UM1654
User manual

SPIN family evaluation software

Introduction

This user manual describes how to use the SPIN family evaluation software.

The SPIN family evaluation software allows STMicroelectronics® customers to easily evaluate functionalities and performances of the devices of dSPIN™ and cSPIN™ families. This software is designed to work with the IBU universal interface demonstration board (STEVAL-PCC009V2).

Before starting, please take some time to visit the STMicroelectronics web site. There updated datasheets, application notes and the latest version of the software can be found. See www.st.com/dspin and www.st.com/cspin.

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1 Installation

The software requirements are the following:

- Computer mounting Windows 7 OS[a].
- A free USB port.
- IBU universal interface board (STEVAL-PCC009V2).
- One or more demonstration boards compatible with the software environment (check on the STEVAL-PCC009V2 board documentation).

To install the software:

1. Unzip the archive content
2. Start software installation using “SPINFamily Setup.msi” file
3. Follow the guided installation instructions

A link to the application is created into the START menu:
(All Programs/STMicroelectronics/SPINFamily Evaluation Tool).

a. Some old version of the STEVAL-PCC009V2 firmware works on Windows XP OS only. In this case, please refer to *Section 2.1* for the firmware upgrade instructions.

2 Quick start guide

Before start working with the evaluation software the firmware mounted on the IBU universal interface board must be checked in order to verify if it is compatible with the application and eventually update it to the last revision. See *Section 2.1* for the details.

The software is designed to work in demonstration mode, so all functionalities can be explored even if no demonstration boards are present (neither the STEVAL-PCC009V2 nor the demonstration boards of the devices are required in this case).

1. Start the “SPINFamily Evaluation Tool” (by default it is in Start menu > All programs > STMicroelectronics > SPINFamily Evaluation Tool).
2. When the application is started the device selection dialog of *Figure 1* is shown.

Figure 1. Device selection dialog

3. Click on the target device.
4. Plug the STEVAL-PCC009V2 communication board to a free USB port (the cable is not included).
5. Wait a few seconds for board initialization.
6. Connect the SPI_IN connector (black) of the demonstration board to the 10-pin connector of the IBU universal interface board using the provided cable.
   For connecting more devices to the same board, please consult the daisy chain connection paragraph (*Section 3*).
7. Power up the demonstration boards.
8. Click on the button with the USB symbol to connect the IBU universal interface board to the PC and initialize the evaluation environment.
   The application automatically identifies the number of demonstration boards connected.
9. The evaluation environment is ready.

2.1 STEVAL-PCC009V2 firmware upgrade

A tool to update the firmware named “IBUUI updater” is installed with the application.This tool can be also used to check if the firmware mounted on the board is compatible with the evaluation software.

1. Start the **IBUUI updater** tool (by default it is in Start menu > All programs > STMicroelectronics > SPINFamily Evaluation Tool).
   If the communication board mounts an early version of the firmware, the first time the communication board is connected to the PC, driver installation procedure could be required (see *Section 2.2*).
2. Click on the “start” button.
3. Follow the guided procedure.

2.2 Drivers installation (old firmware revision only)

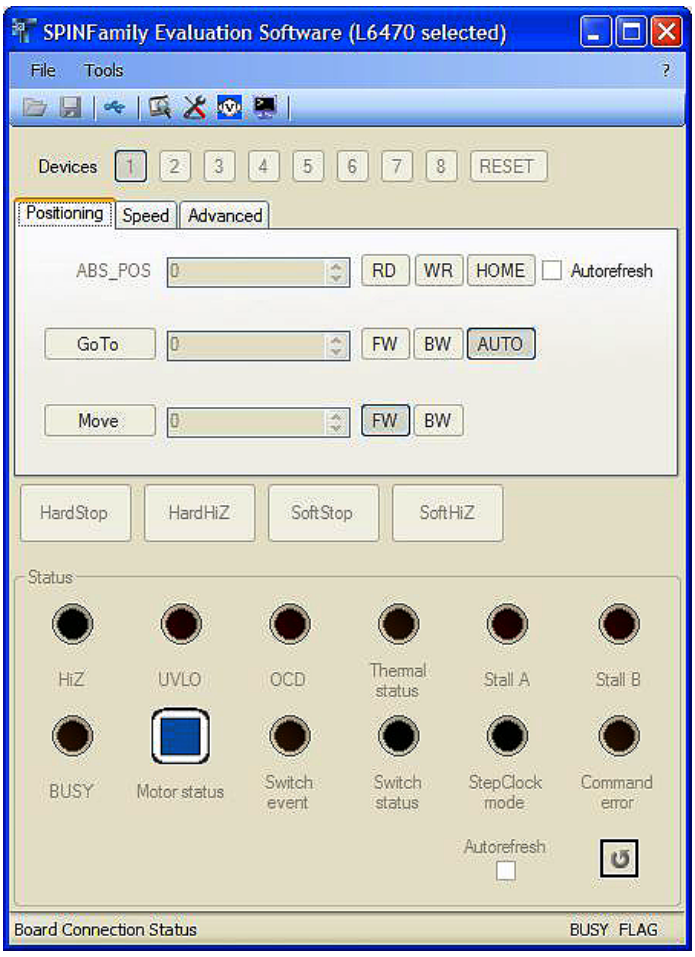
This procedure is used to install STEVAL-PCC009V2 drivers which are required by the early version of the firmware. This operation is requested only the first time the board is connected to the PC; if they are already installed this procedure can be skipped.

1. Connect the board to the PC through a USB cable.
2. System should start the assisted driver installation procedure.
3. Chose “No, not this time” option and click “Next”.
4. Chose to install the device driver automatically (recommended).
5. If the drivers are not found:
   a) Chose to install the device driver from a specific location.
   b) Select the first option and check “Include this location in the search”.
   c) Select the driver path clicking on the “Browse” button: drivers are installed into the “Updater\Drivers\WinXP” subfolder in the SPINFamily Evaluation Tool folder (by default it is Program Files\STMicroelectronics\SPINFamily Evaluation Tool\ Updater\Drivers\WinXP).
6. When the driver certification warning is shown click on the “Continue Anyway” option.
7. Driver installation is completed and the communication board is now operative.

3 SPINFamily evaluation software

When the application starts the form is shown in *Figure 2*.
The form is divided into two main sections: the command section, on the top, that collects all the device commands and allows reading/writing the absolute position and the speed registers. The device status display, on the bottom, that shows the last information collected from the status register.
Between the command section and the toolbar the device selection and reset buttons can be found. When more devices are driven in daisy chain configuration, these buttons can be used to select the device to control. All the commands are sent only to the selected device and the application can drive only one device at a time. See *Section 9 on page 38* for further details.
The “RESET” button forces low the STBY/RESET line of the communication board after a warning message. Clicking on the button again releases the STBY/RESET line.
The menu and toolbar provide access to extra tools and allow opening/saving the device configuration.
The status bar on the bottom side of the form shows the current board status and the SPI communication speed. On the right corner the status of BUSY and FLAG lines can be found: red text indicates that the respective line is low.

Figure 2. Main form



3.1 Menu and toolbar

Table 1 lists the content of the menu of the main form and the toolbar buttons with a brief description of each item.

Table 1. Menu items and toolbar buttons of the main form

Menu item	Toolbar button	Description
File\Open		Load a group of configuration files and write them into the devices.
File\Save		Save the setup of the devices in a group of configuration files.
File\Exit	-	Close the application.
Tools\Connect board		Connect and disconnect the IBU universal interface board from the PC.
Tools\Register map		Open the “Register map” tool (see *Section 4 on page 23*).
Tools\Device configuration		Open the “Device configuration” tool (see *Section 5 on page 26*).
Tools\BEMF compensation		Open the BEMF compensation evaluator tool for the voltage mode driving (see *Section 6 on page 33*).
Tools\Script editor		Open the scripting environment (see *Section 7 on page 35*).
Tools\Options	-	Open the application option dialog (see *Section 8 on page 37*).
?\Help	-	Open the help file.
?\About	-	Show detailed information about the software.
?\Web	-	Open the STMicroelectronics web page.

