

# Energy Management Compact Power Transducer Type CPT-DIN "Advanced version"

CARLO GAVAZZI



- One digital output and RS485 communication port (2 wires only)
- 16 freely configurable alarms with OR/AND logic linkable to up to 2 digital outputs
- RS422/485/RS232 communication port (MODBUS-RTU), iFIX SCADA compatibility

- Class 1 (kWh), Class 2 (kvarh)
- Accuracy  $\pm 0.5$  F.S. (current/voltage)
- Compact power transducer
- Instantaneous variables data format: 4 DGT
- Energies data format: 8+1 DGT
- System variables and phase measurements:  $V_{LL}$ ,  $V_{LN}$ ,  $A$ ,  $A_{max}$ ,  $A_n$ ,  $A_{dmd}$ ,  $A_{dmd\ max}$ ,  $VA$ ,  $VA_{dmd}$ ,  $VA_{dmd\ max}$ ,  $W$ ,  $W_{dmd}$ ,  $W_{dmd\ max}$ ,  $W_{L1-W_{L2-W_{L3\ max}}$ ,  $var$ ,  $PF$ ,  $PF_{L1-PF_{L2-PF_{L3\ min}}$ ,  $Hz$ ,  $ASY$
- Four quadrant power measurement
- Energy measurements: total and partial kWh and kvarh (according to EN62053-21 and EN62053-23)
- Hour counter (5+2 DGT)
- TRMS meas. of distorted sine waves (voltages/currents)
- Universal power supply: 90 to 260 VAC/DC, 18 to 60 VAC/DC
- Dimensions: 45x83.5x98.5mm
- Voltage asymmetry, phase sequence, phase loss control
- Up to 3 analogue outputs (20mA or 10VDC)
- 2 digital outputs

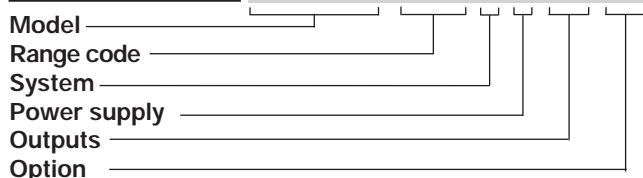
## Product Description

3-phase compact power transducer. Particularly recommended for the measurement of the main electrical variables also on board of machines. Housing for DIN-rail mount-

ing, with up to 3 analogue outputs, or RS485 communication port or alarm outputs or "Dupline" bus. Parameters programmable by means of CptASoft.

## How to order

**CPT-DIN AV5 3 H A3 AX**



## How to order

**CptASoft-kit**

CptASoft: software to program the working parameters of the transducer and to read the energies and the instantaneous variables. The kit includes the communication cable.

## Type Selection

Range codes	System	Outputs	Options
<b>AV5:</b> 400/690V <sub>LL</sub> /1/5(6)AAC V <sub>LN</sub> : 185 V to 460 V V <sub>LL</sub> : 320 V to 800 V <b>AV6:</b> 120/208V <sub>LL</sub> /1/5(6)AAC V <sub>LN</sub> : 45 V to 145 V V <sub>LL</sub> : 78 V to 250 V Phase current: 0.01A to 6A Neutral current: 0.05A to 6A	<b>3 :</b> 1-2-3-phase, balanced/unbalanced load, with or without neutral <b>1 :</b> 1-3-phase, balanced load (*)  (*) Note: the 3-phase balanced load measurement requires the connection of the neutral according to fig. 15 and 16 in the final part of this document.	<b>R2:</b> 2-relay outputs <b>O2:</b> 2-open collector outputs <b>RS:</b> 1-reed relay output + RS485 port (2-wire) <b>A1:</b> 1-analogue output: 0/4 to 20mA DC <b>A3:</b> 3-analogue outputs: 0/4 to 20mA DC <b>V1:</b> 1-analogue output: 0 to 10V DC <b>V3:</b> 3-analogue outputs: 0 to 10V DC <b>S1:</b> RS485/RS422 port <b>S2:</b> RS232 port <b>DB:</b> Dupline bus	<b>AX:</b> advanced functions  <b>Power supply</b> <b>L:</b> 18 to 60 VAC/VDC <b>H:</b> 90 to 260 VAC/VDC

## Input specifications

Rated inputs	System type: 3	Neutral current	
Current	3 (internal current transformers)	Phase-phase voltage	$\pm(2\%RDG+3DGT)$
Voltage	4	Phase-neutral voltage	$\pm(0.5\%RDG+2DGT)$
Current	System type: 1	Active and Apparent power,	$\pm(1.5\%RDG+3DGT)$
Voltage	1 (internal CT)	Reactive power	$\pm(3\%RDG+3DGT)$
	2	Range accuracy: 0.05I <sub>n</sub> to I <sub>max</sub>	
<b>Accuracy (RS485)</b>	I <sub>max</sub> : 6A, V <sub>max</sub> : 400V <sub>LN</sub> (690V <sub>LL</sub> ),	Current	$\pm(0.5\%RDG+2DGT)$
(@25°C $\pm 5^\circ C$ , R.H. $\leq 60\%$ )	I <sub>n</sub> : 5A, V <sub>n</sub> : 230V <sub>LN</sub> (400V <sub>LL</sub> )	Neutral current	$\pm(1\%RDG+3DGT)$
Range accuracy: 0.02I <sub>n</sub> to 0.05I <sub>n</sub>	CT: 1, VT (PT): 1	Phase-phase voltage	$\pm(0.5\%RDG+2DGT)$
Current		Phase-neutral voltage	$\pm(0.5\%RDG+2DGT)$
		Active and Apparent power,	$\pm(1\%RDG+3DGT)$

## Input specifications (cont.)

Reactive power	$\pm(2\%RDG+3DGT)$	Hourcounter	5+2 DGT, max indication 9 999 9.99
Active energy	Class 2 according to EN62053-21 (I start up: 10mA)	<b>Measurements</b>	Current, voltage, power, power factor, frequency TRMS measurement of distorted waves.
Reactive energy	Class 3 according to EN62053-23 (I start up: 10mA)		
Frequency	$\pm 0.1\text{Hz}$ (48 to 62Hz)	Type	Direct
<b>Additional errors</b>	Humidity Frequency	Coupling type	< 3, max 10A peak
		Crest factor	
<b>Temperature drift</b>	$\leq 0.3\% \text{FS}$ , 60% to 90% RH	<b>Input impedance</b>	1.6 M $\Omega$ $\pm 5\%$
<b>Sampling rate</b>	$\leq 0.3\% \text{FS}$ (45 to 48Hz and 62 to 65Hz)	400/690V <sub>L-L</sub> (AV5)	1.6 M $\Omega$ $\pm 5\%$
<b>Measurement refresh time</b>	$\leq 200\text{ppm}/^\circ\text{C}$	120/208V <sub>L-L</sub> (AV6)	$\leq 0.01\Omega$
<b>Measurement format</b>	1600 samples/s @ 50Hz	Current	
Instantaneous variables	1900 samples/s @ 60Hz	<b>Frequency</b>	45 to 65 Hz
Energies	200ms	<b>Overload protection</b>	(max values)
	(serial communication)	Continuous voltage/current	AV5: 460V <sub>LN</sub> /800V <sub>LL</sub> /6A
	4 DGT, max indication 9999	For 500ms: voltage/current	AV6: 145V <sub>LN</sub> /250V <sub>LL</sub> /6A
	8+1 DGT, max indication 999 999 99.9		AV5: 800V <sub>LN</sub> /1380V <sub>LL</sub> /36A
			AV6: 240V <sub>LN</sub> /416V <sub>LL</sub> /36A

