

51.0 SPECIAL COEFFICIENT RESTRICTIONS

This section is relevant to the following control blocks: LAG, DIFF_LAG, INTEGRATE, and PROP_INT.

The input signal to these control blocks is in the range -32768 to $+32767$. The output signal, however, may be limited to something less than this range. The cause of this output range limitation is a trade-off between the range and resolution of the internal math used. As the coefficient value decreases in size, resolution is retained at the expense of range. In the majority of cases, this should not pose a problem due to the normalization factor of $1PN = 4095$.

These blocks contain an integrator. As the integrator coefficient value decreases, its output value may be limited to less than a 16-bit value in order to retain resolution and still use 32-bit math. The following shows the relationship between coefficient value and output limitation.

| <u>Coefficient Value</u> | <u>Max Output Range</u> |
|--------------------------|-------------------------|
| 2-18 to .124996 | ± 8191 |
| .125 to .249992 | ± 16383 |
| .25 to max_val | ± 32767 |

The integrator coefficient for each block can be calculated as follows:

$$\text{LAG: } Kx = \frac{\omega l g}{C}$$

$$\text{DIFF_LAG: } Kx = \frac{\omega l g}{C}$$

$$\text{INTEGRATE: } Kx = \frac{K I}{C}$$

$$\text{PROP_INT: } Kx = \frac{\omega l d \times K p}{C}$$

where:

$$C = \frac{\omega m}{\text{TAN} \left(\frac{\omega m * T}{2} \right)}$$

T = scan period in seconds.

If ωm is defaulted (not programmed), then

$$\omega m = \frac{\omega s}{20} = \frac{2\pi}{20T} = \frac{\pi}{10T}$$

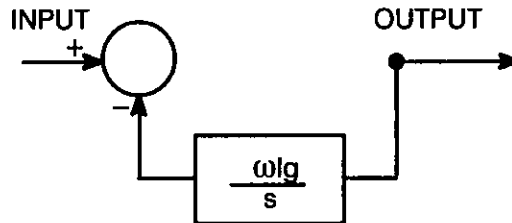
and

$$C = \frac{\left(\frac{\pi}{10T} \right)}{\text{TAN} \left(\frac{\pi}{20} \right)}$$

$$= \frac{.314159}{T}$$

$$= \frac{1.9835}{T}$$

The DIFF_LAG block is a special case because the integrator is in the feedback path:



If the integrator output is limited, the OUTPUT is limited to the input minus the output of the integrator. Therefore, if the integrator output is limited to 8191 and the input is set to 32767, the output will settle out to $32767 - 8191 = 24576$, not zero, as would be expected with a DIFF_LAG function. Therefore, if the coefficient value can cause the integrator output to be limited to less than ± 32767 , make sure that the input does not exceed the limit of the integrator.