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Service Manual

This REMstar Plus with C-Flex CPAP system is the subject of U. S. patents #5239995 and #6105575. Other patents pending. REMstar is a registered trademark of Respironics, Inc. The C-Flex mark is used under license.

Limited Warranty

Respironics warrants that the REMstar Plus with C-Flex CPAP device shall be free from defects of workmanship and materials and will perform in accordance with the product specifications for a period of two years from the date of sale by Respironics. If the product fails to perform in accordance with the product specifications, Respironics will repair or replace - at its option - the defective material or part. Respironics will pay customary freight charges from Respironics to the dealer location only. This warranty does not cover damage caused by accident, misuse, abuse, alteration, and other defects not related to materials or workmanship.

Respironics disclaims all liability for economic loss, loss of profits, overhead, or consequential damages which may be claimed to arise from any sale or use of this product. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty is given in lieu of all other express warranties. In addition, any implied warranty, including any warranty of merchantability or fitness for the particular purpose, is limited to two years. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

The warranty for repairs is ninety days for labor and one year on the part(s) that was replaced.

To exercise your rights under this warranty, contact your local authorized Respironics Inc. 1001 Murry Ridge Lane, Murrysville, Pennsylvania 15668, 1-800-345-6443 (USA and Canada only) or 1-724-387-4000.

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Overview: REMstar Plus with C-Flex Service Manual

Warranty	Details the Respironics warranty.
Chapter 1: Introduction	Introduces the REMstar Plus with C-Flex CPAP System.
Chapter 2: Warnings, Cautions, and Notes	Lists the Warnings, Cautions, and Notes.
Chapter 3: Specifications, Features, Descriptions, and Theory of Operation	Describes the theory of operation for the system including basic operations of the subsystems.
Chapter 4: System Setup Procedures	Details system setup, including instructions on the Therapy Menu Display Screens and Required, Alternate, and Optional Patient Accessories.
Chapter 5: Routine Maintenance	Provides cleaning and routine maintenance instructions.
Chapter 6: Troubleshooting and Diagnostics	Provides troubleshooting flow charts and error code definitions.
Chapter 7: Repair and Replacement	Describes detailed procedures of removing and installing all major components within the unit, including graphics and photographs for visual identification.
Chapter 8: Testing	Includes Run-In, Pressure and Flow Calibration, CPAP Final Test, Heated Humidifier Test, Current Draw Test and Data Sheet.
Appendix A: Tools and Equipment	Details the necessary tools and test equipment required for servicing.
Appendix B: Schematics	Provides Printed Circuit Assembly (PCA) schematics.

NOTE: Schematics are proprietary and are used for reference only.

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Chapter 1: Introduction

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Chapter 1: Introduction

1.1 REMstar Plus with C-Flex CPAP System Overview

The REMstar Plus with C-Flex CPAP system, shown in Figure 1-1, is a microprocessor-controlled device that delivers Continious Positive Airway Pressure (CPAP) therapy only for the treatment of adult Obstructive Sleep Apnea (OSA). CPAP provides a constant level of positive pressure throughout the breathing cycle to pneumatically splint the airway open. C-Flex improves CPAP therapy by tracking the patient's breathing to lower the amount of pressure delivered at exhalation. Patients can select one of three C-Flex level settings to best suit their needs.

The unit incorporates a user interface made up of a Liquid Crystal Display (LCD), five tactile feedback user control keys, and three Light-Emitting Diodes (LED). The LEDs may be used as either system alert/alarm indicators and as back lighting for the user interface control keys. The unit may be operated using either AC (100 - 240 VAC) or DC (11 - 17 VDC) power.

Warning: DC power can be used only when the REMstar Plus with C-Flex CPAP System is used independently of the Heated Humidifier.

Figure 1-1
REMstar Plus with C-Flex

1.2 Service Notice

This service manual was prepared by Respironics primarily for use by technicians to service the REMstar Plus with C-Flex CPAP system.

The individuals using this manual to service the REMstar Plus with C-Flex CPAP system should have prior training or experience servicing ventilatory devices.

1.3 Technical Support Statement

Respironics is committed to customer satisfaction and may be contacted with any questions or for technical support. For technical assistance or replacement part ordering information contact Respironics Customer Satisfaction.

U.S.A. and Canada

Phone:1-800-345-6443
Fax: 1-800-886-0245

International

Phone: 1-724-387-4000
Fax: 1-724-387-5012

Email: service@respironics.com

1.4 Training

Respironics offers service training for BiPAP and CPAP systems. For more information, Email Respironics at:

service.training@respironics.com

Visit Respironics Home Page on the World Wide Web at:

www.respironics.com

Chapter 2: Warnings, Cautions, and Notes

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Notes

Chapter 2: Warnings, Cautions, and Notes

WARNING:	Indicates the possibility of injury to the patient, operator, or technician.
CAUTION:	Indicates the possibility of damage to the device.
NOTE:	Places emphasis on an operating characteristic.

2.1 WARNINGS

2.1.1 Safety

- This device is intended for adult use only.
- This device is not intended for life support or life sustaining applications.
- The instructions in this manual are not intended to supersede established medical protocols.

2.1.2 Operational

- This warning applies to most Continuous Positive Airway Pressure (CPAP) devices. At low CPAP pressures, the air flow through the exhalation port may not be enough to clear all of the exhaled gas (CO_2) from the mask. You may breathe in some of the air that you have exhaled.
- If oxygen is used with this device, the oxygen flow must be turned off when the device is turned off. If the device's air flow is turned off and the oxygen flow is left on, oxygen may accumulate in the REMstar Plus with C-Flex CPAP system enclosure and may create a risk of fire. This warning applies to most types of CPAP devices.
- When supplemental oxygen is used at a fixed flow rate, inhaled oxygen concentrations will vary depending on pressure settings, patient breathing patterns, mask selection, and leak rate.

Warnings (Continued)

- Oxygen supports combustion. Do not use oxygen in the presence of open flames, cigarette smoke, electrical spark, or other sources of ignition.
- This device is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.
- In situations where risk of contamination between the user and the device is high (e.g.: sleep lab devices; rental devices; users with respiratory infections), a low-resistance, main flow bacteria filter should be placed in-line between this device and the circuit.
- Most CPAP devices have the potential to induce rebreathing of exhaled air. To reduce this potential, use only Respironics circuit accessories, do not wear the mask and headgear for more than a few minutes while the unit is not operating, and do not block or try to seal the vent holes in the exhalation port.

2.1.3 Service

- Electronic components used in this device are subject to damage from static electricity. Repairs made to this device must be performed only in an antistatic, Electro-Static Discharge (ESD) protected environment.
- To assure the safety of the service technician and the specified performance of the device, Respironics recommends that only technicians having prior training or experience servicing ventilatory devices perform any repairs or adjustments to the REMstar Plus with C-Flex CPAP system.
- High voltages are present inside this device. To avoid electrical shock, disconnect the electrical supply before attempting any repairs on the device.

2.1.4 Cleaning

- To avoid electrical shock, disconnect the electrical supply before cleaning the REMstar Plus with C-Flex CPAP system. DO NOT immerse this device into any fluids.

2.2 CAUTIONS

- Federal law (U.S.) restricts this device to sale by, or on the order of a physician.
- Care should be taken to avoid exposure of the REMstar Plus with C-Flex CPAP system to temperatures at or near the extremes of those specified in Chapter 3. If exposure to such temperatures has occurred, the device should be allowed to return to room temperature before being turned on.
- Always use an intake filter when the REMstar Plus with C-Flex CPAP system is in use.
- Never place liquids on or near the REMstar Plus with C-Flex CPAP system.
- Discontinue using this device if any of the parts are damaged. Replace any damaged parts before continuing use.
- The information in this manual is provided for service personnel reference and is not intended for system setup or use. System setup should be performed by appropriate personnel using Home Care Dealer Instructions.

2.3 NOTES

- Refer to the REMstar Plus with C-Flex CPAP system Manuals for product use additional warnings, cautions, and notes.

Additional WARNINGS, CAUTIONS, and NOTES are located throughout this manual.

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Chapter 3: Specifications Features, Description, and Theory of Operation

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Notes:

Chapter 3: Specifications, Features, Description, and Theory of Operation

3.1 Overview

This chapter describes the REMstar Plus with C-Flex system specifications and system features, and provides a functional description and theory of operation.

3.2 Specifications

ENVIRONMENTAL:

Operating Temperature	41 to 95°F (5 to 35°C)
Storage Temperature	-4 to 140°F (-20 to 60°C)
Humidity (Operating / Storage)	15 to 95% non-condensing

NOTE: The outlet temperature rise can be as much as 18°F (10°C) higher than room temperature measured at the end of a 6 ft. tube.

Atmospheric Pressure	76.7 to 102 kPascals
Elevation	0 to 5500 ft. (1676.4 m)
Noise Level	No specification is given because various instruments, test procedures and unit operating conditions produce varying results.

FUSES:

Fuses	There are no replaceable fuses.

PHYSICAL:

Dimensions	9 1/2″ x 6 7/8″ x 4 1/2″ (24 cm x 17 cm x 12 cm)
Weight	< 4 lbs. (1.8 kg)

ELECTRICAL:

AC Input Voltage	100 - 240 VAC ± 10% 47 - 63 Hz
DC Voltage	11.5 - 14.5 VDC
AC Current Consumption	1.0 A maximum
DC Current Consumption	3.0 A maximum
Power Consumption	80 VA maximum
Type of Protection Against Electrical Shock	Class II Equipment 2-prong AC power inlet
Degree of Protection Against Electrical Shock	Type BF Applied Part

Specifications (Continued)

Degree of Protection Against Ingress of Water	IPX0-Ordinary Equipment
Degree of Safety of Application in the Presence of a Flammable Anaesthetic Mixture with Air, Oxygen, or Nitrous Oxide.	Equipment not suitable for use in the Presence of a Flammable Anaesthetic Mixture with Air, Oxygen, or Nitrous Oxide.
Mode of Operation	Continuous

STANDARDS COMPLIANCE:

This product complies with the requirements found in the following standards.

IEC 60601-1	General Requirements for Safety of Medical Electrical Equipment
EN ISO 17510-1	Sleep Apnea Breathing Therapy Devices

FUNCTIONS:

Modes	Provider Mode
	User Mode
	Diagnostic Mode
	Humidifier Operation

RAMP:

Minimum Ramp Press	4.0cm H_2O to current CPAP setting
Ramp Resolution	1 cm H_20
Ramp Time	5 to 45 minutes
Ramp Time Resolution	5 minute increments

ALTITUDE COMPENSATION:

Pressure Range	77 to 102 kPascals
	1 = less than 2,500 ft. (< 762 m) 2 = 2,500 - 5,000 ft. (762 m - 1524 m) 3 = 5,001 - 7,500 ft. (1525 m - 2286 m)

COMPLIANCE METER:

Compliance Meter (LCD)	Total Operation Time
	Therapy Time

COMFORT SETTING:

Therapy Type	CPAP
	C-Flex

Specifications (Continued)

PRESSURE:

AC Operation	4 - 20 cm H_2O
DC Operation	4 - 20 cm H_2O
CPAP Mode	4 - 20 cm H_2O
Resolution	1 cm H_2O (with fine adjust of 0.1 cm H_2O from -1.9 to +1.9

NOTE: Pressure accuracy measurements shall be taken at the end of a six foot patient circuit with a Whisper Swivel® II exhalation port.

Static Pressure Accuracy	+/- 1 cm H_2O of the displayed pressure setting
Pressure Drop with Humidifier	0.3 cm H_2O @ 20 cm H_2O

COMMUNICATION:

SleepLink™ system	The REMstar Plus with C-Flex unit's SleepLink system collects therapy and error code data when connected to a PC.

3.3 System Features

AC Power Connector	Connect AC power here.
DC Power Connector	Optional DC Power Connection for CPAP
Air Outlet Port	Connect flexible tubing here.
LCD Display	Displays all system settings, blower hours, and sessions > 4 hours.
Filter Cap & Filter	The pollen filter screens out normal household dust and pollens. This must be in place at all times when operating the REMstar Plus with C-Flex CPAP system.
Pressure On / Off Button	This button turns the airflow on or off. DO NOT turn the airflow on until the circuit tubing is connected.
Ramp Button	This button decreases the pressure to the minimum ramp pressure setting.
Heated Humidifier Button	Use this button only when the optional Heated Humidifier is connected. Follow the instructions included with the humidifier.
User Buttons	These buttons can be used to change some of the device settings.
Communications Connector	When connected to a PC, eeror code and data retrieval are possible via this connector.

Display Screen	Meanings
	C-Flex Symbol
	Elevation
	Attention is needed
	Patient disconnect activated/enabled
	Button lights are ON
	Ramp start pressure
	Ramp pressure is being delivered
cm H_2O	Centimeters of water
	Humidifier is ON
	Hours of use
	Number of nights with more than 4 hours usage
	Therapy setup menu
	Settings are being erased

Control Buttons		**Meanings** — **Pressure Start / Stop**
		**Ramp start**
		**Humidifier On / Off**

REMstar Plus with C-Flex CPAP Labels		**Meanings** — **Attention, consult accompanying documents**
		DC Power
		**AC Power**
		**Type BF Applied Part**
		**Class II (Double insulated)**
	IPX0	**Ordinary Equipment Rating**
		**European CE Declaration of Conformity**
		**Notified Body Approval for Standards Compliance**
		**Canadian / US Certification**

3.4 Functional Description

The REMstar Plus with C-Flex CPAP system is a microprocessor controlled Continuous Positive Airway Pressure (CPAP) device that will produce positive pressure.

The REMstar Plus with C-Flex CPAP will operate in straight CPAP mode, or CPAP with the comfort setting of C-Flex as determined by the provider. The pressure range in AC and DC operation is: 4.0 - 20.0 cm H_2O.

Integral to the generation of airflow is the blower assembly. Ambient air is drawn through the air intake filter, and pressurized by the energized blower. Ultimately, therapeutic pressure is provided to the patient via the patient circuit. The microprocessor regulates the motor speed, which in turn adjusts and controls the pressure.

The REMstar Plus with C-Flex CPAP system may be AC (100 - 240 VAC) or DC (11.5 - 14.5 VDC) powered. AC power enters the unit via an AC inlet and appropriate power cord. A DC power cord connector enables the patient to use the system when AC voltage is not accessible.

The system filter ensures optimum operation for the user. An air outlet port and pressure port allows for connection to the patient circuit.

The patient circuit is made up of flexible tubing, exhalation port, and nasal mask. The unit applies CPAP to the patient's upper airway to keep the airway open during sleep. Airflow generated from the unit is directed to the patient via a mask and flexible tubing that connects to the air outlet port of the unit.

The ramp feature lets the user reduce the pressure from the REMstar Plus with C-Flex CPAP system so the patient can fall asleep at a lower, more comfortable pressure at any time or as many times as needed during the night.

The REMstar Plus with C-Flex CPAP system is not intended for life support or life sustaining applications. The following sections describe the major components of the REMstar Plus with C-Flex CPAP system and their basic theory of operation.

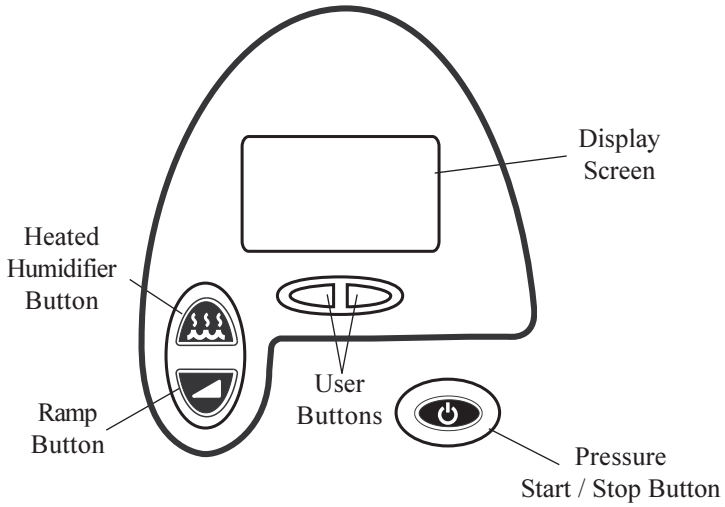

Figure 3-1
Control Panel

3.5 Theory of Operation

3.5.1 Control Pad & Liquid Crystal Display (LCD)

The control pad consists of five user buttons (Ramp Button, On / Off button, Heated Humidifier Button, and Right and Left User Buttons for other functions). The On / Off button activates and deactivates the pressure. The range of pressure is 4.0 to 20.0 cm H_2O with AC and DC operation. The Ramp Button initiates a ramp cycle which incrementally and automatically increases the pressure. The Ramp begins at the set ramp pressure, and over the specified time period, increases until the therapeutic pressure is reached. Ramp Time is adjustable from 0 to 45 minutes in five minute increments (0 would be off). An LCD is used to show various operating parameters while the unit is powered.

