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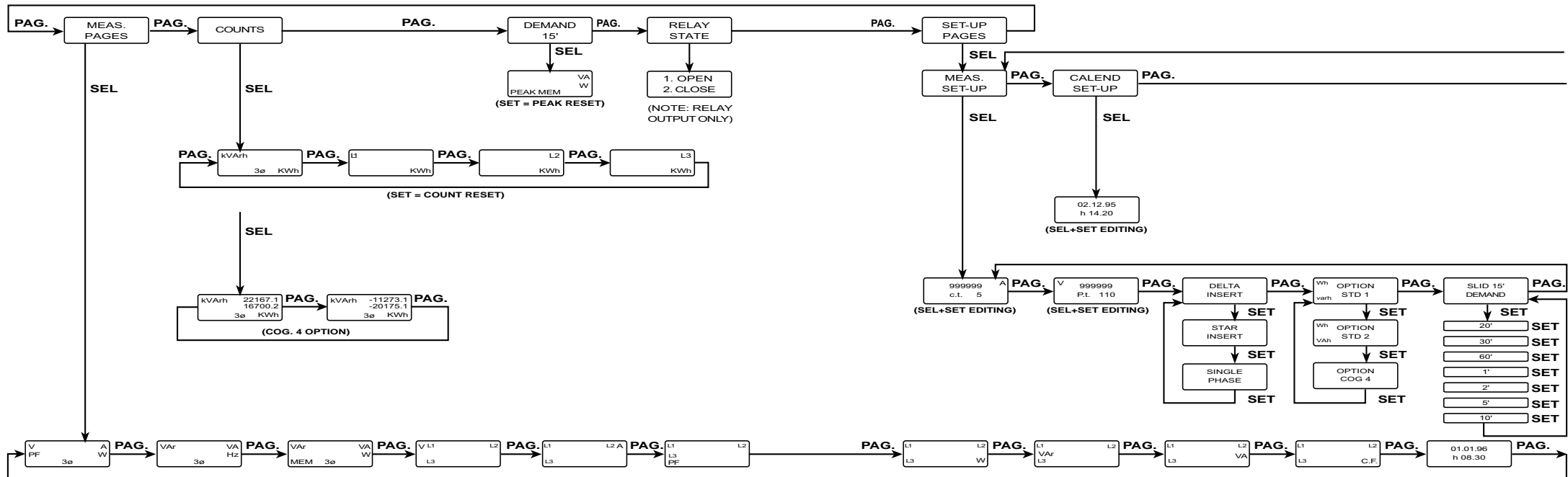
<http://www.elcontrol-energy.it>

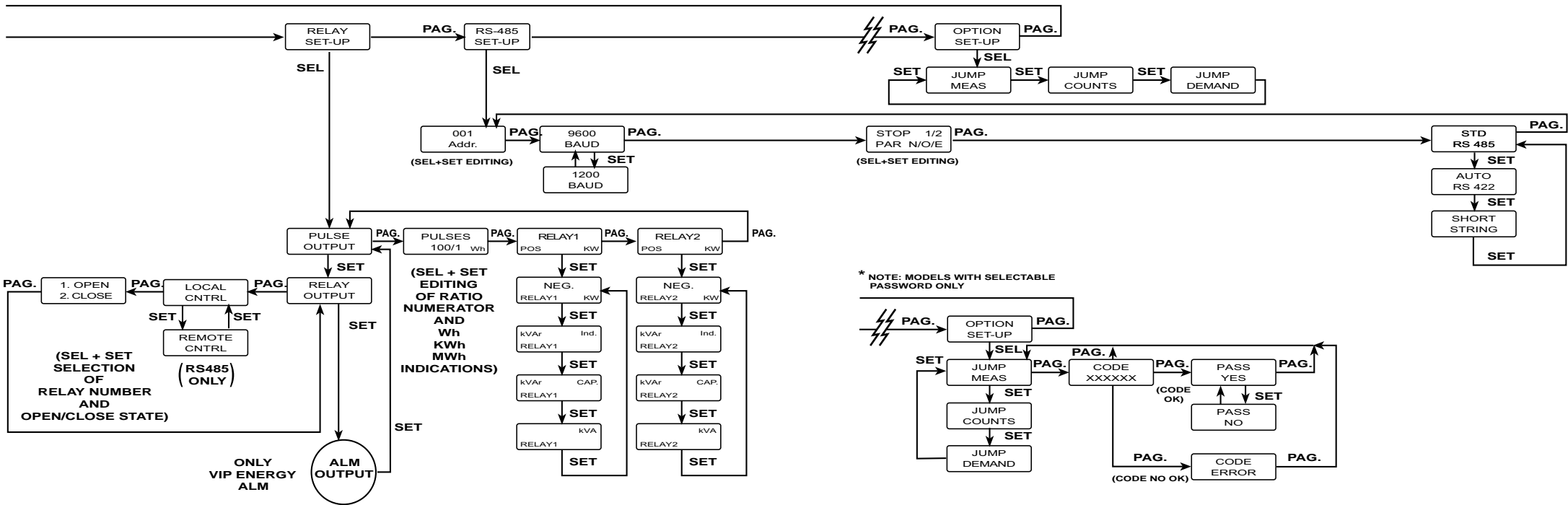
VIP ENERGY

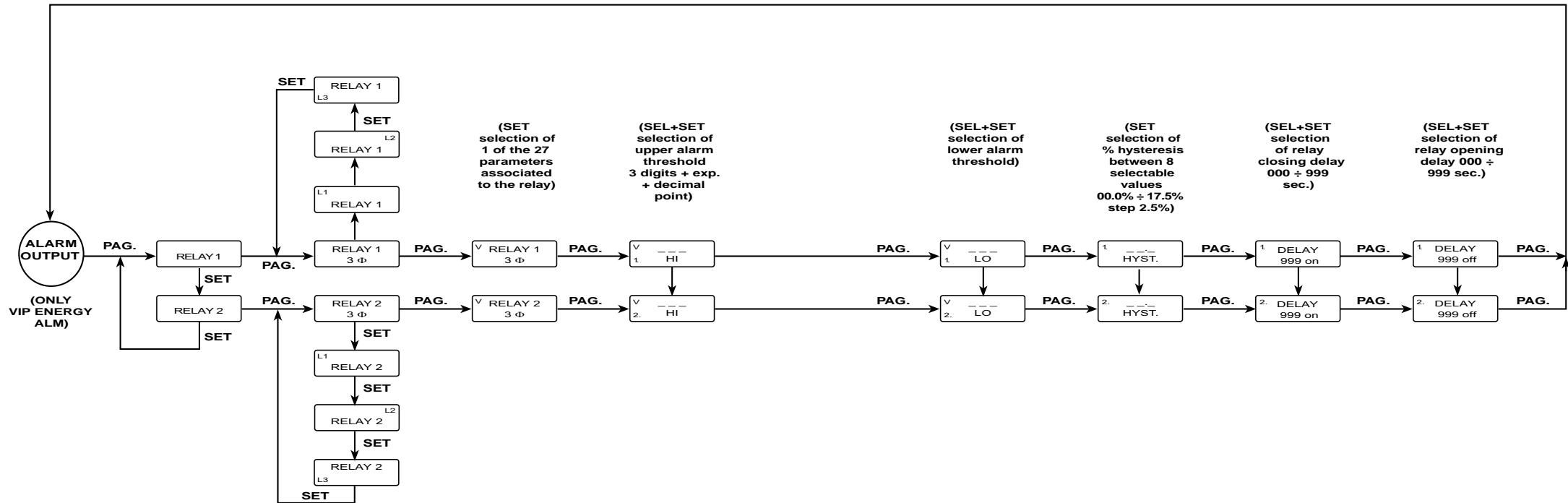


USER MANUAL

VIP ENERGY RPQS-485 and ALM-485 MENU







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1 SAFETY

1.1 Introduction

This instrument has been constructed and tested in accordance with IEC 348 class 1 standards for operating voltages below 650 VACrms and in accordance with VDE 0110 group C isolation standards for operating voltages of 500 VACrms or less, IEC 1010 550V standards with regard to category III installation and level of protection 2 under IEC 664-664A, and left the production factory in perfect conditions of technical safety: in order to maintain these conditions and to ensure safe operation, the user must comply with the instructions and markings given in these manual.

Before installation ensure that the operating voltage and mains voltage set are the same.

The power lead must only be connected to a socket with ground wire.

The power lead must be connected before the measuring and control circuit is switched on.

Caution! Any interruption in the ground wire inside or outside the instrument, or disconnection of the ground wire, may make the instrument dangerous. Do not interrupt intentionally.

During opening of covers or the removal of pieces, except carried out by hand, live components may be stripped. The connection points may also be live. Before carrying out any compensation, servicing, repair or replacement or repair of pieces requiring the instrument to be opened, it must be disconnected from all power sources.

The capacitors inside the instrument may be charged even after the instrument has been disconnected from all power sources.

If the safe use of the instrument is no longer possible, it must be taken out of service and precautions taken against accidental use.

Safe operation is not possible in the following cases:

- when the instrument shows clearly visible damage;
- when the instrument no longer works;
- after lengthy storage in unfavorable conditions;
- after serious damage incurred during transport.

1.2 Operator safety

Read these pages carefully before installing and using the instrument.

The instrument described in this manual is intended for use by suitably trained staff only. Maintenance and or repair operations must be carried out - exclusively - by qualified, authorised staff.

For proper, safe use of the instrument and/or repair it is essential that the person instructed to carry out the procedures follow normal safety precautions.

1.3 Symbols



Read the instructions

1.4 Precautions in case of break-downs

In case of suspicion that the instrument is no longer safe, for example because of damage incurred during transport or use, it must be taken out of service and precautions taken to prevent accidental use. Contact authorized technicians for control and any repairs.

1.5 Installation instructions

1.5.1 Preliminary inspections

When the instrument is received, check that it is complete and has not been damaged during transport. For any problems contact the ELCONTROL ENERGY after-sales service for repairs or replacements.

1.6 Safety instructions

1.6.1 Grounding

Before making any connections the instrument must be grounded.

1.6.2 Power supply voltage



The instrument can take a power supply voltage with range 100/120V-50/60 Hz or 200/240V-50/60Hz. Versions for 24VDC power supply are also available.

IMPORTANT

As the instrument is not fitted with a fuse on the power supply line, the installation engineer must ensure that the instrument supply is protected with a 100mA T fuse on the AC supply.

Since this is a permanently connected 3 phase instrument (see CEI EN61010-1 or IEC1010-1, 6.12.2.1), a circuit-breaker must be provided as required by these standards. This must be installed in the near vicinity of the instrument, must be within easy reach of the operator and must be marked as the equipment cut-off device.

1.6.3 Measurement voltage



The VIP ENERGY can measure phase-to-phase voltages up to 550 Vrms. However, the instrument has been constructed in accordance with IEC 348 class 1 for operating voltages below 650 VACrms and in accordance with VDE 0110 group C isolation standards for operating voltages of 500 VACrms or less, IEC 1010 550V standards with regard to category III installation and level of pollution 2 under IEC 664-664A.

1.7 Cleaning instructions

After ensuring that the instrument is isolated or disconnected from supply and measurement circuits, the outside of the container may be cleaned using a soft damp cloth (water only). Do not use abrasives or solvents. Never allow water to wet the terminals or enter the instrument.

2 PRESENTATION

2.1 General specifications

The VIP ENERGY is a measuring instrument in a 9 module DIN standard container allowing direct installation on a 35 mm. DIN Rail, prior to insertion in an EUROPA series container.

The instrument can be used in three-phase systems with 3 or 4 wires (2 voltage and 2 current or 3 voltage and 3 current) in low voltage systems or (by means of connection to a voltage transformer) in average and high voltage systems.

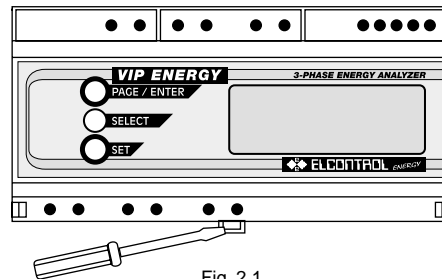


Fig. 2.1

The electrical parameters measurable are: Volt, Amp, Cos ϕ P.F., kW, kVA, kVAr, Hz, kWh, KVArh, kVA Peak, kW Peak, Average KW, Average KVA, Average KVAh, THDF, Date, Time.

The instrument also supplies the active and apparent power peak values with an integration time of 10, 15, 20, 30, 60, 1, 2, 5 minutes.

ELCONTROL ENERGY also supplies several models of the VIP ENERGY which are:

- VIP ENERGY 485 for connection to RS 485 serial line for electrical energy monitoring networks,
- VIP ENERGY RPQS with pulsed output proportional to active, reactive and apparent power,
- VIP ENERGY RPQS 485 with RS 485 serial output and possibility of remote control of 2 loads from PC,
- VIP ENERGY ALM with 2 relay outputs for MAXIMUM and MINIMUM alarms for 2 values to be selected among the 27 displayed ones,
- VIP ENERGY ALM 485 with RS 485 serial output and all functions of ALM and RPQS 485 models.

2.2 Supply Kit

The VIP ENERGY can be panel mounted using the C.VIPD3 (Frame and accessories kit Cod. 4AAF2).

2.3 Power Supply and Connection

To attach the instrument to the DIN Rail, use a screw driver to lower the black plastic hook located at the base of the instrument and fit it onto the rail (Fig. 2.1).

The power supply of the instrument is for voltages of 110V~ ±10% 50-60 Hz, or 220V~ ±10% 50-60 Hz inserting the power supply cables into the screw terminals (Max cable gauge 2,5 sq. mm) as shown in Fig. 2.2.

The instrument is supplied for power supplies of 200 ÷ 240V~.

Versions at 24VDC are also available.

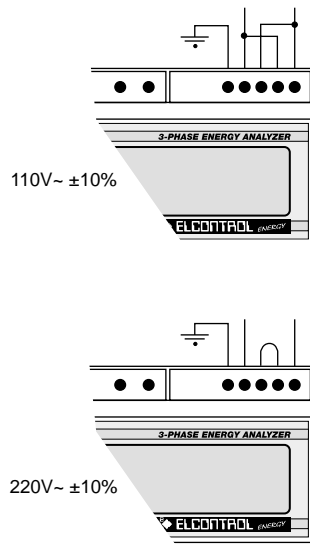


Fig. 2.2

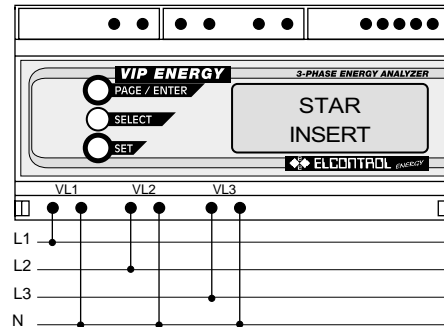


Fig. 2.3a

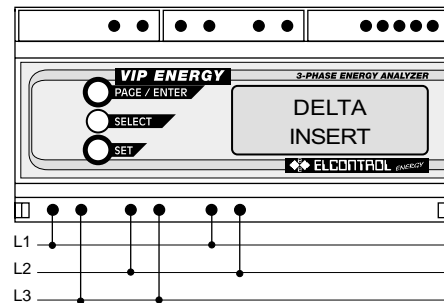


Fig. 2.3b

After the connection is carried out the first measurements page is displayed.

For the voltage connection use the appropriate terminals (Max cable gauge 2,5 sq. mm) as shown in Fig. 2.3a, 2.3b. In case of DELTA connection please take into consideration the note at page 38.

