

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 ± 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

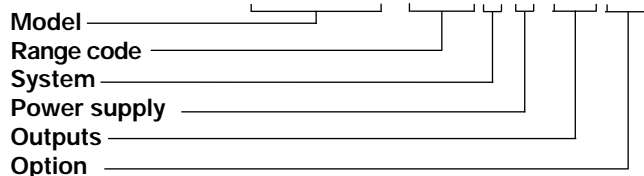
Product Description

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



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

Input specifications

Rated inputs 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) ± 0.1 Hz (48 to 62Hz)
Accuracy (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	Additional errors Humidity	$\leq 0.3\%$ FS, 60% to 90% RH
Current	0.25 to 6A: $\pm(0.5\%$ FS +1DGT) 0.03A to 0.25A: $\pm(0.5\%$ FS +7DGT)	Temperature drift	≤ 200 ppm/ $^\circ C$
Neutral current	0.25 to 6A: $\pm(1.5\%$ FS +1DGT) 0.09A to 0.25A: $\pm(1.5\%$ FS+7DGT)	Sampling rate	1400 samples/s @ 50Hz 1700 samples/s @ 60Hz
Phase-phase voltage	$\pm(1.5\%$ FS + 1DGT)	Measurement refresh time	700ms
Phase-neutral voltage	$\pm(0.5\%$ FS + 0.1DGT)	Measurement format	Instantaneous variables Energies
Active and Apparent power,	0.25 to 6A: $\pm(1\%$ FS +1DGT); 0.03A to 0.25A: $\pm(1\%$ FS+5DGT)	Hour counter	4 DGT (Max indication: 9999) 9 DGT (Max indication: 999 999 99.9)
Reactive power	0.25 to 6A: $\pm(2\%$ FS +1DGT);		7 DGT (Max. indication: 9 999 9.99)



Input specifications (cont.)

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

Serial Port Specifications

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

RS232 Configuration Bus

Connections	RJ12 (3-wire) for special cable	Insulation	By means of optocouplers, 2kV _{RMS} output to measuring input. 4kV _{RMS} 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

CptBSoft	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.	Working mode	Two different working modes can be selected: - management of a local RS485 network; - management of communication from a single instrument to PC (RS232);
		Data access	By means of RS232 serial port, RS485 serial port or RS232 configuration port.

Software functions

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

Power Supply Specifications

Auxiliary power supply	90 to 260VAC/DC 16 to 60VAC/DC	Power consumption	AC: 4.5 VA DC: 4W
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General Specifications

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

Measurements available on the communication port

Variables that can be retrasmitted 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 _{LN} alarm	PF system	V _{LN} alarm: alarm status if V _{LN} 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

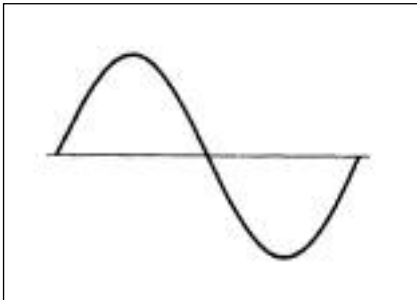


Figure A
Sine wave, undistorted
 Fundamental content 100%
 Harmonic content 0%
 $A_{rms} = 1.1107 |A|$

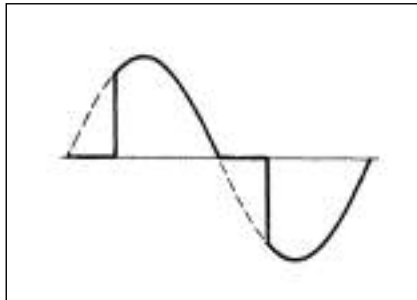


Figure B
Sine wave, indented
 Fundamental content 10...100%
 Harmonic content 0...90%
 Frequency spectrum: 3rd to 16th harmonic
 Additional error: <1% FS

