BSM II

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Engine Control Monitor

User Manual

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II. Overview

A. Sensor Measurement

- Acquisition and conditioning of signals from sensors (16 analogue inputs as PT100, +/-10V, +/-20mA, VDO)
- Measure displayed on PC or external automate (MODBUS)

B. Integrated micro-Programmable Logical Controller

- Added specific equations possibilities
- 3 writing levels protected by passwords
- Replace a micro PLC

C. Displayed of all engine measurements on PC

- Bargraph of analog inputs
- Display of digital input / output
- Display of 10 parameters that you can choose

D. Event archiving

- Real time clock
- 64koctets flash (127Koctets max)
- Adjustable time interval between backups (Sample Rate)
- Storage of date and time at every backup
- Storage of 50 variables at the most per event
- Event buffers download through PC (Compatibility with Excel)
- Activating with the PLC or an digital input or a threshold of an analog input

E. Circular archiving

- Real time clock
- 64kbytes flash (127Kbytes max)
- Adjustable time interval between backups (Sample Rate)
- Up to 50 parameters archiving
- Date and time saved with each backup
- Circular buffers download through PC (Compatibility with Excel)
- Activating with the PLC or an digital input or a threshold of an analog input

F. Real Time archiving

- Archiving on the PC memory
- One second interval time between backups
- Archiving of the 10 parameters of Information web page, of all analog inputs and of all digital inputs
- File compatible with Excel

G. SCADA connection via RS485 with MODBUS protocol (slave only)

H. CAN bus with CANopen protocol

- Slave CANopen protocol, compatible with GENSYS
- 1 SDO server, 8 RxPDO and 11 TxPDO fully settings
- Communication with a second BSMII

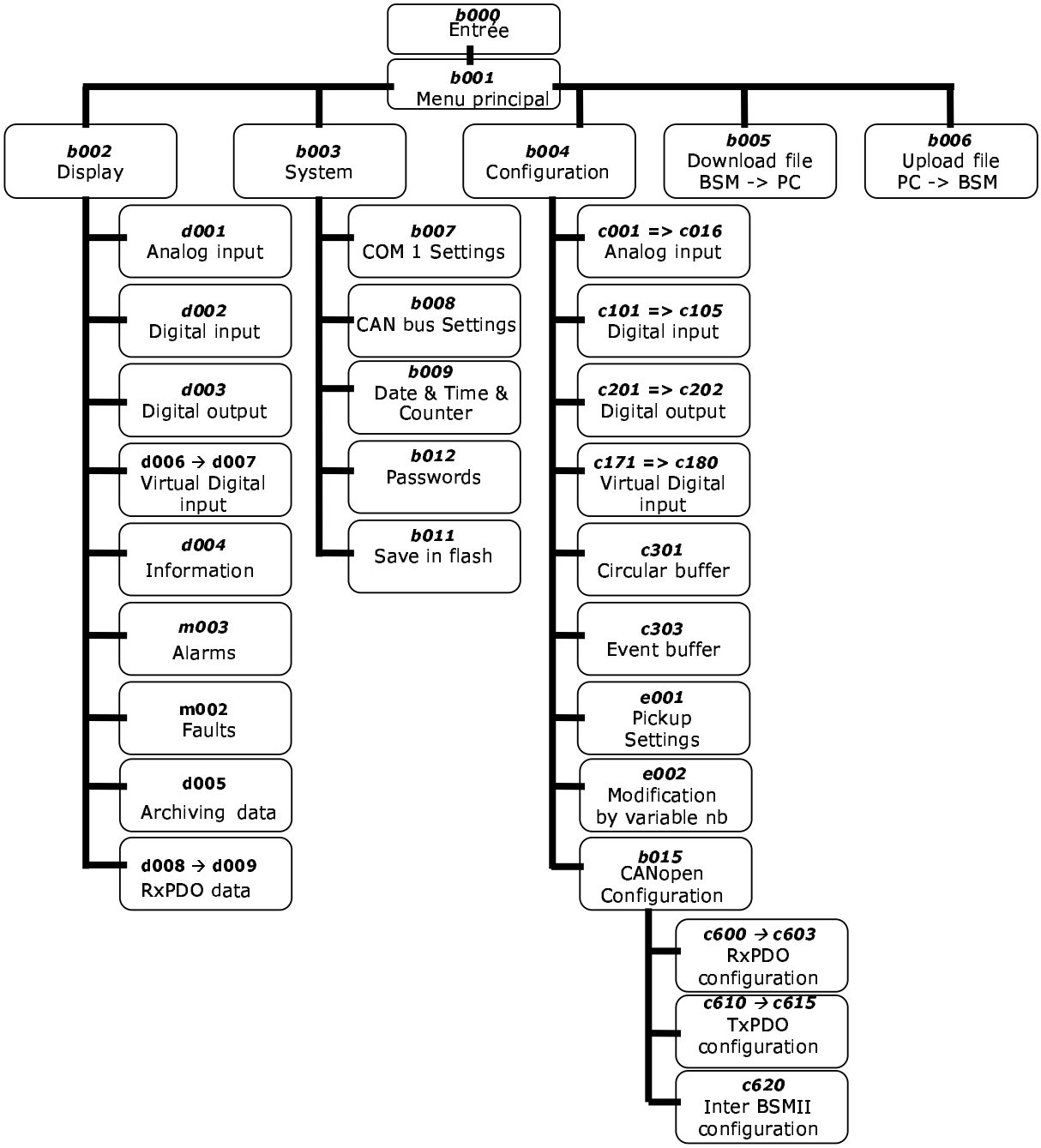
I. Local or remote operation with PC and Internet navigator (Internet explorer, Netscape, ...)

- No specific software
- Compatibility for many years

J. Counter

- Running hour meter stored in non volatile RAM

III. Menus structure



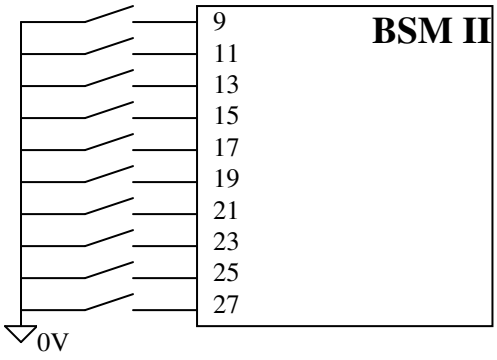
IV.Inputs / Outputs

BSM II consists of one electronic board with all functionality. BSM II is designed to monitor industrials installations and thermal engines. BSM II is based around a micro-controller structure dedicated to the acquisition and control command of systems. A 1MBytes memory flash permit a large capacity storage. The signals conditioning are achieved with inputs / outputs which are completely configurable

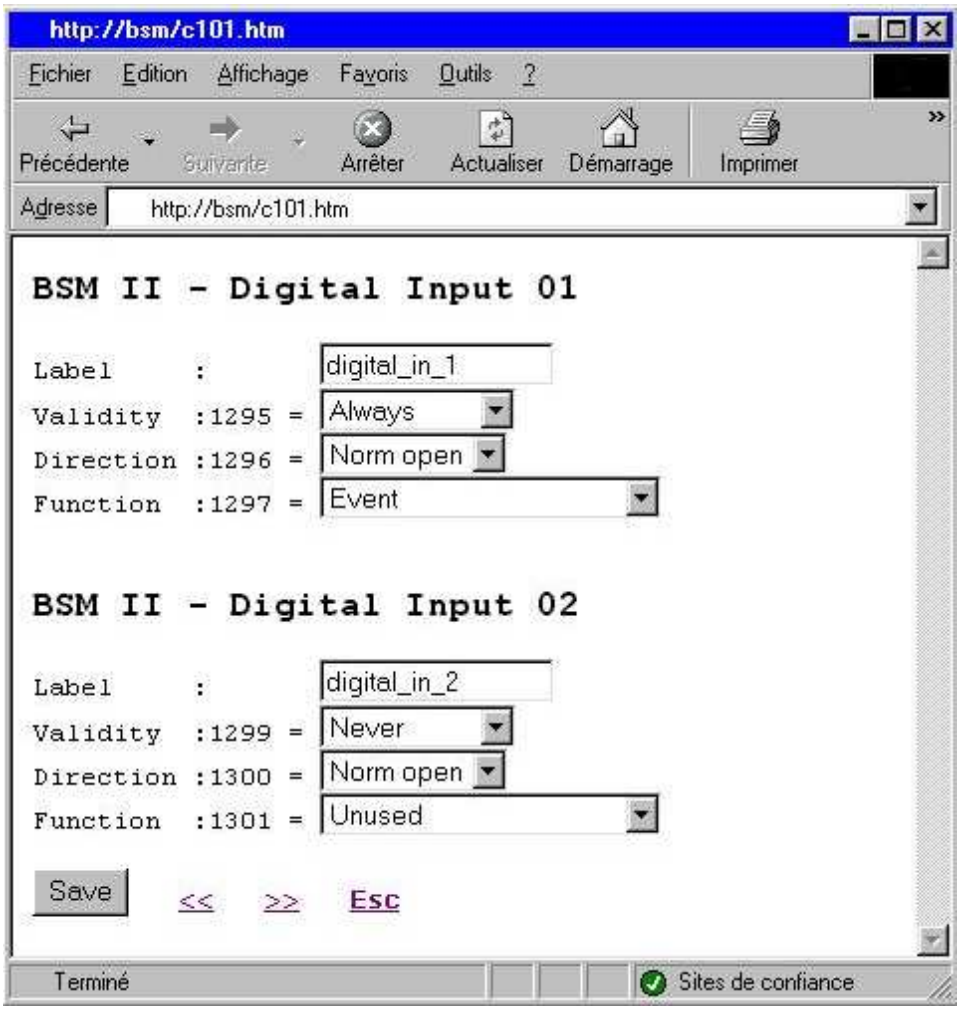
A. Digital Inputs

10 digitals inputs are available on the BSM II.

Terminals: 9, 11, 13, 15, 17, 19, 21, 27. Contact to 0V.
Terminal capacity: 2.5 / 12 (mm² / AWG).
Load: 10kOhms.



