

# SPOC™+2 User Manual

## Multichannel SPI High-Side Power Controller

### About this document

#### Scope and purpose

This User Manual is intended to enable users to integrate the SPOC™+2 Software for the SPOC™+2-Demoboard.

#### Intended audience

This document is intended for anyone using the SPOC™+2 Software.

#### Document conventions

**Table 1** Conventions

| Convention     | Explanation   |
|----------------|---|
| <b>Bold</b>    | Emphasizes heading levels, column headings, table and figure captions, screen names, windows, dialog boxes, menus and sub-menus                     |
| <i>Italics</i> | Denotes variable(s) and reference(s)  |
| Courier New    | Denotes APIs, functions, interrupt handlers, events, data types, error handlers, file/folder names, directories, command line inputs, code snippets |

#### Conventions for reading the configuration class field

The following examples help the integrator to identify the configuration class of the parameter for a given delivery type.

## Abbreviations and definitions

**Table 2**      **Abbreviations**

| <b>Abbreviation</b>      | <b>Definition</b>                   |
|--------------------------|-------------------------------------|
| SPOC <sup>TM</sup> +2    | SPI Power Controller                |
| SPOC <sup>TM</sup> +2 MB | SPOC <sup>TM</sup> +2 Motherboard   |
| SPOC <sup>TM</sup> +2 DB | SPOC <sup>TM</sup> +2 Daughterboard |
| NC                       | Not Connected                       |
| LHI                      | Limp Home Input                     |
| IS                       | Sense current                       |

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# 1 General information

## 1.1 Required hardware

First of all some special hardware is needed:

- SPOC™+2 MB
  - SPOC™+2 Motherboard
  - See Figure 1



Figure 1 – SPOC™+2 MB

- SPOC™+2 DB
  - Product specific (BTSxxxxx-xxxx)
  - See Figure 2



Figure 2 – SPOC™+2 DB

- **μIO-Stick**
  - Communication between your computer and the Demoboard
  - Isar Number: SP001215532
  - See Figure 3



Figure 3 - μIO-Stick

- **Connection cable**
  - Ribbon cable
    - 16 pin female connector
  - See figure 4

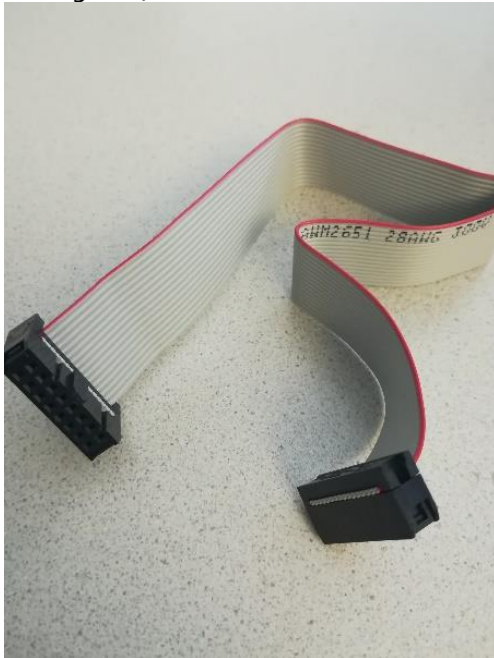


Figure 4 - Connection cable

- USB-Stick
  - For software installation
  - See Figure 5



Figure 5 - Software installation USB-Stick

## 1.2 Software Installation

### 1.2.1 SPOC™+2 Application

How to install software for the SPOC™+2 Evaluation Board:

- Plug in the Software-USB-Stick into a USB port of your computer
- Run **setup.exe** in the following location:
  - **USB-Drive:\SPOC+2\_Installer\Volume\setup.exe** (see Figure 6)

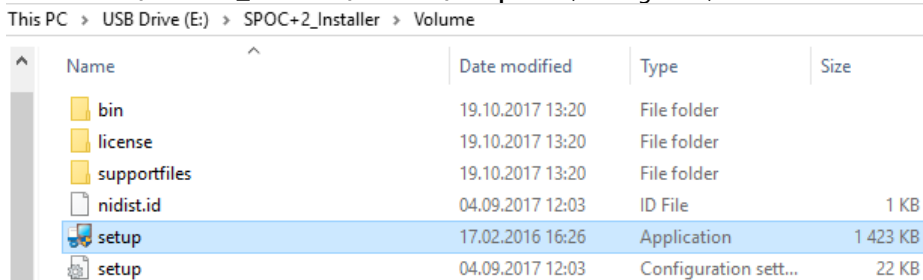


Figure 6 – SPOC™+2 - setup.exe

- Note: You must log in as administrator!
- Follow the steps of the Installation Wizard (see Figures below):
  - Select installation directory, then click “next”

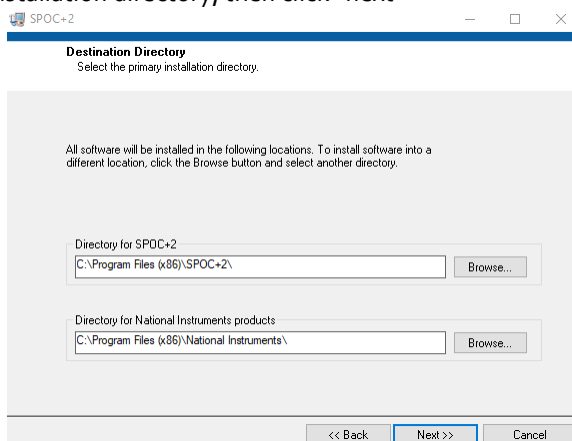


Figure 7 - SPOC™+2 Application - Select Directory

- Again click “next”

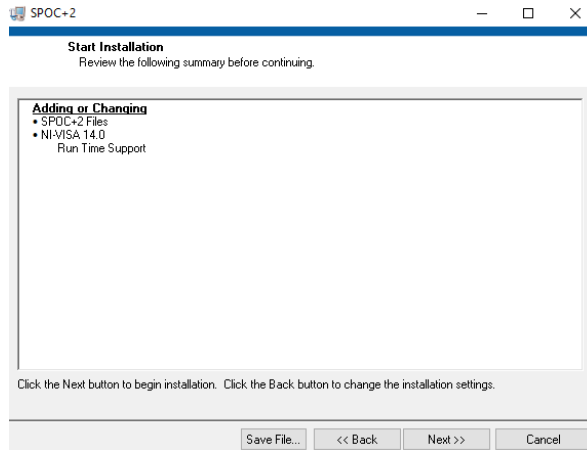


Figure 8 – SPOC™+2 - Application - Start Installation

- The installation will start, after that click „finish“

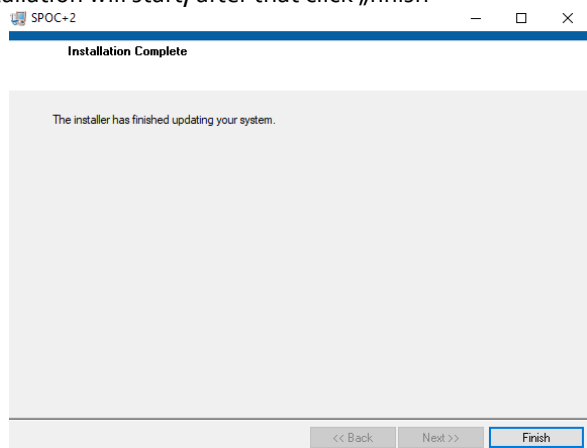


Figure 9 – SPOC™+2 - Application – Finish

### 1.2.2 μIO-Stick Driver Install

After installing the SPOC™+2-Application keep the Software-USB plugged in and plug in the μIO-Stick. In order to use the virtual COM-port (necesairy for the application) go to <https://www.ehitex.de/usb-application-sticks/infineon/2529/uio-stick>, scroll to **Available Downloads** and select **Download uIO Updater (zip file)** see Figure 10. Extract the zip file and run *UpdatePEK* afterwards.

