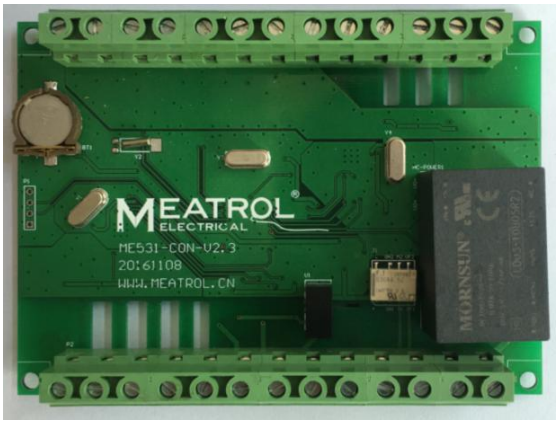
ME531 Three-phase Power Meter



Feature

Specification	
Model	ME531
Product component type	Multifunction power meter
Poles description	3PH4W 3PH3W 1PH2W (L-N); 1PH2W(L-L);1PH3W(L-L-N)
Device application	Power analysis Energy meter
Input type	External CT(333mV only) And External Rogowski coil
Display	None Display
Sampling rate	8k samples per second
Mounting mode	DIN RAIL
Harmonic	52th Max
Mechanical characteristics	
Weight	125g
Dimension	L*W*D:122*87*23mm

Instantaneous rms Values	
Voltage	U，UTH2，UTH3，UTH4(Per Phase,AVG）
Current	I,ITHD2，ITHD3，ITHD4(Per Phase,AVG）
Power	P,FQ,S,PF(Per Phase,SUM）
Energy	EP,EFQ,ES,Freq(Per Phase,SUM） **over 999.9MWh,value reset**
UTHD(%)	UTHD,THD2,THD3,THD4(Per Phase,AVG）
ITHD(%)	ITHD,THD2,THD3,THD4(Per Phase,AVG）
Line voltage	Uab,Ubc,Uac(only enable in 3PH4W)
Voltage angle	Uab,Ubc,Uac
Current angle	Iab,Ibc,Iac
DPF	DPFa,DPFb,DPFc,AVG
Update rate	
Data acquisition rate	400ms
Display update rate	0.5s
Calibration	
Current	Per phase,all
Voltage	Per phase,all
Power factor	Per phase,all
Energy	Reset to “0” EP,EQ,ES all phase

MODBUS RS485

Communication	
Transmission mode	RS485 port,Half duplex
RS485 link	3 wires
Communication protocol	MODBUS RTU
Settings	
Communication address	1 to 247 (default 1)
Baud rate(communication speed)	1200 to 57600 baud (default 9600)
Parity	Even(default),Old,None
Data bit	8
Stop bit	1

Certificate

Environmental conditions	
Operating temperature	-25℃ to +55℃
Storage temperature	-40℃ to +85℃
Humidity rating	5 to 95% RH at 50℃(non-condensing)
Pullution degree	2
Overvoltage category	III,for distribution systems up to 277/480VAC
Dielectric withstand	As per IEC61010-1, Doubled insulated front panel display
Altitude	3000m Max
IP degree of protection	IP20 conforming to IEC 60629
Colour	White
Contractual warranty	12months
EMC	
Electrostatic discharge	Level IV(IEC61000-4-2)
Immunity to radiated fields	Level III (IEC61000-4-3)
Immunity to fast transients	Level IV (IEC61000-4-4)
Immunity to surge	Level IV (IEC61000-4-5)
Conducted immunity	Level III (IEC61000-4-6)
Immunity to power frequency magnetic fields	0.5mT (IEC61000-4-8)
Conducted and radiated emissions	Class B (EN55022)
Standard compliance	
EN 62052-11,EN61557-12,EN 62053-21,EN 62053-22,EN 62053-23,EN 50470-1,EN 50470-3, EN 61010-1,EN 61010-2,EN 61010-031	

Specification

Measurement accuracy	
Current	0.5% from 1% to 120%(don't ensure accuracy when <10A)
Rated current	500A(0.5% from 10A to 600A) 3000A(0.5% from 30A to 3600A) 10kA(0.5% from 100A to 12kA)
Rogwoski coil specification	85mV/kA@50Hz±0.5%
Voltage	0.2% from 80V to 400V(or 100 to 500V)
Power factor	±0.005 from 10% to 120%
Active/Apparent Power	IEC62053-22 Class 0.5
Reactive power	IEC62053-21 Class 2
Frequency	0.01% from 45 to 65Hz
Active energy	IEC62053-22 Class 0.5s
Reactive energy	IEC62053-21 Class 2

Measurement arrange	
Measured voltage	80V to 400V AC(or 100 to 500V)
Frequency range	50/60Hz
Input-current characteristics	
Primary current range	Adjustable from 0.1A to 9999A
Measurement input range	$1/2^{25}$mV-333mV
Permissible overload	600mV for 10s/hours
Control Power	
AC/DC	85 to 265V AC/DC, 3.5W
Output	
Relay	1×digital output(2 ports) from 1pcs relay,rated 24V/800mA, 75mΩ max, 2.5kVrms insulation(controlled by Modbus) Maximum Switching Power ： 0.5A, 125VAC 1A, 30VDC
Opticalcoupler	Max voltage :80VDC;Max current 50mA Recommend Current :10mA
Wire diameter for terminals	
Connections-terminals	Screw terminals 2.5mm^2,interval 5.08mm
Alarm	
Setting	U and I Each phase,AVG
Output form	Relay

