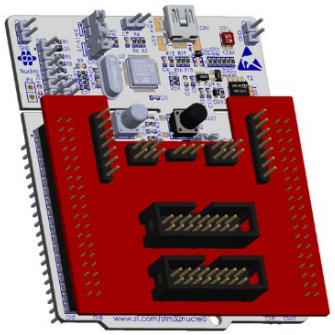
BROADCOM®

User Guide

HEDS-9955PRGEVB
HEDS-9955EVB
Magnetic Encoder IC: Programming Kit Evaluation Board



Description

The Broadcom® AEAT-9955 is an angular magnetic rotary sensor that provides accurate angular measurement over a full 360 degrees of rotation.

A sophisticated system uses integrated Hall sensor elements with complex analog and digital signal processing within a single device. A simple two-pole magnet generates the necessary magnetic field by rotating perpendicularly. Wide magnetic field sensor configurations allow on-axis (end-of-shaft) or off-axis (side-of-shaft) modes in application. The AEAT-9955 is a versatile solution capable of supporting a broad range of applications with its robust architecture to measure and deliver both absolute and incremental signals.

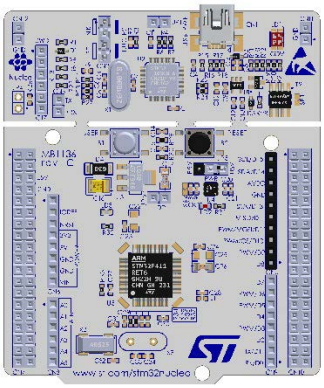
The absolute angle measurement provides an instant indication of the magnet's angular position with a selectable and multi-time programmable resolution from 10 to 18 bits. When a resolution is selected, its positioning data is then represented in digital form to be assessed through a standard SSI (parity) and SPI (with the CRC and parity option) communication protocol. Where desired, users may also choose to receive its absolute angle position in PWM-encoded output signals. The incremental positions are indicated on ABI and UVW signals with a wide user-configurable resolution from 1 CPR to 20,000 CPR of ABI signals and from 1 to 32 pole pairs (2 to 64 poles) for UVW commutation signals.

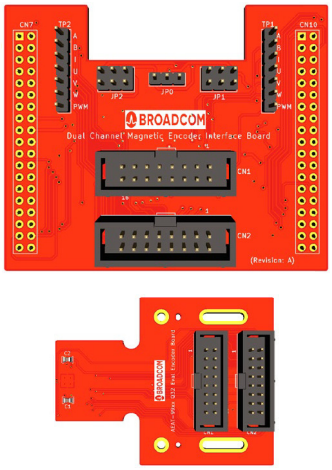
For ease of setup, Broadcom has made available development tools to perform the calibration process without other measurement equipment. The programming kit and evaluation board are available through the normal Broadcom sales channels.

HEDS-9955PRGEVB Programming Kit Contents

The programming kits include the following items:

- STM32-Nucleo 64 Programming Board (x1)
- AEAT-9955 Interface Board (x1)
- HEDS-9955EVB (x1)
- 16-pin ribbon cable, 2 ft (x1)
- Micro USB cable (x1)
- USB drive (x1)





HEDS-9955EVB Board Contents

The board kit includes the following item:

- AEAT-9955 mounted on board

HEDS-9955PRGEVB Programming Kit Pinout

The following figure shows the pin assignment for each I/O port.

CH#2 Auxiliaries Output (TP2)

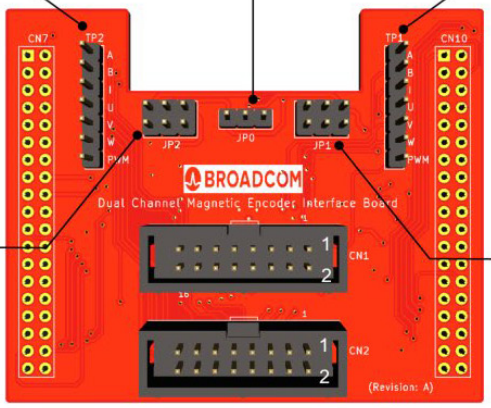
Pin #	TP2
1	A_2
2	B_2
3	I_2
4	U_2
5	V_2
6	W_2
7	PWM_2 / M3_3