Configuration Web pages: **principal => Configuration => Digital input**

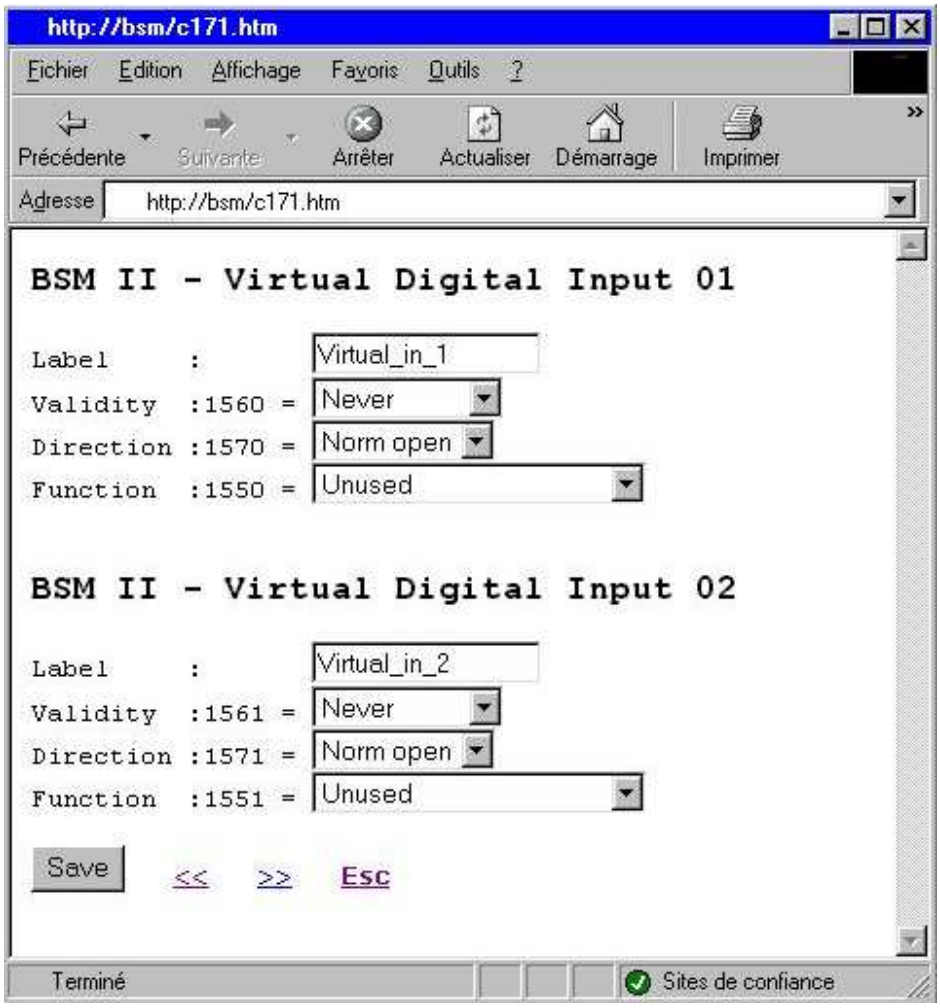


Validity: Validity of input (**Never**, always, after running)
Direction: **Normally open** or normally closed
Function: **Unused**, Used in equations, After running, Activating circular buffer, Event, Alarm, Fault, Rest of Faults and Alarms

B. Virtual Digital Inputs

20 virtual digital inputs are available on the BSM II. They have the same function as the digital inputs

Configuration Web pages: **principal => Configuration => Virtual Digital input**



Validity: Validity of input (**Never**, always, after running)
Direction: **Normally open** or normally closed
Function: **Unused**, Used in equations, After running, Activating circular buffer, Event, Alarm, Fault, Rest of Faults and Alarms

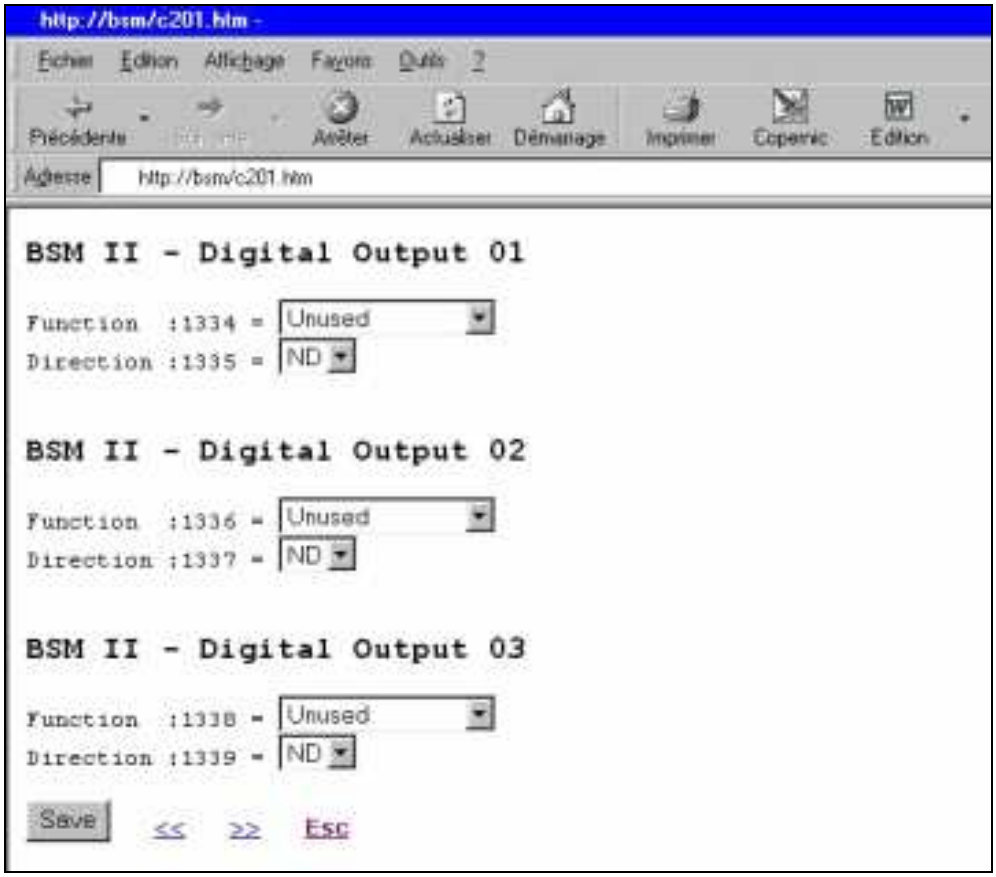
C. Digital Outputs

6 digital outputs are available on the BSM II. The outputs are working with transistor.

Terminals: 6, 8, 10, 12, 14, 16. the outputs are set to high level when they are active. The outputs are Normally energised.

Terminal capacity: 2.5 / 12 (mm² / AWG).

Configuration Web pages: **principal => Configuration => Digital output**

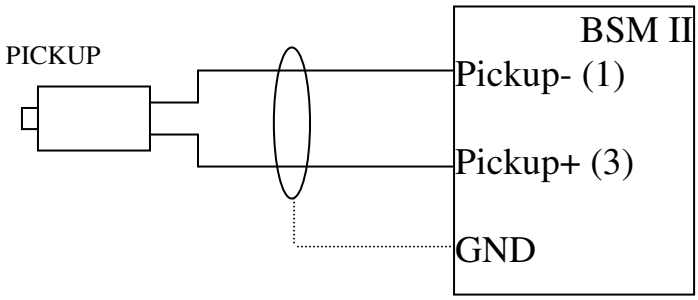


Function: **Not used**, alarm.
Direction: **Normally de energised** or Normally energised.

D. Pickup

Speed input is available on the BSM II for magnetic pickup

Measurement: Measure from 50 Hz to 10 kHz.
Minimal voltage for detection 1 VRMS
Terminals: Pickup + => 3, Pickup - => 1.



E. Analog Inputs

16 analog inputs are available on the BSM II.

Configurable analog inputs

Functions : Used for sensors like :
Thermocouples (K, J)
Current Input (0-1mA, 0-20mA, 4-20mA, ±20mA)
Voltage Input (0-5V, 0-10V, ±1VDC, ±10V)
Resistor Input (PT100, sondes type automobile, VDO, DATCON…).

Configuration : The configuration of sensor type is made with **Dipswitch**. There is 10 switch per input and the positioning is defined by:

DIPSWITCH	PT100-200	(+/- 20mA)	(+/- 10V)	THK K,J
SWx:1	OFF	ON	ON	OFF
SWx:2	ON	OFF	OFF	OFF
SWx:3	OFF	OFF	ON	OFF
SWx:4	OFF	OFF	OFF	ON
SWx:5	ON	ON	ON	OFF
SWx:6	OFF	ON	ON	OFF
SWx:7	OFF	OFF	OFF	ON
SWx:8	ON	ON	ON	OFF
SWx:9	OFF	ON	OFF	OFF
SWx:10	ON	OFF	OFF	OFF

Terminals :

Entrée	Terminals	Dipswitch	Factory
AN1	29, 31, 33	SW1	PT100
AN2	30, 32, 34	SW9	PT100
AN3	35, 37, 39	SW2	PT100
AN4	36, 38, 40	SW10	PT100
AN5	41, 43, 45	SW3	±20mA
AN6	42, 44, 46	SW11	±20mA
AN7	47, 49, 51	SW4	±20mA
AN8	48, 50, 52	SW12	±20mA

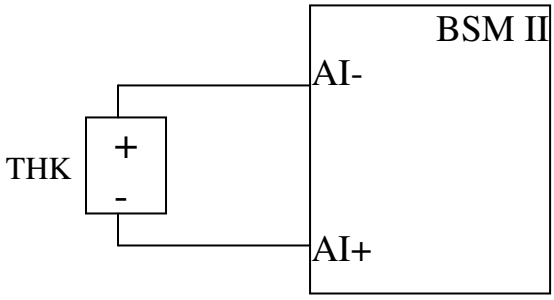
Entrée	Terminals	Dipswitch	Factory
AN9	53, 55, 57	SW5	±10V
AN10	54, 56, 58	SW13	±10V
AN11	59, 61, 63	SW6	±10V
AN12	60, 62, 64	SW14	±10V
AN13	65, 67, 69	SW7	THK
AN14	66, 68, 70	SW15	THK
AN15	71, 73, 75	SW8	THK
AN16	72, 74, 76	SW16	THK

Calibration : Each input is convert in 0-5VDC voltage signal witch is compatible with microprocessor. after that voltage is converted in 1024 measurement point. The calibration of sensor is made with 1024 point calibration table. See chapter Calibration of Analog Input for more explanations.

