Repair Instructions – Service No./Modi, Error list

1 Service and Access Codes/Release Option

Enter the number under “service diagnosis” (Evita) or ventilation (Evita 2 dura) during operation. For release Hardware Option wait 30 seconds and switch Evita off and on. Release Software Option:
Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.5.2, Diagnosis page “Option Release” (release of software options), page 76.

1.1 Service Numbers for Software Versions 1.00 to 1.04 and 1.08

3 0 3 2	to change configuration of ventilation
1 3 1 1	to clear user logbook
4 6 5 5	to select Service Mode
4 6 4 4 + 4 6 5 5	to select Service Mode with info text in DS error list
1 3 2 2	to clear DS error list
4 7 4 7	to select calibration of PEEP valve
4 7 4 8	to clear PEEP valve calibration data
4 8 1 1	to activate DC module
4 8 1 0	to deactivate DC module
6 7 9 5	to activate CO_2 module
8 3 9 6	to activate SpO_2 module
9 4 9 5	to deactivate all options

1.2 Service Numbers for Evita 4 and Evita 2 dura

Evita 4 with Software 1.05, 1.06, 1.07, 1.09 and 2.n and higher; for Evita 2 dura as of Software 3.00

3 0 3 2	To change configuration of ventilation.
1 3 9 9 + 1 3 1 1	To clear user logbook.
3 9 9 9 + 3 9 4 8	Deactivation of leakage compensation (re-activated by switching the Evita off/on).
3 9 9 9 + 3 9 5 8	Deactivation of BTPS conversion (re-activated after switching the Evita off/on). Important: This is only possible if P Ambient is larger than 960 mbar, otherwise the Evita will perform a re-start (see Test Certificate).
7 2 9 9 + 7 2 3 5 + 0 0 0 0	Deactivation of the hose compliance correction (re-activated after switching the Evita off/on).
4 6 5 5	To select Service Mode. With Evita 2 dura units without “Service Plus” option, connect a download cable (service coding) to COM1.
4 6 4 4 + 4 6 5 5	To select Service Mode with info text in DS error list.(Evita 4 only). With Evita 2 dura units, software version 3.00 or higher, without “Service Plus” option, connect a download cable (service coding) to COM1.
1 3 9 9 + 1 3 2 2	To clear DS error list
4 7 9 9 + 4 7 4 7	To select calibration of PEEP valve
4 7 9 9 + 4 7 4 8	To clear PEEP valve calibration data
4 8 1 1	To activate DC module
4 8 9 9 + 4 8 1 0	To deactivate DC module
6 7 9 5	To activate CO_2 module
6 7 9 9 + 6 7 9 4	To deactivate CO_2 module
8 3 9 6	To activate SpO_2 module
8 3 9 9 + 8 3 9 5	To deactivate SpO_2 module
9 4 9 9 + 9 4 9 5	To deactivate all options

2 List of Evita 2 dura/Evita 4 error numbers

Error list as at February 1998 (corresponding to SW 3.n of Evita 4/Evita 2 Dura)

Overview of error number assignment

02	Error recognised by safety software which runs on CPU 68332 PCB, Pneumatic Controller PCB and Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura)
03	Error in control console components not located on printed circuit card of Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura), e.g. Touchscreen
04	Error in electronic unit components not located on printed circuit cards, e.g. power pack
05	Error in pneumatic system components
06	Error in extension box components
07	Software error in Rosy operating system which runs on CPU 68332 PCB, Pneumatic Controller PCB, Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura) and Communication PCB.
08	Exception
09	For future expansion
10	Error on Pneumatic Controller PCB
11	Error on HPSV Controller (Air) PCB or in Air mixer cartridge. On the Evita 4, such errors are stored with software version 1.09 and as of version 2.21; on the Evita 2 dura with versions greater than 3.00. With older software versions, such errors are only displayed as "mixer fault". The error status can be read out in diagnosis mode if the error is currently present.
12	Error on HPSV Controller (O2) PCB or in O2 mixer cartridge. On the Evita 4, such errors are stored with software version 1.09 and as of version 2.21; on the Evita 2 dura with versions greater than 3.00. With older software versions, such errors are only displayed as "mixer fault". The error status can be read out in diagnosis mode if the error is currently present.
13	Error on CPU 68332 PCB
14	Error on CO2 Carrier PCB
15	Error on Communication PCB
16	Error on Paediatric Flow PCB
17	Error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura)

2.1 Error code 02 Safety Software

The service codes 02.00.. to 02.22.. are recognised on the CPU 68332 PCB; they correspond to 02.40.. to 02.62.. as recognised on the Pneumatic Controller PCB.

Fault	Item	Cause/Remedy
02.00.001	si0_Err, New start, cause incorrect, reset	Monitoring of cold/warm start storage in RAM on CPU 68332 PCB. Cause: Software error on CPU 68332 PCB
02.00.002	si0_Err, Fast data chksum error, reset	Data packets between CPU 68332 PCB and Pneumatic Controller PCB cannot be transferred in full. CPU 68332 PCB or Pneumatic Controller PCB defective.
02.00.003	si0_Err, Safety software of partner CPU not started, reset	After starting, it was not possible within 10 seconds to establish synchronisation between CPU 68332 PCB and Pneumatic Controller PCB. Cause: CPU 68332 PCB or Pneumatic Controller PCB defective.
02.00.004	si0_Err, Input data, chksum error, reset	Data packets between CPU 68332 PCB and Pneumatic Controller PCB cannot be transferred in full. CPU 68332 PCB or Pneumatic Controller PCB defective.
02.00.005	si0_Err, Vector for NMI incorrect, reset	RAM or SW error on CPU 68332 PCB
02.00.020	si0_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.

Fault	Item	Cause/Remedy
02.01.001	si1_ Err, Adjuster has incorrect pixel sum, X alarm, reset:	Screen content (with Evita 2 dura also 7-segment displays) is read out and compared to request. Cause: Hardware or SW error on Graphics Controller PCB (Evita 4)/Front Panel PCB (Evita 2 dura) or CPU 68332 PCB or Pneumatic Controller PCB. If display plausible, then SW error; otherwise high probability of hardware error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura). Table for X: 1 Paw high adjuster selected 2 Paw high arrow selected 3 MV min adjuster selected 4 MV min arrow selected 5 O2 adjuster selected 6 Last adjuster plus one 7 Paw high adjuster not selected 8 Paw high arrow not selected 9 MV min adjuster not selected 10 MV min arrow not selected 11 O2 adjuster not selected 12 Paw high line 30 top 13 Pressure scale values top 30 14 Paw high line 60 top 15 Pressure scale values top 60 16 Paw high line 100 top 17 Pressure scale values top 100 18 Paw high line 30 bottom 19 Pressure scale values bottom 30 20 Paw high line 60 bottom 21 Pressure scale values bottom 60 22 Paw high line 100 bottom 23 Pressure scale values bottom 100 24 Paw high line 30 bargraph 25 Pressure scale values bargraph 30 26 Paw high line 60 bargraph 27 Pressure scale values bargraph 60 28 Paw high line 100 bargraph 29 Pressure scale values bargraph 100 30 Paw high display 1 31 Paw high display 2 32 MV min display 1 33 MV min display 2 34 Cold start screen

Fault	Item	Cause/Remedy
02.01.002	si1_Err, Paw high, Si copy, consistency X alarm, reset	Alarm values relevant to safety are checked for plausibility. Cause: RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.01.003	si1_Err, MV min, Si copy, consistency X alarm, reset	Alarm values relevant to safety are checked for plausibility. Cause: RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.01.004	si1_Err, O2 adjust, Si copy, consistency X alarm, reset	Alarm values relevant to safety are checked for plausibility. Cause: RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.01.005	si1_Err, Paw high, invalid value, reset	Alarm values relevant to safety are checked for plausibility. Cause: RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.01.006	si1_Err, MV min, invalid value, reset	Alarm values relevant to safety are checked for plausibility. Cause: RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.01.007	si1_Err, O2 adjustment, invalid value, reset	Alarm values relevant to safety are checked for plausibility. Cause: RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.01.020	si1_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.01.021	si1_Err, Xxx is set, case incorrect, reset	Only applies up to SW 1.04. RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB
02.01.022	si1_Err, Control console, status, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.

Fault	Item	Cause/Remedy
02.02.001	si2_Err, Identifier has incorrect pixel sum, X alarm, reset	Screen content (with Evita 2 dura also 7-segment displays) is read out and compared to request. Cause: Hardware or SW error on Graphics Controller PCB (Evita 4) / Front Panel PCB (Evita 2 dura) or CPU 68332 PCB or Pneumatic Controller PCB. If display plausible, then SW error; otherwise high probability of hardware error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura). Refer to error 02.01.001 for X table.
02.02.002	si2_Err, Identifier not announced, X alarm, reset	Refer to error 02.02.001.
02.02.003	si2_Err, Value has incorrect pixel sum, X alarm, reset	Refer to error 02.02.001.
02.02.020	si2_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.03.001	si3_Err, Keypad input sequence, counter incorrect, reset	SW or transmission error from Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura) via CPU 68332 PCB to Pneumatic Controller PCB. Cause: Probably error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
02.03.002	si3_Err, Rotary knob button pressed, incorrectly displayed, reset	SW or hardware error when reading out keys on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
02.03.003	si3_Err, Silence button pressed, incorrectly displayed, reset	Refer to error 02.03.002.
02.03.004	si3_Err, Reset button pressed, incorrectly displayed, reset	Refer to error 02.03.002.
02.03.005	si3_Err, Extraction button pressed, incorrectly displayed, reset	Refer to error 02.03.002.
02.03.006	si3_Err, Inspiration hold button pressed, incorrectly displayed, reset	Refer to error 02.03.002.
02.03.007	si3_Err, Expiration hold button pressed, incorrectly displayed, reset	Refer to error 02.03.002.

Fault	Item	Cause/Remedy
02.03.020	si3_Err, S boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.04.001	si4_Err, MV exp, 12 consistency, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.04.002	si4_Err, Flow exp, quotient, 12 consistency, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.04.003	si4_Err, Standard flow sensor in neo-mode, X alarm, reset	According to safety software, wrong flow sensor being used in neo-mode. Cause: RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.04.004	si4_Err, Neo flow sensor in adult mode, X alarm, reset	According to safety software, wrong flow sensor being used in adult mode. Cause: RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.04.020	si4_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.05.001	si5_Err, Factor for NTPD to BTPS incorrect, X alarm, reset	SW error or impermissible activation of BTPS deactivation at ambient pressure less than 961 mbar.
02.05.002	si5_Err, Flow insp, counter current, reset	HPSV actuation monitoring signals error. Cause: HPSV cartridge (Air or O2) or one of the two HPSV actuation PCBs or Pneumatic Controller PCB defective. Error status can be read out in diagnosis mode “Valves“ if error is present at the time.
02.05.003	si5_Err, MV insp, 12 consistency, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.05.004	si5_Err, Factor for NTPS to BTPS incorrect, X alarm, reset	SW error or impermissible activation of BTPS deactivation at ambient pressure less than 961 mbar.
02.05.020	si5_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.06.001	si6_Err, MV deactivation, confirmation X signal incorrect, reset	Probably software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura) or also CAN communication problem with CPU 68332 PCB and Pneumatic Controller PCB.

Fault	Item	Cause/Remedy
02.06.002	si6_Err, MV deactivation, request Y signal incorrect, reset	Refer to error 02.06.001.
02.06.003	si6_Err, Paed MV deactivation, confirmation X signal incorrect, reset	Refer to error 02.06.001.
02.06.004	si6_Err, Paed MV deactivation, request Y signal incorrect, reset	Refer to error 02.06.001.
02.06.020	si6_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.06.021	si6_Err, Si Y signal, case incorrect	Refer to error 02.06.020, however defective Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura) also possible.
02.07.020	si7_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.08.001	si8_Err, O2 measurement deactivation, confirmation X signal incorrect, reset	Probably software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura) or also CAN communication problem with CPU 68332 PCB and Pneumatic Controller PCB.
02.08.002	si8_Err, O2 measurement deactivation, request Y signal incorrect, reset	Refer to error 02.08.001.
02.08.020	si8_Err ,Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.08.021	si8_Err, Si Y signal, case incorrect, reset	Refer to error 02.08.021, however defective Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura) also possible.
02.09.001	si9_Err, Disconnection manoeuvre, disconnection too long, reset	CPU 68332 PCB monitors timing of Pneumatic Controller PCB. One of the two systems is defective.
02.09.002	si9_Err, Disconnection manoeuvre, post-oxygenisation too long, reset	Refer to error 02.09.001.
02.09.003	si9_Err, Disconnection manoeuvre, pre-oxygenisation too long, reset	Refer to error 02.09.001.

Fault	Item	Cause/Remedy
02.09.004	si9_Err, Disconnection manoeuvre, no button, reset	SW error on Graphics Controller PCB (Evita 4) / Front Panel PCB (Evita 2 dura) or CPU 68332 PCB or Pneumatic Controller PCB.
02.09.020	si9_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.09.021	si9_Err, Si status change, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.11.001	si11_Err, O2 cal. too long, reset	CPU 68332 PCB monitors timing of Pneumatic Controller PCB. One of the two systems is defective.
02.11.002	si11_Err, O2 calibration sequence incorrect, reset	CPU 68332 PCB monitors timing of Pneumatic Controller PCB. One of the two systems is defective.
02.11.020	si11_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.12.001	si12_Err, Paw high too long, reset	Inspiration pressure too high for more than 1 second and cannot be dissipated via emergency vent Y1.3. Inspiration pressure is measured on Pneumatic Controller PCB and CO2 Carrier PCB. Possible causes: – Measurement of inspiration pressure on Pneumatic Controller PCB (1st channel) or CO2 Carrier PCB (2nd channel) defective. Read out values by way of service mode. If error is on CO2 Carrier PCB, contact problems may be the cause. CO2 Carrier PCB must be secured in position with both screws. – Inspiration pressure sensor defective. – Pneumatic fault. – Too high a measured value from the expiratory pressure sensor (Note: If ground (GND) is missing, the Paw sensors will measure approx. 115 mbar.)

Fault	Item	Cause/Remedy
02.12.020	si12_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.13.020	si13_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.14.001	si14_Err, Breathing cycle, insp. timer, 12 consistency, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.14.002	si14_Err, Breathing cycle, exp. timer, 12 consistency, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.14.020	si14_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.15.001	si15_Err, Nebuliser des., Si copy, consistency, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.15.020	si15_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.16.001	si16_Err, Hardware boot, test data not reset, reset	RAM or SW error on CPU 68332 PCB.
02.16.002	si16_Err, Hardware datum, Si copy, inconsistent, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.16.020	si16_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.17.001	si17_Err, Reset alarm, Xxx incorrect, reset	RAM or SW error probably on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura), but may also be on CPU 68332 PCB or Pneumatic Controller PCB.
02.17.002	si17_Err, Incorrect tone recognition by loudspeaker monitoring, reset	RAM or SW error probably on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura), but may also be on CPU 68332 PCB or Pneumatic Controller PCB.
02.17.020	si17_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.17.021	si17_Err, Si Reset alarm, case incorrect	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB, but may also be on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
02.18.001	si18_Err, Silence incorrectly activated, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB or Graphics Controller PCB (Evita 4) / Front Panel PCB (Evita 2 dura).

Fault	Item	Cause/Remedy
02.18.002	si18_Err, Silence too long, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB or Graphics Controller PCB (Evita 4) / Front Panel PCB (Evita 2 dura).
02.18.003	si18_Err, Confirmation signal for standby incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB or Graphics Controller PCB (Evita 4) / Front Panel PCB (Evita 2 dura).
02.18.020	si18_Err, Si boot, case incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.19.001	si19_Err, Memory consistency, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.19.002	si19_Err, Auxiliary alarm mute, number 1 incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.19.003	si19_Err, Auxiliary alarm mute, number 2 incorrect, reset	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.21.000	sic_Err, Task recognises error	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.
02.22.000	sil_Err, Task recognises error	RAM or SW error on CPU 68332 PCB or Pneumatic Controller PCB.

The service codes 02.40.. to 02.62.. are recognised on the Pneumatic Controller PCB; they correspond to 02.00.. to 02.22.. as recognised on the CPU 68332 PCB.

Fault	Item	Cause/Remedy
02.71.001	No acoustic alarm	Actuation signal from CPU 68332 PCB to loudspeaker (approx. 50 ohms) is tapped via series resistor (5 ohms) on Graphics Controller / Front Panel PCB and supplied to the system as digital information. This signal is used for desired/actual comparison of the loudspeaker actuation. The loudspeaker is in the control console/front section. Possible cause of trouble: -Software error if error occurs between several aspiration modes without intervening ventilation. This error has been rectified on the Evita 4 as of SW 2.21 (Japan as of SW 1.09) and on the Evita 2 dura with versions greater than 3.00. -Cable fault between CPU 68332 PCB and loudspeaker in control console -Loudspeaker defect Trouble-shooting: -Measure resistance of loudspeaker via connecting cable of control console, incl. cable between pins 9 and 10 of SUB-D cable connector. Test value = 55 plus/minus 8 ohms. This value incl. shunt resistance must be 5 ohms higher than loudspeaker value, which can be measured after opening control console. -Using diagnosis mode with lowest volume setting, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.2.1, Diagnosis page “Microprocessor” of “Front”, page 57. - Using external DS mode via PC with lowest volume setting, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.4.7, Loudspeaker test, page 141. or Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.5.7, Testing of loudspeaker, page 151. instructions. Note: See also errors 02.71.012 and 02.71.013

02.71.002	Flow measurement on Pneumatic Controller PCB defective	Remedy: As of SW 1.05: Renew Pneumatic Controller PCB. Up to SW 1.04: Fault is set if ambient pressure is less than 961 mbar on switch-on, but is not displayed on screen. Only renew Pneumatic Controller PCB if error message is displayed on screen during operation.
02.71.003	Gold Cap capacitor, capacitance too low	In the event of power failure, Gold Cap on CO2 Carrier PCB supplies piezo alarm tone generator with voltage and thus signals mains failure. The duration of this mains failure alarm is governed by the capacitance of the Gold Cap. Both the function and the capacitance are therefore tested once an hour, starting 5 minutes after switch-on of the unit. A unit fault is signalled if one of the following criteria is met: a. Final charging voltage too high (greater than 11 V), voltage regulator defective b. Final charging voltage too low (less than 8 V), charging circuit defective c. Reference voltage too high (greater than 6.3 V), discharge circuit defective d. Reference voltage too low (less than 4.5 V), no Gold Cap e. Capacitance less than 30mF, Gold Cap capacitance too low Remedy: refer to section of "Repair Instructions - Electronic Components" Chapter 5.5, Conversions, page 39 CO2 Carrier PCB.
02.71.004	Gold Cap capacitor, voltage too high	see error 02.71.003
02.71.005	Gold Cap capacitor, voltage too low	see error 02.71.003
02.71.006	Gold Cap capacitor, tester defective	see error 02.71.003

02.71.007	Boot test defective	Cause of trouble: CPU 68332 PCB (more likely) or Pneumatic Controller PCB defective Note: Additionally displayed with other error messages
02.71.008	Piezo alarm generator, auxiliary alarm triggering defective	In addition to signalling mains failure, the piezo assumes the alarm function of the loudspeaker if CPU 68332 is defective (stopped). To ensure that this is the case, the piezo on the CO2 Carrier PCB is suppressed by the CPU 68332 PCB with a square-wave signal. If this cyclical clocking fails, the associated muting of the piezo is cancelled and a continuous beep sounds. Muting is deliberately cancelled to test the piezo. The current through the piezo, which then increases as a result of cancelling the muting, can be measured as voltage drop across a series resistor by the A/D converter on the CO2 Carrier PCB. Possible cause of trouble: a. CO2 Carrier PCB defective b. CPU 68332 PCB defective Trouble-shooting: - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.3.2, Diagnosis page “Microprocessor” of “Electronics”, page 63. - With external DS mode via PC, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.4.6, Horn test, page 140. instructions
02.71.009	Piezo alarm generator, current too high	refer to error 02.71.008
02.71.010	Piezo alarm generator, current too low	refer to error 02.71.008
02.71.011	Monitoring of nebuliser valve defective	The required nebuliser valve position is constantly compared to the checkback signal of the actuation electronics. Remedy: Renew Pneumatic Controller PCB Note: There is no recognition of whether or not valve is connected.

02.71.012	Loudspeaker too seldom recognised	The actuation signal from the CPU 68332 PCB to the loudspeaker (approx. 50 ohms) is tapped via a series resistor (5 ohms) on the Graphics Controller PCB and supplied to the system as digital information. This signal is used for desired/actual comparison of the loudspeaker actuation. A unit fault is signalled if an error is established in the course of this desired/actual comparison. The loudspeaker is located in the control console/front section. Possible cause: a. Cable fault between CO2 Carrier PCB and loudspeaker in control console b. Loudspeaker defective c. Graphics Controller PCB defective d. CPU 68332 PCB defective Trouble-shooting: - Measure resistance of loudspeaker via connecting cable of control console incl. cable between pins 9 and 10 of SUB-D cable connector. Test value = 55 plus/minus 8 ohms. This value incl. shunt resistance must be 5 ohms higher than loudspeaker value, which can be measured after opening control console. - Using diagnosis mode with lowest volume setting, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.2.1, Diagnosis page “Microprocessor” of “Front”, page 57. - Using external DS mode via PC with lowest volume setting, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.4.7, Loudspeaker test, page 141. or Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.5.7, Testing of loudspeaker, page 151. instructions. Note: Refer also to error 02.71.001
02.71.013	Loudspeaker recognised too frequently	refer to error 02.71.012

02.71.014	+ 15 V too low	The operating voltages accessible via an A/D converter on the CO2 Carrier PCB are cyclically compared to the defined tolerances. An undershoot of + 14 V produces a unit fault message. Possible cause: a. Power pack defective (source) b. CO2 Carrier PCB defective Check voltages from power pack, various possibilities: - Measure voltage with multimeter, refer to section of "Repair Instructions - Electronic Components" Chapter 1, Power Supply Unit, page 6 - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.2.1, Diagnosis page “Microprocessor” of “Front”, page 57. - With external service mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.4.1, Testing voltages, page 131. If OK = Renew CO2 Carrier PCB If not OK = Renew power pack
02.71.015	+10V reference voltage too low	This voltage is stepped down from the +15 V on the CO2 Carrier PCB, where it is also measured. An undershoot of + 9 V produces this unit fault message. Remedy: Renew CO2 Carrier PCB
02.71.016	AD conversion for O2 measurement defective	The pre-amplified O2 sensor voltage is read in on the Pneumatic Controller PCB by two independent AD converters. These values differ. Trouble-shooting: - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.4.2, Diagnosis page “Sensors” of “Pneumatics”, page 70. - With external service mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.3.4, Sensors, page 123. Remedy: Renew Pneumatic Controller PCB

02.71.017	O2/Air switching-valve actuation defective	The required O2/Air switching valve position is constantly compared to the checkback signal of the actuation electronics on the Pneumatic Controller PCB. Trouble-shooting: - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.4.1, Diagnosis page “Valves” of “Pneumatics”, page 67. - With external service mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.3.1, Valve switching, page 121. Remedy: Renew Pneumatic Controller PCB Note: There is no recognition of whether or not valve is connected
02.71.018	Incorrect nebuliser gas	During nebulisation, the required air/O2 switching valve position is thus constantly compared to the checkback signal of the actuation electronics. Trouble-shooting: - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.4.1, Diagnosis page “Valves” of “Pneumatics”, page 67. - With external service mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.3.1, Valve switching, page 121. Remedy: Renew Pneumatic Controller PCB

02.71.019	Cold/warm start recognition defective	Cold/warm start recognition is effected by way of mains-switch auxiliary contacts in power pack, which are read in via CO2 Carrier PCB. Trouble-shooting: - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.3.2, Diagnosis page “Microprocessor” of “Electronics”, page 63. - With external service mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.4.2, Power pack status, page 133. Possible cause of trouble: - Mains-switch auxiliary contacts in power pack defective - CO2 Carrier PCB defective
02.71.020	Hardware initialisation, interrupt masks defective	The data for initialising the interrupt masks have not been properly stored on the CPU 68332 PCB. Cause: Fault in one of the following printed circuit cards (RAM or SW error): a. CPU 68332 PCB b. Pneumatic Controller PCB c. Graphics Controller / Front Panel PCB
02.71.021	Quartz time discrepancy	Quartz times of CPU 68332 PCB and Pneumatic Contoller PCB are compared and an error message generated if the two differ Cause: Defect in one of the following printed circuit cards: a. CPU 68332 PCB b. Pneumatic Controller PCB

2.2 Error Code 03 Control-Console Components

Fault	Item	Cause/Remedy
03.01.001	Touchscreen is not recognised during BOOT	Following switch-on of Evita 4, touchscreen is not recognised by Graphics Controller PCB. The touchscreen communicates with the Graphics Controller PCB via RS232. Trouble-shooting: - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.2.1, Diagnosis page “Microprocessor” of “Front”, page 57. - With external service mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.5.5, Testing of touchscreen, page 148. Defect in one of the following printed circuit cards: a. Touchscreen b. Graphics Controller PCB
03.01.002	TOUCHSCREEN NO RESET - ACK	similar to error 03.01.001, but occurs during operation
03.01.003	OUCHSCREEN NO REPORT	similar to error 03.01.001, but occurs during operation

03.07.001	Reset line fault	Reason: Interruption in reset line between CPU 68332 PCB and Graphics Controller / Front Panel PCB. Possible cause: a. Control console / Front Panel PCB not connected b. Fault in cable to control console / Front Panel PCB c. CPU 68332 PCB defective d. Graphics Controller / Front Panel PCB defective e. Connector between printed circuit cards defective Trouble-shooting: 1. Check and if necessary renew front-section cable 2. Remove housing cover to reveal service LEDs on CPU 68332 PCB. If necessary, insert card in one of the upper slots (all identical). 3. Connect up control console ready for operation. 4. Switch on unit. 5. LED 6 must light briefly after switching on: If not = CPU 68332 PCB defective If yes = CPU 68332 PCB probably OK, renew Graphics Controller / Front Panel PCB