Port definition

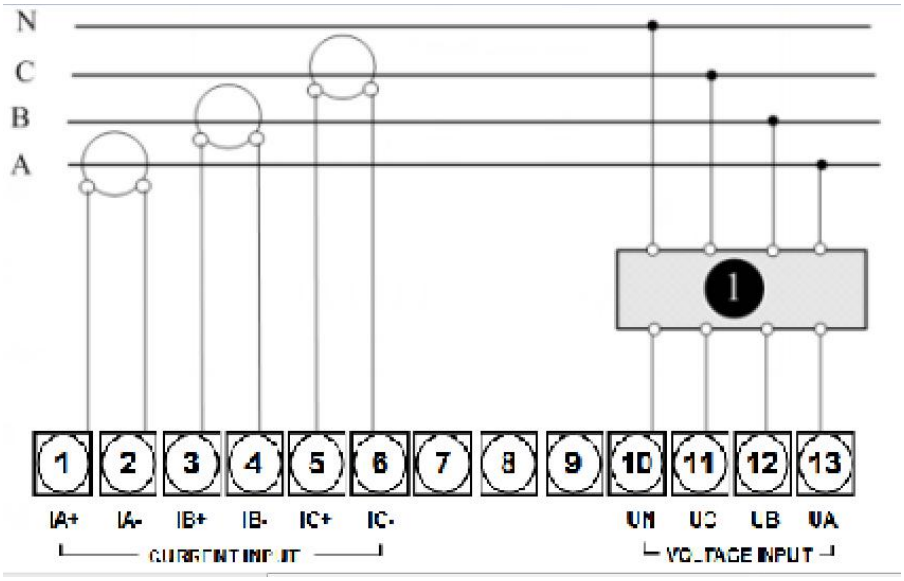
Port number	Port name	Port function	Remarks
1	IA+	A-phase current input positive	A-phase current
2	IA-	A-phase current input negative	
3	IB+	B-phase current input positive	B-phase current
4	IB-	B-phase current input negative	
5	IC+	C-phase current input positive	C-phase current
6	IC-	C-phase current input negative	
7	N/A	To be option	Option
8	N/A	To be option	
9	N/A	To be option	
10	Un	C-phase voltage input	Voltage input
11	Uc	B-phase voltage input	
12	Ub	A-phase voltage input	
13	Ua	N-phase voltage input	
14	N/A	To be option	Option
15	N/A	To be option	
16	N/A	To be option	
17	N/A	To be option	
18	A	RS485 A	RS485 communication
19	B	RS485 B	
20	GND	RS485 GND	
21	OP+	Coupler output +	Coupler output
22	OP-	Coupler output -	
23	RCOM	Relay output -	Relay output
24	RO1	Relay output +	
25	V-	Power supply -	Power 85~265V AC/DC
26	V+	Power supply +	

Wiring

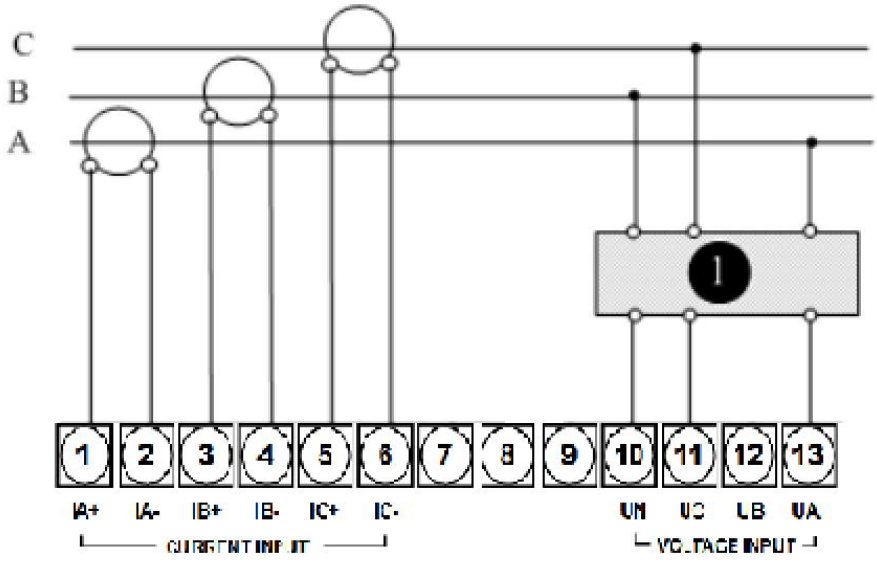
*：Rogowski coil secondary output voltage can not over 333mV rms.

^：CT must be voltage output,secondary output can not over 333mV rms.

