EMU 72

HVAC

Use of the
Diagnostic Program and
SW upload

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		Rev 00
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1   Purpose of the document

This document describes the equipments needed and the procedure to use the diagnostic program for the HVAC control unit installed on board of the unit EMU-72, and its SW uploading.

2   Equipments needed

- PC with Windows (*) operative system, with a serial port (COM1) with a baudrate of 9600 at least;
  - For the communication use a serial connection of the type indicated in the fig. 1
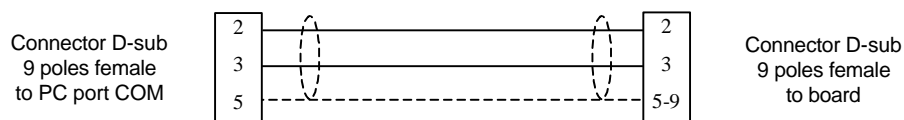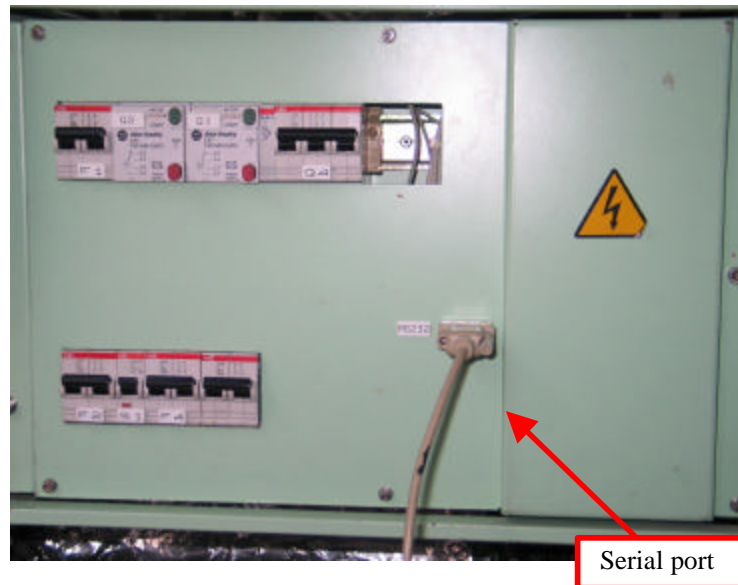

Fig. 1 – Connection for HVAC

(*) Windows '98 is needed for the uploading procedure

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3   Connections

- Use the connection from COM port of the PC to the serial port of the Toilette control unit (see picture)

Serial port

4   PC SETTING

4.1   Installation of the file in the PC

- The diagnostic program is given in a package of files called "HVAC.zip".
- Extract this files in a directory called e.g. "HVAC".
- The communication is setted for the port COM1 with this parameter:
  - Connection to COM1:
    - o   baudrate   4800 bit/s
- For the uploading procedure is requested the operative system Windows '98
- The execution file is called Spp.exe and there is a "Dos" short circuit file that you can copy in the desk top for utility.

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5   Use of the diagnostic program

5.1   Start of the program, and Main menù

- Connect the serial port COM1 of the PC to the serial port of the HVAC control unit.

- It is possible to connect also with the equipment already in use supplied by the battery voltage. In case of problem for the activation of the communication, reset the unit trough the power supply.

- Open the program called Spp.exe or use the Dos short-circuit file created before.

- After the start of the program it will appear the Main menu; the selection of all the menu and submenu is possible by pressing the correspondent number or with the arrow selection and the Return key.

```
                    HVAC service software


            [1] Terminal mode
            [2] Logged faults
            [3] Test modes
            [4] Recording
            [5] Download
            [6] Options
            [7] Select configuration / connect via CAN



       select with arrow keys and press <RETURN> / <ESC> leave
```

1	Terminal mode	SW version check;
		Operation in "Service Mode" for signal forcing
2	Logged fault	Create / Erase the logged fault stored in the unit
3	Test modes	Selection of function modes off line, for test purpose
4	Recording	On-line visualization and eventually recording of the variables chosen trough the "Select configuration".
5	Download	SW Upload
6	Options	Selection of some program options
7	Select configuration / connect via Can	Selection of the variables configuration for the "Recording" mode.
		Selection of the Cab electronic unit via can-bus.

