CONFIGURATION HANDBOOK

IPL 144V

Table of contents

RS232 link setting

LOREME

The device can be configured or updated in terminal mode via an RS232 link.

Step 1: Driver installation for USB / RS232 adapter

- download driver at www.loreme.fr:
> http://www.loreme.fr/aff_produits.asp?rubid=53&langue=fr

- Click on executable file to install the driver,
- Plug the cable on a USB port, Windows install a new serial communication port **COMx** (x >= 4).

Note :
The use of the cable on another USB port don't generates a new communication port. Use of another adapter generates another communication port number (COMx) and requires the reconfiguration of the hyperterminal.

Step 2: Setting of terminal emulation software (PC with windows).

1 The terminal emulation software for PC « HyperTerminal » is resident in windows up to XP version. For later versions, it is downloadable on : **www.loreme.fr in download part** (http://www.loreme.fr/HyperTerm/htpe63.exe)

=> Run the downloaded software to install it.

2 Start a "hyper Terminal" connection :
- Click on **"START"** button
Up to XP version
- Go to **"Programs \ Accessories \ Communication \ Hyper Terminal"**
- Click on **"Hypertrm.exe"**
Or if the software was downloaded
- Go to **"All programs \ HyperTerminal Private Edition"**
- Click on **"HyperTerminal Private Edition"**

3 Enter name for the new connection

4 Choose the communication port related to the adapter.

5 Choose:
- 9600 bauds
- 8 DATA bits
- no parity
- 1 stop bit
- **XON/XOFF**

6 The PC is now in terminal mode, connect it to the device by plugging the RS232 cable. The measure is now displayed on the terminal. To access configuration, press 'C' key.

7 When leaving Hyper terminal, the following window will appear. By saving, the terminal session will start with the same configuration.

Thus, the shortcut LOREME.ht will permit to communicate with all LOREME devices.

Note: To modify the parameters of terminal session whereas this one is connected, it is necessary to disconnect it, modify the parameters and then to reconnect it.

Device Presentation

LOREME

The purpose of this configuration handbook is to allow to become familiar with functions supplied by the device.
The device provides functions required to the analysis of every networks. It possess 3 voltage inputs and 3 current inputs isolated allowing to realise direct and alternating measures, one-phase or three-phase, balanced or unbalanced, with or without neutral.

It's necessary to notice the differences between different available models:
      .IPL144V: basic version.
      .IPL144V/R: 2 configurable relays in alarm or meter option.
      .IPL144V/CM: 1 MODBUS/JBUS RS485 link option.
      .IPL144V/CP: 1 PROFIBUS link option.

The technical data sheets are downloadable here: http://www.loreme.fr/fichtech/CPL35_eng.pdf

USER INTERFACE

LED Display

Push buttons
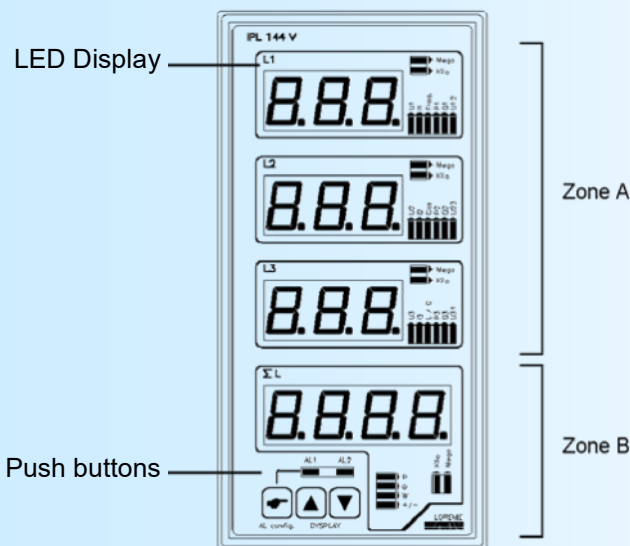
Zone A

Zone B

The IPL144V front side is composed of :
- 3 displays of 3 digits, 1000 points (zone A)
- 1 display of 4 digits, 10000 points (zone B)
- 2 reds leds indicating alarms state,
- 8 reds leds indicating scale factor for each displayed value
- 22 reds leds indicating display value type

- 3 push-buttons:
      "Al config" allows to access to alarm threshold adjustment (subsequently available),

      "Up" allows to select displayed measure type for zone A,

      "Down" allows to select displayed measure type for zone B.

      A simultaneously press on "Up" and "Down" keys allows to reset all energies measures if the function is validated in RS232 configuration.

Each zone disposes of 6 display modes:
For zone A, display possibilities are the next:
      - Star voltage phase 1, 2, 3 ("U" leds are on),
      - Currents phase 1, 2, 3 ("I" leds are on),
      - Frequency, Cos Phi and network type, ("F", "Cos" and "L/C" leds are on),
      - Actives powers phase 1, 2, 3 ("P" leds are on),
      - Reactive powers phase 1, 2, 3 ("Q" leds are on),
      - Interlinked voltage phase 12, 23, 31 ("U12", "U23" and "U31" leds are on),

For zone B, display possibilities are the next:
- Network active power, ("P" led is on)
- Network reactive power, ("Q" led is on),
- Network consumed active energy, ("W" led and "P" led are on),
- Network inductive reactive energy, ("W" led and "Q" led are on),
- Network generated active energy, ("W" led, "P" led and "+/-" led are on),
- Network capacitive reactive energy, ("W" led, "Q" led and "+/-" led are on)

Measures are given in Kilo when "K" led is on, Mega when "M" led is on, Giga when "K" and "M" leds are on.

Configuration

LOREME

1) Visualization:

When switching on, device is automatically put in measure mode.2 displays modes are available:

    2 lines mode: one only measure visualization,

    Full-screen mode: all measures visualization.

This access keyboard keys allow to modify visualization mode on RS232:

"1"	phase 1,	**"Space"**	measure type change,
"2"	phase 2,	**"$"**	full-screen (PC only),
"3"	phase 3,	**"Enter"**	2 lines mode return,
"S"	network (3L).	**"C"**	configuration access,

On 2 lines display mode, the visualization is the next:

STAR VOLTAGE L1	Measure type and phase displayed
230 V	Measure value

On full screen display mode, the visualization is the next:

	L1	L2	L3	3L
VOLTAGE	230 V	229 V	225 V	228 V
	398 V	392 V	392 V	394 V
CURRENT	1.13 A	1.23 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
TI RATIO	1.00

For a better visualization of full-screen mode on PC, it is advised to use KERMIT software. This utilisation mode slows down the device, It is recommended to quit this mode when it is not necessary.

2) Method:

This manual recapitulates different possibilities of configuration: language, network, energy, relay 1, relay 2, communication. To enter in configuration mode, type on **"C"** key.

2.1) Menu selection:

Example: INPUT

             Y - N

The choice is done by typing on **"Y"** or **"N"** keys. This choice allows access to different configuration menus.

2.2) Parameter selection:

Example: VOLTAGE   or   VOLTAGE

             (Y-N) YES   (Y-N) NO

Previous choice = YES:	- push on **"Y"**	=> Validation, choice = YES,
	- push on **"Enter"**	=> Validation, choice = YES,
	- push on **"N"**	=> Change, choice = NO.
Previous choice = NO:	- push on **"N"**	=> Validation, choice = NO,
	- push on **"Enter"**	=> Validation, choice = NO,
	- push on **"Y"**	=> Change, choice = YES.

Choices are made pushing on **"Y"** or **"N"** keys, and validation by pushing on **"Enter"** (PC) / **"EXE"** (PSION) when the answer **"Y"** or **"N"** is displayed. Pushing on the key **"Enter"** / **"EXE"** without modification allows to validate previous answer.

2.3) <u>Value acquisition:</u>
Example: LOW SCALE
                  4 mA
Two possibilities: - The validation without modification by pushing on **"Enter"** / **"EXE"**,
                         - The keyboard value modification (simultaneous display), then the validation by **"Enter"** / **"EXE"**.