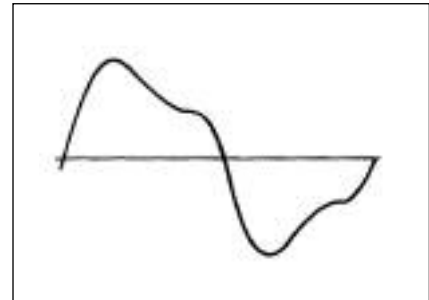
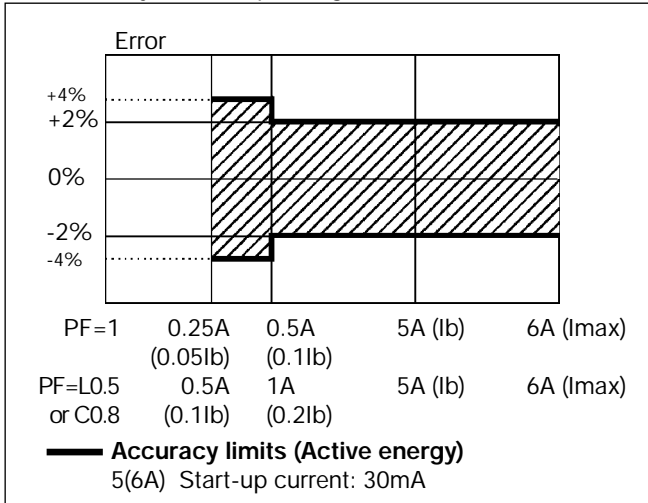


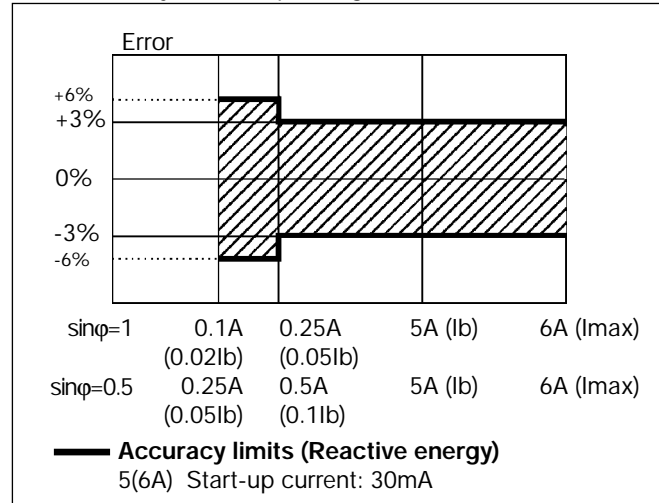
Figure C
Sine wave, distorted
 Fundamental content 70...90%
 Harmonic content 10...30%
 Frequency spectrum: 3rd to 16th harmonic
 Additional error: <0.5% FS

Accuracy

Wh, accuracy (RDG) depending on the current



varh, accuracy (RDG) depending on the current



Used calculation formulas

Phase variables

Instantaneous effective voltage

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

Instantaneous active power

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

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

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

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

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

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

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

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

Where:

i = considered phase (L1, L2 or L3)

