BARGRAPH DISPLAY
CONTROLLED BY MODBUS

LOREME

CONFIGURATION HANDBOOK

BGL144D

REV0 - 15/02/10

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Dialogue - Mode Terminal

The whole of the configuration parameters can be visualized and modified with any system emulating a terminal and equipped with RS232 link. The dialogue and configuration parts being resident in device memory, no software or specific interface is necessary for their configuration.

Different procedures are enumerated below.
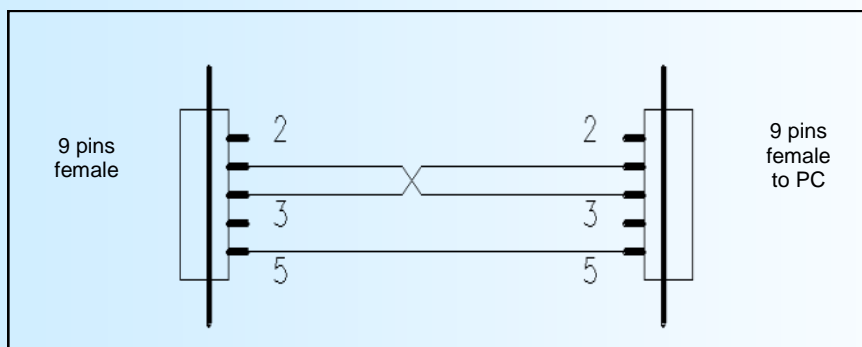
1) PC with WINDOWS:

To start up the terminal emulation program,

1 - Click on **"START"**,
2 - Point on **"Programs"**, **"Accessories"**, and **"Hyper Terminal"**,
3 - Double-click on **"Hyperterm.exe"**

The communication parameter are : 9600bds, 8bit of DATA, 1 stop, no parity, no flux control
Hyperterminal program can be downloaded at :
 http://www.loreme.fr/HyperTerm/htpe63.exe

Dialogue - Mode Terminal

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1) Visualization:

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

2 information are available on screen:

"Height" mode	22.80 m	Value of the display
	12.52 %	Value of the bargraph
"Temperature" mode	122.8 deg	Value of the display
	82.05 %	Value of the bargraph

To access configuration, type **"C"** on keyboard and follow configuration procedure.
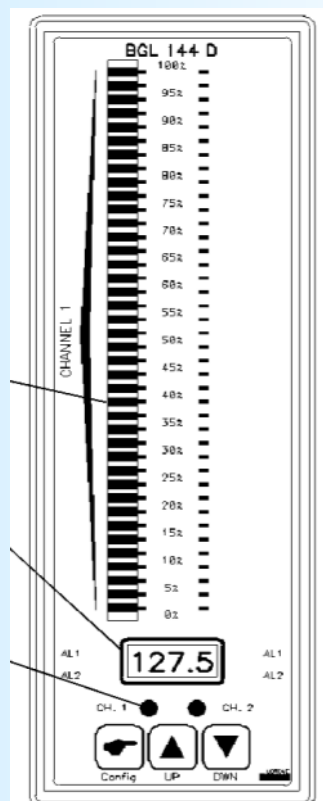
DEVICE PRESENTATION

The purpose of this configuration handbook is to become familiar with the functions supplied by the device.
The BGL144D is a bargraph/display distant controlled by the intermediary of RS485 link with Modbus protocol.

The device is composed of:
- 4 digits matrix display, 10000 points, with automatic definition of the decimal point position in function of the display quantity type,
- 40 leds rack for bargraph information,
- 2 control leds for RS485 link,
- RS232 local link for device configuration,
- RS485 distant link for definition of visualized information.

The RS232 link allows to define the device communication parameters, address, speed, format.

The RS485 link with Modbus protocol allows to define 2 different values, one for the display and the other for the bargraph. These values thus can express different or complementary quantities. For more information about the protocol and the values format, refer to RS485 link specific heading.

