IRMA

SAVING MEASUREMENT DATA ON SD CARD

CONTENTS

1. SAVING MEASUREMENT DATA ON SD CARD

If the option of saving data to SD card is on, after the inserted card is initialised, the program will automatically start to save the results on the card. This will be happening repeatedly.

1.1. Creating files to save data

The data is saved into disk files. If the option of saving data on disk is on, each time the card is initialised a new file for data storage is created. The new file is therefore created in the following situations:

- when the sensor is turned on with a card in the slot (if the storage is on)
- after the card is inserted into the slot while the sensor works (if the storage is on)
- after the card is formatted and initialised (if the storage is on)
- when the storage is turned on via the madur.exe program (if it has been turned off earlier)
- after the button on the data logger has been shortly pressed and the storage has been stopped. Unless the card is removed from the slot it will be initialised again after 10 seconds and a new storage data will be created.

To avoid creating too many files of great sizes we introduced a mechanism of an automatic file closure if the number of records reaches the limit value. The limit is 10 000 records. When the file reaches the size of 10 000 records it is closed, the card is reinitialised and a new file for data storage is opened.

REMARK: when closing the file due to its reaching maximum size a short break in data storage appears (about 20 ÷ 30s).

1.2. Name for data storage file

The name of the file for data storage consists of eight digits and is created according to the number kept in the sensor's flash memory and is suplemented with ".rmp" extension. The number in the sensor's memory is incremented by one each time the new file is opened. Therefore the names of the following files are:

00000000.rmp
00000001.rmp
00000002.rmp
00000003.rmp
.....

1.3. Content of data file created by IRma sensor

The data file is a binary one and consists of a header and a number of results records. The header's size is 512 bytes and it contains a set of information on the sensor's settings for the moment the file was opened. Each results' record is the size of 256 bytes and includes current measurement results. The detailed contents of the header and the results record is shown below.

1.4. Content of data file header

Table 1. Content of data file header

#	Field	Position	Size	Content	Description
1	HeaderSize	0	2	hl hh	Size of the header area, LSB first
2	RecordSize	2	2	rl rh	Size of the results record, LSB first
3	DeviceInfo	4	15	15 digits ASCII	**'madur CHF3IR v.'** or **'madur mamos v. '**
4	Firmware	19	6	6 digits ASCII	Firmware version, for example: **' 1.2.3' or '25.0.0'**
5	Vacat1	25	7	00 … 00	Not-yet-used area
6	FlashContent	32	439	102 * [xx xx xx xx]	Device's flash memory content (102 pages 4 bytes each)
7	Vacat2	440	72	00 … 00	Not-yet-used area

REMARK 1: The detailed content of the FlashContent field is not described in this document. Its knowledge is not essential to read and process result records.

REMARK 2: The size of the header is 512 bytes. Both the header and the record size can be increased in the future versions – it is necessary to use HeaderSize and RecordSize fields to determine the location of each result record.

1.5. Content of results record from data file

Table 2. Content of results record from data file

#	Field	Position	Size	Content	Description
1	RecNo	0	2	rl rh	Record number, LSB first
2	RecDateTime	2	7	ss mm hh dw DD MM YY	BCD format, see table #10
3	RecStatus	9	2	ss 00	LSB: work phase, MSB: always 0x00 – see Table 7.
4	RecDisplay1	11	5	bb vl vh ud uu	see Table 3.
5	RecDisplay2	16	5	bb vl vh ud uu	see Table 3.
6	RecDisplay3	21	5	bb vl vh ud uu	see Table 3.
7	RecDisplay4	26	5	bb vl vh ud uu	see Table 3.

