ams

Eval Kit Manual

AS726x-iSPI

Evaluation Kit GUI User Guide

Content Guide

1   General Description

This Application Note describes the evaluation of AS726x device with ams AS726x Spectral Sensing iSPI GUI running on a Windows based personal computer system. The application will work with the special FTDI cable provided by ams in the test system.

Please note, the AS726x iSPI is a common hardware platform that is equipped with the specifically requested AS726x device and corresponding firmware pre-installed in the serial flash devices (only for the smart sensor types). The differing iSPI demo kits utilize common functions and components as described here. A comment in this manual will be given separately in case of any differences between the individual demo kits.

The following table lists the demo kits the sensor and filter channel characteristics and relevant channel references detailed in the device data sheet and presented by the graphical user interface. Note, other sensors are in development. Therefore, see in the sensor data sheets for more details in case of the used sensor is not listened here.

	AS7261(N) Demo-Kit	**AS7262 Demo Kit**	**AS7263 Demo Kit**	**AS7264N**
Sensor reference	AS7261 or AS7261N	AS7262	AS7263	AS7264N
Spectral response	X, Y, Z, DK, NIR 850nm, CL	V 450nm, B 500nm, G 550nm, Y 570nm, O 600nm, R 650nm	R 610nm, S 680nm, T 730nm, U 760nm, V 810nm, W 860nm	X, Y, Z, Bb440nm, B 490nm, NIR 850nm

XYZ = CIE1931 (detector with standard observer function), DK = Dark (detector capped), CL= Clear (detector without filter)

Figure 1: Alternative Demo kits with sensor reference

2   Installation

The evaluation kit requires one time installation of FTDI CDM Driver for the USB-MPSSE cable if it is not already installed on the computer. The installation file can be found in the USB Memory Stick. For additional assistance on installation of the FTDI driver, please refer to www.ftdichip.com for more information.

The AS726x Spectral Sensing – iSPI software does not require separate installation. Simply copy the following files to any folder on the host system and start the .exe file to start the GUI. The .NET Framework is the programming framework used to develop this application software. Thus, this software application requires 4.5 or above version of .NET Framework to be installed. It is recommend install the most up-to-date version of .NET, assuming your OS supports it.

Connect a AS726x test board (hardware release ≥ 1V1) to your PC before you start the test software.

3   Operation

After launching the application, the GUI displays as below Figure 2. The GUI consists of three portions marked in three rectangles. The one on the top has the device selection with two buttons for connecting and initializing the device. The one in the middle has control functions with a tab control with many pages. The last one at the bottom is the status bar for cable connection, cable serial number, and AS726x device ID.

Figure 2: ams AS726x Spectral Sensing iSPI GUI

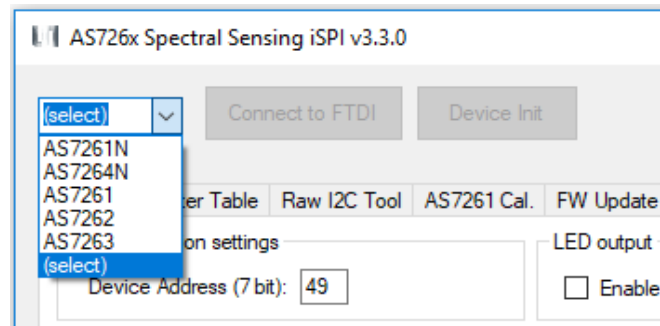Select the right demo kit from the pull down device selection list as shown in the below figure 3.

