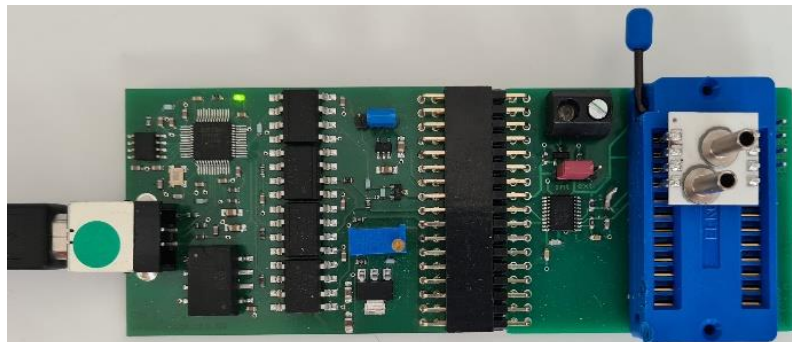


# User Guide

## Starter Kit AMS 5935



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**INTRODUCTION**

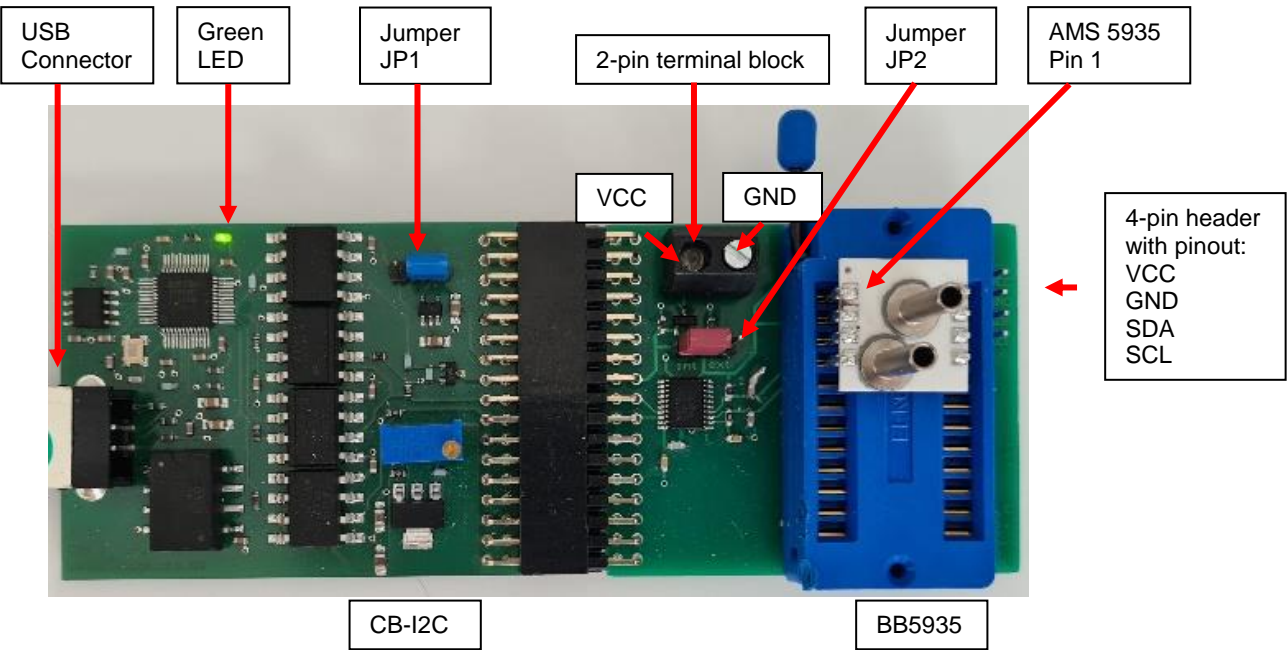
The USB Starter Kit AMS 5935 is designed for quick and easy testing and evaluation of AMS 5935 pressure sensors using a standard PC with Windows operating system. Without additional components, the kit allows to read the current digital pressure and temperature measurement values from the AMS 5935 sensor and to display them on a PC. With the implemented data logger it is possible to save the measured data in a file. In addition, the starter kit can be used to program an individual I2C address to an AMS 5935 pressure sensor. This individual I2C address is necessary for the operation of several AMS 5935 together on the same I2C bus.

