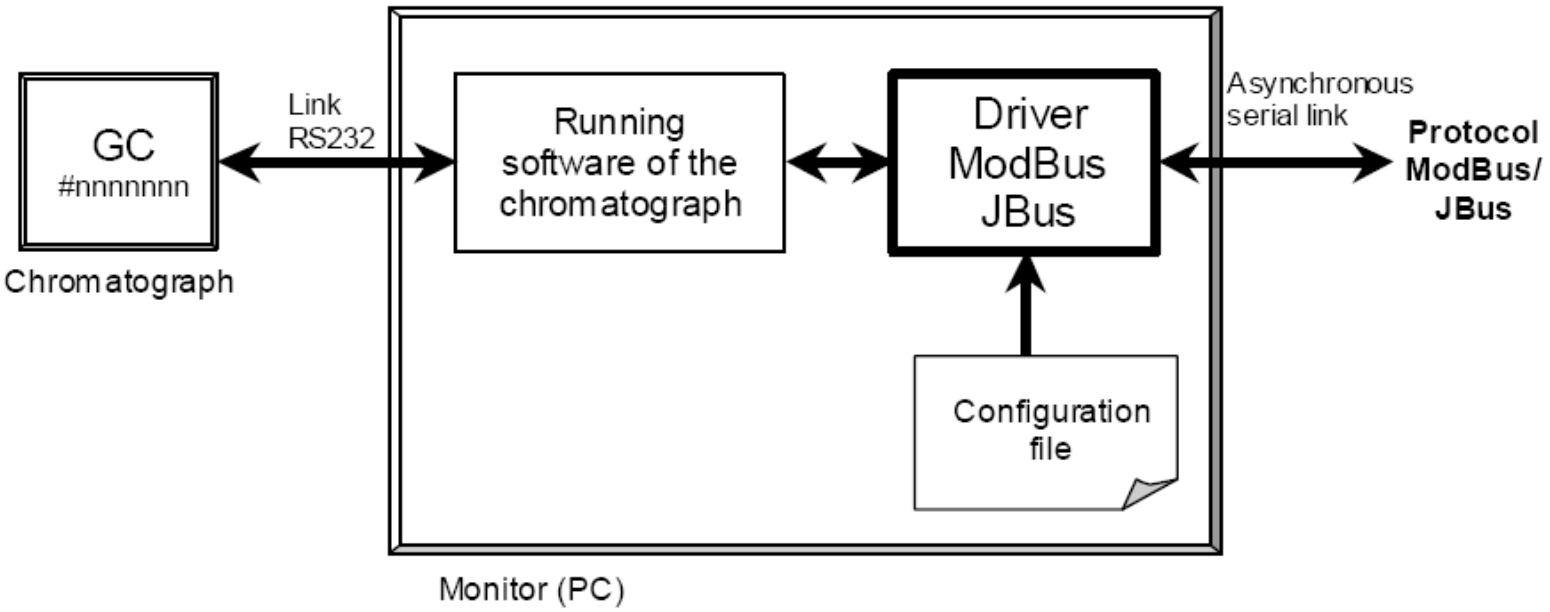
DRIVER MODBUS/JBUS TRAINING

Chromatotec®

Overview


GC
#nnnnnnn
Chromatograph
Link
RS232
Running
software of the
chromatograph
Driver
ModBus
JBus
Asynchronous
serial link
Protocol
ModBus/
JBus
Configuration
file
Monitor (PC)

COMMUNICATION PROTOCOLS

• Considering PC networks and telecommunications, a ***communication protocol*** is define to be a specification of several rules dedicated to a specific communication type.

• Initially, a protocole was defined as a set of rules used to communicate on a same « abstraction level » between two different machines. By extension we also use today this word to talk about the communication rules between two abstraction levels on a same instrument.
The mostly used protocol is the network one.

DEFINITION : MODBUS

• **Modbus** and **Jbus** are *communication protocols* used for *programmable automatons* networks. They are working on Master / Slave mode. They are made up of frames containing the selected automatom address, the action to be done, function, (writing, reading), the data and the error check code called CCR (control of cyclic redundancy).

• The *Modbus* protocol (**Modicon trade mark**) and the *Jbus* one (**April trade mark**) are dialogue protocols based on a hierarchical structure between a master and several slaves.

OVERVIEW

There are two ways to communicate :

1. The Master talks to the Slave and waits for an answer.

2. The master talks to all the slaves without waiting any answer (general broadcasting)

The Master is able to address up to 255 slaves.

COMMUNICATION RULES

- The Master handles alone the exchanges : **He decides**,
- Repeat the question if an erroneous exchange,
- Consider a slave missing after a time-out,
- A single equipment at the same time in emission, on one line,
- No slave can send message witjout request from the master,
- Possible side communication between slaves if and only if the Master was programmed to receive data and send them from a slave to an otherone.

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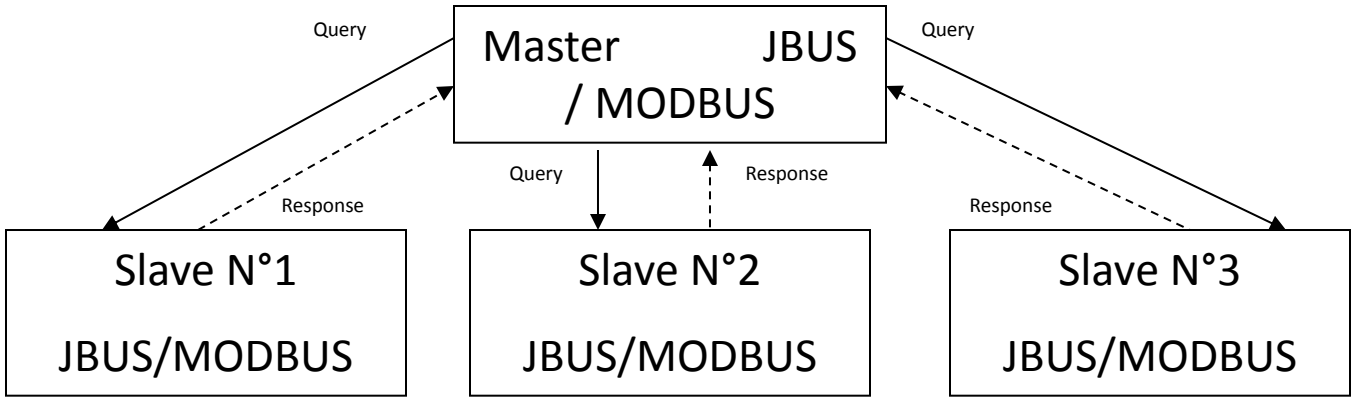
TREATED ON A HIERARCHICAL BASIS STUCTURE

