

# Exa D6 & 96, Exa TR and Exa MID

## Class 0,5S Energy Analyzers



The Exa series are microprocessor-based energy meters / analyzers suitable for harsh environments. Equipped with an RS485 Modbus RTU port. Indication of the phase sequence, four operating time counters in addition to more than one hundred measurements. Versions with digital and analogue inputs - outputs. Perform the functions of analyzer, counter and multimeter.

### 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

Exa D6, 96 and Exa MID are equipped with an LCD graphic display (dot matrix) with LED backlighting and 2 levels of contrast. Simultaneous reading of 4 parameters and of their symbols with high visibility mode.



The 6-key Joystick keypad (in line for the Exa 96) and the menu column on the display for configuring provide a simple and rational instrument use. In addition the initial page displayed when the instrument is turned on can be defined by the user. On the front panel two red LEDs, for calibration checking, pulse with a frequency proportional to the active and reactive energy imported. Under the sine wave symbol next to the Electrex logo a red LED indicates the operation status, while 2 other LEDs (one red and one green) below the white band indicate the communication activities of the RS485 port.

### Versatile in application

All Exa (except Exa MID) are equipped with RS485 port and suitable for use on any type of grid, 3 or 4 wire, symmetrical or asymmetrical, 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 quadrant (import / export). A keyboard programming allows you to set all operating parameters such as RS485 port, network type, LV / MV, CT and eventual VT ratio (free setting), integration time (1-60 min.) and depending on the version: analog outputs, digital outputs, relay and alarm outputs (thresholds, delay and hysteresis), analog and digital inputs. The programming system is password protected against unwanted changes.

Exa MID is instead suitable for insertions in three-phase 3 and 4 wires, low voltage systems and only with ..5A CTs.

### Measures

Parameter	Type	Range
Voltage	U L-N	(Excluding Exa MID) 20,0V...400 kV  Exa MID U <sub>L-N</sub> : 230V ±10% U <sub>L-L</sub> : 400V ±10%
	U L-L	
	U L-N Min	
	U L-L Min	
	U L-N Max	
Current	I	10 mA ...10,0 kA
	I Max	
	I AVG <sup>1</sup>	
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 <sup>3</sup>	
	P AVG <sup>2</sup>	
Reactive Power	P MD <sup>2</sup>	± 0,00...1999 Mvar
	Q Ind	
	Q Cap	
	Q AVG Ind <sup>2</sup>	
	Q AVG Cap <sup>2</sup>	
Apparent Power	Q MD Ind <sup>2</sup>	± 0,00...1999 MVA
	Q MD Cap <sup>2</sup>	
	S	
Operating time (4)	S AVG <sup>2</sup>	0,01...99.999,99 h
	S MD <sup>2</sup>	
Active Energy	h, h/100	0,1 kWh...100 GWh
	Ea Imp <sup>5</sup>	
Reactive Energy	Ea Exp <sup>5</sup>	0,1 kvarh...100 Gvarh
	Er Ind Imp <sup>5</sup>	
	Er Cap Imp <sup>5</sup>	
	Er Ind Exp <sup>5</sup>	
Apparent Energy	Er Cap Exp <sup>5</sup>	0,1kVAh...100 GVAh
	Es Imp <sup>5</sup>	
Pulse Counter	Es Exp <sup>5</sup>	
	CNT <sup>6</sup>	

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 MID models the frequency is between 45 Hz and 55 Hz. The energy counters at the terminals level (total and each phase) in both Import and Export are non-resettable (MID) and resettable partial total counters are displayed at 9 digits (one decimal); internal counters are logged as in point (5).
- (8) Three partial counters for each measurement marked

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Via Aldo Moro, 39 42124 Reggio Emilia Italy  
Tel. +39 0522 924 244 Email: info@electrex.it Web: www.electrex.it

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### 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.

### Serial port communication

The Exa 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.

### Operating time counters

The Exa display the 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.

### Versions of Exa D6, 96 and Exa TR D6

The Exa are available in different versions:

- **Standard:** No built-in inputs or outputs
- **1DI 2DO Self-Powered:** 1 self powered digital input and 2 digital outputs rated at 250V 100mA
- **2AO4-20mA:** 2 analog outputs 4-20mA
- **2DI 1RO24VDC Self-Powered:** with 2 digital inputs self powered and 1 relay output (24VDC)
- **2RO24VDC:** 2 relay outputs (24VDC)
- **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

### Digital Inputs and Tariffs

The Exa .. **1DI or 2DI or 4DI** are equipped with optically insulated digital inputs complete with programmable filter for input glitches. The digital input is set by default to operate for external pulse count of, example, water meters, gas meters (insulation to meet the ATEX requirements), quantity count, etc. The 1DI .. or the 2DI 1RO the max sampling rate 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) applying a 10-30Vdc to the digital input (2 tariffs) or to two digital inputs (4 tariffs). An external 10-30Vdc power supply is required. The **Exa 1DI 2DO Self-Powered and Exa 2DI 1RO Self-Powered** instead are provided with self powered digital inputs.

