
Chapter 19

Equipment and Accessory Setup and Troubleshooting

(Revision 3, Aug 2007)

The information in this chapter is provided to assist you in avoiding some of the common pitfalls associated with setting up and using the various accessories, cables and sensors required for performing routine balance or vibration survey jobs with the Viper 4040.

19.1. - Battery Charger and Battery

The following troubleshooting paragraphs apply only to the Nickel Cadmium (NiCd) battery installed as original equipment in analyzers having a 01xxx serial number.

CAUTION

The charger is built for indoor use only. Don't expose the charger to the elements.

WARNING

Power requirements must be determined on an individual basis. Operating the Viper with the battery charger connected can affect the accuracy of the acquired readings. The analyzer was not intended to be operated during the charging process.

Always replace the cap on the "BATT CHG" port of the analyzer. The unprotected pins may short out on surrounding material and cause damage to the analyzer or battery.

Battery Specifications

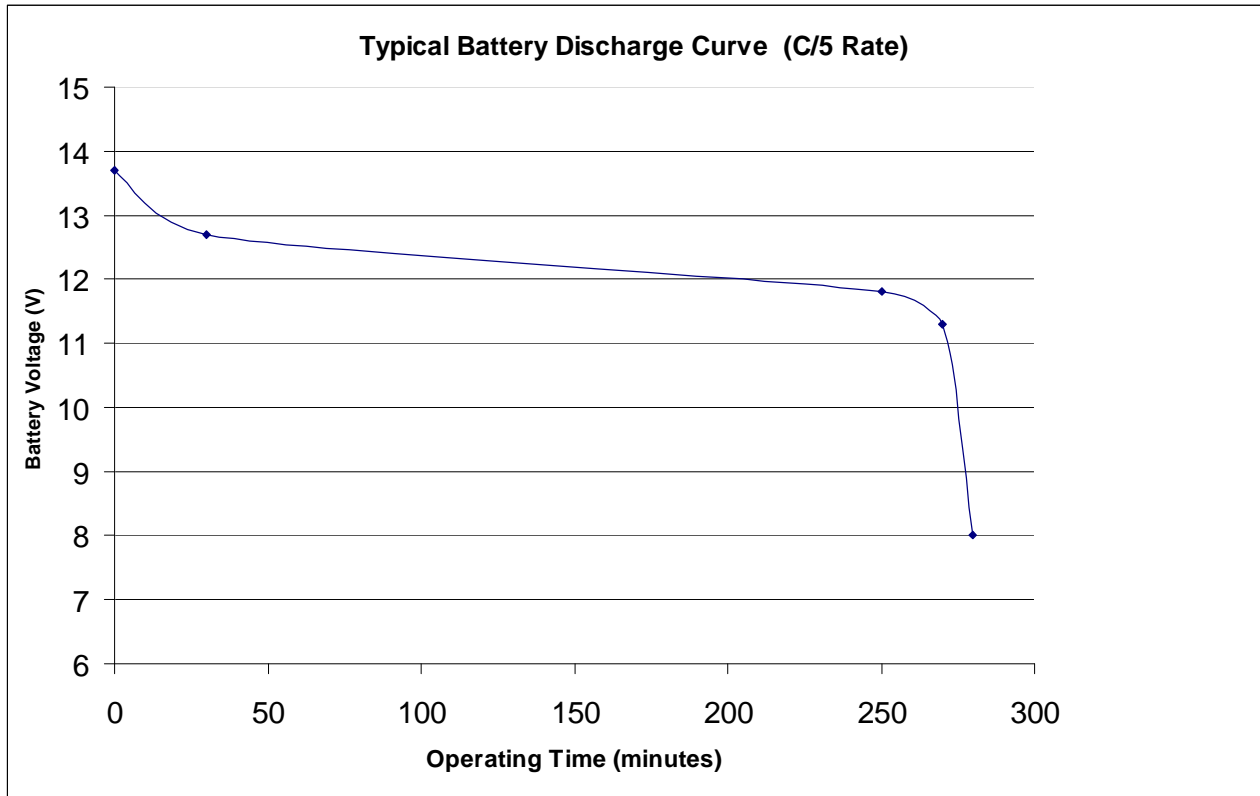
The Viper 4040 battery pack is a custom built 12V NiCd pack. The specifications of the battery pack are:

- ◆ Nominal 12V pack voltage.
- ◆ Fully charged voltage 14V.
- ◆ 3000mAh nominal capacity

- ◆ The custom pack is composed of 10 size C 1.2V cells.