The VIP ENERGY can measure phase-to-phase voltages up to 550 Vrms. The instrument has been manufactured in accordance with IEC 348 class 1 standards for voltages up to 650 VACrms and group C VDE 0110 isolation standards for operating voltages up to a maximum of 500 VACrms, IEC 1010 550V standards with regard to category III installation and level of pollution 2 under IEC 664-664A.

For medium and high voltage measurements, the measuring transformers (see point 4.1) must be used. For current measurements, use the clips provided (max. wire gauge 2.5 sq. mm) as shown in Fig. 2.4.

Note: For direct measurements up to 5 Amps, mains cable can be directly connected (see Fig. 2.4). For indirect measurements, it is possible to select a CT with a 1, 2, 2.5 or 5 secondary

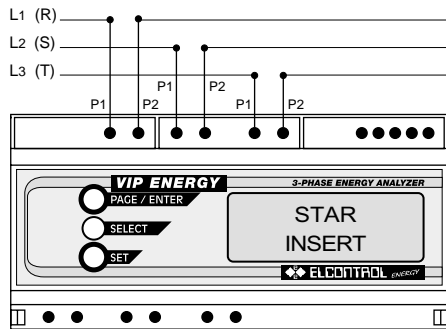


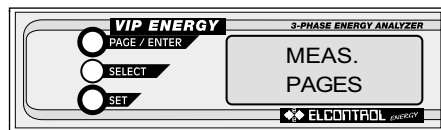
Fig. 2.4

up to a maximum of 999999A of primary. In this case, connect the CT secondary to the terminals of a current transformer (see Fig. 4.6). For VIP ONE 30A, current cable should be passed through the transformer through hole (see Fig. 4.7).

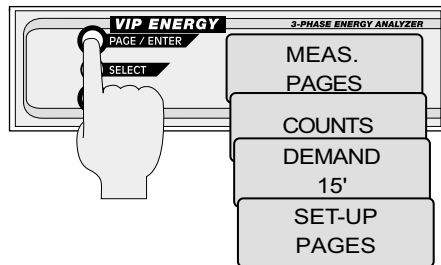
3 INSTRUMENT FUNCTIONS

3.1 PAGE/ENTER, SELECT, SET Pushbuttons

When switched on, the VIP ENERGY shows a measuring page. Press the PAGE key for 3 seconds to access the list of main menus. Press PAGE again to scroll through the menu.

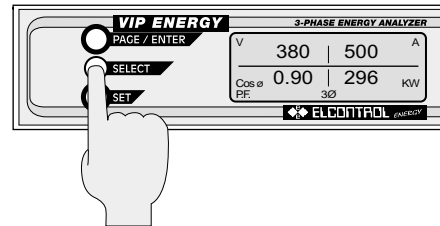


Press SEL to access the menus.



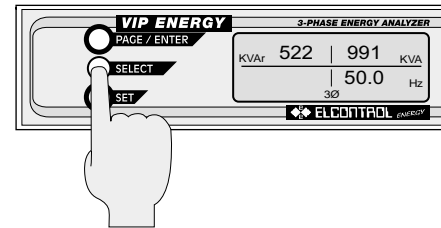
Press SELECT from the "MEAS. PAGES" menu to access the main measurements, contained in 11 pages. Press PAGE to scroll from one page to the next. To exit from this menu, press PAGE for 3 seconds.

"MEAS. PAGES" MENU



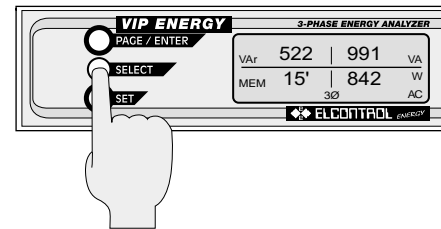
Page 1: THREE-PHASE MEASUREMENTS

- Three-phase V, A, P.F., W
max 999 kV and kA, 999 GW (MkW)
N.B. Volt Phase-Neutral (STAR)
Volt Phase-Phase (DELTA)



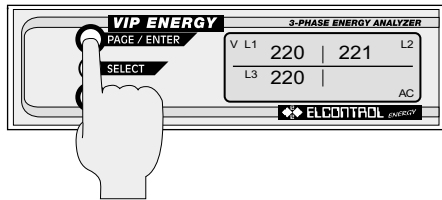
Page 2: THREE-PHASE MEASUREMENTS

- VAr, VA, FREQUENCY OF PHASE L1
max 999 GVar, GVA (MkVAr, MkVA)



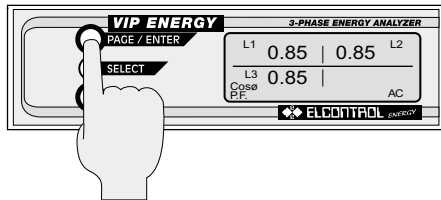
Page 3: THREE-PHASE AVERAGE MEASUREMENTS

- VAr, VA, Integration time, Watt
max 999 GVar, GVA, GW (MkVAr, MkVA, MKW)



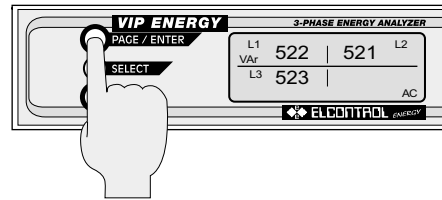
Page 4: PHASE-NEUTRAL VOLTAGE MEASUREMENTS

- Volt L1, Volt L2, Volt L3 (STAR)
- Volt L1-L3, Volt L2-L3, Volt L1-L2 (DELTA)



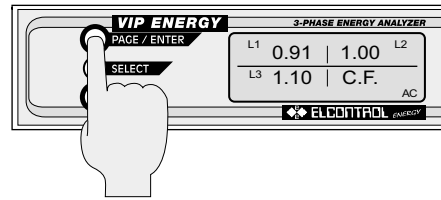
Page 6: PHASE POWER FACTOR MEASUREMENTS

- P.F. L1, P.F. L2, P.F. L3 (only STAR)



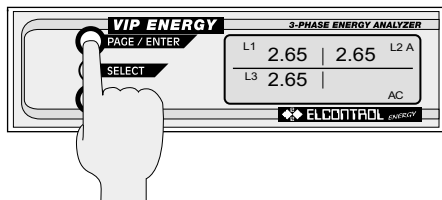
Page 8: PHASE REACTIVE POWER MEASUREMENTS

- Var L1, Var L2, Var L3 (STAR)
- Var L1-L3, Var L2-L3 (DELTA)



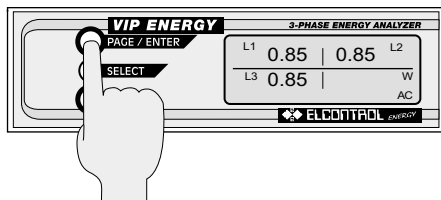
Page 10: PHASE C.F. (Crest Factor) MEASUREMENTS

- C.F. L1, C.F. L2, C.F. L3 (1/THDF)



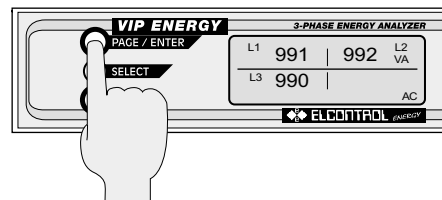
Page 5: PHASE CURRENT MEASUREMENTS

- Amps L1, Amps L2, Amps L3



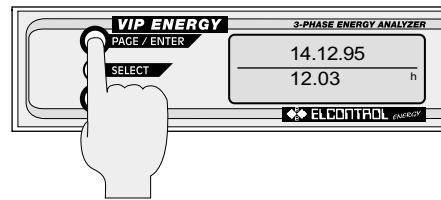
Page 7: PHASE ACTIVE POWER MEASUREMENTS

- Watt L1, Watt L2, Watt L3 (STAR)
- Watt L1-L3, Watt L2-L3 (DELTA)



Page 9: PHASE APPARENT POWER MEASUREMENTS

- VA L1, VA L2, VA L3 (STAR)
- VA L1-L3, VA L2-L3 (DELTA)

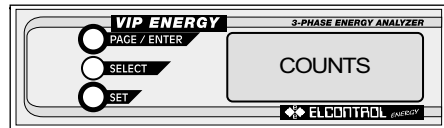


Page 11: CALENDAR CLOCK

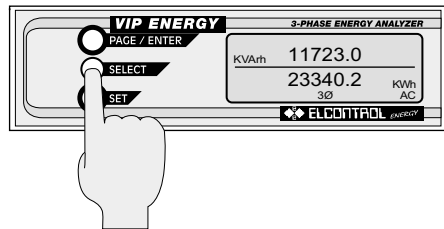
Last page of the "MEAS. PAGES" menu.

To exit from the pages of this menu and return to the list of main menus, keep the PAGE Key pressed for 3 seconds.

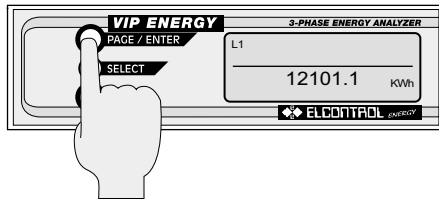
"COUNTS MENU"



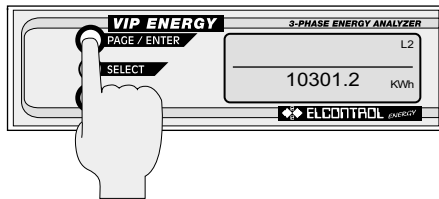
To access this menu, press the SELECT Key; to exit from this menu press the PAGE key for 3 seconds.



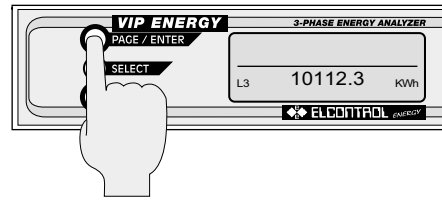
Three-phase kVArh and kWh counters.
Max 999.999 Mvarh, MWh.



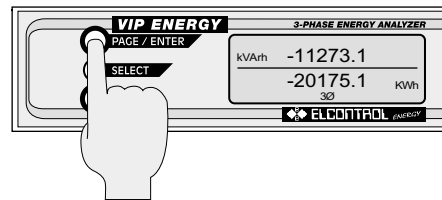
Phase L1 kWh counter (only STAR option, no COG4).
Max 999.999 MWh.



Phase L2 kWh counter (only STAR option, no COG4).
Max 999.999 MWh.



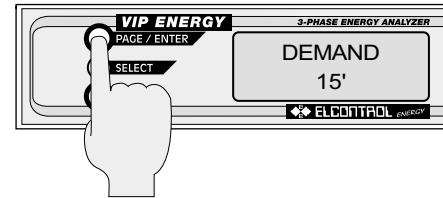
Phase L3 kWh counter (only STAR option, no COG.4).



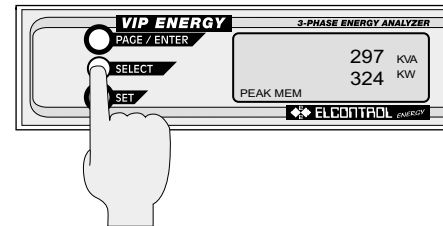
Option STAR, COG4 and DELTA only.
Negative kWh and kVArh (generated).
Max. 999.999 MWh, MVArh.

To exit from this menu press the PAGE key.

"DEMAND 15" MENU



To access this menu, press the SELECT Key; to exit from this menu press the PAGE key for 3 seconds.

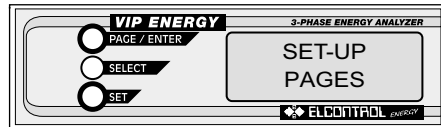


Three-phase apparent and active power peaks averaged over the integration time set

in the "MEAS. SET-UP" menu.

To exit from this menu press the PAGE key for 3 seconds.

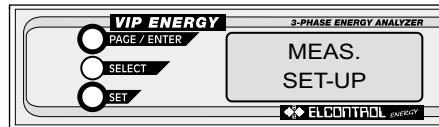
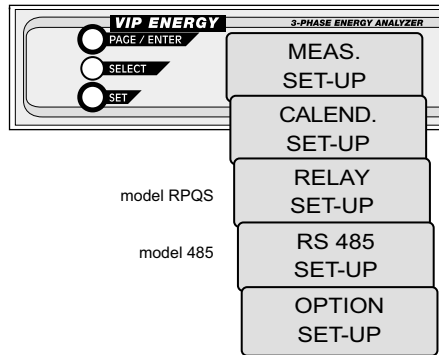
"SETUP-PAGES" MENU



Press the SELECT key from this page to access the list of the SETUP menus, which include:

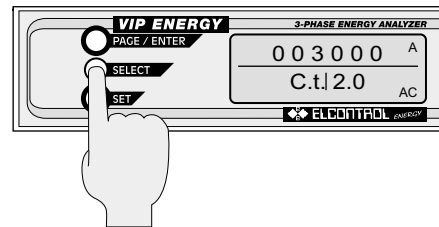
- MEAS. SET-UP
- CALEND. SET-UP
- RELAY SET-UP (only model RPQS)
- RS 485 (only model 485)
- OPTION SET-UP

Note: If the PASSWORD is enabled, enter CODE 311299 (fixed) and press the PAG key to enter the "SET-UP PAGES".

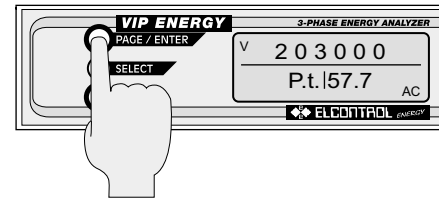


From this page, press the SELECT key to access the measurements set-up pages, which consist of a list of 5 pages allowing the user to program all the measuring parameters.

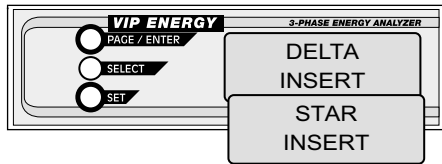
To exit from this menu, press the PAGE key for 3 seconds at any moment.



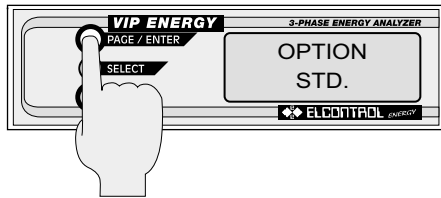
Page 1: Programming the current ratio.
On the first line, enter the value of the primary using the SELECT key to select the digit and SET to confirm. The value can be set freely between 1A and 999999A. On the second line, set the value of the secondary, by pressing SET, using a table inside the instrument which contains the values 1, 2, 2.5 and 5A.



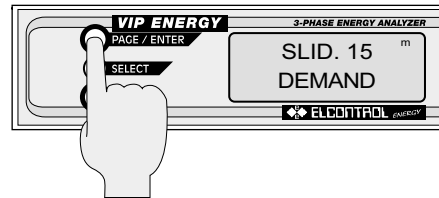
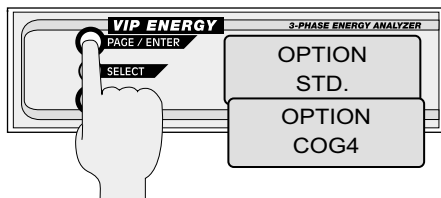
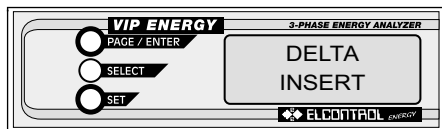
Page 2: Programming the voltage ratio.
On the first line, enter the value of the primary using the SELECT key to select the digit and SET to confirm. The value can be set freely between 1V and 999999V. On the second line, set the value of the secondary, by pressing SET, using a table inside the instruments which contains the values 57.7, 63.5, 100, 110, 115, 120, 173, 190, 200 and 220 V.



