SIEMENS

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Torque Control of SINAMICS V90

SINAMICS V90, Torque Control

Content

1 Abstract

Four basic control modes are available for the SINAMICS V90 servo drive:

- PTI Pulse train input position control mode
- IPos Internal position control mode
- S Speed control mode
- T Torque control mode

While using torque control mode with SINAMICS V90, the torque on the motor shaft is output in accordance with the torque setpoint. In most of the applications, a motor with torque control works with a speed master, for example, to realize the line tension control, or pressure control, etc.

Otherwise, if a motor with torque control works alone, and the output torque is larger then the load torque, the motor will keep accelerating, until overspeed occurs. SINAMICS V90 will inhibit the pulse, and output a fault signal, if overspeed occurs.

This document introduces that how to configure torque control for SINAMICS V90.

2 Function description of torque control of SINAMICS V90

2.1 Activation of torque control mode

Torque control mode can be activated by setting P29003=3.

Attention:

Restart the servo drive to apply the settings of the torque control mode!

2.2 Torque setpoint source

2 sources can be used as torque setpoint alternatively. It can be selected by the command TSET:

- TSET = 0 (Default) Use AI2 as torque setpoint
- TSET = 1 Use P29043 as torque setpoint

2.2.1 Use AI2 as torque setpoint

In torque control mode, AI2 is used as torque setpoint by setting TSET = 0.

The reference torque of AI2 is set in P29041[0]. For example:

- P29041[0] = 100% 10V corresponds to Rated_Torque*100%
- P20041[0] = 50% 10V corresponds to Rated_Torque*50%

2.2.2 Use P29043 as torque setpoint

In torque control mode, P29043 is used as torque setpoint by setting TSET = 1.

The value -100 ~ 100 set in P29043 corresponds to (-100% ~ 100%)* Rated_Torque.

2.3 Direction and stop

The commands CWE and CCWE are used to control the motor rotating direction and stop:

- CWE = 1 Clockwise rotating enable
- CCWE = 1 Counter-clockwise rotating enable
- Both signals = 0/1 Stop, the internal setpoint is 0

2.4 Overspeed monitoring

In torque control mode, if the actual speed is higher than the overspeed threshold, the fault F07901 is triggered, and the pulse is inhibited. The overspeed threshold is:

- Positive threshold: Positive speed limit + P2162
- Negative threshold: Negative speed limit - P2162

The default setting of P2162 is 0rpm.

4 sources in total are available for the speed limit. You can select one of them via a combination of the commands SLIM1 and SLIM2:

Speed limit		Digital signal	
		SLM2	SLM1
Internal speed limit 1	P29070[0]: positive speed limit P29071[0]: negatvie speed limit	0	0
External speed limit(AI)	P29060: Scaling for analog speed setpoint (maximum speed setpoint corresponding to 10 V)	0	1
Internal speed limit 2	P29070[1]: positive speed limit P29071[1]: negatvie speed limit	1	0
Internal speed limit 3	P29070[2]: positive speed limit P29071[2]: negatvie speed limit	1	1

<Table 2-1 Speed limit selection>

3 Example: Use toque control of SINAMICS V90

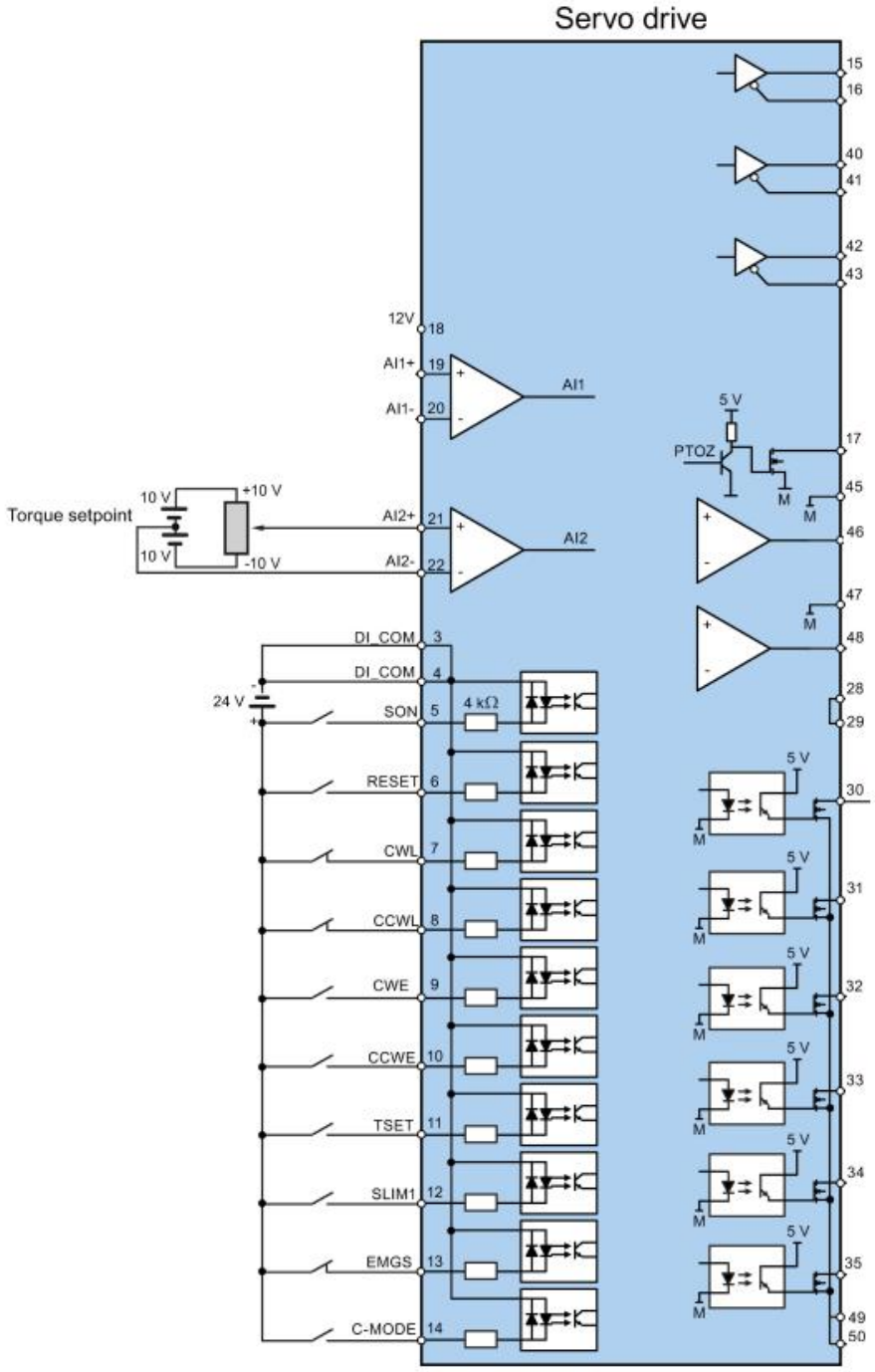
3.1 Project planning

In this example, AI2 is used as the torque setpoint, and the speed limit is set in “Internal speed limit 1”, the other commands are planning as below:

Signal	Command	Initial state	Comment
DI1	SON	0	Servo ON： • Rising edge: servo power ON • Falling edge: OFF2 in T mode
DI2	RESET	0	Reset alarms: • Rising edge: reset alarms
DI3	CWL	1	Positive hardware limit: • High level: condition for operation • Falling edge: E-stop(OFF3)
DI4	CCWL	1	Negative hardware limit: • High level: condition for operation • Falling edge: E-stop(OFF3)
DI5	CWE	0	Clockwise rotating enable: • High level: Enable clockwise rotating • Low level : Disable clockwise rotating Refer to chapter 2.3.
DI6	CCWE	0	Counter-clockwise rotating enable: • High level: Enable counter-clockwise rotating • Low level : Disable counter-clockwise rotating Refer to chapter 2.3.
DI7	TSET	0	Set to 0, AI2 is used as torque setpoint. Refer to chapter 2.2
DI8	SLIM1	0	Set to 0, “Internal speed limit 1“ is selected by SLIM1 and SLIM2. Refer to chapter 2.4
DI9	EMGS	1	E-stop: • High level: condition for operation • Falling edge: E-stop(OFF3)

3.2 Hardware connection

The hardware connection diagram is shown in Fig3-1.



<Fig 3-1 Hardware connection diagram>

3.3 Parameter setting and commissioning steps

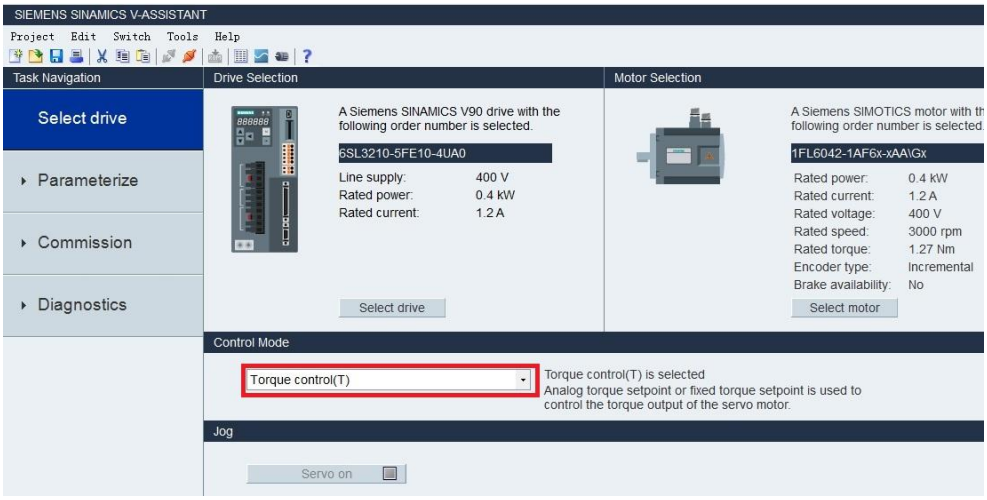
Step	Description
1	Switch off the main supply.
2	Power off the servo drive and connect the cables as shown in Fig3-1. The digital signals CWL, CCWL and EMGS must be kept at high level to ensure normal operation.
3	Power on the servo drive.
4	Switch to the torque control mode by setting P29003 = 3.
5	Restart the servo drive to apply the settings of the torque control mode.
6	Configure necessary digital input signals by setting the following parameters: • p29301[3] = 1, DI1 : SON • p29302[3] = 2, DI2 : RESET • p29303[3] = 3, DI3 : CWL • p29304[3] = 4, DI4 : CCWL • p29305[3] = 12, DI5 : CWE • p29306[3] = 13, DI6 : CCWE • p29307[3] = 18, DI7 : TSET • p29308[3] = 19, DI8 : SLIM1
7	Configure the torque setpoint scaling and speed limitation by setting the following parameters: • p29041[0] = 100, the reference torque of AI2 is Rated_Torque*100% • P29070[0] = 3000, positive speed limit is 3000rpm • P29071[0] = -3000, negative speed limit is -3000rpm
8	Initialize the digital input signals: • DI3(CWL), DI4(CCWL) and DI9(EMGS) are at high level(1). • Other DIs are at low level(0).
9	Clear the faults and alarms by the rising edge of DI2 (RESET).
10	Change SON status to be high level (1) and servo motor starts running according to the configured torque setpoint. The actual torque of the servo motor can be viewed from the BOP operating display. The default display is actual speed. You can change it by setting p29002=2 to display the actual torque.
11	The system commissioning in torque control mode ends. You can check the system performance. If it is not ok, you can adjust it.