BATTERY LIFE/DISCHARGE

When the battery pack is fully charged, the battery voltage is approximately 14V, which is considered above the 100% charge level. When the analyzer is used, the battery voltage will quickly drop (within the first 20-30 minutes of use) to 12.4V, which is approximately 60% indicated charge level. At that point the voltage will stabilize near 12.3V to 12.2V, with a slight decrease with use, until the full capacity is reached, at which point the voltage will drop VERY quickly. When the battery voltage reaches the 8% charge level, which is 11.8V, the battery voltage is beginning to decrease VERY rapidly. This is a standard discharge characteristic of ALL NiCd batteries. A typical discharge curve is presented below to illustrate this behavior.



Under typical usage conditions, using two channels, an optical tachometer and the backlight ON, the analyzer should maintain an operational charge for approximately 4.5 hours. If the backlight is turned off or otherwise not used, this time increases to near 7 hours.

CHARGING

The most important guideline for charging is that no charger should be left connected to the analyzer for an indefinite amount of time. The charger can safely be used overnight (12-14 hours), but leaving it connected for longer periods can lead to overcharging, over heating, and reduced capacity effects. A good rule of thumb is to charge only when needed and then for overnight time periods. If you practice this method, the battery pack should last 5 years. If the charger is connected indefinitely (for days until the unit is needed), the battery pack will probably be damaged and require replacement after only 6 months.

The reason for this is that the charger uses a constant-voltage charge technique and is not true “trickle-charger”. The charger does reach a quasi trickle-charge state, which is a slow charge, but the battery eventually reaches a point where it cannot accept any additional charge. At that point, heat buildup and electrolyte breakdown begins resulting in permanent and irreversible damage to the battery pack.

Some common charging problems are leaving the battery connected to the charger for too long of a time period (overcharging) and repeated shallow cycling of the battery (memory effect). Both of these charging problems result in reduced battery capacity, but in most cases are reversible problems.

OVERCHARGING

If the battery is left on the charger for an extended period of time, overcharging can occur. This occurs when either the charge rate exceeds the ability of the battery pack to recombine oxygen gas and limit pressure buildup or when it generates more heat than the battery can safely dissipate. Overcharging can damage the battery and **SIGNIFICANTLY** reduce the capacity. Some studies suggest a capacity of up to 30%! This effectively reduces the typical 4.5hrs of battery life to a little over 3 hours.

Overcharging is a **REVERSIBLE** problem, in that a few full charge and discharge cycles will restore normal voltage and expected capacity. This means that the analyzer should be used, or setup on a desk in a measurement mode, until the battery is drained and the unit shuts itself off. The charger should then be connected for 12-14 hours and then disconnected. The unit should then be used or run again until the battery is completely drained. Full discharge of the battery does not have to be standard operating procedure (done every time the unit is used), but should be done periodically to keep the battery pack properly “conditioned” to obtain the full capacity.

VOLTAGE DEPRESSION/MEMORY EFFECT

Voltage depression or “Memory Effect” is a common complaint about NiCd batteries. If a battery is short cycled repetitively, partially discharged and then recharged the voltage and delivered capacity will gradually decrease. If the battery is then fully

discharged, the discharge voltage is reduced compared to the original full discharge. This basically means that the original 4 hours of life, now reaches the re-charge/cutoff voltage after 3.5 hours. This makes the battery appear to “remember” the lower capacity of the shallow discharge. This phenomenon is REVERSIBLE. The battery can be restored to full capacity with a few full discharge-charge-reconditioning cycles as described above in the OVERCHARGING section.

The “memory” problem is typically induced when the battery charged following short usage periods of one-to-two hours. When this cycle is repeated several times, the process effectively conditions the battery to react at 40-50% charge range as if it were the effective full capacity. Subsequent use of the unit results in the voltage reaching the shutoff level much sooner.

TYPICAL USE

The battery pack will perform best when it is used in full charge/full discharge cycles. This means connecting the analyzer to the charger for 10-14 hours, then disconnecting it and using the analyzer until the battery capacity is 0% indicated charge. Since this is not a typical use pattern, the customer should ensure that periodic complete discharges are performed. You may discharge the unit by simply turning it on, turning on the backlight and allowing it to sit until it shuts off automatically. This will keep the battery pack conditioned and prolong life and capacity.

NOTE

You must set the Power-Off Timeout option to “NO” in order to discharge the battery using this method. See Chapter 18, “MISCELLANEOUS ITEMS” in this manual for making this setting.

TROUBLESHOOTING

If you experience problems with battery life, make sure that everyone who uses the analyzer understands the procedures for caring for battery care.

If the overcharging and memory effects are not severe and electrolyte damage has not occurred, you may be able to recover full battery functions by performing several full discharge/charge cycles. Use the following steps:

1. Setup a Transient or Monitor Overall job to measure all 4 analog and all 4 tach inputs and turn the backlight on (there does not have to be an actual inputs on any of the channels).
2. Leave the unit running on a desktop or bench until the unit turns itself off.