Note concerning the value acquisition:
- It is possible, when a mistake is made during a value acquisition, before validating it, to go back by pressing the "DEL" key (only on PSION), which re-displays the message without taking notice of the wrong value.
- In configuration mode, if there's no action during 2 minutes, device goes back in operating mode without taking notice of the modifications made before.- In configuration mode, if you want to shift to measure mode without taking notice of modifications made before, you just have to press "ESC" (PC) or "SHIFT + DEL" (PSION) key.

In configuration, if channels/phases sum is chosen, device calculates:
      - channels mean for voltages, currents and frequency.
      - channels sum for powers and energies.
      - network result for cos phi (power factor)

3) <u>Language:</u>
Languages possibilities are French or English.

4) <u>Network:</u>
The possibilities of wiring on network are: - in AC: - one-phase,
                                                                      - balanced three-phase without neutral,
                                                                      - balanced three-phase with neutral,
                                                                      - unbalanced three-phase without neutral,
                                                                      - unbalanced three-phase with neutral.
                                                        - in DC: - 1 channel,
                                                                      - 2 channels,
                                                                      - 3 channels.

It is also necessary to configure ratio transformer if inputs are not directly wired on network:
      - PT ratio, potential transformer,
      - CT ratio, current transformer.
Ex: Intensity transformer with 100 A primary and 5 A secondary.
         Transformer ratio setting = primary / secondary = 20.

5) <u>Energy:</u>
This menu gets the possibility to:
      - validate the access to the energies reset with push-buttons on device's front side (display option),
      - reset all the energies.

            Warning: All the energies are definitely reset.

6) <u>Relays 1 and 2:</u>
Each of the two relays has the same possibilities of configuration.
The relay can be use in two modes : alarm or energy meter.

6.1) <u>Alarm:</u>
The relays configuration in alarm is composed of 2 rubrics:
- measures parameters:
      measured value:
            - star voltage or interlinked voltage (according to network type),
            - current,
            - frequency,
            - cos phi,
            - active, reactive, apparent power
            - active consumed or generated energy,
            - reactive inductive or capacitive energy.

measured phase or channel according to network configuration:
- phase or channel 1,
- phase or channel 2,
- phase or channel 3,
- phases or channels sum or mean.

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

The alarm works in this way:
- **High threshold** detection: .alarm is activated when measure goes beyond threshold,
.alarm is removed when measure goes below threshold less hysteresis.
- **Low threshold** detection: .alarm is activated when measure goes below threshold,
.alarm is removed when measure goes beyond threshold more hysteresis.

6.2) Energy meter:

The relays configuration in meter is composed of 2 rubrics:
- measures parameters:
measured value:
- consumed or generated active energy,
- inductive or capacitive reactive energy,
measured phase or channel according to network configuration:
- phase or channel 1,
- phase or channel 2,
- phase or channel 3,
- phases or channels sum.
- meter parameter:
impulse load value (kW.h or kvar.h).

7) Communication:
7.1) MODBUS:

The communication configuration is composed of 3 rubrics:
- **device address** in communication network (1 to 255),
- **speed** (1200, 2400, 4800, 9600, 19200, 38400 bauds),
- **parity** (even, odd, without).

7.2) PROFIBUS:

The communication configuration is composed of 2 rubrics:
- **device address** in communication network (0 to 126),
- **speed** (9600, 19200, 93.75K, 187.5K, 0.5M, 1.5Mbauds)
The data exchange are the measure in 32b integer and the command for reset the energy.

It is necessary to also configure the data format which will be used in the communication:
- data in "NORMAL" mode : 32 bits integer, MSB send first.
- data in "SPECIAL" mode : 32 bits integer, LSB send first.

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

Wiring Function
(Function reserved for experienced users)

Function is only used for a balanced or unbalanced three-phase with or without neutral network. It allows a wiring adaptation at device operating mode. It is so possible to permute voltage and current by a simple intervention on key-board by way of RS232 link. Three keys are used, "+" to permute phase order, "-" to reverse current direction, "Enter" to validate wiring.

1) Balanced three-phase:
1.1) Operating mode:
In this operating mode, device use only one voltage and one current (L1 and I1 input, see diagrams of connection). It measures voltage, current and frequency, calculates powers, cos phi, energies of measured phase and, according to the network configuration, with or without neutral, determinates finals results of the network (3L).

The device allows to adapt itself to an existing wiring or to a bad identification of voltages and currents, that is to say that it can use L1, L2 or L3 voltage with I1, I2 or I3 current for a wiring with neutral or L12, L23 or L31 voltage with I1, I2 or I3 current for a wiring without neutral.

1.2) Method:
The function is realized by the way of RS232 link. It's by a "Cos Phi" value visualization that user will be able to determinate if wiring is correct or if it must be modify.
To do that, it's necessary to be in 2 lines mode and to select "Cos Phi" measure ("Space" key).
The function start is realized by "+" or "-" keyboard keys.
At this moment, a message indicates operating mode:

WIRING 1	Wiring message, wiring type
-0.51	Example of incorrect "Cos Phi" value
	"1" specifies wiring number

The "+" key allows to modify wiring with insertion of a phase between voltage and current.
The "-" key allows to reverse current direction if there is phase opposition, negative Cos Phi value.

When Cos Phi value becomes coherent according to installation, we obtain the next transmission:

WIRING -X	Wiring message, wiring type
0.90	Example of correct "Cos Phi" value
	"-" reverses current, "X" specifies wiring number

At this moment, you just have to validate selected wiring by "Enter" key.
This one is stored and remain active even after a power off.

In the balanced three-phase mode, it exists 3 different wiring types. So, in few seconds and without intervention on connection, device adapt itself completely to network.

2) Unbalanced three-phase without neutral:
2.1) Operating mode:
n this operating mode, device uses two voltages and two currents (L1, L2 and I1, I2 inputs, see diagrams of connection). It measures voltage, current and frequency, calculates powers, cos phi, energies of each of the two phases and determinates finals results of the network (3L).

The device allows to adapt itself to a bad identification of U/I couple of each phase. For instance, by default, device associates L1 input voltage, that's to say L13, with I1 input current and L2 input voltage, that's to say L23, with I2 input current. The wiring function allows to choose current/voltage association. So, it is possible to use L13 and L23 with I1 and I2, L12 and L32 with I1 and I3 or L21 and L31 with I2 and I3. More, measure couples order will be able to be permuted. The single obligation of wiring is the use of voltage phase in which no current is measured as reference phase. It must be wired on voltage measure ground terminal. (L3 and N, see diagrams of connection).

Whenever, a verification will be realized to inform user of a double use of a current or a voltage, or a no conformity wiring.

2.2) Method:
The function is realized by the way of the RS232 link. It's by a "Cos Phi" value visualization on phases 1 and 2 that user will be able to determinate if wiring is correct or if it must be modify.

To do that, it is necessary to be in 2 lines mode and to select "Cos Phi" measure ("Space" key). For correct each phase, it is essential to visualize phase that must be corrected (key "1" for phase "1", key "2" for phase "2").

The function start is realized by "+" or "-" keyboard keys.
At this moment, a message indicates operating mode:

WIRING L1 1/1	Wiring message, corrected phase, wiring type
-0.51	Example of incorrect "Cos Phi" value
	1/1 associates L1 with I1

The "+" key allows to modify wiring by specify current (I1 or I2) associated to voltage (L1 or L2).
The "-" key allows to reverse current direction if there is phase opposition, negative Cos Phi value.

When Cos Phi value becomes coherent according to installation, we obtain the next transmission:

WIRING L1 -X/Y	Wiring message, corrected phase, wiring type
0.90	Example of correct "Cos Phi" value
	"-" reverses current, "X/Y" associates LX with IY

At this moment, you just have to validate the selected wiring by "Enter" key.
This one is stored and remain active even after a power off.
The procedure is the same for phase 1 and 2.