One Master, several slaves



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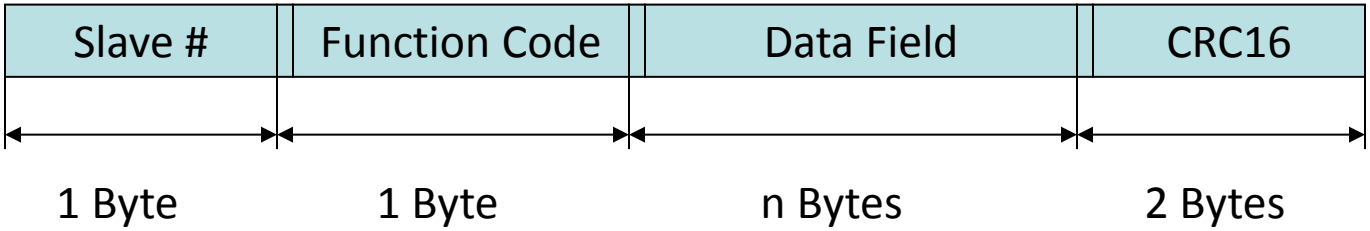
FRAME JBUS / MODBUS



Slave # : 0 to 255 (0 = general broadcast for writing functions only).

Function Code : Indicates the exchange type (see next pages)

Data Field : Information field containing the parameters linked to the function : word address, word value, number of words…

CRC16 : Word used to detect transmission errors (Cyclic Redundary Check).

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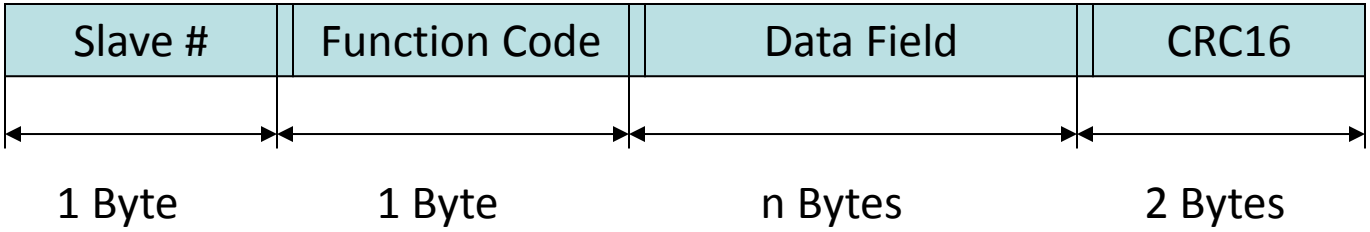
FRAME : The Query ?

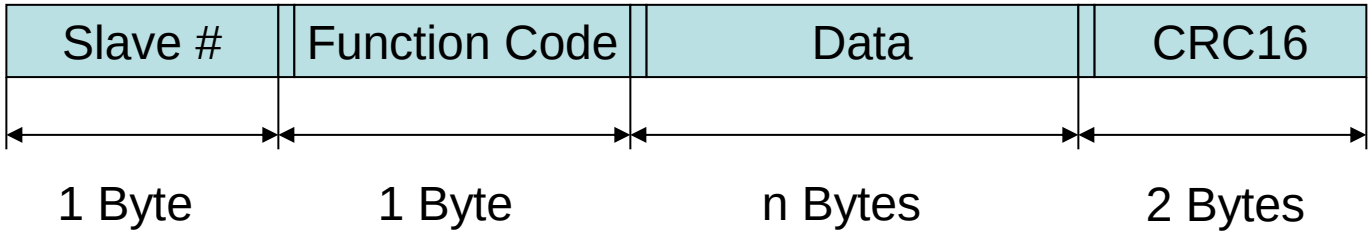
It contains a Function Code indicating to the sent addressed slave, which type of action is asked. The data contain additional information which the slave needs to execute this function.

The CRC16 allows the slave to make sure of the completeness of the contents of the question.



FRAME : The Response

Slave Address 11
Function 04
Byte Count 02
Data Hi (Register 30009) 00
Data Lo (Register 30009) 0A
Error Check (LRC or CRC) —

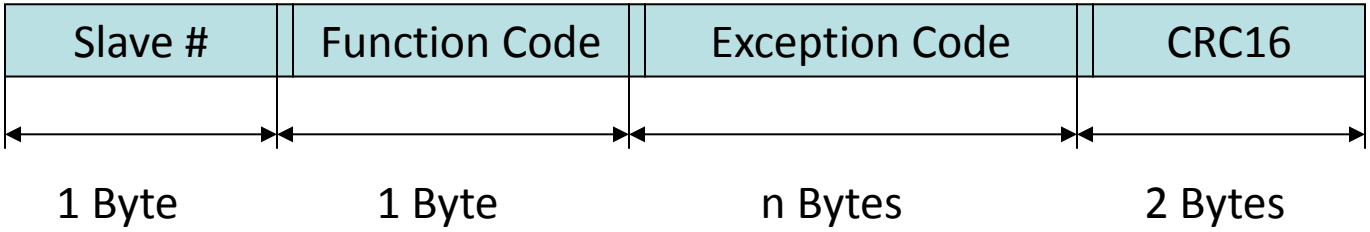


FRAME : The Response

If an error appears, function code is modified to indicate that the answer is an error answer.

The data contain then an exception code identifying the error type.

The control field allows the master to confirm that the message is valid.



