

tyco / Healthcare

KENDALL

SCD EXPRESS™

Compression System

Operation and Service Manual

Systeme De Compression

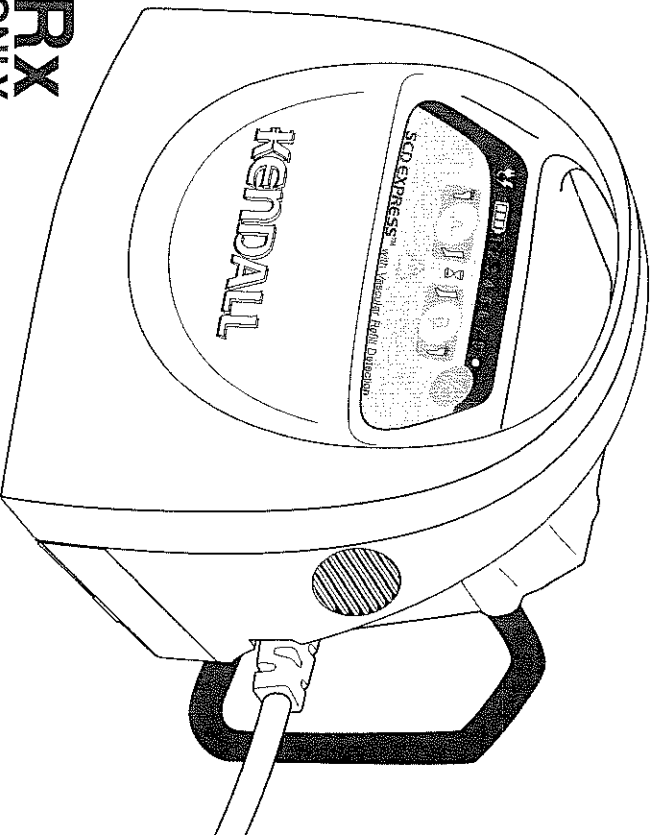
Manuel D'utilisation Et D'Entretien

Sistema De Compresión

Manual De Operación Y Servicio

Sistema De Compressão

Manual De Funcionamento E Assistência



See Instructions 0123

CE **RX**
ONLY

TABLE OF CONTENTS

Indications	1
Contraindications	1
Cautions	1
Explanation of Symbols Used	2
Front Panel Display	2
Section I - General Operating Instructions	3
Set up	3
Start-up	3
Garment Configuration & Detection	3
Normal Operation	4
Pressure Settings	4
Vascular Refill Detection	4
Garment Compatibility	4
Tubing Set Compatibility	4
Portable Controller Configuration	4
Section II - Battery Operation	4
Battery Indicators Status	5
Charging the Battery	5
Battery Warnings	6
Section III - Fault Conditions and Troubleshooting	6
Watchdog Circuit	6
Section IV - Service and Maintenance	8
Introduction	8
Warranty and Factory Service	8
Fan Screen and Ventilation	9
Fuses	9
Electrical Safety	9
Suggested Preventative Maintenance Schedule	9
Cleaning	10
Electrical/Electronics Description	10
Pneumatic Operation Description	10
Section V - Test Methods and Calibration	10
Test Mode 01 - Burn-In	10
Test Mode Look up Chart	11
Test Mode 02 - General Function Test	11
Test Mode 03 - Pressure Transducer Calibration	11
Test Mode 04 - Pressure Transducer Calibration Verification	11

TABLE OF CONTENTS

Test Mode 05	— Self Test	12
Test Mode 06	— Leak Test	12
Test Mode 07	— Performance Test	12
Test Mode 08	— Manufacturing Test	12

Section VI - General Disassembly / Reassembly 13

Battery Pack (Removal / Installation)	13
Compressor (Removal / Installation)	13
Valve Manifold and Bed Hook (Removal / Installation)	13
Muffler (Removal / Installation)	13
Power Supply Board (Removal / Installation)	13
Fan and Screen (Removal / Installation)	14
Main Controller Board (Removal/Installation)	14

Section VII - Specifications 15

Section VIII - Schematics 16

Figure 1 - Parts Assembly Diagram Exploded View	16
Controller Parts List	17
Figure 2 - Pneumatic & Electrical Schematic	18

Section IX - Purge Diagrams 20

Diagram 01	20
Diagram 03	20
Diagram 02	21
Diagram 04	21

Indications

The SCD EXPRESS™ Compression System is designed to apply intermittent pneumatic compression to increase venous blood flow in at-risk patients in order to help prevent deep vein thrombosis and pulmonary embolism. The System consists of the Controller, the Tubing Sets (provided with the Controller) and single-patient use garments (purchased separately from this Controller). The garments, both leg sleeves and foot cuffs, compress the limbs to enhance venous blood movement. After the compression, the Controller measures the time it takes for the limbs to refill with blood and waits that period of time before the next compression is initiated.

Leg Compression

The use of the SCD EXPRESS Compression System with Leg Sleeves is indicated for:

1. Deep vein thrombosis and pulmonary embolism prophylaxis.

Foot Compression

The use of the SCD EXPRESS Compression System with Foot Cuffs is indicated for:

1. Circulation enhancement.
2. Deep vein thrombosis prophylaxis.
3. Edema – Acute.
4. Edema – Chronic.
5. Extremity pain incident to trauma or surgery.
6. Leg Ulcers.
7. Venous stasis / venous insufficiency.

If you need further information regarding the SCD EXPRESS Compression System or its clinical benefits, please contact your

tyco Healthcare / KENDALL Sales Representative.

Contraindications

Leg Compression

The SCD EXPRESS Compression System may not be recommended for use with Leg Sleeve on patients with the following:

1. Any local leg condition in which the sleeves may interfere, such as: (a) dermatitis, (b) vein ligation [immediate postoperative], (c) gangrene, or (d) recent skin graft.
2. Severe arteriosclerosis or other ischemic vascular disease.
3. Massive edema of the legs or pulmonary edema from congestive heart failure.
4. Extreme deformity of the leg.
5. Suspected pre-existing deep venous thrombosis.

Foot Compression

The SCD EXPRESS Compression System may not be recommended for use with Foot Cuffs on patients with the following:

1. Conditions where an increase of fluid to the heart may be detrimental.
2. Congestive heart failure.
3. Pre-existing deep vein thrombosis, thrombophlebitis or pulmonary embolism.

Use with caution on the infected or insensate extremity.

Cautions

1. Federal (U.S.A.) law restricts this device to sale by or on the order of a physician.
2. Patients with diabetes or vascular disease require frequent skin assessment.
3. Explosion hazard. Not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

WARNING: Do not attempt to repair or replace broken tubing connectors as hazardous inflation of the sleeves may occur.

Kendall's SCD EXPRESS Compression System is protected by one or more of the following U.S. patents: 5,022,387; 5,031,604; 5,478,119; 5,876,359; Des.363,988; Des.364,460; Des.369,664; Des.373,192. Other patents pending. Tyco Healthcare expressly states that no implied license with respect to use of non-Tyco Healthcare components is granted by the sale or lease of this system.

The use of an intermittent pneumatic compression controller with a compression garment to measure venous refill time in a limb, without permission from Tyco Healthcare Group LP, may constitute infringement of Tyco Healthcare's U.S. Patent No. 6,231,532.

Explanation of Symbols Used



Refer to Accompanying Documents

See Instructions

SN

Controller Serial Number



Type BF Protection Against Electronic Shock

REF

Reorder number for the device located on the carton label



Manufacturing Date Code



Vascular Refill Detection occurring while illuminated



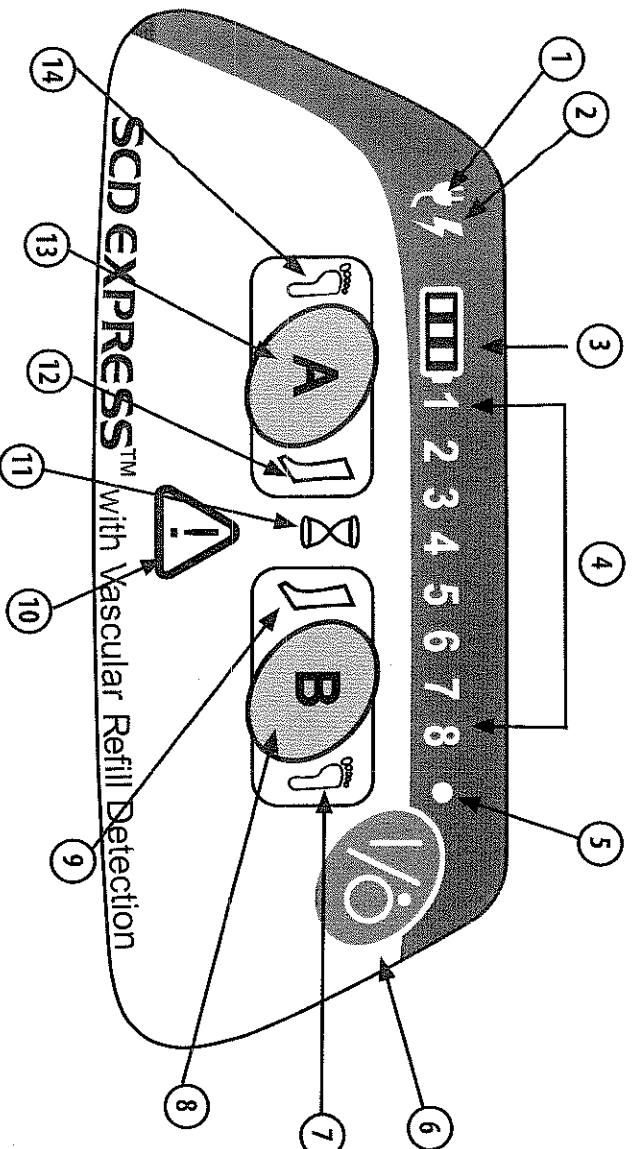
Underwriters Laboratories (UL) Classification mark for Canada and the United States



