Application Note

- AC30 – Ajustable Switching frequency

HA504826 Issue A

ADJUSTABLE SWITCHING FREQUENCY

1: Description

For some high-speed applications, the high output frequency requires a high switching frequency. Increasing the switching frequency increases the losses by commutation of the IGBTs and results in a derating of the drive.

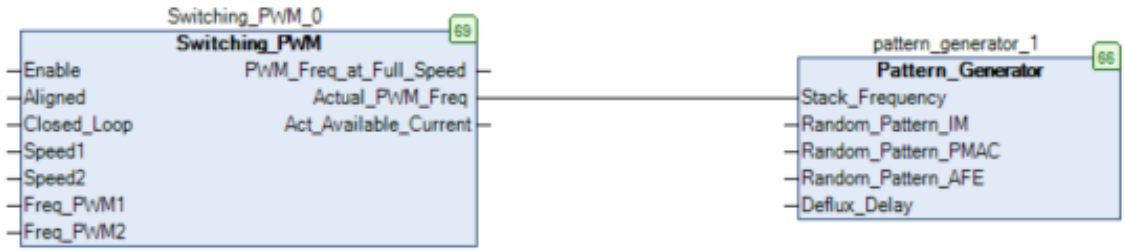
For the AC30, the ratio of output frequency to switching frequency is 1/6 for a PMAC motor controlled in closed loop (resolver or Sin/Cos encoder) and 1/8 for a PMAC motor in sensorless control mode.

In summary, for the same number of poles, the higher the motor speed, the higher the switching frequency, and therefore the less power available at the output of the inverter.

In order to optimise each inverter size, the AC30 allows the switching frequency to be changed dynamically according to the motor speed. For a given size of AC30, there will therefore be more current available at low speed than at high speed, which very often, and particularly for the MGV motor range, corresponds to the motor curves.

2: Programming

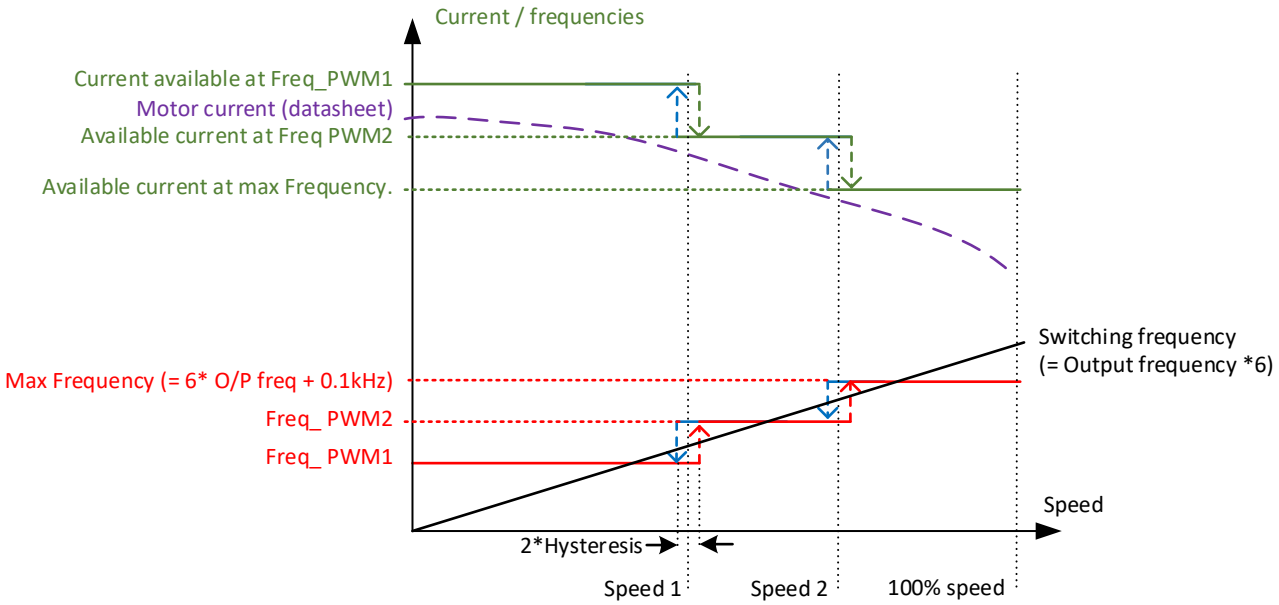
The function Block (FB) switching frequency according to the output frequency is not included in the default configuration of the AC30. Its implementation therefore requires the addition of a function block named switching_PWM which allows the setting of two speed thresholds and the associated switching frequency values. The output of the block must then be connected to the Pattern_Generator :: Stack_Frequency [412] parameter:



Parameter description:

Parameter	Format / Unit	Description
Enable	Bool.	If false, the Actual PWM Freq output is equal to PWM Freq at Full Speed. If true, Actual PWM Freq varies depending on the settings of the other inputs
Aligned	Bool	If false, Actual PWM Freq is forced to 4kHz. In case the alignment must be done at each power-up (Sin/cos), this input must be connected to the "Alignment Done" bit
Closed Loop	Bool	If false, the switching frequency/output frequency ratio is 8 (open loop), if true, the ratio is 6 (closed loop).
Speed 1	Real / rpm	Speed threshold 1 (see diagram below) Must be lower than (Speed 2 - 500rpm)
Speed 2	Real / rpm	Speed threshold 2 (see diagram below) Must be lower than (Max Application Speed - 500rpm)
Freq PWM1	Real / kHz	Switching frequency between zero speed and speed threshold 1 (with hysteresis of 400 rpm - see diagram)
Freq PWM2	Real / kHz	Switching frequency between speed threshold 1 and speed threshold 2 (with hysteresis of 400 rpm - see diagram)
PWM Freq at Full Speed	Real / kHz	Informative. PWM Freq at Full Speed. Indicates the switching frequency at full speed calculated from the number of motor poles and the set maximum speed: $PWM@Full\ Spd = \left(\frac{poles}{2}\right) * \left(\frac{Max\ speed}{60.000}\right) * ratio + 0{,}1$
Actual PWM Freq	Real / kHz	Block Output: Variable switching frequency. ⇨ To be connected to *Stack_Frequency [412].*
Act Available Current	Real / A	Informative. Indicates the current available (100%) for the inverter size according to the Actual switching frequency. The overload (110 or 150%) of this value depends on the selected operating mode (normal or heavy duty).

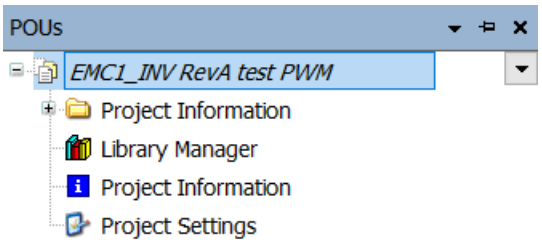
NB: The block uses the absolute value of the speed and therefore works in both directions.



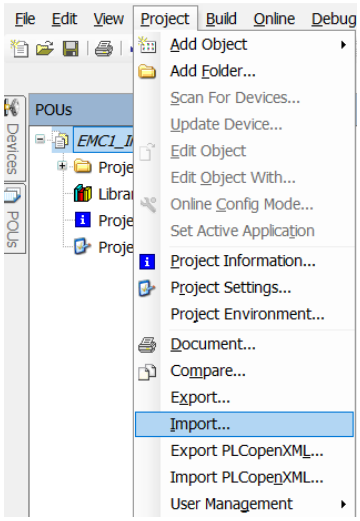
If only one switching step is required, simply set the same values for both points.:
Speed 2 = Speed 1
Freq PWM2 = Freq PWM1

3: Installation using PDD

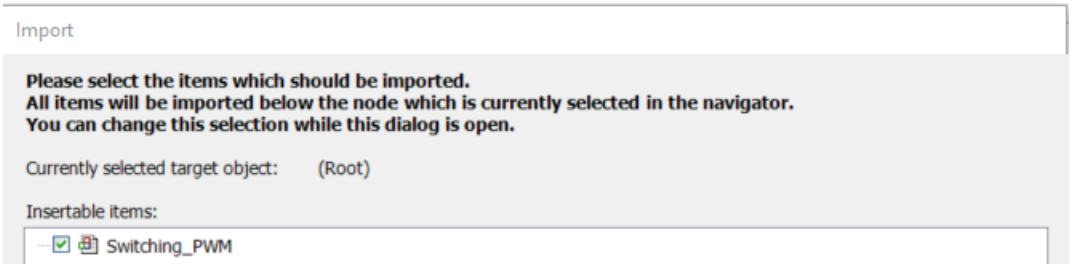
a- In POU box, select the top of the tree



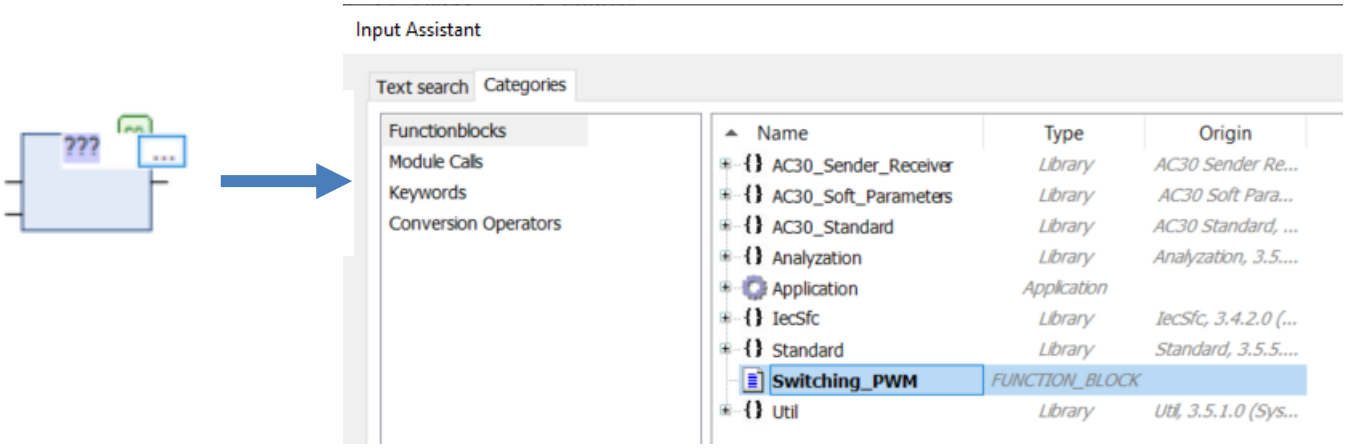
b- In the Command bar, select Project/Import :



c- Select the folder where the *Switching_PWM.export* file is located and click OK:



d- In the Application layer, insert a Box from the ToolBox and use the assistant to select the function block we just imported:



e- Connect it to the *Pattern Generator* function block and set the inputs accordingly to the application as explained above. Example: