

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

CARLO GAVAZZI



- RS232 serial port on request
- Alarms (only from serial communication port)  $V_{LN}$ ,  $A_n$

- Class 2 (active energy)
- Class 3 (reactive energy)
- Accuracy  $\pm 0.5$  F.S. (current/voltage)
- Compact Power transducer
- Instantaneous variables data format: 4 digit
- Energies data format: 8+1 digit
- System variables and phase measurements:  $W$ ,  $W_{dmd}$ ,  $W_{dmd\ max}$ ,  $var$ ,  $VA$ ,  $VA_{dmd}$ ,  $PF$ ,  $V$ ,  $A$ ,  $A_n$ ,  $A_{dmd}$ ,  $A_{max}$ ,  $A_{dmd\ max}$ ,  $Hz$
- Energy measurements: kWh and kvarh
- Hour counter (5+2 DGT)
- TRMS meas. of distorted sine waves (voltages/currents)
- Power supply: 90 to 260VAC/DC and 18 to 60VAC/DC
- Protection degree (front): IP20
- Dimensions: 45x83.5x98.5mm
- RS422/485 serial port

## Product Description

3-phase compact power transducer. Particularly recommended for the measurements of the main electrical variables.  
Housing for DIN-rail mount-

ing, protection degree IP20 as standard, and RS485 or RS232 serial port. Parameters programmable by means of CptBSoft.

## How to order

	CPT-DIN	AV5	3	H	S1	BX
Model						
Range code						
System						
Power supply						
Outputs						
Option						

## How to order

CptBSoft-kit

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

## Type Selection

Range codes	System	Power supply	Outputs
<b>AV5:</b> 400/(690) $V_{L-L}/5(6)AAC$ $VL-N$ : 185 V to 460 V $VL-L$ : 320 V to 800 V <b>AV6:</b> 120/(208) $V_{L-L}/5(6)AAC$ $VL-N$ : 45 V to 145 V $VL-L$ : 78 V to 250 V Phase current: 0.03A to 6A Neutral current: 0.09 to 6A	<b>3 :</b> 1, 2 or 3-phase, unbalanced and balanced load, with or without neutral <b>1 :</b> 1-3-phase, balanced load (*)	<b>L:</b> 18 to 60VAC/DC <b>H:</b> 90 to 260VAC/DC  (*) Pay attention: the 3-phase measurement is carried out as one current and one phase to neutral voltage measurement.	<b>S1:</b> RS485 port <b>S2:</b> RS232 port  <b>Options</b> <b>BX:</b> Basic features

## Input specifications

<b>Rated inputs</b> Current Voltage	3 (current transformers) 4	Active energy Reactive energy Frequency	0.03A to 0.25A: $\pm 2\%$ FS +5DGT) Class 2 (I start up: 30mA) Class 3 (I start up: 30mA) $\pm 0.1$ Hz (48 to 62Hz)
<b>Accuracy</b> (RS485/RS232) (@25°C $\pm 5^\circ C$ , R.H. $\leq 60\%$ )	with CT=1 and VT=1 AV5: 1150W-VA-var, FS:230VLN, 400VLL; AV6: 285W-VA-var, FS: 57VLN, 100VLL	<b>Additional errors</b> Humidity	$\leq 0.3\%$ FS, 60% to 90% RH
Current	0.25 to 6A: $\pm (0.5\% \text{ FS} + 1\text{DGT})$	<b>Temperature drift</b>	$\leq 200\text{ppm}/^\circ C$
Neutral current	0.03A to 0.25A: $\pm (0.5\% \text{ FS} + 7\text{DGT})$ 0.25 to 6A: $\pm (1.5\% \text{ FS} + 1\text{DGT})$	<b>Sampling rate</b>	1400 samples/s @ 50Hz 1700 samples/s @ 60Hz
Phase-phase voltage	0.09A to 0.25A: $\pm (1.5\% \text{ FS} + 7\text{DGT})$	<b>Measurement refresh time</b>	700ms
Phase-neutral voltage	$\pm (1.5\% \text{ FS} + 1\text{DGT})$	<b>Measurement format</b>	
Active and Apparent power,	$\pm (0.5\% \text{ FS} + 0.1\text{DGT})$	Instantaneous variables	4 DGT (Max indication: 9999)
Reactive power	0.25 to 6A: $\pm (1\% \text{ FS} + 1\text{DGT})$ ; 0.03A to 0.25A: $\pm (1\% \text{ FS} + 5\text{DGT})$ 0.25 to 6A: $\pm (2\% \text{ FS} + 1\text{DGT})$ ;	Energies	9 DGT (Max indication: 999 999 99.9)
		Hour counter	7 DGT (Max. indication: 9 999 9.99)