General External VDD Input (JP0)

Pin #	1	2	3
JP0	EXT_VDD	-	GND

CH#1 Auxiliaries Output (TP1)

Pin #	TP1
1	A_1
2	B_1
3	I_1
4	U_1
5	V_1
6	W_1
7	PWM_1 / M3_1



CH#2 VDD Selection (JP2)

JP2			
VDD_2	5.0V	EXT_VDD	3.3V

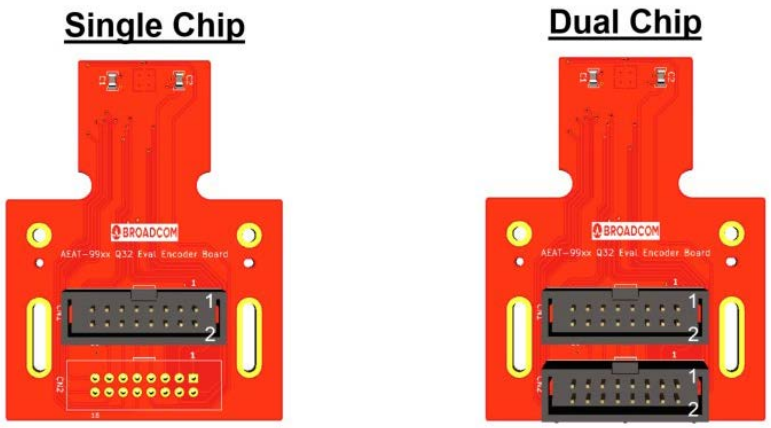
CH#1 VDD Selection (JP1)

JP2			
VDD_2	5.0V	EXT_VDD	3.3V

Pin #	Channel 1 (CN1)	Channel 2 (CN2)	Pin #	Channel 1 (CN1)	Channel 2 (CN2)
1	M3_1	M1_2	9	ZR_1	B_2
2	M2_1	M0_2	10	SLEEP_1	ERR_2
3	B_1	M2_2	11	MSEL_1	I_2
4	A_1	VDD_2	12	ERR_1	ZR_2
5	U_1	M3_2	13	VDD_1	U_2
6	I_1	GND_2	14	GND_1	SLEEP_2
7	W_1	A_2	15	M1_1	V_2
8	V_1	MSEL_2	16	M0_1	W_2

HEDS-9955EVB Evaluation Board Pinout

The following figure shows the pin assignment for each I/O port.



Pin #	Channel 1 (CN1)	Channel 2 (CN2)	Pin #	Channel 1 (CN1)	Channel 2 (CN2)
1	M3_1	M1_2	9	ZR_1	B_2
2	M2_1	M0_2	10	SLEEP_1	ERR_2
3	B_1	M2_2	11	MSEL_1	I_2
4	A_1	VDD_2	12	ERR_1	ZR_2
5	U_1	M3_2	13	VDD_1	U_2
6	I_1	GND_2	14	GND_1	SLEEP_2
7	W_1	A_2	15	M1_1	V_2
8	V_1	MSEL_2	16	M0_1	W_2

