Product Document

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Manuel for 12V High Side Battery Sensor Reference Design

Purpose of this reference design is to sense current and voltage of a 12V battery as well as the temperature of the PCB. From these measurements battery charge is counted (Coulomb counter) and battery impedance is calculated whenever load current change is > 5A.

This sensor supports both, normal measurement mode 1 as well as low power standby mode 1 (see AS8510 / AS8525 data sheet) were the sensor wakes up at 5s time interval to perform a current measurement and threshold comparison.

The sensors are not calibrated and response differs due to initial spread of shunt resistance, gain, attenuator ratio and temperature sensor!

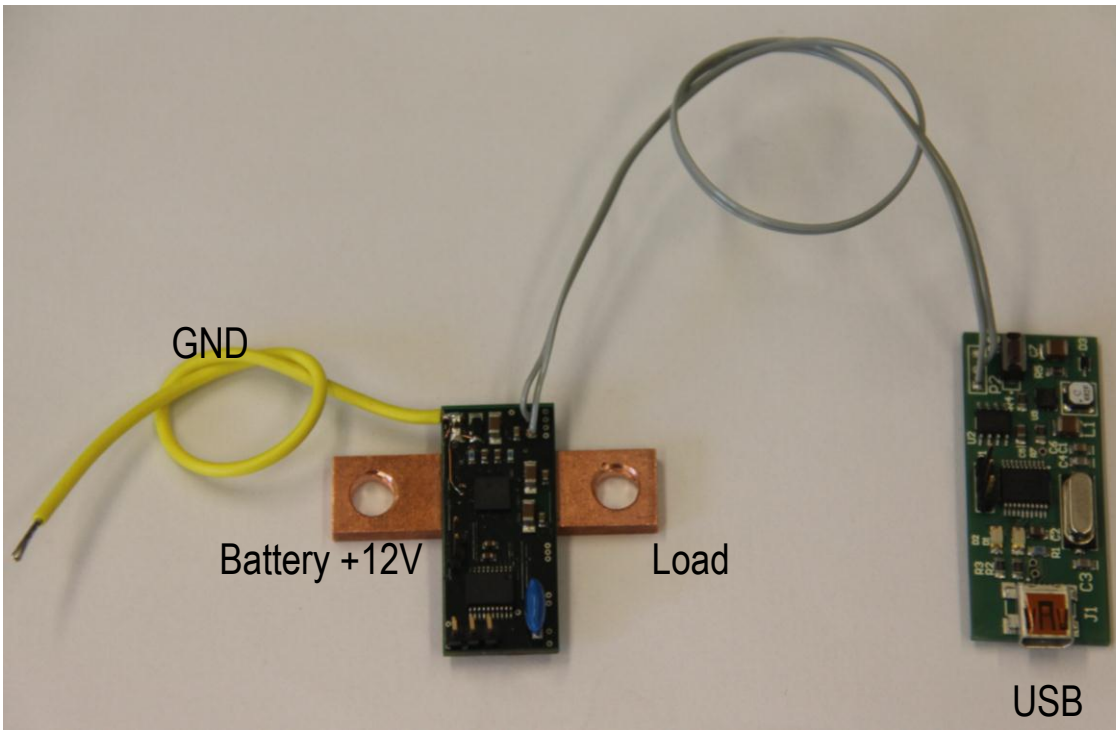
Specifications:

- Temperature range: -40°C to +125°C
- Pre programmed current measurement range: +/-400A, can be adjusted through gain setting menue
- Supply range 6V – 18V. Limited towards low supply by LIN interface. Works down to typ 4,5V at room temperature from experience.
- Accuracy for current measurement after system calibration: Typ. +/-0,2% over entire signal and temperature range except were quantization gets dominant at low current readings. In addition there is a common mode error of 0,05%/V when battery voltage changes. This error can be canceled by software as for each current measurement there is a synchronized voltage measurement.
- Accuracy for voltage measurement after system calibration: Typ +/- 0,1% for -20 to +65°C. Could be improved by software correction of ADC reference drift through internal temperature sensor.
- Accuracy for temperature measurement after single point calibration: +/-3° for -20° to +65°
- Linearity: better 0,01%
- Offset: < +/- 1 LSB
- Current consumption of the sensor slave in standby mode: 100 uA typical
- Sensor current consumption in Normal mode: 8 mA
- Maximum voltage in load dump condition for 500 ms: 42V
- Withstands ISO pulses
- Reverse polarity protected
- LIN 2.1 interface - conformance and EMC tested, go to sleep and wake through LIN instruction
- Controller type MB96F315, 128 + 32 kB of flash memory

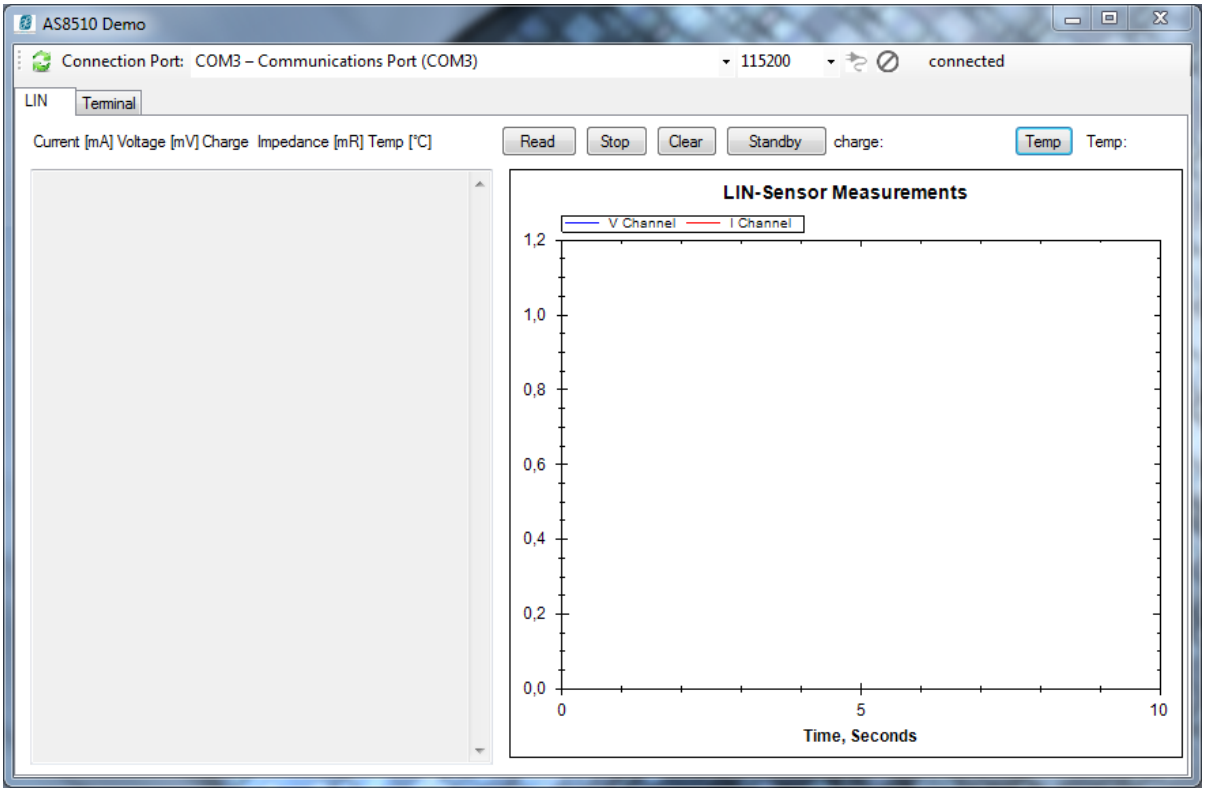
The sensor system consists of the shunt sensor module as a LIN slave, The LIN master with LIN and USB controller as well as the GUI software which is available from AS8510 demo board download area.
The sensor need to be connected to 12V, GND and through LIN bus, the master need to be connected through USB cable to laptop USB port. After starting the application and pressing the connect button, the read button can be clicked and sensor starts to measure.