NOTE

You must set the Power-Off Timeout option to “NO” in order to discharge the battery using this method. See chapter 18, “MISCELLANEOUS ITEMS” in this manual for making this setting.

3. Connect the unit to the charger for NO MORE than 14 hours.
4. Repeat the above steps at least once, ideally 2 times to fully cycle the battery.

If this process does not restore full battery capacity, the batter pack has been damaged and must be replaced.

TIPS/SUMMARY

- ◆ Ensure you have and are using the proper charger.
- ◆ Non ACES Supplied chargers are not recommended due operational limits and possible damage that may be incurred.
- ◆ The analyzer will drop rapidly from 100% charge to around 70% and stabilize there with a much slower rate of decrease over the rest of the discharge cycle. Don't be alarmed by the initial sudden drop in the % charge indication.
- ◆ If the use of the backlight is not necessary, battery life can be greatly extended (up to 2.5 hours in a typical configuration) if it is left in the OFF position.
- ◆ No charger should be left connected to the unit for more than an overnight charge period (12-14 hours).
- ◆ Periodic full discharge/charge cycles will properly “condition” the battery and maintain full life and capacity.
- ◆ Partial discharges followed by full charges should be avoided, if possible, to prevent a “memory” effect.
- ◆ Overcharging and memory effects can often be resolved/repared by completing several (2 or 3) full discharge/recharge cycles. If the problem is not resolved using these cycles, the battery has been damaged and must be replaced.

19.2. - Cables

Cables can be damaged if pinched in doors and windows. Always check for pinches, cuts, and abrasions prior to using the cable. Discard, replace or repair cables as necessary if damage is discovered. Exercise care when making connections.

Bent or damaged pins may cause problems with normal operation. Check all connectors for evidence of damage. An optional automatic cable check device is available from ACES Systems.

Route cables away from all hot areas and electrical equipment. If the cable is used while it is lying on the ground, you may experience radio interference. Secure the cable to the aircraft

fuselage (off the ground) with duct tape to correct this interference. Duct tape or wire ties are excellent for securing the cables.

19.3 - LASETACH®

WARNING

Never look directly into the laser aperture. Damage to the eye can occur.

Don't use the LASETACH® when the weather conditions include precipitation. A single drop of water on the aperture lens can dissipate or block the laser beam. When humidity and temperature conditions meet certain levels, fog may develop in the intake of the some jet engines due to the low pressure being produced there by engine operation. If this occurs, the fog may be dense enough to effectively block the laser beam from reaching the reflective target. Under these circumstances, you may have to incorporate an alternate tachometer source or wait for conditions to become more favorable.

Never use any reflective target tape other than that recommended in the manual (3M Tape, Model 7610 or ACES Systems' P/N 10-400-0176). The incorrect type of reflective tape can render the LASETACH ineffective in high-speed applications. An angle of 5 to 10 degrees from the perpendicular of the LASETACH/reflective tape is best.

If the shape of the laser beam becomes oblong or egg shaped, this may indicate a scratched or damaged lens. If this is associated with erratic or unstable tachometer readings, return the Lasetach to ACES Systems for repair.

19.4. - Phototach

The Phototach is very rugged. It is water resistant, but water on the lens may render it ineffective. Always check the lens for cleanliness and to be sure it is free of damage such as cracks and scratches.

The optimum range of the Phototach is 12 to 18 inches. It may work at closer or more distant ranges, although it may not be as reliable. In some high-speed applications, the amount of tape passing through the Phototach beam may need to be increased to insure a good trigger. If the indicated speed (in the analyzer function) becomes erratic or unstable at higher speeds, increase the length (or width as the case may be) of tape so that the tape remains in the beam for a longer period of time during each rotation. See paragraph 19.6.1 below for more details.

19.5. – Propeller Protractor

The protractor is made of hard plastic. If folded or crimped it will bend and remain bent. To straighten it, lay it on a flat surface and heat it with a hair dryer on a high setting. Discontinue the heat and leave the protractor in its flat position on the level surface to cool.

19.6. - Reflective Tape (3M Tape, Type 7610)

Always thoroughly clean the area where the tape is to be applied. Using scissors or some other cutting tool, round off corners of the tape and be sure all edges are pressed down. Rounded corners help to prevent tape from peeling up during use. Remove any bubbles in the tape by pressing them toward the edge of the tape to prevent “lifting” due to the airfoil effect during high speed runs. If used on a very high speed application, you may use a very thin coat of super glue or clear nail polish on the edges of the tape to prevent the tape from peeling back due to the force of high velocity air along the edges of the tape.

