PROGRAMMABLE NETWORK CONVERTER ANALYZERS

IPL144

UTILIZATION

AND CONFIGURATION

HANDBOOK

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fait le : 29/01/01

Rev2.0/c

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DIALOGUE - TERMINAL MODE

Numeric devices can converse with all terminal emulation mode systems. As the dialogue and configuration part are in device's memory, no software or specific interface are necessary for their configuration.
Two terminal emulation mode systems are presented: the PSION and the PC.
Differents procedures are enumerated below.

1) PSION serie 2:

First of all manipulation, plug in "COMMS LINK" on the PSION. To start up the PSION, push on the **"ON"** key.
The PSION displays this menu: **RECH SAUV AGENDA**
CALC PROG EFFACE

Push on the **"C"** key until the menu **"COMMS"**, and validate with **"EXE"**.
The PSION displays this menu: **TRANSMIT RECEIVE**
SETUP TERM AUTO

Push on the **"T"** key until the menu **"TERM"**, and validate with **"EXE"** to obtain a empty screen. The PSION is now in terminal mode and you can link the PSION to the device, by plugging in the RS 232. The measure is displayed, to configurate, push on the **"C"** key.

2) PSION Workabout:

To start up the PSION push on the **"ON"** key.
At the presentation, push on the **"MENU"** key. Select **"SYSTEME SCREEN"** mode and validate by **"ENTER"**.

Icons display: **DATA CALC SHEET PROGRAM COMMS**

Select icon **"COMMS"** and validate by **"ENTER"**, on display, a cursor flashing. The **PSION** is in terminal mode. Plug in "RS232" on PC. The measure is displayed and, to configure, push **"C"** on keyboard.

To quit terminal mode and switch off PSION, push on **"OFF"** key. When you re-start the **PSION** in terminal mode, it start automaticaly and directely in terminal mode without re-start configuration.

3) PC with DOS:

The terminal emulation mode software with DOS **"IBM®-PC KERMIT-MS V2.26"** is available at simple request. After the PC has booted, type **"a: K"** then press **"ENTER"**. The PC is in terminal mode and uses COM port 1.
If you want to use the second serial communication port (COM2), type:

"A:KERMIT" and **"ENTER"** to launch the program,
"SET PORT 2" and **"ENTER"** to select **COM2**,
"SET BAUD 9600" and **"ENTER"** to select speed,
"CONNECT" and **"ENTER"**, to enter in the terminal mode.

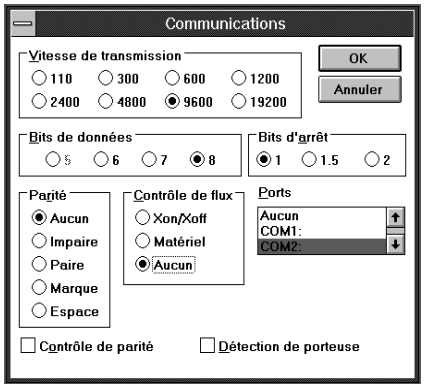
The PC is now emulating a terminal and may be connected to the device by plugging in the RS 232 link cable.
Measure is now displayed and configuration's acces allowed by a press on **"C"** key.

To quit kermit, press **"CTRL-$"** then press the key **"C"**.
When the message KERMIT-MS appears, type **"QUIT"** to return to MS-DOS commands.

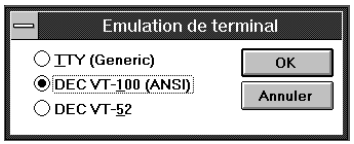
4) PC with WINDOWS 3.11:

Start **WINDOWS** and in "**ACCESSOIRES**" group, double-click on  icon wich get access to terminal mode.

In "**PARAMETRES**" menubar, click on "**COMMUNICATION**" sub-menu. We access to the following windows. Configure communication parameters, 9600 bauds, no parity, 8 data bits, 1 stop bit, no flow control and validate.



Begin terminal emulation by click on "**PARAMETRES**", then on "**EMULATION TERMINAL**". the following board is displayed.



Choose terminal mode **DEC-VT-100(ANSI)** and validate. The PC is in terminal mode, connect it to device by plugging the RS232 link cable. Measure is now displayed and to access at configuration, press on **"C"** key.

5) PC with WINDOWS 95/98:

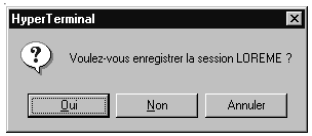
To start up terminal program:
1 - Clique on button **"START"**,
2 - Tick off **"PROGRAMS"**, **"ACCESSOIRES"**, and **"HYPER TERMINAL"**,
3 - Click twice on  .

Hypertrm.exe

The following window is displayed. Enter a name for a new connection and validate, the hereunder window will appear

Choose a communication port and validate. The belowing windows is displayed

Configure communication parameters, 9600 bauds, no parity, 8 data bits, 1 stop bit, no flow control and validate. The PC is in terminal mode, connect to device by plugging in the RS232 link cable. Measure is now displayed and to access at the configuration, press on **"C"** key .



When quitting HyperTerminal will be diplayed the following window. To dialog with all LOREME devices without re-start all the method, click on **"OK"**

To load LOREME session directly:
1 - Click on button **"Start"**.
2 - Tick off **"Programs"**, **"Accessories"**, and **"HyperTerminal"**.
3 - Click twice on the icon 

LOREME.ht

6) Visualization:

When switching on, device is automatically put in measure mode.

On 2 lines display mode, the next messages will be displayed:

CONFIGURATION	Accessing to configuration mode
TAPEZ SUR C	Press on "C" key

Access keyboard keys:

"C"	device configuration access.
"$"	full-screen mode (PC only),
"Enter"	2 lines display mode,

The presentation of the measures in a full-screen mode is as follows:

	L1	L2	L3	3L
VOLTAGE	230 V	229 V	225 V	228 V
	398 V	393 V	394 V	395 V
CURRENT	1.13 A	1.26 A	1.24 A	1.21 A
FREQUENCY	50 Hz	50 Hz	50 Hz	50 Hz
COS PHI	0.99	0.99	0.99	0.99
ACTIVE P.	260 W	287 W	279 W	829 W
REACTIVE P.	14 Var	15 Var	17 Var	46 Var
APPARENT P.	259 VA	287 VA	279 VA	829 VA
ACTIVE CONS. W.	54 kW.h	47 kW.h	49 kW.h	150 kW.h
ACTIVE GENE. W.	0 kW.h	0 kW.h	0 kW.h	0 kW.h
REACTIVE IND. W.	0 kvar.h	0 kvar.h	0 kvar.h	0 kvar.h
REACTIVE CAP. W.	5 kvar.h	4 kvar.h	4 kvar.h	13 kvar.h

UNBALANCED TRIPHASE NETWORK WITH NEUTRAL

CT RATIO	1.00
PT RATIO	1.00

Full-screen mode is available only on a PC with KERMIT software. It isn't possible to use this mode with WINDOWS. Full-screen mode slows down the device. It is recommended to quit this mode when it is not necessary.

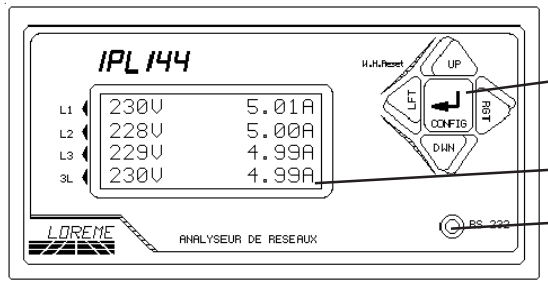
DEVICE PRESENTATION

The purpose of this configuration handbook is to allow to become familiar with the functions supplied by the device.
Device is provided of functions required to the analyst of every networks. It possesses 3 voltage inputs and 3 current inputs totaly isolated among it, which allow realization of direct or alternating, monophased or triphased, balanced or unbalanced, with or without neutral measures.

It can receive up to 8 slots. Number and types are listed below and must be specified at the order:

- analogical slot, current, voltage,
- relay slot, alarm, energy meter, direct control,
- logical slot,
- communication slot, RS485 MODBUS / JBUS.

USER INTERFACE



The front side of IPL144 is composed of:

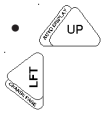
- 1 LCD display, back-lighted 4 lines x 16 characters,
- 1 jack 3.5 plug for RS 232 link,
- 3 reds leds for time range
  - off-peak hours,
  - on-peak hours,
  - peak hours.

- 5 push buttons:

  - 

push buttons "Up" and "Down" allows to change displayed datas, measures or slots,
  - 

push buttons "Left" et "Right" allows to change displayed tables, measures tables or slots tables,
  - 

push buttons "Config" allows to display network or time range configuration,
  - 

a simultanous press on this two buttons allows to reset all energies meter if this function is validated in RS232 configuration.

