

Manual

Signal calibration box (SCB)



Features

- 35 mm rail mounting
- Pluggable screw connections
- 1 signal input
- 10 indicator outputs
- 1 NMEA0183 compatible output
- USB connection
- Scaling with Windows™ based software

Compliant to the following international standards:

- LR TA System Specification 1 of 2002
- EN 60945: 2002
- ISO 20673: 2007
- EN20672:2007
- EN22554:2007
- EN22555:2007

Application

The SCB is designed to match an electrical signal to electrical indicators. A specific application is rudder angle transmitters and marine/bridge indicators.

In practice, there is often an alignment error between the rudder-shaft and the transmitter-shaft, resulting in an additional mechanical error to the already existing errors in potentiometers, amplifiers and indicators. Since the release of the international standard ISO 20673 (2007-05) a maximum error between shaft and indicators of 0,75% (full scale) is allowed.

Description

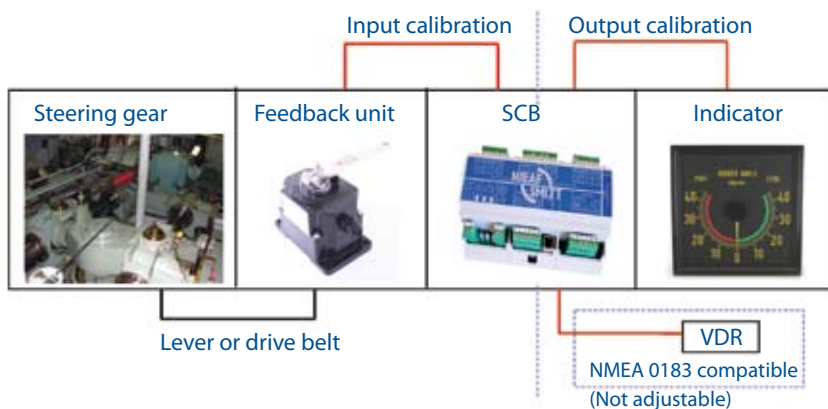
The SCB has the possibility, to correct the rudderangle-signal, so that the errors are eliminated. The necessary correction is determined by rotating the rudder machine in a certain number of positions. At these positions the input value will be recorded and saved.

After "learning-in" of the rudder-position, the output of the SCB is corresponding with a "near perfect", for mechanical and electrical errors, corrected signal.

The SCB has a number of outputs for analogue indicators. The output signal for each connected indicator can individually be adjusted (if necessary) so all connected indicators comply with the mentioned standard.

Together with the SCB unit a Windows™ based software tool is developed for the technician who installs the rudder/steering installation on board. This software is not for the ship operator.

Principle diagram



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1. Technical specifications

Supply Voltage	24 VDC (-25% + 30%)
Power consumption	+/- 3.6 W
Operating temperature	-15 °C...+70 °C

Input 1 x adjustable rudder angle input
The input type of the rudder angel is selectable by software;

- Three wire potentiometer (1k Ω – 10k Ω)

The potentiometer will be supplied from the SCB

• <u>Current signal</u>	4 / 12 / 20 mA	RI(max) 150 Ω
	0 / 10 / 20 mA	RI(max) 150 Ω
• <u>Voltage signal</u>	0 / +5 / +10 Volt	RI(min) 5MΩ
	-10 / 0 / 10 Volt	RI(min) 5MΩ
	-12 / 0 / 12 Volt	RI(min) 5MΩ

Outputs 10 x adjustable indicator outputs -10 / 0 / 10 Volt
-12 / 0 / -12 Volt

Maximum load of 40mA for all output's combined, max 5mA per output The output type is selectable by software. Maximum of 3 outputs may be shorted at the same time.

1 x NMEA 0183 compatible output

Talker device: Engine room Monitoring Systems (ER)

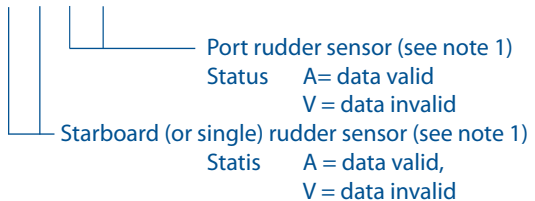
Sentence format: Rudder Sensor Angle (RSA)

Baudrate: 4800

Message frequency: +/- 10 Hz

Message format:

\$--RSA, x.x, A, x.x, A*hh<CR><LF>



Note 1

Relative measurement of rudder angle without units, "-" = bow turns to port. Sensor output is proportional to rudder angle but not necessarily 1:1

