SINAMICS S110

Supplement to the Function Manual (FH3), 06/2012, 6SL3097-4AB10-0BP4

8.3.5 Response times

Note

You can only see the actual value of the monitoring clock cycle (r9780), if you are connected ONLINE with the drive. However, for an initial calculation of the response times you can use the value r9780 = 2 ms.

Controlling the Basic Functions

Control of the Basic Functions via terminals

The table below shows the control response times via terminals.

Table 8-3   Response times when controlling the Basic Functions via terminals

Function	Typical[1]	Worst case[1]
STO	2 x r9780 + t_E[2]	7 x r9780 + t_E[2]
SBC	4 x r9780 + t_E[2]	11 x r9780 + t_E[2]
SS1 (time controlled) Selection until STO is initiated	2 x r9780 + p9652 + t_E[2]	7 x r9780 + p9652 + t_E[2]
SS1 (time controlled) Selection until SBC is initiated	4 x r9780 + p9652 + t_E[2]	11 x r9780 + p9652 + t_E[2]

[2] For t_E (debounce time of the digital input F-DI 0):

p9651 = 0	t_E = p0799 (default = 4 ms)
p9651 ≠ 0	t_E = p9651 + 1 ms

Control of Basic Functions via PROFIsafe

The following table lists the response times from receiving the PROFIsafe telegram at the Control Unit up to initiating the particular response.

Table 8-4   Response times when controlling the Basic Functions via PROFIsafe

Function	Typical	Worst case
STO	5 x r9780	5 x r9780
SBC	6 x r9780	13 x r9780
SS1 (time controlled) Selection until STO is initiated	5 x r9780 + p9652	5 x r9780 + p9652
SS1 (time controlled) Selection until SBC is initiated	6 x r9780 + p9652	13 x r9780 + p9652

Controlling the Extended Functions

The tables below show the response times, when functions STO, SS1, or SS2 are selected, between recognition of the selection at the Control Unit and the initiation of the relevant braking response. The entries for monitoring functions SOS, SLS, SAM, and SSM show the time between when the relevant limit value is exceeded and when the response is initiated.

Control of Extended Functions with encoder via PROFIsafe

The following table lists the response times from receiving the PROFIsafe telegram at the Control Unit up to initiating the particular response.

Table 8-5   Reaction times when controlling the Extended Functions with encoder via PROFIsafe

Function	Typical	Worst case
STO	4 x p9500 + r9780	4 x p9500 + 3 x r9780
SBC	4 x p9500 + 2 x r9780	4 x p9500 + 9 x r9780
SS1 (time and acceleration controlled), SS2 selection until braking initiated	4 x p9500 + 2 ms	5 x p9500 + 2 ms
SAM response of the safe acceleration monitoring	2 x p9500 + 2 ms	2.5 x p9500 + r9780 + p9511
SOS standstill tolerance window violated	1.5 x p9500 + 2 ms	3 x p9500 + p9511 + 2 ms
SLS speed limit violated [2]	2 x p9500 + 2 ms	3.5 x p9500 + p9511 + 2 ms
SSM [3]	4 x p9500	4.5 x p9500 + p9511

The specified response times involve internal SINAMICS response times. Program run times in the F host and the transmission time via PROFIBUS or PROFINET are not taken into account.

Control of Extended Functions with encoder via terminals

The table below shows the response times after the appearance of a signal at the terminals.

Table 8-6   Response times when controlling the Extended Functions with encoder via safe on-board terminals

Function	Typical[1]	Worst case[1]
STO	2.5 x p9500 + r9780 + t_E[6]	3 x p9500 + 6 x r9780 + t_E[6]
SBC	2.5 x p9500 + 2 x r9780 + t_E[6]	3 x p9500 + 9 x r9780 + t_E[6]
SS1 (time and acceleration controlled), SS2 selection until braking initiated	2.5 x p9500 + t_E[6] + 2 ms	4 x p9500 + t_E[6] + 4 ms
SAM response of the safe acceleration monitoring	2 x p9500 + 2 ms	2.5 x p9500 + r9780 + p9511
SOS standstill tolerance window violated	1.5 x p9500 + 2 ms	3 x p9500 + p9511+ 2 ms
SLS speed limit violated [2]	2 x p9500 + 2 ms	3.5 x p9500 + p9511 + 2 ms
SSM [4]	3 x p9500	3.5 x p9500 + p9511

Control of Extended Functions without encoder via PROFIsafe

The following table lists the response times from receiving the PROFIsafe telegram at the Control Unit up to initiating the particular response.

Table 8-7   Response times when controlling the Extended Functions without encoder via PROFIsafe

Function	Typical	Worst case
STO	4 x p9500 + r9780	4 x p9500 + 3 x r9780
SBC	4 x p9500 + 2 x r9780	4 x p9500 + 9 x r9780
SS1 (time and acceleration controlled)	4 x p9500 + 2 ms	5 x p9500 + 2 ms

Function		Typical	Worst case
SAM response of the safe acceleration monitoring		3 x p9500 + 31 ms	3.5 x p9500 + r9780 + 57 ms
SLS speed limit violated [2]	Standard	3 x p9500 + 31 ms	4.5 x p9500 + r9780 + 57 ms
	Starting phase[5]	3 x p9500 + 31 ms + p9586[5]	4.5 x p9500 + r9780 + 57 ms + p9586[5]
SSM without encoder		6 x p9500 + p9587 + 4 ms	6.5 x p9500 + p9587 + 32 ms
SDI without encoder until braking initiated	Standard	2.5 x p9500 + p9587 + 6 ms	4 x p9500 + r9780 + p9587 + 32 ms
	Starting phase[5]	2.5 x p9500 + p9587 + 6 ms + p9586[5]	4 x p9500 + r9780 + p9587 + 32 ms + p9586[5]

