Attached is one native pdf file

| REV | DESCRIPTION OF CHANGE | CHANGE REFERENCE | ORIGINATOR | VERIFIED | APPROVED |
|---|---|---|---|---|---|
| | | | DATE AND SIGN | DATE AND SIGN | DATE AND SIGN |
| | | | DATE AND SIGN | DATE AND SIGN | DATE AND SIGN |
| A | Initial Release | LN-06-101 | DATE AND SIGN Mauricio La Borde | DATE AND SIGN Arne Hegland | DATE AND SIGN Steinn Birger Fodnestøl |



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| REFERENCE | REPLACES | REV | TITLE |
|---|---|---|---|
| N/A | N/A | - | **Technical Manual SimMan Mk.2** |

| PRODUCT GROUP | TOOL | PART NO | REV | DOCUMENT NO | PAGE | ATTACH | REV |
|---|---|---|---|---|---|---|---|
| 211 | N/A | 211-19550 | A | PRO-PR02-0017 | 1 of 3 | 1 | A |

# Specification of Printed Matter

| Product Name: | Technical Manual SimMan Mk.2 | | |
|---|---|---|---|
| Part no.: | 211-19550 | Revision | A |

| 1. Functionality | | Description |
|---|---|---|
| a. | Function | Technical Service Manual |

| 2. Pre-press | | Description |
|---|---|---|
| a. | Drawing Document | Ref. CD |
| b. | Pre-press file | CD / DocuShare |
| c. | Correction | Proof print to Laerdal |
| d. | File reference | Ref. CD / DocuShare |

| 3. Press | | Description |
|---|---|---|
| a. | Color | 4+4 CMYK |
| b. | Paper type, jacket | Plastic foil |
| c. | Paper type insides | Silk |
| d. | Paper Weight, jacket | 0,0116 mm |
| e. | Paper Weight insides | 80 grams |
| f. | Paper Color | Ref. item 9 below |

| 4. Label | | Description |
|---|---|---|
| a. | Cutting of label | NA |
| b. | Type of clue | NA |
| c. | Size | NA |
| d. | Type surface | NA |
| e. | Label thickness / weight | NA |
| f. | Other | NA |

| 5. Envelope | | Description |
|---|---|---|
| a. | Format | NA |
| b. | Type of clue | NA |
| c. | Type of window | NA |
| d. | Type of paper | NA |
| e. | Paper weight | NA |
| f. | Other | NA |

| 6. Post-press | | Description |
|---|---|---|
| a. | Number printed | Ref. Purchase Order |
| b. | No. Of pages | 48 pages without front and back page |
| c. | Size on product | Ref. item 9 below |
| d. | Clue line on book | NA |
| e. | No. of nails | NA |
| f. | Laminated | NA |
| g. | Corner on paper | NA |
| h. | Finish of the material | Ref. item 9 below |

| 7. Delivery | | Description |
|---|---|---|
| a. | Packing | Boxes, marked with art.no, PO no. and how many in the box |
| b. | Delivery note | Yes |
| c. | Delivery date | Ref. Purchase Order |
| d. | Place of delivery | Ref. Purchase Order |

| 8. Incoming inspection | | Description |
|---|---|---|
| a. | COA, COC sertificate | NA |
| b. | Finish product | Ref. master sample |
| c. | Color on product | Ref. master sample |
| d. | Other | NA |

## 9. Additional information

**Ref. item 3.h above:**

Jacket:

- Front page is transparent plastic foil
- Back page is white plastic foil
- Front and back pages is just a dust jacket without print

Insides:

- White paper

**Ref. item 6.c above**:

Jacket is 3mm bigger then insides,
On head, foot and right side, except on the side who shall be spiral binded (left side)

**Ref. item 6.h:**

- Spiral binding
- Insides need to be printed on both sides

Laerdal SimMan™
Universal Patient Simulator

# TECHNICAL SERVICE MANUAL

# AND MANIKIN BLOCK DIAGRAMS

## CAT No. 211-00050

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**Table of content** page

## 1.0 General

The information provided in this manual is limited to what is required for checking, maintenance and repair of the SimMan manikin. This service manual provides a general understanding of the design and function of the manikin and Link Box as well as information on the mechanical assembly of the manikin.

The Directions for Use manual provided with every new unit should be consulted for detailed information on use as well as the Software Help Files.

Service of the SimMan should only be performed by authorized service personnel. Service by others may invalidate the warranty of the device.

Refer to the local purchaser for service on the PC or Video/Audio equipment. ELO Patient Monitor, PDA, USB WEB Camera is serviced by manufacturer and has to be returned to site of purchase.

**Warning.**
Do not open the air compressor with compressed air in the tank; always drain the compressed air before service.

## 2.0 Technical Specification

### 2.1 Power consumption:

| | | |
|---|---|---|
| Link Box and manikin | Input 110/220VAC | 1,4A |
| | Output 12VDC | 5,0A |
| Patient Monitor | Input 110/220VAC | 2,0A |
| Compressor Unit | Input 110VAC | 1,9A, internal thermo protection |
| | Input 220VAC | 1,0A, internal thermo protection |

### 2.2 Air/CO2 pressure:

| | | |
|---|---|---|
| Compressor air outlet | 1,1 bar +/- 10% | (15.95psi) |
| Compressor CO2 outlet | 0,7 bar +/- 15% | (10.15psi) |

### 2.3 Weight and size:

| | | |
|---|---|---|
| SimMan manikin | 23kg (50,4 lbs.) | 106x55x23cm (lxhxd) |
| Legs | 2 x 3,25kg | 75x12cm |
| Compressor | 15kg (32,9 lbs) | 40x43x24cm |
| Regulator unit | 1,5kg (3,3 lbs) | 20,5x16x11cm |
| Patient Monitor | 7 kg (15,3 lbs) | 40x35x15cm |
| Link box | 2,4kg (5,3 lbs) | 21x10x22cm |

### 2.4 Environmental condition:

| | |
|---|---|
| Operating temperature: | +10 C - +40 C |
| Storage temperature: | -15 C - +50 C |
| Humidity | 15-90% RH (non condensing) |

### 2.5 Approvals:

Council Directive 89/336/EEC, EMC-directive

## 3.0 Functional Description

### 3.1 General System Overview SimMan

The SimMan Training System consists of the following components:

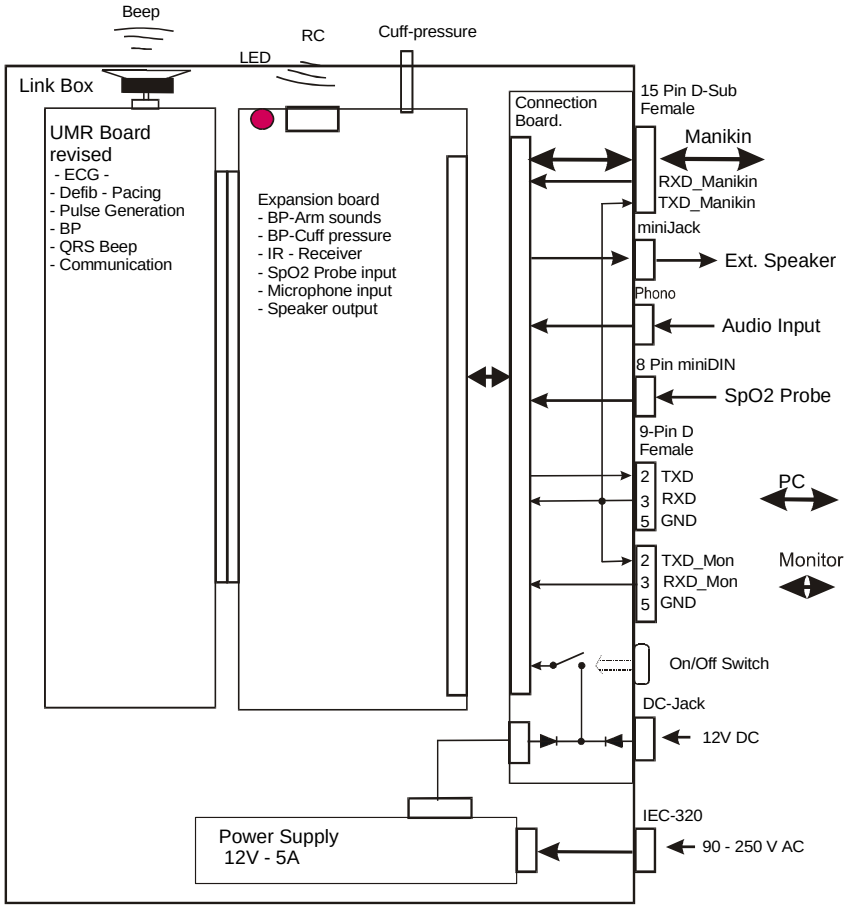
-Laerdal SimMan Manikin
-SimMan Software CD-ROM Ver. 3.0
-Directions for Use
-PDA User Guide
-Quick Installation Guide
-$SpO_2$ (Pulse Oximetry Probe)
-Set of Defibrillation Studs:
-Hands Free Defibrillation/Pacing Adaptors (Heartstart and Physio control)
-Plates for Manual Defibrillation
-Replaceable Neck Skin Collars (6)
-Roll of Crico-Thyroid Membrane Hy-Tape (2)
-Chest Tube Insertion Modules (6)
-Airway Lubricant
-Upper Dentures [one (1) non-breakable installed, and (3) breakable]
-Replaceable Male and Female Genitalia with Urinary Connection Valves
-Tool Kit, consisting of:
-Pliers
-Screw-driver
-Nut Driver
-Bolts for attaching legs to body (with locking wing nuts)
-Maintenance/Repair Kit, consisting of:
-Extra Pneumothorax Bladders
-Modeling Wax
-Talcum Powder
-IV Kit, consisting of:
-Tubing (2)
-Simulated Blood Concentrate
-IV Bag (2)-Blood Pressure Measuring Kit-Track Suit (jacket and trousers)

For further details on the SimMan system refer to Directions for Use

## 3.2 Link Unit Overview:

The Link Box is used in the SimMan Training System to maintain the following functions:

- Power supply for Link and Manikin.
- Remote control receiver.
- Interconnect to Monitor.
- Interconnect to Manikin.
- SpO2 dummy probe input.
- Blood pressure function (Cuff pressure and sound generation).
- Audio input and sound output for Manikin speech and oral sounds.
- ECG and Pulse generation, including Defibrillation and Pacing detection.
- QRS – beep.

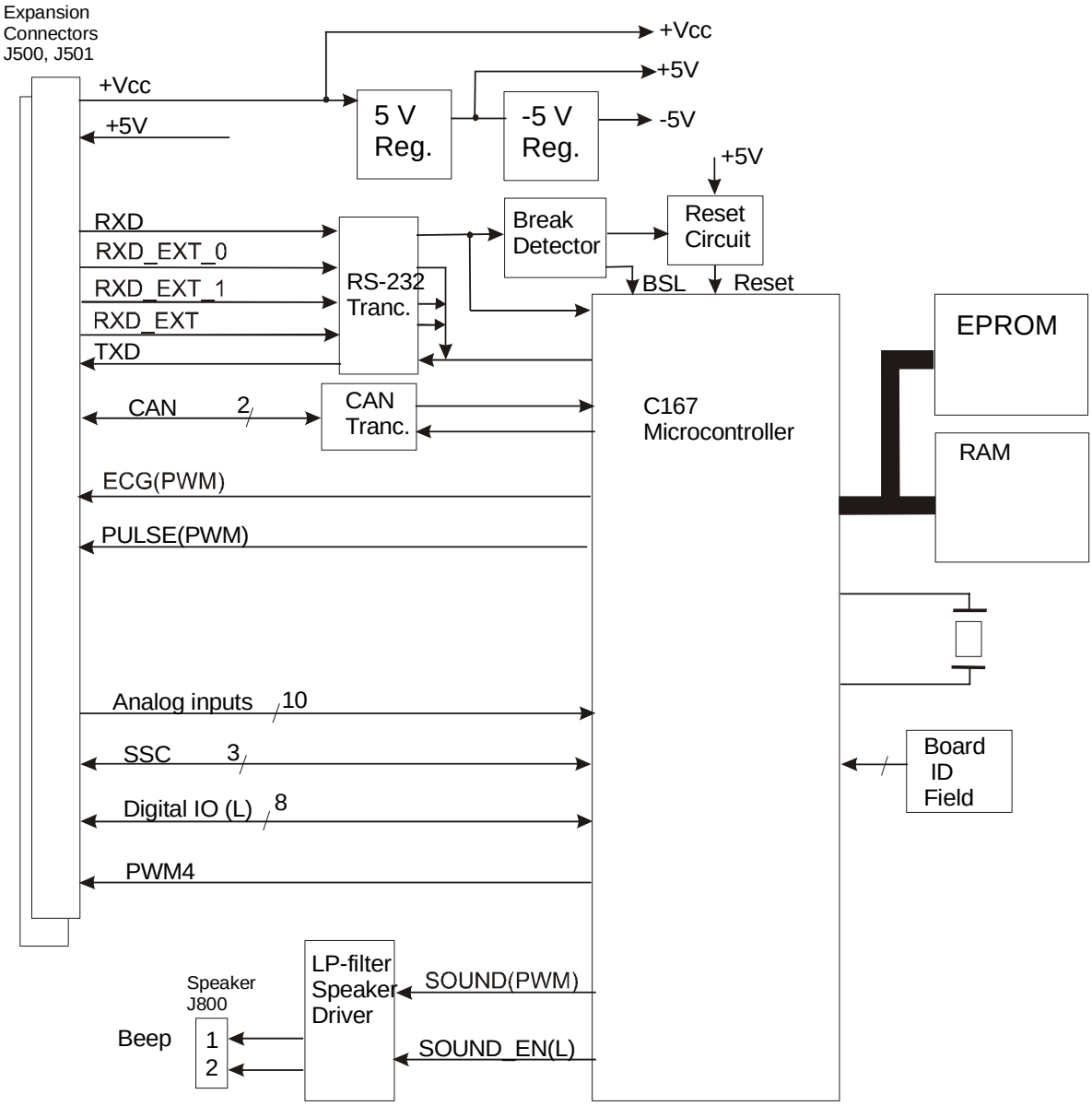


### 3.3 Main Board.

The main board in the Link box is FST1826, is the same board that is used in the HeartSim 4000. Not all the functions on the board are used in this application.
Unique functions and connections for the SimMan Link application shall be implemented on the SimMan Link Expansion Board, which are connected to one of the expansion connectors J500 / J501.

#### 3.3.1 Main Board Block diagram:

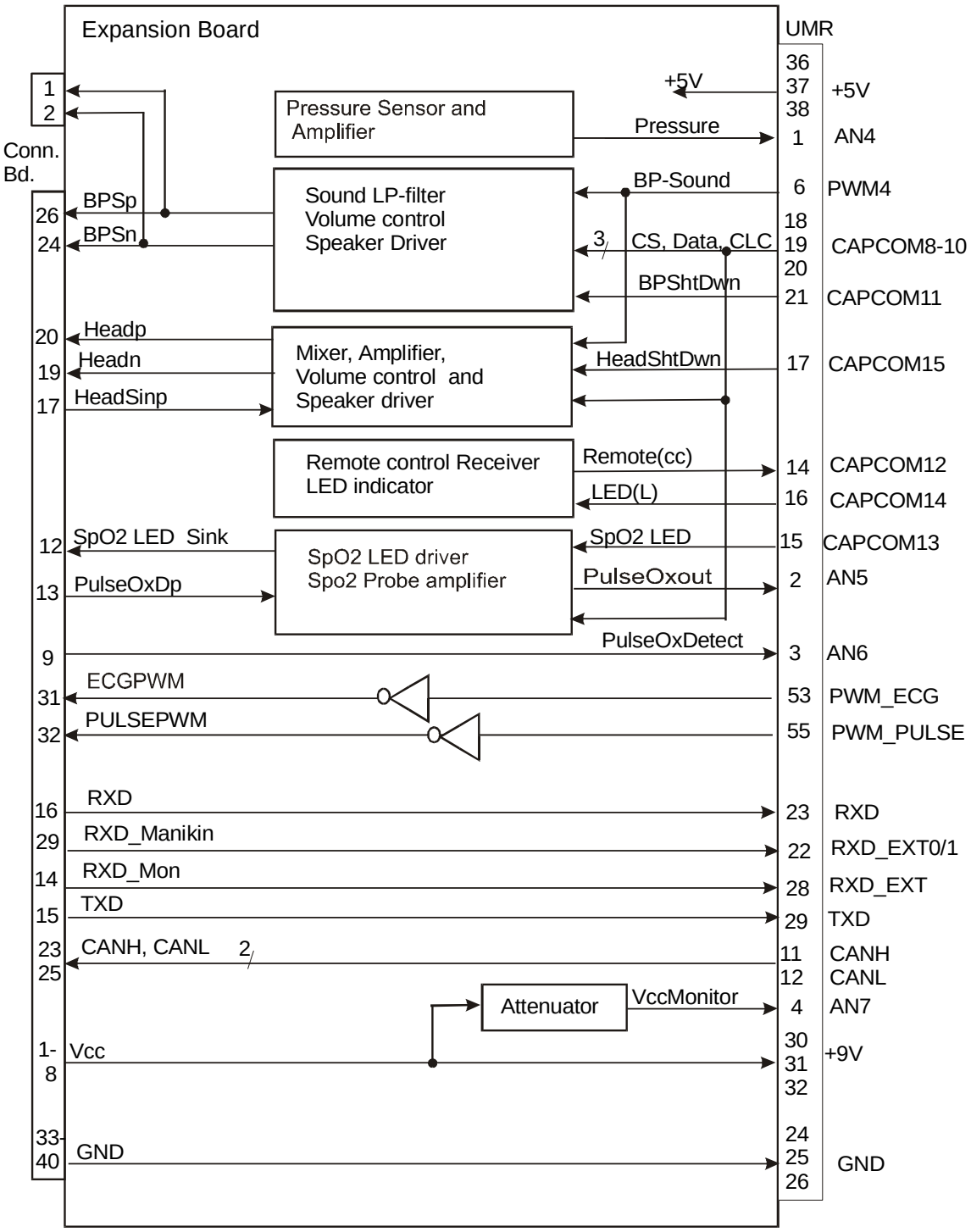
This block diagram shows the functions that are used in this application.