Display possibilities are:

- measures display:

	Voltage - Current	Cos - Frequency	Active power	Reactive power
L1...	228 V 5.01 A	0.99 50.0 Hz	1140 W	120 VAR
L2...	229 V 5.00 A	0.99 50.0 Hz	1149 W	115 VAR
L3...	230 V 4.99 A	0.99 50.0 Hz	1157 W	118 VAR
3L...	229 V 5.00 A	0.99 50.0 Hz	3446 W	350 VAR

Apparent power	Active energy +	Reactive energy +	Active energy -
1142 VA	10 KW.H	1 KVAR.H	-11 KW.H
1150 VA	11 KW.H	1 KVAR.H	-9 KW.H
1160 VA	9 KW.H	2 KVAR.H	-10 KW.H
3452 VA	30 KW.H	4 KVAR.H	-30 KW.H

Reactive energy -	Interlinked voltage
-1 KVAR.H	398 V
-2 KVAR.H	397 V
-1 KVAR.H	398 V
-4 KVAR.H	398 V

- slots display:

Slot 1	Slot 2	Slot 3	Slot 4
SLOT 1 (ANALOG)	SLOT 2 (ANALOG)	SLOT 3 (RELAY)	SLOT 4 (RELAY)
0 V L1	0 A L1	HIGH ALARM	METER
400 V	100 A	60 kW 3L	10 kW.h 3L
15.95 mA	12.56 mA	ACTIVE	

Slot 5	Slot 6	Slot 7	Slot 8
SLOT 5 (RELAY)	SLOT 6 (LOG)	SLOT 7 (LOG)	SLOT 8 (RS485)
DIRECT CONTROL			ADDRESS 12
10.0 s			SPEED 9600
INACTIVE	INACTIVE	ACTIVE	PARITY NONE

- configuration display:

• measure:

228 V	5.01 A
229 V	5.00 A
230 V	4.99 A
229 V	5.00 A

A press on this button displays network configuration.

UNBALANCED
NETWORK
WITH NEUTRAL
TP: 10 TI: 1000

• energy:

10 kW.h
11 kW.h
9 kW.h
30 kW.h

A press on this button displays time range configuration.

TIME: 15:27	
07:00	22:00
09:00	11:00
18:00	20:00

CONFIGURATION

The handbook explains in detail differents possibilities of configuration:
Language, input caliber, network, energy, time, slots.
To enter configuration mode, just press **"C"** key.

1) Method:

At the configuration, the user is asked different types of questions.
For each one, several answers are possible.
You will find below the detailed description of each case.

1.1) Menu selection:

exemple: INPUT
Y - N

The user makes a choice by pressing the keys **"Y"** or **"N"**. This choice allows to access the different menus of configuration.

1.2) Parameter selection:

exemple: VOLTAGE or VOLTAGE
(Y - N) YES (Y - N) NO

Previous choice = YES:
- pressing **"Y"** => choice validation = YES,
- pressing **"↵"** => choice validation = YES,
- pressing **"N"** => choice changing = NO.

Previous choice = NO:
- pressing **"N"** => choice validation = NO,
- pressing **"↵"** => choice validation = NO,
- pressing **"Y"** => choice changing = YES.

Choice is made by pressing **"Y"** or **"N"** keys, and validation is made by pressing corresponding key to displayed answer (**"Y"** for YES and **"N"** for NO) or **"↵"** (PC)/**"EXE"** (PSION). Pressing key **"↵ / EXE"** without modification allows to validate the previous answer.

1.3) Value acquisition:
exemple: LOW SCALE
4 mA

Two cases are possible:
- validation without modification, just press **"↵ / EXE"**,
- value modification on keyboard (simultaneous display), followed by validation with **"↵ / EXE"**.

Note concerning acquisition value :
- It is possible, when a mistake is made during a value acquisition, before validating it, to go back by pressing "DEL" key (only on PSION), which re-displays the message without taking notice of the wrong value.
- In configuration mode, if there is no action, device goes back in operating mode after a two minutes delay without taking notice of modifications made before.
- In configuration mode, if you want to shift to measure mode without taking notice of the modifications made before, you just have to press "ESC" (PC) or "SHIFT + DEL" (PSION) key.

During configuration, if sum has been chosen, device calculate:
- channels mean for voltage, current and frequency.
- channels sum for power and energy.
- channels result for cos φ.

2) Language:
Languages possibilities are:
- French,
- English.

3) Caliber:
On inputs voltage, 2 calibers are available in standard. To use one of twos, just select it in configuration:
- voltage 125 V,
- voltage 500 V.

4) Network:
Network wiring possibilities are:
- in alternating current:
  - monophase,
  - balanced triphase without neutral,
  - balanced triphase with neutral,
  - unbalanced triphase without neutral,
  - unbalanced triphase with neutral.
- in direct current:
  - 1 channel,
  - 2 channels,
  - 3 channels.

It is also necessary to configure:
- PT ratio (potential transformer),
- CT ratio (current transformer).

5) Energy:
In this menu, it is possible to:
- validate energies reset access by front side push-buttons.
- reset all the energies.
  Warning: all energies are definitely reseted.

6) Time:
6.1) Energy meter:
It is possible to use energy meters in two process modes, in meter per phases or in meter per time ranges.
- meter per phases:
  - energy meter 1 for phase 1.
  - energy meter 2 for phase 2.
  - energy meter 3 for phase 3.
  - energy meter 4 for phase sum.

- meter per time ranges:
  - energy meter 1 for off peak hours time range,
  - energy meter 2 for on peak hours time range,
  - energy meter 3 for peak hours time range,
  - energy meter 4 for time range sum.

The **time range** mode has 2 process modes, off peak hours - on peak hours or off peak hours - on peak hours - peak hours. If no time range is valided, device is in **meter per phases**.

6.2) Time ranges:

The time ranges "on peak hours" and "peak hours" are validing and configuring by start and end hour of time range. On the outside of these time range, the counters "off peak hours" are used. The time range "peak hours" can be insered, juxtaposed or detached of time range "on peak hours". The end of time range must be posterior to the time range start. The time ranges control is made over a range which begins at 0 h 00 mn and finishes at 23 h 59 mn.

The time ranges configuration is composed of 4 rubrics:

- present hour:

  control of present hour with hours and minutes acquisition.

- on peak hour:

  • "Yes": validate the process in **"time range"**, validate the "on peak hours" time range and give the control access. The device functions in off peak hours - on peak hours.

  • "No": unvalidate the process in **"time range"**. The device functions in **meter per phases**.

- peak hour 1:

  • "Yes": validate the first time range "peak hours" and give control access. The device functions in off peak hours - on peak hours - peak hours.

  • "No": unvalidate the time range "peak hours". The device functions in off peak hours - on peak hours.

- peak hour 2:

  • "Yes": validate the second time range "peak hours" and give control access.

  • "No": unvalidate the second time range "peak hours".

7) Slots:

7.1) Analogical slot:

Analogical slot configuration is composed of 2 rubrics:

- output assignement:
  - measured value:
    - star voltage, interlinked voltage (only in 3 wattmeters),
    - current,
    - frequency,
    - cos phi,
    - active, reactive, apparent power
    - consumed/generated active, inductive/capacitive reactive energy.
  - measured phase, according to network configuration:
    - phase 1,
    - phase 2,
    - phase 3,
    - phases sum or mean.
  - measure scale, low and high.

- output parameters:
  - type, current or voltage,
  - scale, low and high,
  - numerical filter,
  - limitation.

    Numerical filter allows to smooth an analogical output, measure of which would be disrupted, fluctuating or exposed to interferences.
    Limitation allows to peak clip the output signal swing at scale configuration.

7.2) Relay slot:

Relay slot can be used in alarm, energy meter or direct control.

7.2.1) Alarm:

Slot relay configuration in alarm is composed of 2 rubrics:

- alarm assignement:
  - measured value:
    - star voltage, interlinked voltage (only in 3 wattmeters),
    - current,
    - frequency,
    - cos φ,
    - active, reactive, apparent power
    - consumed/generated active, inductive/capacitive reactive energy.
  - measured phase, according to the configuration of the network:
    - phase 1,
    - phase 2,
    - phase 3
    - phases sum or mean.

- alarm parameters:
  - detection type, high or low threshold,
  - threshold,
  - hysteresis.

Detection type works in this way:

- **High threshold:**
  - .alarm is active when measure is beyond threshold,
  - .alarm is inactive when measure is below threshold less hysteresis.
- **Low threshold:**
  - .alarm is active when measure is below threshold,
  - .alarm is inactive when measure is beyond threshold more hysteresis.