If the message "WIRING NO CONFORMITY" displays, It must take account only after 2 measured phases correction. Whenever, if this message displays after complete correction of network, it does mean that a current or a voltage has been used twice and that chosen wiring is incorrect. It is so necessary to modify wiring by simply changing reference phase voltage (wired-up in L3-N).
In this unbalanced three-phase without neutral operating mode, it exists for each phase 4 different wiring types. So, in few seconds and with a tiny intervention on voltage connection, device adapt itself completely to network.

Possible wiring:	Phase L1	voltage 1 with current 1
		voltage 1 with current 2
		voltage 2 with current 1
		voltage 2 with current 2
	Phase L2	voltage 1 with current 1
		voltage 1 with current 2
		voltage 2 with current 1
		voltage 2 with current 2

3) Unbalanced three-phase with neutral:
3.1) Operating mode:
In this operating mode, device uses the three voltages and the three currents (L1, L2, L3 and I1, I2, I3 inputs, see diagrams of connection). It measures voltage, current and frequency, calculates powers, cos phi, energies for each of the three phases and determinates finals results of the network (3L).

The device allows to adapt itself to a bad identification of U/I couple of each phase. For instance, by default, device associates L1 input voltage with I1 input current, and the same for each phase. The wiring function allows to choose current/voltage association, that's to say that L1, L2 and L3 will be able to be associated with I1, I2 or I3 in the desire order.

Whenever, a verification will be realized to inform user of a double use of a current, wiring no conformity.

3.2) Method:
The function is realized by the way of RS232 link. It's by a "Cos Phi" value visualization on phases 1, 2 and 3 that user will be able to determinate if wiring is correct or if it must be modify.
To do that, it is necessary to be in 2 lines mode and to select "Cos Phi" measure ("Space" key). For correct each phase, it is essential to visualize phase that must be corrected (key "1" for phase "1", key "2" for phase "2", key "3" for phase "3").

The function start is realized by "+" or "-" keyboard keys.
At this moment, a message indicates the functioning mode:

WIRING L1 1/1	Wiring message, corrected phase, wiring type
-0.51	Example of incorrect "Cos Phi" value
	1/1 associates L1 with I1

The "+" key allows to modify wiring by specify the current (I1, I2 or I3) associated to corrected phase voltage. The "-" key allows to reverse current direction if there is phase opposition, negative Cos Phi value.

When Cos Phi value becomes coherent according to installation, we obtain the next transmission:

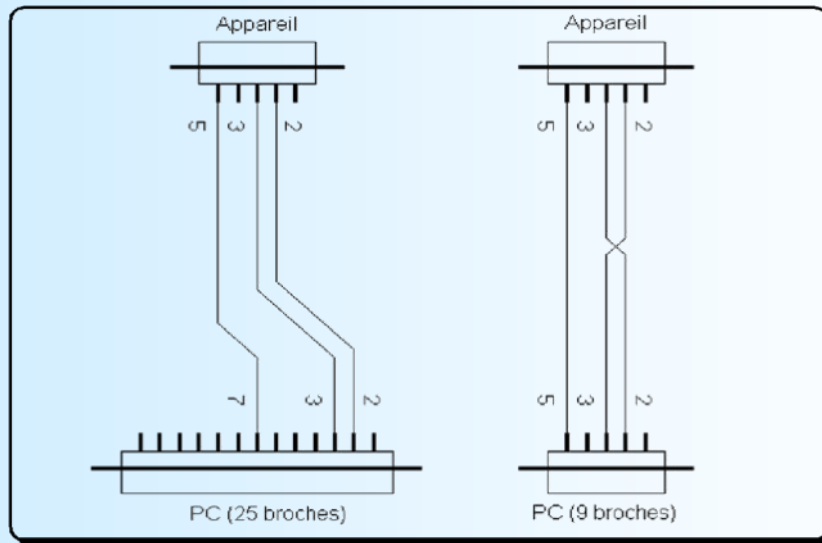|	
WIRING L1 -1/X	Wiring message, corrected phase, wiring type
0.90	Example of correct "Cos-Phi" value
	"-" reverses current, "1/X" associates L1 with IX

At this moment, you just have to validate the selected wiring by "Enter" key.
This one is stored and remain active even after a power off.
The procedure is the same for phase 1, 2 and 3.

If the message "WIRING NO CONFORMITY" displays, It must take account only after 3 measured phases correction. Whenever, if this message displays after complete correction of network, it does mean that a current has been used twice and that chosen wiring is incorrect.

In the unbalanced three-phase with neutral operating mode, it exists for each phase 3 different wiring types. So, in few seconds and without intervention on connection, device adapts itself completely to network.

Possible wiring:	Phase L1	voltage 1 with current 1
		voltage 1 with current 2
		voltage 1 with current 3
	Phase L2	voltage 2 with current 1
		voltage 2 with current 2
		voltage 2 with current 3
	Phase L3	voltage 3 with current 1
		voltage 3 with current 2
		voltage 3 with current 3

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PC - ANALYZER LINK

DIAGRAMS OF CONNECTIONS

Single phase

Three phase balanced with neutral
default wiring with L1 / i1
For other use of voltage or current, the "wiring function" may be
used to adapt the device to network