Figure 3: Device Selection

Connect to AS726x-iSPI demo board through the right FTDI cable by clicking "Connect to FTDI" button. If there are more than two FTDI cables connected to the computer, it would popup the window as below. Please select the correct cable and click 'OK". In this example, selected "FT0CVY6L" to connect to AS726x-iSPI board. On the other hand if there is only one FTDI cables it will not popup a window instead will automatically select the connected cable.
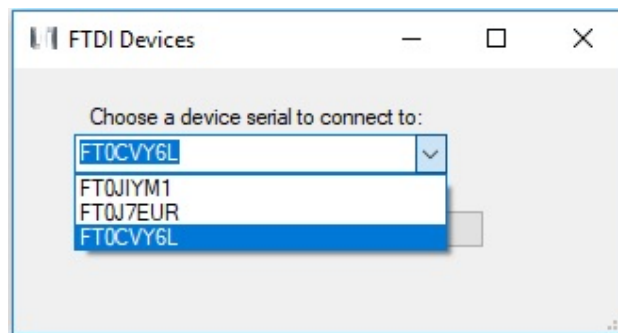
Figure 4: Cable Selection

After the connection, the status bar should show "FTDI: Connected" and "FTDI Serial Number: FT0CVY6L". Then AS726x device needs to be initialized by clicking "Device Init" button.

The status bar should display the Device HW ID, for example "Device HW ID: 0x403F" in this case. Otherwise follow the instructions in Chapter 4.1 Trouble shooting.

3.1 Main Page

The Main Page allows to configure AS726x device based on, light sensor settings, control LED current, Bank selection, read sensor temperature, Enabling optimization, Plotting graphs and Reading sensor values. The below example in figure 5 shows the main page parameters selected for AS7262 demo kit.

Figure 5: Main Page

- *Communication Settings*: Sets the 7-bit AS726x I²C slave address in hexadecimal format. By default, it is 0x49.
- *LED Output*: Check Enable for switch on the LED and set LED currents. The current can be set as 12.5mA, 25mA, 50mA, and 100mA.

- *Sensor Settings for conversion*: Configures AS726x Integration Time and Gain. The Integration Time can be either set by moving the slider bar or clicking the up or down arrow button. The Gain can be picked by choosing one of 1x, 3.7x, 16x, and 64x from the selection list. The higher these parameters the higher the sensor values (Raw and other) and accuracy. Please note, gain and integration time must be adjusted depend on the application and required accuracy. Note, to achieve Full Scale Range, the integration time at minimum of 182ms[1] must be used.

- *Bank Select*: Select one of Bank selections with various channels depends on the used demo kit. The Bank select will give the flexibility to select the channel based on different options. When the bank select setting is Mode 0, Mode 1, or Mode 2, the spectral data conversion process operates continuously, with new data available after each 2,78ms period. Whereas when the Bank node 3 is selected 1-shot mode initiated (2*2,78ms). One-Shot mode is intended for use when it is critical to ensure spectral conversion results are obtained contemporaneously. Note, the selected *Bank* has effects which results after how many steps are represented as sensor result. For more details see the sensor's data sheets.

- *Temperature Sensor*: Gives the device temperature in degree Celsius. Clicking the "Read" button would update the temperature.

- *Optimized Settings Detection*: Enabling "Optimized Settings Detection" will automatically find the best (max as possible) parameters options for Gain and Integration time to get the maximum optimized raw as referred in the init file. It is suggested to disable the "Optimized Settings Detection" after taking one measurement as it keep changing the parameter values for measurement to achieving an optimized raw value.

- *Light Sensor Data*: Click the "Read Once" button and update the raw data with current sample depend on *Bank select*. Click the "Read Continuous" button and keep updating the raw data. If the stop after is selected and number of samples are mentioned, the mentioned samples will be measured. *Samples taken* shows the number of finished measurements.

- *Sensor Values*: This displays the measured Raw, Calibrated and Basic values based on the control parameters selected.

- *Plot*: Selecting the Line Graph, Spectrum and Color space (AS7261 only) user can graphically see the corresponding response of sensor readings. Selection or deselection switch on/off the graphical functions.

Raw values are represent the counts from the ADC depending on the used setup (Gain, Integration time, LED-current). Basic sensor values are divided by codes which are determined by these setup parameters. Therefore Basic sensor counts are not depend on setup parameters or on their changing in case of using dynamic gain or *Optimized Settings Detection*.

Basic sensor values are corrected also by multiplying raw values with temperature coefficient which is divided by the register scaling values of Gain and Integration time. Temperature_compensation _sheet.csv file contains the temperature coefficient values from 0°C to 100°C. While calculating the basic values the corresponding internal temperature coefficient value is take from the .csv file. User can define this values, by default it is 1 in .csv file.

