NEWS: 08/05/2012

ANNOUNCEMENT

Please be kindly informed that we have a SUPER PROMOTION going on for our famous portable analyser MICROVIP3 PLUS !!!

For any information please contact us at the following address: sales@elcontrol-energy.net or contact us at the following phone number:+39 051 6782006.

ELCONTROL ENERGY NET S.R.L.
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MICROVIP3 *Plus*

PORTABLE POWER & HARMONICS ANALYSER FOR BOTH SINGLE-PHASE AND THREE-PHASE SYSTEMS.

USER MANUAL

ELCONTROL ENERGY NET S.R.L.
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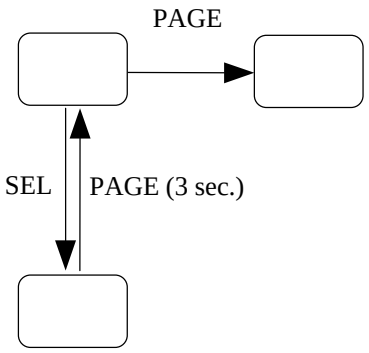
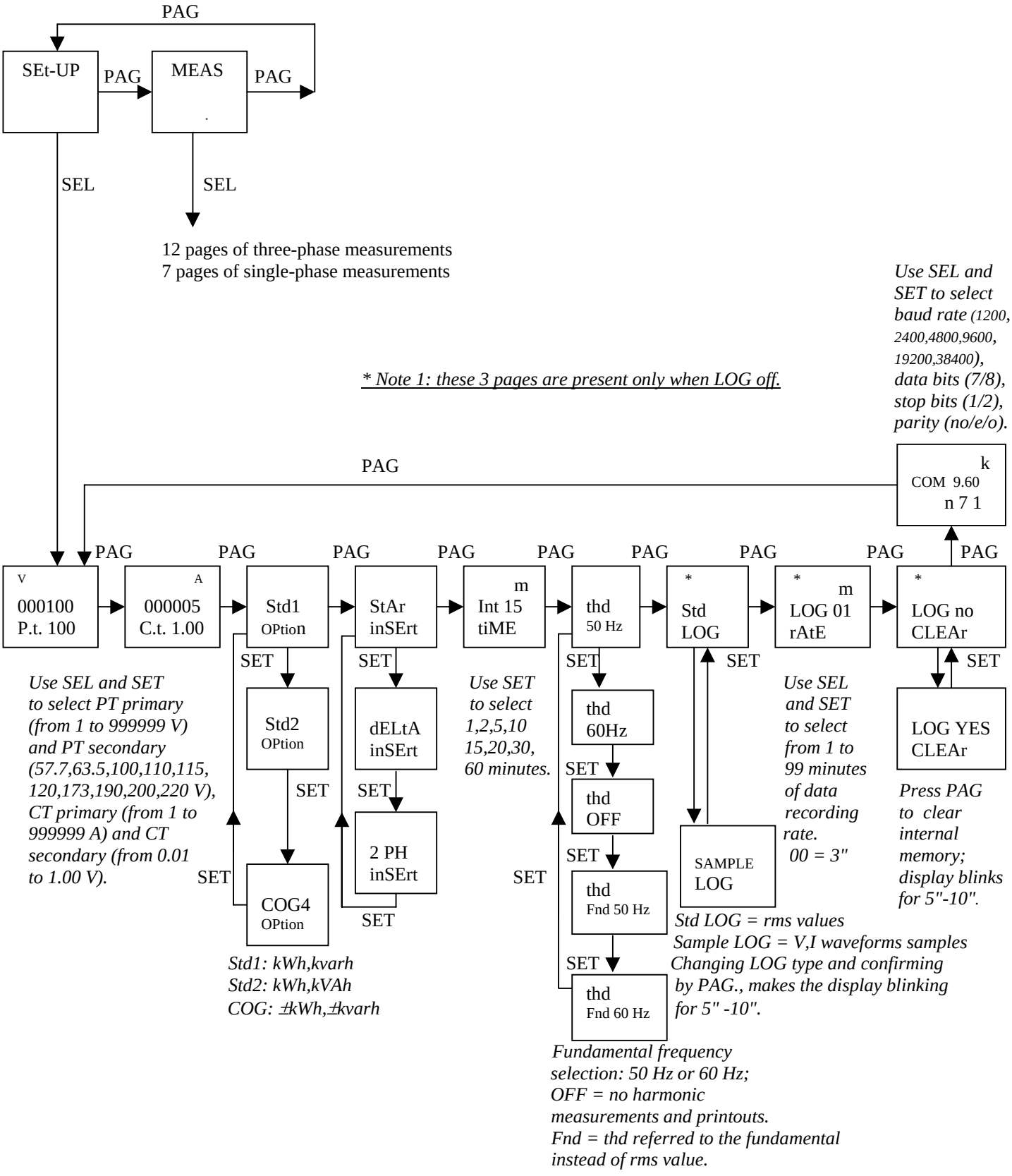
FUNCTION	PUSHBUTTONS TO BE USED
MOVING ON THE SAME MENU LEVEL	
PASSAGE TO A LOWER MENU LEVEL	
EDITING	SEL + SET = SEL = select digit SET = change digit SET = change value
ESCAPE TO AN UPPER MENU LEVEL	PAGE/ENTER (for 3 sec.)


PAG
SEt-UP
PAG
MEAS
PAG
SEL
SEL
12 pages of three-phase measurements
7 pages of single-phase measurements
* Note 1: these 3 pages are present only when LOG off.
Use SEL and SET to select baud rate (1200, 2400,4800,9600, 19200,38400), data bits (7/8), stop bits (1/2), parity (no/e/o).
k
COM 9.60
n 7 1
PAG
V
000100
P.t. 100
A
000005
C.t. 1.00
Std1
OPtion
StAr
inSErt
m
Int 15
tiME
thd
50 Hz
*
Std
LOG
*
m
LOG 01
rAtE
*
LOG no
CLEAr
SET
Use SEL and SET to select PT primary (from 1 to 999999 V) and PT secondary (57.7,63.5,100,110,115, 120,173,190,200,220 V), CT primary (from 1 to 999999 A) and CT secondary (from 0.01 to 1.00 V).
Std2
OPtion
COG4
OPtion
dELtA
inSErt
2 PH
inSErt
Use SET to select 1,2,5,10 15,20,30, 60 minutes.
thd
60Hz
thd
OFF
thd
Fnd 50 Hz
thd
Fnd 60 Hz
SAMPLE
LOG
Use SEL and SET to select from 1 to 99 minutes of data recording rate.
00 = 3"
LOG YES
CLEAr
Press PAG to clear internal memory; display blinks for 5"-10".
Std1: kWh,kvarh
Std2: kWh,kVAh
COG: ±kWh,±kvarh
Std LOG = rms values
Sample LOG = V,I waveforms samples
Changing LOG type and confirming by PAG., makes the display blinking for 5" -10".
Fundamental frequency selection: 50 Hz or 60 Hz;
OFF = no harmonic measurements and printouts.
Fnd = thd referred to the fundamental instead of rms value.

INDEX

1 USER SAFETY

- This instrument has been manufactured and tested to the standards laid down in IEC 1010-1 600V with regard to category III installation and level of protection 2 under IEC 664-664A.
- It has left our factory in perfect working order.
- In order to maintain your instrument in perfect working order and to ensure safe operation, always follow the instructions and notices given in this manual.
- Before connecting the instrument to the mains, check that the mains power and the instrument's power requirements correspond.
- Only connect the instrument to a grounded mains socket. Never use an extension lead without a ground wire.
- Plug in the main power plug before you switch on the measuring and control circuits.

Warning !

- Any breakage in the ground wire inside or outside the instrument, or the disconnection of the ground wire itself can make the instrument dangerous to use. Do not interfere with the ground wire.
- During opening of covers or the removal of pieces, parts and connection points may also be live.
- Disconnect the instrument from the mains power source before starting any adjustment, maintenance, repair, or replacement of components, and whenever the instrument has to be opened.
- Remember that capacitors inside the instrument may maintain their charge for a time even after the instrument has been disconnected from the mains.
- Make sure that any replacement of safety devices are exactly the of right type and rated amperage. Never operate the instrument with repaired safety devices or bypassed fuse holders.
- If it becomes clear that the instrument cannot be used in complete safety, remove it from service to prevent it being used inadvertently.
- Safe operation cannot be guaranteed in the following cases :
  - if the instrument is visibly damaged;
  - if the instrument fails to operate correctly;
  - if the instrument has been stored under unsuitable conditions for an extended period of time;
  - if the instrument has been damaged during transit.
- Use only 80 mA T 250V fuses with 230VAC +/- 10% mains power.
- Use only 160 mA T 250V fuses with 110VAC +/- 10% mains power.

Read these pages carefully before installing and using the instrument.

1.1 INTRODUCTION

The instrument described in this manual is intended for use by suitably trained personnel only.
Maintenance and repair operations involving the removal of the instrument cover must be carried out - exclusively - by qualified and authorised staff.

1.2 SAFETY PRECAUTIONS

All personnel operating, servicing, or repairing the instrument must always follow standard safety procedures.

1.3 SYMBOLS

READ THE USER MANUAL !

1.4 PRECAUTIONS IN CASE OF MALFUNCTIONING

If you have reason to believe that the instrument may not be functioning as it should, for example if it has been damaged in transit or in operation, remove it from service and make sure that no other persons can use it inadvertently. Consign it immediately to authorised personnel for checking and repair.

2 INTRODUCTION TO THE MICROVIP3 PLUS

2.1 MAIN FEATURES

The MICROVIP3 PLUS is a low cost, class 1 (IEC1036) high technology portable analyzer for both single phase and three phase systems, manufactured by ELCONTROL ENERGY and supplied complete with three 1000A clip-on CTs, voltage leads and all accessories in strong carry case.
The MICROVIP3 PLUS is capable of performing 189 true effective value measurements on an unbalanced three phase system starting from three voltage and three current measurements: 33 parameters are displayed on its crisp high-contrast back-lit LCD, 156 only on its built-in printer.
The instrument comes complete with a printer for manually controlled or automatic timed printout of all measurements, as well as a calendar/clock for the display and printout of time and date.
The instrument can operate from 230 VAC Voltage supply (110VAC model is also available) or from internal rechargeable batteries with an autonomy of over 7 hours provided no printing is performed and the display back-lit is switched off.
A non-volatile flash 1 MB on-board memory provides data storage over extended survey periods including waveform capture for current and voltage.
The MICROVIP3 PLUS is fitted with an RS232 port for connection to a Personal Computer for remote data control and fast download via high-speed serial link.
The instrument has been designed for portable, mobile use in industrial environments.

2.2 GREAT VERSATILITY

The MICROVIP3 PLUS measures average three-phase and phase-neutral true rms voltage on all three phases, (max 600 Vrms), equivalent three phase current and true rms current per phase, total three phase power and power per phase, total three-phase power factor and power factor per phase, reactive and apparent three phase system power, frequency, active and reactive energy consumption/export, voltage and current total harmonic distortion per phase.
MICROVIP3 PLUS memorises energy consumption up to 999999 MWh and MVArh/MVAh and also memorises active, reactive and apparent power peaks integrated using the technique of mobile averages over 1, 2, 5, 10, 15, 20, 30 or 60 minutes.
The basic model, supplied with three 1000A AC clamp meters, is capable of measuring power level from a minimum of 35W (5V, 7A) single phase to a maximum of 1,80MW (600V 1000A) three phase.
Optional AC clamp meters for up to 3000A and other DC models are also available.
All external CT/PT ratios, star/delta connection and power integration period are fully programmable.
The built-in 42 column graphic printer provides additional 156 parameters against manual print commands, and is coupled to a calendar-clock to print out date and time along with measurements and to permit the generation of automatically timed printed printouts at intervals of 1 to 99 minutes (with all measurements related to the printout start time): data includes V & I harmonics to 24th multiple with both DC component and Displacement factor, and V & I waveform/harmonic bar chart printout.

2.3 PURPOSE AND USE

The MICROVIP3 PLUS is intended for use by electrical power users who need to obtain an in-depth knowledge of their plant and systems. It is also extremely useful for plant engineers, installers, maintenance engineers and electricians in fault diagnosis and in the adjustment and repair of active electrical plant.

The MICROVIP3 PLUS enables you to:

- Control loads and consumption;
- Reduce overloads and power loss;
- Check on the correct sizing of new plant entering service;
- Prevent overheating and insulation problems;
- Solve power factor correction problems;
- Identify and eliminate load peaks and associated power problems;
- Check 400 Hz naval plants and 600 Hz aeronautical plant;
- Check uninterrupted power supplies with AC inputs and DC outputs;
- Measure asymmetrical signal for PWM controllers.

2.4 DESCRIPTION OF THE INSTRUMENT

The following components are located on the instrument's front panel:

1: backlit liquid crystal display for read-out of measurements;
2: PAGE/SEL/SET keys for display and control of measurements;;
3: liquid crystal display for read out of calendar-clock;
4: PRG/SELC/SETC keys for control of calendar-clock;
5: PAPER key for manual paper feed;
6: PRINT key for manual printout of all measurements;

The following figure shows the layout of the above components.

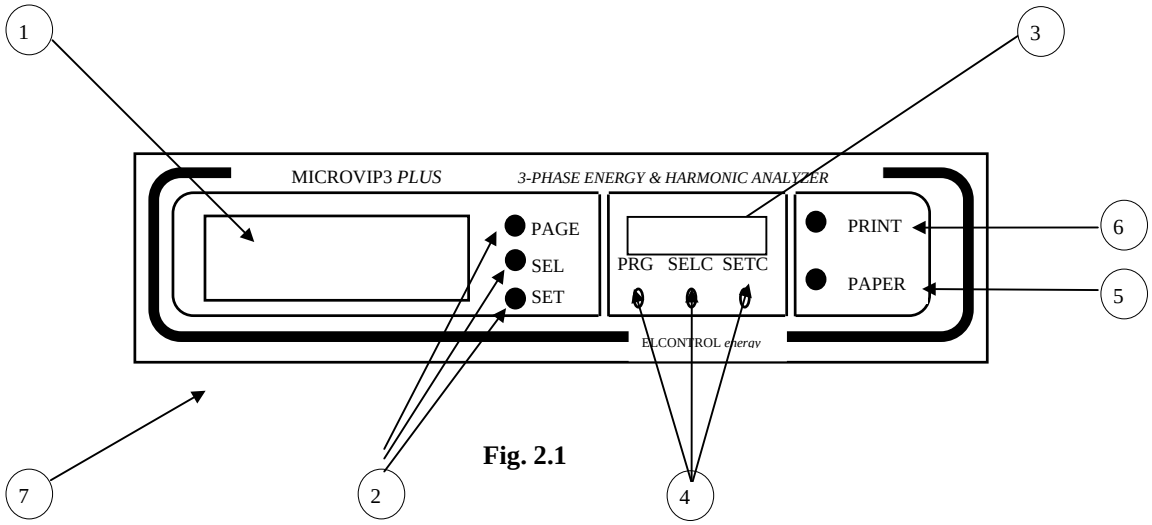


Fig. 2.1

The following components are located on the rear panel:

1: mains power socket (for use with cable provided);
2: removable fuse-holder for safety fuse;
3: ON (I)/STANDBY (O) switch for activation of instrument;
4: RS232 port for connection to Personal Computer for remote data control, and fast download via high-speed serial link;
5: single phase/three phase selector;
6: display backlight ON/OFF button (for use during battery operation to save power: the backlight can be left on during mains operation).

The following figure shows the layout of the above components.

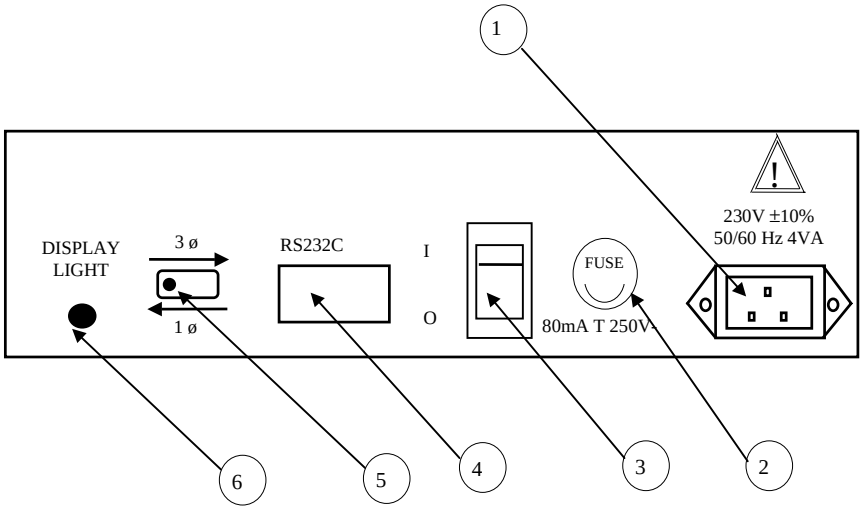
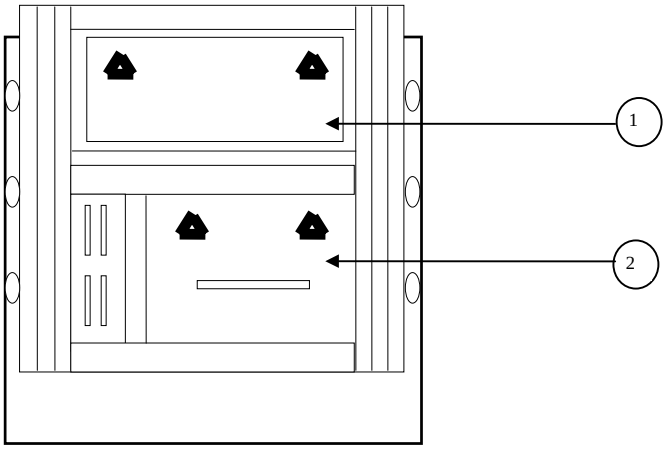


Fig. 2.2

The following components are located on the top of the instrument:

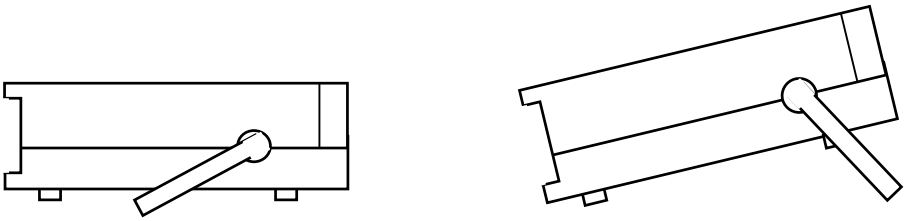
1: connectors compartment with voltage and current measurement connectors;
2: printer.

The following figure shows the layout of these components.

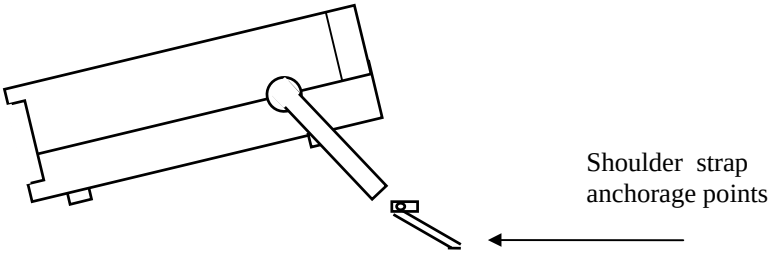


2.5 HANDLING THE INSTRUMENT

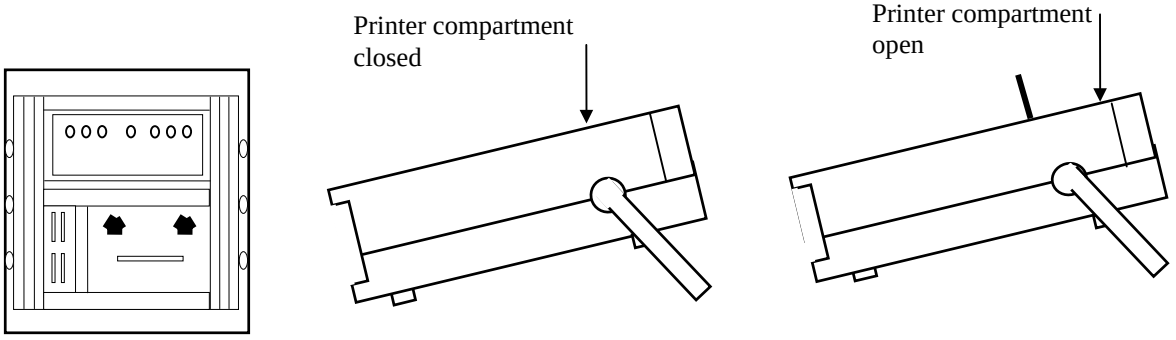
Adjustable Handle: the handle can be adjusted as required to support the instrument at the angle for display readability.



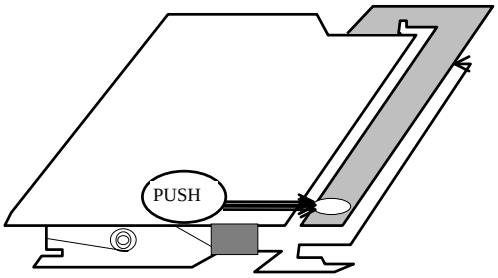
Shoulder Strap Hooks: The shoulder strap provided with the kit can be used for carrying the instrument. The handle has special holes into which the shoulder strap hooks can be inserted.



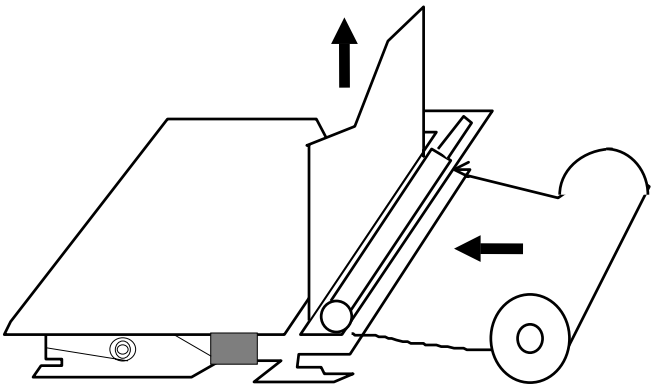
Printer Access: to open the printer compartment, simply press lightly on the ribbed section of the printer cover as shown.



Replacing the printer cartridge: open the printer compartment and press down on the area marked PUSH to remove the old cartridge. Fit the new cartridge and push gently down into position.

