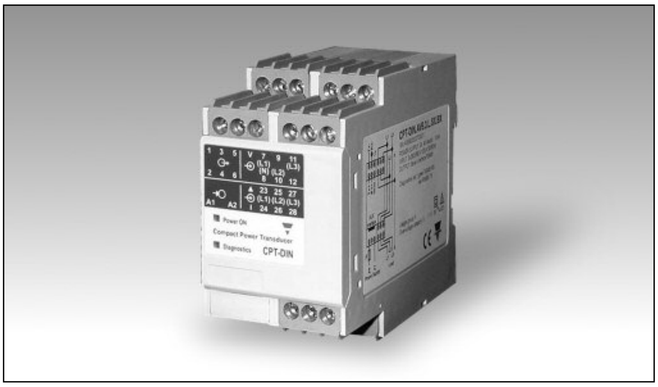
Energy Management
Compact Power Transducer
Type CPT-DIN "Basic version"

CARLO GAVAZZI



- **RS232 serial port on request**
- **Alarms (only from serial communication port) V_{LN}, An**
- **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, An, 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 mounting, 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 — CPT-DIN
Range code — AV5
System — 3
Power supply — H
Outputs — S1
Option — 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

AV5: 400/(690)V_{L-L}/5(6)AAC
VL-N: 185 V to 460 V
VL-L: 320 V to 800 V
AV6: 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

System

3 : 1, 2 or 3-phase, unbalanced and balanced load, with or without neutral
1 : 1-3-phase, balanced load (*)

Power supply

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

(*) Pay attention: the 3-phase measurement is carried out as one current and one phase to neutral voltage measurement.

Outputs

S1: RS485 port
S2: RS232 port

Options

BX: Basic features

Input specifications

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

CARLO GAVAZZI

Input specifications (cont.)

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

Serial Port Specifications

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

RS232 Configuration Bus

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

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 VT/PT	 1 to 999 1.0 to 99,9	**Alarms**	Programmable, for the VLN∑ and An (neutral current). Note: the alarm is only a status transmitted via communication port.
Filter Operating range Filtering coefficient	 0 to 99.9% of the input electrical scale 1 to 16	**Reset**	Independent alarm (VLN∑, An) max: A dmd, W dmd all energies (Wh, varh) hour counter

CARLO GAVAZZI

Power Supply Specifications

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

General Specifications

Front LED's Power on Diagnostics	 Green Green (TX data) Red (RX data)
Operating temperature	0° to +50°C (32° to 122°F) (RH < 90% non condensing)
Storage temperature	-10° to +60°C (14° to 140°F) (RH < 90% non condensing)
Installation category	Cat. III (IEC 60664, 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.
Dielectric strength	$4kVAC_{RMS}$ (for 1 min)

EMC Emissions Immunity	 EN61000-6-3, EN60688 residential environment, commerce and light industry EN61000-6-2 industrial environment.
Pulse voltage (1.2/50μs)	EN61000-4-5
Safety standards	IEC60664, EN60664
Measurement standards	IEC60688, EN60688
Approvals	CE, cURus, cCSAus
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

CARLO GAVAZZI

Waveform of the signals that can be measured

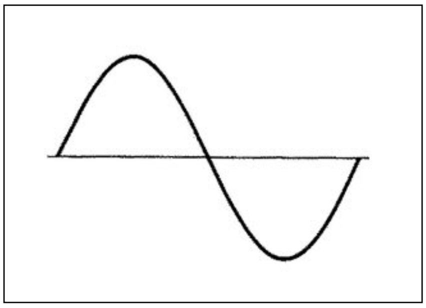


Figure A
Sine wave, undistorted
Fundamental content 100%
Harmonic content 0%
A_{rms} = 1.1107 | A |