CE Mark

0123

Front Panel Display



Item	Explanation	Item	Explanation
1	AC Power Indicator	8	Port B Garment Configuration Button
2	Battery Charging Indicator	9	Port B Leg Indicator
3	Battery Status Indicators 1-3	10	Service Required Error Indicator
4	Test Mode/Error Code Indicators 1-8	11	Vascular Refill Assess Indicator
5	Power On Indicator	12	Port A Leg Indicator
6	Power On/Standby Button	13	Port A Garment Configuration Button
7	Port B Foot Indicator	14	Port A Foot Indicator

SCD EXPRESS™

Section I - General Operating Instructions

Set up

- Place the Controller on the footboard via the bed hook or place it on a horizontal surface appropriate for the environment, such as on a table, within reasonable proximity to the point of use. Be sure to allow adequate air flow to the vents located on either end of the controller.
- The controller can operate with one or two garments attached to the patient.
- Plug the tubing set(s) into the back of the controller. Route the tubing toward the patient's limbs, being careful to leave access ways clear and eliminate tripping hazards.
- Plug the tubes into garment(s) wrapped onto the patient's limbs.
- Match the left and right ports with the left and right limbs of the patient. Although the operation of the controller is not affected, troubleshooting can be easier. Check tubing set(s) for kinking and secure attachment at the controller and the garment(s).
- Plug the controller power cord into a properly grounded hospital grade receptacle.

Start-up

- Press the Power On/Standby button to begin normal operation. If using leg sleeves, no further user intervention is required unless there is a fault condition detected or if therapy must be discontinued.
 - The Controller will beep and then flash all the LEDs.
- LED Indicator Sequence:
1. Port A Leg, Port A Foot, Port B Leg, Port B Foot, Vascular Refill, Battery Status 1-3 → GREEN
 2. Port A Leg, Port A Foot, Port B Leg, Port B Foot, Service Required, Battery Status 1 → RED
 3. Error Code/ Test Mode 1-8 → RED
- An automatic valve and pump test will be quickly performed as the system tests microprocessor function and system memory.
 - The pump will begin to operate as part of the Garment Detection procedure.
 - Detection of inoperative LEDs and the audible alarm function at start-up is the user's responsibility.

Garment Configuration & Detection

- After startup, the Garment Configuration procedure allows the user to select when foot compression is required at either of the two Controller ports:
- On the front display, the Port A Leg and Port B Leg indicators for both ports will be flashing green to indicate the default garment configuration (leg compression).
 - Pressing a port configuration button will cause the corresponding port's Leg indicator to turn off and the Foot indicator will be lit to signify foot compression. The port configuration buttons must be pressed for each port that is connected to a foot cuff to turn on the corresponding Foot indicator(s).

Note: Leg sleeve compression is the default garment configuration when the Controller is first powered on. Therefore, the configuration buttons do not have to be pressed to begin compression therapy when leg sleeves are being used.

The configuration buttons need to be pressed only when foot compression is to be used.

Also after startup, the Controller immediately begins conducting the Garment Detection procedure at each port to determine if the garments have been properly attached to the controller:

- If necessary, the port configuration buttons may be pressed again to turn the Foot indicator off and revert back to leg compression.
- During Garment Detection, the compressor and valves are operating and air is delivered out the Controller ports to detect the number and type(s) of garment(s) connected (Leg Sleeve(s) and/or Foot Cuff(s)).
- If the Controller senses a properly attached garment and the type of garment detected matches the User-selected garment (or the default configuration), then the corresponding Port Status indicator (Leg or Foot, A or B side) on the front display will be lit green.
- If the Controller senses a properly attached garment but the type of garment detected does not match the User-selected garment (or the default configuration), then a Garment Mismatch alarm is triggered. Garment Mismatch errors can be corrected by pushing the corresponding Port Configuration button to change the User-selected garment type (Leg or Foot).
- Once the Garment Detection procedure is completed and any garment mismatch errors are addressed, the Port configuration buttons will be disabled and normal operation begins by starting the compression therapy.
- If only one Controller port is connected to a garment for single-limb compression, then the User-selected garment (or the default) configuration setting (Leg or Foot) for the open port will be ignored and both the leg and foot indicators will be turned off after Garment Detection.
- If any garments are not properly detected or if no garments are attached to the Controller, the system will alarm until it is turned off. Check the garment application and tubing connections then restart the Controller if necessary.

Note: If a garment is attached anytime after the Garment Detection procedure has started, the system must be restarted to ensure that the proper therapy will be applied to the limb(s).

Normal Operation

- Verify that the corresponding Port Status Indicators are green for each disposable garment attached to the controller.
- After garments have been successfully detected, the Controller begins the process of applying intermittent compression alternating from one port to the other if two garments are attached. Otherwise, the controller applies compression to only one port when one garment is attached.
- On successive cycles, the controller automatically adjusts its operating parameters to maintain set pressure.

Pressure Settings

- The Controller features microprocessor-controlled automatic pressure adjustment.
- The pressure setting depends on the type of garment: 45 mmHg for Leg Sleeves; 130 mmHg for Foot Cuffs.

Vascular Refill Detection

- The SCD EXPRESS Compression System incorporates Tyco Healthcare's patented "Vascular Refill Detection" method to customize the therapy for each patient's physiology. This system measures the time it takes for the veins in the limb to refill after having been compressed by the system. The time is then used in subsequent cycles as the time between compressions.
- The vascular refill detection method is used when first powering on the System after it reaches set pressure and every thirty minutes thereafter.
- The hourglass-shaped Vascular Refill Indicator on the front display will be illuminated during a measurement cycle.
- The method works best when the patient is still, however it will accommodate movement.
- If an error is detected during any measurement or if the compression is not within the System pressure specifications, the refill time measurement will be repeated after the next compression cycle.
- The time between compressions on the same limb will never be shorter than twenty seconds or longer than sixty seconds.
- If both Controller ports are being used, then the longer of the two measurements will be used to adjust the time between cycles.

Garment Compatibility

The SCD EXPRESS Compression System is designed for use with KENDALL garment Reorder Codes:

- | | |
|--|--|
| • 9545 Leg Sleeve (Small Thigh Length) | • 9545T Leg Sleeve (Small Thigh Length Tear-Away) |
| • 9530 Leg Sleeve (Medium Thigh Length) | • 9530T Leg Sleeve (Medium Thigh Length Tear-Away) |
| • 9780 Leg Sleeve (Large Thigh Length) | • 9780T Leg Sleeve (Large Thigh Length Tear-Away) |
| • 9529 Leg Sleeve (Medium Knee Length) | • 5897 Foot Cuff (Regular Foot) |
| • 9789 Leg Sleeve (Large Knee Length) | • 5898 Foot Cuff (Large Foot) |
| • 9736 Leg Sleeve (Sterile Thigh Length) | |

Further instructions for garment application and use are included with the Leg Sleeve and Foot Cuff packaging.

Tubing Set Compatibility

The garments connect to the Controller via the Tubing Sets provided with the Controller. Additional or replacement Tubing Sets are available as Reorder Code 9528. The Extension Tubing Sets are also available as Reorder Code 9595.

Portable Controller Configuration

- The SCD EXPRESS Compression System Controller can be configured without the bed hook for easier portability. The System can also be used without the cord cover door so that the power cord can be disconnected at the Controller instead of at the AC power wall outlet.
- An optional Shoulder Strap for the SCD EXPRESS Compression System is available as Reorder Code 9527.

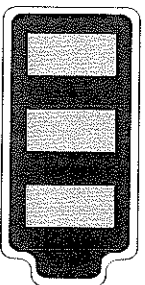
Note: Removal of the bed hook and the cord cover door is described in Section VI — Disassembly and Reassembly.

Section II - Battery Operation

The SCD EXPRESS Compression System is designed to operate normally on AC line power or DC battery power without interruption. If the Controller is equipped with the optional battery pack, there are three Battery Status Indicator LEDs used to represent the charge level of the battery. Once the Controller is powered on, it may take the system a few seconds to establish communication with the battery and display the charge level. If the Controller is not connected to a battery then the indicator lights will remain off.

Note: To prevent a potential shock hazard, the battery compartment should not be left vacant while operating the SCD EXPRESS Compression System. The battery pack, or a dummy pack (if so equipped), must be installed in the controller to prevent the user from having access to the battery's electrical connection.

The battery pack for the SCD EXPRESS Compression System is optional. To order a new or replacement battery please contact Kendall Customer Service.