The USB Starter Kit AMS 5935 consists of two printed circuit boards, the accompanying communication software package CS5935 and an USB cable used to connect the hardware to a PC with Windows 10 or higher operating system. The kit is powered via the PC's USB port, an external power supply is not required.

**Note:** Before using the starter kit, we recommend that you read AMS 5935's datasheet, which can be found on Analog Microelectronics' website.

**HARDWARE**

The starter kit's hardware consists of two printed circuit boards: the communication board *CB-I2C* and the adapter board *BB5935* with a ZIF socket, which is used to connect an AMS 5935 sensor to the starter kit and thus to a PC. *Figure 1* shows the assembled kit with mounted sensor.



**Figure 1: Assembly of the Starter Kit AMS 5935** - The communication board *CB-I2C* and the adapter board *BB5935* are connected via a 34-pin connector. AMS 5935 sensor is mounted on the ZIF socket with pin 1 in the upper left corner.

The *CB-I2C* PCB provides the hardware that allows a Windows PC with USB 2.0 port to communicate with a pressure sensor with I2C interface, while the *BB5935* PCB offers a simple way to connect an AMS 5935 pressure sensor to the *CB-I2C*. The connection between the *CB-I2C* and *BB5935* is realized via a 34-pin connector. A zero insertion force (ZIF) socket on the *BB5935* allows easy mounting and exchange of an AMS 5935 pressure sensor. Pin 1 of the sensor has to be located at the upper left corner of the ZIF-Socket (see *Figure 1*).

The two jumpers JP1 and JP2 are used to set the supply voltage of the sensor (see *Table 1*): JP1 on the communication board *CB-I2C* is in the 3.3 V position by default. This position has to be maintained, as changing the position of JP1 will damage the AMS 5935 sensor. In the factory setting JP2 on the adapter board *BB5935* is in the int. position, wherein AMS 5935 is powered by the starter kit with 3.3 V. With JP2 in the ext. position AMS 5935 can be powered with an external power supply to test AMS 5935's operation in its complete voltage range of 1.8 ... 3.6 V. The external voltage supply is connected to the 2-pin terminal block on *BB5935*, with the pin assignment as shown in *Figure 1*. Do not power the AMS 5935 sensor with more than 3.6 V otherwise it will be damaged.

Sensor supply voltage	Jumper position JP1	Jumper position JP2
internal 3.3 V	3.3 V	int.
external 1.8 ... 3.3 V	3.3 V	ext.

**Table 1: Jumper Configurations:** Jumper JP1 has to remain set to 3.3 V. Jumper JP2 has to be positioned according to the desired voltage supply type.

Additionally, there is a 4-pin header on the *BB5935*. This header can be used to monitor the sensor's supply voltage and to connect and test sensors, which have been soldered to another PCB already. The pin assignment is shown in *Figure 1*.

To put the starter kit into operation, connect the *CB-I2C* to a free USB port on a PC using the included USB cable.

#### Important:

1. If an AMS 5935 sensor is connected to the 4-pin plug connector on *BB5935*, the sensor has to be supplied by the starter kit to ensure full functionality of the starter kit software.
2. Jumper JP1 has to be set to the 3.3 V position. Any other position will damage the AMS 5935 sensor.
3. If an external voltage supply is used, the voltage range has to be set between 1.8 and 3.6 V. Exceeding 3.6 V will damage the sensor.

## SOFTWARE

The free CS5935 software package enables communication between the PC and the starter kit hardware and is supplied on the included USB-Stick.

### Installation

Before you start installing the CS5935 software package, please disconnect the starter kit from the PC. By executing the “CS5935 Installer.exe” file with administrator rights, an installation program is started that guides you through the installation process. During the installation you can select a target directory for the installation. By default, the program will be installed in “C:\Program Files (x86)\Starter Kit AMS5935”. After the installation of the starter kit software is completed, an additional installation of the starter kit’s USB driver is required. The driver installation program “Driver\_Setup.exe” is located in the target directory. Run the driver installer so that the PC is able to communicate with the starter kit hardware. As soon as the driver is installed the USB Starter Kit AMS 5935 can be connected to the PC.

