Technologie

02/10/2006 Edition

User's guide of APR16 DFR

dfv Technologie
Z.A. Ravennes-les-Francs
2 avenue Henri Poincaré
BP 80009
59588 BONDUES CEDEX
FRANCE

Tel : 33 (0) 3.20.69.02.85
Fax : 33 (0) 3.20.69.02.86

Email : contact@dfv.fr
Site Web : www.dfv.fr

TABLE OF CONTENT

I GENERAL

The mains network analysis requires a very large calculation capacity.
The APR16 uses a high capacity signal processor. Due to this technology, the real time analysis of a mains network becomes possible.

Example: calculation of Fourier Transform of 128 points in 1 millisecond.

APR16 alone replaces two analyser/recorders:

1) APR16 continuously records each mains network electrical parameter (U,I,P,Q,S,Phase,Harmonics ...) with an integrating period adjustable between one minute and one hour and this with a period of 15 days max. (Option -PE-LOGCYCL)

2) APR16 detects and records low frequency events (voltage drop, over-voltages, wave distortion) with a sampling frequency of 6400 Hz.

According to its programming the APR16 enables an electrical network to be monitored in real time disturbance mode.

Monitoring:
– 2-phase or 3-phase networks (3 or 4 wires)

Detection:
- voltage drops
- over-voltages
- wave distortion

Restoration:
– RMS. voltages and currents
– Active, reactive power
– Cosine and tangent
– Asymmetrical mode (3-phase networks)
– Harmonic levels V and I by order (2 to 63), and transfer direction
– Level of global distortion for V and I

Measurement storage is optimised to reduce the memory occupation as far as possible without affecting the measurement accuracy.

Analysis of measurements is achieved with an PC, this analysis is performed with all the 3-phase mains network parameters, by means of APRWIN software.

During the data transfer or processing, APR16 continues scanning and storage of measurements.

APR16 calculation capacity permits the RMS. value and the curve of the wave of 8 alternating channels (Voltage or current) to be monitored in real time, as well as the variation in state of 16 logical channels. It is possible to survey 16 analog channels and 32 logical channels by adding a second data acquisition card, an analog measuring unit and a logical channel unit.

Triggering:

The triggering and storage of measurements may be obtained:

– by overrunning a max. or min. threshold of RMS. value on one of channels
– by variation of signal amplitude in time (dv/dt or di/dt)
– by overrunning a max. or min. threshold of rate on an harmonic order
– by overrunning global rate threshold
– by variation of state of one or more logical channels (AND function, OR function)

Threshold and duration alignments of each channel are completed by the user using the keyboard.
In these 2 modes the APR16 stores measurements with a pre-time adjustable from 20 to 200 ms, and a post-time adjustable from 400 ms to 4800 ms.
If triggering occurs before the post-time end, the recording time is increased by the time of the post-time.
The max. storage time is 5 seconds

Measurement storage:
The storage of measurements is performed on the APR16 hard disk or CF card (option)

Measurement processing:
The processing of measurements is achieved :
with an IBM or compatible Personal Computer, measurement may be transferred by means:
- of CF memory card
- of RS 232 link, locally or remotely on the switched network.

II APR16 description

The APR16 is made up of two main parts:

1) A measuring and detection module

This module is based on a high-capacity signal processor, DSP 56000 by Motorola.
DSP performances permit a real-time measurement and detection of overrunning the programmed thresholds onto 8 analog and 16 numerical channels (or 16 analog and 32 logical channels).
Measured signals are sampled at an average frequency of 6400 Hz. An automatic synchronisation system enables adjustment of the sampling frequency to obtain 128 samples per period (input frequency of 50 Hz). All channels are simultaneously sampled by the use of blocker-samplers.
Each input signal period is fractioned into a series of 128 complex numbers (Fast Fourier Transform) characterising the module and the phase of each component of the signal up to the 63rd harmonic. This mode of representation greatly facilitates all future numerical processing:

- RMS. value calculation
- Calculation of active, reactive power and apparent of the cosine and tangent phase taking into account an input voltage and an input current.
- Calculation of direct, forward and homopolar voltage taking into account a 3-phase system.

With this mode of representation, it is possible to restore the original signal (visualisation).
Each sampled period is analysed in real-time to detect a programmed event. In case of detection the DSP transfers the set of measurements corresponding to the element detected into the host system memory (second part) and informs it for immediate acknowledgement and storage.

2) Host module for dialog and storage

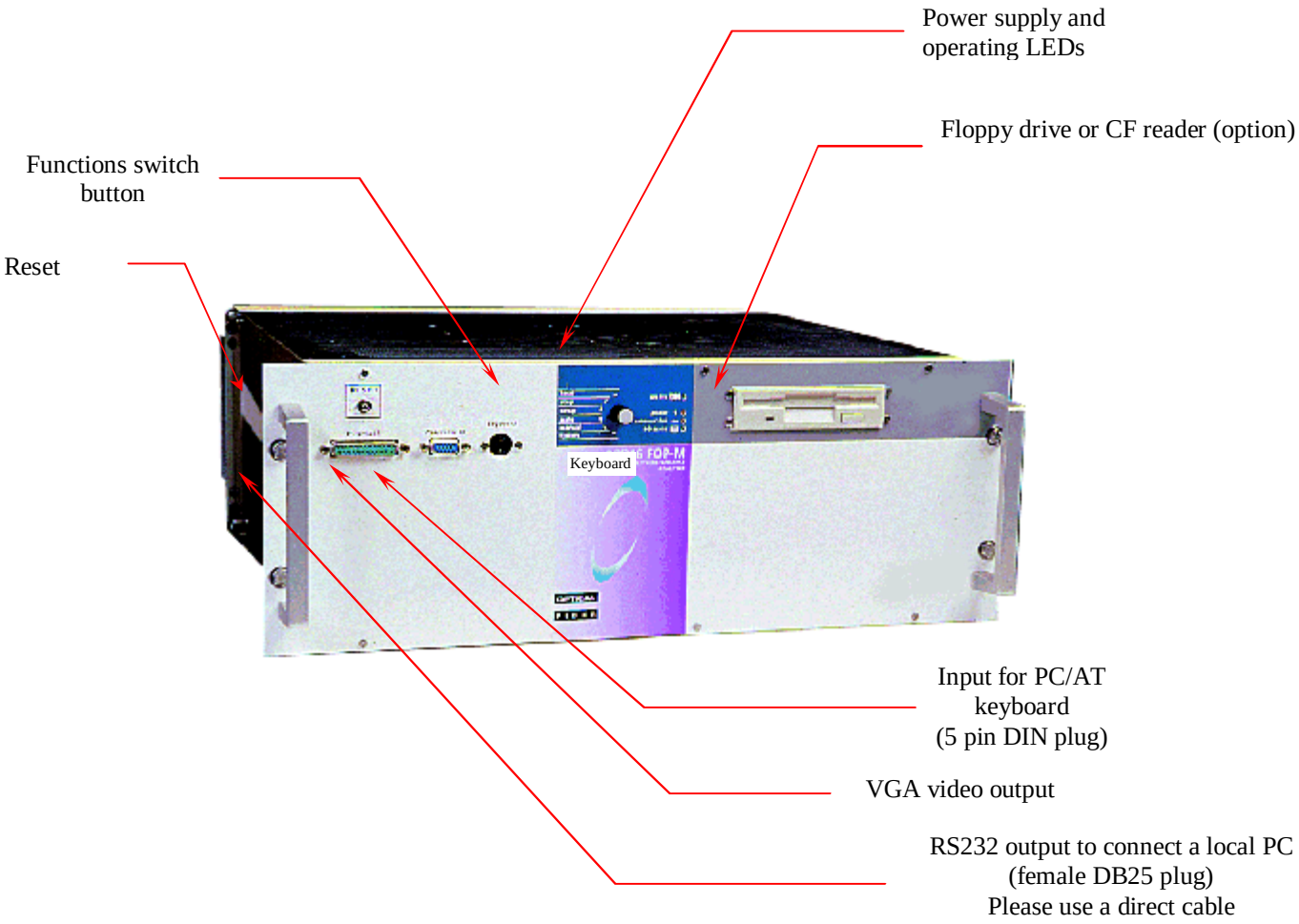
This module drives the detection module. It is constituted of a CPU board equipped with a 80486DX micro-processor with:
– 16 Mbytes of RAM
– 1 x 3.5 inch floppy disk
– 1 x 2Gbyte hard disk or (CF memoy card)
– 1 x parallel output for external printer
– 3 x serial outputs (modem, radio clock)
– 1 x VGA output for external video monitor
The operating system used is a multi-task system, called SDOS. This system enables the best management of the host processor activity, by modifying the priority of processing tasks to be accomplished according to detected events.

All software is stored on the hard disk to simplify any possible modification or improvement. The software which manages the DSP is also stored on the hard disk and automatically loaded in its memory during the initialisation. Host module functions are:

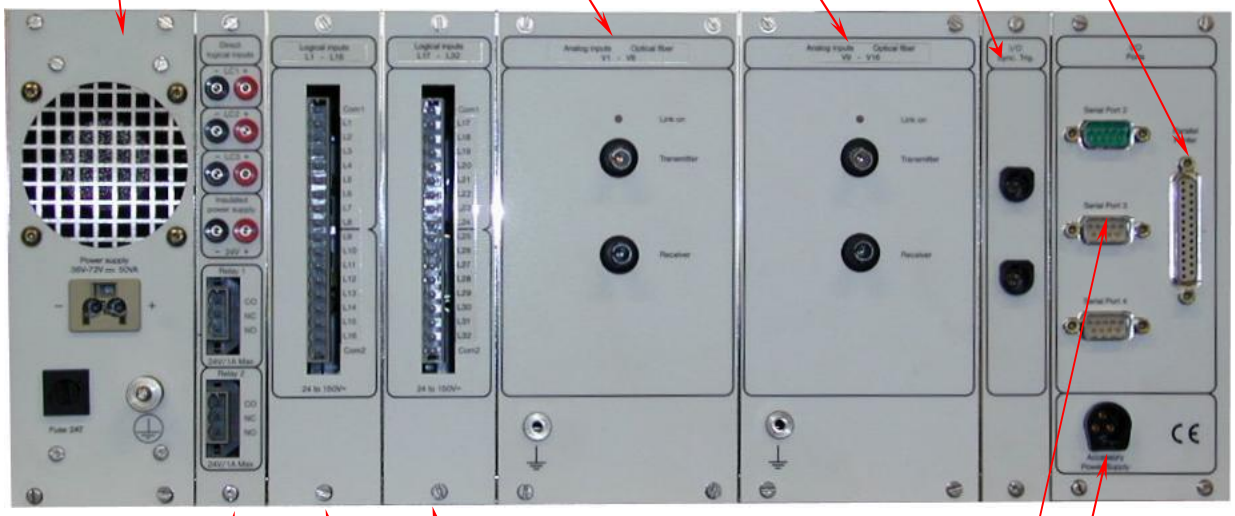
– Detection module programming:
When measurement begins, the software detection module is loaded in the DSP module memory, and also the set of overrunning parameters requested by the operator. These overrunning parameters are introduced in the APR16 by means of an interactive software.

– Storage of events detected by the DSP:
A priority task, advised by the detection module that an event has to be stored, processes the raw data, compacts and stores them on the hard disk, which decreases the space used and increases the storage capacity.
Management of memory is optimised to permit a detection of consecutive events without APR16 saturation. The maximum duration of an event is 5 seconds.