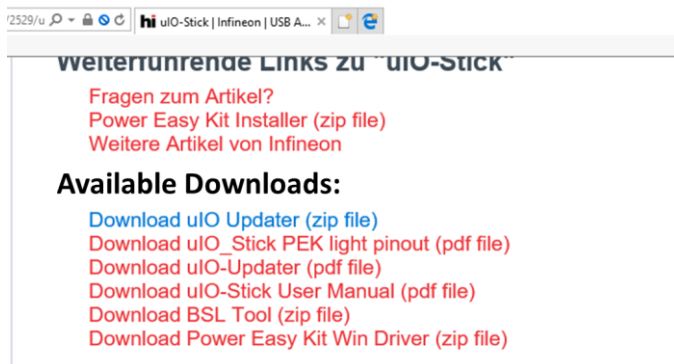


Figure 10 - uIO-Updater (for vCOM)

### 1.3 Setup Hardware

- Plug the SPOC™+2 DB onto the SPOC™+2 MB (see Figure 11)



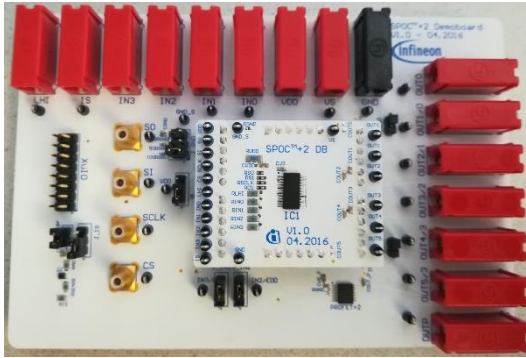


Figure 11 – SPOC™+2 DB plugged onto SPOC™+2 MB

- Connect the  $\mu$ O-Stick to the SPOC™+2 MB via the connector cable (see Figure 12)
  - **Be careful:** Position of Pin 1 is marked with a dot on the SPOC™+2 MB!

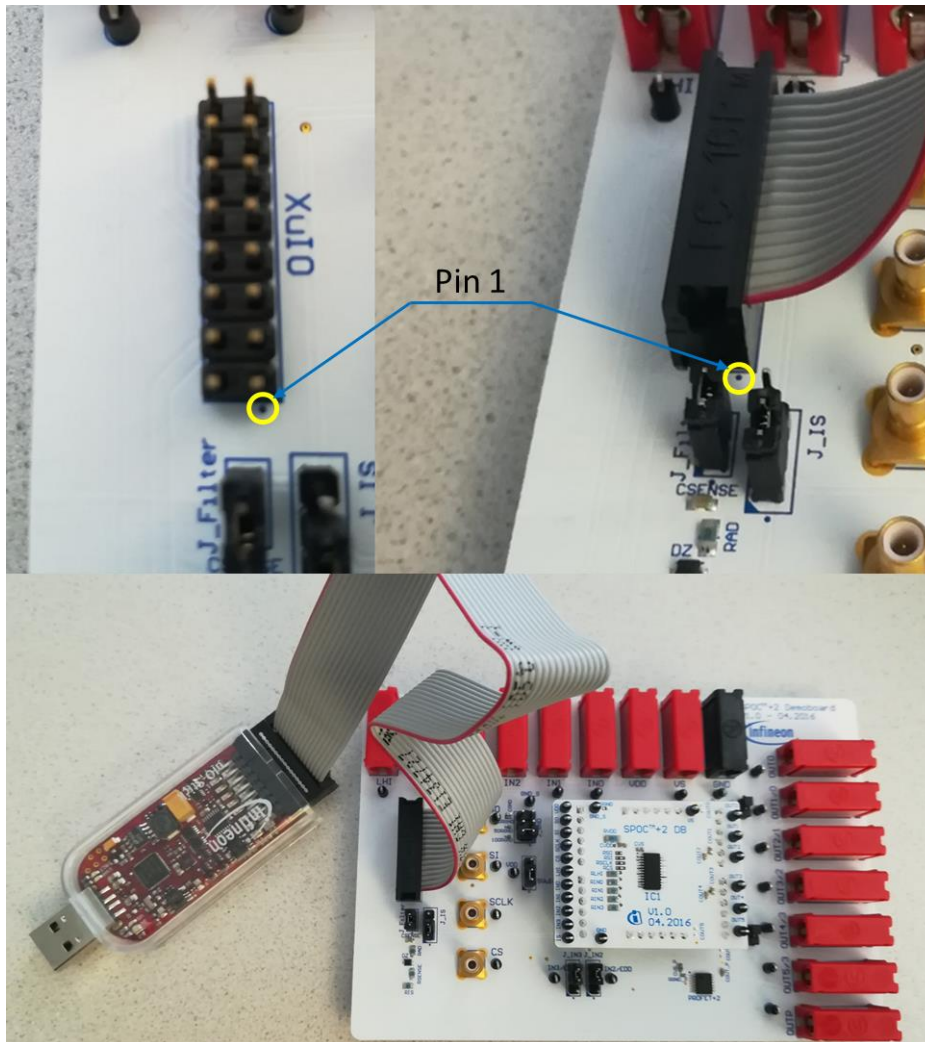


Figure 12 - Connecting  $\mu$ O-Stick to SPOC™+2 MB

- Connect the  $\mu$ O-Stick to your computer and run the SPOC™+2-Application. (see Figure 13)

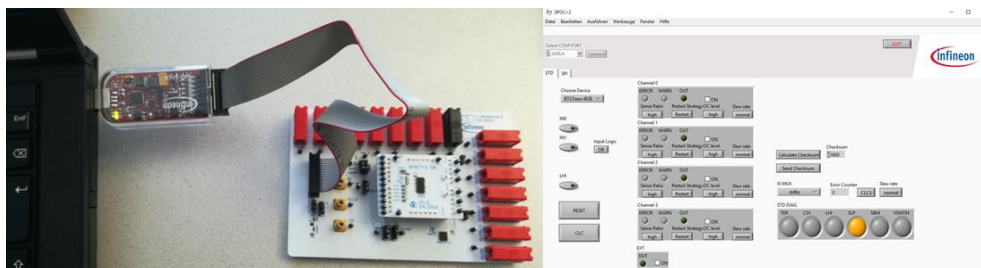


Figure 13 - Finished setup

### 1.3.1 Setup details

| Table 3                   |  |
|---------------------------|--|
| X $\mu$ IO                |  |
| Pin #                     |  |
| ○ 1                       | NC   |
| ○ 2                       | GND  |
| ○ 3                       | NC   |
| ○ 4                       | +5V $\mu$ IO   |
| ○ 5                       | NC   |
| ○ 6                       | NC   |
| ○ 7                       | NC   |
| ○ 8                       | IN <sub>3</sub>  |
| ○ 9                       | CS   |
| ○ 10                      | IN <sub>2</sub>  |
| ○ 11                      | SCLK   |
| ○ 12                      | IN <sub>1</sub>  |
| ○ 13                      | SO   |
| ○ 14                      | IN <sub>0</sub>  |
| ○ 15                      | SI   |
| ○ 16                      | Sense  |
| <b>J_Filter</b>           | Closed by default  |
| <b>J_IS</b>               | 1-2 closed by default<br>If 2-3 is closed: <ul style="list-style-type: none"> <li>• J_Filter has to be opened!</li> <li>• Sense directly switched to IS (Filter disconnected)</li> </ul>   |
| <b>J_GND</b>              | 1-2 closed: R_GND = 150 $\Omega$ (default)<br>3-4 closed: R_GND = 50 $\Omega$<br>5-6 closed: R_GND = 0 $\Omega$  |
| <b>J_IN<sub>2</sub></b>   | 3-2 closed by default.<br>If 1-2 is closed: <ul style="list-style-type: none"> <li>• Connect PROFET <sup>2</sup></li> </ul>  |
| <b>J_IN<sub>3</sub></b>   | 3-2 closed by default.<br>If 1-2 is closed: <ul style="list-style-type: none"> <li>• Connect PROFET <sup>2</sup></li> </ul>  |
| <b>J_VDD</b>              | 1-2 closed (default VDD via $\mu$ IO-Stick): <ul style="list-style-type: none"> <li>• Use +5V<math>\mu</math>IO (USB) as digital supply voltage</li> </ul> 2-3 closed: <ul style="list-style-type: none"> <li>• VDD via external supply</li> </ul> |
| <b>J_cho <sup>1</sup></b> | Closed if 4 Channel SPOC <sup>TM</sup> +2 is used:   |

|                                   |  |
|-----------------------------------|--|
|                                   | <ul style="list-style-type: none"> <li>• OUT<sub>0</sub> and OUT<sub>1/0</sub> in parallel.</li> </ul>                                       |
| J_ch <sub>3</sub> <sup>1</sup>    | Closed if 4 Channel SPOC+2 is used: <ul style="list-style-type: none"> <li>• OUT<sub>4/3</sub> and OUT<sub>5/3</sub> in parallel.</li> </ul> |
| SO                                | Slave Out (SPI Interface)  |
| SI                                | Slave In (SPI Interface)   |
| SCLK                              | Serial Clock (SPI Interface)   |
| CS                                | Chip Select (SPI Interface)  |
| IN <sub>0</sub>                   | activate the corresponding output channel  |
| IN <sub>1</sub>                   | activate the corresponding output channel  |
| IN <sub>2</sub> /EDD <sup>2</sup> | activate the corresponding output channel  |
| IN <sub>3</sub> /EDO <sup>2</sup> | activate the corresponding output channel  |
| OUT <sub>0</sub>                  | Output channel 0   |
| OUT <sub>1/0</sub> <sup>1</sup>   | Output channel 1 if J_cho is open,<br>Output channel 0 if J_cho is closed  |
| OUT <sub>2/1</sub> <sup>1</sup>   | Output channel 2 if J_cho is open,<br>Output channel 1 if J_cho is closed  |
| OUT <sub>3/2</sub> <sup>1</sup>   | Output channel 3 if J_cho is open,<br>Output channel 2 if J_cho is closed  |
| OUT <sub>4/3</sub> <sup>1</sup>   | Output channel 4 if J_ch <sub>3</sub> is open,<br>Output channel 3 if J_ch <sub>3</sub> is closed  |
| OUT <sub>5/3</sub> <sup>1</sup>   | Output channel 5 if J_ch <sub>3</sub> is open,<br>Output channel 3 if J_ch <sub>3</sub> is closed  |
| OUTP                              | Output PROFET <sup>2</sup>   |
| IS                                | Sense current  |
| LIH                               | Limp Home Input  |
| VDD                               | Digital supply voltage   |
| GND                               | Ground   |
| VS                                | Supply voltage   |

