

PQTH

Технические характеристики

По вопросам продаж и поддержки обращайтесь:

Алматы (7273)495-231	Казань (843)206-01-48	Новокузнецк (3843)20-46-81	Смоленск (4812)29-41-54
Архангельск (8182)63-90-72	Калининград (4012)72-03-81	Новосибирск (383)227-86-73	Сочи (862)225-72-31
Астрахань (8512)99-46-04	Калуга (4842)92-23-67	Омск (3812)21-46-40	Ставрополь (8652)20-65-13
Барнаул (3852)73-04-60	Кемерово (3842)65-04-62	Орел (4862)44-53-42	Сургут (3462)77-98-35
Белгород (4722)40-23-64	Киров (8332)68-02-04	Оренбург (3532)37-68-04	Тверь (4822)63-31-35
Брянск (4832)59-03-52	Краснодар (861)203-40-90	Пенза (8412)22-31-16	Томск (3822)98-41-53
Владивосток (423)249-28-31	Красноярск (391)204-63-61	Пермь (342)205-81-47	Тула (4872)74-02-29
Волгоград (844)278-03-48	Курск (4712)77-13-04	Ростов-на-Дону (863)308-18-15	Тюмень (3452)66-21-18
Вологда (8172)26-41-59	Липецк (4742)52-20-81	Рязань (4912)46-61-64	Ульяновск (8422)24-23-59
Воронеж (473)204-51-73	Магнитогорск (3519)55-03-13	Самара (846)206-03-16	Уфа (347)229-48-12
Екатеринбург (343)384-55-89	Москва (495)268-04-70	Санкт-Петербург (812)309-46-40	Хабаровск (4212)92-98-04
Иваново (4932)77-34-06	Мурманск (8152)59-64-93	Саратов (845)249-38-78	Челябинск (351)202-03-61
Ижевск (3412)26-03-58	Набережные Челны (8552)20-53-41	Севастополь (8692)22-31-93	Череповец (8202)49-02-64
Иркутск (395)279-98-46	Нижний Новгород (831)429-08-12	Симферополь (3652)67-13-56	Ярославль (4852)69-52-93
Россия (495)268-04-70	Киргизия (996)312-96-26-47	Казахстан (7172)727-132	

Energy Management Modular Smart Power Quality Transducer Type PQT-H



- Up to 12 optional digital inputs (sync function, remote digital input control)
- Up to 16 optional digital outputs (pulse, alarm, remote control)
- 16 freely configurable alarms with OR/AND logic linkable with up to 4 relay outputs and up to 16 open collector outputs
- Up to 8 optional analogue outputs (+20mA, +10VDC, +/- 5mA)
- Universal power supply: 18-60VAC/VDC, 90-260 VAC/VDC
- Protection degree: IP 20

- Class 0.2 (current/voltage)
- ARM® powered
- Measurement of single phase and system instantaneous variables: W, var, VA, PF, VLL, VLN, A_L, A_n, Hz, THD, ASY VLL, ASY VLN (for all measurements max, min, dmd/AVG and max dmd/AVG values)
- Measured energies (imported/exported): kWh and kvarh
- Current and voltage inputs with autoranging capability
- Instantaneous variable in IEEE-754 floating point format
- Total and partial energies unsigned 64bit data format
- Energy measurements according to ANSI C12.20, CA 0.5, EN62053-22 CL 0.5S and ANSI C12.1, EN62053-23 CL 2
- 4 total 3-phase, 48 partial 3-phase and 12 total single phase independent energy meters to be used as single, dual, multi-time tariff management
- Harmonic distortion analysis (FFT) up to the 63rd harmonic with numeric indication (current and voltage)
- Harmonics source detection
- Data stamping of up to 10,000 events: alarm, min, max, digital input status, digital output status as remote control, resets
- 3 independent communication ports: optional RS 422/485 serial port, optional RS232 + real time clock function (with back-up), optional Ethernet port
- MODBUS RTU and TCP, JBUS protocol, iFIX SCADA compatibility
- Real time clock function (without back-up)

Product Description

3-phase utility grade power quality transducer. Particularly recommended for the measurement of the main electrical variables. Housing for DIN rail mounting. RS485/RS232 commu-

nication ports, Ethernet port, pulse and alarm outputs available on request. Parameters programming and data reading by means of PqtHSoft.

How to order

PQT-H see next page

How to order

PqtHSoft

Parameters programming and data reading by means of PqtHSoft.

Modules Combination

Description	Part N.	Slot A	Slot B	Slot C	Slot D	Slot E
PQT-H base	AD2020					
Power supply (18-60VAC/DC)	AP1021					
Power supply (90-260VAC/DC)	AP1020					
Measuring input (AV5: 400/690VL-L)	AQ2030					
Measuring input (AV6: 120/208VL-L)	AQ2031					
RS485 port (9 600 bps)	AR1034		1-port			
RS485 port (115,200 bps)	AR2040		1-port			
Ethernet/Internet port	AR1061	1-port				
Analogue output (20mA DC)	AO2050	2-out	2-out			
Analogue output (10V DC)	AO2051	2-out	2-out	2-out	2-out	
Analogue output (+/-5mA DC)	AO2052	2-out	2-out	2-out	2-out	
Relay output	AO1058	1-out	1-out	1-out	1-out	
Relay output	AO1035			2-out	2-out	
Open collector output	AO1059	1-out	1-out	1-out	1-out	
Open collector output	AO1036	2-out	2-out	2-out	2-out	
Open collector output	AO1037	4-out	4-out	4-out	4-out	
Digital inputs	AQ1038	3-in	3-in	3-in	3-in	
Digital inputs + Aux	AQ1042	3-in	3-in	3-in	3-in	
RS232 port + RTC (9 600 bps)	AR1039					1-port



How to order PQT-H

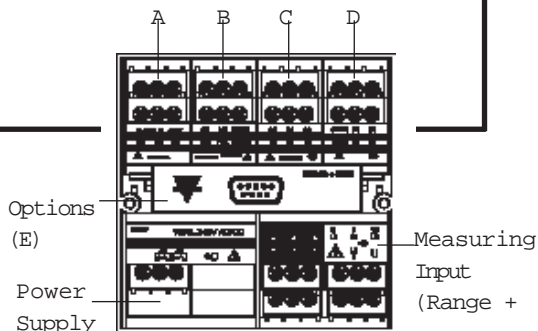
Ordering key (fully assembled instrument):