7.2.2) Energy meter:

Relay slot configuration in energy meter is composed of 2 rubrics:

- meter assignement:
  - measured value:
    - consumed active energy,
    - generated active energy,
    - inductive reactive energy,
    - capacitive reactive energy,
  - measured phase or time range according to network configuration:
    - phase 1 or off peak hour time range,
    - phase 2 or on peak hour time range,
    - phase 3 or peak hour time range,
    - phases or time range sum.
- counting parameters:
  - impulse load value, in kvar.h or kW.h.

7.2.2) Direct control:

The relay slot in direct control is only commanded by **RS485 Modbus link**. It can function in 2 differents modes. In **permanent** mode, the relay stay in command state, waiting a new order. In **temporized** mode, the relay make the command order during a defined time at configuration, then cancel the command order at the end of this time.

7.3) Logical slot :

The logical slot has no configuration parameters. His input state, active or unactive, is visualized on the display and can be read with **RS485 Modbus link**.

7.4) RS485 slot:

Configuration of communication is composed of 3 rubrics:

- device **address** in communication network, from 1 to 255,
- **speed**, 600, 1200, 2400, 4800, 9600, 19200 or 38400 bauds,
- **parity**, even, odd or without.

Measure datas are available on differents formats:

- 32 bits floatting IEEE for measures,
- 32 integer unsigned bits for energies,

For more details, see RS485 communication Modbus chapter at the end of handbook.

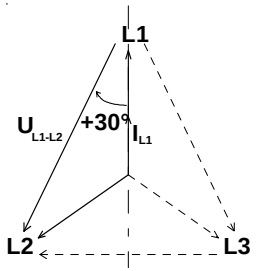
INITIAL ANGLE

Function reserved for experienced users.

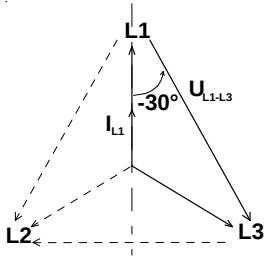
Used only for a balanced triphase network without neutral.This function allows a wiring adaptation. Phase angle acquisition between voltage and current allows to use any voltage phase with any current phase.

To determine the initial angle, you must:

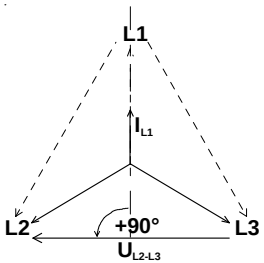
- be in measure mode,
- type **"PHAS"**, function access code, after each code, a beep is emit,
- the message **"INITIAL ANGLE"** followed by initial angle value appears,
- enter the new value of angle,
- then press **"ENTER"** to memorize angle, message **"OK !"** appears.



With I1, L1 and L2, +30° initial angle



With I1, L1 and L3, -30° initial angle



With I1, L2 and L3, +90° initial angle

VALUE TO ENTER AT THE QUESTION : INITIAL ANGLE

	I1	I2	I3
With L1 and L2	**+30°**	**-30°**	**+90°**
With L1 and L3	**-30°**	**+90°**	**+30°**
With L2 and L3	**+90°**	**+30°**	**-30°**

EMC CONSIDERATION

1) Introduction:

In order to satisfy its policy as regards EMC, based on the Community directive 89/336/CE, the LOREME company takes into account the standards relative to this directive from the very start of the conception of each product.
As the devices are devised to work in industrial environments, the various tests are carried out in the sight of the EN 50081-2 and EN 50082-2 standards, in order to make out a statement of conformity.
As the devices lie in certain typical configurations during the tests, it is not possible to secure the outcomes in any possible configuration.
To ensure the best functioning possible of each device, it would be judicious to comply with several recommendations of use.

2) Recommendations of use:

2.1) General remarks:

- Comply with the recommendations of assembly indicated in the technical sheet (direction of assembly, spacing between the devices, ...).
- Comply with the recommendations of use indicated in the technical sheet (temperature range, protection index).
- Avoid dust and excessive humidity, corrosive gas, considerable sources of heat.
- Avoid disturbed environments and disruptive phenomena or elements.
- If possible, group together the instrumentation devices in a zone separated from the power and relay circuits.
- Avoid the direct proximity with considerable power distance switches, contactors, relays, thyristor power groups, ...
- Do not get closer within fifty centimetres of a device with a transmitter (walkie-talkie) of a power of 5 W, because the latter can create a field with an intensity higher than 10 V/M for a distance fewer than 50 cm.

2.2) Power supply:

- Comply with the features indicated in the technical sheet (power supply voltage, frequency, allowance of the values, stability, variations ...).
- It is better that the power supply should come from a system with section switches equipped with fuses for the instrumentation element and that the power supply line be the most direct possible from the section switch.
- Avoid using this power supply for the control of relays, of contactors, of electrogates, ...
- If the switching of thyristor statical groups, of engines, of speed variator, ... causes strong interferences on the power supply circuit, it would be necessary to put an insulation transformer especially intended for instrumentation linking the screen to earth.
- It is also important that the installation should have a good earth system and it is better that the voltage in relation to the neutral should not exceed 1V, and the resistance be inferior to 6 ohms.
- If the installation is near high frequency generators or installations of arc welding, it is better to put suitable section filters.

2.3) Inputs / Outputs:

- In harsh conditions, it is advisable to use sheathed and twisted cables whose ground braid will be linked to the earth at a single point.
- It is advisable to separate the input / output lines from the power supply lines in order to avoid the coupling phenomena.
- It is also advisable to limit the lengths of data cables as much as possible.

PC - ANALYZER LINK

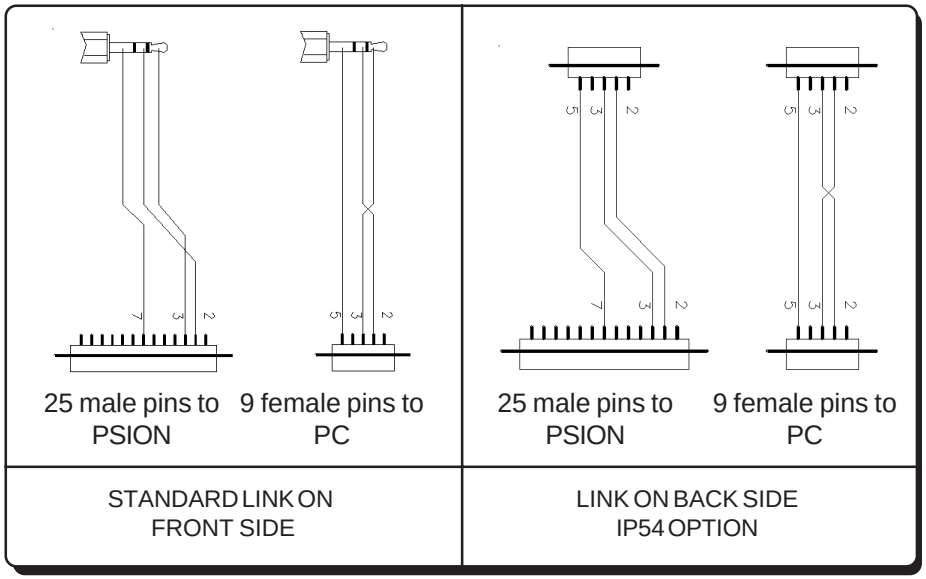
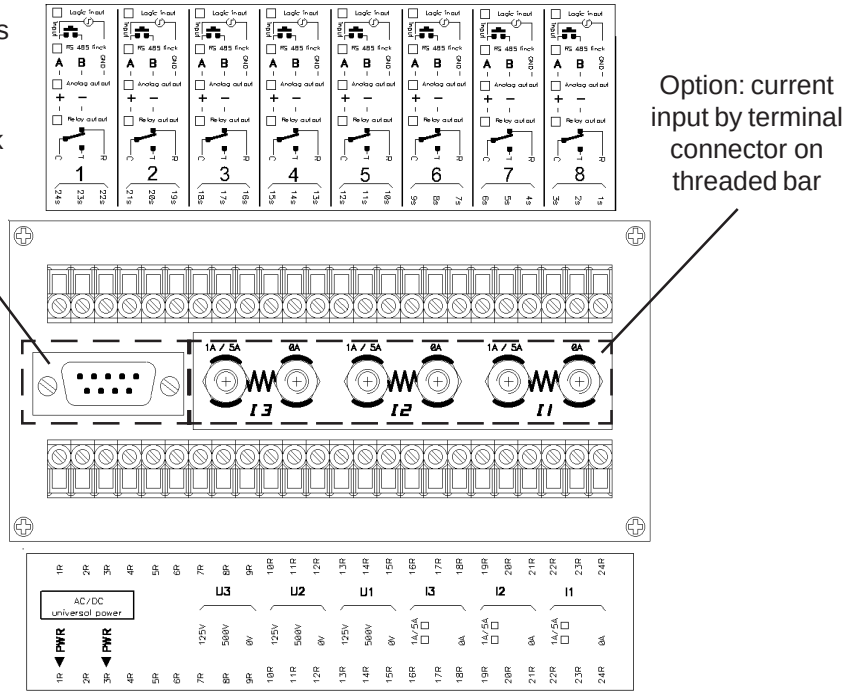


