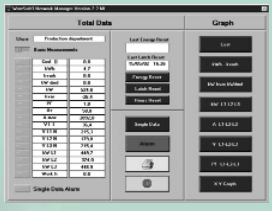
CARLO GAVAZZI
Automation Components

CARLO GAVAZZI

Solutions for Energy Management



- Softwares
- Accessories
- Components for fieldbus

- Modular Power Quality Transducers
- Modular Transducers

- Modular Power Analyzers
- Modular Energy Meters
- Modular Utility Meters

- Multifunction Meters, for DIN-rail and flush mounting

- Universal Utility Meters
- Modular Power Analyzers

Control

Energy Management

Introduction

Big Industries

Nowadays saving energy is becoming increasingly important not only to save the resources of the planet but also because the costs related to energy consumption now have a major role in the final price of the products (as far as industries are concerned) and in the bills of private users.
By means of the measurement and control of some important electrical parameters, such as:

- active and reactive power (fixed costs of the supply);
- active and reactive energy (variable costs of the supply);
- power factor (correct operating of the loads).

It's possible to control the energy consumption and as a consequence the relevant costs.
The more and more widely spread presence of non-linear loads and power electronic devices that produce and are sensitive to electrical disturbances such as:

- inverters for compressors and pumps;
- inverters for industrial automation;
- switching power supplies for computers and communication systems;
- power converters.

All this requires to make a deeper analysis and control of the mains and of the loads, not only taking into account the above mentioned parameters, but also measuring the pollution degree of the electrical lines. The latter parameter is a result of the analysis (FFT) of the harmonic distortion. A continuous harmonic distortion analysis allows to carry out an effective action of control and prevention of the failures in the loads, thus avoiding interruptions in the production processes.

Substations

Shopping centers

Apartment buildings

The problems

The problems can therefore be summed up into two parts:

- the costs due to the consumption of electrical energy
- the costs due to the maintenance and to the stopping of the machinery.

The Solutions

Carlo Gavazzi presents a complete package of products for the energy management, such as:

- Current transformers and voltage transformers for transducers / measuring instruments: TAD and TVX, TVY;
- Transducers for the remote retransmission of all the parameters of an electrical line: CVT, SPT and PQT;
- Energy meters for single-phase and three-phase systems: EM1, EM2, EM3 and EM4.
- Instruments for the analysis of the main parameters and control of the power quality: WM1, WM12, WM2, WM22, WM23, WM24, WM3 and WM4.
- Accessories for the conversion and the adaptation of the serial communication: SIU-PC85, SIU-DIN8585
- Software for analysis and management of electrical parameters: WattSoft2 and WattSoft3.

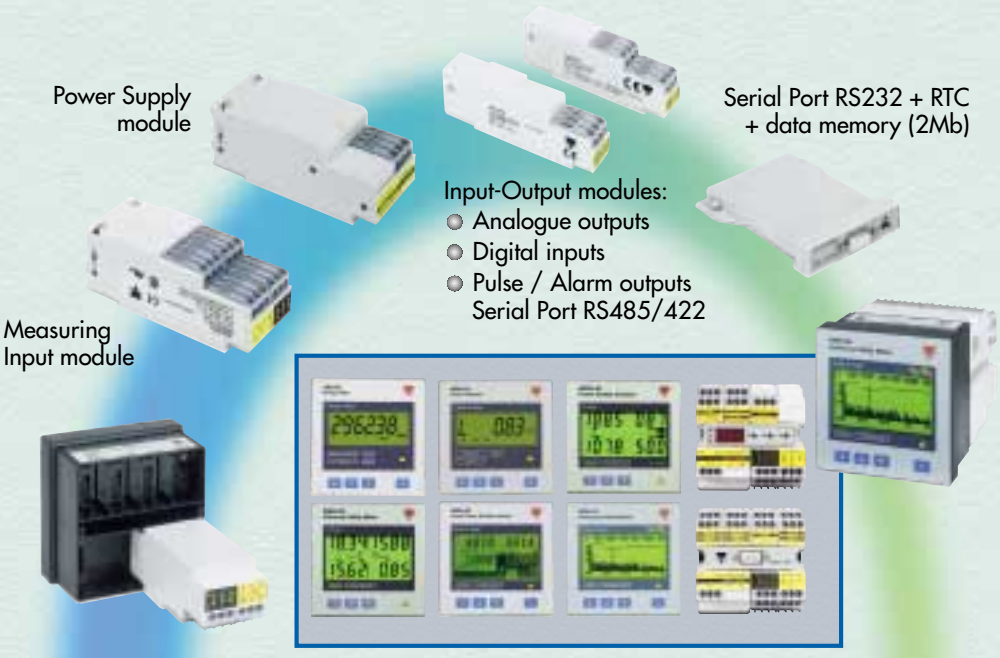
Today this package, together with measuring and accuracy characteristics granted by all the Carlo Gavazzi Instrumentation, offers a further advantage, which is given by a new concept of modularity available for the flush-mounting and DIN-Rail mounting instruments.

A new concept of modularity

In addition to the obvious need to improve the performances of the measuring instruments in order to keep them up-to-date with the state-of-the-art technology, it is more and more important to offer user-friendly instruments being easily and quickly adaptable to the application and management needs of the customers.

These needs have resulted in a new and modern range of instruments which, according to various criteria of signal processing and displaying, can be turned into:

- transducers
- indicators
- controllers.



The circle of modularity

Technical Advantages and Cost Benefits

- PLUG and PLAY modules common to all models; Maximum in-field flexibility;
- Possibility to expand the number and the kind of outputs according to new application needs without replacement of the instruments in-field.
- Small number of models in-house, with a high offer of possible combinations at the same time.
- Investments in the instrumentation are only limited to the present needs with the possibility to expand it in the future for any additional requirements.

List of the Characteristics Icons

- Accuracy of the main variables
- Standard-compliant energy metering
- Housing front protection degree
- Max measured current in case of direct connection
- Digit number of display
- Harmonic analysis
- Asymmetry control
- Max and/or minimum signal detection and storage
- Data logging
- Internal clock
- Energy metering by time period
- Load profile displaying and recording
- Digital filter with action on display and signals output
- Energy, gas, water metering and displaying
- Instantaneous variables displaying
- Digital inputs for gas/water metering or Wdmd synchro
- Pulse outputs for energy retransmission
- Analogue outputs for variable retransmission
- Alarm outputs for variable control
- Communication port
- Management of external analogue modem
- Management of external GSM modem and SMS messages

The product range

Model	EM1-DIN	EM2-DIN	EM2-96	EM3-DIN
Description	Energy meter	Energy meter	Energy meter	Energy meter
Housing	Front: 89x35mm	Front: 89x107mm	Front: 96x96mm	Front: 90x162.5
Type	STD	STD	Modular	Modular
Display type	Mechanical	LCD (back lighted)	LCD (back lighted)	Mechanical
Variab. on display	YES	YES	YES	YES
Instant. variables	N.A.	N.A.	N.A.	N.A.
Energy variables	5+1 DGT (0.1kW res.)	6 DGT	6 DGT	6+1 DGT
Accuracy	Class 2 (EN 61036)	Class 1	Class 1	Class 2 (EN61036) Class 3 (EN61268)
Temperature drift	≤200ppm/°C	≤250ppm/°C	≤250ppm/°C	≤ 250ppm/°C
Sampling rate	2 samples/s	3 samples/s	3 samples/s	2 samples/s
System type	1-phase	Balanced: 1-3-phase Unbalanced: 3-phase	Balanced: 1-3-phase Unbalanced: 3-phase	Balanced: 3-phase Unbalanced: 3-phase
Voltage inputs (Un)	230VAC	250/433VAC	250/433VAC	120/208VAC, 230/400VAC 380/660VAC
Current inputs (In)	Ib: 15A, Imax: 22.5AAC	5AAC	5AAC	Ib: 20A, Imax: 90AAC
Digital inputs	N.A.	N.A.	N.A.	N.A.
Primary of CT / VT	N.A.	CT: prog. up to 5000A	CT: prog. up to 5000A	N.A.
Measurements: **Variables**	TRMS method kWh	TRMS method Total: kWh, kvarh Partial: kWh, kvarh	TRMS method Total: kWh, kvarh Partial: kWh, kvarh	TRMS method kWh or kvarh (selectable)
Harmonic distortion	N.A.	N.A.	N.A.	N.A.
Outputs: **Pulse** **Alarm** **Analogue** **Serial** **Digital filter**	N.A. 1 (open collector type) N.A. N.A. N.A. N.A.	Up to 2 N.A. Driven by the RS485 port N.A. RS422/485 (Modbus) Action: on RS485 output	Up to 1 N.A. N.A. N.A. RS422/485 (Modbus) Action: on RS485 output	Up to 2 2 (open collector type) N.A. N.A. N.A. N.A.
Other characteristics	Start-up current: 50mAAC	N.A.	Modular concept Plug-in modules: AC power supply DC power supply Relay output Open collector output RS485 port	Start-up current: 80mAAC
Power supply	Self power supply	24VAC, 48VAC 115VAC, 230VAC	24V, 48V, 115V, 230VAC 18 to 60V , 90 to 260VDC	Self power supply, 115VAC, 230VAC
Protection degree	IP40	IP40	IP65	IP40





	EM4-DIN	WM1-DIN	WM12-DIN	WM12-96	WM2-96
	Energy meter	Power analyzer	Multifunction meter	Multifunction meter	Power analyzer
	Front: 90x162.5 mm	Front: 89x71.5mm	Front: 107.5x90mm	Front: 96x96mm	Front: 96x96mm
	Modular	STD	STD	STD	Modular
	LCD (back lighted)	LED	LED	LED	LCD (back lighted)
	YES	YES	YES	YES	YES
	3 1/2 DGT	3 DGT	3 DGT	3 DGT	3 DGT to 3 1/2 DGT accord. to the CT primary
	8 DGT + 7 1/2 DGT	3 DGT	N.A.	N.A.	6 DGT
	Class 1 (EN61036) Class 2 (EN61268)	V-A: ±2% F.S.	W-VA:±(1% F.S.+1DGT) var: ±(2% F.S.+ 1DGT) V_{LL}: ±(1.5% F.S.+ 1DGT) V_{LN}-A: ±(0.5% F.S. +1DGT)	W-VA:±(1% F.S.+1DGT) var: ±(2% F.S.+ 1DGT) V_{LL}: ±(1.5% F.S.+ 1DGT) V_{LN}-A: ±(0.5% F.S. +1DGT)	V-A: ±1% F.S.
	≤200ppm/°C	≤250ppm/°C	≤200ppm/°C	≤200ppm/°C	≤250ppm/°C
	2 samples/s	1 sample/s	1.5 samples/s	1.5 samples/s	3 samples/s
	Balanced: 3-phase Unbalanced: 3-phase	Balanced: 1-3-phase	Balanced: 1-2-3-phase	Balanced: 1-2-3-phase	Balanced: 1-3-phase Unbalanced: 3-phase
	57/100V,120/208VAC 230/400V, 380/660VAC	250/430VAC	100/208VAC, 400/660VAC	100/208VAC, 400/660VAC	250/433VAC
	Ib: 5A, Imax: 10AAC Ib: 20A, Imax: 90AAC	5AAC and 27AAC	5AAC	5AAC	5AAC
	2 indep. (H_2O/gas count., 4 time period selection)	1 for key-pad enabling	N.A.	N.A.	N.A.
	CT: prog. up to 5000A VT: prog. up to 20kV	CT: prog. up to 5000A	CT: prog. up to 5000A VT: prog. up to 10kV	CT: prog. up to 5000A VT: prog. up to 10kV	CT: prog. up to 5000A
	TRMS method Total: kwh, kvarh, H_2O, gas t1-t2-t3-t4: kWh, kvarh; t1-t2: gas; W_{L1}, W_{L2}, W_{L3}, Wdmd	STD System: V, A, VA, W, var, PF, Wh, VAh varh. Max: VA, W, var	TRMS method System: V_{LL}, V_{LN}, An, VA, VAdmd, Wdmd, W, var, PF, Hz. Max: A, Wdmd Single phase: V_{LL}, V_{LN}, A, VA, W, var, PF	TRMS method System: V_{LL}, V_{LN}, An, VA, VAdmd, Wdmd, W, var, PF, Hz. Max: A, Wdmd Single phase: V_{LL}, V_{LN}, A, VA, W, var, PF	TRMS method System: V_{LL}, V_{LN}, A, W, var, PF; Total: Wh, varh; Partial: Wh, varh; Single phase: V_{LL}, V_{LN}, A, W, var, PF
	N.A.	N.A.	N.A.	N.A.	N.A.
	Up to 3 2 (open collector type) 1 (open collector or relay) N.A. RS422/485 (Modbus) N.A.	Up to 1 1 (open collector type) 1 (TRIAC type) N.A. RS485 N.A.	Up to 1 N.A. N.A. N.A. RS422/485 (Modbus) Action: on variables and outs	Up to 1 N.A. N.A. N.A. RS422/485 (Modbus) Action: on variables and outs	Up to 2 1 (open collector type) N.A. N.A. RS422/485 (Modbus) Action: on RS485 output
	Modular concept Plug-in modules: Relay output Open collector output RS485 port Digital inputs	Display scrolling of all the variables by means of the front key-pad	Over neutral current or under and overvoltage indication (warning signal)	Over neutral current or under and overvoltage indication (warning signal)	Modular concept Plug-in modules: AC power supply DC power supply Relay output Open collector output RS485 port
	Self power supply, 24, 48VAC 115V, 230VAC, 18-60VDC	115VAC 230VAC	24VAC, 48VAC, 115VAC, 230VAC, 18 to 60VDC	24VAC, 48VAC, 115VAC, 230VAC, 18 to 60VDC	24V, 48V, 115V, 230VAC 18 to 60V , 90 to 260VDC/AC
	IP40	IP40	IP50	IP50	IP65

WM3-96 Smart Power Q

32-bit µP

The product range

Model	WM2-DIN	WM22-DIN	WM23-96	WM24-96
Description	Power analyzer	Power analyzer	Power quality analyzer	Universal Utility Meter
Housing	Front: 89x107mm	Front: 90x162.5mm	Front: 96x96mm	Front: 96x96mm
Type	STD	Modular	Modular	Modular
Display type	LCD (back lighted)	LCD (back lighted)	LCD (back lighted)	LCD (back lighted)
Variab. on display	YES	YES	YES	YES
Instant. variables	3 DGT to 3 1/2 DGT accord. to the CT primary	4x3 1/2 DGT	4x3 1/2 DGT	4x3 1/2 DGT
Energy variables	6 DGT	7 1/2 DGT	N.A.	7 1/2 DGT
Accuracy	V_{LN}-A: ±1% F.S.	V_{LN}-A: ±(0.5% RDG+1DGT) W-VA: ±(1% RDG+1DGT) Class 1 (EN61036) Class 2 (EN61268)	V_{LN}-A: ±(0.5% F.S.+2DGT) V_{LL}-W-VA: ±(1% F.S. +2DGT) var: ±(2% F.S. +2DGT) THD: ±(3% F.S. +2DGT)	V_{LN}-A: ±(0.5% RDG+1DGT) W-VA: ±(1% RDG+1DGT) Class 1 (EN61036) Class 2 (EN61268)
Temperature drift	≤250ppm/°C	≤200 ppm/°C	≤200 ppm/°C	≤200 ppm/°C
Sampling rate	3 samples/s	2 samples/ s	1.5 samples/s	1.5 samples/s
System type	Balanced: 1-3-phase Unbalanced: 3-phase	Balanced: 3-phase Unbalanced: 3-phase	Balanced: 3-phase Unbalanced: 3-phase	Balanced: 3-phase Unbalanced: 3-phase
Voltage inputs (Un)	250/433VAC	57/100VAC, 120/208VAC 230/400VAC, 380/660VAC	57/100VAC, 120/208VAC 230/400VAC, 380/660VAC	57/100VAC, 120/208VAC 230/400VAC, 380/660VAC
Current inputs (In)	5AAC	Ib: 5A, Imax: 10AAC Ib: 20A, Imax: 90AAC	5A	5A
Digital inputs	N.A.	N.A.	2 for Wdmd and VAdmd synchro. 1 for prog. lock	3 for time period management
Primary of CT / VT	CT: prog. up to 5000A	CT: prog. up to 5000A VT: prog. up to 10kV	CT: prog. up to 5000 VT: prog. up to 20kV	CT: prog. up to 5000 VT: prog. up to 20kV
Measurements: Variables	TRMS method System: V_{LL}, A, W, var, PF; Total: Wh, varh; Partial: Wh, varh; Single phase: V_{LN}, A, W, var, PF	TRMS method System: V_{LN}, VA, W, var, PF, Hz, total Wh, total varh, partial Wh, partial varh Single phase: V_{LN}, A, VA, W, var, PF, THD. Average: W, VA	TRMS method System: V_{LN}, V_{LL}, An, VA, W, var, PF, Hz, Single phase: V_{LN}, V_{LL}, A, W, var, PF, THD. Average: W, VA	TRMS method System: V_{LN}, VA, W, var, PF, Hz, total Wh, total varh, partial Wh, partial varh, gas, H_2O Single phase: V_{LN}, A, VA, W, var, PF. Average: W, VA
Harmonic distortion	N.A.	Up to the 7th H (V and A)	Up to the 16th H (V and A)	N.A.
Outputs: **Pulse** **Alarm** **Analogue** **Serial** **Digital filter**	Up to 2 1 (open collector type) N.A. N.A. RS422/485 (Modbus) Action: on RS485 output	Up to 3 2 (open collector type) 1 (open collector or relay) 1 (20mA, 10V) RS422/485 (Modbus) Action: on variables and outs	Up to 4 N.A. Up to 2 (relay or o. coll.) Up to 1 (20 mA, 10V) RS485 (Modbus), RS232 Action: on variables and outs	Up to 3 Up to 2 (open collector type) Up to 2 (relay or o. coll.) N.A. RS485 (Modbus), RS232 Action: on variables and outs
Other characteristics	Display scrolling of all the variables by means of the front key-pad	Modular concept Plug-in modules: Relay output Open collector output RS485 port Analogue output Phase asymmetry ctrl	Modular concept Plug-in modules: Relay output Open collector output RS232/RS485 port Analogue output Phase asymmetry ctrl	Modular concept Plug-in modules: Relay output Open collector output RS232/RS485 port Phase asymmetry ctrl Energy time period management
Power supply	24VAC, 48VAC 115VAC, 230VAC	Self power supply, 24, 48VAC 115V, 230VAC, 18-60VDC	24V, 48V, 115V, 230VAC, 18-60V, 90 to 260VAC/DC	24V, 48V, 115V, 230VAC, 18-60V, 90 to 260VAC/DC
Protection degree	IP40	IP40	IP65	IP65