Présentation de l'appareil

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CONFIGURATION

The handbook resumes in detail the different possibilities of configuration: language and communication. To access configuration mode, press the **"C"** key.

1) Method:

In configuration, different type of questions are asked. For each of them, several answers are possible.
Here is their description:

1.1) Menu selection:

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

1.2) Parameter selection:

Example: FRENCH   or   ENGLISH
             (Y-N) YES   (Y-N) NO

Previous choice = YES: - type **"O"**   => validation, choice = YES,
                         - type **"Enter"**   => validation, choice = YES,
                         - type **"N"**   => change, choice = NO.
Previous choice = NO: - type **"N"**   => validation, choice = NO,
                         - type **"Enter"**   => validation, choice = NO,
                         - type **"O"**   => change, choice = YES.

Choices are made by typing **"Y"** or **"N"**, and validation by typing displayed answer (**"Y"** for YES and **"N"** for NO) or by **"Enter"**. Typing **"Enter"** without modification allows to validate previous answer.

1.3) Value acquisition:
Exemple: SPEED
             9600 bds

Two possibilities:
- The validation without modification by typing **"Enter"**,
- The keyboard value modification (simultaneous display), then the validation with **"Enter"**.

It is possible, when a mistake is made during a value acquisition, before validating it, to go back pressing "DEL" key, which re-displays the message without taking notice of the wrong value.

1.4) Remarks:
- In configuration mode when there is any action during two minutes, the device exits of this mode without taking notice of the modifications made before. - In configuration mode, if you want to shift to measure mode without taking notice of the modifications made before, just press "ESC".

2) Language:
The language possibilities are:
        - English,
        - French.

3) Communication:
The communication configuration is composed of 3 parts:
        - **address** of the device in communication network, 1 to 250,
        - **speed**, 1200, 2400, 4800, 9600, 19200, 38400 bauds,
        - **parity** even, odd, without.

For more information about the communication using, refer to Modbus documentation at the end of this handbook.

EMC Consideration

1) Introduction

In order to satisfy its policy as regards EMC, based on the Community directive 2004/108/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 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 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.