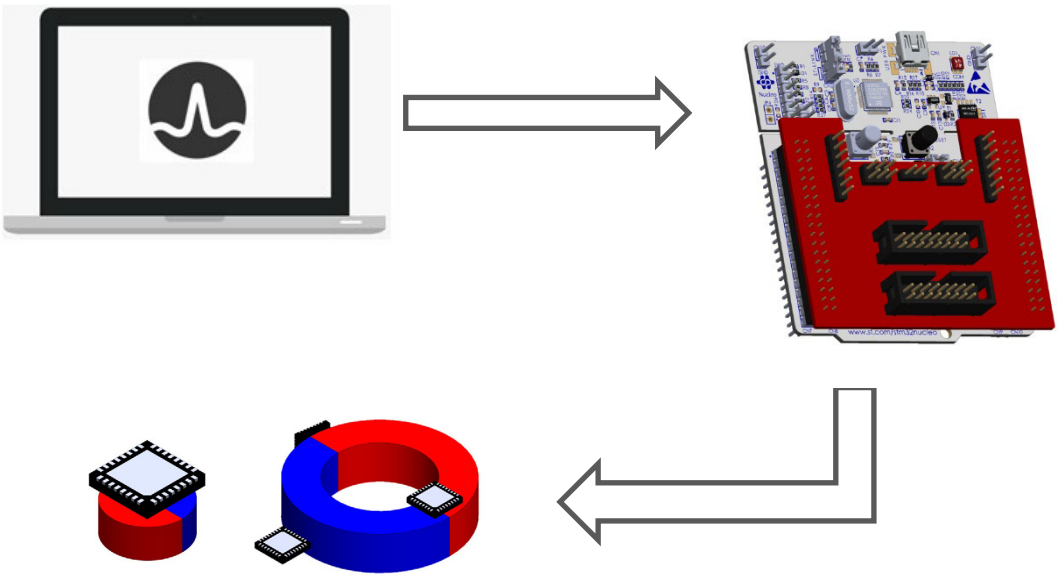
Configurable Interface I/O and Selection Table (MATS Table)

Mode / Pin	SPI3	SSI3a	SSI3b	SSI2a	SSI2b	SPI4-16a	SPI4-16b	SPI4-16c	SPI4-8	PWM
MSEL	0	0	0	0	0	1	1	1	1	1
PSEL	x	0	1	0	1	0	0	0	0	1
SPI4[1]	x	x	x	x	x	0	0	1	1	x
SPI4[0]	x	x	x	x	x	0	1	0	1	x
M0	0	1	1	1	1	NCS	NCS	NCS	NCS	-
M1	DIN	NSL	NSL	0	0	MOSI	MOSI	MOSI	MOSI	-
M2	SCK	SCL	SCL	SCL	SCL	SCK	SCK	SCK	SCK	-
M3	DO	DO	DO	DO	DO	MISO	MISO	MISO	MISO	PWM

NOTE: PSEL, SPI4[1], and SPI4[0] are configured through memory.
MSEL and M0 are configured through I/O pads.

Hardware Setup

1. Connect the HEDS-9955PRGEVB to a PC via a USB port.
2. Connect the 16-pin ribbon cable, one end to interface board and the other end to the encoder.
3. Select the operating voltage of the sensor by connecting the jumper to either 3.3V or 5V.



Program Installation

The installation software for the programming kit is available in the USB drive provided. To install the application software, double-click the `HEDS-9955 PRGEVB Programming Evaluation Kit.msi` software file, and follow the on-screen instructions to finish the installation.

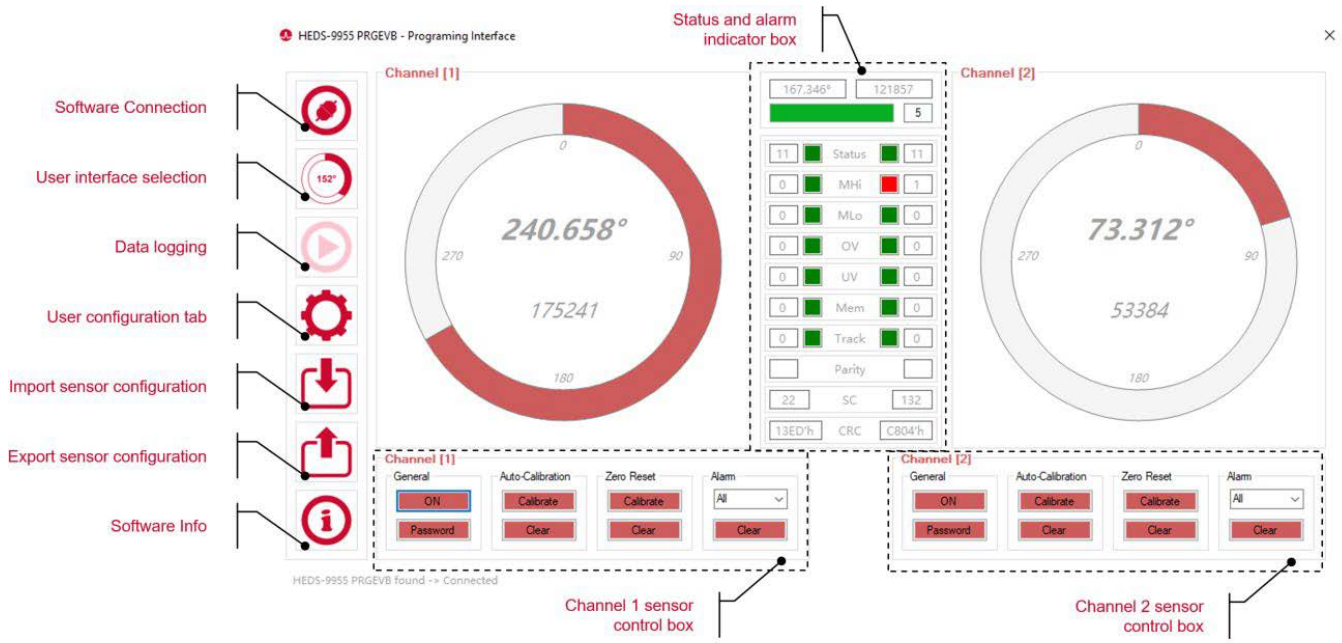
After the installation is complete, the program is available in the selected working directory.