4 Configure torque control of SINAMICS V90 via the PC software tool: V-ASSISTANT

Attention: You cannot switch on the servo drive via the control panel of V-ASSISTANT in torque control mode.

4.1 Select torque control mode

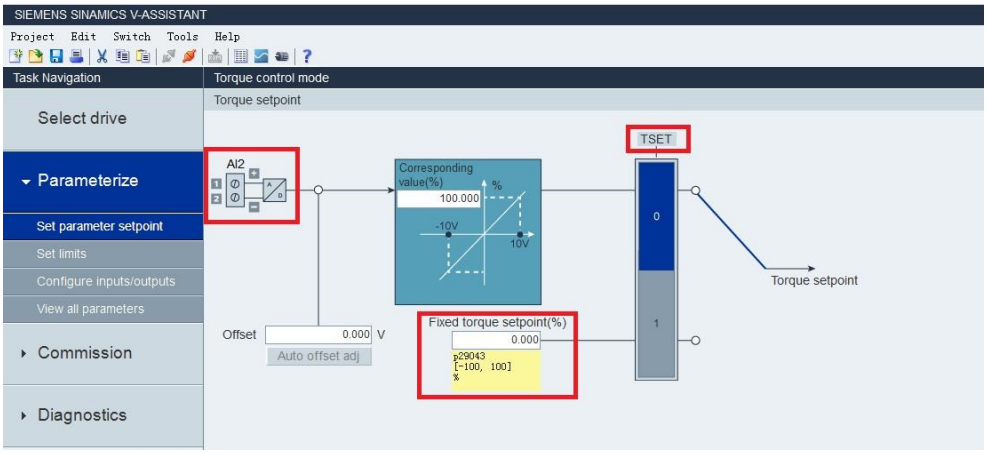
See Fig4-1.



<Fig4-1 Select torque control mode>

4.2 Select torque setpoint source

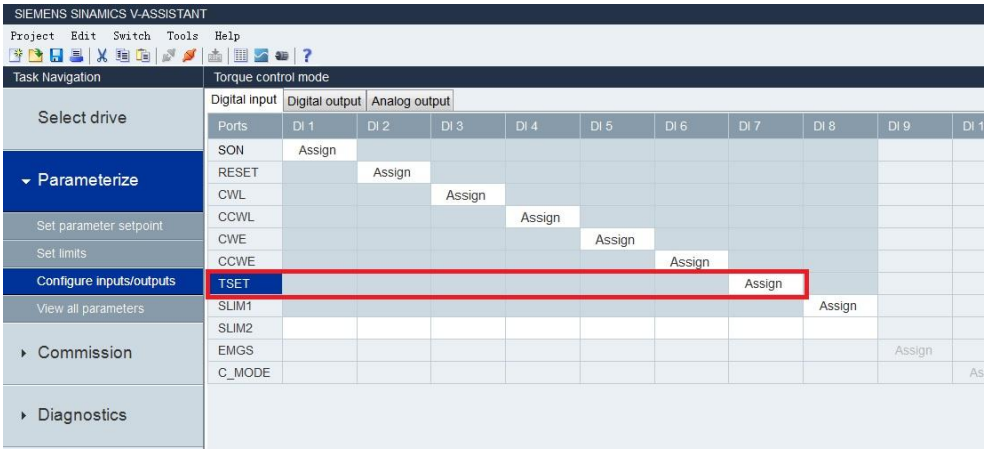
See Fig4-2.



<Fig4-2 Select torque setpoint source>

4.3 Set the function of the digital input signals

See Fig4-3.



<Fig 4-3 Set the function of the digital input signals>