SLE5000 INFANT VENTILATOR

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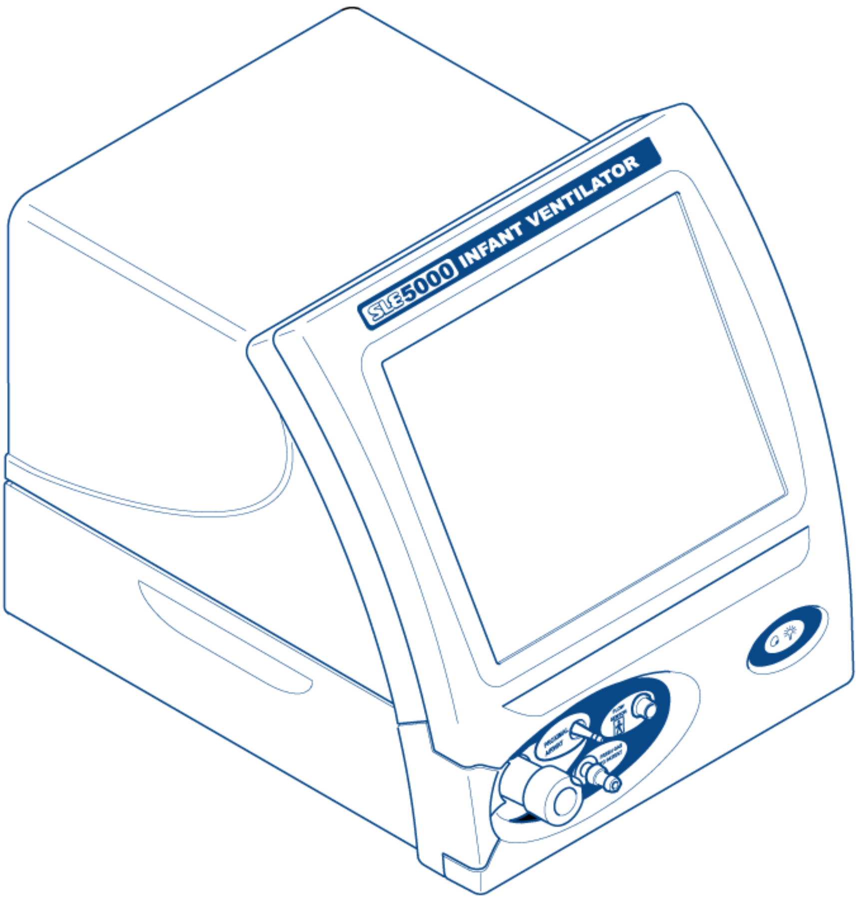
SERVICE MANUAL



Model A

ISSUE 10

Software/Manual application Information:

Note: This manual is to be used only with model A ventilators using the following software version:

Version 3, 3.1, 3.2, 3.3, 4 & 4.1

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Manual : **SM0015 Issue 10**
SLE Part Nº: **N6645**

Contents

Warnings and Cautions

1. Warnings and Cautions

1.1 Warnings

1. The electronic and pneumatic units of the SLE5000 infant ventilator are sealed at the factory with two Warranty Void If Label Broken seals. If the ventilator is subject to a warranty agreement do not attempt to carry out any procedure that would involve breaking these seals. If you make a warranty claim and these seals are broken SLE may deem the warranty claim null and void. If the ventilator develops a fault within the warranty period please refer to your warranty documentation.

2. Oxygen - Fire Hazard. Oxygen vigorously supports combustion and its use requires special precaution to avoid fire hazards. Keep all sources of ignition away when oxygen is in use. Do not use oil or grease on oxygen fittings or where oxygen is used.

3. Check the condition of the gas supply hoses to the ventilator. Do not use any hose that shows signs of cracking, abrasion, kinking, splits, excessive wear or ageing. Make sure that the Air or O_2 hose has not come into contact with oil or grease.

4. The SLE5000 ventilator contains temperature dependant devices which perform normally in controlled environments in hospitals. However if the ventilator has been stored at a temperature different to that in which it will be used, allow the unit to acclimatize before powering up.

5. Failure to comply with the recommended service programs could lead to injury of the patient, operator or damage to the ventilator. It is the owners responsibility to ensure that the equipment is regularly maintained.

6. The SLE5000 contains static sensitive electrical devices. Anti static precuations must be observed at all time when working on the ventilator.

1.2 Cautions

1. When working on the pnuematic unit, protect the front facia panel by resting it on a soft pad.

2. Do not use a sharp instrument, such as a pen to activate the controls as the excessive pressure applied by the point will damage the touch screen membrane.

3. The Ventilator must be connected to a suitably rated and grounded electrical power source.

4. If the SLE5000 is adversely affected by equipment emitting electromagnetic interference then that equipment should be switched off or removed from the vicinity of the SLE5000. Conversely, if the SLE5000 is the source of interference to other neighbouring equipment, it should be switched off or taken to another location.

5. The functioning of this machine may be adversely affected by the operation of equipment such as high frequency surgical (diathermy) equipment, defibrillators, mobile phones or short-wave therapy equipment in the vicinity.

7. The equipment is not suitable for use with, or in the presence of flammable anaesthetic mixtures.

6. The SLE5000 flow monitoring system is calibrated to work in an air / oxygen mixture, the use of other gas mixtures may affect the flow monitoring accuracy of the ventilator.

7. Disposal of the Oxygen Sensor should be in accordance with local regulations for hazardous substances. Do not incinerate. SLE offer a cell disposal service.

8. The SLE5000 contains four batteries, three 2 cell sealed lead acid batteries and one PCB mounted lithium battery. At the end of their useful life these batteries should be disposed of in accordance with local authority guidelines.

9. Apart from the above, the SLE5000 and accessories do not contain any hazardous components therefore no special precautions are required for their disposal.

10. Care should be taken when attaching other equipment as this may affect mechanical stability.

11. Any computer connected to the ventilator must be specified for medical use (ie. it must comply with the requirements of BS-EN-60601:1990).

12. There is no special protection provided against ingress of water or liquids.

13. Do not use solvent based cleaning solutions to clean the touch screen or covers.

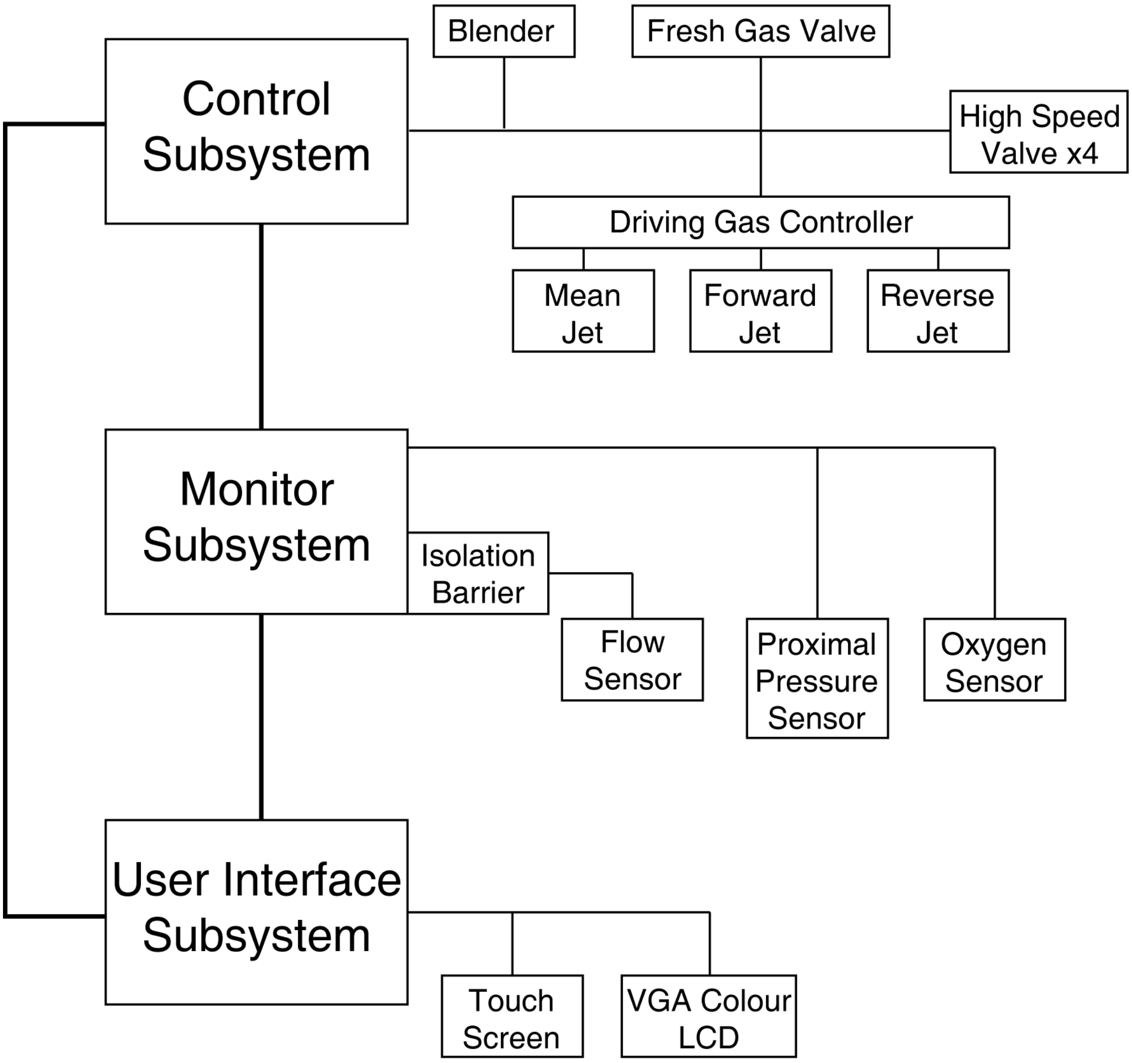
Principles of Operation

2. Principles of Operation

The SLE5000 infant ventilator consists of an electronic system in the upper section of the ventilator and a pneumatic system in the lower.

2.1 Electronic System

The electronic system comprises three autonomous subsystems, one responsible for monitoring the patient, one responsible for controlling the valves of the pneumatic system and one for the user interface (touchscreen and displayed data). They are connected together by three serial communication links in a delta configuration.



The ventilator has an internal battery that can power the ventilator in the event of a mains power fail. If the mains power fails with the battery fully charged, then operation will continue for 30 to 60 minutes depending on ventilation mode.

See "Electrical Block Diagram" on page 378.

2.2 Pneumatic System

The pneumatic system comprises of the tubing and electro-mechanical valves necessary to provide the gas in conventional and oscillatory ventilation modes. The two gas controlling functions are blending and pressure generation

2.2.1 Blending

The method used for blending air and oxygen in known proportions is to pressure regulate the two supplies (air and oxygen) so they produce equal flow rates and then allow each supply into a mixing chamber for a time period equivalent to the proportions required. For example, delivering oxygen at a set flow rate into a mixing chamber for 1 second and air at the same flow rate for 2 seconds will result in a mixture of 1 part oxygen to 2 parts air (resulting in a mix of 47.3%).

2.2.2 Pressure Generation

There are three nozzles within the exhalation block in the pneumatic subsystem. One for generating negative pressure in the patient circuit and the other two for generating positive pressure. The pressures generated from the three nozzles are controlled by three electronically controlled pressure regulators. The negative and one of the positive nozzle pressures can also be switched on and off rapidly with in-line (high speed) solenoid valves.

The other positive nozzle (the mean jet) is used to generate steady pressures in ventilation (CPAP or PEEP pressures in conventional modes and mean pressures in HFO modes). These three nozzles (or jets) are used in various combinations to generate all ventilation modes.

2.2.3 Conventional ventilation

In non HFO modes the negative (or reverse) jet is used in a steady mode to provide a small amount of flow to offset the inadvertent patient circuit pressure generated from the fresh gas flow of 8 lpm. The mean jet is also used in a steady mode to generate the base pressure level (CPAP or PEEP) and the forward jet is used to generate the PIP pressure during the inspiratory phase. The rise time of the inspiratory phase is controlled by dynamically controlling the forward jet pressure regulator rather than switching a steady pressure with the high speed valves.

This provides a smooth rise in pressure and allows user adjustable rise times rather than abrupt changes and pressure “ringing” which can result from high speed switching. The fall of the inspiratory wave is also controlled by the forward jet pressure regulator to bring the pressure down quickly and smoothly, using the high speed valves to do this would again result in inadvertent ‘ringing’ which causes difficulties for the monitor subsystem in trying to detect a patient breath attempt by monitoring the pressure alone. Once the pressure has been brought close to the base pressure, after about 100 ms, the forward jet solenoid is switched off to prevent any further artefact causing false triggering.

Note that all jet pressures actually sum in the exhalation block, for example, to ventilate a patient with a PEEP pressure of 5 mbar and a PIP pressure of 30 mbar, the mean jet will be set to generate a continuous circuit pressure of 5 mbar and the forward jet will be set to generate a circuit pressure varying between zero (exp phase) and 25 mbar (insp. phase). Since the jet pressures will sum, this will result in the desired patient pressure.

2.2.4 HFO ventilation

In pure HFO mode the mean jet pressure regulator is used purely to set the mean pressure. The forward and reverse jet pressure regulators are used to generate steady positive and negative delta P components that will be superimposed on the mean pressure. These components are switched quickly using the high-speed solenoid valves to generate the HFO pressures.

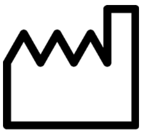
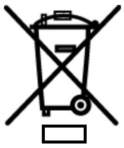
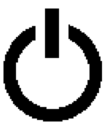
For example to ventilate a patient with a mean pressure of 10 mbar and a delta P pressure of 60 mbar, the mean jet will be set to generate a continuous pressure of 10 mbar, the forward jet will be set to generate a continuous pressure of 30 mbar and the reverse jet will be generating a continuous pressure of –30 mbar. The HFO rate is determined by the rate of switching between the forward and reverse pressures on the high-speed valves. Again, because the jet pressures sum, the resulting patient pressures will be switching between –20 mbar and +40 mbar.

Mean HFO pressures up to 35mbar are required but the mean jet can only generate pressures up to about 20 mbars. To obtain higher mean pressures than 20mbars in HFO it is necessary to apply a higher pressure on the forward pressure regulator and a lower pressure on the reverse pressure regulator. Using this method, the desired mean must be less than half the desired delta p pressure plus 20 mbars.

See “Pneumatic Unit Schematic” on page 379.

Description of Symbols

3. Description of Symbols

Symbol	Description
	Type BF connection (Situated on front panel)
	Type B device (Situated on rear panel)
	Read manual (Situated on rear panel)
	Date of Manufacture (Appears on serial number label)
	Do not dispose of as general waste (WEEE directive). (Appears on serial number label).
CE 0120	EEC conformity marking showing compliance with the Medical Devices Directive (Appears on serial number label)
O I	Power Off (Embossed on power switch) Power ON
	Indicates the mains power switch
	Heavy, Lift with care (Situated on rear panel)

Symbol	Description
	Mains/Battery power indicator (Situated on front panel)
	Indicates a warning in the manual
	Observe anti static precuations
	Indicates a note in the manual
	Indicates a caution in the manual
☑	Check list item.

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Equipment List

4. Equipment list

To service the SLE5000 infant ventilator the service personnel will require the following equipment. Items marked with an SLE part number can be obatined by contacting the service department.

- Electronic engineers tool kit.
- [a/b] Calibration analyser (calibrated in mbar) ....SLE Part Nº: N2830
- [a] Patient circuit ....SLE Part Nº: N5188
- [a] Humidification chamber (MR220 ....SLE Part Nº: N3220
- [b] Test lung ....SLE Part Nº: N6647
- Foam support pad
- [a] Digital Multimeter (1mv resolution)
- [a] 24V power supply
- [a] 'Y' piece tube connector fitted with 0-2 bar reliving regulator on one limb.
- [a] Assorted tubing to connect analysers to ventilator.
- Static protection wrist band
- Anti-static protective bags (300mm x 300mm)
- [a] Flow sensor cable...SLE Part Nº: N6635
- [a] Flow sensor ....SLE Part Nº: N5201
- [a] Exhalation block ....SLE Part Nº: N6622
- [a] Oxygen supply
- [a] Air supply

[a] Note all items marked with an '**a**' are required for servicing and overhaul. Without these items the user will be unable to service or overhaul the SLE5000 ventilator.

[b] Note items marked with a '**b**' are required to carry out the functional testing routine.

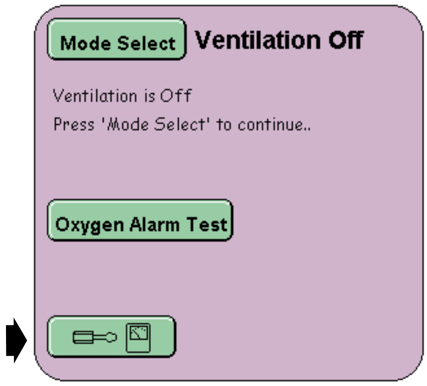
Engineering Mode Software

5. ENGMODE

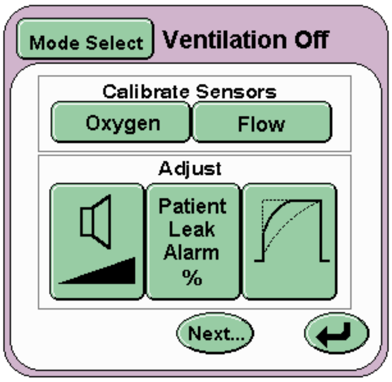
The SLE5000 ventilator is calibrated via two calibration programs, one for the ventilator and one for the Touch screen. The calibration programs are accessed via the Controller Services panel in the user interface.

5.1 Accessing the Calibration Programs

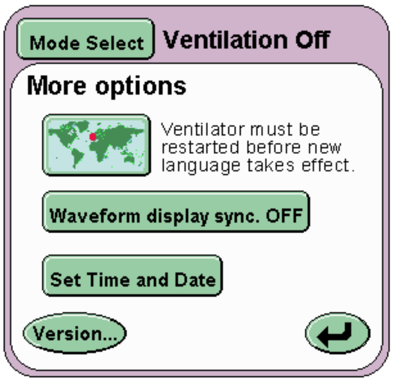
Step 1 Press the Options and Service Data Button.



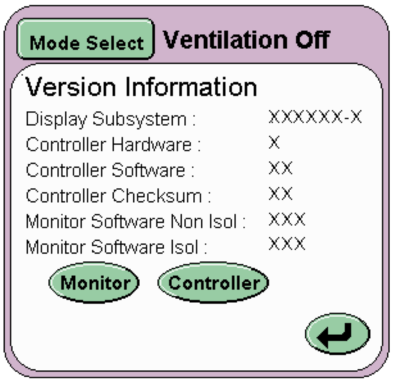
Step 2 Press the next button.



Step 3 Press the version button.

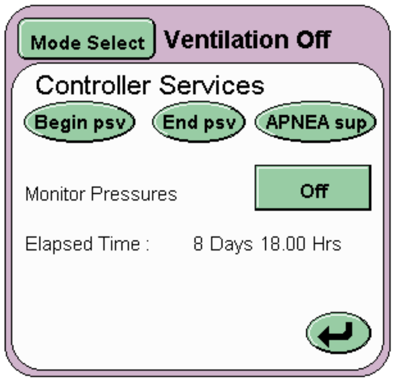


Step 4 Press the Controller button.



Step 5 Enter the code supplied by SLE into the ventilator via the controller services panel to activate the required calibration program.

Begin psv is the **A** button.
End psv is the **B** button.
Apnea sup is the **C** button.

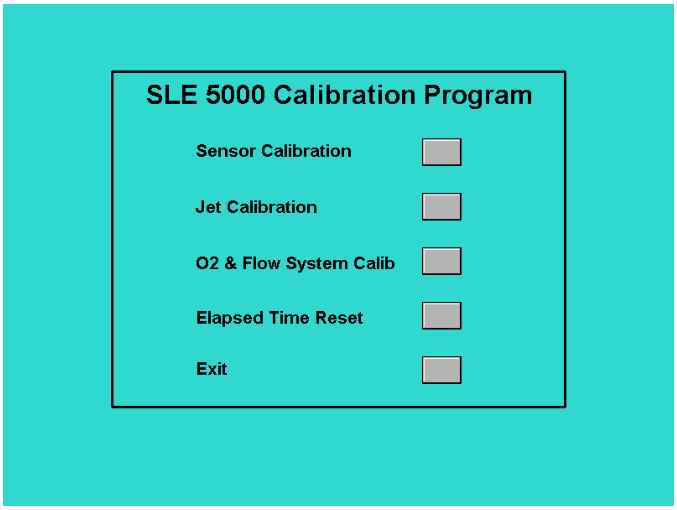


Enter your code here____________________

5.2 Ventilator Calibration Program

The calibration program has four main functions.

1. Sensor Calibration
2. Jet Calibration
3. O_2 & Flow System Calibration
4. Elapsed Time Reset.
5. Exit

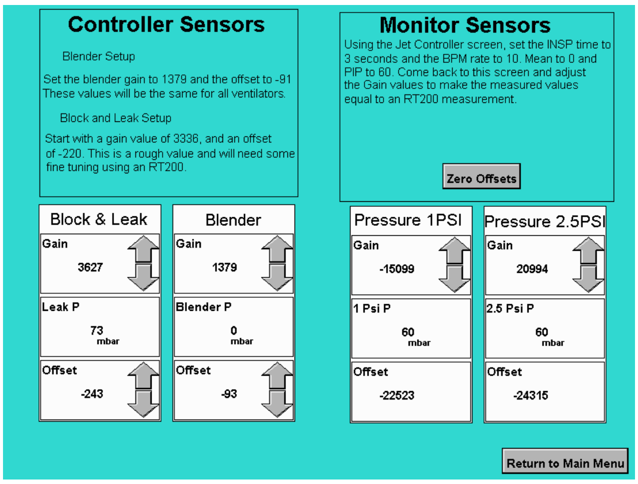


5.2.1 Sensor Calibration

The sensor calibration panel allows the following sensors to be calibrated.

Controller
The setting of the Block and leak sensor Offset and Gain.
The setting of the Blender sensor Offset and Gain.

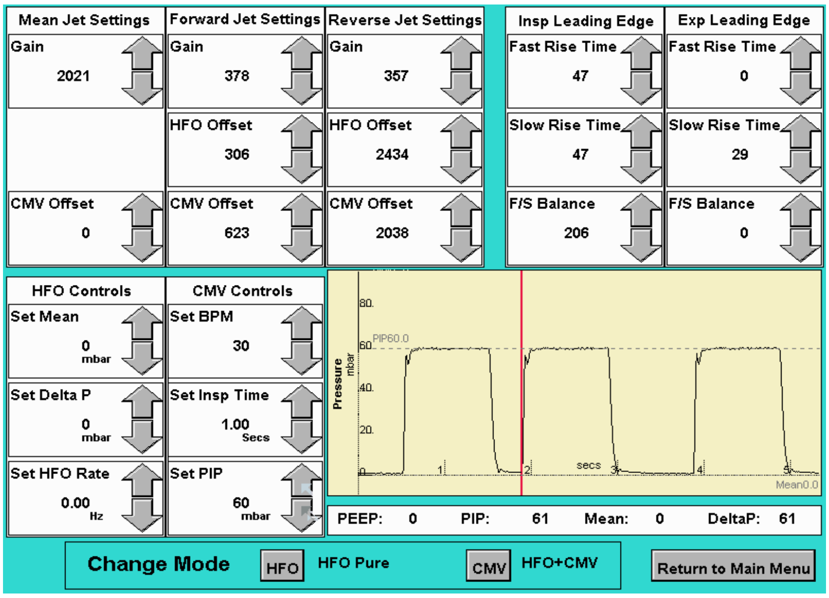
Monitor
The setting of the Blender sensor Gain.



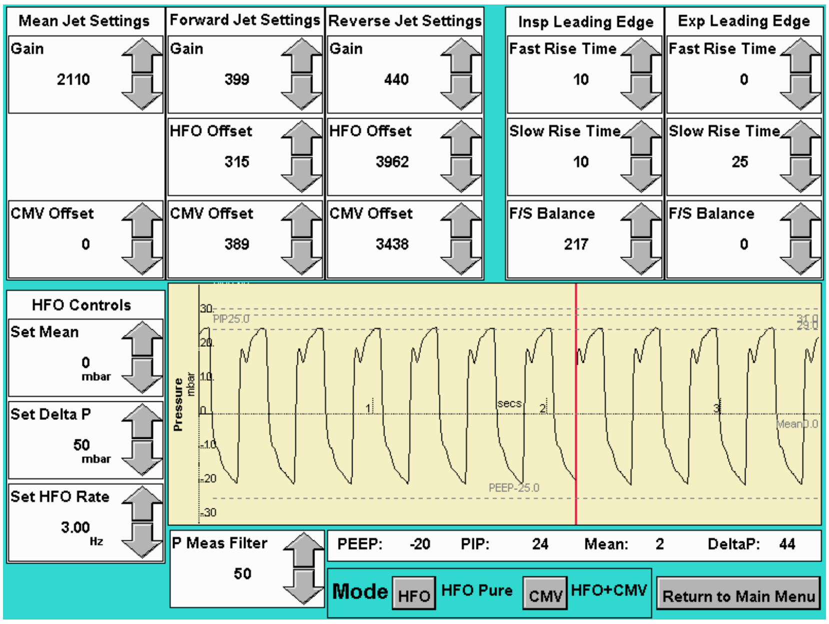
5.2.2 Jet Calibration

The jet calibration panel allows the forward jet, reverse jet and mean jet to be adjusted. Also contained within this panel are the controls to adjust the inspiratory and expiratory leading edges of the CMV wave form. Associated controls to set the ventilator in CMV or HFO mode are also displayed.

Layout for Version 3 to 3.2 software



Layout for Version 3.3 software



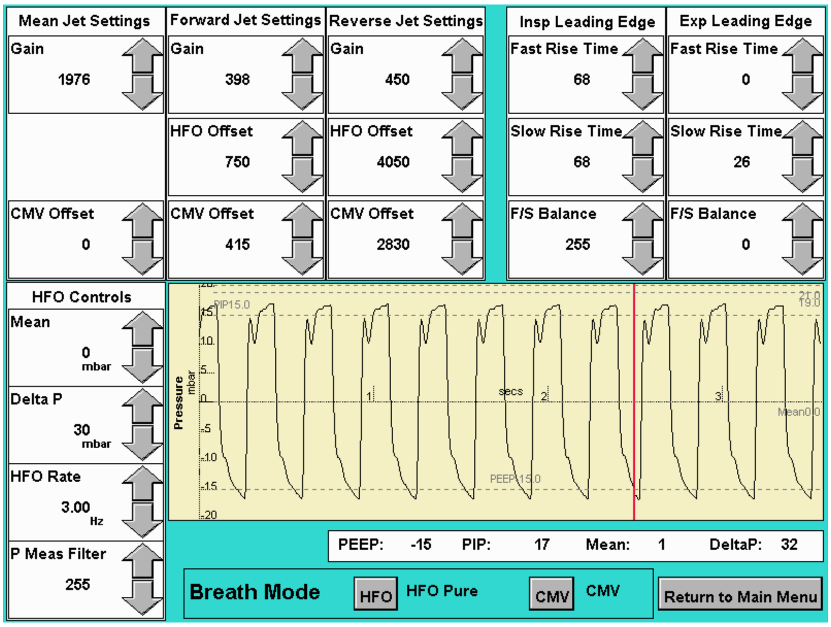
Warning: Version 3.3 software has a new parameter the "P Meas Filter". This is a low pass filter which removes high frequency components from the displayed waveform.

This is required as the new N6623/33 pressure regulators produce a greater initial high frequency component. N6623/33 pressure regulator can only be used in conjunction with version 3.3 software.

SLE

Warning: N6623/33 regulators cannot be used with version 3 to 3.2 software as the high frequency component can not be removed making the ventilator unusable.

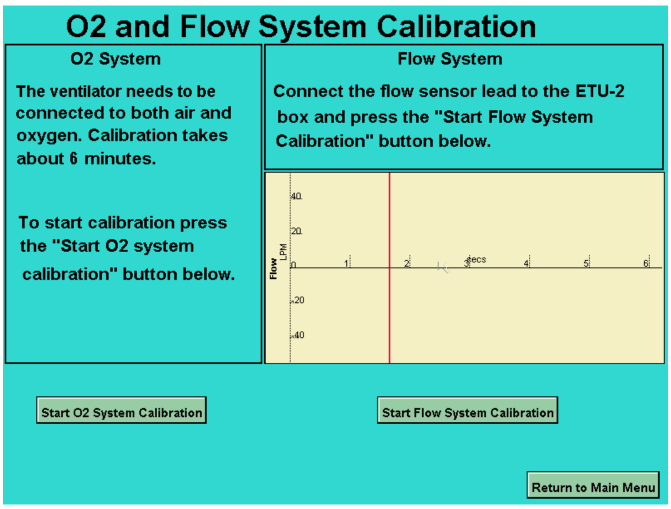
Layout for Version 4 software



5.3 O_2 & Flow System Calibration

The O_2 & Flow System Calibration panel allows the calibration of the oxygen monitoring system (2 point calibration, 100% and 21%) and the calibration of the flow system.

The flow system is a factory set system and requires an ETU-2 for calibration.

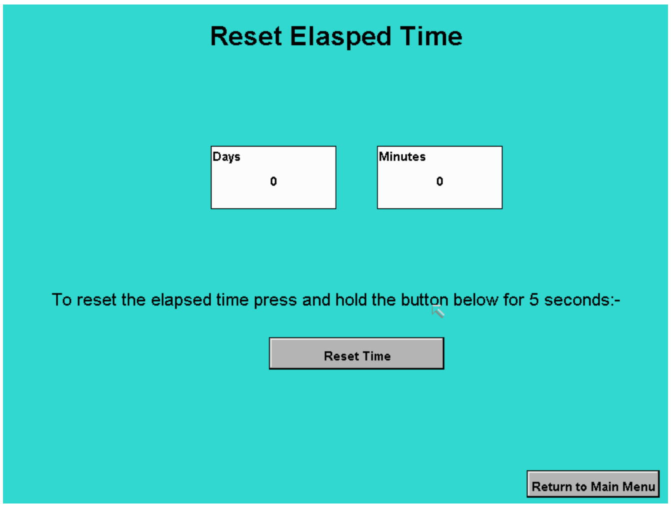


Note: For version 3.3 & 4 software O_2 calibration time is 7 minutes.

5.4 Reset Elapsed Time

The reset elapsed time panel allows the ventilators time counter to be reset to zero days and minutes.

This function is only used at the 20,000 hour overhaul.



5.5 Exit

The exit button will return the user to a DOS prompt. To return to the ventilator to its normal operating mode, restart the ventilator.

5.6 Touch Screen Calibration Program

The touch screen calibration program is accessed by the same method as for the calibration program. See '5.1 Accessing the Calibration Programs' on page 24.

Enter you code here____________________

Four the touch screen please follow the on screen instructions.

To return to the ventilator to its normal operating mode, restart the ventilator.

Warning: Failure to carry out the touch screen calibration correctly can cause the ventilator to become unusable. A failed touch screen calibration can only be corrected by connection of a specialist device. Please contact SLE or your distributor in this situation.

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Component Replacement

6. Component Replacement Procedure

The component replacement procedures detailed in this chapter describes how to replace the individual component in isolation. Each procedure details what setup is required to return the ventilator to service. After completing any or all of the following procedures a full functional test as described in this manual **must** be carried out.

The following replacement and setup procedures are detailed in this chapter.

Electronic unit

- CAN card .... SLE Part Nº: N6634
- PC battery .... SLE Part Nº: M0909
- Disk on chip .... SLE Part Nº: D0724
- Computer Board....................................... SLE Part Nº: N6631/01
- Serial controller (Touch screen) .... SLE Part Nº: N6631/06
- Control and monitor board .... SLE Part Nº: A0763/02
- Power supply unit..................................... SLE Part Nº: M0900
- Batteries .... SLE Part Nº: M0901
- Transducer PCB assembly .... SLE Part Nº: A0761
- LCD .... SLE Part Nº: N6631/02
- Touch screen... SLE Part Nº: N6631/05
- Inverter PCB .... SLE Part Nº: N6631/03 or /10

Pneumatic Unit

- Conical and Duckbill filters........................ SLE Part Nº: N2185/06 & /05
- Blender... SLE Part Nº: L0287
- Fresh gas bypass solenoid SV7 .... SLE Part Nº: N2195/06
- Purge regulator PR7 .... SLE Part Nº: N6612
- Regulator PR5 .... SLE Part Nº: N6613
- Speed controller FR1 .... SLE Part Nº: N6614
- Regulator input air PR1............................ SLE Part Nº: N6615/01
- Regulator input oxygen PR2..................... SLE Part Nº: N6615/02
- High speed jet valves SV9, 10, 11 & 12.... SLE Part Nº: N6624
- Pressure regulators PR3, PR4 & PR6 ...... SLE Part Nº: N6623 /33 or /S38

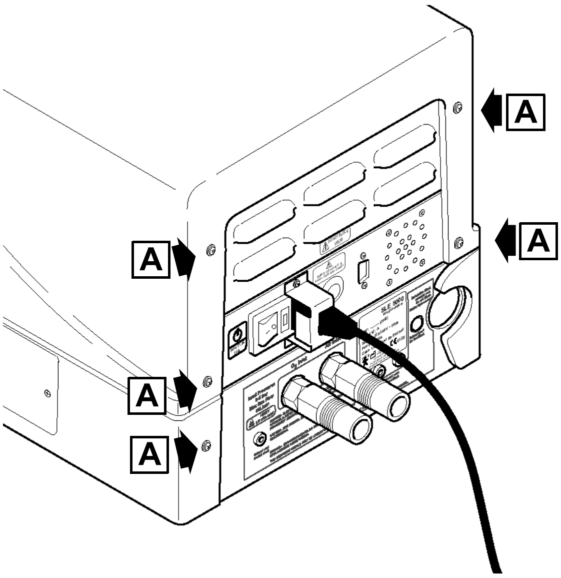
7. Preparing the SLE5000

Caution: the SLE5000 ventilator weighs 23.6kg fully assembled. Care should be taken when handling the ventilator.

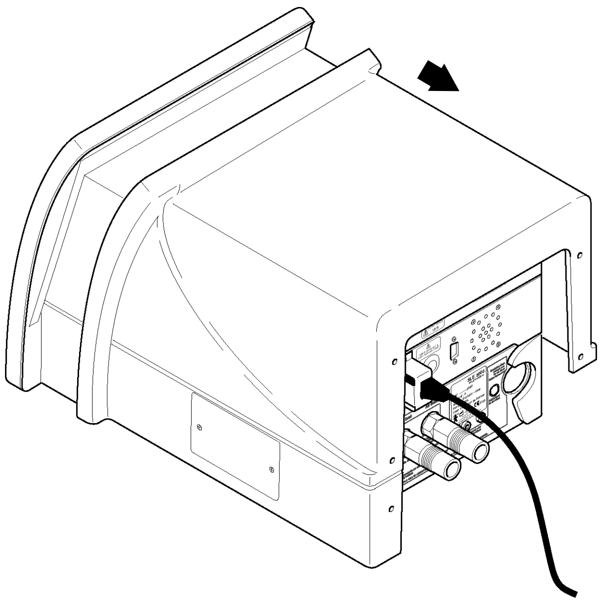
If preparing to work on both the electronic and pneumatic units of the SLE5000 remove the ventilator from the stand and place it on a flat stable surface. The SLE5000 ventilator is attached to the trolley or pole by two screws with shake proof washers. Retain the screws and washers for re-attachment of the ventilator.

If work is to be carried out on the electronic unit only it is advisable to leave the ventilator attached to the trolley.

Step 1 Remove the 5 fixing screws **(A)** indicated from the rear cover.



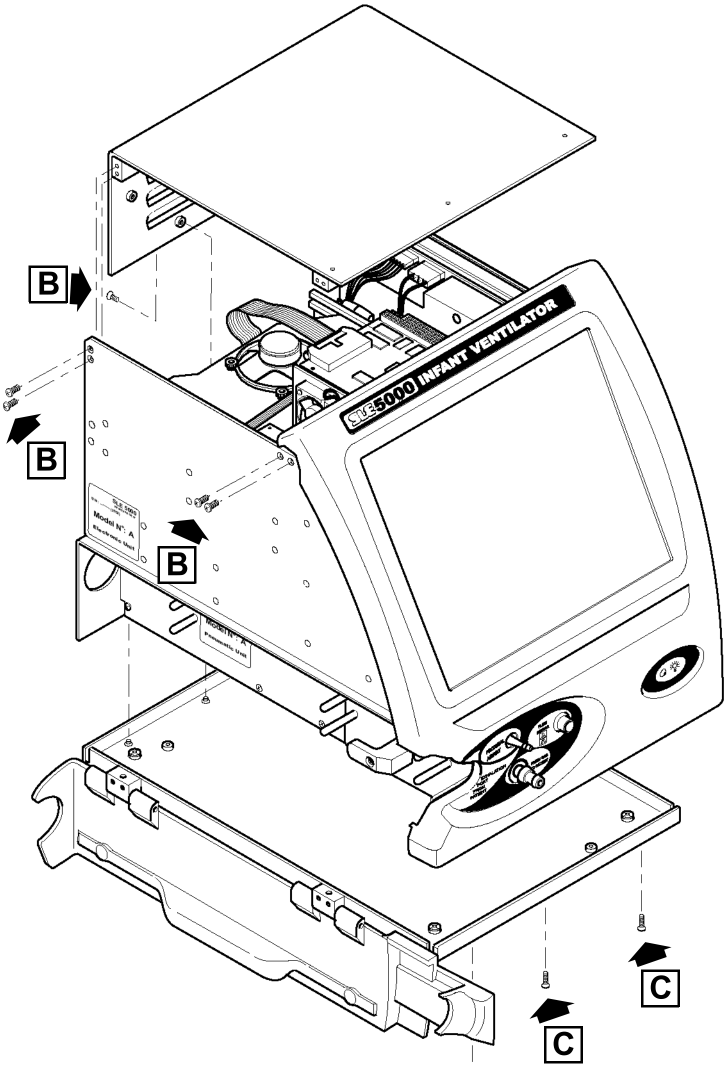
Step 2 Slide the rear cover towards the rear of the machine. When the lip has been disengaged lift the cover off.



Warning: If the ventilator is under a warranty agreement removal of the inner covers may void the agreement. Please refer to the warranty documentation.

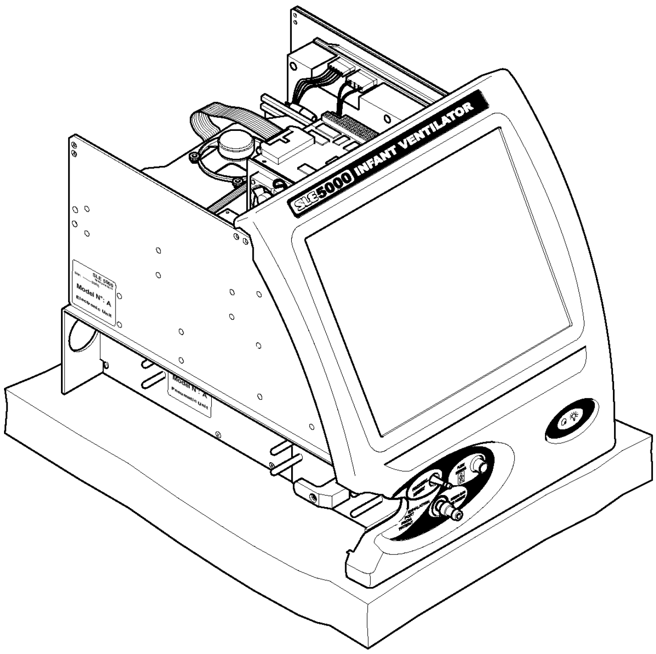
Step 3 Remove the screws **(B)** (10 screws) to release the electronic inner cover.

Note: The design of the inner cover may vary.



Step 4 Remove the screws **(C)** (6 screws) to release the pneumatic unit base plate.

Step 5 Rest the ventilator on a soft pad.



Note: Keep the ventilator plugged into the mains supply, but with the supply turned off. This is to earth the ventilator and prevent static build up.

8. Component Replacement (Electronic unit)

8.1 N6634 CAN Card

Warning: the CAN Card is a static sensitive device.

1. Disconnect the two ribbon cables **(A & B)** from the CAN card.

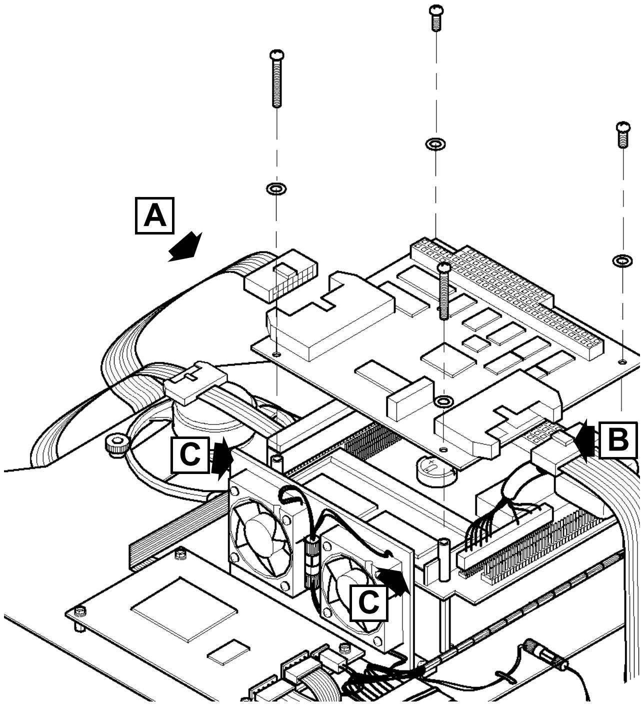
2. Remove the four screws retaining the CAN card.

3. Gently disconnect the CAN card from the PC board by lifting the card vertically, until all the connector pins are disengaged from the socket.

4. The two nylon spacers **(C)** are now loose. Care should be taken to prevent them falling into the electronic unit.

5. Assembly is reversal of removal.

Setup: No setup is required for this device.



8.2 BIOS battery

Warning: The PC board is a static sensitive device.

1. Remove the CAN card as described in section 8.1

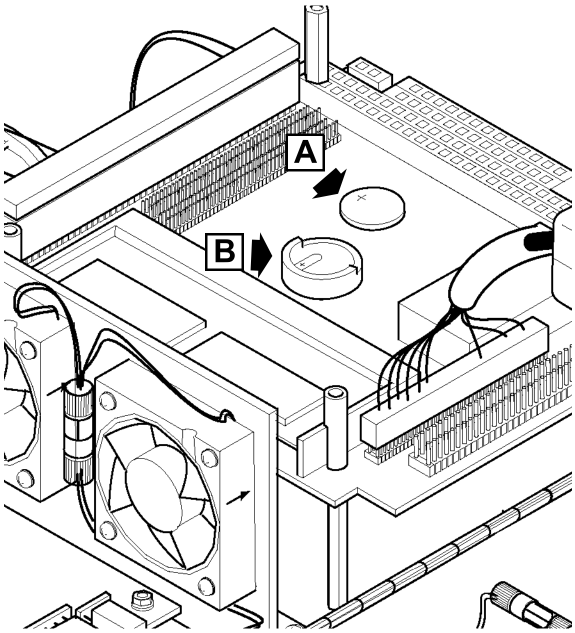
2. Remove the battery **(A)** from the battery housing **(B)**

3. Assembly is reversal of removal.

4. Re-assemble the ventilator and turn it on.

Setup: Enter the “More Options” panel of the user interface and reset the time and date.

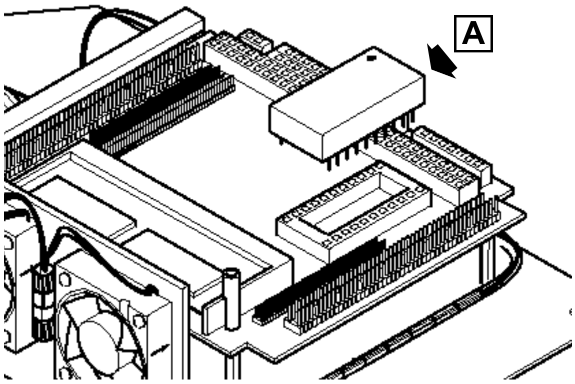
(Refer to the user manual for more details on how to set the time and date.)



8.3 Disk-on-Chip

Warning: The PC board is a static sensitive device.

Warning: Failure to fit the Disk-on-Chip correctly will cause the Disk-on-Chip and the N6631/01 PC board to fail.



1. Remove the can card as described in section 8.1

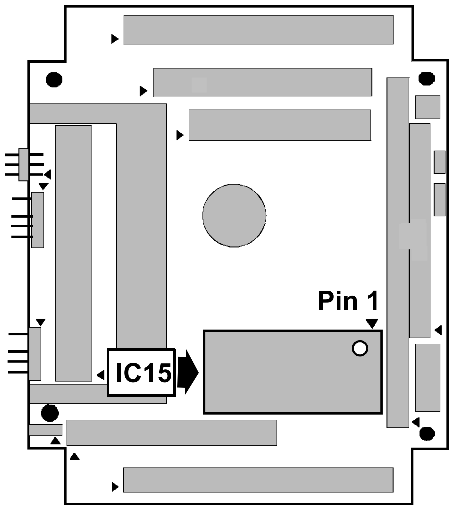
2. Remove the Disk-on-Chip **(A)** using an IC extraction tool.

Warning: Protect the Disk-on-Chip from static damage by placing the pins in anti static foam and the complete chip in an anti static bag.

3. Insert the new Disk-on-Chip into the IC15 socket on the N6631/01 board.

Note: Make sure that Pin 1 on the Disk-on-Chip and the N6631/01 PC board correspond.

4. Re-assemble the ventilator and turn it on.



Setup:

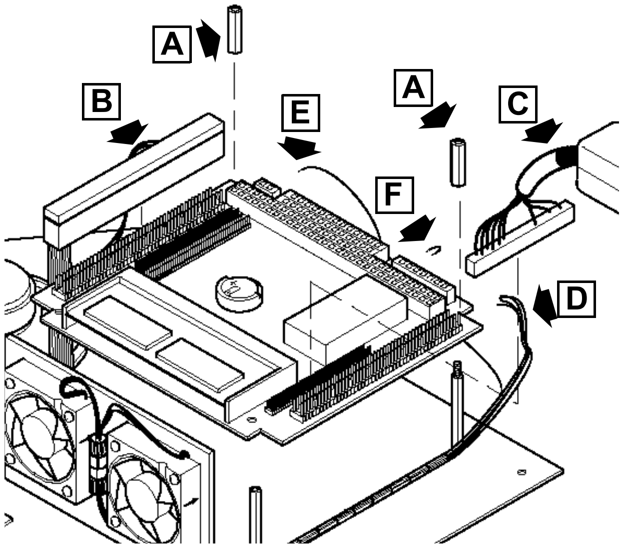
For a Disk-on-Chip with the same version of software, touch screen calibration, reset the time / date and full functional test.

For a Disk-on-Chip with the a new version of software, touch screen calibration, full system calibration, reset the time / date and full functional test.

Note: Software upgrades are usually in conjunction with upgrades to other programmable devices on the control monitor board.

8.4 N6631/01 PC Board

Warning: The PC board is a static sensitive device.



1. Remove the CAN card as described in section 8.1.
2. Unscrew the two pillars **(A)**.
3. Disconnect the 50 way connector **(B)**.
4. Disconnect the display connector cable **(C)**.
5. Disconnect the wires **(D & E)**.
6. Remove the link wire **(F)**.

Assembly is the reverse of removal.

Connect the wires **D** to P18**, E** to P26 and link wire **F** to P18 as per figure 1.

Reconnect the 50 way connector **B** to P22 and the display connector cable **C** to P6 as per figure 2.

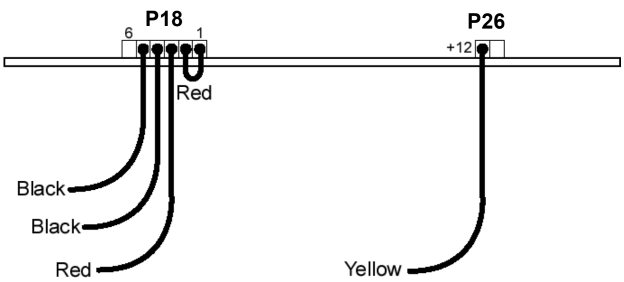


Fig. 1

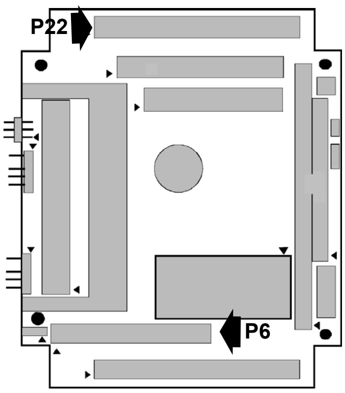


Fig. 2

Note: Check that the new PC board has been pre-programmed with the correct version of software. (Refer to the accompanying documentation).

7. Re-assemble the ventilator and turn it on.

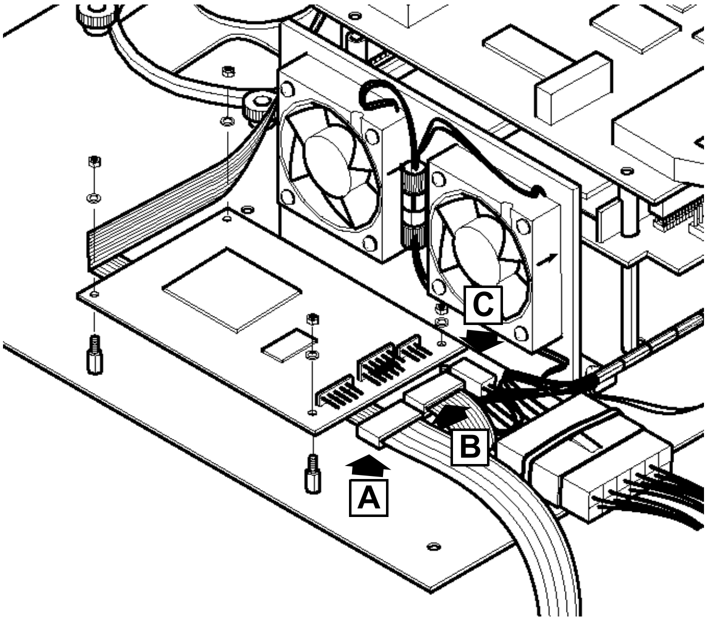
Setup: If the original Disk-on-chip has been used, touch screen calibration, reset the time / date and full functional test.

If a new Disk-on-chip has been fitted or a supplied with the board, touch screen calibration, full system calibration, reset the time / date and full functional test.

8.5 N6631/06 Serial controller (Touch screen)

Warning: The Serial controller is a static sensitive device.

1. Disconnect the touch screen ribbon cable **(A)** from the board.
2. Disconnect the PC link ribbon cable **(B)** from the board.
3. Disconnect the power cable **(C)** from the board.



4. Remove the four nuts and washers retaining the serial controller PCB.
5. Remove the serial controller PCB.
6. Assembly of the serial controller PCB is the reverse of removal.

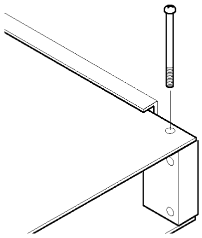
Setup: Touch screen calibration.

8.6 A0763/02 Control and Monitor Board

Warning: The Control and Monitor Board is a static sensitive device.

1. Remove the CAN card as described in section 8.1.

2. Remove the PCB locking screw. This will allow the top board assembly to slide forward a small amount which gives better access to the edge connectors of the top board.



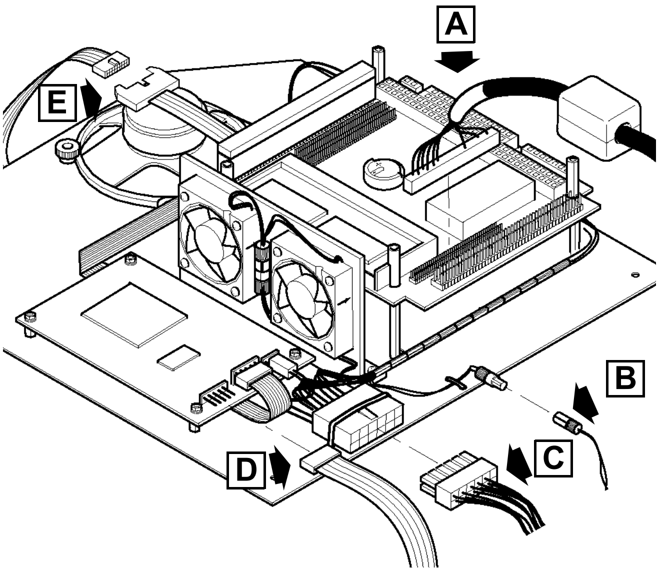
3. Disconnect the display connector cable **(A)**.

4. Disconnect the cooling fan power supply connector **(B)**.

5. Disconnect the board power connector cable **(C)**.

6. Disconnect the touch screen connector cable **(D)**.

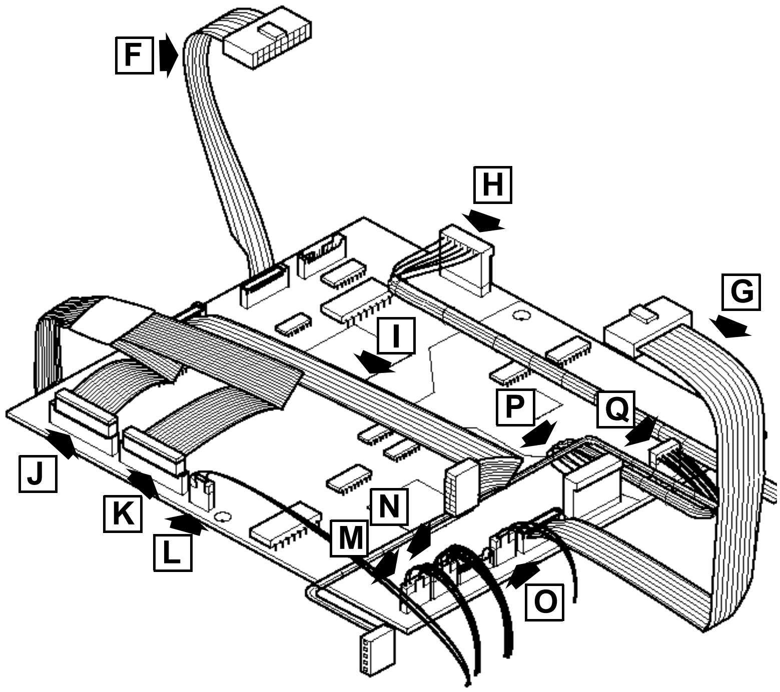
7. Disconnect the RS232 connector cable **(E)**



8. The PC carrier board can now be removed by sliding towards the rear of the ventilator.

The Control monitor board can now be accessed.

9. Disconnect the following cables.



10. CAN card link ribbon cable controller side **(F)**. (P3)

11.CAN card link ribbon cable controller side **(G)**. (JP3)

12. Power supply connector controller side, main loom **(H)**. (P4)

13. Controller to A0761 transducer assembly ribbon cable **(I)**. (P5)

14. Conventional valve drive ribbon cable **(J)**. (P6)

15. Analogue valve drive ribbon cable **(K)**. (P7)

16. Alarm sounder cable, main loom **(L)**. (JP5)

17. Battery/power supply sensing connector, main loom **(M)**. (JP9)

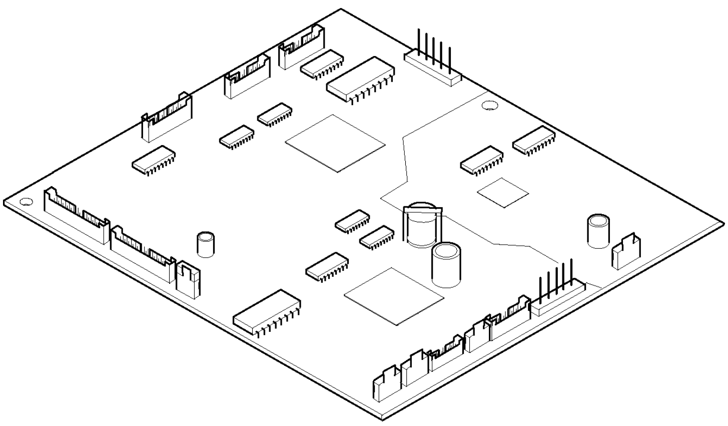
18. Controller to A0761 transducer assembly connector **(N)**. (JP7)

19. O_2 cell connector **(O)**. (JP8)

20. Power supply connector monitor side, main loom **(P)**. (JP6)

21. Flow sensor connector **(Q)**. (JP4)

22. The control and monitor board can now be removed.



Note: For a detailed description .Refer to “A0763/02 Monitor and control board” on page 74.

Assembly is the reversal of removal.

Setup: A full system calibration is required for this component.

8.7 M0900 Power Supply Unit

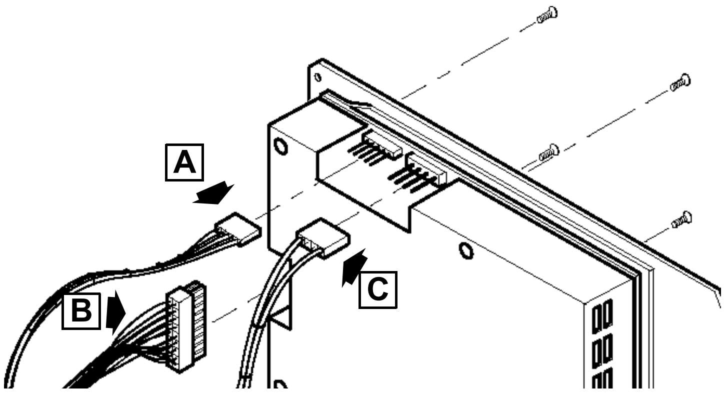
1. Disconnect the main power supply.

2. Remove the four fixing screws.

3. Disconnect the battery monitor cable **(A)**.

4. Disconnect the main loom power cable **(B)**.

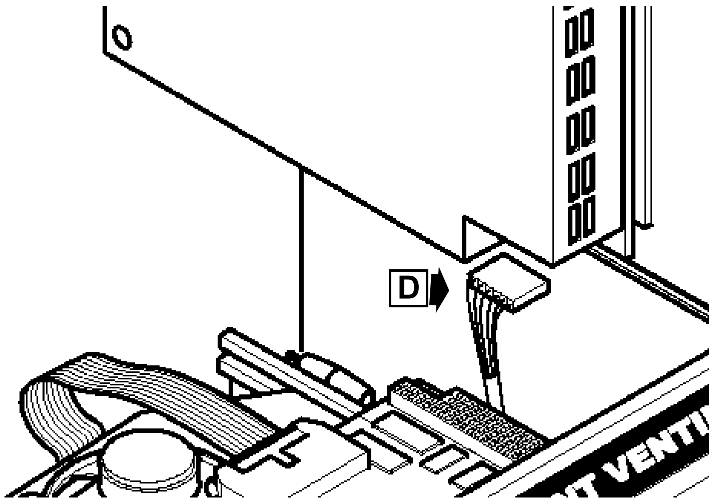
5. Disconnect the battery monitor cable **(C)**.



6. Lift the power supply to reveal the mains inlet cable **(D)**.

7. Disconnect the mains inlet cable and remove the power supply.

8. Assembly is reversal of removal.



Setup: No setup is required for this device.

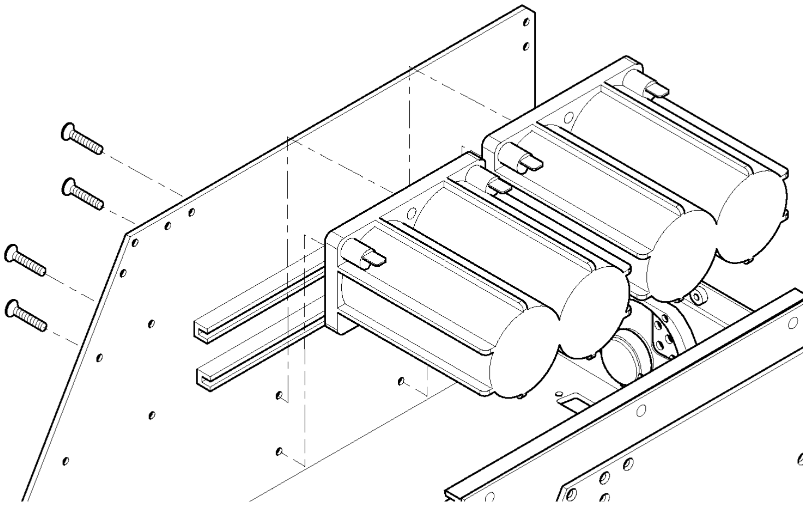
8.8 M0901 Batteries

1. Remove the CAN card as described in section 8.1.

2. Remove the PC board and the monitor control board as described in section 8.6.

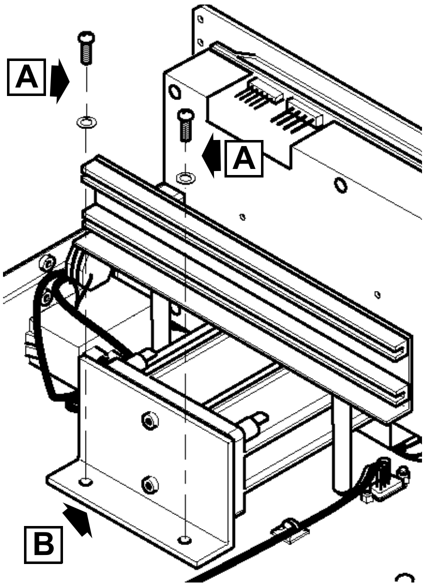
3. Disconnect all the battery terminal leads.

4. Remove the four retaining screws for the first two battery blocks.



5. Remove the two batteries.

6. Remove the two fixing screws and washers **(A)**, securing the fixing bracket **(B)** for the third battery.

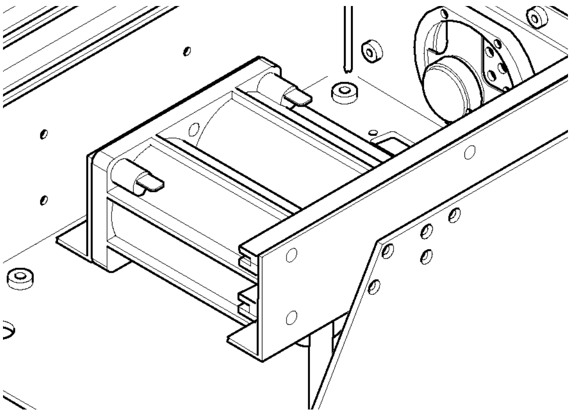


7. Slide the battery forward and lift clear.

8. Remove the two fixing screws to release the bracket from the battery block.

9. Assembly is reversal of removal.

Setup: No setup is required for this device. The ventilator should be left connected and turned on for a minimum of 24 hours to fully charge the batteries.



8.9 A0761 Transducer PCB Assembly

Warning: The Transducer PCB is a static sensitive device.

Note: Screen removed for clarity.

1. Remove the CAN card as described in section 8.1.

2. Remove the PC board and the monitor control board as described in section 8.6.

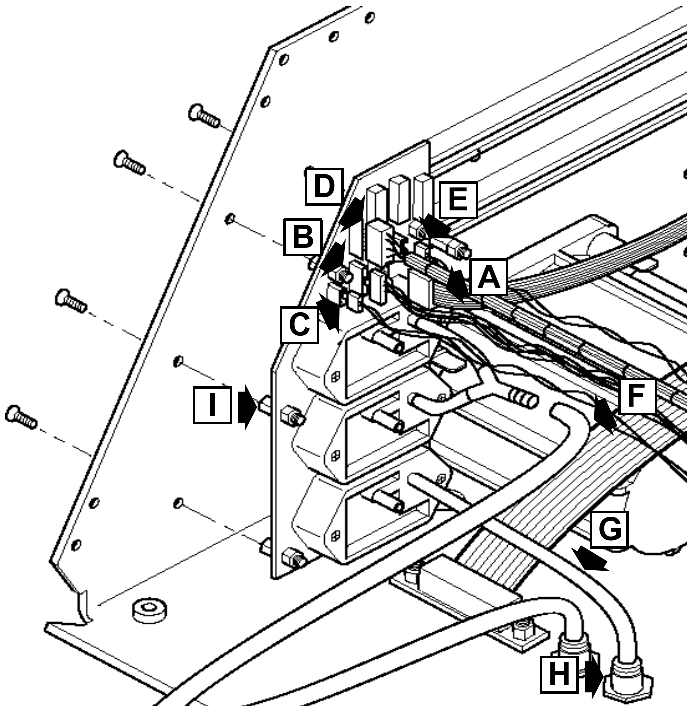
3. Disconnect the ribbon cable from J2 **(A)**.

4. Disconnect the main loom connector from J5 **(B)**.

5. Disconnect the LED connector from J4 **(C)**.

6. Disconnect the loom connector from J3 **(D)**.

7. Disconnect the loom connector from J1 **(E)**.



Note: The tubes connected to the transducer PCB are attached using an adhesive.

Note:Please note that replacement assemblies use an open pcb tansducer. (Ventilator serial N° 51859 onwards).

8. Remove the tube **(F)** from the Y piece connector.

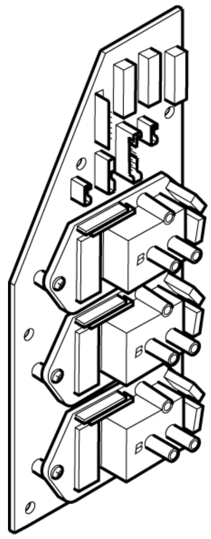
9. Remove the tube **(G)** from the bulk head connector **(H)**.

10. Remove the six fixing screws retaining the transducer PCB.

11. Remove the support pillars, retaining nuts and washers **(I)** from the old PCB and transfer them to the replacement PCB.

12. Assembly is reversal of removal.

Setup: A full system calibration is required for this component.



8.10 Inverter PCB

8.10.1 N6631/03 Inverter PCB

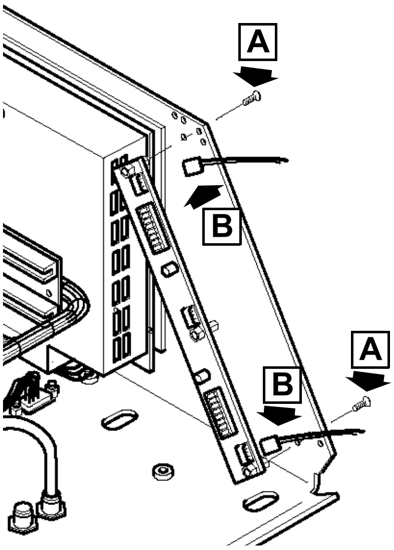
Warning: The Transducer PCB is a static sensitive device.

Note: Screen removed for clarity.

1. Remove the CAN card as described in section 8.1.

2. Remove the PC board and the monitor control board as described in section 8.6.

3. Remove the two screws **(A)**.

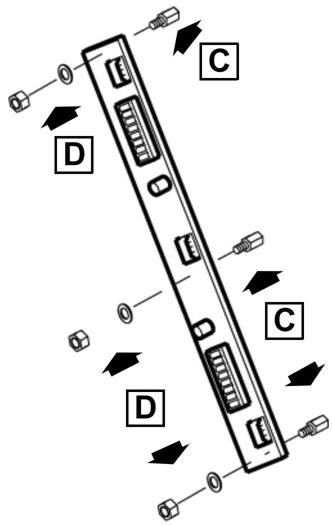


Warning: The PCB is still attached by the backlight connectors to the LCD / Touch screen assembly.

4. Disconnect the two backlight connectors **(B)**.

5. Remove the PCB from the electronic unit.

6. Remove the three support pillars **(C)** by removing the nut and washers **(D)**.



7. Assembly is reversal of removal.

Setup: No setup is required for this device.

8.10.2 N6631/10 Inverter PCB

Warning: The Transducer PCB is a static sensitive device.

Note: Screen removed for clarity.

1. Remove the CAN card as described in section 8.1.

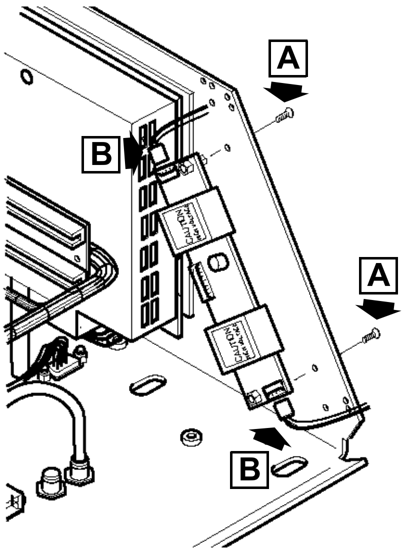
2. Remove the PC board and the monitor control board as described in section 8.6.

3. Remove the two screws **(A)**.

Warning: The PCB is still attached by the backlight connectors to the LCD / Touch screen assembly.

4. Disconnect the two backlight connectors **(B)**.

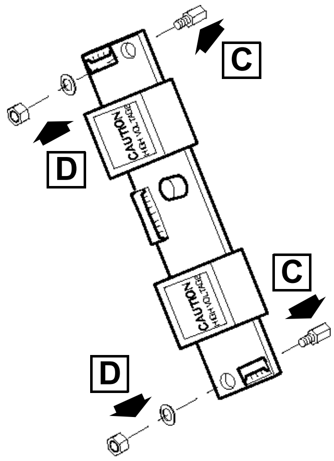
5. Remove the PCB from the electronic unit.



6. Remove the two support pillars **(C)** by removing the nut and washers **(D)**.

7. Assembly is reversal of removal.

Setup: No setup is required for this device.



8.10.3 N6631/13 Inverter PCB

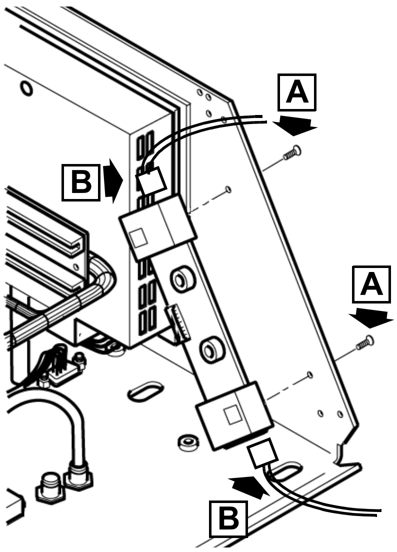
Warning: The Transducer PCB is a static sensitive device.

Note: Screen removed for clarity.

1. Remove the CAN card as described in section 8.1.

2. Remove the PC board and the monitor control board as described in section 8.6.

3. Remove the two screws **(A)**.

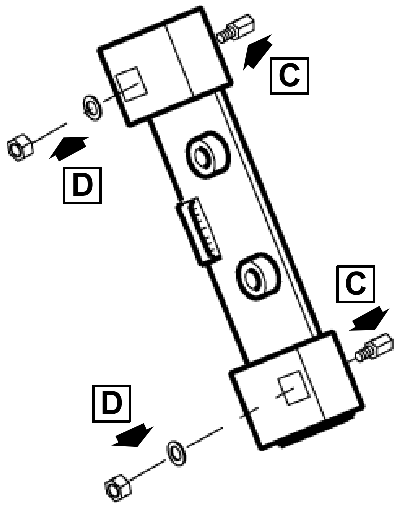


Warning: The PCB is still attached by the backlight connectors to the LCD / Touch screen assembly.

4. Disconnect the two backlight connectors **(B)**.

5. Remove the PCB from the electronic unit.

6. Remove the two support pillars **(C)** by removing the nut and washers **(D)**.



7. Assembly is reversal of removal.

Setup: No setup is required for this device.

8.11 N6631/02 LCD & N6631/05 Touch Screen

8.11.1 For ventilators 51010 to 51084

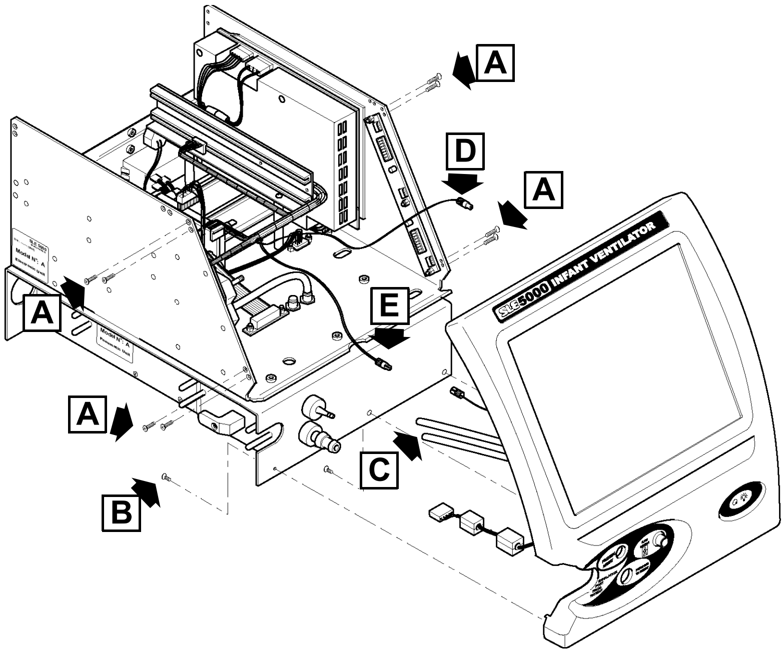
1. Remove the CAN card as described in section 8.1.

2. Remove the PC board and the monitor control board as described in section 8.6.

3. Remove the 8 screws **(A)** retaining the screen tie bars.

4. Remove the 3 remaining facia retaining screws **(B)**.

5. Gently draw the front panel assembly away from the unit.



Note: Display / touch screen cables not shown for clarity.

6. Disconnect the two backlight power leads from the inverter board (See section 8.10 on page 44).

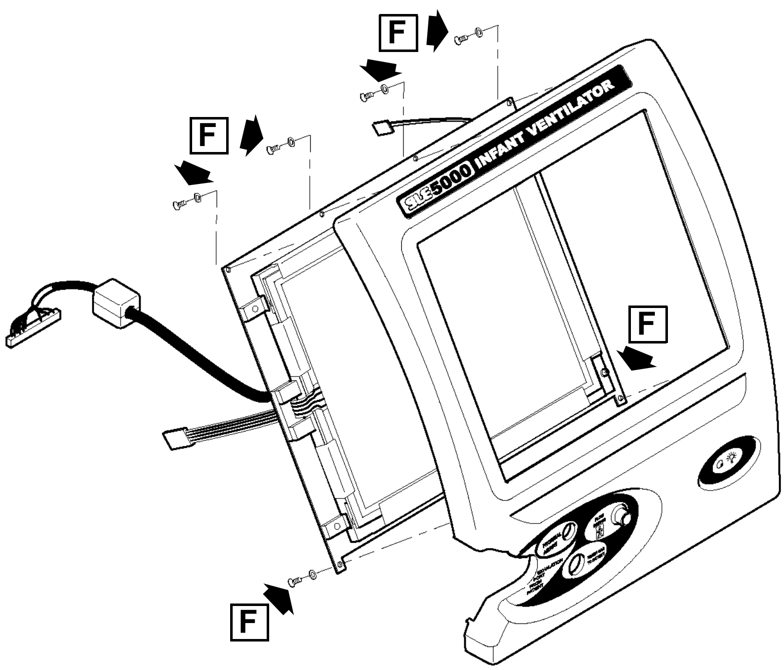
7. Disconnect the two tubes **(C)**.

8. Disconnect the fan electrical connector **(D)**.

9. Disconnect the led electrical connector **(E)**.

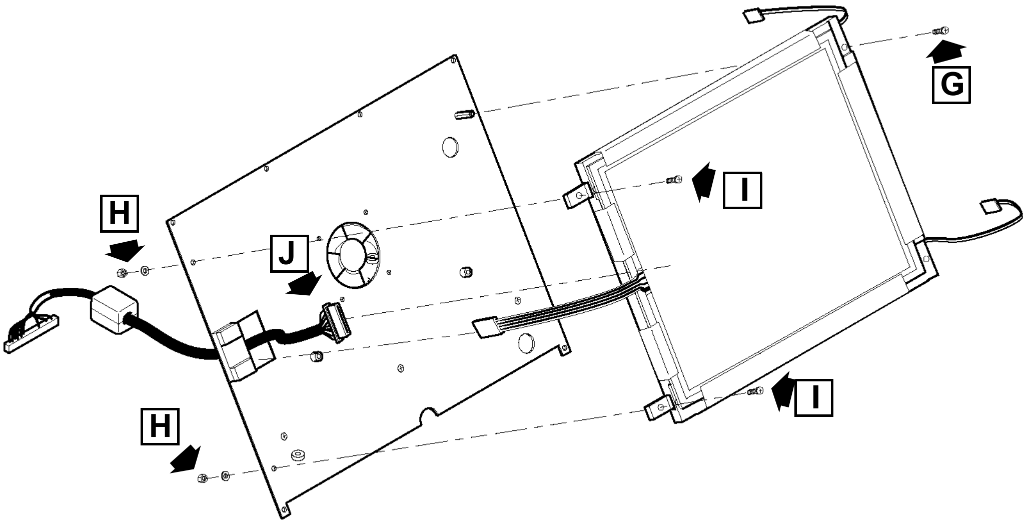
10. Remove the 6 facia retaining screws and washers **(F)**.

11. Remove the front facia.



12. Remove the 2 screws **(G)** retaining the right hand side of the LCD / touch screen assembly.

13. Remove the 2 nuts, washers **(H)** and screws **(I)** retaining the left hand side of the LCD / touch screen assembly.



14. Separate the LCD / touch screen assembly from the mounting plate.

15. Disconnect the connecting cable **(J)** from the rear of the LCD assembly.

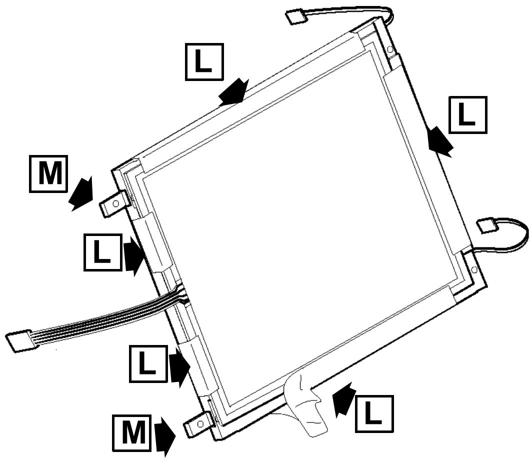
16. The LCD / touch screen assembly is now free.

17. To remove the touch screen, peel off the adhesive tape **(L)**.

18. Once the tape is remove the touch screen can be removed.

Warning: Do not touch the LCD screen with bare hands. This is to prevent grease contamination of the surface (i.e. finger prints).

19. With the touch screen removed the two LCD mounting blocks **(M)** can be removed as access to their fixing screws is now possible.



20. Assembly is reversal of removal.

Setup: If the entire assembly or just the touch screen has been replaced the screen calibration routine will have to be carried out.

8.11.2 For ventilators 51085 to 51526

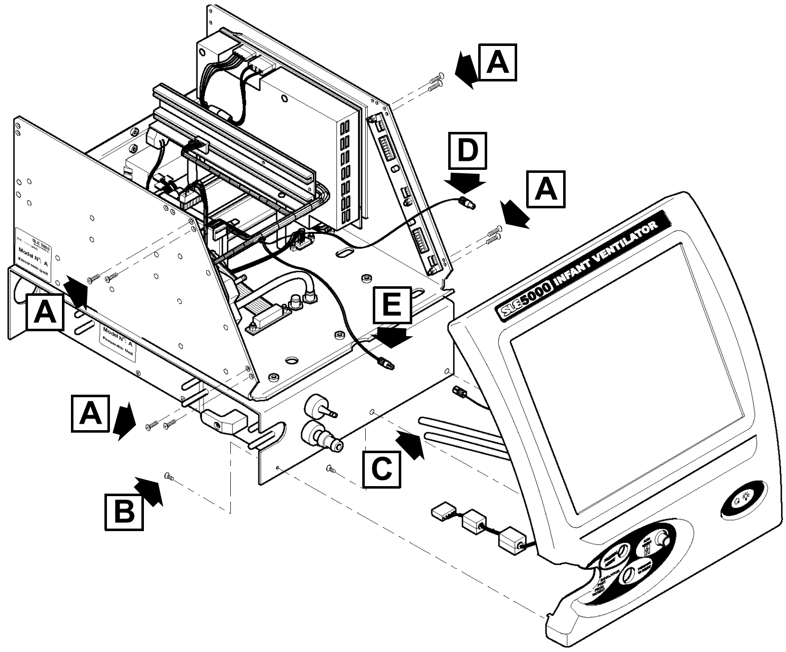
1. Remove the CAN card as described in section 8.1.

2. Remove the PC board and the monitor control board as described in section 8.6.

3. Remove the 4 screws **(A)** retaining the screen tie bars.

4. Remove the 3 remaining facia retaining screws **(B)**.

5. Gently draw the front panel assembly away from the unit.



Note: Dispaly / touch screen cables not shown for clarity.

6. Disconnect the two backlight power leads from the inverter board (See section 8.10 on page 44).

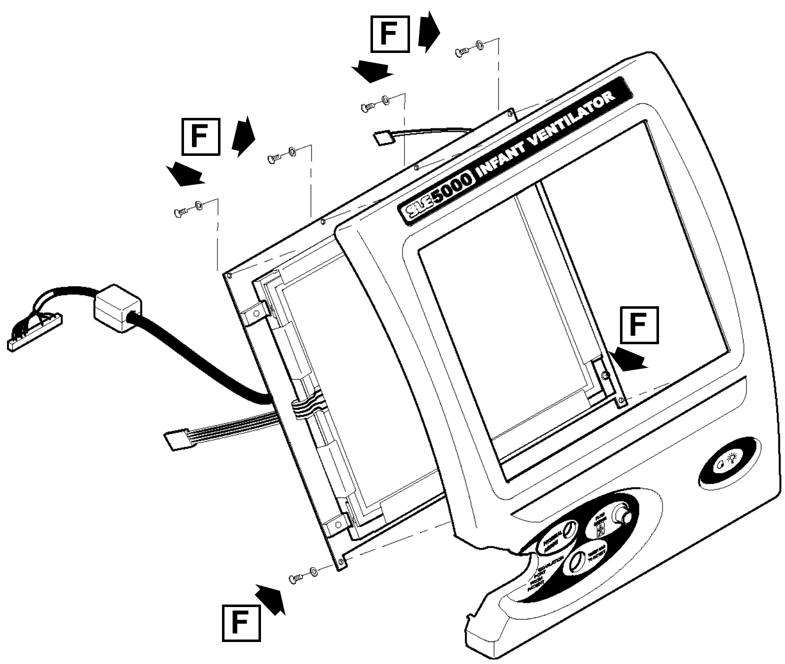
7. Disconnect the two tubes **(C)**.

8. Disconnect the fan electrical connector **(D)**.

9. Disconnect the led electrical connector **(E)**.

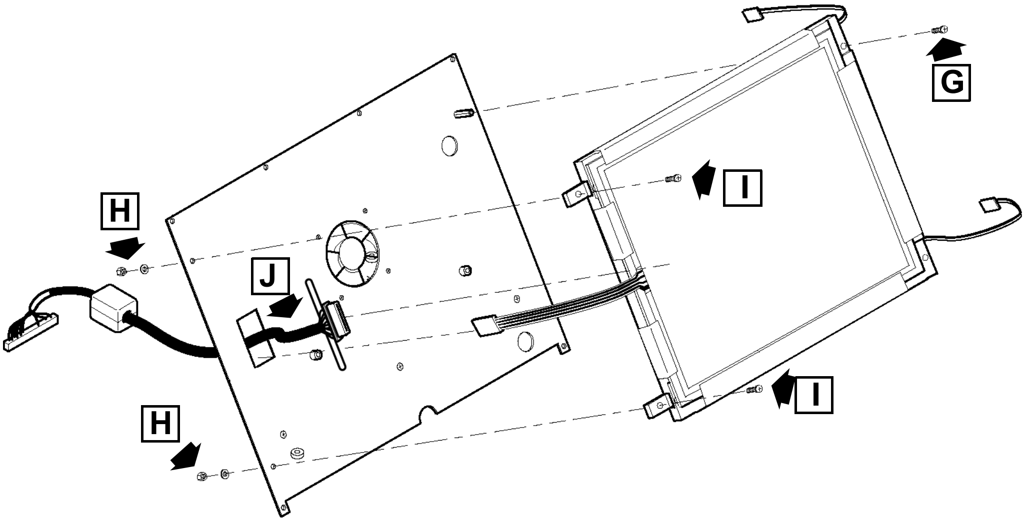
10. Remove the 6 facia retaining screws and washers **(F)**.

11. Remove the front facia.



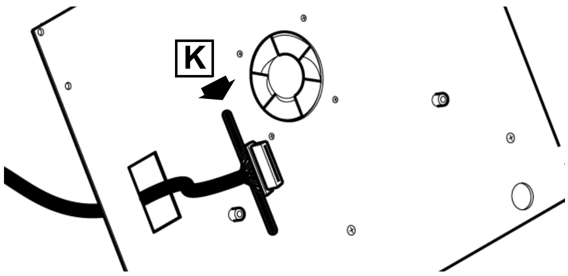
12. Remove the 2 screws **(G)** retaining the right hand side of the LCD / touch screen assembly.

13. Remove the 2 nuts, washers **(H)** and screws **(I)** retaining the left hand side of the LCD / touch screen assembly.

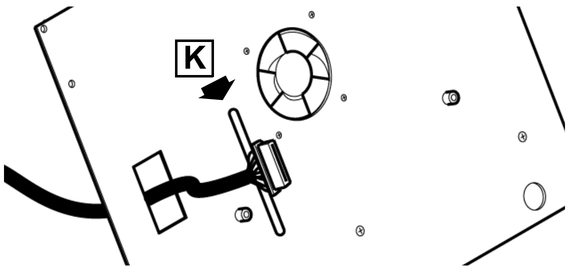


14. To free the cable, detach the locking rod **(K)** by cutting the adhesive, (White locking rod only).

Note: For ventilators serial number 51085 to 51163 the connecting cable is locked in position by a black nylon locking rod (K) (Part Nº: T1306).



For ventilators serial number 51164 to 51569 the connecting cable is locked in position by a white nylon locking rod (Part Nº: T1306/01). The locking rod is also held in postion by a white silicone adhesive.



Warning:The black locking rod should not be used on ventilators 51164 onwards as it is thicker and will not allow correct assembly of the LCD/ Touch screen.

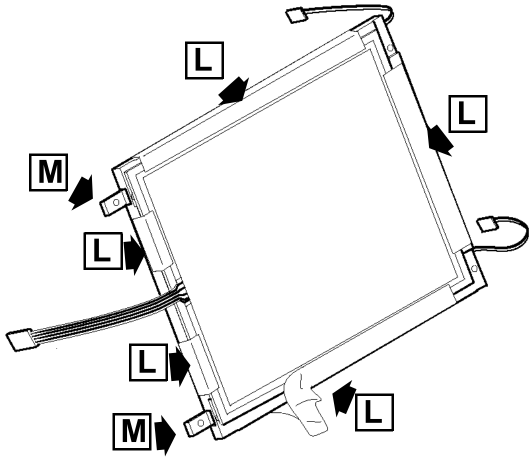
Note: For ventilators serial number 51164 onwards the LCD cable assembly is cable tied to a pillar on the rear face of the mounting plate. Ventilators prior to serial number 51164 may also have the LCD cable assembly cable tie if fitted with service kit N9052.

15. Separate the LCD / touch screen assembly from the mounting plate.

16. Disconnect the connecting cable **(J)** from the rear of the LCD assembly.

17. The LCD / touch screen assembly is now free.

18. To remove the touch screen, peel off the adhesive tape **(L)**.



19. Once the tape is remove the touch screen can be removed.

Warning: Do not touch the LCD screen with bare hands. This is to prevent grease contamination of the surface (i.e. finger prints).

20. With the touch screen removed the two LCD mounting blocks **(M)** can be removed as access to their fixing screws is now possible.

21. Assembly is reversal of removal.

Setup: If the entire assembly or just the touch screen has been replaced the screen calibration routine will have to be carried out.

8.11.3 For ventilators 51527 to 51569

1. Remove the CAN card as described in section 8.1.

2. Remove the PC board and the monitor control board as described in section 8.6.

3. Remove the 4 screws **(A)** retaining the screen tie bars.

4. Remove the 3 remaining facia retaining screws **(B)**.

5. Gently draw the front panel assembly away from the unit.

Note: Dispaly / touch screen cables not shown for clarity.

6. Disconnect the two backlight power leads from the inverter board (See section 8.10 on page 44).

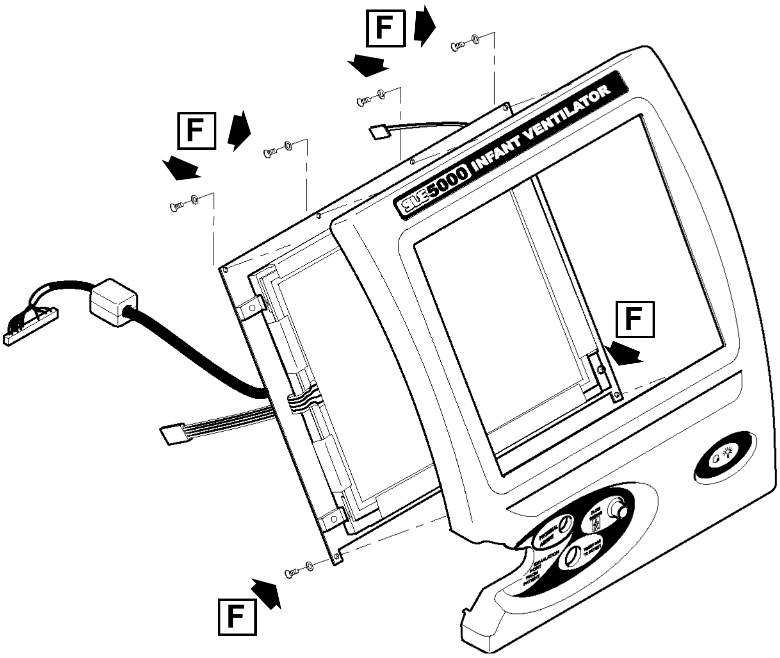
7. Disconnect the two tubes **(C)**.

8. Disconnect the fan electrical connector **(D)**.

9. Disconnect the led electrical connector **(E)**.

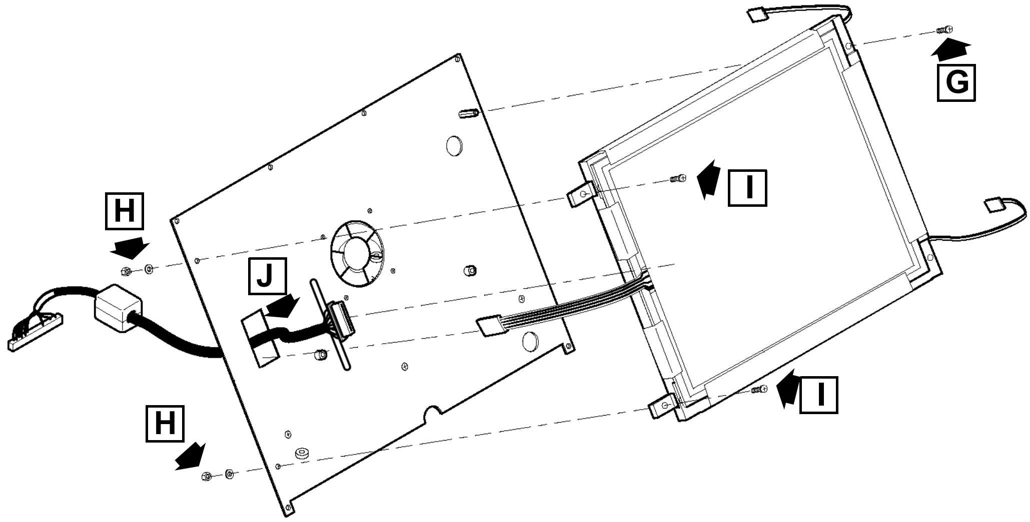
10. Remove the 6 facia retaining screws and washers **(F)**.

11. Remove the front facia.



12. Remove the 2 screws **(G)** retaining the right hand side of the LCD / touch screen assembly.

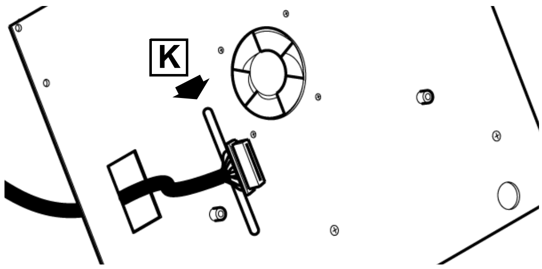
13. Remove the 2 nuts, washers **(H)** and screws **(I)** retaining the left hand side of the LCD / touch screen assembly.



14. To free the cable **(J)**, detach the locking rod **(K)** by cutting the adhesive.

15. Separate the LCD / touch screen assembly from the mounting plate.

16. Disconnect the connecting cable **(J)** from the rear of the LCD assembly.

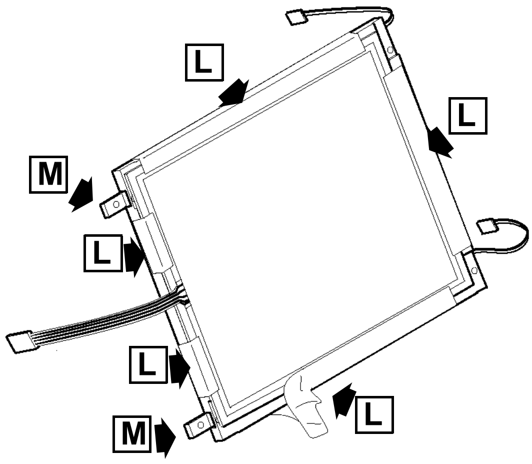


17. The LCD / touch screen assembly is now free.

18. To remove the touch screen, peel off the adhesive tape **(L)**.

19. Once the tape is remove the touch screen can be removed.

Warning: Do not touch the LCD screen with bare hands. This is to prevent grease contamination of the surface (i.e. finger prints).



20. With the touch screen removed the two LCD mounting blocks **(M)** can be removed as access to their fixing screws is now possible.

21. Assembly is reversal of removal.

Setup: If the entire assembly or just the touch screen has been replaced the screen calibration routine will have to be carried out.

8.11.4 For ventilators 51570 onwards

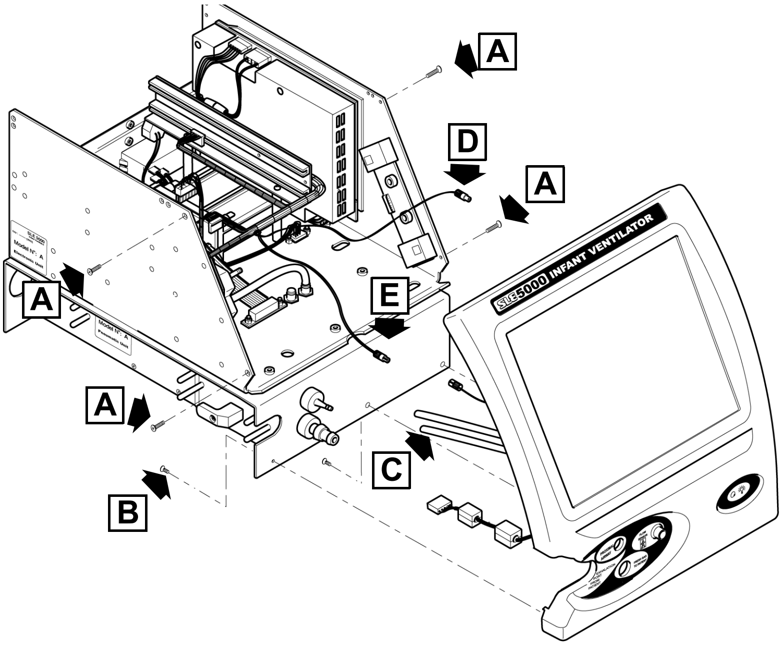
1. Remove the CAN card as described in section 8.1.

2. Remove the PC board and the monitor control board as described in section 8.6.

3. Remove the 4 screws **(A)** retaining the screen tie bars.

4. Remove the 3 remaining facia retaining screws **(B)**.

5. Gently draw the front panel assembly away from the unit.



Note: Dispaly / touch screen cables not shown for clarity.

6. Disconnect the two backlight power leads from the inverter board (See section 8.10 on page 44).

7. Disconnect the two tubes **(C)**.

8. Disconnect the fan electrical connector **(D)**.

9. Disconnect the led electrical connector **(E)**.

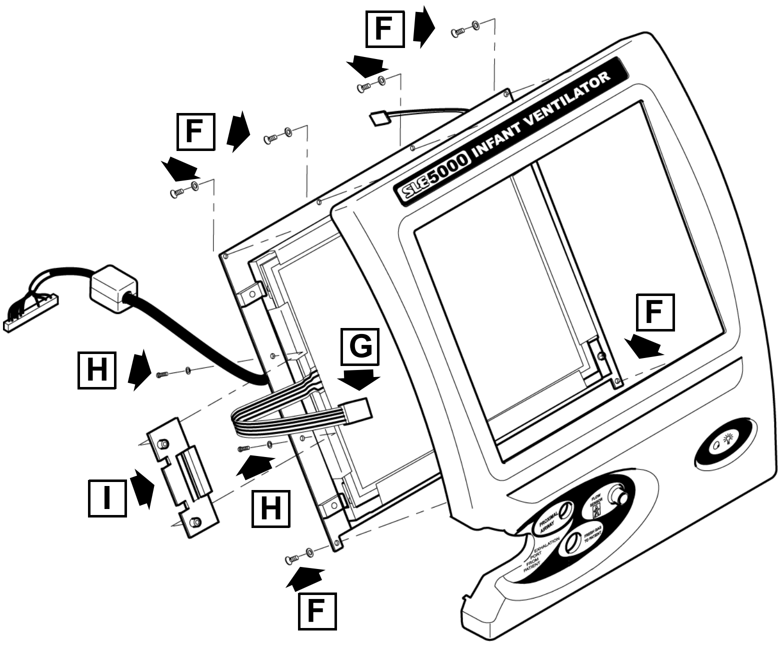
10. Remove the 6 facia retaining screws and washers **(F)**.

11. Remove the front facia.

12. Withdraw the touch screen cable **(G)** through the hole in the LCD cable clamp plate **(I)**.

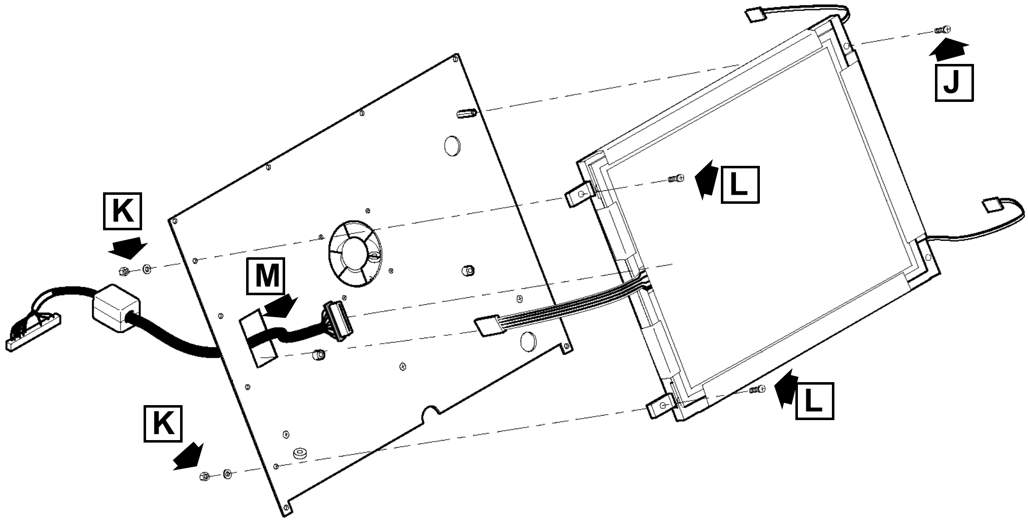
13. Remove the two screws and washers **(H)** retaining the LCD cable clamp plate **(I)**.

14. Slide out the LCD retauning clamp **(I)**.



15. Remove the 2 screws **(J)** retaining the right hand side of the LCD / touch screen assembly.

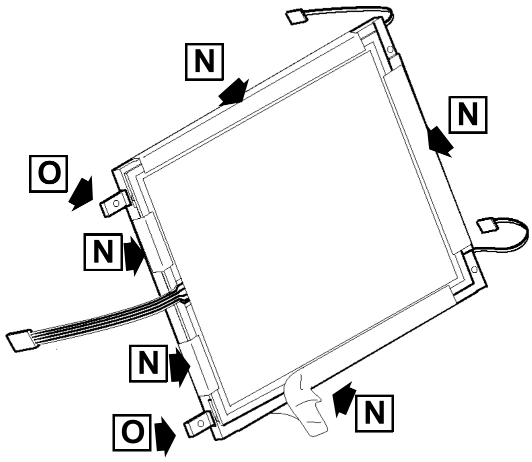
16. Remove the 2 nuts, washers **(K)** and screws **(L)** retaining the left hand side of the LCD / touch screen assembly.



17. Separate the LCD / touch screen assembly from the mounting plate.

18. Disconnect the connecting cable **(M)** from the rear of the LCD assembly.

19. The LCD / touch screen assembly is now free.



20. To remove the touch screen, peel off the adhesive tape **(N)**.

21. Once the tape is remove the touch screen can be removed.

Warning: Do not touch the LCD screen with bare hands. This is to prevent grease contamination of the surface (i.e. finger prints).

22. With the touch screen removed the two LCD mounting blocks **(O)** can be removed as access to their fixing screws is now possible.

23. Assembly is reversal of removal.

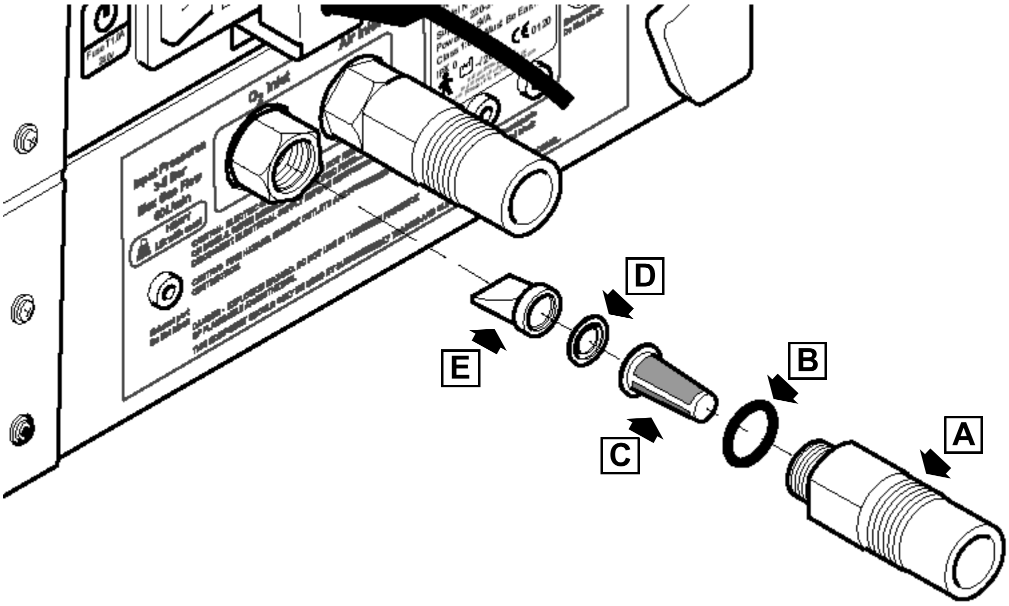
Setup: If the entire assembly or just the touch screen has been replaced the screen calibration routine will have to be carried out.

9. Component Replacement (Pneumatic unit)

9.1 N2185/05 & 06 Duckbill and conical filters.

Note: The O_2 inlet connector is used to illustrate the process, the procedure is the same for the Air inlet connector.

1. Using a spanner remove the inlet connector **(A)**.



2. Remove O-ring **(B)**, Nylon filter cone **(C)**, Washer **(D)** and Duckbill check valve **(E)**.

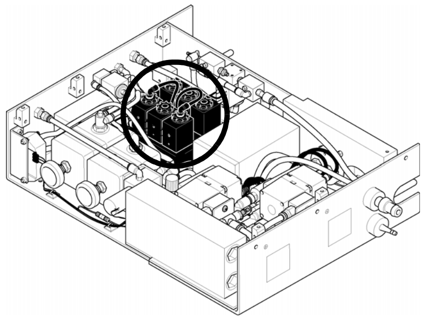
3. Assembly is reversal of removal.

Note: The O-ring (B) should always be replaced with a new item.

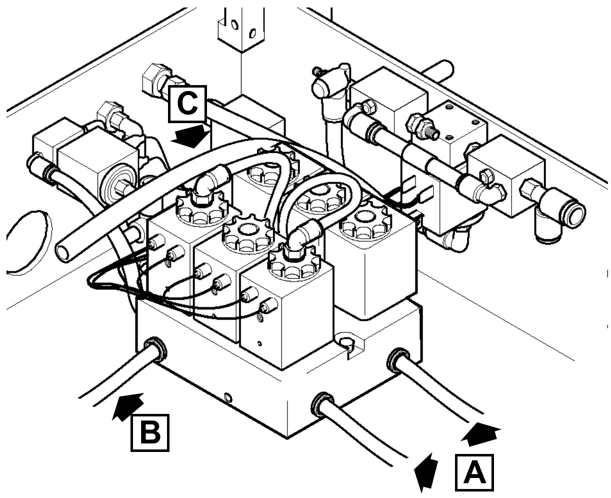
Setup: No setup is required for this device.

9.2 L0287 Blender Assembly

Location in pneumatic unit.



1. Disconnect the two mixing chamber tubes **(A)**.
2. Disconnect the PR1 tube **(B)**.
3. Disconnect the PR2 tube **(C)**.



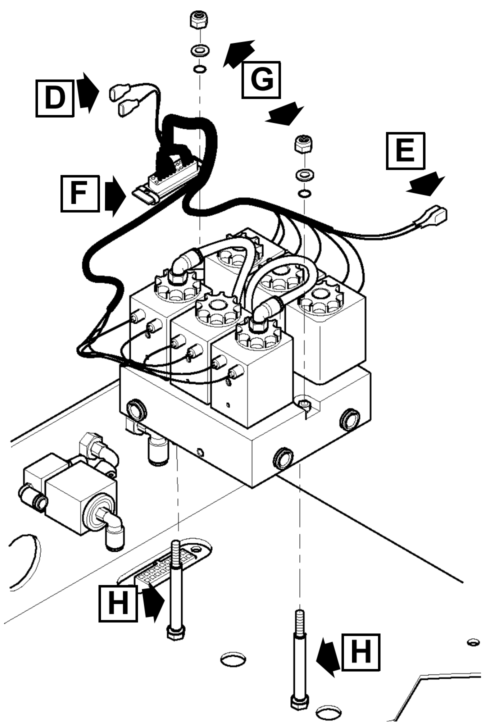
4. Disconnect the electrical connectors from SV8 **(D)**.
5. Disconnect the electrical connectors from SV7 **(E)**.
6. Disconnect the blender loom connector from the bulk head **(F)**.
7. Remove the two shake proof nuts, washers and O-rings **(G)**.

The blender can now be removed.

Note: Ensure that the rubber sleeves (H) remain on the blender support studs.

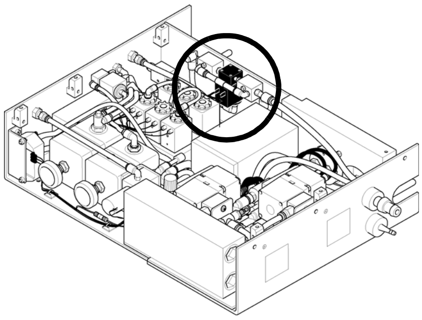
8. Assembly is reversal of removal.

Setup: A full system calibration is required for this component.

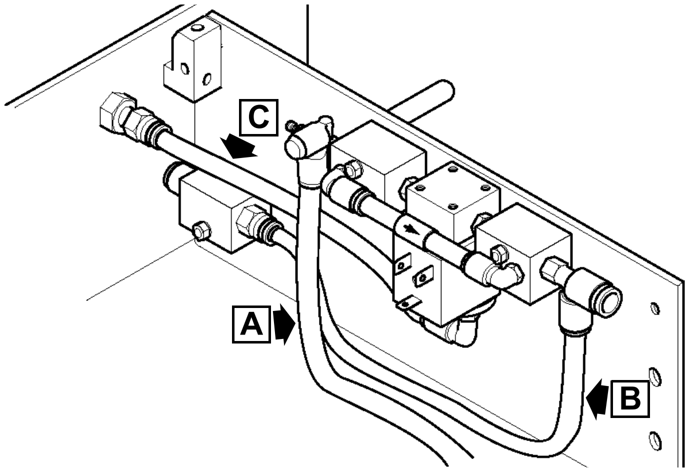


9.3 N2195/06 Fresh Gas Supply solenoid (SV7)

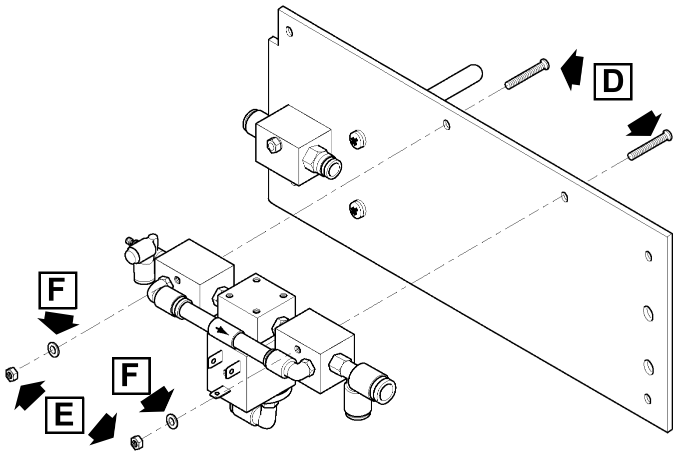
Location in pneumatic unit.



