POWER ANALYZER ARM1

The **ARM1** is an instrument that measures, calculates and displays the main electrical parameters in industrial and domestic single-phase power networks. The measurement is an RMS value made by direct measurement of the current and voltage. The measured and calculated parameters are shown in the table of variables.

> You must disconnect the unit from the power supply before performing any maintenance operations, connection modifications, repairs, etc. When a failure in the unit's operation or in its protection is suspected, the unit must be removed from service. The design of the unit makes it easy to replace in the event of a fault.

1.- Button

The **ARM1** analyzer's front panel has a six digit *LCD* display as well as a button function that enables the user to navigate through the different display screens of the primary electrical variables.

This button is used for two types of navigation, depending on how it is pressed:

SHORT PRESS: This type of press occurs when the user maintains the function button pressed for less than two seconds. With a short press, the device moves through the different navigation screens, displaying all the electrical parameters on the display (refer to section 2.- Display). In numerical setting, the short press allows a cyclical increase the value of the digit.

LONG PRESS: This type of press occurs when the user maintains the function button pressed for longer than two seconds. With a long press, the device intermittently displays the maximum and minimum values of the variable that is displayed at that moment. With a long press on the partial power values, the unit resets these values. In numerical settings, long press allows the left lateral selection and posterior digit validation. If the selected value is not correct, the digits will blink indicating the user to enter a correct value (refer to section 5.- Setup, allowed values).

2.- Display

The unit's front panel incorporates an *LCD* display with six digits. By repeatedly pressing the function button located on the front panel, the unit displays the different measured electrical parameters and the symbol corresponding to the displayed variable.

3.- Measurement

The Power analyzer **ARM1** is a measuring unit with four quadrants, which is valid for conventional power consumption systems and systems where a certain type of generation source exists.

For this, the unit is able to display the primary electrical variables with their sign (*KW* and *KVA*), displaying the direction of the current.

3.1.- Electrical Variables

The electrical variables are displayed on the unit by a rotating display screen system. This enables the user to quickly display all the electrical variables by repeatedly pressing the function button.

Upon start-up and after the unit is connected to an auxiliary power supply, the unit displays the firmware versionfollowed by the following electrical variables:

3.1.1.- Phase – neutral voltage

Voltage between the phase and the neutral with a maximum resolution of 1 decimal points (*235.1 V*). By pressing and holding the voltage value, the unit displays the maximum value by fast flashing and the minimum recorded value by slow flashing.

3.1.2.- Current

Briefly pressing the function button, the unit displays the Current with a maximum resolution of 2 decimal points (*15.24 A*).

By pressing and holding the voltage value, the unit displays the maximum value flashing quickly and the minimum recorded value flashing slowly.

3.1.3.- Active Power

By briefly pressing the function button, the unit displays the Active Power with a maximum resolution of 2 decimal points (*3.24 KW*). If the measurement is taken at the output of a power generator load, the parameter is displayed with a negative sign.

By pressing and holding the active power value, The unit displays the maximum value flashing quickly and the minimum recorded value flashing slowly.

3.1.4.- Reactive Power

By briefly pressing the function button, the unit displays the Reactive Power with a maximum resolution of 2 decimal points (*2.12 KVAR*).

The unit displays the work quadrant with its sign; if the value is positive, it displays the Inductive Reactive Power (kvarL); if the value is negative, it displays the Capacitive Reactive Power (kvarC).

By pressing and holding the reactive power value, The unit displays the maximum value flashing quickly and the minimum recorded value flashing slowly.

3.1.5.- Apparent Power

By briefly pressing the function button, the unit displays the Apparent Power with a maximum resolution of 2 decimal points (*5.10 KVA*). If the measurement is taken at the output of a power generator load, the parameter is displayed with a negative sign.

By pressing and holding the apparent power value, the unit displays the maximum value flashing quickly and the minimum recorded value flashing slowly.