## Output Specifications

<b>Analogue Outputs</b>	Number of outputs	Up to 3	Set-point adjustment	From 0 to 100% of the retransmitted scale
	Accuracy (@ 25°C $\pm 5^\circ\text{C}$ , R.H. $\leq 60\%$ )	$\pm 0.3\% \text{FS}$	Hysteresis	from 0 to full scale
	Range	0 to 20mA or 0 to 10 VDC	On-time delay	0 to 255s
	Scaling factor:	Programmable within the whole range of retransmission; it allows the retransmission management of all values from: 0 and 20 mA, 0 and 10VDC	Output status	Selectable; normally de-energized and normally energized
	Response time	$\leq 400 \text{ms}$ typical (filter excluded)	Min. response time	$\leq 400\text{ms}$ , filters excluded and with alarm delay: "0 s"
	Ripple	$\leq 1\%$ , according to IEC 60688-1, EN 60688-1	<b>Note</b>	The 2 digital outputs can also work as one pulse output and one alarm output.
	Total temperature drift	$\leq 500 \text{ppm}/^\circ\text{C}$	<b>Static outputs</b>	
	Load: 20 mADC	$\leq 350 \Omega$	Purpose	For alarm outputs or for pulse outputs
	Insulation	By means of optocouplers, See table "Insulation between inputs and outputs"	Signal	V <sub>ON</sub> 1.2 VDC/ max. 100 mA V <sub>OFF</sub> 30 VDC max.
			Insulation	By means of optocouplers, See table "Insulation between inputs and outputs"
<b>Digital outputs</b>			<b>Relay outputs</b>	
Pulse			Purpose	For alarm outputs or for pulse outputs
Number of outputs	Up to 2		Type	Relay, SPST type
Type	Programmable from 0.01 to 500 pulses per kWh/kvarh (total counters)			AC 1-5A @ 250VAC
	Outputs connectable to the total energy meters (Wh/varh)			DC 12-5A @ 24VDC
	$\geq 100\text{ms}$ < 120msec (ON), $\geq 120\text{ms}$ (OFF) according to EN62053-31		Insulation	AC 15-1.5A @ 250VAC DC 13-1.5A @ 24VDC
				See table "Insulation between inputs and outputs"
Alarm			<b>Reed relay output</b>	
Number of outputs	up to 2, independent		Purpose	For alarm output or for pulse output
Alarm modes	Up alarm, down alarm, in window alarm, out window alarm. Start-up deactivation function at power-on for all kinds of alarm. All of them connectable to all variables (see the table "List of the variables that can be connected to")		Type	Reed relay, SPST type NO
			Switching voltage	Max 200VDC, peak AC resistive
			Switching current	Max 0.5ADC, peak AC resistive
			Carry current	Max 2ADC, peak AC resistive
			Mechanical life	300x10 <sup>6</sup> operations (1V/10mA)
			Insulation	See table "Insulation between inputs and outputs"



## Output Specifications (cont.)

<b>RS422/RS485</b>	(on request) Multidrop bidirectional (static and dynamic variables) 2 or 4 wires, max. distance 1200m, termination directly on the instrument	<b>RS232</b>	Halfduplex communication Point to point connection 3-wire, max. distance 15m 1 to 255 selectable via software MODBUS/JBUS (RTU) 4800, 9600, 19200, 38400 bits/s other characteristics like R422/RS485 port
		Type Connections Address Protocol Baud-rate	
Connections	From 1 to 255, selectable via software MODBUS/JBUS (RTU)	<b>Dupline</b>	Full Dupline compatibility Programmable using CptASoft kWh, kvarh + 8 variables chosen among the available ones. By means of optocouplers. See table "Insulation between inputs and outputs"
Addresses	System and phase variables: see table "List of variables..." All the configuration parameters.	Bus Address Variables	
Protocol	1 start bit, 8 data bit, no parity, 1 stop bit	Insulation	
Data (bidirectional) Dynamic (reading only)	4800, 9600, 19200, 38400 bits/s		
Static (writing only)	By means of optocouplers, See table "Insulation between inputs and outputs"		
Data format			
Baud-rate			
Insulation			

## RS232 Configuration Bus

Connections	RJ12 (3-wire) for special cable	Insulation	By means of optocouplers, See table "Insulation between inputs and outputs"
Baud-rate	4800 bits/s		
Data format	1 start bit, 8 data bit, no parity, 1 stop bit		

## CptASoft software: parameter programming and data reading

<b>CptASoft</b>	Multi language software to program the working parameters of the transducer and to read the energies and the instantaneous variables. Compatibility with Windows 95/98/98SE/2000/XP.		Filtering parameters Alarm variables Alarm set-points and relevant parameters Variables to be connected to the analogue outputs Scaling of analogue outputs Energies to be connected to the pulse outputs Parameters related to the pulse outputs Reset function: max/min values, energies, dmd
Working mode	Two different working modes can be selected: - management of a local RS485 network; - management of the communication from single instrument to PC (RS232);		
Programming parameters	System selection: 1-2-3 phases CT/VT ratios	<b>Data access</b>	By means of RS232 serial port, RS485 serial port or RS232 configuration port (RJ12)

## Software functions

<b>System selection</b>		<b>Transformer ratio</b>	
System 3, unbalanced	3-phase (3-wire, 4-wire) 3-phase ARON 2-phase (3-wire)	CT VT (PT)	1 to 60 000 1.0 to 6 000.0
System 3, balanced	1-phase (2-wire) 3-phase (3-wire, 4-wire) 3-phase (3-wire) "1CT+1VT" 3-phase (3-wire) "1CT+3VT"	<b>Filter</b>	
System 1, balanced	3-phase (4-wire) "1CT+1VT" 3-phase (4-wire), phase to neutral voltage measurement 1-phase (2-wire)	Operating range	0 to 100% of the retransmitted scale
		Filtering coefficient	1 to 32
		Filter action	Measurements, alarms, serial output (fundamental variables: V, A, W and their derived ones).



## Software functions (cont.)

<b>Alarms</b> Working mode	"OR" or "AND" or "OR+AND" functions (see "Alarm parameter and logic" page). The user can freely program up to 16 total alarms. (out1+out2). The alarms can be connected to any variables available in the table "List of the variables that can be connected to"	- W dmd max, VA dmd max, A <sub>1</sub> max, A <sub>2</sub> max, A <sub>3</sub> max, W <sub>L1</sub> max, W <sub>L2</sub> max, W <sub>L3</sub> max, W sys max, A <sub>1</sub> dmd max, A <sub>2</sub> dmd max, A <sub>3</sub> dmd max, VA sys dmd max, W sys dmd max, PF <sub>1</sub> min, PF <sub>2</sub> min, PF <sub>3</sub> min - all the counters: total kWh, partial kWh, total kvarh, partial kvarh, hour counters - reset of all the above mentioned variables in a single command
<b>Reset</b>	The following resets are available by means of the configuration software: - all the maximum/min values:	

## Power Supply Specifications

<b>AC/DC voltage</b>	90 to 260VAC/DC 18 to 60VAC/DC	<b>Power consumption</b>	AC: 2.5 VA DC: 2W
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## General Specifications