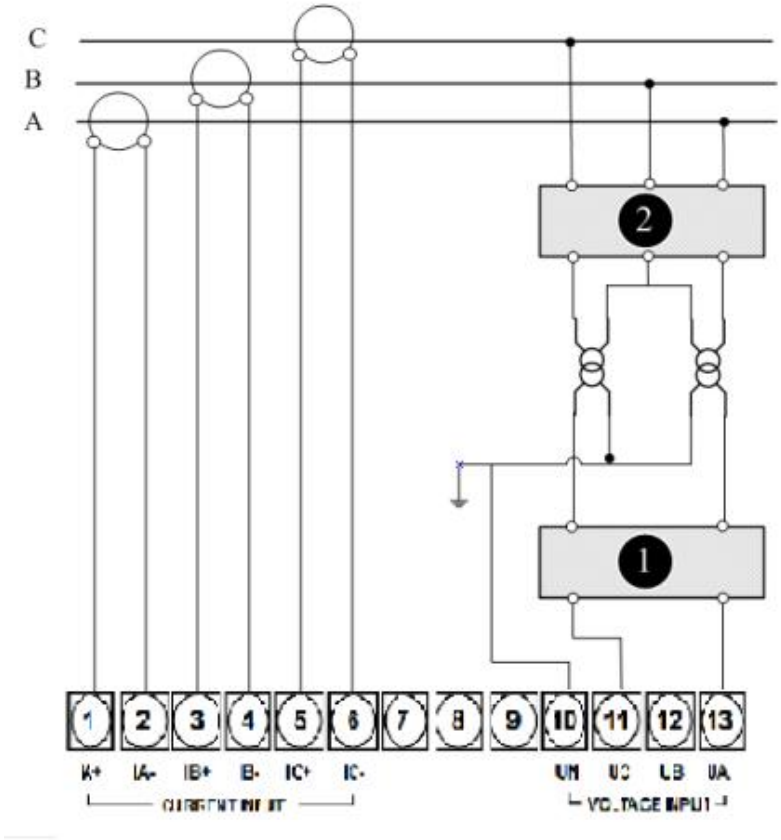
3PH4W no VT



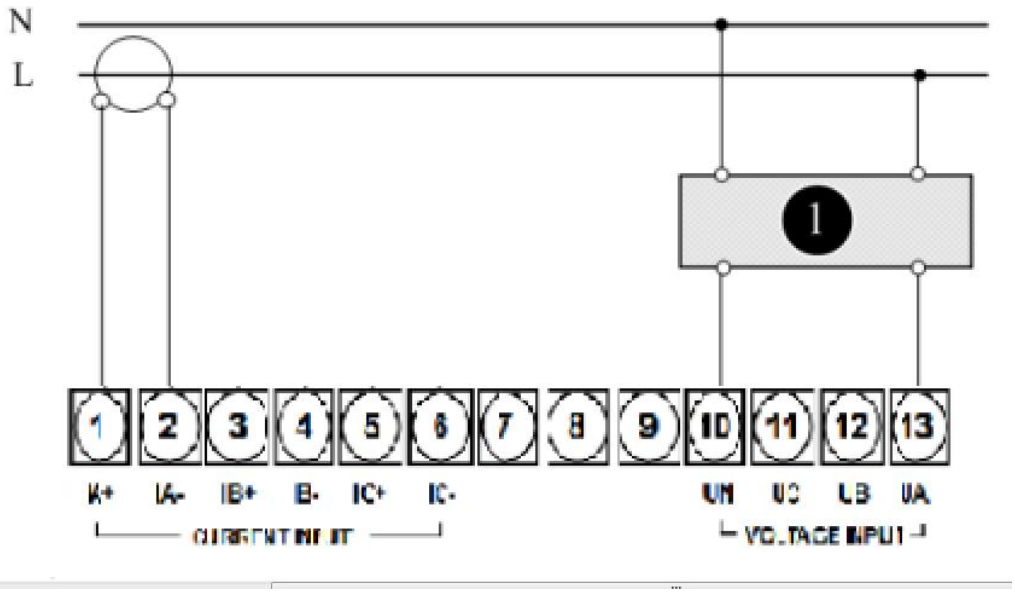
3PH4W no VT



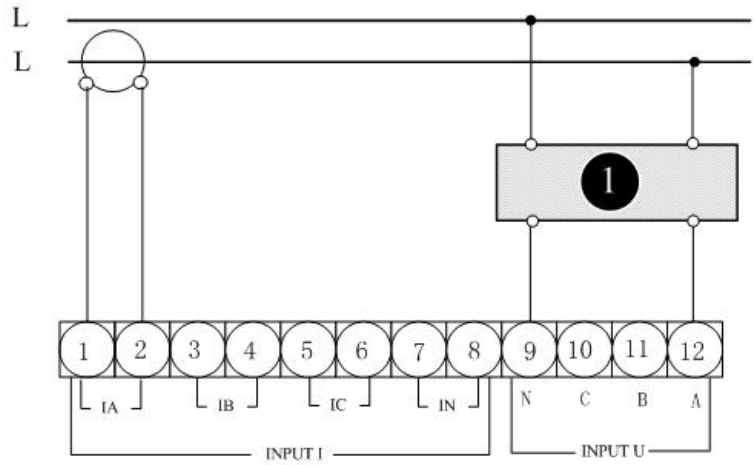
3PH3W with VT



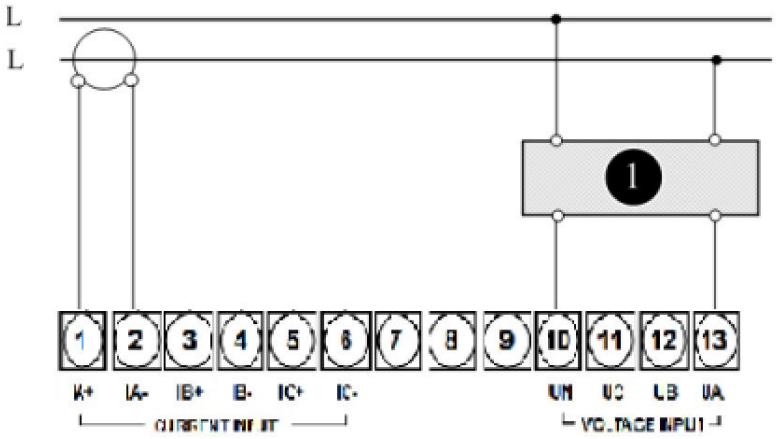
1PH2W L-N



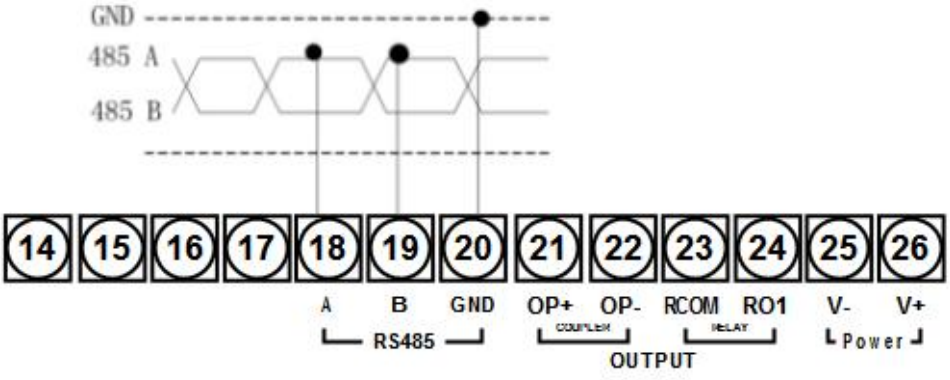
1PH2W L-L



1PH3W L-L-N



ModBus communication &output Wiring diagram



Communication Protocol

V2.2

Shanghai PINYAN M&C Technology Co., Ltd.
24 February 2016

Modbus communications overview

ME631 adopts standard protocol—Modbus-RTU. Baud rate of communication can change to 1200、2400、4800、9600 etc. through program . Error detection: CRC16 (cyclic redundancy check).

Modbus communications settings

Before communicating with the device using Modbus-RTU protocol, use the HMI to configure the following settings:

Parameters	Available Values	Default Value
Baud rate	-1200 Baud -2400 Baud -4800 Baud -9600 Baud -19200 Baud -38400 Baud -57600 Baud	9600 Baud
Parity	– Odd – Even – None number of stop bits = 1	Even
Address	1–247	1

Command Request

Slave Address	Function Code	Command Block	CRC
8-Bits	8-Bits	N×8-Bits	16-Bits Checking

Functional code

Functional code tells what function addressed terminal equipment can execute. The following table lists the functional code that used by this instrument, as well as their significance and function.

Function Code		Function Name	Behavior
Decimal	Hexadecimal		
3	03H	Read Holding Registers	Read present HEX from one or more registers.
16	10H	Write Multiple Registers	Write present HEX on multiple registers.

Register table

Register tables have the following columns:

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description

- **Register Alias**: The meaning of the register
- **Register Address**: Modbus address of register encoded in the Modbus frame, in decimal (dec)
- **Action**: The read/write by command register
- **Size**: The data size in Int16
- **Type**: The encoding data type
- **Units**: The unit of the register value
- **Range**: The permitted values for this variable, usually a subset of what the format allows
- **Description**: Provides information about the register and the values that apply

Unit Table

The following data types appear in the Modbus register list:

Type	Description	Range
