SUPPLY NETWORK ANALYZER

AR.5

(Code 7 71 301)

INSTRUCTION MANUAL

(M 981 501 / 99 A)

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1.- BASIC INSTRUCTIONS

This manual is aimed to familiarize de user with the operation of the portable power analyzer model AR5 in order to get the best from its features.

AR5 analyzers have been built with components incorporating the most advanced technology in microelectronics and offer benchtop features over the market in measurement and recording of electrical magnitudes in industrial power supply networks.

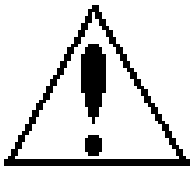
You are kindly requested to **carefully read this manual before connecting and powering the analyzer** in order to avoid irreversible damage which might be caused by an improper connection.

1.1.- Introduction: check the contents of your package

After receiving the analyzer, please check the following points:

a) The analyzer model corresponds with your order specifications.
b) After unpacking, check that the instrument has not been damaged in transit.
c) The standard set includes the following items:
* 1 Power supplier set 230 / 12 V.
* 1 Connection cord between the power supplier set and the 230 V a.c. main.
* 1 Connection cable between the AR5 and the power supplier set.
* 1 RS-232 communication cable.
* 4 Voltage leads.
* 4 Alligator clamps.
* 1 Instruction Manual.
* 3.5” floppy disks with the PC program

1.2.- Safety conditions



The manual you hold in your hands contains information and warnings about the **AR5** that the user should respect in order to guarantee a proper operation of all the instrument functions and keep its safety conditions.

1.3.- Connection instructions

Before powering and connecting the analyzer check the following points:

a) Supply voltage: Through and external power supplier set.
Input mains 230 V a.c., ± 15 % / output to AR5 12V d.c.
b) Frequency : 45...65 Hz.
c) Maximum voltage at the voltage measuring circuit:
- ☑ 500 V a.c. phase-neutral
- ☑ 866 V a.c. between phases

d) Current measuring range: according to the ammeter clamp used

Clamp CP-2000-200	20 to 2000 A a.c. (switch at 2000) 2 to 200 A a.c. (switch at 200)
Clamp CPR-1000	10 to 1000 A a.c.
Clamp CPR-500	5 to 500 A a.c.
Clamp CP-200 (M1-U)	2 to 200 A a.c.
Clamp CP-100 (M1-U)	1 to 100 A a.c.
Clamp CP-5	50 mA to 5 A a.c.

NOTE: It is advisable to measure near of full scale value to get better accuracy.

1.4.- Operation instructions

The **AR5** is a programmable instrument so offering diverse operation modes which can be selected from the available programming menus (8.-PROGRAMMING THE AR5).

Please read carefully the paragraphs involving **STARTING UP (6.-) AND PROGRAMMING (8.-) THE AR5** in order to select the most suitable operation mode for your requirements.

2.- ANALYZER MAIN FEATURES

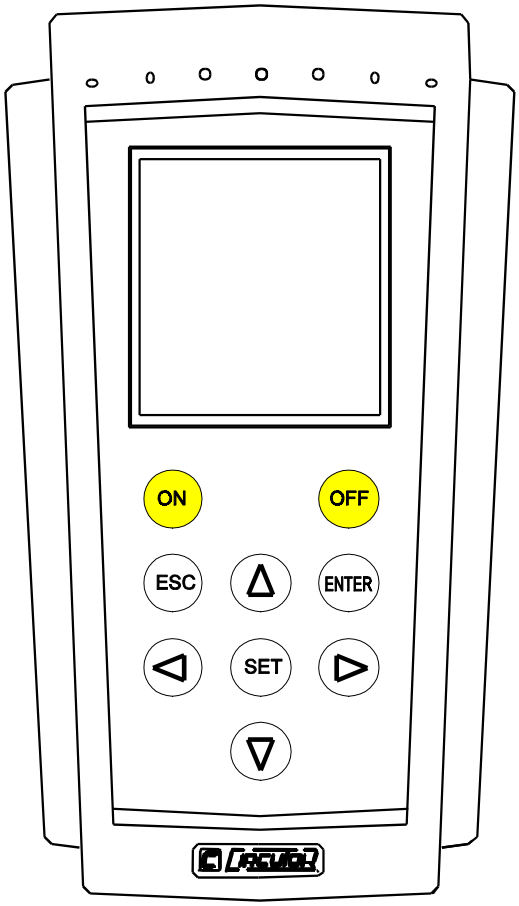
2.1.- Basic features

The AR5 series analyzers are programmable instruments that **measure, calculate and store to memory** the main parameters of three phase electrical supply networks.

Measurement, by means of three A.C. voltage inputs and three A.C. current inputs (through ... /2 V a.c. current clamps), that permit a simultaneous analysis of voltage, current and active power, always for the three phases, as well as the frequency, in a certain supply network.

Calculation, by means of an internal processor that calculates the rest of electrical parameters such as the power factor, inductive or capacitive reactive power of the three phases, as well as the active and reactive (inductive and capacitive) energies.

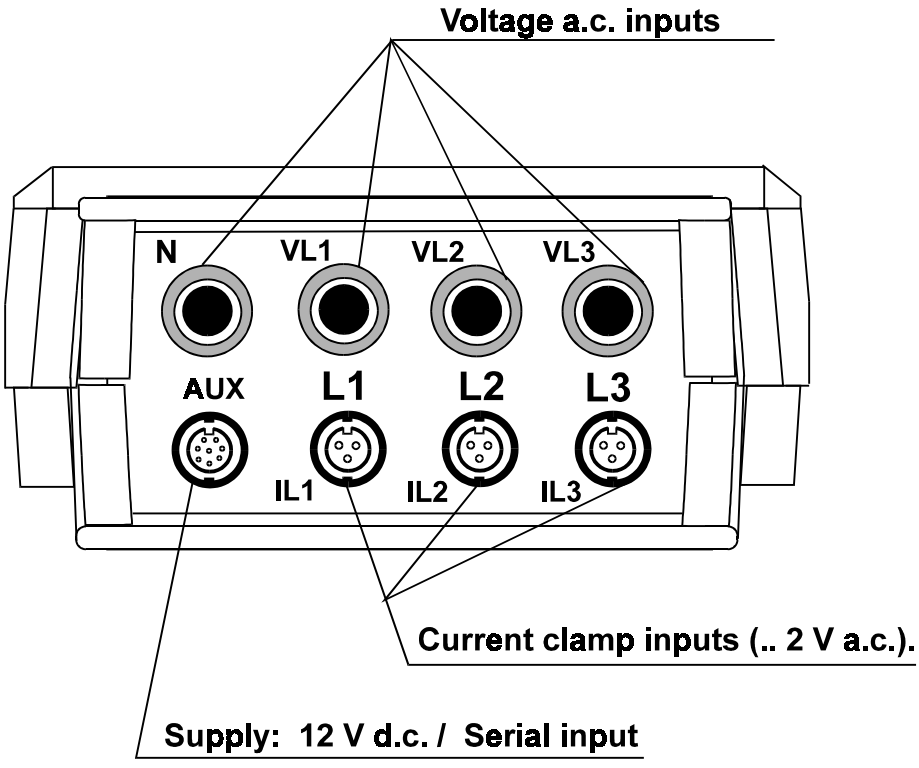
Data collection in an **internal memory** (**256 kbytes or 1 Mbytes according to the model)** for a further downloading to a PC. Measured and calculated data are periodically saved on that memory at user-defined time intervals (from 1 s to 4 h).



Other features:

- **LCD graphic display** (160 x 160 pixels) that permits the visualization of **instantaneous, maximum and minimum** values of all the parameters and for each phase.

- **Membrane type keyboard** with 9 keys to perform controlling and setting actions over the diverse operation modes of the instrument.



3.- OPERATION MODES

Analyzers series ***AR5*** are equipped with a membrane type keyboard that permits, by means of menus, to select among the diverse operation and result displaying modes delivered by the AR5 (PROGRAMMING THE AR5).

The most remarkable operation modes are listed below:

- Standard mode with measurement and recording in memory of average values of main electrical parameters.
- Possibility of **setting a recording threshold**, thus only data for values higher or lower that the defined thresholds are stored to memory.

3.1.- MEASURED AND CALCULATED PARAMETERS

3.1.1.- Single instantaneous values (L1, L2 & L3).

- Single VOLTAGE of the three phases, RMS value: V1, V2, V3.

  Vn = Vrms = $\sqrt{\frac{1}{T}\int u(t)^2 dt}$; [Vrms = $\sqrt{\frac{1}{N}\cdot\sum_1^N (u)^2}$]

- CURRENT of the three phases, RMS value: I_1, I_2 & I_3.

  In = Irms = $\sqrt{\frac{1}{T}\int i(t)^2 dt}$; [Irms = $\sqrt{\frac{1}{N}\cdot\sum_1^N (i)^2}$]

- ACTIVE POWER of the three phases: P1, P2 & P3.

  Pn = $\frac{1}{T}\int u(t)\times i(t)\cdot dt$; [P = $\frac{1}{N}\cdot\sum_1^N u\cdot i$]

- COS PHI (of the three phases): PF1, PF2 & PF3.

  PFn = $\frac{Pn}{Irms\cdot Urms}$

- REACTIVE POWER of the three phases: Q1, Q2 & Q3 (inductive & capacitive). Value measured with the current signal 90º shifted related to the voltage.

  Qn = $\frac{1}{T}\int u(t)\times i(t+\pi/2)\cdot dt$

- FREQUENCY: F (Hz) is measured over the voltage phase L1.