P = active power

Q = reactive power

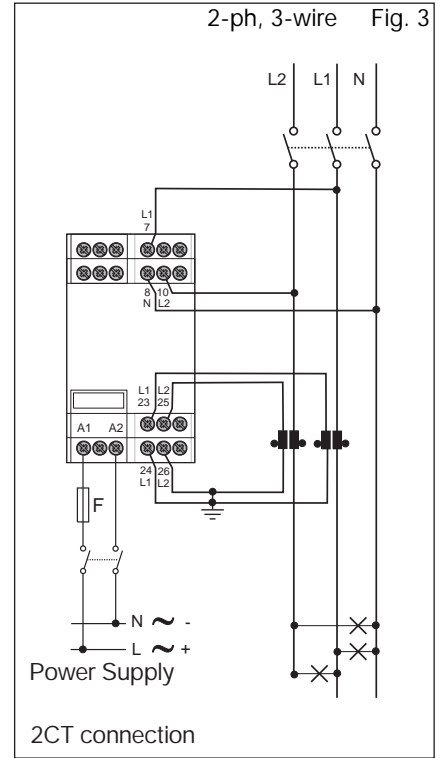
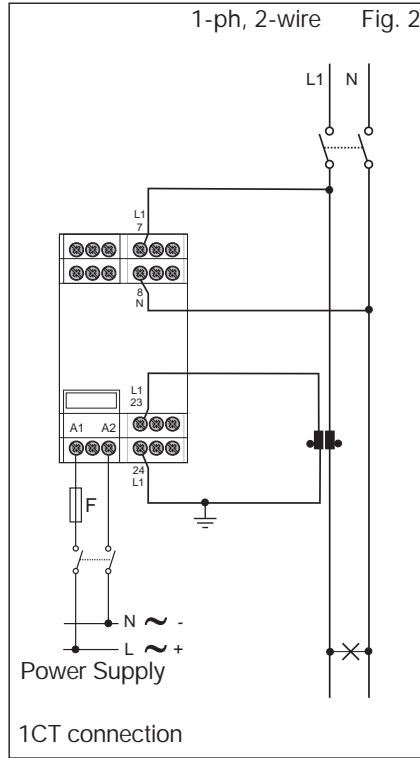
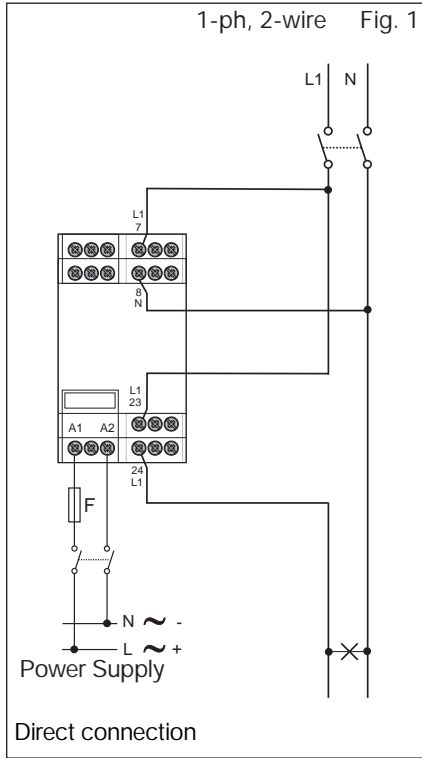
t₁, t₂ = starting and ending time points of consumption recording

n = time unit

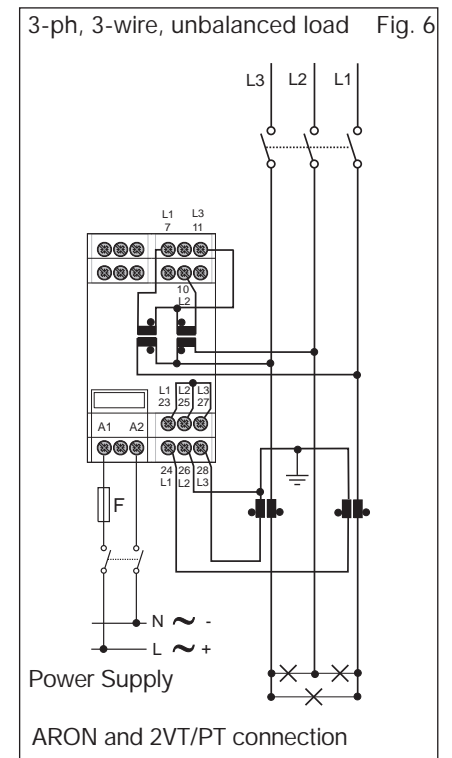
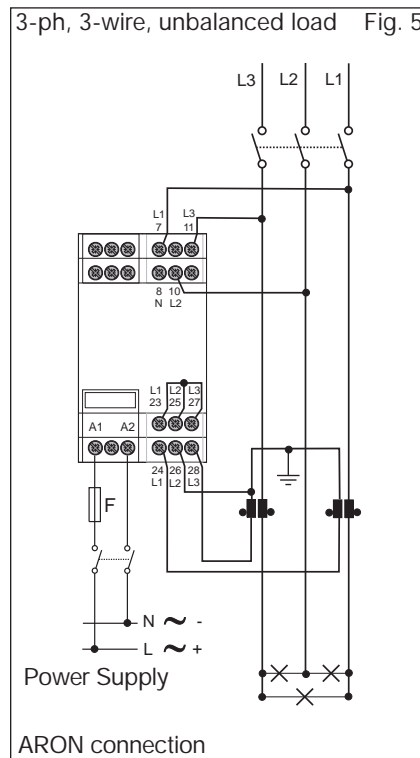
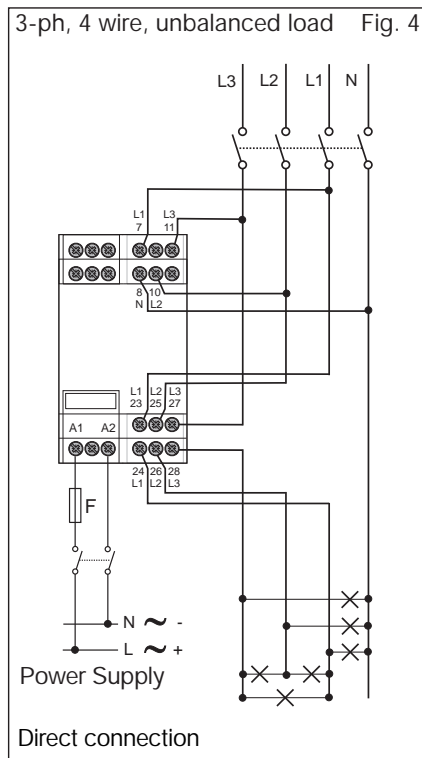
Δt = time interval between two successive power consumptions