3.2 Command section

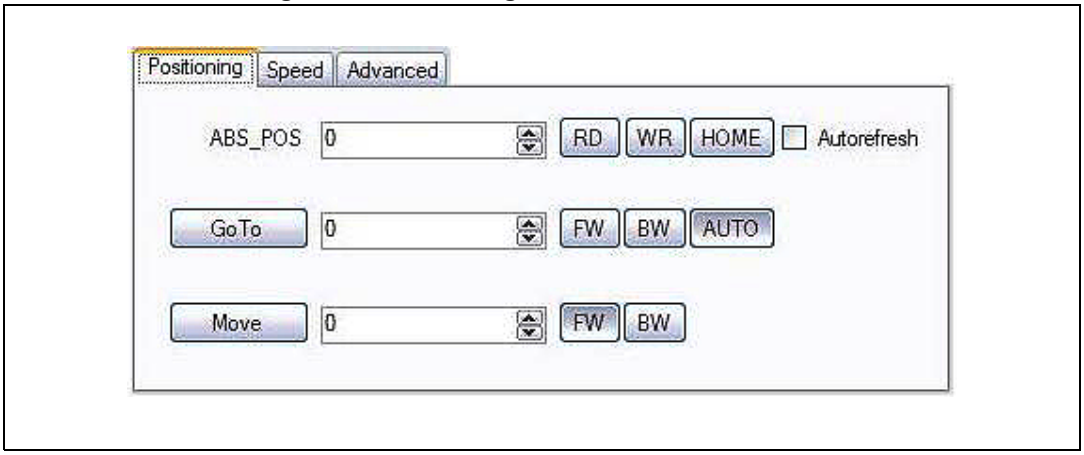
Command section collects all commands and allows reading and writing ABS_POS, MARK and SPEED registers.

For a detailed description of the command set of the device, please refer to the DS6582, DS8858, DS9080 and DS9306 device datasheets and AN4241, AN4290 application notes on st.com.

3.2.1 “Positioning” tab

The positioning tab collects all the motion commands allowing the device to reach target positions.

Figure 3. Positioning tab in command section



GoTo and GoTo_DIR commands can be sent to the selected device clicking on the “GoTo” button. If the “AUTO” button is selected, the GoTo command is sent and the motion direction is selected by the device using the minimum path algorithm. “FW” and “BW” buttons force a forward/backward direction sending a GoTo_DIR command.

Position argument is set by a numeric box next to the button and can vary within -2097152 and 2097151 (the absolute position is expressed in a 2 s complement format). The target position can be written directly or it can be changed using up and down arrows positioned on the right side of the box. GoTo or GoTo_DIR command can also be sent pushing the return key in this numeric box.

Clicking on the “Move” button a Move command is sent to the current active device. The motion direction is selected through “FW” (forward) and “BW” (backward) buttons and the number of steps is set by a numeric box next to the button. This value goes from 0 to 4194303. The value can be directly written within the box or it can be adjusted using up and down arrows.

The Move command can also be sent pushing the return key in the numeric box.

The “Positioning” tab also gives quick access to the ABS_POS register. Clicking on the “RD” button the current ABS_POS value of the selected device is read and it is returned into the numeric box. If “Autorefresh” is checked, the absolute position is automatically updated at the selected polling rate.

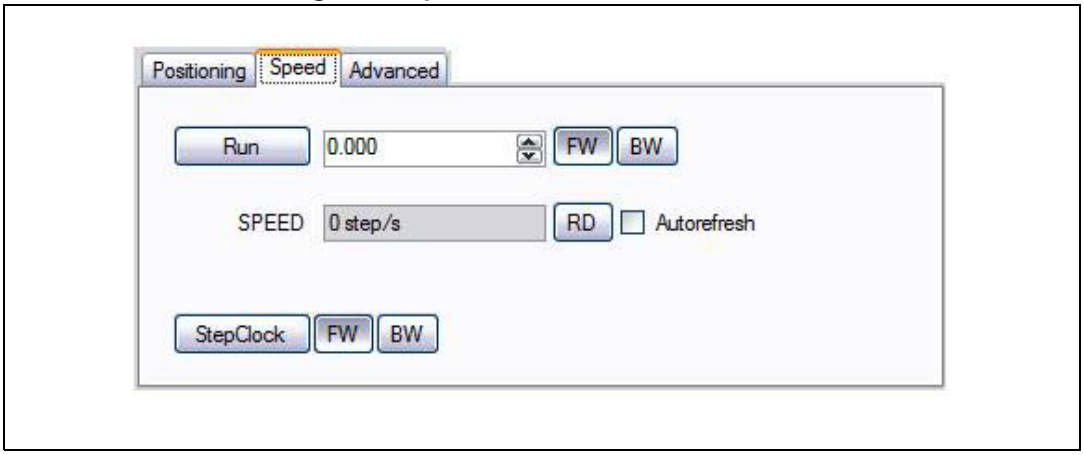
Clicking the “WR” button the ABS_POS register is written, the desired value must be set into the numeric box (-2097152 to 2097151). The same operation can be performed pushing the return key in the numeric box.

The “HOME” button resets ABS_POS register to home position (zero).

3.2.2 “Speed” tab

The speed tab collects all the motion commands allowing the device to reach a target speed.

Figure 4. Speed tab in command section



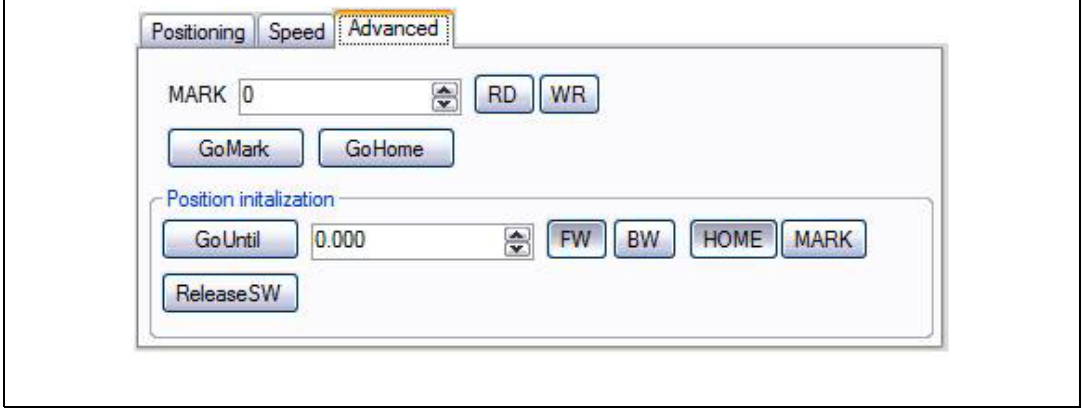
Clicking on the “Run” button a Run command is sent to the current active device. Motion direction is selected through “FW” (forward) and “BW” (backward) buttons and target speed is set by a numeric box next to the button. This value ranges from 0 to 15624.985 (expressed in step/s) and can be directly written in the box or it can be changed using the up and down arrows.

Pushing the return key in the number box sends a Run command also.

In the “Speed” tab is also allowed reading the current SPEED register value by clicking on the “RD” button. If “Autorefresh” is checked, the speed value is automatically updated at the selected polling rate.

3.2.3 “Advanced” tab

Figure 5. Advanced tab in command section



The “GoMark” and “GoHome” buttons in the “Advanced” tab send the respective command to the selected device. In this tab quick access to MARK register is also provided. Clicking on the “RD” button or the current MARK value of the selected device is read and it is returned into the numeric box. The register can be written setting the desired value into the numeric box (-2097152 to 2097151) and pushing the return key or clicking on the “WR” button.

The “GoUntil” button sends the respective command using the parameters indicated by the adjacent controls:

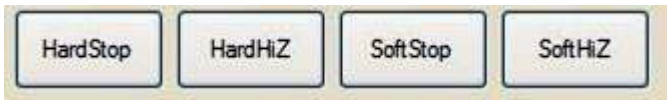
- The numeric box defines the target speed (expressed in step/s). Its value ranges from 0 to 15624.985 and can be set directly or by means of the up and down arrows.
- The “FW”/”BW” buttons select the motion direction.
- The “HOME”/”MARK” buttons select the action performed at the SW falling edge. If “HOME” is selected the ABS_POS register is set to zero (home position), otherwise its value is stored into the MARK register.

Pushing the return key in the numeric box DOES NOT SEND a GoUntil command, the “GoUntil” button has to be used.

The “ReleaseSW” button sends a ReleaseSW command using the parameters indicated by the same controls used for the GoUntil command. In this case, the “HOME”/”MARK” buttons select the action performed at the SW rising edge as described in the DS6582, DS8858, DS9080 and DS9306 device datasheets on st.com.