## Input specifications (cont.)

<b>Measurements</b>	Current, voltage, power, power factor, frequency, energy, hour counter TRMS measurement of distorted waves.	400/690V <sub>L-L</sub> (AV5) 120/208V <sub>L-L</sub> (AV6) Current	1 MΩ ±5% 453 KΩ ±5% ≤ 0.02Ω
Type	Direct	<b>Frequency</b>	48 to 62 Hz
Coupling type	Direct	<b>Overload protection</b>	(max values)
Crest factor	< 3, max 10A peak	Continuos voltage/current	AV5: 460V <sub>LN</sub> , 800V <sub>LL</sub> /6A AV6: 145V <sub>LN</sub> , 250V <sub>LL</sub> /6A
<b>Input impedance</b>		For 500ms: voltage/current	AV5: 800V <sub>LN</sub> , 1380V <sub>LL</sub> /36A AV6: 240V <sub>LN</sub> , 416V <sub>LL</sub> /36A

## Serial Port Specifications

<b>RS422/RS485</b>	Halfduplex communication		no parity, 1 stop bit
Type	Multidrop bidirectional (static and dynamic variables)	Baud-rate	9600 bit/s
Connections	2 or 4 wires, max. distance 1200m, termination directly on the instrument	Insulation	By means of optocouplers, 2kV <sub>RMS</sub> output to measuring input. 4kV <sub>RMS</sub> output to power supply
Addresses	1 to 255 selectable via software	<b>RS232</b>	Halfduplex communication
Protocol	MODBUS/JBUS (RTU)	Type	Point to point connection
Data (bidirectional)		Connections	3-wire, max. distance 15m
Dynamic (reading only)	System, phase variables and energies	Address	1 to 255 selectable via software
Static (writing only)	All configuration parameters	Protocol	MODBUS/JBUS (RTU)
Data format	1 start bit, 8 data bit,	Baud-rate	9600bits/s other characteristics like R422/RS485 port

## RS232 Configuration Bus

Connections	RJ12 (3-wire) for special cable	Insulation	By means of optocouplers, 2kV <sub>RMS</sub> output to measuring input. 4kV <sub>RMS</sub> output to power supply
Baud-rate	4800 bits/s		
Data format	1 start bit, 8 data bit, no parity, 1 stop bit		

## CptBSoft: parameter programming and reading data software

<b>CptBSoft</b>	Multi language software to program the working parameters of the transducer and to read the energies and the instantaneous variables. The program runs under Windows 95/98/98SE/2000/NT/XP.	<b>Working mode</b>	Two different working modes can be selected: - management of a local RS485 network; - management of communication from a single instrument to PC (RS232);
		<b>Data access</b>	By means of RS232 serial port, RS485 serial port or RS232 configuration port.

## Software functions

<b>System selection</b>	3-ph. with or without N, unbal. 3-phase balanced "1CT + 1VT" 3-phase ARON, unbalanced 2-phase Single phase	<b>Filter action</b>	Measurements, alarms, serial out. (fundamental var: V, A, W and their derived ones).
<b>Transformer ratio</b>		<b>Alarms</b>	Programmable, for the V <sub>LNΣ</sub> and A <sub>n</sub> (neutral current). Note: the alarm is only a status transmitted via communication port.
CT	1 to 999		
VT/PT	1.0 to 99,9		
<b>Filter</b>		<b>Reset</b>	Independent alarm (V <sub>LNΣ</sub> , A <sub>n</sub> ) max: A dmd, W dmd all energies (Wh, varh) hour counter
Operating range	0 to 99.9% of the input electrical scale		
Filtering coefficient	1 to 16		

## Power Supply Specifications

Auxiliary power supply

90 to 260VAC/DC  
16 to 60VAC/DC

Power consumption

AC: 4.5 VA  
DC: 4W

## General Specifications

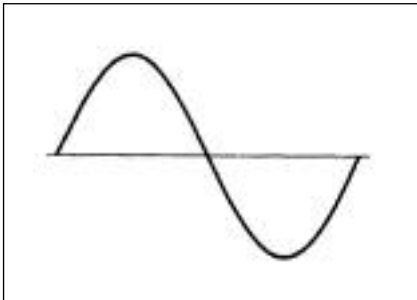
<b>Front LED's</b> Power on Diagnostics	Green Green (TX data) Red (RX data)	<b>EMC</b> Emissions	EN61000-6-3, EN60688 residential environment, commerce and light industry
<b>Operating temperature</b>	0° to +50°C (32° to 122°F) (RH < 90% non condensing)	Immunity	EN61000-6-2 industrial environment.
<b>Storage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

