BiPAP systems are the subject of one or more of U.S. Patents #5148802, #5239995, #531937, #5433193, Canadian Patent #2, 024, 477, European Patent #EPO425092, German Patent #69021681.5-08, and other pending U.S. and foreign patents. BiPAP is a registered trademark of Respironics Inc.

Limited Warranty

Respironics warrants that the BiPAP® Synchrony™ System 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 no 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 dealer or contact Respironics at:

RESPIRONICS INC.®
1001 Murry Ridge Lane
Murrysville, Pennsylvania
15668-8550 USA

RESPIRONICS®
Deutschland
Gewerbestrasse 17
D-82211 Herrsching Germany

CE
0123

Table of Contents

(This page left intentionally blank.)

Overview: BiPAP Synchrony Systems

Warranty		Details the Respironics warranty
Chapter 1:	**Introduction**	Lists the chapters included in this manual.
Chapter 2:	**Warnings, Cautions, and Notes**	Introduces the BiPAP Synchrony system.
Chapter 3:	**Specifications, Features, Descriptions, and Theory of Operation**	Describes the theory of operation for the BiPAP Synchrony 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:	**Troubleshooting and Diagnostics**	Provides troubleshooting flow charts and error code definitions.
Chapter 6:	**Repair and Replacement**	Describes detailed procedures of removing and installing all major components within the unit., including graphics and photographs for visual identification.
Chapter 7:	**Testing**	Includes Overview, Performance Verification and Performance Verification Data Sheet.
Chapter 8:	**Optional Oxygen Module Repair and Replacement**	Describes detailed procedures of removing and installing the Oxygen Module., including graphics and photographs for visual identification.
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: These are proprietary and are used for reference only.

Index:	Item location guide.

Chapter 1: Introduction

(This page left intentionally blank)

Chapter 1: Introduction

1.1 BiPAP Synchrony System Overview

The BiPAP Synchrony System (Synchrony), shown in Figure 1-1, is a noninvasive, pressure support ventilator used to augment the breathing of adult patients suffering from acute or chronic respiratory insufficiency, and to maintain airway patency. It may also be used to support patients who experience obstructive sleep apnea. The BiPAP Synchrony is not intended to provide the total ventilatory requirements of the patient.

The Synchrony ventilator incorporates a control panel with a Liquid Crystal Display (LCD), Light-Emitting Diode (LED), operational keys and internal audible and visual alarms. The Synchrony ventilator also has an option for an internal modem that can be connected directly to your phone line via an RJ-11 jack.

Figure 1-1
BiPAP Synchrony

1.2 Service Notice

This service manual was prepared by Respironics primarily for use by technicians to service the Synchrony ventilatory system. The individuals using this manual to service the Synchrony ventilatory system should have prior experience servicing ventilatory devices.

Only limited repairs and testing may be performed on this unit. For any major repairs, the device calibration must be performed at a Respironics Service Center that is equipped with a Multi Functional Calibration Station.

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 at the following.

U.S. and Canada

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

International

Phone: **1-412-731-2100**
Fax: **1-412-473-5012**

Visit Respironics Home Page on the World Wide Web at:

www.respironics.com

RESPIRONICS INC.®
1001 Murry Ridge Lane
Murrysville, Pennsylvania
15668-8550 USA

RESPIRONICS®
Deutschland
Gewerbestrasse 17
82211 Herrsching Germany

CE 0123

Chapter 2: Warnings, Cautions, and Notes

(This page left intentionally blank)

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 patients (>66 lbs.; >30 kg)
- 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 Positive Airway Pressure devices. At low Expiratory Positive Airway Pressure (EPAP) pressures, the air flow through the exhalation port may not be enough to clear all of the exhaled gas from the mask. Some rebreathing may occur.
- Do not use the device in ambient temperatures above 95°F. If the device is used at ambient temperatures above 95°F, the temperature of the patient air may exceed 106 °F, which could cause thermal irritation or injury to the patients airway.
- This device is not suitable for use in the presence of a flammable mixtures, gases, anesthetics or liquids.
- 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 patient circuit.
- Most bi-level devices have the potential to induce rebreathing of exhaled air. To reduce this potential, use only Respironics circuit accessories, do not wear the mask or 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 Synchrony.
- 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 Synchrony. DO NOT immerse this device into any fluids or allow any liquid to enter the case or inlet filter.

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 Synchrony 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 a foam filter when the Synchrony is in use.
- Never place liquids on or near the Synchrony.
- 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 Synchrony User's Manual for product use, additional warnings, cautions, and notes.

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

(This page left intentionally blank.)

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

(This page left intentionally blank.)

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

3.1 Overview

This chapter describes the BiPAP Synchrony specifications and system features, and provides a functional description and theory of operation of the unit.

Figure 3-1
Bi-PAP Synchrony

3.2 Specifications

ENVIRONMENTAL:

Operating Temperature	41 - 95 F (5 - 35 C)
Storage Temperature	-4 - 140 F (-20 - 60 C)
Humidity	15 - 95% non-condensing
Atmospheric Pressure	83 - 102 kPascals
Elevation	0 - 5,500 ft. (0 - 1.67 km) with automatic altitude adjustment.
Noise Level	No specification is given because various test instruments, test procedures, and unit operating conditions produce varying results.

FUSES

Fuses	There are no replaceable fuses

PHYSICAL:

Electrical Safety	IEC 601-1, general safety requirements for medical devices
Dimensions	12.50" (L) x 7.25 (W) x 5.75" (H) (31.75 x 18.4 x 14.6 cm)
Weight	5.75 lbs (2.6 kg) 6.5 lbs (2.9 kg)

ELECTRICAL:

AC Input Voltage	85 - 265 VAC @ 45 - 66 Hz
DC Input Voltage	11 - 17 VDC
AC Current Consumption	1.25 A Maximum
DC Current Consumption	5.5 A Maximum
Power Consumption	90 VA Maximum
Class	Class II
Type	Type BF

Specifications (Continued)

FUNCTIONS:

Mode	CPAP Spontaneous/ Timed Pressure Controlled Timed

EMC NORMATIVE DOCUMENTS:

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

IEC 601-1-2	Medical Electrical equipment, general requirements for safety, and electromagnetic compatibility.
IEC 1000 -2	Electrostatic discharge require ments for industrial process measurements and control equipment.
IEC 1000 -3	Radiated electromagnetic field requirements for industrial precess measure-ment and control equipment.
IEC 1000 - 4	Electrically fast transients for industrial process measure-ment and control equipment.
CISPR	Limits and methods of measurement of electromag-netic disturbance characteris-tics of industrial, scientific, and medical (ISM) equip-ment.

DATA STORAGE:

Time	Minimum resolution of 1/4 hour (15 minutes).
System Alarm Log	Minimum of 100 time-tagged alarm events.
Patient Alarm Log	Minimum of 100 time-logged alarm events.
Patient Alarm Summary	Summary of patient alarms with a count of the number of alarms of each type.
Usage Log (Time Meter)	Accumulated hours of blower operation stored in 0.1 hour increments.

Patient Therapy Log	Accumulated hours of patient therapy stored in 0.1 hour increments.
Therapy Log	Compatible with Encore Data Management Software.

ALTITUDE COMPENSATION:

Pressure Range	83 - 102 kPascals

NOTE: The BiPAP Synchrony automatically adjusts for altitude changes.

PRESSURE:

CPAP Mode	4.0 - 20.0 cm H2O
Spontaneous Mode	IPAP Pressure Range 4.0 - 30.0 cm H2O EPAP Pressure Range 4.0 - 15 0 cm H2O
Spontaneous/Timed Mode	IPAP Pressure Range 4.0 - 30.0 cm H2O EPAP Pressure Range 4.0 - 15 0 cm H2O
Timed Mode	IPAP Pressure Range 4.0 - 30.0 cm H2O EPAP Pressure Range 4.0 - 15 0 cm H2O
Pressure Control Mode	IPAP Pressure Range 4.0 - 30.0 cm H2O EPAP Pressure Range 4.0 - 15 0 cm H2O
Breath Rate	1 - 30 BPM
Rise Time	0.1 - 0.6 Sec.
Timed Inspiration	0.5 - 3.0 Sec.
Resolution	1 cm H2O 0.1 Sec.
Accuracy	+/- 2.0 cm H2O of the programmed set point.
Setting Stability	+/- 1.3 cm H2O over 8 hours

3.3 System Features

AC Power Connector	Connect the AC power cord here.
Air Outlet Port	Connect the flexible tubing here.
DC Power Connector	Optional DC power connection.
Liquid Crystal Display	Display all system functions.
Filter Cap & Filters	The pollen filter screens out normal household dust and pollens. This must be in place at all times when the Synchrony is operating. An optional, disposable ultra-fine filter is also included for more complete filtration of very fine particles. The filter cap can be positioned to direct the air flow away from your bedside.
Pressure On / Off Button	This turns the air flow either on or off.
AC Power Cord	IEC 320 Style
LED Signal Lights	Alarm indicators alert you when a problem occurs.
AC / DC Power Indicators	Alerts you when operating on AC or DC power.
Stand By Key	Starts and Stops the unit.

Symbol	Meaning
	AC Power Indicator
	DC Power Indicator
	Alarm Indicator
	Type BF Applied Part
	Class II for Protection Against Electric Shock
	Attention, consult accompanying documents
	Standby Key (Start/Stop)
	Up Key
	Down Key
	Enter Key
	Ramp Start/Alarm Silence Key

3.4 Functional Description

The BiPAP Synchrony is a noninvasive, pressure support ventilator used to augment the breathing of adult patients (> 66lbs.; > 30 kg) suffering from acute or chronic respiratory insufficiency, or to maintain airway patency and provide ventilatory support to patients who experience obstructive sleep apnea. The Synchrony is not intended to provide the total ventilatory requirements of the patient.

The Synchrony is intended for use in the home, but may be also be used in the hospital or other institutional settings.

The Synchrony is intended for use with nasal masks and full-face masks as recommended by Respironics.

Bi-level ventilation with the Synchrony Ventilatory Support System helps you to breathe by supplying two levels of air pressure. The Synchrony provides a higher pressure known as IPAP (Inspiratory Positive Airway Pressure) when you inhale, and a lower pressure known as EPAP (Expiratory Positive Airway Pressure) when you exhale. The higher pressure makes it easier to inhale and the lower pressure makes it easier to exhale while still keeping your airway open.

Integral to the generation of air flow 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 control circuitry regulates the motor speed, which in turn adjusts and controls the pressure.

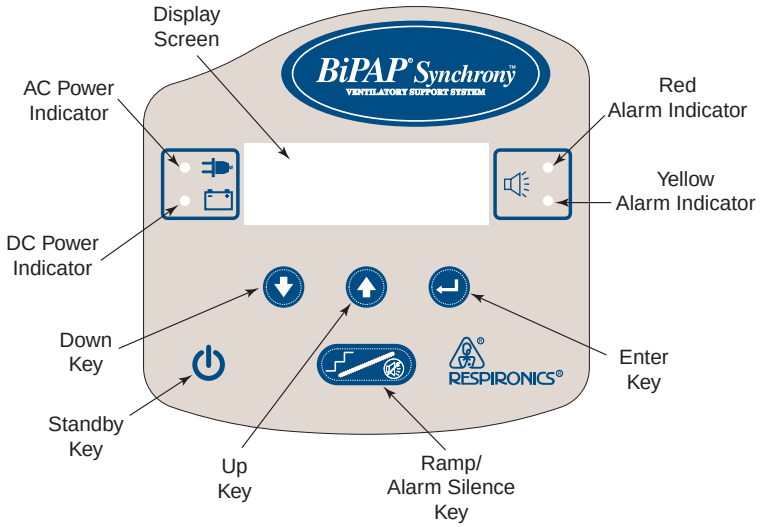
The unit may be powered from either AC (85 - 265 VAC) or from DC power (11 - 17 VDC). AC power enters the unit via an IEC - 320 style AC inlet and appropriate power cord. A DC power connector enables the patient to use the system when AC voltage is not accessible.

The two system filters, the foam and the ultra-fine, ensure optimum operation for the user. An air outlet port allows for connection to the patient circuit.

The patient circuit is made up of the flexible tubing, exhalation port, and nasal mask. The unit applies bi-level pressures to the patient's upper airway to keep the airway open during sleep. Air flow 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.

3.5 Theory of Operation

3.5.1 Control Pad & Liquid Crystal Display



3.5.2 Main Printed Circuit Assembly

Control of the Synchrony Main PCA is accomplished with the use of a 16-bit microcontroller. The device provides digital I/O, timers, a QSPI interface, serial communication lines, an 8-channel A/D converter, and a 16-bit data bus with built-in chip selects.

The motor used in the Synchrony is a three phase Wye connected design with the internal motor common. The three phases are driven in a push pull fashion by three P-channel and 3 N-channel MOSFETS. The output is then processed by the A/D converter.

Motor commutation of the three windings is accomplished with the use of a sensorless motor controller chip. This provides the correct commutation pattern to the three phases of the motor. An align and start-up sequence is initiated when the brake and align inputs are allowed to float. Once the motor is rotating, the back-EMF of the motor is sensed. This governs the commutation of each phase.

The speed of the motor is controlled through a DAC driving the VSPEED of the sensorless motor controller chip. The motor controller chip provides a TACH signal to the A/D converter in order to indicate motor speed. The TACH feedback is then read with an Input Capture of the A/D converter and is compared to the desired speed vs. pressure table.

3.5.3 Pressure Sensor Circuitry

Two sensors redundantly measure the pressure at the valve outlet. The circuitry employs sensors from two different sensors to decrease the liklihood of common drift. Both sensors compensate for variations in temperature. The main sensor MT4, is rated from 0 to 0.8 psig. This sensor may contain one or two ports. When the dual port or differential sensor is used, the tube is connected to the positive port and the negative port is vented to atmosphere. The redundant sensor, MT5, is rated from 0 to 1.0 psig.

A seperate instrumentation amplifier (INA) conditions the output of each sensor. The signals are filtered actively by operational amplifiers (OPA) and routed to the microcontroller's 10 bit analog to digital converter (ADC). The output of the INA connected to MT4 is used as the main feedback parameter for the valve controller.

The voltage output from these sensors is a single output (0 to 4.6 Volts), offset from ground to zero pressure and calibrated on every unit.

3.5.4 Flow Sensor Circuitry

A mass flow sensor is used to measure a small pressure drop proportional to the velocity of air exiting the unit. The pressure drop created by the flow element within the Synchrony machine induces a small flow of air in a parallel path through the sensor MT1. The measurement incorporates the thermodynamic properties of an element heated above ambient temperatures. As the element thermally interacts with the air, a measure of the total mass passing through the sensor is supplied in voltage terms to INAs. This term is in direct proportion to the flow out of the machine and forms a functional relationship between sensor output and standard patient flow.

This relationship is calibrated during production. Because the machine also measures temperature and barometric pressure, the true volumetric flow exiting the machine may be calculated from this voltage.

The sensor and instrumentation are designed to measure flows from -200 to +200 liters per minute. The bipolar output from the sensor is converted to two unipolar inputs for the microcontroller's ADC by crossing the positive and negative outputs of the sensor, using two INAs and two ADC channels. One channel always reads zero and the channels switch their operation when the direction flow is reversed. The output from each INA is clamped by Shottkey diodes above ground. Both the positive and the negative flow signals are actively fileterd with OPAs

3.5.5 Power Supply Printed Circuit Assembly

The Synchrony has a switching power supply, which is built on an independent PCA and mounted to the top of the enclosure insert. The switching power supply operates properly on any AC voltage between 85 to 265 VAC (45 - 66 Hz) input range with a EMI filter (2 wire operation); 11 to 17 VDC input range with EMI filter through an on board DC jack. The power supply has an output voltage of 29 V (+/- 3V) at 1.7 A under AC operation and an output voltage of 24.5 V (+/- 1.5V) at 1.9A under DC operation.

3.5.6 Valve Control

The Synchrony utilizes a sleeve valve to control inspiratory and expiratory pressure. This is accomplished through the use of an analog PID controller. A DAC is used to set the reference pressure. Once this is set, the analog control loop compares the reference pressure to the actual pressure from the pressure circuitry. The analog control loop then automatically adjusts the valve position to regulate the reference pressure.

3.5.7 Communications Via Optional Modem

The modem setup is accomplished with a separate Respironics software package.

3.5.8 Communications with Encore Software

The Respironics Encore software package can extract compliance data from the Synchrony system. Use the Respironics-supplied RS232 cable to connect the Synchrony to an IEC60850, EN60950, or UL1950 approved computer with the Encore software loaded. Figure 3-1shows a typical setup.

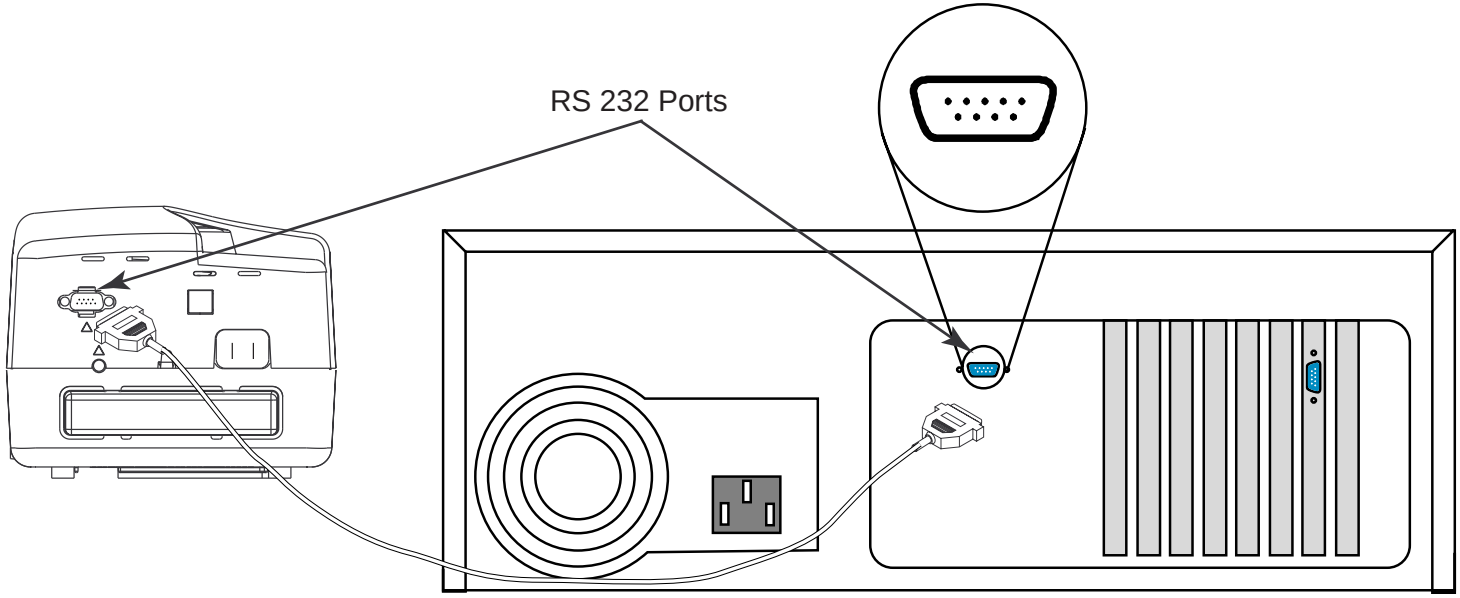


Figure 3-1

Chapter 4: System Setup Procedures

(This page left intentionally blank.)

Chapter 4: System Setup Procedures

4.1 Overview

This section provides an overview of the system setup including detailed instructions on the Setup menu Display screens.

NOTE: Display screens and options will vary depending on the model of BiPAP Synchrony.

NOTE: This section provides directions for accessing the Setup menu. Prescribed Therapy settings can only be set using the Setup menu. (The patient's User's Manual provides directions to access only the Patient controls, which limits access to settings. To prevent patients from tampering with the settings, the directions to access the Setup menu should not be revealed to the patient).

CAUTION: If the BiPAP Synchrony System has been exposed to either very hot or very cold temperatures, allow it to adjust to room temperature (approximately two hours) before beginning setup.

4.2.1 System Self Test

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

Step 2 Press the STANDBY key. The unit will sound two beeps, briefly light the alarm indicators, display the start-up screen for a few seconds, then display the self test screen. This is the internal test performed by the unit.

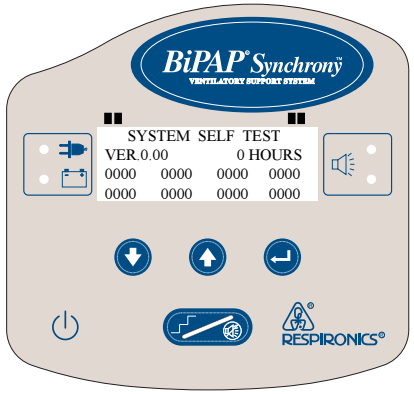


Figure 4-1
Self Test Screen

The on screen display provides the software version, total operating hours and the last 10 three - digit error codes.

4.2.2 Monitoring Screen Displays

Step 1 After the System Self Test, the blower motor will start and the Monitoring screen will appear. It shows the current pressure measurements and breathing rate.

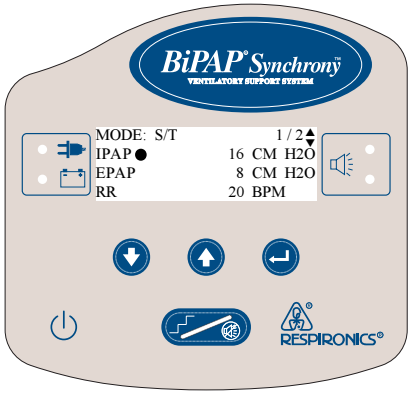


Figure 4-2
Monitoring Screen

The Spontaneous/ Timed mode screen appears in Figure 4-2. Note the indicator next to IPAP. It indicates the pressure is currently at the IPAP level. It will move to the EPAP as the pressure changes. Another indicator will appear next to RR if the unit indicates a breath.

The upper right of the screens indicate that this is Page 1 of 2, and the ▲▼ indicator shows that the ⇧ or ⇩ keys will move to page 2 of 2.

Step 2 If you press ⇩ while the Monitoring screen is displayed, Page 2 of 2, called the Patient Control screen, is displayed. In the S/T mode , Patient Control screen contains two options, as shown in Figure 4-3.

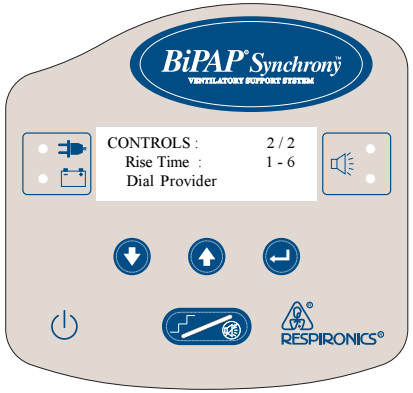


Figure 4-3
Patient Control Screen

The Patient Control screen gives the patient the ability to adjust the rise time between EPAP and IPAP for comfort. Dial Caregiver automatically dials your homecare provider to send information about the unit.

4.2.3 Setup Screen Displays

Step 1 To enter the SETUP mode, simultaneously press the Ramp Start / Alarm Silence Key and the Enter Key. Hold the two keys down for 3 seconds.