1. Disconnect the FR1 to mixing chamber tube **(A)**.
2. Disconnect the SV7 to PRV1 tube **(B)**.
3. Disconnect the SV7 to overboard dump tube **(C)**.



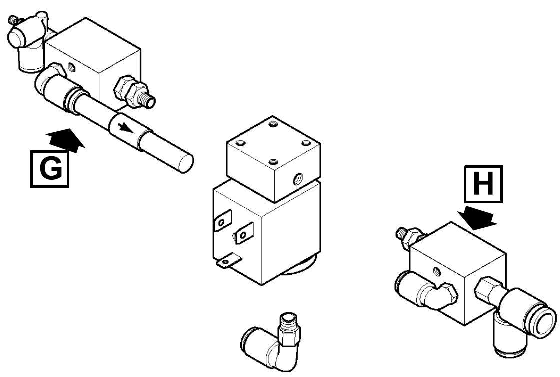
4. Remove the two screws **(D)**, nuts **(E)** and washers **(F)** securing the SV7 solenoid assembly to the bulkhead.



5. Detach the SV7 solenoid valve from the two bypass mounting block assemblies **(G)** and **(H)** as shown.

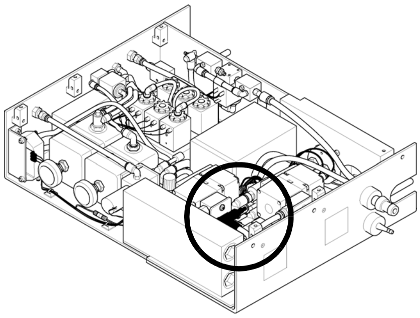
6. Assembly is reversal of removal.

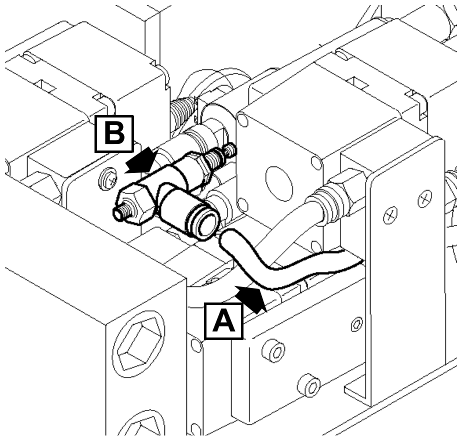
Setup: The pneumatic setup procedure is required for this component.



9.4 N6612 Purge Regulator (PR7) Pre PAM (Proximal Airway Modification)

Location in pneumatic unit.



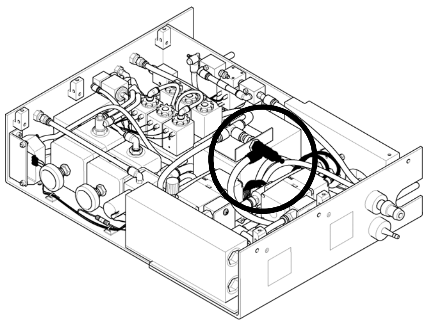


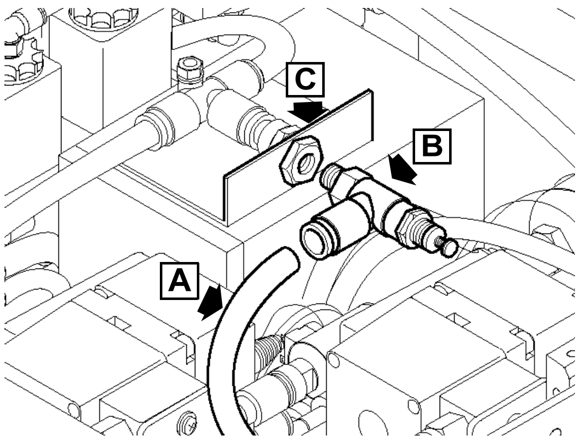
1. Remove the outlet hose **(A)**.
2. Remove the purge regulator **(B)** using a spanner to undo the base nut.
3. Assembly is reversal of removal.

Setup: The pneumatic setup procedure is required for this component.

9.5 N6612 Purge Regulator (PR7) Post PAM (Proximal Airway Modification)

Location in pneumatic unit.



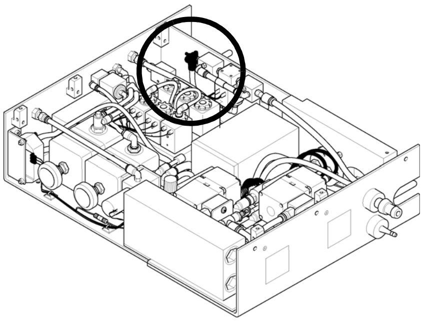


1. Remove the outlet hose **(A)**.
2. Remove the purge regulator **(B)** using a spanner to undo the base nut. Take care not to loosen the bulkhead flitting **(C)**.
3. Assembly is reversal of removal.

Setup: The pneumatic setup procedure is required for this component.

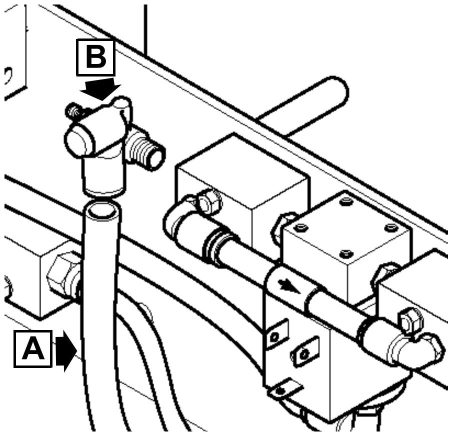
9.6 N6614 Speed controller (FR1)

Location in pneumatic unit.



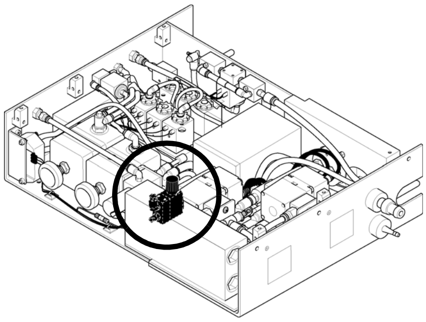
1. Remove the outlet hose **(A)**.
2. Remove the Speed controller **(B)** using a spanner to undo the base nut.
3. Assembly is reversal of removal.

Setup: The pneumatic setup procedure is required for this component.



9.7 N6613 Purge Regulator (PR5) Pre Proximal Airway Modification

Location in pneumatic unit.



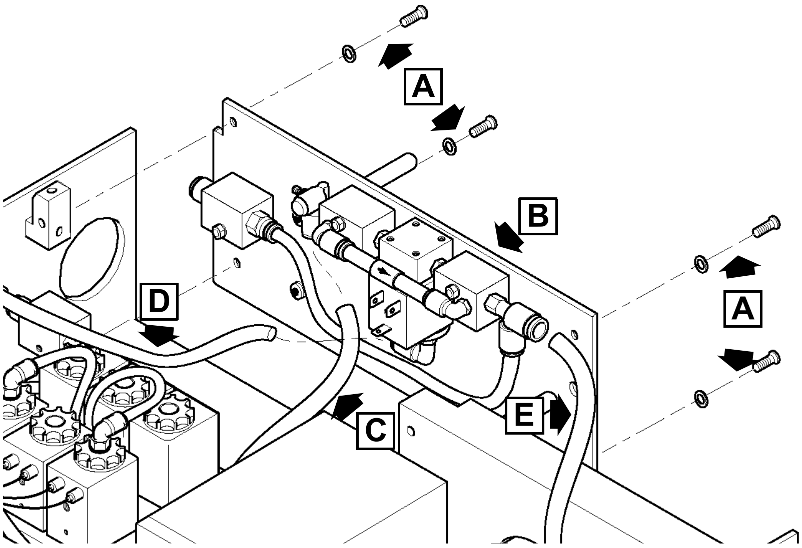
1. Remove the four screws and washers **(A)** retaining the partition assembly **(B)**.

2. Gently release the assembly so access the tubing.

3. Disconnect the tube connected to FR1 **(C)**.

4. Disconnect the tube connected to SV7 **(D)**.

5. Disconnect the fresh gas tube connected to the SV7 bypass mounting block **(E)**.



6. Remove the partition assembly **(B)** from the pneumatic unit.

7. Disconnect the following tubes.

Fresh gas monitoring tube **(F)**.

Proximal airway monitoring tube **(G)**.

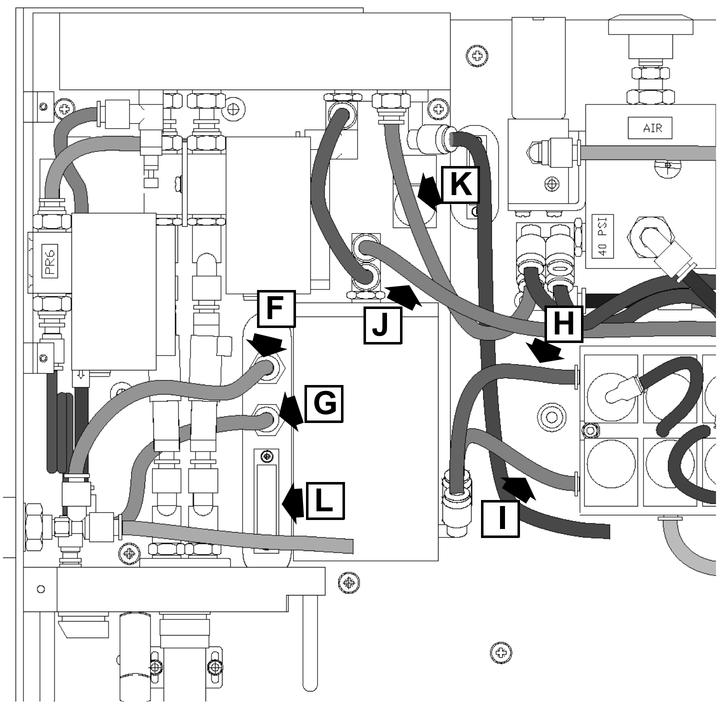
Blender port 3 to mixing chamber tube **(H)**.

Blender port 4 to mixing chamber tube **(I)**.

Mixing chamber to SV8 tube **(J)**.

Manifold to air regulator tube **(K).**

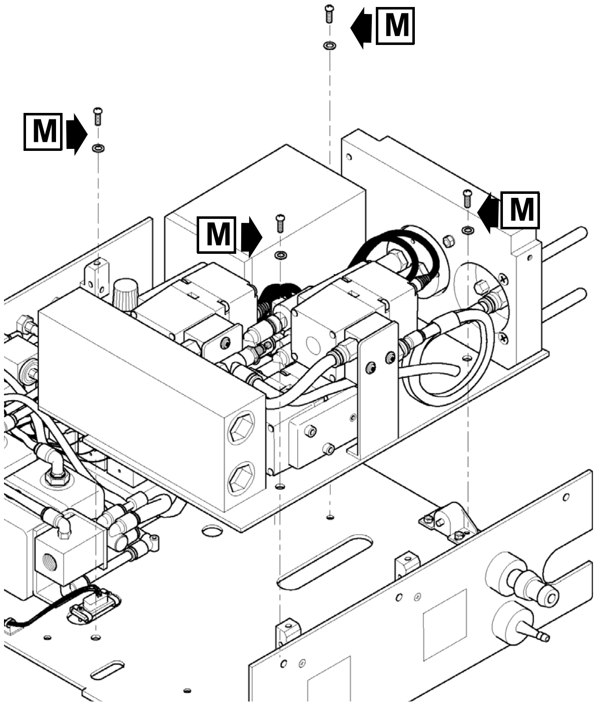
8. Disconnect the electrical loom connector **(L)**.



9. Remove the four screws and washers **(M)** retaining the HFO module.

10. Remove the module from the pneumatic unit.

Note: The fresh gas and proximal airway tube fittings impede the removal of the module.

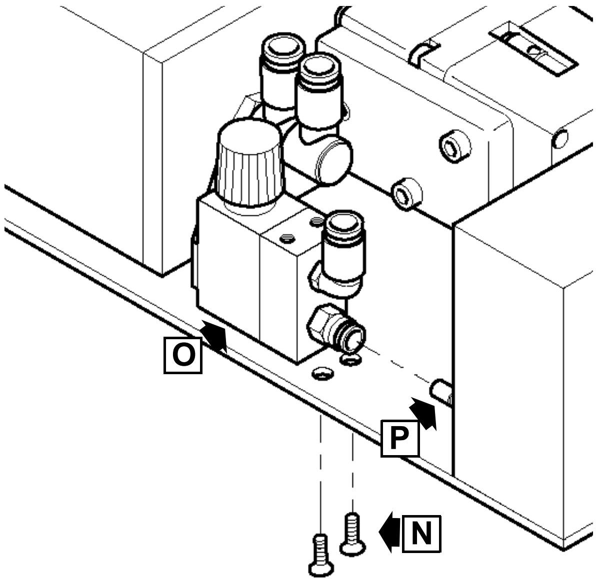


11. Remove the two screws **(N)**.

12. Slide the purge regulator PR5 **(O)** off the manifold fitting **(P)**.

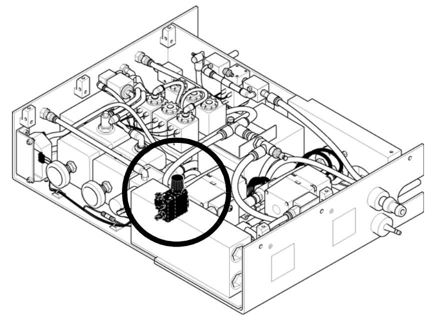
13. Assembly is reversal of removal.

Setup: The pneumatic setup procedure is required for this component.



9.8 N6613 or /03 Purge Regulator (PR5) Post Proximal Airway Modification

Location in pneumatic unit.



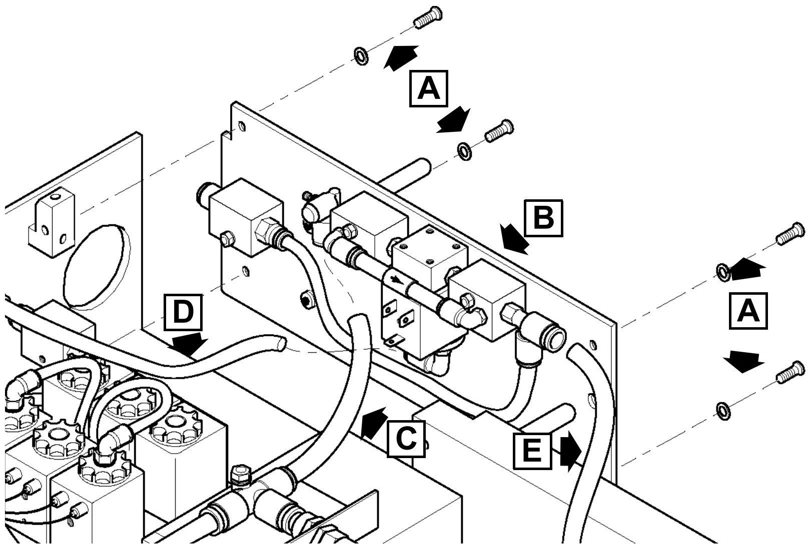
1. Remove the four screws and washers **(A)** retaining the partition assembly **(B)**.

2. Gently release the assembly so access the tubing.

3. Disconnect the tube connected to FR1 **(C)**.

4. Disconnect the tube connected to SV7 **(D)**.

5. Disconnect the fresh gas tube connected to the SV7 bypass mounting block **(E)**.



6. Remove the partition assembly **(B)** from the pneumatic unit.

7. Disconnect the following tubes.

Fresh gas monitoring tube **(F)**.

Proximal airway monitoring tube **(G)**.

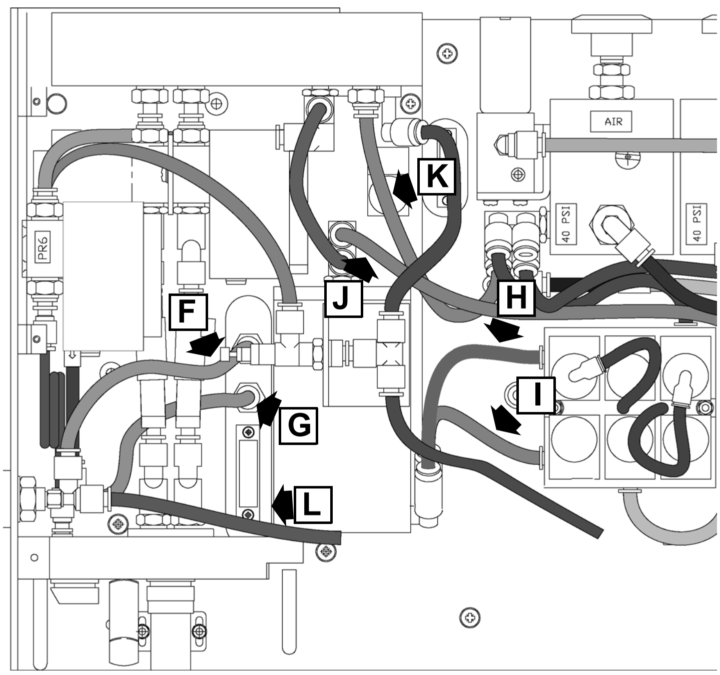
Blender port 3 to mixing chamber tube **(H)**.

Blender port 4 to mixing chamber tube **(I)**.

Mixing chamber to SV8 tube **(J)**.

Manifold to air regulator tube **(K).**

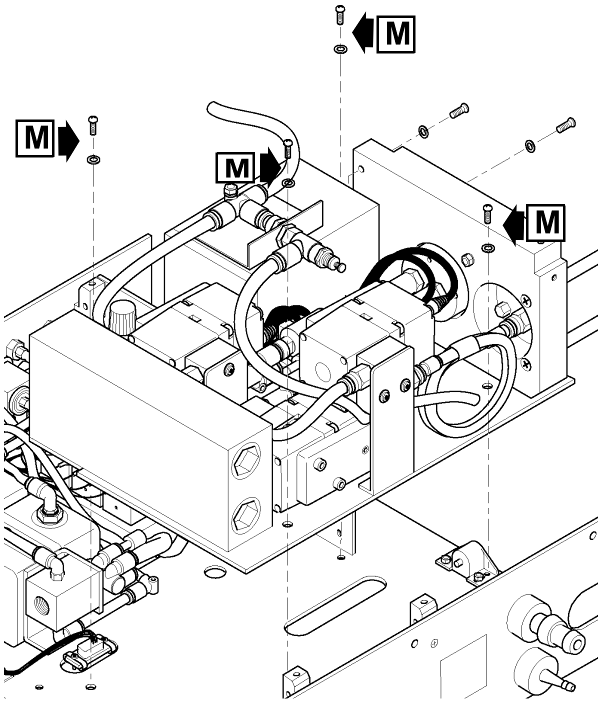
8. Disconnect the electrical loom connector **(L)**.



9. Remove the four screws and washers **(M)** retaining the HFO module.

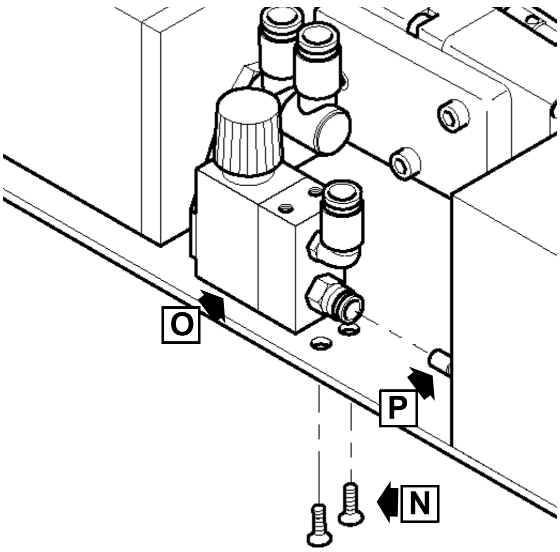
10. Remove the module from the pneumatic unit.

Note: The fresh gas and proximal airway tube fittings impede the removal of the module.

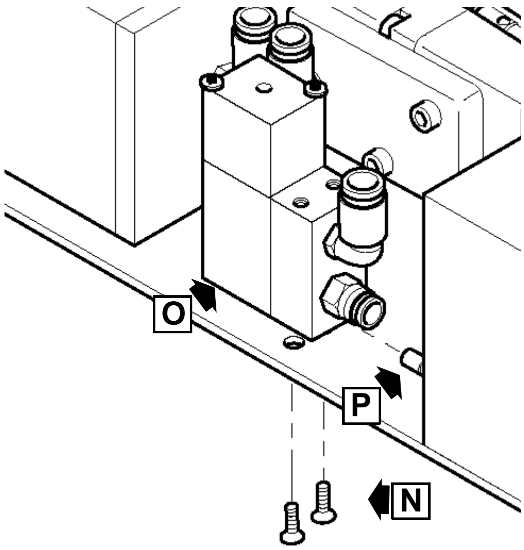


11. Remove the two screws **(N)**.

12. Slide the purge regulator PR5 **(O)** off the manifold fitting **(P)**.



N6613



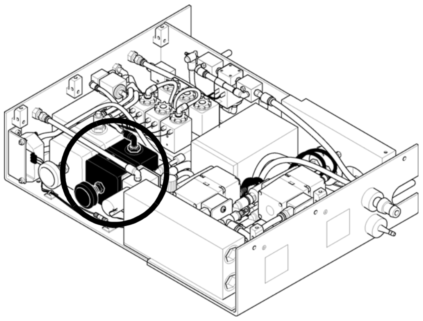
N6613/03

13. Assembly is reversal of removal.

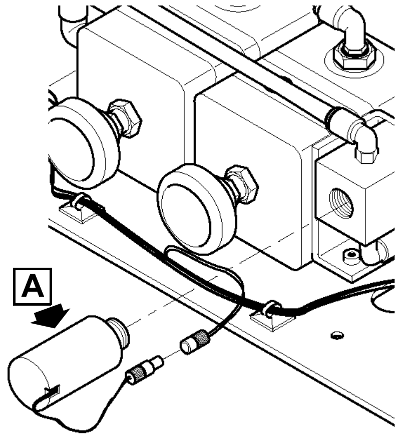
Setup: The pneumatic setup procedure is required for this component.

9.9 N6615/01 Input Air Regulator (PR1)

Location in pneumatic unit.



1. Remove the Oxygen cell.



2. Disconnect the following tubes.

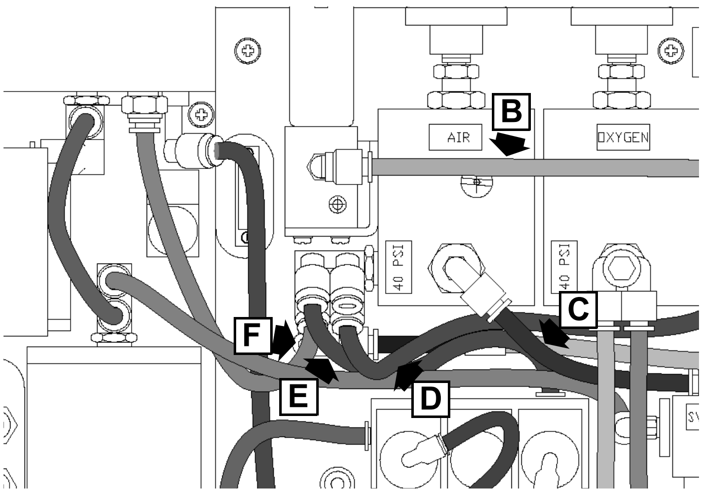
Oxygen cell to overboard dump **(B)**.

Air inlet to 40PSI air regulator **(C)**.

40PSI air regulator to differential pressure transducer **(D)**.

40PSI air regulator to blender port 1 **(E)**.

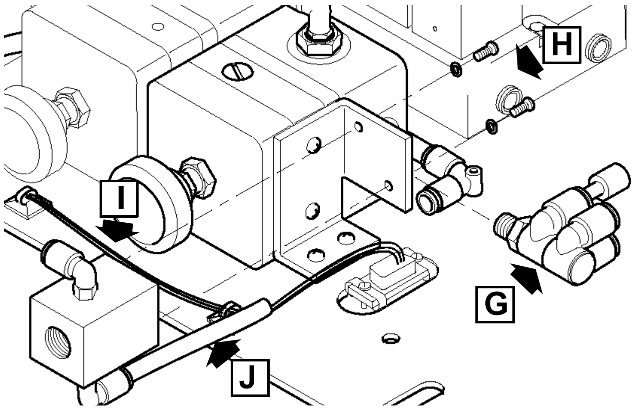
40PSI air regulator to manifold **(F)**.



3. Using a spanner remove the pneumatic fitting **(G)**.

4. Remove the two screws and washers **(H)** to release the Oxygen cell manifold **(I)**.

Note: The Oxygen cell manifold should be removed with the tube (J) attached.

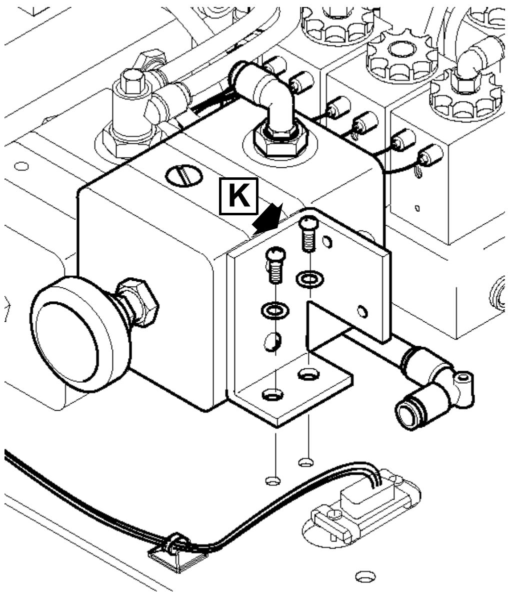


5. Remove the two screws and washers **(K)**.

6. The 40PSI air regulator can now be removed from the Pneumatic unit.

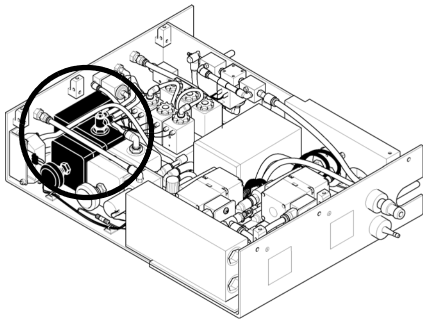
7. Assembly is reversal of removal.

Setup: The pneumatic setup procedure is required for this component.



9.10 N6615/02 Input Oxygen Regulator (PR2)

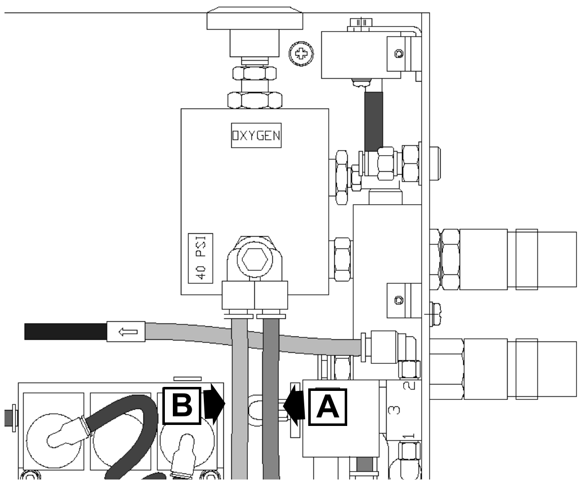
Location in pneumatic unit.



1. Remove the 40PSI air regulator as described on page 65.
2. Disconnect the following tubes.

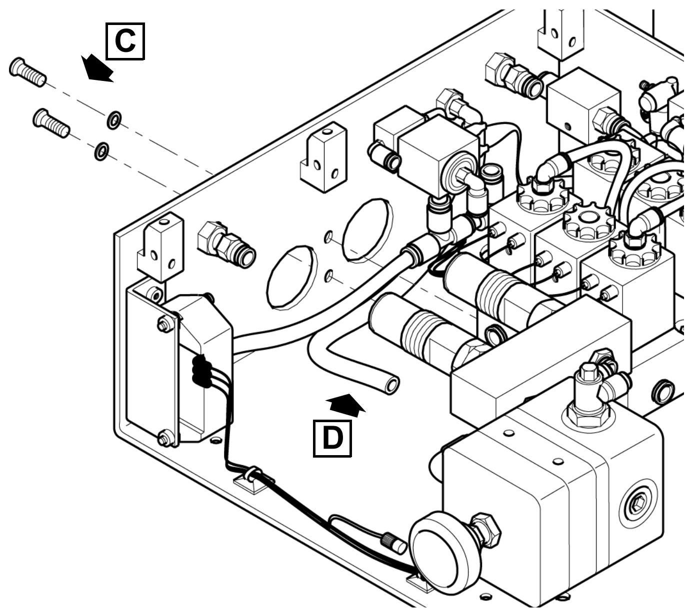
40PSI oxygen regulator to SV8 **(A)**.

40PSI oxygen regulator to blender O_2 inlet **(B)**.



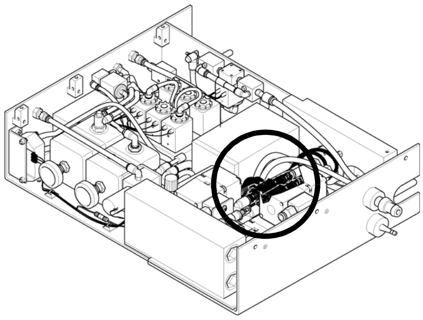
3. Remove the two fixing screws and washers **(C)**.
4. Withdraw the 40PSI oxygen regulator so that the inlet connectors are clear of the chassis. Disconnect the tube **(D)**.
5. The 40PSI oxygen regulator can now be removed from the Pneumatic unit.
6. Assembly is reversal of removal.

Setup: The pneumatic setup procedure is required for this component.



9.11 N6624 High Speed Jet Valves (SV9/10/11/12)

Location in pneumatic unit.

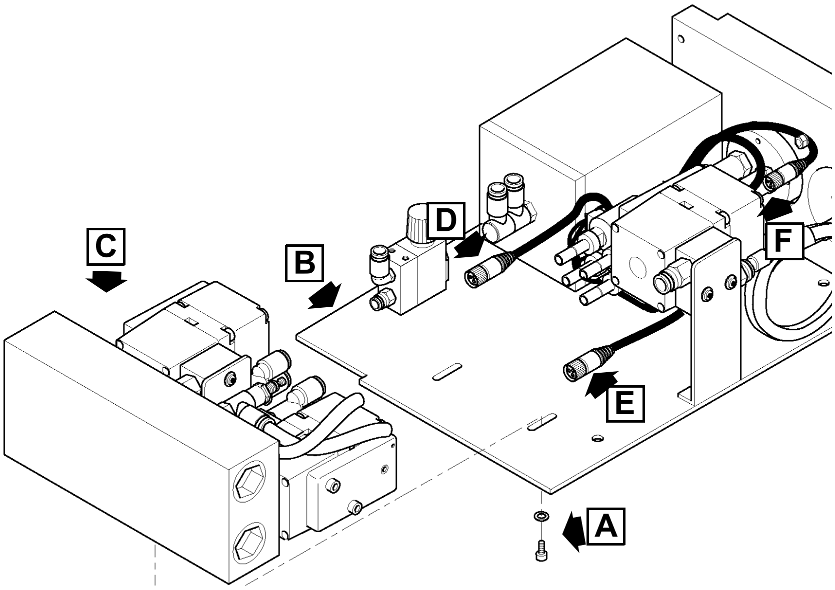


1. Remove the HFO module as described in section 8.7 on page 61

2. Remove the two screws and washers **(A)** that retains the manifold to the base plate **(B)**.

3. Slide the assembly **(C)** so as to disengage the jet valves from the pneumatic connectors.

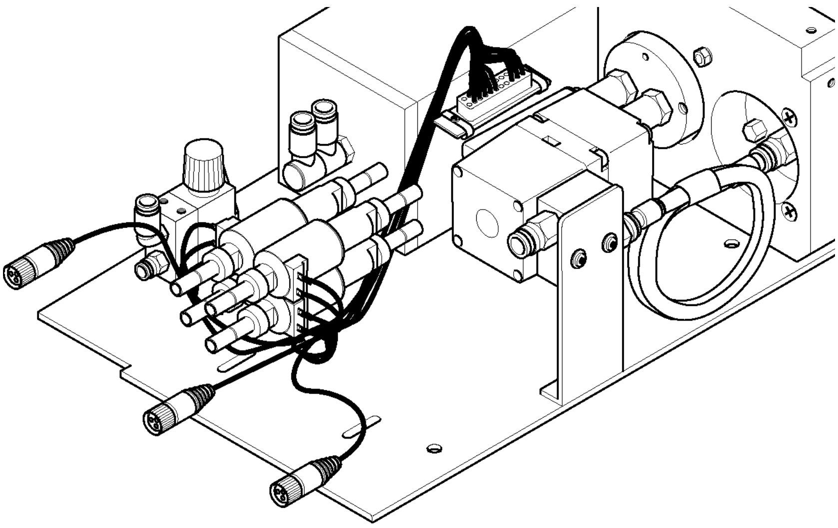
4. Unscrew the electrical connectors **(D, E & F)** from the pressure regulators.



5. Withdraw the jet valve assembly from the pneumatic connectors

Note: The jet valves are independent and are only connected together via the loom.

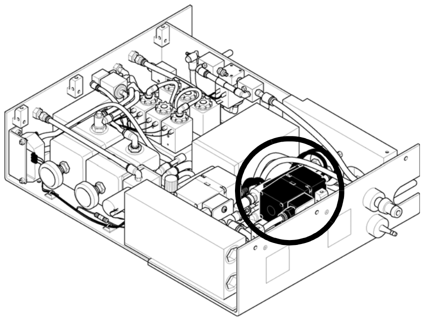
6. Assembly is reversal of removal.



Setup: A full system calibration is required for this component.

9.12 N6623, N6623/33 or N6623/S38 Pressure regulators (PR6)

Location in pneumatic unit.

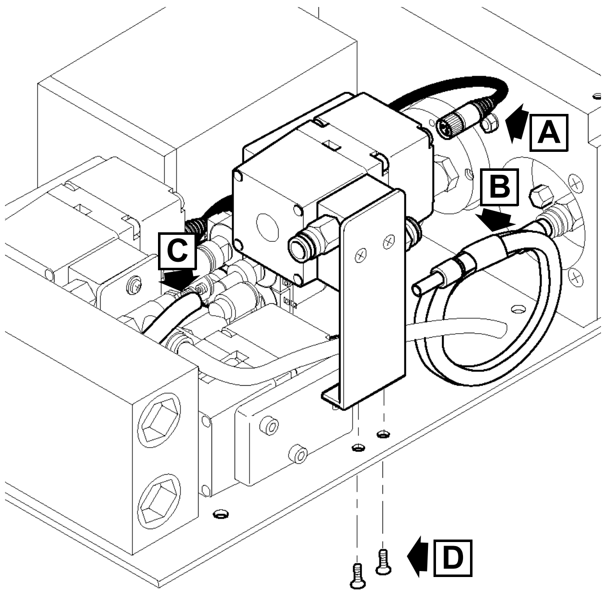


1. Remove the HFO module as described in section 9.7 on page 61

2. Unscrew the electrical connector **(A)** from the pressure regulator PR6.

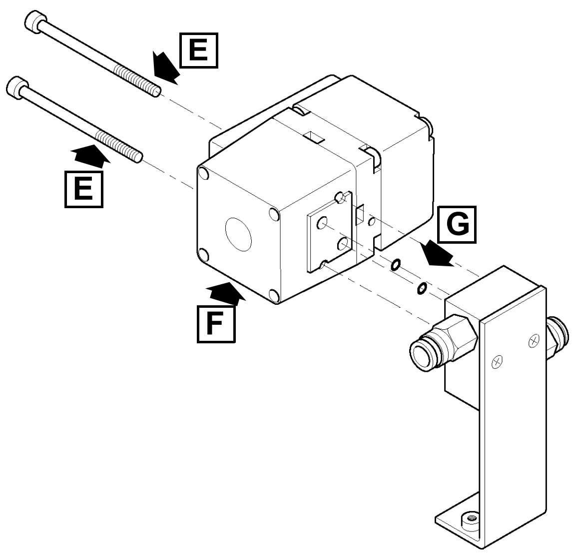
3. Disconnect the tubes **(B & C)** from the pressure regulator manifold block.

4. Remove the two countersunk screws **(D)** that retain the PR6 regulator assembly bracket to the base plate.



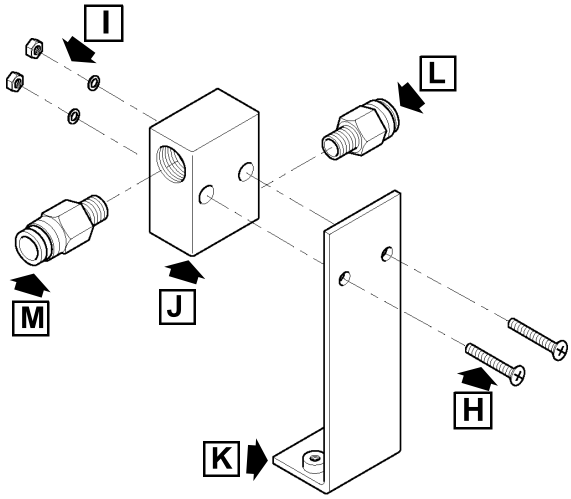
5. Remove the two allen cap screws **(E)** that retain the PR6 pressure regulator **(F)** to the manifold.

Note: On removing the regulator the two O-ring's (G) are freed. These O-ring's must be replaced each time that the assembly is dismantled.



6. Remove the two countersunk screws **(H)** washers and nuts **(I)** that retain the manifold **(J)** to the bracket **(K)**.

7. Remove the pneumatic tube connectors **(L & M)**.



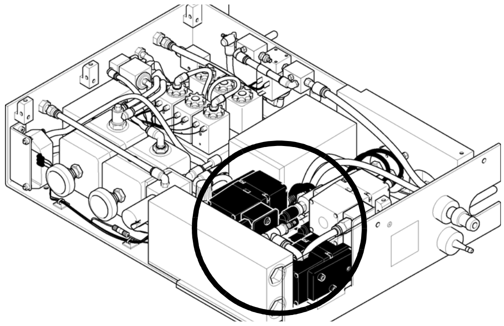
Note: The PR6 pressure regulator is made up of the following components, pressure regulator (F), allen cap screws (E), O-rings (G) and manifold (J).

8. Assembly is reversal of removal.

Setup: A full system calibration is required for this component.

9.13 N6623, N6623/33 or N6623/S38 Pressure regulators (PR3 &PR4)

Location in pneumatic unit.

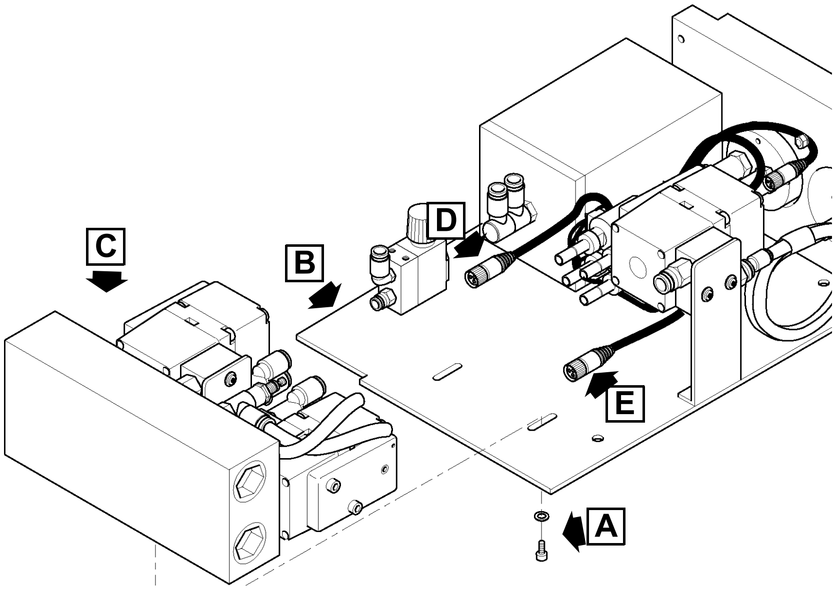


1. Remove the HFO module as described in section 9.7 on page 61.

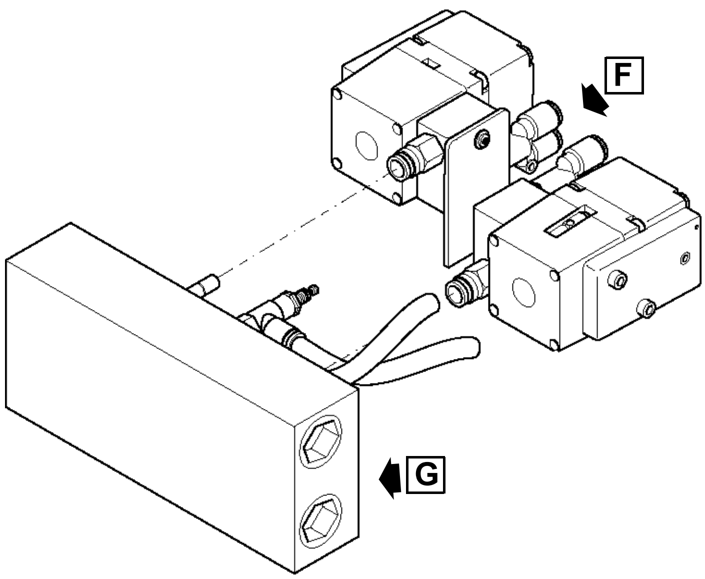
2. Remove the two screws and washers **(A)** that retains the manifold to the base plate **(B)**.

3. Slide the assembly **(C)** so as to disengage the jet valves from the pneumatic connectors.

4. Unscrew the electrical connectors **(D & E)** from the pressure regulators.

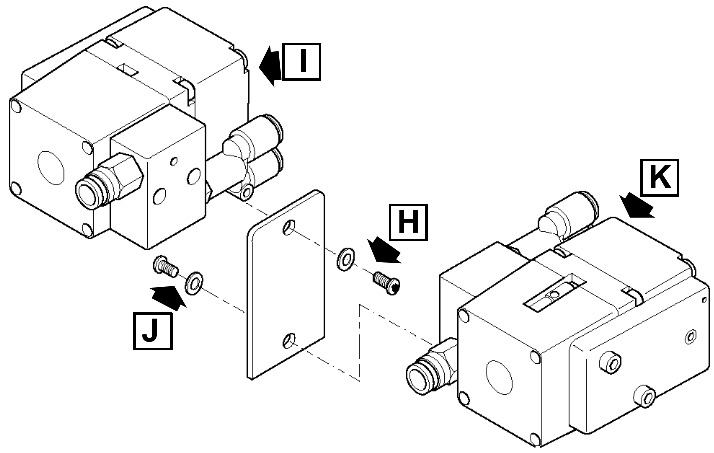


5. Separate the pressure regulator assembly **(F)** from the manifold **(G)**.



6. Remove the screw and washer **(H)** that retains the pressure regulator PR3 **(I)**.

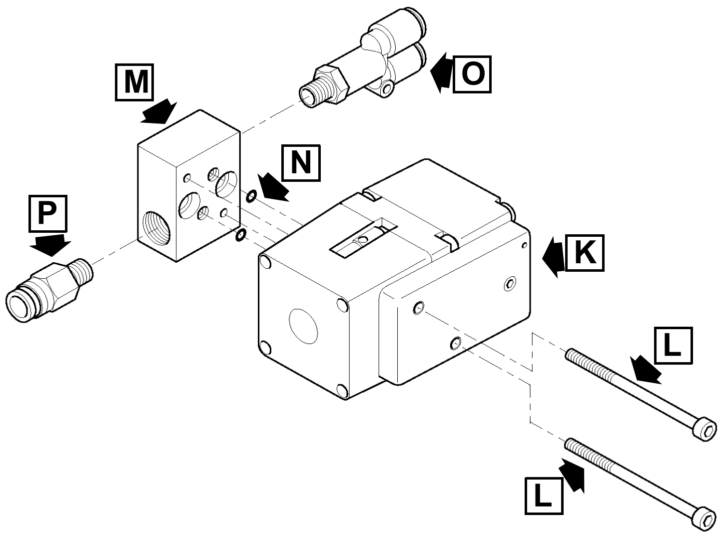
7. Remove the screw and washer **(J)** that retains the pressure regulator PR4 **(K)**.



8. Remove the two allen cap screws **(L)** that retain the PR4 pressure regulator **(K)** to the manifold **(M)**.

Note: On removing the regulator the two O-ring's (N) are freed. These O-ring's must be replaced each time that the assembly is dismantled.

9. Remove the pneumatic tube connectors **(O & P)**.



Note: The procedure is the same for the PR3 pressure regulator.

10. Assembly is reversal of removal.

Setup: A full system calibration is required for this component.

A0763/02 Board

10. A0763/02 Monitor and control board

The SLE5000 has two revisions of the base A0760 PCB that make up the A0763/02 board, A0760 Rev D & A0760 Rev E.

The differences between the REV D board and Rev E A0760 base PCB are new tracks. These are to remove the need for the L0273 adaptor stack and the J0764/A adaptor board.

When replacing the A0763/02 confirm the following:

If the replacement board is marked as **A0760 Rev D** this requires either the L0273 adaptor stack and the J0764/A adaptor board for IC's mounted at U23 & U33.

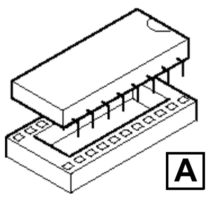
Warning: For Rev D A0760 base PCB's fitting the IC's to U23 & U33 directly will cause them to fail on power up. L0273 adaptor stack or the J0764/A adaptor board must be used.

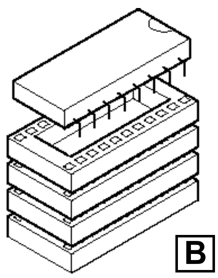
If the replacement board is marked as **A0760 Rev E** the IC's mounted at U23 & U33 are fitted directly to the board mounted sockets.

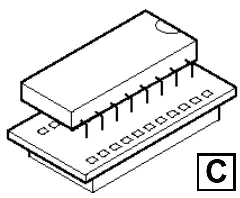
Warning: For Rev E A0760 base PCB's fitting the L0273 adaptor stack or the J0764/A adaptor board will cause U23 & U33 to fail on power up.

10.1 U23 and U33 socket configurations for A0760 Rev D base PCB.

The IC mounted at U23 and U33 can be connected to the A0763/02 board with in 3 ways.







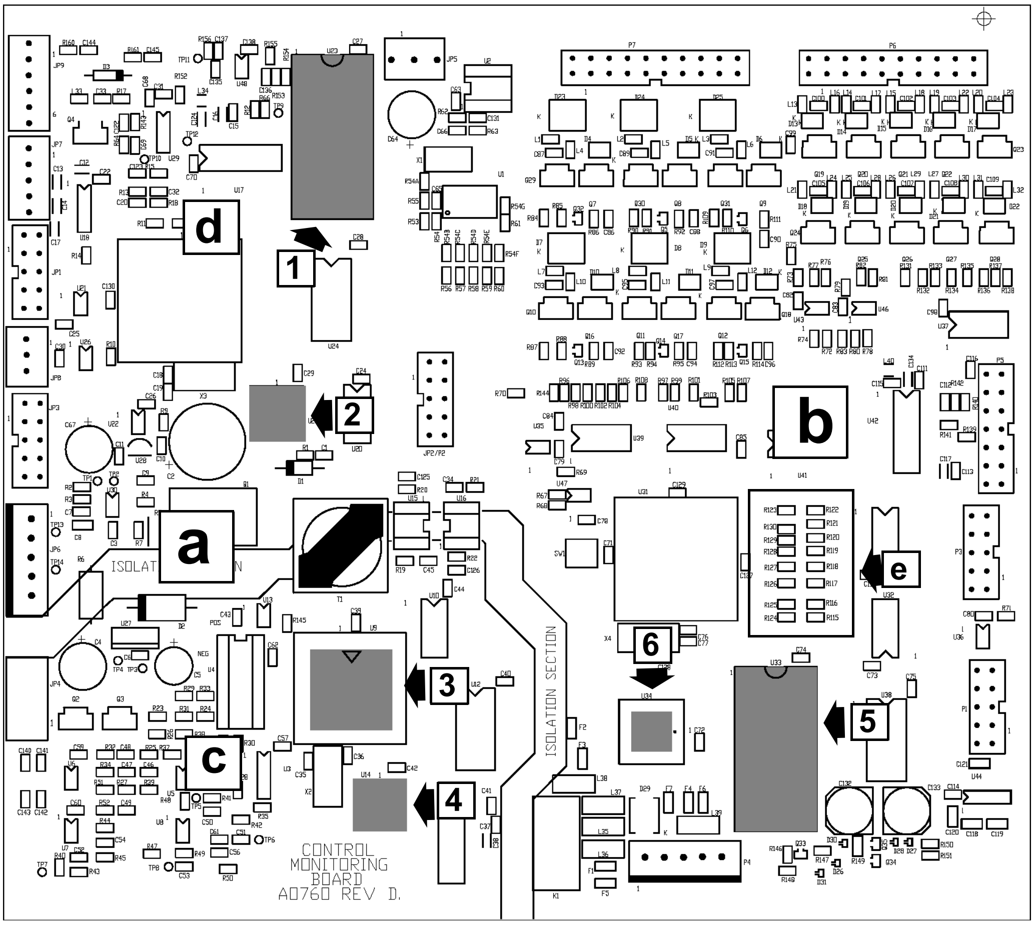
A) direct
B) Via a 28way adaptor socket SLE part Nº: L0273
C) Via the adaptor board SLE part Nº: J0764/A

Note For REV D boards only: IC's mounted directly to the A0763/02 board (A) are Electrically Erasable Programmable Read Only Memory. IC's mounted via L0273 or J0764/A are UV Erasable Programmable Read Only Memory.

Warning: IC's mounted directly to the U23 and 33 cannot be used with either adaptor. IC's mounted via the adaptors cannot be connected directly to the board. Connection of the devices incorrectly will cause them to fail.

10.2 A0763/02 board progammable devices

The A0763/02 board is divided into two sections a) the monitor side and b) the control side.The monitor section is divided into a further two sections c) monitor isolated and d) monitor non islolated.



On the A0763/02 board there are six programmable devices. These devices are:

1) U23 monitor software non isolated IC
2) U25 monitor non isolated PAL
3) U9 monitor software isolated IC
4) U14 monitor isolated PAL
5) U33 controller software IC
6) U34 controller PAL

Note: On early versions of the A0763/02 board some of the PAL devices are soldered to the board rather than socketed.

10.3 A0763/02 Board Hardware Identifier

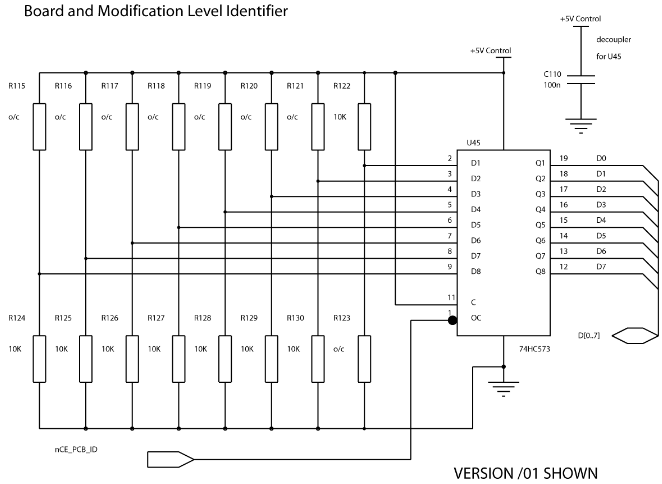
The A0763/02 board has a group of resistors that allow the software to recognise the pneumatic unit configuration. There are 9 hardware idents possible on the board.

The table below outlines the resistor groups to produce specific hardware ID’s. The SLE4000 model A and SLE5000 model A use Hardware Ident 3.

BOARD IDENTIFICATION TABLE

VERSION	HARDWARE Ident No.	DESCRIPTION	o/c	10k
/00	1	BLENDER-ALL CHANNELS CLOSED	R115-R122	R123-R130
/01	2	BLENDER-2 CHANNEL 1 N/O+1 N/C	R115-R121 & R123	R122 & R124-R130
/02	3	BLENDER-2 CHANNEL 2 N/O	R115-R120,R122,R130	R121 & R123-R129
/03	4	TO BE ADVISED	R115-R119,R121,R122,R129	R120,R123-R128,R130
/04	5	TO BE ADVISED	R115-R118,R120-R122,R128	R119,R123-R127,R129,R130
/05	6	TO BE ADVISED	R115-R117,R119-R122,R127	R118,R123-R126,R128-R130
/06	7	TO BE ADVISED	R115,R116,R118-R122,R126	R117,R123-R125,R127-R130
/07	8	TO BE ADVISED	R115,R117-R122,R125	R116,R123,R124,R126-R130
/08	9	TO BE ADVISED	R116-R122 & R124	R115,R123,R125-R130
/09	10	SLE4000 Model B	R115-R118,R120,R121,R123 & R128	R119,R122,R124-R127,R129 & R130

Board and Modification Level Identifier



VERSION /01 SHOWN

Electrical Safety Testing

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11. Electrical Safety Testing of the SLE5000

This test is performed using an approved electrical safety testing device.

The electrical safety test must be carried out on the unit with all the electrical connections intact.

Ensure the mains switch on the ventilator is ON for the duration of these tests.

Equipment under test is : SLE5000 Infant Ventilator Class 1B (flow sensor is a Floating type applied part)

Test	Expected Results	
Class B Tests	Expected Value	Tolerance
Mains Voltage	240V	240V
Insulation Resistance	>200MΩ	
Earth Continuity	<0.2Ω	
Earth Leakage	0 µA	+150 µA
Earth Leakage (supply o/c)	0 µA	+150 µA
Enclosure Leakage (normal)	0 µA	+150 µA
Enclosure Leakage (earth o/c)	0 µA	+150 µA
Enclosure Leakage (supply o/c)	0 µA	+150 µA
Patient Leakage on Applied Part	0 µA	+150 µA
Patient Leakage on Applied Part (Earth o/c)	0 µA	+150 µA
Patient Leakage on Applied Part (supply o/c)	0 µA	+150 µA
Class BF Tests		
Mains on Applied Part Normal	0 µA	+150 µA
Mains on Applied Part Reversed	0 µA	+150 µA

Check that in all the preceding tests:

Check the resistance to earth on the internal metal screening is less than 0.2Ω.

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PSU Testing

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12. PSU Testing.

This check should only be carried out if the PSU is suspected to be faulty.

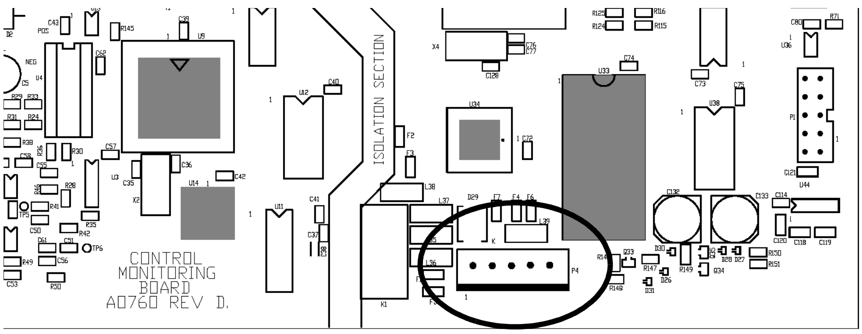
a) Unplug the battery connector from the PSU.

b) Remove the PC Board

c) Turn on the ventilator and check the output voltages of the power supply at the following points on the wireloom.

On P4 (connection to the controller side of the controller monitor board) check the following pins.;	**Voltage Lower Limit**	**Voltage Upper Limit**
PL4/1	22.8V	25.2V
PL4/2	11.4V	12.6V
PL4/3	4.875V	5.325V
PL4/4	4.875V	5.325V
PL4/5	GND (digital)	GND (digital)
PL4/6	GND (high power, solenoid return)	GND (high power, solenoid return)
Battery connector voltage	13.8V	14.2V

Location of P4



d) Turn off the ventilator and reconnect the battery connector.

e) Refit the PC board

f) Turn on the ventilator and check that the cooling fan and the two fans within the PSU are rotating and the power LED on the front panel is illuminated (requires control/monitor pcb plugged in).

g) On the battery connection, check that the voltage indicates battery charging. Look for the voltage increasing gradually as the battery charges. 13.8V = o/c condition or battery fully charged.

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Maintenance and Overhaul

13. Maintenance and Overhaul

The ventilator has the following maintenance / overhaul schedule.

6 months	Preventative maintenance	Kit: N9010/06
12 months	Preventative maintenance	Kit: N9010/12
18 months	Preventative maintenance	Kit: N9010/06
24 months (10,000hrs)	Overhaul	Kit: N9010/24
30 months	Preventative maintenance	Kit: N9010/06
36 months	Preventative maintenance	Kit: N9010/12
42 months	Preventative maintenance	Kit: N9010/06
48 months (20,000hrs)	Overhaul	Kit: N9010/48

13.1 Preventative Maintenance

Their are two types of preventative maintenance kit available, the N9010/06 (six month kit) and the N9010/12 (twelve month kit).

The N9010/06 contains the following:

Conical filter	Qty 2	Part Nº: N2185/06
Duckbill valve	Qty 2	Part Nº: N2185/05
Duckbill washer	Qty 2	Part Nº: T1170
“O” rings	Qty 2	Part Nº: N6618
CPU battery	Qty 1	Part Nº: M0909
Orifice block “O” rings	Qty 2	Part Nº: N2042

The N9010/12 contains the following:

Conical filter	Qty 2	Part Nº: N2185/06
Duckbill valve	Qty 2	Part Nº: N2185/05
Duckbill washer	Qty 2	Part Nº: T1170
“O” rings	Qty 2	Part Nº: N6618
CPU battery	Qty 1	Part Nº: M0909
Orifice block “O” rings	Qty 2	Part Nº: N2042
Oxygen cell	Qty 1	Part Nº: N2191/10
AA Battery 1.5v	Qty 2	Part Nº: M0484/03

6, 18, 30 & 42 Month Maintenance

SLE

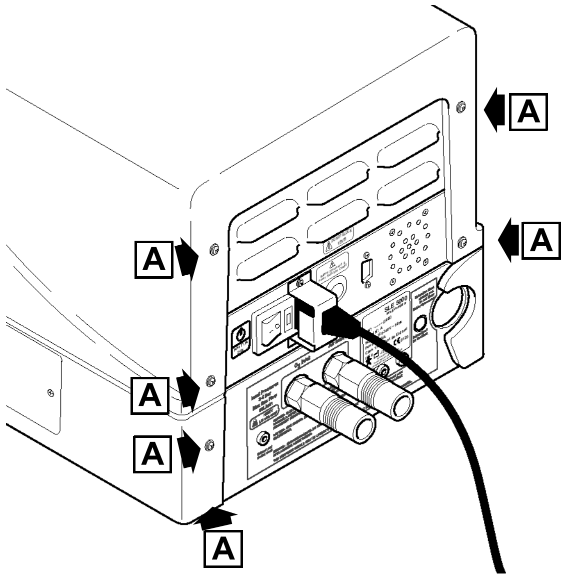
13.2 6, 18, 30 & 42 month preventative maintenance procedure

13.2.1 Ventilator preparation

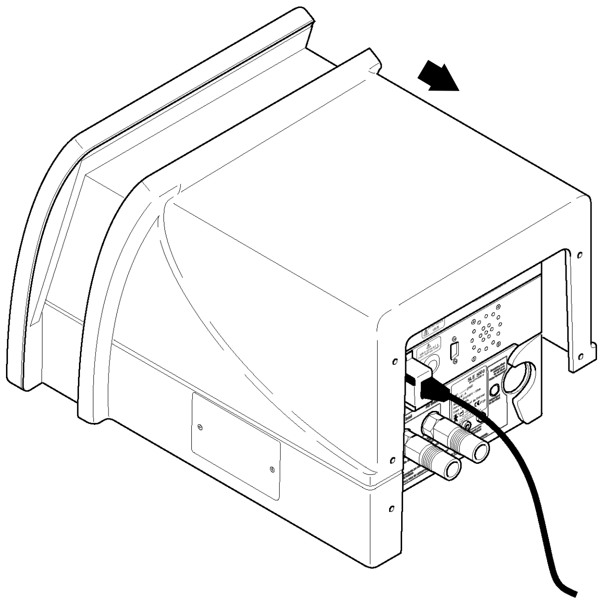
1. Preventative maintenance should be carried out with the ventilator still attached to the trolley.

2. Disconnect the air and oxygen supply hoses.

3. Remove the seven fixing screws **(A)** indicated from the rear cover.



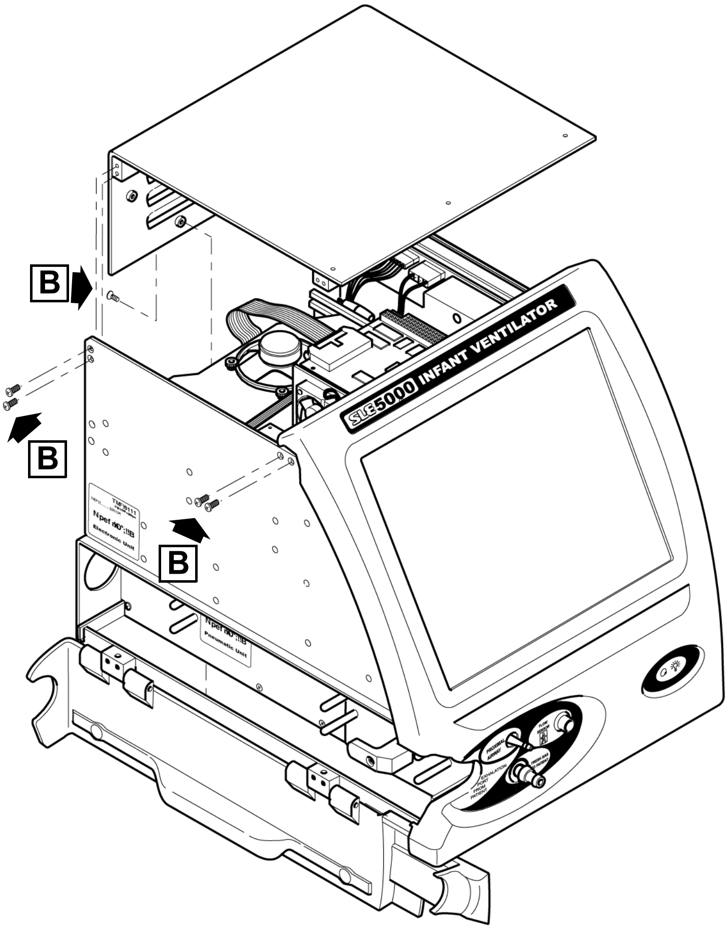
4. Slide the rear cover towards the rear of the machine. When the lip has been disengaged lift the cover off.



Warning: If the ventilator is under a warranty agreement removal of the inner covers may void the agreement. Please refer to the warranty documentation.

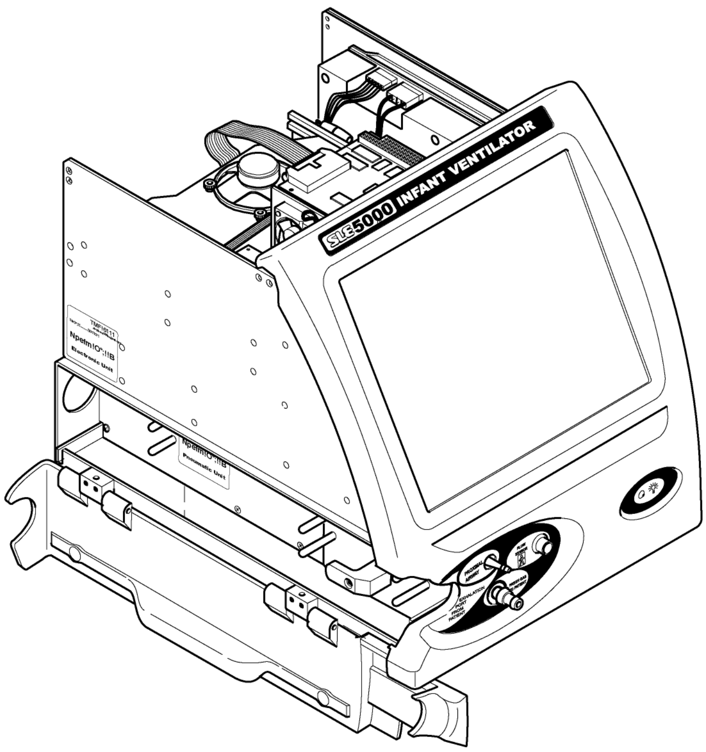
5. Remove the screws **(B)** to release the electronic inner cover.

Note: The design of the inner cover may vary.



The ventilator is now ready for maintenance.

Note: Keep the ventilator plugged into the mains supply, but with the supply turned off. This is to earth the ventilator and prevent static build up.

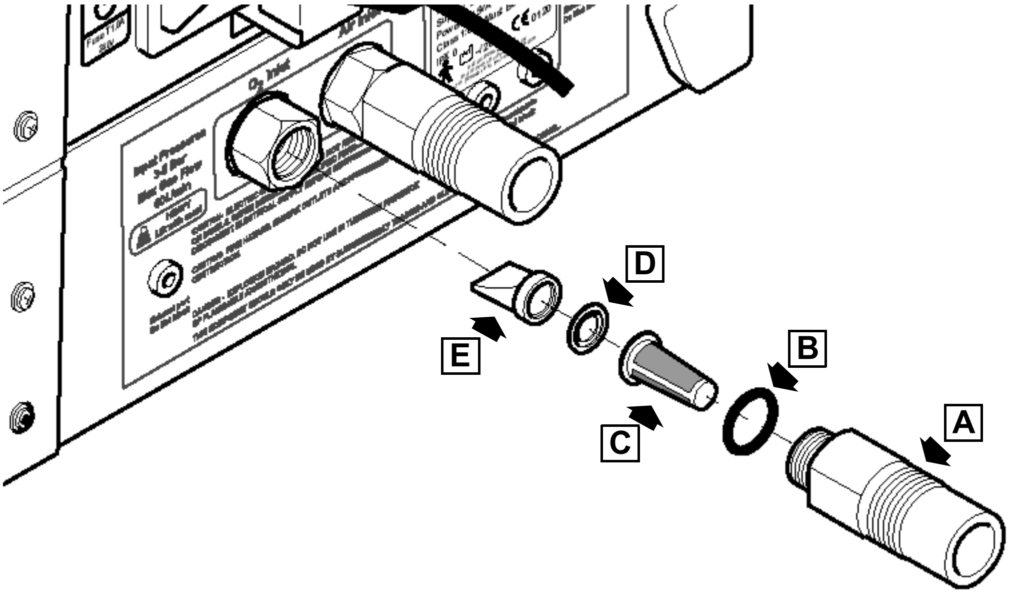


13.2.2 Duckbill and conical filter replacement.

The procedure is the same for both air and oxygen inlets.

1. Using a spanner remove the inlet connector **(A)**.

Note: The O_2 connector is a left hand thread and the Air connector is a right hand thread.



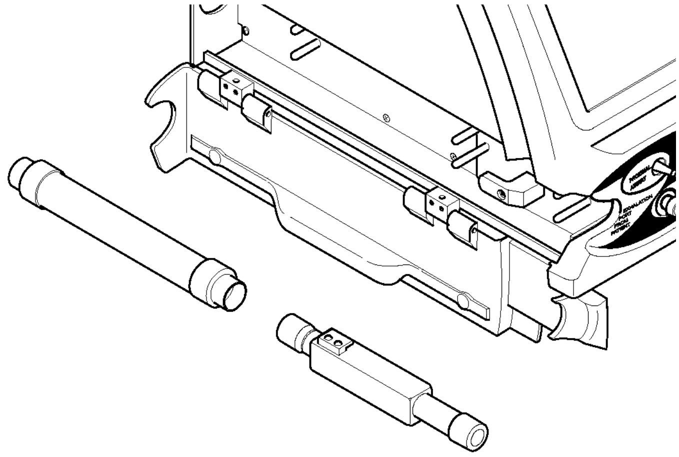
2. Remove O-ring (N6618) **(B)**,
   Nylon filter cone (N2185/06) **(C)**,
   Washer (T1170) **(D)**
   Duckbill check valve (N2185/05) **(E)**.

3. Discard the O-ring, Nylon filter cone, washer and Duckbill check valve.

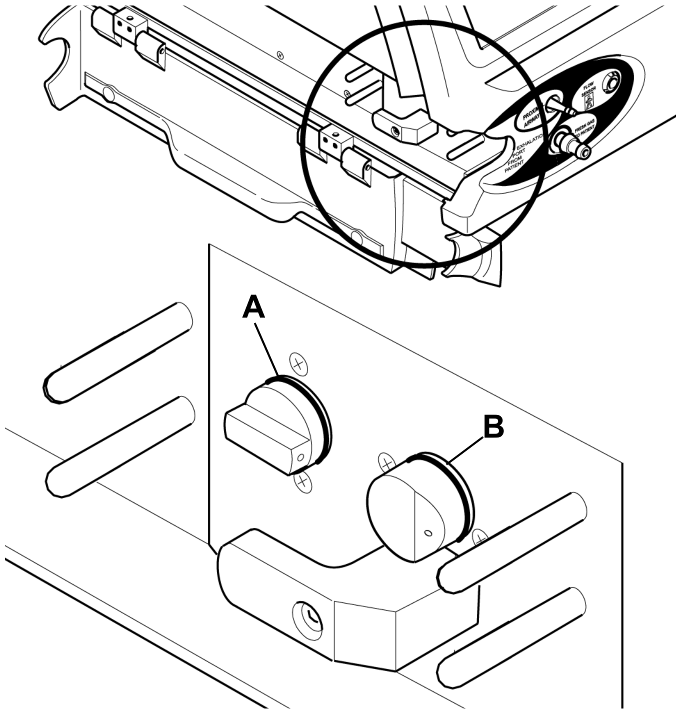
4. Re-assemble with the new components.

13.2.3 Replacement of N2042 “O” Rings

1. Remove the silencer and exhalation block from the ventilator.



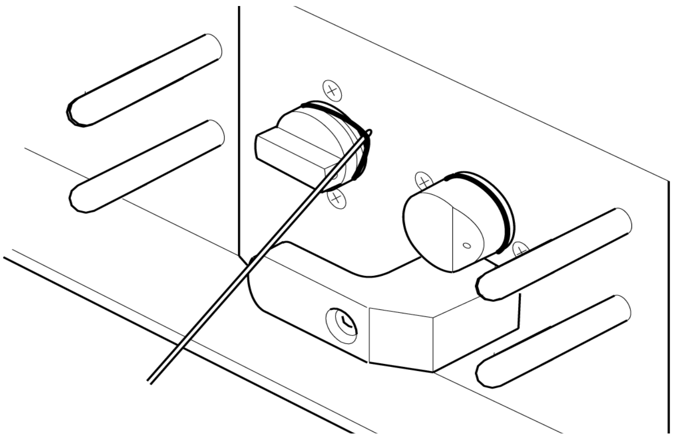
2. Locate the two ’O’ rings located (A & B) on gas ports.



3. Using a blunt probe lift out the old ’O’ ring and discard. Repeat the process for the other ’O’ ring.

4. Wipe the gas ports with an approved sterilizing solution.

5. Place new ’O’ rings into the grooves.



13.2.4 Replacement of the M0909 CPU battery

Replacement of the CPU battery requires the removal of the CAN card.

Warning: the CAN Card and PC board are static sensitive devices.

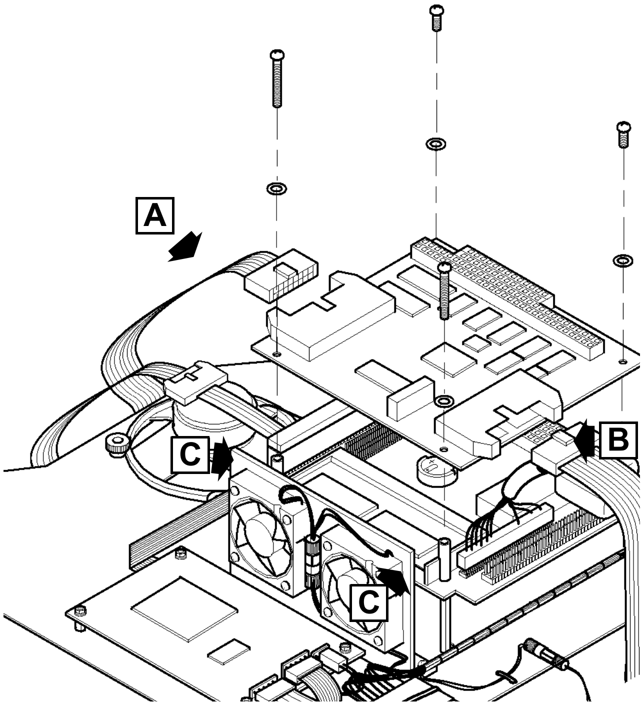
1. Disconnect the two ribbon cables **(A & B)** from the CAN card.

2. Remove the four screws retaining the CAN card.

3. Gently disconnect the CAN card from the PC board by lifting the card vertically, until all the connector pins are disengaged from the socket.

4. The two nylon spacers **(C)** are now loose.

Care should be taken to prevent them falling into the electronic unit.



5. Remove the battery **(D)** from the battery housing **(E)** and discard.

6. Fit the new battery.

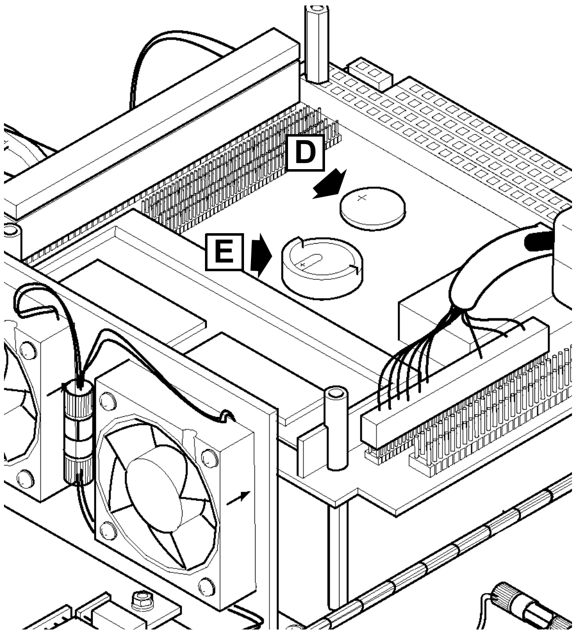
7. Re-assemble the CAN card.

8. Re connect the gas hoses to the ventilator.

9. Turn on the ventilator.

10. Re-set the time and date. (Refer to the user manual)

13. Carry out a full functional test.



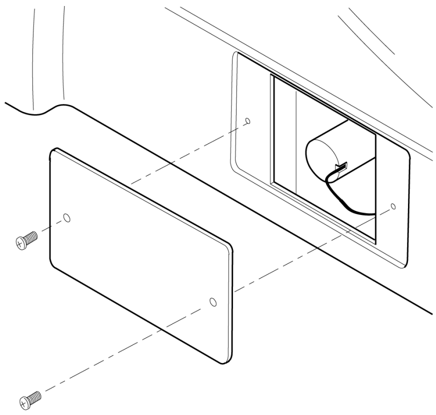
12 & 36 Month Maintenance

13.3 12 and 36 month preventative maintenance procedure

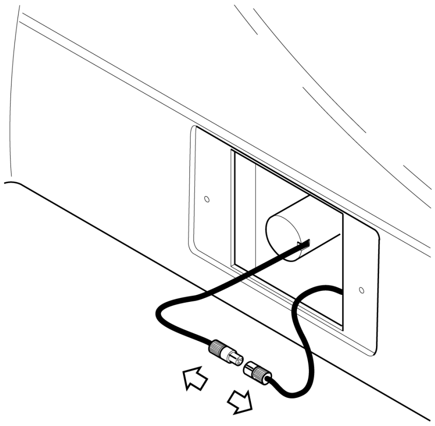
Carry out a six month preventative maintenance procedure plus the following.

13.3.1 Replacement of N2191/10 O_2 Cell

1. Remove the two screws from the cover located on the right hand side of the ventilator (When viewed from the front.



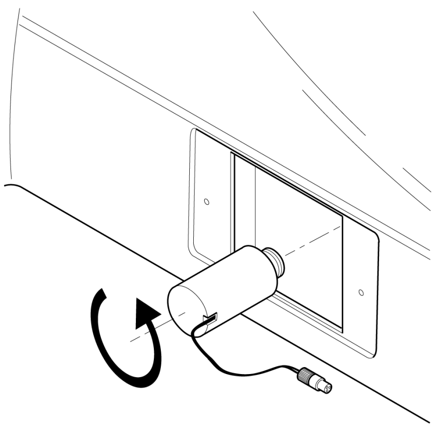
2. Pull out the cable until the connector is visible. Gently pull apart the connector.



3. Unscrew the cell counter clockwise until free and discard.

4. Replacement of the cell is the reversal of removal.

5. In addition to the tests carried out in the previous preventative maintenace procedure, carry out a 2 point oxygen calibration routine.

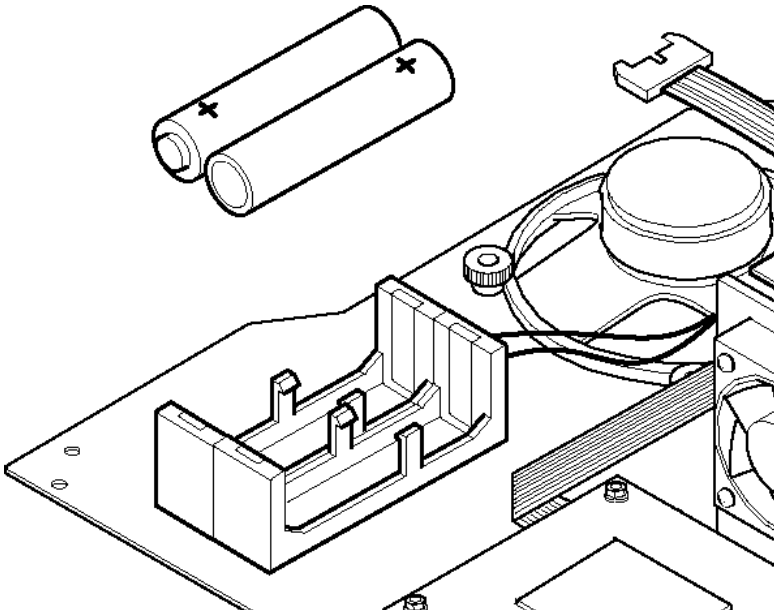


13.3.2 Replacement of CMOS backup batteries

These batteries are fitted to units that have had the CMOS battery backup upgrade.

1. Remove the two AA batteries and discard in accordance with local waste authority guidlines.

2. Replace the batteries taking care to correctly insert the cells.



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24 & 48 Month Hour Overhaul

13.4 24 month and 48 month overhaul procedures

The ventilator has two overhaul points, the first at 24 months or 10,000 hours (whichever is sooner) and 48 months or 20,000 hours (whichever is sooner).

The **24 month / 10,000 hour** overhaul consists of the replacement of the following components.
These components are supplied in the form of an overhaul kit part Nº: N9010/24

Conical filter	Qty 2	Part Nº: N2185/06
Duckbill valve	Qty 2	Part Nº: N2185/05
Duckbill washer	Qty 2	Part Nº: T1170
“O” rings	Qty 2	Part Nº: N6618
CPU battery	Qty 1	Part Nº: M0909
Orifice block “O” rings	Qty 2	Part Nº: N2042
Oxygen cell	Qty 1	Part Nº: N2191/10
Backup battery	Qty 3	Part Nº: M0901
AA battery	Qty 2	Part Nº: M0484/03

The **48 month / 20,000 hour** overhaul consists of the replacement of the following components.
These components are supplied in the form of an overhaul kit part Nº: N9010/48

Conical filter	Qty 2	Part Nº: N2185/06
Duckbill valve	Qty 2	Part Nº: N2185/05
Duckbill washer	Qty 2	Part Nº: T1170
“O” rings	Qty 2	Part Nº: N6618
CPU battery	Qty 1	Part Nº: M0909
Orifice block “O” rings	Qty 2	Part Nº: N2042
Oxygen cell	Qty 1	Part Nº: N2191/10
Pressure regulators (PR3, PR4 & PR6)	Qty 3	Part Nº: N6623/S38
Oxygen Blender Assy.	Qty 1	Part Nº: L0287
Fresh gas supply solenoid (SV7)	Qty 1	Part Nº: N2195/06
Backup battery	Qty 3	Part Nº: M0901
AA battery	Qty 2	Part Nº: M0484/03
Purge regulator (PR7)	Qty 1	Part Nº: N6612
0-30 PSI regulator (PR5)	Qty 1	Part Nº: N6613/03
Speed controller (FR1)	Qty 1	Part Nº: N6614
Input air pressure regulator (PR1	Qty 1	Part Nº: N6615/01
Input O_2 pressure regulator (PR2)	Qty 1	Part Nº: N6615/02
High speed jet valves. (SV9,10,11 &12)	Qty 4	Part Nº: N6624
O_2 calibration solenoid (SV8)	Qty 1	Part Nº: N6625/01
Pressure relief valve (PRV1)	Qty 1	Part Nº: N2194
Tubing	Qty AR	Part Nº: N2373

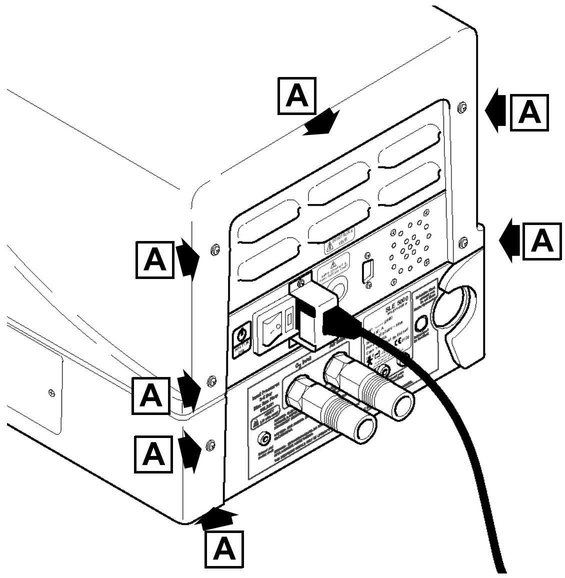
For the 48 month overhaul the user has three options.
Option 1. To carry out a service exchange of the pneumatic unit.
Option 2. To purchase a new pneumatic unit
Option 3. To carry out the overhaul from the N9010/48 kit of parts.

24 Month / 10,000 Hour Overhaul

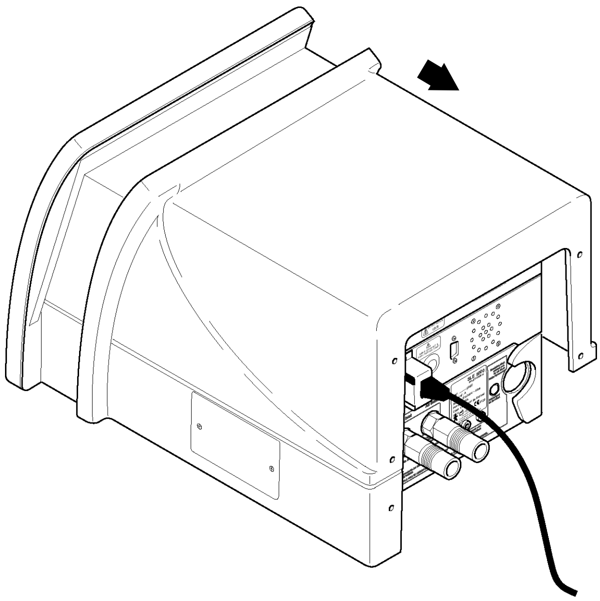
13.5 24 month / 10,000 hour overhaul procedure

The following instructions list the order in which the 24 month overhaul should be carried out.

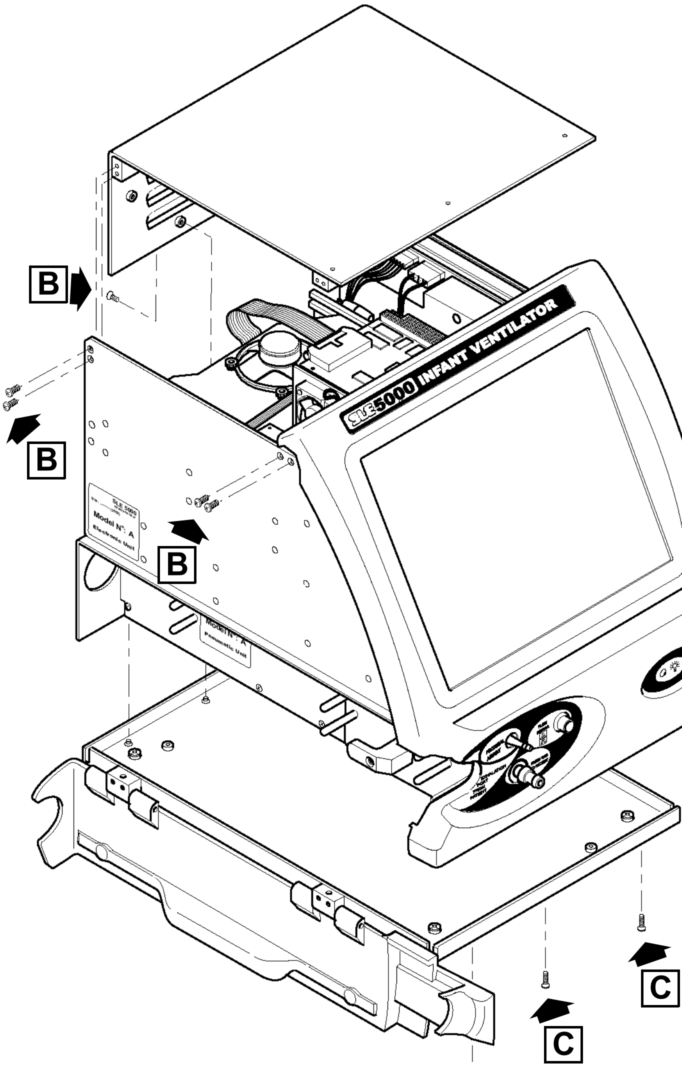
1. Remove the seven fixing screws **(A)** indicated from the rear cover.



2. Slide the rear cover towards the rear of the machine. When the lip has been disengaged lift the cover off.



Warning: If the ventilator is under a warranty agreement removal of the inner covers may void the agreement. Please refer to the warranty documentation.

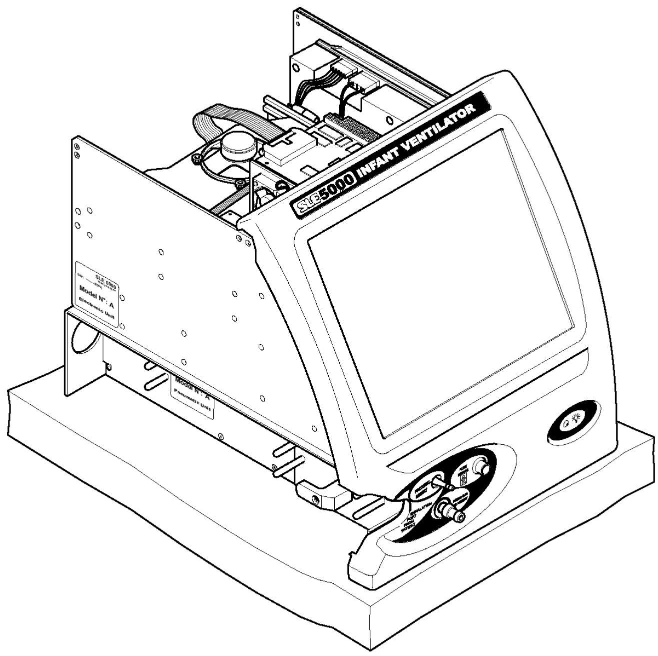


3. Remove the screws **(B)** (10 screws) to release the electronic inner cover.

Note: The design of the inner cover may vary.

4. Remove the screws **(C)** (6 screws) to release the pneumatic unit base plate.

5. Rest the ventilator on a soft pad.



Note: Keep the ventilator plugged into the mains supply, but with the supply turned off. This is to earth the ventilator and prevent static build up.

13.5.1 Removal of the N6634 CAN Card

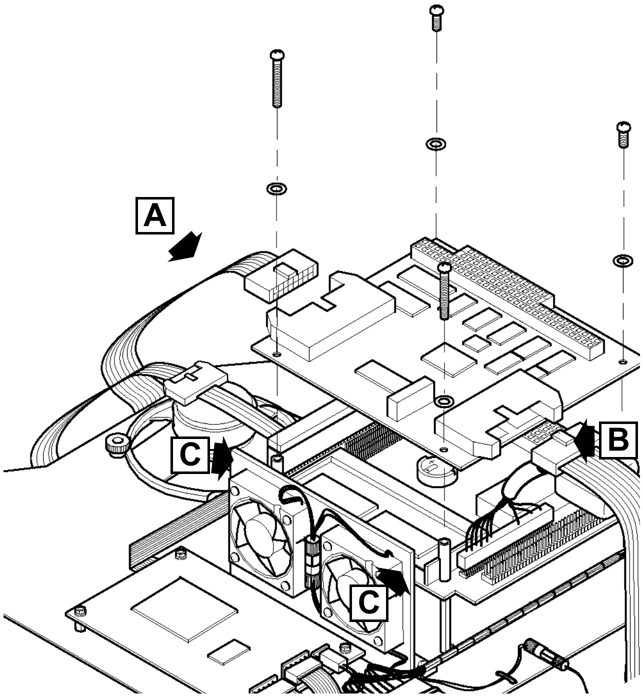
Warning: the Can Card is a static sensitive device.

1. Disconnect the two ribbon cables **(A & B)** from the CAN card.

2. Remove the four screws retaining the CAN card.

3. Gently disconnect the CAN card from the PC board by lifting the card vertically, until all the connector pins are disengaged from the socket.

4. The two nylon spacers **(C)** are now loose. Care should be taken to prevent them falling into the electronic unit.



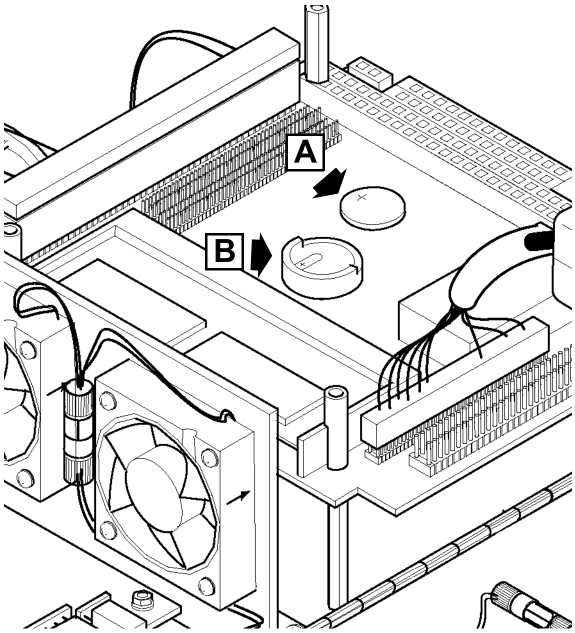
13.5.2 Replacement of the CPU battery

Warning: The PC board is a static sensitive device.

1. Remove the can card as described in section 13.5.1

2. Remove the battery **(A)** from the battery housing **(B)**

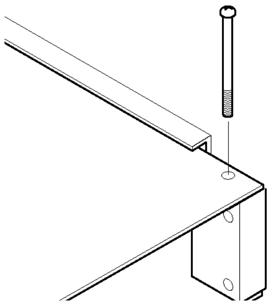
3. Fit the new battery. (Part Nº: M0909)



13.5.3 Removal of the PC carrier board and the Control and Monitor Board

Warning: The Control and Monitor Board is a static sensitive device.

1. Remove the PCB locking screw. This will allow the top board assembly to slide forward a small amount. This allows better access to the edge connectors of the top board.



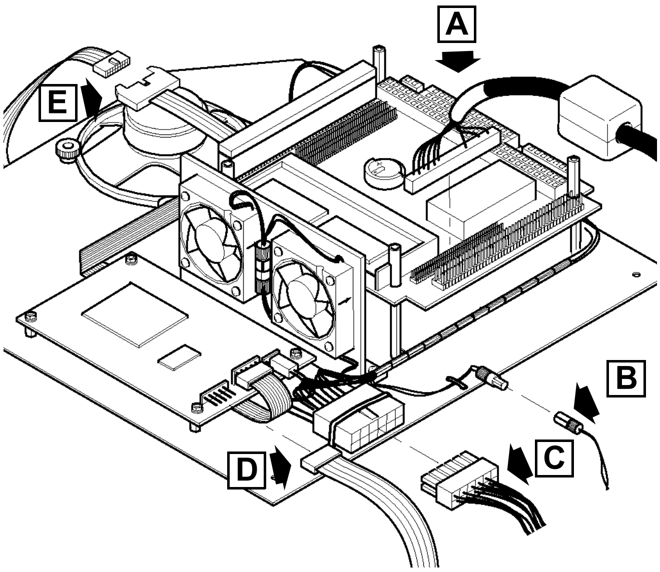
2. Disconnect the display connector cable **(A)**.

3. Disconnect the cooling fan power supply connector **(B)**.

4. Disconnect the board power connector cable **(C)**.

5. Disconnect the touch screen connector cable **(D)**.

6. Disconnect the RS232 connector cable **(E)**

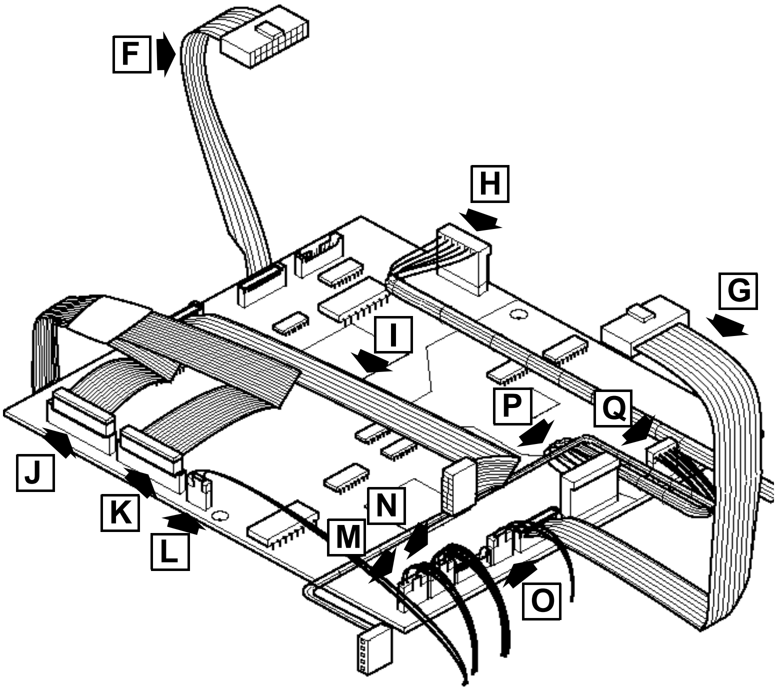


7. The PC carrier board can now be removed by sliding towards the rear of the ventilator.

8. Place the PC carrier board in a anti static bag or store the board in an appropriate anti static environment.

The Control monitor board can now be accessed.

9. Disconnect the following cables.



10. CAN card link ribbon cable controller side **(F)**. (P3)

11.CAN card link ribbon cable controller side **(G)**. (JP3)

12. Power supply connector controller side, main loom **(H)**. (P4)

13. Controller to A0761 transducer assembly ribbon cable **(I)**. (P5)

14. Conventional valve drive ribbon cable **(J)**. (P6)

15. Analogue valve drive ribbon cable **(K)**. (P7)

16. Alarm sounder cable, main loom **(L)**. (JP5)

17. Battery/power supply sensing connector, main loom **(M)**. (JP9)

18. Controller to A0761 transducer assembly connector **(N)**. (JP7)

19. O_2 cell connector **(O)**. (JP8)

20. Power supply connector monitor side, main loom **(P)**. (JP6)

21. Flow sensor connector **(Q)**. (JP4)

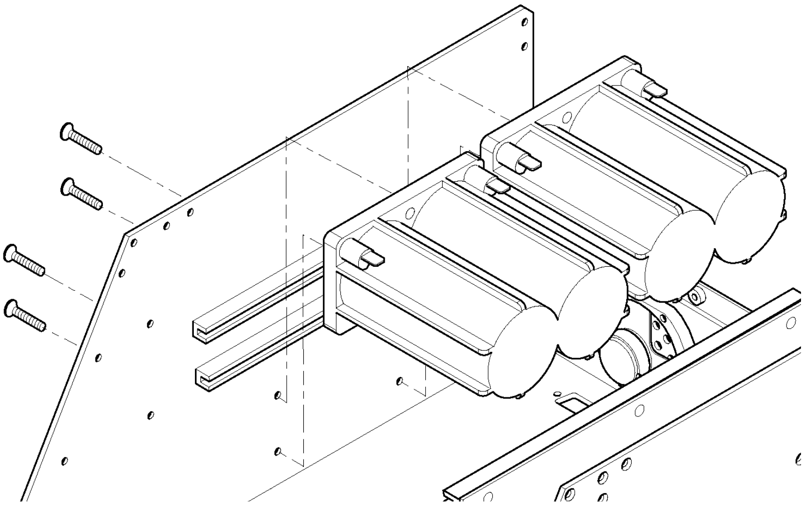
22. The control and monitor board can now be removed.

13.5.4 Removal of the Backup Batteries

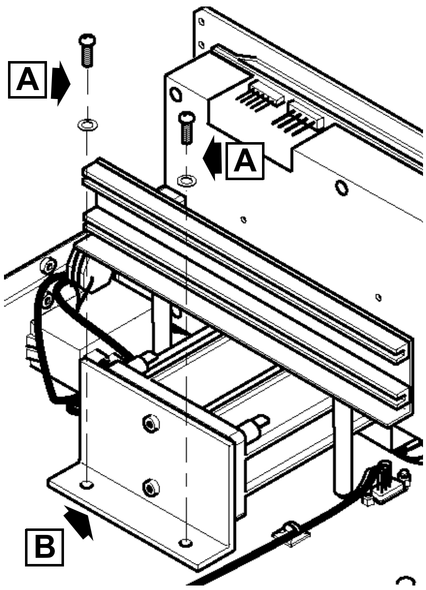
1. Disconnect all the battery terminal leads.

2. Remove the four retaining screws for the first two battery blocks.

3. Remove the two batteries.

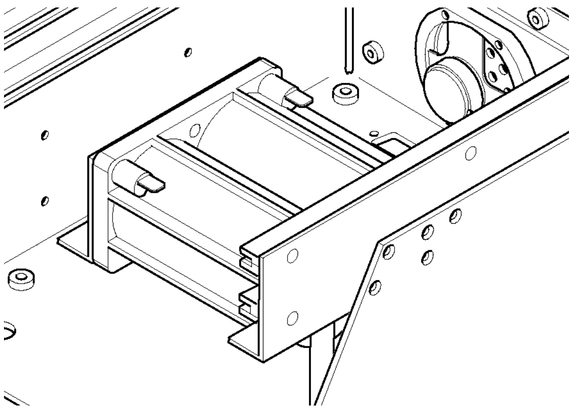


4. Remove the two fixing screws and washers **(A)**, securing the fixing bracket **(B)** for the third battery.

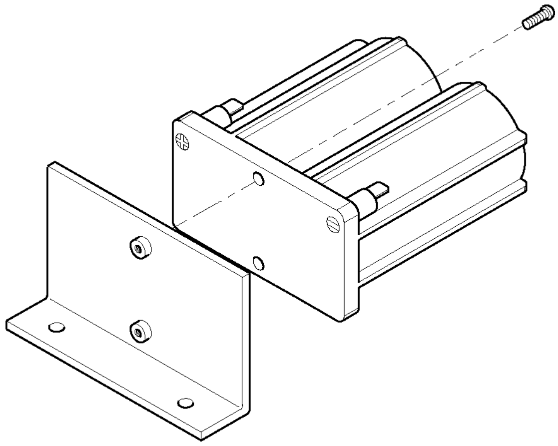


5. Slide the battery forward and lift clear.

6. Remove the two fixing screws to release the bracket from the battery block.



7. Remove the two screws retaining the bracket to the battery.



8. Reversing the procedure for replacement of the batteries, re-install all the electronic module components.

9. Carry out the following to complete the 24 month overhaul.

Replace the duckbill & conical filters, the N2042 “O” rings, as described in the 6 month PPM routine, the N2191/10 O_2 cell and the CMOS backup batteries as described in the 12 month PPM routine.

13.5.5 Setup

1. Reset the time and date.
2. Carry out the two point oxygen calibration.
3. Carry out a full functional test.
4. Replace all the covers.

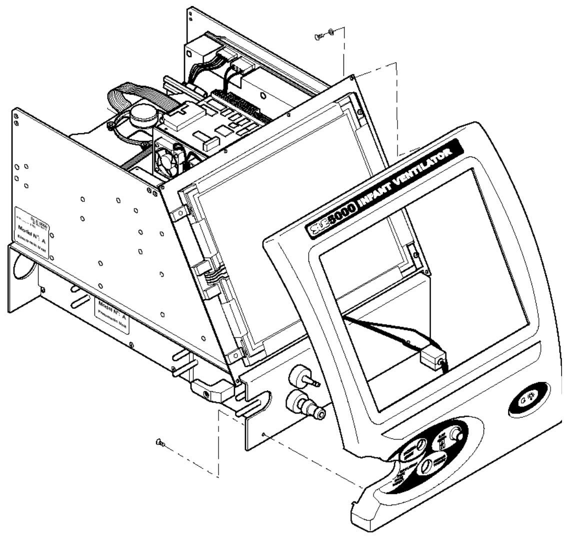
48 Month / 20,000 Hour Overhaul

13.6 48 month / 20,000 hour overhaul procedure

The procedure for the 48 month / 20,000 overhaul is as follows for option 1 and 2

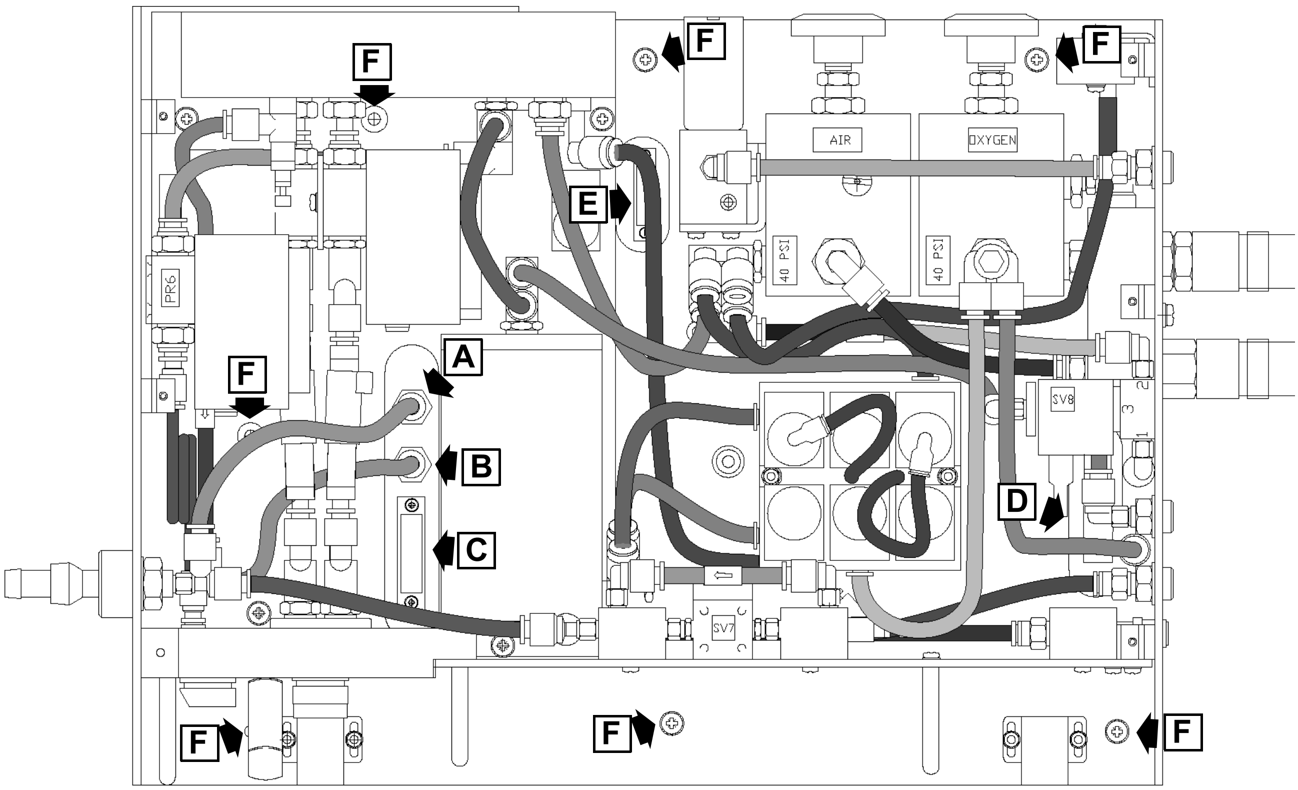
1. Remove the outer cover, inner cover and base plate

2. Remove the front facia panel by removing the attaching countersunk screws.



Note: The front facia panel cannot be removed completely as it remains connected via two electrical cables to the electronic unit.

3. Disconnect the following tubes (A & B).



Pre-proximal airway modification pneumatic unit shown.

4. Disconnect the three looms **(C, D & E)** from the bulkhead connectors.

5. Remove the seven fixing screws and washers **(F)**.

6. Attach the new pneumatic unit (reverse of removal).

7. Refit the front facia panel.

After replacement of the pneumatic unit a full system calibration followed by a complete functional tests must be carried out.

After calibration and functional testing, carry out a full electrical safety test.

13.7 48 month overhaul procedure using N9010/48 overhaul kit.

The overhaul of the electronic unit follows the same procedure as that of a 24 month overhaul.

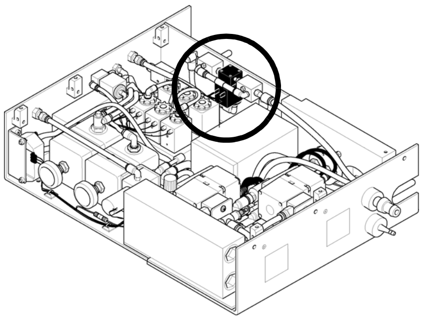
13.7.1 Pneumatic unit 48 month overhaul procedure

Note: Replace any tubing deemed to be brittle, damaged or discoloured. Tubing should be removed and replaced as the item it is attached to is removed from the pnuematic unit.

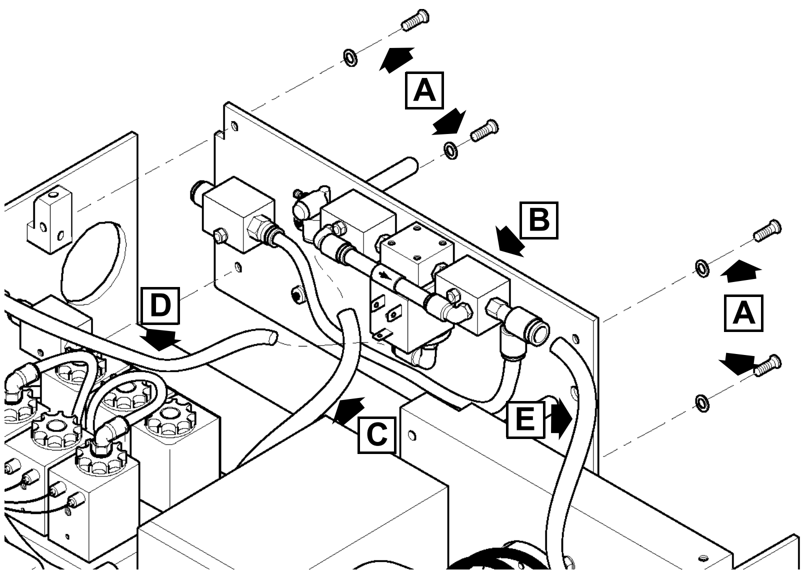
13.7.2 Removal of the partition assembly

Replacement of the fresh gas supply solenoid (SV7), speed controller (FR1) and pressure relief valve (PRV1).