Front panel of the APR16



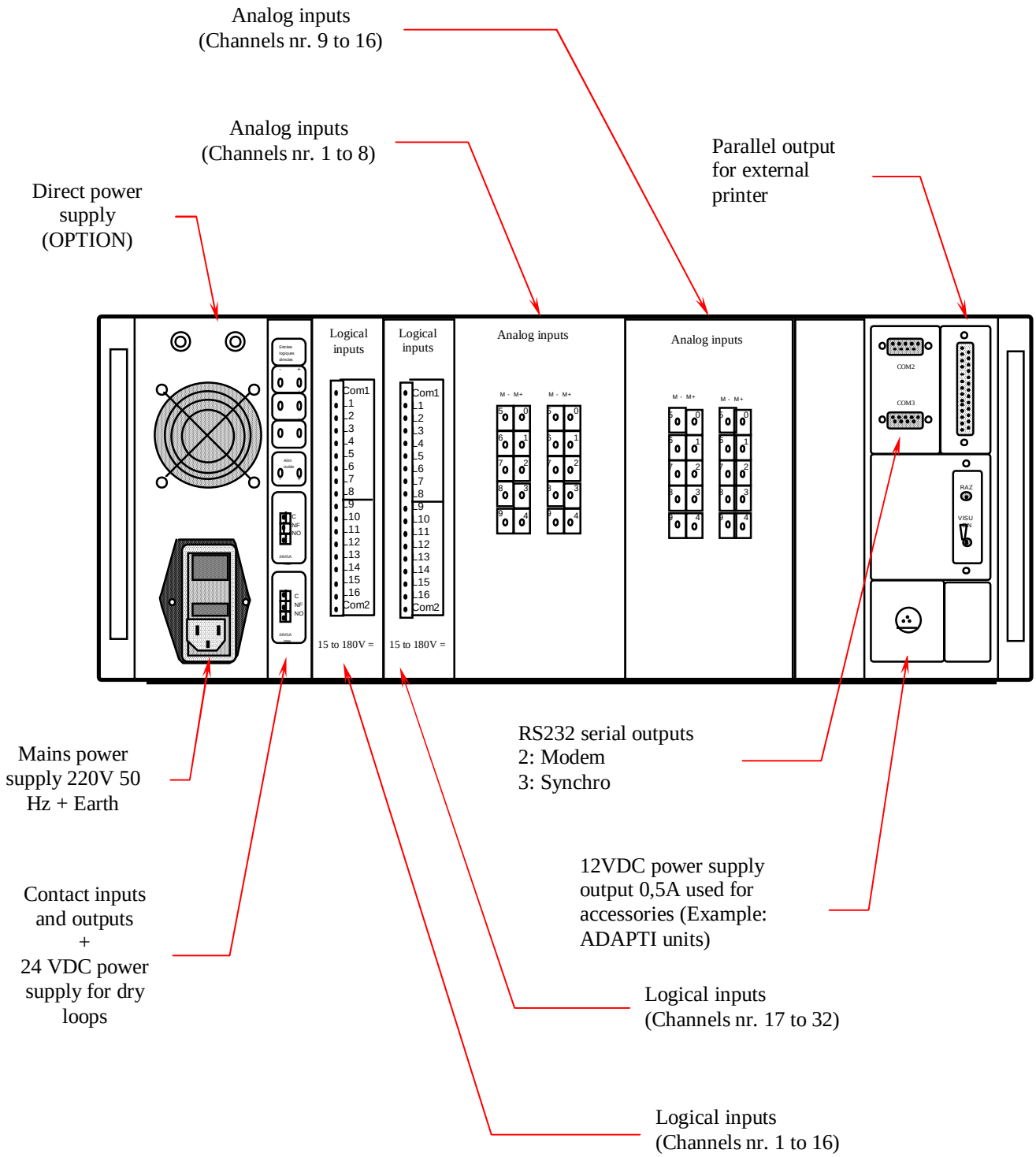
Rear panel of the APR16 (Fiber optic)



Remarks :

- All connectors for digital channels and relays are provided with the APR16
- Annalog channels are connected to the BFOP2 via a duplex optical fiber 62,5/125 ST/ST.
- Digital channels can also be connected remotely via optical fiber using a DRU unit

Rear panel of the APR16 (Direct input)



Note : The connectors used for analog channels and logical channels and contact outputs are delivered with the APR16.

III Technical features

III.1 Technical features of the APR16

Sampling principle
Sampling is automatically synchronised in order to obtain 128 points per period or 6400Hz for a fundamental frequency of 50 Hz. The frequency may vary according to the software used.
Sampling frequency :
Analog channels : 6400 Hz (50 Hz)
Logical channels : 1600 Hz definition 0,6 ms

APR16 local analog channels
Number : 16 differential inputs (8 optional)
Measurement range (2 ranges) : 0 to 2,4 volts and 0 to 240 volts switching by software
Permanent overload : 8KV direct current
Input impedance : 10 Mohms
Bandwidth = sampling freq. / 2
Resolution 12 byte + 1 sign bit

APR16 remote analog channels (see BFOP2)

<u>Note</u> : The analog channels accept just as well the AC voltages as the DC voltages (in this case the P, Q, S, ... measurements are invalid)

APR16 logical channels
Number : 32 (16 optional)
Consumption 1 mA (>12 volts <220 volts)
Response time : 0,6 ms

Setting-up of analog measurement channels
Each channel is definite by :
- His name (11 characters)
- The measurement unit V, A, °C etc ...
- The beginning and end values of scale of the parameter measured
- The beginning and end values of scale of the sensor used

Setting-up of logical channels
Each channel is definite by :
- His name (11 characters)
- Name of low status (0)
- Name of high status (1)

Measurement accuracy
- RMS value +/- 0,2 %
- Apparent, active, reactive power and tangent and cosine +/- 0,4 %
- Harmonics
  Analysis of order 2 to 63 (50 Hz)
  Accuracy +/- 0,2 %

Real time clock
- Saved clock (saved about 1 year)
- Date, month, day, year, hour, minute, second

Storage
- 3 ½ inch disk 1.44 MB and 2Gb hard disk
or Compact Flash card

Display screen
- On the APR16 : external screen (VGA)

Keyboard
- On the APR16 : External keyboard (5-pin DIN PC AT-style keyboard)

Outputs
- 3 RS232 connections (Mouse, Modem, Clock)
- 1 CENTRONICS parallel external printer connection
- 1 VGA external display screen connection

Contact outputs
- output nr. 1 closure of active contact (about 3 seconds) by detection of an event. The contact is definitively closed if the hard disk is full.
- output nr. 2 closure of active contact during APR16 operating, opening of active contact in case of stand-by or failure of the APR16.

Features of the contacts :

Reverse contacts cut-off power on resistive circuit 1 A 24 VDC or 24VAC. An external noise reducing circuit is necessary in case of inductive circuit.

Modem (optional)
- External compatible Hayes modem, please consult us for the type of modem to be used.

Triggering conditions
The triggering conditions are set by the software used.

Power supply
- 230 volts +/- 20 % - 45 - 400 Hz
- Possibility of external D.C. power supply (Optional : 48 V or 127 V).

Physical dimensions
- APR16 : 178 x 485 depth 485 mm

Weight :
- 17 Kg for the APR16

Environment :
- Storage temperature : - 20°C to + 60°C
- Operating temperature : + 5°C to + 45 °C
- Humidity : 0 to 70 %.

Warranty :
- 12 month (Return to factory)

IV Principle of measurement

IV.1 Principle of the cyclic measurement

The signal is sampled each second then integrated on a progammable duration from 1 minute to 60 minutes.

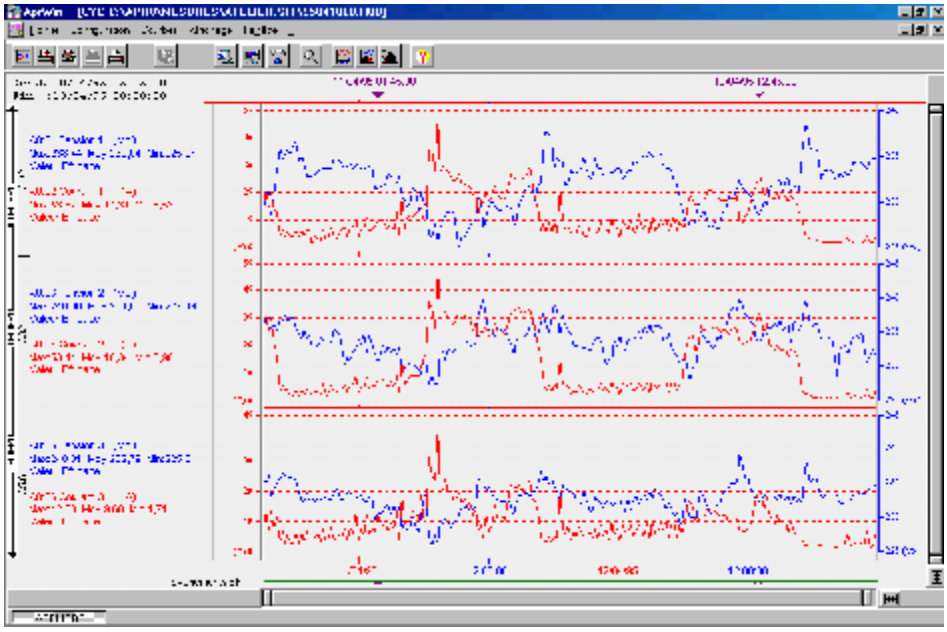
All following parameters may be drawn :

- RMS value
- Single-phase active power
- Single-phase reactive power
- Single-phase apparent power
- 3-phase active P (with or without neutral)
- 3-phase reactive P (with or without neutral)
- 3-phase apparent P (with or without neutral)
- V/I phase
- Harmonic global ratio
- Harmonic order (from 2 to 63) + Fundamental + continuous component
- Reverse voltage
- Direct voltage
- Homopolar voltage

The maximum measurement duration is 15 days long.

If LF events come during measurement period, they are stored and marked on cyclic restitution.

<u>Example of restitution</u>

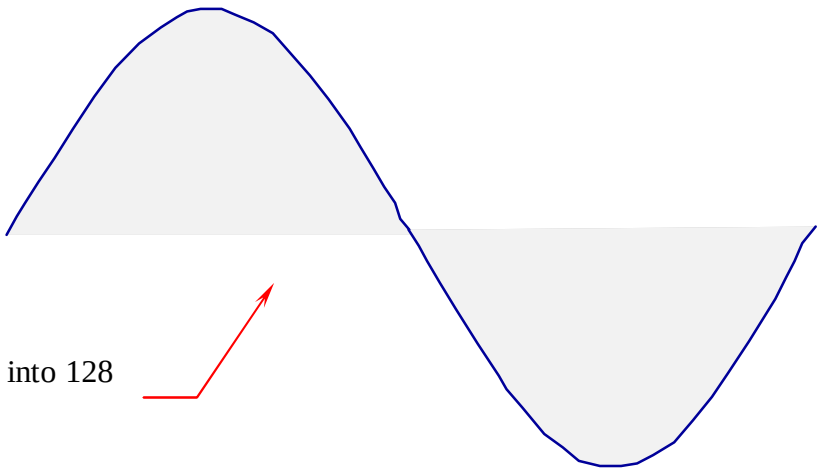


IV.2 Principle of LF measurement

All analog channels are simultaneously sampled at a frequency proportional to the frequency of the fundamental signal.

For a fundamental frequency of 50 Hz, the sampling frequency is 6400 Hz. The bandwidth is 3200 Hz.

Samples are numerical values coded with 12 bits (4096 points) and a sign bit.



At the end of **each period**, the signal is decomposed into a series of 128 complex numbers (Fast Fourier Transform), which characterise in module and in phase, **every component** of the signal up to 63rd harmonic.