3.1.2.- Three phase instantaneous values

- Average VOLTAGE of the three phases: $Vavg = \frac{Urms1 + Urms2 + Urms3}{3}$

- Average CURRENT of the three phases: $Iavg = \frac{Irms1 + Irms2 + Irms3}{3}$

- Total three phase ACTIVE POWER: $Pt = P1 + P2 + P3$

- Three phase POWER FACTOR:

$$PFavg = \frac{Pt}{St} = \frac{P1 + P2 + P3}{Ims1x\ Vrms1 + Irms2 \times Vrms2 + Irms3 \times Vrms3}.$$

- Total three phase REACTIVE POWER: Qt (inductive & capacitive).
  $Qt = Q1 + Q2 + Q3$

- ENERGY: - ACTIVE : kWh
  - Inductive REACTIVE : kvarLh
  - Capacitive REACTIVE : kvarCh

4.- Data recording in MEMORY (Automatic mode).

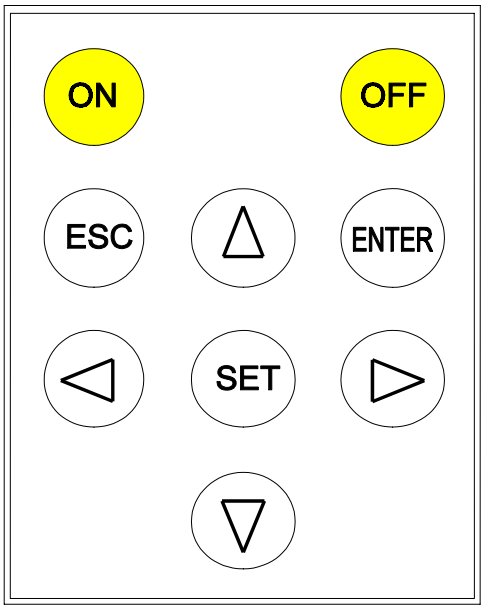
The ***AR5*** is equipped with an internal clock for both date and time that permits to program the automatic data recording in memory (available capacity according to the model) at regular time periods.

Data format in memory and main features of available data management software are detailed in the software user's guide.

Choice of recording period and the need of this action will depend on the previously programmed parameters (Section 8.1.2.-*RECORD Menu*).

5.- KEYBOARD FUNCTIONS

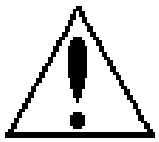
The ***AR5*** analyzers has a 9 buttons keyboard to perform configuration and control actions of all the instrument options.



- **[ON]** to turn the AR5 on.
- **[OFF]** to turn the AR5 off
- **[▼]**, **[▲]**, **[►]** & **[◄]**. To select among several options.
- **[SET]** to access setting options.
- **[ENTER]** to validate a setting option or to program some parameters of the visualization screens.
- **[ESC]** to select different visualization screens or to exit the setting actions.

However, ***most of keys are double-functional***: The own instrument understands the meaning of the order at each case.

6.- Installation AND STARTUP



The manual you hold in your hands contains information and warnings that the user should respect in order to guarantee a proper operation of all the instrument functions and keep its safety conditions.

Whether the instrument is not used according to manufacturer's specifications, the protection of the instrument can be damaged. Note that with the instrument powered on, cover opening or elements removal actions may allow accessing dangerous parts. Therefore, before any adjustment, replacement, maintenance or repairing operation is carried out, the instrument must be disconnected from any power supply source.

When any protection failure is suspected to exist, the instrument must be immediately put out of service. Contact then with a qualified service representative.

6.1.- Starting the AR5 analyzer up

Before connecting the instrument to the mains, please consider following points:

1) Supply voltage: 230 V a.c. +15 % / -15 %, 50... 60 Hz.

The instrument must be energized by a supply circuit with protection earth terminal.

2) Maximum input voltage at the voltage measuring circuit:
   - ☑ 500 V a.c. phase-neutral
   - ☑ 866 V a.c. between phases

Use always the voltage leads factory-shipped with the instrument.

3) Burden: 8 VA.

4) Operation conditions:

   - Operation temperature: 0º to 50ºC.
   - Operation humidity: 25% to 75 % RH.

5) Safety : Designed to meet protection class II as per EN 61010.

6) Current measuring range: according to the ammeter clamp used

Clamp CP-2000-200	20 to 2000 A a.c. (switch at 2000) 2 to 200 A a.c. (switch at 200)
Clamp CPR-1000	10 to 1000 A a.c.
Clamp CPR-500	5 to 500 A a.c.
Clamp CP-200 (M1-U)	2 to 200 A a.c.
Clamp CP-100 (M1-U)	1 to 100 A a.c.
Clamp CP-5	50 mA to 5 A a.c.

To start measurement works with the analyzer:

7) Connect to the main 230 V a.c./ 12 V d.c., Code. 7 71 351, with the factory-shipped cables. Also connect the protection earth terminal to avoid possible disturbances over the analyzer.

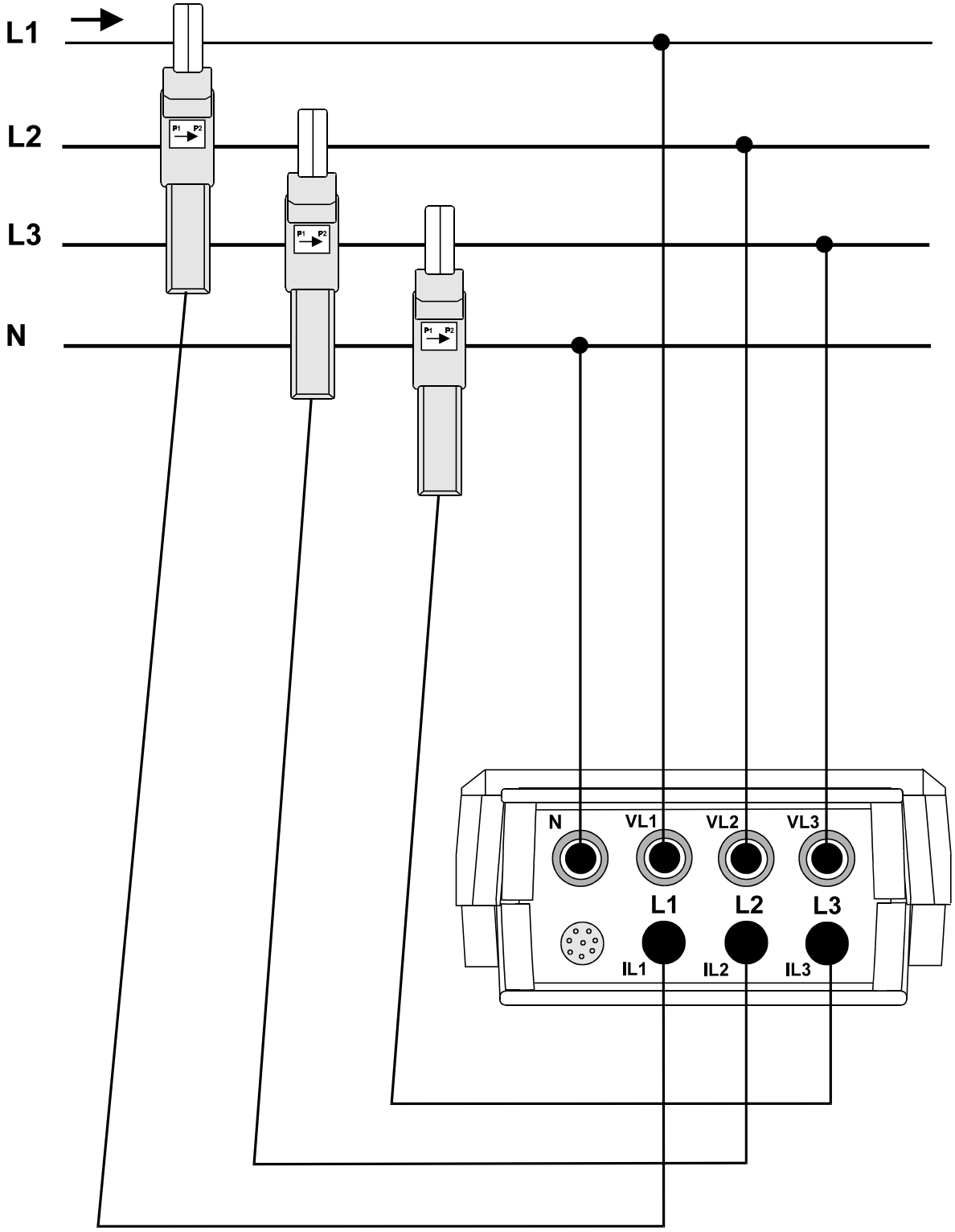
8) Connect the voltage leads at each phase of the monitored system, as well as the neutral whether it exists.

9) Connect the ammeter clamps at each phase conductor. Each current phase must coincide with its voltage phase.

10) Respect the connection modes shown at each diagram to correctly achieve powers, P.F. and energies readouts.