PQT-H AV53 H XX XX XX XX XX

Description	Ch	Part No.	Legend
Model			
PQT-H base		AD2020	PQT-H
Range code + system (measuring inputs)			
400/690VL-L 1/5A (10A)		AQ2030	AV5.3
120/208VL-L 1/5A (10A)		AQ2031	AV6.3
Power supply			
18-60VAC/DC power supply		AP1021	L
90-260VAC/DC power supply		AP1020	H
SLO A			
None			XX
Ethernet/Internet port	1	AR1061	E2
Digital inputs	3	AQ1038	D1
Digital inputs + aux	3	AQ1042	D2
Open collector output	4	AO1037	O4
Open collector output	2	AO1036	O2
Open collector output	1	AO1059	O1
Relay output	1	AO1058	R1
Analogue output 20mADC	2	AO2050	B1
Analogue output 10VDC	2	AO2051	W1
Analogue output +/-5mA	2	AO2052	B2
SLO B			
None			XX
Digital inputs	3	AQ1038	D1
Digital inputs + aux	3	AQ1042	D2
Open collector output	4	AO1037	O4
Open collector output	2	AO1036	O2
Open collector output	1	AO1059	O1
Relay output	1	AO1058	R1
Analogue output 20mADC	2	AO2050	B1
Analogue output 10VDC	2	AO2051	W1
Analogue output +/-5mA	2	AO2052	B2
RS485 9600bps	1	AR1034	S1
RS485 115200bps	1	AR2040	S2
SLO C			
None			XX
Digital inputs	3	AQ1038	D1
Digital inputs + aux	3	AQ1042	D2
Open collector output	4	AO1037	O4
Open collector output	2	AO1036	O2
Open collector output	1	AO1059	O1
Relay output	1	AO1058	R1
Relay output	2	AO1035	R2
Analogue output 10VDC	2	AO2051	W1
Analogue output +/-5mA	2	AO2052	xx
SLO D			
None			XX
Digital inputs	3	AQ1038	D1
Digital inputs + aux	3	AQ1042	D2
Open collector output	4	AO1037	O4
Open collector output	2	AO1036	O2
Open collector output	1	AO1059	O1
Relay output	1	AO1058	R1
Relay output	2	AO1035	R2
Analogue output 10VDC	2	AO2051	W1
Analogue output +/-5mA	2	AO2052	B2
OPTIONS SLO E			
Utility grade			XX
RS232 + RTC (utility grade)	1	AR1039	SX
Revenue approval. An "instrument setting" form must be properly filled up by the user.			XU
RS232+RTC + "XU" option	1	AR1039	SU

Example of which modules to order for:
PQT-H AV53 H B1 S1 R2 O2 SX

Bill of material	Ordering No.
PQT-H	AD2020
AV53 measuring inputs (400/690VL-L)	AQ2030
90-260VAC/DC power supply	AP1020
Analogue output 20mA (2 channels)	AO2050
RS485 serial port 9600 bps	AR1034
Relay output (2 channels)	AO1035
Open collector (2 channels)	AO1036
RS232 port+RTC	AR1039



Input specifications

Number of analogue inputs		Energies (@ 20°C ± 5°C, R.H. ≤ 75%)	Active: class 0.5 according to EN62053-22, ANSI C12.20 Reactive: class 2 according to EN62053-23, ANSI C12.1 In: 5A, I _{max} : 10A 0.1In: 500mA, Start-up current: 5mA Un: 400/690V _{L-L} (AV5) Un: 120/208V _{L-L} (AV6) 1% FS (FS: 100%) phase: ±2°; I _{min} : 5mA _{RMS} ; I _{max} : 15Ap; U _{min} : 30V _{RMS} ; U _{max} : 500Vp
Current	1 (1-phase; system code: 3) 3 (3-phase; system code: 3)	Harmonic distortion (@ 20°C ± 5°C, R.H. ≤ 75%)	
Voltage	1 (1-phase; system code: 3) 4 (3-phase; system code: 3)		
Digital inputs (on request)	Up to 12		
AQ1038	No. of inputs: 3 (voltage-free)		
Purpose	“dmd” measurements synchronisation. Tariff selection: energy. Contact status reading. Clock synchronisation.		
Contact measuring current	<8mA/ 17.5 to 25VDC		
AQ1042	Number of inputs: 3 + excitation output		
Purpose	“dmd” measurements synchronisation. Tariff selection: energy. Contact status reading. Clock synchronisation.		
Excitation output	16V<+Aux<24VDC Max 15mA		
Contact measuring current	15mA		
Common characteristics			
Close contact resistance	Max 1kΩ		
Open contact resistance	Min 100kΩ		
Insulation	see “Insulation between inputs and outputs” table		
Accuracy (display, RS232, RS485)	In: 5A, I _{f.s.} : 10A Un: see voltage ranges below from 0.05In to I _{max} : ±(0.2%RDG+2DGT) from 0.01In to 0.05In: ±(0.5%RDG+2DGT)		
Current (A _{L1} , A _{L2} , A _{L3}) (@20°C ± 5°C, R.H. ≤ 75%)	±0.5% RDG (0.2 to 2 In) @ 40 to 100 Hz		
Current (A _n)			
Voltage (@20°C±5°C,R.H.≤75%) range AV5:	400/690V _{L-L} AC V _{L-N} : 185 V to 460 V V _{L-L} : 320 V to 800 V ±(0.2%RDG+1DGT)		
range AV6:	120/208V _{L-L} AC V _{L-N} : 45 V to 145 V V _{L-L} : 78 V to 250 V ±(0.2%RDG+1DGT) Includes also: frequency, power supply and output load influences		
Frequency	±0.1% RDG (40 to 440 Hz)		
Active power and apparent power (@ 20°C ± 5°C, R.H. ≤ 75%)	0.05In to I _{max} , PF 1: ±(0.5%RDG+1DGT) 0.01In to 0.05In, PF 1: ±(1%RDG+1DGT) 0.1In to I _{max} , PF0.5L, PF 0.8C: ±(0.6%RDG+1DGT) 0.02In to 0.1In, PF0.5L, PF 0.8C: ±(1%RDG+1DGT)		
Reactive power (@ 20°C ± 5°C, R.H. ≤ 75%)	0.1In to I _{max} , senφ 0.5L/C: ±(2%RDG+1DGT) 0.05In to 0.1In, senφ 0.5L/C: ±(2.5%RDG+1DGT) 0.05In to I _{max} , senφ 1: ±(2%RDG+1DGT) 0.02In to 0.05In, senφ 1: ±(2.5%RDG+1DGT)		
		Temperature drift	≤200ppm/°C (AV), ≤300ppm/°C (all the other measurements)
		Sampling rate	6400 samples/s @ 50Hz 7680 samples/s @ 60Hz
		Measurement format	(serial communication) IEEE-754 32-bit floating point Unsigned 64bit (minimum resolution 1Wh)
		Measurements	Current, voltage, power, energy, power factor, frequen- cy, harmonic distortion (see “list of the variables that...”). TRMS measurement of a distorted wave (voltage/cur- rent).
		Coupling type	Direct.
		Crest factor	< 3, max 10A peak
		Input impedance	400/690V _{L-L} (AV5) 120/208V _{L-L} (AV6) Current
			1.77 MΩ ±5% 885 kΩ ±5% ≤ 0.01Ω
		Frequency	40 to 440 Hz
		Overload protection	(max values)
		Continuous voltage/current	AV5: 460V _{L-N} , 800V _{LL} /10A AV6: 145V _{L-N} , 250V _{LL} /10A
		For 500ms: voltage/current	AV5: 800V _{L-N} , 1380V _{LL} /36A AV6: 240V _{L-N} , 416V _{LL} /36A



