Signal Calibration Box V2
Manual

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General

The Signal Calibration Box (SCB) is designed to convert signals from a sensor and display these corrected signals on one or more panel indicators. The reason for the conversion is that the sensor and the indicators may have a certain deviation. The sensor can have an additional deviation caused by the alignment of the sensor.

The SCB is compliant to the international standards as summarized below, in short this means the SCB can compensate sensor and panel indicator deviations.

Configure the SCB to identify the sensor and indicator(s). Ideally the scale of the sensor matches the scale of the indicator(s). This is not mandatory. The SCB can be used for basically any type of system.

To know how to compensate the deviations, the SCB must be calibrated for the sensor and active indicators. Once calibrated, the sensor signal is converted to a "near perfect" reading on the indicator display. Please note that additional indicators and indicators that are replaced also need to be calibrated.

Use the SCB software tool to configure and calibrate the SCB.

Features

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

Compliant to the following international standards

- LR TA System Specification 1 of 2002
- EN 60945: 2002
- ISO 20673: 2007
- EN 20672:2007
- EN 22554:2007
- EN 22555:2007

Contents

1. Technical specification

Supply voltage	24 VDC (-25% + 30%)
Power consumption	+/- 3.6 W
Operating temp.	-15 °C … +70 °C
Input	1 x adjustable sensor input. The input type of the rudder angle is selectable by software; • Three wire potentiometer (1 kΩ – 10 kΩ) The potentiometer will be supplied with 5 VDC from the SCB. • Current signal 4 / 12 / 20 mA RI(max) 150Ω 0 / 10 / 20 mA RI(max) 150Ω • Voltage signal 0 / 5 / 10 V RI(min) 5MΩ -10 / 0 / 10 V RI(min) 5MΩ -12 / 0 / 12 V RI(min) 5MΩ
Outputs	10 x adjustable indicator outputs 0 / 5 / 10 V -10 / 0 / 10 V -12 / 0 / -12 V Maximum load of 40 mA for all output's combined, maximum 5 mA 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 Please note that this output is only enabled for a rudder angle system type. Talker device: Engine Room Monitoring Systems (ER) Sentence format: Rudder Sensor Angle (RSA) Baud rate: 4800 Message frequency: +/- 10 Hz

Message format:
$--RSA, x.x, A, x.x, A*hh<CR><LF>

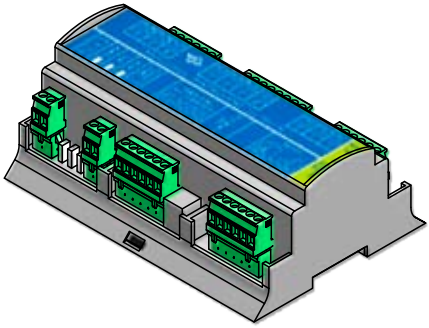
Port rudder sensor*
Status A= data valid
V = data invalid
Starboard (or single) rudder sensor*
Status A = data valid,
V = data invalid

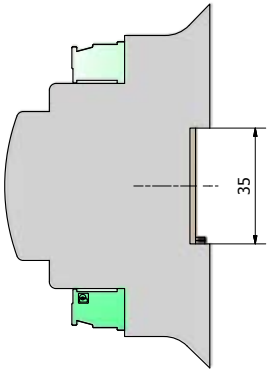
* Relative measurement of rudder angle without units, "-" = bow turns to port. Sensor output is proportional to rudder angle but not necessarily 1:1

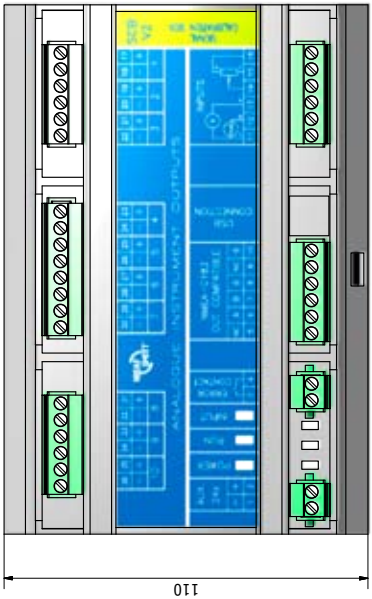
Connected NMEA devices should have an isolated input.