### 3.4 Expansion Board.

The Expansion Board, FST1858 expands the UMR board with and additional sound channel for BP-sound generation plus pressure measurement for BP cuff pressure. In addition the board contains an IR remote control receiver and a status LED, an amplifier for the operator voice simulation and interface for a simulated $SpO_2$.

#### 3.4.1 Expansion Board Block diagram.



### 3.5 Signals and outputs:

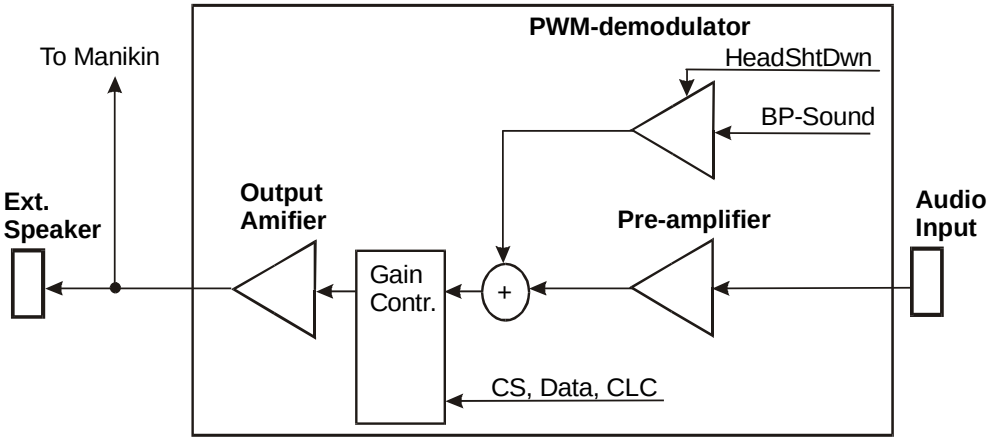
**ECG and Pulse output.**
The Link box generates ECG and Pulse signals as Pulse with Modulated signals. The signals are routed to the Manikin and are generated based on samples and data received from the PC. Signal frequency for ECG is 20 kHz and for Pulse 39kHz.

**QRS Beep output.**
QRS beep is generated on an internal speaker in the Control Unit when SpO2 probe is attached and when SpO2 probe is not connected. Beep volumes could be set to Off, Low, Medium and High. The beep frequency will depend on SpO2 setting.

**Blood pressure function:**
The pressure transducer measures the blood pressure cuff pressure with a signal scale of 12mV/mmHg (100mmHG=1,2V). When the Cuff pressure is set between the set Systolic and Diastolic pressure, Korotkoff sounds (phase 1-4 dependent on BP) are generated on the BP sound output.

### 3.6 Manikin Audio Input - Output.

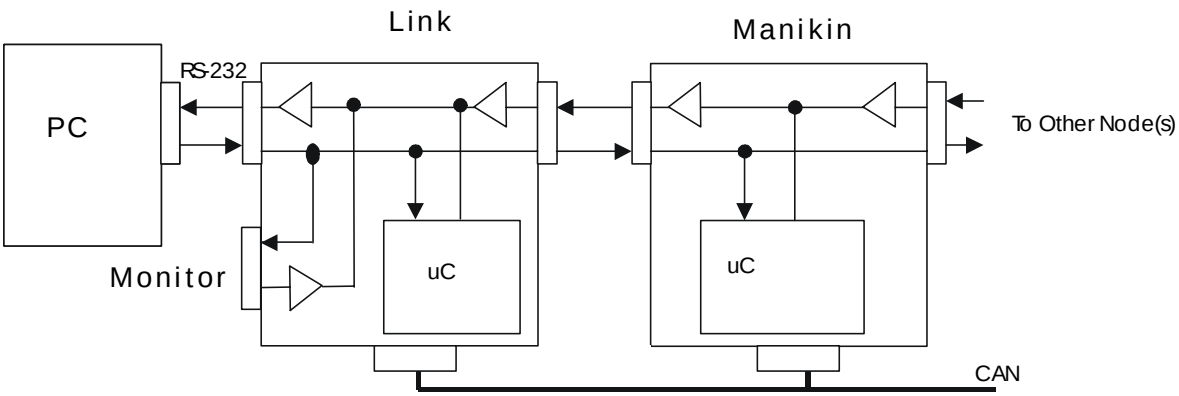
The Link has an audio input that accepts input from an audio line output source. This audio input makes it possible to mix with the BP-sound output.
The Link has an audio speaker output with volume control. The output is connected to the manikin and to an external speaker connector.



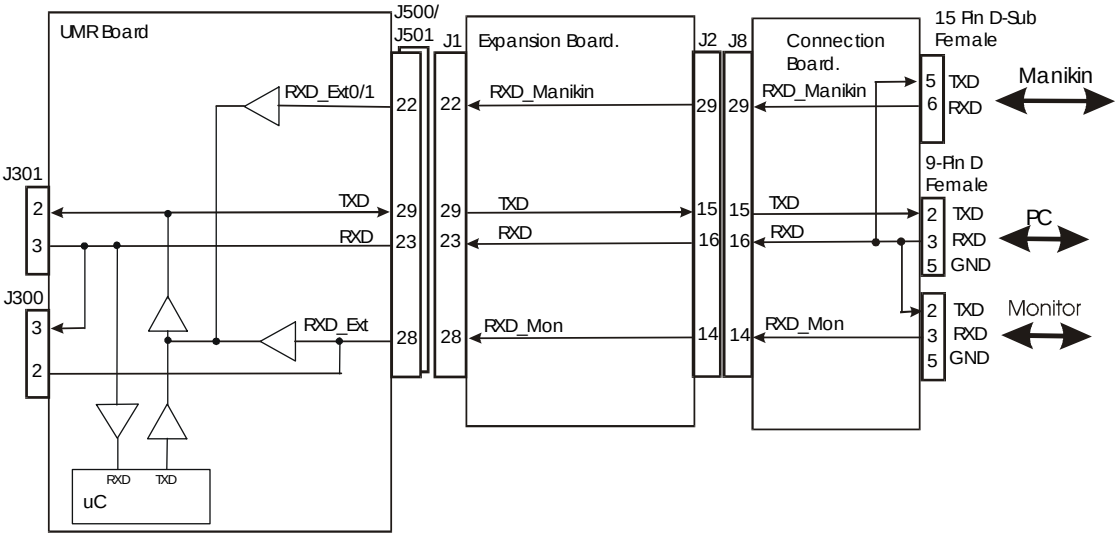

**$SpO_2$ Probe Input.**
The Link have a connection to Dummy SpO2 probe that allows simulation of probe attachment /detachment. The probe has an LED and a photo-detector that is possible to turn on and off from the microcontroller.

## 3.7 Communication.

### 3.7.1 System Communication Block diagram.




### 3.7.2 Link box distribution of RS-232 communication signals.




## 3.8 PC – Monitor Communication

The RS-232 receive signal from the PC is hardwired further to the Monitor connector. The receive signal from the Monitor is “bussed” into the transmit line from the Link to the PC. (See figure above). The communication speed is set to 19200 baud, 8-bit, No parity and 1 stop bit.

### 3.8.1 Link – Manikin Communication.

The Link shall communicate with the Manikin through the CAN-bus. All communication from PC to Link is repeated on the CAN-bus. All Communication received on the CAN-bus by the Link is repeated to the PC with a communication speed of 125 kb/s.

**Manikin Connector.**

| | | |
|---|---|---|
| Connector type: | | 15-pin D-sub, Female |
| Connector attachment: | | Screw, M3 |
| Pinout: | | |
| **Pin #** | **Signal** | **Description** |
| 1, 2 | GND | Ground |
| 3, 4 | CANH, CANL | CAN bus High and Low |
| 5 | TXD | RS-232 from Link (PC) to Manikin |
| 6 | RXD | RS-232 from Manikin to Link (PC) |
| 7 | PulsePWM | Generated Pulse, PWM signal to Manikin |
| 8 | ECGPWM | Generated ECG, PWM signal to Manikin |
| 9 | Pacing/ Defib | Pacing / Defib detection from Manikin (Not used) |
| 10, 11 | BPSp,BPSn | BP sound output to Manikin |
| 12, 13 | Headp,Headn | Head Sound output to Manikin |
| 14, 15 | Vcc | Power to Manikin, +12V nom. |

### 3.8.2 Programming of Link and Manikin Boards.

Both the Link and manikin boards contain Flash EPROM that can be programmed from the PC through the serial line.

## 3.9 Manikin Functions.

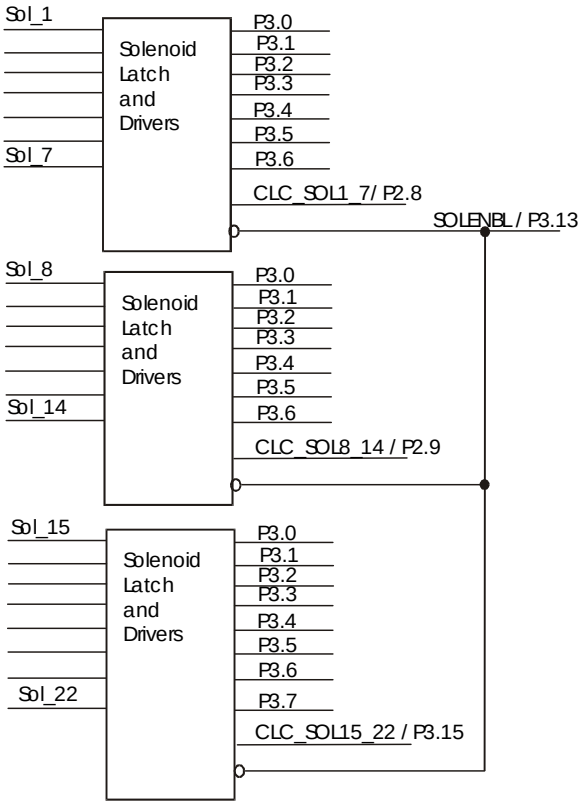
Inflation and deflation of bladders control the functions in the manikin.

The Control Unit controls the manikin functions by activating air solenoids in the manikin. Each function have an inflate solenoid and a deflate solenoid. Only one inflate solenoid is activated at a time. Deflate solenoids can be activated simultaneously. When several solenoids are activated simultaneously, the system puts the activations on queue and activates them consecutively.

The air solenoids are activated based on key commands from the PC, Keyboard or the Remote Control.
LED indicators on the Keyboard indicate which airway functions are active, and which are not.

A valve block controls the air bladders. Routing of the different control tubes is integrated in a manifold, placed in the manikin torso. The manifold has nipples for connection to the individual bladders, and to the bronchi and lungs. The manifold also includes the Left and Right lung valve.

### 3.9.1 Solenoid Control Block diagram.




### 3.9.2 Solenoids Controls on the Microcontroller

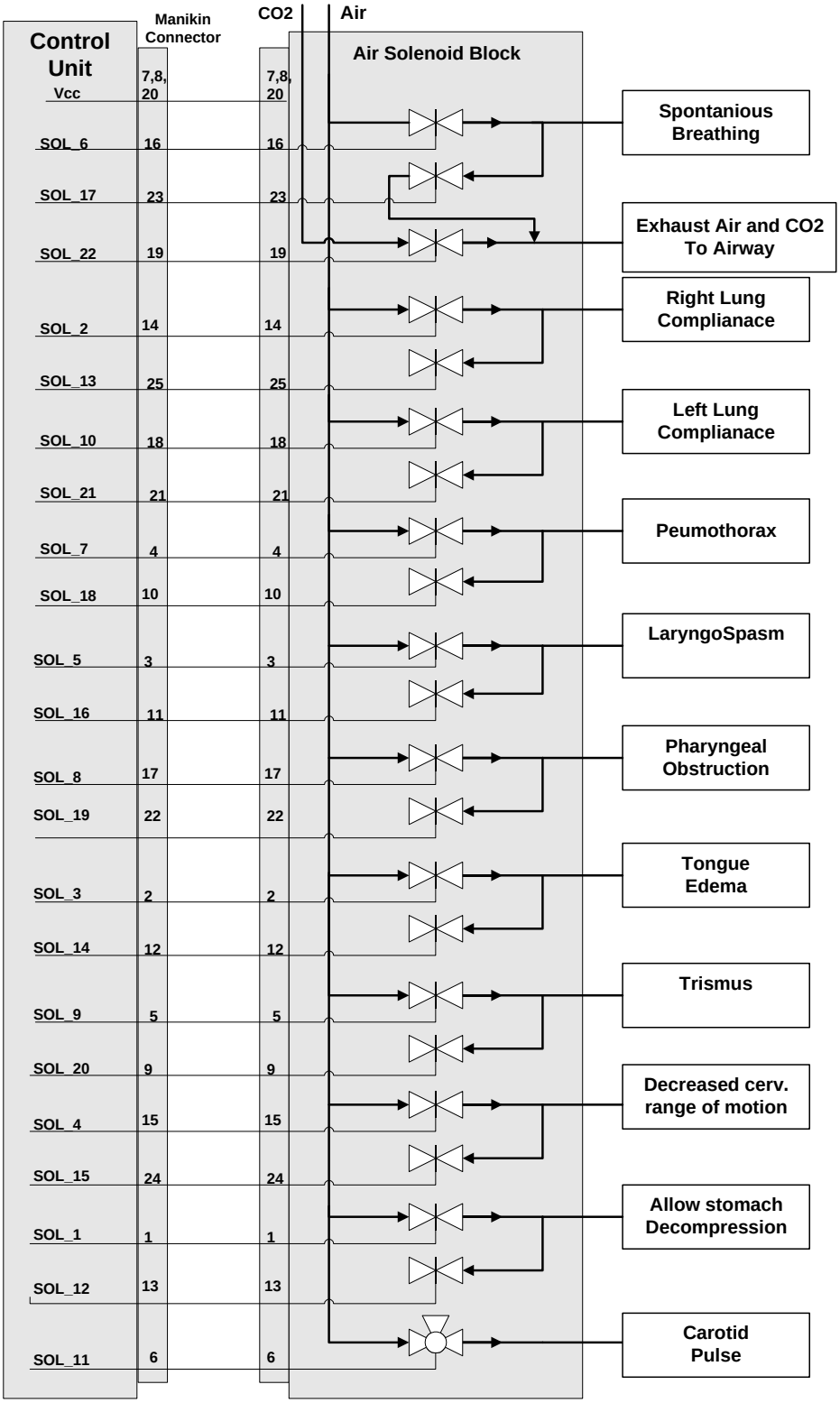
| Port name | Pin | Name | Function | Note |
|---|---|---|---|---|
| P3.0 – P3.6 | 65-70,73 | P3.0 – P3.6 | Logic Output Bus signal. | P3.0 – P3.6 = Solenoid 1 to 7<br>Solenoid 8 to 14<br>P3.0 – P3.7 = Solenoid 15 to 22 |
| P2.8 | 57 | CAPCOM8 / CLC_SOL1_7 | Logic output. Latch for SOL_1 - 7 | Latch on Low -> High |
| P2.9 | 58 | CAPCOM9 / CLC_SOL8_14 | Logic output. Latch for SOL_8 - 14 | Latch on Low -> High |
| P3.15 | 81 | CPU_CLC / CLC_SOL15_22 | Logic output. Latch for SOL_15 - 22 | Latch on Low -> High |
| P3.13 | 80 | SSC_CLC / SOLENBL | Logic output. Solenoids Enable. | LOW = Solenoid drive Enable |

### 3.9.3 Solenoid Functions

| Function | Inflation Solenoid | Inflation time (ms) | Deflation Solenoid | Deflation time (ms) |
|---|---|---|---|---|
| Respiration | SOL_6 | | SOL_17 | Period –Inflation |
| Exhale $CO_2$ | SOL_22 | 500 | | |
| Right Lung | SOL_2 | 450 | SOL_13 | 2700 |
| Left Lung | SOL_10 | 450 | SOL_21 | 2700 |
| Pneumothorax | SOL_7 | 1420 | SOL_18 | 4480 |
| Laryngospasm | SOL_5 | 600 | SOL_16 | 2520 |
| Pharyngeal Obstruction | SOL_8 | 700 | SOL_19 | 4000 |
| Tongue | SOL_3 | 808 | SOL_14 | 2540 |
| Trismus | SOL_9 | 1060 | SOL_20 | 2640 |
| Decreased Cervical | SOL_4 | 1060 | SOL_15 | 2640 |

| Function | Inflation Solenoid | Inflation time (ms) | Deflation Solenoid | Deflation time (ms) |
|---|---|---|---|---|
| ROM | | | | |
| Stomach Decompression | SOL_1 | 300 | SOL_12 | 2700 |
| Pulse | SOL_11 | 100 | | |