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5.2   Description of the Sub-Menu

5.2.1   [1] Terminal Mode

- In the terminal mode is presented a terminal window where is possible to write some commands.

- The main commands (press *Return* key after command) are:
  Ctr E   to show the actual SW release
  sm   to enter into **service mode**

  Under the **service mode** are available this main commands:
  m bwxxx 1   force of the signal number xxx to 1
  m bwxxx 0   force of the signal number xxx to 0
  reset   to reset the control unit and release all forcing

- Below the results of some commands given in the Terminal window.

```
*
000001_saloon_041
*


*sm
service mode
*reset
abcdefghijklmnnopqrs






ESC=Exit F1=Digital F2=Analogue F3=Timer F4=Symbol F5=Macro F6=Protocol
```

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5.2.2 [2] Logged fault

- In the logged fault menu, below reported, is possible to read or erase the faults logged in the memory of the HVAC control unit

```
                    HVAC service software




             [1] Read logged faults

             [2] Erase logged faults




         select with arrow keys and press <RETURN> / <ESC> leave
```

- If it is selected *[1] Read logged faults* the it will be presented a new page where is requested the train number.
- Then it will be created a file of the logged faults: take note of the file name. The file will be put in the working directory of the HVAC program, and is readable with any text reader (e.g. NotePad, WordPad, Word, …)
- Below are reported the sequence for the file generation and an example of file

```
                     HVAC service software



 Reading error memory;
 Train number ? 72-018
 .........
                     +--------------------------------+
                     ¦ Faults saved to "200610AA .ERR" ¦
                     +--------------------------------+
                          press any key to continue !
```

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- If it is selected *[2] Erase logged faults* it will be erased the content of the diagnostic memory.

```
Sample of a logged fault file (the fault that are in active state are fault
present at the moment of the logging)

Date of reading logged faults: 20.6.2005
Train number:  72018

Error State    Count First occurrence
1     inactive 1      01.01.70 00:01:00
2     inactive 1      01.01.70 00:01:16
3     inactive 1      01.01.70 00:01:32
4     inactive 1      01.01.70 00:01:47
5     inactive 1      01.01.70 00:02:03
6     inactive 1      01.01.70 00:02:18
7     inactive 1      01.01.70 00:02:34
8     inactive 1      01.01.70 00:02:49
9     inactive 1      01.01.70 00:03:05
10    inactive 1      01.01.70 00:03:20
11    active   2      01.01.70 00:00:28
12    inactive 2      01.01.70 00:00:29
13    active   2      01.01.70 00:00:30
14    inactive 3      01.01.70 00:00:31
15    active   2      01.01.70 00:00:32
16    inactive 2      01.01.70 00:00:33
17    active   2      01.01.70 00:00:34
18    active   2      01.01.70 00:00:35
19    inactive 6      01.01.70 00:00:36
20    inactive 3      01.01.70 00:00:37
24    inactive 3      01.01.70 00:09:20
27    inactive 31     01.01.70 00:02:29
30    inactive 306    01.01.70 00:21:18
31    inactive 51     01.01.70 00:40:49
32    active   438    01.01.70 00:40:56
33    inactive 34     01.01.70 00:41:09
34    inactive 355    01.01.70 00:07:30
35    inactive 4      01.01.70 00:14:55
104   inactive 5      01.01.70 01:53:38
```

- Below are reported the meaning of the error message codes for HVAC passengers and driver cabin.

error number	defect (saloon)
01	sensor room temp. vestibule 1 short circuit (AA001)
02	sensor room temp. saloon 3 short circuit (AA002)
03	sensor room temp. saloon 2 short circuit (AA003)
04	sensor room temp. saloon 1 short circuit (AA004)
05	sensor outside short circuit (AA005)
06	sensor room temp. toilet short circuit (AA006) (only TT car)