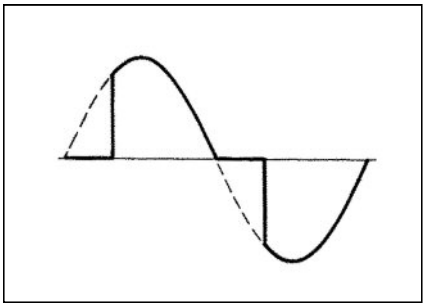


Figure B
Sine wave, indented
Fundamental content 10...100%
Harmonic content 0...90%
Frequency spectrum: 3rd to 16th harmonic
Additional error: <1% FS

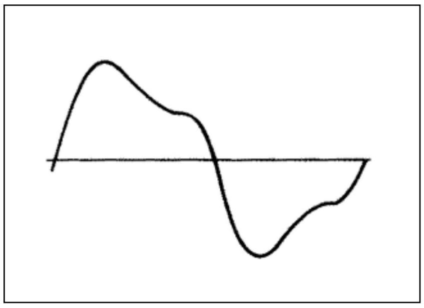
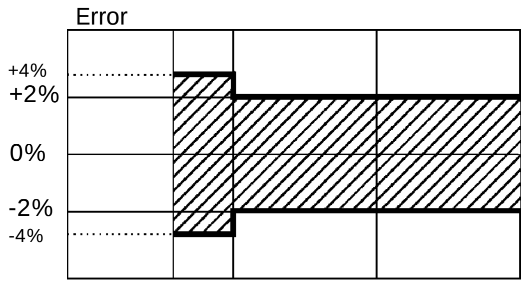


Figure C
Sine wave, distorted
Fundamental content 70...90%
Harmonic content 10...30%
Frequency spectrum: 3rd to 16th harmonic
Additional error: <0.5% FS

Accuracy

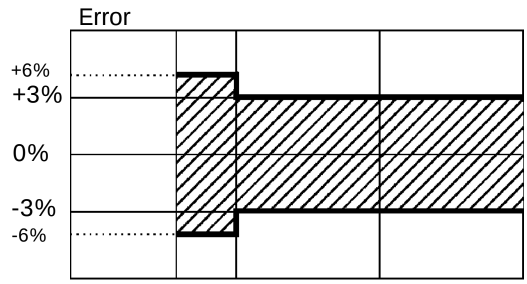
Wh, accuracy (RDG) depending on the current



PF=1	0.25A (0.05Ib)	0.5A (0.1Ib)	5A (Ib)	6A (Imax)
PF=L0.5 or C0.8	0.5A (0.1Ib)	1A (0.2Ib)	5A (Ib)	6A (Imax)

Accuracy limits (Active energy)
5(6A) Start-up current: 30mA

varh, accuracy (RDG) depending on the current



sinφ=1	0.1A (0.02Ib)	0.25A (0.05Ib)	5A (Ib)	6A (Imax)
sinφ=0.5	0.25A (0.05Ib)	0.5A (0.1Ib)	5A (Ib)	6A (Imax)

Accuracy limits (Reactive energy)
5(6A) Start-up current: 30mA

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)

Energy metering

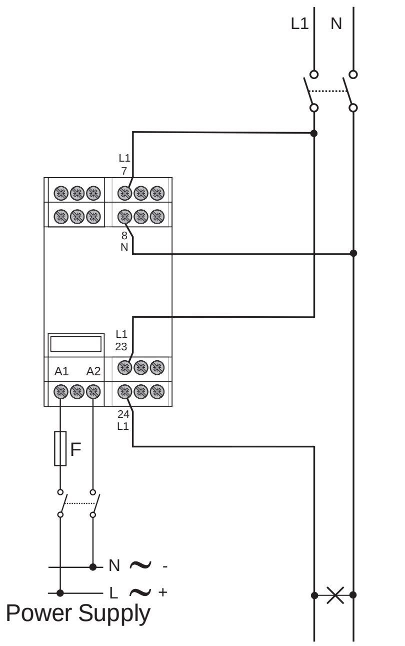
$$kWh_i = \int_{t_1}^{t_2} P_i(t)\,dt \cong \Delta t \sum_{n_1}^{n_2} P_{n,i}$$