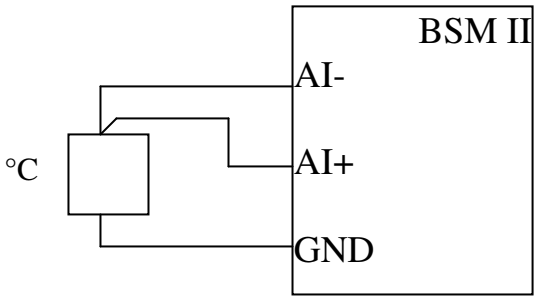
All wiring must be made with shielded wire. (EMC).

THK :

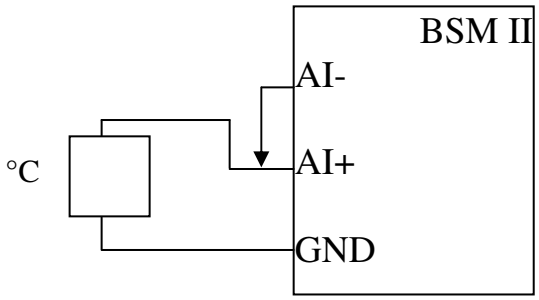
For Thermocouple, signals must be isolated and the connection must be made like the schematics (signal + on AI- and signal - (or GND) on AI+).



PT100 /200 :

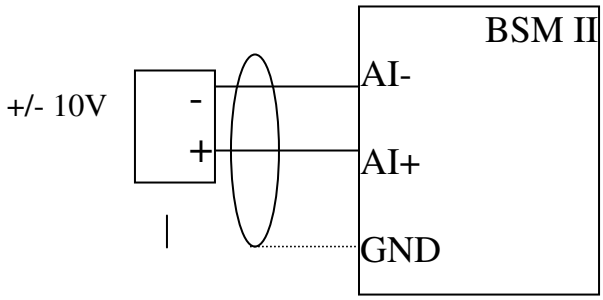


3 wires connection

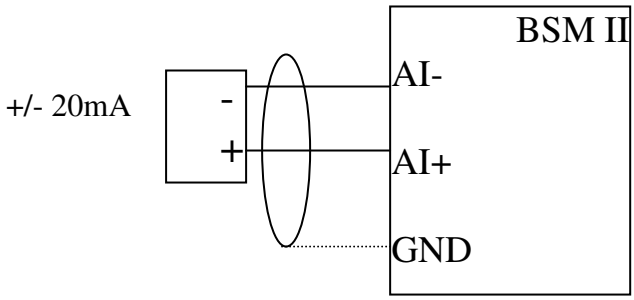


2 wires connection

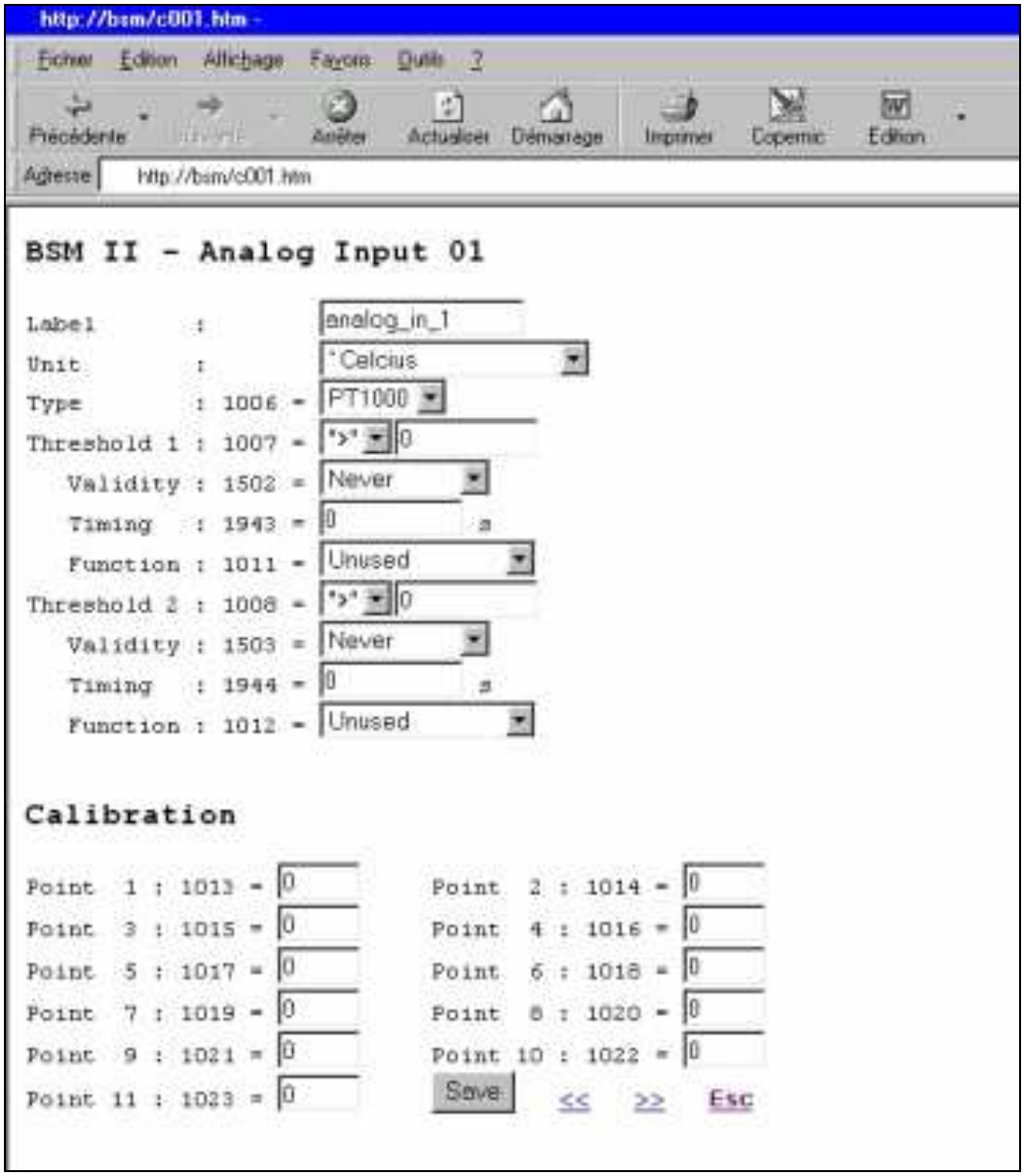
+/- 10 V :



+/- 20 mA :



Configuration web page : **Menu principal => Configuration => Analog Input**



Unit :	Unit associated with Input
Type :	Sensor type
Threshold1 :	First threshold
Validity :	Validity of the first threshold (**Never**, Always, After running)
Function :	**Not used**, Activating circular buffer, Event, Alarm, Fault
Threshold2 :	Second threshold
Validity :	Validity of the second threshold (**Never**, Always, After running)
Function :	**Not used**, Activating circular buffer, Event, Alarm, Fault

F. Analog Inputs Calibration

Calibration is obligatory for all sensors type.

1. Thermocouples :

For Thermocouples the method is a little bit different from the other sensors. It is necessary :

Step 1 : Keep a steady value on the LM35 input (room temperature or any value using a simulator, Variable 128 in information menu). That value will be called Ta.

Step 2 : On the setting page for the THK you want to calibrate enter the following values in the 11 points (0, 102, 204, 306, 408, 510, 612, 714, 816, 918, 1020).

Step 3 : Connect a THK or a simulator on you THK input and adjust the temperature until you reach the following values :

Valeur lue	Température
0 + Ta	**T1**
102 + Ta	**T2**
205 + Ta	**T3**
307 + Ta	**T4**
409 + Ta	**T5**
512 + Ta	**T6**
614 + Ta	**T7**
716 + Ta	**T8**
818 + Ta	**T9**
921 + Ta	**T10**
1023 + Ta	**T11**

Step 4 : Go back to the THK setting page and enter the following values in the 11 calibration points : T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11.

2. Other sensors :

Calibration for all other sensors type (PT100, +/- 20mA, +/- 10V, VDO…).

Step 1: Go to the menu « Menu Principal -> Configuration -> Analog Input » (setting web page).

Step 2: Choose the sensor type and enter the following values in the 11 calibration points :

Point 1:	0
Point 2:	102
Point 3:	205
Point 4:	307
Point 5:	409
Point 6:	512
Point 7:	614
Point 8:	716
Point 9:	818
Point 10:	921
Point 11:	1023

Step 3: Connect a simulator on your input and adjust the values until you reach the previous values. You can look the values on the information page (« Menu Principal -> Display -> Analog Input (or Information) »).

Step 4: Go back to the setting page and enter the values that you have found.
Then analog input will be calibrate for the good sensor type.

Example of values for different sensors :

Calibration point	PT100 (°C)	+/- 20mA	+/- 10V
Point 1	-11	-22.5	-10.9
Point 2	18	-18.05	-9.28
Point 3	47	-13.49	-6.96
Point 4	76	-9	-4.63
Point 5	106	-4.5	-2.33
Point 6	136	0	0
Point 7	167	4.5	2.3
Point 8	197	9	4.63
Point 9	228	13.49	6.96
Point 10	260	18.05	9.28
Point 11	291	22.5	10.9

V. Archiving

The BSM II has 4 different types of archiving:

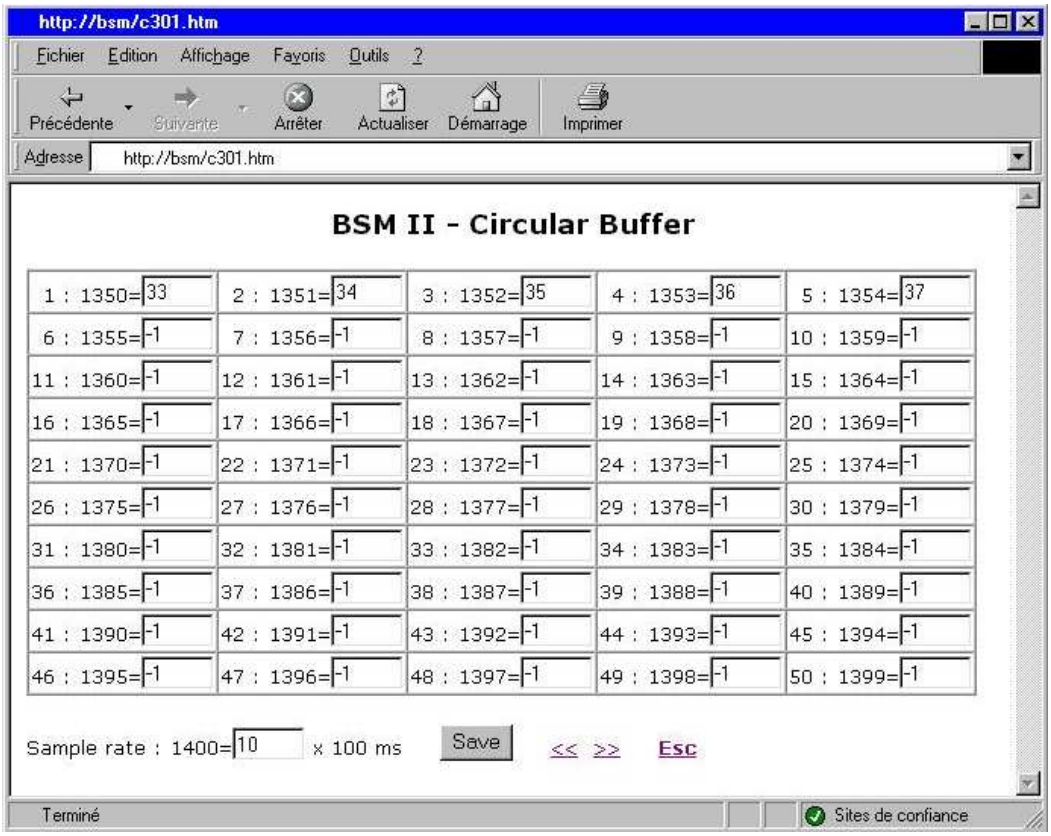
- Circular Archiving
- Event Archiving
- Running hour counter
- Real Time Archiving on PC

A. Circular archiving

The users choose the variables he wants to archive in the configuration web page and also interval between two recording.
Archiving is control by the PLC with **variable E2016 (Circular)**. When that variable is activated (High level or 1) then archiving is working. When that variable is not activated (Low level or 0) then archiving is stopped
Archiving can be also control with the overtaking of a threshold on a analog input or an activation of a digital input.

- **Configuration web page** : **Menu principal -> Configuration -> Circular Buffer**.

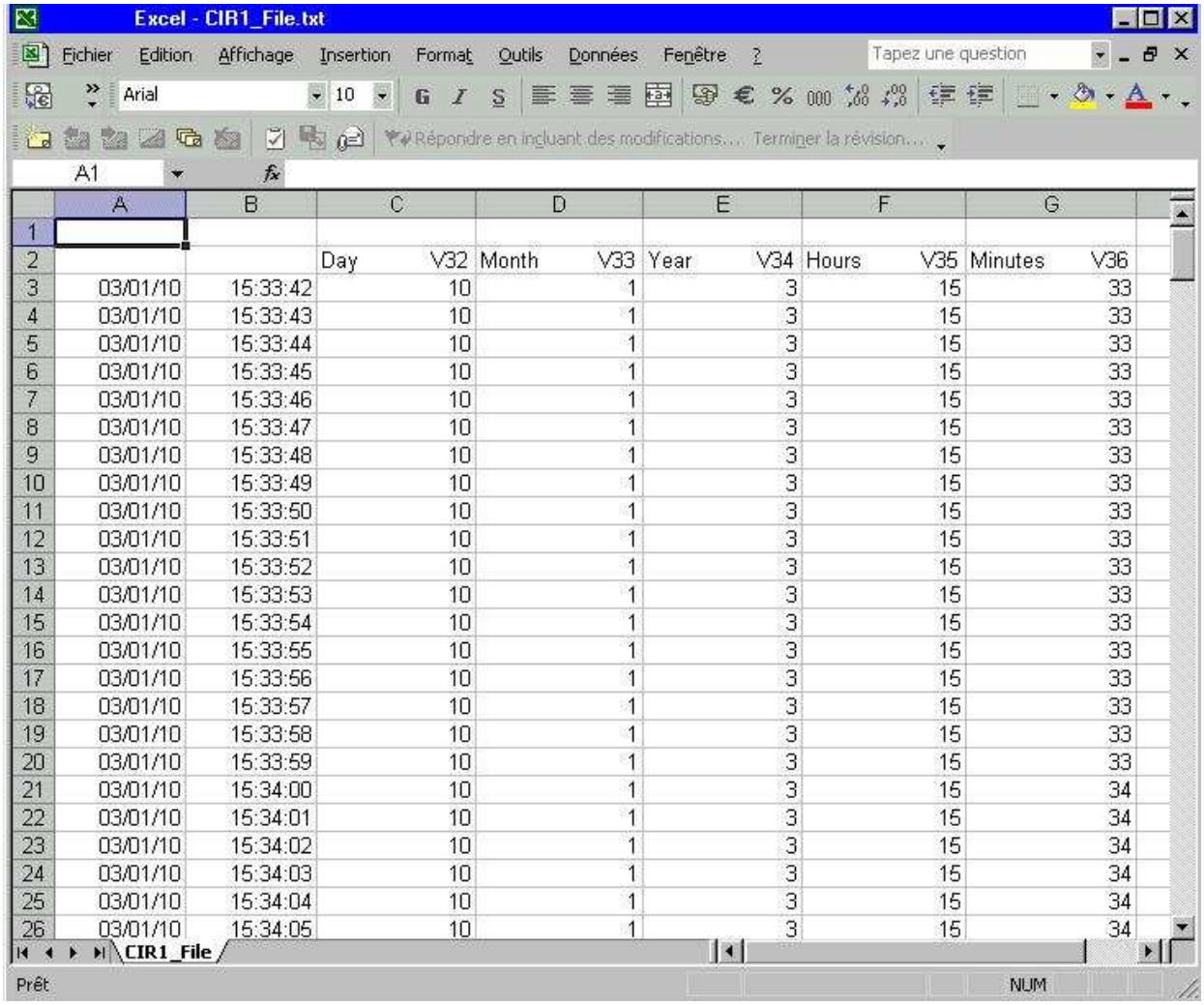
The defaults values are -1



- We can choose **50 variables** at the most to archive with a time between recording proportional to 100ms.
- For example we have choose to archive the variables E0033 (month), E0034 (year), E0035 (Hour), E0036 (Minute), E0037 (Second) every 1 seconds.

Nota : Default value is -1. If all the box on the configuration tab are set to -1 then archiving will not be activated.

- To pick up the files you must go the page:: **Menu principal -> Display -> Archiving Data** and then you click on the files CIRX._File.txt.



	A	B	C	D	E	F	G
1							
2			Day V32	Month V33	Year V34	Hours V35	Minutes V36
3	03/01/10	15:33:42	10	1	3	15	33
4	03/01/10	15:33:43	10	1	3	15	33
5	03/01/10	15:33:44	10	1	3	15	33
6	03/01/10	15:33:45	10	1	3	15	33
7	03/01/10	15:33:46	10	1	3	15	33
8	03/01/10	15:33:47	10	1	3	15	33
9	03/01/10	15:33:48	10	1	3	15	33
10	03/01/10	15:33:49	10	1	3	15	33
11	03/01/10	15:33:50	10	1	3	15	33
12	03/01/10	15:33:51	10	1	3	15	33
13	03/01/10	15:33:52	10	1	3	15	33
14	03/01/10	15:33:53	10	1	3	15	33
15	03/01/10	15:33:54	10	1	3	15	33
16	03/01/10	15:33:55	10	1	3	15	33
17	03/01/10	15:33:56	10	1	3	15	33
18	03/01/10	15:33:57	10	1	3	15	33
19	03/01/10	15:33:58	10	1	3	15	33
20	03/01/10	15:33:59	10	1	3	15	33
21	03/01/10	15:34:00	10	1	3	15	34
22	03/01/10	15:34:01	10	1	3	15	34
23	03/01/10	15:34:02	10	1	3	15	34
24	03/01/10	15:34:03	10	1	3	15	34
25	03/01/10	15:34:04	10	1	3	15	34
26	03/01/10	15:34:05	10	1	3	15	34

B. Event archiving

Recording of all the variables choose in the event configuration web page when the event appears with the date and time.

- The number of variables is at the **most 50**
- Sample rate is a multiple of 100ms
- You can also choose the number of record before and after event

Archiving on event is triggered:

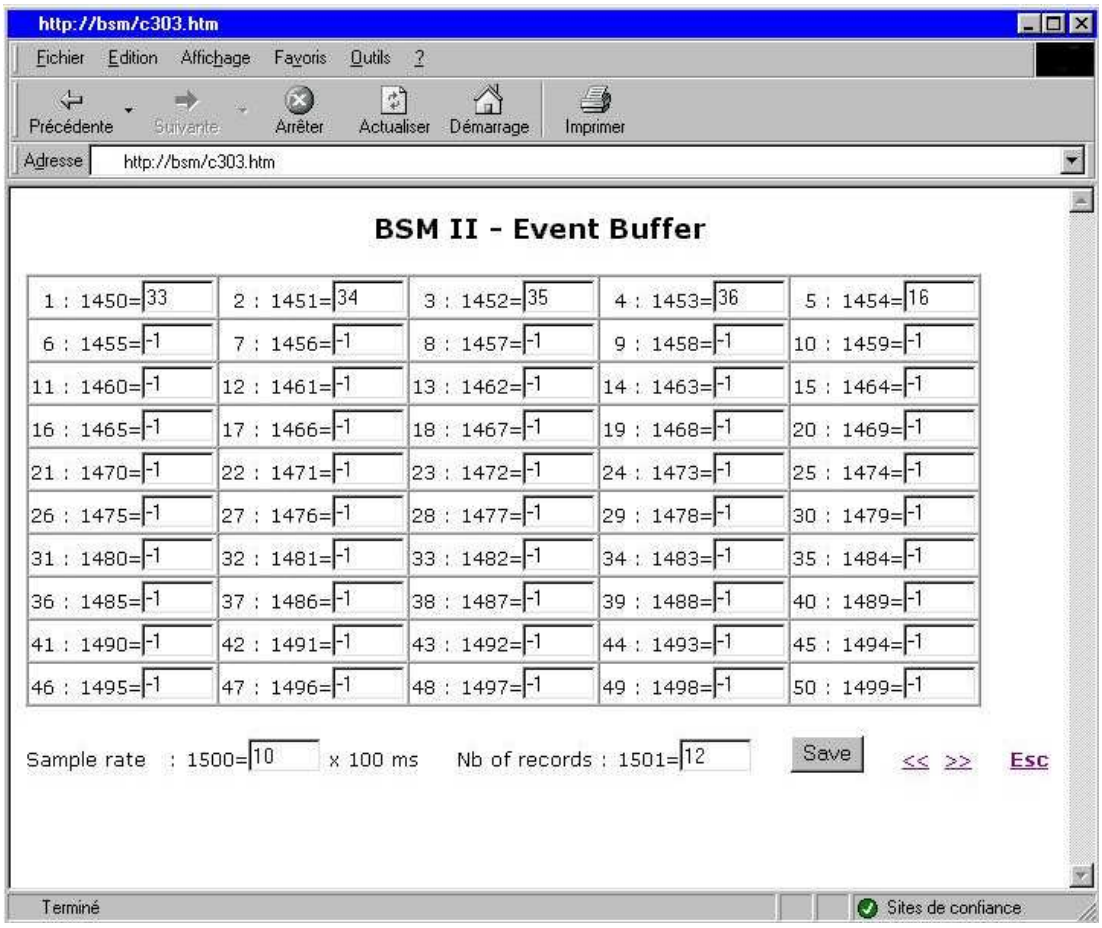
- With the activation of a digital input or a virtual input or the overtaking of a threshold on an analog input.
- OR with the activation (set to 1 = high level) of the **variable E2015 (Event)**.

