

APPLICATIONS: LCC MODEL 470 DIGITAL SPEED MONITOR
LCC SERIES 200 DISTRIBUTED CONTROL SYSTEMS
LCC SERIES 2 GOVERNORS
LCC SERIES 2 TSI

SUBJECT: INSTALLATION GUIDELINES FOR SPEED PROBES

REV: 2 of April 23, 2008, Updated Honeywell Probe Part Numbers

OVERVIEW

This guideline provides a sequential list of application engineering items which must be evaluated to insure the proper function of an electronic speed probe feedback system. Questions concerning this guideline should be addressed to LCC engineering.

1.0 Target Gear Considerations

1.01 Shaft Location Factors

- 1.01a. The selected shaft location should not be subject to rotor thrust or thermal growth motion to the magnitude which would offset the gear from acceptable alignment with the speed probe/s sensing tip. During all periods of operation a projection of the probe tip should intersect the target gear over a minimum of 80% the circular area as illustrated in Figure 1 .
- 1.01b. The total indicator runout (TIR) of the shaft at the target gear mounting position should not exceed .001-inch.
- 1.01c. There should be no electrical cables carrying greater than 24 VDC within three feet of the gear location.
- 1.01d. Stub-Shafts with any previous history of failure, i.e. coupling disconnect, should not be used for target gear mounting.

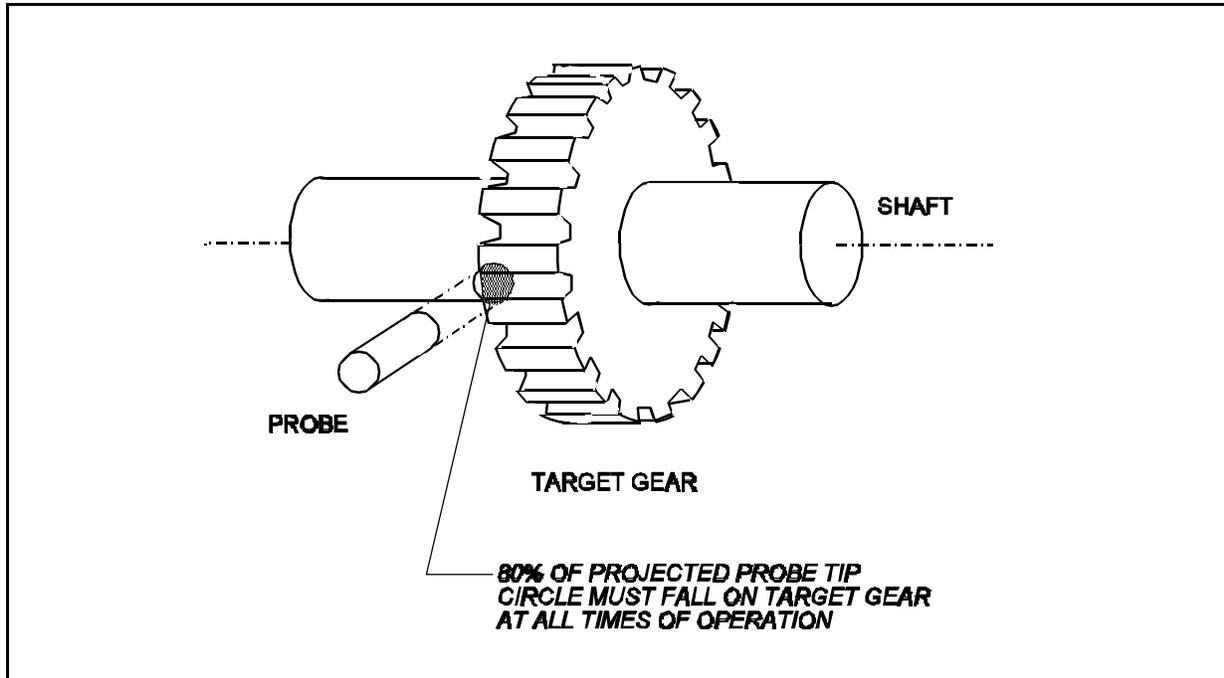


Figure 1

- 1.02 Gear material must be magnetic.
- 1.03 Gear total tooth count should be within range of product system, and must be reported to LCC Engineering Department for electronics configuration.
 - 1.03a. 12 to 200 teeth for Model 470 DSM.
 - 1.03b. 20 to 160 teeth for 200-Series Governors
 - 1.03c. 12 to 160 teeth for Series-2 Governors and TSI
- 1.04 Gears should be key-way mounted and secured so as to provide for zero lateral movement with respect to the shaft.
- 1.05 Mounted gears should have less than .001-inch TIR in axial motion on the diameter.
- 1.06 Target gear tooth tip surfaces must be smooth and free from wear marks or machining indentations.

