ELECTREX
the energy saving technology

Engineered and manufactured in Italy
Made in Italy
Pensato, progettato e prodotto in Italia

LOW ENERGY CONSUMPTION

Atto and Atto E-Wi™

Transducer Energy Analyzer

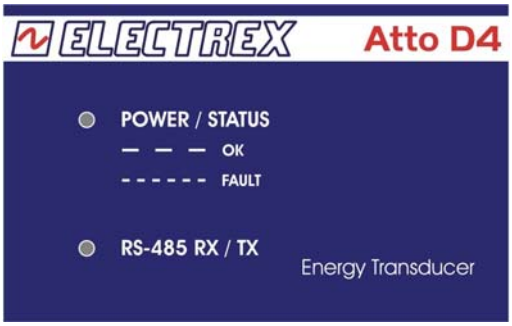
The **Atto** is a microprocessor based transducer / energy analyzer with outstanding flexibility and accuracy designed to meet the most demanding applications of electrical parameters analyses and energy supply monitoring in the residential, tertiary and industrial sectors.
DC versions are available for direct current readings (e.g. photovoltaic and telecommunications systems).
The **Atto E-Wi** has the same features of the Atto without inputs and outputs and in addition **transmit and receive the data via radio waves**, without limitations (wireless) using the E-Wi protocol based on the IEEE 802.15.4 standard.

True-RMS and accurate measurements

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

The **Atto** is suitable for virtually all type of electrical grid, three phase 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. Via Energy Brain software (free or full version) it is possible to configure 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, RS485 serial communication.



Two LED on the frontal panel report the instrument status and the RS485 port activity.

Power Supply

The **Atto** is equipped with a transformer power supply 230-240Vac. Other special versions on request: transformer type 115/120 Vac or 400Vac and switching type 15÷36Vac/18÷60Vdc and 9÷24Vac/9÷36Vdc.

Readings

Parameter	*Type*	L1	L2	L3	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)	•	•	•				
	$U_{L-L\ MIN}$ (1)	•	•	•				
Current	I	•	•	•	•	•		*10 mA…10,0 kA*
	I_{MAX} (1)	•	•	•				
	$I_{AVG\ THERM}$ (2)	•	•	•				
	$I_{MD\ THERM}$ (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)					•		
	$Q_{MD\ CAP}$ (3)					•		
Apparent Power	S	•	•	•		•		*± 0,00…1999 MVA*
	S_m (3)					•		
	S_{MD} (3)					•		
Temperature	T (°C e F) (4)					•		*-10…+50 °C*
Life Time	h (1/100 h)					•	•	*0,01…99.999,99 h*
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 (6)					•	•	

(1) *(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 over.*
(6) *Only for RS485 versions with digital inputs (not for E-Wi)*

Serial communication

The **Atto** is equipped, as a standard feature on all versions, 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.

Types and versions of Atto D4

The **Atto D4** are available in different types (and versions):

- ***Atto D4*** using any CT ../5A or ../1A (standard type);
- ***.. 70A*** using external 70A 9MM CT (special CT with voltage secondary output and hole diameter of 9mm; 1 included in the packaging). Ready for single phase applications (e.g. 6kW), while it is necessary to purchase other 2 for 3-phase applications (e.g. 18-20kW). It is possible to choose between two current full scales (14A e 70A) to increase the accuracy of the instrument in the case of small currents;
- ***.. 70A ECT*** using external CT max 70A not included, with the possibility of choosing between three types of CT 70A ECT: 9MM, 13MM and Split core.

- *Versions*:
  - *Standard*..... no inputs and outputs
  - *1DI 2DO* ..... 1 digital input and 2 digital outputs
  - *1DI 2DO Self-Powered* 1 self powered digital input and 2 digital outputs rated at 250V 100mA
  - *2AO4-20mA* ..... 2 analog 4-20mA outputs (external power supply needed for resistance > 250 ohm)
  - *2DI 1RO24VDC Self-Powered* 2 self powered digital input and 1 relay output (24VDC)
  - *2RO24VDC*.....2 relay outputs (24VDC)
  - *2RO230V*.....2 relay outputs (230V)
  - *4DI*.....4 digital inputs
  - *4DO*.....4 digital outputs
  - *2DI 2DO* ..... 2 digital inputs and 2 digital outputs

Atto D4 DC DC for measuring DC loads (see related data sheet).

Atto D4 E-Wi and **Femto 96 E-Wi** for wireless E-Wi protocol communication.

