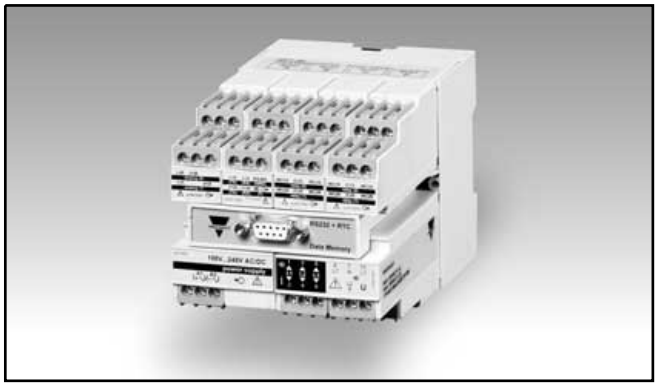
Energy Management
Modular Power Quality Transducer
Type PQT-90

CARLO GAVAZZI



- **MODBUS RTU, JBUS protocol**
- **Transmission and reception of SMS messages (variables and alarm status)**
- **Data transmission and reception by means of analogue modem**
- **Up to 4 optional pulse outputs**
- **Up to 4 optional alarm outputs**
- **Up to 4 optional analogue outputs**
- **Universal power supply: 18-60VAC/VDC, 90-260 VAC/VDC**
- **Class 0.5 (current/voltage)**
- **Universal trasducer: energy, water and gas**
- **32-bit µP-based multifunction power transducer**
- **Front size: 90x90 mm**
- **Measurement of single phase and system instantaneous variables: W, Wdmd, var, var dmd, VA, VA dmd, PF, PF avg, V_{LN}, V_{LL}, A_L, A_n, Hz, THD (for all measurements max and min values)**
- **Measured energies: kWh and kvarh on 4 quadrants**
- **Current and voltage inputs with autoranging capability**
- **48 independent energy meters to be used as single, dual, multi-time energy management**
- **Interface with watt-hour meters by means of digital inputs (+kWh, +kvarh, -kWh, -kvarh)**
- **Interface with gas and water meters by means of digital inputs (one water meter, two gas meters to be used as single or dual time management)**
- **Harmonic distortion analys (FFT) up to the 50th harmonic (current and voltage)**
- **Harmonics source detection**
- **Optional RS422/485 serial port**
- **Optional RS232 + real time clock function and 2Mb data logging of alarms, MIN/MAX events and up to 8 variables with programmable time interval.**

Product Description

Power quality transducer which can be used in 3 different operating modes:
- direct measurements for the power quality analysis (LV or MV/HV connection);
- indirect energy and power measurements by means of watt-hour meters (LV or MV/HV connection);
- direct measurements for the instantaneous variables (LV connection) and indirect measurements for the energy variables (LV or MV/HV).

It's possible to add the management of gas and water metering to all of these working modes.
Automatic transmission of SMS alarm messages.
Remote read-out from GSM mobile phones of all the instantaneous variables, the last variables available in the data logging and the energy meters.

How to order

PQT-90 AV53H XX XX XX XX X

Model
Range code
System
Power supply
Slot A
Slot B
Slot C
Slot D
Options

How to order

PqtSoft Network
PqtSoft Remote

PqtSoft Network: programm to download memory data and to manage a modem. PqtSoft Remote: programm to set all the programming parameters.

Type selection

Range code (on request)

XXX: **None**
AV5: 240/415 VAC- 1/5 AAC (max. 300 V (L-N)/ 520 V (L-L) - 6 A)
AV7: 400/690VAC - 1/5 AAC (max. 480V (L-N) / 830 V (L-L) / 6 A

Power supply

L: 18 to 60VAC/VDC
H: 90 to 260VAC/VDC

Slot A (interfacing)

XX: None
D2: 3 universal digital inputs + excitation output (16-24VDC)
A1: Single analogue output, 20mADC [1)]
A2: Single analogue output, ±5mADC [1)]
A3: Single analogue output, ±10mADC [1)]
A4: Single analogue output, ±20mADC [1)]

Slot A (interfacing cont.)

B1: Dual analogue output, 20mADC [1)]
B2: Dual analogue output, ±5mADC [1)]
B3: Dual analogue output, ±10mADC [1)]
B4: Dual analogue output, ±20mADC [1)]
V1: Single analogue output, 10VDC [1)]
V2: Single analogue output, ±1VDC [1)]
V3: Single analogue output, ±5VDC [1)]
V4: Single analogue output, ±10VDC [1)]
W1: Dual analogue output, 10VDC [1)]
W2: Dual analogue output, ±1VDC [1)]
W3: Dual analogue output, ±5VDC [1)]
W4: Dual analogue output, ±10VDC [1)]

Note: Slot A + Slot B Max 4 analogue outputs.
Slot C + Slot D max 4 digital outputs.
[1)] On request

Slot B (communication)

XX: None
S1: Serial output, RS485 multidrop, bidirectional
B1: Dual analogue output, 20mADC [1)]
B2: Dual analogue output, ±5mADC [1)]
B3: Dual analogue output, ±10mADC [1)]
B4: Dual analogue output, ±20mADC [1)]
W1: Dual analogue output, 10VDC [1)]
W2: Dual analogue output, ±1VDC [1)]
W3: Dual analogue output, ±5VDC [1)]
W4: Dual analogue output, ±10VDC [1)]

Slot C (alarm or pulse)

XX: None
R1: Single relay output (AC1-8AAC, 250VAC)
R2: Dual relay output, (AC1-8AAC, 250VAC)
O1: Single open collector output (30V/100mADC)
O2: Dual open collector output (30V/100mADC)
D1: 3 digital inputs for voltage-free contacts
D2: 3 universal digital inputs + excitation output (16-24VDC)

Slot D (alarm or pulse)

XX: None
R2: Dual relay output, (AC1-8AAC, 250VAC)
O2: Dual open collector output (30V/100mADC)
O4: Four open collector output (30V/100mADC)

Options

X: None
M: Serial port RS232+RTC+ 2Mb or Data memory to store all events, continuous record up to 8 variables and load profile W_{dmd}