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

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

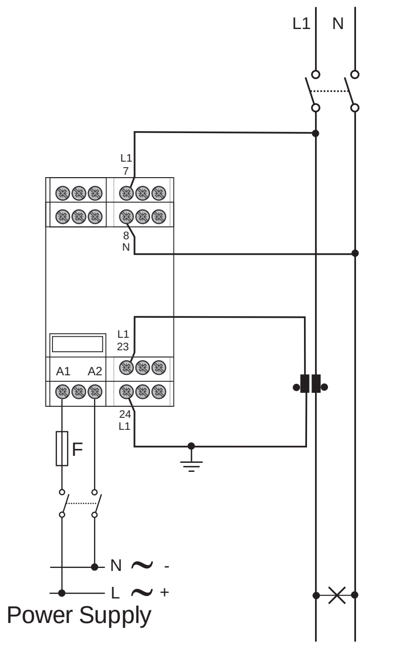
Wiring diagrams “system type selection: 3”

1-ph, 2-wire Fig. 1



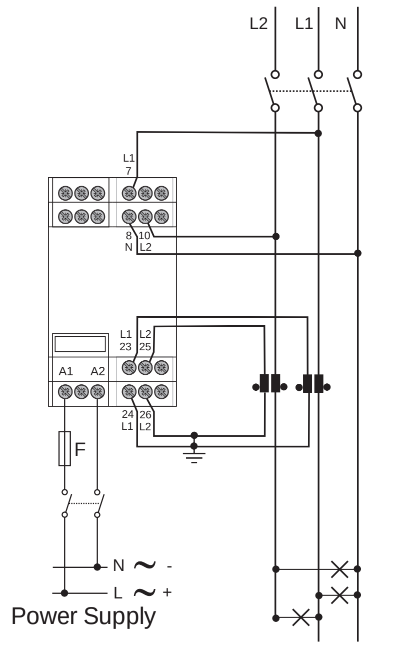
Direct connection

1-ph, 2-wire Fig. 2



1CT connection

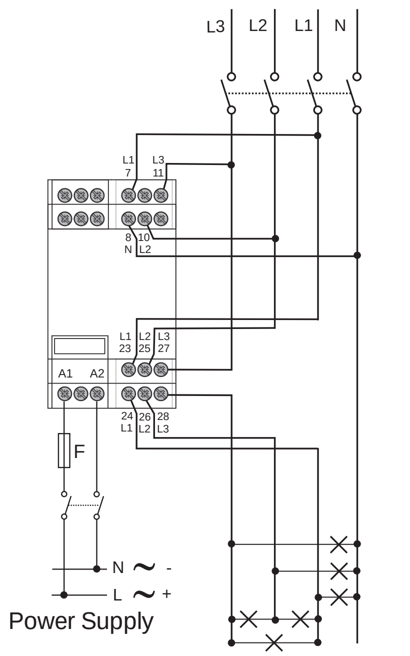
2-ph, 3-wire Fig. 3



2CT connection

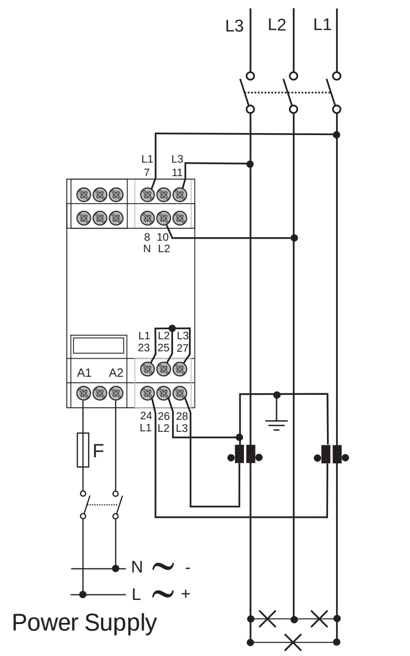
F= 630 mA T (18 to 60VAC/DC)
125 mA T (90 to 260VAC/DC)

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



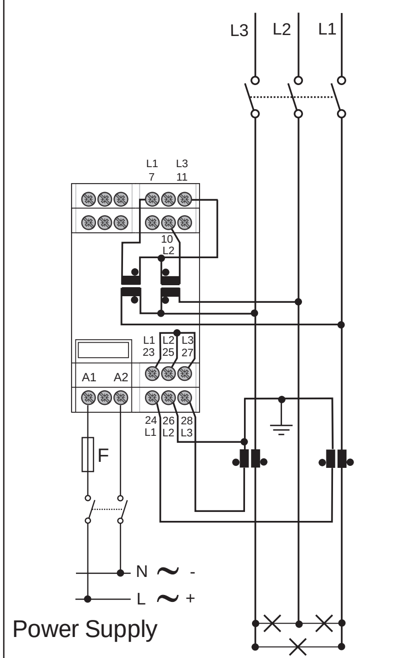
Direct connection

3-ph, 3-wire, unbalanced load Fig. 5



ARON connection

3-ph, 3-wire, unbalanced load Fig. 6

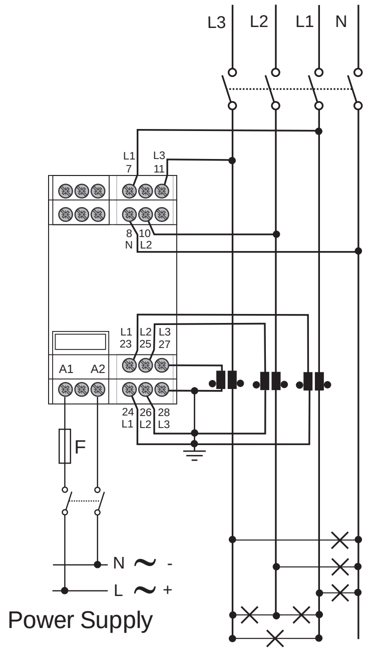


ARON and 2VT/PT connection

CARLO GAVAZZI

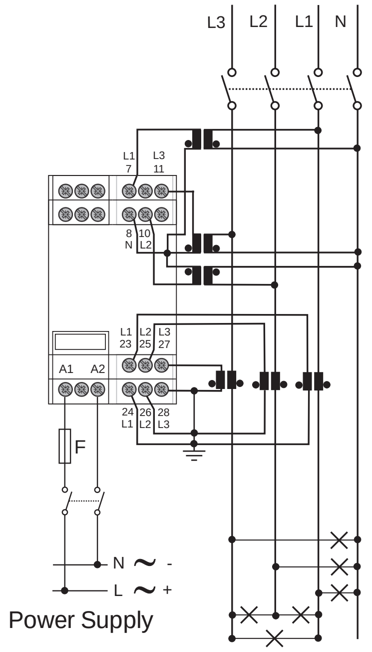
Wiring diagrams "system type selection: 3" (cont.)