3.5.2 Main Printed Circuit Assembly (Main PCA)

The Main PCA is the control center of the REMstar Plus with C-Flex CPAP system. The Main PCA utilizes a microcontroller chip which reads from and writes to various I/O devices (control pad, LCD, memory, flow sensor, motor control circuitry, RS-232 interface, etc.) With all of this information, the microcontroller makes appropriate decisions so the blower is properly controlled to deliver the desired CPAP therapy in a safe and reliable manner.

The microcontroller and the interface circuitry provide closed loop control of the blower motor's speed. The blower motor is a three phase brushless DC motor with permanent magnet rotor, stationary coils that are connected in a "Y" configuration and serve as its stator coils, and a Hall-Effect sensor to detect the motion of the rotor. Proper timing and sequencing of the stator switching is provided by the microcontroller which senses the motor's shaft position by monitoring a Hall-Effect sensor within the motor.

The microcontroller also sets the motor speed (and consequently the output pressure) by varying the voltage which is delivered to the motor. It does this by controlling the pulse width of commutation signals.

The unit has a switching power supply which is built on the Main PCA and mounted within the unit's top enclosure. The switching power supply operates properly on any AC voltage between 100 - 240 VAC; 47 - 63 Hz and produces an output of approximately 16 VDC. The switching power supply automatically adjusts for various input voltages. No voltage selector switch or fuse changing is required, which allows for worldwide operation.

Chapter 4: System Setup Procedures

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4.2 REMstar Plus with C-Flex CPAP System Setup 4-4

4.3 Recommended, Alternate, and Optional Circuit Accessories 4-9

Notes:

Chapter 4: System Setup Procedures

4.1 Overview

This section provides an overview of the system setup including detailed instructions on the therapy menu display screens. Refer to Chapter 7, Repair and Replacement, or Chapter 5, Routine Maintenance, for filter and filter cap installation instructions.

4.2 System Setup

Step 1 Plug the male end of the AC power cord into an electric outlet.

Step 2 Simultaneously, press the two User buttons (below the display screen) then plug the female end of the AC power cord into the AC inlet on the back of the REMstar Plus with C-Flex CPAP system. Continue to hold the two buttons down until the unit beeps twice (see Figure 4-1). Upon being powered, the unit's startup screen appears, the software version is displayed, the blower turns on, and the screen shown in Figure 4-1 appears.

NOTE: If a system Error 8 "key stuck" occurs, repeat the process in Step 2.

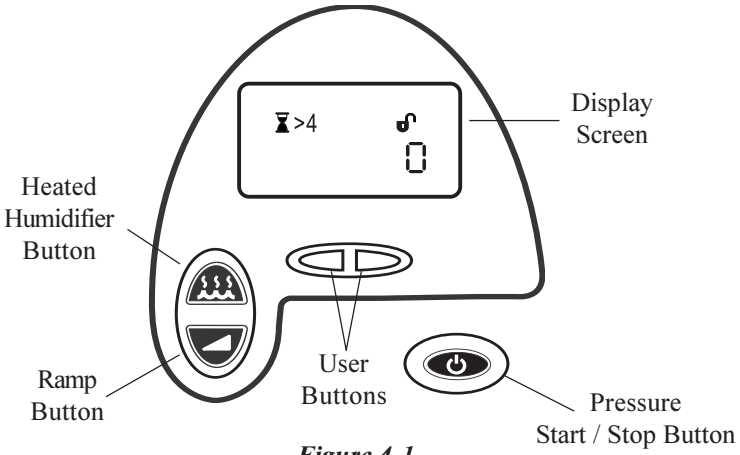


Figure 4-1
Touchpad Features

Figure 4-2
Connecting and Entering the Therapy Mode

4.2.1 Display Screens

NOTE: You cannot turn the air flow on when you are in the Therapy Setup menu. When you exit this menu, the Therapy Time will be displayed.

NOTE: During system setup, press the left or right User button to view a setting. Press the humidifier or ramp button to change the setting.

Step 1 Erase the Therapy Hours

The number of nights the REMstar Plus with C-Flex CPAP was used for therapy for more than 4 hours will appear. Press and hold the ramp or humidifier button until the erase icon disappears to delete the therapy hours. Press the right user button to continue to the next setting.

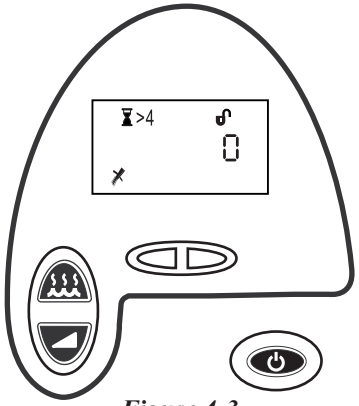
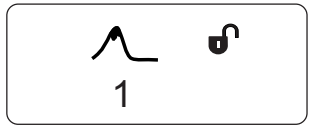


Figure 4-3
Erasing the Therapy Hours

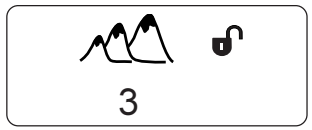
Step 2 Setting the Elevation

When the elevation symbol appears, press the ramp or humidifier button to scroll through the three elevation settings. Once you have selected the elevation setting, press the right user button to continue to the Comfort Selection display screen.



1 = less than 2,500 ft. (<762 m)

2 = 2,500 - 5,000 ft. (762 m to 2286 m)



3 = 5,001 - 7,500 ft. (1525 m to 2286 m)

Figure 4-4
Setting the Elevation

Step 3 Comfort Selection

The REMstar Plus with C-Flex CPAP can operate in CPAP mode (constant level of positive pressure throughout the breathing cycle) or C-Flex mode (adjustable pressure relief during exhalation). Pressing the ramp or humidifier buttons will toggle between the two settings. Choose the desired setting and press the right user button to continue to the next setting.

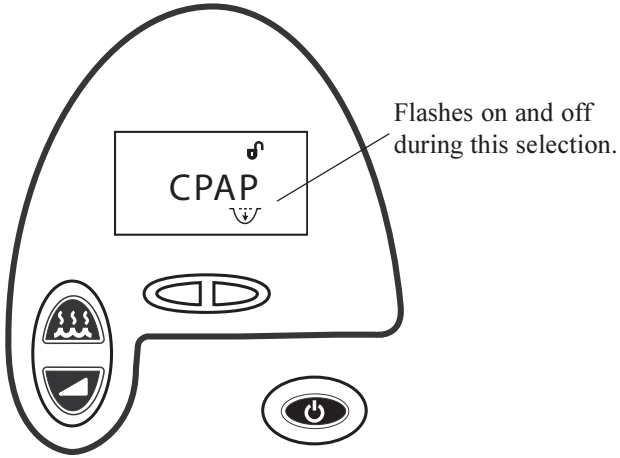


Figure 4-5
Setting the Mode

System Setup (Continued)

Step 4 Setting the Pressure

The CPAP pressure setting will be displayed. Press the ramp button or the humidifier button to select the proper pressure. Press the right user button to continue to the next setting.

Range: 4 - 20 cm H_2O
1 cm H_2O increments (with fine adjustment of 0.1 cm H_2O from -1.9 to +1.9)

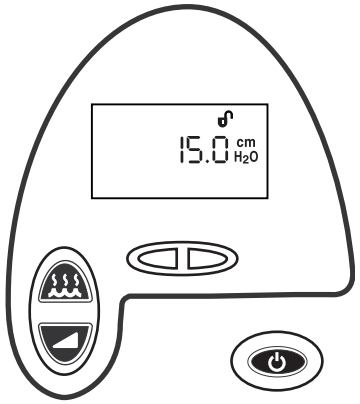


Figure 4-5
Setting the Pressure

System Setup (Continued)

Step 5 Fine Adjusting the Pressure

The Pressure setting can be fine adjusted in increments of 0.1 cm H_2O between -1.9 and +1.9. Use the Fine Adjust setting to provide an accurate CPAP setting.

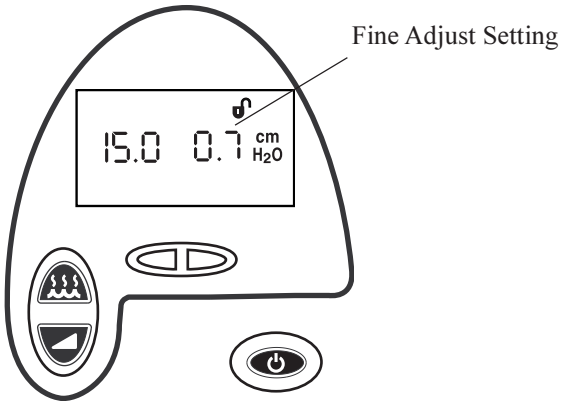


Figure 4-6
Fine Adjust Setting

Step 6 Setting the Comfort Setting

NOTE: The comfort setting will only be displayed when the unit is operating in C-Flex mode.

The comfort setting will be displayed. Press the ramp button or the humidifier button to select 1-3. Press the right user button to continue to the next setting.

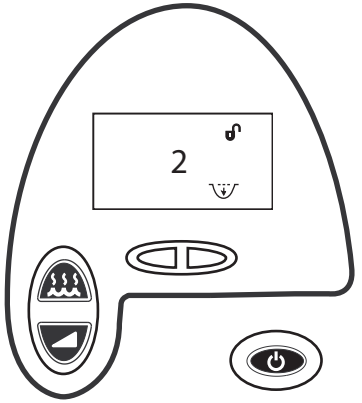


Figure 4-7
Setting the Comfort Setting

Step 7 Setting the Ramp Time

The ramp time will be displayed. Press the ramp button or the humidifier button to select the proper setting. Press the right user button to continue to the next setting.

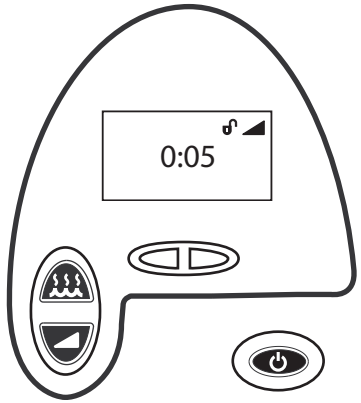


Figure 4-8
Setting the Ramp Time

Step 8 Setting the Minimum Ramp Pressure

The ramp pressure will be displayed. Press the ramp button or the humidifier button to select the proper setting. Press the right user button to continue to the next setting. If the Ramp Time is equal to zero, or if the Pressure setting is set to 4, the Ramp Pressure display screen will not appear and the Ramp Pressure can not be set.

Range: 4.0 - (Value of CPAP Setting) cm H_2O
1 cm H_2O increments

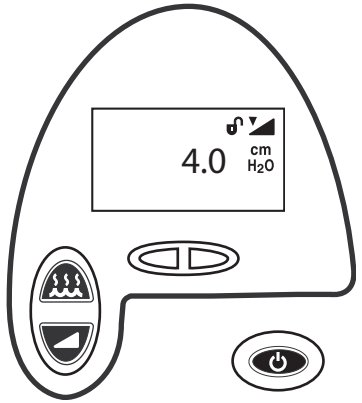


Figure 4-9
Setting the Minimum Ramp Pressure

System Setup (Continued)

Step 9 Set the Mask Alert

The mask alert setting will be displayed. Press the ramp button or the humidifier button to select the proper setting. Press the right user button to continue to the next setting.

Selection: 0 - Off
1 - On

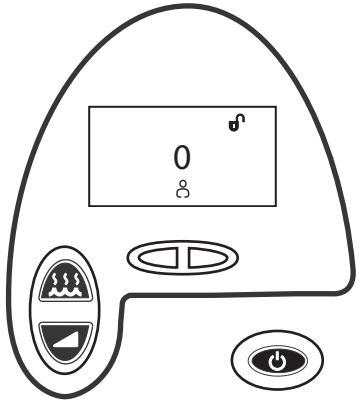


Figure 4-10
Setting the Mask Alert

Step 10 Set the Button Lights

This setting allows the lights behind the buttons to be on or off when the airflow is turned on. Press the ramp button or the humidifier button to select the proper setting. Pressing the right user button will bring you back to the first set up screen. Pressing the Start / Stop button will take you out of the set-up menu and turn the blower off.

Selection: 0 - Off
1 - On

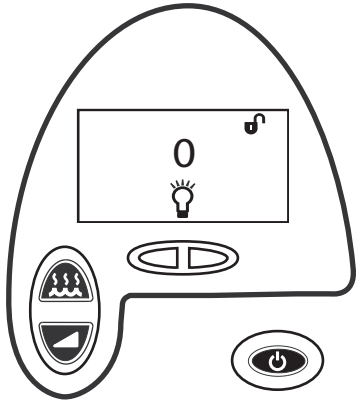


Figure 4-11
Setting the Button Lights

4.3 Recommended, Alternate, and Optional Circuit Accessories

This section addresses the recommended, alternate, and optional circuit accessories that can be used with the REMstar Plus with C-Flex CPAP system. For additional information, refer to the User's Manual or the Home Care Providers Manual, or the literature supplied with accessory.

4.3.1 Recommended Accessories

To use the REMstar Plus with C-Flex CPAP system, the following accessories are recommended in order to assemble the circuit.

WARNING: If using the REMstar Plus with C-Flex CPAP system with other patient circuits than the recommended patient circuit identified below, pressures should be verified before use.

Recommended Patient Circuit

- Respironics Nasal Mask with integrated Exhalation Port (or Respironics mask with separate exhalation port such as the Whisper Swivel II*).
- Respironics 6 ft. (1.83 m) Flexible Tubing.
- Respironics Headgear or Softcap (not shown).

Figure 4-11
REMstar Plus with C-Flex CPAP System with Recommended Circuit

4.3.2 Alternate and Optional Circuit Accessories

The Respironics alternate accessories listed in Table 4-1 can be used in place of the recommended accessories. The optional accessories can be added to the patient circuit. Refer to Table 4-1 for changes in the pressure / flow characteristics when using these accessories.

Table 4-1, Patient Circuit Accessory Pressure / Flow Characteristics

	Pressure Drop @ 30 lpm (cm H_2O)	Pressure Drop @ 60 lpm (cm H_2O)
Recommended Patient Circuit		
Nasal Mask (disposable, reusable)	0.03	0.09
Profile Lite Nasal Mask (reusable)	0.03	0.09
Simplicity Mask	0.20	0.77
Whisper Swivel II (reusable)	0.02	0.08
6 ft. (1.83m) Flexible Tubing	0.11	0.30
Alternate Accessories		
Spectrum Full Face Mask	0.04	0.10
Plateau Exhalation Valve (reusable)	0.05	0.20
6 ft. Disposable Circuit & Exhalation Port	0.20	0.34
Optional Accessories		
REMstar Passover Humidifier	0.00	0.30
REMstar Heated Humidifier	0.00	0.30
King Bacteria Filter (disposable)	0.74	1.65

WARNING! Appropriate diagnostic pressures must be determined when alternate or optional accessories are in place. Respironics reusable circuit accessories are washable but are for single patient use only. They are not intended to be used on multiple patients.

Recommended, Alternate, and Optional Circuit Accessories (Continued)

The following graph provides the exhaust / flow characteristics of the exhalation port accessories that can be used with the REMstar Plus with C-Flex CPAP system. This information may help assess the CO_2 rebreathing potential of various circuit configurations at different applied pressures.

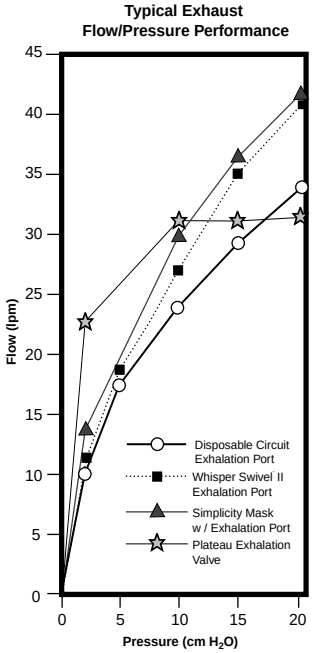


Figure 4-12
Typical Exhaust Flow / Pressure Performance

WARNING: Appropriate diagnostic pressures must be determined when alternate or optional accessories are in place. Respironics reusable circuit accessories are washable, but are for single patient use only. They are not intended to be used on multiple patients.

