

# Using AUX1 input as an additional voltmeter

Revision 2

## Overview:

EFMS100 has a built in battery (sender unit power supply) voltmeter. If you need an additional voltmeter, this application note describes how to use the AUX1 input of the sender unit as a wide range voltmeter.

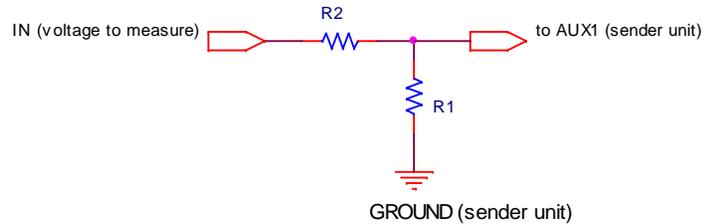
AUX2 input could be used but this is not recommended because the procedure is more complex.

## Information from EFMS100 user manual regarding AUX1:

- Voltage range = 0 to 2.5V
- Input leakage current = 50nA max.

## Principle:

2 resistors are used to scale down the "voltage to measure" to AUX1 voltage range.



Assuming AUX1 input leakage current is zero:

$$V_{IN} = (R1+R2) / R1 \times V_{AUX1} \quad (\text{equation1})$$

R1 should be chosen in order to minimize the effect of AUX1 input leakage current.

To limit the error to less than 1% choose

$$R1 < 2.5V \times 1\% / 50nA = 500k\Omega$$

**R1 = 100kΩ = 100 000 Ω is a good value**

R2 should be chosen based on the maximum voltage you need to measure and on (equation1).

$$R2=10 \times R1 \text{ will allow you to measure voltages up to } 2.5V \times 11 = \mathbf{27.5V}$$

Therefore  $R2 = 1\text{Meg}\Omega = 1\,000\,000\,\Omega$

1MegΩ is a relatively high value and may be hard to find.

In this case reduce the values of both resistors (e.g. R1=47k and R2=470k)

## Configuration of AUX1 using the menu of the display unit

Set the parameter "MIN CALIBRATED VALUE" to 0

Set the 11 data points as indicated in this table:

Data point	Parameter	Value
1	RAW AT CAL=MIN	0
2	RAW AT CAL=MIN+10%	410
3	RAW AT CAL=MIN+20%	819
4	RAW AT CAL=MIN+30%	1229
5	RAW AT CAL=MIN+40%	1638
6	RAW AT CAL=MIN+50%	2048
7	RAW AT CAL=MIN+60%	2458
8	RAW AT CAL=MIN+70%	2867
9	RAW AT CAL=MIN+80%	3277
10	RAW AT CAL=MIN+90%	3686
11	RAW AT CAL=MAX	4095

## Setting the parameter "MAX CALIBRATED VALUE"

You can choose option 1 or option 2 based on this table:

	PROS	CONS
<b>Option 1</b>	you don't need a voltmeter	you need accurate resistors for both R1 and R2
<b>Option 2</b>	you don't need accurate resistors for R1 and R2	you need an accurate digital voltmeter

Option 2 is preferred (better accuracy) if the accuracy of your voltmeter is better than 1%.

### Option 1

1% resistors or better are recommended

You can directly set the parameter "MAX CALIBRATED VALUE" to

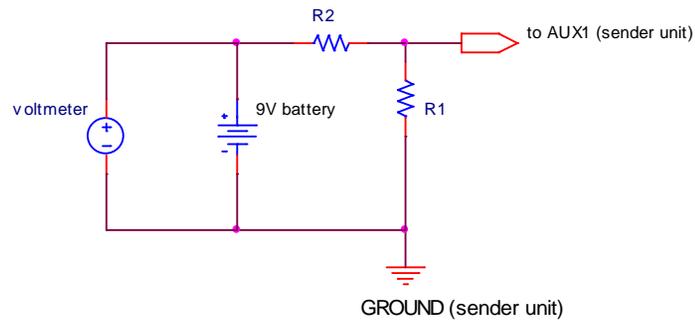
$$(R1+R2) / R1 \times 2.5V$$

$$= 27.5V \text{ if } R2=10 \times R1$$

### Option 2

An accurate (1% or better) digital voltmeter is needed.

Apply a stable voltage to the input (IN). You can use a 9V battery for example.



Measure this voltage with your voltmeter.

We will call this value "VIN".

Read the RAW VALUE (make sure you have chosen to show the RAW VALUE and not the CALIBRATED VALUE) of AUX1 on the display unit.

We will call this value "RAW".

Set the parameter "MAX CALIBRATED VALUE" to

$$4095 \times VIN / RAW$$

Verification: change de configuration of AUX1 to display the CALIBRATED VALUE.

Verify that the display unit shows the value indicated by the voltmeter.