With these results, it is easy to compute the following values:

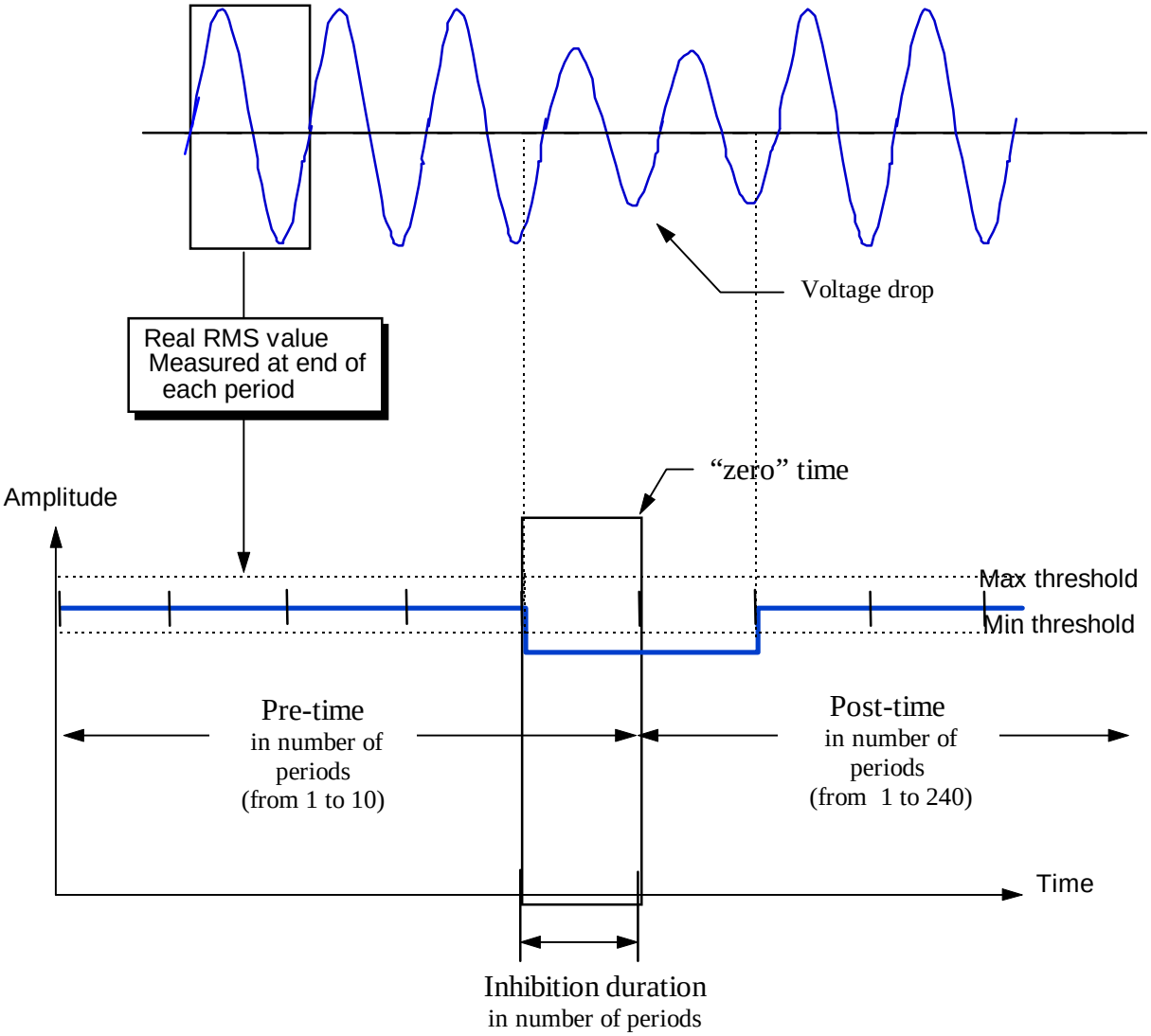
- RMS. Value
- Active and reactive power, cosine and tangent on a single or 3-phase network
- Direct, forward, homopolar voltage on 3-phase network
- Voltage and current harmonic order 2 through 63 and global distortion rate
- Harmonic power and transfer direction

In the “LF mode”, APR16 may be triggered by 5 different conditions:

– overrunning a max. or min. threshold (RMS. value)
– relative threshold (RMS. value)
– rate of the global harmonic (harmonic distortion)
– rate of a specific harmonic order
– activation of a logical channel (level 0, level 1 or state modification)

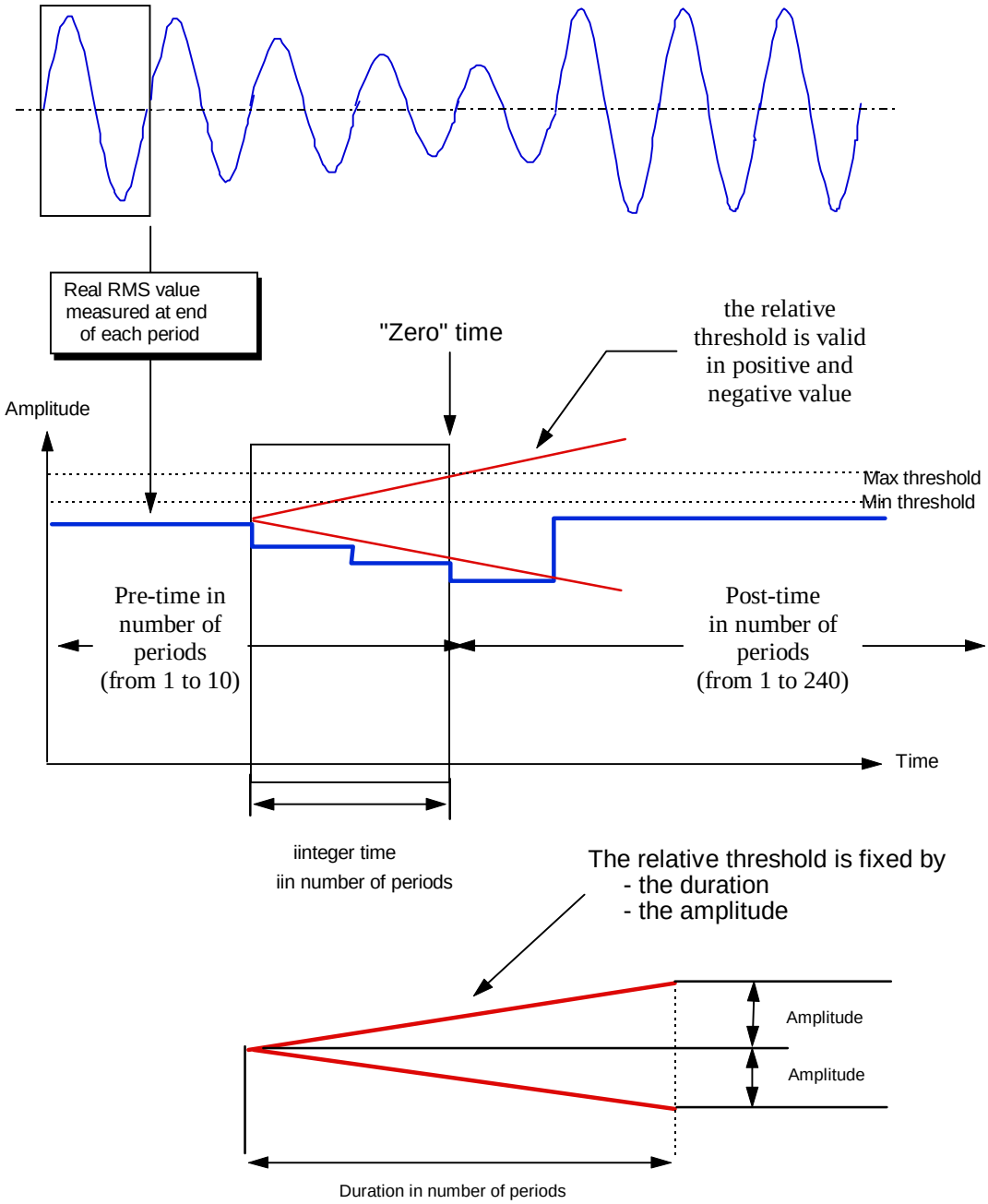
Detection of RMS value (Mini and Maxi threshold)

The threshold values are adjusted by software for each analog channel.



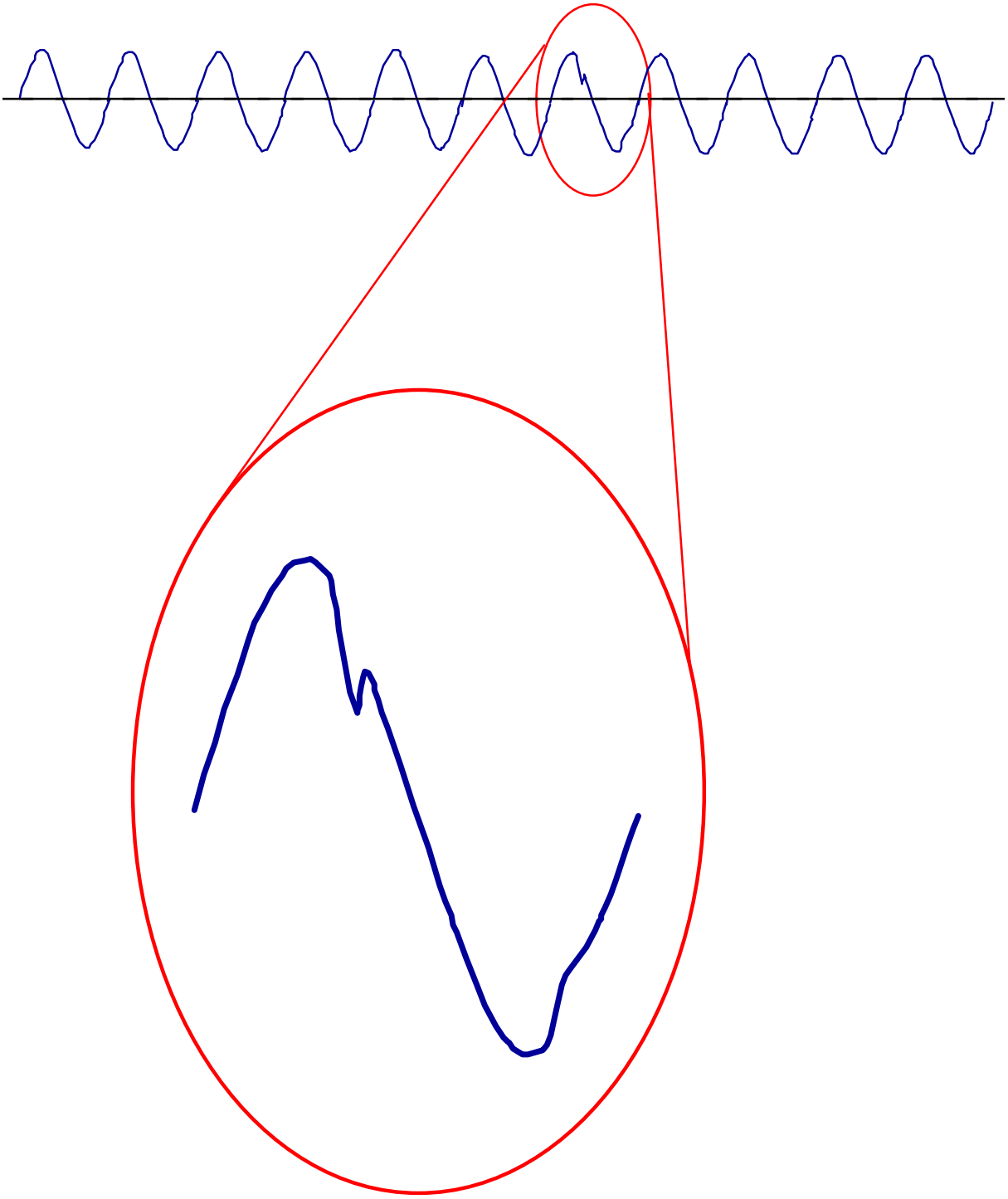
The inhibition is the duration for which an occurence is not account. The APR16 detects the event if it lasts longer than the inhibition duration.

Detection on a relative variation of amplitude (dV/dT or dI/dT)



Detection on wave distortion

Monitoring of 12 harmonic orders and of global ratio (period by period). A distortion of the wave can be detected because the wave produces a modification of the harmonic spectrum.