<sup>1</sup> If 4-Channel-SPOC™ are used J\_cho and J\_ch<sub>3</sub> had to be closed, otherwise (6-Channel-SPOC) opened.

<sup>2</sup> If Jumpers J\_IN<sub>2</sub> and J\_IN<sub>3</sub> are set to 1-2: SPOC™ Outputs EDD and EDO can control the PROFET.

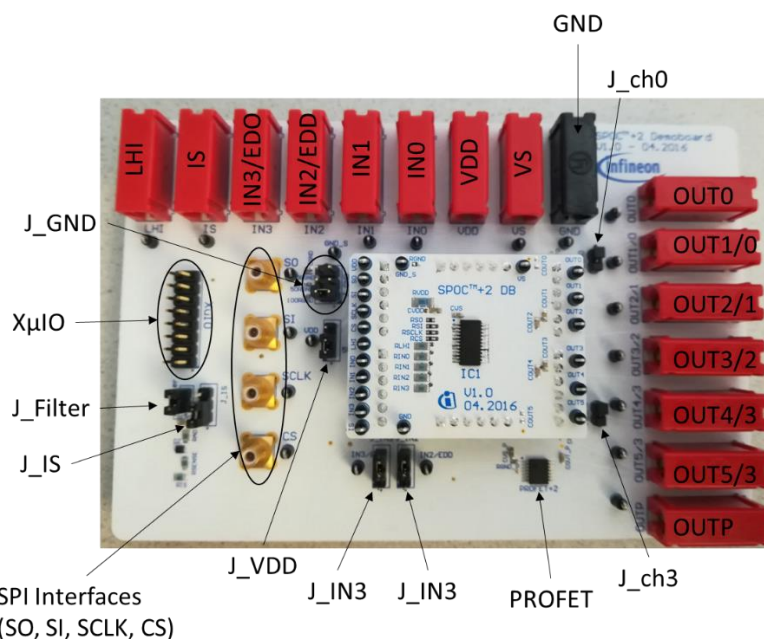


Figure 14 - Device components

## 2 Using the software

### 2.1 Starting the program

- Installed Application can be found in the windows start menu in the section "all programs" → "SPOC+2" → SPOC+2 (see Figure 15):

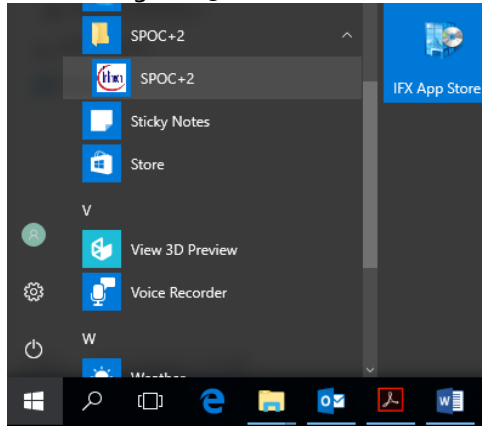


Figure 15 - SPOC+2 - Application - Finding it

or by using the search bar (see Figure 16):

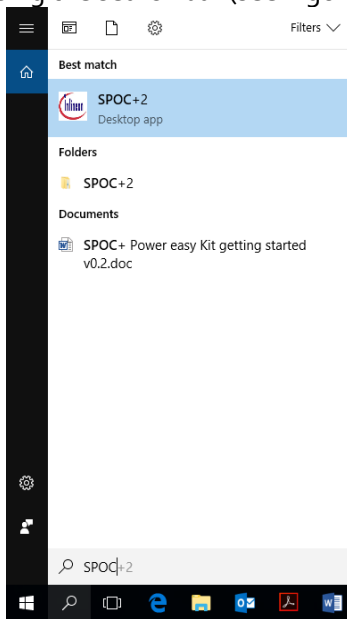


Figure 16 – SPOC™+2 - Application - searching for it

- Run the program by clicking on the file (see Figures 15 and 16)