WIRING DIAGRAM

Power supply: terminal 1, terminal 2
RS485   terminal 5 (A+), terminal 6 (B+)
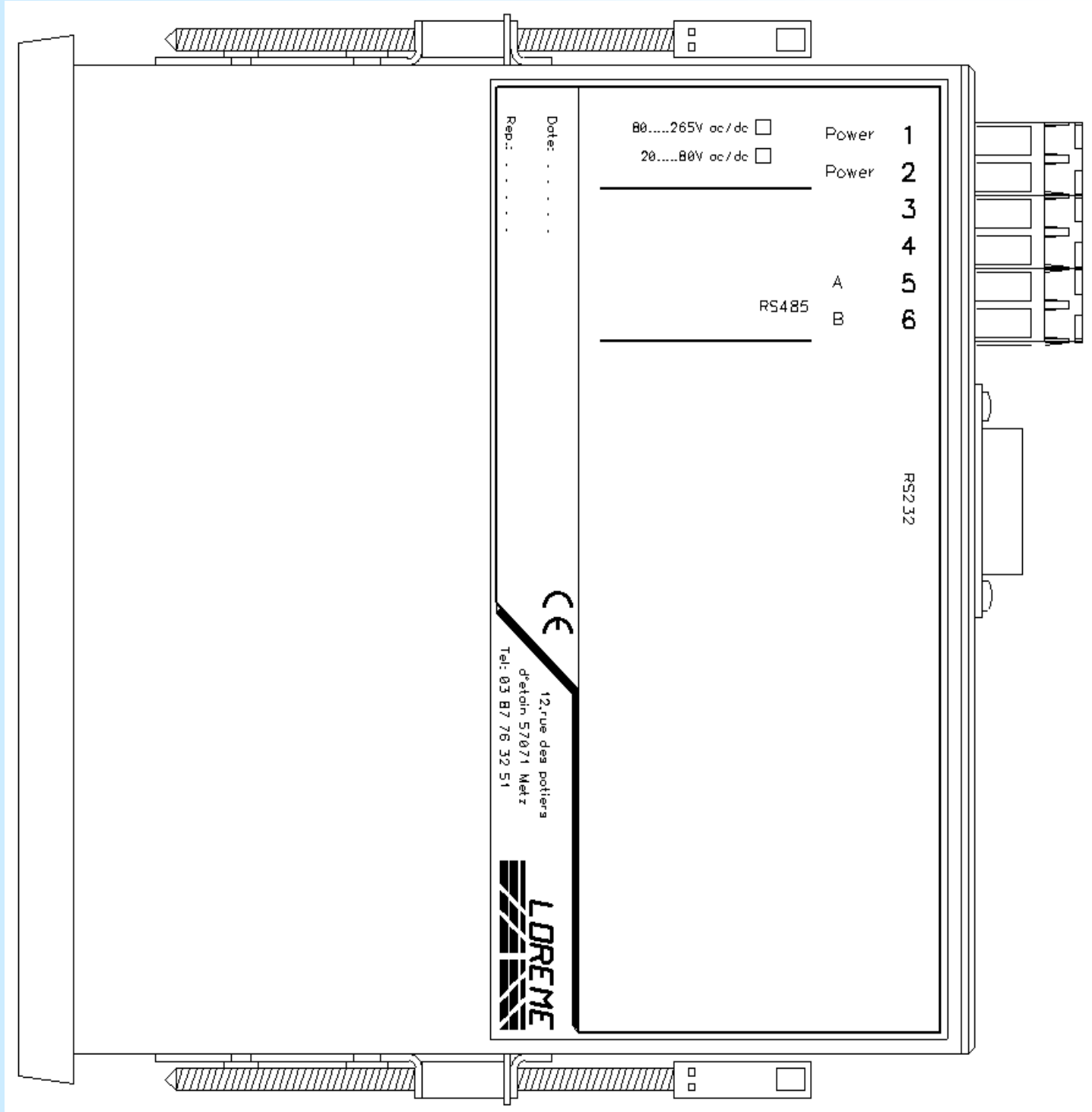
1) Internal structure:
1.1) Presentation:
The device is divided in two cells. Each cell has a specific function while keeping a continuous exchange of pieces of information with the second cell.The first cell is in charge of the display, bargraph and control. The second cell