PROGRAMMABLE NUMERIC

CONVERTER

95B200, 95R200

CONFIGURATION HANDBOOK

LOREME 12, rue des Potiers d'Etain
Actipole BORNY - B.P. 35014 - 57071 METZ CEDEX 3
Telephone 03.87.76.32.51 - Fax 03.87.76.32.52
Contact: Commercial@Loreme.fr - Technique@Loreme.fr

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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.

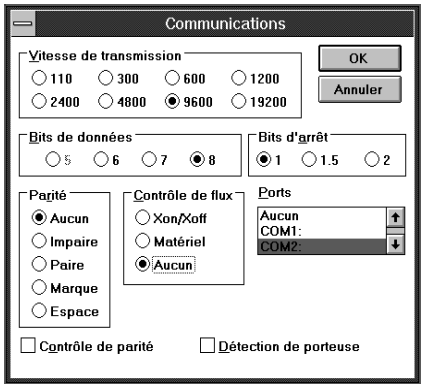
To quit kermit, press **"CTRL-$"** then press the key **"C"**.
When the message KERMIT-MS appears, type **"QUIT"** to return to MS-DOS commands.

4) PC with WINDOWS 3.11:

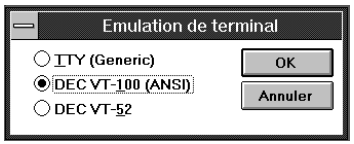
Start **WINDOWS** and in "**ACCESSOIRES**" group, double-click on  icon wich get access to terminal mode.

Terminal

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"**,

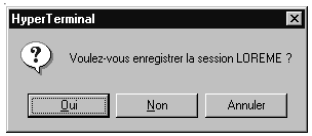
3 - Click twice on  .

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 it starts up, the device is in measure mode.

6.1) Converter mode:
Only one information is send at the terminal:

285.5 DC	Measure value

6.2) Calculator mode:
Several informations can be saw on terminal:

CHANNEL 1	Channel n° 1 displayed, key access **"1"**
255.2 M3/h	Measure value
CHANNEL 2	Channel n° 2 displayed, key access **"2"**
52.1 DC	Measure value
RESULT	Channel n° 3 displayed, key access **"3"**
180.5 M3/h	Result value

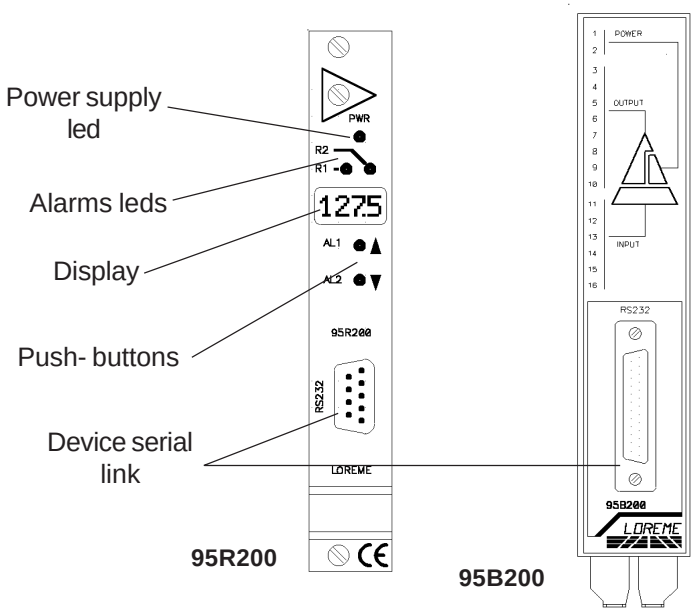
To change the visualization of one information to another, use **"1"**, **"2"**, **"3"** or **"$"** keys for a complete visualization (only on PC). To return in 2 lines display, use the **"ENTER"** key.

DEVICE PRESENTATION

The purpose of this configuration handbook is to allow to become familiar with the functions supplied by the device. It's necessary to notice the difference between different models:

95B200:	Case version with or without display,
95R200:	Rack version with or without display,
95B200/S:	Case version + 1 configurable analog output,
95R200/S:	Rack version + 1 configurable analog output,
95B200/S2:	Case version + 2 configurables analogs outputs.
95B200/C:	Case version + 1 RS485 MODBUS / JBUS link,
95R200/C:	Rack version + 1 RS485 MODBUS / JBUS link.

USING INTERFACE



The 95B200 front panel is composed of a SUB - D 25 pins connector.
The device configuration is make will be making by this RS 232 link .

The 95R200 front panel is composed by:

- one 4 digits display (10000 pts) for the measure visualization,
- 3 leds:
  - R1, alarm 1,
  - R2, alarm 2,
  - PWR: power supply.
- 1 SUB - D 9 pins connector for the RS 232 link (see 95B200),
- 2 buttons:
  - AL1: adjusting the alarm 1 threshold access in measue mode, threshold incrementation in configuration mode (alarms actived and control access authorized)
  - AL2: adjusting the alarm 2 threshold access in measue mode, threshold incrementation in configuration mode. (alarms actived and control access authorized)

To access to front panel adjusting threshold , 95R200 only, press one of buttons (AL1 or AL2) during device is in measure mode. The corresponding led flash.
To increment threshold value, press on ▲ and on ▼ to decrement.