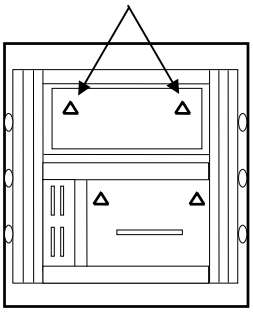


Replacing the printer roll: open the printer compartment and press down gently on the area marked PUSH to remove the printer cartridge. Fit the paper toll and shown in the figure. Press the PAPER key repeatedly to feed the paper through the mechanism. Replace the cartridge and check paper alignment.

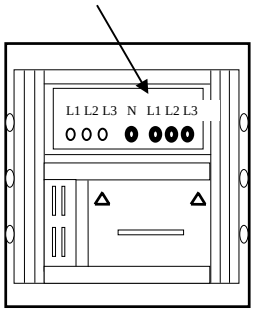


Access to the volt and ampere measuring connectors: press on the ribbed area of the connectors compartment cover on the top of the instrument (as for opening the printer compartment) and open it. The connector are located inside (see figure). There are four single pole connectors for voltage measurements (N = neutral; L1 = R phase connection; L2 = S phase connection; L3 = T phase connection) and 3 three pole connectors for the current measurement clamp meters (L1, L2, L3).

Press at ribbed areas



Voltmeter and current connection compartment



3 INSTALLATION

3.1 PRELIMINARY INSPECTION

When you receive your MICROVIP3 PLUS, check that the kit is complete and that the instrument has not been damaged in transit.
Refer to ELCONTROL ENERGY service network for any repair or replacement.

3.1.1 KIT CONTENTS

The instrument comes in a practical impact resistant case and with a number of accessories. The complete kit should comprise:

1 MICROVIP3 PLUS instrument case
1 MICROVIP3 PLUS
1 power cable
1 set of voltage measuring cables
3 1000A/1Vrms AC clamp meters with cables
2 5X20 T 80 mA fuse (230VAC ± 10% power); T160 mA (110VAC± 10% power)
1 spare printer ribbon cartridge
1 spare printer paper roll
1 shoulder strap
1 instruction manual
1 guarantee certificate
1 calibration certificate

check that the kit is complete before starting to install the instrument.

3.2 SAFETY INSTRUCTIONS

3.2.1 GROUNDING

The MICROVIP3 PLUS instrument can be powered from the mains using the cable provided or from the internal battery. When using the instrument under mains power, always connect up the power cable before making in measuring connections, and make sure that the mains cable is plugged in to a grounded power socket.
Only use extension mains cables with suitable ground connections.
Use the internal battery only for shorter periods of operation.

3.2.2 POWER REQUIREMENTS

The instrument can operate from mains power of 230VAC±10% 50/60 Hz (a special version is available for use with 110VAC±10% 50/60 Hz).

3.2.3 MAINS POWER FUSE

With 230 VAC± 10% mains power only use 80 mA 250 V type T fuses of size 5X20.
With 110 VAC ± 10%mains power only use 160 mA 250 V type T fuses of size 5X20.
Always disconnect the instrument from the mains before replacing a fuse.
To replace a fuse, simply unscrew the fuse holder on the rear panel.
Make sure that replacement fuses are of the same type and rating as the one removed.
Do not use the instrument with repaired or short-circuited fuses.

3.3 INSTRUMENT POWER

3.3.1 MAINS POWER

The kit includes a power cable for connection to the mains supply.
Make sure that mains power is 230VAC ± 10% 50/60 Hz (or 110VAC ± 10% 50/60 Hz if your version is designed for this rating).
Simply plug the mains cable into the socket at the rear of the instrument (see Fig. 3.1) and into the mains power outlet.

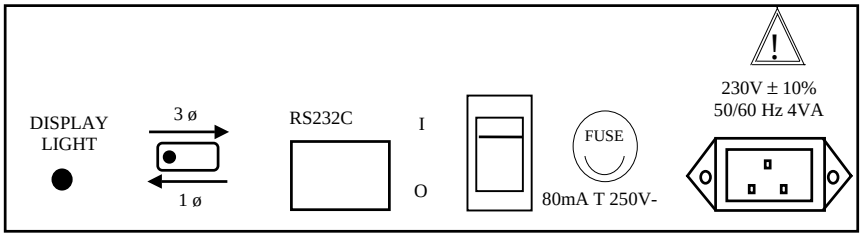
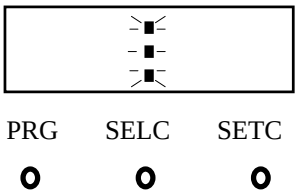


Fig. 3.1

Set the I/O switch to I to switch the instrument on.
The I/O switch only affects the instrument's low tension circuits and battery output circuits (practically speaking, with the switch set to I, the instrument operates normally; with the switch set to O, the instrument control circuits are switched off but the battery charging circuit remains on).
With the instrument switched on, you can make the measuring connections required.

3.3.2 BATTERY POWER

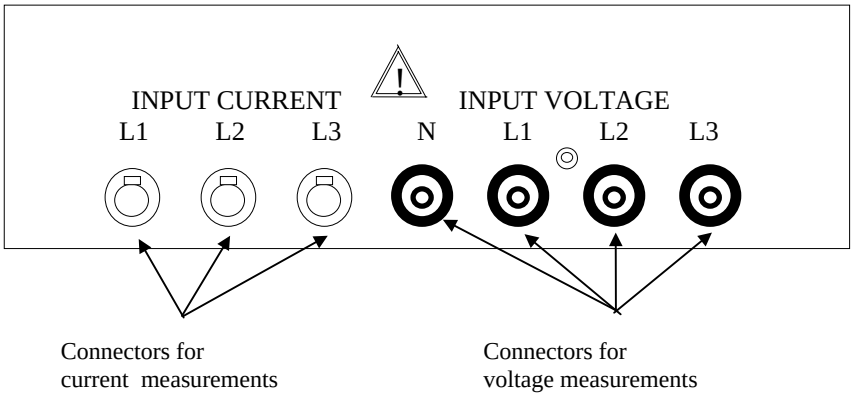
The MICROVIP3 PLUS can also work by its internal rechargeable battery. The instrument automatically switches to battery power as soon as the mains cable is disconnected.
The MICROVIP3 PLUS uses a Ni-Cd 6V 940 mAh battery (with five 1,2 V 940 mAh elements in series) giving the instrument an autonomy of over seven hours providing no printouts are required and the display backlight is switched off (the display backlight can be activated by pushing the button on the rear panel, and switches off after approximately 15 seconds from the moment the button is released).
Do not use battery power for long measuring operations or when extensive printing is needed.
The instrument warns of low battery level by displaying three flashing dots on the calendar-clock display. When battery power is low, the instrument automatically disables the print function (see figure).



To restore printer functions, connect the instrument to the mains power at least until the third dot goes out (15 minutes approx.).
If the battery is completely drained, for example after a long period in storage, the instrument may not switch on at all.
If it happens, simply connect the instrument to the mains to recharge the battery.
Leave the instrument switched off (standby) and connected to the mains for 24 hours to fully charge the battery.
IMPORTANT: no ground connection is needed when the instrument is working by battery:
DO NOT CONNECT THE INSTRUMENT TO GROUND.

3.4 MEASURING CONNECTIONS

The connectors for use in voltmeter and ammeter connections are located in the top of the instrument.



Follow these instructions carefully to avoid measurement errors.

3.4.1 VOLTMETER CONNECTIONS

Use the cables supplied for the purpose in the kit.

3.4.2 CURRENT MEASURING CONNECTIONS

Use the clamp meters supplied for the purpose in the kit.

When making current measurement make absolutely sure that each clamp meter is connected to the same phase as the corresponding voltage measurement.

Incorrect connections can give rise to significant measuring errors since a phase angle between current and voltage of 120 degrees can be added.
When connecting the clamp meters with Std1 or Std2 option selected, you do not need to know the direction of flow since the instrument automatically inverts in case of reversed connections.
The following diagram (fig. 3.2) shows the correct connection layout.

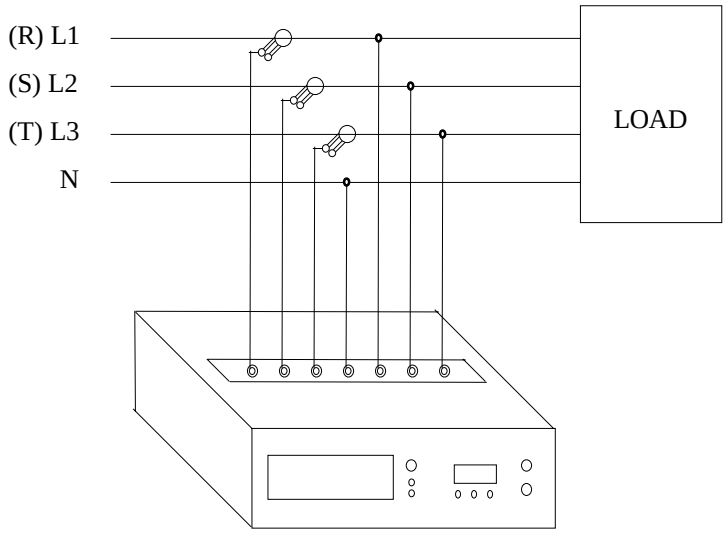


Fig. 3.2

4 OPERATION

4.1.1 MEASURING THREE PHASE POWER (STAR SYSTEM)

Set the connection type selector on the rear panel to 3 ø (THREE-PHASE) (see Fig. 4.1).

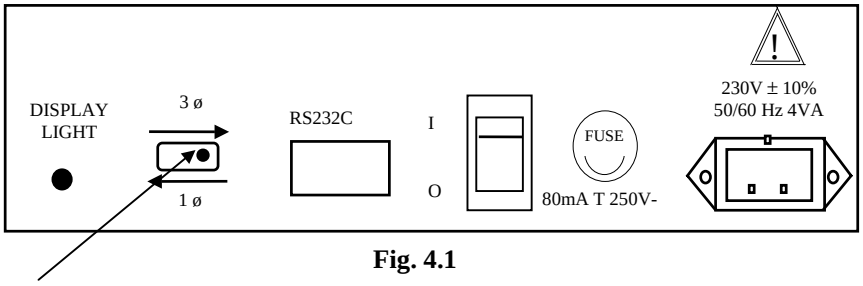


Fig. 4.1

Make all connections as shown Fig. 4.2.

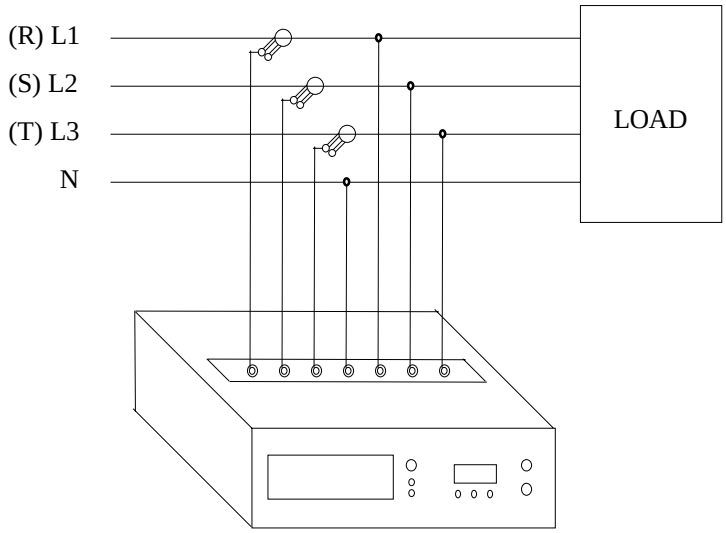


Fig. 4.2

If the neutral is unavailable it is possible to reconstruct it using the DSC-MT accessory (code 4AAC4) for voltages up to 120VAC, DSC-400VAC (code 4AANY) for voltages up to 400VAC or DSCD2 (code 4AAHG) for voltages up to 700VAC. Make the necessary connections as shown in fig. 4.3.1

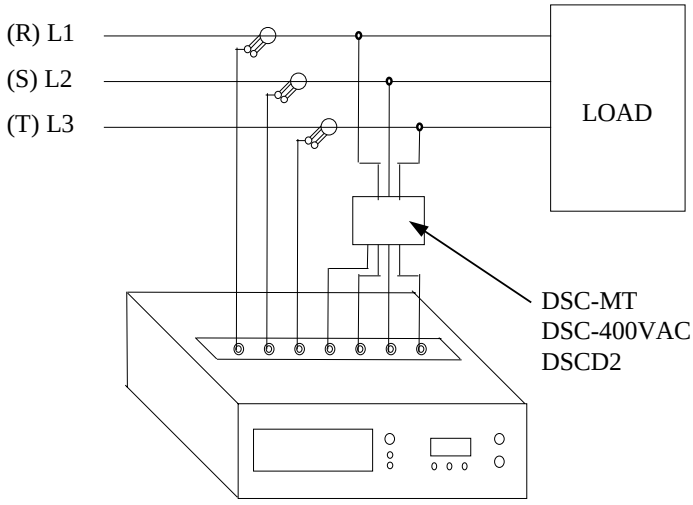


Fig. 4.3.1

4.1.2 MEASURING THREE-PHASE POWER (DELTA SYSTEM)

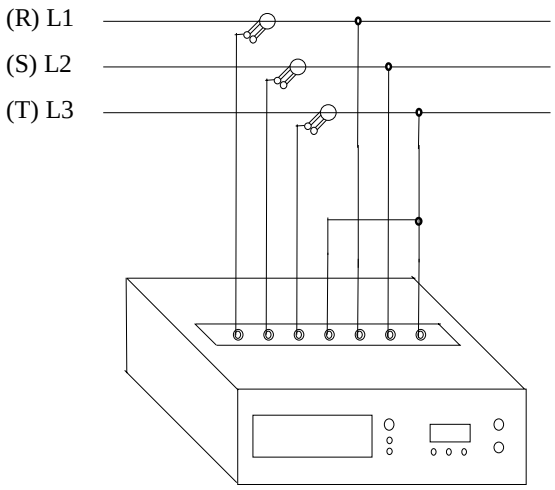
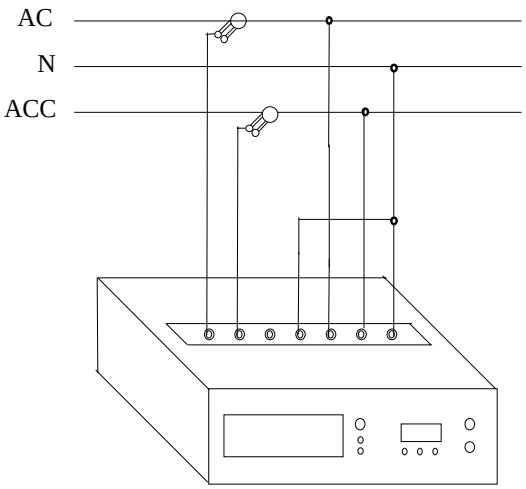


Fig. 4.3.2

Connect L1, L2, L3; then connect the neutral voltage input to L3.
Note: Select Delta in Set-up Pages Menu

4.1.3 MEASURING TWO PHASE POWER



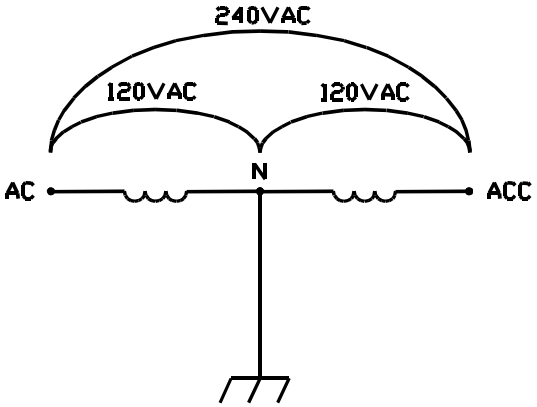


Fig. 4.3.3

Connect L1 and L2; then connect the neutral Voltage input to L3.
Note : Select 2 PH in Set-up Pages Menu.

4.2 MEASURING SINGLE PHASE POWER (PHASE-NEUTRAL)

Set the connection type selector on the rear panel to 1ø (SINGLE-PHASE). Use only the instrument's L1 phase inputs (current to connector L1 and voltage between connectors L1 and N) as show in fig. 4.4.

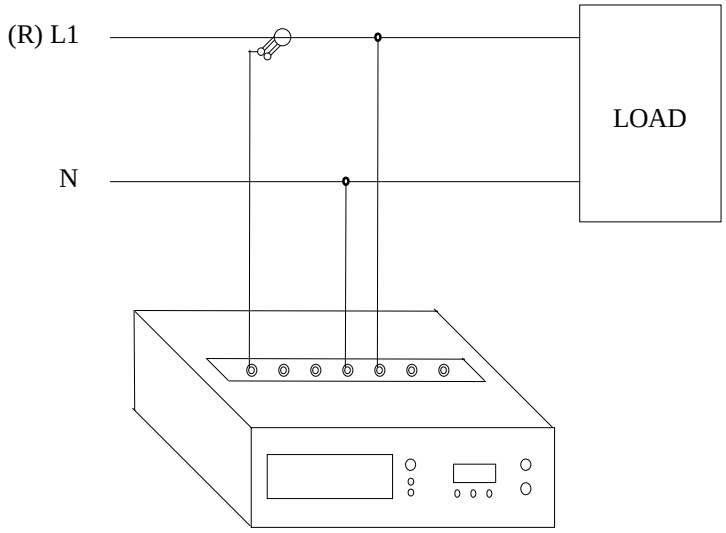


Fig. 4.4

4.3 AC / DC MEASUREMENTS

When taking measurements from DC circuits or networks, or circuits where alternating signals have direct components superimposed (e.g. inverters, U.P.S., rectifiers), use the Hall effect clamp meters designed for these applications which are available from the ELCONTROL ENERGY accessories catalogue. Use the ADAPTA-1V/1V adapter (code 4AACQ) for connections to the MICROVIP3 PLUS as shown in fig. 4.5 for the phase L1 inputs and in figs. 4.6 and 4.7 for three phase systems (taking care to ensure that voltage and current inputs correspond).

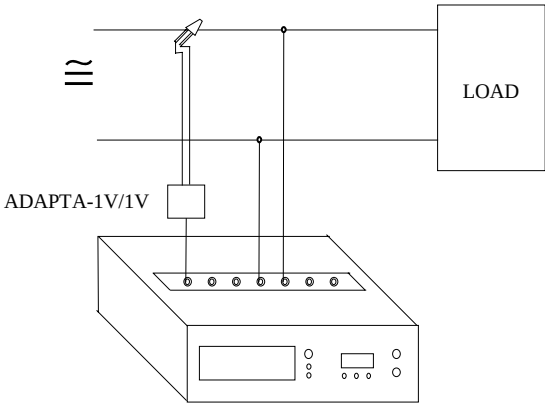


Fig. 4.5

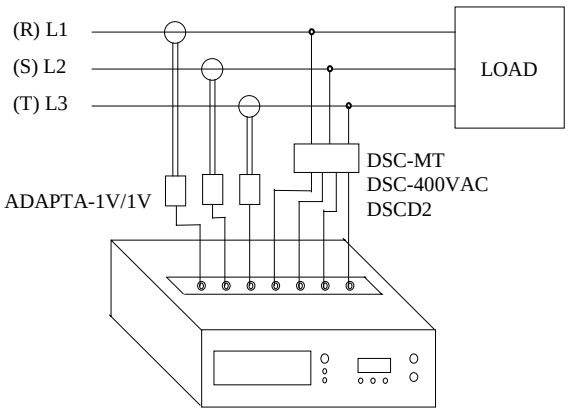


Fig. 4.6

When either option Std1 or Std2 is selected, the clamp meters can be connected in either direction since the MICROVIP3 PLUS automatically inverts current direction if necessary.

4.4 SPECIAL CONNECTIONS

4.4.1 CTs AND NON-STANDARD CLAMP METERS

When using current transformers or current measuring clamp meters other than those supplied, use adapter interfaces

INTA/1 (code 4AABB) and INTA/5 (code 4AABD), as listed in the ELCONTROL catalogue.

1) Connect the CT secondary to the INTA/1 or INTA/5 interface.
2) Remove the short circuit from the CT.
3) Connect the interface to the instrument taking care that the voltage and current inputs correspond.

CAUTION: always use the correct connection layout to avoid serious damage to the instrument (see Fig. 4.7).

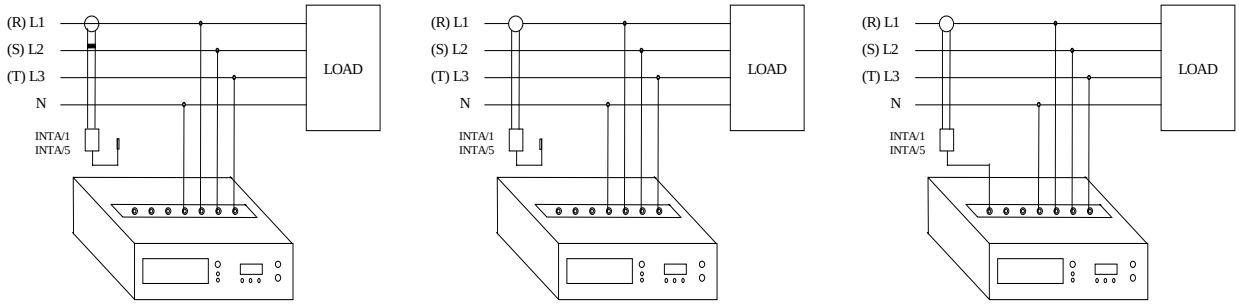


Fig. 4.7

When your measuring is finished:
1) Disconnect the interface from the instrument
2) Short circuit the CT secondary
3) Disconnect the CT secondary from the INTA/1 or INTA/5 interface

Fig. 4.8 shows example of CT and non standard clamp meter connections.
Make sure that you program the values of the CT primary as instructed in chapter 5 below.

