

ANALIZADOR DE ENERGIA RIEL DIN WIFI

SDE400 (K) , SDE430-C (K) , SDE430 -R (K)

1. GENERAL

SDE430-C mini DIN rail 3 phase power analyzer is designed special for renovation project of energy management (EMS). It has 3 external split core CTs (5~600A) or 3 Rogowski coils (200~6000A), so we don't need to dismantle bus to install it. By its DIN rail installation, it is very suitable to be used with breakers, contactors.

Besides electrical energies, it can 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. It is designed as just 2 modules, so it can be installed in any so small space or to use it as multi channel 3 phase analyzer. Every SDE430-C has a RS485 interface to transfer its measuring data to other master devices, such as PLC, data center computers.

SDE430-C has good cost performance, as an intelligent unit and a digital electrical data collection unit, it has been widely used in many intelligent systems.

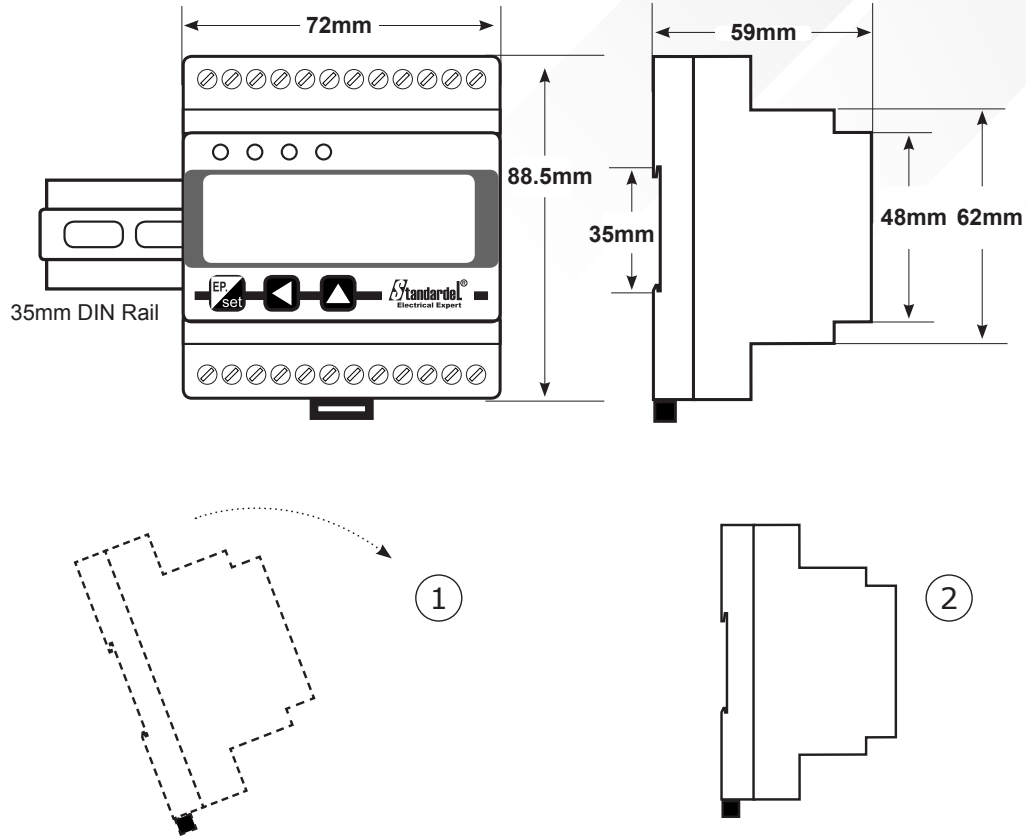
2. FUNCTIONS

- **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 LCD, display range 000000.00~99999999 kWh;
keep kWh value without power;
dot will move according to energy value to 8 integer digits;
- **Dimension:** 4 modules (72x89x74mm);
- **Current Input:**
SDE430-C: split core CT (option 5A, 20A, 40A, 60A, 100A, 200A, 400A, 600A);
SDE430-R: rogowski coil (option 200, 600A, 1kA, 2kA, 4kA, 6kA);
(5A split core CT is applied on the secondary cable of original 5A CT);
- **Line & Voltage Input:**