#	Field	Position	Size	Content	Description
8	RecDisplay5	31	5	bb vl vh ud uu	see Table 3.
9	RecDisplay6	36	5	bb vl vh ud uu	see Table 3.
10	RecDisplay7	41	5	bb vl vh ud uu	see Table 3.
11	RecDisplay8	46	5	bb vl vh ud uu	see Table 3.
12	RecAnaOut1	51	7	bb vl vh ud uu el eh	see Table 4.
13	RecAnaOut2	58	7	bb vl vh ud uu el eh	see Table 4.
14	RecAnaOut3	65	7	bb vl vh ud uu el eh	see Table 4.
15	RecAnaOut4	72	7	bb vl vh ud uu el eh	see Table 4.
16	RecAnaOut5	79	7	bb vl vh ud uu el eh	see Table 4.
17	RecAnaOut6	86	7	bb vl vh ud uu el eh	see Table 4.
18	RecAnaOut7	93	7	bb vl vh ud uu el eh	see Table 4.
19	RecAnaOut8	100	7	bb vl vh ud uu el eh	see Table 4.
20	RecRelay1	107	2	mm ss	see Table 8.
21	RecRelay2	109	2	mm ss	see Table 8.
22	RecRelay3	111	2	mm ss	see Table 8.
23	RecRelay4	113	2	mm ss	see Table 8.
24	RecInOut	115	2	io 00	see Table 8.
25	RecVacat	117	11	xx … xx	not yet used
26	free	128	128	xx … xx	not yet used

Table 3. RecDisplayN field format

Bytes	Description
bb	The number of the measurement block 0÷63 from which the result is taken – see measurement blocks Table 5.
vl, vh	Numeric value (Lo, Hi), in +8000H code
ud	unit/DP, byte with information on the unit and number of decimal places in the following format: uuuuuddd | ||_|____ the number of decimal places |___|_____ the unit (see unit Table 6.)
uu	Byte with the repeated information on a unit (see unit Table 6.)

Table 4. RecAnaOutN field format

Bytes	Description
bb	The number of the measurement block 0÷63 from which the result is taken – see measurement blocks Table 5.
vl, vh	Numeric value (Lo, Hi) from the measurement block in +8000H code
ud	unit/DP, byte with information on the unit and number of decimal places in the following format: uuuuuddd | | |_|_____ the number of decimal places |___|_____ the unit (see unit Table 4.)
uu	Byte with the repeated information on a unit (see unit Table 6.)
el, eh	Electrical value on the analogue output (Lo, Hi) in [mV] for the voltage output or [uA] for current ones, binary simple

Table 5. Measurement blocks

Code	Signature	Measured value
0	BL_O2	Volume concentration of oxygen
1	BL_CO2	Volume concentration of carbon dioxide
2	BL_CH4	Volume concentration of methane
3	BL_CO	Volume concentration of carbon monoxide
4	BL_NO	Volume concentration of nitric oxide
5	BL_NO2	Volume concentration of nitrogen dioxide
6	BL_NOX	Volume concentration of nitrogen oxides (total)
7	BL_SO2	Volume concentration of sulphur dioxide
8	BL_H2S	Volume concentration of hydrogen sulphide
9	BL_X	Volume concentration of X gas – see Table 11.
10	BL_Y	Volume concentration of Y gas
11	BL_Z	Volume concentration of Z gas
12	---	- not assigned -
13	---	- not assigned -
14	BL_PumpFlow	Gas flow velocity in the device's gas channel
15	BL_PressAbs	Atmospherical pressure
16	BL_PressDif	Differential pressure
17	BL_Tamb	Ambient temperature
18	BL_Tgas	Measured gas temperature
19	BL_T3_KTYPE	Temperature T3
20	BL_T4_PT500	Temperature T4
21	BL_SL	Stack loss
22	BL_Tint	Sensor's inner temperature
23	BL_Eta	Combustion efficiency