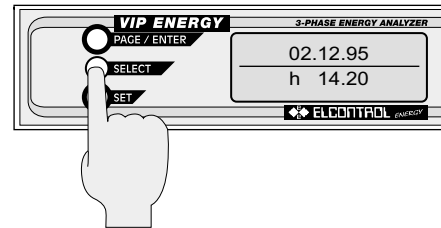
Page 3: Measurement connection and programming.
Press SET to preset the instrument for connection to DELTA or STAR electrical systems.



Page 4: Counter programming.
Press SET to preset the instrument for standard 1/2 counters or COG4 counters (kWh, -kWh, kvarh, -kvarh).
In DELTA connection the counters are always of COG4 type.

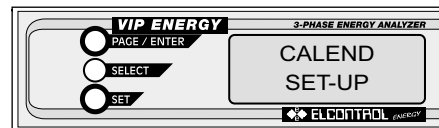


Page 5: Integration time programming.
Press SET to preset the instrument for one of the mean value integration times available in the table: 10, 15, 20, 30, 60, 1, 2, 5 minutes.



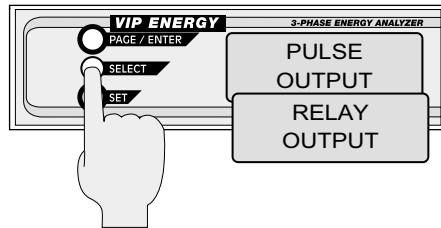
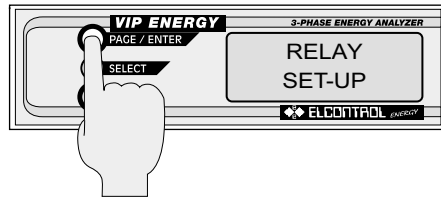
Page 1: Time and date programming.
On the first page, the Day, Month and Year can be programmed using SELECT to choose the digit and SET to confirm the value.
On the second line, use the same keys in the same way to set the Hours and Minutes.
This is the last page in this menu; to exit from this set-up function keep the PAGE key pressed for 3 seconds.

"CALEND SET-UP" MENU



Press select to access this menu and program the clock. To exit from this menu, press the PAGE key for 3 seconds.

"RELAY SET-UP" MENU
(model RPQS and RPQS-485 only)

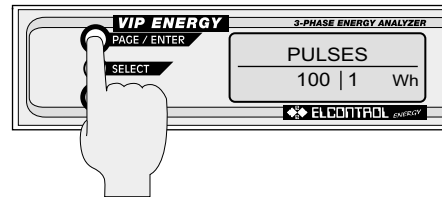


Press the SELECT key to access the RELAY SET-UP menu. Press the SET key to preset the instrument's two relay outputs as 2 pulsed outputs for metering the active, reactive

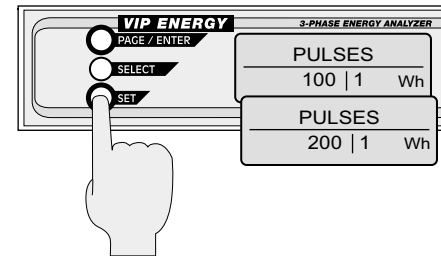
and apparent power ("PULSE OUTPUT") or as two open/closed (off/on) outputs for controlling loads ("RELAY OUTPUT") in remote control mode (by RS485) or in local (manual) mode.

To access the PULSE OUTPUT submenu and select metering of active, reactive or apparent power values, press the PAG key.

To exit from this menu, press the PAG key for 3 seconds at any moment.

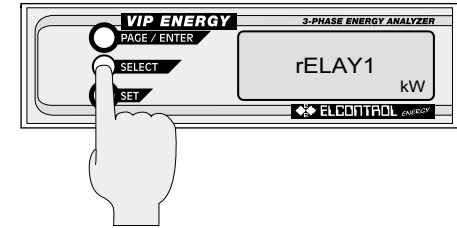


The SEL + SET keys can be used to select different frequencies for the output pulses: from 1 to 999 pulses per Wh, kWh or MWh.

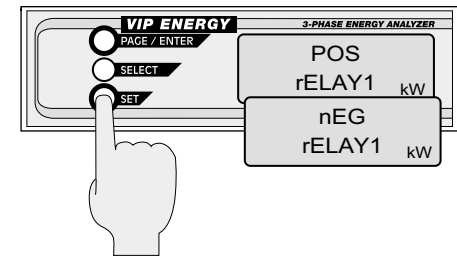


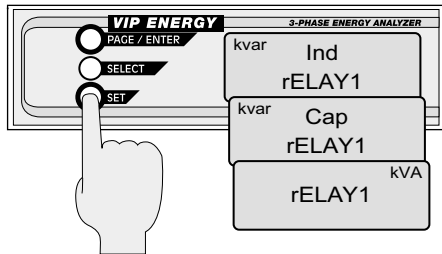
If the number of pulses programmed is higher than the maximum permitted (100,000 pulses/hour) the word PULSES and the measuring pages blink (also see Annex D).

When the PAG button is pressed to confirm the selection, the system moves on to selection of the RELAY1 output parameter.



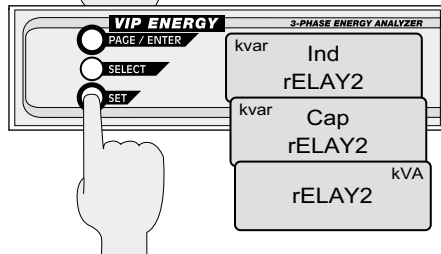
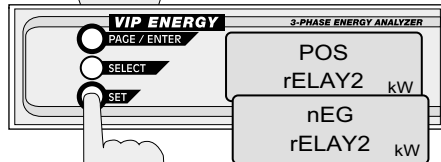
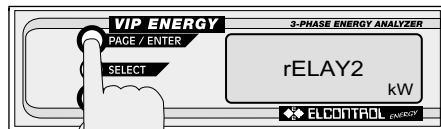
Use the SET button to select PPOS, PNEG, QPOS (IND), QNEG (CAP) or S.



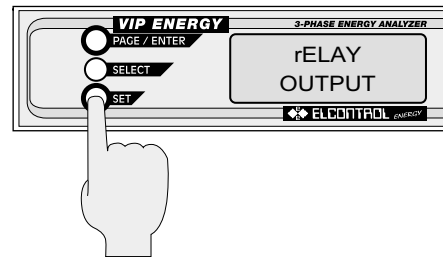


Press the PAG key to confirm the selection made and pass to the RELAY2 menu.

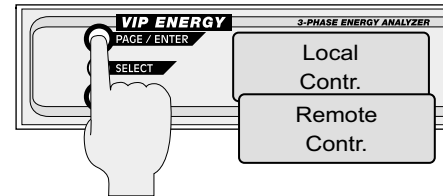
Repeat exactly the same procedure for RELAY2.



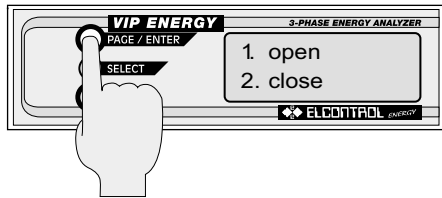
Press the SET key to pass from the PULSE OUTPUT page to the RELAY OUTPUT page.



Press the PAG key to select the 2 relay outputs for local control mode or remote control mode (RS 485).

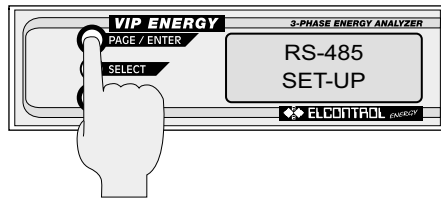


The SET key can be used to switch control of the open/closed status of the 2 output relays from LOCAL (manual) to REMOTE (RS 485).

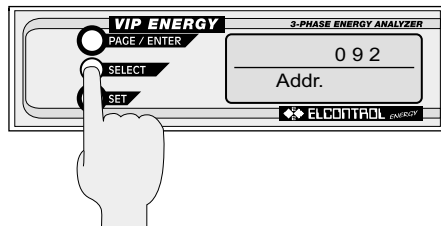


Press the PAG key from the LOCAL Cntrl page to access the page for local control of the two relays. Use the SEL key to select RELAY1 or RELAY2 and then the SET key to select open/closed status. To confirm, press the PAG key, which returns the system to the RELAY OUTPUT page.

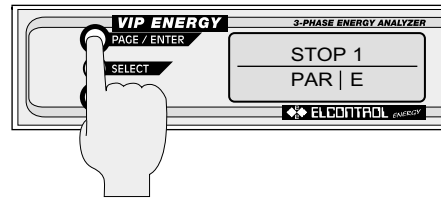
RS485 SETUP (model VIP ENERGY 485 only)



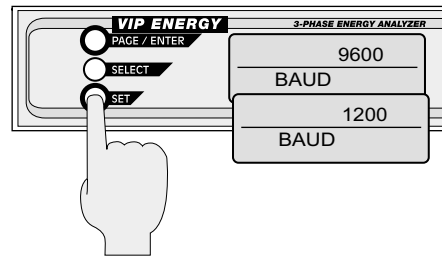
Press SELECT to access this menu and program RS 485 serial transmission. To exit from this menu, press the PAG key for 3 seconds at any moment.



Page 1: Instrument address programming. The 485 address is programmed on the first line. The address can be set from 1 to 247. Use the SELECT key to choose the digit and SET to confirm the value.



Page 3: stop bit and parity programming. Press SELECT to choose between the number of STOP BITS (1 or 2) and the type of PARITY: no, odd or even.

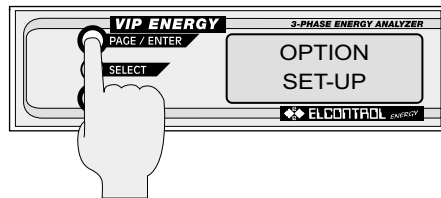


Press SET to confirm the number of stop bits and the type of parity bit. This is the last page in this menu; to exit from these set-up pages keep the PAGE key pressed for 3 seconds.

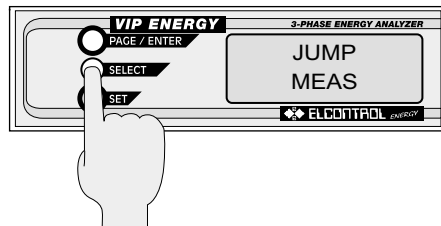
Page 2: Transmission speed programming. Press SET to set the transmission speed, 9600 or 1200 baud.

"OPTION SET-UP" MENU

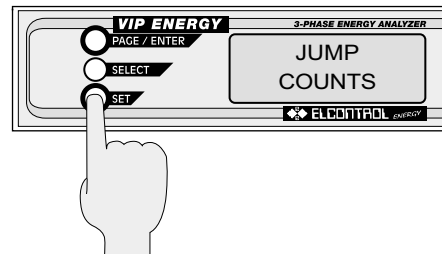
To access this menu, press the SELECT key.
To exit from this menu press the PAGE key for 3 seconds.



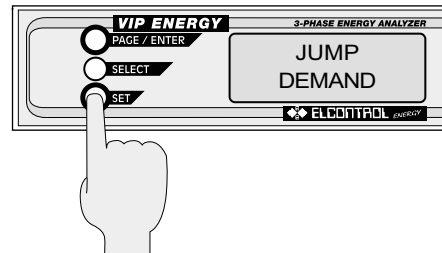
Press SET to select the measuring pages block to which the VIP ENERGY will jump when switched on.



Select "MEAS" if you wish the VIP ENERGY to display the main measurement pages after POWER ON.

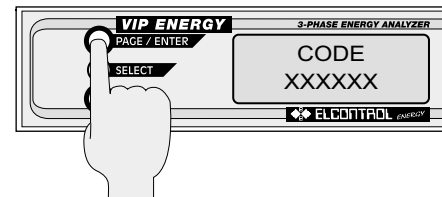


Select "COUNTS" if you wish the VIP ENERGY to display the counter pages after POWER ON.



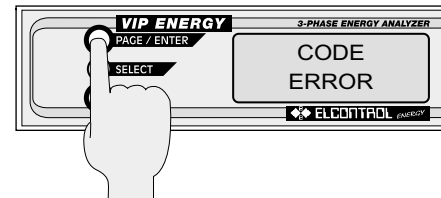
Select "DEMAND" if you wish the VIP ENERGY to display the peak pages after POWER ON.

In the model with the PASSWORD, press the PAG. key to display the page on which the PASSWORD must be entered.

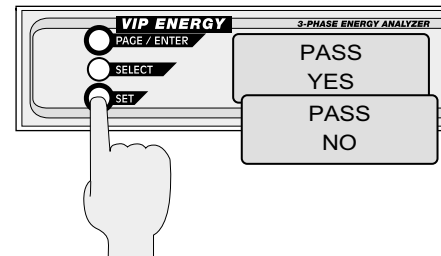


Enter the code 311299 (fixed) through SEL+SET keys and press the PAG. key to enter the page Enable/Disable PASSWORD.

By pressing the PAG key if no code or the wrong code is entered, the page is displayed.



Press again the PAG key to return to the JUMP selection page.



The PASSWORD for Counters RESET, Peaks RESET and SETUP MENU can be enabled/disabled through the SET key.

3.2 The RESET functions of the SET button

Press the button in the relative measurement page to reset the energy counters (kVARh and kWh); zeros appear on the display (see Fig. 3.1).

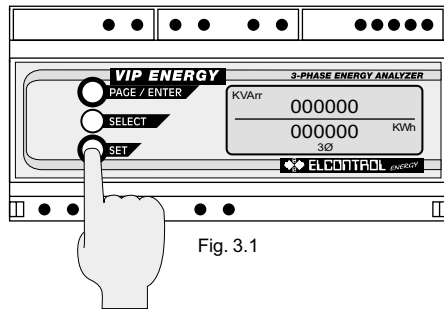


Fig. 3.1

Press the button in the relative measurement page to reset the active power peak values and the apparent power average three-phase values and also the buffer which is utilised to calculate the averages.

Therefore the measurement is not valid for a period of time equal to the programmed integration time.

A series of dashes is displayed (see Fig. 3.2).

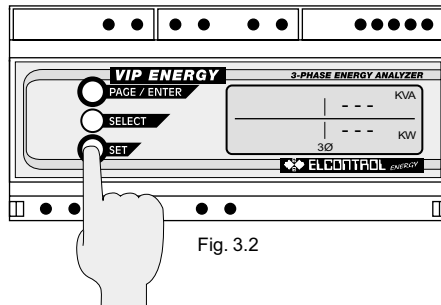


Fig. 3.2

Note: In the models with PASSWORD, if the PASSWORD is enabled enter CODE 311299 (fixed) and press the PAG. key to reset.

Once the reset has been carried out, press the PAGE button to exit from this menu.

4 CONNECTION OF THE VIP ENERGY

4.1 Voltage Connection

Direct connection to three-phase network with neutral.

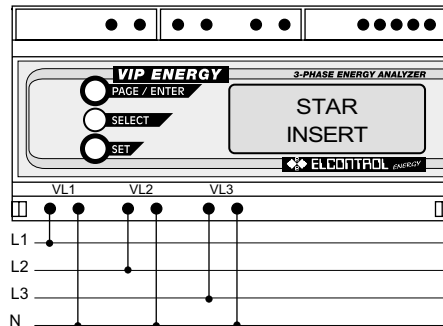


Fig. 4.1

Direct connection to three-phase network without neutral.