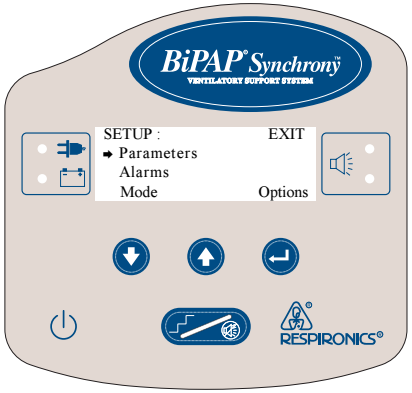


Figure 4-4
Setup Screen

Step 2 The select arrow is pointing to Parameters as shown in Figure 4-4. To enter the parameters, press the Enter Key. In this mode the patient pressures, breath rate, timed inspiration and the rise time can be adjusted as shown in Figure4-5. When finished adjusting a parameter, press the enter key.

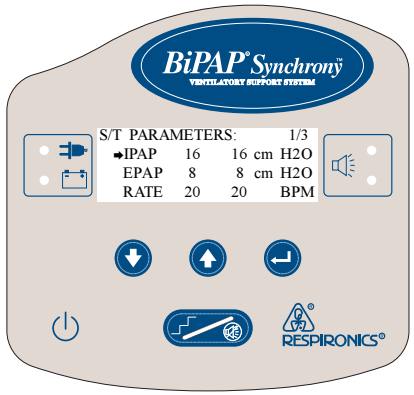


Figure 4-5
Parameter Screen

Step 3

To move the select arrow from PARAMETERS to ALARMS (see fig. 4-4). Press the down button on the control pad until the select arrow is pointing to ALARMS. Then press the enter button on the control pad to view the ALARMS screen. To move between the Patient Disconnect alarm and the Apnea alarm, press the up or down button. The Patient Disconnect alarm can be adjusted to 15 seconds, 60 seconds or OFF. The Apnea alarm can be adjusted to 10 seconds, 20 seconds, 30 seconds, 40 seconds or OFF.

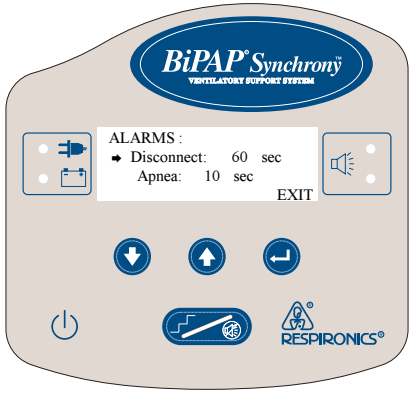


Figure 4-6
Alarms Screen

Step 4

Move the select arrow from ALARMS to MODE by pressing the down button on the control pad until the select arrow is pointing to MODE. Then press the enter button on the control pad to view the MODE screen.

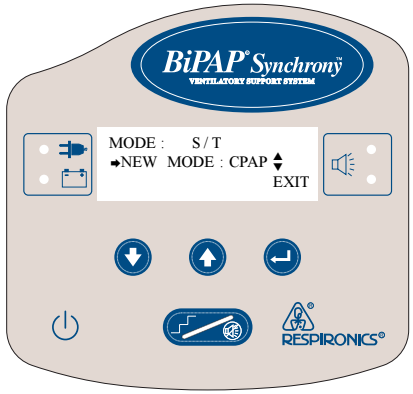


Figure 4-7
Mode Screen

Step 5

Press the enter key to enter the MODE settings. By pressing the down button on the control pad, the MODE can be changed to CPAP, S, S/T, PC or T. Once the MODE has been decided, press the enter button on the control pad to lock the MODE. The select arrow will then move to EXIT. Press the enter button on the control pad to exit this screen.

Step 6 Move the select arrow from MODE to OPTIONS by pressing the down button on the control pad until the select arrow is pointing to OPTIONS. Then press the enter button on the control pad to view the MODE screen.

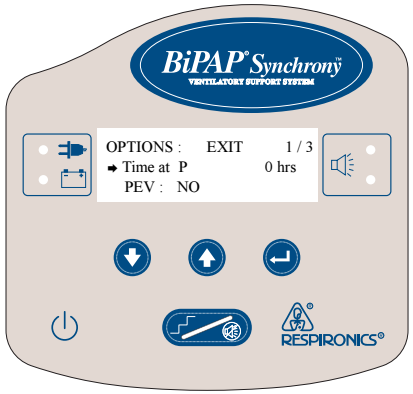


Figure 4-8
Options Screen

The time at pressure screen displays in hours the actual time at the present pressure settings. To reset the hours, move the select arrow to Reset and press enter.

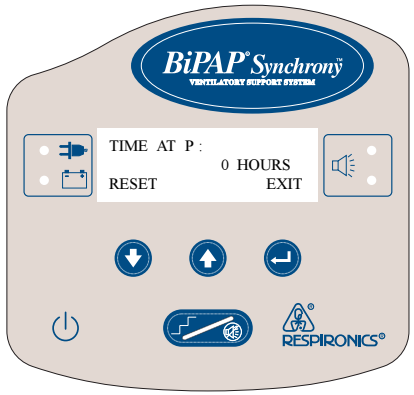


Figure 4-9
Time at Pressure Screen

Step 7 In the setup menu under options, move the select arrow to PEV (Plateau Exhalation Valve) and press the enter key. PEV can be turned On or Off.

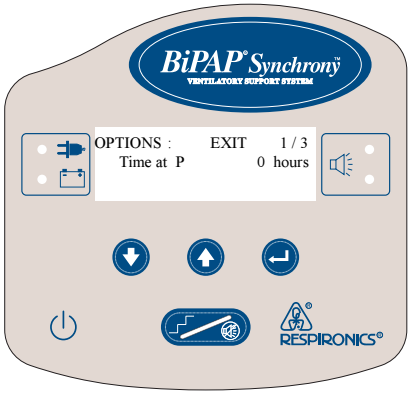


Figure 4-10
Option Screen

4.3 Recommended, Alternate, and Optional Circuit Accessories

This section addresses the required, alternate, and optional circuit accessories that can be used with the BiPAP Synchrony. For additional information, refer to the User's Manual, the Home Care Providers Manual, or the literature supplied with the accessory.

4.3.1 Recommended Accessories

To use the BiPAP Synchrony system, the following accessories are required in order to assemble the circuit.

WARNING: The BiPAP Synchrony system should only be used with the recommended patient circuit identified below.

Recommended Patient Circuit.

- Respironics Nasal Mask & Whisper Swivel Exhalation Port (or Respironics mask w / integrated exhalation port such as the Monarch Mini Mask)
- Respironics 6 ft. (1.83M) Flexible Tubing Assembly (reusable or lightweight)
- Respironics Headgear or Softcap (not shown)

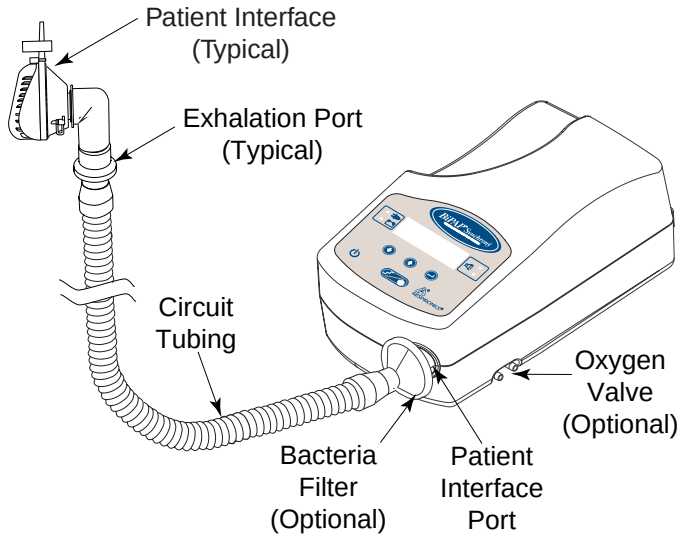


Figure 4 - 11
BiPAP Synchrony with Patient Circuit

Recommended, Alternate, and Optional Circuit Accessories (Continued)

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
GoldSeal Nasal Mask (reusable)	0.03	0.09
Monarch Mini Mask	0.20	0.77
Whisper Swivel II (reusable)	0.02	0.08
6 ft. (1.83m) Reusable Flexible Tubing	0.11	0.30
Alternate Accessories		
Spectrum Disposable Full Face Mask	0.04	0.10
Plateau Exhalation Valve (reusable)	0.05	0.20
6 ft. (1.83m) Disposable Circuit & Exhalation Port	0.20	0.34
Optional Accessories		
Respironics LX Humidifier	0.14	0.40
24 in. Reusable Tubing (used with humidifier)	0.03	0.10
18 in. Disposable Tubing (used with humidifier)	0.00	0.00
18 in. Reusable Tubing (used with humidifier)	0.00	0.10
King Bacteria Filter (disposable)	0.74	1.65
Comfort Flap Mask Accessory (reusable)	0.00	0.00

Required, 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 BiPAP Synchrony system. This information may help assess the CO_2 rebreathing potential of various circuit configurations at different applied pressures.

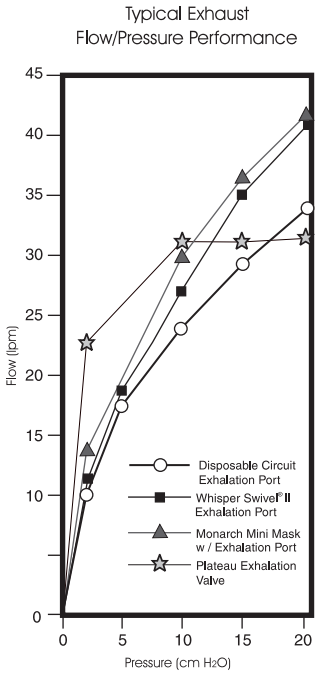


Figure 4 - 16
Typical Exhaust Flow / Pressure Performance

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 Shielded DC Power cord (RI P/N 1001956) can be used to operate the BiPAP Synchrony in a stationary recreational vehicle, boat, or motor home.

The Respironics DC Battery Adapter Cable (RI P/N 532209) when used with the DC Power Cord enables the BiPAP Synchrony system to be operated from a 12 VDC freestanding battery.

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

The BiPAP Synchrony should not be operated while any vehicle is in motion.

CAUTION: Only use Respironics DC Power Accessories. Use of any other system may cause damage to the BiPAP Synchrony System or your vehicle.

CAUTION: DC Power is not intended to be used as battery backup.

Required, Alternate, and Optional Circuit Accessories (Continued)

4.3.4 Adding a Humidifier

When using a humidifier, always disconnect the humidifier tubing from the BiPAP Synchrony system when it is turned off. DO NOT use a room humidifier within 6 ft. (1.83m) of the BiPAP Synchrony. Moisture can build up in the system and cause damage. Follow the instructions included with the humidifier.

WARNING: When the Synchrony is used with a humidifier, position the humidifier such that the water level in the humidifier is lower than the patient, and the humidifier is on the same level or lower than the Synchrony.

4.3.5 Adding Oxygen to the System

Please note the following warnings when using oxygen with the BiPAP Synchrony System.

WARNING: When using oxygen with the BiPAP Synchrony system, turn the Synchrony on before turning the oxygen on. Turn the oxygen off before turning the Synchrony 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.

4.3.6 Oxygen Module

A solenoid is used to ensure there is no chance of oxygen build up inside the unit during use. The solenoid is energized when the blower is in use, otherwise it is de-energized and the oxygen is cut-off from the patient circuit. Oxygen is prevented from entering the patient circuit and building up in the unit when the blower is not running. The circuit used to drive the oxygen module is a simple open-drain MOSFET controlled by the control circuitry. A kick-back diode is used to de-energize the coil during turnoff of the solenoid.

Chapter 5: Alarms, Trouble-shooting and Diagnostics

(This page left intentionally blank)

Chapter 5: Alarms, Troubleshooting and Diagnostics

5.1 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.

CAUTION: Due to required calibration after parts replacement, the following parts may not be field replaced unless the unit is System Final Tested at a Respironics Service Center equipped with a Bi-Level Calibration Station:

- Main Printed Circuit Assembly (Main PCA)
- Power Supply Printed Circuit Assembly
- Blower Assembly
- Enclosure Insert
- Pressure Tubing
- Mass Flow Sensor Tubing
- Valve Assembly
- Flow Element
- Flow Averaging Rings
- Temperature Circuit

This section contains information necessary to troubleshoot and diagnose problems with the BiPAP Synchrony 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 code, the associated problem, and the suggested corrective action to be taken.

5.2 Common System Level Problems

Screen Message	Description	Result	Corrective Action
Patient Disconnect	• A large circuit leak, such as mask removal has been detected.	• Red LED alarm indicator blinking. • High Priority audible alarm.	• Check the circuit (flexible tubing, pressure tubing, mask) for any leaks and adjust the mask and head-gear. • Press the enter key to Clear the alarm.

Screen Message	Description	Result	Corrective Action
Low Minute Ventilation	• Patient Tidel Volume below setpoint.	• Red LED alarm indicator blinking. • High Priority audible alarm.	• Check patient circuit. • Start breathing into circuit • Clear alarm

Screen Message	Description	Result	Corrective Action
Apnea	• Large circuit leak • Patient stopped breathing	• Red LED alarm indicator blinking. • High Priority audible alarm.	• Check patient circuit. • Start breathing into circuit • Clear alarm

Common System Level Problems (Continued)

Screen Message	Description	Result	Corrective Action
Low Pressure Support	• Malfunctioning unit. • Synchrony continues to operate	• Red LED alarm indicator blinking. • High Priority audible alarm.	Check for the following: dirty inlet filters, blocked air intake, excessive leak in patient circuit. If alarm continues, notify Respironics World Wide Technical support.

Screen Message	Description	Result	Corrective Action
High Pressure	• Synchrony continues to operate. • Malfunctioning unit	• Red LED alarm indicator blinking. • High Priority audible alarm.	If alarm continues, notify Respironics World Wide Technical Service.

Screen Message	Description	Result	Corrective Action
Low Pressure	• Synchrony continues to operate.	• Red LED alarm indicator • High Priority audible alarm.	Check for the following: dirty inlet filters, blocked air intake, excessive leak in patient circuit. If alarm continues, notify Respironics World Wide Technical Service.

Common System Level Problems (Continued)

Screen Message	Description	Result	Corrective Action
Invalid Prescription Call Provider	• Synchrony shuts down • The prescription data is corrupted.	• Red LED alarm indicator blinking • High Priority audible alarm.	Contact provider to reinstall prescription data. If problem continues, contact Respironics World Wide Customer Service.

Screen Message	Description	Result	Corrective Action
Ventilator Inoperative (Error Codes Displayed)	• Synchrony shuts down • Internal device failure.	• Red LED alarm indicator blinking • High Priority audible alarm.	Remove power from the Synchrony. Contact Respironics World Wide Technical Service.

Screen Message	Description	Result	Corrective Action
Blank Screen	• Synchrony shuts down	• Red LED alarm indicator blinking • High Priority audible alarm.	Remove power source from the Synchrony. Contact Respironics World Wide Technical Service.

Common System Level Problems (Continued)

Screen Message	Description	Result	Corrective Action
Battery Failure	• Battery discharged	• Yellow LED alarm indicator flashing. • Medium Priority audible alarm.	Recharge or replace battery

Screen Message	Description	Result	Corrective Action
Battery Voltage Too High	• Synchrony continues to operate. • Wrong or malfunctioning battery or charger.	• Yellow LED alarm indicator flashing. • Medium Priority audible alarm.	Confirm that the D.C. power source is the correct voltage.

Screen Message	Description	Result	Corrective Action
Low Battery	• Synchrony continues to operate. • Battery nearly discharged.	• Yellow LED alarm indicator flashing • Medium Priority audible alarm.	Recharge or replace battery

Common System Level Problems (Continued)

Screen Message	Description	Result	Corrective Action
Power Failure Battery In Use	• Synchrony continues to operate. • AC power was lost, the unit is now operating on battery (DC) power.	• Yellow LED alarm indicator flashing. • Low Priority audible alarm.	Check AC power, seek reliable power source.

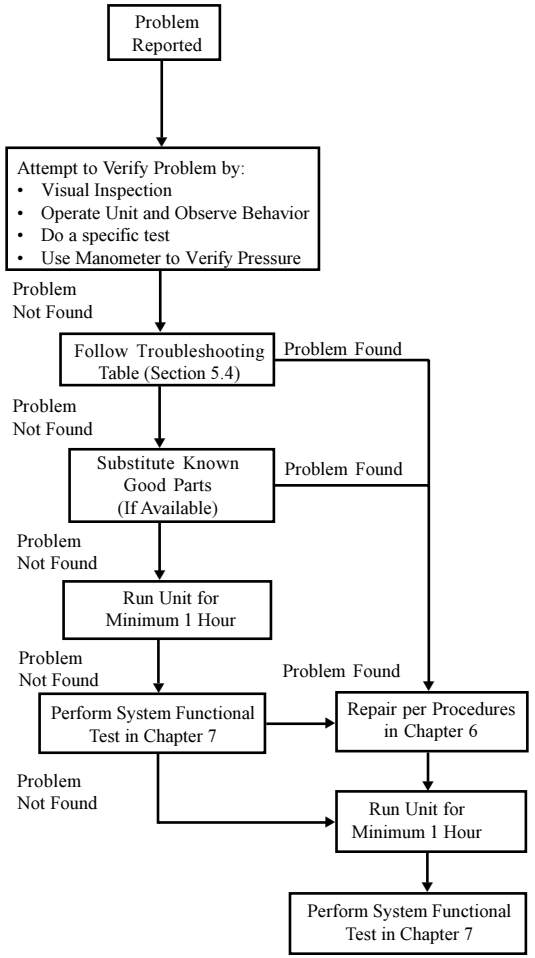
Screen Message	Description	Result	Corrective Action
Battery in Use	• Synchrony continues to operate. • Information message upon start-up that battery power is being used.	• Yellow LED alarm indicator blinking. • Low Priority audible alarm.	• Press the return key to confirm that you wish to operate the Synchrony on battery power.

Screen Message	Description	Result	Corrective Action
Call for Service Code : 000 (See section 5.6 for a description of the error code.)	• Synchrony continues to operate.	• Yellow LED alarm indicator blinking. • Low Priority audible alarm.	Continue to use the Synchrony. Write down the error code and notify Respironics World Wide Technical Service.

Common System Level Problems (Continued)

Screen Message	Description	Result	Corrective Action
Momentary Loss of Power	• Synchrony continues to operate. • Power was lost for more than two minutes while the unit was providing therapy.	• Yellow LED alarm indicator blinking. • Low Priority audible alarm.	Press the return key to clear the information message.

5.3 Troubleshooting Flow Chart



5.4 Trouble Shooting Table

Symptom	Cause	Verification	Corrective Action
Audible Alert - During audible alarm condition, the audible alarm is not functioning.	• Main PCA	Perform power up sequence. Visually verify the LED's and display illuminate. Reestablish original audible alert conditions. Listen for audible alert.	• If audible alert does not work, replace Main PCA. (see Note[1]).
Indicator - Light Emitting Diodes or other indicators are not working.	• Interface cable lose. • Control Pad	Perform power up sequence. Visually verify all LED's illuminate.	• Check for secure connection of ribbon cables to Main PCA. • Inspect ribbon cables for damage. • Replace Control Pad. Replace Main PCA (See Note[1]).

NOTE 1: Due to required testing, this repair must be performed at a Respironics Service Center equipped with a Multi-Functional Calibration Station.

Trouble Shooting Continued

Symptom	Cause	Verification	Corrective Action
Display - Display is blank or contains erroneous information	• Display Assembly • Main PCA	Inspect the Ribbon cable between the display and the Main PCA. Make sure the ribbon cable is not on back-wards.	Replace in order until solved. • Display PCA • Main PCA (see Note[1]) • Power Supply (see Note[1])
Intermittent Power Supply- An intermittent on / off condition exists, unit alarms randomly, or indicator lights blink	• Power Cord • AC Inlet • Loose Connections • Power Supply	Inspect power cord for fraying at cable ends. Inspect all connectors on the Power Supply and Main PCA.	If +5 or +8 Voltage supplies are not within specification, replace the power supply. If power cord or connectors are faulty, replace items as required.

NOTE 1: Due to required testing, this repair must be performed at a Respironics Service Center equipped with a Multi-Functional Calibration Station.

Trouble Shooting Continued

Symptom	Cause	Verification	Corrective Action
Unit does not operate from a 12 volt power source - Unit blows fuses in the DC cord during DC operation.	• Faulty DC cord • Low DC voltage • Fuse in DC cord is faulty. • Wrong DC cord	Ensure the DC power source is a minimum of 12 volts. Monitor the DC voltage at the back of the DC connector mounted on the power supply. Check the DC power cord for continuity.	Replace in order until solved. • D.C. Cord • Power Supply (see Note[1]) • Main PCA (see Note[1])
Noise -	• Blower malfunctioning • Missing or damaged bottom foam strip.	Turn the Synchrony over and inspect the bottom strip for damage. Check for loose screws.	• Replace bottom strip • Retighten screws • Replace blower

NOTE 1: Due to required testing, this repair must be performed at a Respironics Service Center equipped with a Multi-Functional Calibration Station.

Trouble Shooting 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.
Outlet Air Temperature - the outlet air temperature is too warm.	• Foam Filter dirty • Ultra-fine Filter dirty • Blower • Main PCA	Ensure the filters are clean and not restricting air flow. Monitor the outlet air temperature at the end of the six foot tubing. A rise in temperature can be expected. Ensure the unit is not next to any heat source.	Replace: • Filters • Replace blower • Main PCA

NOTE 1: Due to required testing, this repair must be performed at a Respironics Service Center equipped with a Multi-Functional Calibration Station.

Trouble Shooting Continued

Symptom	Cause	Verification	Corrective Action
Pressure Related Problems - The outlet does not change or adjust properly.	• Pressure tubing has been blocked, kinked or disconnected. • Main PCA, valve or blower malfunction	Inspect pressure tubing for secure connections and kinks. Check blower for air leaks.	Secure pressure tubing connections. Replace Main PCA, valve or blower as required.
Pressure Offset - Static pressure fluctuates -1.0 cm to +2.0 cm H_2O.	• The delivered pressure is higher or lower than the set value by more than +2.0 to -1.0 cm H_2O.	Inspect pressure tubing for secure connections and kinks. Check blower for air leaks.	Check tubing for leaks. Replace Main PCA.

NOTE 1: Due to required testing, this repair must be performed at a Respironics Service Center equipped with a Multi-Functional Calibration Station.

Trouble Shooting 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 EPAP Pressure. • Main PCA • Ramp key not functioning.	Make sure the patient's prescription specified ramp. Make sure unit was set for ramp.	Set unit for ramp. Replace control pad or Display PCA. Replace Main PCA.
Pressure Variation - The pressure varies around the set value, pressure fluctuates greater than 1.0 cm H_20.	• Internal air leak. • Filters dirty. • Faulty Valve • Main PCA or Blower. • Air path partially blocked.	Replace Filters. Perform Testing Process (see Chapter 7)	Replace Valve. Replace Blower. If pressure still drifts, replace Main PCA.

NOTE 1: Due to required testing, this repair must be performed at a Respironics Service Center equipped with a Multi-Functional Calibration Station.

5.5 Corrective Action Definitions:

NOTE: The corrective action definitions listed are possible solutions to error codes that may occur with the Synchrony.