3.2.4 Stop buttons

Figure 6. Stop buttons in command section

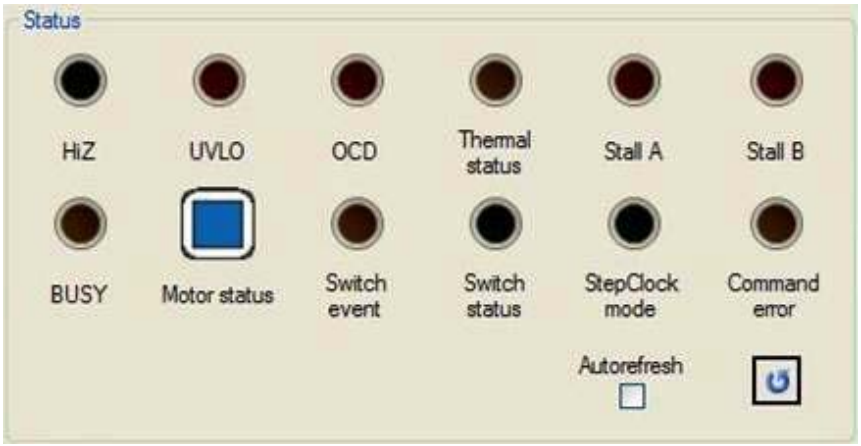


At the bottom of the command section the stop commands can be found. Clicking on “HardStop”, “HardHiZ”, “SoftStop” or “SoftHiZ” buttons the respective command is sent to the current active device.

3.3 Status display

The status display shows the last STATUS register value of the current active device. This display is updated every time the STATUS register is read through a GetStatus or a GetParam command.

Figure 7. Status display



The status display shows the last STATUS register value of the current active device. This display is updated every time the STATUS register is read through a GetStatus or a GetParam command.

If the “Autorefresh” box is checked, the display is automatically updated at selected polling rate, but error/failure flags are not cleared (GetParam command is used to get STATUS value instead of GetStatus command).

Failure conditions can be cleared using the button in the lower right corner which sends a GeStatus command to the selected device.

Detailed differences between GetParam and GetStatus command can be found on the DS6582, DS8858, DS9080 and DS9306 device datasheets or AN4241, AN4290 application notes on st.com.

3.3.1 HiZ LED

The “HiZ” LED indicates the high impedance status: if it is lit (green) the device outputs are disabled; otherwise the outputs are active.

The LED status is related to the HiZ bit value of the STATUS register according to *Table 2*.

Table 2. HiZ LED indicator

HiZ	LED	Status
1		Power stage disabled.
0		Power stage enabled.

3.3.2 UVLO LED

When the “UVLO” LED is red an undervoltage or the reset/power-up event occurred. If it is off (gray) no fails are present.

If a device of the cSPIN™ family is used (L648x), the LED reports the UVLO_ADC failure through a yellow light.

The LED status is related to the UVLO bit and eventually to the UVLO_ADC bit values of the STATUS register according to *Table 3*.

Table 3. UVLO LED indicator

UVLO	UVLO_ADC (L648x)	LED	Status
1	1		Operative conditions.
1	0		Undervoltage on ADC input.
0	X		Undervoltage condition.

3.3.3 OCD LED

The “OCD” LED indicates that an overcurrent has been detected: if it is on (red) an overcurrent event occurred; otherwise no fails are present.

The LED status is related to the OCD bit value of the STATUS register according to *Table 4*.

Table 4. OCD LED indicator

OCD	LED	Status
1		No failures.
0		Overcurrent failure occurred.

3.3.4 Thermal status LED

The “Thermal status” LED indicates the thermal status of the device:

- Gray means that the device temperature is below the warning threshold.
- Yellow indicates that the warning temperature has been reached.
- Red indicates that a thermal shutdown event occurred (the device temperature reached the shutdown threshold).
- Purple indicates that a device shutdown event occurred (L648x only).

When a device of the dSPIN™ family is used, the LED status is related to TH_WRN and TH_SD bit values. When a device of the cSPIN™ family is used, it is related to the TH_STATUS parameter value.

The relations are described in *Table 5*.

Table 5. Thermal status LED indicator

TH_WRN (L647x)	TH_SD (L647x)	TH_STATUS (L648x)	LED	Status
1	1	00		No failures.
0	1	01		Warning temperature exceeded.
0	0	10		Power stage shutdown temperature exceeded.
N. A.	N. A.	11		Device shutdown temperature exceeded.
1	0	N. A.	Not allowed	

3.3.5 Stall LEDs

The “Stall A” and “Stall B” LEDs indicate a stall detection warning. If the LED is on (red) a stall event occurred in the respective bridge; otherwise no fails are present.

Note: This indication is available in the L6470 and L6480 devices only.

The LED statuses are related to the STEP_LOSS_A and STEP_LOSS_B bit values of the STATUS register according to *Table 6*.

Table 6. Stall LED indicators

STEP_LOSS_X (L6470 and L6480)	LED	Status
1		No failures.
0		Stall failure occurred.

3.3.6 BUSY LED

The “BUSY” LED is turned on (yellow) during a command execution. When it is off (gray), the last command has been executed and the device is idle.

The LED status is related to the BUSY bit value of the STATUS register according to *Table 7*.

Table 7. Busy LED indicator

BUSY	LED	Status
1		Ready for a new command.
0		Command under execution.

3.3.7 Motor status indicator

The “Motor status” icon indicates the current status of the motor. Different icons represent the acceleration, deceleration, constant speed and holding status in both directions.

The displayed icon depends on DIR and MOT_STATUS parameters of the STATUS register according to *Table 8*.

Table 8. Motor status indicator

Motor status	DIR	MOT_STATUS	Icon
Stopped	X	00	
Accelerating in forward direction	1	01	
Decelerating in forward direction	1	10	
Running in forward direction	1	11	
Accelerating in backward direction	0	01	
Decelerating in backward direction	0	10	
Running in backward direction	0	11	

3.3.8 Switch event and switch status LEDs

If the “SW Event” LED is on (yellow), the SW input has been forced low (switch turn-on event); otherwise no falling edges has been detected on the input.

The LED status is related to the SW_EVN bit value of the STATUS register according to *Table 9*.

Table 9. SW event LED indicator

SW_EVN	LED	Status
0		No falling edges on SW input were detected.
1		Falling edge on SW input occurred.

The “SW Status” LED indicates the SW input status: if it is on (green) the SW input is low (switch closed); otherwise the SW input is high (switch open).

The LED status is related to the SW_F bit value of the STATUS register according to *Table 10*.

Table 10. SW status LED indicator

SW_F	LED	Status
0		SW input is high.
1		SW input is low.

3.3.9 StepClock mode LED

If the “StepClock mode” LED is on (green), the device is operating in StepClock mode; otherwise the device is operating in standard mode.

The LED status is related to the SCK_MOD bit value of the STATUS register according to *Table 11*.

Table 11. StepClock mode LED indicator

SCK_MOD	LED	Status
0		Normal operation.
1		StepClock mode operation.

3.3.10 Command error LED

If the “Command error” LED is on (yellow), a wrong or a not performable command has been sent to device; otherwise all sent commands have been correctly executed.

When a device of the dSPIN™ family is used, the LED status is related to WRONG_CMD and NOTPERF_CMD bit values. When a device of the cSPIN™ family is used, it is related to the CMD_ERROR parameter value.

The relations are described in *Table 12*.

Table 12. Command error LED indicator

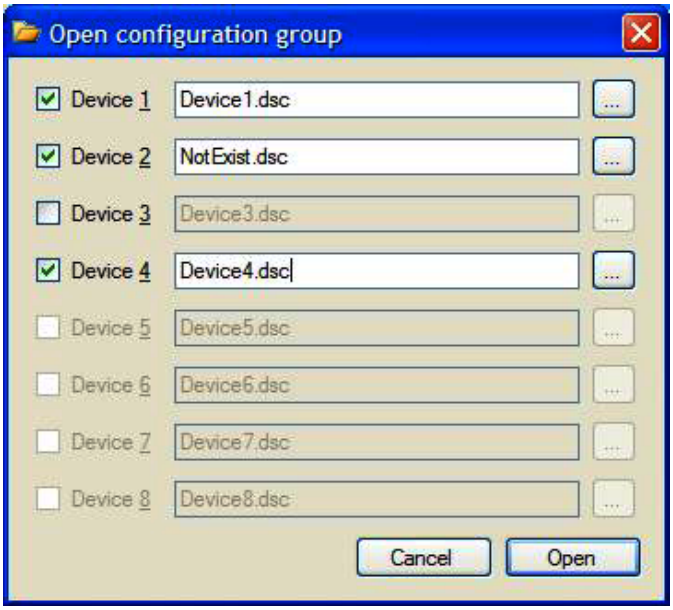
NOTPERF_CMD (L647x)	WRONG_CMD (L647x)	CMD_ERROR (L648x)	LED	Status
0	0	0		No failures detected.
X	1	1		A wrong command was received.
1	X	N. A.		A not performable command was received.

