

# ConfigurationSelector

Bosch Sensortec



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## ConfigurationSelector

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Document number

Technical reference code(s)

Notes Data in this document are subject to change without notice. Product photos and pictures are for illustration purposes only and may differ from the real product's appearance.



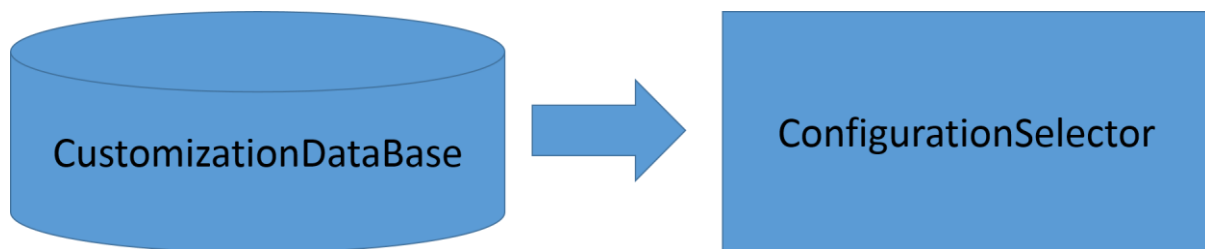
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## 1. About the ConfigurationSelector

The *ConfigurationSelector* has been developed for Engineers and Field Application Engineers of Bosch Sensortec. The main purpose of this tool is, to assist the user to select a customized configuration for a BSX4 Sensor Fusion Library.

The *ConfigurationSelector* has been designed as standalone application. To run the *ConfigurationSelector* a *CustomizationDataBase* is required.



The *CustomizationDataBase* contains all required configuration parameters which can be configured by the user. For each Release of the BSX4 Library a *CustomizationDataBase* will be provided. Please consider, that only the *CustomizationDataBase* of the target library can be used.

## 2. Installation

The installation of the tool can be divided in the following steps

- Installation of MATLAB Runtime Environment
- Copying *ConfigurationSelector.exe*

### 2.1 MATLAB Runtime

The MATLAB Runtime is a non standard peacy software. Therefore you have to follow the process for the installation of non standard peacy software. Please contact your local IT partner in case of questions.

An example for the installation process is available in the tool belonging [wiki](#). The [wiki](#) is linked in the [BSX for Android 5.0 Lollipop project](#) community in [Bosch Connect](#).




#### **BSX for Android 5.0 Lollipop project** Restricted

47 people, 2 groups | Updated by Gut Juergen (BST/ESA2) | Today 10:27 AM | Tags: 5.0, android, bsx, l, ladon, lollipop

This is the BSX for Android L project comunity, which should be used by BSX for Android L project members to document, share and discussion infrom ation. The community is RESTRICTED. i.e. the access will only be given to project members and stakeholders. The following rule applies:

After you got the confirmation to install the MATLAB Runtime (e.g. from your department manager), you can download the latest version of the MATLAB Runtime for the MATLAB R2014b version at the MathWorks [home page](#).


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### MATLAB Runtime

**Run compiled MATLAB applications or components without installing MATLAB**

The MATLAB Runtime is a standalone set of shared libraries that enables the execution of compiled MATLAB applications or components on computers that do not have MATLAB installed. When used together, [MATLAB](#), [MATLAB Compiler](#), and the MATLAB Runtime enable you to create and distribute numerical applications or software components quickly and securely.

To download and install the MATLAB Runtime:

- Click the version and platform that corresponds to the application or component you are using.

Note: you can find this information in the `readme.txt` file that accompanies the application or component.

Release (MATLAB Runtime Version#)	Windows	Linux	Mac
R2015b (9.0)*	<a href="#">32-bit / 64-bit</a>	<a href="#">64-bit</a>	<a href="#">Intel 64-bit</a>
R2015aSP1 (8.5.1)	<a href="#">32-bit / 64-bit</a>	<a href="#">64-bit</a>	<a href="#">Intel 64-bit</a>
R2015a (8.5)	<a href="#">32-bit / 64-bit</a>	<a href="#">64-bit</a>	<a href="#">Intel 64-bit</a>
<b>R2014b (8.4)</b>	<a href="#">32-bit / 64-bit</a>	<a href="#">64-bit</a>	<a href="#">Intel 64-bit</a>
R2014a (8.3)	<a href="#">32-bit / 64-bit</a>	<a href="#">64-bit</a>	<a href="#">Intel 64-bit</a>
R2013b (8.2)	<a href="#">32-bit / 64-bit</a>	<a href="#">64-bit</a>	<a href="#">Intel 64-bit</a>
R2013a (8.1)	<a href="#">32-bit / 64-bit</a>	<a href="#">64-bit</a>	<a href="#">Intel 64-bit</a>
R2012b (8.0)	<a href="#">32-bit / 64-bit</a>	<a href="#">64-bit</a>	<a href="#">Intel 64-bit</a>
R2012a (7.17)	<a href="#">32-bit / 64-bit</a>	<a href="#">32-bit / 64-bit</a>	<a href="#">Intel 64-bit</a>