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Input specifications

Number of analogue inputs	
Current	1 (1-phase; system code: 3) 3 (3-phase; system code: 3)
Voltage	1 (1-phase; system code: 3) 4 (3-phase; system code: 3)
Digital inputs	
AQ1038	No. of inputs: 3 (voltage-free)
Purpose	W_{dmd} measurement synchronization + var_{dmd} and PF_{dmd}. Interfacing with watt-hour meters (+kWh, +kvarh). Tariff selection: energy.
Contact measuring current	<8mA/ 17.5 to 25VDC
AQ1042	Number of inputs: 3 + excitation output
Purpose	W_{dmd} measurement synchronization + var_{dmd} and PF_{dmd}. Interfacing with watt-hour meters (-kWh, -kvarh) or/and measurements of gas /water m^3. Tariff selection: energy or GAS.
Excitation output	16V<+Aux<24VDC Max 15mA
Contact measuring current	15mA
Common characteristics	
Input frequency	Max 20 Hz, dutycycle 50%
Close contact resistance	Max 1kΩ
Open contact resistance	Min 100kΩ
Insulation	4000VRMS
Max. input number	6 in the configuration: AQ1038+AQ1042 or 2*AQ1042
Accuracy (display, RS232, RS485)	In: 5A, If.s.: 6A Vn: 240VL-N, Vf.s.: 300VL-N
Current (A_{L1}, A_{L2}, A_{L3})	±0.5% RDG (0.2 to 1.2 In)
(@ 25°C ± 5°C, R.H. ≤ 60%)	±5mA (0.02 to 0.2 In)
Current (A_n) @ 40 to 100 Hz	±1% RDG (0.2 to 1.2 In)
Voltage range AV5:	±0.5% RDG (from 48 to 300V_{L-N})
range AV7:	±0.5% RDG (from 80 to 480V_{L-N})
(@ 25°C ± 5°C, R.H. ≤ 60%)	Includes also: frequency, power supply and output load influences
Frequency	±0.1% RDG (40 to 440 Hz)
Active power	
(@ 25°C ± 5°C, R.H. ≤ 60%)	±0.5% (RDG + FS) (PF 0.5 L/C, 0.1 to 1.2 In, range AV5) or ±1% RDG (PF 0.5 L/C, 0.1 to 1.2 In, range AV5)
Reactive power	
(@ 25°C ± 5°C, R.H. ≤ 60%)	±0.5% (RDG + FS) (PF 0.5 L/C, 0.1 to 1.2 In, range AV5) or ±1% RDG (PF 0.5 L/C, 0.1 to 1.2 In, range AV5)
Apparent power	
(@ 25°C ± 5°C, R.H. ≤ 60%)	±0.5% (RDG + FS) (0.1 to 1.2 In, range AV5) or ±1% RDG (0.1 to 1.2 In, range AV5)
Energies	
(@ 25°C ± 5°C, R.H. ≤ 60%)	Active: class 1 according to EN61036 Reactive: class 2 according to EN61268 Ib: 5A, Imax: 6A 0.1Ib: 500mA, Start-up current: 20mA Un: 240V (AV5), 400V (AV7)
Harmonic distortion (@ 25°C ± 5°C, R.H. ≤ 60%)	1% FS (FS: 100%) phase: ±2°; Imin: 0.1Arms; Imax: 15Ap; Umin: 50V_{RMS}; Umax: 500Vp Sampling frequency: 6400 samples/s @ 50Hz
Additional errors	
Humidity	≤ 0.3% RDG, 60% to 90% R.H.
Input frequency	≤ 0.4% RDG, 62 to 400 Hz
Magnetic field	≤ 0.5% RDG @ 400 A/m
	NOTE: all accuracies are referred to measurements carried out with the analogue input module
Temperature drift	≤200ppm/°C
Sampling rate	6400 samples/s @ 50Hz
Measurements	Current, voltage, power, energy, power factor, frequency, harmonic distortion (see "Display Pages"). TRMS measurement of a distorted wave (voltage/current) .
Coupling type	Direct.
Crest factor	≤3, max. 15Ap/500Vp "AV5" (L-N), 15Ap/800Vp "AV7" (L-N)
Ranges (impedances)	
AV5	58/100 V (> 500 kΩ) - 1 AAC (≤ 0.3 VA) 58/100 V (> 500 kΩ) - 5 AAC (≤ 0.3 VA) 240 V/415 V (> 500 kΩ) - 1 AAC (≤ 0.3 VA) 240 V/415 V (> 500 kΩ) - 5 AAC (≤ 0.3 VA)
AV7	100/170 V (> 500 kΩ) - 1 AAC (≤ 0.3 VA) 100/170 V (> 500 kΩ) - 5 AAC (≤ 0.3 VA) 400/690 V (> 500 kΩ) - 1 AAC (≤ 0.3 VA) 400/690 V (> 500 kΩ) - 5 AAC (≤ 0.3 VA)
Frequency	40 to 440 Hz
Overload protection	
Continuous: voltage/current:	AV5: 300V_{L-N} / 500V_{L-L} / 6A AV7: 480V_{L-N} / 830V_{L-L} / 6A
For 1s: voltage/current:	AV5: 600V_{L-N}/1040V_{L-L}/120A AV7: 960V_{L-N}/1660V_{L-L}/120A

Output Specifications

Analogue outputs (on request)	
Number of outputs	Up to 4 (on request)
Accuracy	±0.2% f.s. (@ 25°C ±5°C, R.H. ≤60%)
Range	0 to 20 mADC, 0 to ±20 mADC 0 to ±10 mADC, 0 to ±5 mADC 0 to 10 VDC, 0 to ±10 VDC 0 to ±5 VDC 0 to ±1 VDC

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Output specifications (cont.)

Scaling factor	Programmable within the whole range of retransmission; it allows the retransmission management of all values from: 0 to 20 mADC, 0 to ±20 mADC 0 to ±10 mADC, 0 to ±5 mADC 0 to 10 VDC, 0 to ±10 VDC 0 to ±5 VDC 0 to ±1 VDC
Variables to be retransmitted	All (see table"List of the variables that can be connected to:"...)
Response time	≤ 200 ms typical (filter excluded, FFT excluded)
Ripple	≤ 1% according to IEC 60688-1 and EN 60688-1
Temperature drift	≤ 200 ppm/°C
Load: 20 mA output	≤ 600 Ω
±20 mA output	≤ 550 Ω
±10 mA output	≤ 1100 Ω
± 5 mA output	≤ 2200 Ω
10 V output	≥ 10 kΩ
±10 V output	≥ 10 kΩ
± 5 V output	≥ 10 kΩ
± 1 V output	≥ 10 kΩ
Insulation	By means of optocouplers, 4000V_{rms} output to measuring input 4000V_{rms} output to supply input
RS422/RS485 (on request)	Multidrop bidirectional (static and dynamic variables)
Connections	2 or 4 wires, max. distance 1200m, termination directly on the module
Addresses	from 1 to 255, key-pad selectable
Protocol	MODBUS RTU/JBUS
Data (bidirectional)	
Dynamic (reading only)	All variables, see also the table, "List of the connected variables".
Static (writing only)	All configuration parameters energy reset, activation of digital outputs.
Data format	1 start bit, 8 data bit, no parity/even parity/ odd parity, 1 stop bit
Baud rate	9600 bit/s
Insulation	By means of optocouplers, 4000 V_{RMS} output to measuring inputs 4000 V_{RMS} output to power supply input
RS232 (on request)	Bidirectional (static and dynamic variables)
Connections	3 wires, max. distance15m
Data format	1 start bit, 8 data bit, no parity, 1 stop bit
Baud rate	9600, 38400 bit/s
Protocol	MODBUS RTU (JBUS)
Other features	As per RS422/485
Communication by modem	
Analogue modem	For the remote communication of all the data measured and managed by PQT. External communication Modem. Recommended type: US Robotics
GSM Modem	For the transmission of SMS messages: alarms, instantaneous variables, last available variables of data logging (only average values) and energy meters. The alarm messages are given with the date and the time of the event. The type and value of the set-point can be put into the alarm message (max 99 characters). The alarms can also be transmitted automatically, while the variables can be recalled by means of special SMS question codes.
GSM kit type-tested for PQT	Siemens kit (external) model "TC35 TERMINAL" included GSM module, antenna and 230V power supply.
Digital outputs (on request)	To be used as alarms and/or retransmission of the energy metering and/or outputs remotely controlled by the serial communication port. The outputs are completely programmable independently of the type of module being used.
Pulse outputs (on request)	
Number of outputs	Up to 4
Type	From 1 to 1000 pulses programmable for k-M-G Wh, k-M-G varh, open collector (NPN transistor) V_{ON} 1.2 VDC/ max. 100 mA V_{OFF} 30 VDC max. Outputs connectable to total and/or partial energy meters
Pulse duration	220 ms (ON), ≥ 220 ms (OFF) According to DIN43864
Insulation	By means of optocouplers, 4000 V_{RMS} output to measuring inputs, 4000 V_{RMS} output to power supply input.
Notes	The outputs can be either open collector type or relay type (for the relay output refer to the specifications described in the "alarm outputs" section).