<b>Front LED's</b> Power on Diagnostics RS485/RS422/RS232 Dupline bus Alarm outputs Pulse outputs Analogue outputs	Green  TX data (Green) RX data (Red) TX data (Green) RX data (Red) 1st output activation (Green) 2nd output activation (Red) 1st output activation (Green) 2nd output activation (Red) Output signal within the programmed scale (Green) Output signal exceeding 110% of full scale (Red)	4kVAC <sub>RMS</sub> between power supply and RS485/RS232/programming port (RJ12)	
<b>Operating temperature</b>	0° to +50°C (32° to 122°F) (RH < 90% non condensing)	<b>Dielectric strength</b>	4kVAC <sub>RMS</sub> (for 1 min)
<b>Storage temperature</b>	-10° to +60°C (14° to 140°F) (RH < 90% non condensing)	<b>EMC</b>	EN61000-6-3, EN60688 residential environment, commerce and light industry EN61000-6-2 industrial environment.
<b>Overvoltage category</b>	Cat. III (IEC 60664, EN60664)	Emissions	
<b>Insulation</b> (for 1 minute)	4kVAC <sub>RMS</sub> between measuring inputs and power supply. 4kVAC/DC @ I <sub>z</sub> 3mA between measuring inputs and RS485/RS232/programming port (RJ12)	Immunity	EN61000-4-5
<b>Operating temperature</b>	0° to +50°C (32° to 122°F) (RH < 90% non condensing)	<b>Pulse voltage (1.2/50µs)</b>	IEC60664, IEC61010-1 EN60664, EN61010-1
<b>Storage temperature</b>	-10° to +60°C (14° to 140°F) (RH < 90% non condensing)	<b>Safety standards</b>	IEC60688, EN60688, EN62053-31, EN62053-23
<b>Overvoltage category</b>	Cat. III (IEC 60664, EN60664)	<b>Approvals</b>	CE, cURus
<b>Insulation</b> (for 1 minute)	4kVAC <sub>RMS</sub> between measuring inputs and power supply. 4kVAC/DC @ I <sub>z</sub> 3mA between measuring inputs and RS485/RS232/programming port (RJ12)	<b>Connections 5(6) A</b> Max cable cross sect. area	Screw-type 2.5 mm <sup>2</sup>
<b>Operating temperature</b>	0° to +50°C (32° to 122°F) (RH < 90% non condensing)	<b>Housing</b> Dimensions (WxHxD) Material	45 x 83.5 x 98.5 mm ABS self-extinguishing: UL 94 V-0
<b>Storage temperature</b>	-10° to +60°C (14° to 140°F) (RH < 90% non condensing)	<b>Mounting</b>	DIN-rail
<b>Overvoltage category</b>	Cat. III (IEC 60664, EN60664)	<b>Protection degree</b>	IP20
<b>Insulation</b> (for 1 minute)	4kVAC <sub>RMS</sub> between measuring inputs and power supply. 4kVAC/DC @ I <sub>z</sub> 3mA between measuring inputs and RS485/RS232/programming port (RJ12)	<b>Weight</b>	Approx. 200 g (pack. incl.)

## List of the variables that can be connected to:

- RS485/RS422/RS232 communication port
- Analogue outputs ("max" variables, "energies" and "hour counter" excluded)
- Alarm outputs ("max" variables, energies and "hour counter" excluded)
- Pulse outputs (only "energies")
- Dupline bus (only "total energies" + up to 8 selectable variables)

No	Variable	1-phase system	2-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.	Notes
1	V L1	x	x	x	x	o	o	
2	V L2	o	x	x	x	o	o	
3	V L3	o	o	x	x	o	o	
4	V L-N sys	o	x	x	x	o	o	Sys = system
5	V L1-2	o	x	x	x	x	x	
6	V L2-3	o	x	x	x	x	x	
7	V L3-1	o	o	x	x	x	x	
8	V L-L sys	o	x	x	x	x	x	Sys = system
9	A L1	x	x	x	x	x	x	#
10	A L2	o	x	x	x	x	x	#
11	A L3	o	o	x	x	x	x	#
12	Amax/ Admd max	x	x	x	x	x	x	◆ Highest value among the 3-ph
13	An	o	x	x	x	x	x	
14	W L1	x	x	x	x	o	o	◆
15	W L2	o	x	x	x	o	o	◆
16	W L3	o	o	x	x	o	o	◆
17	W sys	o	x	x	x	x	x	Sys = system
18	var L1	x	x	x	x	o	o	
19	var L2	o	x	x	x	o	o	
20	var L3	o	o	x	x	o	o	
21	var sys	o	x	x	x	x	x	Sys = system
22	VA L1	x	x	x	x	o	o	
23	VA L2	o	x	x	x	o	o	
24	VA L3	o	o	x	x	o	o	
25	VA sys	o	x	x	x	x	x	Sys = system
26	PF L1	x	x	x	x	o	o	★
27	PF L2	o	x	x	x	o	o	★
28	PF L3	o	o	x	x	o	o	★
29	PF sys	o	x	x	x	x	x	Sys = system
30	Hz	x	x	x	x	x	x	
31	Phase seq.	o	o	x	x	x	x	
32	ASY L-N	o	x	x	x	x	x	
33	ASY L-L	o	x	x	x	x	x	
34	VA sys dmd	x	x	x	x	x	x	Sys = system ◆
35	W sys dmd	x	x	x	x	x	x	Sys = system ◆
36	A L1 dmd	x	x	x	x	x	x	dmd = (*)
37	A L2 dmd	o	x	x	x	x	x	dmd = (*)
38	A L3 dmd	o	o	x	x	x	x	dmd = (*)
39	VA L1 dmd	x	x	x	x	x	x	dmd = (*)
40	VA L2 dmd	o	x	x	x	x	x	dmd = (*)
41	VA L3 dmd	o	o	x	x	x	x	dmd = (*)
42	W L1 dmd	x	x	x	x	x	x	# dmd = (*)
43	W L2 dmd	o	x	x	x	x	x	# dmd = (*)
44	W L3 dmd	o	o	x	x	x	x	# dmd = (*)
45	kWh	x	x	x	x	x	x	Total and partial
46	kvarh	x	x	x	x	x	x	Total and partial
47	hours	x	x	x	x	x	x	

(x) = available (o) = not available

◆ These variables are available also for the MAX values stored in the EEPROM when the instrument switches off.

★ These variables are available also for the MIN values stored in the EEPROM when the instrument switches off.  
(\*) dmd value integrated in a programmed time interval.