DIAGRAM OF CONNECTION

Inputs / outputs slots

IP54 option : RS232 serial link on back side

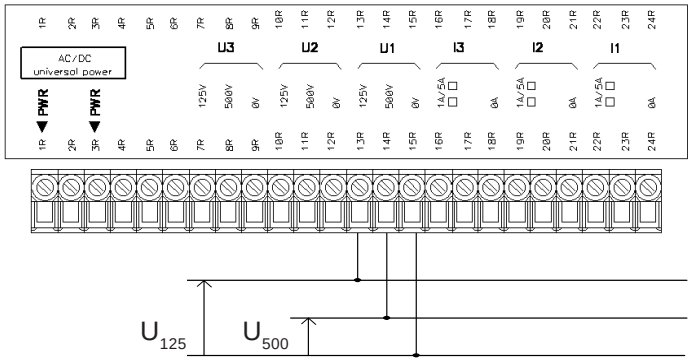
Option: current input by terminal connector on threaded bar



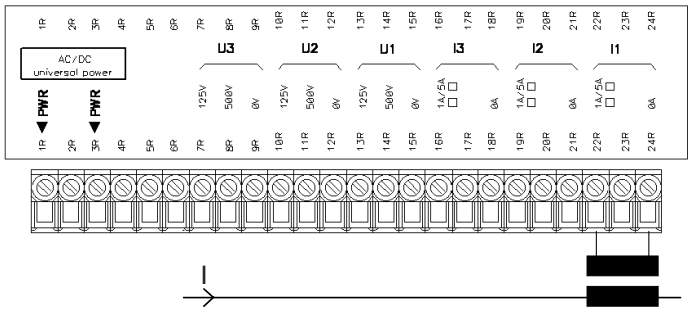
Caliber choices are in function of measure.

- Voltage:
  Two voltage calibers are presents in device, 125 V or 500 V.
  Choice between them is realized in RS232 configuration.
- Current:
  Two versions of the device can be made depending on current caliber, 1 or 5 A.
  The caliber must be precised when ordering.

DIAGRAM OF CONNECTION

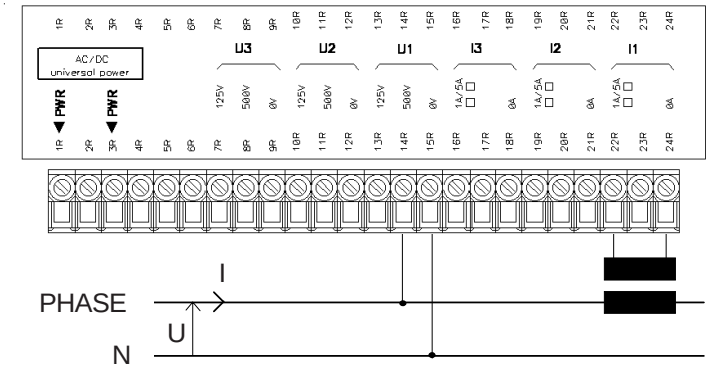


VOLTAGE MEASURE

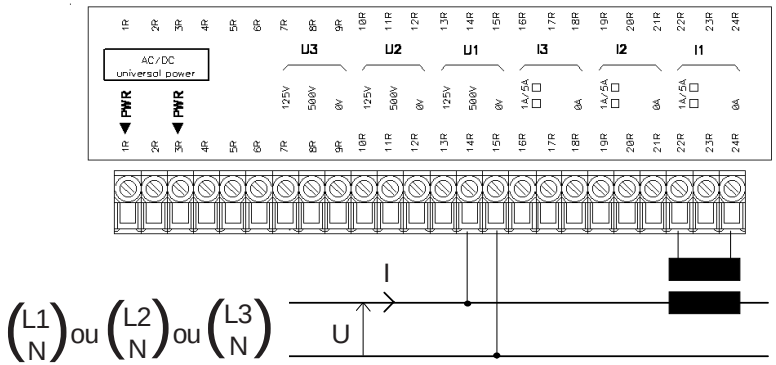


CURRENT MEASURE

DIAGRAM OF CONNECTION

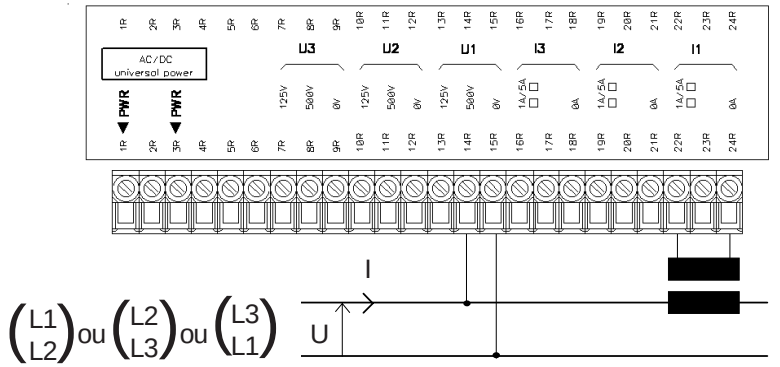


SINGLE PHASE

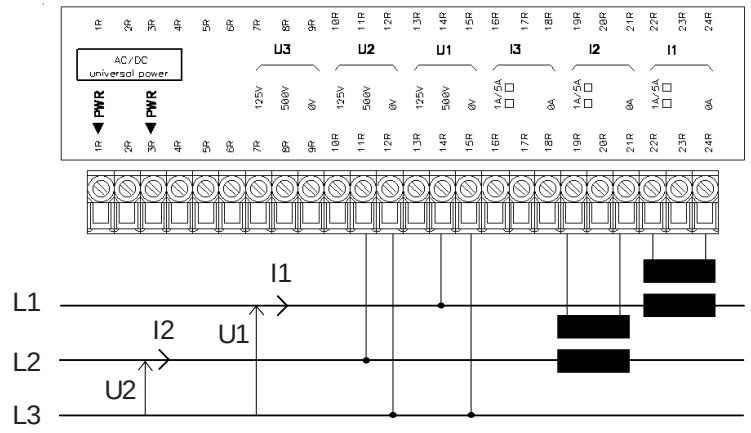


BALANCED TRIPHASE WITH NEUTRAL

DIAGRAM OF CONNECTION

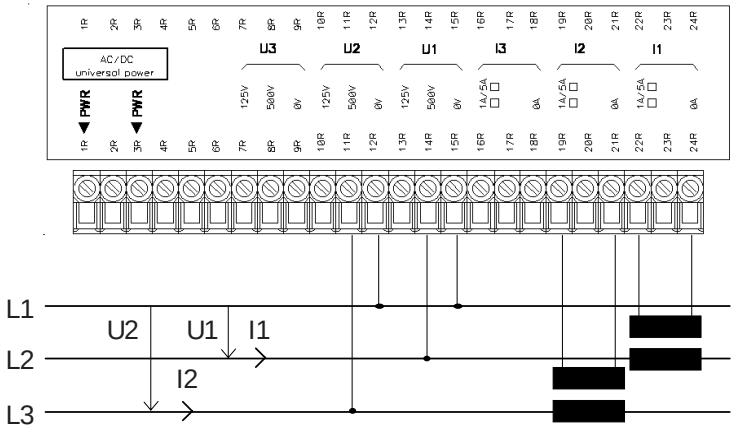


BALANCED TRIPHASE WITHOUT NEUTRAL
Using of initial angle for wiring adaptation

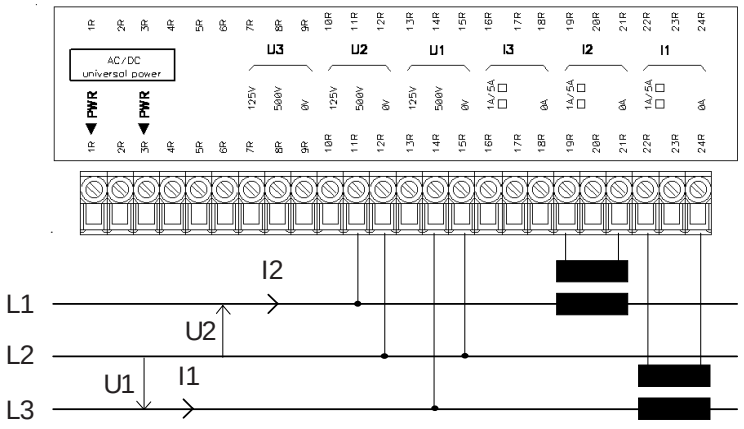


UNBALANCED TRIPHASE WITHOUT NEUTRAL
2 wattmeters methode with I1 and I2 available