Software functions

<p>Password</p> <p>1st level 2nd level</p>	<p>Numeric code of max 4 digits from 0 to 1000; 2 protection levels of the programming data Password "0": no protection Password from 1 to 1000: all data are protected.</p>	<p>Reset</p>	<p>By means of PqtHSoft (configuration software) it is possible to reset the following data:</p> <ul style="list-style-type: none"> - all the min, max, dmd, dmd-max values. - total and partial counters. - latch alarms. - all the events.
<p>System selection</p> <p>System 1 System 2, unbalanced System 3, balanced System 3, unbalanced</p>	<p>1-phase (2 wires) 2-phase (3 wire) 3-phase (3 wires+1CT) 3-phase (3 wires) 3-phase (4 wires)</p>	<p>Data stamping Type of data</p>	<p>Alarm, min, max, digital input status, digital output status as remote control, resets. All events are stored with date (dd:mm:yy) and hour (hh:mm:ss) reference</p>
<p>Transformer ratio</p>	<p>CT up to 60 kA (6000 max) VT (PT) up to 600 kV (6000 max)</p>	<p>Number of events Data management type: Data storage type</p>	<p>Up to 10,000 FIFO Data flash</p>
<p>Filters</p> <p>Filter operating range Filtering coefficient Filter action</p>	<p>0.1 to 100% of the input electrical scale. 1 to 255 Alarms, serial outputs (fundamental variables: V, A, W and their derived ones).</p>		
<p>Alarms</p> <p>Working mode</p>	<p>"OR" or "AND" or "OR+AND" functions (see "Alarm parameter and logic" page). Freely programmable on up to 16 alarms. The alarms can be connected to any variables available in the table "List of the variables that can be connected to"</p>		

PqtHSoft parameter programming and variable reading software

<p>PqtHSoft</p> <p>Working mode</p>	<p>Multi-language software (Italian, English, France, German, Spanish) for variable reading, instrument calibration and parameters programming. The program runs under Windows /98/98SE/2000/NT/XP. Two different working modes can be selected:</p>	<p>Data Storing Data Transfer</p>	<ul style="list-style-type: none"> - management of local RS232 (MODBUS); - management of a local RS485 network (MODBUS); - In pre-formatted XLS files (Excel data base). - Manual or automatic at programmable timings.
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Time period management

Meters Total Partial and multitariff	4 (9-digit) 48 (9-digit)	Energy Meters Total energy meters	4 (+kWh, +kvarh, -kWh, -kvarh) It is possible divide each energy meter here above listed in 3 additional energy meters (1 for each phase "L1-L2-L3") 48 (for energy meters for each month "+kWh, +kvarh, -kWh, -kvarh") 16 (using digital inputs: max 4 tariffs). 48 (using the internal clock: max 12 tariffs)
Tariffs	Up to 12	Monthly energy meters	
Time periods Number of periods	Up to 24 per day Up to 100 different days per year	Partial energy meters	
Pulse output	Connectable to total and/or partial meters (multitariff)		
Energy metering recording	Consumption history by recording of the monthly energy meters (12 previous months). Recording of total and partial energy meters. Energy meter recording (EEPROM) Max. 999,999,999kWh/kvarh.		

Harmonic distortion analysis

Analysis principle	FFT	possible to know if the distortion is absorbed or generated. Note: if the system has 3 wires the angle cannot be measured.
Harmonic measurement Current Voltage	Up to the 63 rd harmonic Up to the 63 rd harmonic	
Type of harmonics	THD (VL1 and VL1-N) THD odd (VL1 and VL1-N) THD even (VL1 and VL1-N) The same for the other phases: L2, L3. THD (AL1) THD odd (AL1) THD even (AL1) The same for the other phases: L2, L3.	Harmonic details The harmonic contents is given as a numerical information: THD % / RMS value THD even % / RMS value THD odd% / RMS value single harmonics in % / RMS value
Harmonic phase angle	The instrument measures the angle between the single harmonic of "V" and the single harmonic of "I" of the same order. According to the value of the electrical angle, it is	System The harmonic distortion can be measured in single-phase, 3-wire or 4-wire systems. Tw: 0.02 sec@50Hz without filter

General Specifications

Operating temperature	-10 to +45°C (14 to 113°F) (R.H. < 90% non-condensing)	ANSI/IEEE C37.90-1989 (surge, withstand and fast transient test)
Limit range of operating temp.	-20 to +55°C (-4 to 131°F) (R.H. < 90% non-condensing)	Pulse voltage (1.2/50µs)
Storage temperature	-30 to +60°C (-22 to 140°F) (R.H. < 90% non-condensing)	Safety standards
Installation category	III	IEC60664, IEC61010-1 EN60664, EN61010-1
Pollution degree	2	Measurement standards
Altitude	up to 2000m (6560 feet) above sea-level	IEC60688, EN60688, EN62053-22, EN62053-23, ANSI C12.20, ANSI C12.1
Insulation reference voltage	300 V _{RMS} to ground (AV5 input)	Approvals
Dielectric strength	4kVAC _{RMS} (for 1 min)	CE, cURus and CSA
Noise Rejection CMRR	100 dB, 48 to 62 Hz	Connections 5(6) A
EMC		Screw-type max. 2.5 mm ² wires (2x 1.5mm ²) Max. screws tightening torque 0.5 Nm
Emissions	EN61000-6-3, EN60688 residential environment, commerce and light industry	Housing
Immunity	EN61000-6-2 industrial environment.	Dimensions Material
		90x90x140 mm ABS, self-extinguishing: UL 94 V-0
		Protection degree
		IP20
		Weight
		Approx. 600 g (packing included)

Supply specifications

AC/DC voltage	90 to 260V (standard) 18 to 60V (on request)	Power consumption	≤ 30VA/12W (90 to 260V) ≤ 20VA/12W (18 to 60V)
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Revenue approval settings

- The access to the programming parameters via serial communication ports is locked.
- A proper "instrument settings" form must be filled up by the user before equipment supplying.
- PQT-H is supplied with the desired modules plugged and sealed in the proper slots.
- PQT-H fulfils:
 - the ANSI/IEEE C12.20-1998 requirements;
 - the CAN3-C17-M84 requirements;
 and can be certified according to:
 - C12.20-1998, class 0.5 (independent labs);
 - AE-0924 Industry Canada Approval.



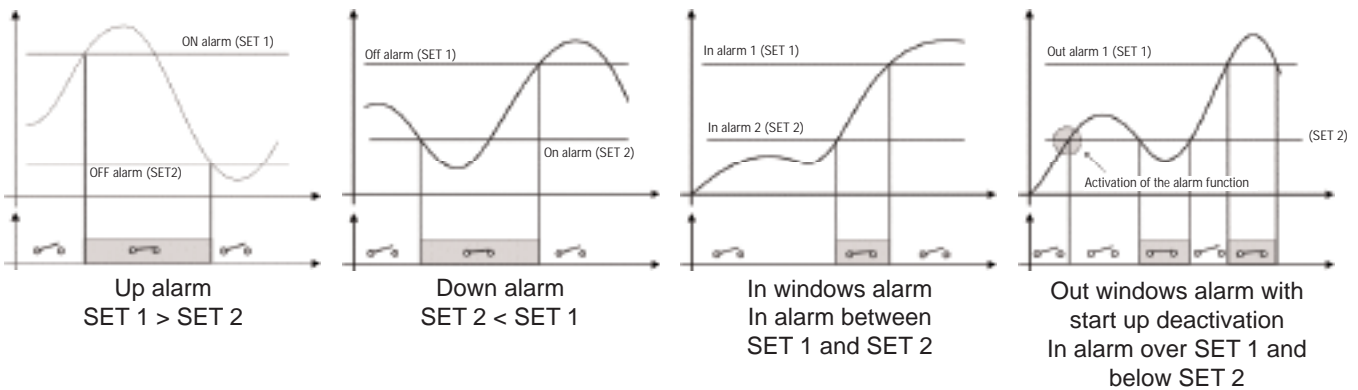
Alarm parameters and logic



- Block enable.
 - Controlled variable (VLN, ...).
 - Alarm type (up, down, window int, window ext).
 - Activation function.
 - Latch
- SET 1.
 - SET 2.
 - ON delay.
 - OFF delay
 - Logical function (AND, OR).
 - Digital output (1 to 16).