If neither button is pressed during 5 s, device come-back in measure mode, and the new value of the threshold is validated.

Remark:
To adjust alarms thresholds, it is needed alarms are activated and front panel adjusting threshold access is validated.

CONFIGURATION

This manual recapitulates a detailed account of several configuration possibilities: language, input, range display, special functions, analog output, relay, communication. To access configuration mode, type on **"C"** key.

1) Method:

At configuration, several question types are asked. For each of them, several answers are possibles. Description of each of them:

1.1) 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.

1.2) Parameter selection:

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

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

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

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

1.3) Value acquisition:

Example: LOW SCALE
4 mA

Two possibilities:
- The validation without modification by pushing on **"↵"** / **"EXE"**,
- The keyboard value modification (simultaneous display), then the validation by **"↵"** / **"EXE"**.

Note concerning the value acquisition:
- It is possible, when a mistake is made during a value acquisition, before validating it, to go back 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, the device goes back in operating mode after a two minutes delay 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, you just have to press "ESC" (PC) or "SHIFT + DEL" (PSION) key.

2) Working modes:

This device is provided, in standard, two differents ways to run:

- converter mode: one input (mV, V, mA, Ω, Hz, Pt100, Pt 1000 or Tc), measure range, calculations functions (square root,linearization), one or two analogical outputs (95 (R,B) 200/S or /S2), two relays, communication.

- calculator mode: two inputs not isolated (forced in mV), one measure range for each input, specials functions (two coefficients by input, one operation on inputs, one range for output), one or two analogicals outputs (95 (R,B) 200/S or /S2), two relays, communication.

To change runing mode:
- be in measure mode,
- type **"MODE",** function access code (after each typed code, wait a **"BIP"**),
- select the desired mode (converter or calculator),
- the **"OK !"** message is displayed, the runing mode is validate.

3) Language:

The possibilities of language are:
- french,
- english,
- italian.

4) Input:

4.1) Converter mode:

input possibilities are:

- Voltage (mV, V),
- Current (mA),
- Resistance (Ω),
- Pt 100 (°C),
- Pt 1000 (°C),
- Thermocouple (°C),

for each input type, configure:

- low scale,
- high scale.

Particularity:

- Differential voltage (mV):

To realize a gauge bridge measure, select the differential mV voltage input. Characteristics as the sensitivity and the power supply (2.5 V) of the gauge bridge are necessary to adjust the measure scale:

Example: sensitivity 2 mV/V,
power supply 2.5 V.

The measure scale for the full range of the signal is:

- low scale: -5 mV,
- high scale: 5 mV.

View wiring diagram for gauge bridge wiring.

- Thermocouple:

Choice of thermocouple type (B, E, J, K, R, S, T),
Choice of compensation type (internal, external or carried off).
Choose the **internal compensation** when the thermocouple is connected on device with a compensation cable.
Choose the **external compensation** when a compensation box where the temperature will be know and fixed is used. Enter this temperature as the external compensation value.
Choose the **carried off compensation** when the compensation measure is realized by the device at the meeting point of the couple with the copper cable by a sensor of carried off temperature (on request in order) .

- Potentiometer:

Configure voltage input (V):

- low scale: 0 V,
- high scale: 2.5 V.

Move the potentiometer at the start and at the end of the range and measure the values.

Change the voltage input (V):

- low scale: value of start plage,
- high scale: value of end plage.

View wiring diagram for potentiometer wiring.

- Sensor power supply:

To supply a converter in 2 wires technical and measure the current in the loop, it's necessary to configure the device in 4-20 mA current input and select "SENSOR POWER".
View wiring diagram for sensor power supply and current input wiring.

- Resistance, Pt 100, Pt1000:

It's possible to choose between measure modes in 2, 3 or 4 wires.
3 or 4 wires selecte is realized by configuration. 2 wires mode is realized by a bridge with the third wire on the terminal block.

- Meter:

The acquisition value is the minimal width of impulses to measure.

4.2) Calculator mode:

Both of input channels are forced in voltage (mV).
For each channels, it is necessary to configure:

- low scale,
- high scale.

5) Display range:

The range converts the input signal to a physical quantity. This one facilitates the measures' interpreting.

Ex: Input 4-20 mA / Range 0 - 1000 kg
➔ Input = 12 mA, Range = 500 kg

For display range configure:

- unit,
- low scale,
- high scale,
- decimals number.

The unit of the range-display is facultative. It allows only to interpret the real value. It's limited to 4 characters.