DIAGRAM OF CONNECTION

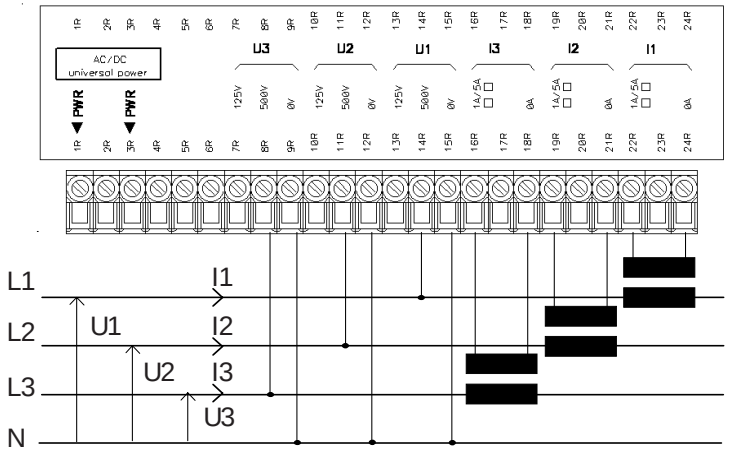


UNBALANCED TRIPHASE WITHOUT NEUTRAL
2 wattmeters methode with I2 and I3 available

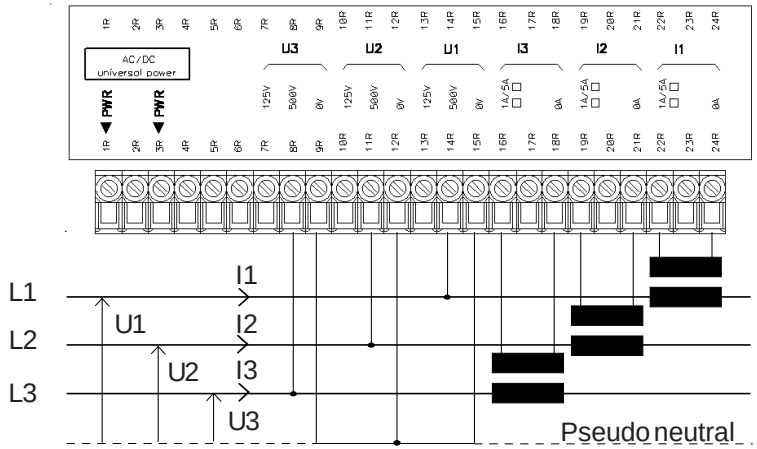


UNBALANCED TRIPHASE WITHOUT NEUTRAL
2 wattmeters methode with I3 and I1 available

DIAGRAM OF CONNECTION



UNBALANCED TRIPHASE WITH NEUTRAL



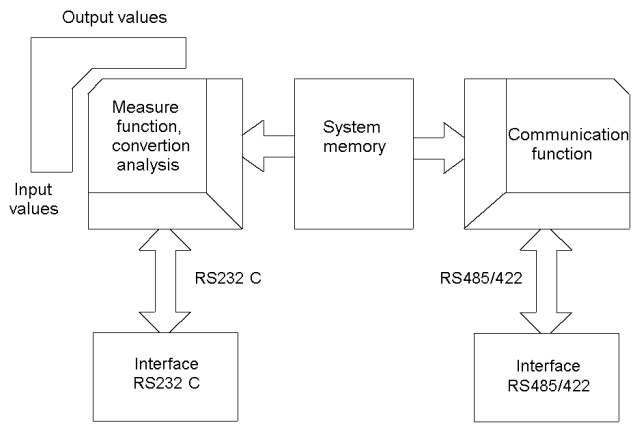
UNBALANCED TRIPHASE WITHOUT NEUTRAL
WITH 3 CURRENTS
Unbalanced three-phase with neutral configuration, the three 0V are linked, device reconstitue a pseudo neutral

RS485 COMMUNICATION MODBUS

1) Internal structure:

1.1) Presentation:

The device is divided in two cells. Each cell has a specific function which keeping a continuous exchange of pieces of information with the second cell. The first cell is in charge of the measure, analysis and conversion function. The second cell is in charge of the communication function. The information exchange is continuous and automatic.



1.2) Measure function:

The measure cell runs the acquisition of the different signals and calculates all the values with regards to the configuration of the device.
It also runs all the output functions (analogical, alarm, meter, RS 232). All measured or calculated parameters are stored in the system memory and are constantly refreshed.

1.3) Communication function:

The communication cell runs the RS485 communication interface in the MODBUS/JBUS protocol. It analyzes the requests of the main station and answers if the device is addressed. It draws all these datas from the system memory that can be continuously accessed.

1.4) System memory:

Each cell can continuously access the system memory. The latter has a dual access, which allows a reading/writing of the data without any possible internal conflicts.

2) Communication:

The type of used protocol is MODBUS/JBUS in RTU mode. The communication has neither header nor delimitator of frame. The detection of the frame start is made by a silence whose time is at least equal to the transmission of 3.5 bytes. It implies that a frame received can be processed only after a time equal to the silence given before. The time of this silence is directly linked to the speed of transmission of the system:

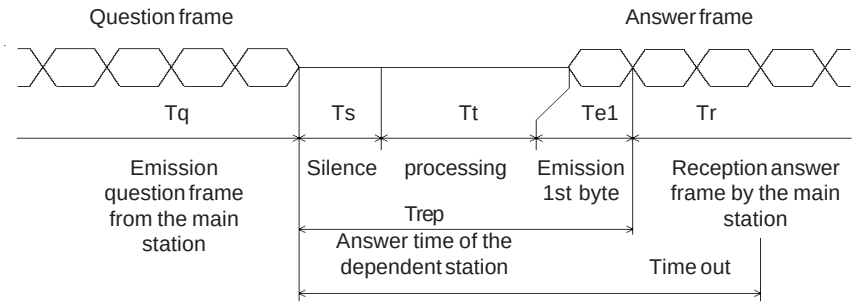
Ex: Speed 9600 bauds - no parity (10 bits/byte)
Silence = (3.5 x 10) / 9600 = 3.64 ms

The device starts to process the frame 3.64 ms after receiving the last byte.

Note: The time separating two bytes from a same frame must be inferior to a silence. If the user does not comply with this condition, the second byte will be considered as the first one of a new frame.

The interval of time separating the end of reception of the last byte of the question frame and the end of emission of the first byte of the answer frame (detection of frame of the main station) constitutes the answer time of the device.
This answer time Trep includes:

- the silence (time of 3.5 bytes) Ts,
- the processing of the frame Tt,
- the emission of the first byte Te1.



The time beyond which the device does not answer is called **Time out**. It depends on the transmission parameters (speed, format) and the type of the function asked (reading, writing). This time must be defined by the user and must be superior to the answer time of the device.
A complete cycle of communication includes :

- the transmission of the question frame Tq
- the answer time of the device Trep
- the transmission of the answer frame Tr

Three reasons might cause a **time out**:

- wrong transmission data at the time of the question frame
- wrong configuration of the **time out** on the main station
- dependent station out-of-order.

3) Implementation:

3.1) Parametrizing:

Before starting up the RS485 MODBUS/JBUS communication, make sure that:

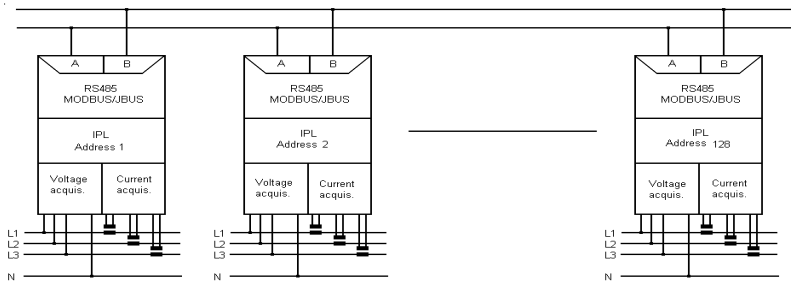
- the speed of transmission is identical between the dependent stations (LOREME devices) and the main station.
- the parity is identical between the dependent stations (LOREME devices) and the main station.
- the addresses are correctly distributed among the dependent stations (LOREME devices), no identical addresses for two dependent stations.
- the time out is correctly adjusted on the main station.

