

#### LIMITED WARRANTY;

With proper care, handling, and storage, your TENTEL Spindle Height (TSH) gauge should provide many years of trouble-free, accurate spindle height measurements. The TSH gauge is guaranteed to be free of defects in materials and workmanship for a period of one (1) year after delivery to the original purchaser.

Note: This warranty does not cover damage caused by accident, abuse, alteration, disassembly, or failure to follow operating cautions and instructions. TENTEL assumes no responsibility or liability beyond the purchase price of the unit. The instruction manual is intended as a helpful guide in conjunction with the factory service manual for the particular recorder being tested, however specifications are subject to manufacturers standards and thus TENTEL assumes no liability for specification changes or from misuse or misapplication. We believe this gauge to be the finest, most easily used gauge for measuring spindle heights and related problems available; and will continue to produce gauges to TENTEL's own demanding specifications.

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#### CAUTION NOTES:

There are several cautions which should be observed before operation of a TSH gauge in a video recorder.

- 1) Never force a TSH gauge into a machine. It may be necessary to remove the carriage assembly, if the transport will not recognize the TSH gauge as a 'cassette'.
- 2) On machines where the cassette and elevator assembly are lowered into the machine automatically, make sure the TSH gauge is inserted fully and correctly into the cassette chamber, lower the cassette chamber (with gauge), into the machine by depressing the fast forward (FF) button. DO NOT depress the Play button as the machine will "lock-up" when it detects the absence of take-up tension. If this should occur, follow the service manual to reestablish the eject circuitry. (Try un-plugging the machine, and plugging it back in, to reset the circuits.)
- 3) On normal machines, hold the eject button down longer than 'normal' to override the 'logic', allowing the eject mechanism to function.
- 4) When using the metal block to simulate the tape path, make certain that the end of the block is not on a label and is flat on the TSH plate surface. If one end is on a label, the block will not be flat and thus will cause the guide checking end to be at the wrong height.

#### SHIMS:

Shim washers are provided as a convenience by TENTEL. These shims are provided in .005" (.125mm) thickness. Shims are available from the VCR manufacturers in various thicknesses.

#### ALIGNMENT MIRROR:

The 'dental type' precision alignment mirror is provided to help view the alignment between the metal bar and the various tape guides.

#### TSH-V5 / TSH-M11 Additional Notes:

Guide height is performed using the same specifications shown in any of the VHS manufacturers service manuals. The TENTEL TSH-V5 & TSH-M11 base plate thickness has been controlled to exacting specification to allow the metal bar, included with the V5, to be used for extending out into the tape guide area. The .497" width of the bar simulates the path of the

tape. The guides can then be adjusted to match this "projected" guide height. Make certain spindle height is within specifications, since spindle height determines the height at which the tape enters or exits the cassette.

#### TSH-B7 Additional Notes:

Guide height is performed to the same specifications as shown in any of the Beta/BETACAM service manuals. The TENTEL TSH-B7 base plate thickness has been controlled to exacting specification to allow the precision ground metal bar, included with the B7, to be used for extending out into the tape guide areas. The .497" width of the bar simulates the path of the tape. The guides can be adjusted to match this 'projected' guide height. Make certain spindle heights are within specification, since spindle height determines the height at which the tape enters or exits the cassette.

On many of the new SONY BETACAM recorders, it's recommended by SONY to set the spindle heights up by using the factory Go-No Go procedure and then adding a .25 mm shim to one or both spindles. With the use of the TENTEL TSH-B7, it allows more precise settings and thus TENTEL's recommendation for these newer SONY machines is to simply set the spindle height to a higher specification of 2.15 to 2.2 mm of spindle height (+.15 mm to +.20 mm on the meters). The use of the .25 mm shim is NOT necessary if the machines are set to this tighter specification.

#### TSH-U9 Additional Notes:

The TENTEL TSH-U9 base plate thickness has been controlled to exacting specification to allow the precision ground metal block, included with the U9, to be used for extending out into the tape guide areas. Use the reduced end of the block to check for guide heights. The relief allows the block to measure the guide heights for both supply and take-up. Take-up tape guides are located 1.2 mm (.047") higher than supply side guides (spindle height also has this difference). The block should be used with the relief facing down for the take-up guides and with the relief facing up for the supply side guides. The reduced end of the block is .75" and thus simulates the ideal path of the tape as it enters or exits from the cassette. The guides can be adjusted to match this guide height.

