

Atto

Transducer Energy Analyzer



Atto is a microprocessor based Transducer / Energy Analyzer with outstanding flexibility and accuracy designed to meet the most demanding applications of electrical parameters analyses and energy supply monitoring in the industrial and residential environment. DC versions is available for direct current readings (e.g. photovoltaic and batteryzed systems).

True-RMS

All the readings are "true-RMS" and they are obtained with a continuous sampling of the voltage and current waveforms in order to ensure the maximum metering accuracy of rapidly varying loads (e.g. spot welding). A sophisticated digital measurement method with a compensation system of the internal amplifiers' offsets ensure the maximum metering accuracy and stability irrespective of the signal level and the environmental working conditions.

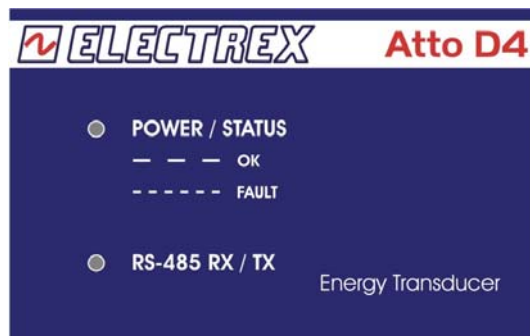
The 64 bit resolution allows an high detail of the energy value useful especially with small loads (e.g. devices in stand-by).

Versatile in application

Atto is suitable for virtually all type of electrical grid, 3- and 4-wire, symmetrical and asymmetrical, balanced or unbalanced, single- and bi-phase, Low Tension and High Tension, with 1, 2 or 3 CTs as well as for 2 and 4 quadrant (import/export) measurement.

The instrument supports extensive configuration of its operating mode in order to meet most diverse application.

The instrument programming takes place via RS485 serial port by means of the Energy Brain software (or by other Modbus compatible software). It allows the setting of all the operational parameters such as grid type, LT/HT, CT and VT ratios (free setting) integration time (1-60 min), digital output and alarms (thresholds, delays, hysteresis), digital input (operating mode) and serial communication parameters.



Two Led indicators located on the front panel provide an indication of instrument's state and RS485 port operation.

Readings

Parameter	Type	L	1	2	3	n	Σ	P	Range
Voltage	U _{L-N}	•	•	•	•	•	•	•	20,0V...400 kV
	U _{L-L}	•	•	•	•	•	•	•	
	U _{L-N} MAX (1)	•	•	•	•	•	•	•	
	U _{L-L} MAX (1)	•	•	•	•	•	•	•	
	U _{L-N} MIN (1)	•	•	•	•	•	•	•	
Current	I	•	•	•	•	•	•	•	10 mA...10,0 kA
	I _{MAX} (1)	•	•	•	•	•	•	•	
	I _{THERM} (2)	•	•	•	•	•	•	•	
Power Factor	PF	•	•	•	•	•	•	•	0,00ind..1,00..0,00cap
Frequency	f	•	•	•	•	•	•	•	45 ... 65 Hz
Harmonic distortion	THD-U _{L-N}	•	•	•	•	•	•	•	0...199,9%
	THD-U _{L-L}	•	•	•	•	•	•	•	
	THD-I	•	•	•	•	•	•	•	
Active Power	P	•	•	•	•	•	•	•	± 0,00...1999 MW
	P _m (3)	•	•	•	•	•	•	•	
	P _{MD} (3)	•	•	•	•	•	•	•	
Reactive Power	Q _{IND}	•	•	•	•	•	•	•	± 0,00...1999 Mvar
	Q _{CAP}	•	•	•	•	•	•	•	
	Q _m IND (3)	•	•	•	•	•	•	•	
	Q _m CAP (3)	•	•	•	•	•	•	•	
	Q _{MD} IND (3)	•	•	•	•	•	•	•	
Apparent Power	S	•	•	•	•	•	•	•	± 0,00...1999 MVA
	S _m (3)	•	•	•	•	•	•	•	
	S _{MD} (3)	•	•	•	•	•	•	•	
Temperature	T	•	•	•	•	•	•	•	-10...+50 °C
Life Time	h (1/100 h)	•	•	•	•	•	•	•	0,01...99.999,99 ore
Active Energy	E _a IMP (5)	•	•	•	•	•	•	•	0,1 kWh...99.999,9 MWh
	E _a EXP (5)	•	•	•	•	•	•	•	
Reactive Energy	E _r IND IMP (5)	•	•	•	•	•	•	•	0,1 kvarh...99.999,9 Mvarh
	E _r CAP IMP (5)	•	•	•	•	•	•	•	
	E _r IND EXP (5)	•	•	•	•	•	•	•	
	E _r CAP EXP (5)	•	•	•	•	•	•	•	
Apparent Energy	E _s IMP (5)	•	•	•	•	•	•	•	0,1kVAh...99.999,9 MVAh
	E _s EXP (5)	•	•	•	•	•	•	•	
Pulse Counter	CNT	•	•	•	•	•	•	•	