n₁, n₂ = starting and ending discrete time points of consumption recording

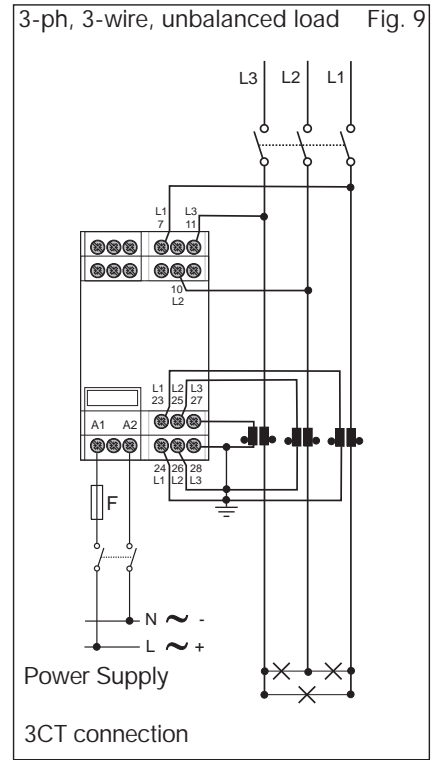
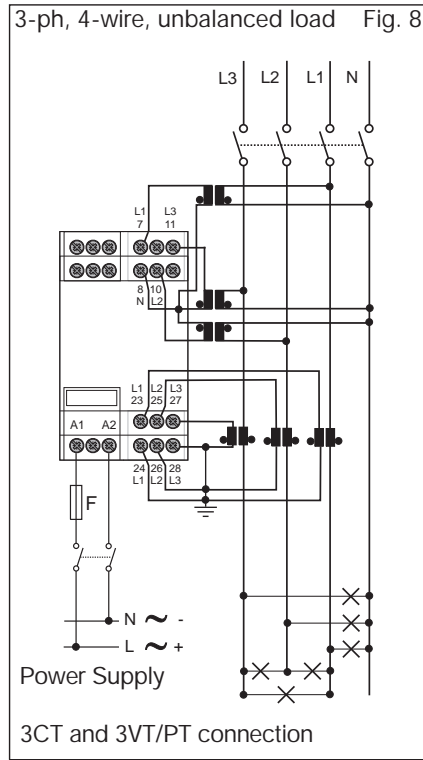
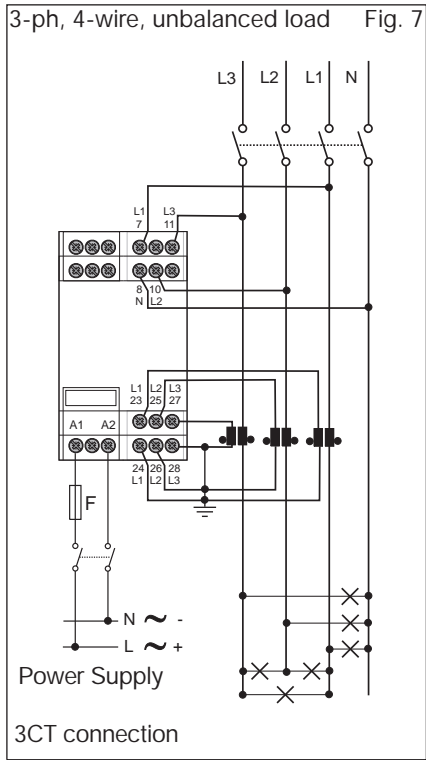
Wiring diagrams "system type selection: 3"