	WM3-96	WM4-96	SPT-90	PQT-90	CVT-DIN
	Power quality analyzer	Universal utility meter	Power transducer	Power quality transducer	Compact transducer
	Front: 96x96mm	Front: 96x96mm	Front: 90x90mm	Front: 90x90mm	Front: 89x71.5mm
	Modular	Modular	Modular	Modular	STD
	Graph LCD, 128x64 pixels (back light.)	Graph LCD, 128x64 pixels (back light.)	LED	N.A.	N.A.
	YES	YES	N.A.	N.A.	N.A.
	Select.: 4x3 1/2 DGT or 4x4 DGT	Select.: 4x3 1/2 DGT or 4x4 DGT	N.A.	N.A.	N.A.
	4x9 DGT, 4x6 DGT	4x9 DGT, 4x6 DGT	N.A.	N.A.	N.A.
	V_{LN}-A: ±(0.5% RDG+1DGT) Hz: ±0.1% F.S. THD: ±1% F.S.; Class 1 (EN61036) Class 2 (EN61268)	V_{LN}-A: ±(0.5% RDG+1DGT) Hz: ±0.1% F.S. THD: ±1% F.S.; Class 1 (EN61036) Class 2 (EN61268)	V_{LN}: ±0.5% F.S. A: ±0.5% F.S. Hz: ±0.5% F.S.	V_{LN}-A: ±(0.5% RDG+1DGT) Hz: ±0.1% F.S. THD: ±1% F.S.; Class 1 (EN61036) Class 2 (EN61268)	Voltage: ±0.5% F.S. Current: ±0.5% F.S. Frequency: ±0.5% F.S.
	≤200ppm/°C	≤200ppm/°C	≤300ppm/°C	≤200ppm/°C	≤200ppm/°C
	10 samples/s	10 samples/s	Response time: ≤250ms	Response time: ≤200ms	Response time: ≤300ms
	Balanced: 1-3-phase Unbalanced: 3-phase	Balanced: 1-3-phase Unbalanced: 3-phase	Balanced: 1-3-phase Unbalanced: 3-phase	Balanced: 1-3-phase Unbalanced: 3-phase	1-phase
	Autoranging 240/415VAC, 400/690VAC	Autoranging 240/415VAC, 400/690VAC	57/100VAC 250/433VAC	Autoranging 240/415VAC, 400/690VAC	100VAC, 500VAC 60mVDC, 10VDC 200VDC
	Autoranging: 1/5AAC	Autoranging: 1/5AAC	1AAC, 5AAC	Autoranging: 1/5AAC	1AAC, 5AAC, 1ADC
	3 independent, for time period synchro.	Up to 6 independent, for time period synchro.	3 independent (to be used with RS485)	Up to 6 independent, for time period synchro.	N.A.
	CT: prog. up to 30000A VT: prog. up to 600kV	CT: prog. up to 30000A VT: prog. up to 600kV	CT: prog. up to 5000A VT: prog. up to 100kV	CT: prog. up to 30000A VT: prog. up to 600kV	All
	TRMS method System: V_{LN}, V_{LL}, An, VA, W, var, PF, Hz, Wh, varh. Single phase: V_{LN}, V_{LL}, A, VA, W, var, PF, THD Average: W, VA, An, PF	TRMS method System: V_{LN}, V_{LL}, VA, W, var, PF, Hz, Wh, varh, gas, H_2O Single phase: V_{LN}, V_{LL}, A, VA, W, var, PF, THD Average: W, VA, var, PF	TRMS method System: V, Amax, VA, W, var, PF, Hz, Wh, varh. Single phase: V Average: W	TRMS method System: V_{LN}, V_{LL}, VA, W, var, PF, Hz, Wh, varh, gas, H_2O Single phase: V_{LN}, V_{LL}, A, VA, W, var, PF, THD Average: W, VA, var, PF	STD V AC V DC A AC A DC Hz (45-65Hz, 350-450Hz)
	Up to the 50th H (V and A)	Up to the 50th H (V and A)	N.A.	Up to the 50th H (V and A)	N.A.
	Up to 8 Up to 4 (open collector type) Up to 4 (relay or o. coll.) Up to 4 (20 mA, 10V) RS485 (Modbus), RS232 Action: on variables and outs	Up to 8 Up to 4 (open collector type) Up to 4 (relay or o. coll.) N.A. RS485 (Modbus), RS232 Modem - GSM management Action: on variables and outs	Up to 3 1 (open collector type) 1 (relay or open coll.) Up to 2 (20mA, 10V) RS485 (Modbus), RS232 Action: on variables and outs	Up to 8 Up to 4 (open collector type) Up to 4 (relay or o. coll.) Up to 4 (20mA, 10V) RS485 (Modbus), RS232 Modem - GSM management Action: on variables and outs	1 N.A. N.A. 0-20, 4-20mA; ±1, 0-10V N.A. N.A.
	Real time clock with alarms and Min/Max variable recording. W, VA, PF and An integration time programming. Energy time period management.	Real time clock with alarms and Min/Max variable continuos recording (2Mb memory). Energy time period and gas, H_2O management. Official watt-hour meter interf.	W integration time programming. Parameter programming by means of removable key-pad or by RS232 port (with proper Software)	Real time clock with alarms and Min/Max variable continuos recording (2Mb memory). Energy time period and gas, H_2O management. Official watt-hour meter interf.	Current or voltage input in the same transducer. Field adjustment from 50 to 130% of the A/V input
	18 to 60VAC/DC, 90 to 260VAC/DC	18 to 60VAC/DC, 90 to 260VAC/DC	18 to 60VAC/DC, 90 to 260VAC/DC	18 to 60VAC/DC, 90 to 260VAC/DC	24VAC, 48VAC 115VAC, 230VAC
	IP65	IP65	IP40	IP65	IP40

Accessories

Model	SIU-PC85	SIU-DIN.8585	SIU-DIN.RLY	PSU-DIN (DC/AC)	PSU-DIN (AC/DC)
Description	Serial communication line adapter	Serial communication line amplifier, driver	Serial communication relay outputs	Power supply unit DC to AC	Power supply unit AC to DC
Housing	Front:165x80mm	Front: 89x71.5mm	Front: 89x71.5mm	Front: 89x71.5mm	Front: 89x71.5mm
Signal input:	RS232	RS485, RS422	RS485, RS422	N.A.	N.A.
Working mode	2-wire comm.	2 or 4-wire comm.	2 or 4-wire comm.	N.A.	N.A.
Line Bias	N.A.	YES	N.A.	N.A.	N.A.
Line termination	N.A.	YES	YES	N.A.	N.A.
Connections	9-pole, female	Screw terminal block	Screw terminal block	Screw terminal block	Screw terminal block
Output:	RS422 RS485	RS422	4 relays 5A, 250V	24VDC (max. 50mA) 48VDC (max.125mA) 115VDC (max.250mA)	5VDC (max. 200mA) 12VDC (max. 100mA) 24VDC (max. 50mA)
Working mode	4-wire comm.	4-wire comm.	SPDT contacts	Switching mode	By transformer
Line Bias	YES	YES	N.A.	N.A.	N.A.
Line termination	YES	YES	N.A.	N.A.	N.A.
Connections	Screw terminal block	Screw terminal block	Screw terminal block	Screw terminal block	Screw terminal block
Baud rate	Max. 19200 Baud	Max. 19200 Baud	Max. 9600 Baud	N.A.	N.A.
Protection	All inputs/outputs	All inputs/outputs	N.A.	Output: by fuse	Output: electronic
Indication (by means of LEDs)	Power-on Data-stream	Power-on	Power-on Comm. status Output status	Power-on	Power-on
Insulation	Input/output: 2kV Input/output and power supply: 4kV	N.A.	Input/output: 4kV Input/output and power supply: 4kV	N.A.	Input/output: 4kV
Operating temperature	0 to +50°C (R.H. <90% non condensing) -10 to +60°C (R.H. <90% non condensing)	0 to +50°C (R.H. <90% non condensing) -10 to +60°C (R.H. <90% non condensing)	0 to +50°C (R.H. <90% non condensing) -10 to +60°C (R.H. <90% non condensing)	0 to +50°C (R.H. <90% non condensing) -10 to +60°C (R.H. <90% non condensing)	0 to +50°C (R.H. <90% non condensing) -10 to +60°C (R.H. <90% non condensing)
Included set	1.8m cable with 9 to 9-pole connectors, 9 to 25-pole adapter, power supply cable	N.A.	N.A.	N.A.	N.A.
Other characteristics	Wrong-line connection and full overvoltage protection. Reverse conversion capability	Dual purpose: distance increase by 1200m per unit; network increase	4 relay outputs to be driven by an RS485 communication port	Stabilised AC voltage output. Stability: ≤4% Un @ max. current	Stabilised DC voltage output. Stability:≤0.5% Un @ max. current. Non-stabilised DC voltage outputs: 2V-20V-30VDC
Power supply	24VAC, 48VAC, 115VAC, 230VAC	24VAC, 48VAC, 115VAC, 230VAC	24VAC, 48VAC, 115VAC, 230VAC	9 to 16VDC 18 to 60VDC 80 to 240VDC	24VAC, 48VAC, 115VAC, 230VAC
Protect. degree	IP20	IP40	IP40	IP40	IP40

Current transformers

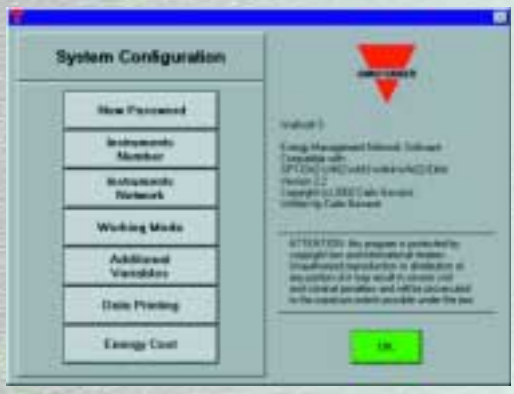
Model	TADK	TADK2	TAD 2	TAD 3	TAD 4
Class	0.5	0.5	0.5/ 1/ 3	0.5/ 1	0.5/1
Bus–bar size		25x5 mm	20x8 mm	21x14 or 31x11 mm	32x16 or 41x11 mm
Dimensions (H x W x D)	115.5x75x44 mm	115.5x75x44 mm	98.5x58x44 mm	98.5x58x44 mm	75x115.5x44 mm
Standards	IEC 60185	IEC 60185	IEC 60185	IEC 60185	IEC 60185
Accuracy class depending on the burden output	Class 0.5 Burden VA	Class 0.5 Burden VA	Class 0.5 1 3 Burden VA VA VA	Class 0.5 1 Burden VA VA	Class 0.5 1 Burden VA VA
Primary current Nominal output current 1A/5A	1 A 10 5 A 10 10 A 10 15 A 10 25 A 10 40 A 10	1 A 10 5 A 10 10 A 10 15 A 10 25 A 10 40 A 10 50 A 10 60 A 10 80 A 10 100 A 10 150 A 10 200 A 10 250 A 10	40 A 3 50 A 3 60 A 3 80 A 3 100 A 3 4 150 A 3 4 6 200 A 3 4 6 250 A 5 8 10 300 A 5 8 10	100 A 3 150 A 3 4 200 A 3 4 250 A 5 8 300 A 5 8 400 A 6 10 500 A 6 10 600 A 6 10	100 A 3 150 A 3 200 A 4 250 A 6 300 A 6 400 A 10 500 A 10 600 A 10 800 A 10

Model	TAD 6	TAD8	TAD 12	TACO 110	TACO 200
Class	0.5/1	0.5/1/5P10	0.5/1/5P10	0.5/1/5P10	0.5/1/5P10
Bus–bar size	55x22 or 65x20 mm	82x32 or 65x34 mm	127x51 or 102x53 mm	Max 110 mm	Max 200 mm
Dimensions (H x W x D)	105x145x44 mm	140x120x55 mm	183x170x65 mm	183x170x 65 mm	295x280x45 mm
Standards	IEC 60185	IEC 60185	IEC 60185	IEC 60185	IEC 60185
Accuracy class depending on the burden output	Class 0.5 1 Burden VA VA	Class 0.5 1 5P10 Burden VA VA VA	Class 0.5 1 5P10 Burden VA VA VA	Class 0.5 1 5P10 Burden VA VA VA	Class 0.5 1 5P10 Burden VA VA VA
Primary current Nominal output current 1A/5A	400 A 6 12 500 A 6 12 600 A 10 20 800 A 10 20 1000A 20 40 1200A 20 40 1500A 30 60 2000A 30 60	400 A 4 12 5 500 A 6 12 5 600 A 10 20 5 800 A 15 20 5 1000A 20 40 5 1200A 30 40 5 1500A 40 60 5 2000A 50 60 5 2500A 60 100 5	800 A 15 30 10 1000A 20 40 10 1200A 30 60 10 1500A 40 80 10 2000A 50 100 10 2500A 60 120 10 3000A 80 160 10 4000A 100 200 10	800 A 15 30 10 1000A 20 40 10 1500A 40 80 10 2000A 50 100 10 2500A 60 120 10 3000A 80 160 10 4000A 100 200 10	1000A 15 30 10 1500A 15 30 10 2000A 15 30 10 2500A 40 80 10 3000A 40 80 10 4000A 50 100 10 5000A 50 100 10 6000A 50 100 10

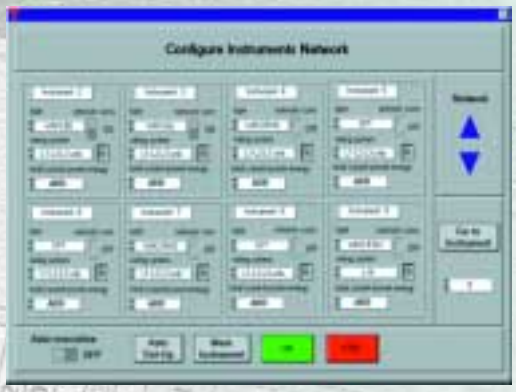
Cable/Bus–bar type current transformers. Standard output 5A (1A on request). Rated primary currents from 40A to 6000A. DIN–rail or panel mounting. Current transformer 1-phase AC; operating frequency: 40 to 60 Hz; max system voltage: 0.72 kV; rated insulation level: 3kV/1min @ 50Hz; security factor: ≤5; rated secondary current: 5A standard (1A on request).

WattSoft2 and WattSoft3

WattSoft2 and WattSoft3 are a Windows 95/98/NT/2000 and Windows XP SCADA software for energy management. These powerful virtual instruments combined with the Carlo Gavazzi hardwares are the most updated answer to all the power and energy parameter control needs. WattSoft3 is a software package that is able to figure-out two basic problems: the management up to 255 mixed field hardwares like: SPT, EM2, EM4, WM2, WM22, WM3, WM4 and so on by means of a MODBUS (RS485) linking system; the supervision and control of all the electrical variables being measured in order to optimize the energy consumption and therefore to save money.
WattSoft2 is a Software package that is addressed to those application where there is a limited instruments network (one or up to 12 instruments) and neither energy costs nor tariffs management are needed. The graph analysis is limited just to the main instrument.



The set-up menus
The following configuration submenus are available:
- Data protection PASSWORD;
- NUMBER OF INSTRUMENTS which belong to the network.
- Details belonging to the INSTRUMENTS NETWORK.
- Kind of network WORKING MODE.
- ADDITIONAL VARIABLE which has to be managed and displayed.
- Parameters belonging to the ENERGY COSTS management.
- Parameters of the DATA PRINTING MODE.



The instruments network configuration menu
For the parameter selection of:
- The instrument number (address) given by the software.
- The type of field hardware: SPT, EM2, EM4, WM2, WM22, WM3, WM4 and so on.
- The network communication activation: ON / OFF.
- The type of wiring system.

In the WattSoft2 the network is limited to 12 instruments.

The alarm set-points menu
The available parameters are:
- Label programming;
- List of network available instruments;
- Type of set-point variable.
- Type of alarms
- SW and HW alarm working mode.

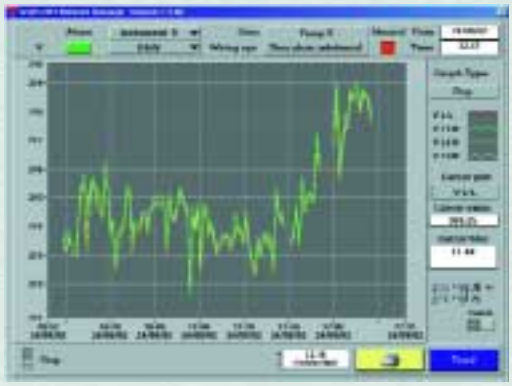
In the WattSoft2 the alarms are limited to the main instrument.

The define Cost Parameters menu
The available cost parameters are:
- Installed power;
- Monthly tariff;
- Over power demand tariff;
- Active energy tariff;
- Reactive energy limit 1 and limit 2;
- Reactive energy tariff 1 and tariff 2;
- Tax on used energy;
- Tax on used power;

The energy costs can be managed by single tariff or dual tariff (night and day).
In the WattSoft2 this page is not available.

Total data page
The main page “TOTAL DATA” shows the execution status of the measurements, indicating the list of all the variables with the measurement results; giving the possibility to reset the total consumed energies, the alarms, the hour counter and allowing the operator to enter various graphs: cost, energy, power, current, voltage, power factor and combination of variables.

Single data page
The page “SINGLE DATA” shows the details of a group of up to six instruments, indicating: the number of the displayed monitoring page, the labels of the instruments “USERS”; the list of all the variables with the measurements results and those measurements indicating the presence of alarm status; the user is allowed to enter every single data page and to see where an alarm condition has been detected by Wattsoft3.
In the WattSoft2 the alarms in this page are not managed.



Data graph page
This monitoring page can be divided into four parts:
- on the upper area it is possible to select the instrument to which the graph belongs and the type of time base needed to be displayed; this page also shows the alarm status of the system, the user label, the wiring system of the instrument, the current date and time;
- on the middle left, the graph of up to four variables;
- on the middle right, all the info connected to the graph (including zoom functions and selection between automatic or manual axis range);
- on the lower right, manual printing enabling of the graph and possibility to go back to the TOTAL DATA page.

In the WattSoft2 this page is available only for the main instrument.

Alarm history page
This page shows the whole list of the occurred alarms with the indication of the relevant instrument, of the variable (variable name, set-point, actual value and hysteresis), of the start and stop time of the alarm.
The Clear key, protected by password, resets the alarms which are called off.
By means of the Print key, the whole alarm history is printed by the default printer.
Note: exiting the execution, the alarm history is reset.
In the WattSoft2 the Alarm history page is managed only for the main instrument.

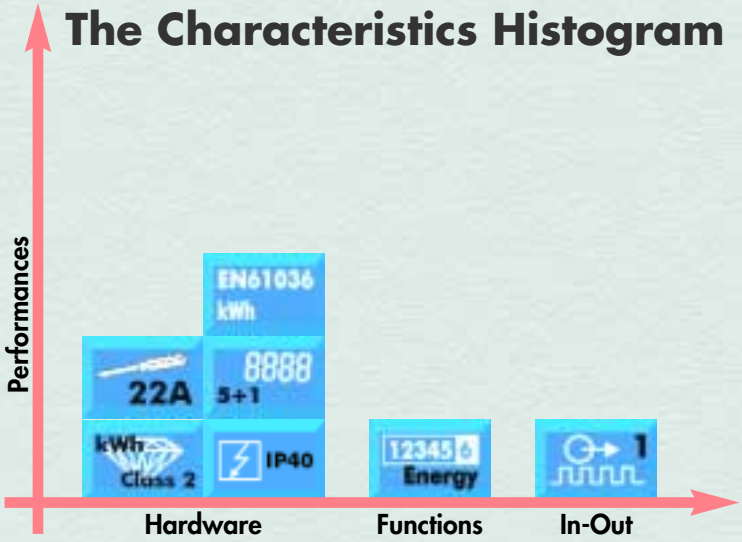
Simplyfied single data page
This page shows the data of up to 18 instrument by page. The measurements are related to cost-kWh-kvarh-kW-PF variables. According to the kind of instrument the ON/OFF switch allows to turn on or off the relevant load.

EM1-DIN

Compact Energy Meter

In the household applications and in the services it is often necessary to measure the consumed active energy of loads belonging to a certain part of the electrical installation. The meter has to be space saving and very easy to connect and to use. EM1-DIN represents the ideal solution: in only one 2-DIN module housing there is a complete active energy meter offering many advantages.

The Characteristics Histogram



- direct connection up to 22.5 A, no CT is needed
- TRMS measurement
- Self power supply, easy connection

EM2-DIN

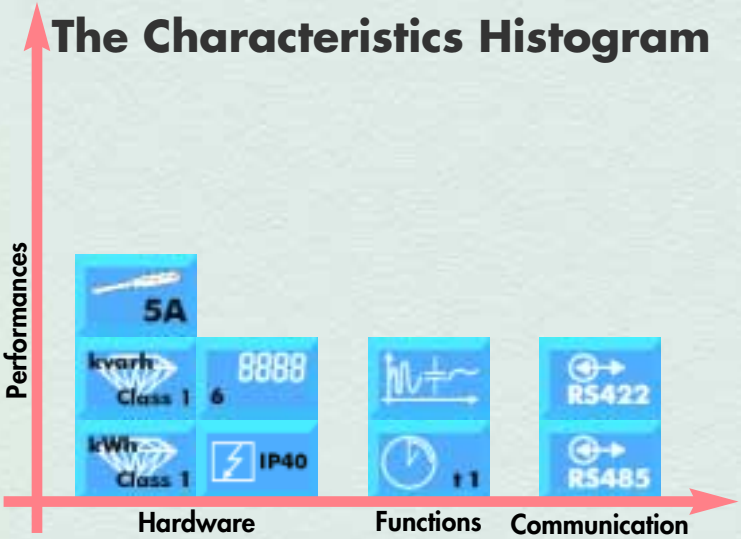
Energy Meter

- **Large display**
- **Compact housing, only 107mm wide**
- **User friendly**

EM2-DIN has been developed for energy metering in various services and light/medium industries.

EM2-DIN displays the total or partial active and reactive energy (kWh and kvarh). In addition, the relay output can be activated via the RS485 interface and can be used, for example, for the remote control of the connection or disconnection of the loads.

The Characteristics Histogram



EM2-96

Modular Energy Meter

EM2-96 is suitable to measure the consumed energy in various services and light/medium industries. This instrument is normally connected downstream the official Watt-hour meter to measure the energy consumed by machines or other kind of loads and branches according to the application needs in order to split the costs accordingly.

EM2-96 displays the total and the partial active and reactive energy (kWh and kvarh). In addition, either the relay or the open collector output can be activated via RS485 interface and can be used, for example, for the remote control of load connection/disconnection.

The advantages given by the exclusive Carlo Gavazzi modular system

- **Plug and play modules**
- **Maximum in-field flexibility**
- **Possibility to add any outputs only when really needed by the application**

EM2 96 is the ideal solution for:

- Panel makers
- Installers
- Engineering companies
- Building automation
- OEM's

The most significant applications are:

- In the industry, the consumption measurement of lines and loads
- In the services sector the energy measurements in offices, buildings, shopping centres and supermarkets.

The Characteristics Histogram

The displayed energies

EM3-DIN

Energy Meter

The advantages given by the exclusive Carlo Gavazzi modular system

- **Plug and play modules**
- **Maximum in-field flexibility**
- **Possibility to add any outputs only when really needed by the application**

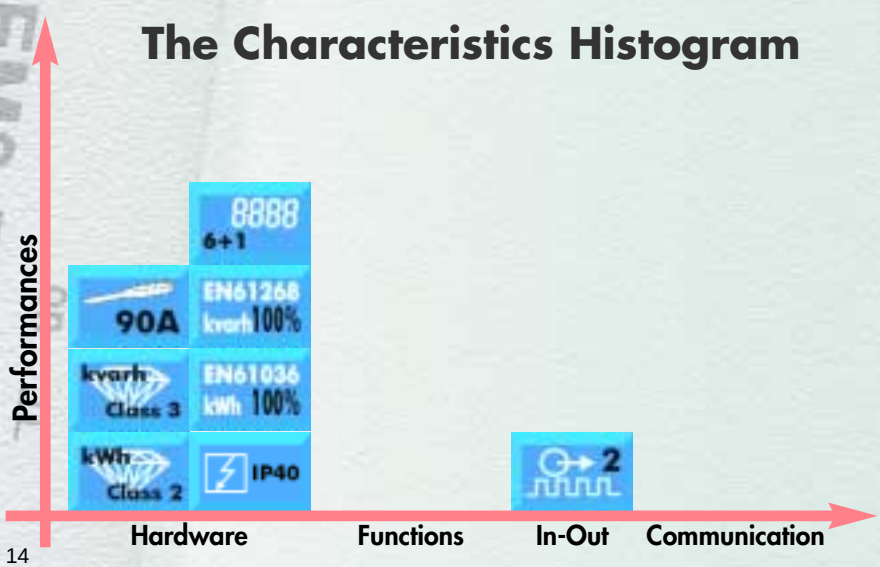
EM3-DIN is an energy meter that has been developed to meet the requirements of those applications where a very simple and reliable instrument is needed.

The main advantages

- Electromechanical display allowing the user to read the consumed energy even when the load or the meter is not power supplied.
- Easy installation avoiding any programming set-up.
- Self power supply making the installation easier and more reliable.
- Direct connection up to 90A allowing the user to save the costs of external current transformers and relevant wiring.
- Dual pulse output transmitting to a PLC or other equipment the active and reactive energy simultaneously.
- Wall mounting avoiding any other protection enclosure.
- Full compliance with both EN61036 (active energy) and EN61268 (reactive energy) granting more reliable and accurate measurements.

EM3-DIN is suitable to be used to meter the active or reactive energy in the light/medium industries, in the services sector and tourism to allocate downstream the official watt-hour meter the production or services costs.

The Characteristics Histogram



The screw terminals
Connections for cables with cross-section area from 6 to 35mm^2 instead of passing-by types assuring a “contactor type” wiring and connection protection.

EM4-DIN

Modular Energy Meter

The advantages given by the exclusive Carlo Gavazzi modular system

- **Plug and play modules**
- **Maximum in-field flexibility**
- **Possibility to add any outputs only when really needed by the application**

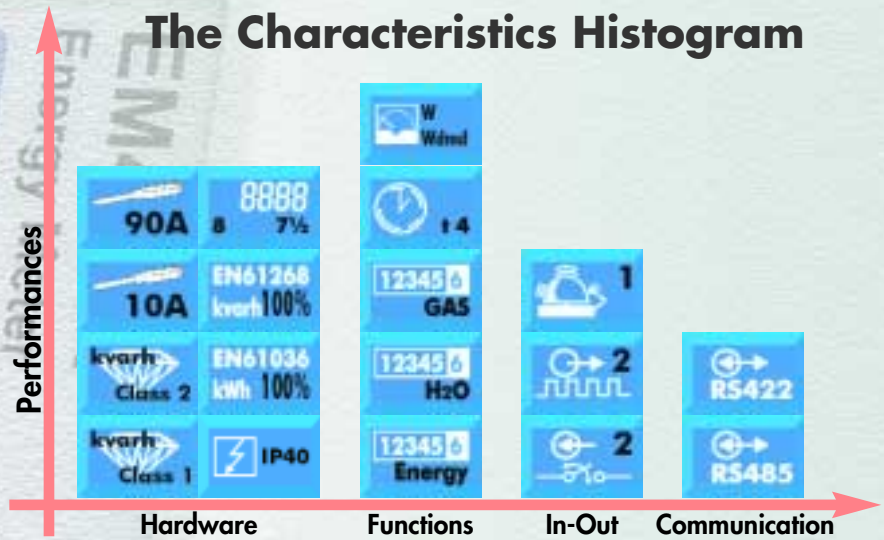
EM4-DIN is an advanced utility meter capable to measure not only the usual consumed energies but also Gas and Water by means of the optional dual contact inputs module.

The main advantages

- High accuracy and resolution for a fine cost calculation.
- Simultaneous indication of both active and reactive energy allowing the user to read the variables at a glance.
- Displaying of the active power demand with manual or external synchronisation. The fixed power supply costs are calculated with the same system used by the electricity board.
- Management of the pulses from gas and water meters based on single or dual tariff calculation and energy multi tariff management (by means of two selection contact inputs) giving more flexibility and meeting the application needs.
- Metering of energy, water and gas in the same instrument allowing the data transmission by means of the same communication port.
- Effective control of phase sequence, serial communication and wrong connection of the current inputs statuts making the instrument installation: easy, fast and free of wiring errors.
- Self power supply working even in case of one phase line failure granting continuous metering of energy.

EM4-DIN has been designed to meet all the application needs in the light/medium industry, offices, buildings, shopping centres, supermarkets and so on in order to allocate, downstream the official watt-hour meter, the production or services costs.

The Characteristics Histogram



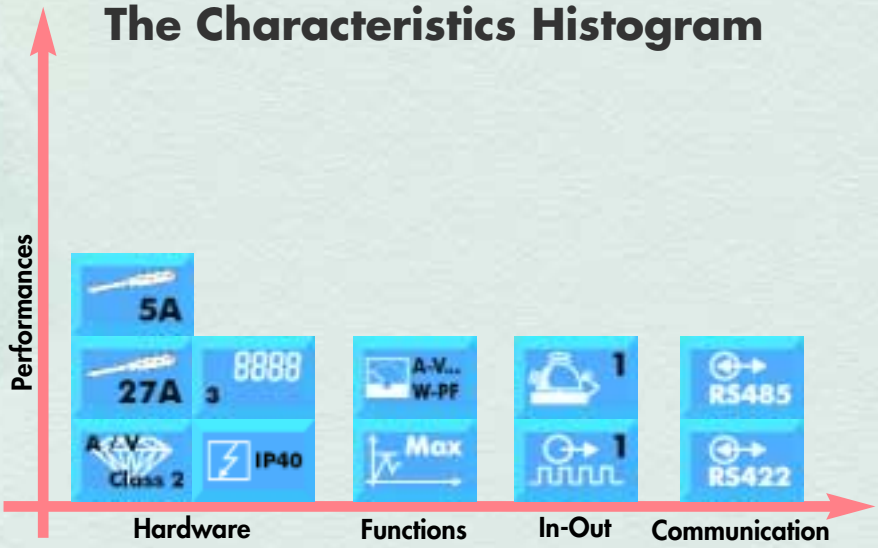
The sealing capability
The new housing concept grants a full sealing capability and connection protection.

