

FAQ • 07/2016

SIMATIC Safety

Fail-safe function blocks for storage and retrieval machines

FAQ – notes on how to handle faults in the position sensing system



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NOTICE	This document is a supplement to the following manuals:					
	 "SIMATIC fail-safe function blocks for storage and retrieval machines - TIA Safety Advanced with S7-1500F" 					
	 "SIMATIC fail-safe function blocks for storage and retrieval machines - Distributed Safety/TIA Safety Advanced" 					

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1 External measuring system fails

1.1 Predicted measuring system failure (service situation)

It is assumed that if maintenance and service personnel are working on the system, then the external measuring system (e.g. laser position measuring system) will signal a fault. Here, it can be assumed that the protective door has been opened and persons are in the travel aisle of the storage and retrieval machine. If the measuring system has been mounted close to the floor, it is possible that somebody could pass by and interrupt the laser beam. In this case, the storage and retrieval machine will either come to a standstill, or as a maximum move with a crawl speed.

The measuring systems provide feedback indicating an interrupted or valid laser signal. This can be in the form of an error bit or as substitute value 0.

If this feedback signal is not processed, then the system must be referenced at block F_SAFE_POS - which means that the storage and retrieval machine must be moved to the reference position.

The considerable work involved can be avoided if input POS1_VALID at block F_SAFE_POS is reset for the feedback signal for an interrupted laser signal - and if it is being used, also input POS2_VALID (3 encoder version). It is permissible to switch the inputs back to true as soon as a valid encoder signal is available. When service is being carried out, when entering/exiting the protected area, both inputs could be directly reset or set.

To move the storage and retrieval machine again, it is sufficient to simply issue an acknowledge signal at block input ACK.

Fig.	1-1: Block F_	SAFE_	POS to	generate	a safety-related	position	for slip
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"F SAFE	POS"
_ EN	-
T_SAMPLE	
POS_CONFIG	
- POS1	
POS1_VALID	
– POS1_REF	
POS2	
- POS2_VALID	
POS2_REF	
- POS_SI	
POS_SI_VALID	
POS_SI_REF	
POS_SI_T_	
_ SAMPLE	
POS_SI_COUNT	
- MAX_POS	
MIN_POS	
POS_STARTUP_	SAFE_POS -
- TOL	POS_VALID
POS_DISC_	REFERENCED -
WINDOW	SAFE_V -
- POS_SETPOINT	V_VALID -
V_DISC_	STANDSTILL -
WINDOW	MOVES_
V_SYNC_	POSITIVE _
	MOVES_
V_MAX	
- V_STANDSTILL	ACK_REQ -
= SEI	ERROR -
- SYNC	DIAG -
- ACK	ENO -

POS1_VALID	Bool	1st direct measuring signal - encoder signal status 1: Encoder signal valid 0: Encoder fault
POS2_VALID	Bool	2nd direct measuring signal - encoder signal status 1: Encoder signal valid 0: Encoder fault
SET	Bool	Referencing 0 -> 1: Determine the offset of encoders regarding POS_SETPOINT
АСК	Bool	Acknowledgment If a fault has occurred in normal operation, then this must be reset using ACK before the system is restarted. The acknowledgment is realized using a positive signal edge at ACK; in normal operation this has no effect.
POS_VALID	Bool	Position actual value status 1: SAFE_POS has been generated in a safety-related way

Table 1-1: Important interface	variables when t	the measuring system	m fails
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Signal timing



1.2 Measuring system suddenly fails (fault scenario)

This scenario can occur if, for example, the laser beam is interrupted by a falling product or packaging material. In this case, it must be assumed that the storage and retrieval machine is operating in the automatic mode. This means that as a result of the invalid encoder value, it is mandatory that the storage and retrieval machine is stopped.

In this case, the encoder system feedback signal must be used as explained under Point 1.1. If this feedback signal is not processed, then the system must be referenced at block F_SAFE_POS – which means that the storage and retrieval machine must be moved to the reference position.

The considerable work involved can be avoided if, for the feedback signal for an interrupted laser signal, input POS1_VALID is reset, and if it is being used, also input POS2_VALID (3 encoder version) at block F_SAFE_POS. It is permissible to switch the inputs back to true as soon as a valid encoder signal is available.

By resetting output POS_VALID of block F_SAFE_POS, the stop response (SS1) is automatically triggered. This is realized, as the position is declared invalid by POS1_VALID/POS2_VALID = 0.

If the position is again valid, i.e. the encoder neither outputs an error bit nor a substitute value, then the fault can be simply acknowledged using block input ACK so that the storage and retrieval machine can be again moved.

"F_SAFE	POS"
- EN	
T_SAMPLE	
POS_CONFIG	
- POS1	
POS1_VALID	
– POS1_REF	
POS2	
– POS2_VALID	
POS2_REF	
- POS_SI	
POS_SI_VALID	
POS_SI_REF	
POS_SI_T_	
SAMPLE	
POS_SI_COUNT	
MAX_POS	
MIN_POS	
POS_STARTUP_	SAFE_POS -
TOL	POS_VALID
POS_DISC_	REFERENCED -
WINDOW	SAFE_V
POS_SETPOINT	V_VALID -
V_DISC_	STANDSTILL -
WINDOW	MOVES_
V_SYNC_	POSITIVE
	MOVES_
V_MAX	NEGATIVE _
V_STANDSTILL	ACK_REQ -
- SET	ERROR -
- SYNC	DIAG -
- ACK	ENO -

1 External measuring system fails

POS1_VALID	Bool	1st direct measuring signal - encoder signal status 1: Encoder signal valid 0: Encoder fault
POS2_VALID	Bool	2nd direct measuring signal - encoder signal status 1: Encoder signal valid 0: Encoder fault
SET	Bool	Referencing 0 -> 1: Determine the offset of encoders regarding POS_SETPOINT
ACK	Bool	Acknowledgment If a fault has occurred in normal operation, then this must be reset using ACK before the system is restarted. The acknowledgment is realized using a positive signal edge at ACK; in normal operation this has no effect.
POS_VALID	Bool	Position actual value status 1: SAFE_POS has been generated in a safety-related way

Table 1-2: In	nportant interface	variables when	the measuring	system fails

Signal timing



2

Power on reset at SINAMICS or the SIMATIC control

In this case, block F_SAFE_POS must be re-referenced. To do this, the storage and retrieval machine must be manually traversed to the reference position with its crawl velocity.