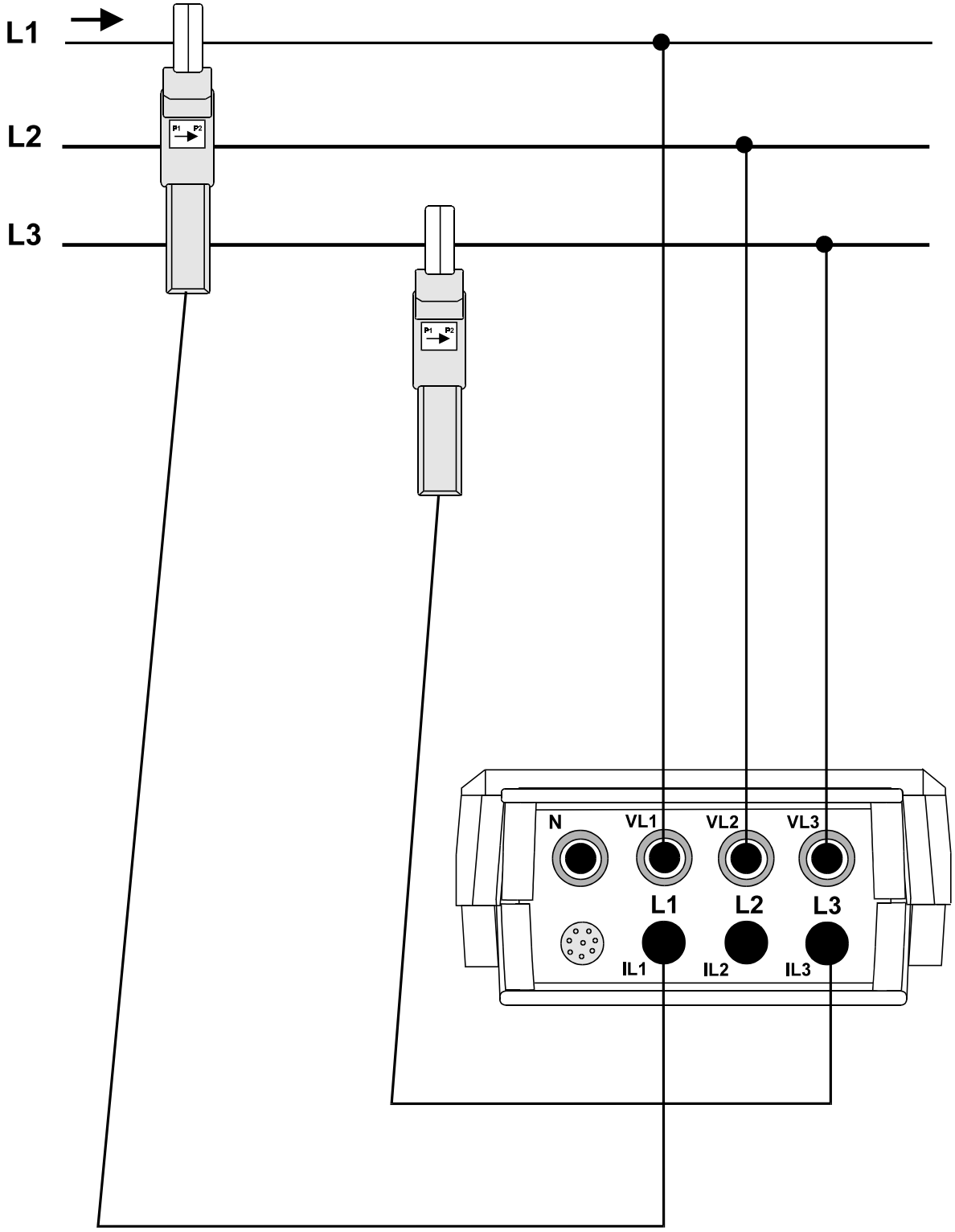
A.- THREE PHASE MODE CONNECTION DIAGRAM

(SET ---> SETUP ---> MEASURE ---> CIRCUIT ---> TRIFA)



B.- ARON MODE CONNECTION DIAGRAM

(SET ---> SETUP ---> MEASURE ---> CIRCUIT ---> ARON)



To turn the instrument on:

11) Press the switch **<ON>** at the analyzer frontal cover. The AR5's introduction screen appears. The user can now select the operation mode program for the AR5.

12) After some seconds, a screen allowing the choice of the AR5 program to be used is shown up.

13) After some seconds the principal electrical parameters of the network are displayed.

NOTE : Whether nothing is shown on display, a discharged battery or any problem with the display contrast might exist. (See section A.-*TROUBLESHOOTING*).

Initial considerations after the analyzer startup:

- Format the memory if necessary (see section 8.4.-*FILES menu***)**.

- Clear maximum & minimum values as well as energy counters if necessary (see section 8.5.-*CLEAR menu: Deleting data*).

- Open a file with the desired name (see section 8.1.2.3.-*NAME: recording file name*). All data will be automatically saved in this file until a new one is opened. The analyzer internal memory can contain several files (different analysis).

Warning :

Take into account that when the memory is formatted all previously stored data is lost. When opening a new file (a different name that the previous one) the internal memory is not deleted.

When starting new measurements at any installation **the meter programming** must be checked and modified if necessary (following steps attached at Section 8.-*PROGRAMMING THE AR5*). Otherwise, the AR5 will work according the last used program (this is saved in memory even after powering the meter off). **Points to be mainly checked would be:**

- Ratio of ammeter clamps (see section 8.1.1.2.-)
- Voltage transformer ratio (see section 8.1.1.2.-)
- Recording period (see section 8.1.2.1.-)

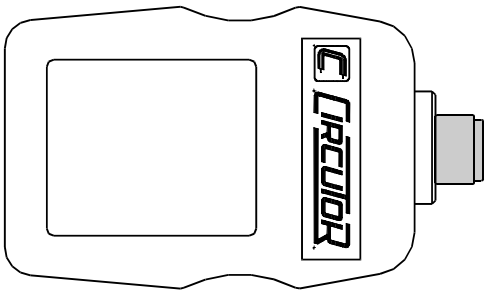
6.2.- Loading a new program

The AR5 has an internal memory to save diverse operation mode programs to be used by the user.

Before initiating this procedure, check than the AR5 battery is charged. Loading program action cannot be done whether the power supplier set is connected to the AR5, since the cartridge is to be connected to the input also used to connect the power supplier set.

To load any program, follow these instruction precisely:

- Turn the meter off.
- Connect the cartridge to the *AUX* input of the meter.
- Turn the meter on.
- Select with the keys **[▲]** & **[▼]** that you want to perform a program loading action (LOAD PROGRAM). Press **[ENTER]** or wait for a while to confirm this operation.
- Select the position to save the program into.
- The AR5 will perform a test to check that the cartridge has been properly connected.
- If an inserted cartridge is detected, then the program will be loaded.
- Once the loading is completed, reset the meter.
- If no cartridge was found or a loading mistake occurred, reset the meter and redo the above steps.



A cartridge will be only valid for the analyzer which the program was for the first time loaded into.
Note on the cartridge the serial number of its related AR5.

6.3.- Choice of the working program

The AR5 can hold in memory different operation mode programs. The choice of the program to be used is done when starting the meter up.

- Turn the AR5 on.
- A list of available programs will be shown on display.
- Use keys **[▲]** & **[▼]** for the choice of the desired program.
- Press **[ENTER]** or wait for a while to confirm this operation.

CHECK THE SETUP UP !!!!

All programs have an independent setup, therefore, the setup must be always check to ensure a proper operation.

For instance, whether the setup is modified at the “ANALYZER” program, these modification will not be valid for the “HARMONIC” program, and so for any program.

6.4.- Recharging the AR5 analyzer battery

The AR5 is equipped with an intelligent energy charging system. This means that the instrument continuously checks in an automatic way the state of the battery, thus the charging process stops when the battery is at its maximum charge level. The span life of the battery is so increased.

To enable the battery charging proceed as follows:

- Connect the power supplier set to the main.
- Connect the AR5 to the power supplier set.
- Turn the AR5 on by pressing button **[ON]**.

Provided the analyzer is connected to the main through the power supplier set, the battery is self-recharging.

If the battery is exhausted, the charging process should last at least 3 hours with no interruption; although a charging period of 16 hours is advisable in order to completely charge the battery.

The AR5 shows on screen a battery charge indicator:

NOTE: *The battery charge is only used while the AR5 is turn on.*

6.5.- Energy saving

The AR5 has an energy saving system. So, if no key is pressed for at least 5 minutes, the display is automatically off. The analyzer continues the recording data process but nothing appears on display.

The display will be automatically on when any key[1] is pressed.

[1] Keys that light the display on are: **[◄],[►],[▲],[▼],[SET],[ENTER] y [ESC].**
The key **[ON]** has no effect
The key **[OFF]** turns the meter off without lighting the display

7.- DATA VISUALIZATION ON DISPLAY

All measured instantaneous values, as well as maximum and minimum, can be read on a 160 x 160 pixel, liquid, crystal display.

An indication of the type of data being displayed is shown at the upper right corner.

7.1.- Base screen

7.1.1.- Screen of instantaneous values

When powering the AR5 on, the display will show:

AR5 ANALYZER

INST	L1	L2	L3	III
Vp-n	220	221	223	221
A				
kW				
kvarL				
kvarC				
P.F.				
Hz				
kVA				

kWh 0.000
kvarhL 0.000
kvarhC 0.000

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Voltage : Readout of the instantaneous RMS value measured at each phase (L1, L2 & L3) and the average value of the instantaneous values of the three phases (III).

Voltage measurement can be performed:

- Directly (at low voltage systems) from 20 to 866 V (R.M.S.) between phases, or from 20 to 500 V (R.M.S.) between phase and neutral.
- Through voltage transformers (user-programmable V.T. ratio: section 8.1.1.2.-*TR.REL : Transformer ratios*).

Readouts are auto-scaled. Units are **V** or **kV,** as convenient.