Software:

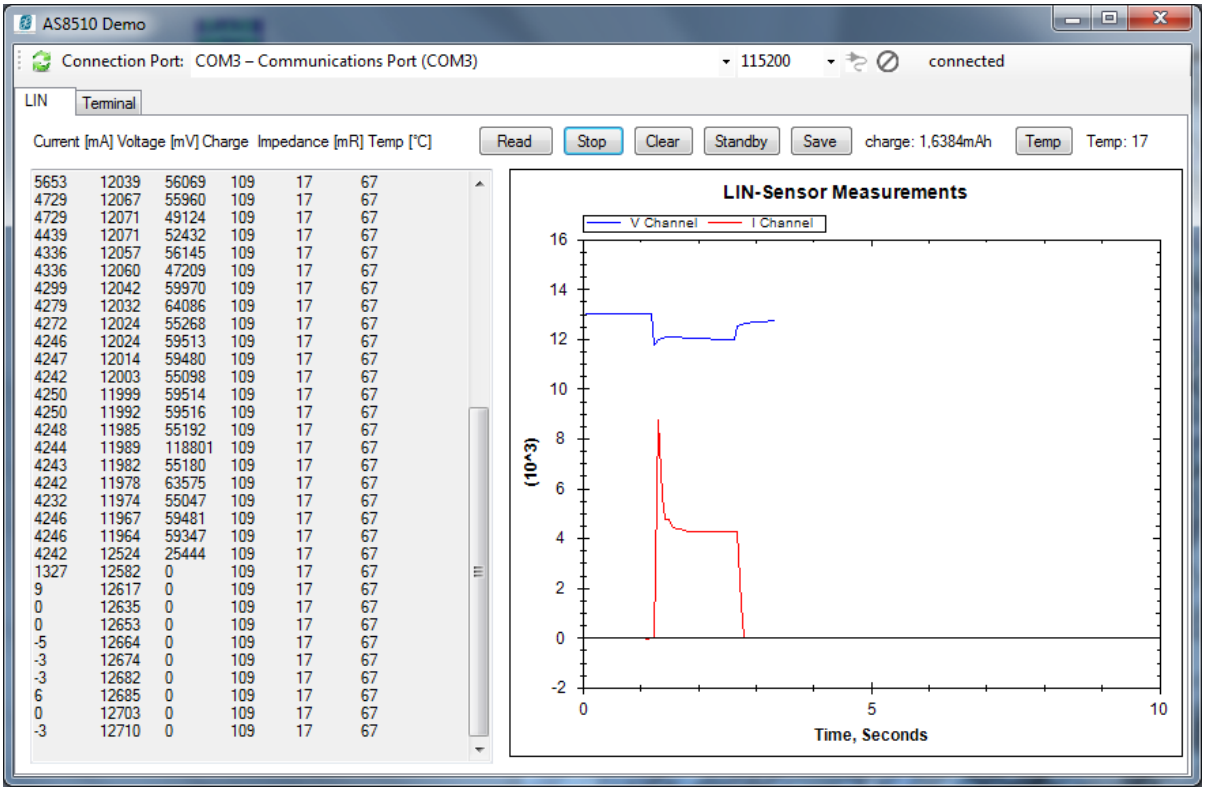
- Download .net Framework and software:
- http://www.ams.com/eng/Support/Design-Resources/Demoboards/Data-Converters/Data-Acquisition-Front-End/AS8510-DK
- Install both
- Connect the USB/LIN Board via USB
- Windows will ask for a new driver for the device this driver is in the installation folder of the software in the driver subdirectory
- After installation check which com port was associated with the new device in the device manager
- Start the demo software
- Power the demo Board according to the following picture:



- Select the correct com port (normally it should already be pre-selected) and click the connect button (grey plug)
- The LIN Tab will open automatically



- You can start the measurement with the read button



- You can save the measurement data with the save button. File format is .csv which is easily opened in for example in Excel

The columns in the table are as follows:

- Current [mA]
- Voltage [mV]
- Charge integration value
- Impedance [mΩ]
- Temperature [°C]
- Check value

In addition the charge sum is displayed in the small charge box at top the graphic display in [mAh]. The temperature in the right box is also updated automatically. The graphic display allows seamless zoom and scrolling even while the measurement is active. With a right click you can open a menu which lets you save and navigate through the graphics.

Buttons:

- Read: Starts the measurement
- Stop: Stops the measurement
- Clear: Resets the table and the graphic window as well as the charge counter
- Standby: If the sensor is in stop mode it will send the whole demo board into standby. You will only be able to see a difference in current consumption otherwise there is no indication of the change to standby mode
- Save: Saves the whole left table into a .csv file
- Temp: Will initialize a single temperature measurement. The temperature will be displayed in RAW format
- Gain: With this dropdown menu you can adjust the internal gain of the ADC. It will have an effect on noise and offset. You should only change the gain setting while the ADC is in stop mode.

