IPOS
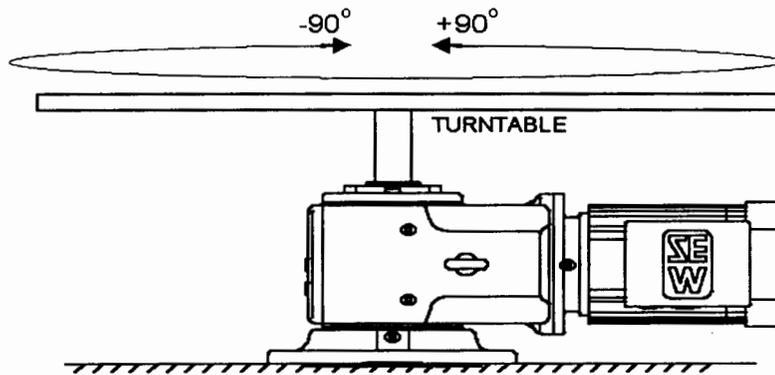
- We have many applications (Index conveyors and Turntables etc.) that have a requirement for positioning in the same direction of rotation. This can lead to accumulation error and log term drift in final position.
- Traditionally we have used 'touchprobe' correction or complex (re)referencing to offset this drift.

Let us assume that the above application needs to move in 90 deg. Increments.

The gearbox has a gear ratio of 44.32 :1 (Actually 39/21 x 33/8 x 81/14 : 1   = 44.32270408 :1)

Here is where the problem lies :

To do a 90 deg. movement of the turntable we need to move :

($\frac{1}{4}$ rev) x [(39/21) x (33/8) x (81/14)] x 4096 = **45,386.44989**   increments (at the motor)

(Roughly 11.08 motor revolutions = $\frac{1}{4}$ of an output shaft revolution).

We can only move a whole number of increments : either 45,386 or 45,387 .

Both are very close , but let us consider using 45,386 incs as the move :-

Assuming the turntable is moving in the same direction with 1 index every 2 secs (30 per min) .
At the end of an 8 hour shift , we have done (30 x 60 x 8) = 14,400 indexes.

This means we would be at a position = 14,400 x 45,386 = 653558400 incs.

The position we 'should' be at = 14,400 x 45386.44989 = 653564865.3 incs.

A difference of 6465.3 incs. Or approx. **13 degrees** at the output shaft.

This would be totally unacceptable , we can see that with only a fraction of an increment error this will accumulate into a very large error.

Thus the term – *'ACCUMULATION ERROR'*

We can fix the problem by tracking the error and at a suitable time offsetting the accumulation error to get back on track. This is where the task gets tricky , we need to find a suitable point where we have reached a whole number of increments so that we can make a correction.

If we use the 'Wingear' calculation program (for the above data) as follows :

WINDOWS Getriebeberechnung

Accumulation error - Offset Calculation

39	33	81	1	4096	1	1
21	8	14	4	1	1	1
1	1	1	1	1	1	1
1	1	1	1	1	1	1
1						
1						

49   P 762

2223936   P 763

We can see now why the 'Wingear' program is beneficial , when we press the Calculation button the resultant fraction is rationalized to give us the smallest possible numerator and denominator.

The 49 is very important.

This means that on the 49th move we will have reached a point where we have a whole number of increments.

In the case above each move will be = 45386 incs.

This would give a total move (after 49 indexes) = 49 x 45386 incs = 2223914 incs.

We should be at a position of (after 49 indexes) = 49 x 45386.44898 = 2223936 incs.

i.e. we are 22 incs. out of position (note the whole numbers!).

It is relatively easy now to set up an index counter that counts from 0 to 49 . For the first 48 moves we move 45386 incs. On the 49th move we move 45386+22 (=45408 incs.) , and reset the counter back to zero.

If positive and negative moves are required we should set the counter from –49 to +49.

For Example :

```
        M3   :CALL    M1
              CALL    M2
              JMP     UNCONDITIONED  , M3
        -------------------------------------

        M1   :JMP     LO I0000000000001000, M4
              ADD     H0   + 1
              JMP     H0   == 49        , M5
              GOR     WAIT  H1                      ;H1 is set =
45386
              JMP     UNCONDITIONED  , M6
        M5   :GOR     WAIT  H2                      ;H2 is set =
45408
              SET     H0   = 0
              JMP     UNCONDITIONED  , M6

        -------------------------------------
```

```
        M4   : JMP       LO I0000000000010000, M6
             SUB         H0    - 1
             JMP         H0    == -49        , M7
             GOR         WAIT  H3                        ;H3 is set = -
45386
             JMP         UNCONDITIONED   , M6
        M7   : GOR       WAIT  H4                        ;H4 is set = -
45408
             SET         H0    = 0
        M6   : RET



        ----------------------------------------------------
        Reference Routine. - Important to use Cam (Not ZP)
        ----------------------------------------------------
        M2   : JMP       LO I0000000000000010, M8
             JMP         LO I0000000000000001, M8
             GO0         U,  W,CAM
             GOA         WAIT  H8                        ;H8 is offset to
Lineup.
             SET         H0    = 0
        M8   : RET
```

This will also work for other gear ratio's and external ratio's. You should watch that the final maximum error (in this case 22 incs.) is not outside the customer's allowed positioning tolerance.

One important point , the internal counter of 2^{31-1} will eventually overflow. This is **not** a problem as internally the drive recognizes the overflow , rolling over the number to a negative number and keeping the count correct.