Drive System Application

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Energy-saving mode with MICROMASTER 440 and SINAMICS G120

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Application description
for MICROMASTER 440 and SINAMICS G120

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Preposition

Aim of the application

This application was generated in order to show users the possibility of the realisation of the energy saving mode on the drive inverters MICROMASTER 440 and SINAMICS G120.

Scope

The following core issues are discussed in this application:

- Description of the method
- Parameterization of the drive inverter
- Executing scripts in STARTER

Exclusion

This application does not include any description of the following

- STARTER commissioning tool
- Basic commissioning of the frequency inverter
- Commissioning higher-level controls

It is assumed that readers have basic knowledge about these subjects.

Reference to the Automation and Drives Service & Support

This article is from the Internet Application Portal of the Automation and Drives Service & Support. You can go directly to the download page of this document using this link.

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Application description

This application shows how the energy saving mode can be executed on the drive inverters MICROMASTER 440 and SINAMICS G120.

1 Description

MICROMASTER 430 is a drive inverter which has been specifically designed for pump and fan drive applications. When compared to standard drive units, special functions have been implemented, for example, the energy-saving mode. The following document will show how for applications, where the MICROMASTER 430 is not suitable as a result of the supply voltage and power rating, the energy-saving mode functionality can be implemented using the free blocks of MICROMASTER 440.

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value difference. If, as a result of the closed-loop control, the setpoint / actual value difference is less than the value P2889, the set input of the RS-FF1 is withdrawn. The drive goes to the minimum speed which should be set so that water is pumped at precisely this speed. If the actual value continues to increase, the setpoint / actual value deviation becomes negative. When the negative limit (P2890) is exceeded, RS-FF1 is reset. Timer 1 implements an adjustable power-off delay. When this expires, the drive inverter is powered-down again. The drive inverter is only powered-up again if the system deviation increases above the limit value parameterized using P2889.

