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Standardel[®]
Electrical Expert

Technical Manual

Version: 2108



SDT670V DIN Rail Power Analyzer

Shanghai Standardel Co., Ltd.

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1. General

SDT670V DIN rail power analyzer is designed special for energy management system (EMS). By its DIN rail installation, it is very suitable to be used with breakers, contactors. Besides electrical energies, it may measure all the parameters on the electrical networks, such as currents, voltages, active powers, reactive powers, apparent powers, frequency, power factors and 4 quadrant energies.

We may connect up to 100A current to **SDT670V** directly. It has a 8 digits LCD display with backlight. By its front keys, you may easily check different display data or program its parameters. It has a RS485 interface to transfer the measuring data to other master devices, such as PLC, data center computers.

SDT670V has good cost performance, as an intelligent unit and a digital electrical data collection unit, it has been widely used in many intelligent systems.

2. Functions

- **Measuring:** 30 parameters on AC electrical network:
AL1, AL2, AL3(current senses), VL1, VL2, VL3, VL1-2, VL2-3, VL3-1, Fr, PL1, PL2, PL3, PL,QL1, QL2, QL2, QL, SL1, SL2, SL3, SL, PF1, PF2, PF3, PF, imp & exp kWh, L & C kvarh
- **Display:** With 8 digits white backlight, display range 000000.00~99999999 kWh;
keep kWh value without power;
dot will move according to energy value to 8 integer digits;
- **Dimension:** 7 modules (126x89x74mm);
- **Current Input:** 5A (Ext. CT), 16A, 32A, 63A, 100A;
- **Line & Voltage Input:**
3P4L (3x57.7/100V, 3x127/220V, 3x230V/400V,3x240/415V,3x400/690V);
3P3L (3x100V, 3x230V, 3x400V,3x690V)
- **Power Supply:** AC/DC85-265V;
- **Communication:** With 2 cables **isolated RS485** interface up to 38400bps
(Def. **Modbus-RTU** protocol);
- **Pulse:** kWh impulse output (comply DIN43864);
- **Autodiagnosis:** for wiring error alarm, check error reason by alarm code;
- **Mounting:** 35mm standard DIN rail installation;
- **Software:** With free testing software, to easily read its data and set its parameters by computer;
- **Secondary Develop:** provide DLL dynamic library and C# example, to develop you own software;



3. Features

Technical Feature		Parameters
Input	Wiring	2P3L, 3P3L, 3P4L
	Voltage	2x110V/220V, 3x57.7/100V, 3x127/220V, 3x230V/400V,3x240/415V,3x400/690V 3x100V, 3x230V, 3x400V, 3x690V
		Rated 0.9 ~ 1.1Un; Max 0.7 ~ 1.2Un
		Consumption ≤5VA / line
	Current	3x5A(Ext. CT), 3x16A, 3x32A, 3x63A, 3x100A
		Consumption ≤4VA / line
	Frequency	50 / 60Hz
	Accuracy	U,I,P 0.2%, kWh 0.5%, kVarh 1.0%
Thermal drift	<200ppm	
RS485 interface	Wiring	2 cables isolated RS485 (Modbus-RTU protocol)
	Baud rate	1200,2400,4800,9600,19200,38400bps
	Parity	n81,n82,e81,o81
	Bus Capacity	32
Energy Impulse		kWh impulse (open-collector)
		VCC<48V, Iz<50mA
		Constant: 10imp/kWh
Isolation		2kVAC/min (input / output / power supply)
		input / housing and output / housing >50MΩ
Installation		Standard 35mm DIN rail
Standard		IEC 61557-12 Class 0.5
		IEC 62053-21 Class 1.0
Environment		Work Temperature: -20C ~ +55C
		Storage Temperature: -40C ~ +70C
		Relative humidity: 5% ~ 95% (no condensation)
		Altitude: < 2500m
Others		Dimension: 126x89x74 (mm)
		Weight: 745g

4. Dimension

Dimension

Note:

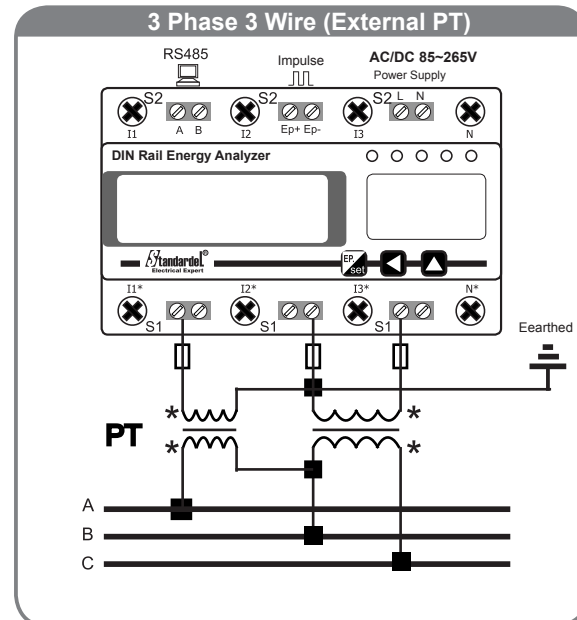
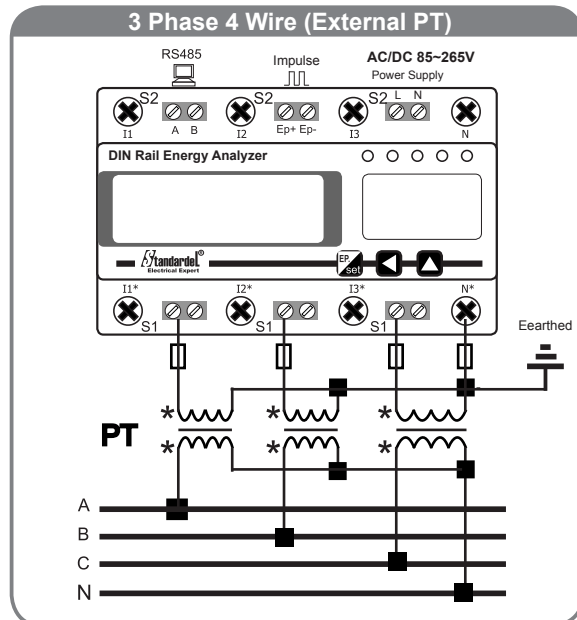
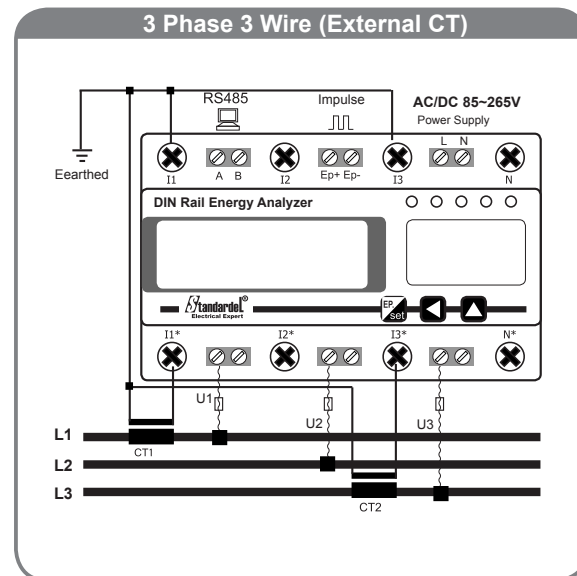
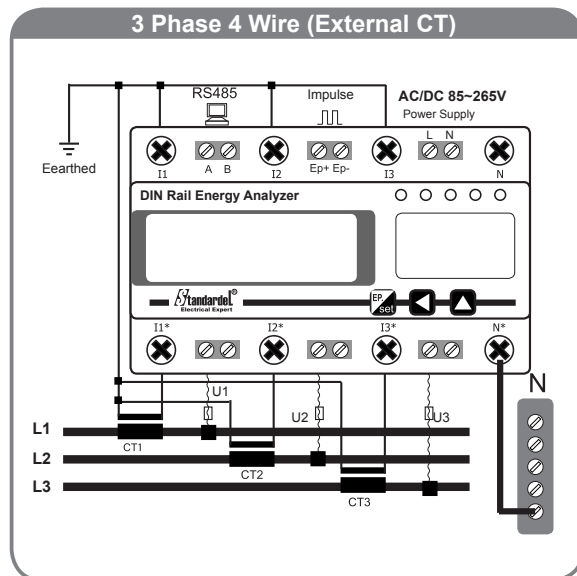
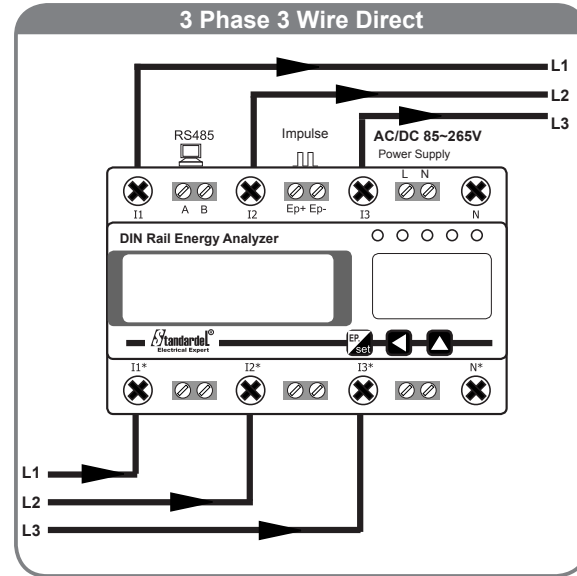
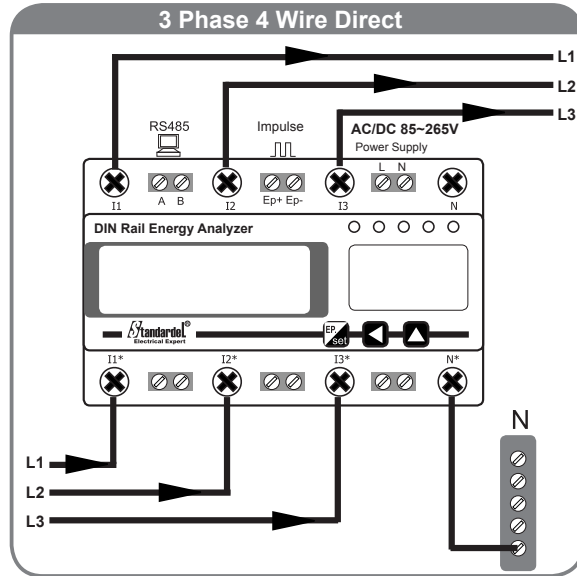
- SDT670V is easily fixed on the 35mm standard DIN rail.
- There are 2 seals points on their front transparent cover. After Wiring, mount seals, they can be good anti-stealing.
- When the current is more than 80Amp, please use special connector to make sure the wiring security.