3.4 Opening and saving multiple device configurations

From main form it is possible to save and set the configuration of all the devices in the chain at the same time.

Clicking on the “Open” button or selecting the “File\Open” menu item the dialog is shown in *Figure 8*.

Figure 8. Open configuration group form



In order to load the configuration of multiple devices (daisy chain only) the following procedure should be used:

1. Select which devices have to be configured checking the related box.
2. Write the target file path in the text box or browse it clicking on the “...” button.
3. Click on the “Ok” button.

If one or more of the file does not exist an error message is shown.

The new configurations are immediately written into the devices.

Warning: The information included into a configuration file is strictly related to the respective device (L6470, L6472, L6480 or L6482). Any attempt to open a configuration file of a device type into another one will cause an error.

Clicking on the “Save” button or selecting the “File\Save” menu item the dialog is shown in *Figure 9*.

Figure 9. Save configuration group form

In order to save the configuration of multiple devices (daisy chain only) the following procedure should be used:

1. Select which device configurations have to be saved checking the related box
2. Write the target file path in the text box or browse it clicking on the “...” button
3. Click on the “Ok” button

If one or more of the file already exists warning message is shown. If one or more of the file is read-only or the user is not allowed to write on the target folder an error message is shown.

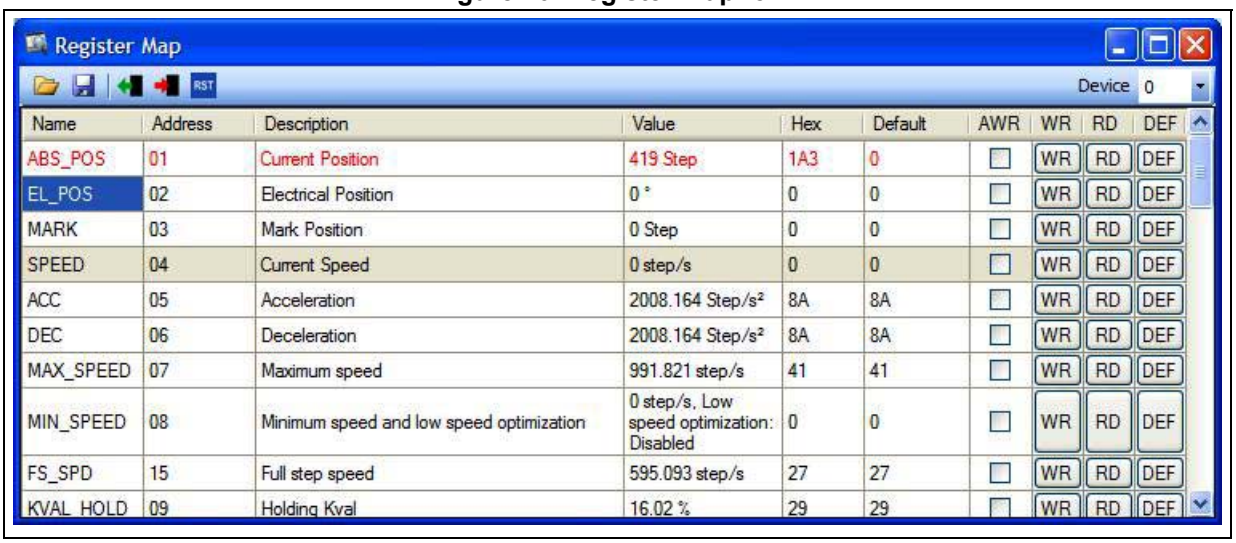
All the writable registers of the selected devices are updated through a GetParam command before saving the configuration.

4 Register map

The register map tool gives an overview of the current device register values. It can be opened from the application main form clicking on the respective toolbar button or selecting “Register map” in the “Tools” menu.

If more than one device is connected to the communication board (daisy chain configuration, *Section 9 on page 38*), the active device can be selected through the drop list on the top right corner of the toolbar.

Figure 10. Register map form



The registers are represented as rows of a table with information stored in different columns:

- “Name” column contains the register mnemonic name.
- “Address” column indicates the register address in hexadecimal format.
- “Description” column contains a brief description of the register content.
- “Value” column shows the current register “decoded” value.
- “Hex” column shows the value of the register in hexadecimal format. This is the only writable column and it can be used to change the register value.
- “Default” column shows the default value of the register in hexadecimal format.

There are also columns that allow reading/writing registers:

- Clicking on “WR” column buttons the register value is written.
- Clicking on “RD” column buttons the register value is read.
- Clicking on “DEF” column buttons the register value is set to its default value.
- Checking “AWR” boxes the register value is automatically written every time its value in “Hex” column is changed.

Warning: **Reading/writing buttons are only displayed when the IBU universal interface board is correctly connected to the PC. They will be hidden also when a script code is running.**

The colors of the rows are used to identify register status:

- ***Black text on white background*** indicates that the register is writable and that the displayed value is updated (A GetParam or SetParam command refreshed the “Hex” column value).
- ***Red text on white background*** indicates that the “Hex” column value has been changed by the user but it is not written yet into the device.
- ***Black text on grey background*** indicates read-only registers.

4.1 Writing registers

Single registers can be written changing their value in the “Hex” column (hexadecimal format) and clicking on the “WR” button. When the “Hex” value is changed the “Value” column is immediately updated showing the new decoded value, but the register is not written. This situation is indicated by the row text color in red. This way the GUI shows a preview of how new register value will affect the device configuration without make this change effective.

In order to set if a specific register has to be automatically written every time the “Hex” value is changed checking the respective “AWR” column box.

Warning: **When auto-write (“AWR”) is enabled, any accidental change in the “Hex” column will cause the respective register to be written.**

The whole register map can also be written clicking on the  button in the toolbar. This way all the registers (whatever their value has been changed or not) will be written according to the current “Hex” column value.

Clicking on the 

button all registers (whatever their value has been changed or not) will be set to the respective default value.

Read-only registers are indicated with black text on grey background rows.

Warning: **If the autorefresh of the ABS_POS register in main form is enabled (see *Section 3.2.1 on page 10*), the ABS_POS row is updated at the current polling rate. This condition makes difficult to set the ABS_POS register to the desired value. In order to change the ABS_POS register value the autorefresh should first be disabled.**

4.2 Reading registers

Single registers can be read clicking on the “RD” button. The “Hex” and “Value” columns will be updated according to the current register value. Unwritten changes (red text) will be rejected (black text).

The whole register map can also be read clicking on the  button. This way all the registers will be read updating “Hex” and “Value” columns.

4.3 Loading and saving configurations

Current device configuration can be saved clicking on the “Save” button. A file selection dialog will be opened to choose if creating a new configuration file or overwriting an existing one.

Warning: **Saved values are the “Hex” column ones, whatever they are actually written into the device or not.**

Configuration files can be loaded clicking on the “Open” button. A file selection dialog will be opened to choose the configuration file.

When it is loaded, the “Hex” column is updated, but no value is written into the device (changed registers will be highlighted with red text) even if the respective “AWR” box is checked. To write the configuration the  or the “WR” buttons must be used.

5 Device configuration tool

This form allows an easy configuration of the IC. All registers content is displayed through a user-friendly interface and the parameters are converted in a common format (e.g. speeds are expressed in step/s, current thresholds in Amperes, etc.). The device configuration form can be opened from the application main form clicking on the respective toolbar button or selecting “Device configuration” in “Tools” menu.

If more than one device is connected to the communication board (daisy chain configuration, *Section 9 on page 38*), the active device can be selected through the drop list on the top right corner of the toolbar.

Changing the form control values does not modify the actual value of the device registers. Configuration is written into the device and changes are made effective clicking on the  button of the toolbar or clicking on “Ok” or “Apply” buttons in the bottom right corner of the form.

