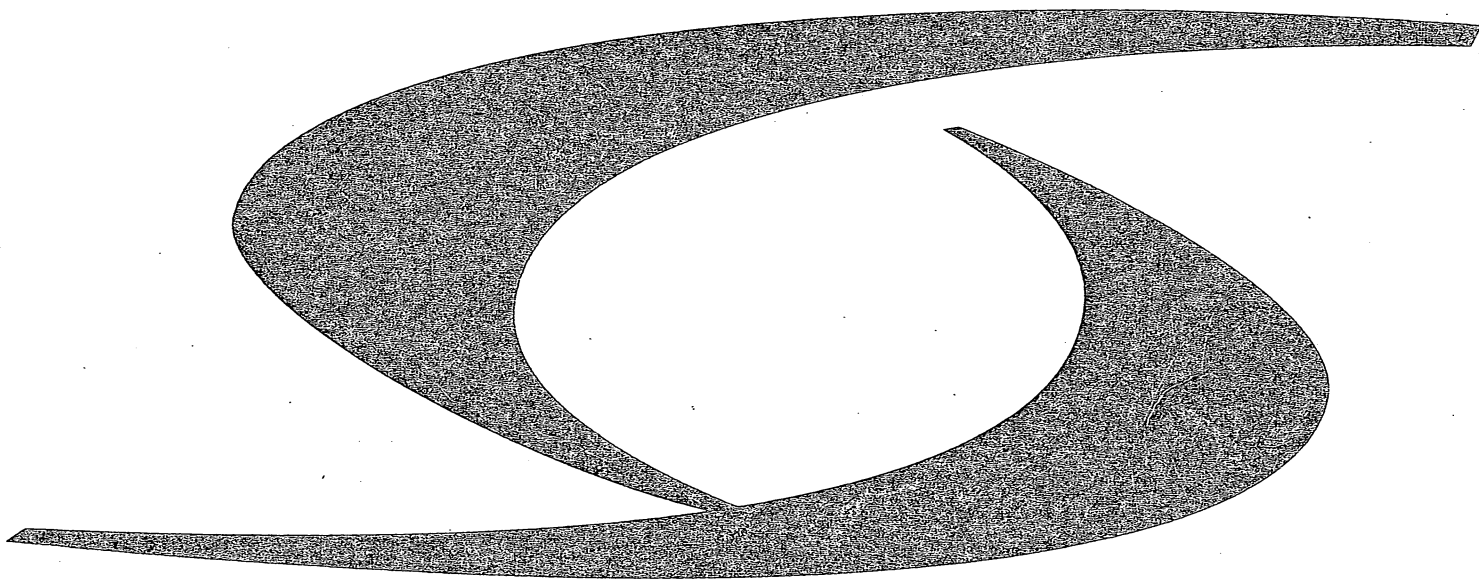


BikeMax 1000/3000



700 C/R and 500 C/R  
Service Manual  
LT-03084



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# CHAPTER 1 INTRODUCTION

Welcome to the *BikeMax 1000/3000 Service Manual*. This book can help Tectrix-trained service personnel diagnose and correct almost any problem with a BikeMax alternator bike. In addition to this introduction, it covers the following subjects:

- |            |                                                                                                                     |
|------------|---------------------------------------------------------------------------------------------------------------------|
| Chapter 2  | Assembly instructions.                                                                                              |
| Chapter 3  | Basic troubleshooting procedures for electrical and mechanical problems, and instructions on where to go next.      |
| Chapter 4  | How to use BikeMax's test mode feature.                                                                             |
| Chapter 5  | A series of short segments on each component of the BikeMax, describing how to check and, if necessary, replace it. |
| Appendix A | Parts list                                                                                                          |
| Appendix B | Advanced electrical troubleshooting techniques.                                                                     |
| Appendix C | Engineering drawings.                                                                                               |

## We're Here to Help

If you have any questions about any of the information in this book, or if you're still having problems with your BikeMax after following all of the appropriate instructions, please contact us so we can help you get riding again. You can reach our technical support department in any of three ways:

- By phone, Monday through Friday: call 800/767-8082 or 508/533-4300, and ask for Technical Support.
- Send us a fax at 508/533-5183.

## CHAPTER 2 ASSEMBLY

It's easy to assemble BikeMax—it will probably take about 45 minutes. You need these common tools:

- 3/16" Hex (Allen) wrench
- #2 Phillips screwdriver
- ½" box end or open-end wrench (if you have the optional Polar heart rate monitor).

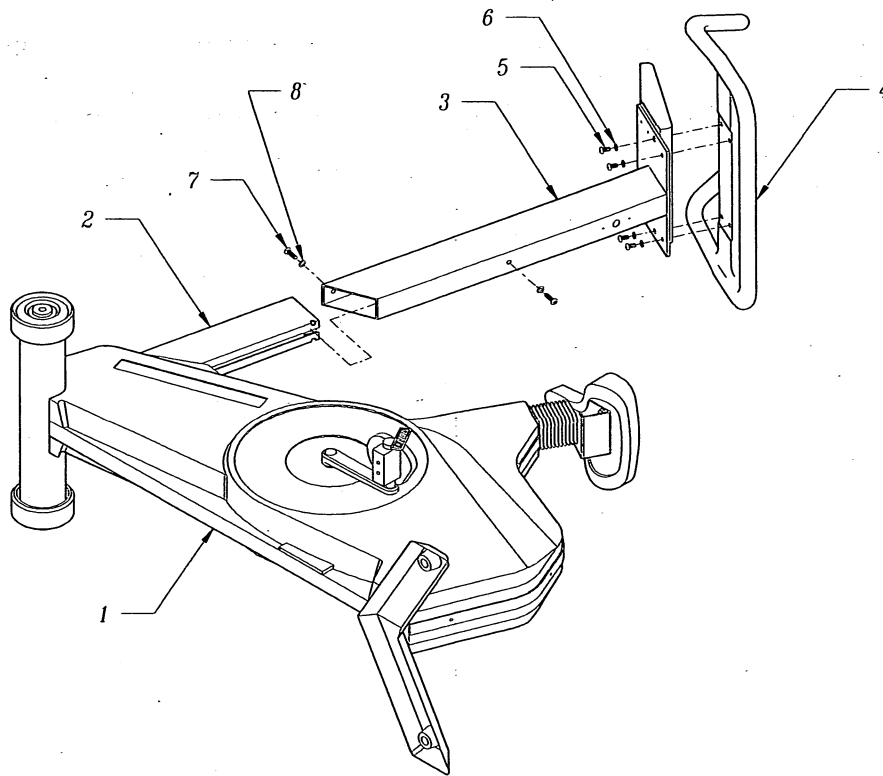
Here's an overview of the steps in the assembly:

1. Unpack BikeMax and make sure you have all the parts.
2. Follow the detailed assembly instructions. There are separate sections on assembling the recumbent (BikeMax-R) and upright (BikeMax-U) bikes.
3. If you choose to, plug in your BikeMax with the optional external power supply.
4. If you have more than one BikeMax, connect the communications ports to allow group racing.

### **Unpack BikeMax**

Cut and remove the nylon tie straps holding the chassis feet to the pallet. Remove all the other parts from the shipping carton.

## Assembling the Upright BikeMax (BMU)



*Figure 2-1*

### Attach the Display Upright

Position the display upright (3) over the chassis and plug the ribbon cable from the upright to the ribbon cable in the chassis. Tuck the cables inside the neck of the chassis (2) to make sure they don't get pinched when you attach the display upright. Slide the display upright (3) down over the neck on the chassis. Using a 3/16" hex wrench, secure them with two 5/16" by 1" button-head screws (7) and washers (8).

**If your bike has a CardioTouch heart rate monitor:**

Remove the upper three round plugs from the display upright. Feed the cable from the CardioTouch handlebars through the large hole in the display upright until it emerges through the hole in the display console mounting plate. Attach the handlebars to the display upright with two 1/2" screws.

**If your bike has a Polar heart rate receiver:**

Remove the 3 circular plastic plugs that are installed in a vertical pattern on the display upright tube; there are 2 small plugs surrounding a larger plug.

The Polar cable—a short cable with a white “polar” label near one end—must be routed from the largest of these openings up through the upright and attached to the display console. Feed the unlabeled end into the large round opening and up until it comes out the top of the upright. Plug the end of the cable with the white label into the connector on the receiver. Verify that the tab on the connector locks the brown 3-conductor cable connector into place.

Position the receiver so the locking tab on the connector is on top, nearest to the console. If there is an UP ARROW on the receiver, it should be pointing toward the console. Secure the receiver to the display upright tube with 2 Phillips screws supplied with the kit.

## Attach the Display Console

Remove the display console from the configuration kit. Attach the ribbon cable from the display upright to the back of the display board. The connector is keyed so you cannot insert it backwards. Attach the green ground cable to the single flat connector next to the ribbon cable connector. Make sure the cables are firmly connected before continuing.



If you have the CardioTouch or Polar heart rate monitor option, attach the heart rate monitor cable to the back of the console.

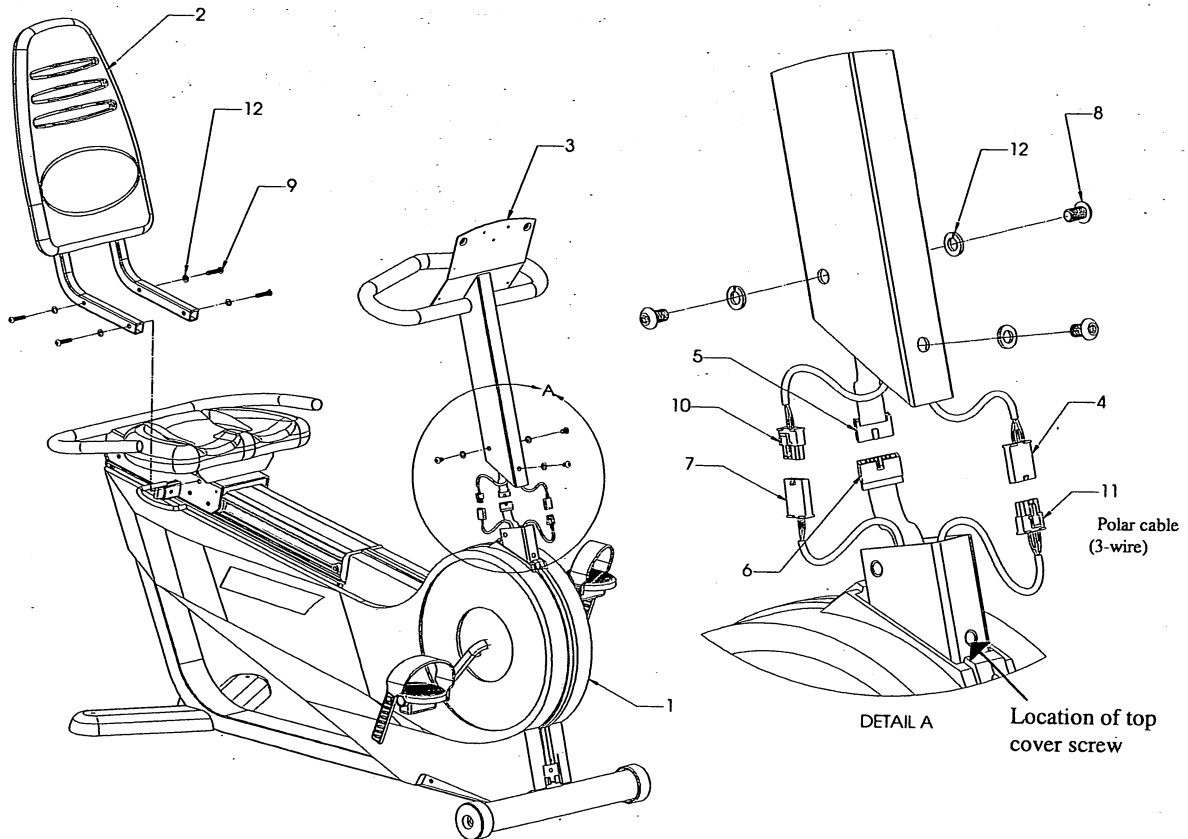
Use the four Phillips head screws from the configuration kit to attach the display console to the console back-plate. See Figure 2-3.

Attach the water bottle holder to the back plate using three screws. **Important:** if you choose not to install the water bottle holder, you must still screw the three screws into the open holes in the back plate to protect the electronics from the environment.

## Attach the Handlebar

Use the 3/16" hex wrench to attach the handlebar (4) to the console back-plate with four 5/16" button-head screws (5) and lock washers (6).

## Assembling the Recumbent BikeMax (BMR)



**Figure 2-2**

### Attach the Seat Back Assembly

(See Figure 2-2.) Attach the seat back assembly (2) to the seat shuttle with four 5/16 x 1-3/4 button-head cap screws (9) and lock washers (12), using a 3/16" hex wrench. If you have difficulty aligning the screws, loosen the four button-head cap screws on the back of the seat. Attach seat supports to the seat shuttle and fully tighten, then tighten screws on seat back.

### Attach the Display Upright

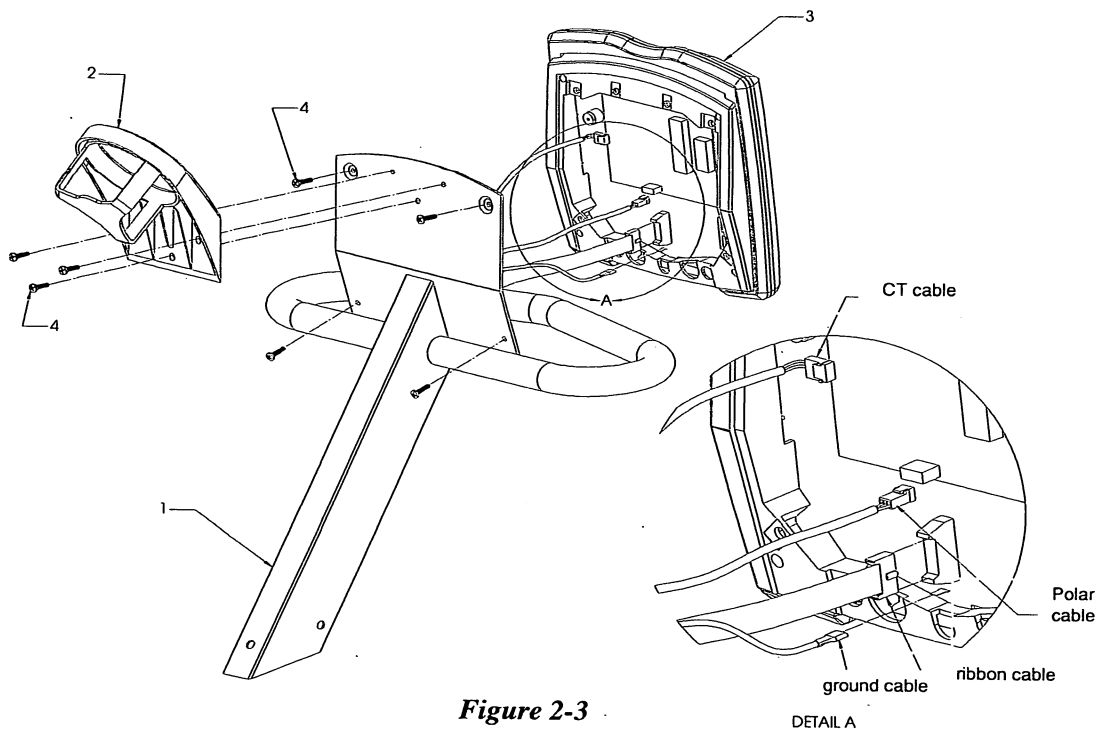
All of the cable connections are shown in detail A of Figure 2-2. Connect the two ends of the ribbon cable (5 and 6) which emerge from the bike base and the display upright (3). Connect the ends of Polar cable (4 and 11) and CardioTouch cable (7 and 10), if applicable. To help support the display upright, move the seat forward and rest the handlebar of the upright on the seat.



Loosen the top cover screw (see detail A). Feed excess cable into the upright. Slide the display upright down over the neck of the chassis, taking care not to pinch the cables. Fasten the display console assembly using three 5/16-18 x 3/8 button-head cap screws (8) and lock washers (12). Tighten the top cover screw at the front of the bike.

## Attach the Display Console

(See Figure 2-3.) Remove the display console (3) from the configuration kit. Attach the ribbon cable from the display upright to the back of the display board. The connector is keyed so you cannot insert it backwards. Attach the green ground cable to the single flat connector next to the ribbon cable connector. Make sure the cables are firmly connected before continuing.



**Figure 2-3**

♥ If you have the CardioTouch or Polar heart rate monitor option, attach the heart rate monitor cable to the back of the console. See Figure 2-3, detail A.

Use the four Phillips head screws from the configuration kit to attach the display console to the console back-plate. See Figure 2-3.

Attach the water bottle holder to the back plate using three screws.

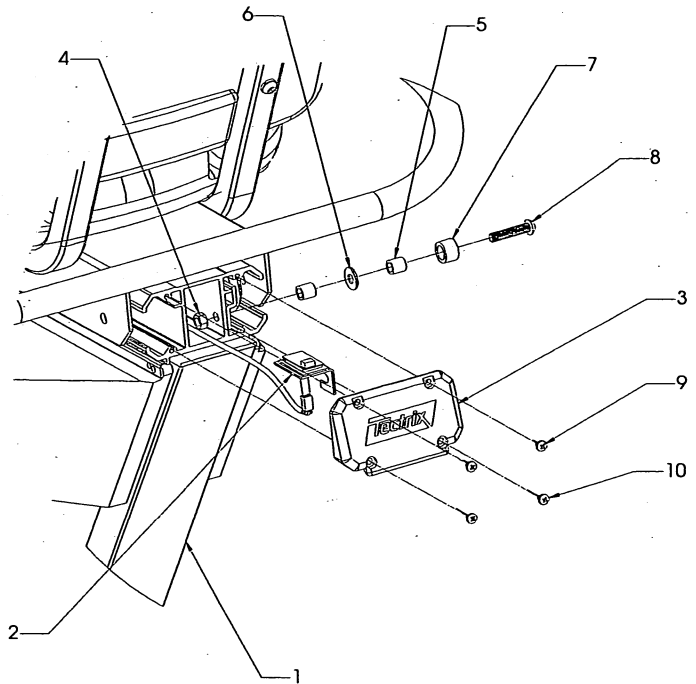
**Important:** if you choose not to install the water bottle holder, you must still screw the three screws into the open holes in the back plate to protect the electronics from the environment.

## Install the Optional Polar Heart Rate Receiver

Tools needed:

#2 Phillips screwdriver  
 1/2" box end or open-end wrench

Remove the plate at the rear of the bike (3). Plug the cable, already inside the seat rail, into the Polar receiver (2). Loosen the 1/2" nut (4) on inside of seat rail, and slide the Polar receiver bracket onto the bolt (8) shaft. Tighten the nut to secure the bracket, and replace the rear plate (3).



## Plugging in the BikeMax

Figure 2-4

Because of its alternator design, you do not need to plug BikeMax into a wall socket; it generates all the electricity it needs from the power of your pedaling. An optional power adapter (part number 13018 / 110 volt, part number 13019 / 230 volt) lets you plug the BikeMax in if you want; this makes some features easier to use. Simply plug the adapter into the outlet on the front (wheel side) of the BikeMax. There is no power switch; you may unplug the adapter to turn off the display (normally you can leave it on all the time).