FRAME : The coding

Two types of code can be used to communicate on a Modbus network. All the present equipments on the network must be configured according to the same type.

ASCII Type : each componant of the frame is coded with ASCII charaters (2 x 8 bits)

RTU Type (Remote Terminal Unit) : each byte composing a frame is coded with hexadecimal characters (2 x 4 bits). The maximal size of the data is 256 bytes.

The RTU mode allows a higher data flow for the same transmission speed.

MODBUS FUNCTIONS

The MODBUS protocol is composed of predefined functions, associated with a particular code, which we can be classified in 3 families :

1.- Data access : these functions allow to reach in reading and\or writing mode, bits, words or files of ModBus equipments.

2.- Diagnostics : these functions allow to make some diagnose on a ModBus equipment.

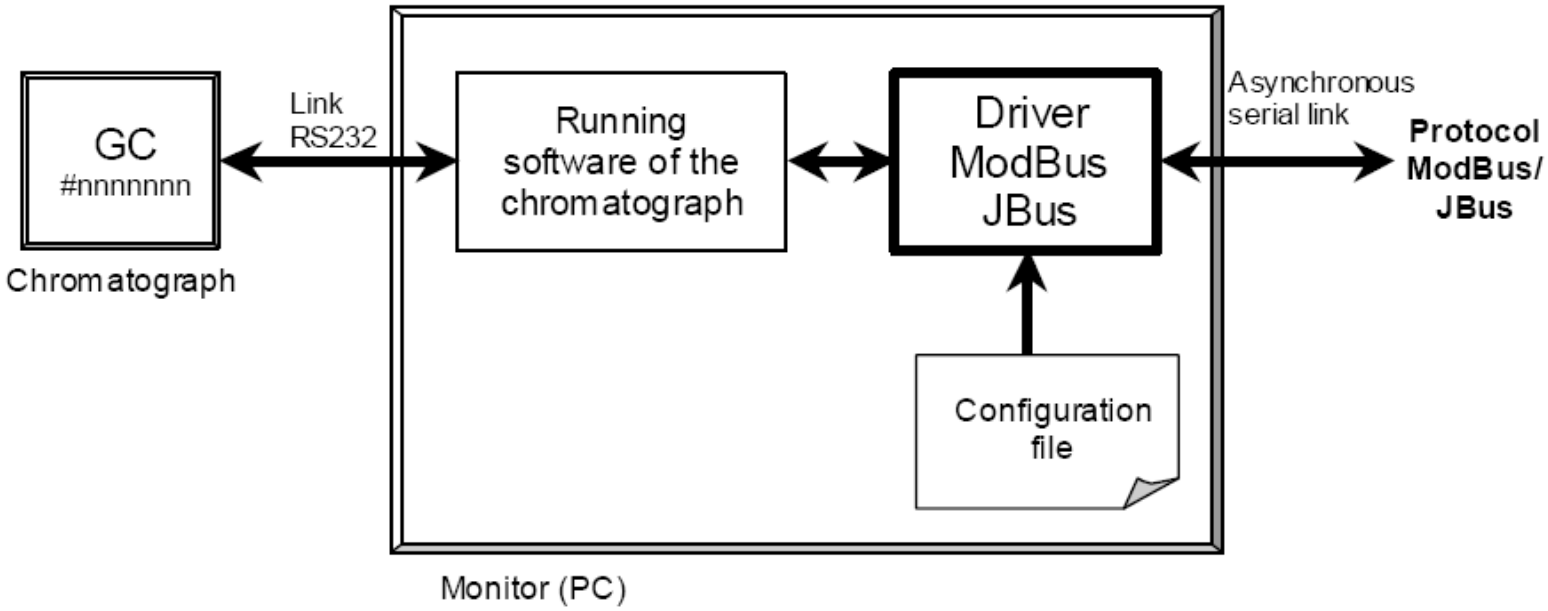
3.- Others : These functions allow the encapsulation of the MODBUS protocol on another one (ex: Can open)

MJBus CHROMATOSUD Driver Overview

✔ The MJBus driver is a program that realizes the interface between the software Vistachrom, that pilots the chromatograph and the ModBus (RTU mode) or Jbus communication protocol. This driver uses the Vistachrom real time database (RTDB or BDTR : Base de Donnée Temps Réel, in french).

✔ This is a shared memory area that contains amongst other things, the latest results received from the instruments.

MJBus CHROMATOSUD Driver Overview



MJBus CHROMATOSUD Driver Overview

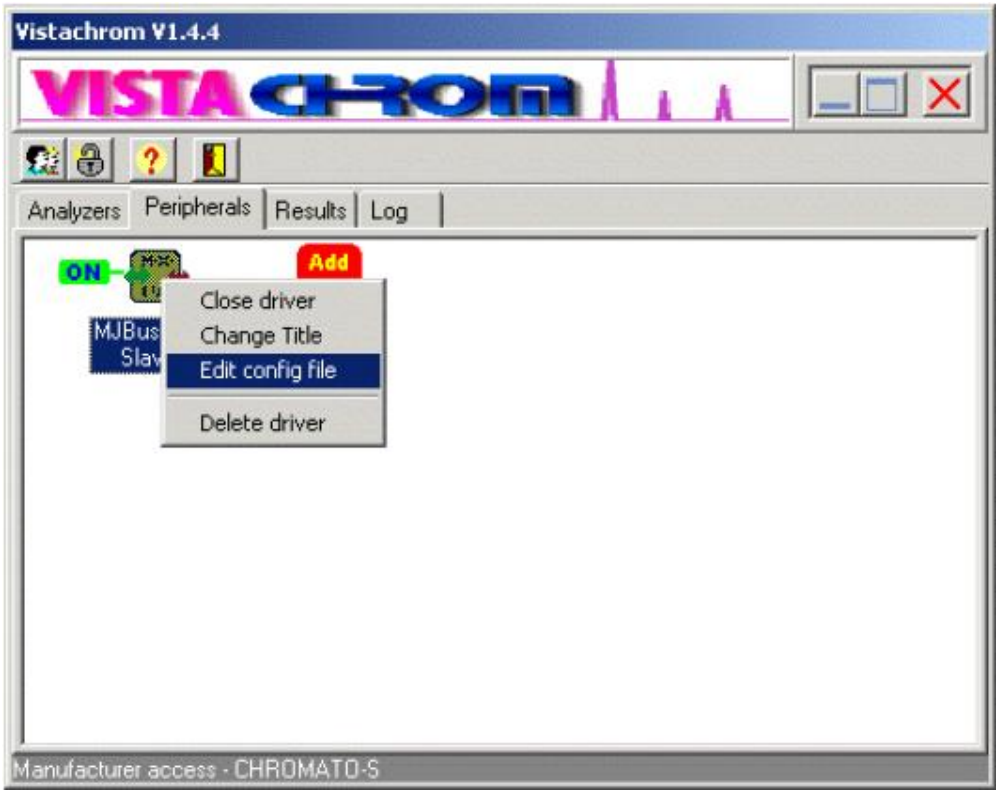
✔ This driver can run several slave numbers if necessary. Currently it implements, the following 3 functions of the protocol:

- Reading of n words.
- Writing of a word
- Simultaneous writing of several words

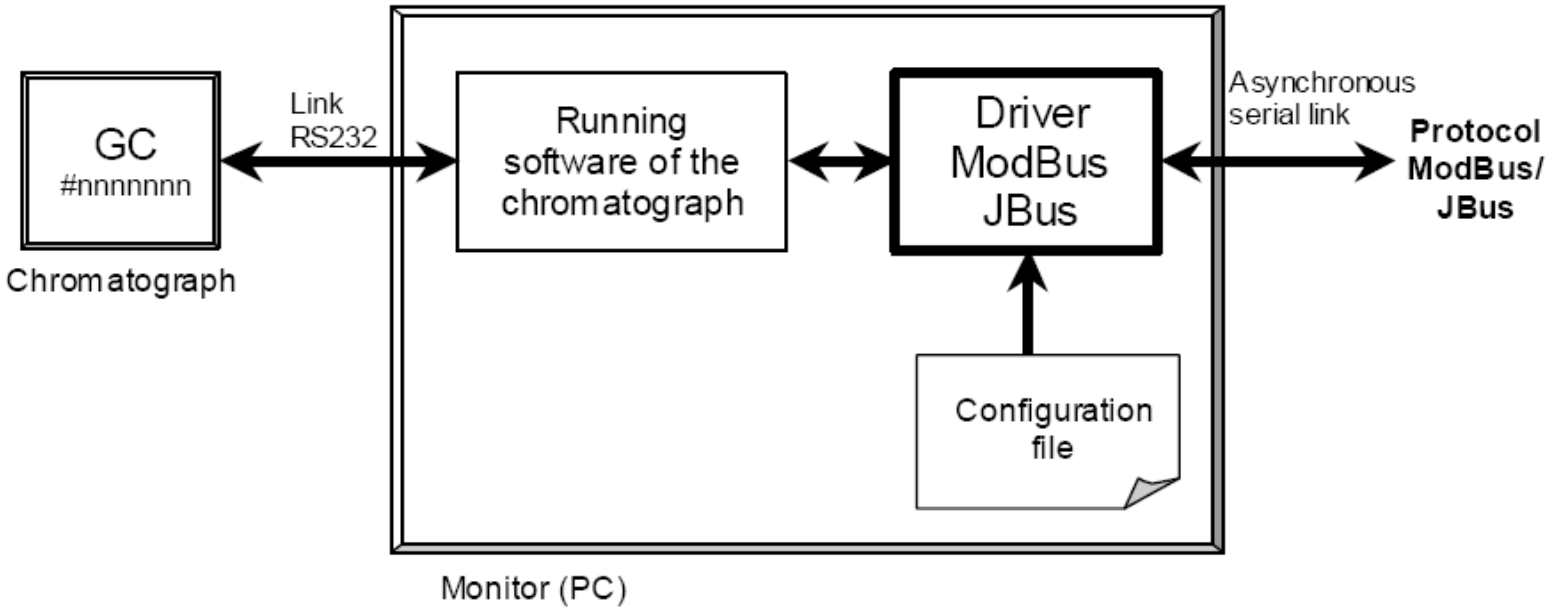
MJBus CHROMATOSUD Driver Configuration : Mapping

✔ Before using the MJBus driver, the configuration file must be checked and edited. To do it you have to:

· You should have a configured file, let's see what it looks like. The configuration file will define what we call the MAPPING of MJBus driver.