All the parameters of speed, parity and address must be configured on the devices with the RS232 link.
The possibilities of configuration of the devices are the following ones:

- address: from 1 to 255
- speed: 600, 1200, 2400, 4800, 9600, 19200, 38400 bauds
- parity: even, odd, without.

3.2) Interconnection:

The RS485 interface used allows to connect 128 dependent stations on the same network. For better operating conditions (noise immunity), the network will have to be made up of a twisted pair.



4) Communication time:

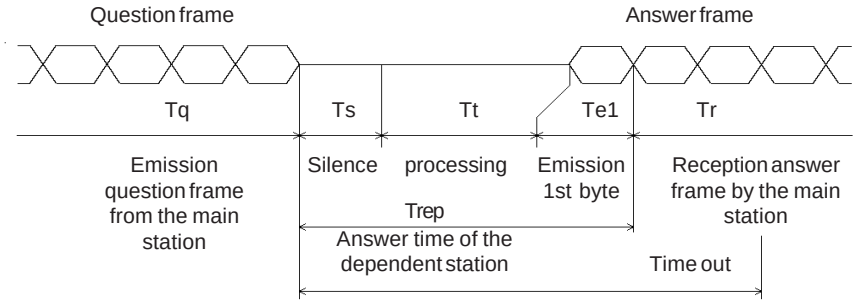
4.1) Procedure:

Analysis of the times of communication for parameters of data transmission and for particular cases.

- measures phase reading, energy reading,
- energy reset, energy value writing,
- speed: 9600 bauds, parity: none.

4.2) <u>Phase measures reading:</u>

Reading of 16 words (32 bytes) from address $0FFE to $100D (phase 1)

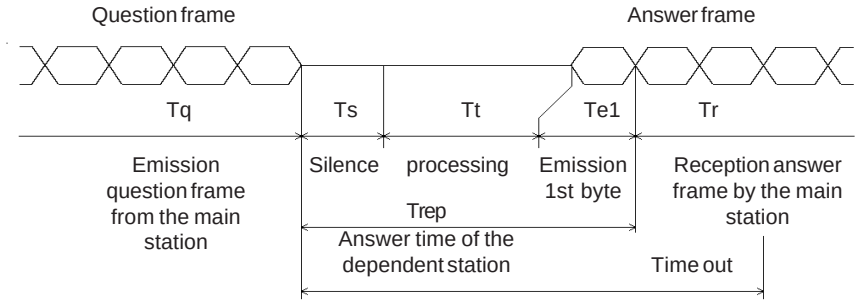


- 8 bytes question frame	Tq = (8 x 10) / 9600 = 8.33 ms
- Silence	Ts = (3.5 x 10) / 9600 = 3.64 ms
- Processing	Tt = 40 ms
- Emission 1st byte	Te1 = (1 x 10) / 9600 = 1.04 ms
- Answer time	Trep = Ts + Tt + Te1 = 44.68 ms
- Answer frame (37 bytes)	Tr = [(37 - 1) x 10] / 9600 = 37.5 ms
- Complete cycle	Tcyc = Tq + Trep + Tr = 90.5 ms

The processing time Tt is fixed. It depends neither on the speed nor on the format of transmission. Consequently, for new parameters of transmission, all the times are going to change but for Tt.
To set the **time out** of the system, you just have to calculate the answer time Trep of the dependent station according to the parameters of communication.
For a total reading of the phase, the time of cycle of the system is about 90 ms.

4.3) <u>Energies reading:</u>

Reading of 16 words, 32 bytes, of the address $5000 to $500F (positives energies).

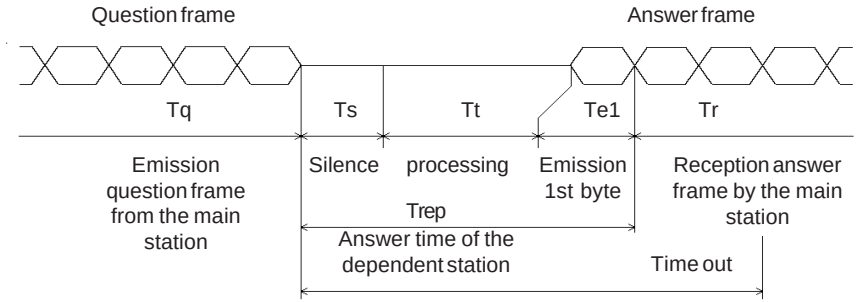


- 8 bytes question frame	Tq = (8 x 10) / 9600 = 8.33 ms
- Silence	Ts = (3.5 x 10) / 9600 = 3.64 ms
- Processing	Tt = 40 ms
- Emission 1st byte	Te1 = (1 x 10) / 9600 = 1.04 ms
- Answer time	Trep = Ts + Tt + Te1 = 44.68 ms
- Answer frame (37 bytes)	Tr = [(33 - 1) x 10] / 9600 = 37.5 ms
- Complete cycle	Tcyc = Tq + Trep + Tr = 90.5 ms

The processing time Tt is fixed. It depends neither on the speed nor on transmission format. Consequently, for new parameters of transmission, all the times are going to change but for Tt.
To set the **time out** of the system, you just have to calculate answer time Trep of the dependent station according to the parameters of communication.
For a total phase reading, the system time cycle is about 90 ms.

4.4) <u>Energies reset:</u>

Reset of all energies, consumed and generated actives, inductives and capacitive reactives, by writing of $55AA at the address $7000.

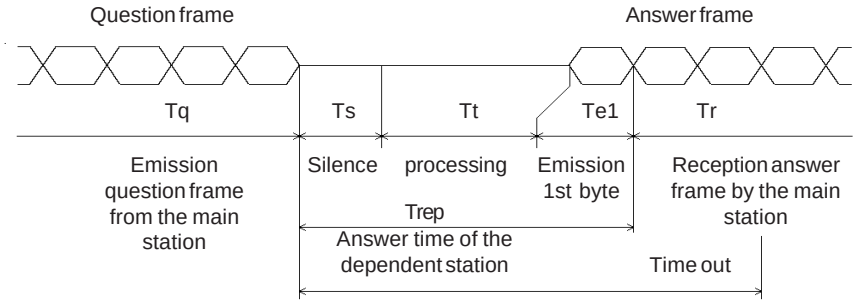


- 8 bytes question frame	Tq = (8 x 10) / 9600 = 8.33 ms
- silence	Ts = (3.5 x 10) / 9600 = 3.64 ms
- processing	Tt = 40 ms
- emission 1st byte	Te1 = (1 x 10) / 9600 = 1.04 ms
- answer time	Trep = Ts + Tt + Te1 = 44.68 ms
- 8 bytes answer frame	Tr = [(8 - 1) x 10] / 9600 = 7.29 ms
- complete cycle	Tcyc = Tq + Trep + Tr = 60.3 ms

The processing time Tt is fixed. It depends neither on the speed nor on the format of transmission. Consequently, for new parameters of transmission, all the times are going to change but for Tt.

To set the **time out** of the system, you just have to calculate the answer time Trep of the dependent station according to the parameters of communication. For a complete reset of the energies, the time of cycle of the system is about 60 ms.

4.5) <u>Energy value writing</u>:
Writing of one energy value at once, active consumed or generated, reactive inductive or capacitive energy on the sum of the channels. Writting of 2 words, 4 bytes, at the adress $500C (active consummed energy).



- 13 bytes question frame	Tq = (13 x 10) / 9600 = 13.54 ms
- Silence	Ts = (3.5 x 10) / 9600 = 3.64 ms
- Processing	Tt = 40 ms
- Emission 1st byte	Te1 = (1 x 10) / 9600 = 1.04 ms
- Answer time	Trep = Ts + Tt + Te1 = 44.68 ms
- 8 bytes answer frame	Tr = [(8 - 1) x 10] / 9600 = 7.29 ms
- Complete cycle	Tcyc = Tq + Trep + Tr = 65.51 ms

The processing time Tt is fixed. It depends neither on the speed nor on the format of transmission. Consequently, for new parameters of transmission, all the times are going to change but for Tt.
To set the **time out** of the system, you just have to calculate the answer time Trep of the dependent station according to the parameters of communication. For a writing of energy value, the time of cycle of the system is about 65 ms.

5) <u>Frames structure:</u>
5.1) <u>Words reading:</u>
Function code used: $03 or $04

Phase 1 table reading:	address $0FFE to $100D
Phase 2 table reading:	address $1FFE to $200D
Phase 3 table reading:	address $2FFE to $300D
Sum phase measure reading:	address $3FFE to $400D
Consumed and inductive energy reading:	address $5000 to $500F
Generated and capacitive energy reading:	address $6000 to $600F
Slots reading	address $8000

Question: length of frame 8 bytes.