3P4L (3x57.7/100V, 3x127/220V, 3x230V/400V,3x240/415V);
3P3L (3x100V, 3x220V, 3x380V)
- **Power Supply:** Default axiliary power supply AC/DC85~265V;
Optional DC5V/12V/24V/48V
- **Communication:** With 2 cables isolated RS485 interface up to 38400bps (Def. Modbus-RTU protocol);
- **Pulse:** kWh impulse output (comply DIN43864);
- **Relay ouput:** Optional 1 relay output as remote switch or as alarm;
- **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	1P2L, 3P3L, 3P4L
	Voltage	2x110V/220V, 3x57.7/100V, 3x127/220V, 3x230V/400V,3x240/415V 3x100V, 3x220V, 3x380V
		Rated 0.9 ~ 1.1Un; Max 0.7 ~ 1.2Un
		Consumption ≤5VA / line
	Current	SDE430-C: 5A (to measure normal 5A CT), 20A, 40A, 60A, 100A, 200A, 400A, 600A (Split core CT) SDE430-R: 200A, 600A, 1kA, 2kA, 4kA, 6kA(Rogowski Coil)
		Consumption ≤4VA / line
	Frequency	50 / 60Hz
Accuracy	U,I,P 0.5%, kWh 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
Relay Ouput (Option K)	Mode	Dry Contact
	Capacity	Capacity: AC250/3A,DC24/5A
Energy Impulse		kWh impulse (open-collector)
		VCC<48V, I _z <50mA
		Constant: 10imp/kWh
Auxiliary power supply		AC/DC85-265V; Consumption < 5VA
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)
Others		Altitude: < 2500m
		Dimension: 72x89x74 (mm)
		Weight: 345g (net without CT)

4. DIMENSION

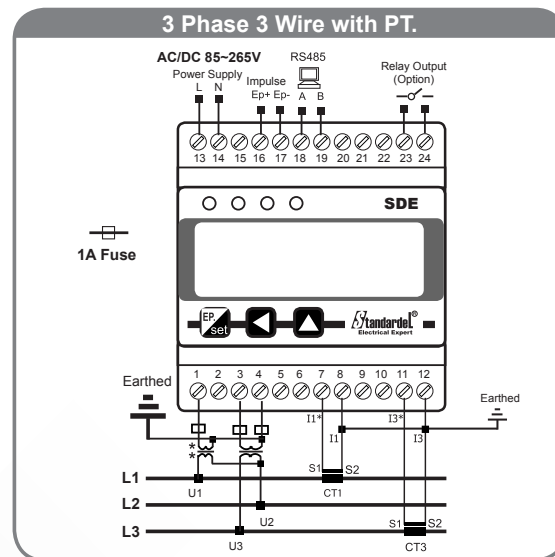
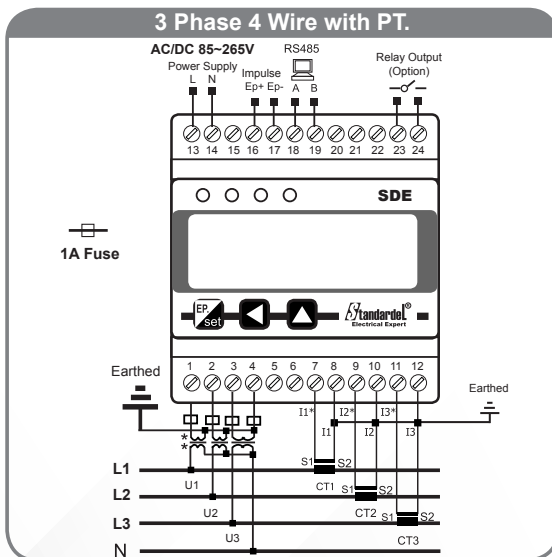
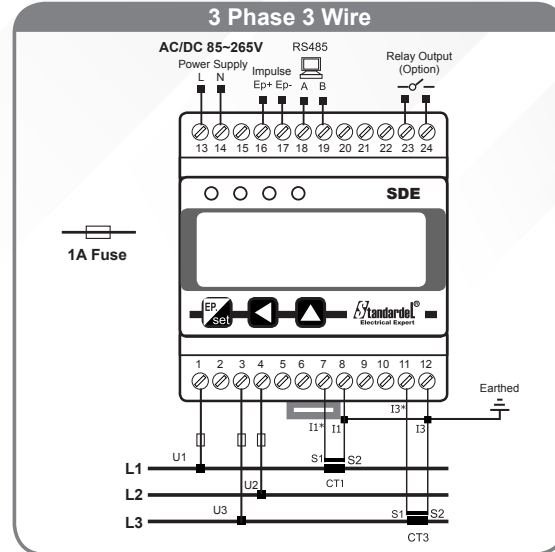
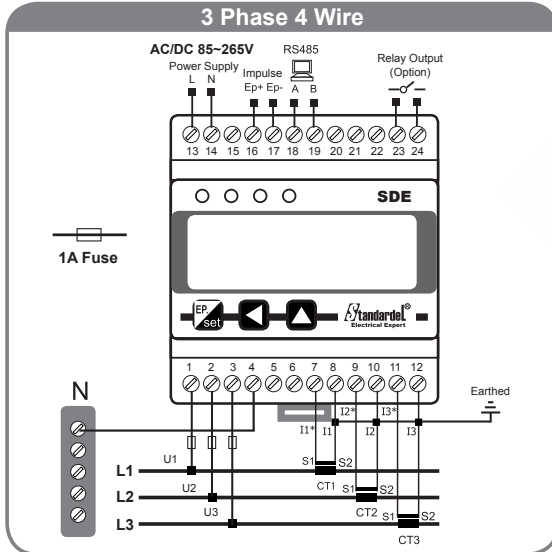