For the latest software updates, visit the product webpage.

NOTE: The software is for PCs running on the Windows operating system. The minimum requirement is a Windows 10 64-bit operating system.

User Interface of Calibration Software

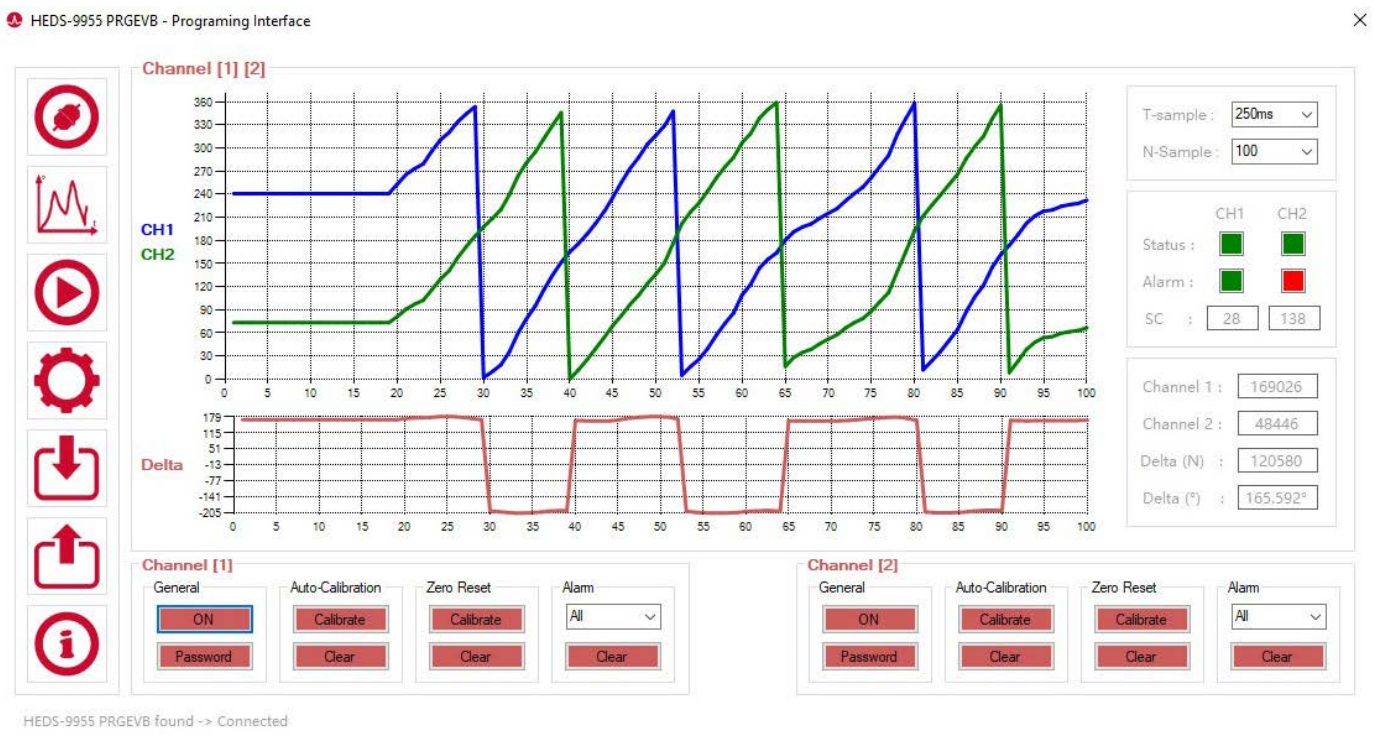
Main Tab



The functional description of each button is as follows.

Name	Description
Software connection	Enables the software connection to the board.
User interface selection	Toggles between Chart mode and Plot mode.
Data logging	Records position streaming in Plot mode.
User configuration tab	Sensor configuration mode.
Import sensor configuration	Recalls the encoder configuration from a saved file.
Export sensor configuration	Saves the existing encoder configuration to a file.
Software info	Software revision.