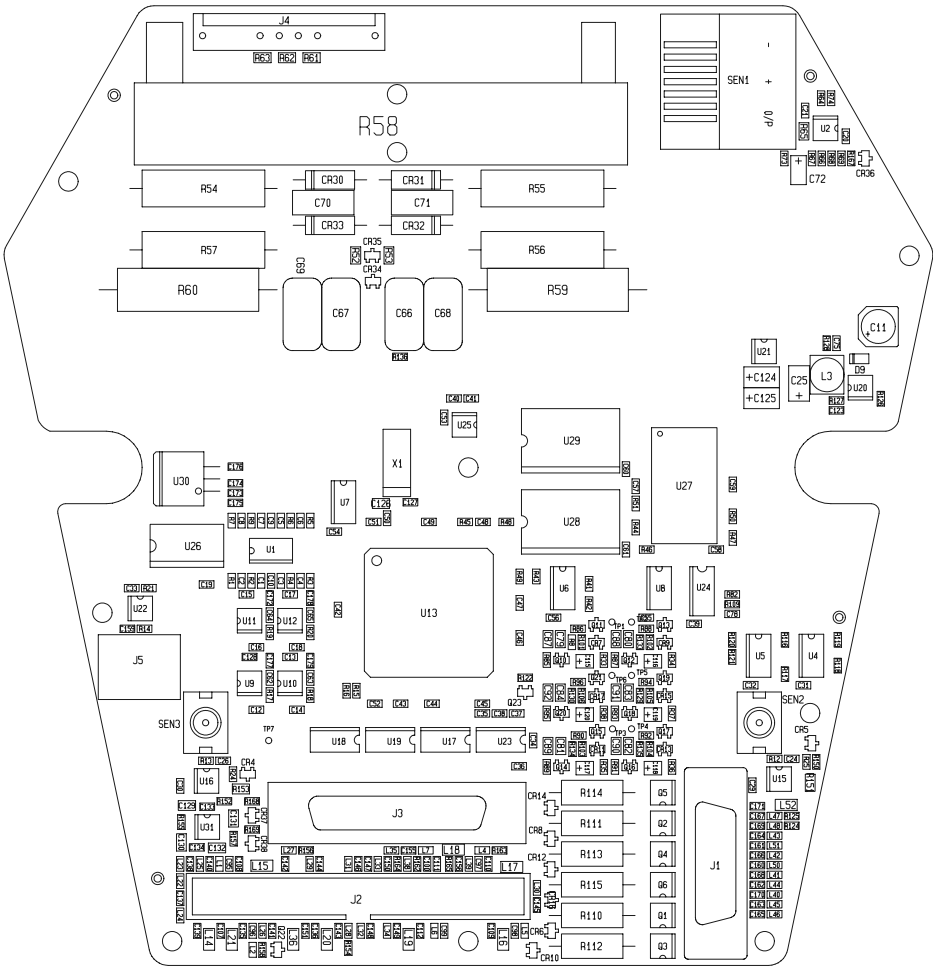
### 3.9.4 Solenoids Block Diagram



### 3.10 LED output.

The Red LED indicates the status and if the LED blinks at a frequency of 1Hz the Link has no connection with PC host program. LED shall be steady on with a very short blink every second when Link has connection with PC host program. When a valid Remote Control signal is received the Led is blinking with the frequency of 10 Hz.

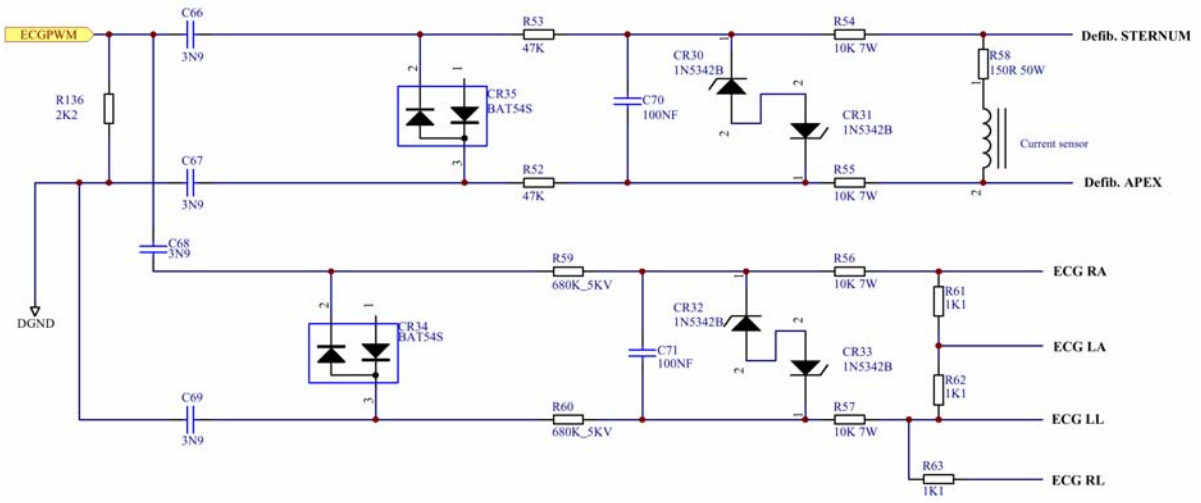
### 3.11 Manikin Main Board - layout



## 3.12 Main Board functions

### 3.12.1 ECG output

The ECG signal is a 20 kHz +-2 kHz, 0- 5V Pulse width modulated signal, originating at the SimMan Link Box. The circuit shown below demodulates the PWM signal:



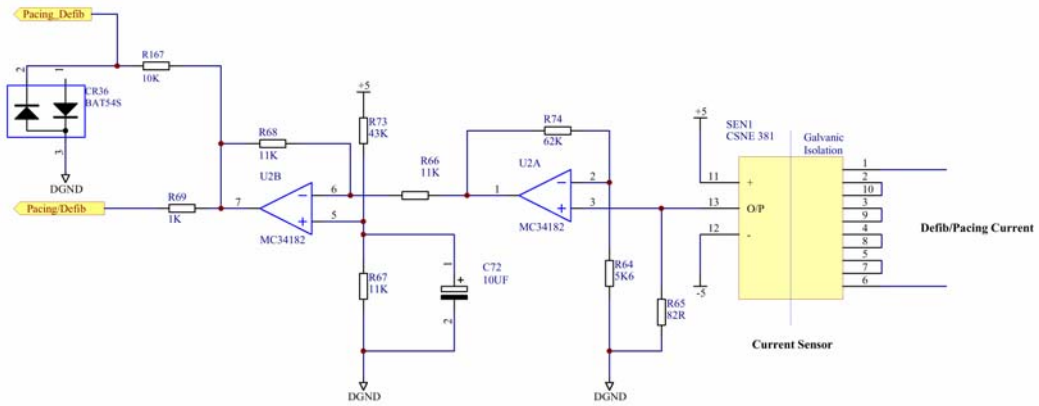

The circuit provides two demodulators, one for defibrillator connection and one for connection to monitoring leads. The analog ECG waveform is regenerated across capacitors C70 and C71. Further attenuation by resistors creates correct ECG amplitudes. The circuit provides safety against leakage current by the use of AC coupling through capacitors C66-C69.

Typical peak-peak ECG amplitude at 5Hz, PWM modulated from 10-90%:

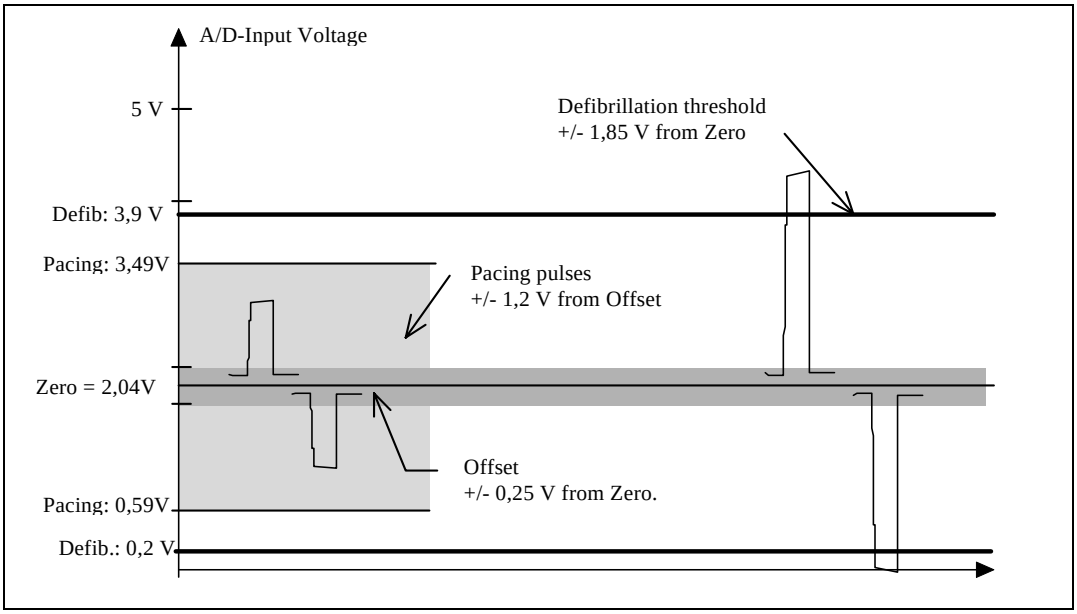
Defib. Apex-Defib. STERNUM : 4.8mV
ECG RA-ECG LL: 6mV
ECG RA-ECG LA: 3mV

### 3.12.2 Pacing/Defibrillation Input

A current sensing circuit as shown below detects defibrillation and Pacing:
The circuit generates two similar signals, both analog 0-5V. Pacing/Defib is connected to the SimMan Link Box trough connector J1.Pacing_Defib is connected to the Micro-controller input P5.4/AN4. The defibrillation impedance is 150Ω.



Typical signals from the circuit are shown below:




### 3.12.3 Defib / ECG connection, J4

Connector type: AMP 10 pos. Male header MTA-156. Pin # 2,3 and 8,9 are removed from connector.

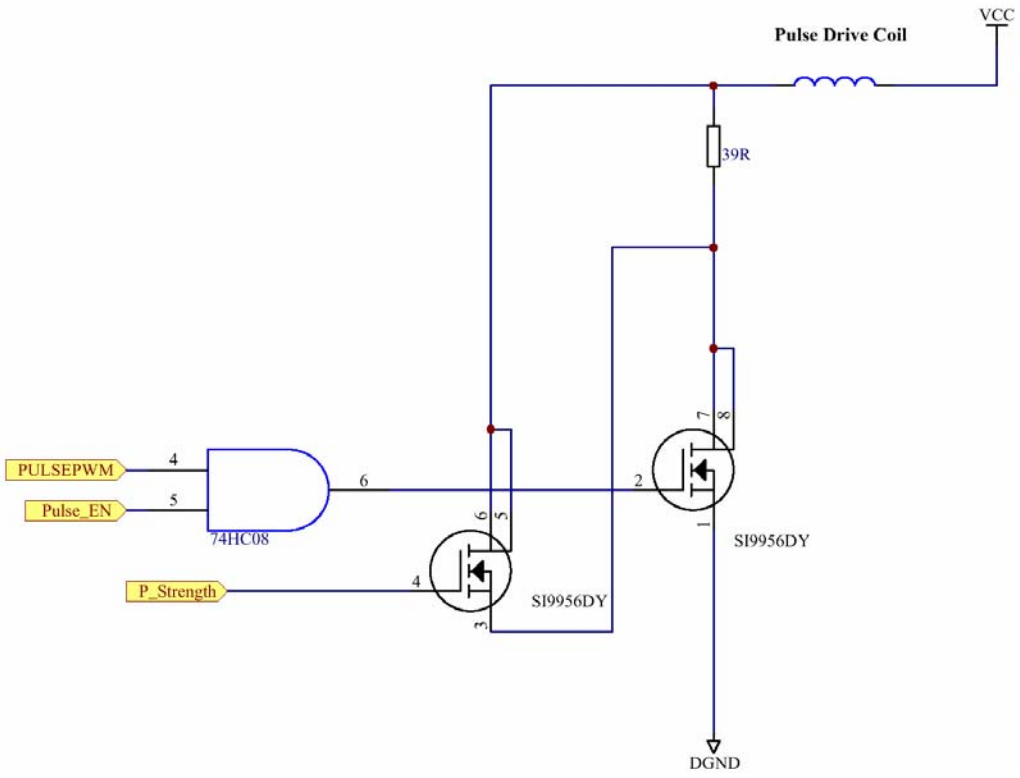
| J4, Pin # | Signal Annotation | Note |
|---|---|---|
| 1 | Defib. APEX | Defibrillation Apex connection |
| 4 | ECG RA | ECG Monitoring, Right Arm Lead |
| 5 | ECG LA | ECG Monitoring, Left Arm Lead |
| 6 | ECG LL | ECG Monitoring, Left Leg Lead |
| 7 | ECG RL | ECG Monitoring, Right Leg Lead |
| 10 | Defib. STERNUM | Defibrillation Sternum connection |

### 3.12.4 Pulse Detection / Drive

The board will detect and drive a total of 6 Laerdal Pulse units (Item # 2154). In addition a driver is provided for a 12V Air-valve Solenoid, used to generate Carotid Pulse by bladders.

### 3.12.5 Pulse drive circuit, Laerdal pulse units

The pulse drive circuit is shown below:




The PULSEPWM signal is supplied from the SimMan Link Box. The signal is 0-5V, 39 kHz pulse width modulated. The PULSEPWM signal is common to all pulse units. The pulse is enabled by the Pulse_EN signal. There is one Pulse_EN signal pr. pulse unit. The pulse units can be driven at two amplitude levels. When the Pulse Strength signal is active the pulse is driven to full amplitude. Pulse amplitude can be set individually for Radial/Brachial and Femoral pulse units. The pulse drive coils will mechanically demodulate the pulse from the digital drive to analog mechanical movement. A total of 6 drive circuits are provided on the board.

### 3.12.6 Pulse Drive signals on the Microcontroller

| Port name | Pin # | Name | Function | Note |
|---|---|---|---|---|
| P3.9 | 76 | R_Bra_Pulse_EN | Right Brachial Pulse Enable | Enables 12V PWM drive to pulse unit |
| P3.7 | 74 | L_Bra_Pulse_EN | Left Brachial Pulse Enable | Enables 12V PWM drive to pulse unit |
| P3.8 | 75 | R_Rad_Pulse_EN | Right Radial Pulse Enable | Enables 12V PWM drive to pulse unit |
| P3.6 | 73 | L_Rad_Pulse_EN | Left Radial Pulse Enable | Enables 12V PWM drive to pulse unit |
| P3.13 | 80 | R_Fem_Pulse_EN | Right Femoral Pulse Enable | Enables 12V PWM drive to pulse unit |
| P3.15 | 81 | L_Fem_Pulse_EN | Left Femoral Pulse Enable | Enables 12V PWM drive to pulse unit |
| P4.7 | 92 | Rad_P_Strength | Brachial/Radial Pulse Amplitude | Enables full pulse amplitude |
| P4.4 | 89 | Fem_P_Strength | Femoral Pulse Amplitude | Enables full pulse amplitude |

### 3.12.7 Detection (palpation) Carotid Pulse

Switches located in the manikin do pulse detection of the carotid pulse.

| Port name | Pin # | Name | Function | Note |
|---|---|---|---|---|
| P2.1 | 48 | R_Car_Pulse | Right Carotid Pulse Detection | Low logic level when switch in manikin is operated |
| P2.0 | 47 | L_Car_Pulse | Left Carotid Pulse Detection | Low logic level when switch in manikin is operated |

### 3.12.8 Carotid Pulse detection on the Microcontroller

#### 3.12.8.1 Drive, Carotid pulse

The carotid pulse is bladder-based. It uses one 12V Air-valve solenoid. The drive for this solenoid is provided by Q23.