UInt16	16-bit unsigned integer	0–65535
Int16	16-bit signed integer	-32768–+32767
UInt32	32-bit unsigned integer	0–4 294 967 295
UInt64	64 bit unsigned integer	0–18 446 744 073 709 551 615
UTF8	8-bit field	multibyte character encoding for Unicode
Float32	32-bit value	Standard representation IEEE for floating number (with single precision)

Bitmap	–	–
Date Time	–	-

Date Time Format:

Word	Units															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	Reserved (0)								Year (0–99,year from 2000)							
2	Month (1–12)								Day (1–31)							
3	Hour (0–23)								Minute (0–59)							
4	Millisecond (0–59999)															

Configure Meter

You can configure the power meter by writing command and command parameters to corresponding command registers using Modbus function 16.

Command request

The following table describes a Modbus command request:

Slave Address	Function Code	Command Register Address	Command Register Number	Data Length	Command Register Value	CRC
1-247	16	300(up to 423)	N	N×2		

Command Result

The command result can be obtained by reading registers 424and 425.

The following table describes the command result:

Register Address	Content	Size (Int16)	Data (example)
424	Requested Command Number	1	1001(set Date Time)
425	Result	1	0 = Valid Operation 80 = Invalid Command 81 = Invalid Parameter 82 = Invalid Number of Parameters 83= Operation Not Performed

Command Request Example

The following table describes setting Date Time by Command Register:

Slave Address	Function Code	Command Register Address	Command Register Number	Data Length	Command Register Value	CRC
1	16	300	7	14	1001,2016,1,1,10,10,10	

NOTE: All the reserved parameters can be considered as any value. e.g. 0.

Command List

Set System Date Time

Command Number	Action R/W	Size	Type	Units	Range	Description
1001	W	1	UInt16	-	2000-2099	Year
	W	1	UInt16	-	1-12	Month
	W	1	UInt16	-	1-31	Day
	W	1	UInt16	-	0-23	Hour
	W	1	UInt16	-	0-59	Minute
	W	1	UInt16	-	0-59	Second

Set Communications

Command Number	Action R/W	Size	Type	Units	Range	Description
1002	W	1	UInt16	-	1-247	Slave Address
	W	1	UInt16	-	0,1,2,3,4,5,6	Baud Rate 0=1200 1=2400 2=4800 3=9600 4=19200 5=38400 6=57600
	W	R/WC	UInt16	-	0,1,2	Parity 0 = ODD 1 = EVEN 2 = None