\* MATLAB Runtime 9.0, for R2015b, is intended to work with MATLAB 8.6, which is also R2015b.


- Save the MATLAB Runtime installer file on the computer on which you plan to run the application or component.
- Double click the installer and follow the instructions in the installation wizard.

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For the installation of the MATLAB Runtime please follow the steps on the MathWorks [home page](#).

## 2.2 ConfigurationSelector

To complete the installation please copy the *ConfigurationSelector.exe* from the release package to a local directory on your pc. The installation is now complete and the *ConfigurationSelector* can be started.

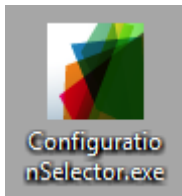
**Compatibility:** Please ensure that you have the valid version of the *ConfigurationSelector* tool. The *ConfigurationSelector* must be compatible with the desired BSX4 target library which you want to customize/configure. The valid *ConfigurationSelector* is always part of the provided BSX Library Release Package. For further Information about compatibility and backwards traceability check chapter Compatibility and Traceability.



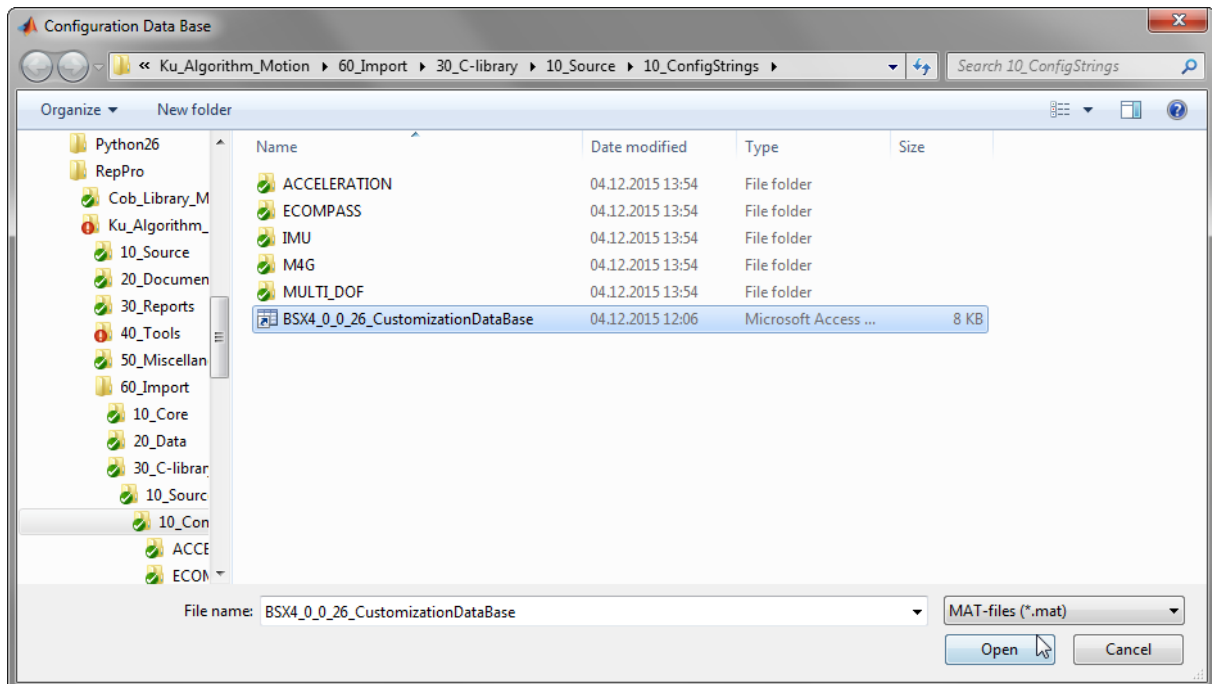
## 3. User Guide

### 3.1 Start

Please start the *ConfigurationSelector* by double click on *ConfigurationSelector.exe*.