Definitions:

LCD : Four line by twenty character liquid crystal display.

BB RAM : Battery-backed, random access memory

Check Keypad : Verify that the keypad assembly is properly connected to the PCA. Verify that the keypad and LED's work correctly. Replace if necessary.

Check LCD : Verify that the LCD is properly connected to the Main PCA. Verify that the LCD works correctly. Replace if necessary.

Expected Operation : This behavior is normal and expected. A code exists for this condition so that it can be logged for historical benefit. If this code seems inappropriate for the current context, replace Main PCA.

Check Motor/Valve : Verify that the blower motor and valve are properly connected to the Main PCA. Verify that the blower and valve are working properly. Replace if necessary.

Check Power Supply : Verify that the cable from the power supply is properly connected to the Main PCA. Verify that the power supply is operating properly. Replace if necessary.

Check Audible Alarm : Verify that the audible alarm is properly connected to the Main PCA. Verify that the audible alarm is working properly. Verify that the stop/start key is not stuck.

Recalibrate Device : Use a calibration station to recalibrate device. If the problem reoccurs, replace the Main PCA.

Corrective Action Definitions (Continued)

Check Temperature Circuit :	Verify that the thermistor is properly connected to the Main PCA. Verify that the thermistor is operating correctly. Replace if necessary.
Check Internal Tubing :	Verify that all the internal tubing is properly connected to the appropriate pressure sensors and pick-offs and is not kinked or damaged.
Unexpected execution path :	The software has unexpectedly executed code, such as the “default” case of a switch statement, an “else” block, etc., that should never be reached.
Replace Main PCA :	Replace the Main PCA and recalibrate unit.

5.6 Error Code Chart

Error Code	Description	Probable Cause	Corrective Action
000	Software Error	Unexpected execution path	Replace Main PCA
001	Software Error	Unexpected execution path	Replace Main PCA
002	Central Processing Unit failure	BIST that checks CPU integrity has failed	Replace Main PCA
003	Stack overflow failure	BIST has determined that the stack has written to memory beyond its upper limit	Replace Main PCA
004	Stack underflow error	BIST has determined that the stack has written to memory below its lower point	Replace Main PCA
005	Using Reserved Stack area	BIST has determined that the stack has written to reserved memory and is approaching the upper limit	Replace Main PCA
006	Random Access Memory failure	BIST has determined that the RAM on the main PCA is not functioning properly	Replace Main PCA
007	Key on keypad is stuck	One or more of the keys is stuck in the closed position.	Verify that nothing is pressing a key. Replace keypad. If error persists, replace Main PCA.
008	Prescription mode setting is corrupted	BIST has determined that the prescription mode is indeterminate and cannot be corrected automatically	Check battery Reinstall Prescription Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
009	Prescription setting in current mode is corrupted	BIST has determined that one or more of the prescription parameters in the current mode is indeterminate and cannot be corrected automatically	Check battery Reinstall prescription. Replace Main PCA
010	Prescription setting outside of current mode is corrupted	BIST has determined that one or more of the prescription parameters in a mode other than the current mode is indeterminate and cannot be corrected automatically	Check battery Replace Main PCA
011	Alarm setting is corrupted	BIST has determined that one or more of the alarm is indeterminate and cannot be corrected automatically	Check battery Reinstall prescription Replace Main PCA
012	System data is corrupted	BIST has determined that one or more values of system data is indeterminate and cannot be corrected automatically.	Check battery Replace Main PCA
013	Modem setting is corrupted	BIST has determined that one or more values of modem data is indeterminate and cannot be corrected automatically	Check battery Replace Main PCA
014	Usage log is corrupted	BIST has determined that one or more values of usage log is indeterminate and cannot be corrected automatically	Check battery Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
015	Software version information is corrupted	BIST has determined that the software version is indeterminate and cannot be corrected automatically	Check Battery Replace Main PCA
016	Software version mismatch	BIST has determined that the S/W version does not match the constant in FLASH	Possible S/W Upgrade Replace Main PCA
017	Data storage flash erasure failure	One or more of the sectors of data FLASH could not be written.	Replace Main PCA
018	Data storage flash write failure	One or more of the addresses in a sector of Data FLASH could not be written	Replace Main PCA
019	Data overlap on data storage flash page 1	A test pattern that was written to only Data FLASH sector 1 was detected in one or more other sectors	Replace Main PCA
020	Data overlap on data storage flash page 2	A test pattern that was written to only Data FLASH sector 2 was detected in one or more other sectors	Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
021	Data overlap on data storage flash page 3	A test pattern that was written to only Data FLASH sector 3 was detected in one or more other sectors	Replace Main PCA
022	Data overlap on data storage flash page 4	A test pattern that was written to only Data FLASH sector 4 was detected in one or more other sectors	Replace Main PCA
023	Audible alarm failure	BIST has determined the buzzer did not turn on properly	Check buzzer Replace Main PCA
024	Unable to load custom characters into LCD display	BIST detected a character other than the custom character written to the LCD	Check LCD Replace Main PCA
025	Red alarm LED failure	BIST has determined the Red LED did not turn on properly	Check Keypad Replace Main PCA
026	Yellow alarm LED failure	BIST has determined the Yellow LED did not turn on properly	Check Keypad Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
027	Green DC power LED failure	BIST has determined the Green DC power LED did not turn on properly	Check Keypad Replace Main PCA
028	Green AC power LED failure	BIST has determined that the Green AC Power LED did not turn on properly	Check Keypad Replace Main PCA
029	Real time clock failure	BIST has determined that the real time clock is not running	Check Battery Replace Main PCA
030	Low or missing battery on real time clock	BIST has determined that the real time clock battery is low or missing	Check Battery Replace Main PCA
031	Invalid real time clock values	BIST has determined that one or more values of the real time clock (i.e. month, day, hour, year) is out of the valid range	Check Battery Replace Main PCA
032	Watchdog timer failure	The watchdog timer circuitry failed to reset the CPU during the watchdog test	Replace Main PCA
033	CPU exception	Unexpected execution path	Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
034	CPU exception	The CPU has detected a Breakpoint Exception	Replace Main PCA
035	CPU exception	The CPU has detected a Bus Error	Replace Main PCA
036	CPU exception	The CPU has detected a software Interrupt	Replace Main PCA
037	CPU exception	The CPU has detected an Illegal Instruction Exception	Replace Main PCA
038	CPU exception	The CPU has detected a Divided By Zero Exception	Replace Main PCA
039	CPU exception	The CPU has detected an Unused Interrupt Exception	Replace Main PCA
040	CPU exception	The CPU has detected an Uninitialized Interrupt Exception	Replace Main PCA
041	CPU exception	The CPU has detected a spurious interrupt exception.	Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
042	Inactive software error	The High Priority Thread has inadvertently become inactive	Replace Main PCA
043	Inactive software error	The Low Priority Thread has inadvertently become inactive	Replace Main PCA
044	Inactive software error	The Background Thread has inadvertently become inactive	Replace Main PCA
045	Keypad failure	The keypad test that expects none of the keys to be pressed has failed	Check Keypad Replace Main PCA
046	Keypad failure	The keypad test that expects the “up” key to be pressed has failed.	Check Keypad Replace Main PCA
047	Keypad failure	The keypad test that expects the “down” key to be pressed has failed	Check Keypad Replace Main PCA
048	Keypad failure	The keypad test that expects the “enter” key to be pressed has failed	Check Keypad Replace Main PCA
049	Keypad failure	The keypad test that expects the “ramp” key to be pressed has failed	Check Keypad Replace Main PCA
050	Keypad failure	The keypad test that expects the “secret” key to be pressed has failed	Check Keypad Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
051	LCD display communication time-out	The CPU timed out while waiting for the LCD control registers to become "ready"	Check LCD Replace Main PCA
052	LCD display communication time-out	The CPU timed out while waiting for the LCD data registers to become "ready"	Check LCD Replace Main PCA
053	LCD display communication time-out	The CPU timed out while waiting to read the LCD data registers	Check LCD Replace Main PCA
054	ADC failure	The A/D conversion was not complete when the CPU expected data	Replace Main PCA
055	System data is out of range	One or more pieces of system data are outside their normal ranges of values	Check Battery Replace Main PCA
056	Power Failure, Battery in Use	Unit switched to D.C. power source due to loss of A.C. power source.	Expected Operation
057	Momentary Loss of Power	Power was lost for more than two minutes while the unit was providing therapy.	Expected Operation
058	Battery in Use	Unit powered up on D.C. power source.	Expected Operation

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
059	Low Battery Alarm	Voltage on D.C. power source is too low.	Expected Operation
060	Battery Failure	Voltage on D.C. power source is too low.	Expected Operation
061	Battery voltage too high	Voltage on D.C. power source is too high.	Expected Operation
062	Low Minute Ventilation	May occur during normal patient usage.	Expected Operation
063	Exhalation Port Alarm	May occur during normal patient usage.	Expected Operation
064	Apnea Alarm	May occur during normal patient usage.	Expected Operation
065	Patient Disconnect Alarm	May occur during normal patient usage.	Expected Operation
066	High pressure	The patient pressure is above its maximum limit for an accumulated time of 5 seconds	Check Blower and Valve Check Internal Tubing Replace Main PCA
067	Low pressure	Either the patient or the valve outlet pressure is below their minimum threshold	Check Blower and Valve Check Internal Tubing Replace Main PCA
068	Proximal pressure line	Proximal pressure line is disconnected or pinched.	Reconnect or replace proximal pressure line.
069	Software Error	Unexpected execution path	Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
070	Software Error	Unexpected execution path	Replace Main PCA
071	Software Error	Unexpected execution path	Replace Main PCA
072	Software Error	Unexpected execution path	Replace Main PCA
073	Software Error	Unexpected execution path	Replace Main PCA
074	Software Error	Unexpected execution path	Replace Main PCA
075	Software Error	Unexpected execution path	Replace Main PCA
076	Software Error	Unexpected execution path	Replace Main PCA
077	Corrupt ROM CRC om unit software	Power on BIST has detected that the ROM CRC is corrupted	Replace Main PCA
078	12 volt reference failure	The 12 volt reference is either higher than its maximum limit or lower than its minimum threshold	Check Power Supply Replace Main PCA
079	Audible alarm failure	BIST has detected that the voltage of the audible alarm capacitor is below its low threshold	Check Buzzer Replace Main PCA
080	Keypad failure	The keypad test that expects the start/stop key to be pressed has failed	Check Keypad Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
081	Out of memory to display alarm	To many alarms have occurred.	Replace Main PCA
082	Calibration data is corrupt	BIST has detected that the Calibration Data CRC does not match	Recalibrate Synchrony
083	Air stream over temperature	The measure of air temperature is above its maximum limits	Check Temperature Circuit Replace Main PCA
084	Air Stream under temperature	The measured air temperature is below its minimum threshold	Check Temperature Circuit Replace Main PCA
085	Audible Alarm Failure	Power to the buzzer circuitry is outside its acceptable range	Check Buzzer Replace Main PCA
086	Blower failure	BIST has detected a motor error condition	Replace Blower Replace Main PCA
087	Software Error	Unexpected Execution Path	Replace Main PCA
088	Software Error	Unexpected Execution Path	Replace Main PCA
089	Software Error	Unexpected Execution Path	Replace Main PCA
090	Software Error	Unexpected Execution Path	Replace Main PCA
091	Resistance calculation error	Resistance calculations attempted on a unit without a proximal pressure sensor.	Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
092	Software Error	Unexpected Execution Path	Replace Main PCA
093	Corrupt known leak data	Known leak data has been corrupted	Check Battery Replace Main PCA
094	Software Error	Unexpected Execution Path	Replace Main PCA
095	Barometric sensor failure	The barometric pressure reading is outside its acceptable range	Replace Main PCA
096	Bad resistance table	The data in the dynamic circuit model table is invalid	Replace Main PCA
097	Excessive sensor drift	One or more of the sensor drift values have exceeded their maximum limits	Check Internal Tubing Replace Main PCA
098	Sensor drift high	One or more of the sensor drift values are approach ing their maximum limits	Check Internal Tubing Replace Main PCA
099	Corrupt sensor drift data	Drift data does not pass CRC even after setting the default drift values	Check Battery Replace Main PCA
100	CPU exceeded maximum number of resets	Three watchdog resets have occurred within 24 hours	Replace Main PCA
101	Corrupt Access Key	Access key area corrupted	Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
102	Corrupt compliance/therapy log	BIST has detected that one or more of the data log parameters in BB RAM are corrupt	Check Battery Replace Main PCA
103	Software Error	An invalid test was requested via RASP	Replace Main PCA
104	Illegal Board Revision	The hardware version and software revision are not compatable.	Replace main PCA
105	Blower error signal failed	The motor error signal was not active while the motor brake was on or the motor error signal failed while the motor was not in the standby state	Check Motor/Valve Replace Main PCA
106	Blower current high failure	The blower current has exceeded its maximum limit	Check Motor/Valve Replace Main PCA
107	Blower current low failure	The blower current is below its low threshold	Check Motor/Valve Replace Main PCA
108	Blower speed high failure	The blower speed has exceeded its maximum RPM limit or the measured blower speed is not zero while the blower is stopped	Check Motor/Valve Replace Main PCA
109	Blower speed low failure	The motor failed to start or the motor is below the RPM set point	Check Motor/Valve Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
110	Valve failure	The valve is not controlling pressure	Check Tubing Check Motor/Valve Replace Main PCA
111	1.25 volt reference failure	The 1.25 volt reference is outside its valid range	Replace Main PCA
112	Software Error	Unexpected execution path	Replace Main PCA
113	Software Error	Unexpected execution path	Replace Main PCA
114	Software Error	The functions necessary to reprogram the device are not usable	Replace Main PCA
115	Software Error	The UI event queue is full	Replace Main PCA
116	Software Error	The rise rate index is set above its maximum allowed value	Replace Main PCA
117	Software Error	The rise rate filter has computed a pressure command greater than the maximum pressure limit or less than zero	Replace Main PCA
118	Airflow sensor failure	Both channels of the airflow sensor are above the maximum allowed value.	Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
119	Barometric sensor failure	The raw value from the barometric pressure sensor A/D converter is outside its valid range of values	Replace Main PCA
120	Proximal pressure sensor failure	The raw value from the barometric pressure sensor A/D converter is outside its valid range of values	Check Internal Tubing Replace Main PCA
121	Primary valve pressure sensor failure	The raw value from the primary sensor for the valve pressure A/D converter is outside its valid range of values	Check Internal Tubing Replace Main PCA
122	Secondary valve pressure sensor failure	The raw value from the secondary sensor for the valve pressure A/D converter is outside its valid range of values	Check Internal Tubing Replace Main PCA
123	Data storage flash erase failure	One or more sectors of the data storage FLASH could not be erased	Replace Main PCA
124	Data storage flash write error	Data cannot be written to Data FLASH	Replace Main PCA
125	Access Key version error	The Access Key version is not recognized by the software	Replace Main PCA
126	Primary vs. Secondary pressure sensor error	The primary and secondary valve pressure sensor readings differ by more than 5 cm H_2O for more than 5 seconds.	Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
127	Software Error	Unexpected execution path	Replace Main PCA
128	Software Error	Unexpected execution path	Replace Main PCA
129	Software Error	Unexpected execution path	Replace Main PCA
130	Software Error	Unexpected execution path	Replace Main PCA
131	Unable to log therapy data	Compliance and therapy logger could not write data to queue in BB RAM	Check Battery Replace Main PCA
132	Bad system/patient alarm log data checksum	System and/or patient alarm log checksums do not match	Check Battery Replace Main PCA
133	Corrupt system alarm log	The system alarm log parameters stored in BB RAM failed the triple storage check	Check Battery Replace Main PCA
134	Corrupt system alarm log	The patient alarm log parameters stored in BB RAM failed the triple storage check	Check Battery Replace Main PCA
135	Software Error	Unexpected execution path	Replace Main PCA
136	Blower current high failure	While motor was off, the motor current exceeded the allowable limit for more than 3 seconds	Check Motor/Valve Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
138	Invalid unit type	Unable to determine unit type	Replace Main PCA
139	Corrupt compliance/therapy log	The size of the data or the checksum of the data logging queues in BB RAM are corrupt	Check Battery Replace Main PCA
140	Unexpected watchdog reset	Watchdog reset that was not part of a watchdog timer test	Replace Main PCA
141	Software Error	Unexpected execution path	Replace Main PCA
142	Software Error	Unexpected execution path	Replace Main PCA
145	Error code to test interface	Interface test active	Replace Main PCA
146	Error code to test interface	Interface test active	Replace Main PCA
147	Error code to test interface	Interface test active	Replace Main PCA
148	Error code to test interface	Interface test active	Replace Main PCA

Error Code Chart (Continued)

Error Code	Description	Probable Cause	Corrective Action
149	Error code to test interface	Interface test active	Replace Main PCA
150	Error code to test interface	Interface test active	Replace Main PCA
151	Low Pressure support	Blower or valve unable to provide pressure support	Replace Blower Replace Valve Replace Main PCA
152	Invalid prescription for unit type	Access key information is indeterminate	Recalibrate unit
153	Software Error	Unrecognized error code in system	Replace Main PCA

Chapter 6: Repair & Replacement

(This page left intentionally blank.)

Chapter 6: Repair & Replacement

6.1 Overview

Figure 6-1 lists the names and identifies the locations of the replaceable components in the BiPAP Synchrony System. The exploded view 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).

CAUTION: Due to required calibration after parts replacement, the following may not be field replaced unless the unit is Final Tested at a Respironics Service Center equipped with a Multi Functional Calibration Station.

- Main Printed Circuit Assembly (Main PCA)
- Power Supply Printed Circuit Assembly
- Blower Assembly
- Enclosure Insert
- Pressure Tubing
- Mass Flow Sensor Tubing
- Valve Assembly
- Flow Element
- Flow Averaging Rings
- Temperature Circuit

For technical assistance or replacement part ordering information contact Respironics World Wide Technical Service.

U.S. and Canada

Phone: **1-800-345-6443**
Fax: **1-800-422-5816**

International

Phone: **1-412-631-2100**
Fax: **1-412-463-5012**

Visit Respironics Home Page on the World Wide Web at:

www.respironics.com

6.1.1 BiPAP Synchrony System Exploded View

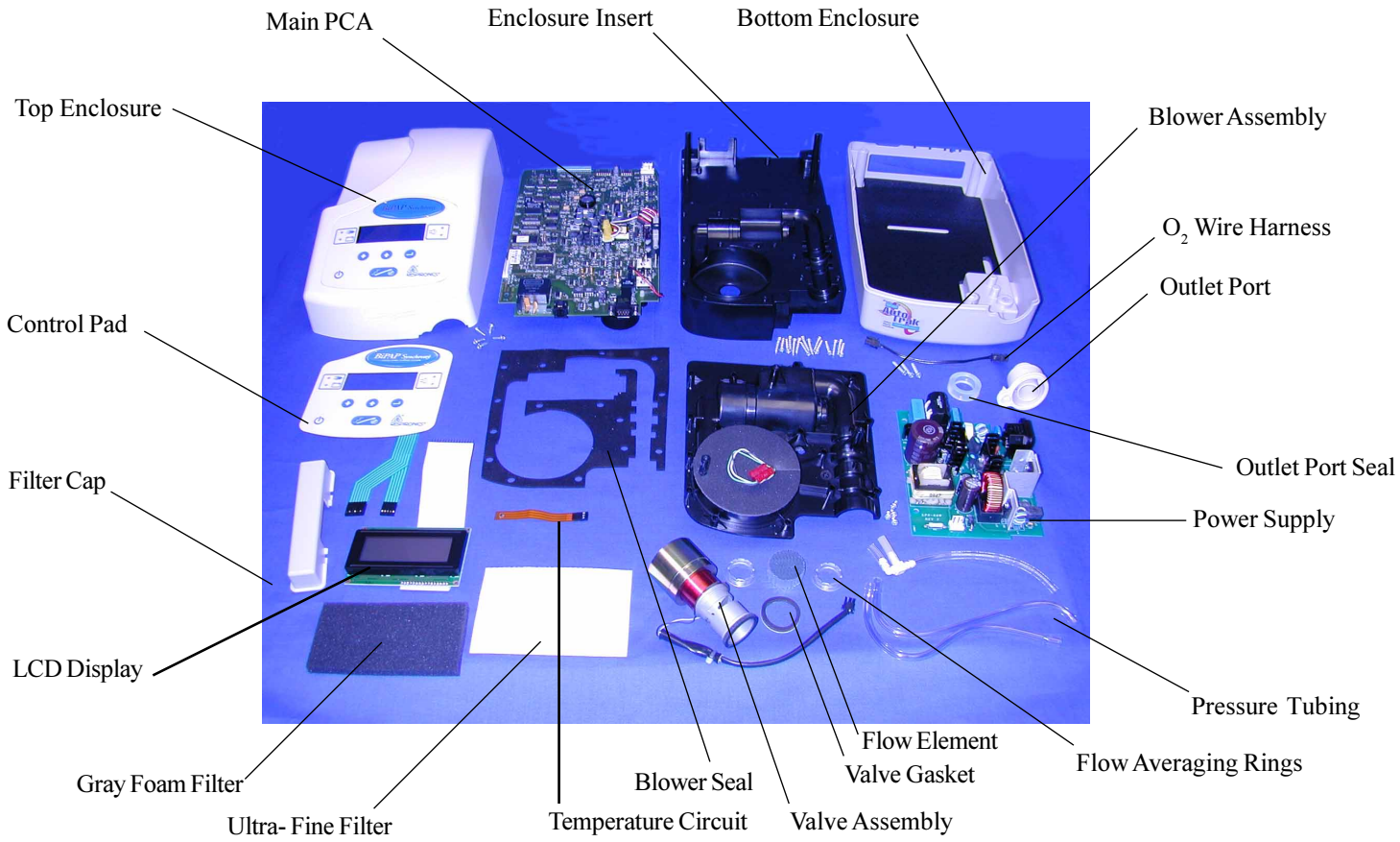


Figure 6-1
BiPAP Synchrony System Exploded View

6.2 BiPAP Synchrony System Repair Parts

Replacement Part	Replacement Part No.	Page No.
AC Power Cord	622243 See Note[2]	N.A.
Blower Assembly Includes • Blower Assembly • Blower - to - enclosure insert seal. • Flow Element / Flow Averaging Rings • 6 - 13 x 3/4″ screw (x15)	622187 See Note[1]	6-35
Bottom Enclosure Includes • Bottom Enclosure (with bottom strip) • 8 - 18 Hi - Lo x 3 / 4″ screw (x5) • Accessory Cover	1003513 See Note[1]	6 - 12
Control Pad	1003519	6 - 21
Display Assembly Includes: • LCD	1003520	6 - 18

BiPAP Synchrony System Repair Kits (Continued)

Replacement Part	Replacement Part No.	Page No.
DC Power Cord (Shielded) (optional)	1001956	N.A.
Enclosure Insert Includes • Enclosure Insert • Blower to Enclosure Insert Seal	622184	6 - 48
Filter, Disposable, Ultra-fine (x6)	622219	N.A.
Filter, Reusable, Gray Foam (x2)	622220	N.A.
Filter Cap	1000344	N.A.
Filter Kit Includes: • Filter, Disposable, Ultra-fine (x6) • Filter, Reusable, Gray Foam (x2)	622221	N.A.
Main Printed Circuit Assembly (Main PCA with modem) Includes: • Main PCA • 6 - 19 x 3 / 8″ screw (x5) (Plastite 48 - 2)	1003518 See Note [1]	6 - 24

BiPAP Synchrony System Repair Kits (Continued)

Replacement Part	Replacement Part No.	Page No.
O_2 Enrichment Port (Used for Testing)	312010	A - 3
Outlet Port Includes • Outlet Port • Outlet Port Seal	1000346	6 - 32
Power Supply Printed Circuit Assembly Includes • Power Supply PCA • 6 - 13 x 1 / 4″ screw (x4)	1002071	6 - 44
Pressure Tubing Kit Includes: • Pressure Tubing (5″) x 1 • Mass Flow Sensor Tubing (9″) x 2	1003517	6 - 29
Test Orifice	622244	N.A.
Temperature Circuit	1003522	6 - 49

BiPAP Synchrony System Repair Kits (Continued)

Replacement Part	Replacement Part No.	Page No.
Main Printed Circuit Assembly (Main PCA without modem) Includes: • Main PCA • 6 - 19 x 3 / 8" screw (x5) (Plastite 48 - 2)	1004052	
Top Enclosure (with modem port) Includes • Top Enclosure • 8 - 18 Hi - Lo x 3 / 4″ Screw (x3)	1003514	6 - 14
Top Enclosure (without modem port) Includes • Top Enclosure • 8 - 18 Hi - Lo x 3 / 4" Screw (x3)	1003523	6 - 14
Valve Assembly Includes • Valve Assembly • Blower - to - Enclosure Insert Seal • Flow Element • Flow Averaging Rings	622242	6 - 40
Synchrony Service Manual	1003512	N.A.
Oxygen Module	1000348	N.A.