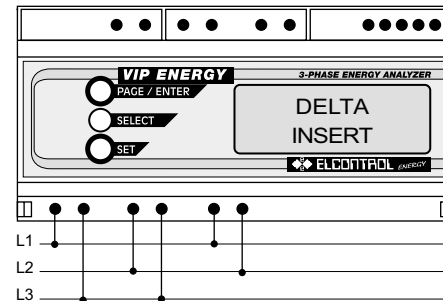


Fig. 4.2

Connection between two voltage transformers

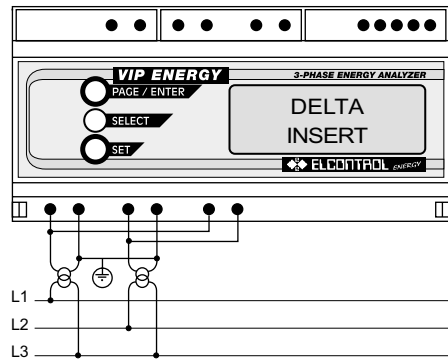


Fig. 4.3

Connection by means of 3 star voltage transformers with one phase of the secondary grounded.

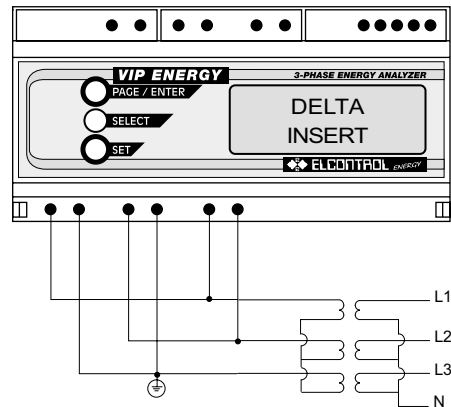


Fig. 4.4

4.2 Current connection

Direct connection to three-phases and three currents.

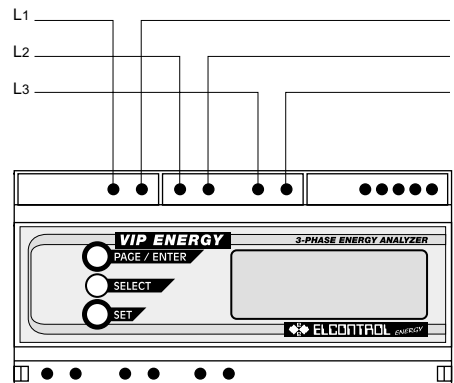


Fig. 4.5

Connection to three-phases and three CTs.

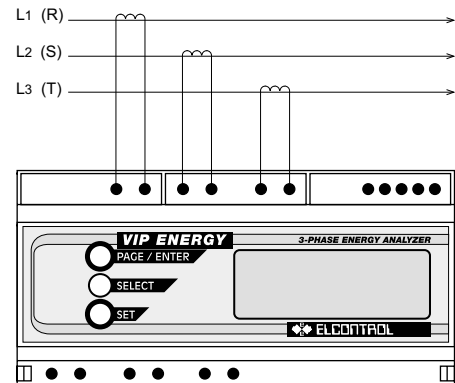


Fig. 4.6

Current connection utilizing only two CTs.

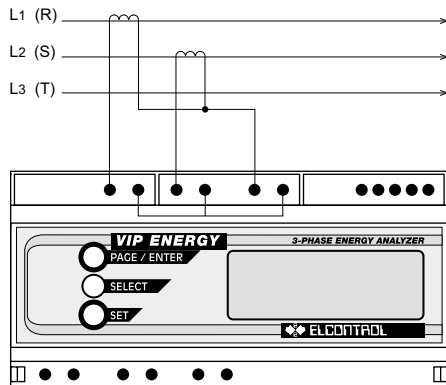


Fig. 4.7

5 TECHNICAL DATA

5.1 General specifications

- Inputs: L1-N, L2-N, L3-N max 550 Vrms (STAR connection)
L1-L3, L2-L3, L1-L2 max 550 Vrms (DELTA connection) from 20 to 600 Hz.
Current inputs: 5A from 20 to 600 Hz.
- Voltage input overload: peak voltage 2000 Vrms (60 seconds).
- Current input overload: 20 times the full scale value - 1 sec. (with an overload cut-out triggered at the limit values)
- Number of scales: 2 voltage scales; 3 current scales.
- Automatic scale change: scale response time: 1.2 sec;
passage to the scale above occurs at 105% of the scale activated;
passage to the scale below occurs at 20% of the scales activated.
- Dimensions: length= 157.5 mm (9 DIN modules);
Height= 90 mm; Depth= 73 mm
- Battery: lithium battery: 3V, 280 mAh

- Weight: 1 kg.
- Degree of protection: instrument IP20; front panel IP40.
- Data back-up is guaranteed by means of the internal EEPROM (1.000.000 write cycles min.) 40 years.

5.2 Service and testing conditions

- Ambient service conditions: ambient temperature range: from -10 °C to +60 °C; relative humidity (U.R.): from 20% to 80%.
- Storage temperature: from -20 to +70 °C.
- Condensation: not permitted.
- Insulation to VDE 0110 group C for operating voltage - 500 VAC rms.
- Insulation resistance ³ 500 M Ω between input terminals and outer casing.
- Insulation voltage between input connectors: testing at 2000 Vrms at 50 Hz for 60 sec. Between each connector and the container: testing at 3000 Vrms for 60 sec.
- Safety reference standards: IEC 348, VDE 411, class 1 for operating voltage - 650 VAC rms; IEC 1010 550 V.
- EMC reference standards: EN 50081-1, EN 50082-2, EN 55011, EN 55022.

5.3 Power supply

- Mains: 110/220V~ ±10% 50/60 Hz.
- Instrument consumption: 8 VA.
- Immunity to voltage microints: 0.1 sec.

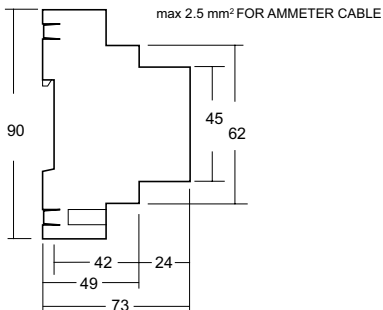
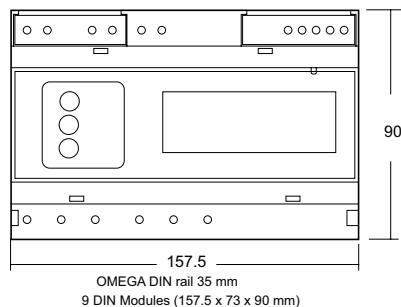
5.4 Measurements of primary parameters

- Measuring method: fixed sampling and analog/digital conversion.
- Sampling frequency: 1.25 KHz.
- Number of samples for phase: 125 (100 msec).
- Measuring interval: 1.2 sec.
- Zero self-correction: every 1.2 sec.

5.5 Measurement accuracy for primary parameters

- Measuring error in ambient from 18°C to 25°C (after 30' warm-up) - see the tables
- Measuring error outside this temperature range: ± 0.02% F.S. for each °C out of range.
- Sensitivity and accuracy in voltage measurements:
direct input with max voltage = 550 Vrms at Full Scale; Input voltage crest factor ≈ 1.6 ; 0.03 VA for each phase.

Dimensions (mm)



5.6 Displayed values

	Volt	Ampère	Watt	VA	Var	cosØ, PF	THDF (A)	Max demand (peak) KW	Max demand (peak) KVA	Average KW	Average KVA	Average Kvar	KWh	Kvarh	KWh Import/export	Kvarh Import/export	Date	Time
L1	•	•	•	•	•	•	•						•	•				
L2	•	•	•	•	•	•	•						•					
L3	•	•	•	•	•	•	•						•				•	•
3Ø	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		

Alternating voltage sensitivity, Full scale and accuracy

Nominal Range	Sensitivity	Full Scales	ε from 20% F.S. to 100%F.S.
			VIP ENERGY
140 Vrms	111 mV	140 V	0.3% F.S. + 0.3% Rdg
550 Vrms	480 mV	550 V	0.3% F.S. + 0.3% Rdg

Alternating current sensitivity, Full scale and accuracy

Nominal Range	Sensitivity	Full Scales	ε from 20% F.S. to 100%F.S.
			VIP ENERGY
0.30 A	0.2 mA	0.30 A	0,5%F.S. + 0,5% Rdg
1.50 A	1 mA	1.50 A	0,3%F.S. + 0,3% Rdg
5.00 A	3.2 mA	5.00 A	0,3%F.S. + 0,3% Rdg

Sensitivity and accuracy in current measurements.

Direct input with max. 5A at Full Scale. 0.07Ω Burden for each current transformer.

Input current crest factor ³ 1,6.

Accuracy in voltage and current measurements in relation to frequency: for signal frequencies in the range 20÷90 Hz no error in addition to those indicated in the tables above.

Precision in measurement of secondary parameters: measurements (single-phase or three-phase), of power, CosØ, active energy: Class 1 IEC 1036.

Frequency measurement accuracy: 20 ÷ 99 Hz ± 0.1 Hz - 100 ÷ 600 Hz ± 1 Hz + 0.5% Rdg.

Measurements of other secondary parameters: the error is expressed by the formula which defines the parameter in relation to V, I W.

5.7 Formulae used for single-phase measurements

Instantan.rms voltage	$V_{1N} = \sqrt{\frac{1}{n} \sum (V_{1N})^2}$
Instantan.active power	$W_1 = \frac{1}{n} \sum (V_{1N}) \cdot (A_1)$
Instantan.power factor	$\cos\phi_1 = \frac{W_1}{VA_1}$
Instantan.rms current	$A_1 = \sqrt{\frac{1}{n} \sum (A_1)^2}$
Instantan.apparent power	$VA_1 = V_{1N} \cdot A_1$
Instantan.reactive power	$VAR_1 = \sqrt{(VA_1)^2 - (W_1)^2}$
Crest Factor (1/Transformer Harmonic Derating Factor)	$C.F.1 = \frac{I_{peak}}{\sqrt{2} I_{RMS}}$

5.8 Formulae used for three-phase measurements

Three-phase voltage	$V_V = \frac{V_{L1}+V_{L2}+V_{L3}}{\sqrt{3}}$ STAR $V_V = \frac{V_{12}+V_{23}+V_{31}}{3}$ DELTA
Three-phase reactive power	$VAR_V = VAR_1 + VAR_2 + VAR_3$
Three-phase current	$A_V = \frac{VA_V}{\sqrt{3} \cdot V_V}$
Three-phase active power	$W_V = W_1 + W_2 + W_3$
Three-phase apparent power	$VA_V = \sqrt{W_V^2 + VAR_V^2}$
Three-phase power factor	$\cos\phi_V = \frac{W_V}{VA_V}$

6 ANALYZER TYPES

• STANDARD VERSION

(DIN rail mounting analyzer)

Measurements on STAR (4 wires) or DELTA (3 wires) systems with internal CT, PT up to 5A, 550V max or with external CT, PT up to 999999A, 999999V max.

Measures and displays Volts, Amps, W, P.F.cosØ, VAR, VA, Hz, kWh, kvarh, VA Peak, W Peak, Average kW, Average kVA, Average kvar, Crest factor (1/THDF), Date, Time, replacing 42 instruments and using the space and connections of just one.

Possibility of LV, MV and HV measurements with DELTA or STAR connection.

Measurements of active and reactive energy with 4 quadrants (cogeneration) selected by the user. Measurement transformer ratios can be freely selected by the user.

• VIP ENERGY 485

RS 485 SERIAL OUTPUT for energy monitoring networks up to 247 analyzers.

A Personal Computer which contains either VIPVIEW or VIPLINK software can easily

control all the measurement data from a distance.

Two way optic fibre RS 485 output can be carried out by means of the external converter "PC485 OF-LINK" and "VIP485 OF-LINK".

• VIP ENERGY RPQS

PULSED OUTPUT Control of loads, industrial monitorings etc.

In addition to the measuring functions it is equipped with 2 solid state relay outputs, volt-free contacts (250VACrms 100mA).

They supply pulses with frequency proportional to any 2 of the parameters active power P (P+ and P- with option COG4 selected), apparent power (S), or reactive power (positive Q+ inductive, negative Q- capacitive), selected using the keyboard.

The number of pulses/KWh (or kvarh or kVAh) can be freely selected by the specific menu page (see page 20).

• VIP ENERGY RPQS 485

The pulsed output can also be controlled by a PC or PLC by means of the RS 485 serial line, and can be used as OUTPUTS for the remote control of loads.

VIP ENERGY ALM

2 relay outputs

MINIMUM and MAXIMUM alarms for 2 values among the 27 displayed ones. Selection of the ON and OFF delay time (0 to 999 seconds) and hysteresis of MINIMUM and MAXIMUM thresholds (0 to 17.5% with 2.5% steps) for each of the 2 relays which can be connected to the alarms.

VIP ENERGY ALM-485

Serial output RS485

All functions of VIP ENERGY ALM and RPQS 485 models.

ANNEX A

A.1 Positive and negative energies and powers

Measuring active and reactive energy and power correctly using a conventional instrument requires great care and specialist personnel.

The voltage and current measurement connections must be made in the right direction; otherwise, the active power absorbed by a typical load (positive by convention) will appear with an incorrect negative sign. The corresponding energy counter, which only moves on for positive (i.e. actually absorbed) power, will not be increased, and consumption levels will appear to be nil even for very high absorption.

The same applies to reactive power; in case of inductive reactive power (positive by convention) incorrect connection would lead to negative readings and failure to increase the relative counter. Therefore a strongly inductive load would appear to have a perfect power factor, with serious economic consequences. The standard setting allows the operator not to worry about the clip connection direction, since the instrument assumes that it is measuring a load which absorbs power

from the mains and thus automatically provides a positive active power reading, modifying the power factor and reactive power in consequence.

A.2 The cogeneration option COG4

There are a series of applications in which it is useful to preserve the real sign of the active power; in other words, all cases where the characteristics of a generator supplying power to the network have to be measured.

In cases of this kind, the VIP ENERGY active power counter is increased for both absorbed and generated power, meaning that the reading is not correct. Use of the COG4 (COGENERATION) option allows correct measurement even in these cases. The operator has to make the voltage and current measurement connections correctly, checking their direction to ensure that when a load is measured, the active power is positive (or negative in the case of a generator). In case of mixed use (for example, a lift where power is absorbed during ascent and generated during descent), the COG4 option allows measurements of both the active power absorbed and the power generated and supplied to the network (the origin of the term COGENERATION).

In the COG4 version, the instrument displays the energy consumption and energy production counts simultaneously in the two consecutive power count pages, indicating them with positive and negative sign respectively (see Fig. A.1).

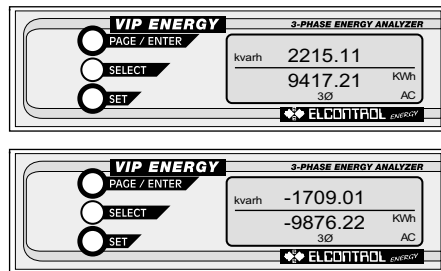


Fig. A.1

The COGENERATION option also offers the Pulse Output option (RPQS); in this case, an extra parameter can be selected as pulsed output, as follows:

Standard version	COGENERATION version
P	P+
Q+	P-
Q-	Q+
S	Q-
	S

where:

- P + = active power consumed
- P - = active power produced
- Q + = inductive reactive power
- Q - = capacitive reactive power

Note: The DELTA connection is always of COG4 type; therefore it is necessary to make the voltage and current connections as described in A.2 paragraph.