A threshold on the global ratio may be programmed to detect a wave distortion.

V STARTING UP

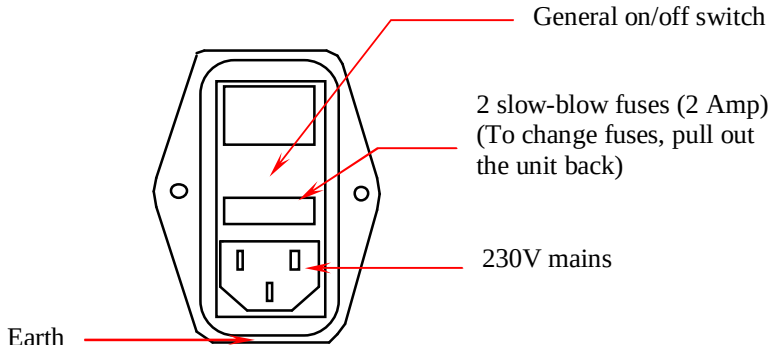
Security, Warning:

Any intervention on POWERED conductors induces some dangers. This handbook only contains information and advice concerning metrology. The USER or its OPERATOR, is expected to know all rules of SECURITY on ELECTROTECHNICAL subjects.
Except contrary indication, the information contained in this handbook is based on our laboratory work, executed in part through simulation. At the present time, the results obtained in « true-size » and brought to our knowledge, have confirmed the validity of these works. When faced with the diversity of measurement conditions and sites, the user or its operator should appreciate:
- by reading this handbook, if the equipment in his possession corresponds to the use he wishes to make of it.
- the conditions in which the measurements are executed.
- at any moment, if his equipment has retained its original qualities.

Our technical department remains available in order to answer any questions relative to the use of the equipment.

230 VAC 50 Hz power supply

Connect the APR16 to the 230 VAC mains by means of the mains cable lead provided. The main plug should be equipped with an earth conductor which meets standard specifications in force.



WARNING :

The APR16 is protected by means of para-overvoltage devices to avoid serious damage. These protections safeguard from brief overvoltages between **live and neutral, live and earth** and **neutral and earth**. It is recommended to feed APR16 with a protected line equipped with a differential circuit breaker adjusted at 30 mA to avoid the destruction of para-overvoltage devices during long duration defects.

- If the circuit breaker triggers or
- If one of the APR16 fuses “burns”,

either a permanent or brief defect has occurred. In this case, the APR16 should not be reconnected before checking the mains distribution.

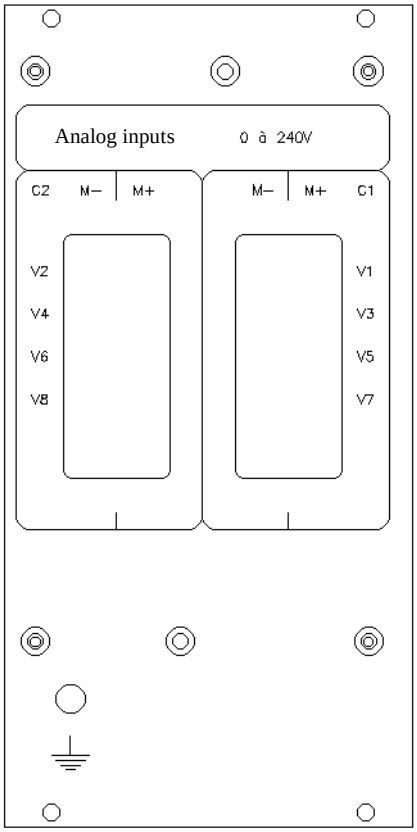
Direct current power supply (OPTION)

This type of power supply is provided as an option. Possible voltages are:

Nominal voltage	Voltage range
48 VDC	from 36 to 76 VDC
127 VDC	from 100 to 200 VDC

If the APR16 is equipped with a direct current power supply, connections are ensured by means of 2 plugs 4 mm dia, located at the rear, in the top left-hand corner.
DC power supply is protected against overvoltages and polarity errors by means of 2 fuses incorporated in the APR16.

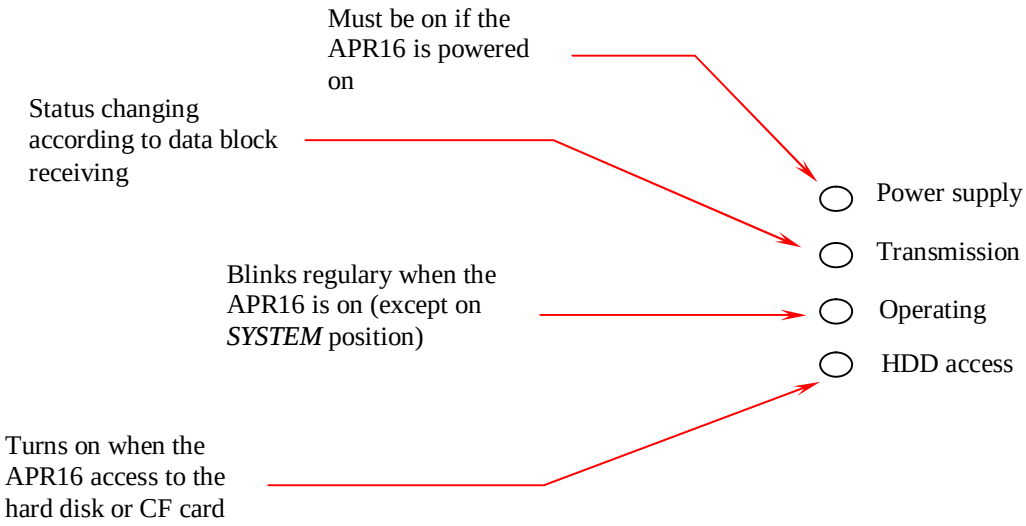
For reliable operation and safety requirements, we recommend that you ground the APR16 to a current standard earth, in this case connection is ensured by means of the plug located at the bottom of the analog input unit.



APR16 unit

Operating control :

The front panel of the APR16 is equipped with control lights.



VI Description of software

The software installed on the APR16 enables the setting-up and operating of the measurements.

According to the function switch position, the APR16 will run different programs which enables you to do the following :

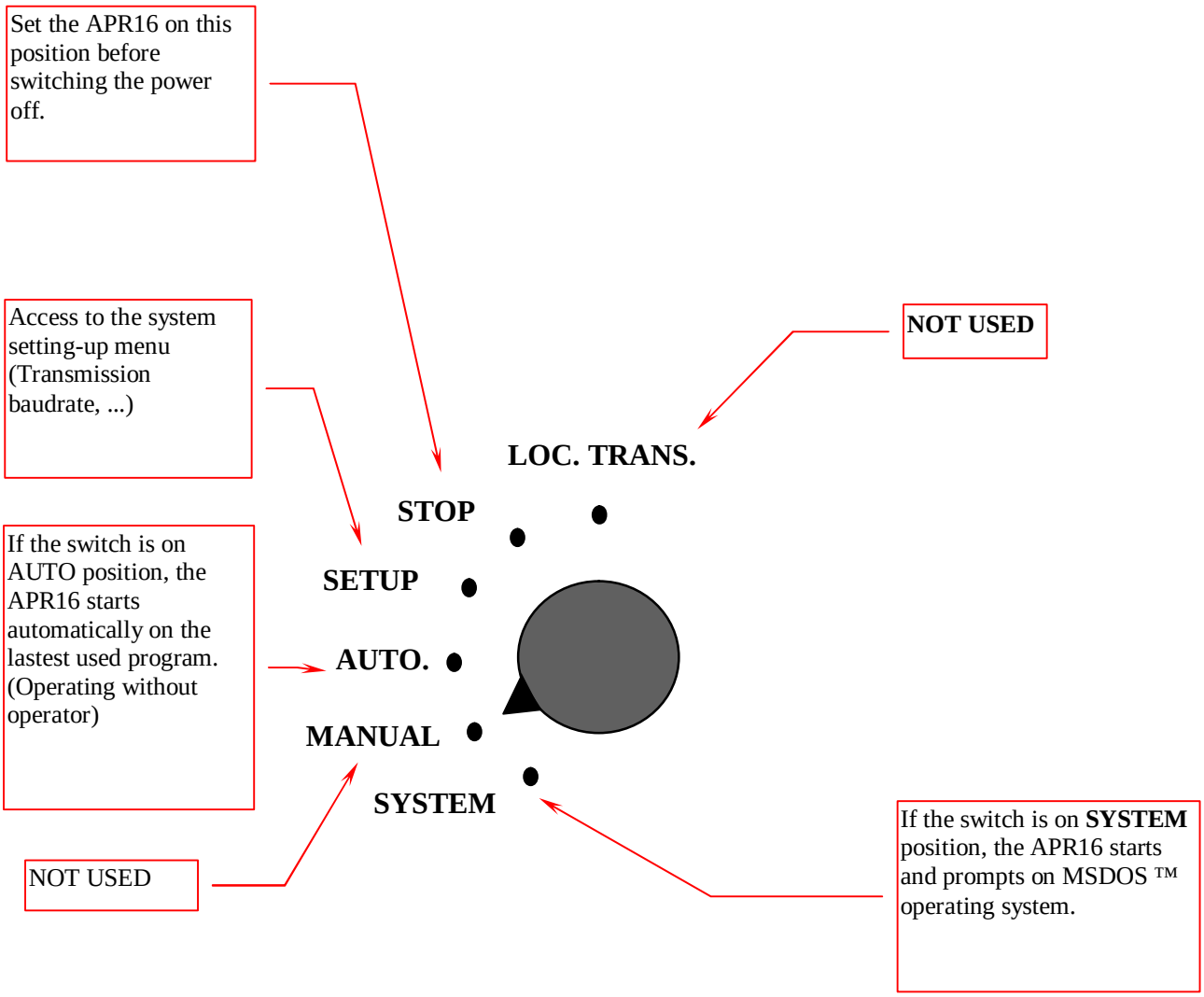
- high speed local dialog NOT USED
- System stop
- Setting-up
- Operating in AUTOMATIC mode (without operator)
- Operating in MANUAL mode (with an operator) NOT USED
- Access under MSDOS operating system

Each program is explained in details in the following.

Note : For the APR16, the displaying and data acquisition described in this manual can be achieved if a VGA display screen and a PC/AT keyboard are connected on front panel.

After setting up, the APR16 unit is fully controlled by the APRWIN Software running on a PC.

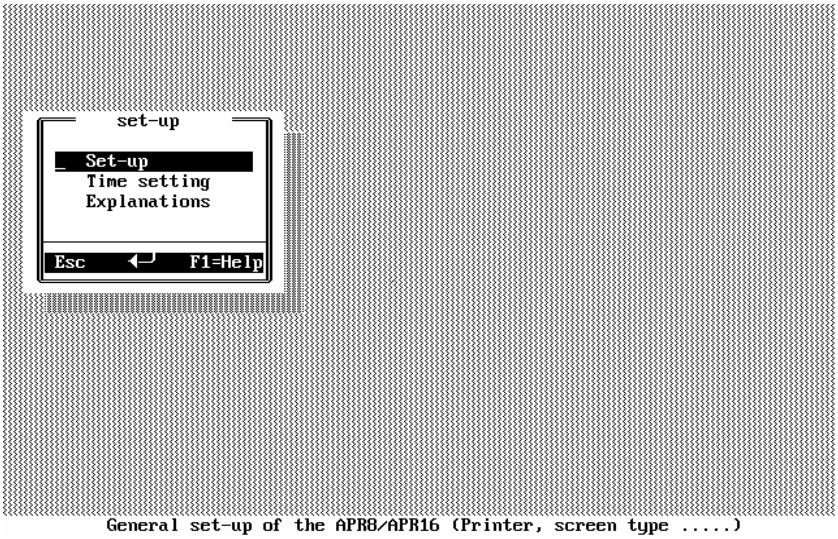
VI.1 APR16 function switch



Note : When the switch is on SYSTEM or LOC. TRANS. position, you can switch it without effect. To exit of the system position, you must set the switch on the position you wish and press on RESET button.