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error number	defect (saloon)
07	Free
08	Free
09	sensor duct temp. short circuit (AA009)
10	sensor room temp. vestibule 2 short circuit (AA010)
11	sensor room temp. vestibule 1 open loop (AA001)
12	sensor room temp. saloon 3 open loop(AA002)
13	sensor room temp. saloon 2 open loop (AA003)
14	sensor room temp. saloon 1 open loop (AA004)
15	sensor ouitside open loop (AA005)
16	sensor room temp. toilet open loop (AA006) (only TT car)
17	Free
18	Free
19	sensor duct temp. open loop (AA009)
20	sensor room temp. vestibule 2 open loop (AA010)
21	AIC failure (internal hardware error)
22	c0 failure (internal hardware error)
23	c1 failure (internal hardware error)
24	high pressure failure (BY001=1L but BA003=0L)
25	low pressure failure (3 times in 30 minutes)
26	overtemp. airheater (thermostate BA004=0L during heating, 5 times in 30 minutes)
27	overtemp. supply fans (thermostate BA014=0L during BY006=1L, 5 times in 30 minutes)
28	overtemp. condenser fans (thermostate BA015=0L during BY008=1L, 5 times in 30 minutes)
29	overtemp. toilet heater (thermostate BA005, 5 times in 15 minutes)
30	overtemp. vestibule 1 heater (thermostate BA006, 5 times in 15 minutes)
31	overtemp. saloon 1 heater (thermostate BA007, 5 times in 15 minutes)
32	overtemp. saloon 2 heater (thermostate BA008, 5 times in 15 minutes)
33	overtemp. saloon 3 heater (thermostate BA009, 5 times in 15 minutes)
34	overtemp. vestibule 1+2 heater (thermostate BA010, 5 times in 15 minutes)
35	airflow fault (supply fans active and 5 minutes no responce, BA016=0L)
36	room temperature saloon 1 too cold (10 times in 5 hours, room colder than TR_w-3K)
37	room temperature saloon 2 too cold (10 times in 5 hours, room colder than TR_w-3K)
38	room temperature saloon 3 too cold (10 times in 5 hours, room colder than TR_w-3K)

error number	defect (driver´s cab)
101	driver´s cab: sensor outside temp. defect (AA001)
102	driver´s cab: sensor duct temp. defect (AA002)
103	driver´s cab: sensor room temp. defect (AA003)
104	setpoint switch defect (AA004)
105	driver´s cab: c0 failure (internal hardware error AIC, analog input control)
106	driver´s cab: c1 failure (internal hardware error AIC, analog input control)
107	driver´s cab: low pressure failure (3 times in 30 minutes)

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5.2.3   [3] Test modes

- With this selection is possible to force different functioning modes, independently from the external conditions (e.g. external or internal temperature).

- The *Test mode* menu is below reported;

- After the selection by arrow and "Return" key, the system start in the mode selected. To activate the visualization of the internal parameters proceed normally with the selecting configuration [7] and Recording [4] commands.

- To stop the *Test mode* status, reset the control unit as described in §5.2.1. or switch off the power supply.

```
 [3] Test modes

                         HVAC service software


        [ ] 1_supply_fans                    [ ] ...
        [ ] 3_exhaust_fan                    [ ] 21_driver_prepare
        [ ] 4_condenser_fan                  [ ] 22_driver_convheat
        [ ] 5_flap_position_1                [ ] 23_driver_cooling
        [ ] 6_flap_position_2                [ ] 24_driver_airheat
        [ ] 7_flap_position_3                [ ] ...
        [ ] 8_flap_100%outside               [ ] 25_mode_OFF
        [ ] 9_flap_100%recircuit             [ ] 26_mode_venting
        [ ] 10_cooling                       [ ] 27_mode_heating
        [ ] 11_bypass                        [ ] 28_mode_automatic
        [ ] 12_airheater                     [ ] 29_mode_fire
        [ ] 13_conv_heat_saloon_1
        [ ] 14_conv_heat_saloon_2
        [ ] 15_conv_heat_saloon_3
        [ ] 16_conv_heat_vestibule
        [ ] 17_conv_heat_WC(onlyTT)
        [ ] 18_emergency_mode

         select with arrow keys and press <RETURN> / <ESC> leave
```

- The conditions of the *Test mode* menu are below reported;