ANNEX B

B.1 The VIP ENERGY-485 and the local network VIPNET-485 instruments

ELCONTROL ENERGY solves the problem of price and dependability with its VIPNET-485 (monitoring network), a complete electrical energy measurement and control system, by connecting the VIP ENERGY-485, VIP ONE 485 to a Personal Computer which has installed the VIPVIEW software for use in a Windows environment and VILOAD software for use in a DOS environment.

The network connection of the RS485 instruments data lines is carried out by a normal shielded twisted pair, which is suitable for this type of connection (see page 114).

The network is based on the EIA RS485 electrical standard, while the communication protocol respects the MODBUS industrial standard. According to this standard it is possible to address and manage up to 247 instruments. These instruments are distributed on at least 8 lines interconnected by REPEATER-485 signal repeaters.

Each line can contain a maximum of 32 devices, subdivided into VIP ENERGY, VIP ONE and REPEATER-485.

The first line can contain 31 instruments plus the PC485 BOARD (a RS232/RS485 internal converter for personal computer) or the PC485-BOX external converter.

ELCONTROL ENERGY has optoisolated the data lines of its VIP ENERGY-485 instruments and has equipped the electrical interface circuits with a galvanically isolated power supply, so as to enable the VIPNET-485 networks to be able to operate both in industrial environments with strong interferences and in the presence of severe events such as atmospheric discharges.

The instantaneous overvoltage allowable is 2500 VAC for 1 minute.

DAISY CHAIN TOPOLOGY (preferential)

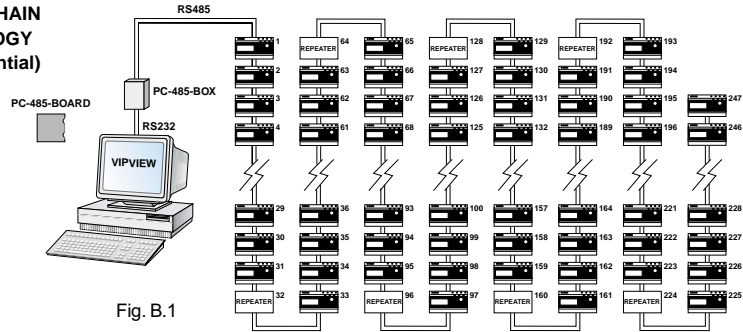


Fig. B.1

TREE TOPOLOGY

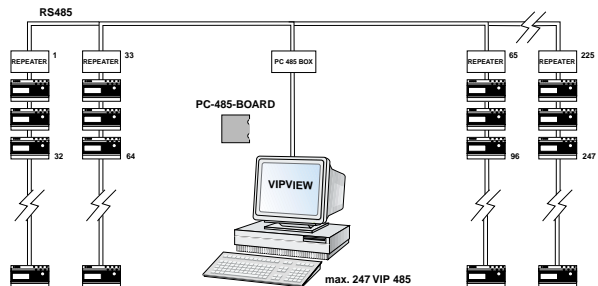


Fig. B.2

max. 247 VIP 485

B.2 External connections and setup of the RS485 option

The VIP ENERGY-485 can be connected to a Personal Computer with a 2-pole shielded cable with maximum length 1200 meters. Other devices can be connected to the same line (VIP ENERGY-485, VIP ONE 485 or REPEATER-485 signal repeaters) up to a maximum of 31 units. By utilizing REPEATER-485 signal repeaters other groups of 32 units can be added, up to a maximum of 247 VIP ENERGY-485, and VIP ONE 485.

Every VIP ENERGY-485 is identified by its own address, which can be set on the display by means of a selection video page.

The connection of VIP ENERGY-485 to the network is by means of a shielded bi-polar cable connected to the terminals located in the top of the instrument, next to the power supply terminals.

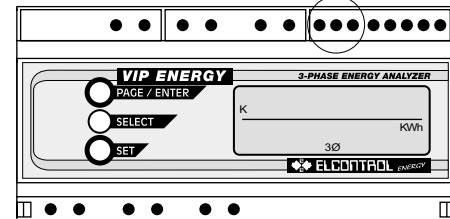
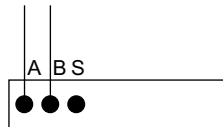
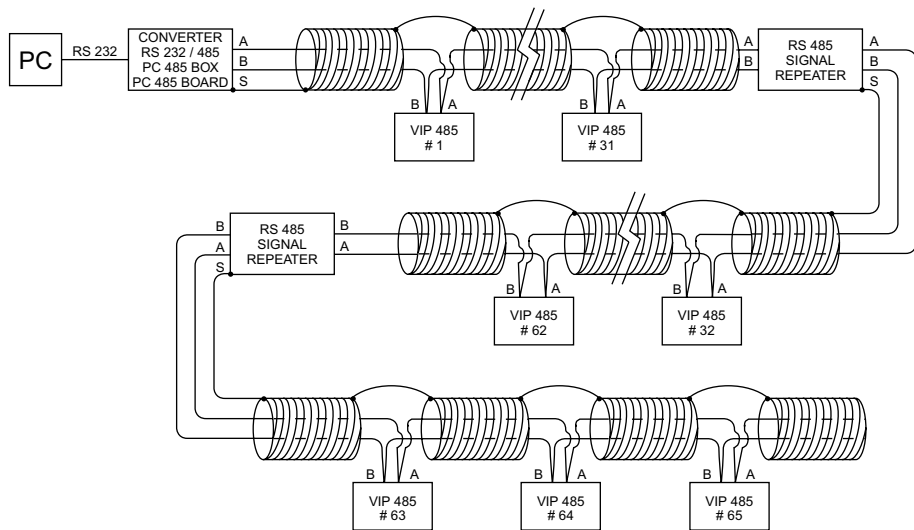


Fig. B.2

Where:
 A = Positive
 B = Negative
 S = Shield (not connected)

Example of shielded twisted pair connection



Note: Shield's opening must be as short as possible. Connect the shield only at one end. Multiple connections can generate dangerous ground loop currents.

B.3 The REPEATER-485 signal repeater

Power supply 220 VAC \pm 10% or 110 VAC \pm 10%. The REPEATER-485 signal repeater is a bidirectional amplifier which is connected to the VIPNET-485 network according to the following diagram:

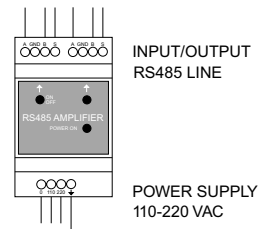


Fig. B.3

Depending on the type of system, the REPEATER-485 can be utilized in various network configurations, linear type (Linear Bus Topology Daisychain) - Fig. B.1 - for long areas and "tree" type (Tree Topology) - Fig. B.2 - for more extended areas.

B.4 The Board for Personal Computer PC485-BOARD

The master of the VIPNET-485 network is a PC485-BOARD installed in a free slot of a PC with the following minimum specifications:

Personal Computer Specifications:

- CPU 80486 66 MHz or greater IBM® compatible
- Central Memory RAM 8 Mbytes
- VGA graphic video controller board
- Floppy disk unit: 3.5 inch 1,44 MBytes
- Hard disk: 180 Mbytes
- 2 RS232 serial ports
- 1 CENTRONICS parallel port
- VGA color video
- Mouse
- Microsoft MSDOS® operative system 5.0 version or equivalent
- Microsoft Windows™ ambient version 3.1 or Windows 95

B.5 The PC485-BOX external converter

The PC485-BOX, an RS232/485 external converter, is also available powered by the power suppliers of the Personal Computer or externally by a power supply 220V \pm 10%, 110 VAC \pm 10%.

B.6 Characteristics of the VIP ENERGY 485 serial communications software protocol (including RPQS/ALM options)

The software communications protocol complies with the MODBUS standard (RS 485) with a master represented by the PC485 BOARD internal RS232-RS485 conversion board for personal computer (or the PC 485 BOX external RS232-RS485 converter) and a maximum of 247 VIP ENERGY-485 slaves.

- Selected transmission mode: ASCII
- Coding system: HEX (uses printable ASCII characters: 0-9, A-F).
- Error detection mode: LRC
- Serial protocol characteristics:
 - Baud rate: 9600/1200
 - Data bits: 7
 - 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 measurement page to be displayed at power-on
 - Selection of the switching type: STAR/DELTA/SINGLE-PHASE
 - Selection of option: STANDARD1, STANDARD2, COGENERATION4
 - Programming of the integration time for average values
 - Data and time programming
 - Selection of the relay output type of RPQS/ALM models: Pulse, Relay, Alarm
 - Programming of pulse weight for RPQS
 - Selection of parameters associated to the RPQS pulse outputs
 - Selection of Local mode/Remote mode for Relay output
- On-off control of relays 1 and 2 of models RPQS/ALM
 - Programming of the setup of the ALM relay outputs
 - Programming of the ALM alarm thresholds
 - Programming of the ALM relay activation and disactivation time.

List of MODBUS protocol commands implemented and their limitations

READING OF N. WORDS

P.C. VIP

`:,AA,03H (04H),SSSS,WWWW,LRC,CR,LF` `----->`
`<-----` `:,AA,03H (04H),BB,D1,...,Dn,LRC,CR,LF`

where:

- AA = address of the VIP selected (2 bytes ascii)
- 03H (04H) = 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 N.B.: The address must always be even)
- **External RAM reading** (0810H <= SSSS <= 08FEH; Valid range: 0810H-08FFH)
- **Internal RAM reading** (0C00H <= SSSS <= 0FDEH; Valid range: 0C00H-0FDFH)
- **External RAM reading** (SSSS = 0FE00H)
- **External RAM reading** (SSSS = 0FE02H (only if "Short string" is selected))

WRITING OF 1 BIT

P.C. VIP

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

OR THE FOLLOWING "RADIO BROADCASTING" MESSAGE CAN BE USED; IT SENDS THE COMMAND TO ALL THE INSTRUMENTS SIMULTANEOUSLY WITHOUT OBTAINING ANY REPLY:

P.C. VIP

`:,00H,05H,NNNN,bbbb,LRC,CR,LF` `----->`

where:

- AA = address of the VIP selected (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/RPQS** (NNNN = 0002H; bbbb = FF00H)
- **Local mode selected (RPQS: Relay output)** (NNNN = 0003H; bbbb = 0000H)
- **Remote mode selected (RPQS: Relay output)** (NNNN = 0003H; bbbb = FF00H)
- **Short Pulse selected (RPQS: Pulse output)** (NNNN = 0004H; bbbb = 0000H)

N.B. The first command given by the P.C. must be disabling of the keyboard, in order to avoid simultaneous modification of the setup parameters both by the P.C. and locally on the VIP, which might create troublesome problems.

In case of interruption of communications with the P.C. with the keyboard disabled, the keyboard can be re-enabled (in programming mode) using the following procedure:

- find the "Set-up pages" heading in the instrument menu;
- press the Sel key (or Enter) for about 1 minute until the display shows the page of PASSWORD request (if the password is enabled) or the page for programming the CT coefficient K (if the password is disabled). At this point the keyboard has been re-enabled (in programming mode).

WRITING OF 1 WORD

	P.C.		VIP
:,AA,06H,SSSS,D1,D2,LRC,CR,LF		----->	
		<-----	:,AA,06H,SSSS,D1,D2,LRC,CR,LF

OR THE FOLLOWING "RADIO BROADCASTING" MESSAGE CAN BE USED; IT SENDS THE COMMAND TO ALL THE INSTRUMENTS SIMULTANEOUSLY WITHOUT OBTAINING ANY REPLY:

	P.C.		VIP
:,AA,06H,SSSS,D1,D2,LRC,CR,LF		----->	

where:

- AA = address of the VIP selected (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 (2 consecutive writing commands)

-1) SSSS = 0032H:

- D1 = CT primary in amps (in BCD) (last 2 digits)
- D2 = CT primary in amps (in BCD) (middle 2 digits)

-2) SSSS = 0034H:

- D1 = CT primary in amps (in BCD) (first 2 digits)
- D2 = CT secondary (in binary)
- 00H = 1 Amps
- 01H = 2 Amps
- 02H = 2,5 Amps
- 03H = 5 Amps

N.B. Only the low nibble of datum D2 is written.

N.B. 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 CT primary and secondary are immediately updated. This might lead to a lack of synchronization between the primary/secondary values set and the CT coefficient K implemented (not updated until after the second command). Also remember that whenever the CT primary is greater than 9999 A the value is rounded up or down for calculation of the K, since the internal precision is of 4 figures (the most significant).

E.g. - CT primary = 100050 A
 - CT secondary = 1 A
 - CT K = 100100 / 1 = 100100 A.

- 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

N.B. Only the high nibble of datum D2 is written.

N.B. 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 figures (the most significant).

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

- Writing in eeprom of the flags for selection of the data page to be displayed at power-on
 (SSSS = 0001H; D2 = 30H):

Structure of datum "D1":

7	6	5	4	3	2	1	0	bit	
-	-	0	0	-	-	-	-	==>	jump meas
-	-	0	1	-	-	-	-	==>	jump counts
-	-	1	0	-	-	-	-	==>	jump demand
-	-	1	1	-	-	-	-	==>	jump meas

(any others not used)

N.B. Only bit 5 and 4 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.

- Writing in eeprom of the flag for selection of Start/Delta/Single-Phase switching
 (SSSS = 0001H; D2 = 09H):

Structure of datum "D1":

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

(any others not used)

N.B. 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).

N.B. 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).

N.B. 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.

N.B. 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)

N.B. 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

N.B. 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 eeprom of the relay set-up (RPQS / ALM) (SSSS = 00CBH; D2 = 0C0H):

- If only the RPQS option is active:

Structure of datum "D1":

7	6	5	4	3	2	1	0	bit
0	0	-	-	-	-	-	-	==> Pulse output
0	1	-	-	-	-	-	-	==> Relay output

- If only the ALM option is active:

Structure of datum "D1":

7	6	5	4	3	2	1	0	bit
0	1	-	-	-	-	-	-	==> Relay output
1	0	-	-	-	-	-	-	==> Alarm output

- If both the RPQS and ALM options are active:

Structure of datum "D1":

7	6	5	4	3	2	1	0	bit
0	0	-	-	-	-	-	-	==> Pulse output
0	1	-	-	-	-	-	-	==> Relay output
1	0	-	-	-	-	-	-	==> Alarm output.

N.B. Only bits 7 and 6 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 eeprom of the number of pulses set in BCD + exponent of powers associated to the output relays (RPQS)

(SSSS = 00E2H):

- D1 = Number of pulses set (in BCD) (last 2 digits)

- D2 = Number of pulses set (in BCD) (first digit) + exponent of the powers associated to the output relays

bit 7,6 = 0								
bit 5,4 = Selected power exponent:								
7	6	5	4	3	2	1	0	bit
-	-	0	0	-	-	-	-	==> No exponent
(" ")								
-	-	0	1	-	-	-	-	==> "K"
-	-	1	0	-	-	-	-	==> "M"
-	-	1	1	-	-	-	-	==> Not used (for now forced to "")

bit 3, 2, 1, 0 = 1st digit of the number of pulses set in BCD.

N.B. Only bits 5, 4, 3, 2, 1 and 0 of datum D2 are written.