Set Power System

Command Number	Action R/W	Size	Type	Units	Range	Description
1003	W	1	UInt16	-	0,1,2,3,4	Wiring 0 = 1PH2W L–N 1 = 1PH2W L–L 2 = 3PH4W 3 = 3PH3W 4 = 1PH3W_LLN
	W	1	UInt16	Hz	50,60	Nominal Frequency
	W	2	UInt32	V	-	VT Primary
	W	1	UInt16	V	100,110,115,120	VT Secondary
	W	2	UInt32	A	-	CT Primary
	W	1	UInt16	mV	MaxValue:333mV	CT Secondary

	W	2	UInt32	A	-	Rcoil Primary
	W	1	UInt16	mV	MaxValue:333mV	Rcoil Secondary
	W	1	UInt16	-	0,1	Voltage Connection 0 = Direct Connect 1 = 3PH4W (3 VTs)
	W	1	UInt16	-	0,1	Current Connection 0 = Rogowski coil 1 = CT

Set harmonic times

Command Number	Action R/W	Size	Type	Units	Range	Description
1004	W	1	UInt16	-	2-52	HX harmonic times
	W	1	UInt16	-	2-52	HY harmonic times
	W	1	UInt16	-	2-52	HZ harmonic times

Set Digital Output

Command Number	Action R/W	Size	Type	Units	Range	Description
1005	W	1	UInt16	-	-	0 = Relay-Open 1 = Relay-Closed

Reset Energy

Command Number	Action R/W	Size	Type	Units	Range	Description
1006	W	1	UInt16	-	2050-2053	2050：Reset Phase 1 2051：Reset Phase 2 2052：Reset Phase 3 2053：Reset Phase 1,2,3

Modbus Register List

Meter

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Meter Model	50	R	20	UTF8	-	
Serial Number	70	R	2	UInt32	-	
Firmware Version	72	R	1	UInt16	-	DLF format: X.Y.ZTT
Date time	73	R/WC	4	Date time	-	Date/Time Reg.73: Year00-99 (year from 2000 to 2099) Reg.74: Month (b15:b8), day (b7:b0)

						Reg. 75: Hour (b15:b8) ,Minute (b7:b0) Reg. 76: Millisecond

Communications

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Address	80	R/WC	1	UInt16	-	1-247
Baud Rate	81	R/WC	1	UInt16	-	0=1200 1=2400 2=4800 3=9600 4=19200 5=38400 6=57600
Parity	82	R/WC	1	UInt16	-	0 = ODD 1 = EVEN 2 = None

Power System

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Wiring Type	90	R/WC	1	UInt16	-	0 = 1PH2W L–N 1 = 1PH2W L–L 2 = 3PH4W 3 = 3PH3W 4 = 1PH3W_LLN
Nominal Frequency	91	R/WC	1	UInt16	Hz	
VT Primary	92	R/WC	2	UInt32	V	
VT Secondary	94	R/WC	1	UInt16	V	
CT Primary	95	R/WC	2	UInt32	A	
CT Secondary	97	R/WC	1	UInt16	mV	MaxValue:333mV
Rcoil Primary	98	R/WC	2	UInt32	A	
Rcoil Secondary	100	R/WC	1	UInt16	mV	MaxValue:333mV
Voltage Connection	101	R/WC	1	UInt16	-	0 = Direct Connect 1 = 3PH3W (2 VTs) 2 = 3PH4W (3 VTs)
Current Connection	102	R/WC	1	UInt16	-	0 = Rogowski coil 1 = CT

Digital Outputs

Register	Register	Action	Size	Type	Units	Description

Alias	Address	R/WC				
Digital Output Status	150	R/WC	1	Bitmap	-	0 = Relay-Open 1 = Relay-Closed

Command Register

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Command	300	R/W	1	UInt16	-	
Parameter 001	301	R/W	1	UInt16	-	
Parameter 002	302	R/W	1	UInt16	-	
…	…	R/W	1	UInt16	-	
Parameter 123	423	R/W	1	UInt16	-	
Requested Command	424	R	1	UInt16	-	
Command Result	425	R	1	UInt16	-	0 = Valid Operation 80 = Invalid Command 81 = Invalid Parameter 82 = Invalid Number of Parameters 83= Operation Not Performed

Basic Data

Power factor ,frequency, harmonics, Current, voltage, power,

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Power Factor						
PF1	2000	R	2	Float32	-	Phase 1 Power Factor
PF2	2002	R	2	Float32	-	Phase 2 Power Factor
PF3	2004	R	2	Float32	-	Phase 3 Power Factor
PF Avg	2006	R	2	Float32	-	Average Of PF1, PF2, PF3
DPF1	2008	R	2	Float32	-	Phase 1 Displacement Power Factor
DPF2	2010	R	2	Float32	-	Phase 2 Displacement Power Factor
DPF3	2012	R	2	Float32	-	Phase 3 Displacement Power Factor
DPF Avg	2014	R	2	Float32	-	Average Of DPF1,DPF2, DPF3
Frequency						
Freq1	2016	R	2	Float32	Hz	Phase 1 Frequency
Freq2	2018	R	2	Float32	Hz	Phase 2 Frequency
Freq3	2020	R	2	Float32	Hz	Phase 3 Frequency
FreqAvg	2022	R	2	Float32	Hz	Average of Freq1, Freq2, Freq3
Harmonics Configuration						
HX harmonic times	2024	R/WC	1	UInt16	-	Range:2-52