The size of corresponding split core CT & rogowski coil

Items	Max.Current	Hole Size	Whole Size
Split Core CT	5A	9mm	23mm
Split Core CT	20A	16mm	35mm
Split Core CT	40A	16mm	35mm
Split Core CT	60A	16mm	35mm
Split Core CT	100A	16mm	35mm
Split Core CT	200A	25mm	60mm
Split Core CT	400A	32mm	75mm
Split Core CT	600A	45mm	82mm
Rogowski Coil	800A	100mm	116mm
Rogowski Coil	1kA	100mm	116mm
Rogowski Coil	2kA	150mm	166mm
Rogowski Coil	4kA	200mm	216mm
Rogowski Coil	6kA	300mm	316mm

5. WIRING

5.1 SDE400E (FOR NORMAL 5A (1A) CT.)



1. Voltage Input:

- (1) When line-line voltage is more than rating 500V, it's best to use PT;
- (2) For safe wiring and lightning protection, best to wire the 1A fuse on voltage inputs and power supply L line;

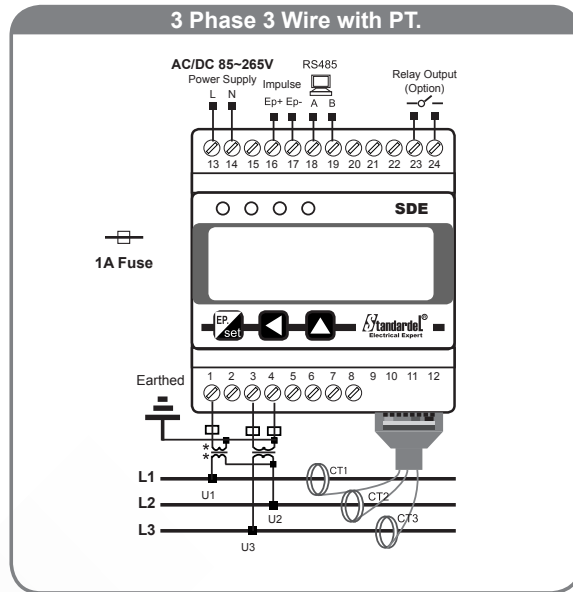