- Writing in eeprom of the relay output setup (RPQS)

(SSSS = 00CBH; D2 = 3FH):

- D1 = Relay output setup:

bit 7, 6 = 0								
bit 5, 4, 3 = Setting of power associated to relay 2:								
7	6	5	4	3	2	1	0	bit
-	-	0	0	0	-	-	-	==> Positive active power (P+)
-	-	0	0	1	-	-	-	==> Negative active power (P-)
-	-	0	1	0	-	-	-	==> Inductive reactive power (Q+)

-	-	0	1	1	-	-	-	==> Capacitative active power (Q-)
-	-	1	0	0	-	-	-	==> Apparent power (S)
-	-	1	0	1	-	-	-	==> Not used (for now forced to S)
-	-	1	1	0	-	-	-	==> Not used (for now forced to S)
-	-	1	1	1	-	-	-	==> Not used (for now forced to S)

bit 2, 1, 0 = Setting of power associated to relay 1:

7	6	5	4	3	2	1	0	bit
-	-	-	-	-	0	0	0	==> Positive active power (P+)
-	-	-	-	-	0	0	1	==> Negative active power (P-)
-	-	-	-	-	0	1	0	==> Inductive reactive power (Q+)
-	-	-	-	-	0	1	1	==> Capacitative reactive power (Q-)
-	-	-	-	-	1	0	0	==> Apparent power (S)
-	-	-	-	-	1	0	1	==> Not used (for now forced to S)
-	-	-	-	-	1	1	0	==> Not used (for now forced to S)

- - - - - 1 1 1 ==> Not used (for now forced to S)

N.B. Only bits 5, 4, 3, 2, 1 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 RAM for the command for operation of relays 1 and 2 (RPQS / ALM) (SSSS = 0D00H; D2 = 03H):

Structure of datum "D1":

7	6	5	4	3	2	1	0	bit
-	-	-	-	-	-	0	0	==> Relay 1 open (off) and relay 2 open (off)
-	-	-	-	-	-	0	1	==> Relay 1 close (on) and relay 2 open (off)
-	-	-	-	-	-	1	0	==> Relay 1 open (off) and relay 2 close (on)
-	-	-	-	-	-	1	1	==> Relay 1 close (on) and relay 2 close (on)

N.B. Only bits 1-0 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.

N.B. Before using this command it is ESSENTIAL to switch the vip energy to Relay output - Remote mode. Otherwise this command is ignored.

- Writing in eeprom of the setup of the alarm outputs (ALM) (SSSS = 00E4H):

- D1 = Setup of alarm output 1
- D2 = Setup of alarm output 2

N.B. Both setups, D1 and D2, have the following structure:

Bit 7, 6, 5 = Setting of hysteresis on the alarm threshold:

7	6	5	4	3	2	1	0	bit
0	0	0	-	-	-	-	-	==> hysteresis = 00,0 %
0	0	1	-	-	-	-	-	==> hysteresis = 02,5 %
0	1	0	-	-	-	-	-	==> hysteresis = 05,0 %
0	1	1	-	-	-	-	-	==> hysteresis = 07,5 %
1	0	0	-	-	-	-	-	==> hysteresis = 10,0 %
1	0	1	-	-	-	-	-	==> hysteresis = 12,5 %
1	1	0	-	-	-	-	-	==> hysteresis = 15,0 %
1	1	1	-	-	-	-	-	==> hysteresis = 17,5 %

bit 4, 3, 2 = Setting of parameter associated to the alarm:

7	6	5	4	3	2	1	0	bit
-	-	-	0	0	0	-	-	==> Volt
-	-	-	0	0	1	-	-	==> Cosphi
-	-	-	0	1	0	-	-	==> Watt
-	-	-	0	1	1	-	-	==> VAr
-	-	-	1	0	0	-	-	==> VA
-	-	-	1	0	1	-	-	==> - Avr. VAr (if three-phase is selected): - Ampere (if "phase L1, L2, L3" is selected)

- - - 1 1 0 - - ==> - Avr. VA (if "three-phase" is selected);
- Hertz (if "phase L1" is selected);
- Not used (now forced to Amps) (if "phase L2-L3" is selected))
- - - 1 1 1 - - ==> - Avr. Watt (if "three-phase" is selected);
- Not used (now forced to "Hertz" (if "phase L1" is selected));
- Not used (now forced to Amps) (if "phase L2-L3" is selected))

bit 1, 0 = Selection of the phase associated to the alarm:

- | | | | | | | | | | |
|---|---|---|---|---|---|---|---|-----|-------------|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | bit | |
| - | - | - | - | - | - | 0 | 0 | ==> | Three-phase |
| - | - | - | - | - | - | 0 | 1 | ==> | Phase L1 |
| - | - | - | - | - | - | 1 | 0 | ==> | Phase L2 |

- - - - - - - 1 1 ==> Phase L3.

N.B. Three-phase forcing must be fixed if the instrument is single-phase.

- Writing in eeprom of the thresholds of alarm 1 (ALM) (3 consecutive writing commands):

- 1) SSSS = 00E6H:
 - D1 = Alarm 1 upper threshold (in BCD) (last 2 digits)
 - D2 = Alarm 1 upper threshold (in BCD) (first digit)
- 2) SSSS = 00E8H:
 - D1 = Exponent of 10 (in binary (complemented to 2) of the alarm 1 upper threshold
 - D2 = Alarm 1 lower threshold (in BCD) (last 2 digits)
- 3) SSSS = 00EAH:
 - D1 = Alarm 1 lower threshold (in BCD) (first digit)
 - D2 = Exponent of 10 (in binary (complemented to 2) of the alarm 1 lower threshold.

N.B. If for any reason only one of the three 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 alarm threshold is immediately updated. This might lead to a threshold setting error since it would only be partially modified:

N.B. Exp V = 0÷3 Exp A = -3÷3 Exp Pot. = 0÷9 Exp Hz = -1,0 Exp P.F. = -2

- Writing in eeprom of the delay time for activation of alarm 1 (ALM)

- (SSSS = 00ECH):
- D1 = Alarm 1 activation delay time in seconds (in BCD) (last 2 digits (00H-99H))
 - D2 = Alarm 1 activation delay time in seconds (in BCD) (first digit (0-9)).

- Writing in eeprom of the delay time for disactivation of alarm 1 (ALM)

(SSSS = 00EEH):

- D1 = Alarm 1 disactivation delay time in seconds (in BCD) (last 2 digits (00H-99H))
- D2 = Alarm 2 disactivation delay time in seconds (in BCD) (first digit (0-9)).

- Writing in eeprom of the thresholds of alarm 2 (ALM) (3 consecutive writing commands):

-1) SSSS = 00F0H:

- D1 = Alarm 2 upper threshold (in BCD) (last 2 digits)
- D2 = Alarm 2 upper threshold (in BCD) (first digit)

-2) SSSS = 00F2H:

- D1 = Exponent of 10 (in binary (complemented to 2) of the alarm 2 upper threshold
- D2 = Alarm 2 lower threshold (in BCD) (last 2 digits)

-3) SSSS = 00F4H:

- D1 = Alarm 2 lower threshold (in BCD) (first digit)
- D2 = Exponent of 10 (in binary (complemented to 2) of the alarm 2 lower threshold

N.B. If for any reason only one of the three 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 alarm threshold is immediately updated. This might lead to a threshold setting error since it would only be partially modified.

- Writing in eeprom of the delay time for activation of alarm 2 (ALM)

(SSSS = 00F6H):

- D1 = Alarm 2 activation delay time in seconds (in BCD) (last 2 digits (00H-99H))
- D2 = Alarm 2 activation delay time in seconds (in BCD) (first digit (0-9)).

- Writing in eeprom of the delay time for disactivation of alarm 2 (ALM)

(SSSS = 00F8H):

- D1 = Alarm 2 disactivation delay time in seconds (in BCD) (last 2 digits (00H-99H))
- D2 = Alarm 2 disactivation delay time in seconds (in BCD) (first digit (0-9)).

- 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

N.B. Only datum D1 is written at the address indicated; D2 is ignored.

The year is only written in eeprom when the VIP is switched off and provided at least 30 minutes have passed since the VIP was switched on.

N.B. On reception of the first command, the clock is automatically switched to stand-by mode to avoid synchronization errors during the programming of the date and time.

On reception of the third command, the date and time are written in the clock, which is re-activated. If communications with the P.C. are interrupted during clock programming, the user must access the date and time programming function (Calend set-up) locally and then exit to re-activate the clock and calendar.

LIST OF THE ERROR STRINGS IMPLEMENTED AND THEIR MEANING

ILLEGAL FUNCTION.

Error generated by reception of an unknown function code.

P.C.	VIP
<- - - - -	:,AA,FF,01H,LRC,CR,LF

where:

- AA = address of the VIP selected (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.	VIP
<- - - - -	:,AA,FF,02H,LRC,CR,LF

where:

- AA = address of the VIP selected (2 bytes ascii)
- FF = Code of the command received with bit 7 forced to 1 (2 bytes ascii);
e.g. 83H (84H): 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.	VIP
<- - - - -	:,AA,FF,03H,LRC,CR,LF

where:

- AA = address of the VIP selected (2 bytes ascii)
- FF = Code of the command received with bit forced to 1 (2 bytes ascii);
e.g. 83H (84H): 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.

VIP

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

where:

- AA = address of the VIP selected (2 bytes ascii)
- FF = Code of the command received with bit 7 forced to 1 (2 bytes ascii);
e.g. 83H (84H): 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).

- Command valid but not enabled (e.g. writing of command for activation of relay 1/2 when it is active in local mode).
In this case, the VIP does not send any reply to the P.C., thus switching it to time-out.

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:

- $01H + 03H + FEH + 00H + 00H + 21H = 123H (291)$
- $123H / 100H (256) = 01H \text{ RESTO} = 23H (35)$
- $100H (256) - 23H = DDH$

therefore:

- LRC = DDH.

Description of the operational reading functions implemented

READING OF ALL MEASUREMENTS

- WITH STD.RS485 OPTION SELECTED:

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, 6, 5, 4, 3 = Not used

bit 2 = Alarms option (ALM):

7	6	5	4	3	2	1	0	bit
-	-	-	-	-	0	-	-	==> option not present
-	-	-	-	-	1	-	-	==> option not present

bit 1 = Option RPQS:

7	6	5	4	3	2	1	0	bit
-	-	-	-	-	-	0	-	==> option not present
-	-	-	-	-	-	1	-	==> option present

bit 0 = Serial line option:

7	6	5	4	3	2	1	0	bit
-	-	-	-	-	-	-	0	==> option not present
-	-	-	-	-	-	-	1	==> option present

- Instrument options (OPTIO2) (2nd byte):

bit 7, 6, 5, 4 = Not used

bit 3, 2, 1, 0 = Software version (0-15)

- 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 = Jump to initial video page:

7	6	5	4	3	2	1	0	bit
-	-	0	0	-	-	-	-	==> jump meas
-	-	0	1	-	-	-	-	==> jump counts
-	-	1	0	-	-	-	-	==> jump demand
-	-	1	1	-	-	-	-	==> jump meas

Bit 3, 0 = Selection of switching type:

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

-	-	-	-	1	-	-	1	==> Single Phase
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

- Instrument setup (CONF12) (2nd byte):

bit 7 = selection of Standard 1/2:								
7	6	5	4	3	2	1	0	bit
0	-	-	-	-	-	-	-	==> Standard 1 (Wh, Varh) active
1	-	-	-	-	-	-	-	==> Standard 2 (Wh, VAh) active

N.B. This selection bit is only valid if bit 1 of CONFIG=0 (no Cogeneration)

bit 6, 5, 4, 3 = free								
bit 2 = Password enabling/disabling (if present):								
7	6	5	4	3	2	1	0	bit
-	-	-	-	-	0	-	-	==> Password enabled
-	-	-	-	-	1	-	-	==> Password disabled
bit 1 = Sensib enabling/disabling:								
7	6	5	4	3	2	1	0	bit
-	-	-	-	-	-	0	-	==> "Sensib" not active
-	-	-	-	-	-	1	-	==> "Sensib" active
bit 0 = Enabling/disabling of keyboard programming mode:								
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)
- Phase L1 current crest factor
- Phase L2 current crest factor
- Phase L3 current crest factor

- 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) (VAr)
- 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 switching is selected, or Star or single-phase switching and the Cogeneration 4 option), or Phase L1 kWatthours (kWh) (if Star switching and the Standard 1/2 option are selected)
- Negative three-phase kVArhours (single-phase if single-phase is set) (kVArh) (if Delta switching is selected, or Star or single-phase switching and the Cogeneration 4 option), or Phase L2 kWatthours (kWh) (if Star switching and the Standard 1/2 option are selected)
- Phase L3 kWatthours (kWh) (if Star switching and the Standard 1/2 option are selected)
- Relay control byte (BYRELAY = B_RELAY):

bit 7 = Local/remote control with RPQS or ALM option active and RELAY OUTPUT selected:

7	6	5	4	3	2	1	0	bit
0	-	-	-	-	-	-	-	==> Local
1	-	-	-	-	-	-	-	==> Remote

bit 6 = Relay 1/2 selected from keyboard with ALM option active and ALARM OUTPUT selected:

7	6	5	4	3	2	1	0	bit
-	0	-	-	-	-	-	-	==> Relay 1 selected

-	1	-	-	-	-	-	-	==> Relay 2 selected
Bit 5, 4 = Relay setup with RPQS or ALM option active:								
7	6	5	4	3	2	1	0	bit
-	-	0	0	-	-	-	-	==> "PULSE OUTPUT" active
-	-	0	1	-	-	-	-	==> "RELAY OUTPUT" active
-	-	1	0	-	-	-	-	==> "ALARM OUTPUT" active
-	-	1	1	-	-	-	-	==> "ALARM OUTPUT" active
bit 1 = Status of relay 2:								
7	6	5	4	3	2	1	0	bit
-	-	-	-	-	-	0	-	==> Open (off)
-	-	-	-	-	-	1	-	==> Close (on)
bit 0 = Status of relay 1:								
7	6	5	4	3	2	1	0	bit
-	-	-	-	-	-	-	0	==> Open (off)
-	-	-	-	-	-	-	1	==> Close (on).

- 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.

- WITH AUTO RS-422 OPTION SELECTED:

A string of 65 words is transmitted automatically whenever a new measurement has been made. The meaning of the 130 bytes received is exactly as described in the STD.RS-485 option.

- WITH SHORT STRING OPTION SELECTED:

This is carried out by reading 41 words starting from address 0FE00H or reading 40 words starting from address 0FE02H (in this latter case, the first 2 bytes of the string described below are not received).

N.B. The reading only takes place starting from the addresses mentioned above, in order to obtain the required data string. The real addresses are actually different and the string desired is only composed if the above-mentioned addresses are received.

The meaning of the 82 bytes received is as follows:

- Type of instrument and various settings:

bit 7 = Connection type:								
7	6	5	4	3	2	1	0	bit
0	-	-	-	-	-	-	-	==> Single-phase
1	-	-	-	-	-	-	-	==> Three-phase
bit 6, 5 = free								
bit 4 = Baud rate selected:								
7	6	5	4	3	2	1	0	bit

-	-	-	0	-	-	-	-	==> 9600
-	-	-	1	-	-	-	-	==> 1200
Bit 3, 2, 1, 0 = Type of instrument selected:								
7	6	5	4	3	2	1	0	bit
-	-	-	-	0	0	1	1	==> VIPD3.

- Instrument options (OPTION):

7	6	5	4	3	2	1	0	bit
-	-	-	-	-	-	-	1	==> Serial line present

- Three-phase voltage (V)
- Three-phase current (I)
- Three-phase active power (W)
- Three-phase cos ϕ
- 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)
- Three-phase apparent power (VA)
- Three-phase reactive power (VAr)
- Frequency (Hz)

- Positive three-phase kWh (single-phase if single-phase is set) (kWh)
- Positive three-phase kVAh (single-phase if single-phase is set) (kVAh)
- 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)
- 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)
- Phase L1 current crest factor
- Phase L2 current crest factor
- Phase L3 current crest factor
- Datum to be rejected (1st byte)

N.B. Each of these measurements is transmitted in the following 3 byte format (not including meter values):

- 1st byte: value (in BCD) of the measurement (low byte)
- 2nd byte: value (in BCD) of the measurement (high byte) with sign (bit 7 = 1: sign negative; bit 7 = 0: sign positive)
- 3rd byte: exponent of 10 (in binary (complemented to 2)).

Example 1: 1st byte = 46H
 2nd byte = 01H
 3rd byte = 01H

means: 1460.

Example 2: 1st byte = 62H

2nd byte = 04H
 3rd byte = FEH
 means: 4,62.

The meter values (kWh and kVAh) are transmitted in the following 5 byte format.

- 1st byte: value (in BCD) of the measurement (low byte)
- 2nd byte: value (in BCD) of the measurement
- 3rd byte: value (in BCD) of the measurement
- 4th byte: value (in BCD) of the measurement (high byte) with sign (bit 7 = 1: sign negative; bit 7 = 0: sign positive)
- 5th byte: exponent of 10 (in binary (complemented to 2)).

Example:

1st byte = 15H
 2nd byte = 27H
 3rd byte = 36H
 4th byte = 00H
 5th byte = 00H

means: 362.715 K.

N.B. If the instrument is single-phase, all the three-phase measurements are the same as the phase L1 measurement and the measurement of phases L2 and L3 are meaningless.

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)

N.B. All the data received are in BCD.

In actual fact the year is allocated to the eeprom; it is automatically read at the end of the other data, to avoid having to give 2 consecutive reading commands.

READING OF THE RELAYS CONTROL BYTE (B_RELAY)

It is carried out reading 1 word beginning from address 0D00H (which is the logic address; in fact physical address is "0FC4BH").

The meaning of the 2 bytes received is the following:

- Relay control byte (B_RELAY) (1st byte):

- Local/remote control with "RPQS" or "ALM" option activated and "RELAY OUTPUT" selected:

bit: 7 6 5 4 3 2 1 0

0 - - - - - ==> Local

1 - - - - - ==> Remote

- Relay selection on keyboard with "ALM" option activated and "ALARM OUTPUT" selected:

bit: 7 6 5 4 3 2 1 0

- 0 - - - - - ==> Relay 1 selected

- 1 - - - - - ==> Relay 2 selected

Relay set-up with option "RPQS" or "ALM" activated:

bit: 7 6 5 4 3 2 1 0

- - 0 0 - - - - ==> "PULSE OUTPUT" active

- - 0 1 - - - - ==> "RELAY OUTPUT" active

- - 1 0 - - - - ==> "ALARM OUTPUT" active

- - 1 1 - - - - ==> "ALARM OUTPUT" active

- Status of relay 2:

bit: 7 6 5 4 3 2 1 0

- - - - - 0 - ==> Open (off)

- - - - - 1 - ==> Close (on)

- Status of relay 1:

bit: 7 6 5 4 3 2 1 0

- - - - - 0 ==> Open (off)

- - - - - 1 ==> Close (on)

- Datum to be rejected (2nd byte).

EXAMPLES OF COMMUNICATION BETWEEN THE VIP ENERGY AND THE MODBUS SOFTWARE

All the samples are carried out with Vip Energy address 1.

Example n. 1:

Reading of 1 word at address 0CCA Hex. String to be sent:

: 0 1 0 3 0 C C A 0 0 0 1 2 5 CR LF

Where all the characters are ASCII (: is equivalent to 3AH, 0 to 30H, etc.)

: = Start character
01 = Vip Energy address (between 1 and 247)
03 = Command for reading N words
0CCA = Indirizzo di partenza lettura N words
0001 = Starting address for reading N words
25 = LRC
CR = carriage return (0D Hex)
LF = line feed (0A Hex)

After receiving this string of characters the Vip Energy replies with the following string:

: 0 1 0 3 0 2 0 0 0 1 F 9 CR LF

Where:

: = Start character
01 = Vip Energy address (between 1 and 247)

03 = Command for reading N words
02 = Number of bytes sent
00 = Value of first byte (contents of address 0CCA Hex)
01 = Value of second byte (contents of address 0CCB Hex)
F9 = LRC
CR = carriage return (0D Hex)
LF = line feed (0A Hex)

Example n. 2:

Writing of 1 word at address 032 Hex. String to be sent:

: 0 1 0 6 0 0 3 2 8 3 4 5 F F CR LF

Where all the characters are ASCII (: is equivalent to 3AH, 0 to 30H, etc.)

: = Start character
01 = Vip Energy address (between 1 and 247)
06 = Command for writing N words
0032 = Starting address for writing 1 word
8345 = Value to be written at address 0032 Hex
FF = LRC
CR = carriage return (0D Hex)
LF = line feed (0A Hex)

After receiving this string of characters the Vip Energy replies with the same string:

: 0 1 0 6 0 0 3 2 8 3 4 5 F F CR LF

If the Vip Energy echoes the writing string, it has carried out the command correctly.

B.7 Q-Basic example for VIP ENERGY-485 reading

```
'      EXAMPLE OF VIP ENERGY-485 READING
'
'      INSTRUMENT TYPE      : VIP ENERGY-485
'      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$ = "0103FE000041"
  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, "O")
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 RS485 MODBUS PROTOCOL

REQUEST at instrument with address 01:
":0103FE000041BD"+CR+LF

Start Transmission
:

Instrument Address	Command	memory Address	#words to read	LRC
01	03	FE00	0041	BD

End Transmission
0D0A

RESPONSE from instrum. 01 to all measurements request