VI.2 Setting-up

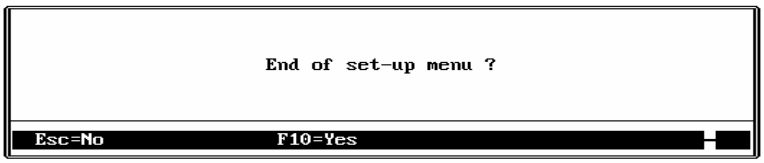
Set the function switch on **CONFIG** position, the « Setting-up » menu is displayed :



The using details are described in the following pages.

Exit of « Config » mode

Press *Esc* key to exit of the Configuration mode, a message waits a confirmation.
Press F10 key to confirm exit.
An other message asks you to set the function switch on the position you wish.

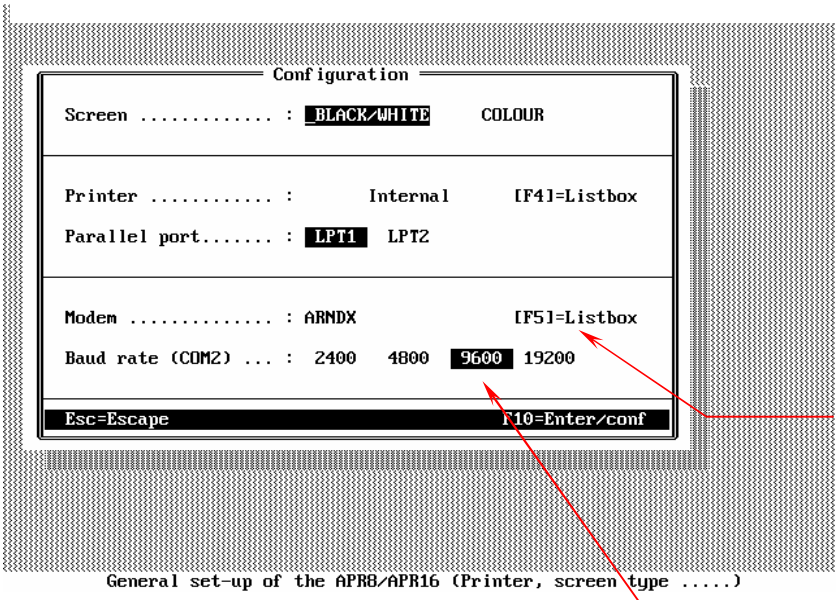


At this moment, the APR16 resets and starts once more on the function asked.

1) System setting-up :

This menu enables you to set up the software according to used equipment :

- Display screen
- Printer
- Parallel port
- Transmission baudrate by modem mode
  (or locally between the APR16 connected on serial port nr.2)
- The "driver modem"



Choice of modem by a list popup

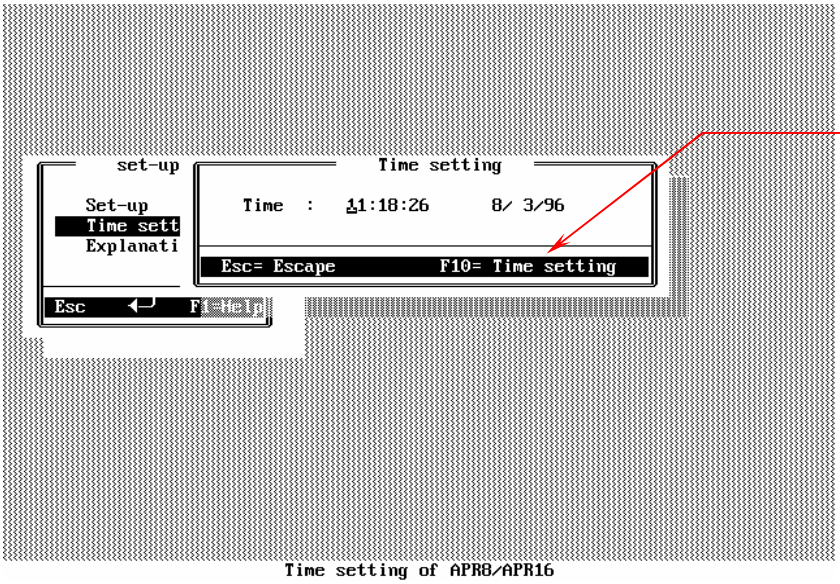
Transmission baudrate to the modem.The modem must be connected on the APR16 serial port nr.2

2) Setting in time

Note : The time of APR16 can be also set by a radio clock:

-ACEB (STET)
-SCLE (STET)
-MOUSECLOCK (DCF77)

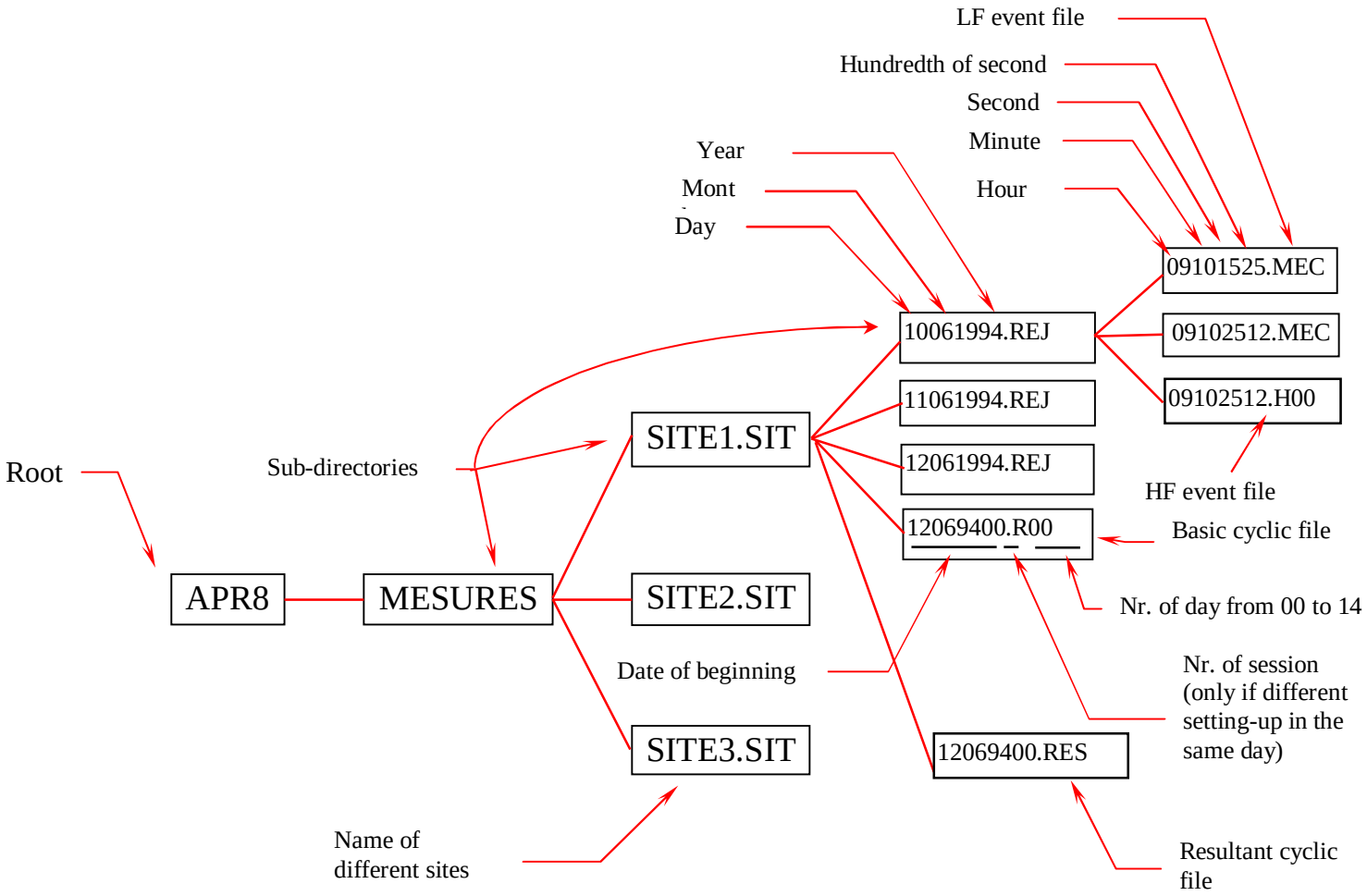
See chapter : *Time synchronisation*



Time setting of APR8/APR16

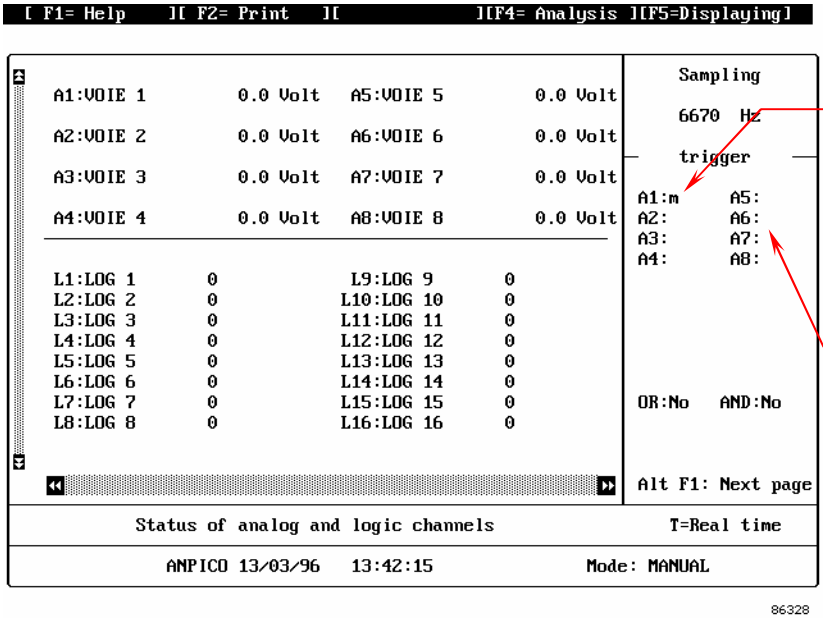
Press on F10 key to change the time of the APR16

VI.3 Block diagram of files



VI.4 Automatic operating (AUTO position)

When the function switch of the APR16 is set on AUTO position, the APR16 starts the measures by using the last loaded parameter.



Here the channel nr.1 is triggered in mini threshold

Triggering flags

In automatic mode, the APR16 records permanently the entered signals (if the cyclic mode is validated) and controls and detects the LF events. It is in this mode that the APR16 must be set when it is installed on a site.

The screen displays the cyclic mode status :

STOP : Stand-by of the cyclic mode

FUNCT : Operating

WAITING : Waiting for starting-up

System saturation

If 70 triggerings occur a day, the triggering system will not record any more events on the hard disk, and will wait until the next day before starting once more. This restriction has been fitted to prevent the hard disk from being saturated if a threshold has not been correctly adjusted.

A second safety protection has also been fitted: if the remaining capacity of the hard disk drops to 10 MB, the system stops and displays a saturation message.