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Output specifications (cont.)

Alarm outputs (on request)	
Number of set-points	Up to 4, independent
Alarm type	Up alarm, down alarm with or without latch , phase asymmetry, phase loss, neutral loss.
Monitoring of the variable	All the variables listed at the paragraph “List of the connectable variables”.
Set-point adjustment	0 to 100% of the electrical scale
Hysteresis	0 to 100% of the electrical scale
On-time delay	0 to 255 s
Relay status	Selectable: normally de-energized or normally energized
Output type	Relay, SPDT AC 1-8A, 250VAC DC 12-5A, 24VDC AC 15-2.5A, 250VAC DC 13-2.5A, 24VDC
Min. response time	≤ 150 ms, filters excluded, FFT excluded, setpoint on-time delay: ”0s”
Insulation	4000 V_{RMS} output to measuring input, 4000 V_{RMS} output to power supply input.
Notes	The outputs can be either relay type or open collector type (for this latter one, see the specifications mentioned in the pulse outputs)

Software functions

Operating mode selection	- Direct measurements for the power quality analysis (LV or MV/HV connection); - Indirect energy and power measurements by means of watt-hour meters (LV or MV/HV connection); - Direct measurements for the instantaneous variables (LV connection) and indirect measurements for the energy variables (LV or MV/HV). It’s possible to add the management of gas and water metering to all of these working modes.
Pulse weight	Water/gas meter inputs: selectable from 1 to 10000 pulses/m^3, energy from 1 to 10000.00 imp/kWh/kvarh
Transformer ratio	Up to 6000 (CT up to 30kA) Up to 6000 (VT up to 600kV)
Filters	
Filter operating range	0 to 99.9% of the input electrical scale.
Filtering coefficient	1 to 255
Filter action	Display, alarms, serial outputs (fundamental variables: V, A, W and their derived ones).
Event logging	Only with RS232+RTC module+ Data memory
Type of data	Alarms and max./min. (max. 480 events) stored with date (dd:mm:yy) and hour (hh:mm:ss) reference, data logger.
Sampling management	Only for data logger. The sample stored within the selected time interval results from the continuous average of the measured values. The average is calculated (min. sample) with an interval within two following measurements of approx. 200 ms. The variables, up to 8 can be stored as average value, minimum and maximum instantaneos values. Minimum is intended as lowest value among those sampled in the programmed time interval. Maximum is intended as highest value among those sampled in the programmed time interval. See “The working mode of data logging”.
Data management type:	FIFO
Memory size	2Mb
Battery life	10 years
Data logger function	The data are stored at time intervals from 1 to 60 min.; up to 8 instantaneous variables can be selected.
Historical data storing time	Two different data logger function can be selected: - average calculation within the programmed time interval. - Minimum, maximum values and average calcula-

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Software functions (cont.)

	tion within the programmed time interval. See the “Historical data storing time” table.
Data format	date: day, month time: hours, minutes, seconds, type of stored variable variable value.

Load profile	Storage at time intervals of 5-10-15-20-30 min of Wdmd.
Historical data storing time	30 weeks: with recording interval of 5min. 90 weeks: with storing interval of 15min.
Data format	Wdmd variable value, minutes, seconds, day, month.

PqtSoft software: parameter programming and memory data transfer

PqtSoft Network	English language software to transfer memory data and write messages to be coupled to the SMS alarms, plus modem communication management. The program runs under Windows /95/98/98SE/2000/NT/XP.
Working mode	Three different working modes can be selected: - management of a local RS485 network; - management of modem communication from a single instrument to PC (data download); - management of modem communication from local networks (RS485 communication) to a common PC (data download).
Data Storing	In pre-formatted XLS files (Excel data base). The instantaneous and the energy, gas, water variables are stored into two separated files.
Data Transfer	Manual or automatic at programmable timings.
Modem communication	Phone book management (save up to 100 numbers). Each number is associated to a modem that corresponds either to the single instrument or to a network of instruments. Each network can manage up to 255 local instruments.
PqtSoft Remote	English language software to program the working parameters of the transducer The program runs under Windows 95/98/98SE/2000/NT/XP.
Data access	By means of RS232 serial port to be coupled to a GSM or analogue modem or RS485 port (also multi-drop availability.).

General Specifications

Operating Temperature	0 to +50°C (32 to 122°F) (R.H. < 90% non-condensing)
Storage temperature	-10 to +60°C (14 to 140°F) (R.H. < 90% non-condensing)
Insulation reference voltage	300 VRMS to ground (AV5 input)
Insulation	4000 VRMS between all inputs/outputs to ground
Dielectric strength	4000 VRMS for 1 minute
Noise Rejection	
CMRR	100 dB, 48 to 62 Hz
EMC	EN 50081-2, EN 50082-2
Other standards	
Safety	IEC 61010-1, EN 61010-1
Product	Energy measurements: EN61036, EN61268.
Pulse output	DIN43864
Approvals	CE UL and CSA
Connector	Screw-type max. 2.5 mm^2 wires (2x 1.5mm^2)
Housing	
Dimensions	90x90x140 mm
Material	ABS, self-extinguishing: UL 94 V-0
Protection degree	Front: IP20
Weight	Approx. 600 g (packing included)

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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)

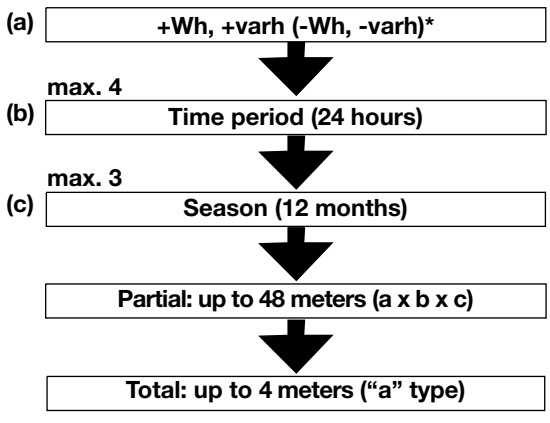
Harmonic distortion analysis

Analysis principle	FFT
Harmonic measurement	
Current	Up to the 50th harmonic
Voltage	Up to the 50th harmonic
Type of harmonics	THD (V_{L1}) THD odd (V_{L1}) THD even (V_{L1}) The same for the other phases: L2, L3. THD (A_{L1}) THD odd (A_{L1}) THD even (A_{L1}) The same for the other phases: L2, L3.
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 possible to know if the distortion is absorbed or generated. Note: if the system has 3 wires the angle cannot be measured.
Harmonic details	THD % / RMS value THD even % / RMS value THD odd% / RMS value single harmonics in % / RMS value
System	The harmonic distortion can be measured in single-phase, 3-wire or 4-wire systems. Tw: 0.02