Current : Readout of the instantaneous RMS value measured at each phase (L1, L2 & L3) and the average value of the instantaneous values of the three phases (III).
Current measurement can be performed:

a) Through appropriate ammeter clamps
b) Through the secondary output of current transformers by always using a 5 A a.c. / 2 V d.c. shunt .

For a correct current measurement with the ***AR5,*** the ratio of the clamps (or transformers) used for the current signal capture must be set. Do it just setting the

rated primary current, as the secondary one is always set at 2 V a.c.(section 8.1.1.2.-*Transformer ratios*).

The measuring range will depend on the clamp used at each case. Units are always **A**.

Active power: The active power is calculated from instantaneous voltage and current data. The readout gives the instantaneous values of the active power of each phase and also the three phase total instantaneous active power, which is the addition of each phase value.

Inductive reactive power: The inductive reactive power is calculated from instantaneous voltage and current data. The readout gives the instantaneous values of the inductive reactive power of each phase and also the three phase total instantaneous inductive reactive power, which is the addition of each phase value.

Capacitive reactive power: The capacitive reactive power is calculated from instantaneous voltage and current data. The readout gives the instantaneous values of the capacitive reactive power of each phase and also the three phase total instantaneous capacitive reactive power, which is the addition of each phase value.

Power factor : Readout of the power factor of each phase and the three phase average value.

Frequency : Readout of the instantaneous value of the frequency (Hz).

Apparent power : Readout of the three phase total instantaneous apparent, which is the addition of each phase value.

Energies:
Readout of the instantaneous value of the active energy accumulated.
Readout of the instantaneous value of the inductive reactive energy accumulated.
Readout of the instantaneous value of the capacitive reactive energy accumulated.

All above energies are measured from **the moment when counters were reset to zero.** (8.5.-*CLEAR menu: Deleting data*). After powering the AR5 off, energy values are keep on memory for more than 60 days (internal battery, RAM memory).

Time and Date. (time/date): Readout of present time and date. For any modification, see section 8.1.4.-*CLOCK: Internal clock*.

The clock is hold even though the analyzer is powered off thanks to an internal rechargeable battery.

7.1.2.- Screen of maximum and minimum values

AR5 ANALYZER

MAX	L1	L2	L3	III
Vp-n	220	221	223	221
A				
kW				
kvarL				
kvarC				
P.F.				
Hz				
kVA				

kWh - 0.000
kvarhL - 0.000
kvarhC - 0.000

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Screen of maximum values

An indication of the type of data being displayed is shown at the upper right corner: INST (Instantaneous), MAX (Maximum) or MIN (Minimum).

Maximum and minimum values displayed correspond to the maximum and minimum values obtained from the instantaneous values.

The negative energy counters are then displayed in place of positive energies.

7.2.- Other visualization screens

Through the key **[ESC]** other additional screens can be displayed.

7.2.1.- Visualization of 3 parameters in a big size mode

Three instantaneous parameters of your choice can be bigger-size displayed for a clearer reading.

INST AR5 ANALYZER	
Vp-n L1	**220**
Vp-n L2	**221**
Vp-n L3	**224**
25 / 06 / 95 17 : 31 : 29	

NOTE : *The 3 parameters to be displayed can be selected as follows:*

a.- Pressing: ***SET --> DISPLAY -->OPTIONS ---> MEASURE ---> EXPAND.V***

b.- Directly pressing ***[ENTER]****:*

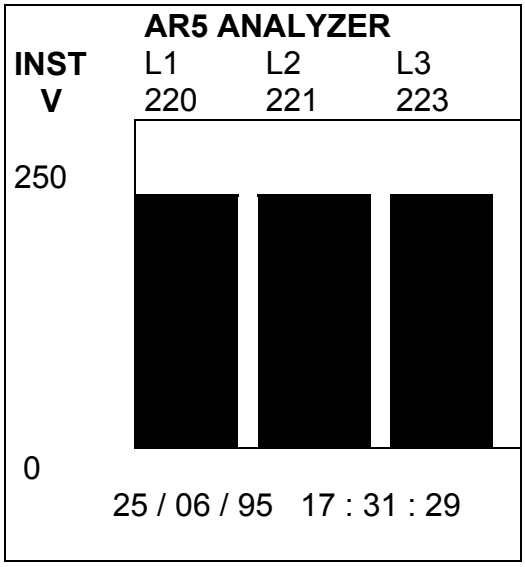
To modify:

- *Select with the keys* ***[▼], [▲], [▶]*** *or* ***[◀]*** *the desired parameter and press* ***[SET]*** *to validate the choice.*
- *Select "CLEAR ALL " on display +* ***[SET]*** *to clear all parameters.*
- ***[ENTER]*** *to validate the choice or* ***[ESC]*** *to exit with no modification.*

Only three parameters can be selected at once.

7.2.2.- Bar graphs

Simultaneous graphic representation on display of the three phases (L1, L2 & L3) of the selected parameter.



NOTE : *Both the parameter to be displayed and the graphic scale can be selected as follows:*

a.- Press: ***SET --> DISPLAY -->OPTIONS ---> MEASURE ---> BAR.GR.V***

b.- Directly pressing ***[ENTER]****:*

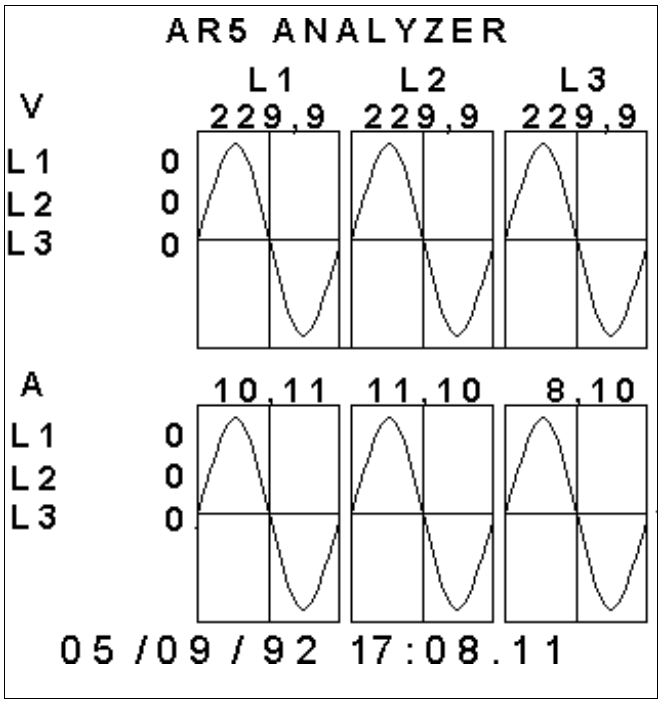
- Select with keys ***[▼]*** *or* ***[▲]*** the desired parameter: *Vp-n, Vp-p, kVA, Hz, PF, kvarC, kvarL, kW* & *A.* Press ***[ENTER]*** to validate the choice.

- Set the scale offset (ZERO SCALE) with keys ***[▼], [▲], [►], [◄], [SET]*** & press ***[ENTER]*** to validate the operation.

- Set the full-scale value (FULL SCALE) with keys ***[▼], [▲], [►], [◄], [SET]*** & press ***[ENTER]*** to validate the operation.

7.2.3.- Oscilloscope

The display concurrently shows the wave forms of voltage and current of each phase (L1, L2 & L3).



- Above each wave form the R.M.S. values of the captured cycle are shown, both for the voltage and the current waves.

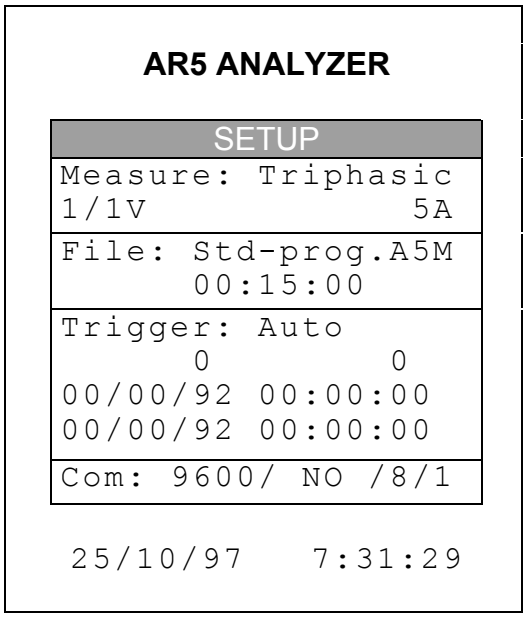
- Pressing ***[ENTER]*** a new wave form is captured.

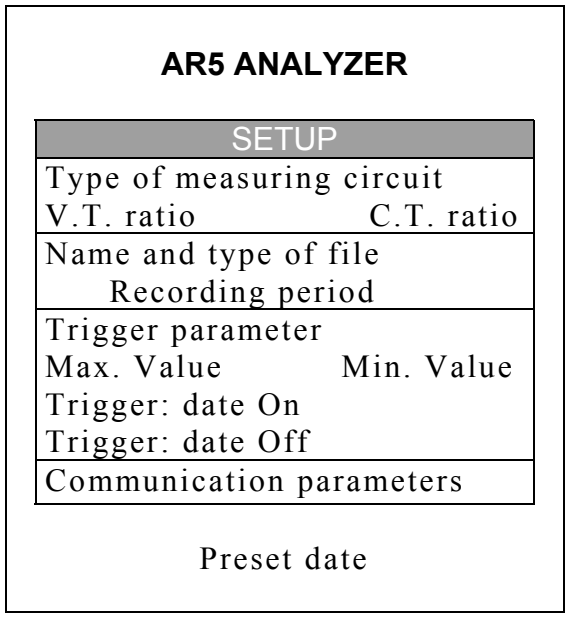
- Keys ***[▸]*** & ***[◂]*** permit moving the cursor across the horizontal axis, and the instantaneous values of voltage and current are shown for each point.