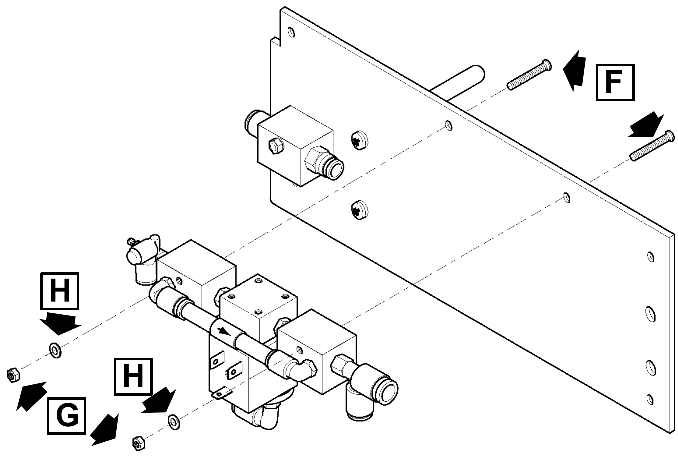
Location in pneumatic unit.



1. Remove the four screws and washers **(A)** retaining the partition assembly **(B)**.
2. Gently release the assembly so access the tubing.
3. Disconnect the tube connected to FR1 **(C)**.
4. Disconnect the tube connected to SV7 **(D)**.
5. Disconnect the fresh gas tube connected to the SV7 bypass mounting block **(E)**.
6. Remove the partition assembly **(B)** from the pneumatic unit.

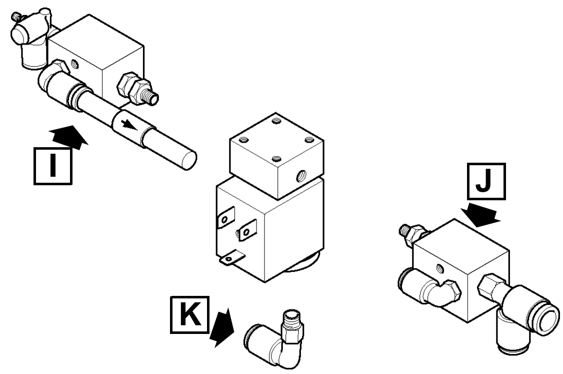


7. Remove the two screws **(F)**, nuts **(G)** and washers **(H)** securing the SV7 solenoid assembly to the bulkhead.

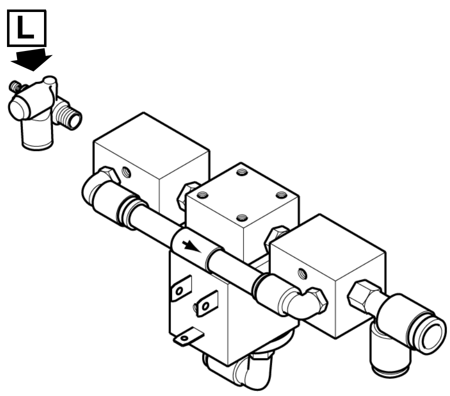


8. Detach the SV7 solenoid valve from the two bypass mounting block assemblies **(I)** and **(J)** as shown. Remove the elbow tube connector **(K)**.

9. Replace the solenoid valve.

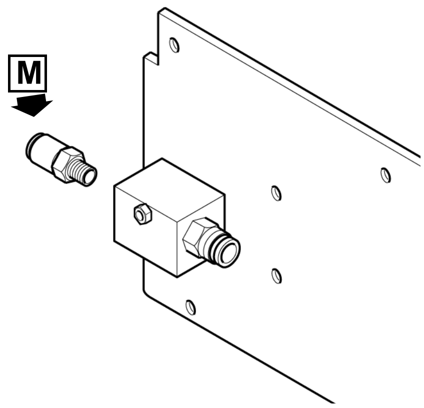


10. Replace the Speed controller (FR1) **(L)** using a spanner to undo the base nut.



11. Replace the pressure relief valve (PRV1) **(M)**.

12. Reassemble the partition assembly and place to one side.



13. Disconnect the following tubes.

Fresh gas monitoring tube **(N)**.

Proximal airway monitoring tube **(O)**.

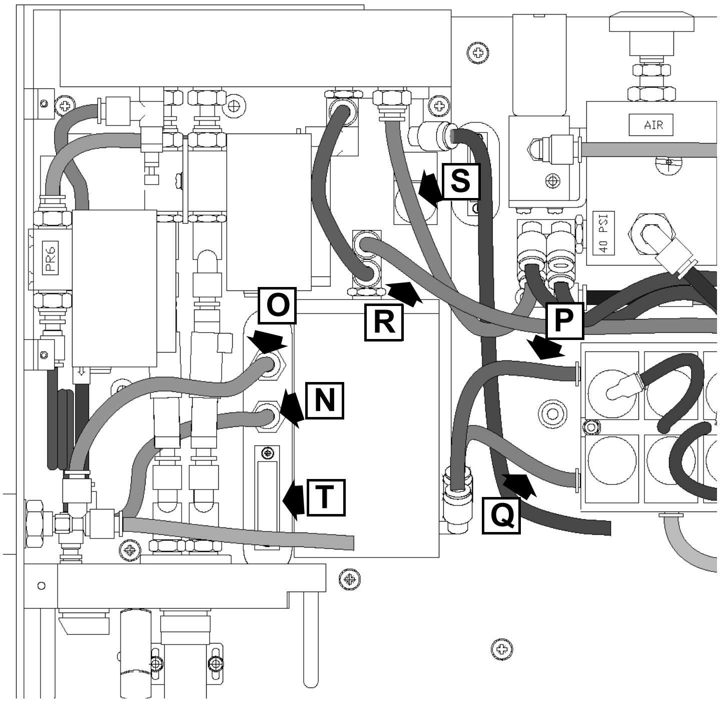
Blender port 3 to mixing chamber tube **(P)**.

Blender port 4 to mixing chamber tube **(Q)**.

Mixing chamber to SV8 tube **(R)**.

Manifold to air regulator tube **(S).**

14. Disconnect the electrical loom connector **(T)**.

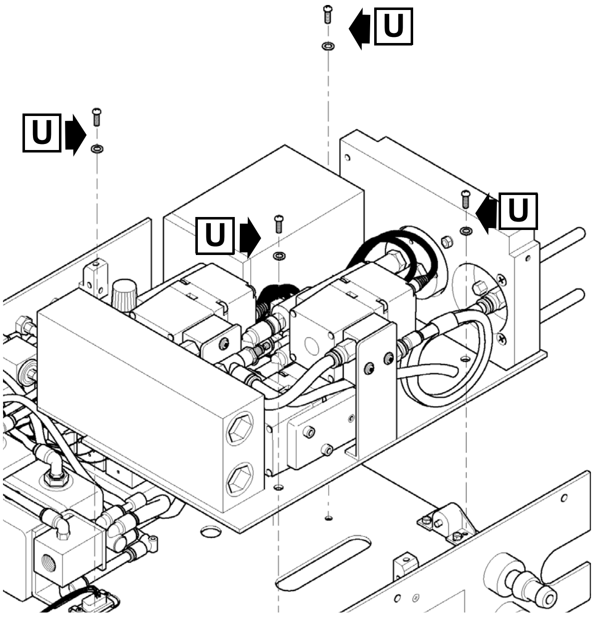


15. Remove the four screws and washers **(U)** retaining the HFO module.

16. Remove the module from the pneumatic unit.

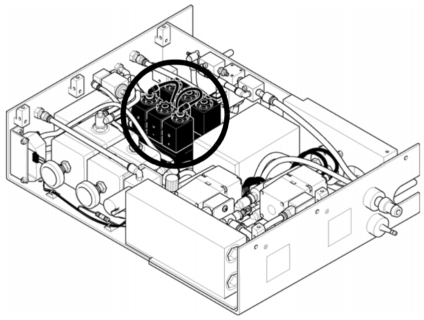
Note: The fresh gas and proximal airway tube fittings impede the removal of the module.

17. Place the HFO module to one side.

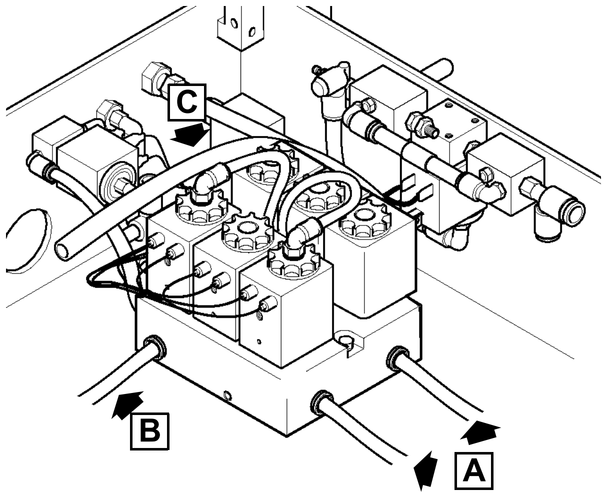


13.7.3 Removal of the Blender Assembly

Location in pneumatic unit.



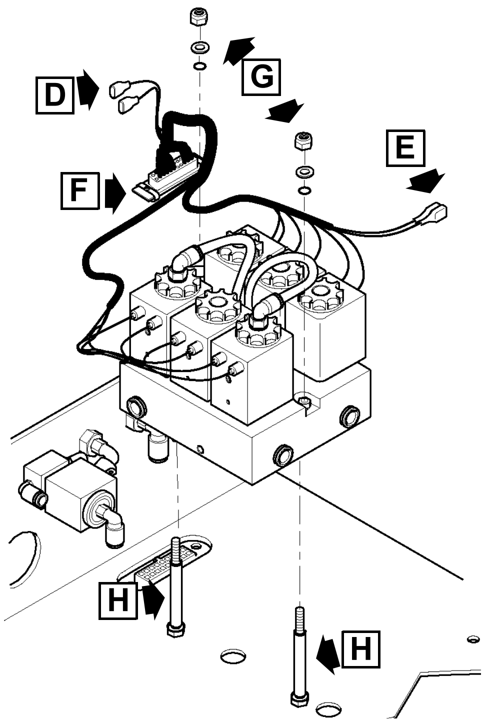
1. Disconnect the two mixing chamber tubes **(A)**.
2. Disconnect the PR1 tube **(B)**.
3. Disconnect the PR2 tube **(C)**.



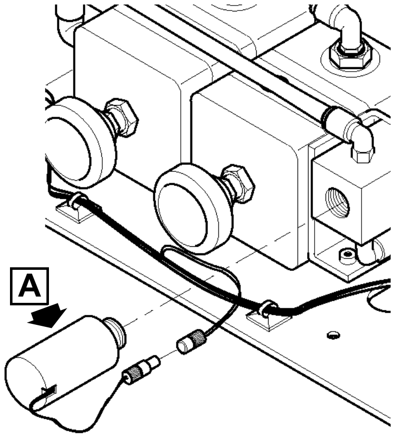
4. Disconnect the electrical connectors from SV8 **(D)**.
5. Disconnect the electrical connectors from SV7 **(E)**.
6. Disconnect the blender loom connector from the bulk head **(F)**.
7. Remove the two shake proof nuts, washers and O-rings **(G)**.

The blender can now be removed.

Note: Ensure that the rubber sleeves (H) remain on the blender support studs.



13.7.4 Removal of the inlet air regulator PR1



1. Remove the Oxygen cell **(A)** if still fitted.

2. Disconnect the following tubes.

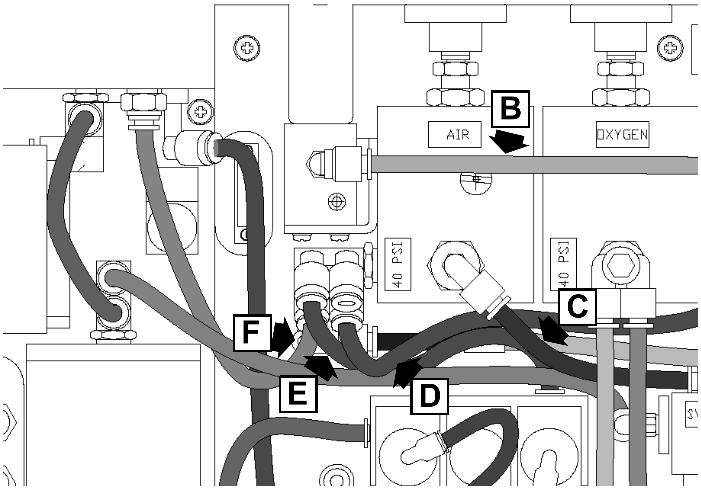
Oxygen cell to overboard dump **(B)**.

Air inlet to 40PSI air regulator **(C)**.

40PSI air regulator to differential pressure transducer **(D)**.

40PSI air regulator to blender port 1 **(E)**.

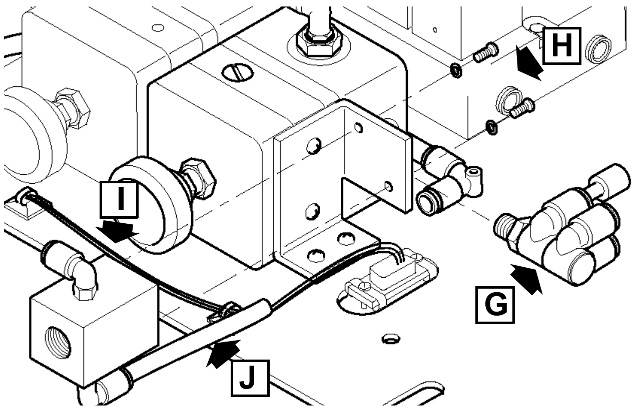
40PSI air regulator to manifold **(F)**.



2. Using a spanner remove the pneumatic fitting **(G)**.

3. Remove the two screws and washers **(H)** to release the Oxygen cell manifold **(I)**.

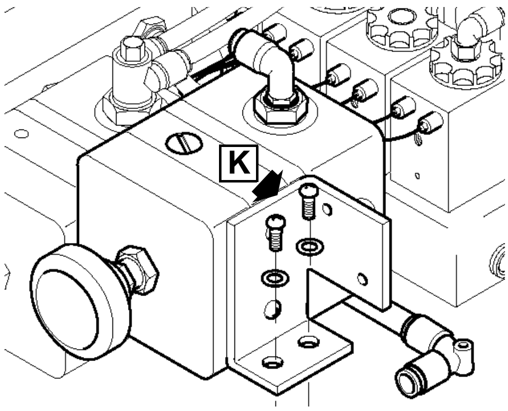
Note: The Oxygen cell manifold should be removed with the tube (J) attached.



4. Remove the two screws and washers **(K)**.

6. The 40PSI air regulator can now be removed from the Pneumatic unit.

7. Remove the bracket from the old regulator and attach to the replacement regulator.



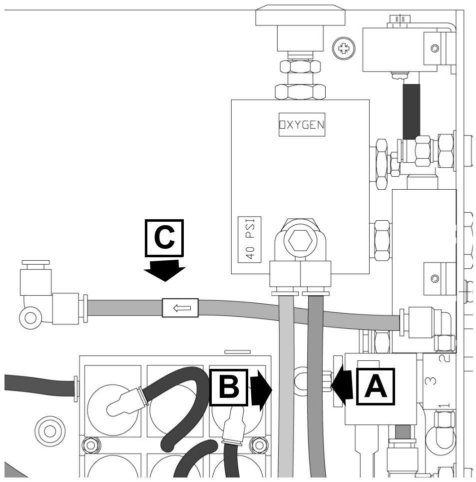
13.7.5 Removal of the inlet oxygen regulator PR2

1. Disconnect the following tubes.

40PSI oxygen regulator to SV8 **(A)**.

40PSI oxygen regulator to blender O_2 inlet **(B)**.

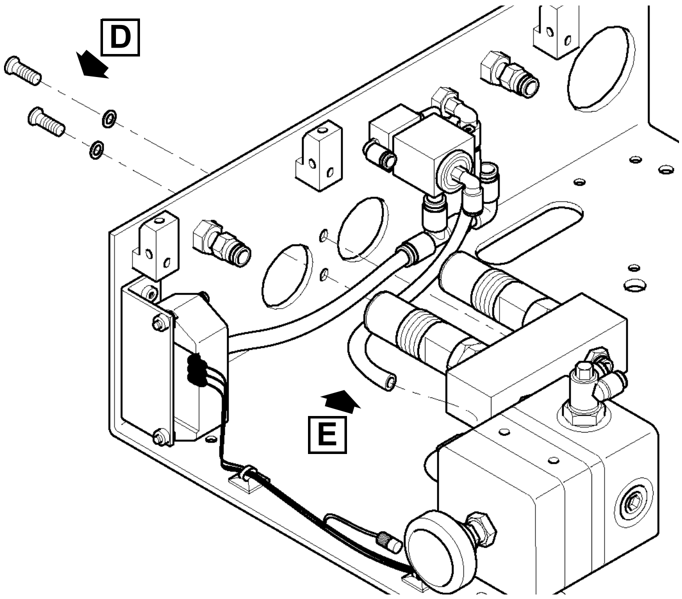
SV8 to O_2 cell **(C)** tube complete with restrictor and elbow.



2. Remove the two fixing screws and washers **(D)**.

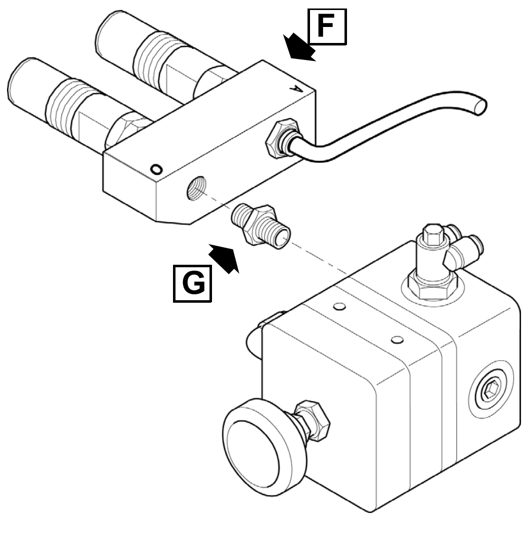
3. Withdraw the 40PSI oxygen regulator so that the inlet connectors are clear of the chassis. Disconnect the tube **(E)**.

4. The 40PSI oxygen regulator can now be removed from the Pneumatic unit.



5. Disconnect the connector assembly **(F)** from the regulator by removing the adaptor fitting **(G)**.

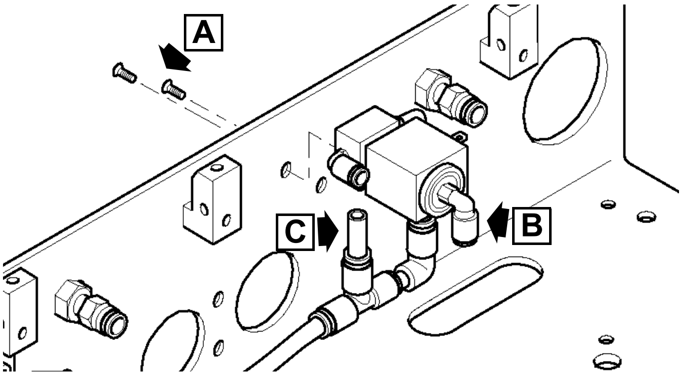
6. Re-connect the new regulator to the connector assembly **(F)**. Place the assembly to one side.



13.7.6 Removal of the O_2 calibration solenoid (SV8)

1. Remove the two fixing screws **(A)**.

2. Remove the solenoid assembly **(B)** from the bulkhead and disconnect the tube **(C)**.

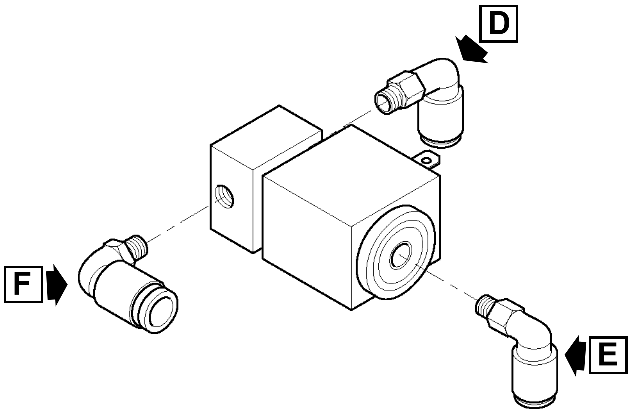


3. Disconnect the tube connectors **(D, E & F)**.

4. Replace the solenoid valve.

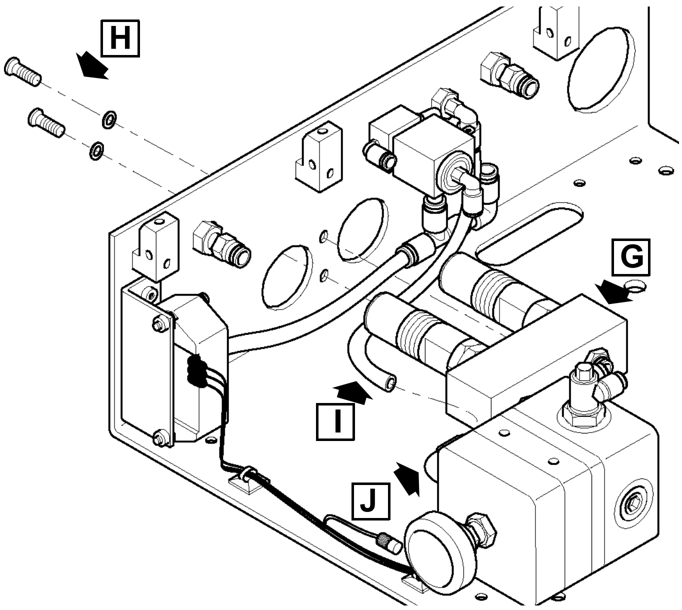
5. Re-fit the tube connectors.

6. Re-install the solenoid assembly to the bulk head, making sure that the hose **(C)** is fitted securely.



7. Re-install the inlet gas and O_2 regulator assembly **(G)** to the rear bulkhead using the screws and washers **(H)**.

9. Connect the O_2 bleed tube **(I)** to the elbow connector **(J)**.



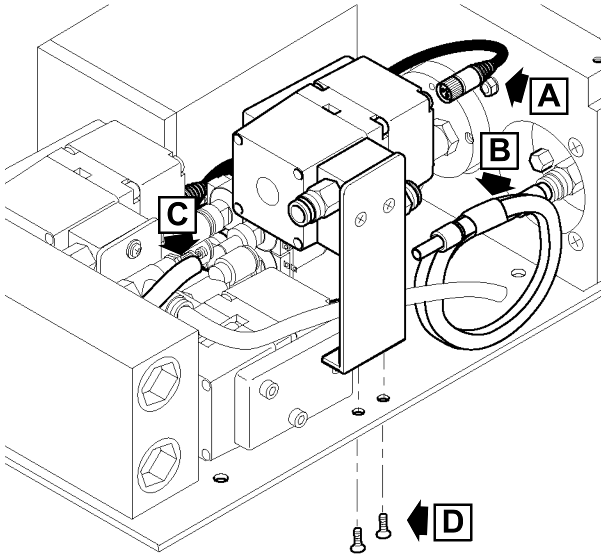
13.7.7 HFO module component replacement

1. Return to the HFO module

2. Unscrew the electrical connector **(A)** from the pressure regulator PR6.

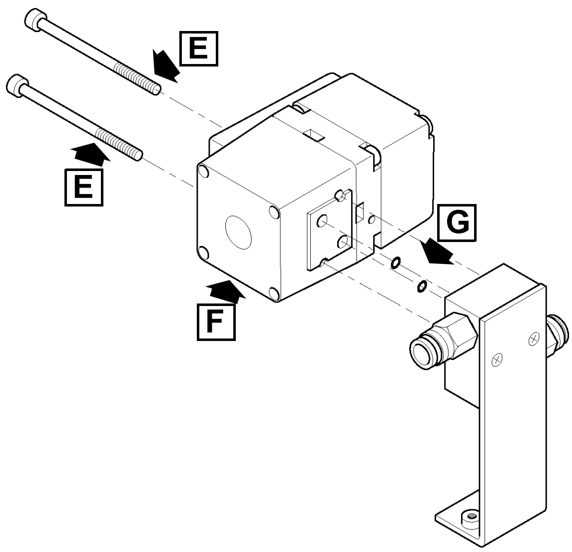
3. Disconnect the tubes **(B & C)** from the pressure regulator manifold block.

4. Remove the two countersunk screws **(D)** that retain the PR6 regulator assembly bracket to the base plate.



5. Remove the two hex socket cap screws **(E)** that retain the PR6 pressure regulator **(F)** to the manifold.

Note: On removing the regulator the two O-ring's (G) are freed.

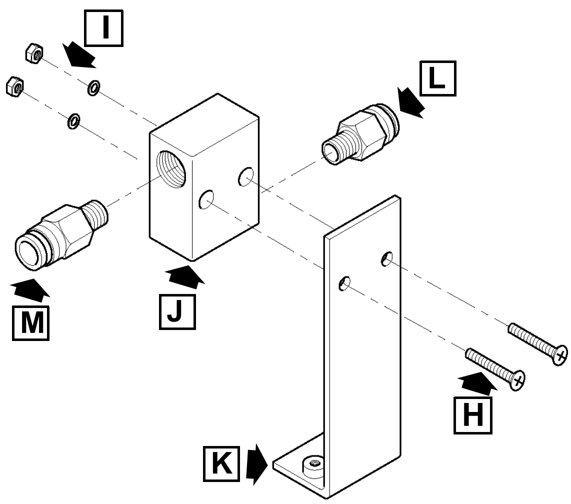


6. Remove the two countersunk screws **(H)** washers and nuts **(I)** that retain the manifold **(J)** to the bracket **(K)**.

7. Remove the pneumatic tube connectors **(L & M)**.

Note: The PR6 pressure regulator is made up of the following components, pressure regulator (F), hex socket cap screws (E), O-rings (G) and manifold (J).

8. Reverse the above procedure to install the new PR6 regulator to the bracket (K). Do not re-attach the bracket to the HFO module base plate.

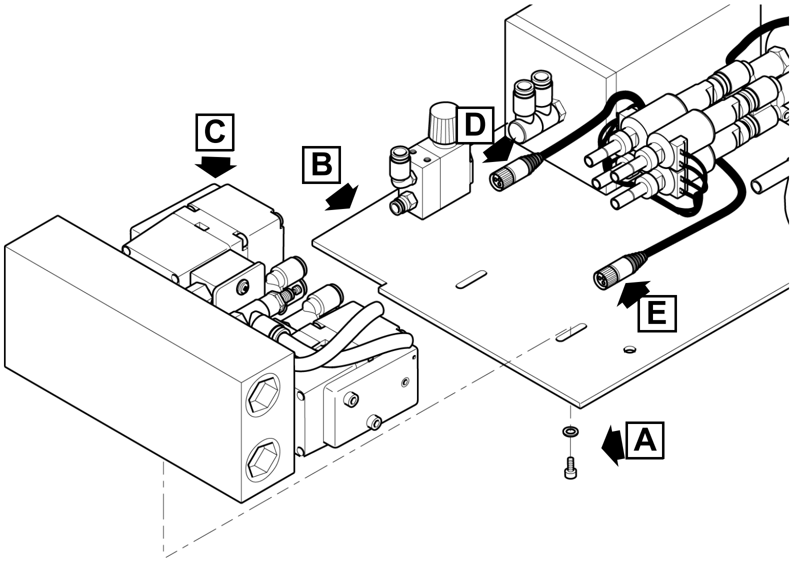


13.7.8 PR3 & PR4 replacement

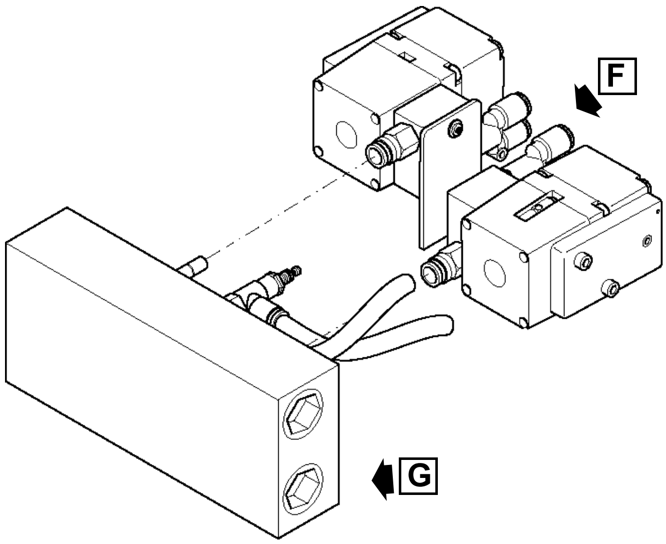
1. Remove the two screws and washers **(A)** that retains the manifold to the base plate **(B)**.

2. Slide the assembly **(C)** so as to disengage the jet valves from the pneumatic connectors.

3. Unscrew the electrical connectors **(D & E)** from the pressure regulators.

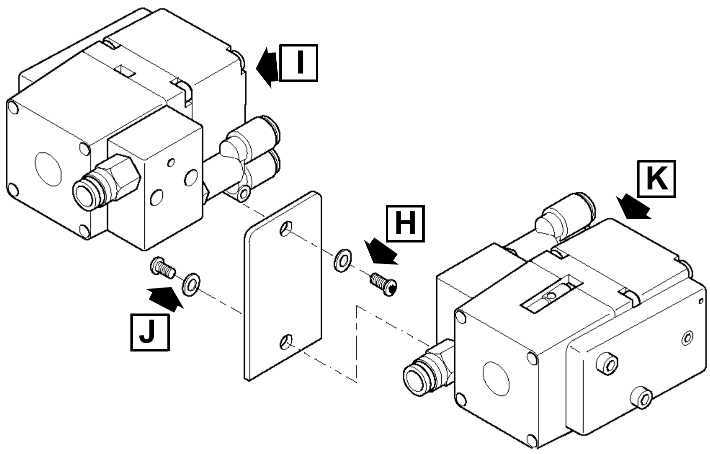


4. Separate the pressure regulator assembly **(F)** from the manifold **(G)**.



5. Remove the screw and washer **(H)** that retains the pressure regulator PR3 **(I)**.

6. Remove the screw and washer **(J)** that retains the pressure regulator PR4 **(K)**.

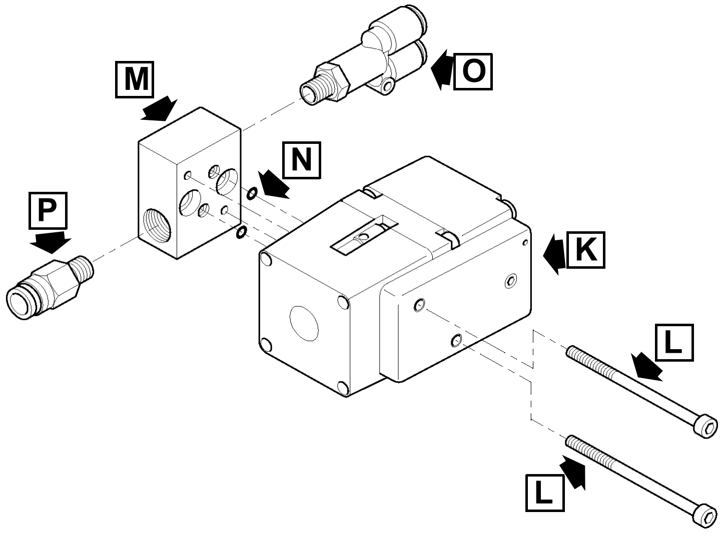


7. Remove the two hex socket cap screws **(L)** that retain the PR4 pressure regulator **(K)** to the manifold **(M)**.

Note: On removing the regulator the two O-ring's (N) are freed. These O-ring's must be replaced each time that the assembly is dismantled.

8. Remove the pneumatic tube connectors **(O & P)**.

Note: The procedure is the same for the PR3 pressure regulator.

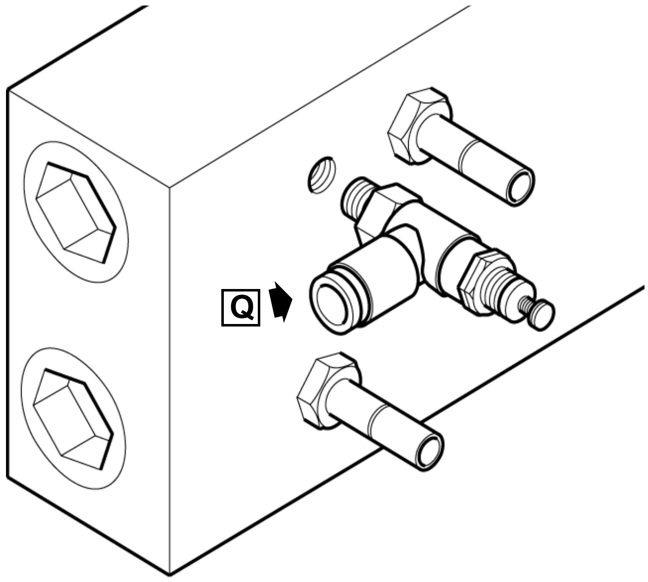


10.Reverse the above procedure to install the new PR3 & PR4 regulators. Do not attach to the manifold, place the assemblies to one side.

13.7.9 PR7 replacement Pre Proximal Airway Modification

11. Remove the purge regulator **(Q)** using a spanner to undo the base nut from the manifold block.

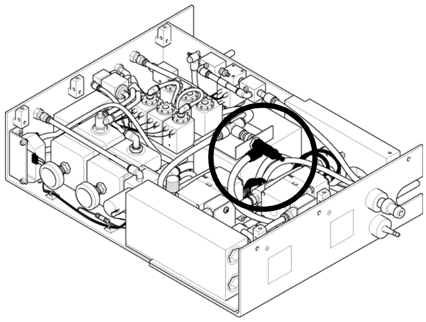
12. Assembly is reversal of removal.



SLE

13.7.10 PR7 replacement Post Proximal Airway Modification

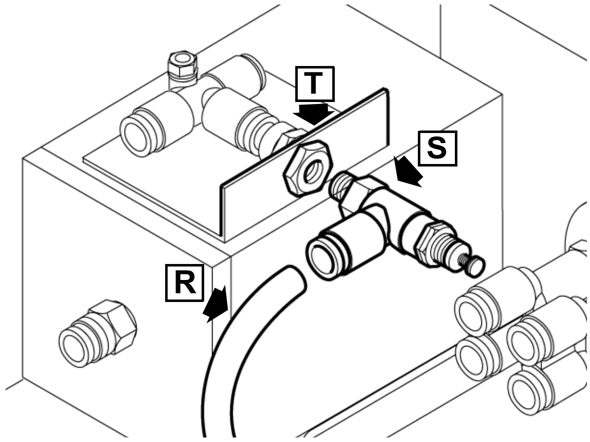
Location in pneumatic unit.



1. Remove the outlet hose **(R)**.

2. Remove the purge regulator **(S)** using a spanner to undo the base nut. Take care not to loosen the bulkhead flitting **(T)**.

3. Assembly is reversal of removal.



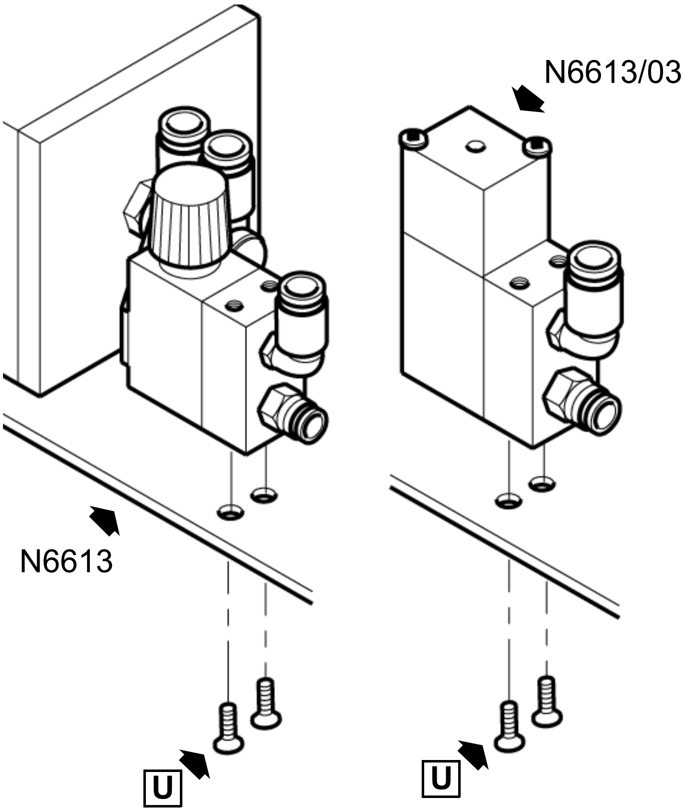
13.7.11 0-30 PSI (PR5) purge regulator replacement.

1.On the HFO module remove the two screws **(U)** that secure the regulator.

2. Remove the fittings from the old regulator and fit them to the replacement regulator.

3.Refit the regulator

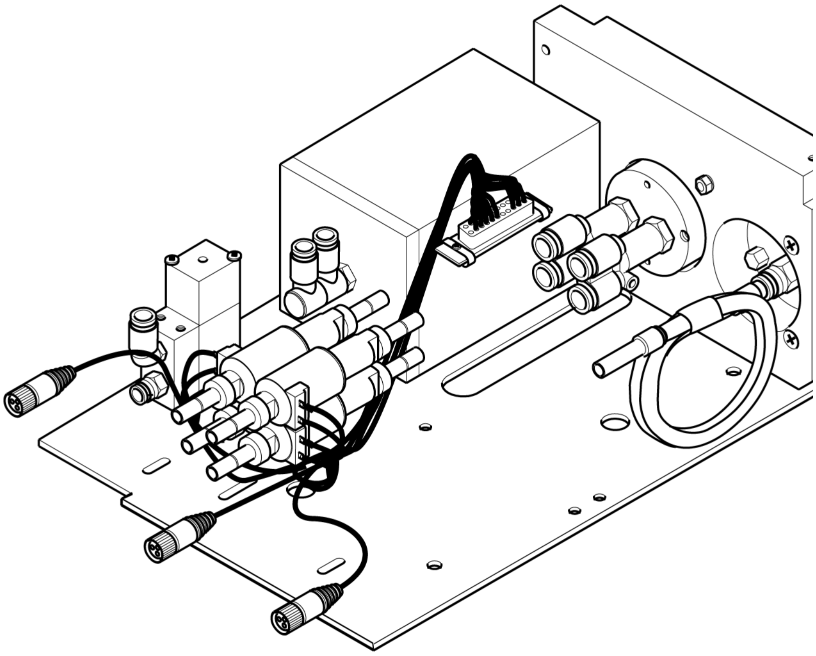
Note: The replacement regulator will be part Nº: N6613/03



13.7.12 High speed jet valves replacement

1. Withdraw the jet valve assembly from the pneumatic connectors.

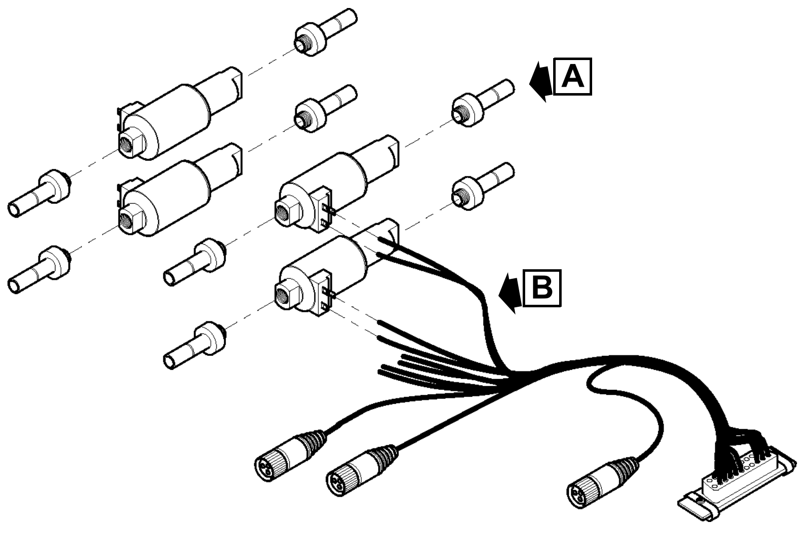
Note: The jet valves are independent and are only connected together via the loom.



2. Unscrew the adaptor stems **(A)** from the valve bodies.

3. De-solder the wires **(B)** from valve bodies.

Note: The electrical connectors are not polarized.

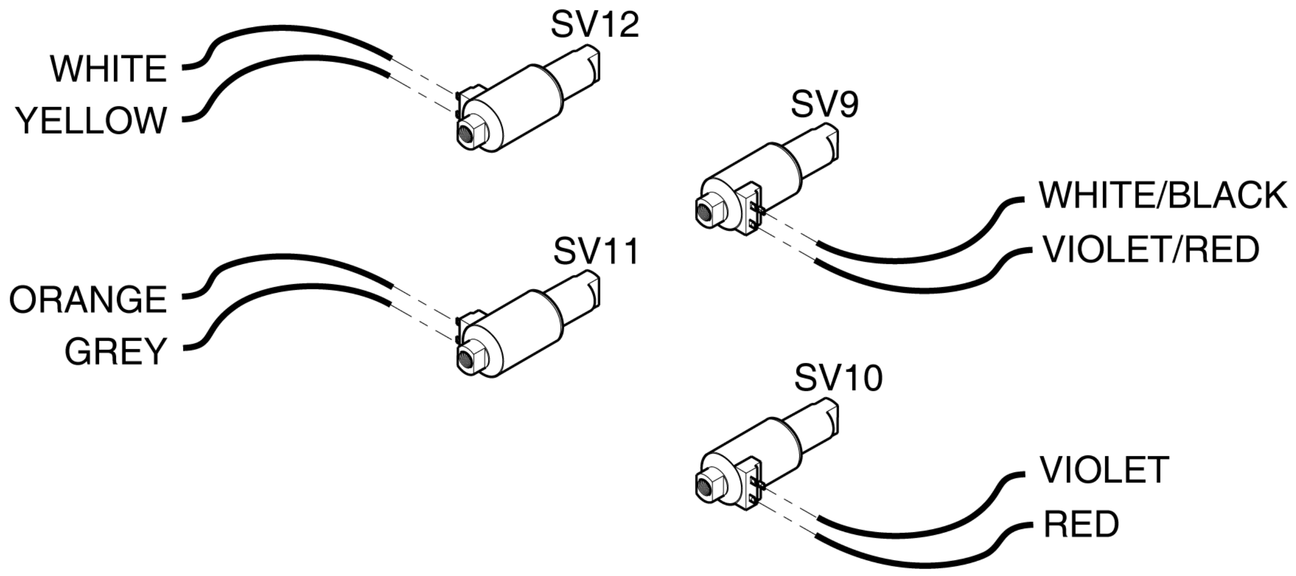


13.7.13 High speed jet valve re-assembly

4. Mark the new high speed jet valves as follows:

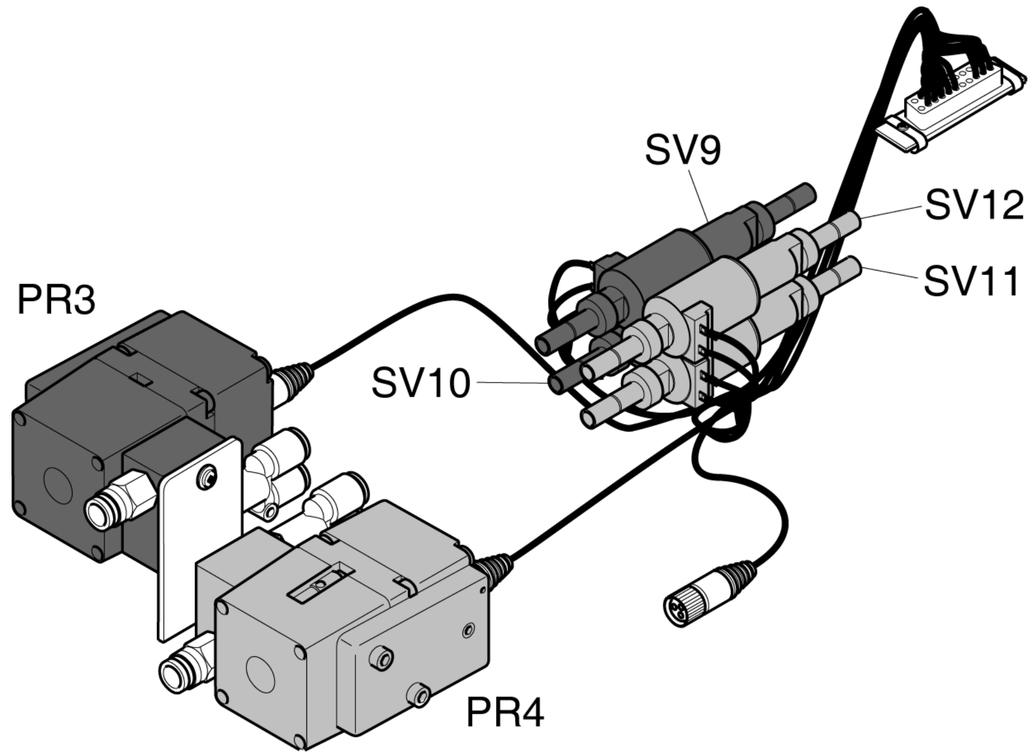
SV9
SV10
SV11
SV12

5. Re-solder the wires as per the following diagram:



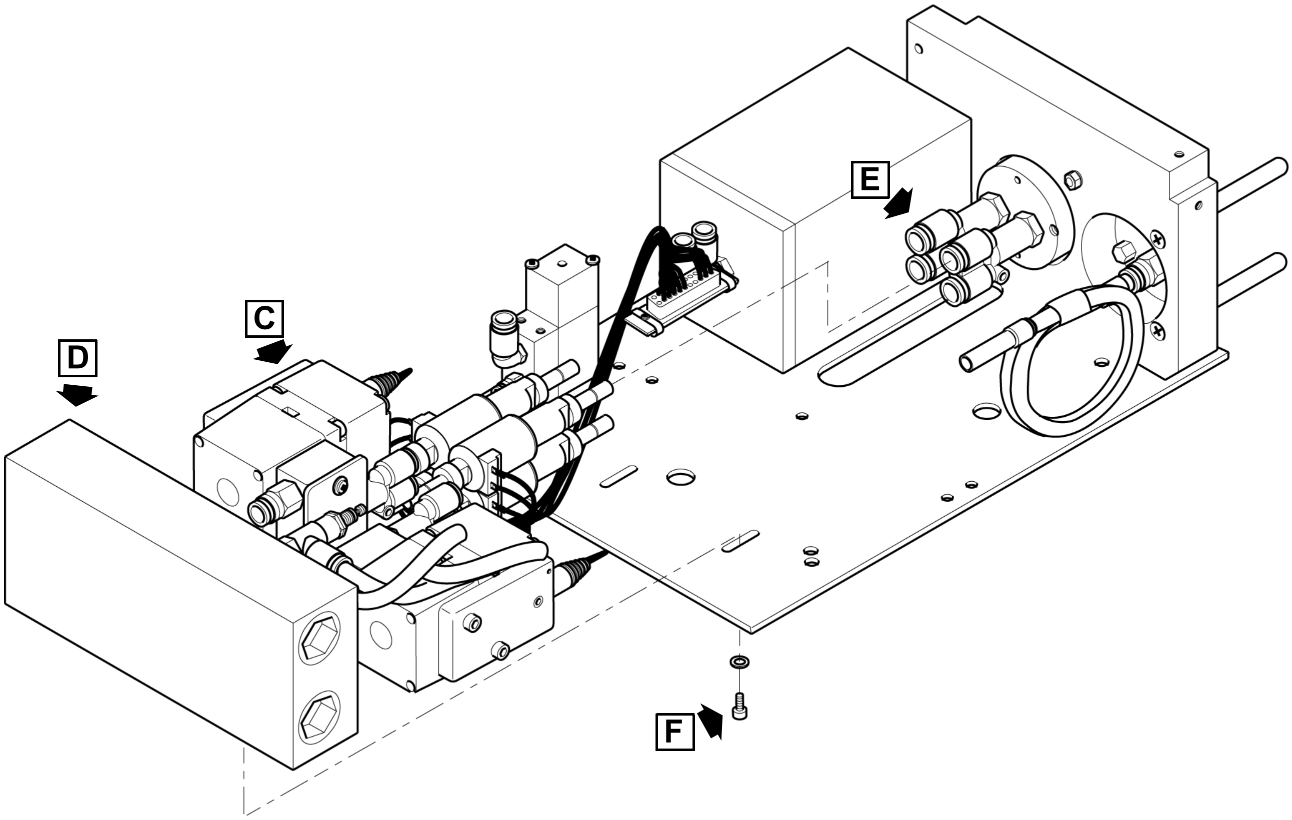
6. Re-attach the adaptor stems to the valves.

7. Insert the high speed valves in the following order into the PR3 and PR4 pressure regulator assemblies.



8. Reconnect PR3 and PR4 regulator electrical connectors. The cable marked 4 connects to PR4 and the cable marked 3 connects to PR3.

9. Attach the pressure regulators and high speed valve assembly **(C)** onto the manifold block **(D)** by pushing the two pneumatic connectors onto the two free adaptor stems.

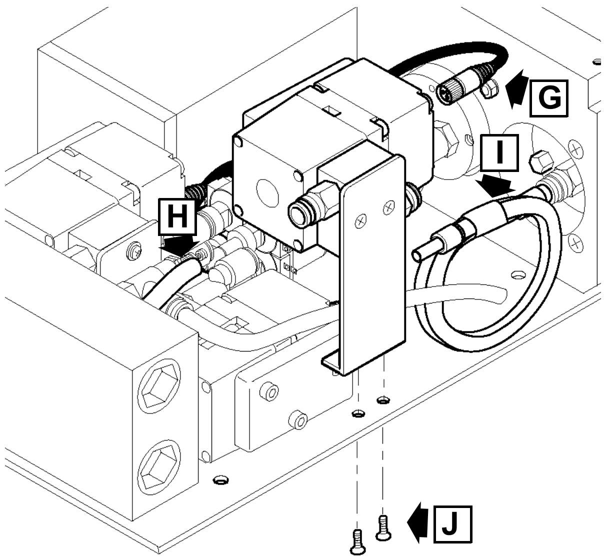


10. Insert the assembly **(C,D)** into the four free pneumatic connectors **(E)** and secure the unit with the screw and washers **(F)**.

11. Screw the last free electrical connector **(G)** to the pressure regulator PR6.

12. Connect the tubes **(H & I)** to the pressure regulator manifold block.

13. Use two countersunk screws **(J)** to retain the PR6 regulator assembly bracket to the base plate.



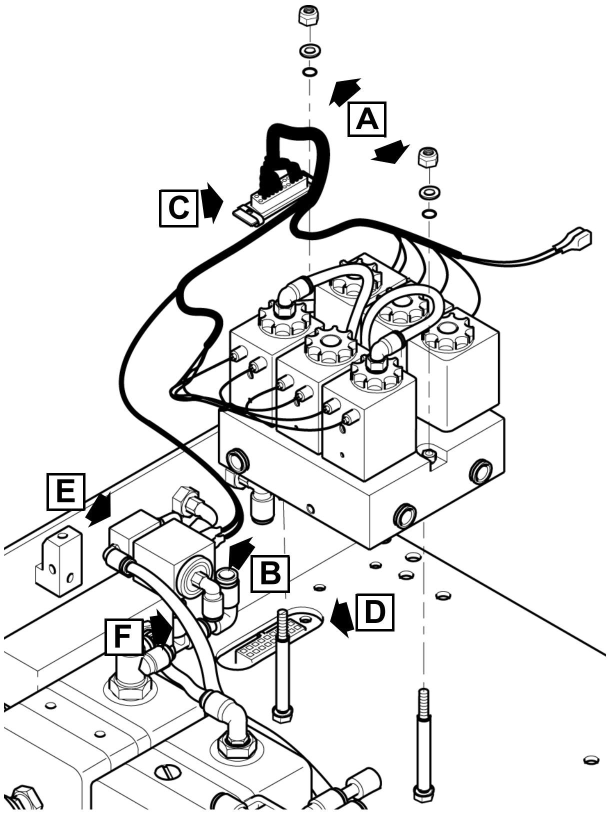
13.7.14 Fitting the blender

1. Install the blender using the two shake proof nuts, washers and O-rings **(A)**.

2. Reconnect the electrical connectors from SV8 **(B)**.

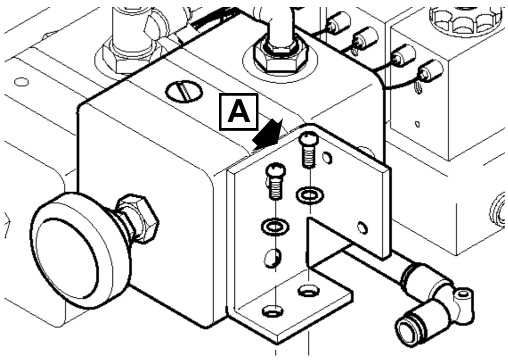
3. Reconnect the blender loom connector **(C)** to the bulk head connector **(D)**.

4. Reconnect the tubing, restrictor and elbow **(E)** to the SV8 solenoid **(F)**.



13.7.15 Fitting of inlet air regulator

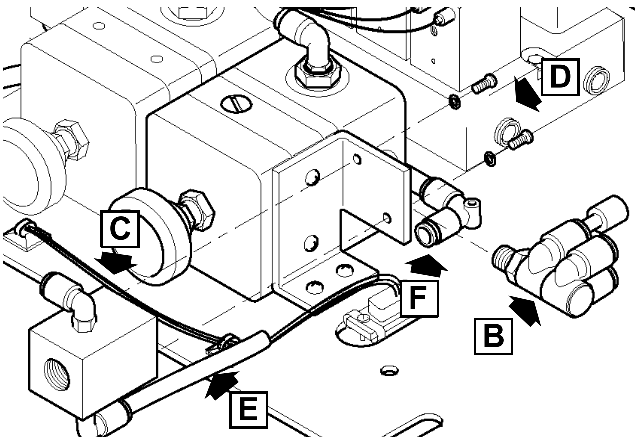
1. Place the regulator into position and secure using the two screws and washers **(A)**.



2. Using a spanner attach the pneumatic fitting **(B)**.

3. Attach the Oxygen cell manifold **(C)** using the two screws and washers **(D)**.

4. Connect the tube **(E)** to the free pnuematic connection **(F)**.

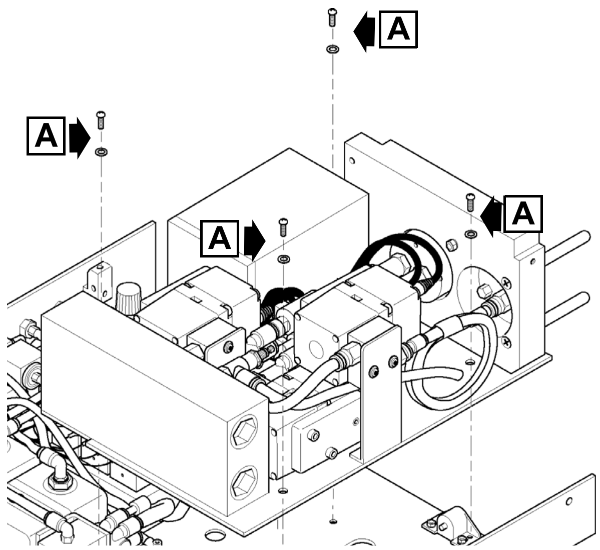


13.7.16 HFO module re-assembly

1. Place the HFO module into the pneumatic unit.

2. Use four screws and washers **(A)** to secure the HFO module.

Note: The fresh gas and proximal airway tube fittings impede the fitment of the module.



3. Reconnect the following tubes.

Fresh gas monitoring tube **(B)**.

Proximal airway monitoring tube **(C)**.

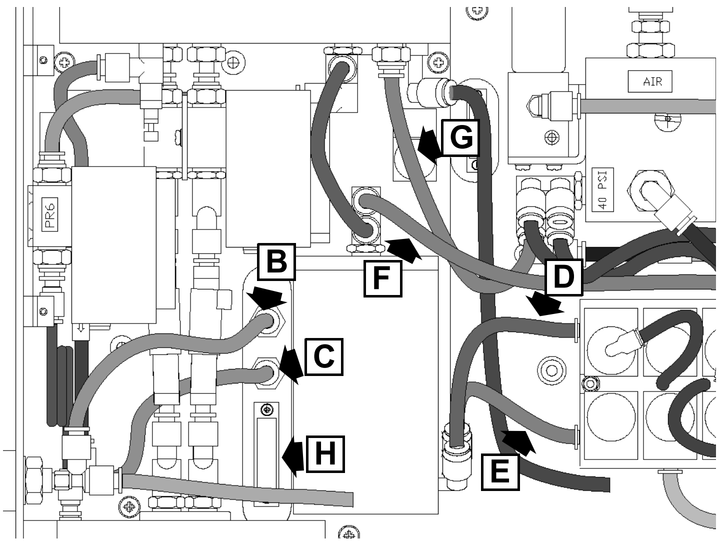
Blender port 3 to mixing chamber tube **(D)**.

Blender port 4 to mixing chamber tube **(E)**.

Mixing chamber to SV8 tube **(F)**.

Manifold to air regulator tube **(G).**

4. Reconnect the electrical loom connector **(H)**.



5. Re-connect the following tubes.

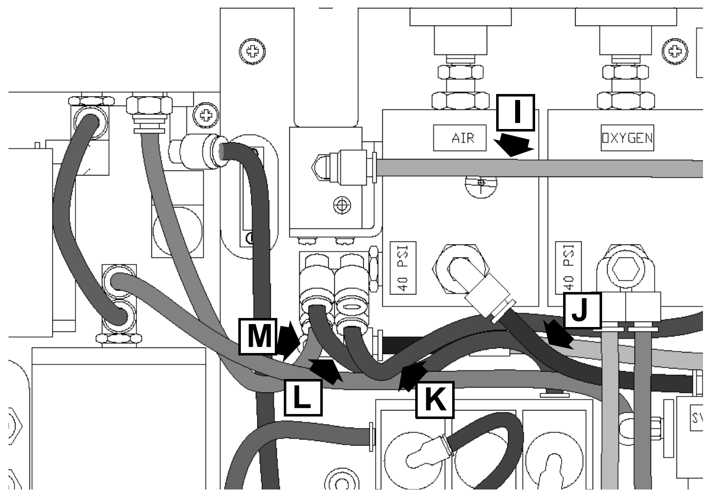
Oxygen cell to overboard dump **(I)**.

Air inlet to 40PSI air regulator **(J)**.

40PSI air regulator to differential pressure transducer **(K)**.

40PSI air regulator to blender port 1 **(L)**.

40PSI air regulator to manifold **(M)**.



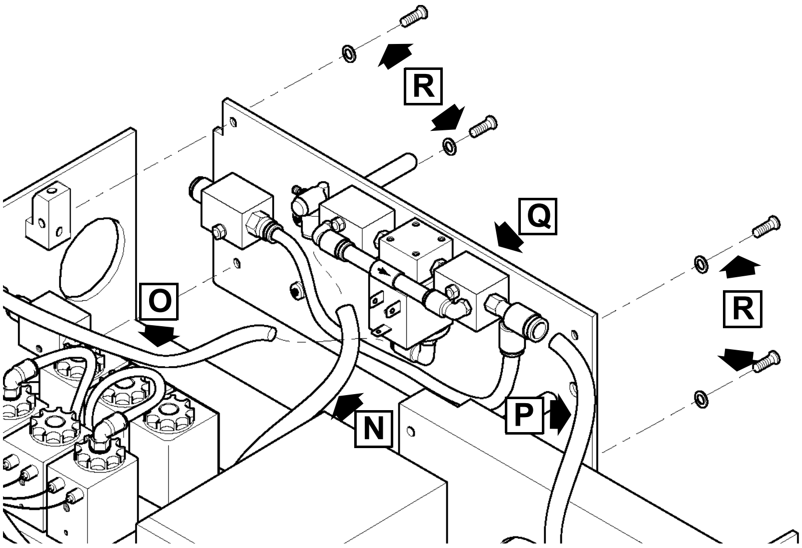
6. Offer the partition assembly up to the ventilator.

7. Reconnect the tube connected to FR1 **(N)**.

8. Reconnect the tube connected to SV7 **(O)**.

9. Reconnect the fresh gas tube connected to the SV7 bypass mounting block **(P)**.

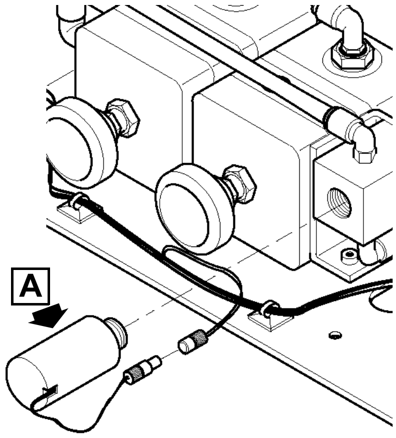
10. Secure the partition assembly **(Q)** with the four screws and washers **(R)**.



11. Fit the new oxygen cell.

12. Refit the base plate to the ventilator and the term the ventilator over.

13. Reversing the procedure for replacement of the batteries, re-install all the electronic module components.



13.7.17 Setup

1. Carry out a full system calibration using the calibration procedure appropriate to the installed version of software.

2. Reset the time and date.

3. Carry out the two point oxygen calibration.

4. Replace all the covers.

Calibration Procedure V3 to 3.2

14. Calibration Procedure for V3, V3.1 & 3.2 software

The calibration procedure is to be used in-conjunction with a checklist. The checklist is used to record the calibration values set during the procedure. This checklist will be become part of the service record of the ventilator. A template checklist (which should be copied) is to be found in **Appendix 1** of this manual on page 401.

Where information needs to be recorded the user will see ☑ symbol next to the section.

Note:Prior to calibration enter ENGMODE and record the following Gain / Offset values. This will allow you to revert the ventilator back to it pre-calibrated state if required.

Gain and Offset for the 1 PSI and 2.5 PSI pressure transducers.
Gain, HFO Offset and CMV Offset for the Forward jet.
Gain and CMV Offset for the Mean jet.
Gain, HFO Offset and CMV Offset for the Reverse jet.
Insp leading Edge Fast / Slow rise time and F/S Balance.
Exp leading Edge Fast / Slow rise time and F/S Balance.

☑ **Use the table at the back of Appendix 1.**

14.1 Preliminary Inspection before calibration

a) Check all tubing connections are fully home in their fittings.

b) Check that the oxygen fuel cell is properly located (finger tight) and that its electrical connector is mounted on an adhesive clip.

c) Check that the electrical connections to the high speed valves are screwed on tightly (finger tight).

d) Check the pneumatic harness with particular attention to the connections to the 25 way ‘D’ type connectors, the pressure transducer and the oxygen cell.

e) Ensure that the exhalation block can be removed and relocated easily and that the nozzle assemblies (jet blocks) and ‘O’ rings correctly fitted – orange coloured.

f) Ensure “duckbill” non-return valves are fitted to the 0_2 and air intakes by directly connecting a hose between the air and oxygen regulator outputs. Apply air and disconnect the air supply hose to prove there is no leak and then reconnect and check the oxygen supply hose for no leak.

g) Check for leaks in the pneumatic system.

14.2 Pneumatic set up

a) Connect the ventilator to gas supplies at 4 bar.

b) Set the air and oxygen input pressure regulators PR1 & PR2 to 40 psi ± 0.1 psi.

c) Set the oxygen regulator to 40 psi ± 0.1 psi. Tighten the tension nut to lock thespindle in position ensure that the pressure is still within 0.1 psi of 40. (The oxygenregulator will not be adjusted again). Set the other regulator to match the firstsetting within 0.1 psi.

d) Tee into the output of PR5 with (SV7) de-energised and monitor the fresh gas pressure output and adjust output of regulator (PR5) to 30psi ± 1psi. These are non-relieving regulators so it may be necessary to disconnect the output to allow the pressure to drop and then reconnect. These regulators do drift a little after setting so need to be rechecked several times.

☑ **e)** Connect a 24V PSU to SV7 to energise. With the fresh gas valve SV7 energised, monitor the flow from the fresh gas outlet port on the front panel, and adjust the needle valve FR1 to give a flow at this port of 8LPM ± 0.25LPM.
Check list Item 5.

☑ **f)** With the fresh gas valve SV7 de-energised, ensure the flow at the fresh gas port is at least 1.2LPM (typ. 1.8LPM).
Check list Item 6.

☑ **g)** Occlude the fresh gas supply with SV7 de-energised and ensure that the pressure developed in the fresh gas limb is between 10 and 20 mbar.
Check list Item 7.

☑ **h)** Monitor the flow from the proximal airway pressure port using a precision flow meter and adjust regulator PR7 (approx. 12PSI) to achieve a flow at this port of 0.2LPM ± 0.05LPM.
Check list Item 8.

☑ **i)** Ensure that the fresh gas pressure relief valve is activated at greater than 140 mbar and no more than 170 mbar.
Check list Item 9.

☑ **j)** Verify the flow past the oxygen cell is at least 3 lpm and not greater than 5 lpm.
Check list Item 10.

k) Check that the exhuast oxygen from the relief port on the oxygen Watson Smith is not greater than 1.5 lpm.

14.3 Calibration of Controller and Monitor subsystems

a) Before the controller can be calibrated it is necessary to calibrate the pressure sensors of the Monitor Subsystem.

b) Enter the Calibration program. See “Accessing the Calibration Programs” on page 24.

14.3.1 Monitor Pressure sensor calibration

Note: The ventilator must be at working temperature with the metal electronic unit top cover on before calibrating the pressure transducers, (machine must be on for at least half an hour).

c) Enter the **Jet Calibration** option panel.

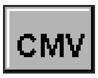
d) Set: Forward jet settings gain to 400 and remaining calibration values to zero.

e) Enter **Sensor Calibration** screen and disconnect all gas from the ventilator.

f) Press the “zero offsets” button and ensure that the two proximal pressure transducers read zero.

Acceptable tolerance: ± 1 mbar

g) Reconnect the gas and enter the **Jet Calibration** screen.

h) Set up the ventilator to CMV mode 

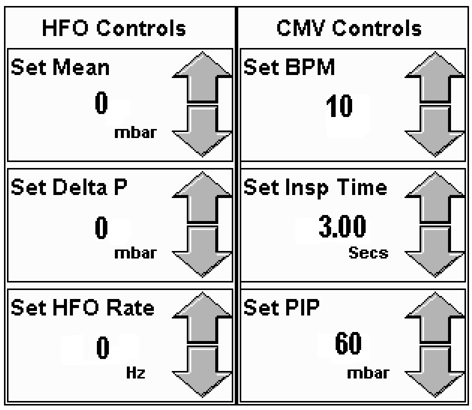
and set the following parameters:

BPM to 10

Insp. time to 3 sec

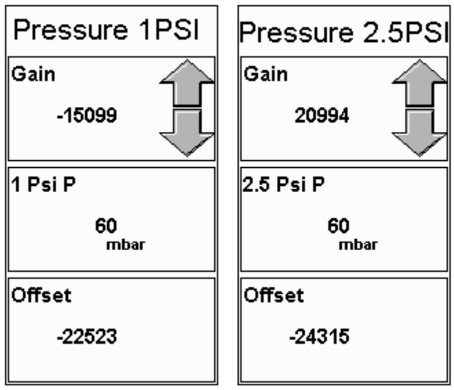
Set the PIP control to 60mbar

Set all the controls in the HFO panel to Zero



i) Enter **Sensor Calibration** screen and adjust the gain of both the pressure sensors so that the 1psi and the 2.5psi pressure transducers agree with each other and with the Calibration Analyser.

Acceptable tolerance: ±1mbar.



j) Go to **Jet Calibration** screen and set the PIP as specified in **PIP Pressure Setting** column of the table below.

k) Re-enter sensor calibration screen and check that the sensor readings (at 1 and 2.5 psi) agree with **Calibration Analyser** within the set tolerance.

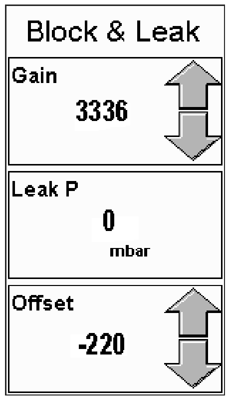
PIP Pressure Setting (1 PSI sensor)	**Tolerance**
60	± 1 mbar
30	± 1 mbar
10	± 1 mbar

PIP Pressure Setting (2.5 PSI sensor)	**Tolerance**
60	± 1 mbar
30	± 1 mbar
10	± 1 mbar

14.4 Controller "Block and Leak" pressure sensor calibration

a) Connect a Y-piece with a variable restrictor to the fresh gas port and monitor generated pressure with the calibration analyser

b) Enter **Sensor Calibration** screen and set the Block and Leak Gain to **3336** and Offset to **-220.**

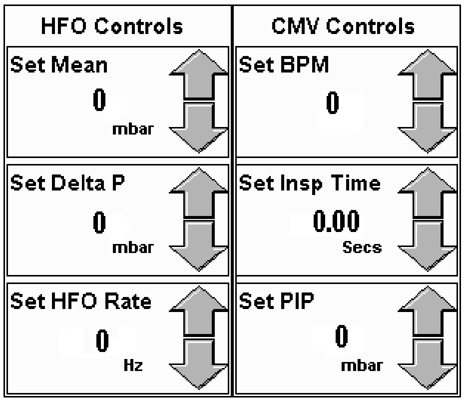


c) Return to the **Jet Calibration** screen.

d) Set up the ventilator to CMV mode 

.

Set all the controls to zero



e) Adjust the restrictor to set a pressure of **140 mbar** on the calibration analyser.

f) Adjust Block and Leak pressure sensor gain until the sensor reading and the calibration analyser agree.

Acceptable tolerance: ± 1 mbar

g) Remove the tube from the fresh gas port and adjust the Block and Leak pressure sensor offset until the sensor reading is zero.

Acceptable tolerance: ± 1 mbar

h) Repeat steps **f** and **g** until pressure sensor and calibration analyser agree

Acceptable tolerance: ± 1 mbar

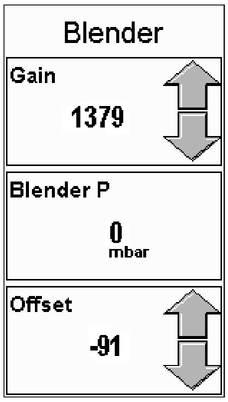
i) Re-connect the Y-piece with a variable restrictor to the fresh gas port and monitor generated pressure with the calibration analyser.

Verify the setting by setting the following pressures via the restrictor.

Set Pressure	Tolerance
0	± 2 mbar
30	± 2 mbar
60	± 2 mbar
90	± 2 mbar
120	± 2 mbar

14.5 Controller Blender Pressure Sensor zeroing and Input pressure regulator trim

a) Enter **Sensor Calibration** screen and set the blender pressure transducer gain to 1379 and the offset to –91.



b) Remove the gas supplies to the ventilator and ensure that the Blender pressure transducer reads 0 ± 2 mbar (allow the sensor reading time to settle). Fine tune with the offset control if necessary.

c) Reconnect the gas and after the pressure sensor has settled check the pressure sensor reads 0.

Acceptable tolerances: ± 7 mbar

d) Tighten the locking nut on the PR1 pressure regulator (Air). If the sensor reading is outside the tolerance 0 ± 7 mbar then adjust the PR1 pressure regulator and then tighten the locking nut.

☑ **Check list Item 11. Recording of pressure sensor calibration constants.**

14.6 Mean Jet Pressure Regulator Calibration

a) Enter the **Jet Calibration** screen.

b) Connect the ET manifold to the calibration analyser.

c) Set up the ventilator to CMV mode 

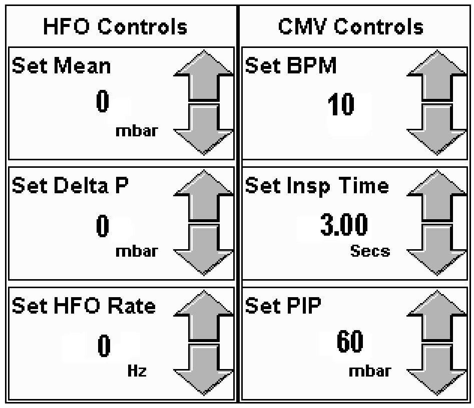
and set the following parameters:

BPM to 30

Insp. time to 0 sec

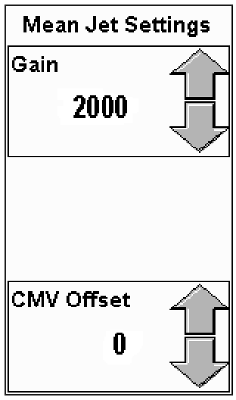
Set the PIP control to 0 mbar

Set all the controls in the HFO panel to Zero

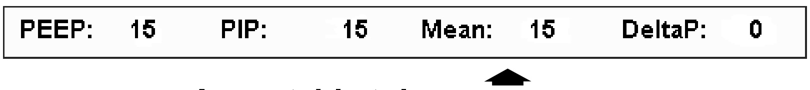


Set the Gain to 2000

Set the mean Jet CMV offset to 0



d) Set the mean control in the HFO panel to 15 mbar and adjust the mean jet gain control to achieve 15mbar, as shown in the pressure display bar below the waveform window.

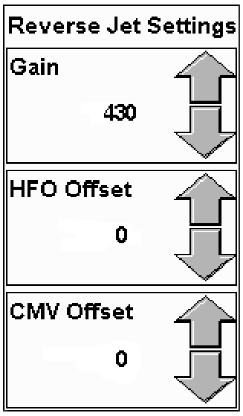


Acceptable tolerance: none.

e) Set the reverse jet gain to 430

f) Set the mean control to zero and increase the CMV offset on the reverse jet to achieve 0 mbar.

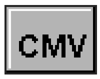
g) Repeat steps **c, d** and **e** until the set and measured agree.



h) Verify mean pressure setting by setting the following pressures on the HFO control panel and verifying the displayed pressure in the pressure display bar.

Set Mean Pressure	Acceptable tolerance:
0 mbar	+1 mbar
5 mbar	+1 mbar
10 mbar	+1 mbar
15 mbar	+1 mbar
max.	>18 mbar

14.7 Forward Jet Pressure Regulator Calibration

a) In Jet Calibration, set up the ventilator to CMV mode 

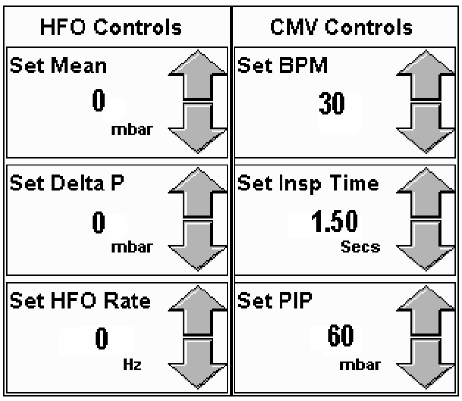
and set the following parameters:

BPM to 30

Insp. time to 1.5 sec

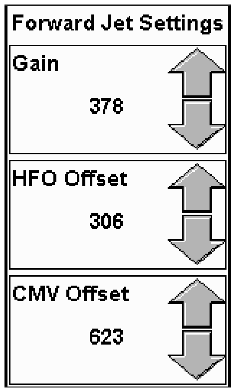
Set the PIP control to 60 mbar

Set all the controls in the HFO panel to Zero



b) Adjust the **Forward Jet Gain** to achieve 60 mbar ± 1 mbar on the plateau of the Inspiratory phase.

c) Set the PIP to 5 mbar and adjust the **Forward Jet CMV Offset** to achieve 5 mbar ± 1 mbar on the plateau. Repeat steps **b** to **c** until the set and measured agree within 1 mbar.



d) Verify mean pressure setting by setting the following PIP pressures and verifying the displayed pressure in the pressure display bar.

Set PIP Pressure	Acceptable tolerance:
0 mbar	+1 mbar
5 mbar	±1 mbar
10 mbar	±1 mbar
20 mbar	±1 mbar
30 mbar	±1 mbar
40 mbar	±1 mbar
50 mbar	±1 mbar
60 mbar	±1 mbar
max.	>63 mbar

14.8 Wave shaping for leading and trailing edge of insp. phase

a) Set up the ventilator to CMV mode 

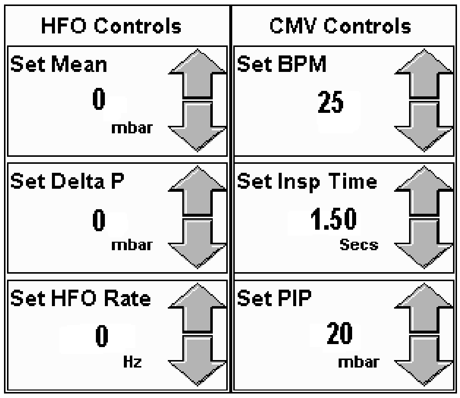
and set the following parameters:

BPM to 25

Insp. time to 1.5 sec

Set the PIP control to 30 mbar

Set all the controls in the HFO panel to Zero

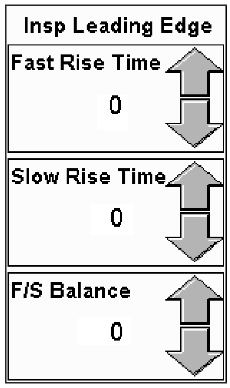


b) Using the insp leading edge adjustment controls, shape the leading edge to produce a square response.

Starting with all insp leading edge calibration values set to zero, increase the slow rise time until the pressure waveform does not rise above the plateau.

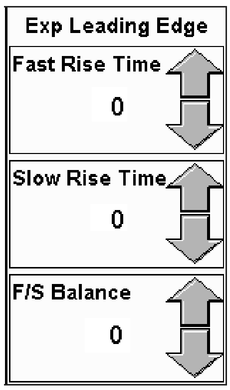
Set the fast rise time to the same value as the slow rise time.

Increase the F/S balance from 0 until the waveform is square.



c) Using the insp. trailing edge adjustment controls, shape the trailing edge to reduce overshoot.

d) Increase the exp leading edge, slow rise time control to minimize the overshoot on the fall waveshape.



14.9 Reverse Jet Pressure Regulator Calibration

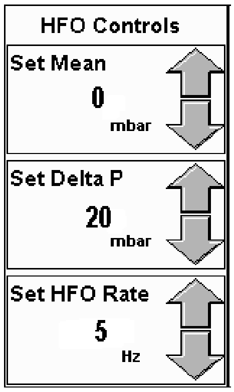
Note: The ventilator must be at working temperature with the metal electronic unit top cover on before calibrating the reverse jet pressure regulators, (machine must be on for at least half an hour).

a) Set up the ventilator to HFO mode HFO and set the following parameters:

Set the Mean to 0 mbar

Set the Delta P to 20 mbar

Set the HFO rate to 5Hz



b) Increase the **Forward and Reverse HFO Offsets** to achieve the set pressures (ignore transient overshoots).

c) Ensure the mean remains at zero.

Acceptable tolerance: + 1 mbar

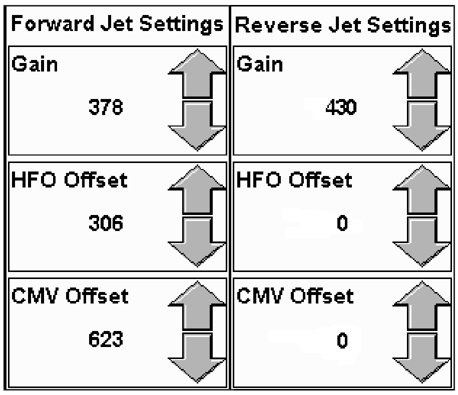
d) Set the delta p to 150 and adjust the reverse gain if necessary to achieve the set pressure.

e) Ensure that the mean remains at zero.

Acceptable tolerance: + 5 mbar

f) Ensure a minimum delta P of 165 mbar can be achieved

Acceptable tolerance: + 32 mbar



Check list Item 12. Record of Pressure Regulator Calibration Constants.

Check list Item 13. Wave shape calibration constants.

14.10 O_2 System Calibration

Ensure that the ventilator has been turned on and connected to air for **1 hour** prior to carrying out the O_2 system calibration. Connect the oxygen supply. **Press start the O_2 System Calibration button.** This takes about 5 mins – listen for the solenoid click to indicate the calibration is finished.

14.11 Flow System Calibration

The flow system is a factory set system and requires an ETU-2.

14.12 Pressure Triggering Verification

a) Ensure the ventilator is connected to air and oxygen. Turn on the ventilator and allow it to enter standby mode.

b) Fit a patient circuit with a test lung. Check that the pressure trigger operates in PTV mode with no flow sensor connected.

☑ **Check list Item 14.**

14.13 Gas Fail Detection Verification

a) With the air and oxygen hoses connected to separately controllable pressure sources

Set the ventilator to CMV

Gas inlet pressures to 4 Bar

BPM: 60

Insp Time: 0.5

PIP: 30 mbar

PEEP: 0 mbar

b) Ensure there are no current alarm conditions.

c) Disconnect the air supply and ensure that the “No Air Supply” alarm is activated.

d) Reconnect the air and ensure that the “No Air Supply” alarm clears.

e) Disconnect oxygen supply and ensure that the “No O_2 Supply” alarm is activated.

f) Reconnect the oxygen and ensure that the “No O_2 Supply” alarm clears.

☑ **Check list Item 15.**

14.14 Blender and Oxygen Monitoring Verification

Ensure that the ventilator has been turned on and connected to air for **1 hour** prior to carrying out the verification. Using a calibrated oxygen analyser, check the accuracy of the blender and the oxygen measurement throughout the range at the following ventilator mode settings.

a) Set the ventilator to CPAP mode,

CPAP set to 0

Set Oxygen concentration	Lower Limit	Upper limit
21%	20%	24%
30%	27%	33%
40%	37%	43%
50%	47%	53%
60%	57%	63%
70%	67%	73%
80%	77%	83%
90%	87%	93%
100%	97%	100%

☑ **Check list Item 16.**

14.15 Soak Test

After a complete calibration, the ventilator should be soaked tested for 50 hours to ensure normal operation. The soak test is divide into to halves, 25 hours in HFO mode and 25 hours in CMV.

Connect gas to the ventilator. The soak test can be carried out with air connected to the oxygen inlet but a dummy 100% O_2 cell will need to be fitted. (This device is available from SLE on request, part number: L0291).

Connect a full N5188 patient circuit with test lung.

Carry out a 100% oxygen calibration (One point) with the dummy 100% O_2 cell.

Set the ventilator up in HFO mode,
- **Set HFO rate to 5 Hz**
- **Mean to 10 mbar**
- **Delta p set to achieve 60 mbar**
- **FiO_2 set to 96%**

Run for a minimum of **25 hours.**

After 25 hours of HFO soak, check the delta p and the mean are within 10% of initial values.

Set the ventilator to CMV mode
- **Set BPM to 100**
- **PIP to 50**
- **PEEP to 10**
- **Insp Time to 0.35 sec.**
- **FiO_2 set to 96%**

Run for a minimum of **25 hours.**

After 25 hours of CMV soak,

Check the PIP pressure is unchanged.

Acceptable tolerance: ±1mbar.

Check the PEEP is unchanged

Acceptable tolerance: ±1mbar.

14.16 Battery Charge Verification

Check that the battery has fully charged by checking the battery connector voltage is at least 13.7V when the unit is powered from the mains.

Acceptable tolerance: >13.7 mbar.

☑ **Check list Item 17.**

14.17 Battery Life Verification

After the battery has been fully charged (from the soak test), leave the unit in pure HFO mode at 20Hz on the battery alone.
Ensure the ”Main Power Fail” alarm is active.
Ensure that the ventilator runs for a minimum of 30 minutes before the “Battery low alarm” is activated.
Ensure that the ventilator continues operation on battery for a further 15 minutes (minimum) after the battery low alarm first occurred.

☑ **Check list Item 18.**

14.18 Total Power Fail Alarm Test

Check the operation of the total power fail alarm by switching the mains switch off and, with the unit powered by the battery alone, half press the power off button (on the back panel). A continuous loud alarm should sound. Press the power off button in fully and the sound should cancel.

☑ **Check list Item 19.**

14.19 Pressure Calibration Verification

Check the pressure settings and wave shapes in CMV mode at the following settings:

BPM 25

Insp time 1.5 seconds,

PEEP 0

PIP Setting	Acceptable tolerance
10 mbar	±1mbar
20 mbar	±1mbar
30 mbar	±1mbar
40 mbar	±1mbar
50 mbar	±1mbar
60 mbar	±1mbar

☑ **Check list Item 20.**

Check the mean pressure reading and wave shapes in HFO mode at the following settings:

Rate set to 5Hz

Mean set to zero.

Delta P setting	Acceptable tolerance
min	+1 mbar
40 mbar	+2 mbar
80 mbar	+2 mbar
120 mbar	+4 mbar
160 mbar	+5 mbar
max	+12 mbar

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Calibration Procedure V3.3

15. Calibration Procedure for V3.3 software

The calibration procedure is to be used in-conjunction with a checklist. The checklist is used to record the calibration values set during the procedure. This checklist will be become part of the service record of the ventilator. A template checklist (which should be copied) is to be found in **Appendix 1** of this manual on page 401.

Where information needs to be recorded the user will see symbol next to the section.

Note:Prior to calibration enter ENGMODE and record the following Gain / Offset values. This will allow you to revert the ventilator back to it pre-calibrated state if required.

Gain and Offset for the 1 PSI and 2.5 PSI pressure transducers.
Gain, HFO Offset and CMV Offset for the Forward jet.
Gain and CMV Offset for the Mean jet.
Gain, HFO Offset and CMV Offset for the Reverse jet.
Insp leading Edge Fast / Slow rise time and F/S Balance.
Exp leading Edge Fast / Slow rise time and F/S Balance.

☑ **Use the table at the back of Appendix 1.**

15.1 Preliminary Inspection before calibration

a) Check all tubing connections are fully home in their fittings.

b) Check that the oxygen fuel cell is properly located (finger tight) and that its electrical connector is mounted on an adhesive clip.

c) Check that the electrical connections to the high speed valves are screwed on tightly (finger tight).

d) Check the pneumatic harness with particular attention to the connections to the 25 way ‘D’ type connectors, the pressure transducer and the oxygen cell.

e) Ensure that the exhalation block can be removed and relocated easily and that the nozzle assemblies (jet blocks) and ‘O’ rings correctly fitted – orange coloured.

f) Ensure “duckbill” non-return valves are fitted to the 0_2 and air intakes by directly connecting a hose between the air and oxygen regulator outputs. Apply air and disconnect the air supply hose to prove there is no leak and then reconnect and check the oxygen supply hose for no leak.

g) Check for leaks in the pneumatic system.

15.2 Pneumatic set up

a) Connect the ventilator to gas supplies at 4 bar.

a) Set the air and oxygen input pressure regulators PR1 & PR2 to 40 psi ± 0.1 psi.

b) Set the oxygen regulator to 40 psi ± 0.1 psi. Tighten the tension nut to lock the spindle in position ensure that the pressure is still within 0.1 psi of 40. (The oxygen regulator will not be adjusted again). Set the other regulator to match the firstsetting within 0.1 psi.

c) Tee into the output of PR5 with (SV7) de-energised and monitor the fresh gas pressure output and adjust output of regulator (PR5) to 30psi ± 1psi. These are non-relieving regulators so it may be necessary to disconnect the output to allow the pressure to drop and then reconnect. These regulators do drift a little after setting so need to be rechecked several times.

☑ **d)** Connect a 24V PSU to SV7 to energise. With the fresh gas valve SV7 energised, monitor the flow from the fresh gas outlet port on the front panel, and adjust the needle valve FR1 to give a flow at this port of 8LPM ± 0.25LPM.
Check list Item 5.

☑ **e)** With the fresh gas valve SV7 de-energised, ensure the flow at the fresh gas port is at least 1.2LPM (typ. 1.8LPM).
Check list Item 6.

☑ **f)** Occlude the fresh gas supply with SV7 de-energised and ensure that the pressure developed in the fresh gas limb is between 10 and 20 mbar.
Check list Item 7.

☑ **g)** Monitor the flow from the proximal airway pressure port using a precision flow meter and adjust regulator PR7 (approx. 12PSI) to achieve a flow at this port of 0.2LPM ± 0.05LPM.
Check list Item 8.

☑ **h)** Ensure that the fresh gas pressure relief valve is activated at greater than 140 mbar and no more than 170 mbar.
Check list Item 9.

☑ **i)** Verify the flow past the oxygen cell is at least 3 lpm and not greater than 5 lpm.
Check list Item 10.

j) Check that the exhuast oxygen from the relief port on the oxygen Watson Smith regulator (N6615/02) is not greater than 1.5 lpm.

15.3 Calibration of Controller and Monitor subsystems

a) Before the controller can be calibrated it is necessary to calibrate the pressure sensors of the Monitor Subsystem.

b) Enter the Calibration program. See “Accessing the Calibration Programs” on page 24.

15.3.1 Monitor Pressure sensor calibration

Note: The ventilator must be at working temperature with the metal electronic unit top cover on before calibrating the pressure transducers, (machine must be on for at least half an hour).

c) Enter the **Jet Calibration** option panel.

d) Set: Forward jet settings gain to **400** and remaining calibration values to zero.

e) Enter **Sensor Calibration** screen and disconnect all gas from the ventilator.

f) Press the “zero offsets” button and ensure that the two proximal pressure transducers read zero.

Acceptable tolerance: ± 1 mbar

g) Reconnect the gas and enter the **Jet Calibration** screen.

h) Set up the ventilator to CMV mode 

and set the following parameters:

Set the controls in the CMV Panel as follows

BPM to 10

Insp. time to 3 sec

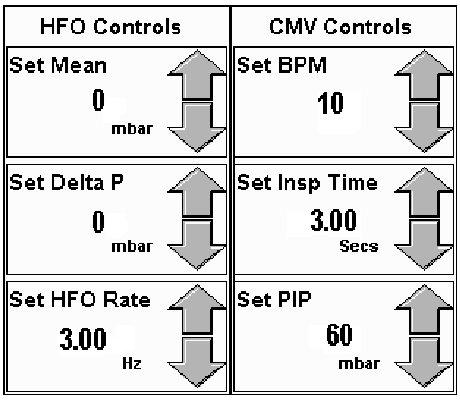
Set the PIP control to 60mbar

Set the controls in the HFO panel as follows

Set Mean to 0

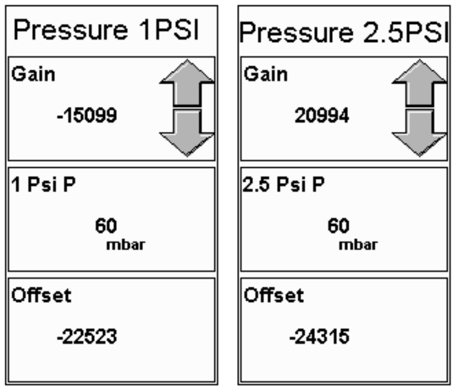
Set Delta P to 0

Set HFO Rate to 3



i) Enter **Sensor Calibration** screen and adjust the gain of both the pressure sensors so that the 1psi and the 2.5psi pressure transducers agree with each other and with the Calibration Analyser.

Acceptable tolerance: ±1mbar.



j) Go to **Jet Calibration** screen and set the PIP as specified in **PIP Pressure Setting** column of the table below.

k) Re-enter sensor calibration screen and check that the sensor readings (at 1 and 2.5 psi) agree with **Calibration Analyser** within the set tolerance.

PIP Pressure Setting (1 PSI sensor)	Tolerance
60	± 1 mbar
30	± 1 mbar
10	± 1 mbar

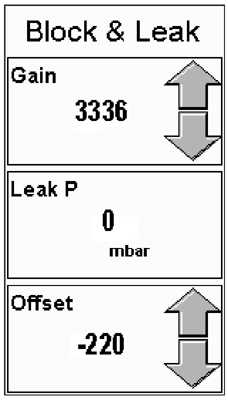
PIP Pressure Setting (2.5 PSI sensor)	Tolerance
60	± 1 mbar
30	± 1 mbar
10	± 1 mbar

Note: The set values may not correspond with the Calibration Analyser Reading

15.4 Controller "Block and Leak" pressure sensor calibration

a) Connect a Y-piece with a variable restrictor to the fresh gas port and monitor generated pressure with the calibration analyser

b) Enter **Sensor Calibration** screen and set the Block and Leak Gain to **3336** and Offset to **-220.**

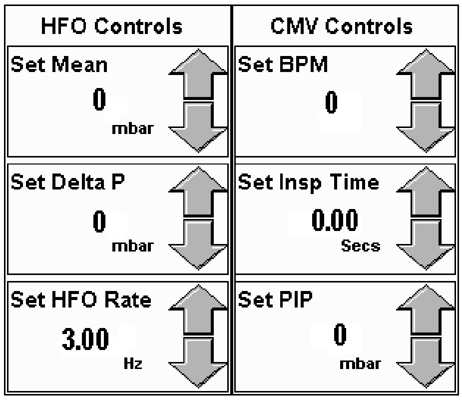


c) Return to the **Jet Calibration** screen.

d) Set up the ventilator to CMV mode 

.

Set HFO Rate 3
Set all other controls to zero



e) Adjust the restrictor to set a pressure of **140 mbar** on the calibration analyser.

f) Adjust Block and Leak pressure sensor gain until the sensor reading and the calibration analyser agree.

Acceptable tolerance: ± 1 mbar

g) Remove the tube from the fresh gas port and adjust the Block and Leak pressure sensor offset until the sensor reading is zero.

Acceptable tolerance: ± 1 mbar

h) Repeat steps **f** and **g** until pressure sensor and calibration analyser agree

Acceptable tolerance: ± 1 mbar

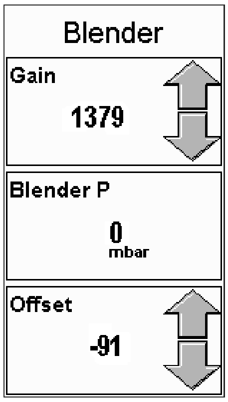
i) Re-connect the Y-piece with a variable restrictor to the fresh gas port and monitor generated pressure with the calibration analyser.

Verify the setting by setting the following pressures via the restrictor.

Set Pressure	Tolerance
0	± 2 mbar
30	± 2 mbar
60	± 2 mbar
90	± 2 mbar
120	± 2 mbar

15.5 Controller Blender Pressure Sensor zeroing and Input pressure regulator trim

a) Enter **Sensor Calibration** screen and set the blender pressure transducer gain to 1379 and the offset to –91.



b) Remove the gas supplies to the ventilator and ensure that the Blender pressure transducer reads 0 ± 2 mbar (allow the sensor reading time to settle). Fine tune with the offset control if necessary.

c) Reconnect the gas and after the pressure sensor has settled check the pressure sensor reads 0.

Acceptable tolerances: ± 7 mbar

d) Tighten the locking nut on the PR1 pressure regulator (AIR). If the sensor reading is outside the tolerance 0 ± 7 mbar then adjust the PR1 pressure regulator and then tighten the locking nut.

☑ **Check list Item 11. Recording of pressure sensor calibration constants.**

15.6 Mean Jet Pressure Regulator Calibration

a) Enter the **Jet Calibration** screen.

b) Connect the ET manifold to the calibration analyser.

c) Set up the ventilator to CMV mode CMV and set the following parameters:

BPM to 30

Insp. time to 0 sec

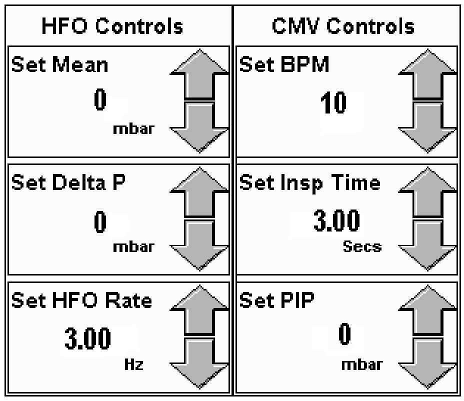
Set the PIP control to 0 mbar

Set the controls in the HFO panel as follows

Set Mean 0

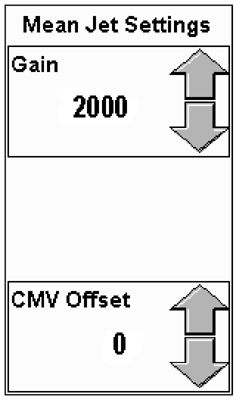
Set Delta P 0

Set HFO Rate 3



Set the Gain to 2000 &

the mean Jet CMV offset to 0



d) Set the mean control in the HFO panel to 15 mbar and adjust the mean jet gain control to achieve 15mbar, as shown in the pressure display bar below the waveform window.

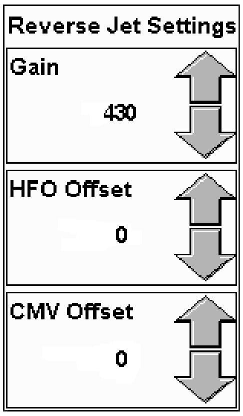
PEEP:	15	PIP:	15	Mean:	15	DeltaP:	0

Acceptable tolerance: none.

e) Set the reverse jet gain to 430

f) Set the mean control to zero and increase the CMV offset on the reverse jet to achieve 0 mbar.

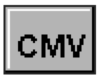
g) Repeat steps **c, d** and **e** until the set and measured agree.



h) Verify mean pressure setting by setting the following pressures on the HFO control panel and verifying the displayed pressure in the pressure display bar.

Set Mean Pressure	Acceptable tolerance:
0 mbar	+1 mbar
5 mbar	+1 mbar
10 mbar	+1 mbar
15 mbar	+1 mbar
max.	>18 mbar

15.7 Forward Jet Pressure Regulator Calibration

a) In Jet Calibration, set up the ventilator to CMV mode 

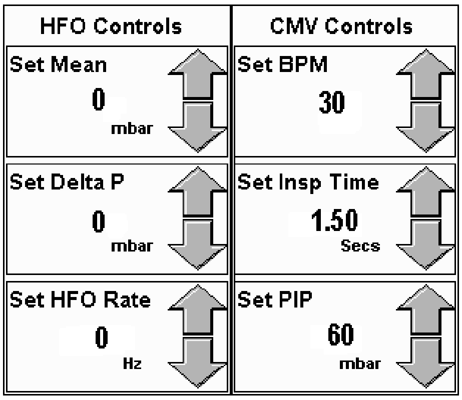
and set the following parameters:

BPM to 30

Insp. time to 1.5 sec

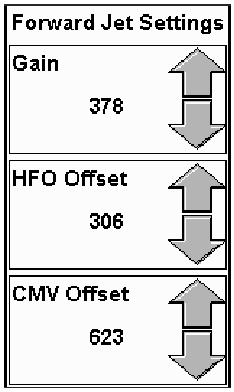
Set the PIP control to 60 mbar

Set all the controls in the HFO panel to Zero



b) Adjust the **Forward Jet Gain** to achieve 60 mbar ± 1 mbar on the plateau of the Inspiratory phase.

c) Set the PIP to 5 mbar and adjust the **Forward Jet CMV Offset** to achieve 5 mbar ± 1 mbar on the plateau. Repeat steps **b** to **c** until the set and measured agree within 1 mbar.



d) Verify mean pressure setting by setting the following PIP pressures and verifying the displayed pressure in the pressure display bar.

Set PIP Pressure	Acceptable tolerance:
0 mbar	+1 mbar
5 mbar	±1 mbar
10 mbar	±1 mbar
20 mbar	±1 mbar
30 mbar	±1 mbar
40 mbar	±1 mbar
50 mbar	±1 mbar
60 mbar	±1 mbar
max.	>63 mbar

15.8 Reverse Jet Pressure Regulator Calibration

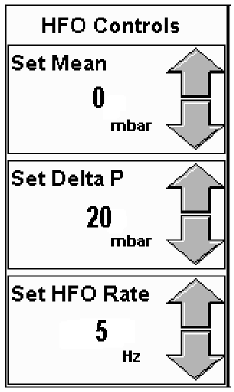
Note: The ventilator must be at working temperature with the metal electronic unit top cover on before calibrating the reverse jet pressure regulators, (machine must be on for at least half an hour).

a) Set up the ventilator to HFO mode HFO and set the following parameters:

Set the Mean to 0 mbar

Set the Delta P to 20 mbar

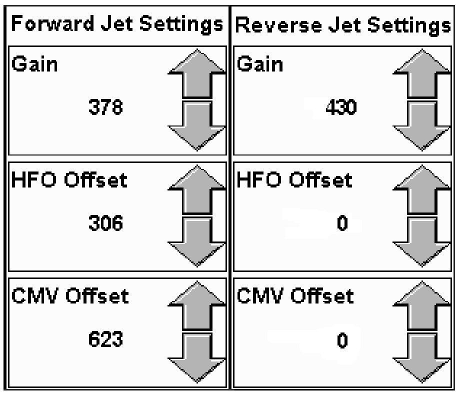
HFO rate to 5Hz



b) Increase the **Forward and Reverse HFO Offsets** to achieve the set pressures (ignore transient overshoots).

c) Ensure the mean remains at zero.

Acceptable tolerance: + 1 mbar



d) Set the delta p to 150 and adjust the reverse gain if necessary to achieve the set pressure.

e) Ensure that the mean remains at zero.

Acceptable tolerance: + 5 mbar

f) Ensure a minimum delta P of 168 mbar can be achieved

Acceptable tolerance: + 32 mbar

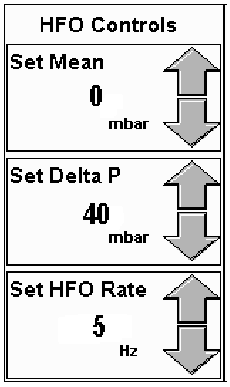
☑ **Check list Item 12. Record of Pressure Regulator Calibration Constants.**

15.9 Time Constant for pressure measurement waveform

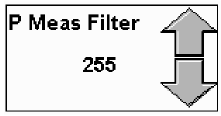
Set the Mean to 0 mbar

Set the Delta P to 40 mbar

HFO rate to 5Hz



Starting with the P Meas Filter set at 255, reduce it until the transient overshoot on the positive cycle is in range of 25 mbar ± 1 mbar.



☑ **Check list Item 12A. Recording of P Meas Filter Value.**

15.10 Wave shaping for leading and trailing edge of insp. phase

a) Set up the ventilator to CMV mode  and set the following parameters:

BPM to 25

Insp. time to 1.5 sec

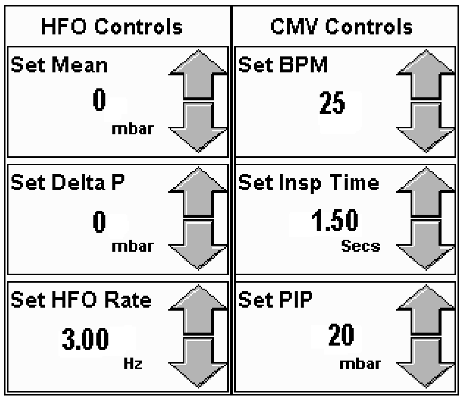
Set the PIP control to 20 mbar

Set the controls in the HFO panel as follows

Set Mean 0

Set Delta P 0

Set HFO Rate 3



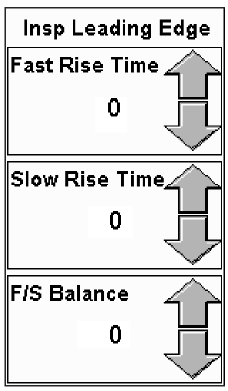
b) Using the insp leading edge adjustment controls, shape the leading edge to produce a square response.

Starting with the insp leading edge calibration values for the fast and slow rise times set to zero, and the F/S balance set to 255.

Increase the fast rise time until the pressure waveform does not dip below the plateau.

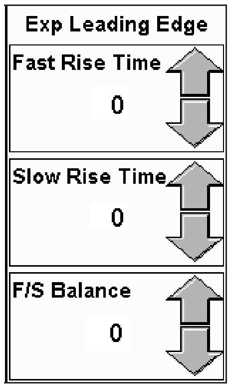
Increase the slow rise time to minimise the initial spike (probably somewhere between 10 and 20)

Decrease the F/S balance until the waveform is square.



c) Using the insp. trailing edge adjustment controls, shape the trailing edge to reduce overshoot.

d) Increase the exp leading edge, slow rise time control to minimize the overshoot on the fall waveshape.



☑ **Check list Item 13. Wave Shape calibration.**

15.11 O_2 System Calibration

Ensure that the ventilator has been turned on and connected to air for **1 hour** prior to carrying out the O_2 system calibration. Connect the oxygen supply. **Press start the O_2 System Calibration button.** This takes about 6 minutes, the system will indicate when calibration is finished.

15.12 Flow System Calibration

The flow system is a factory set system and requires an ETU-2.

15.13 Pressure Triggering Verification

Fit a patient circuit with a test lung. Check that the pressure trigger operates in PTV mode with no flow sensor connected.

☑ **Check list Item 14.**

15.14 Gas Fail Detection Verification

a) With the air and oxygen hoses connected to separately controllable pressure sources

Set the ventilator to CMV

Gas inlet pressures to 4 Bar

BPM: 60

Insp Time: 0.5

PIP: 30 mbar

PEEP: 0 mbar

b) Ensure there are no current alarm conditions.

c) Disconnect the air supply and ensure that the “No Air Supply” alarm is activated.

d) Reconnect the air and ensure that the “No Air Supply” alarm clears.

e) Disconnect oxygen supply and ensure that the “No O_2 Supply” alarm is activated.

f) Reconnect the oxygen and ensure that the “No O_2 Supply” alarm clears.

☑ **Check list Item 15.**

15.15 Blender and Oxygen Monitoring Verification

Ensure that the ventilator has been turned on and connected to air for **1 hour** prior to carrying out the verification. Using a calibrated oxygen analyser, check the accuracy of the blender and the oxygen measurement throughout the range at the following ventilator mode settings.

a) Set the ventilator to CPAP mode,

CPAP set to 0

Set Oxygen concentration	Lower Limit	Upper limit
21%	20%	24%
30%	27%	33%
40%	37%	43%
50%	47%	53%
60%	57%	63%
70%	67%	73%
80%	77%	83%
90%	87%	93%
100%	97%	100%

☑ **Check list Item 16.**

15.16 Soak Test

After a complete calibration, the ventilator should be soaked tested for 50 hours to ensure normal operation. The soak test is divide into to halves, 25 hours in HFO mode and 25 hours in CMV.

Connect gas to the ventilator. The soak test can be carried out with air connected to the oxygen inlet but a dummy 100% O_2 cell will need to be fitted. (This device is available from SLE on request, part number: L0291).

Connect a full N5188 patient circuit with test lung.

Carry out a 100% oxygen calibration (One point) with the dummy 100% O_2 cell.

Set the ventilator up in HFO mode,
Set HFO rate to 5 Hz
Mean to 10 mbar
Delta p set to achieve 60 mbar
FiO_2 set to 96%

Run for a minimum of **25 hours.**

After 25 hours of HFO soak, check the delta p and the mean are within 10% of initial values.

Set the ventilator to CMV mode
Set BPM to 100
PIP to 50
PEEP to 10
Insp Time to 0.35 sec.
FiO_2 set to 96%

Run for a minimum of **25 hours.**

After 25 hours of CMV soak,

Check the PIP pressure is unchanged.
Acceptable tolerance: ±1mbar.

Check the PEEP is unchanged
Acceptable tolerance: ±1mbar.

15.17 Battery Charge Verification

Check that the battery has fully charged by checking the battery connector voltage is at least 13.7V when the unit is powered from the mains.

Acceptable tolerance: >13.7 mbar.

☑ **Check list Item 17.**

15.18 Battery Life Verification

After the battery has been fully charged (from the soak test), leave the unit in pure HFO mode at 20Hz on the battery alone.
Ensure the ”Main Power Fail” alarm is active.
Ensure that the ventilator runs for a minimum of 30 minutes before the “Battery low alarm” is activated.
Ensure that the ventilator continues operation on battery for a further 15 minutes (minimum) after the battery low alarm first occurred.

☑ **Check list Item 18.**

15.19 Total Power Fail Alarm Test

Check the operation of the total power fail alarm by switching the mains switch off and, with the unit powered by the battery alone, half press the power off button (on the back panel). A continuous loud alarm should sound. Press the power off button in fully and the sound should cancel.

☑ **Check list Item 19.**

15.20 Pressure Calibration Verification

Check the pressure settings and wave shapes in CMV mode at the following settings:

BPM 25

Insp time 1.5 seconds,

PEEP 0

PIP Setting	Acceptable tolerance
10 mbar	±1mbar
20 mbar	±1mbar
30 mbar	±1mbar
40 mbar	±1mbar
50 mbar	±1mbar
60 mbar	±1mbar

☑ **Check list Item 20.**

Check the mean pressure reading and wave shapes in HFO mode at the following settings:

Rate set to 5Hz

Mean set to zero.

Delta P setting	Acceptable tolerance
min	+1 mbar
40 mbar	+2 mbar
80 mbar	+2 mbar
120 mbar	+4 mbar
160 mbar	+5 mbar
max	+12 mbar

Calibration Procedure V4 & 4.1

16. Calibration Procedure for V4 & 4.1 software

The calibration procedure is to be used in-conjunction with a checklist. The checklist is used to record the calibration values set during the procedure. This checklist will be become part of the service record of the ventilator. A template checklist (which should be copied) is to be found in **Appendix 1** of this manual on page 401.