Clicking on the “Ok” button the new configuration is written into the selected device and the form is closed.

Clicking on the “Apply” button the new configuration is written into the selected device and the form is kept open.

Clicking on the “Cancel” button the form is closed without writing the new configuration into the selected device.

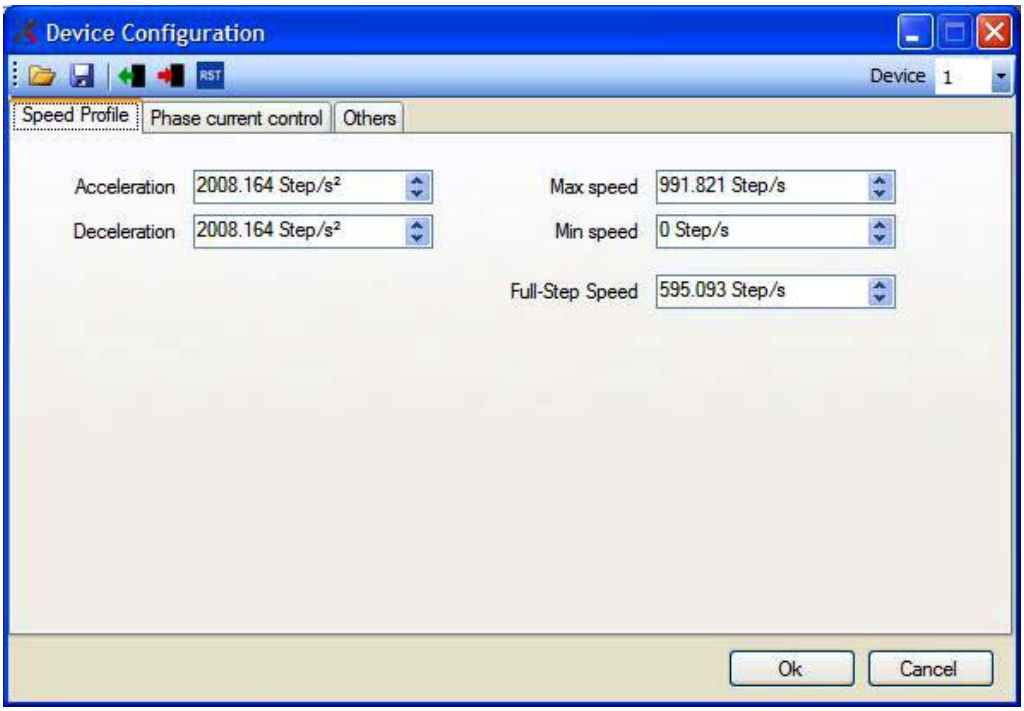
The actual configuration can be loaded clicking on the  button of the toolbar.

The default device configuration can be set clicking on the 

button of the toolbar.

5.1 “Speed Profile” tab

Figure 11. Speed profile tab in device configuration form



This tab collects all the device parameters that are related to speed profile boundaries and in general to the configuration of the motion engine of the device.

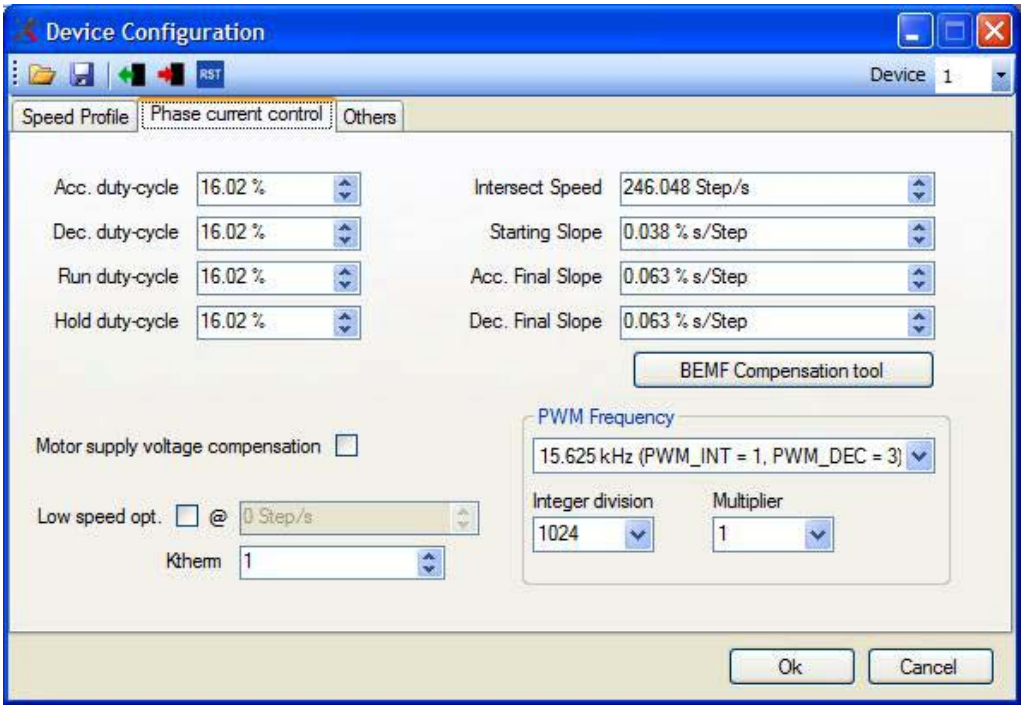
The values can be changed writing the new value in common format (step/s^2 for acceleration/deceleration and step/s for speed) or in hexadecimal format using the '0x' prefix. In the first case the value is rounded to the nearest available. For example the “Acceleration” can be set to 2008.164 step/s^2 writing '2010' or '0x8A'. If the inserted value is out of the range of the parameter, the change is ignored.

Clicking on up and down buttons the parameter value is increased or decreased of one unit according to its resolution.

Warning: Considering that the low speed optimization threshold and the minimum speed parameters are determined by the same register, the two boxes are always forced to the same value.

5.2 “Phase current control” tab for the voltage mode devices

Figure 12. Voltage mode driving tab in device configuration form



All the parameters related to the voltage mode control are listed in this tab. Values in numeric boxes can be changed writing the new value or using up/down arrows.

The “Acc. duty-cycle”, “Dec. duty-cycle”, “Run duty-cycle” and “Hold duty-cycle” boxes show KVAL_X register values expressed in percentage format. When a new value is written into the boxes the allowed formats are decimal (e.g '0.25'), percentage (e.g. '25%') and hexadecimal using the '0x' prefix (e.g. '0x40'). If the inserted value is out of the range of the parameter, the change is ignored.

The “Intersect Speed” box contains the INT_SPEED register value. When a new value is written into the box the allowed formats are decimal (e.g. '230.5') and hexadecimal using the '0x' prefix (e.g. '0x53A'). If the inserted value is out of the range of the parameter, the change is ignored.

The BEMF compensation slopes (ST_SLP, FN_SLP_ACC and FN_SLP_DEC) are shown in “Starting Slope”, “Acc. Final Slope” and “Dec. Final Slope” boxes. When a new value is written into the box the allowed formats are decimal (e.g. '0.00048') and hexadecimal using the '0x' prefix (e.g. '0x1F'). If the inserted value is out of the range of the parameter, the change is ignored.

Clicking on the “BEMF Compensation tool” button the BEMF compensation tool is immediately opened (see *Section 6 on page 33*).

The PWM frequency can be selected using “Integer division” and “Multiplier” lists (corresponding to F_PWM_INT and F_PWM_DEC parameters of the CONFIG register) or directly from the “PWM Frequency” list. This list contains all the available PWM frequencies according to the current clock configuration.

Checking the “Motor Supply Voltage Compensation” box the respective compensation is enabled. In this case the VS resistor divider on the demonstration board must be correctly configured (see the DS6582 and DS9080 device datasheets for details).