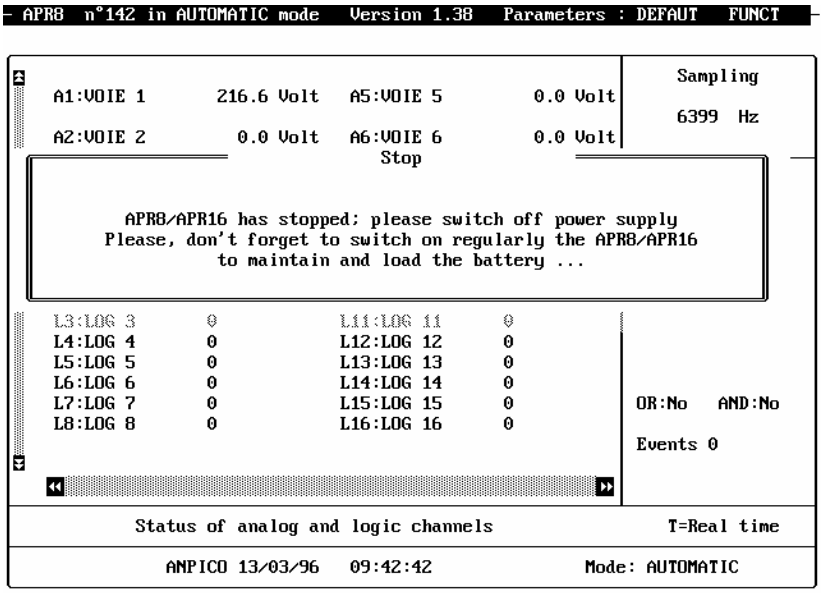
Note: The limitation of 70 triggerings a day is sufficient for most applications but may be modified for specific applications (please consult us).

VI.5 System stop (STOP)

The APR16 is equipped with a power supply saved by battery on-board. It is necessary to follow the following procedure to stop correctly the device :

- Set the function switch on « STOP » position

- Wait a moment, the sound signal rings and the following message is displayed :



- Disconnect the analog measurements and logical channels

- Switch off the APR16 by switching the general interruptor (Rear panel) on “Off” position. At this moment, the digit and the lamps light off.

Note : Disconnect the power supply for the APR16 equipped with the DC power supply (48V or 127V).

The way you does is necessary to obtain a right stopping.

VI.6 System position (SYSTEM)

If the function switch of the APR16 is on this position, the APR16 starts up or resets by handing back control to the user under MSDOS operating system. This possibility is very interesting because it enables to operate easily on the system

Nevertheless please **do not modify the system files** (CONFIG.SYS and AUTOEXEC.BAT) because of a system bug or a malfunction of the software. Please consult us in case of problem.

VII Wiring and using recommendations

After connecting and adjusting each channel (thresholds/beginning scale, etc.), a « real time » measurement should be carried out to check that wiring is correct.

Check that the nr.1 analog channel is correctly wired because it is needed for synchronisation signal.

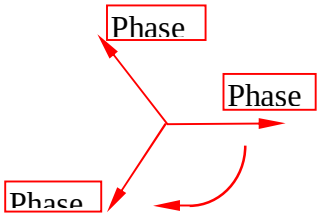
The frequency range in which this synchronisation is possible is between 35 and 65 Hz. If the signal frequency on nr.1 analog channel is out of this range, two cases are possible:

- The signal frequency has never been in this range since system initialisation. The sampling frequency is then fixed at 50 Hz.

- The signal frequency was in this range at system initialisation but is no longer in it. The sampling frequency is then fixed at the **last valid frequency**.

Verify phase directions using « 3-phase P » diagram, you should obtain this kind of diagram:

Observe vector directions



Direct direction

Verify V and I phase shifts using « Single-Phase P » screen.

The DC component should be nearly equal to RMS. value and negative seq. and homopolar voltages should be nearly equal to 0 on a balanced network.
If the forward component is equal to the RMS. value, channel inputs are not correctly connected (see drawing above).

Active power calculation**:** active power sum calculated with each harmonic voltage-current couple.

Reactive power calculation**:** active power calculated with each harmonic voltage-current couple.
The reactive power sign corresponds to the quadrant in which is placed current using voltage as reference.

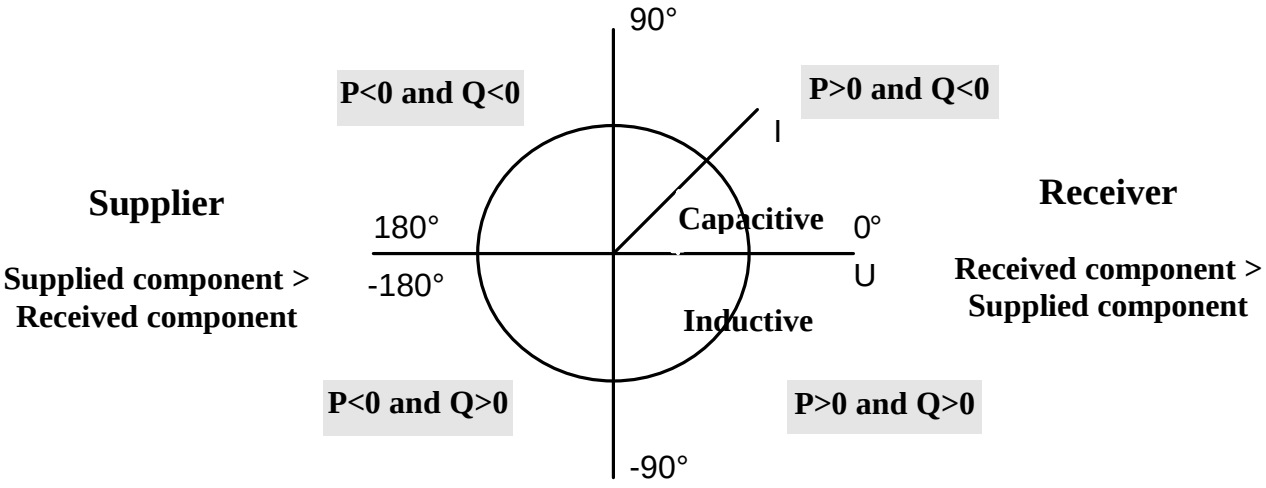
Voltage-current phase: it is the phase angle of the fundamental components of the voltage-current couple which is calculated. It is given in the interval $[-p,+p]$.

Power factor: it is the ratio $\frac{\text{Active power}}{\text{Apparent power}}$.

Harmonics and harmonic powers measurements

Harmonics and harmonic power measurements are only satisfactory if the APR16 sampling frequency is synchronised with the mains network frequency.
A compression algorithm which allows recording volume to be reduced, restrains all orders with a rate lower than 0.2%.

Case of EDF (Supplier)



N.B.: It is necessary to verify the validity of « Supplier/Receiver » indication according to measurement conditions because APR16 ″sees″ the result (Sum) of harmonics supplier and receiver components from the measurement point.

Measurements on a single-phase network

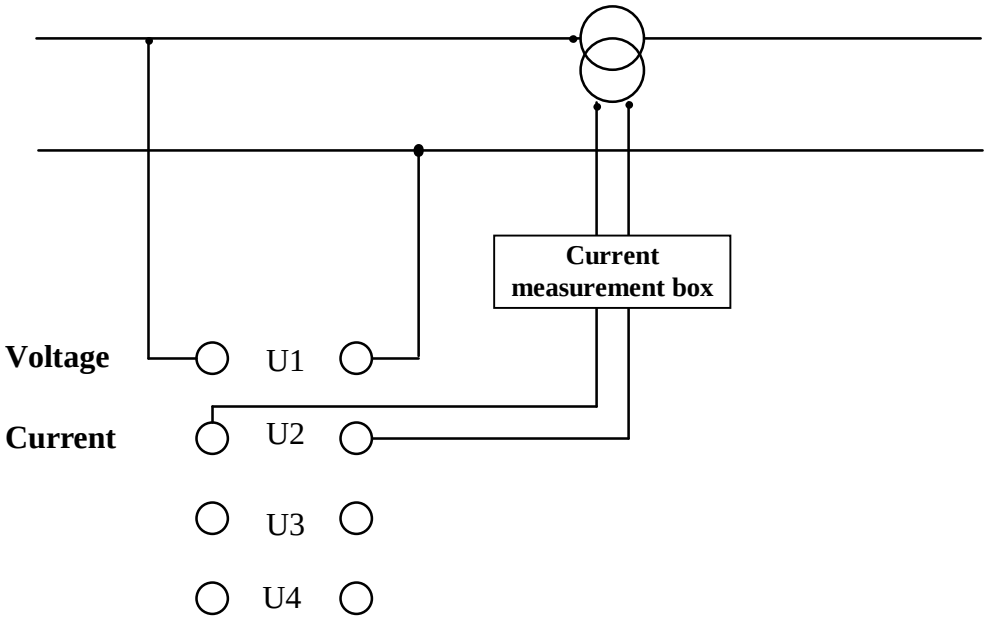
The following measurements will only be satisfactory if the wiring conditions are as follows:

- Voltages designated as U1, U2, U3 and U4 must be connected to 1, 3, 5 and 7 analog inputs (in the 16-channel variant, voltages designated as U5, U6, U7 and U8 must be connected to 1, 3, 5 and 7 analog inputs of unit nr.2).

- Current designated as I1, I2, I3 and I4 must be connected to 2, 4, 6 and 8 analog inputs (in the 16-channel variant, currents designated as I5, I6, I7 and I8 must be connected to 2, 4, 6 and 8 of unit nr.2).

- Measurement parameter voltages must be expressed in Volts and currents in Amperes.

Wiring to be observed



Measurements are carried out independently on each voltage-current couple:
RMS. real value of voltage or current:

$V_{eff} = \sqrt{\frac{\sum_{i=1}^{128} x_i^2}{128}}$ where x_i is the x_{th} sample of the measured period

Measurements on a 3-phase network with neutral

The following measurements will only be satisfactory if the wiring conditions are as follows:

Voltages designated as U1, U2, U3 corresponding to single-voltages must be connected to 1, 3, 5 analog inputs (in the 16-channel variant, voltages designated as U5, U6, U7 must be connected to 1, 3, 5 analog inputs of unit nr.2).

Current designated as I1, I2, I3 must be connected to 2, 4, 6 analog inputs (in the 16-channel variant, currents designated as I5, I6, I7 must be connected to 2, 4, 6 analog inputs of unit nr.2).

In measurement parameter the voltages must be expressed in Volts and currents in Amperes.

Measurements are carried out in the same manner as that for the single phase network. Active and reactive power values correspond to computed values for each phase. Active and reactive powers appear under the « Total » caption. They are algebraic sums of active and reactive powers. It is therefore essential to connect voltage and current in the right direction:
- For voltages, neutral must be connected to the black plugs of U1, U2 and U3 inputs.
- For currents, the left input plug of the boxes corresponds to « return ».
- Nevertheless, it is possible to control this connection easily thanks to U and I vector diagrams displayed on the same screen: U1/U2 (I1/I2) phase-shift should be equal to 120°, those of U1/U3 (I1/I3) equal to 120°. In addition, in this case, the measurement validity of symmetrical components is safeguarded.

Measurement of symmetrical components
Measurement conditions for voltages (wiring direction and diagram) are the same as those for 3-phase power measurement.

Displayed values are:

- RMS. true values of U1, U2 and U3 voltages
- unbalanced rate $\frac{\text{Forward voltage}}{\text{Direct voltage}} \times 100$
- fundamental relative phases of U1, U2 and U3 voltages
- fundamental values of homopolar , forward and direct voltages.
- vectorial diagrams only give an indication of the phase between vectors.
- amplitude representation is optimised to permit an adaptation to very little or very big values.

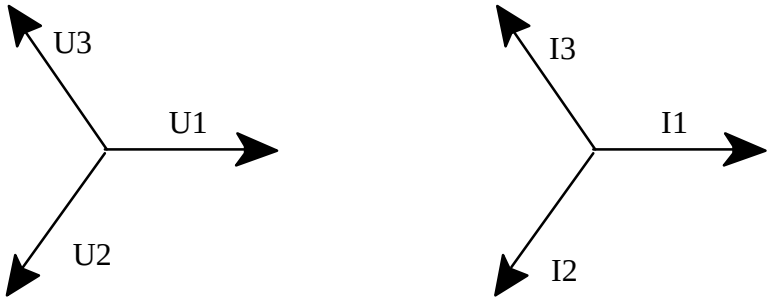
APR16 allows the 3 single-phase powers or a single-phase power in the 4 wire diagram (3-phases and the neutral) to be measured.