Battery Indicator Status:

Unit plugged in and Powered On (Charging)

Battery State	Battery Status 1	Battery Status 2	Battery Status 3
100% charge	Green	Green	Green
67-99% charge	Green	Green	Green (Pulsing)
34-66% charge	Green	Green (Pulsing)	Off
0-33% charge	Green (Pulsing)	Off	Off

Unit not plugged in and Powered On (Operating on Battery)

Battery State	Battery Status 1	Battery Status 2	Battery Status 3
67-100% charge	Green	Green	Green
34-66% charge	Green	Green	Off
< 34% charge	Green	Off	Off
15-40 minutes left*	Amber (Flashing)	Off	Off
< 15 minutes left*	Red (Flashing)	Off	Off

* With 15-40 minutes of battery charge left, an alarm will sound in a sequence of three beeps once every two minutes. Once there is less than 15 minutes of battery charge left, the alarm will sound continuously.

Unit Powered Off (Charging when plugged in)

Battery State	Battery Status 1	Battery Status 2	Battery Status 3
0-100% charge	Off	Off	Off

Charging the Battery

The battery will begin charging as soon as the unit is plugged into an AC power source. The amount of time required to charge the battery will vary depending on the battery's overall condition, age, and the controller's state during charging. For example, charging a new, fully drained battery will take approximately 4 hours with the controller on Standby and 8 hours with the controller powered on. The Battery Status indicators should always be used to determine the state of charge for the battery. A fully charged battery will typically provide 6-8 hours of operation time depending on the sleeve configuration, sleeve application, and the battery condition.

Note: If the operation time on battery power is extremely short the battery should be returned for service or replacement.

Note: The battery may sustain permanent damage and become unrecoverable if it is left unused for extended periods of time. It is recommended that the battery pack be stored with a minimum charge of 50% and kept near 25° C (77°F) if prolonged storage is necessary.

Battery Warnings

The SCD EXPRESS Compression System battery pack contains Lithium Ion (Li-Ion) battery cells and must be used properly for safety and to maintain optimal performance.

- Store only between -20°C (-4°F) and 60°C (140°F).
- Do not drop, impact or immerse in water.
- Do not touch or ingest any leaking electrolyte. If contact occurs, rinse skin and/or eyes immediately and seek medical attention if irritation develops. If ingested, contact local poison control center.
- Do not open battery, dispose of in fire, or short circuit. Doing so may cause the battery to ignite, explode, leak, or become hot and cause personal injury.
- Dispose of improperly working or damaged battery packs according to local regulations.
- Charge only with specified chargers according to Kendall's instructions.


Section III - Fault Conditions and Troubleshooting

When the microprocessor detects a fault condition, it interrupts the normal operation of the Controller, deactivates all valves to vent the air from the garment(s), displays a fault code, and sounds an audible alarm. If a Garment Mismatch alarm is triggered the user may remedy the problem by pressing the corresponding port configuration button(s). All other alarms will remain active until the Controller is turned off, or the battery runs out of charge (if operating on battery power).



- The most common Controller alarm is the Garment Pressure alarm, indicated by flashing red Port Status Indicator(s). Garment Pressure alarms can usually be remedied by checking the disposable garment(s) for proper application and tubing set connection(s) for any leaks or kinks, and then restarting the System. However, if the alarm condition persists or if the Service Required Error Indicator is illuminated then the Controller should be returned for service.

Watchdog Circuit

- If the microprocessor cannot continue normal function, the watchdog circuit will trip. This causes the Controller to go into reset and restart normal operation.
- If the cause of the disruption is still present, the unit will continue to attempt to reset which will cause the alarm to sound once every second.
- If the cause of the disruption was transient, such as a high energy RF pulse, the Controller will restart and continue normal operation.

Alarm Code	Fault Type	Description	Troubleshooting
	• Garment Mismatch	• The Garment Detection procedure has detected a garment configuration (Leg or Foot flashing green) that does not match the User-selected configuration (Leg or Foot red).	• Press the port configuration button(s) to turn the foot selection on/off depending on what type of garment(s) is connected to the Controller. • If the proper garment is selected and the problem persists have the Controller serviced by a professional.
1	• System High	• System pressure has exceeded 90 mmHg (Leg sleeve) or 180 mmHg (Foot Cuff).	- Check tubing set for any kinks.
2	• High Pressure	• Leg Sleeve pressure is greater than 47 mmHg after 5 consecutive cycles; Foot Cuff pressure is greater than 135 mmHg after 5 consecutive cycles.	- Check garment application (too loose or tight). - Check tubing connections.
3	• Low Pressure	• Leg Sleeve pressure is less than 43 mmHg after 5 consecutive cycles; Foot Cuff pressure is less than 125 mmHg after 5 consecutive cycles. This alarm will also be triggered when no garments are detected at either Controller port (A or B) during startup.	- Check for leaks in the garment(s) and the tubing. If suspect, substitute a new tubing set or garment(s). - Turn the Controller off and restart - If the problem persists have the Controller serviced by a professional.

Alarm Code	Fault Type	Description	Troubleshooting
4	System Pressure	Leg Sleeve pressure is not between 35 and 55 mmHg for 12 consecutive cycles; Foot Cuff pressure is not between 110 and 150 mmHg for 12 consecutive cycles.	<ul style="list-style-type: none"> -Check garment application (too loose or tight). -Turn the Controller off and restart.
5	Valve Error	If a valve electrically malfunctions, this error will be displayed.	<ul style="list-style-type: none"> -Verify that the valve assembly is properly connected. -Turn the Controller off and restart. -If the problem persists have the Controller serviced by a professional.
6	Software Error	Upon startup, the microprocessor performs diagnostic tests. If the Controller fails to pass these tests this error will be displayed.	<ul style="list-style-type: none"> - Turn the Controller off and restart. -If the problem persists have the Controller serviced by a professional.
7	Pump Error	If the pump electrically malfunctions this error will be displayed.	<ul style="list-style-type: none"> -Verify that the pump is properly connected. -Turn the Controller off and restart. -If the problem persists have the Controller serviced by a professional.
8	Vent Error	The pressure in a garment is greater than 20 mmHg at the end of any vent period. The pressure detected during an inflation cycle does not rise above 5mmHg.	<ul style="list-style-type: none"> - Check tubing for kinks. -Check garment application (too loose or tight). -Check to make sure there are no kinks in the internal tubing. -Turn the Controller off and restart. -If the problem persists have the Controller serviced by a professional.
9 (Battery Indicator 1)	Low Battery Alarm	There is less than 10 minutes of battery charge remaining. The pump and valves will continue to operate for as long as there is enough power.	<ul style="list-style-type: none"> -Plug the Controller into an AC power outlet. -If the problem persists recalibrate or replace the battery pack. The battery can be calibrated by using test mode 01 Burn-In (Section V).

Alarm Code	Fault Type	Description	Troubleshooting
10 Battery Error (Battery Indicator 1) 	Battery Error	If a battery calibration error or battery cell failure is detected this error will be displayed.	<ul style="list-style-type: none"> - Turn the Controller off, plug it into an AC power outlet, and restart. - If the problem persists recalibrate or replace the battery pack.
11 (Error Indicators 5 & 7) 	Temperature Error	If the internal case temperature of the Controller drops below 5° C (41° F) or exceeds 55° C (131° F).	<ul style="list-style-type: none"> - Make sure the controller is not covered and that the fan port is not obstructed. - Turn the Controller off, allow it to cool, and restart. - Verify that the cooling fan is properly connected. - Have the Controller serviced by a professional if the problem persists.

Section IV - Service and Maintenance

This service manual is intended for use as a guide to technically-qualified personnel when evaluating System malfunctions. It is not to be construed as authorization to perform warranty repairs. Unauthorized service will void the warranty.

Introduction

The SCD EXPRESS Controller contains no user serviceable parts. User maintenance is covered in the sections that follow. All other maintenance must be performed by appropriately qualified service technical personnel.

Service technicians should be familiar with the operator's portion of this manual and the operating principles of the SCD EXPRESS Compression System. If a Controller is to be returned to Kendall for service, a description of the operating conditions and the fault code displayed should accompany the unit. The fault codes displayed by the Controller are useful in diagnosing service problems.

This manual describes service procedures to the board level, with an exploded view of the Controller shown in Figure 1. If a component failure on a circuit board is suspected, the unit should be returned for service. It is recommended that the system be returned with the circuit board in place, as removal of the board(s) invokes additional risk of mechanical damage and damage from electrostatic discharge (ESD).

Warranty and Factory Service

Tyco Healthcare Group LP warrants that your SCD EXPRESS Compression System is free from defective material and workmanship. Our obligation under this warranty is limited to the repair of Controllers returned to a service center, transportation charges prepaid, within one year of delivery to the original purchaser. Specifically, we agree to service and/or adjust any Controller as required if returned for that purpose, and to replace and repair any part which, upon our examination, is proven to have been defective. This warranty does not apply to the Tubing Set or the disposable garments, or to equipment damaged through shipping, tampering, negligence, or misuse, including liquid immersion, autoclaving, ETO sterilization, or the use of unapproved cleaning solutions.