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Diagram of connection

I1 L
I1 H
I2 L
I2 H
I3 L
I3 H

125V
500V

L1 1
L2 2
L3 3
N 4
Pwr 5
Pwr 6
T 7
R 8
C 9
T 10
R 11
C 12
B 13
A 14
RS 485

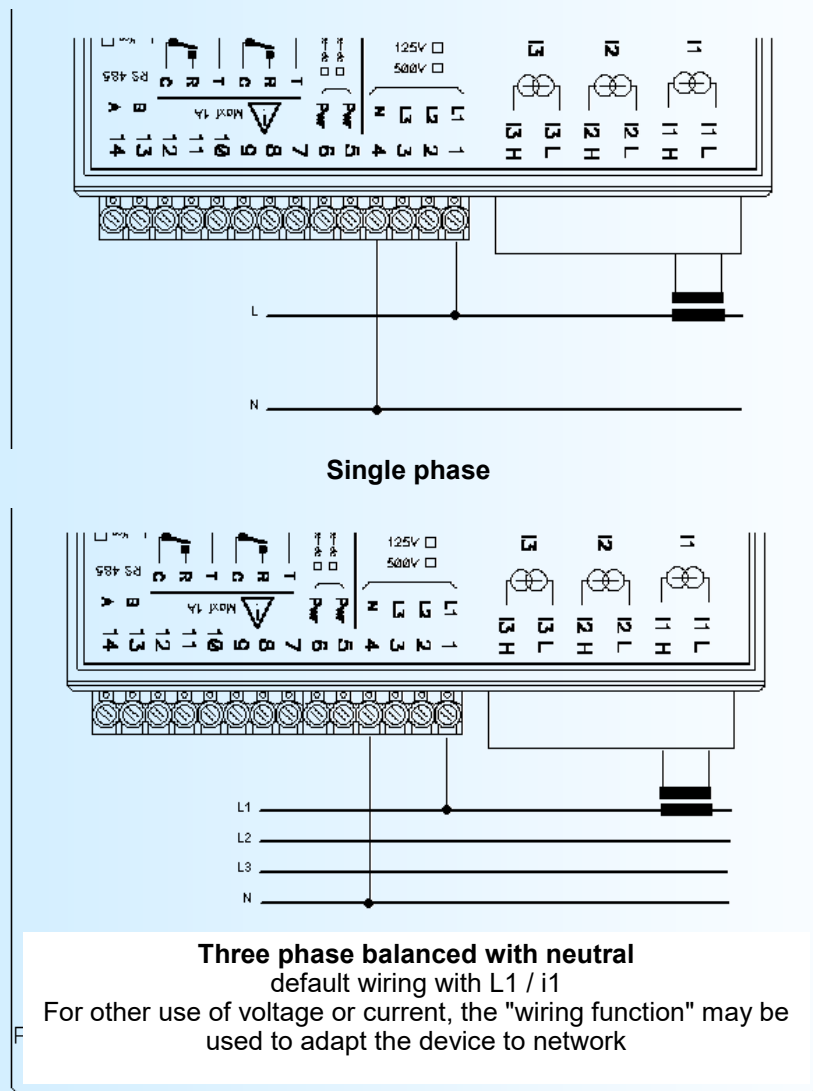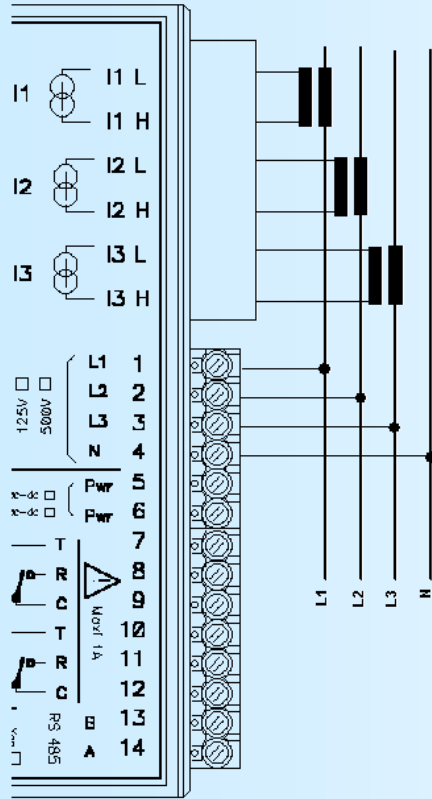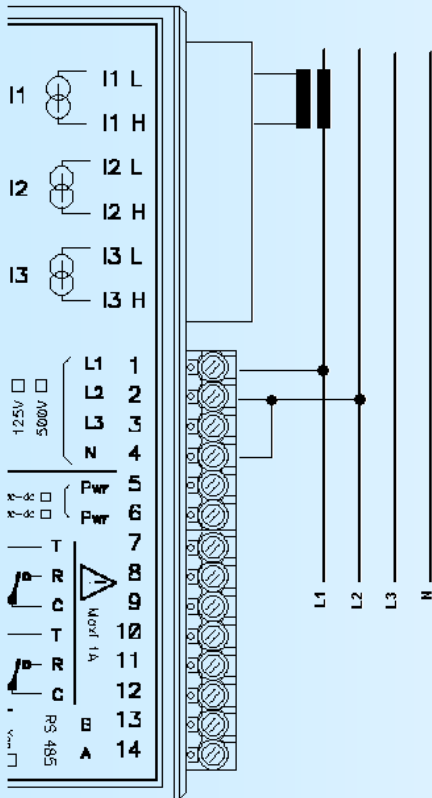**Three phase unbalanced with neutral**
default wiring with L1 / i1, L2 / i2 and L3 / i3
For other use of voltage / current couple, the "wiring function" may be used to adapt the device.

Three phase unbalanced without neutral and 3 currents
default wiring with L1 / i1, L2 / i2 and L3 / i3
Setting in "tree phase , unbalanced, with neutral" the 3x 0V are internally linked, the device reconstruct a pseudo neutral.
For other use of voltage / current couple, the "wiring function" may be used to adapt the device.
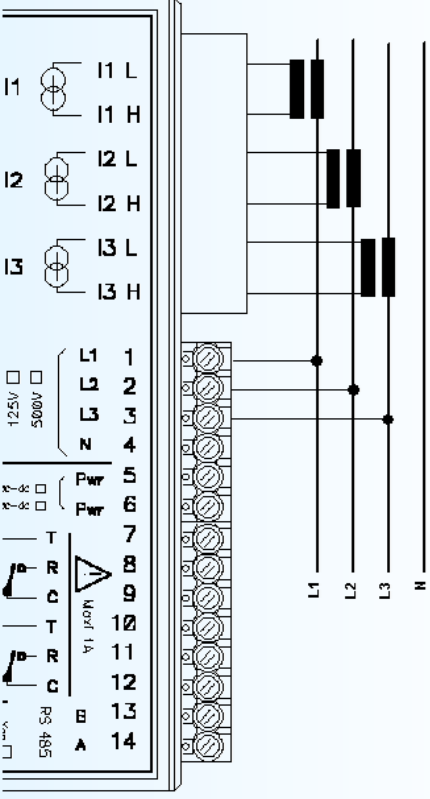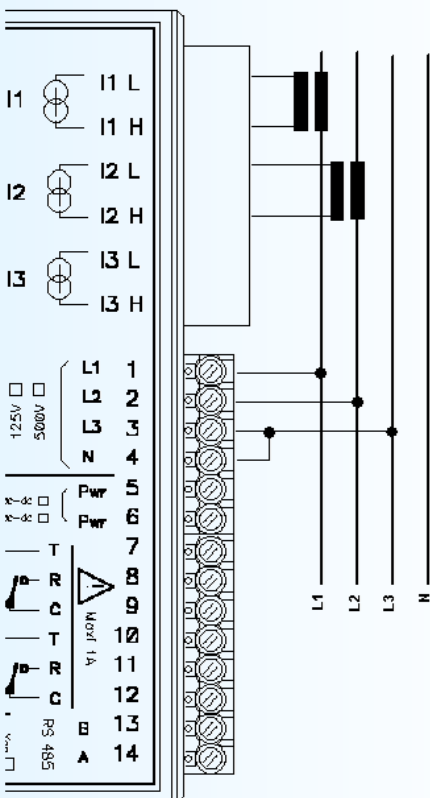
Diagram of connection

Three phase balanced without neutral
default wiring with L12 / i1
For other use of voltage or current, The "wiring function" may be used to adapt the device to network
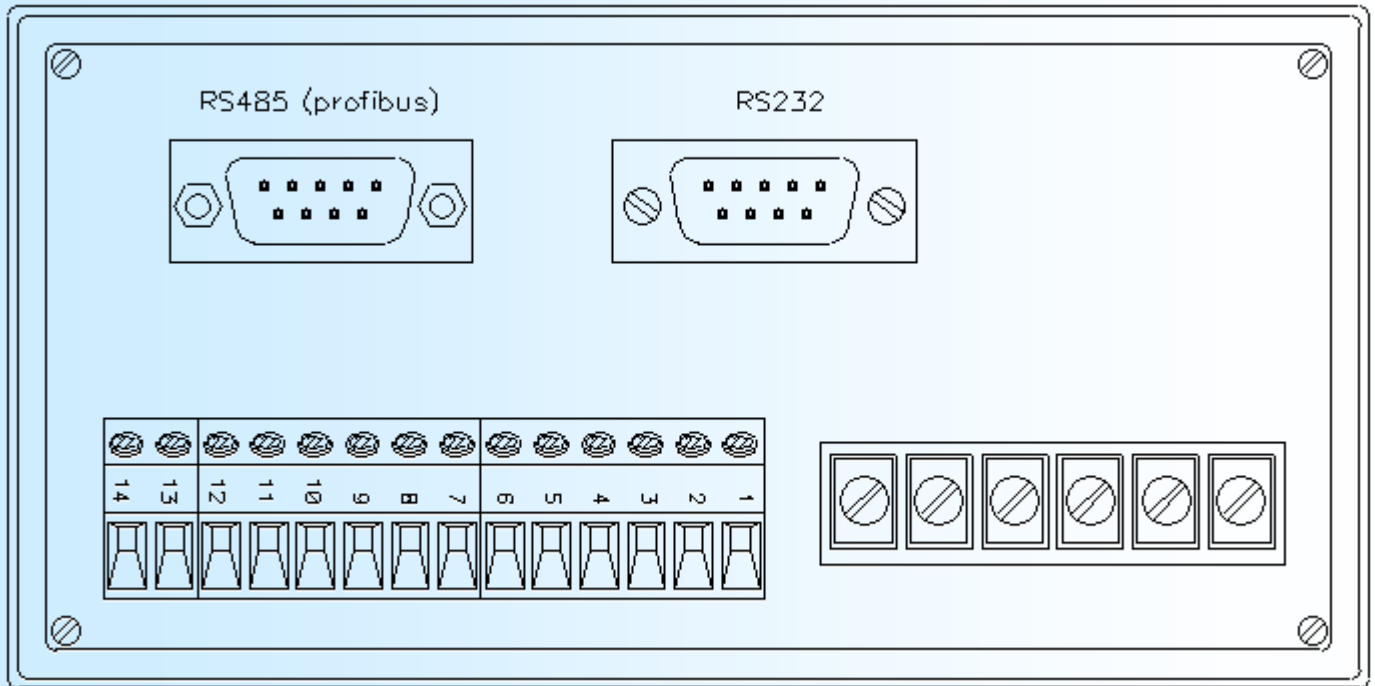
Three phase unbalanced without neutral
default wiring with L13 / i1 and L23 / i2
For other use of voltage / current couple, the "wiring function" may be used to adapt the device to network. Ensure that voltage use as reference is the phase (L3 - N) with no current measurement.