Calibrated values are calculated from the raw values based on the factory calibration.

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[1] Eight bit value that specifies the integration time in 2.78ms intervals. 0x00 indicates 2.78ms, 0x01 indicates 5.56ms. The maximum ALS value depends on the integration time. For every 2.78ms, the maximum value increases by 1024. This means that to be able to re reach ALS full scale, the integration time has to be at least 64*2.78ms.

The init_file.txt file is present in the same folder where the .exe file and is important to have it in the folder. The initialization file is used for locating and using the defined values of certain parameter data that is used in GUI. The init_file contains the MinCounts, MaxCounts, GainScaleList, MinIntegrationTime, and MaxIntegrationTime. The user can define the minimum and maximum counts for the optimization (dynamic range) of raw data in MinCounts and MaxCounts respectively. An important remark is that the scaling of gain and integration time depends on the register scaling values in firmware. The "Optimized Settings Detection" works based on this values in init_file.txt.

Note, inside of the init_file, the sizes can be adapted but do not change the keywords (e.g. MinCounts) in case of editing the init_file.

```
// Minimum and maximum of counts [0..65536]
MinCounts=10000
MaxCounts=60000

// Maximum of gain (register value [0,1,2,3])
MaxGain=3

// Scaling of gain depending on the register values
// Number of values = 4
// Default values: 0 = 1, 1 = 3.7, 2 = 16, 3 = 64
GainScaleList=1,3.7,16,64

// Minimum and maximum of integration time (register value [1..255])
MinIntegrationTime=65
MaxIntegrationTime=255
```

Figure 6: Example of init_file

3.2   Register Table Page

The "Register Table" page lists all I²C registers values with the address, the name and information about authorization to read or write.
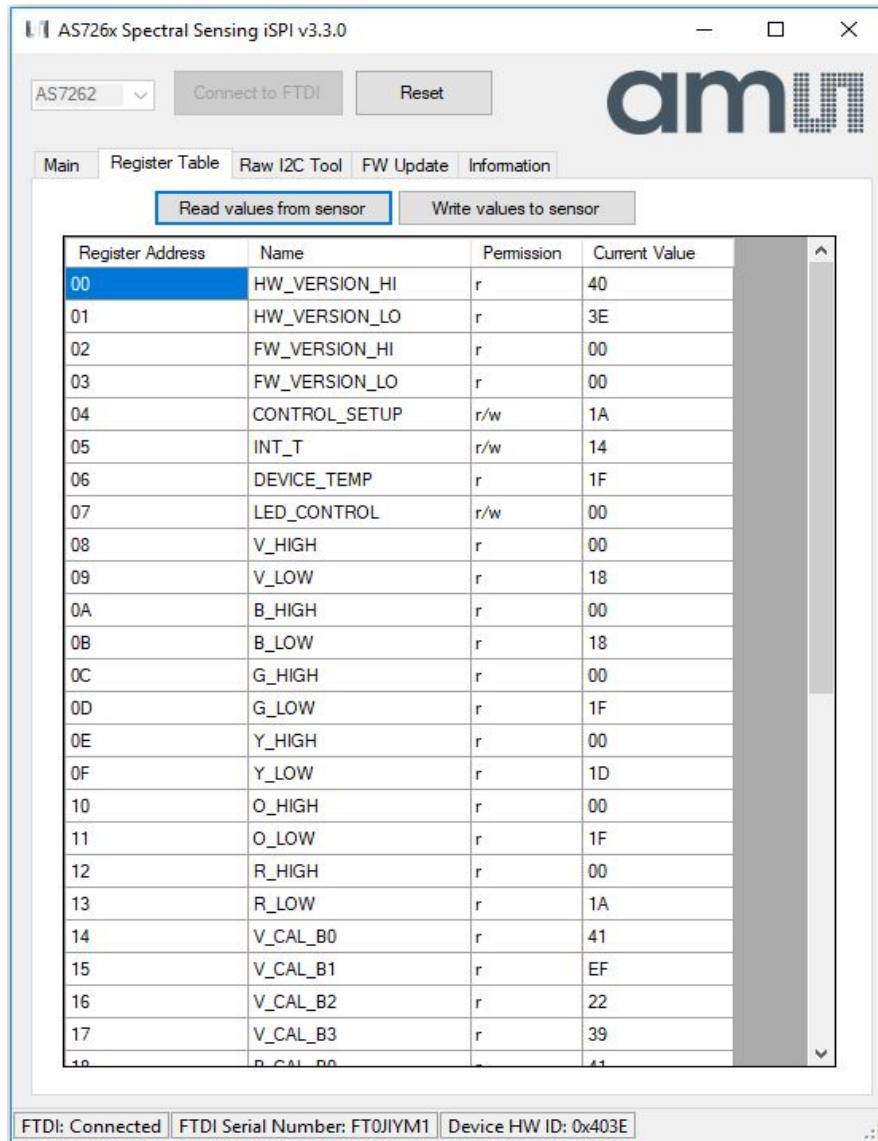
Figure 7: Register Table Page