1.07 Gear pitch or teeth per inch should be 12 DPI or coarser.

2.0 Probe Selection Considerations

2.01 Gear Pitch Sensitivity

The pitch, or teeth per inch of the gear diameter must be within the application range of the specified probe. For most probes this is 12 teeth per inch of diameter or coarser. This measurement is often stated in "DPI" or "deviations per inch".

2.02 Target Velocity

The gear tip velocity (feet/second) must be within the probe specifications at the highest potential shaft speed.

2.03 RFI/EMI

In areas of known high radio frequency intensity or high electromagnetic field intensity (including proximity to plant communications repeaters), advised.

2.04 TEMPERATURE

Verify that the ambient area temperature does not exceed the probe's continuous service rating. These are listed below for commonly used probes by LCC:

2.04a. Honeywell DZH-400

= -40 °C to +125 °C

2.04b. Airpax H1512-005

= -25 °C to +70 °C

2.04c. Airpax 047-series

= -25 °C to +90 °C

3.0 Probe Mounting Considerations

3.01 Alignment

Whether held by a fabricated mounting bracket or threaded through a bearing or pedestal cover, the center-line of each probe must be no more than 2-degrees deviant from a line to the shaft center as shown in Figure 2.

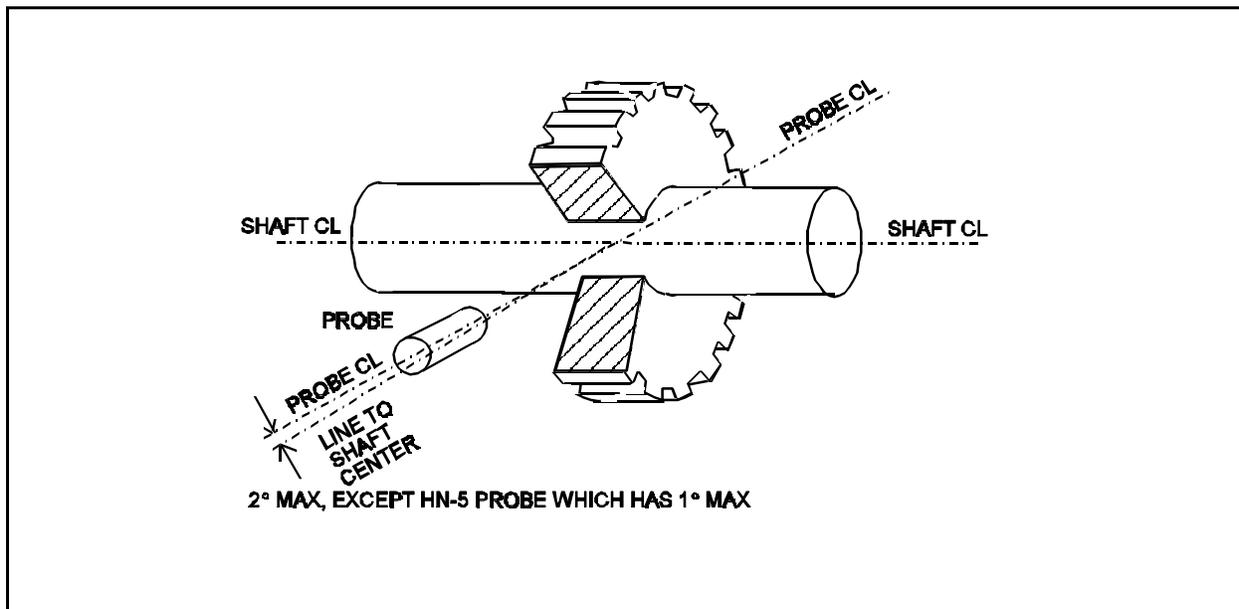


Figure 2

3.02 Interference

There should be no metallic objects (other than the gear), i.e. other probes, casting bosses, seal runners, etc. within two-and-one-half probe tip diameters from each probe tip. The presence of metallic targets within this region can induce false triggering.