## Connecting Bikes for Racing

BikeMax offers a group race feature, where two to eight users compete against each other. To use this feature, you need to use the telephone-style SmartLink cables to attach the bikes. You can link up to 8 bikes in this manner:

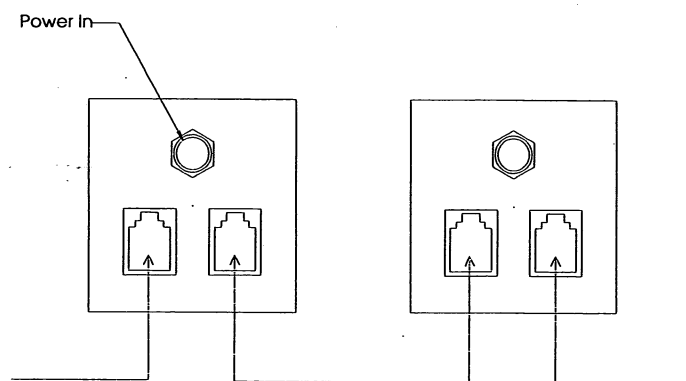


Figure 2-5

1. Each BikeMax is shipped with a termination plug already inserted in one of the communications sockets. You may need to remove this plug before making the connections described below.
2. Place a termination plug in the left socket of the first bike. Run a SmartLink cable from the right socket on that bike to the left socket on the second.
3. Run another cable from the right socket on the second bike to the left socket on the third. See the dotted lines on Figure 2-5.
4. Continue in this way until you reach the last bike. Place a termination plug in the right socket of the last bike.



While the SmartLink cables look like standard telephone cables, their internal wiring is different. You cannot use telephone cables to connect the bikes; you *must* use SmartLink cables.

## CHAPTER 3 TROUBLESHOOTING

The BikeMax is designed so you can find and fix most mechanical and electrical problems in one hour or less. This chapter helps you diagnose what's troubling your BikeMax: to go from "it doesn't work" or "something seems wrong" to "I need to replace this part and everything will be fine." After you finish the procedures here, you can turn to Chapter 5 and perform the required replacement or adjustment.

### Where to Start

When you encounter a problem, the first thing to do is check for the most likely causes:

1. Remove the covers of the bike. See page 22.
2. Make sure the primary and secondary belts are centered on all pulleys, and they are not slack. See pages 24 and 27.
3. Verify that the black conductors on both ends of the 1 ohm load resistor attached to the Alternator Control Board (ACB) are firmly screwed to the resistor.
4. Make sure all electrical cables are connected in the correct locations, and all connections are secure. See "Electrical Cabling" on page 12.

If nothing is obviously wrong in these areas, continue with the section indicated for your symptom in this table:

| <b>Symptom</b>                                                | <b>Section of Manual</b>        | <b>Page#</b> |
|---------------------------------------------------------------|---------------------------------|--------------|
| Bike does not power up when pedaled                           | Electrical Cabling              | 12           |
|                                                               | RPM Sensor                      | 35           |
|                                                               | Battery                         | 39           |
|                                                               | Power-up Sequence               | 49           |
| Bike powers up, but does not provide resistance to the pedals | Electrical Cabling              | 12           |
|                                                               | Test Mode                       | 17           |
| Mechanical noise from the bike                                | Isolation of Mechanical Noise   | 15           |
| No CardioTouch heart rate readout                             | CardioTouch Heart Rate Receiver | 40           |
| No Polar heart rate readout                                   | Polar Heart Rate Receiver       | 43           |

Some diagnosis sections also include information on correcting the problem. For others, after finding the problem you can turn to Chapter 5, which has a section on adjusting or replacing each component. The beginning of that chapter lists each component and the page where its information begins.

## Electrical Cabling

If the bike fails to power up when pedaled, or powers up but doesn't provide any resistance to the pedals, the problem may be a loose or misplaced cable connection. Remove the covers from the bike, as described on page 22, then check all connections. Tables 3-1 and 3-2 and Figures 3-1 and 3-2 show where each cable should be attached.

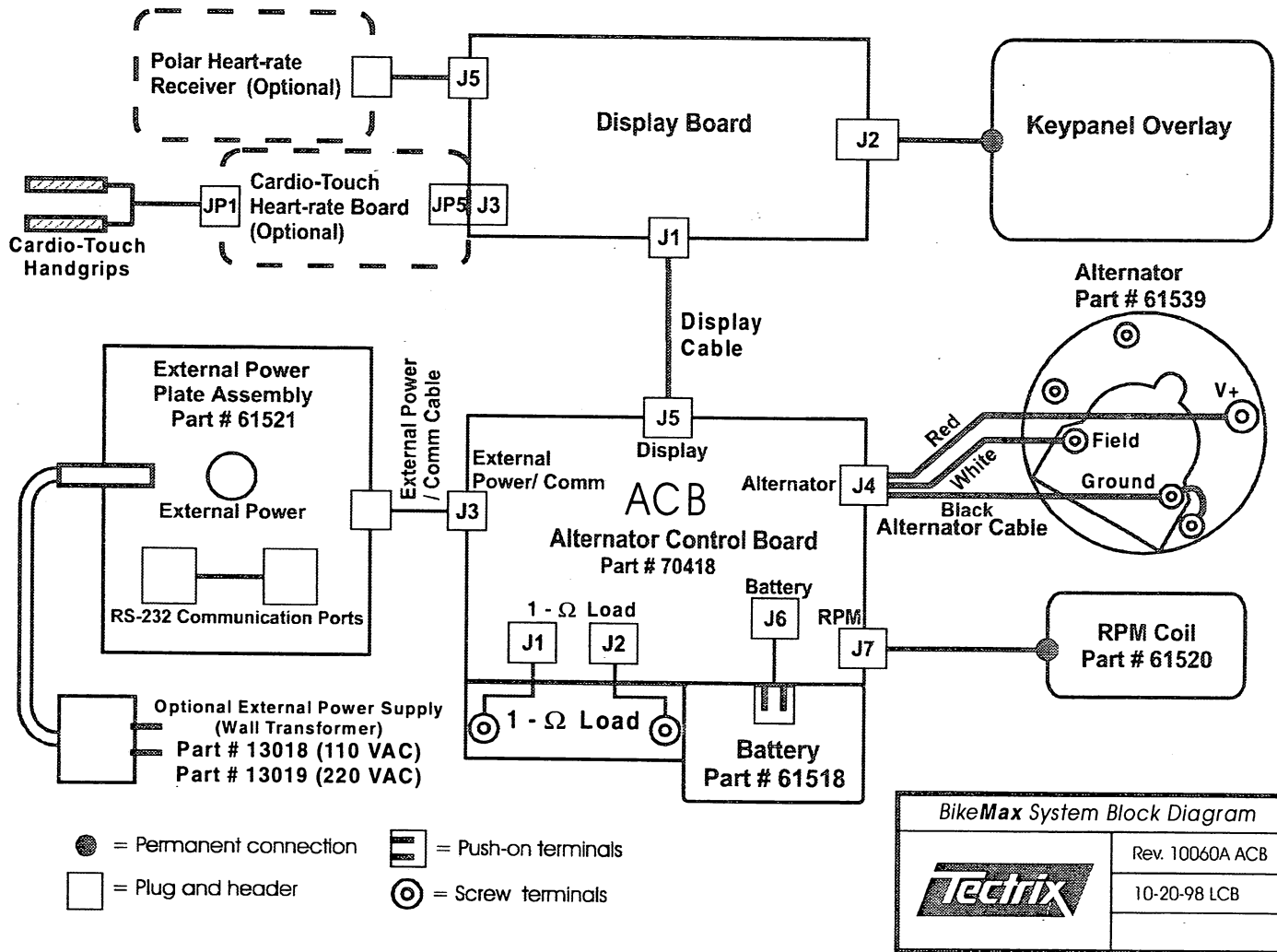
| Connector | Related Component                                                                                                    |
|-----------|----------------------------------------------------------------------------------------------------------------------|
| J4        | <i>Alternator</i> - mounted to the bike frame                                                                        |
| J5        | <i>Display board</i> - connected to the ACB with 2 ribbon cables; 1 in the display upright tube, 1 on the bike frame |
| J6        | <i>6 volt battery</i> - mounted to the ACB assembly                                                                  |
| J7        | <i>RPM sensor</i> - mounted to the alternator                                                                        |
| J1, J2    | <i>1 ohm load resistor</i> - mounted on the side of the ACB                                                          |
| J3        | <i>External power source connector</i> - mounted on the external power plate                                         |
|           | <i>SmartLink Communications connector</i> - mounted on the external power plate                                      |

**Table 3-1: ACB Connectors and Related Components, ACB Rev. 10060-A  
Post-October 1998 Alternator Bikes**

| Connector | Related Component                                                                                                    |
|-----------|----------------------------------------------------------------------------------------------------------------------|
| JP1       | <i>Alternator</i> - mounted to the bike frame                                                                        |
| JP2       | <i>Display board</i> - connected to the ACB with 2 ribbon cables; 1 in the display upright tube, 1 on the bike frame |
| JP3       | <i>6 volt battery</i> - mounted to the bike frame                                                                    |
| JP5       | <i>RPM sensor</i> - mounted to the alternator                                                                        |
| JP6       | <i>1 ohm load resistor</i> - mounted on the side of the ACB                                                          |
| JP7       | <i>External power source connector</i> - mounted on the switchplate                                                  |
| JP8       | <i>SmartLink Communications connector</i> - mounted on the switchplate                                               |

**Table 3-2: ACB Connectors and Related Components  
Pre-October 1998 Alternator Bikes**

If all cable connections are correct and secure, but the bike still won't power up, you may want to continue with Appendix B, "Advanced Electrical Troubleshooting." You should perform the procedures described there only if you are familiar with using a volt-ohm meter and other electrical diagnostic procedures.



L:\BMX\VECHSERV\8m xblock-10060-m anualportatt.CDR

**Figure 3-1: BikeMax Electrical Connections**  
**Post-October 1998 Altorator Bikes**

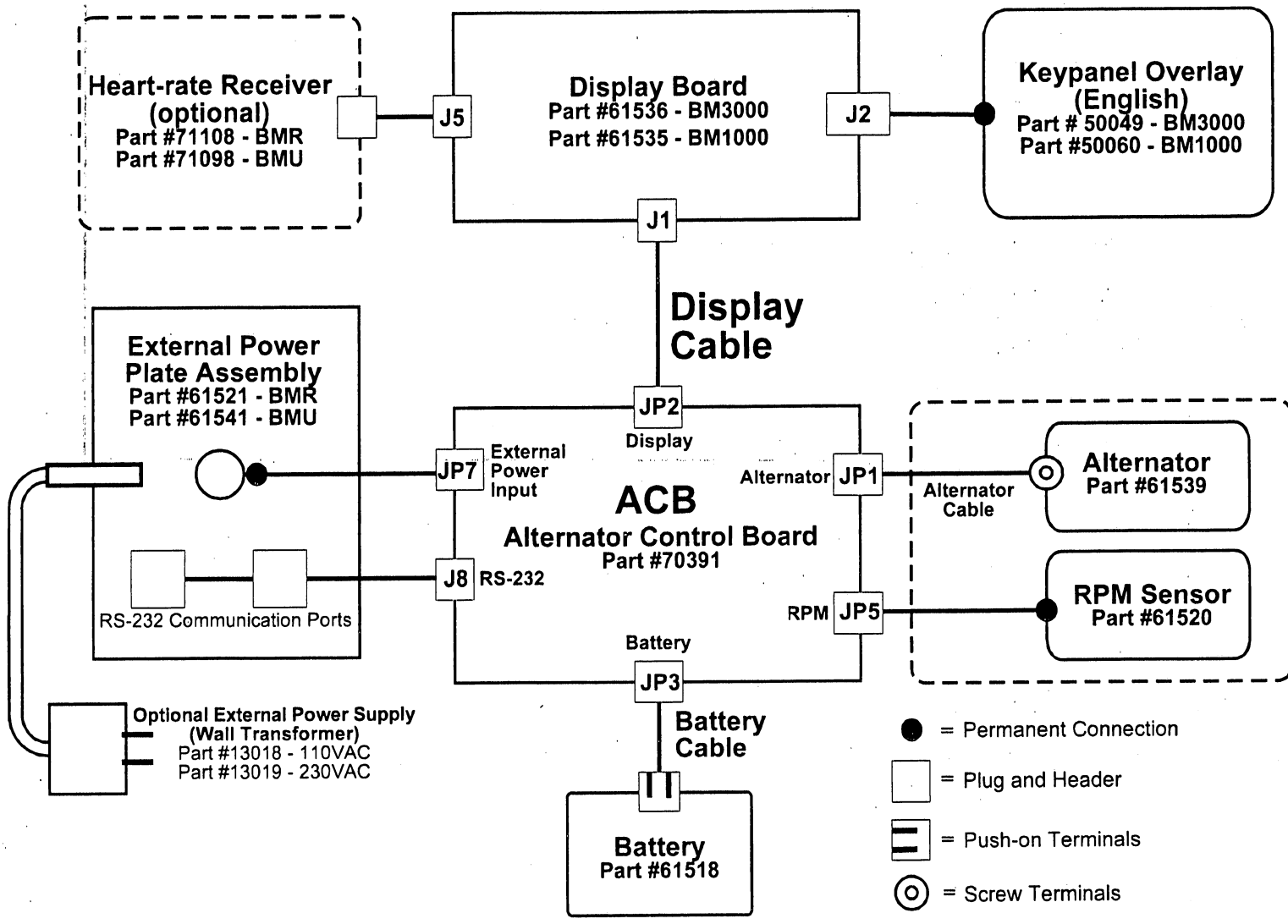


Figure 3-2: BikeMax Electrical Connections  
Pre-October 1998 Alternator Bikes

## Isolating Mechanical Noise

The best tool for troubleshooting a mechanical noise is a long screwdriver. You can place the tip of the screwdriver on the component to check, then rest your ear against the handle to amplify the sound: the screwdriver works like a simple stethoscope.

The following three sections describe how to isolate the source of noise in three general areas of the BikeMax mechanism: the crank arm area, the second stage pulley area, and the alternator.



You may be able to hear a mechanical noise generated in one area of the BikeMax while listening to another area. Use the methods below to identify the source of the noise.

### Mechanical Noise in the Crank Arm Area

Components include the crank arm assembly, primary pulley, 3" grooved pulley, and idler pulley. The crank arm assembly includes the one-piece crank arm and the bearings seated in the engine casting. The primary pulley is mounted to the crank arm assembly. The primary pulley transfers rotational motion to the 3" grooved pulley through the primary belt. The idler pulley provides consistent belt tension to the primary pulley and 3" grooved pulley.

If you hear a noise in the pedal or crank arm area of the bike:

1. Remove the primary belt. This isolates the primary pulley, idler pulley and crank arm.
2. Rotate the idler pulley. If it binds or wobbles, replace it as described on page 26.
3. While rotating the crank arm assembly, use the screwdriver to listen for noise in the assembly:
  - If there is noise around the bracket that secures the engine casting to the frame of the bike, the bracket is loose and needs to be tightened.
  - If there is noise in the crank arm assembly, make sure the two hex screws securing the bearing assembly to the engine casting are tight.
  - Make sure the large collar nut and lock nut that secure the crank arm to the bearing assembly are tight.
4. Recheck the area for noise; if noise is still present, replace the engine assembly.
5. See page 23 for instructions on replacing the primary belt.

### Mechanical Noise in the Second Stage Pulley Area

Components in the second stage pulley area include the second stage pulley, pulley shaft, and 3-inch diameter grooved pulley. The second stage pulley and 3-inch diameter grooved pulley are mounted on the pulley shaft, which rides on bearings at the rear of the engine assembly. The 3-inch diameter grooved pulley receives rotational force from the primary pulley through the primary belt. The 3-inch diameter grooved pulley drives the second stage pulley through the pulley shaft. The second stage pulley transfers rotational motion to the alternator flywheel through the secondary belt.

To check for problems in the second stage pulley area:



1. Remove the secondary belt that runs from the second stage pulley to the alternator flywheel.
2. Rotate the second stage pulley.
3. While rotating the pulley, use the screwdriver to listen for noise from:
  - The pulley shaft and bearings. If there is noise from the bearings, replace the engine assembly
  - The area surrounding the bracket that secures the engine casting to the rear diagonal frame member of the bike; if the bracket is loose, tighten it.
4. See page 26 for instructions on replacing the secondary belt.

### **Mechanical Noise in the Alternator Area**

Alternator area components include the secondary belt, alternator, and alternator flywheel. To diagnose mechanical problems in the alternator area:

1. Make sure the bolts that secure the alternator to the frame are tight. The bolt that secures the top of the alternator to the frame threads into the aluminum alternator case, so make sure you don't strip the hole in the alternator.
2. Remove the secondary belt from the second stage pulley and alternator flywheel.
3. Make sure the flywheel is fully seated on the alternator shaft and the nut that secures the flywheel to the shaft is tight.
4. Rotate the flywheel and use the screwdriver to listen for noise in the alternator. If noise is present, replace the alternator.



Any alternator will make a buzzing noise when the alternator shaft is operating at high speed. This is true for any alternator, whether it is installed in an automobile or stationary bike.

## CHAPTER 4 USING TEST MODE

The BikeMax's test mode lets you test various aspects of the bike's electrical system by pressing the correct key and checking the resulting display. While test mode is very similar on the BikeMax 3000 and BikeMax 1000, there are enough differences that each one has its own section.

### BikeMax 3000 Test Mode

To enter test mode, press and hold the top **HR Control** key while applying power to the display console. You can apply power either by beginning to pedal faster than 40 RPM from a stop, or by plugging in an external power source. When you release the key, the fields at the top of the display should show "BIKE TEST n.nn." The "n.nn" refers to the version of software installed in the bike.

#### Field Indicators

The field indicators (the small red lights by each field) provide the following information while in test mode:

- Elapsed Time: indicates Smart Link communications output
- Time Remaining: indicates Smart Link communication input

| Indicator | Standby  | Communicating |
|-----------|----------|---------------|
| ET        | Blinking | On solid      |
| TR        | Off      | On solid      |

- Heart Rate: lights when the circuitry detects the pulse rate transmitted by a Polar or CardioTouch heart rate monitor.

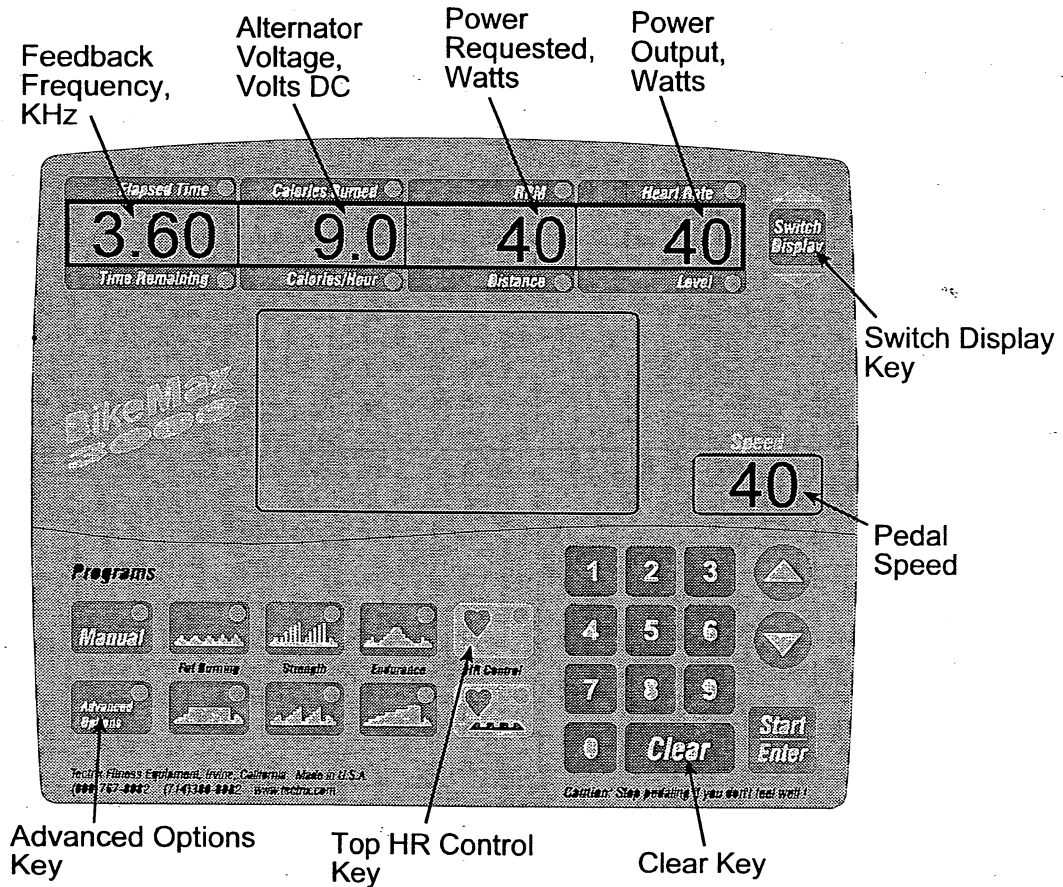
#### Testing Display LEDs

If you want to test the LEDs on your display console, press one of these keys:

- **Start/Enter:** Light all LEDs.
- **Top HR Control:** Light vertical columns of LEDs and individual whole readouts.
- **Bottom HR Control:** Light horizontal rows of LEDs and individual readout segments.