WM1-DIN

Compact Power Analyzer

WM1-DIN is a 3-digit power analyser for the manual scrolling of 8 different measurements (among the possible 12), to be carried out on a single-phase or three-phase, balanced load system. This instrument is suitable to be used in those applications where a simple and reliable instrument is needed. The direct connection up to 27 A simplifies the connections and allows to save money since the CT is not needed.

The Characteristics Histogram



WM1-DIN is suitable to measure the main electrical parameters of:

- motors and machines
- oven
- other 3-phase balanced loads

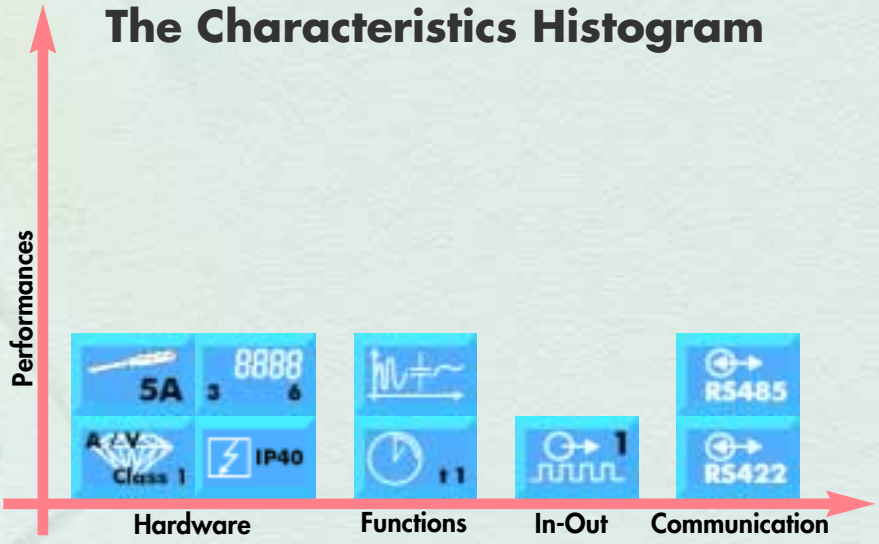
WM2-DIN

Power Analyzer

- **Large display**
- **Compact housing, only 107mm wide**
- **User friendly**

WM2-DIN is capable to measure all the electrical parameters of an electrical line or load. Its user friendless allows it to be mounted in the switch and control gears as local indicator instead of the classical single function instrument. WM2-DIN can also be used as remote unit to transmit the measured energy to a PLC by means of the pulse output or all the available measurements to a Personal Computer by means of the RS485 port.

The Characteristics Histogram



WM12-DIN and WM12-96

Multi Function Meter

WM12-DIN and WM12-96 are general purpose multi function meters that allow to monitor all the mains parameters of an electrical line or load. The compact housings combined with a complete selection of measurements allow the instruments to be mounted in all the switch and control gears as local indicators, instead of the classical single function analogue or digital panel meters.

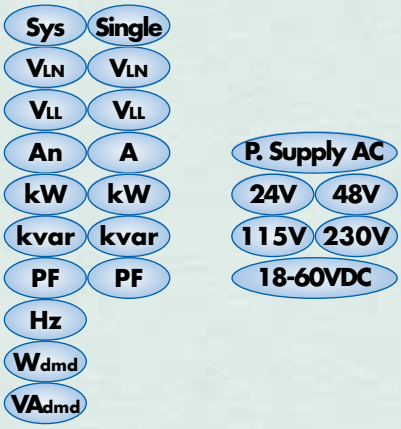
- **Replacement of ordinary "DPMs and analogue instrumentation combined by rotary switches"**
- **Status of system power supply and neutral current available at a glance**
- **96x96 version with only 46 mm housing behind the panel, suitable for all switch and control gears**

The unit is provided with some unique installation visual status functions like:

- the window control of the mains 3-phase voltage notifying the user at a glance if the mains is supplied out of the requested power supply tolerance,
- the neutral current control showing immediately any load or installation anomaly due to high harmonic distortion or load insulation loss (high earth leakage current).

The Characteristics Histogram

The displayed variables and the available power supplies



WM2-96

Modular Power Analyzer

WM2-96 is a general purpose analyser capable to measure all the electrical parameters of an electrical line or load. Its user friendliness allows it to be mounted in the switch and control gears as local indicator instead of the classical single function instruments.

The same instrument can also be used as remote unit to transmit the measured energy to a PLC by means of the pulse output or all the available measurements to a Personal Computer by means of the RS485 port.

The advantages given by the exclusive Carlo Gavazzi modular system

- **Plug and play modules**
- **Maximum in-field flexibility**
- **Possibility to add any outputs only when really needed by the application**

WM2-96 is the ideal solution for:

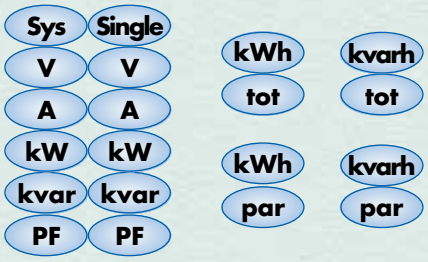
- Panel makers
- Installers
- Engineering companies
- Building automation
- OEM's

The most significant applications are:

- In the industry, monitoring of main and branch lines.
- In the services sector, monitoring of main and branch lines of offices, buildings, shopping centres, super-markets and so on.

The Characteristics Histogram

The displayed variables



WM22-DIN

Modular Power Analyzer

The advantages given by the exclusive Carlo Gavazzi modular system

- **Plug and play modules**
- **Maximum in-field flexibility**
- **Possibility to add any outputs only when really needed by the application**

WM22-DIN is a modular power analyser that allows to monitor all the mains parameters of an electrical line or load. The amazing design of the housing combined with outstanding performances makes WM22-DIN an instrument to be used in all the applications up to 5000A and up to 200kVL-L.

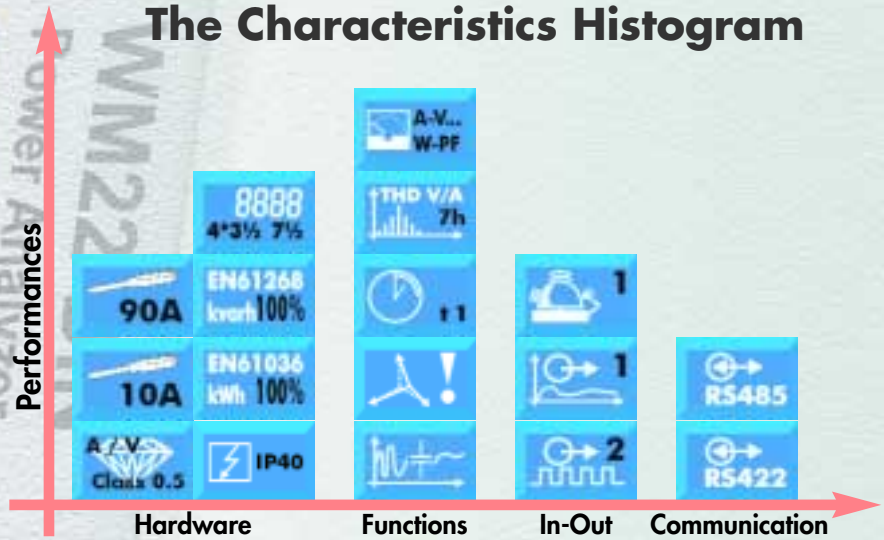
The four remarkable features of WM22-DIN

- Direct measurement of up to 90A. No external current transformer needed.
- Simultaneous display of four variables. Information available at a glance.
- A full range of measurements available. Everything under control.
- Plug and play output modules. Easy interfacing to external devices

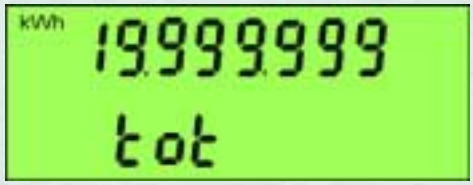
The main advantages

- Total harmonic analysis of both current and voltage notifying potential load failures.
- Phase asymmetry control notifying line failures.
- Dual pulse output, analogue output or RS485 port providing the communication to PLC's and PC's.
- The alarm output connectable to all the system variables, thus providing a local control.
- Serial communication and wrong connection of the current inputs status indication making the instrument installation: easy, fast and out of wiring errors.
- Self power supply working even in case of one phase line failure granting the measurement of all the variables all the time.

The Characteristics Histogram



Example of variables displayed with serial communication diagnostics: r.t (Rx/Tx)



Example of 7 1/2 digit energy displaying

Energy Management and Dupline Field Bus

When an idea becomes a great idea …
Metering of Energy together with Dupline, all the advantages of a versatile Bus for industrial applications and building automation.

Dupline® Fieldbus Installationbus

The introduction of the Climate Change Levy is affecting consumers of energy in one way or another. The basic outcome is that users who are inefficient in their use of energy will pay more than efficient users. There are several ways to avoid or reduce the extra costs of the CCL but most of them involve some major investments in plants or new technologies such as CHP, wind power or other renewable energy sources. The easiest way to offset these extra costs is to control your consumption of energy.

The fundamental questions you have to ask in order to find a solution to save energy and money

- How much energy is consumed?
- Is there any energy waste?

… and the answers?

- Find an easy way to measure it
- For sure, there are loads that are running even if it is not necessary. For instance, lights and extractor fans when the building is empty. Therefore a smart system to turn the loads ON and OFF is needed.

… the solution is a complete package for Energy Metering and Building Automation available now by Carlo Gavazzi …

The meters



The other Fieldbus compatible instruments:
DIN-rail mounting: EM1-WM1-SPT-PQT
Flush mounting: WM2-WM3-WM24-WM4.

The main Bus devices

G 4420 7401
4 individual counter inputs for:
4*kWh meters;
2*kWh + 2*kvarh meters.
Reset feature. Data retention in case of power failure.

G 3890 0014
G 3800 0015
Master channel generator.
Power supply:
115V, 230VAC
or 10 to 30VDC

The data acquisition system

The Dupline DDE Server to acquire the information of the Energy meters through the Dupline field Bus system.

The Dynamic Data linked to an Excel spreadsheet to show all the measurements and make all the cost calculations in a simple and powerful way.

energy management by

Energy

Power Generation Distribution

New modular concept

Maximum field flexibility
Same power supply and output modules for different instruments:
SPT-90
PQT-90
EM2-96
WM2-96
WM23-96
WM24-96
WM3-96
WM4-96

WattSoft3 Energy Meter Management Software. Windows95/98/NT/2000/XP software compatible to manage and to display the energy consumption metered by EM2/ EM4/ WM2/ WM22/ WM3/ WM4/ SPT and so on. Remote ON/OFF switch of the single loads.

Values Management and Transmission

Energy Consumption

Future North American Approvals

CVT-DIN Compact Transducer
Class 0.5, 3 basic models: V-A AC, V-A DC, Hz.
0-20mA, 4-20mA, 0-10V,
0 to ±1VDC output.
Field adjustment capability

V A Hz

SPT-90 Modular TRMS Power Transducer
Class 0.5 (V-A), 2 basic models: 1-ph, 3-ph, 4 input types (from 57V to 433V, 1 or 5A) Available modules: dual analogue output, relay/static output, 3 digital inputs, RS422/485 and RS232 ports, programming keypad. 90x90 mm housing.

Modbus

A V VA
var W W_{dmd}
PF Wh

TopRex®

PQT-90 Power Quality Transducer
Class 0.5 (V-A);
10 samp./s. Graph display. Harmonic analysis. Measurements on: 1-ph., 3-ph. bal./unbal. load. Up to 4 relay/static outputs and mA-V outputs . RS485 or RS232 port. Up to 6 digital inputs. 2Mb data memory.

Modbus

A V VA
VA_{dmd} var W
W_{dmd} PF Hz
THD kWh kvar

EM1-DIN Compact TRMS Energy Meter
Class 2 (EN61036). 5+1-DGT readout. kWh meter.
Up to 22.5A direct connection. 1-ph. system.

kWh
tot

EM2-DIN TRMS Energy Meter
Class 1, 6-DGT readout. Measurements on: 1-ph, 3-ph. balanced/ unbalanced load.
2 total and 2 partial energy meters.
Relay output, RS422/485 port.

Modbus

kWh kvarh
tot/par tot/par

Management

Metering, Recording and Reporting

EM2-96 Modular TRMS Energy Meter
Class 1, 6-DGT readout. Measurements on: 1-ph, 3-ph. balanced/unbalanced load. 2 total and 2 partial energy meters. Relay output, RS422/485 port. 96x96 mm housing.

EM3-DIN Modular TRMS Energy Meter
Class 2 (EN61036), class 3 (EN61268), 6+1-DGT readout. Direct connection up to 90A. 3-phase unbalanced load. 2 pulse outputs available on request. 9-DIN housing.

EM4-DIN Modular TRMS Energy Meter
Class 1 (EN61036) class 2 (EN61268), 8-DGT readout. kWh, kvarh, Gas and H_2O meter. Multi tariff management: t1-t2-t3-t4. Direct connection up to 90A or by CT and VT. 2 pulse outputs, RS422/485 port. 9-DIN housing.

WM1-DIN Compact Power Analyzer
Class 2 (V-A), 3-DGT readout. Measurements on: 1-ph, 3-ph. balanced load. Up to 27A direct connection. Alarm or pulse output, RS422/485 port. 4-DIN housing.

WM12-DIN Multifunction Meter
Class 0.5 (V-A), 3*3 DGT readout. Measurement on: 1-ph, 2-ph, 3-ph balanced/unbalanced loads. Visual An or window V control. RS422/RS485 port. 6-DIN housing.

Modbus

kWh kvarh
tot/par tot/par

Modbus

kWh kvarh
tot tot

Modbus

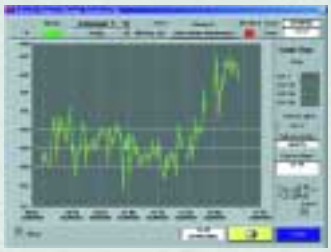
kWh kvarh Gas m^3
tot/par tariff H_2O m^3

A V VA
var W PF

Modbus

A V VA
An var W
W_{dmd} VA_{dmd} Hz
PF A_{max} W^{dmd}_{max}

Energy Man



Wattsoft2 and Wattsoft3 SCADA software for EM2-EM4-WM2-WM22-WM3-WM4-SPT instruments compatible with Windows 95/98/NT/2000/XP.

Back view of the full assembled instrument.

Electrical Parameters monitoring, analysis and control

Future North American Approvals

WM12-96 Multifunction Meter
Class 0.5 (V-A), 3*3 DGT readout. Measurement on: 1-ph, 2-ph, 3-ph balanced/unbalanced loads. Visual An or window V control. RS422/RS485 port. 96x96mm housing.

WM2-DIN TRMS Power Analyzer
Class 1, 3-DGT/ 6-DGT readout. Measurements on: 1-ph, 3-phase bal./unbal. load. System and single phase measurements. Pulse output, RS422/485 port.
6-DIN housing

WM2-96 Modular TRMS Power Analyzer
Class 1, 3-DGT/ 6-DGT readout. Measurements on: 1-ph, 3-phase bal./unbal. load. System and single phase measurements. Pulse output, RS422/485 port.
96x96 mm housing.

WM22-DIN Modular TRMS Power Analyzer.
Class 0.5 (V-A). 4*3 1/2-DGT readout (istant. variables), 7 1/2-DGT (energies). Direct connection up to 90A or by CT and VT. 2 pulse outputs, 10V/20mA DC and alarm outputs, RS422/485 port.
9-DIN housing.

Future North American Approvals

WM23-96 Power Quality Analyzer
Class 0.5 (V-A), 3x3 1/2 DGT read out Measurements on 3-ph. unbalanced loads. Connection by CT and VT. Up to 2 alarms, one analogue output. 96x96mm housing.