HY harmonic times	2025	R/WC	1	UInt16	-	Range:2-52
HZ harmonic times	2026	R/WC	1	UInt16	-	Range:2-52
Current Harmonics						
I1THDx	2027	R	2	Float32	%	Phase 1 X times harmonics current distortion
I2THDx	2029	R	2	Float32	%	Phase 2 X times harmonics current distortion
I3THDx	2031	R	2	Float32	%	Phase 3 X times harmonics current distortion
ITHDx Avg	2033	R	2	Float32	%	Average of I1THDx, I2THDx, I3THDx
I1THDy	2035	R	2	Float32	%	Phase 1 y times harmonics current distortion
I2THDy	2037	R	2	Float32	%	Phase 2 y times harmonics current distortion
I3THDy	2039	R	2	Float32	%	Phase 3 y times harmonics current distortion
ITHDy Avg	2041	R	2	Float32	%	Average of U1THDy, U2THDy, U3THDy
I1THDz	2043	R	2	Float32	%	Phase 1 z times harmonics current distortion
I2THDz	2045	R	2	Float32	%	Phase 2 z times harmonics current distortion
I3THDz	2047	R	2	Float32	%	Phase 3 z times harmonics current distortion
ITHDz Avg	2049	R	2	Float32	%	Average of U1THDz, U2THDz, U3THDz
I1THD	2051	R	2	Float32	%	Phase 1 total harmonics current distortion
I2THD	2053	R	2	Float32	%	Phase 2 total harmonics current distortion
I3THD	2055	R	2	Float32	%	Phase 3 total harmonics current distortion
ITHD Avg	2057	R	2	Float32	%	Average of U1THD, U2THD, U3THD
I1THx	2059	R	2	Float32	V	Phase 1 x times harmonics current
I2THx	2061	R	2	Float32	V	Phase 2 x times harmonics current
I3THx	2063	R	2	Float32	V	Phase 3 x times harmonics current
ITHx Avg	2065	R	2	Float32	V	Average of U1THx, U2THx, U3THx
I1THy	2067	R	2	Float32	V	Phase 1 y times harmonics current
I2THy	2069	R	2	Float32	V	Phase 2 y times harmonics current
I3THy	2071	R	2	Float32	V	Phase 3 y times harmonics current
ITHy Avg	2073	R	2	Float32	V	Average of U1THy, U2THy, U3THy
I1THz	2075	R	2	Float32	V	Phase 1 z times harmonics current
I2THz	2077	R	2	Float32	V	Phase 2 z times harmonics current
I3THz	2079	R	2	Float32	V	Phase 3 z times harmonics current

ITHz Avg	2081	R	2	Float32	V	Average of U1THz, U2THz, U3THz
Voltage Harmonics						
U1THDx	2083	R	2	Float32	%	Phase 1 X times harmonics voltage distortion
U2THDx	2085	R	2	Float32	%	Phase 2 X times harmonics voltage distortion
U3THDx	2087	R	2	Float32	%	Phase 3 X times harmonics voltage distortion
UTHDx Avg	2089	R	2	Float32	%	Average of U1THDx, U2THDx, U3THDx
U1THDy	2091	R	2	Float32	%	Phase 1 y times harmonics voltage distortion
U2THDy	2093	R	2	Float32	%	Phase 2 y times harmonics voltage distortion
U3THDy	2095	R	2	Float32	%	Phase 3 y times harmonics voltage distortion
UTHDy Avg	2097	R	2	Float32	%	Average of U1THDy, U2THDy, U3THDy
U1THDz	2099	R	2	Float32	%	Phase 1 z times harmonics voltage distortion
U2THDz	2101	R	2	Float32	%	Phase 2 z times harmonics voltage distortion
U3THDz	2103	R	2	Float32	%	Phase 3 z times harmonics voltage distortion
UTHDz Avg	2105	R	2	Float32	%	Average of U1THDz, U2THDz, U3THDz
U1THD	2107	R	2	Float32	%	Phase 1 total harmonics voltage distortion
U2THD	2109	R	2	Float32	%	Phase 2 total harmonics voltage distortion
U3THD	2111	R	2	Float32	%	Phase 3 total harmonics voltage distortion
UTHD Avg	2113	R	2	Float32	%	Average of U1THD, U2THD, U3THD
U1THx	2115	R	2	Float32	V	Phase 1 x times harmonics voltage
U2THx	2117	R	2	Float32	V	Phase 2 x times harmonics voltage
U3THx	2119	R	2	Float32	V	Phase 3 x times harmonics voltage
UTHx Avg	2121	R	2	Float32	V	Average of U1THx, U2THx, U3THx
U1THy	2123	R	2	Float32	V	Phase 1 y times harmonics voltage
U2THy	2125	R	2	Float32	V	Phase 2 y times harmonics voltage
U3THy	2127	R	2	Float32	V	Phase 3 y times harmonics voltage
UTHy Avg	2129	R	2	Float32	V	Average of U1THy, U2THy, U3THy
U1	2131	R	2	Float32	V	Phase 1 Voltage
U2	2133	R	2	Float32	V	Phase 2 Voltage
U3	2135	R	2	Float32	V	Phase 3 Voltage
Voltage Avg	2137	R	2	Float32	V	Average of U1, U2, U3
Current						