is in charge of the communication function. The information exchange is continuous and automatic.
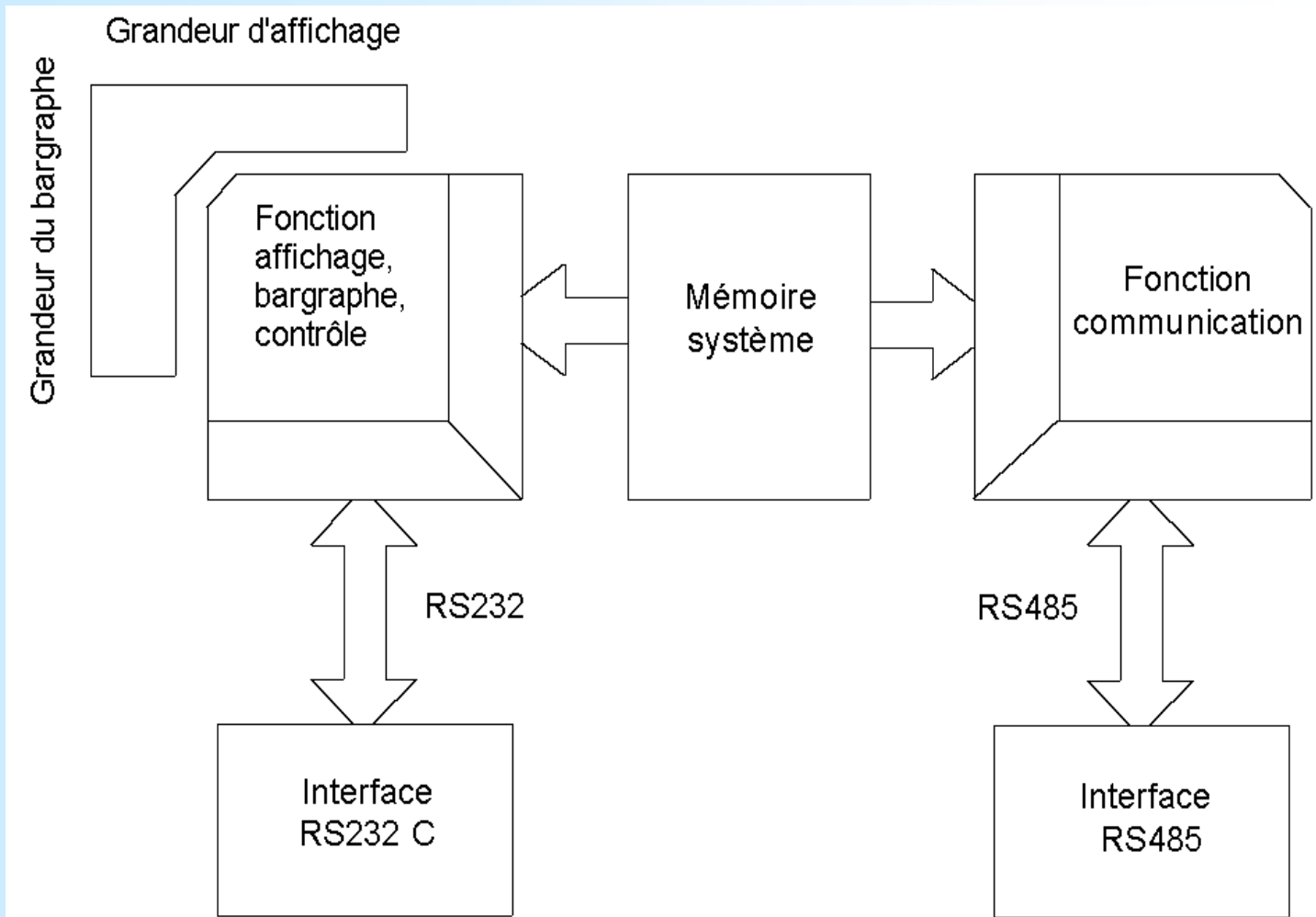
1.2) Display function:
This cell runs the different functions of the device front face, display, bargraph, control leds and also the local access to the device configuration by the RS232 link.
All parameters are stored in the system memory and are constantly refreshed.