- If desired, click the "Read values from sensor" button to update the whole table. It is recommend to update the table when coming or leaving this page.

- Write a value to a register by clicking the "Current Value" cell that corresponds to the register and typing a new value into the cell. Then click the "Write values to sensor" button to program value into the device. After the update, by clicking the "Refresh" button the value in the register is confirmed.

Note: The application synchronizes the changes on the Main Page and the Register Table Page automatically.

3.3 Raw I²C Tool Page and protocol

The page Raw I²C Tool mainly severs as an engineering tool to set read/write registers, check the status of the interrupt pin and to open/close a protocol to save sensor readings into the log file.
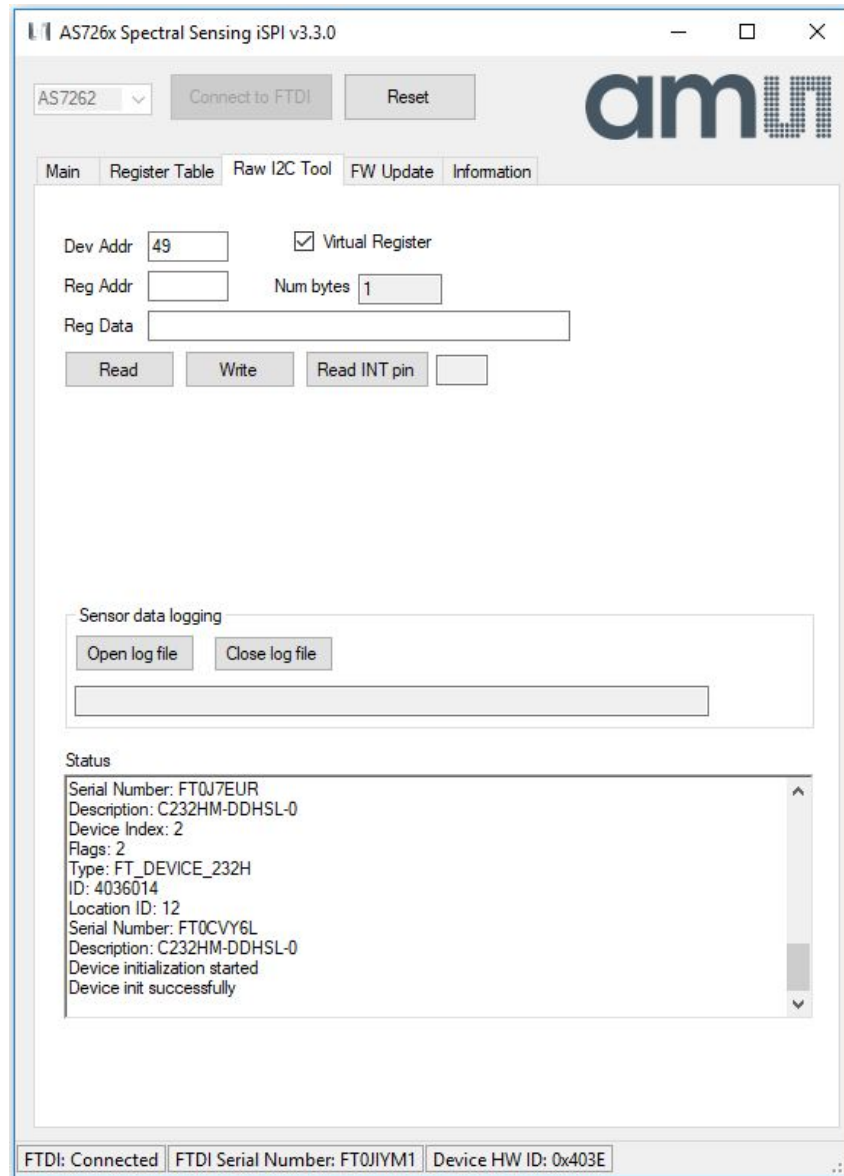
Figure 8: Raw I2C Tool Page