Time period management (energy, water and gas metering)

Time periods	Energy Selectable: single time, dual time and multi-time
Single time	Energy, water, gas
Number of meters	Total: 4 (kWh+/kvar+) from 0.00 to 999,999,999.99 (no partial meters) (kWh-/kvar-) from 0.00 to -999,999,999.99
Dual time	Energy, gas
Number of meters	Total/partial: 4 (kWh+/kvar+) from 0.00 to 999,999,999.99 (kWh-/kvar-) from 0.00 to -999,999,999.99
Time periods	2, programmable within 24 hours
Multi-time	Energy
Number of meters	Total: 4; partial: 48 (kWh+/kvar+) from 0.00 to 999,999,999.99 (kWh-/kvar-) from 0.00 to -999,999,999.99
Time periods	4, programmable within 24 hours
Time seasons	3, programmable within 12 months;
Pulse output	Connectable to total and/or partial meters (dual time, multi-time periods)
Energy metering recording	Energy consumption history, recording of energy metering by months, oldest data: 2 months before current date. Recording of total and partial energy metering. Energy metering recording (EEPROM) Max.999,999,999.99 kWh/kvarh.

Management concept (multi-time)



* Only if measuring analogue inputs are present.

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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.

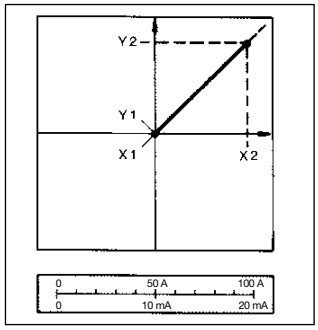


Figure B
The sign of measured quantity and output quantity changes simultaneously. The output quantity is proportional to the measured quantity.

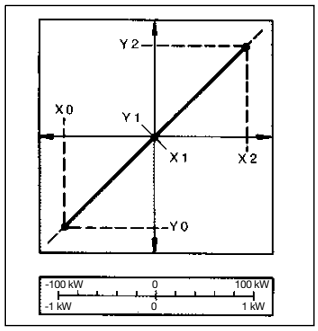


Figure C
The sign of measured quantity and output quantity remains the same. On the range X0...X1, the output quantity is zero. The range X1...X2 is delineated on the entire output range Y0 = Y1...Y2 and thus presented in strongly expanded form.

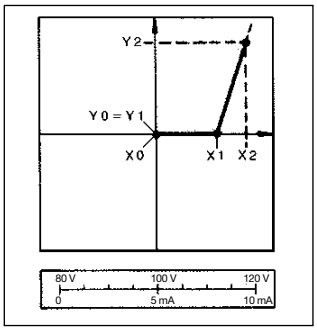


Figure D
The sign of measured quantity and output quantity remains the same. With the measured quantity being zero, the output quantity already has the value Y1 = 0.2 Y2.
Live zero output.

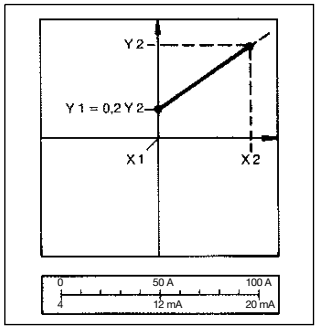


Figure E
The sign of the measured quantity changes but that of the output quantity remains the same. The output quantity steadily increases from value X1 to value X2 of the measured quantity.

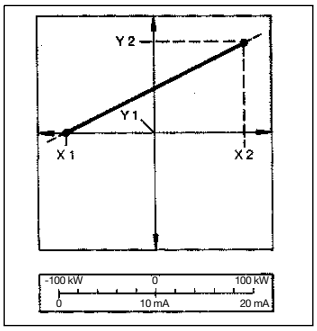
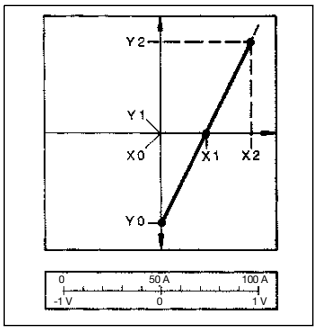


Figure F
The sign of the measured quantity remains the same, that of the output quantity changes as the measured quantity leaves range X0...X1 and passes to range X1...X2 and vice versa.



Used calculation formulas
Phase variables

Instantaneous effective voltage

$$V_{1N} = \sqrt{\frac{1}{n} \cdot \sum_{1}^{n} (V_{1N})_i^2}$$

Instantaneous active power

$$W_1 = \frac{1}{n} \cdot \sum_{1}^{n} (V_{1N})_i \cdot (A_1)_i$$

Instantaneous power factor

$$\cos\phi_1 = \frac{W_1}{VA_1}$$

Instantaneous effective current

$$A_1 = \sqrt{\frac{1}{n} \cdot \sum_{1}^{n} (A_1)_i^2}$$

Instantaneous apparent power

$$VA_1 = V_{1N} \cdot A_1$$

Instantaneous reactive power

$$VAr_1 = \sqrt{(VA_1)^2 - (W_1)^2}$$

System variables

Equivalent three-phase voltage

$$V_\Sigma = \frac{V_{12} + V_{23} + V_{31}}{3}$$

Three-phase reactive power

$$VAr_\Sigma = (VAr_1 + VAr_2 + VAr_3)$$

Neutral current

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

Three-phase active power

$$W_\Sigma = W_1 + W_2 + W_3$$

Three-phase apparent power

$$VA_\Sigma = \sqrt{W_\Sigma^2 + VAr_\Sigma^2}$$

Three-phase power factor

$$\cos\phi_\Sigma = \frac{W_\Sigma}{VA_\Sigma}$$ (TPF)

Total harmonic distortion

$$THD_i = \frac{\sqrt{\sum T_{a,i}^2}}{T_{1,i}}$$

Where:
i = considered phase (L1, L2 or L3)
T = considered variable (V or A)
n = harmonic order

Energy metering

$$kWh_i = \int_{t_1}^{t_2} P_i(t)\,dt \cong \Delta t \sum_{n_1}^{n_2} P_{n,i}$$

$$kVarh_i = \int_{t_1}^{t_2} Q_i(t)\,dt \cong \Delta t \sum_{n_1}^{n_2} Q_{n,i}$$

Where:
i = considered phase (L1, L2 or L3)
P = active power
Q = reactive power
t_1, t_2 = starting and ending time points of consumption recording
n = time unit
Δt = time interval between two successive power consumptions
n_1, n_2 = starting and ending discrete time points of consumption recording

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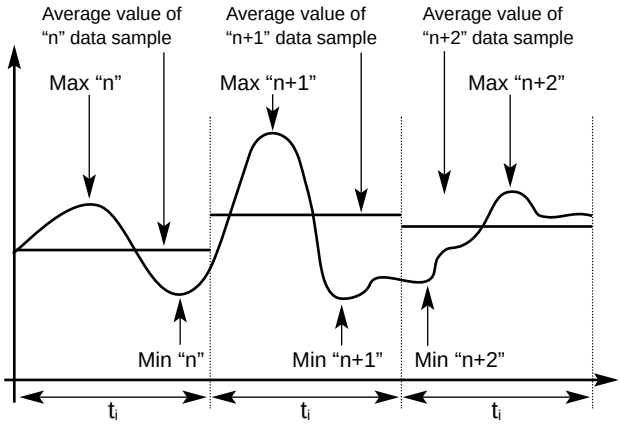
Historical data storing time table