1.3) Communication function:
The communication cell runs the RS485 communication interface with the MODBUS protocol. It analyzes the requests of the main station and answers if the device is addressed. It takes its working parameters in the system memory which is permanently accessible. Its also informs the first cell about the communication events.

1.4) System memory:
Each of the two cells can access permanently to the system memory. This one is in double access, which allows data reading/writing without the possibility of internal conflict.

2) Communication:

The type of protocol used is **MODBUS** in **RTU** mode. The communication has neither header nor frame delimiter. 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 less than this silence. If this condition is not respected, the second byte will be considered as the first one of a new frame.

The interval time separating the end of reception of the last byte of the query frame and the end of emission of the first byte of the answer frame (frame detection by the master station) constitutes the answer time of the device.
This response time **Trep** contains:

        - the silence   **Ts**
        - the frame processing   **Tt**
        - the emission of the first byte **Te1**
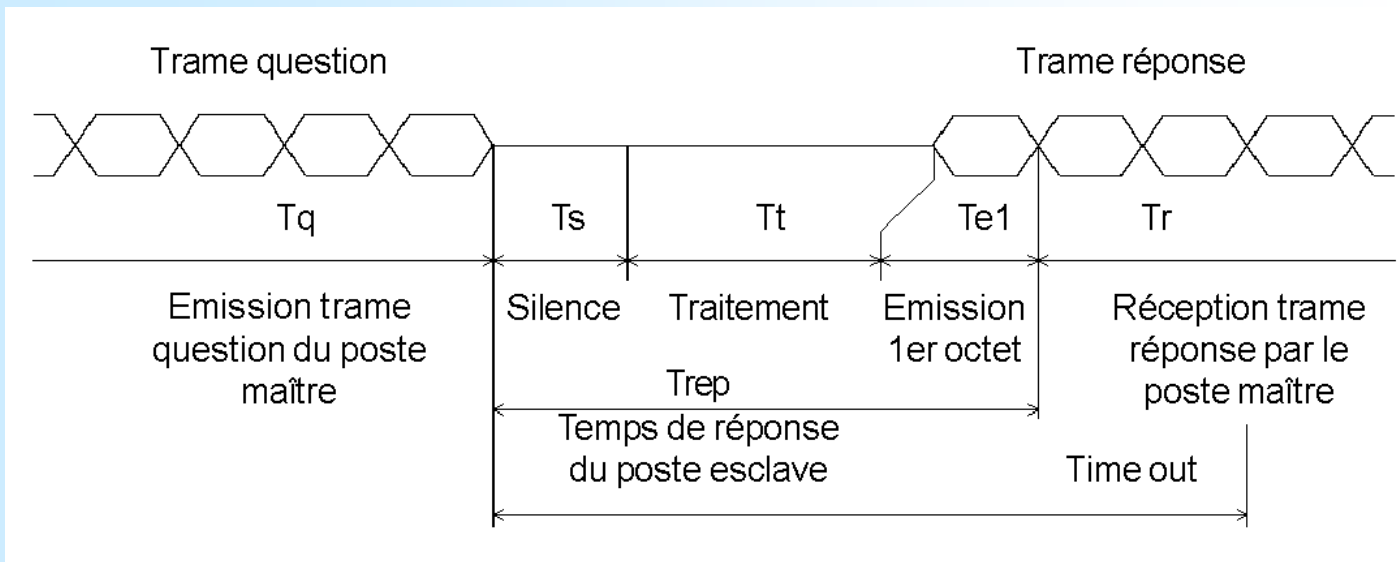
The time beyond which the device does not answer is called **"Time Out"**. It depends on the transmission parameters (speed, format) and the type of the function asked (reading, writing).

This time must be defined by the user and must be greater than the answer time of the device.
A complete cycle of communication includes:
        - the transmission of the query frame **Tq**
        - the response time of the device **Trep**
        - the transmission of the response frame **Tr**

Several reasons might cause a **Time Out**:
        - wrong data transmission of the query frame,
        - wrong configuration of the **Time Out** on the master station,
        - slave station out-of-order.

3) Working:
3.1) Settings:

Before starting up the communication, make sure that:
- the speed and the format of transmission is identical between the slave station and the master station.
- the addresses are correctly distributed among the slave stations, no identical addresses for two slave stations.
- the **TimeOut** is correctly adjusted on the master station.

All the speed, parity and address parameters, must be configured on the devices with the RS 232 link:
- address from 01 to 250
- speed 1200, 2400, 4800, 9600, 19200, 38400 bauds
- parity even, odd or without.

3.2) Connection:

The RS 485 interface used allows to connect 128 slave stations on the same network.
For better operating conditions (noise immunity), use a twisted pair for the network.
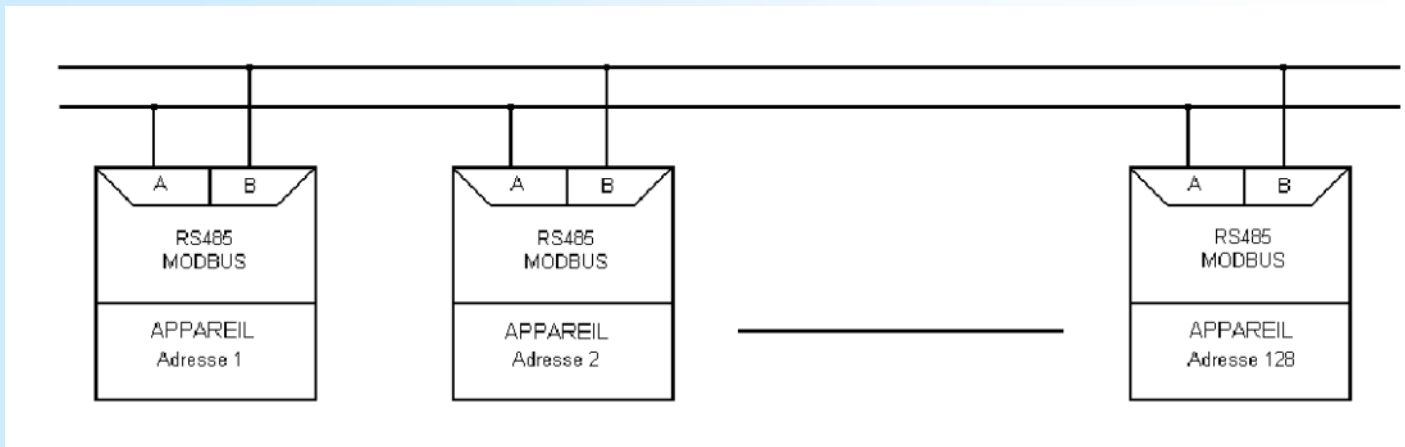
4) Communication time:
4.1) Procedure:

Analysis of the communication times for given transmission parameters and for particular cases.
- writing of display and bargraph values
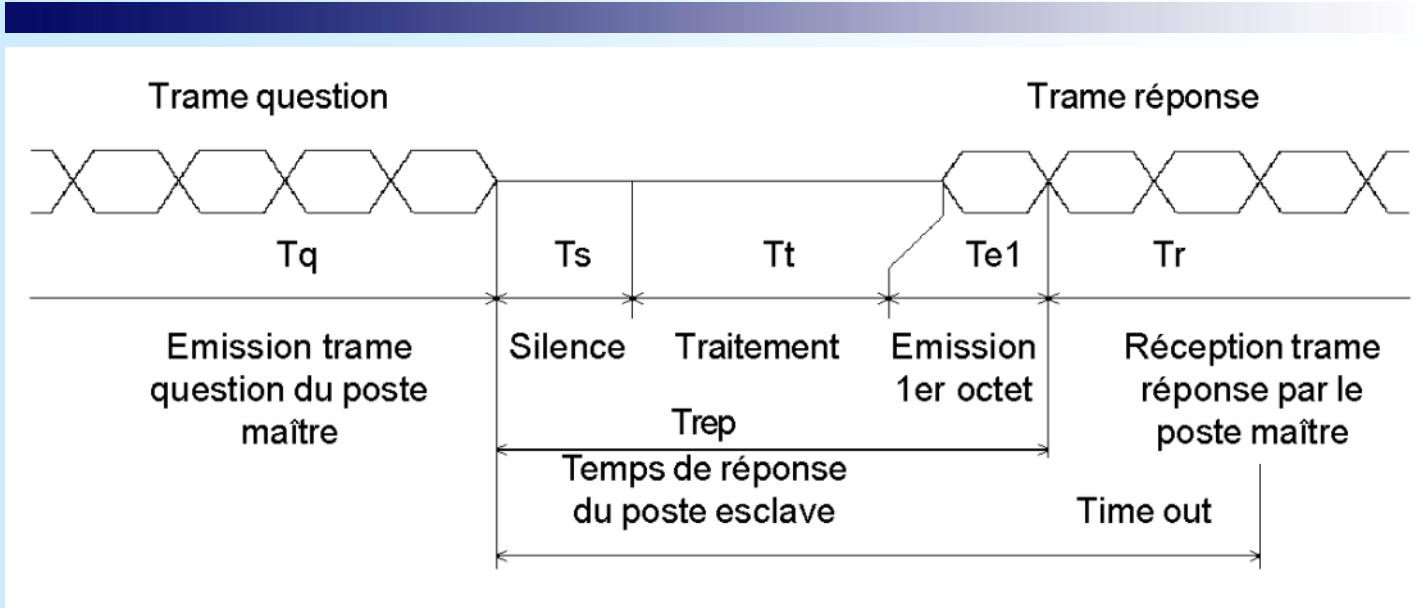   - speed 9600 bauds, no parity.