3.1.6.- Maximum demand

By briefly pressing of the function button, the unit displays the Maximum Demand. The maximum demand is calculated using the sliding window method for a time set by the user via the configuration *setup*.

The maximum demand can be calculated with respect to two selectable variables (*A - KW*). The unit is set as follows by default:

a) *MD CODE*: Active Power (*KW*)
b) *PERIOD*: 15 minutes

By pressing and holding the maximum demand value, the unit displays the maximum value flashing quickly and the minimum recorded value flashing slowly.

3.1.7.- Power Factor

By briefly pressing the function button, the unit displays the Power Factor with a maximum resolution of 2 decimal points (*-0.99*). The unit displays the work quadrant with its sign (see diagram Sign convention).

By pressing and holding the power factor value, the unit displays the maximum value flashing quickly and the minimum recorded value flashing slowly.

3.1.8.- Active Energy

By briefly pressing of the function button, the unit displays *CONS* before the Active Energy Consumption with a maximum resolution of 1 decimal point, with a background scale of *99999.9 KWH*.

3.1.9.- Reactive Energy

By briefly pressing the function button, the unit displays the Reactive Energy Consumption with a maximum resolution of 1 decimal point, with a background scale of *99999.9 KVARH*. The unit displays the work quadrant with its sign (see diagram Sign convention).

3.1.10.- Partial Active Energy

By briefly pressing of the function button, the unit displays *PAR* before the Partial Active Energy Consumption with a maximum resolution of 1 decimal point and a background scale of *99999.9 KWH*. By pressing and holding the partial active energy value, the unit resets both partial meters (partial active energy consumption and partial reactive energy consumption).

3.1.11.- Partial Reactive Energy

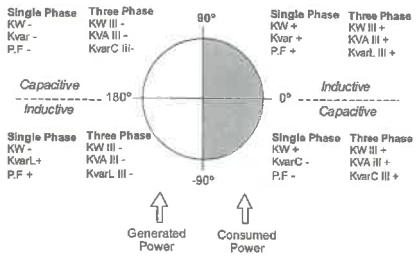
By briefly pressing of the function button, the unit displays the Partial Reactive Energy with a maximum resolution of 1 decimal point, with a background scale of *99999.9 KVAR-H*. The unit displays the work quadrant with its sign (see diagram Sign convention). By pressing and holding the partial active energy value, the unit resets both partial meters (partial active energy consumption and partial reactive energy consumption).

3.1.12.- Generated Active and Reactive Energy

By activating the measurement in four quadrants via the *setup*, the analyzer displays *GEN* before the Generated Active and Reactive Energy as well as a second block of partial meters.

By pressing and holding the partial meters display, the unit resets both partial meters (generated partial active energy and generated partial reactive energy).

4.- Sign convention



5.- Setup

To enter the configuration setup, display an energy variable (any), and make a long press to the function button, to display on the screen *SETUP*.

By pressing and holding, the unit displays the different configuration sections, and by pressing briefly, you can change their values.

a) *MPER*: peripheral number *001...254* - Default (*1*)*
b) *BAUD*: rate *2400-4800-9600-19200* - Default (*19.200*)*
c) *QUAD*: *2* quadrants / *4* quadrants
d) *MAXIMUM DEMAND CONFIGURATION*
   - *MD VAR*: *3* (kW- active power) / *2* (A - current)
   - *MD PER*: *1...60* minutes
e) *F.OUT*: *PULSE* (pulse function) / *ALARM* (alarm function)*

   PULS – FUNCTION ENERGY IMPULSE:
   - *P VAR*: *10, 11, 12, 13* (consumed)) *18., 19, 20 ,21* (generated)
   - *P TIME*: *40...200* ms. (pulse duration)

   ALARM – ALARM FUNCTION:
   - *A VAR*: *1...9* (instant variable)
   - *A MAX*: maximum value
   - *A MIN*: minimum value
   - *ADLAY*: delay connection and disconnection (*0...60* sec)

In the alarm function, the digital output is maintained open between the maximum and minimum value. In the case of programming an inverse logic (normally closed), invert the maximum and minimum values in the Setup menu.