Installation



5. Wiring

5.1 Measuring Wiring



⚠ Please distinguish from 3P4W and 3P3W on SDT670V when ordering.

1. Voltage Input:

- (1) SDT670V line-line voltage is up to more than 800V;
- (2) For safe wiring and lightning protection, best to wire the 1A fuse on voltage inputs and power supply L line;

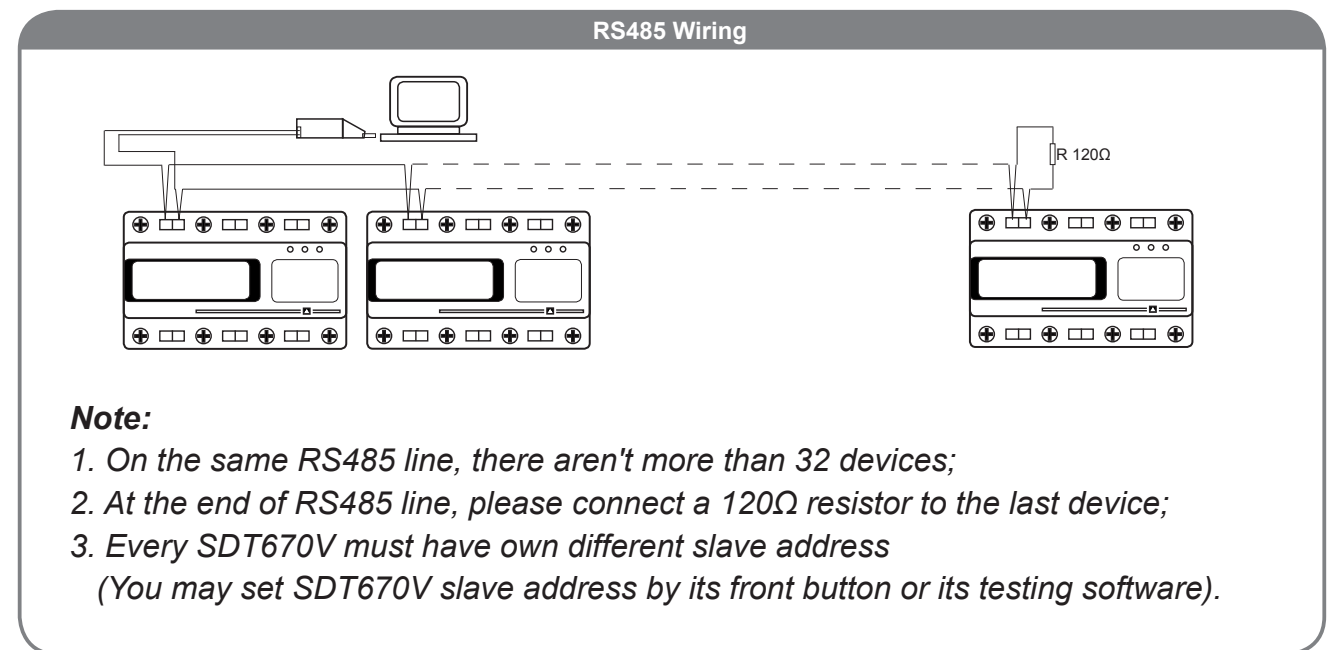
2. Current Input:

- (1) When current is more than rating 5A, it's best to use CT;
- (2) If there is other kWh meter or ammeter on the AC line, please mount SDT670V in series connection with their current transformers;
- (3) Before disconnect current input, make sure disconnect CT primary circuit or short CT secondary circuit;
- (4) Make attention of current transformer direction, including installation direction P1,P2 and wiring direction S1,S2; The reverse current will cause negative active power and negative energy value;

3. Make sure that each phase current matches its voltage, including their phase number and their direction; otherwise it will cause error measuring or error sign;

4. SDT670V need auxiliary power supply to work on AC/DC85-265V;

5.2 RS485 Communication Wiring

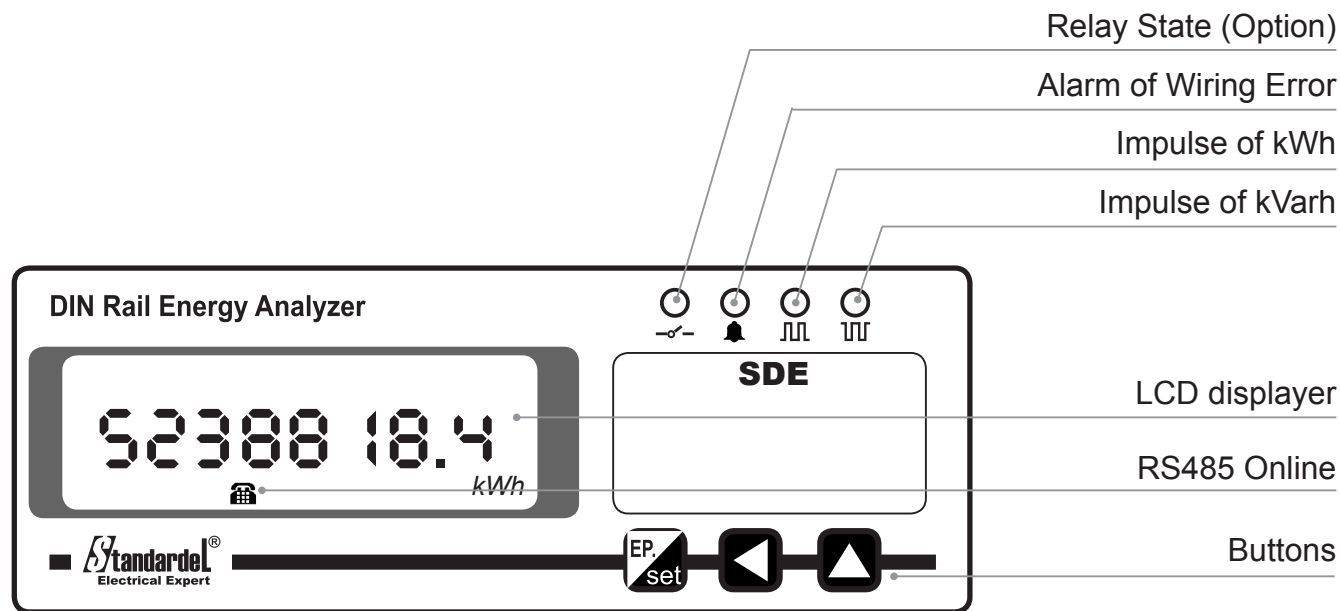


Note:

- 1. On the same RS485 line, there aren't more than 32 devices;
- 2. At the end of RS485 line, please connect a 120Ω resistor to the last device;
- 3. Every SDT670V must have own different slave address (You may set SDT670V slave address by its front button or its testing software).



6. Display



Attention:

1. If under well communication of RS485, the marking will flicker;
2. If there is load current, LED of and will flicker;
3. If lights, it means there is wiring error(s); please check error code to look for the error reason;
4. By front 3 keys, you may change display and setting parameters.