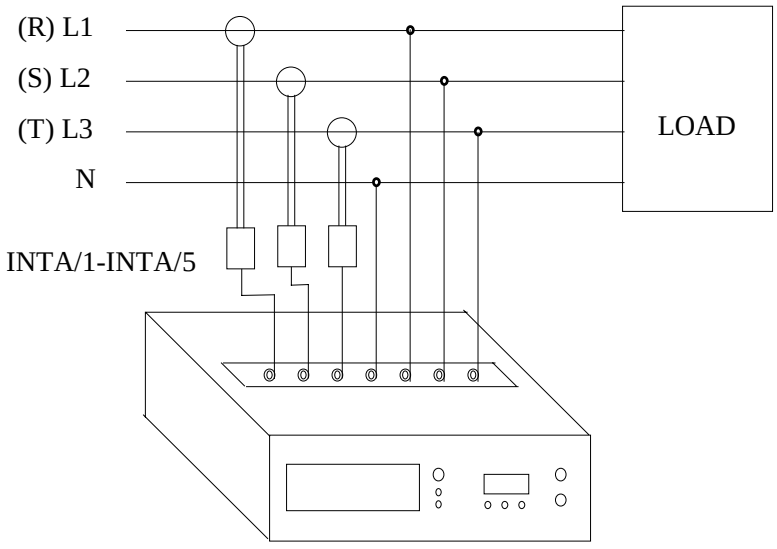


Fig. 4.8

4.4.2 THE INTA/1 AND INTA/5 INTERFACES

Note: one of the CT terminals is normally connected to a common ground (see fig. 4.9).

When using the INTA/1 and INTA/5 interfaces, bear in mind that there is no galvanic separation so that the instrument's ground is actually connected directly to the plant.
You must therefore make sure that there are no spurious voltages between the plant ground and the instrument's grounds and that no other conditions which could cause damage to the instrument exist

In these cases, use an insulating transformer (fig. 4.10), or three SEPA 5X1 interfaces (code 4AAER) available in the ELCONTROL ENERGY accessories catalogue.

Fig. 4.9

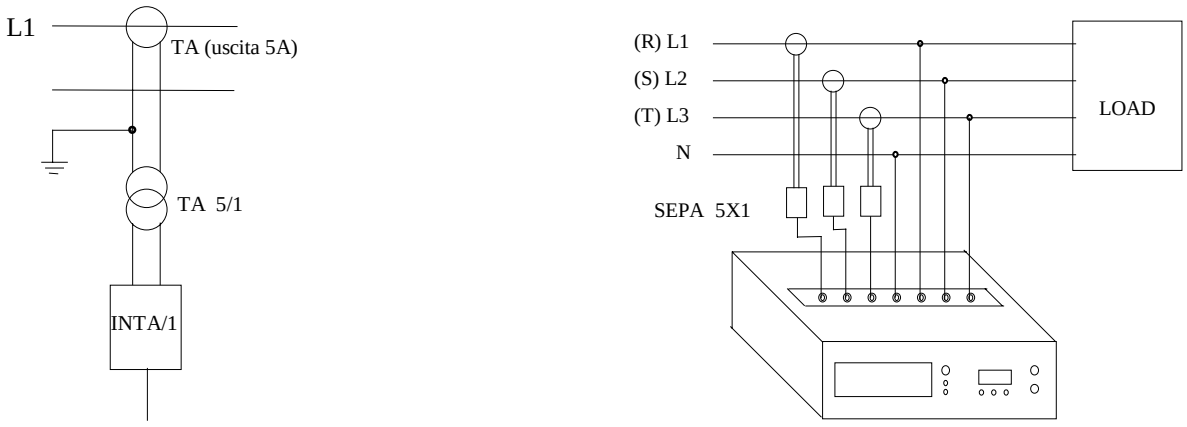
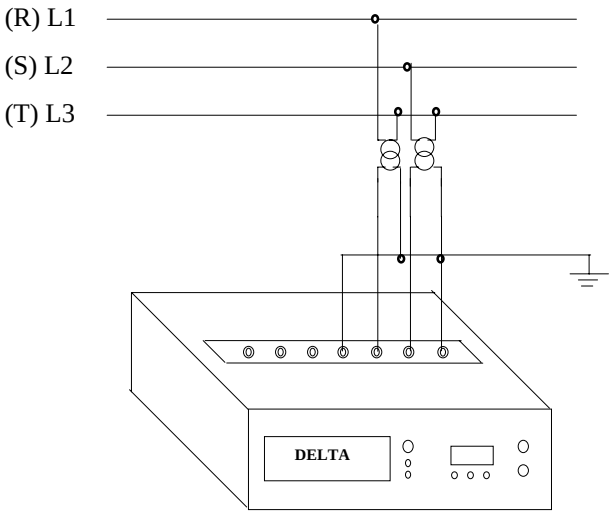
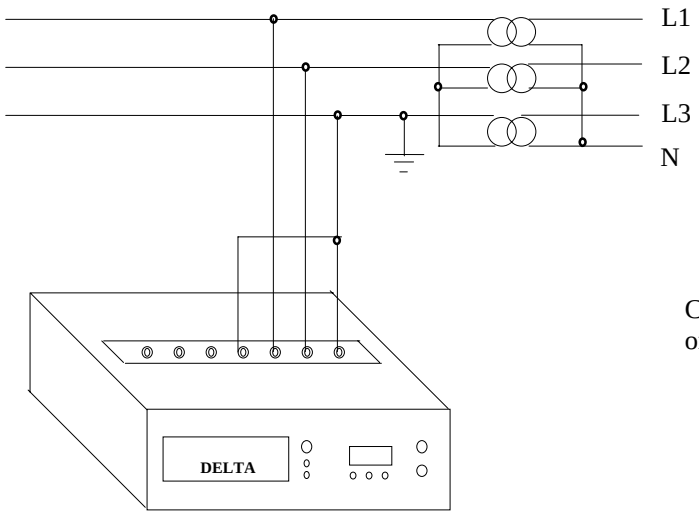


Fig. 4.10

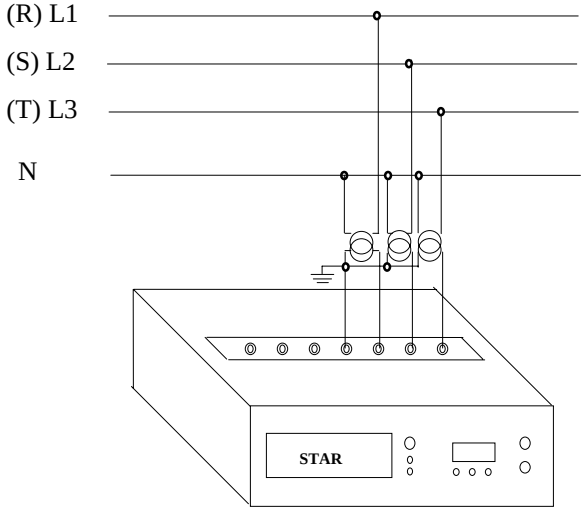
4.4.3 PTs



Connection to 2 voltage transformers
with one phase of the secondary grounded



Connection to 3 star voltage transformers with
one phase of the secondary grounded



Connection to 3 star voltage transformer
(PTs)

5 MICROVIP3 PLUS OPERATING MODES

The MICROVIP3 PLUS displays measurements on its LCD.
A switch on the rear panel allows you to select one of two operating modes.

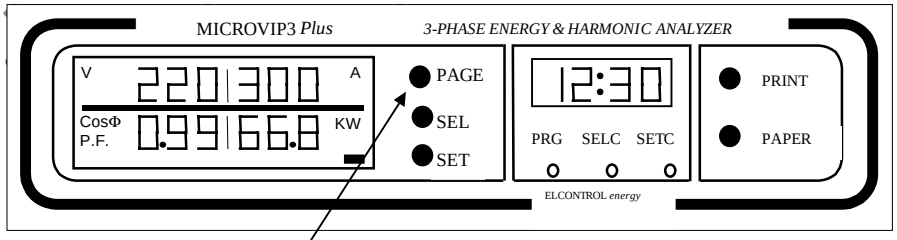
5.1 SINGLE PHASE MODE

The instrument display and data control functions are controlled by the keys on the front panel shown in fig. 2.1.

5.1.1 THE PAGE KEY

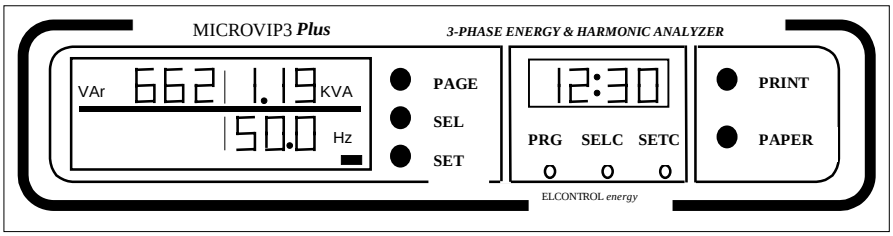
The PAGE key enables you to switch the display between seven measurement pages.
When you switch the instrument on in single phase mode, the first measurement page is displayed by default. Press the PAGE key to move on to the next pages.

First page (single-phase)
Volt: Rms phase-to-neutral voltage
Amp: Rms current
Watt: Active power with full scale value of VxA.
CosΦ P.F.: Power Factor with variations from -0,00 a +0,00.

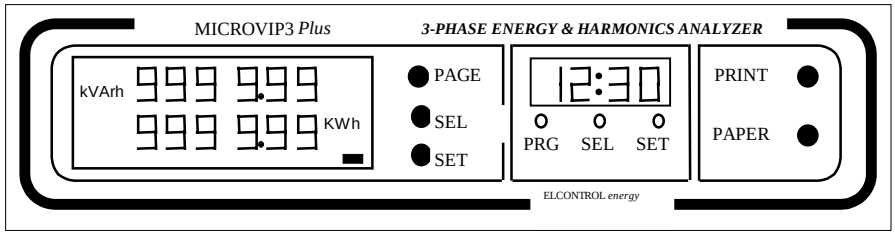


Press page key to display
next pages

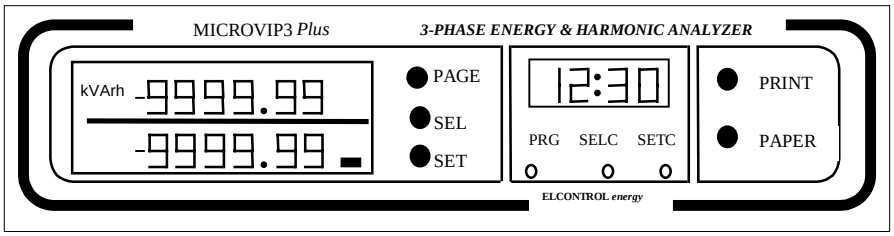
Second page (single-phase)
kVAr: Reactive power.
kVA: Apparent power.
Hertz: voltage Frequency, range 20 to 600 Hz (AC) and 00 Hz (DC).



Third page (single-phase)
kvarh (kVAh) : Reactive energy consumption for the single-phase system
(Apparent energy with STD2 option)
kWh : Active energy consumption for the single-phase system

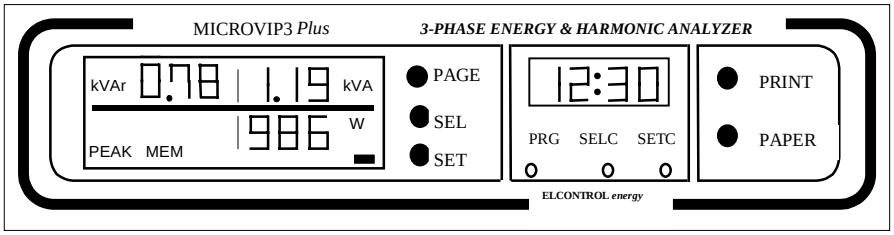


Fourth page (single-phase)
kVArh : Reactive energy export for the single phase system (COG4 option)
kWh : Active energy export (COG4 option)

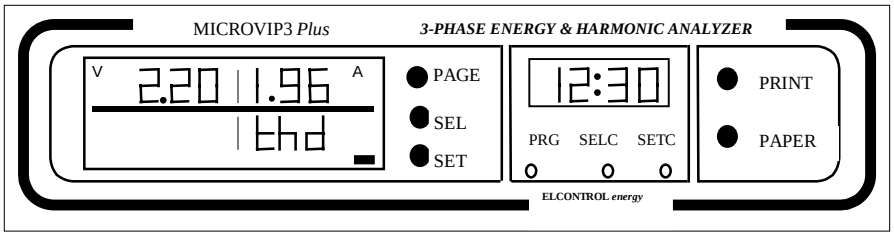


Fifth page (single-phase)
kVAr : Average Reactive power peak of the single phase system
kVA : Average Apparent power peak of the single phase system
kW : Average Active power peak of the single phase system (Maximum demand)

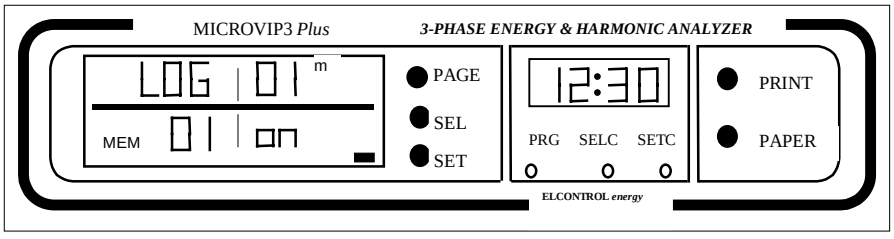
Peak values are memorized and displayed only after an integration period of 1, 2, 5, 10, 15, 20, 30 or 60 minutes from the time the instrument is first switched on. Values are updated every fifth of the integration period.



Sixth page (single-phase)
THDF V - THDF A : Total Harmonic Distortion Factor of Voltage and Current referenced to the rms or to the fundamental value for the 50/60 Hz systems



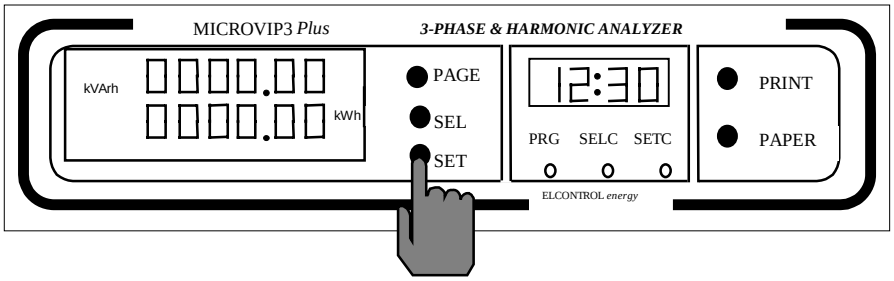
Seventh page (single-phase)
Data storage control page
Log on (off) : to activate (or de-activate) data storage (using the SET key)
01-99 m (minutes) : Data records rate (00 = 3 seconds)
00-100 (%) MEM : % of memory used



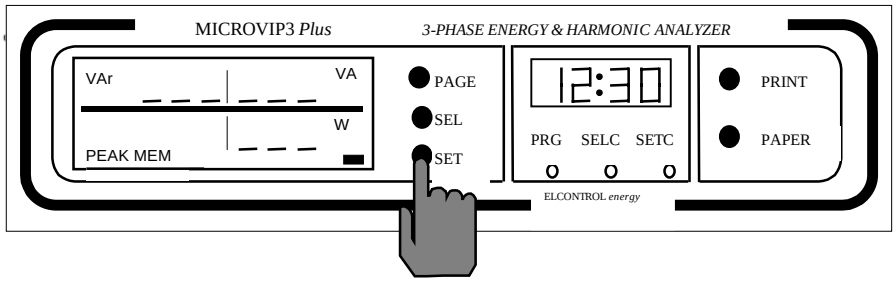
5.1.2 ENERGY CONSUMPTION AND MAXIMUM DEMAND RESET

The SET button resets to zero all electrical energy consumption counts (kVArh, kVAh, kWh) and active, reactive and apparent power peak values. The button is enabled only when the page displayed reads out one of these values (i.e. in pages three, four and five).

If you press the SET button while page three or page four is displayed, the energy counts on the display are reset to zero.



If you press the SET button while the fifth page is displayed, the active and reactive power peak values are reset to zero. The buffer used to calculate average power is also cleared, and this measurement therefore remains invalid until the programmed integration time has elapsed again.
A series of dashes is displayed.



Once you have reset values, press the PAGE key to return to measuring mode.

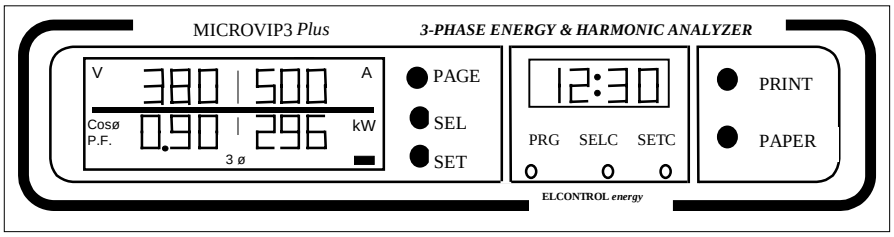
5.2 THREE PHASE MODE

The instrument display and data control functions are controlled by the keys on the front panel. The following keys control the display of measurements:

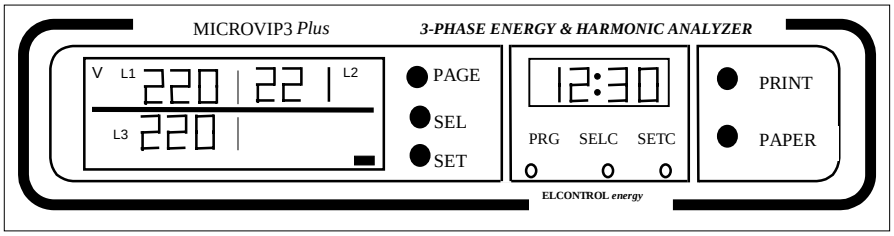
5.2.1 THE PAGE KEY

The PAGE key allows you to display each of 12 measurement pages.
When you switch on the instrument on in three phase mode, the first measurement page is displayed by default.
Press the PAGE key repeatedly to move on the other pages.

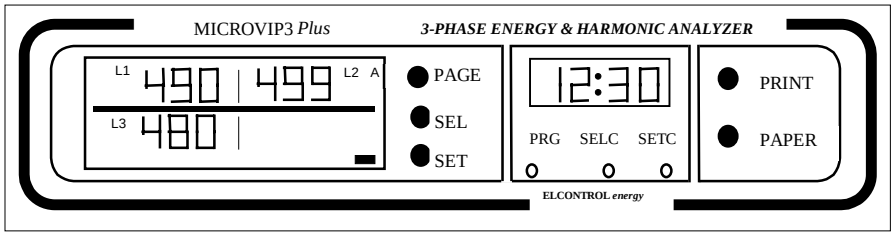
First page (three-phase)
Volt: Rms phase to phase voltage of three phase system (average of the three-phase system).
Amp.: Rms current equivalent to a symmetrical and balanced three phase system .
P.F. Cosø : Power factor of the three phase system.
kWatt : Active power of the three-phase system.



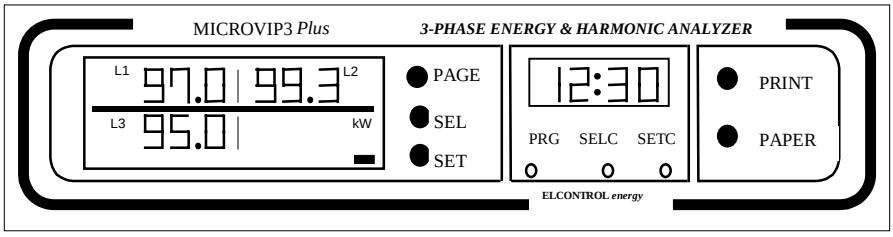
Second page (three-phase)
Volt L1: Rms voltage between phase L1 and neutral (STAR)
Rms voltage between L1 and L3 (DELTA)
Volt L2: Rms voltage between phase L2 and neutral (STAR)
Rms voltage between L2 and L3 (DELTA)
Volt L3: Rms voltage between phase L3 and neutral(STAR)
Rms voltage between L1 and L2 (DELTA)



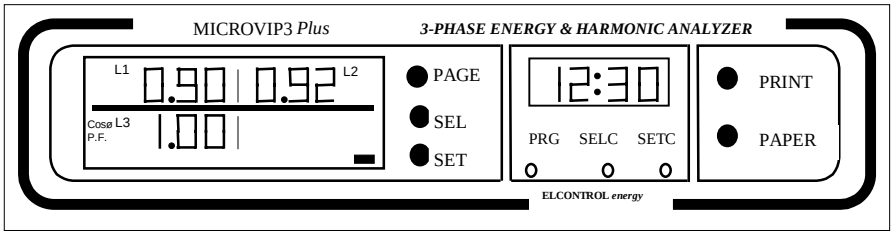
Third page (three-phase)
Amp L1: Rms Current of Phase1.
Amp L2 : Rms Current of Phase2.
Amp L3 : Rms Current of Phase3.