Please select the valid *CustomizationDataBase* and load it into the *ConfigurationSelector* by pressing on the “Open” button.



The *CustomizationDataBase* is always part of the release package. Only the *CustomizationDataBase* of the release package of the desired target library can be used!

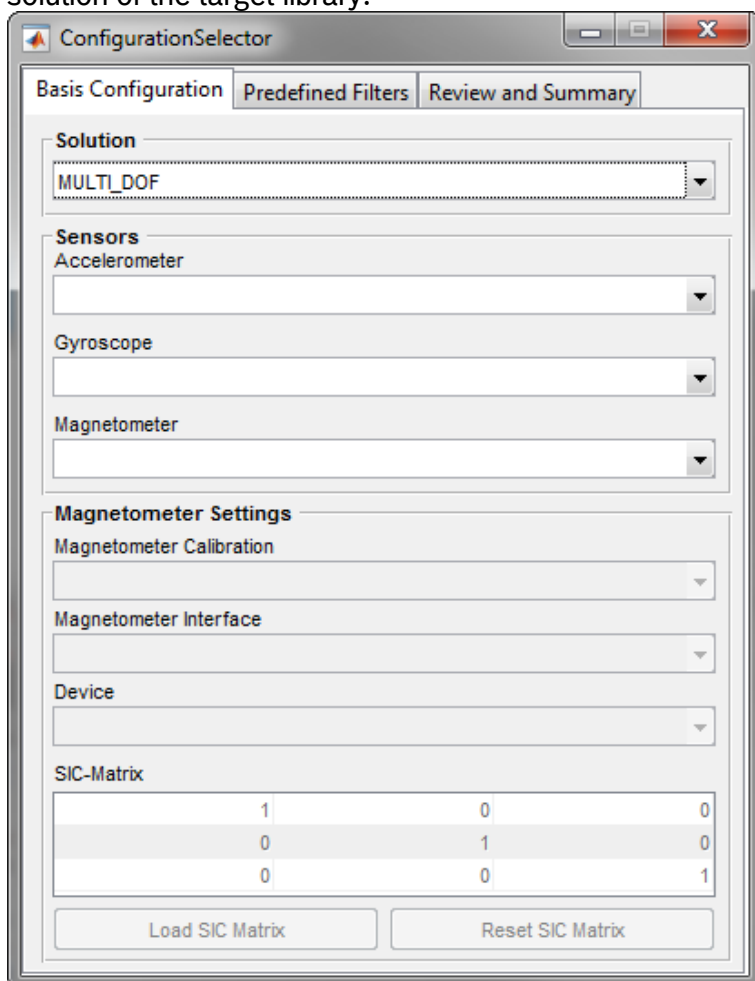
Because of the interdependency of the configuration parameters, the selection of the configuration parameters follows a hierarchical structure. Depending on the user selected parameters, additional fields will be enabled and selectable parameters will be provided. Only valid and proved combinations of configuration parameters can be selected by the user. Therefore you can only configure known customer setups. All known customer setups are currently provided by the *ConfigurationSelector*. Please contact the BSX4 Maintenance Team if you can't select the required parameters (e.g. new magnetometers).

**Warning:** Please select all fields with respect to the setup of the target solution which you want to configure! In case of a non-selection of sensors, all corresponding configuration parameters will be set to the library initial configuration values or pre-configured values. This value can be differ from your desired values!

## 3.2 Basis Configuration

### 3.2.1 Solution

The initial step to start the selection of a customized configuration, is the selection of the solution of the target library.