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



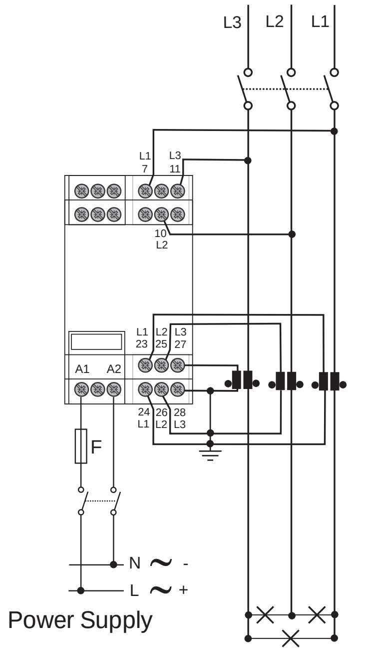
3CT connection

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



3CT and 3VT/PT connection

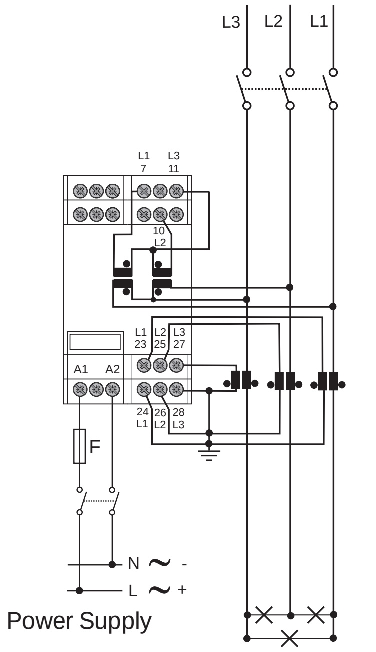
3-ph, 3-wire, unbalanced load Fig. 9



3CT connection

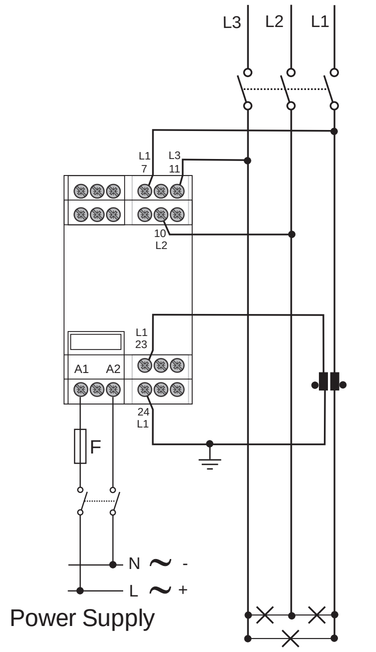
F= 630 mA T (18 to 60VAC/DC)
125 mA T (90 to 260VAC/DC)