Profibus connection

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RS485 Modbus

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1) Internal structure:
1.1) Presentation:
The device is divided in two cells. Each cell has a specific function while 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.
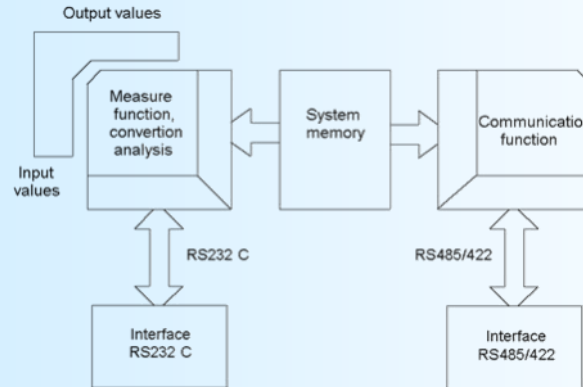
1.2) Measure function:
The measure cell runs the acquisition of the different signals and calculates all the values with regards to the configuration of the device.
It also runs all the output functions (analogical, alarm, meter, RS 232). All measured or calculated parameters are stored in the system 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 addessed. It draws all these data 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 whitout any possible internal conflicts.

2) Communication:
The type of protocol used is: MODBUS/JBUS in RTU mode. The communication has neither header nor delimitator of frame. The detection of the start of frame 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.

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.
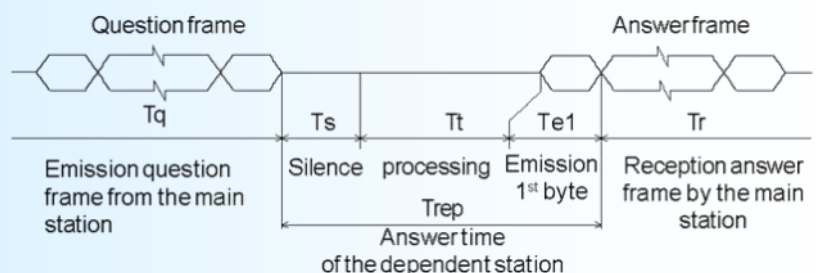
The time beyond which the device does not answer is called **"TIME OUT"**. It depends on the transmission parameters (speed, format) and the type of the function asked (reading, writing). This time must be defined by the user and must be superior to the answer time of the device.

A complete communication cycle includes :
- the question frame transmission Tq
- the device answer time Trep
- the answer frame transmission Tr

Three reasons might cause a TIME OUT:
- wrong transmission data at the question frame time
- wrong configuration of the TIME OUT on the main station
- dependent station out-of-order.

3) Implementation:
3.1) Parameter:
Before starting up the RS485 MODBUS/JBUS communication, make sure that:
- the transmission speed is identical between the slaves (LOREME devices) and the main station.
- the parity is identical between the slaves (LOREME devices) and the main station.
- the addresses are correctly distributed among the stations (LOREME devices),
- the TIME OUT is correctly adjusted on the main station.

All the speed parameters , parity and address must be configured on the devices with the RS232 link.
The devices .configuration possibilities are the following ones:
- address: from 1 to 255
- speed: 600, 1200, 2400, 4800, 9600, 19200, 38400 bauds
- parity: even, odd, without.
- Data format

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.
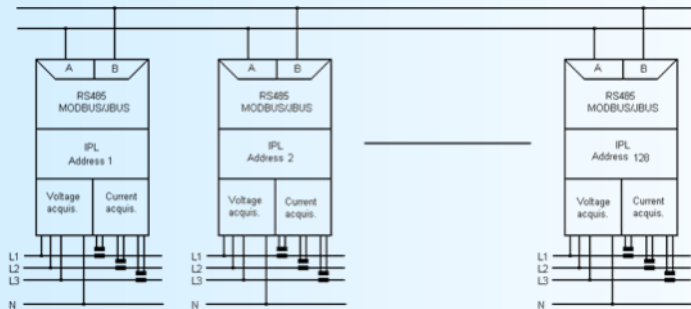
4) Communication time:
4.1) Procedure:
Analysis of the times of communication for parameters of data transmission and for particular cases.
- reading measure phase, energy,
- energy reset,
- speed: 9600 bauds, parity: none.

4.2) Voltages reading:
Reading of 6 words (12 bytes) from address \$A002 to \$A007 (phase 1, 2, 3)

- 8 bytes question frame
$Tq = (8 \times 10) / 9600 = 8.33$ ms
- Silence $Ts = (3.5 \times 10) / 9600 = 3.64$ ms
- Processing $Tt = 6$ ms
- Emission 1_{st} byte
$Te1 = (1 \times 10) / 9600 = 1.04$ ms
- Answer time
$Trep = Ts + Tt + Te1 = 10.68$ ms
- Answer frame (17 bytes)
$Tr = [(17 - 1) \times 10] / 9600 = 16.66$ ms
- Complete cycle
$Tcyc = Tq + Trep + Tr = 35.65$ ms

Question frame — Answer frame

| Tq | Ts | Tt | Te1 | Tr |

Emission question frame from the main station — Silence — Processing — Emission 1st byte — Reception answer frame by the main station

Trep

Answer time of the dependent station

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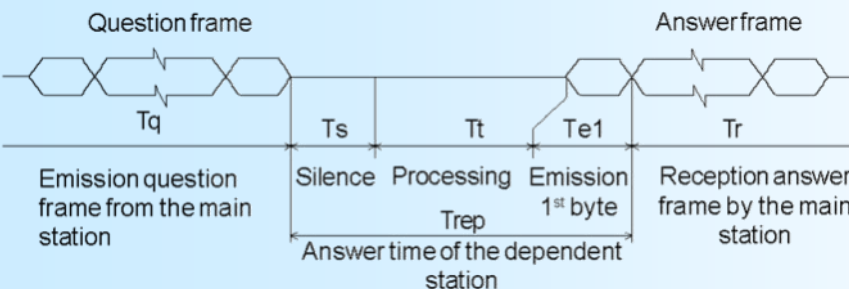
Note:
The processing time Tt is fixed. It depends neither on the speed nor on the transmission format. Consequently, for new transmission parameters, all the times are going to change but for Tt. To set the **TIME OUT** of the system, you just have to calculate the answer time Trep of the dependent station according to the parameters of communication.
For a total phase reading, the time of cycle of the system is about 36 ms.