	Connected NMEA devices should have an isolated input.
Communication	1x USB port for the adjustment software. Built-in USB to serial convertor.
Error detection	Detectable errors <ul style="list-style-type: none"> • Power failure (internal 5V rail). • Out of range detection for current and voltage input. <ul style="list-style-type: none"> - 3% of selected input, except 12/0/12 V = 1,5%. • Cable breach detection for voltage input. • Cable breach detection for the positive and negative wires of the potentiometer. • Processor error, checked by watchdog.
Indication LED's	<ul style="list-style-type: none"> • Power on • Run • Input correct
Error contact	1x relay contact, opens when an error is detected.
Output signal in case of error	The outputs will go to 0V in case of an input or power error. In case of a processor error the outputs will be undefined.
Input overshoot	When the input signal for the SCB unit is higher than set as the set maximum value (in the software input screen), the output signal of the SCB unit can follow the overshoot signal to a maximum of 10° above the set maximum value.
Internal software	Corrects the input signal to a "perfect" signal. Sends the "perfect" signal over the NMEA 0183 compatible output. Converts the "perfect" signal per indicator output. Possibility to adjust via the USB port.
Adjustment software	Windows™ based adjustment software. Possibility to adjust the input and output curves. Option to generate a report file.
Response time	200 ms maximal response time

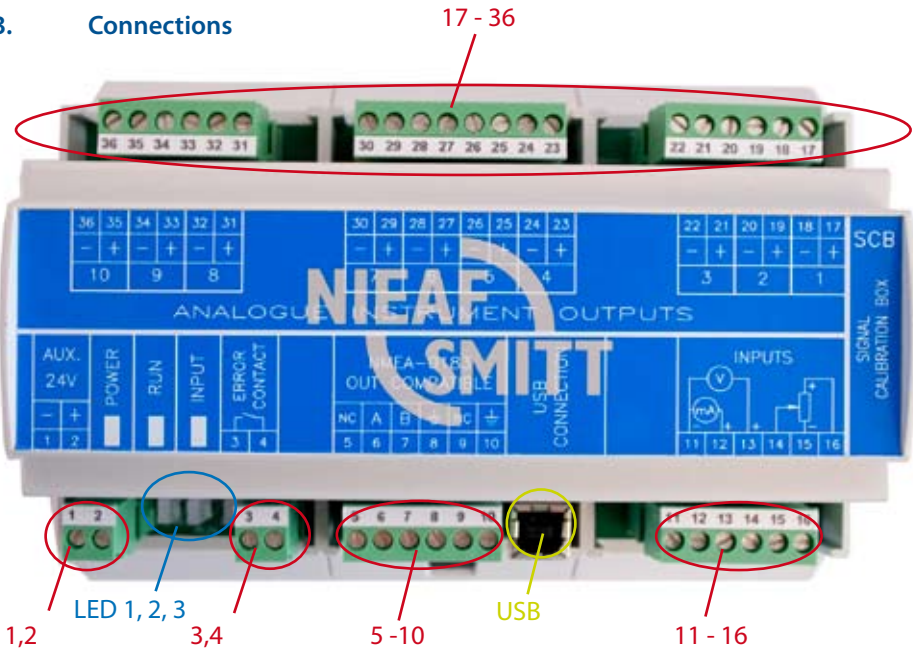
Accuracy	The complete system (from rudder axis to indicator) can be calibrated to accuracy less than 0,75% (in accordance with the standards). Initial factory accuracy 1.0 % Accuracy over temperature range 0.2%.
Compass safe distance	Standard compass: 0.30 m Steering compass: 0.30 m
International Standards	Compliant to the following standards: <ul style="list-style-type: none">• Lloyd's RegisterType Approval System Specification 1 of 2002• EN 60945: 2002• ISO 20673: 2007• EN 20672:2007• EN 22554:2007• EN 22555:2007
Housing dimensions:	160 x 110 x 62 mm (w x d x h), 35 mm rail mounting
Housing material:	Plastic, UL-94 V-0
Connections:	Pluggable screw connectors

2. Mounting



Place the SCB on the 35mm rail, attach with black clip.

3. Connections



- 1-2 Power supply
- 3-4 Error contact.
- 5-10 NMEA-0183 compatible output, 5 and 9 are not used
 - 5 not used
 - 6 A signal (TX+)
 - 7 B signal (TX-)
 - 8 shielding NMEA cable
 - 9 not used
 - 10 shielding extern earth connection
- 11-16 Contacts 11 to 13 are used to input a rudder angle as current or voltage from the steering gear.
 Contacts 14-16 are used to provide a voltage to a potentiometer of a feedback unit and to receive the wiper signal.