## 2.2 User Interface

### 2.2.1 STD-View

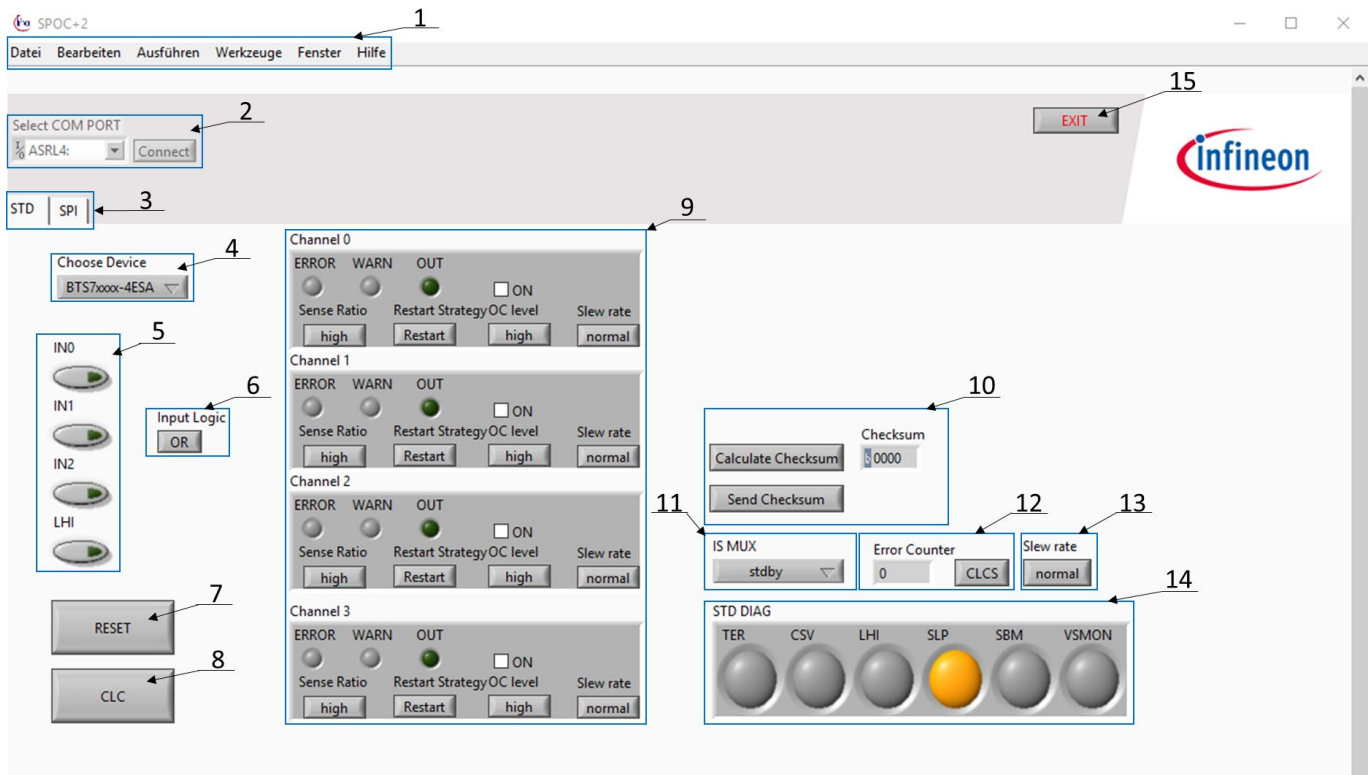


Figure 17 - User Interface - STD-View

Table 4 - STD-View

| Number | Label                 | Description   |
|--------|-----------------------|---|
| 1      | Menu bar              | *   |
| 2      | Port selection        | Software should detect the Comport automatically. <ul style="list-style-type: none"> <li>If not: select the needed Comport.</li> </ul>  |
| 3      | Standard or SPI view  | Change between a button based control(Figure 17) and a low level SPI command control(Figure 18)   |
| 4      | Device selection      | Select the used device type   |
| 5      | Direct inputs and LHI | <ul style="list-style-type: none"> <li>Switch IN0-IN2 on or off</li> <li>LHI can be set on or off</li> </ul>  |
| 6      | Input logics          | OR/AND operation between direct inputs (IN0-IN3) with the channel's on-status (channel 0 to 3)  |
| 7      | Reset                 | Reset SPOC <sup>TM</sup> +2   |
| 8      | Clear                 | Clear all Error latches and error counter   |
| 9      | Channels              | Indicates the Status of a channel (Error, Warn, OUT, Slew rate) and configures the channel (ON, Sense ratio, Restart Strategy, OC level) <ul style="list-style-type: none"> <li></li> </ul> |
| 10     | Checksum              | Shows the calculated checksum reflecting the configuration. This value will be transmitted when clicking on send checksum.  |
| 11     | IS MUX                | Configure the mux setting. For more information see datasheet of SPOC <sup>TM</sup> +2  |
| 12     | Error counter         | Error counter of the selected channel <ul style="list-style-type: none"> <li></li> </ul>  |
| 13     | Slew rate settings    | configures the slew rate of the selected channel  |
| 14     | Status display        | Visualizes the standard diagnosis (spi response)  |
| 15     | Exit button           | Closes connection and program   |

### 2.2.2 SPI-View

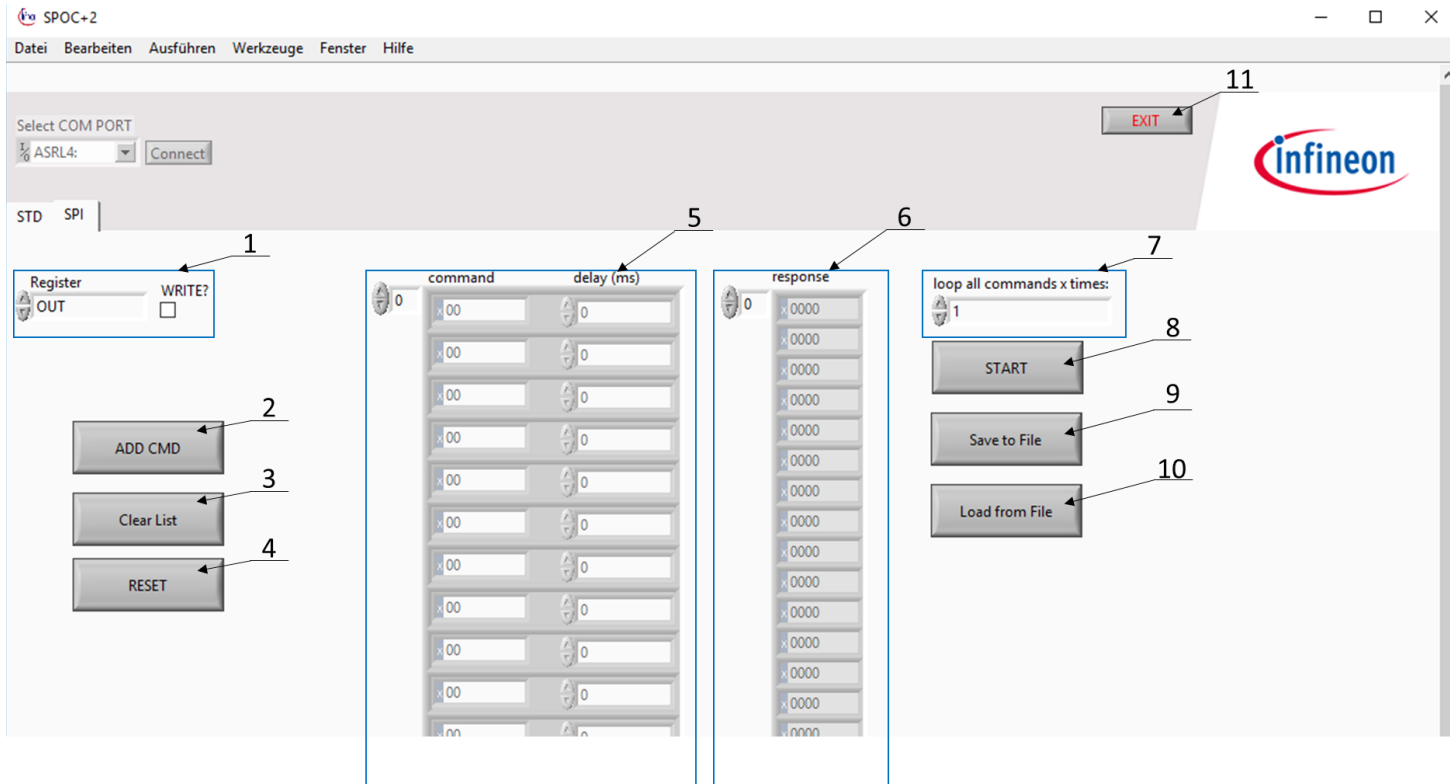


Figure 18 - User Interface - SPI-View

| Number | Function           | Description   |
|--------|--------------------|---|
| 1      | Register selection | Select the register address and in case WRITE is enabled the content for the next spi command. If WRITE is disabled a read command will be added. |
| 2      | Add command        | Adds the composed command to the command list (see 8)   |
| 3      | Clear command list | Clears the content of the command list  |
| 4      | Reset              | Resets SPOC™+2  |
| 5      | Command list       | Displays all added commands in ascending order  |
| 6      | Response list      | Displays SPOC™+2's response to the currently processed command (see datasheet of the used SPOC™+2)  |
| 7      | Loop configuration | Commands are embedded in a loop<br>Change the number of iterations (default is 1)   |
| 8      | Start button       | Starts the command sequence resp. the loop  |
| 9      | Save to file       | Saves the command sequence to a file  |
| 10     | Load from File     | Loads a saved command sequence from a file  |
| 11     | Exit button        | Closes connection and program   |

\*...menu description not necessary at the moment → Tobias



### 2.3 Examples: Command sequences, SPI-View

Figure 19 below illustrates a possible test setup. The examples in 2.3.1 and 2.3.2 refer to this setup.