In the first case, the number of the variable which triggered the event is stored in the **variable E2017 (Which_in_Event).**

Event is active as long as the variable which triggered the event is active.

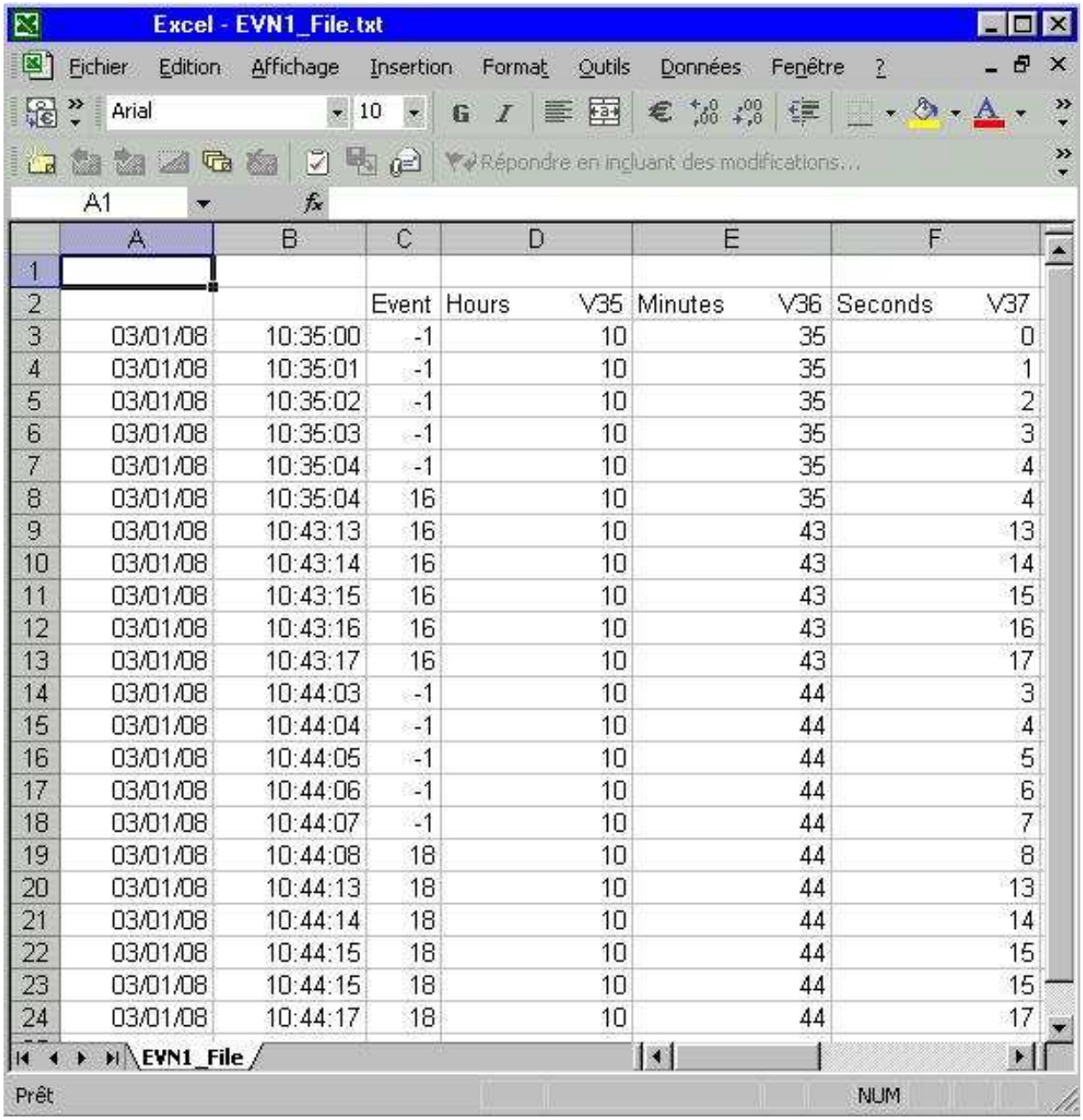
Records before the event and the record of the event are stored when the event becomes active. Records after will be stored when the event will disappear (go to low level).

- **Configuration** : **Menu principal -> Configuration -> Event Buffer**.



In this case we have decided to archive the variables E0033 (Month), E0034 (Year), E0035 (Hour), E0036 (Minute), E0016 (Digital input 1).
The time between two recording is 1 second (Sample Rate = 10). The number of recording before and after the event is 12 (Nb of records = 12).
The activation of event archiving is doing with the digital input 1 (E0016) with the equation : E2015 :=E0016 .

- To pick up the files you must go the page **: Menu principal -> Display -> Archiving Data** and then you click on the files EVNX._File.txt.



	A	B	C	D	E	F
1						
2			Event	Hours V35	Minutes V36	Seconds V37
3	03/01/08	10:35:00	-1	10	35	0
4	03/01/08	10:35:01	-1	10	35	1
5	03/01/08	10:35:02	-1	10	35	2
6	03/01/08	10:35:03	-1	10	35	3
7	03/01/08	10:35:04	-1	10	35	4
8	03/01/08	10:35:04	16	10	35	4
9	03/01/08	10:43:13	16	10	43	13
10	03/01/08	10:43:14	16	10	43	14
11	03/01/08	10:43:15	16	10	43	15
12	03/01/08	10:43:16	16	10	43	16
13	03/01/08	10:43:17	16	10	43	17
14	03/01/08	10:44:03	-1	10	44	3
15	03/01/08	10:44:04	-1	10	44	4
16	03/01/08	10:44:05	-1	10	44	5
17	03/01/08	10:44:06	-1	10	44	6
18	03/01/08	10:44:07	-1	10	44	7
19	03/01/08	10:44:08	18	10	44	8
20	03/01/08	10:44:13	18	10	44	13
21	03/01/08	10:44:14	18	10	44	14
22	03/01/08	10:44:15	18	10	44	15
23	03/01/08	10:44:15	18	10	44	15
24	03/01/08	10:44:17	18	10	44	17

We can see above file that we have pick up for the event archiving.
First Event started at 10h35'04'' and stopped at 10h43'13''. The time between each recording is 1 second.
Second Event began at 10h44'08'' and stopped at 10h44'13''.

C. Counter

The BSM II can count and record number of running hours. To do that the engine must be running. If it is stopped the counter will not working. You must to connect pickup to the terminals 1 and 3 of BSM II

D. Real Time Archiving on PC

The BSM II offers the possibility of making an archiving in real time on PC.
To perform this archiving you must to go to : **Menu principal -> Display -> Information.**
The archiving is perform on this parameters:

- The 10 parameters of the Information web page
- The 16 analog inputs
- The 10 digital inputs

For that purpose, it is enough to choose the name of the file and to click **Start**. To stop, it is enough to click on **Stop**. The file will be in the place which you indicated him (default place: C:/bsm001).

bsm001.xls

	A	B	C	D	E	F	G	H	I	J	K	L	M
1		analog_in_3	analog_in_4	analog_in_5	analog_in_6	analog_in_7	analog_in_6	analog_in_5	analog_in_9	analog_in_9	analog_in_10	analog_in_1	analog_in_2
2	07/01/03 16:31:01	1010	1020	1020	1006	0	1006	1020	26	26	26	0	1020
3	07/01/03 16:31:02	1010	1020	1020	1006	0	1006	1020	26	26	26	0	1020
4	07/01/03 16:31:03	1010	1020	1020	1006	0	1006	1020	26	26	26	0	1020
5	07/01/03 16:31:05	1010	1020	1020	1006	0	1006	1020	27	27	27	0	1020
6	07/01/03 16:31:06	1010	1020	1020	1006	0	1006	1020	26	26	26	0	1020
7	07/01/03 16:31:07	1010	1020	1020	1006	0	1006	1020	26	26	26	0	1020
8	07/01/03 16:31:08	1010	1020	1020	1006	0	1006	1020	26	26	26	0	1020
9	07/01/03 16:31:09	1010	1020	1020	1006	0	1006	1020	26	26	26	0	1020
10	07/01/03 16:31:11	1010	1020	1020	1006	0	1006	1020	26	26	26	0	1020
11	07/01/03 16:31:12	1010	1020	1020	1006	0	1006	1020	26	26	26	0	1020
12													

bsm001

VI.Serial Port

A. RS 485

All the logical and analogue input/output values, and all the other parameters which appear in the BSM II menus can be obtained by the serial port RS485 (4 wires).

Speed:	4800, 9600, **19200**, 38400 Baud.
Electronic:	Not isolated.
Function:	
Protocol :	Modbus RTU slave. 04 (analogue reading) and 03 (registers reading).
Terminals :	4 wires : 1 Tx+ -> terminal 20 2 Tx- -> terminal 22 3 Rx- -> terminal 26 4 Rx+ -> terminal 24 Shield -> terminal 28 2 wires : You must to connect Tx+ with Rx+ and Tx- with Rx-.
Address:	The RTU address of the variables is the same than their number, converted in hexadecimal.
Number of bits by character:	8
Number of parity bits:	0
Number of stop bits:	1

B. RS232

Speed:	4800, 9600, **19200**, 38400 Baud.
Function :	Communication with a local computer. Used for configuration, archiving, parameter, file downloading and uploading.
Protocol :	Use TCP/IP protocol to communicate.
Terminals :	DB9 female, RS232 standard, Straight cable is needed.