Digital inputs

The **Atto D4 .. 1DI** or **2DI** or **4DI** are equipped 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. For the 1DI .. or the 2DI 1RO the max sampling frequency is 100Hz (5ms), while for the 2DI 2DO and the 4DO 500Hz (2ms). 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.

The **Atto D4 1DI 2DO Self-Powered** and **Atto D4 2DI 1RO Self-Powered** are equipped instead with self powered digital inputs.

Digital outputs

The **Atto D4 .. 2DO** or **.. 4DO** are equipped with two optically insulated transistor outputs rated 27 Vdc 27 mA according to DIN 43864 standards.

The **Atto D4 1DI 2DO SELF-POWERED** instead is equipped with two optomos outputs rated at max 250V 100mA AC/DC. The outputs may be set for the transmission of pulses or alternatively configured as outputs of the internal alarms (see Alarms) or as remote output modules controlled via serial line and Modbus commands.

Relay outputs

The **Atto D4 2DI 1RO** or **Atto D4 2RO24VDC** are equipped with one relay output with changeover contact rated at max 30V max 2A (resistive load). The **Atto D4 2RO230V** is equipped with 2 relay outputs with changeover contact rated at max 250V max 2A (resistive load).

The outputs may be related to the status of the internal alarms (see Alarms) or as remote output modules controlled via serial line and Modbus commands.

Alarms

The **Atto .. 2DO** or **4DO** or **1RO** or **2RO** are equipped with outputs which can be related to the internal alarms. Each alarm can be linked to any one of the parameters available, for example, either as a minimum and/or as a maximum. All the alarm outputs can be linked to the same parameter in order to have more alarm thresholds. It is possible to set a delay on the activation / deactivation of each alarm (from 1s to 99 min), the hysteresis (% of the threshold value) and the polarity of the output contact (NA, NC, except for the **1RO** which is always NC). The alarms state information is always available on serial communication as Modbus "*coils*". Due to the numerous combinations available, only a part of them are programmable by keyboard while are entirely programmable via serial port with the Energy Brain software or via serial port using Modbus *Holding registers*.

Analog 4-20mA outputs

The **Atto 2AO4-20mA** is equipped with 2 galvanic 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 an external power supply (12Vdc) will be needed (up to 750 ohm). The outputs ensure a response time of max. 200 ms. Each output can be associated to any of the parameters.

Atto E-Wi

The **Atto E-Wi** has the same features of the Atto without inputs/outputs and in addition transmits and receives all the data, without any limit, at 250kbps with a frequency of 2.4 GHz at a distance, without signal boosting and can reach up to 800 m in open field.

The E-Wi versions use the E-Wi protocol based on IEEE 802.15.4 and transmit to the E-Wi Coordinator, in addition to the measures, also the quality and intensity of the signal in order to facilitate the adjustment of the correct level of communication.

Special versions on request

Atto can be provided, on request, also in other hardware configurations.

Technical Specifications

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 Input (depending on type):

- *Galvanically insulated*
- *Programmable functionality: external pulse count, ON/OFF state detection , tariff changeover*
- *Programmable 10/100 Hz filter for input glitches (500Hz for versions 2DI 2DO and 4DI)*
- *External powered needed: 10-30Vdc*
- *Current absorbed: ..... from 2 to 10mA or self-powered (Self-Powered version)*

Digital Output (depending on type):

- *Galvanically insulated*
- *Programmable functionality: weighted pulse output, alarm contact, remotely commanded*
- *NPN according to DIN 43864 (max 27Vdc, max 27mA)*
- *Or* Self-Powered version with a solid state relay *(opto-mos) ..... up to 250V 100mA ac/dc*
- *Analog 4-20mA output (Galvanically insulated):*
- *Scale: ..... 0-20mA or 4-20mA (programmable)*
- *Update interval: 200ms*
- *Max load resistance: ..... 250 ohm ..... (750 ohm with external power supply 12Vdc)*
- *Maximum current supplied: ..... 27 mA*
- *Accuracy:..... 1% of the reading from 4 to 20mA*

Relay output (depending on type):

- *Programmable functionality: alarm contact, remotely commanded*
- changeover contact *max 30Vdc 2A* (resistive load)
- or changeover contact *max 250V 2A* (resistive load)

Transceiver for ***Femto E-Wi****:*

- *Transceiver module occupies the place of the DI-DO module*
- *Transmission ..... up to 13,7dBm (higher, up to 20 dBm only where permitted)*
- *reception ..... -102dBm*
- *Distance: up to 800 m in open space*
- E-Wi protocol based on *IEEE 802.15.4 standard*
- *Auto-reset in case of temporary obstacle preventing communication*

Front panel

LED ..... 1 for status and 1 for the RS485 port

Electrical characteristics

*Connection (**standard version**): single-, bi-phase & 3-phase, LT and MT systems, ... balanced, unbalanced, 3- and 4-wire, 1, 2 or 3 CT*

Voltage inputs:

Direct: ..... up to 300 Vrms phase-neutral or 519 Vrms phase-phase (300 Vrms 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 (standard type):

with external CTs:

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.