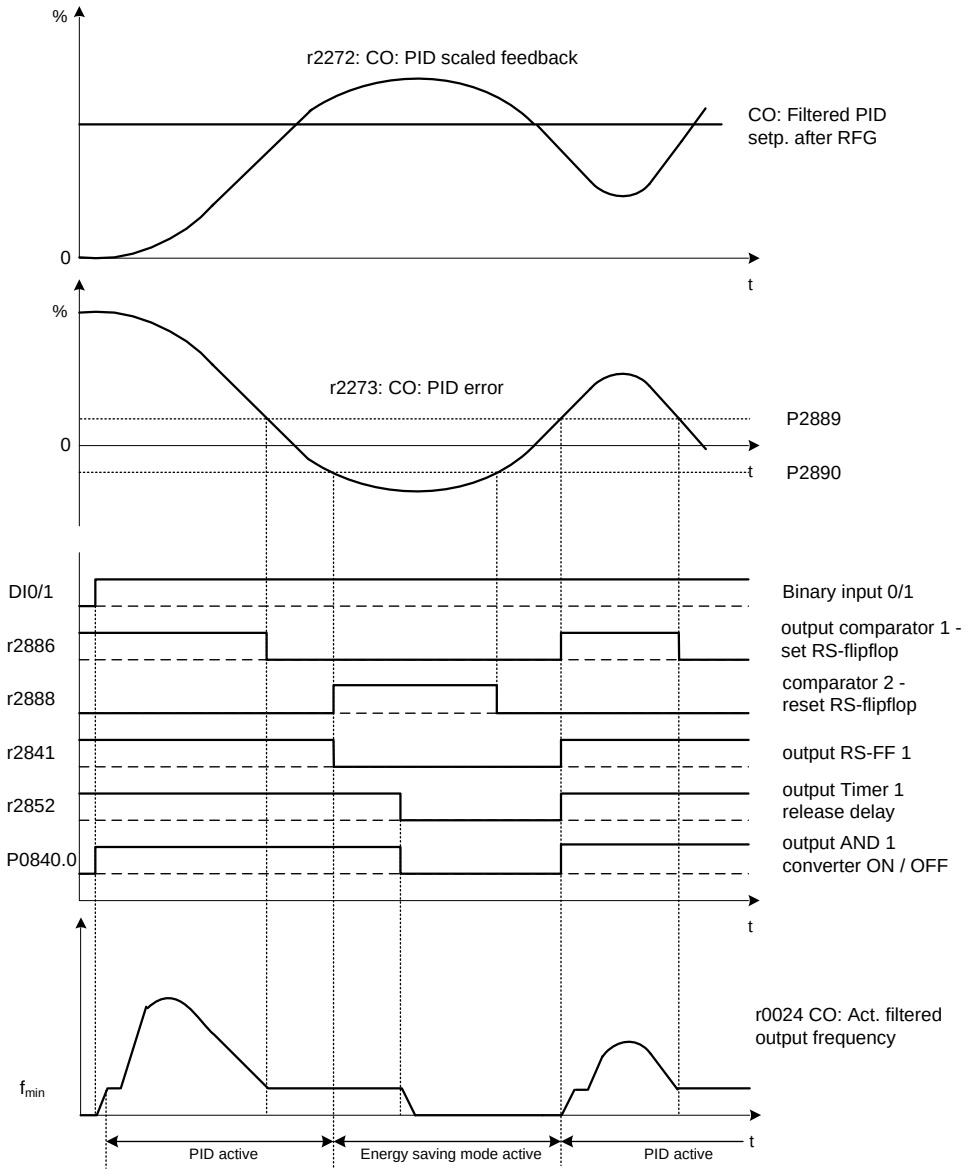

Figure 3-2 Sequence diagram, energy-saving mode

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4 Parameterization of the drive inverter

Minimum frequency: The minimum frequency P1080 must be set so that the drive is able to establish additional pressure in the pressure reservoir in order to initiate the shutdown via the limit value monitor.

Limiting the PID controller: The PID controller is always operational if power is connected to the drive. The limit of the output is set to zero. In order that the drive doesn't suddenly accelerate to the value of the PID controller output when it is powered-up, the PID controller output limit is withdrawn using a ramp-function generator (P2293) as soon as the PID controller is enabled.

4.1 Enabling the PID controller permanently

Enabling the PID controller: The PID controller is enabled via the function f_{act} > P2155. P2155 should, for example, be 0.05 Hz below the value of P1080.

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Table 4-1 Parameterization of the drive inverter

Parameter No.	Designation	Parameter value	Note / comments
P0003	Access level	3	3: Expert
P0701[0]	Digital input 0/1 (DI0/DI1)	99	99: Enable BICO parameterization
P0840[0]	BI: ON/OFF1	r2811.0	Enable ON/OFF1 = Output of the AND1
P1070[0]	CI: Main setpoint	0	no main setpoint
P1080[0]	Min. frequency	30.00	Min. frequency = 30 Hz
P1120[0]	Ramp-up time	2.00	Ramp-up time = 2.00 s
P1120[0]	Ramp-down time	2.00	Ramp-down time = 2.00 s
P2200[0]	BI: Enable PID controller	1	1: PID controller permanently activated
P2251	PID mode	1	1: PID as trim
P2253[0]	CI: PID setpoint	r0755.0	CI: PID setpoint = analog input 0/1
P2257	Ramp-up time for PID setpoint	10.00	Ramp-up time for PID setpoint = 10.00 s
P2258	Ramp-down time for PID setpoint	10.00	Ramp-down time for PID setpoint = 10.00 s
P2264[0]	CI: PID feedback	r0755.1	PID feedback = analog input 1/2
P2293	Ramp-up /-down time of PID limit	2.00	Ramp-up /-down time of PID limit = 2.00 s

Parameter No.	Designation	Parameter value	Note / comments
P2800	Enable FFBs	1	1: Enable
P2801[0]	Activate FFBs	1	Activate AND1 (Level 1)
P2801[14]	Activate FFBs	1	Activate RS-FF1 (Level 1)
P2802[0]	Activate FFBs	1	Activate Timer1 (Level 1)
P2802[12]	Activate FFBs	1	Activate CMP1 (Level 1)
P2802[13]	Activate FFBs	1	Activate CMP2 (Level 1)
P2810[0]	BI: AND 1	r0722.0	1st input of the AND1 = DI0/1
P2810[1]	BI: AND 1	r2852.0	2nd input of the AND1 = Output of the Timer 1
P2840[0]	BI: RS-FF 1	r2886.0	Set input of the RS-FF1 = Output of the CMP1
P2840[1]	BI: RS-FF 1	r2888.0	Reset input of the RS-FF1 = Output of the CMP2
P2849	BI: Timer 1	r2841.0	Input signal of the Timer 1 = Q-output of the RS-FF1
P2850	Delay time of timer 1	5.0	Delay time of timer 1 = 5.0 s
P2851	Mode timer 1	1	1: OFF delay (seconds)
P2885[0]	CI: CMP 1	r2273.0	1st input of the CMP1 = PID error
P2885[1]	CI: CMP 1	P2889	2nd input of the CMP1 = Fixed setpoint 1 in [%]
P2887[0]	CI: CMP 2	P2890	1st input of the CMP2 = Fixed setpoint 2 in [%]
P2887[1]	CI: CMP 2	r2273.0	2nd input of the CMP2 = PID error
P2889	CO: Fixed setpoint 1 in [%]	5.00	Fixed setpoint 1 = 5.00 %
P2890	CO: Fixed setpoint 2 in [%]	-5.00	Fixed setpoint 2 = -5.00 %