Where information needs to be recorded the user will see ☑ symbol next to the section.

Note:Prior to calibration enter ENGMODE and record the following Gain / Offset values. This will allow you to revert the ventilator back to it pre-calibrated state if required.

Gain and Offset for the 1 PSI and 2.5 PSI pressure transducers.
Gain, HFO Offset and CMV Offset for the Forward jet.
Gain and CMV Offset for the Mean jet.
Gain, HFO Offset and CMV Offset for the Reverse jet.
Insp leading Edge Fast / Slow rise time and F/S Balance.
Exp leading Edge Fast / Slow rise time and F/S Balance.

☑ **Use the table at the back of Appendix 1.**

16.1 Preliminary Inspection before calibration

a) Check all tubing connections are fully home in their fittings.

b) Check that the oxygen fuel cell is properly located (finger tight) and that its electrical connector is mounted on an adhesive clip.

c) Check that the electrical connections to the high speed valves are screwed on tightly (finger tight).

d) Check the pneumatic harness with particular attention to the connections to the 25 way ‘D’ type connectors, the pressure transducer and the oxygen cell.

e) Ensure that the exhalation block can be removed and relocated easily and that the nozzle assemblies (jet blocks) and ‘O’ rings correctly fitted – orange coloured.

f) Ensure “duckbill” non-return valves are fitted to the 0_2 and air intakes by directly connecting a hose between the air and oxygen regulator outputs. Apply air and disconnect the air supply hose to prove there is no leak and then reconnect and check the oxygen supply hose for no leak.

g) Check for leaks in the pneumatic system.

16.2 Pneumatic set up

a) Connect the ventilator to gas supplies at 4 bar.

b) Set the air and oxygen input pressure regulators PR1 & PR2 to 40 psi ± 0.1 psi.

c) Set the oxygen regulator to 40 psi ± 0.1 psi. Tighten the tension nut to lock the spindle in position ensure that the pressure is still within 0.1 psi of 40. (The oxygen regulator will not be adjusted again). Set the other regulator to match the firstsetting within 0.1 psi.

d) Tee into the output of PR5 with (SV7) de-energised and monitor the fresh gas pressure output and adjust output of regulator (PR5) to 30psi ± 1psi. These are non-relieving regulators so it may be necessary to disconnect the output to allow the pressure to drop and then reconnect. These regulators do drift a little after setting so need to be rechecked several times.

☑ **e)** Connect a 24V PSU to SV7 to energise. With the fresh gas valve SV7 energised, monitor the flow from the fresh gas outlet port on the front panel, and adjust the needle valve FR1 to give a flow at this port of 8LPM ± 0.25LPM.
Check list Item 5.

☑ **f)** With the fresh gas valve SV7 de-energised, ensure the flow at the fresh gas port is at least 1.2LPM (typ. 1.8LPM).
Check list Item 6.

☑ **g)** Occlude the fresh gas supply with SV7 de-energised and ensure that the pressure developed in the fresh gas limb is between 10 and 20 mbar.
Check list Item 7.

☑ **h)** Monitor the flow from the proximal airway pressure port using a precision flow meter and adjust regulator PR7 (approx. 12PSI) to achieve a flow at this port of 0.2LPM ± 0.05LPM.
Check list Item 8.

☑ **i)** Ensure that the fresh gas pressure relief valve is activated at greater than 140 mbar and no more than 170 mbar.
Check list Item 9.

☑ **j)** Verify the flow past the oxygen cell is at least 3 lpm and not greater than 5 lpm.
Check list Item 10.

k) Check that the exhuast oxygen from the relief port on the oxygen Watson Smith regulator (N6615/02) is not greater than 1.5 lpm.

16.3 Calibration of Controller and Monitor subsystems

a) Before the controller can be calibrated it is necessary to calibrate the pressure sensors of the Monitor Subsystem.

b) Enter the Calibration program. See “Accessing the Calibration Programs” on page 24.

16.3.1 Monitor Pressure sensor calibration

Note: The ventilator must be at working temperature with the metal electronic unit top cover on before calibrating the pressure transducers, (machine must be on for at least half an hour).

c) Enter the **Jet Calibration** option panel.

d) Set: Forward jet settings gain to **400** and remaining calibration values to zero.

e) Enter **Sensor Calibration** screen and disconnect all gas from the ventilator.

f) Press the “zero offsets” button and ensure that the two proximal pressure transducers read zero.

Acceptable tolerance: ± 1 mbar

g) Reconnect the gas and enter the **Jet Calibration** screen.

h) Set up the ventilator to CMV mode 

and set the following parameters:

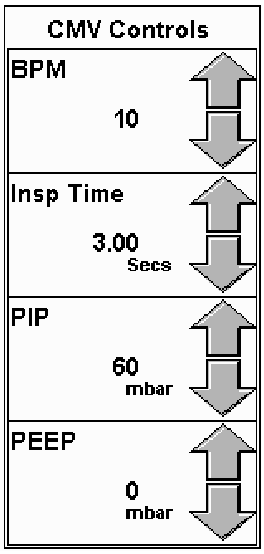
Set the controls in the CMV Panel as follows

BPM to 10

Insp. time to 3 sec

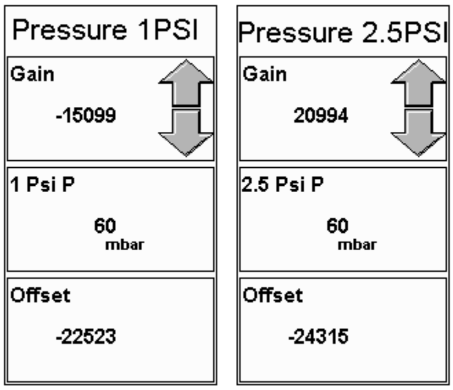
Set the PIP control to 60mbar

PEEP to 0



i) Enter **Sensor Calibration** screen and adjust the gain of both the pressure sensors so that the 1psi and the 2.5psi pressure transducers agree with each other and with the Calibration Analyser.

Acceptable tolerance: ±1mbar.



j) Go to **Jet Calibration** screen and set the PIP as specified in **PIP Pressure Setting** column of the table below.

k) Re-enter sensor calibration screen and check that the sensor readings (at 1 and 2.5 psi) agree with **Calibration Analyser** within the set tolerance.

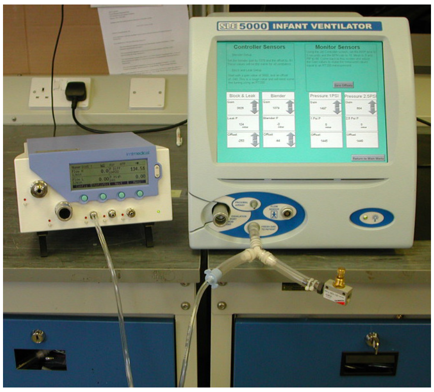
PIP Pressure Setting (1 PSI sensor)	Tolerance
60	± 1 mbar
30	± 1 mbar
10	± 1 mbar

PIP Pressure Setting (2.5 PSI sensor)	Tolerance
60	± 1 mbar
30	± 1 mbar
10	± 1 mbar

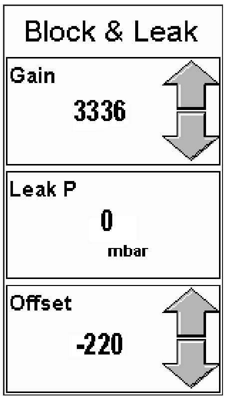
Note: The set values may not correspond with the Calibration Analyser Reading

16.4 Controller “Block and Leak” pressure sensor calibration

a) Connect a Y-piece with a variable restrictor to the fresh gas port and monitor generated pressure with the calibration analyser.



b) Enter **Sensor Calibration** screen and set the Block and Leak Gain to **3336** and Offset to **-220.**



c) Return to the **Jet Calibration** screen.

d) Set up the ventilator to HFO pure mode HFO. Check that Mean and Delta P are set to zero and HFO rate is 3.00 Hz.

e) Adjust the restrictor to set a pressure of **140 mbar** on the calibration analyser.

f) Adjust Block and Leak pressure sensor gain until the sensor reading and the calibration analyser agree.

Acceptable tolerance: ± 1 mbar

g) Remove the tube from the fresh gas port and adjust the Block and Leak pressure sensor offset until the sensor reading is zero.

Acceptable tolerance: ± 1 mbar

h) Repeat steps **f** and **g** until pressure sensor and calibration analyser agree

Acceptable tolerance: ± 1 mbar

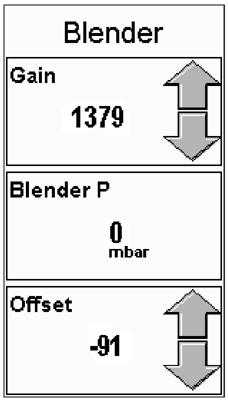
i) Re-connect the Y-piece with a variable restrictor to the fresh gas port and monitor generated pressure with the calibration analyser.

Verify the setting by setting the following pressures via the restrictor.

Set Pressure	Tolerance
0	± 2 mbar
30	± 2 mbar
140	± 2 mbar

Note: If using the N9053 fresh gas restrictor a tolerance of ± 5 mbar can be used.

16.5 Controller Blender Pressure Sensor zeroing and Input pressure regulator trim



a) Enter **Sensor Calibration** screen and set the blender pressure transducer gain to 1379 and the offset to –91.

b) Remove the gas supplies to the ventilator and ensure that the Blender pressure transducer reads 0 ± 2 mbar (allow the sensor reading time to settle). Fine tune with the offset control if necessary.

c) Reconnect the gas and after the pressure sensor has settled check the pressure sensor reads 0.

Acceptable tolerances: ± 7 mbar

d) Tighten the locking nut on the PR1 pressure regulator (AIR). If the sensor reading is outside the tolerance 0 ± 7 mbar then adjust the PR1 pressure regulator and then tighten the locking nut.

☑ **Check list Item 11. Recording of pressure sensor calibration constants.**

16.6 Mean Jet Pressure Regulator Calibration

a) Enter the **Jet Calibration** screen.

b) Connect the ET manifold to the calibration analyser.

c) Set up the ventilator to CMV mode 

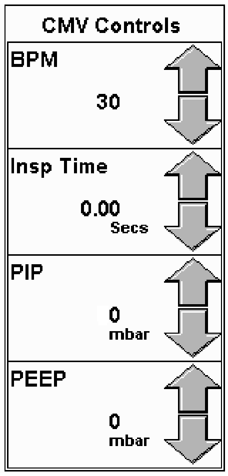
and set the following parameters:

BPM to 30

Insp. time to 0 sec

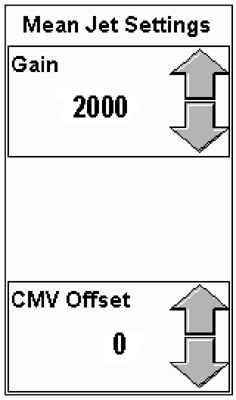
Set the PIP control to 0 mbar

PEEP to 0

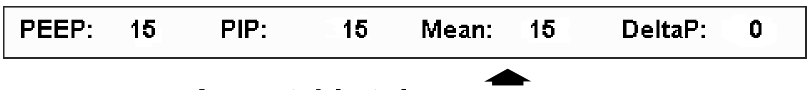


Set the Gain to 2000 &

the mean Jet CMV offset to 0



d) Set the PEEP to 15 mbar and adjust the mean jet gain control to achieve 15mbar, as shown in the pressure display bar below the waveform window.

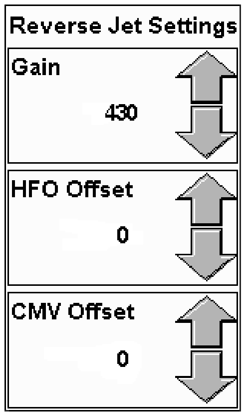


Acceptable tolerance: none.

e) Set the reverse jet gain to 430

f) Set the PEEP control to zero and increase the CMV offset on the reverse jet to achieve 0 mbar.

g) Repeat steps **c, d** and **e** until the set and measured agree.



h) Verify PEEP pressure setting by setting the following pressures on the CMV control panel and verifying the displayed pressure in the pressure display bar.

Set PEEP Pressure	Acceptable tolerance:
0 mbar	+1 mbar
5 mbar	+1 mbar
10 mbar	+1 mbar
15 mbar	+1 mbar
max.	>18 mbar

16.7 Forward Jet Pressure Regulator Calibration

a) Set up the ventilator to CMV mode 

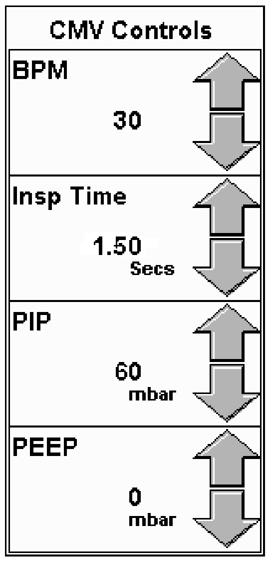
and set the following parameters:

BPM to 30

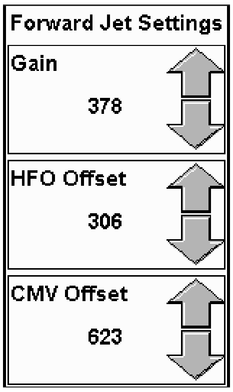
Insp. time to 1.5 sec

Set the PIP control to 60 mbar

PEEP to 0



b) Adjust the **Forward Jet Gain** to achieve 60 mbar ± 1 mbar on the plateau of the Inspiratory phase.



c) Set the PIP to 5 mbar and adjust the **Forward Jet CMV Offset** to achieve 5 mbar ± 1 mbar on the plateau. Repeat steps **b** to **c** until the set and measured agree within 1 mbar.

d) Verify mean pressure setting by setting the following PIP pressures and verifying the displayed pressure in the pressure display bar.

Set PIP Pressure	Acceptable tolerance:
0 mbar	+1 mbar
5 mbar	±1 mbar
10 mbar	±1 mbar
20 mbar	±1 mbar
30 mbar	±1 mbar
40 mbar	±1 mbar
50 mbar	±1 mbar
60 mbar	±1 mbar
max.	>63 mbar

16.8 Reverse Jet Pressure Regulator Calibration

Note: The ventilator must be at working temperature with the metal electronic unit top cover on before calibrating the reverse jet pressure regulators, (machine must be on for at least half an hour).

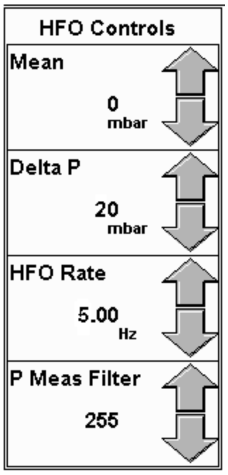
a) Set up the ventilator to HFO Pure mode 

and set the following parameters:

Set the Mean to 0 mbar

Set the Delta P to 20 mbar

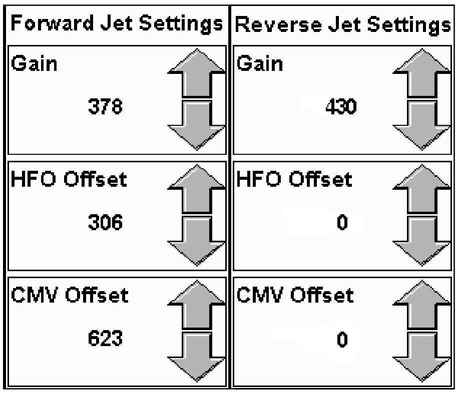
HFO rate to 5Hz



b) Increase the **Forward and Reverse HFO Offsets** to achieve the set pressures (ignore transient overshoots).

c) Ensure the mean remains at zero.

Acceptable tolerance: + 1 mbar



d) Set the delta p to 150 and adjust the reverse gain if necessary to achieve the set pressure.

e) Ensure that the mean remains at zero.

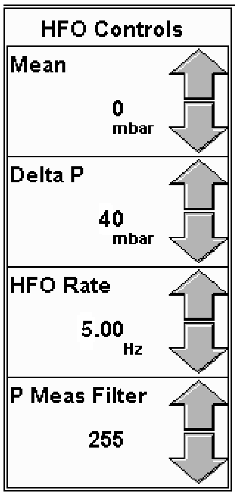
Acceptable tolerance: + 5 mbar

f) Ensure a minimum delta P of 168 mbar can be achieved

Acceptable tolerance: + 32 mbar

☑ **Check list Item 12. Record of Pressure Regulator Calibration Constants.**

16.9 Time Constant for pressure measurement waveform



Set the Mean to 0 mbar

Set the Delta P to 40 mbar

HFO rate to 5Hz

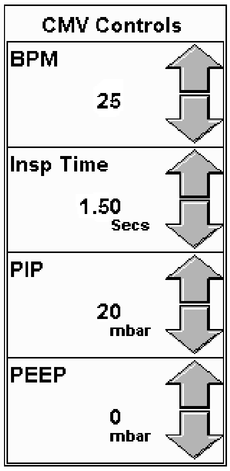
Starting with the P Meas Filter set at 255, reduce it until the transient overshoot on the positive cycle is in range of 25 mbar ± 1 mbar.

☑ **Check list Item 12A. Recording of P Meas Filter Value.**

16.10 Wave shaping for leading and trailing edge of insp. phase

a) Set up the ventilator to CMV mode 

and set the following parameters:



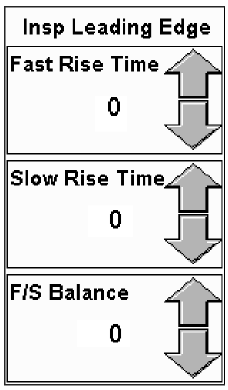
BPM to 25

Insp. time to 1.5 sec

Set the PIP control to 20 mbar

Set the PEEP to 0

b) Using the insp leading edge adjustment controls, shape the leading edge to produce a square response.



Starting with the insp leading edge calibration values for the fast and slow rise times set to zero, and the F/S balance set to 255.

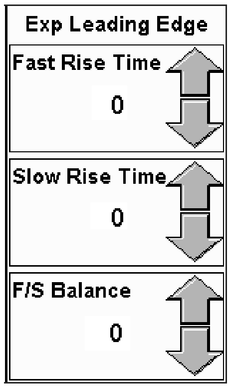
Increase the fast rise time until the pressure waveform does not dip below the plateau.

Increase the slow rise time to minimise the initial spike (probably somewhere between 10 and 20)

Decrease the F/S balance until the waveform is square.

c) Using the insp. trailing edge adjustment controls, shape the trailing edge to reduce overshoot.

d) Increase the exp leading edge, slow rise time control to minimize the overshoot on the fall waveshape.



☑ **Check list Item 13. Wave Shape calibration.**

16.11 O_2 System Calibration

Ensure that the ventilator has been turned on and connected to air for **1 hour** prior to carrying out the O_2 system calibration. Connect the oxygen supply. **Press start the O_2 System Calibration button.** This takes about 6 minutes, the system will indicate when calibration is finished.

16.12 Flow System Calibration

The flow system is a factory set system and requires an ETU-2.

16.13 Pressure Triggering Verification

Fit a patient circuit with a test lung. Check that the pressure trigger operates in PTV mode with no flow sensor connected.

☑ **Check list Item 14.**

16.14 Gas Fail Detection Verification

a) With the air and oxygen hoses connected to separately controllable pressure sources

Set the ventilator to CMV

Gas inlet pressures to 4 Bar

BPM: 60

Insp Time: 0.5

PIP: 30 mbar

PEEP: 0 mbar

b) Ensure there are no current alarm conditions.

c) Disconnect the air supply and ensure that the “No Air Supply” alarm is activated.

d) Reconnect the air and ensure that the “No Air Supply” alarm clears.

e) Disconnect oxygen supply and ensure that the “No O_2 Supply” alarm is activated.

f) Reconnect the oxygen and ensure that the “No O_2 Supply” alarm clears.

☑ **Check list Item 15.**

16.15 Blender and Oxygen Monitoring Verification

Ensure that the ventilator has been turned on and connected to air for **1 hour** prior to carrying out the verification. Using a calibrated oxygen analyser, check the accuracy of the blender and the oxygen measurement throughout the range at the following ventilator mode settings.

a) Set the ventilator to CPAP mode,

CPAP set to 0

Set Oxygen concentration	Lower Limit	Upper limit
21%	20%	24%
30%	27%	33%
40%	37%	43%
50%	47%	53%
60%	57%	63%
70%	67%	73%
80%	77%	83%
90%	87%	93%
100%	97%	100%

☑ **Check list Item 16.**

16.16 Soak Test

After a complete calibration, the ventilator should be soaked tested for 50 hours to ensure normal operation. The soak test is divide into to halves, 25 hours in HFO mode and 25 hours in CMV.

Connect gas to the ventilator. The soak test can be carried out with air connected to the oxygen inlet but a dummy 100% O_2 cell will need to be fitted. (This device is available from SLE on request, part number: L0291).

Connect a full N5188 patient circuit with test lung.

Carry out a 100% oxygen calibration (One point) with the dummy 100% O_2 cell.

Set the ventilator up in HFO mode,
Set HFO rate to 5 Hz
Mean to 10 mbar
Delta p set to achieve 60 mbar
FiO_2 set to 96%

Run for a minimum of **25 hours.**

After 25 hours of HFO soak, check the delta p and the mean are within 10% of initial values.

Set the ventilator to CMV mode
Set BPM to 100
PIP to 50
PEEP to 10
Insp Time to 0.35 sec.
FiO_2 set to 96%

Run for a minimum of **25 hours.**

After 25 hours of CMV soak,

Check the PIP pressure is unchanged.
Acceptable tolerance: ±1mbar.

Check the PEEP is unchanged
Acceptable tolerance: ±1mbar.

16.17 Battery Charge Verification

Check that the battery has fully charged by checking the battery connector voltage is at least 13.7V when the unit is powered from the mains.

Acceptable tolerance: >13.7V

☑ **Check list Item 17.**

16.18 Battery Life Verification

After the battery has been fully charged (from the soak test), leave the unit in pure HFO mode at 20Hz on the battery alone.
Ensure the ”Main Power Fail” alarm is active.
Ensure that the ventilator runs for a minimum of 30 minutes before the “Battery low alarm” is activated.
Ensure that the ventilator continues operation on battery for a further 15 minutes (minimum) after the battery low alarm first occurred.

☑ **Check list Item 18.**

16.19 Total Power Fail Alarm Test

Check the operation of the total power fail alarm by switching the mains switch off and, with the unit powered by the battery alone, half press the power off button (on the back panel). A continuous loud alarm should sound. Press the power off button in fully and the sound should cancel.

☑ **Check list Item 19.**

16.20 Pressure Calibration Verification

Check the pressure settings and wave shapes in CMV mode at the following settings:

BPM 25

Insp time 1.5 seconds,

PEEP 0

PIP Setting	Acceptable tolerance
10 mbar	±1mbar
20 mbar	±1mbar
30 mbar	±1mbar
40 mbar	±1mbar
50 mbar	±1mbar
60 mbar	±1mbar

☑ **Check list Item 20.**

Check the mean pressure reading and wave shapes in HFO mode at the following settings:

Rate set to 5Hz

Mean set to zero.

Delta P setting	Acceptable tolerance
min	+1 mbar
40 mbar	+2 mbar
80 mbar	+2 mbar
120 mbar	+4 mbar
160 mbar	+5 mbar
max	+12 mbar

Functional Testing

17. Functional Testing

The functional test procedure is to be used in-conjunction with a checklist. The checklist is used to record that each test has been passed. This checklist will be become part of the service record of the ventilator. A template checklist (which should be copied) is to be found in **Appendix 2** of this manual on page 409.

Where information needs to be recorded the user will see symbol next to the section.

17.1 Ventilator setup

The ventilator needs to be connected to air and oxygen. Fit the exhalation block and silencer. A complete patient circuit needs to be connected with a N6647 test lung at the ET manifold. Make sure that all the covers are in place. Connect the ventilator to the mains power supply.

Prepare a calibration analyser with an ET tube connection.

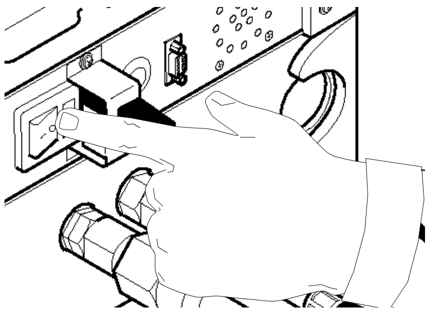
17.1.1 Complete Power Fail Alarm Test.

Step 1 The SLE5000 ventilator has a complete power fail alarm. This alarm is activated when both mains power and back-up battery power fail. This alarm is a high pitched, continuous tone emitted by the ventilator in the event of complete power failure.

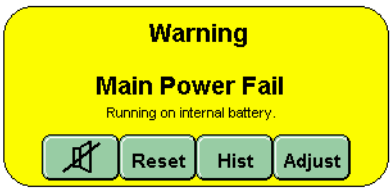
Turn **ON** the ventilator allow the start up screen to clear and wait for it to enter the **Ventilation Off** mode.

Calibrate Flow Sensor (for this calibration there is no need to occlude the flow sensor).

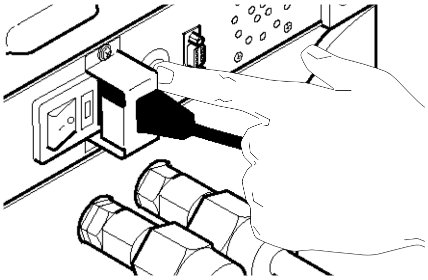
Turn the ventilator **OFF** at the mains power switch located on the rear of the machine.



This will trigger the mains power fail alarm.



Slowly depress the battery power termination switch. Before the switch reaches the end of its full travel, the audible complete power fail alarm should be initiated. Once the alarm has been triggered release the button, the alarm should continue.

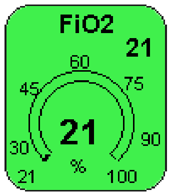


Re-press the battery power termination switch fully to cancel the alarm.

☑ Turn **ON** the ventilator and wait for it to enter the ventilation off mode.

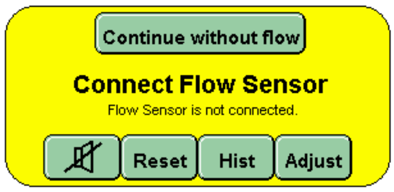
17.1.2 Setting FiO_2

Step 2 In the ventilation off mode select the FiO_2 parameter and using the arrow keys set the value to 21% FiO_2. The ventilator defaults to 21% on start up.The measured value will be displayed once the O_2 cell has finished it's self calibration routine. When finished, the set value and measured value should correspond. ☑



17.1.3 Functional Testing with No Flow Sensor

Step 3 If the SLE5000 is to be used without a flow sensor fitted then press the **"continue without flow"** button in the alarm panel.



Fit a test lung to the ET manifold.

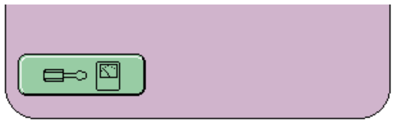
The user should now advance to **section 17.1.5**

Note: the functional testing routines have been written with the flow sensor fitted. The user will be told to skip a section if it applies to testing a flow related function.

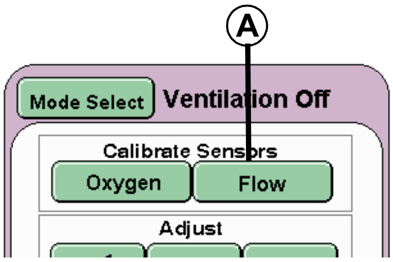
17.1.4 Calibration of the Flow sensor

Step 4 Make sure that there is no flow passing the through the sensor. For this purpose, occlude the flow sensor by holding it between two fingers, closing both ends as shown in the following picture.

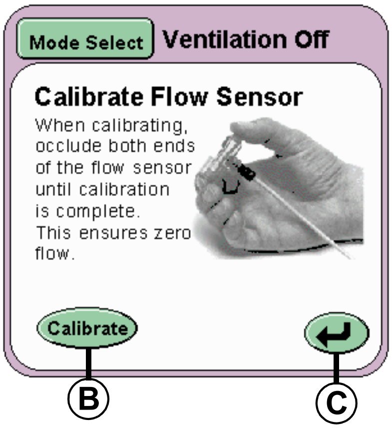
Press the **Options and Service Data** Button.



From the services panel press the **Flow** button **(A)**



With the flow sensor now occluded press the **Calibrate button (B).** This initiates the calibration cycle for the flow sensor. Keep the sensor occluded until the words **"Calibration Complete"** appear above the Calibrate button.



The sensor has now been calibrated and can be fitted into the patient circuit.

Fit a test lung to the flow sensor.

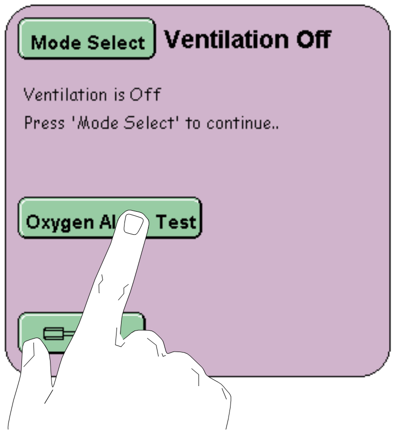
Press the **Return Button (C)** twice to return to the **Ventilation Off panel** or allow the panel to self cancel after 30 seconds.

Warning: If the flow sensor is incorrectly calibrated, i.e. whilst fitted to the patient circuit or partially occluded, the user must note that the resistance and compliance readings in the lung mechanics and measurement panel will be incorrect. Measured values in the parameter controls will also be incorrect and could lead a condition detrimental to the patient. Recalibration of the sensor when occluded must be carried out at all times.

17.1.5 Oxygen Alarm Test

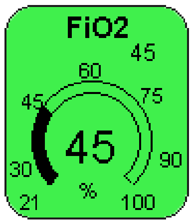
Step 5 In ventilation off mode panel press the **Oxygen Alarm Test Button**

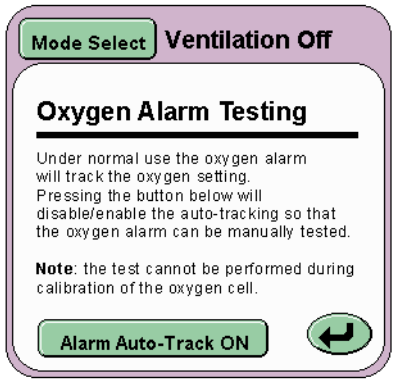
Note: Ensure that a two point oxygen calibration has been carried out before commencing the oxygen alarm test.



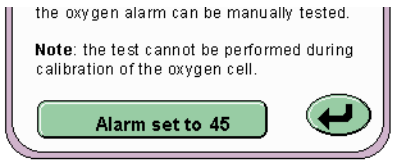
The Oxygen alarm testing window will now be displayed in the Mode Panel.

With the **Alarm Auto-Track Button** set to **ON** set the FiO_2 parameter to 45% O_2.

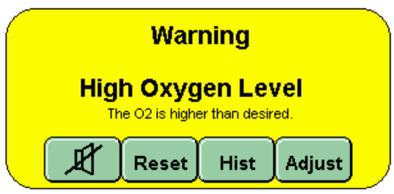




Once set, press the **Alarm Auto-Track Button**. The Button will now read **Alarm set to 45**



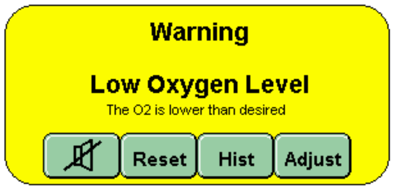
Increase the percentage of oxygen to **53%**.The blender will increase the percentage of oxygen to the set value. The **High Oxygen Alarm** will now be triggered.



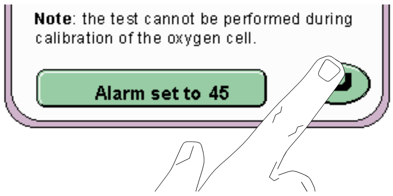
Return the percentage of oxygen to **45%** and press the reset button 

on the alarm panel.

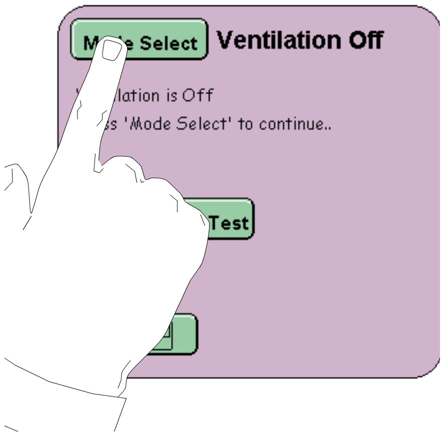
Decrease the percentage of oxygen to **37%**. The blender will reduce the percentage of oxygen to the set value. The **Low Oxygen Alarm** will now be triggered.



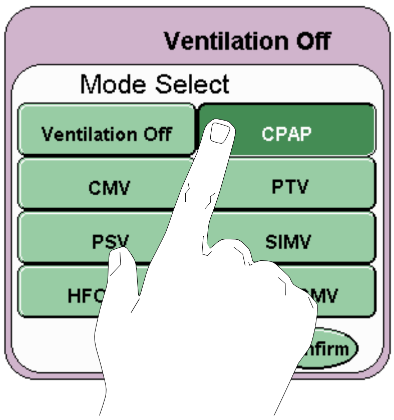
☑ Further decrease the the percentage of oxygen to **21%** and press the **Return Button** to cancel the Oxygen alarm test.



Step 6 Press the **Mode Select button** to enter the Mode select panel.



Step 7 From the **Mode Select** panel select **CPAP,** but **DO NOT** press the confirm button. Advance to **Step 8**.



17.1.6 Function and alarm testing

Step 8 Set the following parameters in the CPAP preview mode:

Ti.......................... 1 sec
CPAP................... 5 mbar
PIP....................... 20 mbar
FiO_2..................... 21%

After pressing the confirm 

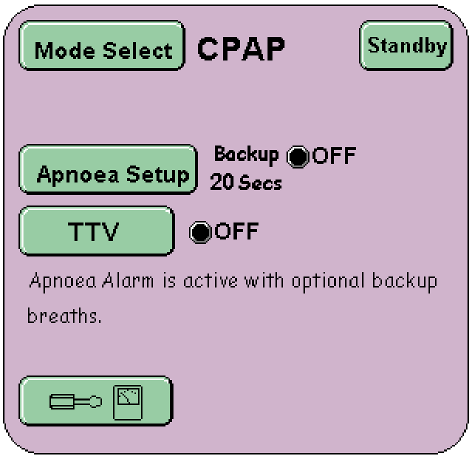
button the user will be presented with the **CPAP** screen.

Set high alarm to 30mbar

Step 9 Check that:

Apnoea Support should be set to OFF and apnoea is detected after 20 seconds (Default value after power up).

TTV .... is set to OFF. *(This button will not appear when functional testing with no flow sensor fitted).*

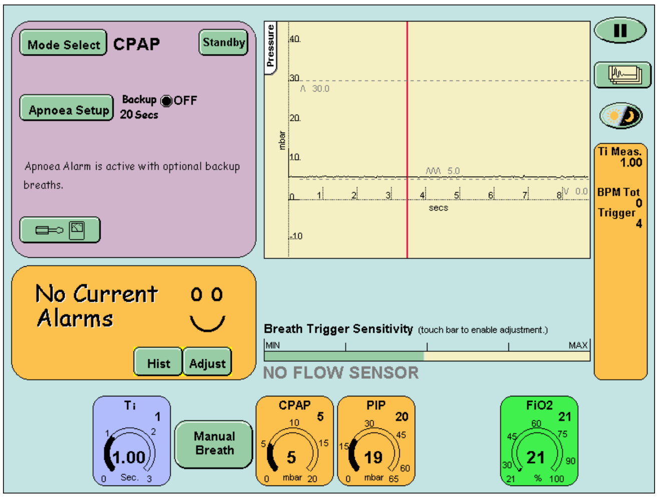


Note: Press the manual breath button twice to display the measured PIP value.

Step 10 Verify that:

☑ the test lung inflates.

Note: If functional testing the ventilator without a flow sensor fitted the TTV button will not appear and the Flow v Time & Tidal Volume v Time windows will be replaced by the Breath Trigger Level bar.



Step 11 Remove the test lung and connect the ET manifold to the calibration analyser.

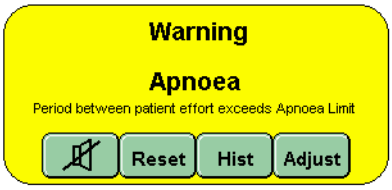
☑ Check that the analsyer reads 5 mbar. Increase the CPAP pressure to 10 mbar. Verify that the readings correspond. return the CPAP pressure to 5 mbar.

Re-fit the test lung to the ET manifold.

Step 12 Pull the test lung to mimic a breath, then acknowledge and reset the alarm.

☑ Verify that:

after 20 seconds the visual and audible **Apnoea** alarm is triggered.



Step 13 Pull the test lung to mimic a breath, then acknowledge and reset the alarm.

☑ Verify that:

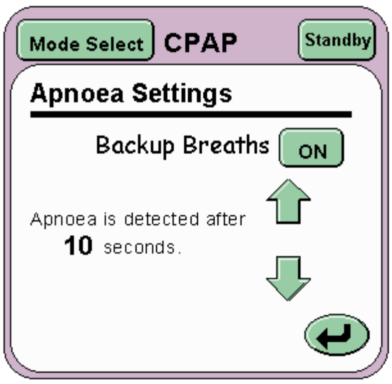
a manual breath is delivered when the manual breath button is pressed.

Step 14 Press the **Apnoea Setup** button on the **Mode Panel**. The **Apnoea Settings** panel will now be displayed.

Set Apnoea detection after **10 seconds.**

Set the **Backup Breaths** button to **ON**

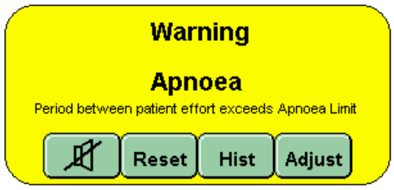
Press the **Return** button to return to the mode panel.



Pull the test lung to mimic a breath, then acknowledge and reset the alarm.

Verify that:

after 10 seconds that the ventilator delivers a backup breath and the visual and audible **Apnoea** alarm is triggered.



Note: Functional testing with a flow sensor, but with the patient circuit occluded, the Breath Not Detected alarm will be triggered on the second mechanical breath. This is because the ventilator registers the second mechanical breath via the flow sensor as an incomplete patient breath. When functional testing without the flow sensor, only the Apnoea alarm can be triggered as there is no Breath Not Detected alarm in this mode of operation.

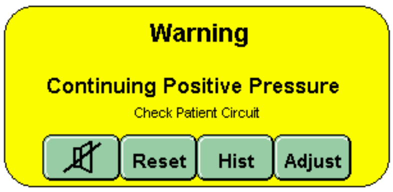
Step 15 Set the **Backup Breaths** button to **Off.**

Step 16 Gently constrict the proximal airway tube so as to increase the pressure. Allow the pressure to increase but do not allow it to exceed the high alarm threshold. (This can be achieved by releasing the constriction of the proximal airway tube by a small amount.)

Do not reset any Apnoea alarms that may be generated.

Verify that:

after 10 seconds the continuing positive pressure alarm is triggered and that the fresh gas supply is cut off.



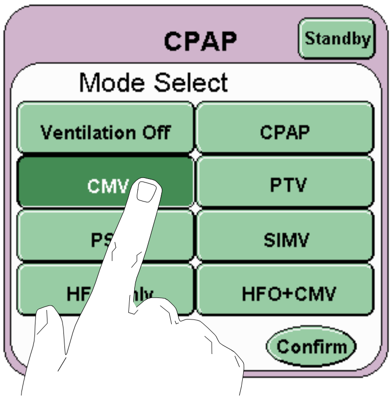
When the gas supply is cut off release the constriction from the proximal airway tube.

After 6 seconds the fresh gas supply should be re-instated.

Step 17 Press the reset button in the alarm panel to clear all alarm notifications.

Step 18 Press the Mode Select 

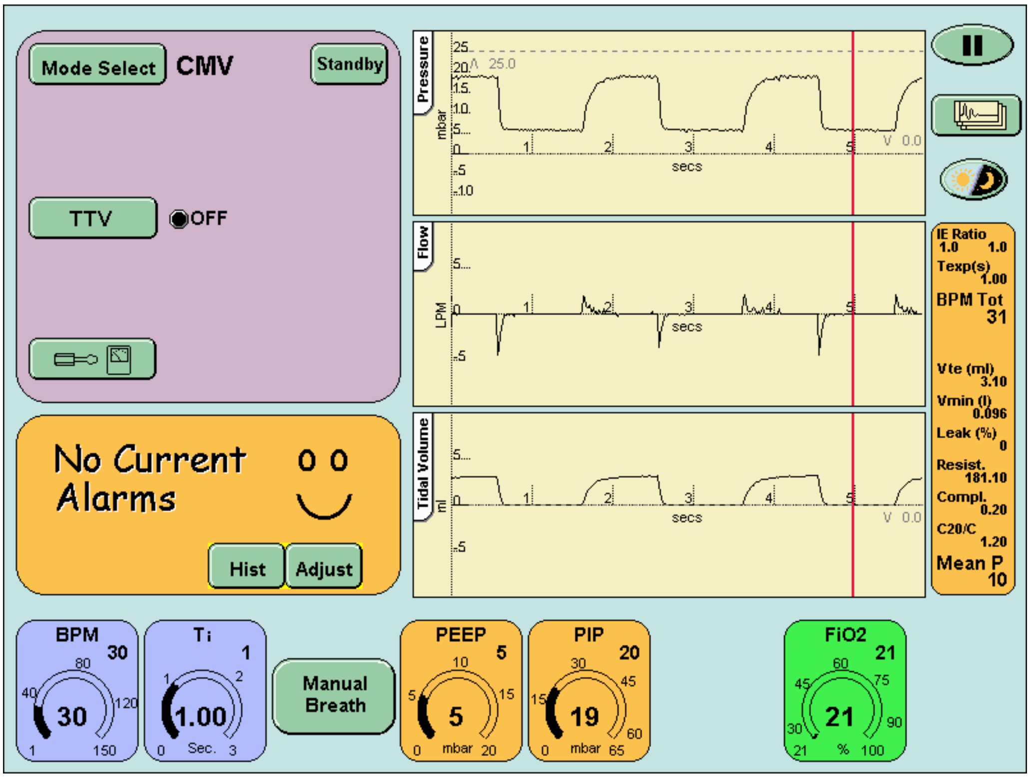
button and select **CMV** from the **Mode Select panel,** but **Do Not** press the confirm button. Advance to **Step 19**.



Step 19 Set the following parameters in the CMV preview mode:

BPM 30
Ti ....1 sec
PEEP....................5mbar
PIP ....20 mbar
FiO_2......................21%

Step 20 Press the confirm button to enter the **CMV** mode.



☑ Verify

a waveform appears in all the waveform windows and that they correspond to the set parameters.

Step 21 Set the following parameters in the **CMV** mode:

BPM.................... 18
Insp. Time........... 3 sec
PEEP................... 5mbar
PIP....................... 20 mbar
FiO_2..................... 21%

Step 22 Remove the test lung and connect the calibration analyser to the ET manifold.

☑ Verify that the calibration analyser alternates between the PEEP and PIP settings.

Refit the test lung.

17.1.7 High Pressure Alarm

Step 23 Reduce high alarm setting to 19mbar. This should initiate an audible alarm and a **High Pressure** visual alarm.

Reduce the high alarm threshold a further 6mbar below the measured PIP. The high pressure alarm should remain but all fresh gas should now be cut off (the PEEP will be maintained). After 3 seconds the fresh gas should be re-instated and a further 6 seconds the ventilator should try to re-instate ventilation. The fresh gas cut off cycle should repeat.

☑ Return alarm setting to 25mbar and press the reset button 

to clear the alarm panel of the alarm notification and restart ventilation.

17.1.8 Low Alarm

Step 24 Increase the low alarm setting to 6mbar. This should initiate an audible alarm and a **Low Pressure** visual alarm.

Increase the low alarm threshold a further 6mbar above the measured PEEP. The low pressure alarm should remain but all fresh gas should now be cut off (the PEEP will be maintained).

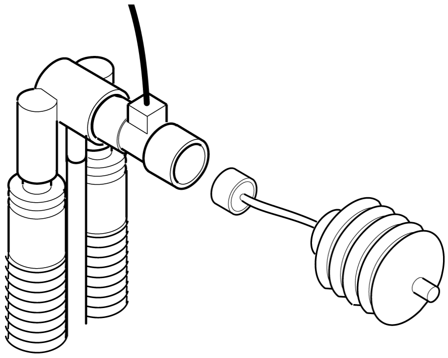
☑ Return alarm setting to 0mbar and press the reset button 

to clear the alarm panel of the alarm notification and restart ventilation.

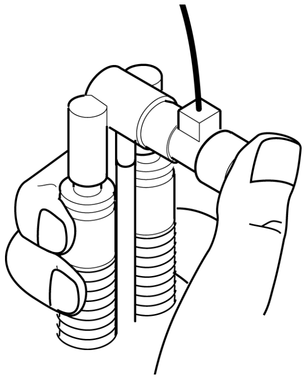
17.1.9 Breath Not Detected Alarm

Step 25 Set the **PEEP to 1 mbar**

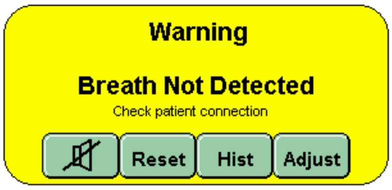
Remove the test lung from the flow sensor.



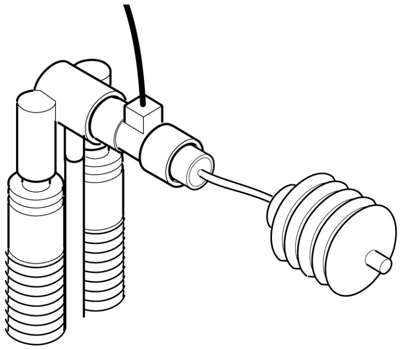
Occlude the flow sensor.



After 10 seconds this should initiate an audible and visual Breath Not Detected alarm.



Refit the test lung to the flow sensor. The Alarm should self cancel.



☑ Press the reset button  to clear the alarm panel of the alarm notification.

Set the **PEEP to 5 mbar**

17.1.10 Leak/block Alarm

Step 26 ☑ Disconnect the fresh gas tubing from the ventilator. This should initiate an audible and visual **LEAK** alarm indication.

Step 27 Occlude the fresh gas outlet. This should initiate an audible and **BLOCK** visual alarm indication.

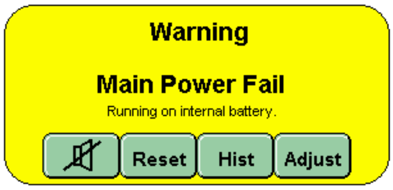
Reconnect the tubing, audible and visual alarms should reset.

☑ Press the reset button  to clear the alarm panel of the alarm notification.

17.1.11 Mains failure alarm

Do not turn the ventilator off by using the rear power switch.

Step 28 Disconnect mains power by switching off or removing mains plug from power socket.



This should initiate an audible / visual alarm. The ventilator should continue to cycle.
Reconnect mains power supply, the alarm should cancel, but the alarm notification should remain.

☑ Press the reset button  to clear the alarm panel of the alarm notification.

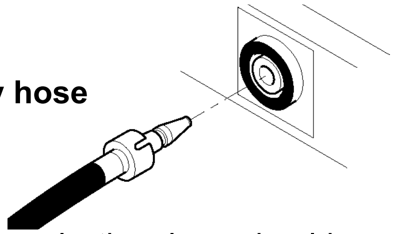
17.1.12 Gas supply alarms

Warning: Disconnect the gas supplies from the wall outlet only. DO NOT unscrew the hose connections from the rear of the ventilator.

Step 29 Disconnect Air supply from wall outlet, an audible / visual alarm should be activated.

☑

Air supply hose

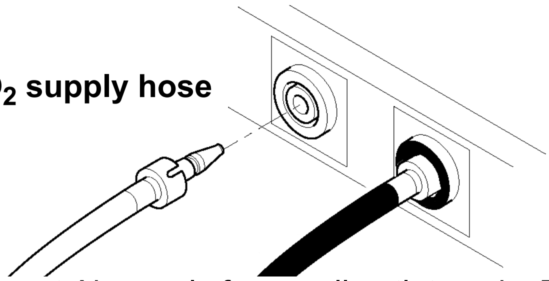


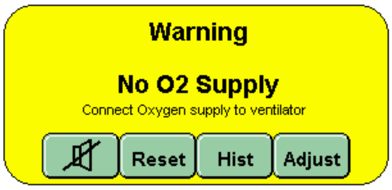
Reconnect Air Supply, the alarm should cancel.

Step 30 Disconnect O_2 supply from wall outlet, an audible / visual alarm should be activated.

☑

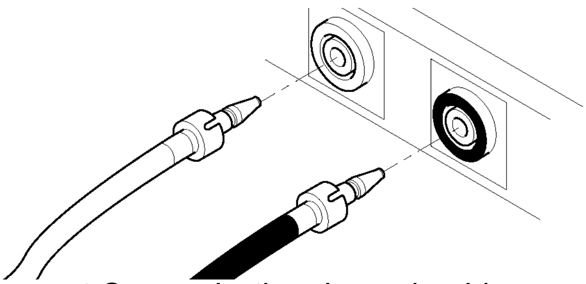
O_2 supply hose

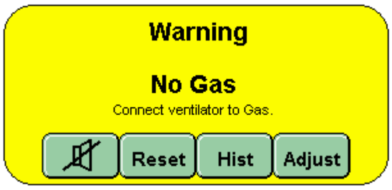




Step 31 Disconnect Air supply from wall outlet again. The No Gas audible / visual alarm should be activated.

☑





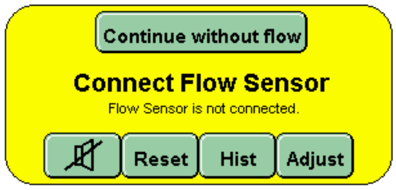
Reconnect O_2 supply, the alarm should cancel.
Reconnect Air Supply, the alarm should cancel.

Note: The patient circuit under certain conditions can pressurize the internal fresh gas pressure transducer causing it register a pressure of between 0.1 to 1 mbar. In this case the disconnection of both the Air and O_2 supplies will trigger a leaking fresh gas alarm. The user should note that the PEEP and PIP will drop to zero.

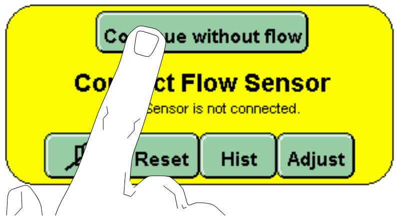
17.1.13 Flow sensor disconnect alarm

Note: If functional testing without the flow sensor advance to Step 33.

Step 32 ☑ Disconnect the flow sensors plug from the ventilator an audible / visual alarm should be activated.

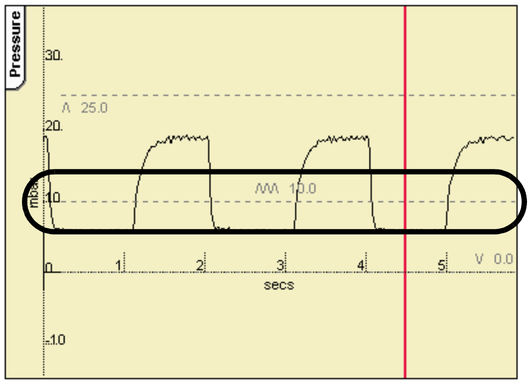


Press the **Continue without flow** button.



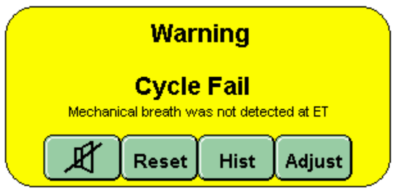
17.1.14 Cycle Fail Alarm

When the SLE5000 ventilator is used with out a flow sensor a **Cycle Fail** alarm threshold becomes active in the pressure waveform window.



Set the High alarm threshold to **30mbar**
Set the Low alarm threshold to **-5mbar**

Step 33 Increase the alarm setting so that alarm cursor line is above peak pressure wave on the screen. This will initiate an audible and visual **CYCLE FAIL** alarm.



Return alarm setting to within the pressure wave, audible alarm should self cancel.

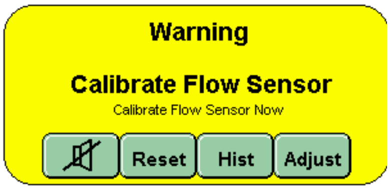
Press the reset button Reset to clear the alarm panel of the alarm notification.

Decrease the alarm setting so that alarm cursor line is below pressure wave on the screen. This will initiate an audible and visual **CYCLE FAIL** alarm.

Return alarm setting to within the pressure wave, audible alarm should self cancel.

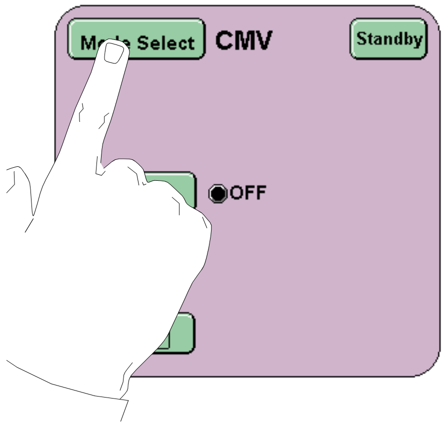
☑ Press the reset button **Reset** to clear the alarm panel of the alarm notification.

Step 34 Reconnect the flow sensor and a new audible / visual alarm **Calibrate Flow Sensor** should be activated and replace the **Connect Flow Sensor** alarm

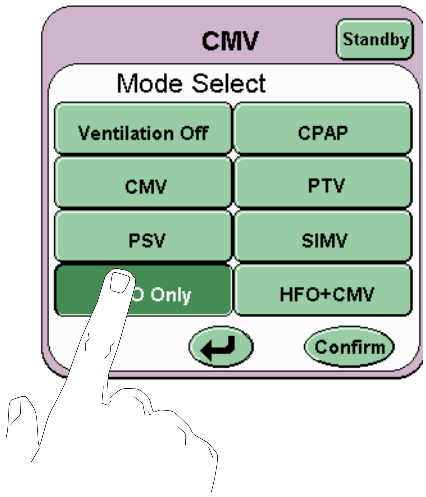


Recalibrate the flow sensor. Repeat **Step 4** and then advance to **Step 35.**

Step 35 Press the **Mode Select button** to enter the Mode select panel.



Step 36 Select **HFO Only** from the **Mode Select panel,** but do not press the confirm button. Advance to **Step 37**.



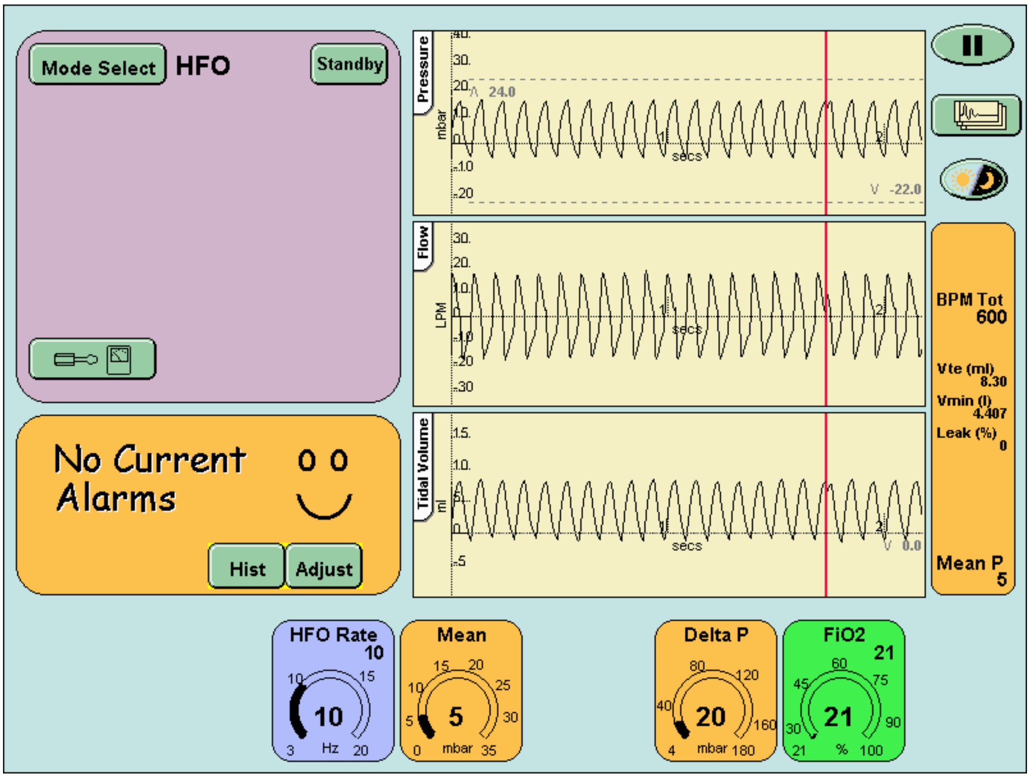
17.1.15 Functional test of HFO Mode (SLE5000 only)

Step 37 Set the following parameters in the **HFO Only** preview mode

HFO Rate 10Hz
Mean 5mbar
FiO_2 .... 21%

Delta P................. Not available in preview mode

After pressing the confirm button  the user will be presented with the **HFO** screen.



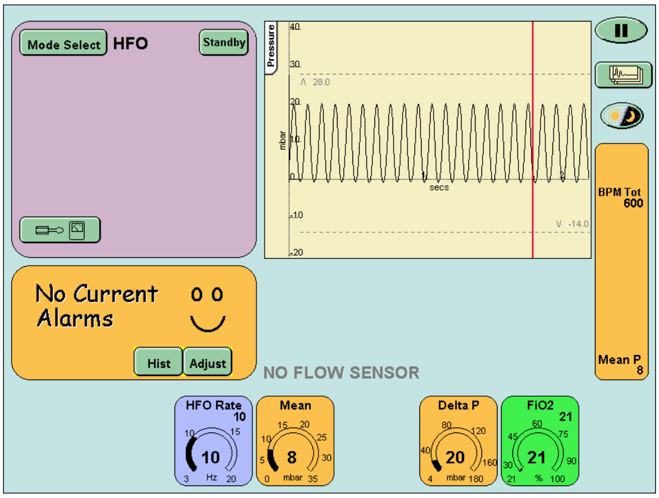
Set the Delta P to **20mbar**

Step 38 Verify that:

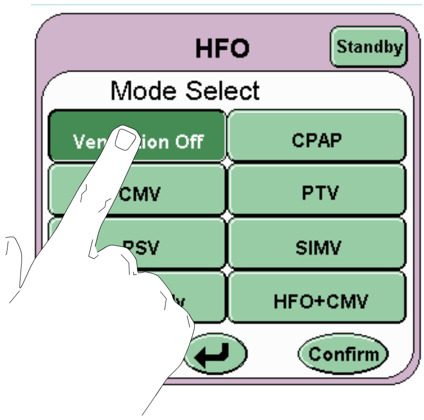
the ventilator is oscillating,
the oscillation waveform appears in the waveform windows.

☑

Note: If functional testing the ventilator without a flow sensor fitted the Flow v Time & Tidal Volume v Time windows will not appear.



Step 39 Press the Mode Select Mode Select button and select **Ventilation Off** from the **Mode Select panel.** Press the confirm button.



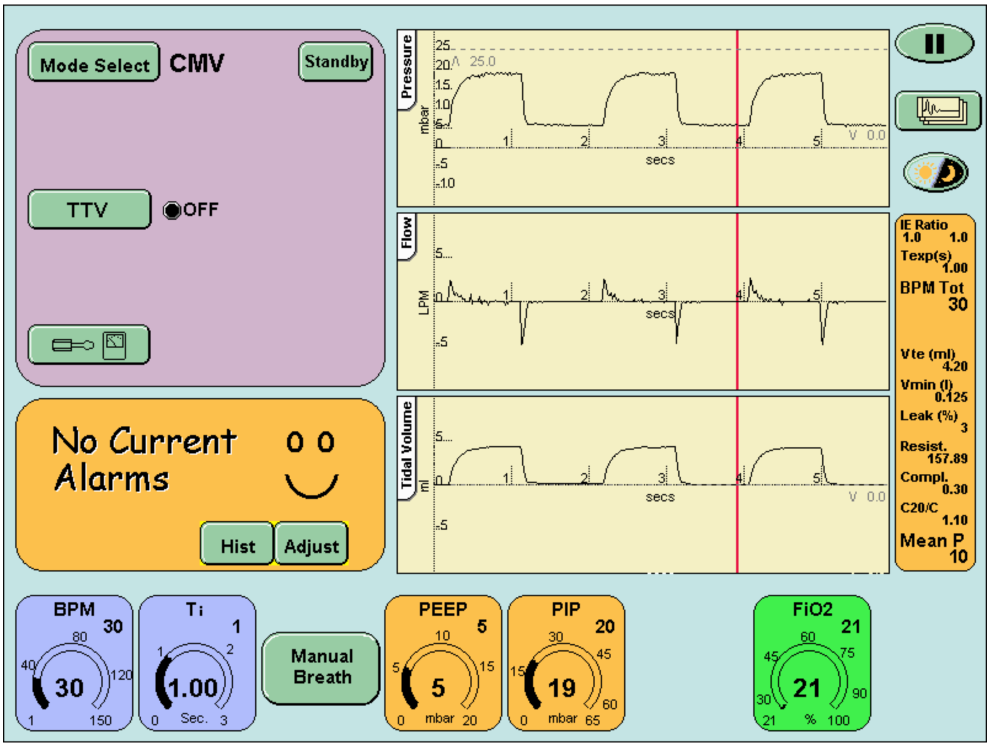
Note: At this point the user can terminate the functional testing. If the user would like to functional test all the functions of the ventilator they should press the Mode Select Mode Select button and select CMV from the Mode Select panel, do not press the confirm button. Advance to Step 40.

17.1.16 Functional test of CMV Mode

Step 40 Set the following parameters in the **CMV** preview mode:

BPM.................... 30
Ti......................... 1 sec
PEEP 5mbar
PIP....................... 20 mbar
FiO_2 .... 21%

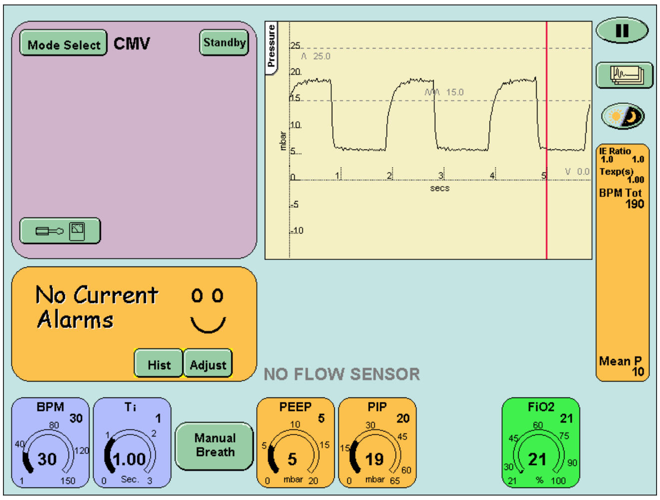
After pressing the confirm button  the user will be presented with the **CMV** screen.



Check that:

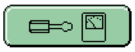
TTV .... is set to OFF. ***(This button will not appear when functional testing with no flow sensor fitted).***

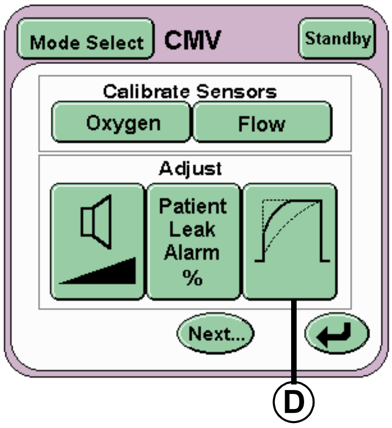
Note: If functional testing the ventilator without a flow sensor fitted the Volume Limit button and the Tidal Volume waveform will not appear.



Step 41 Verify that:

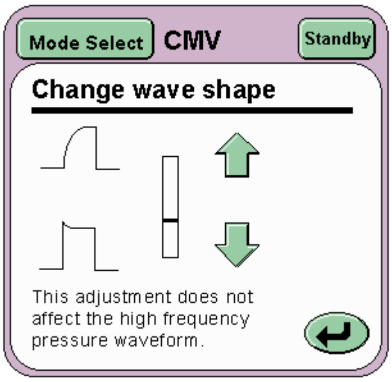
the ventilator is cycling,
the I:E ratio in the breath parameter panel reads 1.0 : 1.0,
the waveforms appear in the waveform windows.

Step 42 Press the **Options and Service Data Button**  on the **Mode Panel** to activate the **Services** panel.



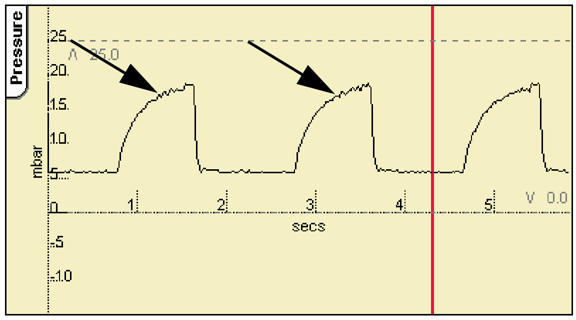
Press the **Wave Shaping** Button **(D)**.

From the **Change Wave shape** panel set the indicator bar at the midpoint.



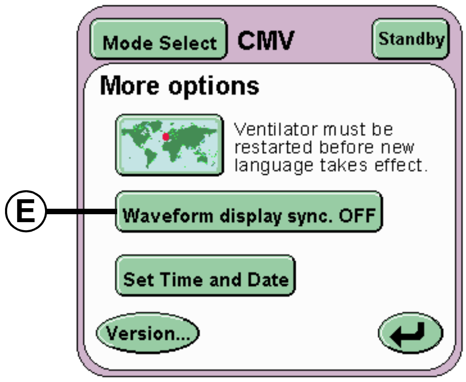
Step 43 Verify that:

☑ the pressure wave form is modified accordingly.



Step 44 Return the indicator bar to its original position and press the **Return** button to return to the **Services panel** panel.

Step 45 Press the **Next.. button** to reach the **More Options panel**. Press the **Waveform display sync button (E)** to toggle between ON and OFF. The button should then display the word **ON**.



Step 46 Verify that:

☑ In the waveform window the waveforms should be displayed starting at the left hand edge of the window.

Step 47 Set the **Waveform display sync** to **OFF**.

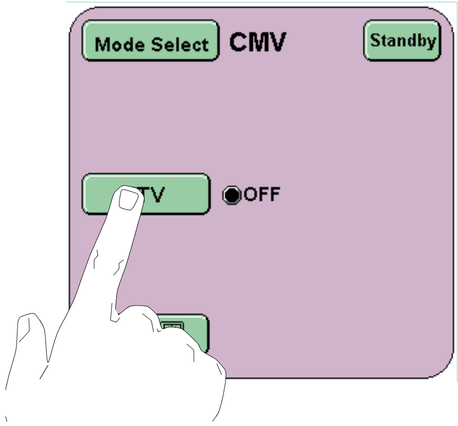
☑ Verify that:

In the waveform windows the waveforms should be displayed starting anywhere in the window.

Press the **Return**  button twice to return to the Mode panel.

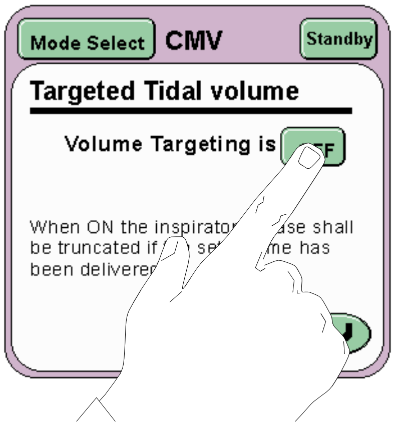
Step 48 From the mode select panel press the **TTV** button.

(Skip Step 48 to Step 52, if functional testing without a flow sensor).

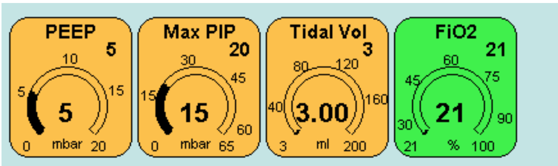


Step 49 Turn on the Volume limiting by pressing the button marked OFF. The text in the button will change to **ON.**

Press the **Return** button to return to the **Mode Panel.**



Step 50 The **Tidal Vol** parameter will now appear.

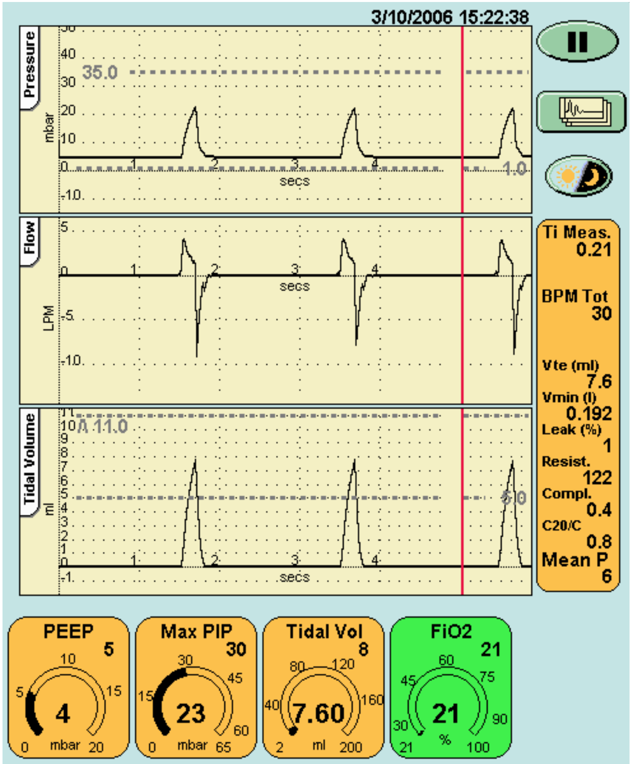


Note: The PIP parameter control changes to the MAX PIP parameter control when volume limiting is turned on.

Step 51 Set a Tidal volume of **8ml** and a **Max PIP** of **30mbar**

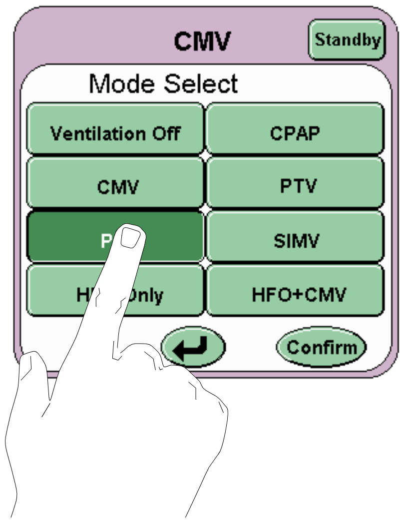
☑ Verify that:

The displayed waveform changes showing a rise in flow with a sharp cut off.



Step 52 Turn off the volume limiting.

Step 53 Press the Mode Select **Mode Select** button and select **PSV** from the **Mode Select panel,** but do not press the confirm button. Advance to **Step 54**.



SLE

17.1.17 Functional test of PSV Mode

Step 54 For the functional test set the following parameters in the **PSV** preview mode:

Backup ....20 breaths
PEEP....................5 mbar
PIP ....20 mbar
Max Ti ....1 sec
FiO_2......................21%

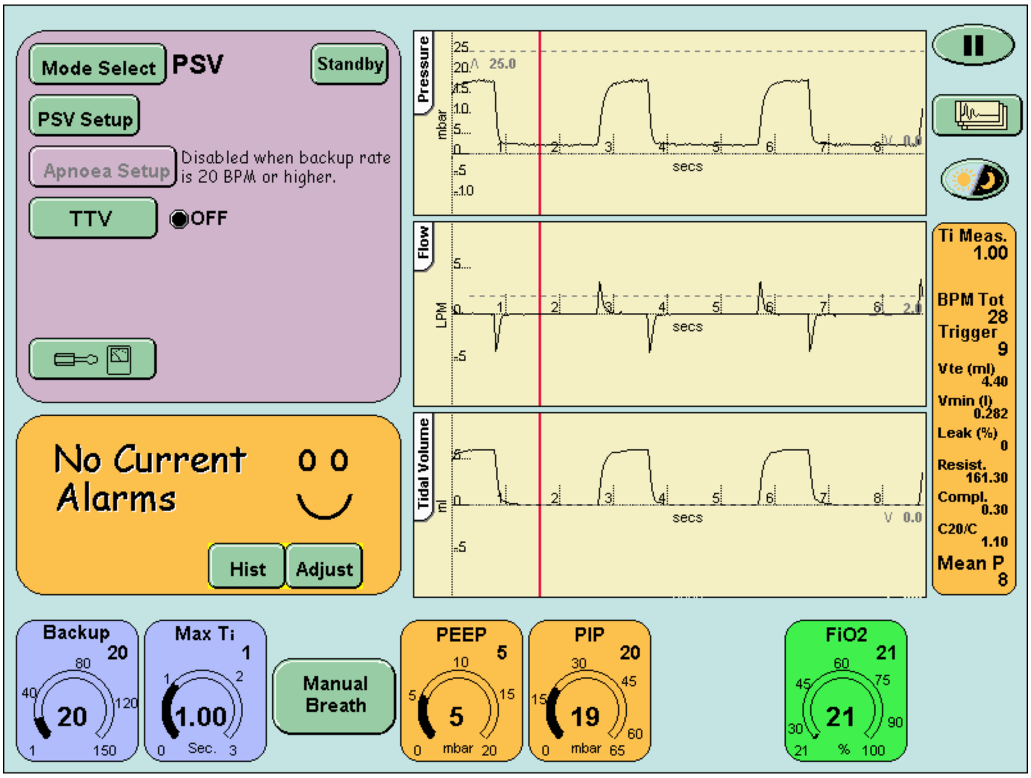
After pressing the confirm button 

the user will be presented with the **PSV** screen.

Check that:

TTV ....is set to OFF *(This button will not appear when functional testing with no flow sensor fitted).*

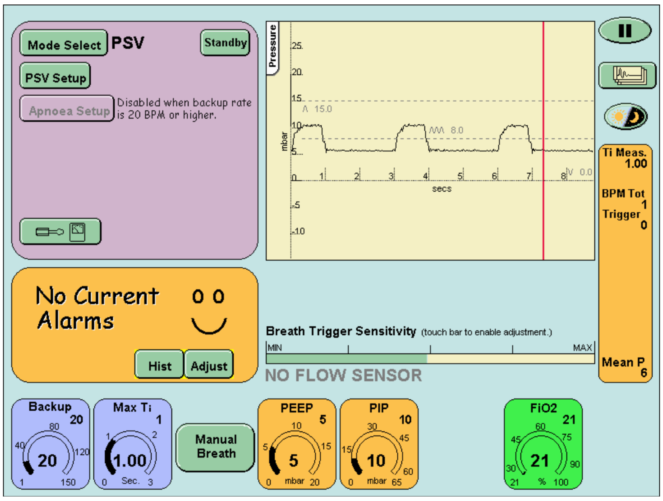
.



Step 55 Check that the:

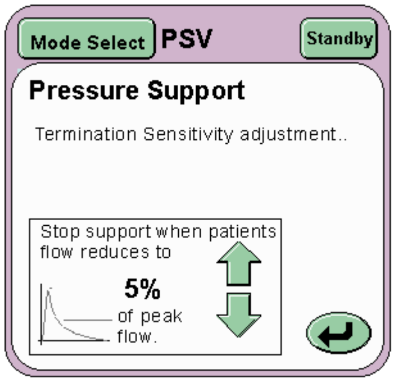
Breath detection threshold is set to 2.0 lpm
The ventilator should start to provide backup breaths.

Note: If functional testing the ventilator without a flow sensor fitted TTV button will not appear and the Flow v Time & Tidal Volume v Time windows will be replaced by the Breath Trigger Level bar.

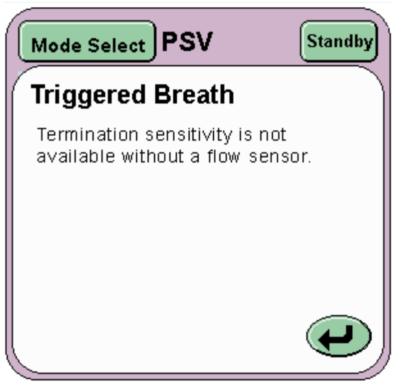


Step 56 Press the **PSV Setup** button to display the **Pressure Support** panel.

Ensure that stop support is set to **5%.**



Note: Without the flow sensor fitted the user will only be able to set the stop support percentage.

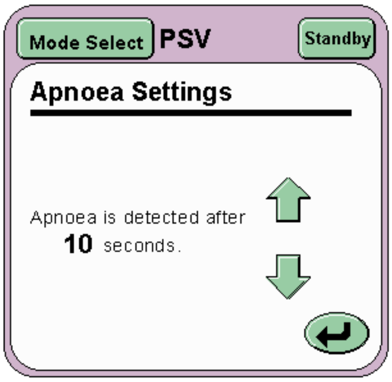


☑ Verify that:

When the test lung is pulled that a waveform appears in the waveform window. When the test lung is squeezed then released that the ventilator provides support by helping reinflate the test lung.

Step 57 Reduce the back up rate to **19 BPM**. The **Apnoea Setup** button should now become active.

Press the **Apnoea Setup** button on the **Mode Panel**. The **Apnoea Settings** panel should now be displayed.



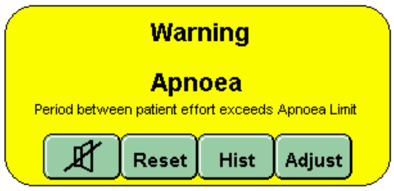
Set the apnoea detection to **10 seconds**.

Press the **Return**  button to return to the Mode panel.

Step 58 Squeeze the test lung to mimic a breath.

☑ Verify that:

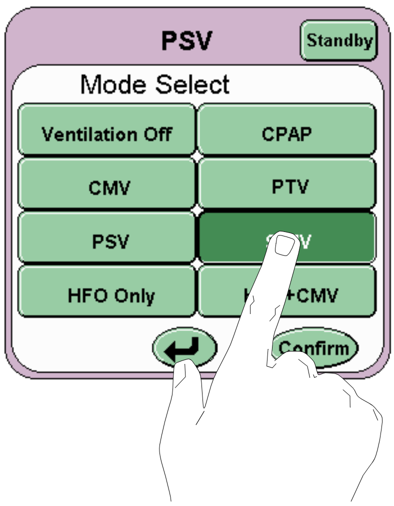
after 10 seconds that visual and audible **Apnoea** alarm is triggered.



Increase the back up rate to **20 BPM**.

Step 59 Press the Mode Select 

button and select **SIMV** from the **Mode Select panel,** but do not press the confirm button. Advance to **Step 60**.



17.1.18 Functional test of SIMV Mode

Step 60 For the functional test set the following parameters in the **SIMV** preview mode:

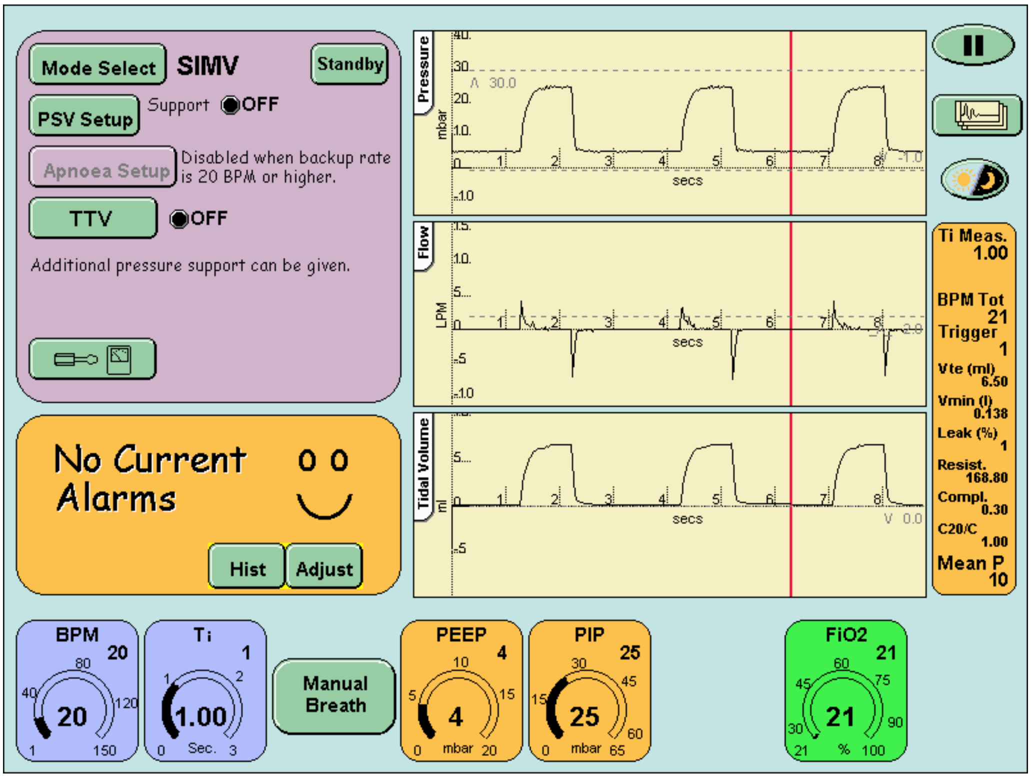
BPM.................... 20
Ti......................... 1 sec
PEEP 4mbar
PIP .... 25 mbar
FiO_2 .... 21%

After pressing the confirm button 

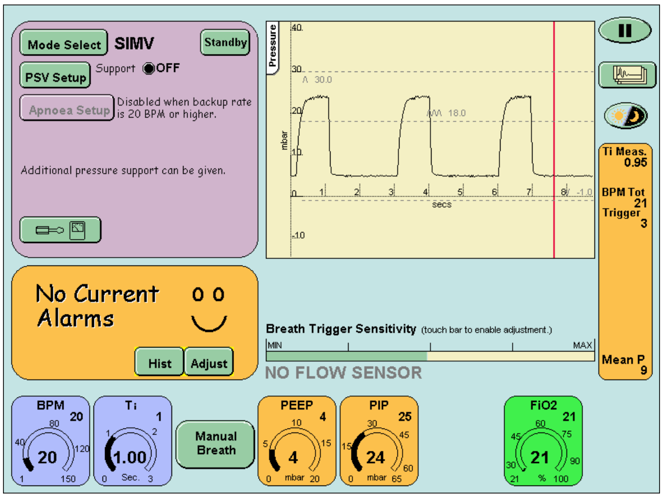
the user will be presented with the **SIMV** screen.

Check that:

PSV setup........... is set to OFF
TTV...................... is set to OFF (This *button will not appear when functional testing with no flow sensor fitted).*



Note: If functional testing the ventilator without a flow sensor fitted the TTV button will not appear and the Flow v Time & Tidal Volume v Time windows will be replaced by the Breath Trigger Level bar.



Step 61 Verify that:

the ventilator cycles,
the cycle waveform appears in the waveform windows,
after 1 minute the **BPM Tot** should read 20 BPM in the breath parameter window.

Step 62 Wait for the ventilator to deliver a mandatory breath, on completion of this breath pull the test lung.

Verify that:

the ventilator delivers a synchronized breath.

Step 63 Wait for the ventilator to deliver a new mandatory breath, on completion of this breath pull the test lung, after the ventilator has delivered the synchronized breath, then pull the test lung in approximately 0.5 second intervals.

Verify that:

the ventilator does not trigger on the 2 to 3 test lung initiated breaths before delivering the next synchronized breath.

Step 64 Remove the test lung and connect the calibration analyser.

☑ Verify that:

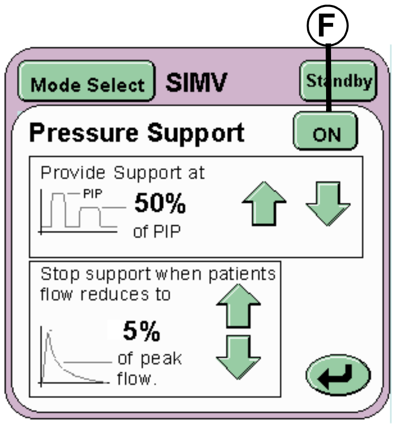
the PIP is **25 mbar.**

Refit the test lung.

Step 65 Press the **PSV Setup button** to display the **Pressure Support** settings panel.

Ensure that support is provided at **50%**.

Press the ON button **(F)**.



Trigger a number of breaths and observe that the next supported breath s now **50%** of the original setting i.e. **12-13 mbar**

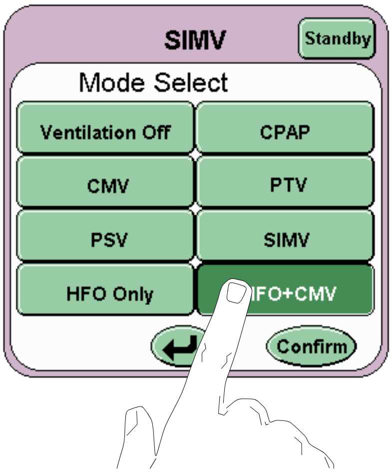
☑ Verify that:

a triggered breath is now supported to **50%** of the original setting i.e. **12-13 mbar**

Note: due to the SIMV windows you may trigger breaths that are not supported.

Step 66 Set Pressure support to **OFF**

Step 67 Press the Mode Select Mode Select button and select **HFO+CMV** from the **Mode Select panel,** but do not press the confirm button. Advance to **Step 68**.



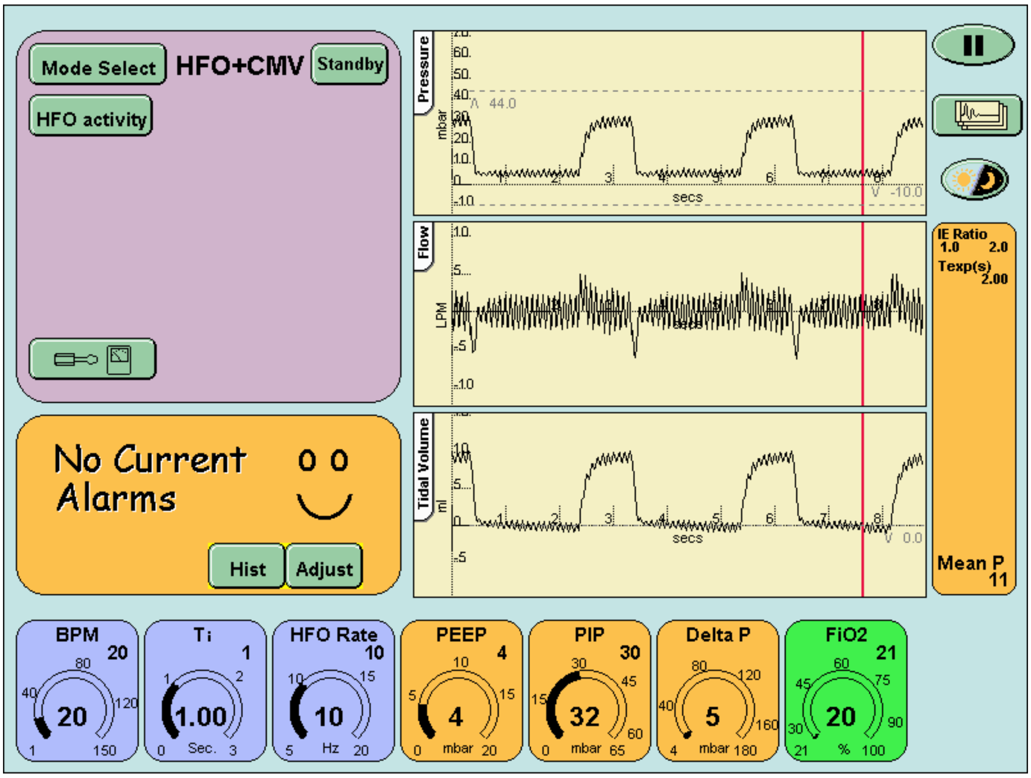
17.1.19 Functional test of HFO+CMV Mode (SLE5000 only)

Step 68 For the functional test set the following parameters in the **HFO+CMV** preview mode

BPM.................... 20
Ti......................... 1 sec
HFO Rate 10Hz
PEEP 4mbar
PIP .... 30 mbar
Delta P................. Not available in preview mode
FiO_2 .... 21%

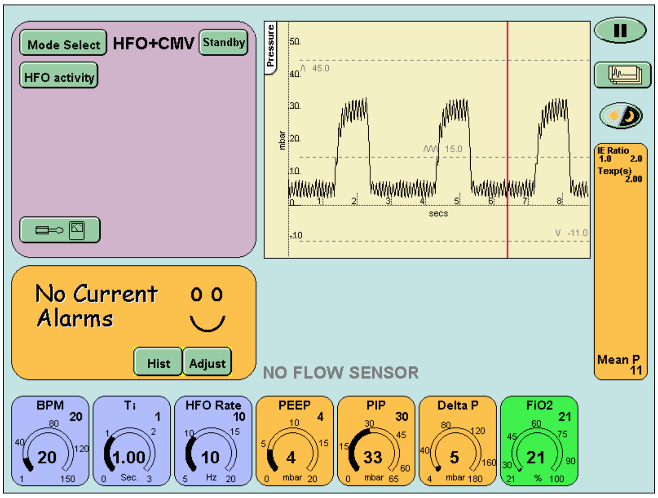
After pressing the confirm button 

the user will be presented with the **HFO + CMV** screen.



Set a **Delta P** of **4mbar**

Note: If functional testing the ventilator without a flow sensor fitted Flow v Time & Tidal Volume v Time windows will not appear.



Step 69 Verify that:

the ventilator cycles with oscillations in both the inspiratory and expiratory phases

the waveforms appear in the waveform windows

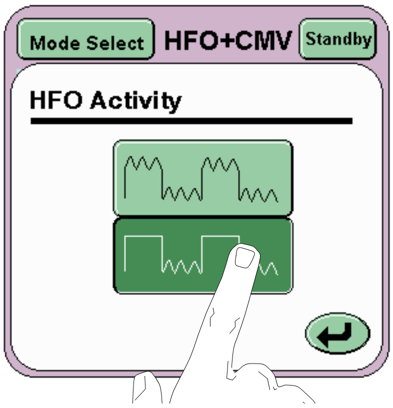
the I:E ratio in the breath parameter panel reads 1.0 : 2.0

☑

Step 70 Press the **HFO Activity** HFO activity button on the Mode panel to activate the **HFO Activity Panel**.

Press the **Expiratory Only** button.

Press the **Return** button.



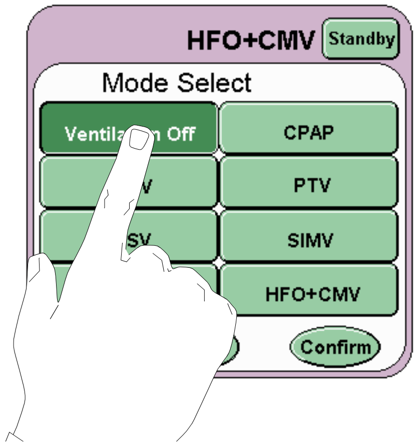
☑ Verify that:

the ventilator cycles with oscillations in the expiratory phase only.

Step 71 Reset the HFO activity to continuous.

Step 72 Press the Mode Select Mode Select button and select **Ventilation Off** from the **Mode Select panel.**

Press the confirm button to enter the **Ventilation Off** mode.



Functional testing is now complete.

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Trouble shooting

18. Trouble Shooting Chart

1. Symptom: Ventilator does not power up when turned on but is connected to mains supply.

Possible Cause

Mains power supply turned off.
Blown main fuse.

Remedy

Turn on mains supply.
Replace main fuse.

2. Symptom: Ventilator screen remains blank on power up. Power LED is On.
or
Ventilator screen blank with alarm tone being generated. Ventilator continuing to ventilate.

Possible Cause

LCD cable disconnected.
Back light power cable disconnected.
Back light PCB failed.
Defective PC Board (Contains video driver).

Remedy

Check LCD cable connected. Fit locking rod if required. (See “N6631/02 LCD & N6631/05 Touch Screen” on page 47).
Check backlight power connector.
Check backlight PCB. (See “N6631/03 Inverter PCB” on page 44).
Replace PC board (See “N6631/01 PC Board” on page 37).

3. Symptom: Ventilator start up screen blue and user interface missing all graphics.

Possible Cause

Un-installed foreign language mode selected.(UK ventilators only up to serial number 51449 running software versions 3 to 3.2).

Remedy

Re-select the English language.

4. Symptom: Ventilator screen blank. Power LED is Off. Continuous alarm tone being generated.

Possible Cause

Complete power failure.

Remedy

Restore mains power and restart ventilator.
If the ventilator does not display any battery related alarms. To check battery level turn off ventilator at rear (do not press the battery disconnect switch). If screen becomes blank again batteries are flat and require recharging.

5. Symptom: Touch screen buttons do not operate as expected.

Possible Cause

Touching the screen at two points.
Touch screen out of alignment.
Touch screen damaged.

Remedy

Inspect touch screen for damage. Re-calibrate touch screen.
If touch screen damaged replace. (See “N6631/02 LCD & N6631/05 Touch Screen” on page 47).

6. Symptom: Touch screen buttons do not operate.

Possible Cause

Touch screen cable disconnected.
Touch screen failure.

Remedy

Examine touch screen cable.
Replace touch screen. (See “N6631/02 LCD & N6631/05 Touch Screen” on page 47).

7. Symptom: Total power fail alarm active (Audible Only) after turning off the ventilator.

Possible Cause

Battery disconnect button not fully depressed on power down.

Remedy

Depress button fully to cancel alarm.

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8. Symptom: Mains power fail alarm active even though connected to mains. Alarm Message: Main Power Fail.

Possible Cause

Mains power has failed.
The ventilators main power switch has been set to off.
Power supply has developed a fault.

Remedy

Restore mains power.
If mains is connected, power supply faulty. Replace power supply (See “M0900 Power Supply Unit” on page 41).

9. Symptom: Monitor failure alarm. Alarm Message: Monitor Fail.

Possible Cause

A hardware fault has developed within the control/monitor board or the ribbon cables between the control/monitor board and the CAN card.

Remedy

Check the ribbon cables.
Replace the control/monitor board. (See “A0736/02 Control & Monitor Board” on page 39).

10. Symptom: Sub ambient pressure alarm. Alarm Message: Sub Ambient Pressure.

Possible Cause

Failure of reverse pressure regulator PR3.

Remedy

Replace pressure regulator PR3. (See “N6623 or N6623/33 Pressure regulators (PR3 & PR4)” on page 69).

11. Symptom: Controller failure alarm. Alarm Message: Controller Not Responding. (Displayed below alarm panel).

Possible Cause

Controller services activated from user interface.

Remedy

Turn off the controller services function.

12. Symptom: System fail alarm. Alarm Message: System Fail (Memory Checksum Error).

Possible Cause

Error in the monitor software.

Remedy

Complete re-calibration of the ventilator monitor/controller subsystems.

13. Symptom: Controller alarm. Alarm Message: Controller Failure.

Possible Cause

Hardware fault in the controller subsystem or fault in the Controller/CAN link.
Fuse F4 on control/monitor board blown.

Remedy

Check the ribbon cables.
Replace the control/monitor board.
Replace fuse F4.

14. Symptom: No Gas alarm. Alarm Message: No Gas.

Possible Cause

Air and Oxygen supplies not connected to ventilator.
Air and Oxygen supply Failed.
Air and Oxygen supplies below 4bar.

Remedy

Connect Air and Oxygen supplies to ventilator.
Restore Air and Oxygen supplies.
Increase input pressure to 4bar.

15. Symptom: No Air or O_2 alarm. Alarm Message: No Air / No Oxygen.

Possible Cause

Gas supplies connected but Air and Oxygen supplies below 4bar.

Remedy

Increase input pressure to 4bar.
Calibration of input pressure regulators required.

16. Symptom: Battery fault alarm. Alarm Message: Battery Fault.

Possible Cause

Batteries have no charge.
Ventilator was turned off and on again in very short period of time.
The internal battery has failed or the power supply has developed a fault.

Remedy

Charge batteries.
Turn the ventilator off, wait minimum of 5 seconds before turning on again.
Check in-line fuse (10A) on battery wiring harness.
Check connections on batteries.
Replace batteries.
Replace power supply.

17. Symptom: Pressure sensor drift alarm. Alarm Message: Pressure Sensor Drift.

Possible Cause

A pressure sensor transducer has failed an internal system check.

Remedy

Re-calibrate the ventilator.
Replace Transducer PCB assembly. (See “A0761 Transducer PCB Assembly” on page 43).

18. Symptom: System fail alarm Alarm Message: System Fail with one of the following sub messages (Monitor Isolated System fail) or (Monitor Error Comms) or (Monitor Isol System Fail) or (Unable to calibrate flow ADC) or (Alarm controller Fail)

Possible Cause

Hardware fault in the monitor subsystem or fault in the monitor/CAN link.

Remedy

Check the CAN card ribbon cable.
Replace the control/monitor board.

19. Symptom: Faulty flow sensor alarm. Alarm Message: Faulty flow sensor.

Possible Cause

A flow sensor heated wire has broken.
Faulty flow sensor cable.
Loose connection in flow sensor wiring harness.
Defective control/monitor board.

Remedy

Replace flow sensor.
Replace flow sensor cable.
Inspect flow sensor wiring harness.
Replace the control/monitor board.

20. Symptom: User interface failure alarm. Alarm Message: User interface failure.

Possible Cause

Internal hardware reset has occurred.

Remedy

Re-start the ventilator.

21. Symptom: Fresh gas solenoid fail alarm. Alarm Message: Fresh Gas Solenoid Fail.

Possible Cause

Block and leak pressure transducer out of calibration.
Fresh gas solenoid fail.

Remedy

Calibrate block and leak pressure transducer.
Replace fresh gas solenoid SV7. (See “N2195/16 Fresh Gas Bypass Valve (SV7)” on page 58).

22. Symptom: Monitor/display comms fail alarm. Alarm Message: Monitor/display comms fail.

Possible Cause

Hardware fault in the monitor subsystem or fault in the monitor/CAN link.

Remedy

Check the CAN card ribbon cable.
Replace the control/monitor board.

23. Symptom: High Patient Leak alarm. Alarm message: High Patient Leak

Possible Cause

Flow sensor just within specification.

Remedy

Replace flow sensor.

24. Symptom: Ventilator locking up on power up. Start up routine does not progress beyond SLE logo.

Possible Cause

Bios battery requires replacement.

Remedy

Replace Bios battery (See “BIOS battery” on page 35).

25. Symptom: Extended boot up time or boot up stops requesting “Press F1 to resume”.

Possible Cause

BIOS battery on PC Board requires replacement.

Remedy

Replace Bios battery (See “BIOS battery” on page 35).

26. Symptom: Set PIP / PEEP pressure do not meet delivered pressures.

Possible Cause

Tolerance of 1 mbar.
Pressure transducers out of calibration.
Forward and mean jets out of calibration.

Remedy

Re-calibrate pressure transducers.
Re-calibrate forward and mean jets.

27. Symptom: Set O_2% is not the same as displayed O_2%.

Possible Cause

O_2 cell has aged.
O_2 system requires calibration.
Two point calibration carried out with blender set to a value higher than 21%.
Blender fault.

Remedy

Carry out a two point calibration with the blender set to 21%.
Measure the%O_2 from the fresh gas port. If the external analyser reading reads the same as the set, replace O_2 cell.
Measure the%O_2 from the fresh gas port. If the external analyser reading differs from the set, replace the blender.

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Software Version History

19. Software Version History

The following is a list of software versions used on the SLE4000 and SLE 5000 infant ventilators.

19.1 SLE4000 Software

Version 3 software breakdown as displayed on version information panel.
Display subsystem: 121203-4, Controller Hardware: 2, Controller Software: 28, Controller checksum: 89, Monitor software Non Isol: 128, Monitor software Isol: 105

Version 3.2 software breakdown as displayed on version information panel.
Display subsystem: 270105-4, Controller Hardware: 2, Controller Software: 28, Controller checksum: 89, Monitor software Non Isol: 130, Monitor software Isol: 105

Version 3.3 software breakdown as displayed on version information panel.
Display subsystem: 230305-4, Controller Hardware: 2, Controller Software: 28, Controller checksum: 89, Monitor software Non Isol: 132, Monitor software Isol: 107

Version 4 software breakdown as displayed on version information panel.
Display subsystem: 181005-4, Controller Hardware: 2, Controller Software: 30, Controller checksum: 185, Monitor software Non Isol: 135, Monitor software Isol: 108

Version 4.1 software breakdown as displayed on version information panel.
Display subsystem: 170306-4, Controller Hardware: 2, Controller Software: 31, Controller checksum: 109, Monitor software Non Isol: 136, Monitor software Isol: 109
Version 4.1.1software breakdown as displayed on version information panel.
For ventilators SNº51734 onwards.
Display subsystem: 170306-4, Controller Hardware: 2, Controller Software: 31, Controller checksum: 109, Monitor software Non Isol: 136, Monitor software Isol: 110

19.2 SLE5000 Software

Version 1 software breakdown as displayed on version information panel.
Display subsystem: 21-March-2003, Controller Hardware: 2, Controller Software: 24, Controller checksum: 213, Monitor software Non Isol: 123, Monitor software Isol: 104

Version 2 software breakdown as displayed on version information panel.
Display subsystem: 23-07-03, Controller Hardware: 2, Controller Software: 26, Controller checksum: 223, Monitor software Non Isol: 125, Monitor software Isol: 105

Version 3 software breakdown as displayed on version information panel.
Display subsystem: 19-11-03, Controller Hardware: 2, Controller Software: 28, Controller checksum: 89, Monitor software Non Isol: 128, Monitor software Isol: 105

Version 3.1 software breakdown as displayed on version information panel.
Display subsystem: 19-11-03, Controller Hardware: 2, Controller Software: 28, Controller checksum: 89, Monitor software Non Isol: 128, Monitor software Isol: 107

Version 3.2 software breakdown as displayed on version information panel.
Display subsystem: 270105-5, Controller Hardware: 2, Controller Software: 28, Controller checksum: 89, Monitor software Non Isol: 130, Monitor software Isol: 107

Version 3.3 software breakdown as displayed on version information panel.
Display subsystem: 230305-5, Controller Hardware: 2, Controller Software: 28, Controller checksum: 89, Monitor software Non Isol: 132, Monitor software Isol: 107

Version 4 software breakdown as displayed on version information panel.
Display subsystem: 181005-5, Controller Hardware: 2, Controller Software: 30, Controller checksum: 185, Monitor software Non Isol: 135, Monitor software Isol: 108

Version 4.1 software breakdown as displayed on version information panel.
Display subsystem: 170306-5, Controller Hardware: 2, Controller Software: 31, Controller checksum: 109, Monitor software Non Isol: 136, Monitor software Isol: 109
Version 4.1.1software breakdown as displayed on version information panel.
For ventilators SNº51734 onwards.
Display subsystem: 170306-5, Controller Hardware: 2, Controller Software: 31, Controller checksum: 109, Monitor software Non Isol: 136, Monitor software Isol: 110

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Technical Information

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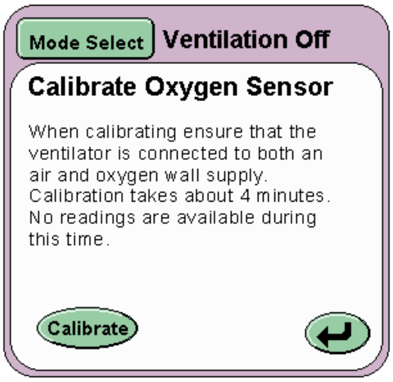
20. Oxygen Calibration Routines

The SLE5000 ventilator has two oxygen cell calibration routines. The first calibration is the 100% oxygen calibration (**One Point**). This calibration is carried at the following intervals after the unit is turned on: 0.5 min.(V3.3) or 10 min.(V3.2) , 30 minutes, 60 minutes, 90 minutes and then at 8 hourly intervals.

The second routine is the 21% and 100% oxygen calibration (**Two Point**). This calibration should only be carried out if the oxygen cell has been replaced or has registered below 21% (cell drifting with age).

20.1 One point or 100% Oxygen system calibration

The user can carry out a one point calibration of the system by accessing the oxygen senor calibration panel from the services panel from the user interface.



The ventilator can be connected to a patient for this calibration.

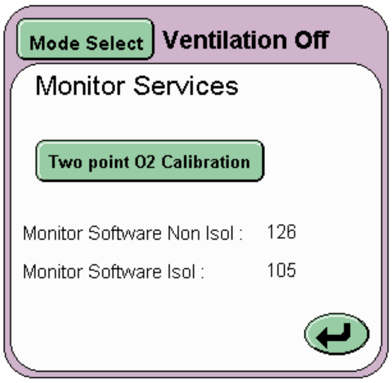
The FiO_2 measured value will read **CALIB** in the FiO_2 parameter control until the routine is complete.

20.2 Two point or 21% & 100% Oxygen system calibration

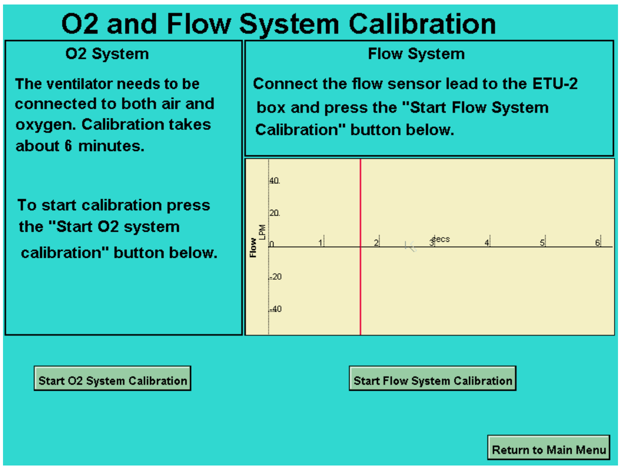
Note: Only qualified service personnel should carry out the following two point calibration.

The two point calibration process can be started via two controls.

The first is through the user interface from the **Monitor Services** panel.



The second through the engineering mode software from the **O_2 & Flow System Calibration** screen.



Warning: The user must not carry out the two point calibration whilst connected to a patient. The Calibration process will deliver 21% O_2 to the patient for 7 minutes.

Warning: (For version 3 to 3.3 software)The user must set the blender to 21% before commencing with the two point calibration when calibrating from the user interface. Failure to set the blender to 21% will cause the ventilator to display an oxygen cell exhausted alarm. This alarm can only be cleared by running the calibration process again with the blender set at 21%. From the enginneering mode the blender is automatically set to 21%.

Pressing the **Two Point O2 Calibration** button the user will have to wait 7 minutes before carrying out any new operation.

From the user interface the user the FiO_2 measured value will read **CALIB** in the FiO_2 parameter control until the routine is complete.

Note:(For versions 3 to 3.2). From the engineering mode the user will not see any indication that the calibration is complete.

21. Alarms

21.1 Alarm Protocols

The following descriptions summarizes the alarms to be generated by the ventilator. The alarms are sorted by their priority ratings. An alarm of a higher priority can interrupt a lower priority alarm, effectively, masking lower priority alarms. Upon the generation of alarms a message indicating the type of alarm will be displayed and then an audible alarm with the correct priority level is generated.

Some alarms are mutable, the mute interval being 1 minute.

21.2 Alarm Sounds

The ventilator produces four types of alarm tones. Three pulsed tones and one continuous.

The three pulsed tones correspond to the alarm sounder priorities, **High**, **Medium** and **Low**.

The pulsed tones are generated when the ventilator encounters an alarm condition. All the generated pulsed tone alarms are accompanied by visual alarm indication.

The High alarm sounder consists of 3 bleeps followed by 2 bleeps which is repeated once with a 10 second gap before restarting.

The Medium alarm sounder consists of 3 bleeps followed by a 20 second gap.

The Low alarm sounder consists of 1 bleep followed by a 10 second gap.

In Ventilation Off mode or when the ventilator is set to Standby all alarm sounds are muted to the minimum setting (1).

When changing between modes, for any alarms that have been triggered the alarm sounder volume is set to its minimum setting, for a period of 10 seconds. After the 10 seconds has expired the volume will return to the user set value.

Note: In a mains power fail situation the user will hear two high priority alarms. The ventilator's power supply generates its own alarm as a backup to the main alarm. The difference between the two sounds is that the power supply alarm is of a higher pitch.

The continuous tone is generated in a complete power fail situation, where the mains supply and the back-up battery supply both fail.

21.3 Alarm Descriptions and actions to be taken

Alarm 1. Monitor Failure

Alarm message.................................... Monitor failure
Alarm sub message .... Remove ventilator from service
Priority of alarm.................................. 1
Monitor mode....................................... N/A
Can alarm be muted .... No
Sounder Priority .... High
Alarm Description:
If the monitor system fails this alarm is generated by the controller system.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 2. Sustained Sub-ambient Pressure

Alarm message.................................... Sustained sub ambient pressure
Alarm sub message .... Controller operation temporarily disabled
Priority of alarm.................................. 2
Monitor mode....................................... All
Can alarm be muted .... No
Sounder Priority .... High
Alarm Description:

If the proximal pressure falls below -2mbar for $\geq$50ms a sub-ambient alarm is generated and a message will be sent to the control sub-system to shut off all gasses. If the gas is not cut-off during the next 50ms the monitor will intervene and cut all the gasses. Fresh gas reinstated after 6 seconds ventilation restarted after a further 2 seconds.