Modbus		
A	V	VA
An	var	W
W_{dmd}	VA_{dmd}	Hz
PF	A_{max}	W^{dmd}_{max}

Modbus		
A	V	var
W	PF	kWh
kvarh	tot/par	

Modbus		
A	V	var
W	PF	kWh
kvarh	tot/par	

Modbus		
A	V	VA
VA_{dmd}	var	W
W_{dmd}	PF	Hz
THD	kWh	kvar

Modbus		
A/An	V	VA
VA_{dmd}	var	W
W_{dmd}	PF	Hz
THD	W^{dmd}_{max}	PF_{min}

agement

TopRex
Top Performances

The modularity family, same modules for different instruments: SPT-90, PQT-90, EM2-96, WM2-96, WM23-96, WM24-96, WM3-96 and WM4-96.

- 4 static outputs module, 100mA pulse according to DIN43864/ alarm outputs (WM3, WM4 and PQT only)
- 3 digital inputs module and excitation output (16 to 24 VDC) (WM4 and PQT only)
- RS232 + real time clock 2Mb data memory module (WM4 and PQT only)

PQT-90

SPT-90

- RS232 (SPT-90 and WM3-96) + real time clock module (WM3-96 only)
- 3 digital inputs module (WM2 and EM2 excluded)
- Single/dual analogue output module: 5-10-20mA, 1-5-10VDC (WM4 and WM24 excluded)

The Modularity Concept

Maximum field flexibility

DEPENDING ON THE MODEL

ALL MODELS

- Single/dual relay output module
- Single/dual static output module 100mA pulse according to DIN43864/ alarm outputs
- RS485 communication module
- Universal power supply module
  18 to 60VAC/DC
  90 to 260VAC/DC

Integrated load profile indication

Future North American Approvals

c UL us SA

WM24-96 Universal Utility Meter
Class 0.5 (V-A), 3x3 ½ DGT read out. Measurements on 3-ph. unbalanced loads. Connection by CT and VT. Up to 2 pulse outputs, up to 2 alarms. 96x96mm housing.

c UL us SA

TopRex

WM3-96 Power Quality Analyzer
Class 0.5 (V-A); 10samp./s. Graph display. Harmonic analysis. Measurements on: 1-ph., 3-ph. bal./unbal. load. Up to 4 relay/static outputs. Up to 4 mA, V outputs. RS485 or RS232 port.

c UL us SA

TopRex

WM4-96 Universal Utility Meter
Class 0.5 (V-A); 10samp./s. Graph display. Harmonic analysis. Measurements on: 1-ph., 3-ph. bal./unbal. load. Up to 4 relay/static outputs. RS485 or RS232 port. Up to 6 digital inputs. 2Mb data memory.

WM2-96

EM2-96

Modbus			Modbus			Modbus			
A/V	VA	VA_{dmd}	A/An	V	VA	A	V	VA	VA_{dmd}
var	W	W_{dmd}	VA_{dmd}	var	W	var	W	W_{dmd}	PF
PF	Hz	kWh	W_{dmd}	PF	Hz	PF_{AVG}	Hz	THD	Min Max
kvar	GAS	H_2O	THD	kWh	kvar	kWh	kvar	GAS	H_2O

... making energy metering easy in very noisy plants

Many problems… One solution … One supplier!

The unlimited efficient solution possibilities provided by the Dupline Field Bus

- Light control, switching ON/OFF and dimming lights;
- Temperature control, detecting signals from infrared remote controls or PIR sensors and acting on heating elements and/or valves;
- Ventilation control, measure of room and outdoor temperature;
- Monitoring of doors, locks and windows;
- Monitoring of fire alarms from smoke detectors;
- Water leakage detection using proper sensors;
- And many others …

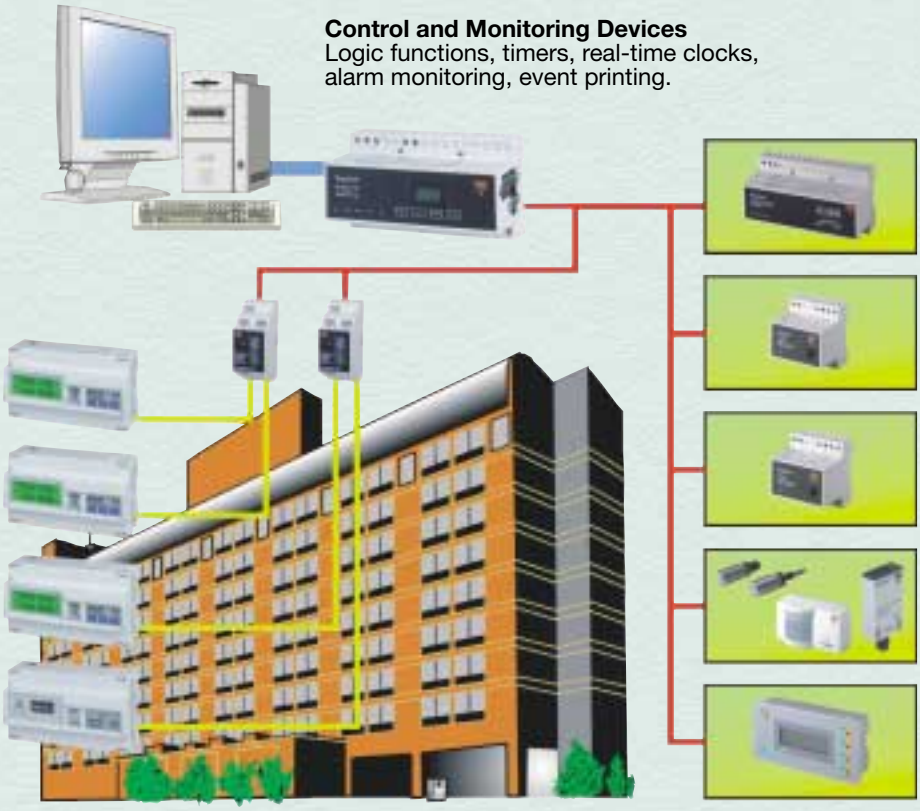

Touristic ports


Apartment buildings


Shopping centers


Industrial applications

Full load control... Energy saving... Cash saving!



Control and Monitoring Devices
Logic functions, timers, real-time clocks, alarm monitoring, event printing.

The Dupline components

Gateways and Interfaces
Profibus-DP, Devicenet, Lon-Work, Interbus-S, ModBus. PLC direct interfaces, Modem.

Digital I/O Modules
1 to 8 contact inputs, 1 to 8 outputs, combined I/O modules.

Analogue I/O Modules
1or 4*20mA/10VDC inputs, 1or 4*20mA/10VDC outputs.

Bus-Powered Sensors
Inductive-magnetic proximity switches, PIR-sensors, temperature sensors.

Displays and accessories
LCD text display, LED display, coding units, repeater.

Main application advantages

- Free topology for a fast, flexible and easy to build step-by-step installation; the system can be easily adapted to new unexpected requirements.
- User friendly: easy to code addresses and test, easily accessible data from a PC/PLC.
- High electrical noise immunity, no shielded cables are needed therefore existing cable/conduit/pipe can be exploited.
- Data communication up to 10 km, no signal repeaters are needed.
- Integration of the metering system with the Dupline door-light-intrusion-remote controls and load switching.
- Cost-effective solution when compared with the ordinary systems.

WM23-96

Power Quality Analyzer

When Carlo Gavazzi makes the difference

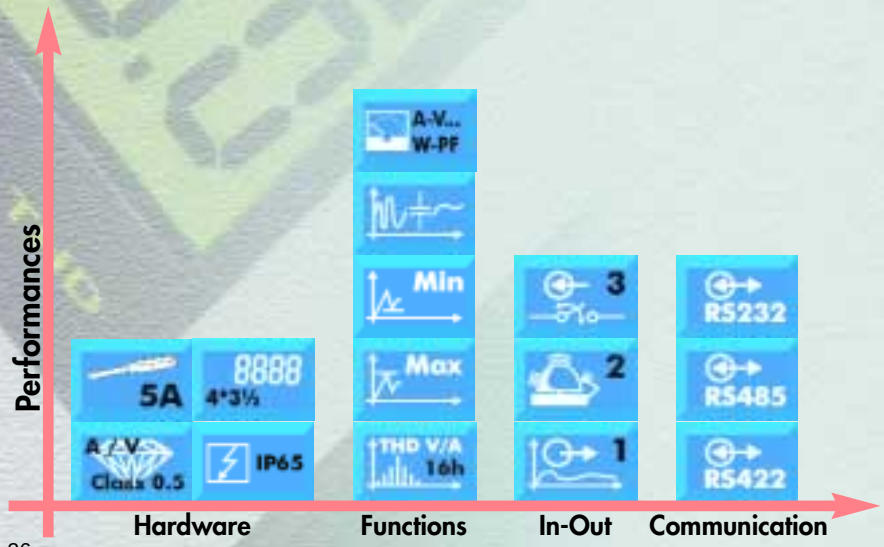
- **Powerful performances**
- **Plug and play modules**
- **Maximum in-field flexibility**
- **Possibility to expand the inputs/ outputs only when really needed by the application**

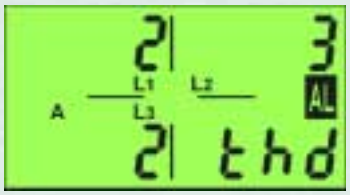
WM23-96 is a modular power quality analyser that allows the operator to continuously monitor the mains. All measurements with a direct connection up to 830VAC (phase-phase), up to 20kV (VT connection) and up to 5.000A (CT connection) allow the operator to use WM23-96 in all the light and medium industry applications. This flexible instrument has a standard IP65 protection degree, a 0.5 accuracy class, an FFT analysis up to the 16th harmonics and on request up to 2 alarms, one analogue output and one RS422/485 or RS232 communication port.

WM23-96 can be equipped with different modules like the three digital inputs. Two of those inputs can be connected to the official Watt-hour meter to synchronise the W and VA demand calculation, while the last input can be used to lock the programming of the equipment.

This power quality analyzer is able to show any single current and voltage harmonics and the THD on which it is possible to connect an alarm output.

The Characteristics Histogram





The wide LCD display with high contrast features is able to show all the measurements and in addition the recording of the MAX active powers: WL1, WL2, WL3, Wsys, Wdmd and the MIN power factors: PF1, PF2, PF3, PFsys.

WM24-96

Universal Utility Meter

When Carlo Gavazzi makes the difference

- **Powerful performances**
- **Plug and play modules**
- **Maximum in-field flexibility**
- **Possibility to expand the inputs/ outputs only when really needed by the application**

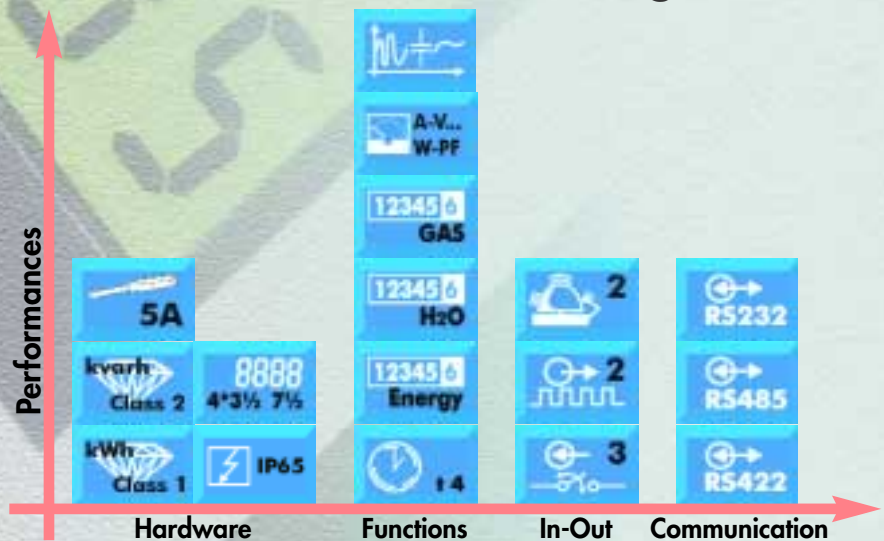
WM24-96 is a modular universal utility meter that allows the operator to continuously monitor the mains and measure energy, gas and water by total or partial metering. All measurements with a direct connection up to 830VAC (phase-phase), up to 20kV (VT connection) and up to 5.000A (CT connection) allow the operator to use WM24-96 in all the light and medium industry applications. This universal utility meter has a standard IP65 protection degree and the metering of energy is in compliance with class 1 “EN61036” and class 2 “EN61268”.

WM24-96 is capable to measure and control, by means of the two optional alarm outputs all the main variables and the maximum demanded power.

This universal utility meter is able to measure and display the total energies in the four quadrants (+kvar-L, -kvar-L, +kvar-C, -kvar-C). The access to the programming parameters can be locked in order to avoid undesired modifications.

Furthermore the measured energies can be managed by time period/tariff: t1-t2-t3-t4 by means of three input contacts. Those contacts can be used, in alternative, as counter inputs to measure m³ of gas and water.

The Characteristics Histogram



WM3-96

Modular Power Quality Analyzer

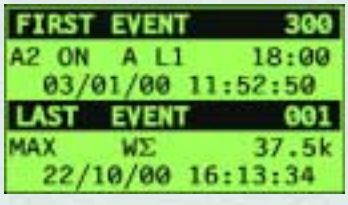
When Carlo Gavazzi makes the difference

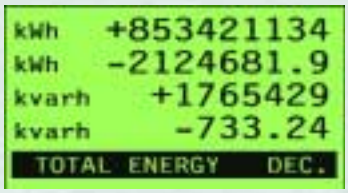
- **Powerful performances**
- **Plug and play modules**
- **Maximum in-field flexibility**
- **Possibility to expand the inputs/ outputs only when really needed by the application**

WM3-96 is a modular analyser of the mains' quality that, thanks to a 32-bit µ-Processor, allows the operator to continuously and completely monitor the mains. All measurements with a direct connection up to 830VAC (phase-phase), up to 600kV (VT connection) and up to 30kA (CT connection) allow the operator to use WM3-96 in any kind of installation. WM3-96 is a flexible, powerful instrument that can be used in any kind of installation, thanks to its mechanical and electrical features, such as for instance: IP65 protection degree, 0.5 accuracy class, 10 samplings/second, FFT analysis up to the 50th harmonic, tariff management and automatic recording of the alarms together with the availability of any kind of input/output interfaces.

The already powerful performances of WM3-96 become outstanding performances with the addition of the RS232+RTC module.

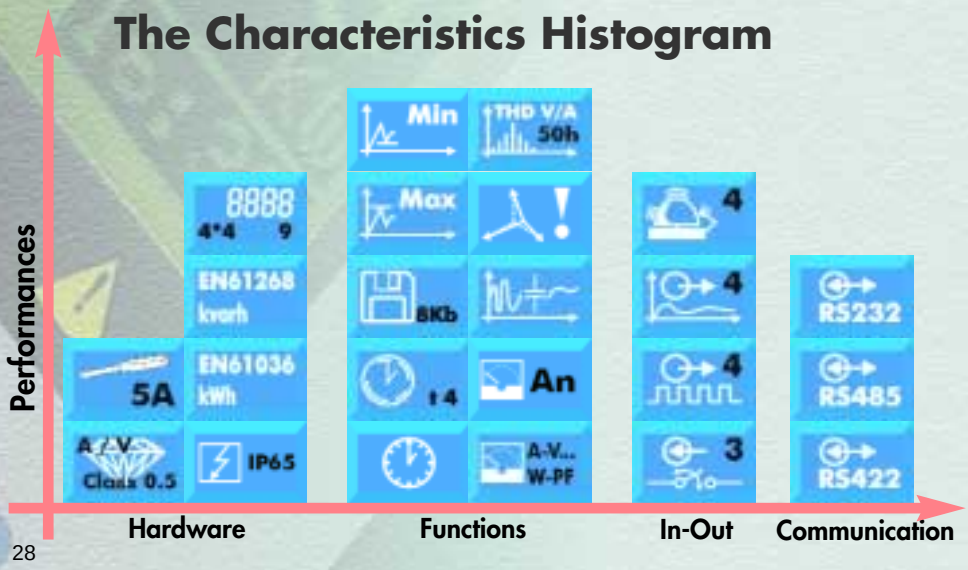
Example of recording of events
It's possible to record up to 480 events that can be the combination of alarms, diagnostics, minimum and maximum value, with reference to: date, time and variable being controlled.





Example of energy consumption storage. The RS232+RTC module allows the storage of the energy consumption of the previous two months.