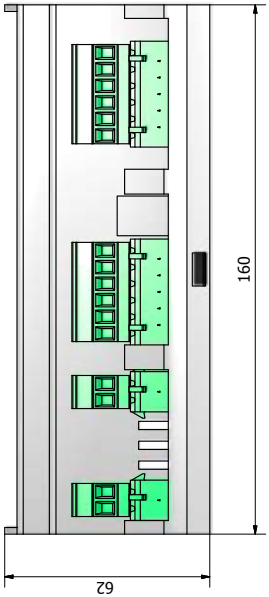
Communication	1x USB port for the adjustment software. Built-in USB to serial converter.
Error detection	Detectable errors • Power failure (internal 5 V rail) • Out of range detection for current and voltage input - 3% of selected input, except 12/0/12 V = 1.5%. • Cable breach detection for voltage input • Cable breach detection for the positive and negative wires of the potentiometer • Processor error, checked by watchdog
Indication LED's	• 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 0 V 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 100 above the set maximum value.
Internal software	Corrects the input signal to a "near perfect" signal. Sends the corrected signal over the NMEA 0183 compatible output. Converts the "near 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	300 ms maximal response time
Accuracy	The complete system (from rudder axis to indicator) can be calibrated to accuracy less then 0.5% (in accordance with the standards). Initial factory accuracy 1.0 %. Accuracy over temperature range 0.2%.
Compass safe distance	• Lloyd's Register Type Approval System Specification 1 of 2002 • EN 60945: 2002 • ISO 22554: 2007 • ISO 22555: 2007 • ISO 20672: 2007 • ISO 20673: 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




35

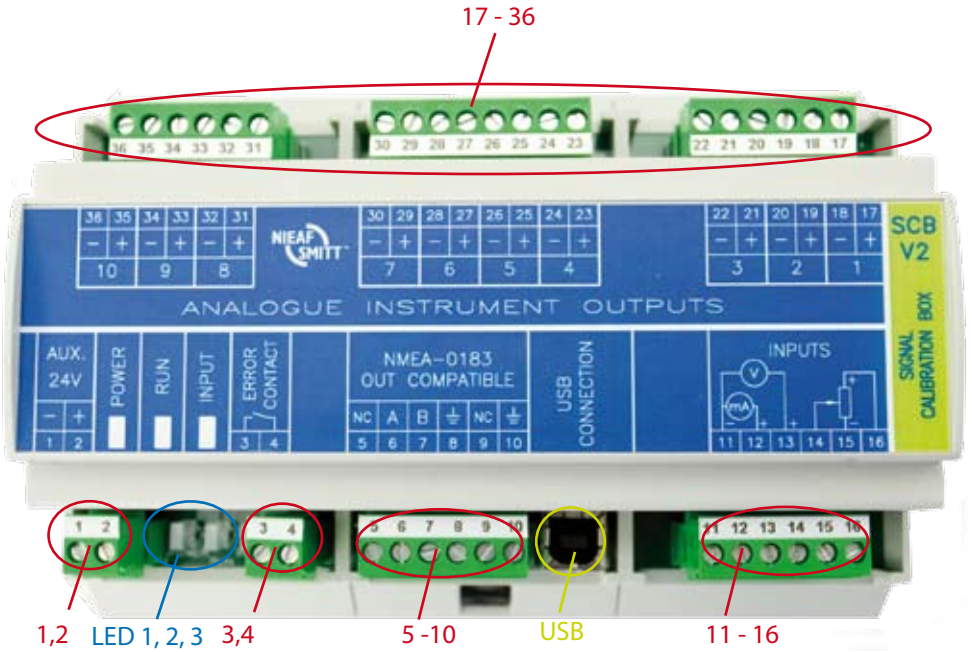

110


160
62

2. Mounting

Place the SCB on the 35 mm rail. Connect with black clip.

3. Connections



1-2	Power supply	
3-4	Error contact	
5-10	NMEA-0183 compatible output	
	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	Sensor inputs	
	11	Negative input, mA- and Volt signal
	12	Positive input, mA signal
	13	Positive input, Volt signal
	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	
LED 2	Run LED; Processor in normal state, switches off during calibration	
LED 3	Input LED; Input signal correct	
USB	USB port	

4. Software

The software consists of two executables: a driver installation and the SCB software tool. Make sure the system meets the requirements as described in 5.1 before running the software.

Please note that Microsoft.NET Framework 3.5 is required to run the SCB software tool.

The driver is third party software from Future Technology Devices International Limited. For more information visit their website: http://www.ftdichip.com

Use 'CDM 2.04.16.exe' or a more recent version.