4.3) Energies reading:
Reading of 8 words, 16 bytes, of the address $A01E to $A025 (active consumed and generated, and reactive inductive and capacitive energies)

- 8 bytes question frame $Tq = (8 \times 10) / 9600 = 8.33$ ms
- Silence $Ts = (3.5 \times 10) / 9600 = 3.64$ ms
- Processing $Tt = 6$ ms
- Emission 1_{st} byte $Te1 = (1 \times 10) / 9600 = 1.04$ ms
- Answer time $Trep = Ts + Tt + Te1 = 10.68$ ms
- Answer frame (37 bytes) $Tr = [(21 - 1) \times 10] / 9600 = 20.83$ ms
- Complete cycle $Tcyc = Tq + Trep + Tr = 39.84$ ms

4.4) Energies reset:
Reset of the active consumed and generated, and reactive inductive and capacitive energies by the writing of word $55AA at the address $7000.
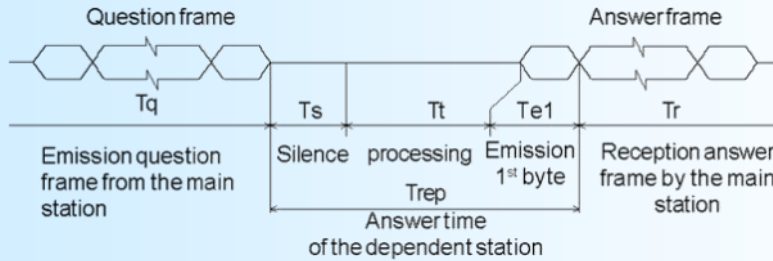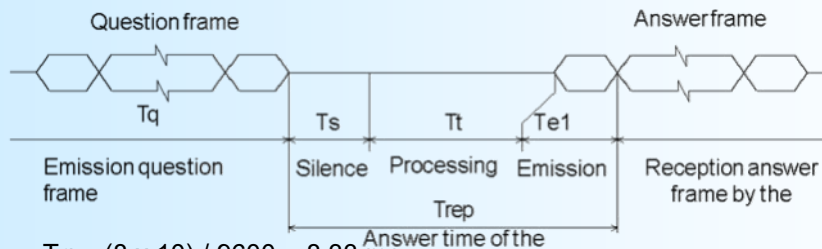

- question frame $Tq = (8 \times 10) / 9600 = 8.33$ ms
- silence $Ts = (3.5 \times 10) / 9600 = 3.64$ ms
- processing $Tt = 6$ ms
- emission 1st byte $Te1 = (1 \times 10) / 9600 = 1.04$ ms
- answer time $Trep = Ts + Tt + Te1 = 44.68$ ms
- answer frame 8 bytes $Tr = [(8 - 1) \times 10] / 9600 = 7.29$ ms
- complete cycle $Tcyc = Tq + Trep + Tr = 26.3$ms

5) Frames structure:
5.1) Words reading:
Function code used: $03 or $04, address $A000 to $A05B

Question: length of frame 8 bytes.

Address dependent	Function Code	Address 1st word		Word value		CRC16	
		PF	Pf	PF	Pf	Pf	PF
1	1	2		2		2	

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

Address dependent	Function Code	Number of bytes	Words value	CRC16 Pf PF
1	1	1		2

5.2) Word writing (reset energies):
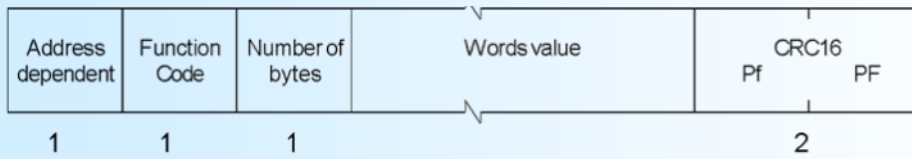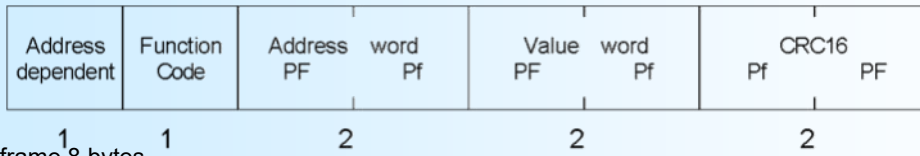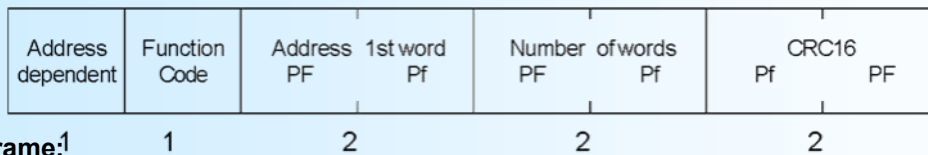Function code used: $06, Address $7000, Word value $55AA

Question: length of frame 8 bytes.

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

5.3) Exception frame:[1]
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.

Address dependent	Function code	Error code	CRC16 Pf PF
1	1	1	2
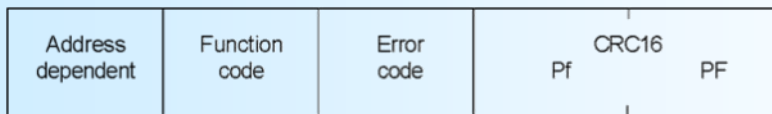
Features of the exception frame:
- Function code: The function code of the exception frame is identical to the one of the question frame, but its bit of strong load is set to 1 (logical or with $80).

- 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 or $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.
$04	Slave Not Ready.

6) Communication data:
6.1) Reading:
All measures are accessible in reading mode, voltage, current, frequency, power, cosinus phi, energies on phases 1, 2, 3 and sum.

Numerical values are:
        - on 2 words at signed 32 bits integer format (4 bytes), for voltages, currents, frequency,   active, reactive, apparent powers and cos.
        - on 2 words at 32 bits unsigned integer format (4 bytes) for energies (value in KW.h and KVAR.h)
Consult the enclosed tables for measures detail.

6.2) Writing:
It's possible to reset all energies with a single writing. Reset is made by writing $55AA value at $7000 address

6.3) Data format:
Data are given in integer 32 bits format.
NORMAL format : Data transmitted Most significant word first, compound of 4 bytes i.e 2 words.

SPECIAL format : Data transmitted least significant word first, compound of 4 bytes i.e 2 words.

The data write for the energy reset is a hexadecimal code. This code is compound of 2 bytes, i.e.1 word.
Code $55AA: reset of all energies.

7) Data Table:

Decimal word address (Hexadecimal)	b7 b6 b5 b4 b3 b2 b1 b0		Total Words	Bytes
40960 ($A000)	Reserve	Byte 1 Word 1	1	1
		Byte 2		2
40961 ($A001)	Reserve	Byte 3 Word 2	2	3
		Byte 4		4
40962 ($A002)	Star voltage	Byte 1 Word 1	3	5
	phase 1	Byte 2		6
40963 ($A003)	(V)	Byte 3 Word 2	4	7
		Byte 4		8
40964 ($A004)	Star voltage	Byte 1 Word 1	5	9
	phase 2	Byte 2		10
40965 ($A0005)	(V)	Byte 3 Word 2	6	11
		Byte 4		12
40966 ($A006)	Star voltage	Byte 1 Word 1	7	13
	phase 3	Byte 2		14
40967 ($A007)	(V)	Byte 3 Word 2	8	15
		Byte 4		16
40968 ($A008)	Interlinked voltage	Byte 1 Word 1	9	17
	Phase 1-2	Byte 2		18
40969 ($A009)	(V)	Byte 3 Word 2	10	19
		Byte 4		20
40970 ($A00A)	Interlinked voltage	Byte 1 Word 1	11	21
	Phase 2-3	Byte 2		22
40971 ($A00B)	(V)	Byte 3 Word 2	12	23
		Byte 4		24
40972 ($A00C)	Interlinked voltage	Byte 1 Word 1	13	25
	Phase 3-1	Byte 2		26
40973 ($A00D)	(V)	Byte 3 Word 2	14	27
		Byte 4		28
40974 ($A00E)	Current	Byte 1 Word 1	15	29
	Phase 1	Byte 2		30
40975 ($A00F)	(A)	Byte 3 Word 2	16	31
		Byte 4		32