2.3 Error Code 04 Components of Electronics Unit

Fault	Item	Cause/Remedy
04.01.001	Power pack fault, 5V supply voltage greater than 6 V	The operating voltages accessible via an A/D converter on the CO2 Carrier PCB are cyclically compared to the defined tolerances of plus/minus 20 %. Possible cause: a. Power pack defective (source) b. CO2 Carrier PCB defective (monitoring) Trouble-shooting: Check voltages from power pack, various possibilities: - Measure voltage with multimeter, refer to section of "Repair Instructions - Electronic Components" Chapter 1, Power Supply Unit, page 6 instructions - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.3.2, Diagnosis page “Microprocessor” of “Electronics”, page 63. - With external service mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.4.1, Testing voltages, page 131. If OK = Renew CO2 Carrier PCB If not OK = Renew power pack Important: 001Power pack +5V too high (for digital components) 002Power pack +5 V too low 003Power pack +12V too high (for HPSVs, fan in power pack) 004Power pack +12V too low 005Power pack +15V too high (for analog components) 006Power pack +15V too low 007Power pack -15V too high (for analog components) 008Power pack -15V too low 009Power pack +24V too high (for valves and control console) 010Power pack +24V too low

04.01.002	Power pack fault, 5V supply voltage less than 4 V	refer to error 04.01.001
04.01.003	Power pack fault, 12V supply voltage greater than 14.4 V	refer to error 04.01.001
04.01.004	Power pack fault, 12V supply voltage less than 9.6 V	refer to error 04.01.001
04.01.005	Power pack fault, 15V supply voltage greater than 18 V	refer to error 04.01.001
04.01.006	Power pack fault, 15V supply voltage less than 12 V	refer to error 04.01.001
04.01.007	Power pack fault, -15V supply voltage greater than -18 V	refer to error 04.01.001
04.01.008	Power pack fault, -15V supply voltage less than -12 V	refer to error 04.01.001
04.01.009	Power pack fault, 24V supply voltage greater than 28.8 V	refer to error 04.01.001
04.01.010	Power pack fault, 24V supply voltage less than 19.2 V	refer to error 04.01.001

2.4 Error Code 05 Pneumatic System Components

Fault	Item	Cause/Remedy
05.01.001	Short circuit in fan in pneumatic system	Fan for cooling pneumatic-system printed circuit cards defective or not connected Recognition: a. Actuation current of fan is measured with an A/D converter via a shunt. In normal operation, this fan current must be subject to fluctuations greater than 50 mV. The minimum and maximum levels of this fan voltage are measured for 60 s each. If the max./min. difference is less than 50 mV, this indicates a fault. b. Measured value of fan voltage = 0 V (open circuit) c. Measured value of fan voltage greater than or equal to 2.9 V (short circuit) Trouble-shooting: - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.4.3, Diagnosis page “Microprocessor” of “Pneumatics”, page 74. - With external service mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.3.5, Voltages, page 127. - Fan connected? - Fan operation? No = Renew fan Yes = Renew Pneumatic Controller PCB
05.01.002	Fan in pneumatic system not connected	refer to error 05.01.001
05.01.003	No operation of fan in pneumatic system	refer to error 05.01.001

05.02.001	Reset-up line fault	Interruption in reset line between CPU 68332 PCB and Pneumatic Controller PCB. Possible cause: a. CPU 68332 PCB defective b. Pneumatic Controller PCB defective c. Connector between printed circuit cards defective Trouble-shooting: 1. Remove housing cover to reveal service LEDs on CPU 68332 PCB. If necessary, insert card in one of the upper slots (all identical). 2. Switch on unit. 3. Following LEDs must light briefly after switching on: LED 4 (together with 3) for reset-up LED 5 for reset-down If not = CPU 68332 PCB defective If yes = CPU 68332 PCB probably OK, renew Pneumatic Controller PCB
05.02.002	Reset-down line fault	refer to error 05.02.001
05.02.003	Interruption in disable line	Interruption in disable line between CPU 68332 PCB and Pneumatic Controller PCB. Possible cause: a. CPU 68332 PCB defective b. Pneumatic Controller PCB defective c. Connector between printed circuit cards defective Trouble-shooting: 1. Removing housing cover to reveal service LEDs on CPU 68332 PCB. If necessary, insert card in one of the upper slots (all identical). 2. Switch on unit. 3. LED 7 must flash/light after switching on until pneumatic system is activated (approx. 10 s): If not = CPU 68332 PCB defective If yes = CPU 68332 PCB probably OK, renew Pneumatic Controller PCB Note: Only possible with software versions 1.00 to 1.05, 2.00 and 2.10

05.04.001	O2/Air switching valve cannot be switched on	The required O2/Air switching valve position is constantly compared to the checkback signal of the actuation electronics If required position and checkback signal do not tally, a unit fault message is generated. Trouble-shooting: - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.4.1, Diagnosis page “Valves” of “Pneumatics”, page 67. - With external service mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.3.1, Valve switching, page 121. Remedy: Renew Pneumatic Controller PCB Note: There is no recognition of whether or not valve is connected.
05.04.002	O2/Air switching valve not switched off	refer to error 05.04.001
05.04.003	O2/Air switching valve not switched over	refer to error 05.04.001
05.04.004	Incorrect O2/Air switching valve position	refer to error 05.04.001
05.04.005	O2/Air switching valve does not switch to Air	In unit check, a test pressure of 30 mbar is only built up in tubing system with one connected pressure supply (O2 or Air) in each case. The O2/Air switching valve Y1.1 then effects switching to the other compressed gas. This causes the tubing system to be vented to below 10 mbar. Trouble-shooting: - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.4.1, Diagnosis page “Valves” of “Pneumatics”, page 67. - With external service mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.3.1, Valve switching, page 121. Remedy: Renew valve Y1.1 in gas connection.

05.04.006	O2/Air switching valve does not switch to O2	refer to error 05.04.005
05.05.001	Safety valve cannot be switched on	Up to SW 1.04 only Cause: Safety valve or actuation on Pneumatic Controller PCB defective
05.05.002	Safety valve cannot be switched off	Up to SW 1.04 only Cause: Safety valve or actuation on Pneumatic Controller PCB defective
05.05.003	Safety valve cannot be switched	Up to SW 1.04 only Cause: Safety valve or actuation on Pneumatic Controller PCB defective
05.05.004	Incorrect safety valve position	Up to SW 1.04 only Cause: Safety valve or actuation on Pneumatic Controller PCB defective
05.05.005	Pressure venting via safety valve Y1.3 defective	Test pressure of 30 mbar is built up in patient system during unit check. This is followed by venting via safety valve Y1.3 to below 10 mbar. Trouble-shooting: - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.4.1, Diagnosis page “Valves” of “Pneumatics”, page 67. - With external service mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.3.1, Valve switching, page 121. Remedy: Renew valve Y1.3 in gas connection.
05.05.006	Test pressure of 30 mbar cannot be built up during unit check	Pressure of 30 mbar should be built up in tubing system during unit check with test lung connected. Cause: - Leak in tubing system - Test lung not connected Note: As of SW 1.04, this fault is only indicated by an “ F “ in the unit check.

2.5 Error Code 07 ROSY (operating-system software errors)

The following applies to all Rosy errors: Operating-system software errors. The operating system runs on the CPU 68332 PCB, the Pneumatic Controller PCB, the Graphics Controller PCB (Evita 4)/Front Panel PCB (Evita 2 dura) and the Communication PCB. Please report any problems to Lübeck.

2.6 Error Code 08 Exceptions (SW)

The following applies to all Exception errors: Software problem on CPU 68332 PCB, Pneumatic Controller PCB, Graphics Controller PCB (Evita 4) / Front Panel PCB (Evita 2 dura) or Communication PCB. Please report any problems to Lübeck.

2.7 Error Code 10 Pneumatic Controller

Fault	Item	Cause/Remedy
10.01.020	Pneumatic Controller PCB defective (Timeout)	Remedy: Renew Pneumatic Controller PCB
10.01.040	Pneumatic Controller PCB defective (Timeout)	Remedy: Renew Pneumatic Controller PCB
10.02.001	Pneumatic Controller PCB defective (RAM error)	Remedy: Renew Pneumatic Controller PCB
10.03.001	Pneumatic Controller PCB defective (Flash EPROM error)	Remedy: Renew Pneumatic Controller PCB
10.97.xxx	ROSY SHUTDOWN	refer to: Rosy error codes (07..)

SW:

Fault	Item	Cause/Remedy
10.99.000	PNT UNEXPECTED END OF_TASK	Software error on Pneumatic Controller PCB.
10.99.020	LM UNEXPECTED END OF TASK	Software error on Pneumatic Controller PCB.
10.99.030	DSPT UNEXPECTED END OF TASK	Software error on Pneumatic Controller PCB.
10.99.040	VS INVALID MSG RECEIVED	Software error on Pneumatic Controller PCB.
10.99.050	UE INVALID MSG RECEIVED	Software error on Pneumatic Controller PCB.
10.99.060	BEAT ILLEGAL MSG	Software error on Pneumatic Controller PCB.
10.99.061	BEAT ILL MSGSIZE	Software error on Pneumatic Controller PCB.
10.99.062	BEAT ILL BREATH STATE	Software error on Pneumatic Controller PCB.
10.99.063	BEAT ILL VENTILATION MODE	Software error on Pneumatic Controller PCB.
10.99.064	BEAT ACTIVATE ILL BMODE	Software error on Pneumatic Controller PCB.
10.99.065	BEAT ILL DEACTIVATION	Software error on Pneumatic Controller PCB.
10.99.070	bau: BAU Task should never reach this point	Software error on Pneumatic Controller PCB.
10.99.071	BAU ILLEGAL SETTING, incorrect Ti Te, calculation in parameter adjustment, apnoea ventilation	Software error on Pneumatic Controller PCB.
10.99.080	eba: EBA Task should never reach this point	Software error on Pneumatic Controller PCB.
10.99.081	EBA ILL MSG ID	Software error on Pneumatic Controller PCB.
10.99.082	EBA LONG MSG	Software error on Pneumatic Controller PCB.
10.99.083	EBKB TERMINATE OPERATION	Software error on Pneumatic Controller PCB.

10.99.084	EBKB O2 ILL STATE	Software error on Pneumatic Controller PCB.
10.99.085	EBKB PAED ILL STATE	Software error on Pneumatic Controller PCB.
10.99.086	EBKB ILL BRONCHSTATE	Software error on Pneumatic Controller PCB.
10.99.087	EBKB ILL FLOWSTATE1	Software error on Pneumatic Controller PCB.
10.99.088	EBKB ILL FLOWSTATE2	Software error on Pneumatic Controller PCB.
10.99.101	BB INVALID MSG RECEIVED	Software error on Pneumatic Controller PCB.
10.99.110	MSF INVALID MSG RECEIVED	Software error on Pneumatic Controller PCB.
10.99.111	MSF, AD VALUES shifted	Incorrect AD conversion on Pneumatic Controller PCB. Cause: Pneumatic Controller PCB defective or supply voltages not stable. Further cause: In the case of abnormal mixer noise on switch-on, an HPSV is impermissibly loading the minus 15 V.
10.99.112	MSF, AD VALUES on ZERO	Refer to error 10.99.111.
10.99.801	EEPROM WRITE QUEUE FULL	Software error on Pneumatic Controller PCB.
10.99.901	DL UNEXPECTED END OF TASK	Software error on Pneumatic Controller PCB.
10.99.911	1ST CD LENGTH CORRUPT, false central data length for first object in frame arrived	Software error on Pneumatic Controller PCB.
10.99.912	1ST LONG MSG CORRUPT, start frame data of multi packet receive message RPC corrupt	Software error on Pneumatic Controller PCB.
10.99.913	CAN ERROR INT, CAN controller marked ill interrupt by sending error frames	CAN Controller error on CPU 68332 PCB or Pneumatic Controller PCB or Graphics Controller PCB (Evita 4)/Front Panel PCB (Evita 2 dura). Most likely cause: Pneumatic Controller PCB.
10.99.914	NET QUEUE OVERFLOW, data overflow in applications receive queue	Software error on Pneumatic Controller PCB.

10.99.915	CIX TOO BIG, found cix out of range (greater than NO OF CIX)	Software error on Pneumatic Controller PCB.
10.99.916	INVALID SW LEVEL, sw identification infos transferred with login does not match	Wrong software version on Pneumatic Controller PCB. All printed circuit cards with download capability must feature the same version.
10.99.917	NO PREDECESSOR, no preceding neighbour found	Software error on Pneumatic Controller PCB.
10.99.918	NO SUCCESSOR	Software error on Pneumatic Controller PCB.
10.99.919	NTH LONG MSG CORRUPT, any frame data of multi packet receive message RPC corrupt	Software error on Pneumatic Controller PCB.
10.99.920	OS MESSAGE TYPE ERROR, unknown message type in operating system's mailbox	Software error on Pneumatic Controller PCB.
10.99.921	SD INC TOO BIG, wrong slow data increment specified in NCU	Software error on Pneumatic Controller PCB.
10.99.922	TASK LOCATION ERROR, found cobid 0 for a local task in ncu.h's task table	Software error on Pneumatic Controller PCB.
10.99.923	CORRUPT MDT REQUEST, unknown message format received by mdt task	Software error on Pneumatic Controller PCB.
10.99.924	SEND MIX TOO BIG, mass data index out of range in request message	Software error on Pneumatic Controller PCB.
10.99.925	RECEIVE MIX TOO BIG, mass data index out of range in network frame	Software error on Pneumatic Controller PCB.
10.99.926	CAN BUSSTATUS	CAN Controller hardware error on CPU 68332 PCB or Pneumatic Controller PCB or Graphics Controller PCB (Evita 4)/Front Panel PCB (Evita 2 dura). Most likely cause: Pneumatic Controller PCB.
10.99.927	CAN BUSSTATUS2	Refer to error 10.99.926.
10.99.928	CAN ERROR INT2	Refer to error 10.99.926.
10.99.929	CAN OVERRUN	Refer to error 10.99.926.
10.99.930	CAN OVERRUN2	Refer to error 10.99.926.

10.99.940	SEND Q FULL	Software error on Pneumatic Controller PCB.
10.99.941	ZDA EXCLUSIVE STACK OVERFLOW	Software error on Pneumatic Controller PCB.
10.99.942	ZDA EXCLUSIVE STACK UNDERFLOW	Software error on Pneumatic Controller PCB.
10.99.950	MBX NO OWN MAILBOX	Software error on Pneumatic Controller PCB.
10.99.951	MBX NO TARGET MAILBOX	Software error on Pneumatic Controller PCB.
10.99.952	MBX TARGET MAILBOX OVERFLOW	Software error on Pneumatic Controller PCB.
10.99.953	MBX TARGET SIGNAL OVERFLOW	Software error on Pneumatic Controller PCB.
10.99.960	GU UNEXPECTED END OF TASK	Software error on Pneumatic Controller PCB.
10.99.970	BAQU ILLEGAL BA1, paramerror in baqu_ZusatzVonBA	Software error on Pneumatic Controller PCB.
10.99.971	BAQU ILLEGAL BA2, paramerror in baqu_GrundVonBA	Software error on Pneumatic Controller PCB.
10.99.972	BAQU ILLEGAL BA3, paramerror in baqu_getBackupFor Betriebsart	Software error on Pneumatic Controller PCB.
10.99.973	BAQU ILLEGAL BA4, paramerror in baqu_Betriebsart	Software error on Pneumatic Controller PCB.

2.8 Error code 11 HPSV Air

Fault	Item	Cause/Remedy
11.01.001	HPSV Air, Status 1, ROM error	This error message occurs on the Evita 4 as of SW 2.21 (Japan as of SW 1.09) and on the Evita 2 dura with versions greater than 3.00. "Mixer fault" only is displayed with older SW versions and no unit error message is stored. HPSV Air or HPSV Controller PCB for Air (lower pneumatic-system slot) defective. To locate fault, interchange the two HPSV Controller PCBs. If the error then occurs in the HPSV O2, the problem is to be found on the HPSV PCB now located in the centre slot. If the error remains with the HPSV Air, then the HPSV Air cartridge is defective.
11.01.003	HPSV Air, Status 3, zero offset error	refer to error 11.01.001
11.01.004	HPSV Air, Status 4, seriall 0 error	refer to error 11.01.001
11.01.005	HPSV Air, Status 5, latch up error	refer to error 11.01.001
11.01.006	HPSV Air, Status 6, IIC error	refer to error 11.01.001
11.01.007	HPSV Air, Status 7, Boot error	refer to error 11.01.001
11.01.008	HPSV Air, Status 8, Boot latch up error	refer to error 11.01.001
11.01.009	HPSV Air, Status 9, flow set error	refer to error 11.01.001
11.01.010	HPSV Air, Status 10, internal ADC error	refer to error 11.01.001
11.01.011	HPSV Air, Status 11, pressure ADC error	refer to error 11.01.001
11.01.012	HPSV Air, Status 12, latch up travel error	refer to error 11.01.001
11.01.013	HPSV Air, Status 13, valve typ error	refer to error 11.01.001
11.01.014	HPSV Air, Status 14, RAM error	refer to error 11.01.001
11.01.015	HPSV Air, Status 15, stack error	refer to error 11.01.001

2.9 Error code 12 HPSV O2

Fault	Item	Cause/Remedy
12.01.001	HPSV O2, Status 1, ROM error	This error message occurs on the Evita 4 as of SW 2.21 (Japan as of SW 1.09) and on the Evita 2 dura with versions greater than 3.00. "Mixer fault" only is displayed with older SW versions and no unit error message is stored. HPSV O2 or HPSV Controller PCB for O2 (centre pneumatic-system slot) defective. To locate fault, interchange the two HPSV Controller PCBs. If the error then occurs in the HPSV Air, the problem is to be found on the HPSV PCB now located in the lower slot. If the error remains with the HPSV O2, then the HPSV O2 cartridge is defective.
12.01.003	HPSV O2, Status 3, zero offset error	refer to error 12.01.001
12.01.004	HPSV O2, Status 4, seriall 0 error	refer to error 12.01.001
12.01.005	HPSV O2, Status 5, latch up error	refer to error 12.01.001
12.01.006	HPSV O2, Status 6, IIC error	refer to error 12.01.001
12.01.007	HPSV O2, Status 7, Boot error	refer to error 12.01.001
12.01.008	HPSV O2, Status 8, Boot latch up error	refer to error 12.01.001
12.01.009	HPSV O2, Status 9, flow set error	refer to error 12.01.001
12.01.010	HPSV O2, Status 10, internal ADC error	refer to error 12.01.001
12.01.011	HPSV O2, Status 11, pressure ADC error	refer to error 12.01.001
12.01.012	HPSV O2, Status 12, latch up travel error	refer to error 12.01.001
12.01.013	HPSV O2, Status 13, valve typ error	refer to error 12.01.001
12.01.014	HPSV O2, Status 14, RAM error	refer to error 12.01.001
12.01.015	HPSV O2, Status 15, stack error	refer to error 12.01.001

2.10 Error Code 13 CPU 68332 PCB

Fault	Item	Cause/Remedy
13.01.020	CPU 68332 PCB defective (Timeout)	Remedy: Renew CPU 68332 PCB
13.01.040	CPU 68332 PCB defective (Timeout)	Remedy: Renew CPU 68332 PCB
13.02.001	CPU 68332 PCB defective (RAM error)	Remedy: Renew CPU 68332 PCB
13.03.001	CPU 68332 PCB defective (Flash EPROM error)	Remedy: Renew CPU 68332 PCB
13.04.001	Serial EEPROM D22 defective	The main processor of the Evita 4/2 dura features an electrically erasable permanent memory (EEPROM), in which all Evita configuration data are stored. The Evita retains the user settings even after a complete loss of all stored data in the battery-buffered RAM. In addition to a component defect, a write reset can cause destruction of the data in the EEPROM. Remedy: Renew CPU 68332 PCB Important: Every new CPU 68332 PCB has a new EEPROM D22 with a new identity number. Normally the old D22 can be re-used. If this is not possible: If hardware options are availabe, these are to be enabled (Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 1, Service and Access Codes/Release Option, page 1.). If SW options were previously available, new 10-digit enable numbers will be required. These are to be requested in writing from Lübeck, stating serial number and item number on rating plate, old ID number (if known) and new ID number.
13.09.001	Watchdog on CPU 68332 PCB defective	The watchdog function is checked once on cold starting. For this purpose the watchdog is not triggered in the test sequence and a reset is awaited for the maximum period. Remedy: Renew CPU 68332 PCB

13.11.001	+ 5 V monitoring upper limit (5.5 V) defective	The 5V monitoring unit of the CPU 68332 PCB is checked as to its undervoltage and overvoltage function immediately after switching on the unit (cold start). An inadequate or excessive supply voltage is simulated using test leads of the 5V monitoring unit. The incorrect voltage must trigger a hardware reset. A unit fault is signalled if there is no reset triggering. Remedy: Renew CPU 68332 PCB
13.11.002	Monitoring lower limit (4.5 V) defective	refer to error 13.11.001
13.97.xxx	ROSY SHUTDOWN	refer to: Rosy error codes (07..)
13.98.001	BOOT error	The CPU 68332 PCB recognises a BOOT error on unit start. Cause: One of the following printed circuit cards at the CAN bus: a. CPU 68332 PCB defective b. Pneumatic Controller PCB c: Graphics Controller / Front Panel PCB This error may also occur if communication is interrupted in external PC service mode; there is then no unit fault. Trouble-shooting: If a sporadic fault is not involved: 1. Start download of operating software on CPU 68332 PCB only, but abort after 5 s. If successful, CPU 68332 PCB is probably functioning. 2. Start download of operating software on Pneumatic Controller PCB only, but abort after 5 s. If successful, Pneumatic Controller PCB is probably functioning. 3. Start download of operating software on Graphics Controller / Front Panel PCB only, but abort after 5 s. If successful, Graphics Controller / Front Panel PCB is probably functioning. In the event of sporadic faults, localise by replacing printed circuit cards.
13.98.002	BOOT error	refer to error 13.98.001

13.98.003	Unstable BOOT behaviour of Communication PCB	CPU 68332 PCB recognises unstable BOOT behaviour of Communication PCB (option). Cause: One of the following printed circuit cards at the CAN bus: a. CPU 68332 PCB defective b. Communication PCB Note: The Evita also functions without Communication PCB

Fault	Item	Cause/Remedy
13.99.010	CPT UNEXPECTED END OF TASK	Software error on CPU 68332 PCB.
13.99.020	DSMT UNEXPECTED END OF TASK	Software error on CPU 68332 PCB.
13.99.030	EEPROM READ ERROR, Read error on restoration from EEPROM D22	Software or hardware error on CPU 68332 PCB.
13.99.039	MAGIC CORRUPT, Magic in EEPROM incorrect, e.g. with new EEPROM	Remedy: Set/alter time, wait 15 seconds and switch unit off and on again. Otherwise error on CPU 68332 PCB. Refer also to error 13.04.001.
13.99.040	OPERATING HOUR BACKUP ERROR	CPU 68332 PCB defective (serial EEPROM D22). Refer also to error 13.04.001.
13.99.050	SPOS ILL MSG ID	Software error on CPU 68332 PCB.
13.99.052	SPOS ABORT TASK	Software error on CPU 68332 PCB.
13.99.060	SPOC ILL MSG ID	Software error on CPU 68332 PCB.
13.99.061	SPOC LONG MSG	Software error on CPU 68332 PCB.
13.99.062	SPOC ABORT TASK	Software error on CPU 68332 PCB.
13.99.070	CO2 ABORT TASK	Software error on CPU 68332 PCB.
13.99.080	MKT INVALID TREND REQUESTED	Software error on CPU 68332 PCB.
13.99.081	MKT INVALID TREND TIMEREF	Software error on CPU 68332 PCB.
13.99.090	lmc: LMC Task should never reach this point	Software error on CPU 68332 PCB.
13.99.100	pdf: PDF Task should never reach this point	Software error on CPU 68332 PCB.
13.99.110	avls: AVLS Task should never reach this point	Software error on CPU 68332 PCB.
13.99.120	lgb: LGB Task should never reach this point	Software error on CPU 68332 PCB.
13.99.130	Watchdog has triggered reset, safety task halted	Hardware or software error on CPU 68332 PCB. There might also be a fault on the Pneumatic Controller PCB.
13.99.140	pfl Read Msg Case incorrect	Software error on CPU 68332 PCB.
13.99.801	EEPROM WRITE QUEUE FULL	Software error on CPU 68332 PCB.

13.99.810	APPLIK1 ABORT TASK	Software error on CPU 68332 PCB.
13.99.811	APPLIK2 ABORT TASK	Software error on CPU 68332 PCB.
13.99.812	APPLIK3 ABORT TASK	Software error on CPU 68332 PCB.
13.99.813	APPLIK STAT SIZE	Software error on CPU 68332 PCB.
13.99.820	CONT ABORT TASK	Software error on CPU 68332 PCB.
13.99.830	LUST ABORT TASK	Software error on CPU 68332 PCB.
13.99.840	PRINT ABORT TASK	Software error on CPU 68332 PCB.
13.99.850	NZDA ABORT TASK	Software error on CPU 68332 PCB.
13.99.901	IDL UNEXPECTED END OF_TASK	Software error on CPU 68332 PCB.
13.99.911	1ST CD LENGTH CORRUPT, false central data length for first object in frame arrived	Software error on CPU 68332 PCB.
13.99.912	1ST LONG MSG CORRUPT, start frame data of multi packet receive message RPC corrupt	Software error on CPU 68332 PCB.
13.99.913	CAN ERROR INT, CAN controller marked ill interrupt by sending error frames	CAN Controller error on CPU 68332 PCB or Pneumatic Controller PCB or Graphics Controller PCB (Evita 4)/Front Panel PCB (Evita 2 dura). Most likely cause: CPU 68332 PCB.
13.99.914	NET QUEUE OVERFLOW, data overflow in applications receive queue	Software error on CPU 68332 PCB.
13.99.915	CIX TOO BIG, found cix out of range (greater than NO OF CIX)	Software error on CPU 68332 PCB.
13.99.916	INVALID SW LEVEL, sw identification infos transferred with login does not match	Wrong software version on CPU 68332 PCB. All printed circuit cards with download capability must feature the same version.
13.99.917	NO PREDECESSOR, no preceding neighbour found	Software error on CPU 68332 PCB.
13.99.918	NO SUCCESSOR	Software error on CPU 68332 PCB.
13.99.919	NTH LONG MSG CORRUPT, any frame data of multi packet receive message RPC corrupt	Software error on CPU 68332 PCB.
13.99.920	OS MESSAGE TYPE ERROR, unknown message type in operating system's mailbox	Software error on CPU 68332 PCB.

13.99.921	SD INC TOO BIG, wrong slow data increment specified in NCU	Software error on CPU 68332 PCB.
13.99.922	TASK LOCATION ERROR, found cobid 0 for a local task in ncu.h's task table	Software error on CPU 68332 PCB.
13.99.923	CORRUPT MDT REQUEST, unknown message format received by mdt task	Software error on CPU 68332 PCB.
13.99.924	SEND MIX TOO BIG, mass data index out of range in request message	Software error on CPU 68332 PCB.
13.99.925	RECEIVE MIX TOO BIG, mass data index out of range in network frame	Software error on CPU 68332 PCB.
13.99.926	CAN BUSSTATUS	CAN Controller hardware error on CPU 68332 PCB or Pneumatic Controller PCB or Graphics Controller PCB (Evita 4)/Front Panel PCB (Evita 2 dura). Most likely cause: CPU 68332 PCB.
13.99.927	CAN BUSSTATUS2	Refer to error 13.99.926.
13.99.928	CAN ERROR INT2	Refer to error 13.99.926.
13.99.929	CAN OVERRUN	Refer to error 13.99.926.
13.99.930	CAN OVERRUN2	Refer to error 13.99.926.
13.99.940	SEND Q FULL	Software error on CPU 68332 PCB.
13.99.941	ZDA EXCLUSIVE STACK OVERFLOW	Software error on CPU 68332 PCB.
13.99.942	ZDA EXCLUSIVE STACK UNDERFLOW	Software error on CPU 68332 PCB.
13.99.950	MBX NO OWN MAILBOX	Software error on CPU 68332 PCB.
13.99.951	MBX NO TARGET MAILBOX	Software error on CPU 68332 PCB.
13.99.952	MBX TARGET MAILBOX OVERFLOW	Software error on CPU 68332 PCB.
13.99.953	MBX TARGET SIGNAL OVERFLOW	Software error on CPU 68332 PCB.
13.99.960	GU UNEXPECTED END OF TASK	Software error on CPU 68332 PCB.
13.99.970	BAQU ILLEGAL BA1, paramerror in baqu_ZusatzVonBA	Software error on CPU 68332 PCB.

13.99.971	BAQU ILLEGAL BA2, paramerror in baqu_GrundVonBA	Software error on CPU 68332 PCB.
13.99.972	BAQU ILLEGAL BA3, paramerror in baqu_getBackupFor Betriebsart	Software error on CPU 68332 PCB.
13.99.973	BAQU ILLEGAL BA4, paramerror in baqu_Betriebsart	Software error on CPU 68332 PCB.

2.11 Error Code 14 CO2 CARRIER PCB

Fault	Item	Cause/Remedy
14.10.001	Reference voltage + 10 V too low	This voltage is stepped down from the +15V on the CO2 Carrier PCB, where it is also measured. The permissible deviation is plus/minus 1 % (up to SW 1.04) or plus/minus 4 % (as of SW 1.05). Trouble-shooting: - With diagnosis mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 3.3.2, Diagnosis page “Microprocessor” of “Electronics”, page 63. - With external service mode, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.4.1, Testing voltages, page 131. Possible remedy: - Renew CO2 Carrier PCB - Load latest SW version if existing version is 1.04 or lower. Pay attention to authorisation in USA.
14.10.002	Reference voltage plus 10 V too high	refer to error 14.10.001
14.13.001	Ambient-pressure sensor defective	This sensor is located on the CO2 Carrier PCB, where it is also evaluated. The measured value is outside the measured range from 600 to 1100 mbar. Remedy: Renew CO2 Carrier PCB.
14.14.001	Problem with communication between CO2 module and Evita	Fault in RS232 communication from CPU 68332 PCB (DUART) via CO2 Carrier PCB (electrical isolation via optocoupler) to CO2 module (signal processor PCB). This message is only set in the error list. Trouble-shooting: With external DS mode via PC, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 9.4.4, CO2 measurement data, page 136. Important: Heed IDM nos. 3 and 11

2.12 Error Code 15 COMMUNICATION PCB

Fault	Item	Cause/Remedy
15.01.020	Communication PCB defective (Timeout)	Remedy: Renew Communication PCB
15.01.040	Communication PCB defective (Timeout)	Remedy: Renew Communication PCB
15.02.001	Communication PCB defective (RAM error)	Remedy: Renew Communication PCB
15.03.001	Communication PCB defective (Flash EPROM error)	Remedy: Renew Communication PCB
15.97.xxx	ROSY SHUTDOWN	refer to: Rosy error codes (07..)

SW:

Fault	Item	Cause/Remedy
15.99.001	COMM ABORT TASK	Software error on Communication PCB.
15.99.010	DSCT UNEXPECTED END OF TASK	Software error on Communication PCB.
15.99.810	APPLIK1 ABORT TASK	Software error on Communication PCB.
15.99.811	APPLIK2 ABORT TASK	Software error on Communication PCB.
15.99.812	APPLIK3 ABORT TASK	Software error on Communication PCB.
15.99.813	APPLIK STAT SIZE	Software error on Communication PCB.
15.99.820	CONT ABORT TASK	Software error on Communication PCB.
15.99.830	LUST ABORT TASK	Software error on Communication PCB.
15.99.840	PRINT ABORT TASK	Software error on Communication PCB.
15.99.850	NZDA ABORT TASK	Software error on Communication PCB.
15.99.901	IDL UNEXPECTED END OF TASK	Software error on Communication PCB.
15.99.911	1ST CD LENGTH CORRUPT, false central data length for first object in frame arrived	Software error on Communication PCB.
15.99.912	1ST LONG MSG CORRUPT, start frame data of multi packet receive message RPC corrupt	Software error on Communication PCB.
15.99.913	CAN ERROR INT, CAN controller marked ill interrupt by sending error frames	Error: CAN Controller on Communication PCB defective, but possibly also CPU 68332 PCB or Pneumatic Controller PCB or Graphics Controller PCB (Evita 4)/Front Panel PCB (Evita 2 dura). Important: If unit functions properly without Communication PCB, then Communication PCB is defective.

15.99.914	NET QUEUE OVERFLOW, data overflow in applications receive queue	Software error on Communication PCB.
15.99.915	CIX TOO BIG, found cix out of range (greater than NO OF CIX)	Software error on Communication PCB.
15.99.916	Wrong software version on Communication PCB	Remedy: Load software version of basic unit on Communication PCB; often forgotten when installing this PCB.
15.99.917	NO PREDECESSOR, no preceding neighbour found	Software error on Communication PCB.
15.99.918	NO SUCCESSOR	Software error on Communication PCB.
15.99.919	NTH LONG MSG CORRUPT, any frame data of multi packet receive message RPC corrupt	Software error on Communication PCB.
15.99.920	OS MESSAGE TYPE ERROR, unknown message type in operating system's mailbox	Software error on Communication PCB.
15.99.921	SD INC TOO BIG, wrong slow data increment specified in NCU	Software error on Communication PCB.
15.99.922	TASK LOCATION ERROR, found cobid 0 for a local task in ncu.h's task table	Software error on Communication PCB.
15.99.923	CORRUPT MDT REQUEST, unknown message format received by mdt task	Software error on Communication PCB.
15.99.924	SEND MIX TOO BIG, mass data index out of range in request message	Software error on Communication PCB.
15.99.925	RECEIVE MIX TOO BIG, mass data index out of range in network frame	Software error on Communication PCB.
15.99.926	CAN BUSSTATUS	CAN Controller hardware error on Communication PCB, however also possible on CPU 68332 PCB or Pneumatic Controller PCB or Graphics Controller PCB (Evita 4)/Front Panel PCB (Evita 2 dura). Important: If unit functions properly without Communication PCB, then Communication PCB is defective.
15.99.927	CAN BUSSTATUS2	Refer to error 15.99.926.

15.99.928	CAN ERROR INT2	Refer to error 15.99.926.
15.99.929	CAN OVERRUN	Refer to error 15.99.926.
15.99.930	CAN OVERRUN2	Refer to error 15.99.926.
15.99.940	SEND Q FULL	Software error on Communication PCB.
15.99.941	ZDA EXCLUSIVE STACK OVERFLOW	Software error on Communication PCB.
15.99.942	ZDA EXCLUSIVE STACK UNDERFLOW	Software error on Communication PCB.
15.99.950	MBX NO OWN MAILBOX	Software error on Communication PCB.
15.99.951	MBX NO TARGET MAILBOX	Software error on Communication PCB.
15.99.952	MBX TARGET MAILBOX OVERFLOW	Software error on Communication PCB.
15.99.953	MBX TARGET SIGNAL OVERFLOW	Software error on Communication PCB.
15.99.960	GU UNEXPECTED END OF TASK	Software error on Communication PCB.
15.99.970	BAQU ILLEGAL BA1, paramerror in baqu Zusatz von BA	Software error on Communication PCB.
15.99.971	BAQU ILLEGAL BA2, paramerror in baqu Grund von BA	Software error on Communication PCB.
15.99.972	BAQU ILLEGAL BA3, paramerror in baqu get Backup for Betriebsart	Software error on Communication PCB.
15.99.973	BAQU ILLEGAL BA4, paramerror in baqu Betriebsart	Software error on Communication PCB.

2.13 Error Code 17 Graphics Controller PCB/FRONT PANEL PCB

Graphics Controller PCB (Evita 4)/FRONT PANEL PCB (Evita 2 dura)

Fault	Item	Cause/Remedy
17.01.020	Graphics Controller / Front Panel PCB defective (Timeout)	Remedy: Renew Graphics Controller / Front Panel PCB
17.01.040	Graphics Controller / Front Panel PCB defective (Timeout)	Remedy: Renew Graphics Controller / Front Panel PCB
17.02.001	Graphics Controller / Front Panel PCB defective (RAM error)	Remedy: Renew Graphics Controller / Front Panel PCB
17.03.001	Graphics Controller / Front Panel PCB defective (Flash EPROM error)	Remedy: Renew Graphics Controller / Front Panel PCB
17.15.001	Front Panel PCB Evita 2 dura defective	No signal from ROM Remedy: Renew Front Panel PCB
17.16.001	Front panel PCB Evita 2 dura defective	Error in RAM of 68020 Remedy: Renew Front Panel PCB
17.17.001	Front Panel PCB Evita 2 dura defective	ROM checksum of 68020 incorrect Remedy: Renew Front Panel PCB
17.97.xxx	ROSY SHUTDOWN	refer to: Rosy error codes (07..)

SW:

Fault	Item	Cause/Remedy
17.99.001	br Illegal Msg ID received by Benu RTC	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.002	br: BR Task should never reach this point	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.003	br Invalid Key Type Received	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.004	br Invalid Softkey Received	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.005	brrf Invalid Display Pos For Param Menu	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).

17.99.006	brf Invalid Curve Position Requested	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.007	brrf Invalid Curve Id Requested	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.008	brrf Invalid Curve Param Requested	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.009	brrf Invalid Curve Request	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.010	brrf No Vacant Graph Id	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.020	bm Illegal Msg ID Received By Benu Meld	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.021	bm: BM Task should never reach this point	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.022	bmal Illegal Alarm Activation Index	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.023	bmal Illegal Alarm Deactivation Index	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.024	bmbm Illegal Mode Text Index	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.025	bmbm Illegal B Mode Text Index	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.026	bmin Illegal InfoText Index	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.027	bmin Illegal Info Typ Index	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.030	bu Illegal Msg ID Received By Benu Menu	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).

17.99.031	bu: BU Task should never reach this point	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.040	bn Illegal Msg ID Received By Benu N Disp	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.041	bn: BN Task should never reach this point	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.050	di Illegal MsgI D Received By Disp Video	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.051	di: DI Task should never reach this point	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.052	di Curve Stack Overflow	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.053	di Invalid Text Object	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.054	di Invalid Request Id	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.055	di Slow Queue Spec Overflow	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.056	di Slow Queue Adm Overflow	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.057	di Max Retry	Graphics processor on Graphics Controller PCB defective
17.99.058	di Max Busy	Graphics processor on Graphics Controller PCB defective
17.99.059	d invalid Ti State	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.060	di Invalid Object Id	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.070	av: AV Task should never reach this point	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).

17.99.080	bt: BT Task should never reach this point	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.090	bi: BI Task should never reach this point	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.101	tre No Vacant Graph Id	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.102	tre No Such Bu Command	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.103	TRE INVALID TREND REQUESTED	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.110	DSFT UNEXPECTED END OF TASK	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.120	dit: DIT Task should never reach this point	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.130	lg: LG Task should never reach this point	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.140	sibf Task recognises Error	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.141	sibf Read Msg Case Incorrect	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.142	sibf Si Boot Case incorrect	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.143	sibf Pix Sum Index too high	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.144	sibf Pix Sum Processing Status Case Incorrect	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.145	sibf Alignment Case incorrect	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).

17.99.150	sidi Font Case incorrect	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.151	sidi Scale Case incorrect	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.152	sidi Fifo full	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.901	DL UNEXPECTED END OF TASK	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.911	1ST CD LENGTH CORRUPT, false central data length for first object in frame arrived	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.912	1ST LONG MSG CORRUPT, start frame data of multi packet receive message RPC corrupt	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.913	CAN ERROR INT, CAN controller marked ill interrupt by sending error frames	CAN Controller error on CPU 68332 PCB or Pneumatic Controller PCB or Graphics Controller PCB (Evita 4)/Front Panel PCB (Evita 2 dura). Most likely cause: Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.914	NET QUEUE OVERFLOW, data overflow in applications receive queue	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.915	CIX TOO BIG, found cix out of range (greater than NO OF CIX)	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.916	NVALID SW LEVEL, sw identification infos transferred with login does not match	Wrong software version on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura). All printed circuit cards with download capability must feature the same version.
17.99.917	NO PREDECESSOR, no preceding neighbour found	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.918	NO SUCCESSOR	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).

17.99.919	NTH LONG MSG CORRUPT, any frame data of multi packet receive message RPC corrupt	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.920	OS MESSAGE TYPE ERROR, unknown message type in operating system's mailbox	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.921	SD INC TOO BIG, wrong slow data increment specified in NCU	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.922	TASK LOCATION ERROR, found cobid 0 for a local task in ncu.h's task table	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.923	CORRUPT MDT REQUEST, unknown message format received by mdt task	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.924	SEND MIX TOO BIG, mass data index out of range in request message	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.925	RECEIVE MIX TOO BIG, mass data index out of range in network frame	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.926	CAN BUSSTATUS	CAN Controller hardware error on CPU 68332 PCB or Pneumatic Controller PCB or Graphics Controller PCB (Evita 4) / Front Panel PCB (Evita 2 dura). Most likely cause: Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.927	CAN BUSSTATUS 2	Refer to error 17.99.926.
17.99.928	CAN ERROR INT 2	Refer to error 17.99.926.
17.99.929	CAN OVERRUN	Refer to error 17.99.926.
17.99.930	CAN OVERRUN 2	Refer to error 17.99.926.
17.99.940	SEND Q FULL	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.941	ZDA EXCLUSIVE STACK OVERFLOW	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.942	ZDA EXCLUSIVE STACK UNDERFLOW	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).

17.99.950	MBX NO OWN MAILBOX	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.951	MBX NO TARGET MAILBOX	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.952	MBX TARGET MAILBOX OVERFLOW	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.953	MBX TARGET SIGNAL OVERFLOW	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.960	GU UNEXPECTED END OF TASK	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.970	BAQU ILLEGAL BA1, paramerror in baqu Zusatz von BA	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.971	BAQU ILLEGAL BA2, param error in baqu Grund von BA	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.972	BAQU ILLEGAL BA3, paramerror in baqu get Backup for Betriebsart	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).
17.99.973	BAQU ILLEGAL BA4, param error in baqu Betriebsart	Software error on Graphics Controller PCB (Evita 4) or Front Panel PCB (Evita 2 dura).

3 Service Diagnosis Mode and Release of Software Options

The service diagnosis mode is designed to assist with Evita 4 and Evita 2 dura servicing. It enables on-line information to be read out at any time in the course of operation. Software options can also be released in diagnosis mode.

The diagnosis pages are split up as follows:

“Front”: Readout of control panel data:

“Microprocessor”: Display type

Touchscreen (only Evita 4)

Keypad

		Loudspeaker monitoring
		RAM test
“Electronic”:	Readout of electronics section data:	
	“Sensors”:	Ambient pressure measurement
		SpO2 measurement
		CO2 measurement
		Paediatric flow measurement
	“Microprocessor”:	Power supply
		internal unit temperature
		AWT sensor
		Ambient pressure sensor
		Inspiration pressure
		RAM/ROM test results
		Service connector
		CAN
		Software options

“Pneumatic”: Readout of pneumatics section data:

“Valves”:	Setting of switching valves
	HPSV (supply pressure, status, O2 measurement, flow)
	PIP/PEEP valve (calibration values))
“Sensors”:	4 airway pressure sensors
	Flow measurement
	O2 measurement
“Microprocessor”:	RAM/ROM test results
	Fan monitoring
	Reference voltages

“Other”: Special functions - error list and software options:

“Logbook”:	Readout of error list
“Option Release”:	Entry of release numbers for software options

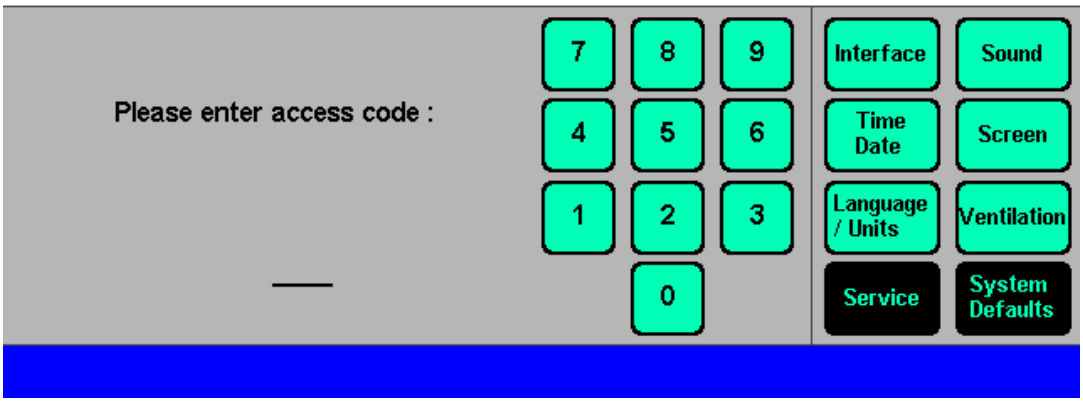
3.1 Call-up of service diagnosis mode

Service diagnosis mode can be called up at any time in the course of operation. This mode only involves data readout; settings are not altered.

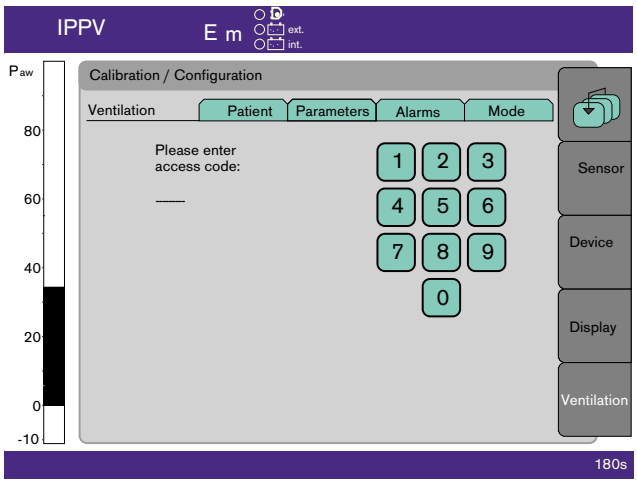
Important: If the Evita 2 dura is not equipped with the software option “Service+”, switch on the service coding on COM1. To switch on the service coding, connect the RS232 extension cable 7901808 or the RS232 adapter 7901888 to the COM1 socket.

- Press “Configuration” key.
- Select “System defaults” menu (Evita 4) or “Ventilation” (Evita 2 dura)..
- Select “Service diagnosis” menu (Evita 4 only).

Evita 4



Evita 2 dura

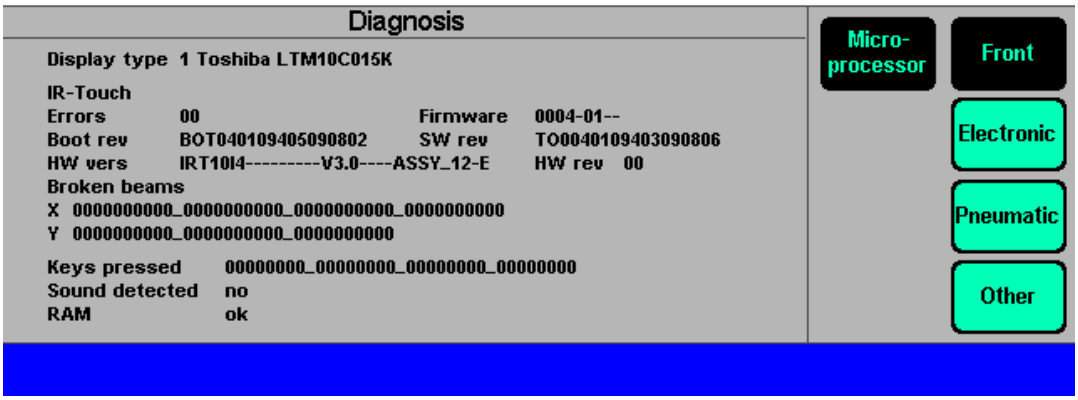


- Enter “4 6 5 5”. Entering “4 6 4 4” beforehand results in the additional display of an info line along the bottom edge of the screen in German (description of software development) as a supplement to the logbook (error list).

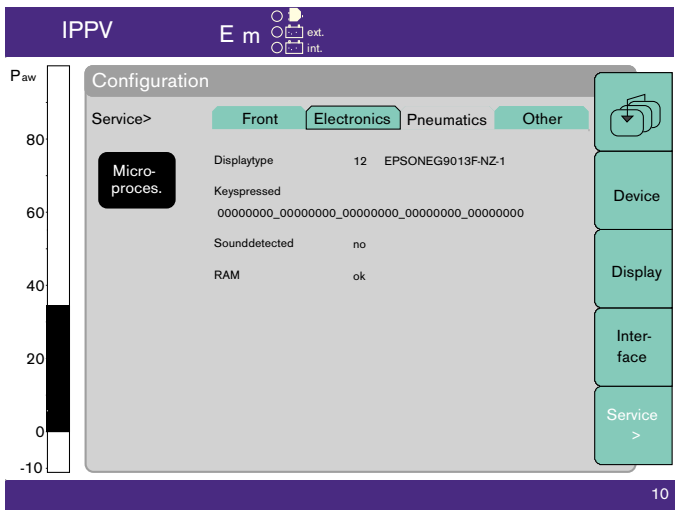
3.2 “Front” diagnosis

3.2.1 Diagnosis page “Microprocessor” of “Front”

Evita 4



Evita 2 dura



Display type Readout of display in control panel. This information is of importance for renewal of background illumination, as this differs from display to display.

Evita 4

The following displays are envisaged:
“1 Toshiba” (with external DC/AC converter for background illumination)
“2 NEC” (with internal DC/AC converter for background illumination)
“3 Sharp” (with external DC/AC converter for backgroundillumination)
“0 Toshiba” (with external DC/AC converter for background illumination)

Important: The decoders D29 and D40 for matching the display on the Graphics Controller PCB are not identical.

Display	D29	D40	Note:
1 Toshiba	83 06 640	83 06 795	all software versions as of 1995
2 NEC	84 11 686	83 06 795	all software versions as of 1996
3 Sharp	84 11 776	83 06 795	all software versions as of 1996
0 Toshiba	84 11 859	83 06 795	for software versions 1.07/1.08; for 2.20 and higher

Important: In the event of display fault, use must always be made of the current display type. The display accessory set contains all the components required for installation, e.g. display, decoders D29 and D40, wiring harnesses, DC/AC converter (if not integrated into display) and mechanical assembly components.

Evita 2 dura

The following Displays are available:
Epson (black & white), with out Decoder D48
NEC (colour), with Decoder D48 (83 09 124)
Sharp (colour), with Decoder D48 (83 09 176)

Evita 4

IR-Touch:

Touchscreen data. These data are determined once in BOOT after switching on Evita. The important touchscreen information is listed below:

Errors:

Output 00 (OK, no error) or output of error number plus error code

Error codes:

01 EPROM error

02 RAM error

04 Broken beams in BOOT, refer to “broken beams”

0a Invalid command

0c Input buffer overflow

0e Incorrect parameter number for command

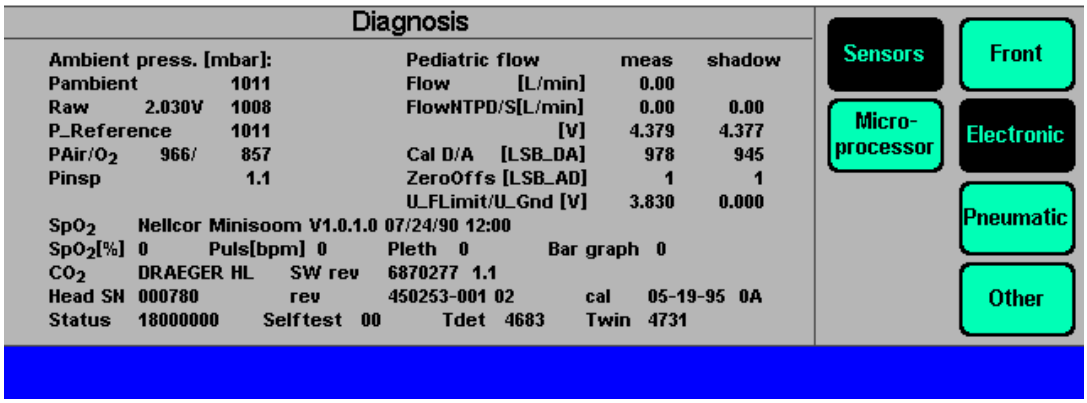
0f Value range parameter exceeded

Broken Beams:	Output of broken beams, detected following switch-on of Evita X beams for columns (40 from left to right) Y beams for lines (30 from botton to top) Output 0 (OK, not broken) or 1 (not OK, broken). Check the following if one or more beams shown as being broken: Was there something in the touch window on switch-on? Touch window surround dirty? Important: Defective light barriers are allowed, provided that the function during operation is not effected, i.e. all screen keys are functional.
Keys pressed:	Keypad test, determined by Graphics Controller PCB: 0 key not pressed 1 key pressed Important: Keys which affect screen content switch Evita out of diagnosis mode.
Sound detected:	Result of current measurement through loudspeaker in control panel. Loudspeaker is actuated by CPU 68332 PCB in electronics section and monitored via a shunt resistor on the Graphics Controller PCB. Detected flow of current through loudspeaker (= yes) continues to be displayed for 10 seconds.
RAM:	Output of result of RAM test, Graphics Controller PCB In the Evita 2 dura are 2 RAMs: RAM 1 = RAM of the CPU 68332 RAM 2 = RAM of the CPU 68020

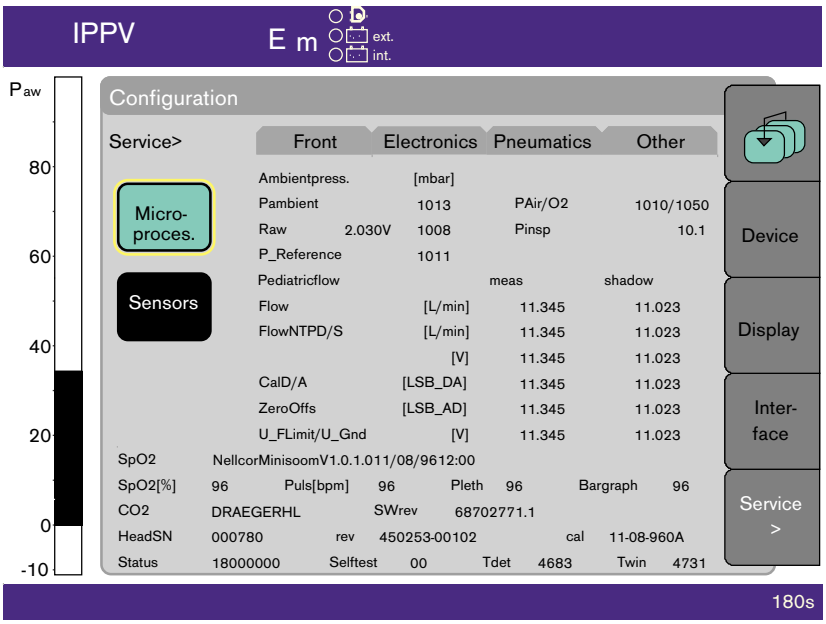
3.3 “Electronic” diagnosis

3.3.1 Diagnosis page “Sensors” of “Electronic”

Evita 4



Evita 2 dura



Ambient press. Output of ambient pressure measurement values. Measuring range 600 - 1100 mbar. Note: Values without a unit are output in mbar. The air pressure sensor with AD conversion is on the CO2 Carrier PCB.

Pambient: Air pressure used in Evita

Raw: Current raw voltage from air pressure sensor with calculated air pressure. Perm. deviation from Preference 12 %.

Preference: Air pressure established as air-pressure reference value when Evita is switched on. If the deviation from PAir or PO2 is more than 8 %, the message “Perform apparatus check” is given. Preference is then set to the mean value of PAir and PO2. If the difference between PAir and PO2 is also more than 8 %, Preference is set to 1013 mbar.

PAir/O2: Air pressure of supply pressure sensors PAir and PO2 determined in last apparatus check.

Pinsp: Second channel of inspiration pressure sensor. The inspiration pressure sensor is located in the pneumatics section and is read in by the Pneumatic Controller PCB (first channel) as well as on the CO2 Carrier PCB for additional safety. For permissible deviation, refer to diagnosis page “Pneumatic” in menu “Sensors” under Paw (CPU PCB).

SpO2: SpO2 measurement values. Valid values are only provided if option has been fitted and released and SpO2 measurement has been activated. The PCB version and the measured values are output. Note: The bar graph value is not displayed on the Evita in operation.

CO2: CO2 measurement values. A list of important CO2 measurement data is given below:

CO2: Output of Signal Processor PCB type for CO2 measurement on CO2 Carrier PCB, e.g. “Andros 4210” or “Dräger HL”.

Software rev: Output of software version on Signal Processor PCB, e.g. “68 70 277 1.1” for Dräger software version 1.1.

Tdet / Twin: Output of decimal value of detector (Tdet) and window (Twin) temperature in CO2 sensor. Approx. 43 °C should have been attained in each case after 3 minutes.
40 °C = 5326
41 °C = 5116
42 °C = 4916
43 °C = 4725
44 °C = 4543
45 °C = 4368
46 °C = 4201
48 °C = 3888
50 °C = 3602

Pediatric-Flow: Paediatric flow measurement values; valid values are only provided if the option has been fitted. The option is available for Evita 4 with software Version 2.20 or higher versions.
“Meas” = amount/value of flow from the gauging wire
“shadow” = shadow/low from the route-direction gauging wire

Flow/MV meas.:	measuring range MV from -50.00 to +50.00 L/min in BTPS negative values = exspiration
Flow/MV shadow:	measuring range MV from 0 to 30.00 L/min in BTPS
Flow NTPD/S meas.:	measuring range FLOW from -30.00 to +30.00 L/min in NTPD/S
Flow NTPD/S shadow:	measuring range FLOW from -30.00 to 0 L/min (expiration only)
[V] meas, shadow:	measuring-circuit voltage, measuring range 0 to 10 V; normal range between 4.3 and 8.0 V
Cal D/A meas, shadow:	comparison DA values for both wires: normal range from 0 to 4095; small negative numbers are the reason for interrupting a comparison, the sensor is not ready for measuring.

-1	gauging wire “meas”	too little resistance
-2	gauging wire “shadow”	too little resistance
-3	gauging wire “meas”	too much resistance
-4	gauging wire “shadow”	too much resistance
-7	sensor INOP	

Zero Offset Meas, Shadow:

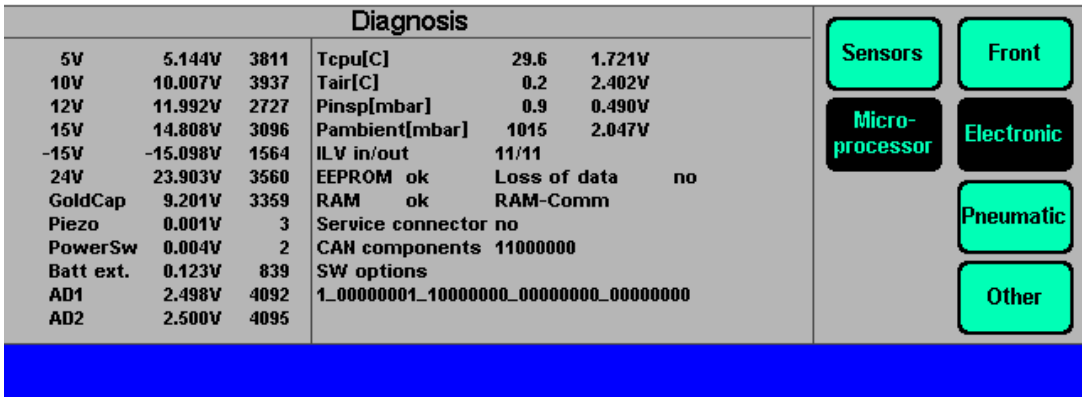
- range - 1792 to 2303
- typical after a comparison of -3 to 3, it is helpful to compare the measuring systems for values larger than 10. If 9999 is displayed, a flow-pass of zero has not been registered for over 15 seconds
- flow-pass of zero has been registered

U_FLimit/UGND for both wires together:

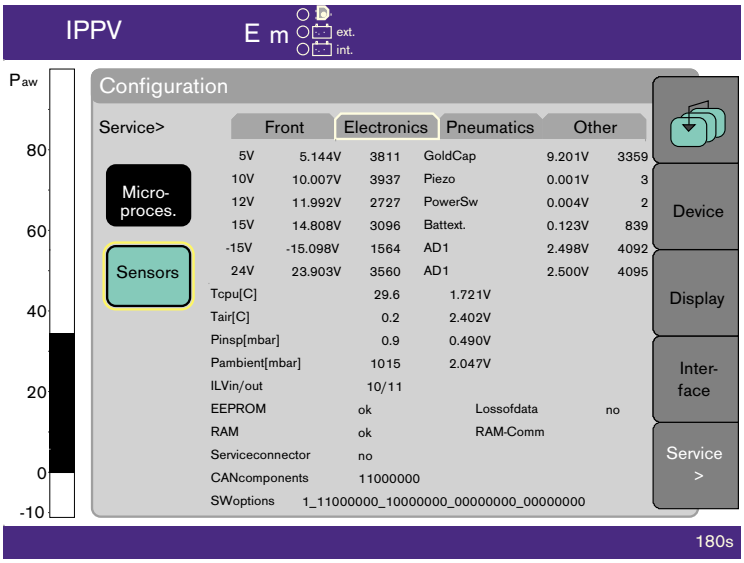
- U_FLimit = 3.828 ± 0.100 V under normal operating conditions
- U_FLimit = 2.6 ± 0.2 V under red-hot conditions
- UGND = 0.0 ± 0.1 V

3.3.2 Diagnosis page “Microprocessor” of “Electronics”

Evita 4



Evita 2 dura



5 V/12 V/15 V/ -15 V/24 V : Power pack supply voltages measured on CO2 Carrier PCB. Output of voltages and decimal values of AD conversion. There are no apparatus error messages with the following values:

5 V	=	4.5 V to 5.5 V
12 V	=	9.6 V to 14.4 V
15 V	=	14 V to 18 V
-15 V	=	-12 V to -18 V

24 V	=	19.2 V to 28.8 V

Important: The power pack is specified as follows; refer to section of "Repair Instructions - Electronic Components" Chapter 1, Power Supply Unit, page 6

5 V	=	5.07 V to 5.23 V
12 V	=	11.76 V to 12.24 V
15 V	=	4.55 V to 15.45 V
-15 V	=	-14.55 V to -15.45 V
24 V	=	22.32 V to 24.72 V

10 V: 10V reference voltage generated from 15V supply voltage on CO2 Carrier PCB. AD conversion is also implemented on the CO2 Carrier PCB. Output of voltage and decimal value of AD conversion.
Set value = 9.9V to 10.1V

GoldCap: Output of GoldCap voltage. The GoldCap capacitor supplies the substitute horn with current. The GoldCap with charging circuit and measurement is located on the CO2 Carrier PCB. Output of voltage and decimal value of AD conversion.
Set value = 8V to 11V

Piezo: The current through the substitute horn is measured on the CO2 Carrier PCB. The voltage via the shunt resistor and the decimal value of the AD conversion are output. To check Evita 4, press and hold “Reset/Check” key.
Piezo detected > 30 decimal (0.018V)
Piezo off < 30 decimal

PowerSW: Output of voltage at mains-switch auxiliary contact. Voltage is important for detecting mains failure. Mains switch is in power pack and evaluation circuit on CO2 Carrier PCB. Output of voltage and decimal value of AD conversion.
Mains switch on < 164 decimal (0.100V)
Mains switch off > 512 decimal (0.312V)

Batt ext.: Output of voltage of externally connected DC power supply (option DC module). Output of voltage and decimal value of AD conversion.

AD1: Output of AD converter reference voltage 1. Output of voltage and decimal value of AD conversion. Value is not directly monitored. Voltage is OK if 10V within tolerance.
Set value approx. 2.500V

AD2: Output of AD converter reference voltage 2. Output of voltage and decimal value of AD conversion. Value is not directly monitored. Voltage is OK if 10V within tolerance.
Set value approx. 2.500V

Tcpu:	Temperature inside unit; measured on CO2 Carrier PCB. Output of temperature in °C and voltage. Permissible temperature range < 65°C. As of 65°C info “fan fault!” (reset at 60°C) and as of 70°C alarm “fan defective!!!” (reset at 65°C). If temperature inside unit is excessively high, check fan in power pack.
Tair:	AWT-sensor breathing-gas temperature; measured on CO2 Carrier PCB. Output of temperature in °C and voltage.
Pinsp:	Second channel of inspiration pressure sensor. The inspiration pressure sensor is located in the pneumatics section and is read in by the Pneumatic Controller PCB (first channel) as well as on the CO2 Carrier PCB for additional safety. For permissible deviation, refer to diagnosis page “Pneumatic” in menu “Sensors” under Paw (CPU PCB).
Pambient:	Air pressure currently being used in Evita (filtered). Air pressure sensor with AD conversion is located on CO2 Carrier PCB. Output of air pressure in mbar and voltage. Perm. measuring range: 600 - 1100 mbar
ILV in/out:	Outputs only defined with ILV ventilation.
EEPROM:	Result of EEPROM test. EEPROM D22 is located on CPU 68332 PCB.
RAM:	Result of RAM test on CPU 68332 PCB.
Loss of data:	Output of data loss of RAM and EEPROM D22 on CPU 68332 PCB. No - OK, no data loss Yes - data loss A loss of data in the RAM may be due to a flat battery on the CPU 68332 PCB. Following data loss, the Evita attempts to restore the data. If this proves possible, the red alarm “data loss” disappears from the screen. The Evita is OK if this alarm is no longer present when the unit is next switched on.
RAM-Comm:	Result of RAM test on Communication PCB. Valid values are only output if PCB fitted (option).
Service connector:	Output of whether or not RS 232 cable with service encoding is connected to COM1 on CPU 68332 PCB. No - service encoding not recognised, normal operation Yes - service encoding recognised, download of operating software or external service mode via PCB possible.
CAN components:	Output of PCBs connected to internal CAN at CPU 68332 PCB (0 = not fitted, 1 = fitted). Sequence is as follows from left to right: Graphics Controller PCB/Pneumatic Controller PCB/Communication PCB/5x undefined

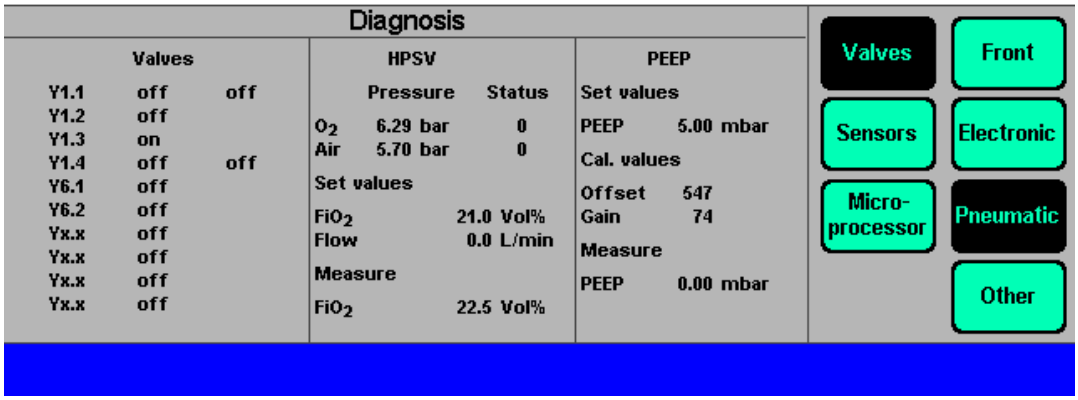
Software options:

The released options are output in the following form:
“1”_(Option 0 - 7)_(Option 8 - 15)_(Option 16 - 23)_(Option 24 - 31)
Significance:
“1” = Block 1 with 32 options (1 = Option fitted, 0 = Option not fitted)
The following options are currently envisaged in block 1:
Option 0 = Communication PCB (Evita 2 dura only)
Option 1 = Pediatric Flow PCB (Evita 2 dura only)
Option 5 = Ventilation Plus (Evita 2 dura only)
Option 7 = SpO2 measurement
Option 8 = CO2 measurement
Option 9 = DC power pack
Option 10 = Comfort Breath (Ventilation mode PPS and tube compensation) (Evita 4 only)
Option 11 = Monitoring Plus (Evita 2 dura only)
Option 12 = Service Plus (Evita 2 dura only)

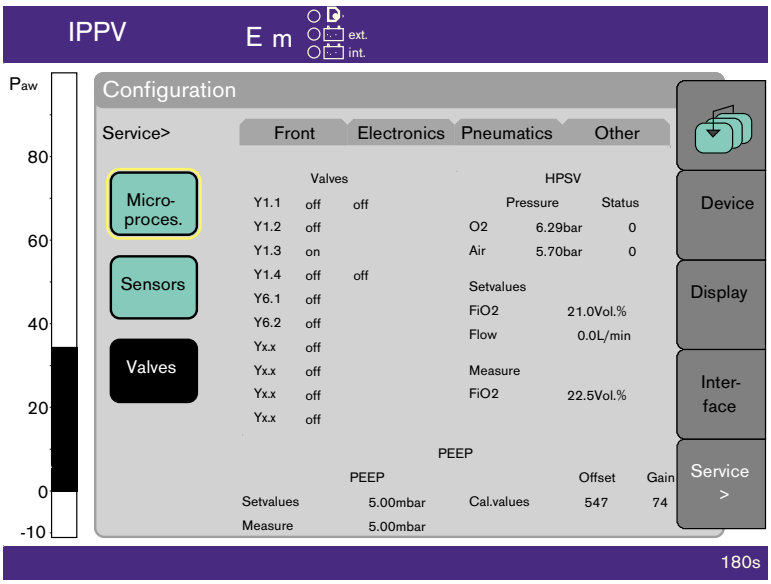
3.4 “Pneumatic” diagnosis

3.4.1 Diagnosis page “Valves” of “Pneumatics”

Evita 4



Evita 2 dura



Valves: Actuation of switching valves in pneumatics section. Actuation is performed by Pneumatic Controller PCB. For the valves Y1.1 and Y1.4 the actuation voltage is read back and output in the second value. Actuation and checkback must be identical.

off	Valve deenergised
on	Valve actuated
Y1.1	O2/air switching valve, off = air

Y1.2	O2 measurement calibration valve, on = O2 measurement calibration
Y1.3	Safety valve, on = ventilation; off = safety shutdown active
Y1.4	Nebuliser valve, off = nebuliser off
Y6.1	Calibration valve for inspiration pressure sensor S6.1, on = calibration
Y6.2	Calibration valve for expiration pressure sensor S6.2, on = calibration
Yx.x	Future option; a total of 10 valves can be connected to the Pneumatic Controller PCB

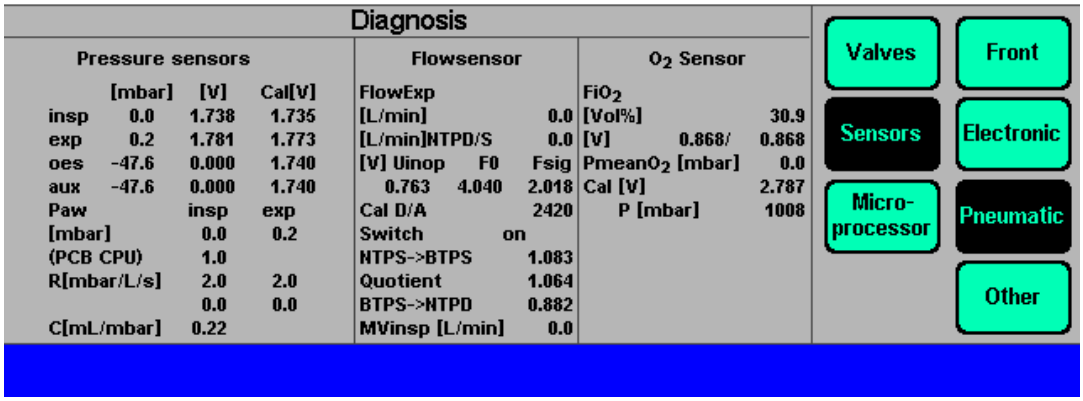
HPSV: Supply pressures and status of cartridges for O2 and air. Settings for flow and FiO2 are additionally output, as is the measured FiO2 value.

Pressure	The absolute air and O2 pressures are output. Absolute pressure = rel. supply pressure + ambient pressure. The supply pressure sensor is located in the respective HPSV cartridge. The supply pressures displayed are read in on the Pneumatic Controller PCB. The respective supply pressure is read in on the corresponding HPSV Controller PCB for valve regulation. refer to "Repair Instructions - Pneumatic Components chapter 4.4, Troubleshooting in Mixer, page 17 in the event of problems with mixer. Measuring range of supply pressure sensors = 0 - 7 bar Sensitivity = 1.58 V/bar +/- 8 mV/bar Offset voltage = 300 mV +/- 30 mV
Status:	Status messages of respective HPSV Controller PCB for O2 and air. 0 - OK, no error 2 - supply pressure less than 2 bar absolute, failure of pressure supply 1, 3 to 15 - errors on HPSV Controller PCB or in HPSV cartridge. If such errors are encountered, interchange the two HPSV Controller PCBs for O2 and air. If the error then occurs with the other type of gas, the HPSV Controller PCB is defective. If the error remains with the same gas, there is a defect in the electronics in the HPSV cartridge.

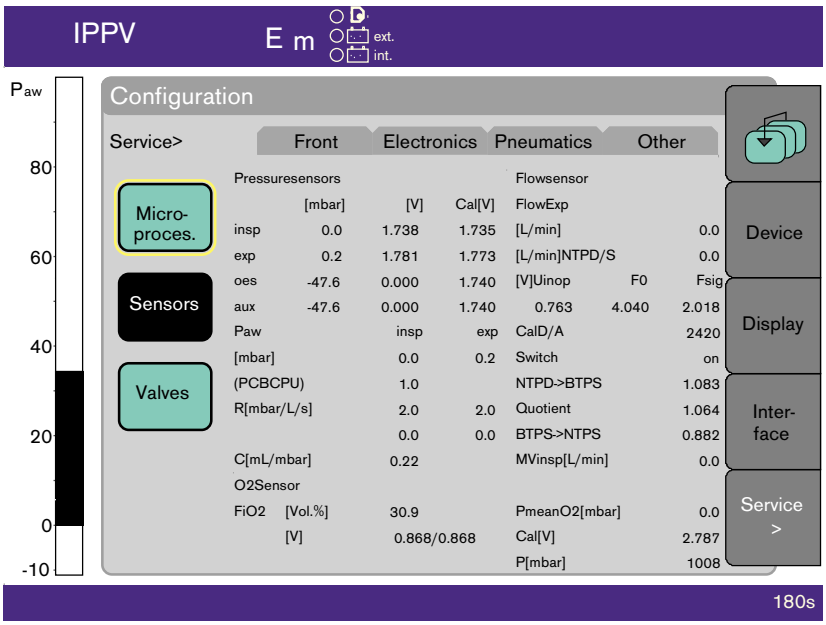
PEEP:	Values for PEEP/PIP valve Y4.1	
	Set values:	PEEP setpoint input in mbar
	Cal. values:	Calibration values for actuation of PEEP/PIP valve. Values for offset and gain are determined in the apparatus and stored in an EEPROM on the Pneumatic Controller PCB. Valve or PCB replacement must be followed by calibration (refer to "Repair Instructions - Pneumatic Components chapter 3.2, Testing and Calibrating the PEEP/PIP Valve, page 8).
	Measure	PEEP measured by airway pressure measurement in mbar

3.4.2 Diagnosis page “Sensors” of “Pneumatics”

Evita 4



Evita 2 dura



Pressure sensors:

Output of measured values from the 4 airway pressure sensors insp., exp., oes and aux (oes and aux are envisaged for future options). The sensors are read in on the Pneumatic Controller PCB. 3 values are output for each sensor:

(mbar):	Pressure in mbar of calibrated sensor
(V):	Output voltage of sensor; read in by Pneumatic Controller PCB. Voltage = Calibration voltage + sensitivity Sensitivity = 36.5 +/- 0.3 mV/mbar Measuring range = 140 mbar
Cal(V):	Calibration voltage of sensor (zero at ambient pressure) Set value = 1.74 +/- 0.50 V

The pressure at the Y-piece (Paw) is also calculated:

Paw (mbar)	Pressure Paw calculated in each case by insp. and exp. pressure sensor with allowance for tubing resistance. Perm. difference between the two values = 5 mbar.
(PCP CPU)	Comparison value in mbar. Output voltage of insp. pressure sensor is additionally read in on CO2 Carrier PCB. Max. difference with respect to Paw insp. = 5 mbar.
R:	Tubing resistance in mbar/L/s Insp.: Tubing resistance between insp. socket and Y-piece Exp.: Tubing resistance between Y-piece and exp. socket Top row: Measured in operation by safety software Bottom row: Determined in apparatus check These values differ as they are measured at different flow rates.
C:	Inspiratory tubing compliance in mL/mbar

Flowsensor: Expiratory flow measurement values. Sensor is read in on Pneumatic Controller PCB. Note: All values are displayed under BTPS conditions unless otherwise stated.
Explanatory notes:

BTPS	Based on 37 °C, ambient pressure + insp. pressure, 100 % rel. humidity. All Evita measured values and settings are based on BTPS.
NTPS	Based on 20 °C, 1013 mbar, 100 % rel. humidity. Corresponds to raw value of measured exp. flow.
NTPD	Based on 20 °C, 1013 mbar, dry. The mixer supplies the flow under these conditions. The Evita setting under BTPS is converted to NTPD for the mixer.
(L/min):	Measured expiratory flow converted to BTPS. Corresponds to displayed value.
(L/min)NTPD/S	Raw flow value measured under NTPS or NTPD conditions
(V)	Flow measurement voltages in V
	Uinop: Voltage set value (0.1 V, sensor probably OK if F0 and Fsig OK. “Flow measurement fault” is displayed if voltage < 0.1 V
	F0: Flow-measurement bridge voltage with 4-fold amplification. Set value in no-flow condition = 4.04 V
	Fsig: Flow-measurement bridge voltage with 2-fold amplification. Set value in no-flow condition = 2.02 V
Cal DA:	Decimal DA converter value for calibration of flow sensor Set value = 2200 - 3200
Switch:	Microswitch for detecting position of flow sensor On - Flow sensor in right-hand operating position Off - Flow sensor not ready for operation in replacement position
NTPS→ BTPS:	Factor for converting raw value of measured flow NTPS to displayed flow BTPS value Permissible deviation from “quotient” = 5 %

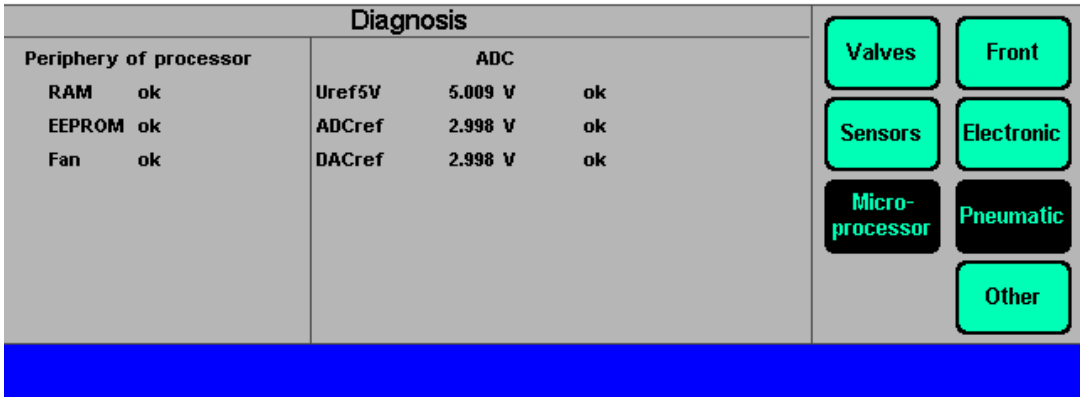
Quotient:	NTPS/BTPS conversion factor calculated in a different way. If difference between “NTPS/BTPS” and “quotient” is more than 5 %, there is an error in the flow measurement on the Pneumatic Controller PCB, as the difference between F0 and Fsig is no longer factor 2.
BTPS→NTPD:	Factor for converting flow BTPS to NTPD
Mvinsp:	Inspiratory minute volume calculated from actuation signals of mixer. The measured expiratory minute volume may be max. 20 % more than this value. “Flow measurement Inop” is displayed if the difference is greater. The problem may be due to the following: - Flow measurement defective - Impermissible feed-in of external flow (e.g. by nebuliser) - Mixer supplying excessive flow rate

O2 Sensor: Measured values and calibration values for inspiratory O2 measurement. Output voltage of O2 sensor is amplified directly at the sensor and read in on the Pneumatic Controller PCB.

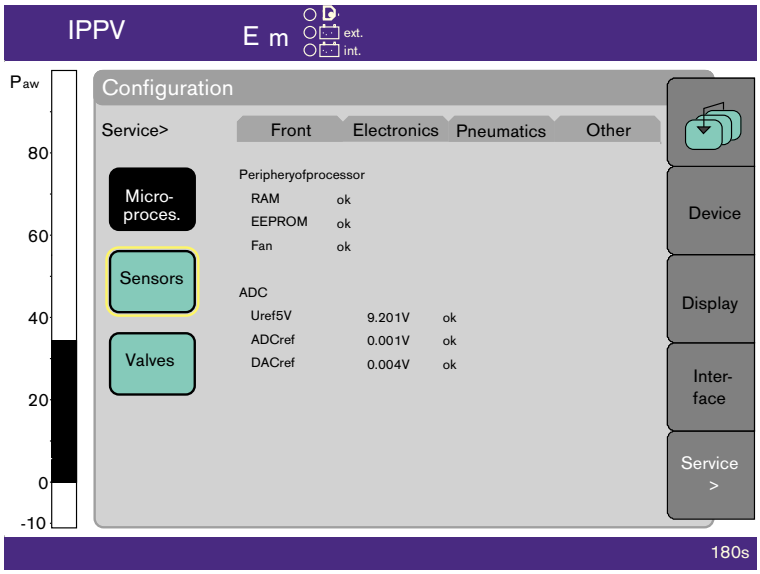
FiO2 (Vol%):	Measured O2 concentration with pressure compensation
(V):	Amplified sensor voltage at Pneumatic Controller PCB input. This voltage is read in twice on this PCB. Refer to Cal(V) for permissible voltage range.
Pmean:	Current mean pressure in tubing system in mbar. Required for pressure compensation of O2 measurement.
Cal (V)	Amplified sensor voltage on calibration with 100 vol. O2 Permissible range: 1.257 to 5.644 V Voltage too low: End of sensor service life Voltage too high: O2 measurement defective (O2 amplifier or Pneumatic Controller PCB)
Cal P (mbar)	Air pressure allowance in mbar on calibrating O2 measurement

3.4.3 Diagnosis page “Microprocessor” of “Pneumatics”

Evita 4



Evita 2 dura



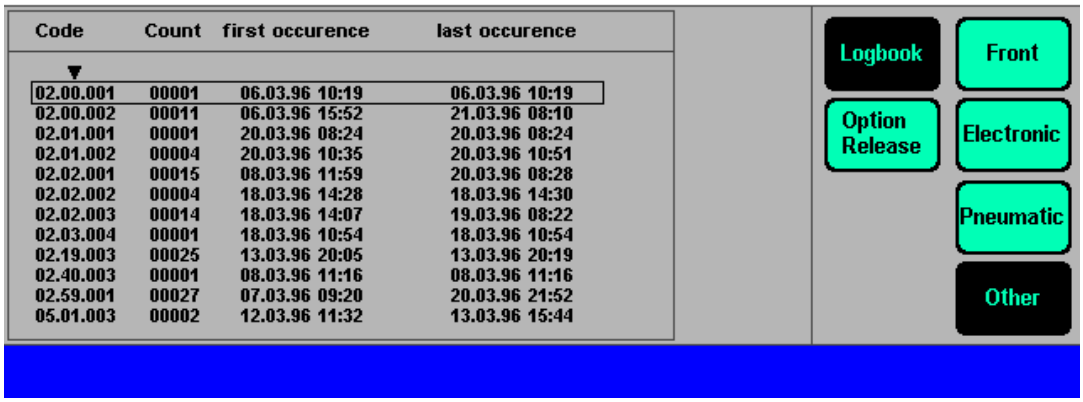
Periphery of processor: Status of processor system of Pneumatic Controller PCB and fan for cooling electronics in pneumatics section. Error message is given in the event of deviation. Fan must be detected within 1 minute.

ADC: POutput of reference voltages of Pneumatic Controller PCB. The voltages are generated on this PCB and also read in. Error message is given in the event of deviation.
Set values:
Uref5V = 4.9V to 5.1V
ADCref = 2.9V to 3.1V
DACref = 2.9V to 3.1V

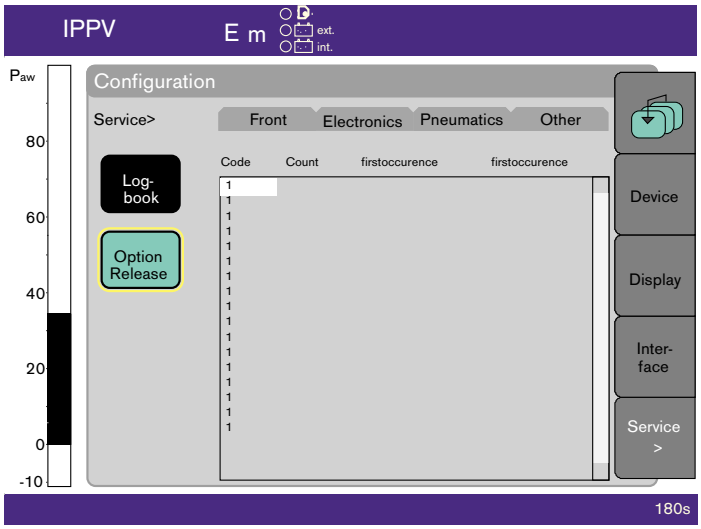
3.5 Error list and release of software options

3.5.1 Diagnosis page “Logbook” (error list)

Evita 4



Evita 2 dura



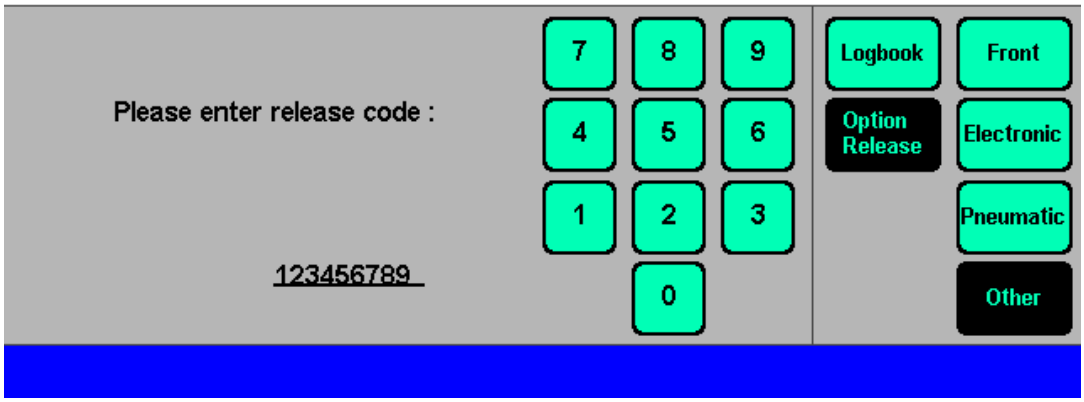
The error table can be sorted by repeatedly pressing the key “Logbook” (Evita 4). The arrow above the table indicates the sorted column.

Code:	Increasing error number
Count:	Decreasing error frequency
First occurence:	Oldest error at top of column
Last occurence:	Latest error at top of column

Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 2, List of Evita 2 dura/Evita 4 error numbers, page 3.

3.5.2 Diagnosis page “Option Release” (release of software options)

Evita 4



This menu can be used to release software options with a 10-position code. The code number is governed by the ID number of the Evita. Checking is performed after entering the number. If check is positive, software option is ready for use next time the unit is switched on.

Important:

In Evita 4 the hardware options (e.g. SpO2, DC, CO2) are enabled under “Configuration” -> “Basic setting” -> “Service diagnosis” with a 4-position code, Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 1, Service and Access Codes/Release Option, page 1.

In Evita 2 dura, the hardware options (e.g. SpO2, DC, CO2) are enabled under “Configuration” -> “Ventilation” with a 4-position code (Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 1, Service and Access Codes/Release Option, page 1.).

Evita 2 dura

The software option for Evita 2 can be released in the operation mode under “configuration” => “unit” => “options”.

4 Fault Diagnosis Chart

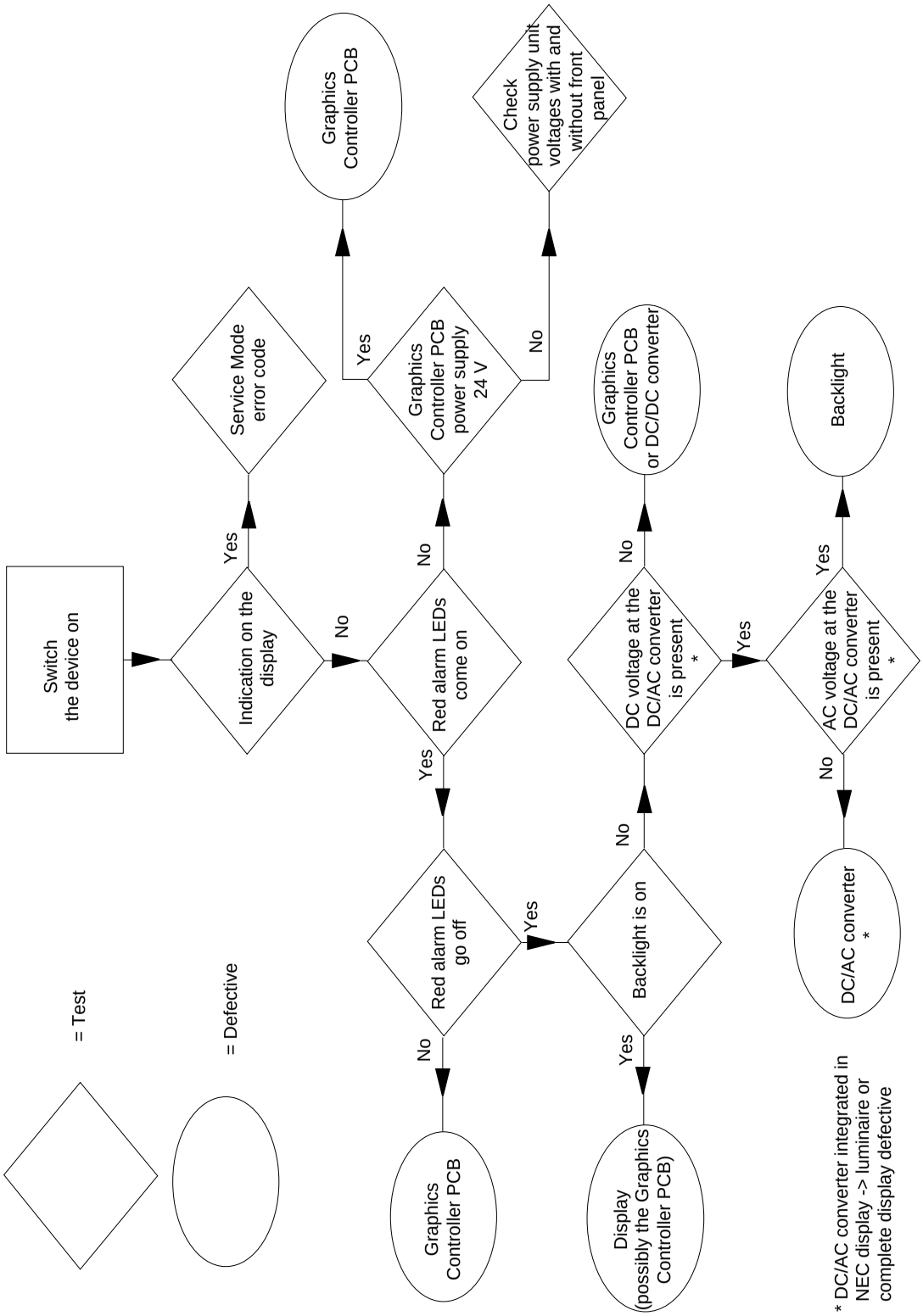


Fig. 1: Fault diagnosis chart

5 Patient monitoring

5.1 Monitoring the high airway pressure limit

5.1.1 First pressure limit (Paw high)

Alarm cause:	a. The patient breathes against the inspiration stroke or coughs b. The inspiration tube is kinked or clogged c. One or both pressure sensor(s) supplies/supply too high a measured value d. The flow source supplies incorrect flow
Detection:	a. The value measured by the inspiratory pressure sensor exceeds the value of the high airway pressure limit Paw high + Insp flow * Rtube_Insp b. The value measured by the expiratory pressure sensor exceeds the value of the high airway limit Paw high
Supression:	a. Detection a is suppressed if a malfunction of the inspiratory pressure sensor is detected. b. Detection b is suppressed if a malfunction of the expiratory pressure sensor is detected.
Reaction:	a. Generation of the high airway pressure warning b. Aborting of the current respiration phase if this respiration phase prevents pulmonary relief via the expiration valve
Cancellation:	a. Onset of the next inspiration (application of inspiration flow) b. 5 s after the occurrence of the cause of the alarm

5.1.2 Second pressure limit (Paw high + 5 mbar)

Alarm cause:	a. The patient breathes against the inspiration stroke or coughs b. The inspiration tube is kinked or clogged c. One or both pressure sensor(s) supplies/supply too high a measured value d. The flow source supplies incorrect flow
Detection:	a. The value measured by the inspiratory pressure sensor exceeds the value of the high airway pressure limit Paw high + Insp flow * Rtube_Insp for more than 200 ms b. The value measured by the expiratory pressure sensor exceeds the value of the high airway limit Paw high for more than 200 ms c. The value measured by the inspiratory pressure sensor exceeds the value of the high airway pressure limit Paw high + 5 mbar + Insp flow * Rtube_Insp for more than 48 ms d. The value measured by the expiratory pressure sensor exceeds the value of the high airway limit Paw high + 5 mbar for more than 48 ms
Supression:	a. Detections a and c are suppressed if a malfunction of the inspiratory pressure sensor is detected. b. Detections b and d are suppressed if a malfunction of the expiratory pressure sensor is detected.
Reaction:	a. Generation of the high airway pressure warning b.Aborting of the current respiration phase and initiation of an emergency phase c. Opening of the electric safety valve d. Generation of the airway relieved message
Cancellation:	a. When an airway pressure of 5 mbar is reached (relief was successful), but at the earliest after: Adults : 500 ms Children : 150 ms b. 5 s after the occurrence of the cause of the alarm

5.2 Monitoring the low airway pressure limit

Alarm cause:	a. The tube system or one of the tubes has fallen off or is leaking. b. The expiratory pressure sensor supplies too low a measu red value.
Detection:	a. In all respiration modes with a minimum PEEP of 3 mbar: If the airway pressure measured with the expiratory pres sure sensor falls below the set PEEP, the PEEP - airway pressure difference is integrated in a sum memory. An alarm is issued if the value of the sum memory exceeds a specific value. The sum memory is cleared if the measur red airway pressure again exceeds the PEEP. b. In volume-controlled (IPPV, SIMV, MMV), pressure-controlled (BIPAP, BIPAP(VG)) and pressure-assisted respiration mode: The value measured by the expiratory pressure sensor does not reach the PEEP setting + threshold limit in two successive mechanical inspiration strokes for more than 100 ns in each case. The amount and derivation of the threshold depend on the form of respiration: Volume-controlled : 5 mbar Pressure-controlled: 0.5 * ΔPinsp (Pinsp - PEEP) Pressure-controlled : 0.5 * ΔPASB (PASB - PEEP)
Suppression:	a. Detection a. is not activated until PEEP settings of 3 mbar and higher. b. Detection b. is not activated in pure CPAP.
Reaction:	Generation of the airway pressure low warning

5.3 Monitoring the AMV

5.3.1 AMV low

Alarm cause:	a. Spontaneous ventilation of the patient is inadequate b. Spontaneous ventilation of the patient is adequate, but not enough flow is measured owing to leakage in the expiration tube c. The HPSVs supply inadequate inspiration flow owing to a defect d. The flow sensor is defective and supplies measured values that are too low
Detection:	a. The AMV determined by a Bessel filter of the fourth order on the basis of the value measured by the expiratory flow sensor falls below the low AMV limit set by the user.
Suppression:	a. After a cold start of the Evita, this monitoring function is automatically suppressed for 1 minute. b. After activation of flow monitoring, this monitoring function is suppressed for 2 minutes. c. The monitoring function is suppressed during cleaning of the respiratory tract and 2 minutes afterwards. Flow monitoring is off.
Reaction:	a. Generation of the AMV low warning
Cancellation:	The measured AMV value falls below the set low AMV limit.

5.3.2 AMV high

Alarm cause:	a. Spontaneous ventilation of the patient is too high b. The HPSVs supply too much inspiration flow owing to a defect c. The flow sensor is defective and supplies measured values that are too high
Detection:	a. The AMV determined by filters on the basis of the value measured by the expiratory flow sensor exceeds the high AMV limit set by the user.
Suppression:	a. Flow monitoring is off.
Reaction:	a. Generation of the AMV high warning
Cancellation:	The measured AMV value falls below the set high AMV limit.

5.4 Monitoring the FiO2

5.4.1 FiO2 low

Alarm cause:	a. The HPSVs supply inspiration flow with an incorrect concentration b. The O2 sensor is defective
Detection:	a. The value measured by the O2 sensor falls below the low FiO2 limit.
Suppression:	a. Calibration of the O2 sensor b. O2 monitoring is off c. After adjustment of FiO2, calibration of the O2 sensor and after standby, monitoring is suppressed for 1 minute
Reaction:	a. Generation of the FiO2 low warning
Miscellaneous:	Cleaning of the respiratory tract changes the set FiO2 to 100 %. At the same time, the limit is also changed.

5.4.2 FiO2 high

Alarm cause:	a. The HPSVs supply inspiration flow with an incorrect concentration b. The O2 sensor is defective
Detection:	a. The value measured by the O2 sensor is above the high FiO2 limit.
Suppression:	a. Calibration of the O2 sensor b. O2 monitoring is off c. After adjustment of FiO2, calibration of the O2 sensor and after standby, monitoring is suppressed for 1 minute
Reaction:	a. Generation of the FiO2 high warning
Miscellaneous:	Cleaning of the respiratory tract changes the set FiO2 to 100 %. At the same time, the limit is also changed.

5.4.3 FiO2 limits

The measured FiO2 value is compared against a high and low limit in order to generate an alarm in the event of a discrepancy. These two limits are derived from the FiO2 setting.

Setting < 60 vol. %	low_alarm limit	= setting - 4 vol. %
	high_alarm limit	= setting + 4 vol. %
Setting > 60 vol. %	low_alarm limit	= setting - 6 vol. %
	high_alarm limit	= setting + 6 vol. %

5.5 Monitoring respiratory cycle changes

5.5.1 Apnoea

Alarm cause:	a. Spontaneous respiration by the patient has stopped b. The tube system is disconnected or has a large-scale leak c. The flow sensor is defective
Detection:	a. The expiration start and end information is derived from the value measured by the flow sensor. If both items of information fail to appear in all modes of operation for longer than the apnoea alarm time, this is evaluated as apnoea. b. The inspiration start and end information is derived from the control information of the HPSVs. If both items of information fail to appear in spontaneous and mixed modes of operation for longer than the apnoea alarm time, this is evaluated as apnoea.
Suppression:	a. Monitoring is suppressed during calibration of the O2 sensor and for the duration of the set apnoea alarm time after calibration. b. Monitoring is suppressed during cleaning of the respiratory tract and for the duration of the set apnoea alarm time after this. c. An airway pressure high alarm has occurred d. An airway pressure low alarm has occurred e. Inspiration Hold is active f. A flow measurement fault alarm has occurred (see note) g. A Fail to Cycle alarm has occurred h. Flow monitoring is off (see note)
Reaction:	Generation of the apnoea warning
Cancellation:	At least one of the items of information concerning inspiration (i.e. the start or end) and one of the items of information concerning expiration no longer fails to appear.
Note:	If a flow measurement fault alarm occurs, only that part of the monitoring function is suppressed that detects the fault on the basis of the expiration start and end information derived from the flow sensor.

5.5.2 Fail to cycle

Alarm cause:	a. The respirator no longer generates any HPSV control infoormation b. Owing to the unit's settings, only very small volumes can be applied if the patient's lungs are hard
Detection:	a. The inspiration start and end information is derived from the control information of the HPSvs. If both items of information fail to appear in purely controlled modes of operation (IPPV, ILV) for longer than the set apnoea alarm time, this is evaluated as Fail to Cycle.
Suppression:	a. Monitoring is suppressed during calibration of the O2 sensor and for the duration of the set apnoea alarm time after calibration. b. Monitoring is suppressed during cleaning of the respiratory tract and for the duration of the set apnoea alarm time after this. c. An airway pressure high alarm has occurred d. An airway pressure low alarm has occurred e. Inspiration Hold is active f. A mode other than IPPV is active
Reaction:	Generation of the Fail to Cycle warning
Cancellation:	At least one of the items of information concerning the start or end of inspiration no longer fails to appear.
Note:	The apnoea and Fail to Cyclealarms are mutually exclusive because they are merely mode-dependent variations.

5.6 Monitoring etCO2

5.6.1 etCO2 low

Alarm cause:	a. Hyperventilation b. The CO2 sensor is defective or wrongly calibrated c. Pure dead space ventilation (Vt too low)
Detection:	a. The measured end tidal CO2 value falls below the set low limit
Suppression:	a. Cleaning of the respiratory tract b. O2 calibration c. CO2 hardware not implemented d. CO2 sensor not connected during commissioning e. CO2 monitoring is off
Reaction:	Generation of the etCO2 low warning
Cancellation:	The measured value is above the low limit

5.6.2 etCO2 high

Alarm cause:	a. Hypoventilation b. The CO2 sensor is defective or wrongly calibrated
Detection:	a. The measured end tidal CO2 value is above the set high limit
Suppression:	a. Cleaning of the respiratory tract b. O2 calibration c. CO2 hardware not implemented d. CO2 sensor not connected during commissioning e. CO2 monitoring is off
Reaction:	Generation of the etCO2 high warning
Cancellation:	The measured value is below the high limit
Miscellaneous:	Monitoring is activated automatically if the CO2 sensor is not connected until during operation. If the sensor is removed again, this results in an alarm.

5.7 Monitoring the spontaneous respiratory rate

Alarm cause:	Rapid shallow breathing by the patient
Detection:	The computed spontaneous respiratory rate (filtered by a Bessel filter of the fourth order) exceeds a limit set by the user for a period of one minute.
Suppression:	a. Monitoring of the spontaneous respiratory rate is only active in operating modes that provide a spontaneous breathing possibility b. Flow monitoring is off
Reaction:	Generation of the high rate warning
Cancellation:	The computed spontaneous respiratory rate is below the set limit

5.8 Monitoring the tidal volume

5.8.1 VTi high

Alarm cause:	a. Owing to a change in pulmonary condition, a larger tidal volume is applied in the pressure-controlled, pressure-limited or pressure-assisted respiration mode. b. The patient is breathing along with the machine
Detection:	a. The inspiration volume exceeded the set VTi high monitoring limit in more than three successive machine inspirations (volume-controlled, pressure-controlled). b. The inspiration volume exceeded the set VDi high monitoring limit in more than three successive spontaneous inspirations (pressure-assisted, purely spontaneous).
Suppression:	None
Reaction:	a. Generation of the VTi high warning b. Aborting of a volume-controlled, pressure-controlled or pressure-assisted inspiration
Cancellation:	a. At the end of a machine inspiration, the applied tidal volume is again lower than the set monitoring limit. b. At the end of a spontaneous inspiration, the applied tidal volume is again less than the set monitoring limit.

5.8.2 Volume not constant

Alarm cause:	a. Owing to a change in pulmonary condition, a too low a tidal volume is applied in the volume-controlled respiration mode with pressure limiting Pmax activated.
Detection:	a. At the end of a volume-controlled inspiration, the applied volume is less than the set tidal volume.
Suppression:	No volume-controlled mode is set.
Reaction:	a. Generation of the volume not constant warning
Cancellation:	a. At the end of a volume-controlled inspiration, the applied tidal volume again corresponds to the set tidal volume

5.9 Monitoring the inspiratory breathing gas temperature

Alarm cause:	a. Breathing gas humidifier heats up the inspiration gas too much b. Breathing gas temperature sensor returns too high a measured value
Detection:	The value measured by the breathing gas temperature sensor is above the limit of 40 °C for more than 1 s
Suppression:	Only active if a breathing gas temperature sensor has been detected as having been plugged in
Reaction:	Generation of the temperature high warning
Cancellation:	The value measured by the breathing gas temperature sensor is below the limit.

5.10 Monitoring functional oxygen saturation

5.10.1 SpO2 low

Alarm cause:	a. Hypoventilation b. SpO2 sensor defective or wrongly calibrated c. SpO2 sensor wrongly positioned
Detection:	The measured functional oxygen saturation SpO2 is below the set low limit
Suppression:	a. SpO2 hardware not implemented b. SpO2 sensor not connected during commissioning c. SpO2 monitoring is off
Reaction:	Generation of the SpO2 low message An SpO2 low warning is generated instead of the message if the cause of the alarm is present for more than 15 s
Cancellation:	The measured value is above the low limit

5.10.2 SpO2 high

Alarm cause:	a. Hypoventilation b. SpO2 sensor defective or wrongly calibrated c. SpO2 sensor wrongly positioned
Detection:	The measured functional oxygen saturation SpO2 is above the set high limit
Suppression:	a. SpO2 hardware not implemented b. SpO2 sensor not connected during commissioning c. SpO2 monitoring is off
Reaction:	Generation of the SpO2 high message An SpO2 high warning is generated instead of the message if the cause of the alarm is present for more than 15 s
Cancellation:	The measured value is below the low limit
Miscellaneous:	Monitoring is activated automatically if the SpO2 sensor is not connected until during operation. Removal of the sensor again results in an alarm.

5.11 Pulse rate monitoring

5.11.1 Pulse low

Alarm cause:	a. Change in the patient's condition b. SpO2 sensor defective or wrongly calibrated c. SpO2 sensor wrongly positioned
Detection:	The measured pulse rate is below the set low limit
Suppression:	a. SpO2 hardware not implemented b. SpO2 sensor not connected during commissioning c. SpO2 monitoring is off
Reaction:	Generation of the pulse low message A pulse low warning is generated instead of the message if the cause of the alarm is present for more than 15 s
Cancellation:	The measured value is below the low limit

5.11.2 Pulse high

Alarm cause:	a. Change in the patient's condition b. SpO2 sensor defective or wrongly calibrated c. SpO2 sensor wrongly positioned
Detection:	The measured pulse rate is above the set high limit
Suppression:	a. SpO2 hardware not implemented b. SpO2 sensor not connected during commissioning c. SpO2 monitoring is off
Reaction:	Generation of the pulse high message A pulse high warning is generated instead of the message if the cause of the alarm is present for more than 15 s
Cancellation:	The measured value is below the high limit

5.11.3 No pulse

Alarm cause:	a. Change in the patient's condition b. SpO2 sensor defective or wrongly calibrated c. SpO2 sensor wrongly positioned
Detection:	The SpO2 module has not been able to detect a pulse for 15 s
Suppression:	a. SpO2 hardware not implemented b. SpO2 sensor not connected during commissioning c. SpO2 monitoring is off
Reaction:	Generation of the no pulse warning
Cancellation:	The measured value is below the high limit
Miscellaneous:	Monitoring is activated automatically if the SpO2 sensor is not connected until during operation. Removal of the sensor again results in an alarm

6 Device monitoring

6.1 Monitoring the airway pressure sensors

Alarm cause:	a. A pressure sensor is defective, e.g. due to breakage of the diaphragm b. Excessive drift of the offset voltage of one or both sensors c. The sensors are no longer receiving a supply of voltage d. A sensor's adjustment valve is defective, with the result that the sensor is switched permanently to ambient pressure A pressure sensor returns invalid, but dynamic measurements
Detection:	a. The maximum and minimum measurements of a pressure sensor are registered during the course of one respiration cycle. At the end of the respiration cycle, the difference between the maximum and the minimum is less than 1 mbar, up to software version 1.04, or 0.2 mbar, software version 1.05 or higher. b. The offset of a pressure sensor has drifted by more than 500 mV between adjustments (3 minutes). c. The offset of a pressure sensor is no longer within the permissible window of 1.74 V +- 500 mV after an adjustment. d. The values measured by the two pressure sensors differ by more than 5 mbar at the end of an expiration.
Suppression:	None
Reaction:	a. Generation of the pressure measurement fault warning b. If merely one pressure sensor has been detected as being defective, the value measured by the fault-free pressure sensor is also used as the value for this sensor. c. The defective pressure sensor(s) is/are adjusted again. The first adjustment takes place immediately after detection of the fault, while further adjustments are repeated every 15 s.
Cancellation:	All above-mentioned detection criteria no longer detect a fault.

6.2 Monitoring flow measurement

6.2.1 Flow measurement fault (sensor defective)

Alarm cause:	a. Flow sensor defective b. Expiration valve defective, with the result that the sensor was not devoid of flow during adjustment c. Flow sensor removed
Detection:	a. The value measured in the Inop channel and/or the measurement channel is less than 0.2 V. Sampling time: 100 ms Sensor OK : Inop > 0,2 V meas. > 0,2 V Measuring wire broken: Inop > 0,2 V meas < 0,2 V Compensation wire broken: Inop < 0,2 V meas > 0,2 V Both wires broken : Inop < 0,2 V meas < 0,2 V b. The measuring bridge voltage required for an adjustment lies outside the dynamic range of the D/A converter. c. The flow sensor measurement is higher than 100 L/min for more than 15 s.
Suppression:	a. a. and c. are normally only detected during normal operation, i.e. not during adjustment of the flow sensor b. b. is only detected during adjustment of the flow sensor. c. Flow monitoring is off
Reaction:	Generation of the flow measurement fault warning
Cancellation:	None of the above-mentioned detection criteria reports a fault condition.

6.2.2 Flow sensor? (sensor not positioned)

Alarm cause:	Flow sensor not inserted in the patient section (flow sensor switch open)
Detection:	The flow sensor switch is detected as being open. Detection of this fault is counted by a fault counter.
Suppression:	Flow monitoring is off
Reaction:	Generation of the flow sensor? alarm

6.3 Monitoring oxygen measurement

Alarm cause:	a. Sensor defective b. HPSVs return an invalid O2 concentration during adjustment
Detection:	a. The value measured by the O2 sensor falls below the limit of 15 Vol% b. The value measured by the O2 sensor exceeds the limit of 106 Vol% c. The voltage of the O2 sensor lies outside the tolerance limits during adjustment to 100 Vol%: low Limit: = 26,5 mV cell voltage * 47,51 = 1,257 V upper Limit: =118,8 mV cell voltage * 47,51 = 5,644 V
Suppression:	a. O2 monitoring is off b. The fault c is only detected during adjustment of the sensor c. The faults a and b are suppressed during an adjustment.
Reaction:	The O2 measurement fault warning is generated
Cancellation:	a. If the alarm has been generated on the basis of criterion a or b, it is cancelled if neither of these fault conditions now applies b. If the alarm has been generated on the basis of criterion c, it can only be cancelled by a new adjustment.
Miscellaneous:	The displayed O2 concentration value is limited to the value range from 15 to 100 VOL%.

6.4 Monitoring the HPSVs

Alarm cause:	HPSV or HPSV control defective
Detection:	By means of a logical high level, the LP HPSV control signals a fault on the fault line F1.
Suppression:	None
Reaction:	a. Generation of the mixer fault warning b. If only one HPSV reports a fault, delivery of the inspiration flow is transferred completely to the intact HPSV. c. If both HPSVs report faults, the electric safety valve is opened.
Cancellation:	The fault line F1 is connected to logical low level.
Miscellaneous:	If, owing to the set concentration, the HPSV is to supply a small flow or no flow at all, the mixer fault message is issued instead of a warning. Message range: HPSV Air FiO2 0.97 - 1.00 HPSV O2 FiO2 0.21 - 0.24 In the future Version 1.11 of the software, the table will follow the HPSV faults.

6.5 Monitoring the expiration valve

Alarm cause:	a. Expiration valve defective b. PEEP valve cannot build up any closing pressure or not enough
Detection:	In more than 3 machine inspiration strokes, an expiration flow has been measured during the inspiration and in every inspiration stroke the integral of this expiration flow exceeded a value of 25% of the inspiratory tidal volume. In each case, the inspiratory tidal volume amounted to at least 12.5 mL.
Suppression:	None
Reaction:	Generation of the expiration valve fault warning
Cancellation:	The first machine inspiration stroke in which the leak through the expiration valve is less than 25% of the inspiratory tidal volume resets the alarm.

6.6 Monitoring the gas supply

6.6.1 No compressed air

Alarm cause:	a. Compressed air supply not connected or has broken down b. Absolute pressure sensor defective
Detection:	a. The value measured by the absolute pressure sensor of the compressed air supply system falls below the limit of 2.2 bar absolute for more than 500 ms. b. During a complete respiration cycle, the maximum of the value measured by the absolute pressure sensor was less than 3.5 bar absolute.
Suppression:	Device check
Reaction:	a. Generation of the no compressed air warning b. Changeover of the Evita gas supply to oxygen
Cancellation:	The value measured by the absolute pressure sensor is higher than 3.5 bar.
Miscellaneous:	If, owing to the set concentration, little or even no flow at all is extracted from the compressed air supply, the no compressed air message is issued instead of a warning. Message ranges HPSV Air FiO2 0.97 - 1.00 If the Evita 4 is performing a device check, the monitoring function is suppressed to be able to run the individual checks.

6.6.2 No oxygen

Alarm cause:	a. Oxygen supply not connected or has broken down b. Absolute pressure sensor defective
Detection:	a. The value measured by the absolute pressure sensor of the oxygen supply falls below the limit of 2.2 bar absolute for more than 500 ms. b. During a complete respiration cycle, the maximum of the value measured by the absolute pressure sensor was less than 3.5 bar absolute.
Suppression:	Device check
Reaction:	a. Generation of the no oxygen warning b. Changeover of the Evita gas supply to compressed air
Cancellation:	The value measured pressure sensor is higher than 3.5 bar.
Miscellaneous:	If, owing to the set concentration, little or even no flow at all is extracted from the compressed air supply, the no oxygen message is issued instead of a warning. Message ranges HPSV O2 FiO2 0.21 - 0.24 If the Evita 4 is performing a device check, the monitoring function is suppressed to be able to run the individual checks.

6.6.3 Pressure supply too high

Alarm cause:	a. Compressed air supply pressure too high b. Absolute pressure sensor defective
Detection:	a. During a complete respiration cycle, the maximum of the value measured by the absolute pressure sensor was higher than 7 bar absolute.
Suppression:	None
Reaction:	Generation of: Caution compressed air supply too high
Cancellation:	The value measured by the absolute pressure sensor is less than 7 bar.
Miscellaneous:	If, owing to the set concentration, little or even no flow at all is extracted from the compressed air supply, the compressed air supply too high message is issued instead of the caution. Message ranges HPSV Air FiO2 0.97 - 1.00

6.6.4 Oxygen supply too high

Alarm cause:	a. Oxygen supply pressure too high b. Absolute pressure sensor defective
Detection:	a. During a complete respiration cycle, the maximum of the value measured by the absolute pressure sensor was higher than 7 bar absolute.
Suppression:	None
Reaction:	Generation of: Caution oxygen supply too high
Cancellation:	The value measured by the absolute pressure sensor is less than 7 bar.
Miscellaneous:	If, owing to the set concentration, little or even no flow at all is extracted from the oxygen supply, the oxygen supply too high message is issued instead of the caution. Message ranges HPSV O2 FiO2 0.21 - 0.24

6.7 Monitoring CO2 measurement

6.7.1 CO2 measurement fault (sensor defective)

Alarm cause:	a. CO2 measuring head or module defective
:Detection:	The CO2 module sends an error message through the interface to the respiration processor.
Suppression:	a. CO2 module not installed b. Sensor not connected when commissioning the unit c. CO2 monitoring off
Reaction:	Generation of the CO2 measurement fault warning
Cancellation:	The CO2 module is no longer issuing an error message.

6.7.2 CO2 measurement fault (sensor disconnected)

Alarm cause:	a. CO2 measuring head electrically disconnected during operation
Detection:	The CO2 module sends an error message through the interface to the respiration processor.
Suppression:	a. Sensor not connected when commissioning the unit b. CO2 monitoring off
Reaction:	Generation of the CO2 sensor warning ?
Cancellation:	The CO2 module is no longer issuing an error message.
Miscellaneous:	The presence of the CO2 sensor is checked when the Evita is switched on. If no sensor is connected, neither CO2 monitoring nor monitoring of the sensor is realised. Monitoring is activated if the sensor is connected during the course of operation.

6.8 Monitoring the electronic circuitry fan

6.8.1 Fan fault

Alarm cause:	a. Fan defective b. Fan opening clogged
Detection:	The value measured by the interior temperature sensor exceeds the limit of 65 ×C for more than 5 s
Suppression:	None
Reaction:	Generation of the fan fault message
Cancellation:	The value measured by the sensor is below the 60 °C limit

6.8.2 Fan defective

Alarm cause:	a. Fan defective b. Fan opening clogged
Detection	The value measured by the interior temperature sensor exceeds the limit of 70 °C for more than 5 s
Suppression:	None
Reaction:	Generation of the fan fault message
Cancellation:	The value measured by the sensor is below the 65 ×C limit

6.9 Monitoring the connection to bilateral respiration

Alarm cause:	a. Connecting cable of the 2 Evita 4 units to bilateral respiration defective b. Interface defective c. Evita off
Detection:	For 15 s, no more information relating to inspirations, expirations or respiratory rates reaches the Evita units through the connecting cable of the 2 Evita units.
Suppression:	Monitoring is only active in the bilateral respiration mode.
Reaction:	a. Generation of the device coupling fault warning (Evita: synchronous fault) b. If the unit detecting the fault is the slave, this unit assumes respiration with the set parameters of the IPPV mode.
Cancellation:	Via the connecting cable, the above-mentioned information is cyclically received again for 15 s.

6.10 Monitoring the ASB stroke

Alarm cause:	a. Leakage in the tube system b. Expiration valve leaking c. Pressure sensor defective
Detection:	No reduction in the inspiration flow is detected for more than four hours after the final value of the ASB ramp is reached in pressure-assisted spontaneous respiration mode. (Reduction in the inspiration flow: the inspiration flow becomes less than 25% of the maximum inspiration flow of this pressure-assisted cycle).
Suppression:	This monitoring mode is only active within the scope of pressure-assisted spontaneous respiration.
Reaction:	a. Pressure assistance is aborted immediately b. The ASB stroke longer than 4 s warning is generated after pressure assistance has been aborted 3 times in succession.
Cancellation:	The inspiration flow decreases within 4 s during pressure assistance.

6.11 Monitoring PEEP

Alarm cause:	a. PEEP valve defective b. Expiration valve defective
Detection:	a. The measured final expiratory airway pressure deviates from the set PEEP by more than - 5 mbar in more than ten successive respiratory strokes.
Suppression:	None
Reaction:	Generation of the PEEP valve fault warning
Cancellation:	The measured PEEP lies within the range from the set PEEP to the set PEEP - 5 mbar.

6.12 Monitoring the expiration resistance (PEEP high)

Alarm cause:	a. Bacteria filter fault b. Expiration tube partly kinked c. PEEP valve defective d. Expiration valve defective
Detection:	a. A time counter is decremented if the measured airway pressure does not fall below the PEEP + threshold during an expiration. A fault is reported if the counter does not reach the value 0. b. The measured final expiratory airway pressure deviates from the set PEEP by more than+5 mbar during more than ten successive respiratory strokes and there was no expiration flow at the time of PEEP measurement.
Suppression:	None
Reaction:	a. Generation of the PEEP high warning b. Opening of the electric safety valve
Cancellation:	a. The time counter is reset when the measured airway pressure drops below the PEEP + threshold limit. b. The measured PEEP lies within the range from the set PEEP to the set PEEP +5 mbar.
Note:	The threshold depends on the chosen application (adults/children). Adult : threshold = 8 mbar Children: threshold = 4,5 mbar

6.13 Monitoring the respiratory gas temperature sensor

6.13.1 Temperature measurement fault (sensor defective)

Alarm cause:	The measured respiratory gas temperature sensor value is so low that a short-circuit in the sensor or in the sensor cable has to be assumed.
Detection:	The measured respiratory gas temperature sensor value is below limit of the A/D converter's reference voltage for more than 1 s.
Suppression:	Detection is only active if a respiratory gas temperature sensor has been detected as having been plugged in.
Reacton:	a. Generation of the temperature sensor fault warning b. Dashes are shown (Inop) instead of the measured value
Cancellation:	The value measured by the respiratory gas temperature sensor is below the limit.

6.13.2 Temperature measurement fault (sensor disconnected)

Alarm cause:	The measured respiratory gas temperature sensor value is so high that a breakage of the sensor cable or removal of the sensor has to be assumed.
Detection:	The measured respiratory gas temperature sensor value exceeds the 95% limit of the A/D converter's reference voltage for more than 1 s.
Suppression:	Detection is only active if a respiratory gas temperature sensor has been detected as having been plugged in.
Reaktion:	a. Generation of the temperature sensor warning ? b. Dashes are shown (Inop) instead of the measured value. c. An information text in the auxiliary line draws attention to the possible cause of the fault, i.e. disconnection of the sensor.
Cancellation:	The value measured by the respiratory gas temperature sensor is below the limit.
Miscellaneous:	After activation of the Evita, the temperature sensor is presumed as not being plugged in. If in the actual value is detected as falling below the above-mentioned limit during activation (self-test) or during normal operation, both monitoring of the inspiratory gas temperature and also monitoring of the temperature sensor is activated.

6.14 Monitoring the pneumatic fan

Alarm cause:	a. Fan defective or not connected
Detection:	a. The controller current of the fan is measured with an A/D converter via a measuring resistor. During normal operation, this fan current mast exhibit fluctuation of more than 50 mV. The minimum and maximum of this fan voltage are each measured for the duration of 60 s. A malfunction has occurred if the maximum/minimum difference is less than 50 mV. b. The measured fan voltage is less than 0 V (discontinuity) c. The measured fan voltage is higher than or equal to 2.9 V (short-circuit)
Suppression:	None
Reaction:	Generation of the device fault warning xx.xxx.xxx
Cancellation:	a. The difference is again higher than 50 mV. b. The measured fan voltage is again between 0 and 3.3 V.

6.15 Monitoring the ambient pressure sensor

Alarm cause:	a. Absolute pressure sensor defective
Detection:	a. The value measured by the absolute pressure sensor is outside of the valid value range. Value range: 600 to 1100 mbar
Suppression:	None
Reaction:	Generation of the absolute pressure sensor fault warning
Cancellation:	a. The measured value again lies within the valid value range, with the result that it has been possible to decrement the fault counter.

6.16 Monitoring SpO2 measurement

6.16.1 SpO2 measurement fault (sensor defective)

Alarm cause:	a. SpO2 sensor or module defective
Detection:	The SpO2 sends an error message to the respiration processor via the interface.
Suppression:	a. SpO2 module pc board not installed b. Sensor not connected when commissioning the unit c. SpO2 monitoring off
Reaction:	Generation of the SpO2 measurement fault warning
Cancellation:	The SpO2 module no longer reports a fault condition

6.16.2 SpO2 measurement fault (sensor disconnected)

Alarm cause:	a. SpO2 measuring head electrically disconnected during operation
Detection:	The SpO2 sends an error message to the respiration processor via the interface.
Suppression:	a. Sensor not connected when commissioning the unit b. SpO2 monitoring off
Reaction:	Generation of the SpO2 measurement fault warning
Cancellation:	The SpO2 module no longer reports a fault condition
Miscellaneous:	The presence of the SpO2 sensor is checked during activation of the Evita 4. If no sensor is connected, no SpO2 monitoring and no monitoring of the sensor is realised. Monitoring is activated if the sensor is connected during ongoing operation.

7 Hardware monitoring

7.1 Monitoring the watchdogs

As a safety facility, the watchdogs must be tested because important safety aspects are transmitted to the watchdogs of the individual processors. This test is only run in the event of a cold start of the unit.

During a cold start, functioning of each watchdog is tested once. To do this, the watchdog is not triggered in the test sequence and the unit waits for the occurrence of a reset for a maximum time.

If the reset occurs within the maximum time, the watchdog is OK. Otherwise, the watchdog is defective.

Owing to the structure of the watchdog, the reset source can be detected after the reset. Thus, this is only evaluated if the reset has been triggered by the watchdog and not by further reset sources.

Audible alarming is active during watchdog reset (the piezo is coupled by hardware to the reset line).

7.2 Monitoring data retention on the CPU 68332 pc board

7.2.1 Monitoring the battery-buffered RAMs

The main processor of the Evita features battery buffering of the entire RAM area. This guarantees retention of data that requires protection (referred to as back-up data, e.g. mode parameters, calibration data, log book and trends) in the event of deactivation or failure of the power supply. This retention of data may be destroyed by the following conditions:
a. The battery voltage is inadequate for buffering the data
b. Writing into a memory cell has been interrupted by a reset
c. An alpha particle has altered the contents of a memory cell.

Therefore, before using this data any further, a check must be made as to whether the retained data has been destroyed. If such destruction of data is detected, wherever possible the data should be restored. Only if restoration is no longer possible by justifiable effort is the data assigned defaults from the ROM. In this case, the unit issues a data loss warning, which it cancels again automatically after 10 s.

7.2.2 Monitoring the EEPROM

The main processor of the Evita features an electrically erasable programmable read-only memory. All configuration data of the Evita 4 is stored in this memory. Even after a complete loss of all stored data in the battery-buffered RAM, Evita 4 still contains the user settings. Apart from being destroyed by a component defect, data retained in the EEPROM may also be destroyed by a reset while data is being written into it. Therefore, before using this data any further, a check must be made as to whether the retained data has been destroyed. If such destruction of data is detected, wherever possible the data should be restored. Only if restoration is no longer possible by justifiable effort is the data assigned defaults from the ROM. In this case, the unit issues a data loss warning, which it cancels again automatically after 10 s.

7.3 Monitoring the RAM

All RAM areas of all processors are subjected to a RAM test.

This RAM test is run through completely in one go after a cold start to be able to detect any possible error source within the scope of the self-test.

7.4 Monitoring the ROM

All ROM areas of all processors are subjected to a ROM test. This RAM test is run through completely in one go after a Power On to be able to detect any possible error source within the scope of the self-test. This ROM test is also run cyclically during execution of the program and, in doing so, the cells to be tested in each program cycle are adapted to the run times.

7.5 Monitoring the I/Os

These components are tested within the scope of execution of the program and not directly after Power On.

7.5.1 Monitoring the air/O2 changeover valve

Monitoring during the hardware check. During the hardware check, functioning of the air/O2 changeover valve is checked by one of the test points. If a malfunction is detected during this test, a changeover valve fault warning is issued. This warning can only be eliminated by repeating the check or by switching off/on.

Monitoring during operation During nebulisation of a medicine, an incorrect setting of the changeover valve may result in an incorrect value of the applied FiO2. During nebulisation, the required setting of the air/O2 changeover valve is therefore continuously compared against the fed-back signal of the electronic control circuitry. A hardware fault message is issued if the required setting and the fed-back signal do not agree.

7.5.2 Monitoring the nebuliser valve

The required setting of the nebuliser valve is compared continuously against the fed-back signal of the electronic control circuitry. A hardware fault message is issued if the required setting and the fed-back signal do not agree.

7.5.3 Monitoring the safety valve

Monitoring during the hardware check. During the hardware check, functioning of the safetyvalve is checked by one of the test points. If a malfunction is detected during this test, a safety valve fault warning is issued. This warning can only be eliminated by repeating the check or by switching off/on.

7.6 Monitoring the power-on test

The maximum times of the power-on test were taken into account when designing the behaviour of the system with regard to communication between the single components.

7.7 Monitoring of 5 V monitoring

Directly after activation of the unit (cold start), the 5 V monitoring unit of the CPU 68332 pc board is checked with regard to its undervoltage and overvoltage functions. Too low or too high a supply voltage is simulated with the aid of test lines of the 5 V monitoring unit. The incorrect voltage must trigger a hardware reset. A hardware fault is reported if reset is not triggered.

7.8 Monitoring the reset lines

Once after activation of the unit (cold start), the CPU -> pneumatic, pneumatic -> CPU and the CPU -> display reset lines are tested by activation of a hardware reset. As the result of resetting of the other processor, the respective processor must detect an interruption in communication, for example. A hardware fault is reported if reset is not triggered.

7.9 Monitoring the A/D converters

The supply voltages of the pressure sensors are monitored in order to check the A/D converters. The +10 V reference voltage for the pressure sensors is generated from the +15 V operating voltage. Both these voltages are applied to inputs of the A/D converter on the CO2 carrier pc board. A hardware malfunction is assumed if the voltages drop below the rated voltages by more than 1 V.

7.10 Monitoring the operating voltages

The operating voltages accessible via an A/D converter are compared cyclically with the defined tolerances of +/- 20%. A hardware malfunction is reported if these tolerances are exceeded for more than 5 s.

7.11 Monitoring the gold cap voltage

In the event of a power failure, the gold cap supplies a voltage to the piezo alarm tone generator, thus issuing a pas failure alarm. The duration of this power failure alarm depends on the capacitance of the gold cap and, therefore, both functioning and also the capacitance are subjected to a test every hour, for the first time five minutes after activation of the unit.

A hardware malfunction is reported if one of the following criteria is fulfilled:

a. The final charge voltage is too high (>= 11 V)	Voltage regulator defective
b. The final charge voltage is too low (< 8 V)	Charging circuit defective
c. The reference voltage is too high (>= 6.3 V)	Discharge switch defective
d. The reference voltage is too low (< 4.5 V)	no gold cap
e. Voltage of the gold cap has dropped by more than 10 % of the reference voltage within 4 s	Gold cap capacitance too low

The test of the gold cap is aborted if it is interrupted by piezo alarming (e.g. lamp test or alarm of the safety software). The test is repeated after a recharging time of ten minutes.

7.12 Monitoring the rechargeable battery voltage

7.12.1 Monitoring the rechargeable battery

If the system detects an optional internal rechargeable battery (in the DC/DC module of the power supply unit), the voltage of this rechargeable battery is compared against the defined limits. The procedure is the same in the event of a further external rechargeable battery. In both cases, an alarm is issued if the defined limits are exceeded.

