

Femto D4 & Atto D4

Class 0,5S Energy Analyzers



The Femto D4 and Atto D4 are respectively energy meters/analyzers and energy transducers/analyzers, extremely versatile, precise and microprocessor based. Designed to satisfy the most sophisticated applications for monitoring electrical parameters and managing energy in the civil, commercial and industrial sectors. Equipped with RS485 port, LED for active energy, indication of the phases sequence, 4 x operating time counters and firmware that can be upgraded remotely. Available in versions with digital inputs and / or digital or analogue outputs. Compliant with EN 50470-1 + EN 50470-3.

True-RMS and accurate measurements

Measurements in true effective value (True-RMS), obtained by continuously sampling the waveforms of voltages and currents, and the automatic offset compensation of the internal amplifiers ensure maximum precision regardless of the variability of loads over time (ex. spot welders), from the signal level and the environmental operating conditions. The 64-bit resolution also ensures a high accuracy of the energy measurement even in the presence of small loads (e.g. equipment in stand-by).

Simple to use

The Femto D4 is equipped with a graphic LCD display (dot matrix) with blue LED backlighting and adjustable contrast. Simultaneous reading of 4 measurements and their identification symbol with high visibility characters.



The 3-key keypad allows a simple and rational use of the instrument, while the page displayed at start-up can be defined by the user. On the front panel a configurable red LED for the calibration, pulses with a frequency proportional to energy.

Versatility

The Femto D4 and Atto D4 are suitable for applications on all types of network, three-phase 3-wire and 4-wire, symmetric or asymmetric, balanced or unbalanced, two-phase, single-phase, low and medium voltage, with 1, 2 or 3 CTs as well as for measurements on 2/4 quadrants (import / export). A keyboard programming allows you to set all the operating parameters such as RS485 port, network type, LV / ML, CT ratio and any VT (free value), integration time (1-60 min.) And depending on the version: analog and digital outputs, relay and alarm (thresholds, delay and hysteresis), analog and digital inputs. The programming system is password protected.

EN 50470 and 62053-21 standards

The Femto D4 & Atto D4 meet the essential requirements of the EN 50470-1 + 50470-3 standards as well as for the 62053-22 as required for White Energy Certificates normative.

Readings

Parameter	Type	Range
Voltage	U L-N	20,0V...400 kV
	U L-L	
	U L-N Min	
	U L-L Min	
	U L-N Max	
Current	I	10 mA ... 10,0 kA ECT: 10 mA ... 400 A Electrex Flex CTs ⁷ : 1A ... (5A - 500A) 4A ... (20A - 2000A) 8A ... (40A - 4000A)
	I Max	
	I AVG ¹	
	I MD ¹	
Power Factor	PF	0,00ind...1,00...0,00cap
Frequency	F	45 ... 65 Hz
Phases sequence	132 antiorario	
Harmonic distortion	U THD L-N	0...199,9%
	U THD L-L	
	I THD	
Active Power	P	± 0,00...1999 MW
	P Max ³	
	P AVG ²	
	P MD ²	
Reactive Power	Q Ind	± 0,00...1999 Mvar
	Q Cap	
	Q AVG Ind ²	
	Q AVG Cap ²	
	Q MD Ind ²	
Apparent Power	S	± 0,00...1999 MVA
	S AVG ²	
	S MD ²	
Operating time (4)	h, h/100	0,01...99.999,99 h
Active Energy	Ea Imp ⁵	0,1 kWh...100 GWh
	Ea Exp ⁵	
Reactive Energy	Er Ind Imp ⁵	0,1 kvarh...100 Gvarh
	Er Cap Imp ⁵	
	Er Ind Exp ⁵	
	Er Cap Exp ⁵	
Apparent Energy	Es Imp ⁵	0,1kVAh...100 GVAh
	Es Exp ⁵	
Pulse Counter	CNT ⁶	

All the instantaneous measurements are calculated on 10 cycles, for e.g. 200mS at 50Hz

- (1) Average values on integration time (1 .. 60 min programmable) and peak (MD).
- (2) Average values (moving average) both in Import and in Export on the integration time (1..60 min programmable) and peaks (MD) or the maximum average value.
- (3) Maximum power values in both Import and Export.
- (4) Non-resettable life time and four partial operating time counters.
- (5) The energies (which consider the CT ratio) in both Import and Export are displayed as 9 digits (one decimal). The internal counters are stored in 64-bit resolution which ensures a minimum definition of 0.1 Wh and a maximum count of 100 GWh.
- (6) Only for versions with digital inputs.
- (7) For use with Electrex Flex CT – primary value as listed
- (8) Three partial counters for each measurement marked in column P.