4.1. System requirements

- Supported operating systems: Windows Server 2003, Windows Server 2008, Windows Vista, Windows XP, Windows 7
- Processor: 400 MHz Pentium processor or equivalent (minimum); 1GHz Pentium processor or equivalent (recommended)
- RAM: 96 MB (minimum); 256 MB (recommended)
- Hard disk: 1 MB of available space may be required
- Display: 800 x 600, 256 colors (minimum); 1024 x 768 high color, 32-bit (recommended)
- Prerequisite software: Microsoft .NET Framework 3.5
  This is standard available in Windows 7. Free download from http://www.microsoft.com for other operating systems.

4.2. Install the software

Run the driver installation 'CDM 2.04.16.exe'. This will automatically install the driver which creates an emulated COM port for the USB connection.

Connect the power supply to the SCB and switch it on.

Plug in the USB A to B type cable into the SCB unit and connect it to the computer. Connect only one SCB unit at a time. A message "New hardware found" will show up and the driver will automatically finish its installation. The SCB unit and software tool are now ready for use.

Start the SCB software tool by running 'SCBTool v2.00.exe'.

4.3. Opening screen

After starting the SCB Tool the following screen is displayed.

Make sure the SCB unit is connected to the computer by the USB cable and that the SCB unit power supply is on.

Press 'Connect' to continue. If successful the configuration screen is displayed.

When the connection with the SCB is established, the RUN LED on the SCB will switch off.

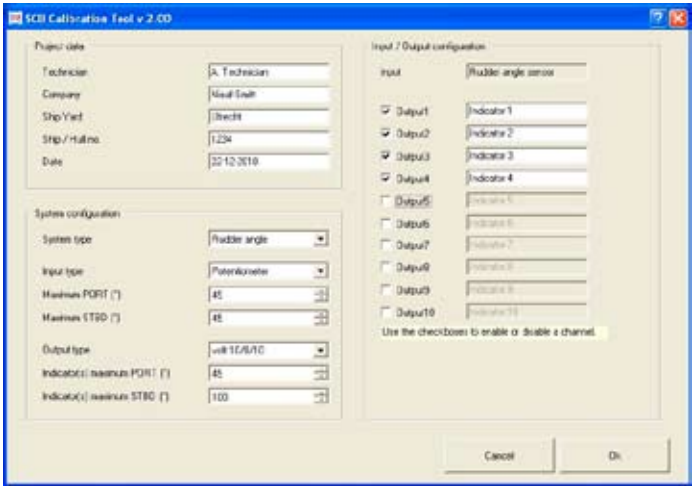
Note:
Do not disconnect the USB cable or turn the SCB unit off while configuring and / or calibrating. All data from that session will be lost.

When receiving the error 'Failed to connect', check the following:

- Is the SCB unit switched on?
- Is the SCB unit connected to the computer using the USB cable?
- Is the driver software installed? Go to Windows Configuration, Software (or 'Add or remove programs', depending on the version of operating system). See whether 'Windows driver package – FTDI CDM Driver Package (date/version)' is listed. If not:
  - Disconnect the USB cable
  - Run 'CDM 2.04.16.exe'
  - Reconnect the USB cable
- Close the SCBTool and run it again. Press 'connect' to continue.

4.4. Configuration screen

The configuration screen is divided in three parts. Fill out all necessary information to properly configure the SCB. Click Ok to save the configuration or Cancel to ignore all changes.



Project data

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

System configuration

The SCB can be configured for basically any type of sensor and indicator. Do not start the calibration until the SCB is properly configured. With exception of the input type and output type, changes to the system configuration will reset the curves to default, undoing earlier calibration during this session (unless saved). The curves are not reset until confirmed by the user.

System type

Select the type of system:
Rudder angle, Pitch, RPM, Rate of turn, Universal

Use Universal for any type of system that is not listed.

Input type

Select the type of the input signal / sensor:
Potentiometer, volt 10 / 0 / 10, volt 12 / 0/ 12, volt 0 / 10,
mA 4 / 12 / 20, mA 0 / 10 / 20

Based on the system type the following entries are available *):

Rudder angle	Maximum PORT, Maximum STBD
Pitch	Minimum ° or %, Maximum ° or %
RPM	Minimum RPM, Maximum RPM
Rate of turn	Maximum PORT, Maximum STBD
Universal	Minimum, Maximum

Output type

Select the type of indicator output:
volt 10 / 0 / 10, volt 12 / 0 / 12, volt 0 / 10

Based on the system type the following entries are available *):