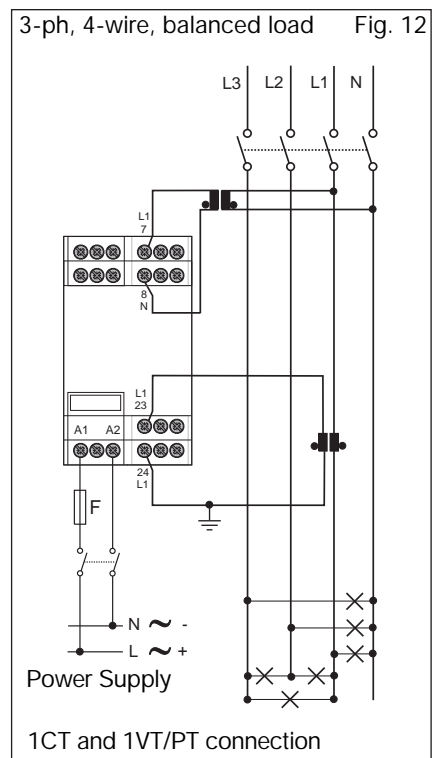
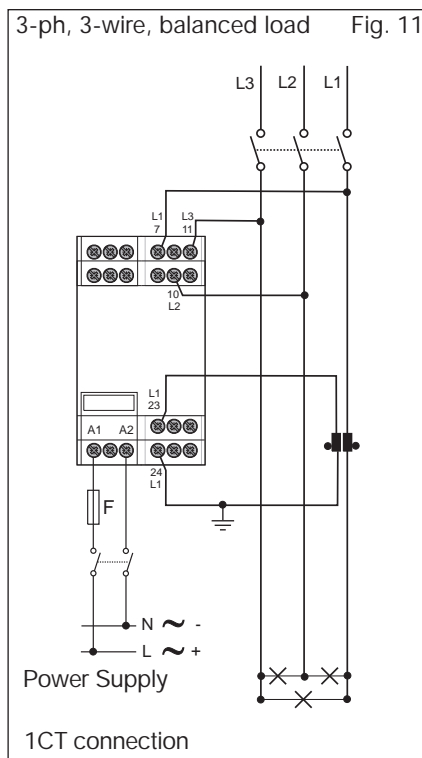
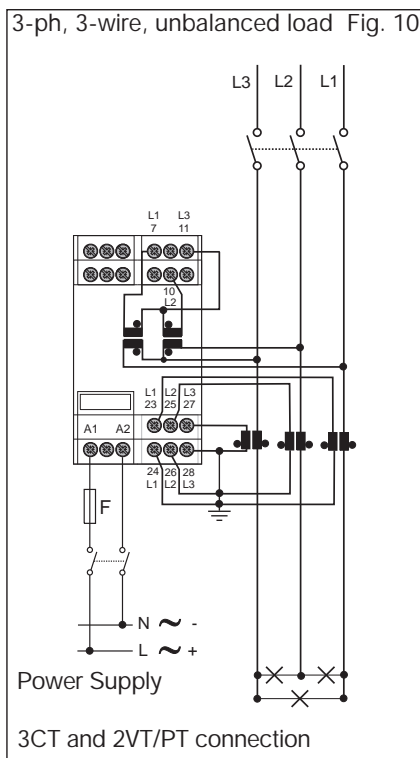
F= 630 mA T (18 to 60VAC/DC)
125 mA T (90 to 260VAC/DC)