Average values only	2 Selected variables			4 Selected variables			6 Selected variables			8 Selected variables		
Time interval (minutes)	Data storing time			Data storing time			Data storing time			Data storing time		
	Days	Week	Years	Days	Week	Years	Days	Week	Years	Days	Week	Years
1	122	17	-	81	12	-	61	9	-	49	7	-
5	610	87	1.7	407	58	1.1	305	44	-	244	35	-
10	-	174	3.4	814	116	2.2	610	87	1.7	488	70	1.3
15	-	262	5.0	-	174	3.4	915	131	2.5	732	105	2
20	-	349	6.7	-	232	4.5	-	174	3.4	976	139	2.7
25	-	436	8.4	-	291	5.6	-	218	4.2	-	174	3.4
30	-	523	10.1	-	349	6.7	-	262	5	-	209	4
35	-	610	11.7	-	407	7.8	-	305	5.9	-	244	4.7
40	-	697	13.4	-	465	8.9	-	349	6.7	-	279	5.4
45	-	785	15.1	-	523	10.1	-	392	7.5	-	314	6
50	-	872	16.8	-	581	11.2	-	436	8.4	-	349	6.7
55	-	959	18.4	-	639	12.3	-	479	9.2	-	384	7.4
60	-	-	20.1	-	697	13.4	-	523	10.1	-	418	8
Average + Min + Max values												
1	73	10	-	43	6	-	31	4	-	24	3	-
5	365	52	1	215	31	-	153	22	-	118	17	-
10	732	104	2	431	62	1.2	305	44	-	236	34	-
15	-	156	3	646	92	1.8	458	65	1.3	354	51	1
20	-	208	4	861	123	2.4	610	87	1.7	472	67	1.3
25	-	262	5	-	154	3	763	109	2.1	591	84	1.6
30	-	314	6	-	185	3.5	915	131	2.5	709	101	1.9
35	-	366	7	-	215	4.1	-	153	2.9	827	118	2.3
40	-	418	8	-	246	4.7	-	174	3.4	945	135	2.6
45	-	471	9.1	-	277	5.3	-	196	3.8	-	152	2.9
50	-	523	10.1	-	308	5.9	-	218	4.2	-	169	3.2
55	-	575	11.1	-	338	6.5	-	240	4.6	-	186	3.6
60	-	628	12.1	-	369	7.1	-	262	5	-	202	3.9

The working mode of data logging



t_i= time interval (programmable from 1 to 60 minutes)

The PqtSoft network potential

Download data files from PQT to PC

Type of Network	No. of Network	No. of PQT	Port	Local Accessory	PC Accessory	User	◆
Local	1	1	AR1041 (RS232)	None	None	PC	A
Local	1	255	AR1041 AR1034	None	SIU-PC	PC	B
Remote	100	1	AR1041 (RS232)	Analogue modem	Analogue modem	PC	A
Remote	100	1	AR1041 (RS232)	GSM modem	Analogue modem	PC	C
Remote	100	255	AR1041 AR1034 (RS485)	SIU-PC+ analogue modem	Analogue modem	PC	B
Remote	100	255	AR1041 AR1034 (RS485)	SIU-PC+ GSM modem	Analogue modem	PC	B

◆ **Notes:**
A- Only data download
B- Data download. Each AR1041 can be connected to a GSM modem in order to manage the SMS messages.
C- The PQT can be set to manage the data download or to manage SMS messages.

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List of the variables that can be connected to:

- **Max./Min. variable detection**
- **Alarm outputs**
- **Analogue outputs**

No	Variable	1-phase system	3-ph. 4-wire balanced sys.	3-ph. 4-wire unbal. sys.	3 ph. 3-wire bal. sys.	3 ph. 3-wire unbal. sys.	meas. module not available	Notes
1	V L1	x	x	x	o	o	o	
2	V L2	o	x	x	o	o	o	
3	V L3	o	x	x	o	o	o	
4	V L-N sys	o	x	x	o	o	o	Sys = system = Σ
5	V L1-2	o	x	x	x	x	o	
6	V L2-3	o	x	x	x	x	o	
7	V L3-1	o	x	x	x	x	o	
8	V L-L sys	o	x	x	x	x	o	Sys = system = Σ
9	A L1	x	x	x	x	x	o	
10	A L2	o	x	x	x	x	o	
11	A L3	o	x	x	x	x	o	
12	An	o	x	x	x	x	o	
13	W L1	x	x	x	o	o	o	
14	W L2	o	x	x	o	o	o	
15	W L3	o	x	x	o	o	o	
16	W sys	o	x	x	x	x	o	Sys = system = Σ
17	var L1	x	x	x	o	o	o	
18	var L2	o	x	x	o	o	o	
19	var L3	o	x	x	o	o	o	
20	var sys	o	x	x	x	x	o	Sys = system = Σ
21	VA L1	x	x	x	o	o	o	
22	VA L2	o	x	x	o	o	o	
23	VA L3	o	x	x	o	o	o	
24	VA sys	o	x	x	x	x	o	Sys = system = Σ
25	PF L1	x	x	x	o	o	o	
26	PF L2	o	x	x	o	o	o	
27	PF L3	o	x	x	o	o	o	
28	PF sys	o	x	x	x	x	o	Sys = system = Σ
29	Hz	x	x	x	x	x	o	
30	THD V1	x	x	x	x	x	o	FFT V1-A1 ON
31	THDo V1	x	x	x	x	x	o	FFT V1-A1 ON
32	THDe V1	x	x	x	x	x	o	FFT V1-A1 ON
33	THD V2	o	x	x	x	x	o	FFT V2-A2 ON
34	THDo V2	o	x	x	x	x	o	FFT V2-A2 ON
35	THDe V2	o	x	x	x	x	o	FFT V2-A2 ON
36	THD V3	o	x	x	x	x	o	FFT V3-A3 ON
37	THDo V3	o	x	x	x	x	o	FFT V3-A3 ON
38	THDe V3	o	x	x	x	x	o	FFT V3-A3 ON
39	THD A1	x	x	x	x	x	o	FFT V1-A1 ON
40	THDo A1	x	x	x	x	x	o	FFT V1-A1 ON
41	THDe A1	x	x	x	x	x	o	FFT V1-A1 ON
42	THD A2	o	x	x	x	x	o	FFT V2-A2 ON
43	THDo A2	o	x	x	x	x	o	FFT V2-A2 ON
44	THDe A2	o	x	x	x	x	o	FFT V2-A2 ON
45	THD A3	o	x	x	x	x	o	FFT V3-A3 ON
46	THDo A3	o	x	x	x	x	o	FFT V3-A3 ON
47	THDe A3	o	x	x	x	x	o	FFT V3-A3 ON
48	VA dmd	x	x	x	x	x	x	
49	PF avg	x	x	x	x	x	x	
50	W dmd	x	x	x	x	x	x	◆
51	var dmd	x	x	x	x	x	x	
52	ASY	o	x	x	x	x	o	

(x) = available (o) = not available

(◆) **Notes: the alarm outputs can be connected to Wdmd total and/or Wdmd tariff1, Wdmd tariff2, Wdmd tariff3, Wdmd tariff4.**