Electrex is a brand of Akse srl

Via Aldo Moro, 39 42124 Reggio Emilia Italy

Tel. +39 0522 924 244 Email: info@electrex.it Web: www.electrex.it

ELECTREX
the energy saving technology

1
Engineered and manufactured in Italy
Made in Italy
Pensato, progettato e prodotto in Italia

Serial port communication

The Femto and Atto are equipped, as a standard feature in all types, with an RS485 serial port with overvoltage protection. The communication protocol used is the “full compliant” Modbus-RTU suitable for communications with PLC and SCADA programs. The processed data are read as numeric registers composed of mantissa and exponent in IEEE format. A transmission up to 38.400bps with max. 125 registers that can be requested per each query (equal to about 62 parameters) without waiting times between two requests ensure an unrivalled communication speed.

Indication of the phases sequence

When the display is set to display the three phase voltages and the frequency, the indication of the phases sequence is also displayed, for example L123.

Types and versions of Femto D4 and Atto D4

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

- **Femto D4** and **Atto D4** using any CT $\dots/1A$ or $\dots/5A$ (standard type);
- **Femto D4 ECT** and **Atto D4 ECT** using Electrex ECT series type CT, mA output (to be ordered separately). Possibility to choose between 2 current full scales to increase the accuracy of the instrument in case of small currents – zoom effect;
- **Femto D4 F** using flexible CT - FCTS (Rogowski) series - in case the standard $\dots/1A$ or $\dots/5A$ CT cannot be used.
- **Femto MID D4 ECT** already wired to the closed ring ECT 100A external CTs (13mm internal diameter and 45cm cable length).

Main versions:

- **Basic:** No built-in inputs or outputs
- **2AO4-20mA:** 2 analog outputs 4-20mA
- **4DI 4COMMON:** 4 digital inputs and separate commons
- **4DO 4COMMON:** 4 digital outputs and separate commons
- **2DI 2DO 4COMMON:** 2 digital inputs and 2 digital outputs

ECT series current transformers

- **ECT TA 100A 13MM Power Quality Current Transformer** Code PFAE000-01: closed ring CT for AC loads up to 100A. Plastic shield. Inner diameter 13 mm. 
- **ECT CTS 16-100A Split Core Power Quality Current Transformer** Code PFAE000-02: split core CT for AC loads up to 100A. Plastic shield. Protection on the opening of the secondary circuit. Equipped with a snap-on closing, screwless mounting system. Inner diameter 16 mm. 
- **ECT CTS 24-200A Split Core Power Quality Current Transformer** Code PFAE000-05: same as above but for loads up to 200A and inner diameter of 24 mm.
- **ECT CTS 36-400A & 23,4-300A Split Core Power Quality Current Transformer** Codes PFAE000-04 & PFAE000-06. Same as above but for loads up to 400A or 300A. Inner diameter respectively 35,9x35,9mm and 23,4x23,4 mm.

The Femto D4 F using Electrex Flex CT (FCTS)

are equipped with dedicated current inputs exclusively for Electrex Flex CT series FCTS (mV output and on request calibration to specific device for more accuracy).

WARNING: Do not connect to these current inputs of CT with output in current (eg. $\dots/1A$ or $\dots/5A$) because it may damage both the Femto D4 F and the CT.

Selectable Full Scale independent from the internal diameter of the Flex CT used: 500A or 1.000A (others on request).



- **FCTS 070-500:** Inner Diameter 7 cm
- **FCTS 120-1000:** Inner Diameter 12 cm
- **FCTS 200-2000:** Inner Diameter 20 cm
- **FCTS 280-4000:** Inner Diameter 28 cm

Digital inputs

The versions \dots 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 \dots or the 2DI 1RO the max sampling frequency is 100Hz (5ms), while for the 2DI 2DO and the 4DO 500Hz (1ms). 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 versions 1DI 2DO Self-Powered and 2DI 1RO Self-Powered are equipped instead with self powered digital inputs.

Digital outputs

The versions \dots 2DO or 4DO are equipped with two optically insulated transistor outputs rated 27 Vdc 27 mA according to DIN 43864 standards.

The version 1DI 2DO SELF-POWERED instead is equipped with two opto-mos 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.

Analog 4-20mA outputs

The version 2AO4-20mA are 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.

Operating time counters

The Femto and Atto series measure the total life-time of the instrument and are equipped with four operating time partial counters that can be activated by internal alarms through configuration via the Energy Brain software; for example, to manage the operating time of a user/machinery when it is operating, when it is in standby and when it is off. The partial operating time counters can be reset.

Alarms

The versions .. 2DO or 4DO or 1RO 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.