## Measurements available on the communication port

Variables that can be retransmitted 3-phase system 4-wire connection

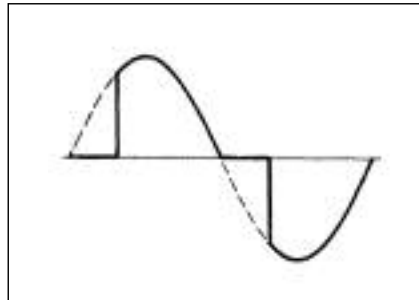
Variables			Notes
V L1	V L2	V L3	
V L12	V L23	V L31	
A L1	A L2	A L3	
A L1 dmd	A L2 dmd	A L3 dmd	dmd = demand (integration time selectable from 1 to 30 minutes)
An	An alarm		An alarm: neutral current alarm
W L1	W L2	W L3	
PF L1	PF L2	PF L3	
var L1	var L2	var L3	
VA L1	VA L2	VA L3	
VA system	W system	var system	
VA dmd (system)	W dmd (system)	Hz	dmd = demand (integration time selectable from 1 to 30 minutes)
W dmd MAX			Maximum sys power demand
Wh			
varh			
V LL system	V <sub>LN</sub> alarm	PF system	V <sub>LN</sub> alarm: alarm status if V <sub>LN</sub> is not within the two set limits.
A MAX			max. current among the three phases
A dmd max			max. dmd current among the three phases
h			working hour counter

## Waveform of the signals that can be measured



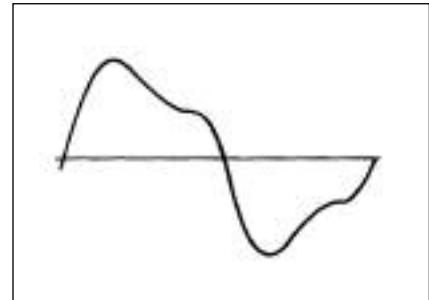
**Figure A**  
Sine wave, undistorted

Fundamental content 100%  
Harmonic content 0%  
 $A_{rms} = 1.1107 | \Delta |$



**Figure B**  
Sine wave, indented

Fundamental content 10...100%  
Harmonic content 0...90%  
Frequency spectrum: 3rd to 16th harmonic  
Additional error: <1% FS

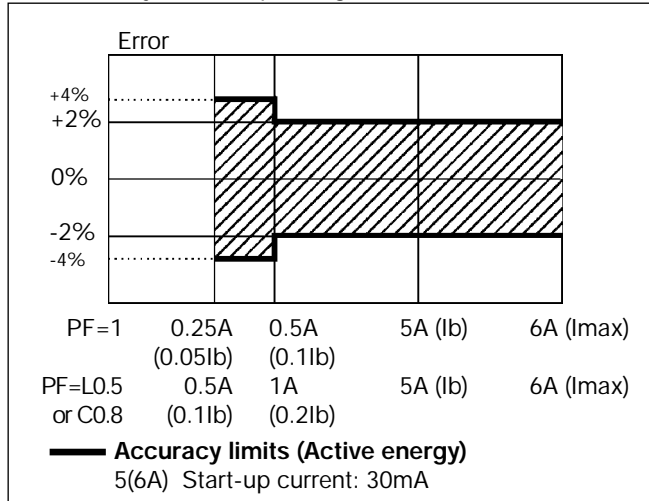


**Figure C**  
Sine wave, distorted

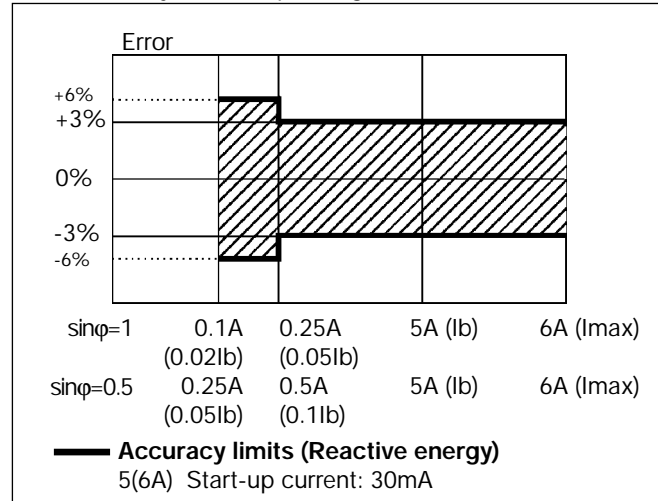
Fundamental content 70...90%  
Harmonic content 10...30%  
Frequency spectrum: 3rd to 16th harmonic  
Additional error: <0.5% FS