**ConfigurationSelector**

**Basis Configuration** | Predefined Filters | Review and Summary

**Solution**

MULTI\_DOF

**Sensors**

Accelerometer

Gyroscope

Magnetometer

**Magnetometer Settings**

Magnetometer Calibration

Magnetometer Interface

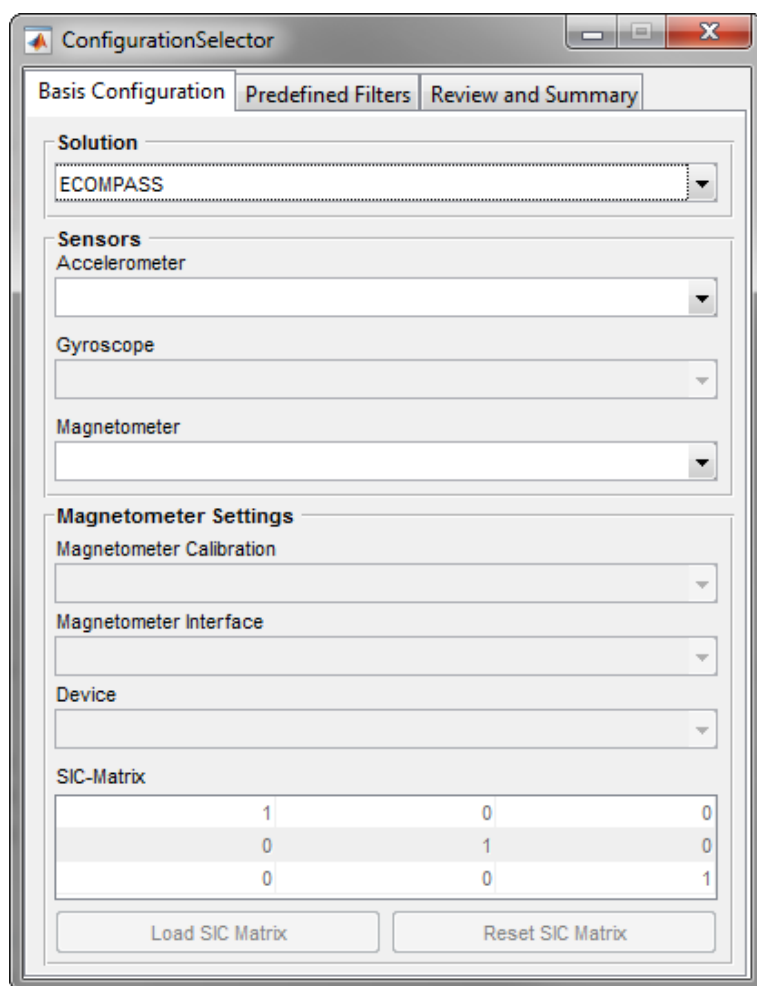
Device

**SIC-Matrix**

1	0	0
0	1	0
0	0	1

Load SIC Matrix | Reset SIC Matrix

Depending on the selected solution the required sensors will be enabled. Sensors which are not needed by the solution are automatically disabled.



**ConfigurationSelector**

**Basis Configuration** | Predefined Filters | Review and Summary

**Solution**

ECOMPASS

**Sensors**

Accelerometer

Gyroscope

Magnetometer

**Magnetometer Settings**

Magnetometer Calibration

Magnetometer Interface

Device

**SIC-Matrix**

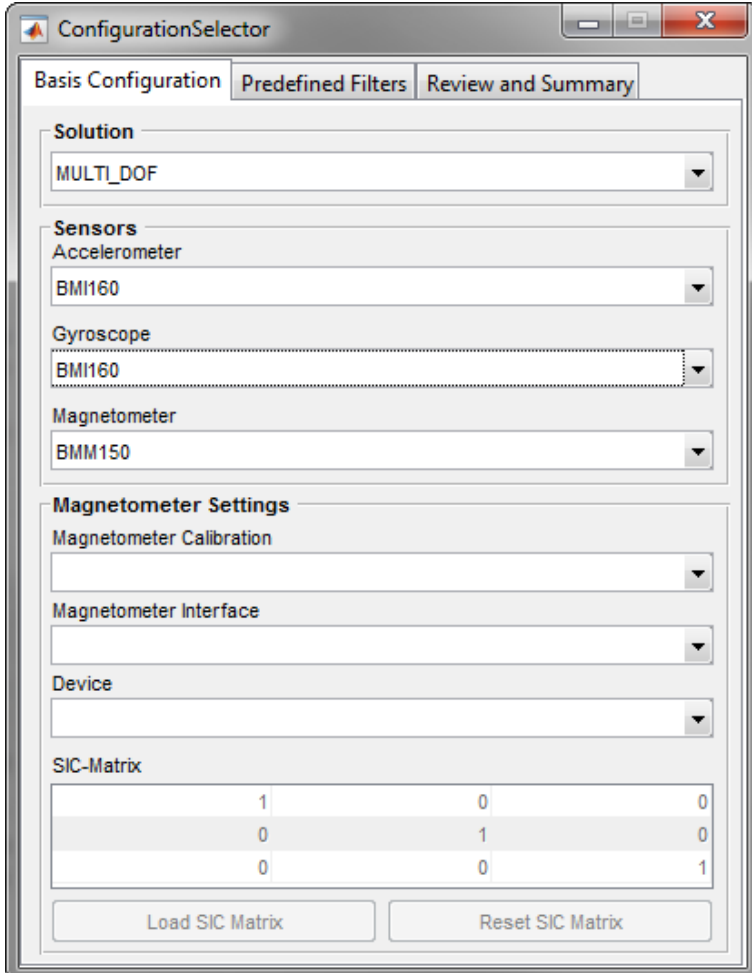
1	0	0
0	1	0
0	0	1

Load SIC Matrix      Reset SIC Matrix

If you select for example the solution E-Compass, you are not able to configure a gyroscope, because an E-Compass only includes the MEMS sensors for acceleration and magnetic field. Therefore the gyroscope is not required and can't be selected for this target solution.