C. CAN Bus

The BSM II uses the **CANopen** protocol. So he can have a dialogue with the GENSYS or quite other CANopen Master.

Baud rate:	**125**, 250, 500, 1000 kbit/s.
Standard Identifier:	11 bits.
Terminals :	2 wires. CANH on terminal 5 and CANL on terminal 7. You must connect an external 120Ohms resistor between this two terminals.

The Node-ID is defined by the parameter **E1975 "My Node ID"** (The number modification will be effective on the next power on).

1. BSMII / GENSYS Communication

The configuration is made by the GENSYS.
You must report to the user manual of the GENSYS (**A40Z09004x**) and also to **application notes A40Z090211x and A43Z090100x**.

The Default application of these notes is used to archiving most significant measurements and variables of GENSYS when a fault appears. That used event archiving with 5 samples and 1s period (5 samples before the fault, 1 at the beginning of the fault and 5 after).

- The values can be refreshed each 100ms or more.
- BSM II can transmit to GENSYS:
    i. 10 digital inputs,
    ii. 16 analog inputs,
    iii. the LM35 sensor measurement (analog input 17),
    iv. the pickup measurement (analog input 18).
- GENSYS can transmit:
    i. 6 digital outputs,
    ii. 24 variables "analog outputs" that can be used in PLC equation or/and archiving.

2. BSMII / BSM II Communication:

- The values can be refreshed each 100ms or more.

- That communication uses **RxPDO8 and TxPDO11** messages.

Identifier of those two messages (COB-ID) is automaticaly calculated using "My Node ID" E1975 and "Remote node ID" E1976, like below:

COB-ID[RxPDO8] = (3A0)hexa + E1976
COB-ID[TxPDO11] = (3A0)hexa + E1975

- The two BSM II transmit each other the same 4 analog variables.

These variables can be used in PLC equations. The equation can be different between the two BSM II.

VII. Mécanique et Connectique

The mechanical architecture and wiring of the BSM II consists of following elements:

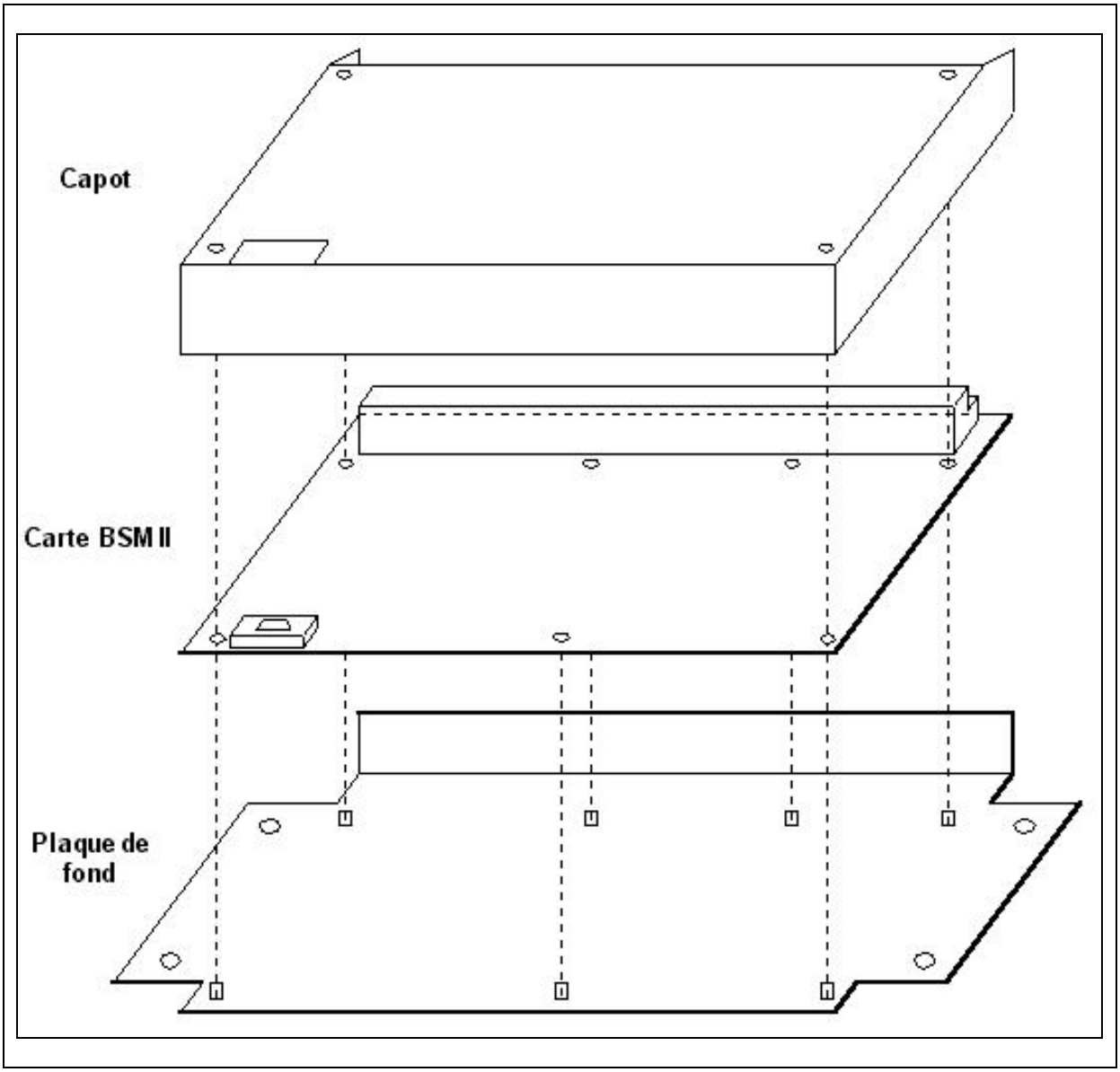
IP00 :

- Cover.
- Bottom plate.
- Electronic board.

IP65 :

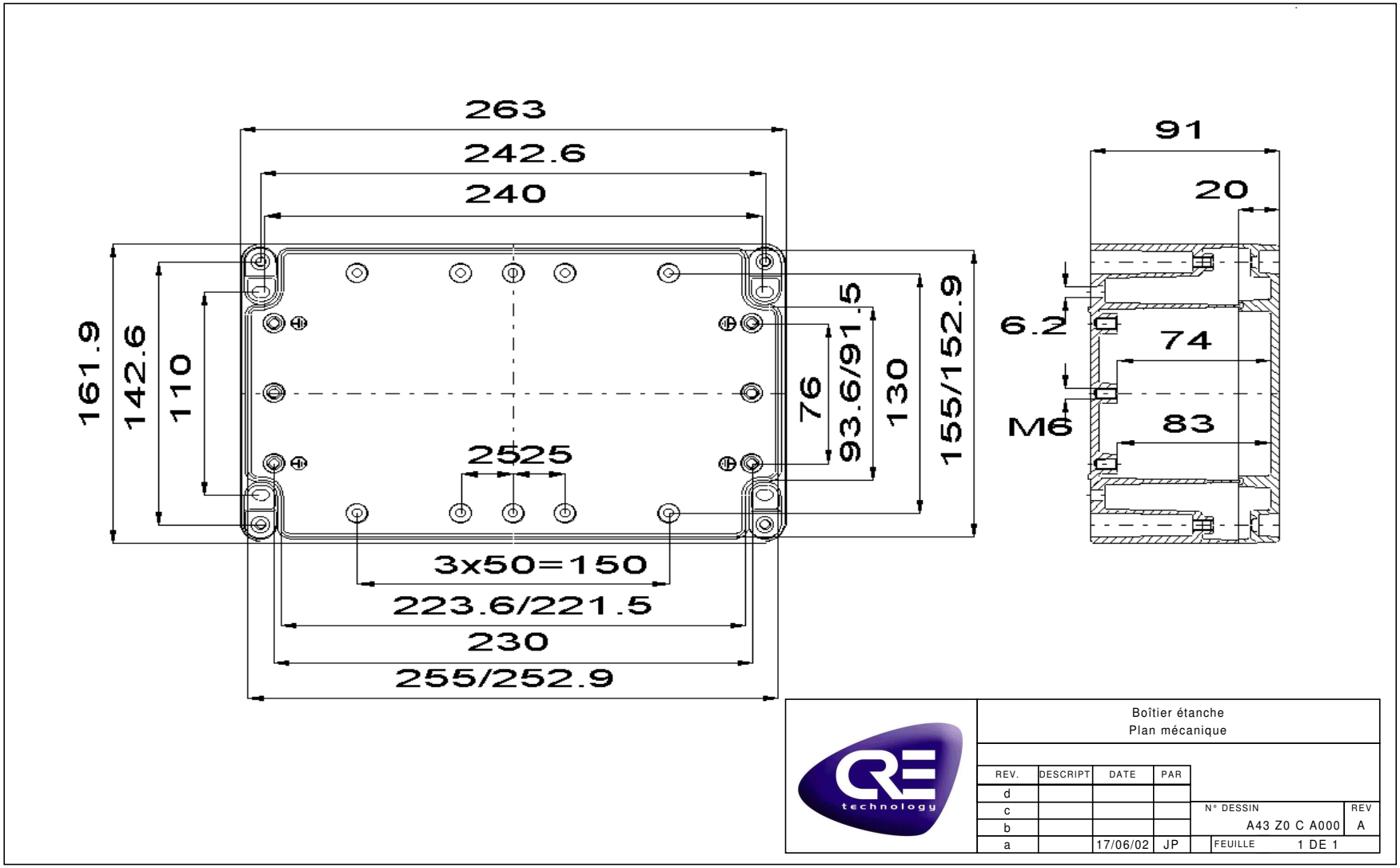
- Plastic or aluminium box.
- Bottom plate.
- protection plate.
- serial connection.
- Electronic board.

A. IP00 Assembling plan



B. Aluminium box

The box is in moulded aluminium.