Address	Function Code	Address 1st word PF Pf	Number of words PF Pf	CRC16 Pf PF
1	1	2	2	2

Answer: length of frame 5 bytes + number of read bytes.

Address	Function Code	Number of bytes	Value of the words	CRC16 Pf PF
1	1	1	number of red bytes	2

5.2) <u>Word writing:</u>
Function code used: $06

Slot state writing	Address $8000	Value $XXXX
Reset of all the energies:	Address $7000	Value $55AA

Question: length of frame 8 bytes

Address	Function Code	Address word PF Pf	Value word PF Pf	CRC16 Pf PF
1	1	2	2	2

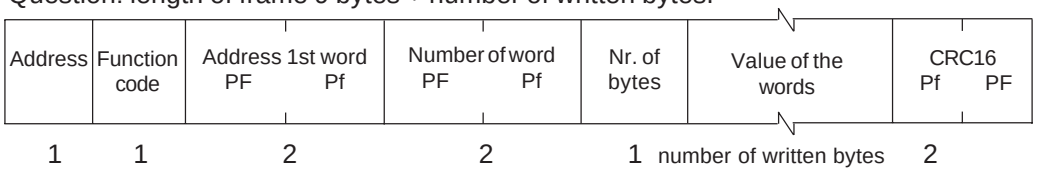
Answer: length of frame 8 bytes

Address	Function Code	Address word PF Pf	Value word PF Pf	CRC16 Pf PF
1	1	2	2	2

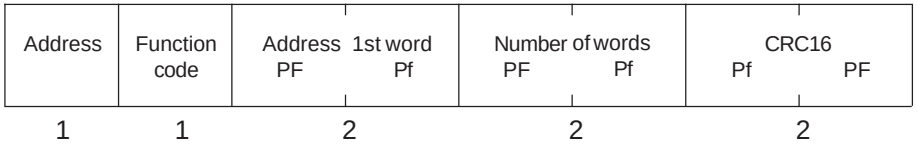
5.3) <u>Words writing</u>:
Function code used: $10

Active consumed energy:	address $500C,
Active generated energy:	address $500E,
Reactive inductive energy:	address $600C,
Reactive capacitive energy:	address $600E.

Question: length of frame 9 bytes + number of written bytes.



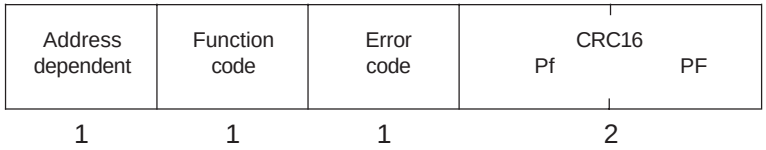
Answer: length of frame 8 bytes.



5.4) <u>Exception frame</u>:

When a physical error of transmission of a question frame occurs (CRC16 or parity), the dependent station does not answer.
If an error of frame (data address, function, value) occurs, an answer of exception will be emitted by the dependent station.

Length of frame: 5 bytes.



Features of the exception frame:
Function code:
The function code of the exception frame is identical to the one of the question frame, but the most significant bit is set to 1 (logical or with $80).
Error code:
Error code establishes the reason of a sending of an exception frame.

Error frame	Meaning
$01	Function code not used. Only the functions reading of words, $03 / $04, writing of a word $06, or words $10 are allowed.
$02	Non-valid data address. Memory access not allowed.
$03	Non-valid value. Value of word not allowed.

6) <u>Communication data</u>:

6.1) <u>Measures / energies reading</u>:

All measures are accessible in reading mode. Voltage, current, frequency, power, cosinus, energy on phases 1, 2, 3 and sum of phases.

Numerical values are:

- 2 words, 4 bytes, at IEEE floating 32 bits format for voltages, currents, frequencies, active, reactive, apparent powers, cosinus.
- 2 words, 4 bytes, at unsigned real integer 32 bits format for all energies (values in kW.h and kvar.h.).

Consult the enclosed tables for address details.

6.2) <u>Energies writing</u>:

It's possible to reset all energies by a write. Reset is made by writting $55AA value.

Phases sum energy values are accessible individually in writing and only one value at time. Writing format is the same as reading one, unsigned 32 bits integer format.

In process without time range, the distribution of the writed energy value is realized with network configuration (monophase, triphase balanced with or without neutral, triphase unbalanced with or without neutral). For exemple, in triphase unbalanced with neutral, the energy value writing is divided equitably over 3 meters of 3 measured phases.

In process with time range, the distribution of the writed energy value is realized with the number of time ranges. For exemple, over 3 time ranges, the energy value writing is divided equitably over 3 meters of 3 time ranges.

6.3) <u>Slots reading / writing:</u>

The "logical" slots, "alarm relay" and "meter relay" are accessible in read-only mode. The "direct control relay" slots are accessible in read and write mode. The "analogical" slots and "RS485" are not accessible neither reading mode nor writing mode and are forced at 0.

A word, at $8000 adress, divided in 2 parts, most significant - least significant, allows to access to slots in reading and writing mode. The most significant is called "control", and the least significant is called "state".

6.3.1) Reading:

A readind access is realized with the function code $03 or $04. The "control", the most signicant of the word at $8000 address, indicates if the slots are in read-only mode (bit at 0) or in reading / writing mode (bit at 1). The least significant indicates the slots state (bit at 0 = low, bit at 1 = high).

Exemple:

control	b7	b6	b5	b4	b3	b2	b1	b0	$8000 address
slot n°	8	7	6	5	4	3	2	1	most significant
value	1	0	0	1	0	0	0	1	

The bits at state 1 define the slots in reading / writing mode (8, 5, 1), the others (7, 6, 4, 3 and 2) are in reading mode.

state	b7	b6	b5	b4	b3	b2	b1	b0	$8000 adress
slot n°	8	7	6	5	4	3	2	1	least significant
value	0	0	0	1	1	1	0	0	

The slots 5, 4 and 3 are at high states, the slots 8, 7, 6, 2 and 1 are at low state.

6.3.2) Writing:

A writing access is realized with the function code $06. The "control", the most signicant of the word at $8000 address, will define the slot(s) which we want to write (bit at 1), the others are not concerned by the writing process (bit at 0). The least significant indicates the slots writing state (bit at 0 = low, bit at 1 = high).

Exemple:

control	b7	b6	b5	b4	b3	b2	b1	b0	$8000 address
n° slot	8	7	6	5	4	3	2	1	most significant
valeur	1	0	0	0	0	0	0	1	

The writing is request on the slots 8 and 1, the others are not concerned.

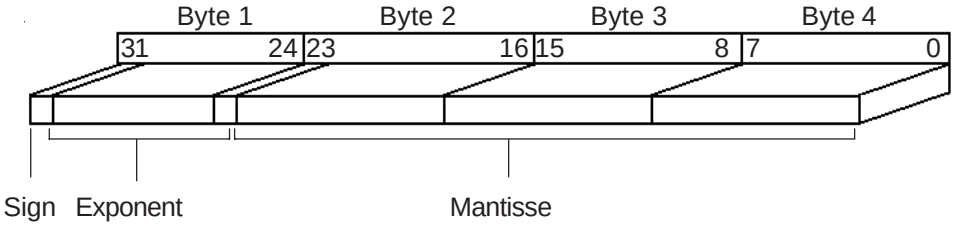
state	b7	b6	b5	b4	b3	b2	b1	b0	$8000 address
slot n°	8	7	6	5	4	3	2	1	least significant
value	1	X	X	X	X	X	X	0	

The writing state for the slot 8 is high, this for the slot 1 is low. The other state bits have no effects.

6.4) Data format:

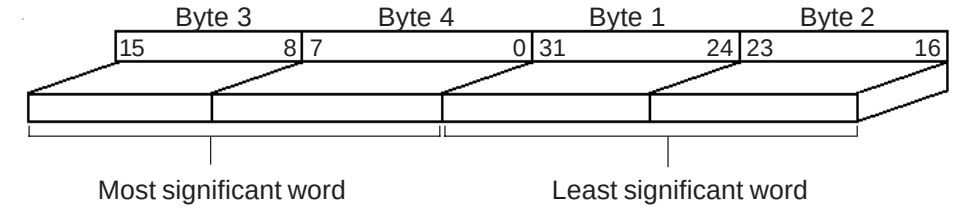
- Data at floating IEEE 32 bits format.

Data transmitted with most significant byte first, composed of 4 bytes, 2 words.



- Data at the format integer 32 bits.

Data transmitted with most significant byte first, composed of 4 bytes, 2 words.



- Writting datas of energy reset is a hexadecimal code. This code is composed of 2 bytes, 1 word.

Code $55AA: reset of all the energies.