I1	2139	R	2	Float32	A	Phase 1 Current
I2	2141	R	2	Float32	A	Phase 2 Current
I3	2143	R	2	Float32	A	Phase 3 Current
Current Avg	2145	R	2	Float32	A	Average of I1, I2, I3
Voltage						
U1	2147	R	2	Float32	V	Phase 1 Voltage
U2	2149	R	2	Float32	V	Phase 2 Voltage
U3	2151	R	2	Float32	V	Phase 3 Voltage
Voltage Avg	2153	R	2	Float32	V	Average of U1, U2, U3
Power						
P1	2155	R	2	Float32	kW	Active Power Phase 1
P2	2157	R	2	Float32	kW	Active Power Phase 1
P3	2159	R	2	Float32	kW	Active Power Phase 1
PTotal	2161	R	2	Float32	kW	Total Active Power
FQ1	2163	R	2	Float32	kVAR	Fundamental Reactive Power Phase 1
FQ2	2165	R	2	Float32	kVAR	Fundamental Reactive Power Phase 2
FQ3	2167	R	2	Float32	kVAR	Fundamental Reactive Power Phase 3
FQTotal	2169	R	2	Float32	kVAR	Total Fundamental Reactive Power
S1	2171	R	2	Float32	kVA	Apparent Power Phase 1
S2	2173	R	2	Float32	kVA	Apparent Power Phase 2
S3	2175	R	2	Float32	kVA	Apparent Power Phase 3
STotal	2177	R	2	Float32	kVA	Total Apparent Power

Energy

Most energy values are available in both unsigned 64-bit integer and 32-bit floating point format.

Energy values – 64-bit integer						
Register Alias	**Register Address**	**Action R/WC**	**Size**	**Type**	**Units**	**Description**
Active Energy						
EP1Imp	3000	R	4	UInt64	Wh	Active Energy Import Phase 1
EP2Imp	3004	R	4	UInt64	Wh	Active Energy Import Phase 2
EP3Imp	3008	R	4	UInt64	Wh	Active Energy Import Phase 3
EPImp	3012	R	4	UInt64	Wh	Total Active Energy Import
EP1Exp	3016	R	4	UInt64	Wh	Active Energy Export Phase 1
EP2Exp	3020	R	4		Wh	Active Energy Export Phase 2

				UInt64		
EP3Exp	3024	R	4	UInt64	Wh	Active Energy Export Phase 3
EPExp	3028	R	4	UInt64	Wh	Total Active Energy Export
Reactive Energy						
EQ1Imp	3032	R	4	UInt64	VARh	Total Reactive Energy Import
EQ2Imp	3036	R	4	UInt64	VARh	Total Reactive Energy Import
EQ3Imp	3040	R	4	UInt64	VARh	Total Reactive Energy Import
EQImp	3044	R	4	UInt64	VARh	Total Reactive Energy Import
EQ1Exp	3048	R	4	UInt64	VARh	Total Reactive Energy Export
EQ2Exp	3052	R	4	UInt64	VARh	Total Reactive Energy Export
EQ3Exp	3056	R	4	UInt64	VARh	Total Reactive Energy Export
EQExp	3060	R	4	UInt64	VARh	Total Reactive Energy Export
Apparent Energy						
ES1Imp	3064	R	4	UInt64	VAh	Total Apparent Energy Import
ES2Imp	3068	R	4	UInt64	VAh	Total Apparent Energy Import
ES3Imp	3072	R	4	UInt64	VAh	Total Apparent Energy Import
ESImp	3076	R	4	UInt64	VAh	Total Apparent Energy Import
ES1Exp	3080	R	4	UInt64	VAh	Total Apparent Energy Export
ES2Exp	3084	R	4	UInt64	VAh	Total Apparent Energy Export
ES3Exp	3088	R	4	UInt64	VAh	Total Apparent Energy Export
ESExp	3092	R	4	UInt64	VAh	Total Apparent Energy Export

Energy values – 32-bit floating point

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Active Energy						
EP1Imp	4000	R	2	Float32	Wh	Active Energy Import Phase 1
EP2Imp	4002	R	2	Float32	Wh	Active Energy Import Phase 2
EP3Imp	4004	R	2	Float32	Wh	Active Energy Import Phase 3
EPImp	4006	R	2	Float32	Wh	Total Active Energy Import Phase All
EP1Exp	4008	R	2	Float32	Wh	Active Energy Export Phase 1
EP2Exp	4010	R	2	Float32	Wh	Active Energy Export Phase 2
EP3Exp	4012	R	2	Float32	Wh	Active Energy Export Phase 3
EPExp	4014	R	2	Float32	Wh	Total Active Energy Export Phase All
EP1	4016	R	2	Float32	Wh	Total Active Energy Phase 1

EP2	4018	R	2	Float32	Wh	Total Active Energy Phase 2
EP3	4020	R	2	Float32	Wh	Total Active Energy Phase 3
EPSUM	4022	R	2	Float32	Wh	Total Active Energy Phase All
Reactive Energy						
EQ1Imp	4024	R	2	Float32	VARh	Reactive Energy Import Phase 1
EQ2Imp	4026	R	2	Float32	VARh	Reactive Energy Import Phase 2
EQ3Imp	4028	R	2	Float32	VARh	Reactive Energy Import Phase 3
EQImp	4030	R	2	Float32	VARh	Total Reactive Energy Import Phase All
EQ1Exp	4032	R	2	Float32	VARh	Reactive Energy Export Phase 1
EQ2Exp	4034	R	2	Float32	VARh	Reactive Energy Export Phase 2
EQ3Exp	4036	R	2	Float32	VARh	Reactive Energy Export Phase 3
EQExp	4038	R	2	Float32	VARh	Total Reactive Energy Export Phase All
EQ1	4040	R	2	Float32	VARh	Total Reactive Energy Phase 1
EQ2	4042	R	2	Float32	VARh	Total Reactive Energy Phase 2
EQ3	4044	R	2	Float32	VARh	Total Reactive Energy Phase 3
EQSUM	4046	R	2	Float32	VARh	Total Reactive Energy Phase All
Apparent Energy						
ES1Imp	4048	R	2	Float32	VAh	Apparent Energy Import Phase 1
ES2Imp	4050	R	2	Float32	VAh	Apparent Energy Import Phase 2
ES3Imp	4052	R	2	Float32	VAh	Apparent Energy Import Phase 3
ESImp	4054	R	2	Float32	VAh	Total Apparent Energy Import Phase All
ES1Exp	4056	R	2	Float32	VAh	Apparent Energy Export Phase 1
ES2Exp	4058	R	2	Float32	VAh	Apparent Energy Export Phase 2
ES3Exp	4060	R	2	Float32	VAh	Apparent Energy Export Phase 3
ESExp	4062	R	2	Float32	VAh	Total Apparent Energy Export Phase All
ES1	4064	R	2	Float32	VAh	Total Apparent Energy Phase 1
ES2	4066	R	2	Float32	VAh	Total Apparent Energy Phase 2
ES3	4068	R	2	Float32	VAh	Total Apparent Energy Phase 3
ESSUM	4070	R	2	Float32	VAh	Total Apparent Energy Phase All

