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ECO Function of SINAMICS G120

SINAMICS G120 ,ECO, Energy saving

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What is ECO function

ECO function（Economic） is energy-saving mode feature, which is suitable for low dynamic response and constant speed setting.

In normal operation of the motor, the air gap flux is basically unchanged, so the current is very small under light load, and the stator current is not reduced as much as the rotor current due to the restraint of excitation current. According to the efficiency formula, it can be calculated that the efficiency will decrease sharply under light load. If the motor runs under light load for a long time, it will consume a lot of electric energy unnecessarily.

From the above analysis, in order to reduce the energy loss under light load, the key is to reduce the air gap flux, which can reduce the core loss and excitation current at the same time. Reduce the stator voltage can achieve this goal.

However, if the voltage and magnetic flux are excessively reduced, the rotor current will inevitably increase, and the stator current may increase instead. The decrease of iron loss will be filled by the increase of copper loss, and the efficiency will be worse.

Therefore, when the load torque is constant, there is an optimal value for reducing voltage and saving energy under light load, and the efficiency is highest at this time.

ECO function of G120

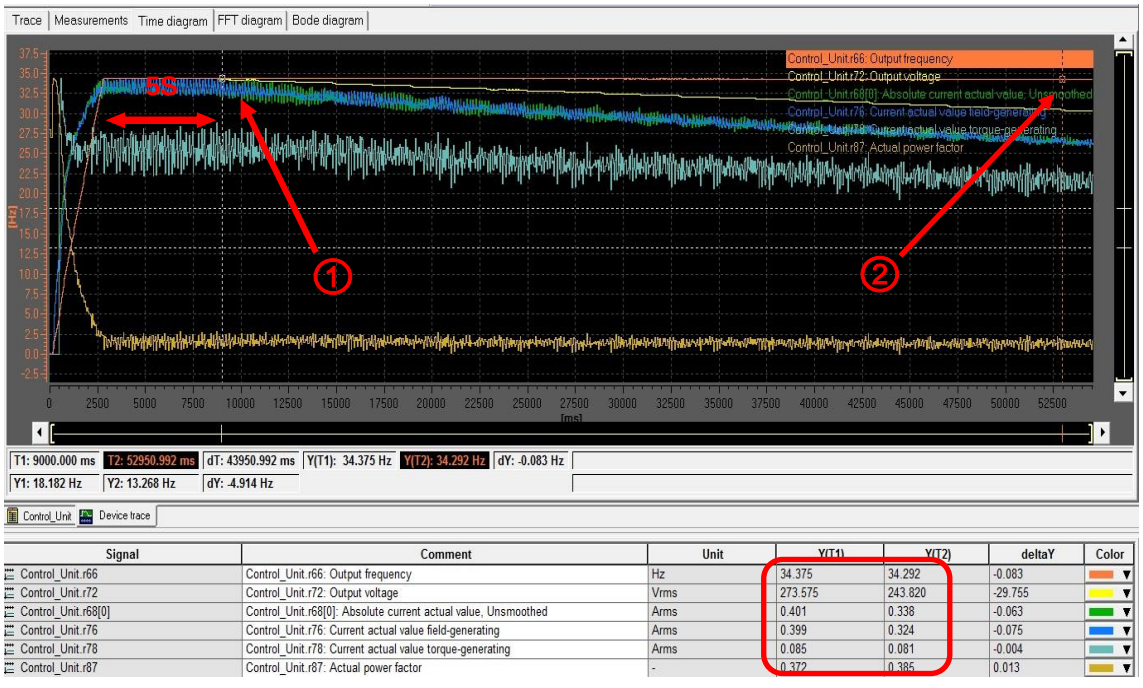
The ECO function in G120 inverter cannot be activated alone, which can be considered as a characteristic optimization for a specific control mode.

There are two operation modes with ECO function

P1300=4: linear V / F control with ECO function

7: Parabolic V / F control with ECO function

The figure below shows the curve of energy saving effect of ECO。



Signal	Comment	Unit	Y(T1)	Y(T2)	deltaY	Color
Control_Unit.r66	Control_Unit.r66: Output frequency	Hz	34.375	34.292	-0.083	
Control_Unit.r72	Control_Unit.r72: Output voltage	Vrms	273.575	243.820	-29.755	
Control_Unit.r68[0]	Control_Unit.r68[0]: Absolute current actual value, Unsmoothed	Arms	0.401	0.338	-0.063	
Control_Unit.r76	Control_Unit.r76: Current actual value field-generating	Arms	0.399	0.324	-0.075	
Control_Unit.r78	Control_Unit.r78: Current actual value torque-generating	Arms	0.085	0.081	-0.004	
Control_Unit.r87	Control_Unit.r87: Actual power factor	-	0.372	0.385	0.013	

Figure 1 Trace diagram of energy saving effect of CO function
In the above test: P1300 = 4, P1310 = 0, frequency 35Hz, light load
It can be seen from the curve that:

After the starting speed of the inverter reaches stable, the voltage begins to decrease after 5s, and the actual output current and excitation current also decrease and the torque current basically remains unchanged.

Attention:
The excitation current and torque current in the above trace diagram are only used for monitoring, and are not involved in the control.

Shaft power at point 1: P1=r72*r68*r87=273.6*0.4*0.372=40.71w

Shaft power at point 2: P2=r72*r68*r87=243.8*0.34*0.385=31.91w

The shaft power is reduced by 8.8W and energy saving is 21.6%,

Summary of ECO Function

- ECO function is suitable for low dynamic response,constant speed setting and light load.
- The optimization effect of ECO function for parabolic V / F control is not obvious.
- Enable ECO function, after reaching the speed set value for 5s, the inverter will automatically reduce the output voltage and optimize the motor characteristics.
- When ECO function is enabled, the inverter will enable slip compensation, and P1335 is automatically set to 100%.
- The tolerance P1148 of ramp function generator must be increased to avoid frequent switching of ECO function when small set point changes occur.
- In case of sudden change of speed or load, the motor may be out of step due to insufficient excitation current.