## Accuracy

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



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



## Used calculation formulas

## Phase variables

Instantaneous effective voltage

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

Instantaneous active power

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

Instantaneous power factor

$$\cos \phi_1 = \frac{W_1}{V_{A1}}$$

Instantaneous effective current

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

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

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

Three-phase reactive power

$$VAR_{\Sigma} = (VAR_1 + VAR_2 + VAR_3)$$

Neutral current

$$A_n = \overline{A_{L1}} + \overline{A_{L2}} + \overline{A_{L3}}$$

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

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

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

Where:

i = considered phase (L1, L2 or L3)

P = active power

Q = reactive power

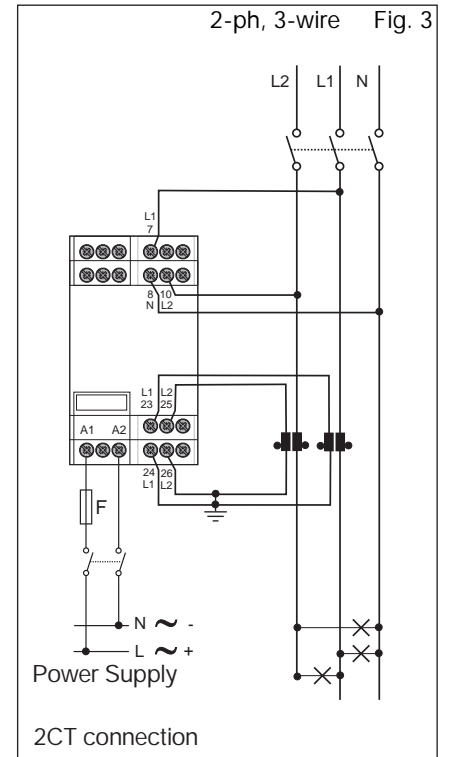
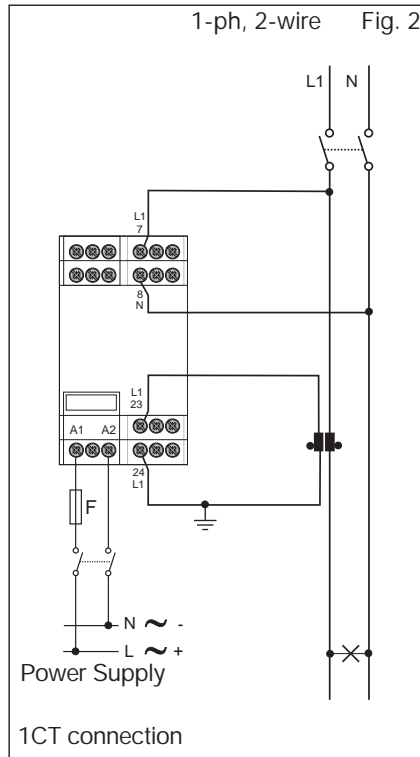
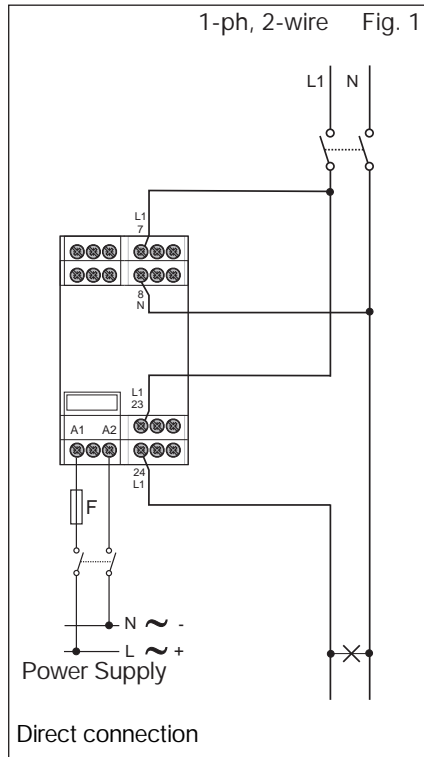
$t_1, t_2$  = starting and ending time points of consumption recording