Harmonics calculations

The power quality analysis values use the following abbreviations:

• Fundamental phase current rms: I1

• Fundamental phase voltage rms: V1
• Total harmonic distortion of the phase current

• Total harmonic distortion of the phase voltage

• Harmonic distortion on the phase current

$$HD_{I_x} = \frac{I_x}{I_1}, x = 2, 3, \ldots, N$$

$$HD_{I_y} = \frac{I_y}{I_1}, y = 2, 3, \ldots, N$$

$$HD_{I_z} = \frac{I_z}{I_1}, z = 2, 3, \ldots, N$$

• Harmonic distortion on the phase voltage

$$HD_{V_x} = \frac{V_x}{V_1}, x = 2, 3, \ldots, N$$

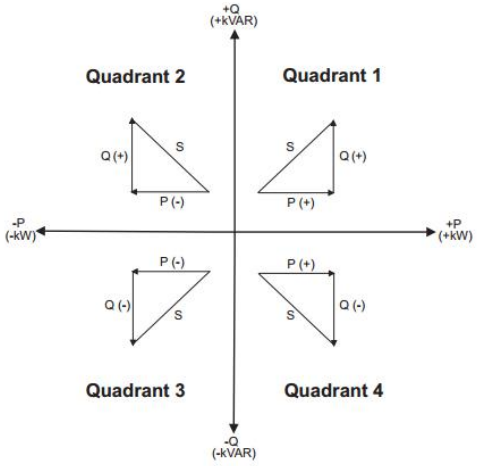
$$HD_{V_y} = \frac{V_y}{V_1}, y = 2, 3, \ldots, N$$

$$HD_{V_z} = \frac{V_z}{V_1}, z = 2, 3, \ldots, N$$

Power, energy and power factor

Power and the PQ coordinate system

The meter uses the values of real power (P) and reactive power (Q) on the PQ coordinate system to calculate apparent power



Power flow

Positive power flow P(+) and Q(+) means power is flowing from the power source towards the load. Negative power flow P(-) and Q(-) means power is flowing from the load towards the power source.

Energy delivered (imported) / energy received (exported)

The meter interprets energy delivered (imported) or received (exported) according to the direction of real power (P) flow.Energy delivered (imported) means positive real power flow (+P) and energy received(exported) means negative real power flow (-P).

Power factor (PF)

Power factor (PF) is the ratio of real power (P) to apparent power (S), and is a number between 0 and 1. An ideal, purely resistive load has no reactive components, so its power factor is one (PF = 1, or unity power factor). A purely inductive or capacitive load no resistive components, so its power factor is zero (PF = 0).

True PF and displacement PF

The meter supports true power factor and displacement power factor values:

• True power factor includes harmonic content(PF).

• Displacement power factor only considers the fundamental frequency(DPF).

PF sign convention

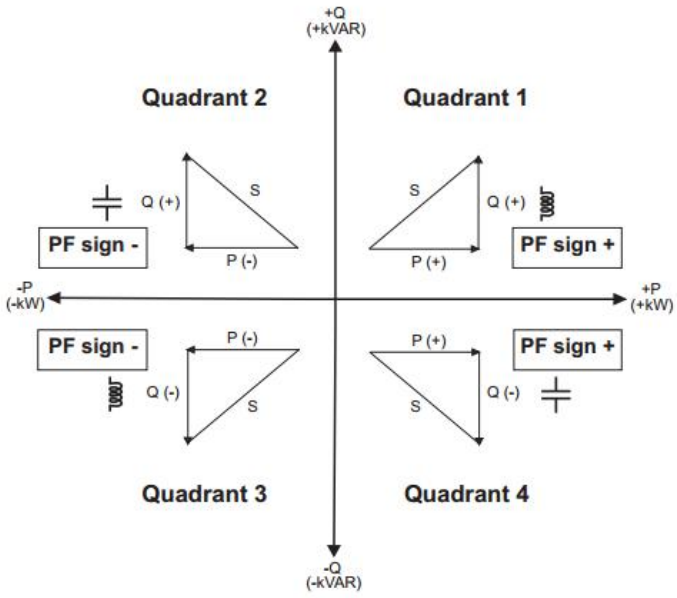
The meter shows positive or negative power factor according to IEC standards.

PF sign in IEC mode

The meter correlates power factor sign (PF sign) with the direction of real power (P)flow.

• For positive real power (+P), the PF sign is positive (+).

• For negative real power (-P), the PF sign is negative (-).



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