In all HFO modes it is the mean pressure that is checked for sub-ambient level.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 3. Sub-ambient Pressure

Alarm message ....Sub ambient pressure
Alarm sub message ....Safety shutdown activated and ventilator restarting
Priority of alarm 3
Monitor mode ....All
Can alarm be muted ....No
Sounder Priority...................................High
Alarm Description:

If the proximal pressure falls below -2mbar for <50ms a sub-ambient alarm is generated but mean pressure is maintained. Fresh gas maintained for 6 seconds ventilation restarted after a further 2 seconds.

In all HFO modes it is the mean pressure that is checked for sub-ambient level.

Action: Check patient. Adjust ventilation parameters. If a alarm continues to be triggered remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 4. Controller Failure

Alarm message ....Controller failure
Alarm sub message ....Remove ventilator from service
Priority of alarm 4
Monitor mode ....All
Can alarm be muted ....No
Sounder Priority...................................High
Alarm Description:

The controller sub-system sends life-ticks at regular intervals to the monitor. If the above life ticks are interrupted for more than a prescribe time it will be assumed that the controller sub-system is not functioning properly and the “Controller Error” alarm will be generated. Any system error message received from the controller will also activate this alarm.

After the generation of the alarm all gasses to the patient will be cut-off.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 5. 101 System Fail (Memory Checksum Error)

Alarm message.................................... Monitor EEPROM fail
Alarm sub message .... Monitor checksum Fail
Alarm code.. 101
Priority of alarm.................................. 5
Monitor mode...................................... All
Can alarm be muted .... No
Sounder Priority .... High
Alarm Description:
At power up flow data in EEPROM corrupt.
Action: Remove ventilator from service.

Alarm 6. 102 System Fail (Memory Checksum Error)

Alarm message.................................... Monitor EEPROM fail
Alarm sub message .... Monitor checksum Fail
Alarm code.. 102
Priority of alarm.................................. 6
Monitor mode...................................... All
Can alarm be muted .... No
Sounder Priority .... High
Alarm Description:
At power up oxygen data in EEPROM corrupt.
Action: Remove ventilator from service.

Alarm 7. 103 System Fail (Memory Checksum Error)

Alarm message.................................... Monitor EEPROM fail
Alarm sub message .... Monitor checksum Fail
Alarm code.. 103
Priority of alarm.................................. 7
Monitor mode...................................... All
Can alarm be muted .... No
Sounder Priority .... High
Alarm Description:
At power up pressure offset data in EEPROM corrupt.
Action: Remove ventilator from service.

Alarm 8. 104 System Fail (Memory Checksum Error)

Alarm message ....Monitor EEPROM fail
Alarm sub message ....Monitor checksum Fail
Alarm code 104
Priority of alarm 8
Monitor mode ....All
Can alarm be muted ....No
Sounder Priority..................................High
Alarm Description:
At power up pressure gain data in EEPROM corrupt.
Action: Remove ventilator from service.

Alarm 9. 105 System Fail (Memory Checksum Error)

Alarm message ....Monitor EEPROM fail
Alarm sub message ....Monitor checksum Fail
Alarm code 105
Priority of alarm 9
Monitor mode ....All
Can alarm be muted ....No
Sounder Priority..................................High
Alarm Description:
At power up pressure time constant data in EEPROM corrupt.
Action: Remove ventilator from service.

Alarm 10. Controller Failure

Alarm message ....Controller Failure
Alarm sub message ....Controller has reset unexpectedly
Priority of alarm 10
Monitor mode ....All
Can alarm be muted ....No
Sounder Priority..................................High
Alarm Description:
If a command could not be sent to the alarm generator this message is produced.
Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 11. Continuing Positive Pressure

Alarm message.................................... Continuing positive pressure
Alarm sub message .... Check patient circuit
Priority of alarm.................................. 11
Monitor mode...................................... All
Can alarm be muted .... Yes
Sounder Priority .... High
Alarm Description:
When the ventilator detects a increase of 5mbar above the PEEP that is maintained for more than 10 seconds this alarm is generated.

Action: Check patient. Check patient circuit.

Alarm 12. High Pressure

Alarm message.................................... High pressure
Alarm sub message .... High pressure threshold exceeded
Priority of alarm.................................. 12
Monitor mode...................................... All
Can alarm be muted .... Yes
Sounder Priority .... High
Alarm Description:
If the proximal pressure is above the set high-pressure level this alarm is generated.
If the proximal pressure is more than 5mbar above the high-pressure level an additional command is sent to the control sub-section to cut the gasses.

Action: Check patient. Adjust ventilation parameters or high alarm threshold.

Alarm 13. Low Pressure

Alarm message.................................... Low Pressure
Alarm sub message .... Pressure below low threshold
Priority of alarm.................................. 13
Monitor mode...................................... All
Can alarm be muted .... Yes
Sounder Priority .... High
Alarm Description:
If the proximal pressure is below the users settable low-pressure level this alarm is generated.

Action: Check patient. Adjust ventilation parameters or low alarm threshold. Check patient circuit & water trap.

Alarm 14. Pressure Change Detected

Alarm message ....**Pressure Change Detected**
Alarm sub message ....**Check Patient Connection**
Priority of alarm **14**
Monitor mode ....**HFO+CMV only**
Can alarm be muted ....**Yes**
Sounder Priority....................................**High**
Alarm Description:
When the user changes a pressure related parameter the ventilator stores the maximum inspiration and expiration pressure values. On a maximum pressure change greater than 2mbar from the stored value this alarm is generated.

Action: Check patient. Check patient circuit.

Alarm 15. Failure To Cycle

Alarm message ....**Cycle Fail**
Alarm sub message ....**Mechanical breath not detected at ET**
Priority of alarm **15**
Monitor mode ....**All**
Can alarm be muted ....**Yes**
Sounder Priority....................................**High**
Alarm Description:
If during each ventilator cycle the proximal pressure fails to go above and then below the user selected fail to cycle threshold this alarm is generated.

Action: Check patient. Adjust ventilation parameters or cycle fail alarm threshold. Check patient circuit & water trap.

Alarm 16. Pressure Sensor Drift

Alarm message ....**Pressure sensor drift**
Alarm sub message ....**Drift in prox pressure sensor detected**
Priority of alarm **16**
Monitor mode ....**All**
Can alarm be muted ....**Yes**
Sounder Priority....................................**High**
Alarm Description:
If the readings from two pressure transducers differ by more than 5 mbar this alarm is generated.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 17. Unexpected Rise in Mean P

Alarm message................................... Unexpected rise in mean P
Alarm sub message .... Press autoset to adjust HFO alarms to new pressures
Priority of alarm.................................. 17
Monitor mode...................................... HFO Only
Can alarm be muted .... Yes
Sounder Priority .... High
Alarm Description:
When the ventilator set alarm threshold of 5mbar above the mean pressure level is crossed this alarm is generated.

Action: Check patient. Press autoset or adjust ventilation parameters.

Alarm 18. Unexpected Drop in Mean P

Alarm message................................... Unexpected drop in mean P
Alarm sub message .... Press autoset to adjust HFO alarms to new pressures
Priority of alarm.................................. 18
Monitor mode...................................... HFO Only
Can alarm be muted .... Yes
Sounder Priority .... High
Alarm Description:
When the ventilator set alarm threshold of 5mbar below the mean pressure level is crossed this alarm is generated.

Action: Check patient. Press autoset or adjust ventilation parameters.
Check patient circuit & water trap.

Alarm 19. Unexpected Rise in Max P

Alarm message................................... Unexpected rise in max P
Alarm sub message .... Press autoset to adjust HFO alarms to new pressures
Priority of alarm.................................. 19
Monitor mode...................................... HFO Only
Can alarm be muted .... Yes
Sounder Priority .... High
Alarm Description:
When the ventilator set alarm threshold of 5mbar above the max pressure is crossed this alarm is generated.

Action: Check patient. Press autoset or adjust ventilation parameters.

Alarm 20. Unexpected Drop in Max P

Alarm message ....**Unexpected drop in max P**
Alarm sub message ....**Press autoset to adjust HFO alarms to new pressures**
Priority of alarm **20**
Monitor mode ....**HFO Only**
Can alarm be muted ....**Yes**
Sounder Priority...................................**High**
Alarm Description:
When the ventilator set alarm threshold of 5mbar below the max pressure is crossed this alarm is generated.

Action: Check patient. Press autoset or adjust ventilation parameters. Check patient circuit & water trap.

Alarm 21. Unexpected Rise in Min P

Alarm message ....**Unexpected rise in min P**
Alarm sub message ....**Press autoset to adjust HFO alarms to new pressures**
Priority of alarm **21**
Monitor mode ....**HFO Only**
Can alarm be muted ....**Yes**
Sounder Priority...................................**High**
Alarm Description:
When the ventilator set alarm threshold of 5mbar above the min pressure is crossed this alarm is generated.

Action: Check patient. Press autoset or adjust ventilation parameters.

Alarm 22. Unexpected Drop in Min P

Alarm message ....**Unexpected drop in min P**
Alarm sub message ....**Press autoset to adjust HFO alarms to new pressures**
Priority of alarm **22**
Monitor mode ....**HFO Only**
Can alarm be muted ....**Yes**
Sounder Priority...................................**High**
Alarm Description:
When the ventilator set alarm threshold of 5mbar below the min pressure is crossed this alarm is generated.

Action: Check patient. Press autoset or adjust ventilation parameters.

Alarm 23. No Gas

Alarm message.................................... No gas
Alarm sub message .... Connect ventilator to gas
Priority of alarm................................... 23
Monitor mode....................................... All
Can alarm be muted .... No
Sounder Priority .... High
Alarm Description:

If no gas is detected by the ventilator this alarm is generated.

Action: Connect gas supplies to ventilator. If generated whilst connected to a patient, remove patient to alternative form of ventilation.

Alarm 24. No O_2 Supply

Alarm message.................................... No O2 supply
Alarm sub message .... Connect oxygen supply to ventilator
Priority of alarm................................... 24
Monitor mode....................................... All
Can alarm be muted .... No
Sounder Priority .... High
Alarm Description:

If no O_2 is detected by the ventilator this alarm is generated.

Action: Connect gas supplies to ventilator. If generated whilst connected to a patient, remove patient to alternative form of ventilation.

Alarm 25. No Air Supply

Alarm message.................................... No air supply
Alarm sub message .... Connect air supply to ventilator
Priority of alarm................................... 25
Monitor mode....................................... All
Can alarm be muted .... No
Sounder Priority .... High
Alarm Description:

If no Air is detected by the ventilator this alarm is generated.

Action: Connect gas supplies to ventilator. If generated whilst connected to a patient, remove patient to alternative form of ventilation.

Alarm 26. Battery Fault

Alarm message ....Battery fault
Alarm sub message ....Internal battery not detected
Priority of alarm 26
Monitor mode ....All
Can alarm be muted ....No
Sounder Priority...................................High
Alarm Description:

The battery can not be detected by the ventilators monitoring system

Action: Remove ventilator from service. The ventilator will continue to ventilate on mains power if connected to a patient.

Alarm 27. Battery Low

Alarm message ....Battery Low
Alarm sub message ....Remove patient from ventilator
Priority of alarm 27
Monitor mode ....All
Can alarm be muted ....No
Sounder Priority...................................High
Alarm Description:

The battery low signal from the power supply sub-system is monitored while the system is running on battery. When the signal is asserted an alarm indicating imminent power failure is generated.

Action: Reconnect power mains power if available. If not available remove patient to alternative form of ventilation immediately.

Alarm 28. Blocked Fresh Gas

Alarm message ....Blocked fresh Gas
Alarm sub message ....Fresh gas supply to patient may be blocked
Priority of alarm 28
Monitor mode ....All
Can alarm be muted ....No
Sounder Priority...................................High
Alarm Description:

If the fresh gas supply is blocked this alarm is generated.

Action: Check patient circuit.

Alarm 29. Leaking Fresh Gas

Alarm message .... **Leaking fresh gas**
Alarm sub message .... **Fresh gas supply to patient may be leaking**
Priority of alarm **29**
Monitor mode .... **All**
Can alarm be muted .... **No**
Sounder Priority .... **High**
Alarm Description:

If the fresh gas supply is detected to be leaking this alarm is generated.

Action: Check patient circuit.

Alarm 30. System Fail (Serial Communication Error)

Alarm message .... **System fail**
Alarm sub message .... **Monitor error (comms)**
Priority of alarm **30**
Monitor mode .... **Flow**
Can alarm be muted .... **Yes**
Sounder Priority .... **High**
Alarm Description:
Errors detected within the flow monitoring device.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 31. System Fail (Isolate System Error)

Alarm message .... **System Fail**
Alarm sub message .... **Monitor isolated system fail**
Priority of alarm **31**
Monitor mode .... **Flow**
Can alarm be muted .... **Yes**
Sounder Priority .... **High**
Alarm Description:
Errors detected within the flow monitoring device.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 32. Flow Monitor (Flow ADC Unable to Calibrate)

Alarm message .... System Fail
Alarm sub message .... Unable to calibrate flow ADC
Priority of alarm 32
Monitor mode .... Flow
Can alarm be muted .... Yes
Sounder Priority .... High
Alarm Description:
Errors detected within the flow monitoring device.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 33. Flow Monitor (Flow Sensor Defect)

Alarm message .... Faulty Flow Sensor
Alarm sub message .... Flow sensor defective
Priority of alarm 33
Monitor mode .... Flow
Can alarm be muted .... Yes
Sounder Priority .... Medium
Alarm Description:
If one of the flow sensor wires break this alarm is generated.

Action: Replace and discard the defective flow sensor.

Alarm 34. Clean Flow Sensor

Alarm message .... Clean flow sensor
Alarm sub message .... Flow sensor contaminated
Priority of alarm 34
Monitor mode .... Flow
Can alarm be muted .... Yes
Sounder Priority .... Medium
Alarm Description:
If the measured flow is >15LPM for 3.5 seconds this alarm is generated.

Action: Recalibrate or replace with clean flow sensor.

Alarm 35. Connect Flow Sensor

Alarm message.................................... Connect flow sensor
Alarm sub message .... Flow sensor is not connected
Priority of alarm................................... 35
Monitor mode....................................... Flow
Can alarm be muted .... Yes
Sounder Priority .... Medium
Alarm Description:
If the sensor is not connected or both wires have been broken this alarm is generated.
Action: Connect flow sensor, if sensor already in situ replace and discard the defective flow sensor.

Alarm 36. Cannot Calibrate Flow

Alarm message.................................... Flow calibration fail
Alarm sub message .... Unable to calibrate flow sensor
Priority of alarm................................... 36
Monitor mode....................................... Flow
Can alarm be muted .... Yes
Sounder Priority .... Medium
Alarm Description:
If calibrating flow fails for any reason this alarm is generated.
Action: Replace flow sensor.

Alarm 37. Calibrate Flow Sensor

Alarm message.................................... Calibrate flow sensor
Alarm sub message .... Calibrate flow sensor now
Priority of alarm................................... 37
Monitor mode....................................... Flow
Can alarm be muted .... Yes
Sounder Priority .... Medium
Alarm Description:
The above alarm is generated whenever the ventilator is turned ON or upon the re-connection of the flow sensor.
Action: Carry out flow sensor calibration routine.

Alarm 38. User Interface Failure

Alarm message ....User interface failure
Alarm sub message ....User interface has reset unexpectedly
Priority of alarm 38
Monitor mode ....All
Can alarm be muted ....Yes
Sounder Priority...................................High
Alarm Description:
When a hardware reset has taken place within the ventilator this alarm is generated.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 39. High Min. Volume

Alarm message ....High min. volume
Alarm sub message ....Minute volume high threshold exceeded
Priority of alarm 39
Monitor mode ....Flow
Can alarm be muted ....Yes
Sounder Priority...................................High
Alarm Description:
Minute volumes that are higher than the user-selected thresholds generate this alarm.

Action: Check patient. Adjust ventilation parameters or alarm threshold.

Alarm 40. Patient Leak

Alarm message ....High patient leak
Alarm sub message ....Check patient circuit
Priority of alarm 40
Monitor mode ....Flow
Can alarm be muted ....Yes
Sounder Priority...................................High
Alarm Description:
If the calculated patient leak is over user set threshold this alarm is generated.

Action: Check patient. Check patient circuit and ET tube. Adjust alarm threshold.

Alarm 41. Low Tidal Volume

Alarm message.................................... High tidal volume
Alarm sub message .... Tidal volume below low threshold
Priority of alarm.................................. 41
Monitor mode...................................... Flow
Can alarm be muted .... Yes
Sounder Priority .... High
Alarm Description:
Tidal volumes lower than a user-selected threshold will generate this alarm.

Action: Check patient. Adjust ventilation parameters or alarm threshold. Check patient circuit & water trap.

Alarm 42. High Tidal Volume

Alarm message.................................... Low tidal volume
Alarm sub message .... Tidal volume above high threshold
Priority of alarm.................................. 42
Monitor mode...................................... Flow
Can alarm be muted .... Yes
Sounder Priority .... High
Alarm Description:
Tidal volumes higher than a user-selected threshold will generate this alarm.

Action: Check patient. Adjust ventilation parameters or alarm threshold.

Alarm 43. Low Min. Volume

Alarm message.................................... Low min volume
Alarm sub message .... Minute volume below low threshold
Priority of alarm.................................. 43
Monitor mode...................................... Flow
Can alarm be muted .... Yes
Sounder Priority .... Medium
Alarm Description:
Minute volumes that are lower than the user-selected thresholds generate this alarm.

Action: Check patient. Check patient circuit & water trap. Adjust ventilation parameters or alarm threshold.

Alarm 44. Breath Not Detected

Alarm message ....Breath not detected
Alarm sub message ....Check patient connection
Priority of alarm 44
Monitor mode ....Flow
Can alarm be muted ....Yes
Sounder Priority...................................Medium
Alarm Description:
If after a machine delivered breath the ventilator does not detect a patient response within 10 seconds then this alarm is generated.

Action: Check patient. Check patient circuit & ET tube.

Alarm 45. Apnoea (Volume)

Alarm message ....Apnoea
Alarm sub message ....Period between breaths exceeds apnoea limit
Priority of alarm 45
Monitor mode ....Flow
Can alarm be muted ....Yes
Sounder Priority...................................High
Alarm Description:
If a breath is not detected within a user specified apnoea period, an apnoea alarm will be generated. The flow is used to detect a breath.

Action: Check patient. Check patient circuit. Adjust breath detection threshold.

Alarm 46. Apnoea (Pressure)

Alarm message ....Apnoea
Alarm sub message ....Period between breaths exceeds apnoea limit
Priority of alarm 39
Monitor mode ....Pressure
Can alarm be muted ....Yes
Sounder Priority...................................High
Alarm Description:
If a breath is not detected within a user specified apnoea period an apnoea alarm will be generated. The proximal pressure is used to detect a breath.

Action: Check patient. Check patient circuit. Adjust breath trigger sensitivity.

Alarm 47. Main Power Failure

Alarm message.................................... Main power fail
Alarm sub message .... Running on internal battery
Priority of alarm................................... 46
Monitor mode....................................... All
Can alarm be muted .... Yes
Sounder Priority .... High
Alarm Description:
If the mains supply fails this alarm is generated.

Action: Check mains connection. Prepare alternative form of ventilation whilst running on battery.

Alarm 48. Fresh Gas Solenoid Fail

Alarm message.................................... Fresh gas solenoid fail
Alarm sub message .... Remove ventilator from service
Priority of alarm................................... 47
Monitor mode....................................... All
Can alarm be muted .... Yes
Sounder Priority .... High
Alarm Description:
When the ventilator pressure transducer detects no gas from the solenoid this alarm is generated.

Action: Remove patient to alternative form of ventilation immediately, then remove ventilator from service.

Alarm 49. Oxygen Cell Discon. (Disconnected)

Alarm message.................................... Oxygen cell discon.
Alarm sub message .... The oxygen cell is not connected
Priority of alarm................................... 48
Monitor mode....................................... All
Can alarm be muted .... Yes
Sounder Priority .... Medium
Alarm Description:
A disconnection of the oxygen cell will generate this alarm.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 50. Calibrate Oxygen Cell

Alarm message .... **Calibrate oxygen cell**
Alarm sub message .... **The oxygen cell needs calibrating**
Priority of alarm **49**
Monitor mode .... **All**
Can alarm be muted .... **Yes**
Sounder Priority .... **Medium**
Alarm Description:
If at any time the measured oxygen is >100% this alarm will be generated.

Action: Recalibrate O_2 sensor. If alarm re-appears remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 51. Oxygen Cell Exhausted

Alarm message .... **Oxygen cell exhausted**
Alarm sub message .... **A new oxygen cell is required**
Priority of alarm **50**
Monitor mode .... **All**
Can alarm be muted .... **Yes**
Sounder Priority .... **Medium**
Alarm Description:
If the oxygen cell could not be calibrated during calibration this alarm will be generated.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 52. Oxygen Calibration Failure

Alarm message .... **O_2 calibration fail**
Alarm sub message .... **Check O_2 supply**
Priority of alarm **51**
Monitor mode .... **All**
Can alarm be muted .... **Yes**
Sounder Priority .... **Medium**
Alarm Description:
If during 100% oxygen calibration the measured oxygen level is below a certain level this alarm is generated.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 53. High Oxygen Level

Alarm message .... **High oxygen level**
Alarm sub message .... **The O_2 is higher than desired**
Priority of alarm **52**
Monitor mode .... **All**
Can alarm be muted .... **Yes**
Sounder Priority .... **High**
Alarm Description:
If the delivered oxygen differs from the user selected level by more than 5% the above alarm is generated.

Action: Recalibrate O_2 sensor. If alarm re-appears remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 54. Low Oxygen Level

Alarm message .... **Low oxygen level**
Alarm sub message .... **The O_2 is lower than desired**
Priority of alarm **53**
Monitor mode .... **All**
Can alarm be muted .... **Yes**
Sounder Priority .... **High**
Alarm Description:
If the delivered oxygen differs from the user selected level by more than 5% the above alarm is generated.

Action: Recalibrate O_2 sensor. If alarm re-appears remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 55. Monitor/Display Comms Fail

Alarm message .... **Monitor/display comms fail**
Alarm sub message .... **Call engineer**
Priority of alarm **54**
Monitor mode .... **All**
Can alarm be muted .... **No**
Sounder Priority .... **High**
Alarm Description:
When the ventilator detects a communications failure between the contoller and the monitor/display system this alarm is generated.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 56. Alarm Controller Fail

Alarm message .... **System Fail**
Alarm sub message .... **Alarm Controller Fail**
Priority of alarm **55**
Monitor mode .... **All**
Can alarm be muted .... **No**
Sounder Priority .... **High**
Alarm Description:
If the alarm controller fails this message is generated.

Action: Remove patient to alternative form of ventilation, then remove ventilator from service.

Alarm 57. Complete Power Fail Alarm

Type .... **Audible Only**
Can alarm be muted .... **No**
Alarm Description:
If both mains power and battery power fail this alarm is sounded.

Action: Remove patient immediately to alternative form of ventilation, then remove ventilator from service.

21.4 Software and System Fail Protocols

The ventilator has been specifically designed to minimize the risk of system failure and software programming error. This has been achieved by dividing the system into individual subsystems that can operate independently and manage themselves via a well defined and robust messaging system.

It is possible for the user interface to fail (no display), and the controller and monitor can continue to operate normally and ventilate the patient, although the user would not be able to change ventilation settings.

Furthermore the entire system is backed up from a rechargeable internal battery which is periodically monitored to check its integrity. If the battery is not detected then an alarm is provided. If the mains power fails then the system reverts to battery and an alarm for this condition is displayed. A further alarm sounder in the power supply itself also sounds independently of the monitor alarm. The battery voltage is also monitored during battery use and a threshold alarm is given when the battery starts to run low. This allows the patient to be transferred off the system before all power sources are exhausted. This also protects the battery from deep discharge damage.

22. Cleaning, disinfection and sterilization

All cleaning, disinfection and sterilizing should be carried out under the direction of the appropriate hospital authority.

DO NOT allow moisture to enter the electronic module or its electrical sockets. Electronic malfunction may result.

DO NOT steam autoclave the ventilator or otherwise subject it to temperatures above 62°C.

DO NOT immerse any part of the ventilator in any liquid, with the exception of the expiratory exhalation block (SLE part No N6622).

22.1 Preparation of a new ventilator

Remove all transit packaging. Inspect the fresh gas port and proximal airway port for any packing material. (Retain packaging for future use).

Remove the protective film from the touch screen.

Clean, disinfect and sterilize in accordance with the instructions in section 22.2 .

Remove the inlet air and O_2 gas port caps. (Retain for future use).

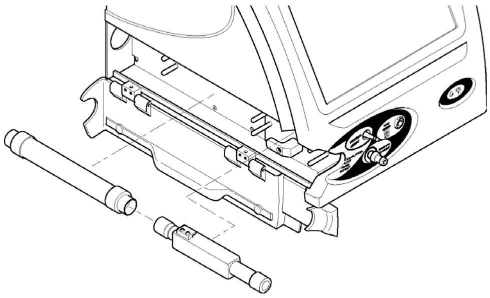
22.2 Cleaning and disinfection of an in-service ventilator

Table 1 outlines the areas of the ventilator which can be uniquely cleaned, disinfected and sterilized.

Before cleaning or disinfecting the exterior of the ventilator the following tasks should be performed:

- The mains cable should be disconnected from the mains supply.
- Remove the patient circuit and bacterial filters. Discard any single use items as per appropriate hospital authority guidelines. Reusable items should be processed as per appropriate hospital authority guidelines and the manufacturers instructions.
- Disconnect the gas supplies from the wall outlets.
- Disconnect the Oxygen and Air hoses from the ventilator and cap the inlet ports.
- Open the side flap.

- Unlock the exhalation block by turning the clamp through 90 degrees until it is horizontal.
- Gently pull away the exhalation block and silencer from the gas ports.
- Separate the silencer and exhalation block.



Refitting the silencer and exhalation block is the reversal of removal. **Do not force the exhalation block into place.**

22.2.1 Cleaning, Disinfection & Sterilization chart

Item	Clean	Disinfect	Sterilize
Ventilator	Yes	Yes	
Silencer			Yes
Flow sensor	Yes	Yes	Yes
Exhalation block	Yes	Yes	Yes

Table 1

Warning (General): Do not insert any object (such as a needle) in to the gas ports. This action will result in damage to the port. If the user believes there is a foreign object in a gas port, please refer the ventilator to qualified service personnel for inspection and repair.

Note: The silencer should be autoclaved only. If the silencer is found to have visual contamination internally, discard and replace with a new silencer.

22.3 Cleaning method

Note: Cleaning is an essential prerequisite to disinfection and sterilization.

Ventilator. For cleaning use three clean, disposable, absorbent, non-shedding cloths. Wipe clean with the first cloth using a hand hot water/mild general purpose detergent solution (as prescribed by the appropriate hospital authority). Do not overload the cloth with liquid. Remove the water/mild general purpose detergent solution with the second cloth using water only. Do not overload the cloth with liquid. Wipe dry with the remaining cloth. Care should be taken to ensure that the ventilator gas jets in the ports are not blocked by any debris.

Ensure that the detergent solution does not enter the unit or the exhalation block gas ports on the side of the machine.

(Touch Screen) Do not use any abrasive cleaners on the touch screen surface.

Flow Sensor
Wash in hand hot water/mild general purpose detergent solution (as prescribed by the appropriate hospital authority). Rinse with sterile water.

Warning: Do not clean the flow sensor with compressed air or water jet. As this will destroy the sensor wires

Exhalation block. The exhalation block can be immersed and agitated in the detergent solution. Do not insert any objects into the exhalation block. Rinse the exhalation block in clean water, it must be allowed to dry thoroughly before sterilization.

22.4 Disinfection method

Note: Alcohols such as 70% isopropanol have a good activity against bacteria and viruses. They should only be used after all visible surface dirt has been removed from the area to be disinfected.

Ventilator. For disinfection use two clean, disposable, absorbent, non-shedding cloths. Wipe clean with the first cloth using Alcohol (70% isopropanol). Wipe dry with the remaining cloth.

Flow Sensor
Immersion in disinfectant recommended for use with plastic materials. Immersion times and concentrations must be in accordance with manufacturers instructions. Rinse with sterile water.

Warning: Disinfectants containing compounds similar to PHENOL or ALKYLAMINES (Glucorrotamine) are unsuitable.

Exhalation block. The exhalation block can be immersed in Alcohol (70% isopropanol). The exhalation block must be allowed to dry thoroughly before sterilization.

22.5 Sterilization method

The silencer (N2186/01), flow sensor (N5201) and exhalation block (N6622) must be sterilized between use on patients. The ventilator cannot be sterilized.

The exhalation block must be cleaned as an essential prerequisite to sterilization.

For the **silencer**, **flow sensor** and **exhalation block**.

Autoclave with pure dry saturated steam at:

134ºC (277ºF) (Allowable variation of temperature of +3ºC) at 220kPa (32psi) with a minimum holding time of 3 minutes

or

121ºC (248ºF) (Allowable variation of temperature of +3ºC) at 96kPa (14.1psi) with a minimum holding time of 15 minutes.

The silencer can be autoclaved up to 20 times. The body of the silencer should be marked after each autoclave cycle with a high temperature, water proof, permanent maker to indicate number of sterilization cycles completed.

For the **flow sensor** only.

Ethylene Oxide at 55ºC (131ºF) plus the recommended time for aeration

23. Technical Specification

This section summarizes the specification of the ventilator in terms of the modes, ranges and limits that are required on the controls and the displays. It also summarizes the mechanical and electrical power constraints.

23.1 Operating Modes Conventional Ventilation

23.1.1 CPAP

Inspiratory Time:	0.1 to 3.0 seconds, steps of 0.01 seconds
CPAP Pressure:	0 mbar to 20 mbar
Inspiratory Pressure:	0 mbar to 65 mbar
Volume Targeting:	2 ml to 200 ml
FiO_2:	21% to100%

Backup breaths are pressure limited, time cycled.

23.1.2 CMV

BPM:	1 to 150
I:E Ratio:	Calculated from BPM and Inspiratory time settings. (11.2:1 to 1:600)
Inspiratory Time:	0.1 to 3.0 seconds, steps of 0.01 seconds
PEEP Pressure:	0 mbar to 20 mbar
Inspiratory Pressure:	0 mbar to 65 mbar
Volume Targeting:	2 ml to 200 ml
FiO_2:	21% to 100%

Breaths can be pressure limited, time cycled or pressure limited, flow cycled.

23.1.3 PTV

Inspiratory Time:	0.1 to 3.0 seconds, steps of 0.01 seconds
CPAP Pressure:	0 mbar to 20 mbar
Inspiratory Pressure:	0 mbar to 65 mbar
Volume Targeting:	2 ml to 200 ml
FiO_2:	21% to 100%

Backup breaths are pressure limited, time cycled.

23.1.4 PSV

Inspiratory Time:	0.1 to 3.0 seconds, steps of 0.01 seconds
CPAP Pressure:	0 mbar to 20 mbar
Inspiratory Pressure:	0 mbar to 65 mbar
Volume Targeting:	2 ml to 200 ml
FiO_2:	21% to 100%

Backup breaths are pressure limited, time cycled.

23.1.5 SIMV

BPM:	1 to 150
I:E Ratio:	Calculated from BPM and Inspiratory time settings. (11.2:1 to 1:600)
Inspiratory Time:	0.1 to 3.0 seconds, steps of 0.01 seconds
PEEP Pressure:	0 mbar to 20 mbar
Inspiratory Pressure:	0 mbar to 65 mbar
Volume Targeting:	2 ml to 200 ml
FiO_2:	21% to 100%

Breaths are flow cycled pressure limited. Backup breaths are time cycled pressure limited.

23.2 HFO Ventilation

23.2.1 HFO Only

Frequency Range:	3-20Hz. (1Hz resolution.)
I:E Ratio	1:1
Delta Press Range:	4 mbar to 180 mbar
Mean airway range:	0 mbar to 35 mbar maximum
FiO_2:	21% to 100%

23.2.2 HFO+CMV

BPM:	1 to 150
Inspiratory Time:	0.1 to 3.0 seconds, steps of 0.01 seconds
Frequency Range:	3-20Hz. (1Hz resolution.)
I:E Ratio	Calculated from BPM and Inspiratory time settings. (11.2:1 to 1:600)
Inspiratory Pressure:	0 mbar to 65 mbar
Delta Press Range:	4 mbar to 180 mbar
Mean airway range:	0 mbar to 35 mbar maximum
FiO_2:	21% to 100%

23.2.3 Controls (Via touch screen display)

Adjust button:	Activates alarm thresholds for modification
Alarm Auto-Track button:	Sets selected %0_2 for testing
Apnea Sup Button:	Sends diagnostic pulse
Apnoea setup button:	Activates Backup/Apnea settings panel
Arrow buttons:	Increments value
Auto set Button:	Autoset high, cycle and low alarm thresholds
Backup parameter control:	1 to 150 bpm
Begin psv Button:	Sends diagnostic pulse
BPM parameter control:	1 to 150 bpm
Calibrate button:	Calibrates flow sensor
Calibrate Flow Sensor button:	Activates calibrate flow sensor panel
Camera button:	Stores a loop to memory
CMV button:	Selects CMV mode
Confirm button:	Confirms selection
Continue without flow button:	Selects pressure monitoring operation
Continuous HFO button:	Selects oscillations in both inspiratory and expiratory phases.
Controller button:	Activates controller services panel
CPAP button:	Selects CPAP mode
CPAP parameter control:	0 to 20 mbar
Delta P parameter control:	4 to 180 mbar
Default button	Returns the waveform display to default layout.
End psv button:	Sends diagnostic pulse
Expiratory Only button:	Selects oscillations in expiratory phase only
F/P button:	Selects flow versus pressure loop display
F/V button:	Selects flow versus volume loop display
FiO_2 button:	Selects fractional concentration of inspired oxygen against time display
FiO_2 parameter control:	21% to 100%

Flow button:	Activates flow sensor calibration panel
Folder button:	Retrives loop from memory
Graphs button:	Activates waveform and loops panels
HFO activity button:	Activates HFO activity panel
HFO Only button:	Selects HFO only mode
HFO rate parameter control:	3 to 20 Hz
HFO+CMV button:	Selects HFO+CMV mode
Hist. button:	Display alarm history panel
Langauage button:	Change interface langauge
Manual Breath button:	Delivers one manual breath
Mean parameter control:	0 to 35 mbar
Min Vol button:	Selects minute volume against time display
Mode select button:	Activates mode select panel
Monitor button:	Activates monitor services panel
Monitor Pressure Button:	Toggles between waveforms, diagnostic use only
Mute button:	Mutes a mutable alarm for 1 minute.
Next button:	Activates next panel
Night and screen lock button:	Activates night mode for LCD
ON/OFF button:	Toggles function state between on and off
Options and service data button:	Activates calibration options panel
Oxygen alarm test button:	Activates Oxygen Alarm testing panel
Oxygen button:	Activates oxygen sensor calibration panel
P Max button:	Selects maximum pressure against time display
P Mean button:	Selects mean pressure against time display
P Min button:	Selects minimum pressure against time display
Pause/Play button:	Freezes & unfreezes waveform display (60 secs max)
PEEP parameter control:	0 to 20 mbar
PIP parameter control:	0 to 65 mbar

Picture capture button	Stores loop to memory
PSV button:	Selects PSV mode
PSV Setup: button:	Activates pressure support panel
PTV button:	Selects PTV mode
Reset button:	Resets current alarm
Reset contamination alarm button:	Resets the alarm
Return button:	Returns to previous panel
Select button:	Tabs between time and date values
Set BPM button:	Selects BPM against time display
Set time and date button:	Activates time and date panel
Set Trigger button	Activates breath detection trigger threshold
SIMV button:	Selects SIMV mode
Standby button:	Sets ventilator into 90 second standby mode
Stored loop button	Displays stored loops
Ti parameter: control:	0.1 to 3 seconds
Tidal vol parameter: control:	2 to 200 ml
TTV button:	Selects TTV on/off panel
Two point O_2 calibration button:	Activates calibrates O_2 system
Ventilation Off button:	Selects ventilation off mode
Version button:	Activates version information panel
Vmin	Selects minute volume against time display
V/P button:	Selects volume versus pressure loop display
Vte button:	Selects tidal volume against time display
Waveform display sync button:	Toggles waveform display synchronization
Waveshaping button:	Activates change wave shape panel
Zero button:	Zeros seconds
Zoom in button	Zooms in on a trend display
Zoom out button	Zooms out of a trend display

23.2.4 Controls

Battery power termination	Terminates backup battery power supply
ON/OFF:	Control for mains power supply

23.3 Measurement

23.3.1 Flow and Volume

Flow Sensor Type:	10 mm dual-hot-wire-anemometer with replaceable hot-wire subassembly, autoclaveable. Sensor electrically isolated.
Flow Rate:	0.2 lpm to 32 lpm (Accuracy ±8 % maximum)
Expiratory Tidal Volume:	
	0 to 999ml (0.1ml)
Expiratory Minute Volume:	
	0 to 18L (Resolution: 1ml)
Deadspace:	1 ml
Weight:	10 g

Conventional Ventilation and combined modes only:

Tube Leakage:	0 to 50% (Resolution: 5%)
	Averaged over 5 breaths
Breath Rate (total):	0 to 250 BPM (Resolution: 1BPM)
Dynamic Compliance:	0 to 100ml/mbar (Resolution: 1ml/mbar)
C20/C:	Resolution 0.1
Sampling Time:	2ms
Resistance:	0 to 1000 mbar.second/l
Triggering:	Inspiratory flow (0.2 to 10 lpm)

Above values are obtained under ATPD (ambient temperature and pressure, dry) conditions.

HFO only:

$DC0_2$:	Resolution 1

23.3.2 Oxygen Concentration

Range:	21% to 100% (Resolution 1%)

23.3.3 Pressure

Real Time Pressure:	Resolution 1mbar
Drift detection:	detects drift when there is a pressure difference of more than 5mbar between the two pressure transducers. Only active when the measured pressure is below 70mbar.
Sampling Time:	2ms
Peak Pressure:	0 to 175 mbar (resolution 1mbar)
PEEP Pressure:	0 to 175 mbar (resolution 1mbar)
Mean Pressure:	-175 to 175 mbar (resolution 1mbar).
Delta P	In HFO combined mode Delta P is measured during expiration only.

23.4 Alarms

23.4.1 User settable Alarms

High Pressure:

Autoset when patient pressure controls are adjusted, or manually adjustable.

Range:	10 to 110 mbar
Resolution:	0.5 mbar

Cycle Fail:

Autoset when patient pressure controls are adjusted, or manually adjustable.

Range:	0 or 5 mbar above low-pressure threshold (whichever is lower) to 5 mbar below high-pressure threshold.
Resolution:	0.5 mbar

Low Pressure:

Autoset when patient pressure controls are adjusted, or manually adjustable.

Range:	-10 mbar (Conventional)/ -70 mbar(HFO modes) to 10 mbar below high-pressure threshold.
Resolution:	0.5 mbar

High Tidal Volume:

Range:	3 to 200 ml
Resolution:	0.2 ml

Low Tidal Volume:

Range:	0 to 200 ml
Resolution:	0.2 ml

Low Minute Volume:

Range:	0 to 0.1 litres below High minute volume threshold.
Resolution:	0.1 litre

High Minute Volume:

Range:	0 to 18 litres.
Resolution:	0.1 litre

Apnoea time:

Range:	5 to 60 seconds
Resolution:	1 second

23.4.2 Obligatory Alarms (non adjustable by user)

Monitor Failure
Sustained sub ambient
Sub ambient
Controller Failure
System fail, Memory checksum error
System fail, Alarm controller error
Gas not connected
O_2 not connected
Air not connected
Block alarm
Leak alarm
Battery fault
Battery low
Continuing positive pressure
Pressure sensor drift
Isolate system error
Flow ADC unable to calibrate
Serial communication error
Flow sensor defect
Clean flow sensor
Flow sensor not connected
Unable to calibrate flow sensor
Flow sensor not calibrated
User interface failure
Patient Leak
Pressure change detected
Mains failure
Fresh gas solenoid fail
Oxygen too high
Oxygen too low
Oxygen cell not connected
Oxygen cell needs calibrating
Oxygen cell needs replacing
Oxygen calibration failure
Monitor/Display comms fail
Alarm controller failure
Complete power fail

23.5 Patient circuits

Volume of 10mm patient circuit without humidifying chamber: 400ml

Resistance of 10mm circuit with 5 L/min fresh gas flow = 0.3mbar (as measured from patient manifold to atmosphere).

23.6 Outputs

Analogue:	None
Digital Input/Outputs:	Serial Port, IBM-AT-compatible serial port, 9-pin DSub, RS-232C
Available parameters:	

Set BPM,
Set CPAP level
Set Tidal Volume
Set Insp Time
Set PIP
Set FIO_2
Set HFO Delta P
Set HFO Mean
Set HFO Rate
Ventilation Mode
TTV Status
Set Termination Sensitivity
Set Breath Trigger level
Set Breath Trigger threshold
Set Waveshape value
Set Patient Leak alarm value
Set Apnoea alarm value
Set Low Pressure alarm threshold
Set Cycle Fail alarm threshold
Set High Pressure alarm threshold
Set Low Tidal Volume alarm threshold
Set Low Minute Volume alarm threshold
Set High Minute Volume alarm threshold
Measured Total BPM
Measured CPAP
Measured Insp Time
Measured Insp Volume
Measured Exp Volume
Measured PEEP
Measured PIP
Measured FIO_2
Measured HFO Delta P
Measured HFO Mean
Trigger Count
Measured Minute Volume
Measured Leak
Measure Resistance
Measured Compliance
Measured C20/C
Current Alarm ID

For more details refer to the RS232 addendum. Contact SLE for more details.

Compatability with: Vuelink. Contact SLE for more details.

23.7 Gas supplies

Note: The ventilator requires the gas input pressures to be between 4-5bar. The ventilator can operate with the gas pressures at 3-4bar, but when there is a high demand for gas, No O_2 Supply or No Air Supply alarms can be triggered. This is due to the supply regulators becoming unbalanced as demand for one gas exceeds its ability to supply. The imbalance is recognized by the ventilator as being the absence of one of the gases.

23.7.1 Oxygen supply

The ventilator requires a supply of pure oxygen between 4 to 5 bar.

23.7.2 Air supply

The ventilator requires a supply of medical grade compressed air to ISO8573.1 Class 1.4.1 (minimum level of filtration) between 4 to 5 bar. Recommended level of filtration is class 1.1.1.

Description of Class 1.4.1
1= particle size of 0.1 microns. 4 = Pressure dewpoint of +3ºC. 1= oil content 0.01Mg/m3

Description of Class 1.1.1
1= particle size of 0.1 microns. 1 = Pressure dewpoint of -70ºC. 1= oil content 0.01Mg/m3

If the compressed air supply is found to fall below the ISO8573.1 standard then in-line filtration of the air is required.

23.7.3 Flows

Fresh Gas Flow:	8 litres/minute
Maximum gas flow:	60 litres/minute

23.8 Power, Dimensions, Standards etc.

Voltage :	100-240V/ 50-60Hz
Power :	115 VA
Fuses :	100-250V~50-60Hz : Fuse T(2.0AH) 250v
Battery Back up	12 volt. Up to 45-60 minutes dependant on mode.
Battery life	10 years
Battery Charging	Full charge 24 Hours
	80% charge 8 hours
Rating:	Class 1. Unit must be earthed.

Operating Environment:

Temp:	10-40ºC
Humidity:	30-75% (Non condensing)
Size, Ventilator only:	330mm W x 330mm H x 470mm D
Height on pole:	1140 cms
Weight (ventilator only):	23.6 Kgs

Constructed to conform to:

BS EN 475: 1995

BS EN 794-1:1997

BS EN 60601-1:1990

BS EN 60601-1-2:1993

BS EN 60601-1-4: 1996

Medical Devices Directive (93/42/EEC)

Patient Circuit Required:

Model: 10 mm Single use for use with incubators (SLE Part Nº: N5188)

Model: 10mm Single use for use cots (SLE Part Nº: N5188/02

Model: 10 mm Re-usable (SLE Part Nº: N2391/50)

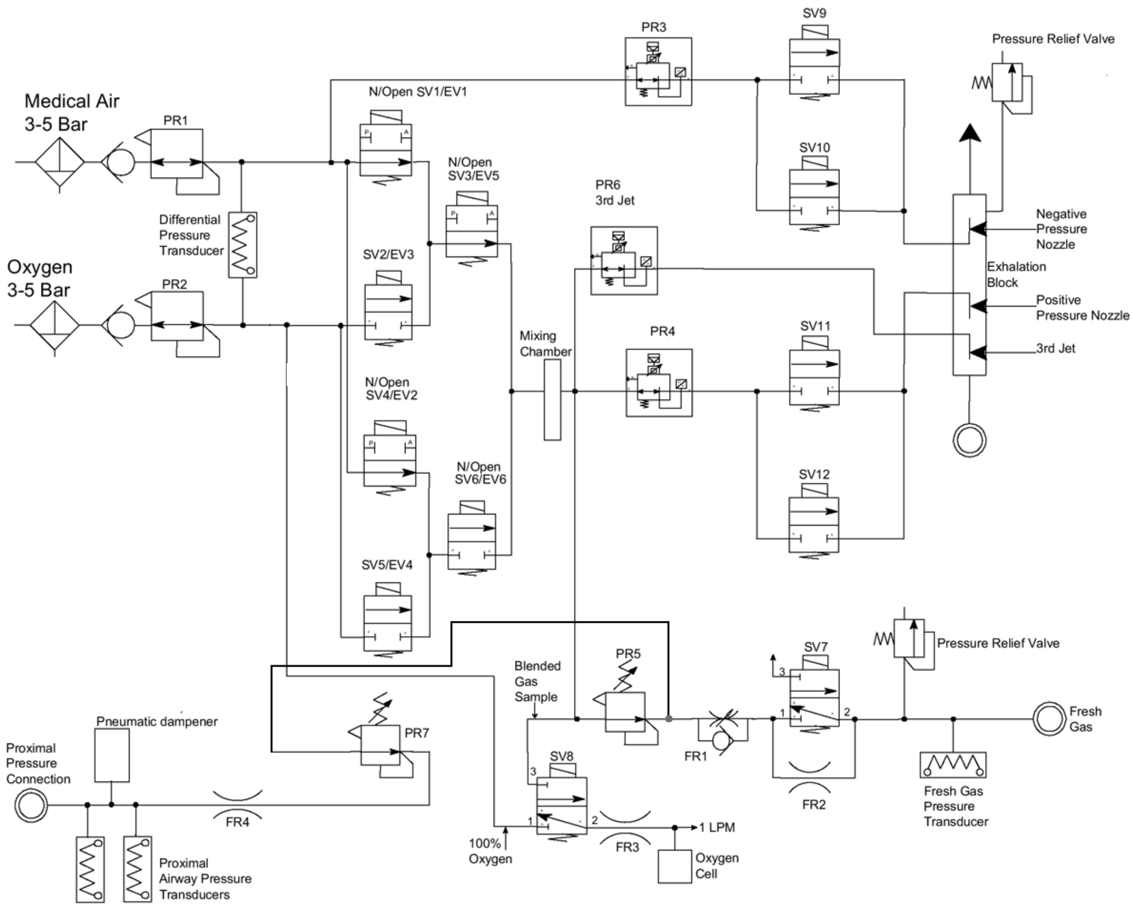
23.9 Environmental Storage Conditions

When packed for transport or storage;

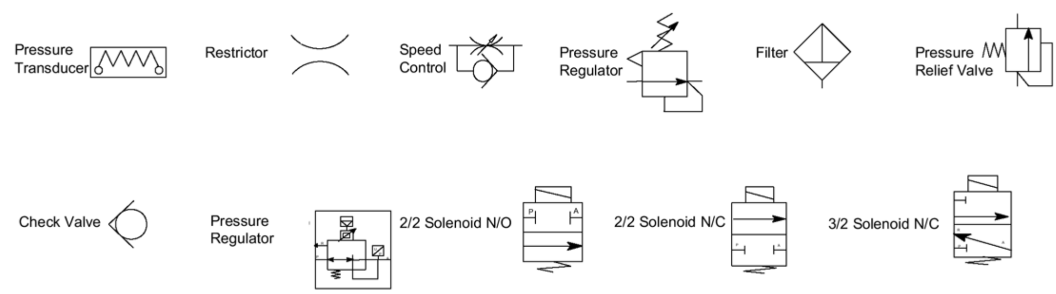
Ambient Temperature	-40°C to +70°C
Relative Humidity	10% to 90% non condensing
Atmospheric Pressure	500hPa to 1060hPa

24. Pneumatic Unit Schematic

Below is a schematic representation of the pneumatic unit of the ventilator.

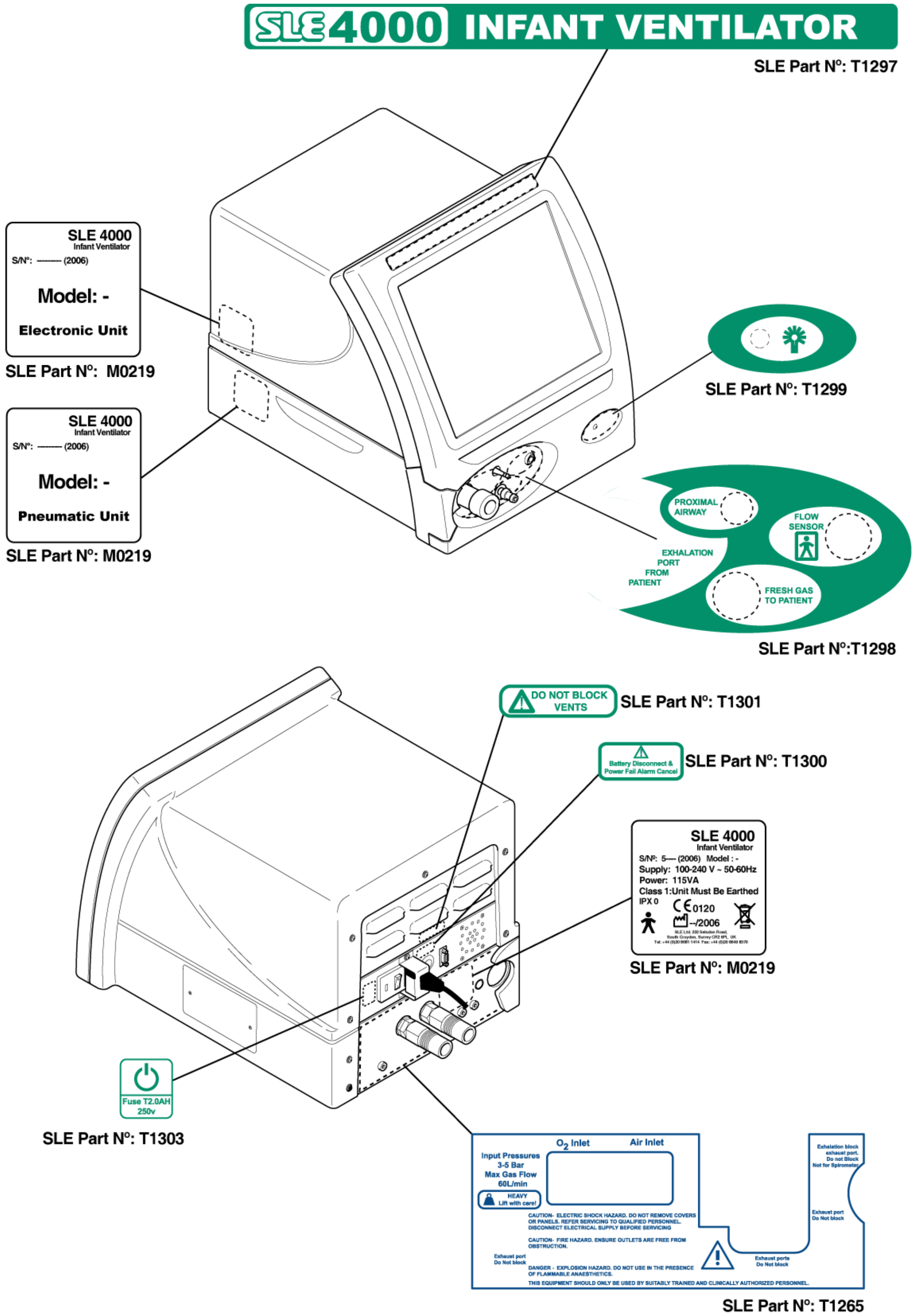


Legend



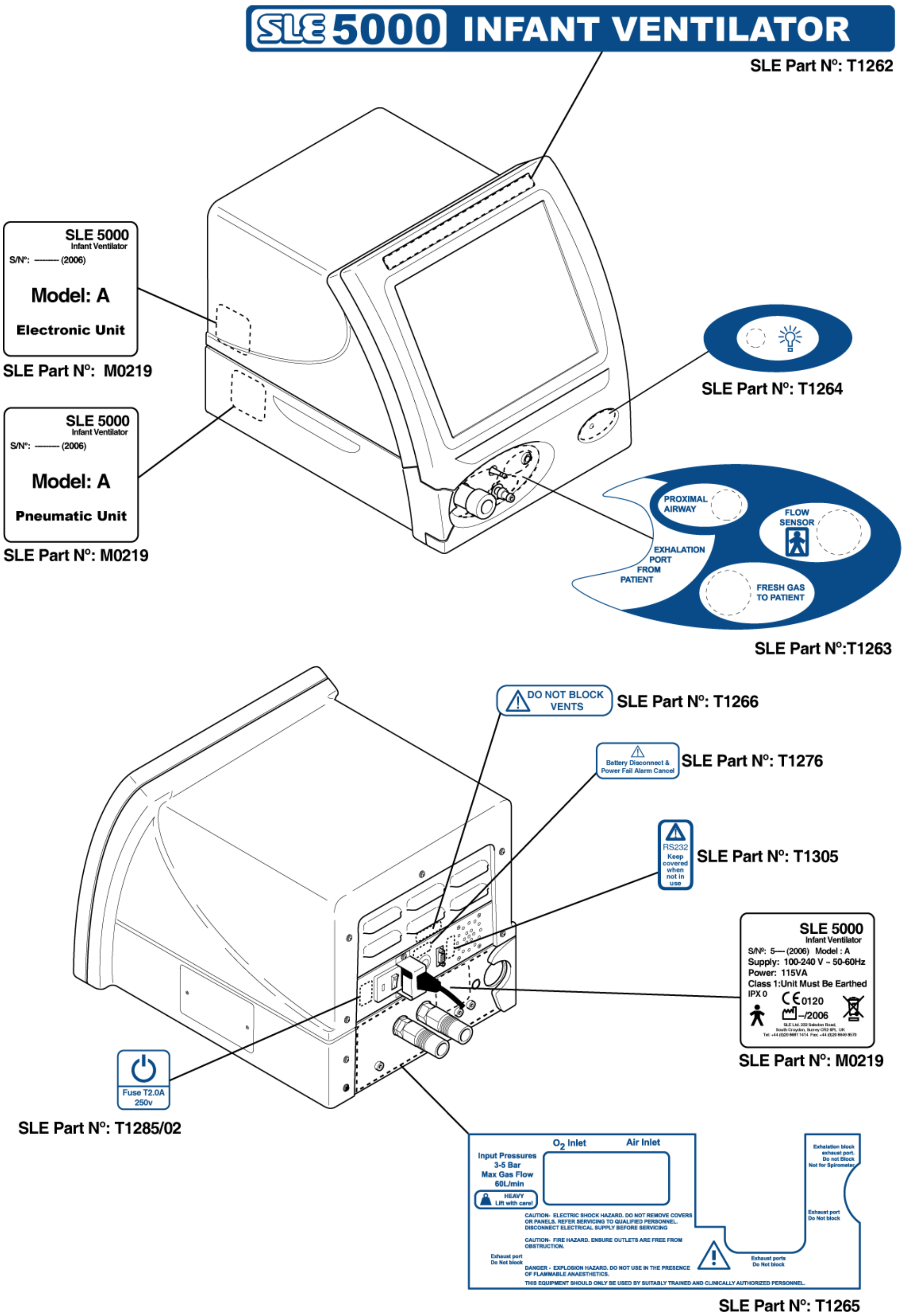
25. Ventilator labelling

25.1 SLE4000



SLE

25.2 SLE5000



Illustrated Parts List

26. Illustrated Parts List

How to use the illustrated parts list

The parts list is divided into five columns, Items Nº, SLE Part Nº, Description, Effectivity code and Units Per Assy.

Item Nº: refers to the numbered part in the appropriate figure. An item number preceded by a dash (-20) is not illustrated. Gaps in the sequence of item numbering indicate that numbers have been reserved for new components or a component variant.

SLE Part Nº: refers to the items SLE part number. This number should be quoted when ordering spares. Where two items with part numbers that are same are followed by a number in brackets; Example T7789 (1), T7789 (2) this denotes that this is an assembly that when ordered as a spare only requires the one part number.

Assembly numbers L5000-00-00

Assembly numbers that belong to the L5000-00-00 series have been created to simplify the breakdown of components in this illustrated parts list. In the description of the assembly actual base components are referenced. Example (See items 85-125).

The assembly number breaks down into three components the first six characters L5000- denotes the main assembly, the next two digits denotes the figure to which that part is illustrated -02- and the final two or three digits -20 denotes the item number for that figure.

Description: A description of the relevant part.

Effectivity code: When the box is blank that part is common to all variants. When a letter appears in the box then that part applies only to the top assembly marked with that code letter.

Units Per Assembly: Quantity used for that assembly**.**
Example parts list.

Item Nº	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 1	E2559	Main Assembly 110v	A	RF
-1A	E2559/01	Main Assembly 230v	B	RF
20	L5000-01-20	.Top Assembly (See items 50-85)		1
21	N2193	.Plate	A	
21A	N2193/01	.Plate	B	
25	T7789 (1)	..Switch		1
30	T7789 (2)	..Switch, bezel		1
-35	T5553	..Foot, Rubber		4
		Attaching Parts		
40	H2208	..Screw		4
		* * *		

- Item Not illustrated

The Dot classification system.

Items within the parts list have a dot prefix.

The item with no dot as a prefix is the main assembly for that figure.

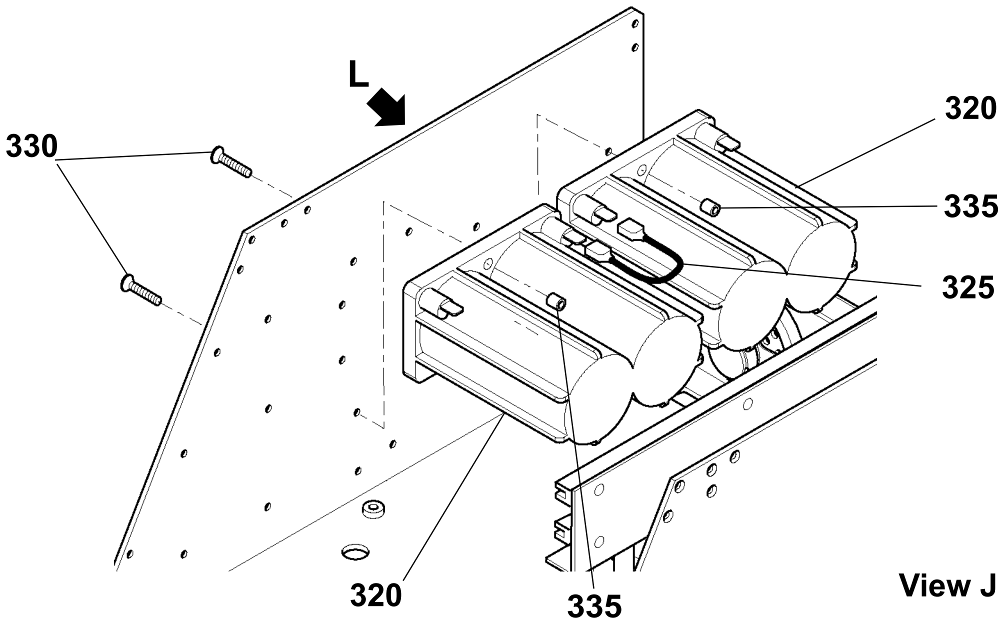
Any item with one dot belongs to the main assembly.

Any item with two dots is attached to the one dot item above it. (Three dot items are attached to two dot items etc).

Three stars indicate the end of a sub assembly.

The main assembly is always referenced (RF).

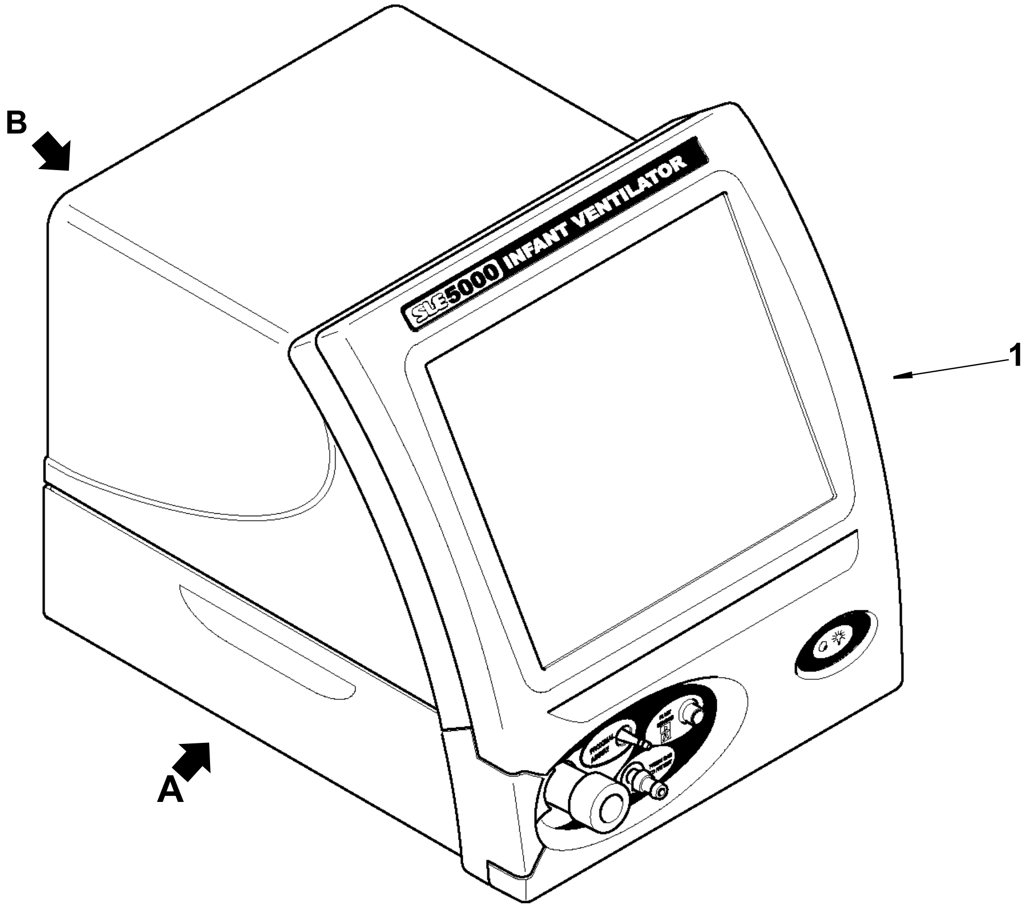
Figures
The ventilator is illustrated in disassembly order, each figure is made up of a number of sheets, that reduce that assembly to its base components.

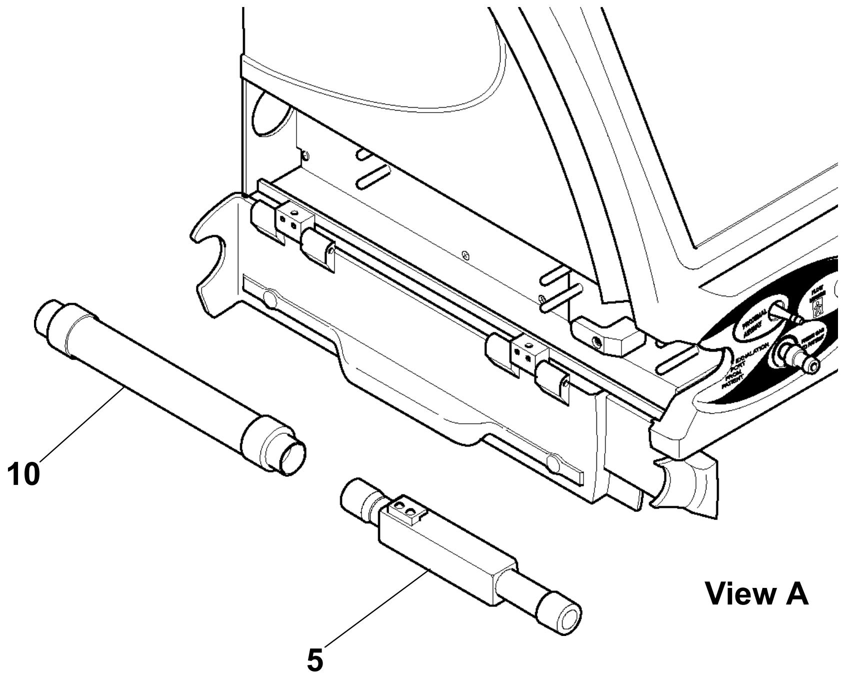


Following each set of illustrations is the parts list for that figure.

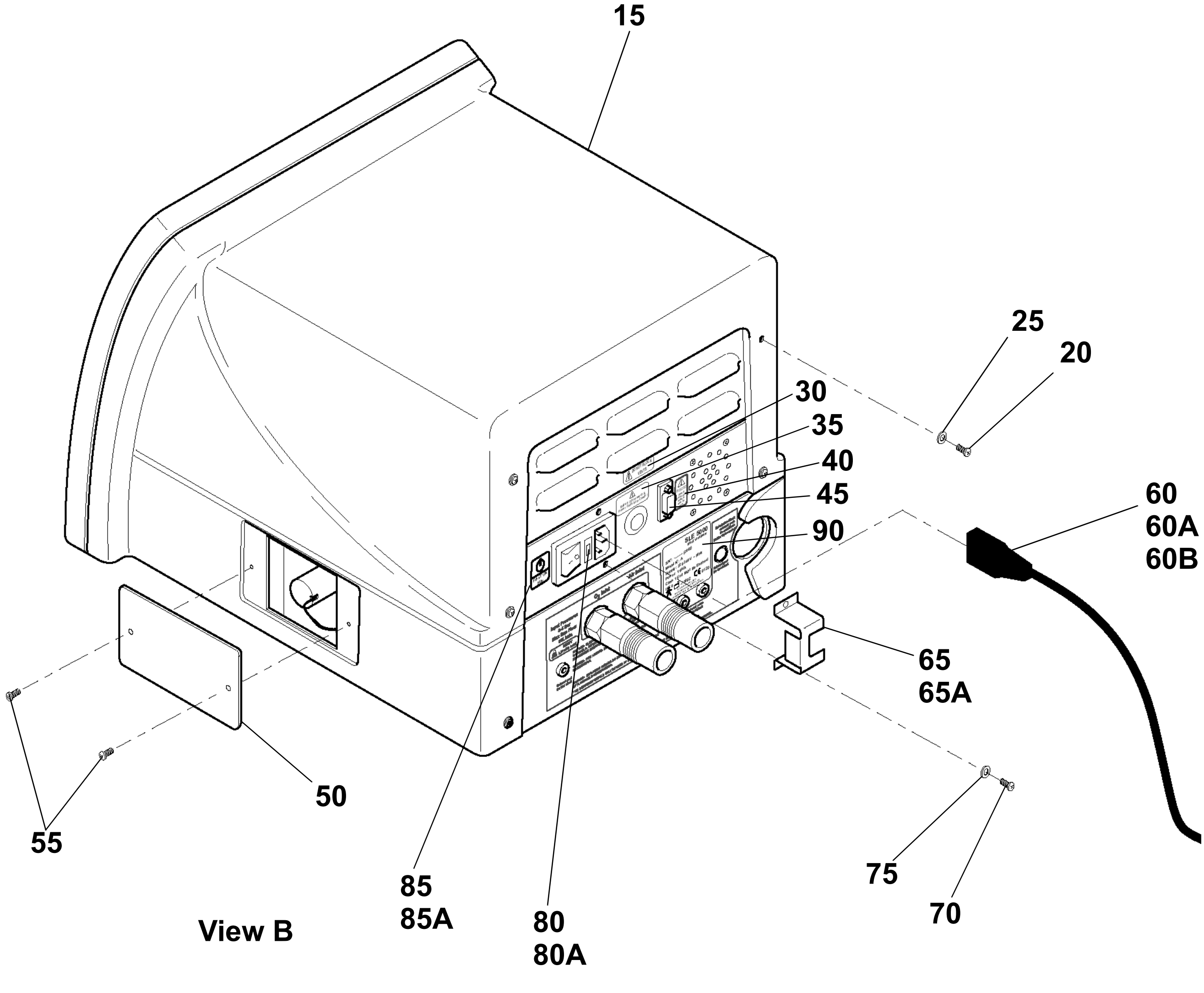
Not all screws, washers and nuts are illustrated. This is for clarity. If an item is attached with a large number of screw, nuts and washers, one set is illustrated and the rest are referenced in the units per assembly column of the parts list.

Please note though the illustrations show the assemblies in disassembly order, the actual disassembly procedure may differ. Please refer to the Overhaul and Repair Manual for further information.

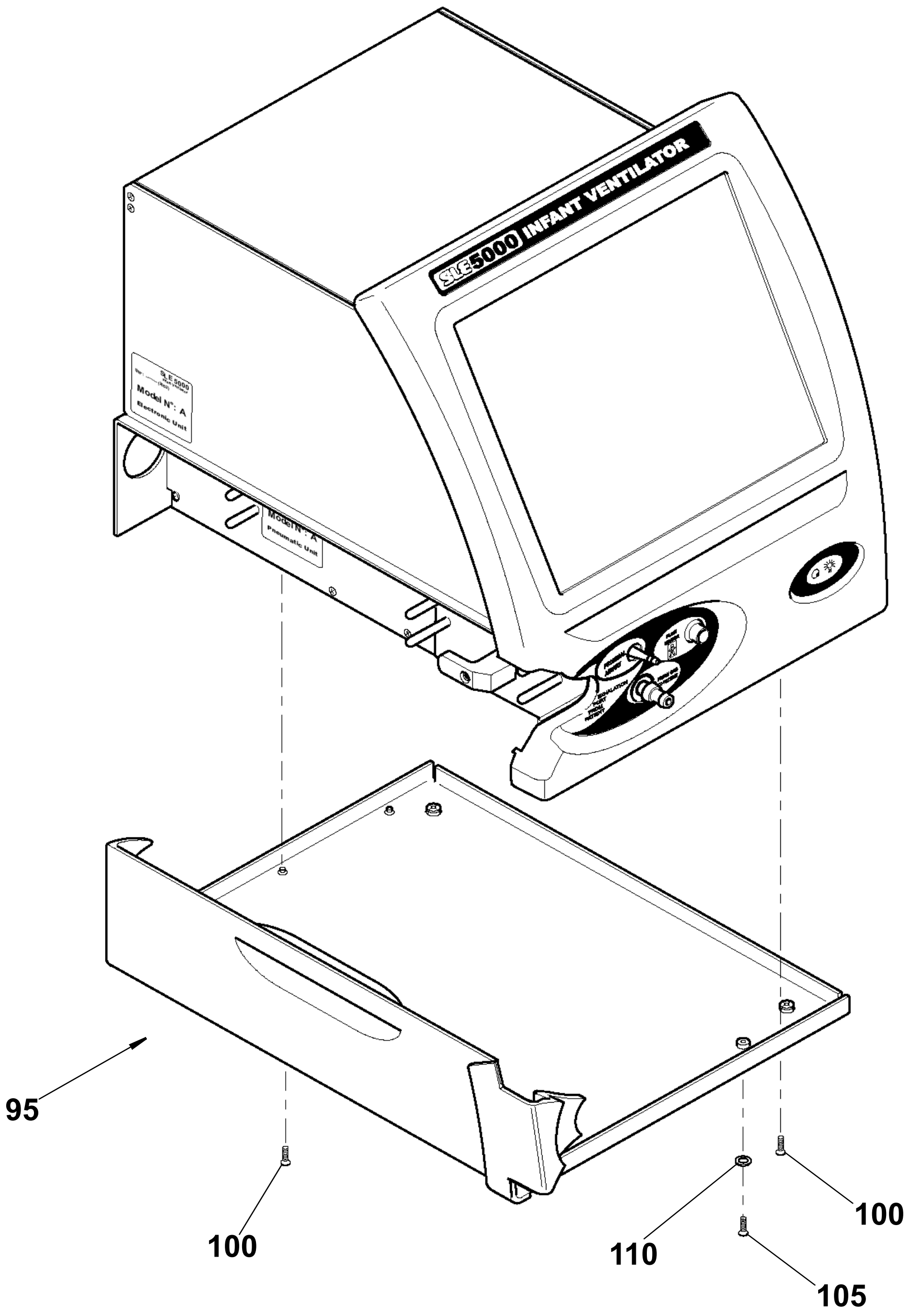




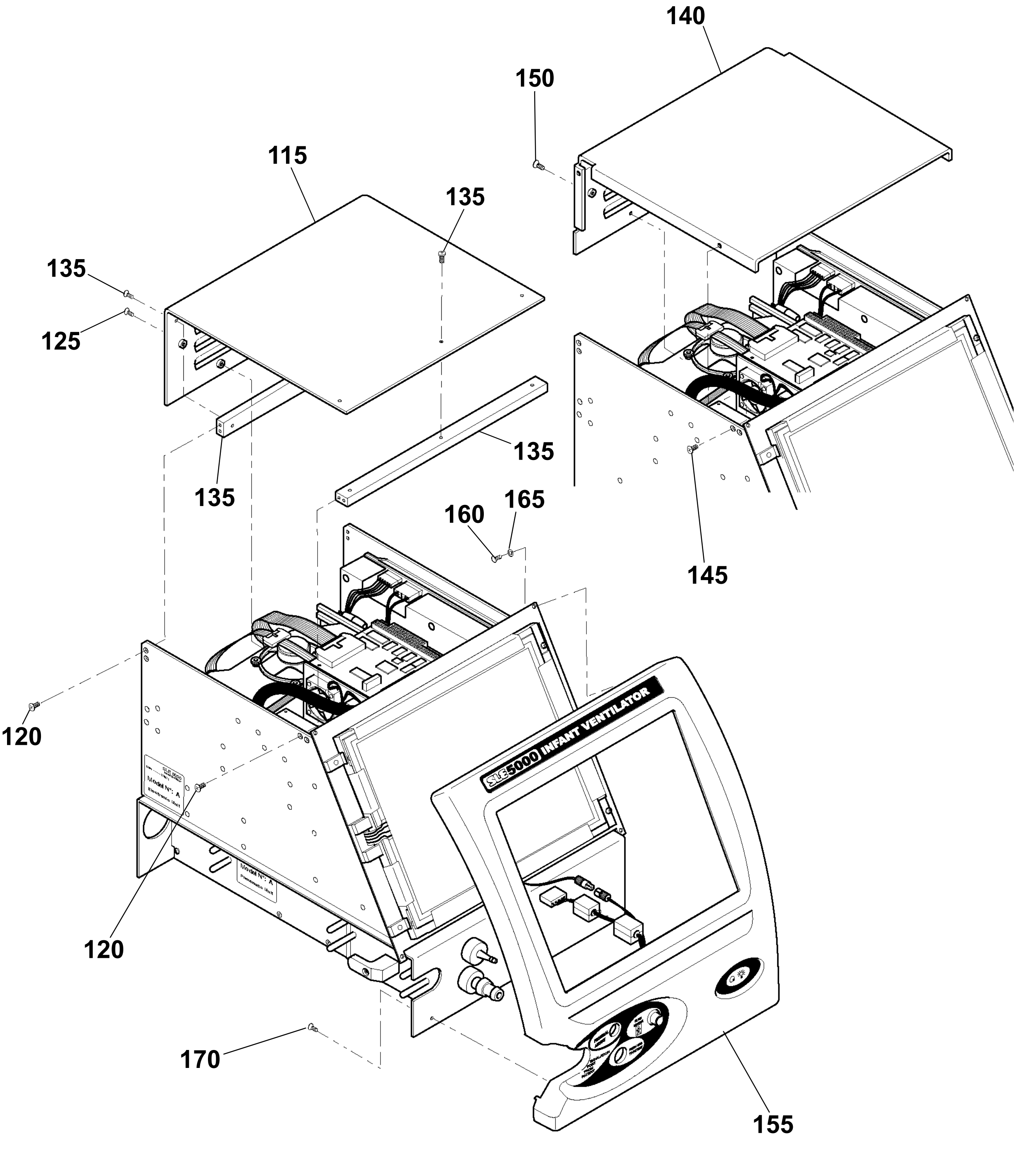
Ventilator assembly
Figure 1
(Sheet 1 of 5)



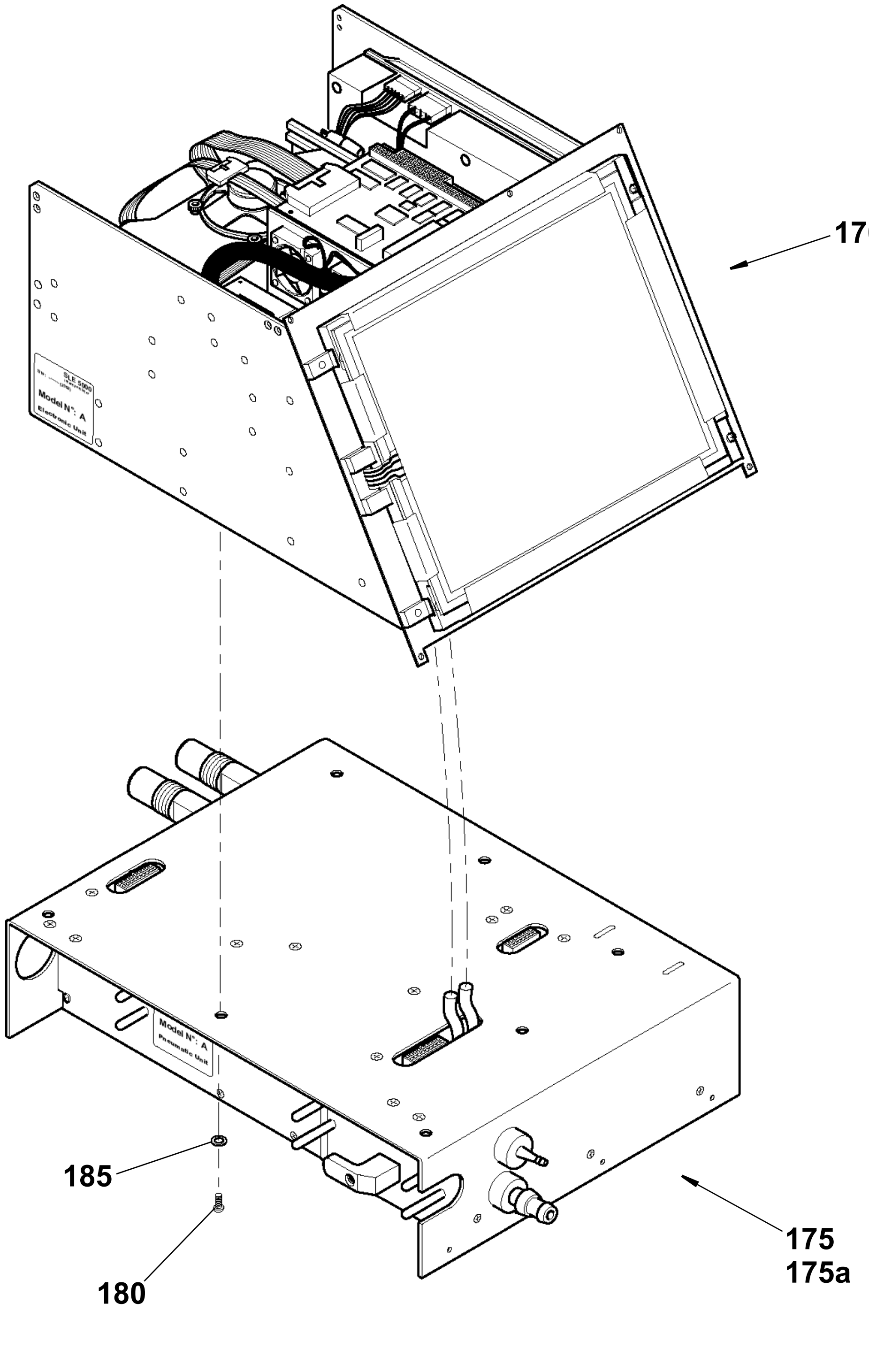
Ventilator assembly
Figure 1
(Sheet 2 of 5)



Ventilator assembly
Figure 1
(Sheet 3 of 5)



Ventilator assembly
Figure 1
(Sheet 4 of 5)



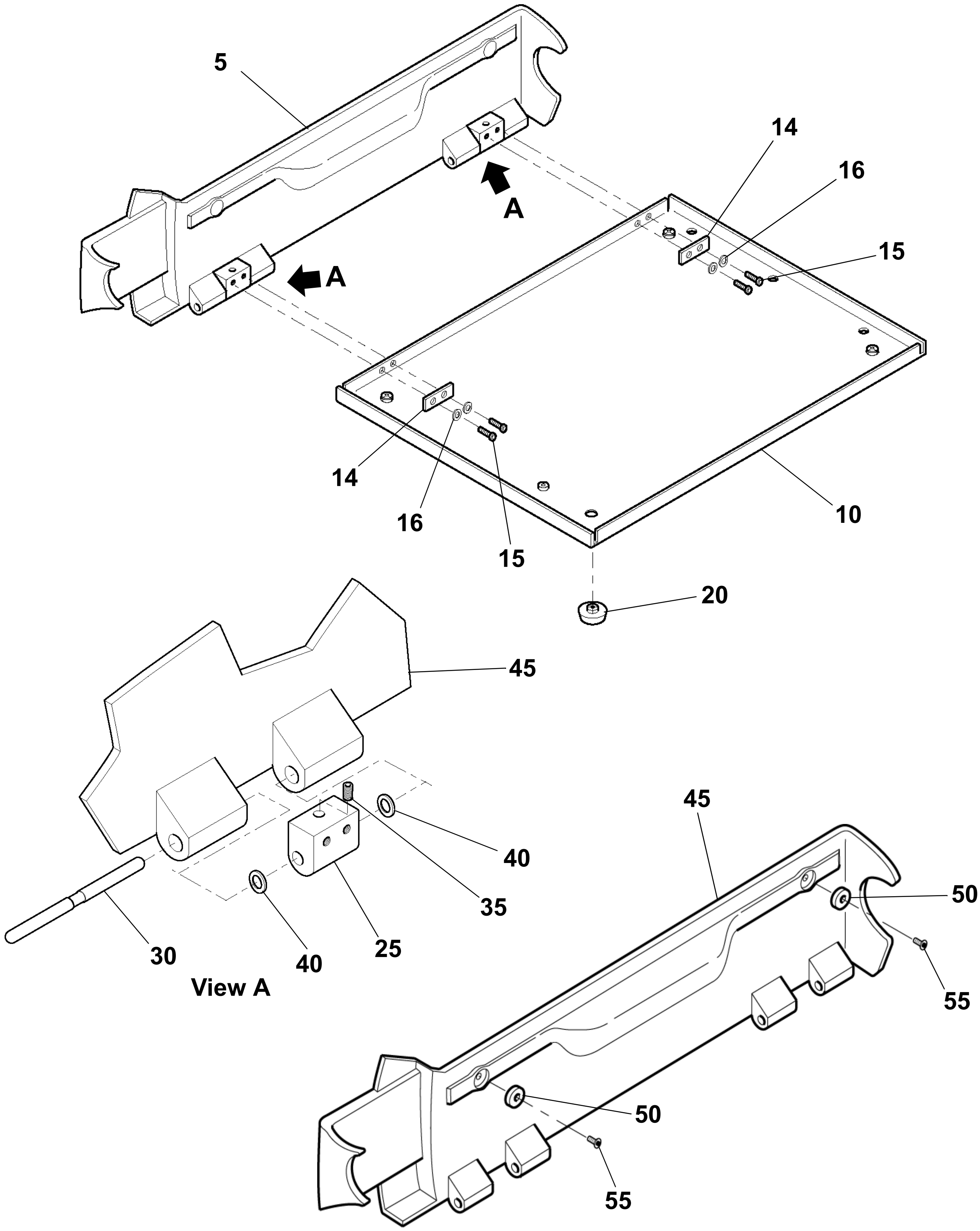
Ventilator assembly
Figure 1
(Sheet 5 of 5)

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
1 1	L5000	Infant Ventilator, Model A (For UK market)	A	RF
-1A	L5000/01	Infant Ventilator, Model A (For European market)	B	RF
-1B	L5000/10	Infant Ventilator, Model A (For Japanese market)	C	RF
5	N6622	.Exhalation Block Assy		1
10	N21866/01	.Silencer, Long		1
		* * *		
15	T1267	.Moulding, Case rear		1
		Attaching Parts		
20	H4116	..Screw (M4 x 16mm)		5
25	H4095	..Washer, nylon (M4)		5
		* * *		
30	T1266	.Label, air vent	A	1
35	T1276	.Label, battery disconnect	A	1
40	T1305	.Label, RS232	A	1
45	P0407/01	.Cap, RS232 port		1
50	T1195	Cover plate, Oxygen cell		1
		Attaching Parts		
55	H4208	..Screw (M4 x 8mm)		2
		* * *		
60	M0255/07	.Mains Cable, 13A moulded sq pin plug (IEC/BS 1363/A)	A	1
-60A	M0255/06	.Mains Cable, Schuko, IEC socket	B	RF
-60B	P0454/03	.Mains Cable, Nema, 5-15P Plug-IEC Socket	C	RF
		Attaching Parts		
65	T1242	..Clamp, Cable	A	1
65A	T1242/01	..Clamp, Cable	B,C	1
70	H3108	..Screw (M3 x 8mm)		2
75	H3094	..Washer, shakeproof (M3)		2
		* * *		
80	M0284	Fuse, 1 amp		1
-80A	M0457/01	Fuse, 2 amp	A,B,C	RF
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
1 85	T1285/02	Label Fuse, 2 amp 240V	A,B,C	1
-85A	T1285/01	Label Fuse, 2 amp 110V Obsolete item		RF
		* * *		
90	M0219	Label, serial number		1
		* * *		
95	L5000-01-95	.Base plate and side door assembly (See figure 2 for detailed breakdown) Attaching Parts		1
100	H3208	..Screw (M3 x 8mm)		6
		* * *		
105	H4110	.Screw, trolley fixing (M4 x10mm)		2
110	H4094	.Washer, shakeproof (M4)		2
		* * *		
115	T1193	.Inner Cover Obsolete item Use item 135 Attaching Parts		1
120	H3208	..Screw (M3 x 8mm)		8
125	H4208	..Screw (M4 x 8mm)		2
		* * *		
130	T1191	.Cross Bar Obsolete item Attaching Parts		2
135	H3208	..Screw (M3 x 8mm)		5
		* * *		
140	T1193/01	.Inner Cover Attaching Parts		1
145	H3208	..Screw (M3 x 8mm)		4
150	H4208	..Screw (M4 x 8mm)		2
		* * *		
155	L5000-01-155	.Front facia assembly (See figure 3 for detailed breakdown) Attaching Parts		1
160	H3108	..Screw (M3 x 8mm)		6
165	H3094	.Washer, shakeproof (M3)		6
170	H3208	..Screw (M3 x 8mm)		3
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
1 170	L0270	.Electronic module assembly (See figure 4 for detailed breakdown)		1
175	L5000-01-175	.Pneumatic module assembly Obsolete item. Use item 175a (See figure 5 for detailed breakdown)		1
175A	L0280	.Pneumatic module assembly Addition of Proximal airway modification (See figure 6 for detailed breakdown)		1
		Attaching Parts		
180	H4108	..Screw (M4 x 8mm)		7
185	H4094	.Washer, shakeproof (M4)		7
		* * *		

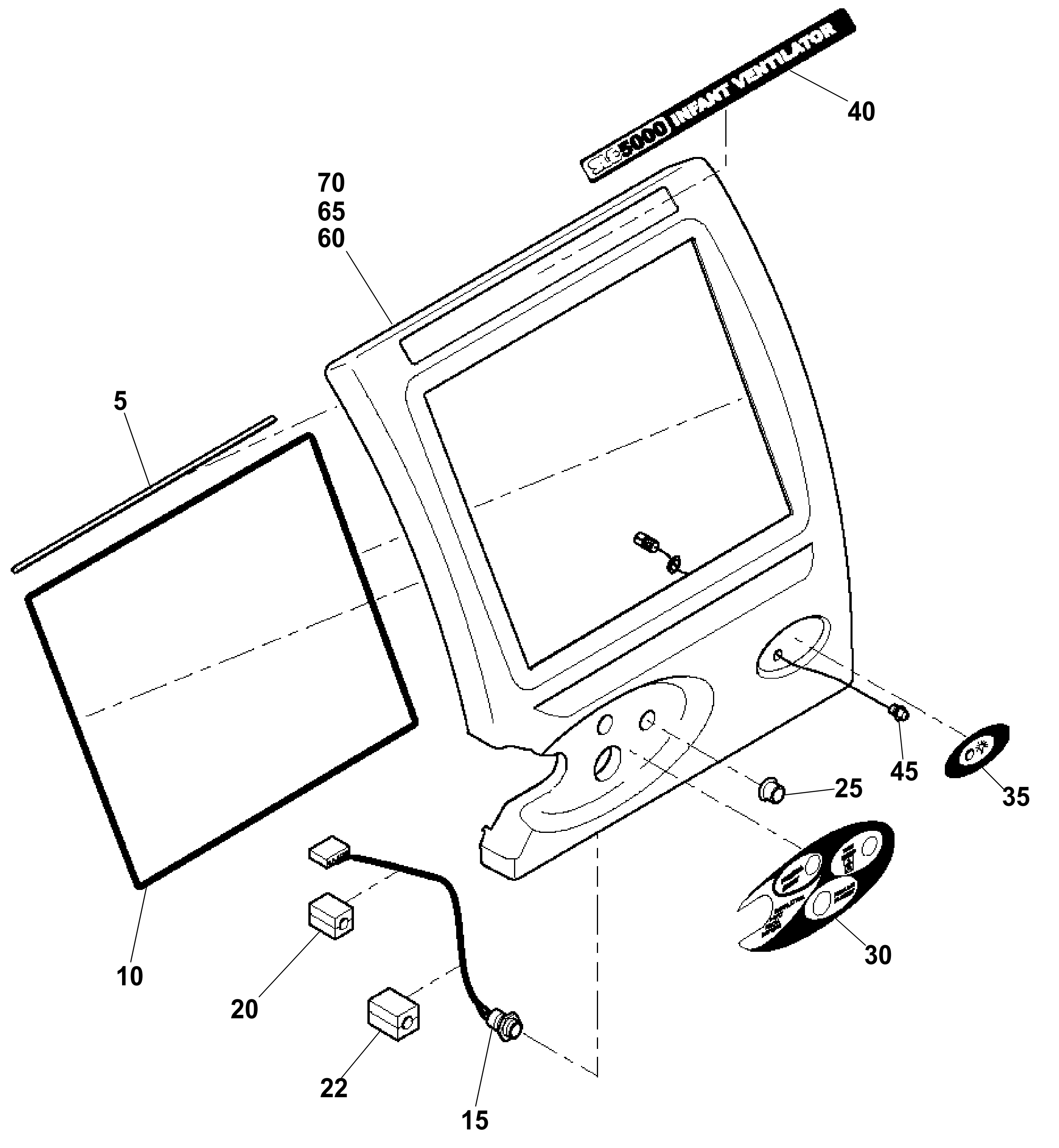
- Item Not illustrated



Base plate and side door assembly
Figure 2

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
2 -1	L5000-01-95	Base plate & side door assembly (See figure 1 for next highest assembly)		RF
5	L5000-02-05	.Side Door Assembly (See items 25-55)		1
10	T1194	.Pneumatic Unit Base Tray		1
		Attaching Parts		
14	T1252	..Plate, flap door fixing		2
15	H3098	..Screw, (M3 x 8mm)		4
16	H3094	..Washer, shakeproof (M3)		4
		* * *		
20	M0607/09	..Foot, rubber		4
		* * *		
25	T1239	..Hinge Block		2
30	T1233	..Hinge Pin		2
		Attaching Parts		
35	H9513	..Screw, Grub (M3 x 5mm)		2
40	H4094	.. Washer, (M4)		4
		* * *		
45	T1269	..Side Door Moulding		1
50	N6630/01	..Keeper Plate		2
		Attaching Parts		
55	H3206	..Screw (M3 x 6mm)		2
		* * *		

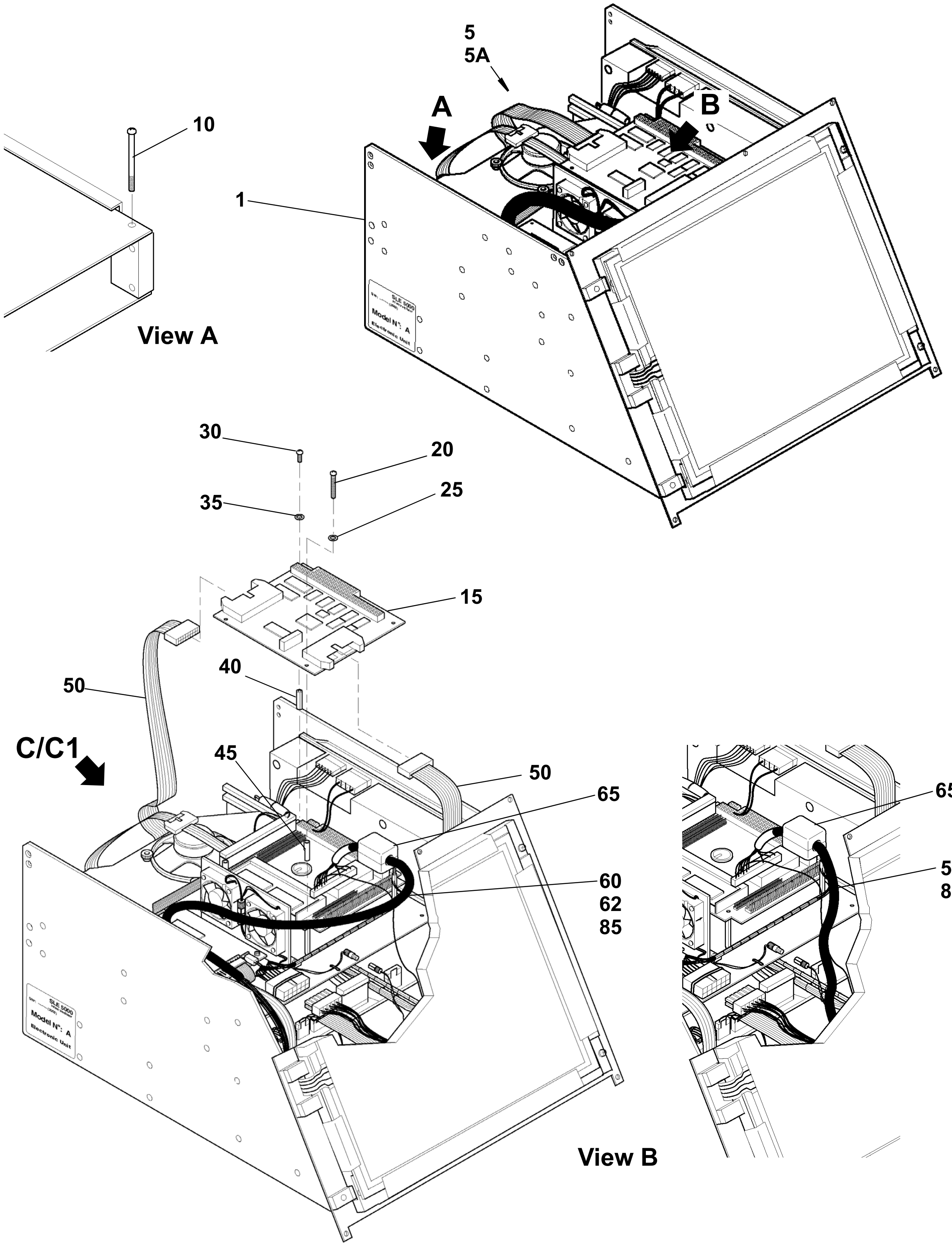
- Item Not illustrated



Front facia assembly
Figure 3

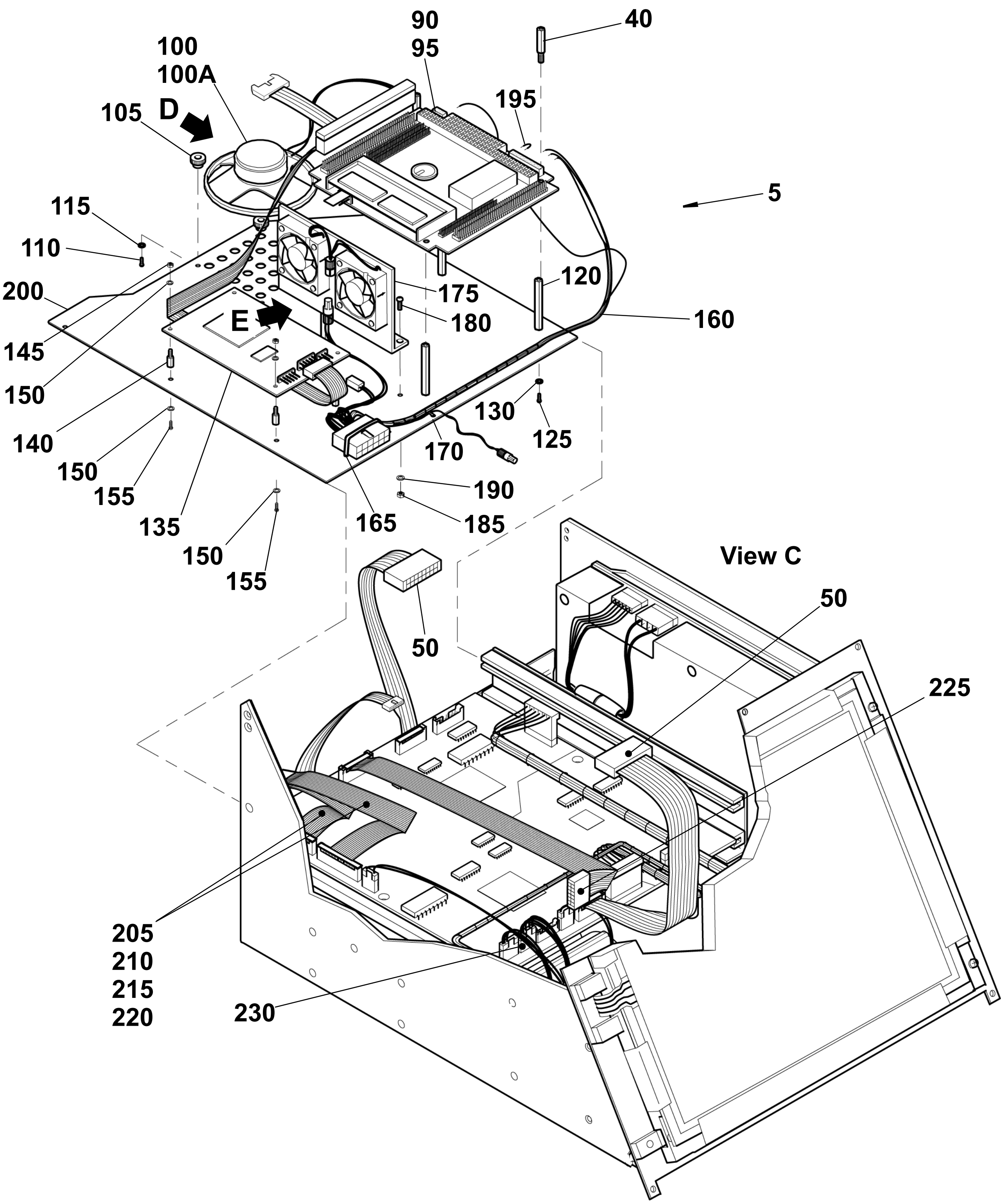
Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
3 -1	L5000-02-155	Front facia assembly (See figure 1 for next highest assembly)	A	RF
5	N6633	.Seal, cover		1
10	N6632	.Seal, screen		1
		* * *		
15	W0334	.Loom, flow senor		1
20	M0767/06	.Core, ferrite hinged		1
22	M0767	.Core, ferrite hinged		1
		Attaching Parts		
25	T1261	..Bezel		1
		* * *		
30	T1263	.Label, main	A	1
35	T1264	.Label, LED		1
40	T1262	.Label, top	A	1
		* * *		
45	L5000-03-45	.LED, loom assembly (See items 50-55)		1
		* * *		
-50	D0715	..LED, green		1
-55	W0333	..Loom		1
		* * *		
60	T1268	.Front facia		1
-65	M0434	..Cable tie		1
-70	M0433/01	..Base, cable tie		1
		* * *		

- Item Not illustrated



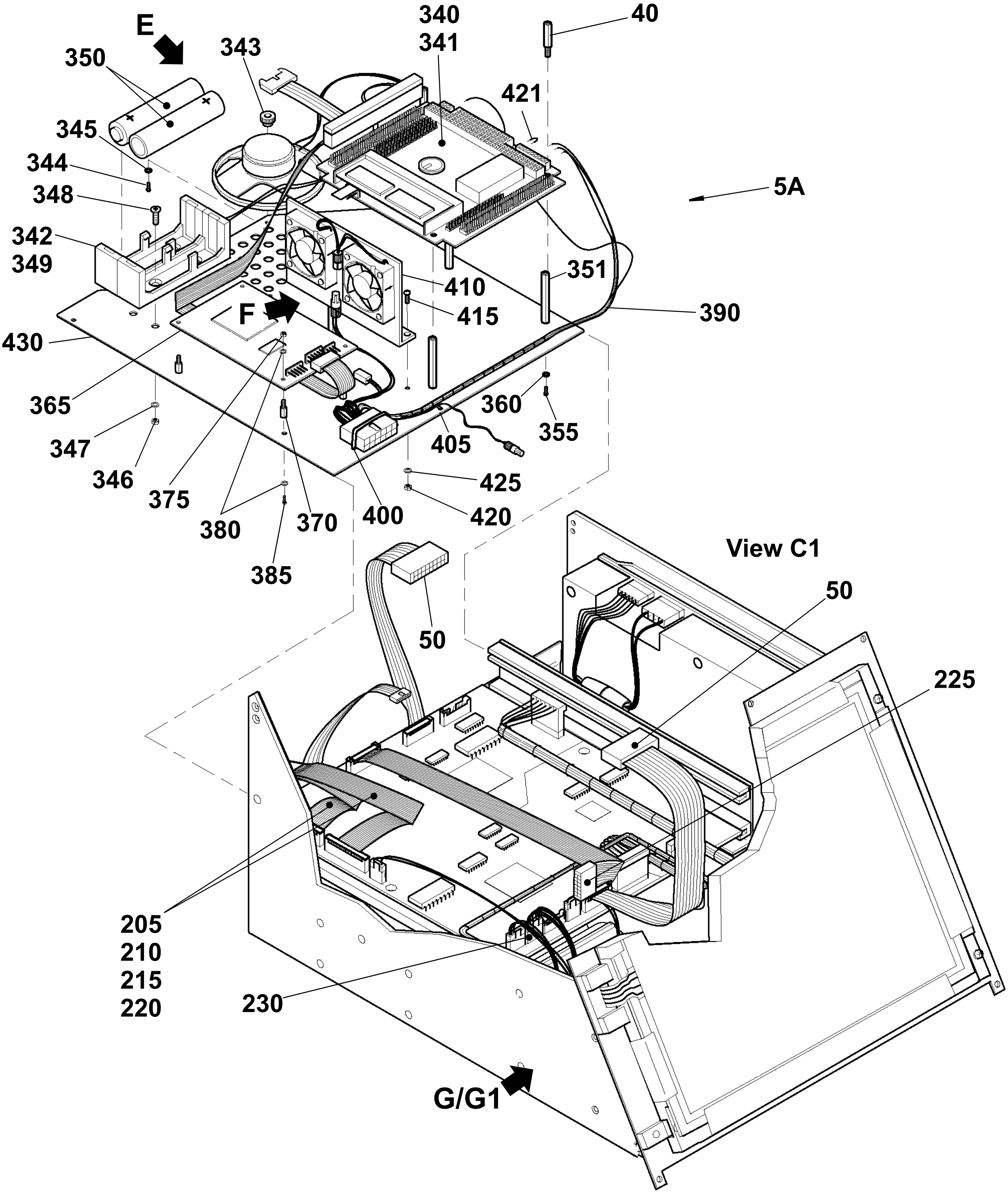
Electronic module
Figure 4
(Sheet 1 of 18)

SLE

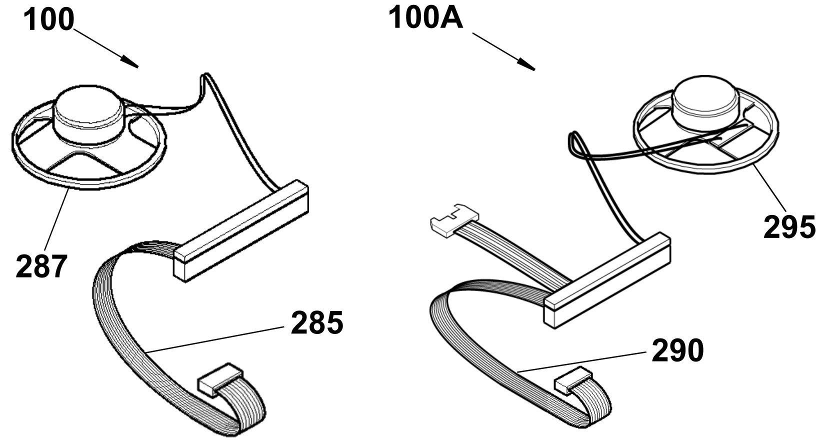


Electronic module
Figure 4
(Sheet 2 of 18)

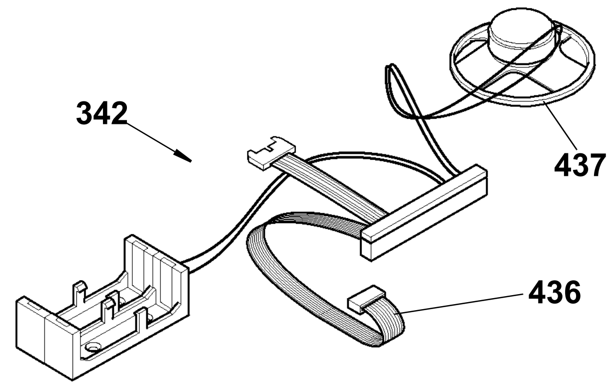
SLE



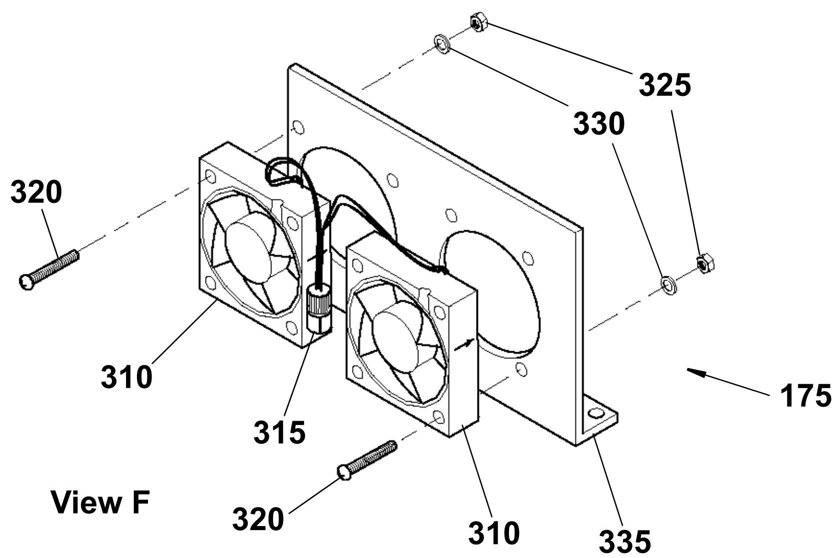
Electronic module
Figure 4
(Sheet 3 of 18)