Power supply and Special versions on request

The Femto D4 and Atto D4 can also be requested in other hardware configurations such as with different power supply:

- Transformer type rated 115/120 Vac or 400Vac
- Switching type: 15÷36Vac/18÷60Vdc
- Switching type: 9÷24Vac/9÷36Vdc.

The **Femto MID D4** instead cannot be modified.

TECHNICAL SPECIFICATIONS

Functional characteristics	
Measurement system	True-RMS meas. 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)
RS485 serial port	Automatic compensation of the offset and of the angle error of the current transformer
	Galvanically insulated
	2.400 to 38.400 bps programmable speed
	Built-in over-voltage protection
Digital Input (depending on type):	Modbus-RTU protocol, full compliant
	Galvanically insulated
	Programmable functionality: external pulse count, ON/OFF state detection, tariff change-over
	Programmable 10/100 Hz filter for input glitches (500Hz for versions 2DI 2DO and 4DI)
Digital Output (depending on type):	External powered needed
	10-30Vdc
	Current absorbed
	2 ... 10mA
Analog 4-20mA output (depending on type):	Galvanically insulated
	Programmable functionality: external pulse count, ON/OFF state detection, tariff changeover
	NPN compliant with DIN 43864 (max 27Vdc, 27mA)
	Or Self-Powered version with a solid state relay (opto-mos) (max 250V 100mA ac/dc)
Analog 4-20mA output (depending on type):	Galvanically insulated
	Scale: 0-20mA or 4-20mA (programmable)
	Update interval: 200 mS
	Max load resistance:
	250 ohm
	Maximum current supplied:
27 mA	
Accuracy: 1% of the reading from 4 to 20mA	

Electrical characteristics		
Connection	single-, bi-phase & 3-phase, LT and MT systems, balanced, unbalanced, 3- and 4 wires	
Voltage inputs	Direct	from 20 to 500V PH-PH (max. 1,7 crest factor)
	Via external CTs	max. 400 kV primary max 300V secondary (programmable)
	Max voltage to ground:	300 Vrms
	Absorbed power	< 0,3 VA
Current Inputs	Input impedance	> 2 MΩ
	Overload	max, 900 Vrms PH-PH for 1 sec.
	Standard external CTs	max. 10kA primary ..1A and ..5A secondary Programmable CTs
	External ECT CTs	max. 400A primary mA secondary output
Auxiliary power supply (Not Femto MID)	FCTS Flexible split CTs	max. 4000A primary mV secondary output
	Load on the CT	< 0,7 VA
	Overload	max. 40 Arms peak for 1 sec
Consumption	230/240 Vac +/- 10% 50/60 Hz	
	115/120 Vac +/- 10% 50/60Hz	
	400 Vac +/- 10% 50/60 Hz	
	15÷36 Vac 50/60 Hz, 18÷60 Vdc	
	9÷24 Vac 50/60 Hz, 9÷36 Vdc	
Frequency	< 2,5 VA	
	45-65 Hz	

Mechanical characteristics		
Working temperature range	Femto D4	-25/+60 °C
	Atto D4	-25/+70 °C
Relative Humidity	95% R.H. non condensing	
Enclosure	Self-extinguishing plastic material class UL94 V-0	
Protection degree	IP40 (Front panel), IP20 (Terminals side)	
Size	70 x 90,5 x 62 mm (4 moduli DIN)	
Mounting	DIN rail	
Terminals	screws, wire's max section 4 mm ²	
Weight	around 315 g (packaging included)	
Weight	around 260 gr. net	

Electrex is a brand of Akse srl

Via Aldo Moro, 39 42124 Reggio Emilia Italy

Tel. +39 0522 924 244 Email: info@electrex.it Web: www.electrex.it

 **ELECTREX**
the energy saving technology

3

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

Front panel (Femto D4)	
Display	graphic LCD white/blue with adjustable contrast 100x64 dots
Size of the visible area	43x25 mm
Backlight	White LEDs
Display update interval	1 s
Keyboard	3 keys
Calibration LEDs	1 for Active Energy (10.000 pulses / kWh)

Standards	
General	EN 50470-1
Static counters	EN 50470-3
Safety	CEI EN 61010-1 CAT III-300V, class 2
E.M.C.	CEI EN 61326-1A
Accuracy	CEI EN 62053-22, EN 50470-1, EN 50470-3
Digital Outputs	DIN 43864
MTBF (100.000 h)	MIL-HDBK-217F

Accuracy		
Voltage	0,25% of reading +/- 1 from 40 to 300V, min. reading: 10V	
Current	Standard CTs	0,25% of reading +/- 1
	ECT CTs	0,25% of reading +/- 1, min. reading: 10mA
Frequency	0,02 Hz da 45 a 65 Hz	
Power	0,5% of reading +/- 1	
Active Energy	Class 0,5S according to CEI EN 62053-22 Class C according to EN 50470-3	
Reactive Energy	Class 1 EN 62053-24	