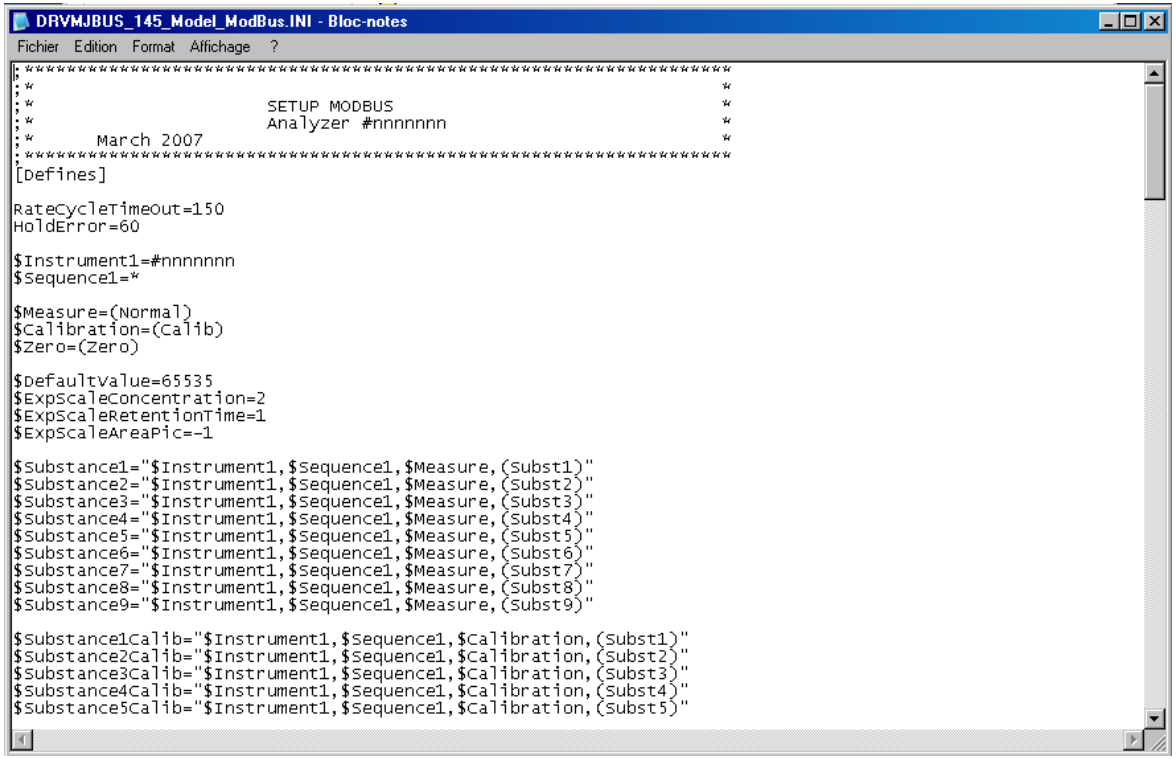
MJBus CHROMATOSUD Driver Overview



MJBus CHROMATOSUD Driver Configuration : Defines

✔ These details are divided in several sections. These sections begin with a name of section, this name is framed with brackets.

· The first section called [Defines] allows to set few functions and to define the symbolic constant that will be used in the other sections in order to make the writing or the configuration easier.



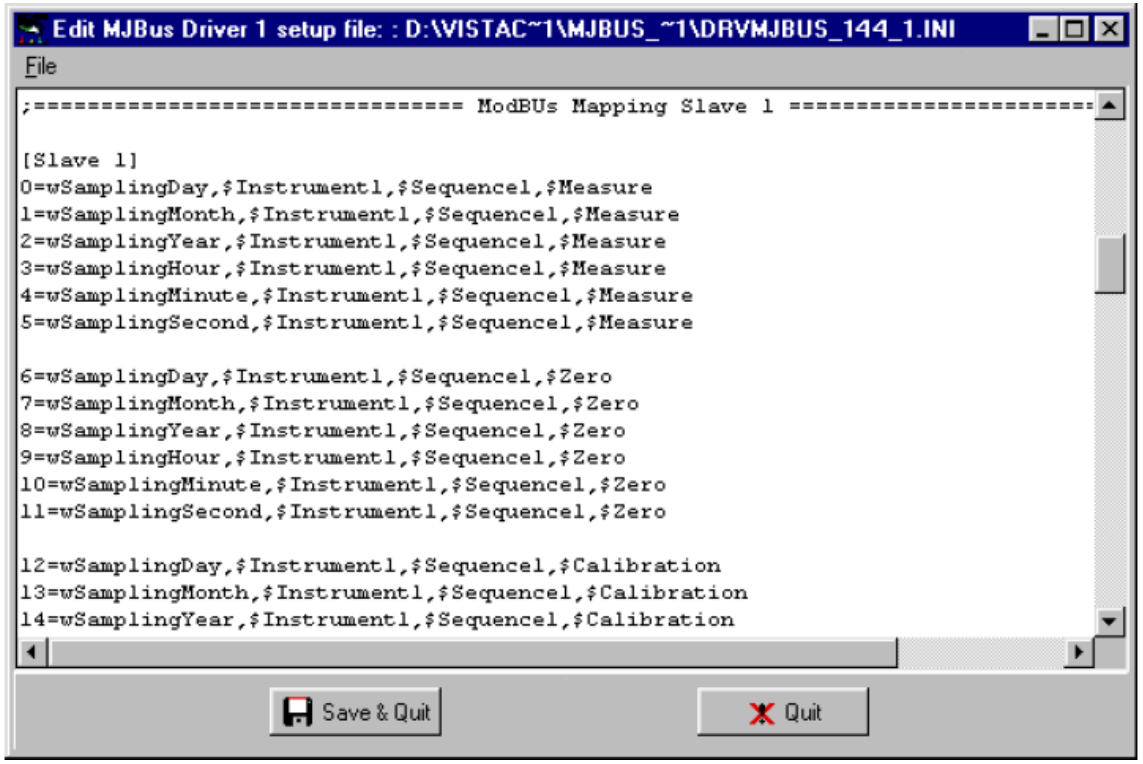
MJBus CHROMATOSUD Driver Configuration : Defines

✔ SECTION CONFIGURATION [DEFINES] : This section can modify the value of two parameters and to define the characters string symbolic constants.

- RATE CYCLE TIME OUT : This parameter indicates the maximum time accepted between two measures series in rate cycle time out (percentage). It defines the maximum allowed delay for the analyser to release its next results.
- DEFINITION OF SYMBOLIC CONSTANTS : In order to make the writing and configuration of definition sections of the Modbus slave mapping ([Slave n]) easy, we can define the symbolic constants that stand for a string.
- Save time!

MJBus CHROMATOSUD Driver Configuration : Slaves overview

· The following sections allow to define the ModBus / Jbus registers « mapping » of the different slaves necessary to the setting up. The name of these sections is in the form [Slave n] where n is the ModBus/Jbus slave number. You can define as many slave as necessary for you configuration but generally one slave is sufficient.



MJBus CHROMATOSUD Driver

Configuration : Slaves Mapping definition1

· ***Important note*** : the register numbering varies between Modus and Jbus protocol, despite the other parts are identical. The Modbus protocol starts the register numbering with 1 (or 40001) and the Jbus starts with 0. Depending on the Modbus client, this may lead that the register address may be 1 shifted and one should take in account when building request.

· Each line of this section defines a field in the slave register space. According to its value type, a field can use one or more registers to fit.

