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AS5115

Programmable 360° Magnetic Angle Encoder with SINE & COSINE Output Signals

1   General Overview

The AS5115 is a contactless rotary encoder sensor for accurate angular measurement over a full turn of 360º and over an extended ambient temperature range of -40ºC…+150ºC.
Based on an integrated Hall element array, the angular position of a simple two-pole magnet is translated into analog output voltages. The angle information is provided by means of buffered sine and cosine voltages. This approach gives maximum flexibility in system design, as

it can be directly integrated into existing architectures and optimized for various applications in terms of speed and accuracy.
An SSI Interface is implemented for signal path configurations, as well as a one time programmable register block (OTP), which allows the customer to adjust the signal path gain for different mechanical constraints and magnetic fields.

2   The AS5115 Demoboard

The AS5115 demoboard is a complete rotary encoder system with built-in microcontroller, USB interface, and graphical LCD display. The board is USB powered or externally supplied with a 9V battery for standalone operation.
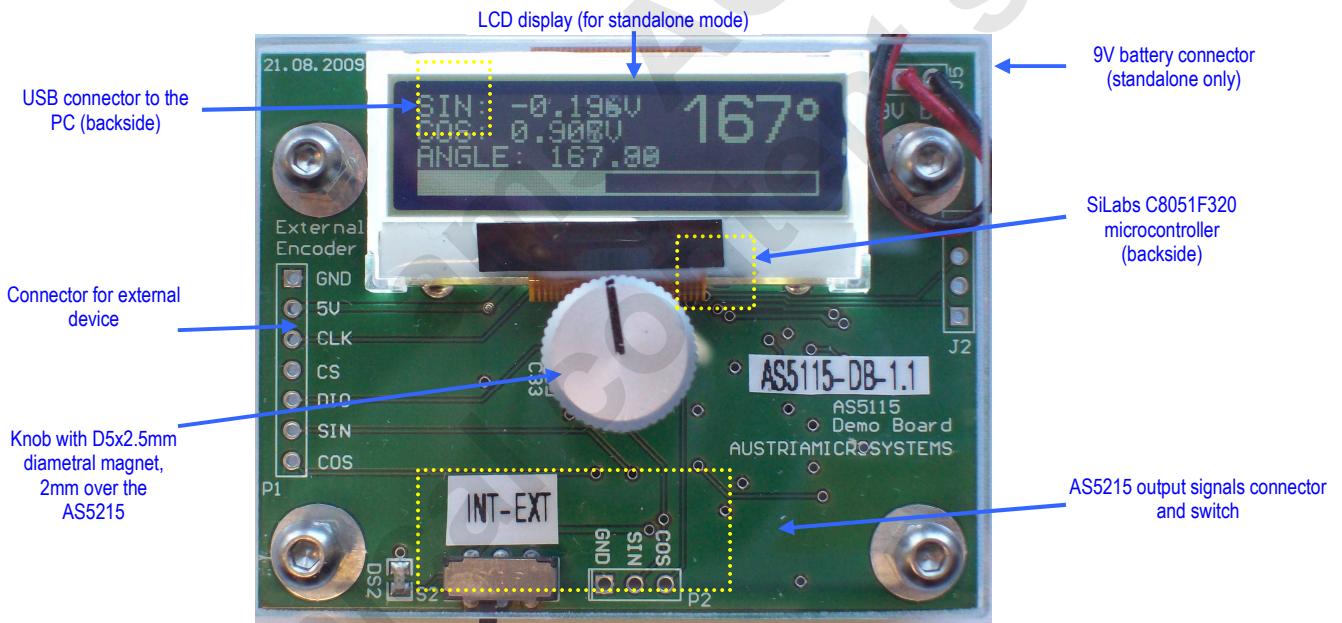

Figure 1: AS5115 Demoboard hardware with mounted magnet knob

Demoboard v1.1 has additional pull-up resistors at the communication lines. The demoboard v1.2 has a new controller (C8051F342) implemented and supports updating of the firmware via bootloader (please refer to AN5000-60_FirmwareUpgrade).

3   Operating the AS5115 Demoboard

The AS5115 demoboard can be used in several ways:

- **As standalone unit supplied by a 9V battery**
  Connect a 9V battery to the battery connector on the top right side of the board. No other connections are required.

- **As standalone unit supplied by an USB port**
  Connect the demoboard to a PC using a USB/USB cable (included in demoboard shipment). The board is supplied by the 5V supply of the USB port. No other connections are required.
- **As input device for the AS5000 Programmer GUI software**
  This configuration uses the same USB hardware connection as mentioned above, but additionally the AS5000 Programmer GUI software is running. The LCD display will be turned off and the Angle/Sine/Cosine value will be displayed on the PC screen.

3.1 Hardware Indicators

3.1.1 Graphic LCD display

The LCD display shows the real-time absolute angle position of the magnet as a digital word (0…360), as well as the current sine and cosine value of the output voltage.
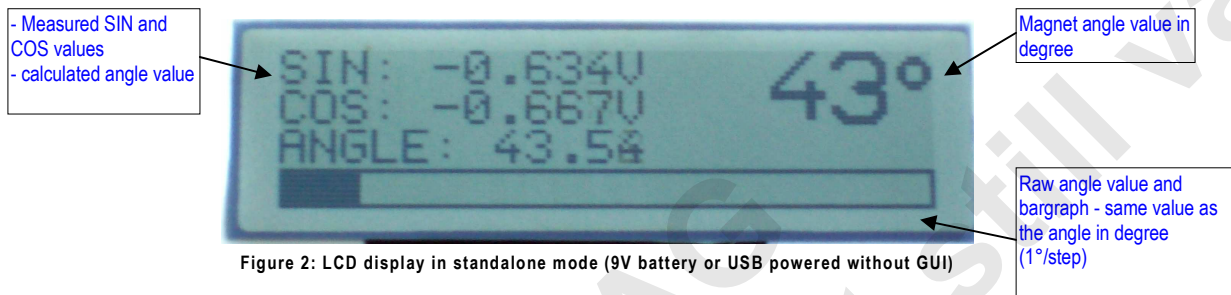Turning the knob clockwise will increase the angle value until 359, then 0.

- Measured SIN and COS values
- calculated angle value

Magnet angle value in degree

Raw angle value and bargraph - same value as the angle in degree (1°/step)

Figure 2: LCD display in standalone mode (9V battery or USB powered without GUI)

3.1.2 EXT LED

The EXT LED indicates whether the internal (on board) AS5115 or an external device is used and which values are shown on the display. By switching S2 to the left side the LED is turned on and one can use an external AS5115 by connecting it at P1.
The header P1 is pin compatible with the AS5115-AB.

4 AS5000 Programmer GUI software

4.1 Installing the GUI on the PC

The preliminary software is developed for a Microsoft Windows XP operating system with Service Pack 2. In addition the dotnet (.NET) framework version 2.0 or more must be installed on the PC. This package can be downloaded free of charge from the Microsoft webpage:
http://www.microsoft.com/downloads/details.aspx?FamilyID=0856eacb-4362-4b0d-8edd-aab15c5e04f5&displaylang=en

Following Procedure is recommended before starting the GUI:

1. check on your PC if Service Pack 2 is installed
2. install the mentioned .NET package to your computer
3. execute setup.exe
4. Finally start the GUI using the shortcut in the start menu or desktop.

4.2 The Home tab

Figure 3 shows the main window of the GUI. On the top left corner, board information as firmware (FW) version and demoboard name declaration can be found.
By default the GUI is in the auto detection mode. Any connected austriamicrosystems demoboard and programming tool will be automatically detected and displayed in the right top corner. The GUI is divided into three main sections HOME, TWI and OTP.
By selecting the TWI (AS5115 bidirectional serial protocol) tab, the information of the angular position appears. See figure 4.
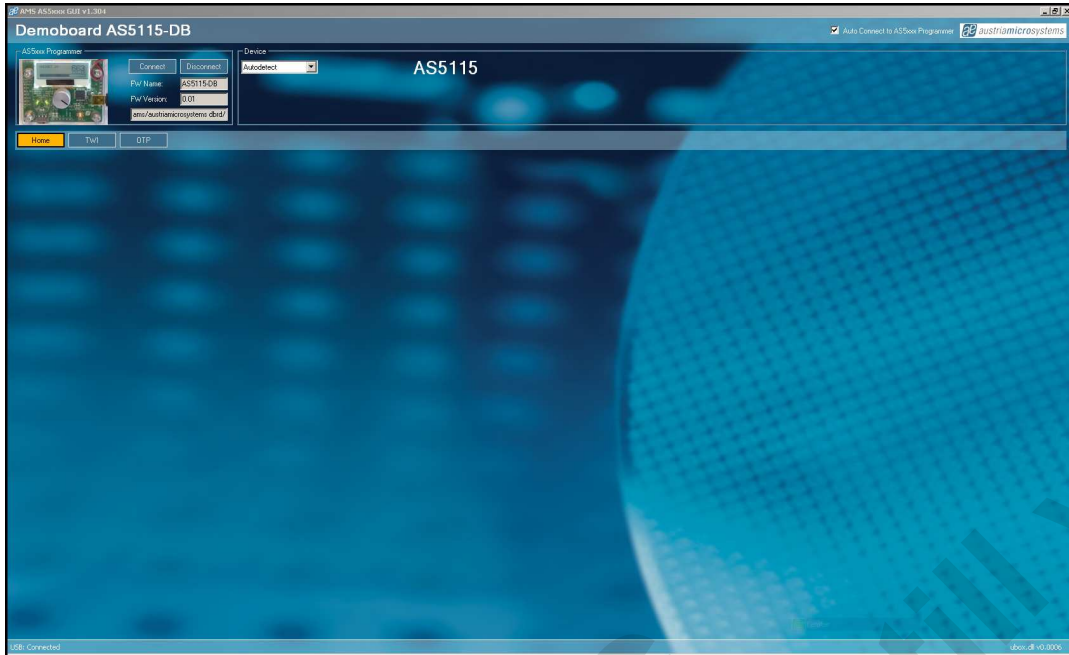
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Figure 3: AS5000 GUI detected the AS5115 Demoboard

4.3 The TWI tab

This mode displays in realtime the angle value, Multiturn register value, AGC value and the UVW signal status.

Figure 4: TWI tab, allows access to the AS5115 registers from the serial bus

The **Read Interval** can be modified from 10 ms (fastest) to 1 s (slowest).

By clicking on Digital Interface, a new window opens, and allows the user to write directly into the AS5115 registers. See chapter 4.4.
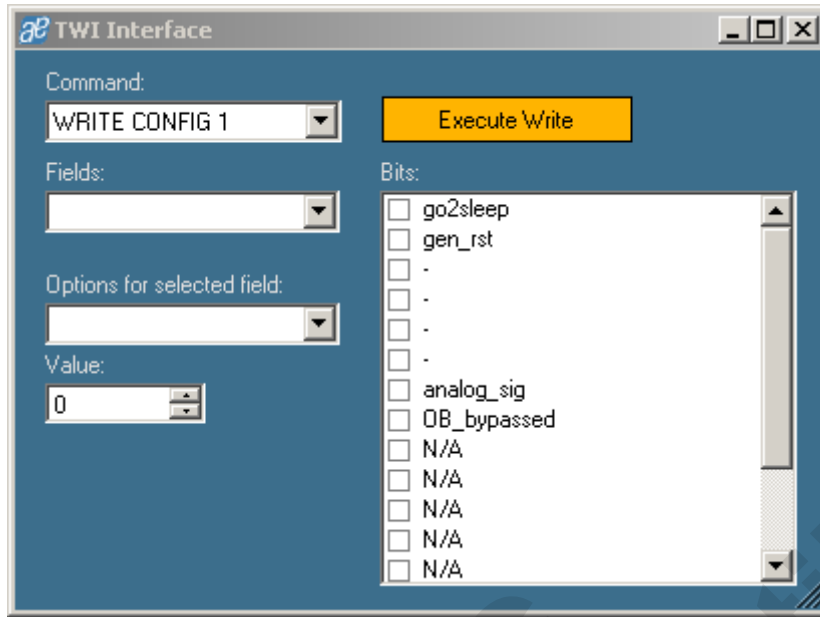
4.4 Digital Interface sub-window

Figure 5: TWI interface sub-window

The Digital interface window allows accessing the internal registers of the AS5115:

#	command	bin	mode	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
23	WRITE CONFIG 1	10111	write	go2sleep	gen_rst					analog_sig	OB_bypassed								
16	EN_PROG	10000	write	1	0	0	0	1	1	0	0	1	0	1	0	1	1	1	0

The parameters don't need to be checked manually in the "Bits" window on the right, but can be set by the "Fields" and "Options for the selected bits" values. The corresponding bits will be checked automatically.

To validate the command, the Execute Write button bust be clicked.

For further information please refer to datasheet.

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4.5 OTP tab

The OTP tab is normally used for the AS5000 programmer, but the OTP bits can be changed on the AS5115 demoboard as well.

Options like gain and Hall bias can be changed by selecting the function in *"Fields"*, then changing the parameter in *"Options for the selected field"* or directly the decimal value of this parameter in *"Value"*.

Each time a field's value has been changed, the corresponding OTP bits will be automatically checked in the right window.
The button Write should be clicked to write the parameter into the AS5115.
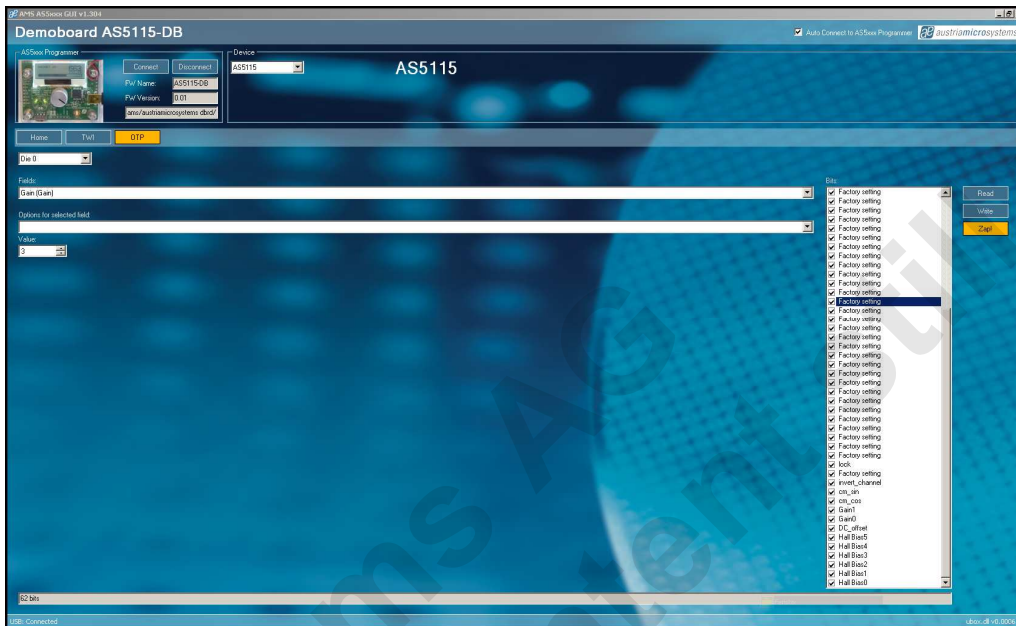The Read button reads back the OTP register, and updates the "Field" parameter as well as the OTP bits window.

Figure 6: OTP tab

Field Gain: Sets the gain of the internal signal path.
- 0: Sensitivity = 1.65
- 1: Sensitivity = 1.88
- 2: Sensitivity = 2.11
- 3: Sensitivity = 2.35

Field Hall Bias: To change the Hall Bias current:
- 0 – 63: depending on the desired output voltage

Note that the Zap! button is used for the AS5000 Programmer only and has no effect on the AS5115 Demoboard.
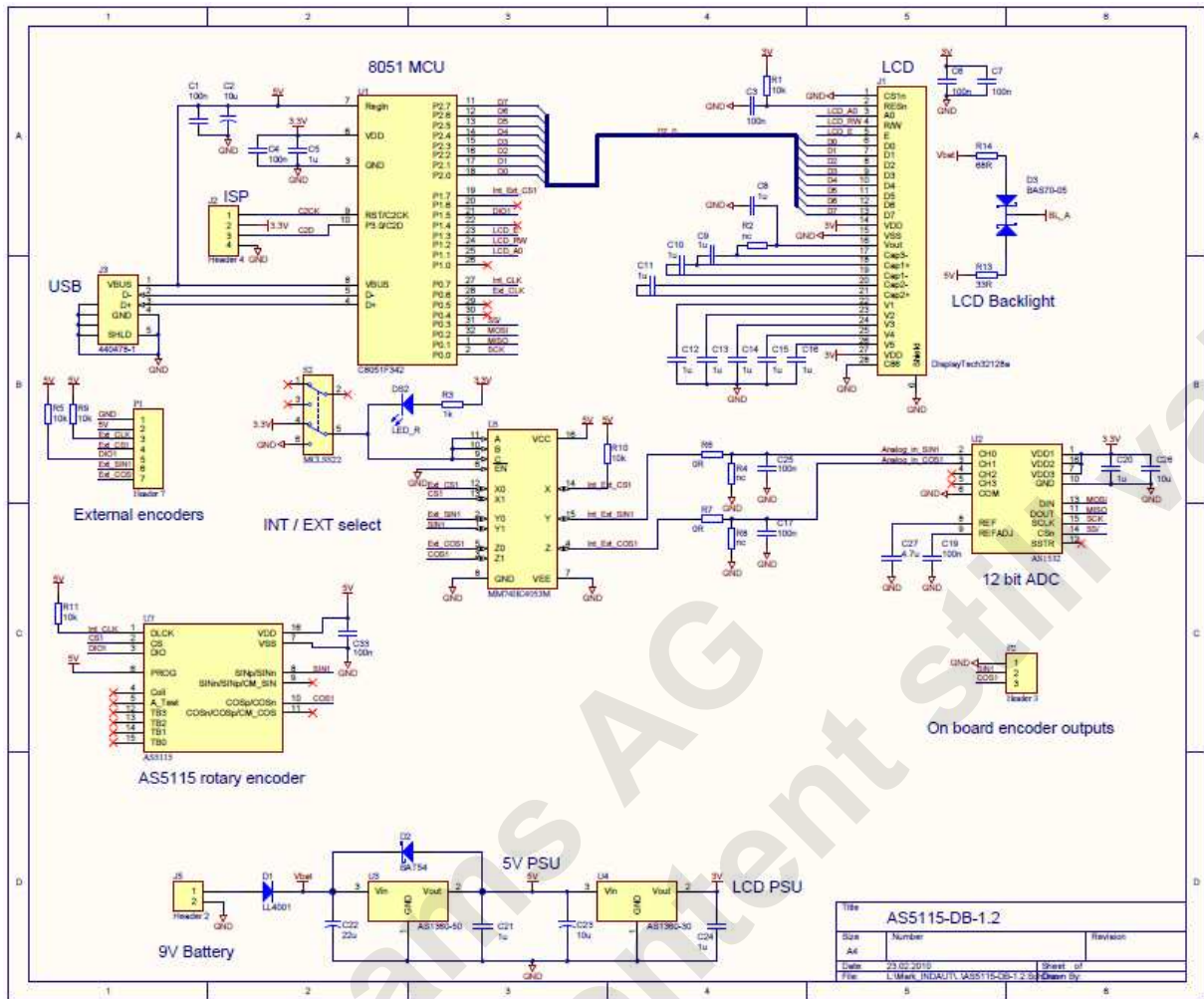
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5   AS5115 Demoboard Schematics

Figure 7: AS5115 Demoboard schematics

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Revision History

Revision	Date	Description
1.0	17.August, 2009	First version
1.1	26. February, 2010	New Demoboard revision v1.2

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