*Connection (**70A type**):single-, bi-phase & 3-phase, LT systems, ... balanced, unbalanced, 3- and 4-wire, 1, 2 or 3 CT*

Voltage inputs:

Direct: ..... up to 300 Vrms phase-neutral or 519 Vrms phase-phase (300 Vrms if bi-phase)

Current Inputs with external CT 70A ECT:

Primary: ..... max. 70A

Secondary: ..... voltage output

Hole diameter: 9mm

Plastic shell

*if **Atto D4 70A ECT** also of 13mm and 16mm (Split CT)*

*Connection (**70A type**): ..... single, bi-phase, LT, with 1, 2 or 3 CT*

Power Supply:

Standard version: ..... 230/240Vac +/- 10% 50/60Hz

Versions on request: ..... 115/120Vac +/- 10% 50/60Hz
400Vac +/- 10% 50/60Hz
15÷36Vac 50/60Hz, 18÷60Vdc
9÷24Vac 50/60Hz, 9÷36Vdc

Self consumption: ..... < 3VA

Galvanic insulation:

Power supply (separate): ..... 4 kV

RS485 serial port: ..... 1,5 kV

Digital Input & Outputs: ..... 1,5 kV

4-20mA Analogue Outputs: ..... 1,5 kV

Accuracy

Voltage: ..... 0,5% of reading from 40 to 300V, min. reading: 10V

Current: ..... 0,5% of reading from 0,02 to 1,2A or from1,2 to 6A, min. reading: 10mA

Frequency: ..... 0,02Hz from 45 to 65 Hz

Power: ..... 1% of reading

Active Energy: ..... Class 1 complying with IEC EN 62053-21
Class B according to EN 50470-1, EN 50470-3

Reactive Energy: ..... Class 2 complying with IEC EN 62053-23

Standards

Safety:..... IEC EN 61010-1 CAT III-300V, class 2
E.M.C.:..... IEC EN 61326-1A
Accuracy:..... IEC EN 62053-21
Digital Outputs:..... DIN 43864
MTBF (100.000 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 mm^2 (stranded cable) / 4 mm^2 (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 2AO4-20mA	*PFA7411-62*
Atto D4 70A ECT RS485 230-240V	*PFA7451-02*
Atto D4 70A RS485 230-240V	*PFA6431-02*
Atto D4 70A RS485 230-240V 1DI 2DO	*PFA7431-12*
Atto D4 70A RS485 230-240V 1DI 2DO Self-Pow..	*PFA7431-E2*
Altre Versioni a richiesta	
ECT TA 70A 9MM (TA speciale non sostituibile) ..	*PFAE000-00*
ECT TA 70A 13MM (TA speciale non sostituibile)	*PFAE000-01*
ECT CTS 16-70 (TA apribile non sostituibile)	*PFAE000-02*
Atto D4 E-Wi HI 230-240V	*PFA741H-02*
Atto D4 70A E-Wi HI 230-240V	*PFA743H-02*

For the codes of the Atto D4 DC for DC loads refer to the product data sheet.

For the other versions of Atto RS485

CODICE P F A 7 4 _ _ - _ _

Type	Code

BULDING CODE ..... PFA 7 4 1 1 - 1 2

Atto family = **6**

4 DIN rail modules = **4**

Type
Atto D4 = **1**
Atto D4 70A = **3**
Atto D4 70A ECT = **5**

Communication ..... RS485 = **1**
..... E-Wi = **H**

Internal module Atto D4 [or E-Wi version]:
No internal Module [or E-Wi version] ***0***
Module 1DI 2DO ***1***
Module 2DI 1RO24VDC Self Powered ***2***
Module 2RO24VDC ***5***
Module 2AO4-20mA ***6***
Module 2RO230V ***8***
Module 1DI 2DO Self Powered..... ***E***
Module 4DI ..... ***N***
Module 4DO ..... ***P***
Module 2DI 2DO..... ***Q***

Power supply:
230Vac +/- 10% ***2***
120Vac +/- 10% ***1***
400Vac +/- 10% ***3***
15÷36Vac/18÷60Vdc ***8***
9÷24Vac/9÷36Vdc ***7***

Distributor

ELECTREX the energy saving technology

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