View D



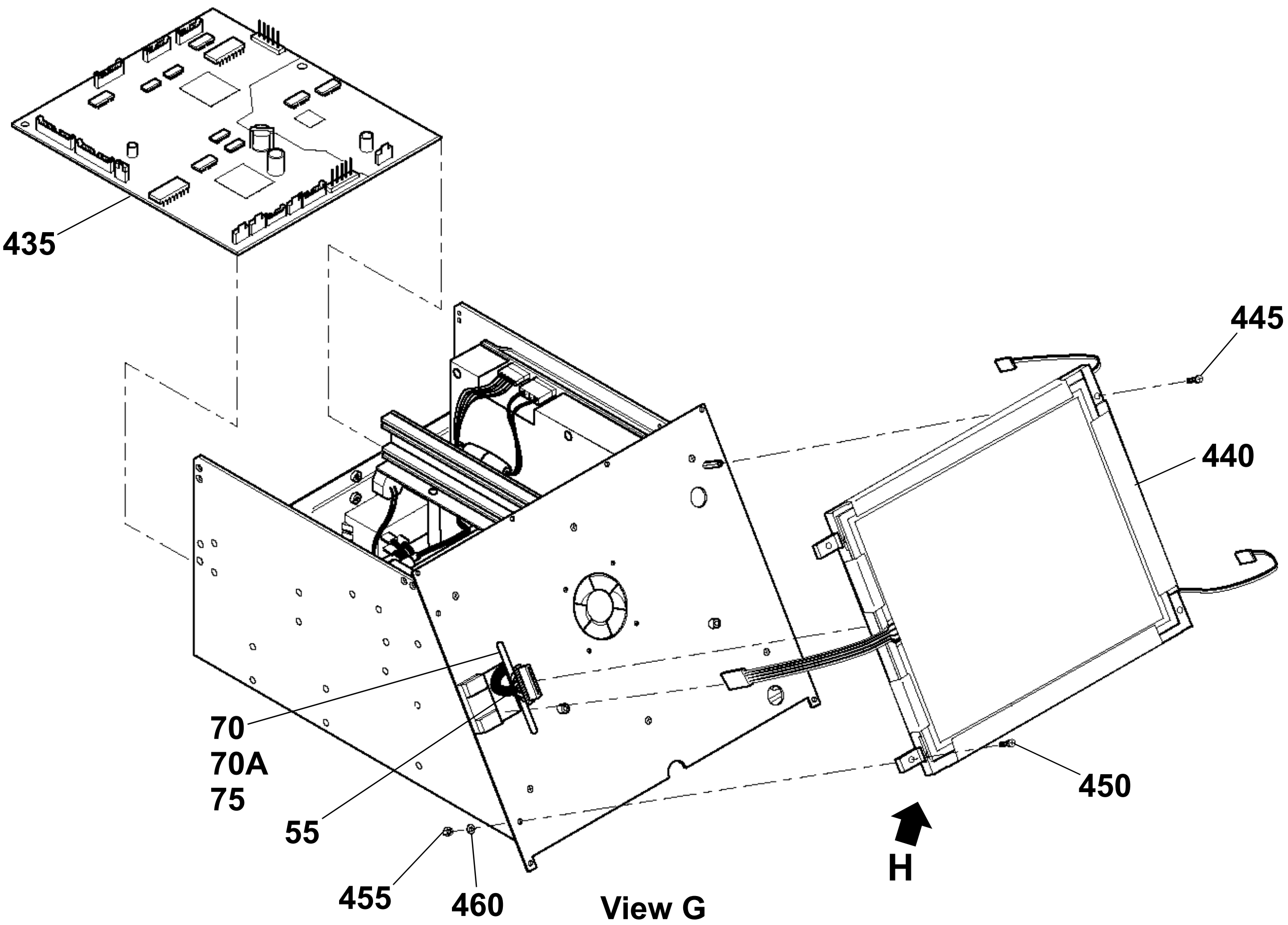
View E



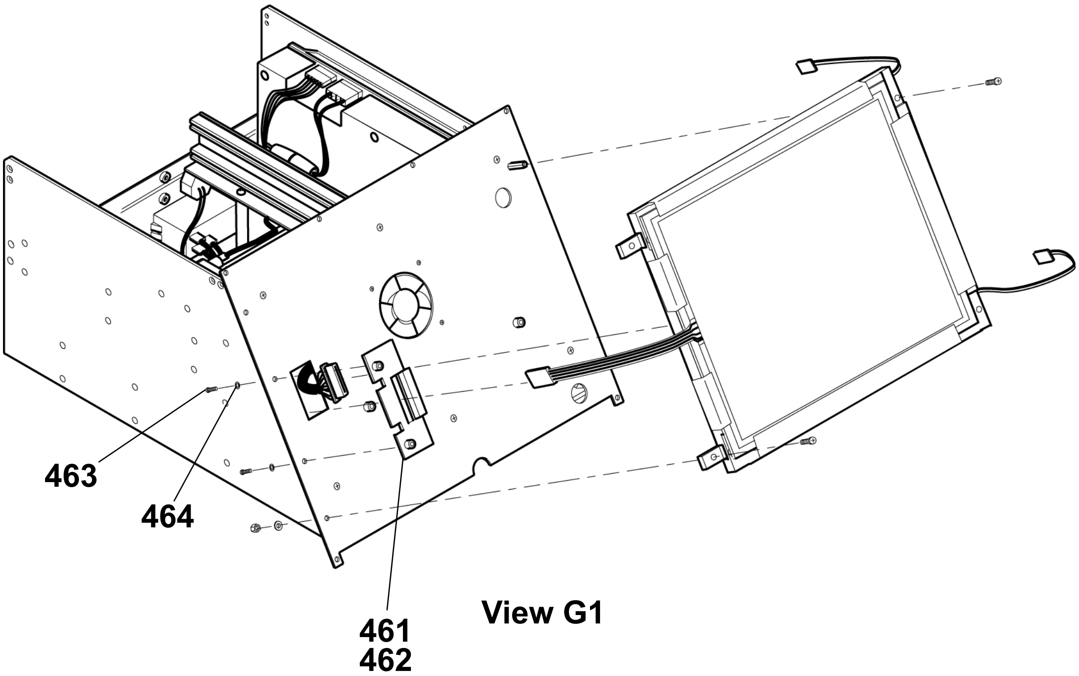
View F

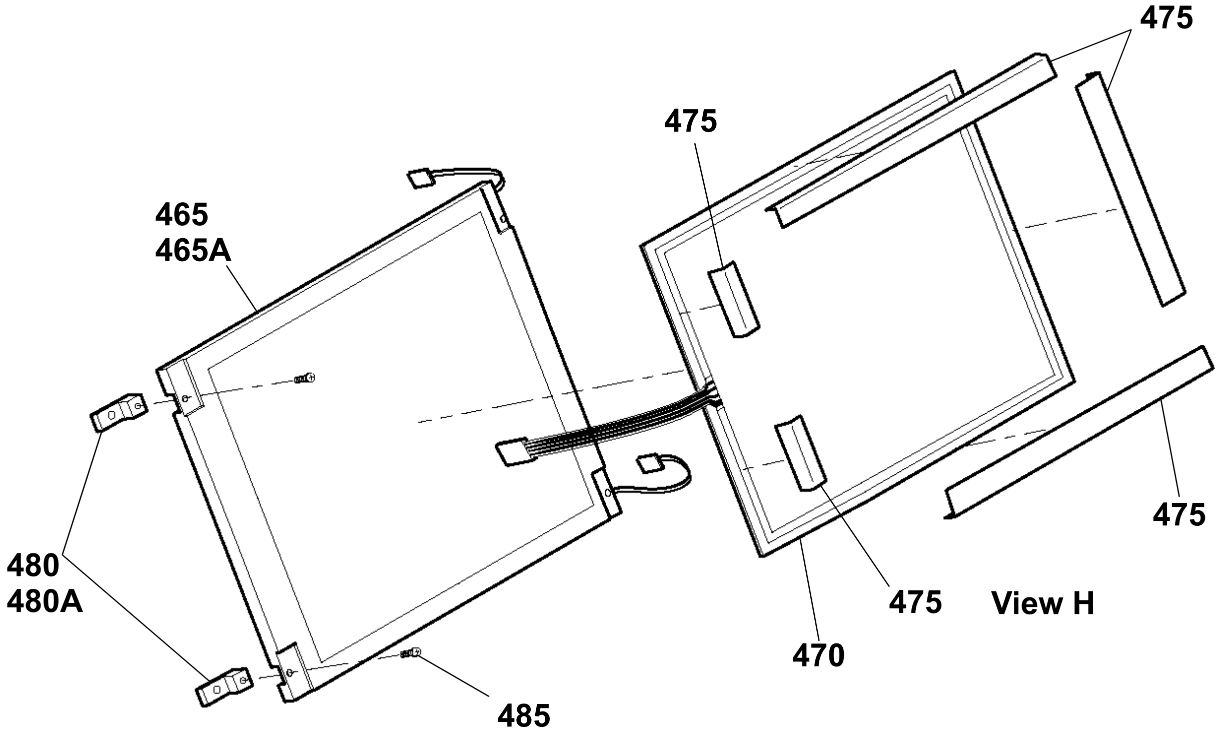
Electronic module
Figure 4
(Sheet 4 of 18)

SLE

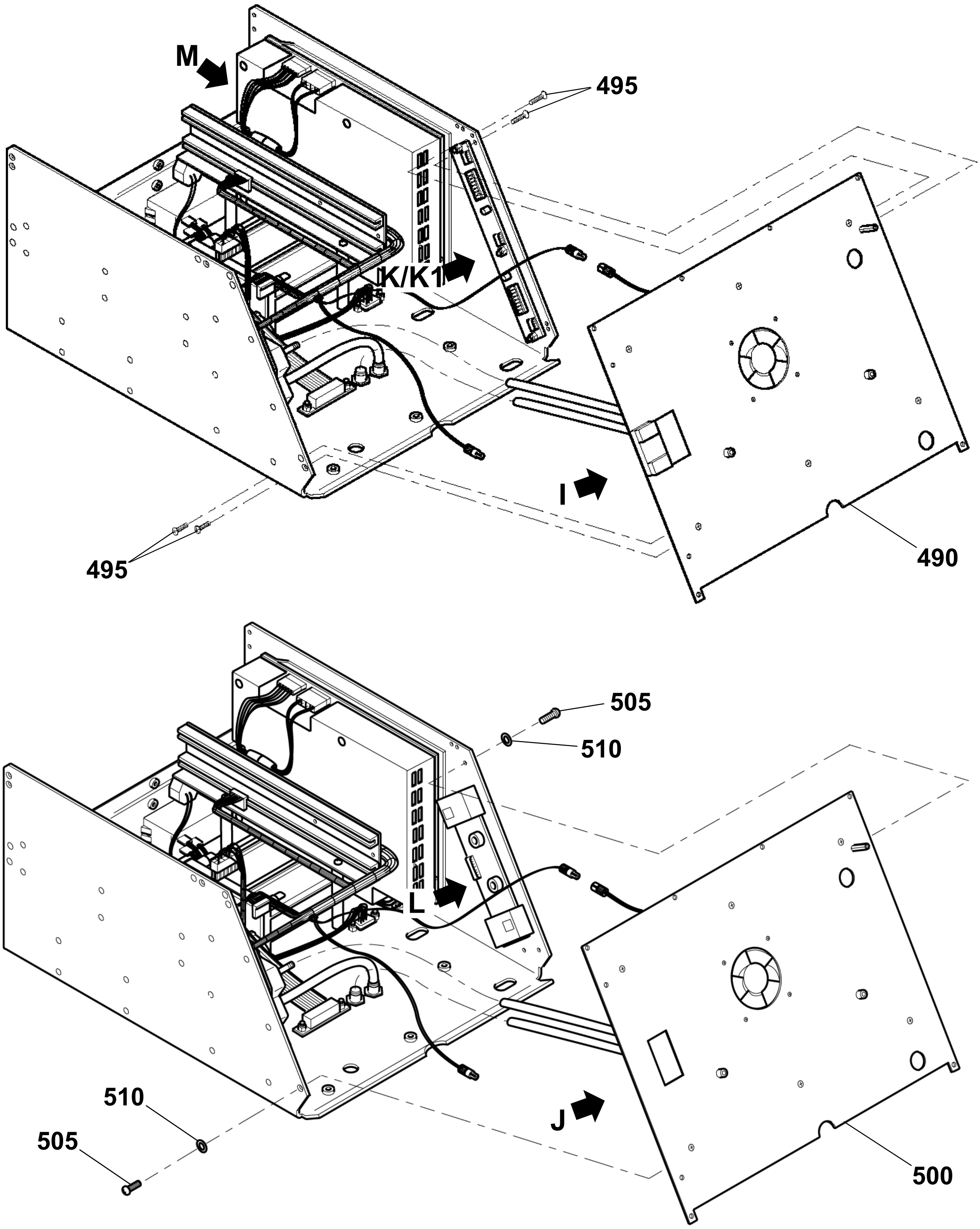


Electronic module
Figure 4
(Sheet 5 of 18)

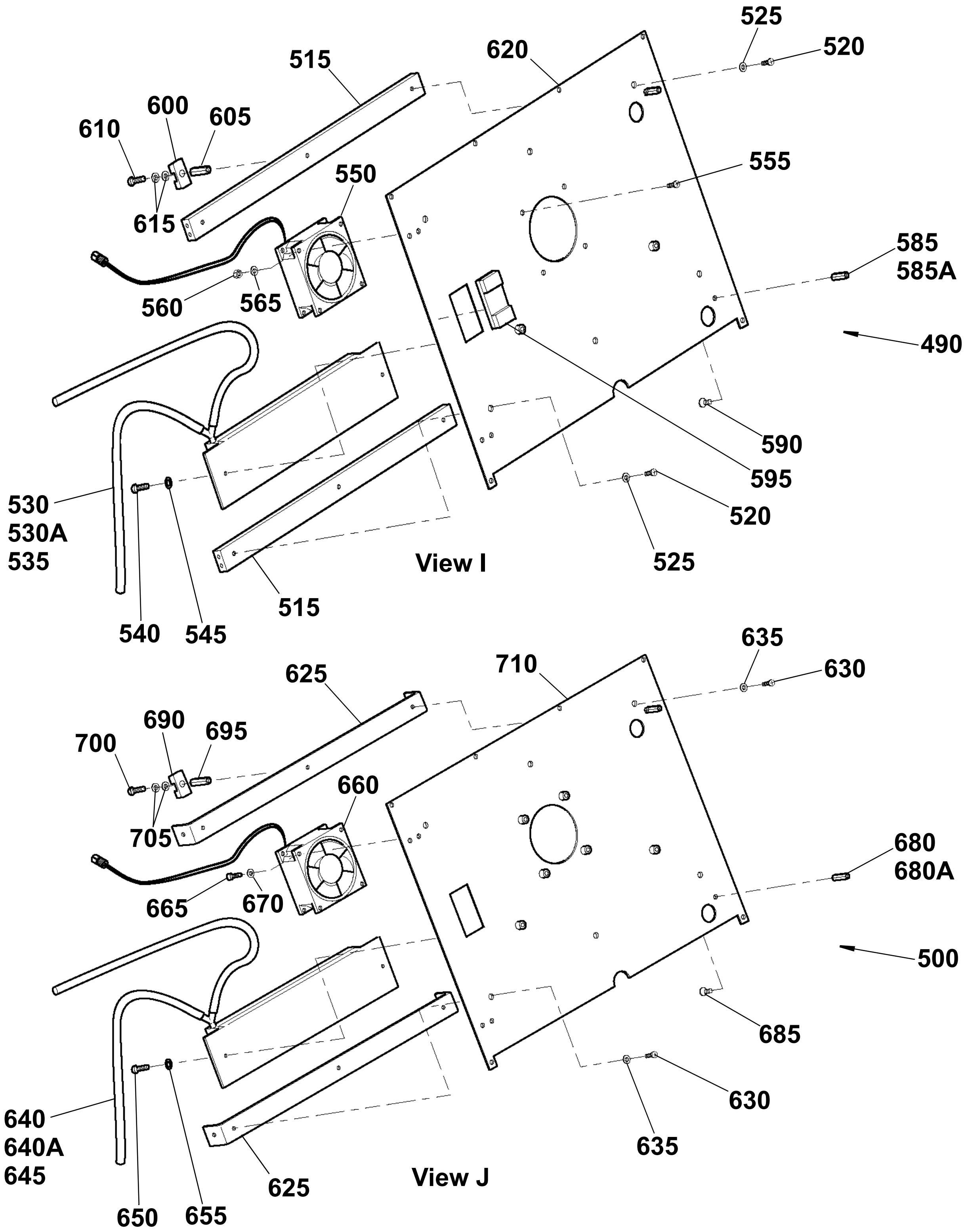




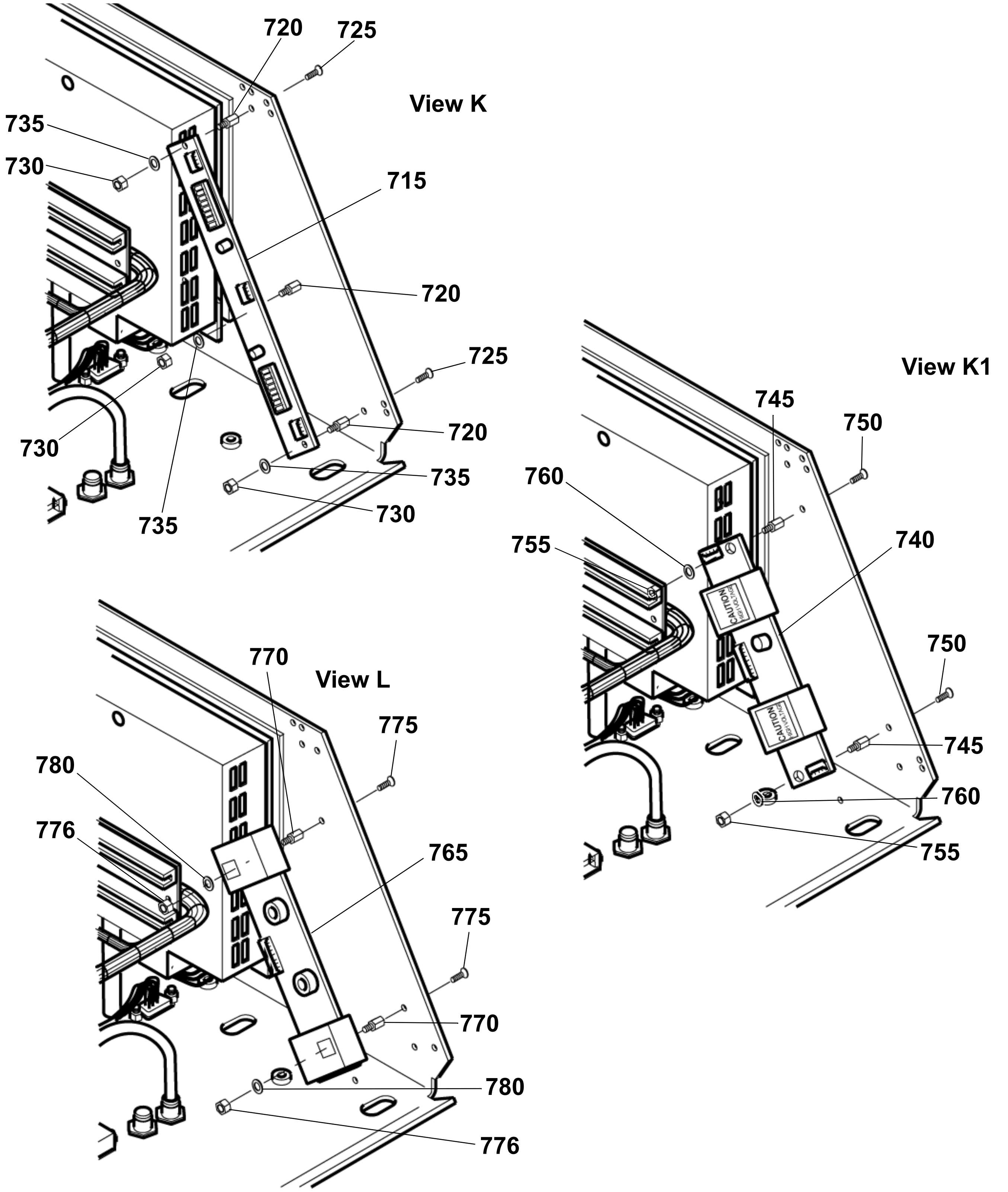
Electronic module
Figure 4
(Sheet 6 of 18)



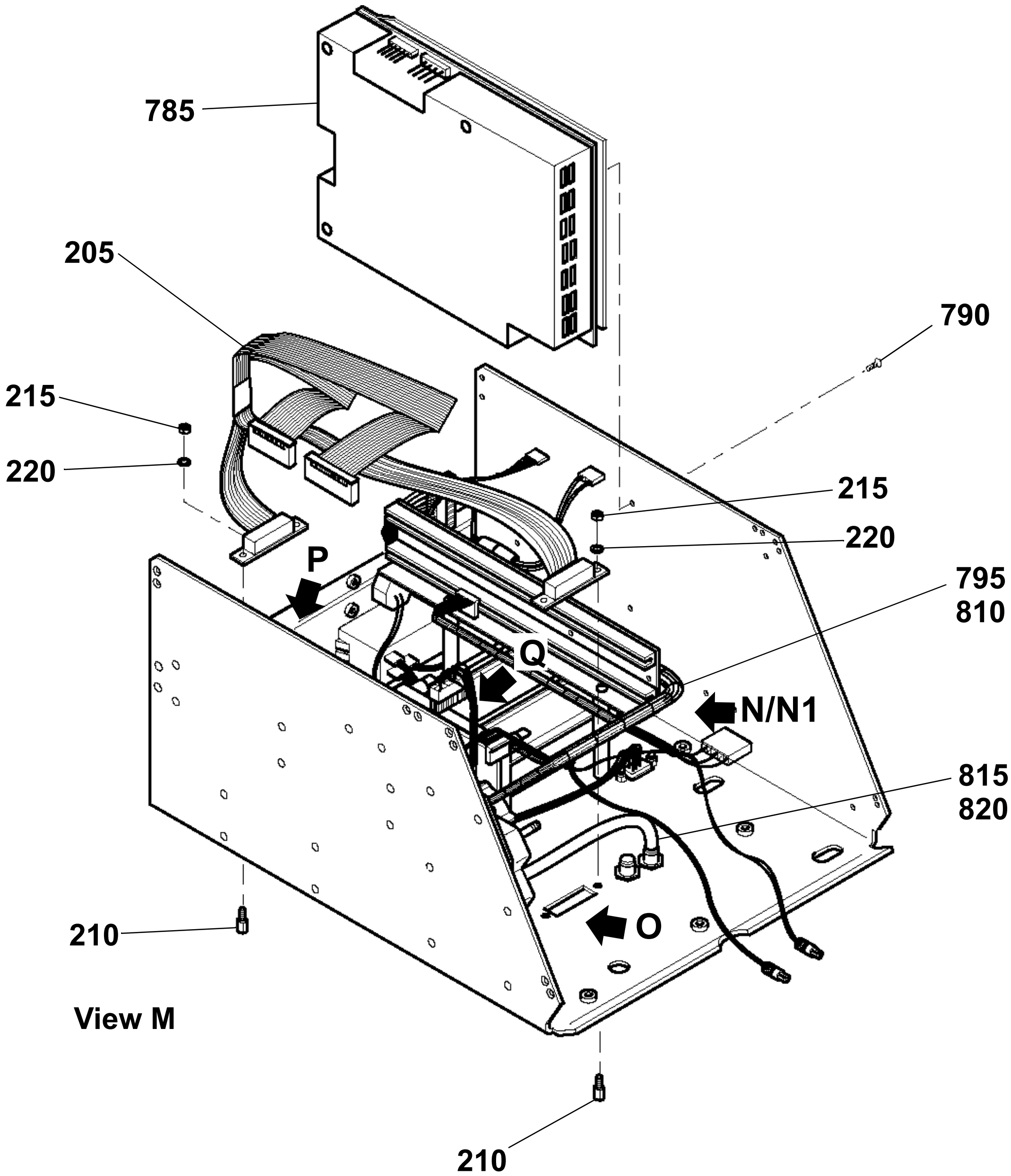
Electronic module
Figure 4
(Sheet 7 of 18)



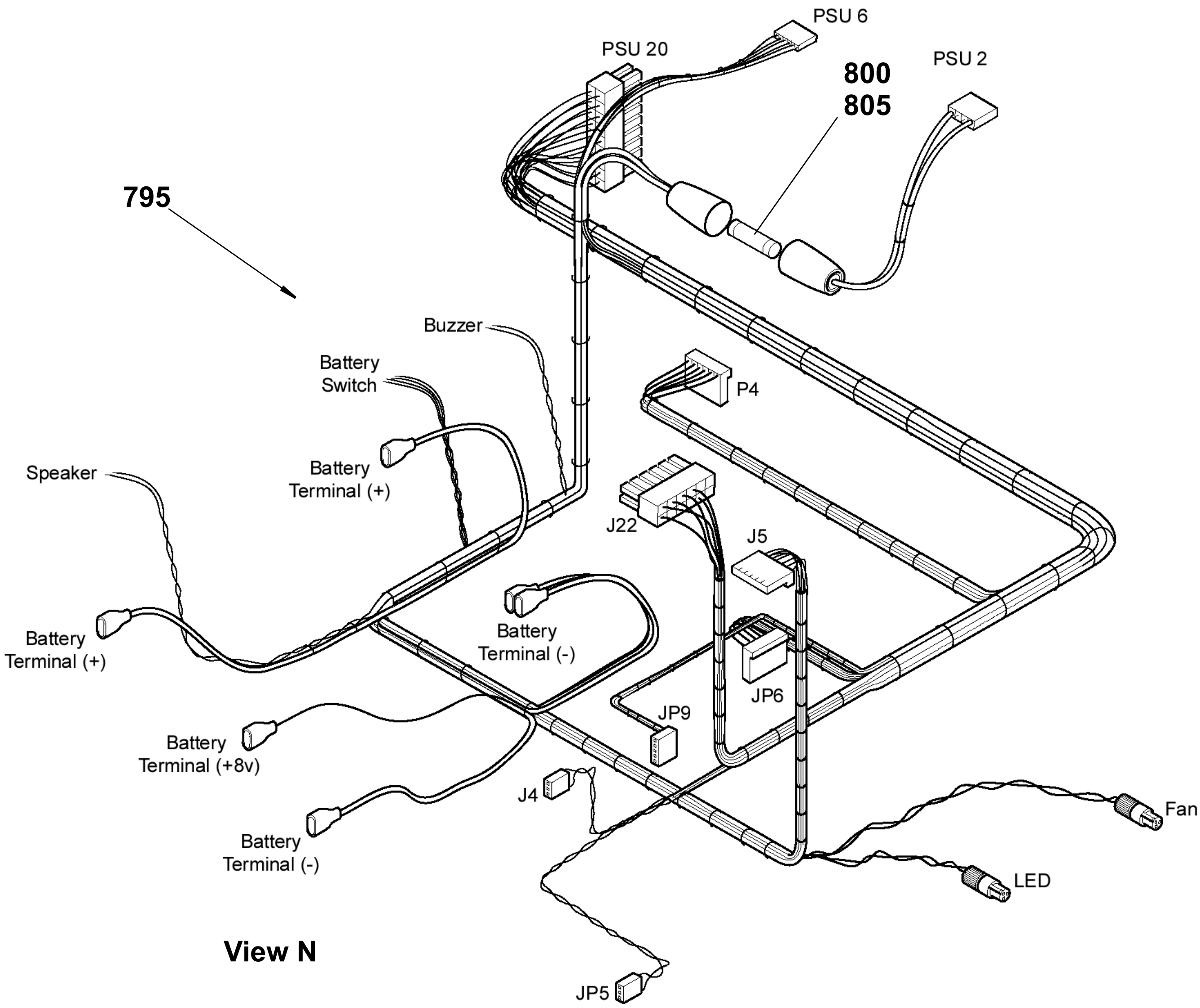
Electronic module
Figure 4
(Sheet 8 of 18)



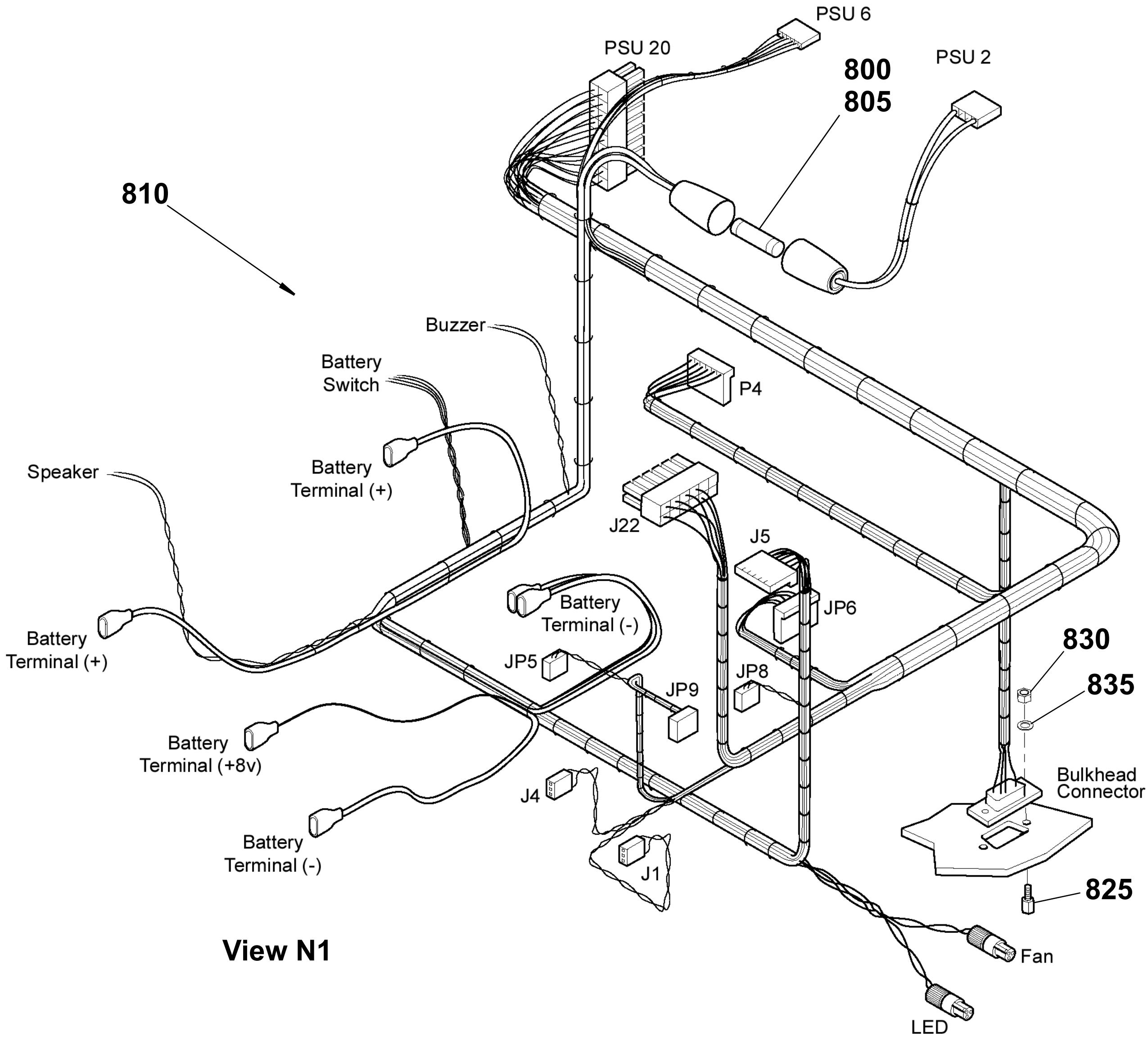
Electronic module
Figure 4
(Sheet 9 of 18)



Electronic module
Figure 4
(Sheet 10 of 18)

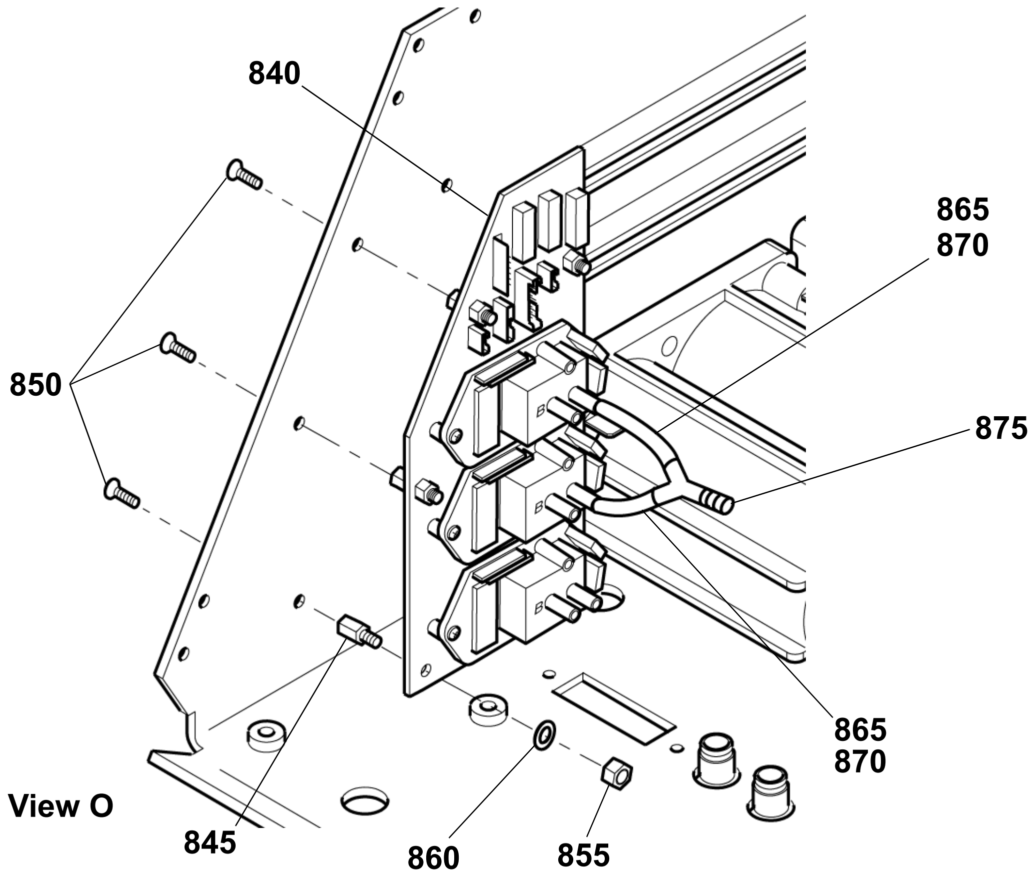


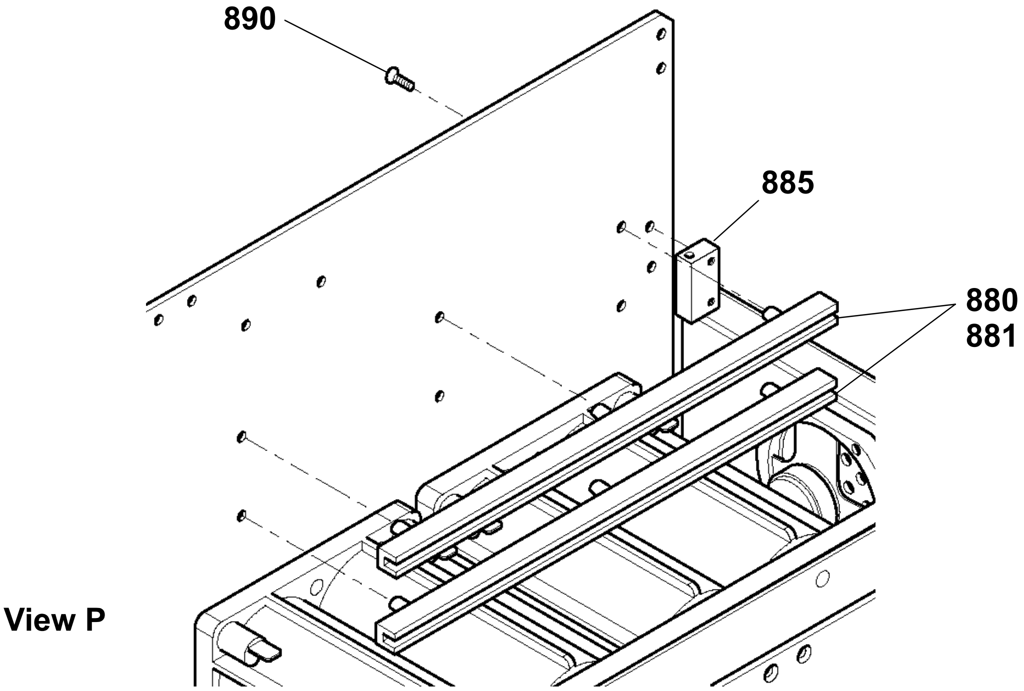
Electronic module
Figure 4
(Sheet 11 of 18)



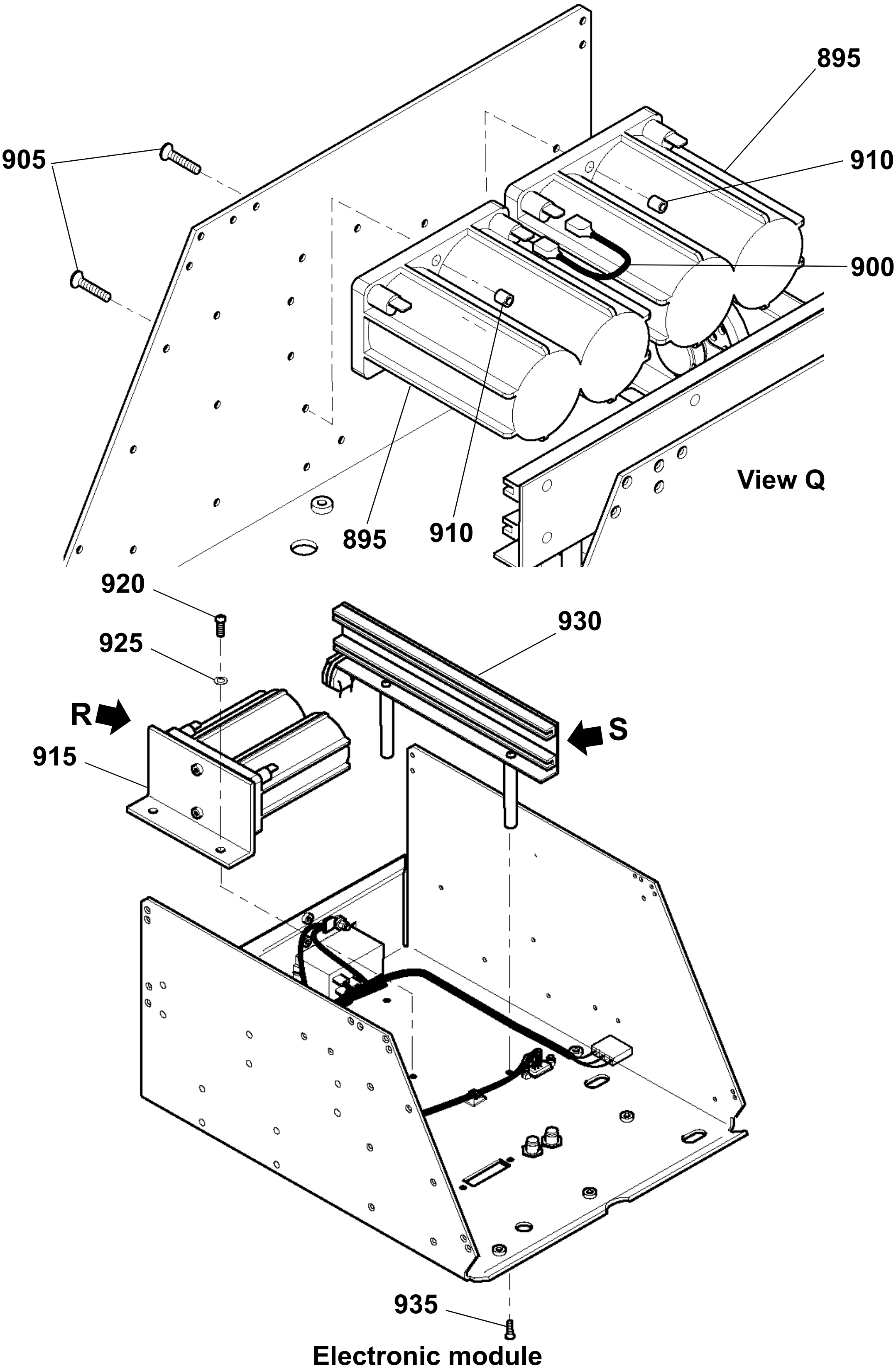
Electronic module
Figure 4
(Sheet 12 of 18)

SLE

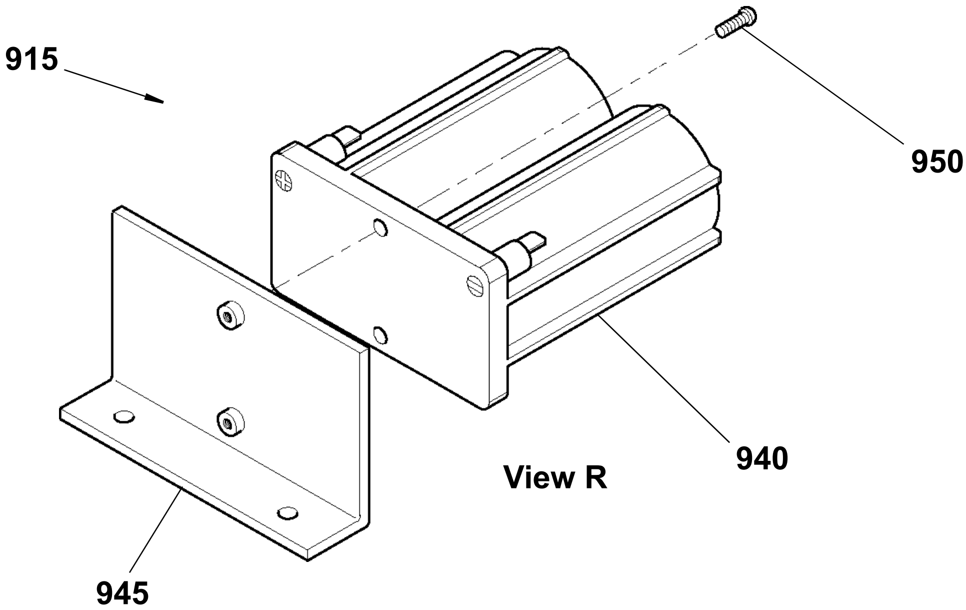


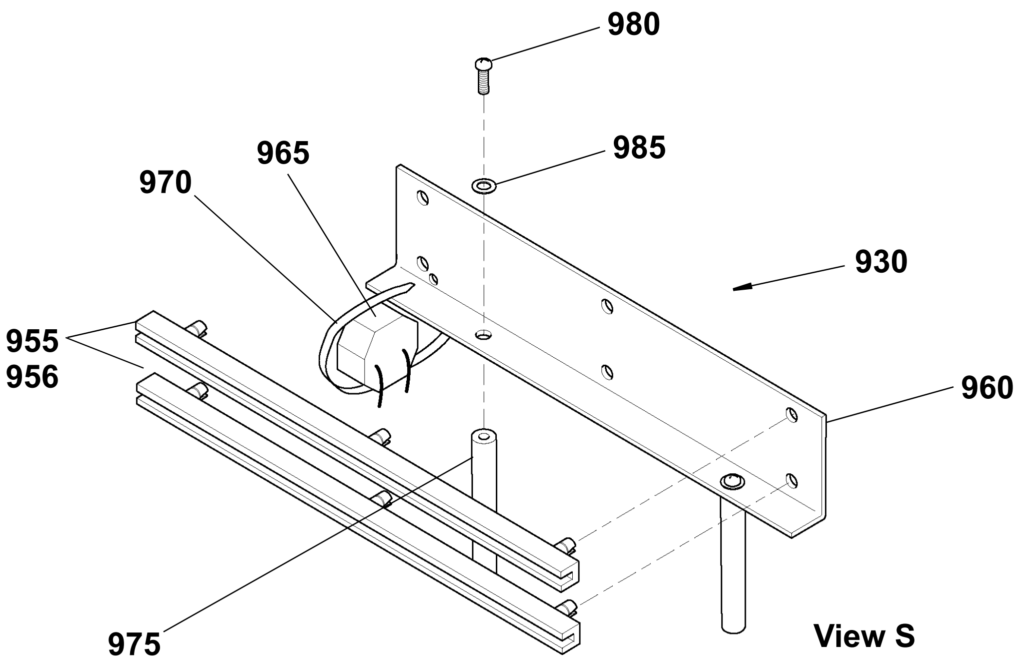


Electronic module
Figure 4
(Sheet 13 of 18)

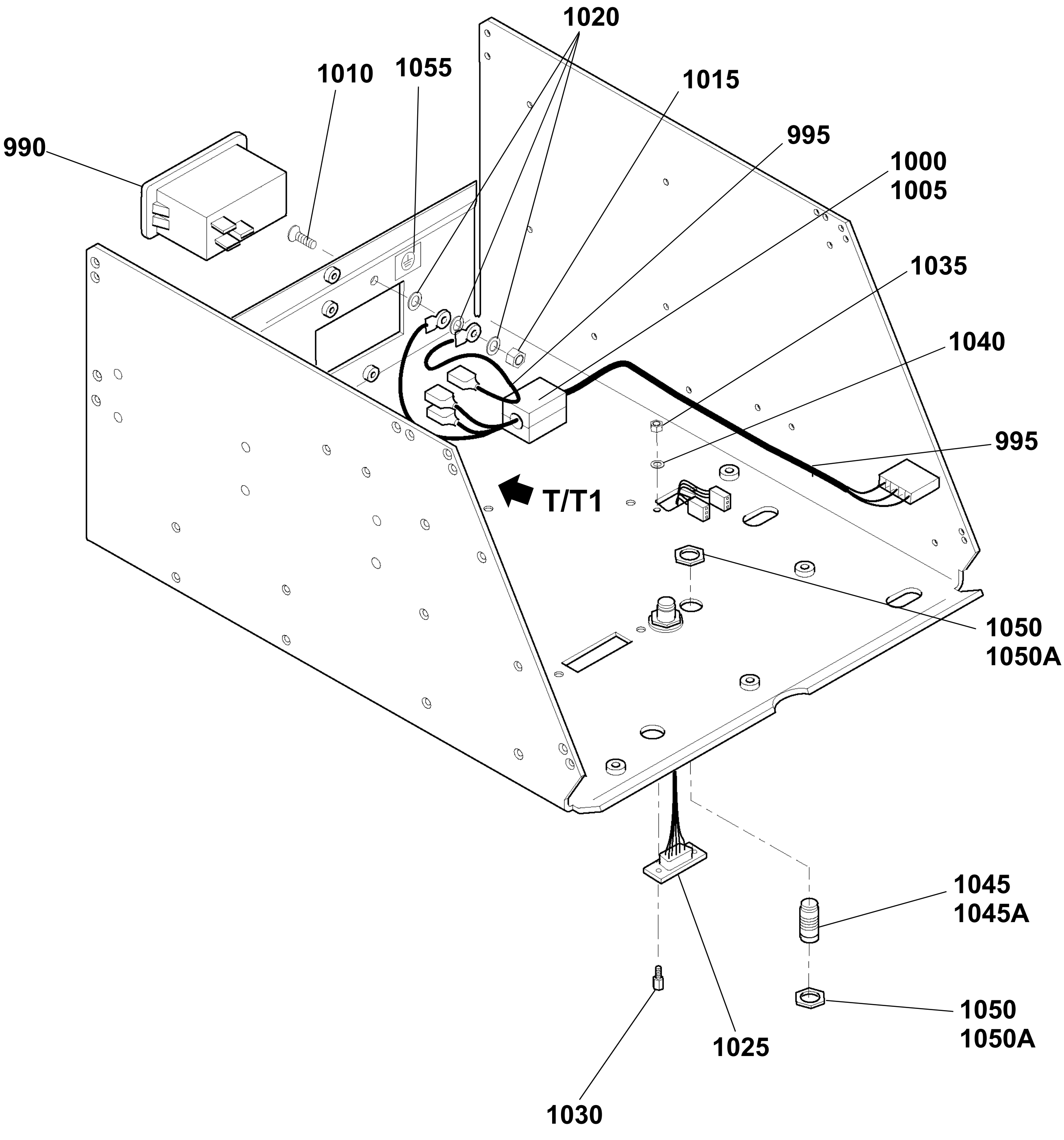


Electronic module
Figure 4
(Sheet 14 of 18)

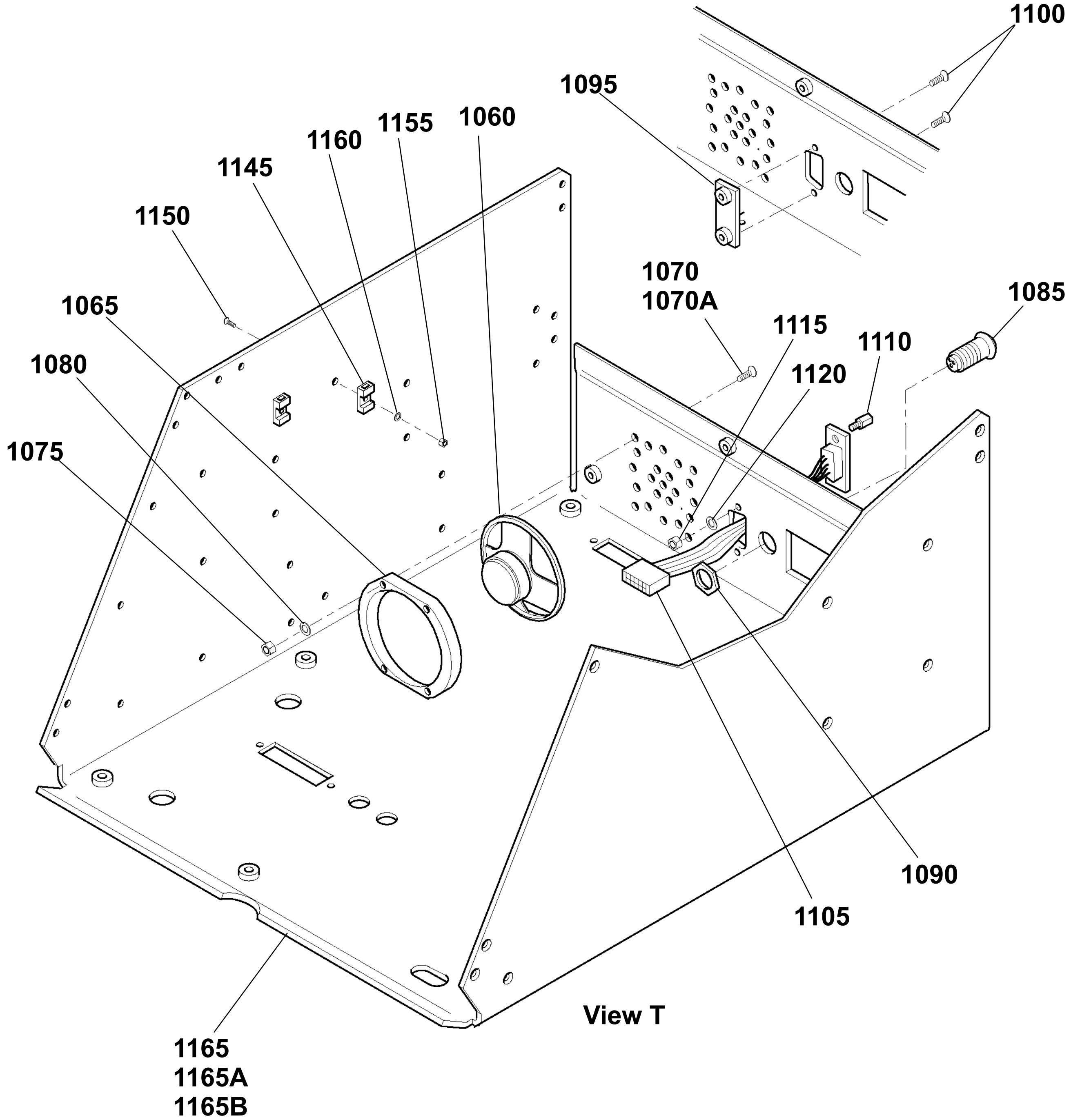




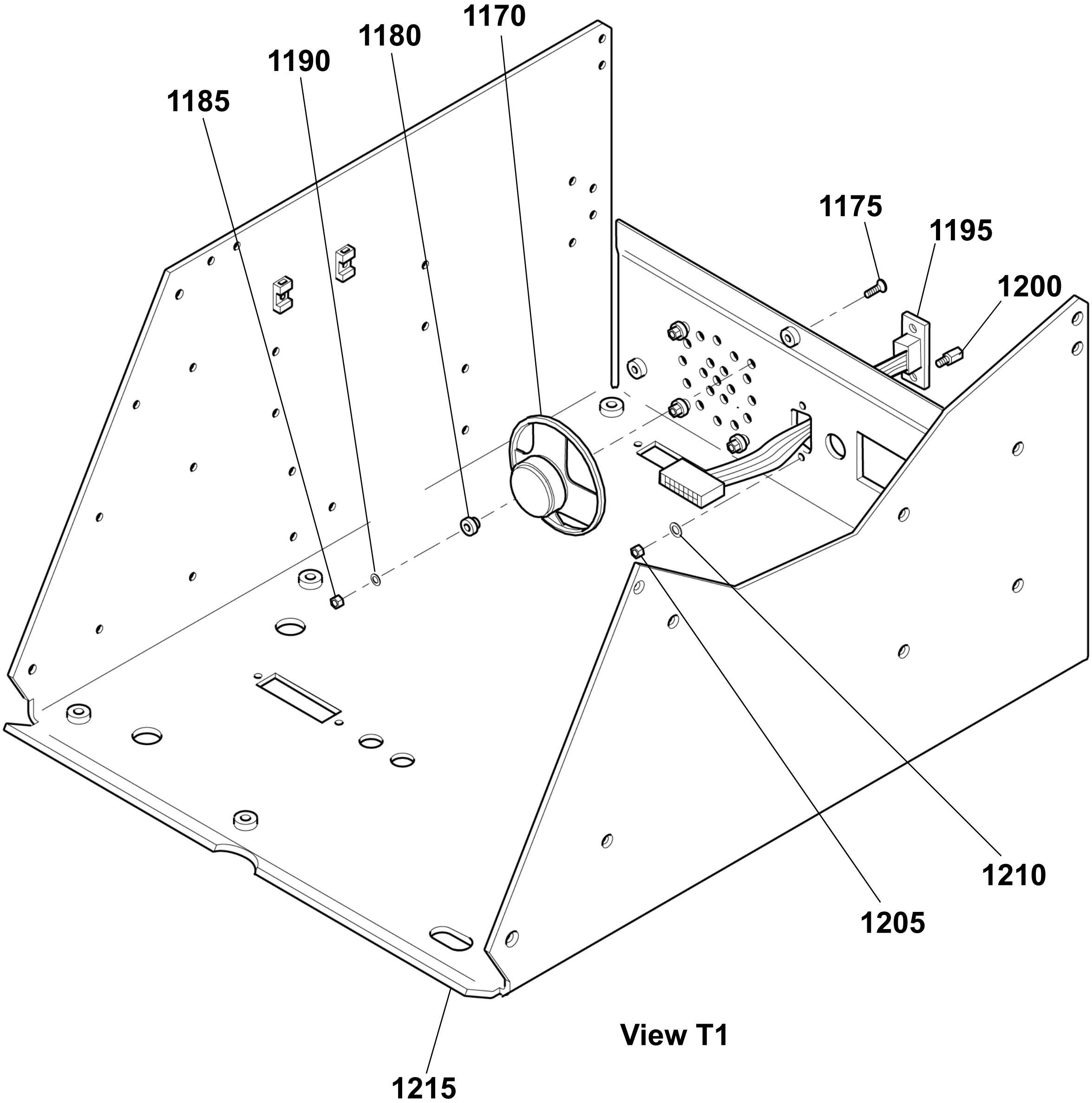
Electronic module
Figure 4
(Sheet 15 of 18)



Electronic module
Figure 4
(Sheet 16 of 18)



Electronic module
Figure 4
(Sheet 17 of 18)



View T1

Electronic module
Figure 4
(Sheet 18 of 18)

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 1	L0270	Electronic module assembly (See figure 1 for next highest assembly)		RF
5	L5000-04-05	.Computer & display control Assembly Obsolete item Use item 5A		1
5A	L0272	.Computer & display control Assembly (with CMOS battery backup)		1
		Attaching Parts		
10	H3135	.Screw (M3 x 35mm)		1
		* * *		
15	N6634	..Can Card		1
		Attaching Parts		
20	H3125	..Screw (M3 x 25mm)		2
25	H3094/01	..Washer, crinkle (M3)		2
30	H3106	..Screw (M3 x 6mm)		2
35	H3094/01	..Washer, crinkle (M3)		2
		* * *		
40	M0305/46	..Spacer, brass		2
45	T0336/02	..Spacer, nylon		2
		* * *		
50	W0329	.Ribbon cable		2
		* * *		
55	L5000-04-55	.Cable LCD assembly Uses N6631/04 Obsolete item (For Serial Nº: 51110 51449)		1
60	L5000-04-60	.Cable LCD assembly Uses N6631/11 (For Serial Nº: 51450 to 51569)		1
62	N6631/12	.Cable LCD assembly (For Serial Nº: 51570 onwards)		1
65	M0767/12	.Core, ferrite hinged		1
70	T1306	.Rod, locking Obsolete item (For Serial Nº: 51085 to 51163)		1

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 70A	T1306/01	.Rod, locking (For Serial Nº: 51164 onwards)		1
		Attaching Parts		
-75	M0745/01	.Adhesive, silicone		1
-80	M0434	.Cable Tie, Nylon		1
-85	M0434	.Cable Tie, Nylon		3
		* * *		
90	N6631/01	..PC Board		1
-95	N6631/07	...Heatsink, clip on		1
		* * *		
100	L5000-04-100	..Speaker and loom assembly Obsolete item (For Serial Nº: 51010 to 51133) (See items 285 & 287)		1
100A	L5000-04-100A	..Speaker and loom assembly Obsolete item (See items 290 & 295)		1
		Attaching Parts		
105	T0209/01	.Thumb nut		4
110	H3108	..Screw (M3 x 8mm)		4
115	H3094	..Washer, shakeproof (M3)		4
		* * *		
120	M0305/33	..Pillar		4
125	H3106	..Screw (M3 x 6mm)		4
130	H3094	..Washer, shakeproof (M3)		4
		* * *		
135	N6631/06	.Serial Controller, PCB		1
		Attaching Parts		
140	M0305/36	.Pillar		4
145	H3091	.Nut (M3)		4
150	H3094	..Washer, shakeproof (M3)		8
155	H3106	..Screw (M3 x 6mm)		4
		* * *		
160	L5000-04-160	.Connector loom (Ref: Dwg AS/L0272)		1
		Attaching Parts		
165	M0434/01	.Cable tie		1
170	M0434	.Cable tie		1
		* * *		

SLE

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 175	L5000-04-175	.Cooling fan assembly (See items 310-335) Attaching Parts		1
180	H3108	..Screw (M3 x 8mm)		2
185	H3091	..Nut (M3)		2
190	H3094	..Washer, shakeproof (M3)		2
		* * *		
195	L5000-04-195	.Link wire (16/0.2)		AR
		* * *		
200	T1260	.Mounting plate		1
		* * *		
205	W0327	.Cable, ribbon assy Attaching Parts		1
210	M0306 (1)	..Screwlock, screw		4
215	M0306 (2)	..Screwlock, nut		4
220	M0306 (3)	..Screwlock, washer		4
		* * *		
225	W0330	.Cable, ribbon assy		1
		* * *		
230	W0331	.Cable, ribbon assy		1
		* * *		
235	S0250	.Cover, PCB connector		1
		* * *		
285	W0335	.Display/RS232, ribbon cable Obsolete item (For Serial Nº: 51010 to 51133)		1
287	M0903/65	.Speaker		1
		* * *		
290	W0337	.Display/RS232, ribbon cable		1
295	M0903/65	.Speaker		1
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 310	M0902/40	Cooling fan		2
315	P0448/03	Socket, electrical		1
		Attaching Parts		
320	H3116	..Screw (M3 x 16mm)		8
325	H3091	.Nut (M3)		8
330	H3094	..Washer, shakeproof (M3)		8
		* * *		
335	T1296	..Bracket, twin fan		1
		* * *		
340	N6631/01	..PC Board		1
-341	N6631/07	...Heatsink, clip on		1
		* * *		
342	L5000-04-342	..Speaker and loom assembly (See items 435 & 436)		1
		Attaching Parts		
343	T0209/01	.Thumb nut		4
344	H3108	..Screw (M3 x 8mm)		4
345	H3094	..Washer, shakeproof (M3)		4
346	H3091	.Nut (M3)		4
347	H3094	..Washer, shakeproof (M3)		4
348	H3108	..Screw (M3 x 8mm)		4
-349	M0434/01	.Cable tie		1
		* * *		
350	M0484/03	.AA cell, 1.5v		2
		* * *		
351	M0305/33	..Pillar		4
355	H3106	..Screw (M3 x 6mm)		4
360	H3094	..Washer, shakeproof (M3)		4
		* * *		
365	N6631/06	.Serial Controller, PCB		1
		Attaching Parts		
370	M0305/36	.Pillar		4
375	H3091	.Nut (M3)		4
380	H3094	..Washer, shakeproof (M3)		8
385	H3106	..Screw (M3 x 6mm)		4
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 390	L5000-04-160	.Connector loom (Ref: Dwg AS/L0272)		1
		Attaching Parts		
400	M0434/01	.Cable tie		1
405	M0434	.Cable tie		1
		* * *		
410	L5000-04-175	.Cooling fan assembly (See items 310-335)		1
		Attaching Parts		
415	H3108	..Screw (M3 x 8mm)		2
420	H3091	..Nut (M3)		2
425	H3094	..Washer, shakeproof (M3)		2
		* * *		
421	L5000-04-195	.Link wire (16/0.2)		AR
		* * *		
430	T1260	.Mounting plate		1
		* * *		
435	A0763/02	.Control & Monitor PCB Note: See “A0736/02 Monitor and control board” on page 74.		1
		* * *		
436	W0345	.Display/RS232, ribbon cable		1
437	M0903/65	.Speaker		1
		* * *		
440	N6631/14	.Display assembly (See items 465-485)		1
		Attaching Parts		
445	H3106	..Screw (M3 x 6mm)		2
450	H3110	..Screw (M3 x 10mm)		2
455	H3091	.Nut (M3)		2
460	H3094	..Washer, shakeproof (M3)		2
		* * *		
461	T1310/02	.Strap,Connector (For Serial Nº: 51570 onwards)		1
462	M0603	.Pad, Foam. (23mm)		1
		Attaching Parts		
463	H3108	..Screw (M3 x 8mm)		2
464	H3094	..Washer, shakeproof (M3)		2
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 465	L5000-04-465	.Liquid Crystal display Obsolete item (For Serial Nº: 51010 to 51163) (Supplier: L.G.Philips) (Part Nº LB121S1)		1
465A	N6631/02	.Liquid Crystal display (For Serial Nº: 51164 onwards) (Supplier: L.G.Philips) (Part Nº LB121S02-A2)		1
470	N6631/05	.Touch screen		1
		Attaching Parts		
475	M0907	..Tape		AR
		* * *		
480	T0253/01	..Spacer, block Obsolete item (For Serial Nº: 51010 to 51163)		2
480A	T0253/02	..Spacer, block (For Serial Nº: 51164 onwards)		2
		Attaching Parts		
485	H3106	..Screw (M3 x 6mm)		2
		* * *		
490	L5000-04-490	.Screen Mounting Assembly (For Serial Nº: 51010 to 51526) (See items 515-620)		1
		Attaching Parts		
495	H3208	..Screw (M3 x 8mm)		8
		* * *		
500	L5000-04-500	.Screen Mounting Assembly (For Serial Nº: 51527 onwards) (See items 625-710)		1
		Attaching Parts		
505	H4108	..Screw (M4 x 8mm)		4
510	H4094	..Washer, shakeproof (M4)		4
		* * *		
515	T1191	.Tie Bar		2
		Attaching Parts		
520	H3108	..Screw (M3 x 8mm)		6
525	H3094	..Washer, shakeproof (M3)		6
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 530	L0011/60	.Dampener Assembly Obsolete item Use item 340A (For Serial Nº: 51010 to 51332)		1
530A	L0011	.Dampener Assembly (For Serial Nº: 51333 onwards)		1
-535	M0434	.Cable tie		1
		Attaching Parts		
540	H3108	..Screw (M3 x 8mm)		2
545	H3094	..Washer, shakeproof (M3)		2
		* * *		
550	L5000-04-550	.Fan assembly Obsolete item (For Serial Nº: 51010 to 51699) (See items 570-580)		1
		Attaching Parts		
555	H3112	..Screw (M3 x 12mm)		4
560	H3091	..Nut (M3)		4
565	H3094	..Washer, shakeproof (M3)		4
		* * *		
-570	M0902	..Fan, cooling		1
-575	P0448/03	..Plug		1
-580	M0309/01	..Sleeve (20mm)		AR
		* * *		
585	T1253	.Spacer Obsolete item (For Serial Nº: 51010 to 51163)		2
585A	M0305/29	.Spacer (For Serial Nº: 51164 onwards)		2
		Attaching Parts		
590	H3208	.Screw (M3 x 8mm)		2
		* * *		
595	M0630	..Foam pad (92mm) Obsolete item (For Serial Nº: 51010 to 51084)		0
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 600	M0856	.Clamp, cable tie		1
605	M0305/10	.Spacer, Nylon (12mm long)		1
		Attaching Parts		
610	H3220	..Screw (M3 x 20mm)		1
615	H3093	..Washer (M3)		2
		* * *		
620	L5000-04-620	.Screen Mounting Plate Obsolete item Use item 710 (For Serial Nº: 51010 to 51569)		1
		* * *		
625	T1310	.Tie Bar		2
		Attaching Parts		
630	H3108	..Screw (M3 x 8mm)		6
635	H3094	..Washer, shakeproof (M3)		6
		* * *		
640	L0011/60	.Dampener Assembly Obsolete item Use item 340A (For Serial Nº: 51010 to 51332)		1
640A	L0011	.Dampener Assembly (For Serial Nº: 51333 onwards)		1
-645	M0434	.Cable tie		1
		Attaching Parts		
650	H3108	..Screw (M3 x 8mm)		2
655	H3094	..Washer, shakeproof (M3)		2
		* * *		
660	L5000-04-660	.Fan assembly (For Serial Nº: 51700 onwards) (See items 676-678)		1
		Attaching Parts		
665	H3908	..Screw, Skt Cap. (M3 x 8mm)		4
670	H3094	..Washer, shakeproof (M3)		4
		* * *		
-676	M0902/01	..Fan, cooling		1
-677	P0448/03	..Plug		1
-678	M0309/01	..Sleeve (20mm)		AR
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 680	T1253	.Spacer Obsolete item (For Serial Nº: 51010 to 51163)		2
680A	M0305/29	.Spacer (For Serial Nº: 51164 onwards)		2
		Attaching Parts		
685	H3208	.Screw (M3 x 8mm)		2
		* * *		
690	M0856	.Clamp, cable tie		1
695	M0305/10	.Spacer, Nylon (12mm long)		1
		Attaching Parts		
700	H3220	..Screw (M3 x 20mm)		1
705	H3093	..Washer (M3)		2
		* * *		
710	T1240	.Screen Mounting Plate		1
		* * *		
715	N6631/03	.Inverter PCB (For Serial Nº: 51010 to 51444)		1
		Attaching Parts		
720	M0305/36	..Pillar		3
725	H3206	..Screw (M3 x 6mm)		2
730	H3091	..Nut (M3)		3
735	H3094/01	..Washer crinkle (M3)		3
		* * *		
740	N6631/10	.Inverter PCB (For Serial Nº: 51445 to 51569)		1
		Attaching Parts		
745	M0305/36	..Pillar		2
750	H3206	..Screw (M3 x 6mm)		2
755	H3091	..Nut (M3)		2
760	H3094/01	..Washer crinkle (M3)		2
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 765	N6631/13	.Inverter PCB (For Serial Nº: 51570 onwards) Attaching Parts		1
770	M0305/36	..Pillar		3
775	H3206	..Screw (M3 x 6mm)		2
776	H3091	..Nut (M3)		3
780	H3094/01	..Washer crinkle (M3)		3
		* * *		
785	M0900	.Power Supply Unit Attaching Parts		1
790	H3210	..Screw (M3 x 10mm)		4
		* * *		
795	L5000-04-795	.Main Loom Obsolete item (For Serial Nº: 51010 to 51134)		1
800	M0779/10	.Fuse, 10amp		1
-805	M0434	.Cable tie		AR
		* * *		
810	W0328	.Main Loom (For Serial Nº: 51135 onwards)		1
		* * *		
815	N2373	.Tube, Polyurethane (Length165mm)		1
-820	M0434	.Cable tie		1
		* * *		
825	M0306 (1)	..Screw		2
830	M0306 (2)	..Nut		2
835	M0306 (3)	..Washer		2
		* * *		
840	A0761	.Transducer PCB Assembly (Open PCB transducer used from ventilator serial Nº: 51859 onwards) Attaching Parts		1
845	M0305/36	..Pillar		6
850	H3206	..Screw (M3 x 6mm)		6
855	H3091	..Nut (M3)		6
860	H3094	..Washer, shakeproof (M3)		6
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 865	N2373	.Tube		AR
-870	M0434	.Cable tie		4
875	N2520	.Y Piece Connector		1
		* * *		
880	M0904	.PCB Runner		2
		Attaching Parts		
-881	M0752	..Adhesive		AR
		* * *		
885	T1243	.Locking Block, PCB		1
		Attaching Parts		
890	H3208	..Screw (M3 x 8mm)		2
		* * *		
895	M0901	.Battery, Back-up		2
900	W0332	.Link Cable, Battery		1
		Attaching Parts		
905	H4212	..Screw (M4 x 12mm)		4
910	T1192	..Boss, battery mounting		4
		* * *		
915	L5000-04-915	.Battery/Bracket Assembly (See items 940-950)		1
		Attaching Parts		
920	H4110	..Screw (M4 x 10mm)		2
925	H4094	..Washer, shakeproof (M4)		2
		* * *		
930	L5000-04-930	PCB Bracket Runner Assembly (See items 955-985)		1
		Attaching Parts		
935	H3210	..Screw (M3 x 10mm)		2
		* * *		
940	M0901	.Battery, Back-up		1
945	T1254	.Bracket, Battery		1
		Attaching Parts		
950	H5110	..Screw (M5 x 10mm)		2
		* * *		

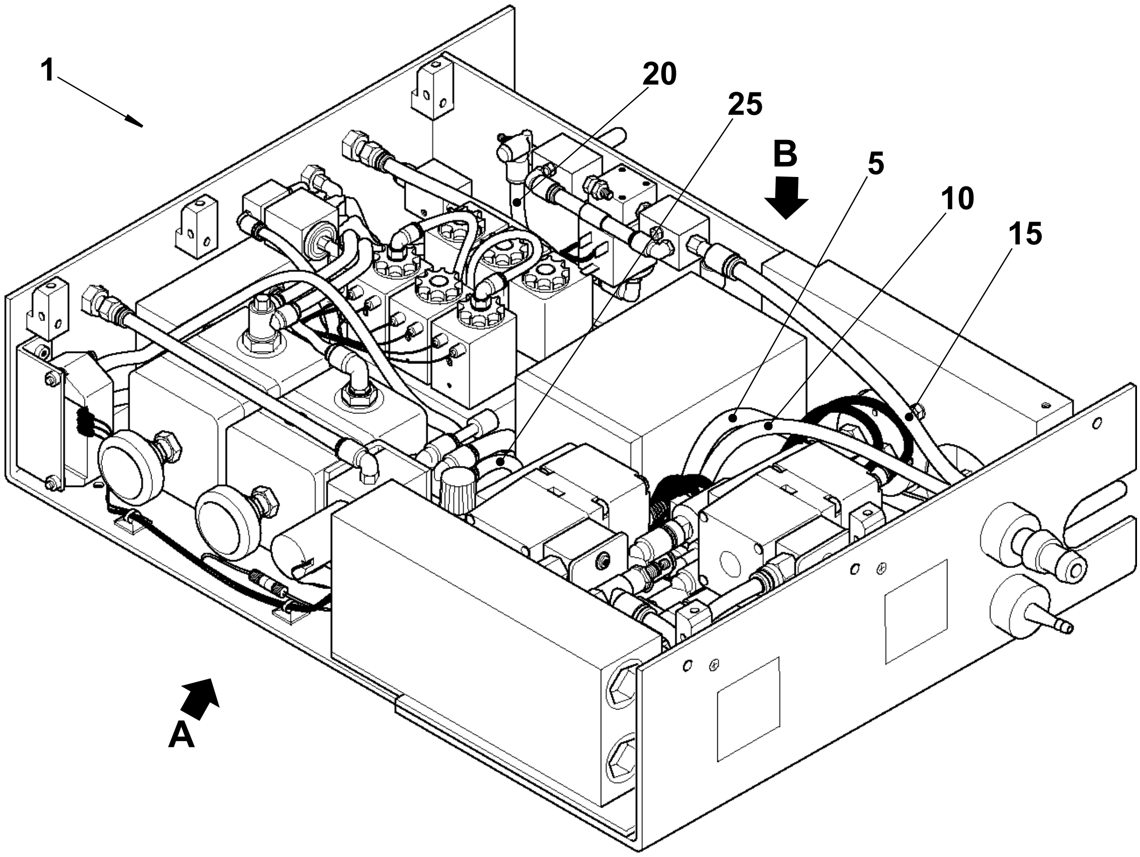
Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 955	M0904	.PCB Runner		2
-956	M0752	..Adhesive		AR
960	T1249	.Bracket, PCB Runner		1
965	N2096	.Buzzer		1
970	M0434/01	.Cable tie		1
975	T1244	.PCB Spacer		2
		Attaching Parts		
980	H3108	..Screw (M3 x 8mm)		2
985	H3094	..Washer, shakeproof (M3)		2
		* * *		
990	P0494/50	.Connector, Mains Inlet		1
995	W0325	.Mains power loom		1
1000	M0767	.Core, Ferrite		1
1005	M0660	.Pad, adhesive		1
		Attaching Parts		
1010	H4216	..Screw (M4 x 16mm)		1
1015	H4091	..Nut (M4)		1
1020	H4094	..Washer, shakeproof (M4)		3
		* * *		
1025	W0326	.Loom Obsolete item. (For Serial Nº: 51010 to 51134)		1
		Attaching Parts		
1030	M0306 (1)	..Screw		2
1035	M0306 (2)	..Nut		2
1040	M0306 (3)	..Washer		2
		* * *		

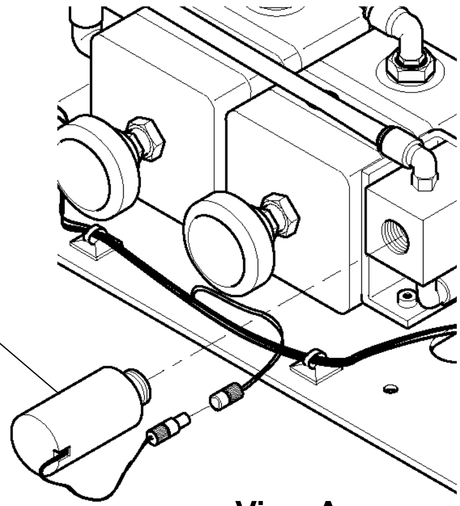
Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 1045	L5000-04-1045	.Pneumatic connector Obsolete item (For Serial Nº: 51010 to 51133) (Supplier: SMC)		2
1045A	N6616 (1)	.Pneumatic connector (For Serial Nº: 51134 onwards) (Supplier: West Group)		2
		Attaching Parts		
1050	L5000-04-1050	..Nut, Locking Obsolete item (For Serial Nº: 51010 to 51133) (Supplier: SMC)		4
1050A	N6616 (2)	..Nut, Locking (For Serial Nº: 51134 onwards) (Supplier: West Group)		4
		* * *		
1055	M0706/02	.label, earth		1
		* * *		
1060	M0903	.Speaker		1
1065	T1245	.Clamp, Speaker		1
		Attaching Parts		
1070	H3210	..Screw (M3 x 10mm) (For Serial Nº: 51456 onwards)		4
1070A	H3212	..Screw (M3 x 12mm) Obsolete item (For Serial Nº: 51010 to 51455)		4
1075	H3091	..Nut (M3) Obsolete item (For Serial Nº: 51010 to 51455)		4
1080	H3094	..Washer, shakeproof (M3) Obsolete item (For Serial Nº: 51010 to 51455)		4
		* * *		
1085	O0431 (1)	.Switch, Push Button		1
		Attaching Parts		
1090	O0431 (2)	.Nut, locking		1
		* * *		
1095	T1250	.Plate, Blanking		1
		Attaching Parts		
1100	H3208	.Screw (M3 x 8mm)		2
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 1105	W0338	.Cable, Ribbon RS232 connector (For Serial Nº: 51100 & 51115 to TBA) Attaching parts		1
1110	M0306 (1)	..Screw		2
1115	M0306 (2)	..Nut		2
1120	M0306 (3)	..Washer		2
		* * *		
1145	M0856	.Clamp, cable tie Attaching parts		2
1150	H3206	..Screw (M3 x 6mm)		2
1155	H3091	..Nut (M3)		2
1160	H3094	..Washer, shakeproof (M3)		2
		* * *		
1165	L5000-04-1165	.Chassis, Electronic Unit Obsolete Item. (For Serial Nº: 51010 to 51133)		1
1165A	L5000-04-1165A	.Chassis, Electronic Unit Obsolete Item. (For Serial Nº: 51134 to 51428)		1
1165B	L5000-04-1165B	.Chassis, Electronic Unit Obsolete Item. (For Serial Nº: 51429 to 51526)		1
		* * *		
1170	M0903	.Speaker Attaching parts		1
1175	H3212	..Screw (M3 x 12mm)		4
1180	T0209/02	..Washer, shouldered		
1185	H3091	..Nut (M3)		4
1190	H3094	..Washer, shakeproof (M3)		4
		* * *		
1195	TBA	.Cable, Ribbon RS232 connector (For Serial Nº: TBA onwards) Attaching parts		1
1200	M0306 (1)	..Screw		2
1205	M0306 (2)	..Nut		2
1210	M0306 (3)	..Washer		2
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
4 1215	T1188	.Chassis, Electronic Unit (For Serial Nº: 51527 onwards) * * *		1

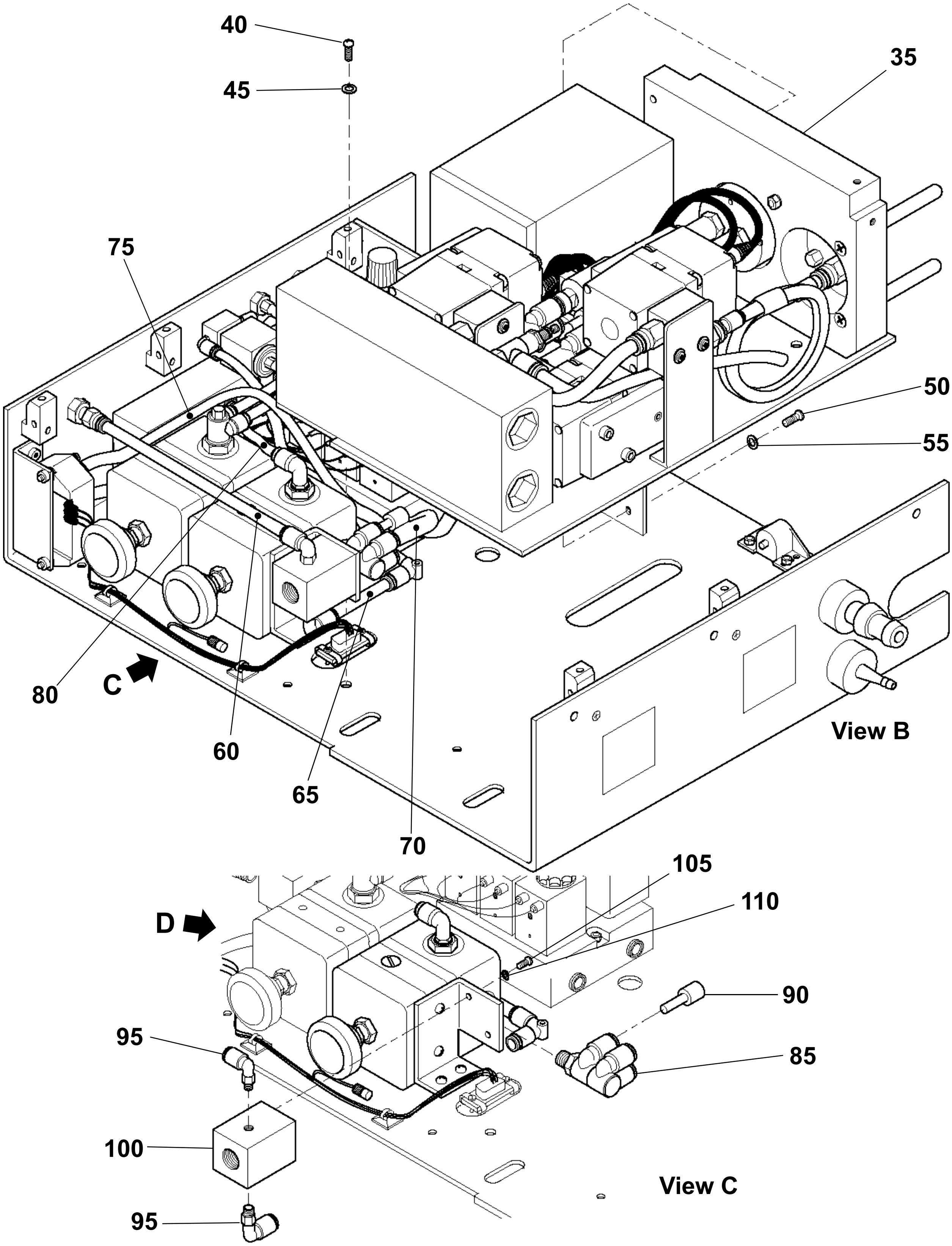
- Item Not illustrated



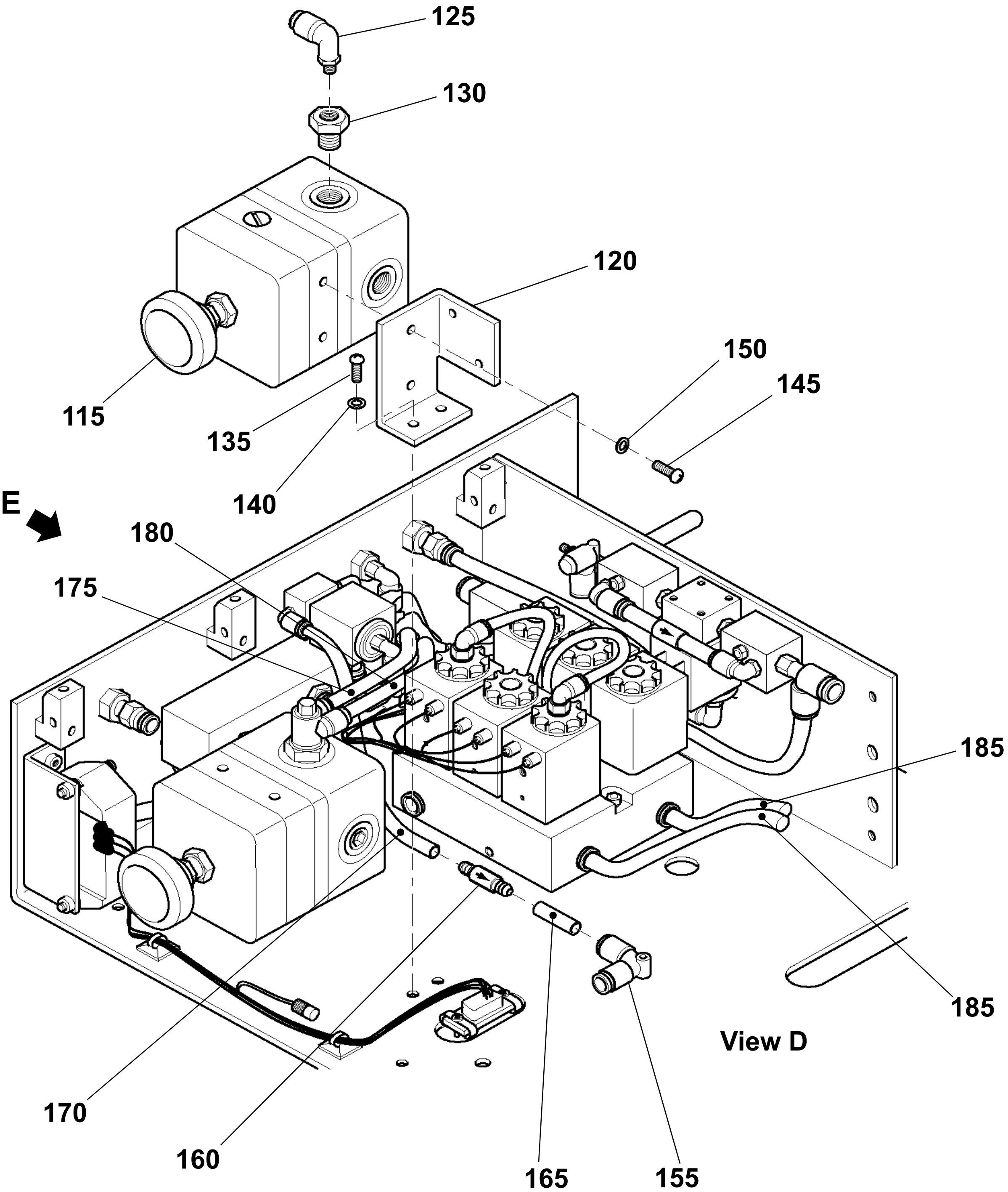


View A

Pneumatic module
Figure 5
(Sheet 1 of 4)

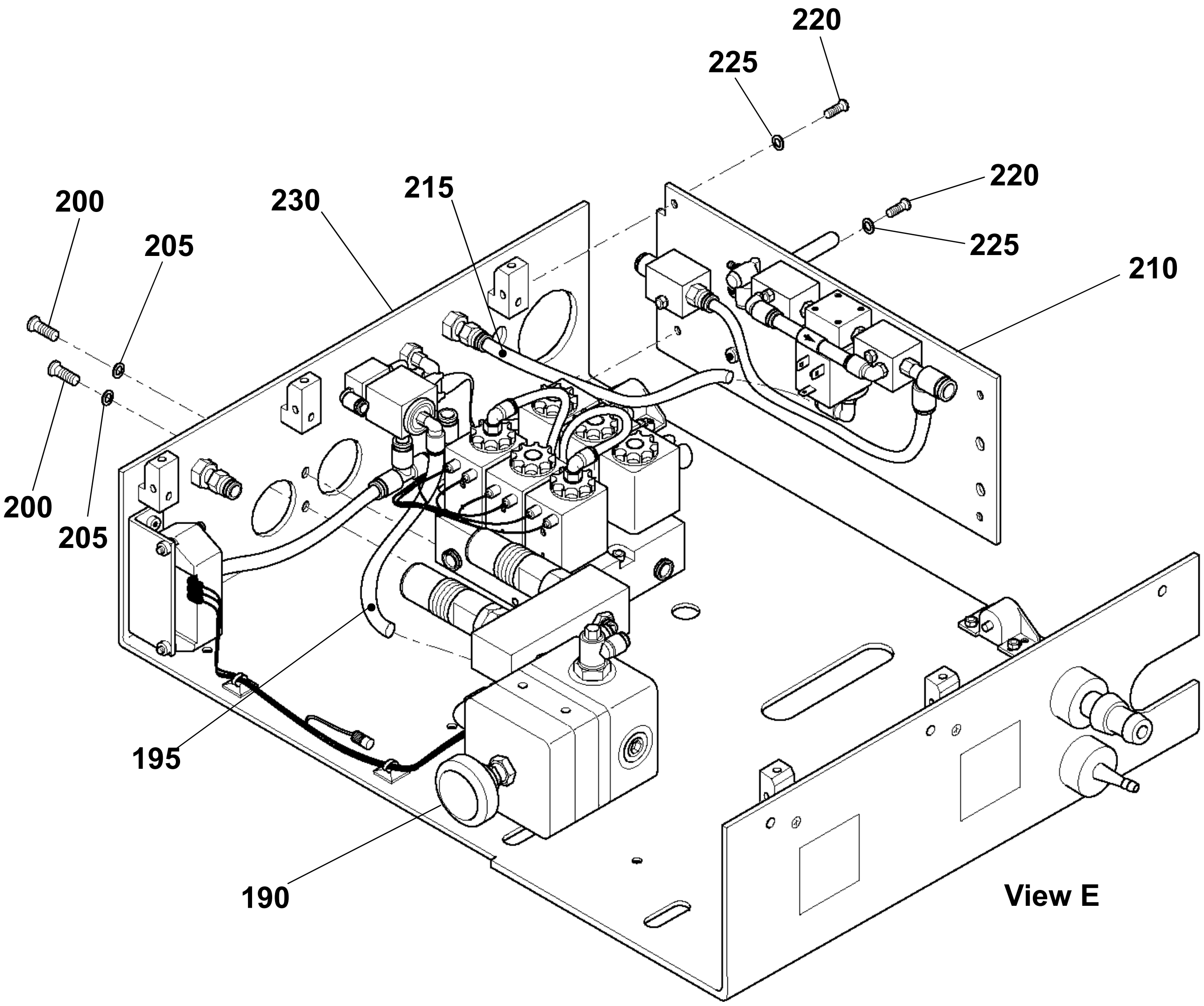


Pneumatic module
Figure 5
(Sheet 2 of 4)



Pneumatic module
Figure 5
(Sheet 3 of 4)

SLE

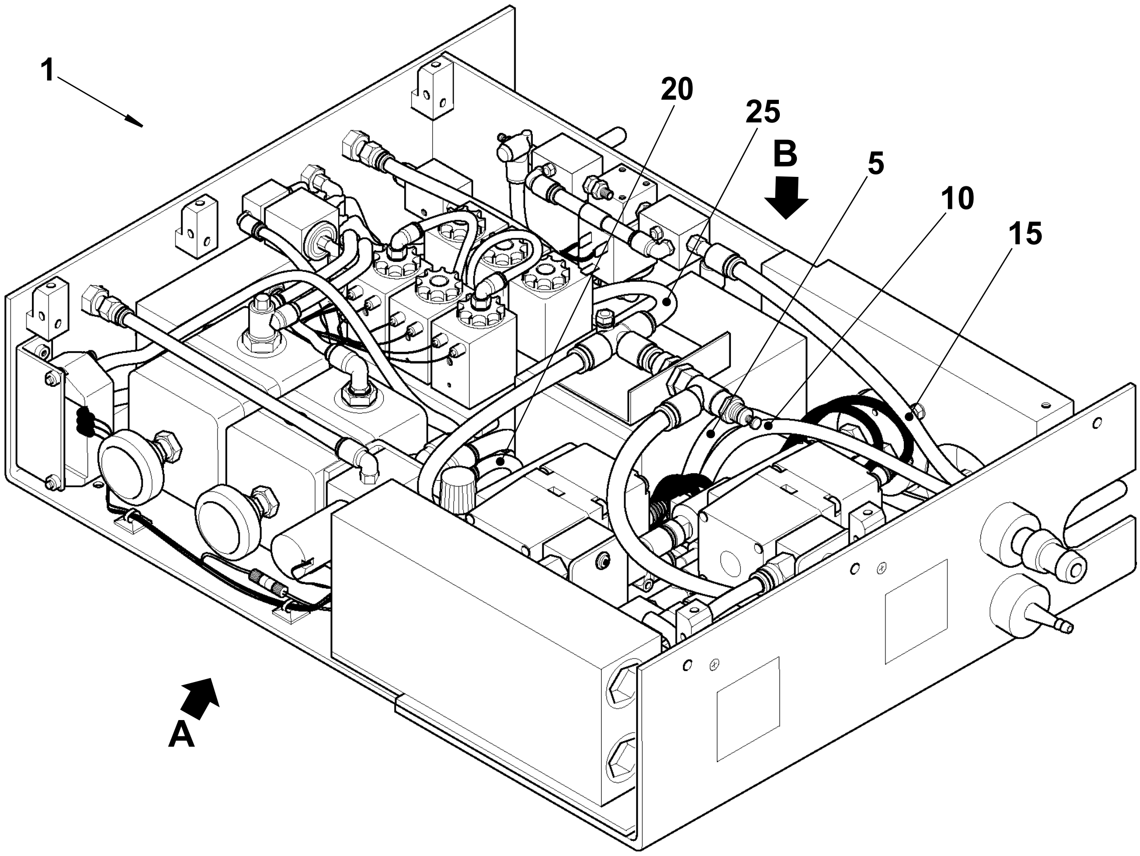


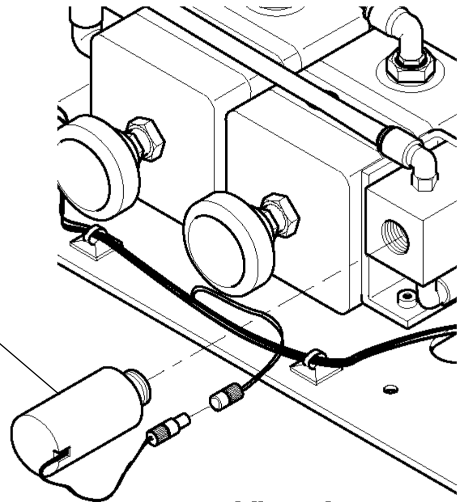
Pneumatic module
Figure 5
(Sheet 4 of 4)

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
5 1	L5000-01-175	Pneumatic module assembly Obsolete item. (Use Part Nº: L0208, Fig 6, item 1) (See Figure 1 for next highest assembly)		RF
5	N2373	.Tube, Polyurethane (Length 155mm)		1
10	N2373	.Tube, Polyurethane (Length 190mm)		1
15	N2373	.Tube, Polyurethane (Length 135mm)		1
20	N2373	.Tube, Polyurethane (Length 300mm)		1
25	N2373	.Tube, Polyurethane (Length 170mm)		1
		* * *		
30	N2191/10	.Oxygen sensor cell		1
		* * *		
35	L5000-05-35	.HFO module Obsolete item. (Use Part Nº: L0281, Fig 8 item 1) (See Figure 7 for detailed breakdown)		1
		Attaching Parts		
40	H4108	..Screw (M4 x 8mm)		4
45	H4094	....Washer, shakeproof (M4)		4
50	H3018	..Screw (M3 x 8mm)		2
55	H3094	..Washer, shakeproof (M3)		2
		* * *		
60	N2373	.Tube, Polyurethane (Length 125mm)		1
65	N2373	.Tube, Polyurethane (Length 55mm)		1
70	N2373	.Tube, Polyurethane (Length 190mm)		1
75	N2373	.Tube, Polyurethane (Length 250mm)		1
80	N2373	.Tube, Polyurethane (Length 140mm)		1
		* * *		
85	N6617/14	.Double twin banjo elbow		1
90	N6620	.Plug, plastic		1
95	N6601/05	.Elbow connector, swivel		2
100	T1160	.Mounting block, oxygen cell		1
		Attaching Parts		
105	H3108	..Screw (M3 x 8mm)		2
110	H3094	..Washer, shakeproof (M3)		2
		* * *		

Fig Item		SLE Part Nº	Description	Effectivity code	Units Per Assy.
5	115	N6615/01	.Pressure regulator		1
	120	T1169	.Bracket, regulator		1
	125	N6601/18	.Elbow Connector		1
	130	N2512/18	.Parallel reducer		1
			Attaching Parts		
	135	H4110	..Screw (M4 x 10mm)		2
	140	H4094	..Washer, shakeproof (M4)		2
	145	H3108	..Screw (M3 x 8mm)		2
	150	H3094	..Washer, shakeproof (M3)		2
			* * *		
	155	N6607	.Elbow, 90º union		1
	160	N2070/09	.Restrictor, in line 0.009"		1
	165	N2373	.Tube, Polyurethane (Length 45mm)		1
	170	N2373	.Tube, Polyurethane (Length 90mm)		1
			* * *		
	175	N2373	.Tube, Polyurethane (Length 150mm)		1
	180	N2373	.Tube, Polyurethane (Length 200mm)		1
	185	N2373	.Tube, Polyurethane (Length 210mm)		2
			* * *		
	190	L0282	.Oxygen regulator module assembly (See Figure 9 for detailed breakdown)		1
	195	N2373	.Tube, Polyurethane (Length 230mm)		1
			Attaching Parts		
	200	H4108	..Screw (M4 x 8mm)		2
	205	H4094	..Washer, shakeproof (M4)		2
			* * *		
	210	T1207	Partition Assembly (See Figure 10 for detailed breakdown)		1
	215	N2373	.Tube, Polyurethane (Length 165mm)		1
			Attaching Parts		
	220	H3108	..Screw (M3 x 8mm)		2
	225	H3094	..Washer, shakeproof (M3)		2
			* * *		
	230	T1187	.Pneumatic module, sub assembly (See Figure 12 for detailed breakdown)		1
			* * *		

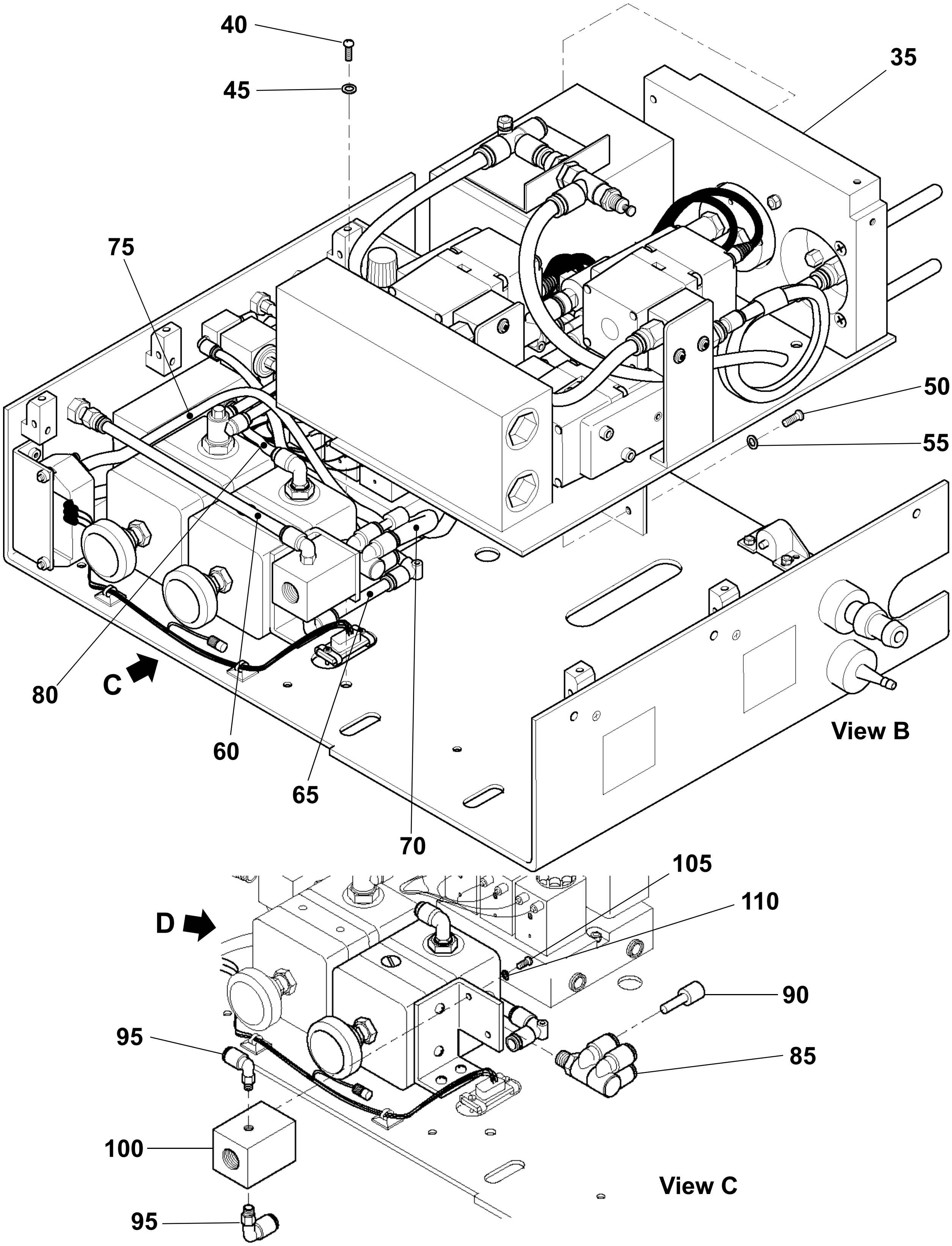
- Item Not illustrated



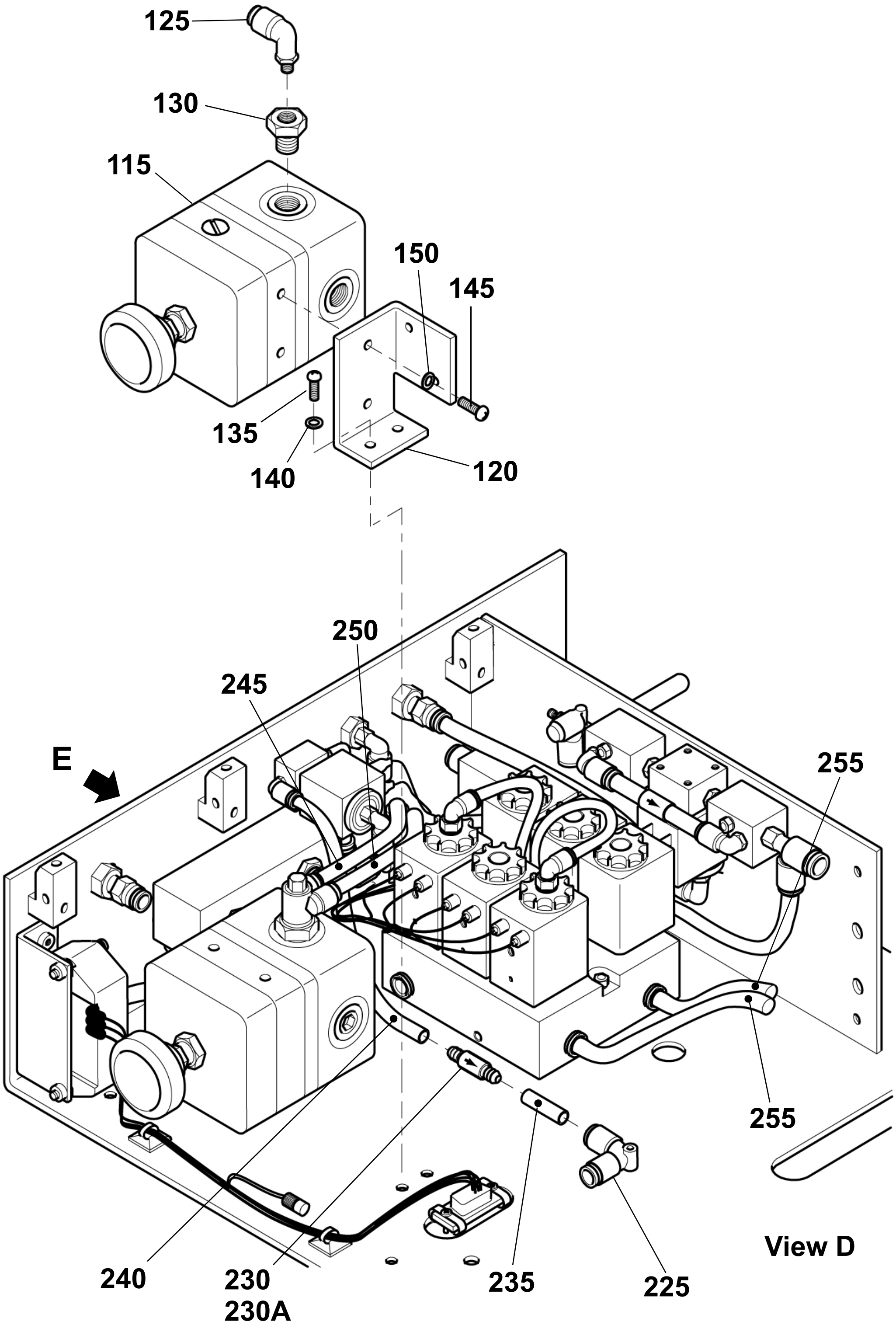


View A

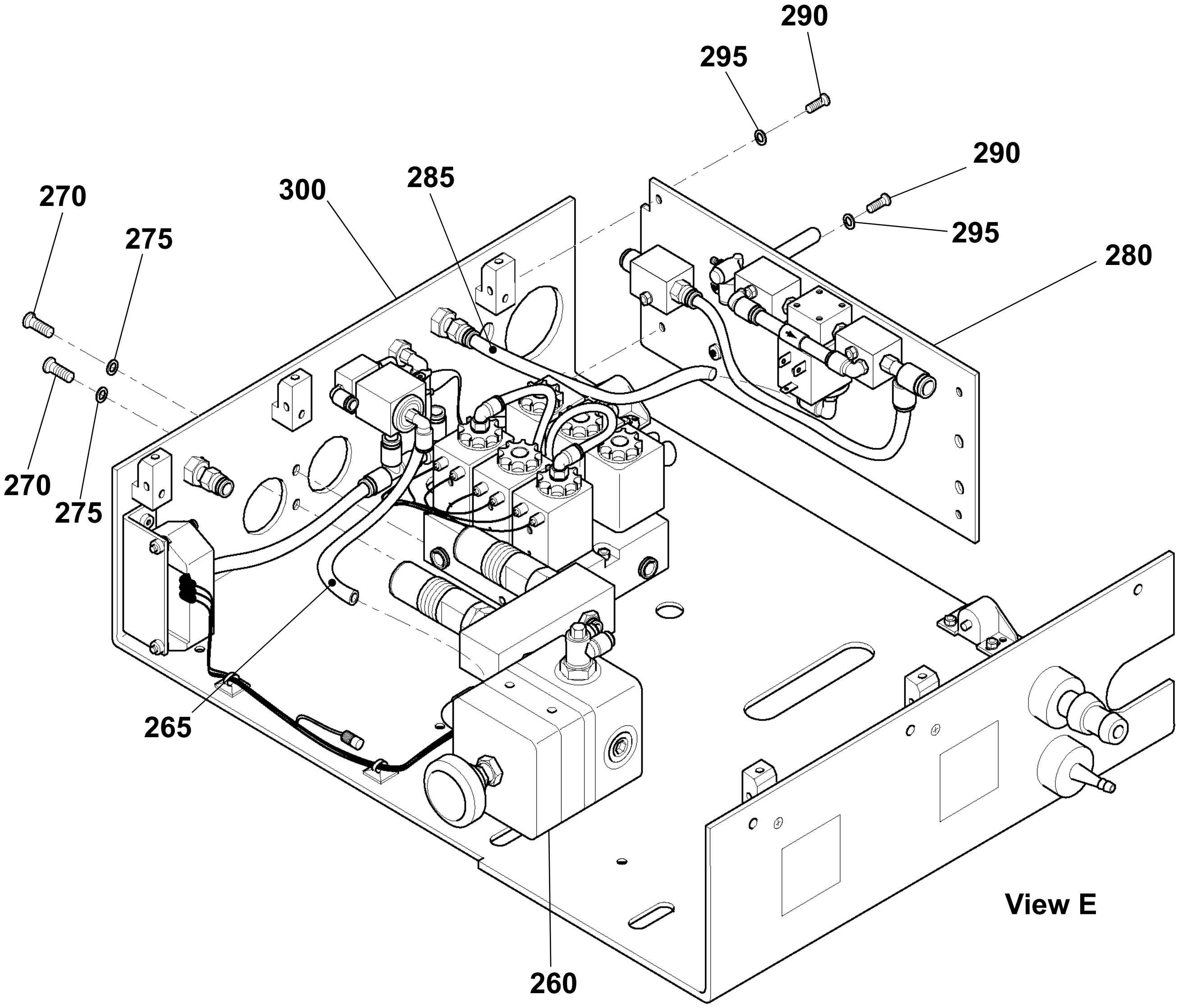
Pneumatic module
Figure 6
(Sheet 1 of 4)



Pneumatic module
Figure 6
(Sheet 2 of 4)



Pneumatic module
Figure 6
(Sheet 3 of 4)



Pneumatic module
Figure 6
(Sheet 4 of 4)