Rudder angle inputs

- 11 Negative input, mA- and Voltsignal
- 12 Positive input, mA signal
- 13 Positive input, Voltsignal
- 14 Wiper of potentiometer
- 15 Negative supply of potentiometer
- 16 Positive supply of potentiometer

17-36 Indicator outputs.

17-18	Indicator 1
19-20	Indicator 2
21-22	Indicator 3
23-24	Indicator 4
25-26	Indicator 5
27-28	Indicator 6
29-30	Indicator 7
31-32	Indicator 8
33-34	Indicator 9
35-36	Indicator 10

LED 1 Power

LED 2 Processor in normal state, switches off during calibration

LED 3 Input signal correct

USB USB port

4. Software

4.1 Installing drivers

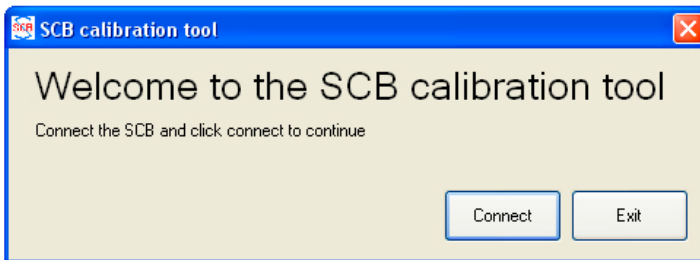
The software runs on Windows™ based systems.

To install the driver run the CDM 2.04.16.exe provided.

Connect the power supply of the SCB. Connect the SCB to a laptop or PC using a USB A to B type cable. Your computer will mention: new hardware found and will install the drivers automatically. After installation the SCB unit + software are ready to use.

4.2 Opening Screen

Start the SCBTool.exe file, the following screen will appear:



Click on connect to continue.

When the connection with the SCB is established, LED 2 will fade and the 'Error contact' will open.

In case a message 'Failed to connect' appears, wait for approx. 10 seconds. If the connection is still not made.

Check the USB cable and/or remove and connect again, or check the power supply of the SCB unit.

Note:

Do not disconnect the USB cable during the adjusting of the SCB. All data will be lost.

4.3 Setting Screen

Project data		System configuration	
Technician	A. Stölker	Input type	-10 / 0 / +10 Volt
Company	Niel-Smilt	Max PORT deflection	37
Ship Yard	Utrecht	Max STDB deflection	37
Ship / Hull no.	1234	Output type	-10 / 0 / +10 Volt
Date	11-03-2009	Indicator(s) scale range	45 / 0 / 45 Degrees

Input / Outputs configuration	
Input	Rudder sensor
Output 1	<input checked="" type="checkbox"/> Enabled Wing SB
Output 2	<input checked="" type="checkbox"/> Enabled Indicator 2
Output 3	<input checked="" type="checkbox"/> Enabled ECR room
Output 4	<input checked="" type="checkbox"/> Enabled Overhead
Output 5	<input checked="" type="checkbox"/> Enabled Bridge PS
Output 6	<input checked="" type="checkbox"/> Enabled Bridge SB
Output 7	<input type="checkbox"/> Enabled Indicator 7
Output 8	<input type="checkbox"/> Enabled Indicator 8
Output 9	<input type="checkbox"/> Enabled Indicator 9
Output 10	<input type="checkbox"/> Enabled Indicator 10

Project data

Fill out the project data with the relevant information of the ship/project.

System configuration

Fill out the 'System configuration' with the following information:

- **Rudder angle input type**: type of input signal / sensor used. Select one of the available input signals.
- **Max PORT deflection***: maximum mechanical deflection of the rudder system / steering gear to port side. (e.g. 37° in case of a 35o rudder, to be obtained from the steering gear)
- **Max STDB deflection***: maximum mechanical deflection of the rudder system / steering gear to starboard side. (e.g. 37° in case of a 35o rudder, to be obtained from the steering gear)
- **Output type**: select the signal type for the connected indicators.
- **Indicator scale range**: select the scale range of the connected indicators (all indicators must have the same scale); if correct range is not mentioned in the menu, select the closest higher range.