### User Interface

After the installation, the CS5935 software can be executed by double-clicking on the “CS5935.exe” icon in the target directory. CS5935’s user interface is divided into the following four registers: “Initialization and Communication Check”, “Measurement”, “Data Logger” and “I2C Address”.

The “Initialization and Communication Check” register establishes the communication between the PC and the sensor and allows setting the sensor type for later use during data readout. The “Measurement” register enables the user to read the pressure and temperature data from the AMS 5935 sensor. For more detailed data analysis with data logging and readout of the sensor’s status the register “Data Logger” is available. The option to change the I2C address is located in the “I2C Address” register. All registers are described in detail below.

### Register “Initialization and Communication Check”

The “Initialization and Communication Check” register is shown in *Figure 2*. It is activated automatically after the software is started. The steps listed below are used to verify that the sensor and the starter kit are operative.

1. Click on the *Search Starter Kit* button to establish a connection between the software and the communication board *CB-I2C*. The status field next to the *Search Starter Kit* button indicates whether the connection to the starter kit was established. If no starter kit is found, see item 4 in chapter INITIAL OPERATION. If the connection to the *CB-I2C* was successfully established, the *Search Sensor Address* button is activated.
2. Click the *Search Sensor Address* button to determine the sensor address and establish communication with the sensor. The status field to the right of the button shows the sensor’s status. If the communication with the sensor is established without errors, the status field displays: “Sensor responds, No error”. If no sensor is found, check the correct placement of the sensor, the connection of the *BB5935* to the *CB-I2C* and the position of JP1 and JP2. If the error still occurs, the sensor might be broken. The detected I2C address is shown in the *Sensor I2C Address* field.
3. Select the type of the AMS 5935 sensor mounted in the ZIF-socket from a list of all AMS 5935 standard types displayed in the *Sensor Type* dropdown list. The corresponding pressure range of the chosen sensor type is automatically displayed in the panels below. In case of a custom sensor type, select “Custom Range” in the *Sensor Type* dropdown list as shown in *Figure 3*. Now the individual pressure range as well as the corresponding pressure unit can be entered in the input fields located beneath the dropdown list.

The screenshot shows the 'Initialization and Communication Check' tab of the software. It features three main sections:

- Search Starter Kit:** A button labeled 'Search Starter Kit' and a text box containing 'Found Starter Kit'.
- Search Sensor Address:** A button labeled 'Search Sensor Address' and a text box containing 'Sensor corresponds, No Error'. Below this is a label 'Sensor I2C Address (hex):' followed by a text box containing '28'.
- Sensor Type and Pressure Range:** A label 'Sensor Type:' followed by a dropdown menu showing 'AMS 5935-0100-D'. Below this is a label 'Pressure Range:' followed by two text boxes containing '-100' and '100', and a dropdown menu showing 'mbar'.

The bottom of the window has a red bar with the 'analog microelectronics' logo on the left and the text 'Starter Kit AMS 5935' on the right.

**Figure 2: Initialization and Communication Check Register:** Follow the steps from top to bottom to initialize the communication between the PC, the starter kit and the AMS 5935 and to select the sensor type.

This screenshot shows a close-up of the 'Sensor Type' and 'Pressure Range' settings. The 'Sensor Type' dropdown menu is set to 'Custom Range'. The 'Pressure Range' section has two text boxes containing '-75' and '75', and a dropdown menu set to 'mbar'.