The Characteristics Histogram



Analysis of the power quality and control of the electrical parameters

The problems that more frequently occur in electrical systems with:

- inverters and power converters;
- switching power supplies for computer and communication system applications;

are the following:

- failures on compensation capacitors;
- blowing of capacitor fuses;
- overheating of power supply transformers with a load current below the rated value;
- overheating of motors and frequent failures;
- high neutral conductor currents;
- problems on electronic motor controls.

They are mainly due to the harmonic contents of currents and voltages.

The best solution is WM3-96 that allows to continuously monitor the harmonic contents of currents and voltages together with all other electrical parameters. The control of more than one electrical parameter by means of alarm set-points and the automatic recording of events allow the operator to monitor any anomalies of the installation and of the loads in real time, so as to promptly decide and plan any maintenance actions, thus avoiding possible damages to the loads and/or expensive stopping of the machinery.

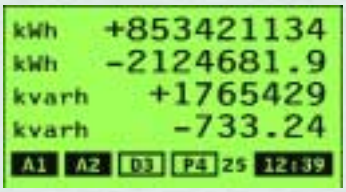
Variables that can be monitored and displayed

Main variables	System	Single phase	Average	Min	Max	Alarm Out	Analog Out	RS485 port	Pulse
V_{LN}, V_{LL}	○	○		○	○	○	○	○	
V asymmetry	○			○	○	○	○	○	
A		○		○	○	○	○	○	
An	○		○	○	○	○	○	○	
Hz	○			○	○	○	○	○	
VA	○	○	○	○	○	○	○	○	
var	○	○		○	○	○	○	○	
W	○	○	○	○	○	○	○	○	
PF	○	○	○	○	○	○	○	○	
+kWh (*)	○							○	○
-kWh (*)	○							○	○
+kvarh (*)	○							○	○
-kvarh (*)	○							○	○
THD (A-V)		○		○	○	○	○	○	
THD even (A-V)		○		○	○	○	○	○	
THD odd (A-V)		○		○	○	○	○	○	
Single harmonic		○						○	

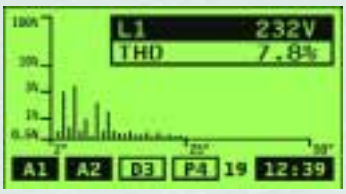
(*) Total and time-period energies

Examples of display pages

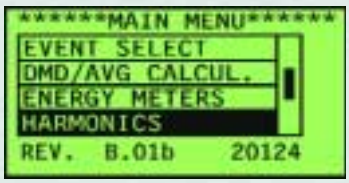
- Four contemporaneously displayable variables
- One page with four variables freely selectable among the available ones
- More than 26 display pages
- More than 400 displayable variables
- Combination among different kinds of system variables
- Combination between system and phase-variables



- Energy meter function
- Up to 48 partial energy meters (6 digits)
- 4 total energy meters (9 digits)
- Tariff Management: single time, dual time and multi time
- kWh and kvarh meters with separate metering of the imported and exported energy
- EEPROM data saving



- Histogram displaying of the harmonic contents relating to every single phase for currents and voltages
- Complete harmonic analysis up to the 50th harmonic
- Numerical displaying as an absolute and percentage value of the single harmonic
- Four-quadrant displaying of the harmonic phase with source detection (generated harmonics and imported harmonics)



- Simple and intuitive programming menu
- Selection menus available depending on the modules:
  System type, CT ratio, VT ratio, Display page, Min-Max values, Power average type, Energy meters, Harmonics, Clock, Digital outputs, Analogue outputs, Serial communication port, Digital filter.

WM4-96

Modular Universal Utility Meter

When Carlo Gavazzi makes the difference

- **Powerful performances**
- **Plug and play modules**
- **Maximum in-field flexibility**
- **Possibility to expand the inputs/ outputs only when really needed by the application**

WM4-96 is a Universal Utility meter and Power Quality Analyzer. This high-tech instrument has been developed to meet the most advanced application needs. WM4-96 offers to the user many advantages and solutions that can be summarised in:

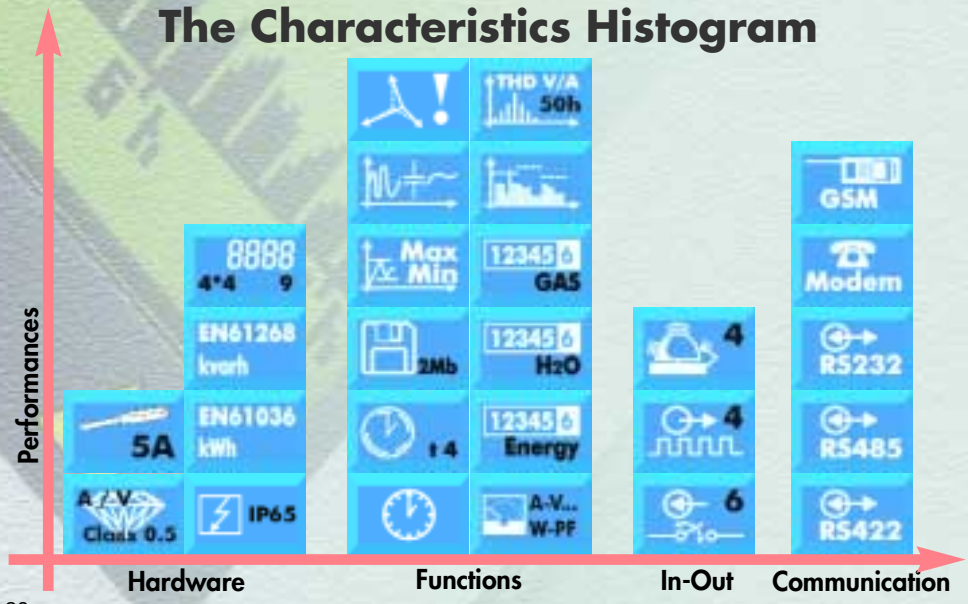
- Quick assembly and maintenance using Plug and Play modules.
- Load failure prevention:
  Harmonic analysis (A/V) with source detection and control;
  up to 4 alarms for a powerful variable control;
  Alarms logging and data stamping.
- Remote control facilities:
  up to 4 pulse outputs, RS485 port (Modbus RTU), RS232 port.
- Load profile display to keep supply costs under control.
- Energy cost allocations with independent import/export kWh/kvarh and kWh/kvarh multi-tariff management
- Water and gas metering and communication using the same instrument.

RS232 serial communication port provided with a 2Mb data memory.

The main applications where the WM4-96 can be fully exploited

- Electrical parameters analysis, control and utility metering in the medium and heavy industry.
- Electrical parameters analysis and utility metering in the public buildings and shopping centres particularly when there is the need to collect the data from many buildings in different locations by means of Wm4Soft.
- Electrical parameters analysis and local control in the aqueducts with remote centralised supervision capability using GSM communication and Wm4Soft data acquisition system.

The Characteristics Histogram



Variables that can be monitored and displayed

Main variables	System	Single phase	Average	Min	Max	Alarm Outputs	RS485 port	Pulse
V_{LN},V_{LL}	●	●		●	●	●	●	
V asymmetry	●			●	●	●	●	
A	●	●	●	●	●	●	●	
Hz	●			●	●	●	●	
VA	●	●	●	●	●	●	●	
var	●	●		●	●	●	●	
W	●	●	●	●	●	●	●	
PF	●	●	●	●	●	●	●	
+kWh (*)	●						●	●
-kWh (*)	●						●	●
+kvarh (*)	●						●	●
-kvarh (*)	●						●	●
GAS (*)	●						●	●
H_2O	●						●	●
THD (A-V)		●		●	●	●	●	
THD even (A-V)		●		●	●	●	●	
THD odd (A-V)		●		●	●	●	●	
Single harmonic		●					●	

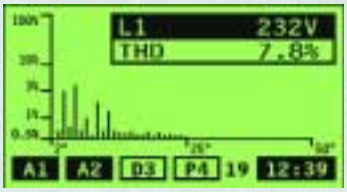
(*) Total and time-period energies

Official watt-hour meter interface, the 3 interfacing methods of WM4-96 are:

- Direct measurement 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 of the instantaneous variables (LV connection) and indirect measurements of the energy variables (LV or MV/HV connection).

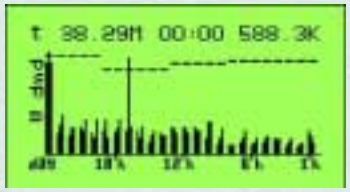
Powerful variable analysis and great communication capabilities: this is the strength of WM4-96

- Energies-water-gas and instantaneous variables readable on the display of your GSM mobile phone giving you maximum control freedom, saving time and money.
- Alarms transmitted as soon as they occur via GSM or analogue modem notifying the plant abnormal conditions.
- Data logging and stamping of up to 8 programmable instantaneous variables for a time duration up to 90 weeks with date and time references to build up the history of your electrical installation.
- Wm4Soft network communication software to download, manually or automatically (via RS485-analogue modem-GSM modem) up to 2Mb data stored in the WM4-96. These information can be plotted simply in an Excel spreadsheet.



Mains quality analysis because the harmonics are cause of load failures and production stop.

Load profile display with alarms to keep the power consumption and cost under full control.



- Continuous data stamping and communication: RS232, RS485, modem, GSM.
- Powerful data acquisition by means of Wm4Soft and mobile phones wherever you are.

CVT-DIN

Compact Transducer

The CVT-DIN is a series of compact and simple transducers for the measurement of voltage, current and frequency. In a module which is 71.5 mm wide, suitable for DIN rail mounting, it offers three basic hardwares to measure: AC voltage and current; DC voltage and current; frequency.

The current and voltage models allow to adjust the transducer calibration from 50 to 130 % of the rated inputs simply using a digital multimeter set on the resistance measurement.

Some adjustment examples

Input	Formula	Example 1	Example 2
5AAC	$R_{adj} = \frac{15000}{A_{in}\ (A)}$	A in= 3A R adj= 5000Ω	A in= 6A R adj= 2500Ω
500VAC	$R_{adj} = \frac{1500000}{V_{in}\ (V)}$	V in= 250V Radj= 6000Ω	V in= 650V R adj= 2307Ω
1AAC	$R_{adj} = \frac{3000}{A_{in}\ (A)}$	A in= 0.9A R adj= 3333Ω	A in= 1.2A R adj= 2500Ω
100VAC	$R_{adj} = \frac{300000}{V_{in}\ (V)}$	V in= 80V R adj= 3750Ω	V in= 110V R adj= 2727Ω
1ADC	$R_{adj} = \frac{3000}{A_{in}\ (A)}$	A in= 0.9A R adj= 3333Ω	A in= 1.2A R adj= 2500Ω
200VDC	$R_{adj} = \frac{600000}{V_{in}\ (V)}$	V in= 190V R adj= 3157Ω	V in= 240V R adj= 2500Ω
60mVDC	$R_{adj} = \frac{180000}{V_{in}\ (V)}$	V in= 35mV R adj= 5142Ω	V in= 65mV R adj= 2769Ω
10VDC	$R_{adj} = \frac{30000}{V_{in}\ (V)}$	V in= 6V R adj= 5000Ω	V in= 12V R adj= 2500Ω

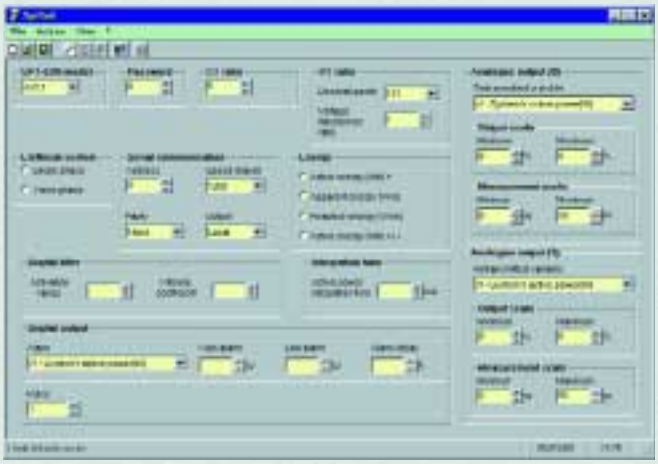
The Characteristics Histogram

The three basic transducers

SPT-90

Smart Power Transducer

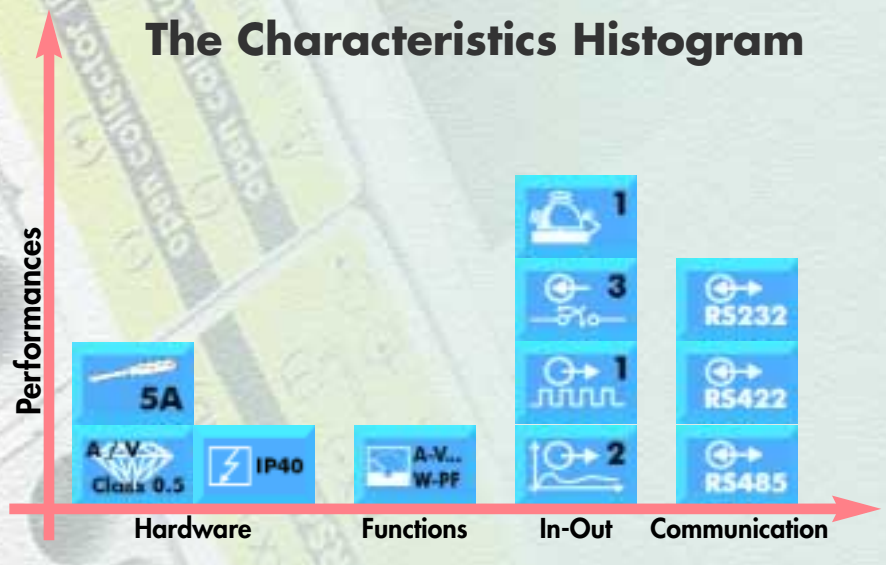
The SPT-90 is a generation of programmable "smart" transducers, for the measurement of all major characteristics of an electrical system including power, energy, voltage, current and frequency.
The SPT-90 series has a large number of functions available to the user.
Configuration and control can be done in field, interfacing the transducer at high levels as a remote unit.



The two SPT-90 programming systems:
- removable key-pad
- RS232 communication port

SptSoft
It is a software tool that can be used to easily download or upload the programming parameters from an SPT-90 to a PC and from a PC to a single SPT or a group of them connected in a communication network. The same software can be used to check the communication itself.

The Characteristics Histogram



The advantages
Compared to a traditional transducer the SPT-90 offers:
- Modularity available for the power supply and for the output modules allowing the transducer to be quickly adapted to the application needs
- TRMS measurement, that means reliable and true measurement not affected by distortion
- Selection among many types of measurements without changing the transducer
- Wide scaling capability solving the major field application problems
- Combination of analogue and serial outputs
- One integrated transducer with dual analogue outputs

PQT-90

Power Quality Transducer

When Carlo Gavazzi makes the difference

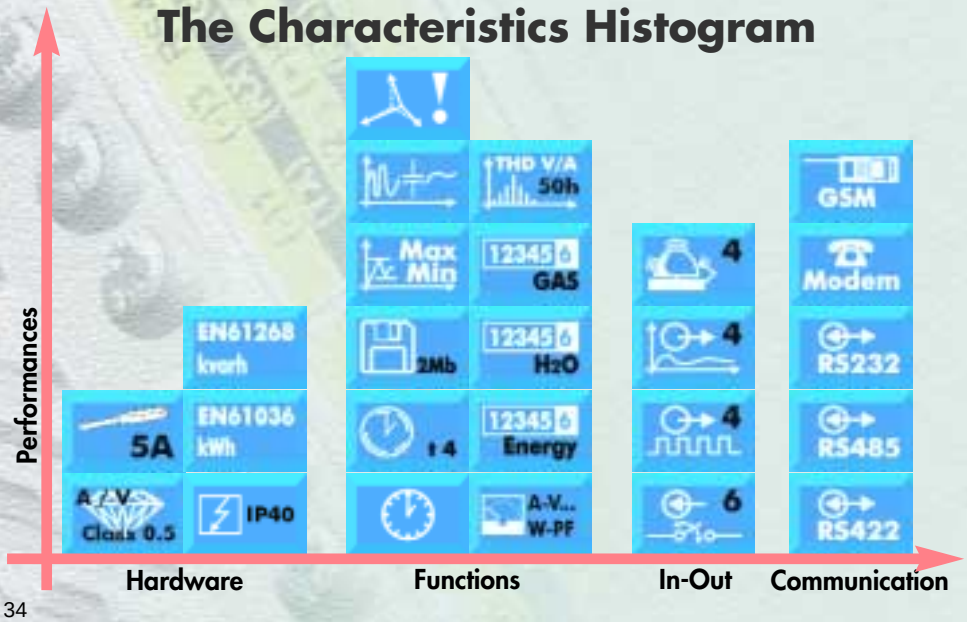
- **Powerful performances**
- **Plug and play modules**
- **Maximum in-field flexibility**
- **Possibility to expand the inputs/ outputs only when really needed by the application**

PQT-90 is a Power Quality Transducer. This new transducer offers to the user many advantages and solutions that can be summarised in:

- Quick assembly and maintenance using Plug and Play modules.
- Load failure prevention:
  Harmonic analysis (A/V) with source detection and control;
  up to 4 alarms for a powerful variable control;
  Alarms logging and data stamping.
- Remote control facilities:
  up to 4 pulse outputs, up to 4 analogue outputs, RS485 port (Modbus RTU), RS232 port.
- Energy cost allocations with independent import/export kWh/kvarh and kWh/kvarh multi-tariff management
- Water and gas metering and communication using the same instrument.

