Analog sensor testing
application description

A notice:
The German version is the original version of the installation instructions

Status: 12 /2013

Contents

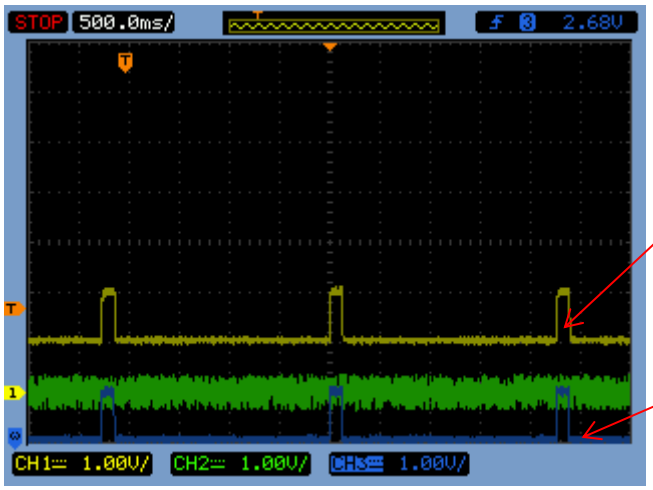
1 Objective

To achieve PI c / EN13849 and better, automatic diagnostics are required. The analog sensor testing function contains an automatic test for diagnosing sensors specially equipped for this purpose. The following description contains notes and explanations on how to use this function.

2 Application of the function

2.1 Function in general

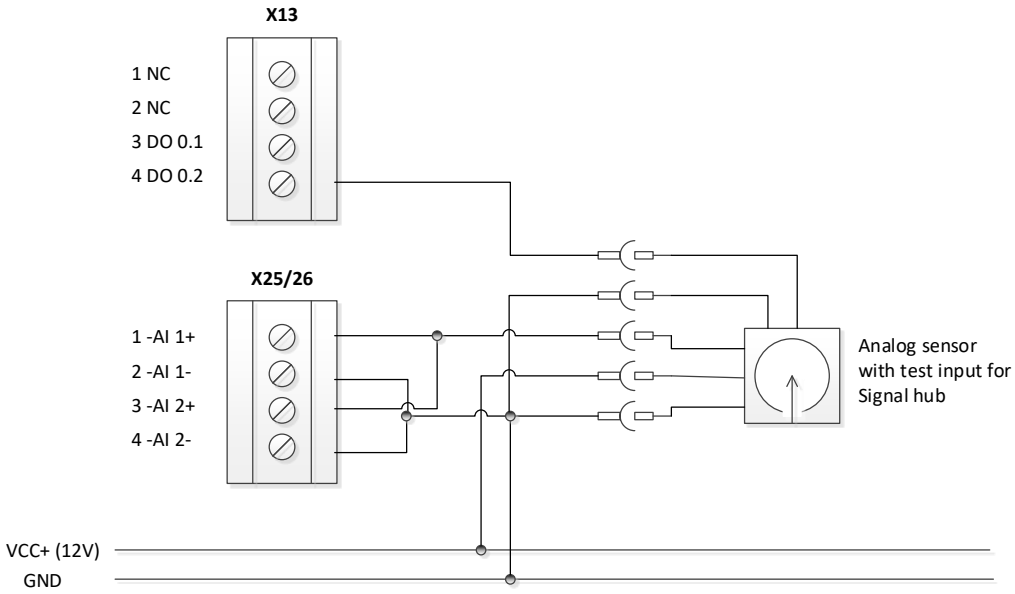
The function for diagnosing/testing analog sensors switches an assigned output at configurable intervals and for a configurable time period. This output signal is fed to a corresponding input on the analog sensor and triggers a reaction there. This reaction consists of a defined increase in the output signal for the duration of the test. The function checks the signal swing against a configurable value including a tolerance of 60% based on the signal swing. If the test result is positive, the test is repeated after the set test interval. If the test result is negative, the test is repeated three times again with the configured test interval, followed by a fixed pause of 5 minutes and then the test is repeated. If the test is consistently negative, this is repeated again after a further 5 minutes. If this test also concludes with a negative result, a sensor failure is detected and a corresponding alarm is triggered.



2.2 Analog sensor testing parameters:

parameter	value range	Description
test interval duration	125 ms..120min	time between two tests
test duration	8 ms .. 8 min	duration of a test
signal stroke	1mV..10V	Change of the signal during testing
tolerance signal swing	+/- 60%	Fixed tolerance for the signal swing
repetition duration	5 minutes	Fixed time for repeating the test if the signal swing is outside of tolerance
error detection time of the diagnosis	Max. 10 min	Worst-case time for error detection. This time cannot be influenced by parameters

2.3 Connection configuration:



Connection of an analog sensor with test input 24V

Note: The outputs can only be used to test one sensor at a time. If two sensors are connected and to be tested, separate outputs must be used.

2.4 Special features of the analog sensor test

The test function is based on a standard function for diagnosing common industrial analog sensors, e.g. force sensors. Various limitations arise from the signal image and the function within the application.

- For various sensors, the test in the sensor is triggered by a reed relay . The switching frequency of these relays must be taken into account when determining the test frequency = test interval time. As a rule, test interval times of > 10 minutes are required to ensure a service life of > 10 years for the sensor.

- The test is carried out uncoordinated with the application. This can lead to higher or lower signal strokes during the test, depending on the application . In order to avoid unwanted triggering of the sensor alarm, the automatic test repetition is therefore fixed.

- The test duration should be as short as possible to avoid incorrect measurements of the signal swing even with high-frequency signal curves. However, the limit frequency of the sensor in relation to the signal swing must be taken into account.