4.3.3 DC Power Accessories

The Respironics Shielded DC Power Cord (RI P/N 1001956) can be used to operate the REMstar Plus with C-Flex CPAP system in a stationary recreational vehicle, boat, or motor home.

The Respironics DC Battery Adapter Cable (RI P/N 532209) when used with the Respironics Shielded DC Power Cord enables the Respironics CPAP system to be operated from a 12 VDC free-standing battery.

NOTE: Respironics recommends a 100 amp-hour deep cycle marine battery.

The REMstar Plus with C-Flex CPAP system should not be operated while the vehicle is in motion.

CAUTION: Only use the Respironics DC Power Accessories. Use of any other system may cause damage to the REMstar Plus with C-Flex CPAP system or your vehicle.

CAUTION: DC Power is not intended to be used as battery backup. DO NOT connect the DC Power while the REMstar Plus with C-Flex CPAP system is operating on AC Power. System damage may occur.

CAUTION: DC power can be used when the CPAP and Heated Humidifier are connected together as a system. However the Heated Humidifier will not function on DC power. It will function as a cold passover humidifier.

4.3.4 Adding Oxygen to the System

Please note the warnings listed below when using oxygen with the REMstar Plus with C-Flex CPAP system.

WARNING: When using oxygen with the REMstar Plus with C-Flex CPAP system, turn the unit on before turning the oxygen on. Turn the oxygen off before turning the REMstar Plus with C-Flex CPAP system off. This will prevent oxygen accumulation in the room.

WARNING: Oxygen supports combustion. Do not use oxygen in the presence of open flames, cigarette smoke, electrical spark, or other sources of ignition.

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Chapter 5: Routine Maintenance

5.1 Overview 5-3

5.2 Cleaning the System 5-3

5.3 Cleaning / Replacing the Intake Filter 5-3

5.4 REMstar Plus with C-Flex CPAP System Preventive Maintenance Schedule 5-5

Notes:

Chapter 5: Routine Maintenance

5.1 Overview

This chapter provides guidelines and illustrates the cleaning and maintenance procedures for the REMstar Plus with C-Flex CPAP system.

Before cleaning or performing any routine maintenance, always switch the REMstar Plus with C-Flex CPAP system's Pressure Start / Stop button to the Stop position and unplug the power cord from the rear of the unit.

5.2 Cleaning the System

WARNING: To avoid electrical shock, disconnect the electrical supply before attempting to clean the REMstar Plus with C-Flex CPAP system. DO NOT immerse the unit in water or allow any liquid to enter the cabinet or the filter intake.

Step 1 Wipe the outside of the unit with a cloth slightly dampened with water and a mild detergent. Let the unit dry before reconnecting the electrical supply.

5.3 Cleaning / Replacing the Intake Filter

The gray pollen filter is a reusable filter that screens out pollens and some household dust. This filter should be cleaned at least once every two weeks under normal usage, or as required, and replaced with a new one every six months. One additional pollen filter is included with the system. The pollen filter must be in place at all times when the unit is operating.

CAUTION: Failure to replace a dirty filter may cause the device to operate at higher than normal temperatures and damage the device.

5.3.1 Removing, Cleaning, and Replacing the Filter

Step 1 With the airflow turned off, disconnect the AC or DC power cord from the back of the unit.

Cleaning / Replacing the Intake Filters (Continued)

Step 2 Remove the filter cap by gently lifting up on the bottom of the filter cap, then pulling it away from the back of the unit.

Figure 5-1
Removing the Filter Cap

Step 3 Remove the pollen filter by gently pulling the edges of the filter. Rinse the filter in a steady stream of running water. Squeeze out the water, and repeat. Allow the pollen filter to air dry for 8 to 12 hours, or in a clothes dryer for 15 to 20 minutes.

Figure 5-2
The Filter Cap and Filters

Cleaning / Replacing the Intake Filters (Continued)

Step 4 Place the pollen filter into the filter area in the back of the REMstar Plus with C-Flex CPAP system.

CAUTION: The pollen filter must be completely dry before use. Never place a wet filter into the device. Respironics recommends that you clean the filter in the morning and alternate using the two pollen filters provided with the system to ensure enough drying time for the cleaned filter.

CAUTION: DO NOT place both pollen filters into the unit at the same time.

Step 5 Install the filter cap. The opening in the filter cap for the REMstar Plus with C-Flex CPAP system should face down and away from the patient.

5.4 Preventive Maintenance Schedule

The following Preventive Maintenance Schedule lists the items that must be inspected or tested periodically, or after service is performed. Use the Preventive Maintenance Schedule to record the dates on which the maintenance items are performed.

The Preventive Maintenance Schedule may be copied for each unit serviced.

REMstar Plus with C-Flex CPAP System Preventive Maintenance Schedule (Continued)

5.4.1 REMstar Plus with C-Flex CPAP System Preventive Maintenance Schedule (Factory Recommended)

Maintenance Item	Verification Reference	Service Interval	Date
Record Blower Hours	Displayed On Options Screen	As desired.	
Clean / Replace Pollen Filter	Section 5.3.1	Clean every 2 weeks, or as required; Change every 6 months.	
Perform Testing Process	Section 8.1	After service is performed.	
Cleaning	Section 5.2	As required.	

Chapter 6: Trouble-shooting and Diagnostics

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6.2 Common System Level Problems 6-4

6.3 Troubleshooting Flow Chart 6-6

6.4 Troubleshooting Table 6-7

6.5 Error Code Retrieval 6-13

6.6 Error Code Chart 6-14

Notes:

Chapter 6: Troubleshooting and Diagnostics

6.1 Overview

WARNING: Electrical Shock Hazard: Disconnect the electrical supply before repairing the unit.

CAUTION: Electronic components used in this unit are subject to damage by static electricity. Use proper static discharge equipment and grounding precautions when servicing the equipment. Service only at a static-free workstation.

This section contains information necessary to troubleshoot and diagnose problems with the REMstar Plus with C-Flex system. It provides a summary of common system problems as well as a flowchart and table to simplify the troubleshooting process. The error code chart lists all error codes, the associated problem, and suggested corrective action to be taken.

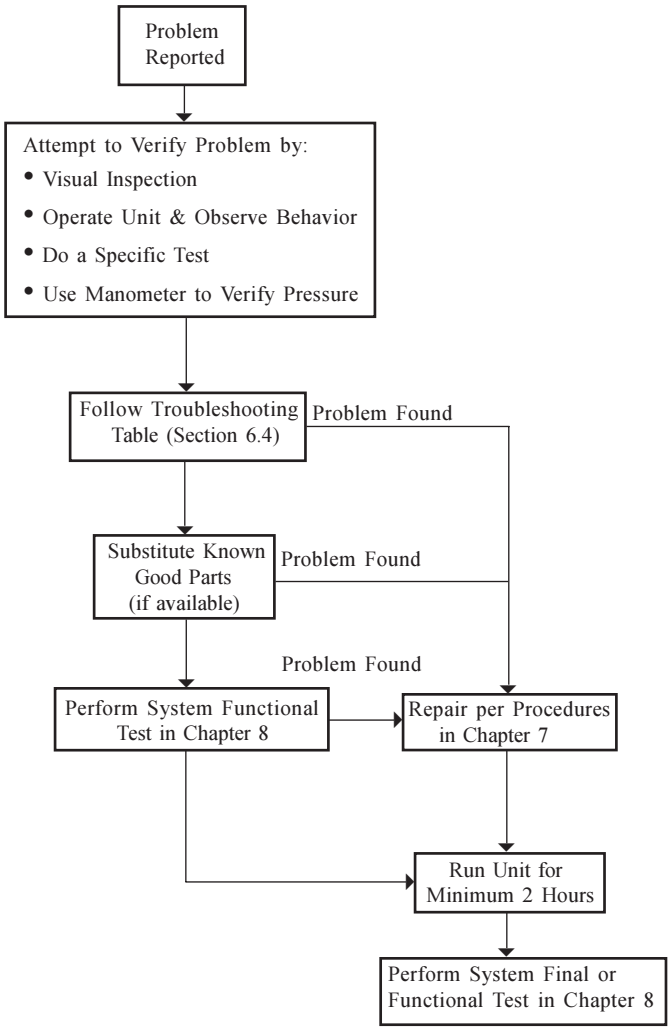
6.2 Common System Level Problems

Screen Message	Description	Result	Corrective Action
Mask Alert	A large circuit leak, such as mask removal, has been detected.	• The audible alarm will sound in approximately 35 - 65 seconds (if the mask alert feature has been turned on). • The airflow will turn off in approximately 45 - 80 seconds (if the auto-off feature has been turned on).	• Press any button on the REMstar Plus with C-Flex CPAP system to silence the audible alarm and clear the display screen. • Check the circuit (flexible tubing assembly, mask) for any leaks and adjust the mask and headgear. • Press the Pressure On / Off button to restart the airflow. **Note:** The audible Mask alarm setting / auto-off can be enabled or disabled. (See Section 4.2 - System Setup for instructions.)

Common System Level Problems (Continued)

Screen Message	Description	Result	Corrective Action
E - XXX	The REMstar Plus with C-Flex CPAP system is not functioning correctly and may need servicing.	• The airflow will turn off immediately. • The alert tone will sound. • The back light will flash on and off. • The signal light on the humidifier will turn off.	• Reset the unit by unplugging the power cord from the electrical outlet and then plugging it in again. • If the message appears again, refer to the Error Code Chart (Section 6.6) for a description of the error and corrective action. **Note:** This alert setting cannot be turned off.

6.3 Troubleshooting Flow Chart



6.4 Troubleshooting Table

Symptom	Cause	Verification	Corrective Action
Audible Alarm - During audible alarm condition, the alarm is not audible.	Main printed circuit assembly.	Perform power up sequence. Visually verify the LED's and display illuminate. Reestablish original alert conditions. Listen for audible alarm.	• If audible alarm does not work, replace Main PCA. • If visual indicators are not present at power up, perform user interface checkout procedure. • If device fails user interface checkout procedure, replace Main PCA. • If alarm is audible during both tests, no corrective action is required.
Unit does not operate from the 12 VDC power source.	Faulty DC plug, low DC voltage, fuse in DC cord is blown. Main PCA.	Ensure the DC voltage supply is a minimum of 11.5 VDC. Ensure the DC voltage is stable. Monitor the voltage at the back of the DC connector mounted on the Main PCA. If DC voltage is below 11.5 VDC, replace or recharge DC source. If there is no DC measured at the Main PCA, then check the DC adapter cord for continuity.	• If DC source is not at 11.5 VDC or higher, replace or recharge power source as required. • If 12 VDC supply is ok, replace Main PCA.

Troubleshooting Table (Continued)

Symptom	Cause	Verification	Corrective Action
Display Indicator - LED or other indicator not working.	Main printed circuit assembly.	Perform user interface checkout procedure.	• If device fails user interface checkout procedure, replace Main PCA.
Display - Display is blank or contains erroneous information.	Display assembly. Main PCA.	Inspect solder joints between display board and Main PCA.	• Replace Main PCA.
Intermittent Power Supply Problem - An intermittent on / off condition exists, unit alarms randomly, or indicator lights blink sporadically.	Power cord, AC inlet, Main PCA, loose connections.	Inspect power cord for fraying at cable ends. Inspect all connections on the Main PCA.	• Replace Main PCA.
Noise -	Missing or damaged bottom feet on bottom of unit, blower malfunctioning.	Turn over and inspect the bottom for missing or damaged bottom feet.	• If bottom feet are missing, replace bottom enclosure. Tighten any loose screws. • Replace Blower.

Troubleshooting Table (Continued)

Symptom	Cause	Verification	Corrective Action
Odor	Tubing smells new, unit smells new, airborne residue buildup.	Visually inspect patient tubing for contamination.	• Run unit in a clean environment for a few hours to eliminate new smell. Wash tubing with soap and water. To clear residue buildup, replace all subassemblies in the patient air stream (blower filters, patient circuit).
Outlet air temperature - The outlet air temperature is too warm.	Filters dirty, blower, Main PCA.	Ensure the filter is clean and not restricting airflow. Monitor the outlet temperature at the end of the six foot patient tubing. A rise in temperature can be expected (See Section 3.2.1 for Operating Temperature).	Replace in order until solved. • Filters • Blower • Main PCA
Pressure Related Problems - The outlet pressure does not change or properly adjust.	Flow tubing has been blocked, disconnected, or kinked. Main PCA or blower malfunction.	Inspect flow tubing for secure connections and kinks. Check blower for leaks.	• Secure flow tubing connections. • Replace blower, flow tubing, or Main PCA.

Troubleshooting Table (Continued)

Symptom	Cause	Verification	Corrective Action
Pressure Offset - Static pressure fluctuates from -1.0 cm to +2.0 cm H_2O.	The delivered pressure is higher or lower than the set value by more than -1.0 cm to +2.0 cm H_2O.	Perform power up process.	• Check tubing for kinks. • Replace the Main PCA.

Troubleshooting Table (Continued)

Symptom	Cause	Verification	Corrective Action
Ramp Pressure - The pressure does not ramp correctly.	No ramp time prescribed. Ramp minimum pressure has to be lower than CPAP pressure. Main PCA. Ramp Button not functioning.	Verify the patients prescription specified ramp. Make sure unit was set for ramp. Perform user interface checkout procedure (see Section 8.1).	• Set unit for ramp. • Replace Main PCA. • If device fails user interface checkout procedure, replace control pad or display PCA.
Pressure Variation - The pressure varies around the set value, pressure fluctuates greater than 1.0 cm H_2O. (This could be normal if the device is in C-Flex mode and in use by the patient.)	Internal air leak. Filters dirty. Main PCA, blower. Air path blocked.	Replace filter. Perform Testing Process (see Section 8.1).	• Replace blower. • If pressure still drifts, then replace Main PCA.

Troubleshooting Table (Continued)

Symptom	Cause	Verification	Corrective Action
Humidifier will not turn on.	Faulty power cord.	Inspect main power cord for fraying at cable ends.	• Replace Power Cord.
	Broken or damaged Light Tube.	Inspect power cord between CPAP and humidifier base.	• Replace Main PCA in humidifier base.
	No infrared connection.	Inspect Light Tube inside CPAP for misalignment.	• Realign or replace light tube.
	Damaged Heater Plate.	Make sure receiver on Humidifier base is not damaged.	• Replace Humidifier Main PCA.
	Humidifier Main PCA.	Inspect Main PCA to see if there is damage to the transmitter on the Main PCA.	• Replace Main PCA.
	CPAP Main PCA.	Make sure CPAP is seated on humidifier base properly.	• Reseat CPAP on humidifier base.
		Inspect Main PCA for damage to the Humidifier On / Off button.	• Replace Main PCA.
		Inspect Heater plate to see that it is connected to the humidifier Main PCA and that it is not damaged.	• Replace Heater Plate in humidifier base.

6.5 REMstar Plus with C-Flex CPAP System Error Code Retrieval

The REMstar Plus with C-Flex CPAP system stores error codes that may aid the technician in troubleshooting. The following instructions aid in the retrieval of those error codes.

Step 1 Installing the Software

a. Follow the instructions that are included with the Respironics Utility Software (RI p/n 1011422). Included with the instructions are the following:

1. System requirements
2. Intended use
3. Warnings

Step 2 Connecting the REMstar Plus with C-Flex to your Computer

a. Connect the Mini DIN communication cable between the REMstar Plus with C-Flex CPAP system and the computer serial port.

b. Connect the REMstar Plus with C-Flex CPAP system to the proper power source.

Step 3 Retrieving the Error Codes

a. With your mouse click on the **Start Button** of your computer.

b. Select:
Programs
Respironics
Tools
Read Error Log

c. The software will load automatically

d. With your mouse click on the Run Arrow ➡ located in the upper left corner of the computer screen.

e. The software will automatically read and display any error codes stored in the unit along with the time the error occured.

Step 4 Closing the Software

a. With your mouse click on **File**.

b. Select:
Exit

Step 5 Disconnect the REMstar Plus with C-Flex CPAP System

a. Disconnect the Power cord and the Mini DIN communication cable from the REMstar Plus with C-Flex CPAP system.

