

Teres Reference II Motor Manual

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I. Description

The Teres reference motor includes a smart speed controller and a custom built Maxon precision motor packaged in a heavy aluminum housing. The Teres controller has a unique circuit that quickly brings the platter up to the correct speed. However, after the platter has reached the proper speed the controller switches to a mode that can only change the output voltage a few millivolts per minute. This avoids hunting (constantly making small speed adjustments) that degrades sonic performance of typical automated DC controllers. Once locked in the Teres controller adjusts the speed only enough to compensate for the slow speed drift that occurs during operation. The Teres is best described as a self calibrating fixed DC regulator.

In addition to automatic speed control the Teres motor has some nice ergonomic features that make it a pleasure to use. Giving the platter a gentle push automatically starts the motor. Slowing the platters speed with your hand automatically shuts off the motor. If you happen to fall asleep during a late night listening session the motor will automatically shut off after 45 minutes. Changing speed from 33 to 45 RPM is done by simply holding down the pushbutton for 2 seconds.

The Reference motor includes a battery supply with charger/controller circuit board, cable and a 12 amp hour sealed lead acid battery housed in an aluminum enclosure. The charging circuit consists of a simple current limited voltage regulator that provides “trickle” charging of the battery. The charging circuit is disconnected when the motor is locked into the correct speed.

This provides complete isolation from the AC line while the turntable is in operation. It has been determined that having the charging circuit connected during play causes a small sonic degradation. A fully charged battery will operate the turntable constantly for more than 200 hours. The charging circuit is engaged any time that the motor is not running to keep the battery fully charged.

II. Installation and Setup

1. Install the AC cord.
2. Connect the power cable from the battery supply to your Teres motor unit. The connector is keyed for proper orientation.
3. Insert the infrared sensor into the turntable base so that it is 1 to 2mm from the strobe disk (a little less than 1/16" is ideal) and secure in place with adhesive. The sensor's orientation does not matter.
4. Plug the sensor cable into the bottom of the motor pod. The connector is keyed for proper orientation
5. Place the motor pod next to the turntable and install the mylar tape belt around the platter and the motor pulley.
6. With the drive belt fairly loose turn the platter by hand a couple of turns to align the belt. After the belt is aligned slowly slide the motor pod outward to tension the belt. The belt needs only a small amount of tension to work properly. Use just enough tension to avoid slippage.
7. Slide the motor pod to tension the thread. The thread does not need much tension to work properly. When tensioned correctly the thread should slip on the pulley for a few seconds during startup. The tension is not critical and a little experimentation will quickly deliver good results.

Initially the battery will be partially discharged and will require 4-10 hours of charging before it is fully charged. **WARNING:** The battery will be damaged if it sits when partially discharged. For long battery life the charger should be plugged in at all times.

III. Operation

The Teres controller utilizes an embedded micro controller that makes operation simple and elegant. To start the motor press the controller button or give the platter a push. The red LED comes on when the motor is coming up to speed. After 5-10 seconds the green LED should also come on indicating that the speed is within 1%. The green LED will flash several times before coming on steady. After the green light has been on for about 4 seconds then the red LED will turn off indicating that the speed is locked in.

To turn off the motor press the controller button again or slow down the platter by hand.

Holding the pushbutton down for more than one second will switch between 33.3 and 45 rpm.

IV. Motor Unit Troubleshooting

Background

The Teres motor has green and red LEDs that indicate status of the controller. When the motor first starts the red LED comes on to indicate that the controller is in spin up mode. In spin up mode the controller attempts to quickly bring the platter up to the correct speed. The green light comes on whenever the speed is within 1.5% of the correct speed. As the platter is spinning up the green light will flicker as the controller attempts to establish the correct speed.

Once the controller has established the correct speed the red LED will turn off. This indicates that the controller has switched to a slow integrative mode that keeps the speed locked in and can only compensate for minor speed drift.

If for any reason the speed goes out of tolerance after it has locked in the red light will come back on and the green light will flicker as the controller tries to again establish the correct speed. When this happens there is a clearly audible speed variation. This is by design. If the mechanical setup of the turntable does not allow the speed to stay in tolerance it is important to know about it so that it can be corrected. Unfortunately, this feature often is misinterpreted as a controller/motor fault.

Any turntable drive system must be properly setup for good speed stability. The Teres motor quickly brings subtle problems to your attention so that they can be corrected.

Symptom:

Spinning the platter does not start the motor. Green light does not come on at all. This indicates that there is no signal from the sensor.