4.2) Writing of values:

Writing of 2 words, 4 bytes, to the address $0001/0001 or $000b/0011.

- query frame 13 bytes $Tq = (13 \times 10) / 9600 = 13.54$ ms
- silence $Ts = (3.5 \times 10) / 9600 = 3.64$ ms
- processing $Tt = 5.5$ ms
- 1st byte emission $Te1 = (1 \times 10) / 9600 = 1.04$ ms
- response time $Trep = Ts + Tt + Te1 = 10.18$ ms
- response frame 8 bytes $Tr = [(8 - 1) \times 10] / 9600 = 7.29$ ms
- complete cycle $Tcyc = Tq + Trep + Tr = 31.01$ ms

The processing time **Tt** is fixed. It depends neither of the speed nor of the transmission format. Consequently, for new parameters of transmission,
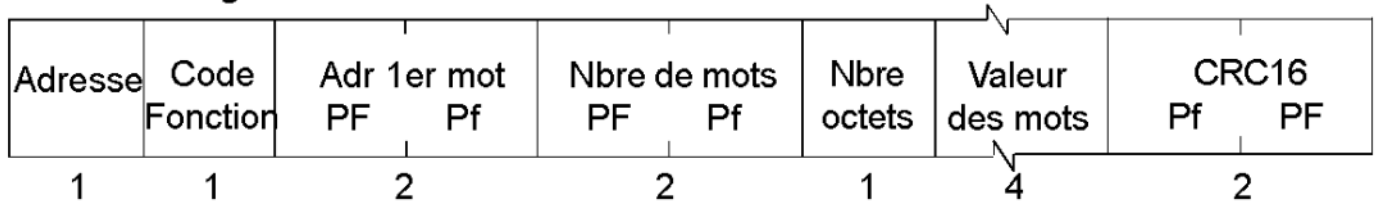all the times are going to change except for **Tt**.
To set the **time out** of the system, you just have to calculate the answer time **Trep** of the slave station according to communication parameters. For writing the values, the cycle time is about 31ms.
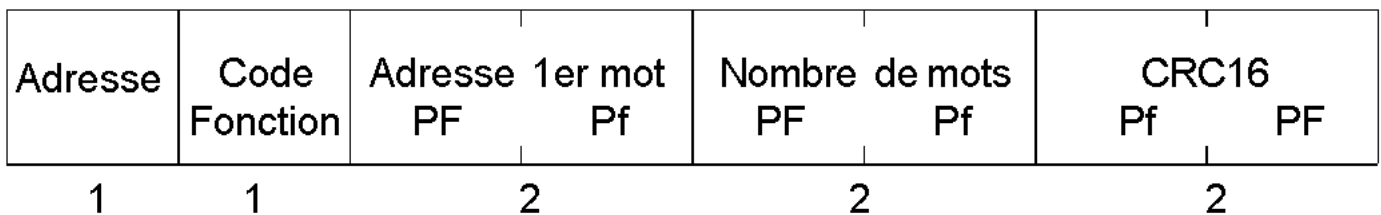
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Trame question   Trame réponse

| Tq | Ts | Tt | Te1 | Tr |

Emission trame question du poste maître | Silence | Traitement | Emission 1er octet | Réception trame réponse par le poste maître

Trep

Temps de réponse du poste esclave

Time out

5) Frame structure:
5.1) Writing of words:

Question: longueur de trame 13 octets.

Adresse	Code Fonction	Adr 1er mot PF Pf	Nbre de mots PF Pf	Nbre octets	Valeur des mots	CRC16 Pf PF
1	1	2	2	1	4	2

Réponse: longueur de trame 8 octets.