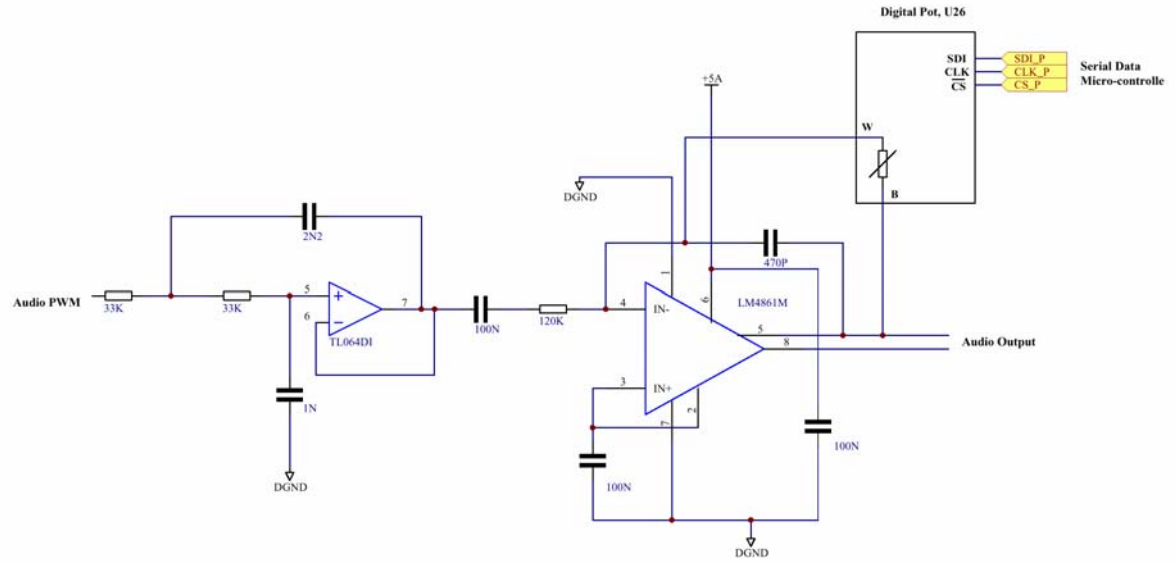
#### 3.12.8.2 Carotid Pulse drive on the Microcontroller

| Port name | Pin # | Name | Function | Note |
|---|---|---|---|---|
| P3.5 | 70 | Car_Pulse | Right/Left Carotid Pulse Drive | Low side solenoid drive through Q23 |

### 3.12.9 Sound Output

The board generates sounds in order to simulate Heart, Lung and Bowel sound. The audio-circuit is illustrated below:

The board has 4 identical audio channels. The Audio PWM signal is 0-5V, 78 kHz pulse width modulated. The audio circuit consists of a demodulator in the form of a two-pole low-pass filter and an audio amplifier. Volume control is performed by a digital potentiometer circuit (U26). The digital potentiometer provides four individual potentiometers of 50 kΩ. The Micro-controller can set each of the potentiometers with 8 bits of resolution. The audio-circuitry is powered from a dedicated +5V regulator in order to avoid voltage dips on the logic power.
Volume: 256 levels linearly divided
Max gain: 0.83
Nominal Bandwidth: 20-3000 Hz
Min. Speaker impedance: 4Ω, differential output (symmetrical with respect to DGND).

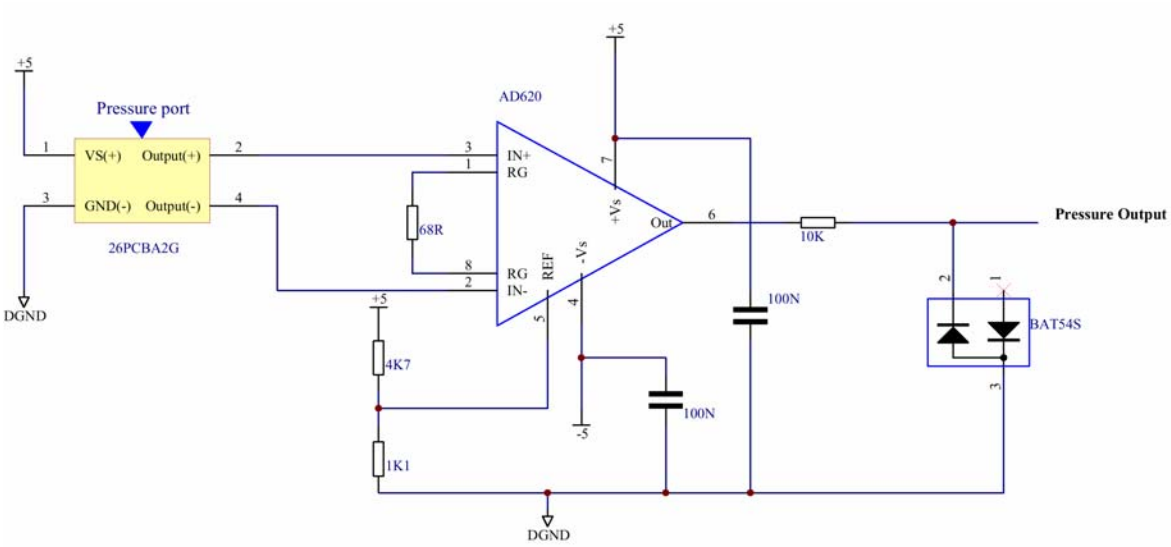


### 3.12.10 Sound Signals at the Microcontroller

| Port name | Pin # | Name | Function | Note |
|---|---|---|---|---|
| P7.0 | 19 | R_LungPWM | Right Lung PWM Sound | Amplifier output: R_Lungp/R_Lungn |
| P7.1 | 20 | L_LungPWM | Left Lung PWM Sound | Amplifier output: L_Lungp/L_Lungn |
| P7.2 | 21 | HeartPWM | Heart PWM Sound | Amplifier output: Heartp/Heartn |
| P7.3 | 22 | BowelPWM | Bowel PWM Sound | Amplifier output: Bowelp/Boweln |
| P6.7 | 8 | SDI_P | Serial data for Potentiometer setting | - |
| P6.6 | 7 | CLK_P | Serial CLK for Potentiometer setting | - |
| P6.5 | 6 | CS_P | Potentiometer Chip Select | - |

### 3.12.11 Lung Pressure

The board calculates manikin lung inflation by measuring lung pressure. The pressure measurement circuit is illustrated below:

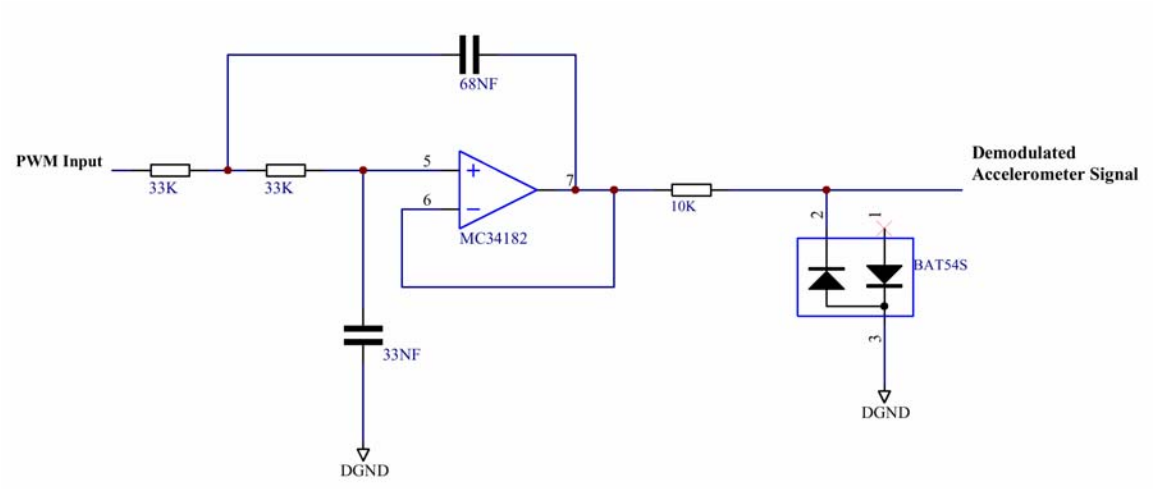



Two pressure measurement circuits are provided, for right and left lung. The pressure sensors used are a piezoresistive bridge-configuration with a linear pressure rage of 5 psi (260 mmHg). An instrumentation amplifier (AD620) amplifies the output from the pressure sensor. The instrumentation amplifier has a forced positive offset of approx. 1V in order to avoid a “deadband” if the pressure sensors exhibit a negative offset.

| | |
|---|---|
| Sensitivity: | 70mV / mmHg |
| Maximum pressure: | 30 mmHg |
| Nominal output for 20 mmHg: | 2.4V |
| Maximum output for 20 mmHg: | 3.0V |
| Minimum output for 20 mmHg: | 1.7V |

### 3.12.12 Chest Compressions

The manikin uses an accelerometer-based sensor in order to detect chest compressions. The compression sensor generates pulse width modulated signals representing acceleration in the horizontal and vertical plane. The PWM signal is 0-5V, 1 kHz.
The compression sensor has a measurement range of +-2g. At 0 g the sensor output is PWM at 50% duty cycle.
The compression sensor has bandwidth of 0-100Hz. The board demodulates the PWM by use of a 2 pole low-pass filter as illustrated below. The filter has a –3dB point at 100Hz.




### 3.12.13 Accelerometer Signals at the Microcontroller

| Port name | Pin # | Name | Function | Note |
|---|---|---|---|---|
| P5.2/AN2 | 29 | COMPR | Signal representing acceleration from chest compressions | Analog voltage, 0-5V range |
| P5.3/AN3 | 30 | Movement | Signal representing acceleration in the horizontal plane ( at 90° of chest compressions) | Analog voltage, 0-5V range |

### 3.13 Spare Driver

The board has one uncommitted low side driver (open drain).

| | |
|---|---|
| Transistor driver: | BSH102 (Q22) |
| Maximum voltage: | 30V |
| Maximum current: | 850mA |
| Driver resistance: | 0.4Ω, nom. |

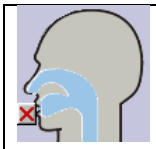
### 3.13.1 Driver signal at the Microcontroller

| Port name | Pin # | Name | Function | Note |
|---|---|---|---|---|
| P3.4 | 69 | P3.4 | Spare low side driver | Open drain, 30V max, 850mA max. |

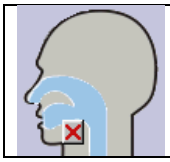
### 3.14 Difficult Airway Functions.

The airway has the following difficult airway functions:

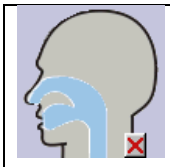
**Trismus**

| | |
|---|---|
|  | Will dramatically lock the teeth together and severely limit mandibular movement. |
| | Controlled by inflating an air bladder in the skull. |
| | When the bladder is inflated, it holds the pressure for at least 3 min. |
| | The distance between upper and lower teeth when Trismus active is set to 6-10 mm. |
| | The required force to open jaw to 25 mm distance between teeth is set to 100 N Max (22.48lbs) |

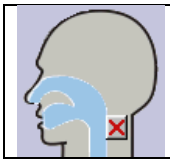
**Tongue Edema**

| | |
|---|---|
|  | Tongue becomes severely enlarged causing visual obstruction of the epiglottis. |
| | Controlled by inflating an air bladder in the tongue. |
| | When the bladder is inflated, it shall hold the pressure for at least 3 min. |

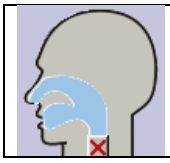
**Decreased Cervical Range of Motion**

| | |
|---|---|
|  | Locks the neck at a position slightly more forward than neutral position. |
| | Controlled by inflating two air bladders in the head/neck. |
| | When the bladder is inflated, it shall hold the pressure for at least 3 min. |
| | The required force to move the neck +/- 5° is set to min.10 N (2.25lbs)At the forehead |

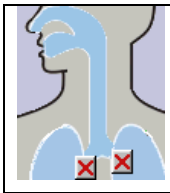
**Pharyngeal Obstruction**

| | |
|---|---|
|  | The posterior pharyngeal surface swells into the anterior pharyngeal cavity. |
| | Controlled by inflating an air bladder behind the pharyngeal wall. |
| | When the bladder is inflated, it shall hold the pressure for at least 3 min. |

**Laryngospasm**

| | |
|---|---|
|  | Closing of the vocal cords. |
| | Controlled by inflating two air bladders, one each side of the vocal cords. |
| | When the bladders are inflated, it shall hold the pressure for at least 3 min. |

**Decreased Lung Compliance**

| | |
|---|---|
|  | Close air entry to the right and/or left lung. Each lung shall be controlled individually. |
| | Controlled by closing and opening a valve for each lung. The valves are controlled by pressured air. |
| | When the bladders are inflated, it shall hold the pressure for at least 3 min. |
| | When closed, the valves withstand a pressure of: 0,3 bar (4.35psi) |

**Lungs.**

| |
|---|
| The manikin has two independent lungs. |
| The lungs have a realistic compliance of 10 – 50 ml / cm $H_2O$ and a resistance of 2 - 8 cm $H_2O$ /l/sec (Normal 2-4 cm $H_2O$ /l/sec) In the range 400 – 700 ml. |
| The volume of each lung: 1 +/- 0,15 L ( Total Lung volume: 1.8 – 2.3 L) |
| During bag- mask or bag-tube ventilation, a volume of 300 ml total will give visible chest-rise of min. 3 mm. |
| Chest rise shall be bilateral. If one lung is closed, a volume of 200 ml will give visible chest rise on the open lung side. |
| $CO_2$ shall be exhaled through the lungs, above (bronchi side) the lung compliance valves. Exhalation of $CO_2$ is controlled by the $CO_2$ valve. |
| At the rate 20 breaths/min. The % exhaled $CO_2$ will be in the range 2-20% |

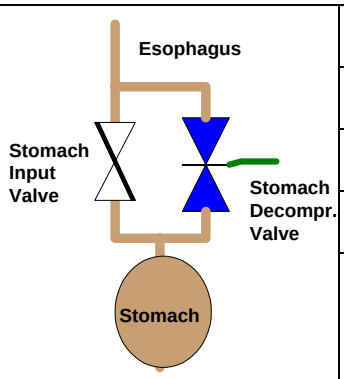
**Spontaneous Breathing.**

| |
|---|
| The manikin is able to simulate spontaneous breathing with a variable rate up to 40 / min.with a chest rise of min. 3 mm |
| During spontaneous breathing, the manikin will give realistic chest rise. |
| Spontaneous breathing is be controlled by inflation and deflation of and air bladder. |
| |
| The bleed air from the breathing bladder is exhaled through the lungs, above (bronchi side) the lung compliance valves. |

**Pneumothorax.**

| |
|---|
| The manikin is able to simulate left and right tension pneumothorax. |
| Proper insertion of a catheter into the appropriate site gives airflow out of the thorax area. |
| The pneumothorax function has 4 bladders, two on each side of the chest. |
| The bladders are self-sealing and allow at least 10 punctures before they must be replaced. |