The *P VAR* and *A VAR CODES* are specified in the Modbus/RTU memory Map table, in the **Var** column. If you do not wish to programme a variable, select *00*.

To validate the modified data in *setup*, ensure you can view all of the display screens by pressing and holding, until completing all of the configuration options. At the end of the process, the unit validates and saves the changes that have been carried out.

If the configuration process is not completely finished and after not having pressed the function key for 10 seconds, the unit returns to the display screen, and exits the *setup* menu without saving the data that has been modified by the user.

*Options a) and b), are listed in model RS485, since it expressly references the device's communication parameters. Option e) is fixed to "pulse-active energy consumed" in the MID certified device.The rest of the options are listed in all the **ARM1** range references.

6.- Modbus/RTU memory map

Parameters	Symbol	Var	Instantaneous	Maximum	Minimum	Units
Voltage	V	1	0000-0001	0032-0033	0044-0045	V x10
Current	A	2	0002-0003	0034-0035	0046-0047	A x100
Active Power	kW	3	0004-0005	0036-0037	0048-0049	± kW x100
Reactive Power (L/C)	kvar	4	0006-0007	0038-0039	004A-004B	± kvar x100
Inductive Reactive Power	kvarL	5	0008-0009	003A-003B	004C-004D	± kvarL x100
Capacitive Inductive Power	kvarC	6	000A-000B	003C-003D	004E-004F	± kvarC x100
Apparent power	kVA	7	000C-000D	003E-003F	0050-0051	± kVA x100
Power Factor	PF	8	000E-000F	0040-0041	0052-0053	PFx100
Maximum Demand	kW / A	9	0010-0011	0042-0043	0054-0055	kW / A x100
Active energy	kW·h	10	0012-0013	-	-	kW·h x100
Inductive Reactive Energy	kvarL·h	11	0014-0015	-	-	kvarL·h x100
Capacitive Reactive Energy	kvarC·h	12	0016-0017	-	-	kvarC·h x100
Reactive Energy (L/C)	kvar·h	13	0018-0019	-	-	kvar·h x100

Parameters	Var	Symbol	Instantaneous	Maximum	Minimum	Units
Partial Active Energy	14	kW·h	001A-001B	-	-	kW·h x100
Partial Inductive Reactive Energy	15	kvarL·h	001C-001D	-	-	kvarL·h x100
Partial Capacitive Reactive Energy	16	kvarC·h	001E-001F	-	-	kvarC·h x100
Partial Reactive Energy (L/C)	17	kvar·h	0020-0021	-	-	kvar··h x100
FOUR QUADRANTS MEASUREMENT						
Generated Active Energy	18	kW·h	0022-0023	-	-	kW·h x100
Generated Inductive Reactive Energy	19	kvarL·h	0024-0025	-	-	kvarL·h x100
Generated Capacitive Reactive Energy	20	kvarC·h	0026-0027	-	-	kvarC·h x100
Generated Total Reactive Energy (L/C)	21	kvar·h	0028-0029	-	-	kvar·h x100
Partial Generated Active Energy	22	kW·h	002A-002B	-	-	kW·h x100
Partial Generated Inductive Reactive Energy	23	kvarL·h	002C-002D	-	-	kvarL·h x100
Generated Capacitive Reactive Energy	24	kvarC·h	002E-002F	-	-	kvarC·h x100
Partial Generated Total Reactive Energy (L/C)	25	kvar·h	0030-0031	-	-	kvar·h x100

7.- ARM1 communication

One or several -**ARM1** analyzers can be connected to a controller or PLC. Using this system you can operate each of the analyzers as usual as well as centralize the data in a single location. **ARM1** incorporates an RS-485 type communications output. If more than one analyzer is connected to an RS-485 serial bus, each of them must be assigned a peripheral number or address so that the communications master can send the queries regarding the different measured or calculated records to those addresses.the RS-485 connection is carried out via the shielded twisted pair communication cable, with a minimum of two wires and with a maximum distance between the communications master and the last unit of 1,200 metros. The device uses an RS-485 communications line that can support a maximum of 32 units in series per bus.