# The variables are available also for the max values. When the instrument switches off, the values are not stored.

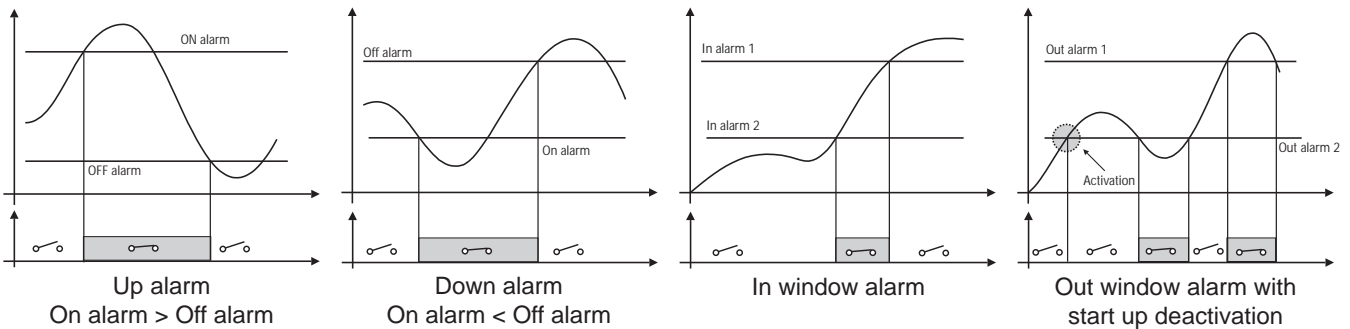


## Alarm parameters and logic



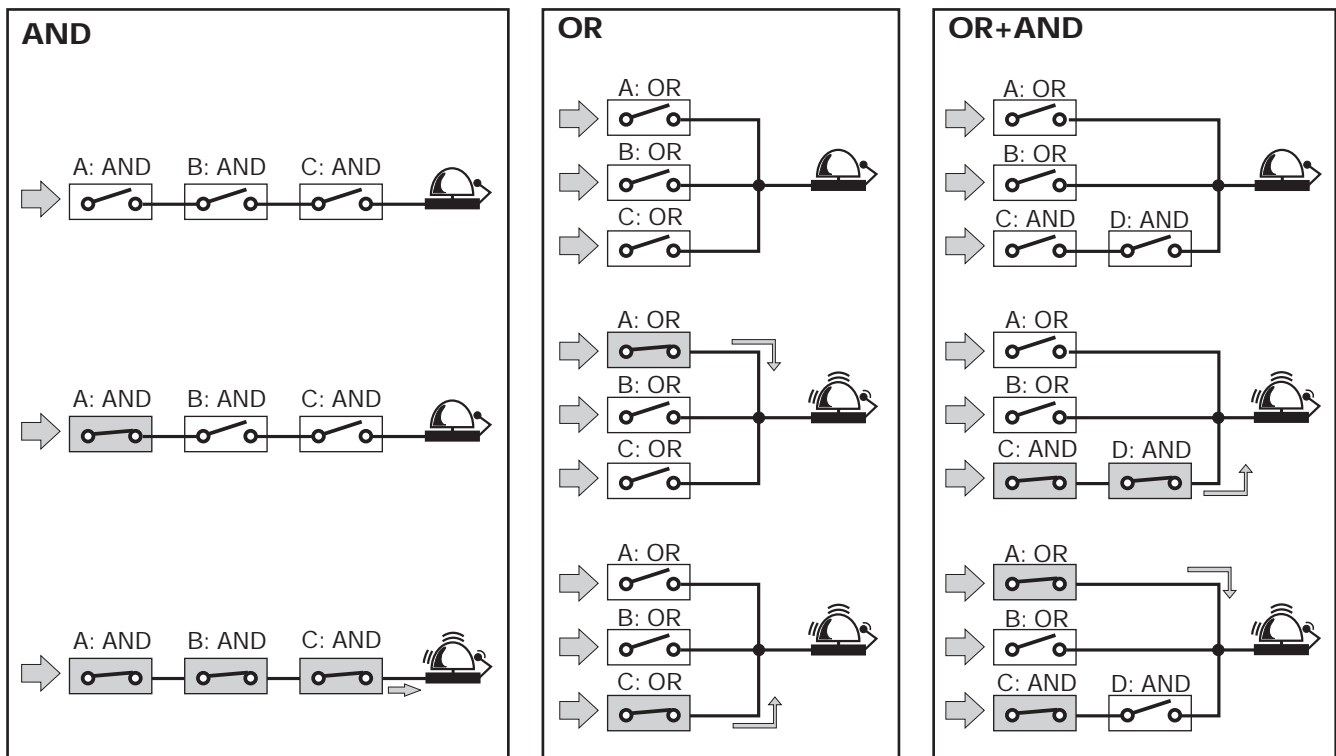
- Block enable.
- Controlled variable (VLN, ...).
- Alarm type (up, down, in window alarm, out window alarm).
- Activation function.
- ON set-point.
- OFF set-point.
- ON delay.
- Logical function (AND, OR).
- Digital output (1, 2).

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



**Note:** any alarm working mode can be linked to the "start up deactivation" function which disables only the first alarm after power on of the transducer.

### AND/OR logical alarm examples:

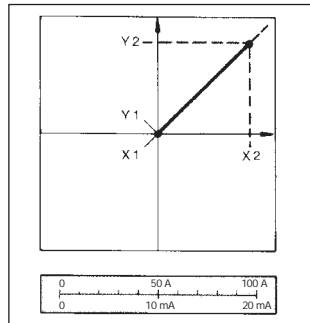


## Function Description

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

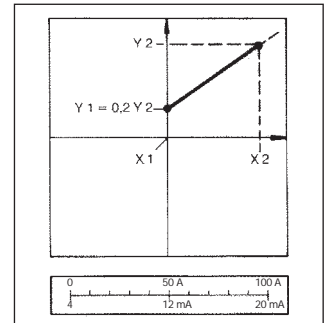
**Figure A**

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



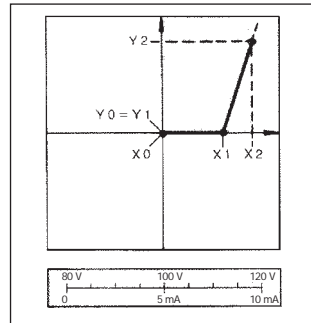
**Figure C**

The sign of measured quantity and output quantity remains the same. With the measured quantity being zero, the output quantity already has the value  $Y_1 = 0.2 Y_2$ . Live zero output.



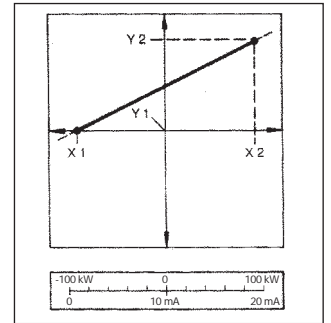
**Figure B**

The sign of measured quantity and output quantity remains the same. On the range  $X_0...X_1$ , the output quantity is zero. The range  $X_1...X_2$  is delineated on the entire output range  $Y_0 = Y_1...Y_2$  and thus presented in strongly expanded form.



**Figure D**

The sign of the measured quantity changes but that of the output quantity remains the same. The output quantity steadily increases from value  $X_1$  to value  $X_2$  of the measured quantity.



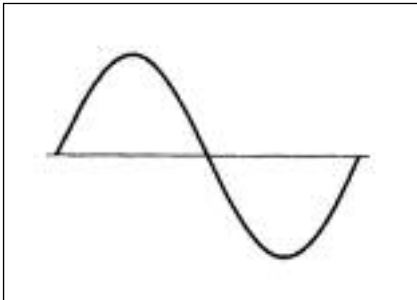
## Insulation between inputs and outputs

	Measuring Input	Relay Output	Open collector output	Reed relay	Dupline output	Analogue Output	RS232/RS485	RS232 (RJ12)	90-260VAC/DC Power supply	18-60VCA/CC Power supply
Measuring input	-	4kV	2,5kV @ $I \geq 3mA$	2,5kV	2,5kV	2,5kV @ $I \geq 3mA$	2,5kV @ $I \geq 3mA$	2,5kV @ $I \geq 3mA$	4kV	4kV
Relay output	4kV	-	-	-	-	-	-	4kV	4kV	4kV
Open collector output	2,5kV @ $I \geq 3mA$	-	-	-	-	-	-	4kV	4kV	4kV
Reed relay	2,5kV	-	-	-	-	-	100V <sub>RMS</sub>	4kV	4kV	4kV
Dupline output	2,5kV	-	-	-	-	-	-	2,5kV	2,5kV	2,5kV
Analogue output	2,5kV @ $I \geq 3mA$	-	-	-	-	-	-	4kV	4kV	4kV
RS232/RS485	2,5kV @ $I \geq 3mA$	-	-	100V <sub>RMS</sub>	-	-	-	4kV	4kV	4kV
RS232 (RJ12)	2,5kV @ $I \geq 3mA$	4kV	4kV	4kV	2,5kV	4kV	4kV	-	4kV	4kV
90-260 VAC/DC	4kV	4kV	4kV	4kV	2,5kV	4kV	4kV	4kV	-	-
18-60 VAC/DC	4kV	4kV	4kV	4kV	2,5kV	4kV	4kV	4kV	-	-

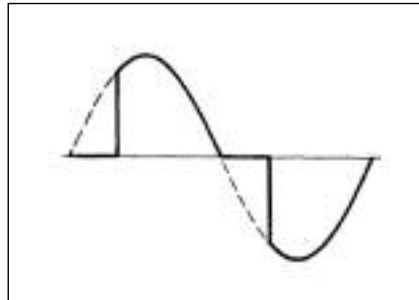
NOTE: in case of fault of first insulation the current from the measuring input to the ground is lower than 2mA.