- To read a register, input the register address (one byte hexadecimal number XX) into "Reg Addr" and input the length of the register in "Num Bytes" if it is necessary. Then click "Read" button and the register value will display in "Reg Data" field. The register data would be one a hexadecimal number.

  The number of bytes can be only changed with AS726xN demo kits, which have no **ams** associated firmware. For example, if an AS7261N demo kit is in evaluation, unselect Virtual Register and input the length of number bytes.

- To write to a register, input the register address into "Reg Addr" (one byte hexadecimal number XX) and the register value into "Reg Data". Then click "Write" button and verify the write by click the "Read" button or see if the write is successful or not in the status textbox. The write data should be in the format XX, which is the value in hexadecimal. For example, if the write data is 0x01, the value 01 should be input and the value 1 would make the write unsuccessfully.

- Click "Read INT Pin" button to get the status of the interrupt pin.

- Sensor data logging: Open/Close log file to save sensor data. For example, open a log file by clicking the button and navigate to the location where data should be saved. Give the file name and click OK. Then switch to the main page. Input number of samples and check "Stop After" in Light sensor data section. Start the reading by pressing "Read Continuous" button. The reading will automatically stop after the specified number of samples. Then go back "Raw I^{2}C Tool" page to close the file. The log file is saved as CSV file and compatible to MS Excel or simple text editors. Depend on the used sensor board the header and terms are partly different and correspond to the respective designation of the sensor filters.

Sample	X	Y	Z	NIR	DK	CL	-	-	-	Time stamp	TINT	Gain	LED Current	Internal Temp
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-

As shown above, the logged data format is saved in Excel CSV format. Data is saved in the user specified file name and location based on the selected board. The logged data format varies based on the selected board.

Note: The changes by reading/writing a register on this page may not synchronize with other pages.