	Testmode	Outputs to be set on	Input conditions
1.	[ ] supply_fan	- supply fans (BY006) - no emergency (BY010)	- 400V OK (BA018=1L)
2.	[ ]		
3.	[ ] exhaust_fan	- exhaust fan (BY011) - no emergency (BY010)	- 400V OK (BA018=1L)
4.	[ ] condenser_fan	- condenser fan (BY008) - no emergency (BY010)	- 400V OK (BA018=1L)
5.	[ ] flap_position_1	- flap to position „1" - no emergency (BY010)	
6.	[ ] flap_position_2	- flap to position „2"	

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	Testmode	Outputs to be set on	Input conditions
		- no emergency (BY010)	
7.	[ ] flap_position_3	- flap to position „3" - no emergency (BY010)	
8.	[ ] 100%_fresh_air	- flap to position „100% outside air" (BY005) - no emergency (BY010)	
9.	[ ] 0%_fresh_air	- flap to position „100% recirculation air" (BY004) - no emergency (BY010)	
10.	[ ] cooling	- compressor (BY001) - mv liquid line (BY003) - supply fans (BY006) - exhaust fan (BY010) - condenser fan (BY008) - flap to position „2" - no emergency (BY010)	- 400V OK (BA018=1L) - not „compressor OFF (BA016=0L) - airflow OK (BA015=1L) - safety chain OK (BA003=1L while cooling) - low pressure OK (BA002=1L)
11.	[ ] Bypass	- mv bypass (BY002) - no emergency (BY010)	- 400V OK (BA018=1L) - not „compressor OFF (BA016=0L) - airflow OK (BA015=1L) - safety chain OK (BA003=1L while cooling) - low pressure OK (BA002=1L)
12.	[ ] airheater	- airheater (BY009 / TY009) - supply fans (BY006) - exhaust fan (BY010) - flap to position „2" - no emergency (BY010)	- 400V OK (BA018=1L) - airflow OK (BA015=1L) - duct temperature<75°C
13.	[ ] conv_heat_saloon1	- covection heater saloon 1 (BY015 / TY015) - no emergency (BY010)	- thermostate BA007=1L
14.	[ ] conv_heat_saloon2	- covection heater saloon 2 (BY014 / TY014) - no emergency (BY010)	- thermostate BA008=1L
15.	[ ] conv_heat_saloon3	- covection heater saloon 3 (BY013 / TY013) - no emergency (BY010)	- thermostate BA009=1L
16.	[ ] conv_heat_vestibule	- covection heater vestibule (BY012 / TY012) - no emergency (BY010)	- thermostate BA006=1L - thermostate BA010=1L
17.	[ ] conv_heat_WC	- covection heater WC (BY020 / TY020) - no emergency (BY010)	- thermostate BA005=1L
18.	[ ] emergency_mode	- emergency mode (BY010) will be switched OFF	
19.	free		
20.	free		
21.	[ ] driver_prepare	- prepare (BY001 on FPC4R)	- 400V OK (BA004=1L on FPC4R)
22.	[ ] driver_convheat	- convection heater (BY002/TY002 on FPC4R)	---

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	Testmode	Outputs to be set on	Input conditions
23.	[ ] driver_cooling	- compressor (BY003 on FPC4R)	- 400V OK (BA004=1L on FPC4R) - ventilation on (BA003=1L on FPC4R) - low pressure OK (BA002=1L on FPC4R) - not „compressor OFF" signal (BA001=0L on FPC4R)
24.	[ ] driver_airheat	- airheater (BY004/TY004 on FPC4R)	- 400V OK (BA004=1L on FPC4R) - ventilation on (BA003=1L on FPC4R) - duct temperature<70°C
25.	[ ] mode_OFF	- no emergency mode (BY010)	
26.	[ ] mode_venting	- no emergency mode (BY010) - supply fans (BY006) - exhaust fan (BY011) - flap to position „100% fresh air"	- 400V OK (BA018=1L)
27.	[ ] mode_heating	regulation, same function as choosed by bus signal „heating - no emergency mode (BY010) - supply fans (BY006) - exhaust fan (BY011) - flap position, airheater and all convection heaters depends on ambient conditions (regulation)	different conditions needed
28.	[ ] mode_automatic	regulation, same function as choosed by bus signal „heating - no emergency mode (BY010) - supply fans (BY006) - exhaust fan (BY011) - flap position, airheater, cooling unit and all convection heaters depends on ambient conditions (regulation)	different conditions needed
29.	[ ] mode_fire	- no emergency mode (BY010) - supply fans (BY006) - exhaust fan (BY011) - flap to position „100% fresh air"	- 400V OK (BA018=1L) - duct temperature < 80°C

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5.2.4   [4] Recording

- With this selection is possible to have the visualization and recording of the internal parameter.

- The selection and the signal package presented is done with the *Select configuration [7]* menu.

- The selection of the visualization mode and recording mode is done with the *Option menu [6]* menu.

- If in the *"record display type"* selection of the *Option* menu have been selected the *"text"* mode visualization of the signal will be as below reported. This mode is recommended for passengers HVAC.

```
[4] Recording

  hagenuk              HVAC service software                    20.6.2005

  10:53:43      file = OFF     section 1                   time multiplier 1

   AD310            AA003           AA009  BA003  BA017   BY001   BY003
          AA002            AA004          BA002  BA016   BA018   BY002   BY006

  +23,9   +23,7   +20,5   +21,5   +15,3  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,3  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,4  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,4  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,4  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,4  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,4  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,5  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,5  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,5  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,5  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,5  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,6  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,6   +21,5   +15,6  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,6  1   0   1   0   1   0   0   0   1
  +23,9   +23,7   +20,5   +21,5   +15,6  1   0   1   0   1   0   0   0   1
```

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- If in the *"record display type"* selection of the *Option* menu have been selected the *graph* the visualization of the signals will be as below reported. This mode, for the limited number of signal, is possible only for driver cab HVAC.
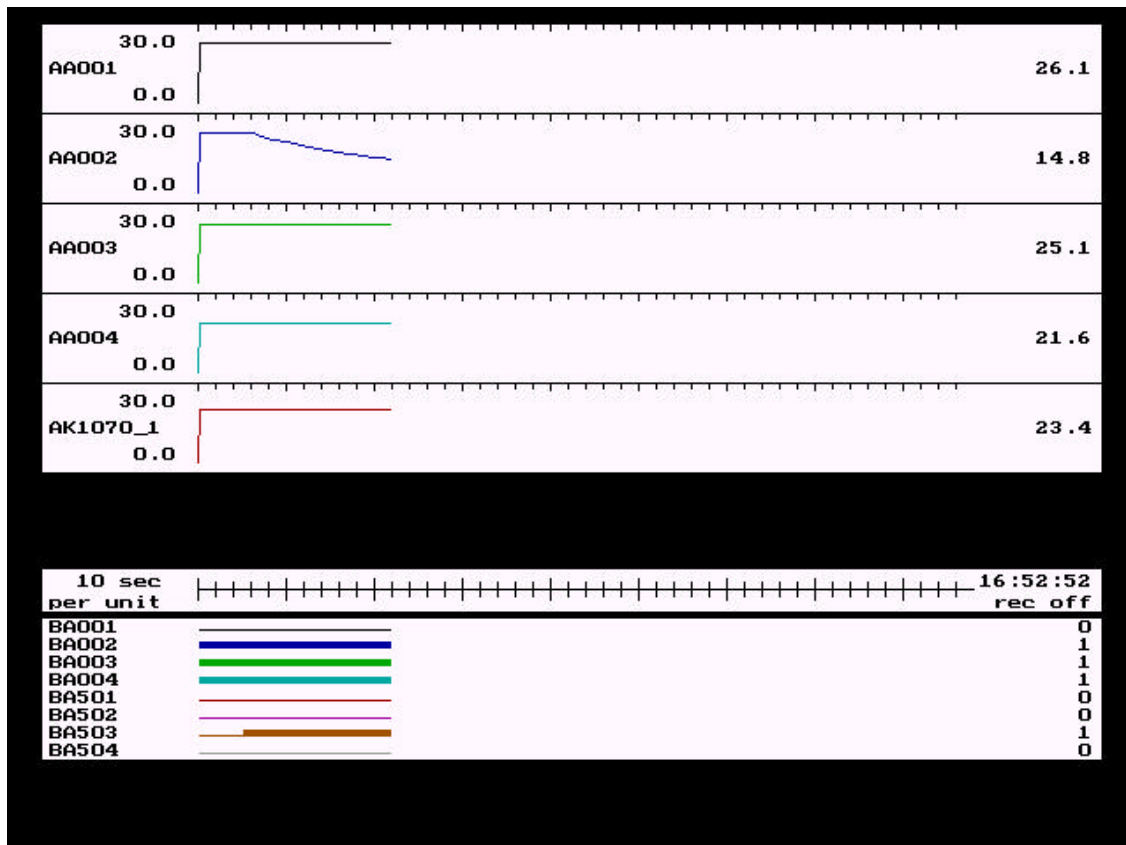
- The list of the signal is below reported:

Passengers HVAC

Analog inputs

SW adress	connector X..	Meaning
AA001	402:9	room temperature vestibule 1
AA002	402:7	room temperature saloon 3
AA003	402:5	room temperature saloon 2
AA004	402:3	room temperature saloon 1
AA005	402:1	outside temperature
AA006	403:9	room temperature WC *(only car typ TT)*
AA009	403:3	duct temperature
AA010	403:2	room temperature vestibule 2

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Digital inputs

SW Adress	connector X..	meaning
BA001	701:1	end position flap
BA002	701:2	low pressure OK
BA003	701:3	safety chain OK
BA004	701:4	thermostate airheater ok
BA005	701:5	temp. WC OK
BA006	701:7	temp. vestibule 1 ok
BA007	701:8	temp. saloon group 1 ok
BA008	701:9	temp. saloon group 2 ok
BA009	701:10	temp. saloon group 3 ok
BA010	701:11	temp. vestibule 1+2 ok
BA011	702:11	---
BA012	702:10	---
BA013	702:9	---
BA014	702:8	thermostate supply fans ok
BA015	702:7	thermostate condenser fans ok
BA016	702:5	airflow OK
BA017	702:4	compressor OFF
BA018	702:3	400V ok
BA019	702:2	local ventilation
BA020	701:1	local auto

Digital outputs

SW Adress	connector X..	meaning
BY001	301:2	compressor on
BY002	301:3	mv bypass
BY003	301:4	mv liquid line
BY004	301:5	flap recirc. air
BY005	301:6	flap outside air
BY006	302:2	supply fans
BY007	302:3	---
BY008	302:4	condenser fan on
BY009	302:5	airheater
BY010	302:6	**no** emergency mode
BY011	501:5	exhaust fan
BY012	501:4	conv.heat vestibule
BY013	501:3	conv.heat saloon group 3
BY014	501:2	conv.heat saloon group 2
BY015	501:1	conv.heat saloon group 1
BY020	502:1	conv.heat toilet *(only car typ TT)*

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Driver cab HVAC

Analog inputs

SW adress	connector X..	meaning
AA001	X6:2	outside temperature (TO)
AA002	X6:4	duct temperature (TD)
AA003	X6:6	room temperature (TR)
AA004	X6:8	setpoint switch (TR_w)

Digital inputs

SW Adress	connector X..	meaning
BA001	X2:7	compressor OFF
BA002	X2:5	low pressure OK
BA003	X2:3	ventilation on + airflow ok
BA004	X2:1	400V OK

Digital outputs

SW Adress	connector X..	meaning
BY001	X3:6	prepare mode
BY002	X3:4	convection heater
BY003	X3:3	compressor
BY004	X3:1	airheater

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5.2.5 [5] Download

- With this selection is possible to check and eventually download the SW in the control unit.

- I a new Applicative SW is given separately for the uploading, if not   has to be copied in the working directory of the program (e.g. c:\condiz\). The file name is defined:
  saloon.crc   for passengers HVAC
  driver.crc   for driver cab HVAC

- The download is possible only if the PC have the Windows '98 operative system.