### 3.2.2 Sensors

Depending on the selected solution, all valid and configurable sensor combinations will be provided. If a solution contains a magnetometer, the magnetometer settings will be enabled.



The screenshot shows the ConfigurationSelector application window with the 'Basis Configuration' tab selected. The window contains the following sections:

- Solution:** A dropdown menu showing 'MULTI\_DOF'.
- Sensors:**
  - Accelerometer:** A dropdown menu showing 'BMI160'.
  - Gyroscope:** A dropdown menu showing 'BMI160'.
  - Magnetometer:** A dropdown menu showing 'BMM150'.
- Magnetometer Settings:**
  - Magnetometer Calibration:** A dropdown menu.
  - Magnetometer Interface:** A dropdown menu.
  - Device:** A dropdown menu.
  - SIC-Matrix:** A table with the following values:

1	0	0
0	1	0
0	0	1

At the bottom of the window, there are two buttons: 'Load SIC Matrix' and 'Reset SIC Matrix'.





### 3.2.3 Magnetometer Settings

The calibration mode and the magnetometer interface has to be selected with respect to the desired target library, solution and hardware setup.

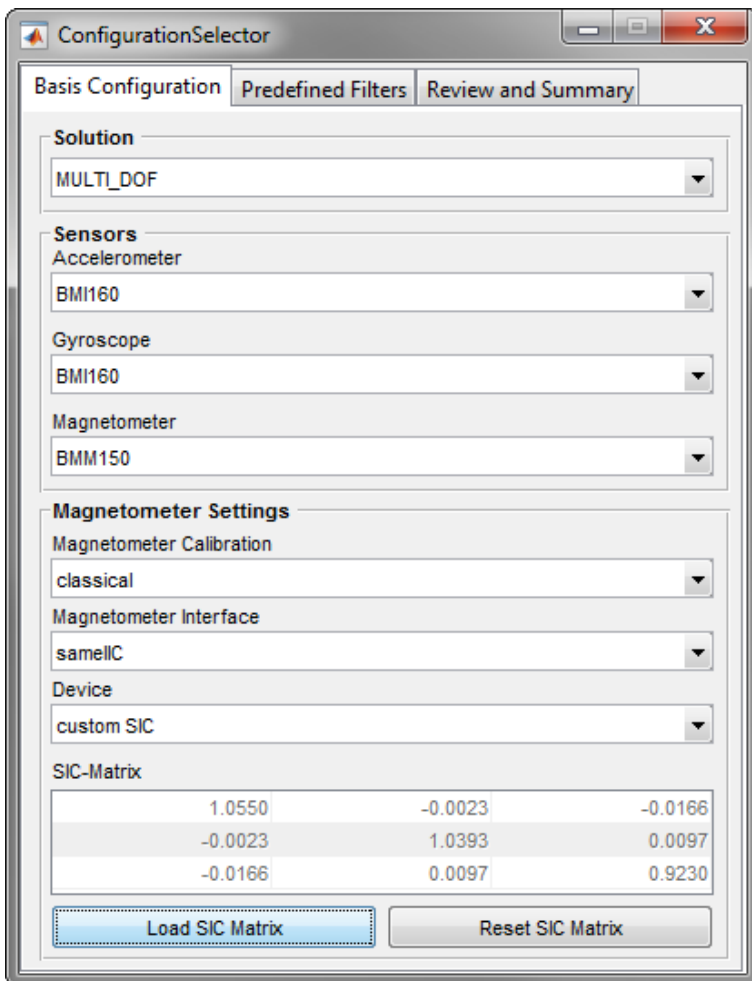
Depending on the selected device, the appropriate SIC-Matrix will be displayed in the matrix.