## Advanced Diagnostic Information

Press the **Advanced Options** key to display diagnostic information as shown in Figure 4-1.



**Figure 4-1: BikeMax 3000 Test Mode Display**

- The “Elapsed Time” field indicates the feedback frequency. It should read between 1.000 KHz and 3.600 KHz; 3.60 is shown. This information is for factory use only; it is not adjustable in the field.
- The “Calories Burned” field shows the alternator output in volts DC. It should be at least 9.0 volts DC, as shown, when pedaling the bike at 40 to 45 RPM, with 40 watts of power requested.
- The “RPM” field shows the power requested by the current resistance setting. This is 40 watts in Figure 4-1. You can change this amount, in steps of 5, by pressing the **Up Arrow** or **Down Arrow** key. This information is for factory use only.
- The “Heart Rate” field shows the current power output of your pedaling. This can be from 40 to 600 watts; in Figure 4-1, it is 40.
- As you pedal, the “Speed” field shows the pedal RPM, as reported by the RPM sensor. If this changes correctly as you speed up or slow down, you know the sensor is working. Figure 4-1 shows a pedal speed of 40 RPM.

## Odometer

You can also read the BikeMax's odometer in Test Mode; press the **Switch Display** key to do so.

## Leaving Test Mode

To leave Test Mode, press the **Clear** key twice.

## BikeMax 1000 Test Mode

To enter test mode, press and hold the **HR Control** key while applying power to the display console. You can apply power either by beginning to pedal faster than 40 RPM from a stop, or by plugging in an external power source. When you release the key, the fields at the top of the display should show "BIKE TEST n.nn." The "n.nn" refers to the software EPROM version installed in the bike.

## The Test Mode Display

While you're in test mode, the console displays the information shown in Figure 4-2:

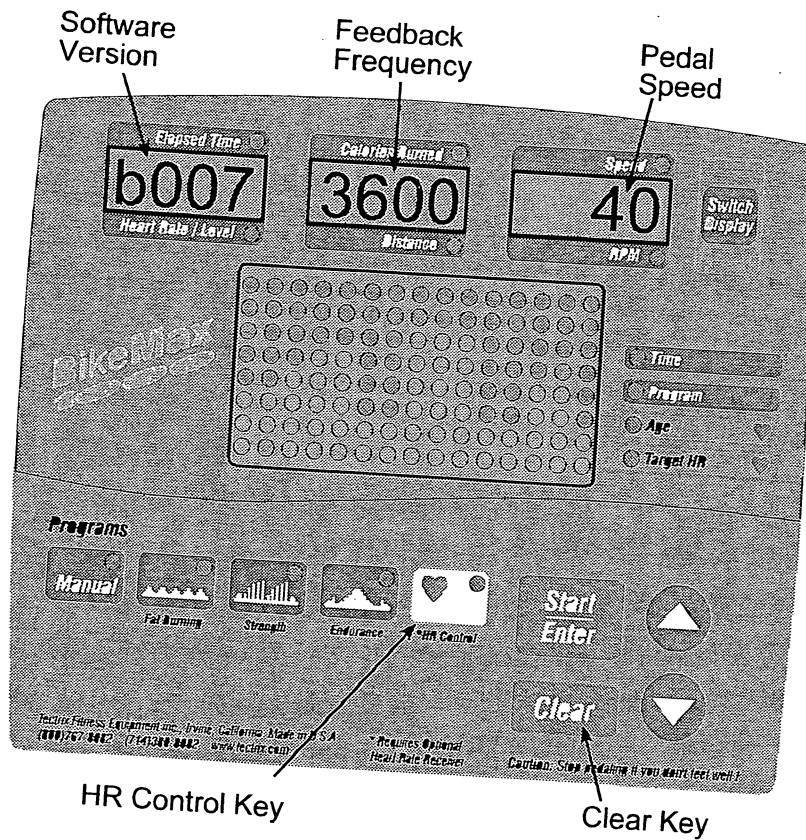


Figure 4-2 : BikeMax 1000 Test Mode Display

- The software version displays in the “Elapsed Time” field as ‘**bnnn.**’ The ‘b’ indicates BikeMax and ‘nnn’ is the version number. In Figure 4-2, the version is 007. It may be different on your bike.
- The feedback frequency in the “Calories Burned” field should read between 3.595 and 3.605 kHz; 3.60 is shown. This information is for factory use; it is not adjustable in the field.
- The “Speed” field shows the pedal RPM, as reported by the RPM sensor. If this changes correctly as you speed up or slow down, you know the sensor is working. Figure 4-1 shows a pedal speed of 40 RPM. You can change the pedal resistance by pressing the **Up Arrow** or **Down Arrow** key.

### Heart Monitor Information

If your BikeMax has a Polar heart rate receiver, the field indicator (small red light) for “Heart Rate/Level” lights if the BikeMax detects the pulse rate signal from the Polar transmitter.

### Testing Display LEDs

If you want to test the LEDs on your display console, press one of these keys:

- **Start/Enter:** Light all LEDs.
- **Endurance:** Light vertical columns of LED segments.
- **Strength:** Light individual LED segments. Press the key again for the next segment.

### Leaving Test Mode

To leave Test Mode, press the **Clear** key twice.

## CHAPTER 5

# COMPONENT REPAIR AND REPLACEMENT

This chapter contains a number of individual sections. Each describes how to check, adjust, and/or replace an individual component of your BikeMax. To make it easy to find any section, each one starts on a new page. The page numbers are in the list below.

The first section describes how to remove the cover from your bike; this section is referred to by many of the others.

| <b>Section</b>           | <b>Page</b> |
|--------------------------|-------------|
| Cover Removal            | 22          |
| External Power           | 23          |
| First Stage Drive        | 24          |
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Before beginning any procedure, please carefully read the entire instructions for it.

## Cover Removal

1. If the bike is equipped with the optional AC adapter, unplug the adapter from the bike.
2. On the upright BikeMax only, you must detach the seat bellows from the cover before removing the cover. Raise the seat as high as it will go. Grasp the rubber accordion bellows and gently pull upward to unsnap it from the plastic bike cover.
3. Remove the ten Phillips-head screws that secure the cover halves to the bike frame.
4. Rotate the right (as if you were sitting on the bike) crank arm to the 12 o'clock position. Grasp the bottom of the right cover half and pull it away from the frame. Gently lift the cover over the crank arm and off the bike.
5. Rotate the left crank arm to the 12 o'clock position and remove the left cover half.

To replace the covers, perform these steps in reverse order.

## External Power Supply

The optional external power adaptor can be very useful as a troubleshooting tool. It allows easy recharging of the battery, and makes Test Mode easier to use.

The table below gives the part numbers and descriptions of the AC adapters available from Tectrix.

| <b>Tectrix Part Number</b> | <b>Description</b>                    |
|----------------------------|---------------------------------------|
| 13018                      | Adapter, 110 VAC input, 10 VAC output |
| 13019                      | Adapter, 230 VAC input, 10 VAC output |

Plug the AC adapter into the circular connector on the switchplate. The switchplate is located at the front of the bike, above the stationary axle.



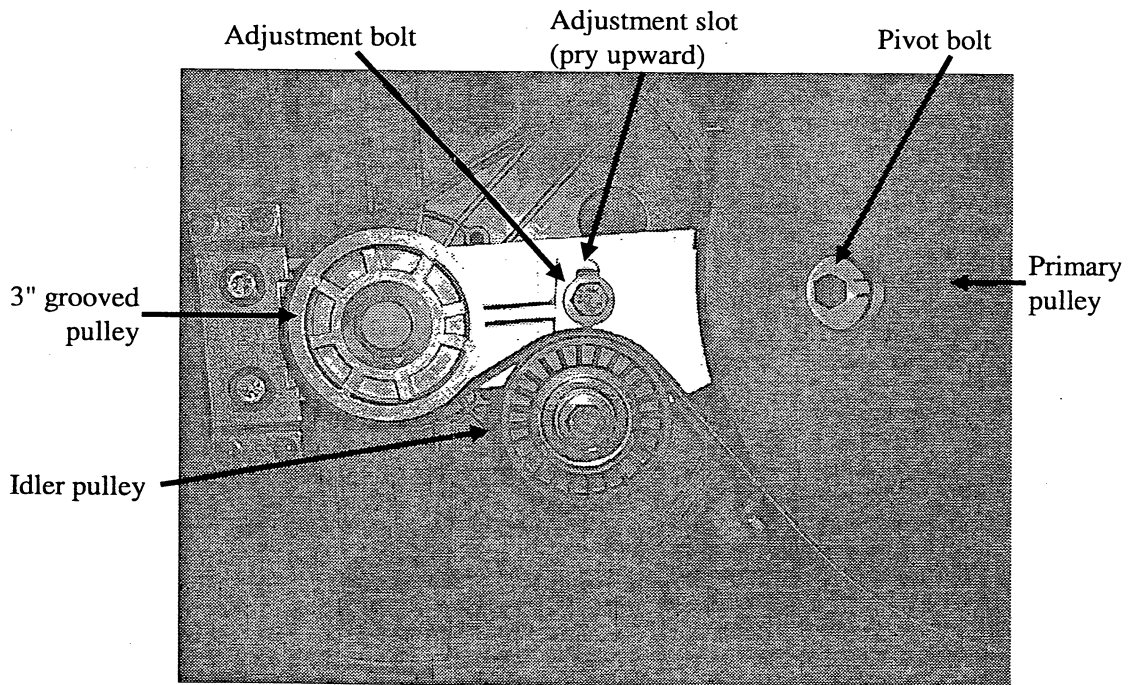
## First Stage Drive

**Tools Needed:**     *9/16" socket and wrench*                     *9/16" open-end wrench*  
                               *Flat-blade screwdriver*                     *#2 Phillips screwdriver*

The 13" primary pulley, which is attached to the pedal crank arm, begins the transfer of pedaling power to the drive engine of the bike. It turns the 10-groove primary belt, which turns the 3" grooved pulley. This assembly, which includes other parts, is called the "first stage drive." This section describes how to remove and replace the primary belt, and how to adjust the belt's tension.



**Important:** Proper primary belt tension is set at the factory. If you need to remove and replace the belt, you should normally do so *without* relaxing the tension on the belt. If you do need to change the tension, see the instructions below.



**Figure 5-1: First Stage Drive Components**

To remove and replace the primary belt:

1. If the bike is equipped with the optional external power adapter, unplug the adapter from the bike.
2. Remove the bike covers. See page 22.
3. Rotate the primary pulley clockwise and carefully move the primary belt off the outside edges of the primary pulley, idler pulley, and 3" grooved pulley.

4. Loop the new belt around the idler and 3" grooved pulleys first, as shown in Figure 5-1, then wrap the belt around the primary pulley while rotating the primary pulley counter-clockwise to pull the belt up onto the surface. Make sure the belt is centered in the grooves on all the pulleys.
5. Replace the bike covers. See page 22.

To change tension on the primary belt:

1. If the bike is equipped with the optional external power adapter, unplug the adapter from the bike.
2. Remove the bike covers. See page 22.
3. Loosen the idler arm pivot bolt, located behind the primary pulley. Some BikeMax models have a hole in the primary pulley to make access to this bolt easier, as shown in Figure 5-1.
4. Loosen the idler arm adjustment bolt, located just above the idler pulley.
5. Place the flat-blade screwdriver in idler pulley adjustment slot, above the adjustment bolt. Make sure the blade of the screwdriver rests on the engine casting.
6. Carefully move the idler arm upward to apply tension to the belt. Apply tension so the belt is tight, but not so tight that the idler pulley is distorted sideways.
7. Hold the screwdriver in place and tighten the adjustment bolt, then tighten the pivot bolt.
8. Rotate the crank arm to ensure the belt is tracking in the center of the primary pulley and 3" grooved pulley.
9. Replace the bike covers. See page 22.

## Idler Pulley

The idler pulley is part of the first stage drive; it maintains constant tension on the primary belt. The primary belt transfers pedal motion to the 3" grooved pulley and idler pulley. If the bushing inside the idler pulley is worn, the pulley will start to wobble and the primary belt can slip off the three pulleys.

**Tools Needed:**     *9/16" socket and wrench*                      *9/16" box-end or open-end wrench*  
                                 *Flat-blade screwdriver*



Please refer to Figure 5-1 on page 24 for the location of the first stage drive components referred to below.

To remove the idler pulley:

1. If the optional AC transformer is installed, unplug it from the bike.
2. Remove the bike covers. See page 22.
3. Loosen the idler bracket pivot bolt, located behind the primary pulley.
4. Place the flat-blade screwdriver in the adjustment slot of the idler bracket, above the adjustment bolt. Rest the tip of the screwdriver on the engine casting.
5. Loosen the idler bracket adjustment bolt and let the bracket rest against the shaft of the screwdriver. Slowly remove the screwdriver from the adjustment slot.
6. Rotate the primary pulley counter-clockwise and remove the primary belt from the primary pulley, 3" grooved pulley, and idler pulley.
7. Remove the bolt, washer, and nut that secure the idler pulley to the idler pulley bracket.
8. Remove the idler pulley.

To install the idler pulley:



The idler pulley comes with the bushing pre-installed by the factory. The bushing is exposed on the back side of the pulley. The mounting bolt and washer are installed through the front side of the pulley.

1. Install the bolt and washer through the idler pulley.
2. Place the idler pulley against the idler pulley bracket, so the bushing contacts the bracket.
3. Install the nut on the bolt and tighten the nut. Spin the idler pulley and verify that it does not bind on the bushing.
4. Install the primary belt and adjust the belt tension. See page 24.
5. Replace the bike covers. See page 22.

## Second Stage Drive

The 13" secondary pulley applies pedaling power to the alternator through the secondary belt. This section describes how to remove and replace the secondary belt, adjust the belt tension, and replace the entire second stage assembly (secondary pulley, pulley shaft, and 3" grooved pulley).

### Replacing the Secondary Belt

1. If the bike is equipped with the optional AC adapter, unplug the adapter from the bike.
2. Remove the bike covers. See page 22.
3. Slowly rotate the secondary pulley on the left side of the bike.
4. Carefully move the belt to the outside edge of the pulley, then off the pulley.
5. Remove the remainder of the belt from the small alternator pulley.
6. Install the new belt by looping it around the alternator pulley, then around the secondary pulley as you slowly turn the pulley in either direction.
7. Make sure the belt is centered on both pulleys.
8. Replace the bike covers. See page 22.



**Important:** You should remove and replace the secondary belt *without* relaxing the tension on the belt. Proper tension is set at the factory and should normally remain correct. If you do need to change the tension, see the instructions below.

### Adjusting the Secondary Belt

**Tools Needed:**       $\frac{3}{4}$ " box-end or open-end wrench       $\frac{3}{4}$ " Socket wrench  
                                  Flat-blade screwdriver                                      #2 Phillips screwdriver  
                                   $\frac{1}{2}$ " box-end or open-end wrench

1. If the bike is equipped with the optional AC adapter, unplug the adapter from the bike.
2. Remove the bike covers. See page 22.
3. Loosen the  $\frac{1}{2}$ " bolt that secures the alternator to the slotted frame bracket.
4. Loosen the  $\frac{3}{4}$ " bolt and nut that secure the alternator to the frame bracket.
5. Using your hands, carefully move the alternator in the direction necessary to apply tension to the secondary belt.
6. When the tension from the secondary belt provides enough resistance to stop movement of the alternator, tighten the  $\frac{1}{2}$ " adjustment bolt. ***Do not overtighten the bolt or you may strip the threaded hole in the alternator.***
7. Tighten the  $\frac{3}{4}$ " pivot bolt and nut.

8. Rotate the second stage pulley and make sure the belt does not overlap the edges of either pulley.
9. Verify the alignment of the RPM sensor to the alternator. See page 35.
10. Replace the bike covers. See page 22.

## Replacing the Second Stage Assembly

**Tools Needed:** *Flat-blade screwdriver*

You may need to remove the second stage assembly in order to remove or install the engine assembly into the bike. The second stage assembly includes the secondary pulley, pulley shaft, and 3" grooved pulley.

1. If the bike is equipped with the optional AC adapter, unplug the adapter from the bike.
2. Remove the bike covers. See page 22.
3. Remove the primary belt (see page 24) and the secondary belt (see page 27).



The pulley shaft is attached to the second stage pulley with a nut. Do not unscrew the pulley shaft from the nut unless you are replacing the pulley and not the shaft.

3. Using the flat-blade screwdriver, carefully pry up on the c-clip that secures the 3" grooved pulley to the pulley shaft.
4. Remove the two washers on the outside edge of the 3" grooved pulley. Slide the pulley off the pulley shaft.
5. Remove the remaining two washers from the pulley shaft.
6. Carefully slide the second stage pulley and pulley shaft out of the bearings in the engine casting.
7. Carefully slide the new second stage pulley and pulley shaft into the bearings of the engine casting.
8. Place two washers on the pulley shaft.
9. Install the 3" grooved pulley on the pulley shaft. The pulley should go on so it will freewheel in a counter-clockwise direction when viewed from the right side of the bike (the side it's on). The small arrow on the hub of the pulley goes toward the bike frame.
10. Install the other two washers and c-clip on the pulley shaft.
11. Make sure the pulley shaft rotates freely in the bearings. If it does not, replace the engine (see page 29).
12. Install the primary and secondary belts. See pages 24 and 27.
13. Replace the bike covers. See page 22.

## Engine Assembly

**Tools Needed:** #2 Phillips Screwdriver      1/2" box-end or open-end wrench  
1/2" Socket and wrench

The main engine assembly is the connection between the moving components and the frame of the bike. If replacement is necessary, a complete assembly, including the engine casting, primary, secondary, idler, and 3" grooved pulleys, and bearings is available. Follow the procedures below to remove and replace the engine assembly.



The engine assembly is bulky and can be awkward to maneuver in and out of the bike frame. Be very careful to avoid injury during the replacement.

For your reference, there is an exploded view of the engine assembly at the end of this section.

### Removing the Engine Assembly

1. If the bike is equipped with the optional AC adapter, unplug the adapter from the bike.
2. Remove the bike covers. See page 22.
3. Remove the secondary belt:
  - Slowly rotate the secondary pulley on the left side of the bike.
  - Carefully move the belt to the outside edge of the pulley, then off the pulley.
  - Remove the remainder of the belt from the small alternator pulley.
4. Remove the pedal and cover plate from the left side of the bike.
  - Remove the pedal from the left crank arm.
  - Remove the three Phillips screws from the cover plate that surrounds the left crank arm.
  - Remove the cover plate from the bike.
5. On a recumbent BikeMax, you may need to remove the primary belt, then remove the 3" grooved pulley, pulley shaft, and secondary pulley before removing the engine. If you need to do this, see "Replacing the Second Stage Assembly" on page 28.
6. Remove the two 1/2" bolts and washers from the brass-colored mounting plate that secures the front of the engine casting to the semi-circular frame mounting bracket.
7. Remove the four Phillips screws that hold the brass-colored rear engine mounting plate to the right side of the bike frame. Remove the mounting plate.



During the next step, you must support the rear of the engine assembly before you remove the second 1/2" bolt that secures the engine to the bike frame.

8. Remove the two 1/2" bolts and nuts that secure the rear of the engine casting to the bike frame.

9. Rotate the right crank arm so it points toward the rear of the bike. While supporting the front of the engine casting, carefully rock the rear of the engine assembly toward the top of the diagonal frame member. The front of the casting will drop away from its semi-circular frame mounting bracket.
10. When the engine assembly is free within the frame, remove it from the left side of the frame.

### Installing the New Engine Assembly



With a recumbent bike, you must rotate the right crank arm so it points to the rear of the bike before you start the installation. For an upright bike, the left crank arm must point toward the rear of the bike.