- The writing data for slots writing is a binary code. This code is composed of 2 bytes, 1 word which defines control and state of slots (see previous chapter).

7) Table of data:

7.1) Phase 1 measures:

Words address	b7	b6	b5	b4	b3	b2	b1	b0	Total Word	Total Byte
$0FFE	Interlinked voltage				Byte 1		Word 1		1	1
					Byte 2					2
$0FFF					Byte 3		Word 2		2	3
					Byte 4					4
$1000	Star voltage				Byte 1		Word 1		3	5
					Byte 2					6
$1001					Byte 3		Word 2		4	7
					Byte 4					8
$1002	Current				Byte 1		Word 1		5	9
					Byte 2					10
$1003					Byte 3		Word 2		6	11
					Byte 4					12
$1004	Frequency				Byte 1		Word 1		7	13
					Byte 2					14
$1005					Byte 3		Word 2		8	15
					Byte 4					16
$1006	Active power				Byte 1		Word 1		9	17
					Byte 2					18
$1007					Byte 3		Word 2		10	19
					Byte 4					20
$1008	Reactive power				Byte 1		Word 1		11	21
					Byte 2					22
$1009					Byte 3		Word 2		12	23
					Byte 4					24
$100A	Apparent power				Byte 1		Word 1		13	25
					Byte 2					26
$100B					Byte 3		Word 2		14	27
					Byte 4					28
$100C	Cosinus phi				Byte 1		Word 1		15	29
					Byte 2					30
$100D					Byte 3		Word 2		16	31
					Byte 4					32

7.2) Phase 2 measures:

Words address	b7	b6	b5	b4	b3	b2	b1	b0	Total Word	Total Byte
$1FFE	Interlinked voltage				Byte 1		Word 1		1	1
					Byte 2					2
$1FFF					Byte 3		Word 2		2	3
					Byte 4					4
$2000	Star voltage				Byte 1		Word 1		3	5
					Byte 2					6
$2001					Byte 3		Word 2		4	7
					Byte 4					8
$2002	Current				Byte 1		Word 1		5	9
					Byte 2					10
$2003					Byte 3		Word 2		6	11
					Byte 4					12
$2004	Frequency				Byte 1		Word 1		7	13
					Byte 2					14
$2005					Byte 3		Word 2		8	15
					Byte 4					16
$2006	Active power				Byte 1		Word 1		9	17
					Byte 2					18
$2007					Byte 3		Word 2		10	19
					Byte 4					20
$2008	Reactive power				Byte 1		Word 1		11	21
					Byte 2					22
$2009					Byte 3		Word 2		12	23
					Byte 4					24
$200A	Apparent power				Byte 1		Word 1		13	25
					Byte 2					26
$200B					Byte 3		Word 2		14	27
					Byte 4					28
$200C	Cosinus phi				Byte 1		Word 1		15	29
					Byte 2					30
$200D					Byte 3		Word 2		16	31
					Byte 4					32

7.3) Phase 3 measures:

Words address	b7	b6	b5	b4	b3	b2	b1	b0	Total Word	Total Byte
$2FFE	Interlinked voltage				Byte 1		Word 1		1	1
					Byte 2					2
$2FFF					Byte 3		Word 1		2	3
					Byte 4					4
$3000	Star voltage				Byte 1		Word 1		3	5
					Byte 2					6
$3001					Byte 3		Word 2		4	7
					Byte 4					8
$3002	Current				Byte 1		Word 1		5	9
					Byte 2					10
$3003					Byte 3		Word 2		6	11
					Byte 4					12
$3004	Frequency				Byte 1		Word 1		7	13
					Byte 2					14
$3005					Byte 3		Word 2		8	15
					Byte 4					16
$3006	Active power				Byte 1		Word 1		9	17
					Byte 2					18
$3007					Byte 3		Word 2		10	19
					Byte 4					20
$3008	Reactive power				Byte 1		Word 1		11	21
					Byte 2					22
$3009					Byte 3		Word 2		12	23
					Byte 4					24
$300A	Apparent power				Byte 1		Word 1		13	25
					Byte 2					26
$300B					Byte 3		Word 2		14	27
					Byte 4					28
$300C	Cosinus phi				Byte 1		Word 1		15	29
					Byte 2					30
$300D					Byte 3		Word 2		16	31
					Byte 4					32

7.4) Phase sum measures:

Words address	b7	b6	b5	b4	b3	b2	b1	b0	Total Word	Total Byte
$3FFE	Interlinked voltage				Byte 1		Word 1		1	1
					Byte 2					2
$3FFF					Byte 3		Word 1		2	3
					Byte 4					4
$4000	Star voltage				Byte 1		Word 1		3	5
					Byte 2					6
$4001					Byte 3		Word 2		4	7
					Byte 4					8
$4002	Current				Byte 1		Word 1		5	9
					Byte 2					10
$4003					Byte 3		Word 2		6	11
					Byte 4					12
$4004	Frequency				Byte 1		Word 1		7	13
					Byte 2					14
$4005					Byte 3		Word 2		8	15
					Byte 4					16
$4006	Active power				Byte 1		Word 1		9	17
					Byte 2					18
$4007					Byte 3		Word 2		10	19
					Byte 4					20
$4008	Reactive power				Byte 1		Word 1		11	21
					Byte 2					22
$4009					Byte 3		Word 2		12	23
					Byte 4					24
$400A	Apparent power				Byte 1		Word 1		13	25
					Byte 2					26
$400B					Byte 3		Word 2		14	27
					Byte 4					28
$400C	Cosinus phi				Byte 1		Word 1		15	29
					Byte 2					30
$400D					Byte 3		Word 2		16	31
					Byte 4					32

7.5) Actives consumed, inductives reactives energies:

Words adress	b7	b6	b5	b4	b3	b2	b1	b0	Total Words	Total Bytes
$5000	Active energy				Byte 1		Word 1		1	1
	consumed				Byte 2					2
$5001	phase 1				Byte 3		Word 2		2	3
					Byte 4					4
$5002	Reactive energy				Byte 1		Word 1		3	5
	inductive				Byte 2					6
$5003	phase 1				Byte 3		Word 2		4	7
					Byte 4					8
$5004	Active Energy				Byte 1		Word 1		5	9
	consumed				Byte 2					10
$5005	phase 2				Byte 3		Word 2		6	11
					Byte 4					12
$5006	Reactive energy				Byte 1		Word 1		7	13
	inductive				Byte 2					14
$5007	phase 2				Byte 3		Word 2		8	15
					Byte 4					16
$5008	Active energy				Byte 1		Word 1		9	17
	consumed				Byte 2					18
$5009	phase 3				Byte 3		Word 2		10	19
					Byte 4					20
$500A	Reactive energy				Byte 1		Word 1		11	21
	inductive				Byte 2					22
$500B	phase 3				Byte 3		Word 2		12	23
					Byte 4					24
$500C	Active energy				Byte 1		Word 1		13	25
	consumed				Byte 2					26
$500D	phases sum				Byte 3		Word 2		14	27
					Byte 4					28
$500E	Reactive energy				Byte 1		Word 1		15	29
	inductive				Byte 2					30
$500F	Phases sum				Byte 3		Word 2		16	31
					Byte 4					32

7.6) Actives generated, capacitives réactives energies:

Words adress	b7	b6	b5	b4	b3	b2	b1	b0	Total Words	Total Bytes
$6000	Active energy				Byte 1		Word 1		1	1
	generated				Byte 2					2
$6001	phase 1				Byte 3		Word 2		2	3
					Byte 4					4
$6002	Reactive energy				Byte 1		Word 1		3	5
	capacitive				Byte 2					6
$6003	phase 1				Byte 3		Word 2		4	7
					Byte 4					8
$6004	Active energy				Byte 1		Word 1		5	9
	generated				Byte 2					10
$6005	phase 2				Byte 3		Word 2		6	11
					Byte 4					12
$6006	Reactive energy				Byte 1		Word 1		7	13
	capacitive				Byte 2					14
$6007	phase 2				Byte 3		Word 2		8	15
					Byte 4					16
$6008	Active energy				Byte 1		Word 1		9	17
	generated				Byte 2					18
$6009	phase 3				Byte 3		Word 2		10	19
					Byte 4					20
$600A	Reactive enegy				Byte 1		Word 1		11	21
	capacitive				Byte 2					22
$600B	phase 3				Byte 3		Word 2		12	23
					Byte 4					24
$600C	Active energy				Byte 1		Word 1		13	25
	generated				Byte 2					26
$600D	Phases sum				Byte 3		Word 2		14	27
					Byte 4					28
$600E	Reactive energy				Byte 1		Word 1		15	29
	capacitive				Byte 2					30
$600F	Phases sum				Byte 3		Word 2		16	31
					Byte 4					32