n = time unit

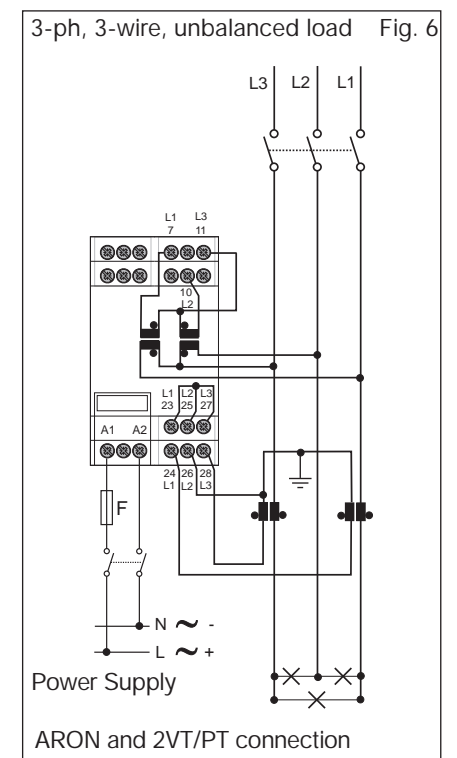
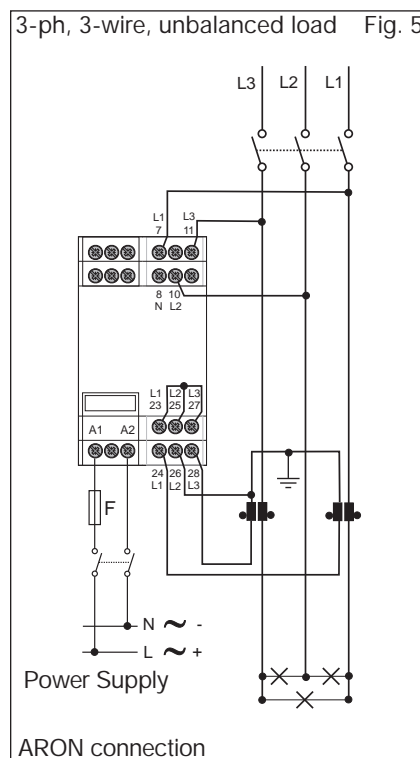
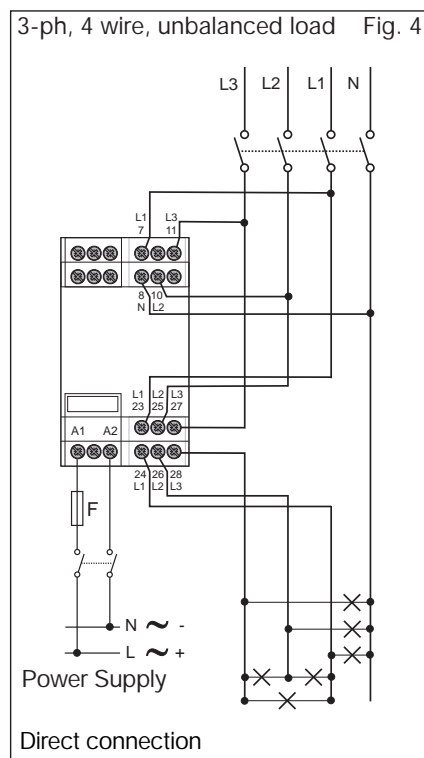
$\Delta t$  = time interval between two successive power consumptions

$n_1, n_2$  = starting and ending discrete time points of consumption recording

## Wiring diagrams "system type selection: 3"



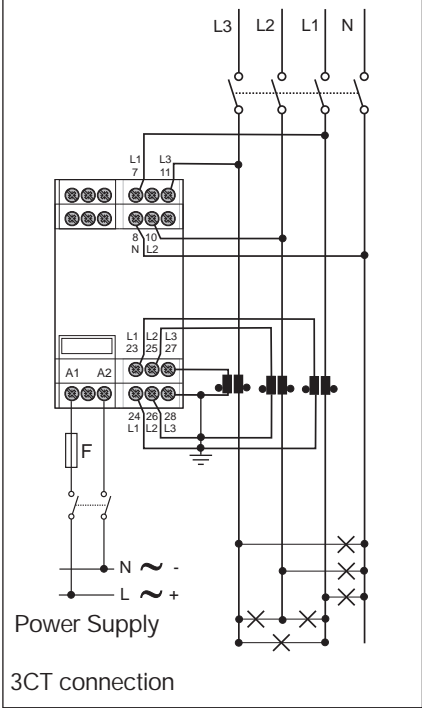
F = 630 mA T (18 to 60VAC/DC)  
125 mA T (90 to 260VAC/DC)



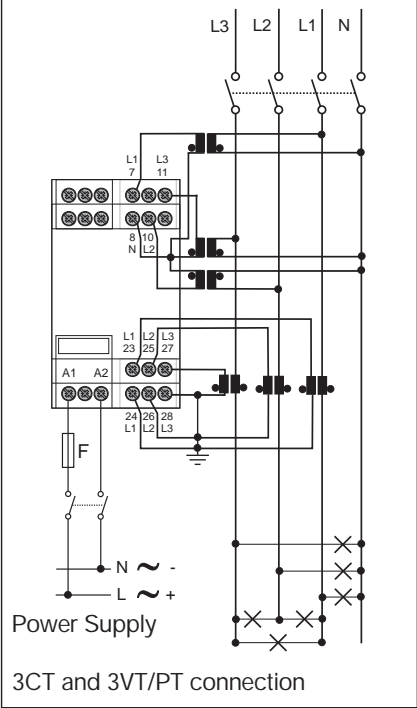


Wiring diagrams “system type selection: 3” (cont.)