1. From the left side of the bike, place the primary (crank arm) pulley and engine assembly through the frame and toward the front of the bike. Rotate the casting so the rear of the casting can be seated into the center of the diagonal frame member.
2. Lift the front of the engine assembly and position the casting into the semi-circular frame mounting bracket. Insert the two ½" bolts and washers through the brass-colored mounting plate and into the frame. **Do not tighten the bolts yet.**
3. Place a ½" bolt and washer through the rear engine mounting plate. Lift the rear of the engine casting and align the holes in the casting with the holes in the frame. Insert the bolt through the casting and bike frame so the plate is properly positioned on the frame. Insert the second ½" mounting bolt and washer through the mounting plate, casting, and bike frame.
4. Install the four Phillips screws through the mounting plate into the diagonal frame member. **Do not tighten the screws yet.**
5. Install the two nuts on the two rear ½" bolts. **Do not tighten the nuts and bolts yet.**
6. Tighten the front two ½" bolts at an even rate, so the mounting plate is fully seated against its mounting surface on the semi-circular frame bracket.
7. Tighten the four Phillips screws to secure the rear mounting plate to the frame.
8. Tighten the two ½" bolts and nuts to secure the rear of the engine casting to the frame.
9. Install the secondary belt as described in "Replacing the Secondary Belt" on page 27.
10. Install the cover plate and pedal as listed in Step 3, in reverse order.

~~The new engine is now installed. Before replacing the covers, test the bike to make sure it's operating properly:~~

1. If the bike has the optional external power supply, plug it into the switchplate.
2. Pedal the bike and make sure you can enter various program modes. *If the bike does not have an external power supply, you must pedal at least 40 RPM.* Make sure the resistance increases when you press the **Up Arrow** is pressed, and decreases when you press the **Down Arrow**.

3. If the bike has a CardioTouch heart-rate sensor, pedal the bike and place your hands on the rubber-coated CardioTouch grips. The bike should sense your heart-rate and display a flashing shield in the upper right of the display. Your heart-rate should appear on the console within 30 seconds.
4. If the bike has a Polar heart-rate sensor, use a Polar chest strap or Polar test transmitter. The bike should sense your heart-rate and display a flashing shield in the upper right of the display. Your heart-rate should appear on the console within 30 seconds.
5. If either heart rate sensor is not working, make sure all cables are attached securely.

Once you know the bike is working correctly, unplug the external power supply (if it has one), and replace the covers. See page 22.



## Alternator

|                      |                                |                                        |
|----------------------|--------------------------------|----------------------------------------|
| <b>Tools Needed:</b> | <i>#2 Phillips screwdriver</i> | <i>1/2" box-end or open-end wrench</i> |
|                      | <i>Flat blade screwdriver</i>  | <i>3/4" box-end or open-end wrench</i> |
|                      | <i>3/4" socket and wrench</i>  | <i>7/8" socket</i>                     |

The alternator provides the pedaling resistance the rider feels. The pulley which connects the alternator with the secondary belt also functions as a flywheel and RPM sensor encoder.

### Removing the Alternator

1. If the bike is equipped with the optional AC adapter, unplug the adapter from the bike.
2. Remove the bike covers. See page 22.
3. Remove the secondary belt:
  - Slowly rotate the secondary pulley on the left side of the bike.
  - Carefully move the belt to the outside edge of the pulley, then off the pulley.
  - Remove the remainder of the belt from the small alternator pulley.
4. Remove the RPM sensor from the alternator case:
  - Remove the 1/2" bolt and washer that secures the sensor to the alternator.
  - Move the sensor away from the area surrounding the alternator.
5. Carefully insert a flat-blade screwdriver through one of the six openings in the alternator pulley and rest the tip against the housing. This will keep the pulley from moving.
6. Loosen and remove the 7/8" retaining nut and washer from the alternator shaft.
7. Carefully remove the alternator pulley from the alternator shaft.



Do not lose the half-moon shaped key that fits into the alternator shaft; the key prevents the pulley from spinning freely on the shaft.

8. Unplug the alternator cable from connector JP1 on the Alternator Control Board (ACB).
9. Do one of the following, depending on the bike model:
  - Recumbent: Unclip and remove the alternator cable from the bottom of the extrusion tube.
  - Upright: Unclip and remove the alternator cable from the right side of the diagonal frame member.
10. Before removing the alternator, you may want to mark its location on the belt tension adjustment slot. This will make it easier to install the new alternator in the correct position.
11. Loosen the 1/2" bolt that secures the alternator to the slotted frame bracket.

12. Support the alternator in place and remove the 1/2" bolt from the slotted frame bracket.

**WARNING:**

To avoid personal injury, you need to support the alternator on the BMR *before* you remove the 3/4" bolt securing the alternator to the frame bracket.

13. Remove the 3/4" bolt and nut that secure the alternator to the frame bracket.
14. Remove the alternator from the frame.

### Installing the New Alternator

Essentially, installing the new alternator is the same as removing the old one, in reverse:

1. Place the alternator in position.
2. Insert the 3/4" bolt and nut that secure the alternator to the frame bracket.
3. Insert the 1/2" bolt and washer into the slotted frame bracket, and carefully thread it into the mounting hole in the alternator.
4. If you marked the old alternator's position on the belt tension adjustment slot, place the alternator in the same position, so the secondary belt tension will be correct. Tighten the 1/2" bolt that secures the alternator to the slotted frame bracket. Tighten the 3/4" bolt and nut that secure the alternator to the frame bracket.
5. Do one of the following, depending on the bike model:
  - Recumbent: Clip the alternator cable to the bottom of the extrusion tube.
  - Upright: Clip the alternator cable to the right side of the diagonal frame member.
6. Plug the alternator cable into connector JP1 on the Alternator Control Board (ACB).
7. Carefully place the flywheel on the alternator shaft. Make sure the half-moon key on the alternator shaft fits into the notch on the flywheel.
8. Install the washer and 7/8" retaining nut on the alternator shaft.
9. Carefully insert a flat-blade screwdriver through one of the six openings in the alternator pulley and rest the tip against the housing. This will keep the pulley from moving. Tighten the 7/8" retaining nut.
10. Place the RPM sensor in position and insert and tighten the 1/2" bolt and washer that secures the sensor to the alternator.
11. Adjust the RPM Sensor, as described on page 35.
12. Install the secondary belt as described on page 27. If necessary, adjust the belt's tension as shown in that section.

The new engine is now installed. Before replacing the covers, test the bike to make sure it's operating properly:

1. If the bike has the optional external power supply, plug it into the switchplate.

2. Pedal the bike and make sure you can enter various program modes. *If the bike does not have an external power supply, you must pedal at least 40 RPM.* Make sure the resistance increases when you press the **Up Arrow**, and decreases when you press the **Down Arrow**.
3. If the bike has a CardioTouch heart-rate sensor, pedal the bike and place your hands on the rubber-coated CardioTouch grips. The bike should sense your heart-rate and display a flashing shield in the upper right of the display. Your heart-rate should appear on the console within 30 seconds.
4. If the bike has a Polar heart-rate sensor, use a Polar chest strap or Polar test transmitter. The bike should sense your heart-rate and display a flashing shield in the upper right of the display. Your heart-rate should appear on the console within 30 seconds.
5. If either heart-rate sensor is not working, make sure all cables are attached securely.

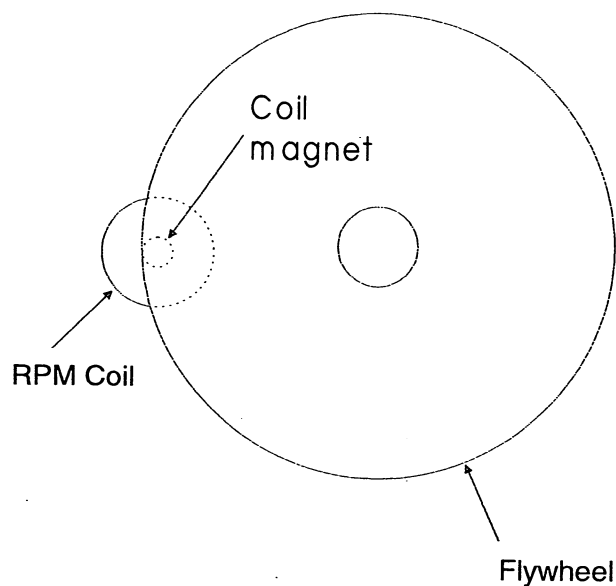
Once you know the bike is working correctly, unplug the external power supply (if it has one), and replace the covers. See page 22.

## RPM Sensor

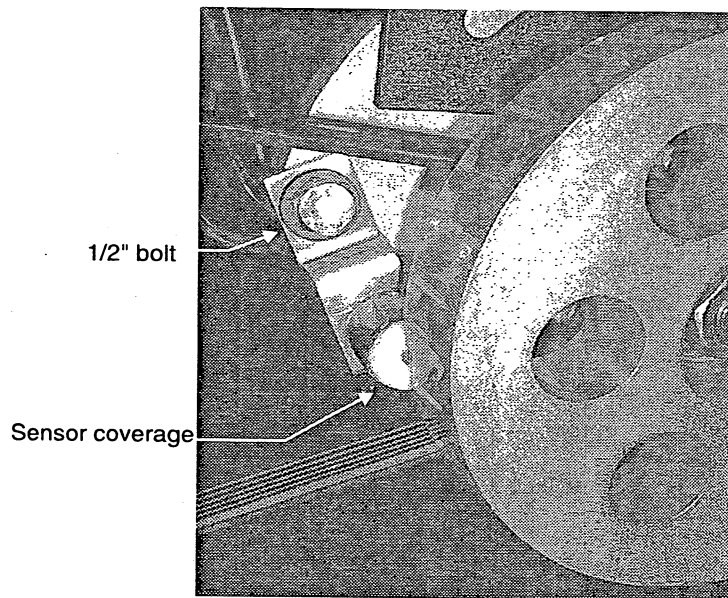
**Tools Needed:** #2 Phillips screwdriver    1/2" box-end wrench  
Feeler gauges, standard  
or metric

The RPM sensor must be adjusted properly near the metal alternator flywheel. The edge of the flywheel must pass over the metal center part of the sensor, and the gap between the sensor and the flywheel must be between 0.020 and 0.060 inches. To adjust the RPM sensor:

1. If the bike is equipped with the optional AC adapter, unplug the adapter from the bike.
2. Remove the bike covers. See page 22.
3. Loosen the 1/2" bolt that secures the RPM sensor to the alternator.
4. Look at the face of the flywheel and RPM sensor. Position the sensor so one-half of the sensor's center core is covered by the flywheel, as shown in the drawing below.



Alignment of RPM Coil with Flywheel  
On Tectrix Alternator BikeMax



4. Tighten the 1/2" bolt. *Do not overtighten the bolt, or you may strip the threaded hole in the alternator.*
5. Verify the air gap between the sensor and the flywheel:
  - Check the bracket to make sure the RPM sensor coil is not bent into or away from the flywheel.
  - Check the air gap between the center core of the RPM sensor and the back of the flywheel. The air gap should be in a range of .020" to .060", or .5mm to 1.5mm. If necessary, carefully bend the sensor bracket to achieve the desired air gap. See the picture below.



6. Test the RPM sensor.

- Press and hold the top **HR Control** button on the console.
  - Pedal the bike at 40 RPM or greater to activate the console, or plug in the optional AC adapter.
  - Verify that the “Speed” field on the console indicates your pedal speed. If the value is zero or non-existent, make sure the RPM sensor is plugged into connector JP5 on the Alternator Control Board (ACB). If the value is still zero or non-existent, replace the RPM sensor.
7. Replace the bike covers. See page 22.

## Alternator Control Board

**Tools Needed:** #2 Phillips screwdriver

You may need to replace the Alternator Control Board (ACB) if the electrical troubleshooting procedure in Chapter 3 recommends it, or if the group race feature is not working for a set of linked bikes. Discrepancies in the bikes' ACBs can keep group racing from working. If this is the case, you should replace the ACB on each linked bike.

To replace the ACB:

1. If the bike is equipped with the optional AC adapter, unplug the adapter from the bike.
2. Remove the bike covers. See page 22.
3. Disconnect the electrical cables from connectors JP3, J4P, JP5, and JP7.
4. Remove the ACB assembly from the frame by unscrewing the two Phillips-head screws.
5. Attach the new ACB assembly to the frame.
6. Reconnect the leads. If you need to, refer to Tables 3-1 and 3-2 or Figures 3-1 and 3-2.
7. Replace the bike cover. See page 22.

## Battery

**Tools Needed:**    *#2 Phillips screwdriver*        *Volt-ohm meter with test leads*  
                          *Optional AC adapter (if*  
                          *available)*

The battery must be functional in order to activate the bike. A fully charged battery will have 6.0 to 6.3 VDC present when it is plugged into connector J6 (Rev. 10060A) or JP3 (Rev. 10050A) on the ACB.

To test the battery:

1. Remove the bike covers. See page 22.
2. Verify that the battery is plugged into the ACB.
3. Set the volt-ohm meter to sense DC volts, using the 20 volt scale (if the meter has this setting available). Make sure the red lead is connected to the VDC connector on the meter and the black lead is connected to the GND connector on the meter.
4. Connect the black meter lead (from the GND connector) to the black wire on connector J6.
5. Connect the red meter lead (from the VDC connector) to the white wire on connector J6.
6. A fully charged battery will indicate 6.0 to 6.3 VDC. A battery with less than 5.7 VDC will not activate the bike. The technician or customer can attempt to charge the battery with the optional AC adapter.

If the AC adapter is available, plug the adapter into the circular connector on the switchplate. The adapter will charge the battery in approximately 2 hours, but the bike may be used at once, while charging.



## CardioTouch Heart Rate Receiver

**Tools Needed:**     #2 Phillips screwdriver     Volt-ohm meter with test leads  
                          Optional AC adapter (if available)     3/16" hex wrench

CT heart rate detection uses special rubber hand grips to sense the heart rate. The heart rate signal is transmitted through electrical cabling to a CT circuit board mounted on the display board in the console. The user must keep both hands on the rubber hand grips during the workout so CT can consistently detect the heart rate. On the recumbent bike, the rubber hand grips are mounted to handlebars on each side of the seat. On the upright bike, the hand grips are on a balance bar directly below the console.

The most common cause of an inconsistent or non-existent readout is that the user does not have his/her hands on the hand grips, or that the grips are covered with perspiration. The first thing to do if you have trouble with CT heart rate readout is clean the hand grips with alcohol to remove built-up perspiration and other dirt.

If cleaning the grips does not fix the problem, you need to examine the individual components of the CT system. Besides the hand grips, the system includes: a cable that terminates at a connector (under the back of the seat on the recumbent bike, outside the balance bar on the upright); extrusion tube and upright tube cables (recumbent bike only), and the CT circuit board.



The CT cable is a 2-conductor cable. The end of the cable that connects to the CT board has a brown, 4-pin connector.

The key to troubleshooting CT is to isolate each component, and test each component independent of the other components. The test process requires the use of a volt-ohm meter, and can involve partial disassembly of the bike.

The most common cause of failure with CT is due to a pinched or disconnected cable at the console or in the display upright tube. To check for this problem:

1. Remove the console and verify that the CT board is installed onto the display board.
2. Make sure the 4-pin connector on the CT cable is plugged into the 4-pin connector on the CT board. (Refer to the system block diagram.)
3. Make sure the CT cable is not pinched or cut where it exits the top of the display upright tube.
4. Make sure the wires are not separated from the 4-pin connector.

If the CT board is installed and the cable integrity and installation is correct, test the CT system as follows:

1. Plug the AC adapter (if available) into the bike, or pedal the bike to activate the console.
2. Place your hands on the CT rubber hand grips.

3. If CT is operating correctly, a flashing indicator will appear in the top right corner of the display. This indicates that CT has sensed your heart rate.
4. Within 30 seconds, a digital readout of your heart rate will display.

If the flashing indicator doesn't appear, or if it does appear, but your heart rate doesn't display, replace the CT circuit board and test CT again. If a new CT board does not correct the problem, troubleshoot the problem as described below. There are different procedures for the recumbent and upright bikes.

### Recumbent Bike CardioTouch Troubleshooting

1. If the AC adapter is installed, unplug it from the bike.
2. Unplug the 4-pin connector cable from the CT board.
3. Set the volt-ohm meter to the 200 ohms setting. Place one meter lead on one of the CT rubber hand grips, and the other meter lead on one of the wires in the 4-pin connector. One wire in the connector is dedicated to each hand grip, so observe the meter for continuity (a change in the numeric display or needle movement). If continuity is present, the connection between that hand grip and the connector is good. Verify the same for the other hand grip and wire in the connector.

If either wire or hand grip fails the continuity test (no needle movement or change in the numeric display), the problem is in one of the CT components. To determine which one, you will check the connections and continuity of the CT cables in the display upright and extrusion tube, and the flex cable that connects the extrusion tube cable to the seat shuttle.

4. Unbolt and remove the display upright tube from the base. Carefully hold the tube and verify that the 2-conductor cable from the extrusion tube is plugged into the 2-conductor cable that connects to the CT board in the console. If the cables are connected, disconnect them and repeat the continuity test for each hand grip and wire within the 2-conductor cable exiting the front of the extrusion tube.

If the hand grips and 2-conductor cable in the extrusion tube pass the continuity test, then the 2-conductor cable in the upright tube is defective. Replace the cable and test CT again.

5. If the continuity test fails, remove the seat shuttle, 2-conductor CT extrusion tube cable, and flex cable (refer to "Extrusion Tube Removal and Installation: BikeMax-R Only on page 45). Perform continuity tests on the 2-conductor CT extrusion tube cable and flex cable independently of each other.

If either cable fails the continuity test, replace it and test CT again.

6. If both the CT cable and flex cable pass the continuity test, then test continuity between the hand grips and the connector on the bottom of the seat shuttle.

If a hand grip and a wire in the connector on the bottom of the seat shuttle fail the continuity test, replace the seat shuttle and test CT again.

7. Once the diagnosis and repairs are complete, test CT again to verify integrity of the CT system.

### **Upright Bike CardioTouch Troubleshooting**

1. If the AC adapter is installed, unplug it from the bike.
2. Unplug the 4-pin connector cable from the CT board.
3. Set the volt-ohm meter to the 200 ohms setting. Place one meter lead on one of the CT rubber hand grips, and the other meter lead on one of the wires in the 4-pin connector. One wire in the connector is dedicated to each hand grip, so observe the meter for continuity (a change in the numeric display or needle movement). If continuity is present, the connection between that hand grip and the connector is good. Verify the same for the other hand grip and wire in the connector.

If either hand grip or wire in the balance bar fails the continuity test, the CT balance bar is defective and must be replaced.

4. Replace the defective CT balance bar and test CT again to verify integrity of the CT system.

## Polar Heart Rate Receiver

**Tools Needed:**    *#2 Phillips screwdriver*    *1/2" open-end wrench*  
                          *3/16" hex wrench*

Polar heart rate detection uses a chest strap that detects the heart rate and transmits it to a receiver module. Depending of the type of BikeMax, the receiver is connected to the display board with one or two 3-conductor electrical cable(s):

- On the recumbent bike, the receiver module is inside the extrusion tube at the back of the bike. It is connected to a 3-conductor cable in the extrusion tube, which exits at the front of the tube. A second 3-conductor cable connects to the cable at the front of the extrusion tube, and carries the heart rate signal to the display board in the console.
- On the upright bike, the receiver module is mounted on the display upright tube below the console.

On both bikes, the end of the Polar cable that connects to the display board has a brown, 3-conductor connector.



On the upright bike, the Polar cable has a white label at one end. The labeled end of the cable plugs into the Polar receiver module.

If the Polar display indicates an erratic heart rate, verify the positioning of the ribbon and Polar cables under the console. The cables should be kept separate from one another, and excess cabling should be within the upright tube.

If no heart rate value is displayed, make sure the Polar cable is plugged into the 3-conductor male connector on the display board. Verify the operation of the Polar chest strap by testing the receiver with another chest strap, or with a Polar test transmitter. If possible, swap the receiver module and test Polar again.

If the heart rate is still not displayed, troubleshoot the problem as described below. There are different procedures for the recumbent and upright bikes.

