FAQ: How do I choose between Single Turn, Geared Single Resolver, or Dual Resolver Transducers?

AMCI manufactures resolver transducers that report the absolute position of either single turn or multiturn applications. The position counts/values will increase or decrease depending upon the rotation direction. This count direction can be easily switched using a software bit or a wiring change.

A complete resolver system not only includes the resolver transducer, but also the electronics module and cable. The resolver transducer is determined by knowing both the number of turns and your required resolution. The electronics module converts the transducer signals into usable, programmable decimal values; i.e. 0 to 359 (for degrees) or 0 to 999. The information contained in the following sections will assist you in narrowing your selection.

Single Turn Applications

Single Turn applications count from zero to its maximum count value with every complete rotation of the transducer's shaft. These applications either cycle back-and-forth within one rotation or always rotate in one direction. If the shaft continues to rotate past one turn, the count will roll over to zero and again begin incrementing as the shaft rotates.

AMCI resolver transducers with *HT-6, HT-20X, H25-XX*, and *R11* part numbers can all be used in single turn applications.

Multiturn Applications

Multiturn applications count from zero to its maximum count value over more than one rotation of the shaft. These transducers are used for applications that have a fixed length of back-and-forth travel, either rotary or linear.; An overhead crane is an example that rotates many turns in one direction and then reverses.

If the maximum number of turns was reached, and the shaft continues to turn in the same direction, the count will roll over to zero and begin counting again. These applications are typically selected to not exceed the maximum number of turns. AMCI resolver transducers with *HT-20-X, HTT-20-X, and HTT-400-X* part numbers can all be used in multiturn applications.

There are two options for your multiturn applications, a *Geared Single Resolver Transducer* or a *Dual Resolver Transducer*. While they both perform the same function, you will have much higher resolution from a Dual Resolver Transducer system.

Geared Single Resolver Transducers

AMCI resolver transducers with an *HT-20-X* part number are single resolver transducers with an internal gear reduction system. The single "T" in the part number indicates that there is a single resolver in the transducer's housing and the "X" in the part number indicates the gear ratio. For example, a *HT-20-10* has a 10:1 gear ratio – 10 turns of the transducer shaft to 1 turn of the internal resolver shaft.

These single resolver geared transducers will work with the same electronic modules as the single turn resolvers. However, using a geared single resolver transducer will decrease the counts per turn resolution by the gear ratio factor. The type of AMCI module used determines the available resolution.

There are three electronic module resolutions available:
➢ 10 Bit, maximum resolution of 1024 counts max.
➢ 12 Bit, maximum resolution of 4096 counts max.
➢ 13 Bit, maximum resolution of 8192 counts max.

To continue the above example, connecting a HT-20-10 to an electronics unit with 13 bit resolution will produce 819.2 counts per turn max. (8,192 / 10 = 819.2)

Dual Resolver Transducers

AMCI resolver transducers with an HTT-20-X part number are dual resolver transducers and can provide high-resolution multiturn position. The two "T"s in the part number indicates the presence of two resolvers; a master (coarse) resolver and a vernier (fine) resolver in the transducer's housing and the "X" indicates the number of turns before count roll over.

There are four transducer options, *HTT-20-100*, *HTT-20-180, HTT-20-1000*, and *HTT-20-1800*. A transducer is selected by having more turns/rotations than the application requires.

The electronic modules that the HTT-20-X transducers interface to are different from those used by the single resolver transducers. The type of AMCI module used determines the available resolution.

There are two electronic module resolutions available:

➢ 18 Bit, maximum resolution of 1,024 counts per turn max.
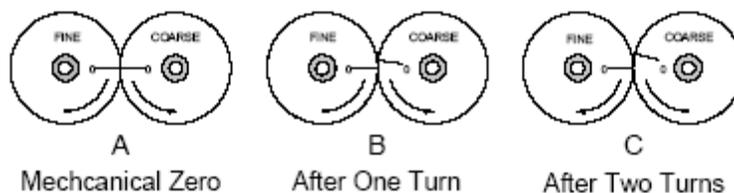➢ 20 Bit, maximum resolution of 4,096 counts per turn max.

To illustrate, a HTT-20-100 transducer connected to a 20 bit unit will produce 409,600 counts over 100 turns (4096 counts/turn max)

Note: The 1,000 and 1,800 turn transducers have a 10:1 gear ratio between the input shaft and the resolvers. Therefore, they can encode ten times the number of turns but at a tenth of the resolution. Example: an HTT-20-1000 connected to a 20 bit unit will produce 409,600 counts over 1000 turns (409.6 counts/turn).

How Dual Resolver Transducers Work

The first of the two resolvers, called the fine resolver, is attached directly to the input shaft through a coupler. The second resolver, called the coarse resolver, is geared to the fine. This gear ratio, either 99:100 or 179:180, determines the number of turns the transducer can encode. At the mechanical zero of the transducer, the electrical zeros of the two resolvers are aligned. See Figure A below.

After one complete rotation, the zero of the coarse resolver lags behind the zero of the fine by one tooth, either 1/100 or 1/180 of a turn. After two rotations, the lag is 2/100 or 2/180. See Figures B and C. After 100 or 180 turns, the resolvers' electrical zeros are realigned and the cycle begins again.

A — Mechcanical Zero   B — After One Turn   C — After Two Turns

The fine resolver yields the absolute position within the turn directly. Using a proprietary algorithm, the electronic module determines the number of turns completed by the difference in positions of the two resolvers. The absolute multi-turn position is then calculated as ((number of turns completed * counts per turn) + fine resolver position).