Possible Causes:

- 1) Sensor is not properly connected
- 2) Defective sensor
- 3) A problem in the controller comparator circuit.

Symptom:

The motor starts when the platter is spun. The green light flickers but does not come on solid. The motor often shuts off after a few seconds. This indicates an inadequate signal from the sensor.

Possible Causes:

- 1) The sensor to strobe disk distance is incorrect. This is by far the most common reason for this symptom. The optical sensor must be 1-2mm from the strobe disk (roughly 1/16"). This setting typically may be verified visually without removing the platter.
- 2) Defective sensor or controller comparator circuit.

Symptom:

After operating correctly for several minutes the motor suddenly speeds up or shuts off.

Possible Causes:

- 1) Static discharge. As static builds up in the platter it can discharge through the drive string into the motor. This confuses the micro-controller resulting in a momentary loss of correct speed. In some cases the controller must be power cycled to restore proper operation. Grounding the bearing normally resolves this problem. The bearing ground wire should be connected to the preamp ground either directly or through the tonearm.

- 2) The Teres motor has an automatic shutoff feature that will turn the motor off after 40 minutes of uninterrupted play. To avoid this timeout restart the motor when the record is changed or re-queued. This feature may be disabled by installing a jumper across J3 on the controller circuit board.

Symptom:

During play there is an audible change in speed. The red light comes on briefly. This symptom usually indicates a mechanical problem somewhere in the drive system.

Possible Causes:

- 1) Grit in bearing. Without the platter installed the bearing should turn smoothly. The damping from the bearing oil will provide a fair amount of resistance but the bearing should turn smoothly. If the bearing does not turn smoothly it must be disassembled, cleaned and inspected.
- 2) Belt tension. If there is not enough belt tension the motor will be unable to maintain proper speed. It is difficult to describe the proper tension. However, a little experimentation will quickly establish how much tension is needed.

Symptom:

Minor speed variances audible when listening. The red light does not come on. This indicates that there is uneven drag on the platter that still allows the speed to stay within the 1.5% tolerance of the controller. Minor speed problems will reduce sound quality but may not be evident as a speed instability issue.

Possible Causes:

- 1) Grit in the bearing (see above).
- 2) Something rubbing on the platter. If the optical sensor is installed so that it touches the platter it will cause subtle but audible speed variations. Cable and wires may also be positioned so that they contact the platter and cause minor speed problems.

V. Battery Supply Trouble Shooting

Sealed lead acid batteries have a lifetime of 2-4 years. The procedure for determining if the battery has failed is fairly simple if you have a voltmeter. Here is the procedure:

1. Make sure that both fuses on the charger PCB are good.
2. Disconnect the red lead to the battery and measure the voltage across the red and black leads coming from the charger. The voltage should be 13.75v +/- 0.02v. Adjust P1 if required.
3. Re-connect the red lead to the battery and measure the voltage. If the voltage climbs slowly this indicates that the battery is accepting a charge. If the battery voltage remains less than 12v after about 4 hours of charging then it is defective (shorted cell).
4. If the battery voltage rises to at least 13v switch on the motor and measure the battery voltage. If the voltage drops below 12v then the battery is defective (open cell).

Fortunately, replacement batteries are inexpensive. For replacement select a PowerSonic model PS-12120 (12v 12AH) or equivalent. A good source is Rage battery:

<http://www.ragebattery.com>

Note: The battery supply may be temporarily configured for operation without a battery. To enable this option:

1. Remove the battery supply cover
2. Remove the shorting jumper from the 2 pin header labeled "S02" near the right rear of the PCB (as viewed from the front of the box).

3. Reinstall the cover.

VI. Testing & Calibration

The Battery option is pre-calibrated and normally will not need to be re-adjusted. The Teres battery option has one adjustment that must be accurately set for proper operation. A multimeter capable of accurately measuring 10mv is required.

1. Begin with the battery supply plugged into AC power, the cable to the motor unit disconnected and the positive lead to the battery disconnected.
2. Connect the multimeter to the battery connectors and adjust P1 for 13.75 volts (+- 0.02v).
3. Re-connect the positive lead to the battery.

VII. Drive Belts

The Teres motor comes with a drive belt fabricated from ½” mylar tape. We prefer the sound of mylar tape but there is not a clear consensus about the best drive belt material. Other materials such as silk thread, fly fishing line and rubber belts have been used with good results.

VIII. Additional Information

Detailed product information and updates are available from the Teres web page.

[Http://www.teresaudio.com](http://www.teresaudio.com)