Channel 1/2 sensor control box	On – Resets the single-turn position. Password – Unlocks the sensor configuration. Calibrate – Calibrates the sensor accuracy. Clear Calibration – Erases the calibration data. Zero Reset – Calibrates the sensor zero position. Clear Zero Reset – Erases the zero position data. Alarm – Clears a specific alarm or all alarms.
Status and alarm indicator box	Displays the delta between Channel 1 and Channel 2. Indicates the status and alarm bit.

Output Interface Tab (Plot Mode)



The absolute output interface is also available in Plot mode view. In this mode, users can use the Data Logging function.

Data Logging

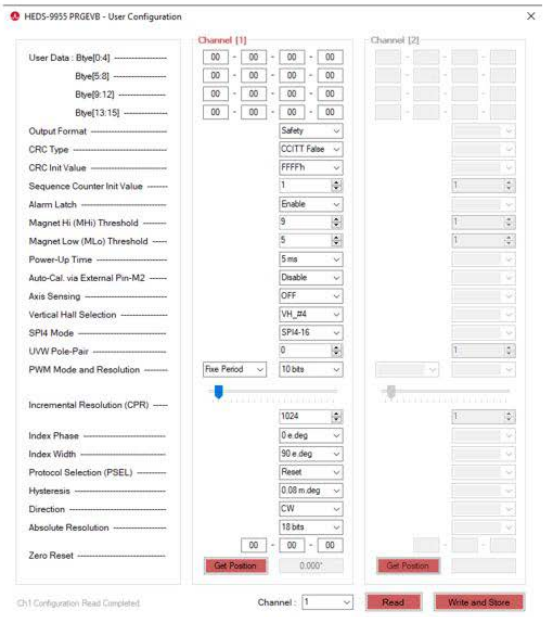
Perform the following steps to log the position data:

1. Click **User interface selection** to switch to Plot mode.
2. Click the **Data logging** button.
3. Enter the file name and select the file location, and then click **Save**.

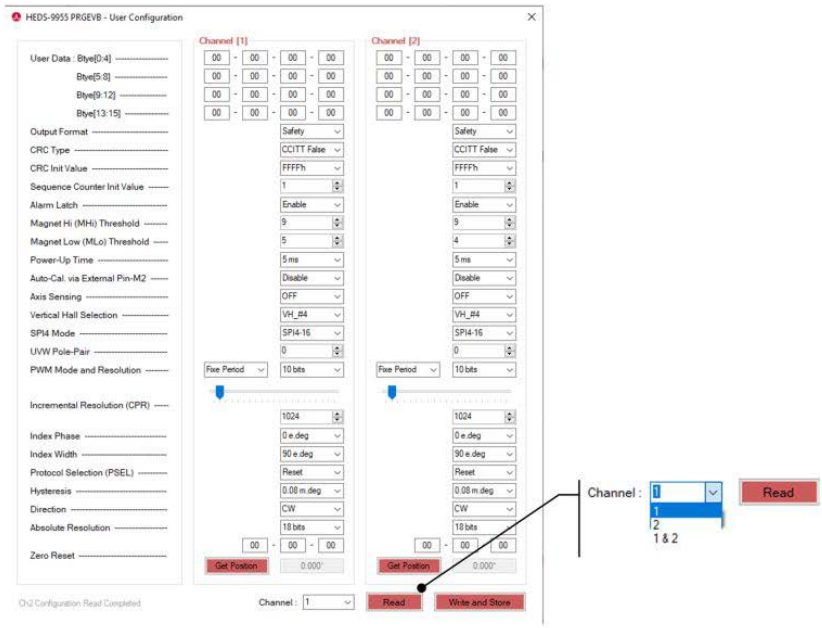
The position will be continuously saved to the file until **Data logging** [stop recording] is pressed again.