Rudder angle	Indicator(s) maximum PORT, Indicator(s) maximum STBD
Pitch	Indicator(s) minimum ° or %, Indicator(s) maximum ° or %
RPM	Indicator(s) minimum RPM, Indicator(s) maximum RPM
Rate of turn	Indicator(s) maximum PORT, Indicator(s) maximum STBD
Universal	Indicator(s) minimum, Indicator(s) maximum

**) There are some limitations. Only integer values are accepted and the difference between both values may not be less than 10. With the exception of rudder angle and rate of turn (they cannot be negative) the minimum value is -10000 and maximum value is 10000.*

Input / output configuration

Enable all output channels that are used. Use the checkbox in front of the channel to do so. It is advised to give a meaningful name to a channel in order to identify the connected indicator, for instance the location or asset number.

Monitor the calibration progress in the configuration screen. When a channel is calibrated (checkbox 'Calibrated' is checked in the calibration screen) this information is also visible in the configuration screen. Switch between calibration screen and configuration screen to monitor the progress.

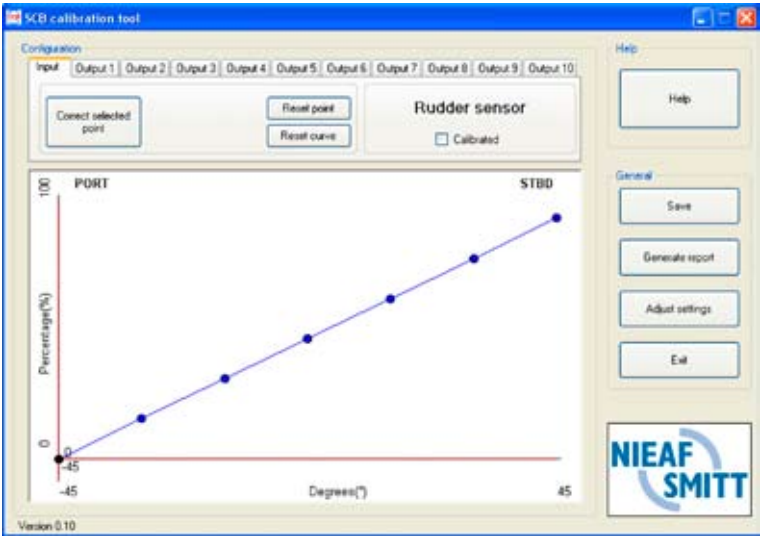
Please note that the calibration progress information is only available during the session. Once the session is closed (application closed or connection with the SCB unit was lost), the progress information is discarded. This does however not affect the calibration itself.

4.5. Calibration screen

To select an input or output channel, click on the concerning tab at the top of the window. Only tab pages from enabled channels are available. If a channel is missing, go to the configuration screen to enable it.

Be aware that the SCB unit cannot detect whether an indicator is connected or not. The only indication is when the display of the indicator shows no change when different points are selected on the curve. In that case check the connection with the indicator.

Step through the tab pages in order to calibrate the entire system.



4.5.1. General buttons

On the right part of the screen there are some buttons available.

Save	Save the changes
Generate report	Generate a report as proof of calibration
Configuration	Go to the configuration screen
Exit	Close the application

4.5.2. Input tab page

Target of the input tab page is to calibrate the sensor that is connected to the input channel of the SCB. Use the tabs (on the top of the screen) to select the input channel.

The following buttons are available on the input tab:

1) 'Correct selected point': calibrate the point
2) 'Draw linear curve': draw a linear curve between the first and the last point
3) 'Reset point': set the default value for the selected point
4) 'Reset curve': set the default value for the curve

In order to calibrate the sensor, seven points must be confirmed. The graph displays the curve that is based on the scale of the input sensor.

Steps to calibrate the sensor:

1) Select the first point with a mouse click or using the arrow keys
2) Adjust the sensor to match the requested value (the value on the horizontal axis)
3) Press 'Correct selected point' to calibrate. In the curve the point will be marked with green
4) Repeat steps 2 and 3 for the other six points in the curve

When done, the SCB is calibrated for the input sensor. It is advised to use the 'calibrated' checkbox to monitor the calibration progress. This will also shown on the calibration report. Please note that this information is only available during this session.