To the extent permitted by applicable law, this limited warranty does not cover, and is intended to exclude, any and all liability on the part of the Company, whether under this limited warranty or any warranty implied by law, for any indirect or consequential damages for breach hereof or thereof. Except as expressly provided above in the limited warranty, to the extent permitted by applicable law, the Company hereby negates and disclaims all express and to the extent permitted by applicable law, implied warranties, including the warranties of merchantability and fitness for a particular purpose.

Controllers requiring repairs should be sent to a service center. Call one of the service centers listed. Obtain a return material authorization number and ship the controller, prepaid and insured in the original carton.

CANADA

Tyco Healthcare Group Canada
 7500 Hans Canada Highway
 Pointe-Claire, QC H9R 5H8
 877-664-TYCO (8926)

UNITED STATES

Tyco Healthcare Group LP
 98-6 Fairhwy Drive
 Watertown, NY 13601
 (800) 448-0190 or (315) 788-5246

Outside U.S. and Canada

Tyco Healthcare Group LP
 20 Garyduff Road
 Ballymore, BT53 7AP
 00-44-(0)-2827-661719 Service Center.
 00-44-(0)-1329-224226 Customer Care

Fan Screen and Ventilation

CAUTION: Unplugging the Controller and remove the battery pack (see Section VI) before fan screen maintenance.

It is very important that the fan screen be cleaned as required to ensure continued trouble-free operation. The Controller should never be run without the fan screen in place. To clean the fan screen, follow the instructions later in this manual in the "Fan and Screen (Removal/Installation)" Section to first remove the fan screen. Brush any loose dirt and lint from the surface of the screen. Reinstall the fan and screen, making sure the gasket material is oriented so as to prevent the screen from touching the fan directly.

During system use, obstruction of the fan cover and vents should be avoided. Free flow of air is necessary to prevent overheating and premature component failure.

Fuses

CAUTION: Unplug the Controller and remove the battery pack (see Section VI) before replacing the fuse(s).

Blown fuses should only be replaced by those indicated on the power supply board near the location of the fuses at the AC inlet. Use only 1.6 A, 250VAC, 5x20mm Sio Bio fuses. The use of fuses that have the Senko and/or VDE marking is preferred. If a fuse blows a second time, it should be presumed that the Controller is defective and requires further service. Please contact your service center. Fuses are not accessible from the outside of the controller. Refer to the Disassembly/Reassembly procedures later in the manual. The fuses are located on the power supply board as part of the power inlet module under the fuse cover.

Electrical Safety

CAUTION: Be sure the Controller is disconnected from the power source (AC line power and DC battery power) before any disassembly. A potential SHOCK HAZARD exists when the front cover is removed even with the unit turned off.

Note: The power supply cord/plug serves as the electrical supply mains disconnect device.

The system should be periodically inspected to ensure its electrical safety. Check the resistance of the power cord ground from the plug to the IEC 60320 connector. This resistance should not exceed 0.1 ohm. If ground resistance exceeds this value or the insulation integrity of the unit has been compromised through mechanical damage, the Controller should be returned to a service center for testing and repair.

* The SCD EXPRESS was designed to provide sufficient isolation inside the controller between all exposed metal components and the electrical supply mains. As a result there is no externally accessible ground on the device. The recommended electrical safety test for proper grounding is a resistance check of the power cord ground.

Suggested Preventative Maintenance Schedule

After Any Repair		Once Per Year
Inspect and Clean Fan Screen		As Required
Verify Transducer Calibration (Test Modes 03 and 04)	X	X
Electrical Safety Tests	X	X
Leak Test (Test Mode 06)	X	
General Function Test (Test Mode 07)	X	

Cleaning

The Controller cabinet can be cleaned with a soft cloth dampened with water. If necessary, a mild disinfectant and/or detergent can be used, excess fluid should be avoided. The Controller should be wiped with a clean, dry cloth afterward. Do not immerse in any liquid. Do not use products containing ammonium chloride, acetone or other aromatic solvents, as those chemicals will degrade the integrity of the case and cause it to become embrittled and possibly crack.

The SCD EXPRESS Compression System cannot be effectively sterilized by liquid immersion, autoclaving, or ETO sterilization, as irreparable damage to the System will occur.

Electrical/Electronics Description

Line voltage is fed into the controller through the power cord to the power supply mounted on the Power Supply PC Board in the rear case of the controller. It is important to disconnect the power cord at the outlet before opening the controller case. Exposure to high voltage on the Power Supply PC Board is likely to occur if it is electrically live.

The power supply converts AC line voltage, 100 to 240 VAC, to DC voltage to power the controller components, including the main Controller PC Board that is mounted onto the front case. Alternately, the main Controller PC Board may be directly powered by the optional battery pack. The Controller PC Board controls all functionality of the system and includes the transducer and buzzer. It does not contain any high voltage. The buttons and indicator LEDs on the front display of the controller are integrated into the membrane panel which connects to the Controller PC Board.

Kendall does not recommend any attempt to repair printed circuit boards. In manufacturing, extensive testing is performed that cannot be duplicated in the field without specialized equipment. Improper repair could result in patient or user hazards.

Pneumatic Operation Description

When the controller is turned on, the compressor operates and the valves are cycled to determine which type of garment is connected. After garment detection has completed, an inflation cycle is initiated, releasing air through the set of valves, mounted to a manifold. A transducer monitors the pressure in the garments. The reading from the transducer assists the controller in adjusting the pump's motor speed to deliver the proper pressure to the garments in the appropriate amount of time.

Section V - Test Methods and Calibration

The SCD EXPRESS Compression System has various test modes that can be accessed by the service technician. They are intended for use by qualified personnel. To activate the test modes follow these steps for entering "Test Access Mode":

1. Plug the controller into an outlet supplying the appropriate line voltage. Do not activate the test modes while operating on battery power.
2. Press the Port A and Port B configuration buttons at the same time while turning the controller on.
3. The buzzer will beep and the test Mode 01 indicator will illuminate signifying "Test Mode 01".

Note: The Error Code Indicators 1-8 double as Test Mode Indicators 1-8.

4. The user can cycle through the test modes by pressing the Port A button. Each test mode is indicated by the illumination of the corresponding test mode indicator number. Pressing the Port A button with the last test mode number illuminated (Test Mode 08) will cycle the test mode back to Test Mode 01.
5. After selecting the desired test mode, the Port B button can be pressed to initiate the test.
6. If test access is entered but no test mode is selected within 2 minutes, it is assumed that the test access mode was entered inadvertently and a Low Pressure alarm will be triggered.
7. If a test mode is entered and left idle for 5 minutes the unit will revert back to test access mode selection.
8. To exit Test Access Mode, turn the controller off.

Test Mode 01 - Burn-In

Note: Burn-In mode is used in manufacturing to ensure proper assembly, to identify premature failures and to calibrate the battery pack. This mode is not generally used outside of the manufacturing environment.

1. Verify nothing is plugged into the ports on the back of the controller and enter test access mode. Select Test Access Mode 01.
2. Press the Port B button to begin Burn-In. The compressor will operate and the valves will actuate, releasing air out of the ports. The process repeats continuously until the Burn-In period is complete (approximately 16 hours).
3. The battery, if equipped, will be discharged then charged for calibration during Burn-In.
4. When 16 hours of Burn-In is completed the controller will go into alarm mode, flashing Test Access Mode 01 red, and the Port A Leg, Port A Foot, Port B Leg, Port B Foot indicators green. The buzzer will not pip during this alarm.

Test Mode Look up Chart

01 – Burn-In Feature	05 – Self Test
02 – Functional Test	06 – Leak Test
03 – Pressure Transducer Calibration	07 – Performance Test
04 – Pressure Transducer Calibration Verification	08 – Manufacturing Test

Test Mode 02 - General Function Test

1. With nothing plugged into the ports on the back of the controller, enter test access mode. Select Test Access Mode 02.
2. Press the Port B button to begin the test.
3. Pressing the Port A button during this test will cause each one of the LEDs to illuminate one at a time in succession and the alarm to pip.
4. Pressing and holding the Port B button will increase the pump speed to its maximum in 4-5 seconds.
5. Releasing the Port B button will allow the pump to decrease its speed.
6. The valves will actuate in succession (valve #1 through valve #6) for two seconds each.

Test Mode 03 - Pressure Transducer Calibration

Note: The transducer used in the SCD EXPRESS Compression System is a state-of-the-art, highly precise and virtually drift free device. Factory calibration certification is void if the case is opened. Recalibration is rarely required and should be done only when necessary. Always perform test 04 before test 03 to verify the pressure transducer calibration.

Required Equipment: A regulated, precision air source accurate to ± 0.1 mmHg over a range of 0 to 130 mmHg.