User Configuration Tab

(1) Channel 1 = ON, Channel 2 = OFF



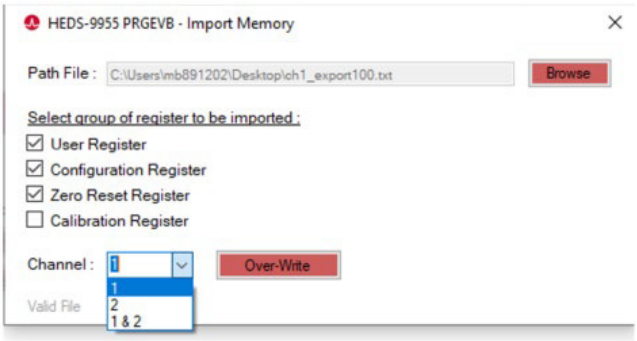
(2) Channel 1 = ON, Channel 2 = ON



The **User Configuration** tab allows a user to configure the various settings available in the sensor. It is available in “Single chip” mode or “Dual chip” mode where the information can be read out individually or separately.

NOTE: **Read** the encoder configuration from memory, and **Write** the configuration into memory after selection.
Store the configuration in memory to be available on the next power-up.
Get Position gets the current absolute position.

Import Sensor Configuration Tab



The **Import sensor configuration** tab consists of four groups of registers. Each group can be selected individually or in different combinations.

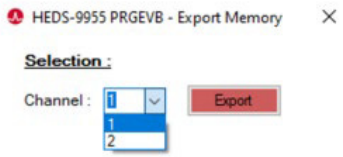
Perform the following steps to import the encoder configuration:

1. Click the **Import sensor configuration** tab; the window above appears.
2. Click **Browse** to select the targeted file.
3. Select one or more checkboxes of the targeted register group.

4. Select the target sensor, either individually or both at the same time (dual chip).
5. Click **Write and Store**.

The completion status appears below the **Write and Store** button.

Export Sensor Configuration Tab



Perform the following steps to export the encoder configuration:

1. Click **Export sensor configuration**.
2. Enter the file name and select the file location, and then click **Save**.

Calibration Process

Once the encoder is assembled (SMT) to the PCB, mount the PCB assembly to the motor system with the magnet set up per the data sheet.

- The encoder configuration can be loaded before or after calibration.
- Perform Auto-calibration followed by Zero Reset calibration.

Auto-calibration

1. Rotate the magnet at a constant speed (any direction).

   The constant speed range is between 50 RPM and 2000 RPM.
2. Once the speed stabilizes, initiate the calibration sequence via the software.
   - SPI commands via the PC software interface.
   - The calibration status will display once complete.

Calibration data is automatically saved in memory at the end of the sequence.

Zero Reset Calibration

1. Stop the magnet at the reset position.
2. Initiate the reset calibration sequence via the software.
   - SPI commands via the PC software interface.
   - The calibration status will display once complete.

Calibration data is automatically saved in memory at the end of the sequence.

NOTE: For a detailed description of each of the parameters, refer to the data sheet and application note.

Ordering Information

Ordering Part Number	Product Description
HEDS-9955PRGEVB	AEAT-9955 Programming Kit, Evaluation Board, and Magnet
HEDS-9955EVB	AEAT-9955 Evaluation Board