The screenshot shows the ConfigurationSelector window with the 'Basis Configuration' tab selected. The 'Solution' dropdown is set to 'MULTI\_DOF'. Under 'Sensors', the 'Accelerometer' is 'BMI160', the 'Gyroscope' is 'BMI160', and the 'Magnetometer' is 'BMM150'. In the 'Magnetometer Settings' section, 'Magnetometer Calibration' is 'classical' and 'Magnetometer Interface' is 'samellC'. The 'Device' dropdown is set to 'BOSCH\_ENGINEERING\_PHONE'. The 'SIC-Matrix' is displayed as a 3x3 table:

0.9014	0.0509	-0.0037
0.0293	1.0766	-0.0075
0.1308	-0.0239	1.0256

At the bottom, there are two buttons: 'Load SIC Matrix' and 'Reset SIC Matrix'.

In case of the selection of an “UNKNOWN” device, the SIC-Matrix will be set to the default value (identity matrix). If you want to implement a custom SIC-Matrix, you can load the SIC-Matrix via the Load-Button. It is only possible to load SIC-Matrices, determined by the SIC-Matrix Tool “Sphere Viewer” or SIC-Matrix’s which are compatible to the description in the “BSX3.X Android Sensor Daemon and HAL Porting Guide” document (Revision: V1.4).



**ConfigurationSelector**

**Basis Configuration** | Predefined Filters | Review and Summary

**Solution**

MULTI\_DOF

**Sensors**

Accelerometer

BMI160

Gyroscope

BMI160

Magnetometer

BMM150

**Magnetometer Settings**

Magnetometer Calibration

classical

Magnetometer Interface

sameIIC

Device

custom SIC

**SIC-Matrix**

1.0550	-0.0023	-0.0166
-0.0023	1.0393	0.0097
-0.0166	0.0097	0.9230

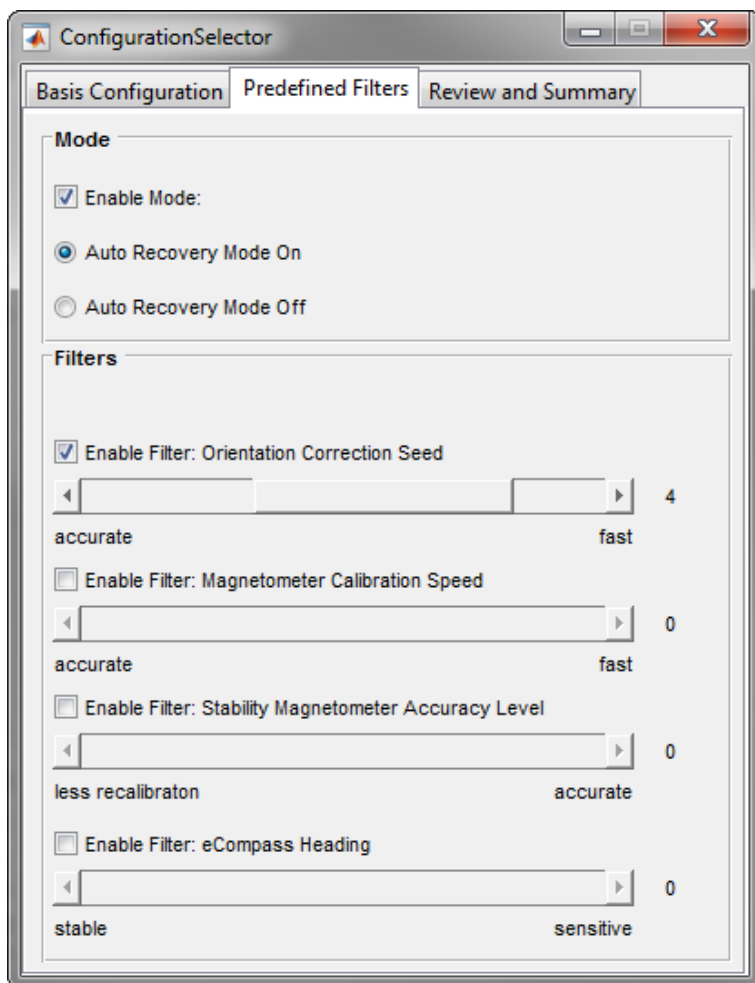
Load SIC Matrix | Reset SIC Matrix

Manuel changes of the SIC-Matrix are not allowed to avoid inconsistencies inside the SIC-Matrix. You can use the “Reset SIC Matrix Button” to reset the SIC Matrix to the default value (identity matrix).

### 3.3 Predefined Filters

For the customization of the BSX4 Library, five *Predefined Filters* are currently implemented into the BSX4 Library. All *Predefined Filters* are initially deactivated and has to be activate manually. *Predefined Filters* represent the tradeoff between different algorithm characteristics e.g. stable heading vs. sensitive heading. The *Predefined Filters* can be used for the optimization of the target library in respect to the customer requirements.