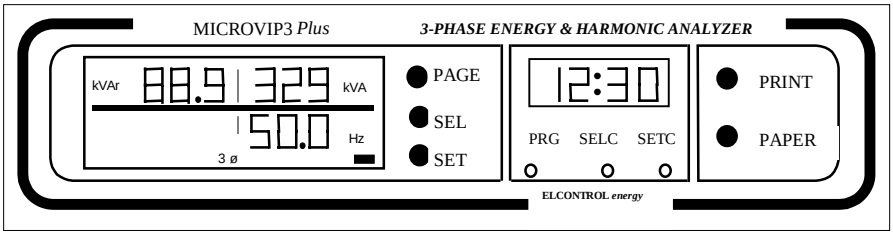
Fourth page (three phase)
kW L1 : Phase L1 active power.
kW L2 : Phase L2 active power.
kW L3 : Phase L3 active power.
(kW L3 only in three-phase, STAR; missing in DELTA)



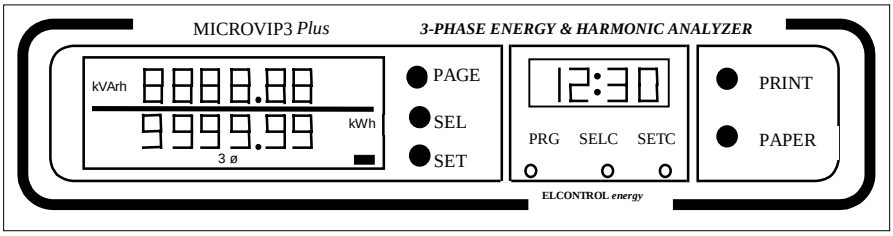
Fifth page (three-phase)
P.F. Cosø L1 : Phase L1 power factor
P.F. Cosø L2 : Phase L2 power factor
P.F. Cosø L3 : Phase L3 power factor
(only in three-phase, STAR; missing in DELTA)



Sixth page (three-phase)
kVAr : Reactive power of the three phase system
kVA : Apparent power of the three phase system
Hz : Voltage frequency

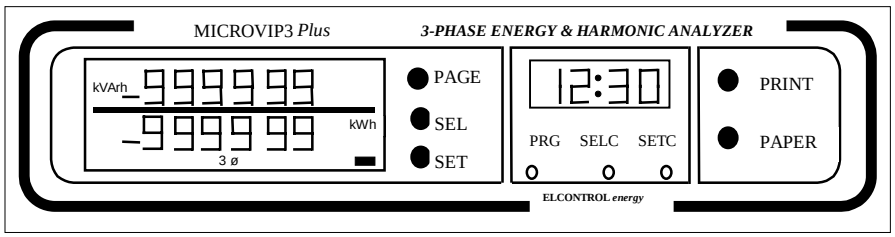


Seventh page (three-phase)
kVArh : Reactive energy consumption for the three phase system (Apparent energy with STD2 option)
kWh : Active energy consumption for the three phase system
Note: Press SET to clear



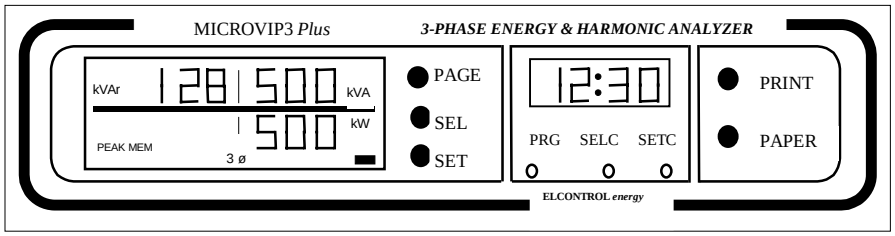
Eighth page (three-phase)

kVArh : Reactive energy export (COG4 option)
kWh : Active energy export (COG4 option)
Note: Press SET to clear



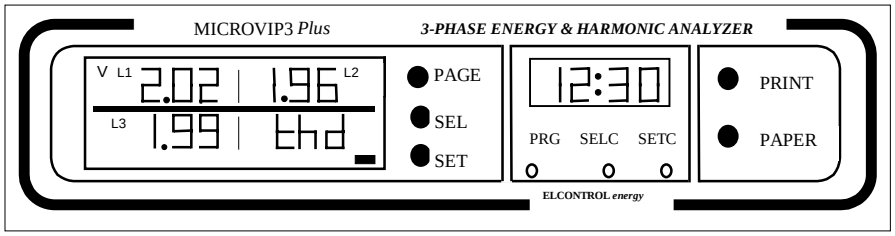
Ninth page (three-phase)

kVAr : Average reactive power peak of the three phase system
kVA : Average apparent power peak of the three phase system
kW : Average active power peak of the three phase system
Note: Press SET to clear



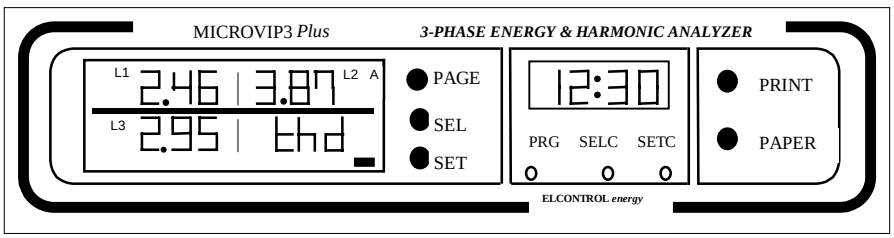
Tenth page (three-phase)

THDF VL1 : Total harmonic distortion factor of the voltage of phase 1 referred to the Rms or to the fundamental value for 50/60 Hz systems
THDF VL2 : Total harmonic distortion factor of the voltage of phase 2 referred to the Rms or to the fundamental value for 50/60 Hz systems
THDF VL3 : Total harmonic distortion factor of the voltage of phase 3 referred to the Rms or to the fundamental value for 50/60 Hz systems

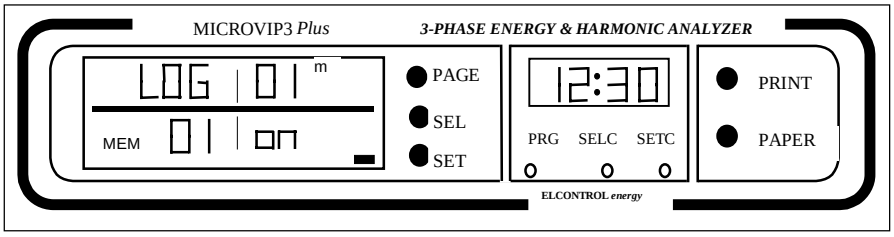


Eleventh page (three-phase)

THDF AL1: Total harmonic distortion factor of the current of phase 1 referred to the Rms or to the fundamental value for 50/60 Hz systems
THDF AL2: Total harmonic distortion factor of the current of phase 1 referred to the Rms or to the fundamental value for 50/60 Hz systems
THDF AL3: Total harmonic distortion factor of the current of phase 1 referred to the Rms or to the fundamental value for 50/60 Hz systems

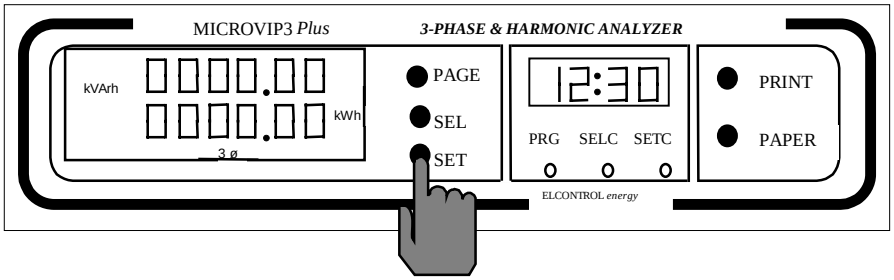


Twelfth page (three-phase)
Data storage control page.
LOG on (off) : To activate (or de-activate) storage (using the SET key)
01 - 99 m (minutes) : Data recording rate (00 = 3 seconds)
00 - 100 (% mem) : % of memory used

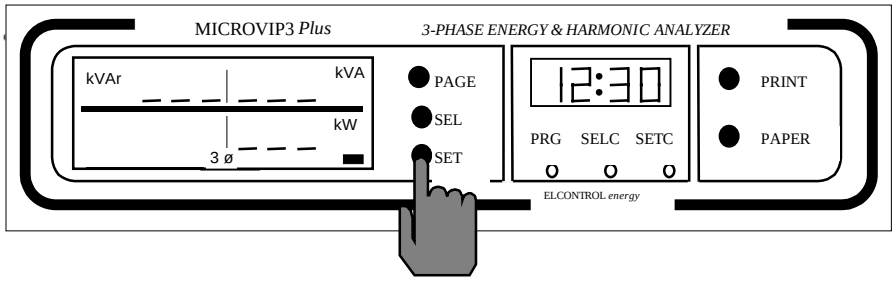


5.2.2 ENERGY CONSUMPTION AND MAXIMUM DEMAND RESET

The SET button resets to zero the electrical energy consumption counts (KVArh, KVArh and kWh) and the average three phase active, reactive and apparent power peak values.
This function of the SET button is enabled only while the seventh, eighth or ninth measurement page is displayed (i.e. where these values appear).
If you press the SET button while the seventh or eight measurement page is displayed, the energy consumption meters are reset to zero.

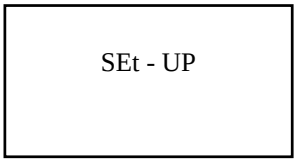


If you press the SET button while the ninth measurement page is displayed, the peak values for average three-phase active, reactive and apparent power are reset to zero.
The buffer used for calculating average power is also reset, so that this value remains invalid until the programmed integration time has lapsed again.
A series of dashes is displayed.



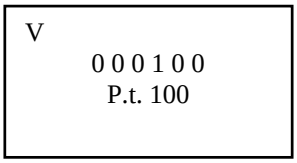
Once you have reset values, press the PAGE key to return to measuring mode.

5.2.3 SETUP PAGES MENU



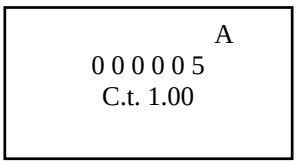
To access this menu, press the SEL key. To exit from this menu, press the PAGE key for 3 seconds. To change the page, press the PAGE key.

First page



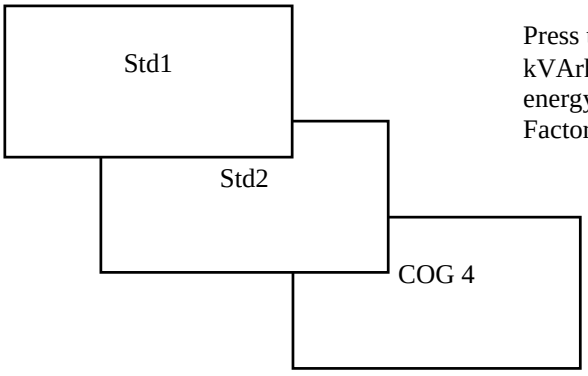
Use SEL and SET to select PT primary (from 1 to 999999V) and PT secondary (57.7, 63.5, 100, 110, 115, 120, 173, 190, 220V).
Factory default : 100V/100V

Second page



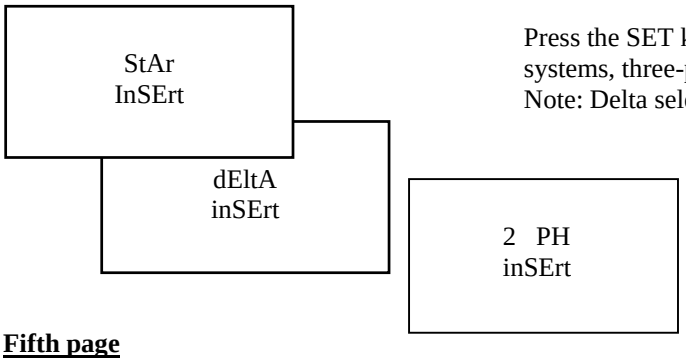
Use SEL and SET to select CT primary (from 1 to 999999 A) and CT secondary (from 0.01 to 1.00V).
Factory default : 1000A/1V

Third page



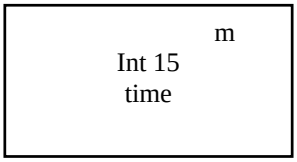
Press the SET key to preset the instrument for Standard 1 (kWh, kVArh), Standard 2 (kWh, kVAh) or COG4 (± kWh, ± kVArh) energy meters.
Factory default : Std1

Fourth page



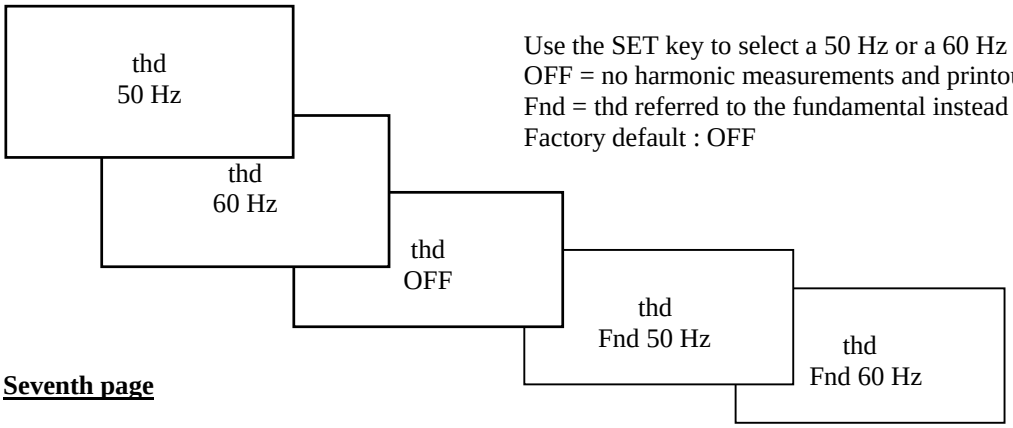
Press the SET key to preset the instrument for three-phase StAr systems, three-phase DELTA systems or two phase (2 PH) systems.
Note: Delta selection forces COG4 mode and third page is hidden.

Fifth page



Use the SET key to select a 1, 2, 5, 10, 15, 20, 30 or 60 minutes integration time.
Factory default : 15 minutes

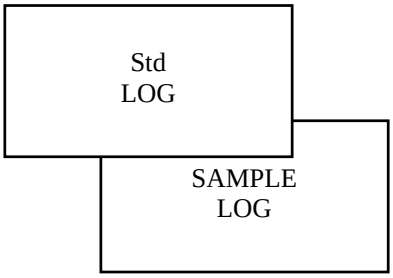
Sixth page



Use the SET key to select a 50 Hz or a 60 Hz fundamental frequency
OFF = no harmonic measurements and printouts
Fnd = thd referred to the fundamental instead of rms value
Factory default : OFF

Seventh page

This page is present only when LOG is OFF

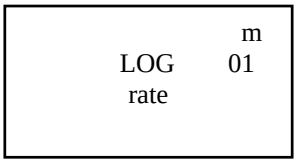


Use the SET key to change the LOG type and confirm using PAGE key : the display will blink for 5-10 seconds.
Standard LOG = rms values are stored
Sample LOG = V, I waveforms samples are stored
Factory default : Std

NOTE : changing the LOG type clears the on-board memory.

Eighth page

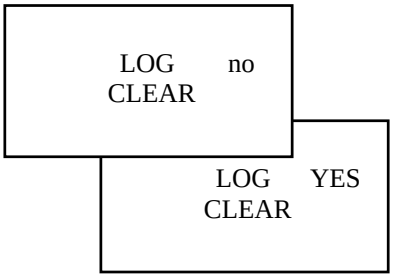
This page is present only when LOG is OFF



Use SEL and SET keys to select from 1 to 99 minutes of data recording rate. 00 = 3 seconds
Factory default : 1 minute

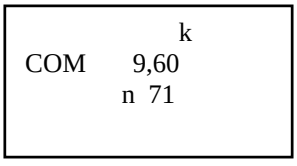
Ninth page

This page is present only when LOG is OFF



Use the SET key to select NO/YES; press the PAGE key to clear internal memory : the display will blink for 5-10 seconds
Factory default : NO

Tenth page

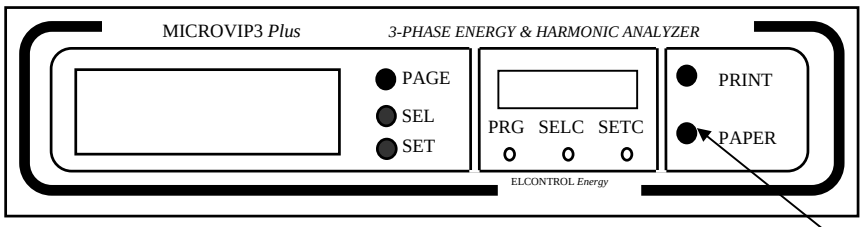


Use SEL and SET keys to select baud rate (1200, 2400, 4800, 9600, 19200 or 38400 baud), data bits (7/8), stop bits (1/2), parity (no/even/odd)
Factory default : 9600, 7, 1, n

5.3 PRINT FUNCTIONS

5.3.1 MANUAL PRINTING

The manual print function enables you to print out numerical (up to 189 parameters) and graphical (V & I waveform or harmonic bar chart) measurements whenever needed.
To print out measurements simply press the PRINT key on the front panel.
Manual printouts give the date and time of printout as well as a list of measurements depending both on the position of the single-phase/three-phase selector on the rear panel and the measurement page displayed on the LCD (see the following table).



Press PRINT key to print out all measurements taken by instrument

Pressing "Print" button with rear panel selector in "1-Φ" (single-phase) position:

Measurement page *Printout format*

In Pg.1,2,3,4,5,7 → V A P.F. kW
kVA kVAr Hz
+ kWh + kvarh
- kWh - kvarh
Peak kVAr Peak kVA Peak kW
*(Format equivalent to **Type 0** automatic printout)*

plus

V and I waveforms
*(Format equivalent to **Type 1** automatic printout)*

In Pg.6 → 1-24th Harmonics and DC component of Voltage and Current expressed as absolute value and in percentage referred to the fundamental;
Total Harmonic Distortion Factors of Voltage and Current;
Displacement Factor (Cosø of the fundamental);
Harmonics Voltage and Current bar-graph diagram
*(Format equivalent to **Type 2** automatic printout)*

Note: Stop Printout pressing "Print" for 5 seconds.

Pressing "Print" button with rear panel selector in "3-Φ" (three-phase) position:

Measurement page *Printout format*

In Pg.1,4,5,6,7,8,9,12 → V A P.F. kW
kVA kVAr Hz
+ kWh + kvarh
- kWh - kvarh
Peak kVAr Peak kVA Peak kW
VL1 VL2 VL3
AL1 AL2 AL3
kW1 kW2 kW3
P.F.1 P.F.2 P.F.3
*(Format equivalent to **Type 0** automatic printout)*

In Pg.2 → V1,V2,V3 waveforms
*(Format equivalent to **Type 1** automatic printout)*

In Pg.3 → I1, I2, I3 waveforms
*(Format equivalent to **Type 3** automatic printout)*

In Pg.10 → 1-24 th Harmonics and DC component of L1, L2, L3 Voltages and Currents expressed as absolute value and in percentage referred to the fundamental;
Total Harmonics Distortion Factors of L1, L2, L3 Voltages and Currents ;
L1, L2, L3 Displacement Factors (Cosø of the fundamental) ;
L1, L2, L3 Harmonic Voltages bar-graph diagrams
*(Format equivalent to **Type 2** automatic printout)*

In Pg.11 → 1-24 th Harmonics and DC component of L1, L2, L3 Voltages and Currents expressed as absolute value and in percentage referred to the fundamental;
Total Harmonic Distortion Factors of L1, L2, L3 Voltages and Currents;
L1, L2, L3 Displacement Factors (Cosø of the fundamental);
L1, L2, L3 Harmonic Currents bar-graph diagrams
*(Format equivalent to **Type 4** automatic printout)*

Note: Stop Printout pressing "Print" for 5 seconds.

5.3.2 TIMED PRINTING

This function enables you to specify a time interval at which the instrument automatically prints out up-to-date measurements and graphs.
The timed printout interval and the Automatic Printout type are programmed using the calendar-clock (see 5.4).
Timed printouts formats are the same than in manual printing but without the indication " Manual "
in the first row.

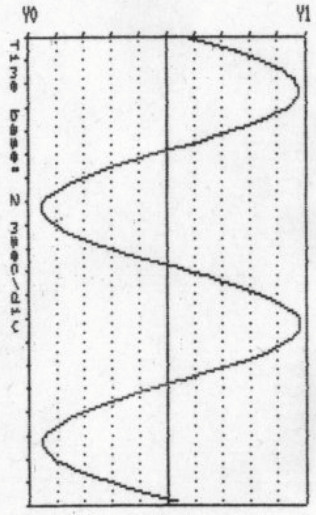
MICROVIP3 PLUS MANUAL PRINTOUTS: SINGLE-PHASE

TYPE 0 (1-ø) corresponding to :
see Manual Printout Format pg. 25

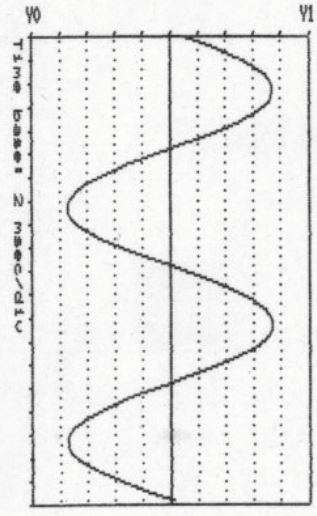
```
microVIP3 Plus 10/06/1999 16:32:55 Manual
  V 230     A 749   P.F. 1.00   KW 173
 KVA 173     Var 0.00  Hz 50.0
 KWh+ 0000.73            KVar+ 0000.00
 KWh- 0000.00            KVar- 0000.00
PEAK MEM  KVar---    VA---    KW---
```

TYPE 1 (1-ø) corresponding to :
see Manual Printout Format pg. 25

```
microVIP3 Plus 10/06/1999 16:32:58 Manual
VOLTAGE WAVEFORM SNAPSHOT    PHASE 1
Vrms=230.6  V Min=-316.4  V Max=335.2  V
Resolution=70.0  V/div
Y0=-350.0  V      Y1=350.0  V
```

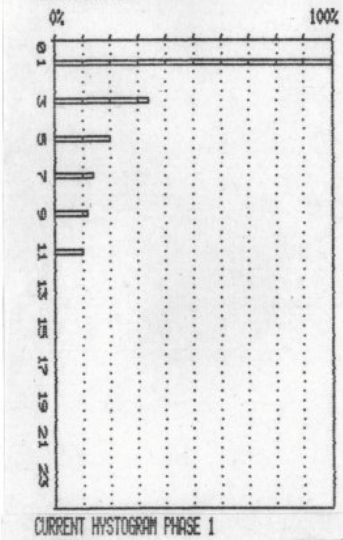



```
CURRENT WAVEFORM SNAPSHOT    PHASE 1
Irms=749.1  A Min=-1056  A Max=1056  A
Resolution=284.0  A/div
Y0=-1420  A      Y1=1420  A
```

