

FAQ Note

How to Determine LTC Degrees per Tap

Problem:

The critical “DEGREES PER TAP” number, needed to program the INCON 1250 is not known. Based on LTC design and where the synchro transmitter is connected to the LTC drive, the DEGREES PER TAP number required by the INCON 1250 for accurate Tap Position reading, will not be the same for every LTC. This DEGREES PER TAP number is not usually specified in any documentation. The synchro transmitter may have been retrofitted to the LTC drive. An improvised mechanical connection to an available rotating shaft can result in unknown degrees of synchro transmitter rotation for each tap change.

Explanation:

The INCON 1250 monitors the rotary position of a synchro transmitter. Most LTC’s rotate a consistent number of degrees for each tap change. (This FAQ Note does not deal with the issue of inconsistent degrees per tap.) A DEGREES PER TAP number is programmed, so that the 1250 can convert the degrees of synchro rotation into tap position segments. Within the range of a tap position segment, the 1250 will display the same tap number. If the DEGREES PER TAP number programmed is not correct, the beginning and end points of each tap segment will be offset. This offset error is cumulative, and over the range of several taps will eventually cause the 1250 to read the wrong tap position.

The typical symptoms of this problem are: The 1250 will display the correct tap position for several taps above and below the “OP27 Loaded” tap. Depending on whether the programmed DEGREES PER TAP is too high or too low, when the LTC moves to the next tap, the 1250 will either skip over a tap number, or will fail to increment until one more tap change. The 1250 will continue to increment with each tap change from this point, but will be “off by one tap” until the error again accumulates, enough to make the 1250 skip another tap.

When programmed in a Segmented Mode, the 1250 will tolerate an accumulated error of up to $\frac{1}{2}$ the programmed DEGREES PER TAP segment, because the mid-point between tap positions is where the transition is made from one tap to the next. For example, if the 1250 is programmed for 10 DEGREES PER TAP, it will read a tap position for +/- 5 degrees. When the synchro transmitter rotates more than 5 degrees, the 1250 will display the next tap position. If the actual DEGREES PER TAP is 9 degrees, a one degree error will accumulate with each tap change. After 5 tap changes, up or down, the 1250 will skip a tap number and will be off by one tap for the next 10 taps.

Solution:

An accurate measurement of DEGREES PER TAP must be made before the 1250 is programmed. This is easily accomplished using the 1250 itself. The 1250 can be quickly programmed to read in DEGREES, and as the LTC is moved through several tap positions, the degree change can be measured.

Application Bulletin

The following steps will deliver the DEGREES PER TAP number needed to program the 1250 for the specific LTC:

1. Enter the Programming Mode: Hold the MENU key until the display goes blank, then press the ENTER key. The display should read “run”. Press the UP key until the display reads OP 2.
2. Press the ENTER key. Change this number to “1” and press the ENTER key. The display should read OP 2. Press the DOWN key until the display reads OP 0.
3. Press the ENTER key. The display should read “run”. Press the ENTER key.
4. The display should read an arbitrary value with one decimal place. Make note of this number and the present LTC tap position.
5. RAISE the LTC one tap position. The display should read a different value. Make note of this number and the present LTC tap position.
6. Subtract the Step #4 number from the Step #5 number. This is the DEGREES DIFFERENCE. Make a special note of the SIGN of this difference. If it is a negative number, you will need to program the 1250 for a NEGATIVE DEGREES PER TAP!
7. If possible, repeat steps #5 and #6 for several tap positions. Each time a DEGREES DIFFERENCE number will be generated for each tap.
8. Calculate an AVERAGE DEGREES PER TAP by summing all of these DEGREES DIFFERENCE measurements and dividing by the number of measurements taken. Again, note the SIGN of this average and program the 1250 accordingly.
9. SPECIAL NOTE: If the LTC is moved through a NEUTRAL tap during one of the measurement steps, pay attention to the DEGREES DIFFERENCE calculated for this tap. It may be DOUBLE or TRIPPLE the normal difference, if there are multiple neutral tap segments. This must be accounted for in the 1250 program.
10. Re-program the 1250 for tap position monitoring using the information gained from steps #8 and #9. The AVERAGE DEGREES PER TAP is programmed into OP21. The NUMBER OF NEUTRALS is programmed onto OP22.