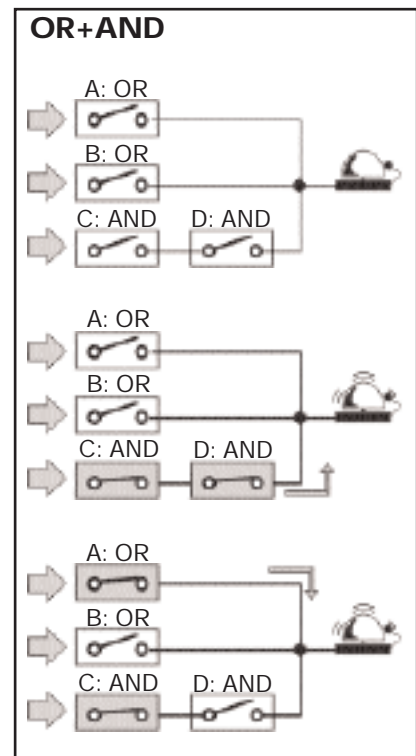
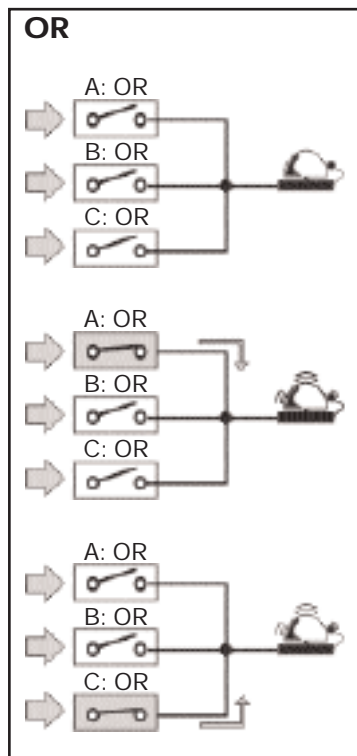
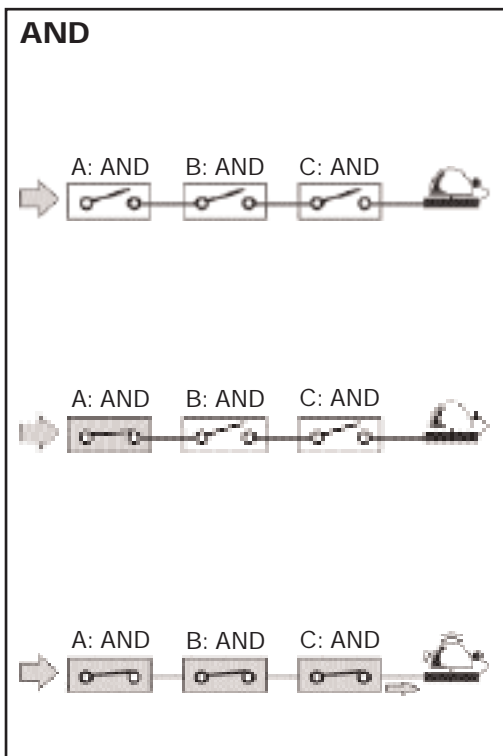


A, B, C... up to 16
parameter control blocks.



Note: any alarm working mode can be linked to the "Activation" function which disables only the first alarm after power on of the transducer. All the alarms can be used with the latch function.

AND/OR logical alarm examples:



Function Description

Input and output scaling capability. Working of the analogue outputs (y) versus input variables (x)

Figure A

The sign of measured quantity and output quantity remains the same. The output quantity is proportional to the measured quantity.

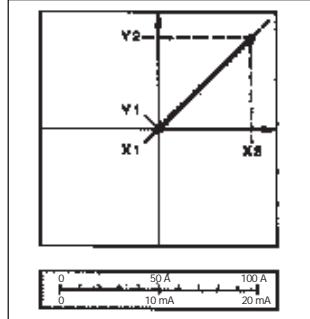


Figure D

The sign of measured quantity and output quantity remains the same. With the measured quantity being zero, the output quantity already has the value $Y1 = 0.2 Y2$. Live zero output.

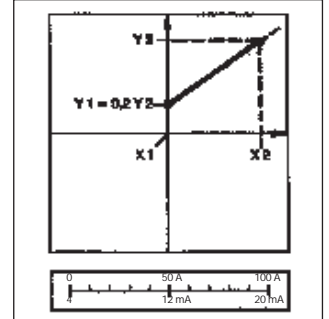


Figure B

The sign of measured quantity and output quantity changes simultaneously. The output quantity is proportional to the measured quantity.

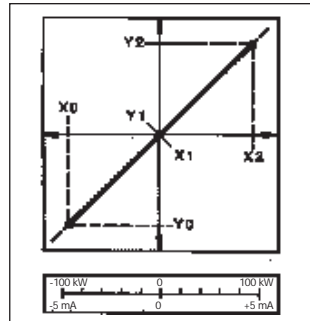


Figure E

The sign of the measured quantity changes but the one of the output quantity remains the same. The output quantity steadily increases from value $X1$ to value $X2$ of the measured quantity.

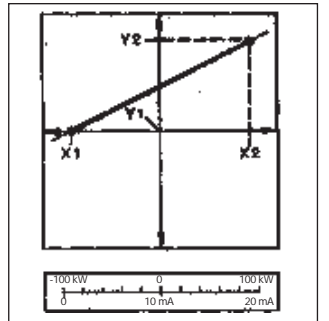


Figure C

The sign of measured quantity and output quantity remains the same. On the range $X0...X1$, the output quantity is zero. The range $X1...X2$ is delineated on the entire output range $Y0 = Y1...Y2$ and thus presented in strongly expanded form.

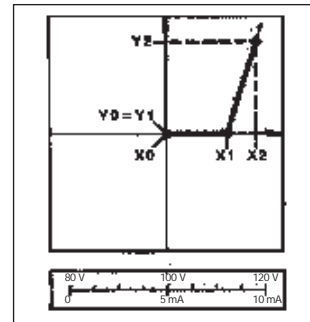
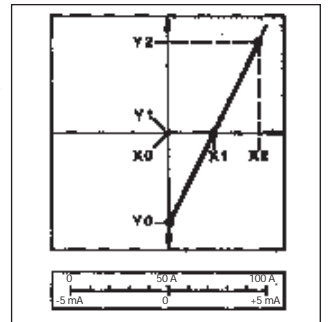


Figure F

The sign of the measured quantity remains the same, the one of the output quantity changes as the measured quantity leaves range $X0...X1$ and passes to range $X1...X2$ and vice versa.



Insulation between inputs and outputs

	Meas. /digital inputs	Relay output	Open collector output	Analogue out. 10V, 20mA	Analogue out. ±5mA	AR1034	AR2040	AR1039	Power Supply 90-260VAC/DC	Power Supply 18-60VAC/DC
Meas. /digital inputs	-	4kV	4kV	2kV	2kV	4kV	2kV	4kV	4kV	4kV
Relay output	4kV	4kV (*)	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV
Open coll.out.	4kV	4kV	4kV (*)	4kV	4kV	4kV	4kV	4kV	4kV	4kV
Analogue out. 10V, 20mA	2kV	4kV	4kV	4kV (*)	4kV	4kV	4kV	4kV	4kV	4kV
Analogue out. ±5mA	2kV	4kV	4kV	4kV	200V (**)	4kV	4kV	4kV	4kV	4kV
AR1034	4kV	4kV	4kV	4kV	4kV	-	-	4kV	4kV	4kV
AR2040	2kV	4kV	4kV	4kV	4kV	-	-	4kV	4kV	4kV
AR1039	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV	4kV
90-260VAC/DC	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	-
18-60VAC/DC	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	-

NOTE: In case of fault of first insulation the current from the measuring inputs to the ground is lower than 2 mA.