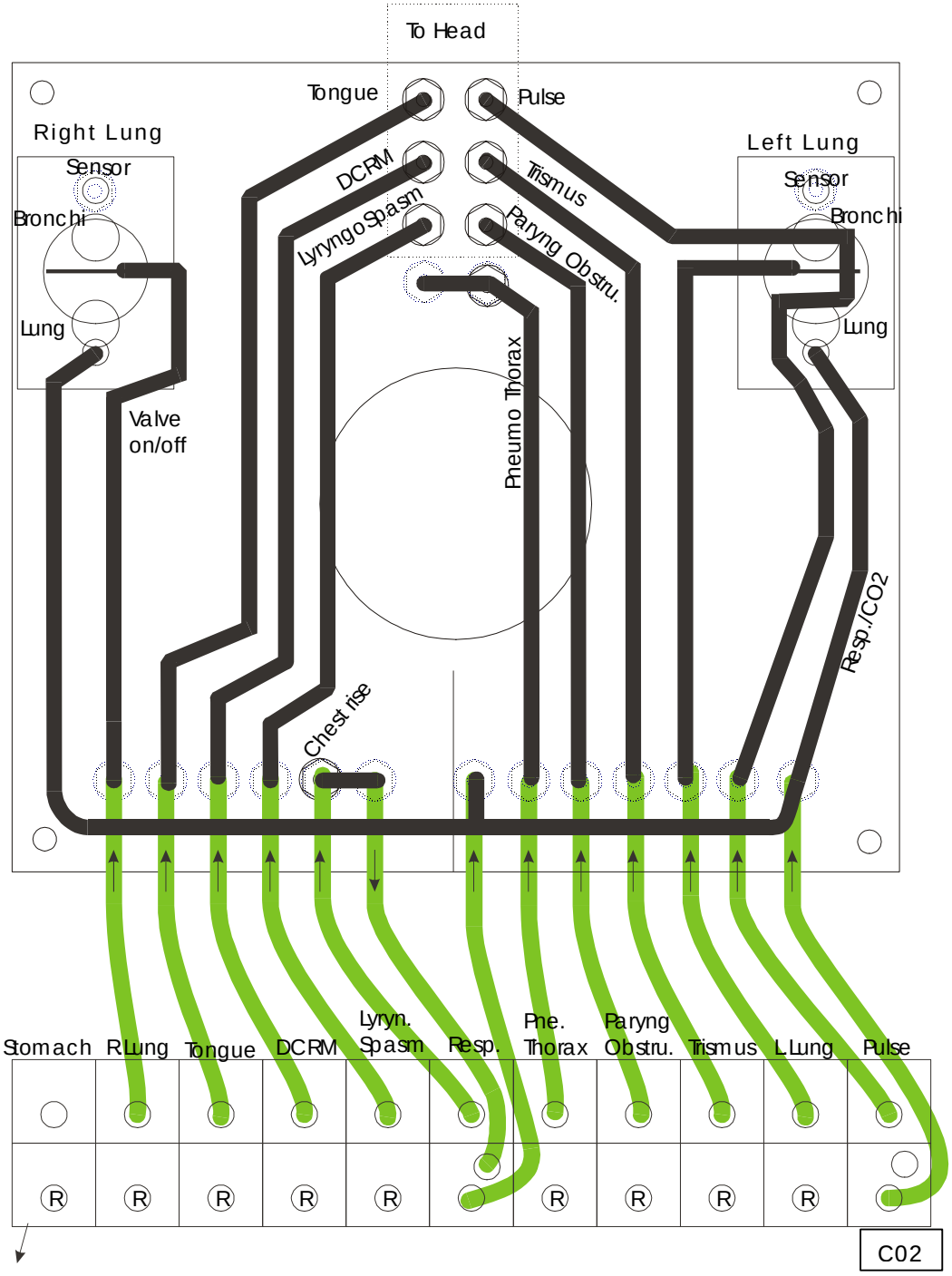
**Stomach**



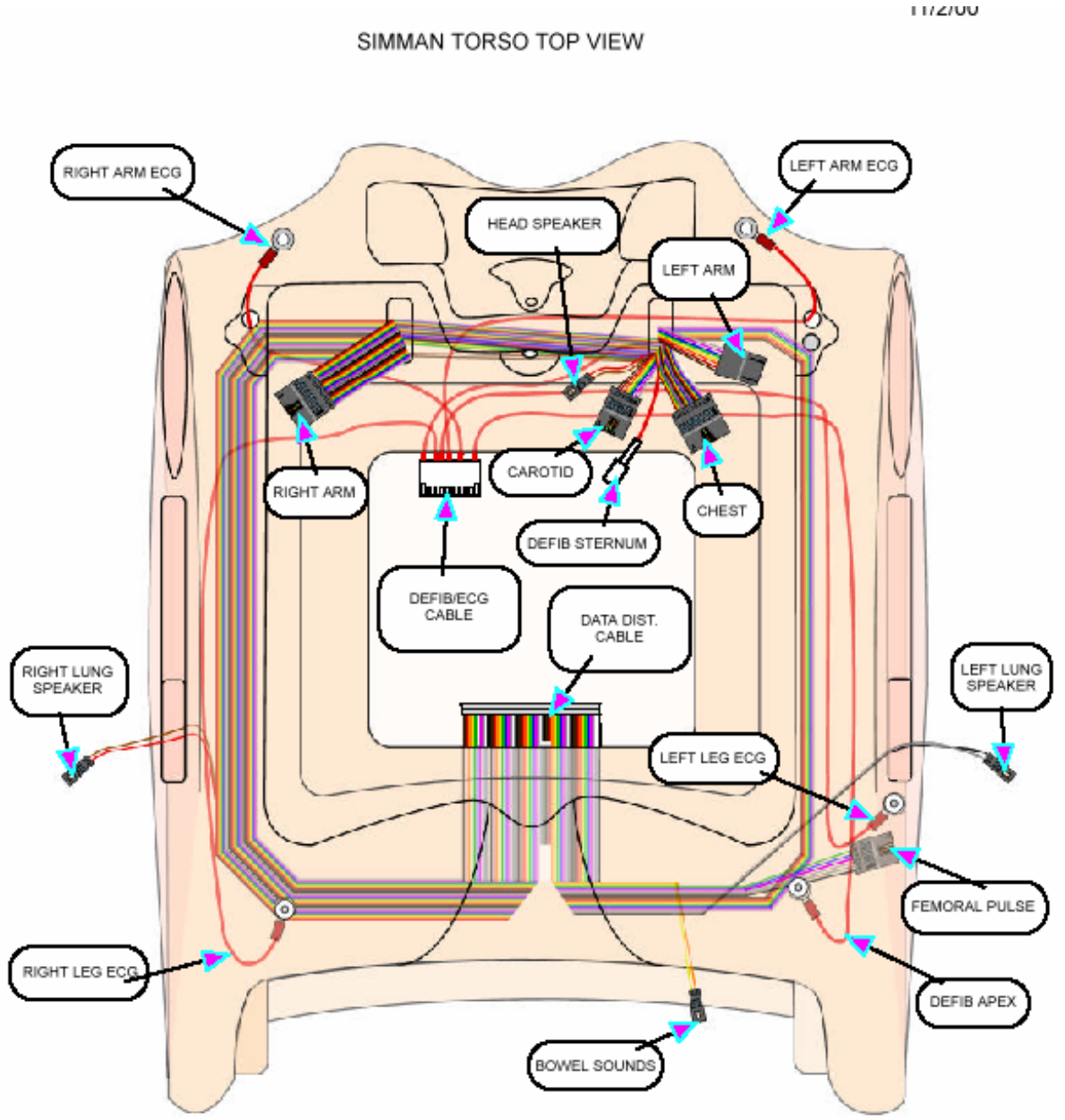

| |
|---|
| The manikin has a stomach, connected to the esophagus via stomach valves. |
| It is possible to insert a gastric tube into esophagus and simulate stomach distention/decompression |
| The stomach input valve opens if the pressure exceeds: 15 +/- 5 cm$H_2O$ |
| The stomach input valve will release air from the stomach if the pressure exceeds: 45 +/-5 cm$H_2O$ |
| The stomach decompression valve will be open or closed for air in both directions, controlled by inflation of an air bladder.<br><br>When gas/air is trapped in the stomach bladder it is able to hold the pressure for at least 3 min. |
| There is a noticeable rise on the outside of the stomach when air is trapped inside the stomach. |

## 4.0 Mechanical Constructions

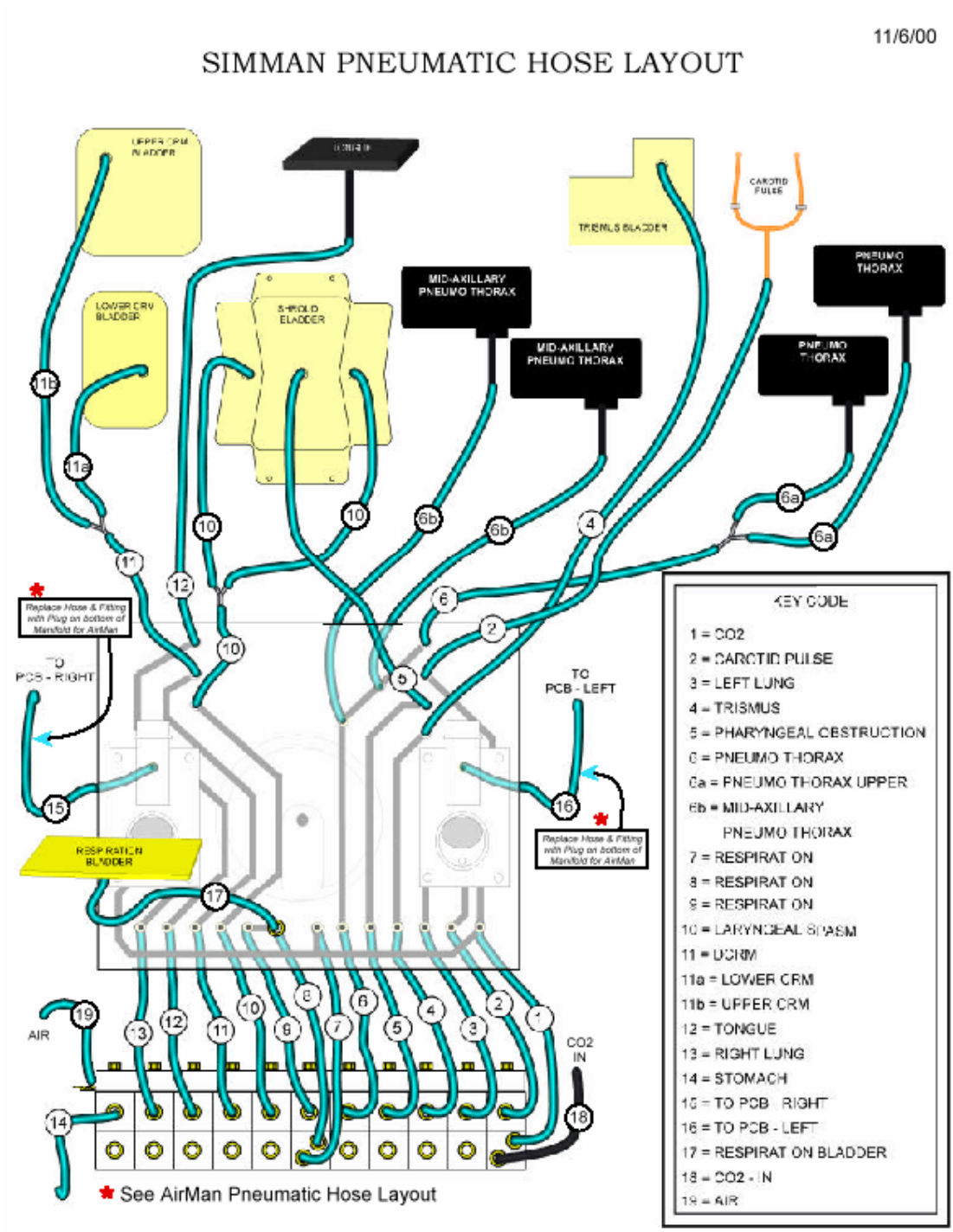
### 4.1 Manifold and Valve block diagram



## 4.2 SimMan Torso top view



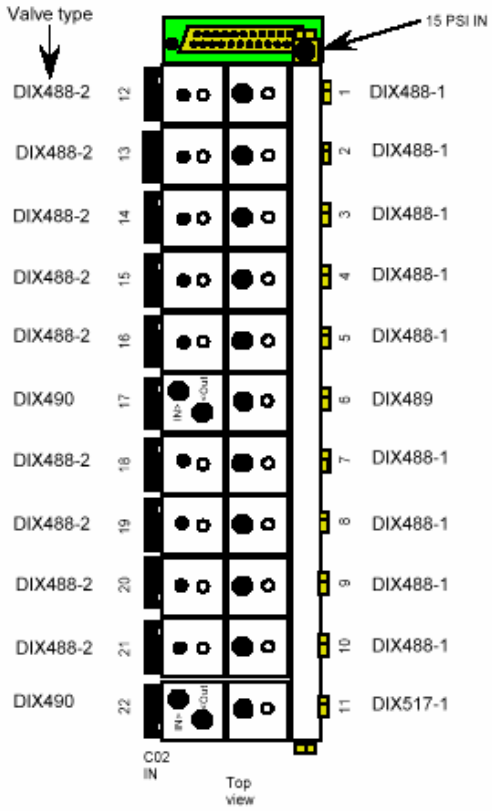
## 4.3 SimMan pneumatic hose layout



## 4.4 Solenoid pin layout

| Valve # | Function | D-Sub Conn. PIN to energise |
|---|---|---|
| 1 | Allow stomach decompression | 1 |
| 2 | Decreased Right Lung Compliance | 14 |
| 3 | Tongue Edema | 2 |
| 4 | Decreased CROM | 15 |
| 5 | Laryngo Spasm | 3 |
| 6 | Respiration | 16 |
| 7 | Pneumo Thorax | 4 |
| 8 | Pharyngeal Obstruction | 17 |
| 9 | Trismus | 5 |
| 10 | Decreased Left Lung Compliance | 18 |
| 11 | Carotid Pulse | 6 |
| 12 | Allow Stomach decompression | 13 |
| 13 | Decreased Right Lung Compliance | 25 |
| 14 | Tongue Edema | 12 |
| 15 | Decreased CROM | 24 |
| 16 | Laryngo Spasm | 11 |
| 17 | Respiration | 23 |
| 18 | Pnuemo Thorax | 10 |
| 19 | Pharyngeal Obstruction | 22 |
| 20 | Trismus | 9 |
| 21 | Decreased Left Lung Compliance | 21 |
| 22 | Carbon Dioxide | 19 |

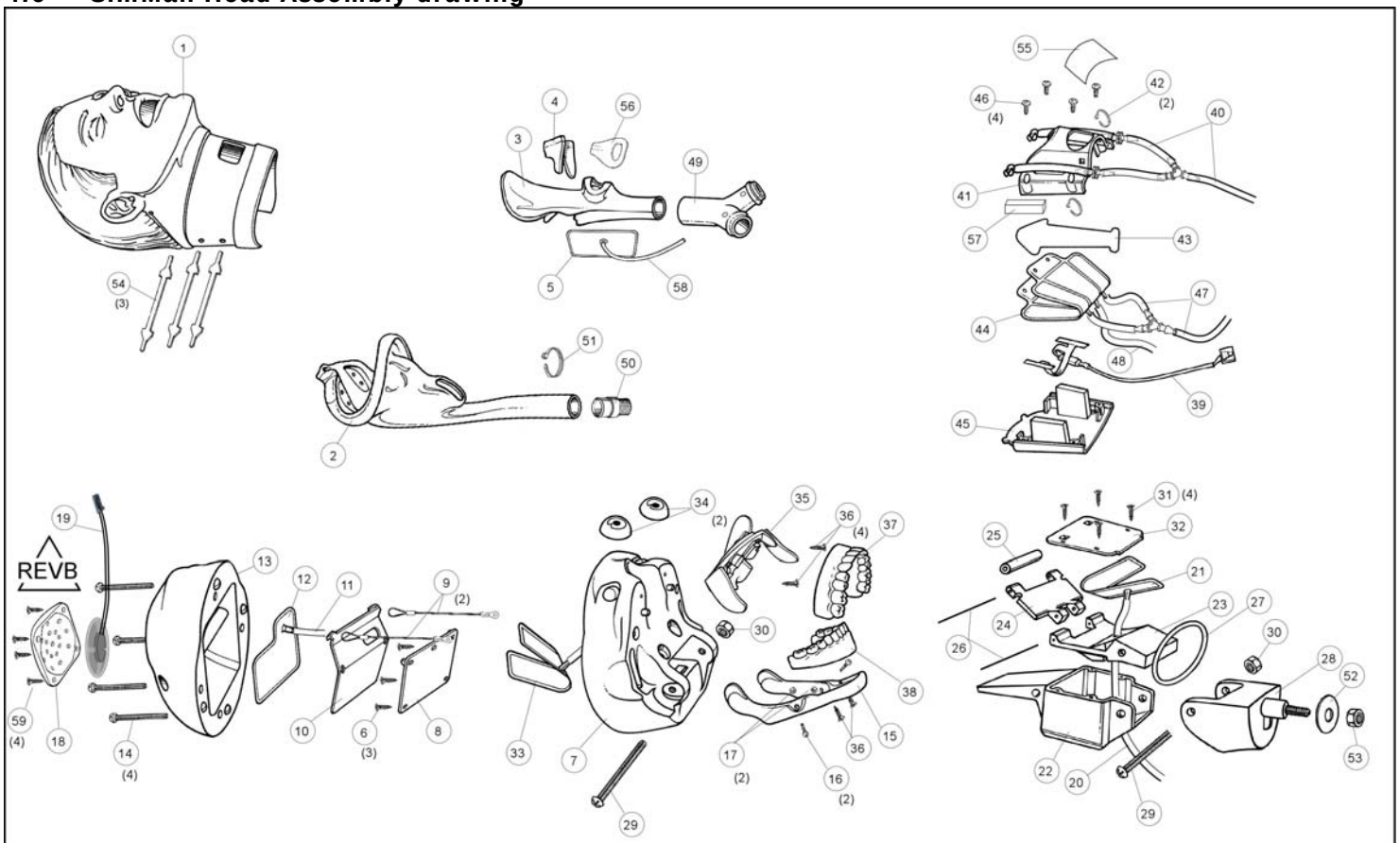
Note: Pins 1-11 are the supply lines. Pins 12-21 are the Exhaust lines. Pin 22 is the co2 supply line. Pins 7, 8, and 20 are all common +12Volt lines.




## 4.5 Split view drawings.

The BOM reference numbers on the illustrated pages are **NOT** spare part numbers that can be ordered. The drawings and number are for illustration please refer to the page 50 for the spare parts.

