How Do I Calculate the Number of Turns Completed by a Resolver in the PLC?

The following ladder logic program can be used to keep track of the number of turns that an AMCI single turn resolver has made. In order to guarantee absolute position, two restrictions must be observed.

1) The resolver must not rotate while the PLC is off, or not scanning the rungs which may occur in the processors Program Mode. If the resolver rotates more that 1/2 of a turn while the PLC is off, the processor will not be able to calculate the correct position when power is reapplied. In this case, the machine will have to homed before normal operations can resume.

2) The resolver cannot complete more that 1/2 of a turn in one PLC scan. Your maximum speed is equal to 30 divided by your maximum scan time is seconds. For example, assume you maximum scan time is 20 milliseconds. Your resolver cannot exceed: (30/0.02) = 1500 RPM.

> The ladder logic is written for Allen-Bradley PLC's. However, the code can be converted to any processor system that AMCI manufactures product for.

Memory Needed

The ladder logic requires four words of memory. The memory should be *signed integer words* as it is the most efficient and supported by all processors.

➢ **N7:0: Current Position.** This is the position data read from the AMCI module this scan.
➢ **N7:1: Previous Position.** This is the position data read from the module during the previous scan.
➢ **N7:2: Δ Position.** The change in position during the scan.
    Δ Position = (Current Position – Previous Position).
➢ **N7:3: Number of Turns.** This is the calculated Number of Turns.

Ladder Logic

Calculate the difference between the current scan position data, N7:0, and the previous scan position data, N7:1. The difference between these two values is stored in N7:2.

```
0000                                                    Current Position -
                                                        Previous Position
                                                        ┌──────SUB──────┐
                                                        │ Subtract      │
                                                        │ Source A  N7:0│
                                                        │           10< │
                                                        │ Source B  N7:1│
                                                        │           12< │
                                                        │ Dest      N7:2│
                                                        │           -2< │
                                                        └───────────────┘
```

If the difference between the two program scans is greater than 1/2 of the scale factor, then the resolver has traveled through its zero point and the position data is decreasing. If this occurs, decrease the number of turns stored in N7:3, by 1. In this example, the Scale Factor is 360, therefore half of the Scale Factor is 180.

```
        Current Position -                              Calculated number of
        Previous Position                               turns
       ┌──────GRT──────┐                                ┌──────SUB──────┐
0001   │ Greater Than (A>B)                             │ Subtract      │
       │ Source A   N7:2│                               │ Source A  N7:3│
       │            -2< │                               │           5<  │
       │ Source B   180 │                               │ Source B  1   │
       │           180< │                               │           1<  │
       └───────────────┘                                │ Dest      N7:3│
                                                        │           5<  │
                                                        └───────────────┘
```

If the difference between the two program scans is less than the negative of 1/2 of the scale factor, then the resolver has traveled through its zero point and the position data is increasing. If this occurs, increase the number of turns stored in N7:3, by 1. In this example, the Scale Factor is 360, therefore the negative of half of the Scale Factor is -180.

```
        Current Position -                              Calculated number of
        Previous Position                               turns
       ┌──────LES──────┐                                ┌──────ADD──────┐
0002   │ Less Than (A<B)│                               │ Add           │
       │ Source A   N7:2│                               │ Source A  N7:3│
       │            -2< │                               │           5<  │
       │ Source B  -180 │                               │ Source B  1   │
       │          -180< │                               │           1<  │
       └───────────────┘                                │ Dest      N7:3│
                                                        │           5<  │
                                                        └───────────────┘
```

Store the Current Position data in register N7:1 for use during the next program scan as the Previous Position data.

```
                                                        Previous Position
                                                        ┌──────MOV──────┐
0003                                                    │ Move          │
                                                        │ Source    N7:0│
                                                        │           10< │
                                                        │ Dest      N7:1│
                                                        │           12< │
                                                        └───────────────┘
```