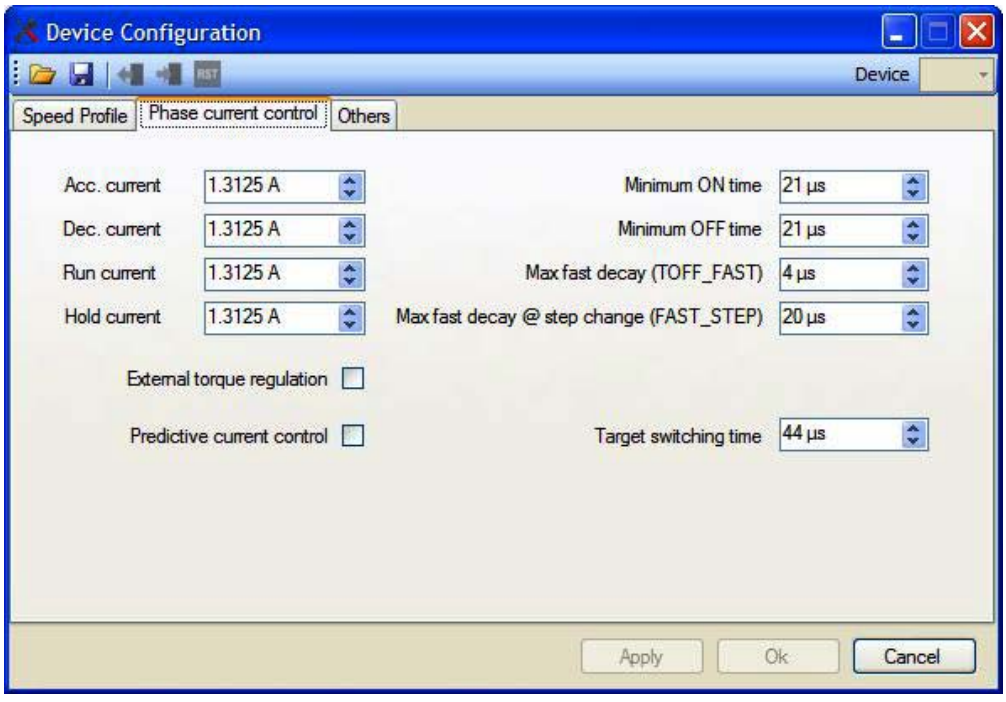
Checking “Low speed opt.” box the low speed optimization feature is enabled. The speed threshold can be set using the numeric box on the right. The allowed formats are decimal (e.g. '112.5') and hexadecimal using the '0x' prefix (e.g. '0x3A'). If the inserted value is out of the range of the parameter, the change is ignored.

Warning: Considering that the low speed optimization threshold and the minimum speed parameters are determined by the same register, the two boxes are always forced to the same value.

The phase resistance thermal drift compensation parameter (K_THERM) can be modified through the “Ktherm” box. The allowed formats are decimal (e.g. '1.16') and hexadecimal using the '0x' prefix (e.g. '0x5'). If the inserted value is out of the range of the parameter, the change is ignored.

5.3 “Phase current control” tab for the current mode devices

Figure 13. Advanced current control driving tab in device configuration form



All the parameters related to the advanced current control are listed in this tab. Values in numeric boxes can be changed writing the new value or using up/down arrows.

The “Acc. current”, “Dec. current”, “Run current” and “Hold current” boxes show TVAL_X register values expressed in Amperes or the reference voltage expressed in Volts in case of cSPIN™ family devices. The allowed formats are decimal (e.g '0.25') and hexadecimal using the '0x' prefix (e.g. '0x40').

The “Minimum ON time” box contains the TON_MIN register value in microseconds. The allowed formats are decimal (e.g. '3.5') and hexadecimal using the '0x' prefix (e.g. '0x5').

The “Minimum OFF time” box contains the TOFF_MIN register value in microseconds. The allowed formats are decimal (e.g. '3.5') and hexadecimal using the '0x' prefix (e.g. '0x5').

The “Max fast decay” and “Max fast decay @step change” boxes contain respectively the TOFF_FAST and the FAST_STEP parameters (T_FAST register) in microseconds. The allowed formats are decimal (e.g. '12') and hexadecimal using the '0x' prefix (e.g. '0x9').

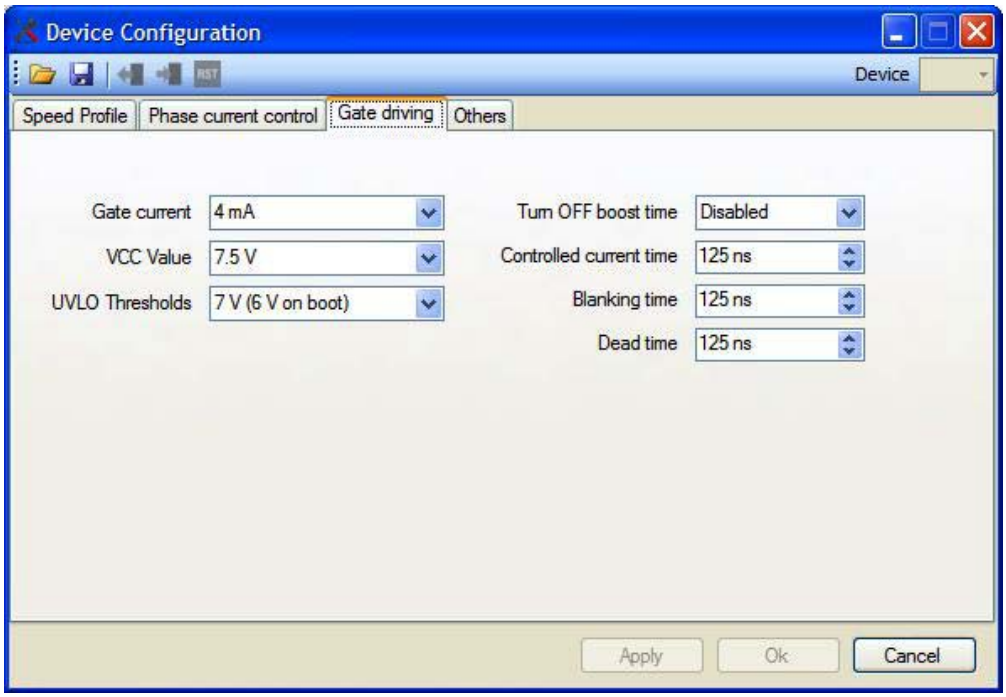
The “Target switching time” box contains the TSW parameter of the CONFIG register in microseconds. The allowed formats are decimal (e.g. '40') and hexadecimal using the '0x' prefix (e.g. '0x36').

Checking the “External torque regulation” box the device uses the ADCIN voltage to set the TVAL value instead of the respective registers. In this case please check that the ADCIN input is correctly driven.

Checking the “Predictive current control” box the predictive mode is enabled.

5.4 “Gate driving” tab (cSPIN™ family only)

Figure 14. Gate driving tab in device configuration form



This tab is used to configure the gate driving circuitry of the device.

The “Gate current” drop box selects the gate current between the available values (IGATE parameter).

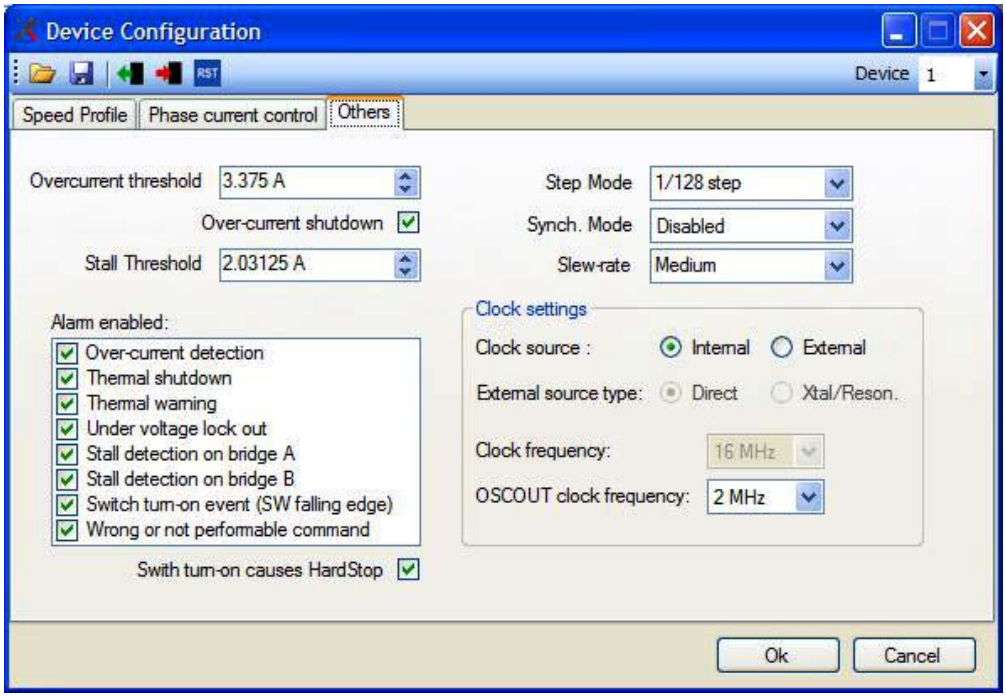
The “Controlled current time”, “Blanking time” and “Dead time” boxes contain the TCC, TBLANK and TDT parameters respectively. The parameters can be changed writing the new value or using up/down arrows. The allowed formats for the new value are decimal (e.g. '250') and hexadecimal using the '0x' prefix (e.g. '0x1').