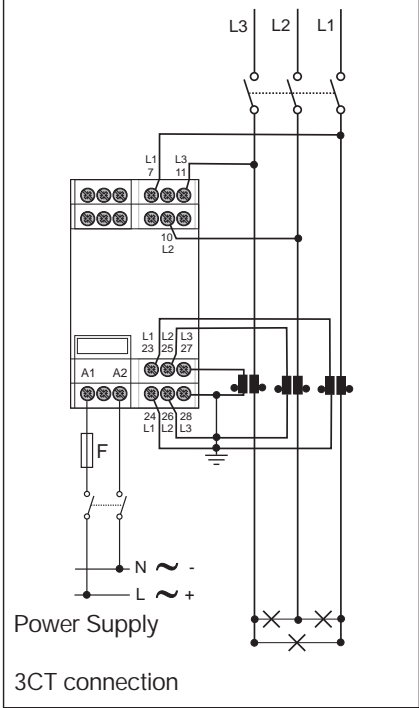
3-ph, 4-wire, unbalanced load Fig. 7



3-ph, 4-wire, unbalanced load Fig. 8

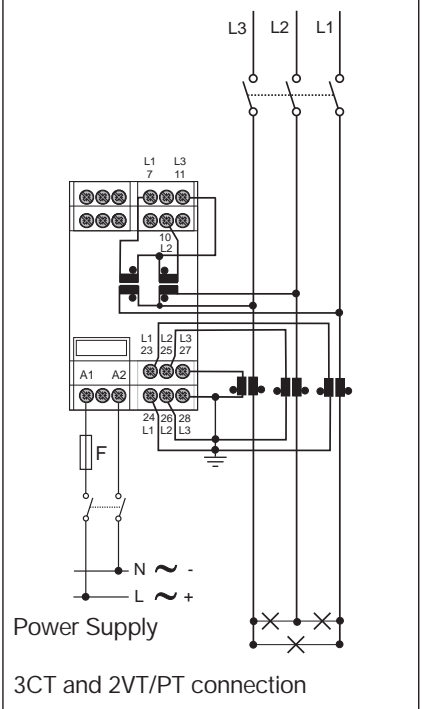


3-ph, 3-wire, unbalanced load Fig. 9

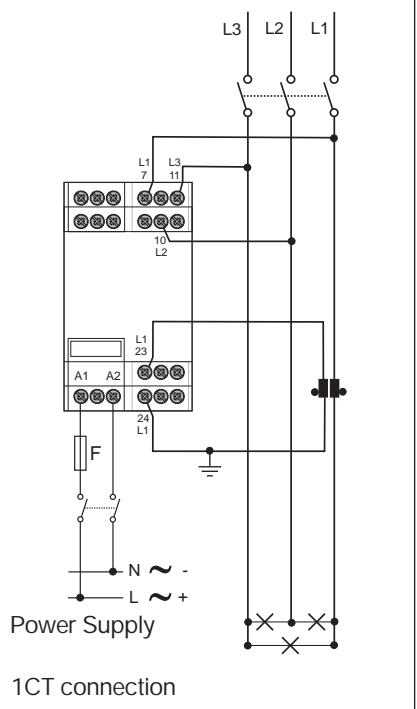


F= 630 mA T (18 to 60VAC/DC)  
125 mA T (90 to 260VAC/DC)