## 4.6 SimMan Head Assembly drawing




| REV. | DATE | BY | APPVL |
|---|---|---|---|
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| | | | |
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DECIMALS: ±
ANGLES: ±
STANDARD:
DO NOT SCALE DRAWING
DATE: 9/24/03

| PRD. APPVL. | DWN. | R & D APPVL. |
|---|---|---|
| ENG. APPVL. | CHK. | SCALE NONE |

MPL professional health educators

TITLE: SIMMAN HEAD ASSEMBLY

SIZE A | DWG. NO. PRO-T-047 SHT. 1 OF 2 | REV. B

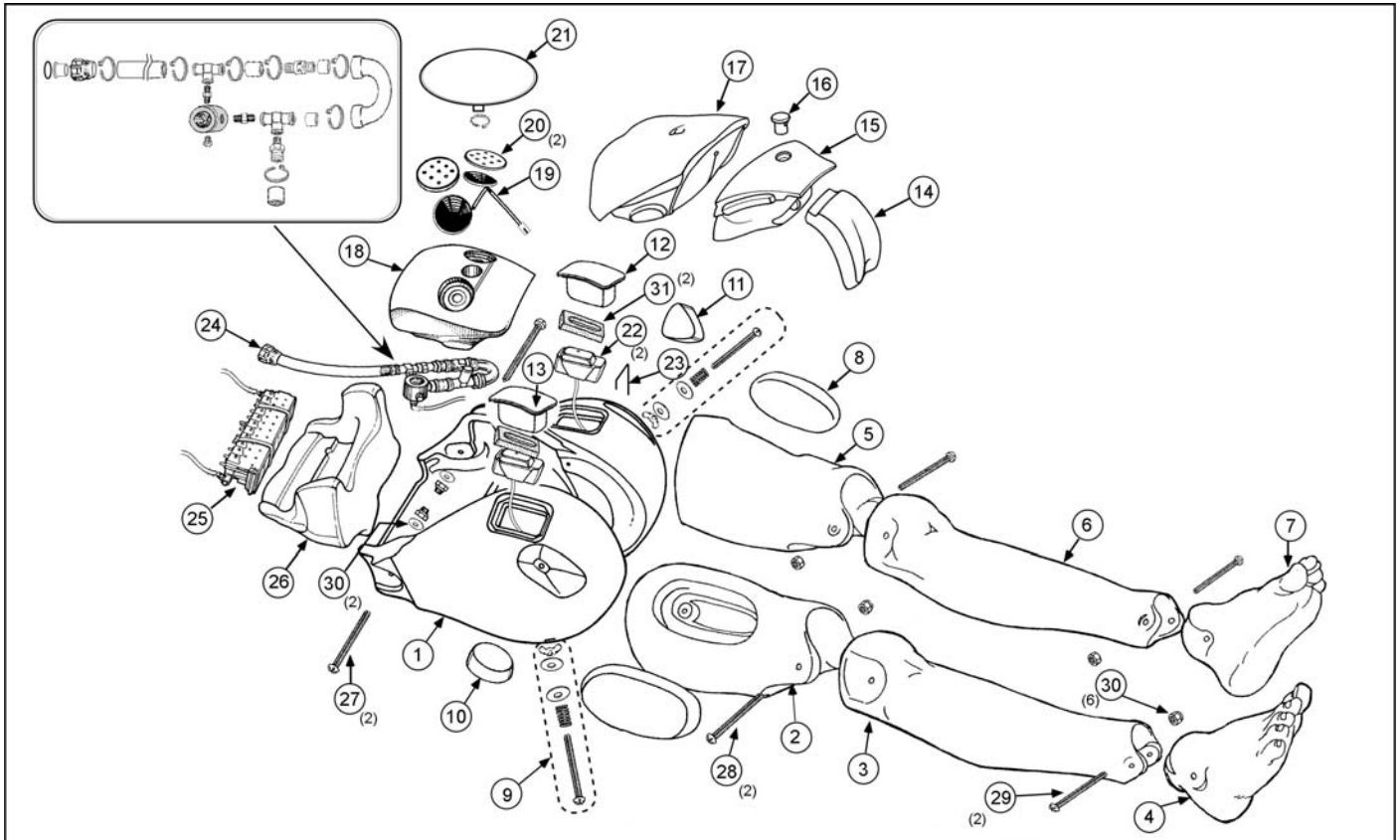
FM 73007-A2

## SIMMAN HEAD ASSEMBLY LAYOUT
## PRO-T-047
## Number to BOM Reference

| | | |
|---|---|---|
| 1 | 1005086S | SKIN, HD-SIM/AIRMAN-STD |
| 2 | 1005013 | AIRWAY, SIM/AIRMAN/ADLT MALE HEADS |
| 3 | 1005006 | TONGUE, SIMMAN |
| 4 | 1005013 | DAM, TONGUE-DA HEAD-PINK |
| 5 | 1005083 | BLADDER |
| 6 | 4715-05-0605 | FCHPSTS, #6-20 X 5/8 LG |
| 7 | 1005002S | SKULL, BOTTOM-SIM/AIRMAN-STD |
| 8 | 1005042 | PLATE, TRISMUS STOP |
| 9 | 1005015 | CABLE, TRISMUS ACTUATION 4.406" LON |
| 10 | 1005012 | PLATE, TRISMUS ACTUATOR |
| 11 | 1005100 | TUBING, TRISMUS BLADDER-SIM/AIRMAN |
| 12 | 1005080 | BLADDER, TRISMUS ACTUATION |
| 13 | 1007006S | SKULL, TOP-SIM/AIRMAN-SCAN |
| 14 | 2117-05-0020 | RHPMS, 1/4-20 UNC X 2-1/2 |
| 15 | 2705 | MANDIBLE, SIM/AIRMAN |
| 16 | 2109-05-0005 | RHPMS, #6-32 UNC X 5/8 |
| 17 | 1422-05-0009 | NUT, HEX-NYLOC #6-32 UNC |
| 18 | 1007010 | COVER, SPKR-HEAD-ADV/DLX ALS |
| 19 | 1007014 | SPKR ASSY, HEAD-AD/DLX ALS |
| 20 | 1005093 | TUBING ASSY, CRM BLADDERS-SIM/AIR M |
| 21 | 1005081 | BLADDER, LOWER DECREASED CRM-SIM/AI |
| 22 | 2232 | NECK BODY, SIM/AIRMAN |
| 23 | 2233 | LEVER, NECK SIM/AIRMAN |
| 24 | 2234 | LOCK LEVER, NECK SIM/AIRMAN |
| 25 | 2248 | ROLL, NECK SIM/AIRMAN |
| 26 | 2436 | ROD, NECK SIM/AIRMAN |
| 27 | 2435 | O-RING, NECK SIM/AIRMAN |
| 28 | 1005005S | NECK CRADLE, SIM/AIRMAN-SCAN |
| 29 | 2117-05-0028 | RHPMS, 1/4-20 UNC X 3-1/2 |
| 30 | 1422-05-0017 | NUT, HEX-NYLOC 1/4-20 UNC |
| 31 | 4709-05-0604 | FCHPSTS, #4-24 X 1/2 LG |
| 32 | 1005079 | COVER, NECK SIM/AIRMAN |
| 33 | 1005017 | BLADDER, UPPER DECREASED CRM-SIM/A |
| 34 | 9500-04-0001 | EYE, HALF GLOBE3N BLUE |
| 35 | 1005057 | PALATE ASSY, SIM/AIRMAN |
| 36 | 4719-05-0606 | FCHPSTS, #8-18 X 3/4 LG |
| 37 | 1005145 | TEETH, UPPER-SIM/AIRMAN HD-VINYL |
| 38 | 1005020 | TEETH, LOWER-SIM/AIRMAN-SOFT |
| 39 | 2026 | PULSE SENSOR, CAROTID |
| 40 | 1005094 | TUBING ASSY, CAROTID PULSE |
| 41 | 3431 | SHROUD, FRONT-MACHINED-SIM/AIRMAN |
| 42 | 6325-01-0001 | TIE, CABLE-4 X .100 NYLON |
| 43 | 1005091 | PROTECTOR, BLADDER-MYLAR |
| 44 | 1005018 | BLADDER, SHROUD |
| 45 | 2704 | SHROUD, BACK-SIM/AIRMAN |
| 46 | 4754-05-9606 | PHPSTS, 3.5MM X 10MM FOR PLAST |
| 47 | 1005092 | TUBING ASSY, SHROUD BLADDER-LARYNGO |
| 48 | 1005110 | TUBING, SHROUD BLADDER-PHARYNGEAL |
| 49 | 2711 | BIFURCATION, BRONCHIAL TREE-SIM/AIRMAN |
| 50 | 1000237 | FITTING, 1/2 MALE NPT TO 7/8 OD.-BLACK |
| 51 | 6325-01-0002 | TIE, CABLE-5.6 X .13 NYLON |
| 52 | 1609-05-0007 | WASHER, FENDER 5/16 X 1-1/4 |
| 53 | 1422-05-0019 | NUT, HEX-NYLOC 5/16-18 UNC |
| 54 | 729 | STRAP, SILICONE-HEAD SKIN-SIM/AIRMAN |
| 55 | DA-1002S | TAPE, CRICO-THYROID |
| 56 | 1005159 | CRICO-THYROID CARTILAGE |
| 57 | 1005177 | CAROTID INSERT |
| 58 | 1200-02-0003 | TUBING 1/8 X 1/4 - 17IN |
| 59 | 4715-05-0604 | FCHPSTS, #6-20 X 1/2 LG |

| TITLE | | |
|---|---|---|
| SIMMAN HEAD ASSEMBLY | | |
| SIZE: A2 | DWG. NO.: PRO-T-047 SHT. 2 OF 2 | REV.: B |

### 4.7 SimMan Pelvis w/leg drawing & BOM




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | DECIMALS: ± | | | DO NOT SCALE DRAWING | MPL professional health educators |
| | | | | ANGLES: ± | | | | |
| | | | | STANDARD: | | | DATE: 10/14/02 | TITLE: Simman Pelvis w/Legs |
| | | | | PRD. APPVL. | DWN. | R & D APPVL. | | |
| REV. | DATE | BY | APPVL | ENG. APPVL. | CHK. | SCALE: NONE | SIZE: A | DWG. NO.: PRO-T-048 SHT. 1 OF 2 — REV.: A |

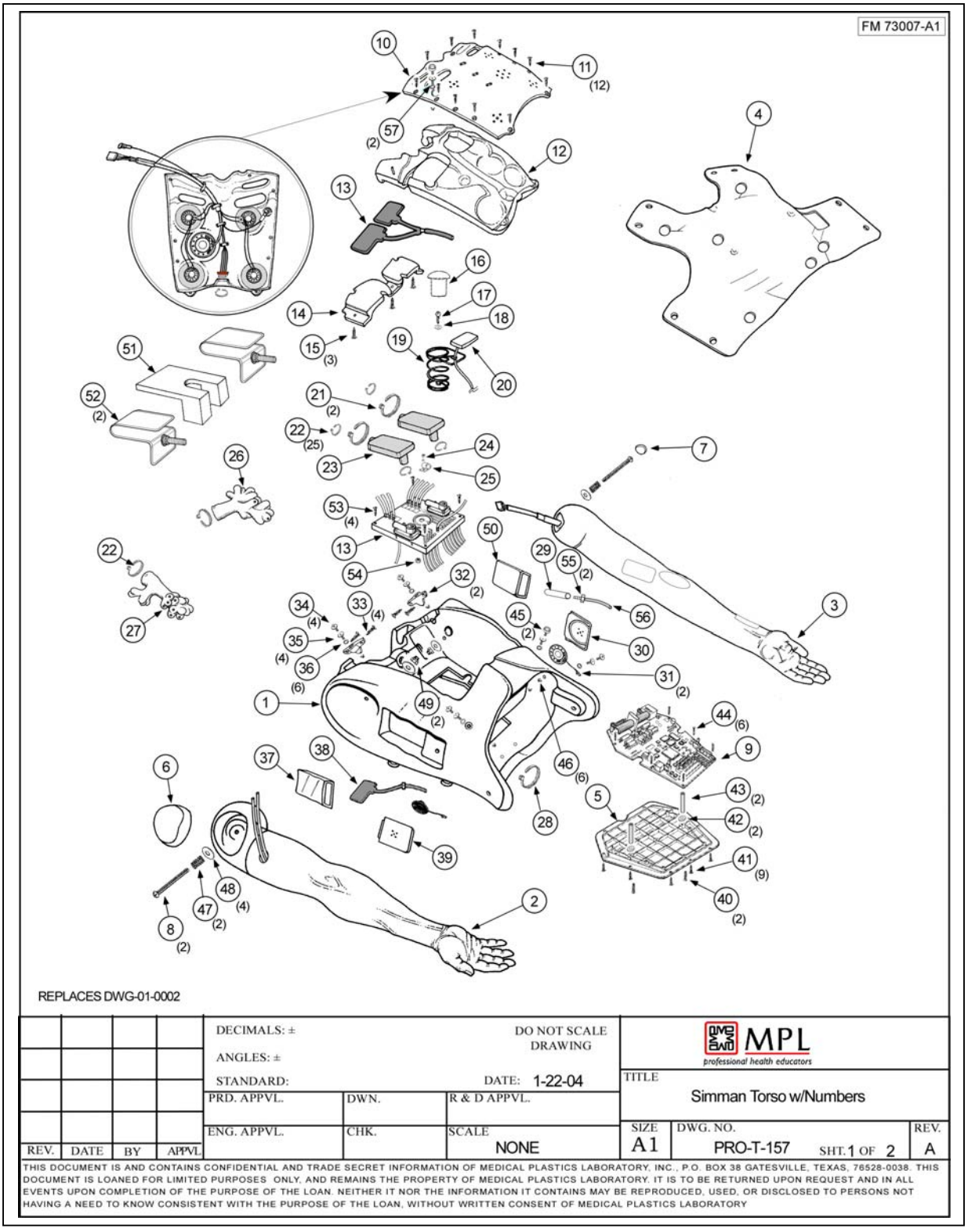
FM 73007-A2

## SIMMAN PELVIS W/LEGS ASSEMBLY LAYOUT
## PRO-T-048
## Number to BOM Reference

| | | |
|---|---|---|
| 1 | 1005027S | PELVIS, SIMMAN W/FEM PULSE HOLES-STD |
| 2 | 1000174S | THIGH, ADLT-RT-STD |
| 3 | 1000181S | LEG, ADLT-RT-LOWER-STD |
| 4 | 1000185S | FOOT, ADLT-RT-STD |
| 5 | 1000175S | THIGH, ADLT-LFT-STD |
| 6 | 1000182S | LEG, ADLT-RT-LOWER-STD |
| 7 | 1000186S | FOOT, ADLT-LFT-STD |
| 8 | 1000176S | PAD ASSY, ADLT-THIGH-STD |
| 9 | 1001329 | HARDWARE SET, ADLT MNKN-LEG/PELVIS |
| 10 | 1000163S | PAD ASSY, AM-GLUTEAL-STD |
| 11 | 1000160S | PAD ASSY, AM-VENTRAL GLUTEAL-STD |
| 12 | 1005052S | SKIN, FEMORAL PLUSE-LFT-SIM-STD |
| 13 | 1005028S | SKIN, FEMORAL PLUSE-RT-SIM-STD |
| 14 | 1000168S | GEN, ADLT MALE-BLANK-STD |
| 15 | 1000203S | BELLYPLT, CONV-AM 1 HOLE RSVR-STD |
| 16 | 1000690S | PLUG, BELLYPLT RSVR-ADLT/PEDI-STD |
| 17 | 1005062S | SKIN, ABD THRUST-SIM/AIR MAN-STD |
| 18 | 1005063 | INSERT, FOAM-ABD THRUST UP SIM/AIR |
| 19 | 1005064 | SPKR ASSY, ABDOMINAL THRUST SIM/AIR |
| 20 | 1001334 | COVER, SPKR-ABD THRUST/HOSP CHESTPL |
| 21 | 1005113 | BLADDER, STOMACH AUSCULTION |
| 22 | 2154 | PULSE UNIT, SIM MAN ARM/PELVIS |
| 23 | 1000169 | PIN, PELVIS |
| 24 | REF. DWG-01-0004 | |
| 25 | 1002898 | VALVE ASSY, AIR BANK-SIM/AIR MAN |
| 26 | 1005040 | INSERT, FOAM-SIM/AIR MAN PELVIS |
| 27 | 2117-05-0020 | RHPMS, 1/4-20 UNC X 2-1/2 |
| 28 | 2117-05-0036 | RHPMS, 1/4-20 UNC X 4-1/2 |
| 29 | 2117-05-0020 | RHPMS, 1/4-20 UNC X 2-1/2 |
| 30 | 1427-05-0017 | NUT, HEX CAP-1/4-20 UNC-NYLOC |
| 31 | 1005076 | INSERT, FOAM FEMORAL/BP ARM PULSE |
| 32 | 1601-05-0009 | WASHER, FLAT 1/4ZINK PLTD |

| TITLE | | |
|---|---|---|
| Simman Pelvis w/Legs | | |
| SIZE A2 | DWG. NO. PRO-T-048 SHT. 2 OF 2 | REV. A |