### Recumbent Bike Polar Troubleshooting

1. If the AC adapter is installed, unplug it from the bike.
2. Unplug the 3-conductor connector from the display board.
3. Remove the end cap from the back of the extrusion tube, loosen the 1/2" nut and hex screw, and remove the Polar receiver. Unplug the receiver from the 3-conductor cable, and carefully pull about 2 inches of the cable out of the tube.
4. Set the volt-ohm meter to the 200 ohms setting. Place one meter lead on one of the wires in the 3-conductor connector at the top of the display upright tube. Place the other meter lead on one of the wires in the 3-conductor cable at the end of the extrusion tube.

Observe the meter for continuity zero ohms, or a low ohms reading, 10 $\cdot$  or less. If continuity is present, verify the same for the other wire in the cables.

If either wire within the cables fails the continuity test, there is probably a disconnected cable or broken wire within a cable. You need to verify good connections and continuity of the Polar cables in the display upright and extrusion tube.

5. Unbolt and remove the display upright tube from the base. Carefully hold the tube and verify that the 3-conductor cable from the extrusion tube is plugged into the 3-conductor cable that connects to the display board in the console. If the cables are connected, disconnect them. Repeat the continuity test on each wire of the 3-conductor cable in the extrusion tube.

If the 3-conductor cable in the extrusion tube passes the continuity test, then the 3-conductor cable in the upright tube is defective. Replace the cable and test Polar again.

If the 3-conductor cable in the extrusion tube fails the continuity test, replace it and test Polar again.

6. If the problem still exists, replace the display board.
7. Once the diagnosis and repairs are complete, test Polar again to verify integrity of the Polar system.

### **Upright Bike Polar Troubleshooting**

1. If the AC adapter is installed, unplug it from the bike.
2. Unplug the 3-conductor connector from the display board.
3. Unscrew and remove the Polar receiver module from the display upright tube. Disconnect the 3-conductor connector from the receiver module.
4. Set the volt-ohm meter to the 200 ohm setting. Place one meter lead on one of the wires in the 3-conductor connector at the top of the display upright tube. Place the other meter lead on the same wire in the 3-conductor cable at the other end of the cable. Observe the meter for continuity zero ohms, or a low ohms reading, 10 $\cdot$  or less. If continuity is present for the first wire, verify the same for the other wire.
5. If either wire in the cable fails the continuity test, replace the cable and test the Polar system for proper heart rate detection and display.
6. If the problem still exists, or if the cable passes the continuity test, replace the display board.
7. Once the proper diagnosis and repairs are complete, test Polar again to verify integrity of the Polar system.

## Extrusion Tube Removal and Installation: BikeMax-R Only

**Tools Needed:** #2 Phillips screwdriver      3/16" hex (Allen) wrench  
1/2" box-end or open-end wrench      1/2" socket and wrench  
1" piece of Scotch tape

This section also includes the removal and installation of the seat shuttle assembly.

1. If the bike is equipped with the optional AC adapter, unplug the adapter from the bike.
2. Remove the rectangular end cap from the rear of the extrusion tube by removing the four Phillips screws that secure it.
3. Remove the seat shuttle from the bike:
  - Remove the 3/16" hex screw and its 1/2" nut from the right rear corner of the extrusion tube. If the bike is equipped with a Polar receiver, remove the receiver from the tube.
  - Phillips screws on either side at the front of the seat shuttle secure a brake plate. Remove the two Phillips screws and the brake plate from the shuttle.
  - Lift the blue locking handle of the seat shuttle, and carefully slide the seat shuttle to the rear-most position of the extrusion tube.
  - If the bike is equipped with CardioTouch, unplug the flex cable from the connector located on the bottom of the rear-most location on the seat shuttle.
  - Carefully slide the seat shuttle off the extrusion tube.
4. Remove the covers from the bike. See page 22.
5. Remove the Alternator Control Board (ACB) and load resistor:
  - Unplug all electrical connectors from the ACB except connector JP6: this cable connects the load resistor to the ACB.
  - Remove the two Phillips screws that secure the ACB and resistor to the frame and remove the ACB and resistor.
6. Remove the extrusion tube from the bike.
  - Two bolts on the underside of the extrusion tube secure it to the frame. These bolts are secured to a removable, threaded retainer. Note the position of the retainer within the tube. Then, using the 1/2" socket and wrench, remove the front bolt, then the rear one.
  - While the tube is still positioned on the frame, remove the two Phillips screws that secure the cable clamp to the top of the tube.



The gray CardioTouch cable is a 2-conductor cable; the gray Polar cable is a 3-conductor cable.

- From the front of the extrusion tube, **carefully** pull the CardioTouch cable and/or Polar cable from the tube. Disconnect the CardioTouch cable from its mating 2-conductor signal cable.

- Lift the extrusion tube from the frame and unclip the alternator cable from the bottom of the extrusion tube.
6. Install the new extrusion tube:
- If applicable, feed the CardioTouch cable into the hole in the top of the extrusion tube, and attach the cable to its corresponding 2-conductor cable at the front of the extrusion tube. Place the flex cable on the top of the tube with approximately 3/4 inch of the cable extending beyond the back of the tube. Secure the flex cable to the top of the tube with the piece of Scotch tape. Replace the cable clamp on the extrusion tube and tighten the two Phillips screws.
  - If applicable, feed the Polar cable through the length of the extrusion tube.
  - Clip the alternator cable to the underside of the extrusion tube.
  - Place the tube on the bike frame and secure it with the 1/2" bolts.
  - Replace the ACB. Follow the instructions in step 5 above, in reverse order.
  - Replace the seat shuttle and Polar receiver (if the bike has one). Follow the instructions in step 3 above, in reverse order.



If the bike has CardioTouch, install the flex cable into its connector on the rear underside of the seat shuttle before sliding the rear-most rollers onto the extrusion tube.

7. Re-attach the end cap using the four Phillips screws.

Before replacing the covers, test the bike to make sure it's operating properly:

1. If the bike has the optional external power supply, plug it into the switchplate.
2. Pedal the bike and make sure you can enter various program modes. *If the bike does not have an external power supply, you must pedal at least 40 RPM.* Make sure the resistance increases when you press the **Up Arrow**, and decreases when you press the **Down Arrow**.
3. If the bike has a CardioTouch heart-rate sensor, pedal the bike and place your hands on the rubber-coated CardioTouch grips. The bike should sense your heart-rate and display a flashing shield in the upper right of the display. Your heart-rate should appear on the console within 30 seconds.
4. If the bike has a Polar heart-rate sensor, use a Polar chest strap or Polar test transmitter. The bike should sense your heart-rate and display a flashing shield in the upper right of the display. Your heart-rate should appear on the console within 30 seconds.
5. If either heart-rate sensor is not working, make sure all cables are attached securely.

Once you know the bike is working correctly, unplug the external power supply (if it has one), and replace the covers. See page 22.

## APPENDIX A PARTS LIST

This appendix lists the parts making up the BikeMax 1000 and/or 3000. Parts found in only the upright or recumbent bike are marked with (BMU) or (BMR), respectively. All other parts are found in both types of bike.

| Description                                                 | Part # |
|-------------------------------------------------------------|--------|
| Alternator                                                  | 61539  |
| Alternator Control Board                                    | 70418  |
| Battery                                                     | 61518  |
| Belt, Primary                                               | 44061  |
| Belt, Secondary (BMR)                                       | 44059  |
| Belt, Secondary (BMU)                                       | 44066  |
| Cable, Alternator                                           | 14148  |
| Cable, Battery                                              | 14148  |
| Cable, CT Flex - Extrusion Tube (BMR)                       | 50116  |
| Cable, CT - Extrusion Tube (BMR)                            | 14155  |
| Cable, CT - Display Upright Tube (BMR)                      | 14157  |
| Cable, Polar - Extrusion Tube (BMR)                         | 14123  |
| Cable, Polar - Display Upright Tube (BMR)                   | 14135  |
| Cable, Polar - Display Upright Tube (BMU)                   | 14134  |
| Cable, Ribbon - Frame (BMR); Display Upright Assembly (BMU) | 14154  |
| Cable, Ribbon - Display Upright Assembly (BMR), Frame (BMU) | 14159  |
| Cable, SmartLink - Switchplate (BMR) for use with 70418     | 14001  |
| Cable, SmartLink - Switchplate (BMU) for use with 70418     | 14000  |
| CardioTouch Board                                           | 61503  |
| Clutch Pulley                                               | 62021  |
| Console, BikeMax 1000 (U.S.)                                | 61533  |
| Console, BikeMax 3000 (U.S.)                                | 61486  |
| Display Board, BikeMax 1000                                 | 61535  |
| Display Board, BikeMax 3000                                 | 61536  |
| Drive Pulley Assembly                                       | 62022  |
| Engine Arm Assembly                                         | 62020  |
| Engine Assembly, Complete                                   | 70380  |
| External AC adapter, 110 volt AC                            | 13018  |
| External AC adapter, 230 volt AC                            | 13019  |
| Flywheel, Alternator                                        | 50070  |
| Overlay, BikeMax 1000 (U.S.)                                | 50060  |
| Overlay, BikeMax 3000 (U.S.)                                | 50049  |
| Pedal Set                                                   | 50068  |
| Polar Receiver Kit (BMR)                                    | 71108  |
| Polar Receiver Kit (BMU)                                    | 71098  |
| Pulley Assembly, Idler                                      | 62019  |



| <b>Description</b>                            | <b>Part #</b> |
|-----------------------------------------------|---------------|
| RPM Sensor Assembly                           | 61520         |
| Seat Back Assembly (BMR)                      | 61309         |
| Seat Shuttle (BMR, non-CT)                    | 70379         |
| Seat Shuttle (BMR - CT)                       | 70384         |
| Secondary Pulley Assembly                     | 62018         |
| Switchplate Assembly (BMR) for use with 70418 | 61003         |
| Switchplate Assembly (BMU) for use with 70418 | 61003         |
| Switchplate Assembly (BMR) for use with 70391 | 61521         |
| Switchplate Assembly (BMU) for use with 70391 | 61541         |
| Wheel, Front Transport                        | 50029         |

## APPENDIX B

# ADVANCED ELECTRICAL TROUBLESHOOTING

One of the features of the BikeMax is that it doesn't require external power; an internal alternator uses the power generated by pedaling to light the BikeMax display and to generate the needed resistance to the pedals. If the display fails to light and no resistance is felt when you pedal at more than 40 RPM - a condition known as a "dead bike" - it indicates a problem somewhere in the BikeMax's electrical system. In fact, a dead bike may be the most common symptom for a BikeMax electrical problem.

The following sections first describe the process that goes on inside a BikeMax during the normal power-up when a user begins to pedal. Then, they lead you through the procedure to diagnose the cause of a dead bike.

### The Power-Up Sequence

In normal operation, the BikeMax powers up when a user begins to pedal at more than 40 RPM. The components involved in power-up are the RPM coil, alternator, Alternator Control Board (ACB) and battery, display console, and their interconnecting cables.

These are the steps in the power-up sequence:

1. The user begins to pedal, generating a small AC current in the RPM coil. Besides sensing alternator RPM, the coil is also a tiny electrical generator.
2. At about 20 RPM or less - the exact RPM depends largely on the gap between the coil magnet and the fluted edge of the flywheel - the coil generates enough current to activate Q11, a semiconductor switch on the ACB. This switch applies battery power to the ACB and makes about 5.7 VDC available to the display board.
3. When the display board has at least 5.0 VDC available, the microprocessor begins to operate. However, the display board does not yet light or give any outward indication that it is operating. Instead, it continues to monitor pedal RPM.
4. At 40 RPM, the display board commands the ACB to supply field current to the alternator, which then outputs the minimum nine volts required for normal BikeMax operation. The display board lights, and the battery is no longer required for source current. In fact, the battery is now being recharged. The BikeMax is fully operational and the user can select workout programs from the opening prompt.

Failure of any of the components involved at any step in the power-up sequence can keep the BikeMax from powering up at all, and cause a dead bike. Knowledge of the power-up sequence is very helpful in following the troubleshooting procedure below.

## Troubleshooting Procedure

The troubleshooting procedure below checks each of the components involved in power-up. First, it verifies the display board, display cable, and the display voltage regulator section of the ACB. Next, it checks the battery and charging system. Finally, it tests the RPM coil. If all of these components function correctly, the problem must be in the ACB.

Two revisions of ACB are covered by the troubleshooting procedure. ACB rev. 10060B (new style) may be identified as the module on which the battery is mounted. (PC board and resistor are smaller than the previous revision). For ACB rev. 10050A the battery is mounted to the frame of the BikeMax separately.

The procedure references headers by their designation on the 10060B ACB. The equivalents for the 10050A ACB are given in the following table:

| Global Changes of ACB Headers |                  |                                 |
|-------------------------------|------------------|---------------------------------|
| Rev 10050A (old)              | Rev 10060A (new) |                                 |
| JP1                           | J4               | ALTERNATOR                      |
| JP3                           | J6               | BATTERY                         |
| JP6                           | J1, J2           | 1-Ω LOAD RESISTOR               |
| JP2                           | J5               | DISPLAY                         |
| HP5                           | J7               | RPM                             |
| JP7, J8                       | J3               | External Power & Communications |
| JP13                          | J8               | Edgecard                        |

An EPROM revision number MAXII 3.04 or greater is required for ACB revision 10050A and MAXII 3.11 or greater for ACB revision 10060B. When replacing a 10050A ACB with a 10060B ACB, remember to update the EPROM also!

### Before You Begin

The troubleshooting procedure makes the assumption that a "field" failure has occurred-the BikeMax functioned correctly before the failure.

**Caution!** The troubleshooting procedure assumes there is a single fault to be isolated in the BikeMax system. Multiple problems may complicate troubleshooting by causing false inferences as a result of any test.

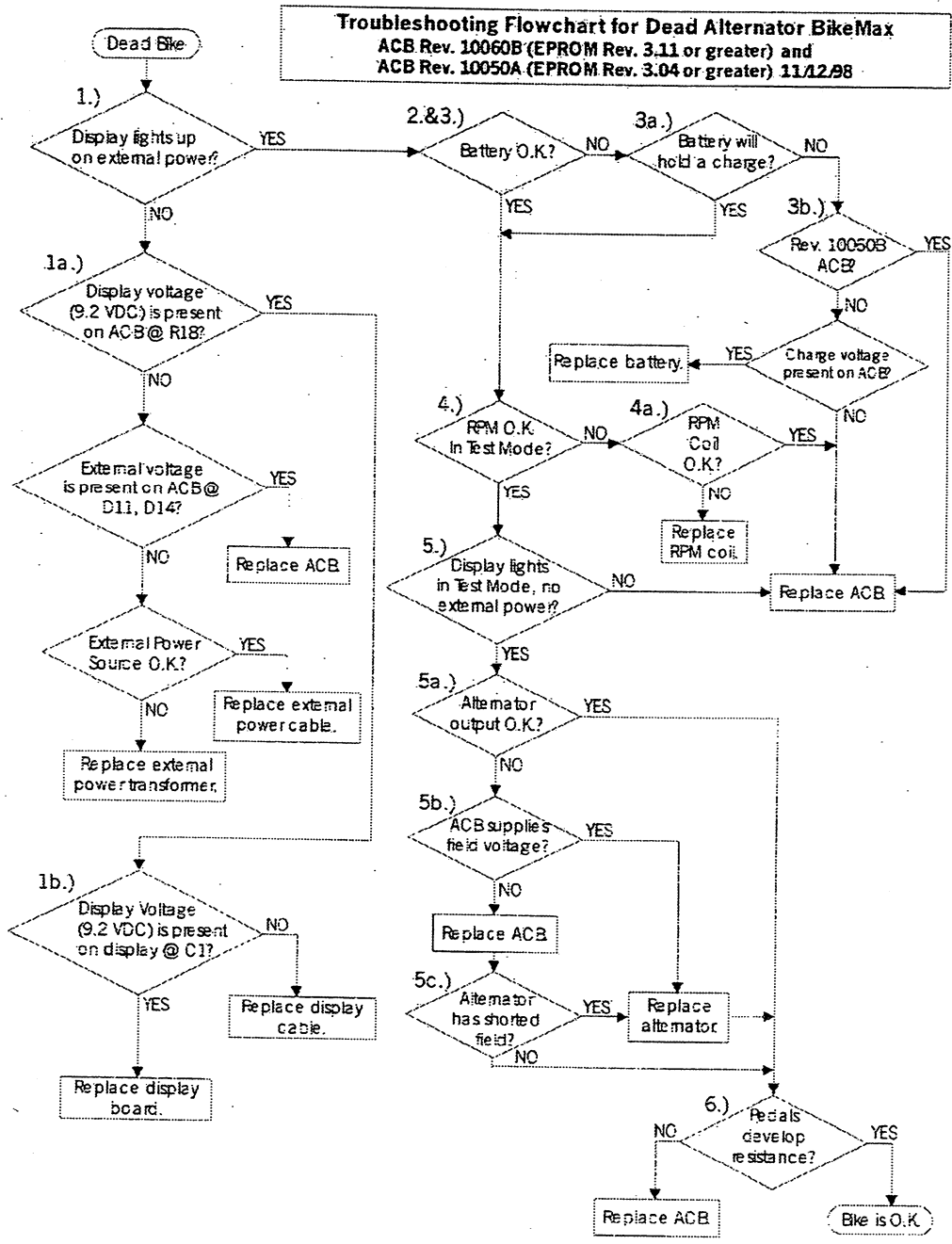
You should have the following tools before you begin:

- An external AC adapter (wall-transformer) with an output of 10-16 VAC or 12-18 VDC @1500mA. The AC adapter is available from Tectrix in either 110 or 230 AC input voltage configurations (see page 23).
- A simple digital or analog volt-ohm-meter.
- A #2 Phillips screwdriver.
- A flashlight.

Unless otherwise specified, all voltages described in this document are direct current (DC) referenced to circuit ground and made on the ACB. Make sure your voltmeter is on an appropriate DC scale. Circuit ground is available on the anode of D1 (the end of D1 not marked with a stripe) near the center of the ACB, just under the large header for the alternator cable (J4). Left, right, top, and bottom refer to the ACB as viewed with the lettering right-side up.

Whenever these instructions refer to a Test Mode feature, please see Chapter 4, "Using Test Mode." For instructions on removing and replacing the various components, if needed, see Chapter 5.

Before you start the troubleshooting procedure, study the BikeMax system block diagram in chapter 3 and the troubleshooting procedure flowchart.



## The Troubleshooting Sequence

The troubleshooting procedure listed below is extensive and can involve recharging the battery, which can take up to three hours. Certain steps in the troubleshooting procedure can require two people to perform the procedure. Also, some steps can be performed only on the BikeMax 3000, not the 1000.

1. The purpose of step 1 is to get the display board into Test Mode using external power. Power up the BikeMax in Test Mode using an external power adapter. To power up in Test Mode, press and hold the top HR Control key while plugging in the external power adapter. (You don't need to pedal to light the display console when external power is applied.) After you release the HR Control key, the console should display "BIKE TEST n.nn". The "n.nn" indicates the software EPROM version installed in the bike. This display verifies a good display board and display cable. If the display powers up with external voltage, proceed to step 2.

If the display does not light up with external power applied, the "dead" BikeMax must have a bad ACB, display cable, or display board (or there is more than one problem).

- 1A. Remove the covers. Look for display voltage (9.2 VDC) on the ACB at the right side of R18 (10060B: upper left corner; 10050A: upper right). If present, proceed to step 1B.  
Make sure the external voltage (AC or DC) is present at the anode of D14 (upper right of the ACB) referenced to the anode of D11. If external voltage is present, replace the ACB. If the voltage isn't present, unplug the external power cable from J3 of the ACB, and check for a bad external power transformer or bad external power cable. If the external power transformer no longer has any output, it may have blown a fuse (probably not replaceable) due to a bad ACB. In this case, replace the ACB, or be prepared to lose another external power transformer. Also check for a bad interconnect board on the external power plate.
  - 1B. If display voltage is present on the ACB, the BikeMax must have a bad display cable or bad display board. Access the rear side of the display board and check for display voltage (9.2 VDC) across C1, an electrolytic capacitor nearest the display cable header. If the display voltage is present, replace the display board. If not present, replace the display cable.
2. Verify correct operation of the BikeMax while operating normally on external power. (Press the "Clear" key twice to exit Test Mode.) If the only problem is a discharged battery, you may be able to recharge it by leaving it on external power. However, there is most likely a problem in the bike that caused the discharged battery. To continue troubleshooting, remove the BikeMax covers as described on page 22.
  3. Make sure the battery is good using the voltmeter. A good battery should measure 6.0 VDC minimum open-cell voltage (neither charging nor discharging- do not pedal or apply external power.) If the battery measures less than this, go to step 3A.