BiPAP Synchrony System Repair Kits (Continued)

Comments:
- Illustration is shown on page 6 - 4
- All items have a quantity of one unless otherwise specified.
- Part replacement procedures are detailed within this chapter.
- Assorted tubing, cables, and hardware are supplied with each Replacement Kit.

Note 1:
- Due to required testing after replacement, these items are only replaceable at a Respironics Service Center equipped with a Multi Functional Calibration Station.

Note 2:
- Contact Respironics International Customer Service for further AC Power Cord Information

Note 3:
- Contact Respironics Worldwide Technical Service for bottom enclosure information.

Note 4:
- This item is optional for this unit. See chapter 8 for option installation instructions.

6.3 Warnings and Cautions

WARNING: To prevent electrical shock, disconnect the electrical supply before attempting to make any repairs to the Synchrony 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.

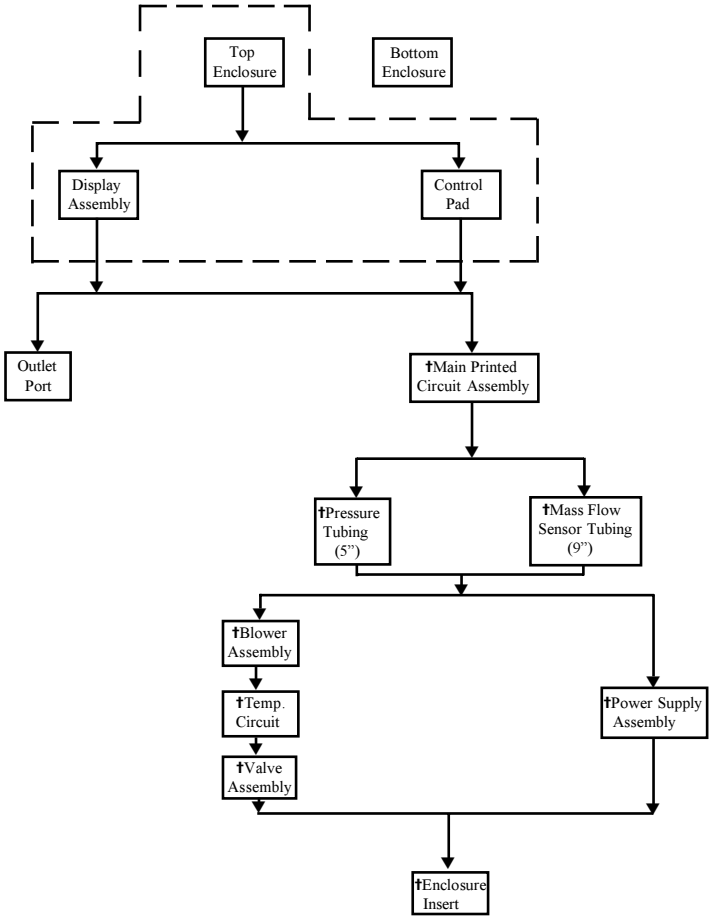
CAUTION: Due to required calibration after parts replacement, the following may not be field replaced unless the unit is System Final Tested on a Multi-Functional Calibration Station.

- Main Printed Circuit Assembly
- Power Supply Printed Circuit Assembly
- Blower Assembly
- Enclosure Insert
- Pressure Tubing
- Mass Flow Sensor Tubing
- Valve Assembly
- Flow Element
- Flow Averaging Rings
- Temperature Circuit

6.4 Replacement Instructions

See Figures 6-2 and 6-3 before removing or installing any component. These figures will detail the order in which each item must be removed or installed and should be used as a guideline for quick reference.

Replacement Instructions (Continued)



Removal Flow Chart

Figure 6-2
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.

† Caution: Due to required testing after replacement, these items are only replaceable at a Respironics Service Center equipped with a Multi Functional Calibration Station.

6.4.1 Bottom Enclosure Replacement

Replacement Part Number (See Note[3] on page 6-8)

Included in kit:	Tools Required:
Bottom enclosure (w / bottom strip) 8-18 Hi - Lo x 3/4" screw (x5) Accessory cover	Phillips screwdriver (medium)

Procedure

Removed / Installed During Process:

- 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 6-3
Bottom Enclosure

Bottom Enclosure Replacement (Continued)

Step 1 Removing the Bottom Enclosure

a. Place the unit upside down on a protected work surface.

b. Remove the two screws that attach the accessory cover to the bottom enclosure.

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

d. Lift the bottom enclosure from the rest of the unit.

e. Carefully, and away from the unit , turn the bottom enclosure over and remove the screws.

Step 2 Installing the Bottom Enclosure

a. Ensure that the outlet port is still properly seated in the bottom enclosure.

b. Align and place the bottom enclosure onto the enclosure insert.

c. Ensure that the bottom enclosure is properly seated in the top enclosure and the outlet port.

d. Install and secure the three mounting screws.

e. Align the accessory cover with the bottom enclosure.

f. Install and secure the two mounting screws.

g. Carefully return unit to upright position.

Figure 6-4
Removing the Bottom Enclosure Screws

6.4.2 Top Enclosure Replacement

Replacement Part Number 1003514 (with modem port)
Replacement Part Number 1003523 (without modem port)

Included in Kit:	Tools Required
Top Enclosure 8-18 Hi - Lo x 3/4" screw (x5)	Phillips screwdriver No# 2 (medium)

Procedure

Removed / Installed During Process:

- Top Enclosure
- Display Assembly
- Control Pad

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 6-5
Top Enclosure

Top Enclosure Replacement (Continued)

Step 1 Removing the Top Enclosure

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

b. Using a Phillips No# 2 screwdriver, remove the three screws that secure the top enclosure to the bottom enclosure.

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

d. Partially separate the top enclosure from the bottom enclosure.

NOTE: The top enclosure is still connected to the unit via the display assembly ribbon cable and the control pad ribbon cable. These will be removed during the following steps.

e. Lift the top enclosure and hold it slightly above the unit to provide access to the control pad ribbon cable and the display assembly ribbon cable connections on the Main Printed Circuit Assembly (Main PCA).

Figure 6-6
Location of the screws

Top Enclosure Replacement (Continued)

f. Remove the control pad ribbon cables and the display assembly ribbon cable connectors by gently pulling them straight out from their receptacles on the Main PCA. The top enclosure is now free from the rest of the unit.

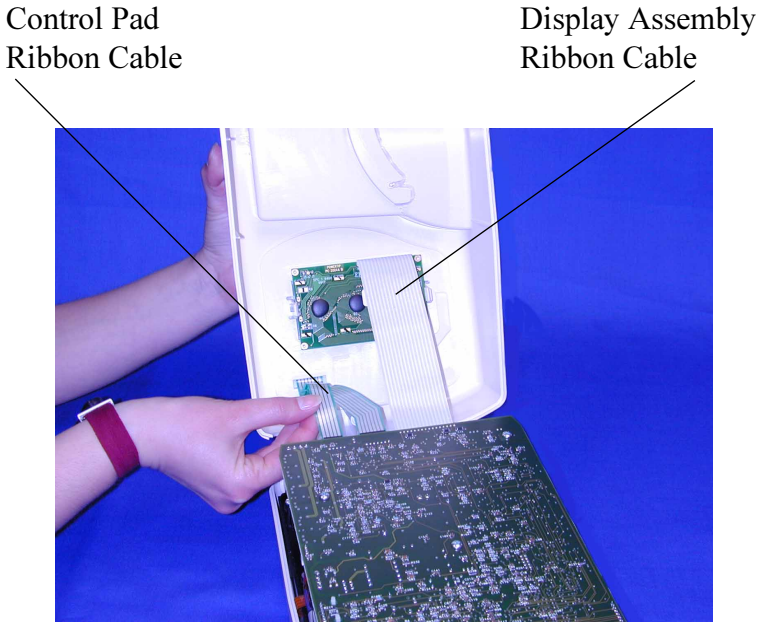


Figure 6-7
Removing the Control Pad Ribbon Cable and Display Assembly Ribbon Cable

Step 2 Removing the Display Assembly

Remove • display assembly

(See Section 6.4.3 for more detailed instructions on removing the display assembly.)

Step 4 Installing the Control Pad

Install • control pad

(See Section 6.4.4 for more detailed instructions on installing the control pad.)

Step 5 Installing the Display Assembly

Install • display assembly

(See Section 6.4.3 for more detailed instructions on installing the display assembly.)

Top Enclosure Replacement (Continued)

Step 6 Installing the Top Enclosure

a. Ensure that the outlet port is still properly seated in the bottom enclosure.

b. While holding the top enclosure slightly above the unit, align the display assembly ribbon cable pins with their receptacle on the Main PCA. Press the cable into the receptacle until completely seated.

c. Still holding the top enclosure slightly above the unit, align control pad ribbon cable connectors with its receptacle on the Main PCA. Press the cable into the receptacle until completely seated.

d. Align the top enclosure with the bottom enclosure and outlet port then set in place.

e. While securely holding the top and bottom enclosure together, carefully turn the unit upside down.

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

g. Return the unit to its upright position.

6.4.3 Display Assembly Replacement

Replacement Part Number 1003520

Included in Kit:	Tools Required:
Display PCA LCD	Phillips screwdriver (medium)

Procedure

Removed / Installed During Process

- Top Enclosure
- Display assembly

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

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

Figure 6-8
Display Assembly

Display Assembly Replacement (Continued)

Step 1 Removing the Top Enclosure

Remove
- three screws
- top enclosure

(See Section 6.4.2 for more detailed instructions on removing the top enclosure.)

Step 2 Removing the Display Assembly

a. Place the top enclosure on a protected work surface and carefully turn it over, exposing the underside.

b. Move the display assembly locking tabs away from the display assembly then lift the display assembly straight up from the top enclosure.

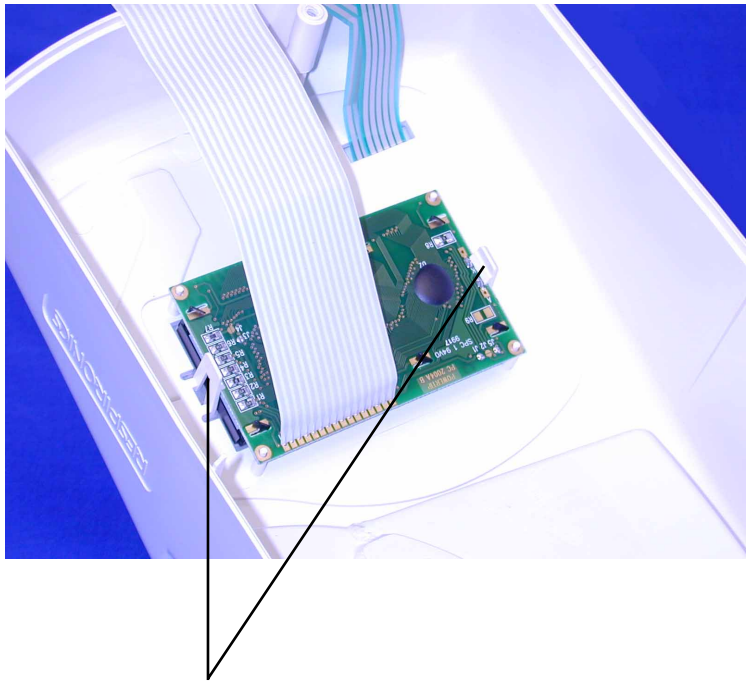


Figure 6-9
Location of the Display Assembly Locking Tabs

Display Assembly Replacement (Continued)

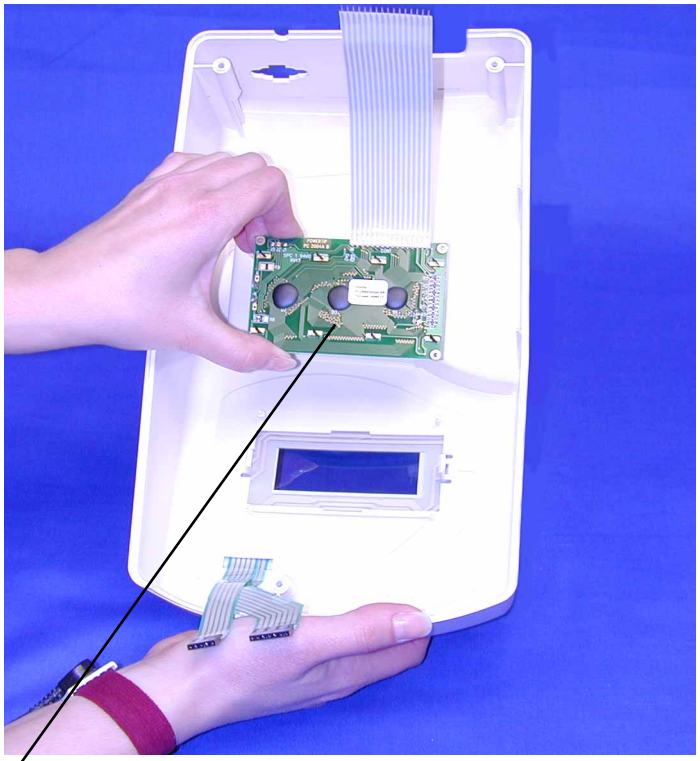


Figure 6-10
Removing the Display Assembly

Step 3 Installing the Display Assembly

a. Align the display assembly with the four mounting posts and gently press into the top enclosure until the locking tabs "snap" into place. Note that the ribbon cable side of the display assembly must point towards the back of the top enclosure.

Step 4 Installing the Top Enclosure

Install:
- top enclosure
- three screws

(See Section 6.4.2 for more detailed instructions on installing the top enclosure.)

6.4.4 Control Pad Replacement

Replacement Part Number 1003519

Included in Kit:	Tools Required:
Control Pad	Phillips screwdriver No#2 (medium) Flat-blade screwdriver No#1 (small) Isopropyl alcohol Cleaning cloth

Procedure

Removed / Installed During Process:

- Top Enclosure
- Control Pad

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

CAUTION: Electrical 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 6-10
Control

Control Pad Replacement (Continued)

Step 1 Removing the Top Enclosure

Remove
- three screws
- top enclosure

(see Section 6.4.2 for more detailed instructions on removing the top enclosure.)

Step 2 Removing the Control Pad

a. Working from the inside of the top enclosure, place a flat-blade screwdriver onto the exposed portion of the control pad, next to the ribbon cable. Gently push until the control pad is partially lifted.

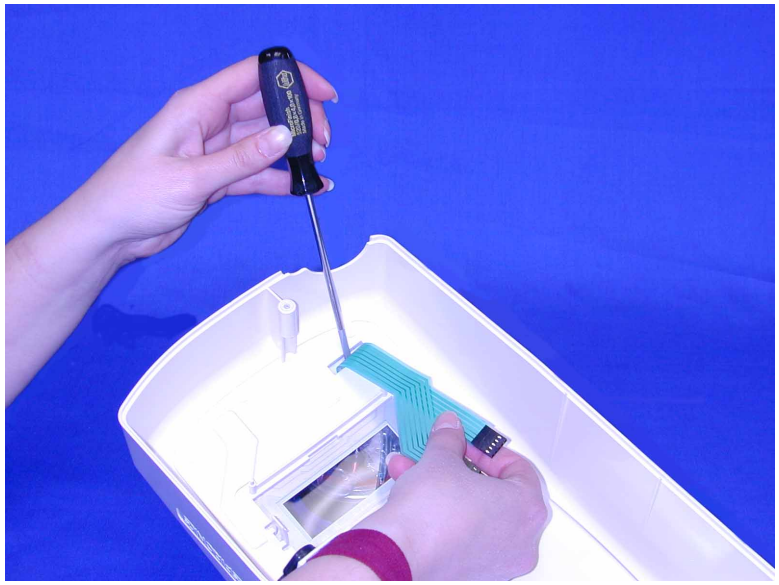


Figure 6-11
Pressing the Control Pad from the Top Enclosure

Control Pad Replacement (Continued)

b. Working from the outside of the top enclosure, carefully lift upwards on the control pad and remove it from the top enclosure.

NOTE: A small amount of isopropyl alcohol may be used during the removal process.

c. As the control pad is being removed, the ribbon cable must be fed through the opening in the top enclosure.

Figure 6-12
Removing the Control Pad

d. Use a small amount of isopropyl alcohol on a cleaning cloth to remove any adhesive residue from the surface of the top enclosure.

Step 3 Installing the Control Pad

a. Remove the protective backing from the back of the control pad (make sure the backing under the ribbon cable is removed.)

b. Feed the control pad ribbon cable through the opening in the top enclosure

c. Starting with the front edge, align the control pad with the indentation in the top enclosure then set in place.

d. Using a rubbing motion, press the control pad firmly onto the top enclosure.

Step 4 Installing the Top Enclosure

Install
- top enclosure
- three screws

(See Section 6.4.2 for more detailed instructions on installing the top enclosure.)

6.4.5 Main Printed Circuit Assembly (Main PCA) Replacement

CAUTION: Due to required testing after replacement, this item is only replaceable at a Respironics Service Center equipped with a Multi Functional Calibration Station.

Replacement Part Number 1003518

Included in Kit:	Tools Required:
Main PCA 6-19 x 3/8" Plastite screw (x5)	Phillips screwdriver No#2 (medium)

Procedure

Removed / Installed During Process

- Top enclosure assembly
- 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.

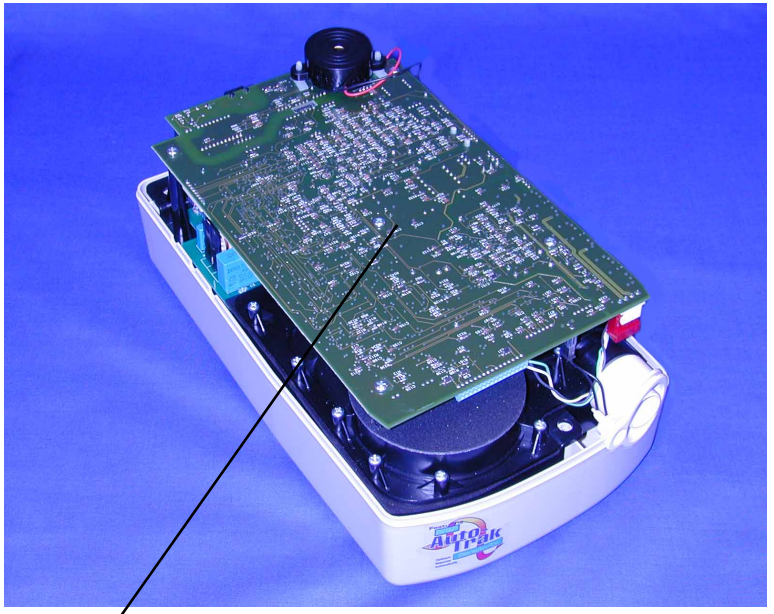


Figure 6-13
Main Printed Circuit Assembly

Main PCA Replacement (Continued)

Step 1 Removing the top Enclosure

a. Place the unit 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.

c. While holding the unit together, return it to the normal position.

d. Slightly lift the top enclosure assembly from the unit to provide access to the control pad ribbon cables and the display ribbon cable connections on the Main PCA.

e. Remove the control pad ribbon cables and the display assembly ribbon connectors by gently pulling straight out from their receptacles.

f. The top enclosure assembly is now free from the rest of the unit.

(See Section 6.4.2 for more detailed instructions on installing the top enclosure.)

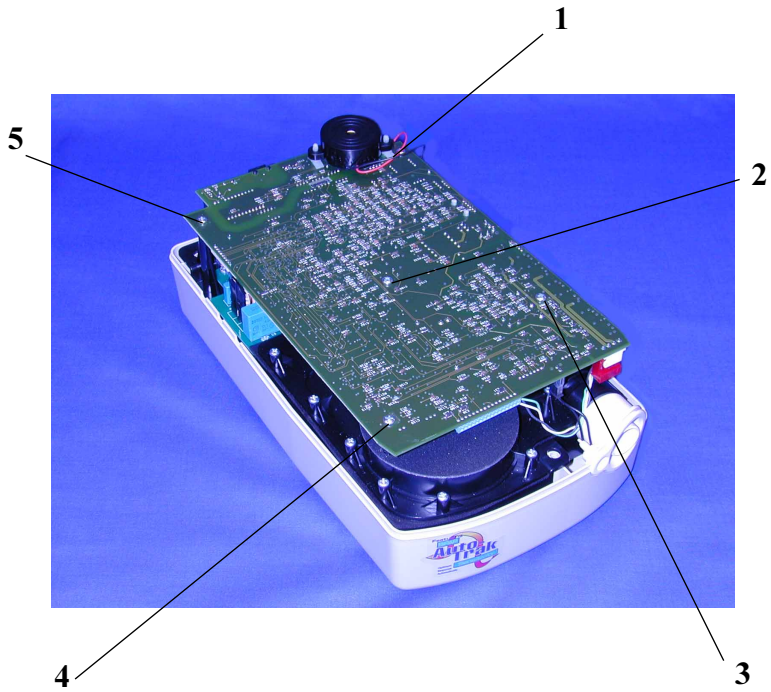


Figure 6-14
Location of the Five Screws Securing the Main PCA

Main PCA Replacement (Continued)

Step 2 Removing the Main PCA

a. Using a Phillips screwdriver, remove the five screws securing the Main PCA to the standoffs on the enclosure insert.