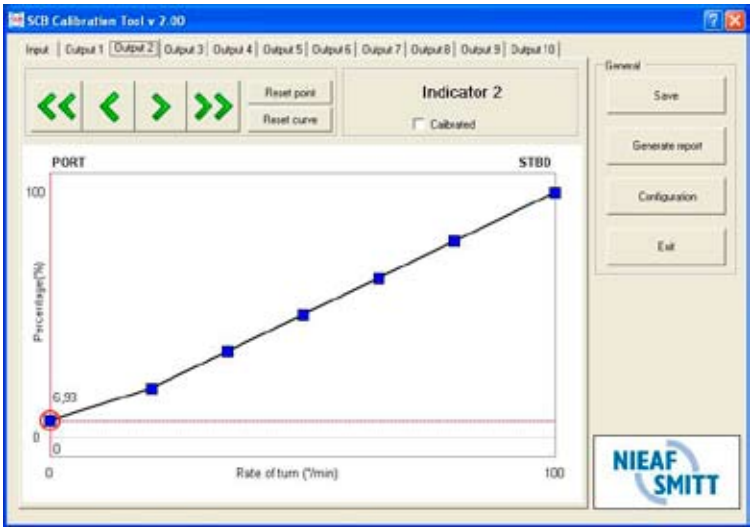
Note:
It is possible to connect the sensor or an indicator in the wrong way. When this is the case for the sensor, it will not be possible to calibrate it. All values are out of range in respect to the curve.

When a panel indicator is connected wrong, the pointer is located in the wrong position on the scale.

When both the sensor and panel indicator are connected wrong, readings may seem correct, but it won't be possible to calibrate the SCB unit.

4.5.3. Output tab page

Target of an output tab page is to calibrate the panel indicator that is connected to the output channel of the SCB. In the image below this is the panel indicator that is connected to the Output 2 channel. Use the tabs (on top of the screen) to select the desired output channel.



The following buttons are available on the input tab:

1. Arrow buttons: move the pointer of the panel indicator with respectively -0.5%, -0.05%, +0.05% and +0.5%. Use the down or up key to move the pointer with respectively -0.015% and 0.015%. The exact value is displayed on the vertical axis in the curve.
2. 'Reset point': set the default value for the selected point
3. 'Reset curve': set the default value for the curve

In order to calibrate the panel indicator, seven points must be confirmed. The graph displays the curve that is based on the scale of the panel indicator.

Steps to calibrate the panel indicator:

1. Select a point with a mouse click or using the left / right arrow keys
2. Use the arrow buttons (or up and down keys) to move the pointer of the panel indicator to the correct position (this will also change the value on the vertical axis). Move the pointer of the panel indicator until it matches the value on the horizontal axis of the curve.
3. Repeat steps 1 and 2 for the other six points in the curve.

When there is no change on the panel indicator while calibrating, please check the connection with the indicator.

When done, the SCB is calibrated for the panel indicator. It is advised to use the 'calibrated' checkbox to monitor the calibration progress. This will also show on the calibration report. Please note that this information is only available during this session.

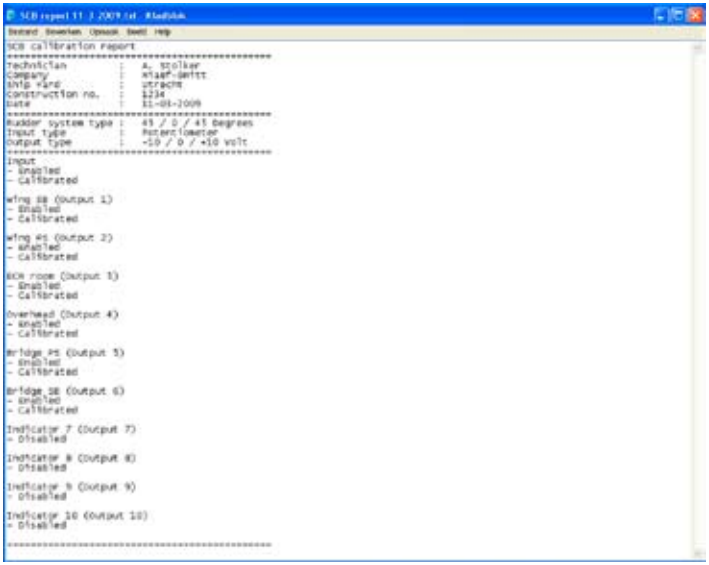
Proceed with the calibration process until all attached panel indicators are calibrated.

6. Calibration report

Generate a calibration report as proof of calibrating the system. Note that this information is only available during the current session. As soon as the SCB unit is switched off or the application is closed, the calibration progress information is discarded.

The report is a text document that can be saved in any location and contains the following information:

- General system information
- Name of each channel (input and output)
- Availability of the channel (enabled or disabled)
- Status of the channel (calibrated or not)



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