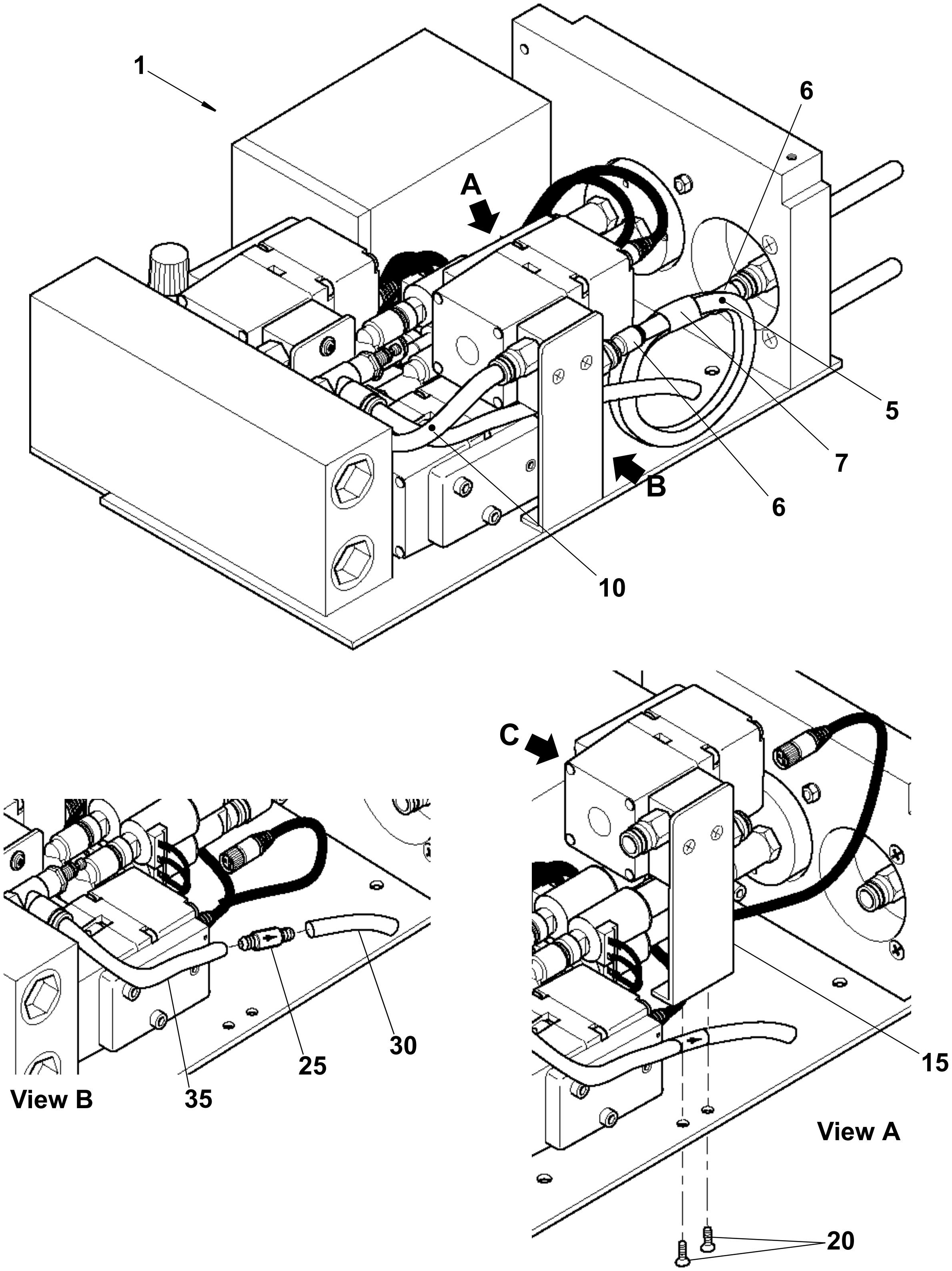
Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
6 1	L0280	Pneumatic module assembly (See Figure 1 for next highest assembly)		RF
5	N2373	.Tube, Polyurethane (Length 155mm)		1
10	N2373	.Tube, Polyurethane (Length 190mm)		1
15	N2373	.Tube, Polyurethane (Length 135mm)		1
20	N2373	.Tube, Polyurethane (Length 230mm)		1
25	N2373	.Tube, Polyurethane (Length 170mm)		1
		* * *		
30	N2191/10	.Oxygen sensor cell		1
		* * *		
35	L0281	.HFO module (See Figure 8 for detailed breakdown)		1
		Attaching Parts		
40	H4108	..Screw (M4 x 8mm)		4
45	H4094	....Washer, shakeproof (M4)		4
50	H3018	..Screw (M3 x 8mm)		2
55	H3094	..Washer, shakeproof (M3)		2
		* * *		
60	N2373	.Tube, Polyurethane (Length 125mm)		1
65	N2373	.Tube, Polyurethane (Length 55mm)		1
70	N2373	.Tube, Polyurethane (Length 190mm)		1
75	N2373	.Tube, Polyurethane (Length 250mm)		1
80	N2373	.Tube, Polyurethane (Length 140mm)		1
		* * *		
85	N6617/14	.Double twin banjo elbow		1
90	N6620	.Plug, plastic		1
95	N6601/05	.Elbow connector, swivel		2
100	T1160	.Mounting block, oxygen cell		1
		Attaching Parts		
105	H3108	..Screw (M3 x 8mm)		2
110	H3094	..Washer, shakeproof (M3)		2
		* * *		

SLE

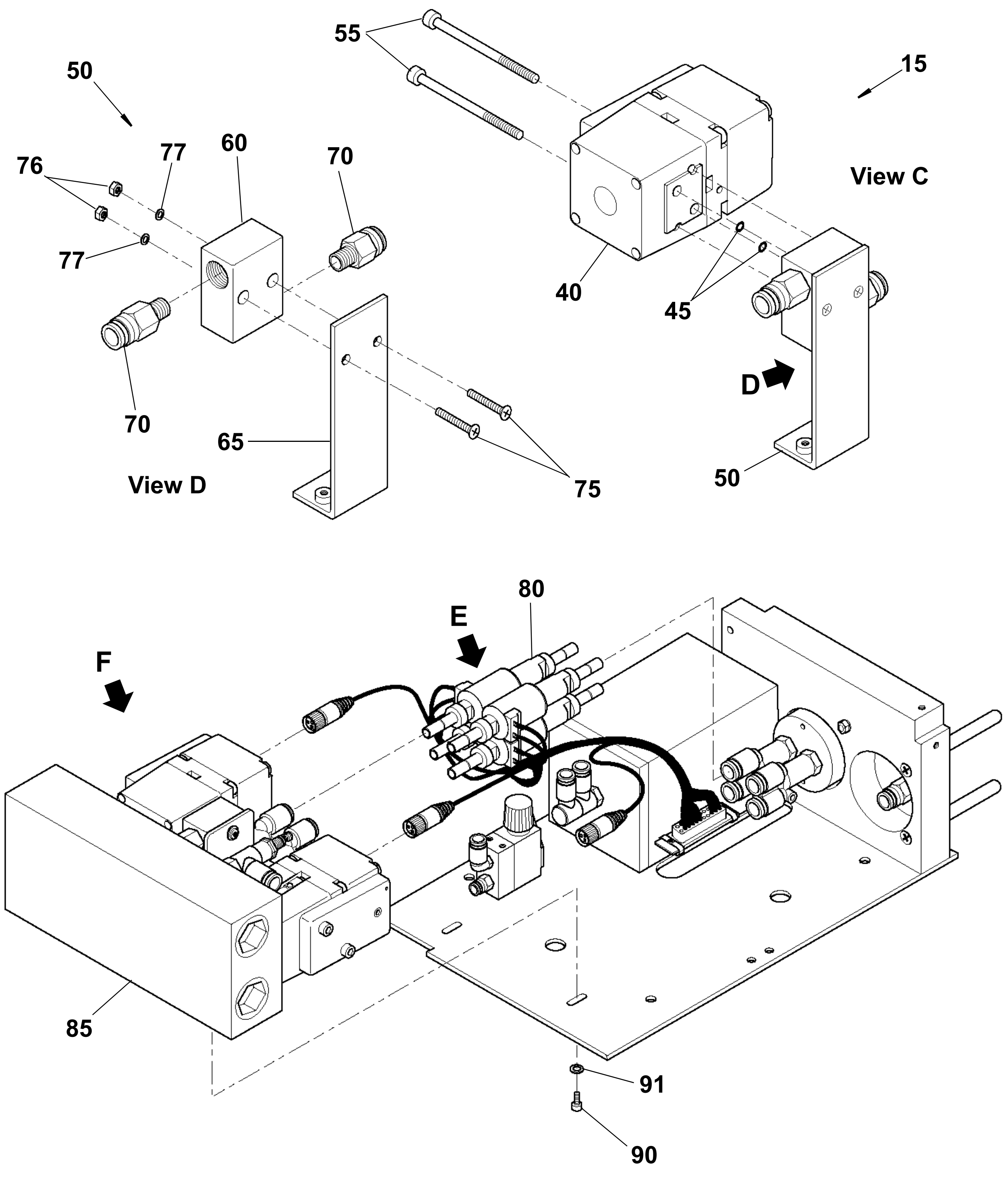
Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
6 115	N6615/01	.Pressure regulator		1
120	T1169	.Bracket, regulator		1
125	N6601/18	.Elbow Connector		1
130	N2512/18	.Parallel reducer		1
		Attaching Parts		
135	H4110	..Screw (M4 x 10mm)		2
140	H4094	..Washer, shakeproof (M4)		2
145	H3108	..Screw (M3 x 8mm)		2
150	H3094	..Washer, shakeproof (M3)		2
		* * *		
225	N6607	.Elbow, 90º union		1
230	N2070/09	.Restrictor, in line 0.009" Obsolete item (For serial Nº: 51010 to 51353) Use item 160A		1
230A	N2070/14	.Restrictor, in line 0.014" (For serial Nº: 51354 onwards)		1
235	N2373	.Tube, Polyurethane (Length 60mm)		1
240	N2373	.Tube, Polyurethane (Length 90mm)		1
		* * *		
245	N2373	.Tube, Polyurethane (Length 90mm)		1
250	N2373	.Tube, Polyurethane (Length 200mm)		1
255	N2373	.Tube, Polyurethane (Length 210mm)		2
		* * *		
260	L0282	.Oxygen regulator module assembly (See Figure 9 for detailed breakdown)		1
265	N2373	.Tube, Polyurethane (Length 230mm)		1
		Attaching Parts		
270	H4108	..Screw (M4 x 8mm)		2
275	H4094	..Washer, shakeproof (M4)		2
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
6 280	T1207.	Partition Assembly (See Figure 10 for detailed breakdown)		1
285	N2373	.Tube, Polyurethane (Length 165mm)		1
		Attaching Parts		
290	H3108	..Screw (M3 x 8mm)		2
295	H3094	..Washer, shakeproof (M3)		2
		* * *		
300	T1187	.Pneumatic module, sub assembly (See Figure 11 for detailed breakdown)		1
		* * *		

- Item Not illustrated

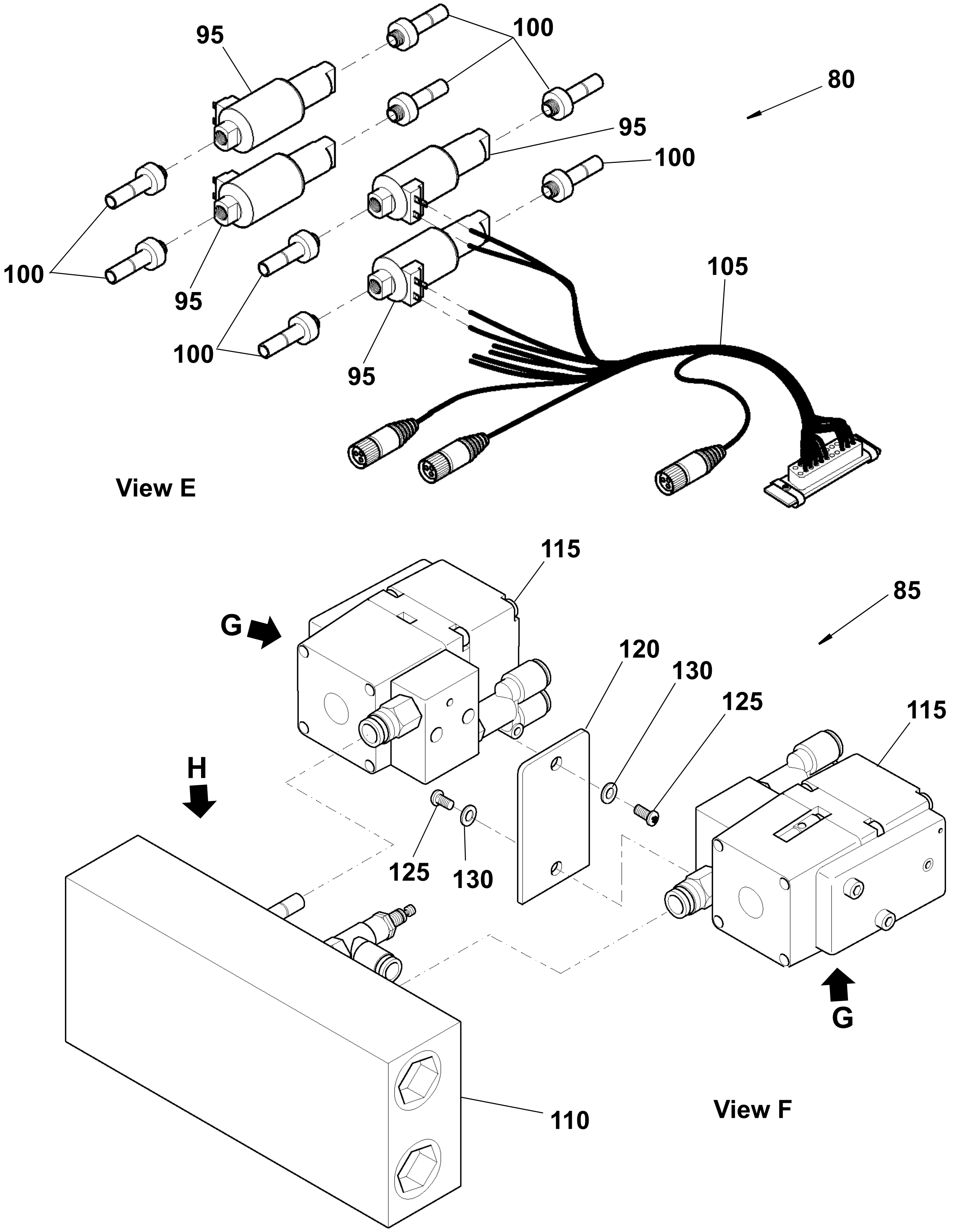


HFO module
Figure 7
(Sheet 1 of 6)

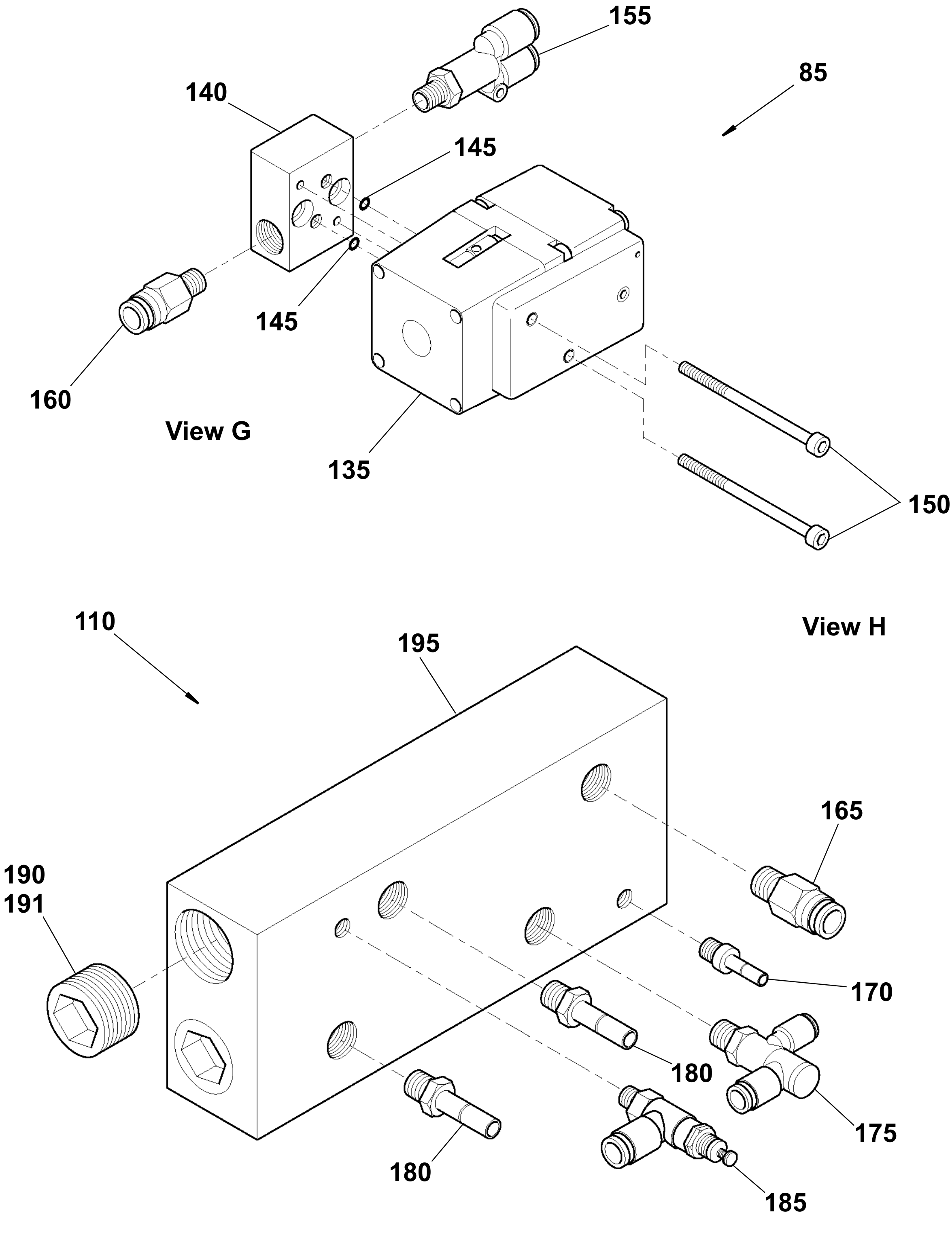


HFO module
Figure 7
(Sheet 2 of 6)

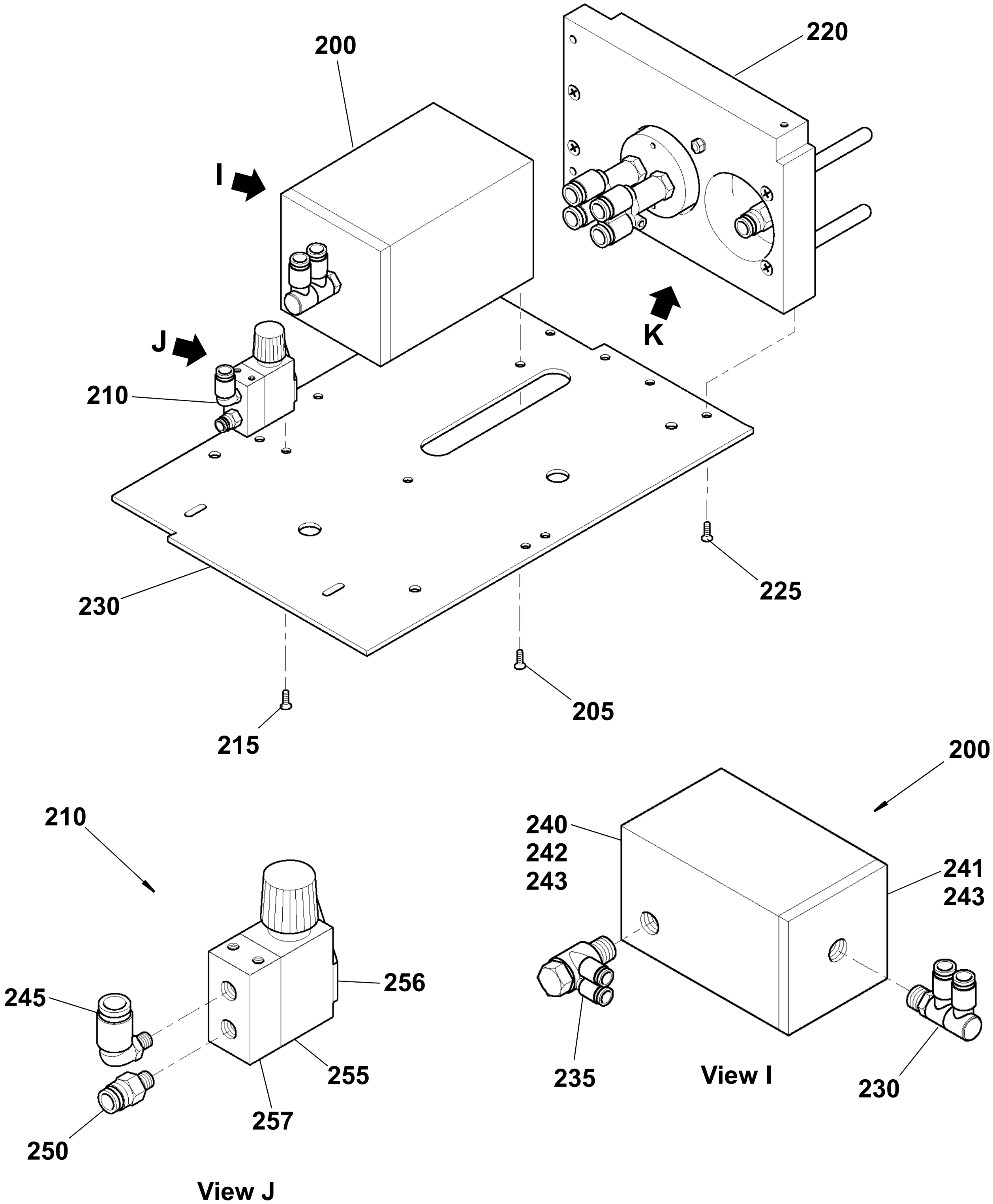
SLE



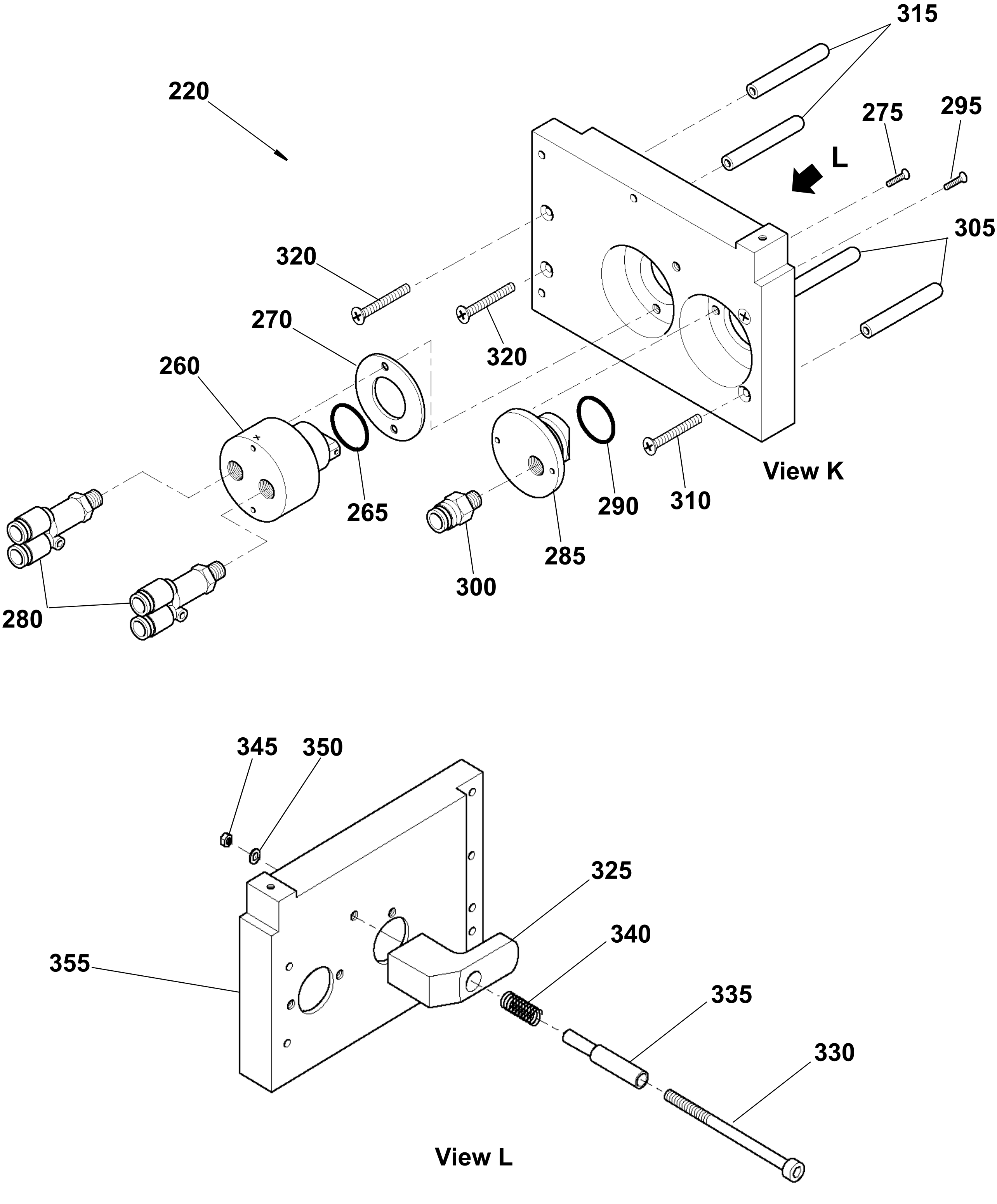
HFO module
Figure 7
(Sheet 3 of 6)



HFO module
Figure 7
(Sheet 4 of 6)



HFO module
Figure 7
(Sheet 5 of 6)



HFO module
Figure 7
(Sheet 6 of 6)

SLE

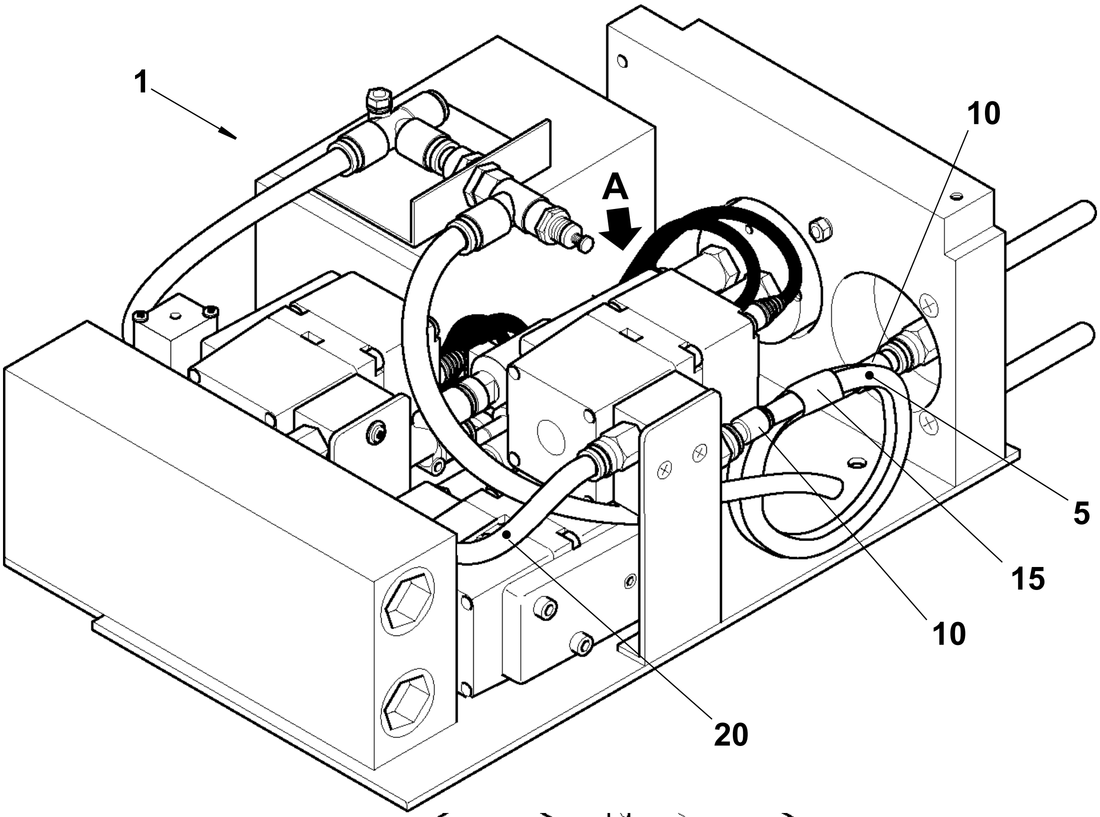
Fig	Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
7	1	L5000-05-35	HFO module Obsolete item. (Use Part Nº: L0281, Fig 8 Item 1) (See figure 5 for next highest assembly)		RF
	5	N6644	.Tube, Polyurethane (Length 650mm)		1
	6	N6642	.Tube connector, plugin reducer		2
			Attaching Parts		
	7	M0907	..Tape		AR
			* * *		
	10	N2373	.Tube, Polyurethane (Length 200mm)		1
			* * *		
	15	L5000-07-15	.Pressure regulator assembly, Nº3 (See items 40-75)		1
			Attaching Parts		
	20	H3208	..Screw (M3 x 8mm)		2
			* * *		
	25	N2070/05	.Restrictor, in line 0.005"		1
	30	N2373	.Tube, Polyurethane (Length 90mm)		1
	35	N2373	.Tube, Polyurethane (Length 145mm)		1
			* * *		
	40	N6623 (1)	.Pressure regulator, Piezo, Nº3		1
	45	N6623 (2)	.O-ring		2
	50	L5000-07-50	Mounting bracket assembly (See items 60-75)		1
			Attaching Parts		
	55	N6623 (3)	..Screws		2
			* * *		
	60	N6623 (4)	.Manifold block		1
	65	T1246	.Bracket		1
	70	N6600/18	.Tube Connector, stud male		2
			Attaching Parts		
	75	H3216	..Screws (M3 x 16mm)		2
	76	H3091	..Nut (M3)		2
	77	H3094	..Washer, shakeproof (M3)		2
			* * *		

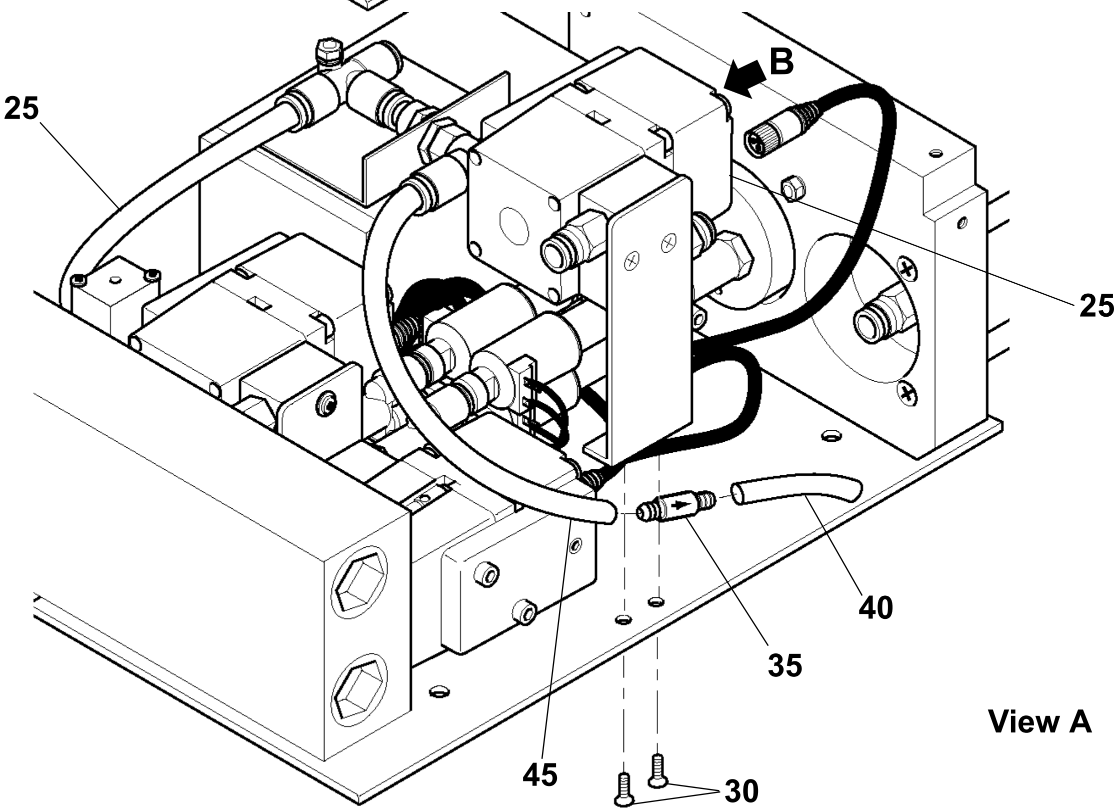
Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
7 80	L5000-07-80	.Solenoid valve assembly (See items 100-105)		1
85	L5000-07-85	.Pressure regulator & manifold assembly (See items 115-130)		1
		Attaching Parts		
90	H3908	..Screws (M3 x 8mm)		2
91	H3094	..Washer, shakeproof (M3)		2
		* * *		
95	N6624	.Solenoid valve, in line		4
100	N6606/05	.Adaptor stem		8
105	L5000-07-105	.Loom, HFO module		1
		* * *		
110	L5000-07-110	.Manifold assembly (See items 165-195)		1
115	L5000-07-115	.Pressure regulator assembly, Nº 1 & 2 (See items 135-160)		2
120	T1166	.Mounting bracket		1
		Attaching Parts		
125	H3106	..Screw (M3 x 6mm)		2
130	H3094	..Washer, shakeproof (M3)		2
		* * *		
135	N6623 (1)	.Pressure regulator, Piezo		2
140	N6623 (2)	.Manifold block		2
145	N6623 (3)	.O ring		4
		Attaching Parts		
150	N6623 (4)	..Screw		4
		* * *		
155	N6603	.Tube connector, "Y" branch		2
160	N6600/18	.Tube connector, stud male		2
		* * *		
165	N6600/18	.Tube connector, stud male		1
170	N6606/05	.Stem adaptor		1
175	N6609/18	.Tube connector double elbow, Banjo		1
180	N6606/18	.Stem adaptor		2
185	N6612	.Pressure regulator		1
190	N6611/12	.Plug, internal		2
-191	M0751	.Tape, PTFE		AR
195	T1155	.Manifold		1
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
7 200	L5000-07-200	.Mixing chamber, blender (See items 230-240)		1
		Attaching Parts		
205	H3206	..Screw (M3 x 6mm)		2
		* * *		
210	L5000-07-210	.Pressure regulator assembly (See items 245-255)		1
		Attaching Parts		
215	H3206	..Screw (M3 x 6mm)		2
		* * *		
220	L5000-07-220	.Jet mounting block assembly (See items 260-350)		1
		Attaching Parts		
225	H3206	..Screw (M3 x 6mm)		3
		* * *		
230	N6609/14	.Tube connector, twin branch elbow		1
235	N6602/14	.Tube connector, double elbow		1
240	T1157	.Mixing chamber, blender		1
241	T1158	.Mixing chamber, cap		1
-242	T1158/01	.Mixing chamber, pole		1
-243	M0799	.Adhesive		AR
		* * *		
245	N6601/05	.Tube connector ,swivel elbow		1
250	N6600/05	.Tube connector, stud male		1
255	N6613	.Pressure regulator, body		1
256	N6613/01	.Pressure regulator, locking clip		1
257	N6613/02	.Pressure regulator, base		1
		* * *		
260	T1150	.Jet block, twin port		1
265	N2042	.Seal, ’O’ ring		1
270	T1234	.Jet block, spacer		1
		Attaching Parts		
275	H3208	..Screw (M3 x 8mm)		2
		* * *		
280	N6603/18	.Tube connector, "Y" branch		2
		* * *		

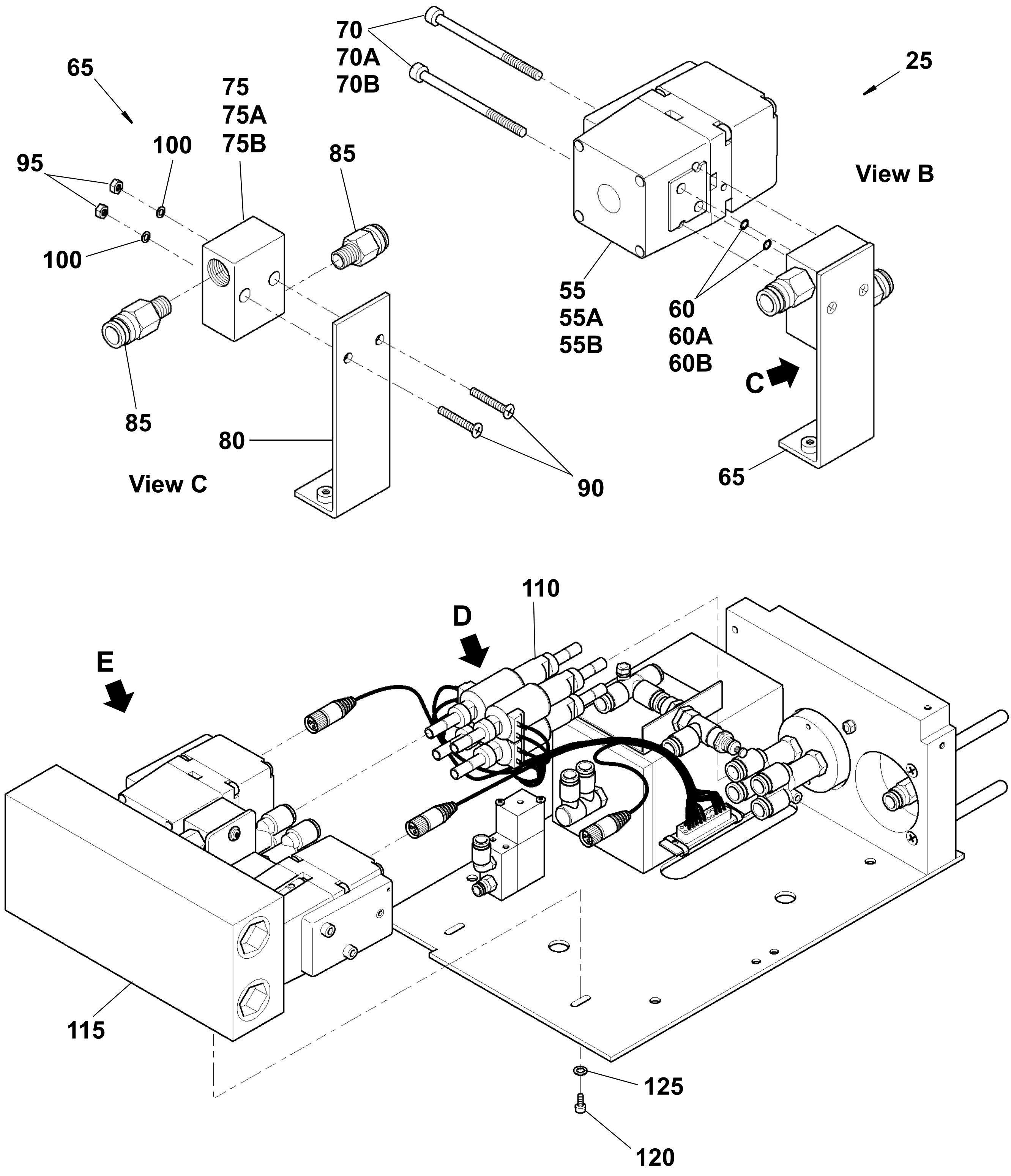
Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
7 285	T1210	.Jet block, fixed single port		1
290	N2042	.Seal, 'O' ring		1
		Attaching Parts		
295	H3208	..Screw (M3 x 8mm)		2
		* * *		
300	N6600/05	.Tube connector, stud male		1
		* * *		
305	T0611	.Post, guide		2
		Attaching Parts		
310	H3225	..Screw (M3 x 25mm)		2
		* * *		
315	T0611	.Post, guide		2
		Attaching Parts		
320	H3216	..Screw (M3 x 16mm)		2
		* * *		
325	T1199	Latch, exhalation block		1
		Attaching Parts		
330	H4950	..Screw, (M4 x 50)		1
335	T1236	..Spacer,		1
340	N6619	..Spring		1
345	H4091	..Nut (M4)		1
350	H4094	..Washer, shakeproof (M4)		1
		* * *		
355	T1206	.Jet mounting block		1
		* * *		

- Item Not illustrated

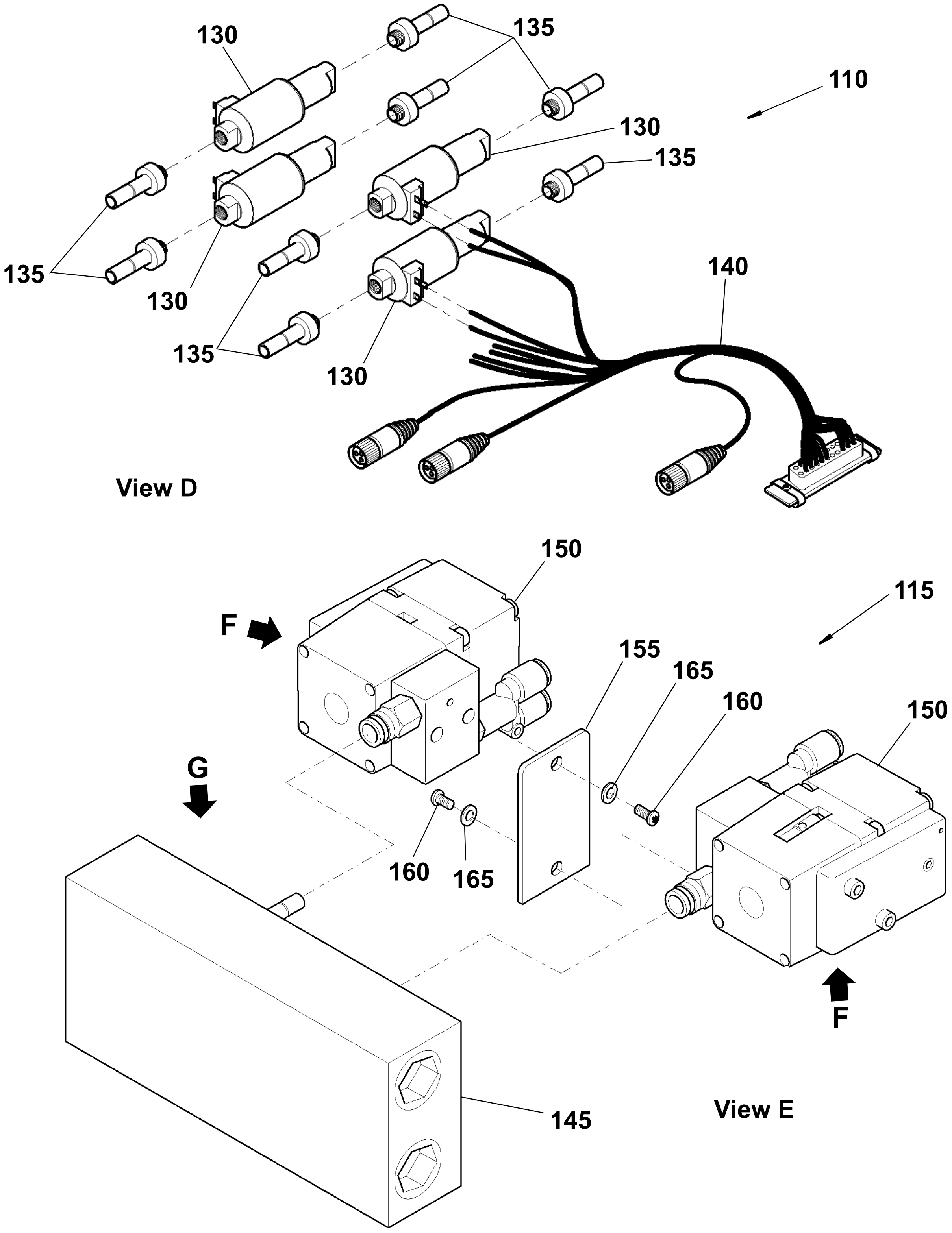




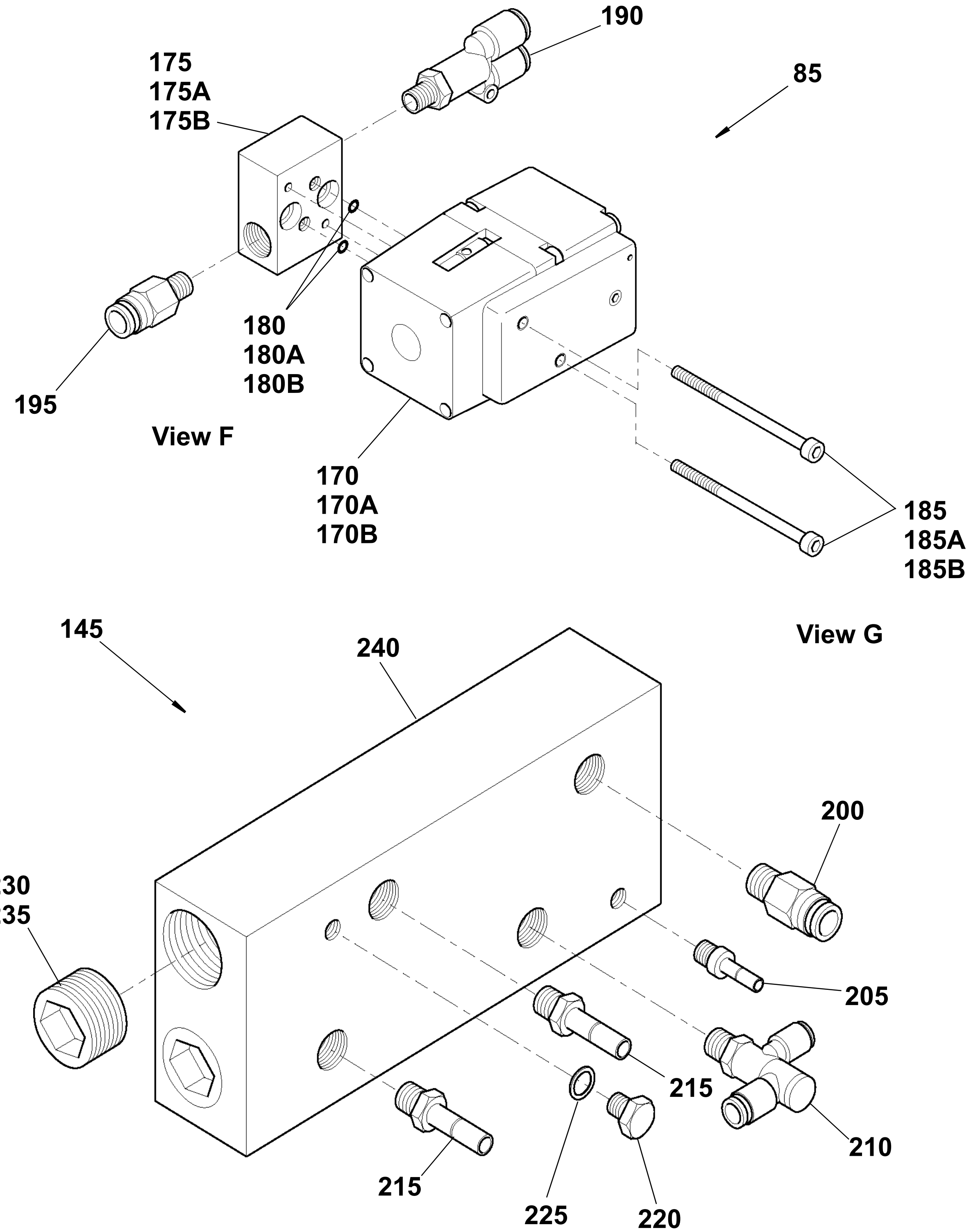
HFO module
Figure 8
(Sheet 1 of 6)



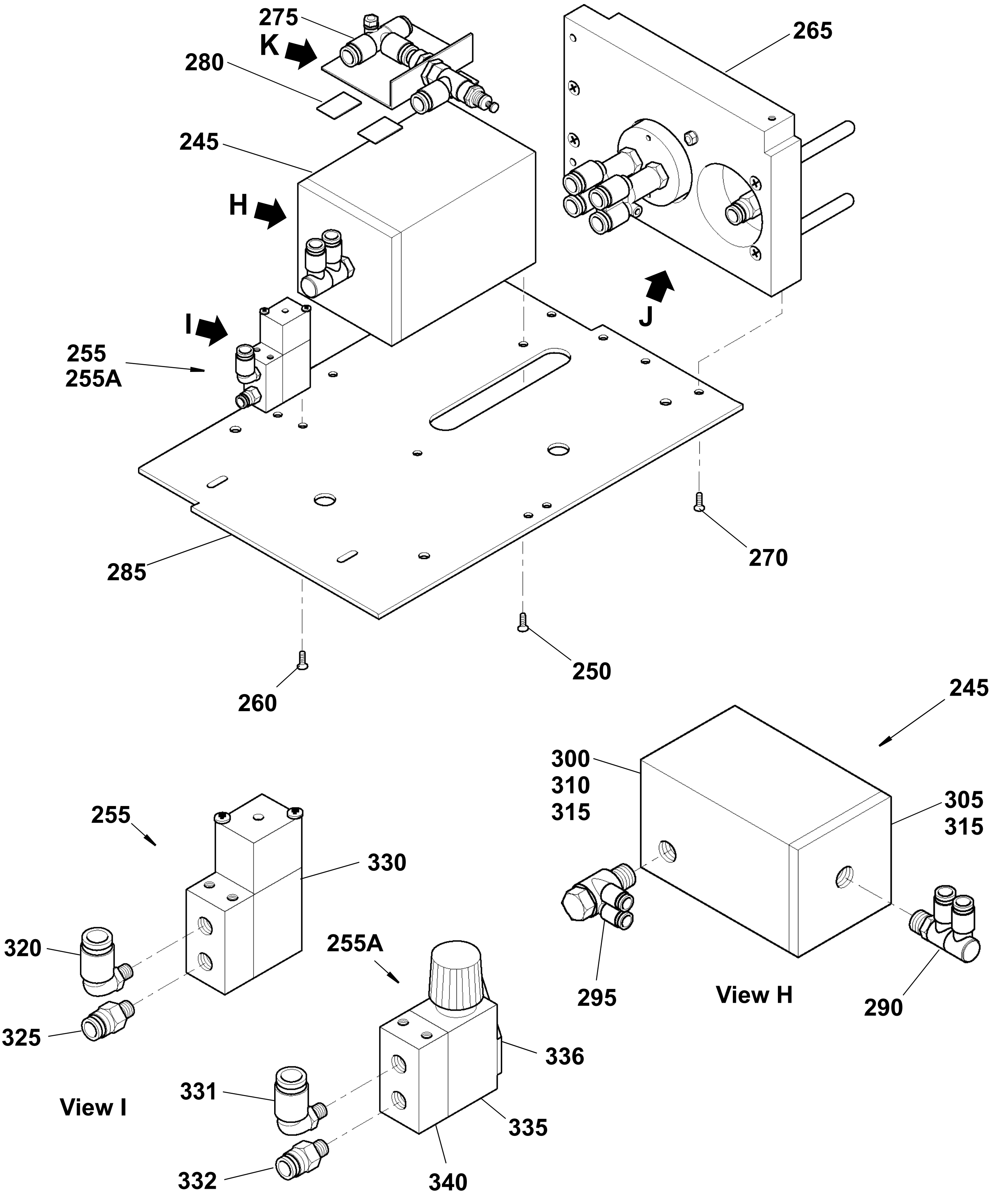
HFO module
Figure 8
(Sheet 2 of 6)



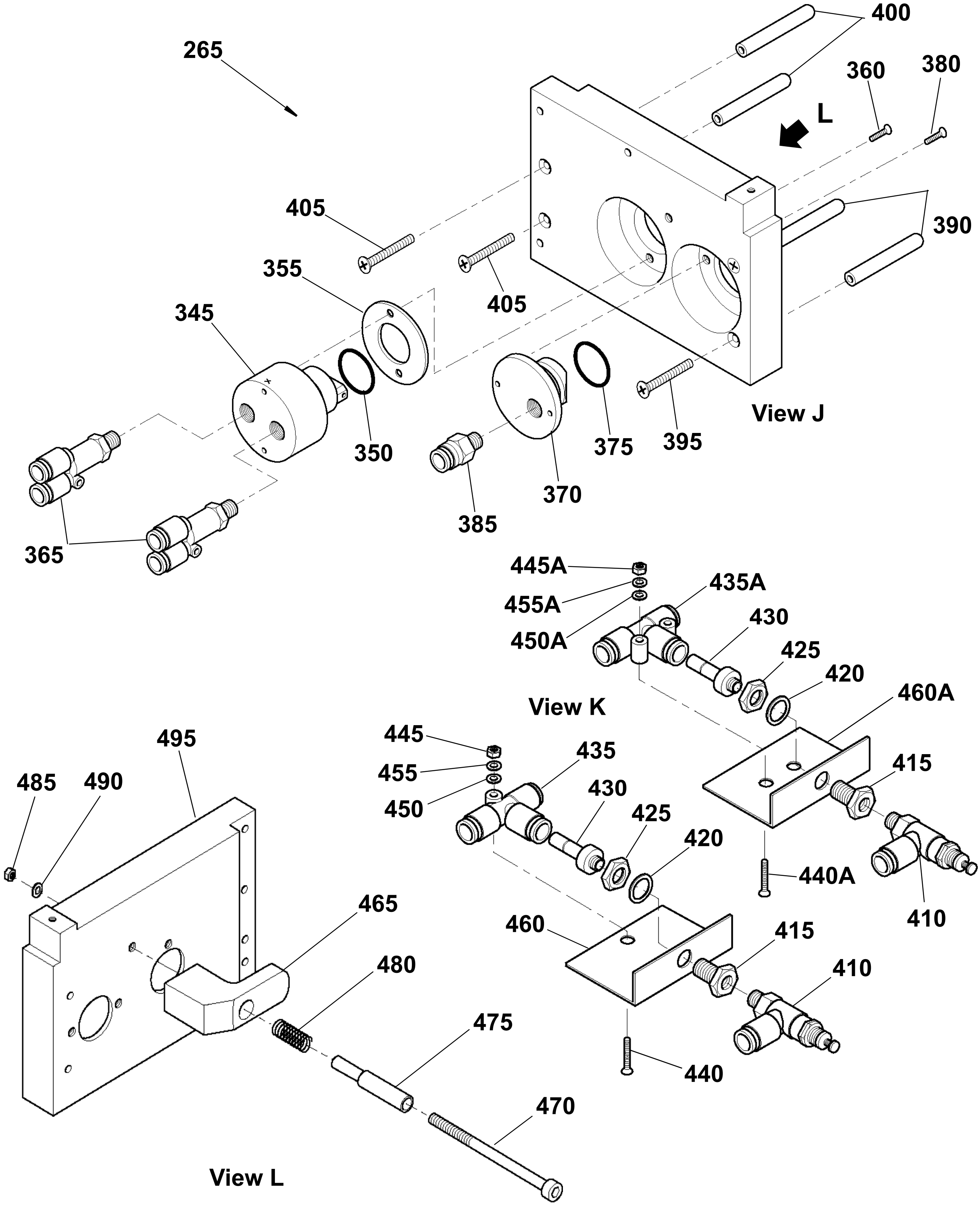
HFO module
Figure 8
(Sheet 3 of 6)



HFO module
Figure 8
(Sheet 4 of 6)



HFO module
Figure 8
(Sheet 5 of 6)



HFO module
Figure 8
(Sheet 6 of 6)

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
8 1	L0281	HFO module (See figure 6 for next highest assembly)		RF
5	N6644	.Tube, Polyurethane (Length 650mm)		1
10	N6624	.Tube connector, plugin reducer Attaching Parts		2
15	M0907	..Tape		AR
		* * *		
20	N2373	.Tube, Polyurethane (Length 200mm)		1
		* * *		
25	L5000-08-25	.Pressure regulator assembly, Nº3 (See items 55-100) Attaching Parts		1
30	H3208	..Screw (M3 x 8mm)		2
		* * *		
35	N2070/05	.Restrictor, in line 0.005"		1
40	N2373	.Tube, Polyurethane (Length 90mm)		1
45	N2373	.Tube, Polyurethane (Length 255mm)		1
50	N2373	.Tube, Polyurethane (Length 160mm)		1
		* * *		
55	N6623 (1)	.Pressure regulator, Piezo, Nº3 Obsolete item Use item 55B (This device can only be used with version 3 to 3.2 software)		1
55A	N6623/33 (1)	.Pressure regulator, Piezo, Nº3 Obsolete item Use item 55B (This device can only be used with version 3.3 software onwards)		1
55B	N6623/S38 (1)	.Pressure regulator, Piezo, Nº3 (This device can only be used with version 3.3 software onwards)		1
60	N6623 (2)	.O-ring		2
60A	N6623/33 (2)	.O-ring		2
60B	N6623/S38 (2)	.O-ring		2
65	L5000-08-65	Mounting bracket assembly (See items 60-75)		1

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
8		Attaching Parts		
70	N6623 (3)	..Screws		2
70A	N6623/33 (3)	..Screws		2
70B	N6623/S38 (3)	..Screws		2
		* * *		
75	N6623 (4)	.Manifold block		1
75A	N6623/33 (4)	.Manifold block		1
75B	N6623/S38 (4)	.Manifold block		1
80	T1246	.Bracket		1
85	N6600/18	.Tube Connector, stud male		2
		Attaching Parts		
90	H3216	..Screws (M3 x 16mm)		2
95	H3091	..Nut (M3)		2
100	H3094	..Washer, shakeproof (M3)		2
		* * *		
110	L5000-08-110	.Solenoid valve assembly (See items 135-140)		1
115	L5000-08-115	.Pressure regulator & manifold assembly (See items 150-165)		1
		Attaching Parts		
120	H3908	..Screws (M3 x 8mm)		2
125	H3094	..Washer, shakeproof (M3)		2
		* * *		
130	N6624	.Solenoid valve, in line		4
135	N6606/05	.Adaptor stem		8
140	L5000-08-140	.Loom, HFO module		1
		* * *		
145	L5000-08-145	.Manifold assembly (See items 200-240)		1
150	L5000-08-150	.Pressure regulator assembly, Nº 1 & 2 (See items 170-195)		2
155	T1166	.Mounting bracket		1
		Attaching Parts		
160	H3106	..Screw (M3 x 6mm)		2
165	H3094	..Washer, shakeproof (M3)		2
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
8 170	N6623 (1)	.Pressure regulator, Piezo Obsolete item Use item 170B (This device can only be used with version 3 to 3.2 software)		2
170A	N6623/33 (1)	.Pressure regulator, Piezo Obsolete item Use item 170B (This device can only be used with version 3.3 software onwards)		2
170B	N6623/S38 (1)	.Pressure regulator, Piezo (This device can only be used with version 3.3 software onwards)		2
175	N6623 (2)	.Manifold block		2
175A	N6623/33 (2)	.Manifold block		2
175B	N6623/S38 (2)	.Manifold block		2
180	N6623 (3)	.O ring		4
180A	N6623/33 (3)	.O ring		4
180B	N6623/S38 (3)	.O ring		4
		Attaching Parts		
185	N6623 (4)	..Screw		4
185A	N6623/33 (4)	..Screw		4
185B	N6623/S38 (4)	..Screw		4
		* * *		
190	N6603	.Tube connector, "Y" branch		2
195	N6600/18	.Tube connector, stud male		2
		* * *		
200	N6600/18	.Tube connector, stud male		1
205	N6606/05	.Stem adaptor		1
210	N6609/18	.Tube connector double elbow, Banjo		1
215	N6606/18	.Stem adaptor		2
220	N2370	.Plug (M5)		1
225	N2371	.Washer		1
230	N6611/12	.Plug, internal		2
-235	M0751	.Tape, PTFE		AR
240	T1155	.Manifold		1
		* * *		

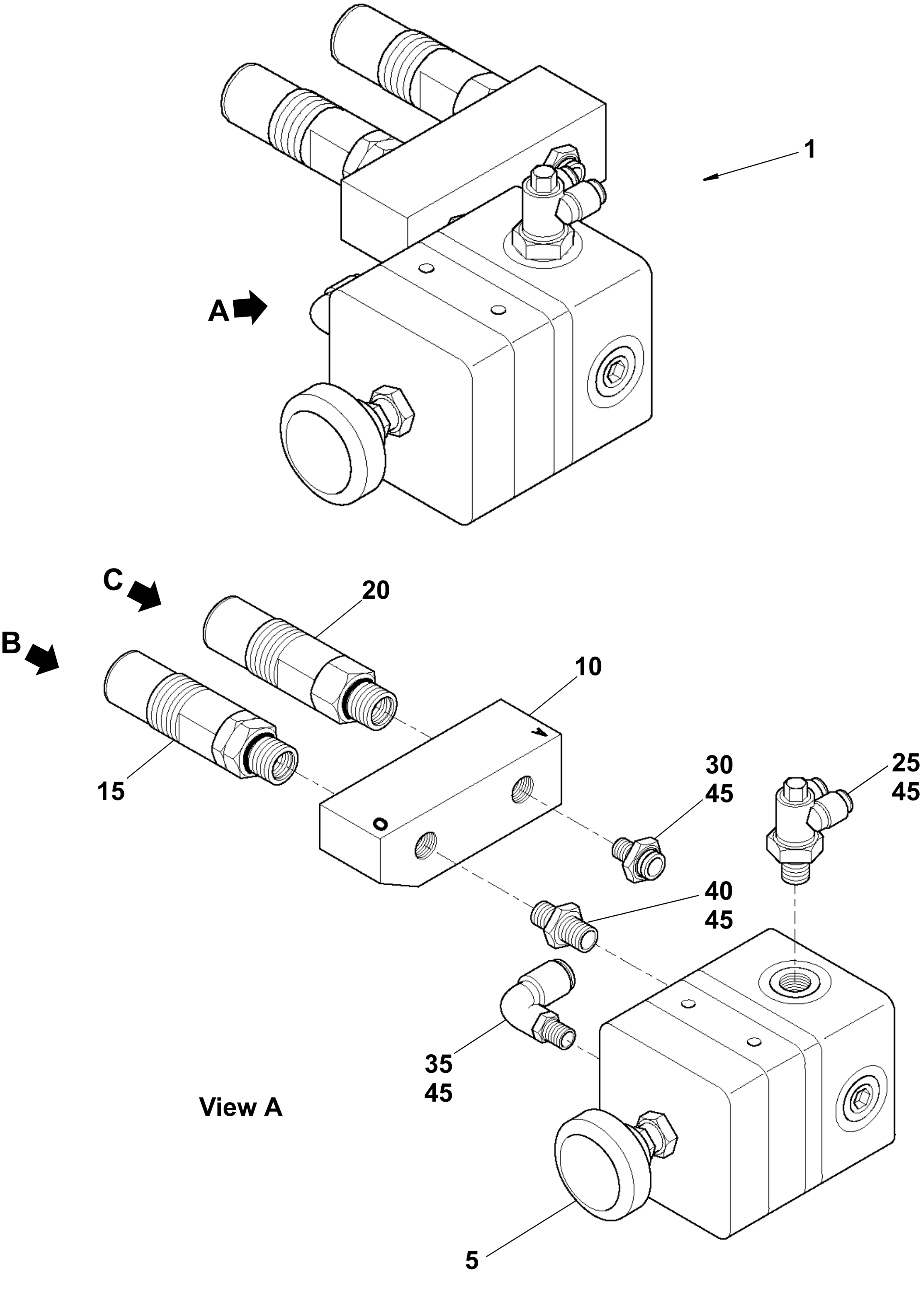
Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
8 245	L5000-08-245	.Mixing chamber, blender (See items 290-315)		1
		Attaching Parts		
250	H3206	..Screw (M3 x 6mm)		2
		* * *		
255	L5000-08-255	.Pressure regulator assembly (For Serial Nº: 51287, 51288, 51347 to 51353, 51423 to 51425, 51427, 51428 & 51450 onwards) (See items 320-330)		1
255A	L5000-08-255A	.Pressure regulator assembly Obsolete item (For Serial Nº: 51010 to 52186, 51289 to 51346, 51354 to 51422, 51426 & 51428 to 51449) Use L5000-08-225 (See items 331-340)		1
		Attaching Parts		
260	H3206	..Screw (M3 x 6mm)		2
		* * *		
265	L5000-08-265	.Jet mounting block assembly (See items 345-405 & 465-495)		1
		Attaching Parts		
270	H3206	..Screw (M3 x 6mm)		3
		* * *		
275	L5000-08-275	.Proximal Purge assembly (See items 410-460)		3
		Attaching Parts		
280	M0660	.Pad, self adhesive		4
		* * *		
285	T1204	.Plate, mounting		1
		* * *		
290	N6609/14	.Tube connector, twin branch elbow		1
295	N6602/14	.Tube connector, double elbow		1
300	T1157	.Mixing chamber, blender		1
305	T1158	.Mixing chamber, cap		1
-310	T1158/01	.Mixing chamber, pole		1
-315	M0799	.Adhesive		AR
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
8 320	N6601/05	.Tube connector ,swivel elbow		1
325	N6600/05	.Tube connector, stud male		1
330	N6613/03	.Pressure regulator		1
		* * *		
331	N6601/05	.Tube connector ,swivel elbow		1
332	N6600/05	.Tube connector, stud male		1
335	N6613	.Pressure regulator, body Obsolete item		1
336	N6613/01	.Pressure regulator, locking clip Obsolete item		1
340	N6613/02	.Pressure regulator, base Obsolete item		1
		* * *		
345	T1150	.Jet block, twin port		1
350	N2042	.Seal, 'O' ring		1
355	T1234	.Jet block, spacer		1
		Attaching Parts		
360	H3208	..Screw (M3 x 8mm)		2
		* * *		
365	N6603/18	.Tube connector, "Y" branch		2
		* * *		
370	T1210	.Jet block, fixed single port		1
375	N2042	.Seal, 'O' ring		1
		Attaching Parts		
380	H3208	..Screw (M3 x 8mm)		2
		* * *		
385	N6600/05	.Tube connector, stud male		1
		* * *		
390	T0611	.Post, guide		2
		Attaching Parts		
395	H3225	..Screw (M3 x 25mm)		2
		* * *		
400	T0611	.Post, guide		2
		Attaching Parts		
405	H3216	..Screw (M3 x 16mm)		2
		* * *		

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
8 410	N6612	.Pressure regulator		1
415	N6648	.Connector, bulkhead		1
420	N6648	.Nut, bulkhead connector		1
425	N6648	.Washer, bulkhead connector		1
430	N6606/05	.Adaptor stem		1
435	N6605	.Tube connector, equal tee (For Serial Nº: 51078 to 51121 & 51234 onwards) (Supplier: SMC)		1
435A	L5000-08-435A	.Tube connector, equal tee Obsolete item. Use item 435 (For Serial Nº: 51122 to 51233) (Supplier: West Group)		1
		Attaching Parts		
440	H3116	..Screw (M3 x 16mm)		1
440A	H3116	..Screw (M3 x 16mm) Obsolete item.		2
445	H3091	..Nut		1
445A	H3091	..Nut Obsolete item.		2
450	H3093	..Washer (M3)		1
450A	H3093	..Washer (M3) Obsolete item.		2
455	H3094	..Washer, shakeproof (M3)		1
455A	H3094	..Washer, shakeproof (M3) Obsolete item.		2
		* * *		
460	T1304	.Bracket, mounting (For Serial Nº: 51078 to 51121 & 51234 onwards)		1
460A	L5000-08-460A	.Bracket, mounting Obsolete item. Use item 460 (For Serial Nº: 51122 to 51233)		1
		* * *		

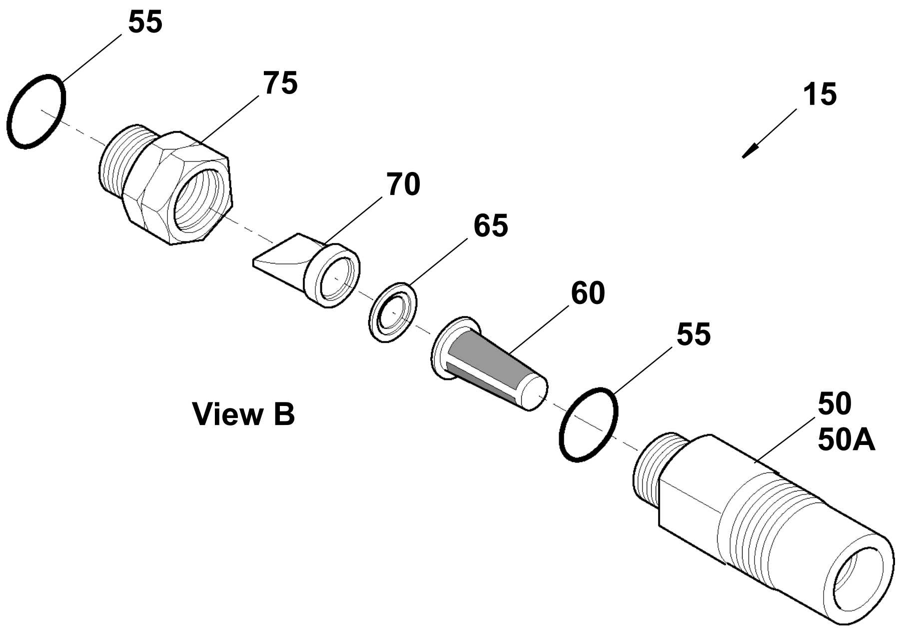
Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
8 465	T1199	Latch, exhalation block		1
		Attaching Parts		
470	H4950	..Screw, (M4 x 50)		1
475	T1236	..Spacer,		1
480	N6619	..Spring		1
485	H4091	..Nut (M4)		1
490	H4094	..Washer, shakeproof (M4)		1
		* * *		
495	T1206	.Jet mounting block		1
		* * *		

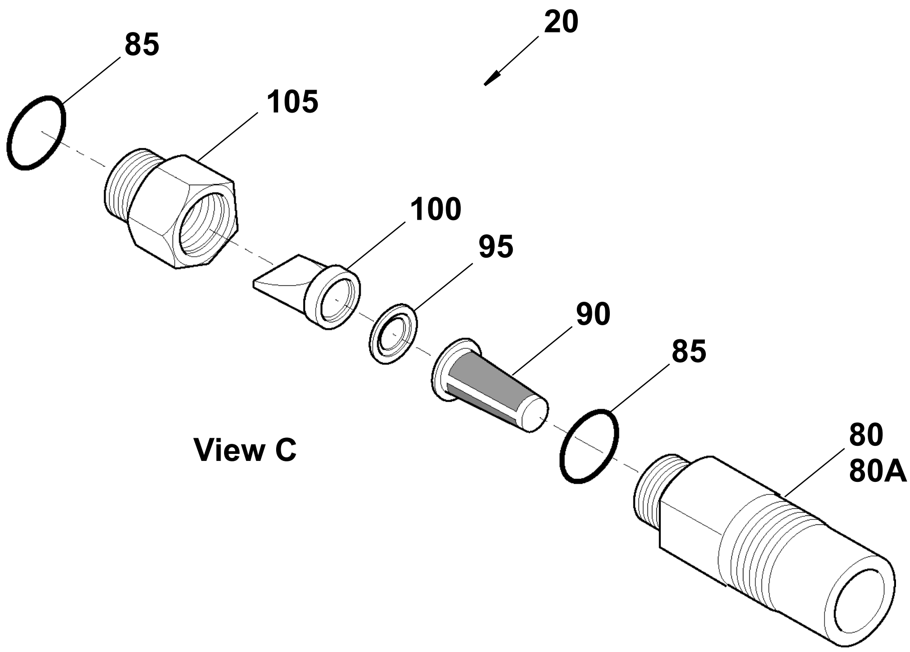
- Item Not illustrated



Oxygen regulator module
Figure 9
(Sheet 1 of 2)

SLE

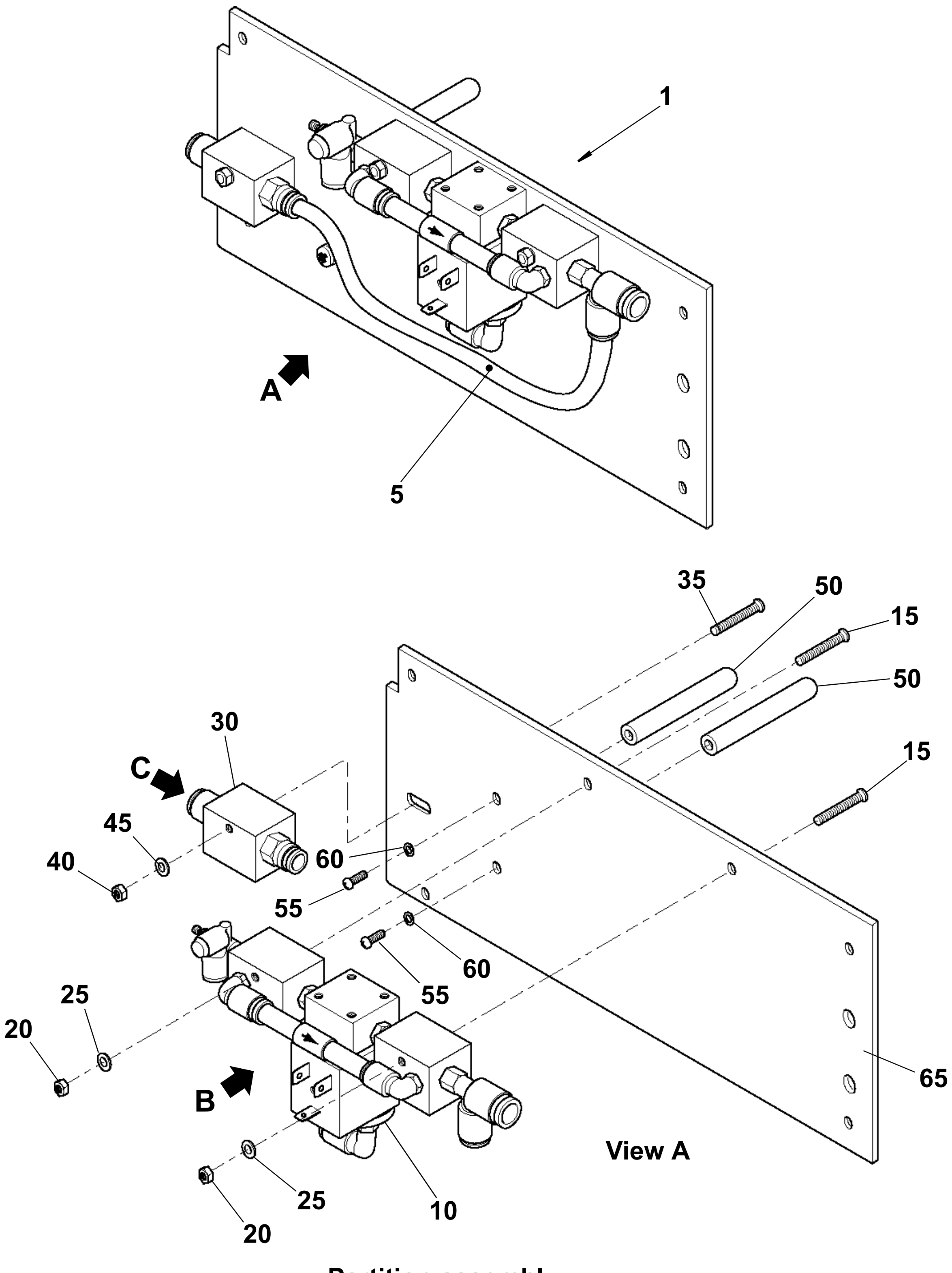




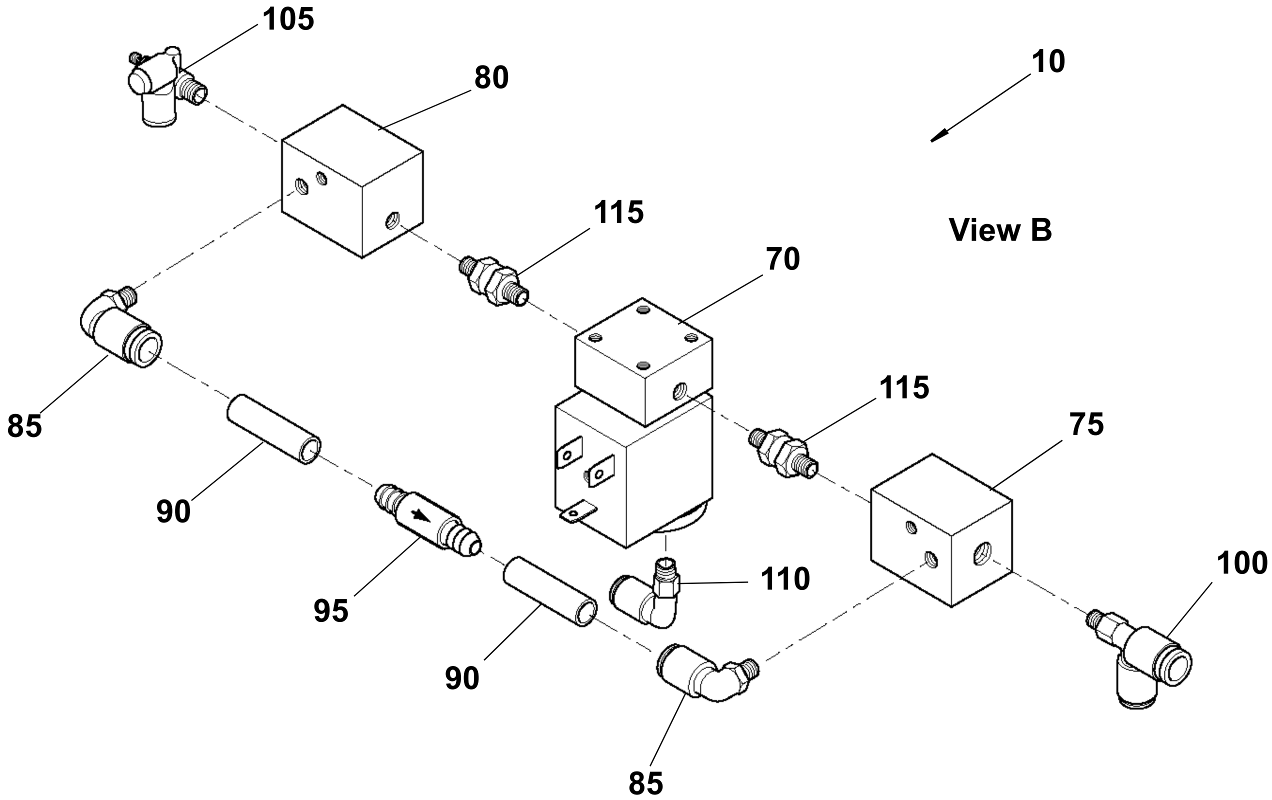
Oxygen regulator module
Figure 9
(Sheet 2 of 2)

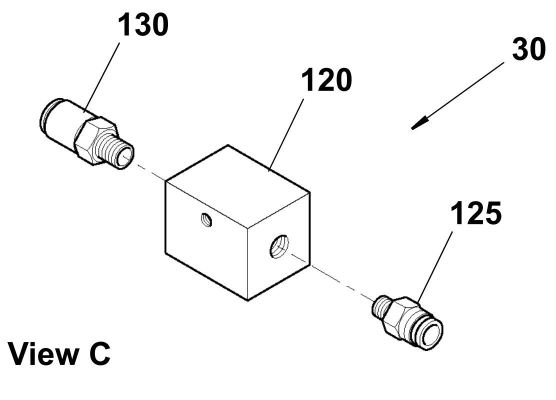
Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
9 1	L0282	Oxygen regulator assembly (See figure 5 for next highest assembly)		RF
5	N6615/02	.Pressure regulator, captive		1
10	T1159	.Input connector block, Air & O_2		1
15	L5000-09-15	.O_2 hose connector assembly (See items 50-75)		1
20	L5000-09-20	.Air hose connector assembly (See items 80-105)		1
25	N6602/14	.Tube connector, twin elbow, Banjo		1
30	N6600/14	.Tube connector, stud male		1
35	N6601/18	.Tube connector, swivel elbow		1
		Attaching parts		
40	N2367/14	.. Adaptor, tapered male		1
-45	M0751	.Tape, PTFE		AR
		* * *		
50	N2185/35	.O_2 inlet connector, (UK & European market)	A,B	1
-50A	N2185/33	.O_2 inlet connector, (Japanese market)	C	1
55	N6618	.O-ring		2
60	N2185/06	.Filter, Nylon cone		1
65	T1170	.Washer, duckbill		1
70	N2185/05	.Check valve, duckbill		1
75	N2185/16	.Connector		1
		* * *		
80	N2185/34	.Air inlet connector, (UK & European market)	A,B	1
-80A	N2185/32	.Air inlet connector, (Japanese market)	C	1
85	N6618	.O-ring		2
90	N2185/06	.Filter, Nylon cone		1
95	T1170	.Washer, duckbill		1
100	N2185/05	.Check valve, duckbill		1
105	T1162	.Connector		1
		* * *		

- Item Not illustrated



Partition assembly
Figure 10
(Sheet 1 of 2)



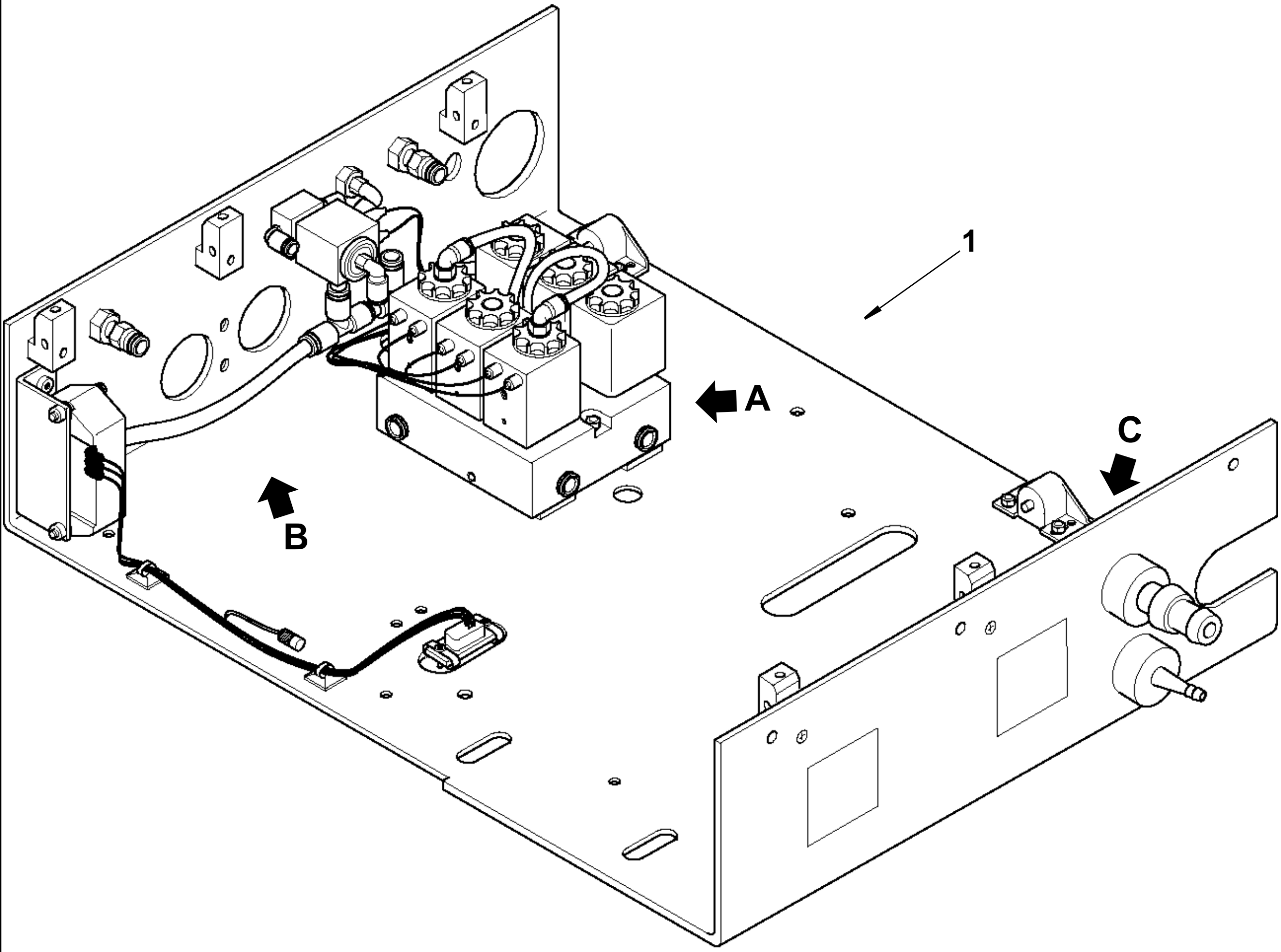


Partition assembly
Figure 10
(Sheet 2 of 2)

Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
10 1	T1207	Partition Assembly (See figure 5 for next highest assembly)		RF
5	N2373	.Tube, Polyurethane (Length 225mm)		1
		* * *		
10	L5000-010-10	.Soleniod valve assembly (See items 70-110) Attaching parts		1
15	H3125	..Screw (M3 x 25mm)		2
20	H3091	..Nut (M3)		2
25	H3094	..Washer, shakeproof (M3)		2
		* * *		
30	L5000-010-30	Block, pressure relief assembly (See items 115-125) Attaching parts		1
35	H3125	..Screw (M3 x 25mm)		1
40	H3091	..Nut (M3)		1
45	H3094	..Washer, shakeproof (M3)		1
		* * *		
50	T0611	.Guide post Attaching parts		2
55	H3108	..Screw (M3 x 8mm)		2
60	H3094	..Washer, shakeproof (M3)		2
		* * *		
65	T1207	.Partition		1
		* * *		
70	N2195/06	.Solenoid valve		1
75	T1165	.Mounting block, bypass RH		1
80	T1164	.Mounting block, bypass LH		1
85	N6601/05	.Tube connector, swivel elbow		2
90	N2373	.Tube, Polyurethane (Length 30mm)		2
95	N2070/12	.Restrictor, in line 0.012"		1
100	N6604/05	.Tube connector, tee		1
105	N6614	.Tube connector, speed controller		1
110	N6601/05	.Tube connector, swivel elbow Attaching parts		1
115	N6610	..Nipple, universal		2
		* * *		

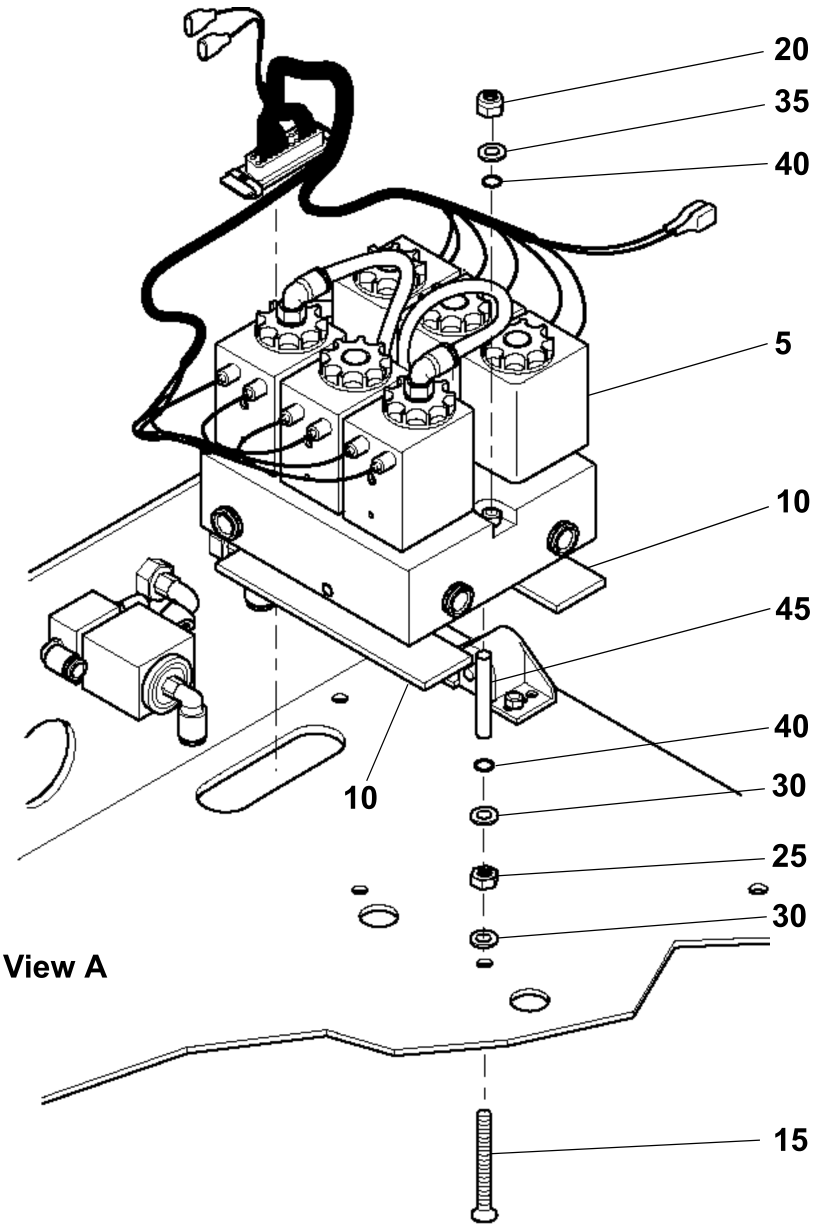
Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
10 120	T1235	.Pressure relief block		1
125	N6600/05	.Tube connector, stud male		1
130	N2194	.Valve, relief		1
		* * *		

- Item Not illustrated

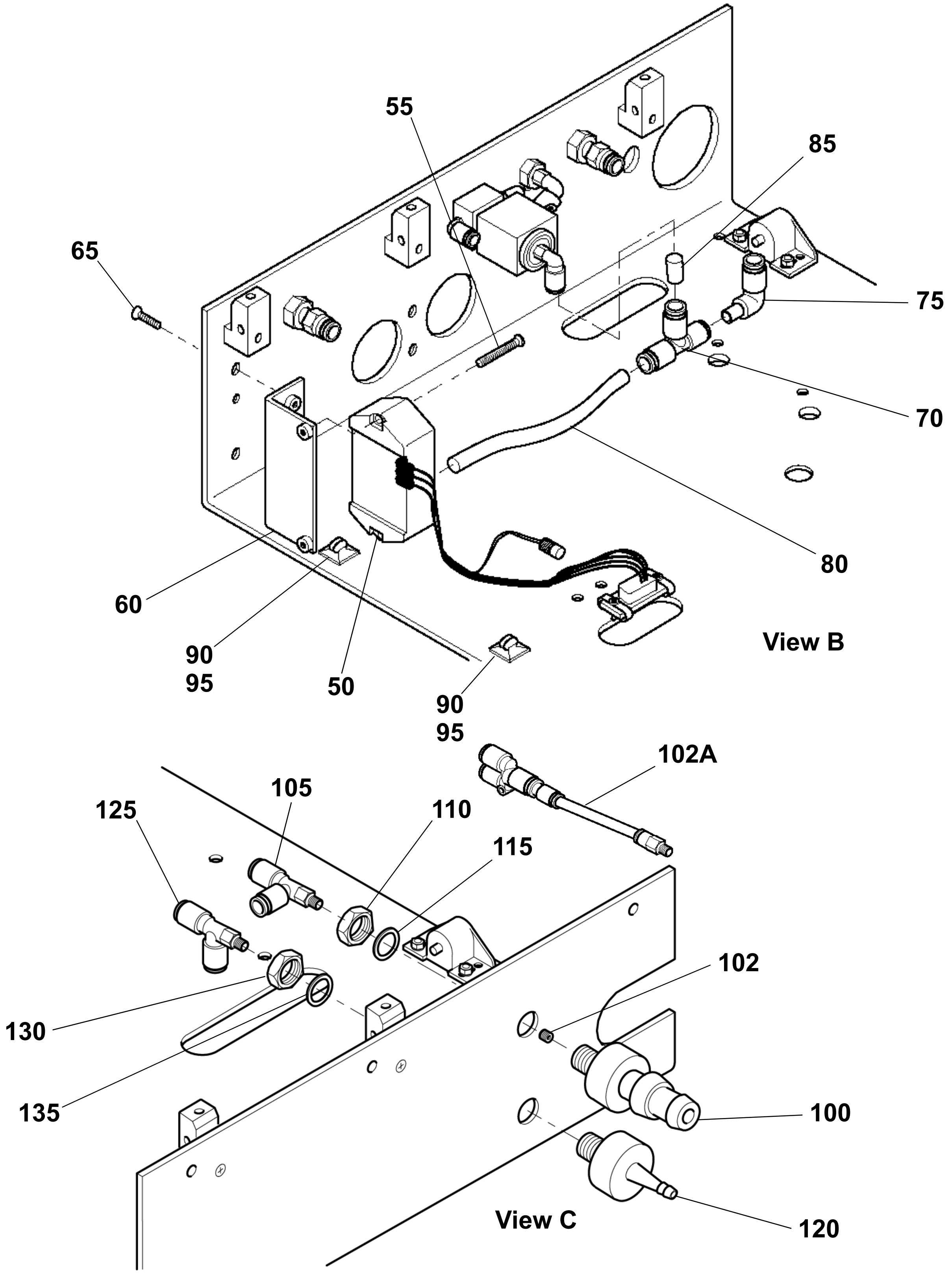


Pneumatic module, sub assembly
Figure 11
(Sheet 1 of 5)

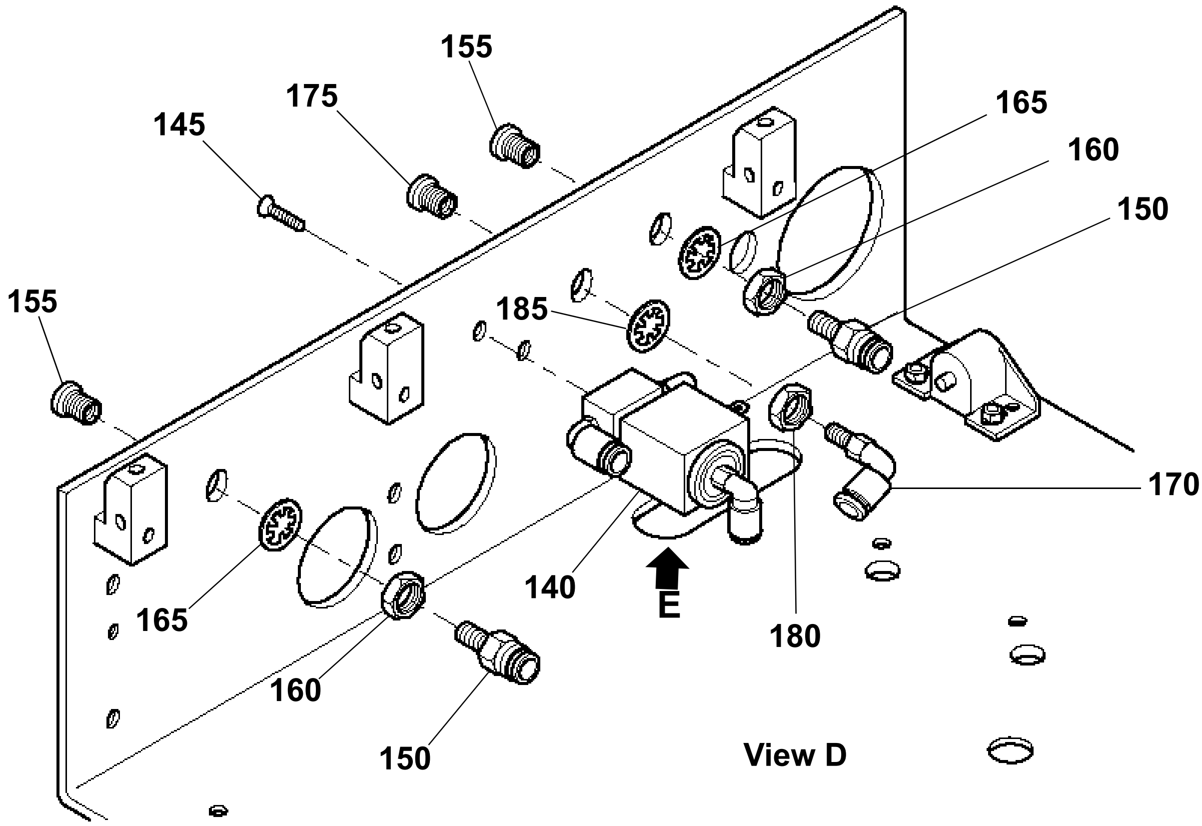
SLE

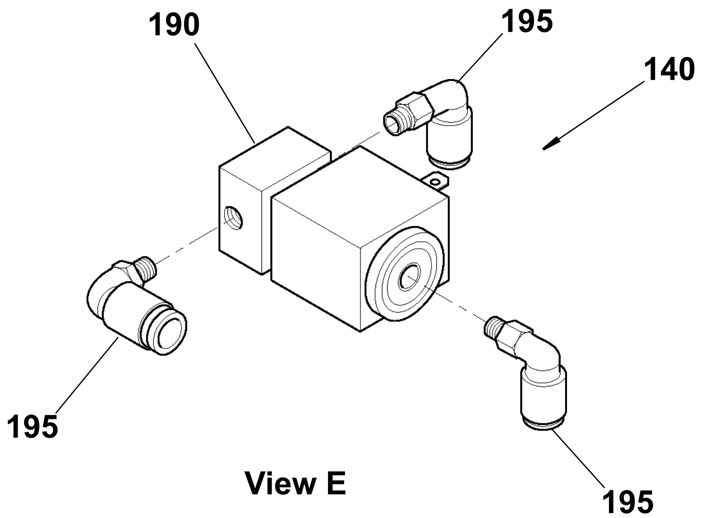


Pneumatic module, sub assembly
Figure 11
(Sheet 2 of 5)

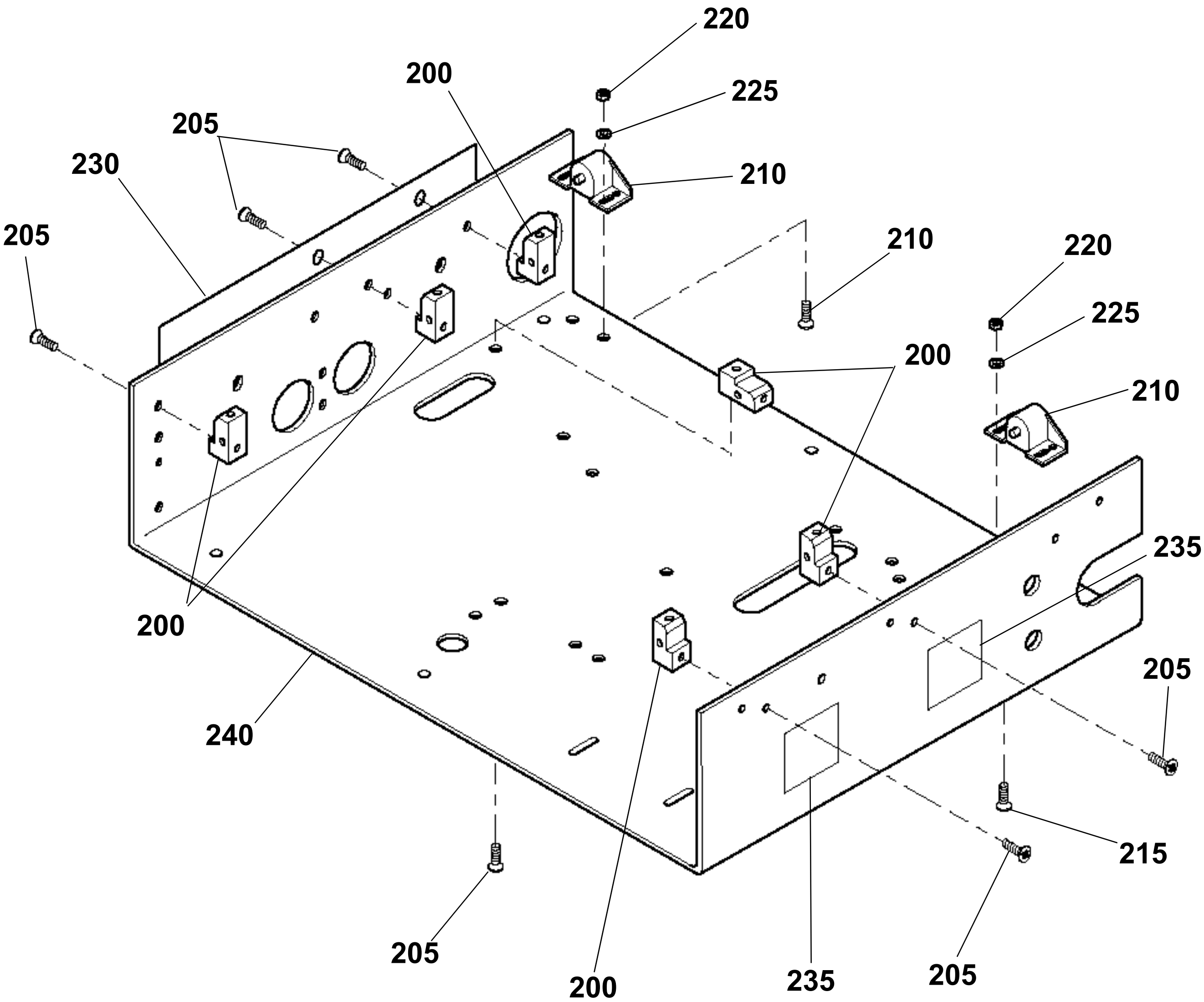


Pneumatic module, sub assembly
Figure 11
(Sheet 3 of 5)





Pneumatic module, sub assembly
Figure 11
(Sheet 4 of 5)



Pneumatic module, sub assembly
Figure 11
(Sheet 5 of 5)

Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
11 1	T1187	Pneumatic module, sub assembly (See figure 5 for next highest assembly)		RF
5	L0287	.Blender & loom assembly		1
10	M0630	.Pad, foam		2
		Attaching parts		
15	H3230	..Screw (M3 x 30mm)		2
20	H3091/03	..Nut, shakeproof (M3)		2
25	H3091	..Nut (M3)		2
30	H3094	..Washer, shakeproof (M3)		2
35	H3095	..Washer, Nylon (M3)		4
40	N6618/01	..O ring		4
45	M0309/03	..Sleeve, rubber		2
		* * *		
50	L5000-011-50	.Pressure transducer/ loom assembly		1
		Attaching parts		
55	H3125	..Screw (M3 x 25mm)		2
		* * *		
60	T1171	.Bracket, pressure transducer		1
		Attaching parts		
65	H3210	..Screw (M3 x 10mm)		2
		* * *		
70	N6605	.Tube connector, equal tee		1
75	N6608	.Tube connector, plugin elbow		1
		* * *		
80	N2373	.Tube, Polyurethane (Length 145mm)		1
85	N2373	.Tube, Polyurethane (Length 46mm)		1
		* * *		
90	M0433/01	.Cable tie base		2
-95	M0434	.Cable tie		2
		* * *		

Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
11 100	T1238	.Connector, fresh gas		1
102	T1238/01	.Restrictor		1
102A	N9053	.Restrictor, assembly. (Service option).		
		Attaching parts		
105	N6604/05	.Tube connector, tee		1
110	H1093	..Nut (M10)		1
115	H1091	..Washer (M10)		1
		* * *		
120	T1172	.Connector, proximal airway		1
		Attaching parts		
125	N6604/05	.Tube connector, tee		1
130	H1093	..Nut (M10)		1
135	H1091	..Washer (M10)		1
		* * *		
140	L5000-011-140	.Solenoid valve assembly (See items 190-195)		1
		Attaching parts		
145	H3208	..Screw (M3 x 8mm)		2
		* * *		
150	N6600/05	.Tube connector, stud male		2
155	T1173	.Connector, oxygen dump		2
		Attaching parts		
160	H8091	..Nut (M8)		2
165	H8093	..Washer, shakeproof (M8)		2
		* * *		
170	N6601/05	.Tube connector, elbow Obsolete item (For serial number 51010 to 51631)		1
175	T1173	.Connector, oxygen dump		1
		Attaching parts		
180	H8093	..Nut (M8)		1
185	H8091	..Washer, shakeproof (M8)		1
		* * *		
190	N6625/01	.Solenoid valve, mixer		1
195	N6601/05	.Tube connector, elbow		3
		* * *		

Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
11 200	T1237	.Block, fixing		6
		Attaching parts		
205	H3208	..Screw (M3 x 8mm)		6
		* * *		
210	N6630	..Catch, magnetic		2
		Attaching parts		
215	H3210	..Screw (M3 x 10mm)		4
220	H3091	..Nut (M3)		4
225	H3094	..Washer, shakeproof (M3)		4
		* * *		
230	T1265	.Label, rear		1
235	M0776	.Tape		AR
		* * *		
240	T1187	.Chassis, pneumatic unit		1
		* * *		

- Item Not illustrated

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Equipotential Stud Modification

27. Equipotential stud modification

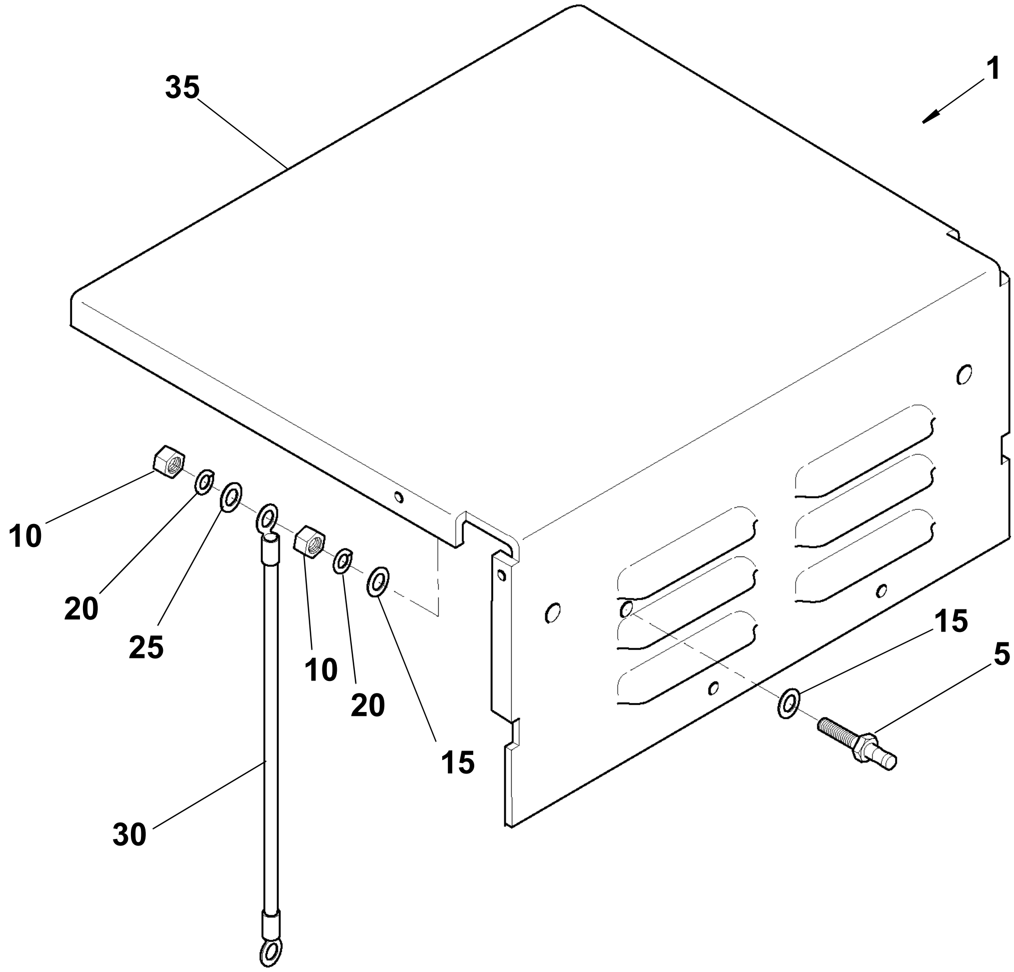
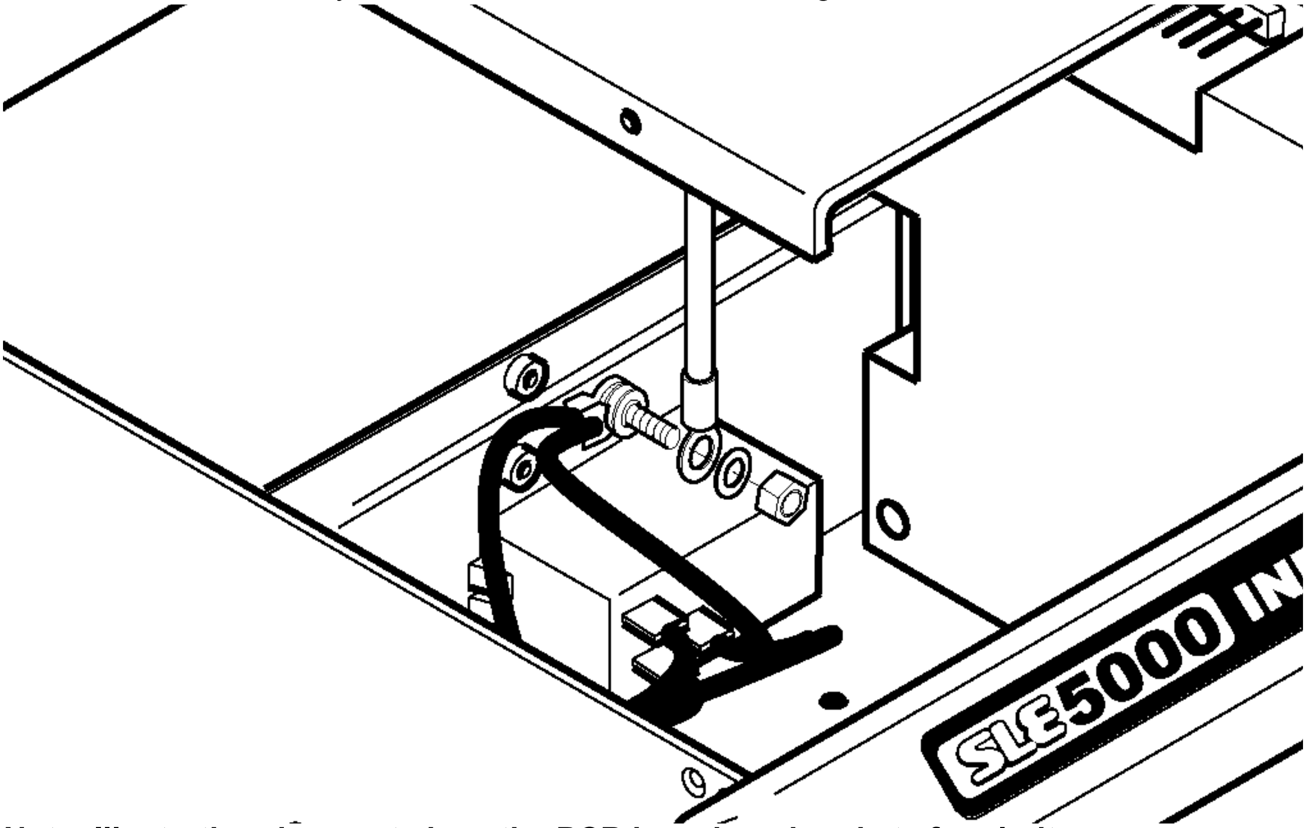


Fig Item	SLE Part Nº	Description	Effectivity code	Units Per Assy.
1	T1193/EP	Top cover with EP stud		RF
5	T1193/EP/01 (1)	Stud, EP		1
		Attaching Parts		
10	T1193/EP/01 (2)	Nut		2
15	T1193/EP/01 (3)	Washer		2
20	T1193/EP/01 (4)	Washer, shakeproof		2
25	H6093	Washer, M6		1
		* * *		
30	W0325/EP	Cable, EP stud earthing		1
		* * *		
35	T1193/02	Top cover, with EP stud hole.		
		* * *		

27.1 Equipotential stud connection

The T1193/EP assembly is connected to the earth bonding stud.