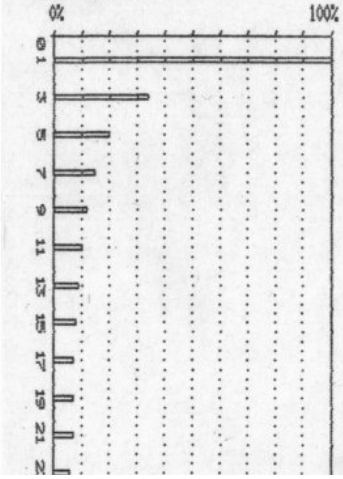


TYPE 2 (1-ø) corrsponding to :
see Manual Printout Format pg. 25

```
microVIP3 Plus 10/06/1999 16:53:28 Manual
HARMONICS ANALYZER PHASE 1
H    Volt     %      Ampere     %
00    0.0     0.0     0.0      0.0
01   11.3     X      225.6     X
02    0.0     0.0     0.0      0.0
03    3.8     33.6    75.6     33.5
04    0.0     0.0     0.0      0.0
05    2.3     20.4    45.9     20.4
06    0.0     0.0     0.0      0.0
07    1.6     14.2    33.3     14.8
08    0.0     0.0     0.0      0.0
09    1.3     11.5    26.5     11.8
10    0.0     0.0     0.0      0.0
11    1.1     9.7     22.2     9.8
12    0.0     0.0     0.0      0.0
13    0.0     0.0     19.5     8.6
14    0.0     0.0     0.0      0.0
15    0.0     0.0     17.5     7.8
16    0.0     0.0     0.0      0.0
17    0.0     0.0     16.3     7.2
18    0.0     0.0     0.0      0.0
19    0.0     0.0     15.3     6.8
20    0.0     0.0     0.0      0.0
21    0.0     0.0     14.6     6.5
22    0.0     0.0     0.0      0.0
23    0.0     0.0     14.2     6.3
24    0.0     0.0     0.0      0.0
THDV= 40.6%  THDA= 43.2%  Cosø fnd= 1.00
VOLTAGE HYSTOGRAM PHASE 1
Resolution=10%
```




```
CURRENT HYSTOGRAM PHASE 1
Resolution=10%
```

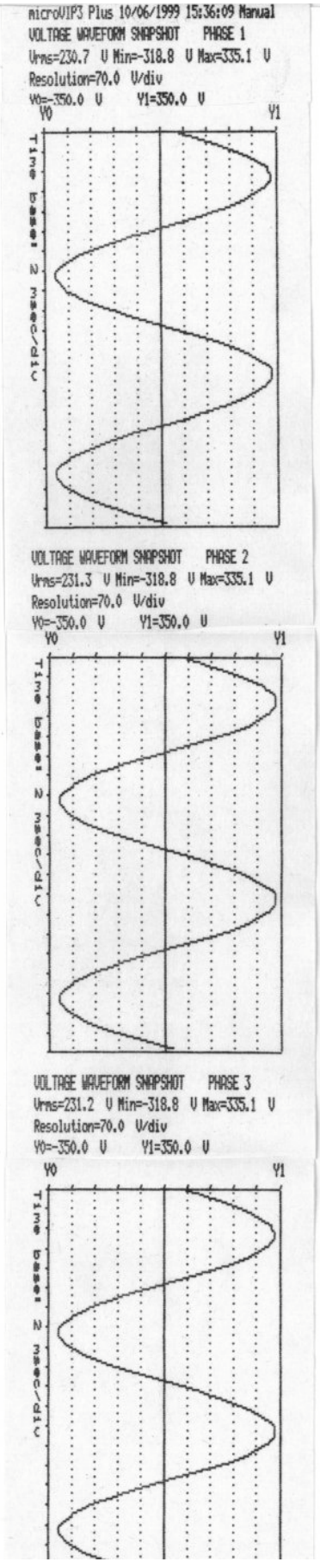


MICROVIP3 PLUS MANUAL PRINTOUTS: THREE-PHASE

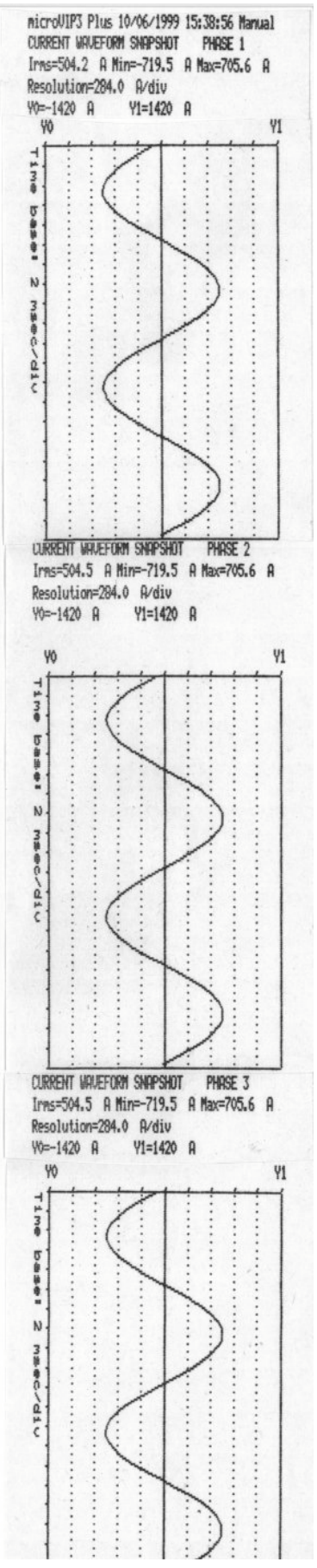
TYPE 0 (3-ø) corresponding to :
see Manual Printout Format pg. 25

```
microVIP3 Plus 10/06/1999 15:27:30 Manual
  V  400     A 504   P.F. 1.00   KW 349
 KVA 349     Var 0.00  Hz 50.0
 KWh+ 0000.87          KVar+ 0000.00
 KWh- 0000.00          KVar- 0000.00
PEAK MEM  KVar 0.00  VA 0.00   KW 0.00
  V       231     231     231
  A       504     504     504
 KW       116     117     117
  P.F.    1.00    1.00    1.00
```

TYPE 1 (3-ø) corresponding to :
see Manual Printout Format pg. 25



TYPE 3 (3-ø) corresponding to :
see Manual Printout Format pg. 25



MICROVIP3 PLUS MANUAL PRINTOUTS: THREE-PHASE

TYPE 2 (3-ø) corresponding to :
see Manual Printout Format pg. 25

microVIP3 Plus 10/06/1999 16:13:55 Manual

HARMONICS ANALYZER PHASE 1

H	Volt	%	Ampere	%
00	0.0	0.0	0.0	0.0
01	11.2	X	225.7	X
02	0.0	0.0	0.0	0.0
03	3.7	33.5	75.7	33.5
04	0.0	0.0	0.0	0.0
05	2.2	20.2	45.9	20.3
06	0.0	0.0	0.0	0.0
07	1.6	14.6	33.3	14.8
08	0.0	0.0	0.0	0.0
09	1.3	11.7	26.5	11.7
10	0.0	0.0	0.0	0.0
11	1.0	9.6	22.2	9.8
12	0.0	0.0	0.0	0.0
13	0.0	0.0	19.4	8.6
14	0.0	0.0	0.0	0.0
15	0.0	0.0	17.6	7.8
16	0.0	0.0	0.0	0.0
17	0.0	0.0	16.3	7.2
18	0.0	0.0	0.0	0.0
19	0.0	0.0	15.3	6.8
20	0.0	0.0	0.0	0.0
21	0.0	0.0	14.7	6.5
22	0.0	0.0	0.0	0.0
23	0.0	0.0	14.3	6.3
24	0.0	0.0	0.0	0.0

THDV= 40.5% THDA= 43.2% Cosø fnd= 1.00

HARMONICS ANALYZER PHASE 2

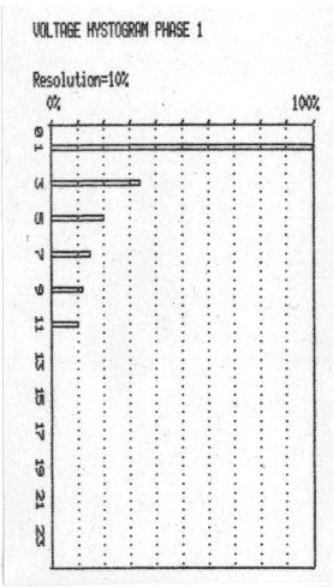
H	Volt	%	Ampere	%
00	0.0	0.0	0.0	0.0
01	11.2	X	225.6	X
02	0.0	0.0	0.0	0.0
03	3.7	33.5	75.6	33.5
04	0.0	0.0	0.0	0.0
05	2.2	20.2	45.9	20.4
06	0.0	0.0	0.0	0.0
07	1.6	14.7	33.4	14.8
08	0.0	0.0	0.0	0.0
09	1.3	11.6	26.4	11.7
10	0.0	0.0	0.0	0.0
11	1.1	9.9	22.3	9.9
12	0.0	0.0	0.0	0.0
13	0.0	0.0	19.5	8.6
14	0.0	0.0	0.0	0.0
15	0.0	0.0	17.6	7.8
16	0.0	0.0	0.0	0.0
17	0.0	0.0	16.2	7.2
18	0.0	0.0	0.0	0.0
19	0.0	0.0	15.4	6.8
20	0.0	0.0	0.0	0.0
21	0.0	0.0	14.6	6.5
22	0.0	0.0	0.0	0.0
23	0.0	0.0	14.3	6.3
24	0.0	0.0	0.0	0.0

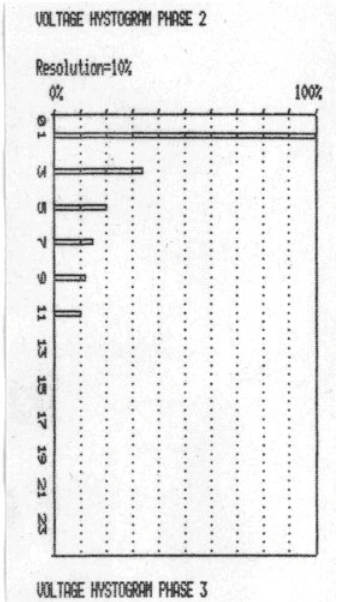
THDV= 40.6% THDA= 43.3% Cosø fnd= 1.00

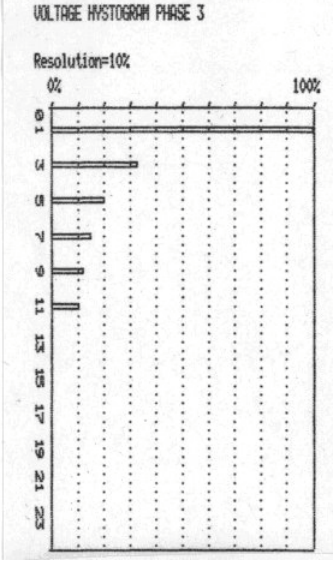
HARMONICS ANALYZER PHASE 3

H	Volt	%	Ampere	%
00	0.0	0.0	0.0	0.0
01	11.2	X	225.7	X
02	0.0	0.0	0.0	0.0
03	3.7	33.4	75.6	33.5
04	0.0	0.0	0.0	0.0
05	2.2	20.2	45.9	20.3
06	0.0	0.0	0.0	0.0
07	1.6	14.7	33.3	14.8
08	0.0	0.0	0.0	0.0
09	1.3	11.6	26.4	11.7
10	0.0	0.0	0.0	0.0
11	1.1	9.8	22.2	9.8
12	0.0	0.0	0.0	0.0
13	0.0	0.0	19.5	8.6
14	0.0	0.0	0.0	0.0
15	0.0	0.0	17.5	7.8
16	0.0	0.0	0.0	0.0
17	0.0	0.0	16.2	7.2
18	0.0	0.0	0.0	0.0
19	0.0	0.0	15.3	6.8
20	0.0	0.0	0.0	0.0
21	0.0	0.0	14.6	6.5
22	0.0	0.0	0.0	0.0
23	0.0	0.0	14.2	6.3
24	0.0	0.0	0.0	0.0

THDV= 40.6% THDA= 43.2% Cosø fnd= 1.00







MICROVIP3 PLUS MANUAL PRINTOUTS: THREE-PHASE

TYPE 4 (3-ø) corresponding to :
see Manual Printout Format pg. 25

microVIP3 Plus 10/06/1999 16:22:05 Manual

HARMONICS ANALYZER PHASE 1

H	Volt	%	Ampere	%
00	0.0	0.0	0.0	0.0
01	11.2	X	225.7	X
02	0.0	0.0	0.0	0.0
03	3.7	33.6	75.7	33.5
04	0.0	0.0	0.0	0.0
05	2.2	20.3	46.0	20.4
06	0.0	0.0	0.0	0.0
07	1.6	14.7	33.3	14.8
08	0.0	0.0	0.0	0.0
09	1.3	11.6	26.5	11.7
10	0.0	0.0	0.0	0.0
11	1.0	9.7	22.3	9.9
12	0.0	0.0	0.0	0.0
13	0.0	0.0	19.4	8.6
14	0.0	0.0	0.0	0.0
15	0.0	0.0	17.5	7.8
16	0.0	0.0	0.0	0.0
17	0.0	0.0	16.4	7.3
18	0.0	0.0	0.0	0.0
19	0.0	0.0	15.2	6.7
20	0.0	0.0	0.0	0.0
21	0.0	0.0	14.7	6.5
22	0.0	0.0	0.0	0.0
23	0.0	0.0	14.4	6.4
24	0.0	0.0	0.0	0.0

THDV= 40.6% THDA= 43.3% Cosø fnd= 1.00

HARMONICS ANALYZER PHASE 3

H	Volt	%	Ampere	%
00	0.0	0.0	0.0	0.0
01	11.2	X	225.6	X
02	0.0	0.0	0.0	0.0
03	3.7	33.5	75.6	33.5
04	0.0	0.0	0.0	0.0
05	2.2	20.3	45.9	20.4
06	0.0	0.0	0.0	0.0
07	1.6	14.6	33.3	14.8
08	0.0	0.0	0.0	0.0
09	1.3	11.6	26.6	11.8
10	0.0	0.0	0.0	0.0
11	1.1	9.8	22.3	9.9
12	0.0	0.0	0.0	0.0
13	0.0	0.0	19.4	8.6
14	0.0	0.0	0.0	0.0
15	0.0	0.0	17.6	7.8
16	0.0	0.0	0.0	0.0
17	0.0	0.0	16.2	7.2
18	0.0	0.0	0.0	0.0
19	0.0	0.0	15.3	6.8
20	0.0	0.0	0.0	0.0
21	0.0	0.0	14.7	6.5
22	0.0	0.0	0.0	0.0
23	0.0	0.0	14.4	6.4
24	0.0	0.0	0.0	0.0

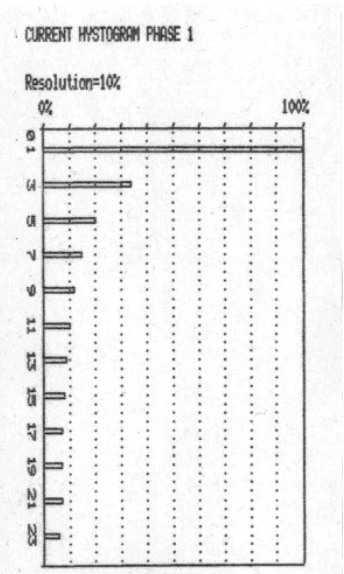
THDV= 40.6% THDA= 43.3% Cosø fnd= 1.00

HARMONICS ANALYZER PHASE 2

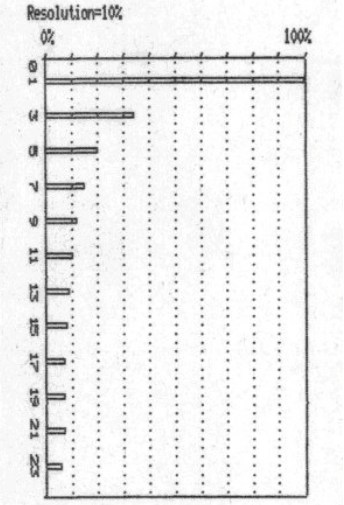
H	Volt	%	Ampere	%
00	0.0	0.0	0.0	0.0
01	11.2	X	225.7	X
02	0.0	0.0	0.0	0.0
03	3.7	33.5	75.7	33.5
04	0.0	0.0	0.0	0.0
05	2.2	20.2	45.9	20.3
06	0.0	0.0	0.0	0.0
07	1.6	14.6	33.3	14.8
08	0.0	0.0	0.0	0.0
09	1.3	11.7	26.4	11.7
10	0.0	0.0	0.0	0.0
11	1.1	9.9	22.3	9.9
12	0.0	0.0	0.0	0.0
13	0.0	0.0	19.5	8.6
14	0.0	0.0	0.0	0.0
15	0.0	0.0	17.6	7.8
16	0.0	0.0	0.0	0.0
17	0.0	0.0	16.2	7.2
18	0.0	0.0	0.0	0.0
19	0.0	0.0	15.2	6.7
20	0.0	0.0	0.0	0.0
21	0.0	0.0	14.6	6.5
22	0.0	0.0	0.0	0.0
23	0.0	0.0	14.3	6.3
24	0.0	0.0	0.0	0.0

THDV= 40.6% THDA= 43.2% Cosø fnd= 1.00

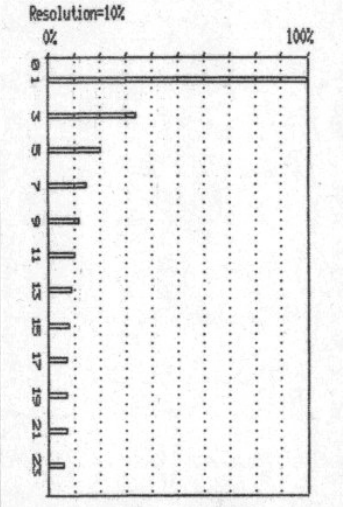
CURRENT HYSTOGRAM PHASE 1



CURRENT HYSTOGRAM PHASE 2



CURRENT HYSTOGRAM PHASE 3

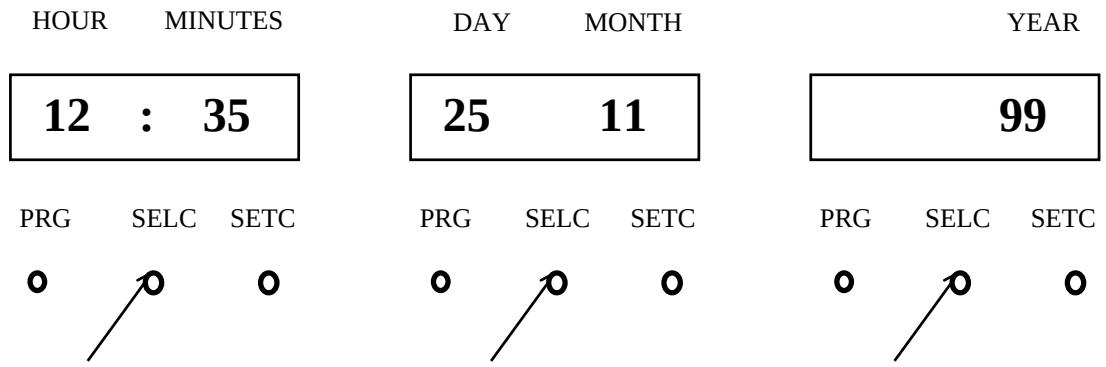


5.4 THE CALENDAR CLOCK

The instrument's calendar clock displays TIME, DAY, MONTH, and YEAR on an LCD on the front panel. The clock also allows to program the type and the intervals for timed (automatic) printouts. You can use the PRG, SELC and SETC buttons underneath the clock display to control clock funtions.

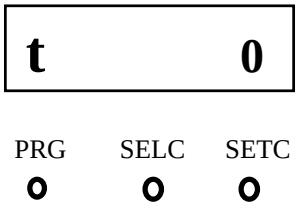
- **Normal clock mode:**

When the instrument is switched on, the clock displays the HOUR and MINUTES.
Press the SELC button to display DAY and MONTH, and press again to display the YEAR. (The clock automatically returns to the hour and minutes display after 20 seconds.)



- **Programming Timed Printouts:**

The MICROVIP3 PLUS allows you to program the type of automatic printout and the interval at which automatic printouts are generated. (Any interval from 1 to 99 minutes can be set).
Press the PRG button to enter clock programming mode (see figure).



A "t" (type) and a zero are displayed initially. Using SETC button, select the type of automatic printout, depending on the position of the single-phase/three-phase selector on the rear panel (see the following table).

Rear panel selector in "1-Φ" (single-phase) position.

***t**ype* *Automatic Printout type*

0 = V A P.F. kW
kVA kVAr Hz
+ kWh + kvarh
- kWh - kvarh
Peak kVAr Peak kVA Peak kW

(Typical printing time = 1 minute)

1 = V, I waveforms

(Typical printing time = 3 minutes)

2 = 1-24th Harmonics and DC component of Voltage and Current expressed as absolute value and in percentage referred to the fundamental;
Total Harmonic Distortion Factors of Voltage and Current;
Displacement Factor (Cosø of the fundamental);
Harmonics Voltage and Current bar-graph diagram ;

(Typical printing time = 5 minutes)

Note: printing time depends on battery charge
.

Rear panel selector in "3-Φ" (three-phase) position.

***t**ype* *Automatic Printout type*

0 = V A P.F. kW
kVA kVAr Hz
+ kWh + kvarh
- kWh - kvarh
Peak kVAr Peak kVA Peak kW
VL1 VL2 VL3
AL1 AL2 AL3
kW1 kW2 kW3
P.F.1 P.F.2 P.F.3

(Typical printing time = 1 minute)

1 = V1, V2, V3 waveforms

(Typical printing time = 3 minutes)

3 = I 1, I2, I3 waveforms

(Typical printing time = 3 minutes)

2 = 1-24 th Harmonics and DC component of L1, L2, L3 Voltages and Currents expressed as absolute value and in percentage referred to the fundamental;
Total Harmonics Distortion Factors of L1, L2, L3 Voltages and Currents ;
L1, L2, L3 Displacement Factors (Cosø of the fundamental) ;
L1, L2, L3 Harmonic Voltages bar-graph diagrams ;

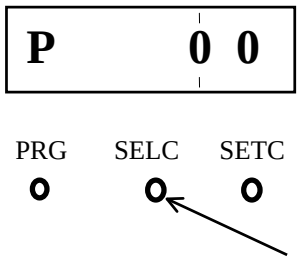
(Typical printing time = 5 minutes)

4 = 1-24 th Harmonics and DC component of L1, L2, L3 Voltages and Currents expressed as absolute value and in percentage referred to the fundamental;
Total Harmonic Distortion Factors of L1, L2, L3 Voltages and Currents;
L1, L2, L3 Displacement Factors (Cosø of the fundamental);
L1, L2, L3 Harmonic Currents bar-graph diagrams ;

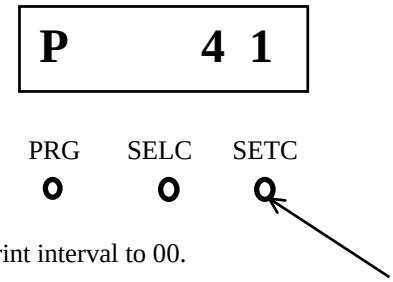
(Typical printing time = 5 minutes)

Press the PRG button to enter Printing Interval selection page.