In this case, it is necessary to wire:

- The 3 voltages on V1, V3 and V5 inputs (neutral on black plug)

- The 3 currents to the V2, V4 and V6 inputs

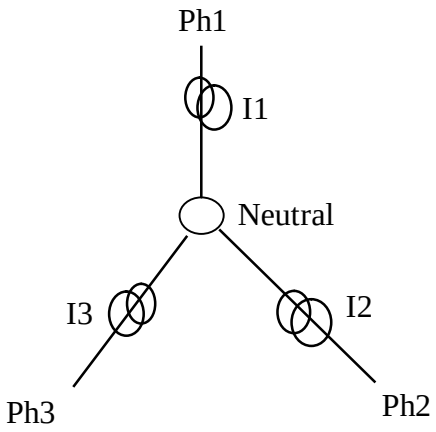
and verify that vectors are :



Be care of the following wiring :

3-phase with neutral

Neutral	**U1**	Phase 1
I1	**U2**	I1
Neutral	**U3**	Phase 2
I2	**U4**	I2
Neutral	**U5**	Phase 3
I3	**U6**	I3
Neutral	**U7**	Earth
I Neutral	**U8**	I Neutral



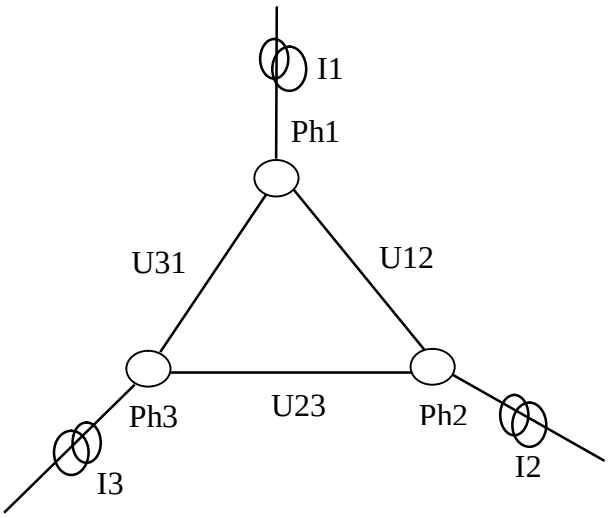
The measurement of the Neutral/Earth voltage and the current of neutral are not necessary

Note : The currents must be connected by means of measurement adaptor units or of voltage output clamps.

Measurements on a 3-phase network without neutral

In case of a 3 wires assembly, the APR16 may be connected as following :

Phase 1 ○ **U1** ○ Phase 2
I1 ○ **U2** ○ I1
Phase 2 ○ **U3** ○ Phase 3
I2 ○ **U4** ○ I2
Phase 3 ○ **U5** ○ Phase 1
I3 ○ **U6** ○ I3



Note : The currents must be connected by means of measurement adaptor units or of voltage output clamps.

Procedure to be used :

Principle of the measurement by means of 2 wattmeters and 2 varmeters.
This procedure enables to measure on balanced or unbalanced network.

$$P = U_{13} \cdot I_1 \cos (U_{13}, I_1) + U_{23} \cdot I_2 \cos (U_{23} , I_2)$$

$$Q = U_{13} \cdot I_1 \sin (U_{13}, I_1) + U_{23} \cdot I_2 \sin (U_{23} , I_2)$$

The single-phase powers cannot be found by means of this procedure.
The displayed values will be :

- U_{21} , I_1
- U_{32} , I_2
- U_{13} , I_3
- three P, three Q and three S
- Vectorial diagrams of the 3 voltages and the 3 currents

P : active power
Q : reactive power
S : apparent power

VIII Communication

When the switch of the APR16 which is installed on a site is set on AUTO position, you can dialog with it by means of the RS232 serial links.

So you can remotely control a mains and transfer recorded measurements and set-up the APR16 once more by connecting a modem.

The transmission may be achieved from 2400 to 115200 baudrates.

You must select the driver in the « Setting-up » menu of the APR16 to use a modem.

IX Time synchronisation (Optional)

The APR16 real time clock can be synchronised by an external clock. APR16 serial port nr.3 is intended to receive information from radio clocks.

There are two different types of clock:

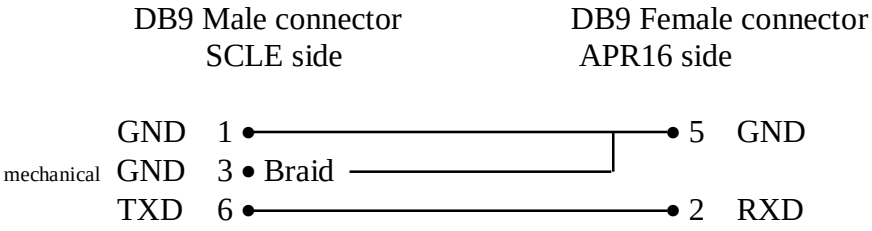
- The SCLE or ACEB clock complying with STET protocol. This clock is synchronised by FRANCE INTER transmitter.

- The MOUSECLOCK receiving time from the FRANKFORT (DCF77) transmitter.

For the APR16 to use a radio clock, it suffices to connect the latter to the number 3 serial port and install the corresponding driver diskette (INSTALL C:).

The MOUSECLOCK should be directly connected to APR16.

The SCLE clock should be connected by means of a cable, the diagram of which is given hereafter:



X Care and maintenance

The APR16 contain a hard disk which is used to store software and measurements. The equipment should therefore be correctly protected during transport. The hard disk should be periodically checked and *cleaned* by a competent operator:

- Use MSDOS CHKDSK software to control data conformity.
- Use MSDOS SCANDISK software to check hard disk area.
- Use MSDOS DEFRAG software to *clean* the hard disk.

A utility software allows low frequency file coherences included on the hard disk to be checked and any possibly damaged files to be erased.
Under MSDOS (Switch to the SYSTEM position):

- Run TSTFICH C: to analyse C: hard disk
- Run TSTFICH C: -d to erase damaged files.

XI Software up-dating

The APR16 software may be very easily up-dated by disks.

Note : Please connect a VGA display screen and a PC AT keyboard to do the up-dating of the APR16 software.

Start-up the APR16 by means of the switch on *System* position to run the up-dating; when the system hands back the control to you, please insert the up-dating disk into the floppy disk drive and type the following commands :

A: ¿
INSTALL C: ¿

At the end of the installation, the program *defrags* the disk. This operation may be rather long if the defragmentation has not be achieved from a long time.

When the system hands back the control to you please set the switch on the required position and press on Reset button (On front panel for the APR16).

A up-dating installation never erase data stored on disk.

You have to up-date all equipements at the same time if you up-date the software.

If you have received a disk which contains the corresponding PC software, please do also the up-dating (See the manual of the software on PC).

XII Problem solving

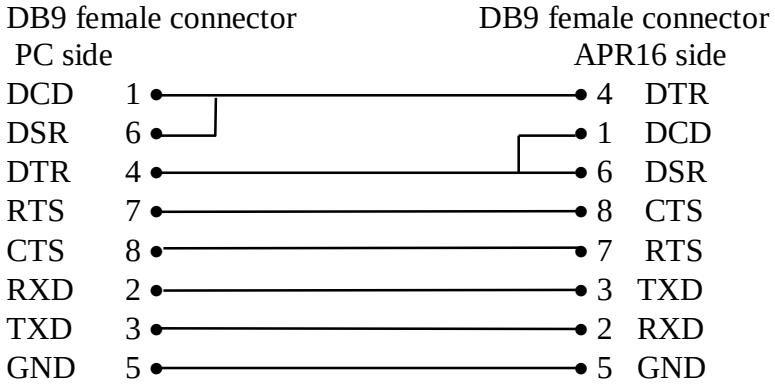
<u>Transmission problem between the PC and the APR16 in local mode</u> :

Please check that the serial port is correctly set-up in the setting-up menu on the PC software (nr. of port and baudrate).

Please check that the baudrate is correctly set-up in the *Setting-up* menu of the APR16 (Switch on *Setting-up* position).

Please check that the cable is plugged on the right serial port on PC side and the serial port nr.2 on APR16 side.

Please check that the used cable is a « twisted » cable and that the pining is according to the following diagram :



<u>Transmission problem between the PC and the APR16 in local mode</u> :

Please check that the serial port is correctly set-up in the setting-up menu on the PC software. (Port number and baudrate = 19200 bauds).

Please check that the cable is plugged to the PC serial port and to APR16 serial port nr. 1. (On front panel).

Please check that the used cable is a « direct » cable

<u>Note</u> : Any operation on the APR16 needs a keyboard and a display screen.

XIII Glossary

Pre-time: Recording duration before detection of an event. If a pre-time of 3 periods has been fixed, it is possible to see 3 signal periods before detection of triggering condition.

Post-time: Recording duration after detection of an event. If the post-time of 20 periods has been fixed, it is possible to see 20 signal periods after detection of triggering condition.

Pre-time and post-time fix the total recording duration.

Relative threshold: If a signal increases or decreases by more than a given value during a given time, APR16 records the event.

Practical example: Sudden increase intensity over a duration of 3 periods although the maximum threshold has not been passed.

Inhibition time: Shortest duration of a defect before the beginning of a recording sequence and the opening of a file. The inhibition duration avoids transient phenomenas.

Cyclic measurements: Integrated measurements have a duration of 1 to 60 minutes, allowing signal progress to be observed over a long period of time (15 days maximum). The basic measurement has a duration of 1 second.

LF measurements: Measurements are sampled at a frequency of 6400 Hz. The recording duration in LF mode is 5 seconds maximum
Active cursor : The cursor is displayed as a full triangle

Hysteresis: shift-out between threshold overrunning and the threshold recovery

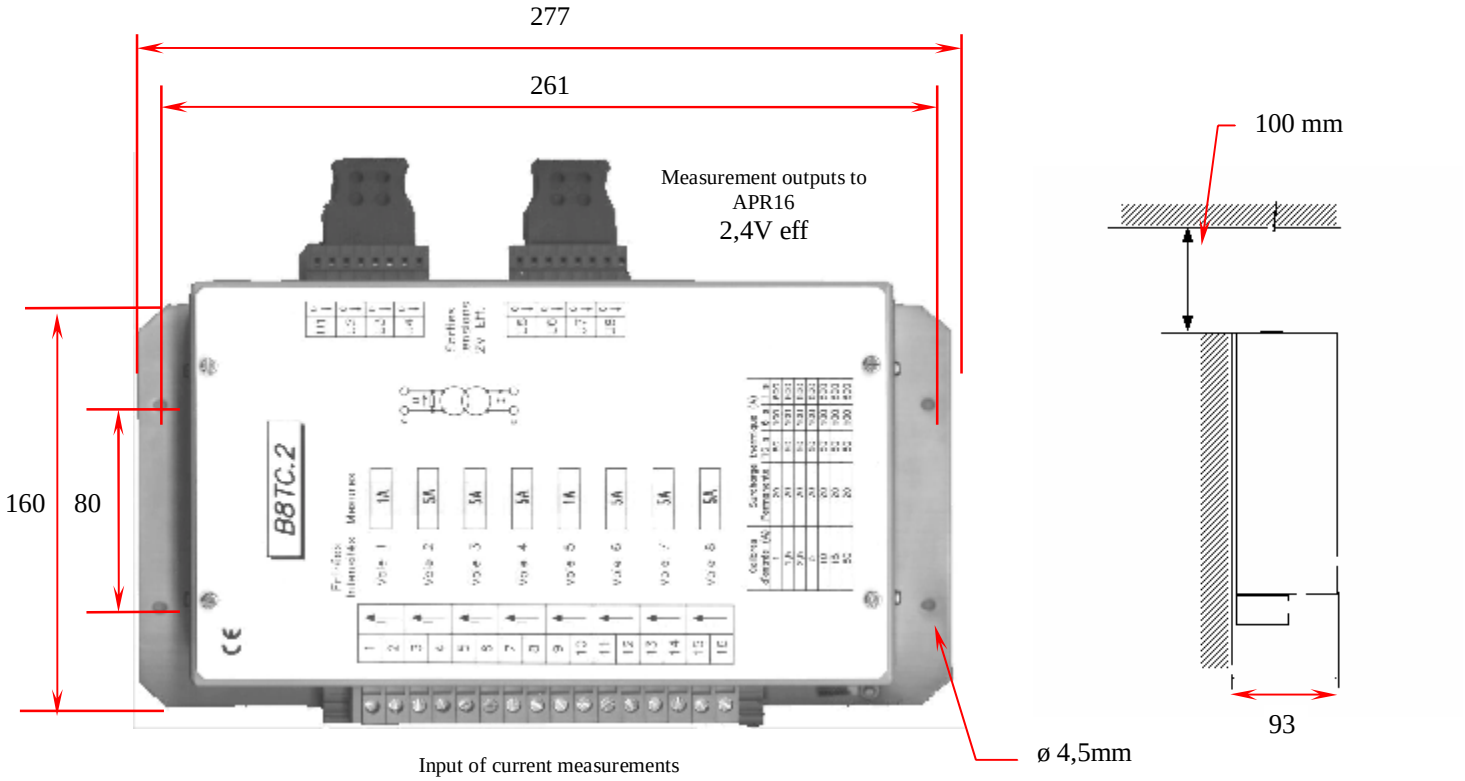
Virtual hard disk: RAM disk created and managed by the RAMDISK driver under MSDOS