1. With nothing plugged into the ports on the back of the controller, enter test access mode. Select Test Access Mode 03.
2. Press the Port B button to begin the test.
3. Test Mode 03 indicator will flash red until the calibration procedure is completed or an error condition occurs.
4. Valve #1 will be energized throughout the procedure, so that the user can verify the calibration of the pressure transducer with the controller case open or closed. The pressure standard can either be directly connected to the transducer with the case open, or it can be attached to the Bladder #1 location at Port A with the case closed. The Bladder #1 location is the left-most fitting within Port A (as viewed from the back of the Controller).
5. Test Mode 04 indicator is lit red to signal that the unit is ready for the 0 mmHg calibration. After all air pressure is disconnected to zero the transducer, press the Port B button to complete calibration for this range.
6. Test Mode 05 indicator is lit red to indicate that the unit is ready for the 18 mmHg calibration. After 18 mmHg (± 0.1 mmHg) of air pressure is applied to the transducer, press the Port B button to complete the calibration for this range.
7. Test Mode 06 indicator is lit red to indicate that the unit is ready for the 45 mmHg calibration. After 45 mmHg (± 0.1 mmHg) of air pressure is applied to the transducer, press the Port B button to complete the calibration for this range.
8. Test Mode 07 indicator is lit red to indicate that the unit is ready for the 130 mmHg calibration. After 130 mmHg (± 0.1 mmHg) of air pressure is applied to the transducer, press the Port B button to complete the calibration for this range.
9. Upon completion, the new calibration values are recorded into memory and the unit beeps and reverts back to Test Access Mode.
10. If the calibration test mode is exited before the process is completed, the previous calibration values remain unchanged.

Test Mode 04 - Pressure Transducer Calibration Verification

Note: The transducer used in the SCD EXPRESS Compression System is a state-of-the-art, highly precise and virtually drift free device. Factory calibration certification is void if the case is opened. Recalibration is rarely required and should be done only when necessary. Always perform test 04 before test 03 to verify the pressure transducer calibration.

Required Equipment: A regulated, precision air source accurate to ± 0.1 mmHg over a range of 0 to 130 mmHg.

1. With nothing plugged into the ports on the back of the controller, enter test access mode. Select Test Access Mode 04.
2. Press the Port B button to begin the test.
3. Test Mode 04 indicator will flash red until the calibration procedure is completed or an error condition occurs.
4. Valve #1 will be energized throughout the procedure, so that the user can verify the calibration of the pressure transducer with the controller case closed. The pressure standard can be directly connected to the Bladder #1 location at Port A with the case closed. The Bladder #1 location is the left most fitting within Port A (as viewed from the back of the Controller).

Note: For each of the calibration verification ranges, if the supplied pressure is less than the specific calibration range then the Port A Leg indicator will light red. If the supplied pressure is greater than the specific calibration range then the Port B Leg indicator will light red. When the supplied pressure is within the calibration range, then both the Port A Leg and Port B Leg indicators will light green.

5. Test Mode 05 indicator is lit red to indicate that the unit is ready for the 0 mmHg calibration verification. With no pressure applied to the transducer, press the Port B button to complete the verification for this range.
6. Test Mode 06 indicator is lit red to indicate that the unit is ready for the 18 mmHg calibration verification. Apply 18 mmHg (± 0.1 mmHg) then press the Port B button to complete the verification for this range.
7. Test Mode 07 indicator is lit red to indicate that the unit is ready for the 45 mmHg calibration verification. Apply 45 mmHg (± 0.1 mmHg) then press the Port B button to complete the verification for this range.
8. Test Mode 08 indicator is lit red to indicate that the unit is ready for the 130 mmHg calibration verification. Apply 130 mmHg (± 0.1 mmHg) then press the Port B button to complete the verification for this range.
9. Upon completion the unit beeps and reverts back to Test Access Mode.

Test Mode 05 - Self Test

1. Enter Test Access Mode and press the Port A button until Test Access Mode 05 is selected.
2. Press the Port B button to begin the self test.
3. The Test Mode 05 indicator will flash until the test is completed.
4. The alarm will pip and the unit will perform the full array of tests performed during Start-up.

Test Mode 06 - Leak Test

The pressure decay/leak test will determine if there are any significant leaks in the system (including the pneumatic circuitry inside the controller and the connections with the tubing set).

1. Attach a tubing set connected to leg sleeves wrapped around appropriately sized leg forms.
2. Enter Test Access Mode and press the Port A button until Test Access Mode 06 is selected.
3. Press the Port B button to begin the Leak Test.
4. The Test Mode 06 indicator will flash until the test is completed.
5. The controller will inflate all the bladders for port A (Valves #1-3) at the same time to 45mmHg and then vent down to 5-7 mmHg.
6. The unit will then hold the pressure for 40 seconds, while reading the pressure at 20 seconds and 40 seconds. (The alarm will pip at the start of the leak test and at the 20-second and 40-second intervals.)
7. If there is a significant pressure drop over that 20-second time period, a Low Pressure alarm will be triggered.
8. If no leak is detected, the unit will repeat the leak test for Port B (Valves #4-6).
9. If no leaks are detected at either port then the system will simply beep and return to Test Access Mode.

Test Mode 07 - Performance Test

When in this mode, the user can verify the pump and valve performance, pressure delivery, and the airflow through the pneumatic circuit. In manufacturing, this test is conducted with known volumes connected to the sleeve ports. Then the inflation cycles run during the test at the low and high pump speeds create backpressures in the volumes that are measured and used to verify system performance.

1. Attach a tubing set connected to leg sleeves wrapped around appropriately sized leg forms.
2. Enter Test Access Mode and press the Port A button until Test Access Mode 07 is selected.
3. Press the Port B button to begin the Performance Test.
4. The Test Mode 07 indicator will flash until the test is completed.
5. After initiating the performance test, the Port A Leg indicator will flash green in sync with an audible alarm.
6. After the Port B button is pressed the Port A Leg indicator will be lit green, the alarm will stop, and the controller will then go through a normal inflation cycle at Port A with the pump operating at a low speed throughout the cycle.
7. Next, the Port B Leg indicator will flash green in sync with an audible alarm.
8. After the Port B button is pressed, the Port B Leg indicator will be lit green, the alarm will stop, and the controller will then go through a normal inflation cycle at Port B with the pump operating at a high speed throughout the cycle.
9. Upon completion the unit beeps and reverts back to Test Access Mode.

Test Mode 08 - Manufacturing Test

Note: Manufacturing Test mode is used in manufacturing with specialized test equipment to ensure proper assembly and performance. This mode is not designed for use outside of the manufacturing environment.

Section VI - General Disassembly / Reassembly

Warning: Always make sure the power cord is unplugged and the battery is removed before attempting to perform any installation or removal procedures.

- Follow ESD (Electrostatic Discharge) safety procedures to protect the electronics located within the controller.
- Remove the power cord cover by first removing the retaining screw on the cord cover door.
- Slide the cord cover door off by pressing the door to the right.
- Remove the power cord by rocking back and forth until the cord is loose.
- Remove the five (5) screws that hold the front cover to the rear cover with a Phillips head screwdriver.
- The front cover may now be carefully pulled away. To separate the front and rear covers, reach in and remove the transducer tube from the transducer on the front cover. (Diagram 01)
- Observe and note the locations of all tubing and wiring harnesses for ease in reassembly.
- If required, disconnect the electrical connectors and tubes so the two case halves can be separated completely.
- Reassembly is the reverse of disassembly.

Battery Pack (Removal / Installation)

- Remove the battery pack screw located on the bottom center of the rear case of the controller.
- Slide the battery pack out by pulling on the tab on the bottom, right side of the unit.
- Installation is the reverse of removal.

Compressor (Removal / Installation)

- The compressor is not a user serviceable component. Do not disassemble. Do not oil. The compressor is mounted to its own separate bracket that, in turn, mounts through the inside of the battery compartment in the rear case of the controller.
- Disconnect the pump wiring harness from the Controller Board on the front case.
- Disconnect the compressor output tube at the check valve. (Diagram 02)
- Remove the compressor intake tubing from the muffler port. (Diagram 02)
- Remove the two (2) screws from the compressor mounting bracket. (Screws are accessible through the right side battery compartment once the battery pack is removed.) (Diagram 01)
- Slide the entire compressor assembly out of the rear case housing.
- Installation is the reverse of removal.

Valve Manifold and Bed Hook (Removal / Installation)

- The valve manifold is located in the center of the controller on the rear case. It is a plastic manifold block with six solenoid valves. No attempt should be made to repair a damaged manifold or valve. Return the entire assembly for repair or replacement.
- Inspect tubes that lead to the manifold for kinks and proper attachment before performing any work. Detach all tubing from the manifold fittings. Note the location of connections and the tubing routing for ease of reassembly.
- Disconnect the valve wiring harness from the Controller Board on the front case.
- Remove the two side screws from the valve manifold assembly and then pull the bed hook away from the rear case. (Diagram 03)
- Remove the center screw from the manifold assembly and remove the valve manifold.
- Some wires may be secured to the manifold with wire ties. Be prepared to reattach these wires after reinstalling the assembly. New wire ties will be required.
- Installation is the reverse of removal.

Muffler (Removal / Installation)

- The muffler is a custom plastic part used to keep the Kendall SCD EXPRESS Compression System running quietly.
- To remove the muffler detach the compressor intake tubing and slide the muffler out from under the power board.
- For reinsertion of the muffler be sure to route the intake tubing properly. (Diagram 02.) Tubing must be run between the muffler and the right side of the rear case to avoid kinking.

Power Supply Board (Removal / Installation)

CAUTION: Use a grounded strap when handling any electronic components.