### 4.8 SimMan torso drawing & BOM



## SIMMAN TORSO W/ARMS ASSEMBLY LAYOUT
## DWG-01-0002
## Number to BOM Reference

FM 73007-A1

| | | |
|---|---|---|
| 1 | 1005033S | TORSO, SIMMAN W/BACKPLT-SCAN |
| 2 | IVR-5100SNDP | ARM ASSY, AM-RT IV MV NO DELT |
| 3 | 1005170S | ARM ASSY, BLOOD PRESSURE |
| 4 | 1005069S | SKIN, CHEST-SIMMAN-SCAN |
| 5 | 2140 | BACKPLATE, SIM/AIRMAN |
| 6 | 1000191S | PAD ASSY, AM-DELT-SCAN |
| 7 | 1000841S | PLUG, ARM-ADLT 1 PC-SCAN |
| 8 | 2117-05-0032 | RHPMS, 1/4-20 UNC X 4“ |
| 9 | FST1857 | PCB ASSY, SIMMAN |
| 10 | 1005054S | LID, CHESTPLT SIM/AIRMAN-SCAN |
| 11 | 4719-05-0606 | FCHPSTS, #8-18 X 3/4” LG |
| 12 | 1005053S | CHESTPLT BACK, SIMMAN |
| 13 | 1005090 | BLADDER ASSY, MID CLAVICULAR |
| 14 | 1005059S | PLATE, BLADDER RETAINING |
| 15 | 4719-05-7506 | OCWHPSTS, #8-18 X 3/4“ LG |
| 16 | 1005026 | SHAFT, COMP-SIMMAN |
| 17 | 2111-05-0008 | RHPMS, #8-32 UNC X 1” |
| 18 | 1601-05-0006 | WASHER, #8 FLAT |
| 19 | 1002906 | SPRING, COMPRESSION SIM/AIRMAN |
| 20 | 1005166 | BLADDER, BREATHING |
| 21 | 6325-01-0008 | TIE, CABLE 6” NYLON |
| 22 | 6325-01-0002 | TIE, CABLE 5.6“ X .13 NYLON |
| 23 | 1005085 | BRONCHIAL SOCK |
| 24 | 2111-05-0004 | RHPMS, #8-32 UNC X 1/2” |
| 25 | 3429 | CLIP, WIRE HARNESS |
| 26 | 2713 | BRANCH, BRONCHIAL TREE-LT |
| 27 | 2712 | BRANCH, BRONCHIAL TREE-RT |
| 28 | 6325-01-0007 | TIE, 3/16 X 12“ CABLE |
| 29 | 1700-19-0002 | SILICONE PLUG |
| 30 | 1005037S | COVER, SPKR-LFT MID AXILLARY |
| 31 | 1004490 | SPKR ASSY, MID AXILLARY-SIMMAN |
| 32 | 1005060S | MNT, ECG LEADS-SIMMAN |
| 33 | 4715-05-0604 | FCHPSTS #6-20 X 1/2” LG |
| 34 | 2995 | POST, ECG MONITORING |
| 35 | 2706 | SOCKET, ECG POST-SIMMAN |
| 36 | 1601-06-0009 | WASHER, FLAT 1/4“ SST |
| 37 | 1005088S | PAD, ALCS-PNEUMO RT-SCAN |
| 38 | 1005133 | BLADDER, MID AXILLARY |
| 39 | 1005038S | COVER, SPKR-RT MID AXILLARY |
| 40 | 2566 | SCREW, PHPMS - 4MM X 20MM |
| 41 | 4719-05-0604 | FCHPSTS 8-18X1/2 LONG |
| 42 | 1609-08-0017 | WASHER, FENDER 1/8 ID X 9/16 OD |
| 43 | 2701 | SPACER, 55MM LONG 4MM THRE |
| 44 | 4754-05-9606 | PHPSTS, 3.5MM X 10MM |
| 45 | 2708A | POST ASSY, DEFIB-LAERDAL |
| 46 | 1401-06-0108 | NUT, HEX-6MM SS |
| 47 | 1725-01-0001 | SPRING, COMP .75 LONG |
| 48 | 1601-05-0009 | WASHER, FLAT-1/4 ZINK PLTD |
| 49 | 1427-05-0017 | NUT, HEX CAP-1/4-20 UNC NYLOC |
| 50 | 1005169S | CHEST DRAIN MODULE |
| 51 | 1005072 | CHEST FOAM |
| 52 | 2400 | LUNG BAG, SIMMAN |
| 53 | 4719-05-10006 | PHPSTS, #8-18 X 3/4 |
| 54 | 1422-05-0011 | NUT, HEX #8-32 NYLOC |
| 55 | 1205-02-0006 | TUBE CONN STRAIGHT 5/32” |
| 56 | 1005173 | TUBING, LEFT MID AXIL PNEUMO |
| 57 | 2707 | SOCKET, DEFIB POST |

| | | |
|---|---|---|
| TITLE: Simman Torso w/Numbers | | |
| SIZE: A1 | DWG. NO.: PRO-T-157 SHT. 2 OF 2 | REV.: A |

## 5.0 Service and Maintenance

### 5.1 Test and inspection SimMan

Unit S/N_____ Date:_____Tested by:_____

Equipment: Heartstart 4000 or Equivalent, Stethoscope, PC, Intubation equipment + Ventilation bag.

| # | Test and inspection method | Tested |
|---|---|---|
| | | |
| **Head/Neck Assembly**: | | |
| 1. | Inspect head skin for overall appearance | |
| 2. | Inspect for silicone closure at back of head and neck (total of 3) | |
| 3. | Perform direct laryngoscopy, inspect: epiglottis, vocal cords, upper trachea, esophageal area for damage, rupture or leakage. | |
| 4. | Inspect teeth and neck assembly for overall appearance | |
| | | |
| **Torso Assembly:** | | |
| 5. | Inspect skin for overall appearance. Check that that ECG studs and defib. connectors are clean. | |
| 6. | Inspect for overall external appearance | |
| 7. | Ensure head assembly-to-torso hardware is tight and that head rotates freely from side to side and forward and backward. | |
| 8. | Inspect chest plate for overall appearance and free movement into and out of torso cavity | |
| 9. | Inspect torso-to-pelvis attachment screws. Each should be properly secure (check with screwdriver). | |
| | | |
| **Pelvis Assembly:** | | |
| 10. | Inspect for overall appearance | |
| 11. | Inspect femoral pulse for proper feel | |
| | | |
| **Right arm Assembly:** | | |
| 12. | Inspect skin and veins for holes or damage. | |
| 13. | Inspect arm-to-torso attachment screw: phillips head and properly secure to allow full articulation. | |
| | | |
| **Left arm Assembly** | | |
| 14. | Inspect for overall appearance and check brachial and radial pulse for proper feel | |
| 15. | Inspect arm-to-torso attachment screw: phillips head and properly secure to allow full articulation | |
| 16. | Inspect deltoid pad for damage | |
| | | |
| **Cable and Air/CO2 Connections** | | |
| 17. | Check connector and cable for damage and for easy connection to mating parts | |
| | | |
| **Sounds:** To be ausculated with a stethoscope and verified for quality and clarity of sound. All sounds to be in default volume of “5”, then allow volume increase and decrease. | | |
| 18. | Confirm presence of heart sound, change heart sound and reconfirm | |
| 19. | Confirm presence of right lung sound, change lung sounds and reconfirm x 6 locations. | |
| 20. | Confirm presence of left lung sound, change lung sounds and reconfirm x 6 locations | |

| | | |
|---|---|---|
| 21. | Confirm presence of bowel sound, change bowel sound and reconfirm. | |
| | | |
| # | Test and inspection method | Tested |
| | | |
| 22. | Confirm presence of BP sound in left arm. Sound should be present at set systolic pressure and diminish to absent at diastolic. | |
| 23. | Confirm correct function of auscultatory gap. | |
| 24. | Confirm presence of vocal sounds x 3 | |
| | | |
| **Pulses:** | | |
| 25. | With BP set at 120/80, confirm presence of carotid pulse x 2, femoral pulse x 2, brachial pulse, and radial pulse | |
| 26. | With systolic BP set at 65 mmHg, confirm presence of carotid pulse x 2 only | |
| 27. | With systolic BP set at 75 mmHg, confirm presence of carotid x 2 and femoral x 2 pulses only | |
| 28. | Confirm "sense" (on computer screen) and event log for:<br>- Femoral x 2 - Brachial<br>- Radial pulses - Carotid pulses x 2 | |
| | | |
| **SpO2:** | | |
| 29. | Verify that the red light is illuminated on the probe when the unit is plugged into the back of link box. | |
| 30. | Confirm that when the SpO2 probe is plugged in and **not on** SimMan finger, there is no waveform or numerical value produced on the patient data display monitor. | |
| 31. | Confirm that when the SpO2 probe is plugged in and **on** SimMan finger, a waveform or numerical value is produced on the patient data display monitor. | |
| | | |
| **ECG and Electrical Therapy:** | | |
| 32. | Confirm presence of ECG at ¾ lead and at hands free (sternum and apex). White lead on patient's right shoulder, black lead on patient's left shoulder and red lead on patient's left lower torso. | |
| 33. | With running rhythm set at VF, waiting rhythm at NSR, and ignore shock is "active", confirm that defibrillation at 360J **WILL NOT** move waiting to running rhythm. Three (3) shocks at 360J are to be delivered as rapidly as possible. | |
| 34. | With running rhythm set at VF, waiting rhythm at NSR, and shock "enabled", confirm that defibrillation at a minimum of 50J **WILL** move the waiting rhythm to the running rhythm. | |
| 35. | With the running rhythm set at NSR at 40, pacing threshold set at 40mA, and pacing disabled, confirm that pacing at 200mA **WILL NOT** capture | |
| 36. | With the running rhythm set at NSR at 40, pacing threshold set at 40mA, and pacing "enabled", confirm that pacing greater then 80mA **WILL** produce capture and create a pulse rate matching that set on TCP device. | |
| | | |
| **Spontaneous Respirations:** | | |
| 37. | Confirm variable respirations are present when increased/decreased from both computer and remote controls. | |
| 38. | Confirm apnea causes no breathing when activated from computer/remote controls | |
| 39. | When manikin producing spontaneous respirations, confirm presence of respiratory sounds at manikin's mouth opening | |

| | | |
|---|---|---|
| 40. | Confirm presence of capnograph waveform on patient monitor to match each respiratory cycle. | |
| **Chest Movement:** | | |
| 41. | Confirm detection and logging of:<br>- Single precordial thump<br>- CPR compressions<br>- Bag-valve-mask while ventilating | |
| 42. | Confirm that CPR artefacts is being produced on the patient data display monitor when chest compressions are being performed | |
| # | Test and inspection method | Tested |
| **Airway:** (All with "apnea" activated). For all bladders inspect upon initial inflation and leave inflated for 3 min. and recheck! If any failure replace bladder. | | |
| 43. | Perform inspection of the entire airway including bronchial trees. | |
| 44. | Confirm that mask ventilation produces acceptable chest rise, capnograph waveform, displayed lung filling on computer screen, and breath sound. | |
| 45. | Activate "Decreased Rt. Lung": Confirm that rt. Lung is not filled and not shown as filled on computer screen. | |
| 46. | Activate "Decreased Lt. Lung": Confirm that lt. Lung is not filled and not shown as filled on computer screen. | |
| 47. | Activate "Decreased Rt. Lung" and "Decreased Lt Lung". Confirm that ventilation attempts do not result in chest rise, that lungs are not shown as filled on computer screen, and that no capnograph waveform is created | |
| 48. | Activate "Stomach Decompression". Confirm that mask ventilation causes air to be held in abdomen and that deactivation of that function allows the air to be released. | |
| 49. | Activate "Rt. Pneumothorax". Confirm inflation of pneumothorax bladders x 4, blocking of rt. Lung fill, and absence of rt. Lung sounds. | |
| 50. | Activate "Lt. Pneumothorax". Confirm inflation of pneumothorax bladders x 4, blocking of lt. Lung fill, and absence of lt. Lung sounds. | |
| 51. | Activate "Pharyngeal Obstruction". Visually confirm activation. Confirm complete deflation upon deactivation. | |
| 52. | Activate "Tongue Swelling". Visually confirm activation. Confirm complete deflation upon deactivation | |
| 53. | Activate "Decreased Cerv. ROM". Visually confirm activation. Confirm complete deflation upon deactivation | |
| 54. | Activate "Trismus". Visually confirm activation. Teeth will close to an opening of no less than 6mm and no greater than 10mm. Confirm complete release upon deactivation | |
| 55. | Activate "Laryngospasm". Confirm that vocal cords close to a point of complete opposition and that a 3 EET cannot be inserted between the cords | |
| 56. | Upon intubation of the right mainstem bronchus, confirm that only the right lung is inflated, that the chest rises only on the right, and that only the right lung is shown filled, on the computer screen, during ventilation. | |
| 57. | With the tube in place, as shown in the above item, confirm that activation of CO2 causes an adult EasyCap (CO2 detector) to have the correct change in colour for both inspiration and exhalation. | |
| 58. | When CO2 is deactivated the EasyCap should return to purple, and when reactivated it should turn yellow on exhalation | |
| 59. | Upon correct insertion and use of Combitube trainer, confirm proper chest rise, displayed lung fill icon, and chest rise upon ventilation with infant/pedi manual bag-valve device. | |
| 60. | Upon correct insertion and use of #4 LMA Classic/LMA Unique/LMA Fastrack, confirm proper chest rise, displayed lung fill icon, and chest rise upon ventilation with infant/pedi bag-valve device. | |

## 5.2 SimMan Trouble Shooting Guide

Before using this guide you should ensure that:

1) All components are connected as shown in the directions for use.
2) The Link box just has been powered up.
3) The Monitor just has been powered up.
4) The PC is powered up and is not running any SimMan software.

### 5.2.1 Short form

The SimMan system has built in a few indicators that give a quick overview of the running status of the system.

| 1.1.1 Indicator | 1.1.2 Status | 1.1.3 Description |
|---|---|---|
| Link box LED | Blinking 50% off and 50% on. | Indicates that the link box has power, but has no connection with SimMan PC program. |
| | Almost always on, just shut off for a very short time at regular intervals. | Indicates that the link box is communicating with the SimMan PC program. |
| | Always on or always off. | SimMan Link box is not running. Try to switch power off and on again. |
| Color of Manikin field in SimMan host program window.<br>This window is displayed when, after the SimMan program is started, clicking on the red heart icon in the right bottom corner off the screen, on the windows task bar. | Color is green. | Indicates that the Manikin is properly connected and running. |
| | Color is red. | Indicates that the Manikin is not properly connected. Check connections and try to restart Link box. |
| Clock display in upper left corner of Patient Monitor, after SimMan program is started. | The clock is not displayed. | The Patient Monitor is not properly connected. Check connections or try to restart Monitor. |
| | Clock is displayed and is running. Shall have the same time as the event logging clock of the SimMan program. | The Patient Monitor is communicating with the SimMan program. |
| | Clock is displayed but is frozen. (While SimMan program event clock is not paused.) | Try to restart the Patient Monitor. |

### 5.3 Compressor Troubleshooting Guide, Maintenance and service

**If your compressor is experiencing any of the following symptoms listed below follow the described steps:**

**'…not functioning', '…will not turn on…', '…has a leak…', '…will not hold air…', '…is smoking…', '…runs continuously…', '…making an unusual noise…' etc….**

**A) Is the compressor being started for the first time?**
If the answer is yes, then

- Ask for confirmation that the start procedure in the 'User Guide Compressor Unit' has been followed.
- Follow the start procedure step by step.

If the answer is no, then follow step B.

**B) Restarting of the compressor?**
If the compressor has been running OK before, first go through the 'Stop / Shut Down Steps' and then the 'Start procedure'.

**C) Does compressor run and rest in alternating cycles?**
All the compressors have a defined 'normal' cycle of running and resting (cooling).

- Use the compressor in a typical mode of compressor and manikin set-up, and then verify that the compressor does run and stop in intervals.

If the compressor does not start and stop in intervals, then:

- Check the drain valve (1) on the compressor unit. This valve shouldl be 'closed' in normal operation mode.

If the compressor still runs continuously with the drain valve closed,

- Turn the 'air valve' (2) to the 'closed' position while the compressor is running.

If the compressor runs continuously for more than 2 minutes after the air valve is shut, this could indicate internal leakage with potential overheating as a consequence.

***If the compressor is still not working correctly after going through the above steps, then the compressor will need to be serviced or repaired.***

**User guide Compressor Unit.**

## Start procedure:

1. Check Compressor Unit for transport damage.
2. Check that Power switch **(4)** is set to off position “0”.
3. Plug power supply cable into plug **(5)** in Compressor panel.
4. Plug power supply cable into power source.
5. Connect all hoses to manikin.
6. Check that Drain valve **(1)** is closed.
7. Close Air valve **(2)** and $CO_2$ valve **(3)**.
8. Push Power switch **(4)** to on position “1”, the Compressor will start and run for approx. 45 seconds to build up pressure in tank.
9. When Compressor stops you can start to use the manikin.
   Open the Air valve **(2)** and the $CO_2$ valve **(3)**. ($CO_2$ supply to be connected to the “Input $CO_2$” connector using the black hosing attached).
10. The Compressor will start and stop with different intervals depending on consumption of air.

## Stop procedure:

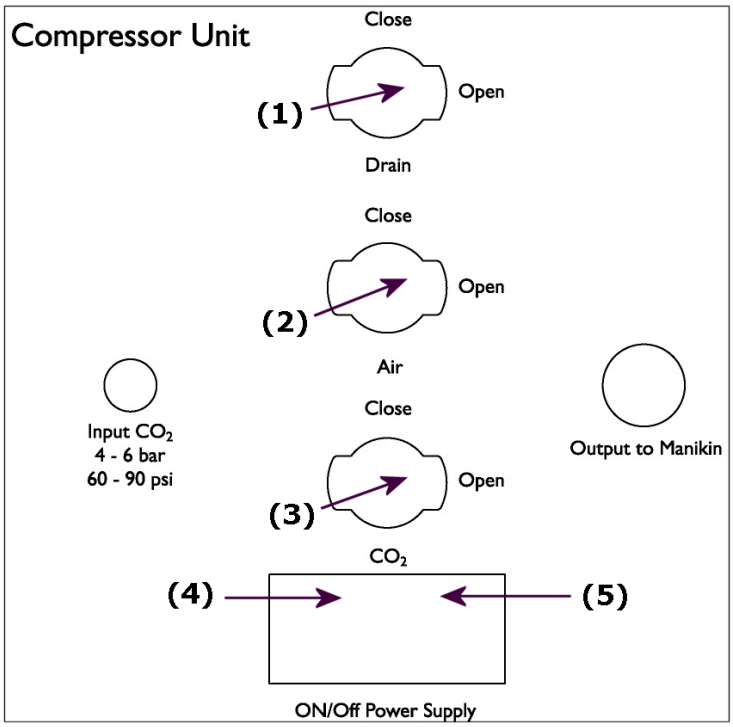
1. Push Power switch **(4)** to off position “0”, the Compressor will stop if it is running.
2. Open Drain valve **(1)** and drain air out of system.
3. Close Drain valve **(1)** and disconnect all hoses.