- (1) Absolute value (mean over 10 cycles - example: 200ms at 50Hz).
- (2) Mean value (rolling average) over the integration time (1.. 60 min. programmable).
- (3) Import/Export mean value (rolling average) over the integration time (1.. 60 min. programmable).
- (4) Internal temperature of the Microprocessor.
- (5) Import/Export energies displayed as 9 digits in floating-point readings; internal energy metering performed with 0,1 Wh minimum resolution and 99.999.999,9999 kWh maximum energy count before rollover.

Digital input

Atto 1DI 2DO is equipped, as standard feature, with an optically insulated digital input complete with programmable filter for input glitches. The digital input is set to operate for external pulse count of, example, water meters, gas meters (insulation to meet the ATEX requirements), quantity count, etc. Other user selectable operative modes are ON/OFF state input (example for reading the ON/OFF state of machines and switches) and tariff change input (example for day-night tariff changeover).

The digital input requires an external 10-30Vdc power supply.

Digital or Analogue 4-20mA outputs

Atto 1DI 2DO is equipped, as standard feature, with two optically insulated transistor outputs rated 27Vdc 27mA per DIN 43864 standards. The two outputs are factory set to the transmission of pulses proportional to the Active energy and the Reactive energy (pulse weight and length are user programmable). The outputs may be alternatively configured as outputs of the internal alarms (see Alarms) or as remote output devices controlled via serial line and Modbus commands.

Atto 2AO4-20mA is equipped with 2 galvanically insulated analogue outputs 4-20 mA or 0-20 mA providing an extremely high accuracy and signal stability. The outputs are active for resistor loads up to 250 ohm, for higher loads they became passive and an external power supply will be needed (12Vdc). The outputs ensure a response time with max. 200 ms.update interval. Each of the two outputs may be linked to any one of the metered parameters.

Alarms

Atto 1DI 2DO is complete with 2 programmable alarms offering the maximum configuration flexibility for adapting to the most diverse requirements. Each alarm can be selected to link to any one of the parameters available, either as a minimum or as a maximum alarm. Linking of both alarms to the same parameter is also possible for operating as dual threshold alarm. The alarms configuration includes the option of precise setting of a delay time (1-99 sec), an hysteresis cycle (in % of threshold value) and the polarity of the output contacts (NO, NC). The alarms state information is always available on serial communication as Modbus "coils". The alarms are entirely programmable via serial port with the Energy Brain software or via serial port by means of Modbus Holding registers.

Energy Brain software

The Energy Brain is the software package designed for the realization of all types of local and/or wide area networks of instruments. It is suitable for application with all the Electrex instruments equipped with communication port and it supplies all the functions needed for an accurate monitoring and targeting of industrial energy consumption.



Configuration

The available choices enable the maximum flexibility in adapting the software to the type of network (several types of simultaneously connected networks too) and to the operator needs.

Several Energy Brain versions are available according to the functions and the number of channels required.

Serial communication

Atto is equipped, as standard feature on all types, with an optoinsulated and over-voltage protected RS485 serial communication port. The protocol is a *full compliant* Modbus-RTU suitable for communication with PLCs and with SCADA programs. The instrument data are read as numerical registers composed by mantissa and exponent in the IEEE format. A transmission speed of up to 38.400 bps, with maximum 125 registers (equivalent to 62 parameters) per query with no waiting time between queries, ensure an unrivalled communication speed and dialogue efficiency.

Power supply

Atto is equipped with 230-240Vac power supply (transformer type). On request 115/120Vac or 400 Vac transformer power supply and 15÷36Vac/18÷60Vdc (switching type).

Standard versions

Atto is available in 5 versions:

- *Basic* without inputs and outputs
- *1DI 2DO* with 1 digital input and 2 digital outputs
- *2AO4-20mA*..... with two 4-20mA analogue outputs (external power supply needed for loads over 250 ohm)
- *DC 230-240Vac* for direct current readings

Types on request

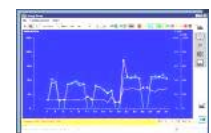
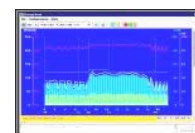
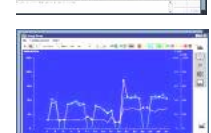
Several hardware configurations are available on request. They include different power supply and Input/Output configurations.