Display Pages

Energies

- Import active energy: 123456.78 kWh
- Export active energy: -000006.78 kWh
- Inductive reactive energy: 002346.78 kVarh
- Capacitive reactive energy: -000456.78 kVarh

Parameters

- Product Model: SDT670V
- Modbus Slave Address: Addr 030
- Baud rate: bAud9.600
- Data Format: dAtA n.8.1
- PT Ratio: Pt 0 100
- CT Ratio: Ct 0050
- Pulse constant: 6400
- Wiring Error Code: AL - 0 10

Electrical Values

- Voltage of Phase L1: U_A 219.9 v
- Voltage of Phase L2: U_B 220.0 v
- Voltage of Phase L3: U_C 220.0 v
- Voltage of Phase L1&L2: U_{AB} 219.9 v
- Voltage of Phase L2&L3: U_{BC} 220.0 v
- Voltage of Phase L3&L1: U_{AC} 220.0 v
- Current of Phase L1: I_A 30.000 A
- Current of Phase L2: I_B 29.999 A
- Current of Phase L3: I_C 30.001 A
- Total Active Power: P_B 9.90 kW
- Active Power L1: P_A 3.30 kW
- Active Power L2: P_B 3.30 kW
- Active Power L3: P_C 3.30 kW
- Total Reactive Power: Q_B 9.90 kvar
- Reactive Power L1: Q_A 3.30 kvar
- Reactive Power L2: Q_B 3.30 kvar
- Reactive Power L3: Q_C 3.30 kvar
- Total Apparent Power: S_B 19.80 kVA
- Apparent Power L1: S_A 6.60 kVA
- Apparent Power L2: S_B 6.60 kVA
- Apparent Power L3: S_C 6.60 kVA
- Total Power Factor: PF_B 0.500
- Power Factor L1: PF_A 0.500
- Power Factor L2: PF_B 0.500
- Power Factor L3: PF_C 0.500
- Frequency: F 50.00 Hz

While 3P3L, only displays line voltages

While 3P3L, there isn't power value of each phase

Note:

- SDT670V can display main 27 parameters, the user may change display page by button;
- After set PT or CT ratio, SDT670V displays real values; you don't need multiply the PT or CT ratio again;
- SDT670V/R doesn't need to set CT ratio, because it reads the real values on bus;
- You may check SDT670V parameters without into setting menu;
- [AL] wiring error code: with 3 digits.

	X	X	X
Normal	0 – Normal	0 – Normal	0 – Normal
Error	1 – phase sequence error	1 – reversed current	1 – lose phase voltage
Reason	There is unmatched of phase current and phase voltage	There is split core CT mounted reversedly	There is missing of phase voltage



7. Programming

7.1 Button Setting Locally

Programming Menu	
Code 0000	Enter programming password 1. Under reading pages, press and keep 4 seconds to go into Programming mode; 2. Default enter programming password is 0000; 3. Press to choose digit, Press to confirm password.
net 3P4L	Choose Network: - 3P4L - 3P3L Press to change value;
baud 9.600	Set RS485 Baud rate: 1. Option value: -1.200(1200bps) -2.400(2400bps) -4.800(4800bps) -9.600(9600bps) -19.20(19200bps) -38.40(38400bps) 2. Press to change value;
pt 0001	Set PT Ratio: 1. Option value: 0001- 9999 2. Press to change value; (4000/400V, set PT = 10)
ct 0001	Set CT Ratio: 1. Option value: 0001- 9999 2. Press to change value; (200/5A, set CT= 40)
con mod	Choose Protocol: - mod (Modbus-RTU) - 645 (DL/T645) Press to change value;
sAddr 020	Set Modbus Slave Address: 1. Option value: 1- 247 2. Press to change value;
save no	Save programming values: 1. press & keep 3sec to enter Save Page; 2. Option value: - no - yes 3. Press to choose; Press to confirm saving.

Attention:

- SDT670V is cabled on 3P4W or 3P3W, then set network on it;
- SDT670V's CT ratio is fixed under production, no need to change;
- After setting, have to save the setting;

To check the good setting on the parameter menu, after setting

7.2 Software Setting Remotely by RS485

The screenshot shows the SDT670 Testing Tool interface. It includes sections for Connection Set (IP: 192.168.8.236, Port: 8899), Parameter Set (Addr: 1, Baudrate: 9600bps), and Measuring Data. The Measuring Data section displays various electrical parameters such as Volt L-N, Currents, React. Power, Power Factors, and Energies. A Data Detection window at the bottom shows the software send and connected device responses in hexadecimal.