- The *Download* menu is below reported

```
[5] Download

                        HVAC service software



                [1] Download application software

                [2] Download system software





        select with arrow keys and press <RETURN> / <ESC> leave

```

- Select [1] for the applicative sw download; the further visualization will show the present SW installed (first row) and the SW available for the uploading (second row). The requested password is "RAIN".

- Below the visualization for passengers HVAC uploading

```
[5] Download / [1] Download application software      (*) RAIN

   +-----------------------------------------------------------------------+
   ¦                      HVAC service software                            ¦
   +-----------------------------------------------------------------------+

      +--------------------------------------------------------------------+
      ¦                   WARNING: Are you sure to replace                 ¦
      +--------------------------------------------------------------------¦
      ¦ EMU_Class72_saloon, 0.41, 21002, K81G731_000_00A__ by              ¦
      +--------------------------------------------------------------------¦
      ¦ EMU_Class72_saloon, 0.41, 21002, K81G731_000_00A__ ?               ¦
      +--------------------------------------------------------------------¦
      ¦                        Password:  (*)                              ¦
      +--------------------------------------------------------------------+
```

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- Below the visualization for driver cab HVAC uploading

```
+-------------------------------------------------------------------------------+
¦                              HVAC service software                            ¦
+-------------------------------------------------------------------------------+


      +-----------------------------------------------------------------------+
      ¦                         WARNING: Are you sure to replace              ¦
      +-----------------------------------------------------------------------+
      ¦ EMU_Class72_driver, 0.2, 100500, K81G732_000_00A by                   ¦
      +-----------------------------------------------------------------------+
      ¦ EMU_Class72_driver, 0.2, 100500, K81G732_000_00A ?                    ¦
      +-----------------------------------------------------------------------+
      ¦                            Password: (*)                              ¦
      +-----------------------------------------------------------------------+


(*)RAIN
```

- After the confirmation wait for the uploading completition.
- Reset then the control unit and check the correct SW uploading.

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5.2.6 [6] Options

- With this selection is possible the selection of some options and parameters. The menu presented is below reported.

```
[6] Options
+------------------------------------------------------------------------------+
¦                           HVAC service software                              ¦
+------------------------------------------------------------------------------+

                 [1] Serial port                   : COM1

                 [2] Serial baud rate              : 4800

                 [3] Write recording to a file     : on

                 [4] Time multiplier               : 1

                 [5] Test modes exclusive          : on

                 [6] Recording display type        : text




                              change with arrow keys / <ESC> leave

```

- The possible selections are:
  - [1] , [2] communication port setting
  - [3]   activation of a log file during the visualization of the internal parameters
  - [4]   time constant for the signal refresh
  - [5]   n.a.
  - [6]   Selection of the display modes (text or graphics)

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5.2.7 [7] Select configuration

- With this menu is possible the selection of one signal configuration that will be presented in the visualization in the "*Record"* mode.
  The menu presented is below reported.

```
[7] Select configuration / connect via CAN

        [ ] spp.cfg
        [ ] spp_ai.cfg
        [ ] spp_di1.cfg
        [ ] airheat.cfg
        [*] cooling.cfg
        [ ] convheat.cfg
        [ ] venting.cfg
        [ ] flaps.cfg
        [ ] salo_can.cfg
        [ ] 485signa.cfg
        [ ]
        [ ] driver.cfg
        [ ] driv_can.cfg
        [ ] driv_ca2.cfg




        select with arrow keys and press <RETURN> / <ESC> leave
```

- The signal avaliable in the different configuration are useful depending on the function that you are going to verify.
- The function related to the configurations are below reported:

spp.cfg	All the parameters are avaliable when is activated the record mode
spp_ai.cfg	Main analog inputs
spp_di1.cfg	Main digital inputs
airheat.cfg	Signals related to the heating function
cooling.cfg	Signals related to the cooling function
convheat.cfg	Signals related to the convection heaters
venting.cfg	Signals related to the ventilation function
flaps.cfg	Signals related to the flaps positioning
salo_can.cfg	n.a.
485signa.cfg	n.a.
driver.cfg	Selection of the signals from the driver cab HVAC
driv_can.cfg	n.a.
driv_ca2.cfg	n.a.