The number of decimals is the digit number displayed after the decimal point. This number is limited by the input type, the scale of the display range and the device's resolution.

6) <u>Special functions:</u>

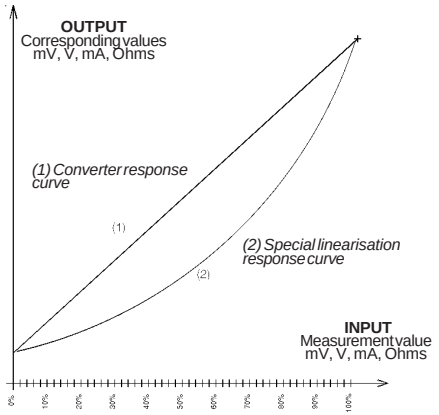
6.1) <u>Converter mode:</u>

This functions are not availables for a Pt100, Pt 1000 or Tc inputs.

Square root: this function executes a square root on the measure percentage of the input range and is reported on analog output.

Special linearization: when this function is choosed, it is directly validated, but the linearization configuration isn't modified. To modify the special linearization, it is necessary to validate by YES the configuration suggest.
When the special linearization is enabled, the converter will use the curve that you program (2).

To have a special linearization curve (2), it's necessary to put for each curve point the physical input value and the corresponding linearized value (max.: 20 signed points including 0 % and 100 % of the input). So, for each measure in the input range (***device can't use the linearization function out of range***), the device will make the corresponding of linearized value.



6.2) <u>Calculator mode:</u>

For each measure channel, it is possible to define 2 calculation values A and B (span and offset) to realize the Ax+ B operation.
The span is a coefficient without unit. The offset is exprimed in the input or the display range unit of the configured channel.
The operation realizable between two channels, defining the calcul result can be:

- an addition,
- a substraction,
- a multipicaion,
- a divison.

Now, configure final result range. It corresponds at the output scale (for an analog slot). See display range chapter.

7) <u>Analog output (95 (R,B) 200/S or /S2):</u>

Analog outputs configuration is presented through 2 rubrics:

- Output type:
  - current output (mA),
  - voltage output (V).

with for each output type, the choice of:

- low scale,
- high scale.

- Output parameters:
  - security value,
  - response time,
  - limitation.

The security value allows to set the output on a known state when there is a sensor breaking or a measure range overflow.
The acquisition value is sended to the output.

The response time is adjustable from 100 ms to 60 s. It allows to filter the output signal when the measure is disturbed.

The limitation allows, for all input signal values, to peak clip the output signal swing at scale configuration.
Only the **security value** goes beyond this function.

8) <u>Relay:</u>

The 2 relays configuration is presented through 2 rubrics:

- Detection type:
  - breaking detection,
  - threshold detection.

The breaking detection activates the alarm on sensor breaking or on measure range overflow.

The threshold detection activates the alarm on threshold overstepping. It is necessary to choose the threshold type (high or low), threshold and hysteresis values.

The two **detections types** can be chosen simultaneous.

The **threshold detection** runs in this way:
- **high threshold** detection:
  .the alarm is activated when the measure goes above the threshold,
  . the alarm is removed when the measure goes below the threshold less the hysteresis.
- **low threshold** detection:
  .the alarm is activated when the measure goes below the threshold,
  . the alarm is removed when the measure goes above the threshold more the hysteresis.

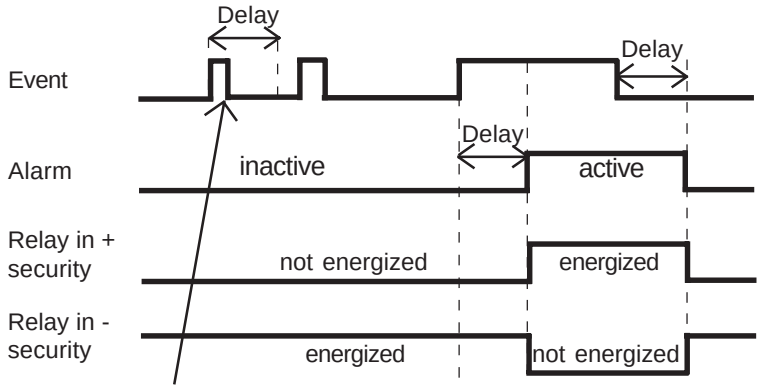
- Relay parameter:
  - security,
  - delay,
  - control.

The security works in this way:
- in positive security, the relay is energized when the alarm is active,
- in negative security, the relay is energized when the alarm is inactive.

The delay value (in seconds), determines the time above which the alarm changes his statement after detection of the event. The delay is active at the appearance and disappearance of the event.

When the alarm is using in threshold detection, it's possible to access at the **threshold control** of the alarm by **press buttons**.
This possibility can be desactivate on configuration (version with display).

Alarms and relays runing:



the time is reseting after the event disappearing

9) Communication:
The configuration of the communication is composed of 3 rubrics:
- **address** of the device in the communication network from 1 to 255,
- **speed** 600, 1200, 2400, 4800, 9600, 19200 or 38400 bauds,
- **parity** even, odd or without.