To activate the *Predefined Filters*, a preselection of the target solution on the tabulator “Basis Configuration” is mandatory. In case of a “differential” configuration of the target library, no further parameters (e.g. sensors) hast to be selected. Depended on the selected solution only the solution compatible filters can be used. Filters which are not part of the selected solution will not be considered and will be automatically disabled.



To enable a *Predefined Filter*, the checkboxes has to be checked by the user. After the checkbox is checked the *Predefined Filters* are initially set to the default or to the last selected value. The *Predefined Filters* can be switched by the sliders between 6 dedicated steps. The selected step is shown on the right side of the sliders. The tradeoff of the selectable *Predefined Filters* are described below.

### Auto Recovery Mode:

Auto Revocery	No Auto Recovery
+ no recalibration required, if offsets have not been changed	- recalibration required, even if offset are still the same
- possibly wrong heading and accuracy level 3 if no magnetometer data from different positions is available after magnetic disturbance and offset change.	+ if accuracy level 3 is shown, heading accuracy is reliably high

**Orientation Correction Speed:**

High magnetometer calibration speed	Low magnetometer calibration speed
+ fast magnetometer calibration time	- longer magnetometer calibration time
- lower heading accuracy directly after accuracy level 3 is reached	+ better heading accuracy directly after accuracy level 3 is reached

**Magnetometer Calibration Speed:**

High magnetometer calibration speed	Low magnetometer calibration speed
+ fast magnetometer calibration time	- longer magnetometer calibration time
- lower heading accuracy directly after accuracy level 3 is reached	+ better heading accuracy directly after accuracy level 3 is reached

**Stability Magnetometer Accuracy Level:**

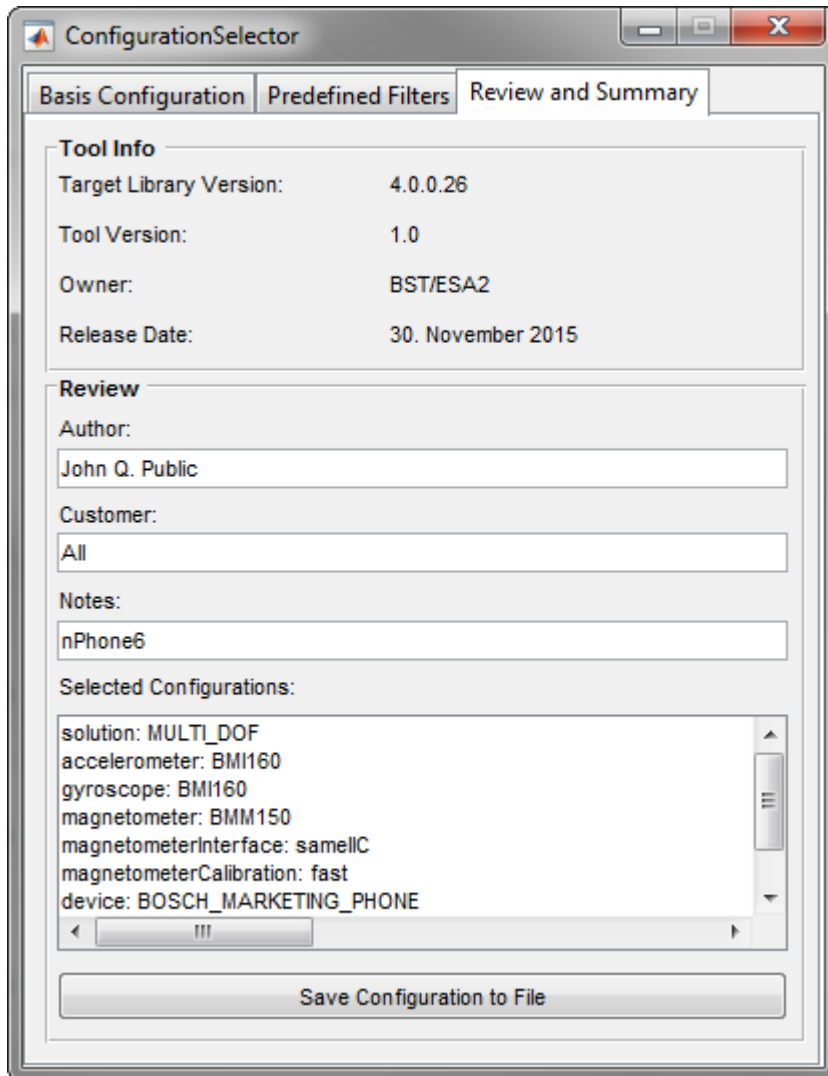
Stable Accuracy Level	Sensitive Accuracy Level
+ no recalibration by user is requested when accuracy decreases slightly	- accuracy level always shows need for recalibration when accuracy decreases slightly
- inaccurate heading, even if accuracy level 3 is shown	+ always accurate heading for accuracy level 3