6.6 Error Code Chart

Error Code	Problem	Corrective Action
E-1	PROM Test - The code in the PROM is corrupt.	Replace Main PCA.
E-2	RAM Test - The RAM on the Main PCA is not functioning properly.	Replace Main PCA.
E-3	Stack Test - The Stack memory on the Main PCA is not functioning properly.	Replace Main PCA.
E-4	Invalid Parameters - A failure has been detected in the nonvolatile memory on the Main PCA.	Reset the parameter by simultaneously pressing the on/off, ramp, and humidifier buttons while reconnecting the power cord. Reset will be displayed on the screen. Then remove power from the device. Reconfigure unit and test for proper operation. If error repeats, replace Main PCA.
E-5	Parameter Copies - A failure has been detected in the non-volatile memory on the Main PCA.	Reset the parameter by simultaneously pressing the on/off, ramp, and humidifier buttons while reconnecting the power cord. Reconfigure unit and test for proper operation. If error repeats, replace Main PCA.
E-6	Watchdog Test - The watchdog in the microprocessor has failed.	Replace Main PCA.
E-7	Watchdog Time-out - The system was reset due to a watchdog time-out.	Cycle power to the unit. If error repeats, replace the Main PCA.
E-8	Key Stuck - One of the keys is stuck in the closed position.	Verify that nothing is pressing a key. Replace control pad. If error persists, replace Main PCA.

Error Code Chart (Continued)

Error Code	Problem	Corrective Action
E-9	Motor Overspeed	Replace blower assembly. If error persists, replace Main PCA.
E-10	Motor Underspeed - The speed of the motor was determined to be below acceptable limits.	Replace blower assembly. If error persists, replace Main PCA.
E-11	R20 / R21 Corrupt	Replace Main PCA.
E-12	Motor edge lost	Check blower wire connections. Replace Blower Assembly. Replace Main PCA.
E-13	Motor Brake	Check blower wire connections. Replace Blower Assembly. Replace Main PCA.
E-14	Motor Current - The motor current has exceeded its limit.	Check blower wire connections. Replace Blower Assembly. Replace Main PCA.
E-15	Rotor Locked - The motor could not be started.	Check Wiring. Replace Blower Assembly. If error persists, replace Main PCA.
E-16	Program Sequence - External conditions prevented the proper operation of the software.	Replace Main PCA.
E-17	Software Error	Replace Main PCA. Contact Respironics Product Support.
E-18	A/D Converter	Replace Main PCA.

Error Code Chart (Continued)

Error Code	Problem	Corrective Action
E-19	DC voltage too low.	Check DC supply voltage. Replace Main PCA.
E-20	DC voltage too high.	Check DC supply voltage. Replace Main PCA.
E-21	Unused	N/A
E-22	Invalid flow table.	Replace Main PCA.
E-23	Pressure offset.	Check for leaks or kinked internal tubing. Replace Main PCA.
E-24	Flow offset.	Check for leaks or kinked internal tubing. Replace Main PCA.
E-25	Pressure line loss.	Check for leaks. Replace Main PCA.
E-26	Unknown interrupt.	Replace Main PCA.
E-27	Invalid hardware flags.	Replace Main PCA.
E-28	Motor edge extra.	Check blower wire connections. Replace Blower Assembly. Replace Main PCA.
E-29	Motor current on high.	Replace Main PCA.
E-30	Motor VcenterEst. Bad.	Replace Main PCA.
E-31	Invalid error.	Replace Main PCA. Contact Respironics Product Support.

Chapter 7: Repair & Replacement

7.1 Overview 7-3

7.2 REMstar Plus with C-Flex CPAP System Repair Kits 7-4

7.3 Warnings and Cautions 7-8

7.4 Replacement Instructions 7-8

Notes:

Chapter 7: Repair & Replacement

7.1 Overview

Section 7.2 illustrates the names and locations of the replaceable components in the REMstar Plus with C-Flex CPAP system. This provides a quick reference and overview of the unit. Within each replacement section, more detailed support information is provided to illustrate the exact component location and replacement procedure(s).

For technical assistance or replacement part ordering information, contact Respironics Corporate Technical Service.

USA and Canada

Phone: 1-800-345-6443
Fax: 1-888-886-0245

International

Phone: 001-724-387-4000
Fax: 001-724-387-5012

Email

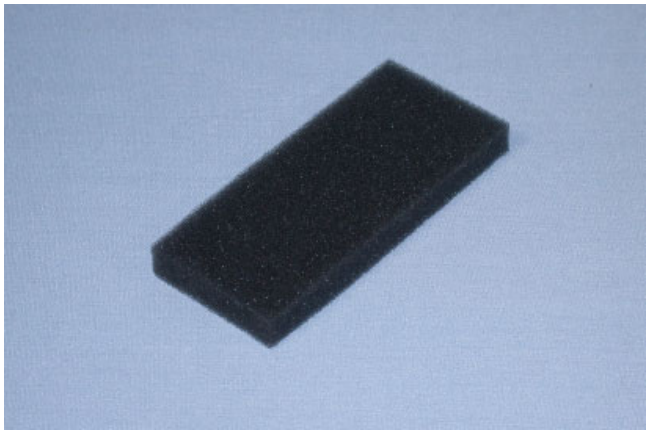
service@respironics.com

Visit Respironics Home Page on the World Wide Web at:

www.respironics.com

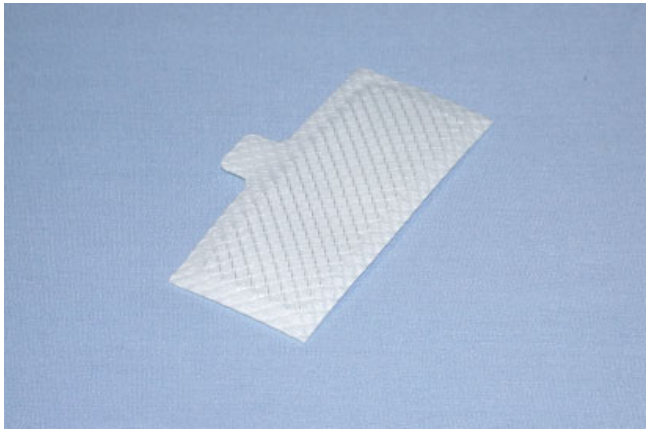
7.2 REMstar Plus with C-Flex System Repair Kits

AC Power Cord RP#1005894*

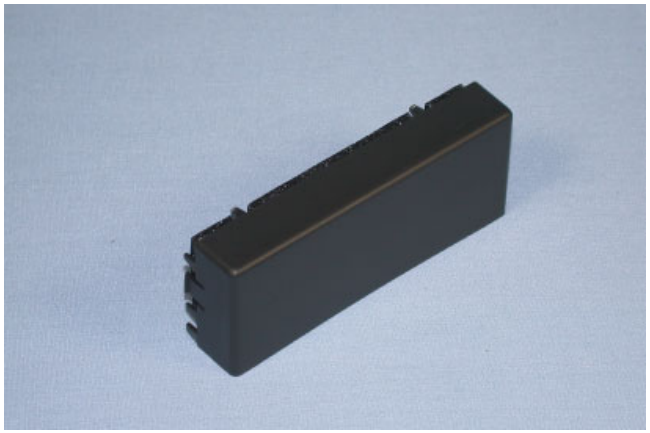


Pollen Filter RP#1005964

Communication Cable RP#1009231



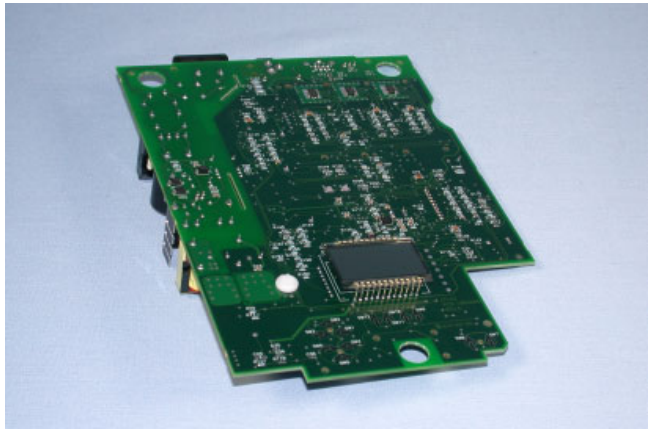
Ultra-Fine Filter RP#1005945



Filter Cap RP#1008479

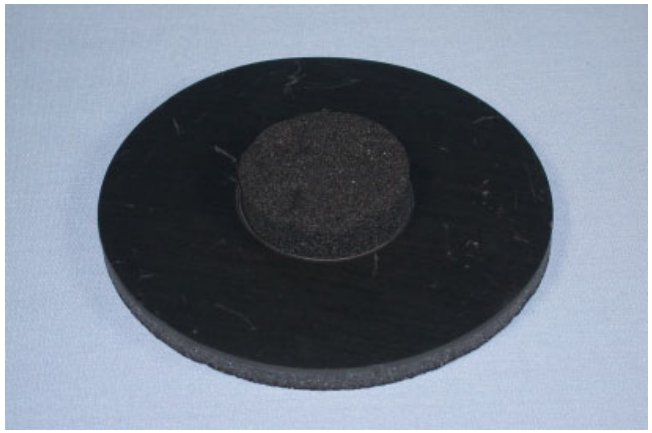
Key Pad RP#1008476

Top Enclosure RP#1013898**



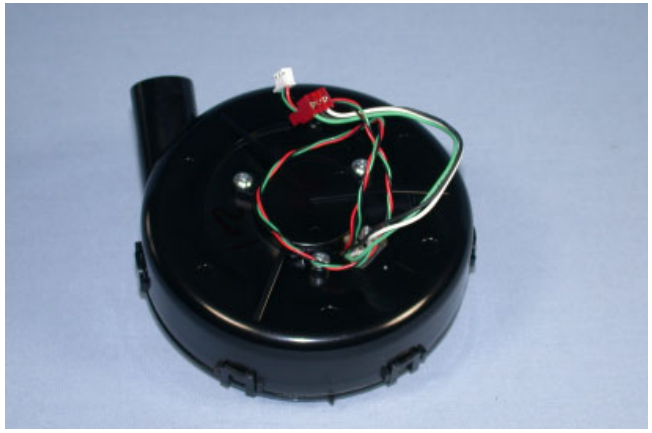
Main PCA RP#1013895

REMstar Plus with C-Flex System Repair Kits Continued

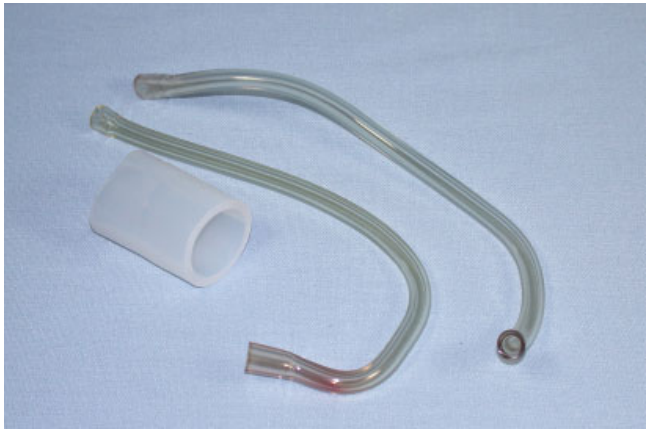


Foam Hat RP#1011060

Outlet Port RP#1013896



Blower RP#1011213



Tubing Kit RP#1017358

REMstar Plus with C-Flex System Repair Kits Continued

Flow Element RP#1008490

Warning Label RP#1009132*

Bottom Enclosure RP#1011215**

Respironics Utility Software RP#1011422

* Contact Respironics International Customer Service for further AC power cord ordering information.

** Contact Respironics Product Support for the proper labeling when replacing the bottom enclosure, or top enclosure.

7.3 Warnings and Cautions

WARNING: To prevent electrical shock, disconnect the electrical supply before attempting to make any repairs to the REMstar Plus with C-Flex CPAP system.

CAUTION: Electronic components used in this unit are subject to damage from static electricity. Repairs made to this unit must be performed only in an antistatic, Electro-Static Discharge (ESD)-protected environment.

7.4 Replacement Instructions

Refer to the flow charts in Figures 7-1 and 7-2 before removing or installing any components. These flow charts will detail the order in which each item must be removed or installed and should be used as a guideline for quick reference.

Removal Flow Chart

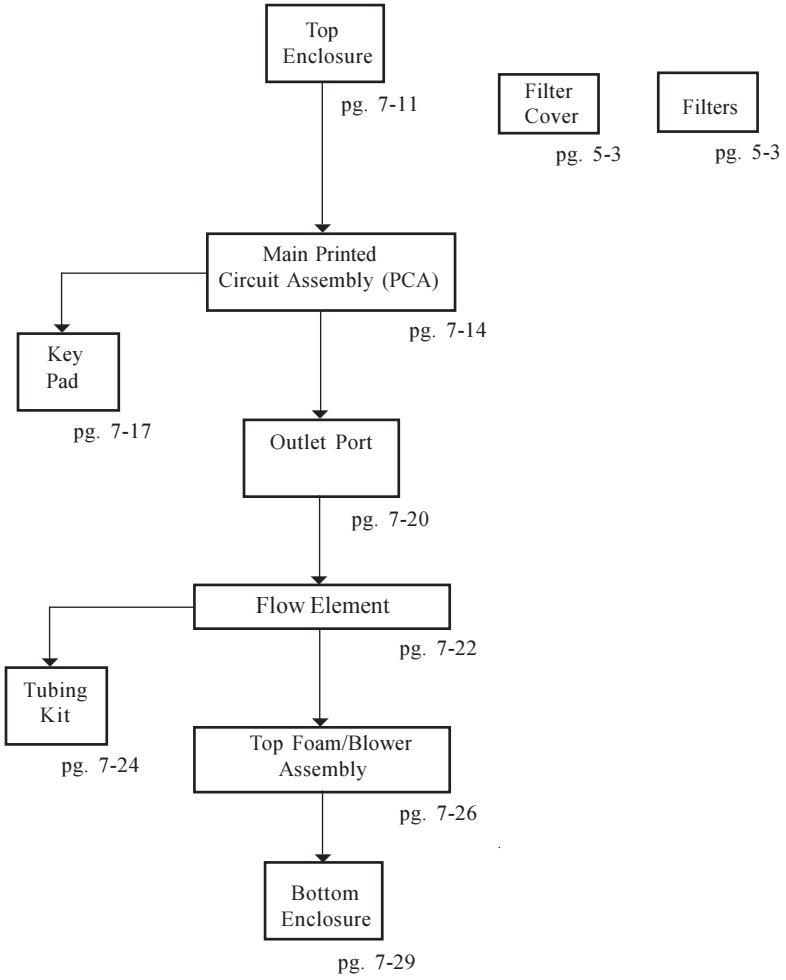


Figure 7-1
Removal Flow Chart

Chart Usage: Determine which item is to be replaced then follow the line of flow back to the "Top Enclosure" and begin the removal process. Detailed procedures begin on the referenced page numbers.

Installation Flow Chart

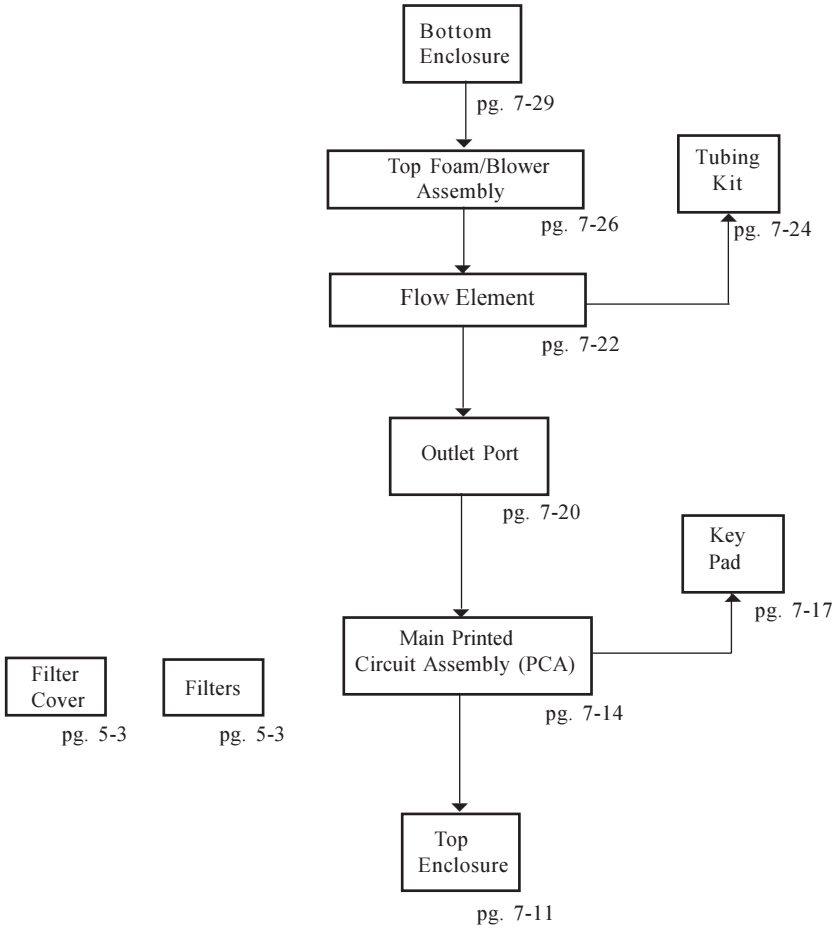


Figure 7-2
Installation Flow Chart

Chart Usage: Determine which item is to be installed then follow the line of flow down to the "Top Enclosure." Detailed procedures begin on the referenced page numbers.