MEASURE MODIFICATION

Sometimes, it may be interesting to modify measure by a keyboard intervention. It can be used in many situations as a sensor's degradation, to calibrate the input with magnifying effect to obtain a better accuracy in the measure window.

To shift the measure, it is necessary:
- be in measure mode,
- type **"MEMO"**, access code for shifting function and reset the previous shifting value, (after each typed code, wait for a **"BEEP"**), the message **"MEMO"** is sended on the RS 232.
- **"<"** and **">"** keys allow to decrement and increment the measure,
- type on **"ENTER"** to save the shifting.

The value of measurement shift is memorized and remains active after a new configuration. To annulate the shift effect, type **"MEMO"** and then **"ENTER"** (reset of the shifting value).

EMC CONSIDERATION

1) Introduction
In order to insure its policy concerning EMC, based on the European directive 89/336/CE, LOREME takes into account all the standards relative to this directive as soon as the design of each device starts.
All the tests made on our devices, designed to work in industrial plants, have been made regarding the EN 50081-2 and EN 50082-2 standards in order to edit a conformity certificate.
It is difficult to guarantee all the results concerning EMC because tests are made in a standard and typical configuration. Results may vary when a change of configuration occurs.
In order to be sure to use all the capabilities of the device, it will be necessary to respect a few rules concerning its installation.

2) Installation and utilization rules

2.1) General remarks

- Installation should be made with respect to the informations given in technical documents (installation, spacing between each device ...).
- Utilization conditions should be in accordance with specifications of the transmitter (temperature range, protection level) specified in technical datasheet. Dust, excessive humidity, corrosives atmospheres or important heat sources should be prohibited in order to insure an optimum utilization.
- Noisy environment or elements creating perturbations should be avoided. If it is possible, it will be better to install instrumentation devices separately from hi-power or commutation devices.
Do not install measurement devices close to hi-power relays, thyristor groups, contactors or all electromagnetic noise generators.
Do not use a portable transmitter (walkie-talkie) at less than 50 cm of the device. A 5 W transmitter may generate a field which intensity may be more than 10 V/m at a distance near of 50 cm.