The “Turn OFF boost time” drop box enables the respective feature and selects the duration of the boost time (TBOOST parameter).

The “VCC value” and “UVLO thresholds” drop boxes select the output voltage of the VCC voltage regulator and set the UVLO protection thresholds.

5.5 “Others” tab

Figure 15. “Others” tab in device configuration form



This tab is used to configure the various device features.

The “Overcurrent threshold” and “Stall threshold” can be set through the respective numeric boxes writing the new value in decimal format or in hexadecimal using the '0x' prefix. Up and down arrows can also be used. The values are expressed in Amperes in case of dSPIN™ family devices or in millivolts in case of cSPIN™ family devices.

If the “Overcurrent shutdown” box is checked the overcurrent events causes the power stage bridges to turn-off.

In the “Step Mode” list the step resolution can be selected and the “Synch. Mode” list allows enabling and configuring the synchronization signal.

The output slew rate is selected using the “Slew-rate” list (dSPIN™ family devices only).

The “Alarm enabled” check list selects the error events which causes the FLAG output to be forced low.

In order to enable the HardStop interrupt on the SW input falling edge the “Switch turn-on causes HardStop” box needs to be checked, otherwise the SW input does not interfere with the motor motion.

Device clock configuration is shown on a dedicated panel. Here all possible clock configuration can be set.

Setting the “Clock source” as “Internal” the integrated 16 MHz oscillator is enabled. If it is set as “External”, the device is forced to use the external clock source defined by the “External source type” selection: “Direct” if clock is directly applied to OSCIN input, “Xtal/Reson.” if a resonator or a crystal is connected between the OSCIN and OSCOUT pins.

The “Clock frequency” list selects the current clock frequency. When the internal oscillator is used, this value is forced to 16 MHz.

The “OSCOUT clock frequency” list selects the frequency that will be supplied by the OSCOUT pin (available only when the internal oscillator is enabled).

In case of cSPIN™ family devices the “External clock watchdog” checkbox is available: when it is checked the device is protected from the failures of the external clock source.

5.6 Load and save configuration

Current device configuration can be saved clicking on the “Save” button in the toolbar. A file selection dialog will be opened where you can choose to create a new configuration file or overwrite an existing one.

Warning: **Configuration file includes ALL writable registers (ABS_POS, EL_POS, MARK, etc.). Make sure that the value of these registers is coherent with the desired one before saving the configuration.**

Configuration files can be loaded clicking on the “Open” button in the toolbar. A file selection dialog will be opened to choose the configuration file.

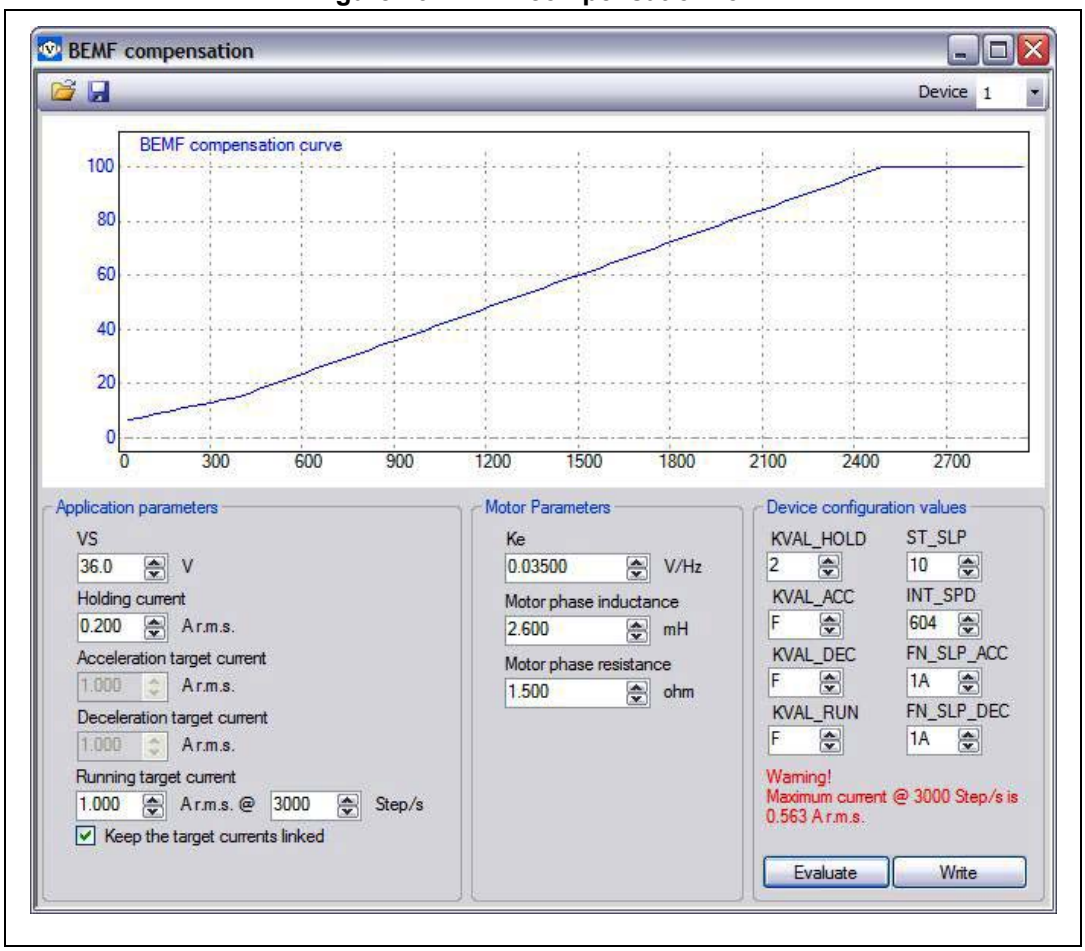
Warning: **The loaded configuration is NOT written into the device. To write the new values the  , “Ok” or “Apply” buttons should be used.**

6 BEMF compensation tool

This tool helps the user to set the BEMF compensation parameters according to your application settings. It can be opened from the application main form clicking on the respective toolbar button or selecting “BEMF compensation” in “Tools” menu.

If more than one device is connected to the communication board (daisy chain configuration, *Section 9 on page 38*), the active device can be selected through the drop list on the top right corner of the toolbar.

Figure 16. BEMF compensation form



The BEMF compensation algorithm is based on the application requirements, as supply voltage, target current and motor characteristics.

In the “Application parameters” panel, motor supply voltage and load currents need to be set:

- “VS” is the supply voltage.
- “Holding current” is the target r.m.s. current when the motor is stopped.
- “Acceleration target current” is the target r.m.s. current when the motor is accelerating.
- “Deceleration target current” is the target r.m.s. current when motor is decelerating.
- “Running target current” is the target r.m.s. current when the motor is running at constant speed.

When “Keep target currents linked” box is checked, acceleration, deceleration and running target currents are forced to the same value.

In the “Motor parameters” panel the motor characteristics need to be set:

- “Ke” is the electric constant of the motor.
- “Motor phase inductance” is the inductance of the motor phases.
- “Motor phase resistance” is the resistance of the motor phases.

When the application parameters and motor characteristics are inserted, the parameters of the voltage mode algorithm can be calculated clicking on the “Evaluate” button.

The resulting configuration settings are shown in the respective numeric boxes in hexadecimal format. The compensation curves which are implemented by the algorithm are shown on the graph in *Figure 16*.

If the system fails to evaluate the parameters, a warning message is displayed. This error could be due to wrong application or motor data: for example you cannot obtain a holding current of 1.5 A with a supply voltage of 10 V and a phase resistance of 10 Ω (maximum current value is 1 A).

The voltage mode algorithm setup can be written into the device registers clicking on the “Write” button.