MJBus CHROMATOSUD Driver
Configuration : Slaves Mapping definition2

- The syntax of these lines is the following : Address=FieldType, parm1, parm2…
- Example :

```
100=wConcentration,#5411002,Seq541,Mth541_1,Toluene,
2,65535
```

- Assigns to register address 100, the integer of the toluene. And this on the condition that the concentration has been obtained with the Mth541_1 method of the Seq541 sequence running on the #5411002 instrument. The default value, without any measurement in the allotted time, is 65535.

MJBus CHROMATOSUD Driver

Configuration : Slaves Mapping definition3

- LIST OF DIFFERENT FIELD TYPES

File type	Description	Size	Type
sConstant	Inserts a fix text	-	String
sDate	Inserts the PC date (in the form of a string)	4	String
sTime	Inserts the PC time (in the form of a string)	3	String
sSamplingDate	Inserts the date of the latest sampling achieved with a data method (in the form of a string) .	4	String
sSamplingTime	Inserts the hour of the latest sampling achieved with a data method (in the form of a string) .	3	String
wSamplingDay	Inserts the date of the latest sampling achieved with a data (in the form of a integer) .	1	Word
wSamplingMonth	Inserts the month of the latest sampling achieved with a data method (in the form of a integer).	1	Word
wSamplingYear	Inserts the year of the latest sampling achieved with a data method (in the form of a integer) .	1	Word
wSamplingHour	Inserts the hour of the latest sampling achieved with a data method (in the form of a integer).	1	Word
wSamplingMinute	Inserts the minutes of the latest sampling achieved with a data method (in the form of a integer)..	1	Word
wSamplingSecond	Inserts the seconds of the latest sampling achieved with a data method (in the form of a integer).	1	Word
fSamplingDay	Inserts the day of the latest sampling achieved with a data method (in the form of a float) .	2	Float
fSamplingMonth	Inserts the month of the latest sampling achieved with a data method (in the form of a float) .	2	Float
fSamplingYear	Inserts the year of the latest sampling achieved with a data method (in the form of a float)	2	Float

MJBus CHROMATOSUD Driver

Configuration : Slaves Mapping definition4

- LIST OF DIFFERENT FIELD TYPES

fSamplingYear	Inserts the year of the latest sampling achieved with a data method (in the form of a float)	2	Float
fSamplingHour	Inserts the hour of the latest sampling achieved with a data method (in the form of a float).	2	Float
fSamplingMinute	Inserts the minutes of the latest sampling achieved with a data method (in the form of a float). .	2	Float
fSamplingSecond	Inserts the seconds of the latest sampling achieved with a data method (in the form of a float) .	2	Float
wConcentration	Inserts the concentration of a substance (in the form of a integer)	1	Word
wRetentionTime	Inserts the retention time of a substance (in the form of a integer)	1	Word
wPicArea	Inserts the peak surface of a substance (in the form of a integer).	1	Word
lConcentration	Inserts the substance concentration (in the form of a integer)	2	Long
lRetentionTime	Inserts the retention time of a substance (in the form of a long integer)	2	Long
lPicArea	Inserts the peak surface of a substance (in the form of a long integer)	2	Long
fConcentration	Inserts the substance concentration (in the form of a float)	2	Float
fRetentionTime	Inserts the retention time of a substance (in the form of a float)	2	Float
fPicArea	Inserts the surface of a substance peak (in the form of a float)	2	Float
a2Concentration	Inserts the substance concentration (in the form of a float number with 2 characters identifying the substance before)	3	CodeSubst +Float
a2RetentionTime	Inserts the retention time of a substance (in the form of a decimal float number with two characters identifying the substance before)	3	CodeSubst +Float
a2PicArea	Inserts the surface of the substance peak (in the form of a float number with two characters identifying the substance before).	3	CodeSubst +Float

MJBus CHROMATOSUD Driver

Configuration : Slaves Mapping definition5

- LIST OF DIFFERENT FIELD TYPES

Command	Inserts a order register allowing to act on the instrument (log on/log off the cycle, calibration, zero)	2	Reg. 32b
Status	Inserts a state register reporting the instrument state (log on/log off, run/standby)	4	Reg. 64b
Default	Inserts a default register reporting some error codes emitted by the instrument	2	Reg. 32b
word	Inserts a RTDB data (non signed integer of 16 bits)	1	Word
int	Inserts a RTDB data (signed integer of 16 bits)	1	Int
long	Inserts a RTDB data (signed integer of 32 bits)	2	Long
float	Inserts a RTDB data (floating comma integer)	2	Float
wLifeSignal	Inserts the « live signal » of an instrument.. In the RTDB it means to the « LifeSignal » rubric value of the instrument key (ex : #5000404.LifeSignal). This value is increased roughly one time by second..	1	Word
wResultsCount	Inserts the « results counter » of an instrument. In the.RTDB, it means to the « ResultsCount » rubric value of the instrument key (ex : #5000404.ResultsCount). This value is increased each time when the instrument supplies new results..	1	Word

MJBus CHROMATOSUD Driver

Declaration of Instrument register fields1

Command register

Command N°	Name	Action
1	LogOn	Asks to Vistachrom to connect to the instrument
2	LogOff	Asks to Vistachrom to disconnect to the instrument
3	Start	Asks to Vistachrom to start up the sequence
4	Stop	Asks to Vistachrom to stop the current sequences
5	Calib	Asks to Vistachrom to insert a calibration method
6	Zero	Asks to Vistachrom to insert a zero method
7	Mth1	Asks to Vistachrom to insert the method 1
8	Mth2	Asks to Vistachrom to insert the method 2
9	Mth3	Asks to Vistachrom to insert the method 3
10	Mth4	Asks to Vistachrom to insert the method 4
11	Mth5	Asks to Vistachrom to insert the method 5
12	Mth6	Asks to Vistachrom to insert the method 6