Software function:

- SDT670V_Testing Tool can
- To test the RS485 communication quality;
 - To read all the measuring data of SDT670V
 - To make mass setting of SDT670V's Modbus slave address and baudrate.;
 - To clear SDT670V's energies data.

Operation Step:

- Step1:** Run "SDT670V_Test.exe".
- Step2:** choose correct serial port, baudrate, parity on PC, input SDT670V slave address (Def. 01); then click [Read] button to begin reading SDT670V's data. (Def. read one time 1 second)
- (if the left bottom displays , software is well connected with SDT670V, and all the measuring data are in their corresponding text box.)
- (if the left bottom displays , software doesn't connect with SDT670V, please check the error reason after .)
- Step3:** If you well read the data of SDT670V, the button [COM Set] [Ep Clr] [Ratio Set] will be activated:
- to click [Ep Clr] to reset all the energies' value to zero;
 - after inputting the slave address or baudrate or parity, to click [COM Set] to change SDT670V's RS485 parameters;
 - after inputting the CT or PT ratio, to click [Ratio Set] to change wiring parameters.



8. Modbus Protocol

8.1 Register Map

Register Code Dec	Hex	Items	Format	Read Write	Explanation
0 - high	00 - high	Slave Address	UInt8	R/W	Range: 001~247 (Default 001)
- low	- low	Baud rate	UInt8	R/W	1:9600bps (Default: 1) 2:4800bps 3:2400bps 4:1200bps 5:19200bps 6:38400bps
1 - high	01 - high	Data Frame format	UInt8	R/W	0: 8,n,1 (Default:0) 1: 8,e,1 2: 8,o,1 3: 8,n,2
- low	- low	Line Mode	UInt8	R	0:3P4L; 1:3P3L (Default: 0)
2~5	02~05	Empty			
6 - high	06 - high	Error Alarm Message	UInt8	R	0000 0 0 0 0 (0-No; 1-Alarm) Er Phases UL3 UL2 UL1
- low	- low	Current sense	UInt8	R	00000 0 0 0 (0 positive; 1 negative) IL3 IL2 IL1
7	07	PT ratio	UInt16	R/W	0001~9999 (External PT 10kV/100V, ratio = 100)
8	08	CT ratio	UInt16	R/W	0001~9999 (External CT 200/5A, ratio = 40)
9 - high	09-high	Control Relay (Option)	UInt16	R/W	0:Open Relay; 1:Close Relay
- low	- low	Relay State (Option)	UInt16	R	0:Open; 1:Close
10,11	0A,0B	Import active energy	UInt32	R/W	RealValue = (65536*Registor_H+Registor_L)/100
12,13	0C,0D	Export active energy	UInt32	R/W	(Unite: kWh)
14,15	0E,0F	Inductive reactive energy	UInt32	R/W	RealValue = (65536*Registor_H+Registor_L)/100
16,17	10,11	Capacitive reactive energy	UInt32	R/W	(Unite: kVarh)
18~49	12~31	Empty			
50	32	Voltage L1-N	UInt16	R	RealValue = RegistorValue/100 (Unit: V)
51	33	Voltage L2-N	UInt16	R	
52	34	Voltage L3-N	UInt16	R	
53	35	Voltage between L1 & L2	UInt16	R	
54	36	Voltage between L2 & L3	UInt16	R	
55	37	Voltage between L3 & L1	UInt16	R	
56	38	Current on phase L1	UInt16	R	RealValue = RegistorValue/100 (Unite: A)
57	39	Current on phase L2	UInt16	R	
58	3A	Current on phase L3	UInt16	R	
59	3B	Active power on phase L1	UInt16	R	RealValue = RegistorValue/100 (Unite: kW)
60	3C	Active power on phase L2	UInt16	R	
61	3D	Active power on phase L3	UInt16	R	
62	3E	Total Active power	UInt16	R	

63	3F	Reactive power phase L1	UInt16	R	RealValue = RegistorValue/100 (Unite: kVar)
64	40	Reactive power phase L2	UInt16	R	
65	41	Reactive power phase L3	UInt16	R	
66	42	Total Reactive power	UInt16	R	
67	43	Apparent power phase L1	UInt16	R	RealValue = RegistorValue/100 (Unite: kVA)
68	44	Apparent power phase L2	UInt16	R	
69	45	Apparent power phase L3	UInt16	R	
70	46	Total Apparent power	UInt16	R	
71	47	Power factor on phase L1	UInt16	R	RealValue = RegistorValue/10000
72	48	Power factor on phase L2	UInt16	R	
73	49	Power factor on phase L3	UInt16	R	
74	4A	Total Power factor	UInt16	R	
75	4B	Frequency	UInt16	R	RealValue = RegistorValue/1000 (Unite: Hz)