On line readings display

- On line display of the readings supplied by the field instruments.

Load and energy profiles/graphs

- Demand profiles (day, month and year)
- Energy profiles (day, month and year)
- MD and TOU tariff profiles (month and year)
- Up to 4 graphs displayed simultaneously
- Zoom and parameter selection tools
- Graphical and numerical print-out
- Data export



Technical Specification

Readings

Voltage: U_{L1-N} , U_{L2-N} , U_{L3-N} , $U_{LN\Sigma}$, U_{L1-L2} , U_{L2-L3} , U_{L3-L1} , $U_{LL\Sigma}$
 Max(ABSOLUTE VALUE): ... U_{L1-N} , U_{L2-N} , U_{L3-N} , U_{L1-L2} , U_{L2-L3} , U_{L3-L1}
 Min(ABSOLUTE VALUE): ... U_{L1-N} , U_{L2-N} , U_{L3-N} , U_{L1-L2} , U_{L2-L3} , U_{L3-L1}
 Current: I_1 , I_2 , I_3 , I_{Σ} , I_N
 Max(ABSOLUTE VALUE): I_1 , I_2 , I_3
 Therm.: I_1 , I_2 , I_3
 Power Factor: PF_1 , PF_2 , PF_3 , PF_{Σ}
 Frequency: f
 Voltage THD: U_{L1-N} , U_{L2-N} , U_{L3-N} , $U_{LN\Sigma}$
 U_{L1-L2} , U_{L2-L3} , U_{L3-L1} , $U_{LL\Sigma}$
 Current THD: I_1 , I_2 , I_3 , I_{Σ}
 Active Power *IMPORT:* P_1 , P_2 , P_3 , P_{Σ}
 EXPORT: P_1 , P_2 , P_3 , P_{Σ}
 Average (AVG) *IMPORT:* P_{Σ}
 EXPORT: P_{Σ}
 Max. Demand (MD) *IMPORT:* P_{Σ}
 EXPORT: P_{Σ}
 Max (ABSOLUTE VALUE): P_1 , P_2 , P_3
 Reactive Power *IMPORT:* Q_{1IND} , Q_{2IND} , Q_{3IND} , $Q_{\Sigma IND}$
 Q_{1CAP} , Q_{2CAP} , Q_{3CAP} , $Q_{\Sigma CAP}$
 EXPORT: Q_{1IND} , Q_{2IND} , Q_{3IND} , $Q_{\Sigma IND}$
 Q_{1CAP} , Q_{2CAP} , Q_{3CAP} , $Q_{\Sigma CAP}$
 Average (AVG) *IMPORT:* $Q_{IND\Sigma}$, $Q_{CAP\Sigma}$
 EXPORT: $Q_{IND\Sigma}$, $Q_{CAP\Sigma}$
 Max. Demand (MD) *IMPORT:* $Q_{IND\Sigma}$, $Q_{CAP\Sigma}$
 EXPORT: $Q_{IND\Sigma}$, $Q_{CAP\Sigma}$
 Apparent Power *IMPORT:* S_1 , S_2 , S_3 , S_{Σ}
 EXPORT: S_1 , S_2 , S_3 , S_{Σ}
 Average (AVG) *IMPORT:* S_{Σ}
 EXPORT: S_{Σ}
 Max. Demand (MD) *IMPORT:* S_{Σ}
 EXPORT: S_{Σ}
 Active Energy *IMPORT:* E_{a1} , E_{a2} , E_{a3} , $E_{a\Sigma T}$, $E_{a\Sigma Part}$.
 EXPORT: $E_{a\Sigma T}$, $E_{a\Sigma Part}$.
 Reactive Energy *INDUCTIVE IMPORT:* E_{r1} , E_{r2} , E_{r3} , $E_{r\Sigma T}$, $E_{r\Sigma Part}$.
 CAPACITIVE IMPORT: $E_{r\Sigma T}$, $E_{r\Sigma Part}$.
 INDUCTIVE EXPORT: $E_{r\Sigma T}$, $E_{r\Sigma Part}$.
 CAPACITIVE EXPORT: $E_{r\Sigma T}$, $E_{r\Sigma Part}$.
 Apparent Energy *IMPORT:* $E_{s\Sigma T}$, $E_{s\Sigma Part}$.
 EXPORT: $E_{s\Sigma T}$, $E_{s\Sigma Part}$.
 Life Time *TOTAL and PARTIAL:* Hours, 1/100 h
 Temperature (internal of the microprocessor): °C, °F
 External pulse counter: $C_{NT T}$, $C_{NT Part}$.