Warning: **The compensation parameters COULD BE NOT the optimal ones. Better performances can be obtained with fine tuning of the parameters. Please refer to the AN4144 application note dedicated to voltage mode driving for furthers details.**

Saving and loading application and motor parameters

The current application and motor parameters can be saved clicking on the “Save” button. A file selection dialog will be opened to choose if creating a new BEMF setup file or overwriting an existing one.

The BEMF setup files can be loaded clicking on the “Open” button. A file selection dialog will be opened to choose the target file.

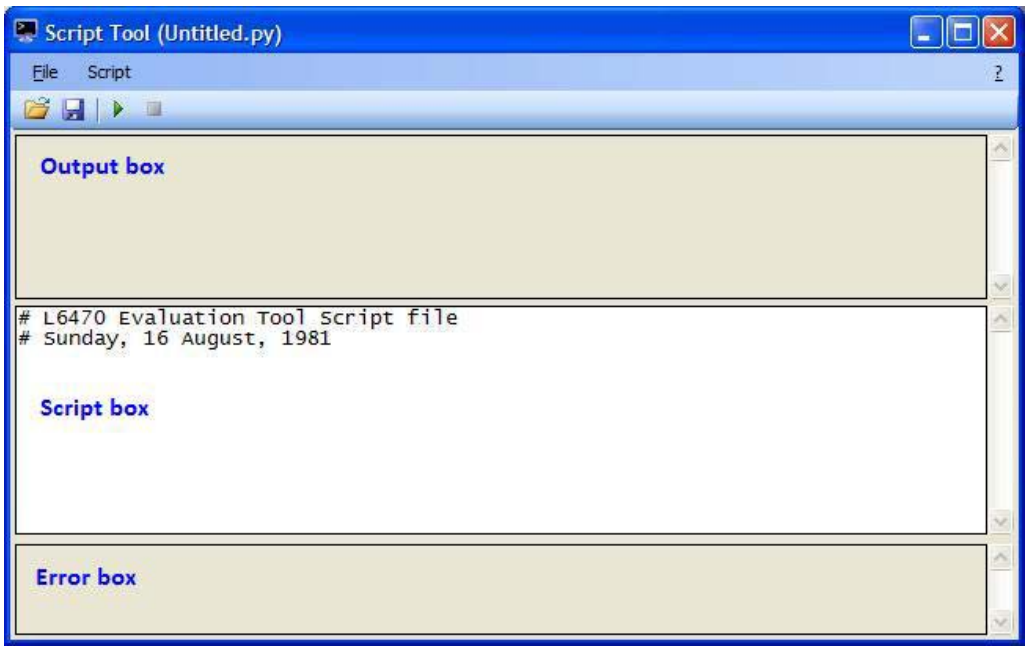
When the selected file is loaded, the new voltage mode algorithm parameters are immediately evaluated, but the new setup is NOT written into the device.

7 Scripting environment

The application includes a scripting environment which allows the user to implement complex command sequences. The script language is a tailor made Python extension for the dSPIN™ and cSPIN™ devices. The scripting environment is based on IronPython, an open-source implementation of the Python programming language for the .NET framework.

The application provides a detailed help file including some Phyton™ basics to write custom automatic routines. Detailed information on Phyton can be found at the “Python Programming Language Official Website” - www.python.org.

Figure 17. Scripting environment form



Scripting environment tool is divided into three text boxes:

- Script box: here the script code can be written.
- Output box: here the script messages will be found.
- Error box: here error messages will be displayed.

At the top of the window a menu and a toolbar can be found.

The menu bar allows to manage script files (“File”), start and stop scripting (“Script”) and quickly access to this help file (“?”).

The toolbar provides shortcuts to the most common commands as “Open” ( ), “Save” ( ), “Run script” ( ) and “Stop script” ( ).

7.1 Writing scripts

The scripting environment is based on Phyton. The application provides a detailed help file including some Phyton basics and a description of all the functions used to control the devices. Detailed information on Phyton can be found at the Python Programming Language official website.

When the tool is started, a new scripting file named “Untitled.py” is generated. You can create a new scripting file anytime through the “New” command in the “File” menu.

You can load an existing script code (.py files) selecting “Open” in the “File” menu or clicking on the respective toolbar button. The script code is shown in the script box, here you can edit it. Standard copy, cut, paste and undo commands can be used writing the script.

Note: Python scripts are simple ASCII text files which can be edited with many different tools, it is not mandatory to write them used the scripting environment.

Changes can be saved selecting “Save” in the “File” menu or clicking on the respective toolbar button. If you want to save the script as a different file keeping the original one unchanged you can do it selecting “SaveAs” in the “File” menu. If you are working on a new (i.e. unsaved) scripting file, “Save” and “SaveAs” act in the same way.

You can restore the current script file to its last saved version using the “Reload” command in the “File” menu.

7.2 Script execution

When the script code is ready, it can be executed selecting “Run script” in the “Script” menu or clicking on the respective toolbar button. When the script is started, the script box is disabled and the  button is checked.

During the script execution output messages are displayed on the output box. At the end of the script execution the result message is shown in the error box, the script box is enabled and the  button is unchecked.

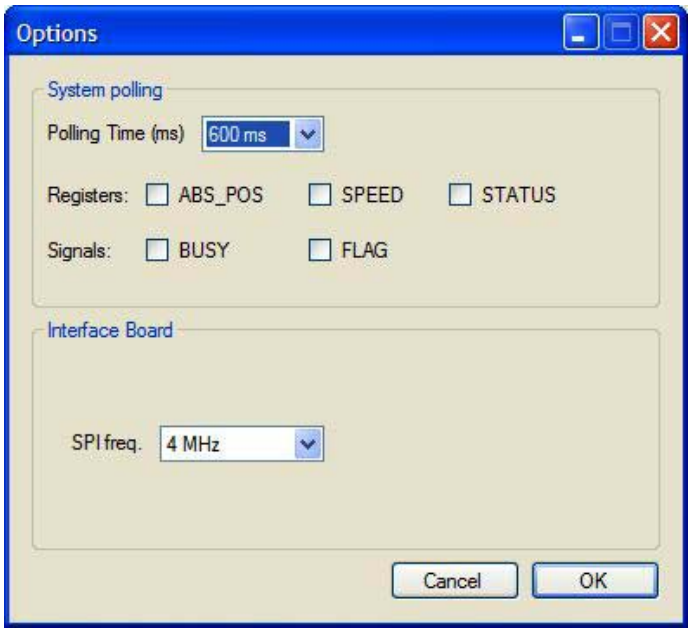
The script execution can be stopped selecting “Stop script” in the “Script” menu or clicking on the respective toolbar button. Stopping the code execution a HardHiZ command is sent to all devices.

Warning: At the end of script execution all the variables are kept in memory. If needed, variable initialization is mandatory at each script execution!

8 Options

The option dialog allows setting some application options. It can be opened from the main form selecting “Options” on the “Tools” menu.

Figure 18. Options dialog



The application can be configured to cyclically refresh the value of ABS_POS, SPEED and STATUS registers. The refresh time can be selected from the “Polling Time” list and the registers can be selected through relative checkboxes or from the main form. The autorefresh cycle can also update the BUSY/FLAG lines values. In this case the line values are shown in the main form status bar.

In the interface board section the SPI speed (“SPI freq.” list) can be selected. The default value is 4 MHz.

9 Daisy chain configuration

More demonstration boards can be connected in daisy chain mode. This way you can control up to eight motors using a single communication board.

To drive two or more boards in daisy chain configuration:

1. Plug the IBU universal interface board to the PC through the USB cable.
2. Connect the interface board 10-pin connector to the SPI_IN connector of the first demonstration board.
3. Open the termination jumper of the demonstration board.
4. Connect the SPI_OUT connector of the previous demonstration board to the SPI_IN connector of the next one.
5. Repeat step *4.* and *5.* for all the others boards of the chain except for the last which must have the termination jumper closed.
6. Check the termination jumpers of all the demonstration boards: all the jumpers except for the last one should be opened.

When chain configuration is set, you can connect the interface board to the PC as usual. The application automatically identifies the number of demonstration boards connected.

Information about the position of the termination jumpers and the SPI connectors can be found on the documentation of the specific demonstration board.

Warning: Increasing the number of the devices connected in chain could degrade SPI communication performances. If communication issues are found, try to reduce SPI clock speed (see *Section 8 on page 37*).

10 Revision history

Table 13. Document revision history

Date	Revision	Changes
03-Sep-2013	1	Initial release.

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