(*) The given insulation is granted among outputs plugged in different slots. The modules equipped with two or four outputs have therefore non insulation among the outputs. (**) Insulation between the 2 outputs of the same module is 200V for 1 min.



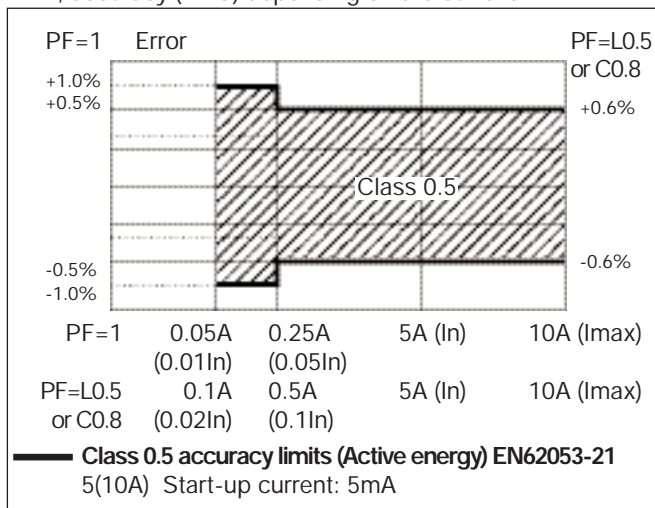
Digital outputs important note

Code	Description	Slot A	Slot B	Slot C	Slot D
AO1058	1 relay output	A0	B0	C0	D0
AO1059	1 open coll. output	A0	B0	C0	D0
AO1035	2 relay outputs	A0 A1	B0 B1	C0 C1	D0 D1
AO1036	2 open coll. outputs	A0 A1	B0 B1	C0 C1	D0 D1
AO1037	4 open coll. outputs	A1 A2 A3 A4	B1 B2 B3 B4	C1 C2 C3 C4	D1 D2 D3 D4

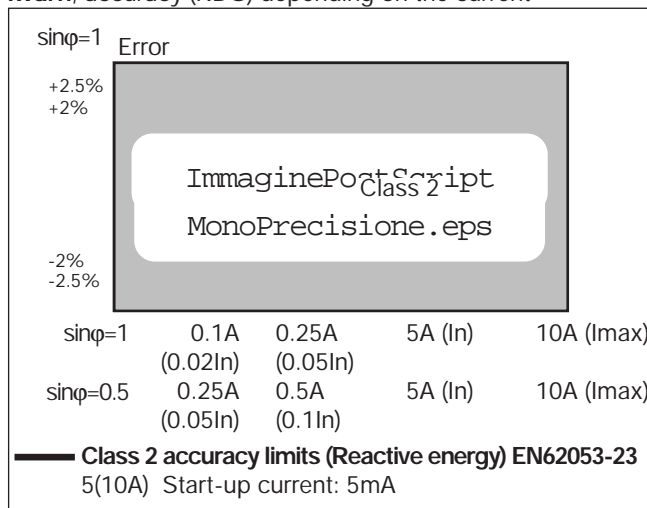
The grey-marked digital outputs are activated for a while during the instrument start-up, therefore they are not suggested for pulse output purpose.

Accuracy

kWh, accuracy (RDG) depending on the current



kvarh, accuracy (RDG) depending on the current



Used calculation formulas

Phase variables

Instantaneous effective voltage

$$V_m = \sqrt{\frac{1}{n} \sum_{i=1}^n (V_{mi})^2}$$

Instantaneous active power

$$W_1 = \frac{1}{n} \sum_{i=1}^n (V_{mi} \cdot I_{mi})$$

Instantaneous power factor

$$\cos\theta_1 = \frac{W_1}{VA_1}$$

Instantaneous effective current

$$A_1 = \sqrt{\frac{1}{n} \sum_{i=1}^n (A_{mi})^2}$$

Instantaneous apparent power

$$VA_1 = V_m \cdot A_1$$

Instantaneous reactive power

$$VAR_1 = \sqrt{(VA_1)^2 - (W_1)^2}$$

System variables

Equivalent three-phase voltage

$$V_2 = \frac{V_{21} + V_{22} + V_{23}}{3}$$

Voltage asymmetry

$$AST_{LL} = \frac{(V_{L1max} - V_{L1min})}{V_{LL} \Sigma}$$

$$AST_{LV} = \frac{(V_{LVmax} - V_{LVmin})}{V_{LV} \Sigma}$$

Three-phase reactive power

$$VAR_2 = (VAR_1 + VAR_2 + VAR_3)$$

Neutral current

$$An = \bar{A}_{L1} + \bar{A}_{L2} + \bar{A}_{L3}$$

Three-phase active power

$$W_2 = W_1 + W_2 + W_3$$

Three-phase apparent power

$$VA_2 = \sqrt{W_2^2 + VAR_2^2}$$

Three-phase power factor

$$\cos\theta_2 = \frac{W_2}{VA_2} \quad (TPF)$$

Energy metering

$$W_2 = \int_{t_1}^{t_2} P(t) dt = \Delta t \sum_{i=1}^n P_i$$

$$VAR_2 = \int_{t_1}^{t_2} Q(t) dt = \Delta t \sum_{i=1}^n Q_i$$

Where:

i= considered phase (L1, L2 or L3)
P= active power; Q= reactive power;
t₁, t₂ =starting and ending time points of consumption recording; n= time unit; Δt= time interval between two successive power measurements;
n₁, n₂ = starting and ending discrete time points of power recording

List of the variables that can be connected to:

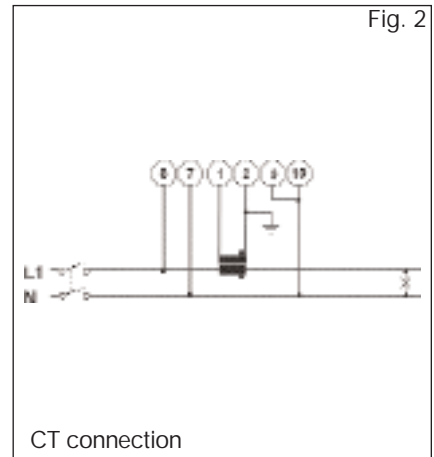
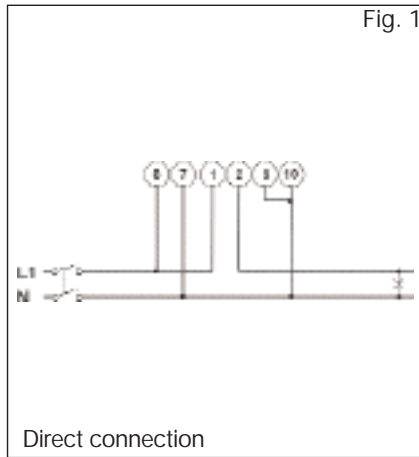
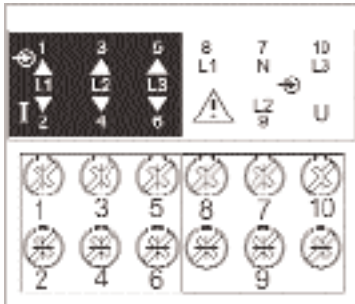
Analogue outputs (all listed variables with the only exception of energies), alarm outputs (all listed variables with the only exception of energies), pulse outputs (only energies), communication (all listed variables).