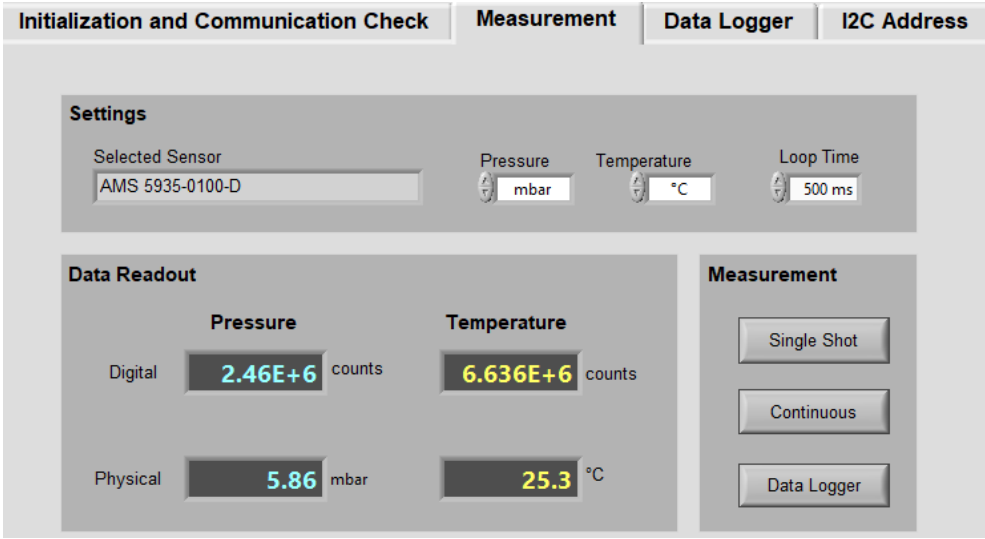
**Figure 3: Initialization of a customized AMS 5935 pressure sensor:** If you are using an AMS 5935 sensor with a customized pressure range, select "Custom Range" as *Sensor Type* and enter the customized range and select the corresponding pressure unit in the text boxes below.

**Register “Measurement”**

The “Measurement” register is shown in *Figure 4*. In the *Settings* field, the *Selected Sensor* box shows the previously selected sensor type. Furthermore the physical units for pressure and temperature measurement as well as the loop time used in continuous measurements can be selected.

A measurement is started using the buttons in the *Measurement* section of the register: the *Single Shot* button starts a single pressure and temperature measurement, the *Continuous* button triggers a series of measurements with the selected loop time and the *Data Logger* button activates the data logging function.

In the *Data Readout* field, the sensor’s digital pressure and temperature measurement values as well as the calculated physical values are displayed.



**Figure 4: Measurement Register:** This register allows the data readout with different settings.

Clicking on the *Data Logger* button opens a dialog box where you can select a file name and location for the data logger file. After the selection is confirmed, data logging starts immediately and the program switches to the “Data Logger” register.

**Register “Data Logger”**

The “Data Logger” register shown in *Figure 5* allows the continuous measurement, graphical display and storage of the pressure and temperature data from the AMS 5935 sensor.

In the *Settings* field, the physical units for the display of the sensor data can be selected. The loop time can also be set here in a range from 10 ms to 1 min. After clicking the *Start* button in the *Logging* field, a dialog window opens where you can select the location and file name for the logged sensor data.

After confirming the file name and path, the dialog window is closed, the *Start* button changes into a *Stop* button and the continuous measurement starts. The graph in the *Graph* field is activated and shows the sensor measurement data over time. Additionally, the current pressure and temperature readings are displayed in the left corner of the *Graph* field. The slider next to the *Graph* field’s label selects whether the digital values or the calculated physical values are displayed in the graph. The field below the graph shows the location of the data file. To stop the continuous measurement, click on the *Stop* button in the *Logging* field.

The measurement dataset is stored as a tab delimited text file with the data sorted in the following order: the measurement time (after start), the time stamp, the pressure in digital and in physical values, the temperature in digital and physical values and the status byte. This byte indicates the sensor’s status and is explained in *Table 2*.

status bit	7	6	5	4	3	2	1	0
default	0	1	0	0	0	0	0	0
meaning	-	-	0, if sensor data is ready	-	-	0, if integrity test was passed	-	0, if sensor is not in overflow

**Table 2: Sensor Status:** The table shows the interpretation of the status byte. MSB is bit 7.

**Note:** If the realtime function is enabled and the data logger is used with a loop time of 10 ms, the number of measurements is limited to 10,000 (larger numbers will delay the measurement). If you want to measure longer than 100 s with a loop time of 10 ms, disable the realtime graph function. This will cause the graph to update only every 500 ms. To deactivate the realtime graph function, deselect the *Realtime Graph* checkbox in the *Settings* field.