HOW TO ORDER

FEMTO D4	
TYPE	CODE
<i>Femto D4 standard</i>	
Femto D4 RS485 230-240V	PFA6411-02-B
Femto D4 RS485 230-240V 1DI 2DO S.P	PFA6411-E2-B
Femto D4 RS485 230-240V 2AO4-20mA	PFA6411-62-B
Femto D4 RS485 230-240V 4DI 4COMMON	PFA6411-B2-B
Femto D4 RS485 230-240V 4DI 4COMMON	PFA6411-C2-B
Femto D4 RS485 230-240V 2DI 2DO 4COMMON	PFA6411-D2-B
<i>Femto D4 ECT</i>	
Femto D4 ECT RS485 230-240V	PFA6451-02-B
Femto D4 ECT RS485 230-240V 2AO4-20mA	PFA6451-62-B
Femto D4 ECT RS485 230-240V 4DI 4COMMON	PFA6451-B2-B
Femto D4 ECT RS485 230-240V 4DO 4COMMON	PFA6451-C2-B
Femto D4 ECT RS485 230-240V 2DI 2DO 4COMMON	PFA6451-D2-B
<i>Femto D4 F</i>	
Femto D4 F RS485 230-240V	PFA64F1-02-C
Femto D4 F RS485 230-240V 2AO4-20mA	PFA64F1-62-C
Femto D4 F RS485 230-240V 4DI 4COMMON	PFA64F1-B2-C
Femto D4 F RS485 230-240V 4DO 4COMMON	PFA64F1-C2-C
Femto D4 F RS485 230-240V 2DI 2DO 4COMMON	PFA64F1-D2-C
<i>Femto MID D4 ECT</i>	
Femto MID D4 ECT RS485 85-440V	PFA64M1-0A-B
Femto MID D4 ECT RS485 85-440V 2DI 2DO SG	PFA64M1-DA-B

ATTO D4	
TYPE	CODE
<i>Atto D4 standard</i>	
Atto D4 RS485 230-240V	PFA7411-02-B
Atto D4 RS485 230-240V 2AO4-20mA	PFA7411-62-B
Atto D4 RS485 230-240V 4DI 4COMMON	PFA7411-B2-B
Atto D4 RS485 230-240V 4DO 4COMMON	PFA7411-C2-B
Atto D4 RS485 230-240V 2DI 2DO 4COMMON	PFA7411-D2-B
<i>Atto D4 ECT</i>	
Atto D4 ECT RS485 230-240V	PFA7451-02-B
Atto D4 ECT RS485 230-240V 2AO4-20mA	PFA7451-62-B
Atto D4 ECT RS485 230-240V 4DI 4COM	PFA7451-B2-B
Atto D4 ECT RS485 230-240V 4DO 4COM	PFA7451-C2-B
Atto D4 ECT RS485 230-240V 2DI 2DO 4COM	PFA7451-D2-B

Other versions of Femto D4 and Atto D4

Building code	
Example: PFA 6¹ 4² 1³ 1⁴ - Q⁵ 2⁶ - B⁷	
TYPE	CODE
<i>Series</i> ¹	6
Femto D4	6
Atto D4	7
<i>Size: 4 moduli DIN</i> ²	4
<i>Current Inputs</i> ³	1
Standard ..5A & ../1A CTs	1
ECT CTs	5
Flexible Split Core CTs (Rogowski)	F
MID ECT	M
<i>RS485 communication</i> ⁴	1
<i>Internal module</i> ⁵	Q
Nessuna scheda interna (anche MID)	0
Scheda 2DI 1 RO Self Powered	2
Scheda 2RO24VDC	5
Scheda 2AO4-20mA	6
Scheda 1DI 2DO Self Powered	E
Scheda 4DI 4COMMON	B
Scheda 4DO 4COMMON	C
Scheda 2DI 2DO 4COMMON (anche MID)	D
<i>Power supply</i> ⁶	2
230Vac +/- 10%	2
120Vac +/- 10%	1
400Vac +/- 10%	3
15+36Vac/18+60Vdc	8
9+24Vac/9+36Vdc	7
Only MID: F-N 230Vac +/- 10% and Ph-Ph 400Vac +/- 10%	A
<i>New generation</i> ⁷	B

Electrex is a brand of Akse srl
Via Aldo Moro, 39 - 42124 Reggio Emilia (RE) - Italy
Tel : +39 0522 924244 - Fax : +39 0522 924245
www.electrex.it - email: info@electrex.it

Subject to modification without prior notice
Data sheet Femto D4 and Atto D4
2021 05 19-ENG