3.4 FW Update

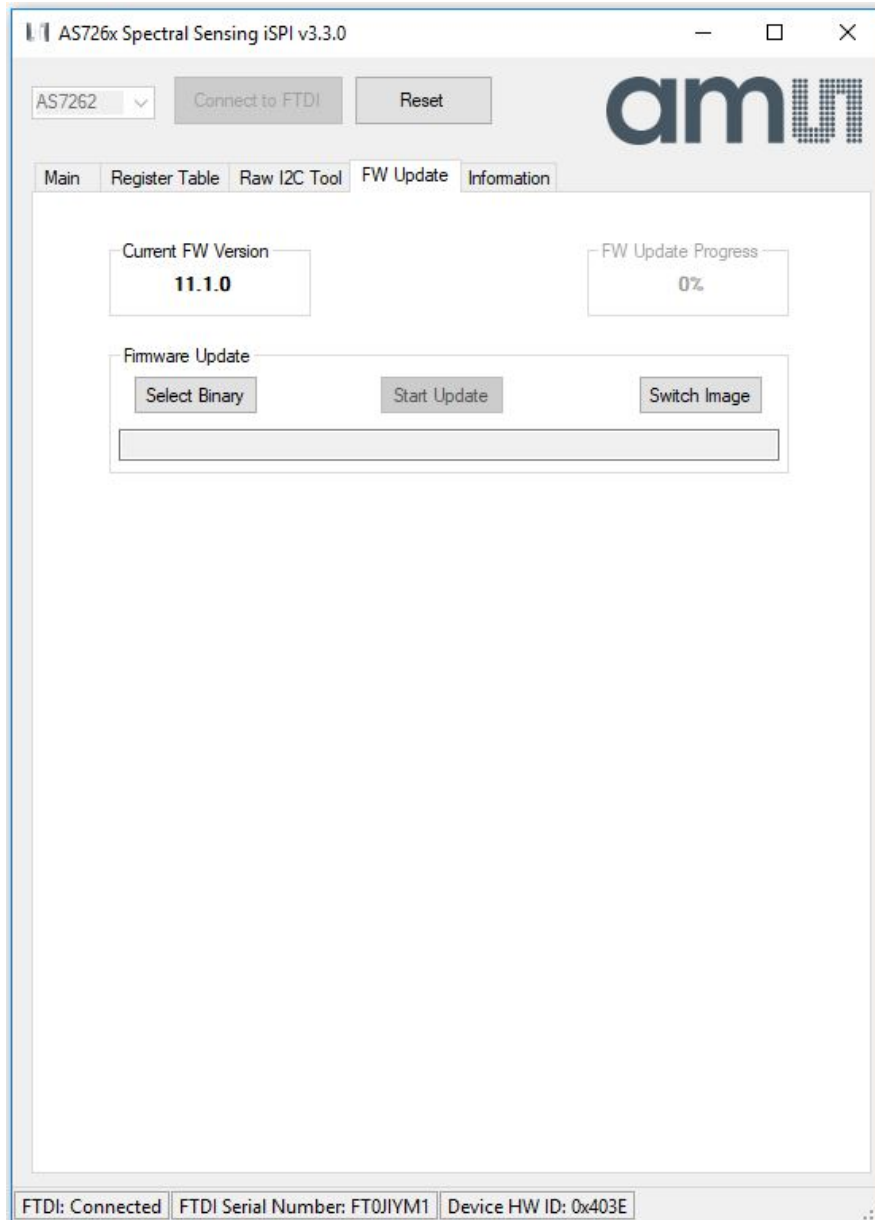FW Update is used to make modifications in the firmware version inserted in the device using the GUI.

Figure 8: FW Update Page

- "Current FW Version" displays the present firmware burned on to the device. In the above example in figure 8, it is FW Version 11.1.0.
- Firmware update could be done by clicking "Select Binary" button and the selecting the corresponding firmware .bin file based on the device provided by ams AG.
- Once the .bin file is selected, clicking "Start Update" button will start updating the firmware. The percentage of uploading will be displayed in "FW Update Progress".

- Once the FW Update Progress is 100%, a message box in figure 9 will be visible to show whether the firmware update is successful.
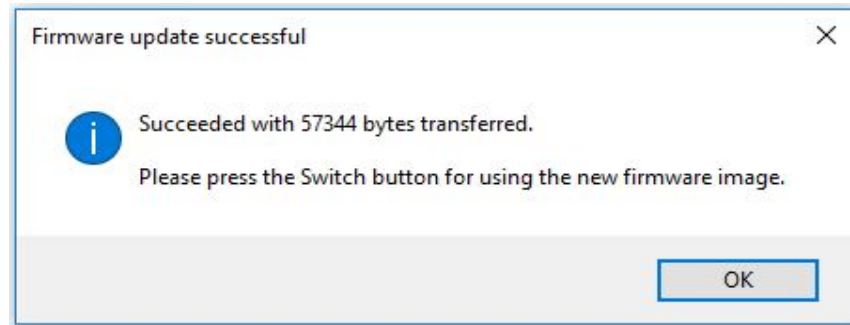