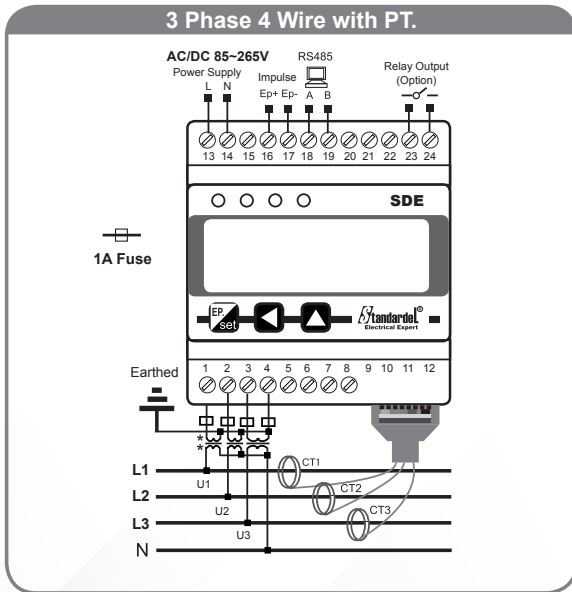
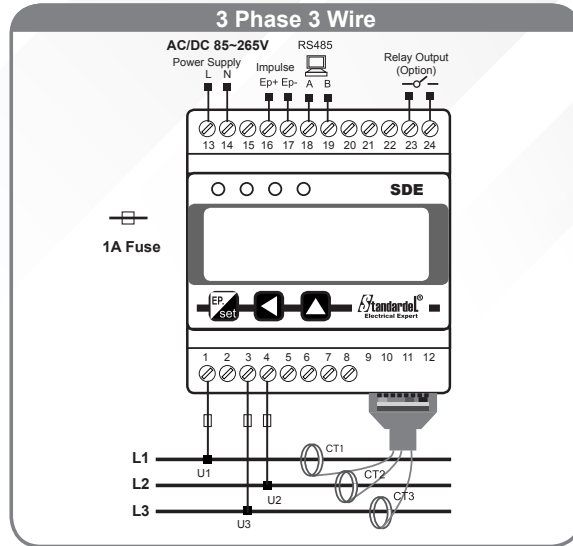
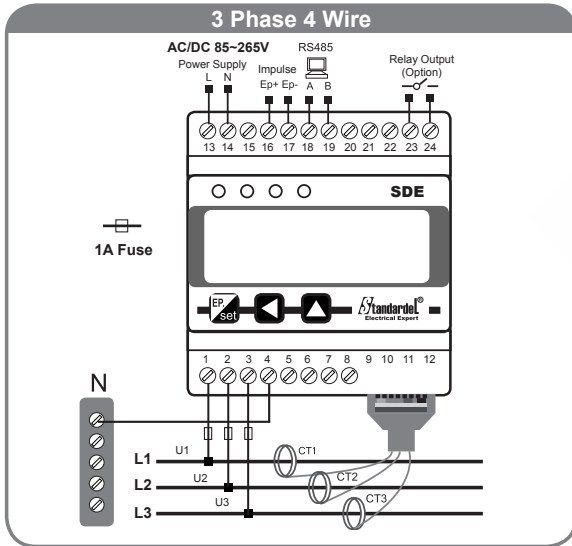
2. Current Input:

- (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 SDE400 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. The normal SDE430 need **auxiliary power supply**, its work voltage is AC/DC85-265V (sometimes we get the its auxiliary power from one phase voltage input);

5.2 SDE430E-C (WITH 3 SPLIT CORE CT.) SDE430E-R (WITH 3 ROGOWSKI COIL)



1. Voltage Input:

- (1) When line-line voltage is more than rating 500V, it's best to use PT;
- (2) For safe wiring and lightning protection, best to wire the 1A fuse on voltage inputs and power supply L line;

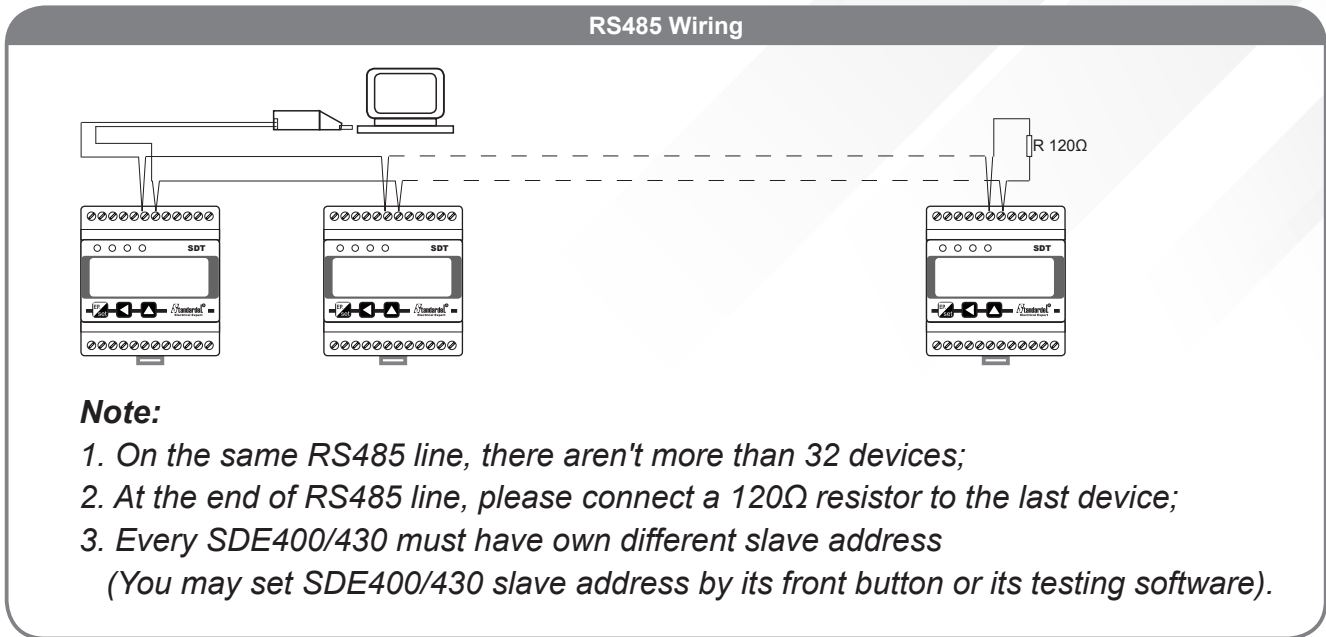
2. Current Input:

- (1) Each SDE430-C/R must be installed with its own 3 split core CTs (or rogowski coils), its has the **same serial number with its own split core CTs (or rogowski coils)**;
- (2) Each split core CT (or rogowski coil) has the **own color for different phase** (yellow-L1, green-L2, red-L3);
- (3) There is an **arrow sticker** on each split core CT (or rogowski coil), and its direction must be **same as current direction**, otherwise it will cause negative active power and energy value;
- (4) split core CT and rogowski coil are special sensor of AC current, **it doesn't need to connect with earth**;

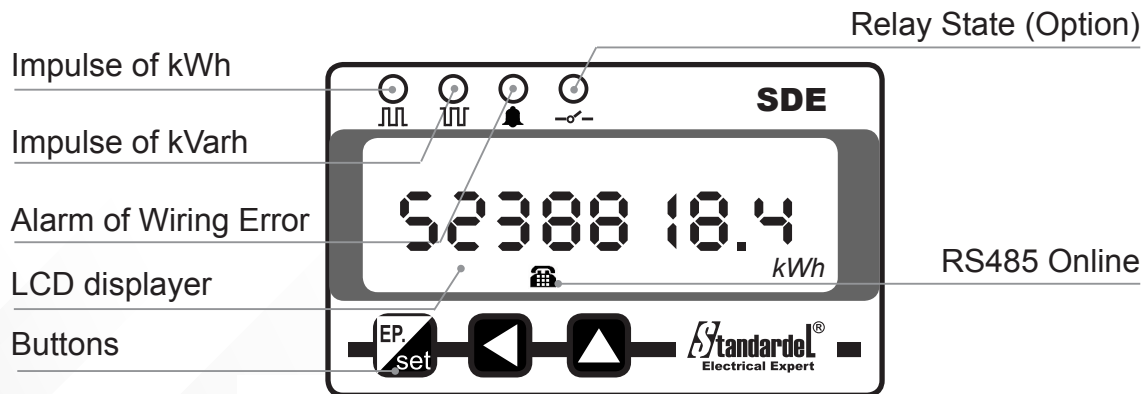
3. Make sure that **each phase current matches its voltage**, including their phase number and their direction; otherwise it will cause error measuring or error sign;

4. The normal SDE430 need **auxiliary power supply**, its work voltage is AC/DC85-265V (sometimes we get the its auxiliary power from one phase voltage input);





5.3 RS485 WIRING



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
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Parameters

Product Model SdE430	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 _{CA} 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 _Σ 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 _Σ 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 _Σ 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 _Σ 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:

- SDE430 can display main 27 parameters, the user may change display page by button;
- After set PT or CT ratio, SDE400 displays real values; you don't need multiply the PT or CT ratio again;
- SDE430-C/R doesn't need to set CT ratio, because it reads the real values on bus;
- You may check SDE400/430 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 unmatch 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			
CodE0000	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.		
inEt 3P4L	Choose Network: - 3P4L - 3P3L Press   to change value;	8bAUd9.600	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;
3Pt 0001	Set PT Ratio: 1. Option value: 0001- 9999 2. Press   to change value; (4000/400V, set PT = 10)	7dAtA n.8.1	Set RS485 frame mode: 1. Option value: - n,8,1 (1 stop bit, no parity) - o,8,1 (1 stop bit, odd parity) - e,8,1 (1 stop bit, even parity) - n,8,2 (2 stop bit, no parity) 2. Press   to change value;
3 Ct 0001	Set CT Ratio: 1. Option value: 0001- 9999 2. Press   to change value; (200/5A, set CT= 40)	8ECLr no	Reset all energies' value: 1. Option value: - no - yes 2. Press   to change value; (Attention: After reset energy values, they can be recovered)
4 CoN Mod	Choose Protocol: - mod (Modbus-RTU) - 645 (DL/T645) Press   to change value;	9boNt 060	Set LCD backlight duration: 1. Option value: 0-255 (seconds) 2. Press   to change value; (value 0: backlight is always ON; default value is 60 seconds)
5Addr 020	Set Modbus Slave Address: 1. Option value: 1- 247 2. Press   to change value;	CodE0000	Set programming password: 1. Option value: 0-9999 (Default 0000) 2. Press   to change value;
		5AUE 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:

1. SDE400/430 is cabled on 3P4W or 3P3W, then set network on it;
2. SDE430's CT ratio is fixed under production, no need to change;
3. 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

SDT670 Testing Tool
Shanghai Standardel Co., Ltd.
www.standardel.com

Connection Set

IP: 192.168.8.236
Port: 8899
Delay: 1000
Addr: 1

COM
TCP

Stop

Parameter Set

Addr: 1
Baudrate: 9600bps
Parity: None

CT Ratio
PT Ratio

COM Set
Ep Clr
Ratio Set

Measuring Data All

Volt L-N		Currents		React. Power		Power Factors	
A	220.5V	A	450.00A	A	84.00kvar	A	0.497
B	220.4V	B	450.00A	B	84.00kvar	B	0.495
C	220.2V	C	450.00A	C	84.00kvar	C	0.507
AVG		450.00A		Σ 255.00kvar		Σ 0.500	
Volt L-L		Act. Power		Apparent P.		Parameters	
A	381.8V	A	48.00kw	A	99.00kva	CT: 1500/5A	
B	381.6V	B	48.00kw	B	99.00kva	PT: 1	
C	381.7V	C	48.00kw	C	99.00kva	3P4L	
Σ		147.00kw		Σ 297.00kva		-	
Frequency							
A	50.03Hz						

Energies Active Ep

Energies

Imp. 690.00kWh
Exp. 0.00kWh
Imp. 729.00kvarh
Exp. 0.00kvarh

Max Demand

MD this Month
-
Happen Time
-

Data Detection

2018-04-11 16:48:22

Software Send:
01 03 00 00 00 4C 44 3F
Connected! Device Responses:
01 03 98 01 01 00 00 00 01 01 02 23 20 19 00 00 00 00 01 01 2C 00 00 00 00 00 E6 00 00 00 00 00 00 F3 00 00
00 00 00 00 00 00 07 C7 10 90 45 76 58 98 6E 89 7F 57 DC 9A 25 3C 02 F9 17 76 38 88 0C A3 0E C4 BD E4 8C D3
AE 80 47 91 55 44 BC 28 DE 74 CC 36 03 5F 00 00 00 E5 00 00 00 00 00 00 00 00 01 01 00 56 1F 56 07
95 27 95 13 95 16 00 96 00 96 00 96 00 10 00 10 00 10 00 31 00 1C 00 1C 00 1C 00 55 00 21 00 21 00 63
13 6A 13 56 13 CE 13 88 C3 6E 0D A2

2018-04-11-16:48:24

Connected! Address:1, Gateway IP:192.168.8.236, Gateway Port:8899

Version: V6.1

– Software function:


SDT670_Testing Tool can

1. To test the RS485 communication quality;
2. To read all the measuring data of SDE400
3. To make mass setting of SDE400's Modbus slave address and baudrate.;
- 3) To clear SDE430's energies data.

– Operation Step:

Step1: Run "SDT670_Test.exe".

Step2: choose correct serial port, baudrate, parity on PC, input SDE400 slave address (Def. 01); then click [Read] button to begin reading SDE400's data. (Def. read one time 1 second)

(if the left bottom displays , software is well connected with SDE400, and all the measuring data are in their corresponding text box.)