- The power supply has no user serviceable parts except for the fuses. No attempt should be made to repair a damaged supply. Return to the factory for repair or replacement.
- Disconnect the 4-pin controller board wiring harness from the power board.
- Remove the muffler as described in "Muffler (Removal/Installation)."

- The power supply board is held in place by channels on the side of the rear case as well as retaining brackets on the front case.
- To remove the power board slide the board out from the rear case.
- Installation is the reverse of removal.

Fan and Screen (Removal / Installation)

- Disconnect the 2-pin fan connector from the power board.
- Observe the angle and orientation of the fan and screen prior to removal to ease reassembly. (Diagram 04)
- Slide the fan and screen out of the case by pulling straight out.
- Installation is the reverse of removal. For optimum cooling and quietness, use only Kendall replacement fans.

Main Controller Board (Removal/Installation)

CAUTION: Use a grounded strap when handling any electronic components.

- The main CPU board has no user serviceable parts. No attempt should be made to repair a damaged board. Return to the factory for repair or replacement.
- Disconnect the 4 pin controller board wiring harness from the power board.
- The main CPU board is located on the front cover and is held in place with two screws.
- Disconnect the two membrane ribbon cables by sliding them out of the connectors on the controller board.
- Remove the controller board.
- Installation is the reverse of the removal.

Section VII - Specifications

SCD EXPRESS Compression System

Safety Standards

Built to UL60601-1, CSA-C22.2 No. 601.1-M90, EN60601-1, and IEC 60601-1-2 Standards
UL Classified File # E189131

UL Device Classification

Class I Equipment
Internally Powered, Portable
Type BF Applied Parts
Not AP or AFG Equipments

Mode of Operation

Continuous

Ingress of Water Protection

Ordinary, IPX0 (IEC 529)

Compression Type

Leg Sleeves: Sequential, Gradient
Foot Cuffs: Uniform

Compression Cycle

Leg Sleeves: 11 Seconds Compression
Foot Cuffs: 5 Seconds Compression
Decompression time based upon Vascular Refill Detection measurement

Set Pressure

Leg Sleeves: 45 mmHg
Foot Cuffs: 130 mmHg

Bed Hook

Yes (Optional)

Power Cord Storage

Yes

Audible/Visual Alarms

Low Pressure, High Pressure, Internal Electronics Malfunction

Power Cord

Hospital Grade Plug

Controller Dimensions:

Height: 6.2 inches (15.8 cm)
Width: 7.0 inches (17.8 cm)
Depth: 4.5 inches (11.4 cm)

Controller Weight

3.5 lbs. (1.6 kg)

Power Requirements

100-240 VAC, 50VA, 50/60 Hz

Battery

16.4 V, 2000mAhr, Lithium Ion (Optional)
Run Time: 6-8 hours
Charge Time: 4 hours (charging only)

Shoulder Strap

Yes (Optional)

Shipping Unit

Each

Shipping Case Dimensions

Height: 11.6 inches (29.4 cm)
Width: 9.0 inches (22.8 cm)
Depth: 11.4 inches (28.9 cm)

Shipping Weight

7 lbs. 6 oz. (3.45 kg)

Tubing Set

Included, set of two individual assemblies

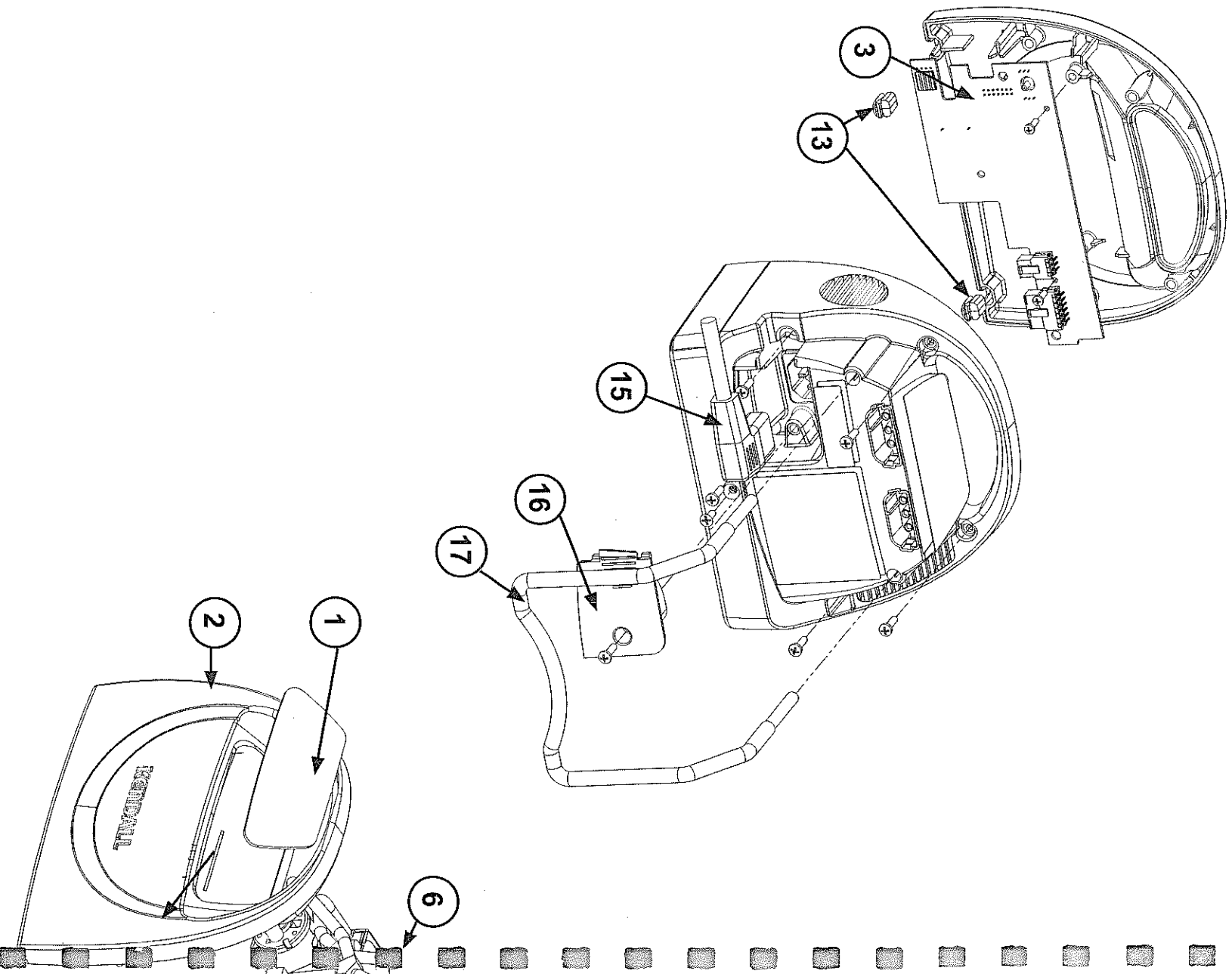
Operation & Service Manual

Included

Transport & Storage

0°C (32°F) to 50° C (122°F)
If the user suspects that the environment conditions for transport and storage have been exceeded, return the unit for service.

Figure 1 - Parts Assembly Diagram - Exploded View



- Controller Parts List**
- | | |
|----------------------------|----------------------------|
| 1. Front Membrane Panel | 10. Fan |
| 2. Front Enclosure | 11. Fan Screen |
| 3. Main Controller Board | 12. Rear Enclosure |
| 4. Valve/Manifold Assembly | 13. Rubber Feet (Set of 2) |
| 5. Wire Barrier | 14. Battery Pack |
| 6. Compressor Assembly | 15. Power Cord |
| 7. Power Supply Board | 16. Cord Capture Door |
| 8. Fuses (Set of 2) | 17. Bed Hook |
| 9. Muffler | |