Figure 9: Firmware Update Successful message page

- Press "OK" and then followed by "Switch Image" button to switch to new firmware, if the switch is successful another message box in figure 10 will pop up and new firmware number will be showed in Current FW Version.
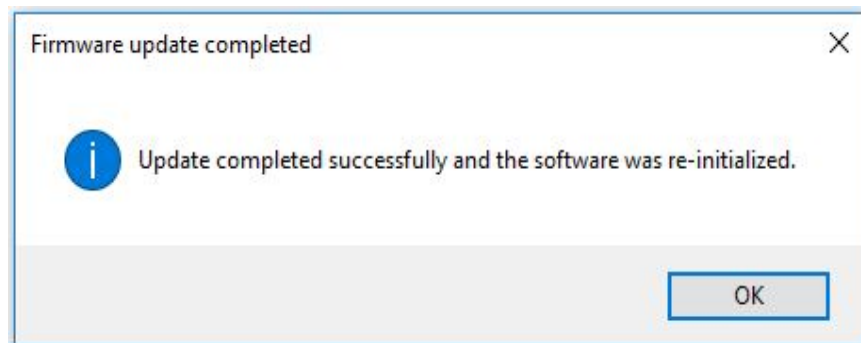

Figure 10: Switch Image successful message page

- "Switch Image" button can be used again to go back to previous firmware version.

Note: It is recommended to use the firmware update functions with a firmware version 11.x.x or higher.

3.5 AS7261 Cal

This page only applies to AS7261-iSPI demo board. It displays sensor raw data, calibrated XYZ data and Lux/CCT, as well as various CIE standard data. The output of the corrected sensor results (based on the factory calibration) can be enabled or disabled. Note, setting this switch also affects the writing of the data's in the protocol (see chapter 3.3).

In the following, only the AS7261 specific functions are listened. For all others see chapter 3.1.

Figure 11: AS7261 Cal Page

- XYZ: Corrected sensor results as *calibrated XYZ* based on the factory calibration

- CIE1931 xy: Calculated CIE1931 xy data based on the calibrated XYZ

- CIE1960 uv: Calculated CIE1960 uv data based on the calibrated XYZ

- CIE1976 u'v': Calculated CIE1976 u'v' data based on the calibrated XYZ

- Lux and CCT: Calculated Lux and CCT based on the calibrated XYZ

- Duv: Calculated derivation from the black body curve

- AS7261 Sensor Control and AS7261 Sensor raw data's X Y Z NIR DK CL

3.6   Information

Information page provides knowledge regarding the Software Version, Firmware Version, link to technical support etc.

4   Trouble shooting

4.1   Driver error

In case of the Sensor board could not be recognized, although the driver was installed and the sensor is plugged via cable and USB to the PC then please de-install and install the driver new. Go to Device Manager with FTDI cable plugged in, select that Serial Port driver, and choose to uninstall it. Then use the Setup files for the FTDI driver on USB to install the driver new. Plug in the FTDI cable to the PC again, and from there, the issue should be resolved.

Other reasons could be an incorrect jumper for the UART/I²C interface on the AS726x-iSPI board (see chapter 3.3 AS726x-iSPI Evaluation Kit User Guide), a defect USB cable (change it), loose connections of any hardware components (check it) or none valid software / firmware versions or combinations. Please contact our sales or distributor to get more support.

4.2   Software / Firmware combinations

Some GUI functions described in this data sheet are depend on the used Scotty firmware version on flash. In case of older firmware versions errors or variances can occur. Please contact our sales or distributor to get more support. The used number of version for firmware and software can be read in the information window.

Note: It is always recommended to use a firmware version 11.x.x or higher in combination with iSPI software version 3.3.0 or higher.

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Headquarters

ams AG

Tobelbader Strasse 30

8141 Premstaetten

Austria, Europe

Tel: +43 (0) 3136 500 0

Website: www.ams.com

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7 Revision Information

Changes from previous version to current revision 3-03 (2018-May-04)	Page
Initial version 2-0.0	All
Version 2-0.0 Alternative demo kits	All
Version 2-0 0 new GUI version, FTDI driver check and install, trouble shooting	All
Version 3-0 3 new software functions, firmware update, hardware release from 1.1	All

Note: Page numbers for the previous version may differ from page numbers in the current revision.

Correction of typographical errors is not explicitly mentioned.