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



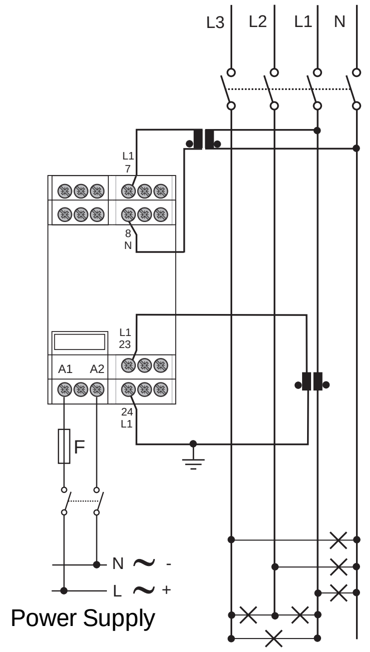
3CT and 2VT/PT connection

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



1CT connection

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

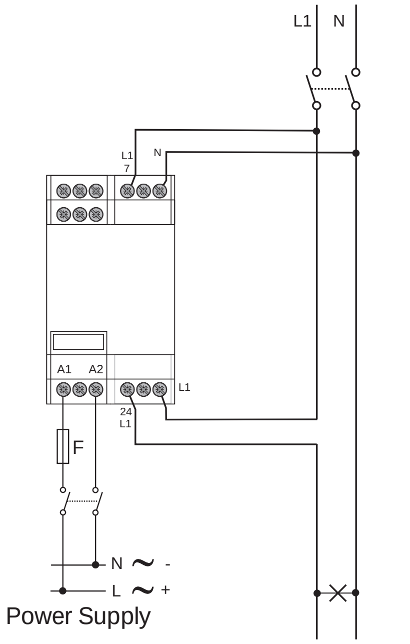


1CT and 1VT/PT connection

CARLO GAVAZZI

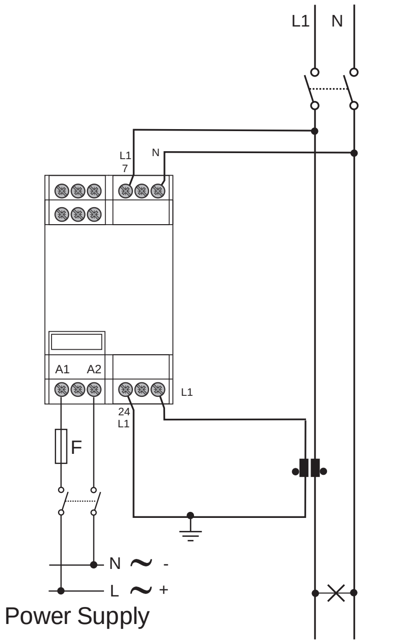
Wiring diagrams "system type selection: 1"

1-ph, 2-wire Fig. 13



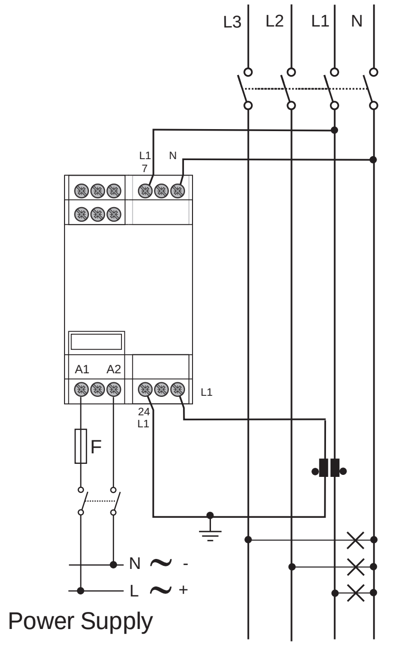
Direct connection

1-ph, 2-wire Fig. 14



1CT connection

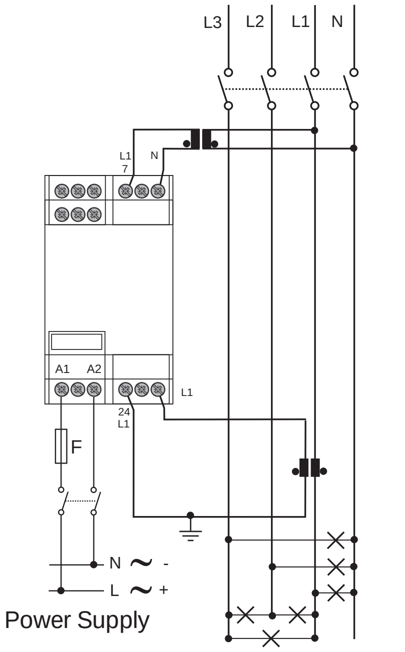
3-ph, 4-wire, balanced load Fig. 15



1CT connection

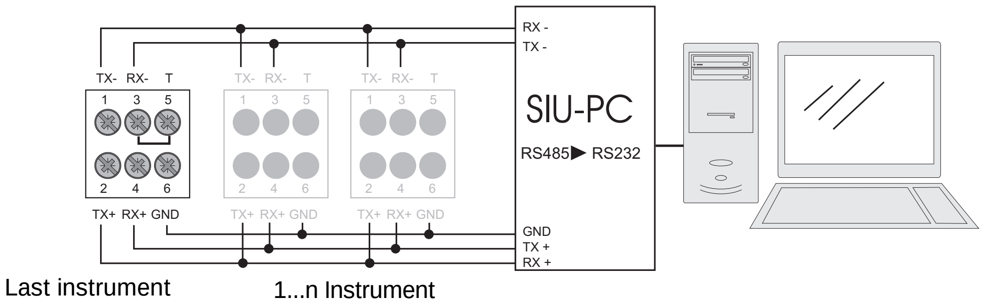
F= 630 mA T (18 to 60VAC/DC)
125 mA T (90 to 260VAC/DC)

3-ph, 4-wire, balanced load Fig. 16

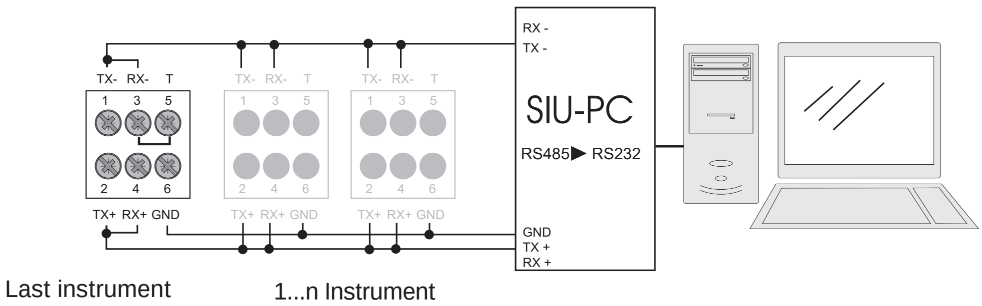


1CT and 1VT/PT connection

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

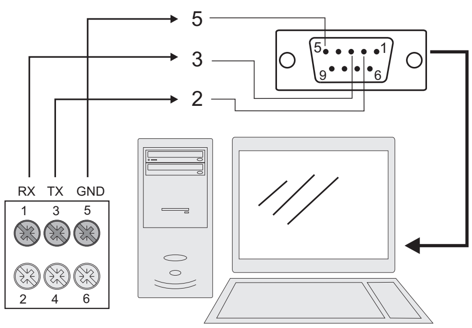


2-wire connection of RS485 serial port, the terminalization must be carried out only on the last instrument of the network

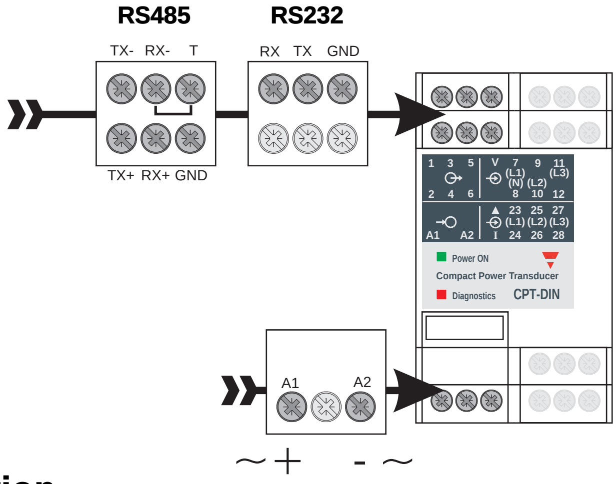
Easy programming

RJ12 communication port for parameters programming. The configuaration 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).

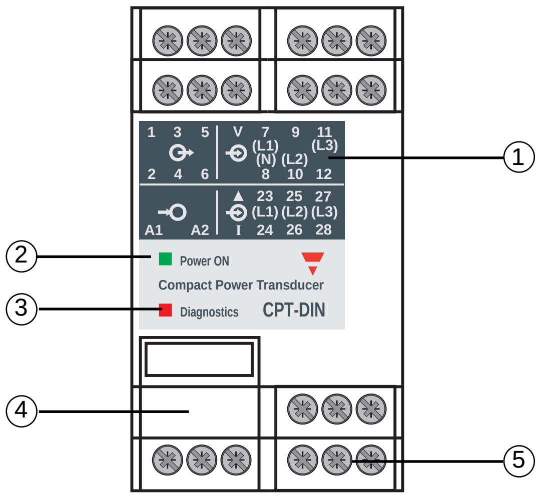
RS232 Serial port connection



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