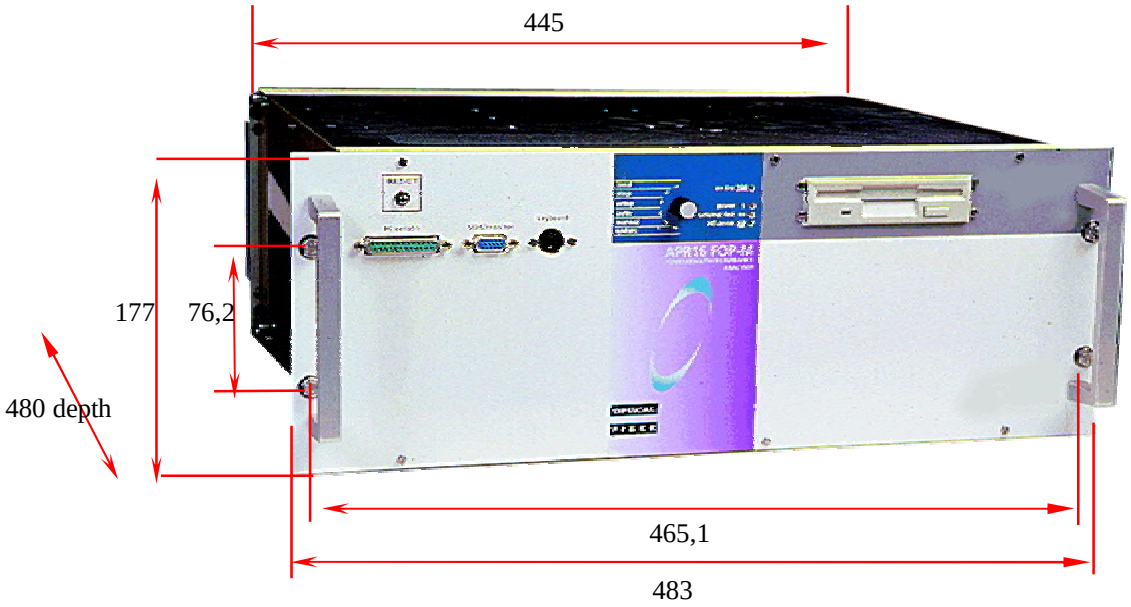
P/P curve: Curve displayed point by point (sinus waves)

V RMS curve: Curve displayed in RMS value

P (Active Power) = VI cos Φ (for a sinus wave regime)
Q (Reactive Power) = - VI sin Φ (for a sinus wave regime)
S (Apparent Power) = VI

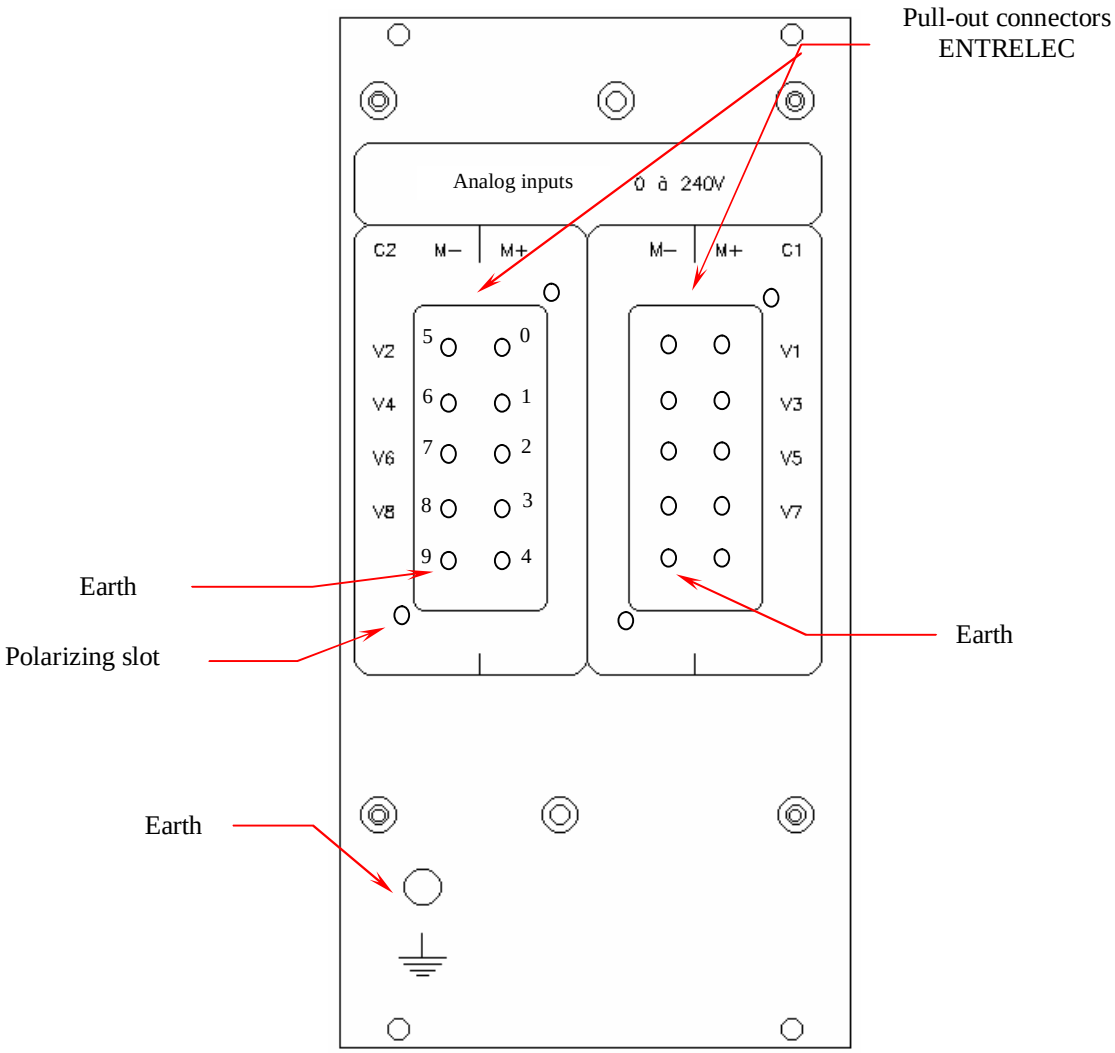
XIV Dimensions



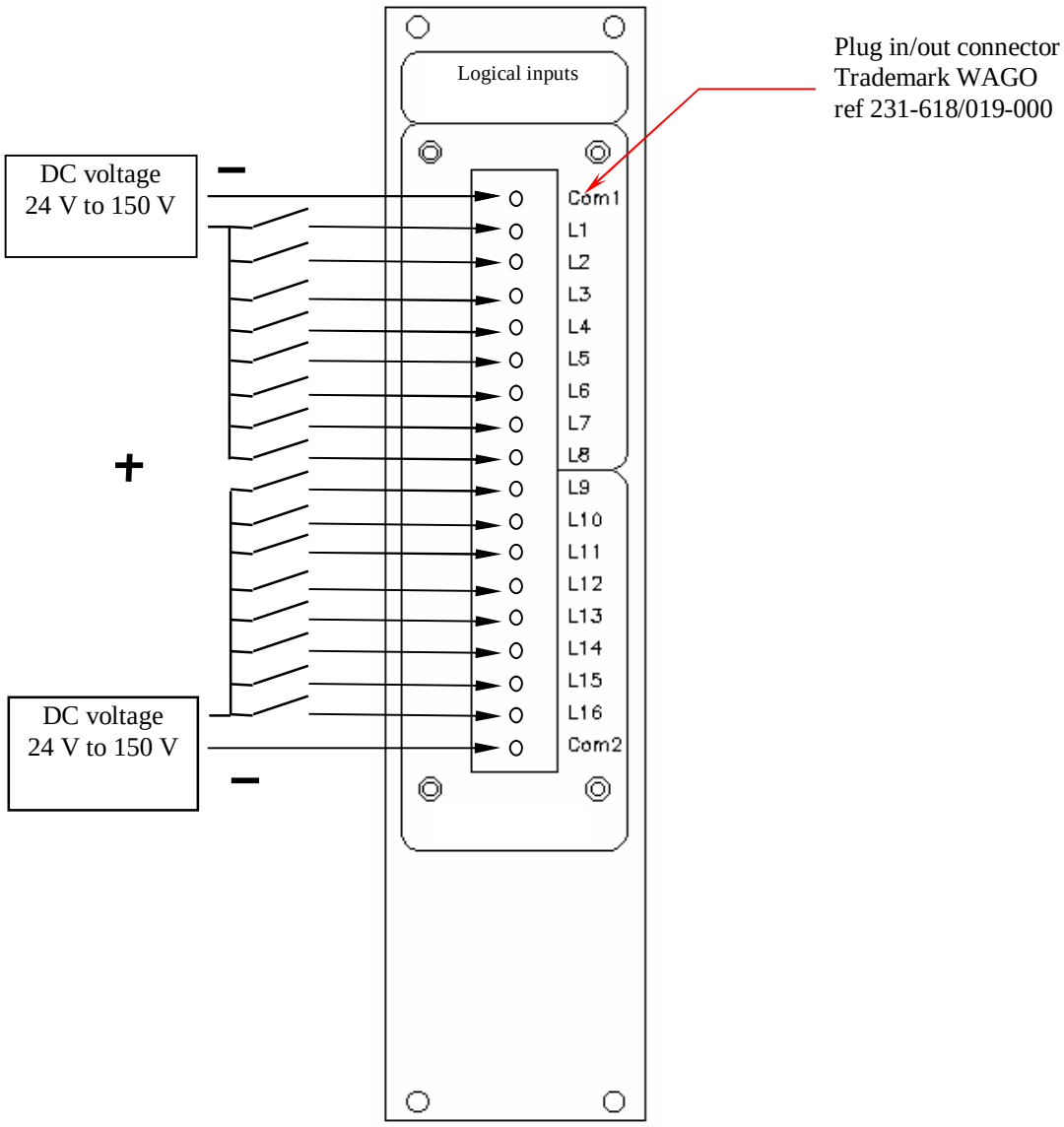


XV Description of the different panels

APR16 Unit with analog inputs



APR16 Unit with logical inputs



APR16 Auxiliary unit