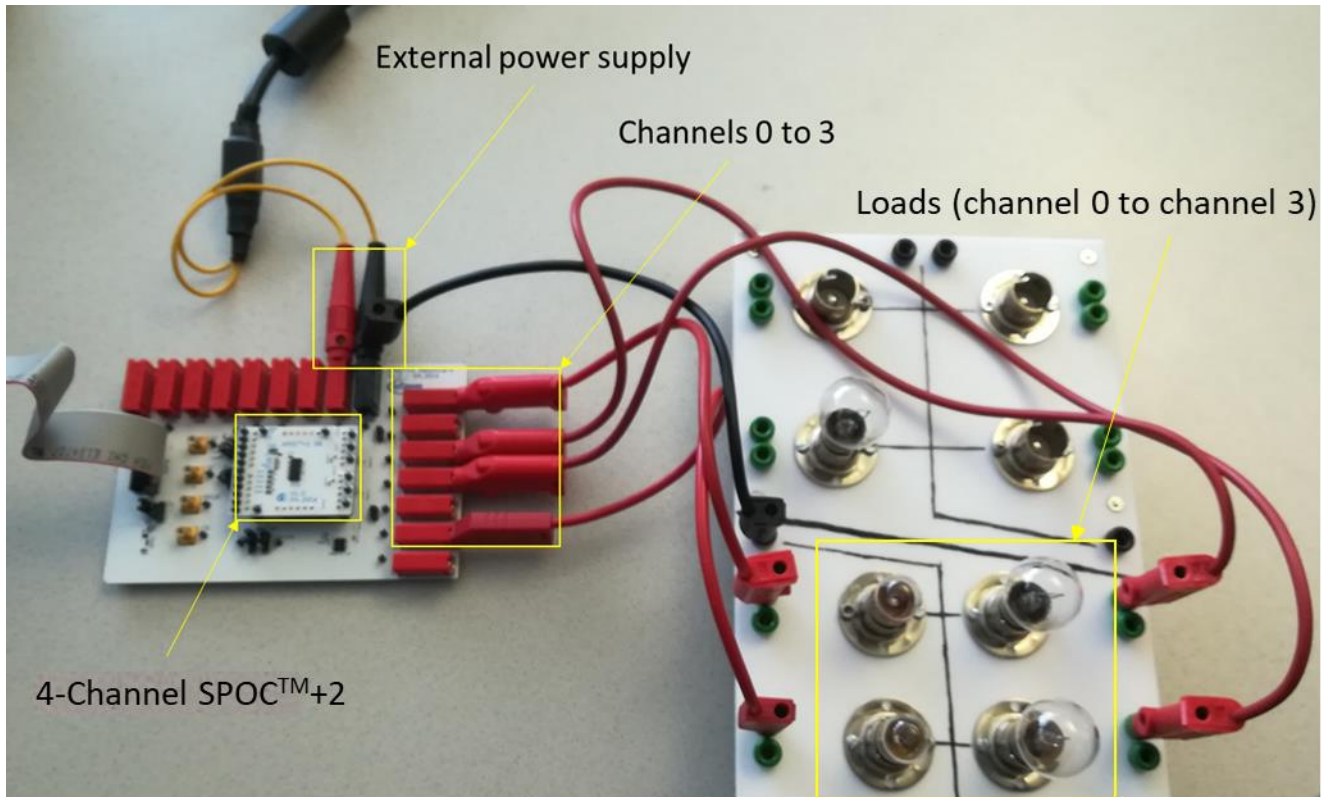


Figure 19 - Possible setup

#### 2.3.1 Example 1: Switching on 4 lights step by step with 1 Second delay

- Switch to SPI view and select register OUT (See Figure 20)

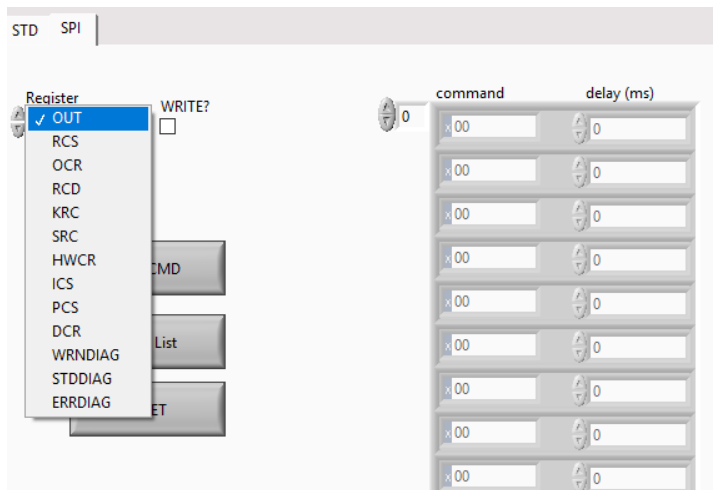


Figure 20 - Select register OUT

- Tick the WRITE?-Box and select no Output (See Figure 21)

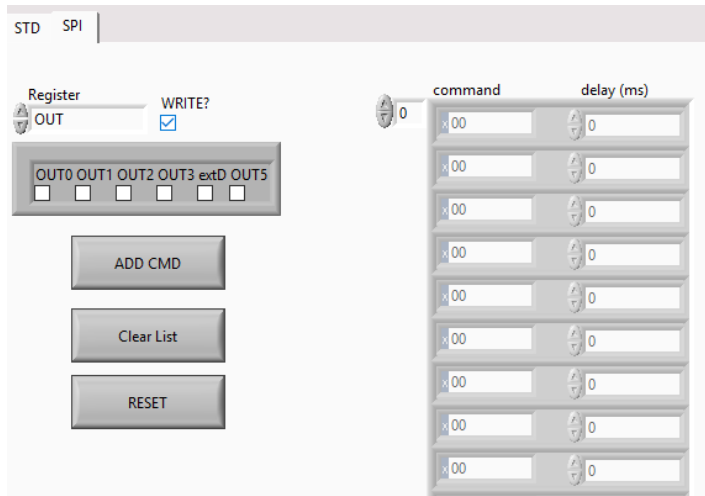


Figure 21 - Write to register OUT

- Click ADD CMD and your command is added to the command list (See Figure 22)

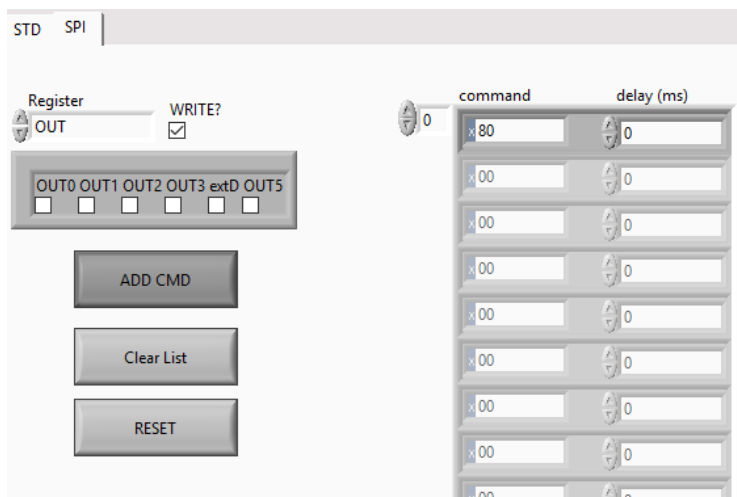


Figure 22 - Add command to command list

- Select OUT0 in the WRITE-Box (See Figure 23)

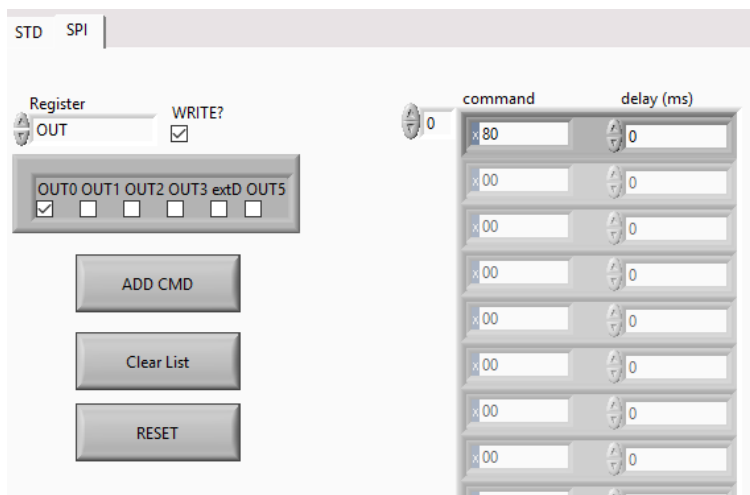


Figure 23 - Write OUT0



- Click ADD CMD (See Figure 24)

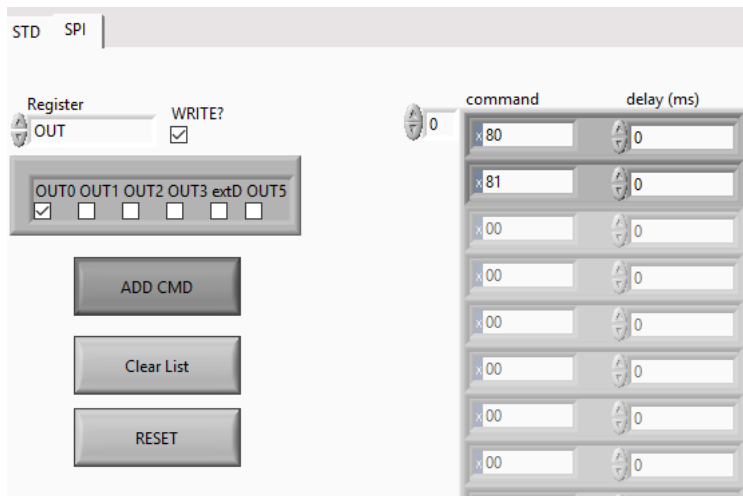


Figure 24 - Add to command list

- Change the delay of each command to 1000 (delay of 1 second, See Figure 25)