19.6.1. - Reflective Tape Width Requirements

If problems are experienced using the Phototach (this does not apply to the Lasetach) while balancing high-speed props with the reflective tape further out on the blade, refer to the following chart for tape placement adjustments.

1. First, measure the distance from the center of the propeller shaft to the location you intend to place the reflective tape.
2. In the chart below, select from the RPM column the first speed greater than the speed at which you intend to balance.
3. From this RPM number, proceed across the chart to the right until you come to the first number larger than the distance measured in Step 1 above.
4. From this point, follow the column up to the top to the minimum tape width required for your application.

As an example, use the following parameters: the distance from the propeller shaft to the intended tape location measures 25 inches and the balance speed is 2300 RPM. Select 2400 from the RPM column since this is the first speed greater than your intended balance speed of 2300. From this number, follow the row across to 26.5, which is the first number higher than your intended tape location of 25 inches. From 26.5 follow the column straight up to the top--2 inches. This is the width of tape required for accurate readings at the intended distance and RPM level. (If your reflective tape is only 1-inch wide, place two 1-inch strips of tape side by side to create 2 inches.)

RPM	Minimum Tape Required			
	1"	2"	3"	4"
1000	31.8	63.7	95.5	127.3
1200	26.5	53.1	79.6	106.1
1400	22.7	45.5	68.2	90.9
1600	19.9	39.8	59.7	79.6
1800	17.7	35.4	53.1	70.7
2000	15.9	31.8	47.7	63.7
2200	14.5	28.9	43.4	57.9
2400	13.3	26.5	39.8	53.1
2600	12.2	24.5	36.7	49
2800	11.4	22.7	34.1	42.4

19.7 - Vibration Sensor

Do not drop the sensor. Although built for rugged use, most accelerometers and velocity sensors are susceptible to internal damage when dropped, especially on hard surfaces such as concrete ramps.

Do not mount a sensor on a hot section of the engine until you are certain it will withstand the maximum amount of heat being generated in that area. A sensor must be designed for high temperature use to be used in this type of environment. The extreme heat may permanently damage the sensor. There are no repair capabilities for most modern sensors.

When connecting cables to the sensor, make sure the cable is not forced against the cowling at the point where it is connected to the sensor. This condition may introduce resonant vibrations, generated by the cowling, into the sensor via the cable and connector. This induced vibration will complicate or render the balance/vibration survey invalid.

Be sure to include your sensor with the analyzer when returning it in for calibration. The sensor will also be checked as part of the calibration procedure.

19.8. – Optical Tachometer

See Section 19.3 LASETACH® or Section 19.4 PhotoTach for tips that also apply to optical tachometers.

19.9. Reinitializing the Analyzer

With the analyzer turned [OFF], push and hold the [5] key. While holding the [5] key down, turn the analyzer on by momentarily pushing the [ON/OFF] key. After the analyzer screen appears, you may release the [5] key and allow the analyzer to continue with the boot process. This may correct some malfunctions associated with corrupt data in the analyzer. After the boot up process is complete, you will see a message on the screen asking “You performed a hard reset. Do you also want to wipe out all information (setups, jobs, etc.) in the database?” You must select either YES by pressing the [F1] key, or NO by pressing the [F5] key at this point to continue. Typically you should select [F5] NO. If any corrupt data is detected in the database, the analyzer will automatically delete it and provide an information message on screen to indicate this. If the corrupt data was in a setup, you may have to re-enter the setup or reload it from a setup file using AvTrend. Start a new job with the analyzer to insure the problem has been rectified. If this procedure fails to correct the encountered problem, call ACES Support.

19.10.– Troubleshooting Ground Loop Issues

If ground loop problems are suspected, the offending connection can usually be tracked down by disconnecting analyzer connections one at a time to see if the problem goes away.

Non-ACES cables may induce ground loops if shields/grounds are terminated incorrectly. Shields should be terminated at **ONE END OF THE CABLE ONLY!** Terminating shields at 2 locations will induce ground loops and noise into the system.

Case-grounded sensors should be avoided as they connect sensor case to the engine and/or aircraft ground, which may be at several VOLTS different ground potential than analyzer ground. If case grounded sensors must be used, they should be used with an isolating mounting pad.

Differential input configuration should be used for most tach/speed connections. This provides a non-ground referenced sensing point that is very high impedance, effectively isolating the analyzer from the tach/speed source (such as a mag pickup or coil, etc).

Single-ended input configuration should typically be used for most vibration sensor inputs. Single-ended is required to provide a good ground reference/return for the analog signal. Some sensors are differential, but external ACES charge amplifiers convert the sensor output differential charge to single-ended (ground-referenced) voltage.