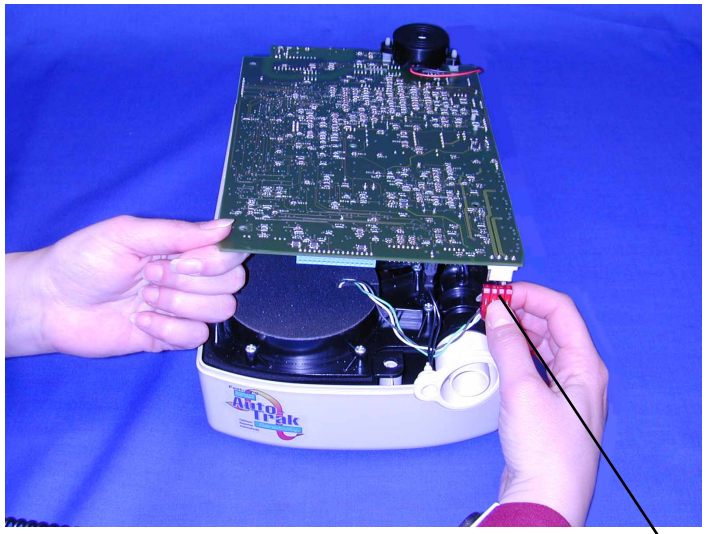


Figure 6-15
Removing the blower Wire Connector from the (J2) Location

b. Lift the Main PCA slightly to provide access to the pressure tubing, blower, and power supply connections.

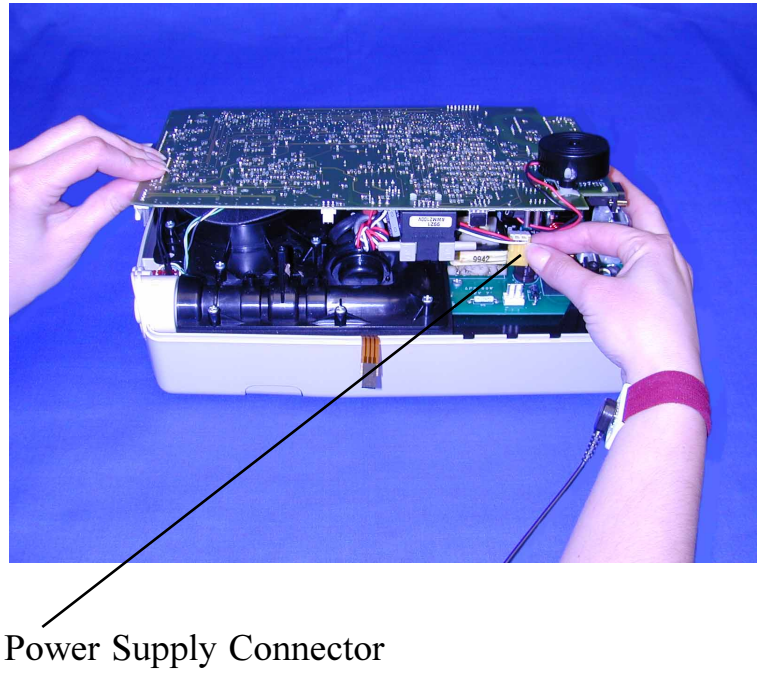


Figure 6-16
Removing the Power Supply Connector from the (J2) Location

Main PCA Replacement (Continued)

c. Remove the blower wire connector from the (J2) location on the Main PCA by pulling it straight down from the receptacle.

d. Remove the power supply connector from the (J2) location on the Power Supply Printed Circuit Assembly by pulling straight up from the receptacle.

e. Remove the valve connector from the (J4) location on the Main PCA.

f. Remove the Oxygen Module wire harness connector from the (J16) location on the Main PCA.

g. Remove the temperature circuit connector from the (J14) location on the Main PCA.

h. Remove the two pieces of 9” mass flow sensor tubing from the MT1 location on the Main PCA.

i. Remove the two pieces of pressure tubing from MT2 and MT4 location on the Main PCA.

j. The Main PCA is now free from the rest of the unit.

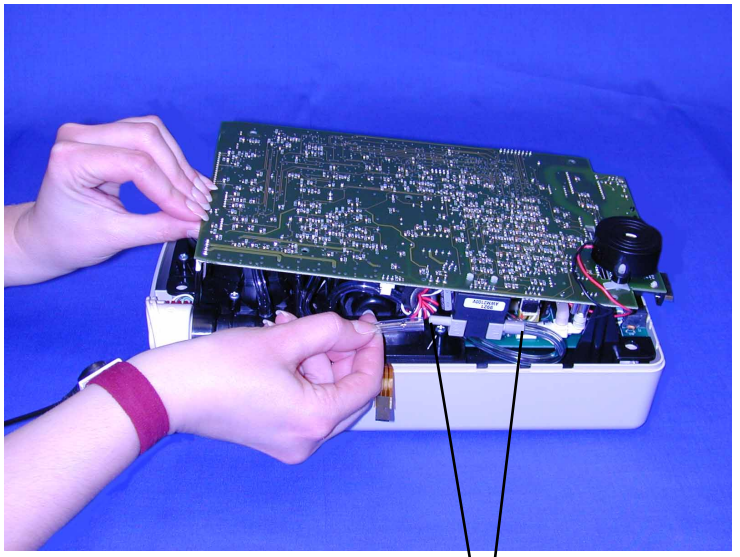


Figure 6-17
Removing the Mass Flow Sensor Tubing

Main PCA Replacement (Continued

Step 3 Installing the Main PCA

a. Connect the two 9’ pieces of tubing to MT1.

b. Connect the two pieces of tubing to MT2 and MT4.

c. Install the valve assembly connector to the (J4) location the Main PCA.

d. Install the blower wire connector to the (J2) location on the Main PCA.

e. Install the temperature circuit connector to the (J14) location on the Main PCA.

f. Install the oxygen module wire harness to the (J16) location on the Main PCA.

g. Secure the Main PCA to the enclosure insert by installing and tightening the five screws provided.

Step 4 Installing the Top Enclosure

Install
- top enclosure
- three screws

(See Section 6.4.2 for more detailed instructions on installing the top enclosure.)

6.4.6 Pressure and Mass Flow Sensor Tubing Replacement

CAUTION: Due to required testing after replacement, this item is only replaceable at a Respironics Service Center equipped with a Multi Functional Calibration Station.

Replacement Part Number 1003517

Included in Kit:	Tools Required:
Pressure tubing (5") x 1 Pressure tubing (1") x 2 Plastic (F) fitting Mass flow sensor tubing (9") x 2	Phillips screwdriver No#2 (medium)

Procedure

Removed / Installed During Process

- Top Enclosure Assembly
- Main PCA
- Mass flow sensor tubing
- Pressure tubing

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.

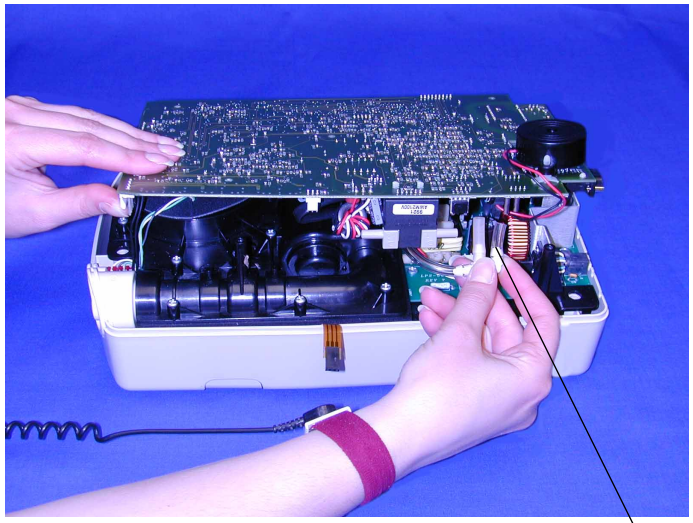


Figure 6-18
Pressure Tubing Removal

Pressure Tubing Replacement (Continued)

Step 1 Removing the Top Enclosure Assembly

Remove
- three screws
- top enclosure
- control pad ribbon cable and display assembly ribbon cable connectors

(See Section 6.4.5, step 1, for more detailed instructions on removing the top enclosure assembly.)

Step 2 Removing the Main PCA (Partial)

NOTE: The pressure tubing can be removed from the Main PCA without disconnecting the blower, power supply and temperature connections. Care should be taken during the process not to damage the Main PCA, blower assembly, or power supply PCA.

Remove
- five screws
- mass flow sensor tubing
- pressure tubing

(See Section 6.4.5, step 1, for more detailed instructions on removing the Main PCA.)

Step 3 Removing the Pressure and Mass Flow Sensor Tubing from the Blower Assembly

a. Disconnect the two pieces of 9” mass flow sensor tubing from the pressure ports on the blower assembly.

b. Disconnect the 5” pressure tubing from the pressure port on the blower assembly.

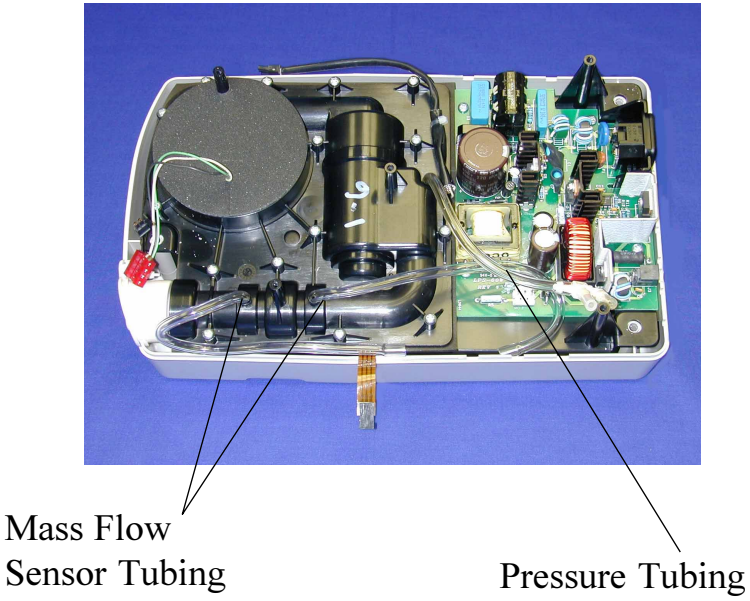


Figure 6-19
Removing the Pressure tubing and Mass Flow Tubing

Pressure Tubing Replacement (Continued)

Step 4 Installing the Pressure and Mass Flow Sensor Tubing on the Blower Assembly

a. Attach the 5" pressure tubing to the pressure port on the blower assembly.

b. Attach the two 9" pieces of mass flow sensor tubing to the pressure ports on the blower assembly.

Step 5 Installing the Main PCA (Partial)

Install:
- pressure tubing
- mass flow sensor tubing
- five screws

(See Section 6.4.5 for more detailed instructions on installing Main PCA.)

Step 6 Installing the Top Enclosure Assembly

Install:
- control pad ribbon cable and display assembly ribbon cable connectors
- top enclosure
- three screws

(See section 6.4.5, step 4, for more detailed instructions on installing the top enclosure assembly.)

6.4.7 Outlet Port Replacement

Replacement Part Number 1003524

Included in Kit:	Tools Required:
Outlet port Outlet port seal	Phillips screwdriver No#2 (medium)

Procedure

Removed / Installed During Process:

- Top enclosure assembly
- 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 6-19
Outlet Port

Outlet Port Replacement (Continued)

Step 1 Removing the Top Enclosure Assembly

Remove
- three screws
- top enclosure
- control pad ribbon cable and display assembly ribbon cable connectors

(see Section 6.4.5 step 1, for more detailed instructions on removing the top enclosure assembly.)

Step 2 Removing the Outlet Port

a. Remove the outlet port and the outlet port seal from the blower outlet by lifting upwards until the outlet port clears the bottom enclosure and pulling it straight out from the blower.

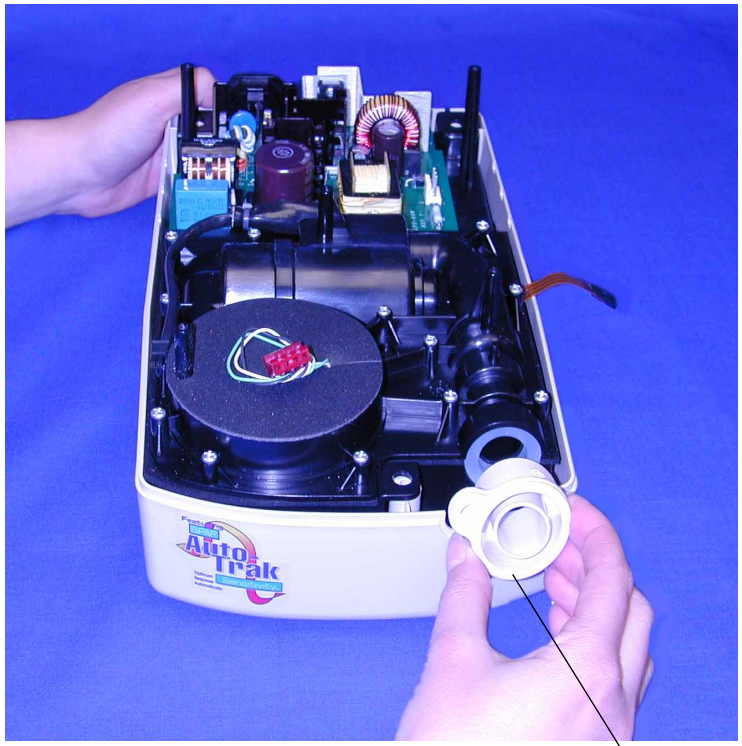


Figure 6-20
Removing the Outlet Port

Outlet Port Replacement (Continued)

Step 3 Installing the Outlet Port

a. Grasp the blower assembly and slightly lift the enclosure insert to allow the outlet port and outlet port seal to clear the bottom enclosure and be inserted into the blower outlet.

b. Slowly lower the enclosure insert assembly into the bottom enclosure while ensuring that the outlet port is properly seated in the bottom enclosure. Note that the pressure fitting on the outlet port must point towards the middle of the bottom enclosure.

Step 4 Installing the Top Enclosure Assembly

Install:
- control pad ribbon cable and display assembly ribbon cable connectors
- top enclosure
- three screws

(See Section 6.4.5, step 4, for more detailed instructions on installing the top enclosure assembly.)

6.4.8 Blower Assembly Replacement

CAUTION: Due to required testing after replacement, this item is only replaceable at a Respironics Service Center equipped with a Multi Function Calibration Station.

Replacement Part Number 622187

Included in Kit:	Tools Required:
Blower Assembly (w / foam baffle)	Phillips screwdriver No#2 (medium)
Blower-to-enclosure insert seal	Torque wrench (in-lbs.)
Flow element / Flow Averaging Rings	
6-13 x 1" screw (x15)	

Procedure

Removed / Installed During Process:

- Top enclosure assembly
- Main PCA
- Pressure tubing / Mass flow sensor tubing
- Outlet port
- Blower assembly
- Flow element / Flow averaging rings
- Blower-to-enclosure insert seal

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.

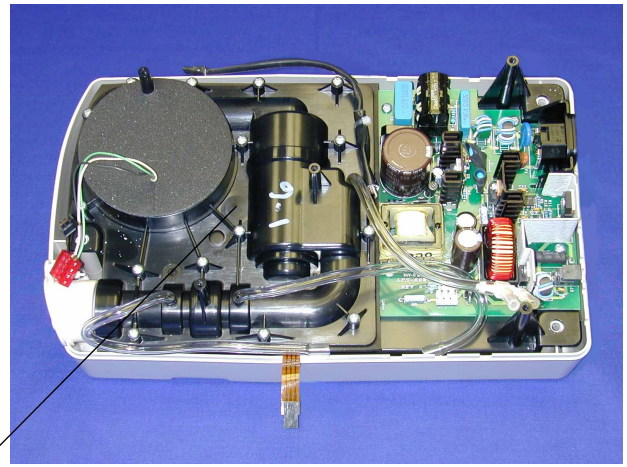


Figure 6-21
Blower Assembly

Blower Assembly Replacement (Continued)

Step 1 Removing the Top Enclosure

Remove
- three screws
- top enclosure
- control pad ribbon cable and display assembly ribbon cable connectors

(See Section 6.4.5, step 1, for more detailed instructions on removing the top enclosure assembly.)

Step 2 Removing the Main PCA

Remove:
- five screws
- blower wire connector
- power supply connector
- valve assembly connector
- temperature circuit connector
- O^2 wire harness connector
- pressure tubing
- mass flow sensor tubing
- Main PCA

(See Section 6.4.5 for more detailed instructions on removing the Main PCA.)

Step 3 Removing the Pressure Tubing

Remove:
- mass flow sensor tubing
- pressure tubing

(See Section 6.4.7 for more detailed instructions on removing the pressure and mass flow sensor tubing.)

Step 4 Removing the Outlet Port

Remove
- outlet port

(See Section 6.4.7 for more detailed instructions on removing the outlet port.)

Blower Assembly Replacement (Continued)

Step 5 Removing the Blower Assembly

a. Using a Phillips screwdriver, remove the 15 screws securing the blower assembly to the enclosure insert.

b. Lift the blower assembly up from the enclosure insert.

c. Note the location and routing of the valve assembly wires.

d. Remove the valve assembly form the enclosure insert.

e. Remove the flow element from the enclosure insert.

f. Remove the flow averaging rings from the enclosure insert.

g. Remove the blower-to-enclosure insert seal from the enclosure insert.

h. Remove the temperature circuit form the enclosure insert.

Figure 6-23
Removing the Blower Assembly

Blower Assembly Replacement (Continued)

Step 6 Installing the Blower Assembly

a. Position the temperature circuit so the sensor is in the middle of the flow path.

a. Position the blower-to-enclosure insert seal in place on the enclosure insert.

b. Ensure that the valve assembly and flow element are correctly positioned.

c. Ensure that the valve assembly wires are correctly positioned and routed.

d. Ensure that the flow element and flow averaging rings are positioned and facing in the proper direction.

e. Align the blower assembly with the holes in the enclosure insert, then set the blower assembly in place.

f. Insert and tighten the 15 screws provided to secure the blower assembly to the enclosure insert.

NOTE: The screws should be torqued to a maximum of 8 in-lbs. Excessive torque may cause the blower impeller to contact the enclosure insert.

Step 7 Installing the Outlet Port

Install
- outlet port

(See Section 6.4.7 for more detailed instructions on installing the outlet port.)

Step 8 Installing the Pressure Tubing

Install:
- pressure tubing
- mass flow sensor tubing

(See Section 6.4.6 for more detailed instructions on installing the pressure and mass flow sensor tubing.)

Step 9 Installing the Main PCA

Install:
- pressure tubing
- mass flow sensor tubing
- O^2 wire harness connector
- temperature circuit connector
- valve assembly connector
- power supply connector

Blower Assembly Replacement (Continued)

- blower wire connector
- Main PCA
- five screws

(See Section 6.4.5 for more detailed instructions on installing the Main PCA

Step 10 Installing the Top Enclosure Assembly

Install
- control pad ribbon cable and display assembly ribbon cable connectors
- top enclosure
- three screws

(See Section 6.4.5, step 4, for more detailed instructions on installing the top enclosure assembly.)

6.4.9 Valve Assembly Replacement

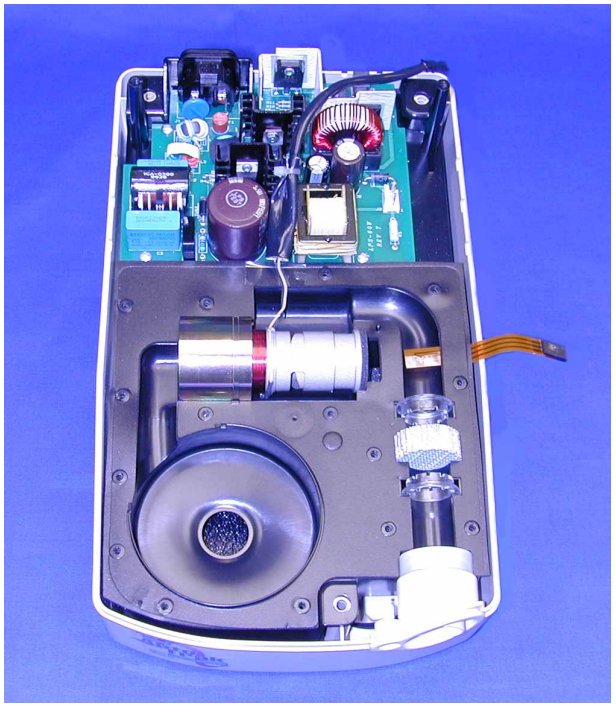
Replacement Part Number 622242

Included in Kit:	Tools Required
Valve assembly Blower-to-enclosure insert seal Flow element / Flow averaging rings	Phillips screwdriver No 2 (medium)

Procedure

Removed / Installed During Process:

- Top enclosure assembly
- Main PCA
- Blower assembly
- Valve assembly
- Flow element / Flow averaging rings
- Blower-to-enclosure insert seal
- Temperature circuit



Valve Assembly
(under Blower Assembly)

Figure 6-24
Valve Assembly

Valve Assembly Replacement (Continued)

Step 1 Removing the Top Enclosure Assembly

Remove:
- three screws
- top enclosure
- control pad ribbon cable and display assembly ribbon cable connectors

(See Section 6.4.5, step 1, for more detailed instructions on removing the top enclosure assembly.)

Step 2 Removing the Main PCA

Remove
- five screws
- blower wire connector
- power supply connector
- valve assembly connector
- temperature circuit connector
- O_2 wire harness connector
- pressure tubing
- mass flow sensor tubing
- Main PCA

(See Section 6.4.5 for more detailed instructions on removing the Main PCA.)

Step 3 Removing the Blower Assembly

Remove:
- fifteen screws
- blower assembly
- valve assembly
- flow element
- flow averaging rings
- blower-to-enclosure insert seal
- temperature circuit

(See Section 6.4.8 for more detailed instructions on removing the blower assembly.)

Valve Assembly Replacement (Continued)

Step 4 Removing the Valve Assembly

a. Remove the valve assembly by lifting it out of the enclosure insert.

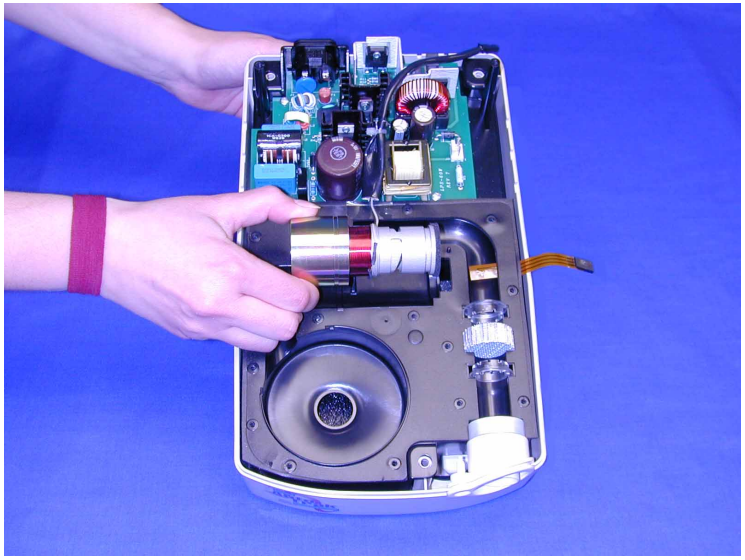


Figure 6-25
Removing the Valve Assembly

Step 5 Installing the Valve Assembly

a. Position the temperature circuit so the sensor is in the middle of the flow path.

b. Ensure that the rubber seal is correctly seated on the end of the valve assembly.

c. Place the valve assembly into its correct position in the enclosure insert.

NOTE: The valve assembly wires should be positioned at 3 and 9 o'clock in relation to the enclosure insert and should not block the pressure port.