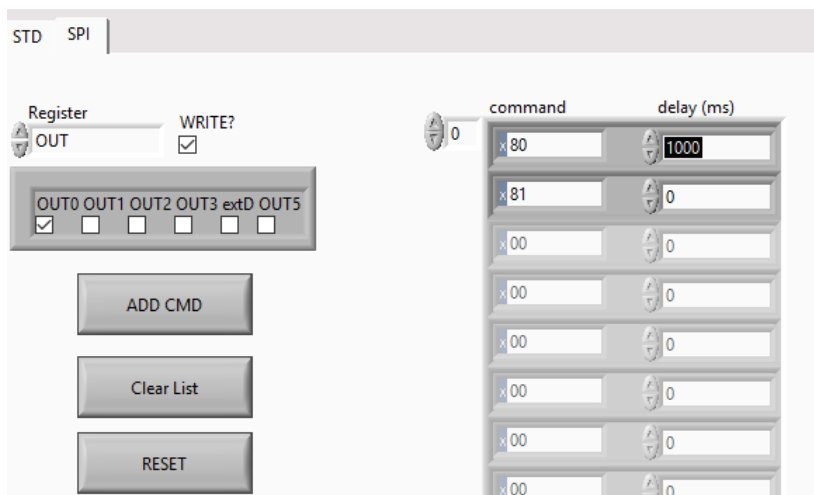


Figure 25 - change delay of commands

- Repeat the last three steps until you reach OUT<sub>3</sub> (See Figure 26)

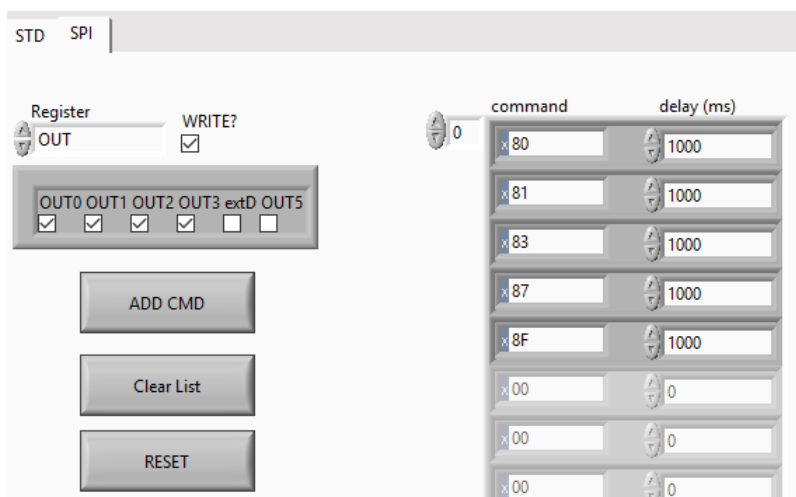


Figure 26 - repeat until all OUTs (OUT0-OUT3) are selected

- Switch to STD view (See Figure 27) and select a channel (0 – 3) at IS MUX (See Figure 28)

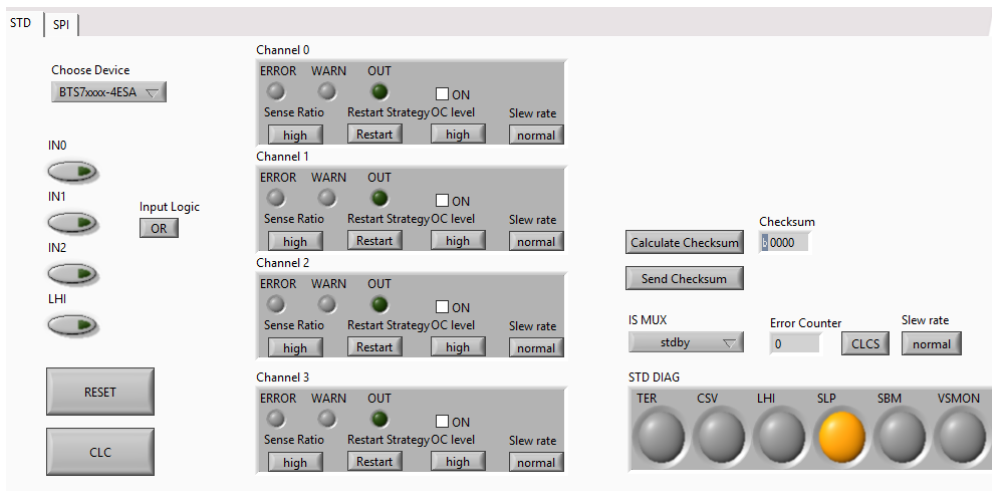


Figure 27 - switch to STD view

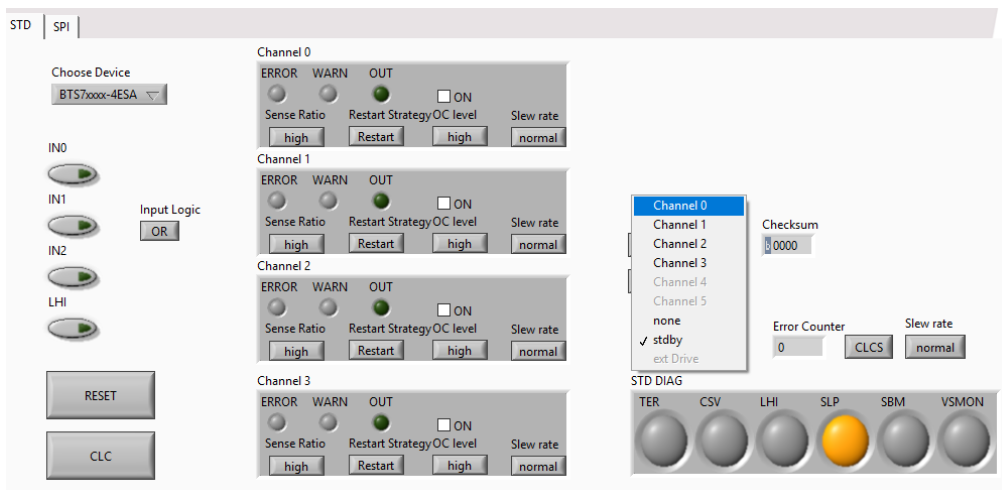


Figure 28 - Select channel at IS MUX

- Switch back to SPI view and click the START-button (See Figure 29)

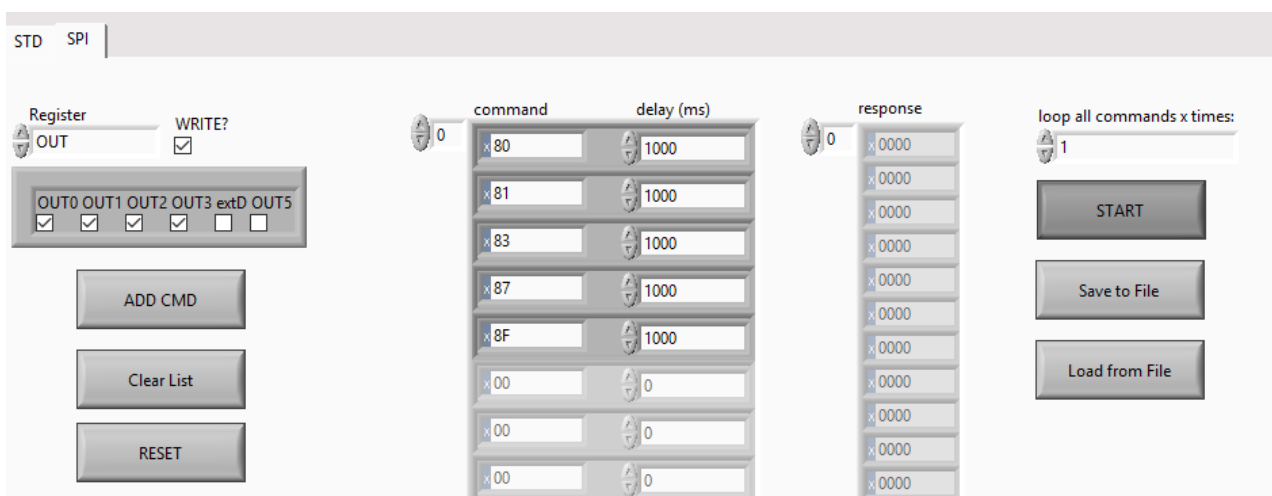


Figure 29 - Start command sequence

- The response of the SPOC<sup>TM</sup>+2 is shown in the response list (See Figure 30)