Functional characteristics

Measurement system:
 - True-RMS measurement up to the 31st harmonic
 - 2 and 4 quadrant measurement (programmable)
 - 12bit A/D converter (6-channel)
 - Continuous sampling of voltage and current waveforms (64 sampling per period, with PLL)
 - Automatic compensation of the offset
 RS485 serial port :
 - galvanically insulated
 - 2.400 to 38.400 bps programmable speed
 - Built-in over-voltage protection
 - Modbus-RTU protocol, full compliant
 Digital Output:
 - galvanically insulated
 - DIN 43864 (27Vdc, 27mA)
 - Programmable functionality: pulse output, alarm contact, remote control.
 Digital Input:
 - galvanically insulated
 - Programmable functionality: external pulse count, ON/OFF state detection.
 - Programmable 10/100 Hz filter for input glitches suppression.
 Analogue 4-20mA Outputs:
 - 2 active for loads up to 250 ohm, passive for higher loads.
 - Galvanically insulated
 - 200 ms update interval
 Front panel
 Led indicators 1 status, 1 RS485 operation

Electrical characteristics

Connection: single-, bi-phase & 3-phase, LT and HT grids, balanced, unbalanced, 3- and 4-wire

Voltage inputs:

Direct: up to 300 Vrms phase-neutral or 519 Vrms phase-phase (300Vrms if bi-phase)
 Via external VTs:
 Primary: programmable (max. 400 kV)
 Secondary: programmable (max. 300 V)
 Frequency: 45÷65 Hz
 Max voltage to ground: 300 Vrms
 Input burden: < 0,3 VA
 Input impedance > 2 MΩ
 Overload: 900 Vrms phase-phase per 1 sec

Current Inputs:

with external CT:
 Primary: programmable (max. 10 kA)
 Secondary: 1 or 5 A
 Max current: 1,2 or 6 Arms
 Input burden: < 0,7 VA
 Overload: 40 Arms, 1 sec.

Digital Inputs (depending on type):

Power supply (external): 10 to 30 Vdc
 Absorbed current: 2 to 10mA
 Max counting frequency: 10 or 100Hz (programmable)

Digital Outputs (depending on type):

Type: open collector (NPN)- per DIN 43864
 Max voltage: 27 Vdc
 Max current: 27mA

Analogue 4-20mA Output:

Range: 0-20mA or 4-20mA (programmable)
 Max load: 250 ohm (750 ohm if powered with 12 Vdc)
 Max current: 27 mA
 Accuracy: 1% from 4 to 20Ma
 (For loads over 250ohm an external power supply is needed)

Power supply (separate from voltage inputs):

standard type: 230/240Vac +/- 10% 50/60Hz
 on request: 115/120Vac +/- 10% 50/60Hz
 400Vac +/- 10% 50/60Hz
 15÷36Vac 50/60Hz, 18÷60Vdc
 Self consumption: < 3VA

Galvanic insulation:

Power supply (separate): 4 kV
 RS485 serial port: 1,5 kV
 Digital Input & Outputs: 1,5 kV
 Analogue 4-20mA Outputs: 1,5 kV

Accuracy

Voltage: 0,5% of reading +/- 1 digit from 40 to 300V, min. reading: 10V
 Current: 0,5% of reading +/- 1 digit from 0,02 to 1,2A or from 1,2 to 6A, min. reading: 10mA
 Frequency: 0,02Hz from 45 to 65 Hz
 Power: 1% of reading +/- 1 digit
 Active Energy: Class 1 complying with IEC EN 62053-21
 Reactive Energy: Class 2 complying with IEC EN 62053-21

Standards

Safety: IEC EN 61010-1 CAT III-300V, class 2
 E.M.C.: IEC EN 61326-1A
 Accuracy: IEC EN 62053-21
 Digital Output: DIN 43864
 MTBF (165.000 hours): MIL-HDBK-217F

Environmental conditions

Working temperature range: -10/+50 °C
 Storage temperature range: -15/+60 °C
 Relative Humidity RH< 95% non-condensing

Mechanical characteristics

Enclosure Self-extinguishing plastic material class V0
 Protection degree Front panel IP40
 Terminals side IP20
 Size: 70 x 90 x 58 mm (4 DIN modules)
 Mount: DIN rail
 Terminals: screw connector
 Max cable size: 2,5 mm² (stranded cable) / 4 mm² (solid cable)

How to order

Type	Code
Atto D4 RS485 230-240V	PFA7411-02
Atto D4 RS485 230-240V 1DI 2DO	PFA7411-12
Atto D4 RS485 230-240V 2AOA-20mA	PFA7411-62
Atto D4 DC RS485 230-240V	PFA7471-02
Other types on request	

Subject to modification without prior notice

Data-sheet Atto 2010 02 03 -ENG

Your distributor