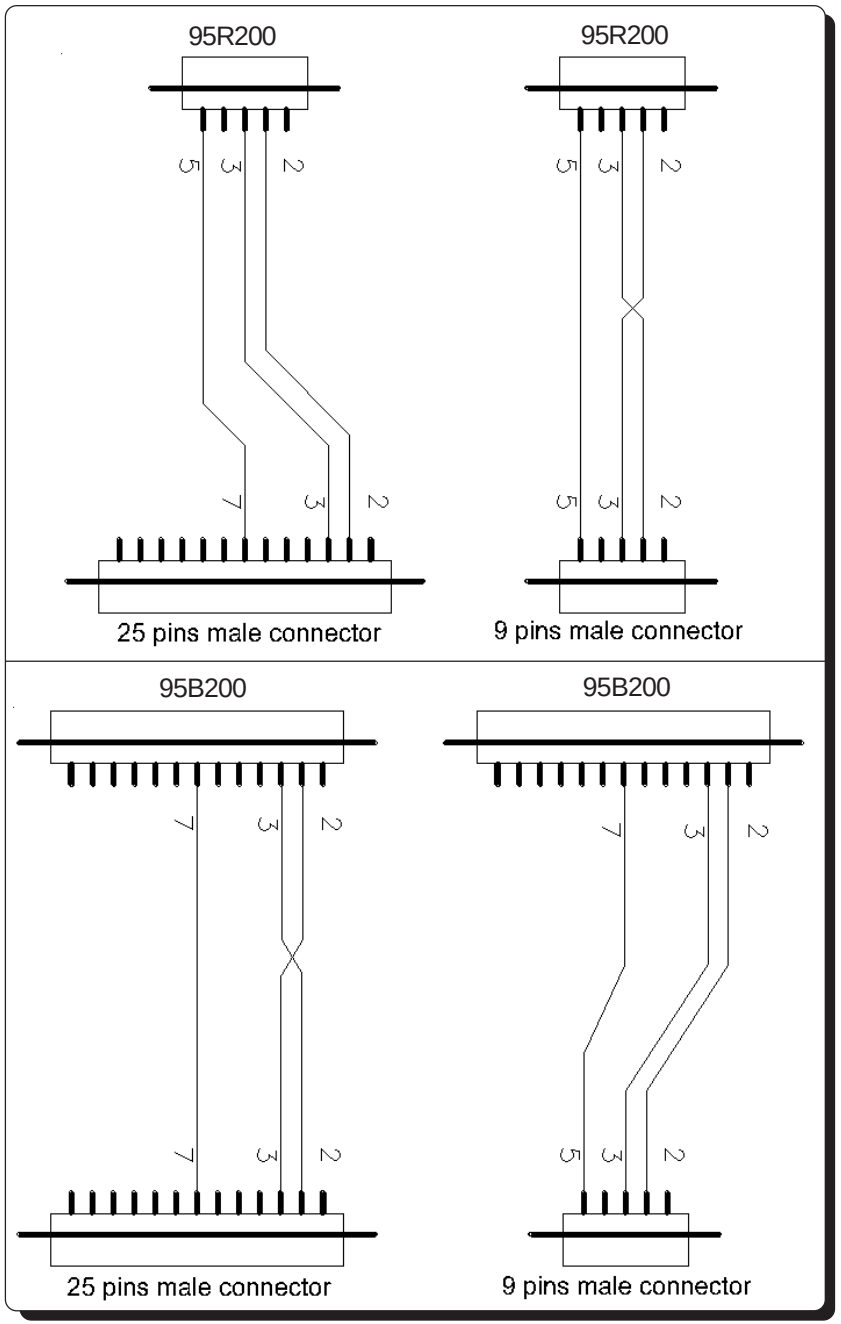
2.2) Power supply

- At first, it's important to install the equipment with respect to the technical specifications given in the device's datasheet (supply voltage, frequency, tolerance of values, stability, variations ...).
- The power supply of the device should be issued from a supply system using section switches and fuses made for instrumentation devices, and the supply line should be as direct as possible from section switch.
Don't use this power supply for relays, contactors or valves command.
- An isolating transformer, with its screen shorted to ground may be necessary if the supply circuit is made noisy with commutation of thyristors, relays, motors, speed variators ...
- It's important that the installation hast to be connected to ground.
The voltage between neutral and earth must be less than 1 V and the resistance must be less than 6 Ohms.
- If the equipment has been installed near hi-frequency generators or arc welding installations, it may be useful to install adequat filters on the mains supply.

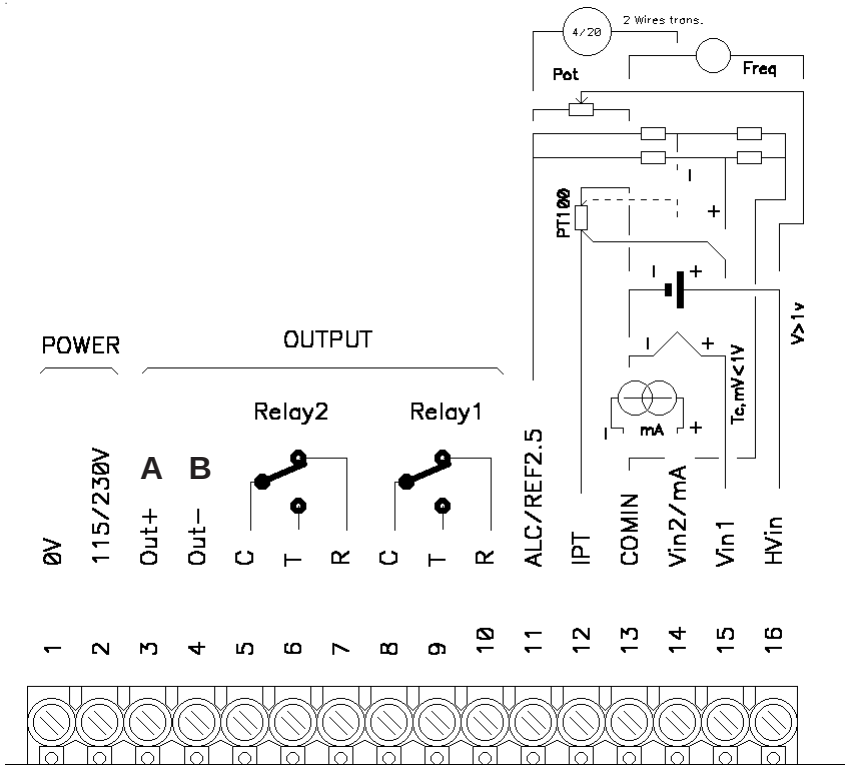
2.3) Inputs / Outputs

- In a noisy environment, it will be better to use shielded and twisted wires. The ground connection will be made at a single end of the wire.
- I/O lines should be well separated from supply wires in order to avoid coupling between these wires.
- Data wires length should be as short as possible.