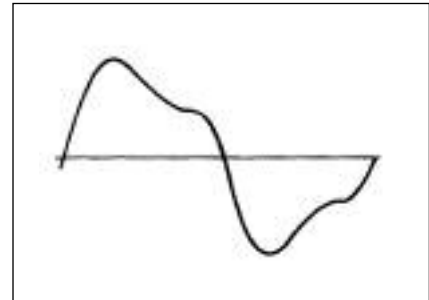
Waveform of the signals that can be measured



**Figure A**  
**Sine wave, undistorted**  
 Fundamental content 100%  
 Harmonic content 0%  
 $A_{rms} = 1.1107 | \bar{A} |$



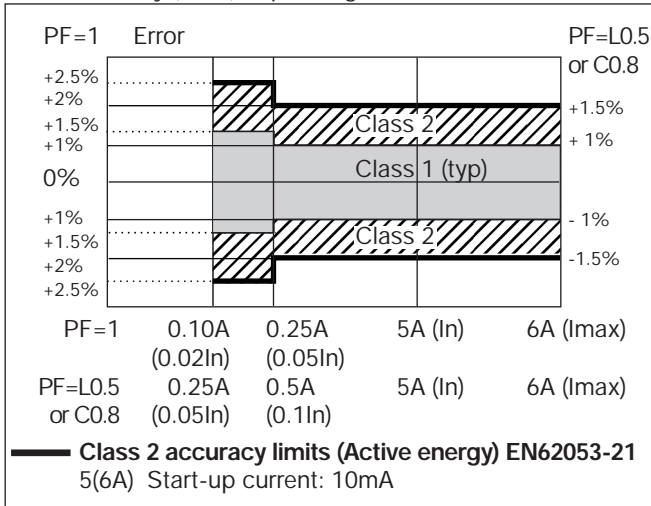
**Figure B**  
**Sine wave, indented**  
 Fundamental content 10...100%  
 Harmonic content 0...90%  
 Frequency spectrum: 3rd to 16th harmonic  
 Additional error: <1% FS



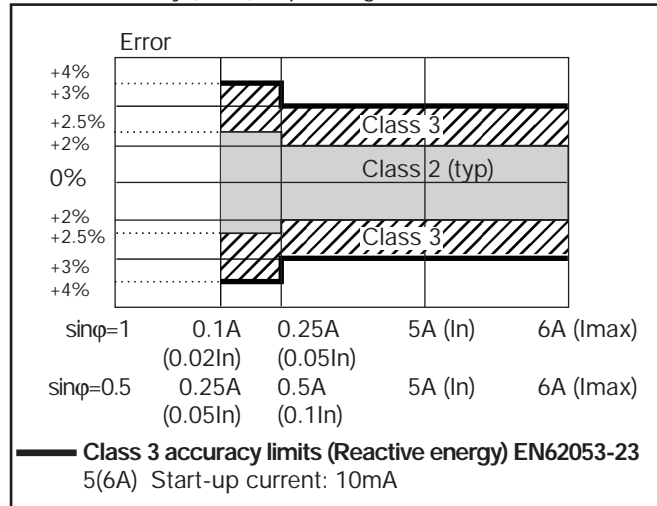
**Figure C**  
**Sine wave, distorted**  
 Fundamental content 70...90%  
 Harmonic content 10...30%  
 Frequency spectrum: 3rd to 16th harmonic  
 Additional error: <0.5% FS

**Accuracy**

**kWh, accuracy (RDG) depending on the current**



**kvarh, accuracy (RDG) depending on the current**



**Used calculation formulas**

**Phase variables**

Instantaneous effective voltage

$$V_{IN} = \sqrt{\frac{1}{n} \cdot \sum_1^n (V_{INi})^2}$$

Instantaneous active power

$$W_1 = \frac{1}{n} \cdot \sum_1^n (V_{INi}) \cdot (A_1)_i$$

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

$$VA_1 = V_{IN} \cdot A_1$$

Instantaneous reactive power

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

**System variables**

Equivalent three-phase voltage

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

Voltage asymmetry

$$ASY_{LL} = \frac{(V_{LLmax} - V_{LLmin})}{V_{LL \Sigma}}$$

$$ASY_{LN} = \frac{(V_{LNmax} - V_{LNmin})}{V_{LN \Sigma}}$$

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 (TPF)

$$\cos\phi_{\Sigma} = \frac{W_{\Sigma}}{VA_{\Sigma}}$$

**Energy metering**

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

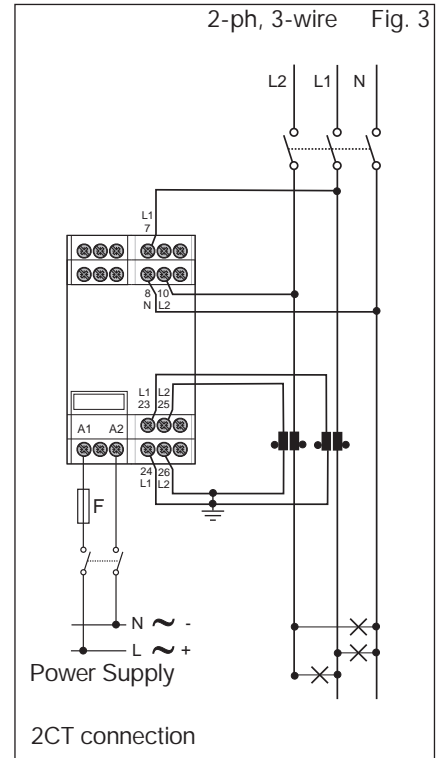
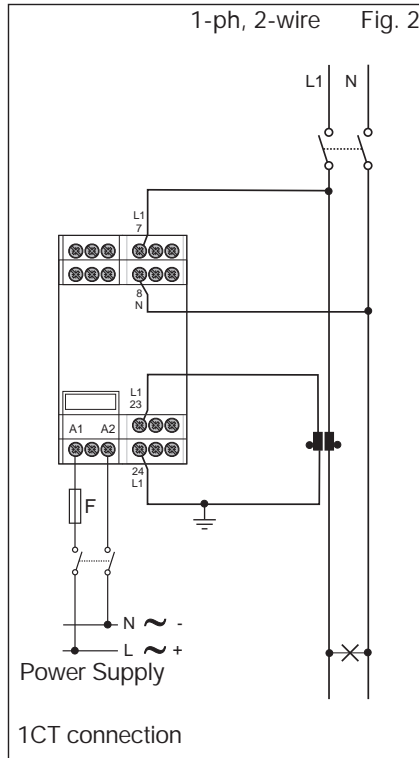
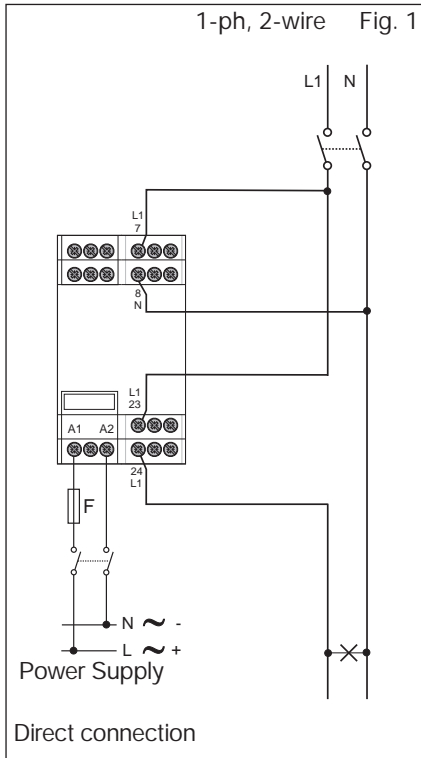
$$kVarh_i = \int_{t_1}^{t_2} Q_i(t) dt \approx \Delta t \sum_{n_1}^{n_2} Q_{i,j}$$

Where:

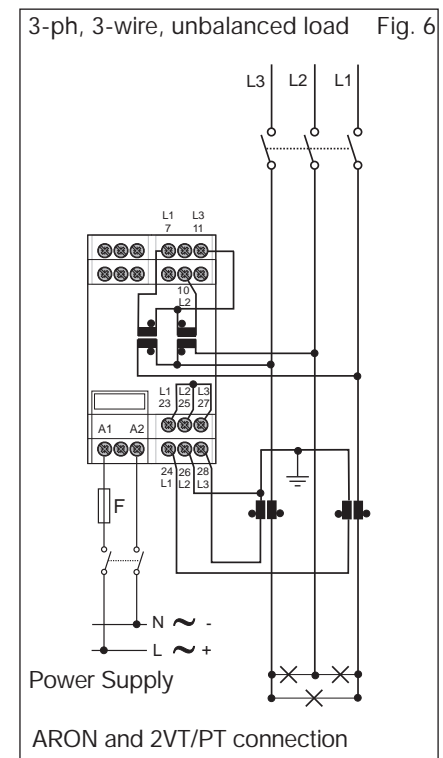
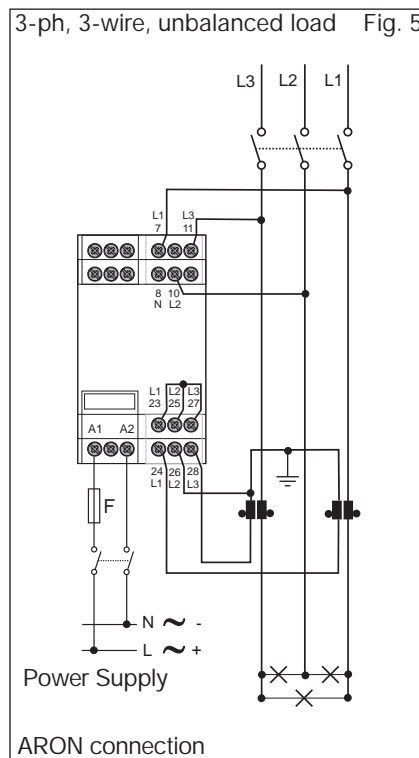
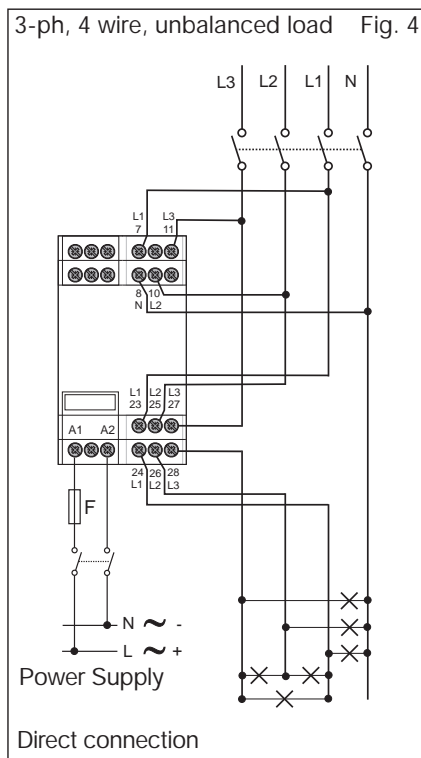
i= considered phase (L1, L2 or L3)  
 P= active power; Q= reactive power;  
 $t_1, t_2$  = starting and ending time points of consumption recording; n= time unit;  $\Delta t$  = time interval between two successive power consumptions;  
 $n_1, n_2$  = starting and ending discrete time points of consumption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



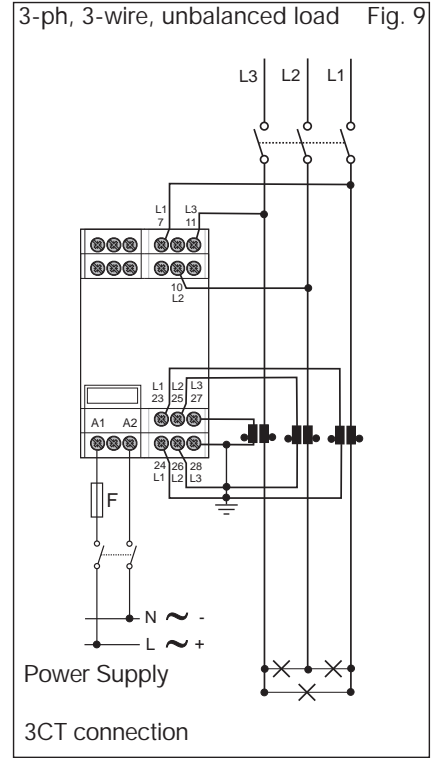
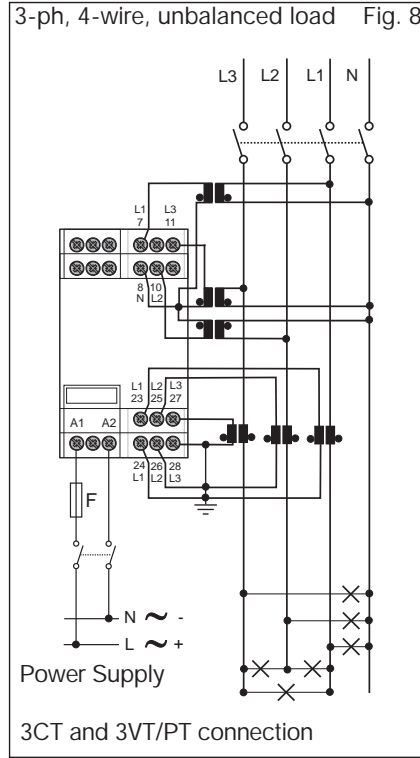
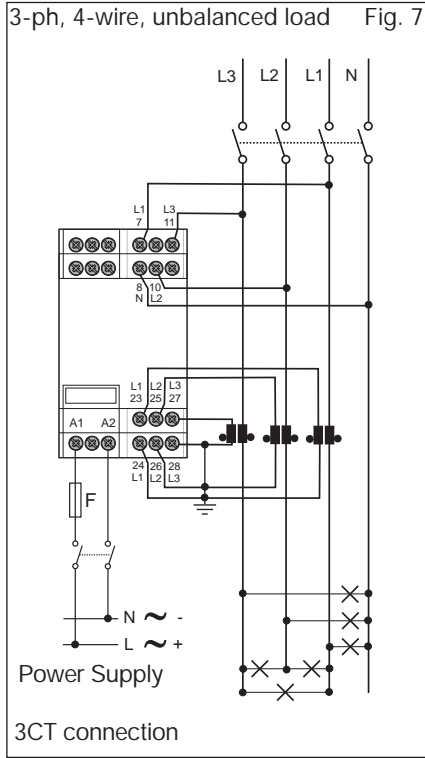
### Wiring diagrams "system type selection: 3"