RS232 serial communication port provided with a 2Mb data memory.

The Characteristics Histogram



The main applications where the PQT-90 can be fully exploited

- Electrical parameters analysis, control and utility metering in the medium and heavy industry.
- Electrical parameters analysis and utility metering in the public buildings and shopping centres particularly when there is the need to collect the data from many buildings in different locations by means of PqtSoft.
- Electrical parameters analysis and local control in the aqueducts with remote centralised supervision capability using GSM communication and PqtSoft data acquisition system.

Powerful variable analysis and great communication capabilities: this is the strength of PQT-90

- Energies-water-gas and instantaneous variables readable on the display of your GSM mobile phone giving you maximum control freedom, saving time and money.
- Alarms transmitted as soon as they occur via GSM or analogue modem notifying the plant abnormal conditions.
- Data logging and stamping of up to 8 programmable instantaneous variables for a time duration up to 90 weeks with date and time references to build up the history of your electrical installation.
- PqtSoft network communication software to download, manually or automatically (via RS485-analogue modem-GSM modem) up to 2Mb data stored in the PQT-90. These information can be plotted simply in an Excel spreadsheet.

- PqtSof to easily download or upload the programming parameters from a PQT-90 to a PC and viceversa.

- Continuous data stamping and communication: RS232, RS485, modem, GSM.
- Powerful data acquisition by means of PqtSoft and mobile phones wherever you are.

Variables that can be managed by PQT-90

Main variables	System	Single phase	Average	Max	Min	Alarm Outputs	RS485 port	Pulse	Analogue outputs
V_{LL}, V_{LN}	●	●		●	●	●	●		●
V asymmetry	●			●	●	●	●		●
A	●	●	●	●	●	●	●		●
Hz	●			●	●	●	●		●
VA	●	●	●	●	●	●	●		●
var	●	●		●	●	●	●		●
W	●	●	●	●	●	●	●		●
PF	●	●	●	●	●	●	●		●
+kWh (*)	●						●	●	
-kWh (*)	●						●	●	
+kvarh (*)	●						●	●	
-kvarh (*)	●						●	●	
GAS (*)	●						●	●	
H_2O	●						●	●	
THD (A-V)		●		●	●	●	●		●
THD even (A-V)		●		●	●	●	●		●
THD odd (A-V)		●		●	●	●	●		●
Single harmonic		●					●		

(*) Total and time-period energies

Official watt-hour meter interface, the 3 interfacing methods of PQT-90 are:

- Direct measurement 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 of the instantaneous variables (LV connection) and indirect measurements of the energy variables (LV or MV/HV connection).

PQA700

Portable Power Quality Analyzer

- Base accuracy 0.5% RDG (current, voltage)
- Measurement of single phase and system variables: V, A, W, VA, var, TPF, DPF, Hz, Wh, varh-L, varh-C, VAh
- Complete Harmonic analysis up to the 50th harmonic
- 20ms continuous signal sampling
- Automatic storage of MIN, MAX and AVG values
- Time-based curve distribution of variable and load
- Statistic management of stored variables
- Oscilloscope functions
- Built-in printer
- RS232 port
- Rechargeable battery
- Complete accessory set
- Carrying case
- Analysis software

Description advantages

PQA700 is a complete power quality analyser suitable to check the electrical phenomena according to what is required by the EN50160 Standard (Harmonics, Supply voltage dips, Supply voltage variations and Supply interruptions). The basic features are particularly interesting because they include: a display which, thanks to its shape, shows the information clearly and neatly; a built-in impact dot matrix printer for printing the measurement results manually and automatically; a rechargeable battery to allow the user to take measurements even under tough disturbances and special power supply conditions; an RS232 communication port to download and process the measurements adequately and last but not least an easy and intuitive operating mode.

All this is supplied together with a rich equipment of accessories including a set of three accurate clamp-on probes which allows to take measurements up to 1200A (with two selectable full scales: 100A or 1000A) a complete set of cables, an analysis software …

On request a 3000A flex clamp probe is available. (model: Flex 3000Q)

… and finally a modern and rugged carrying case.
The compact dimensions, the rugged construction, the shape and the reduced weight of the instrument simplify its use and its location under any condition of installation.

Starting from 1994 with the publication of the EN50160 Standard by CENELEC, the idea of quality of the electric service has been introduced and made executive for the public electrical network at low and medium voltage. This event underlines, for the first time, the necessity to introduce some measuring parameters of the electric product, with the indication of its basic features and the limits within which it is considered as a quality product. The items featuring the service/product in the origin of the installation are the following: its waveform, its frequency, its magnitude and symmetry (in a three-phase system); the relevant conditions are: normal use and emergency use. It is clear that the characteristics of the electric product not only depend on the skill of the supplier in the electrical network management, but also on how the electric product is used. The improvement in the quality of the electric service obviously implies a cost both for the supplier and for the user. The supplier's costs can be summed up in the updating, extension and development of the electrical network; the user's costs: any necessary disturbance compensation, any necessary subordinate electric connection, any possible payment of penalties due to a low power factor or to the overcoming of the limits of power demand. Some additional costs can be even higher and unforeseeable, such as those due to failures of the loads and to the subsequent unplanned maintenance of the machines and of the installations merely due to electric problems.

Electrical phenomena

If we briefly go back to the characteristics of electric voltage in the origin of the installation and in order to closely examine this matter, the Regulation divides these features into two groups;
The first one for which some quantitative information are supplied:

- Frequency
- Harmonic distortion
- Phase Asymmetry

The second one for which a few approximate data are supplied:

- Quick voltage variations
- Voltage dips
- Supply interruptions
- Overvoltages

All these variables have a direct consequence on the service quality, but also on lines and loads.

The problems

The direct consequences of these phenomena on lines and loads can be underlined as follows:

- Failures on compensation capacitors
- Blowing of capacitor fuses
- Overheating of power supply transformers with load current below the rated value
- Overheating of motors and frequent failures
- High neutral conductor currents
- Problems on electronic motor controls
- Frequent activation of UPS.

The solution

In this case the solution to the monitoring of these electric variables can have two different proposals depending on the application needs:

- The first one refers to the occasional analysis and monitoring of the lines and of some critical charges by means of the right instrument, such as PQA700. This analyzer represents therefore the solution according to what is required by EN50160.
- The second and more complete proposal refers to the continuous monitoring and to the automatic recording of various conditions; these are due either to basic phenomena such as the harmonic contents of currents and voltages or to the measurements connected to consumption (current, power, energy, etc.). The latter can be taken with a flush-mounting instrument, like WM3-96, and can be followed by the subsequent research and location of the anomalies by means of a proper measuring and analysis instrument such as PQA700.

The Main Menu

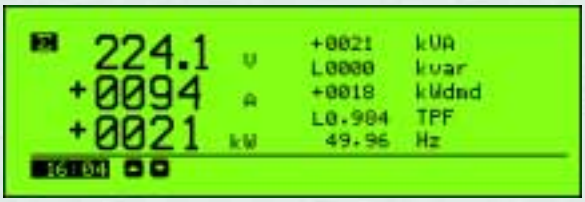
Some examples of display pages

The selection menu of the measuring functions is immediately available by means of a keypad command and allows the operator to:

- Display the instantaneous measurements
- Display the energies
- Enable the oscilloscope function
- Enable the harmonic analysis
- Enable the recording of supply voltage dips
- Enable the MIN / AVG/ MAX recording
- Set the clock
- Program the basic parameters of the instrument

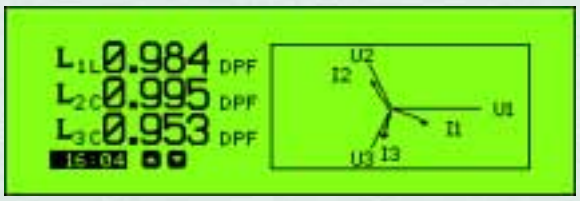
The Instantaneous Variables

The instantaneous variables are displayed clearly and neatly; moreover they're displayed with characters at various heights, according to their importance, and they're grouped per page, by system variables and phase variables so that they can be easily compared among them.



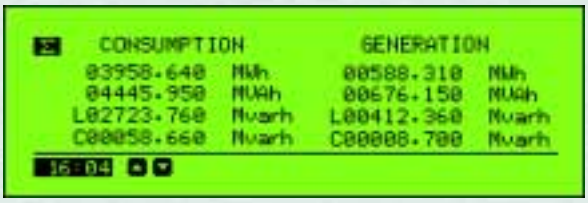
The Power factors

Particular attention has been given to the way of displaying the variables: in case of TPF and DPF the values of each phase are displayed together with the FRESNEL diagram.



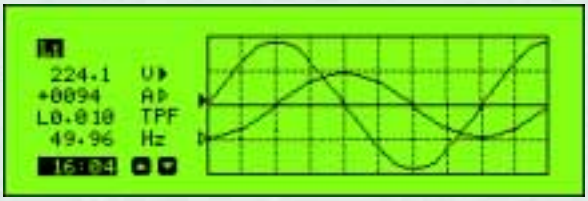
The energies

The energies are displayed: by consumed and exported active, reactive and apparent energy and by time period.



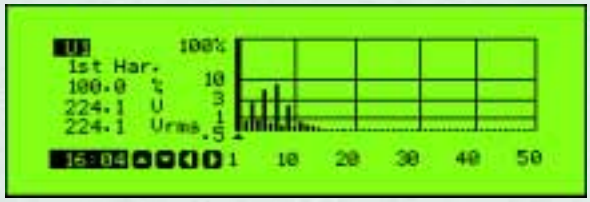
The oscilloscope function

The behaviour of the current and voltage variables is displayed comparing the relevant waveforms for each phase. Moreover, also the main instantaneous variables are displayed in a numeric form: V-A-TPF-Hz.

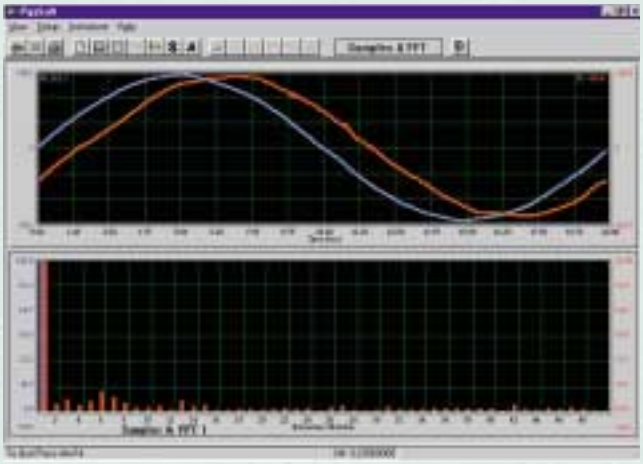


The harmonic analysis

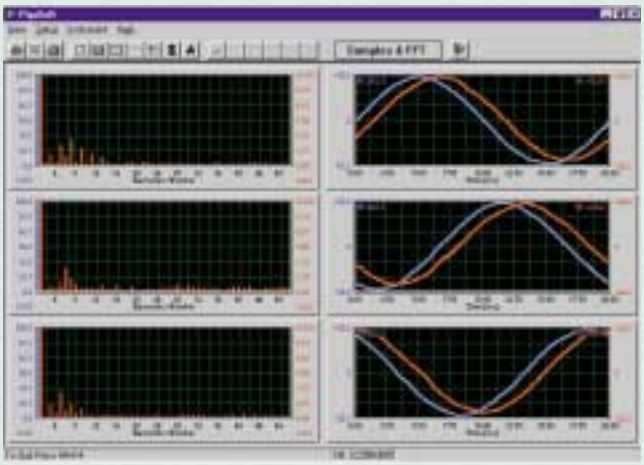
The FFT analysis displays the harmonic content in various pages: by phase, current and voltage. A pointer allows the operator to display for each harmonic the percentage value, the absolute value as a current or voltage and the corresponding harmonic order.



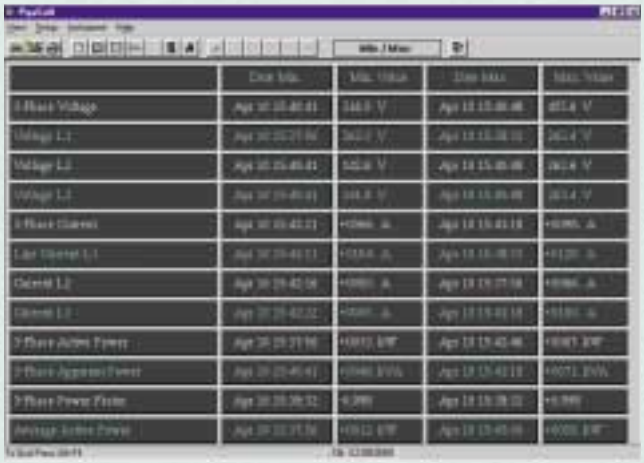
The analysis software PqaSoft



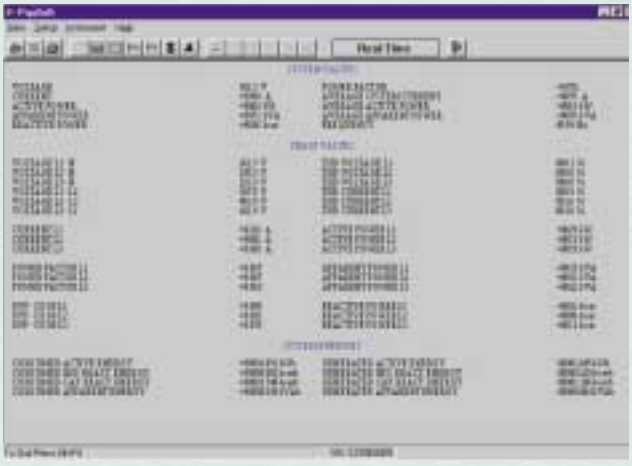
This Windows 95/ 98/ 2000/ XP based software allows the user to download all the data acquired by PQA700 during the measuring phase. PqaSoft allows the user, by means of icon buttons, to display simply and intuitively the data stored in the memory of the instrument; it also allows a graph processing of current and voltage (oscilloscope function) and the displaying of histograms relating to the FFT (harmonic analysis). Other available functions are: management of energy meters by time periods, export of the data acquired as TXT format files readable by different Windows programs, possibility of instrument's configuration from the PqaSoft, data logging of up to 20 variables in TXT format files directly on the hard disk of the PC. All the PqaSoft functions are available connecting PQA700 and the PC directly. Furthemore PQA700 allows the user to dawnload the stored data and to program it by analogue modem.



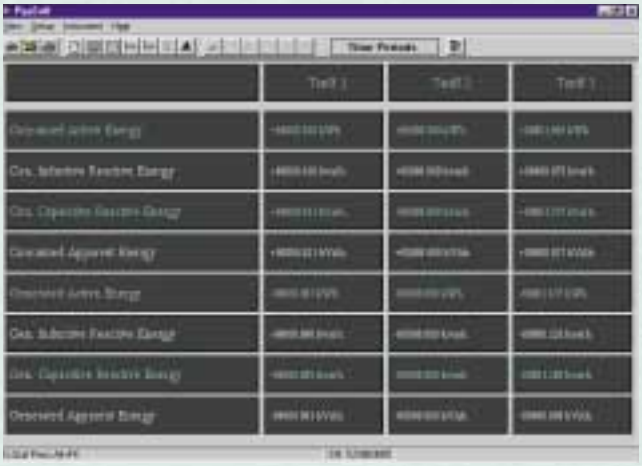
Display of current and voltage for each phase with indication of the harmonic contents.