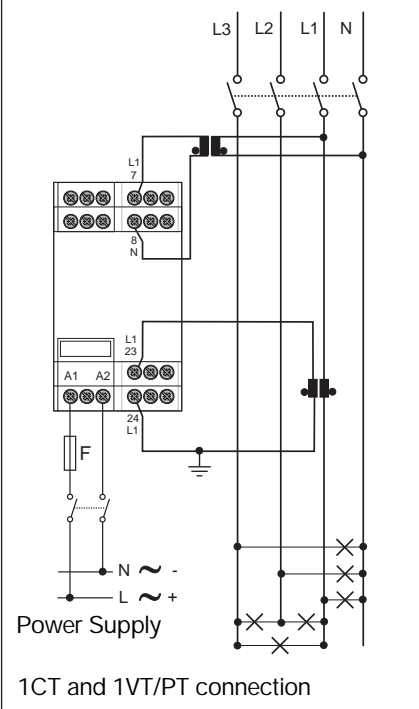
3-ph, 3-wire, unbalanced load Fig. 10



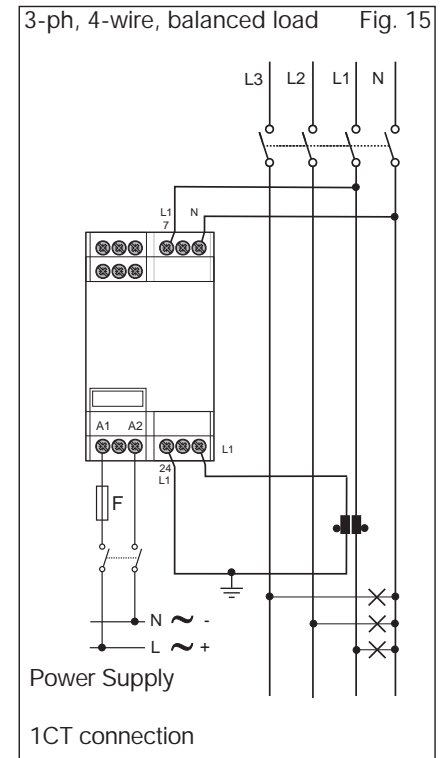
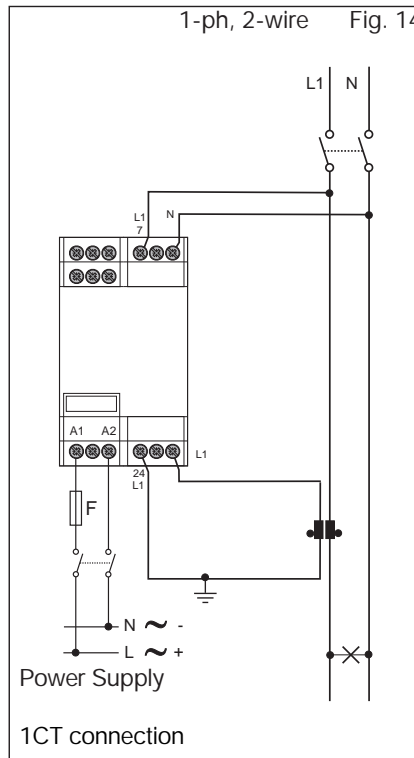
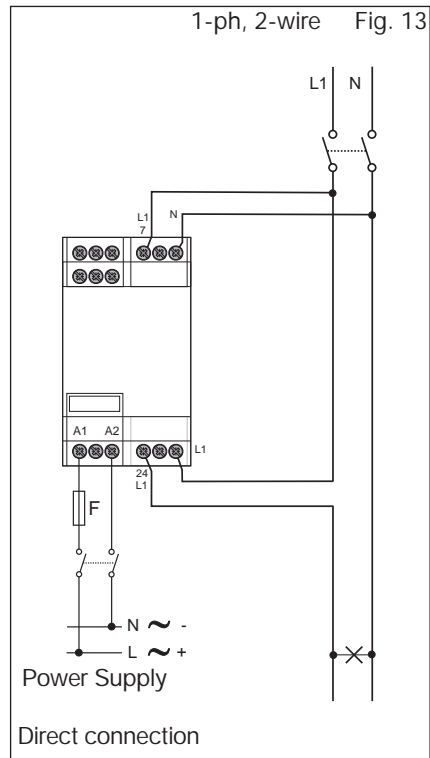
3-ph, 3-wire, balanced load Fig. 11



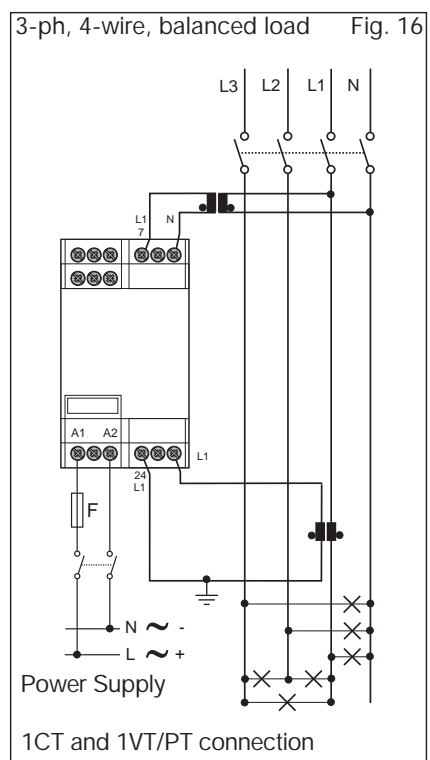
3-ph, 4-wire, balanced load Fig. 12



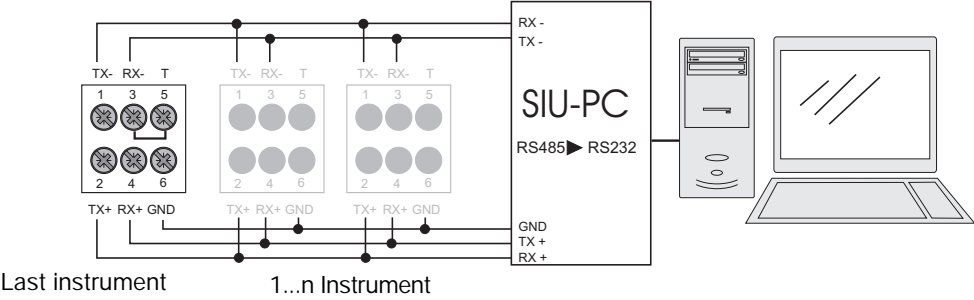
## Wiring diagrams "system type selection: 1"