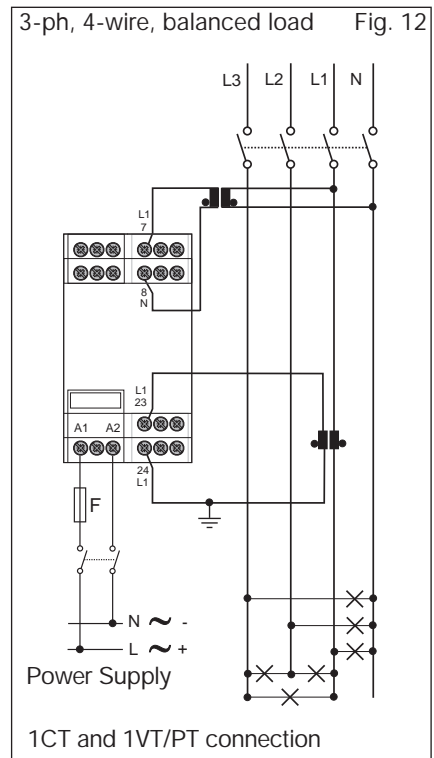
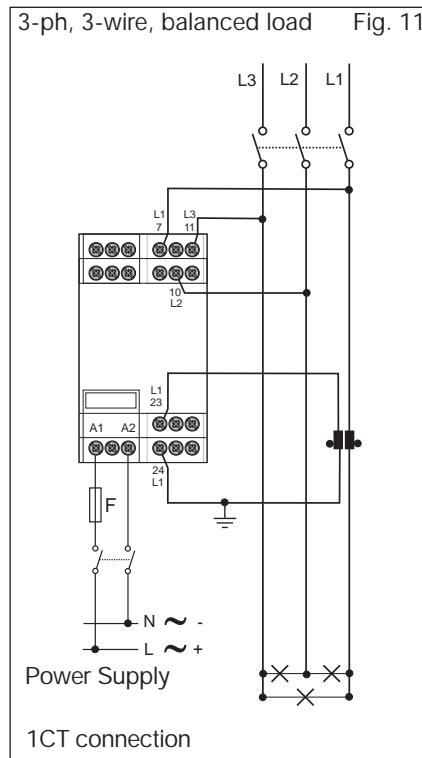
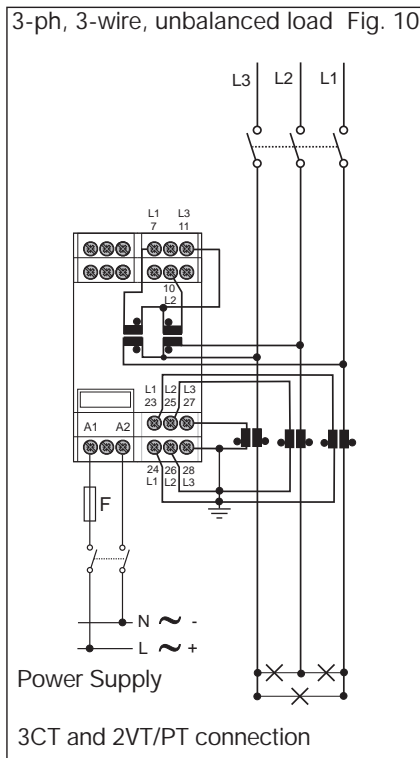
F= 630 mA T (18 to 60VAC/DC)  
125 mA T (90 to 260VAC/DC)



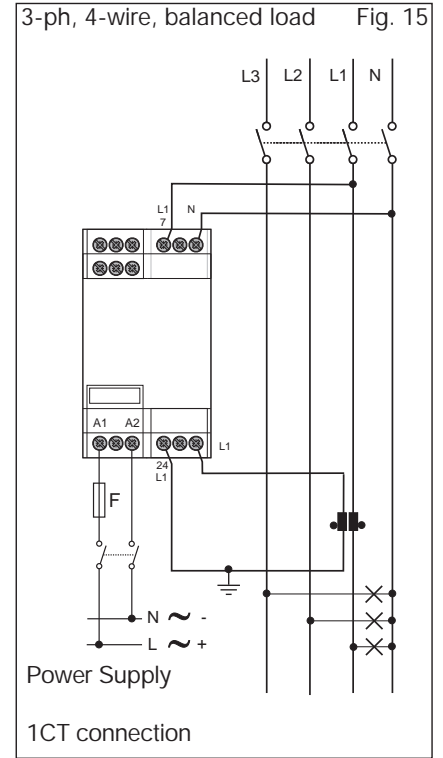
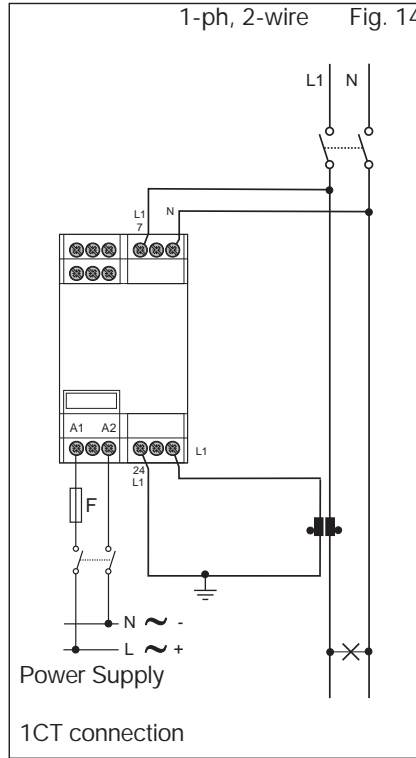
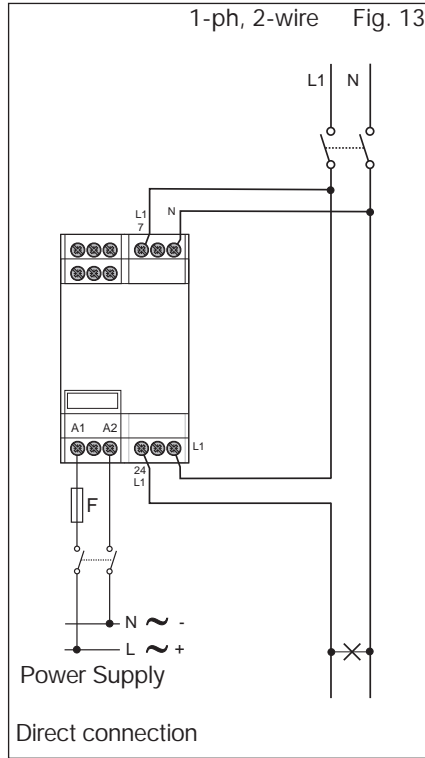
**Wiring diagrams "system type selection: 3" (cont.)**



F= 630 mA T (18 to 60VAC/DC)  
125 mA T (90 to 260VAC/DC)

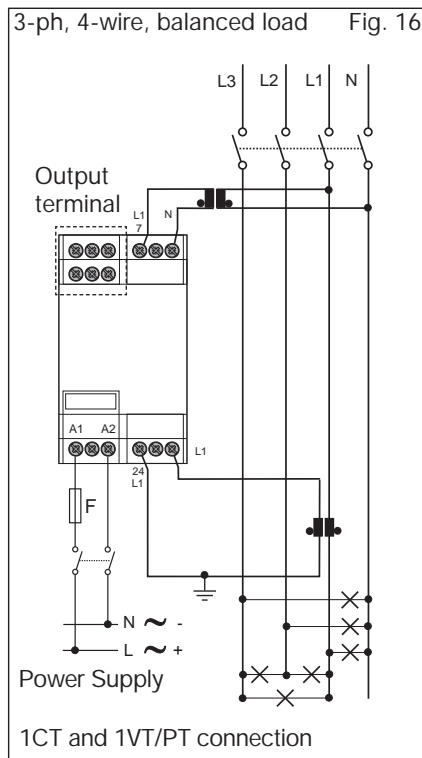


## Wiring diagrams "system type selection: 1"



F= 630 mA T (18 to 60VAC/DC)  
125 mA T (90 to 260VAC/DC)

## Outputs



Analogue output 0-20mA

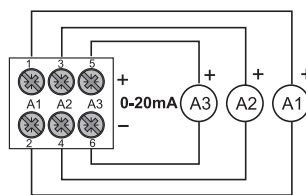


Fig. 17

Analogue output 0-10V

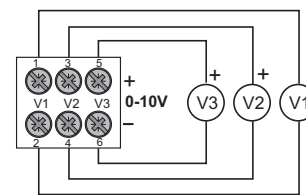


Fig. 18

Relay out.