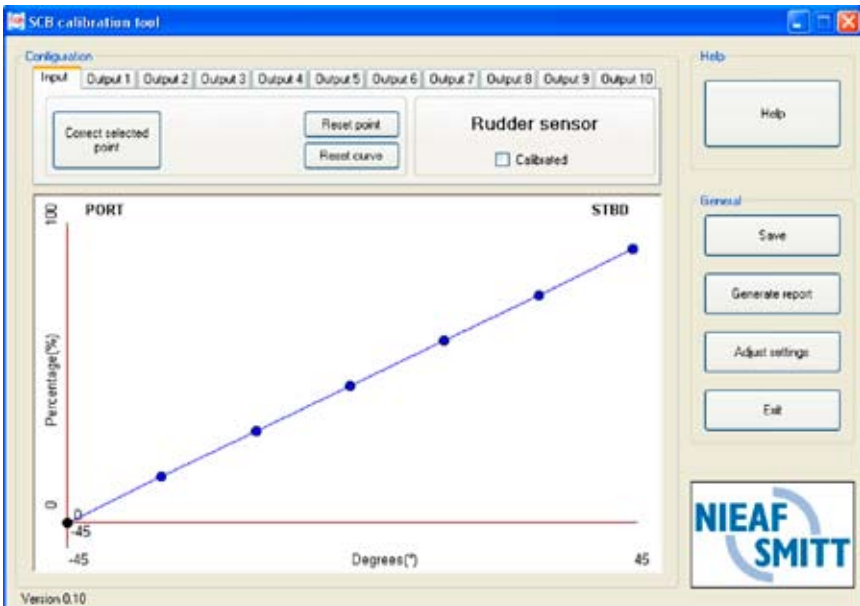
* Deviation must not exceed 50% to 110% of the indicator scale range for proper function.

Input/output configuration

Select per output Enable/Disable to activate or de-activate an output and enter a name for identification per indicator output (not obligatory, but advised).

Click on OK to save the settings.

4.4 Calibration screen



Use the tabs on the top of the screen to select which part you want to calibrate.

4.5 Input tab

In this screen the input curve is calibrated with the adjustment points displayed in the diagram. The rudder has to be moved to the adjustment points shown in the diagram. In this step all inaccuracies from the rudder shaft to the input of the SCB are compensated.

- Select (by mouse or arrow-keys) an adjustment point in the curve. Below the X-axis the degrees appear in which the rudder system has to be placed. Place the rudder / steering gear in the corresponding position and click on 'Correct selected point'.
- To return this point to the default position, select 'reset point', or 'reset curve' for all points.
- Repeat this procedure for all adjusting points. When a point is calibrated, this point will change into green. When all points are calibrated, click on the 'Calibrated' box.

To return this point to the default position, select 'reset point', or 'reset curve' for all points

Repeat this procedure for all adjustment points. When a point is calibrated, this point will change into green. When all points are calibrated, click on the 'Calibrated' box.

Note:

- You can save each action/adjustment anytime by clicking on the 'save' button.
- When you click on 'Exit' button, all your action/adjustments will be saved as well.

Note:

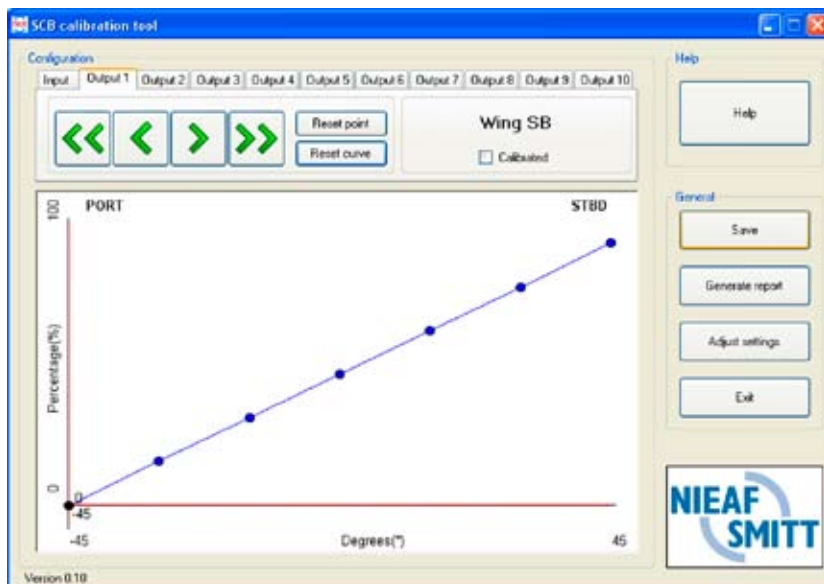
The curve has to go upwards from the bottom left corner to the top right corner at all times. When this is not the case, the curve cannot be saved.