> ⚠️ **CAUTION**
>
> If the safety functions SLS without encoder or SDI without encoder are already selected when the gating pulses for the Power Module are enabled, then during the starting phase, it is absolutely imperative that you take into account the response times when limit values are violated and for system errors in order to extend the time value set in parameters p9586 and p9386[5] with respect to the standard values (see the table above).
>
> The standard response times (see the table above) are valid after the time interval, which is set in parameters p9586 and p9386.

The specified response times involve internal SINAMICS response times. Program run times in the F host and the transmission time via PROFIBUS or PROFINET are not taken into account.

Control of Extended Functions without encoder via terminals

The table below shows the response times after the appearance of a signal at the terminals.

Table 8-8   Response times when controlling the Extended Functions without encoder via terminals

Function		Typical	Worst case
STO		2.5 x p9500 + r9780 + t_E[6]	3 x p9500 + 6 x r9780 + t_E[6]
SBC		2.5 x p9500 + 2 x r9780 + t_E[6]	3 x p9500 + 9 x r9780 + t_E[6]
SS1 (time and acceleration controlled)		2.5 x p9500 + t_E[6] + 2 ms	4 x p9500 + t_E + 2 ms[6]
SAM response of the safe acceleration monitoring		3 x p9500 + 31 ms	3.5 x p9500 + r9780 + 57 ms
SLS speed limit violated [2]	Standard	3 x p9500 + 31 ms	4.5 x p9500 + r9780 + 57 ms
	Starting phase[5]	3 x p9500 + 31 ms + p9586[5]	4.5 x p9500 + r9780 + 57 ms + p9586[5]
SSM without encoder		4 x p9500 + p9587 + 4 ms	4.5 x p9500 + p9587 + 32 ms
SDI without encoder until braking initiated	Standard	2.5 x p9500 + p9587 + 6 ms	4 x p9500 + r9780 + p9587 + 32 ms
	Starting phase[5]	2.5 x p9500 + p9587 + 6 ms + p9586[5]	4 x p9500 + r9780 + p9587 + 32 ms + p9586[5]

> ⚠️ **CAUTION**
>
> If the safety functions SLS without encoder or SDI without encoder are already selected when the gating pulses for the Power Module are enabled, then during the starting phase, it is absolutely imperative that you take into account the response times when limit values are violated and for system errors in order to extend the time value set in parameters p9586 and p9386[5)] with respect to the standard values (see the table above).
>
> The standard response times (see the table above) are valid after the time interval, which is set in parameters p9586 and p9386.

Information on the tables:

[1)] r9780 = 2 ms (fixed)

[2)] SLS: Specification of the response time required for initiation of a braking reaction in the drive, or for the output of the "SOS selected" message to the motion control system.

[3)] SSM: The data corresponds to the times between the limit value being undershot up to sending the information via PROFIsafe.

[4)] SSM: The data corresponds to the times between the limit value being undershot up to output of the information via the terminals.

[5)] This is how you determine the "delay time of the evaluation encoderless" (p9386/p9586)

The delay time p9586/p9386 is used to avoid unnecessary messages/signals while the converter starts.

1. To determine the minimum delay time p9586/p9386, record (trace) the starting behavior of the drive system (with the motor and the intended load). The STARTER trace function allows the value for p9586/p9386 to be determined.

2. In order to avoid unnecessary messages/signals, deselect the "SDI without encoder" and "SLS without encoder" functions.

3. Activate the trace function using the trigger "OFF2 → inactive" and as signals to be recorded/traced: the current in at least one motor phase and OFF2.

   After the ON command, record this motor phase current until I_{rated} is reached. Enter the time that it takes to reach I_{min} (+ 10 % reserve) into p9386.

4. Start the drive as it would normally start in your particular application.

5. From the trace, read-off the time, after which the current peak of the induction motor or the pulse pattern of the rotor position identification has ended, and the current has exceeded the "minimum current actual value sensing without encoder" p9588/p9388.

6. Enter this measured time + approx. 10 % into p9586 (as a result of the parameter doubling function, the same value is automatically entered into p9386).

7. Activate the "SDI without encoder" and "SLS without encoder" functions

8. Restart the machine, and keep the trace function activated.

9. Unnecessary messages/signals should no longer occur.

[6)] The following applies for t_E (debounce time of the digital input being used):

p10017 = 0	t_E = 2 × p0799
p10017 ≠ 0	t_E = p10017 + p0799 + 1 ms

Overview of important parameters (see SINAMICS S110 List Manual)

- p0799[0...2] CU inputs/outputs sampling time
- p9500 SI Motion monitoring clock cycle (processor 1)
- p9511 SI Motion actual value sensing clock cycle (processor 1)
- p9586 SI Motion delay time of the evaluation, encoderless (CU)
- p9651 SI STO/SBC/SS1 debounce time (processor 1)
- p9652 SI Safe Stop 1 delay time (processor 1)
- r9780 SI monitoring clock cycle (Control Unit)