⚠ Safety notice:

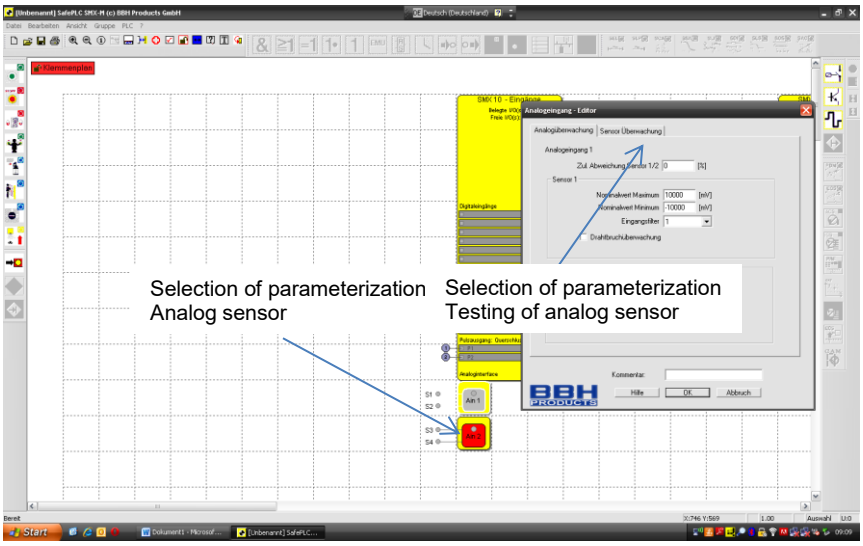
- Only suitable sensors with 24 V test input may be used

- When determining the test frequency = test interval time, the sensor manufacturer's specifications for the switching frequency must be observed. This may result in an unacceptable reduction in the sensor's service life.

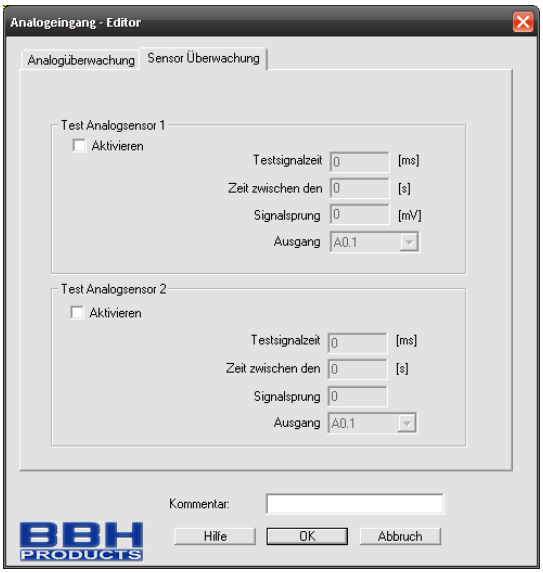
- The worst-case detection time for the diagnosis to respond is test interval time + test time + 10 min.

3 Parameterization of the function

The analog sensor test function is parameterized in the Analog Sensor context menu. To do this, open the corresponding parameterization menu by double-clicking on analog input 1 or 2 and activate the context menu for analog testing by selecting the “Sensor Monitoring” tab.



The parameters are entered via the context menu “Sensor Monitoring”



About the Check-Box **Test Analog Sensor 1** or **Test Analog Sensor 2** activates testing for the respective channel.

Test signal time field, the duration of the test is entered in [ms]

The time between two tests / test interval time is parameterized in the field **Test interval time** in [s]

Signal jump field in the unit [mV]
The output for activating the test can be selected via the **Output** field

4 Safety level of testing / category

The analog channel testing function only represents a diagnostic function for the sensor input subsystem. The resulting architecture/category and DC can be found in the sensor manufacturer's data sheets.

Regarding the evaluation of the overall system including the input, processing and output subsystems in the SMX module, the information in the smx installation manual in chapter “4.2.3” must be observed.

⚠Safety notice:

The analog channel testing function only represents a diagnostic function for the sensor input subsystem.
For a safety-related assessment of the sensor subsystem, the manufacturer's information (architecture, $MTTF_D$, FIT numbers, etc.) must be used, taking into account the test parameters used.

5 Validation

To ensure that the test function is parameterized correctly, the user must check and document the parameters after commissioning and parameterization. This is supported by the validation assistant in the programming interface.

Validation must be carried out each time the system is put into operation for the first time and repeated at least for this parameter if a parameter is changed. The degree or scope of the revalidation must also be determined by means of an impact analysis. This impact analysis must be documented together with the revalidation.

The methodology used for validation must meet the requirements of the target PI according to EN 13849 or target SIL according to EN61508. This means that the scope and quality must at least meet their requirement criteria.

The SMX system provides a validation report for documenting the validation. However, this is only a tool; the sole printing of this report does not constitute validation.
The values entered in the validation report must be checked for compliance with the planning of the individual safety functions and their actual compliance or behavior in the application.

In connection with analogue testing, at least the following parameters must be checked in relation to the application:

- Test interval time in relation to the resulting error detection time sufficient for the application
- Test duration in relation to the cutoff frequency of the sensor signal / application
- Correct setting of the signal swing

⚠ Safety notice:

- The scope and quality of the methodology used for validation must meet the requirements of the target PI according to EN 13849 or target SIL according to EN61508.
- The validation report provided by the SMX system is only a documentation tool; the sole printing of this report does not constitute validation.
- During validation, all parameters must be checked for compliance with the planning of the individual safety functions and their actual compliance or behavior in the application.

6 change index

index	*Page*	*Date*	*editor*	*the change*
1	All	05.08.13	G. Bauer	document created