Display of MIN and MAX values with time reference to the phase voltage and current, to the active and apparent power, to the system power factor together with the average power.



Real time display of the main variables.



Display of all the energies with reference to the consumed and to the exported energies.

PQA700 main features

Display type	Graph, 240 x 64 dots (back lighted)
Display refresh time	500ms
Display language	Selectable: English, Italian, Spanish, German, French
Other indications	Battery recharging by means of a red LED
Accuracy	0.5% RDG + 0.15% F.S. (5 to 120% of the voltage range, resolution: 0.1V), 45 to 65Hz 0.5% RDG + 0.15% F.S. (5 to 120% of the current range), minimum measurable current: 1A (1mV) , 45 to 65Hz 0.05% RDG (frequency) 1% RDG all the other measurements
Sampling frequency	6400Hz @ 50Hz
Sampling time	For instantaneous variables: 20ms / continuous For dips: 10ms
Measuring inputs	Voltage measurements: 4 (not insulated), max. 700V_{LL} RMS Max peak value: 1600Vp for 1s Current measurements: 3 (non insulated, the insulation is achieved by the clamp-on probes) max. 1.4VAC equivalent to 1400A
Type of connections	1-phase, 3-phase balanced load, 3-phase unbalanced load, ARON type
Measuring method	TRMS type, crest factor ≤ 3
Available measurements	Instantaneous single and system variables: W, VA, var, V, A, TPF, DPF, Hz, THD (voltage, current), odd THD, even THD Maximum demand calculation: W, VA, A (system variables), calculation period: programmable from 1 to 60 minutes Automatic calculation of kvar necessary to compensate low PF FRESNEL diagram indication Maximum and minimum calculations (single phase and system variables): W, VA, var, V, A, DPF, TPF, Hz, THD (THD is considered for both current and voltage), odd THD, even THD Energies: + Wh, - Wh, + varh, - varh, +VAh, -VAh (also by time period) FFT analysis (harmonic distortion): histogram indication up to the 50th harmonic, numerical and percentage indication of harmonic contents, of both voltage and current. THD (total, odd, even) and single harmonic measurement. FFT voltage range: 2 to 100% F.S.; FFT current range: 5 to 100% F.S. THD calculation according to EN61000-4-7
Data recording	Type: FIFO or stack Start measuring delay: programmable from 00:00h to 23:59h Data integration time interval (10ms sampling) : programmable from 1 to 999s (15 min.) Type of recording: minimum, maximum and average value or voltage DIPS Data references: date and time (hh:mm:ss) Total available memory: 1Mbyte
Archives function (by means of PqaSoft)	Type: stack measuring period: fully programmble. Data sampling time: programmable from 10 to 999 s. Type of recording: data sampling of up to 20 selectable variables. Data references: date and time (hh:mm:ss)
Other functions (by means of PqaSoft)	Statistic management of the stored variables Time-based curve distribution of variables and loads
Oscilloscope function	Current and voltage (current and voltage of single phase available in the same display page) with automatic trigger
Measurements according to EN50160	Supply voltage dips, slow and fast supply voltage variations, supply interruptions
Outputs (insulated)	RS232: 9 pole connector, programmable baud rate up to 38400
Printer	Impact dot matrix type, paper width: 54mm (numerical and graph data printing)
Power supply	230VAC ±15% (115VAC ±15% on request) and internal rechargeable battery power supply (battery life: 1h)
Installation Category	III / 600V (according to EN61010-1), double insulation
EMC	EN61000-4-2 discharge: 8kV “air” level 3, 4kV “contact” level 2; EN61000-4-3 radiated field: 10V/m level 3; EN61000-4-4 transients: 2kV level 3; EN61000-4-5 surge: 2kV; EN50011 conducted emission, class A
Operating temperature	0 to 55°C (R.H. < 90% non-condensing)
Storage temperature	-10 to 60°C (R.H. < 90% non-condensing)
Carrying case / weight	160 x 340 x 510mm / Instrument: 3.7Kg, the whole set: 10Kg
Standard accessories	4 voltage measuring cables, length 3m 1 RS232 cable + 9-25 pole adapter 1 power supply cable 1 analysis software (PqaSoft) 1 instruction manual (English, Italian, Spanish, German or French) CA 1002: current clamp probe 100-1000AAC, jaw opening 52mm, cable length 2m accuracy: 0.7% @ 100A, 0.5% @ 1000A
Accessories on request	Flex3000Q: current clamp probe 3000AAC, flexible type, sensor length 400mm, measuring range: 0,5A to 3000A, cable legth 2m; accuracy: 1.5% @ 150A, 0.75% @ 1600A, 0.5% @ 3000A

The available modules

Modular flush mounting

Type	Ch.	SPT 90	PQT 90	EM2 96	WM2 96	WM23 96	WM3 96	WM24 96	WM4 96	Ordering code
WM23-96 base 100VLL						●				AH2302
WM23-96 base 208VLL						●				AH2301
WM23-96 base 400VLL						●				AH2300
WM23-96 base 660VLL						●				AH2303
WM24-96 base 100VLL								●		AJ2402
WM24-96 base 208VLL								●		AJ2401
WM24-96 base 400VLL								●		AJ2400
WM24-96 base 660VLL								●		AJ2403
SPT-90 base 57/100V-1AAC 1-ph		●								AA1000
SPT-90 base 57/100V-5AAC 1-ph		●								AA1001
SPT-90 base 250/433V-1AAC 1-ph		●								AA1002
SPT-90 base 250/433V-5AAC 1-ph		●								AA1003
SPT-90 base 400/690V-5AAC 1-ph		●								AA1004
SPT-90 base 57/100V-1AAC 3-ph		●								AA1006
SPT-90 base 57/100V-5AAC 3-ph		●								AA1007
SPT-90 base 250/433V-1AAC 3-ph		●								AA1008
SPT-90 base 250/433V-5AAC 3-ph		●								AA1009
SPT-90 base 400/690V-5AAC 3-ph		●								AA1010
EM2-96 base 250/433V-5AAC 3-ph				●						AC1014
EM2-96 base 400/690V-5AAC 3-ph				●						AC1015
WM2-96 base 250/433V-5AAC 3-ph					●					AB1012
WM2-96 base 400/690V-5AAC 3-ph					●					AB1013
WM3-96 base							●			AD1016
WM4-96 base									●	AD1040
PQT-90 base			●							AD1047
240/415V-1/5AAC input for WM3/4, PQT			●				●		●	AQ1018
400/690V-1/5AAC input for WM3/4, PQT			●				●		●	AQ1019
24VAC power supply				●	●	●		●		AP1025
48VAC power supply				●	●	●		●		AP1024
115VAC power supply				●	●	●		●		AP1023
230VAC power supply		●	●	●	●	●		●		AP1022
18-60VAC/DC power supply		●		●	●	●	●	●		AP1021
90-260VAC/DC power supply		●		●	●	●	●	●		AP1020
Programming unit		●								AR1017
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 (pulse/alarm)	1	●	●		●	●	●	●	●	AO1058
Relay output (pulse/alarm)	2		●			●	●	●	●	AO1035
Open collector output (pulse/alarm)	1	●	●		●	○	●	●	●	AO1059
Open collector output (pulse/alarm)	2		●			○	●	●	●	AO1036
Open collector output (pulse/alarm)	4		●				●		●	AO1037
Digital inputs	3	●	●			●	●	●	●	AQ1038
Digital inputs + Aux	3		●					●	●	AQ1042
RS232 port + RTC	1	●				●	●	●		AR1039
RS232 port + RTC + 2Mb data memory	1		●						●	AR1041

○ Only for alarm purpose

The available modules

Modular DIN-rail mounting

Type	Power Supply	Channels	EM3 DIN	EM4 DIN	WM22 DIN	Ord. code
EM3-DIN 400V$_{L-L}$ / 20(90)AAC	Self power supply		●			AE2000
EM3-DIN 208V$_{L-L}$ / 20(90)AAC	Self power supply		●			AE2001
EM3-DIN 660V$_{L-L}$ / 20(90)AAC	115VAC -15+10%		●			AE2002
EM3-DIN 660V$_{L-L}$ / 20(90)AAC	230VAC -15+10%		●			AE2003
EM4-DIN 400V$_{L-L}$ / 20(90)AAC	Self power supply			●		AG2200
EM4-DIN 208V$_{L-L}$ / 20(90)AAC	Self power supply			●		AG2201
EM4-DIN 400V$_{L-L}$ / 20(90)AAC	230VAC, 50-60Hz			●		AG2202
EM4-DIN 208V$_{L-L}$ / 20(90)AAC	230VAC, 50-60Hz			●		AG2203
EM4-DIN 660V$_{L-L}$ / 20(90)AAC	230VAC, 50-60Hz			●		AG2204
EM4-DIN 400V$_{L-L}$ / 20(90)AAC	115VAC, 50-60Hz			●		AG2205
EM4-DIN 208V$_{L-L}$ / 20(90)AAC	115VAC, 50-60Hz			●		AG2206
EM4-DIN 660V$_{L-L}$ / 20(90)AAC	115VAC, 50-60Hz			●		AG2207
EM4-DIN 400V$_{L-L}$ / 5(10)AAC	230VAC, 50-60Hz			●		AG2214
EM4-DIN 208V$_{L-L}$ / 5(10)AAC	230VAC, 50-60Hz			●		AG2215
EM4-DIN 660V$_{L-L}$ / 5(10)AAC	230VAC, 50-60Hz			●		AG2216
EM4-DIN 400V$_{L-L}$ / 5(10)AAC	115VAC, 50-60Hz			●		AG2217
EM4-DIN 208V$_{L-L}$ / 5(10)AAC	115VAC, 50-60Hz			●		AG2218
EM4-DIN 660V$_{L-L}$ / 5(10)AAC	115VAC, 50-60Hz			●		AG2219
EM4-DIN 100V$_{L-L}$ / 5(10)AAC	230VAC, 50-60Hz			●		AG2226
EM4-DIN 100V$_{L-L}$ / 5(10)AAC	115VAC, 50-60Hz			●		AG2227
EM4-DIN 400V$_{L-L}$ / 20(90)AAC	18-60VDC			●		AG2230
EM4-DIN 400V$_{L-L}$ / 5(10)AAC	18-60VDC			●		AG2233
EM4-DIN 100V$_{L-L}$ / 5(10)AAC	18-60VDC			●		AG2236
WM22-DIN 400V$_{L-L}$ / 20(90)AAC	Self power supply				●	AF2100
WM22-DIN 208V$_{L-L}$ / 20(90)AAC	Self power supply				●	AF2101
WM22-DIN 400V$_{L-L}$ / 20(90)AAC	230VAC, 50-60Hz				●	AF2102
WM22-DIN 208V$_{L-L}$ / 20(90)AAC	230VAC, 50-60Hz				●	AF2103
WM22-DIN 660V$_{L-L}$ / 20(90)AAC	230VAC, 50-60Hz				●	AF2104
WM22-DIN 400V$_{L-L}$ / 20(90)AAC	115VAC, 50-60Hz				●	AF2105
WM22-DIN 208V$_{L-L}$ / 20(90)AAC	115VAC, 50-60Hz				●	AF2106
WM22-DIN 660V$_{L-L}$ / 20(90)AAC	115VAC, 50-60Hz				●	AF2107
WM22-DIN 400V$_{L-L}$ / 5(10)AAC	230VAC, 50-60Hz				●	AF2114
WM22-DIN 208V$_{L-L}$ / 5(10)AAC	230VAC, 50-60Hz				●	AF2115
WM22-DIN 660V$_{L-L}$ / 5(10)AAC	230VAC, 50-60Hz				●	AF2116
WM22-DIN 400V$_{L-L}$ / 5(10)AAC	115VAC, 50-60Hz				●	AF2117
WM22-DIN 208V$_{L-L}$ / 5(10)AAC	115VAC, 50-60Hz				●	AF2118
WM22-DIN 660V$_{L-L}$ / 5(10)AAC	115VAC, 50-60Hz				●	AF2119
WM22-DIN 100V$_{L-L}$ / 5(10)AAC	230VAC, 50-60Hz				●	AF2126
WM22-DIN 100V$_{L-L}$ / 5(10)AAC	115VDC, 50-60Hz				●	AF2127
WM22-DIN 400V$_{L-L}$ / 20(90)AAC	18-60VDC				●	AF2130
WM22-DIN 400V$_{L-L}$ / 5(10)AAC	18-60VDC				●	AF2133
WM22-DIN 100V$_{L-L}$ / 5(10)AAC	18-60VDC				●	AF2136
0-20mADC analogue output		1			●	AO2920
0-10VDC analogue output		1			●	AO2921
Open collector output (pulse/ alarm)		2	●	●	●	AO2900
One relay+one o. collector (pulse/al.)		2		●	●	AO2910
Digital inputs + AUX		2		●		AQ2940
RS485 port		1		●	●	AR2950

Note: other available power supplies: 24VAC, 48VAC and 80 to 140VDC

Modules combination

Modular DIN-rail mounting

EM3-DIN

Power supply	Self p.s.		Auxiliary p.s.	
Slot	A	B	A	B
Open collector output (pulse)	●		●	

EM4-DIN WM22-DIN

Power supply	Self p.s.		Auxiliary p.s.	
Slot	A	B	A	B
Open collector output (pulse/al.)	●		●	
Relay + o. collector (pulse/al.)	●		●	
RS485 port			●	●
Digital input (only for EM4)			●	
Analogue output (only for WM22)				●

Modular flush mounting

SPT-90

Slot	A	B	C	D	E
Output/Input	1	2	3	4	PU
Single analogue output (**)	●	●			
Dual analogue output (**)	●				
RS485 serial port (*)		●			
Single relay output (alarm)			●	●	
Single open coll. output (pulse)			●	●	
Dual relay output (alarm)			●	●	
Dual open coll. output (pulse)			●	●	
3 digital inputs (**)			●		
RS232 serial port (*)					●
Programming unit					●

WM2-96 EM2-96

Slot	B	D
Output/Input	1	2
RS485 serial port	●	
Single relay output (alarm) only EM2		●
Single open coll. output (pulse) only WM2		●
Dual relay output (alarm) only EM2		●
Dual open coll. output (pulse) only WM2		●

PU is the programming unit
(*) The RS232 module works as alternative of the RS485 module.
(**) Digital inputs and analogue outputs can't work together in the same instrument.

WM23-96

Slot	A	B	C	D
Output/Input	1	2	3	4
Single analogue output	●			
Dual analogue output (1)	●			
RS485 serial port		●		
Single relay output (2)			●	
Single open collector output (2)			●	
Dual relay output (2)			●	●
Dual open collector output (2)			●	●
3 digital inputs			●	
Slot	E			
RS232 serial port	●			

WM24-96

Slot	A	B	C	D
Output/Input	1	2	3	4
RS485 serial port		●		
Single relay output (3)			●	●
Single open coll. output (3)			●	●
Dual relay output (3)			●	●
Dual open coll. output (3)			●	●
3 digital inputs			●	
3 digital inputs + aux	●		●	
Slot	E			
RS232 serial port	●			

(1) The second output works as a copy of the first one; (2) alarm function; (3) pulse or alarm functions

WM3-96 PQT-90

Slot	A	B	C	D
Output/Input	1	2	3	4
Single analogue output	●			
Dual analogue output	●	●		
RS485 serial port (**)		●		
Single relay output (*)			●	
Single open collector output (*)			●	
Dual relay output (*)			●	●
Dual open collector output (*)			●	●
4 open collector outputs (*)				●
3 digital inputs			●	
3 digital inputs + AUX (▲)	●		●	
Slot	E			
RS232 port + RTC (**)	●			
RS232 interface + RTC + 2Mb data memory (▲) (**)	●			

WM4-96

Slot	A	B	C	D
Output/Input	1	2	3	4
RS485 serial port (**)		●		
Single relay output (*)			●	●
Single open collector output (*)			●	●
Dual relay output (*)			●	●
Dual open collector output (*)			●	●
4 open collector outputs (*)				●
3 digital inputs			●	
3 digital inputs + aux	●		●	
Slot	E			
RS232 port+ RTC + 2Mb data memory (**)	●			

(*) Alarm or pulse (**) The RS232 port works as alternative of the RS485 module (▲) Available for PQT-90 only