1. Data Format: One register with 2 bytes, high byte before, low byte behind

UInt8: 8bits unsigned integer;

UInt16: 16 bits unsigned integer;

UInt32: 32bits unsigned integer;

Int16: 16 bits signed integer;

2. The registor values are secondary values, and they needs to multiply CT&PT ratio to get real values.



8.2 Interface

- 1. SDT670V is equipped with 2-cables half-duplex RS485 interface...
2. On one RS485 line, there are able to connect maximan 32 devices...
3. The wiring of RS485 cables should be far away HV cables or HV environment...
4. Programmable Baudrate 9600, 4800, 2400, 1200bps, 19200bps, 38400bps default is 9600bps
5. Data Transmit Format: 1 start bit, 8 data bit, 1 stop bit, no parity

8.3 Protocol

Modbus-RTU: it is the communication mode between master device and slave device on one RS485 line. At first, the master device requests one sole slave device; then this slave device reponses master device

Modbus-RTU allow to commnunicate only between master device and slave device and don't allow to communiatue among slave devices. Therefore the slave devices don't occupy the communication line when it initialize.

Master request: request frame includes slave address, function code, data and CRC check.

Table with 4 columns: Slave Address (1 byte), Function Code (1 byte), Data (N bytes), CRC16 Check (2 bytes)

Slave Address: every analyzer has one address different from others on one RS485 line; range from 1~247; only requested analyzer will response master.

Function Code:

Table with 2 columns: Hex order (03H, 10H), Function (Read data from one or several registor(s), Write data into one or several registor(s))

Data: including read or write data

CRC16 check: x^16 + x^15 + x^2 + 1

8.4 Examples

- 1. Read registers: want to read the currents of 3 phases of analyzer's slave address 01.

Master request:

Table with 5 columns: Slave Address (01H), Function (03H), Start Register (00H,38H), Register Number (00H,03H), CRC (84H,06H)

SDT670V response:

Table with 5 columns: Slave Address (01H), Function (03H), Byte Number (06H), Data (27H,27H,27H,11H,27H,0AH), CRC (D2H,E3H)

AL1 = (27Hx100H+27H)/100 = 100.23A
AL2 = (27Hx100H+11H)/100 = 100.01A
AL3 = (27Hx100H+0AH)/100 = 99.94A

- 2. Read registers: want to read the import reactive energy of analyzer's slave address 10.

Master request:

Table with 5 columns: Slave Address (0AH), Function (03H), Start Register (00H,50H), Register Number (00H,02H), CRC (C5H,61H)

SDT670V response:

Table with 5 columns: Slave Address (0AH), Function (03H), Byte Number (04H), Data (01H,02H,03H,04H), CRC (E1H,FCH)

Import kVarh = (10000Hx(100Hx01H+02H) + (100Hx03H+04H))/100 = 169090.00 kVarh

10. Feedback

1. SDT670V doesn't work

SDT670V is powered by auxiliary power supply between AC/DC85-265V.

2. Electrical value error

- 2.1. Please make sure of correct wiring of input current and of input voltage to SDT670V, after wiring, you may use multimeter to check whether the input values are correct;
2.2. Please make sure of phase sequence is correct, it means that L1 current input must be matched to L1 voltage input;
2.3. The measured values by SDT670V are RMS, they are a little diffrent from the measured values by multimeter. It is normal;
2.4 If there is external CT. please check whether it is set CT. ratio;

3. Energy value error

- 3.1 SDT670V's accumulated energy values are based on active power values, if energy values aren't correct, please check whether active power values and PF values are correspoding to real values.
3.2 SDT670V counts bidirectional active energies, if the current wiring or CT secondary wiring is inverse, the active energy will be counted on export active energy. So you have to make current wiring again.

4. SDT670V Err Alarms LED (Please check the error code on display menu)

- 1. There is no current or no voltage on any one of 3 phase;
2. Any current input doesn't match its voltage input;
3. On 3P3L wring, Err Alarm LED will turn on;
4. To measure the unbalance 3 phases load, Err Alarm LED will turn on.