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4.2 Enabling the PID controller as a function of the frequency

Enabling the PID controller: If it is to be avoided that the PID controller is already operational before the drive has reached the minimum frequency, then the PID controller enable (P2200) can be switched as a function of the output frequency f_{act} > P2155 (refer to fig. 4-1). In this case, threshold f_1 (P2155) is set to 0.05 Hz below the minimum frequency (P1080).

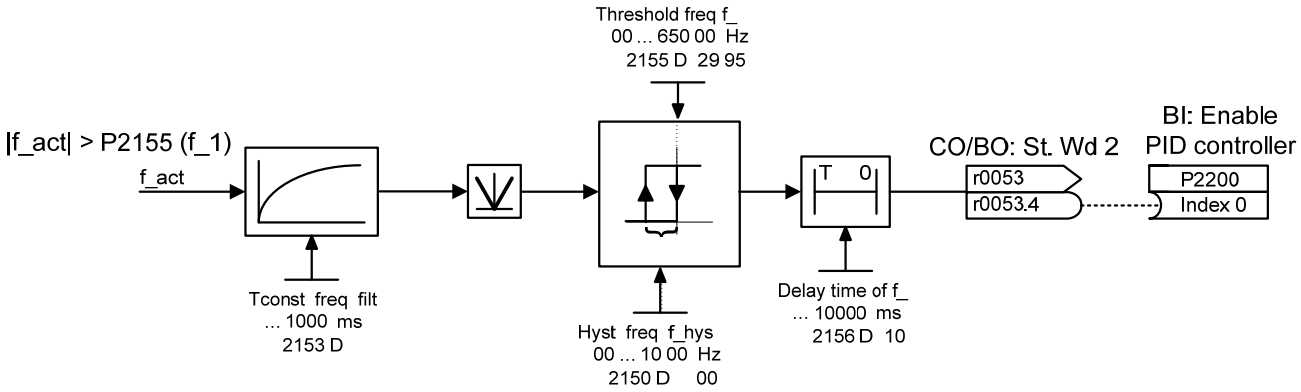

Figure 4-1 Enabling the PID controller as a function of the frequency

The following parameters must in addition be set up in the drive inverter:

Table 4-2 Enabling the PID controller as a function of the frequency

Parameter No.	Designation	Parameter value	Note / comments
P2150[0]	Hysteresis frequency f_hys	2.00	f_hys = 2.00 Hz
P2155[0]	Threshold frequency f_1	29.95	f_1 = 29.95 Hz
P2156[0]	Delay time of threshold freq f_1	0	Delay time of f_1 = 0 ms
P2200[0]	BI: Enable PID controller	r0053.4	Enable PID controller = f_act > P2155 (f_1)

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5 Executing scripts in STARTER

For fast parameter changes, you can use the attached script files.

Note:

Before you execute a script on the drive, please set your drive inverter to the factory settings (P0010 = 30, P0970 = 1) and carry-out a quick commissioning (P0010 = 1) of the drive.

The procedure in detail:

1. Save the attached script file in a folder on your computer hard drive.

2. Set-up a script folder for the drive in your STARTER project by clicking with the righthand mouse key on the drive; then click on “Expert” (lefthand mouse key) and on “Insert script folder” .

   A new folder appears “SCRIPTS” at the lower end of the tree.

3. Import the script from your folder into STARTER as described below:
   – Using the righthand mouse key click on the tab "SCRIPTS" ;
   – Click on

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