## TENTEL SPINDLE HEIGHT GAUGE TSH SERIES

### INSTRUCTION MANUAL

TSH-V5, TSH-B7, TSH-U9, TSH-M11

#### GENERAL:

**Definition: Spindle Height determines the position of the plastic cassette housing and tape reels within the cassette and their relative positions to the cassette locating posts attached to the frame of the machine.**

Faulty spindle height causes the tape to be positioned either too high or too low. This causes tape edge damage by rubbing on tape guides and cassette edges. This also causes tape to pack improperly and bind. Tape edge damage destroys the tape by causing additional guiding problems and subsequent loss of control or audio track. Present customers have told us that we should have named the gauge a "cassette holder problem solver" rather than merely a spindle height gauge due to the multitude of problems that can be diagnosed with the gauge.

TENTEL has a series of TSH (pronounced "TUSH") gauges to fit the four most popular format cassette recorders. We sincerely believe these gauges to be the ultimate method of checking spindle heights and related problems to help prevent tape edge damage and binding cassette problems.

#### CONSTRUCTION:

All TSH gauges are based upon a special stabilized cast aluminum tool and die plate. The plate is machined to the precise dimensions required to simulate a perfect cassette, and base flatness is held to within a few ten thousandths of an inch. Two precision dial indicators are mounted rigidly to the plate and read in both thousandths of an inch and tenths

of a millimeter. The entire assembly is so stable that it should not be necessary to change the calibration during the normal life of the gauge. A master block has been included to allow periodic checking of the indicators.

### CALIBRATION CHECK:

The zero position of the indicators has been established to allow the tolerance to be read directly. (Example: .150+.008/-0.000 would read +.008 to -.000 from the zero on the indicator. The .150 dimension has been set up at TEN-TEL).

To check or reestablish this base dimension, a master gauge block is provided. The procedure is as follows:

1) Make sure the master gauge is clean of foreign matter which may come between the mating surfaces and cause an erroneous reading.

2) Make sure the bottom of the TSH gauge is also clean.

3) Insert the proper end of the master into the TSH gauge opening, (note, only one end is required for VHS, BETA, and M11 versions). NOTE: The U-Matic TSH-U9 gauge requires a dual edged master. Please verify that you're using the end marked "S" on the supply side and the end marked "T" for the take up side.)

4) Wipe clean and then wring (rotate slightly) the master gauge into the bottom of the TSH plate. The indicator should read zero.

5) Repeat for the other indicator. Readings within one half division (.0005") are within tolerance.

**If readjustment is necessary, use the following procedure:**

a) Make sure the master and TSH plate are clean.

b) Make sure the master has not been dropped and damaged; a dented edge will cause a false reading.

c) To reset, loosen the indicator locking screw. Use a .050 allen wrench for the lock screw which secures the bezel and prevents it from turning. The bezel (and scale) of the

indicator will now rotate freely.

d) Hold the master firmly in place and tighten the socket hex screw until the indicator reads zero.

e) The scale should now be tight and not rotate freely; repeated use of the master should show a "zero" reading.

f) The TSH gauge is now adjusted and ready for use.

### OPERATING INSTRUCTIONS:

#### 1) Elevator latch check:

With the TSH gauge "cut-out" facing toward the VCR, insert the gauge into the cassette chamber (see caution notes on automatic loading transports). Lower the cassette carriage (with TSH gauge) into the machine, until it "latches" in place. Alternately press firmly downward on the top of the TSH gauge and release and note if the indicator readings change. If the indicators show a lower reading when the gauge is released, it indicates that the cassette carriage is not latching down properly. This problem should be corrected before proceeding since it means cassettes (and the TSH gauge) are being supported by the bottom of the cassette carriage rather than by the four (4) supporting posts located on the chassis of the machine.

#### 2) Spindle Height:

Continue from step one above "Elevator latch check" making sure latching is O.K. or has been corrected. The spindle (reel) heights can now be measured directly on the indicators. The specification is shown on the TSH label for both the Supply and Take-up spindles.