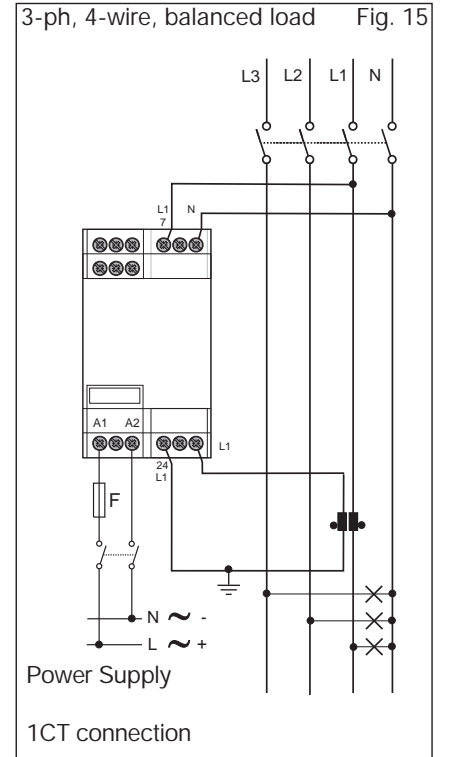
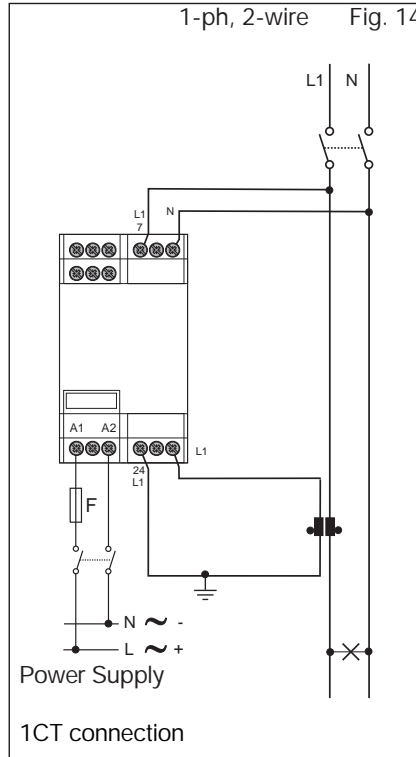
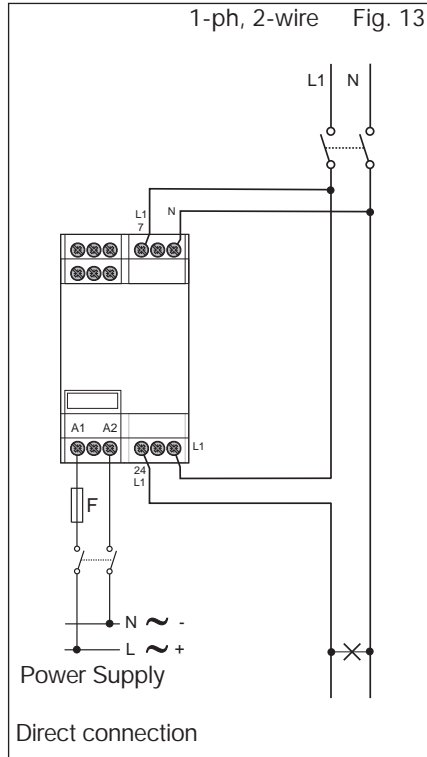
Wiring diagrams "system type selection: 3" (cont.)



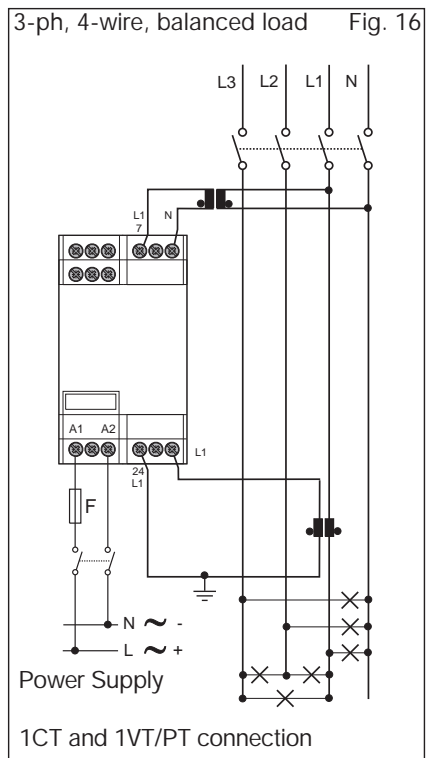
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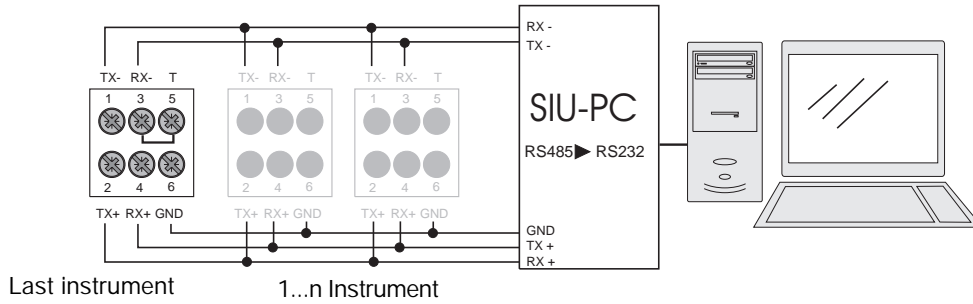
Wiring diagrams "system type selection: 1"