7.2.4.- Setup visualization

This screen permits to check all Setup parameters in the analyzer.

The screen on the left is the one shown on the analyzer's display. The screen on the right explains the meaning of each term.





7.3.- Warning messages

Some warning messages can appear at the visualization screens. These messages inform about the AR5 performance:

- **STOP**: The analyzer is not recording data.
- **TRIG**?: Trigger conditions are not met. No data is being recorded.
- **M. Full**: Memory is full.
- **M.Error**: There is an error in the memory. The memory must be formatted.
- Analyzer's battery status. Notice than when only one bar is shown, the analyzer's battery is very low and this can be powered off at any moment.
- **WARNING MAX 500 V**: The maximum allowable phase to neutral voltage of 500 V has been exceeded during the measuring process. When measuring phase to phase voltages the limit is set at 866 V.

8.- PROGRAMMING THE AR5

To accessing AR5 setup options press the key **[SET]**. The analyzer will then inquiry for a password that consists of a key sequence to be pressed (the user has 15 seconds to press this sequence):

PASSWORD
[◄] [SET] [▲] [SET]

Once this password is entered, the analyzer will permit the user to modify any Setup parameters.

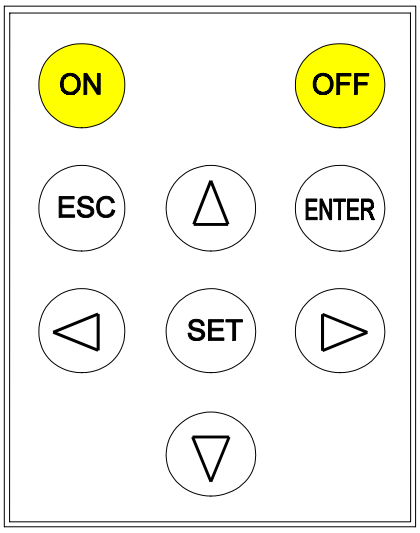
All programs have an independent setup, therefore, the setup must be always check to ensure a proper operation, since any modification will only affect the active operation program.

Diverse setting MENUS are available:

SETUP
DISPLAY
RUN
FILES
CLEAR

☜ INITIAL MENU

- Select one option with keys **[▼]** & **[▲]**.
- To access any menu option use **[►]** or **[ENTER].**
- To close the menu press **[◄]** or **[ESC]**. If this key is used when only the main menu is open, this is closed. Whether any modification over any setup parameter was done, before closing a confirmation of setup change is requested on display.



8.1.- SETUP menu

The ***AR5*** *meter* can be user-configured to different performances involving its data analysis and recording modes, as it is followed shown:

SETUP
➡ MEASURE
RECORD
COMM
CLOCK
RECALL

☜ SETUP menu.

MEASURE	
➡	CIRCUIT — Three phase, ARON.
	TR.REL — C.T and V.T ratios.

RECORD	
➡	PERIOD — hh:mm:ss (1 s to 4 h).
	TRIGGER — Level, Time.
	NAME — File name (8 characters).
	TYPE — File type: Standard or Special.
	PARAM — Special file parameters.

COMM	Baud / Parity / Bits / Stop bits.

CLOCK	DD/MM/YY hh:mm:ss.

RECALL	Standard. Recall Setup sure <yes > <no>.

8.1.1.- MEASURE

Measuring conditions are set at this option: **PROGRAMMING THE CONNECTION TYPE (THREE PHASE or ARON) and C.T. and V.T. RATIOS**

	MEASURE :	
➡	CIRCUIT	Three phase, ARON.
	TR.REL	Prim. V, Secon. V, Prim. I

8.1.1.1.- CIRCUIT: Circuit type

Choice among a THREE PHASE or ARON system (rotary input).

8.1.1.2.- TR.REL : Transformer ratios

V.T. and C.T. are here programmed:

	TR.REL :	
➡	REL. V	Primary and secondary voltage values
	REL. A	Primary current value

- REL. V: Voltage transformer ratio. The primary voltage is firstly asked, and then the secondary voltage.
- REL. I: Ammeter clamp primary.

NOTE 1 : *If voltage is directly measured (no voltage transformer is used), you must set PRIM.V = 1/SECV.V = 1.*
NOTE 2 *: REL. I --> This option permits to program:*

a) *The ratio of the ammeter clamp to be used.*
b) *In case of a high voltage system, the measurement will be carried out through the secondary of current transformers. A shunt ATS-III 5 A a.c./ 2 V a.c. or CP5 clamp will be then required to enter the measurement signal into the* ***AR5*** *analyzer (Never directly connect the 5 A signal to the* ***AR5****.). For this case, the C.T. primary must be set at the primary value of the C.T. used for measuring purposes.*

Ratio set must be modified for each ammeter or transformer type change to avoid measurement mistakes. Standard clamps give a voltage output (generally 2 a.c. at full-scale).
NOTE : *Secondary is always set at 2 V a.c. (it is not user-programmable).*

*- **Example:** We have a clamp type CP-2000-200 / 2 V set at the 2000 A scale. The programming process from the visualization screen would be perform by pressing the next key sequence: SET + SETUP + MEASURE + TR.REL + PRIM.I*
Once in this section: 2 + SET + 0 + SET + 0 + SET + 0 + SET + ENTER (to validate).

8.1.2.- RECORD menu

The recording conditions are here user-programmed:

RECORD	
➡ PERIOD	hh:mm:ss (1 s to 4 h).
TRIGGER	LEVEL, TIME.
NAME	File name (8 characters).
TYPE	File type: standard or special.
PARAM	Parameters stored by the AR5 when selecting an special File

8.1.2.1.- PERIOD: recording period

All values measured by the AR5 can be periodically saved in memory. The recording period (time period between each record) is user-definable.

Each record consists of the average values measured during the pre-defined period. This recording period can be from 1 s to 4 h for the standard type files (files .**A5M**).

*¡ **NOTE!** If a period longer than 4 hours is programmed, the display will show an error message during some seconds:*

- Case (a): " xx:xx OUT OF RANGE ". You must set a period shorter or equal to 4 hours.

8.1.2.2.- TRIGGER: Trigger conditions

TRIGGER
LEVEL
TIME

You can program here certain conditions (Trigger) so that values are saved in memory only when these conditions are met.

Two types of trigger conditions are available:

1) Time trigger (TIME): DATE/TIME of ON (starting measurement process), &/or OFF (ending measurement process).

2) Parameter trigger (LEVEL): you can set a **maximum** threshold (measured values must be higher) &/or a **minimum** (measured values must be lower) that define the value range within the recording actions are performed (thus, for instance, the voltage to be higher than a certain level, or the current lower than another one, etc.).

Whether the defined trigger conditions are met, the ***AR5*** stores data to its internal memory (STORE ON); and, on the contrary, no information is stored to memory (STORE OFF) and the display will show the message *TRIG?*.

- **LEVEL:**

Lets to set the trigger for a parameter, as well as its maximum and minimum range-limiting values.

- PARAM:

Choice of the parameter for the trigger condition: (rotary input).
- Select with keys **[▼]** or **[▲]** the desired parameter:
Vp-p, Vp-n, A, kW, kvarL, kvarC, PF, Hz, kVA, Auto (None).
- **[ENTER]** to validate the choice. (**[ESC]** to exit with no modification**)**

- MAX:

Set here the maximum threshold: (numeric input).
- Select with keys **[▼], [▲], [►]** or **[◄]** the desired value and press **[SET]** to validate each figure.
Select "←" on display + **[SET]** to delete a figure.
- **[ENTER]** to validate the total value or **[ESC]** to exit with no modification.

Note: the set value will be valid only if a trigger parameter was previously defined.

- MIN:
Set here the minimum threshold: (numeric input).
- Select with keys **[▼], [▲], [▶]** or **[◀]** the desired value and press **[SET]** to validate each figure.
- Select "🡐" on display + **[SET]** to delete a figure.
- **[ENTER]** to validate the total value or **[ESC]** to exit with no modification.

Note: the set value will be valid only if a trigger parameter was previously defined.

POINTS TO CONSIDER:

- *If the selected parameter is voltage, current or any power:*

1) *When setting the maximum and minimum values take into account the units:*

Parameter	Format
Voltage	V. With decimals kV ex. 230.V 230.0kV
Current	A
Power	kW

2) *The trigger condition is met when either the instantaneous value of any of the three phases (L1, L2 or L3) or the three phase value of the selected parameter is higher than the maximum or lower than the minimum (the analyzer switch from STORE OFF to STORE ON).*

Minimum *Maximum*
STORE ON <------ .....STORE OFF..... -----> STORE ON
any *any*
lower value *higher value*

- *If no TRIGGER condition is wanted, select AUTO when choosing the parameter*

- *If the frequency is selected, both the maximum and minimum values can be typed with a decimal (xx.x).*

- **TIME:**

Lets to set the time trigger, that is, to define the period to perform the data storage.