Readings too low (-) indicate a need for additional shims under the discrepant spindle. Conversely, readings greater than specification (+) indicate too many shims or shims of improper thickness under the discrepant spindle. (\*See caution notes for new, changed specs on some machines.)

	S.M.P.T.E Standards		Optimum Indicator Readings (settings)	
FORMAT	Supply Height	T/U Height	Supply Height	T/U Height
VHS & M11	2.0mm±.2(1.8/2.2)	2.0mm±.2(1.8/2.2)	±.1mm(±.004")	±.1mm(±.004")
Betacam	2.0mm -.1/+ .2(1.9/2.2)	2.0mm-.1/+ .2(1.9/2.2)	+.15 to+.2mm(+.006"to+.008")	+.15 to+.2mm(+.006"to+.008)
U-Matic	3.8mm -0/+ .2(3.8/4.0)	5.0mm -0/+ .2(5.0/5.2)	0 to +.1mm(+.004")	0 to +.2mm(+.008")

#### 3) Spindle Wobble (Run out):

Spindle wobble can be checked quite easily by pressing the fast forward (FF) button to measure the take up spindle run out and by pressing the rewind (Rew) button to measure the supply spindle run out. Oscillations exceeding .003" (Three scale divisions) indicate excessive wobble; discrepant spindles should be replaced. Some machines including most U-matic recorders may require manual rotation of the spindles while observing the indicators. Run out exceeding .003" should be cause for spindle replacement.

#### 4) Four Point Flatness:

Since three points determine a flat plane, the fourth supporting point may not be in the same plane. This problem may cause the cassette to be positioned differently each time it is inserted, possibly causing tape edge damage and/or binding. Flatness can be measured with the TSH gauge since plate flatness and rigidity have been carefully controlled.

U-Matic (TSH-U9) - By applying alternating finger pressure on diagonal areas of the plate, flatness problems can be located. The magnitude of flatness error can be determined by DOUBLING the range (during rocking) indicated on an indicator. The allowable out of flatness is specified as .20 mm (.008") thus .004" on the TSH-U9 gauge indicators. Consult the respective service manual for the corrective procedure.

Flatness measurements for BETA and VHS are similar, except it may be necessary to remove the top cover of the cassette chamber. Exercise caution to avoid dropping screws into the machine. Rocking exceeding .002" as shown on either of the indicators should be corrected. (.002" indicator motion is .005" to .006" out of flatness at one of the support posts.)

#### 5) End Thrust:

End thrust (End Play) refers to the amount of up-down motion possible for the reel tables. This measurement is not required on transports with direct drive reel motors. For most U-Matics and some BETA machines it is possible to reach into the elevator chamber with the TSH gauge in place, and lift up on the spindles and observe how much up-down motion the spindles have. A needle nose pliers or small screw driver may be used to assist. The top of the cassette chamber will have to be removed where access to the chamber is too confined when the chamber is latched into place.

**Correct END THRUST allows .005" to .014" motion.** Readings too tight (less than .005") may cause a binding of the spindle, and too loose (exceeding .014") may cause erratic tape guiding and packing with subsequent tape edge damage due to the reel tables moving up and down during FF and REW. Newer transports have springs to push down and hold the spindles in place; check these by placing the machine on its side, pull the spindle out and determine that the spring is strong enough to push the spindle back to the bottom of its seat. The TSH gauge is NOT required to do this check. Firm standards have not been established for this measurement, thus you may want to seek the machine manufacturer's assistance for machines producing readings outside the .005" to .014" range. These readings were derived from experience with machines operating properly causing no tape destruction.

#### 6) Tape Guide Height Check:

This gauge is the only known universal way to check tape guide height. The thickness of the base plates have been controlled to allow the use of an additional 1/2" or 3/4" bar, representing the tape itself, to slide across the plate into the tape path. This bar should move in and out of the guide without hitting the top or bottom on the guide itself. This is a fast and accurate visual check of the tape handling guides. Final "tweaking" adjustments may need to be made once the tape is threaded to achieve maximum RF envelope.