7.4.1 Top Enclosure Replacement

Replacement Part Number **1013898**

> **NOTE:** Contact Respironics Product Support Department for Top Enclosure ordering information.

Included in Kit:	**Tools Required:**
Top Enclosure Screws-8 Hi-Lo x 1/2" (x3)	Phillips Screwdriver (No. 2 medium)

Procedure

Removed/Installed During Process:

- Top Enclosure

> **WARNING:** Electrical shock hazard: Disconnect the electrical supply before attempting to make any repairs to the device.
>
> **CAUTION:** Electronic components used in this device are subject to damage from static electricity. Repairs made to this device must be performed only in an antistatic, ESD-protected environment.

Figure 7-3
Top Enclosure

Step 1 Removing the Top Enclosure

a. Place the device on a protected work surface and carefully turn it over, exposing the bottom.

b. Using a Phillips screwdriver, remove the three screws that secure the top enclosure to the bottom enclosure.

Figure 7-4
Location of the Top Enclosure Screws

c. While securely holding the top and the bottom enclosures together, carefully return the device to its upright position.

d. Lift the top up and away from the bottom enclosure.

NOTE: Nothing is connected to the top enclosure.

Figure 7-5
Top Enclosure Removal

Step 2 Installing the Top Enclosure

a. Place the new top enclosure over the keypad and main PCA.

b. While securely holding the top enclosure and bottom enclosure together, carefully turn the device upside down.

c. Insert and tighten the three Phillips screws to secure the top and bottom enclosure together.

d. Return the device to its upright position.

7.4.2 Main Printed Circuit Assembly (Main PCA) Replacement

Replacement Part Number **1013895**

Included in Kit:	**Tools Required:**
Main PCA	Phillips Screwdriver (No. 2 medium)

Procedure

Removed/Installed During Process:

- Top Enclosure
  (See Section 7.4.1 for more detailed instructions.)
- Keypad
  (See Section 7.4.3 for more detailed instructions.)
- Main PCA

WARNING: Electrical shock hazard: Disconnect the electrical supply before attempting to make any repairs to the device.

CAUTION: Electronic components used in this device are subject to damage from static electricity. Repairs made to this device must be performed only in an antistatic, ESD-protected environment.

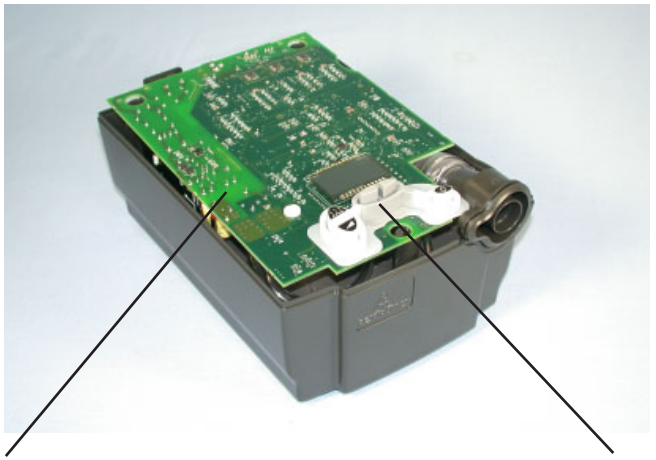


Figure 7-6
Main Printed Circuit Assembly

Step 1 Removing the Top Enclosure

Remove: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on removing the top enclosure.)

Step 2 Removing the Main PCA

a. Lift the main PCA and hold it slightly above the blower assembly to provide access to the blower cable connectors.

b. Disconnect the blower cable connectors from the main PCA.

c. Disconnect the flow element tubing from the PCA.

d. Lift the main PCA up and away from the bottom enclosure assembly.

Step 3 Removing the Keypad

Remove: • Keypad

(See Section 7.4.3 for more detailed instructions on removing the keypad.)

NOTE: The Display Assembly (LCD) is permanently attached to the PCA and is not replaceable.

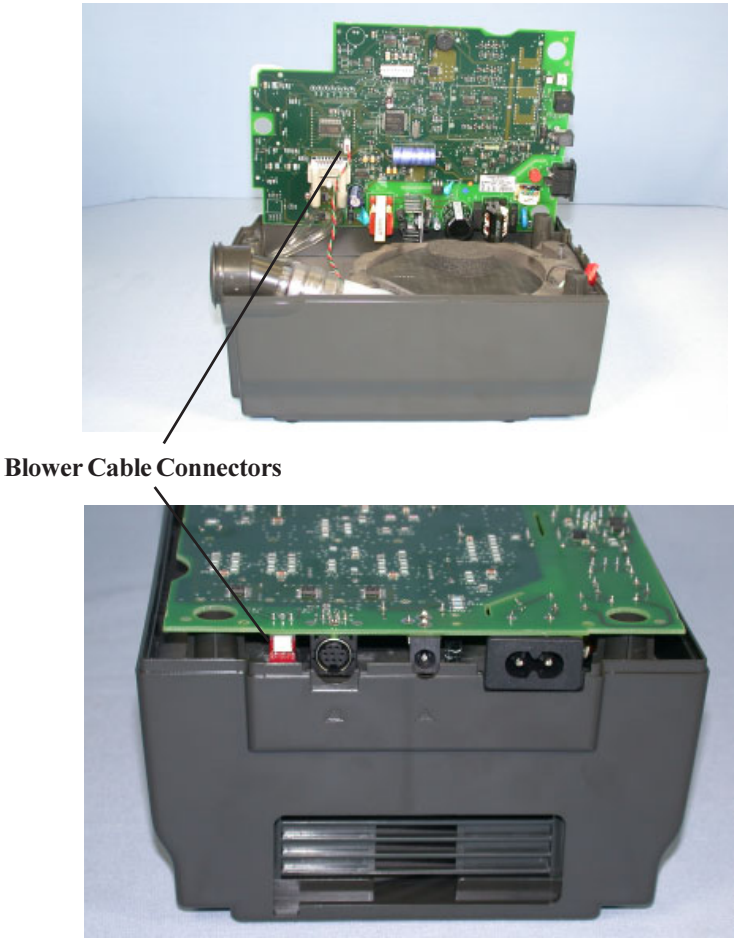
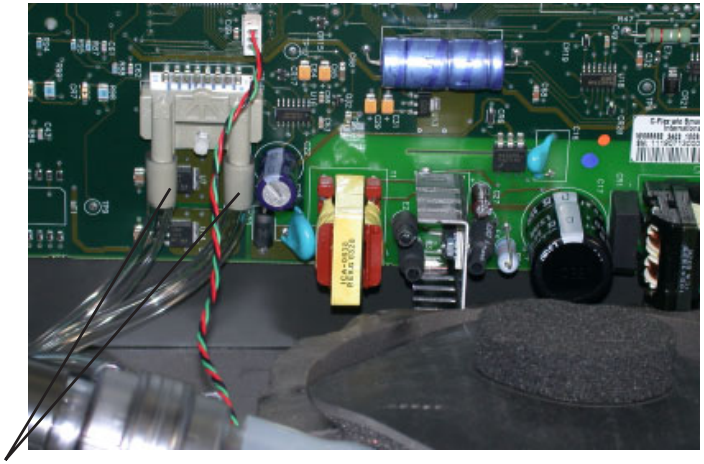


Figure 7-7
Location of the blower cable connectors



Flow Element Tubing

Figure 7-8
Flow Element Tubing

Step 3 Installing the Keypad

Install: • Keypad

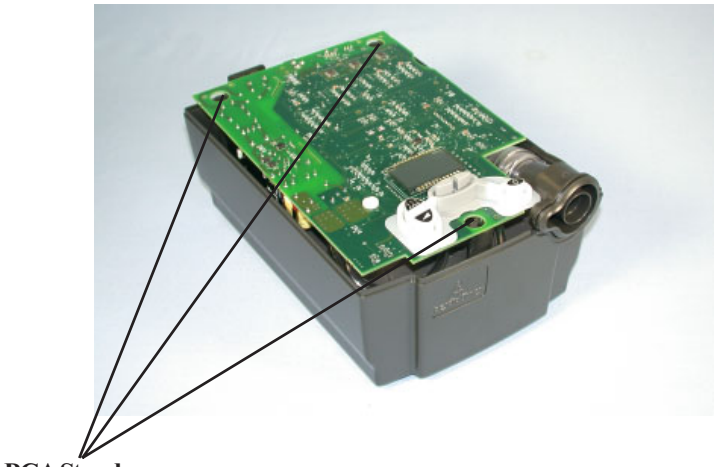
(See Section 7.4.3 for more detailed instructions on installing the keypad.)

Step 4 Installing the Main PCA

a. While holding the main PCA over the bottom enclosure assembly, attach the flow element tubing to the main PCA.

b. Attach the blower connectors to the main PCA.

c. Gently set the main PCA down on the three stands that will hold the main PCA in place.



PCA Stands

Figure 7-9
Placement of the Main Printed Circuit Assembly (PCA)

Step 5 Installing the Top Enclosure

Install: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on installing the top enclosure.)

7.4.3 Keypad Replacement

Replacement Part Number **1008476**

Included in Kit:	**Tools Required:**
Keypad	Phillips Screwdriver (No. 2 medium)

Procedure

Removed/Installed During Process:

- Top Enclosure
  (See Section 7.4.1 for more detailed instructions.)
- Keypad
- Main PCA
  (See Section 7.4.2 for more detailed instructions.)

WARNING: Electrical shock hazard: Disconnect the electrical supply before attempting to make any repairs to the device.

CAUTION: Electronic components used in this device are subject to damage from static electricity. Repairs made to this device must be performed only in an antistatic, ESD-protected environment.

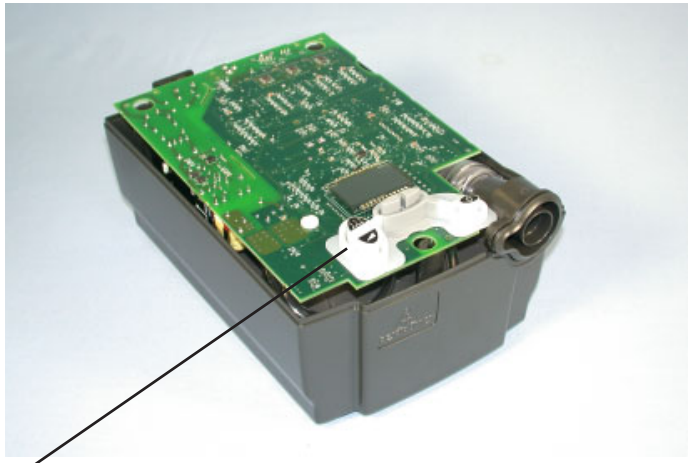


Figure 7-10
Keypad

Step 1 Removing the Top Enclosure

Remove: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on removing the top enclosure.)

Step 2 Removing the Main PCA

Remove: • Main PCA

(See Section 7.4.2 for more detailed instructions on removing the main PCA.)

Step 3 Removing the Keypad

a. Carefully lift the keypad from the main PCA. There are three rubber locking pins that hold the keypad to the main PCA.

NOTE: The Display Assembly (LCD) is permanently attached to the PCA and is not replaceable.

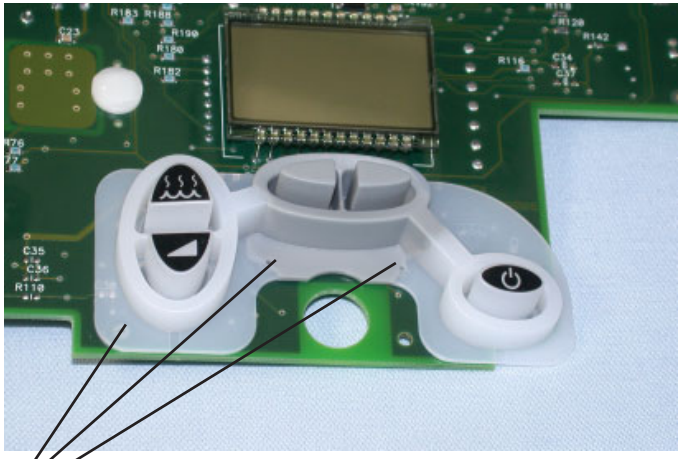
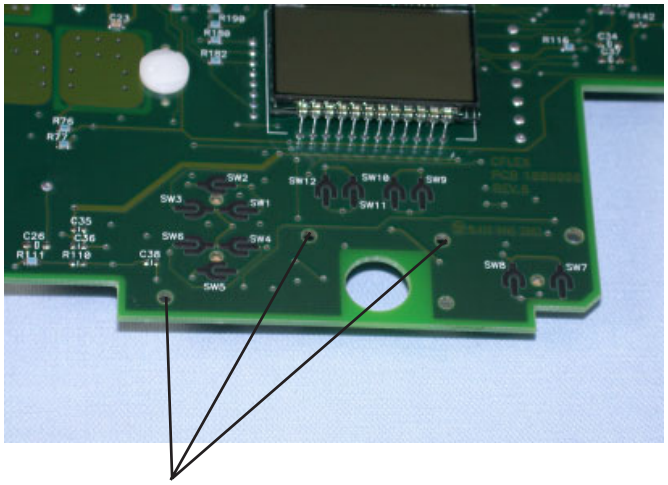


Figure 7-11
Location of Locking Pins on Keypad

Step 4 Installing the Keypad

a. Place the keypad on the main PCA. Align the locking pins with the three holes on the display assembly. Press down on the locking pins until they snap into place.



Align Locking Pins Here

Figure 7-12
Pin Location

Step 5 Installing the Main PCA

Install • Main PCA

(See Section 7.4.2 for more detailed instructions on installing the main PCA.)

Step 6 Installing the Top Enclosure

Install • Top Enclosure

(See Section 7.4.1 for more detailed instructions on installing the top enclosure.)

7.4.4 Outlet Port Replacement

Replacement Part Number **1013896**

Included in Kit:	**Tools Required:**
Outlet Port	Phillips Screwdriver (No. 2 medium)

Procedure

Removed/Installed During Process:

- Top Enclosure
  (See Section 7.4.1 for more detailed instructions.)
- Main PCA
  (See Section 7.4.2 for more detailed instructions.)
- Outlet Port

WARNING: Electrical shock hazard: Disconnect the electrical supply before attempting to make any repairs to the device.

CAUTION: Electronic components used in this device are subject to damage from static electricity. Repairs made to this device must be performed only in an antistatic, ESD-protected environment.

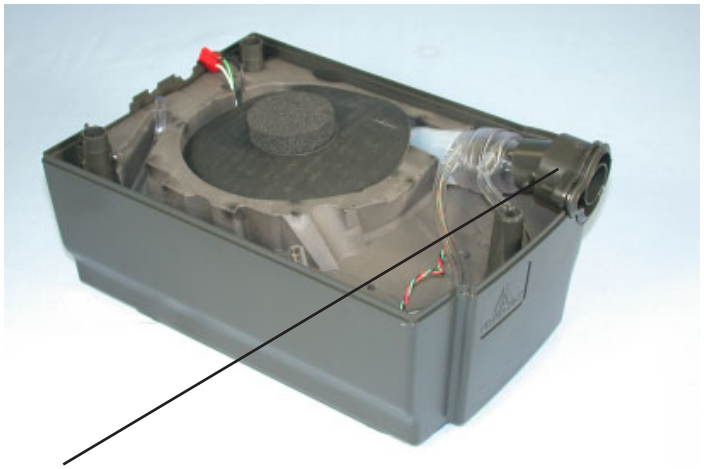


Figure 7-13
Outlet Port

Step 1 Removing the Top Enclosure

Remove: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on removing the top enclosure.)

Step 2 Removing the Main PCA

Remove: • Main PCA

(See Section 7.4.2 for more detailed instructions on removing the main PCA.)

Step 3 Removing the Outlet Port

a. Lift the outlet port out of the bottom enclosure and away from the flow element.

Step 4 Installing the Outlet Port

a. Slide the outlet port into the flow element.

b. Place the outlet port in the bottom enclosure.

Step 5 Installing the Main PCA

Install: • Main PCA

(See Section 7.4.2 for more detailed instructions on installing the main PCA.)