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The available modules

Type	N. of channels	Ordering code
PQT-90 base		AD1047
AV5.3 measuring inputs		AQ1018
AV7.3 measuring inputs		AQ1019
18-60VAC/DC power supply		AP1021
90-260VAC/DC power supply		AP1020
20mADC analogue output	1	AO1050
10VDC analogue output	1	AO1051
±5mADC analogue output	1	AO1052
±10mADC analogue output	1	AO1053
±20mADC analogue output	1	AO1054
±1VDC analogue output	1	AO1055
±5VDC analogue output	1	AO1056
±10VDC analogue output	1	AO1057
20mADC analogue output	2	AO1026
10VDC analogue output	2	AO1027
±5mADC analogue output	2	AO1028
±10mADC analogue output	2	AO1029
±20mADC analogue output	2	AO1030
±1VDC analogue output	2	AO1031
±5VDC analogue output	2	AO1032
±10VDC analogue output	2	AO1033
RS485 port	1	AR1034
Relay output	1	AO1058
Relay output	2	AO1035
Open collector output	1	AO1059
Open collector output	2	AO1036
Open collector output	4	AO1037
Digital inputs	3	AQ1038
Digital inputs + AUX	3	AQ1042
RS232 port + RTC +2MB data memory (1)	1	AR1041

The possible module combinations

Basic unit	Slot A	Slot B	Slot C	Slot D
Single analogue output	●			
Dual analogue output	●	●		
RS485 port		●		
Single relay output (*)			●	●
Single open collector out (*)			●	●
Dual relay output (*)			●	●
Dual open coll. out (*)			●	●
4 open coll. output (*)				●
3 digital inputs			●	
3 digital inputs +aux	●		●	

Basic unit	Slot E
RS232 port + RTC + 2MB data memory	●

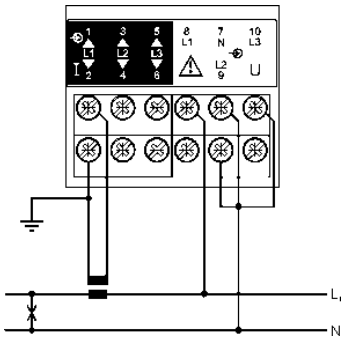
(*) Alarm or pulse.

(1) The RS232 communication port works as alternative of the RS485 module.

Wiring diagrams

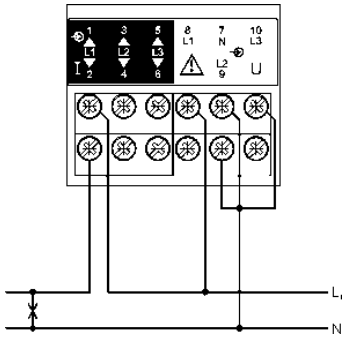
Single phase input connections

Fig. 1



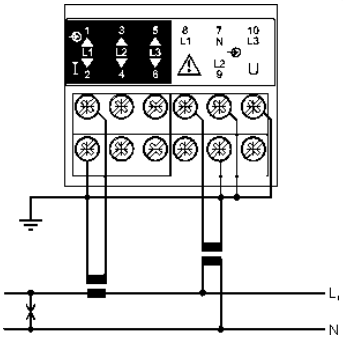
CT connection

Fig. 2



Direct connection

Fig. 3



CT and VT connection

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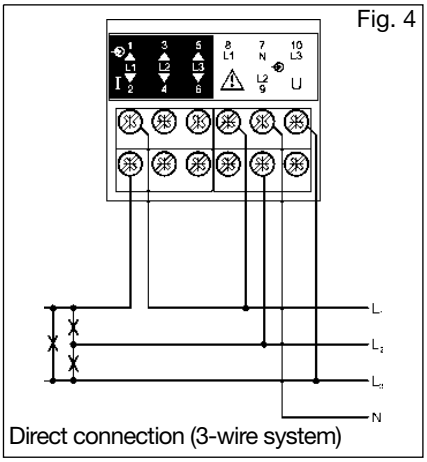
Wiring diagrams (cont.)

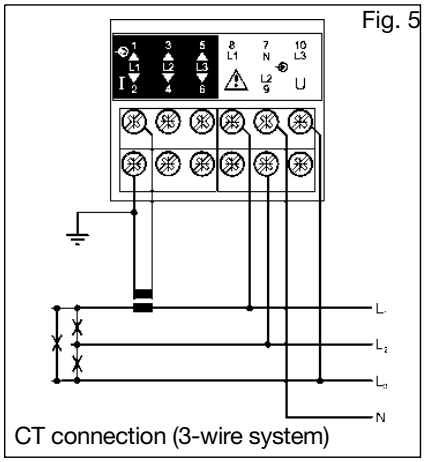
Three-phase, three-wire input connections - Balanced load

Fig. 4



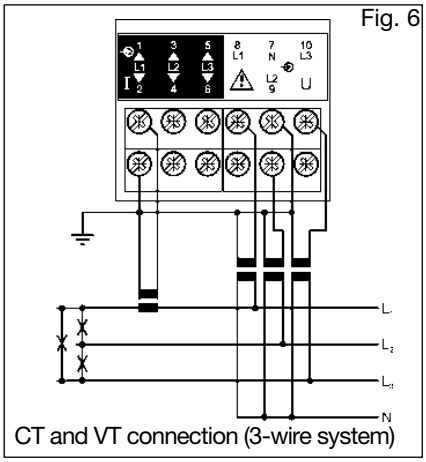
Direct connection (3-wire system)

Fig. 5



CT connection (3-wire system)

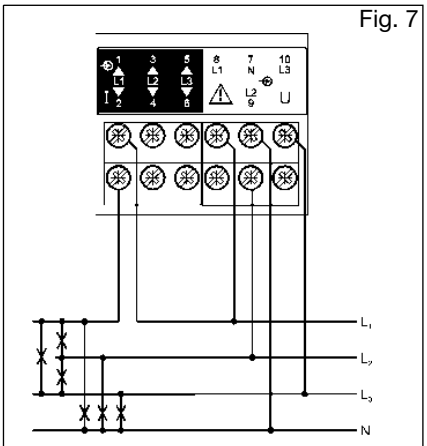
Fig. 6



CT and VT connection (3-wire system)

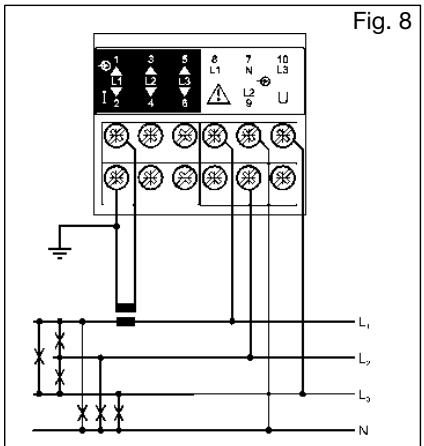
Three-phase, four-wire input connections - Balanced load

Fig. 7



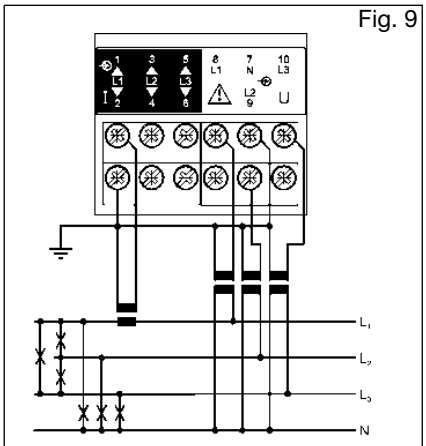
Direct connection (4-wire system)