Check that the battery is correctly wired and plugged into the ACB at connector J6. (For 10050A boards, the battery must be plugged into connector JP3, *NOT* JP7!) The white wire of the battery cable goes to the positive (+) terminal of the battery. Note: the "+" mark on the battery is not visible while the battery is mounted to the assembly; you can determine battery polarity with the voltmeter. If the battery checks out O.K., go to step 4.

- 3A. A battery which measures at least 3.0 VDC may still be rechargeable using the external power supply. Leave the external power supply plugged into the BikeMax for at least one hour; a full charge may require two or three hours. The voltage across a battery should rise slowly to a plateau of 6.9 VDC while charging, but may still require two hours thereafter to reach a full charge.  
For revision 10060B (with battery mounted on the ACB), if the battery measures less than 6.0 VDC after you attempt to charge it replace the ACB.
- 3B. For revision 10050A ACB, if the battery measures less than 6.0 VDC after you attempt to charge it, perform the following test to see if battery charge voltage is present on the ACB. Unplug the battery cable from the ACB at connector JP3. With external voltage applied, measure the charging voltage available at JP3. If the voltage is less than 6.6 VDC or greater than 7.2 VDC, replace the ACB and charge the battery on external power. If the voltage at JP3 is correct (6.6 - 7.2 VDC), the battery is refusing to accept a charge, so replace the battery.
4. Put the BikeMax back into Test Mode on external power. To check the RPM sensor, pedal about 60 RPM and observe the Speed field on the display console. It should accurately show pedal RPM.
  - 4A. If no RPM displays in the Speed field, remove the covers and make sure the coil is in the correct position with respect to the alternator flywheel.

If it is correctly positioned, check the RPM sensor itself. Unplug it from connector J7 on the ACB. Set the voltmeter to a 10 VAC or 20 VAC alternating current range, and probe the two conductors at the plug on the end of the sensor's cable. Measure the voltage produced while someone else pedals the BikeMax at 60 RPM or greater. If this voltage is less than 2.5 VAC, replace the RPM coil. If the RPM sensor passes this test, measure its DC resistance while it is unplugged from the ACB and no one is pedaling. A good RPM sensor should measure about 850 ohms of DC resistance. If the sensor measures less than 750 ohms or more than 1000 ohms, replace it.

If the RPM sensor is good and positioned correctly, but you didn't get an RPM display while pedaling in Test Mode, replace the ACB.

5. Unplug the external power supply and try to start the BikeMax in Test Mode. Pedal faster than 40 RPM while holding down the top HR Control key. If the BikeMax display lights up, go to step 5A. Otherwise: If the display still won't light up on pedal power alone, replace the ACB.

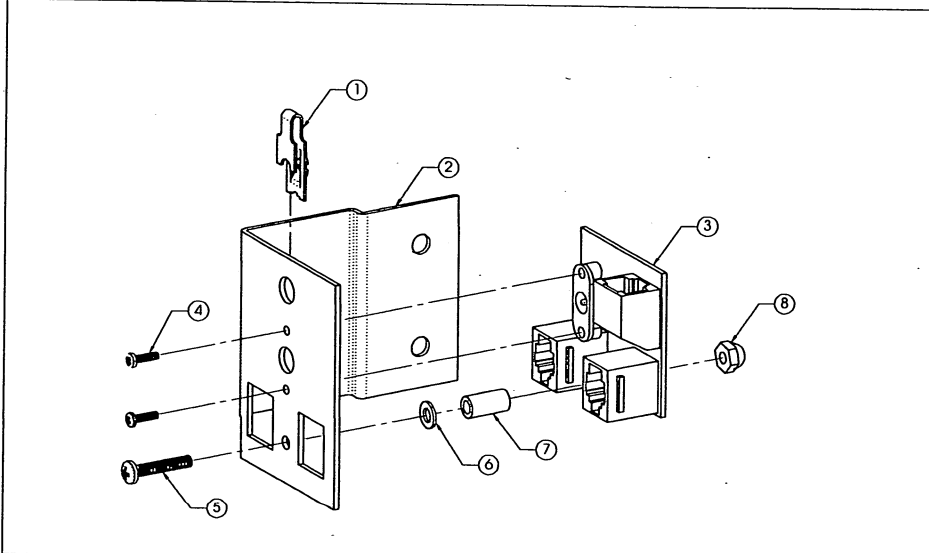
- 5A. If the BikeMax enters Test Mode without external power, but the display remains dim and, after you press the Advanced Options key the V/alt field reads no more than 6.0 VDC, the alternator is not being energized. This indicates a bad ACB, bad alternator cable, or bad alternator. (Unfortunately, it is quite possible that both the alternator and the ACB are bad.) Do not operate the BikeMax indefinitely in this condition. It is operating on battery power only, and the battery will eventually discharge. In this case, go to step 5B. If the display is normal in brightness and the V/alt field reads 9.0 VDC or more, go to step 6.
  - 5B. To see if the problem is the ACB and cable, or in the alternator itself, disconnect the white field wire from the alternator. Leave the black and red wires of the cable connected to the alternator. Connect the voltmeter to the loose ring terminal on the white wire at the end of the alternator cable. (You can ground the meter at the alternator terminal where the black wire is connected.) Pedal the BikeMax and read the voltmeter while pedaling at least 40 RPM (fast enough to light the display to its dim state). If the meter reads more than 4.0 VDC, replace the alternator. Otherwise, check the continuity of the three conductors in the alternator cable. If the cable lacks full continuity, repair or replace it, and retest. If the ACB will not supply 4.0 VDC to the alternator with a good cable, replace the ACB.
  - 5C. Before attempting to operate the BikeMax, check for a shorted field winding in the alternator. With the white field wire still disconnected, measure the DC resistance of the field winding of the alternator. Set the meter to the lowest resistance scale. Measure from the screw terminal on the alternator where the white wire was connected to the terminal where the black wire is connected. A good field winding has a DC resistance of about four ohms. If the meter reads less than two ohms, the alternator's field winding is at least partially shorted. If so, replace the alternator immediately. The bad alternator may have caused the failure of the original ACB, and it may cause the replacement ACB to fail as well.
6. When the BikeMax can power up properly without external power, perform a final check for pedal resistance. (Lack of pedal resistance should not cause a dead BikeMax, but the test verifies functionality of the alternator and ACB.) Enter Test Mode, press the Advanced Options key (you can do this only on the BikeMax 3000), and then press the Up Arrow key to command 300W of power. With enough pedal power (it should require substantial effort), the Actual Power field (the "Heart Rate" field in Test Mode) should also read 300W. Also, the V/alt ("Calories Burned") field should read 15.0 VDC or greater. If there is no pedal resistance, see if the large ribbed load resistor on the ACB is plugged in at header JP6. If it is, replace the ACB.



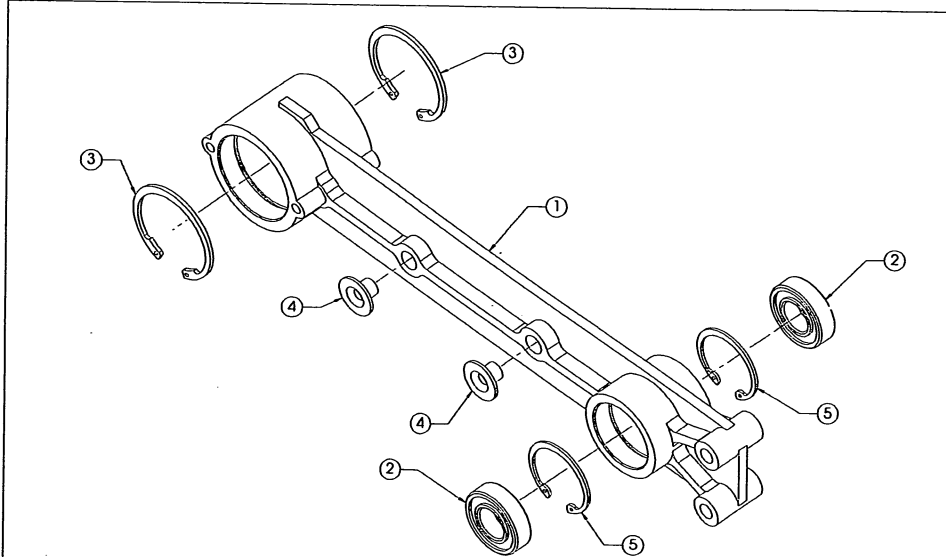
## **APPENDIX C ENGINEERING DRAWINGS**

Beginning on the next page, this appendix contains a number of the engineering drawings for both recumbent and upright BikeMax models. These drawings may help you perform the diagnostic and repair procedures found in this manual.

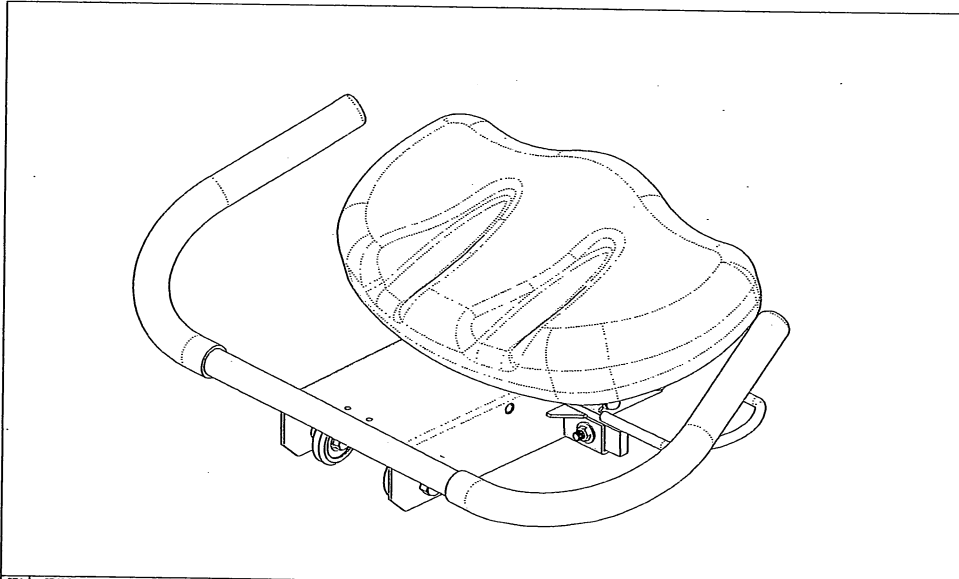
### Engineering Drawings: Post-October 1998 Alternator Bikes



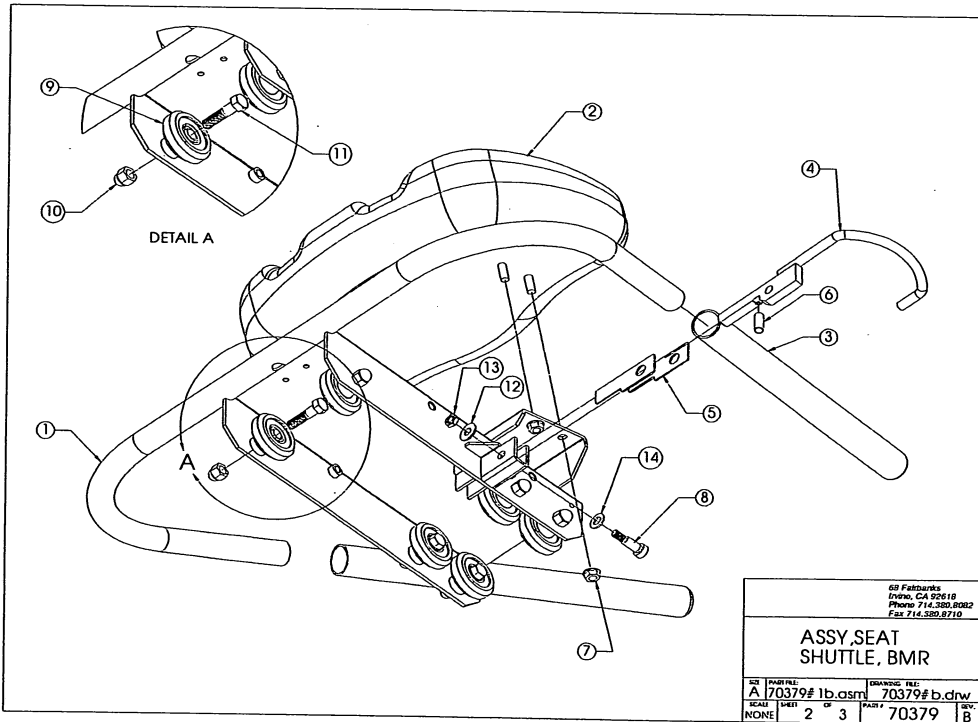
|                                       |    |          |                                                                                     |                                                                             |
|---------------------------------------|----|----------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| REV. REVISIONS                        | BY | DATE     | Tolerances                                                                          | 68 Fairbanks,<br>Irvine, CA 92618<br>Phone 949-389-8782<br>Fax 949-389-4719 |
| - RELEASED FOR PRODUCTION (ECN# 1155) | EA | 06-29-98 | DECIMALS $\pm 0.10$<br>$\pm 0.05$<br>ANGLES $\pm 1.5^\circ$<br>FRACTIONS $\pm 1/64$ |                                                                             |
| MATERIAL: SEE INDIVIDUAL DRAWINGS     |    |          | DRAWN BY: EABENOZA 06-29-98                                                         | ASSY. EXTERNAL POWER<br>PLATE, BMU A1                                       |
| FINISH: SEE INDIVIDUAL DRAWINGS       |    |          | CHECKED BY: DATE                                                                    |                                                                             |
|                                       |    |          | DATE                                                                                | SIZ SCALE INCHES                                                            |
|                                       |    |          | 61003.sldasm                                                                        | A 1/1 61003                                                                 |



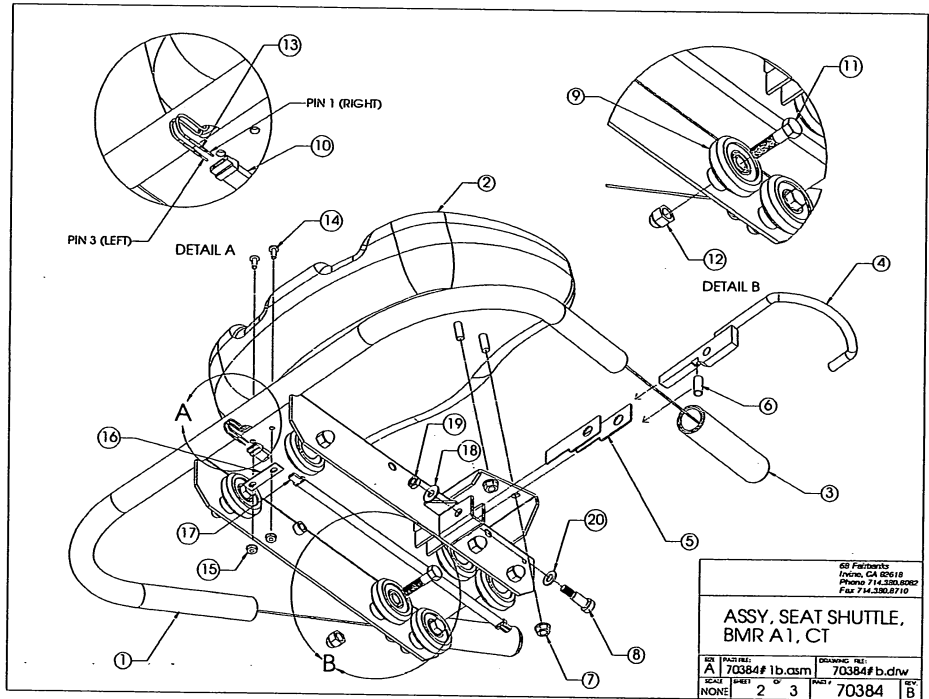
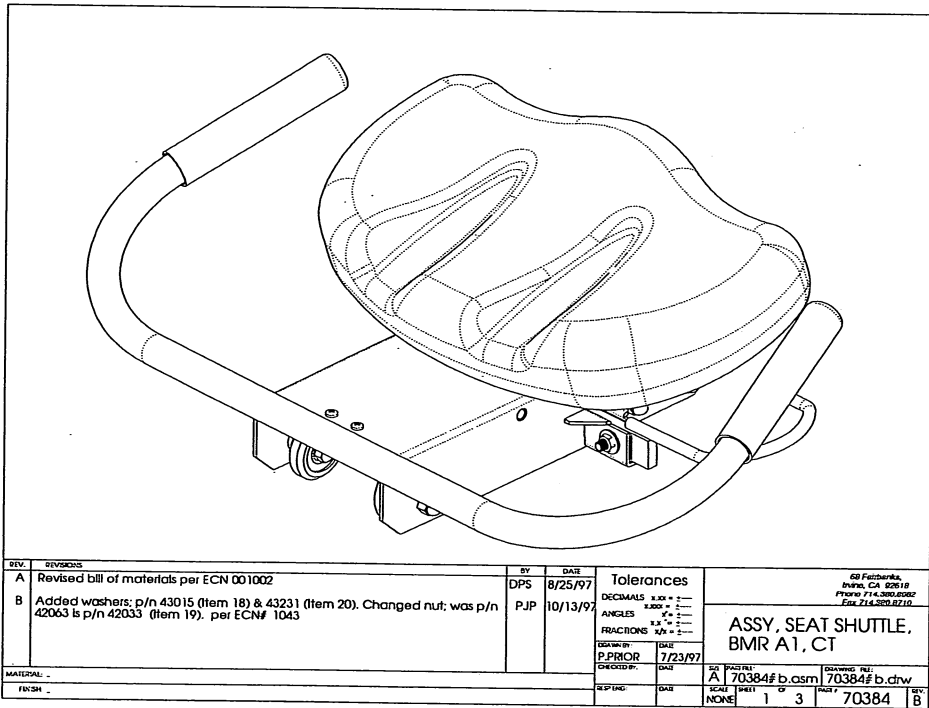
|                                         |     |         |                                                                                     |                                                                             |
|-----------------------------------------|-----|---------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| REV. REVISIONS                          | BY  | DATE    | Tolerances                                                                          | 68 Fairbanks,<br>Irvine, CA 92618<br>Phone 949-389-8782<br>Fax 949-389-4719 |
| A Revise 50108c to 50108d per ECN 01085 | RPM | 12/9/97 | DECIMALS $\pm 0.10$<br>$\pm 0.05$<br>ANGLES $\pm 1.5^\circ$<br>FRACTIONS $\pm 1/64$ |                                                                             |
| MATERIAL: -                             |     |         | DESIGNED BY: P. PRIOR 6/17/97                                                       | ASSY. ENGINE FRAME                                                          |
| FINISH: -                               |     |         | CHECKED BY: DATE                                                                    |                                                                             |
|                                         |     |         | DATE                                                                                | SIZ INCHES                                                                  |
|                                         |     |         | 62020# a.prt                                                                        | DRAWING FILE: 62020# a.dwg                                                  |
|                                         |     |         | 3/8                                                                                 | SCALE SHEET OF 2                                                            |
|                                         |     |         |                                                                                     | 62020                                                                       |