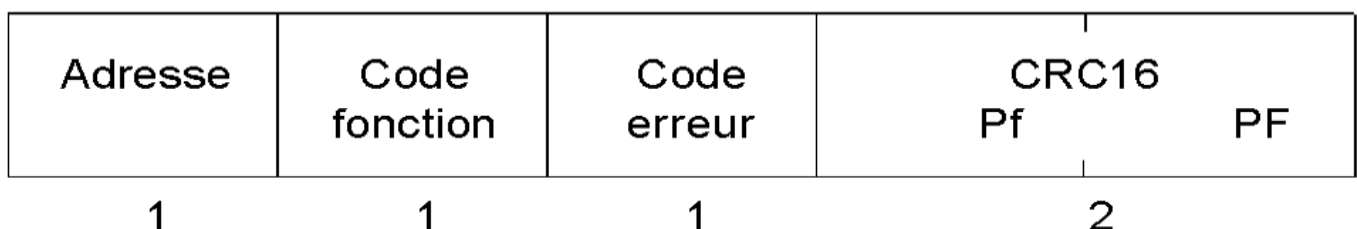| Adresse	Code Fonction	Adresse 1er mot PF Pf	Nombre de mots PF Pf	CRC16 Pf PF
1	1	2	2	2

Used function code: $10.
Address of data: $0001/0001, information "Height".
      or $000b/0011, information "Temperature".

5.2) Exception frame:

Longueur de trame 5 octets.

Adresse	Code fonction	Code erreur	CRC16 Pf PF
1	1	1	2

When a query frame transmission error occurs, CRC16 or parity, the slave station does not answer. If a frame writing error occurs, function code, data address, data number, an exception answer will be emitted by the slave station.

Exception frame particularity:
Function code: The function code of the exception frame is identical to the one of the query frame, but its most significant byte bit is set to 1 (logical or with $80).
Error code: The error code determines the reason of sending an exception frame.

Error code   Mean
$01   Function code not used.
           Only the word writing function $10 are allowed.
$02   Data address or
           data number not allowed.

6) Communication data:
6.1) Writing:
2 types of information can be send to the device, a "height" information or a "temperature" information. The distinction is done by the address at which the writing is realized.

The information is interpreted as "Height" if writing is realized to address $0001/0001. It is interpreted as "Temperature" if writing is realized to address $000b/0011.

For each type of information, "Height" and "Temperature", the display and bargraph values are accessible in simultaneous writing, the two values in a same frame.

For a height, the writing format is:
        .first integer 16 bits real not signed for the display,
        .second integer 16 bits not signed, in %, for the bargraph.

For a temperature, the writing format is:
        .first integer 16 bits real signed for the display,
        .second integer 16 bits not signed, in %, for the bargraph.

6.2) Data format:

- "Height" data type display:

The data is in integer format 16 bits real not signed. It is transmitted the most significant byte first. It is composed of 1 word so 2 bytes.
This value correspond directly to the value which must be displayed.
Only a 1000 division factor is applied to transform the value from millimetre to meter.
The transmitted quantity limitations are: 0 ... 65535.
The displayed quantity limitation are: 0 ... 0.001 ... 65.00.

- "Temperature" data type display:

The data is 16 bits real signed integer format. It is transmitted the most significant byte first. It is composed of 1 word so 2 bytes.
This value correspond directly to the value which must be displayed.
Only a 10 division factor is applied to transform the value from tenth of degrees to degrees.
The transmitted quantity limitations are: -32768 ... 32767.
The displayed quantity limitation are: -999 ... -0.1 ... 0 ... 0.1 ... 999.9.

- "Height" and "Temperature" bargraph data type:
The data is 16 bits non signed integer format. It is transmitted the most significant byte first. It is composed of 1 word so 2 bytes. This value, expressed in percent, correspond to the bargraph position. It is expressed by 0-255 points. The most significant byte of the value is 0.