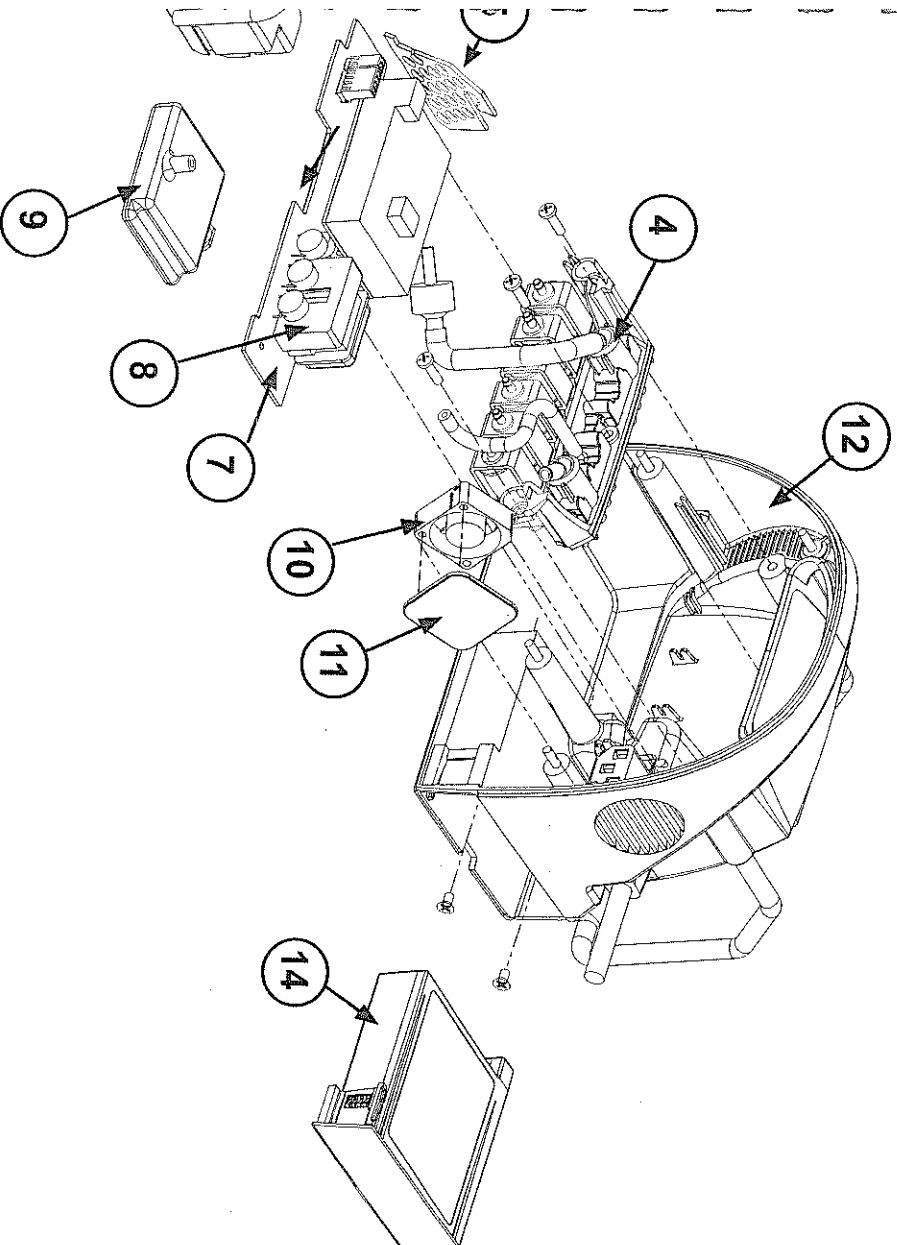
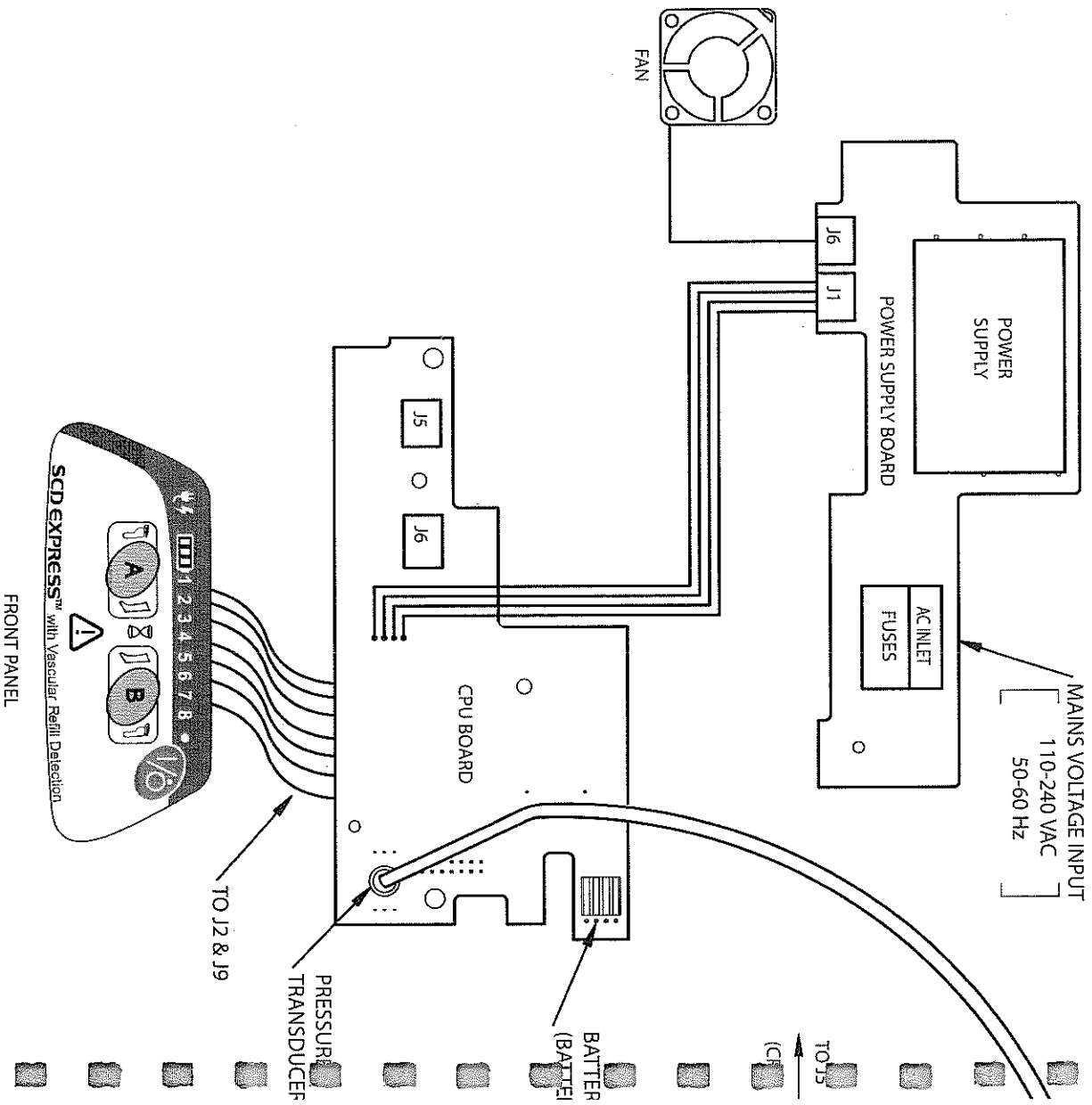
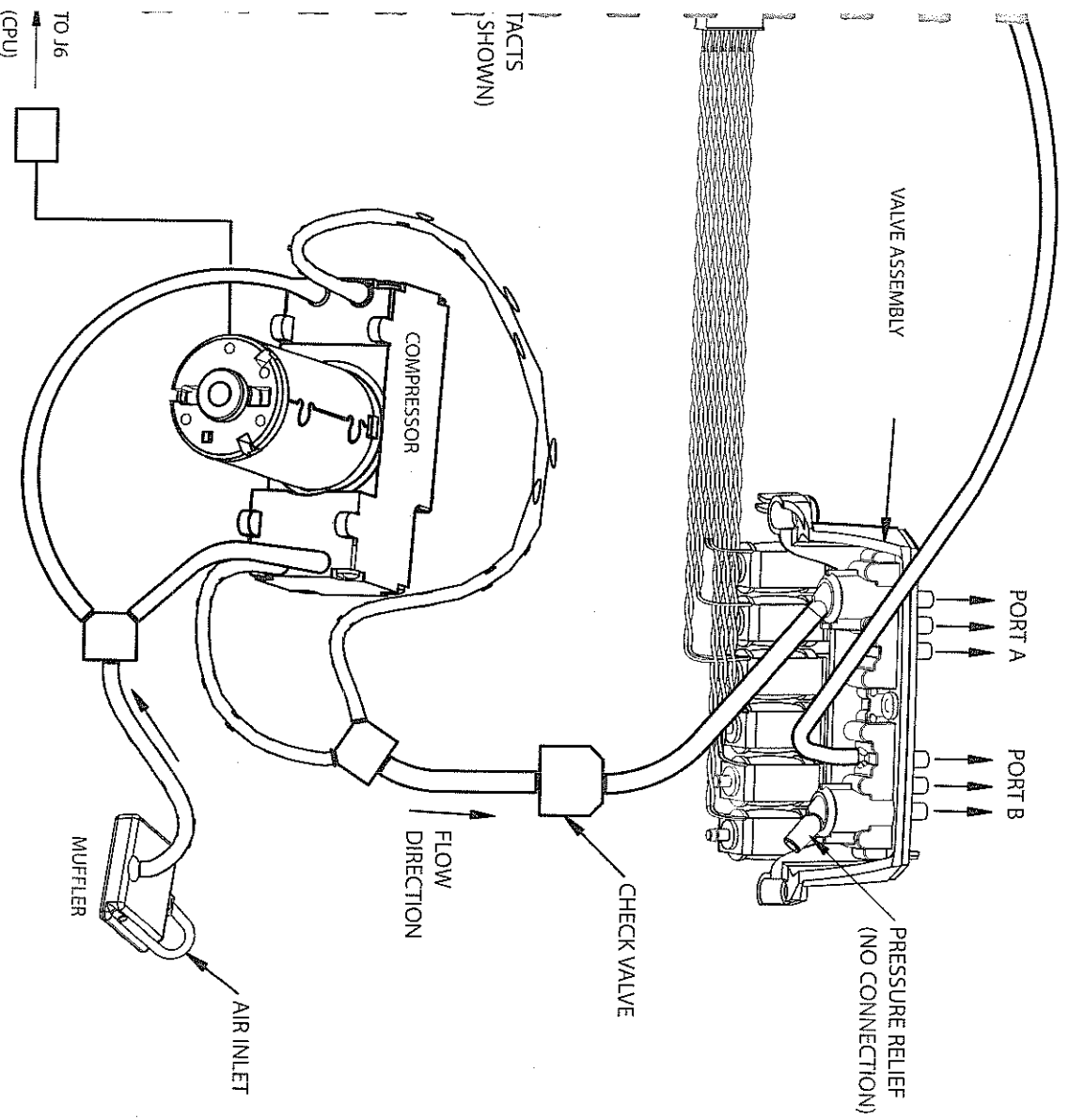