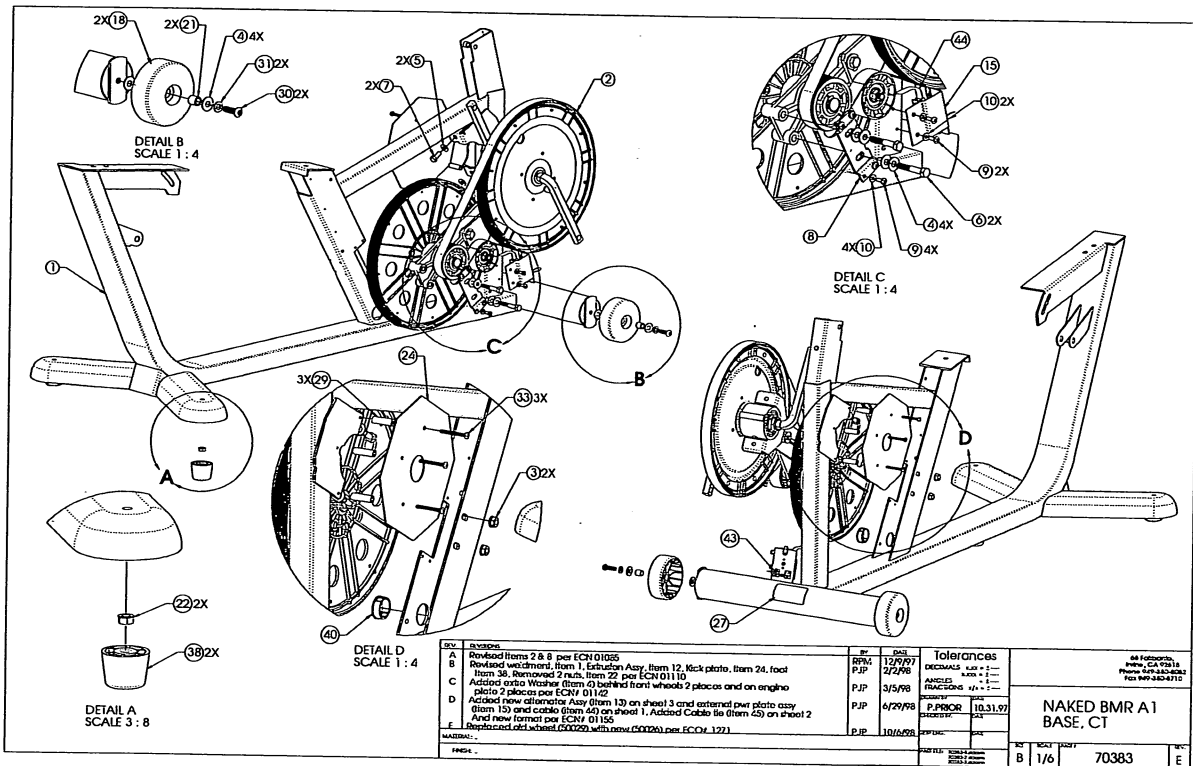
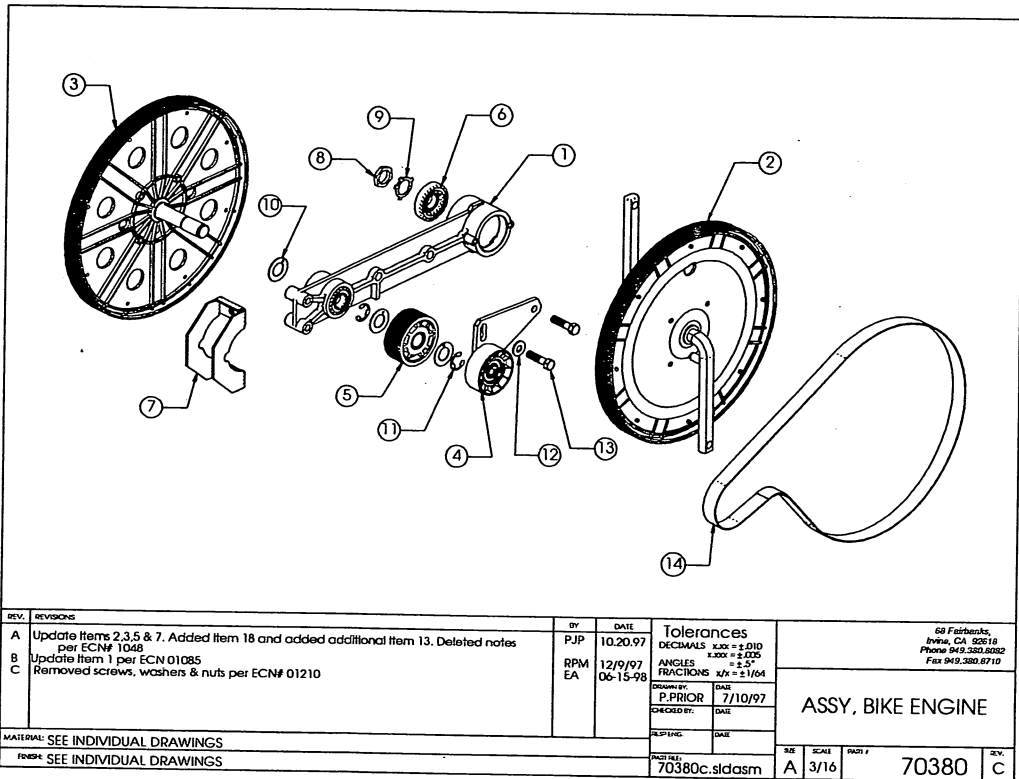


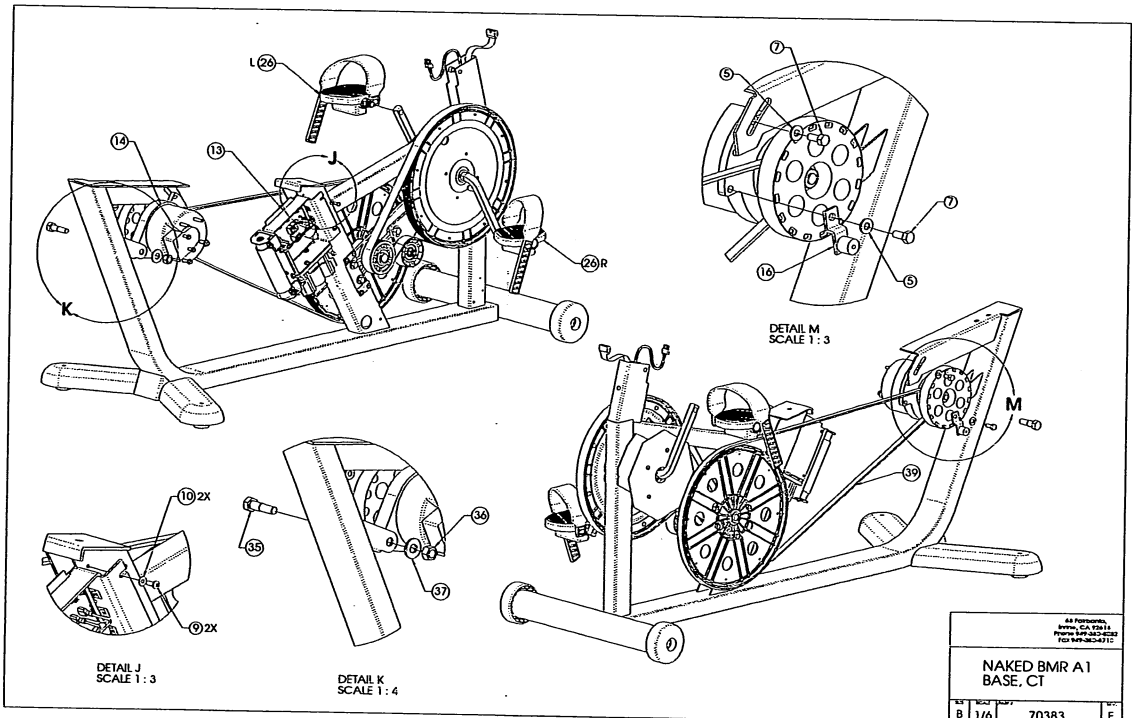
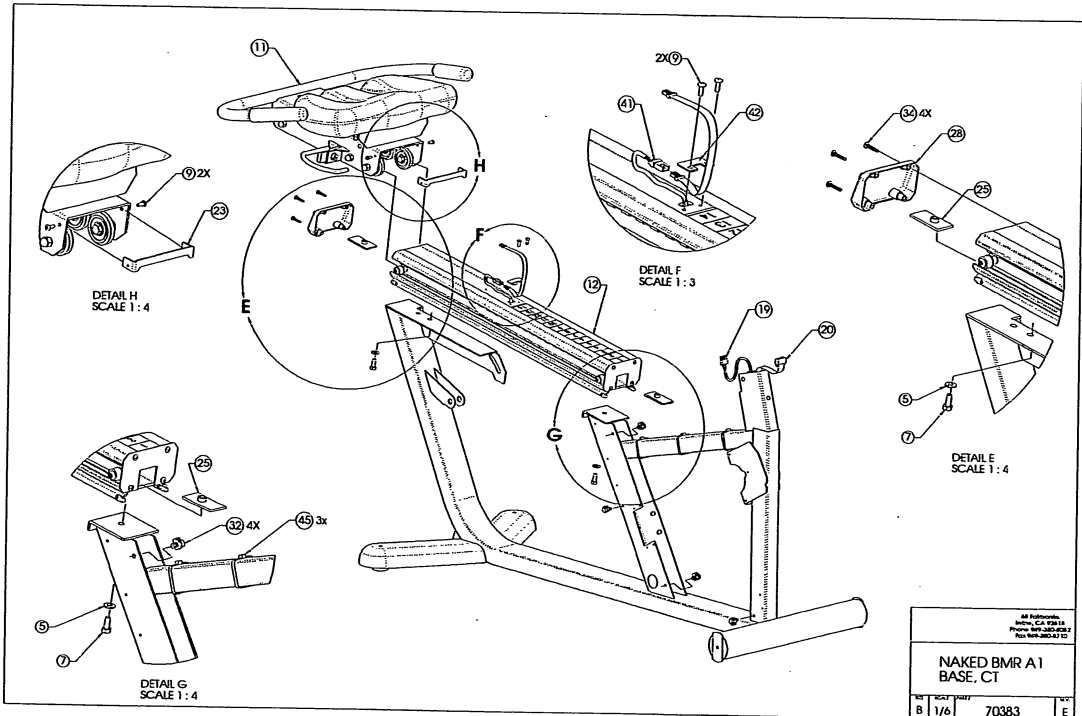
|           |                                                                                                                    |              |          |                                                                                                                       |                                                                            |
|-----------|--------------------------------------------------------------------------------------------------------------------|--------------|----------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| REV.      | REVISIONS                                                                                                          | BY           | DATE     | Tolerances                                                                                                            | 68 Fairbanks<br>Irvine, CA 92618<br>Phone 714.380.8082<br>Fax 714.380.8710 |
| A         | Revised Bill of Material per ECN# 01002                                                                            | PJP          | 8/20/97  | DECIMALS $\pm .000$<br>ANGLES $\pm .1$<br>FRACTIONS $\pm .001$                                                        |                                                                            |
| B         | Added washers: p/n 43015 (item 12) & 43231 (item 14). Changed nut: was p/n 42063 is 42033 (item 13), per ECN# 1043 | PJP          | 10/14/97 | DRAWN BY: P. PRIOR<br>CHECKED BY: [ ]<br>DATE: 7/23/97                                                                | ASSY, SEAT SHUTTLE, BMR                                                    |
| MATERIAL: |                                                                                                                    | DESCRIPTION: |          | SET PART FILE: A 70379# 1b.asm<br>SCALE: NONE<br>SHEET: 1 OF 3<br>DRAWING FILE: 70379# b.drw<br>PART: 70379<br>REV: B |                                                                            |

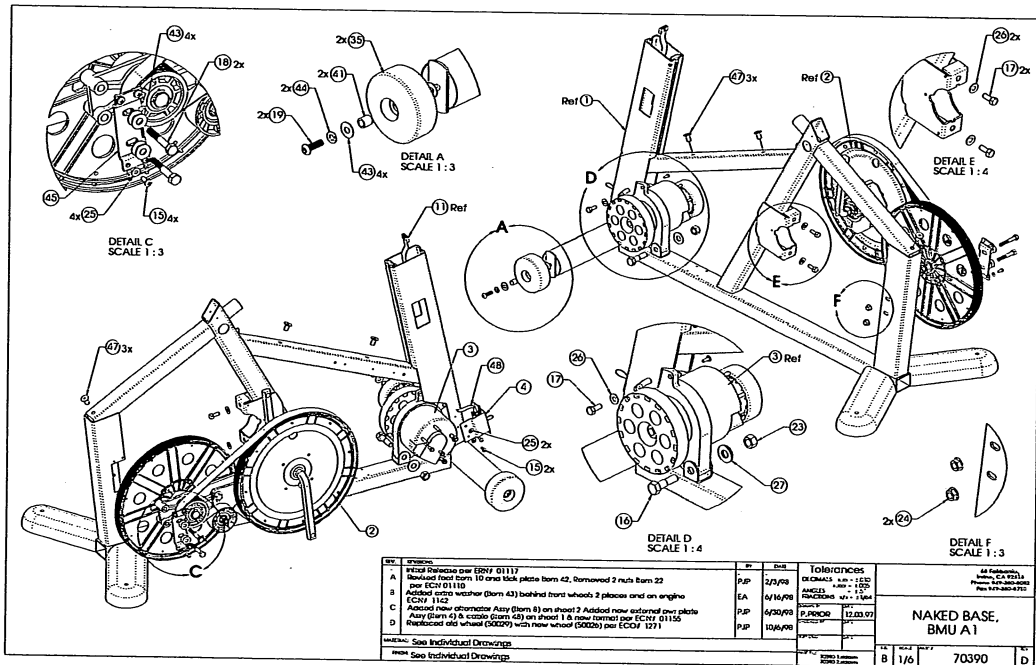
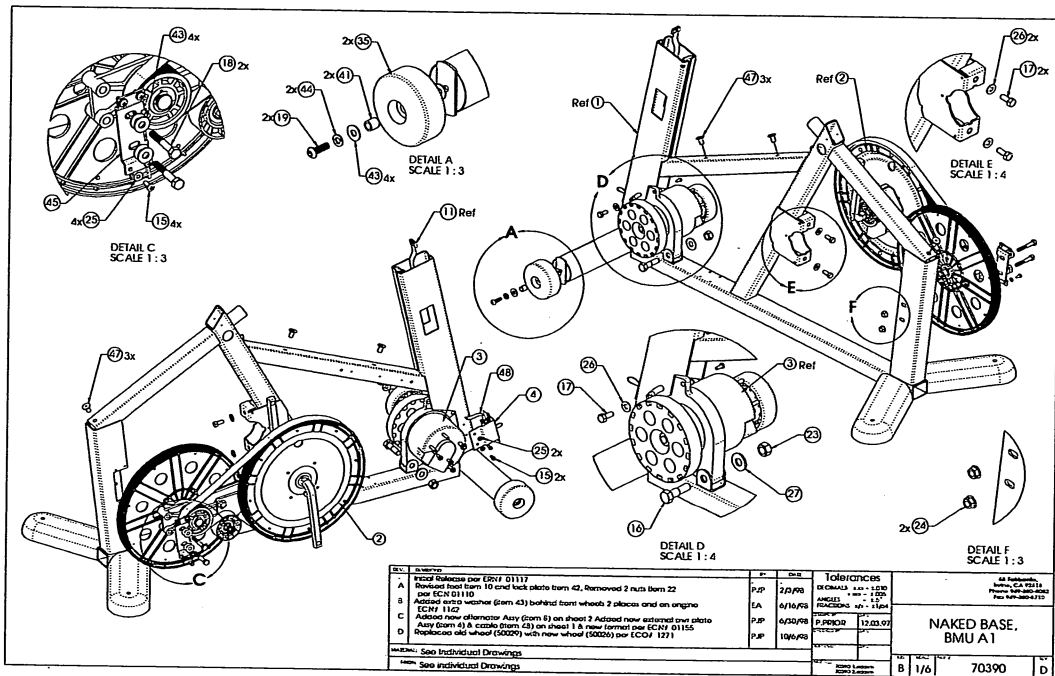


|                                                                            |                 |               |              |
|----------------------------------------------------------------------------|-----------------|---------------|--------------|
| 68 Fairbanks<br>Irvine, CA 92618<br>Phone 714.380.8082<br>Fax 714.380.8710 |                 |               |              |
| ASSY, SEAT SHUTTLE, BMR                                                    |                 |               |              |
| SET PART FILE:                                                             | A 70379# 1b.asm | DRAWING FILE: | 70379# b.drw |
| SCALE:                                                                     | NONE            | SHEET:        | 2 OF 3       |
| PART:                                                                      | 70379           | REV:          | B            |









### Engineering Drawings: Pre-October 1998 Alternator Bikes

NOTES: UNLESS OTHERWISE SPECIFIED  
 1. NUT (ITEM 4c) IS SUPPLIED WITH CABLE (ITEM 4).  
 2. VERIFY POWER JACK THREADS ARE INSULATED FROM POWER PLATE.

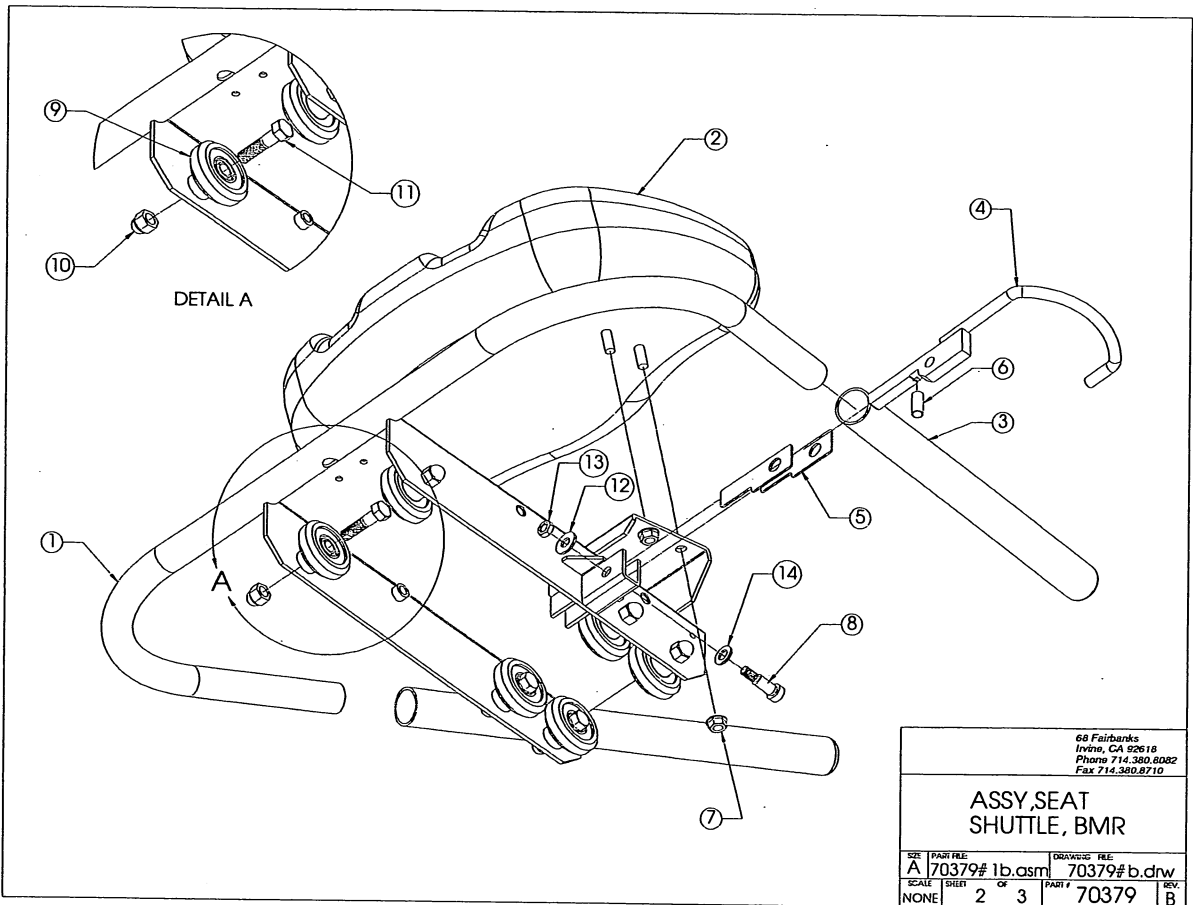
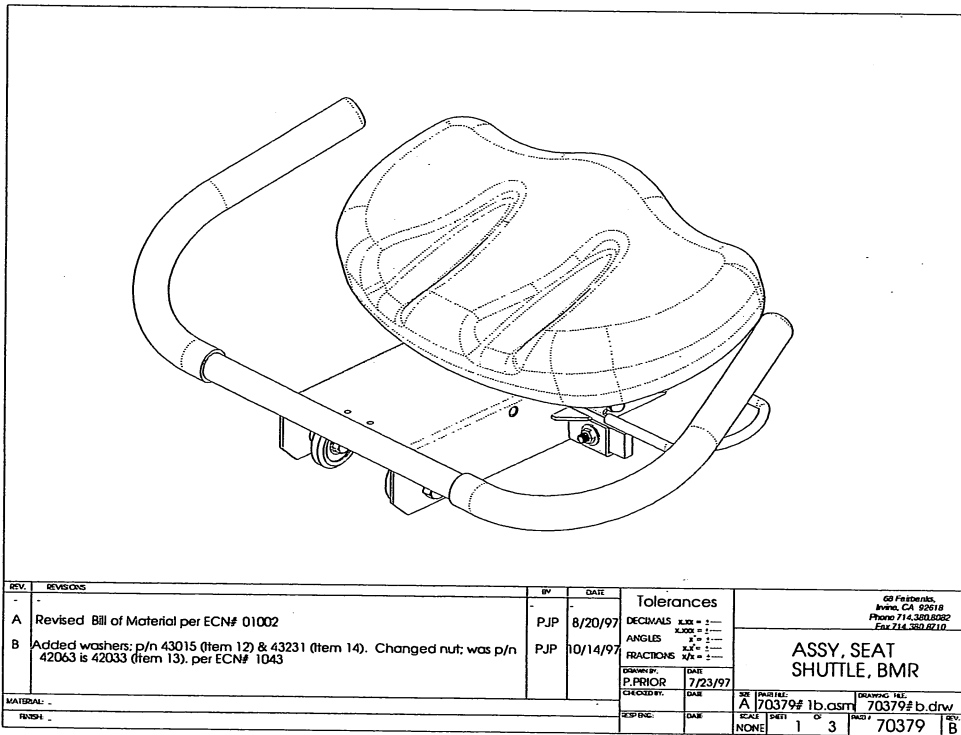
| REV. | REVISIONS | BY | DATE |
|------|-----------|----|------|
|      |           |    |      |