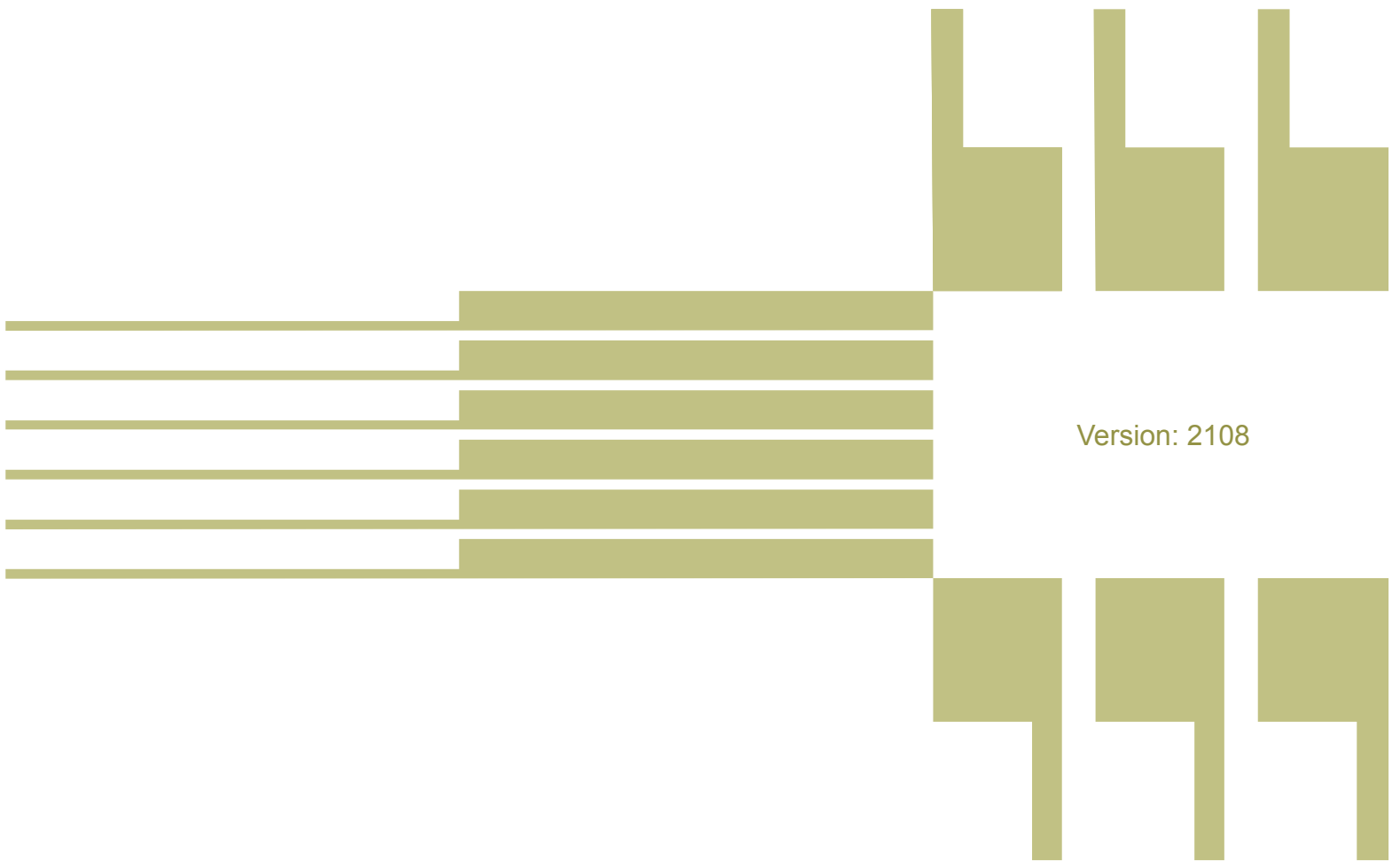
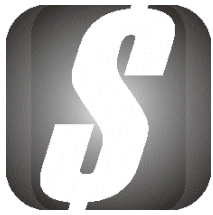
5. RS485 Communication Error

- SDT670V doesn't response

Please make sure the correct RS485 communication setting of SDT670V, they (slave address,baudrate,data frame formate) must match the master devices (PC,PLC); If there are several SDT670V who don't response on a same RS485 line, please check whether this RS485 line is avaiable, or whether the RS485 converter / TCP server work well. If only one SDT670V doesn't response, pleaes check the RS485 cable.

- SDT670V responses error data

Please read SDT670V register map again, make sure the good register number,data format of the register. We suggest using our SDT670V testing software to read.



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