### Digital Outputs

The Exa .. **2DO or 4DO** are equipped with two optically insulated transistor outputs rated 27 Vdc 27 mA per DIN 43864 standards.

The **Exa 1DI 2DO SELF-POWERED** instead are provided with two opto-mos outputs rated at max. 250V or 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 devices controlled via serial line and Modbus commands.

### Relay outputs

The **Exa 2DI 1RO Self-Powered or Exa 2RO24VDC** are equipped with one or two relay outputs with changeover contact rated at max 30V max 2A (resistive load). The outputs are programmable as outputs of the internal alarms (see Alarms) or as remotely controlled output units via serial line and Modbus commands.

### Alarms

The Exa .. **2DO or 4DO or 1RO** are equipped with outputs programmable as alarms. Each alarm is associated to any of the parameters available, for example, either as a minimum alarm 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 and /or 0-10V outputs

The .. **2AO4-20mA** version 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). In order to transform the output in a 0-10V type a 500 ohm resistance must be connected in parallel. The outputs ensure a response time of max. 200 ms. Each output can be associated to any of the parameters.

### Firmware and special versions on request

The **Exa D6 and 96 and the Exa TR** firmware can be remotely updated and the same devices can be requested in other hardware configurations such as with different power supplies:

- Power supply by 115/120 Vac or 400 Vac transformer
- Switching power supply 15÷36Vac/18÷60Vdc
- Switching power supply 9÷24Vac/9÷36Vdc.

The **Exa MID D6** instead cannot be modified.

### Exa MID

**Exa MID and Exa MID 2DI 2DO** are compliant with EN 50470-1 + EN 50470-3 and are suitable for LV insertions in 3 phase, 3 and 4 wires (Phase-Neutral 230V ±15% and Phase - Phase 400V ±15%) systems.



### EN 50470 and 62053-21 standards

All the **Exa** versions 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.

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Via Aldo Moro, 39 42124 Reggio Emilia Italy

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

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## 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	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	2 ... 10mA
Digital 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
Relay Outputs (depending on type):	Accuracy: 1% of the reading from 4 to 20mA	
	Programmable function: alarm signal, remote control output	
	Changeover contact max 30Vdc 2A (resistive load)	

Accuracy (excluding Exa MID)	
Voltage	0,25% of reading from 40 to 300V, min. reading: 10V
Current	0,25% of reading from 0,02 to 1,2A or from 1,2 to 6A (2 scales), lettura minima: 10mA
Frequency	0,02 Hz da 45 a 65 Hz
Power	0,5% of reading
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

Electrical characteristics		
Connection	single-, bi-phase & 3-phase, LT and MT systems, balanced, unbalanced, 3- and 4 wires	
Voltage inputs	Direct	up to 300 Vrms L-N, up to 519 Vrms L-L
	Via external VTs	max. 400 kV primary max 300V secondary (programmable)
	Max voltage to ground:	300 Vrms
	Absorbed power	< 0,3 VA
	Input impedance	> 2 MΩ
Current Inputs	Overload	max, 900 Vrms PH-PH for 1 sec.
	Standard external CTs	max. 10kA primary ../1A and ../5A secondary Programmable CTs
	Load on the CT	< 0,7 VA
	Overload	max. 40 Arms peak for 1 sec
Auxiliary power supply (Not Exa MID)	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	
Consumption	< 2,5 VA	
Frequency	45-65 Hz	
Galvanic isolation (Not Exa MID)	Power supply (separate): 4 kV	
	RS-485 port: 1,5 kV	
	Digital Input & Outputs: 1,5 kV 4-20mA Analogue Outputs: 1,5 kV	

Electrical characteristics Exa MID		
Connection	LV 3-phase, 3 wires 2 CTs or 4 wires 3 CTs	
Voltage inputs	Direct	UL-N 230V ±10% UL-L 400V ±10%
	Max voltage to ground:	300 Vrms
	Current Inputs (galvanic isolation using integrated CTs)	Standard external CTs
Self-powered (remains powered even if missing 2 phases)	Load on the CT	< 0,7 VA
	Overload	max. 40 Arms peak for 1 sec
Consumption	L-N 230Vac +/- 10% 50Hz L-L 400Vac +/- 10% 50Hz < 2,5 VA	

Mechanical characteristics		
Operating temperature	Exa D6	-25/+60 °C
	Exa 96	-25/+70 °C
	Exa TR	-25/+70 °C
	Exa MID	-25/+55 °C
Relative Humidity	95% R.H. non condensing	
Enclosure	Self-extinguishing plastic material class UL94 V-0	
Protection degree	IP40 (frontal), IP20 (terminals side)	
Size	106,3 x 90,5 x 62 mm (6 DIN modules)	
	96 x 96 x 78 mm (cutout 92x92mm)	
Maximum cable section	2,5 mm <sup>2</sup> (stranded cable) / 4 mm <sup>2</sup> (solid cable)	
Weight	around 385 g (packaging included)	

Front panel		
Display	D6	Graphic LCD with 2-level contrast (100x64 dots)
	96	Graphic LCD with 2-level contrast (240x260 dots)
Size of the visible area	D6	43x25mm
	96	49x71,8mm
Backlight	white/blue Led	
Keyboard	D6	6-key Joystick keypad
	96	6-key linear keypad
Calibration LEDs	D6	2 red for Ea and Er (10.000 pulses per kWh or Kvarh)
	96	1 for Ea (10.000 pulses per kWh)
Operation LEDs	1 red under the symbol 	
RS485 LEDs	1 green and 1 red under the white band	

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
Digital Outputs	DIN 43864
MTBF (100.000 h)	MIL-HDBK-217F

## HOW TO ORDER

TYPE	CODE
<i>Exa D6 standard</i>	
Exa D6 RS485 230-240V	PFAE611-02-B
Exa D6 RS485 230-240V 2DI 2DO 4COMMON	PFAE611-D2-B
Exa D6 RS485 230-240V 2AO4-20mA	PFAE611-62-B
<i>Exa TR D6</i>	
Exa TR D6 RS485 230-240V	PFAE6T1-02-B
Exa TR D6 RS485 230-240V 2DI 2DO 4COMMON	PFAE6T1-D2-B
Exa TR D6 RS485 230-240V 2AO4-20mA	PFAE6T1-62-B
<i>Exa MID D6</i>	
Exa MID D6 RS485 85+440V	PFAE6M1-0A
Exa MID D6 RS485 85+440V 2DI 2DO	PFAE6M1-QA
Exa MID D6 Terminal Cover	PFE950-00
<i>Exa 96</i>	
Exa 96 RS485 230-240V	PFAEC11-02-B
Exa 96 RS485 230-240V 2DI 2DO 4COMMON	PFAEC11-D2-B
Exa 96 RS485 230-240V 2AO4-20mA	PFAEC11-62-B

## Other versions of Exa RS485

Building code	
<b>Example: PFA E<sup>1</sup> 6<sup>2</sup> 1<sup>3</sup> 1<sup>4</sup> - 1<sup>5</sup> 2<sup>6</sup> - B<sup>7</sup></b>	
TYPE	CODE
<b>Series<sup>1</sup></b>	<b>E</b>
Exa	E
<b>Size<sup>2</sup></b>	<b>6</b>
6 DIN rail modules	6
flush mount 96x96	C
<b>Type<sup>3</sup></b>	<b>1</b>
Analyzer Exa D6 / 96	1
Transducer Exa TR	T
Analyzer Exa MID D6	M
<b>RS485 communication<sup>4</sup></b>	<b>1</b>
<b>Internal module<sup>5</sup></b>	<b>1</b>
No internal module ( <b>even MID</b> )	0
Module 2DI 1 RO 24Vdc Self Powered	2
Module 2RO24VDC	5
Module 2AO4-20mA	6
Module 1DI 2DO Self Powered	E
Module 1DI 2DO	1
Module 4DI 4COMMON	B
Module 4DO 4COMMON	C
Module 2DI 2DO 4COMMON	D
Module 2DI 2DO ( <b>only MID</b> )	Q
<b>Power supply<sup>6</sup></b>	<b>2</b>
230Vac +/- 10%	2
120Vac +/- 10%	1
400Vac +/- 10%	3
15+36Vac/18+60Vdc	8
9+24Vac/9+36Vdc	7
L-N 230Vac +/- 10% and L-L 400Vac +/- 10% ( <b>Only MID</b> )	A
<b>New generation<sup>7</sup></b>	<b>B</b>