## Warning:

Do not open Compressor box when energized, dangerous voltage inside. Only to be opened by authorized personnel.

**Important:**

If the Compressor Unit is stopped manually with the on/off switch, the air tank has to be drained before restart.



General:

- Keep the unit clean both inside and outside.
- Always drain air after use.
- Close all valves after use.
-

Service at every 2nd year:

- Exchange filter on the compressor air silencer **(Fig.1)**. Part number: 500 510.
- Open air ventilation lock on the tank **(Fig.2)**, turn the to let water out of the tank (This procedure must be adjusted depending on experience of use and climatic conditions where used)
- Check filter on the water separator **(Fig.2)** and exchange if necessary. Part number. 049 381 9607

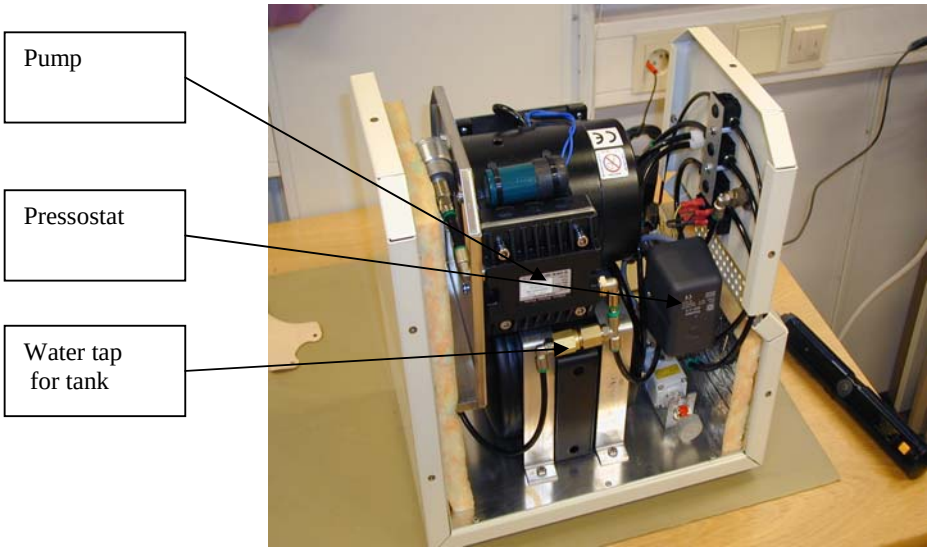



Fig. 1

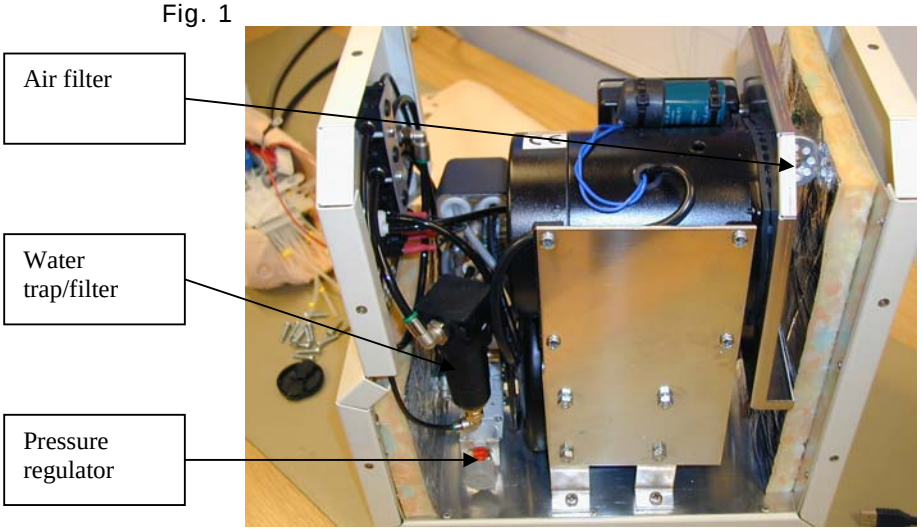
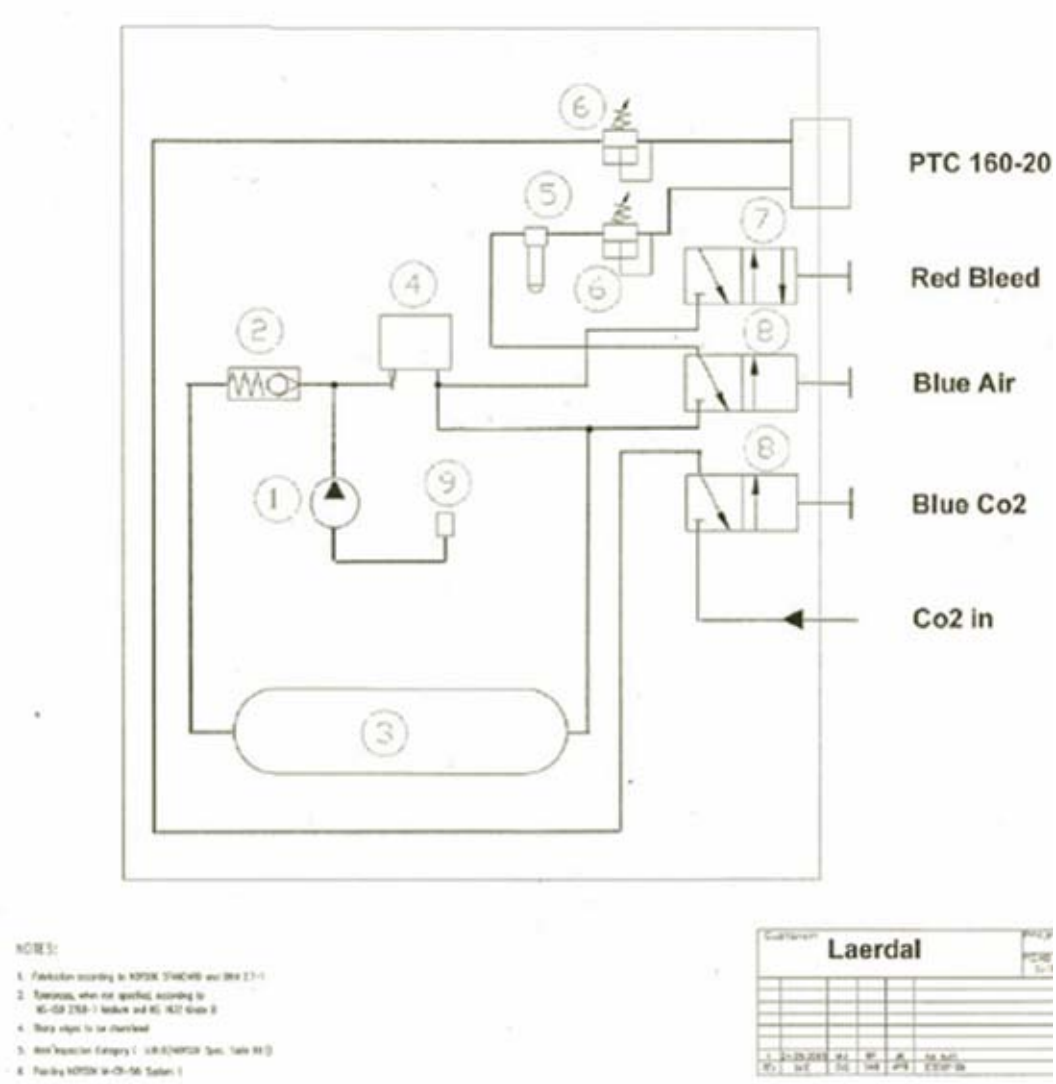


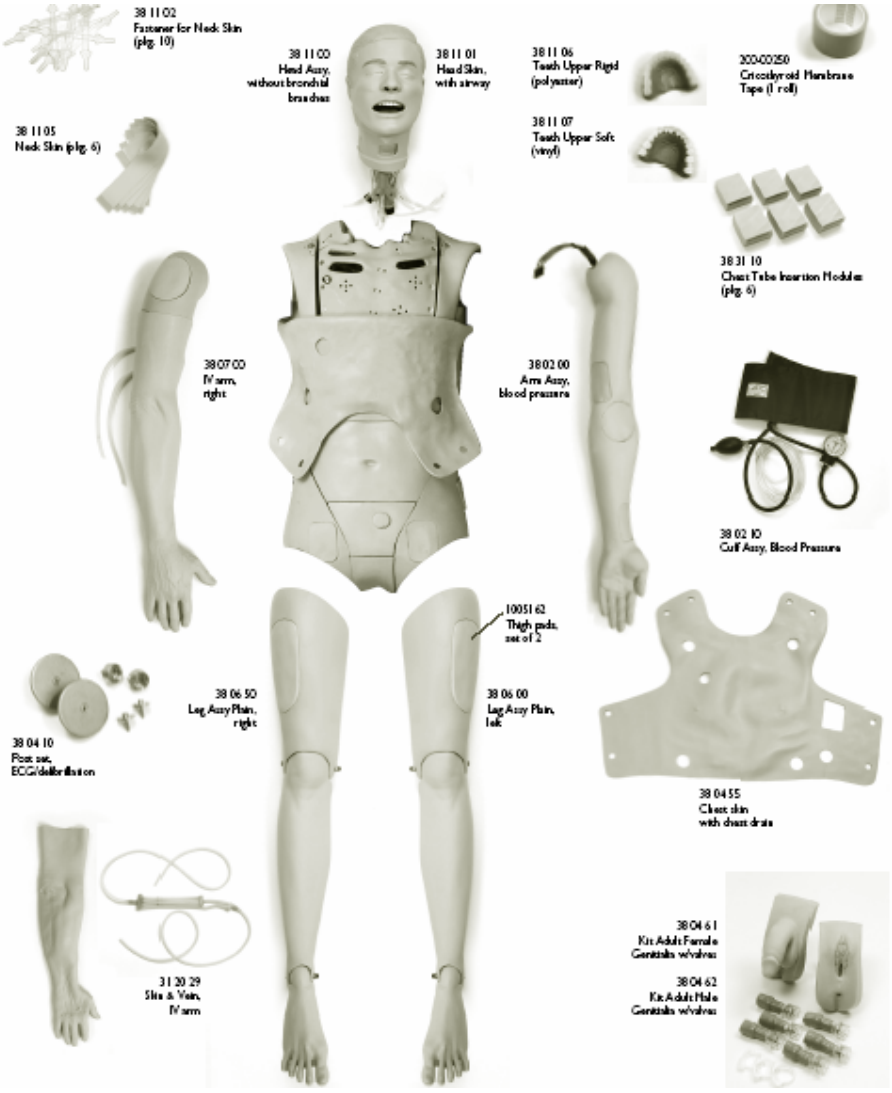

Fig. 2


PTC 160-20
Red Bleed
Blue Air
Blue Co2
Co2 in
Laerdal

## 5.4 Spare Parts List Consumables

| Cat. no. | Description |
|---|---|
| 380305 | Cable main board to link |
| 271500 | Cable 9-pin D-sub (PC to Link Box) |
| 320256 | Power resistor 150R |
| 380100 | Link box |
| 380200 | Arm cpl. Blood pressure SimMan |
| 380201 | Arm bolts set |
| 380210 | Cuff assy., blood pressure SimMan |
| 380300 | Main board SimMan |
| 381107 | Upper teeth soft |
| 380350 | Compression board SimMan |
| 380400 | Chest plate cpl. SimMan |
| 380401 | Speaker set chest plate 8 ohm, w/tape |
| 380402 | Speakers Mid auxiliary, set of 2 |
| 380409 | Mounting strips pkg. of 100 |
| 380410 | Studs ECG & Defib set |
| 380411 | Wire Harness chest plate (Defib and speakers) |
| 380412 | Wire Harness Data distribution |
| 380413 | Wire Harness solenoid, SimMan |
| 380420 | Lung |
| 380430 | Tubing set SimMan |
| 380435 | Breathing Bladder |
| 380446 | Chest Foam |
| 380445 | Top of compression spring |
| 380455 | Chest skin SimMan |
| 382460 | Genitalia blank |
| 380461 | Genitalia, Female w/connectors |
| 380462 | Genitalia; Male w/connectors |
| 380470 | Belly plate |
| 380471 | Plug belly plate |
| 380475 | Pelvic pin |
| 380480 | Abdominal thrust cpl. (stomach cpl.) |
| 380481 | Stomach shut off valve |
| 380482 | Stomach valve |
| 381201 | Jet-vent adapter kit |
| 380484 | Stomach bladder |
| 380485 | Speakers for the stomach, w/wire harness and foam, 8 ohm speakers |
| 380491 | Femoralis pulse right |
| 380492 | Femoralis pulse left |
| 380493 | Wire Harness Femoralis pulses |
| 380600 | Leg plain left |
| 380650 | Leg plain right |
| 380700 | IV arm right |
| 380800 | Plain arm left |
| 380801 | Hand left |
| 380810 | Pad set shoulder and hip |
| 380901 | Jacket SimMan |
| 380902 | Trousers SimMan |
| 381000 | Solenoid block cpl. |
| 381010 | Tubing Assy, Compressor-Manikin Air/CO2 |
| 381011 | Quick connectors, twin female rec. |
| 381050 | Manifold cpl. |
| 381100 | Head cpl. |

| | |
|---|---|
| 381101 | Head skin w/airway |
| 381102 | Fasteners for neck skin (Pkg. 10) |
| 381104 | Speaker Assy, head SimMan |
| 381106 | Upper teeth rigid |
| 381110 | Head bladders set |
| 381120 | Shroud w/pulse and sensors |
| 381130 | Bronchial tree cpl. |
| 211-19550 | SimMan SW 3.0 Technical Service Manual |
| 211-19950 | SimMan CD SW 3.X |
| 245-990XX | PDA (XX=Laguage codes) |
| 245-96050 | USB WEB Camera |
| 245-98050 | USB Hub |
| 245-16750 | Audio Cable |
| 245-16350 | Cable 15-pin D-sub (Link Box to Manikin) |
| 245-18050 | Transportation Case (for Patient Monitor etc.) |
| 210-01050 | Compressor 230V-240 V |
| 210-01150 | Compressor 110V |
| 381655 | SimMan Manikin Transport Case |
| 381220 | Regulator Unit |
| 381850 | Portability Kit |
| 260305 | Power-cord (US) |
| 260306 | Power-cord (EUR) |
| 260307 | Power-cord (UK) |
| 380405 | Bladder Assy, mid clavicular |
| 380406 | Bladder set, mid axillary |
| 380407 | Pneumo pad (set of 2) |
| 381105 | Neck skin (pkg.6) |
| 381133 | Sock, bronchial tree |
| 381300 | Pulse Oximetry probe |
| 383110 | Chest drain modules (pkg.6) |
| 245-95050 | Patient monitor w/touch screen |
| 312029 | Skin & vein IV Arm |
| 200-00250 | Tape crico-thyroid |


3811 02
Fastener for Neck Skin
(pkg. 10)
3811 00
Head Assy,
without bronchial
branches
3811 01
Head Skin,
with airway
3811 06
Tooth Upper Rigid
(polyester)
3811 07
Tooth Upper Soft
(vinyl)
300-00250
Cricothyroid Membrane
Tape (1 roll)
3811 05
Neck Skin (pkg. 6)
3831 10
Chest Tube Insertion Modules
(pkg. 6)
3807 00
IV arm,
right
3802 00
Arm Assy,
blood pressure
3802 10
Cuff Assy, Blood Pressure
10051 62
Thigh pads,
set of 2
3806 50
Leg Assy Plain,
right
3806 00
Leg Assy Plain,
left
3804 10
Post set,
ECG/defibrillation
3804 55
Chest skin
with chest drain
3804 61
Kit Adult Female
Genitalia w/valves
3804 62
Kit Adult Male
Genitalia w/valves
3120 29
Skin & Vein,
IV arm

38 08 10
Pad Set, Shoulder and Hip

38 04 05
Bladder Assy Mid-Clavicular
(Pneumothorax Chest)

38 04 06
Bladder Set Mid-Axiliary
(Pneumothorax Side)

38 13 00
Pulse Oximetry Probe

38 04 35
Breathing Bladder

245-16350
Cable Assy, Manikin-Link Box
(15 pin D-sub)

38 10 10
Tubing Assy,
Compressor-Manikin,
Air/$CO_2$

27 15 00
Cable PC to Link Box
(9 pin D-sub)