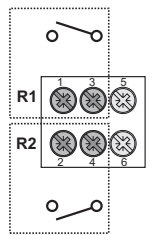


Fig. 19

**NOTE:** the analogue outputs are not insulated among each other.

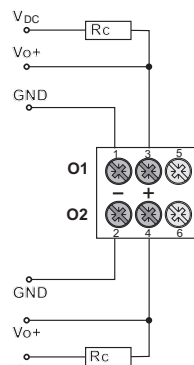


Fig. 20

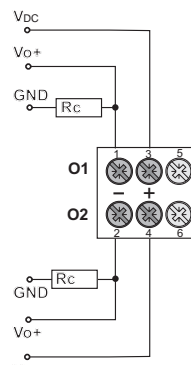
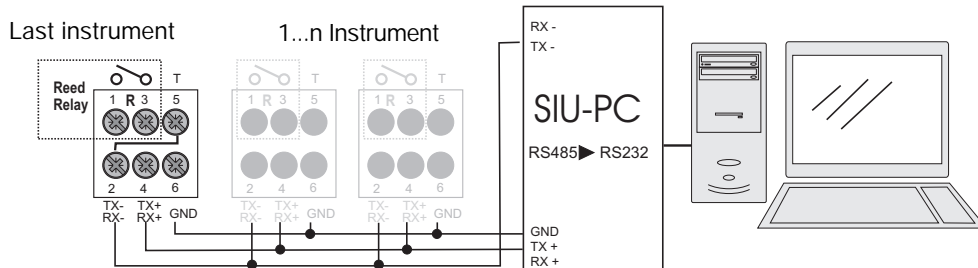


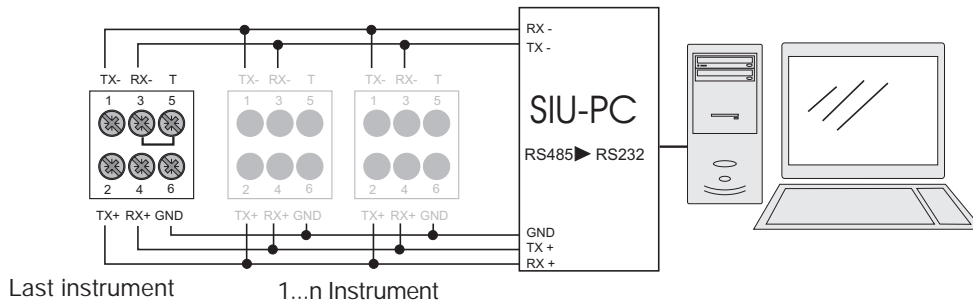
Fig. 21

**Open collector outputs:** The load resistance ( $R_c$ ) must be calculated 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 (external). Vo+: positive output contact (open collector transistor). GND: ground output contact (open collector transistor).

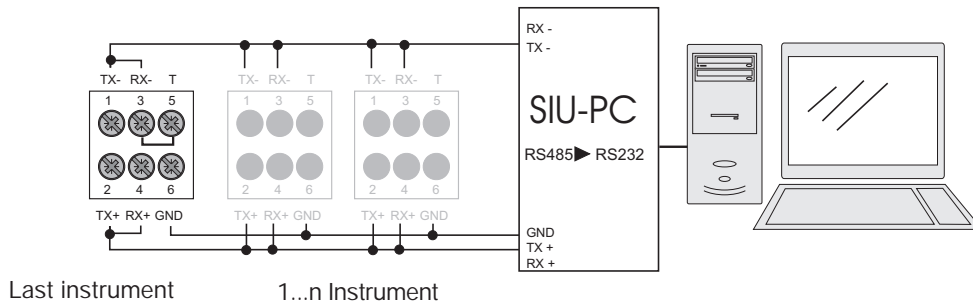
## RS485 serial port and one relay connections



2-wire connection of RS485 serial port + one relay (R). The terminalization must be carried out only on the last instrument of the network



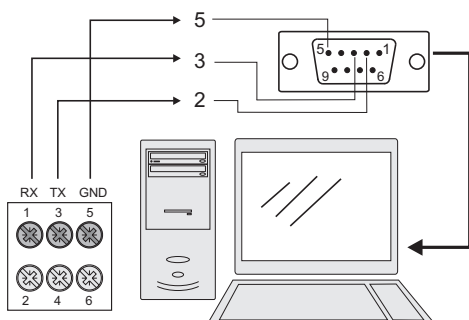
4-wire connection of RS485 serial port, the terminalization must be carried out only on the last instrument of the network



2-wire connection of RS485 serial port, the terminalization must be carried out only on the last instrument of the network

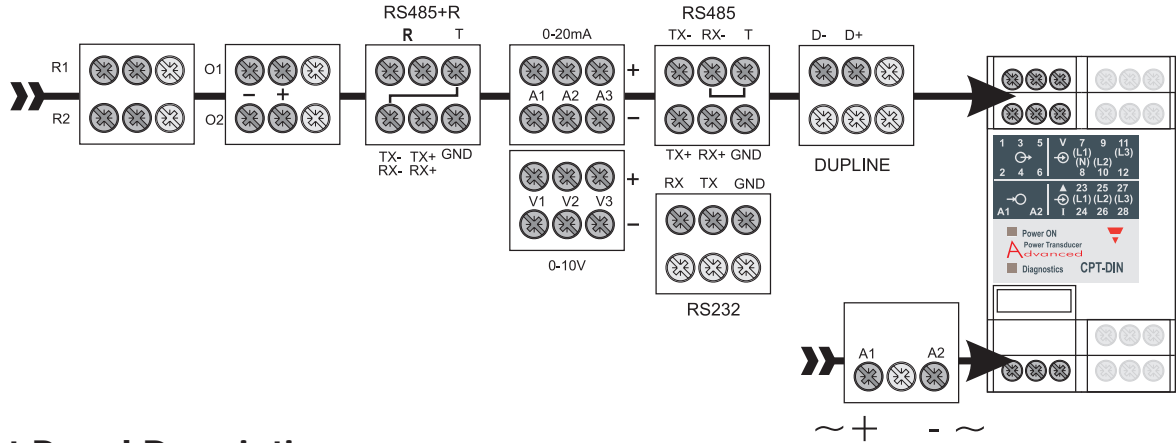
## RS232 Serial port connection

## Easy programming

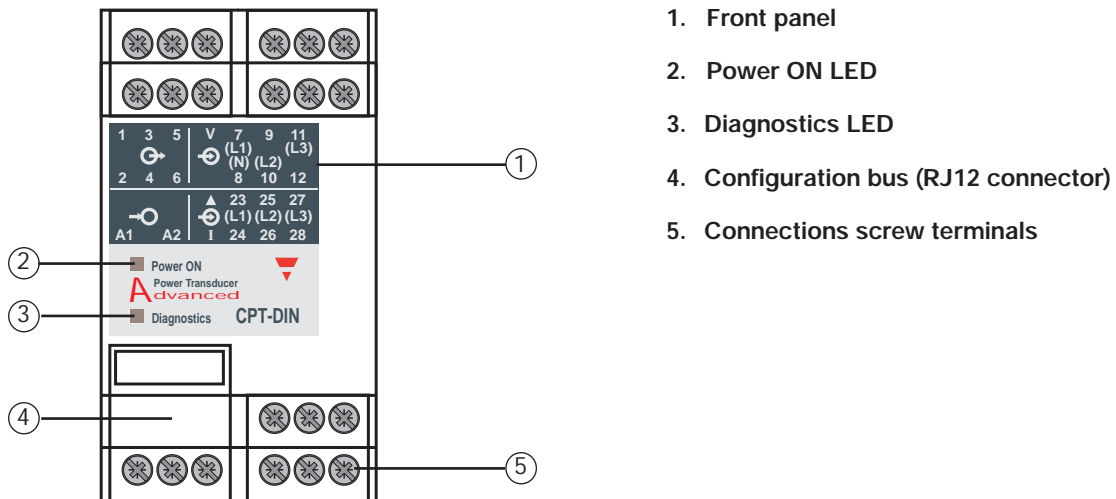


RJ12 communication port for parameters programming. The configuration of the transducer can be easily performed by means of CptASoft. CptASoft-kit includes also 1m long connection cable (RJ12 6-pole / RS232 9-pole female).

## Outputs connections



## Front Panel Description



## Dimensions