The **ARM1** type power analyzer communicates via a **Modbus/RTU©** protocol (Question / answer polling).

8.- Technical specifications

Supply specifications :	
- Single-phase :	88...276 $V_{c.a}$
- Frequency:	50 / 60 Hz
- Maximum consumption :	2 VA
Mechanical specifications:	
- Case material :	Selft-extinguish UL94-V0 plastic
- Protection :	
Fitted unit (front panel) :	IP31
Fitted MID unit (front panel) :	IP51
Non-fitted unit (front panel):	IP20
- Maximum Dimensions (mm) :	85.5 x 64.2 x 18 mm (1 DIN rail module)
- Weight :	150 g
- Maximum cable cross-section:	10 mm^2 (6 mm^2 with end sleeve)
Environmental specifications:	
- Working temperature:	-5...+55 °C
- Storage temperature:	-25...+70 °C
- Humidity:	5...95% non condensing
- Maximum altitude:	2000m
Accuracy:	
- Voltage :	0.5 % ± 1 digit
- Current :	0.5 % ± 1 digit
- Power / Energy :	1 % ± 1 digit
Sensors :	
- Voltage :	Direct. Impedance 1MΩ
- Current :	Direct (shunt <0,5 mΩ)
Power factor :	0.5...1
Measurement range:	0.5...120% FS

Metering circuit:	
- Nominal voltage / Tolerance:	110...230 $V_{c.a}$ / ±20 %
- Nominal voltage / MID Tolerance:	230 $V_{c.a}$ / ±20 %
- Frequency :	50 / 60Hz
- MID frequency:	50Hz
- Nominal current/minimum/maximum:	5 A / 250 mA / 32 A
- Start current (/st):	20 mA
- Reference current (/ref):	5 A
- Transition current (/tr):	500 mA
Output transistor specifications	
- Typo: opto-isolated transistor (open collector)	NPN
- Maximum operating voltage:	42 $V_{c.c}$
- Maximum operating current:	50 mA
- Maximum frequency:	1000 imp / kW·h
- Pulse width:	40... 200ms (configurable)

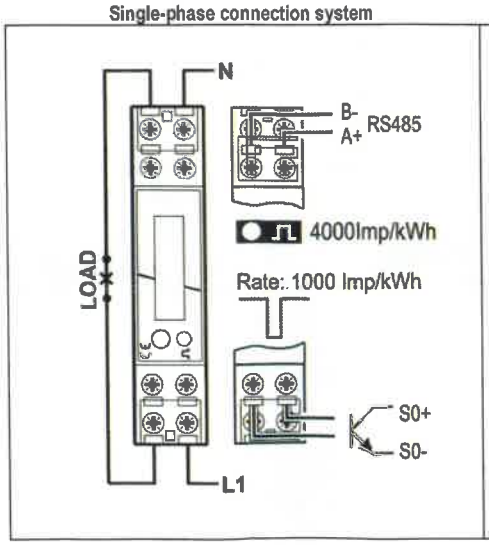
Safety:
CATIII-300 EN61010-1:2010 EN61010-2-030:2011. Double insulation. Pollution degree II. Means for disconnecting the power from the device must be provided in the installation. Wire conductor are must be choosen depending on current to flow acroos the device. Minimum recommended wire is 1mm²

Standards :
EN 50470-1, EN50470-3, EN62053-21, EN62053-23, EN61010-1:2010, EN 61000-6-4, EN 55022

Energy meter: Class B EN50470-3 Active Energy, Class 2 EN62053-23 Reactive Energy.

9.- Connections

Single-phase connection system



RS-485 communications