40976 ($A010)	Current	Byte 1	Word 1	17	33
	Phase 2	Byte 2			34
40977 ($A011)	(A)	Byte 3	Word 2	18	35
		Byte 4			36
40978 ($A012)	Current	Byte 1	Word 1	19	37
	Phase 3	Byte 2			38
40979 ($A013)	(A)	Byte 3	Word 2	20	39
		Byte 4			40
40980 ($A014)	Active power	Byte 1	Word 1	21	41
	Network	Byte 2			42
40981 ($A015)	(W)	Byte 3	Word 2	22	43
		Byte 4			44
40982 ($A016)	Reactive power	Byte 1	Word 1	23	45
	Network	Byte 2			46
40983 ($A017)	(VAR)	Byte 3	Word 2	24	47
		Byte 4			48
40984 ($A018)	Apparent power	Byte 1	Word 1	25	49
	Network	Byte 2			50
40985 ($A019)	(VA)	Byte 3	Word 2	26	51
		Byte 4			52
40986 ($A01A)	Network Cosinus	Byte 1	Word 1	27	53
	(value x 100)	Byte 2			54
40987 ($A01B)		Byte 3	Word 2	28	55
		Byte 4			56
40988 ($A01C)	Network Frequency	Byte 1	Word 1	29	57
	(value Hz x 100)	Byte 2			58
40989 ($A01D)		Byte 3	Word 2	30	59
		Byte 4			60
40990 ($A01E)	Network active	Byte 1	Word 1	31	61
	Consumed energy	Byte 2			62
40991 ($A01F)	(KW.h)	Byte 3	Word 2	32	63
		Byte 4			64
40992 ($A020)	Network reactive	Byte 1	Word 1	33	65
	Inductive energy	Byte 2			66
40993 ($A021)	(KVAR.h)	Byte 3	Word 2	34	67
		Byte 4			68
40994 ($A022)	Network active	Byte 1	Word 1	35	69
	Generated energy	Byte 2			70
40995 ($A023)	(KW.h)	Byte 3	Word 2	36	71
		Byte 4			72

40996 ($A024)	Network reactive	Byte 1	Word 1	37	73
	Capacitive energy	Byte 2			74
40997 ($A025)	(KVAR.h)	Byte 3	Word 2	38	75
		Byte 4			76
40998 ($A026)	Active power	Byte 1	Word 1	39	77
	Phase 1	Byte 2			78
40999 ($A027)	(W)	Byte 3	Word 2	40	79
		Byte 4			80
41000 ($A028)	Active power	Byte 1	Word 1	41	81
	Phase 2	Byte 2			82
41001 ($A029)	(W)	Byte 3	Word 2	42	83
		Byte 4			84
41002 ($A02A)	Active power	Byte 1	Word 1	43	85
	Phase 3	Byte 2			86
41003 ($A02B)	(W)	Byte 3	Word 2	44	87
		Byte 4			88
41004 ($A02C)	Reactive power	Byte 1	Word 1	45	89
	Phase 1	Byte 2			90
41005 ($A02D)	(VAR)	Byte 3	Word 2	46	91
		Byte 4			92
41006 ($A02E)	Reactive power	Byte 1	Word 1	47	93
	Phase 2	Byte 2			94
41007 ($A02F)	(VAR)	Byte 3	Word 2	48	95
		Byte 4			96
41008 ($A030)	Reactive power	Byte 1	Word 1	49	97
	Phase 3	Byte 2			98
41009 ($A031)	(VAR)	Byte 3	Word 2	50	99
		Byte 4			100
41010 ($A032)	Apparent power	Byte 1	Word 1	51	101
	Phase 1	Byte 2			102
41011 ($A033)	(VA)	Byte 3	Word 2	52	103
		Byte 4			104
41012 ($A034)	Apparent power	Byte 1	Word 1	53	105
	Phase 2	Byte 2			106
41013 ($A035)	(VA)	Byte 3	Word 2	54	107
		Byte 4			108
41014 ($A036)	Apparente power	Byte 1	Word 1	55	109
	Phase 3	Byte 2			110
41015 ($A037)	(VA)	Byte 3	Word 2	56	111
		Byte 4			112

41016 ($A038)	Cosinus phi	Byte 1	Word 1	57	113
	Phase 1	Byte 2			114
41017 ($A039)	(Value x 100)	Byte 3	Word 2	58	115
		Byte 4			116
41018 ($A03A)	Cosinus phi	Byte 1	Word 1	59	117
	Phase 2	Byte 2			118
41019 ($A03B)	(Value x 100)	Byte 3	Word 2	60	119
		Byte 4			120
41020 ($A03C)	Cosinus phi	Byte 1	Word 1	61	121
	Phase 3	Byte 2			122
41021 ($A03D)	(Value x 100)	Byte 3	Word 2	62	123
		Byte 4			124
41022 ($A03E)	Frequency	Byte 1	Word 1	63	125
	Phase 1	Byte 2			126
41023 ($A03F)	(value Hz x 100)	Byte 3	Word 2	64	127
		Byte 4			128
41024 ($A040)	Frequency	Byte 1	Word 1	65	129
	Phase 2	Byte 2			130
41025 ($A041)	(value Hz x 100)	Byte 3	Word 2	66	131
		Byte 4			132
41026 ($A042)	Frequency	Byte 1	Word 1	67	133
	Phase 3	Byte 2			134
41027 ($A043)	(value Hz x 100)	Byte 3	Word 2	68	135
		Byte 4			136
41028 ($A044)	Active consumed energy	Byte 1	Word 1	69	137
	Phase 1	Byte 2			138
41029 ($A045)	(KW.h)	Byte 3	Word 2	70	139
		Byte 4			140
41030 ($A046)	Reactive inductive energy	Byte 1	Word 1	71	141
	Phase 1	Byte 2			142
41031 ($A047)	(KVAR.h)	Byte 3	Word 2	72	143
		Byte 4			144
41032 ($A048)	Active generated energy	Byte 1	Word 1	73	145
	Phase 1	Byte 2			146
41033 ($A049)	(KW.h)	Byte 3	Word 2	74	147
		Byte 4			148
41034 ($A04A)	Reactive capacitive energy	Byte 1	Word 1	75	149
	Phase 1	Byte 2			150
41035 ($A04B)	(KVAR.h)	Byte 3	Word 2	76	151
		Byte 4			152

41036 ($A04C)	Active consumed energy	Byte 1	Word 1	77	153
	Phase 2	Byte 2			154
41037 ($A04D)	(KW.h)	Byte 3	Word 2	78	155
		Byte 4			156
41038 ($A04E)	Reactive inductive energy	Byte 1	Word 1	79	157
	Phase 2	Byte 2			158
41039 ($A04F)	(KVAR.h)	Byte 3	Word 2	80	159
		Byte 4			160
41040 ($A050)	Active generated energy	Byte 1	Word 1	81	161
	Phase 2	Byte 2			162
41041 ($A051)	(KW.h)	Byte 3	Word 2	82	163
		Byte 4			164
41042 ($A052)	Reactive capacitive energy	Byte 1	Word 1	83	165
	Phase 2	Byte 2			166
41043 ($A053)	(KVAR.h)	Byte 3	Word 2	84	167
		Byte 4			168
41044 ($A054)	Active consumed energy	Byte 1	Word 1	85	169
	Phase 3	Byte 2			170
41045 ($A055)	(KW.h)	Byte 3	Word 2	86	171
		Byte 4			172
41046 ($A056)	Reactive inductive energy	Byte 1	Word 1	87	173
	Phase 3	Byte 2			174
41047 ($A057)	(KVAR.h)	Byte 3	Word 2	88	175
		Byte 4			176
41048 ($A058)	Active generated energy	Byte 1	Word 1	89	177
	Phase 3	Byte 2			178
41049 ($A059)	(KW.h)	Byte 3	Word 2	90	179
		Byte 4			180
41050 ($A05A)	Reactive capacitive energy	Byte 1	Word 1	91	181
	Phase 3	Byte 2			182
41051 ($A05B)	(KVAR.h)	Byte 3	Word 2	92	183
		Byte 4			184

RS485 Profibus

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1) Data format:
1.1) Overview
The device is divided in two cells. Each cell has a specific function while 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
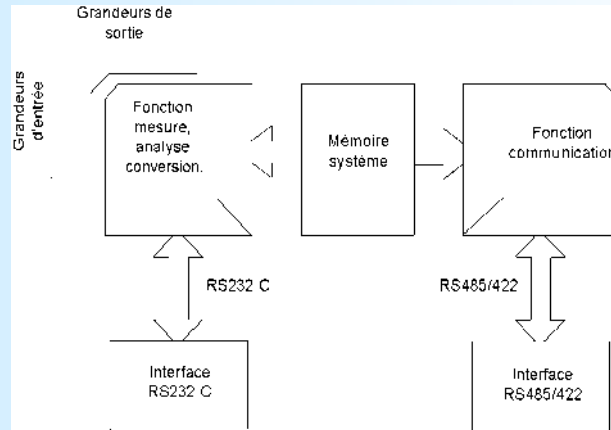
1.2) Measure function
The measure cell run the acquisition of the different signals and calculates all values regards to the configuration of device. It also runs all the output functions (analogical, alarm, meter, RS232). All measures or calculated parameters are stored in the system memory and are constantly refreshed.