Figure 2 - Pneumatic & Electrical Schematic





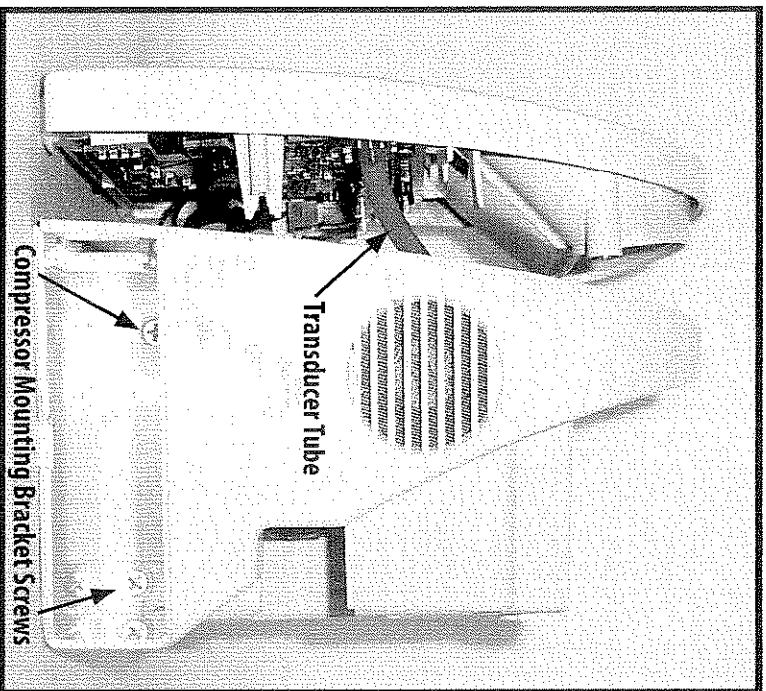


Diagram 01

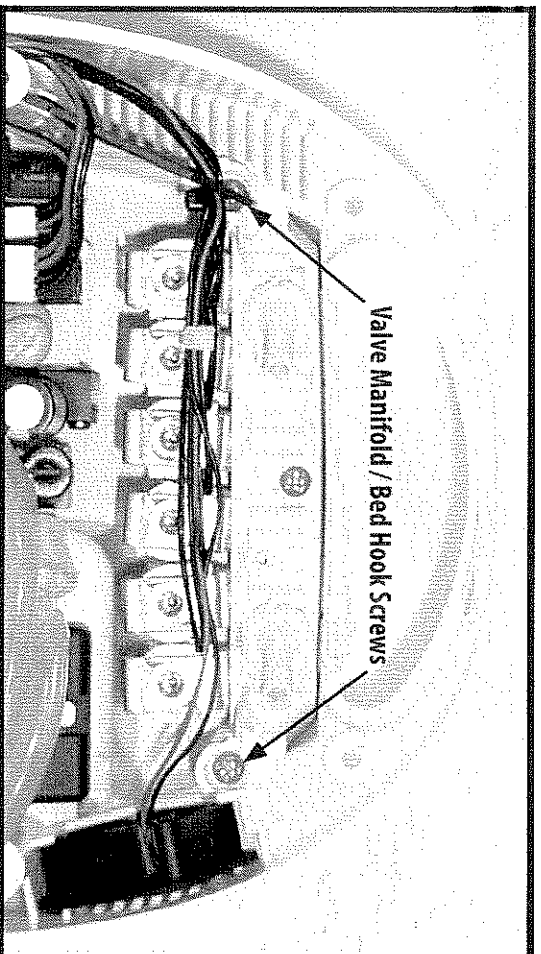


Diagram 03

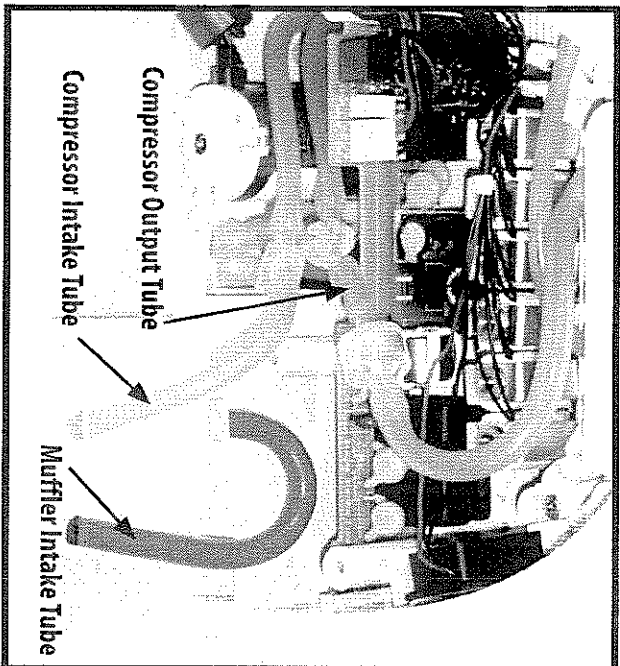


Diagram 02

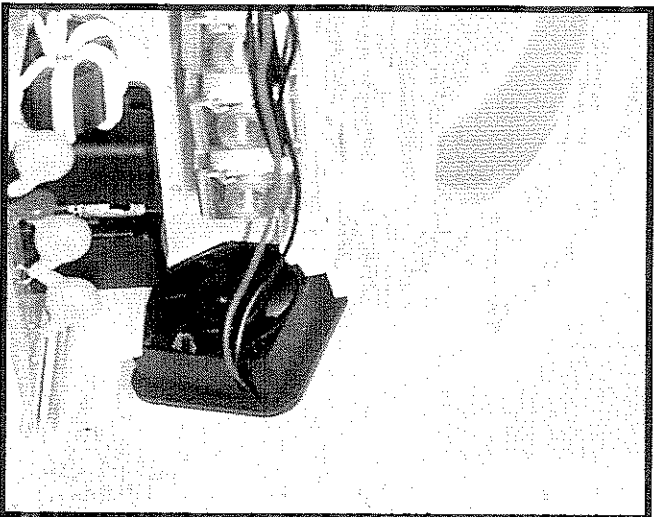


Diagram 04

The SCD EXPRESS Compression System has been built and tested according to UL60601-1, E181931 CSA-C22.2 No.601.1-M90, and EN60601-1-2 Standards.

Emissions Test	Compliance	Electromagnetic Environment - Guidance
Radio Disturbance Emissions - 30 to 1000MHz Electric Field EN55011	Group 1 Class B	The SCD EXPRESS Compression system uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
Conducted Disturbance Emissions - Voltage (EN 55011)	Group 1 Class B	The SCD EXPRESS Compression System is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes
Radiated Disturbance Immunity (EN60601-1-2 / IEC 61000-4-3:2002)	Complies	
Conducted Disturbance Immunity (EN60601-1-2 / IEC 61000-4-6:2001)	Complies	
Power Frequency Magnetic Field Immunity (EN60601-1-2 / IEC 61000-4-8:2001)	Complies	
Voltage dips and sags Immunity (EN60601-1-2 / IEC 61000-4-11:2001)	Complies	
Electrical Fast Transient / Bursts Immunity (EN60601-1-2 / IEC 61000-4-4:2001)	Complies	
Electrostatic Discharge Immunity (EN60601-1-2 / IEC 61000-4-2:2001)	Complies	
Surge Immunity (EN60601-1-2 / IEC 61000-4-5:2001)	Complies	
Voltage Fluctuations/Flicker EN61000-3-2 A1: 2001/ EN61000-3-3 A1: 2001	Complies	
Harmonic Current Emissions EN 61000-3-2:2001/ EN61000-3-2: 2001	Complies	



™ Trademark of Tyco Healthcare Group LP or its affiliate
TYCO HEALTHCARE GROUP LP ■ MANSFIELD, MA 02048 ■ MADE IN U.S.A. ■ © 2005 TYCO HEALTHCARE GROUP LP.
ALL RIGHTS RESERVED. 050516 ■ PRODUCT INFORMATION IN U.S. 1-800-962-9888 ■ www.TycoHealthcare.com
■ EC REP TYCO HEALTHCARE U.K. LTD, GOSPORT, P0130AS, U.K. ■ SWISS DISTRIBUTOR: TYCO HEALTHCARE
SWITZERLAND LTD, ROOSTRASSE 53, POSTFACH CH-8832, WOLLERAU SWITZERLAND