MJBus CHROMATOSUD Driver

Declaration of Instrument register fields2

State Register

Bit number of the internal state	Meaning
33	**Log On** -> The instrument is connected to Vistachrom
34	**Run** -> The instrument executes a sequence
35	**Wait** -> The instrument is on the waiting phase (above all useful when it is in the « slave » mode
36	**Synch** -> th instrument is in progress of synchronisation (ex : waiting for the whole minute for starting up a new method))
37	**Calib** -> The latest results obtaines come from the calibration method.
38	**Zero** -> The latest results obtained come from the zero method.
39	**ResultMth1** -> the latest obtained results come from the method 1
40	**ResultMth2** -> The latest obtained results come from the method 2
41	**ResultMth3** -> The latest obtained results come from the method 3
42	**ResultMth4** -> The latest obtained results come from the method 4
43	**ResultMth5** -> The latest obtained results come from the method 5
44	**ResultMth6** -> The latest obtained results come from the method 6
45	**SamplingMth1** -> the sampling phase of the method 1 is pending
46	**SamplingMth2** -> the sampling phase of the method 2 is pendung
47	**SamplingMth3** -> The sampling phase of the method 3 is pending
48	**SamplingMth4** -> The sampling phase of the mehtod 4 is pending
49	**SamplingMth5** -> The sampling phase of the method 5 is pending
50	**SamplingMth6** -> The sampling phase of the method 6 is pending
51	**TimeOut** -> the insturment has not returned any results in the given time.
52	Reserved
.....	.....
64	Reserved

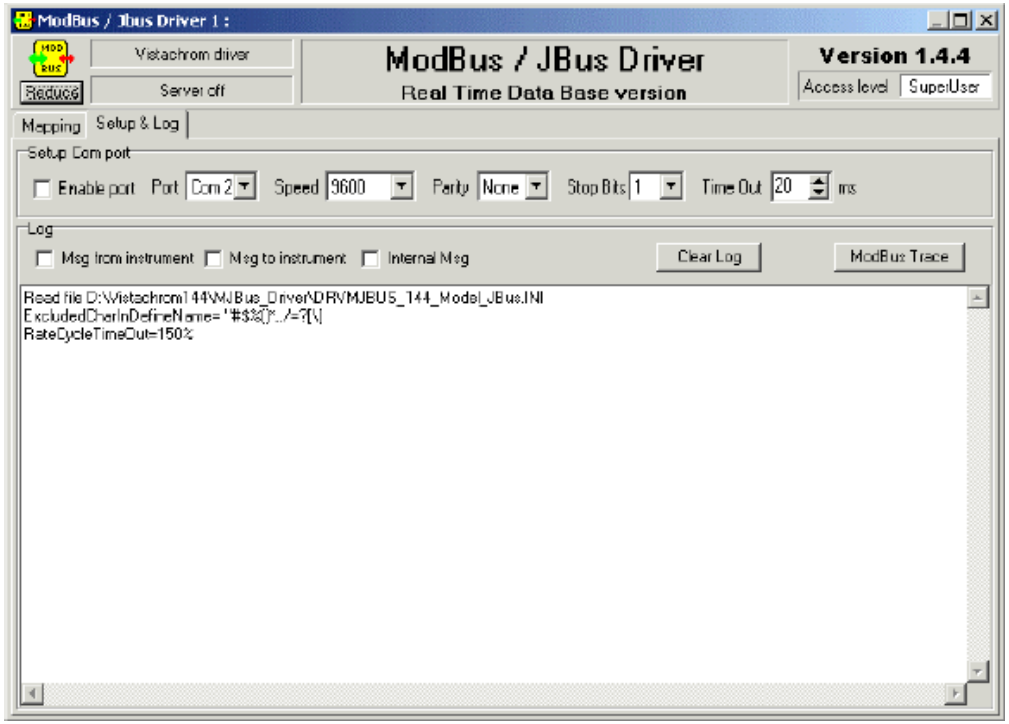
MJBus CHROMATOSUD Driver

INTERFACE DRIVER USER1

THE « SETUP & LOG » TAB

THE “ SETUP COM PORT” FRAME

It allows to setup the asynchronous serial communication port.



MJBus CHROMATOSUD Driver

INTERFACE DRIVER USER2

THE « SETUP & LOG » TAB

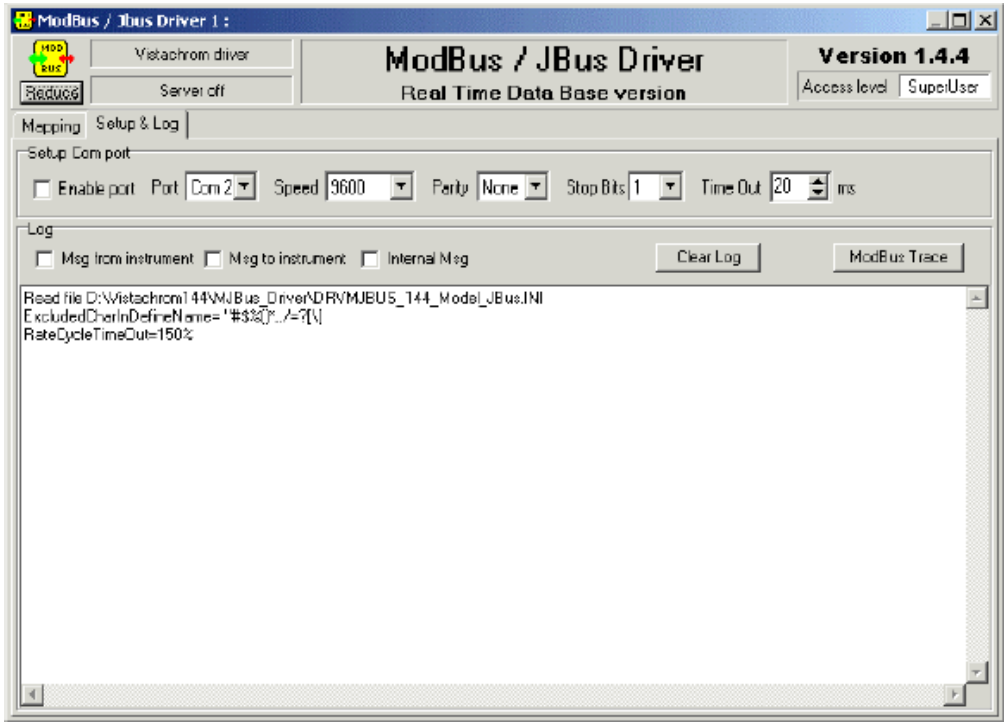
THE FRAME « LOG »

The display area shows the actions executed by the driver.