1.3) Communication
The communication cell runs the RS485 communication interface in the PROFIBUS protocol. It analyzes the requests of the master station and answer if the device is addressed. It draws all these data from the system memory that can be continuously accessible.

1.4) System memory
Each cells 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) Protocol overview
2.1) generality
PROFIBUS-DP use the scanning principle for master/slaves communication. It means that a slave station need requests coming from a master for information exchange. Messages transfer is organized by cycles. A message cycle is made of request frame send by active station (master) and an answer frame send back by a passive station (slave). Global control function exists and permit coordination and synchronisation of many slaves. Before a DP system be operational, each station presents have to own a different address. For slaves, it can be directly made by a function throughout the bus .
All slaves without definitive address start up with the 126 default address. It must be only one device possessing this address. Only a supervisor can access to a slave via this address for fixing a specific address. For security, data exchange between a master and a "126" address slave is forbidden. For data exchange, master must have a valid data base. This database include configuration and parametrical data necessary to each one of his slave. It can contain different bus parameters. If a base is present in a master, it begin by verification assigned slave presence or absence. For present device, master process to the configuration parameterization and verification of each one of them. A slave will accept the parameterization verification requests only if it come from the master which send the data parameters. When these two operations are correctly made, master will inspect slave state by reading diagnosis data.
When ok, EXCHANGE DATA will be authorized.
A slave will accept an exchange request only if it come from the master who have configured it. A master can send a slave new parameters without leaving exchange data mode. Supervisors can read any slaves diagnosis, input and output data. If an event appends in a slave process, it will signal by sending an high priority answer. If the master want to know the event causes, it will have to read slave diagnosis data.
A supervisor can take the slave control every time. In case, slave stop data exchange with master. It recognize this event and regularly verify the slave state until it be free. Master will take slave control by sending parametrical and configuration data.

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2.2) Characteristic :
The device follow the PROFIBUS EN 50710 volume 2 specification
supported baud rate: 9.6K, 19.2K, 93.75K, 187.5K, 0.5M, 1.5Mbauds
transmission type: RS485, 8bits of data, 1 stop, even parity
Connector: sub D 9 pins

3) Using:
The address, the baud rate of bus and data format are to be setting on device via the RS232 link. All needing infor-
mation for communication on network are include in the GSD file provide on our web site : www.loreme.fr
This information are in 3 groups:
- operating information (baud rate supported, available functions, …),
- data configuration (format of input data and output data),
- alarm list and operating default, parameters.

3.1) Detail of input and output data:
We call input data, the data transferred from slave to master, and output data the transfer from master to slave.
There is 73 bytes of input data and 1 byte of output data. The input data are composed of 36 words of measure and 1
byte for the relays alarm status. The output byte is use for reset the energy counters.

3.2) Details of diagnosis data:
The diagnosis data are composed of 6 bytes of standard diagnosis and 2 bytes of device specific diagnosis.

3.3) Exchange data frame:

Reset energy output

b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0/1

bit 0 = 1 => Reset energy

Measure input

Star voltage	Byte 1	Word 1
phase 1	Byte 2	
(V)	Byte 3	Word 2
	Byte 4	
Star voltage	Byte 1	Word 1
phase 2	Byte 2	
(V)	Byte 3	Word 2
	Byte 4	
Star voltage	Byte 1	Word 1
phase 3	Byte 2	
(V)	Byte 3	Word 2
	Byte 4	
Interlinked voltage	Byte 1	Word 1
Phase 1-2	Byte 2	
(V)	Byte 3	Word 2
	Byte 4	
Interlinked voltage	Byte 1	Word 1
Phase 2-3	Byte 2	
(V)	Byte 3	Word 2
	Byte 4	
Interlinked voltage	Byte 1	Word 1
Phase 3-1	Byte 2	
(V)	Byte 3	Word 2
	Byte 4	

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Current	Byte 1	Word 1
Phase 1	Byte 2	
(A)	Byte 3	Word 2
	Byte 4	
Current	Byte 1	Word 1
Phase 2	Byte 2	
(A)	Byte 3	Word 2
	Byte 4	
Current	Byte 1	Word 1
Phase 3	Byte 2	
(A)	Byte 3	Word 2
	Byte 4	
Active power	Byte 1	Word 1
Network	Byte 2	
(W)	Byte 3	Word 2
	Byte 4	
Reactive power	Byte 1	Word 1
Network	Byte 2	
(VAR)	Byte 3	Word 2
	Byte 4	
Apparent power	Byte 1	Word 1
Network	Byte 2	
(VA)	Byte 3	Word 2
	Byte 4	
Network Cosinus	Byte 1	Word 1
(value x 100)	Byte 2	
	Byte 3	Word 2
	Byte 4	
Network Frequency	Byte 1	Word 1
(value Hz x 100)	Byte 2	
	Byte 3	Word 2
	Byte 4	
Network active	Byte 1	Word 1
Consumed energy	Byte 2	
(KW.h)	Byte 3	Word 2
	Byte 4	
Network reactive	Byte 1	Word 1
Inductive energy	Byte 2	
(KVAR.h)	Byte 3	Word 2
	Byte 4	

Network active	Byte 1	Word 1
Generated energy	Byte 2	
(KW.h)	Byte 3	Word 2
	Byte 4	
Network reactive	Byte 1	Word 1
Capacitive energy	Byte 2	
(KVAR.h)	Byte 3	Word 2
	Byte 4	

alarms status

0/1 b7	0/1 b6	0 b5	0 b4	0 b3	0 b2	0/1 b1	0/1 b0

3.5) Detail of alarm status byte:

bit 0: status of relay #1
bit 1: status of relay #2
bit 6: Operating device state. This bit is 1 when the device function is ok.
bit 7: Measure default. this bit is set to 1 when an internal default occurs.

The Measure default appears when the communication slot don't receive the information data from the measure part within a 3 second delay. (it is the case if the user enter in configuration via the RS232 link) In that case, the device set this bit to indicate the not refresh the measure.
When this default is set, all measure are set to 0.

3.6) Measure data format:

The data format available are :

- 2 words (4 bytes) in signed 32 bits integer for the voltage, current, frequency, powers, cosinus.
- 2 words (4 bytes) in unsigned 32bits integer for energies (values in kW.h and kVAR.h).

32 bits integer format :
NORMAL format : Data transmitted Most significant word first, compound of 4 bytes i.e 2 words.

SPECIAL format : Data transmitted least significant word first, compound of 4 bytes i.e 2 words.

EMC Consideration

LOREME

1) Introduction

To meet its policy concerning EMC, based on the Community directives **2014/30/EU** & **2014/35/EU**, the LOREME company takes into account the standards relative to this directives from the very start of the conception of each product.

The set of tests performed on the devices, designed to work in an industrial environment, are made in accordance with **IEC 61000-6-4** and **IEC 61000-6-2** standards in order to establish the EU declaration of conformity. The devices being in certain typical configurations during the tests, it is impossible to guarantee the results in every possible configurations. To ensure optimum operation 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 data sheet (direction of assembly, spacing between the devices, ...).
- Comply with the recommendations of use indicated in the technical data 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 centimeters 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.