Fig. 8



CT connection (4-wire system)

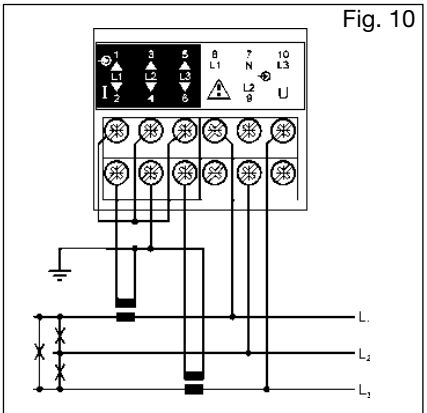
Fig. 9



CT and VT connection (4-wire system)

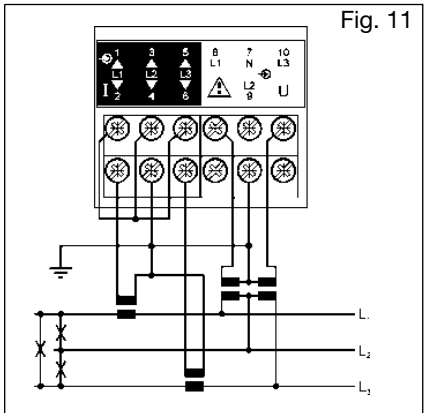
Three-phase, three-wire input connections - Unbalanced load

Fig. 10



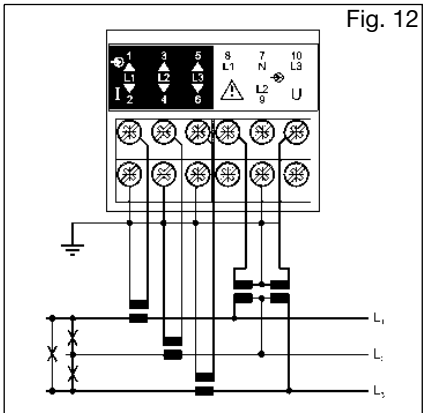
CT connection (3-wire system) ARON

Fig. 11



CT and VT connection (3-wire system) ARON

Fig. 12



CT and VT connection (3-wire system)

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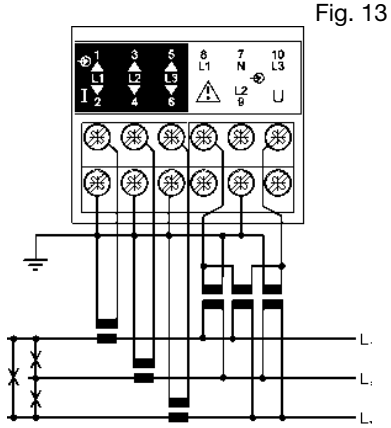
Wiring diagrams (cont.)

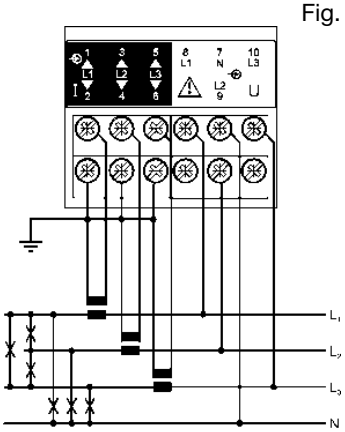
Three-phase, three and four-wires input connections - Unbalanced load

Fig. 13



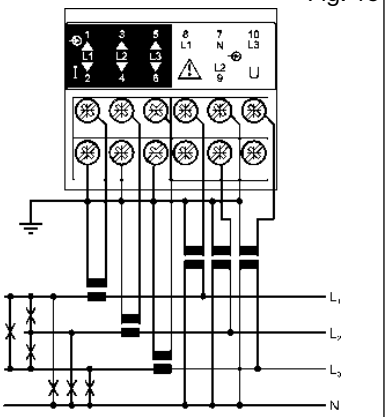
CT and VT connection (3-wire system)

Fig. 14



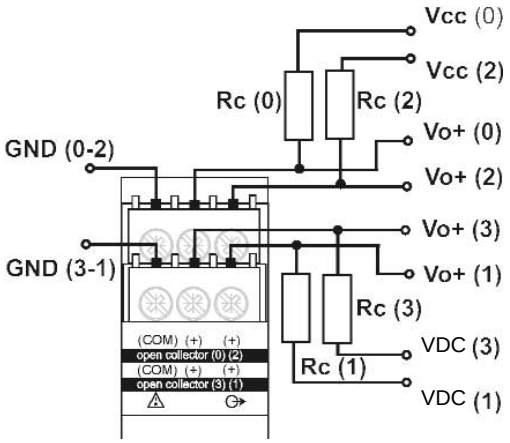
CT connection (4-wire system)

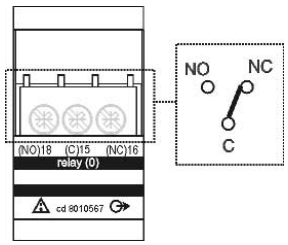
Fig. 15



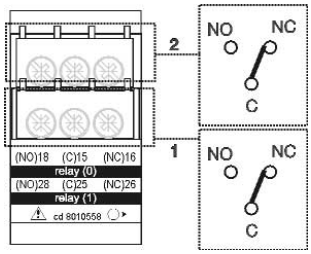
CT and VT connection (4-wire system)

Wiring diagrams of optional modules



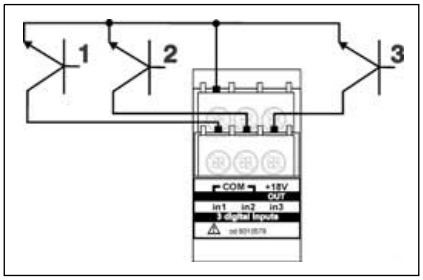


AO1058 1 relay output



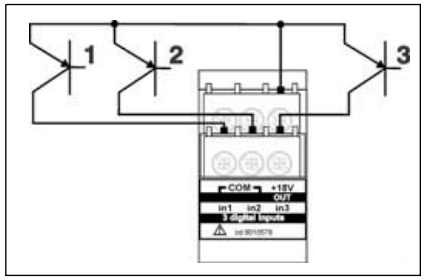
AO1035 2 relay outputs

AO1037 4 open collector outputs: The load resistance (Rc) must be designed so that the closed contact current is lower than 100mA; the VDC voltage must be lower than or equal to 30V.
VDC: power supply voltage output. Vo+: positive output contact (open collector transistor). GND: ground output contact (open collector transistor).



Connection by means of NPN transistor. AQ1042 digital input module.

Connection by means of PNP transistor. AQ1042 digital input module.