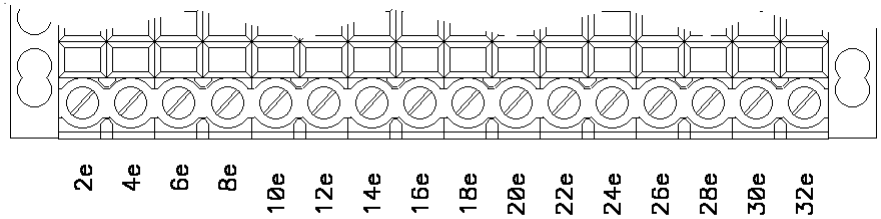
TERMINAL - DEVICE LINK



WIRING INPUTS / OUTPUTS



95B200



95R200

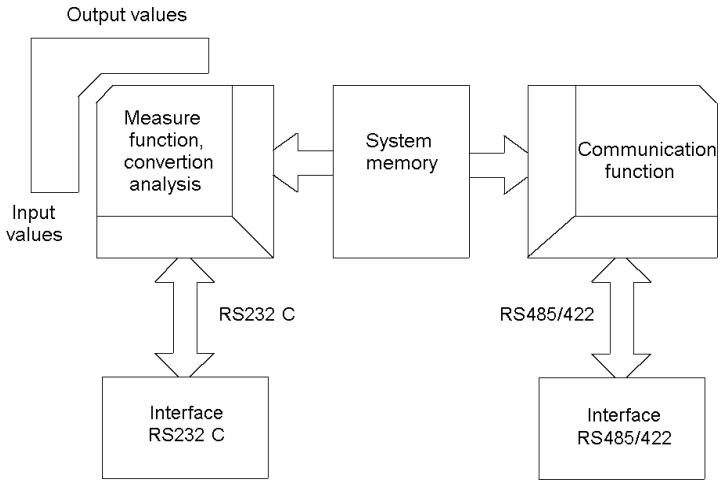
mV, Tc input	terminal 15 (+), terminal 13 (-)
V input	terminal 16 (+), terminal 13 (-)
mA input	terminal 14 (+), terminal 13 (-)
Sensor power supply	terminal 11 (+), terminal 14 (-),
Ohms, Pt100, Pt1000 (2 wires) input	terminal 12 and 15 (+), terminal 13 (-)
Ohms, Pt100, Pt1000 (3 wires) input	terminal 12 (+), terminal 15 (line), terminal 13 (-)
Ohms, Pt100, Pt1000 (4 wires) input	terminal 15 (+), terminal 14 (-) measure terminal 12 (+), terminal 13 (-) power supply
Potentiometre input	terminal 11 (+Vcc), terminal 16 (+), terminal 13 (-)
Gauge bridge input	terminal 15 (+), terminal 14 (-) measure terminal 11 (+), terminal 13 (-) power supply
Hz input	terminal 16 (~), terminal 13 (~)
Meter input	terminal 16 (+ or -), terminal 13 (+ or -)
Analog output	terminal 3 (out+), terminal 4 (out-)
RS 485 output	terminal 3 (A), terminal 4 (B)
Relay 1 output	terminal 8 (C), terminal 9 (T), terminal 10 (R)
Relay 2 output	terminal 5 (C), terminal 6 (T), terminal 7 (R)
Power supply	terminal 1 (~), terminal 2 (~)

RS 485 COMMUNICATION MODBUS

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 RS 485 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

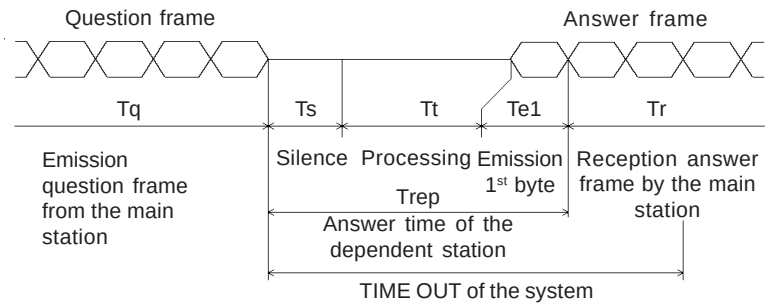
The device starts to process the frame 3.64 ms after receiving the last byte.

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 cycle of communication includes:

- the transmission of the question frame Tq,
- the answer time of the device Trep.

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 RS 485 MODBUS/JBUS communication, make sure that:

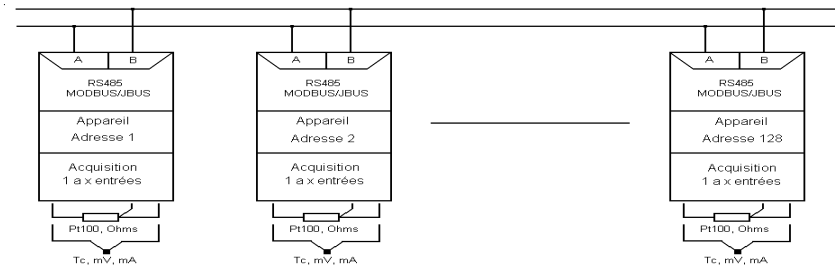
- the speed of transmission is identical between the dependent stations (LOREME devices) and the main station.
- the parity is identical between the dependent stations (LOREME devices) and the main station.
- the addresses are correctly distributed among the dependent stations (LOREME devices), no identical 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 RS 232 link.