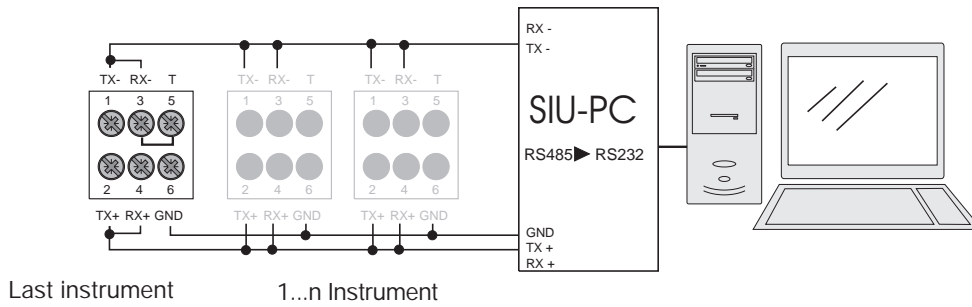
F= 630 mA T (18 to 60VAC/DC)
125 mA T (90 to 260VAC/DC)



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



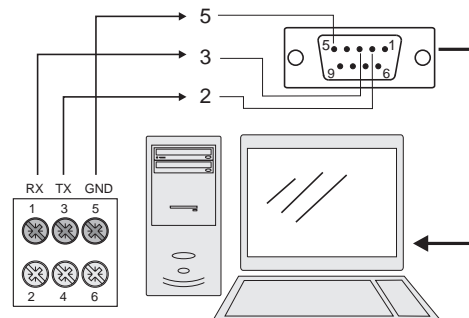
2-wire connection of RS485 serial port, the terminalization must be carried out only on the last instrument of the network

Easy programming

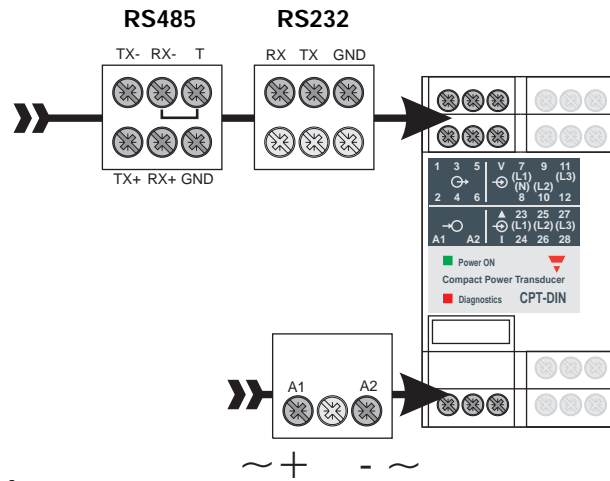


RJ12 communication port for parameters programming. The configuration of the transducer can be easily performed by means of CptBSoft. CptBSoft-kit includes also a connection cable (RJ12 6 pole + RS232 9 pole female).

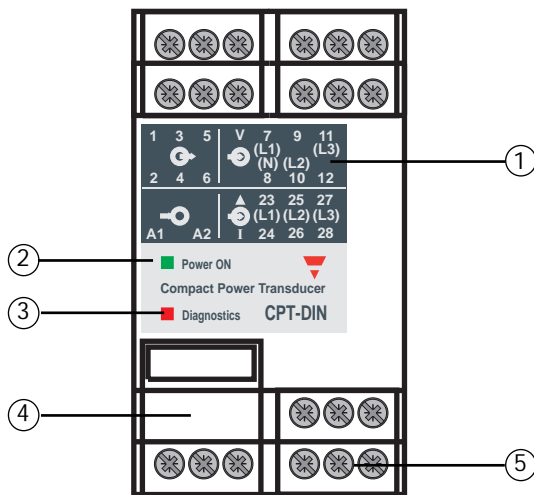
RS232 Serial port connection



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

