

Femto

Energy Analyzer



Femto is a microprocessor based 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. The instrument combines the functions of multimeter, power & energy meter and analyzer. DC versions are available for direct current readings (e.g. photovoltaic and batterized systems).

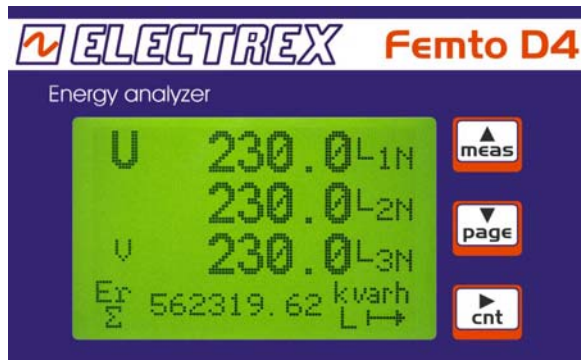
True-RMS

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.

Simple to use

A graphic dot matrix LCD display with a led backlight and adjustable contrast allows the simultaneous reading of 4 parameters and their symbols with high visibility digits.



3 keys make the instrument use simple and rational, while page displayed at switch on is at user choice.

Versatile in application

Femto 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.

A simple keyboard programming 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, RS485 serial communication.

The instrument set-up is password protected against undesired modifications.

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)	•	•	•		•		
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	P _{MAX} (1)	•	•	•		•		± 0,00...1999 Mvar
	Q _{IND}	•	•	•		•		
	Q _{CAP}	•	•	•		•		
	Q _m IND (3)					•		
	Q _m CAP (3)					•		
Apparent Power	Q _{MD} IND (3)					•		± 0,00...1999 MVA
	Q _{MD} CAP (3)					•		
	S	•	•	•		•		
Temperature	S _m (3)					•		-10...+50 °C
	S _{MD} (3)					•		
Life Time	T (°C e F) (4)					•		0,01...99.999,99
Active Energy	h (1/100 h)					•		0,1 kWh...99.999,9 MWh
	E _a IMP (5)	•	•	•		•		
Reactive Energy	E _a EXP (5)	•	•	•		•		0,1 kvarh...99.999,9 Mvarh
	E _r IND IMP (5)	•	•	•		•		
	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

Femto 1DI 2DO is 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. 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.

Femto 1DI 2DO SELF-POWERED instead is provided with a self powered digital input.

Digital and 4-20mA Analogue outputs

Femto 1DI 2DO is equipped with two optically insulated transistor outputs rated 27 Vdc 27 mA 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.

Femto 1DI 2DO SELF-POWERED instead is provided with two optomos relay outputs max. 250V or 100mA AC/DC.

Femto 2A04-20mA 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

Femto 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, for example, either as a minimum and/or as a maximum. 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". 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 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.

Serial communication

Femto 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

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

Femto types

Femto D4 and **Femto 96** meters are available in some versions:

- *Basic*without digital inputs and outputs
- *1DI 2DO*.....with 1 digital input and 2 digital outputs
- *2A04-20mA*.....with two 4-20mA analogue outputs (external power supply needed for loads over 250 ohm)

The **Femto D4** is available in other models:

- *70A type* (Basic and 1DI 2DO). Direct current input via external CTs (special CTs, one included). Ready for single phase wiring (e.g. 6kW). For 3-phase systems (e.g. 15-20 kW) it is necessary to separately order 2 additional CTs type TA 70 A. Furthermore it is possible choosing between two scale of current (14A and 70A) to optimise the accuracy even with low currents.
- *1DI 2DO Self-Powered*.
- *DC 1DI 2 DO (230-240Vac or 15÷36Vac/18÷60Vdc)* for direct current readings.



Types on request

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

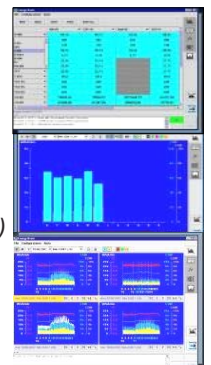
Several Energy Brain versions are available according to the functions and the number of channels required.

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:	.....	$I_1, I_2, I_3, I_\Sigma, I_N$
Max(Absolute Value):	.....	I_1, I_2, I_3
Therm.:	.....	I_1, I_2, I_3
Power Factor:	.....	$PF_1, PF_2, PF_3, PF_\Sigma$
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:	$E_{s\Sigma T}, E_{asPart}$
	EXPORT:	$E_{s\Sigma T}, E_{s\Sigma Part}$
Life Time	TOTAL and PARTIAL:	Hours, 1/100 h
Temperature:	.....	$^{\circ}C, ^{\circ}F$
External pulse counter:	.....	$C_{NT T}, C_{NT Part}$

Functional characteristics

Measurement system:	
-	True-RMS measurement up to the 31 st 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 (depending on type):	
-	DIN 43864 (27Vdc, 27mA) or max 250V 100mA AC/DC
-	Galvanically insulated
-	Programmable functionality: pulse output, alarm contact, remote control.
Digital Input (depending on type):	
-	External powered needed or self-powered
-	Galvanically insulated
-	Programmable functionality: external pulse count, ON/OFF state detection, tariff changeover (max 2 tariffs).
-	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	
Display:	graphic LCD with adjustable contrast
Femto D4	..... 100x64 dots
visible area	..... 43x25 mm
Femto 96	..... 128x64 dots
visible area	..... 61x32 mm
Backlight:	..... yellow/green Led
Display update interval:	..... 1s
Keyboard:	..... 3 keys

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

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.

Current Inputs (70A type):

with external CTs:

Primary: max. 70 A

Secondary: voltage output

Hole diameter 9 mm

Plastic body

Digital Inputs (depending on type):

Max counting frequency: 10 or 100Hz (programmable)

Models 1DI 2DO to be externally powered:

Power supply 10 to 30 Vdc

Absorbed current: 2 to 10mA

Digital Outputs (depending on type):

Model 1DI 2DO Self-Powered:

Type: static relay opto-mos

Max voltage: 250 Vac-dc

Max current: 100mA

Models 1DI 2DO to be externally powered:

Type: open collector (NPN) per DIN 43864

Max voltage: 27 Vdc

Max current: 27mA

4-20mA Analogue Output (depending on type):

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

4-20mA Analogue 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 (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 (FemtoD4)

Front panel IP51 (Femto48 & 96)

Terminals side IP20

Size: Femto D4 70 x 90 x 58 mm (4 DIN modules)

Femto 96 96 x 96 x 72 mm (panel)

Panel cut-out 92 x 92 mm

Femto 48 48 x 96 x 115 mm

Terminals screw connector (plug-in type for Femto 96)

Max cable size: 2,5 mm² (stranded cable) /

4 mm² (solid cable)

How to order

Type	Code
Femto D4 RS485 230-240V	PFA 6411-02
Femto D4 RS485 230-240V 1DI 2DO	PFA 6411-12
Femto D4 70A RS485 230-240V	PFA 6431-02
Femto D4 70A RS485 230-240V 1DI 2DO	PFA 6431-12
TA 70A (dedicated Current Transformer)	PFA E000-00
Femto D4 RS485 230-240V 2AO4-20mA	PFA 6411-62
Femto D4 RS485 230-240V 1DI 2DO Self-Pow.	PFA 6411-E2
Femto D4 DC RS485 230-240V 1DI 2DO	PFA 6471-12
Femto D4 DC RS485 18÷60VDC 1DI 2DO	PFA 6471-18
Femto 96 RS485 230-240V	PFA 6C11-02
Femto 96 RS485 230-240V 1DI 2DO	PFA 6C11-12
Femto 96 RS485 230-240V 2AO4-20mA	PFA 6C11-62
Femto 48 RS485 230-240V	PFA 6A11-02
Femto 48 RS485 230-240V 1DI 2DO	PFA 6A11-12
Other types on request	

Subject to modification without prior notice

Data-sheet Femto 2009 03 18 -ENG

Your distributor