Step 6 Installing the Top Enclosure

Install: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on installing the top enclosure.)

7.4.5 Flow Element Replacement

Replacement Part Number **1008490**

Included in Kit:	**Tools Required:**
Flow Element	Phillips Screwdriver (No. 2 medium)

Procedure

Removed/Installed During Process:

- Top Enclosure
  (See Section 7.4.1 for more detailed instructions.)
- Main PCA
  (See Section 7.4.2 for more detailed instructions.)
- Flow Element Tubing
- Outlet Port
  (See Section 7.4.4 for more detailed instructions.)
- Flow Element

WARNING: Electrical shock hazard: Disconnect the electrical supply before attempting to make any repairs to the device.

CAUTION: Electronic components used in this device are subject to damage from static electricity. Repairs made to this device must be performed only in an antistatic, ESD-protected environment.

Figure 7-14
Flow Element and Tubing

Step 1 Removing the Top Enclosure

Remove: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on removing the top enclosure.)

Step 2 Removing the Main PCA

Remove: • Main PCA

(See Section 7.4.2 for more detailed instructions on removing the main PCA.)

Step 3 Removing the Outlet Port

Remove: • Outlet Port

(See Section 7.4.4 for more detailed instructions on removing the outlet port.)

Step 4 Removing the Flow Element

NOTE: Prior to removing the flow element, note the positioning of the pickoffs. The flow element must be installed with the pickoffs on the upper side of the element.

a. Gently pull the flow element tubing off of the flow element.

b. Slide the flow element out of the silicone tube.

Step 5 Installing the Flow Element

a. Slide the flow element into the silicone tube. Ensure that the flow element pickoffs are on the upper side of the element.

b. Connect the flow element tubing from P2 on the PCA to the port on the flow element closest to the outlet port.

c. Connect the flow element tubing from P1 on the PCA to the port on the flow element closest to the blower.

Step 6 Installing the Outlet Port

Install: • Outlet Port

(See Section 7.4.4 for more detailed instructions on installing the outlet port.)

Step 7 Installing the Main PCA

Install: • Main PCA

(See Section 7.4.2 for more detailed instructions on installing the main PCA.)

Step 8 Installing the Top Enclosure

Install: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on installing the top enclosure.)

7.4.6 Silicone Tube Replacement

Replacement Part Number **1017358**

Included in Kit:	**Tools Required:**
Silicone Tube Flow Element Tubing (x2)	Phillips Screwdriver (No. 2 medium)

Procedure

Removed/Installed During Process:

- Top Enclosure
  (See Section 7.4.1 for more detailed instructions.)
- Main PCA
  (See Section 7.4.2 for more detailed instructions.)
- Outlet Port
  (See Section 7.4.4 for more detailed instructions.)
- Flow Element
  (See Section 7.4.5 for more detailed instructions.)
- Silicone Tube

WARNING: Electrical shock hazard: Disconnect the electrical supply before attempting to make any repairs to the device.

CAUTION: Electronic components used in this device are subject to damage from static electricity. Repairs made to this device must be performed only in an antistatic, ESD-protected environment.

Figure 7-15
Silicone Tube

Step 1 Removing the Top Enclosure

Remove: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on removing the top enclosure.)

Step 2 Removing the Main PCA

Remove: • Main PCA

(See Section 7.4.2 for more detailed instructions on removing the main PCA.)

Step 3 Removing the Outlet Port

Remove: • Outlet Port

(See Section 7.4.4 for more detailed instructions on removing the outlet port.)

Step 4 Removing the Flow Element

Remove: • Flow Element

(See Section 7.4.5 for more detailed instructions on removing the flow element.)

Step 5 Removing the Silicone Tube

a. Slide the silicone tube off of the blower assembly.

Step 6 Installing the Silicone Tube

a. Slide the silicone tube onto the blower assembly.

Step 7 Installing the Flow Element

Install: • Flow Element

(See Section 7.4.5 for more detailed instructions on installing the flow element.)

Step 8 Installing the Outlet Port

Install: • Outlet Port

(See Section 7.4.4 for more detailed instructions on installing the outlet port.)

Step 9 Installing the Main PCA

Install: • Main PCA

(See Section 7.4.2 for more detailed instructions on installing the main PCA.)

Step 10 Installing the Top Enclosure

Install: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on installing the top enclosure.)

7.4.7 Blower Assembly Replacement

Replacement Part Number **1011213**

Included in Kit:	**Tools Required:**
Blower Assembly	Phillips Screwdriver (No. 2 medium)

Procedure

Removed/Installed During Process:

- Top Enclosure
  (See Section 7.4.1 for more detailed instructions.)
- Main PCA
  (See Section 7.4.2 for more detailed instructions.)
- Outlet Port
  (See Section 7.4.4 for more detailed instructions.)
- Flow Element
  (See Section 7.4.5 for more detailed instructions.)
- Silicone Tube
  (See Section 7.4.6 for more detailed instructions.)
- Blower Assembly

WARNING: Electrical shock hazard: Disconnect the electrical supply before attempting to make any repairs to the device.

CAUTION: Electronic components used in this device are subject to damage from static electricity. Repairs made to this device must be performed only in an antistatic, ESD-protected environment.

Figure 7-16
Blower Assembly

Step 1 Removing the Top Enclosure

Remove: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on removing the top enclosure.)

Step 2 Removing the Main PCA

Remove: • Main PCA

(See Section 7.4.2 for more detailed instructions on removing the main PCA.)

Step 3 Removing the Outlet Port

Remove: • Outlet Port

(See Section 7.4.4 for more detailed instructions on removing the outlet port.)

Step 4 Removing the Flow Element

Remove: • Flow Element

(See Section 7.4.5 for more detailed instructions on removing the flow element.)

Step 5 Removing the Silicone Tube

Remove: • Silicone Tube

(See Section 7.4.6 for more detailed instructions on removing the silicone tube.)

Step 6 Removing the Blower Assembly

a. Lift the blower top foam up and away from the blower assembly.

b. While holding down the bottom enclosure, lift the blower assembly up and away from the bottom enclosure.

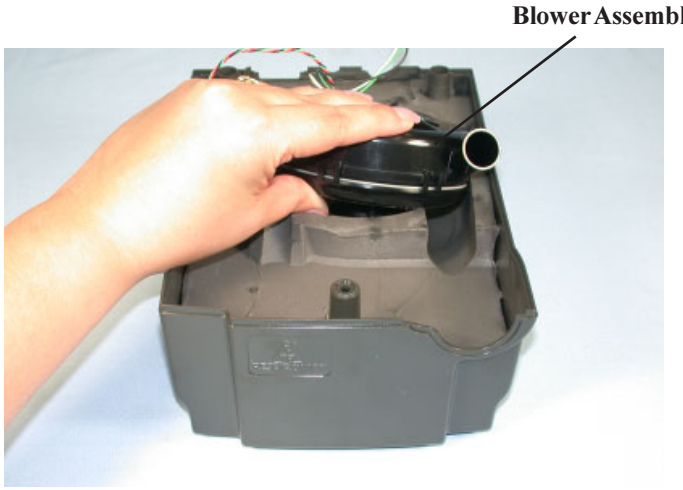


Figure 7-17
Blower Assembly Removal

Step 7 Installing the Blower Assembly

a. Remove the protective backing from the adhesive ring on the blower assembly.

b. Align the blower assembly air outlet with the opening in the foam insert.

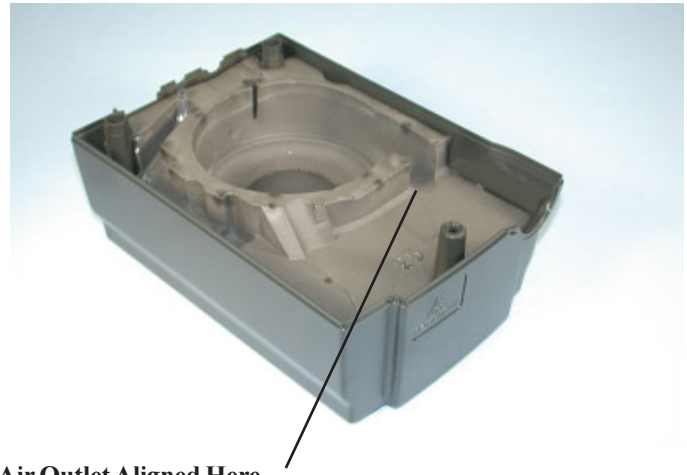


Figure 7-18
Foam Insert

c. Firmly press the blower assembly into the foam insert.

d. Wrap the red/green/black wiring around the bottom of the air outlet one time.

e. Place the blower top foam over the blower assembly and press into the foam insert.

Step 8 Installing the Silicone Tube

Install: • Silicone Tube

(See Section 7.4.6 for more detailed instructions on installing the silicone tube.)

Step 9 Installing the Flow Element

Install: • Flow Element

(See Section 7.4.5 for more detailed instructions on installing the flow element.)

Step 10 Installing the Outlet Port

Install: • Outlet Port

(See Section 7.4.4 for more detailed instructions on installing the outlet port.)

Step 11 Installing the Main PCA

Install: • Main PCA

(See Section 7.4.2 for more detailed instructions on installing the main PCA.)

Step 12 Installing the Top Enclosure

Install: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on installing the top enclosure.)

7.4.8 Bottom Enclosure Replacement

Replacement Part Number **1011215**

Included in Kit:	**Tools Required:**
Bottom Enclosure Screws-8 Hi-Lo x 1/2" (x3)	Phillips Screwdriver (No. 2 medium)

Procedure

Removed/Installed During Process:

- Filters
  (See Section 5.3.1 for more detailed instructions.)
- Top Enclosure
  (See Section 7.4.1 for more detailed instructions.)
- Main PCA
  (See Section 7.4.2 for more detailed instructions.)
- Outlet Port
  (See Section 7.4.4 for more detailed instructions.)
- Flow Element
  (See Section 7.4.5 for more detailed instructions.)
- Silicone Tube
  (See Section 7.4.6 for more detailed instructions.)
- Blower Assembly
  (See Section 7.4.7 for more detailed instructions.)
- Bottom Enclosure

WARNING: Electrical shock hazard: Disconnect the electrical supply before attempting to make any repairs to the device.

CAUTION: Electronic components used in this device are subject to damage from static electricity. Repairs made to this device must be performed only in an antistatic, ESD-protected environment.

Figure 7-19
Bottom Enclosure

Step 1 Removing the Top Enclosure

Remove: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on removing the top enclosure.)

Step 2 Removing the Main PCA

Remove: • Main PCA

(See Section 7.4.2 for more detailed instructions on removing the main PCA.)

Step 3 Removing the Outlet Port

Remove: • Outlet Port

(See Section 7.4.4 for more detailed instructions on removing the outlet port.)

Step 4 Removing the Flow Element

Remove: • Flow Element

(See Section 7.4.5 for more detailed instructions on removing the flow element.)

Step 5 Removing the Silicone Tube

Remove: • Silicone Tube

(See Section 7.4.6 for more detailed instructions on removing the silicone tube.)

Step 6 Removing the Blower Assembly

Remove: • Blower Assembly

(See Section 7.4.7 for more detailed instructions on removing the blower assembly.)

Step 7 Installing the Bottom Enclosure

NOTE: Contact Respironics Product Support Department for bottom enclosure ordering information.

Step 8 Installing the Blower Assembly

Install: • Blower Assembly

(See Section 7.4.7 for more detailed instructions on installing the blower assembly.)

Step 9 Installing the Silicone Tube

Install: • Silicone Tube

(See Section 7.4.6 for more detailed instructions on installing the silicone tube.

Step 10 Installing the Flow Element

Install: • Flow Element

(See Section 7.4.5 for more detailed instructions on installing the flow element.)

Step 11 Installing the Outlet Port

Install: • Outlet Port

(See Section 7.4.4 for more detailed instructions on installing the outlet port.)

Step 12 Installing the Main PCA

Install: • Main PCA

(See Section 7.4.2 for more detailed instructions on installing the main PCA.)

Step 13 Installing the Top Enclosure

Install: • Top Enclosure

(See Section 7.4.1 for more detailed instructions on installing the top enclosure.)

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Chapter 8: Testing

8.1 Testing Process 8-3

8.2 REMstar Plus with C-Flex CPAP System Run-In 8-4

8.3 REMstar Plus with C-Flex CPAP System Calibration 8-5

8.4 REMstar Plus with C-Flex CPAP System Final Test 8-8

8.5 Respironics Heated Humidifier Test 8-9

8.6 Current Draw Test 8-10

REMstar Plus with C-Flex CPAP System w/ Heated Humidifier Testing Data Sheet 8-12

Notes:

Chapter 8: Testing

8.1 Testing Process

The following process should be followed after a repair has been performed on the REMstar Plus w/C-Fex CPAP System or on the Respironics Heated Humidifier.

NOTE: The following tests may be used as a Performance Verification as a way to determine that the CPAP System and Heated Humidifier are functioning properly. This verification shall be performed at periodic intervals commensurate with hospital or home care provider guidelines for preventive maintenance: between rentals or during normal patient usage (as routine maintenance).

Perform the following in order:

1. REMstar Plus with C-Flex CPAP Run-in* (Section 8.2)
2. REMstar Plus with C-Flex CPAP Calibration (Section 8.3)
3. REMstar Plus with C-Flex CPAP Final Test* (Section 8.4)
4. Respironics Heated Humidifier* Test (Section 8.5)

*The same data sheet is used for all tests. Sections not used due to the testing of only the CPAP or Humidifier should be marked as NA (Not Applicable).

8.2 REMstar Plus with C-Flex CPAP System Run-In Procedure

Purpose

This procedure provides setup instructions for the REMstar Plus with C-Flex CPAP System.

CAUTION: Electronic components used in this device are subject to damage from static electricity. Use and follow appropriate Electro-Static Discharge (ESD) procedures.

Equipment

Test Orifice (RI P/N 332353)

Step 1 Blower Hours (Pre Run-In)

a. Connect the REMstar Plus with C-Flex CPAP System into the proper AC Power source.

b. Record the Blower Hours shown on the display screen in the space provided on the REMstar Plus with C-Flex CPAP System Data Sheet.

NOTE: Blower hours are temporarily displayed beside a fan symbol during the power up sequence.

Step 2 Setup

a. Place the test orifice on the outlet of the UUT.

b. Enter the Setup menu and set the pressure to 10cm H_2O. (See Section 4.2 for instructions).

c. Run the unit for a minimum of 2 hours.

Step 3 Blower Hours (Post Run-In)

a. With the blower still running, press the right User button to view the Blower Hours.

b. Record the Blower Hours in the space provided on the REMstar Plus with C-Flex CPAP System Data Sheet.

8.3 REMstar Plus with C-Flex CPAP System Flow Calibration

Purpose

This procedure provides calibration of the REMstar Plus with C-Flex CPAP System.

CAUTION: Electronic components used in this device are subject to damage from static electricity. Use and follow appropriate Electro-Static Discharge (ESD) procedures.

Equipment

Flow Meter (see Appendix A)

3 sections of patient tubing

1 flow control valve (RI P/N 1006120)

O_2 adapter (see Appendix A)

End cap (to produce a dead head pressure)

Negative flow source
(capable of delivering at least 120 lpm @ 20 cm H_2O.)

Flow Sensor Calibration

NOTE: The following calibration should be performed after any repair has been performed on the REMstar Plus with C-Flex CPAP System.

Equipment Setup

NOTE: Refer to Figures 8-1 and 8-2 for proper connections to perform flow calibration.

- Connect one piece of patient tubing between the REMstar Plus with C-Flex and the flow meter.
- Connect one piece of patient tubing between the flow meter and the flow valve.
- Connect one piece of patient tubing between the flow valve and the negative flow source.

Step 1 Flow Offset

a. Hold down the Humidifier and Ramp button while plugging in the power cord. After you hear two tones release the buttons.

b. Press the right user button 4 times to reach the **FOFS7** (flow offset) screen.

c. Press the humidifier or ramp button once to adjust the flow offset. When the numbers on the display screen stop changing, the process is complete.

Step 2 Flow Cal

a. Press the right user button 1 time to reach the **FCAL** (flow cal) screen.

b. Press the ramp button once to null the flow table.

c. Press the humidifier button to start the flow cal. The display screen will be flashing **-120**. It may take a few seconds to start flashing.

d. Turn on the negative flow source.

e. Adjust the flow valve until the flow meter reads -120 lpm.

f. Press the Start / Stop button to preceed to the next value on the display screen.

g. Adjust the flow valve and press the Start / Stop button for each setting that appears on the display screen. When the display screen reaches a flashing **0.0** stop.