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

3.2) Interconnection:

The RS 485 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:

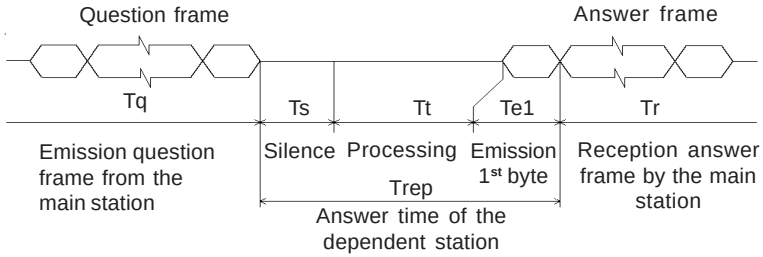
4.1) Procedure:

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

- measure reading,
- measure writing,
- speed 9600 bauds, without parity.

4.2) Measure reading:

Reading of 2 words (4 bytes) of the address $1000 to $1001:



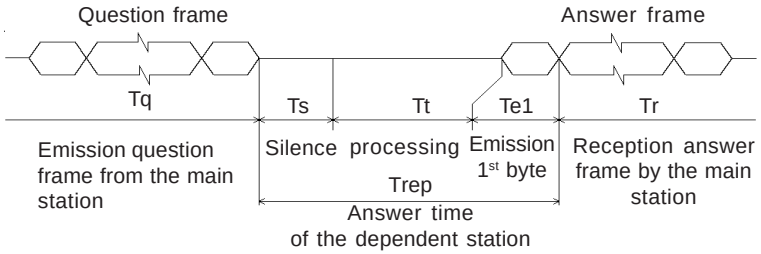
- Question frame 8 bytes — Tq = (8 x 10) / 9600 = 8.33 ms
- Silence — Ts = (3.5 x 10) / 9600 = 3.64 ms
- Processing — Tt = 10 ms
- 1st byte emission — Te1 = (1 x 10) / 9600 = 1.04 ms
- Answer time — Trep = Ts + Tt + Te1 = 14.68 ms
- Answer frame 9 bytes — Tr = [(9 - 1) x 10] / 9600 = 8.33 ms

- Complete cycle — Tcyc = Tq + Trep + Tr = 31.34 ms

Notes:
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 measure reading, the time of cycle of the system is about 30 ms.

4.3) Measure writing:

Measure writing only in counting configuration.
Writing of 2 words, 4 bytes, of the address $1000 to $1001.



- Question frame 13 bytes — Tq = (13 x 10) / 9600 = 13.54 ms
- Silence — Ts = (3.5 x 10) / 9600 = 3.64 ms
- Processing — Tt = 10 ms
- 1st byte emission — Te1 = (1 x 10) / 9600 = 1.04 ms
- Answer time — Trep = Ts + Tt + Te1 = 14.68 ms
- Answer frame 8 bytes — Tr = [(8 - 1) x 10] / 9600 = 7.29 ms

- Complete cycle — Tcyc = Tq + Trep + Tr = 35.51 ms

Notes:
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 measure writing, the time of cycle of the system is about 35 ms.

5) Structure of the frames:

5.1) Reading of words:

Function code used: $03 or $04
Measure reading: address $1000 to $1001
Configuration reading: address $2000 to $200D

Question: length of frame 8 bytes.

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

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

Slave address	Function Code	Number of bytes	Value of the words	CRC16
				Pf PF
1	1	1		2

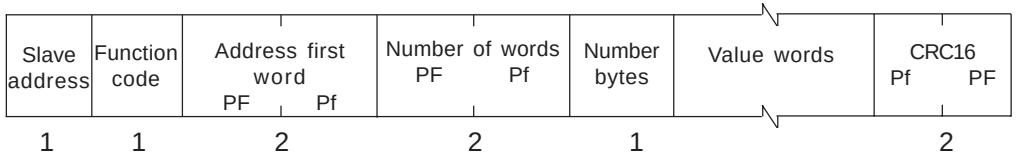
5.2) Writing of words:

Function code used: $10.

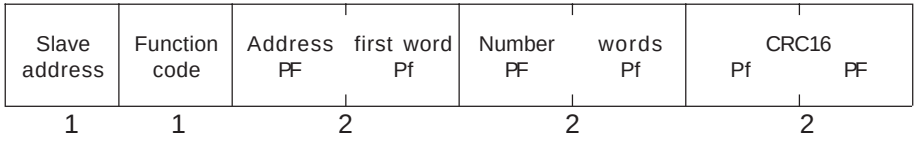
Measure writing: address $1000 to $1001

Configuration writing: address $2000 to $200D

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



Answer: length of frame 8 bytes

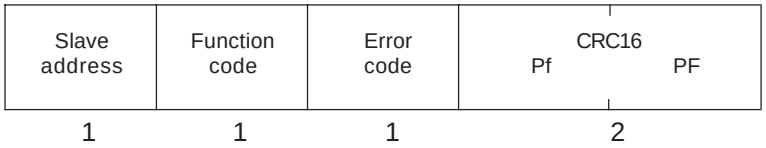


5.3) Exception frame:

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 its bit of strong load is set to 1 (logical or with $80).