No	Variable	1-phase system	2-ph. 3-wire system	3-ph. 4-wire bal. (1 CT)	3-ph. 3-wire unbal. sys.	3-ph. 4-wire unbal. sys.	Notes
1	V L1	x	x	x	o	x	
2	V L2	o	x	x	o	x	
3	V L3	o	o	x	o	x	
4	V L-N sys	o	x	x	o	x	Sys = system = Σ
5	V L1-2	o	x	x	x	x	
6	V L2-3	o	o	x	x	x	
7	V L3-1	o	o	x	x	x	
8	V L-L sys	o	o	x	x	x	Sys = system = Σ
9	A L1	x	x	x	x	x	
10	A L2	o	x	x	x	x	
11	A L3	o	o	x	x	x	
12	An	o	x	x	o	x	An=neutral current
13	W L1	x	x	x	x	x	
14	W L2	o	x	x	x	x	
15	W L3	o	o	x	x	x	
16	W sys	o	x	x	x	x	
17	var L1	x	x	x	x	x	
18	var L2	o	x	x	x	x	
19	var L3	o	o	x	x	x	
20	var sys	o	x	x	x	x	Sys = system = Σ
21	VA L1	x	x	x	x	x	
22	VA L2	o	x	x	x	x	
23	VA L3	o	o	x	x	x	
24	VA sys	o	x	x	x	x	Sys = system = Σ
25	PF L1	x	x	x	x	x	
26	PF L2	o	x	x	x	x	
27	PF L3	o	o	x	x	x	
28	PF sys	o	x	x	x	x	Sys = system = Σ
29	Hz	x	x	x	x	x	
30	ASY VL-N	o	x	x	o	x	Asymmetry of phase-neutral
31	ASY VL-L	o	o	x	x	x	Asymmetry of phase-phase
32	THD V1	x	x	x	o	x	
33	THD V2	o	x	x	o	x	
34	THD V3	o	o	x	o	x	
35	THD V1-2	o	x	x	x	x	
36	THD V2-3	o	o	x	x	x	
37	THD V3-1	o	o	x	x	x	
38	THD A1	x	x	x	x	x	
39	THD A2	o	x	x	x	x	
40	THD A3	o	o	x	x	x	
41	THDo V1	x	x	x	o	x	
42	THDo V2	o	x	x	o	x	
43	THDo V3	o	o	x	o	x	
44	THDo V1-2	o	x	x	x	x	
45	THDo V2-3	o	o	x	x	x	
46	THDo V3-1	o	o	x	x	x	
47	THDo A1	x	x	x	x	x	
48	THDo A2	o	x	x	x	x	
49	THDo A3	o	o	x	x	x	
50	THDe V1	x	x	x	o	x	
51	THDe V2	o	x	x	o	x	
52	THDe V3	o	o	x	o	x	
53	THDe V1-2	o	x	x	x	x	
54	THDe V2-3	o	o	x	x	x	
55	THDe V3-1	o	o	x	x	x	
56	THDe A1	x	x	x	x	x	
57	THDe A2	o	x	x	x	x	
58	THDe A3	o	o	x	x	x	
59	Phase seq.	o	o	x	x	x	Phase sequence

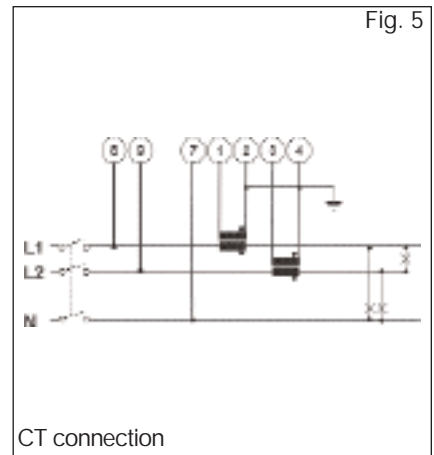
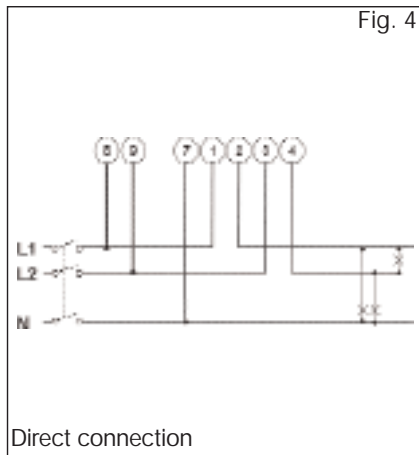
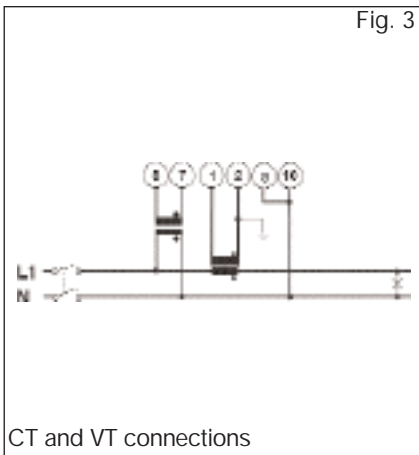
(x) = available (o) = not available

Wiring diagrams

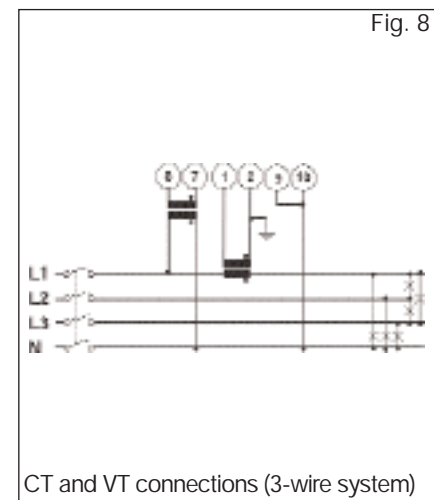
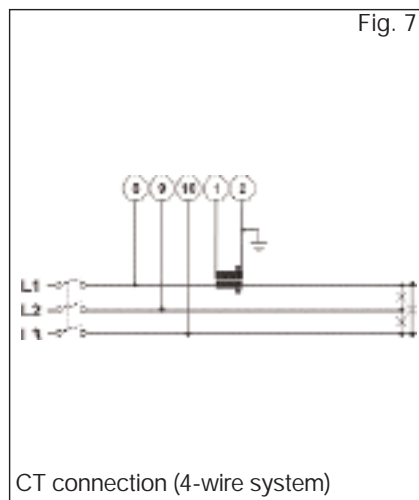
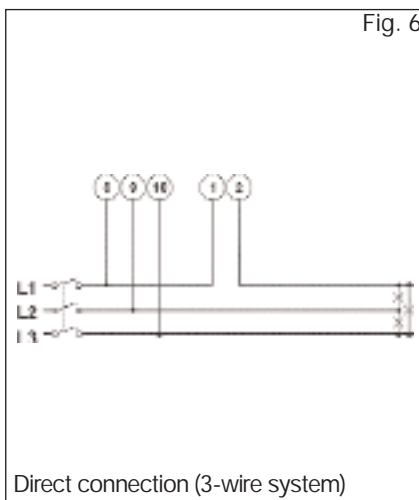
1-phase, 2-wire input connections (1P)