3.03 Probe Layout

It is preferable to lay out multiple probes radially around a target gear rather than axially. Axial-pattern probes may trigger almost simultaneously leading to a potential cross-triggering situation in detection circuitry.

3.04 Probe Holder Resonance

Care must be exercised to avoid probe-holding brackets susceptible to resonant vibration at turbine startup or operational speeds. When brackets must be used (sections of pipe welded to flat-stock mounting plates are preferred) they should be tested with a suitable mechanical shaker system to verify lack of resonance.

3.05 Initial Gapping

Depending upon the probe type, the gapping procedure will vary. The following is provided for the most common probes used by LCC:

3.05a. Honeywell DZH400 : ORIENTED PROBE

= One (1) turn out from tooth tip contact, then in or out to the closest orientation alignment position where the small flat cut on the hex point is perpendicular to the tooth travel direction or parallel to the turbine shaft.

3.05b. Airpax H1512-005 : ORIENTED PROBE

= Two (2) turns out from tooth tip contact, then out to next orientation flat. Orientation flat must be parallel to shaft.

3.05c. Airpax 047-series

= .050 inch, no particular orientation.

3.05d. Magnetic Probes... Gap according to target gear testing on motor-drive probe test unit.

3.06 Secure Cables

Verify that probe cables are secured with appropriate fasteners to prevent whipping. Often probe mount areas incur a good deal of windage in operation.

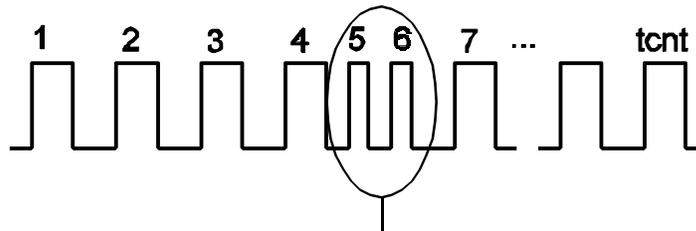
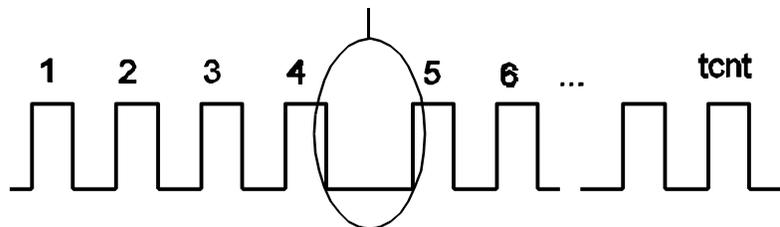
4.0 Channel Alarm Diagnostics

In the event that one or more speed channels has recurrent alarms, it is necessary to place a high-speed (100 Mhz or faster) digital oscilloscope on the probe signal to analyze the fault.

- 4.1. Set the scope to capture at least the tooth pass waveform for one gear revolution. Examine the captured waveform for missing or multiple counts, using Figure 3 as a guide. Missing pulses is generally attributed to a bent or damaged gear tooth, and can often be corrected by decreasing the probe gap 1/2 turn. Multiple counts is generally attributed to the probe reading machine marks on the top of the gear teeth, and is corrected by increasing the gap 1/2 turn.
- 4.2. Adjust the speed probe as determined by examination of the waveform in Step 4.1.
- 4.3. Repeat Steps 4.1 and 4.2 until no adjustments are necessary.

Undercount/Multiple Count Waveforms

Missing pulse, bent or damaged gear tooth.



Overcount, probe reads machine marks on tooth.

Missing Pulse: Try gapping probes 1/2-turn closer to gear.

Overcount: Try gapping probes 1/2-turn further away from gear.

4.4 Waveform Minimum and Maximum Voltages

The probe output waveform should be at TTL levels, meaning the following:

The LOW levels of the square wave must be less than 0.8 VDC.

The HIGH levels of the square wave must be greater than 2.7 VDC.

These levels should be measured under DC coupling using the scope's grid scale (1.0 volts/division or 0.5 volts/division).