- Error code:

The error code establishes the reason of a sending of an exception frame.

Error code	Meaning
$01	Function code not used. Only reading functions of words ($03 or $04) and writing of words ($10) are allowed.
$02	Non-valid data address. Memory access not allowed.
$03	Non-valid value. Value of word not allowed.

6) Communication datas:

6.1) Datas type:

The measure and configuration parameters belows, input type and nature, input scales, range scale and unit are datas accessibles in reading mode.

The measure (only in counting configuration) and configuration parameters belows, input type and nature, input scales, range scale and unit are datas accessibles in writing mode.

➔ Consult the enclosed tables for the detail of datas

6.2) Datas format:

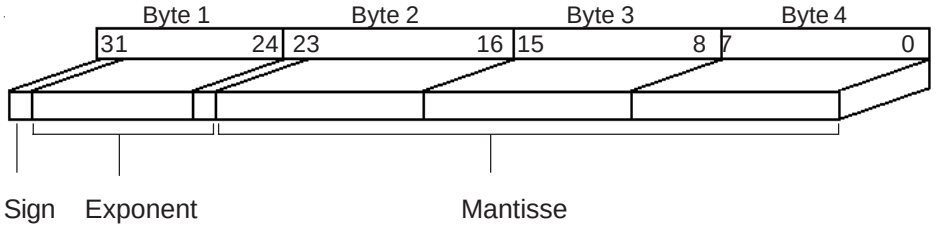
All datas are send most significant byte first.

Communication datas are:

- on 2 words at the IEEE floating 32 bits format (4 bytes) for the measure, the configuration parameters as input and range scale, the external compensation value.
- on 1, 2 or 4 bytes in integer or coding ASCII for configuration parameters as the input type and nature, the Tc type, the decimal point and the range unit.

- Datas at the floating 32 bits format.

This datas are composed of 4 bytes (2 words).



- Datas at the integer format or coding ASCII.
  - Input type:

	B7	B6	B5	B4	B3	B2	B1	B0
mV voltage	0	0	0	0	0	0	0	1
V voltage	0	0	0	0	0	0	1	0
mA current	0	0	0	0	0	0	1	1
ohms resistance	0	0	0	0	0	1	0	0
Hz frequence	0	0	0	0	0	1	0	1
Meter	0	0	0	0	0	1	1	0
°C Pt 100	0	0	0	0	0	1	1	1
°C Pt 1000	0	0	0	0	1	0	0	0
Thermocouple	0	0	0	0	1	0	0	1

  - Measure function:

	B7 - B5	B4	B3	B2	B1	B0
1	X	différential mV	mA passive + sensor pwr	4 wires measure	carried off compensation	external compensation
0	X	no différential	mA active	3 wires measure	internal compensation	

  - Thermocouple type: ASCII code of the thermocouple selected.
Ex: type K thermocouple --> $4B.

  - Range decimal point: the value goes from 0 to 4. It defines the number of digits after the decimal point. This value is limited automatically in internal in function of the input and range resolution.

  - Range unit: ASCII code of units chosen. The number is limited to 4.
Ex: mV unit --> $6D, $56, $00, $00.
Put the $00 code for all characters not used.

7) <u>Measure table:</u>

Words adress	B7	B6	B5	B4	B3	B2	B1	B0	Total Word	Total Byte
$1000	Measure				Byte 1		Word 1		1	1
					Byte 2					2
$1001					Byte 3		Word 2		2	3
					Byte 4					4

8) <u>Configuration table:</u>

Words adress	B7	B6	B5	B4	B3	B2	B1	B0	Total Word	Total Byte
$2000	Input type				Byte 1		Word 1		1	1
	Measure function				Byte 2					2
$2001	Input low scale				Byte 1		Word 1		2	3
					Byte 2					4
$2002					Byte 3		Word 2		3	5
					Byte 4					6
$2003	Input high scale				Byte 1		Word 1		4	7
					Byte 2					8
$2004					Byte 3		Word 2		5	9
					Byte 4					10
$2005	T° de compensation externe				Byte 1		Word 1		6	11
					Byte 2					12
$2006					Byte 3		Word 2		7	13
					Byte 4					14
$2007	Tc type				Byte 1		Word 1		8	15
	Range décimal point				Byte 2					16
$2008	Input low range				Byte 1		Word 1		9	17
					Byte 2					18
$2009					Byte 3		Word 2		10	19
					Byte 4					20
$200A	Input high range				Byte 1		Word 1		11	21
					Byte 2					22
$200B					Byte 3		Word 2		12	23
					Byte 4					24
$200C	Range unit				Byte 1		Word 1		13	25
					Byte 2					26
$200D					Byte 3		Word 2		14	27
					Byte 4					28