C. Bottom plate

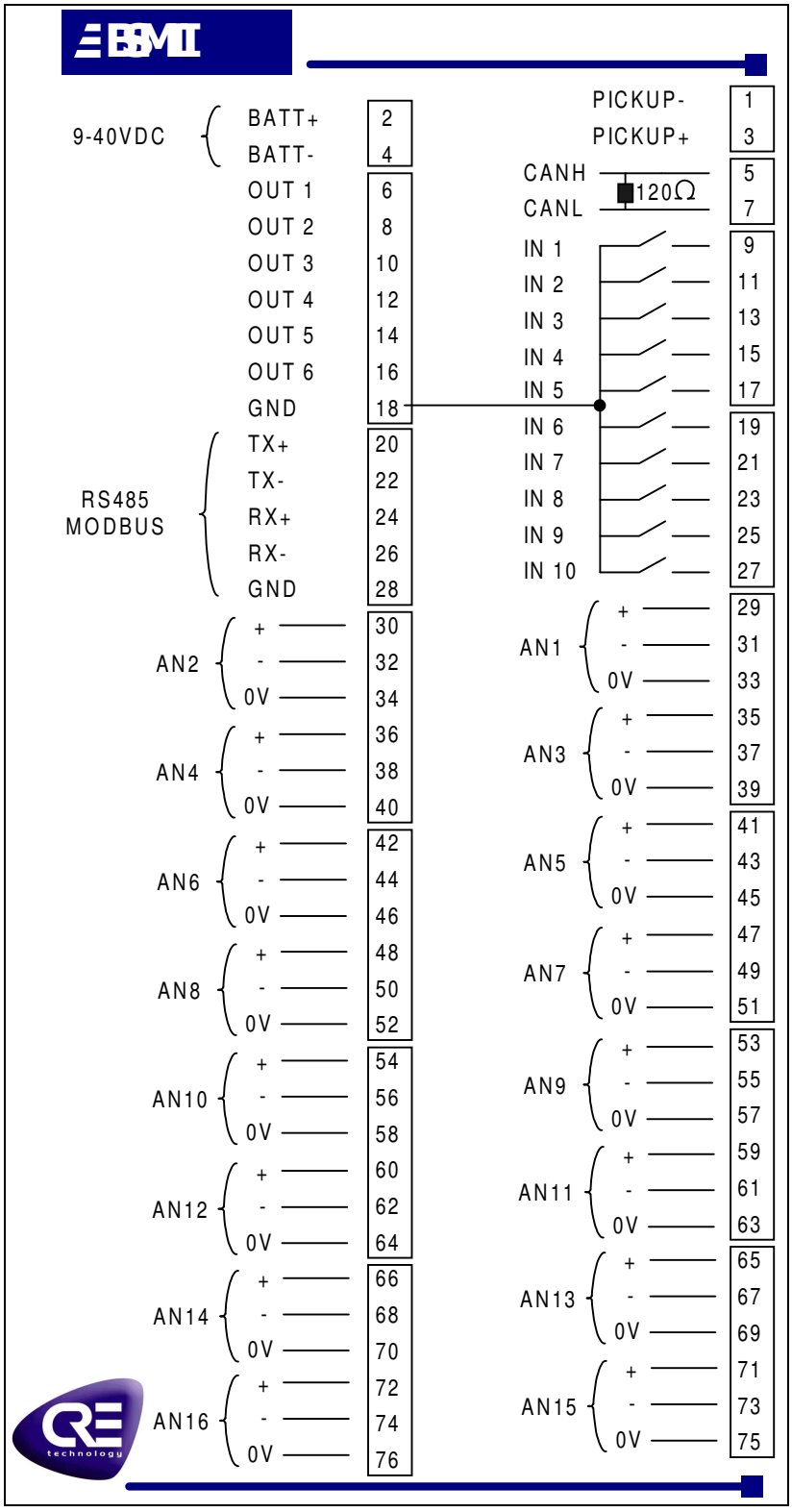
A aluminium bottom plate Ref A43 Z0 C C000 include the mechanical fixation of the card and assures the fixation of the complete assembly to the aluminium box.

D. Protection plate

A plate of protection Ref A43 Z0 G 0000 recover the whole electronic board above the box. This plate realises two functions:

- Mechanical Protection of all the cables and the thread of connecting in the box.
- Shielding of the card against the electromagnetic disturbances.

E. Cabling


9-40VDC
BATT+ 2
BATT- 4
OUT 1 6
OUT 2 8
OUT 3 10
OUT 4 12
OUT 5 14
OUT 6 16
GND 18
RS485 MODBUS
TX+ 20
TX- 22
RX+ 24
RX- 26
GND 28
AN2 + 30 - 32 0V 34
AN4 + 36 - 38 0V 40
AN6 + 42 - 44 0V 46
AN8 + 48 - 50 0V 52
AN10 + 54 - 56 0V 58
AN12 + 60 - 62 0V 64
AN14 + 66 - 68 0V 70
AN16 + 72 - 74 0V 76
PICKUP- 1
PICKUP+ 3
CANH 5
CANL 7
120Ω
IN 1 9
IN 2 11
IN 3 13
IN 4 15
IN 5 17
IN 6 19
IN 7 21
IN 8 23
IN 9 25
IN 10 27
AN1 + 29 - 31 0V 33
AN3 + 35 - 37 0V 39
AN5 + 41 - 43 0V 45
AN7 + 47 - 49 0V 51
AN9 + 53 - 55 0V 57
AN11 + 59 - 61 0V 63
AN13 + 65 - 67 0V 69
AN15 + 71 - 73 0V 75

VIII. Environment

Power Supply

Terminals :	2 Terminals (V+ -> 2, V- ->4).
Dimensions:	IP65 : 263*162*91
	IP00 : 210*150*60
Electrical characteristic:	8-40V / 3A with Protection of polarity inversion.
References :	A43Z0 BSM II IP65 (waterproof box in aluminium)
	A43Z3 BSM II IP00

Both references answer the standards of immunity and emission EMC.
The BSM II possesses of more an electronics adapted to the extreme conditions of the engine.

IX. User Interface and PC Configuration

All the configurations are achieved when BSM II is connected to the local PC with standard RS232 connection
The defaults values for the communications are : 19200 baud for the RS232 protocol and also for the Modbus protocol.

A. BSM II configuration file.

1. File description.

Using a PC and a Web browser, it is possible to upload or download a text file containing the BSM II configuration. The following chapter describes the layout of that file.
The text file is composed of 5 parts:

Parameters, labels and units definitions
Equations initialisations and definitions

Each part is composed of a few text blocks with a title in braces. For example:

```
{PARAMETERS}
V1006   2          AI1 Sensor        +00000  +65535
V1007   0          AI1 LV1           -32768   +32767

{LABELS}
L0000   analog_in_1

{UNITS}
U0000   18

{INIT L1}
BLOC
E2041:=1;
E2042:=0
BEND
.

{EQUATIONS L1(every 100ms)}
PROG 1
        BLOC
                INC E2044;
                TEST (E2044 LT 100) EQ 1 THEN E2021:=1
                TEND;
                TEST ((E2044 LT 200) AND (E2044 GT 100)) EQ 1 THEN E2021:=0
                TEND;
                TEST E2044 EQ 200 THEN E2044:=0
                TEND
        BEND
.

{END OF FILE}

You can write comments here....
```

In the {PARAMETERS} block, **V1006** represents the BSM II variable number 1006, **2** is the value the user wants to attribute to variable 1006. " **AI1 Sensor** " is comments inserted by BSM II to help the file comprehension. "**+00000 +65535**" represents the minimal and maximal value of variable 1006 (other values would be rejected). These fields are not required.
{LABELS} and {UNITS} blocks work in the same way than {PARAMETERS}, except that {LABELS} are represented by character L and have 14 characters maximum, and {UNITS} by character U. Each unit is represented by a number :

00 : No unit	14 : mBar
01 : V	15 : kPa
02 : kV	16 : PSI
03 : mA	17 : °
04 : A	18 : °C
05 : kA	19 : °F
06 : Hz	20 : L
07 : kW	21 : Gal
08 : kWh	22 : s
09 : kVAR	23 : h
10 : kVARh	24 : days
11 : rpm	25 : Hz/s
12 : %	26 : m3/h
13 : Bar	27 : Gal/h
	28 : L/h

The next parts of the file describe PLC equations. Depending on the security level (i.e. depending on the password entered), BSM II users can enter 3 different levels of equations. If an equation in Level 1 and an equation in Level 2 are contradictory, Level 2 equation will be selected. Equations themselves are written in the {EQUATIONS Lx} block, while their variable initialisations are written in the corresponding {INITx} block.
When a user uploads a configuration file from a BSM II, he will only obtain equations corresponding to his password level and lower. For example, a user with a level 2 password will not see level 3 equations. In the same way, a user with a level 2 password can't download level 3 equations to a BSM II. These equations would be rejected by the BSM II.

NOTE:
It is possible to include comments after the {END OF FILE} block.
You can use both TABS and SPACES between variable names and values or in the equations.

NOTE : This file is ONLY a text file. Do not use word processors (like Microsoft© Word) to edit this file: it would include layout information and corrupt the file. Use text editors only (Notepad for example).
The file should not exceed 62Kbytes. If you try to transmit a bigger file to a BSM II, it will be rejected.

2. PLC description.

It is recommended to follow a training to use PLC equations. Contact your dealer to have the schedule.

The PLC is a simple language with a reduce instruction set. The code is intrinsically linear (without any loop).
The "INIT" part is executed only at start, and the "PROG" part is executed each 100 ms.

In the equations you can use all the BSM II variables in the way defines below:

- Variables E0xxx are measurements from inputs. They can be read by PLC equations.
- Variables E1xxx are parameters stores in flash (non volatile memory). They can be read by PLC equations.
- Variables E2xxx are outputs from the PLC, they can be read and written by PLC equations.

A complete listing is available in the Z090030.xls.

Each instruction is terminated by a semicolon (;) except before reserved words (BEND, ELIF, ELSE, TEND).
Init and Prog blocs are terminated by a dot (.).
Instruction set:

- Blocs: BLOC, BEND
- Logical and arithmetic operators: AND, OR, XOR, ! (not) ; and +, -, *, /
- Comparators: EQ (equal), NE (not equal), GT (greater than), LT (lower than), GE (greater or equal), LE (lower or equal)

– Affectations: E2xxx:=calculation. For array you can use: E2xxx[calculation]:=calculation. Calculation is any combination of logical and arithmetical terms and operators.
– Tests: TEST, THEN, ELIF, ELSE, TEND
– Incrementations: INC
– Decrementations: DEC

When you affect or compare a number to a variable, it has to be greater than -32768 and lower than 32767. Be careful about the digit after dot of the variable you affect or compare. If you have one digit after dot, you have to multiply the number by 10. And if you have two digits, multiply by 100. For example, for a variable of which measure is from 0.0 to 6553.5 (you have one digit after dot). If you want to compare this variable to 25.0, you have to write: TEST EXXXX GT 250 THEN... To know the digit after dot, look in the Z090030.xls file, in the ' Mini' / ' Maxi' columns, the number of digits after dot appears.