A "P" and two zeros are displayed initially. These represent the tens and units of the printing interval.
Simply set the number of minutes you require for the interval between one printout and the next.



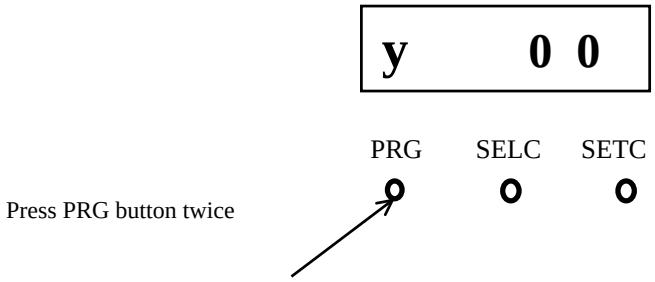
Press the SELC button to switch between the tens and the units. The digit currently programmable flashes.
Press the SETC button repeatedly to set the value you require for each digit. Once you have set the require value, press the PRG button again to enter clock set up page.



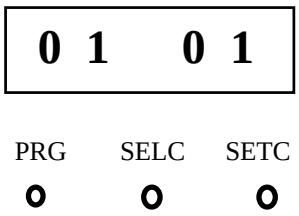
To disable automatic timed printouts, set the print interval to 00.

- **CLOCK SET UP:**

The initial display shows two zeroes. This is for the YEAR value.



Use the SELC button to select the tens and units and press the SETC button to set the required value, and set the current YEAR value
When a new year is set, the month and day values are automatically reset to 1.
Press the PRG button to move on the next display in which you can set DAY and MONTH.
Use the SELC button to select the month or day value, and the SETC button to set the correct date.

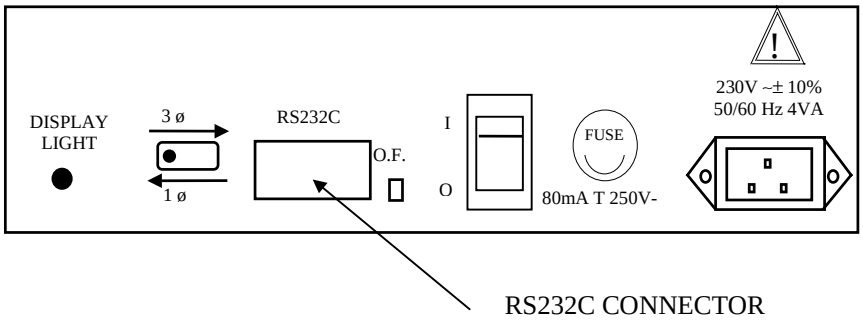


If you set a new month, the day value is automatically reset to 1.
The calendar clock performs a check on the values input to check for incongruities.
Press the PRG button to move on the next setup page in which you can set the HOUR and MINUTES.

Proceed as before to set the hour and minutes. On completion of the clock setup, press the PRG button again to return normal clock mode.

6 RS232 PORT

The rear panel the MICROVIP3 PLUS is fitted with a mini-Canon 9 pin connector for use with a RS232C cable in the transmission of measurement data or V & I waveforms from the instrument to a PC.
This enables measurement data and instrument setup to be controlled from a remote personal computer.
1200, 2400, 4800, 9600, 19200, 38400 baud, 7/8 data bits, 1/2 stop bits, no/even/odd parity are selectable. (For data format see Annex A)



Note : By means of a PC-485-BOX (code 4AAK4)/PC-485-BOARD (code 4AAK1) it is possible to connect a MICROVIP3 PLUS to a RS485 monitoring network: its address is fixed to 1.

6.1 PC SOFTWARE

ELCONTROL ENERGY PC softwares for data acquisition are :

- VIPVIEW (code 4AAGW) - Win95/98 general purpose software for supervision, control and energy data acquisition for RS485 serial networks VIPNET-485

- VIPLINK (code 4AAL3) - VIPLOAD (code 4AAO3) - Simple DOS software for reading, storage and printout of energy measurements for RS485 serial networks VIPNET-485

- MicroWin - Win95/98 and NT4.0 powerful software for stand-alone instruments. It provides features like manual & automatic measurements campaign, downloading of 1MB on board memory via high-speed serial link (38400 baud), V & I harmonic analysis to 24th multiple with both DC component and displacement factor, V & I waveforms display and printout, harmonic bar-chart display and printout.

RS232 CABLE

MICROVIP3 PLUS
9 PIN CANON
MALE

PIN	FUNZIONE		PIN
1	N.C.		N.C.
2	RX	TX	3
3	TX	RX	2
4	N.C.		N.C.
5	GND	GND	5
6	N.C.		N.C.
7	N.C.		N.C.
8	N.C.		N.C.
9	N.C.		N.C.

PC
9 PIN CANON
FEMALE

7 THE ON BOARD MEMORY

The on board memory is a 1 Mbyte non-volatile flash memory for data storage over extended surveys periods including waveform capture for current and voltage.
Two different LOG types are selectable:
- In Standard LOG, Max 7840 records of all the measurements are available after a memory reset.
- In Sample LOG, Max 677 records of all Voltages and Currents waveforms are available after a memory reset.

Data recording rate is selectable from 1 to 99 minutes or fixed at 3 seconds.
Fast data downloading to PC is provided via a high-speed RS232C serial link and based on WIN 95/98 and NT 4.0 software MicroWin.

8 TECHNICAL SPECIFICATIONS

8.1 GENERAL FEATURES

- **Inputs:**
  L1, L2, L3, N, I1, I2, I3.
- **Input specifications:**
  Voltage: (L1-N, L2-N, L3-N) direct inputs max 600 Vrms (STAR);
  (L1-L3, L2-L3, L1-L2) direct inputs max 600 Vrms (DELTA) from 0 to 600 Hz;
  up to 999999 V (with external PTs whose primary and secondary are selectable).
  Input impedance: 4 MΩ
  Current: (I1, I2, I3) direct inputs 1 Vrms up to 600 Hz, or 1 VDC;
  1000A from 30 to 600 Hz (with standard AC clamp meters);
  from 0 to 600 Hz (with optional AC/DC clamp meters);
  up to 999999 A (with external CTs whose primary and secondary are selectable).
  Input impedance: 10 kΩ
- **Voltmeter input overload:**
  maximum acceptable voltage 625 Vrms, peak voltage 825V.
- **Current input overload:**
  5 times full scale value (with protection trip at threshold value).
- **Units of measurement:**
  m, k, M, W, V, A, VA, Var, Hz, Wh, VArh, VAh, P.F. Cosø, THDF.
- **Measurement frequency:**
  1,2 seconds without harmonics - 2,5 seconds with harmonics.
- **Number of scales:**
  3 voltage scales; 3 current scales with automatic scale change.
- **Automatic scale change:**
  Scale change response time: 1,2 secs
  Change to higher scale takes place at 105% active scale.
  Change to lower scale takes place at 20% of active scale.
- **Clock:**
  Quartz, output to LCD
  Printed date and time output.
- **Batteries:**
  One Ni-Cd 6V 940mAh battery of five 1,2V 940mAh elements in series, giving autonomy of approximately 7 hours without printing and display backlight. Battery recharge time: 24 hours (from mains).
  One 3,5V 280mAh lithium battery as memory buffer (guaranteeing memory backup for approximately 7 years).
  IMPORTANT: when the lithium back-up battery is changed, date and time are lost.
  Battery replacement must be carried out by qualified, authorized staff at ELCONTROL ENERGY service centres.
- **Measurement display:**
  Backlight LCD with temperature range of -30°C to +80°C.
- **Clock display:**
  4 digit LCD with temperature range of -10°C to +60°C.
- **Dimensions:**
  251 x 239 x 104 mm.
- **Instrument weight:**
  2,9 Kg.
- **Weight of MICROVIP3 PLUS KIT:**
  6,3 Kg.
- **Degree of protection : IP 40**

8.2 OPERATING CONDITIONS AND TESTING

- **Environmental operating conditions:**
  Environmental temperature range: from -10°C to +50°C.
  Relative humidity (R.H.): from 20% to 80%.
- **Storage temperature:**
  from -20°C to +60°C.
- **Condensation:**
  non-condensing environment.
- **Insulation resistance:**
  ≥ 500 MΩ between voltmeter input connectors short-circuited between each other and instrument frame, between power socket and instrument frame.
  ≥ 2 MΩ between voltage and current inputs.
- **Insulation voltage:**
  Tested to 2000 Vrms at 50 Hz for 60 seconds between voltmeter input connections (including neutral).
  Tested to 3000 Vrms for 60 seconds between each connector and the instrument frame.
- **Construction standards:**
  Safety : IEC 1010-1, EN 61010-1, 600V cat. III
  EMC : EN 50081-1, EN 50082-1, EN55022.
  IEC 801-2, ENV50140 IEC 801-3, IEC 801-4
  Conformity : CEE 89/336 (EMC)
  CEE 73/23 - CEE 93/68 (Low Voltage Directive)

8.3 POWER REQUIREMENTS

- **External mains power:**
  230V ~ ± 10% 50/60 Hz or 110V ~ ± 10% 50/60 Hz
- **Consumption:**
  4 VA.
- **Internal battery power:**
  6V 940mAh N1-Cd battery with five 1,2V 940mAh elements in series.

8.4 PRIMARY MEASUREMENTS

- **Measuring method:**
  fixed sampling, A/D conversion.
- **Sampling frequency:**
  2,5 KHz.
- **Number of samples per phase:**
  250 (100 msec).
- **Measuring frequency:**
  ~ 1,2 sec.
- **Automatic zero regulation:**
  every 1 minute.

8.4.1 PRIMARY MEASUREMENT ACCURACY

- **Measurement error in environment of 18°C to 25°C (after 10' warming up):**
  expressed as ± % Rdg. (reading) + % F.S. (Full Scale) – see tables.
- **Additional measurement error outside this temperature range:**
  ± 0,02% F.S. for each °C outside range.
- **Sensitivity and accuracy of voltage measurements:**
  Direct input with max voltage = 750 Vrms at Full Scale.
  Input voltage peak factor ≥ 1,6.
  Input impedance ≥ 4 MΩ.

Sensitivity, Full Scale and voltage accuracy			
Rated range	Sensitivity	Full Scale	ε between 20% F.S. and 100% F.S.
37 Vrms	24 mV*	37,0 V	0,5%F.S.+ 0,5%Rdg.
174 Vrms	111 mV	174 V	0,3%F.S.+ 0,3%Rdg.
750 Vrms	480 mV	750 V	0,3%F.S.+ 0,3%Rdg.

(*) the minimum measurable signal is 1 V.

- **Sensitivity and accuracy of current measurement:**
  Direct input with max. 1 Vrms at Full Scale.
  Input current peak factor ≥ 1,6

Sensitivity, Full Scale and current accuracy			
Rated range	Sensitivity	Full Scale**	ε between 20%F.S and 100%F.S.
50 mV	32 μV*	50 mV	0,5%F.S.+ 0,5%Rdg.
232 mV	140 μV	232 mV	0,3%F.S.+ 0,3%Rdg.
1 V	640 μV	1 V	0,3%F.S.+ 0,3%Rdg.

(*) the minimum measurable signal is 2 mV.
(**) Full Scales for 50,0 - 232 - 1000 Amp. with 1000 A/1V clamp meters provided
(Error = sum of instrument + clamp meter errors).

- **Accuracy does not take account of clamp meter error.**
- **Voltage and current measurement precision as a function of frequency:**
  no error over errors specified in tables for signal frequencies in 20-90 Hz range.

8.4.2 SECONDARY MEASUREMENTS ACCURACY:

Power (single or three phase), Active Energy (and Power Factor) : class 1 (IEC 1036)

- **Measurement of other secondary values:**
  error is expressed by the formula which defines the value (sections 8.6.1, 8.6.2 and 8.6.3), as a function of V, I and W.

8.5 DISPLAYED AND PRINTED VALUES

	Volt	Ampere	Watt	VA	Var	P.F.	kvar Peak	kW Peak (MD)	kVA Peak	THDFV	THDFI	Hz	kWh	kVAh	kvarh	±kWh	±kvarh	Date	Time
L1	●	●	●			●				●	●	●						●	●
L2	●	●	●			●				●	●								
L3	●	●	●			●				●	●								
3ø	●	●	●	●	●	●	●	●	●				●	●	●	●	●		

8.5.1 ADDITIONAL MEASUREMENTS OF THE PRINTER

	VH0, AH0	VH1, AH1	VH2, AH2	VH0, AH3	VH4, AH4	VH5, AH5	VH6, AH6	VH7, AH7	VH8, AH8	VH9, AH9	VH10,AH10	VH11, AH11	VH12, AH12	VH13, AH13	VH14, AH14	VH15, AH15	VH16, AH16	VH17, AH17	VH18, AH18	VH19, AH19	VH20, AH20	VH21, AH21	VH22, AH22	VH23, AH23	VH24, AH24	Cosø fnd
L1	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
L2	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
L3	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

8. 6 FORMULAE

8.6.1 SINGLE PHASE FORMULAE

True rms voltage $V_{1N} = \sqrt{\frac{1}{n} \sum_{1}^{n} (v_{1N})_i^2}$

Active power $W_1 = \frac{1}{n} \sum_{1}^{n} (v_{1N})_i \cdot (a_1)_i$

Power factor $P.F. = W_1 / VA_1$

True rms current $A_1 = \sqrt{\frac{1}{n} \sum_{1}^{n} (a_1)_i^2}$

Apparent power $VA_1 = V_{1N} \cdot A_1$

Reactive power $VAr = \frac{1}{n} \sum_{1}^{n} (v_{1n})_i \cdot (a_1)_{i+j}$

where $(v_{1N})_i$ $(a_1)_i$: samples of voltage and current

j : number of samples corresponding to 90° electrical degrees

8.6.2 THREE PHASE FORMULAE

Equivalent three phase voltage

$V_\Sigma = (V_{1N} + V_{2N} + V_{3N}) / \sqrt{3}$ (Star)

$V_\Sigma = (V_{12} + V_{23} + V_{31}) / 3$ (Delta)

where $V_{12} = \sqrt{V_{23}^2 + V_{31}^2 - V_{23} \cdot V_{31}}$

$V_\Sigma = (V_{1N} + V_{2N})$ (Two-Phase)

Three phase reactive power

$VAr_\Sigma = (VAr_1 + VAr_2 + VAr_3)$ (Star)

$VAr_\Sigma = (VAr_1 + VAr_2)$ (Delta)

Equivalent three phase current

$A_\Sigma = (VA_\Sigma)/(\sqrt{3} \cdot V_\Sigma)$

$A_\Sigma = VA_\Sigma / V_\Sigma$ (Two-phase)

Three phase active power

$W_\Sigma = W_1 + W_2 + W_3$ (Star)

$W_\Sigma = (W_1 + W_2)$ (Delta)

Three phase apparent power $VA_{\Sigma} = \sqrt{W_{\Sigma}^2 + VAr_{\Sigma}^2}$

Equivalent three phase power factor $Cos\Phi_{\Sigma} = W_{\Sigma} / VA_{\Sigma}$

8.6.3 HARMONIC FORMULAE

Total Harmonic Distortion Factor of Voltage $THDF\ V = \frac{\sqrt{\sum_{2}^{24} V_k^2}}{V_{rms}}$ or $\frac{\sqrt{\sum_{2}^{24} V_k^2}}{V_1}$

Total Harmonic Distortion Factor of Current $THDF\ A = \frac{\sqrt{\sum_{2}^{24} A_k^2}}{A_{rms}}$ or $\frac{\sqrt{\sum_{2}^{24} A_k^2}}{A_1}$

where V_k, A_k = V, I harmonic of 50/60 Hz fundamental
k = 2, 3,..., 24th harmonic computed by means of a DFT

Cos∅ fnd = Cosinus of the phase angle between V1 and A1

8.7 PRINTER SPECIFICATIONS

- **Number of columns:**
  42.
- **Characters:**
  5x7 matrix
- **Print speed:**
  1 line per second.
- **Paper:**
  55g/m^2 pure cellulose smooth.
- **Paper width:**
  57 mm.
- **Paper length:**
  16 m.
- **Print functions:**
  Manual (PRINT key on instrument's front panel prints out all measurements taken).
  Automatic (printouts generated automatically at time intervals of 1 to 99 minutes as programmed on calendar-clock). Congruity of printed measurements ensured by reference to start of printout time.

8.8 CLAMP METER SPECIFICATIONS

- **Measurement range:**
  from 0,1 A to 1200 A.
- **Frequency range:**
  from 30 Hz to 10 kHz.
- **Ratio:**
  1000A/1Vrms.
- **Accuracy:**
  200... 1000A ≤ 0,5% ≤ 0,5° phase angle
  50... 200A ≤ 0,75% ≤ 0,75° phase angle
  10... 50A ≤ 1,5% ≤ 1,5° phase angle
  0,1... 10A ≤ 3% + 0,1 mV

- **Construction standards:**
  (LVD) IEC 1010-1, IEC 1010-2-032 600V CAT III, pollution degree 2
  (EMC) EN50081-1 class B EN50082-2
- **Overload protection:**
  Max. 1200 A for 40'
- **Output impedance:**
  1Ω.

8.9 ON BOARD MEMORY SPECIFICATIONS

- **Size:**
  1 Megabyte (7840 records in Standard LOG, 677 records in Sample LOG)
- **Type:**
  Non-volatile serial flash-memory
- **Number of writings:**
  10.000 write-cycles min.

9 OPERATION AND MAINTENANCE OF INSTRUMENT

9.1 CAUTION AND HINTS

Always remember the following points in order to get the best from your instrument:

- The instrument is designed to operate under mains power. It should be used on the power of the internal rechargeable Ni-Cd battery only for short intervals.
- The battery recharges automatically when the instrument is connected to the mains.
- The I/O switch does not disconnet the instrument from the mains, but merely switches off the instrument's low voltage circuits.
- The backlight should be switched off when the instrument is running off the battery. The backlight can be turned on temporarily by means of a button on the rear panel.
- Regularly check for the amount of paper left and for printer cartridge wear. Do not allow the printer to operate without paper as this causes rapid wear.
- If the printer does not work, an internal fuse may have blown. Refer the instrument to an authorised assistance centre.

ANNEX A

A.1 Characteristics of the MICROVIP3 PLUS Rs232 serial communication software protocol

The software communication protocol complies with the ASCII (7 bits) MODBUS protocol.

- Selected transmission mode: ASCII
- Coding system: HEX (uses printable ASCII characters: 0-9, A-F).
- Error detection mode: LRC
- Serial protocol characteristics:
  - Baud rate: 1200, 2400, 4800, 9600, 19200, 38400
  - Data bits: 7/8
  - Parity bits: None/Odd/Even
  - Stop bits: 1/2

The commands implemented by the MODBUS protocol are:
• Reading of all measurements
• Date and time reading
• Disabling/enabling of the keyboard
• Power peaks and averages reset
• Energy meters reset
• Programming of current transformer ratios
• Programming of voltage transformer ratios
• Selection of the three-phase system type: STAR/DELTA
• Selection of option: STANDARD1, STANDARD2, COGENERATION4
• Programming of the integration time for average values
• Data and time programming

List of MODBUS protocol commands implemented and their limitations

READING OF N. WORDS

P.C. MICROVIP3 PLUS

:,AA,03H,SSSS,WWWW,LRC,CR,LF - - - - - - ->

<- - - - - - -:,AA,03H ,BB,D1,..,Dn,LRC,CR,LF

where:
- AA = 01 = address of the MICROVIP3 PLUS (2 bytes ASCII)
- 03H = Code of the command for reading of N words (2 bytes ascii)
- SSSS = Address from which the reading starts (4 bytes ascii)
- WWWW = Number of words to be read (4 bytes ascii): max. 70 words
- LRC = Longitudinal Redundancy Check (2 bytes ascii)
- CR = 0DH (1 byte ascii)
- LF = 0AH (1 byte ascii)
- BB = Number of bytes read (2 bytes ascii)
- D1,..,Dn = Bytes of data read (2 * Num.ascii bytes)

COMMANDS IMPLEMENTED:
- **Eeprom reading** (0000H <= SSSS <= 00FEH; Valid range: 0000H-00FFH NOTE:: The address must always be even)

- **Internal RAM reading** (SSSS = 0810H)
- **External RAM reading** (SSSS = 0FE00H)

WRITING OF 1 BIT

P.C. MICROVIP3 PLUS

:,AA,05H,NNNN,bbbb,LRC,CR,LF - - - - - - ->

<- - - - - - -:,AA,05H,NNNN,bbbb,LRC,CR,LF

where:
- AA = 01 = address of the MICROVIP3 PLUS (2 bytes ASCII)
- 05H = Code of the command for writing of 1 bit (2 bytes ascii)
- NNNN = Number of the bit to be written (4 bytes ascii):
  0000H <= Number of the bit <= 0003H or number of the bit = FFFEH
- bbbb = FF00H: bit = 1; 0000H: bit = 0 (4 bytes ascii).
- LRC = Longitudinal Redundancy Check (2 bytes ascii)
- CR = 0DH (1 byte ascii)
- LF = 0AH (1 byte ascii)

COMMANDS IMPLEMENTED:
- **Keyboard disabling** (NNNN = 0000H; bbbb = FF00H)
- **Keyboard enabling** (NNNN = 0000H; bbbb = 0000H)
- **Peaks and averages reset** (NNNN = 0001H; bbbb = FF00H)
- **Meters reset** (NNNN = 0002H; bbbb = FF00H)

WRITING OF 1 WORD

P.C. MICROVIP3 PLUS

:,AA,06H,SSSS,D1,D2,LRC,CR,LF - - - - - - ->

<- - - - - - -:,AA,06H,SSSS,D1,D2,LRC,CR,LF

where:
- AA = 01 = address of the MICROVIP3 PLUS (2 bytes ASCII)
- 06H = Code of the command for writing of 1 word (2 bytes ascii)
- SSSS = Address from which writing starts (4 bytes ascii)
- D1 = 1st datum to be written (2 bytes ascii)
- D2 = 2nd datum to be written (2 bytes ascii)
- LRC = Longitudinal Redundancy Check (2 bytes ascii)
- CR = 0DH (1 byte ascii)
- LF = 0AH (1 byte ascii)

COMMANDS IMPLEMENTED:

- **Writing in eeprom of the CT coefficient K** (4 consecutive writing commands)

-1) SSSS = 003AH:
- D1 = CT primary (LSB decimal mantissa)
- D2 = CT primary (MSB decimal mantissa)

-2) SSSS = 003CH:
- D1 = CT primary exponent
- D2 = not significant

-3) SSSS = 003EH:
- D1 = CT secondary (LSB decimal mantissa)
- D2 = CT secondary (MSB decimal mantissa)

-4) SSSS = 00040H:
- D1 = CT secondary exponent
- D2 = not significant

Example writing CT :

Set TA = 1000/1

Set primary
:01 06 00 3A E8 03 Check CR LF Eco
:01 06 00 3C 00 00 Check CR LF Eco

Set secondary
:01 06 00 3E E8 03 Check CR LF Eco

:01 06 00 40 FD 00 Check CR LF Eco

. - CT primary = 1000 exp 0 = 1000 A
- CT secondary = 1000 exp –3 = 1.000 V
- CT K = 1000 / 1 = 1000 A. / 1 V

- Writing in eeprom of the PT coefficient K (2 consecutive writing commands)

-1) SSSS = 0030H:
- D1 = PT primary in volts (in BCD) (middle 2 digits)
- D2 = PT primary in volts (in BCD) (first 2 digits)

-2) SSSS = 002FH:
- D1 = PT primary in volts (in BCD) (last 2 digits)
- D2 = PT secondary (in binary) (actually written in 0035H)
- 00H = 57,7 volts
- 10H = 63,5 volts
- 20H = 100 volts
- 30H = 110 volts
- 40H = 115 volts
- 50H = 120 volts
- 60H = 173 volts
- 70H = 190 volts
- 80H = 200 volts
- 90H = 220 volts

NOTE: Only the high nibble of datum D2 is written.
NOTE: If for any reason only one of the two writing commands is written (because of a break in the line, etc.) the malfunction must be recorded (on P.C.) since after each command the PT primary and secondary are immediately updated. This might lead to a lack of synchronization between the primary/secondary values set and the PT coefficient K implemented (not updated until after the second command). Also remember that whenever the PT primary is greater than 9999 V the value is rounded up or down for calculation of the K, since the internal precision is of 4 digits (the most significant).