Code	Signature	Measured value
24	BL_Lam	Excess air coefficient
25	BL_Flow	Flow velocity
26	BL_Hum	Gas relative humidity
27	BL_CH4mg	Methane mass concentration
28	BL_COmg	Carbon monoxide mass concentration
29	BL_NOmg	Nitric oxide mass concentration
30	BL_NO2mg	Nitrogen dioxide mass concentration
31	BL_NOXmg	Nitrogen oxides total mass concentration
32	BL_SO2mg	Sulphur dioxide mass concentration
33	BL_H2Smg	Hydrogen sulphide mass concentration
34	BL_Xmg	Gas X mass concentration
35	BL_Ymg	Gas Y mass concentration
36	BL_Zmg	Gas Z mass concentration
37	---	- not assigned -
38	---	- not assigned -
39	BL_UI0	Voltage or current of analogue input #0
40	BL_UI1	Voltage or current of analogue input #1
41	BL_UI2	Voltage or current of analogue input #2
42	BL_UI3	Voltage or current of analogue input #3
43	BL_UI4	Voltage or current of analogue input #4
44	BL_UI5	Voltage or current of analogue input #5
45	BL_UI6	Voltage or current of analogue input #6
46	BL_UI7	Voltage or current of analogue input #7
47	---	- not assigned -
48	---	- not assigned -
49	---	- not assigned -
50	BL_NULL	- not assigned -
51	BL_CH4rel	Methane relative mass concentration
52	BL_COrel	Carbon monoxide relative mass concentration
53	BL_NOrel	Nitric oxide relative mass concentration
54	BL_NO2rel	Nitrogen dioxide relative mass concentration
55	BL_NOXrel	Nitrogen oxides total relative mass concentration
56	BL_SO2rel	Sulphur dioxide relative mass concentration
57	BL_H2Srel	Hydrogen sulphide relative mass concentration
58	BL_Xrel	Gas X relative mass concentration
59	BL_Yrel	Gas Y relative mass concentration
60	BL_Zrel	Gas Z relative mass concentration
61	---	- not assigned -
62	---	- not assigned -
63	BL_MediumPress	Measured gas pressure

Table 6. Unit codes

Code	Signature	Unit
0	UnitPPM	[ppm]
1	UnitPROCENT	[%]
2	UnitDEGC	[°C]
3	UnitDEGF	[°F]
4	UnitMGM3	[mg/m3]
5	UnitGGJ	[g/GJ]
6	UnitHPA	[hPa]
7	UnitPA	[Pa]
8	UnitMMH2O	[mmH2O]
9	UnitINH2O	[inH2O]
10	UnitMS	[m/s]
11	UnitmV	[mV]
12	UnitV	[V]
13	UnitmA	[mA]
14	UnitA	[A]
15	UnitNONE	[ ]
16	UnitGM3	[g/m3]
17	UnitLPH	[l/h]

Table 7. IRma work phases

Code	Phase	Description
0	Warming	Initial phase – device warming up
1	Ventilation	Main phase – sensor's zeroing
2	Measuring	Main phase – measurement (two sub-states may occur – the differ in Infusion bit)
3	PreStandby	Main phase – ventilation after measurements
4	Standby	Main phase – stand by (no measurements)
5	DisplayTest	Initial phase
6	DisplayIdentification	Initial phase
7	FirstZeroing	Initial phase – the first zeroing after the device is turned on

Table 8. RecRelayN field format

Bytes	Description	
mm	Relay work mode (steering for N relay):	
	0 - AnalogOut U1	6 - AnalogOut U4
	1 - AnalogOut I1	7 - AnalogOut I4
	2 - AnalogOut U2	8 - Follow In1 – reflects In1
	3 - AnalogOut I2	9 - Follow In2 – reflects In2
	4 - AnalogOut U3	10 - Follow phase – reflects work phase
	5 - AnalogOut I3	>10 - Off – constantly off
ss	76543210 0000000s | ||_____ RelayN state, 1=on |_____|_____ bits not used	

Table 9. RecInOut field format

Bytes	Description
io	76543210 iiiioooo ||||||||_____ Relay1 output |||||||_____ Relay2 output ||||||_____ Relay3 output |||||_____ Relay4 output ||||_____ In1 input |||_____ In2 input ||_____ In3 input |_____ In4 input
00	Not used (always 00H)

Table 10. RecDateTime field format

Bytes	Description
ss	Clock time / seconds, BCD format
mm	Clock time / minutes, BCD format
hh	Clock time / hours, BCD format
dw	Day of the week: 01H = Monday
dd	Day of the month, BCD format
MM	Number of the month, BCD format, 01H = January
yy	Year, BCD format, 00H = 2000

Table 11. Exotic gas codes

Code	Gas type	Description
14	H2	H2 (hydrogen) measured with electrochemical sensor
15	NH3	NH3 (ammonia) measured with electrochemical sensor
16	Cl2	Cl2 (chlorine) measured with electrochemical sensor
17	HCl	HCl (chloride) measured with electrochemical sensor
32	N2O	N2O (nitrous oxide) measured with IR sensor
34	CHF3	CHF3 (fluoroform) measured with IR sensor
43	VOC	VOC (volatile organic compound) measured with PID (photo-ionisation)
44	H2	H2 (hydrogen) measured with TCD (thermal conductivity detector)