- TIME ON:

When selecting this option the present ON conditions are shown on display:

TIME .ON
00 /00 /00 00 :00 : 00

day/month/year hour:minute:second

- Pressing **[ENTER]**: ON values on display are directly validated.
- **To modify:** (rotary input).
- Select with keys **[▸]** or **[◂]** the position to modify.
- Though keys **[▾], [▴]** the value of the selected position is increased or decreased.
- **[ENTER]** to validate the total value or **[ESC]** to exit with no modification.

- TIME OFF:

When selecting this option the present OFF conditions are shown on display; and the procedure is equal to the above one.

TIME .OFF
00 /00 /00 00 :00 : 00

day/month/year hour:minute:second

POINTS TO CONSIDER:

a) To void the time TRIGGER, all values must be zero.

b) If only the ON & OFF TIME are programmed (two DATES set to zero), the defined time period will be cyclically repeated by the AR5.

ADDITIONAL NOTES:

a) The AR5 will save data in memory only when both TRIGGER conditions are met: Time (ON-OFF) and Parameter (maximum and minimum). If any condition is not met, no value is stored to memory (STORE OFF state). In case that trigger conditions are void (ON & OFF set to zero, and parameter set to AUTO), all values will be saved in memory according to the previously defined recording period.

b) If trigger conditions are met at any moment within the defined recording period, the average values for the whole period will be saved in memory.

8.1.2.3.- NAME: recording file name

Type here the file name (8 characters, no extension).

NAME
STD-PROG

- Pressing **[ENTER]**: Text on display is directly validated.
- **To modify:** (alphanumeric input).
- Select with keys **[▼], [▲], [▶]** or **[◀]** the character to modify and press **[SET]** to validate each character.
- Select "🡐" on display + **[SET]** to delete a character.
- **[ENTER]** to validate the total text or **[ESC]** to exit with no modification.

NOTES!

a) memory size: according to the file type selected:

File type	*Size of each record*
File .A5M	200 Bytes
File .A5T	4*nº par + 10 bytes

b) From above data you can calculate the capacity of any memory. For instance, a 256 kb memory permits about 1280 records when working with a file type .A5M (this would mean data for about 13.3 days with a 15 min recording period).

c) If the typed name and extension already exists in memory, when exiting setting actions, the display will show:

"Overwrite file Sure? " --> Do you really overwrite the file?

- If yes is answered, the previous file is deleted.
- If no is answered, setup menu is not exited, thus a new name can be typed for the file, or the setting actions can be cancelled.

8.1.2.4.- TYPE: recording file type.

Select here the file type wanted for the data recording actions of the AR5. With keys **[▼]** or **[▲]** choose the file type: Standard (pre-defined parameters) or Custom (user-selected parameters).

These are distinguished in memory with its extension:
- A5M standard file.
- A5T Custom file.

Custom type files have a variable length of data saving records. This length will depend on the number of parameters to be saved at each record (see section 8.1.2.5.-*PARAM: Choosing the parameters to be saved*).

File type	Record Length	Number of records	
		256k	1M
*.A5M	200 bytes	1200 rec.	5000 rec.
*.A5T	4*nºpar+10 bytes	$\frac{256000-192}{4*n^{o}\,\mathrm{var}+10}$ rec.	$\frac{1000000-192}{4*n^{o}\,\mathrm{var}+10}$ rec.

Note: If the typed name and extension already exists in memory, when exiting setting actions, the display will show:

"Overwrite file Sure? " --> Do you really overwrite the file?

- If yes is answered, the previous file is deleted.
- If no is answered, setup menu is not exited, thus a new name can be typed for the file, or the setting actions can be cancelled.

Parameters of A5M file:

Parameters	L1	L2	L3	III
Phase-Neutral Voltage	x	x	x	x
Max Phase-Neutral Voltage	x	x	x	
Min Phase-Neutral Voltage	x	x	x	
Current	x	x	x	x
Max Current	x	x	x	
Min Current	x	x	x	
Active Power	x	x	x	x
Inductive Power	x	x	x	x
Capacitive Power	x	x	x	x
Power Factor	x	x	x	x
Active Energy				x
Inductive Energy				x
Capacitive Energy				x
Frequency	x			

8.1.2.5.- PARAM: Choosing the parameters to be saved

As said before, parameters to be saved in memory are user-definable when working with Custom type files (extension .A5T - see section 8.1.2.4.-).

Note: This option does not vary the stored parameter if the selected file is a Standard type one (extension .A5M); but would modify the parameters to be stored whether a Custom type file had been selected.

- Pressing **[ENTER]** previously user-defined parameters are automatically validated.

- **To modify:**

- Place over the desired parameter with keys **[▼], [▲], [►]** or **[◄]**.
- Pressing **[SET]** the state of the parameter switches. Parameters to be saved are on a black background, and the ones to be not save are on a white background.
- Placing over the text Inst (Instantaneous values) and pressing **[SET]**, you can now select the maximum values to be saved (MAX).
- Placing over the text Max (Maximum values) and pressing **[SET]**, you can now select the minimum values to be saved (MIN).
- Press **[ENTER]** to validate the choice or **[ESC]** to exit with no modification.

Note: If values are being saved in a file A5T and the parameters to be stored are changed, when exiting setting actions, the display will show:

"Error: New file should be created"

This message is shown since the change of parameters in an already existing file is not allowed. Follow these instructions to change the parameters of a file:

1. If you want to keep the file name.
   - Stop AR5 data recording process: SET -> RUN -> Stop.
   - Exit SETUP.
   - Delete the existing file: SET -> FILES -> DELETE.
   - Modify the parameters to be saved: SET -> RECORD -> PARAM
   - Enable the AR5 data recording process: SET -> RUN -> Run
   - Exit SETUP.

2. If you want to change the file name.
   - Change the file name: SET -> RECORD -> NAME.
   - Modify the parameters to be saved: SET -> RECORD -> PARAM
   - Exit SETUP.

8.1.3.- COMM: Communication parameters

Program here the parameters of the built-in RS-232 serial output. When selecting this option the present parameters are shown on display:

```
COMM
9600    NO   8    1
```

Baud / Parity / Length / Stop bits

- Pressing **[ENTER]**: values on display are directly validated.
- **To modify:** (rotary input).
- Select with keys **[▸]** or **[◂]** the position to modify.
- Though keys **[▾], [▴]** the value of the selected position is increased or decreased.
- **[ENTER]** to validate the total value or **[ESC]** to exit with no modification.

8.1.4.- CLOCK: Internal clock

Set here the AR5 internal clock: date / time. When selecting this option the present values are shown on display:

```
 CLOCK
00 /00 /00          00 :00 : 00
```

day/month/year hour/minute/second

Proceed as for the previous section.

8.1.5.- RECALL: Read configuration

You can here recall a **standard** configuration.

```
RECALL
Reg x
```

- A confirmation is requested: “Recall Setup sure <yes> or <no>“. With keys **[▸]** & **[◂]** select yes or no, and then press **[ENTER]**.

*A “**Standard**” operation program for the AR5 is available to be user-recalled. Its features are:*

- *C.T. Ratio (SET + A) : 5*
- *V.T. Ratio (SET + V) : 1 / 1*
- *TRI/ ARON : Three phase (TRIPH).*
- *Period (SET + PERIOD) : 15 minutes*
- *TRIGGERS (Time and parameter) : All set to zero*
- *File name (FILE Name) : STD-PROG*
- *FILE type : .A5M*
- *Communication parameters : 9600,No,8,1*
- *RUN : RUN*

8.2.- DISPLAY menu

DISPLAY
➡ OPTIONS
CONTRAST

☜ DISPLAY MENU

8.2.1.- OPTIONS: Screen options

OPTIONS
➡ MEASURE
VOLT

Bar graphs, Expanded Param. (3 parameters).
Vphase-phase or Vphase-neutral (Vp-p or Vp-n).

You can at this point define the options about the parameters to be visualized on display, the graphic mode performance, ...

MEASURE --> BAR.GR.V

To determine the parameter to be graphically displayed, in addition with its scaling. Both maximum and minimum values of the graph are inquired for auto-scaling performance.

- Choice with keys **[▼]** or **[▲]**.
- **[ENTER]** to validate selection or **[ESC]** to exit with no modification.

MEASURE -->EXPAND.V

To choose three instantaneous parameters to be bigger-size displayed for a clearer reading.

- Select with keys **[▼], [▲], [►]** or **[◄]** the desired parameter, and enable or disable each one with the key **[SET]**.
- Select "CLEAR ALL " on display + **[SET]** to clear all parameters.
- **[ENTER]** to validate the choice or **[ESC]** to exit with no modification.

VOLT

This option permits the user to choice whether the voltage readout in the main visualization screen corresponds to the voltage between phases (Vp-p) or between phase and neutral (Vp-n).

- Select with keys **[▼]** or **[▲]**.
- **[ENTER]** to validate the choice or **[ESC]** to exit with no modification.

8.2.2.- CONTRAST: Screen contrast

The user can here vary the contrast of the AR5 display:

- With the **[▸]** you can intensify the display contrast and with the key **[◂]** this can be lowered:

LOW ← →HIGH %

8.3.- RUN: data recording process status

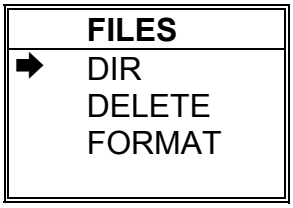
You can here enable or disable the data collection and logging action in the AR5.

- With keys **[▾], [▴]** RUN or STOP are selected.
- **[ENTER]** to validate or **[ESC]** to exit with no modification.