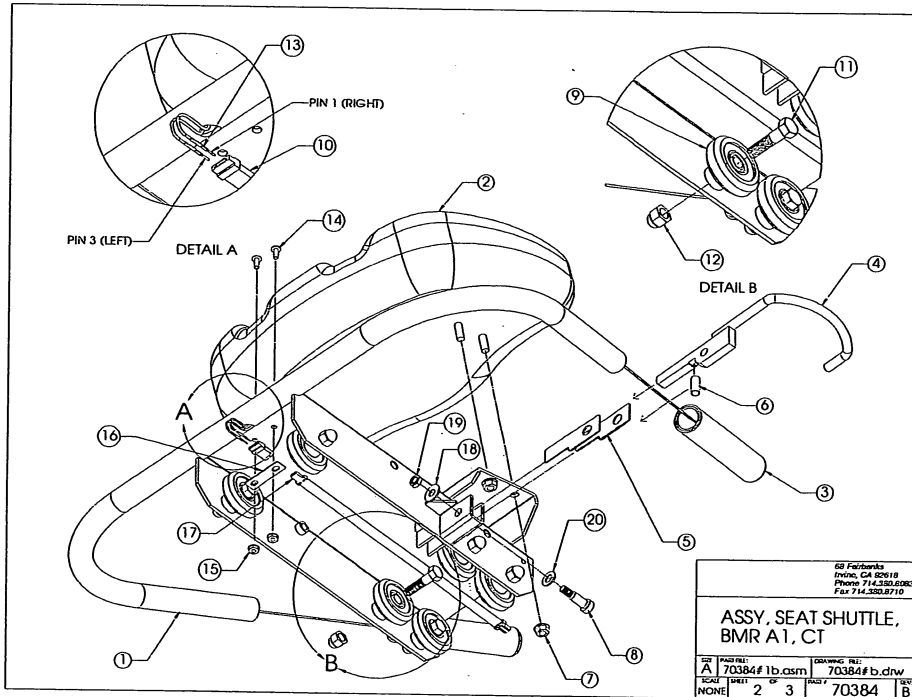
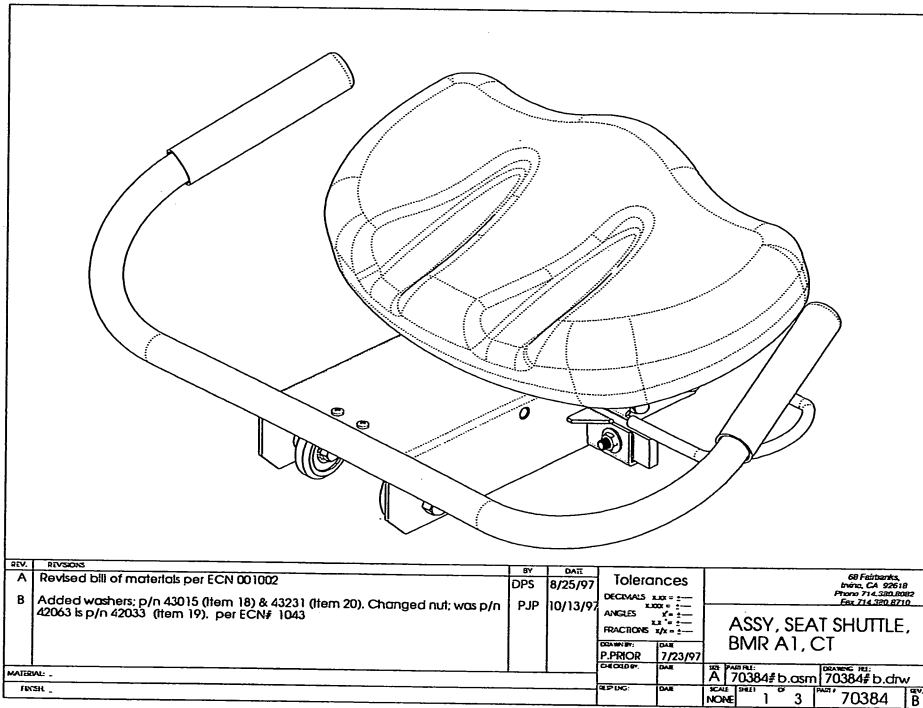
|             |           |                                                                             |            |
|-------------|-----------|-----------------------------------------------------------------------------|------------|
| Tolerances  |           | 60 Fairbanks,<br>Irvine, CA 92618<br>Phone 714.320.0302<br>Fax 714.320.0710 |            |
| DECIMALS    | 0.001 = 1 | ASSY, EXTERNAL POWER<br>PLATE, BMU A1                                       |            |
| ANGLES      | 0.001 = 1 |                                                                             |            |
| FRACTIONS   | 1/16 = 1  |                                                                             |            |
| FRACTIONS   | 1/8 = 1   |                                                                             |            |
| DRAWN BY:   | P.PRIOR   | DATE:                                                                       | 7/28/97    |
| CHECKED BY: |           | DATE:                                                                       |            |
| MATERIAL:   |           | SIZE:                                                                       | A          |
| FORM:       |           | SCALE:                                                                      | 1/1        |
|             |           | SHEET:                                                                      | 1          |
|             |           | OF:                                                                         | 2          |
|             |           | DRAWING FILE:                                                               | 61541#.DRW |
|             |           | REV:                                                                        | 61541      |

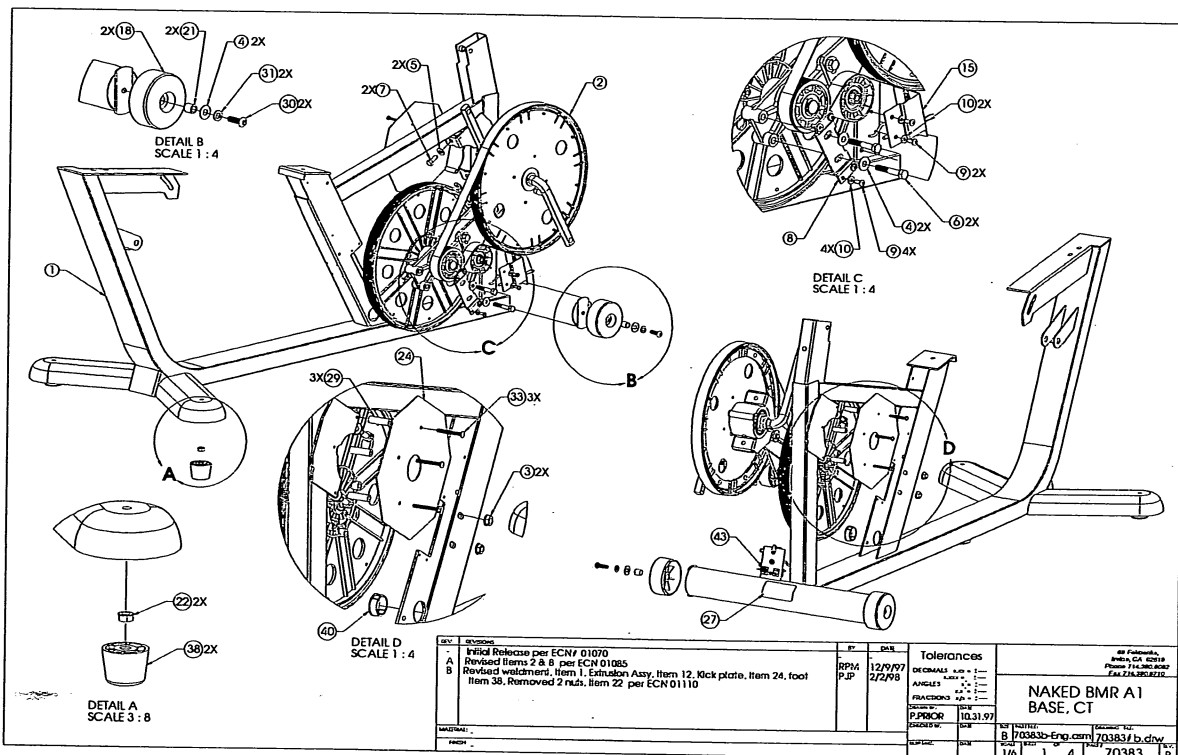
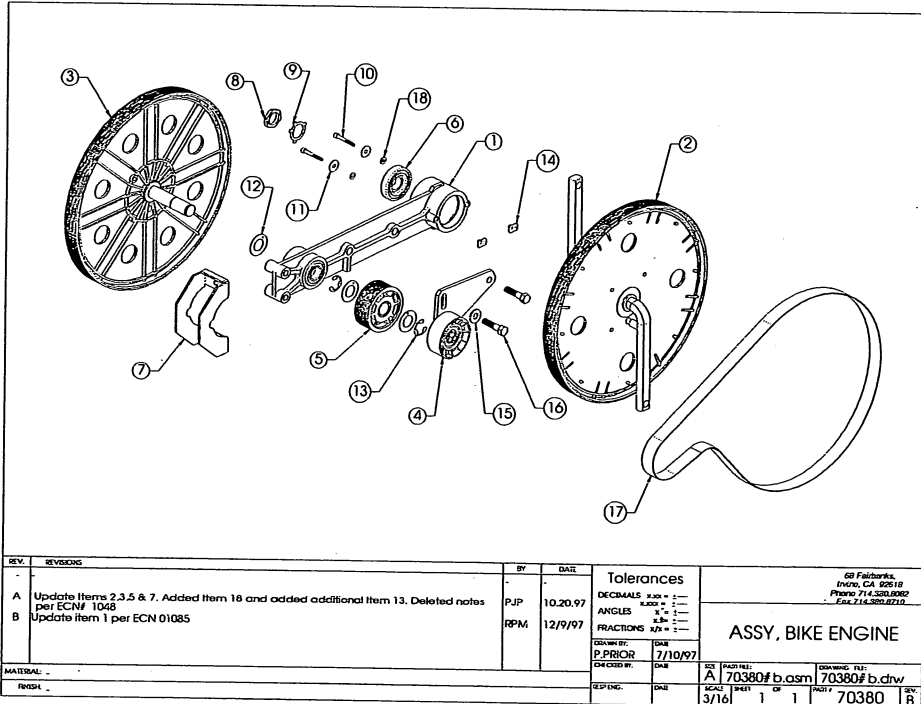
| REV. | REVISIONS                             | BY  | DATE    |
|------|---------------------------------------|-----|---------|
| A    | Revise 50108c to 50108d per ECN 01085 | RPM | 12/9/97 |

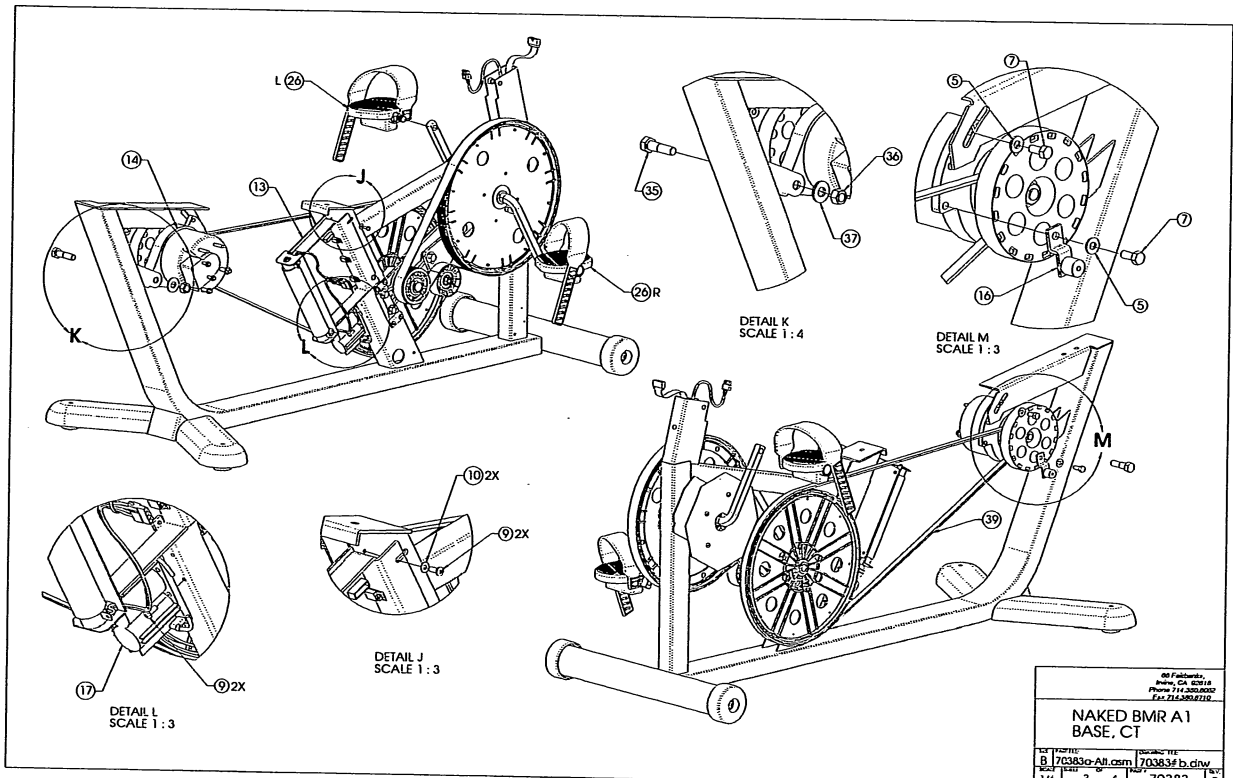
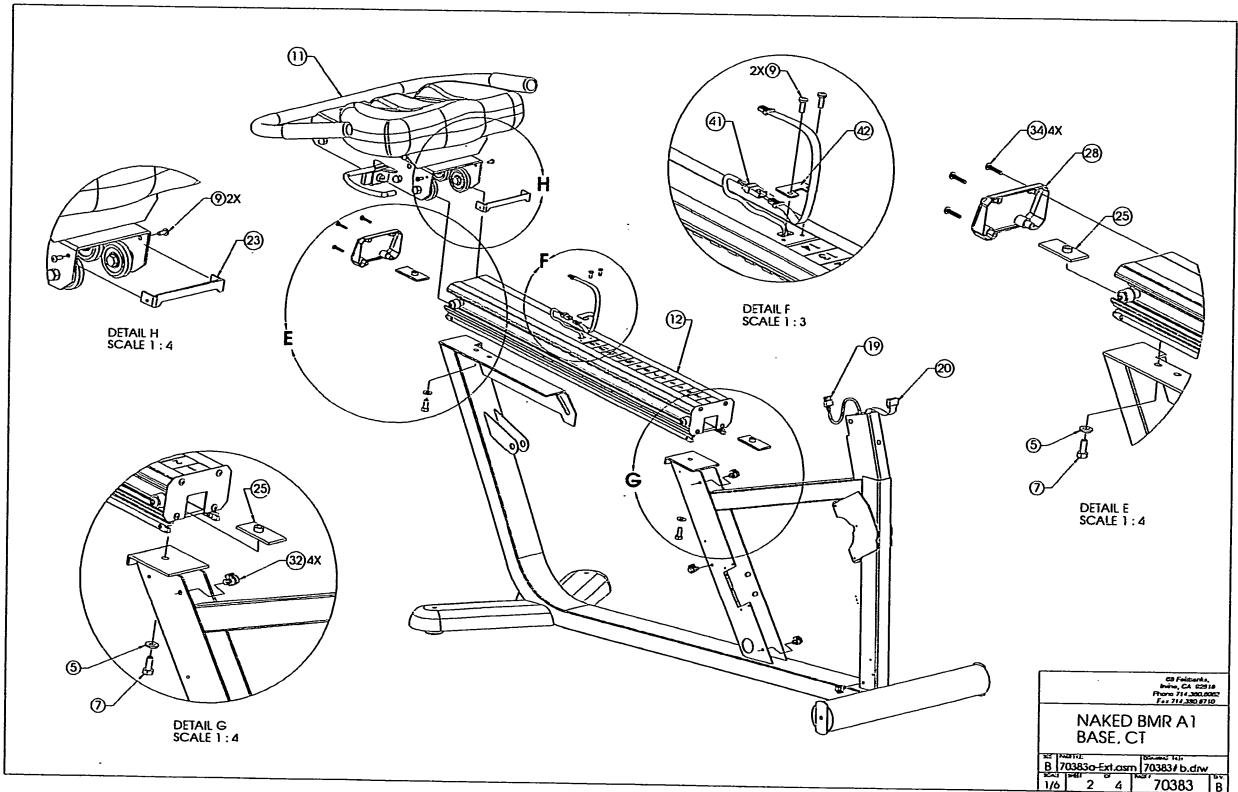
|             |           |                                                                             |              |
|-------------|-----------|-----------------------------------------------------------------------------|--------------|
| Tolerances  |           | 60 Fairbanks,<br>Irvine, CA 92618<br>Phone 714.320.0302<br>Fax 714.320.0710 |              |
| DECIMALS    | 0.001 = 1 | ASSY, ENGINE FRAME                                                          |              |
| ANGLES      | 0.001 = 1 |                                                                             |              |
| FRACTIONS   | 1/16 = 1  |                                                                             |              |
| FRACTIONS   | 1/8 = 1   |                                                                             |              |
| DRAWN BY:   | P.PRIOR   | DATE:                                                                       | 6/17/97      |
| CHECKED BY: |           | DATE:                                                                       |              |
| MATERIAL:   |           | SIZE:                                                                       | A            |
| FORM:       |           | SCALE:                                                                      | 3/8          |
|             |           | SHEET:                                                                      | 1            |
|             |           | OF:                                                                         | 2            |
|             |           | DRAWING FILE:                                                               | 62020# a.prt |
|             |           | REV:                                                                        | 62020        |















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