REMstar Plus with C-Flex CPAP System Calibration (Continued)

h. Turn off the negative flow source. Disconnect the negative flow source and the patient tubing from the flow valve.

i. The display screen should be flashing **0.0**. Press the Start / Stop switch.

j. Adjust the flow valve and press the Start / Stop button for each setting that appears on the display screen.

NOTE: The flow restrictor shown in Figures 8-1 and 8-2 is not available through Respironics. However, available through Respironics is adjustable flow valve, RI P/N 1006120.

Figure 8-1
Flow Calibration (Negative Flow)

k. When the calibration @ 120 lpm is complete, the display will stop flashing and will show the flow as measured by the calibrated flow sensor..

l. Calibration is complete. Disconnect the REMstar Plus with C-Flex from the power source.

Figure 8-2
Flow Calibration (Positive Flow)

8.4 REMstar Plus with C-Flex CPAP System Final Test

Purpose

This procedure provides instructions for the REMstar Plus with C-Flex CPAP System Final Test.

CAUTION: Electronic components used in this device are subject to damage from static electricity. Use and follow appropriate Electro-Static Discharge (ESD) procedures.

Equipment

O_2 Enrichment Attachment (R/I P/N 310001)

Pressure tubing

Outlet end cap

Manometer (see Appendix A)

6 ft. Patient tubing

Whisper Swivel II (R/I P/N 302398)

Step 1 Setup

a. Connect one end of the patient tubing to the outlet of the REMstar Plus with C-Flex

b. Connect the Whisper Swivel II to the other end of the 6 ft. patient tubing.

c. Connect the O_2 enrichment port to the Whisper Swivel II.

d. Place the outlet end cap on the O_2 enrichment port.

e. Connect the pressure tubing between the manometer and the O_2 enrichment port.

Step 2 4 cm H_2O Pressure

a. Enter the Setup menu and set the pressure to 4 cm H_2O. (Refer to Section 4.2 for instructions). The blower will start automatically.

b. Allow the unit to stabilize for 1 minute.

c. Record the pressure reading of the manometer in the space provided on the Testing Data Sheet.

Step 3 20 cm H_2O Pressure

a. Set the pressure to 20 cm H_2O and record the pressure reading of the manometer in the space provided on the Test Data Sheet.

8.5 Respironics Heated Humidifier Test

Purpose

This procedure provides instructions for the Heated Humidifier System Test.

CAUTION: Electronic components used in this device are subject to damage from static electricity. Use and follow appropriate Electro-Static Discharge (ESD) procedures.

Equipment

REMstar Plus w/C-Flew CPAP System

Test Orifice (R/I P/N 332353)

1 piece of pressure tubing

Step 1 Humidifier Preheat Test

a. Connect the REMstar Plus with C-Flex CPAP System to the Heated Humidifier (See Section 4.5 for instructions.)

b. Set the Heated Humidifier setting to 1.

c. Start the preheat mode (blower must be off for preheat) and observe the following:

1. The icon appears on the CPAP display screen.

2. The green LED on the front of the Heated Humidifier is illuminated.

d. Record the results on the Testing Data Sheet.

Step 2 Humidifier Heat Test

a. All connections remain the same as in step 1.

b. Turn the UUT blower on and observe that the green LED on the front of the Heated Humidifier is a solid green LED.

c. Observe heater plate warms.

d. Record the results on the Test Data Sheet.

8.6 Current Draw Test

Purpose

This procedure provides instructions for testing the current draw on the REMstar Plus with C-Flex CPAP system, the Respironics Heated Humidifier or both units together.

CAUTION: Electronic components used in this device are subject to damage from static electricity. Use and follow appropriate Electro-Static Discharge (ESD) procedures.

Equipment

REMstar Plus with C-Flex CPAP System

Test Orifice (R/I P/N 332353)

1 piece of pressure tubing

Multimeter

Test leads

NOTE: The Water Chamber does not need to be in place for testing.

Step 1 CPAP System Setup

a. Place the test orifice on the outlet of the UUT.

b. Enter the Setup menu and set the pressure to 20 cm H_2O. (See Section 4.2 for instructions).

Step 2 CPAP Current Draw Test

a. Connect the REMstar Plus with C-Flex CPAP System and the Multimeter (Set to Current) in series.

b. Connect the AC power cord to the UUT.

c. Connect the AC power cord to the proper source.

d. Turn the UUT blower on and allow the unit to stabilize for 1 minute.

e. Record the current reading from the multimeter in the space provided on the Testing Data Sheet.

Step 3 Heated Humidifier System Setup

a. Connect the REMstar Plus with C-Flex CPAP system to the Heated Humidifier.

b. Set the Preheat Mode to 5.

Step 4 Heated Humidifier Current Draw Test

a. Connect the Respironics Heated Humidifier System power cord and the test leads in series.

b. Connect the test leads to the multimeter.

c. Connect the AC power cord to the UUT.

d. Connect the AC power cord to the proper source.

e. Press the Heated Humidifier button until you hear one audible tone then release.

f. Record the current reading from the multimeter in the space provided on the Testing Data Sheet.

NOTE: Setup remains the same for Step 5.

Step 5 CPAP / Heated Humidifier Current Draw Test

a. Turn the UUT blower on and allow the unit to stabilize for 1 minute.

b. Record the current reading from the multimeter in the space provided on the Testing Data Sheet.

Step 6 Test Complete

a. Sign and Date the Testing Data Sheet.

REMstar Plus with C-Flex CPAP System with Heated Humidifier Testing Data Sheet

CPAP Testing

Notification No. _____ CPAP Serial No. _____ Model No. _____

Notification No. _____ Humidifier Serial No. _____ Model No. _____

Blower Hours Pre Run-In (B = _____)

Blowers Hours Post Run-In (B = _____)

CPAP Final Test 4 cm H_2O (_____) $\pm$1 cm H_2O (Tolerance) 20 cm H_2O (_____) $\pm$2 cm H_2O (Tolerance)

Heated Humidifier Testing

Preheat Mode Display Screen Icon Pass _____ Fail _____ Solid Indicator Pass _____ Fail _____

Heating Mode Solid Indicator Pass _____ Fail _____

Current Draw @ 20 cm H_2O (_____) (Tolerance) < 1.0 A Current Draw @ 5 Preheat (_____) (Tolerance) < .7 A Total Current Draw (_____) (Tolerance) < 1.7 A

NOTE: If a section of this Data sheet is not being used, mark that section as NA (Not Applicable)

Date ____ / ____ / ____ Signature (In Ink) _____

Appendix A: Tools and Equipment

A.1 Service Tools and Supplies A-3

A.2 Acceptable Test Equipment A-4

Notes:

Appendix A: Tools and Equipment

A.1 Service Tools and Supplies

You should have the following hand tools and supplies available for troubleshooting, testing, and repairing the REMstar Plus with C-Flex System.

- Common Hand Tools

  Flat-blade screwdriver - small

  Phillips screwdriver - medium

- Antistatic, Electro-Static Discharge (ESD)-protected work station - minimum requirement is a grounded mat and wrist strap

- Microsoft® Windows®-compatible personal computer running Windows 95, 98, 2000, NT®, and XP® with a CD-ROM drive

- Cleaning Cloth
- Digital Manometer - see Section A.2
- Digital Multimeter - see Section A.2
- Flow Meter - see Section A.2
- Test Leads
- Isopropyl Alcohol
- Mild Detergent
- Pressure Tubing
- Test Orifice (RI P/N 332353)
- Whisper Swivel II (RI P/N 332113)
- Adjustable Flow Valve (RI P/N 1006120)
- CPAP (for negative flow)
- O_2 Enrichment Port (RI P/N 312710)

A.2 Acceptable Test Equipment

A.2.1 Digital Manometer*

Specifications:

0 - 25 cm H_2O (or better)

±0.3 cm H_2O accuracy

±0.1 cm H_2O resolution

Acceptable Options:

- Respironics Digital Manometer
- TSI Certifier FA Test System, High Flow Module (RI P/N 1012598)
- Merical DP2001
- Sensym PDM 200CD
- Any commercially available digital manometer that meets the above specifications.

* A water column manometer may also be used.

A.2.2 Digital Multimeter

Specifications:

2.5 digit readout minimum

0.0 - 20.0 VDC

0.0 - 25.0 VAC

Acceptable Options:

- Fluke 83 or better model
- Any commercially available multimeter that meets the above specifications.

A.2.3 Flow Meter

Specifications:

Range: +180 to -180 LPM

± 2% accuracy

± 1 LPM resolution

Acceptable Options:

- TSI 4000 Series Flow Meter
- Any commercially available flowmeter that meets the above specifications.

Appendix B: Schematics

Schematic Statement **B-2**

Motor Driver **B-3**

Power Supply **B-4**

Display **B-5**

To CPU Board **B-6**

Analog Circuit **B-7**

Microprocessor **B-8**

Appendix B: Schematics

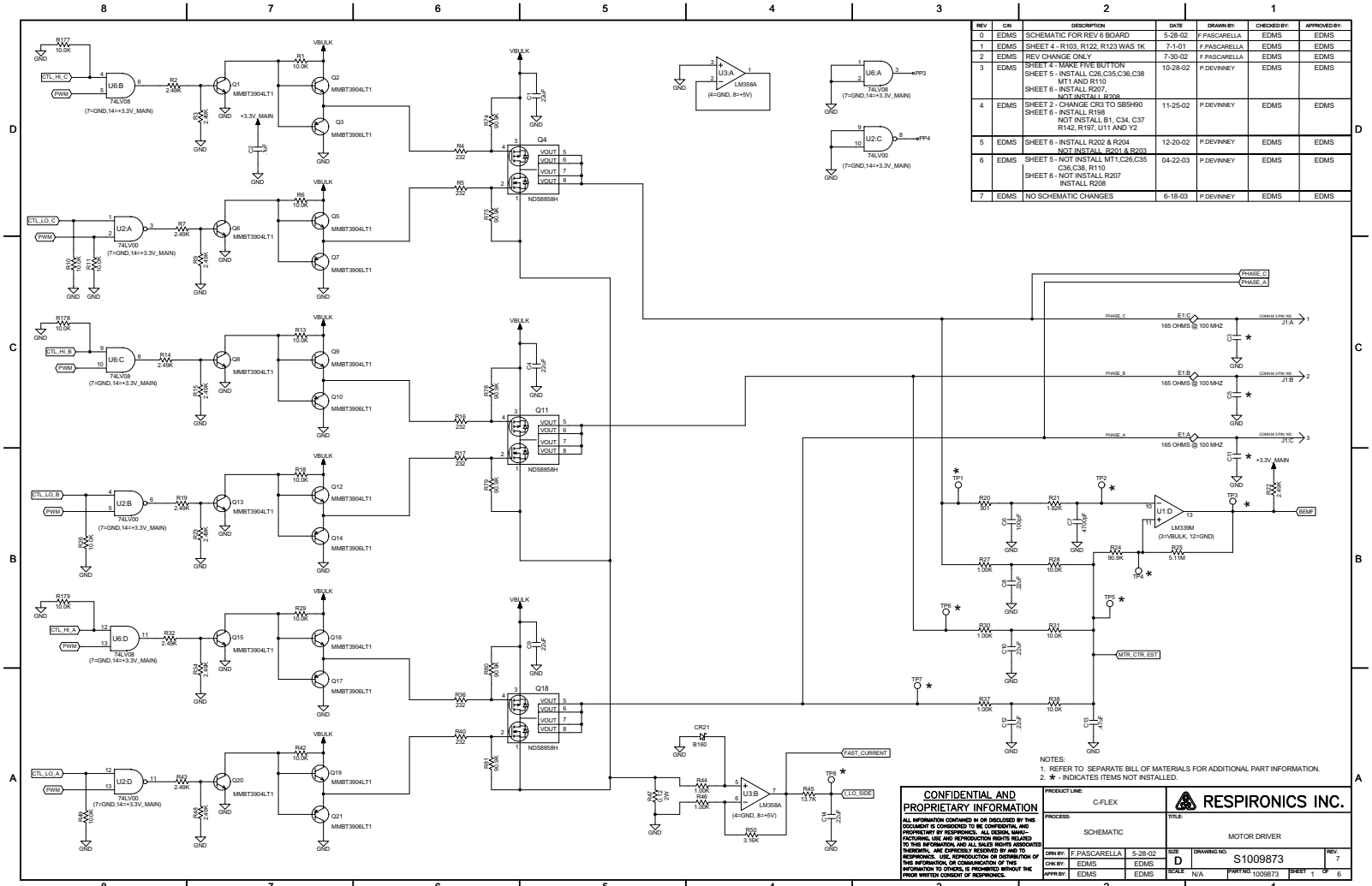
B.1 Schematic Statement

Schematics are supplied with this manual in direct support of the sale and purchase of this product.

The schematics are proprietary and confidential. Do not copy the schematics or disclose them to third parties beyond the purpose for which they are intended. Patents are pending.

The schematics are intended to satisfy administrative requirements only. They are not intended to be used for component level testing and repair. Any changes of components could effect the reliability of the device, prohibit lot tracking of electronic components, and void warranties. Repairs and testing are supported only at the complete board level.

The schematics are of the revision level in effect at the time this manual was last revised. New revisions may or may not be distributed in the future.