LIN Interface description:

The LIN message consists of Sync Break Sync Field Identifier data fields and checksum. Our implementation will accept Sync and break Fields but it has a preconfigured **Datarate of 19200Baud.**
It will recognize the following Identifiers:

- 1: Will prompt a 4 byte standard frame request in the following format **Voltage [2byte] Current [2byte]**
- 2 Will prompt a 14 byte extended frame request in the following format **Voltage [2byte] Current [3byte] Charge_sum [4byte] Impedance [2byte] Temperature [2byte] Status [1byte]**

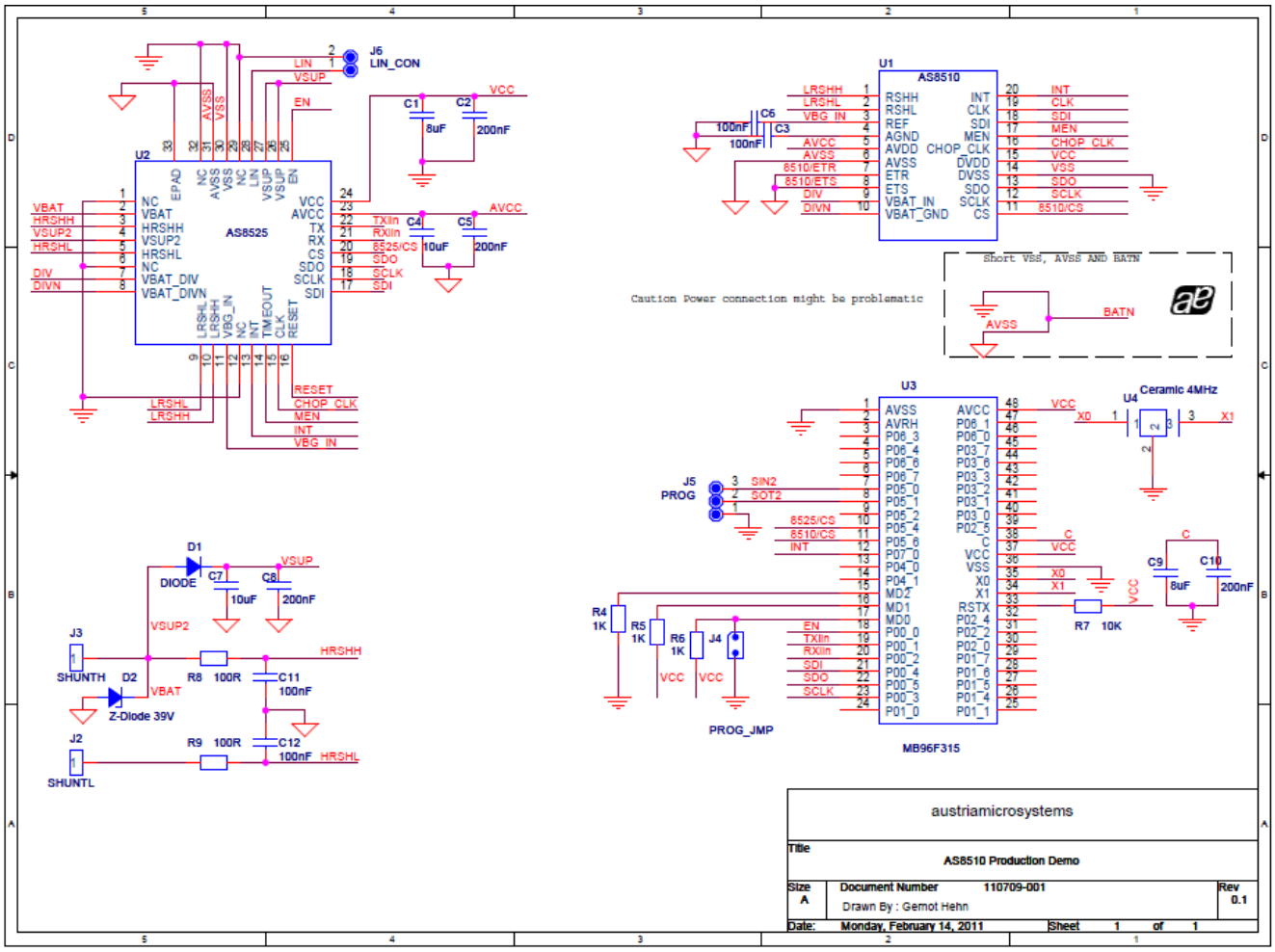
- Anything else will be treated as a normal command. The commands are listed below. They have to be terminated by one of the following characters: “\n” “\r” “:” 0