Limits:	< 10.8 V	Wrong battery polarity
	> 30 V	Wrong rechargeable battery

7.12.2 Monitoring the rechargeable battery voltage

When using the optional DC/DC module, Evita can be operated from 3 voltage sources, which are assigned the following priorities:
1. Mains voltage
2. External rechargeable battery
3. Internal rechargeable battery

Therefore, in the event of a power failure Evita first switches to the external rechargeable battery. If the voltage is inadequate, the DC/DC module then switches to the internal battery. On the basis of a status signal, Evita is able to recognise whether the internal battery is fully charged. As soon as Evita has switched to the internal battery, the rechargeable battery is no longer fully charged. The guaranteed operating time of seven min is monitored by a timer and is indicated to the user by different alarms.

Monitoring the rechargeable battery voltage

State of rechargeable battery	Timer	Alarm
full	10 min	none
not full	< 10 min	Message: internal battery activated
not full	< 2 min	Caution: battery now only 2 min
not full	0 min	Warning: battery not full

If the unit switches back to mains operation after activation of the internal battery, the timer is incremented, but clearly more slowly than during discharging.

7.13 Inop monitoring of the loudspeaker

The loudspeaker's control signal is tapped via a dropping resistor and is made available to the system as digital information. A nominal/actual value comparison of loudspeaker control is possible on the basis of this signal. A hardware malfunction is reported if a fault is detected within the scope of this novel/actual value comparison.

7.14 Monitoring the internal interfaces

During their use, the internal interfaces (CAN, RS232) are checked in relation to operability. A hardware malfunction is reported in the event of a fault.

7.15 Monitoring the piezo alarm tone generator

Besides alarming a power failure, the purpose of the piezo alarm tone generator is to warn of a CPU defect (standstill) instead of a loudspeaker. To guarantee this, the piezo is controlled by the TPU. If cyclic clocking fails, the resulting muting of the piezo is cancelled and a continuous beep sounds. To test the piezo, muting is consciously cancelled. The current through the piezo, which now rises as the result of cancelled muting, can be measured as a voltage drop through a dropping resistor by the A/D converter. The test is repeated every hour.

8 User-prompted hardware check

8.1 Selecting the hardware check

A user-prompted hardware check is only provided in standby mode.

When Evita is in standby mode, the user is offered a hardware check softkey on the main standby page. When this softkey is pressed, the user is shown the result of the last hardware check, along with the date of the check, on the next on-screen page. The results of the check consist of data worthy of protection which is retained even beyond a cold start. (If the check has been run after preparation of the unit, it is possible that Evita will not be switched off until it is used. Nevertheless, it should still be possible to retrieve the result of the hardware check when using the unit.)

A Check softkey is displayed on this on-screen page to start the hardware check.

8.2 Total check

When this check is selected, a complete hardware check is run, involving the following:

- visual check of the patient section
- visual check of the flow sensor
- visual check of the thermometer (optional)
- visual check of tube layout
- visual check of the CO2 sensor (optional)
- visual check of the paediatric flow sensor (optional)
- visual check of the humidifier
- check of the piezo alarm tone generator
- check of the air/O2 changeover valve
- check of the electric safety valve
- adjustment of the flow sensor
- adjustment of the O2 sensor
- adjustment of the CO2 sensor (optional)
- adjustment of the paediatric flow sensor (optional)
- check of the tube system for leaks and determination of compliance

8.3 Sequence of the check

The hardware check runs automatically, but permanently provides the user with information about the currently running test, involving the user in the sequence of the check with prompts that have to be answered by a Yes or No answer. The check can be interrupted at any time by prematurely pressing the Check softkey. It is not possible to press any of the hard keys while a check is running.

8.4 Defects in the hardware check

At the end of the check, the unit lists the scope of the check on an on-screen page along with the results of the check in the form of a checklist containing OK/not OK entries. The user is offered an additional softkey:

- Repeat check: the selected check is repeated.

If the check has been aborted by pressing the Check softkey again, the results of the tests that have not been run are set to the 'Unknown' status.

Identification of test results:

Test OK	n
Test not OK	F
Test not run	–

8.4.1 Repeating the check

If you select a repeated check owing to a defective test result, merely those test points are repeated that were ascertained during the previous check as being defective or which were not run. Only the leakage check of the tube system is run through again each time the check is repeated because user activities within the scope of the other test points call for a re-evaluation.

All test points are run again if the check is repeated from the main standby page.

8.5 Test points of the checklist

1. Visual checks
2. Safety checks
3. Adjustments
4. Leakage check

8.5.1 Visual checks

The user is prompted to check correct seating and latching of the patient system, of the flow sensor, of the AWT sensor, of the CO2 sensor with cuvette and the level and operability of the humidifier. The completeness and correct seating of the tube system and the waterfalls are also checked.

8.5.2 Safety checks

Piezo alarm tone generator:

The user is prompted to specify whether an audible signal of the piezo alarm tone generator can be heard.

Air/O2 changeover valve:

An automatic check of this changeover valve is only possible during the hardware check. A test lung is filled up to reference pressure and the supplied gases must then be deactivated individually.

The test sequence is as follows:

1. The user is prompted to supply the unit with compressed air only.
2. The compressed air supply is checked with the aid of the HPSV's absolute pressure sensor and the HPSV error line F1.
3. The user is prompted to collect a test lung.
4. The unit applies a continuous flow of 30 L/min
5. The test run is filled to a reference pressure of 30 mbar, expiratory measurement.
6. The flow delivery is discontinued when the reference pressure is reached.
7. The air/O2 changeover valve is set to O2.
8. The pressure in the lung must dissipate within a defined time as otherwise the changeover valve is defective.

The user is prompted to fill the unit with oxygen if no pressure can be built up in the test run despite a continuous delivery of flow. The air/O2 changeover valve is defective if pressure now builds up. The electric safety valve is defective if still no pressure is built up.

Electric safety valve

The test sequence is as follows:

1. Connect a test lung.
2. Connect compressed air only.
3. The test lung is filled to 30 mbar by means of a continuous flow (30 L/min).
4. The pneumatic system generates relief, which is monitored with the pressure sensors.
5. Measure the input pressure of the oxygen line.
6. Connect oxygen only.
7. The test lung is filled to 30 mbar by means of a continuous flow (30 L/min).
8. The CPU generates relief, which is monitored with the pressure sensors.
9. Measure the input pressure of the pneumatic line.

A hardware malfunction is generated if the required relief is not detected.

The input pressures of the pressureless supply lines measured during the test serve as a reference for the absolute pressure sensor.

8.5.3 Calibrations

The calibrations of the sensors could basically be combined in one single adjustment because the mechanisms underlying these assessments are very similar. However, both the CO2 and the paediatric flow sensors are options and therefore they do not have to be installed.

8.5.4 Leakage test

Tube system:

The user is prompted to keep the Y-piece of the tube system tight before continuing the test. During the course of the test, a pressure of 60 mbar is built up in the tube system by the application of inspiration flow while the expiration valve is closed. The flow needed to maintain this pressure is determined.

The compliance of the tube system, which can be calculated on the basis of the volume needed to build up a pressure of 60 mbar, is a by-product of this leakage test.

Airway pressure sensors:

The check of the airway pressure sensors and the valves for adjustment can be carried out at the same time as the leakage test. The pressure drop waiting time of 10 s can be used as the period of time for this check. During this time, the sequence of the test is as follows:

1. Once the filling pressure has been reached, wait for one s for the system to stabilise
2. Compare the measured values of both airway pressure sensors
3. Switch the adjustment valve of the inspiratory airway pressure sensor and check the value measured by the sensor
4. Reset the adjustment valve of the inspiratory sensor
5. Switch the adjustment valve of the expiratory sensor and check the value measured by the sensor
6. Reset the adjustment valve of the expiratory sensor
7. Compare the values measured by both pressure sensors

9 External DS mode via PC as of Software 1.05

9.1 Usage and system prerequisites

9.1.1 Usage

External DS mode via PC permits readout of all important parameters (e.g. sensors, voltages, errors or software status), activation of all actuators (e.g. mixer, valves or LEDs) and the implementation of test routines. When doing so, the Evita does not function with the normal operating software, but rather without ventilation employing a special service software. This special status is displayed on the Evita screen. When employing the PC DS mode, actuator activation is not subject to the restrictions which always apply for safety reasons in the case of an internal service mode.

9.1.2 System prerequisites

Usage involves compliance with the following hardware and software prerequisites:

RS232 extension (9-pin Sub D socket on 9-pin Sub D connector; length = 3 m, with service coding)	79 01 808
RS232 adapter RxD and TxD transposed (9-pin Sub D socket on 9-pin Sub D connector; length = 0.15 m, with service coding)	79 01 888

Service PC with Windows 95 or NT

- In the future, new versions of the service software will not run under DOS or Windows 3.n. However, these restrictions do not apply to version 8.n yet.
- Windows 95 requires at least version 8.n of service software 79 01 831.
- If Windows NT is used, it is necessary to disable the screensaver, otherwise the software in the medical device could be damaged while downloading.
- If Windows NT is used, it is necessary to create a DOS partition on the PC (a second operating system). At present, this is only required for BD32.
- The service software for BD32 does not function on IBM laptops.

Service Software

- For Windows 3.n, 95, and NT. — 79 01 831

9.1.3 Start-up of DS mode via PC without modem

- Switch on Evita.
- Set loudspeaker volume to minimum.
- Activate all monitoring parameters (O2, flow, SpO2 and CO2) where fitted or possible.Perform calibration for O2 and flow sensor. Calibration data are adopted for PC service mode. Calibration is however also possible in PC service mode.
- Switch off Evita.
- Important: PC DS service mode also functions in full without control panel.
- Connect Evita (COM1) and PC (COM1 or COM2) using RS 232 extension and RS 232 adapter. Important: This link is not to be interrupted.
- Switch on PC.
- Start PC program under C: by entering “Service” and pressing “Enter” key.
- Use cursor keys to select “Meditest Evita ” and press “Enter” key.
- Use cursor keys to select program “Evita 4 service mode” and press “Enter” key twice.
- Switch on Evita following display of user menu. Evita starts with self-test. “Dräger service mode” is then displayed on the Evita once the control panel has been connected. The display “Remote to Evita ” appears on the PC at the bottom of the screen. Service mode is active as of this point.

  Important: If service mode does not function without control panel, check whether there is a jumper on the Pneumatic Controller PCB at X24 between 1 and 2. This terminates the internal CAN bus with a resistance of 121 ohms. The first units did not feature this jumper. It can remain in the unit.
- Service mode is terminated by switching off the Evita and interrupting the link at COM1 of the Evita. Exit from the PC program via the menu.

9.1.4 Start-up of DS mode via PC with modem

A suitable modem enables the Evita to be switched to external DS mode and all the described commands executed.

9.2 Checking “Status” of Evita (e.g. Software Version and Error List)

These tests enable the following data to be read out and processed:

- Baud rate alteration
- Readout of Evita software version
- Logbook (user logbook) readout, storage and erasure
- Error list readout, storage and erasure and readout of length of time since error list last erased
- Readout of identification and released options
- Readout of Evita operating hours
- Readout of PCBs connected to internal CAN

9.2.1 Baud rate alteration

This command enables the baud rate which is normally 9600bd to be changed. The command has not yet been implemented in the PC software.

9.2.2 Readout of Evita software version

The output takes the form of a 4-position display. For example, the software version 2.00 is output as “0200”. Important: All software versions on the PCBs must be identical.

9.2.3 Logbook readout, storage and erasure

The user logbook to which users have access during operation is processed. Erasure is only permissible if the user no longer requires the data. It is also possible to store data, for example with a view to producing statistics.

Read out Logbook:	Entries with error number (which are not displayed during operation), date, time and plain language message are output.
Logbook storage:	This is a subroutine of “Logbook readout”. The data can be copied, for example, directly onto the floppy disk drive a:. To do so, enter: a:\file name.txt Important: Always enter apparatus data such as serial number, software version, operating hours and other remarks under Comments.
Logbook erasure:	All entries are erased (identical with code entry 1 3 9 9 + 1 3 1 1).

9.2.4 Error list

This permits processing of the error list.

Error list readout:	The error number, first occurrence, last occurrence and error frequency are output.
Operating-hour error list:	The error-list operating hours since last erasure are output. This information is extremely important for error statistics.
Error list storage:	This is a subroutine of “Error list readout” The data can be copied, for example, directly onto the floppy disk drive a:. To do so, enter: a:\file name.txt Important: Always enter apparatus data such as serial number, software version, error-list operating hours, Evita operating hours and other remarks under Comments.
Error list erasure:	All entries are erased (identical with code entry 1 3 9 9 + 1 3 2 2).

9.2.5 Readout of identification and released options

ID readout:	Readout of Evita identification number stored in EEPROM D22 on CPU 68332 PCB. This number is awarded by way of a random generator when the time is first set on an Evita with new EEPROM D22. This number is unique and is required to release software options.
Option list readout:	The released options are output in the following form: “1”_(Option 0 - 7)_(Option 8 - 15)_(Option 16 - 23)_(Option 24 - 31) Significance: “1” = Block 1 with 32 options (1 = Option fitted, 0 = Option not fitted) The following options are currently envisaged in block 1: Option 0 = Communication PCB (Evita 2 dura only) Option 1 = Pediatric Flow PCB (Evita 2 dura only) Option 5 = Ventilation Plus (Evita 2 dura only) Option 7 = SpO2 measurement Option 8 = CO2 measurement Option 9 = DC power pack Option 10 = Comfort Breath (Ventilation mode PPS and tube compensation) (Evita 4 only) Option 11 = Monitoring Plus (Evita 2 dura only) Option 12 = Service Plus (Evita 2 dura only)

Option release:	This menu can be used to release software options with a 10-position code. The code number is governed by the ID number of the Evita. Checking is performed after entering the number. If check is positive, software option is ready for use next time the unit is switched on. Important: Hardware options (e.g. SpO2, DC, CO2) are released under “Configuration” -> “Basic setting” -> “Service diagnosis” with a 4-position code (Refer to section of "Repair Instructions - Service No./ Modi, Error list" chapter 1, Service and Access Codes/Release Option, page 1.).
Option erasure:	Not to be used

9.2.6 Readout of elapsed-time meter

Evita elapsed-time meter which is output during operation. The value is stored in the EEPROM D22 on the CPU 68332 PCB.

9.2.7 Internal CAN communication

Output of PCBs connected to internal CAN at CPU 68332 PCB (0 = not fitted, 1 = fitted). Sequence is as follows from left to right: Graphics Controller PCB/Pneumatic Controller PCB/Communication PCB/5x undefined

9.3 Testing “Pneumatics” section

9.3.1 Valve switching

Actuation of switching valves in pneumatics section. Actuation is performed by Pneumatic Controller PCB. For the valves Y1.1 and Y1.4 the actuation voltage is read back and output in the second value. Actuation and checkback must be identical.

Off = Valve deenergised
On = Valve actuated

Basic setting:	All valves, mixer and PEEP/PIP valve off
Y1.1	O2/air switching valve, off = air
Y1.2	O2 measurement calibration valve, on = O2 measurement calibration
Y1.3	Safety valve, on = ventilation; off = safety shutdown active
Y6.1	Calibration valve for inspiration pressure sensor S6.1, on = calibration
Y6.2	Calibration valve for expiration pressure sensor S6.2, on = calibration
Y1.4	Nebuliser valve, off = nebuliser off
X35 - X38	Future option; a total of 10 valves can be connected to the Pneumatic Controller PCB. X35 - X38 designate the connections for the valves on the Pneumatic Controller PCB.

The voltages at the actuation transistors can be measured on the Pneumatic Controller PCB (refer to section of "Repair Instructions - Electronic Components" Chapter 16, Pneumatics Controller PCB, page 76 under Pneumatic Controller PCB configuration). Measurement is made in each case between X21/2 (AGND) and the ICs D17 and D18 with the actuation transistors. The valves must be connected when performing measurement. A measured voltage of approx. 24 V signifies that the valve is off, whereas approx. 0 V indicates that the valve is on.

Y1.1	O2/air switching valve	D17 / 4 (X30)
Y1.2	O2 measurement calibration valve	D18 / 5 (X39)
Y1.3	Safety valve	D17 / 6 (X32)
Y6.1	Calibration valve for inspiration pressure sensor S6.1	D17 / 7 (X33)
Y6.2	Calibration valve for expiration pressure sensor S6.2	D17 / 14 (X34)
Y1.4	Nebuliser valve	D17 / 5 (X31)
X35	Future option	D17 / 15 (X35)
X36	Future option	D17 / 16 (X36)
X37	Future option	D17 / 17 (X37)
X38	Future option	D18 / 4 (X38)

9.3.2 Mixer

Basic setting:	All valves, mixer and PEEP/PIP valve off
Flow/O2 input:	Setting of volume and O2 concentration attained with adjustable flow
Volume/O2 input:	Setting of constant flow with adjustable O2 concentration
HPSV mixer:	Zeroing of HPSV cartridges

9.3.3 Setpoint input for PEEP valve

In practice it is possible to have a set value between 0 and 120 mbar, as the measuring range of the airway pressure sensors is restricted to 140 mbar. The set pressure is the pressure resulting in the tubing system (= closing pressure in expiration valve) and not the pressure at the outlet of the PEEP/PIP valve.

The current through the PEEP/PIP valve can be measured as voltage by way of a shunt resistor on the Pneumatic Controller PCB between X15/1 (AGND) and X15/2 (1 mV measured = 1 mA). A current of 500 mA corresponds to a PEEP/PIP valve outlet pressure of roughly 120 mbar, refer to "Repair Instructions - Pneumatic Components chapter 3.2, Testing and Calibrating the PEEP/PIP Valve, page 8

Attention: The resultant pressure in the tubing system in the no-flow state is lower than the set value. As starting value for ventilation, the ventilation software adds 2 mbar in each case to the desired pressure value.

Guide values for a calibrated PEEP/PIP valve:

Setting = resultant pressure in tubing system	Pressure at outlet of PEEP/PIP valve
0 mbar	3 mbar
35 mbar	34 mbar

9.3.4 Sensors

Pressure measurement:

The measured values in mbar/bar and the voltages prior to AD conversion are output.

a) Air and O2 supply pressure sensor:

The absolute pressures for air and O2 are output, as are the halved sensor voltages. Absolute pressure = rel. supply pressure + ambient pressure. The supply pressure sensor is located at the respective HPSV cartridge. These displayed supply pressures are read in on the Pneumatic Controller PCB. For valve regulation, the respective supply pressure is read in on the corresponding HPSV Controller PCB. Should mixer problems be encountered, refer to "Repair Instructions - Pneumatic Components chapter 4, HPS Valve, page 13

Pressure:	Pressure in bar absolute
Voltage:	Halved output voltage of sensor read in by Pneumatic Controller PCB. Specification of supply pressure sensors: Measuring range of supply pressure sensors = 0 to 7 bar absolute Sensitivity = 1.58 V/bar +/- 8 mV/bar Offset voltage = 300 mV +/- 30 mV

The output voltages of the pressure sensors PAIR and PO2 can be measured on the Pneumatic Controller PCB at the plug connector X19. The measured voltages correspond to the output voltages of the sensors. The voltage displayed in DS mode is lower by a factor of 2.

X19 / 4	AGND
X19 / 5	PAIR-supply pressure sensor
X19 / 6	PO2-supply pressure sensor

b) Pinsp, Pexp, Poesph and Paux pressure sensors

Output of measured values from the 4 zeroed airway pressure sensors insp, exp, oesph and aux (oes and aux are envisaged for future options). The sensors are read in on the Pneumatic Controller PCB. If a lengthy period has elapsed following calibration of the sensors in operation, this can be performed in the calibration menu (section 9.3.6 on page 129). 2 values are output for each sensor.

Pressure:	Pressure in mbar of calibrated sensor

Voltage:	Output voltage of sensor; read in by Pneumatic Controller PCB Specification of pressure sensors: Measuring range = 140 mbar Voltage = calibration voltage + sensitivity Sensitivity = 36.5 +/- 0.3 mV/mbar

Important: The sensors are calibrated under “Pneumatics” -> “Calibration”. The calibration voltage of the sensors (zero at ambient pressure) must comply with a set value of 1.74 +/- 0.50 V as otherwise the alarm “Pressure measurement fault” will be given in operation.

The output voltages of the pressure sensors Pinsp, Pexp, Poesph and Paux can be measured on the Pneumatic Controller PCB at the plug connector X17. The measured voltages correspond to the output voltages of the sensors.

X17 / 1	Poeso pressure sensor
X17 / 2	Exspirations pressure sensor
X17 / 3	Inspiarations pressure sensor
X17 / 4	Paux pressure sensor
X17 / 5	AGND

Flow measurement:	Expiratory flow measurement values. The sensor is read in on the Pneumatic Controller PCB. If a lengthy period has elapsed since calibration of the flow measurement during operation, this can be implemented in the calibration menu (section 9.3.6 on page 129). Note: All values are displayed under BTPS conditions. BTPS: Based on 37 °C, ambient pressure + insp. pressure, 100 % relative humidity. All Evita measured values and settings are based on BTPS.

Flow signal Fsig:	Measured expiratory flow in L/min. Converted to BTPS; corresponds to display value

	Voltage:	Flow measurement voltages in V Uinop: Voltage set value -> 0.1 V, sensor probably OK if F0 and Fsig OK. “Flow measurement fault” is displayed if voltage -> 0.1 V. F0: Flow-measurement bridge voltage with 4-fold amplification. Set value in calibrated and no-flow condition = 4.04 V Fsig: Flow-measurement bridge voltage with 2-fold amplification. Set value in calibrated and no-flow condition = 2.02 V These voltages can be measured on the Pneumatic Controller PCB at the plug connector X19. X19 / 7 AGND X19 / 8 Fsig X19 / 9 F0 X19 / 10 Finop
	Microswitch::	Microswitch for detecting position of flow sensor On - Flow sensor in right-hand operating position Off - Flow sensor not ready for operation in replacement position
O2 measurement:	Inspiratory O2 measurement values. The output voltage of the O2 sensor is amplified directly at the sensor and read in on the Pneumatic Controller PCB.	
	O2 concentration:	Measured O2 concentration with pressure compensation Display range: 0 - 100 % by vol. Important: Measured values between 101 and 106 % by vol. are fixed on “100” in the display. Values as of 107 % by vol. are again displayed. Display values of more than 100 % by vol. are possible if the pressure at the O2 sensor is greater than the pressure measured by the airway pressure measurement. This is possible for a brief period following completion of O2 calibration. “O2 measurement fault” is displayed if values exceed 106 % by vol.

Channel 1/2 voltage:	Amplified sensor voltage at Pneumatic Controller PCB input. This voltage is read in with two AD channels on this PCB and subjected to comparison. A difference of 17 LSB or 25 mV between the values is permitted. If the difference is greater than the figure indicated above, the AD converter on the Pneumatic Controller PCB is defective.

Important: Amplified sensor voltage in operation and on calibration with 100 vol. O2

Permissible range: 1.257 to 5.644 V

Voltage too low: End of sensor service life

Spannung zu groß:O2-Messung defekt (O2-Verstärker oder LP Pneumatic-Controller).

These voltages from the O2 amplifier and the two supply voltages for the O2 amplifier can be measured on the Pneumatic Controller PCB at plug connector X19.

X19 / 1	amplified O2 sensor voltage from O2 amplifier; corresponds to displayed channel 1/channel 2 voltage
X19 / 2	-15V supply voltage for O2 amplifier
X19 / 3	+15V supply voltage for O2 amplifier
X19 / 4	AGND.

9.3.5 Voltages

Operating voltages:

Output of reference voltages of Pneumatic Controller PCB. The voltages are generated on this PCB and also read in. Error message is given in the event of deviation.

Set values:

Uref5V	= 4.9V to 5.1V
ADCref	= 2.9V to 3.1V
DACref	= 2.9V to 3.1V

The Uref5V voltage can be measured as double voltage (+10 V A) on the Pneumatic Controller PCB at the plug connector X3. All other analog supply voltages are also applied to this plug connector.

X3 / 1	+ 5 V - A
X3 / 2	- 5 V - A
X3 / 3	- 15 V - A
X3 / 4	+ 15 V - C
X3 / 5	+ 15 V - A
X3 / 6	+ 10 V - A
X3 / 7	AGND

Further supply voltages can be measured on the Pneumatic Controller PCB at plug connectors X11 and X21.

X21 / 1	+ 24 V - A
X21 / 2	AGND

X11 / 1	DGND
X11 / 2	not used
X11 / 3	+ 5 V

Fan voltage:

The current through the fan at the bottom right of the pneumatics section is monitored on the Pneumatic Controller PCB. In normal operation, this voltage must be subject to fluctuations of more than 50 mV. The minimum and maximum values for this voltage are each measured for 60 seconds. If the difference is < 50 mV, it is assumed that the fan is not operating.

Fan not connected = 0.0V

Fan short circuit ≥ 2.9V

DAC flow measurement:	Input of decimal DA converter value for calibration of flow sensor on Pneumatic Controller PCB. Set value = 2200 to 3200 This value range must make it possible to set the flow-measurement sensor voltages (section 9.3.4 on page 123) to the calibration values with zero flow.