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4	EDMS	SHEET 2 - CHANGE CR3 TO SB5H90 SHEET 6 - INSTALL R198 NOT INSTALL B1, C34, C37 R142, R197, U11 AND Y2	11-25-02	P.DEVINNEY	EDMS	EDMS
5	EDMS	SHEET 6 - INSTALL R202 & R204 NOT INSTALL R201 & R203	12-20-02	P.DEVINNEY	EDMS	EDMS
6	EDMS	SHEET 5 - NOT INSTALL MT1,C26,C35 C36,C38, R110 SHEET 6 - NOT INSTALL R207 INSTALL R208	04-22-03	P.DEVINNEY	EDMS	EDMS
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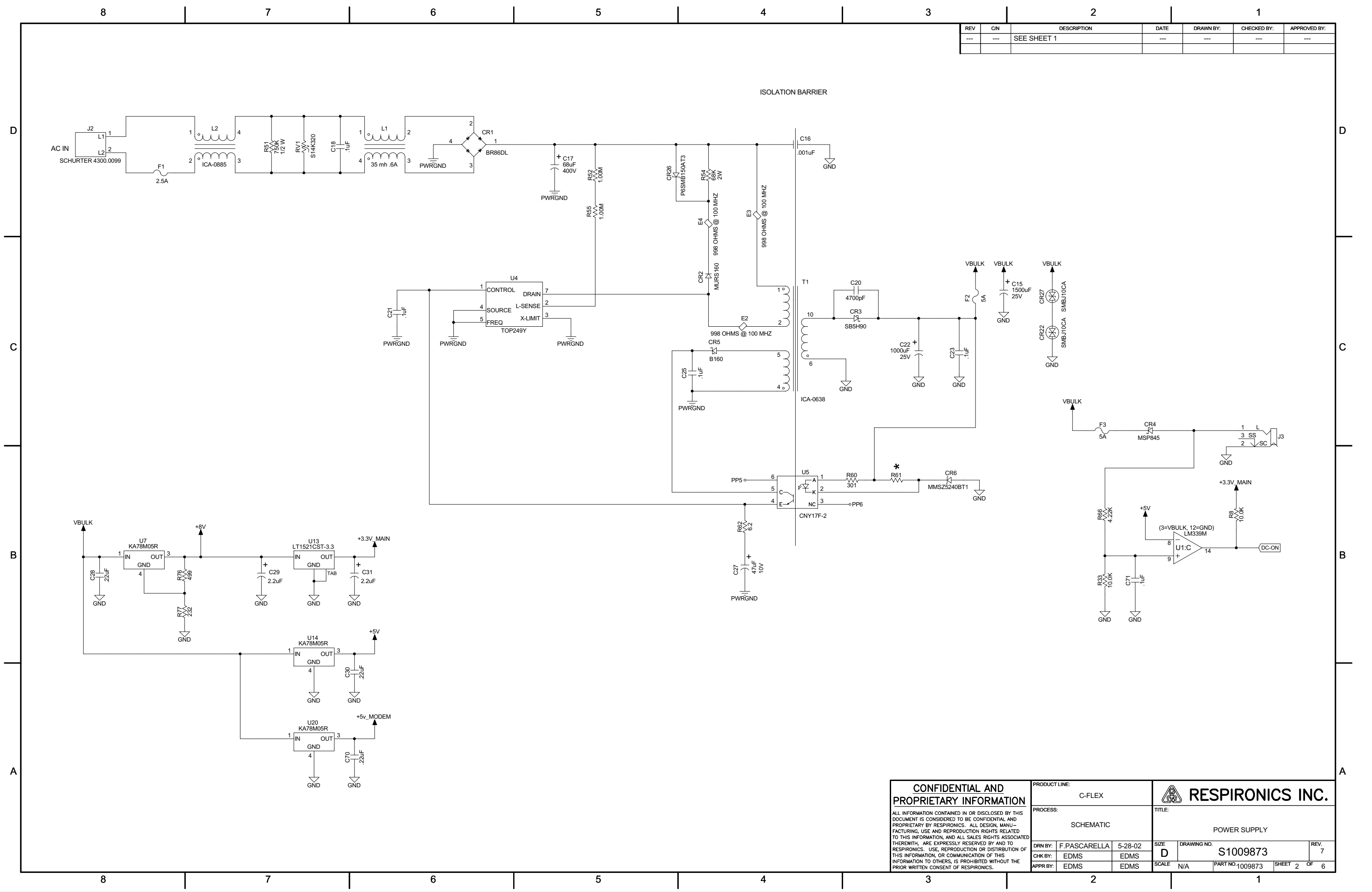
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C15
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R66
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C-FLEX
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APPR BY: EDMS EDMS
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REV. 7
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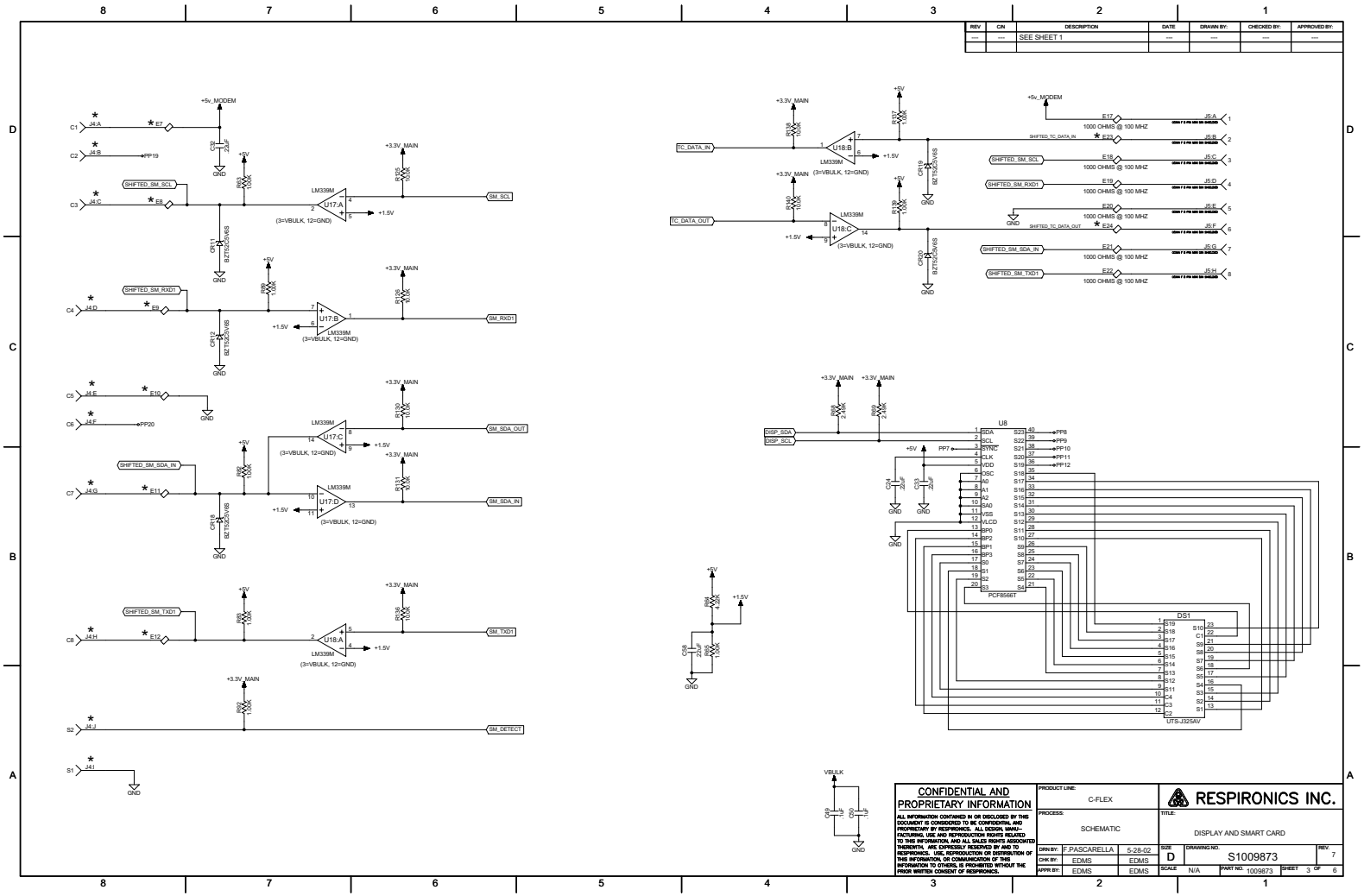
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UTS-J325AV
VBULK
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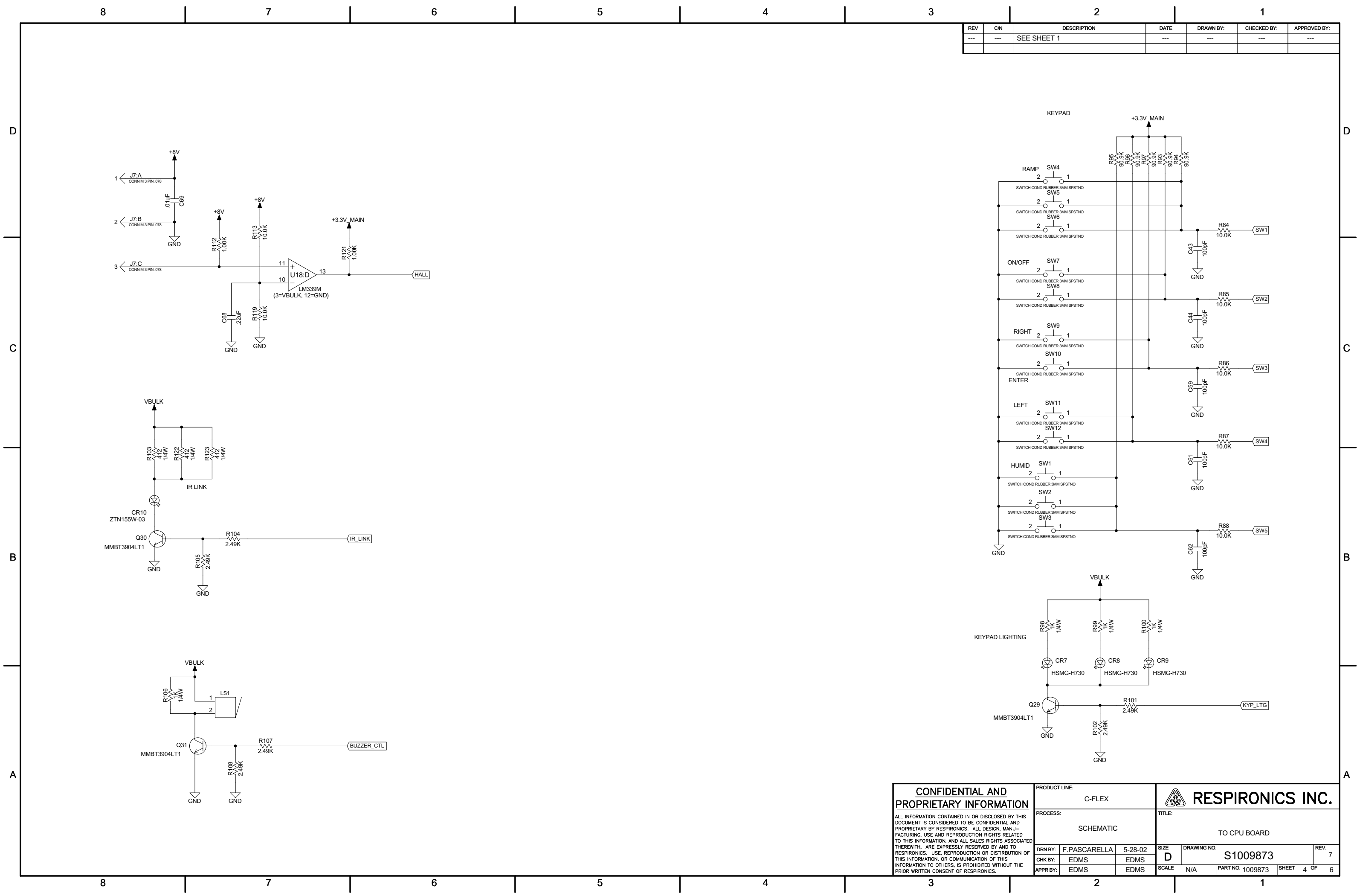
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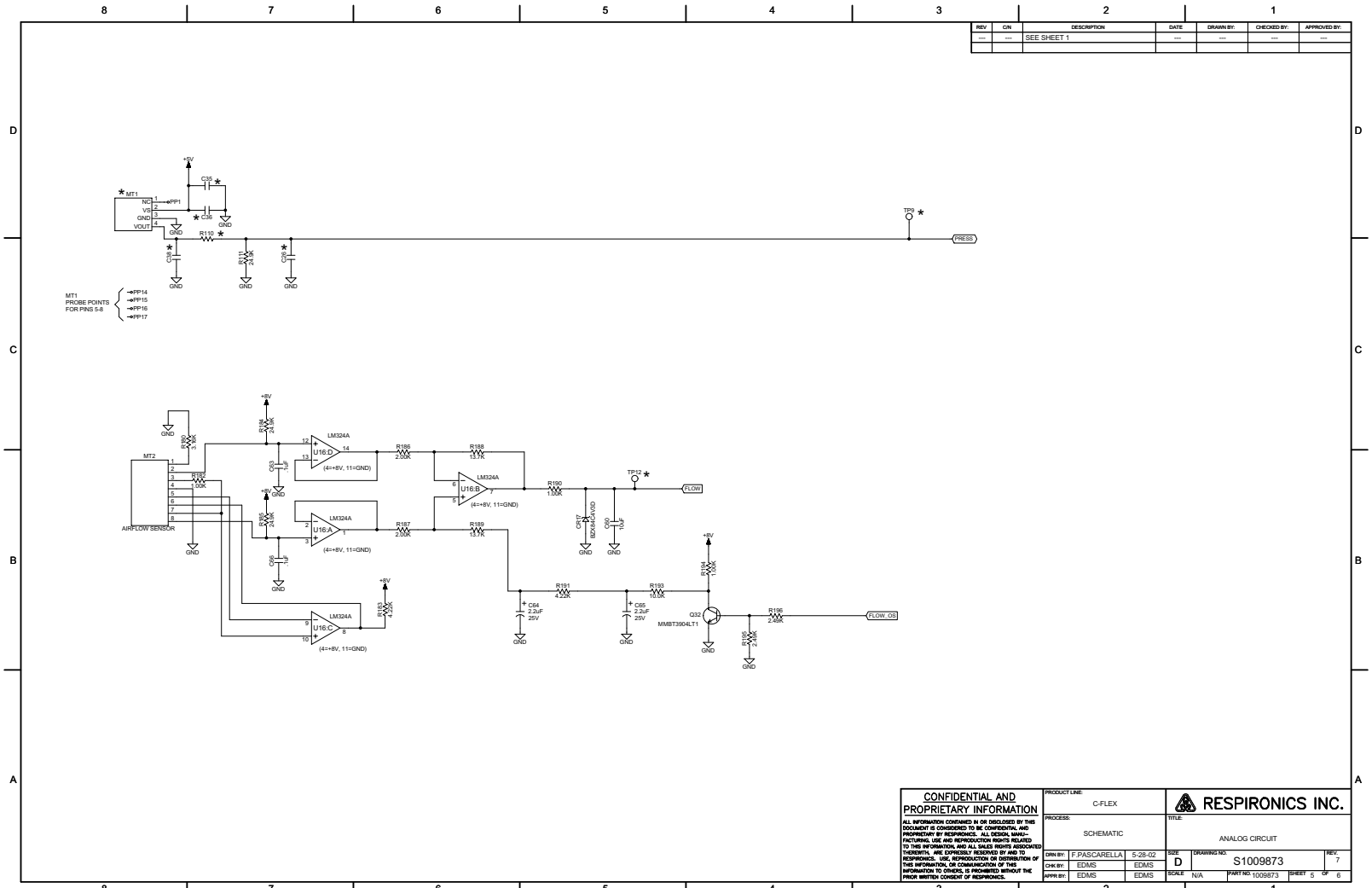
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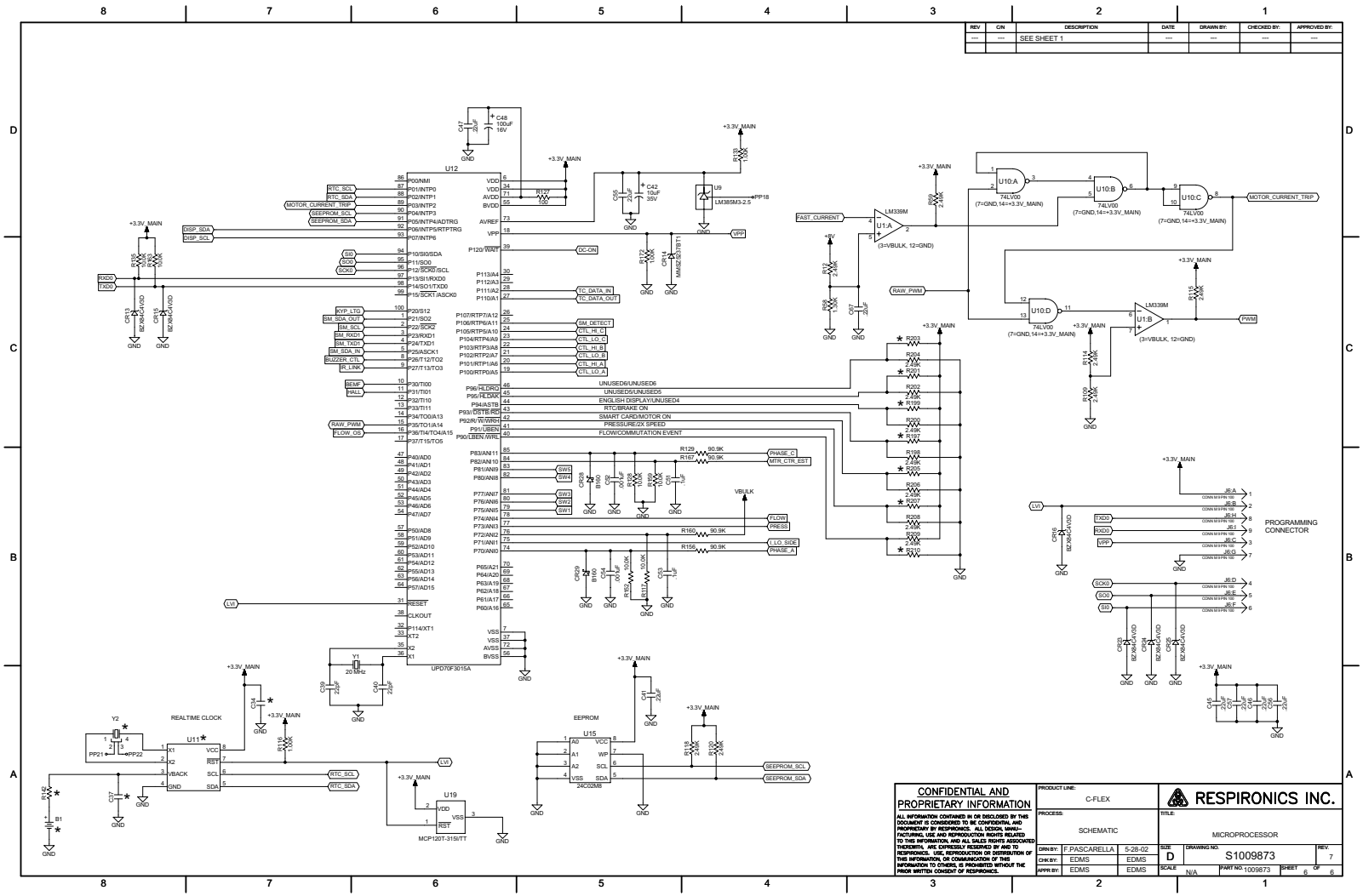
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SHEET 6 OF 6

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TMF 09/12/2003