```

":0103820D010070021204004301FE0101019980FE3802003802003802004301FE4301FE4301FE37030037
03003703009980FE9980FE9980FE8084FF2484FF4784FF4103004003004003009800FE0001FE9800FE02
01013581000005FF41010000FE61020000FE5102005702002504FF10030154010146000000FE47000000F
E47000000FEA8A5"+CR+LF

```

Start Transmission

Address	Command	Echo	# of bytes	Type of instrument	Option1	Option2	Config1
01	03		82	0D (VIP-Energy)	01	00	70
Config2 02	Volt(412) 120400	I (1.43) 4301FE	W (1010) 010101	PF(-.99) 9980FE	V1(238) 380200	V2(238) 380200	V3(238) 380200
I1(1.43) 4301FE	I2(1.43) 4301FE	I3(1.43) 4301FE	W1(337) 370300	W2(337) 370300	W3(337) 370300	PF1(-.99) 9980FE	PF2(-.99) 9980FE
PF3(-.99) 9980FE	Var1(-48) 8084FF	Var2(-42.4) 2484FF	Var3(-44.7) 4784FF	VA1(341) 410300	VA2(340) 400300	VA3(340) 400300	
CF1(.98) 9800FE	CF2 (1) 0001FE	CF3(.98) 9800FE	VA(1020) 020101	Var(-135) 358100	Hz(50) 0005FF	kWh(1.41) 41010000FE	kVArh(2.61) 61020000FE
AvgVAr(251) 510200	AvgVA(257) 570200	AvgW(4.5) 2504FF	PeakVA(3100) 100301	PeakW(1540) 540101			
kWh1 (.46) 46000000FE	kWh2 (.47) 47000000FE	kWh3 (.47) 47000000FE					
Data to be discarded A8	LRC A5			End Transmission CR+LF (0Dh+0Ah)			

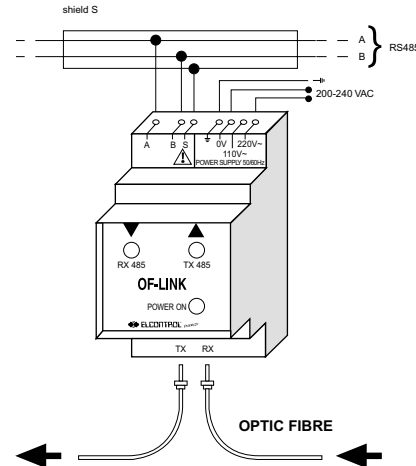
ANNEX C

C.1 "PC 485 OF-LINK" and "VIP 485 OF-LINK" Converters

Power supplied at 220VAC $\pm 10\%$ or at 110VAC $\pm 10\%$, VIP 485 OF-LINK and PC 485 OF-LINK interfaces RS485 twisted pair cable and 2 (TX and RX) optic fibres in EMI high polluted environment. Up to 70 mt. (plastic fibre) or 500 mt. (glass fibre).

The VIP 485 OF-LINK is designed for connection to the RS485 leading out of a VIP ONE 485 or from a VIP ENERGY 485.

The PC 485 OF-LINK is intended for connection to the RS485 - PC side. Up to 32 VIP ONE 485 or VIP ENERGY 485 instruments can be connected to the RS485 side of a single VIP 485 OF-LINK converter (see diagram). Any number of VIP 485 OF-LINK can be connected to the OF side: the only constraint is that of 247 instruments max with RS485 (see Fig. C.1).



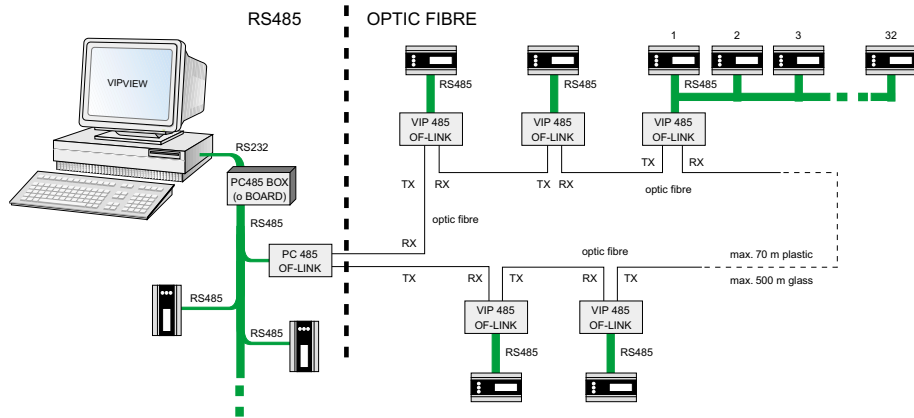


Fig. C.1

C.2 Fibre Optic Preparation Procedure

To connect the Fibre Optic to the PC 485 OF-LINK or VIP 485 OF-LINK is necessary to wire the connector to the cable:

1) Strip the plastic cable with a plastic cutter, uncovering approximately a 7 mm section of the Fibre Optic (see Fig. C.2)

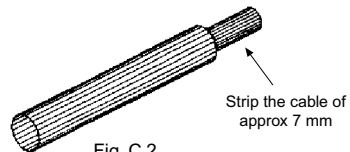


Fig. C.2

2) Insert the crimping ring on the connector, as in Fig. C.3.

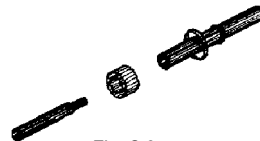


Fig. C.3

3) Insert the cable in the connector until it protrudes at least 1.5 mm on the other side (see Fig. C.4)

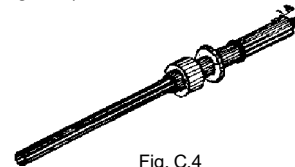


Fig. C.4

4) Crimp the ring on the connector using suitable pliers.

C.3 Cleaning Procedure of the Fibre Optic

Obtain the cleaning kit before carrying out the following operations.

Place the abrasive paper on a flat surface and insert the connector in the cleaning device. Press the connector on the abrasive paper making figure 8 movements as shown in Fig. C.5 below until it is lined up with the cleaning device.

Clean the cleaning device and the connector with a cloth.

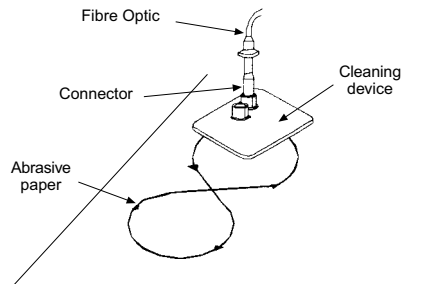


Fig. C.5

Extend the lapping film on the surface and position the cleaning device with the connector inserted. Press at several different points approximately 25 times.

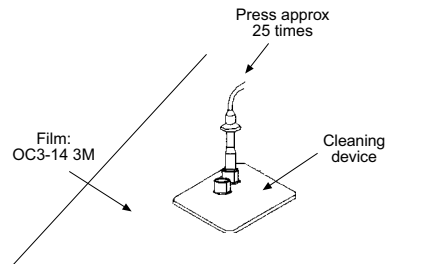


Fig. C.6

Now the Fibre Optic is ready to be used. Insert the Fibre Optic connector in the proper opening of the instrument.

C.4 Specifications of the Fibre Optic to be used

The Fibre Optic to be used must comply with the following specifications:

- Internal Diameter = 1 mm
- Max. external diameter = 2.2 mm
- Attenuation at 25 °C < 0.25 dB/m (650 nm.)
- Ambient temperature from: -40 °C to +70 °C
- Max traction - 8 Kg
- Curvature radius > 9 mm

Inside the instrument there is a female connector for plastic fibre Optic, serial number H.P. HFBR-1523.

To carry out the transmission it is necessary to perform the preparation operations and cleaning of the fibre optic described in the previous section using the components distributed by ELCONTROL ENERGY.

OFP (Ref. 4AAHL):

Plastic fiber optic, single without head, sold by the meter. The tests carried out on the instruments grant the use of a fibre optic with the above-listed specifications for a distance of up to 75 m.

OFP-CM (Ref. 4AAHM):

with crimping ring for terminating the plastic fibre optic.

OFP-Polish (Cod. 4AAHN):

cleaning kit for plastic fibre optic. Must be used with OFP-CM, sufficient for approximately 20 terminations.

Crimping tool to be selected from those in the ELCONTROL ENERGY catalogue (Ex: crimping tool YAC3 - Cod. YDAAY).

C.5 Converter OFP-485-CONVERTER-R

By connecting an OFP-CONVERTER-R with one model fitted with RS485 and with the transmission mode "SHORT RS 422" selected from the menu of RS485 SET-UP, it is possible to carry out a fiber optics network for max. 32 instruments that can be managed by the software DOS VIPLINK and VIPLOAD or by the software WINDOWS PANEL UTILITIES 2.1 in the same way as with the previous models OF.

ANNEX D

D.1 The VIP ENERGY RPQS

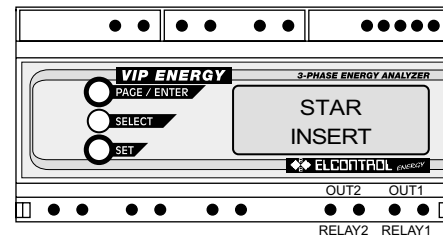


Fig. D.1

100ms = $T_{ON} = T_{CLOSE}$ ("LONG PULSE")

17ms = $T_{ON} = T_{CLOSE}$ ("SHORT PULSE")



Fig. D.2

17ms = $T_{OFF} = T_{OPEN}$ ("SHORT PULSE")

100ms = $T_{OFF} = T_{OPEN}$ ("LONG PULSE")

Characteristics of the output pulses provided by OUT1 and OUT2.

The VIP ENERGY RPQS is equipped with two solid state relay outputs with voltage-free contacts (280 VAC ms max., 100 mA ms max.) - Fig. D.1 - They supply pulses with the characteristics shown in Fig. D.2 and with frequency proportional to any 2 of the parameters active power P, or P+(POS) and P-(NEG) with option COG4 selected, apparent power (S), or reactive power Q+(POS) inductive, negative Q- capacitive, selected using the keyboard by means of the menu page provided.

The number of pulses/KWh (or kvarh or kVAh) can be set from the keyboard from 1 to 999 pulses per Wh, kWh or MWh (min. 1 pulse/MWh, max. 999 pulses/Wh). If the maximum of 100,000 pulses/hour (short pulse) or 17,000 pulses/hour (long pulse) is exceeded, the measuring and RPQS setup pages blink and the relay outputs are locked in OFF (open) status.

D.2 The VIP ENERGY RPQS-485

The VIP ENERGY RPQS-485 is also available with RS485 output. This model features additional MODBUS commands for reading and setting of the RPQS pulsed outputs. It is also possible to control the status of the two relay outputs from a PC, by means of the RS485, thus permitting remote control of two loads. As an alternative, with local mode selected, it is possible to set the open/closed status of the two output relays manually (see RELAY SETUP menu).

ANNEX E

E.1 The VIP ENERGY ALM

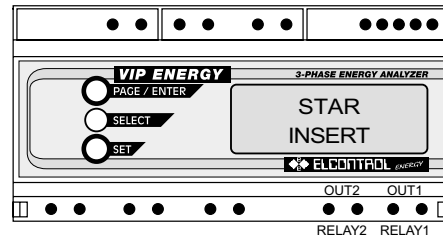


Fig. E.1

The VIP ENERGY ALM is equipped with 2 solid state relay outputs with voltage-free contacts (280 VAC rms max., 100 mA rms max.) - Fig. E.1. A maximum threshold and a minimum threshold of a parameter chosen from 27 of the 43 measurements made by the instrument can be associated to each of them.

For each relay, the user can set an opening delay time and a closing delay time from 0 to 999 seconds and a percentage hysteresis variable from 0 to 17.5% in steps of 2.5% (see RELAY SETUP MENU for this model).

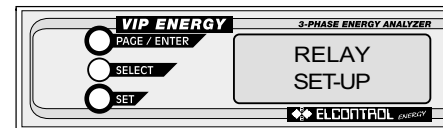
E.2 The VIP ENERGY ALM-485

The VIP ENERGY ALM-485 is also equipped with an RS 485 serial output.

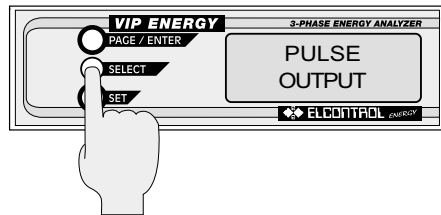
This model has additional MODBUS commands for reading and setting the minimum and maximum alarm thresholds for each of the 2 relays, the opening and closing delay times, and the percentage hysteresis value.

All the functions found on the VIP ENERGY RPQS-485 model are also present and can be selected.

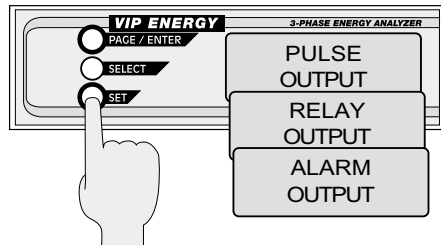
E.3 RELAY SETUP MENU



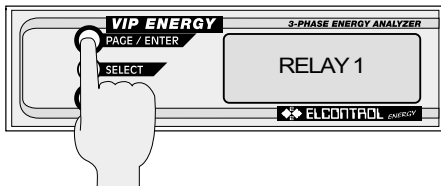
The SEL key gives access to the menu branch for selection of the type of OUTPUT.



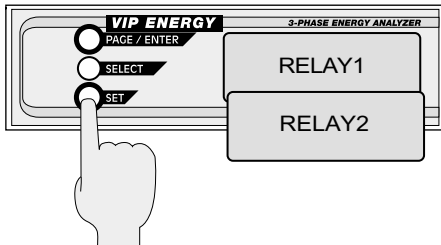
Using the SET key the user can select: PULSE OUTPUT, RELAY OUTPUT or ALARM OUTPUT.



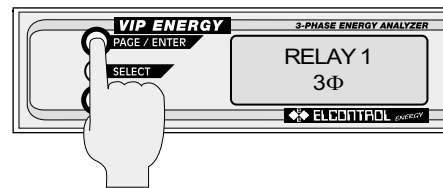
From the ALARM OUTPUT page, the PAG key gives access to the menu for setting the alarm thresholds, the delays and the hysteresis for operation of RELAY 1.



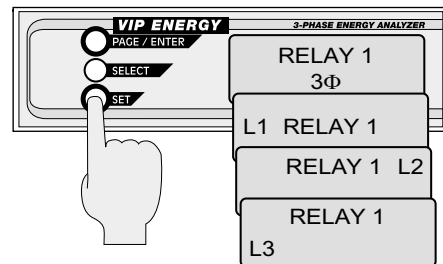
The SET key can be pressed to pass from the menu branch relating to RELAY 1 to that for RELAY 2 and vice-versa.



The PAG key gives access to the menu branch for setup of the phase covered by the alarm.

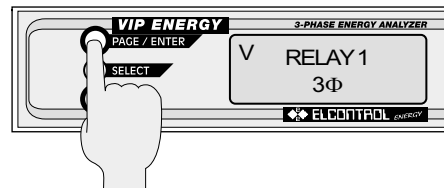


Use SET to select the phase: 3Φ, L1, L2 and L3.



Use the PAG key to access the menu branch for selecting the parameter associated to the relay.

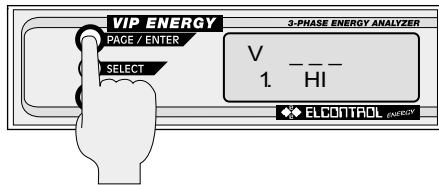
Press SET to select 1 from 27 of the 43 possible parameters.



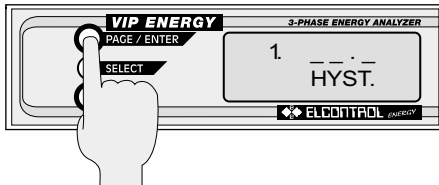
The 27 parameters which can be selected using the SET key are:

- 3Φ: V, P.F., W, var, VA, Avr. Var, Avr.VA, Avr.W
- L1: V, P.F., W, var, VA, A, Hz
- L2: V, P.F., W, var, VA, A
- L3: V, P.F., W, var, VA, A

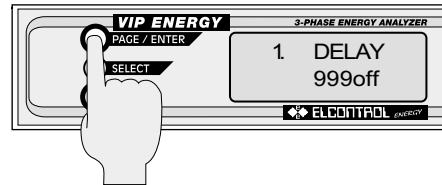
The PAG key gives access to the page for selection of the upper alarm threshold. Use SEL + SET to select the 3 figure value, plus exponent, plus decimal point (0 = NO ALARM).



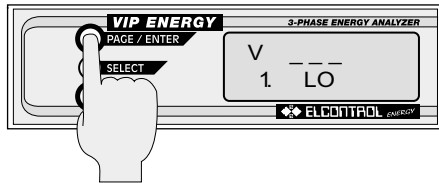
The PAG key gives access to the page for selection of the hysteresis. Use SET to select the % value (choice of 8 values) from 00.0% to 17.5% in steps of 2.5%.



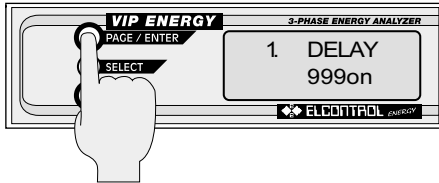
The PAG key gives access to the page for selecting the delay time for closure of the relay. Use SEL + SET to select the value of the RELAY closing delay (from 1 to 999 seconds). Press PAG again to return to the ALARM OUTPUT page.



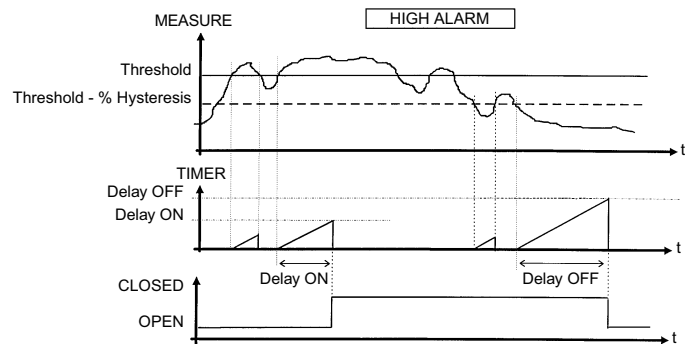
The PAG key gives access to the page for selection of the lower alarm threshold. Use SEL + SET to select the 3 figure value, plus exponent, plus decimal point (0 = NO ALARM).



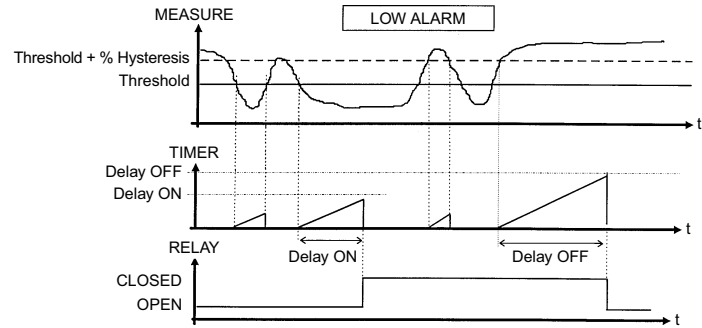
The PAG key gives access to the page for selecting the delay time for opening of the relay. Use SEL + SET to select the value of the RELAY opening delay (from 1 to 999 seconds).



E.4 VIP ENERGY ALM alarm diagrams



- Threshold: occurrence threshold set on VIP ENERGY. For alarms of the “high” type, as soon as the measurements is higher than the threshold, relay closing timer starts counting.
- Delay ON: the relay will close only if the measurements is steadily over the threshold for the set Delay ON time.
- Hysteresis: the opening mechanism will start only if the measurements goes under the Threshold-%Hysteresis value.
- Delay OFF: the relay will open only if the measurements is steadily under the Threshold -%Hysteresis value for the set Delay OFF time.



- Threshold: occurrence threshold set on VIP ENERGY. For alarms of the “low” type, as soon as the measurements is lower than the threshold, relay closing timer starts counting.
- Delay ON: the relay will close only if the measurements is steadily under the threshold for the set Delay ON time.
- Hysteresis: the opening mechanism will start only if the measurements goes over the Threshold+%Hysteresis value.
- Delay OFF: the relay will open only if the measurements is steadily over the Threshold+%Hysteresis value for the set Delay OFF time.

ANNEX F

- Reading in eeprom of the CT coefficient K

P.C.
VIP

:AA,03H(04H),0032,0002, LRC, CR,LF ----->
<----- :AA,03H(04H),04,D1,D2,D3,D4,LRC,CR,LF

where:

-AA = address of the VIP selected(2 bytes ascii)
 -03H(04H) = Code of the command for reading of N words(2 bytes ascii)
 -0032 = address from which the reading starts (4 bytes ascii)
 -0002 = 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)
 -04 = Number of bytes read
 -D1 = CT primary in amps(in BCD, last 2 digits)
 -D2 = CT primary in amps(in BCD middle 2 digits)
 -D3 = CT primary in amps(in BCD first 2 digits)
 -D4 = CT secondary (in binary)

-X0H = 1 Amps
 -X1H = 2 Amps
 -X2H = 2,5 Amps
 -X3H = 5 Amps

Note:

X means don't care in order to read only the low nibble of datum D4

E.g.:

-CT primary = 100050 A
 -CT secondary = 5 A
 -CT K = 100050/5 = 20010

Reading string :

: 01 03 0032 0002 C8 cr lf

Response from VIP :

: 01 03 04 50001023 75 cr lf

- Reading in eeprom of the PT coefficient K

P.C.

VIP

.,AA,03H(04H),002E,0004, LRC, CR,LF ----->

<----- :.,AA,03H(04H),08,D1,D2,D3,D4,D5,D6,D7,D8,LRC,CR,LF

where:

- AA = address of the VIP 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 VIP :

:01 03 08 FC00042050001023 51 cr lf

- Reading in eeprom of the integration time for average values

P.C.

VIP

.,AA,03H(04H),0000,0001, LRC, CR,LF ----->

<----- .,AA,03H(04H),02,D1,D2,LRC,CR,LF

where:

- AA = address of the VIP selected (2 bytes ascii)
 - 03H(04H) = 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 VIP :

: 01 03 02 01 40 B9 cr lf

- Reading in eeprom of the flags for selection of the data page to be displayed at power-on

P.C.

VIP

.,AA,03H(04H),0000,0001, LRC, CR,LF ----->

<----- .,AA,03H(04H),02,D1,D2,LRC,CR,LF

where:

- AA = address of the VIP selected (2 bytes ascii)
- 03H(04H) = 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 - - - - ==> jump meas
 - - 0 1 - - - - ==> jump counts
 - - 1 0 - - - - ==> jump demand
 - - 1 1 - - - - ==> jump meas

E.g. :

-Power-on page "counts"

Reading string :

: 01 03 0000 0001 FB cr lf

Response from VIP :

: 01 03 02 01 50 A9 cr lf

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

P.C.

VIP

:,AA,03H(04H),0000,0001, LRC, CR,LF ----->

<----- :,AA,03H(04H),02,D1,D2,LRC,CR,LF

where:

-AA = address of the VIP selected(2 bytes ascii)
 -03H(04H) = 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
 - - - - 1 - - 0 ==> Single-Phase
 - - - - 1 - - 1 ==> Single-Phase

E.g. :
-Insertion "Delta"

Reading string :

: 01 03 0000 0001 FB cr lf

Response from VIP :

: 01 03 02 01 51 A8 cr lf

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

P.C.

VIP

:,AA,03H(04H),0000,0001, LRC, CR,LF ----->

<----- : ,AA,03H(04H),02,D1,D2,LRC,CR,LF

where:

- AA = address of the VIP selected(2 bytes ascii)
- 03H(04H) = 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 VIP :

: 01 03 02 01 52 A7 cr lf

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

P.C.

VIP

:,AA,03H(04H),00CC,0001, LRC, CR,LF ----->

<----- : ,AA,03H(04H),02,D1,D2,LRC,CR,LF

where:

- AA = address of the VIP selected(2 bytes ascii)
- 03H(04H) = 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 VIP :

: 01 03 02 02 82 76 cr lf

ELCONTROL ENERGY VIPNET 485 NETWORK CABLES

The EIA RS-485 standard envisages a transmission speed of over 1 Mbaud for a distance of 1.2 km. The ELCONTROL ENERGY instrumentation allows transmission at up to a maximum of 9600 bit/sec. This offers better margins of protection against the risk of disturbance and loss of signal power. However, cables specially designed for this type of protocol should be used.

We recommend:

BELDEN CABLES:

type 3105A for RS485

specific for the EIA RS-485 standard, high quality, impedance 120 ohm, gauge 22AWG, twist pitch 5 cm, recommended for VIPNET applications covering large distances and/or for environments with strong electromagnetic disturbances.

type 9841 for RS485

like the 3105A but with gauge 24 AWG. Recommended for environments where the electromagnetic disturbances are not particularly strong.

type 1599A

data transmission cable specifically for LAN and not for RS485, low cost with performance levels good enough to assure VIPNET network communications in environments free from electromagnetic disturbances.

VIP ENERGY with power supply at 24 VDC

The various VIP ENERGY models are available with power supply at 24 VDC, with the following specifications:

- Power supply 24 VDC (15-30 VDC), 3VA
- Automatic reversal of power supply connection
- Any RS485 serial output insulated to 3000 V.