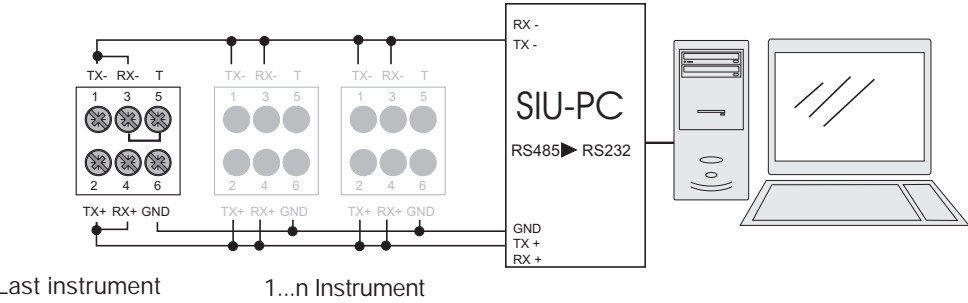
F= 630 mA T (18 to 60VAC/DC)  
125 mA T (90 to 260VAC/DC)



RS485 Serial port connection



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



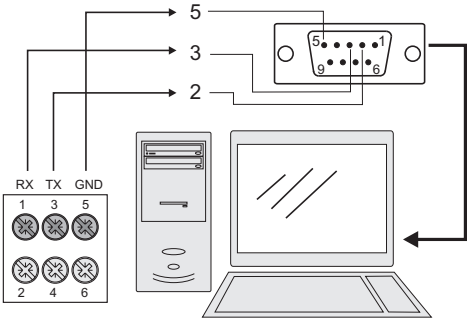
2-wire connection of RS485 serial port, the terminalization must be carried out only on the last instrument of the network

Easy programming



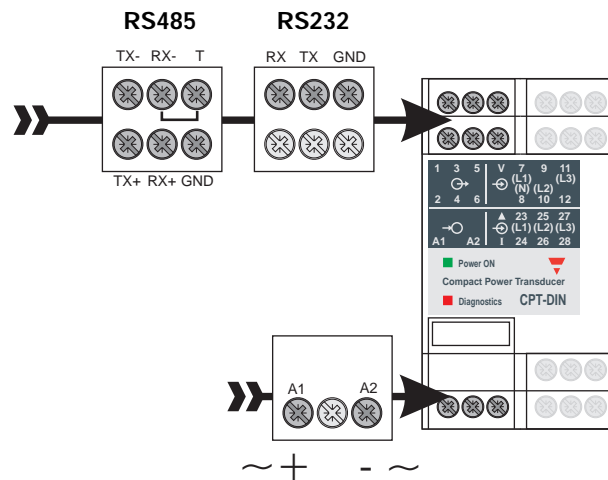
RJ12 communication port for parameters programming. The configuration of the transducer can be easily performed by means of CptBSoft. CptBSoft-kit includes also a connection cable (RJ12 6 pole + RS232 9 pole female).

RS232 Serial port connection

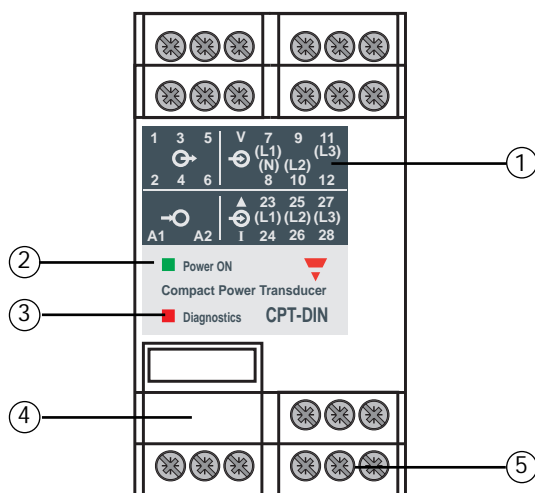




## Outputs connections



## Front Panel Description



1. Front panel
2. Power ON LED
3. Diagnostics LED
4. Configuration bus (RJ12 connector)
5. Connections screw terminals

## Dimensions and Panel Cut-out