(if the left bottom displays , software doesn't connect with SDE400, please check the error reason after .)

Step3: If you well read the data of SDE430, 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 adress or baudrate or parity, to click [COM Set] to change SDE400's RS485 parameters;
- after inputting the CT or PT ratio, to click [Ratio Set] to change wiring parameters.

8. MODBUS PROTOCOL

8.1 REGISTOR MAP

Registor Code Dec	Registor Code 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 = RegisterValue/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	RealValue = RegisterValue/100 (Unite: kVA)
67	43	Apparent power phase L1	UInt16	R	
68	44	Apparent power phase L2	UInt16	R	
69	45	Apparent power phase L3	UInt16	R	RealValue = RegisterValue/10000
70	46	Total Apparent power	UInt16	R	
71	47	Power factor on phase L1	UInt16	R	
72	48	Power factor on phase L2	UInt16	R	RealValue = RegisterValue/10000
73	49	Power factor on phase L3	UInt16	R	
74	4A	Total Power factor	UInt16	R	
75	4B	Frequency	UInt16	R	RealValue = RegisterValue/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 register values are secondary values, and they needs to multiply CT&PT ratio to get real values.

For SDE400 and SDE430-C5, their CT ratio is set according to external CT;

For SDE430-C, their CT ratio is 1 and can't be change;

For SDE430-R, their CT ratio is 5 and can't be change;



8.2 INTERFACE

1. SDE400/430 is equipped with 2-cables half-duplex RS485 interface and it is built-in standard Modbus-RTU protocol; the cables should be Shielded Twisted Pair and its diameter should above 0.5 mm^2 .
2. On one RS485 line, there are able to connect maximan 32 devices; every SDE430 must have own different slave address.
3. The wiring of RS485 cables should be far away HV cables or HV environment; we suggest wiring of Mode T, not Mode Star
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 communicate only between master device and slave device and don't allow to communiante 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.

Slave Address	Function Code	Data	CRC16 Check
1 byte	1 byte	N bytes	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:

Hex order	Function
03H	Read data from one or several registor(s)
10H	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 EXAMPLE

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

Master request:

Slave Address	Function	Start Registor	Registor Number	CRC
01H	03H	00H,38H	00H,03H	84H,06H

SDE430 response:

Slave Address	Function	Byte Number	Data	CRC
01H	03H	06H	27H,27H,27H,11H,27H,0AH	D2H,E3H

$$AL1 = (27H \times 100H + 27H) / 100 = 100.23A$$

$$AL2 = (27H \times 100H + 11H) / 100 = 100.01A$$

$$AL3 = (27H \times 100H + 0AH) / 100 = 99.94A$$

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

Master request:

Slave Address	Function	Start Registor	Registor Number	CRC
0AH	03H	00H,50H	00H,02H	C5H,61H

SDE430 response:

Slave Address	Function	Byte Number	Data	CRC
0AH	03H	04H	01H,02H,03H,04H	E1H,FCH

$$\text{Import kVarh} = (10000H \times (100H \times 01H + 02H) + (100H \times 03H + 04H)) / 100 = 169090.00 \text{ kVarh}$$

10. FEEDBACK

1. SDE400/430 doesn't work

SDE400/430 needs auxiliary power supply to work, and work voltage is AC/DC85~265V. To check its power supply voltage on its connector 13,14.

2. Electrical value error

2.1. Please make sure of correct wiring of input current and of input voltage to SDE400/430, 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 SDE400/430 are RMS, they are a little different 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 SDE400/430'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 corresponding to real values.

3.2 SDE400/430 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. SDE400/430 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 wiring, Err Alarm LED will turn on;

4. To measure the unbalance 3 phases load, Err Alarm LED will turn on.

5. RS485 Communication Error

- SDE400/430 doesn't response

Please make sure the correct RS485 communication setting of SDE400/430, they (slave address,baudrate,data frame format) must match the master devices (PC,PLC); If there are several SDE400/430 who don't response on a same RS485 line, please check whether this RS485 line is available, or whether the RS485 converter / TCP server work well. If only one SDE430 doesn't response, please check the RS485 cable.

- SDE400/430 responses error data

Please read SDE430 register map again, make sure the good register number,data format of the register. We suggest using our SDE400/430 testing software to read.