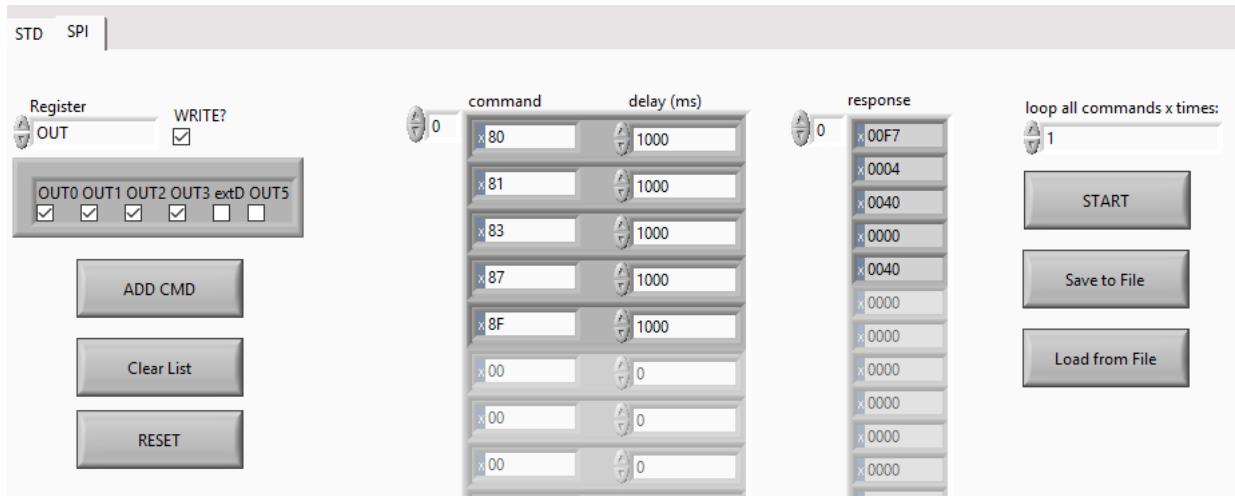


Figure 30 - response of SPOC<sup>TM</sup>+2 to command sequence

### 2.3.2 Example 2: Let one light blink 10 times

|       | Description        | t [ms] |
|-------|--------------------|--------|
| T_ON  | Duration light on  | 500    |
| T_OFF | Duration light off | 500    |

- Switch to SPI view and select register OUT (See Figure 31)

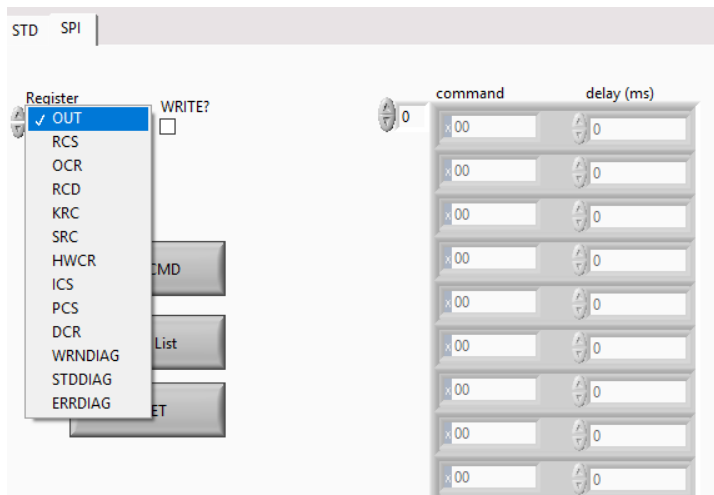


Figure 31 - Select Register OUT

- Tick the WRITE?-Box and select OUT0 and click ADD CMD (See Figure 32)

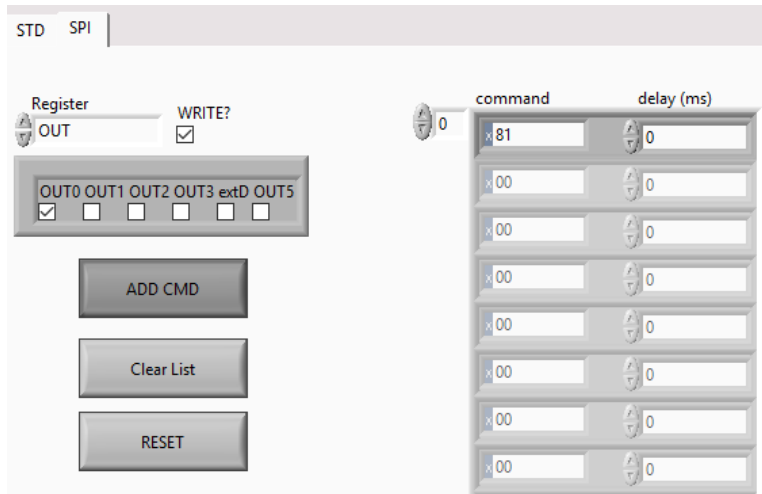


Figure 32 - Select OUT0 and add command

- Select no output in the WRITE-Box and click ADD CMD (See Figure 33)

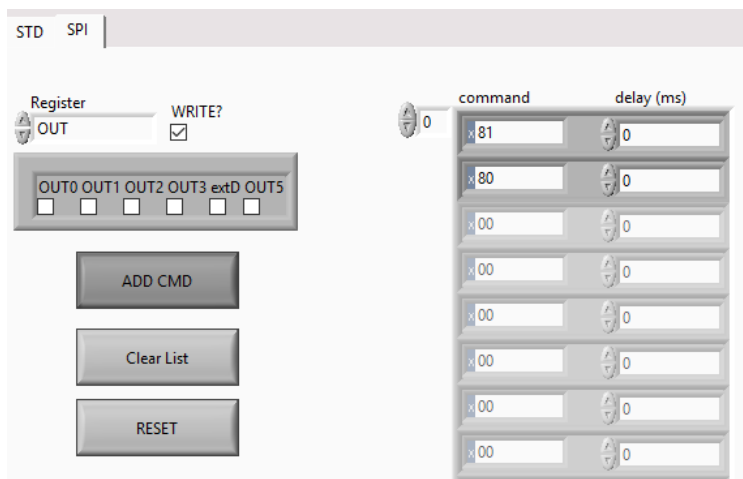


Figure 33 - Select no output and add command

- Also typing in commands directly is possible (See SPOC™+2 datasheet for command reference)
  - E.g.:
    - The command 80<sub>h</sub> means *Write no output to OUT*
    - The command 81<sub>h</sub> would mean *Write to OUT and set OUT to high.*
    - See Figure 32 above
- Change the delay of command 81 to T\_ON, the delay of command 80 to T\_OFF (See Figure 34)

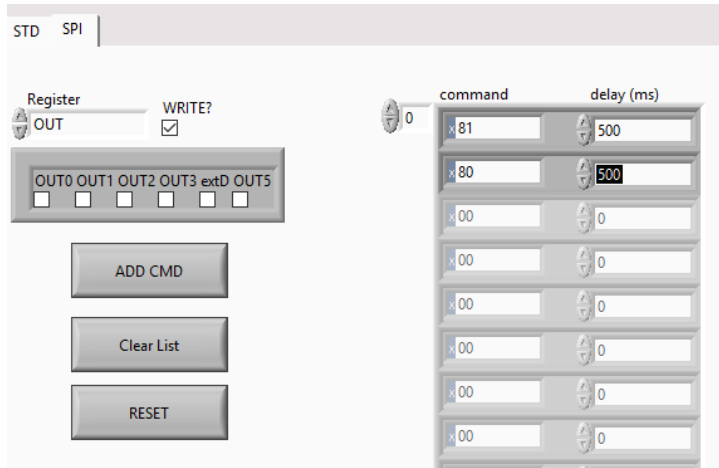


Figure 34 - change delay of commands

- Change loop all commands x times to 10 (See Figure 35)

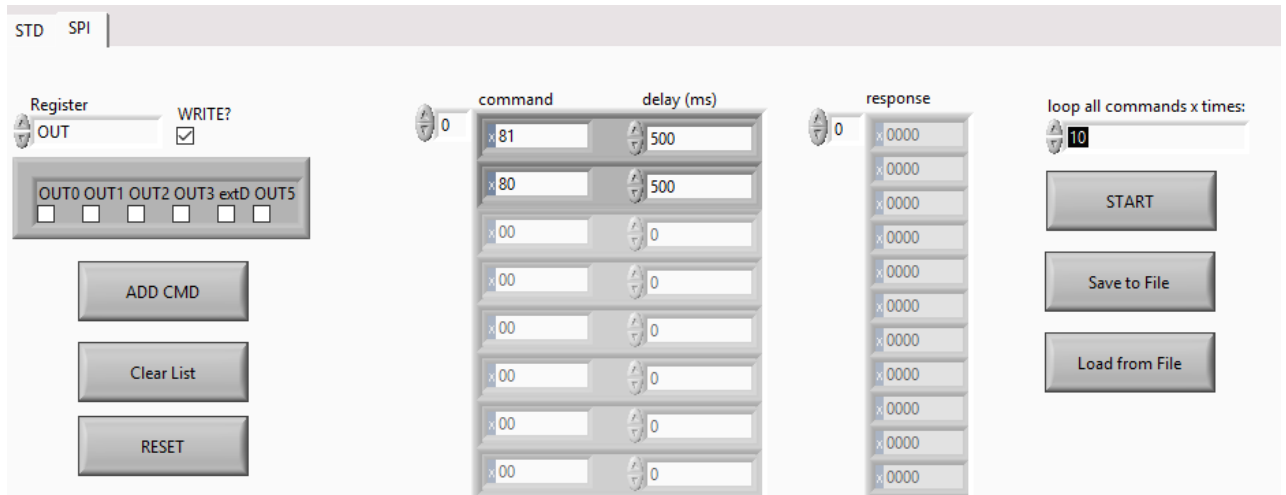


Figure 35 - change number of command sequences iterations

- Switch to STD view (See Figure 36) and select a channel (0 – 3) at IS MUX (See Figure 37)