**eCompass Heading:**

Stable Heading	Sensitive Heading
+ no heading jitter due to magnetometer noise	+ during slow movements heading reacts sensitively
+ less delay of heading	- Possible heading jitter due to magnetometer noise
- heading jumps during slow rotation	- delay of heading in order to reduce jitter by high sensitivity

### 3.4 Review and Summary

For the traceability of the configuration string, the tool allows you to add some metadata to the configuration string.



For the generation of the configuration string, the metadata fields are not mandatory. For a good backwards traceability, it is strongly recommended to add some additional information about the purpose of the generated configuration string. In the ListBox you can review all selected configuration parameter.

## 4. Compatibility and Traceability

### 4.1 Compatibility

**Tool and CustomizationDataBase:** The compatibility of the *CustomizationDataBase* is automatically checked by the *ConfigurationSelector*. Please ask the BSX4 Maintenance Team for the latest version, if your installed tool is not compatible to your *CustomizationDataBase*.



**CustomizationDataBase and target library:** The generated serialization string can only be used for the related target library. Only the *CustomizationDataBase* which has been part of the release package of the target library can be used for the configuration of the target library. In case of the selection of a wrong *CustomizationDataBase*, the configuration of the target library will be failed with the failure “version mismatch” during configuration.

## 4.2 Traceability

To guarantee a backward traceability of the selected settings, the selected configuration parameters will be stored in the output configuration file. The output file contains in the first row the user composited configuration string, which can be used to configure the target library. A typical configuration string looks like:

```
26,0,0,4,127,192,0,0,15,0,111,0,0,0,24,0,0,0,13,162,16,68,128,5,128,0,162,28,0,69,64,68,0,15
4,13,25,8,63,153,20,0,154,13,25,8,63,153,21,0,0,13,0,8,0,0,24,0,1,13,0,8,0,0,25,0,30,14,0,8,0,
0,6,0,1,23,0,8,0,0,8,0,1,24,0,8,0,0,8,0,1,40,0,8,0,0,1,0,1,41,0,8,0,0,1,0,0,3,130,40,63,116,3,255
,241,36,153,255,60,255,189,192,0,134,113,0,63,108,189,255,231,184,149,252,188,255,60,127
,0,132,132,247,63,80,188,0,1,3,0,8,0,0,7,0,0,3,130,40,63,116,3,255,241,36,153,255,60,255,18
9,192,0,134,113,0,63,108,189,255,231,184,149,252,188,255,60,127,0,132,132,247,63,80,188,
0,1,3,0,8,0,0,7,0,1,13,0,8,0,0,24,0,107,0,0,61,0,184,0
```

In the next section, the metadata is stored. The metadata can be divided in two blocks. The first block contains all general information (e.g.)

```
#BSX4 Configuration
#Created on: 09-Dec-2015 09:04:06
#Created by: John Q. Public
#Created for: All
#Library Version: 4.0.0.26
#Tool Version: 1.0
#Info: nPhone6
```

The other block contains all selected configuration parameters and their values (e.g.).

```
#solution: MULTI_DOF
#accelerometer: BMI160
#gyroscope: BMI160
#magnetometer: BMM150
#magnetometerInterface: samellC
#magnetometerCalibration: fast
#device: BOSCH_MARKETING_PHONE
#sicMatrix: [1.0191650390625 -0.0657958984375 -0.0183105003088713;-
0.0402831993997097 0.94305419921875 -0.0161742996424437; 0.0187988001853228
0.0225830003619194 1.03369140625]
#autoRecovMode: 1
```

Remark: For the configuration of the target library, only the first row (configuration string) is relevant.



## 5. Document history and modifications

Rev. No	Chapter	Author	Description of modification/changes	Date
1.0	ALL	Gut Jürgen (BST/ESA2)	Document creation	2015-12-09
1.1	2	Gut Jürgen (BST/ESA2)	Update installation procedure	2016-01-12

Bosch Sensortec GmbH  
Gerhard-Kindler-Strasse 8  
72770 Reutlingen / Germany

[contact@bosch-sensortec.com](mailto:contact@bosch-sensortec.com)  
[www.bosch-sensortec.com](http://www.bosch-sensortec.com)

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