· The configuration file reading (DrvMJBus_14x_1.INI)

· The initialization of RateCycleTimeOut

•The displayed errors occurred when the configuration file is interpreted.



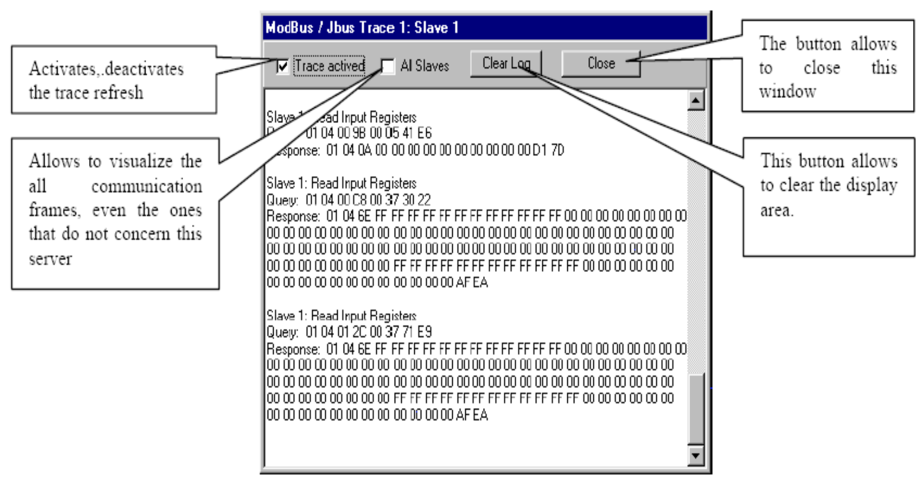
MJBus CHROMATOSUD Driver

INTERFACE DRIVER USER3

<u>THE « SETUP & LOG » TAB</u>

THE FRAME « LOG »

The button « **ModBus Trace** » opens up a window that displays the detail of the ModBus frames in the hexadecimal form exchanged between the driver and the distant Modbus client



MJBus CHROMATOSUD Driver

INTERFACE DRIVER USER4

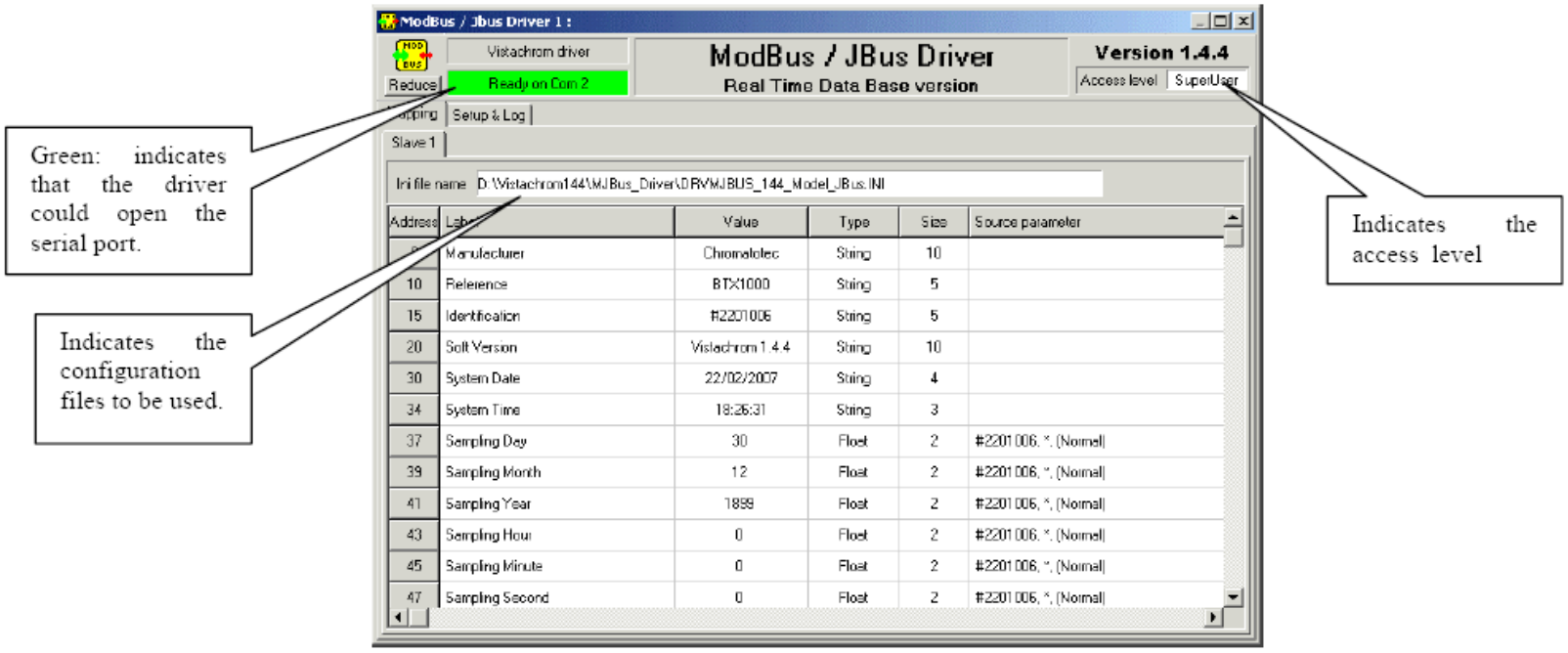
THE « MAPPING » TAB

This tab visualizes the « mapping » of different ModBus / JBus slaves run by the driver. This mapping is under the form of a table. Each line of this one represents a field in the slave register space

MJBus CHROMATOSUD Driver

INTERFACE DRIVER USER4

THE « MAPPING » TAB



MJBus CHROMATOSUD Driver

RUNNING MJBUS DRIVER

- **Now let's practice : hands on the GCs**