Possible errors:

- the input cable has been connected wrong
- the rudder / steering gear was not in the right position(s)
- the input signal has been cut off (temporarily)

Check the connections and the correct rudder / steering gear position(s).

4.6 Output tab




Click on one of the output tabs on the top of the screen. In above screenprint for example output 1. This procedure is used to compensate inaccuracies of the indicators.


Output adjustment

Select (by mouse or arrow-keys) an adjusting point in the curve. The SCB unit will drive the chosen output (indicator) with the output value corresponding to the selected point.

Check if the connected indicator is indicating exactly the corresponding value (mentioned on the X-axis in the software diagram). If there is a deviation in the indication, this can be corrected with the arrow buttons:



 = 0,05 degree

 = 0,5 degree

Repeat this procedure for all adjusting points. When a point is calibrated, this point will change into green. When all points are calibrated, click on the 'Calibrated' box.

To reset a point to its default position, select 'reset point', or 'reset curve' for all points.

Repeat this procedure for all enabled outputs.

Note:

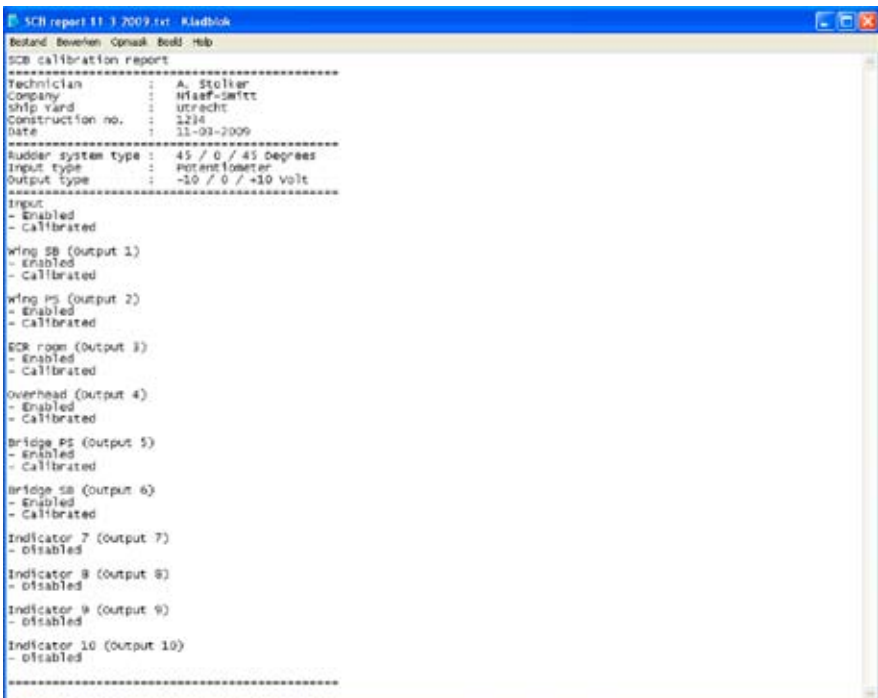
- You can save each action/adjustment anytime by clicking on the 'save' button.
- When you click on 'Exit' button, all your action/adjustments will be saved also.

4.7 Calibration report

As a proof of calibrating the system a report is generated by clicking on the 'Generate Report' box. This is a text document and can be saved local on the connected computer.

This report contains the following:

- general information of the system
- identification of each output
- enabled or disabled outputs
- if these input/outputs are calibrated (or not)



```
SCB report 11-1-2009.txt - Kladblok
-----
Bestand Bewerken Opslaak Beeld Help
-----
SCB calibration report
-----
Technician      : A. Stoller
Company         : Hlaaf-Smitt
Ship yard      : Utrecht
Construction no.: 2234
Date           : 11-01-2009
-----
Rudder system type : 45 / 0 / 45 degrees
Input type         : remote loader
Output type        : -10 / 0 / +10 volt
-----
Input
- Enabled
- Calibrated

wing SB (output 1)
- Enabled
- Calibrated

wing PS (output 2)
- Enabled
- Calibrated

ECR room (output 3)
- Enabled
- Calibrated

overhead (output 4)
- Enabled
- Calibrated

bridge PS (output 5)
- Enabled
- Calibrated

bridge SB (output 6)
- Enabled
- Calibrated

Indicator 7 (output 7)
- Disabled

Indicator 8 (output 8)
- Disabled

Indicator 9 (output 9)
- Disabled

Indicator 10 (output 10)
- Disabled
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Manual V1.2 art. no. 561144150
Date: 23-02-2011

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