8.4.- FILES Menu

Non-volatile AR5 internal memory is storing data up to its maximum capacity. Once full, neither new data will not be saved in, nor stored data will be lost (provided no incorrect operation is done).

When memory is full, the display will show: ***"MEMORY FULL***".



☜ FILES MENU

8.4.1.- DIR: Directory

This option shows on display a directory of all files saved in memory.

AR5 - DIR

STD-PROG. **A5M** xxxxx bytes ☜ *File name / File size*
dd / mm / yy hh : mm : ss ***Day / Time***
TEST1. **A5T** xxxxx bytes
dd / mm / yy hh : mm : ss
STD-PROG. **A5T** xxxxx bytes
dd / mm / yy hh : mm : ss

..... / .....

Free bytes: xxxxxxxxxx ☜ *Number of free bytes in memory*

- Keys **[▼]** or **[▲]** allows reading more files in case that all files stored by the AR5 cannot be shown in only one screen.
- Keys **[ENTER]** or **[ESC]** to exit.

8.4.2.- DELETE: Deleting a file

You can here delete any file from the internal memory.

AR5 – DELETE

STD-PROG. **A5M** xxxxx bytes ☜ *File name / File size*
TEST1. **A5T** xxxxx bytes
STD-PROG. **A5T** xxxxx bytes
....

- With keys **[▼]** & **[▲]** select the file to be deleted.
- **[ENTER]** to confirm selected file erasing. Once press, a confirmation is required.
- Press key **[ESC]** to exit with no modification.

8.4.3.- FORMAT: Formatting the AR5 internal memory

This option lets the user to format the internal memory.

AR5 – FORMAT

Once the format action over the internal memory is confirmed, a confirmation is required. Take into account that this action will mean all stored data to be deleted.

Note: Do not turn the AR5 off during the memory format process, otherwise the display will show an error message and the process should be redone.

8.5.- CLEAR menu: Deleting data

	CLEAR	☜ DATA CLEARING MENU
➡	ENERGY	Erasing energy counters
	MAX/MIN	Erasing maximum and minimum values

ENERGY :

The AR5 have several energy counters which keeps their values even though the analyzer is powered off.

The ENERGY options lets the user to reset these counters to zero.

MAX/MIN:

The AR5 records in memory the maximum and minimum values of measured values. These values are kept in memory even though the analyzer is powered off.

Options MAX/MIN lets the user to clear maximum and minimum values.

9.- AR5 COMMUNICATIONS

PROTOCOL: Question / Answer

9.1.- Demand format

The demand format is: **$00CCCAA.... ch [LF] (example = $00RVI75)**
The answer format is: **$00AA.... ch [LF]**

$	Any message starts with this symbol (ASCII-36)
PP	The identification code for the portable AR5 is always 00
CCC	COMMAND
AA	ARGUMENT (decimal-ASCII)
Ch	CHECK-SUM: Check-sum of all the elements forming the message. It is calculated with the decimal addition of all the previous bytes in ASCII and translating the result to hexadecimal. **Two digits are taken**. example = $00RVI --> 36 + 48 + 48 + 82 + 86 + 73 = 373 373 decimal ≡ 175 hexad. CHECK-SUM = **75 ----> $00RVI75 [LF]**
[LF]	LINE FEED indicates the end of the message (ASCII-10)

9.2.- Commands

COM-MAND	CONCEPT	QUESTION	ANSWER
VER	Read AR5 version	$00 VER ch	$00 4 digits + ch
DIN	Number of files in memory	$00 DIN ch	$00 5 digits + ch
DIR	Directory of one file in memory	$00 DIR + 5 number of the file to be displayed + ch	$00 + 12 file name.ext + 7 num. Bytes + 17 date of file creation + ch
SZC	Ask for a file	$00 SZC + 12 file name.ext + ch	$00 initial date + end date +ch The AR5 starts to communicate under Zmodem protocol. $00 ERR00 + ch. AR5 in Setup menu. $00 ERR if file does not exist
SZP	Ask for a part of a file	$00 SZP + 12 file name.ext + initial date + end date ch	$00 ACK + ch. The AR5 starts to communicate under Zmodem protocol. $00 ERR00 + ch. AR5 in Setup menu. $00 ERR + ch. if file does not exist or initial date > end date
DIF	Consult a file content	$00 DIF 12 file name.ext + ch	$00 12 file name.ext + initial date + end date + 6 number bytes ASCII + ch

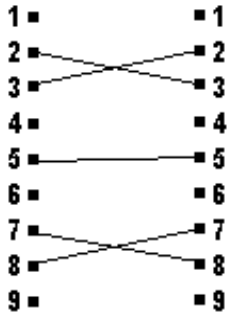
Note: The date format is “DD/MM/AA hh:mm:ss” with a 17 bytes length.

9.3.- Communication wiring

To connection to PC of the AR5 must be done through the power supplier set, which will be necessary connected to the main. Perform the connection using the two wires factory-delivered with the AR5.

One cable will link the AR5 to the power supplier set, and another cable is a standard RS232 connector.

Disposition of contacts of the factory-delivered cable is:



When starting communication tasks take into account:

- Communication parameters of the AR5 and the PC must fully coincide.
- The power supplier set must be plugged into.
- The AR5 cannot be into the setup menu.

CIRCUTOR has a software package that permits the user to retrieve stored data in the AR5 to PC for a further complete analysis.

10.- TECHNICAL SPECIFICATIONS

Supply voltage:
Through an external power supplier set 230 V a.c. (+10% / -15%)
Frequency : 50...60 Hz
Burden : 8 VA
Operation temperature : 0 / 50 ºC
Measuring circuit : THREE PHASE, ARON

Safety : Category II - 600 V, as per EN 61010

Voltage measurement:

Measuring range : 20 to 500 V a.c. (phase-neutral)
20 to 866 V a.c. (between phases)
automatic scale adjustment
Other voltages : through suitable voltage transformers
Frequency : 45 to 65 Hz

Current measurement:

Measuring range: see available current clamps
Current transducer ratio : user-programmable
Measurement units : automatic scale adjustment

Built-in clock with rechargeable battery: Date and time

Display : LCD; 160 x 160 pixels

RS-232 output : serial type output
Internal memory : 256 kbytes or 1 Mb according to the model

Accuracy class:

Voltage ..... 0.5 % of readout ± 2 digits
Current ..... 0.5 % of readout ± 2 digits
Active power ..... 1.0 % of readout ± 2 digits
Reactive power..... 1.0 % of readout ± 2 digits

Measuring conditions to assure accuracy class:
- Errors due to voltage and current transformer not included
- Temperature range : 5 ºC to 45 ºC
- Power factor : 0.5 to 1
- Measuring range : between 5 % and 100 %

MECHANICAL CHARACTERISTICS

Case : Portable case.
Dimensions : 220 x 60 x 130 mm

Connection terminals : input/output terminals
Keyboard/ display : in frontal panel
Weight: 0,8 kg.

RELEVANT STANDARDS
EN 60664,EN 610110, EN 61036, VDE 110, UL 94

EM EMISSION.

- EN 61000-3-2 (1995), Harmonics.
- EN 61000-3-3 (1995), Fluctuations de tensión.
- EN 50081-2 (1993), Industrial emission:
  - EN 55011 (1994): Conducted (EN 55022 - Clase B).
  - EN 55011 (1994): Radiated (EN 55022 - Clase A).

EM IMMUNITY.

- EN 50082-2 (1995), Industrial immunity.
  - EN 61000-4-2 (1995), ESD.
  - ENV 50140 (1993), EM Radiated field of RF.
  - EN 61000-4-4 (1995), EFT burst.
  - ENV 50141 (1993), RF common mode.
  - EN 61000-4-8 (1995), 50 Hz H-field.
- EN 50082-1 (1997), Residential Immunity.
  - EN 61000-4-5 (1995), Surges.
  - EN 61000-4-11 (1994), Dips, Interruptions.

(as shown in the test report reference number: 08077IEM.002)

STANDARD SET (CODE 7 71 301)

- AR5 supply network analyzer
- Power supplier set 230 / 12 V
- 1 Connection cord between the power supplier set and the mains.
- 1 Connection cable between the AR5 and the power supplier set.
- 1 RS-232 communication cable.
- 4 voltage leads (2 m long)
- 4 Alligator clamps
- Instruction Manual
- 3.5” floppy disks with the demo version of the PC program

ACCESSORIES

- Current measurement:

a) Through ammeter clamps:

¨ CP-2000-200 ..... CODE. 7 71 361
¨ CPR-1000 ..... CODE. 7 71 363
¨ CPR-500 ..... CODE. 7 71 365
¨ CP-100 (M1-U) ..... CODE. 7 71 367
¨ CP-5 ..... CODE. 7 71 369

b) Through a ATS-5 shunt (5 A / 2 V a.c.) + current transformers (../5 A)

- carrying case for AR.5 ..... CODE 7 71 376
- carrying case for AR.5 current clamps... CODE 7 71 005

- Software AR5

11.- SAFETY WARNINGS

The user should take into account all installation instructions referred in sections INSTALLATION AND STARTUP, CONNECTION INSTRUCTIONS and TECHNICAL SPECIFICATIONS of the analyzer.

Note that with the instrument powered on, the terminals could be dangerous to touching, and cover opening or elements removal actions may allow accessing dangerous parts. The analyzer has been designed and tested to meet IEC 348 standard and is factory-shipped in proper conditions.

12.- MAINTENANCE

The ***AR5*** does not require any special maintenance. No adjustment, maintenance or repairing actions should be done over the instrument open and, should those are essential, high-qualified operators must perform them.