9.3.6 Calibration

Zeroing of insp. and exp. pressure sensor:	Start of zeroing of airway pressure sensors S6.1 (insp.) and S6.2 (exp.)
Zeroing of oesoph. pressure sensor:	Start of zeroing of oesophagus pressure sensor (option not yet available)
Flow sensor calibration:	Important: There must not be any flow through the flow sensor. This must be ensured by the DS mode user.
O2 sensor:	Start of calibration of O2 measurement. Important: O2 pressure supply must be connected.
PEEP valve:	Start of calibration of PEEP valve (identical with code entry 4 7 9 9 + 4 7 4 7). Important: The test set-up refer to "Repair Instructions - Pneumatic Components chapter 3, PEEP Valve, page 6 On calibration, the apparatus and the PEEP/PIP valve must be in horizontal operating position, as the function of the PEEP/PIP valve is position-sensitive. The safety valve Y1.3 must be switched on prior to calibration. The criterion for positive calibration is the flow pulse from the mixer, which is why no hose is to be attached to the inspiration socket. Calibration OK Flow pulse 0.2 s Calibration not OK: Flow pulse 1.0 s Possible sources of error: Pressure supply not connected Safety valve Y1.3 not switched on Incorrect test set-up or test set-up leaking; refer to "Repair Instructions - Pneumatic Components chapter 3, PEEP Valve, page 6 Expiratory airway pressure measurement defective. The value can be followed up in DS mode; section 9.3.4 on page 123 on airway pressure measurement. Set value must switch back and forth between 3 and 34 mbar. Mechanical PEEP/PIP valve zero point defective; refer to "Repair Instructions - Pneumatic Components chapter 3, PEEP Valve, page 6 Current source on Pneumatic Controller PCB defective; refer to "Repair Instructions - Pneumatic Components chapter 3, PEEP Valve, page 6

PEEP valve reset:	Erasure of PEEP valve calibration values (identical with code entry 4 7 9 9 + 4 7 4 8)
Readout of calibration values:	The calibration values for O2 measurement, exp. flow measurement, insp. and exp. airway pressure measurement and for the PEEP/PIP valve are output.
O2 measurement:	Calibration voltage on calibration with 100 % by vol. O2 100 Vol.% O2. Set value = 1257 to 5644 mV
Exp. flow measurement:	DAC setting on calibration in no-flow condition Set value = 2200 to 3200 decimal
Insp. + exp. pressure sensor:	Calibration voltage at ambient pressure Set value = 1740 +/- 500 mV
PEEP/PIP valve:	The calibration values for gain and offset are output

9.3.7 CPU

This test can be used to check the EEPROM and the RAM area on the Pneumatic Controller PCB. A defective ROM (more precisely flash EPROM) stops the Evita functioning.

RAM test:	Output of OK or error; the last successfully tested RAM address is also output
ROM test:	Always OK if service mode functioning
EEPROM test:	Output of OK or error; the PEEP/PIP valve calibration data are stored in this EEPROM

9.4 Testing “Electronics” section

9.4.1 Testing voltages

5V / 12V / 15V / -15V / 24V:	Supply voltages from power pack; measured on CO2 Carrier PCB. Output of voltages and decimal values of AD conversion. The following values do not result in apparatus error messages: 5V = 4.5V to 5.5V 12V = 9.6V to 14.4V 15V = 14V to 18V -15V = -12V to -18V 24V = 19.2V to 28.8V Important: The power pack is specified as follows; refer also to Section 7.1 Repair instructions: 5V = 5.07V to 5.23V 12V = 11.76V to 12.24V 15V = 14.55V to 15.45V -15V = -14.55V to -15.45V 24V = 22.32V to 24.72V
10V:	10V reference voltage generated from 15V supply voltage on CO2 Carrier PCB. AD conversion is also implemented on the CO2 Carrier PCB. Output of voltage and decimal value of AD conversion. Error message is given in the event of deviation > 4 %. Set value = 9.9V to 10.1V
GoldCap:	Output of GoldCap voltage. The GoldCap capacitor supplies the substitute horn with current. The GoldCap with charging circuit and measurement is located on the CO2 Carrier PCB. Output of voltage and decimal value of AD conversion. Set value = 8V to 11 V
Batt ext.:	Output of voltage of externally connected DC power supply (option DC module). Output of voltage and decimal value of AD conversion.

S8 Ref.: Output of AD converter reference voltage AD1. Output of voltage and decimal value of AD conversion. Value is not directly monitored. Voltage is OK if 10 V within tolerance.

Set value approx 2,500 V

S16 Ref: Output of AD converter reference voltage AD2. Output of voltage and decimal value of AD conversion. Value is not directly monitored. Voltage is OK if 10 V within tolerance.

Set value approx 2,500V

9.4.2 Power pack status

The operating status of the power pack is output.

Internal battery status: The charge of the internal battery in the DC module (option) is displayed. The digital signal from the DC module is read in by the CPU 68332 PCB.

Charge output:

Charged: Internal batteries have reached max. charge voltage

Undefined: Internal batteries have still to reach max. charge voltage or are not connected or are defective

External battery status: The charge of the external battery of the DC module (option) is displayed. The digital signal from the DC module is read in by the CPU 68332 PCB.

Charge output:

Charged: External battery/batteries has/have reached max. charge voltage

Undefined: External battery/batteries has/have still to reach max. charge voltage or is/are not connected or is/are defective

Important: The voltage can be interrogated under “Voltages”. 1 or 2 gel batteries in series with a rated voltage of 12V is/are envisaged. Gel batteries are charged at a charge voltage of 13.8V.

Internal/external battery operation: When supplying the Evita by way of the internal batteries or the batteries of the DC module (option), a digital signal from the DC module is read in on the CPU 68332 PCB.

Off: No supply by internal or external batteries

On: Supply by internal or external batteries

Important: In DC operation, only one signal may be set to “on”.

All status signals from the power pack can be measured at connector X2 of the CPU 68332 PCB. When using an extender board, it is also possible to employ any slot in the motherboard above or below for X2. All signals are low-active.

X2 / 26b Internal battery

X2 / 27b External battery

X2 / 28b Mains operation

Mains switch:

Output of voltage at mains-switch auxiliary contact. The voltage is important for recognising mains failure. The mains switch is located in the power pack and the evaluation circuit on the CO2 Carrier PCB. Output of voltage and decimal value of AD conversion.

Mains switch on < 164 decimal (0.100 V)

Mains switch off > 512 decimal (0.312 V)

The mains switch can be subjected to resistance testing:

Switch off Evita.

Pull out CO2 Carrier PCB.

Measure at CPU 68332 PCB at plug connector X1 with ohmmeter:

Between X1/11c (mains “centre”) and X1/10c (mains “on”):
Apparatus off -> high impedance
Apparatus on -> low impedance

Between X1/11c (mains “centre”) and X1/15c (mains “off”):
Apparatus off -> low impedance
Apparatus on -> high impedance

Possible sources of error:

If both values are high impedance, the mains-switch auxiliary contacts in the power pack may not have been connected. On retrofitting DC module in power pack, connector on PCB in AC power pack may become detached from mains-switch auxiliary contact.

If both values are low impedance, either the mains switch is defective or there is a short circuit.

If both values are inverse, the connector of the mains-switch auxiliary contact on the PCB in the AC power pack has been attached with reversed polarity.

- Assemble apparatus ready for use.

9.4.3 Sensors

Apparatus temperature: Temperature inside apparatus measured on CO2 Carrier PCB. Output of temperature in °C and voltage. Permissible temperature range <65°C. As of 65°C, info “fan fault!” (reset at 60°C) and as of 70°C alarm “fan defective!!!” (reset at 65°C). If temperature inside apparatus is excessively high, check fan in power pack.

Airway temperature: AWT-sensor breathing gas temperature measured on CO2 Carrier PCB. Output of temperature in °C and voltage.

Inspiratory pressure: Second channel of inspiration pressure sensor. The inspiration pressure sensor is located in the pneumatics section and is read in by the Pneumatic Controller PCB (first channel) as well as on the CO2 Carrier PCB for additional safety.

Ambient pressure: Air pressure currently measured in Evita. The air pressure sensor with AD conversion is located on the CO2 Carrier PCB.
Output of air pressure in mbar and voltage.
Permissible measuring range = 600 to 1100 mbar

9.4.4 CO2 measurement data

RS232 test:

Testing of RS 232 interface for CO2 measurement on CO2 Carrier PCB. If a CO2 module is not responding to service commands, this test can be employed to establish whether the fault is due to a non-functioning RS 232 interface or whether the CO2 module is defective.
Test preparation:

- Switch off Evita; PC remains in service program.
- Pull out CO2 Carrier PCB.
- Move jumper on CO2 Carrier PCB at plug connector X14 from position 1 - 2 (operation) to position 2 - 3 (testing).
- Insert CO2 Carrier PCB in electronics section in second slot from top.
- Switch on Evita.
- Measure supply voltage for CO2 module on CO2 Carrier PCB. CO2 module is connected to X9.
  X9 / 1 = GND-Iso-CO2
  X9 / 5 = + 5 V-Iso-CO2

Important: This voltage is generated from the 5V power pack supply voltage on the CO2 measurement Power PCB.

- Perform testing of RS 232.
- OK: CO2 module defective
  Not OK: Possible causes -
  1. CO2 measurement optocoupler on CO2 Carrier PCB defective
  2. Actuation of RS 232 interface on CPU 68332 PCB defective

If the preceding test reveals a fault, perform the following test on the RS 232 interface for CO2 measurement on the CPU 68332 PCB.

- Switch off Evita; PC remains in service program.
- Pull out CO2 Carrier PCB.
- Create short circuit on CPU 68332 PCB at plug connector X2 between 28a and 29a. X2 is the plug connector to the motherboard, which is nearer to the power pack. When using an extender board, it is also possible to employ any slot in the motherboard above or below for X2. If no extender board is available, a soldering link can temporarily be made on the CPU 68332 PCB.
- Switch on Evita.
- Test RS 232.

	OK: Optocoupler on CO2 Carrier PCB defective since CPU 68332 PCB OK Not OK: CPU 68332 PCB defective Important: After testing, return jumper on CO2 Carrier PCB to original position with Evita switched off and re-assemble Evita ready for use. If a soldering link has been made on the CPU 68332 PCB, then this is to be removed.
CO2 temperature:	Output of temperature of detector and window temperature in CO2 sensor. Level should be approx. 43 °C in each case after 3 minutes. Depending on operating conditions, the temperatures may fluctuate between 40 °C and 50 °C.
CO2 Vendor ID:	Output of type of Signal Processor PCB used for CO2 measurement on CO2 Carrier PCB, e.g. “Andros 4210” or “Dräger HL”.
CO2 Software Modification:	Output of software version on Signal Processor PCB e.g. “68 70 277 1.1” for Dräger software version 1.1.
CO2 Head Serialnumber:	Output of serial number of CO2 sensor
CO2 Head Modification:	Output of part number and modification status of CO2 sensor
Cal. date:	Date of factory calibration of CO2 sensor
Status:	CO2 measurement status; data only of relevance for software development

9.4.5 SpO2 measurement data

RS232 test:

Testing of RS 232 interface for SpO2 measurement on CO2 Carrier PCB. If an SpO2 module is not responding to service commands, this test can be employed to establish whether the fault is due to a non-functioning RS 232 interface or whether the SpO2 module is defective.

Test preparation:

- Switch off Evita; PC remains in service program.
- Pull out CO2 Carrier PCB.
- Move jumper on CO2 Carrier PCB at plug connector X15 from position 1 - 2 (operation) to position 2 - 3 (testing).
- Insert CO2 Carrier PCB in electronics section in second slot from top.
- Switch on Evita.
- Measure supply voltages for SpO2 module on CO2 Carrier PCB.
  X5 / 1 = GND-Iso
  X5 / 2 = + 5 V
  X5 / 3 = + 15 V
  X5 / 4 = - 15 V

Important: These voltages are generated from the 24V power pack supply voltage on the CO2 Carrier PCB.

- Perform testing of RS 232.
- OK: SpO2 module defective
  Not OK: Possible causes -
  1. SpO2 measurement optocoupler on CO2 Carrier PCB defective
  2. Actuation of RS 232 interface on CPU 68332 PCB defective

If the preceding test reveals a fault, perform the following test on the RS 232 interface for SpO2 measurement on the CPU 68332 PCB.

- Switch off Evita; PC remains in service program.
- Pull out CO2 Carrier PCB.
- Create short circuit on CPU 68332 PCB at plug connector X2 between 27c and 28c. X2 is the plug connector to the motherboard, which is nearer to the power pack.
- Switch on Evita.
- Test RS 232.
- OK:
  Optocoupler on CO2 Carrier PCB defective since CPU 68332 PCB OK
  Not OK:
  CPU 68332 PCB defective

	Important: After testing, return jumper on CO2 Carrier PCB to original position with Evita switched off and re-assemble Evita ready for use.
Software Modification:	Output of version of SpO2 PCB
SpO2 measured values:	Values from SpO2 measurement. Valid values are only provided if option fitted and released and SpO2 measurement activated. Note: The bar graph value is not displayed on the Evita in operation.

9.4.6 Horn test

Substitute horn:

The substitute horn is located on the CO2 Carrier PCB and is actuated by the CPU 68332 PCB. The horn is supplied by the GoldCaps on the CO2 Carrier PCB. The GoldCap voltage can be read out under “Electronics” -> “Voltages”. The horn can be switched on and off; the horn current value is to be read out.

Possible sources of error if horn cannot be switched on:

- Mains switch defective; for testing section 9.4.2 on page 133. Furthermore GoldCap voltage must be present (section 9.4.1 on page 131).
- Testing horn without suppression signals from CPU 68332 PCB:
  Switch off Evita and pull out CPU 68332 PCB. Switch on Evita. Testing: Continuous horn tone. If this is not the case and the two items above are OK, there is every likelihood that the CO2 Carrier PCB is defective.
- Re-assemble Evita ready for operation.

Possible sources of error if horn cannot be switched off:

- Test horn suppression signals on CPU 68332 PCB without CO2 Carrier PCB. To do so, switch off Evita and pull out CO2 Carrier PCB. Measure voltage on CPU 68332 PCB between DGND (e.g. at X11/3 next to battery) and X2/31c. Switch on Evita and activate horn in menu. DC voltage must be a constant logic high (5V) or low (0V).
  Switch off horn in menu:
  A square-wave voltage switches every 8 ms between high and low. This can be measured with a voltmeter with DC or AC. The voltage level is approx. 2.5 V. If this square-wave voltage is present there is every likelihood that the CO2 Carrier PCB is defective.
- Re-assemble Evita ready for use.

Horn current:

The current through the substitute horn is measured on the CO2 Carrier PCB. The voltage across the shunt resistor and the decimal value for AD conversion are output.

Horn detected > 30 decimal (0,018V)

Horn off < 30 decimal

9.4.7 Loudspeaker test

Note: Identical with test in Section 33.5.7. The loudspeaker in the control panel is actuated by the CPU 68332 PCB in the electronics section. Monitoring is performed by the Graphics Controller PCB by measuring the current through the loudspeaker. The loudspeaker can be subjected to resistance testing (refer to error message 02.71.001). The test tone must be recognised when it is transmitted (volume of test tone depends on setting in operating mode). Detection of current flow through the loudspeaker is displayed for a further 10 seconds. For test purposes, the volume should be set to minimum. This setting is however only possible in normal operation.

9.4.8 GoldCap

Gold Cap:	Output of GoldCap voltage. The GoldCap capacitor supplies the substitute horn with current. The GoldCap with charging circuit and measurement is located on the CO2 Carrier PCB. Output of voltage and decimal value of AD conversion. Set value = 8 to 11 V
Result of GoldCap test:	This test only indicates the last result, as the GoldCap test takes longer than 10 minutes

9.4.9 ILV interface test

The ILV interface is on the CPU 68332 PCB. It features 2 digital outputs and inputs for synchronising 2 ventilators with ventilation from two sides. For test purposes, pin 4 (ILVout1) is to be connected at the ILV interface to pin 8 (ILVin1) with pin 6 (ILVout2) being connected to pin 1 (ILVin2).

ILV interface test:	The test takes roughly 2 seconds.	
	OK/OK:	ILV interface OK
	Not OK:	ILV interface on CPU 68332 PCB defective

9.4.10 CPU test

This test can be used to check the EEPROM (D22) and the RAM area on the CPU 68332 PCB. A defective ROM (more precisely flash EPROM) stops the Evita functioning.

RAM test:	Output of OK or error; last successfully tested RAM address is also output.
ROM test:	Always OK if service mode functioning.
EEPROM test:.	Output of OK or error

Note on “Data loss” alarm:

There is certainly a loss of data in the EEPROM D22 if for example the released options or operating hours are no longer present following switch-on. A data loss in the RAM may be due to a flat battery on the CPU 68332 PCB. After a loss of data, the Evita attempts to restore the data. If this is successful, the red alarm “Data loss” disappears from the screen. The Evita is OK if this alarm is no longer present when the apparatus is next switched on.

9.5 Testing “Front panel”

The term “Front panel” refers to the detachable control panel of the Evita. “Front panel” testing consists of the following steps:

-	Keys:	Read-in of all keys
-	LEDs:	Actuation of all LEDs
-	7-segment:	Actuation of 7-segment displays (Evita 2 dura only)
-	Rotary knob:	Read-in of rotary knob
-	Touchscreen:	Readout of status information (hardware and software statuses, errors and touchscreen test function) (Evita 4 only)
-	Display:	Readout of display type and display test with test pattern
-	Loudspeaker:	Loudspeaker actuation and readout of loudspeaker monitoring status
-	CPU:	RAM and ROM test

9.5.1 Testing of keys

The keys are read in by the Graphics Controller PCB (Evita 4) or by the Frontpanel PCB (Evita 2 dura).

Output:

0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 (last line applies to Evita 2 dura only)

0=Key not pressed
1=Key pressed

Assignment with Evita 4:

First line:	Keys to left of screen from top to bottom (nebuliser to printer, 1x key not present)
Second line:	Keys to right of screen from top to bottom (mode to configuration, 1x key not present)
Third line:	Info key, alarm tone suppression, stop, reset/check, basic screen, standby, 2x keys not present

Fourth line:	8x keys not present

Assignment with Evita 2 dura:

First line:	IPPV, SIMV, printer, free key under exp. hold, VT, Tinsp, second menu key from top, top menu key
Second line:	Ramp, PEEP, additional modes, BIPAP, PASB, Pinsp, f, flow
Third line:	Bottom menu key, curves 1/2, backlighting, screen freeze, insp. hold, exp. hold, fourth menu key from top, third menu key from top
Fourth line:	Values 1/2, none, none, free key on the right-hand side of values 1/2, nebulizer, none, none, 100% O_2
Fifth line:	Trigger, alarm reset, info, free key below trigger, standby, keylock, O_2, silence key

Testing - no key pressed:

All output information on 0

One or more keys pressed:

Respective output information on 1; check all keys present

Possible sources of error:

One key defective:	Keypad defective
Several keys defective:	If several keys in a row or several keys in a column (e.g. nebuliser, mode and info) are defective, the fault is in all likelihood to be found on the Graphics Controller PCB (Evita 4) or Frontpanel PCB (Evita 2 dura)

9.5.2 Testing of LEDs

The LEDs on the keypad are actuated by the Graphics Controller PCB (Evita 4) or Frontpanel PCB (Evita 2 dura). This program enables all LEDs to be jointly switched on and off or individually actuated in a defined manner with “LED test”.

Testing:

Actuation of all LEDS:	All LEDs light. Note: The basic screen, info and reset/check keys have no LEDs.
Switch-off of all LEDs:	All LEDs off

“LED test” function:

Individual LEDs can be selected with the cursor or mouse:

0 = LED off

1 = LED on

Method of input:

Attention: Do not alter number of bits.

LED 1 to 8:	0 0 0 0 0 0 0 0
LED 9 to 16	0 0 0 0 0 0 0 0
LED 17 to 24	0 0 0 0 0 0 0 0
LED 25 to 32	0 0 0 0 0 0 0 0

On the Evita 4, the LEDs are arranged in the following sequence:

No.	LED
1	4 Red alarm
2 to 9	None
10	Yellow alarm, right
11	Standby
12	Yellow alarm, second from right
13	Yellow alarm, second from left
14	Stop
15	Alarm tone suppression
16	Yellow alarm, left
17	None
18	Configuration
19	Calibration
20	In key between calibration and measurement manoeuvre
21	Measurement manoeuvre
22	Measured values
23	Alarm limits
24	Mode
25	None
26	Printer
27	Key above printer
28	Key between 27 and 29
29	Key beneath insp. hold
30	Insp. Hold
31	100% O2
32	Nebuliser

On the Evita 2 dura, the LEDs are arranged in the following sequence:

No.	LED
1	none
2	Info key
3	VT
4	Free key under exp. hold
5	Exp. hold
6	Insp. hold
7	Nebulizer
8	Standby
9	100% O2
10	Flow
11	None
12	f
13	Additional modes
14	Ramp
15	Printer
16	PEEP
17	Backlighting
18	O2
19	Values 1/2
20	Free key below trigger
21	Free key on the right-hand side of values 1/2
22	Trigger
23	IPPV
24	Alarm reset
25	Tinsp.
26	PASB
27	BIPAP
28	Pinsp.
29	Screen freeze
30	Keylock
31	Curves 1/2
32	Silence key
33	SIMV
34	warning yellow
35	warning red

9.5.3 LED 7-segment test

Applies to Evita 2 dura only: all segments can be switched on and off.

9.5.4 Testing of rotary knob

The rotary knob on the front panel is read out by the Graphics Controller PCB (Evita 4) or Frontpanel PCB (Evita 2 dura).

The following changes (measured within 1 second) are output:

- Direction of rotation (anti-clockwise or clockwise)
- Rotation pulses (0 to 128); pulses are only output as of 2 notches
- Knob not pressed (switch open) or pressed (switch closed)

9.5.5 Testing of touchscreen

Note: For Evita 4 only

The touchscreen, which features its own processor system, communicates by way of RS 232 with the Graphics Controller PCB. During communication, a LED on the touchscreen PCB flashes. This can be seen with the control panel open.

The following tests are of relevance to service:

Error codes: These data are determined once only in BOOT after switching on Evita.
Output 00 (OK, no error) or output of number of errors (two positions) plus error code.
Error codes:

01	EPROM error
02	RAM error
04	Broken beams in BOOT; refer to “Beam error”
0a	Invalid command
0c	Input buffer overflow
0e	Wrong number of parameters for command
0f	Value range parameter exceeded

Beam error: Output of broken beams detected after switching on Evita.

Columns	0000000000_0000000000_0000000000_0000000000 (from left to right)
Lines:	0000000000_0000000000_0000000000 (from bottom to top)

Output 0 (OK, not broken) or 1 (not OK, broken). Check the following if one or more beams are shown to be broken:

- Object in touch window on switch-on?
- Touch window surround dirty?

See also Column/line test

Column/line test: This test permits active interrogation of all line or column beams. To do so, run finger slowly over screen. The detection of broken beams blanks the screen at the appropriate point. It must be possible to blank the entire screen.

Important: Defective light barriers are allowed, provided that the function during operation is not effected, i.e. all screen keys are functional.

RS 232 test: RS 232 interface test for touchscreen on Graphics Controller PCB: If a touchscreen is not responding to service commands, this test makes it possible to determine whether the fault is due to a non-functioning RS 232 interface on the Graphics Controller PCB or whether the touchscreen is defective.

Test preparation:

- Switch off Evita; PC remains in service program.
- Open control panel.
- Detach cable to touchscreen on Graphics Controller PCB at connector X2 and create short circuit at X2 between pin 4 (TxD) and pin 5 (RxD).
- Switch on Evita.
- Perform RS 232 test.
- If error message is given, fault is due to defective RS 232 interface on Graphics Controller PCB.

9.5.6 Testing of display

The display is actuated by the Graphics Controller PCB (Evita 4) or Frontpanel PCB (Evita 2 dura).

Important: If the display no longer responds to the following commands, but the rest of the front panel is functioning properly and the background illumination is also visible, then either the display (more likely of the two) or the Graphics Controller PCB may be defective. Testing using simple means is not possible in this case.

Manufacturer test: Readout of display installed in control panel. This information is important for renewing the background illumination, which differs from display to display.

The following displays are envisaged for Evita 4:

“1 Toshiba”	(with external DC/AC converter for 2 background illumination lamps)
“2 NEC”	(with internal DC/AC converter for 1 background illumination lamp)
“3 Sharp”	(with external DC/AC converter for 2 background illumination lamps)
“0 Toshiba”	(with external DC/AC converter for 2 background illumination lamps)

Important: There is a difference between the decoders D29 and D40 for display matching on the Graphics Controller PCB.

Evita 4 only:

Display\Decoder	D29	D40	Note:
1 Toshiba	83 06 640	83 06 795	all software versions as of 1995
2 NEC	84 11 686	83 06 795	all software versions as of 1996
3 Sharp	84 11 776	83 06 795	all software versions as of 1996
			for software versions 1.07/1.08; for 2.20 and higher

Important: In the event of a display fault, use must always be made of the current display type. The display accessory set contains all components needed for installation, e.g. display, decoders D29 and D40, wiring harnesses, DC/AC converter (if not integrated into display) and mechanical components for assembly.

Evita 2 dura	The following Displays are available: Epson (black & white), with out Decoder D48 NEC (colour), with Decoder D48 (83 09 124) Sharp (colour), with Decoder D48 (83 09 176)

Test pattern:	Different test patterns can be set for assessing the display of the Evita: - White grid on black background - Black grid on white background - White surface - Black surface - Red surface - Green surface - Blue surface

9.5.7 Testing of loudspeaker

section 9.4.7 on page 141.

9.5.8 CPU, RAM and ROM test

This test can be used to check the RAM area on the Graphics Controller PCB. A defective ROM (more precisely flash EEPROM) stops the front panel working.

RAM test	Output of OK or error; last successfully tested RAM address is also output.
ROM test	Always OK if communication with Graphics Controller PCB is possible.

9.6 “Communication” testing (Communication PCB)

9.6.1 Testing analog output 1

Testing by way of setpoint input between 0 and 4095 mV. A test cable is in preparation.

9.6.2 Testing analog output 2

Testing by way of setpoint input between 0 and 4095 mV. A test cable is in preparation.

9.6.3 Testing RS 232 interfaces Com 2 and Com 3

Testing is performed by way of a LOOP test. For this purpose, sockets 2 and 3 at the interfaces Com 2 and Com 3 are to be shorted and the test started.

9.6.4 CPU, RAM and ROM test

This test permits checking of the RAM area on the Communication PCB. A defective ROM (more precisely flash EEPROM) stops the PCB functioning.

RAM test	Output of OK or error; last successfully tested RAM address is also output.
ROM test	Always OK if communication with Communication PCB is possible.

9.6.5 Testing external CAN bus

This test has still to be implemented, as use is not made at present of the external CAN bus.

9.7 Special command input in Help menu

9.7.1 Debug, test command

Note: This function can only be called up with a “password” as of Software Version 8.n.

This menu permits the entry of further commands.

- Commands without parameter:
  The 3-position code is to be entered without spaces under command string and the key “Transmit” then pressed.
- Commands with parameter:
  The 3-position code is to be entered without spaces under command string and terminated with “~“ again without leaving any spaces. Enter the parameter under Parameter. In the case of several parameters, these are to be linked with “~“ without leaving any spaces. Then press the key “Transmit”. Note: “~“ is obtained by jointly pressing the keys “Alt” and “+”.

9.8 Unit Error Number Reading Description

A description of unit error messages can be displayed for Service Software Version 8.n and all higher versions under “Help” => “Help”.