E.g.
- PT primary = 100050 V
- PT secondary = 100 V
- PT K = 100100 / 100 = 1001 V.

- Writing in eeprom of the flag for selection of Start/Delta system
(SSSS = 0001H; D2 = 09H):
Structure of datum "D1":

7	6	5	4	3	2	1	0	bit
-	-	-	-	0	-	-	0	==> Star
-	-	-	-	0	-	-	1	==> Delta
								(any others not used)

NOTE: Only bits 3 and 0 of datum D1 are written at the address indicated; D2 is processed as a template of the bits to be written but is not written.

- Writing in eeprom of the flag for selection of Standard 1/Standard 2/Cogeneration 4
(2 consecutive writing commands)

-1) SSSS = 0001H; D2 = 02H:
Structure of datum "D1":

7	6	5	4	3	2	1	0	bit
-	-	-	-	-	-	0	-	==> no cogeneration (standard 1/2)
-	-	-	-	-	-	1	-	==> cog. 4 (Wh, VArh, -Wh, -VArh).

NOTE: Only bit 1 of datum D1 is written at the address indicated; D2 is processed as a template of the bit to be written but is not written.

-2) SSSS = 00CDH; D2 = 80H:
Structure of datum "D1":

7	6	5	4	3	2	1	0	bit
0	-	-	-	-	-	-	-	==> Standard 1 (Wh, VArh)
1	-	-	-	-	-	-	-	==> Standard 2 (Wh, VAh).

NOTE: Only bit 7 of datum D1 is written at the address indicated; D2 is processed as a template of the bit to be written but is not written.

NOTE: If for any reason only one of the two writing commands is written (because of a break in the line, etc.) the malfunction must be recorded (on P.C.) since after each command the selection bit is immediately updated. This might lead to a selection error since the 2 selection bits are paired as follows:

- D1 (1st command) = 00H and D1 (2nd command) = 00H <===> Standard 1
- D1 (1st command) = 00H and D1 (2nd command) = 80H <===> Standard 2
- D1 (1st command) = 02H and D1 (2nd command) = 00H <===> Cogener. 4
- D1 (1st command) = 02H and D1 (2nd command) = 80H <===> Cogener. 4 (possible not used)

NOTE: For the COG4 selection only the 1st control is needed (2nd one is powerless).

- Writing in eeprom of the integration time for average value (SSSS = 0001H; D2 = 0C4H):

7	6	5	4	3	2	1	0	bit
0	0	-	-	-	0	-	-	==> 10 minutes
0	1	-	-	-	0	-	-	==> 15 minutes
1	0	-	-	-	0	-	-	==> 20 minutes
1	1	-	-	-	0	-	-	==> 30 minutes
0	0	-	-	-	1	-	-	==> 60 minutes
0	1	-	-	-	1	-	-	==> 1 minute
1	0	-	-	-	1	-	-	==> 2 minutes
1	1	-	-	-	1	-	-	==> 5 minutes

NOTE: Only bits 7, 6 and 2 of datum D1 are written at the address indicated; D2 is processed as a template of the bit to be written but is not written.

- Writing in RAM/eeprom of the date and time (3 consecutive writing commands):

-1) SSSS = 0DFCH:
- D1 = minutes in BCD
- D2 = hours in BCD

-2) SSSS = 0DFEH:
- D1 = day in BCD
- D2 = month in BCD

-3) SSSS = 0C4BH:
- D1 = year in BCD
- D2 = 00H

NOTE: Only datum D1 is written at the address indicated; D2 is ignored.

- Reading in eeprom of the CT coefficient K

P.C. MICROVIP3 PLUS

:,AA,03H,003A,0004, LRC, CR,LF ------>

<------ :,AA,03H,04,D1,D2,D3,D4,D5,D6,D7,D8,LRC,CR,LF

where:

-AA = 01 = address of the MICROVIP3 PLUS selected(2 bytes ascii)
-03H = Code of the command for reading of N words(2 bytes ascii)
-003A = address from which the reading starts (8 bytes ascii)
-0004 = Number of words to be read (8 bytes ascii)
-LRC = Longitudinal Redundancy Check (2 bytes ascii)
-CR = 0DH (1 byte ascii)
-LF = 0AH (1 byte ascii)
-08 = Number of bytes read
-D1 = CT primary in amps(LSB decimal mantissa)
-D2 = CT primary in amps(MSB decimal mantissa)
-D3 = CT primary exponent
-D4 = not significant
-D5 = CT secondary (LSB decimal mantissa)
-D6 = CT secondary (MSB decimal mantissa)
-D7 = CT secondary exponent
-D8 = not significant

E.g.
- CT primary = 1000A
- CT secondary = 1.0V
- CT K = 1000/1

Reading string :

: 01 03 003A 0004 BE CR LF

Response from MICROVIP3 PLUS :

: 01 03 08 E8030000E8 03 FD 00 21 CR LF

- Reading in eeprom of the PT coefficient K

P.C. MICROVIP3 PLUS

:,AA,03H,002E,0004, LRC, CR,LF ------>

<------ :,AA,03H,08,D1,D2,D3,D4,D5,D6,D7,D8,LRC,CR,LF

where:

-AA = 01 = address of the MICROVIP3 PLUS selected(2 bytes ascii)
-03H(04H) = Code of the command for reading of N words(2 bytes ascii)
-002E = address from which the reading starts (4 bytes ascii)
-0004 = Number of words to be read (4 bytes ascii)
-LRC = Longitudinal Redundancy Check (2 bytes ascii)
-CR = 0DH (1 byte ascii)
-LF = 0AH (1 byte ascii)
-08 = Number of bytes read
-D1 = not used
-D2 = PT primary in volts(in BCD, last 2 digits)
-D3 = PT primary in volts(in BCD middle 2 digits)
-D4 = PT primary in volts(in BCD first 2 digits)
-D5 = not used
-D6 = not used
-D7 = not used
-D8 = PT secondary (in binary)
-0XH = 57,7 Volts
-1XH = 63,5 Volts
-2XH = 100 Volts
-3XH = 110 Volts
-4XH = 115 Volts
-5XH = 120 Volts
-6XH = 173 Volts
-7XH = 190 Volts
-8XH = 200 Volts
-9XH = 220 Volts

Note:
X means don't care in order to read only the high nibble of datum D8 .

E.g. :
-PT primary = 200400 Volts
-PT secondary = 100 Volts
-PT K = 200400/100 = 2004

Reading string :
: 0103 002E 0004 CA cr lf

Response from MICROVIP3 PLUS :
: 01 03 08 FC00042050001023 51 cr lf

- Reading in eeprom of the integration time for average values

P.C. MICROVIP3 PLUS

:,AA,03H,0000,0001, LRC, CR,LF ------>

<------ :,AA,03H,02,D1,D2,LRC,CR,LF

where:

-AA = 01= address of the MICROVIP3 PLUS selected (2 bytes ascii)
-03H = Code of the command for reading of N words (2 bytes ascii)
-0000 = address from which the reading starts (4 bytes ascii)
-0001 = Number of words to be read (2 bytes ascii)
-LRC = Longitudinal Redundancy Check (2 bytes ascii)
-CR = 0DH (1 byte ascii)
-LF = 0AH (1 byte ascii)
-02 = Number of bytes read
-D1 = not used
-D2 = b7 b6 b5 b4 b3 b2 b1 b0 bit

0	0	-	-	-	0	-	-	==>	10 minutes
0	1	-	-	-	0	-	-	==>	15 minutes
1	0	-	-	-	0	-	-	==>	20 minutes
1	1	-	-	-	0	-	-	==>	30 minutes
0	0	-	-	-	1	-	-	==>	60 minutes
0	1	-	-	-	1	-	-	==>	1 minutes
1	0	-	-	-	1	-	-	==>	2 minutes
1	1	-	-	-	1	-	-	==>	5 minutes

E.g. :
-Integration Time = 15'

Reading string :

: 01 03 0000 0001 FB cr lf

Response from MICROVIP3 PLUS :

: 01 03 02 01 40 B9 cr lf

- Reading in eeprom of the flags for selection of the Star/Delta switching

P.C. MICROVIP3 PLUS

:,AA,03H,0000,0001, LRC, CR,LF ------>

<------ :,AA,03H,02,D1,D2,LRC,CR,LF

where:

-AA = 01 = address of the MICROVIP3 PLUS selected(2 bytes ascii)
-03H = Code of the command for reading of N words(2 bytes ascii)
-0000 = address from which the reading starts (4 bytes ascii)
-0001 = Number of words to be read (2 bytes ascii)
-LRC = Longitudinal Redundancy Check (2 bytes ascii)
-CR = 0DH (1 byte ascii)
-LF = 0AH (1 byte ascii)
-02 = Number of bytes read
-D1 = not used
-D2 = b7 b6 b5 b4 b3 b2 b1 b0 bit

-	-	-	-	0	-	-	0	==>	Star
-	-	-	-	0	-	-	1	==>	Delta

E.g. :
-Insertion "Delta"

Reading string :

: 01 03 0000 0001 FB cr lf

Response from MICROVIP3 PLUS :

: 01 03 02 01 51 A8 cr lf

- Reading in eeprom of the flag for selection of Standard /Cogeneration 4

P.C. MICROVIP3 PLUS

:,AA,03H,0000,0001, LRC, CR,LF ------>

<------ :,AA,03H,02,D1,D2,LRC,CR,LF

where:

-AA = 01 = address of the MICROVIP3 PLUS selected(2 bytes ascii)
-03H = Code of the command for reading of N words(2 bytes ascii)
-0000 = address from which the reading starts (4 bytes ascii)
-0001 = Number of words to be read (2 bytes ascii)
-LRC = Longitudinal Redundancy Check (2 bytes ascii)
-CR = 0DH (1 byte ascii)
-LF = 0AH (1 byte ascii)
-02 = Number of bytes read
-D1 = not used
-D2 = b7 b6 b5 b4 b3 b2 b1 b0 bit
- - - - - - 0 - ==> no cogeneration (Standard 1/2)
- - - - - - 1 - ==> cog. 4 (Wh, VArh, -Wh, -VArh).

E.g. :
-Selection Cogeneration 4

Reading string :

: 01 03 0000 0001 FB cr lf

Response from MICROVIP3 PLUS :

: 01 03 02 01 52 A7 cr lf

- Reading in eeprom of the flag for selection of Standard 1/Standard 2

P.C. MICROVIP3 PLUS

:,AA,03H,00CC,0001, LRC, CR,LF ------>

<------ :,AA,03H,02,D1,D2,LRC,CR,LF

where:

-AA = 01 = address of the MICROVIP3 PLUS selected(2 bytes ascii)
-03H = Code of the command for reading of N words(2 bytes ascii)
-00CC = address from which the reading starts (4 bytes ascii)
-0001 = Number of words to be read (2 bytes ascii)
-LRC = Longitudinal Redundancy Check (2 bytes ascii)
-CR = 0DH (1 byte ascii)
-LF = 0AH (1 byte ascii)
-02 = Number of bytes read
-D1 = not used
-D2 = b7 b6 b5 b4 b3 b2 b1 b0 bit
0 - - - - - - - ==> Standard 1 (Wh, VArh)
1 - - - - - - - ==> Standard 2 (Wh, VAh)

Note: this reading has meaning only if no cogeneration is selected
E.g. :
-Standard 2

Reading string :

: 01 03 00CC 0001 2F cr lf

Response from MICROVIP3 PLUS :

: 01 03 02 02 82 76 cr lf

LIST OF THE ERROR STRINGS IMPLEMENTED AND THEIR MEANING

ILLEGAL FUNCTION.
Error generated by reception of an unknown function code.

P.C. MICROVIP3 PLUS

<- - - - - - - :,AA,FF,01H,LRC,CR,LF

where:
- AA = 01 = address of the MICROVIP3 PLUS (2 bytes ASCII)
- FF = Code of the command received with bit 7 forced to 1 (2 bytes ascii);
  e.g. 81H: code of the command for reading 1 bit (not recognized)
- LRC = Longitudinal Redundancy Check (2 bytes ascii)
- CR = 0DH (1 byte ascii)
- LF = 0AH (1 byte ascii)

ILLEGAL DATA ADDRESS.
Error generated by reception of an address relating to the data which is outside the valid range established for that type of command.
E.g.
In a reading command of N words, if "SSSS > 0FDE" this type of error is generated.

P.C. MICROVIP3 PLUS

<- - - - - - - :,AA,FF,02H,LRC,CR,LF

where:
- AA = 01 = address of the MICROVIP3 PLUS s(2 bytes ascii)
- FF = Code of the command received with bit 7 forced to 1 (2 bytes ascii);
  e.g. 83H: code of the command for reading N words
- LRC = Longitudinal Redundancy Check (2 bytes ascii)
- CR = 0DH (1 byte ascii)
- LF = 0AH (1 byte ascii)

ILLEGAL DATA VALUE.
Error generated by reception of a datum which is outside the valid range established for that type of command.
E.g.
In a reading command of N words, if "WWWW > 0046 (70)" this type of error is generated.

P.C. MICROVIP3 PLUS

<- - - - - - - :,AA,FF,03H,LRC,CR,LF

where:
- AA = 01 = address of the MICROVIP3 PLUS (2 bytes ascii)
- FF = Code of the command received with bit forced to 1 (2 bytes ascii);
  e.g. 83H: code of the command for reading N words
- LRC = Longitudinal Redundancy Check (2 bytes ascii)
- CR = 0DH (1 byte ascii)
- LF = 0AH (1 byte ascii)

FAILURE IN ASSOCIATED DEVICE.
Error generated by reception of a non hexadecimal (ascii) character.
The valid Hex characters are: 0-9, A-F.

P.C. MICROVIP3 PLUS

<- - - - - - - :,AA,FF,04H,LRC,CR,LF

where:
- AA = 01 = address of the MICROVIP3 PLUS (2 bytes ascii)
- FF = Code of the command received with bit 7 forced to 1 (2 bytes ascii);
  e.g. 83H: code of the command for reading N words
- LRC = Longitudinal Redundancy Check (2 bytes ascii)
- CR = 0DH (1 byte ascii)
- LF = 0AH (1 byte ascii)

NO RESPONSE.
Communications error generated by:
- Overrun or framing error

- Initial character error (":")
- Address selected not valid
- LRC error
- CR error
- LF error
- Any type of error detected on a "radio broadcasting" command (address = 00H).

HOW THE LRC IS CALCULATED

The LRC is calculated as follows.
- all the bytes to be transmitted before the LCR are added together, except for the string start character (:).
- the value calculated is then divided by 256 and the remainder is noted
- the remainder is then subtracted from 256 to obtain the desired LRC.

Example:
01H,03H,FE00H,0021H,LRC,CR,LF

The LRC will be calculated as follows:
- 01H + 03H + FEH + 00H + 00H + 21H = 123H (291)
- 123H / 100H (256) = 01H RESTO = 23H (35)
- 100H (256)- 23H = DDH

therefore:
- LRC = DDH.

Description of the operational reading functions implemented

READING OF ALL MEASUREMENTS

This is carried out by reading 65 words starting from the address 0810H or 0FE00H.
The meaning of the 130 bytes received is as follows:

- Type of instrument (TIPVIP = 0DH = 13 (Vip Energy))

- Instrument options (OPTION) (1st byte):
bit 7 = 0 (not used)

7	6	5	4	3	2	1	0	bit
-	0	1	1	-	-	-	1	==> Microvip3 Plus

bit 3 = 0 (not used)
bit 2 = 0 (not used)
bit 1 = 0 (not used)
bit 0 = 1 = serial option present

- Instrument options (OPTIO2) (2nd byte):
bit 7, 6, 5, 4, 3, 2, 1, 0 = 0 (not used)

- Instrument setup (CONFIG) (1st byte):
bit 7, 6, 2 = Integration time for averages:

7	6	5	4	3	2	1	0	bit
0	0	-	-	-	0	-	-	==> 10 minutes
0	1	-	-	-	0	-	-	==> 15 minutes
1	0	-	-	-	0	-	-	==> 20 minutes
1	1	-	-	-	0	-	-	==> 30 minutes
0	0	-	-	-	1	-	-	==> 60 minutes
0	1	-	-	-	1	-	-	==> 1 minute
1	0	-	-	-	1	-	-	==> 2 minutes
1	1	-	-	-	1	-	-	==> 5 minutes

bit 5, 4, 3 = 0 (not used)

Bit 1 = Selection of cogeneration / no cogeneration:

7	6	5	4	3	2	1	0	bit
-	-	-	-	-	-	0	-	==> no Cog. 4 (Standard1 / 2)
-	-	-	-	-	-	1	-	==> Cogeneration 4 active

Bit 0 = Selection of switching type:

7	6	5	4	3	2	1	0	bit
-	-	-	-	-	-	-	0	==> Star
-	-	-	-	-	-	-	1	==> Delta

- Instrument setup (CONFI2) (2nd byte):
bit 7 = selection of Standard 1/2:

7	6	5	4	3	2	1	0	bit
0	-	-	-	-	-	-	-	==> Standard 1 (Wh, varh) active (with bit 1 of CONFIG = 0)
1	-	-	-	-	-	-	-	==> Standard 2 (Wh,VAh) active (with bit 1 of CONFIG = 0)

Note :
bit 0 = keyboard Enabling/Disabling

7	6	5	4	3	2	1	0	bit
-	-	-	-	-	-	-	0	==> keyboard enabled
-	-	-	-	-	-	-	1	==> keyboard disabled

- Three-phase voltage (V)
- Three-phase current (I)
- Three-phase active power (W)
- Three-phase cosphi
- Phase L1 voltage (V)
- Phase L2 voltage (V)
- Phase L3 voltage (V)
- Phase L1 current (I)
- Phase L2 current (I)
- Phase L3 current (I)
- Phase L1 active power (W)
- Phase L2 active power (W)

- Phase L3 active power (W)
- Phase L1 cosø
- Phase L2 cosø
- Phase L3 cosø
- Phase L1 reactive power (VAr)
- Phase L2 reactive power (VAr)
- Phase L3 reactive power (VAr)
- Phase L1 apparent power (VA)
- Phase L2 apparent power (VA)
- Phase L3 apparent power (VA)
- 6 ASCII characters = 30 Hex
- 6 ASCII characters = 30 Hex
- 6 ASCII characters = 30 Hex

- Three-phase apparent power (VA)
- Three-phase reactive power (VAr)
- Frequency (Hz)
- Positive three-phase kWatthours (single-phase if single-phase is set) (kWh)
- Positive three-phase kVArhours (single-phase if single-phase is set) (kVArh)
- Three-phase average reactive power (single-phase if single-phase is set) (VAr)
- Three-phase average apparent power (single-phase if single-phase is set) (VA)
- Three-phase average active power (single-phase if single-phase is set) (W)
- Three-phase apparent power peaks (single-phase if single-phase is set) (VA)
- Three-phase active power peaks (single-phase if single-phase is set) (W)
- Negative three-phase kWatthours (single-phase if single-phase is set) (kWh) (if Delta system is selected, or Star system or single-phase switching with the Cogeneration 4 option
- Negative three-phase kVArhours (single-phase if single-phase is set) (kVArh) (if Delta system is selected, or Star system or single-phase switching with the Cogeneration 4 option

5 ASCII charcters = 30 Hex
1 ASCII character = 30 Hex

- WITH SINGLE-PHASE OPTION SELECTED:
the string is always 65 words long. The three-phase measurement and that of phase L1 coincide.
The measurements of phases L2 and L3 are not calculated.

DATA AND HOUR READING
This is carried out by reading 3 words starting from address 0DFCH.
The meaning of the 6 bytes received is as follows:
- Minutes
- Hours
- Day
- Month
- Year
- Datum to be rejected (1 byte)

NOTE: All the data received are in BCD.