Syntax:

– Test examples:
  a) TEST condition THEN instruction TEND
  b) TEST condition THEN BLOC instructions BEND TEND
  c) TEST condition THEN
     TEST condition THEN instruction TEND
     ELSE instruction TEND
  d) TEST condition THEN instruction
     ELIF condition THEN instruction
     ELIF condition THEN instruction
     ELSE instruction TEND
– Calculation / instructions examples :
  a) E2299:=(E2000+E2001+E2002+E2003)/4
  b) E2000:=2; E2299[E2000+1]:=10
  c) E2299:=(E0044 GT 1450) AND ((E0044 GT 1500) OR E2299)
– Conditions examples:
  a) TEST E0016 EQ 1 THEN ...
  b) TEST E0044 GT 1500 THEN ...
  c) TEST (!E2045) AND E2117 AND ((E2150 EQ 14) OR (E2150 EQ 15)) EQ 1 THEN …

There are two ways of using the variables 2xxx. With E2xxx you access the value before program execution. With X2xxx you access the very last value modified by the program.

B. Setting up Windows 95/98/Me

Data transfers occur through a straight serial cable (with 9 wires DB9 connectors).
A few steps are required to configure a PC before controlling a BSM II:

- Check the network properties.
- Install the modem.
- Create a Dial-Up Networking Connection.
- Set-up the internet properties.

Communication between the BSM II and the PC is carried out by Dial-Up Networking. The PC must be configured to communicate with a 19.2K bps modem with TCP/IP networking enabled.

1. Check the network properties

- Click Start, Settings, and Control Panel.
- In Control Panel, double click the networks icon.
- Check **Remote Access Card** and **TCP/IP -> Remote Access Card** protocol. If they are not there, then add them to your Network. For the 2 components, select the Microsoft constructor.
- Select the Remote Access Card and click on **Properties**. In the **Link** tab, check **TCP/IP -> Remote Access Card** is enabled. In the **Advanced** tab, select **Enable Point To Point IP** and check the value is **Yes**.

2. Install the Modem

To install the modem:

- Click Start, Settings, and Control Panel.
- In the Control Panel, double-click the Modems icon.
- In the Modems Properties dialog box, click Add.
- Under Windows 95, in the initial dialog box of the Install New Modem wizard, click **Other** to enable that option, and then click Next. For other Windows see the next step.
- In the next dialog box, click **Don't detect my modem; I will select it from a list** to enable that option, and then click Next.
- In the next dialog box, under Manufacturers, **Standard Model Types** should be selected. Under Models, select **Standard 19200 bps Modem**, then click Next.
- In the next dialog box, select Communications Port (COM1) as the port, and then click Next.
- After Windows installs the modem, click Finish.

3. Set the Modem Properties

– Back in the Modems Properties dialog box, select the new modem (Standard 19200 bps Modem) and then click **Properties**.
– In the Standard 19200 bps Modem Properties dialog box (cf. figure 10), under the **General** tab, ensure that Communications Port (COM1) is selected as the Port. Change the Maximum Speed to 19200.

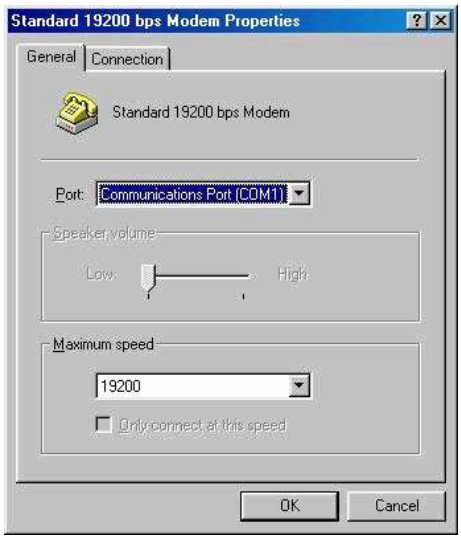


Figure 10: Modem Properties Dialog Box

– Under the Connection tab, ensure that the modem is configured for **8 data bits, no parity**, and **one stop bit**. Then click Advanced.
– In the Advanced Connection Settings dialog box, ensure that the **Use flow control** and **Hardware (RTS/CTS)** options are enabled. Then click OK.
– Under the Connection tab, click Port Settings.
– In the Port Settings dialog box, ensure that the **Use FIFO Buffers** option is disabled. Then click OK.
– Click OK to close the Standard 19200 bps Modem Properties dialog box and Close to close the Modem Properties dialog box.

4. Create a Dial-Up Networking Connection

– Double-click on My Computer, and then on Dial-Up Networking.
– In the Dial-Up Networking dialog box, double-click the Make New Connection icon.
– In the initial dialog box of the Make New Connection wizard, where it asks you to enter a name for the computer you are dialling, enter **BSM** Ensure that the selected modem is **Standard 19200 bps Modem**. Then click Next.
– In the next dialog box, enter any number as the phone number (for example, just the digit 1 by itself). Then click Next.
– In the next dialog box, click Finish.

5. Set the Dial-Up Networking Properties

– In the Dial-Up Networking dialog box, point to the new BSM connection icon. Click the right mouse button and select Properties.
– Under the General tab, ensure that Standard 19200 bps Modem is selected at the bottom.
– Under the Server Types tab (cf. figure 11), ensure that the type of dial-up server is set to **PPP: Internet, Windows NT Server, Windows 98** (or similar PPP setting under Windows 95/ME). Ensure that all Advanced options are disabled. Under Allowed network protocols, select **TCP/IP** and ensure that all other network protocols are disabled.

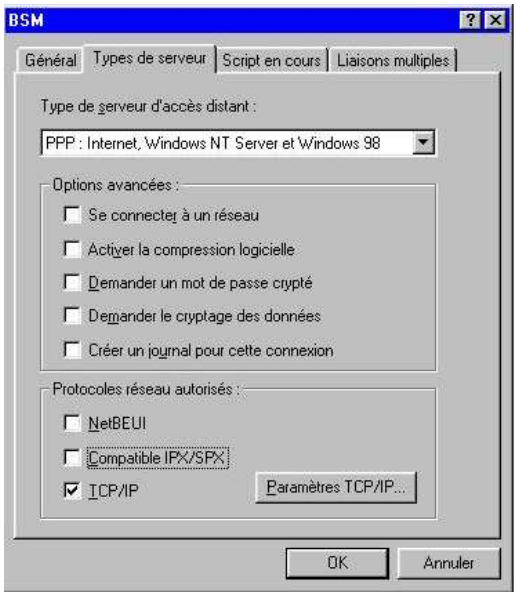


Figure 11: Dial-Up Networking Properties - Server Types – Windows 98

– Under the Server Types tab, click **TCP/IP Settings**.
– In the TCP/IP Settings dialog box (cf. figure 12), click Specify an IP address and type in the following IP address: 192.168.11.2. The **Server assigned name server addresses** option should be enabled. The options **Use IP header compression** and **Use fault gateway on remote network** should be disabled. When all options are set correctly, click OK.

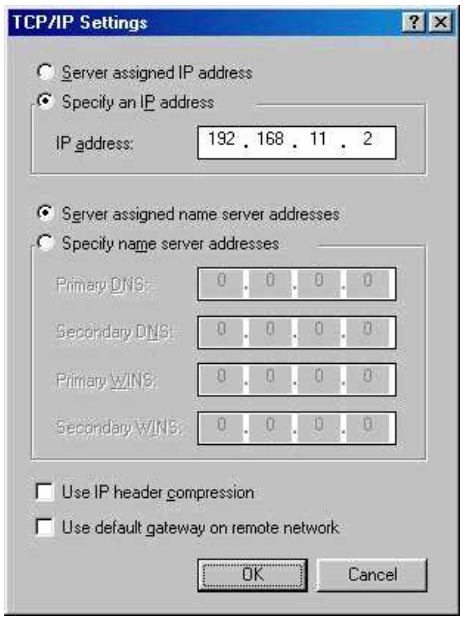


Figure 12: TCP IP Settings

– Under the Scripting tab, ensure that the **Start terminal screen minimised** is enabled.
– If there is a Multilink tab, ensure that its **Do not use additional devices** option is checked, and click OK.
– Point to the BSM icon, click the right mouse button, select Create Shortcut, and answer Yes. A shortcut to the BSM icon should appear on the Windows desktop.

6. Set-up the internet properties

– Click Start, Settings, and Control Panel.
– Look in the control panel for any WINSOCK software icons and make sure to turn-off (unchecked) any proxy server settings. With improper WINSOCK proxy setting, the explorer will dial out but will not communicate through a COM port when locating a URL.
– In the Control Panel, double-click the **Internet** icon.
– Under the **Security** tab, select **Trusted Sites** and click on **Add Sites**…. Check that **Require server verification (https:) for all sites in the zone** is disabled. In the **Zone** field write "**http://Gensys**" and click on **Add**. Click OK.
– Under the **Security** tab, **Customize**…. In **Java** (or Java VM for 95, or Microsoft VM for ME) and **Java permissions**, select **Custom**. Click on **Java Custom Settings**. Under the Edit permissions tab, unable the **Run Unsigned Content**. Click OK.
– Under the **Connection** tab, click on Never establish connection. Click on Parameters, and check that Use a proxy server is disabled. You can also check the settings you already done.
– Under the **Advanced** tab, in the **Java VM** field (Microsoft VM for ME), check that **Java JIT enabled** is selected.
– The BSM must be listed by the DNS as 'BSM' . Done by copying the**hosts** file in c:\windows directory.

7. Connect the BSM II

– Connect one end of a DB-9 serial cable to COM1 port of the PC. Connect the other end of the cable to the connector labelled **RS232 to PC** or modem on the BSM II.
– Double-click the Shortcut to BSM icon. In the Connect To dialog box, click CONNECT.
– A valid connection is indicated by a connection icon in the status bar of Windows 95/98.

8. View Web Pages from the BSM II Web Server

After the TCP/IP connection has been established with BSM II, you can view BSM II menus with any standard web browser such as Netscape or Internet Explorer.

– Start the web browser under Windows 95/98.
– In the “Location” or “Address” field of the web browser, enter the URL of the BSM II: **http://Bsm**
– The BSM II password page should appear in the browser window. Enter a password.
– You can now browse through the different BSM II menus.
– To close the connection, double-click the connection icon in the status bar of Windows 95/98/ME. In the Connected To BSM dialog box, click Disconnect.