Serial Interface description:

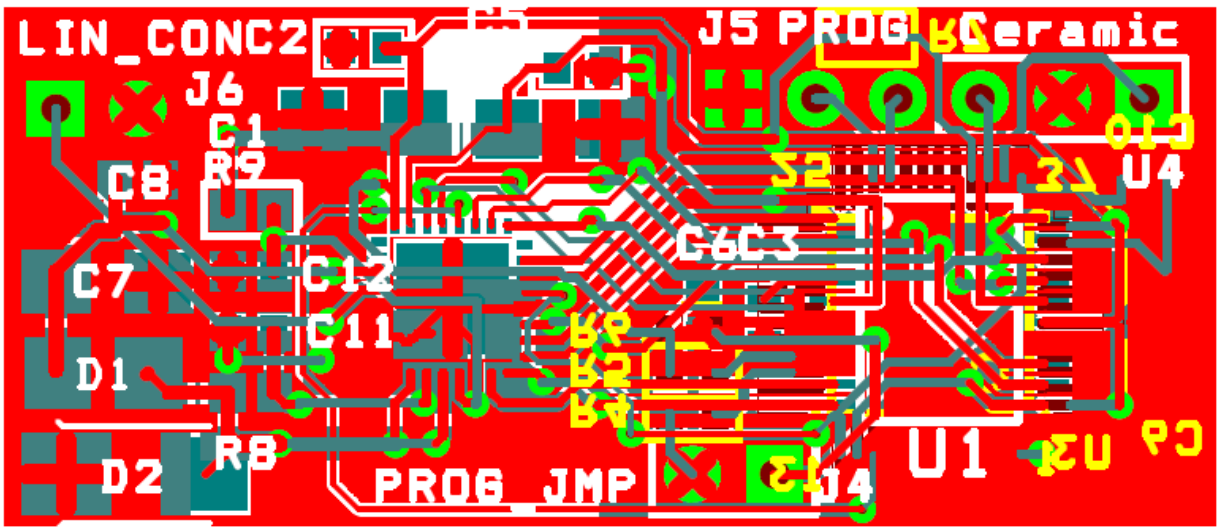
The USB2LIN Board communicates to the PC via a virtual COM port. This Interface hast three distinct commands:

- t#: Will transmit the character following t over the LIN interface
  - t1: Do a single voltage and current read
  - t2: Do a single temperature read
  - t3: Do a continuous read of all parameters
  - t4: Stop continuous read
  - t5: Reset all registers
  - t6: Goto Standby + keep measuring
  - t7: Goto Standby
  - ta: activate UART interface 115200kbps 8N1
  - tb: Set GAIN 5
  - tc: Set GAIN 25
  - td: Set GAIN 50
  - te: Set GAIN 100
  - tf Set RAW data mode
- r: Will do a read of current and voltage
- q: Will do an extended read with all the measurements available.
  Message format is:
  Voltage [2byte] Current [2byte] Charge_sum [4byte] Impedance [2byte]
  Temperature [2byte] Status [1byte]

Schematic:



Board layout:



Sensor board is double sided FR4
PCB dimension 39 x 17 mm

BOM:

Item	Quantity	Reference	Part	farnell-nr
2	4	C2,C5,C8,C10	220nF	1759019
3	4	C3,C6,C11,C12	100nF	1759017RL
4	4	C1,C4,C7,C9	10uF	1833825
5	1	D1	DIODE	1469425RL
6	1	D2	Sup Diode	1189316
9	1	J4	PROG_JMP	stiftleiste
10	1	J5	PROG	stiftleiste
11	1	J6	LIN_CON	stiftleiste
12	4	R4,R5,R6,R10	1K	9330380
13	1	R7	10K	1469749
14	2	R8,R9	100R	9330364
15	1	U1	AS8510	AMS
16	1	U2	AS8525	AMS
17	1	U3	MB96F615	fujitsu direkt
18	1	U4	Ceramic 4MHz	1448125
19	1	Shunt	100µOhm, 5%	Vishay WSBS5012L1000JK

The reference design is clocked by an 4 MHz ceramic resonator to achieve highest accuracy in Coulomb counting over entire temperature range. AS8510 internal precision RC oscillator is disabled.

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