2-phase, 3-wire input connections (2P)

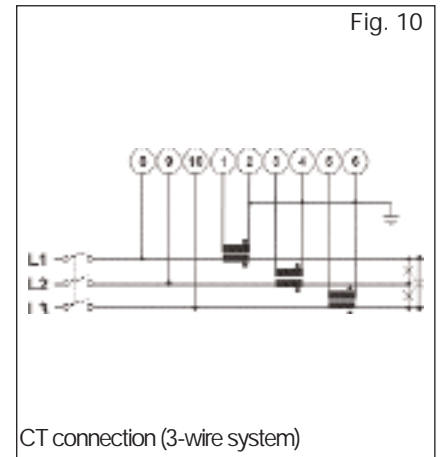
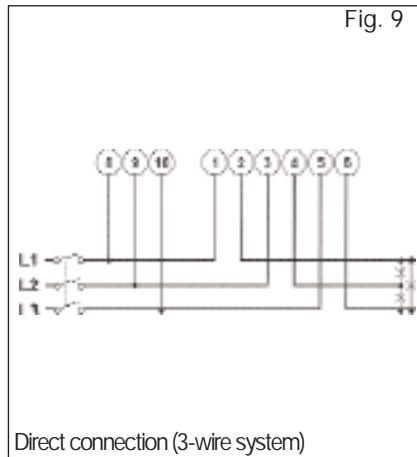
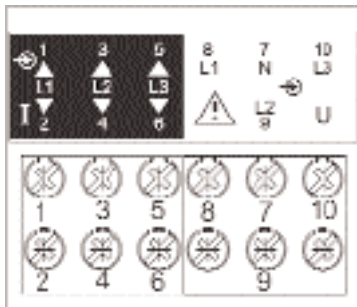


3-phase, 3 and 4-wire input connections - Balanced load (3P-1CT)

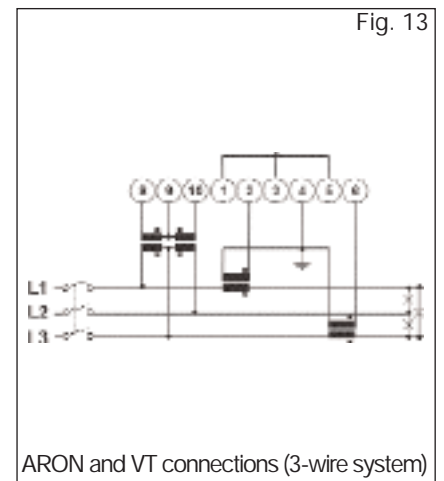
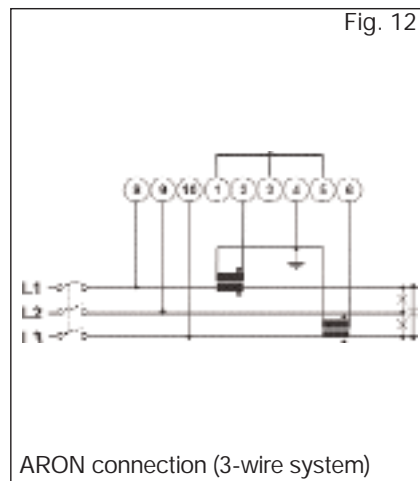
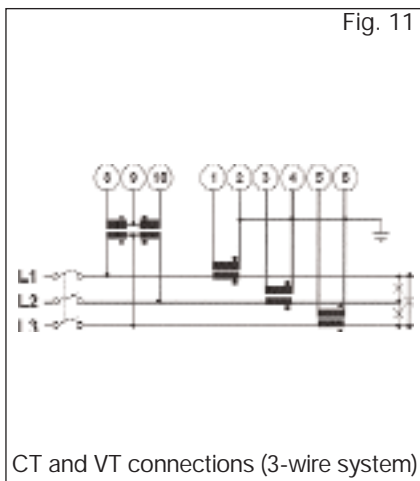


Wiring diagrams (cont.)

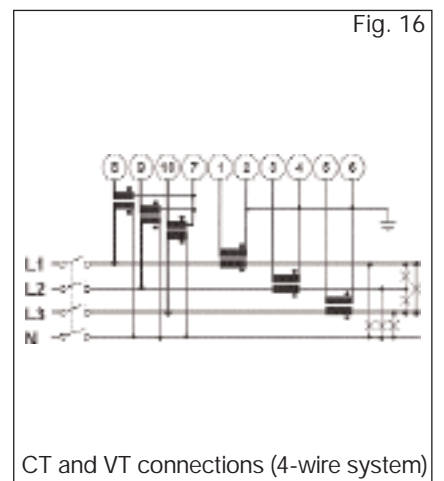
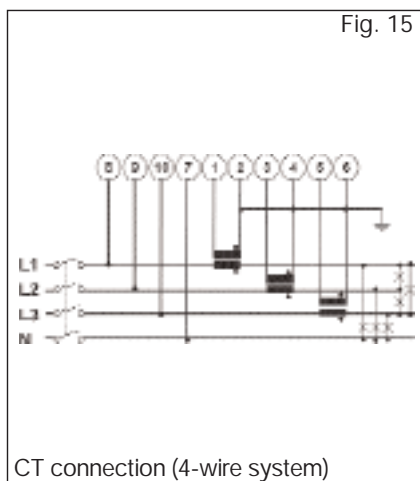
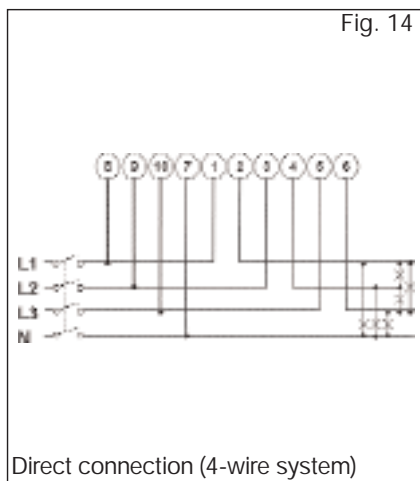
3-phase, 3-wire input connections - Unbalanced load (3P)



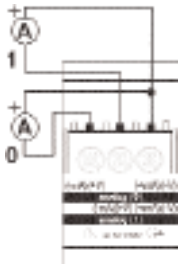
3-phase, 3-wire input connections ARON (3P)



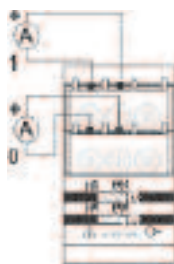
3-phase, 3 and 4 wires input connections - Unbalanced load (3p+N)



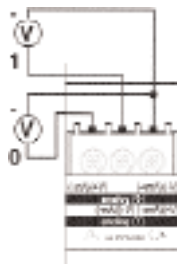
Wiring diagrams (optional modules)



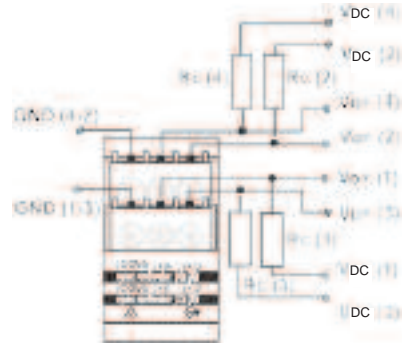
AO2050
2 analogue
outputs (0-20mA)