Before any adjustment, replacement, maintenance or repairing operation is carried out, the instrument must be disconnected from any power supply source.

When any protection failure is suspected to exist, the instrument must be immediately put out of service.

The own instrument design permits a quick replacement in case of damage.

13.- TECHNICAL SERVICE

For any inquiry about the instrument operation mode or in case of malfunction, you can contact CIRCUTOR S.A.'s technical service.

CIRCUTOR S.A. - Aftersales Service
Lepanto, 49
08223 - TERRASSA (SPAIN)
Tel: (+34) 93 745 29 00
Fax: (+34) 93 745 29 14

e-mail: ar5@circutor.es

A.- TROUBLESHOOTING

Some problems can cause the AR5 not to correctly function. This section lists some symptoms and explains how to correct them.

1) The AR5 does not turn on.

The display contrast might be improperly set:

- Turn the AR5 on. A click should sound when starting up
- With for 15 s.
- Press **[▸]** during 30 s or until something is shown on display.
- If nothing appears, press **[◂]** during 30 s or until something is shown on display.

The AR5 battery could be low.

- Power the AR5 through the power supplier set.
- The green light on the power supplier set top is on.
- Check supply cord conditions.

If the battery is suspected to be damaged:

- Remove the AR5 bottom cover and disconnect the battery.
- Turn again the AR5 on.

2) When disconnecting the power supplier set the AR5 does no function

This means that the AR5 is correctly functioning but the battery is not recharging itself. To find this malfunction motive out:

- Remove the AR5 bottom cove and check that the cables linking the battery to the AR5 are in proper conditions.
- If cables are well, the battery is probably damaged.

3) The AR5 does not store data to memory

This is a common situation. Possible causes might be:

- The AR5 data collection option is disabled. The message *STOP* can be read at the bottom of the screen. Select *RUN* through menu SET -> RUN.
- Memory is full. The message *M.FULL* can be read at the bottom of the screen. Some files in memory should be deleted.
- Memory error. The message *M.ERROR* can be read at the bottom of the screen. The memory must be formatted.
- Trigger conditions are not met. The message TRIG? can be read at the bottom of the screen.

To solve above situations see:

- M.Error message
- TRIG? message
- STOP message

4) ***M.Error* message**.

Possible causes for this message might be:

- The memory format process is interrupted.
- The battery is totally discharged.

For both cases, memory should be formatted.

Remove the AR5 power supplier set is the message for low battery is shown and recharge de battery.

5) **TRIG? message**.

No information is being saved since the trigger conditions are not met.

- Check the AR5 set date.
- Check the parameter trigger conditions. If no condition is required, this option must be set at AUTO.
- Check the time trigger conditions, that is, *Time ON* and *Time OFF*. If no condition is required, but *times* must be set at 00/00/00 00:00:00.

6) **STOP message**.

The AR5 data collection process is disabled.
To store data set the option SET -> RUN at *RUN*.

7) **Maximum and minimum values are not correct**

Possible causes for this error might be:

- Previously stored maximum and minimum values were not user-deleted.
- Any C.T. or V.T. ratio was modified.

It is deeply recommended to delete maximum and minimum values after checking the AR5 programming once the wiring connection of the meter is completed.

8) **Energy counter readouts are not correct**

Possible causes for this error might be:

- Energy counter values of previously measurements were not user-deleted.
- Any C.T. or V.T. ratio was modified.
- Any energy counter exceeded the maximum value 999999,999 kW and the accumulation started again from 0.

It is deeply recommended to delete energy counters values after checking the AR5 programming once the wiring connection of the meter is completed.

9) **The AR5 does not measure frequency**

Frequency measurement if perform through the V1 signal. Check following points:

- The voltage lead at V1 is properly connected to both the AR5 and the monitored system.
- Check that a signal exists at this line
- The cable is in right conditions.

10) **The AR5 configuration was not saved**

Possible causes for this error might be:

- The setup option was exited by pressing **[ESC]** when the confirmation was requested.
- The modified option was exited by pressing **[ESC]**
- The AR5 was turn off before exiting the setup option.

11) **The AR5 does not communicate**

If the AR5 does not communicate with the PC software, check the following points:

- The AR5 must be powered on
- The power supplier set is connected to main. The green light at the power supplier set top is on.
- The AR5 is connected to the PC through the power supplier set.
- El AR5 must be at any visualization screen (main screen , graphs, oscilloscope,...), but not at any setup or transmission screen.
- Communication parameters of the AR5 and the PC must fully coincide.
- The communication port set in PC must physically correspond to the one the RS232 communication cable is connected to.
- Check communication cables (Section B.-CABLE DISPOSITION).

12) **Some errors occur during communication and data transfer is not completed.**

Check that no communication cut happened during data transfer process. So, proceed as follow:

- Check that the power supplier set is turn on.
- Check that the communication cable between the PC and the power supplier set is still connected.
- Check that the communication cable between the power supplier set and the AR5 is correctly connected.
- Check that the AR5 is at any visualization screen.
- Check communication cables (Section B.-CABLE DISPOSITION).
- Check that the power supplier set cord properly functions.

13) **Readout are out of range**

Check following points:

- The voltage transformer ratio is correct. This must be set at 1/1 whether the voltage is directly measured from the monitored system. If the measurement is done through voltage transformer, the analyzer ratio must be set at the voltage transformer ratio.
- Current transformer ratio must be set at the full scale value of the ammeter clamp used for the measurement.
- The ammeter clamp is saturated. A current higher than the rated maximum current of the clamp is measured.

14) **Readouts are lines instead of figures**

Measurements are out of range.

- Check set transformer ratios.

15) **Current readouts are shown in lines where no clamp is connected to**

This is provoked by a saturated clamp, since the measured current is higher than the maximum rated current of the clamp.

16) **Voltage units are not correct**

Check voltage transformer ratio setting:

- For a direct measurement from the monitored system, ratio must be set at 1/1, 220/220 ...
- If the measurement is done through voltage transformer, the analyzer ratio must be set at the voltage transformer ratio.

17) **Energy counters does not accumulate energy readings**

- The energy measured by the meter is negative. These values are not accumulated in the positive energy counter.

18) **Signs of power readout and energy counters are not correct**

Check the proper phase relationship between voltage and current:

- An arrow in the clamp indicates the right current direction.
- Each current phase must coincide with its voltage phase.

19) **When deleting an AR5 file, this is still listed in the directory content**

To delete a file and avoid that the memory may re-create it, proceed as follows:

- Stop the data collection process just pressing: SET -> RUN, choose *STOP*.
- Delete the desired file.

20)**When deleting an AR5 file, this is still listed in the directory content**

If when changing the parameters of an A5T type file the following message is shown up:

"Error: New file should be created"

, it means that the user is trying to modify the parameters to be stored of an already existing in memory file. To solve this error act as follows:

1. If you want to change the name of the file.
   - Delete the file that we want to use to save new values: SET -> FILES -> DELETE.
   - Modify the parameters to be stored. SET -> RECORD -> PARAM.
   - Exit setup.

2. If you want to keep the name of the file.
   - Stop data collection process of the AR5: SET -> RUN -> Stop.
   - Exit setup.
   - Delete the existing file: SET -> FILES -> DELETE.
   - Modify the parameters to be stored. SET -> RECORD -> PARAM.
   - Enable data collection process of the AR5: SET -> RUN -> Run.
   - Exit setup.

B.- CABLE DISPOSITION

Different cables used with the AR5 have following dispositions:

- Communication cable: RS232 - Power supplier set

PC	POWER SUPPLIER SET
2	3
3	2
5	5
7	8
8	7

- Power supply/Communication: Power supplier set - AR5.

POWER SUPPLIER SET	AR5
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	-

- AR4-AR5 clamp converter cable (Not included with standard factory-delivered set).

AR5 Connector	AR4 Connector
1	1 & 2
2 (Not used)	3
3	4 & 5

C.- QUICK GUIDE (AR5)

Menu				Description	Options	Standard
Setup	Measure	Circuit		Choice type of measuring circuit.	Three phase Aron	Three phase
		Tr. Rel	Rel. V	Voltage transformers ratio		Primary=1 Secondary=1
			Rel. A	Current transformers ratio		Primary =5
	Record	Period		Recording time	1 s to 4 h	15 minute
		Trigger	Level	Parameter trigger and threshold setting	Auto Vp-p Vp-n A kW kvarL kvarC PF Hz kVA	Auto
			Time	Time trigger setting	No Date On Date Off	No
		Name		Working file name		STD-PROG
		Type		File type (Standard or Custom)	Standard Custom	Standard
		Param		Parameters to be stored to a custom type file	All	
	Comm			Communication parameters setting		9600,n,8,1
	Clock			Analyzer's date and time setting		
	Recall			Recalling a Standard configuration	Standard	
Display	Options	Measure	Bar Gr.	Choice a parameter to be graphical displayed	Vp-n Vp-p kVA Hz PF kvarC kvarL kW A	Vp-n
			Expand	Choice three parameters to be displayed in a big size mode	Instantaneous	Vp-n kW A
		Volt		Choice the voltage readout in the main screen to be Vp-p or Vp-n	Vp-n Vp-p	Vp-n
	Contrast			Contrast		
Run				Enabling / Disabling data recording process	Stop Run	Run.
Files	Dir			Directory of stored files		
	Delete			Deleting a file		
	Format			Clearing all memory content		
Clear	Energy			Clearing energy counters		
	Max/Min			Clearing maximum and minimum values		