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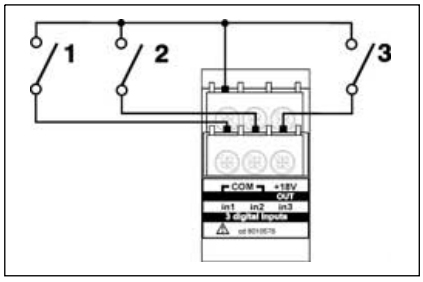
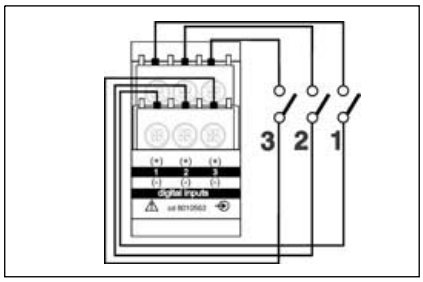
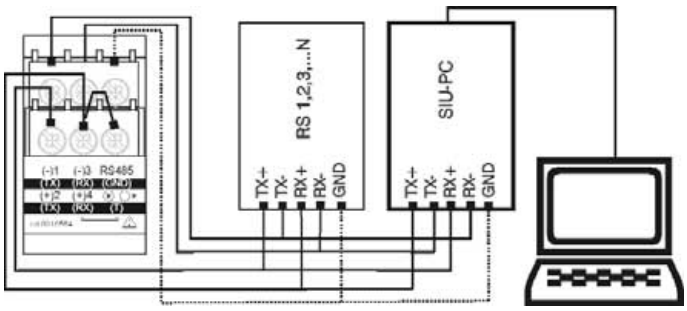
Wiring diagrams of optional modules (cont.)



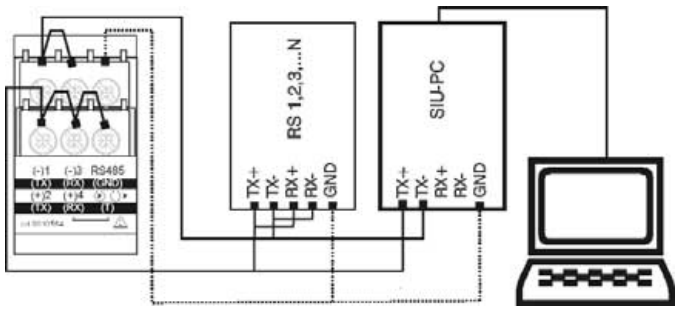
Connection by means of contacts.
AQ1042 digital input module.

Connection by means of contacts.
AQ1038 digital input module.



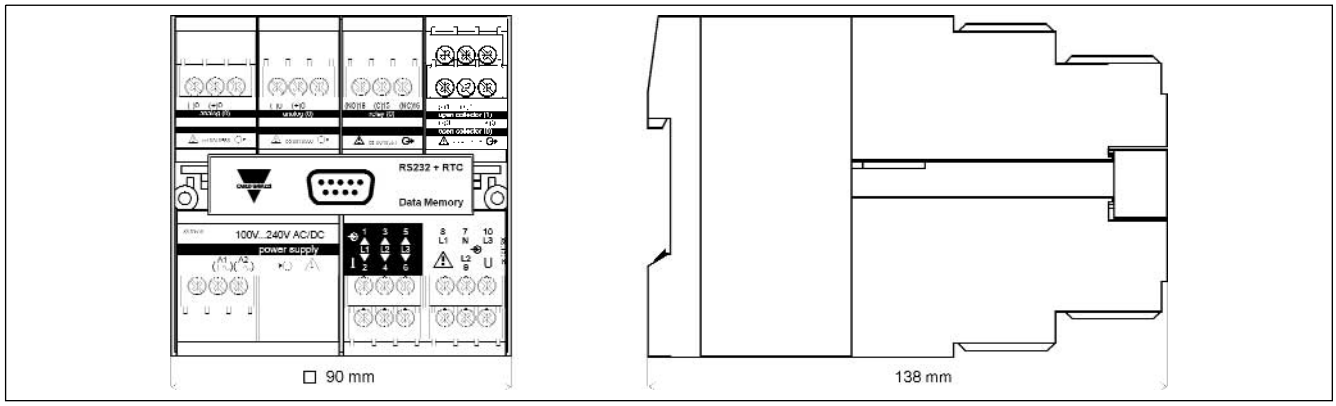


AR1034 RS422/485 4-wires connection: additional devices provided with RS422/485 (that is RS 1, 2, 3...N) are connected in parallel.
The termination of the serial output is carried out only on the last instrument of the network, by means of a jumper between (Rx+) and (T).



AR1034 RS422/485 2-wires connection: 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).

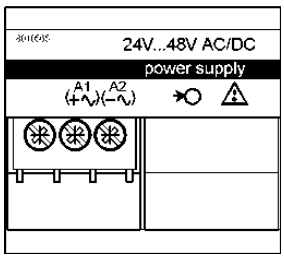
Dimensions



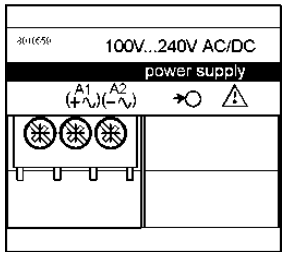
Modules

AR1041
RS232 Port + RTC+2MB Data memory

Power supply modules

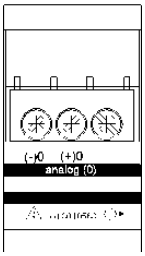


AP1021
Power supply 18-60VAC/DC



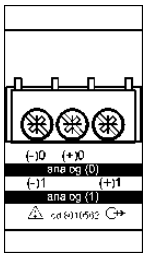
AP1020
Power supply 90-260 VAC/DC

Single analogue output modules



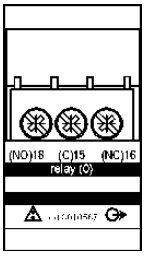
AO1050 (20mADC)
AO1051 (10VDC)
AO1052 (±5mADC)
AO1053 (±10mADC)
AO1054 (±20mADC)
AO1055 (±1VDC)
AO1056 (±5VDC)
AO1057 (±10VDC)

Dual analogue outputs

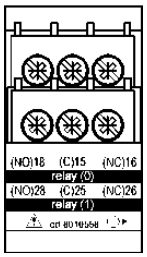


AO1026 (20mADC)
AO1027 (10VDC)
AO1028 (±5mADC)
AO1029 (±10mADC)
AO1030 (±20mADC)
AO1031 (±1VDC)
AO1032 (±5VDC)
AO1033 (±10VDC)

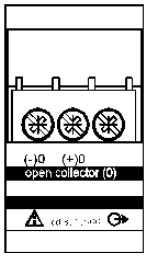
Digital output modules



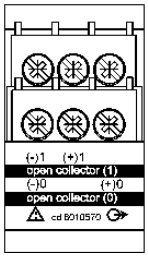
AO1058
Single relay output



AO1035
Dual relay output

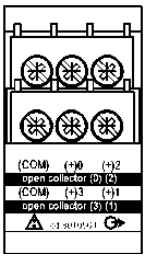


AO1059
Single open collector output



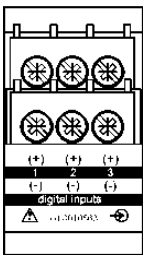
AO1036
Dual open collector output

Digital output modules

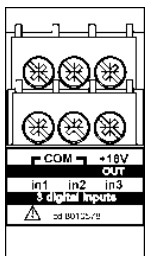


AO1037
4 open collector outputs

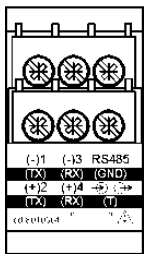
Other input/output modules



AQ1038
3 digital inputs



AQ1042
3 digital inputs + aux



AR1034
RS485 Port