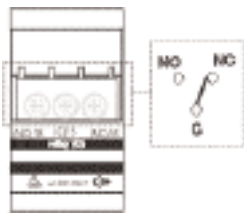
AO2052
2 analogue
outputs (+/-5mA)



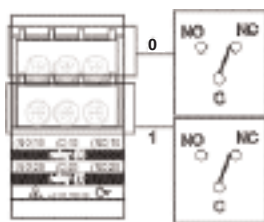
AO1051
2 analogue
outputs (10V)



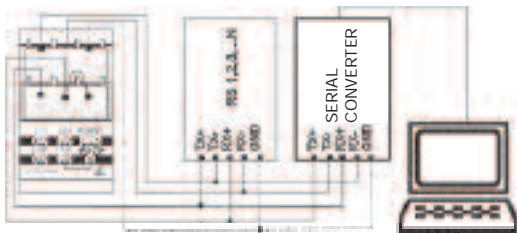
AO1037 4-open collector output connection:
This wiring diagram is valid also for the open collector module with one or two outputs.
The load resistances (RC) must be designed so that the close contact current is lower than 100mA; the VDC voltage must be lower than or equal to 30VDC.



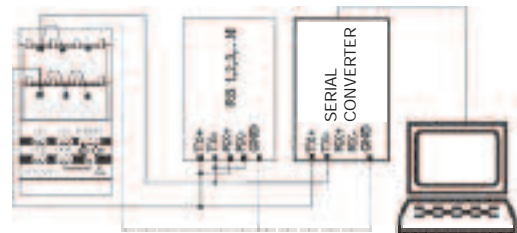
AO1058
1 relay output



AO1035
2 relay outputs



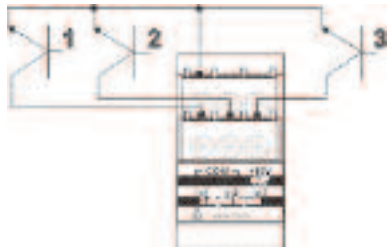
AR1034/AR2040
4-wire connection of RS485 serial port



AR1034/AR2040
2-wire connection of RS485 serial port

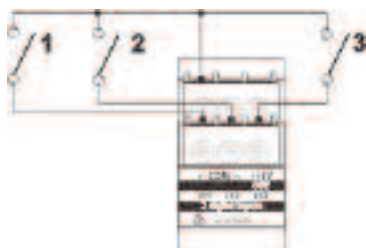
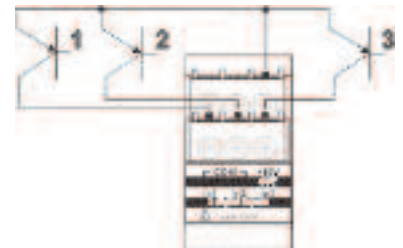
RS422/485 NOTE: additional devices provided with RS422/485 (that is RS 1, 2, 3...N) are connected in parallel. The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (RX+) and (T).

Wiring diagrams: digital input modules



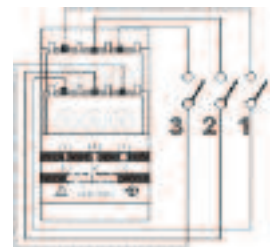
AQ1042
Connection by means of NPN transistors.

AQ1042
Connection by means of PNP transistors.

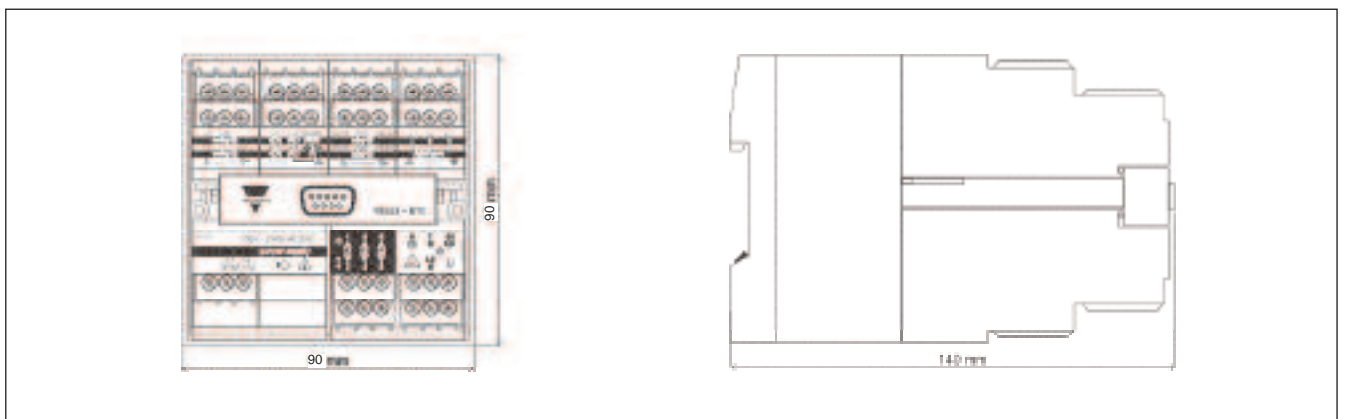


AQ1042
Connection by means of contacts.

AQ1038
Connection by means of contacts.



Dimensions



Modules

Dual analogue output modules

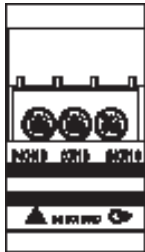


AO2050 (20mADC)
AO2051 (10VDC)



AO2052 (+/-5mADC)

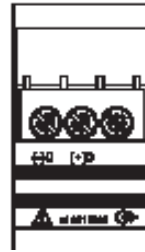
Digital output modules



AO1058
Single relay output



AO1035
Dual relay output



AO1059
Single open collector output

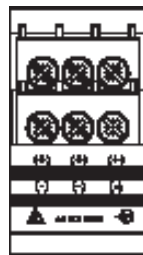


AO1036
Dual open collector output

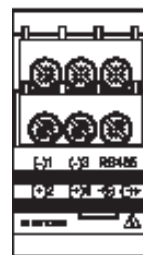
Other input/output modules



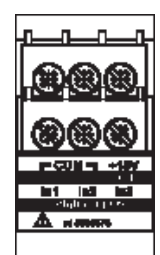
AO1037
4 open collector outputs



AO1038
3 digital inputs

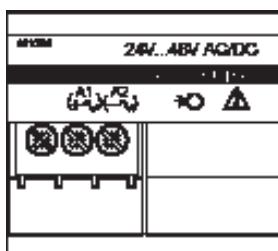


AR1034
AR2040
RS485 port

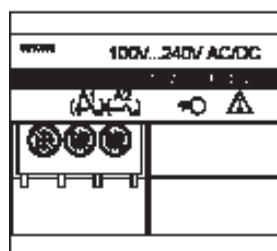


AQ1042
3 digital inputs + aux

Power supply modules



AP1021
18-60VAC/DC power supply



AP1020
90-260 VAC/DC power supply



AR1039
RS232 port + RTC

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Иркутск (395)279-98-46	Нижний Новгород (831)429-08-12	Симферополь (3652)67-13-56	Ярославль (4852)69-52-93
Россия (495)268-04-70	Киргизия (996)312-96-26-47	Казахстан (7172)727-132	