A.2 Q-Basic example for MICROVIP3 PLUS reading

```
'       EXAMPLE OF MICROVIP3 PLUS READING
'
'       INSTRUMENT TYPE       : MICROVIP3 PLUS
'       PHISICAL ADDRESS      : 01
'       TRANSMISSION PARAMETERS : 9600 baud, NO par, 1 Stop BIT

DECLARE SUB Pause (n!)
DECLARE SUB SetArrayMeasures ()
DECLARE FUNCTION CheckLrc! (EnergyReply$)
DECLARE SUB ShowData (EnergyReply$)
DECLARE FUNCTION AsciiToFloat! (Data$)
DECLARE FUNCTION AsciiHexToDec! (A$)
DECLARE FUNCTION LRC$ (strng$)
CONST TRUE = -1: CONST FALSE = 0
TYPE Measure
    Nome AS STRING * 6
    NCh AS INTEGER
    OutRow AS INTEGER
    OutCol AS INTEGER
END TYPE
DIM SHARED Measures(40) AS Measure  '
CR$ = CHR$(13)
LF$ = CHR$(10)

'Name,OutRow,OutCol
DATA V,1,1,A,1,2,W,1,3,PF,2,1,V1,3,1,V2,3,2,V3,3,3,I1,4,1,I2,4,2,I3,4,3
DATA W1,5,1,W2,5,2,W3,5,3,PF1,6,1,PF2,6,2,PF3,6,3
DATA VAr1,7,1,VAr2,7,2,VAr3,7,3
DATA VA1,8,1,VA2,8,2,VA3,8,3,CF1,9,1,CF2,9,2,CF3,9,3
DATA VA,10,1,VAr,10,2,Hz,10,3
DATA kWh,11,1,kVArh,11,2,AvgVAr,12,1,AvgVA,12,2,AvgW,12,3
DATA PeakVA,13,1, PeakW,13,2,kWh1,14,1,kWh2,14,2,kWh3,14,3
SetArrayMeasures

DO
    OPEN "COM1: 9600,N,7,1" FOR RANDOM AS #1
        ' Standard request of 65 words (41H) starting from addr. FE00
                ' Instrument's address=01   ,     Reading Command=03
        Request$ = "01003FE000041"
        Request$ = ":" + Request$ + LRC(Request$) + CR$ + LF$
        PRINT #1, Request$
        INPUT #1, EnergyReply$
        Pause (5)  'pause between two requests
        ' Read clock
        Request$ = "01030DFC0003"
        Request$ = ":" + Request$ + LRC(Request$) + CR$ + LF$
        PRINT #1, Request$
        INPUT #1, Tim$
    CLOSE #1

    CLS : LOCATE 1, 1
    PRINT EnergyReply$
    IF CheckLrc(EnergyReply$) THEN
        ShowData (EnergyReply$)
    END IF
    Min$ = MID$(Tim$, 8, 2): HH$ = MID$(Tim$, 10, 2)
    DD$ = MID$(Tim$, 12, 2): MM$ = MID$(Tim$, 14, 2)

    YY$ = MID$(Tim$, 16, 2)
    LOCATE 23, 1: PRINT "Energy Time = "; HH$; ":"; Min$;
    PRINT " - "; DD$; "/"; MM$; "/"; YY$
    Pause (5)




LOOP WHILE INKEY$ = ""
END

FUNCTION AsciiHexToDec (A$)
'Converts a hexadecimal numbers, written as two ascii char., into a decimal
    MSC$ = LEFT$(A$, 1)  ' first char
    LSC$ = RIGHT$(A$, 1) ' second char

    IF MSC$ >= "A" THEN
        TEMP = (ASC(MSC$) - ASC("A") + 10) * 16
    ELSE
        TEMP = VAL(MSC$) * 16
    END IF
    IF LSC$ >= "A" THEN
        TEMP = TEMP + (ASC(LSC$) - ASC("A") + 10)
    ELSE
        TEMP = TEMP + VAL(LSC$)
    END IF
    AsciiHexToDec = TEMP
END FUNCTION


FUNCTION AsciiToFloat (Data$)
'Convert a number from the Energy reply's format to a float
    Exponent = AsciiHexToDec(RIGHT$(Data$, 2))
    IF Exponent > 200 THEN Exponent = Exponent - 256  ' FF=-1, FE=-2 ect...
```

```
    Num$ = ""
    FOR k = 1 TO LEN(Data$) - 3 STEP 2
        'Rewrites the whole number from the most significant couple of digits
        ' to the last significant
        Num$ = MID$(Data$, k, 2) + Num$
    NEXT k



IF LEFT$(Num$, 1) = "8" THEN
        'Negative number
        Num$ = "-" + RIGHT$(Num$, LEN(Num$) - 1)' Cut char. "8" and add "-"
    END IF
    AsciiToFloat = VAL(Num$) * 10 ^ Exponent
END FUNCTION

FUNCTION CheckLrc (EnergyReply$)
'Compares the Received and the Calculated LRC

    EnergyReply$ = MID$(EnergyReply$, 2, LEN(EnergyReply$)) ' Cut char. ":"
    RxLrc$ = RIGHT$(EnergyReply$, 2)
    EnergyReply$ = LEFT$(EnergyReply$, LEN(EnergyReply$) - 2)' Cut LRC
    CalcLrc$ = LRC(EnergyReply$)
    LOCATE 4, 35
    IF RxLrc$ <> CalcLrc$ THEN
        PRINT "Communication Error !"
        CheckLrc = FALSE
    ELSE
        PRINT "Communication OK !   "
        CheckLrc = TRUE
    END IF
END FUNCTION

FUNCTION LRC$ (strng$)
'Longitudinal  Redundancy Check calculation
    TEMP = 0
    FOR i = 1 TO LEN(strng$) STEP 2
        A$ = MID$(strng$, i, 2)
        DECVALUE = AsciiHexToDec(A$)
        TEMP = TEMP + DECVALUE  ' sum of all character
    NEXT i



TEMP = TEMP MOD 256
    TEMP = 256 - TEMP
    LRC$ = HEX$(TEMP)
END FUNCTION


SUB Pause (n)
    FOR i = 1 TO n: PLAY "P64": NEXT i

END SUB


SUB SetArrayMeasures
'Reads the label and the required screen position
    SHARED Measures AS Measure
    FOR i = 1 TO 38:
        READ Measures(i).Nome, Measures(i).OutRow, Measures(i).OutCol
        Measures(i).NCh = 6
    NEXT i

    'Counters Lenght = 10 characters
    Measures(29).NCh = 10: Measures(30).NCh = 10   'kWh  kVArh
    Measures(36).NCh = 10: Measures(37).NCh = 10   'kWh1  kWh2
    Measures(38).NCh = 10                          'kWh3
END SUB
SUB ShowData (EnergyReply$)
' Shows the measures on the screen
    SHARED Measures AS Measure
    Stepp = 26: PRINT STRING$(80, "Õ")
    Pointer = 17
    FOR i = 1 TO 38



LOCATE 7 + Measures(i).OutRow, (Measures(i).OutCol - 1) * Stepp + 1
        PRINT RTRIM$(Measures(i).Nome); " = ";
        Meas$ = MID$(EnergyReply$, Pointer, Measures(i).NCh)
        PRINT AsciiToFloat(Meas$)
        Pointer = Pointer + Measures(i).NCh
    NEXT i
END SUB
```

EXAMPLE OF MODBUS PROTOCOL

REQUEST to the instrument with address 01:
":010308100041A3"+CR+LF oppure **":0103FE0041BD"+CR+LF**

Start Transmission
:

Instrument Address	Command	memory Address	#words to read	LRC
01	**03**	**0810** oppure **FE00**	**0041**	**A3** oppure **BD**

End Transmission
0D0A

RESPONSE from instrum. 01 to all measurements request

":0103820D3100400012040043 01FE0101019980FE380200380200380200 4301FE4301FE4301FE3703003703003703009980FE9980F E
9980FE8084FF2484FF4784FF4103004003004003000000000000000000000201013581000005FF41010000FE61020000FE510200570 2002504FF1003015401010000000000000000000000000000000000BF"+CR+LF

Start Transmission
:

Address	Command Echo	# of bytes	Type of instrument	Option1	Option2	Config1
01	**03**	**82**	**0D** (MICROVIP3 PLUS)	3**1**	**00**	4**0**

Config2	Volt(412)	I (1.43)	W (1010)	PF(-.99)	V1(238)	V2(238)	V3(238)
00	**120400**	**4301FE**	**010101**	**9980FE**	**380200**	**380200**	**380200**

I1(1.43)	I2(1.43)	I3(1.43)	W1(337)	W2(337)	W3(337)	PF1(-.99)	PF2(-.99)
4301FE	**4301FE**	**4301FE**	**370300**	**370300**	**370300**	**9980FE**	**9980FE**

PF3(-.99)	Var1(-48)	Var2(-42.4)	VAr3(-44.7)	VA1(341)	VA2(340)	VA3(340)
9980FE	**8084FF**	**2484FF**	**4784FF**	**410300**	**400300**	**400300**

			VA(1020)	Var(-135)	Hz(50)	kWh+(1.41)	kVArh+(2.61)
000000	**000000**	**000000**	**020101**	**358100**	**0005FF**	**41010000FE**	**61020000FE**

AvgVAr(251)	AvgVA(257)	AvgW(4.5)	PeakVA(3100)	PeakW(1540)
510200	**570200**	**2504FF**	**100301**	**540101**

kWh- (.46)	kvarh- (.47)
46000000FE	**47000000FE**

0000000000

Data to be discarded	LRC	End Transmission
00	**BF**	**CR+LF (0Dh+0Ah)**

A.3 Reading of Voltage and Current waveforms samples

- The PC *Requests* for 200 samples of V and I waveforms are:

Phase 1:	Phase 2:	Phase 3:
0103040000202 Check CR LF	:010305000202 Check CR LF	:010306000202 Check CR LF

- *Microvip3 Plus Response*:
:01 03 D1 D2 D3 D4 D5 D6 D7 D8 D9 V1..V200 D10 D11D12 D13D14 D15 D16 D17 I1..I200 CS CRLF
Where:
: = start of Modbus string
01 = Microvip3 Plus default address
03 = command for data reading
D1 = number of frames inside the data buffer; "frame" means 200 voltage samples (first frame) or 200 current samples (second frame)
D2 = type of the first frame of 200 samples (the lowest nibble is the scale)

  E.g.:
  Voltage samples, scale 1: D2 = A1 hex
  Voltage samples, scale 2: D2 = A2 hex
  Voltage samples, scale 3: D2 = A3 hex

  D3 = first frame samples number (LSB)
  D4 = first frame samples number (MSB)

  D5 = first frame samples zero (LSB)
  D6 = first frame samples zero (MSB)

  D7 = first frame calibration factor (LSB)
  D8 = first frame calibration factor (MSB)
  D9 = first frame calibration factor (EXP)

  V1...V200 = samples of the first frame (voltage buffer)

  D10 = type of the second frame of 200 samples (the lowest nibble is the scale)

  E.g.:
  Current samples, scale 3: D10 = C3 hex
  Current samples, scale 4: D10 = C4 hex
  Current samples, scale 6: D10 = C6 hex

  D11 = second frame samples number (LSB)
  D12 = second frame samples number (MSB)

  D13 = second frame samples zero (LSB)
  D14 = second frame samples zero (MSB)

  D15 = second frame calibration factor (LSB)
  D16 = second frame calibration factor (MSB)
  D17 = second frame calibration factor (EXP)

  I1...I200 = samples of the second frame (current buffer)

  CS = checksum Modbus

- The "snapshot" of 200 voltage and 200 current samples, followed by the values of the frequency of phase 1 and positive/negative kWh and kvarh can be requested to the instrument as follows:

Phase 1:	Phase 2:	Phase 3:
:010304000021A Check CR LF	:01030500021A Check CR LF	:01030600021A Check CR LF

  Microvip3 Plus Response
  :01 03 D1 D2 D3 D4 D5 D6 D7 D8 D9 V1..V200 D10 D11 D12 D13 D14 D15 D16 D17 I1..I200
  DF0,DF1,DF2,DF3,CWP0,CWP1,CWP2,CWP3,CWP4,CVARP0,CVARP1,CVARP2,CVARP3,CVARP4,
  CWN0,CWN1,CWN2,CWN3,CWN4, CVARN0,CVARN1,CVARN2,CVARN3,CVARN4, CS CRLF

  Up to I200 the string is the same than the previous one.
  The remaining data are:

  DF0 = third data frame starting identifier (E0 hexadecimal)

  DF1,DF2 = Frequency Hz (BCD) (LSB, MSB)
  DF3 = Frequency (hexadecimal) (EXP)

CWP0,CWP1,CWP2,CWP3,CWP4 = three-phase positive kWh (BCD)
where CWP4 is the exponent (hexadecimal)

CVARP0,CVARP1,CVARP2,CVARP3,CVARP4 = three-phase positive kvarh (BCD)
where CVARP4 is the exponent (hexadecimal)

CWN0,CWN1,CWN2,CWN3,CWN4 = three-phase negative kWh (BCD)
where CWN4 is the exponent (hexadecimal)

CVARN0,CVARN1,CVARN2,CVARN3,CVARN4 = three-phase negative kvarh (BCD)
where CVARN4 is the exponent (hexadecimal)

Example:

:01 03 D1 D2 D3 D4 D5 D6 D7 D8 D9 V1..V200 D10 D11 D12 D13 D14 D15 D16 D17 I1..I200
E0 (third frame starting)
0005FF (Frequency 50.0 Hz)
41010000FE (kWh 1.41)
61020000FE (kvarh 2.61)
32080080FE (-kWh 8.32)
79040080FE (-kvarh 4.79)

A.4 On-board Memory downloading via serial line

Use the following command sequence:

1. 8 bit UART Setting

In order to have a correct download of data stored, UART has to be set to 8 bits.
N.B.
This setup is necessary because the data stored inside the internal memory are in decimal format.

PC Request:
:01 05 0006 0000 LRC crlf

Microvip3Plus Response:
Eco

2. Request for the Number of stored records:

PC Request:
:01 03 4000 0001 3B crlf

Microvip3Plus Response:
:01 03 02 nnnn LRC crlf

where nnnn = number of stored records

3. Request for n stored records:

PC Request:
:01 03 xxxx yyyy LRC crlf

xxxx = Address of the starting record (8000h..9EA0h)

yyyy = Number of records to be transmitted
(0001, 0002, 0003 o 0004)

Microvip3Plus Response:
:0103 nn rrr...rrr rrr...rrr LRC CR LF

where nn = number of WORDS transmitted (in the standard Modbus nn should be the number of bytes !)

rrr...rrr = it is the record of 113 bytes stored and transmitted in binary format (therefore it is necessary an 8 bit transmission).

Example 1:
PC Request:
:0103 8000 0001 7A CR LF (request for 1 record of 113 bytes starting from the first address 8000h)

Microvip3 Plus Response (hexadecimal) in case of a campaign of rms meas. in Three-phase, Standard1 mode, Star insertion:

:010339
where 01 = address
03 = reading command
39 = number of transmitted words
D1= 20 (Configuration)

The first byte of each record is that one included in the configuration of the instrument at the moment of the measurement storing inside the internal memory . Its format is as follows:

Bit 7, 6	= type of campaign	(00 = rms meas. 01 = samples)
Bit 5	= single-phase/three-phase	(0 = single-phase, 1= three-phase)
Bit 4, 3	= instrument configuration	(00 = Standard 1, 01 = Standard 2, 10 = Cog 4)
Bit 2	= type of insertion	(0 = Star, 1 = Delta)
Bit 1, 0	= phase number	(00 = phase 1, 01 = phase 2, 10 = phase 3)

D2 = 01 (day) D3 = 06 (month) D4 = 63 (year hex) log date: 1 June 1999
D5 = 00 (seconds) D6 = 08 (minutes) D7 = 09 (hours) log hour: 09:08:00

D8 D9 D10
8C 0F FF (V = 398 three-phase voltage, expressed as LSB, MSB, EXP)

D11 D12 D13
94 11 FF (I = 450 A three-phase current, " " " " ")

D14 D15 D16
40 1F FC (PF= 0.80, " " " " ")

D17 D18 D19
C8 05 FF (W= 148 kW, " " " " ")

D20 D21 D22
1C 0C 02 (VA = 310 kVA, " " " " ")

D23 D24 D25
A0 0A 02 (var = 272 kvar, " " " " ")

D26 D27 D28
88 13 FE (Hz = 50.0, " " " " ")

D29 D30 D31 D32 D33 D34
21 03 45 67 89 56 (positive Wh equal to 210345.678956 MWh)
where byte 21 = 2 Wh * 10 exp 11 + 1 Wh * 10 exp 10
byte 03 = 0 Wh * 10 exp 9 + 3 Wh * 10 exp 8
byte 45 = 4 Wh * 10 exp 7 + 5 Wh * 10 exp 6
byte 67 = 6 Wh * 10 exp 5 + 7 Wh * 10 exp 4
byte 89 = 8 Wh * 10 exp 3 + 9 Wh * 10 exp 2
byte 56 = 5 Wh * 10 exp 1 + 6 Wh * 10 exp 0

D35 D36 D37 D38 D39 D40
12 34 56 00 00 00 (Positive varh equal to 123456.000000 Mvarh)

D41 D42 D43 D44 D45 D46
00 00 12 34 00 00 (Negative Wh equal to 000012.340000 MWh)

D47 D48 D49 D50 D51 D52
00 34 56 00 00 00 (Negative varh equal to 003456.000000 Mvarh)

D53 D54 D55
B8 0B 02 (Average Reactive power peaks = 300 kvar , expressed as LSB, MSB, EXP)

D56 D57 D58
AC 0D 02 (Average Apparent power peaks = 350 kVA, " " " " ")

D59 D60 D61
8C 0A 02 (Average Active power peaks = 270 kW, " " " " ")

D62 D63 D64
FC 08 FF (V phase 1 = 230 V, expressed as LSB, MSB, EXP)

D65 D66 D67
FC 08 FF (V phase 2 = 230 V, " " " " ")

D68 D69 D70
FC 08 FF (V phase 3 = 230 V, " " " " ")

D71 D72 D73
94 11 FF (I phase 1 = 450 A, " " " " ")

D74 D75 D76
94 11 FF (I phase 2 = 450 A, " " " " ")

D77 D78 D79
94 11 FF (I phase 3 = 450 A, " " " " ")

D80 D81 D82
58 20 01 (W phase 1 = 82.8 kW, " " " " ")

D83 D84 D85
58 20 01 (W phase 2 = 82.8 kW, " " " " ")

D86 D87 D88
58 20 01 (W phase 3 = 82.8 kW, " " " " ")

D89 D90 D91
40 1F FC (PF phase 1 = 0.80, " " " " ")

D92 D93 D94
40 1F FC (PF phase 2 = 0.80, " " " " ")

D95 D96 D97
40 1F FC (PF phase 3 = 0.80, " " " " ")

D98 D99 D100 D101 D102 D103 D104 D105 D106 D107 D108 D109 D110 D111 D112 D113
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

D114 = Checksum calculated starting from D1 up to D113 in the following way:

- All the bytes from D1 to D113 are summed;
- The calculated value is divided by 256 and the remainder is saved;
- The remainder is subtracted from 256 to obtain the value stored in D114.

LRC (checksum calculated on the whole string starting from the address up to D114 in the same mode as D114 is calculated)
CR
LF

#**********#

Example 2:
PC Request:

:010380000004 77 CR LF (request for 4 records of 113 bytes each, starting from the first address 8000h)

Microvip3 Plus Response (hexadecimal value) in case of a campaign of samples in Three-phase, Standard 1 mode (i.e. kWh e kvarh energy meters), Star insertion.

:0103E2
01 = address
03 = reading command
E2 = number of transmitted words
D1= 40 (configuration)

The first byte of each record is that one included in the configuration of the instrument at the moment of the measurement storing inside the internal memory . Its format is:

Bit 7, 6 = campaign type	(00 = rms measure,	01 = samples)	
Bit 5 = single-phase / three-phase	(0 = single-phase,	1 = three-phase)	
Bit 4, 3 = instrument configuration	(00 = Standard 1,	01 = Standard 2,	10 = Cog 4)
Bit 2 = insertion type	(0 = Star,	1 = Delta)	
Bit 1, 0 = phase number	(00 = phase 1,	01 = phase 2,	10 = phase 3)

D2 = 02 (day) D3 = 06 (month) D4 = 63 (hex year) log date: 2 June 1999
D5 = 00 (seconds) D6 = 03 (minutes) D7 = 09 (hours) log hour : 09:03:00

D8 = voltage frame starting identifier (the lowest nibble is the scale)
(A1 hex = voltage scale 1, A2 hex = voltage scale 2, A3 hex = voltage scale 3)
D9, D10 = first frame number of samples (C8, 00) (LSB, MSB)
D11, D12 = voltage zero (E8, 08) (LSB, MSB)
D13, D14, D15 = voltage calibration factor (LSB, MSB, EXP)
D16..D215 = 200 voltage samples: the phase is indicated by bit 0 and bit 1 of D1

D216 = current frame starting identifier (the lowest nibble is the scale)
(C1 hex = current scale 1, C2 hex = current scale 2, C3 hex = current scale 3)
D217, D218 = second frame number of samples (C8, 00) (LSB, MSB)
D219, D220 = current zero (E2, 08) (LSB, MSB)
D221, D222, D223 = voltage calibration factor (LSB, MSB, EXP)

D224..D423 = 200 current samples: the phase is indicated by bit 0 and bit 1 of D1

D424 = measurement tag identifier (E0)
D425, D426, D427 = Frequency (8813 FC = 50.0 Hz) (LSB, MSB, EXP)

D428, D429, D430, D431, D432, D433
21 03 45 67 89 56 (Positive Wh counter equal to 210345.678956 MWh)
where byte 21 = 2 Wh * 10 exp 11 + 1 Wh * 10 exp 10
byte 03 = 0 Wh * 10 exp 9 + 3 Wh * 10 exp 8
byte 45 = 4 Wh * 10 exp 7 + 5 Wh * 10 exp 6
byte 67 = 6 Wh * 10 exp 5 + 7 Wh * 10 exp 4
byte 89 = 8 Wh * 10 exp 3 + 9 Wh * 10 exp 2
byte 56 = 5 Wh * 10 exp 1 + 6 Wh * 10 exp 0

D434 D435 D436 D437 D438 D439
12 34 56 00 00 00 (Positive varh equal to 123456.000000 Mvarh)

D440 D441 D442 D443 D444 D445
00 00 12 34 00 00 (Negative Wh equal to 000012.340000 MWh)

D446 D447 D448 D449 D450 D451
00 34 56 00 00 00 (Negative varh equal to 003456.000000 Mvarh)

D452 = Checksum calculated from D1 up to D451in the following way:
- all the bytes from D1 to D451 are summed;
- the calculated value is divided into 256 and the remainder is saved;
- the remainder is subtracted from 256 to obtain the value stored in D452.

LRC (checksum calculated on the whole string starting from the address up to D452 in the same mode as D452 is calculated)

CR
LF

4. UART Reset
The UART is reset to the programming value previously set on Microvip3 Plus.

PC Request:	Microvip3Plus Response:
:01 05 0007 0000 LRC crlf	Eco