Step 6 Installing the Blower Assembly

Install:
- blower-to-enclosure insert seal
- flow element / flow averaging rings
- valve assembly
- blower assembly
- fifteen screws

(See Section 6.4.8 for more detailed instruction on installing the blower assembly.)

Valve Assembly (Continued)

Step 7 Installing the Main PCA

Install:

- pressure tubing
- mass flow sensor tubing
- O_2 wire harness connector
- temperature circuit connector
- valve assembly connector
- power supply connector
- blower wire connector
- Main PCA
- five screws

(See Section 6.4.5 for more detailed instructions on installing the Main PCA.)

Step 8 Installing the Top Enclosure Assembly

Install:

- control pad ribbon cable and display assembly ribbon cable connectors
- top enclosure
- three screws

(See Section 6.4.5 for more detailed instructions on installing the top enclosure assembly.)

6.4.10 Flow Element and Flow Averaging Rings Replacement

NOTE: Flow Element and Flow Averaging Rings are included in the following RP Kits:
Replacement Part Number 1003521
Replacement Part Number 1003516

Procedure

Removed / Installed During Process:

- Top enclosure assembly
- Main PCA
- Blower assembly
- Valve assembly
- Flow Element
- Flow Averaging Rings
- Blower-to-enclosure insert seal

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.

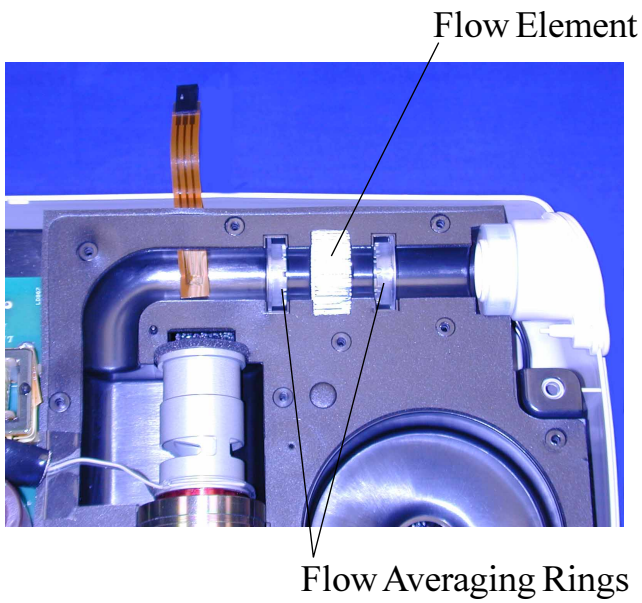


Figure 6-26
Flow Element / Flow Averaging Rings

Flow Element / Flow Averaging Rings Replacement (Continued)

Step 1 Removing the Top Enclosure Assembly

Remove:
- three screws
- top enclosure
- control pad ribbon cable and display assembly ribbon cable connectors

(See Section 6.4.5, step 1, for more detailed instructions on removing the top enclosure assembly.)

Step 2 Removing the Main PCA

Remove
- five screws
- blower wire connector
- power supply connector
- valve assembly connector
- temperature circuit connector
- O_2 wire harness connector
- pressure tubing
- mass flow sensor tubing
- Main PCA

(See Section 6.4.5 for more detailed instructions on removing the Main PCA.)

Step 3 Removing the Blower Assembly

Remove:
- fifteen screws
- blower assembly

(See Section 6.4.8 for more detailed instructions on removing the blower assembly.)

Step 4 Removing the Valve Assembly

Remove
- valve assembly

(See section 6.4.9 for more detailed instructions on removing the blower assembly.)

Flow Element / Flow Averaging Rings Replacement (Continued)

Step 5 Removing the Flow Element and Flow Averaging Rings

a. Remove the flow element and the flow averaging rings by lifting them out of the enclosure insert.

b. Remove the blower-to-enclosure insert seal.

c. Remove the temperature circuit.

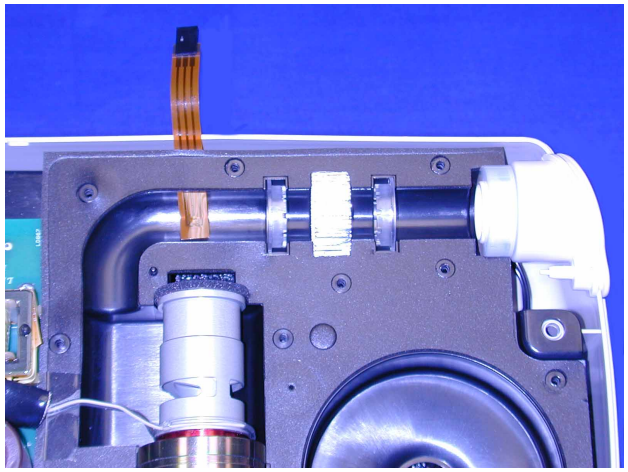


Figure 6-27
Flow Element / Flow Averaging Rings Removal

Step 5 Installing the Flow Element and Flow Averaging Rings

a. Position the temperature circuit so the sensor is in the middle of the flow path.

a. Place the enclosure-to-blower insert seal on the enclosure insert.

b. Place the flow element into the enclosure insert.

c. Place the two flow averaging rings into the enclosure insert.

NOTE: Verify notches on the flow averaging rings face the flow element.

Step 6 Installing the Valve Assembly

Install • valve assembly

(See section 6.4.9 for more detailed instructions on installing the valve assembly.)

Flow Element / Flow Averaging Rings Replacement (Continued)

Step 7 Installing the Blower Assembly

Install:
- blower assembly
- blower-to-enclosure insert seal
- fifteen screws

(See Section 6.4.8 for more detailed instruction on installing the blower assembly.)

Step 8 Installing the Outlet Port

Install
- outlet port

(See Section 6.4.7 for more detailed instructions on installing the outlet port.)

Step 9 Installing the Pressure Tubing

Install:
- pressure tubing
- mass flow sensor tubing

(See Section 6.4.6 for more detailed instructions on installing the pressure and mass flow sensor tubing.)

Step 9 Installing the Main PCA

Install:
- pressure tubing
- mass flow sensor tubing
- O_2 wire harness connector
- temperature circuit connector
- valve assembly connector
- power supply connector
- blower wire connector
- Main PCA
- five screws

(See Section 6.4.5 for more detailed instructions on installing the Main PCA

Flow Element / Flow Averaging Rings Replacement (Continued)

Step 10 Installing the Top Enclosure Assembly

Install
- control pad ribbon cable and display assembly ribbon cable connectors
- top enclosure
- three screws

(See Section 6.4.5, step 4, for more detailed instructions on installing the top enclosure assembly.)

6.4.11 Temperature Circuit Replacement

Replacement Part Number 1003522

Included in Kit:	Tools Required
Temperature Circuit	Phillips screwdriver No 2 (medium)

Procedure

Removed / Installed During Process:

- Top enclosure assembly
- Main PCA
- Blower assembly
- Valve assembly
- Flow Element
- Flow Averaging Rings
- Blower-to-Enclosure Insert Seal

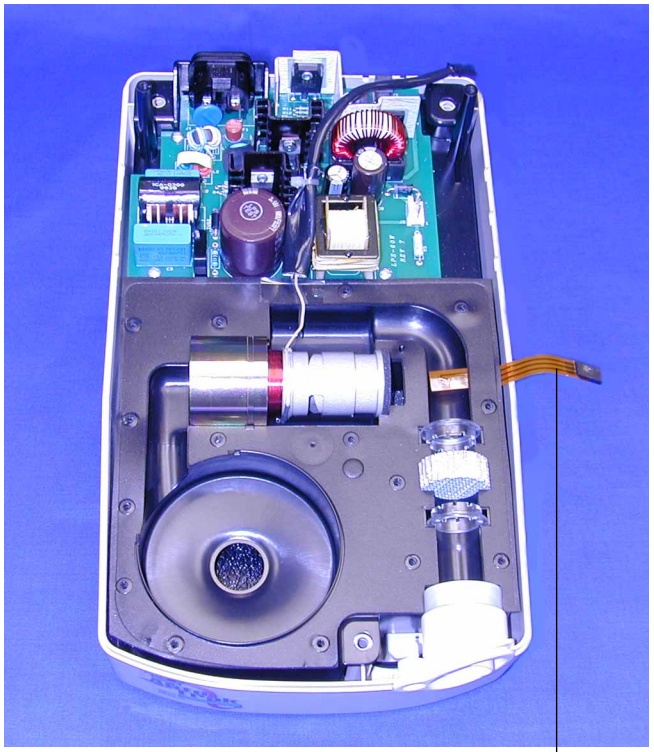


Figure 6-26
Temperature Circuit

Temperature Circuit Replacement (Continued)

Step 1 Removing the Top Enclosure Assembly

Remove:
- three screws
- top enclosure
- control pad ribbon cable and display assembly ribbon cable connectors

(See Section 6.4.5, step 1, for more detailed instructions on removing the top enclosure assembly.)

Step 2 Removing the Main PCA

Remove
- five screws
- blower wire connector
- power supply connector
- valve assembly connector
- temperature circuit connector
- O_2 wire harness connector
- pressure tubing
- mass flow sensor tubing
- Main PCA

(See Section 6.4.5 for more detailed instructions on removing the Main PCA.)

Step 3 Removing the Blower Assembly

Remove
- blower assembly

(See Section 6.4.8 for more detailed instructions on removing the blower assembly.)

Step 4 Removing the Valve Assembly

Remove
- valve assembly

(See section 6.4.9 for more detailed instructions on removing the valve assembly.)

Temperature Circuit Replacement (Continued)

Step 5 Removing the Flow Element, Flow Averaging Rings

Remove
- flow element
- flow averaging rings

(See section 6.4.9 for more detailed instructions on removing the flow element and flow averaging rings.)

Step 6 Removing the Temperature Circuit

a. Remove the temperature circuit from the enclosure insert.

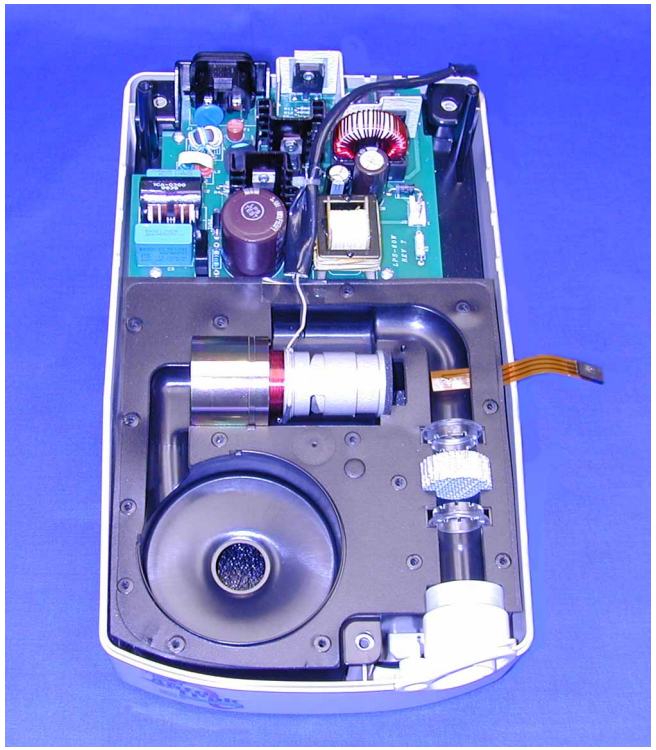


Figure 6-28
Temperature Circuit

Temperature Circuit Replacement (Continued)

Step 7 Installing the Temperature Circuit.

a. Place the temperature circuit on the enclosure insert. Verify that the sensor is centered in the flow path. Sensor component must face down.

b. Place the blower-to-enclosure insert seal on the enclosure insert.

Step 8 Installing the Flow Element and Flow Averaging Rings

Install:
- flow element
- flow averaging rings

(See Section 6.4.10 for more detailed instructions on installing the flow element and flow averaging rings.)

Step 9 Installing the Valve Assembly

Install:
- valve assembly

(See section 6.4.9 for more detailed instructions on installing the valve assembly.)

Step 10 Installing the Blower Assembly

Install:
- blower-to-enclosure insert seal
- flow element / flow averaging rings
- valve assembly
- blower assembly
- fifteen screws

(See Section 6.4.8 for more detailed instruction on installing the blower assembly.)

Step 11 Installing the Main PCA

Install:
- pressure tubing
- mass flow sensor tubing
- O^2 wire harness connector
- temperature circuit connector
- valve assembly connector
- power supply connector

- blower wire connector
- Main PCA
- five screws

(See Section 6.4.5 for more detailed instructions on installing the Main PCA.)

Step 12 Installing the Top Enclosure Assembly

Install:
- control pad ribbon cable and display assembly ribbon cable connectors
- top enclosure
- three screws

(See Section 6.4.5 for more detailed instructions on installing the top enclosure assembly.)

6.4.12 Power Supply Printed Circuit Assembly Replacement

CAUTION: Due to required testing after replacement, this item is only replaceable at a Respironics Service Center equipped with a Multi Function Calibration Station.

Replacement Part Number 1003515

Included in Kit:	Tools Required:
Power supply PCA 6-13 x 1/4" screw (x4)	Phillips screwdriver No 2 (medium)

Procedure

Removed / Installed During Process:

- Top enclosure assembly
- Main PCA
- Power supply 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.

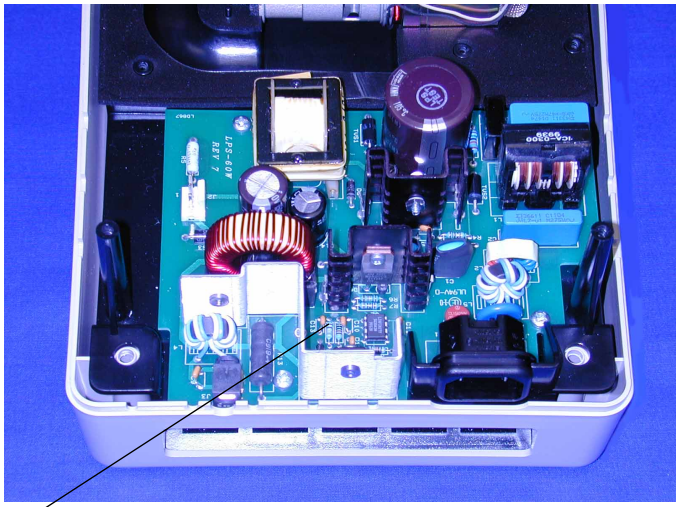


Figure 6-26
Power Supply

Power Supply PCA Replacement (Continued)

Step 1 Removing the Top Enclosure Assembly

Remove:
- three screws
- top enclosure
- control pad ribbon cable and display assembly ribbon cable connectors

(See Section 6.4.5, step 1, for more detailed instructions on removing the top enclosure assembly.)

Step 2 Removing the Main PCA

Remove:
- five screws
- blower wire connector
- power supply connector
- valve assembly connector
- temperature circuit connector
- O^2 wire harness connector
- pressure tubing
- mass flow sensor tubing
- Main PCA

(See Section 6.4.5 for more detailed instructions on removing the Main PCA.)

Step 3 Removing the Power Supply PCA

a. Using a Phillips screwdriver, remove the four screws securing the power supply PCA to the enclosure insert.

b. While holding the enclosure insert in place, lift the power supply PCA from the enclosure insert. It will be necessary to guide the AC input power receptacle from the cutout in the enclosure insert.

Power Supply PCA Replacement (Continued)

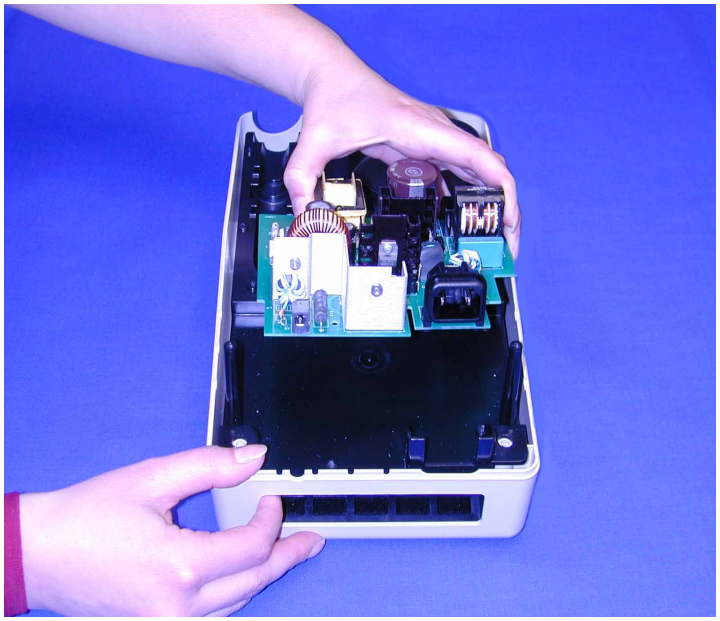


Figure 6-27
Removing the Power Supply PCA

Step 4 Installing the Power Supply PCA

a. Align the holes in the power supply PCA with the holes in the enclosure insert. Note that the AC power input receptacle must be guided into the cutout in the enclosure insert.

b. Insert and tighten the four screws provided to secure the power supply PCA to the enclosure insert.

Step 5 Installing the Main PCA

Install:

- pressure tubing
- mass flow sensor tubing
- O_2 wire harness connector
- temperature circuit connector
- valve assembly connector
- power supply connector
- blower wire connector
- Main PCA
- five screws

(See Section 6.4.5 for more detailed instructions on installing the Main PCA.)

Step 6 Installing the Top Enclosure Assembly

Install:

- control pad ribbon cable and display assembly ribbon cable connectors
- top enclosure
- three screws

(See Section 6.4.5, step 4, for more detailed instructions on installing the top enclosure assembly.)

6.4.13 Enclosure Insert Replacement

CAUTION: Due to required testing after replacement, this item is only replaceable at a Respironics Service Center equipped with a Multi Function Calibration Station.

Replacement Part Number 622184

Included in Kit:	Tools Required:
Enclosure insert	Phillips screwdriver No 2 (medium)
Blower-to-enclosure insert seal	Torque wrench (in-lbs.)

Procedure

Removed / Installed During Process:

- Top Enclosure assembly
- Outlet Port
- Valve Assembly
- Flow Averaging Rings
- Power supply PCA
- Main PCA
- Blower Assembly
- Flow Element
- Temperature Circuit
- Enclosure insert

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.

Enclosure Insert

Figure 6-28
Enclosure Insert

Enclosure Insert Replacement (Continued)

Step 1 Removing the Top Enclosure Assembly

Remove:
- three screws
- top enclosure
- control pad ribbon cable and display assembly ribbon cable connectors

(See Section 6.4.5, step 1, for more detailed instructions on removing the top enclosure assembly.)

Step 2 Removing the Main PCA

Remove:
- five screws
- blower wire connector
- power supply connector
- valve assembly connector
- temperature circuit connector
- O^2 wire harness connector
- pressure tubing
- mass flow sensor tubing
- Main PCA

(See Section 6.4.5 for more detailed instructions on removing the Main PCA.)

Step 3 Removing the Outlet Port

Remove
- outlet port

(See Section 6.4.8 for more detailed instructions on removing the blower assembly.)

Step 4 Removing the blower Assembly

Remove:
- fifteen screws
- blower assembly
- blower-to-enclosure insert seal

(See Section 6.4.8 for more detailed instructions on removing the blower assembly.)

Enclosure Insert Replacement (Continued)

Step 5 Removing the Valve Assembly

Remove • valve assembly

(See section 6.4.9 for more detailed instructions on removing the valve assembly.)

Step 6 Removing the Flow Element, Flow Averaging Rings

Remove • flow element

• flow averaging rings

(See section 6.4.9 for more detailed instructions on removing the flow element and flow averaging rings.)

Step 7 Removing the Temperature Circuit

Remove • temperature circuit

Enclosure Insert Replacement (Continued)

Step 8 Removing the Power Supply PCA

Remove: • four screws

• power supply PCA

(See Section 6.4.10 for more detailed instructions on removing the power supply PCA.)

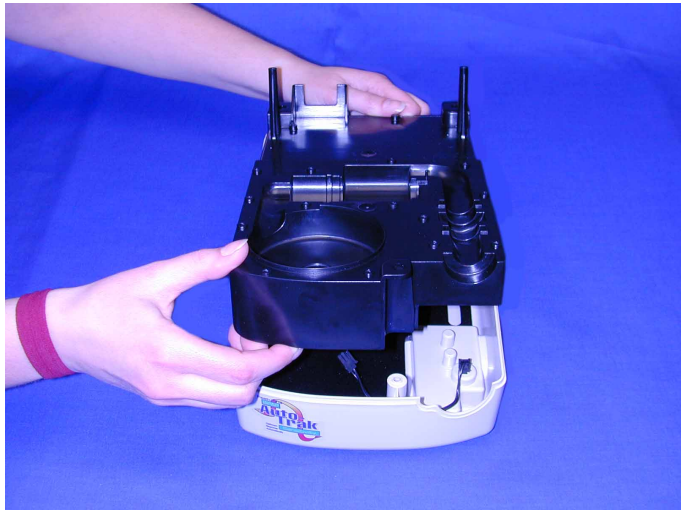


Figure 6-29
Enclosure Insert Removed

Step 9 Removing the Enclosure Insert

a. While holding the bottom enclosure in place, lift the enclosure insert out of the bottom enclosure

Step 10 Installing the Enclosure Insert

a. Align the enclosure insert then place it into the bottom enclosure.

Step 11 Installing the Power Supply PCA

Install:
- power supply PCA
- four screws

(See Section 6.4.10 for more detailed instructions on installing the power supply PCA.)

Step 12 Installing the Temperature Circuit.

a. Place the temperature circuit on the enclosure insert. Verify that the sensor is centered in the flow path. Sensor component must face down.

b. Place the blower-to-enclosure insert seal on the enclosure insert.

Step 13 Installing the Flow Element and Flow Averaging Rings

Install:
- flow element
- flow averaging rings

(See Section 6.4.10 for more detailed instructions on installing the flow element and flow averaging rings.)

Step 14 Installing the Valve Assembly

Install:
- valve assembly

(See section 6.4.9 for more detailed instructions on installing the valve assembly.)

Step 15 Installing the Blower Assembly

Install:
- blower-to-enclosure insert seal
- blower assembly
- fifteen screws

(See Section 6.4.8 for more detailed instructions on installing the blower assembly.)

Enclosure Insert Replacement (Continued)

Step 16 Installing the Outlet Port

Install:
- outlet port

(See Section 6.4.7 for more detailed instructions on installing the outlet port.)

Step 17 Installing the Main PCA

Install:
- pressure tubing
- mass flow sensor tubing
- O_2 wire harness connector
- temperature circuit connector
- valve assembly connector
- power supply connector
- blower wire connector
- Main PCA
- five screws

(See Section 6.4.5 for more detailed instructions on installing the Main PCA.)

Step 19 Installing the Top Enclosure Assembly

Install:
- control pad ribbon cable and display assembly ribbon cable connectors
- top enclosure
- three screws

(See Section 6.4.5, step 4, for more detailed instructions on installing the top enclosure.)

Chapter 7: Testing

(This page left intentionally blank)

Chapter 7: Testing

7.1 Overview

This chapter provides guidelines and procedures to do performance verification on the BiPAP Synchrony System.

7.2 Performance Verification

WARNING: To avoid electrical shock, disconnect the electrical supply before attempting to clean the Synchrony. DO NOT immerse the unit in water or allow any liquid to enter the cabinet or the filter intake.

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

Equipment

Digital Manometer
BiPAP Test Orifice
Mild Soap Solution

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.

Step 2 The gray foam filter is a reusable filter that screens out pollens and some household dust. This filter should be cleaned at least every two weeks by the patient and replaced every six months by the patient. The gray foam filter should also be replaced when the Synchrony is being placed on a new patient. The gray foam filter must be in place at all times when the unit is operating.

The disposable white ultra-fine filter increases filtration of pollens, dust, some tobacco smoke, and small particles. The ultra-fine filter should be used in addition to the gray foam filter. The ultra-fine filter should never be used with out the gray foam filter. The patient should replace the ultra-fine filter after 30 days of use or sooner if it appears dirty. The ultra-fine filter should be replaced when the Synchrony is being placed on a new patient.

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

Step 3 Attach the 0.25 BiPAP test orifice to the outlet port. Connect the Synchrony to the proper line voltage. If the unit under test is an international unit , test the unit at the voltage for that specific country.

Step 4 Start the Synchrony by pressing the On / Off key. The Synchrony will go through a Self Test. Record the hours (blower hours) shown on the Display during the Self Test.

Step 4 Enter the SETUP mode. Simultaneously press the Ramp Start / Alarm Silence Key and the Enter Key. Hold the two keys down for three seconds. Select Options by pressing the down arrow until the select arrow is pointing to Options and then press the Enter Key.

Step 5 Select the Time At Pressure on the display screen. Record the Time at Pressure hours. If placing the Synchrony on a new patient, erase the Time at Pressure.

Step 6 Turn the Synchrony off. Connect a manometer to the pressure pick-off port on the test orifice. Press the On /Off switch and allow the unit to go through the Self Test. Once the Self Test is complete, enter the Setup mode (see Section 4.2.3).

NOTE: After entering the Setup Mode use the following to set and change parameters:

a. Use the Up and Down key to move the select indicator to Mode. Press the Enter key.

b. Press the Enter key, then the Up or Down key to select the Spontaneous (S) Mode. Press the Enter key. Press the Exit Key

c. Use the Up and Down key to move the select indicator to Parameters. Press the Enter key.

d. Press the Enter key then the Up or Down key to set the IPAP pressure to 10 cm H_2O. Press the Enter key.

e. Press the Enter key then the Up or Down key to set the EPAP pressure to 5 cm H_2O. Press the Enter key.

f. Press the Down key once to move the select indicator to Rise Time. Press the Enter key. Press the Up or Down key to set the Rise Time to 6. Press the Enter key.

g. Press the Down key then press the Enter key. Press the Up or Down key to set the Vent Ramp to 1 cm H_2O. Press the Enter key.

h. Press the Enter key to Exit the settings.

Step 7 **Pressure Verification**

Occlude the outlet of the unit for 4 seconds then unocclude the outlet for 4 seconds. Do this several times while observing the manometer reading and the Synchrony display. The indicator on the display should toggle between IPAP and EPAP. Record the manometer readings on the data sheet for IPAP and EPAP.

Repeat steps 6 and 7 for the other pressures on the Data sheet. Record the results on the Data Sheet provided.

Step 8 **Vent Ramp Verification**

Occlude the outlet of the unit for 3 seconds then unocclude the outlet for 3 seconds. Do this several times while observing the manometer reading and the Synchrony display. The indicator on the display should toggle between IPAP and EPAP. Press the Ramp Key. The ramp indicator will appear on the display screen. The IPAP should decrease to 16 cm H_2O. The IPAP will then increase 1cm H_2O with every IPAP cycle. Record the results on the data sheet provided.

7.3 Oxygen Module Verification

Equipment

External Pressure Source (CPAP)

Digital Manometer

O_2 Enrichment Port (RI P/N 312010)

End Cap or Plug (x2)

Pressure Tubing (1/8″ I.D.((x3)

1/8 inch "T" fitting

NOTE: Synchrony setup will remain the same as in **Step 7** of the Performance Verification.

Procedure

Step 1 Place an O_2 enrichment port on the outlet of the external pressure source (CPAP) and occlude the port with one of the end caps.

Step 2 Connect one of the three pieces of pressure tubing from the O_2 enrichment port of the external pressure source to the pressure port intake of the oxygen module on the Synchrony.

Step 3 Connect the second piece of pressure tubing from the manometer to the "T" fitting.

Step 4 Connect the third piece of pressure tubing to the "T" fitting and to the remaining open pressure port on the oxygen module.

Step 5 Turn on the external pressure source (CPAP). Observe the manometer to assure that there is no flow going to the manometer.

Step 6 Block the third opening of the "T" fitting with your finger and press the blower On / Off button to start the Synchrony.

Step 7 Observe the manometer to verify a change in flow coming from the external pressure source. Press the On / Off button to stop the Synchrony. Remove your finger from the "T" fitting for three seconds and then reocclude the fitting. Observe that the flow from the external pressure source has stopped.

Step 8 Repeat Step 6.

Step 9 Observe the manometer to verify a change in flow coming from the external pressure source. Unplug the AC power cord from the Synchrony. Remove your finger from the "T" fitting for three seconds and then reocclude the fitting. Observe that the flow coming from the external pressure source has stopped.

Step 10 Mark Pass or Fail on the data sheet.

7.4 Performance Verification Data Sheet

NOTE: Performance Verification may be used as a way to determine that the BiPAP Synchrony System is functioning properly. This verification shall be performed at periodic intervals commensurate with hospital or home care provider guidlines for preventive maintenance: between rentals, during normal patient usage (as routine maintenance), or after repairs have been performed on the BiPAP Synchrony System.

Serial No. _____ **Notification No.** _____ **Line Voltage** _____

2 **Pollen Filter Cleaned / Replaced** _____ **Ultra Fine Filter Replaced** _____

4 **Blower Hrs.** _____ 5 **Time @ Pressure Hrs.** _____

7 **Pressure Settings IPAP / EPAP**

IPAP PRESSURE	EPAP PRESSURE
10 cm H_2O _____ (9 - 11cm H_2O)	5 cm H_2O _____ (4 - 6 cm H_2O)
15 cm H_2O _____ (14 - 16 cm H_2O)	10 cm H_2O _____ (9 - 11 cm H_2O)
20 cm H_2O _____ (19 - 21cm H_2O)	15 cm H_2O _____ (14 - 16 cm H_2O)

8 **Vent Ramp Pass / Fail** _____

9 **Technicians Signature (in ink)** _____ **Date** _____ / _____ / _____

10 **Optional Oxygen Module Verification** **Pass / Fail** _____

7.5 Calibration and Final Testing

NOTE: Calibration and Final Testing can only be performed at a Respironics Service Center equipped with a Multi-Functional Test Station.

CAUTION: Due to required calibration after parts replacement, the following may not be field replaced unless the unit is Final Tested at a Respironics Service Center equipped with a Multi Functional Calibration Station.

- Main Printed Circuit Assembly (Main PCA)
- Power Supply Printed Circuit Assembly
- Blower Assembly
- Enclosure Insert
- Pressure Tubing
- Mass Flow Sensor Tubing
- Valve Assembly
- Flow Element
- Flow Averaging Rings
- Temperature Circuit

For technical assistance or replacement part ordering information contact Respironics World Wide Technical Service.

U.S. and Canada

Phone: 1-800-345-6443
Fax: 1-800-422-5816

International

Phone: 1-412-631-2100
Fax: 1-412-463-5012

Visit Respironics Home Page on the World Wide Web at:

www.respironics.com

(This page left intentionally blank.)

Chapter 8: Optional Oxygen Module Repair and Replacement

(This page left intentionally blank.)

Chapter 8: Optional Oxygen Module Repair and Replacement

8.1 Overview

The following section describes the replacement procedures for the optional oxygen module available on the BiPAP Synchrony System. For more detailed removal and installation instructions for the components not covered in this chapter, see chapter 6.

CAUTION: Due to required calibration after parts replacement, the following may not be field replaced unless the unit is Final Tested at a Respironics Service Center equipped with a Multi Functional Calibration Station.

- Main Printed Circuit Assembly (Main PCA)
- Power Supply Printed Circuit Assembly
- Blower Assembly
- Enclosure Insert
- Pressure Tubing
- Mass Flow Sensor Tubing
- Valve Assembly
- Flow Element
- Flow Averaging Rings
- Temperature Circuit

8.2 BiPAP Synchrony System Repair Kit

Replacement Part	Replacement Part No.	Page No.
Oxygen Module Accessory / Repair Includes: • Oxygen Module • Oxygen Module Wiring Harness	1000348	8-9

8.3 Warnings and Cautions

WARNING: To prevent electrical shock, disconnect the electrical supply before attempting to make any repairs to the Synchrony 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.

CAUTION: Due to required calibration after parts replacement, the following may not be field replaced unless the unit is System Final Tested on a Multi-Functional Calibration Station.

- Main Printed Circuit Assembly
- Power Supply Printed Circuit Assembly
- Blower Assembly
- Enclosure Insert
- Pressure Tubing
- Mass Flow Sensor Tubing
- Valve Assembly Assembly
- Flow Element
- Flow Averaging Rings
- Temperature Circuit

8.4 Replacement Instructions

Replacement Part Number 1000348

Included in Kit:	Tools Required:
Oxygen Module 3-8 x 3 / 4” screws (x2)	Phillips screwdriver No 2 (medium)

Procedure

Removed / Installed During Process

- Oxygen Module

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 8-1
Oxygen Module

Oxygen Module Replacement (Continued)

Step 1 Removing the Oxygen Module

a. Place the unit upside down on a protected work surface.

b. Using a Phillips screwdriver, remove the two screws that secure the oxygen module in the bottom enclosure.

c. Lift the oxygen module slightly out of the bottom enclosure.

NOTE: The oxygen module wires are still connected to the oxygen module wiring harness.

d. Depress the locking tabs then remove the oxygen module wire connector from the female receptacle on the oxygen module wiring harness.

e. Remove the oxygen module from the bottom enclosure.

Figure 8-2
Removing the Oxygen Module

Oxygen Module Replacement (Continued)

Step 2 Installing the Oxygen Module

a. Insert the oxygen module wire connector into the female receptacle on the oxygen module wiring harness.

b. Align the oxygen module with the mounting holes in the bottom enclosure.

c. Install and tighten the two screws provided to secure the oxygen module in the bottom enclosure.

Appendix A: Tools and Equipment

(This page left intentionally blank)

Appendix A: Tools and Equipment

CAUTION: Due to required calibration after parts replacement, the following may not be field replaced on the BiPAP Synchrony unless the unit is System Final Tested at a Respironics Service Center equipped with a Multi Functional Calibration Station:

- Main Printed Circuit Assembly
- Power Supply Printed Circuit Assembly
- Blower Assembly
- Enclosure Insert
- Pressure Tubing (internal)
- Mass Flow Sensor Tubing
- Valve Assembly
- Flow Element
- Flow Averaging Rings
- Temperature Circuit

A.1 Service Tools and Supplies

You should have the following hand tools and supplies available for troubleshooting, testing, and repairing the BiPAP Synchrony system.

- Common Hand Tools

  Flat-blade screwdriver - small

  Phillips screwdriver - No 2 medium

- Antistatic, Electro-Static Discharge (ESD)-protected work station - minimum requirement is a grounded
- Cleaning Cloth
- Digital Manometer - see Section A.2
- End Cap (supplied with unit)
- Isopropyl alcohol
- Mild Detergent
- O_2 Enrichment Port (RI P / N 312010)

Acceptable Test Equipment (Continued)

- Test Orifice (RI P / N 622244)
- Whisper Swivel II (RI P / N 332113
- Torque wrench (in - lbs.)

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 (RP P/N 302227)
- Merical DP2001
- Sensym PDM 200CD
- RT - 200
- Any commercially available digital manometer that meets the above specifications.

* A water column manometer may also be used.

A.2.3 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 power supply that meets the above specifications.

Appendix B: Schematics

Appendix B: Schematics

B.1 Schematic Statement

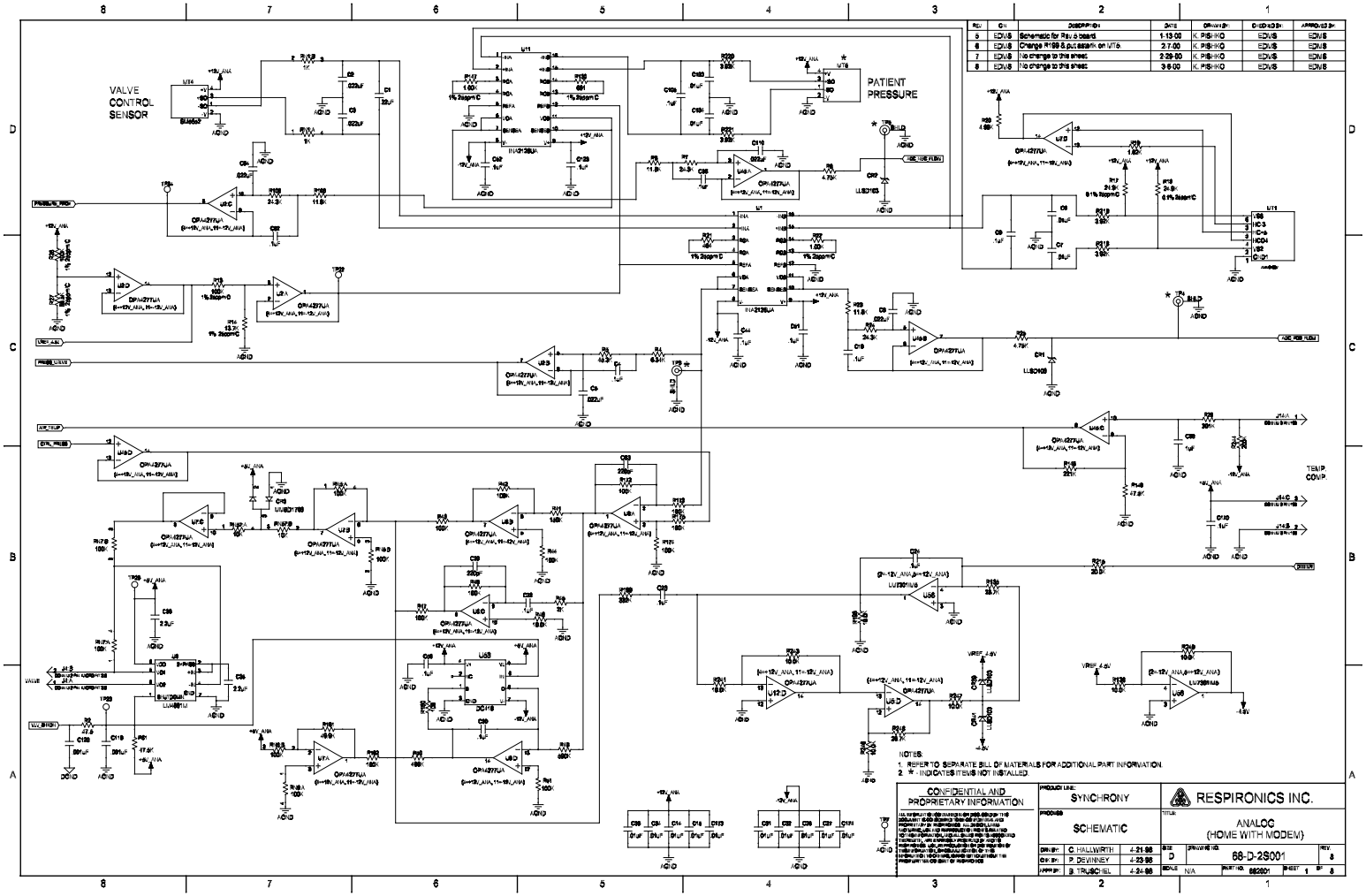
Schematics are supplied with this manual in direct support of the sale and purchase of this product.

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.

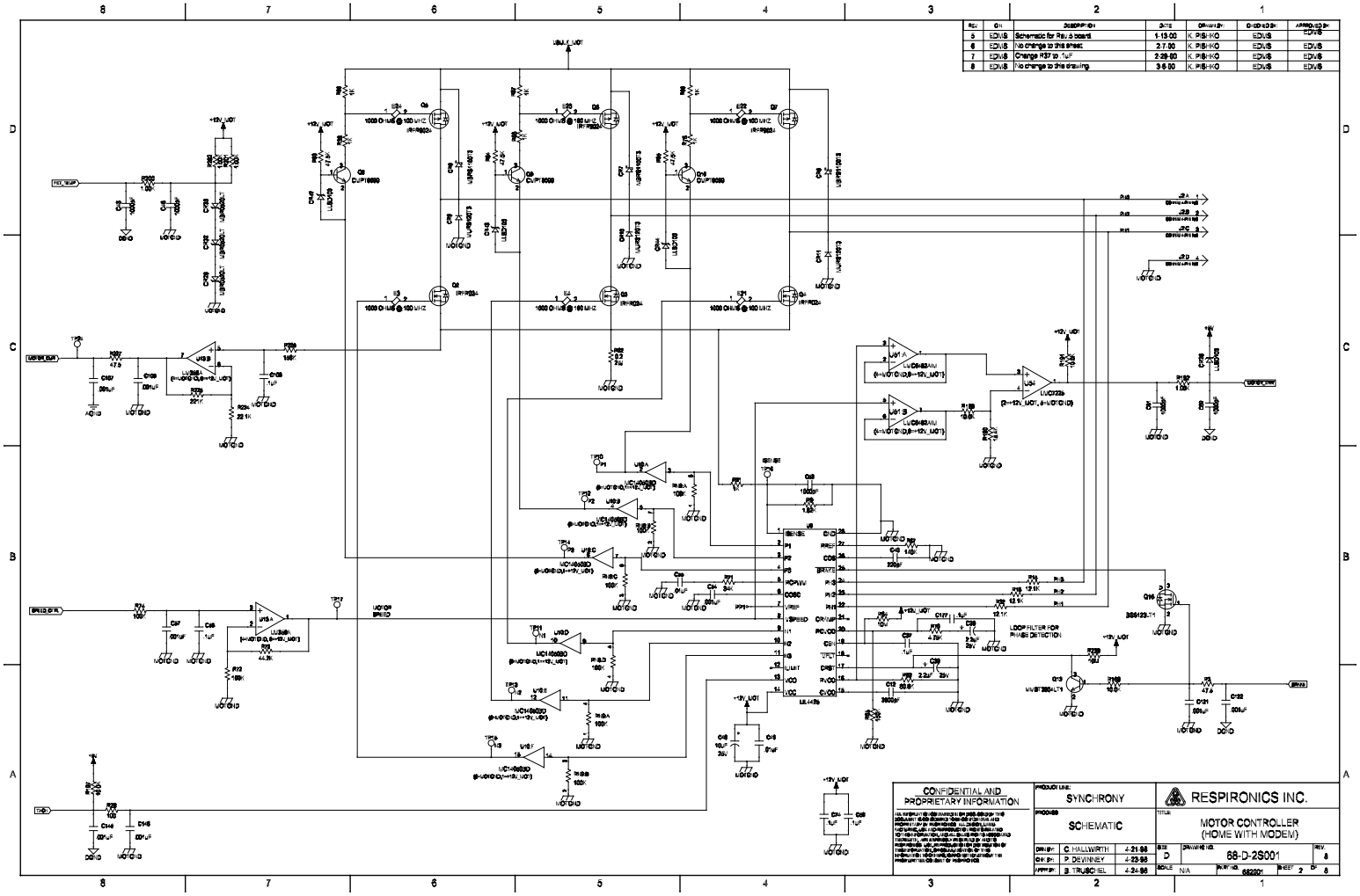
The schematics are intended to satisfy administrative requirements only. They are not intended to be used for component level testing and repair. Any changes of components could effect the reliability of the device, prohibit lot tracking of electronic components, and void warranties. Repairs and testing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

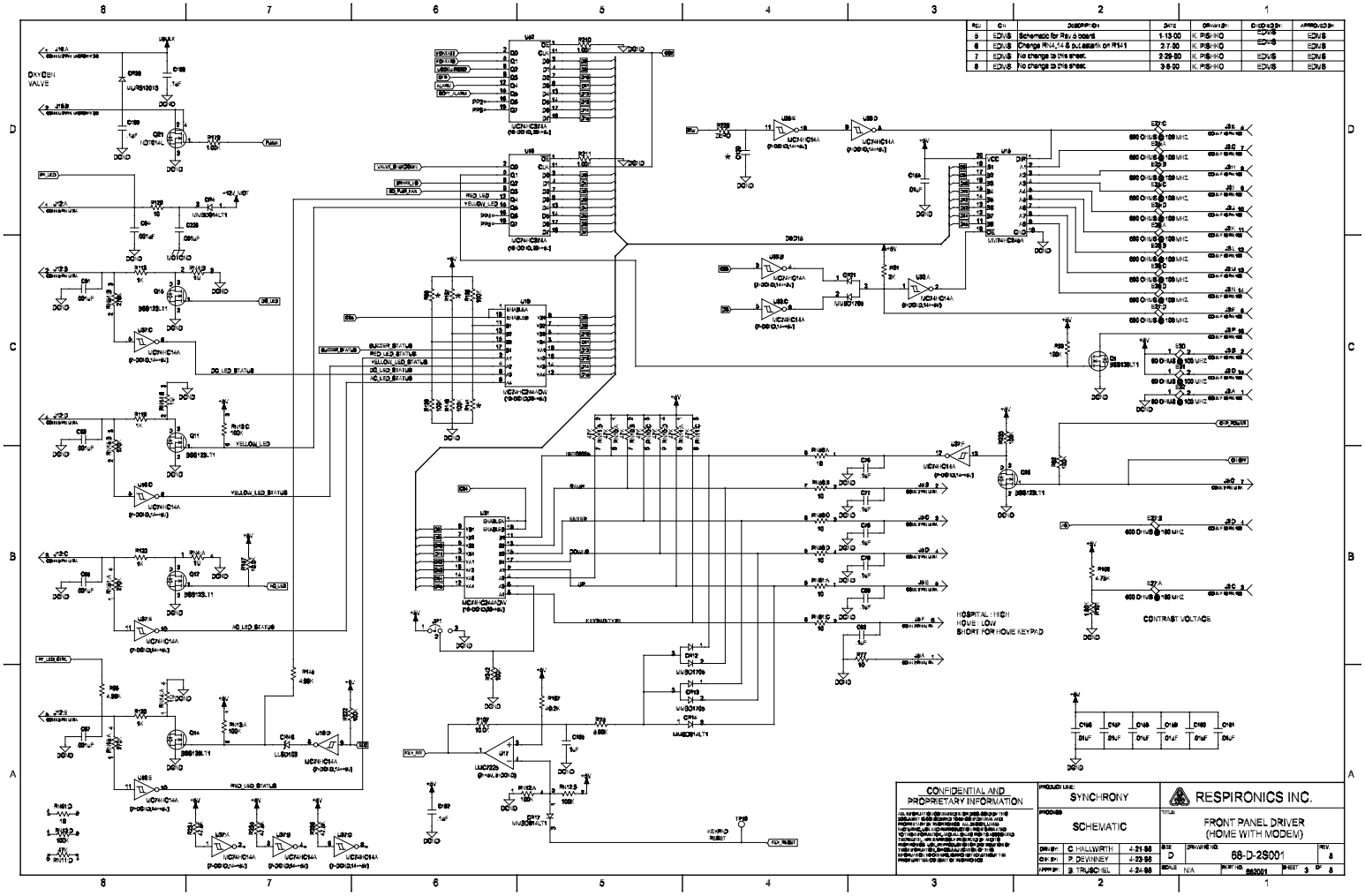
NOTE: The power supply PCA is a purchased item. The schematic is not available for distribution.



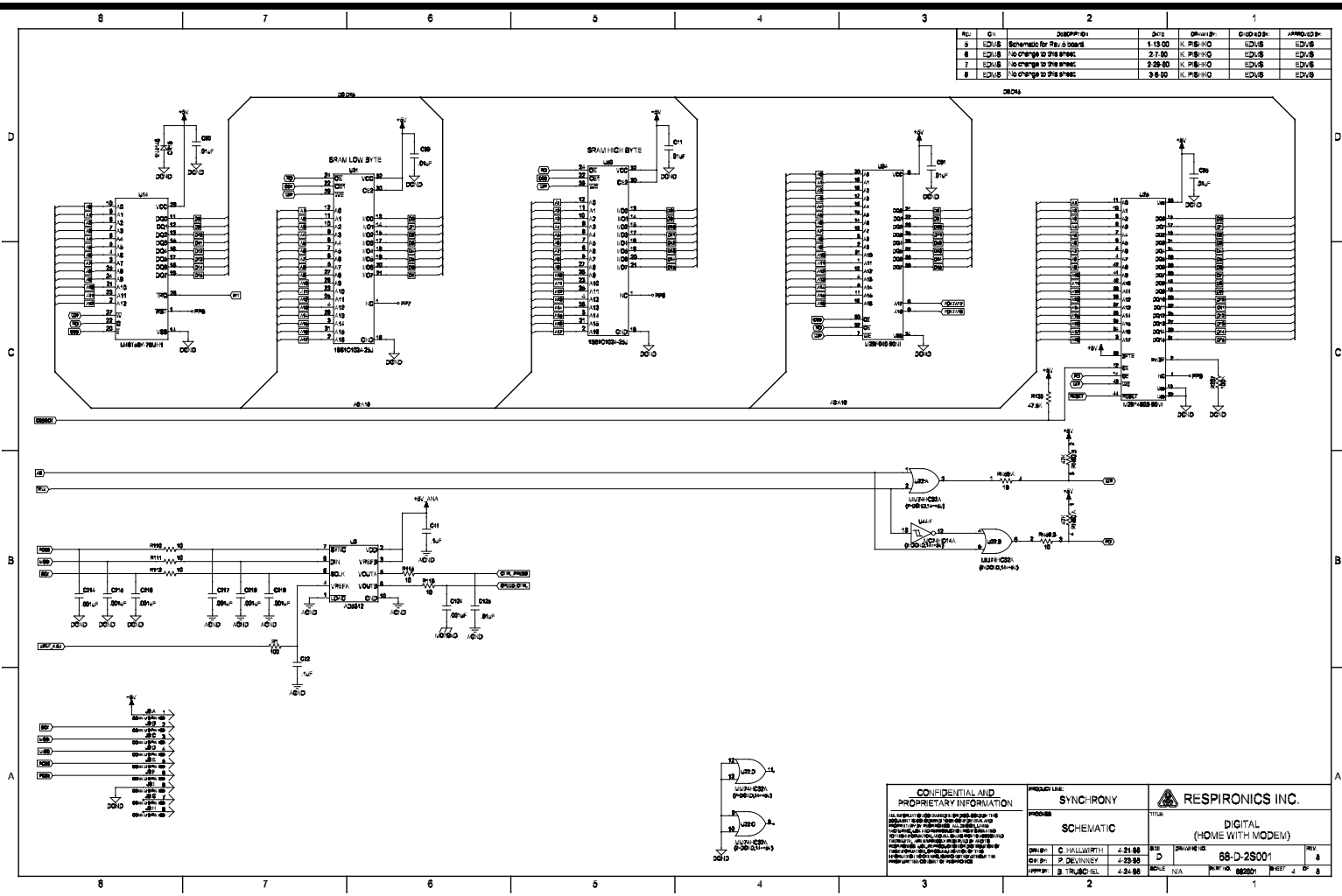
Analog (Home With Modem)



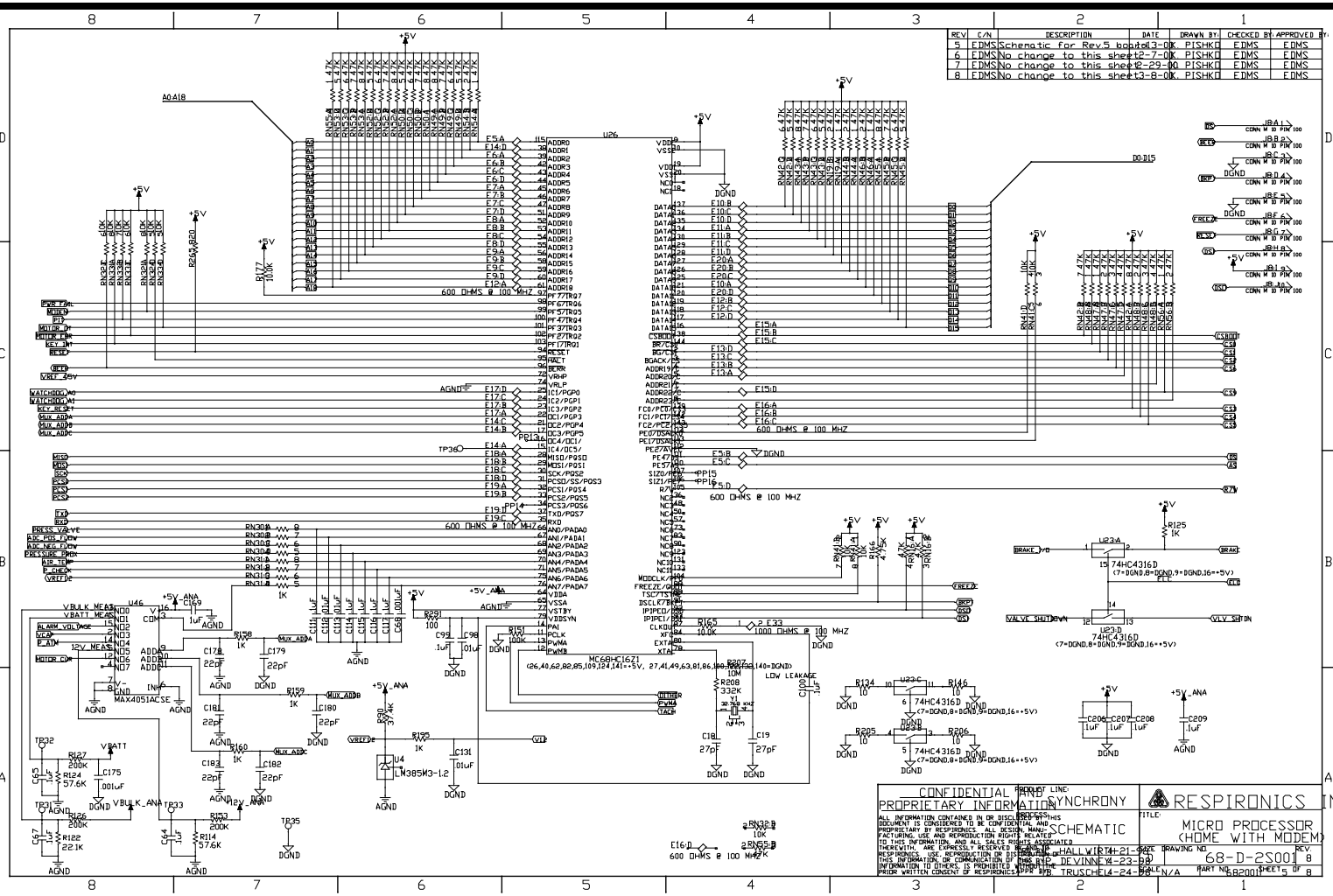
Motor Controller (Home With Modem)



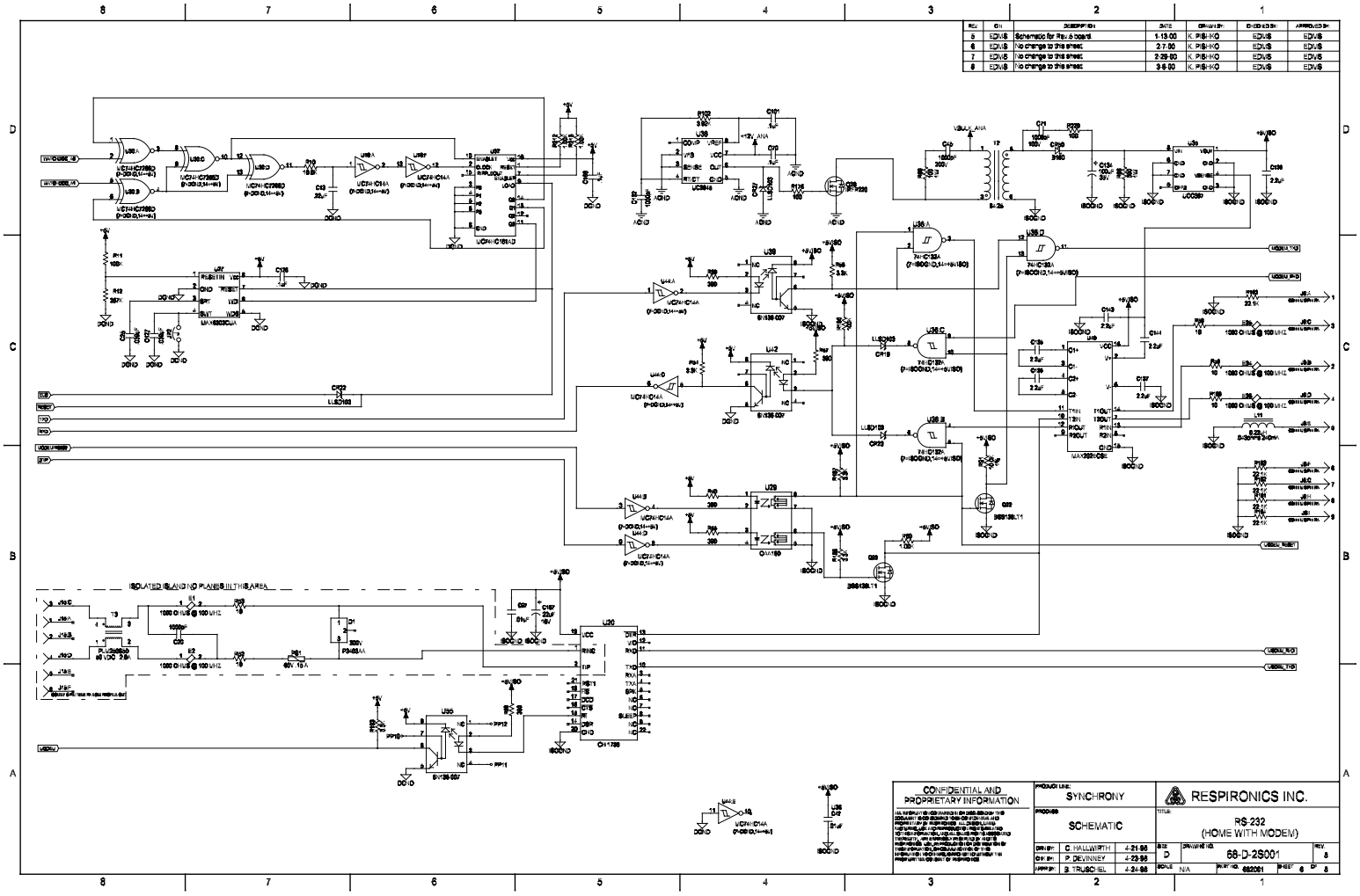
Front Panel Driver (Home With Modem)



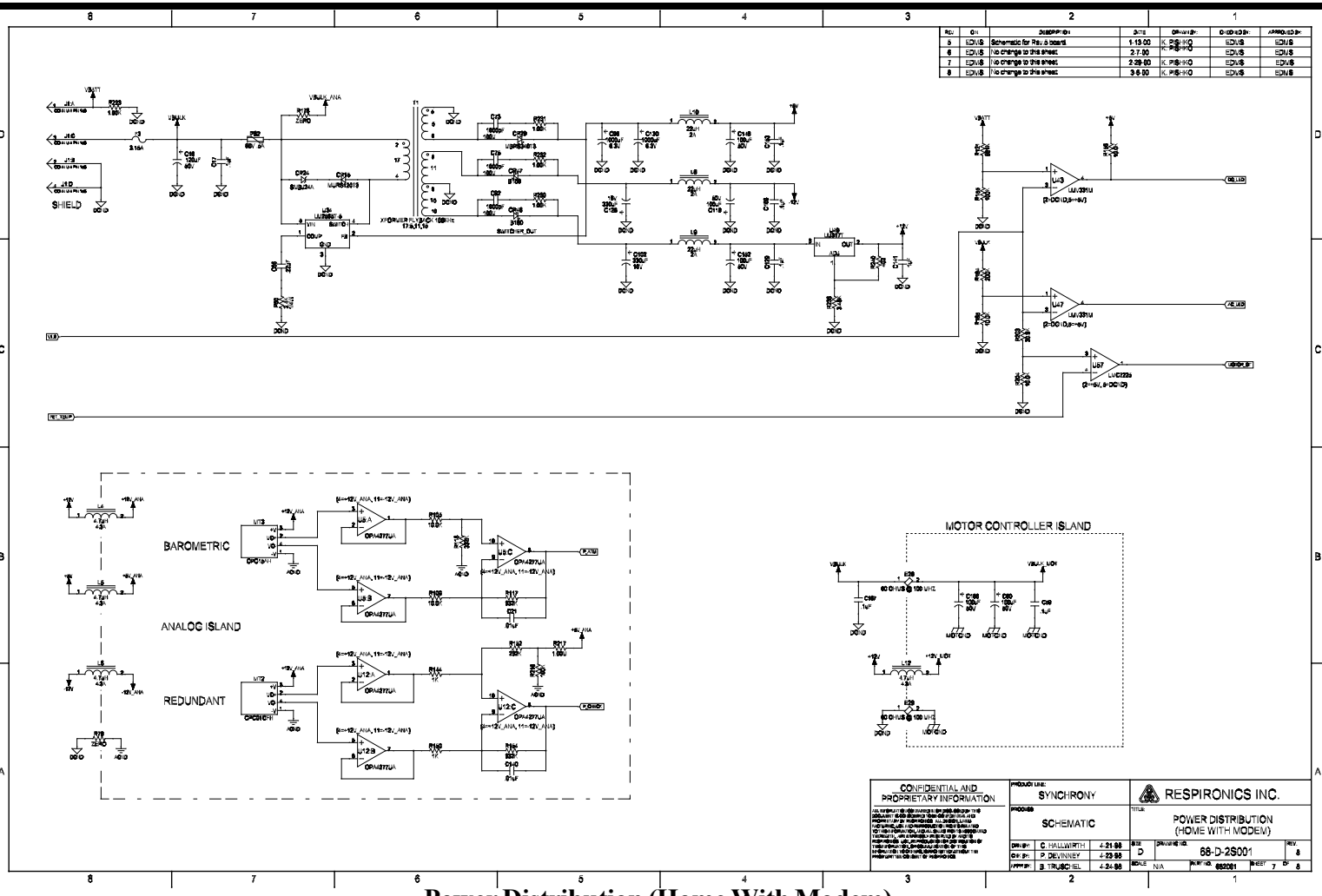
Digital (Home With Modem)



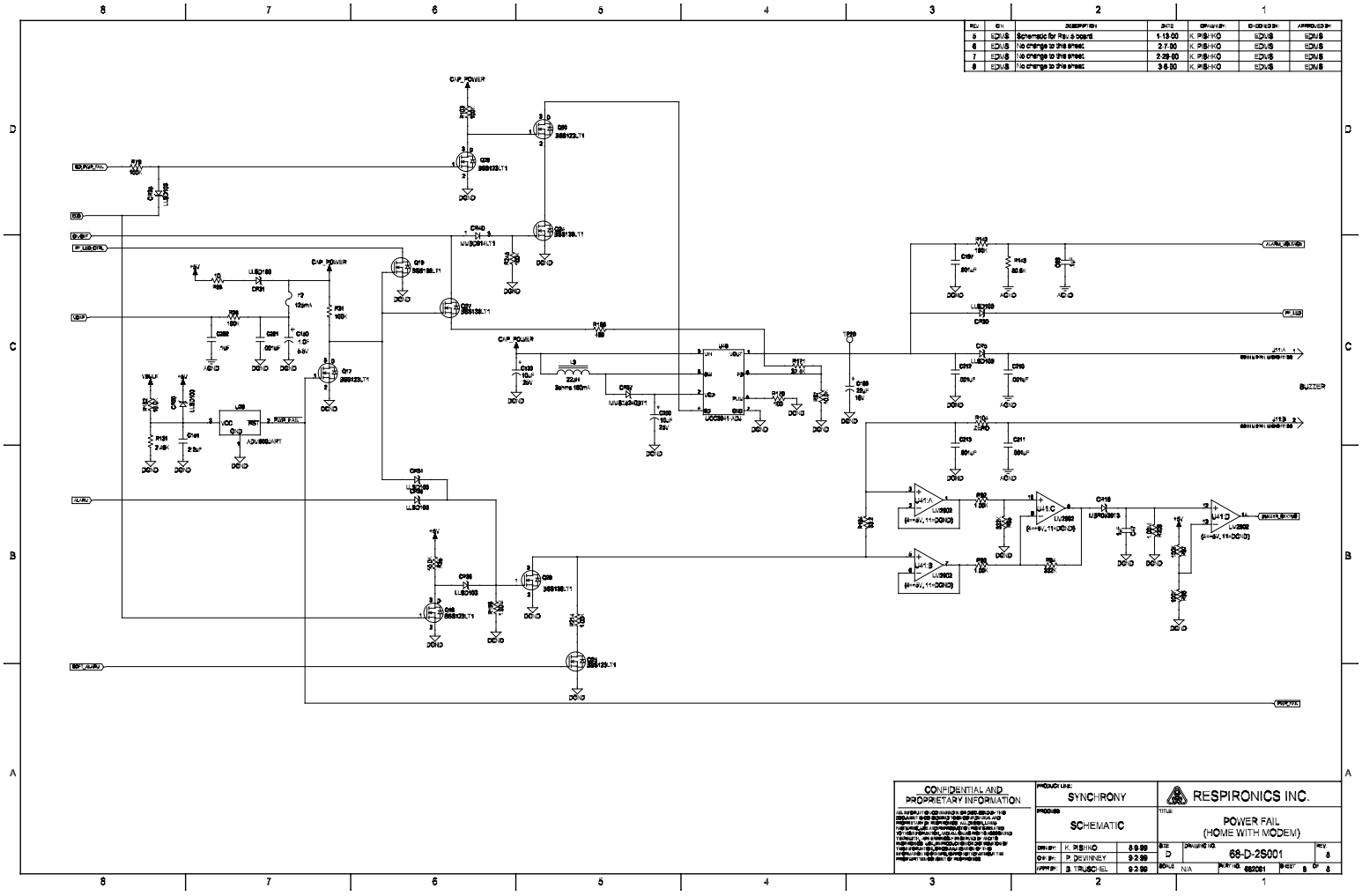
Micro Processor (Home With Modem)



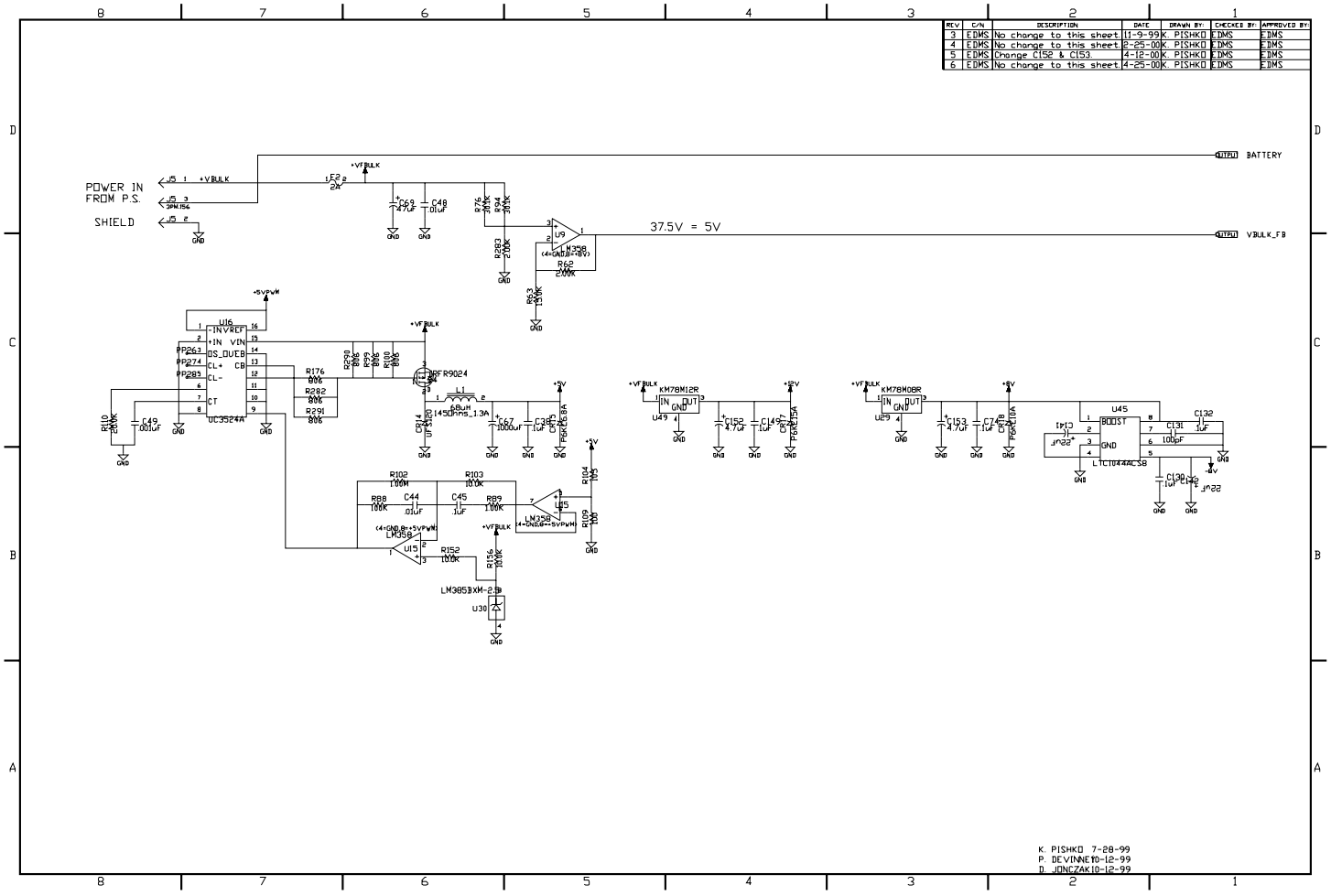
RS - 232 (Home With Modem)



Power Distribution (Home With Modem)



Power Fail (Home With Modem)



Main PCA Power Supply

Index

Index (Continued)

R

S

T

W