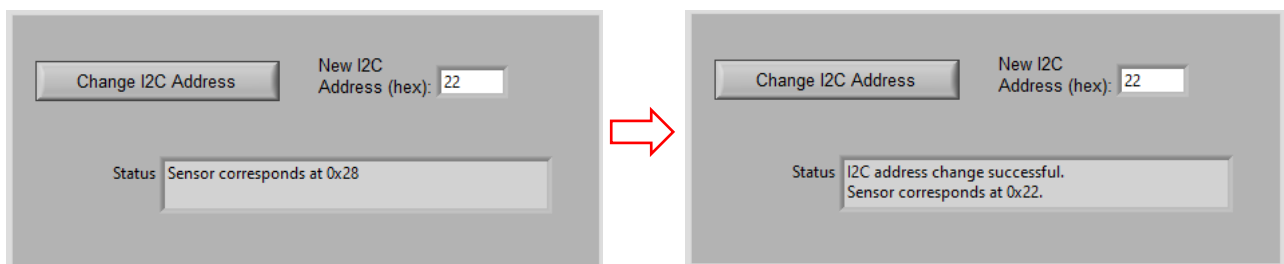
**Figure 5: Data Logger Register:** The button in the *Logging* field of the register starts and stops a continuous data measurement. The pressure and temperature readings are displayed graphically and stored in a data file.



## Register “I2C Address”

AMS 5935 allows changing its standard I2C address of  $0x28_{\text{Hex}}$  to an individual I2C address. This is necessary if more than one AMS 5935 sensor is used on the same I2C bus or if the address  $0x28_{\text{Hex}}$  is already occupied by another device. In general, all I2C addresses from  $0x00_{\text{Hex}}$  to  $0x7F_{\text{Hex}}$  are possible with the exception of  $0x04_{\text{Hex}}$  to  $0x07_{\text{Hex}}$ .

The I2C address change is done in the “I2C Address” register (see *Figure 6*). When this register is selected, AMS 5935 current I2C address is automatically displayed in the *Status* box. To set a new I2C address the desired I2C address has to be entered in the *New I2C Address (hex)* box. Clicking the *Change I2C Address* button executes a complete I2C address change. After the address has been successfully changed, the change is confirmed in the *Status* box.



**Figure 6: I2C Address Register:** Left: Display after selecting the “I2C Address” register, right: Display after executing an I2C address change to the new address  $0x22_{\text{Hex}}$ .

## INITIAL OPERATION

The following steps are required for initial operation of the starter kit:

- 1. Installation of the CS5935 software package and the USB driver**  
 Please refer to the installation instructions in the Software chapter on page 5. Run the *CS5935 Installer.exe* and the USB driver installer on a PC with Windows 10 or higher. Make sure that the starter kit hardware is not connected to the PC during software installation.
- 2. Assembly of the starter kit hardware**  
 Connect the *CB-I2C* communication board and the *BB5935* PCB via the 34-pin connector. Mount the AMS 5935 sensor on the ZIF-socket as shown in *Figure 1*. For the first test, set Jumper JP1 to the 3.3 V position and JP2 to int.
- 3. Connect the starter kit to the PC**  
 Use the included USB cable to connect the USB socket of the starter kit to a free USB port of the PC. The green LED on the *CB-I2C* lights up when the starter kit has been recognized by the PC. The starter kit is now ready for use.
- 4. Possible errors in the “Initialization and Communication Check” register**  
 Message: ‘No Starter Kit found’  
 If the green LED on the *CB-I2C* remains dark, check the correct assembly of the starter kit. Open the Windows Device Manager and check if the starter kit is registered and if the USB driver for the starter kit was installed correctly. Reset the starter kit after the driver installation by disconnecting and reconnecting the USB cable from the PC.  
  
 Message: ‘No sensor found’  
 Check if the AMS 5935 is mounted correctly on the ZIF socket of the adapter board *BB5935*. Check if the jumpers JP1 and JP2 are positioned correctly. Jumper JP1 on the *CB-I2C* has to be in the 3.3 V position. Jumper JP2 on the *BB5935* should be set to int. for the first test.

## ADDITIONAL DOCUMENTS

See <https://www.analog-micro.com/en/products/pressure-sensors/board-mount-pressure-sensors/ams5935/>

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