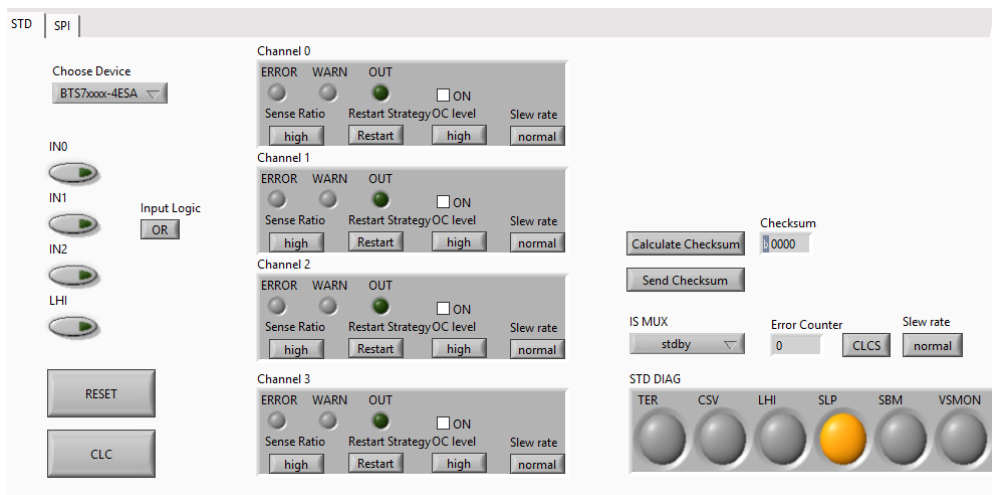


Figure 36 - Switch to STD view

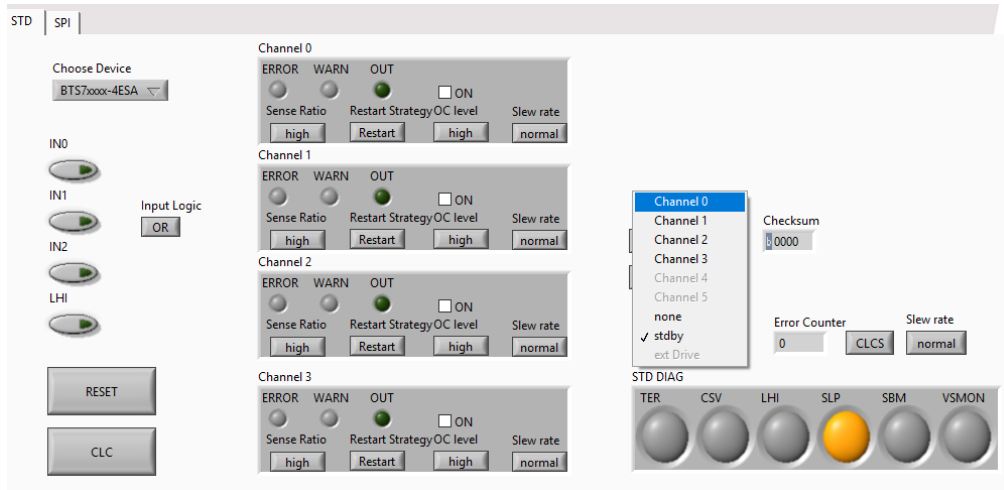


Figure 37 - Select a channel at IS MUX

- Switch back to SPI view and click the START-button (See Figure 38)

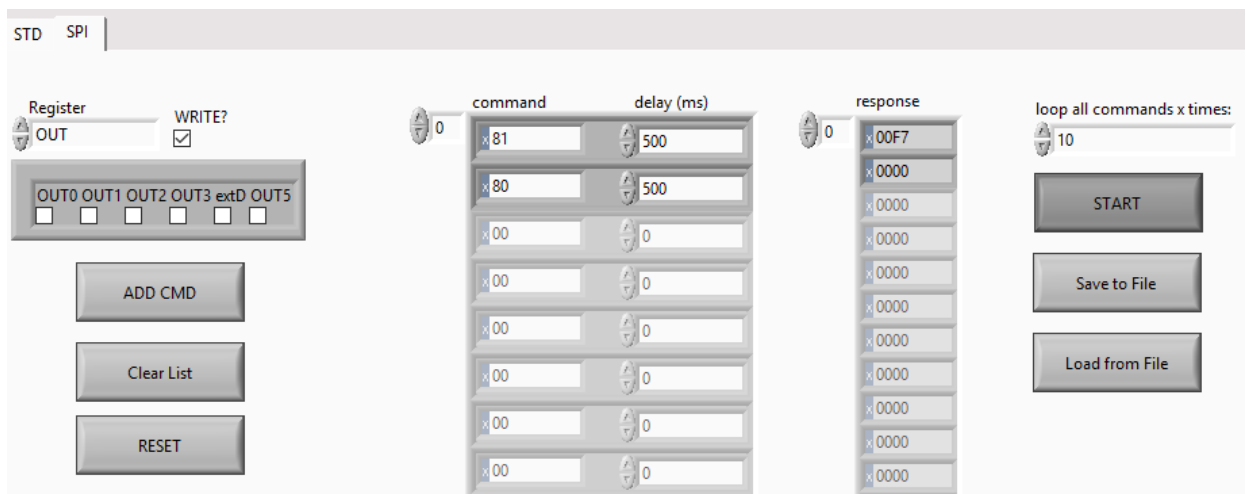


Figure 38 - Switch to SPI and start command sequence

- The response of the SPOC™+2 is shown in the response list (See Figure 39)

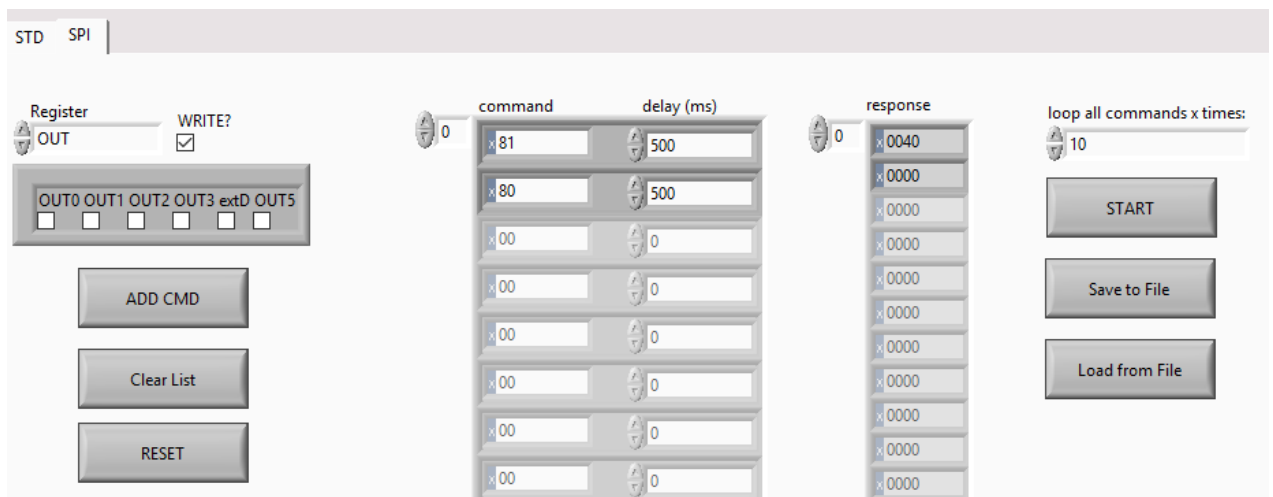


Figure 39 - Response of SPOC™+2 in response list

## Revision history

### Major changes since the last revision

| Date | Version | Description |
|------|---------|-------------|
|      |         |             |
|      |         |             |
|      |         |             |

### Template revision history

Note: *The below table is for reference purpose only. Delete this table before circulation.*

### Changes since the last revision

| Date    | Version | Author      | Description              |
|---------|---------|-------------|--------------------------|
| 11-2017 | 1.0     | Rasser René | Initial released version |
|         |         |             |                          |

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