Note: Illustration does not show the PCB boards or brackets for clarity.

Note: The user will have to discard one lock nut to allow fitment of the earthing cable.

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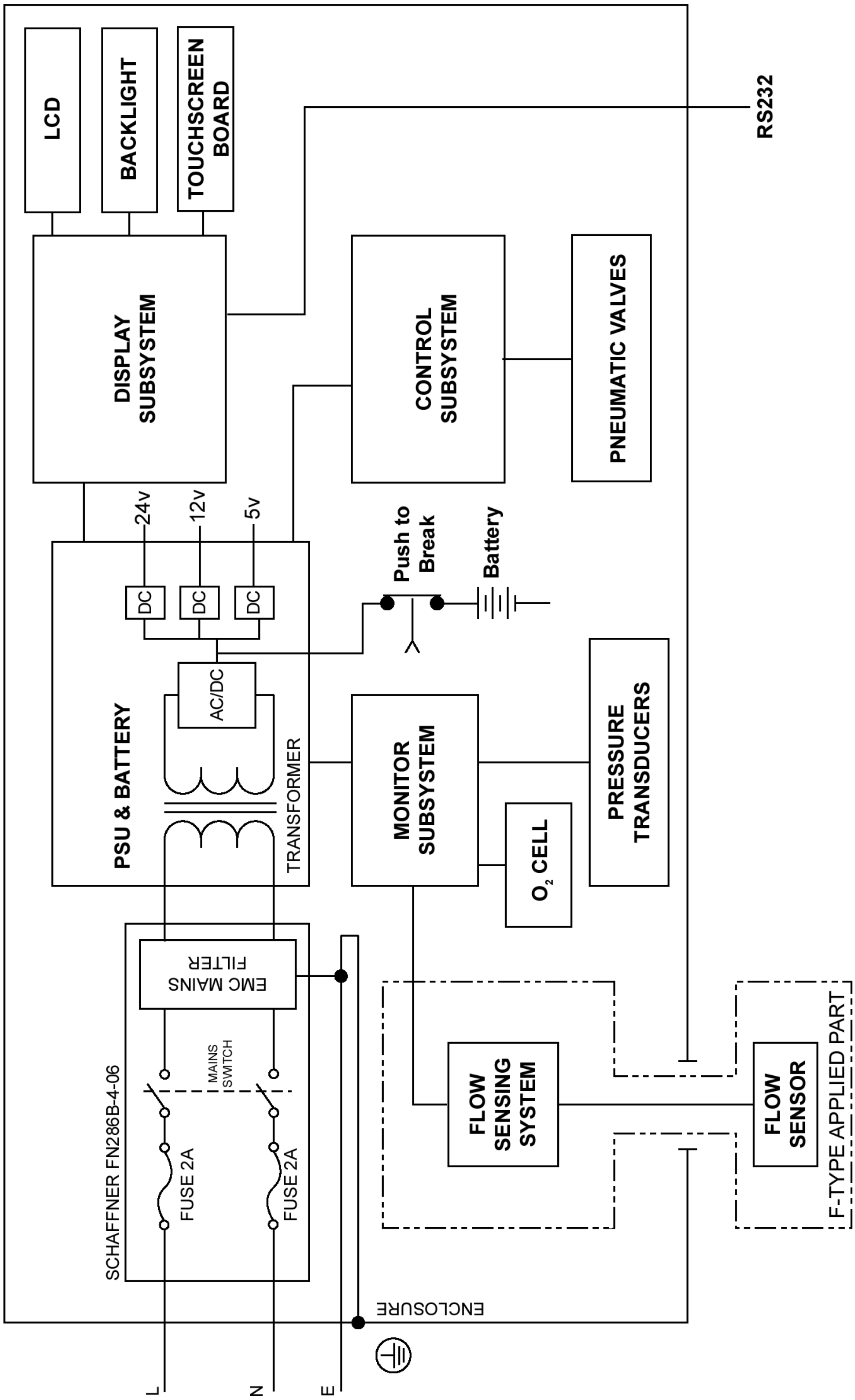
Schematic & Circuit Diagrams

28. Electrical Block Diagram

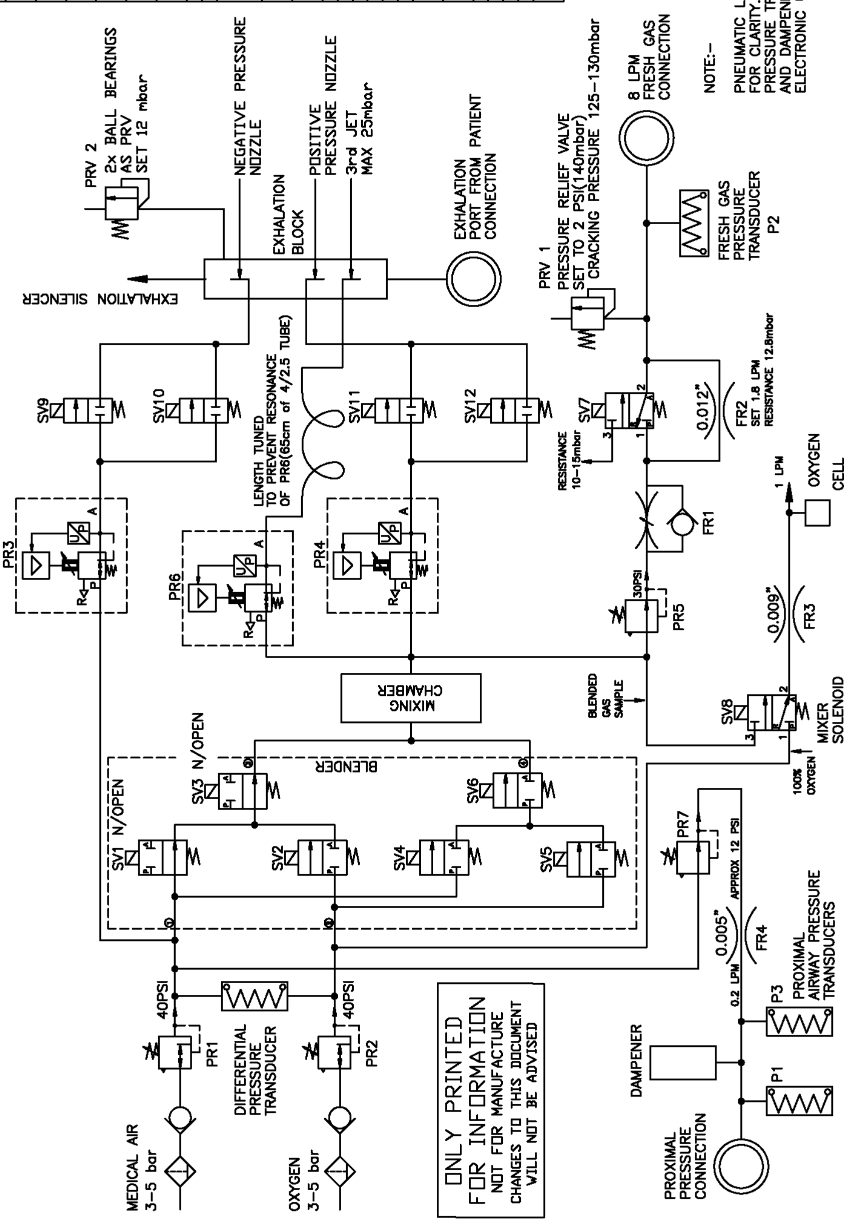


29. Pneumatic Unit Schematic

29.1 Schematic Pre PAM (Proximal Airway Modification)

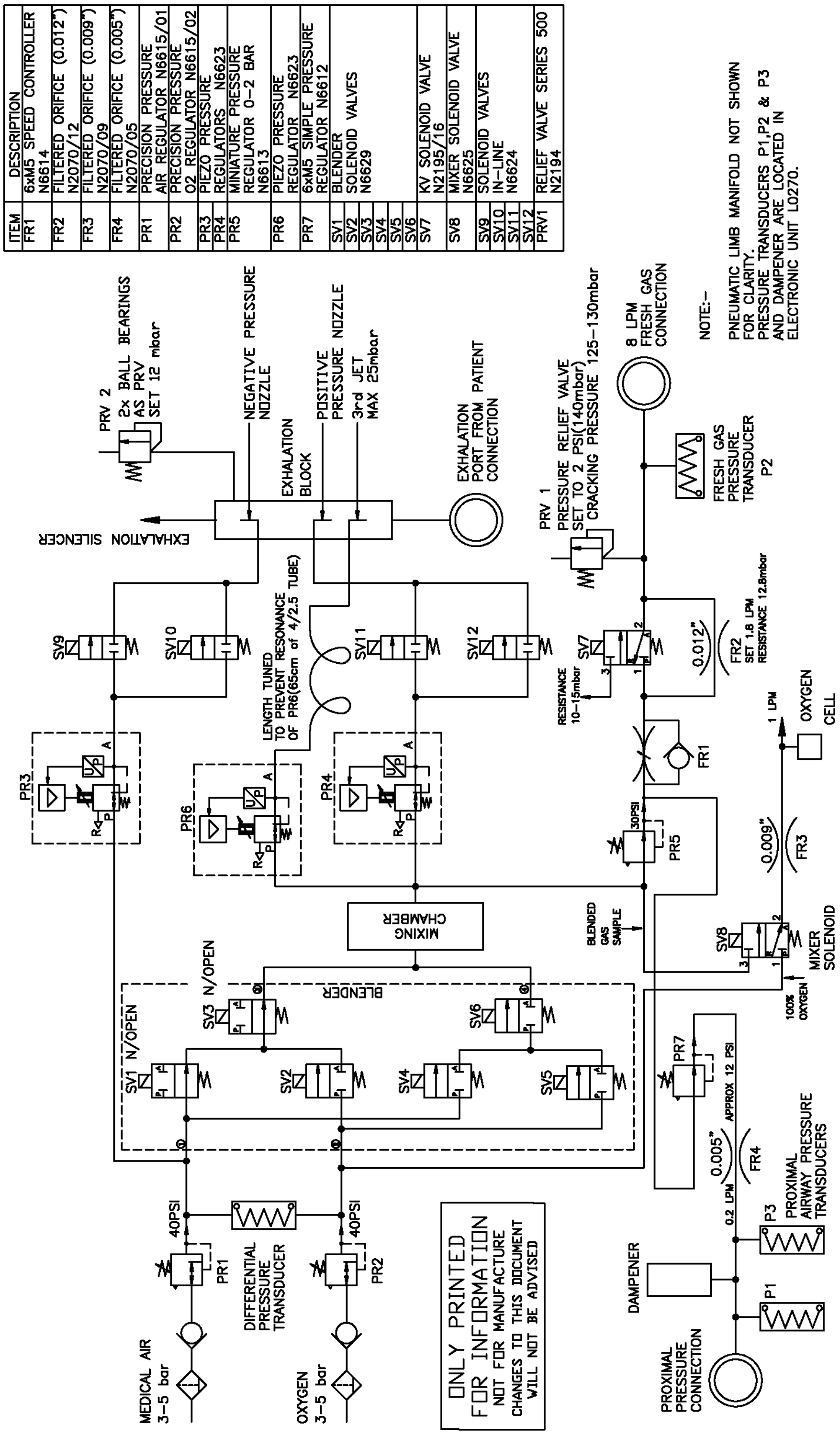
Below is a schematic representation of the pneumatic unit of the SLE5000 ventilator, pre proximal airway modification. To identify if the unit has been modified refer to the pneumatic unit serial number label located in the exhalation block area. If the label is marked with the letters PAM then the unit has been modified. If modified refer to the schematic on page 380.

ITEM	DESCRIPTION
FR1	6xM5 SPEED CONTROLLER N6614
FR2	FILTERED ORIFICE (0.012") N2070/12
FR3	FILTERED ORIFICE (0.009") N2070/09
FR4	FILTERED ORIFICE (0.005") N2070/05
PR1	PRECISION PRESSURE AIR REGULATOR N6615/01
PR2	PRECISION PRESSURE O2 REGULATOR N6615/02
PR3	PIEZO PRESSURE REGULATORS N6623
PR4	
PR5	MINIATURE PRESSURE REGULATOR 0–2 BAR N6613
PR6	PIEZO PRESSURE REGULATOR N6623
PR7	6xM5 SIMPLE PRESSURE REGULATOR N6612
SV1	BLENDER SOLENOID VALVES N6629
SV2	
SV3	
SV4	
SV5	
SV6	
SV7	KV SOLENOID VALVE N2195/16
SV8	MIXER SOLENOID VALVE N6625
SV9	SOLENOID VALVES IN-LINE N6624
SV10	
SV11	
SV12	
PRV1	RELIEF VALVE SERIES 500 N2194



29.2 Schematic Post PAM

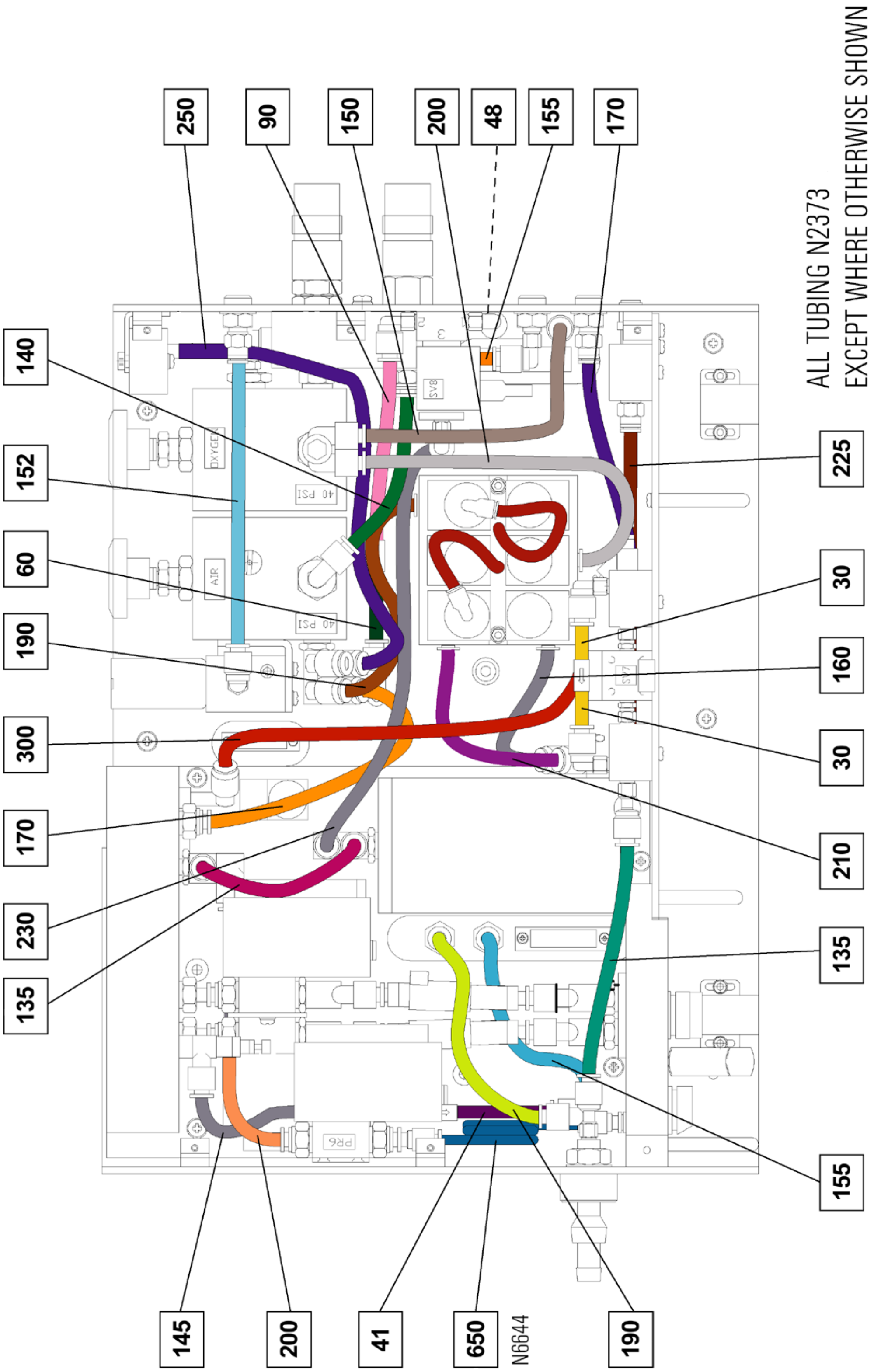
Below is a schematic representation of the pneumatic unit of the SLE5000 ventilator, post proximal airway modification. To identify if the unit has been modified refer to the pneumatic unit serial number label located in the exhalation block area. If the label is marked with the letters PAM then the unit has been modified. If unmodified refer to the schematic on page 379.



ITEM	DESCRIPTION
FR1	6xM5 SPEED CONTROLLER N6614
FR2	FILTERED ORIFICE (0.012") N2070/12
FR3	FILTERED ORIFICE (0.009") N2070/09
FR4	FILTERED ORIFICE (0.005") N2070/05
PR1	PRECISION PRESSURE AIR REGULATOR N6615/01
PR2	PRECISION PRESSURE O2 REGULATOR N6615/02
PR3 PR4	PIEZO PRESSURE REGULATORS N6623
PR5	MINATURE PRESSURE REGULATOR 0-2 BAR N6613
PR6	PIEZO PRESSURE REGULATOR N6623
PR7	6xM5 SIMPLE PRESSURE REGULATOR N6612
SV1 SV2 SV3 SV4 SV5 SV6	BLENDER SOLENOID VALVES N6629
SV7	KV SOLENOID VALVE N2195/16
SV8	MIXER SOLENOID VALVE N6625
SV9 SV10 SV11 SV12	SOLENOID VALVES IN-LINE N6624
PRV1	RELIEF VALVE SERIES 500 N2194

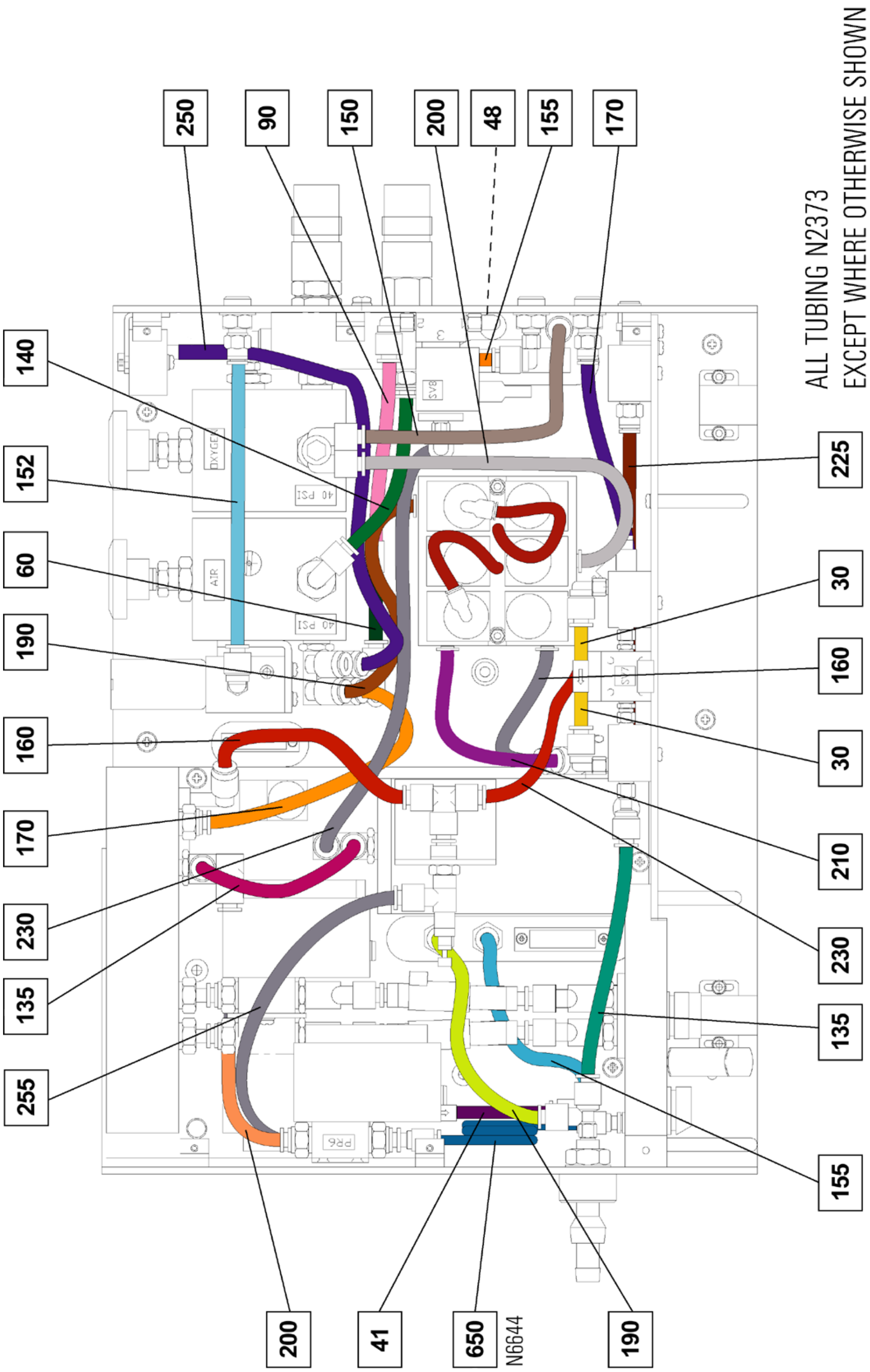
30. Pneumatic Unit Tubing connections

30.1 Tubing Connections Pre PAM



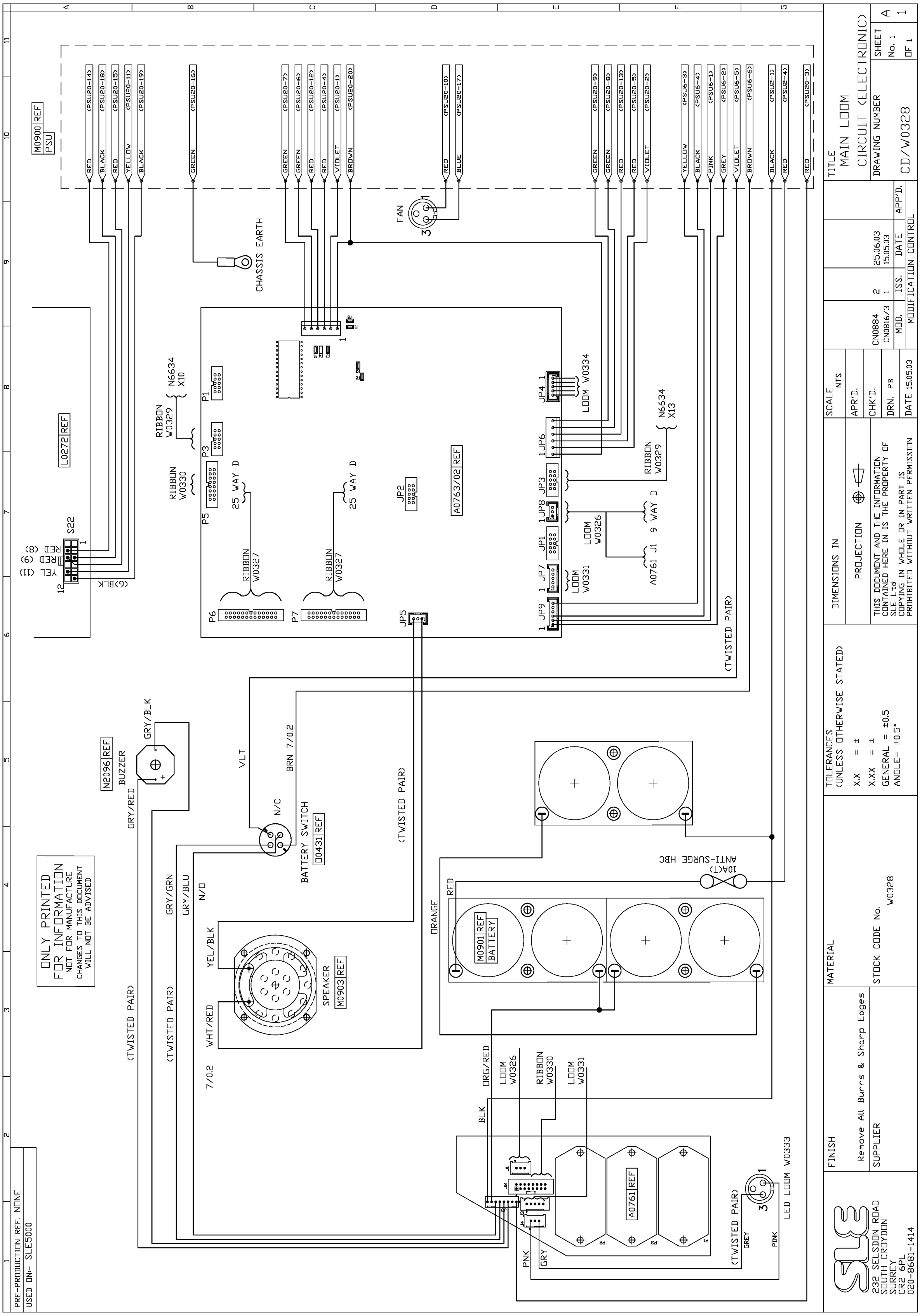
All dimensions are in millimeters.

30.2 Tubing Connections Post PAM



All dimensions are in millimeters.

31. Main Loom Circuit Diagram



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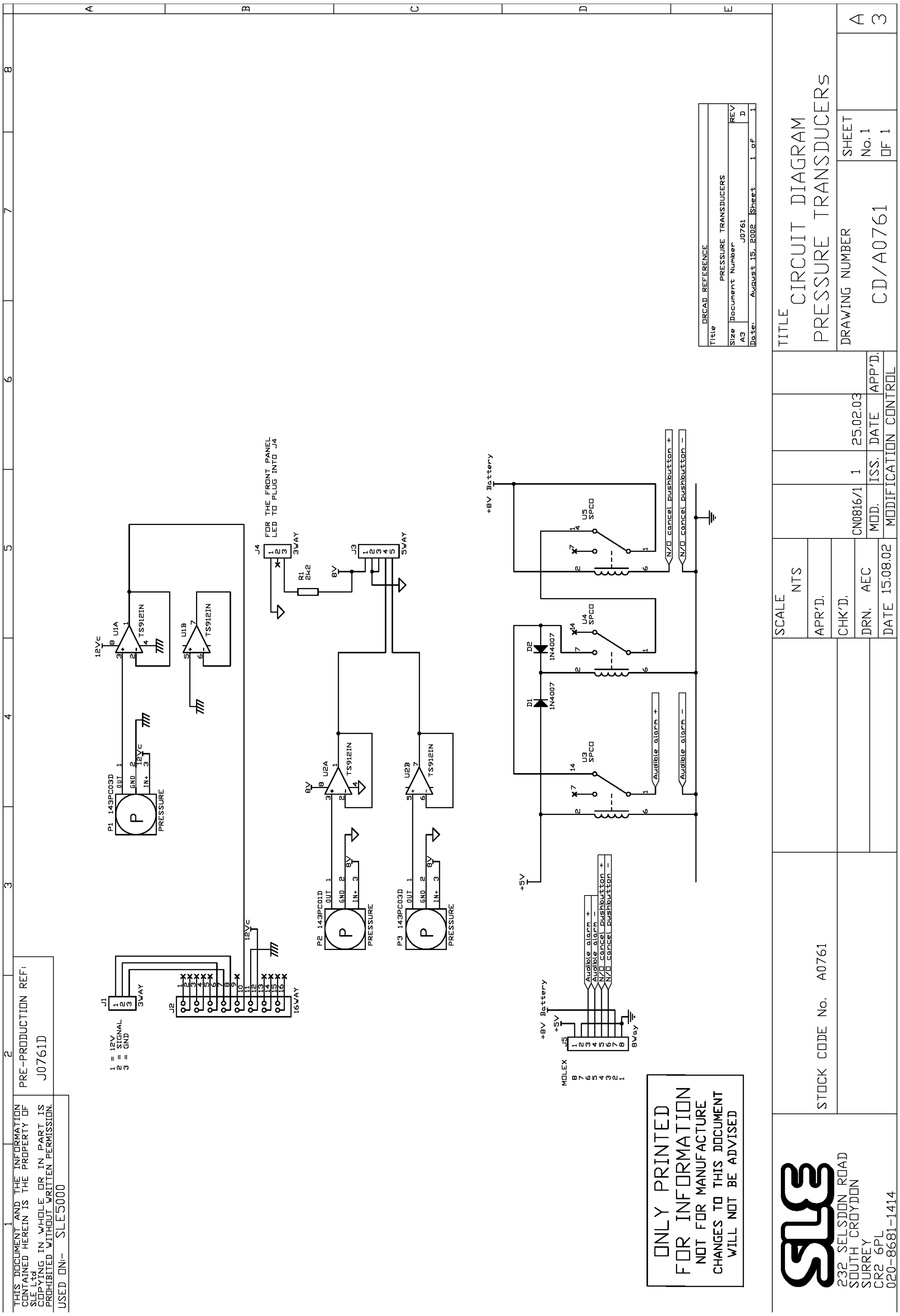
A0761 Circuit Diagram

32. A0761 circuit diagram

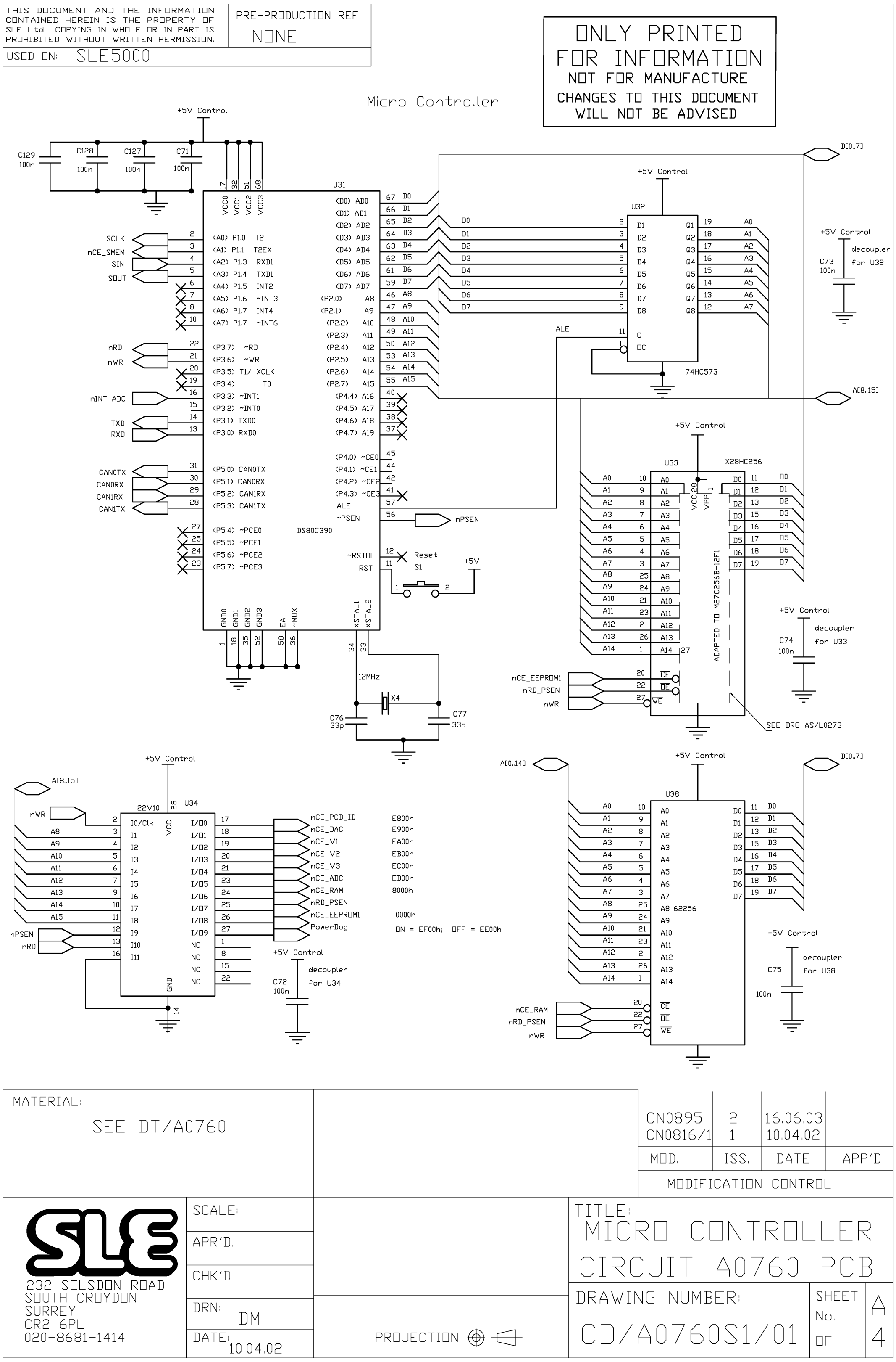
32.1 Transducer PCB Assembly



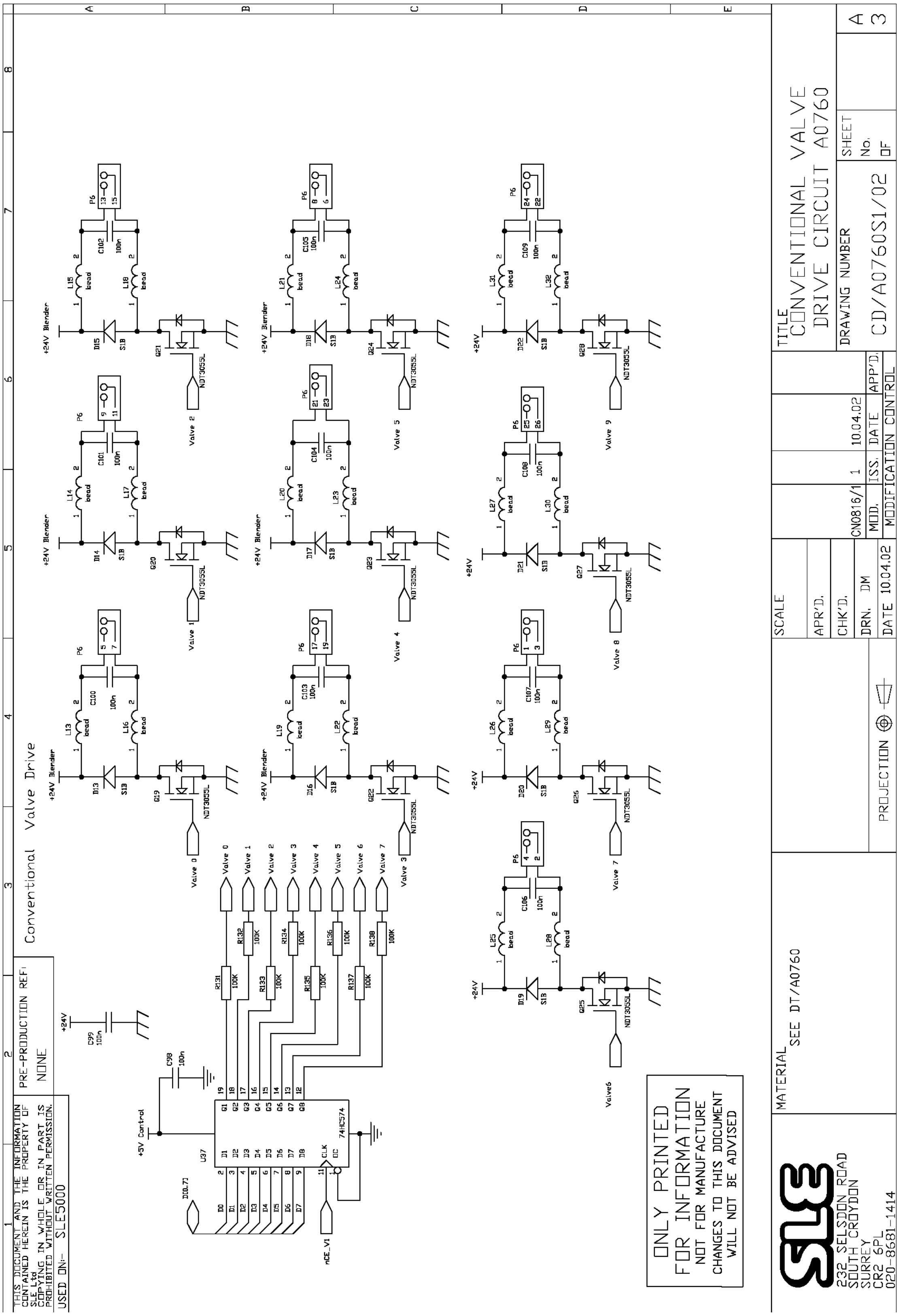
A0763/02 Circuit Diagrams

33. A0763/02 circuit diagrams

33.1 Micro Controller



33.2 Conventional Valve Drive



33.3 Power Distribution And Hardware Identifier

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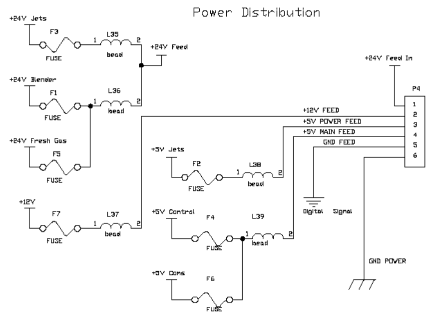
PRE-PRODUCTION REF: NONE

DNI- SLE5000

Power Distribution



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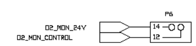
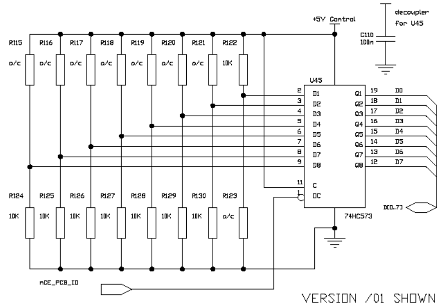
CHANGES TO THIS DOCUMENT WILL NOT BE ADVISED

Oxygen Sensor Calibration Valve



Board and Modification Level Identifier



VERSION /01 SHOWN

BOARD IDENTIFICATION TABLE

VERSION	HARDWARE Ident No.	DESCRIPTION	o/c	10k
/00	1	BLENDER-ALL CHANNELS CLOSED	R115-R122	R123-R130
/01	2	BLENDER-2 CHANNEL 1 N/O+1 N/C	R115-R121 & R123	R122 & R124-R130
/02	3	BLENDER-2 CHANNEL 2 N/O	R115-R120,R122,R130	R121 & R123-R129
/03	4	TO BE ADVISED	R115-R119,R121,R122,R129	R120,R123-R128,R130
/04	5	TO BE ADVISED	R115-R118,R120-R122,R128	R119,R123-R127,R129,R130
/05	6	TO BE ADVISED	R115-R117,R119-R122,R127	R118,R123-R126,R128-R130
/06	7	TO BE ADVISED	R115,R116,R118-R122,R126	R117,R123-R125,R127-R130
/07	8	TO BE ADVISED	R115,R117-R122,R125	R116,R123,R124,R126-R130
/08	9	TO BE ADVISED	R116-R122 & R124	R115,R123,R125-R130
/09	10	SLE4000 Model B	R115-R118,R120,R121,R123 & R128	R119,R122,R124-R127,R129 & R130

MATERIAL: SEE DT/A0760

MODIFICATION CONTROL

MOD.	ISS.	DATE	APP'D.
CN1118	2	04.07.06	
CN0816/1	1	10.04.02	

SLE
232 SELSDON ROAD
SOUTH CROYDON
SURREY
CR2 6PL
020-8681-1414

SCALE:
APR'D.
CHK'D
DRN: DM
DATE: 10.04.02

PROJECTION

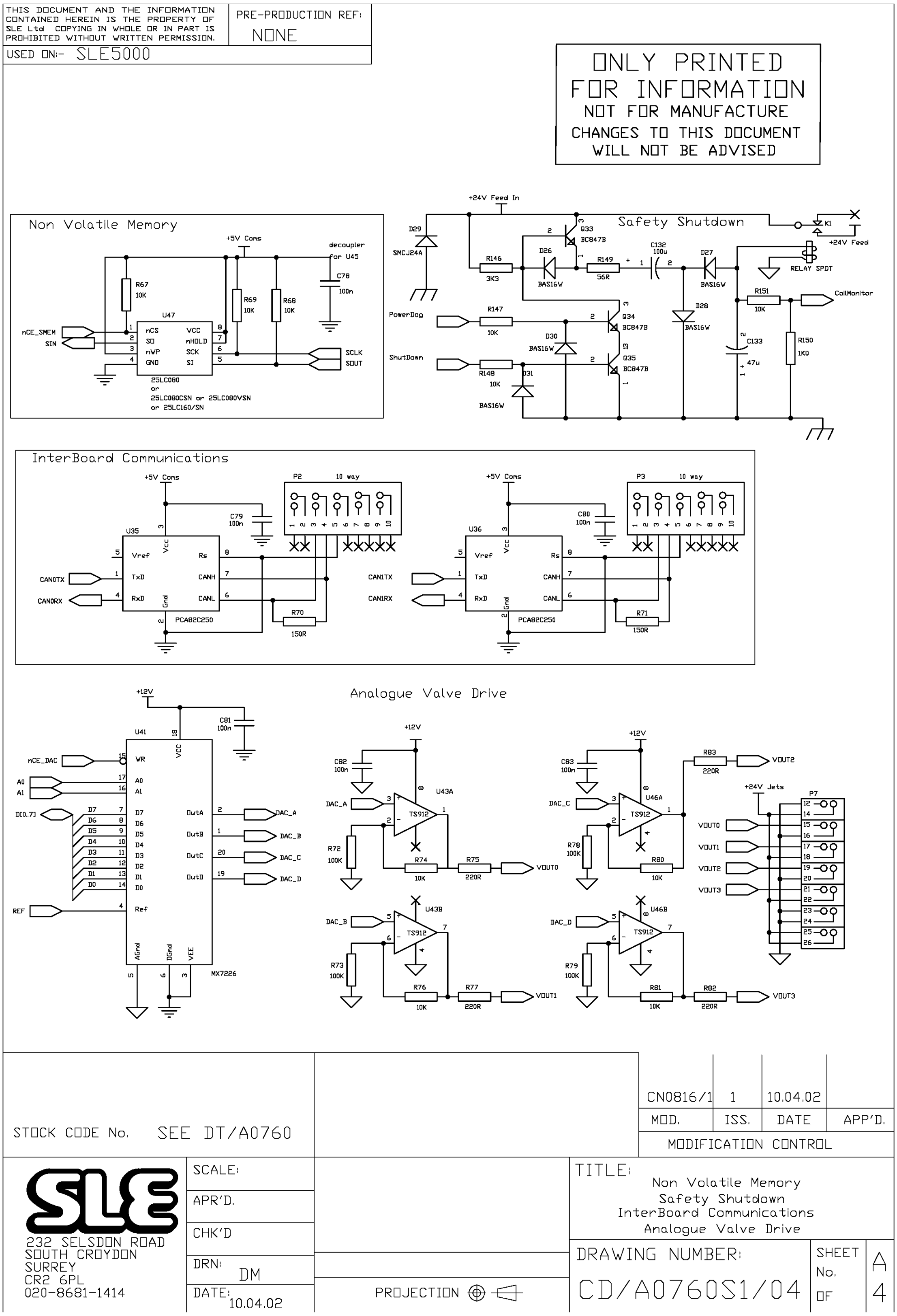
TITLE: Power Distribution
Oxygen Sensor Calibration Valve
Board and Modification Level Identifier

DRAWING NUMBER: CD/A0760S1/03

SHEET No. A OF 4

SHT-1-95

33.4 Analogue Valve Drive / Non Volatile Memory / Interboard Comms.



33.5 High Speed Valve Drive

PRE-PRODUCTION REF: NONE

USED ON:- SLE5000

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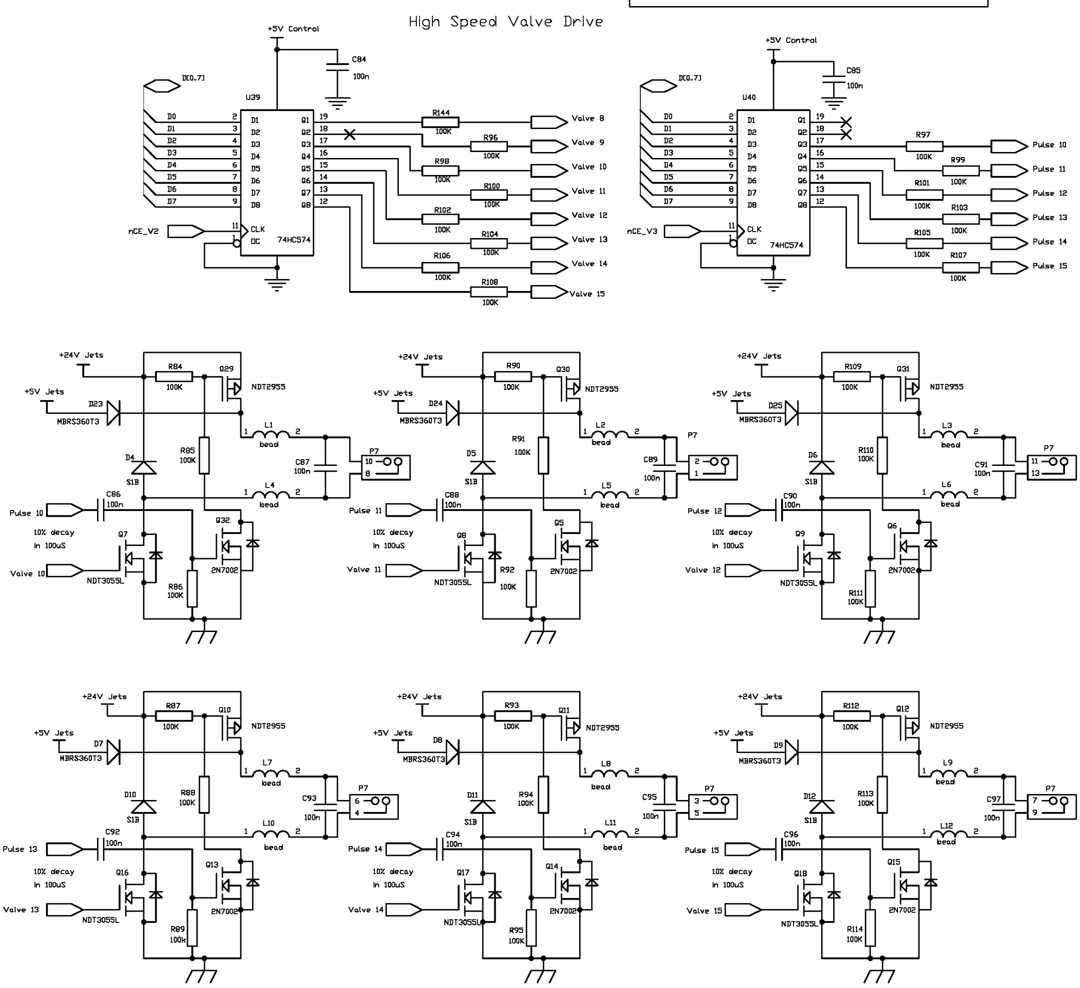

MATERIAL: SEE DT/A0760

MOD.	ISS.	DATE	APP'D.
CN0816/1	1	10.04.02	

MODIFICATION CONTROL

SLE
232 SELSDON ROAD
SOUTH CROYDON
SURREY
CR2 6PL
020-8681-1414

SCALE:
APR'D.
CHK'D
DRN: DM
DATE: 10.04.02

PROJECTION

TITLE: HIGH SPEED VALVE DRIVE ON A760 PCB

DRAWING NUMBER: CD/A0760S1/05

SHEET No. A OF 4

33.6 Analogue Data aquisition/Monitor port

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PRE-PRODUCTION REF: NONE

USED ON:- SLE5000

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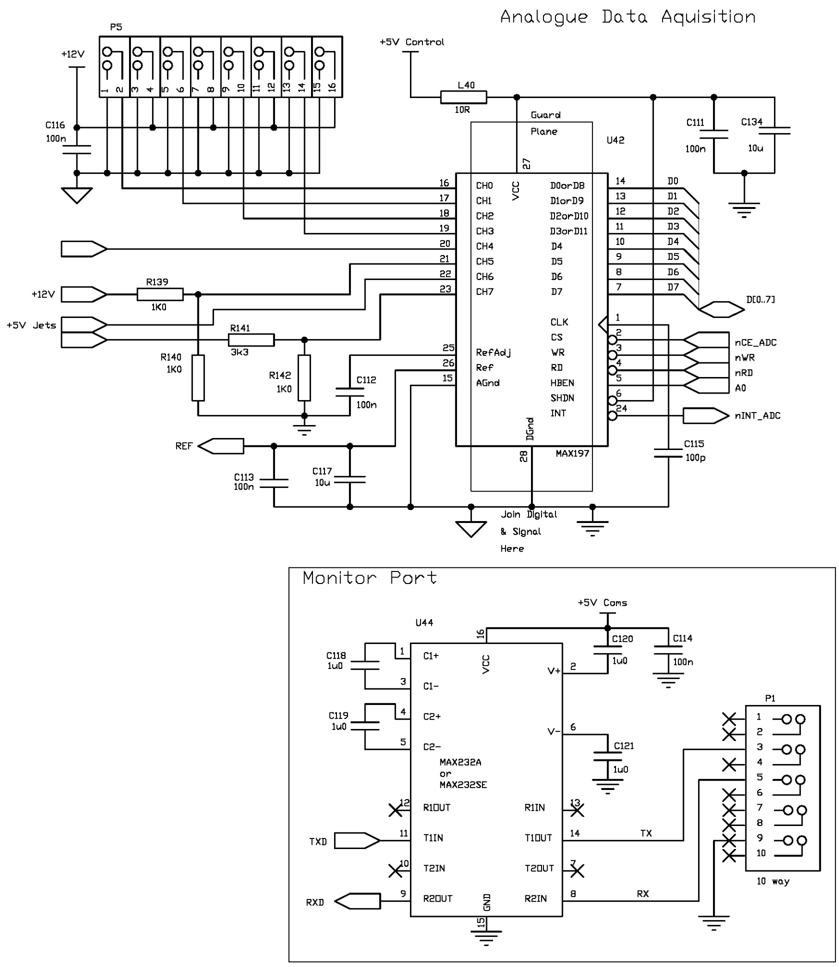
CHANGES TO THIS DOCUMENT WILL NOT BE ADVISED



CN0816/1	1	10.04.02	
MOD.	ISS.	DATE	APP'D.

MODIFICATION CONTROL

SEE DT/A0760

STOCK CODE No.

SLE
232 SELSDON ROAD
SOUTH CROYDON
SURREY
CR2 6PL
020-8681-1414

SCALE:
APR'D.
CHK'D
DRN: DM
DATE: 10.04.02

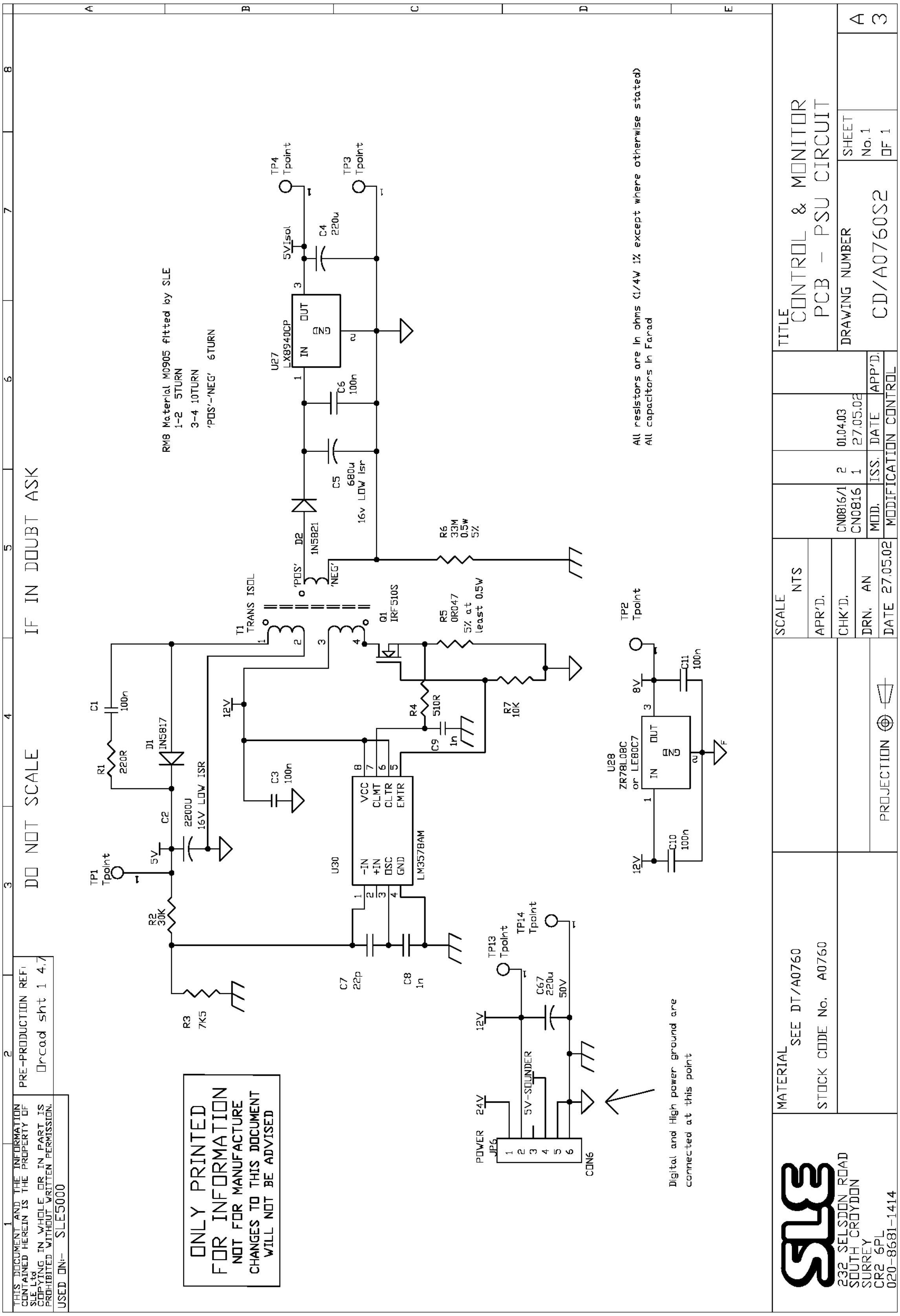
PROJECTION

TITLE:
Analogue Data Aquisition
Monitor Port

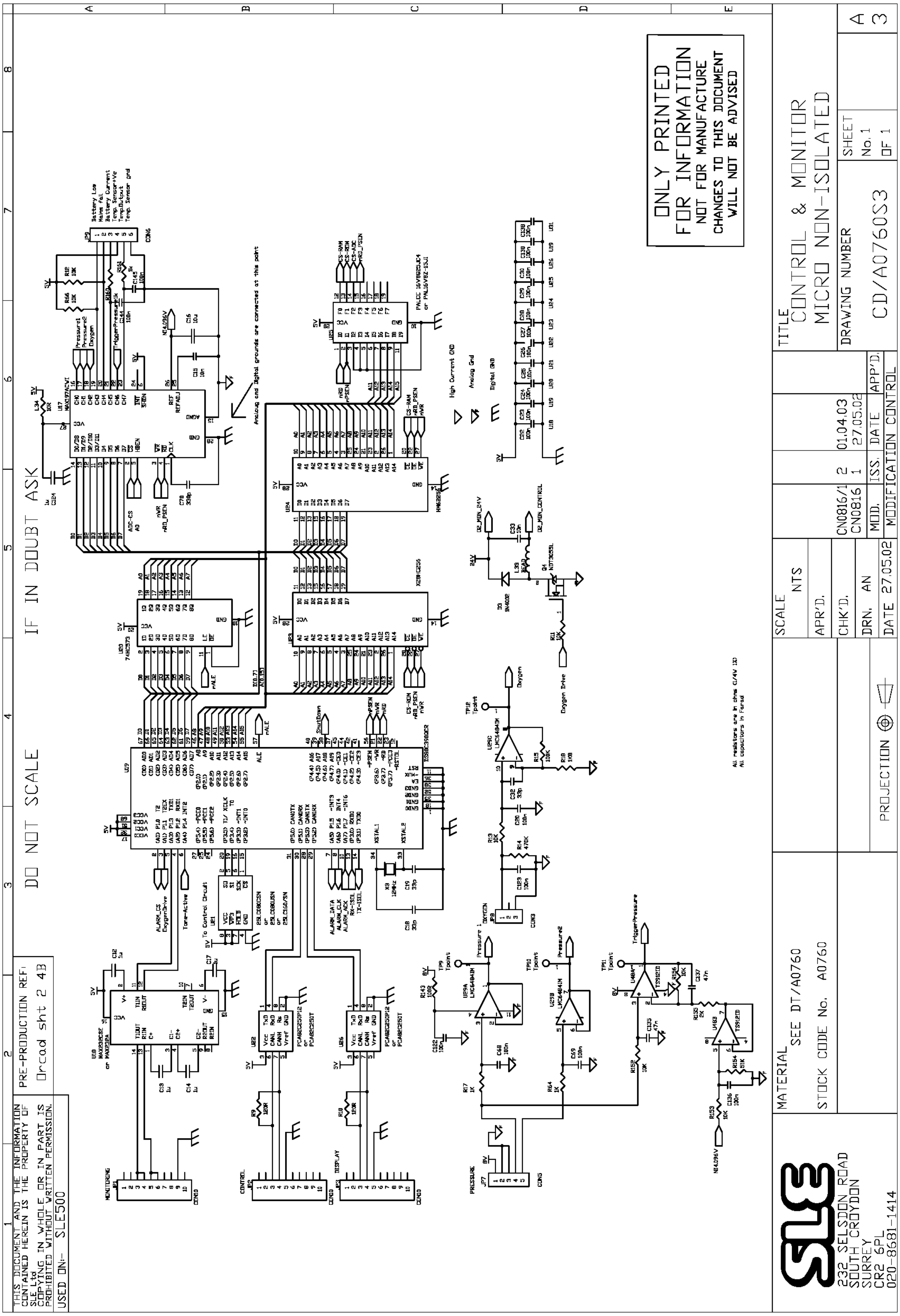
DRAWING NUMBER: CD/A0760S1/06

SHEET No. A OF 4

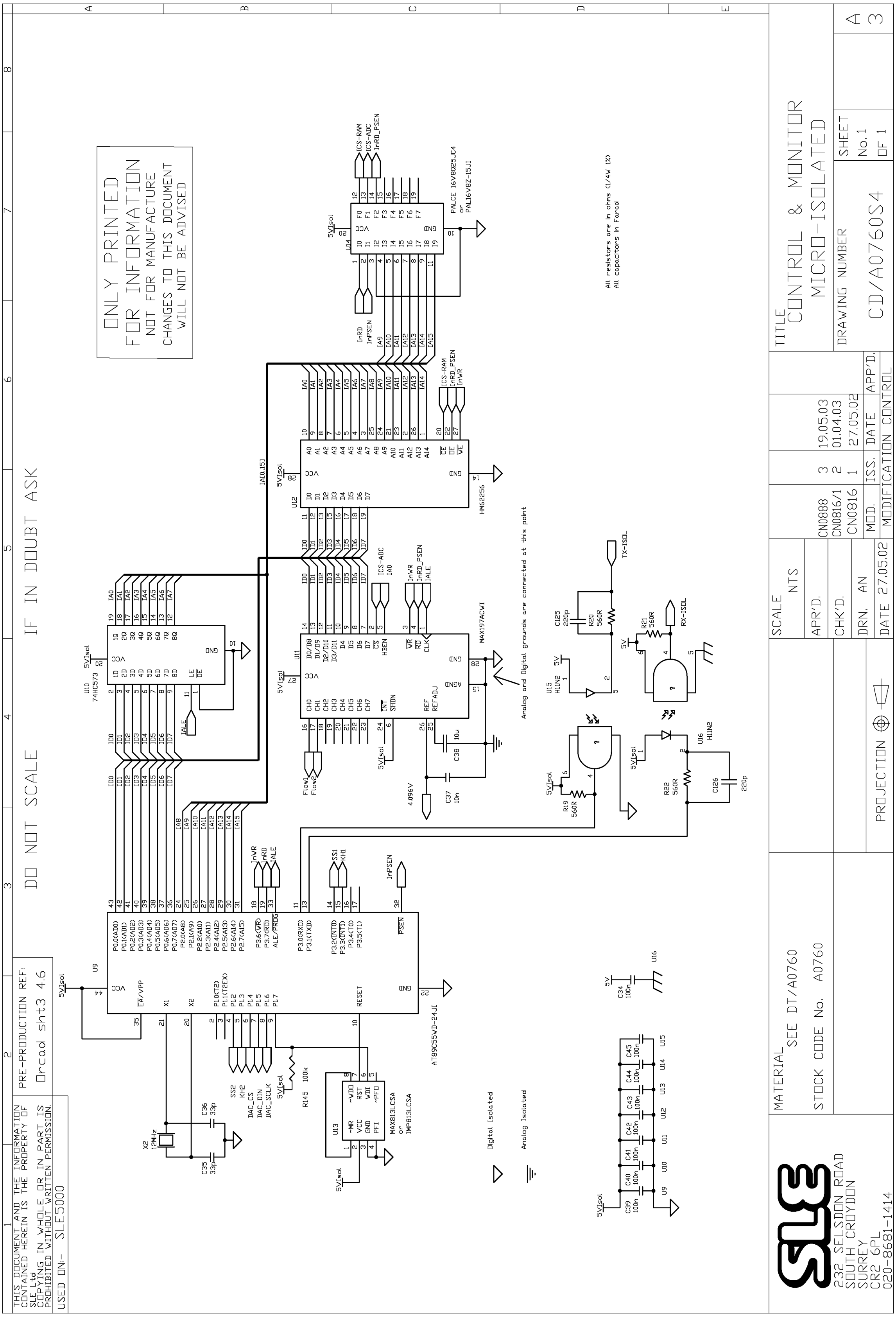
33.7 Control & Monitor, PCB PSU Circuit



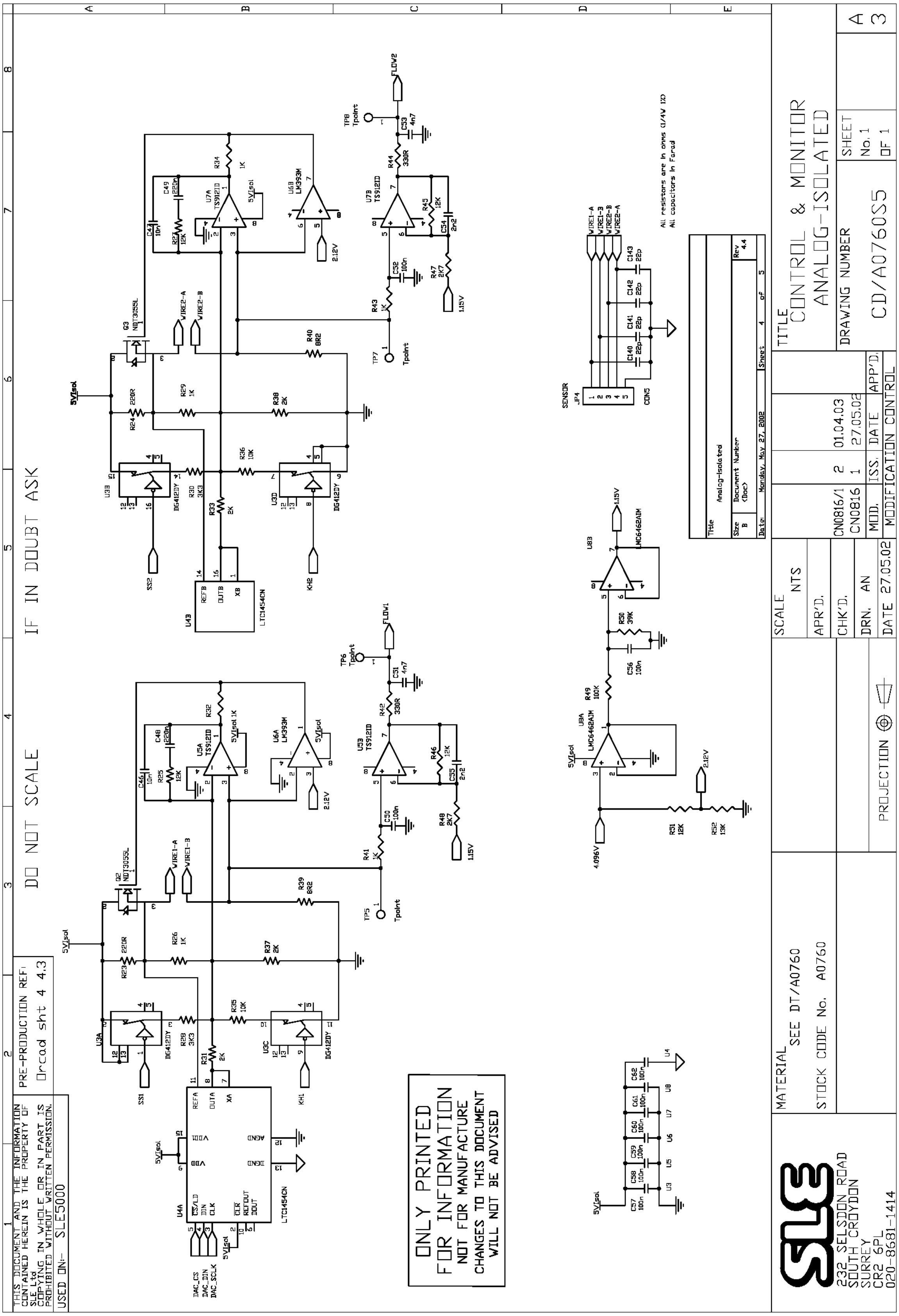
33.8 Control & Monitor, Micro Non-isolated



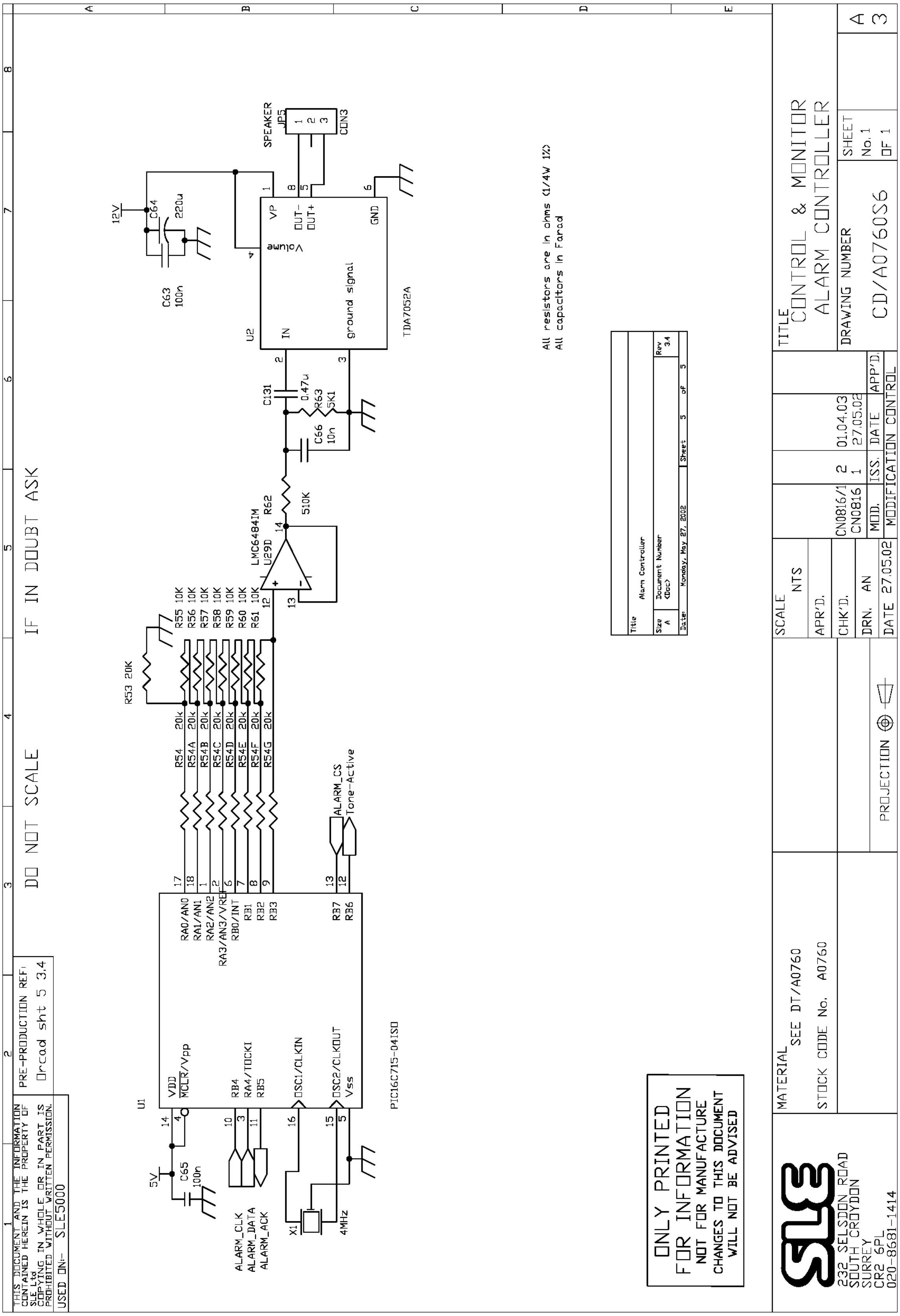
33.9 Control & Monitor, Micro Isolated



33.10 Control & Monitor, Analog Isolated



33.11 Control & Monitor, Alarm Controller



Appendix 1. Calibration Checklist

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Appendix 1. Calibration Checklist

Please make copies of this checklist to record the calibration values at overhaul/service intervals.

Item 1: Ventilator Serial Number Record

Ventilator Serial Number:	

Item 2: Elased time record

Elapsed time:	

Item 3: Service Date

Service Date:	

Item 4: Service Engineer

Name:	

Item 5: Fresh gas flow with SV7 energised.

Lower limit	Actual reading	Upper limit
7.75 lpm		8.25 lpm

Item 6: With SV7 de-energised, check the fresh gas flow is within range

Lower limit	Actual reading	Upper limit
1.2 lpm		2 lpm

Item 7: With SV7 de-energised, and the fresh gas limb occluded, ensure that the fresh gas pressure is within range

Lower limit	Actual reading	Upper limit
10 mbar		15 mbar

Item 8: **Monitor the flow from the proximal airway pressure port and ensure that it is within range.**

Lower limit	Actual reading	Upper limit
0.15 lpm		0.25 lpm

Item 9: **With SV7 energised, and the fresh gas limb occluded, ensure that the fresh gas pressure relief valve relieves within tolerance**

Lower limit	Actual reading	Upper limit
140 mbar		170 mbar

Item 10: **Check that the flow past the oxygen cell is within range**

Lower limit	Actual reading	Upper limit
3 lpm		5 lpm

Item 11: **Record of pressure sensor calibration constants.**

Block and Leak	Blender	±1 PSI Sensor	±2.5 PSI Sensor
Gain:	Gain:	Gain:	Gain:
Offset:	Offset:	Offset:	Offset:

Item 12: Record of pressure regulator calibration constants.

Mean Jet	Forward Jet	Reverse Jet
Gain:	**Gain:**	**Gain:**
	HFO Offset:	**HFO Offset:**
CMV Offset:	**CMV Offset:**	**CMV Offset:**

Item12A: Recording of P Meas Filter Value (For versions 3.3 and 4.1 software only).

P Meas Filter Value.:

Item 13: Wave shape calibration

Insp Leading Edge	Exp Leading Edge
Fast Rise:	Fast Rise:
Slow Rise:	Slow Rise:
F/S Balance:	F/S Balance:

Item 14: Pressure Triggering Verification

Pressure Trigger Verified:

Item 15: Gas Fail Detection Verification

Gas Fail Detection Verified:

SLE

Item 16: Blender and Oxygen Monitoring Verification
CPAP

Set Oxygen concentration	Lower Limit	Actiual Reading	Upper limit
21%	20%		24%
30%	27%		33%
40%	37%		43%
50%	47%		53%
60%	57%		63%
70%	67%		73%
80%	77%		83%
90%	87%		93%
100%	97%		100%

Item 17: Battery Charge Verification

Lower limit	Actual reading	Upper limit
13.7V		>13.7V

Item 18: Battery Life Verification
Results of battery life test:

Start Time:	
Battery Low Alarm Time:	
Power Fail Time:	

Item 19: Total Power Fail Alarm Test

Total power fail alarm test: Initial

Item 20: Pressure Calibration Verification

CMV

PIP Setting	Lower limit	Actual reading	Upper limit
10 mbar	9 mbar		11 mbar
20 mbar	19 mbar		21 mbar
30 mbar	29 mbar		31 mbar
40 mbar	39 mbar		41 mbar
50 mbar	49 mbar		51 mbar
60 mbar	59 mbar		61 mbar

HFO

Delta P setting	Lower limit	Actual reading	Upper limit
min	0 mbar		1 mbar
40 mbar	0 mbar		2 mbar
80 mbar	0 mbar		2 mbar
120 mbar	0 mbar		4 mbar
160 mbar	0 mbar		5 mbar
max	0 mbar		12 mbar

Record of pre-calibration constants.

Block and Leak	Blender	±1 PSI Sensor	±2.5 PSI Sensor
Gain:	Gain:	Gain:	Gain:
Offset:	Offset:	Offset:	Offset:

Mean Jet	Forward Jet	Reverse Jet
Gain:	Gain:	Gain:
	HFO Offset:	HFO Offset:
CMV Offset:	CMV Offset:	CMV Offset:

Insp Leading Edge	Exp Leading Edge
Fast Rise:	Fast Rise:
Slow Rise:	Slow Rise:
F/S Balance:	F/S Balance:

Recording of P Meas Filter Value.

P Meas Filter Value:

Appendix 2. Check list

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Appendix 2. Check list

The ventilator must pass all the test's.

		Pass	Fail
Step 1:	**Complete power fails alarm test.**		
	Audible alarm triggered and cancelled.	☐	☐
Step 2:	**Setting FiO_2.**		
	Measured value corresponds to set.	☐	☐
Step 5:	**Oxygen alarm test.**		
	High and Low alarms triggered	☐	☐
Step 10:	**Function and alarm testing.**		
	Test lung inflates	☐	☐
Step 11:	**Function and alarm testing.**		
	Analyser corresponds to set pressures	☐	☐
Step 12:	**Function and alarm testing.**		
	Apnea alarm triggered after 20 seconds	☐	☐
Step 13:	**Function and alarm testing.**		
	Manual breath delivered	☐	☐
Step 14:	**Function and alarm testing.**		
	Apnoea alarm triggered after 10 seconds	☐	☐
Step 16:	**Function and alarm testing.**		
	Continuing positive pressure alarm is triggered after 10 seconds.	☐	☐
Step 20:	**Function and alarm testing.**		
	A waveform appears in both waveform windows	☐	☐
Step 22:	**Function and alarm testing.**		
	Analyser alternates between set pressures	☐	☐
Step 23:	**High pressure alarm.**		
	Alarm triggered and cancelled	☐	☐

		Pass	Fail
Step 24:	**Low Pressure alarm.**		
	Alarm triggered and cancelled	☐	☐
Step 25:	**Breath Not Detected Alarm.**		
	Alarm triggered and cancelled	☐	☐
Step 26:	**Leak alarm.**		
	Alarm triggered and cancelled	☐	☐
Step 27:	**Block alarm.**		
	Alarm triggered and cancelled	☐	☐
Step 28:	**Mains failure alarm.**		
	Alarm triggered and cancelled	☐	☐
Step 29:	**Gas supply alarms.**		
	No Air supply Alarm triggered and cancelled	☐	☐
Step 30:	**Gas supply alarms.**		
	No O_2 supply Alarm triggered	☐	☐
Step 31:	**Gas supply alarms.**		
	No Gas Alarm triggered and cancelled	☐	☐
Step 32:	**Flow sensor disconnect alarm.**		
	Alarm triggered and cancelled	☐	☐
Step 33:	**Cycle fail alarm.**		
	Alarm triggered and cancelled	☐	☐
Step 38:	**HFO waveform test.**		
	ventilator is oscillating, waveforms appear and I:E ratio = 1:1	☐	☐
Step 41:	**CMV functional test.**		
	ventilator is cycling, waveforms appear and I:E ratio = 1:1	☐	☐
Step 43:	**Wave shape modified.**		
	Pressure wave modified	☐	☐

		Pass	Fail
Step 46:	**Waveform display synchronisation.** Waveforms should be displayed starting at the left hand edge of the window.	☐	☐
Step 47:	**Waveform display synchronisation.** Waveforms should be displayed starting any where in the window.	☐	☐
Step 51:	**Wave shape modified by TTV.** Pressure wave modified	☐	☐
Step 56:	**PSV functional test.** When the test lung is squeezed that a waveform appears in the waveform window.When the pressure is released from the test lung that the ventilator provides support by helping reinflate the test lung.	☐	☐
Step 58:	**PSV functional test.** After 10 seconds that the ventilator delivers a backup breath and the visual and audible Apnoea alarm is triggered.	☐	☐
Step 61:	**SIMV functional test.** The ventilator cycles, the cycle waveform appears in the waveform windows, after 1 minute the BPM total should read 20 BPM in the breath parameter window.	☐	☐
Step 62:	**SIMV functional test.** The ventilator delivers a synchronized breath.	☐	☐
Step 63:	**SIMV functional test.** The ventilator does not trigger on the 2 to 3 test lung initiated breaths before delivering the next synchronized breath.	☐	☐

	Pass	Fail
Step 64: **Pressure Support functional test.**		
Analyser reads PIP as 25mbar	☐	☐
Step 65: **Pressure Support functional test.**		
Ventilator displays PIP as 12-13mbar	☐	☐
Step 69: **HFO+CMV functional test.** the ventilator cycles with oscillations in both the inspiratory and expiratory phases the waveforms appear in the waveform windows the I:E ratio in the breath parameter panel reads 1.0 : 1.0	☐	☐
Step 70: **HFO+CMV functional test.** The ventilator cycles with oscillations in the expiratory phase only.	☐	☐

Appendix 3. RS232

SLE

Appendix 3. RS232

This section describes the data format and connections for the serial interface of the SLE5000 infant ventilator.

33.12 Warnings for RS232

1. Any computer connected to the ventilator must be specified for medical use (i.e. it must comply with the requirements of BS-EN-60601:1990).

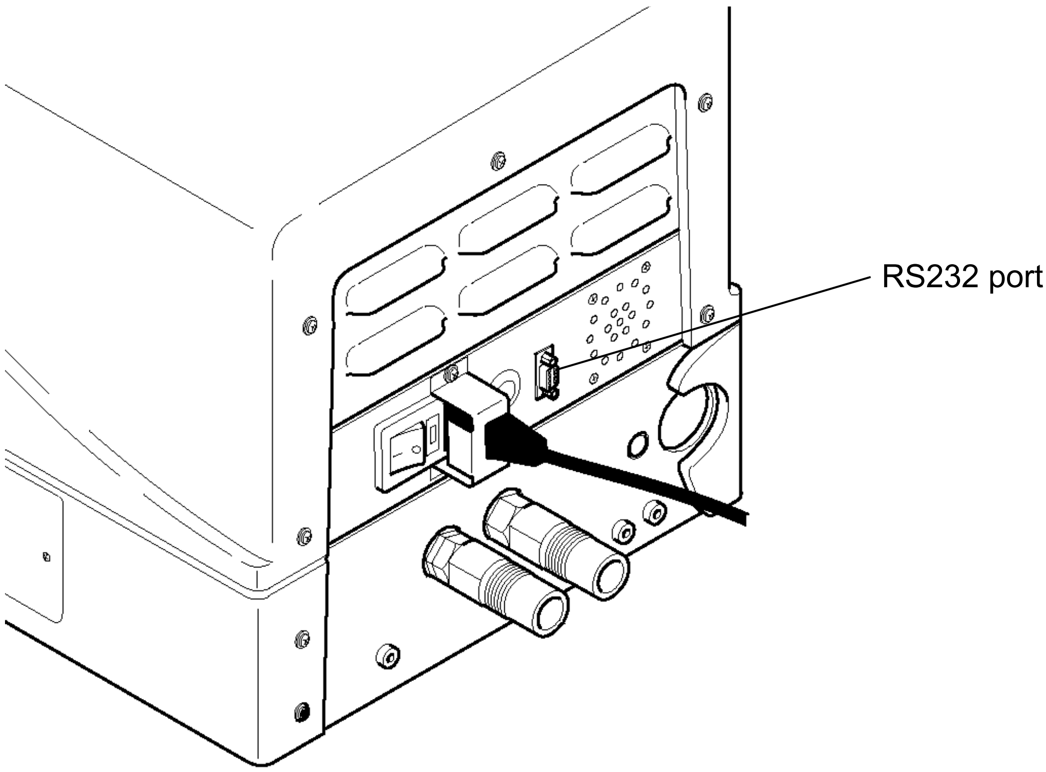
2. Do not connect the RS232 port via the interface cable to other types of devices that do not comply to the requirements of BS-EN-60601:1990.

3. The interface cable should be removed and the RS232 port capped when not in use.

4. Do not allow the ingress of any liquids into the RS232 port.

33.13 Location of RS232 Port

The RS232 port is located at the rear of the ventilator as shown in the diagram below.



33.14 Overview

33.15 Data and Pinout description.

33.15.1 Version 3.3

Data Format: RS232-C compatible, 9600 bps, 8 data bits, 1 stop bit, no parity. The data output is a comma delimited ASCII text string terminated by carriage return and linefeed (<CR>,<LF>). There is 1 second between the end of one text string transmission and the beginning of the next.

33.15.2 Version 4.1

Data Format: RS232-C compatible,19200 bps, 8 data bits, 1 stop bit, no parity. The data output is a comma delimited ASCII text string terminated by carriage return and linefeed (<CR>,<LF>). There is 1 second between the end of one text string transmission and the beginning of the next.

RS232 Pinout: The RS232 interface connector pin assignments are as follows;

Pin	Signal
1	DCD
2	TXD
3	RXD
4	DSR
5	GND
6	DTR
7	CTS
8	RTS

33.16 Cable

This pin assignment allows the ventilator to be connected directly to the RS232-C serial port on a PC with a standard serial cable.

33.17 Parameter Descriptions and format

The text string that is output contains 40 parameters.
e.g.
60,2,6,10,23,100,4,2,100,1,0,5,20,0,45,20,30,160,280,0,0,15000,60,3,10,145,139,3,25,99,22,13,0,824,10,3275,6,39,64,0

A description of each parameter follows;

33.18 List of parameters

Param. Nº	**Description**	**Units**	Details
1	Set BPM	breaths/minute	0 to 150
2	Set CPAP	mbar	Set CPAP pressure 0 to 35 mbar
3	Set Tidal Volume	0.2 ml	Set Target Tidal volume 10 to 1000 (2 to 200ml)
4	Set Insp. Time	0.01 sec.	Set insp. time or max insp time, 10 to 300 (0.10 to 3.00 seconds)
5	Set PIP	mbar	Set PIP pressure 0 to 65 mbar
6	Set FiO2	%	Set O2 Concentration 21 to 100%
7	Set HFO Delta P	mbar	Set HFO Delta P 4 to 180 mbar
8	Set HFO Mean	mbar	Set mean 0 to 35 mbar
9	Set HFO Rate	0.1 Hz	Set HFO rate 30 to 200 (3 to 20Hz)
10	Ventilation Mode	n/a	30 = Ventilation Off 0 = CPAP 1 = CMV 31 = PTV 32 = PSV 3 = SIMV 4 = HFO Only 5 = HFO + CMV
11	TTV Status	n/a	0 = off 255 = on

Param. Nº	Description	Units	Details
12	Set Termination Sensitivity	%	Set percentage 0 to 50 = percentage of max. flow that triggers termination, if value < 0 then termination sens. is off
13	Set Breath Trig. Threshold	lpm for flow triggering. No units for pressure triggering.	2 to 200 (0.2 to 20lpm for flow triggering).
14	Set Waveshape	n/a	Set Rise time value 0 to 25 (rise time is proportional to the value)
15	Set Patient Leak Alarm	%	Percentage leak at which alarm occurs. 10 to 50%. Values above 50 = alarm off.
16	Set Apnoea Alarm	seconds	5 to 60 seconds
17	Set Low Pressure Alarm	0.1 mbar	-1200 to 1100 (-120 to 110 mbar)
18	Set Cycle Fail Alarm	0.1 mbar	0 to 1150 (0 to 115 mbar)
19	Set High Pressure Alarm	0.1 mbar	100 to 1200 (10 to 120 mbar)
20	Set Low Tidal Vol. Alarm	0.1 ml	0 to 2970 (0 to 297ml)
21	Set High Tidal Vol. Alarm	0.1 ml	30 to 3000 (3 to 300ml)
22	Set Low Minute Vol. Alarm	ml	0 to 18000 (0 to 18l)
23	Set High Minute Vol. Alarm	ml	1000 to 18000 (1 to 18l)
24	Measured Total BPM	breaths/min	Total breath count over the last minute 0 to 255.
25	Measured CPAP	mbar	-175 to +175 mbar
26	Measured Insp. Time	0.01 sec.	0 to 32768 (0 to 327.68 seconds)
27	Measured Insp. Volume	0.1ml	0 to 32768 (0 to 3.2768 l)

Param. Nº	Description	Units	Details
28	Measured Exp. Volume	0.1ml	0 to 32768 (0 to 3.2768 l)
29	Measured PEEP	mbar	-175 to 175 mbar
30	Measured PIP	mbar	-175 to 175 mbar
31	Measured FiO2	%	0 to 100 %
32	Measured HFO Delta P	mbar	-175 to 175 mbar
33	Measured HFO Mean	mbar	-175 to 175 mbar
34	Trigger Count	breaths/min	Number of patient triggers in the last minute 0 to 255
35	Measured Minute Vol.	ml	0 to 32768 (0 to 32.768l)
36	Measured Leak	%	0 to 100 % leak
37	Measured Resistance	0.1 mbar.sec/l	Airway resistance 0 to 32768 (0 to 3276.8 millibar seconds per litre)
38	Measured Compliance	0.1 ml/mbar	Total Compliance 0 to 255 (0 to 25.5 millilitres per millibar
39	Measured C20/C	0.1	This value is a ratio of the compliance over the last 20% of the pressure rise compared to the total compliance. 0 to 255 (0 to 25.5)
40	Current Alarm	n/a	This value indicates the currently displayed alarm condition (see table opposite)

33.19 Table of current alarm condition codes.

Value	Currently Displayed alarm condition
0	No Current Alarms
1	Oxygen Cell Disconnected
2	Calibrate Oxygen Cell
3	Oxygen Cell Exhausted
4	O2 Calibration Fail
5	High Oxygen Level
6	Low Oxygen Level
10	Monitor EEPROM Fail
11	System Fail - Monitor Isolated System Fail
15	Pressure Sensor Drift
16	High Pressure
17	Low Pressure
18	Apnoea - pressure
19	Cycle Fail - pressure
20	Continuing Positive Pressure
25	System Fail - monitor error (comms)
26	System Fail - monitor isolated system
27	System Fail - unable to calibrate flow ADC
28	Calibrate Flow Sensor
29	Flow Calibration Fail
30	Connect Flow Sensor
31	Faulty Flow Sensor
32	Clean Flow Sensor
40	System Fail - alarm controller fail.
45	Battery Low
46	Main Power Fail

47	Battery Fault
50	High Minute Volume
51	Low Minute Volume
52	Low Tidal Volume
53	High Patient Leak
54	Apnoea - Volume
55	Breath Not Detected
56	High Tidal Volume
60	Blocked Fresh Gas
61	Leaking Fresh Gas
62	No O2 Supply
63	No Air Supply
64	No Gas
65	Max. Pressure too low
66	Fresh Gas Solenoid Fail
67	Controller Failure - control subsys. not responding to monitor subsys.
68	User Interface Failure
70	Controller Failure - controller has reset unexpectedly
80	Sub Ambient Pressure
81,82	Sustained Sub Ambient pressure
84	Monitor Failure
90	Unexpected Rise in Mean P
91	Unexpected Drop in Mean P
92	Unexpected Rise in Max P
93	Unexpected Drop in Max P
94	Unexpected Rise in Min P
95	Unexpected Drop in Min P
96	Pressure change detected

100	Monitor/Display Comms Fail
101	EEProm Flow data corrupt
102	EEProm Oxygen data corrupt
103	EEProm Pressure Offset data corrupt
104	EEProm Pressure Gain data corrupt
105	EEProm Pressure Time constant Data corrupt

33.20 RS232 Connection Settings and Testing Data Output

33.20.1 Version 3.3

Connect a standard serial cable from the ventilator to the test computer. Turn on the ventilator and allow it to enter ventilation off mode. Open the Hyper Terminal for Windows or the terminal emulator for other operating systems, (Settings: COM1, 9600 bps, 8 Data bits, Parity None, 1 stop bit, Flow None or No handshake). Turn on the ventilator, the hyper terminal should show that comma delimited data is being sent.

33.20.2 Version 4.1

Connect a standard serial cable from the ventilator to the test computer. Turn on the ventilator and allow it to enter ventilation off mode. Open the Hyper Terminal for Windows or the terminal emulator for other operating systems, (Settings: COM1, 19200 bps, 8 Data bits, Parity None, 1 stop bit, Flow None or No handshake). Turn on the ventilator, the hyper terminal should show that comma delimited data is being sent.

33.21 Glossary

Explanation of terms used within this document.

Term	Meaning
ASCII	(American Standard Code for Information Interchange) is the most common format for text files in computers. Not suitable for non-English letters but suitable for numerics.
RS232C	RS232 is a long established standard for low speed serial data communication, “C” being the current version.

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Appendix 4. VueLink Technical Data

SLE

Appendix 4. VueLink Technical Data

This section describes how to connect the SLE5000 to the VueLink/Agilent patient monitor. It also describes the information that is sent from the SLE5000 to the monitor including the waveforms, alarm conditions and patient parameters.

33.22 Glossary

Explanation of terms used within this section.

Term	Meaning
RS232C	RS232 is a standard for low speed serial data communication, “C” being the current version.
VOI	VueLink Open Interface - Proprietary protocol defined by Philips Medical Systems (Philips Medizinsysteme Böblingen GmbH) to allow a medical instrument to communicate with a VueLink module.
SPI	Reference to the standard display on the VueLink System that shows up to 2 waveforms and 6 numerics.
SPI Selectable	Numerics or waveforms that can be selected for display on the SPI. Up to 17 Numerics and 6 waveforms can be SPI selectable. Numerics selected for the SPI can also be trended.
Task Window	A display that can be called up on the VueLink system that shows one waveform and 24 numerics

33.23 Connecting the SLE5000 to the VueLink patient monitor

The SLE5000 RS232 link has been adapted for Agilent Open Interface/VueLink connection. Connection to the monitor must be via the Agilent M1032A VueLink module. The module must be of the ‘Ventilator’ type. The cable from the M1032A module (Agilent part number: M1032-61654) requires the SLE VueLink adaptor (SLE part number: W0344) to connect it to the 9-pin RS232 socket on the back of the SLE5000 ventilator.

The transmission speed is 19200 bps, data format 8 bits, 1 stop bit and no parity. All data transmitted to the VueLink monitor is transferred in packets or telegrams. The VueLink monitor sends data request telegrams and the SLE5000 sends response telegrams. There are 64 request telegrams every 2048ms from the VueLink module.

33.24 Parameter Descriptions

Because the VueLink system accepts measurements from different types of medical equipment there is the possibility of confusion with parameter names that are used on the SLE5000 and those that are used on other equipment. For example, BPM on the VueLink system refers to pulse rate (beats per minute) whereas AWRR refers to airway respiratory rate. Therefore the names of parameters on the VueLink monitor are not the same as those on the SLE5000. A cross reference table follows.

SLE 5000 Nomenclature	VueLink Nomenclature
Pressure (waveform)	AWP (Airway Pressure Wave)
Flow (waveform)	AWF (Airway Flow Wave)
Volume (waveform)	AWV (Airway Volume Wave)
BPM	AWRR (Airway Respiratory Rate measured in rpm)
HFO Rate	HFVRR (High frequency ventilation respiration rate)
HFO delta P	HFVAm (High freq ventilation resp. amplitude)
Mean P	MnAwP (Mean airway Pressure)
Ti	InsTi (Inspiratory Time)
Tidal Vol	TV (Tidal Volume)
Breath Trig Threshold	sTrgFl (Flow Trigger)
Apnoea alarm time	sAADel (Apnoea Alarm Delay)
Vti	TVin (Inspired tidal volume)
Vte	TVex (Expired tidal volume)
Vmin	MV (Minute Volume)
Compl.	Cdyn (Dynamic Lung Compliance)
Resist.	Rdyn (Dynamic Lung Resistance)

Values which are control settings are prefixed with an ‘s’, for example sAWRR for set BPM.

33.25 Data transferred to the VueLink system from the SLE5000

The RS232 interface to the VueLink monitor enables the SLE5000 to send monitored patient data, ventilator settings, waveforms and alarms. Three digital waveforms are transmittable to the VueLink system, which are Pressure (AWP), Flow(AWF) and Tidal Volume(AWV). The sample rate for these waveforms is 8ms.
The following table lists the parameters that are transmitted to the VueLink system:

ID	Name	Range	Units	Description	SPI Select-able (trend-able)	View-able in Task Window
1	sAWRR	0 to 150	rpm	Set respiratory rate. This is the same as the set BPM rate. In HFO only mode this value is set to 0.	✓	✓
2	sInsTi	0.10 to 3.00	sec	Set inspiratory time. Same as the set Ti. In HFO only mode this value is set to 0.	✓	✓
3	sHFVRR	3.0 to 20.0	Hz	Set high frequency ventilation respiratory rate. This is the same as the set HFO rate. In non-HFO modes, this value is set to 0.	✓	✓
4	AWRR	0 to 255	rpm	Measured respiratory rate. Same as the BPM total display except for HFO only mode when it is set to 0.	✓	✓
5	PEEP	-175 to 175	mbar	This is the measured PEEP. In HFO only mode it indicates the minimum pressure.	✓	✓
6	InstTi	0 to 12.75	sec	Measured Inspiratory time. Same as the measured Ti. In HFO mode only this is set to 0.	✓	✓
7	TVex	0 to 999.9	ml	Measured expiratory volume. Same as Vte on the display. Only available with a flow sensor.	✓	✓
8	PIP	0 to 175	mbar	This is the measured PIP. In HFO only mode it indicates the maximum pressure.	✓	✓
9	FIO_2	0 to 100	%	This is the measured FiO_2 value.	✓	✓
10	TVin	0 to 999.9	ml	Measured inspiratory volume. Only available with a flow sensor.	✓	✓
11	HFVAm	0 to 175	mbar	High frequency ventilation amplitude. Measures the difference between maximum and minimum HFO pressures.	✓	✓
12	MnAwP	-175 to 175	mbar	Measured Mean Airway Pressure	✓	✓
13	MV	0 to 99.99	l	Measured minute volume. Only available with a flow sensor.	✓	✓
14	Cdyn	0 to 25.5	ml/ mbar	Measured dynamic compliance. Same as Compl. on the display. Only available with a flow sensor. Set to zero in HFO modes.	✓	✓

15	Rdyn	0 to 999.9	mbar/l/s	Measured dynamic resistance. Same as resist. on the display. Only available with a flow sensor. Set to zero in HFO modes.	✓	✓
16	Leak	0 to 100	%	Patient leak. Only available with a flow sensor.	✓	✓
17	Trig	0 to 255	Trig/min	This is the same as the Trigger value. It display the number of breath triggers in the last minute. It is set to o in HFO modes.	✓	✓
18	sPEEP	0 to 35	mbar	Set PEEP. Same as the set PEEP on the display. Set to zero in HFO only mode	×	✓
19	sTV	3 to 200	ml	Set tidal volume. Set to zero in HFO modes.	×	✓
20	sPIP	0 to 65	mbar	Set PIP. Set to zero in HFO only mode.	×	✓
21	sFIO_2	0 to 100	%	Set FiO_2 value.	×	✓
22	sHFVAm	0 to 180	mbar	Set HFO amplitude. Set to zero in non HFO modes.	×	✓
23	sMeanP	0 to 35	mbar	Set Mean pressure. Set to zero in non HFO modes and set to the PEEP setting in combined mode.	×	✓
24	C20/C	0 to 25.5	(ratio)	Measured C20/C. Only available with a flow sensor. Set to zero in HFO modes.	×	×
25	sMode		(ident)	1 = OFF 2 = CPAP 3 = CMV 4 = PTV 5 = PSV 6 = SIMV 7 = HFO 8 = Combin	×	✓
26	sTrgFl	0.2 to 20.0	l/min	Set flow trigger threshold. When a flow sensor is not available then this value relates to the pressure trigger threshold. 0.2 = min sensitivity, 20.0 = max sensitivity	×	×
27	sAADel	5 to 60	sec	Set Apnoea Alarm delay time.	×	×
28	highP	10 to 120	mbar	Set High Pressure alarm threshold.	×	×
29	lowP	-120 to 110	mbar	Set Low Pressure alarm threshold.	×	×
30	lowTV	0 to 200	ml	Set Low Tidal Volume alarm threshold	×	×
31	highMV	1.0 to 18.0	l	Set High Minute volume alarm threshold	×	×
32	lowMV	0.0 to 18	l	Set Low Minute volume alarm threshold.	×	×
33-63	-	-	-	Dummy Requests.	×	×

33.26 Alarm and inoperative indications

The VueLink display will show ventilator alarms and inoperative conditions. Alarms and Inoperative conditions (inops) are displayed along the top of the VueLink monitor screen.

The inops are shown in green at the top left of the screen, alarms are shown in either yellow (mid top screen) or red (top right).

Red alarms indicate a life-threatening situation which requires an immediate response from the medical staff and yellow alarms indicate a situation where the medical staff are necessary but it is of less critical importance.

The textual alarm messages on the VueLink system are brief summaries of the ventilator alarm conditions. The following table shows how the SLE5000 messages correspond to VueLink display messages.

VueLink Message Type and text	**Corresponding SLE 5000 Alarm conditions (priority in brackets)**	**Notes**
GREEN inop - “VENT INOPERATIVE”	Monitor Failure (1) Controller Failure (4) Monitor Cksm Fail (5) Controller Reset (6) Monitor coms (23) Isol sys fail (26) Flow ADC fail (27) User interface fail (33) Fresh gas sol fail (42) Mon/disp coms fail (49) Alarm cont. fail (50)	Indicates one of 11 alarm conditions has occurred. Refer to the SLE5000 main display to identify cause. All parameter values are displayed as -?-
GREEN inop - “NO FLOW SENSOR”	None	The following parameter values are displayed as -?-TVex TVin MV Cdyn Rdyn Leak C20/C
GREEN Inop - “FLOW SENS. CALIB”	None	Indicates that the flow sensor is currently being calibrated.
GREEN Inop - “O2 CELL FAIL”	O2 Cell Disconn (43) O2 Cell Exhausted (45) O2 Cell Cal Fail (46)	The parameter value for FIO_2 is displayed as -?-

GREEN Inop - “O2 CELL CALIB”	None	Indicates that the oxygen cell is currently being calibrated. The parameter value for FIO_2 is displayed as -?-
GREEN Inop - “PR. SENS. DRIFT”	Pres. Sens. Drift (11)	Indicates that pressure sensor drift has occurred.
RED Alarm - “LOW PRESSURE”	Sust. sub ambient (2) Sub ambient (3) Low Pressure (9)	Indicates one of three low pressure alarm conditions.
RED Alarm - “CONTIN. PRESS”	Cont. positive press (7)	
RED Alarm - “HIGH PRESSURE”	High Pressure (8)	
RED Alarm - “CYCLE FAIL”	Fail to cycle (10) Breath Not Detec. (38)	Indicates one of two alarm conditions.
RED Alarm - “PR. SENS. DRIFT”	Press. Sens. Drift (11)	
RED Alarm - “HFO P CHANGE”	Rise in Mean P (12) Drop in Mean P (13) Rise in Max P (14) Drop in Max P (15) Rise in Min P (16) Drop in Min P (17)	Indicates a change has occurred in the HFO pressure waveform.
RED Alarm - “GAS SUPPLY FAIL”	No Gas (18) No O2 Supply (19) No Air Supply (20)	Indicates that one or both of the input gas supplies have failed.
RED Alarm - “BATTERY FAULT”	No Battery Detec. (21)	
RED Alarm - “BATTERY LOW”	Battery Low (22)	
RED Alarm - “BLOCK - F.G.”	Blocked Fresh Gas (24)	
RED Alarm - “LEAK - F.G.”	Leaking Fresh Gas (25)	
RED Alarm - “APNOEA”	Apnoea - Volume (39) Apnoea - Pressure (40)	
YELLOW Alarm - “FLOW SENS ALARM”	Flow sens. defect (28) Clean Flow Sensor (29) Connect Flow Sens (30) Cannot Cal. Flow (31) Cal. Flow Sensor (32)	Indicates one of five alarm conditions associated with the flow sensor.

YELLOW Alarm - “MIN. VOL. ALARM”	High Minute Vol (34) Low Minute Vol (37)	Indicates either high or low minute volume alarm has occurred.
YELLOW Alarm - “PATIENT LEAK”	Pat. Leak Alarm (35)	
YELLOW Alarm - “LOW TIDAL VOL.”	Low Tidal Vol. (36)	
YELLOW Alarm - “POWER FAIL”	Main Power Fail (41)	
YELLOW Alarm - “O2 CELL FAIL”	O2 Cell Disconn (43) O2 Cell Exhausted (45) O2 Cell Cal Fail (46) O2 Cell Cal Reqd. (44)	Indicates one of four alarm conditions associated with the oxygen cell.
YELLOW Alarm - “O2 CONC ALARM”	High O2 Level (47) Low O2 Level (48)	Indicates an oxygen concentration alarm.

34. VueLink Task Window Layout

The VueLink task window for the SLE5000 will display the parameters as shown below.

```
|-------------------|-------------------|-------------------|
| sPEEP    mbar     | sPIP     mbar     | sAWRR    rpm      |
|                   |                   |-  -  -  -  -  -  -|
| PEEP     mbar     | PIP      mbar     | Trig     trig/min |
|-------------------|-------------------|-------------------|
| sFIO_2 %          | sInsTi   sec      | sTV      ml       |
|                   |                   |-  -  -  -  -  -  -|
| FIO_2    %        | InsTi    sec      | TVex     ml       |
|-------------------|-------------------|-  -  -  -  -  -  -|
| MV       l        | Leak     %        | TVin     ml       |
|-------------------|-------------------|-------------------|
| sHFVAm   mbar     | sMeanP   mbar     | Cdyn     ml/mbar  |
|                   |                   |-  -  -  -  -  -  -|
| HFVAm    mbar     | MnAwP    mbar     | Rdyn     mbar/l/s |
|-------------------|-------------------|-------------------|
| sHFVRR   Hz       | AWRR     rpm      |
|-------------------|-------------------|
```

34.1 Notes on General System Behaviour

The VueLink-SLE5000 communication link is automatically established if the physical link is present, this communication can take about 40 seconds to establish. If the physical connection between the SLE5000 and the VueLink monitor is broken, communication between the two will continue on reconnection but will take about 40 seconds to start again.

Only one alarm is condition is visible on the SPI at a time. As with the SLE5000, if there are several alarm conditions present then only the highest priority alarm will be displayed.

When the mute button is pressed on the SLE5000 to silence the audible alarm, the alarm condition will clear from the SPI display on the VueLink monitor. The VueLink monitor will only display unmuted alarms.

35. Activation of VueLink

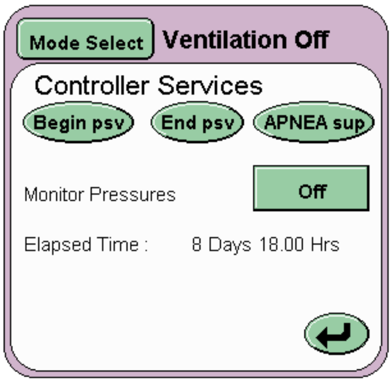
VueLink is activated by entering the activation code into the SLE4000/SLE5000 ventilator.

To access the VueLink activation screen, goto the controller services panel within the user interface.

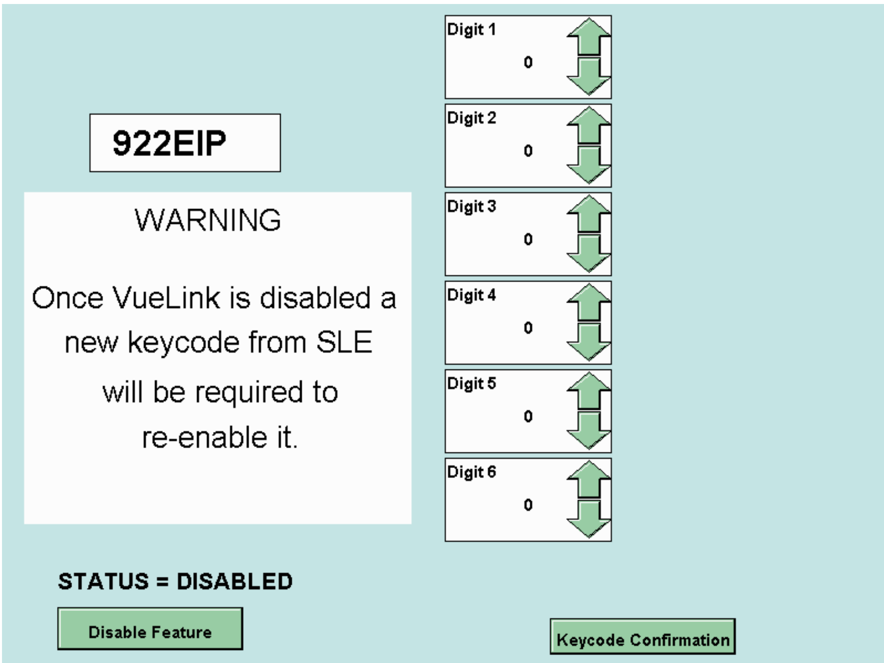
Enter the code provided by SLE into the ventilator via the controller services panel to display the activation screen.

Begin psv is the **A** button.
End psv is the **B** button.
Apnea sup is the **C** button.

Record your code here____________________



The user will now see the VueLink activation screen.



The six digit ventilator code is required when activating VueLink. This code will be used to generate the activation code for VueLink.

Note: The six digit ventilator code is not reset when the activation screen is exited. The user can enter the activation screen any number of times, the code will only change when the VueLink option is disabled.

SLE Limited will then provide the activation code which is entered via the 6 input boxes. An example activation code would be 20, 53, 45, 203, 229, 104.

This code would be entered as follows.

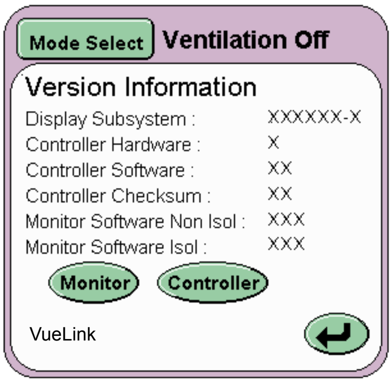
Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6
20	53	45	203	229	104

Once the code has been entered press the Keycode confirmation button.

The status text should change from Disabled to Enabled.

Restart the ventilator.

Goto the version information panel and check that the word VueLink appears in the lower left hand corner.



35.1 Disabling VueLink.

To disable VueLink press and hold down the disable feature button until the text "Disable Feature" appears. The button counts down from 4 to 1, this is to avoid inadvertant button presses.

Once Disabled the user will have to obtain a new activation code from SLE.

SLE reserves the right to make changes without prior notice in equipment, publications and prices as may be deemed necessary or desirable.

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