

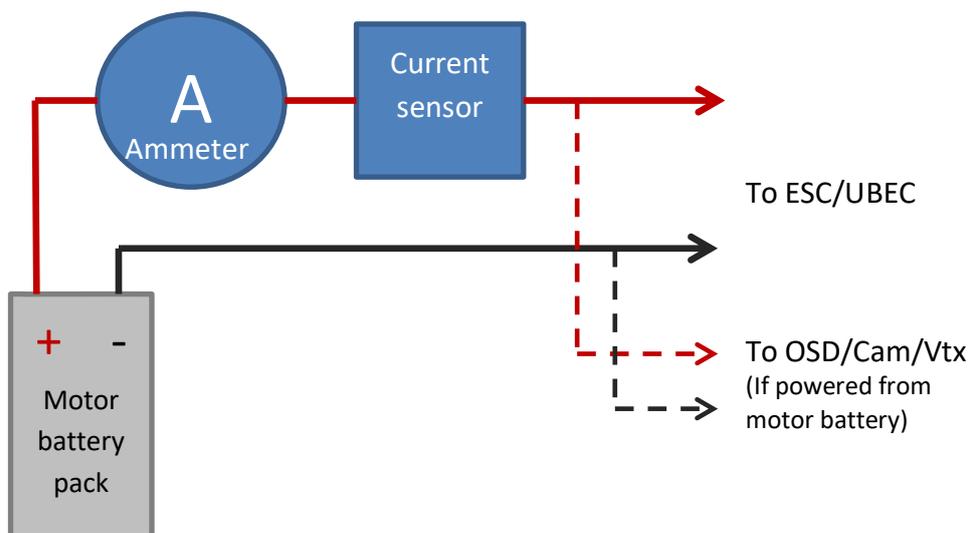
Current sensor calibration

For OSD firmware since version 2.60

Sensor calibration is invoked from OSD menu **Service->Calibrate current** and is performed in two consecutive steps.

NOTE: Calibrate current option is available only when opening menu from 3-button keyboard

To perform full calibration procedure connect external ammeter with at least 10A range in series with battery, to proper measure current drawn from battery.



Picture 1 Ammeter connection

Step1: zero offset

Due to technology some sensor may produce output voltage when no current is flown through sensor. System need to know this offset in order to properly calculate actual current flow.

Typical offset value for Pitlab sensor is 0 or small values close to zero.

For other types of sensor (hall sensors) zero offset has significant value and proper calibration must be performed before use.

To calibrate sensor's zero offset set throttle down (cut engine) to minimize current consumption. Set proper ammeter range to get reliable measurement. Current drawn from battery in this step must not be greater than 2A. If current shown on OSD screen is higher than 2A there will be exclamation mark shown after "Current=x.xx A" message.

Use (press) **Up** or **Down** button on keyboard to change zero offset and set current on OSD screen equal (or as close as possible) to current shown on ammeter. Accept settings by pressing **Enter** button.

Note: Enter button is inactive when current shown by OSD is higher than 2 Amp.

Each button pressing changes value by one. Keeping button pressed for period longer than 1 sec causes value to change fast (10 times per second or more) while button is still pressed.

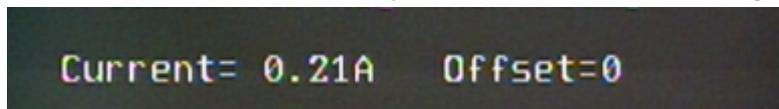
Note: For Pitlab sensors zero offset should be close to 0 (small positive or negative value). For unidirectional Hall sensors sensor zero offset may be 500 or more. For bidirectional Hall sensors zero offset may be bigger than 2000.

Only after proper zero offset calibration, next step (sensitivity calibration) can be successfully performed.

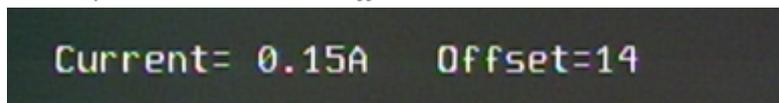
Note: when sensor is already calibrated, and only small correction is intended to apply in sensor sensitivity (step 2), just accept existing offset by pressing Enter key

Example:

Ammeter shows current consumption 0.15A, but OSD shows higher current (0.21A):

A screenshot of an OSD screen with a black background and green text. It displays "Current= 0.21A" and "Offset=0".

Press Up button to increase Offset until OSD will show current closest to ammeter:

A screenshot of an OSD screen with a black background and green text. It displays "Current= 0.15A" and "Offset=14".

Step2: sensitivity

To calibrate **sensitivity** set throttle up (start engine) to produce current consumption bigger than 5A. Set proper ammeter range to get reliable measurement. If current shown on OSD screen is lower than 5A there will be exclamation mark shown after "Current=x.xxA" message.

Note: Almost all cheap Chinese volt/ammeters with nominal "10A" range can handle 20A current for short period of time (1-2 minutes), except original connection wires, which are made from very thin copper wires and usually cannot handle more than 5A-7A. It is highly recommended to replace original wires with thicker ones (e.g. AWG16).

Use (press) **Up** or **Down** button on keyboard to change sensitivity and set current on OSD screen equal (or as close as possible) to current shown on ammeter. Accept settings by pressing **Enter** button.

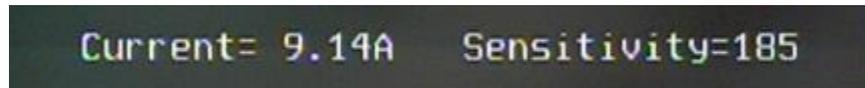
Note: In step 2 Enter button is active also when current shown by OSD is less than 5 Amp. This allows "blind change" of sensitivity and micro adjustment of sensor sensitivity without ammeter measurements.

Each button pressing changes value by one. Keeping button pressed for period longer than 1 sec causes value to change fast (10 times per second or more) while button is pressed.

Note: For Pitlab sensors sensitivity should be positive value close to 5 times sensor current range (value 250 for 50A sensor range). For other (Hall) sensors sensor sensitivity may be in range between -1000 and +700.

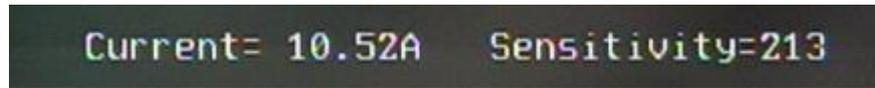
Example:

Ammeter shows current consumption 10.5A, but OSD shows lower current (9.14A):



Current= 9.14A Sensitivity=185

Press Up button to increase Sensitivity until OSD will show current closest to ammeter:



Current= 10.52A Sensitivity=213

Step3: micro adjustment of sensor parameters

After flights (or after longer period of time or significant temperature change) OSD may show capacity discharged from battery slightly different than capacity charged back to battery by charger.

In such case good idea is not perform full re-calibration of sensor with ammeter, but rather “blind change” of **sensitivity** calibration factor by small amount to adjust OSD discharge readings. Usually zero offset should be left unchanged and only sensitivity may be changed.

To perform micro adjustment cut down engine to minimize current drawn from battery and open OSD menu **Service->Current calibration**. In **step 1** just press enter to accept existing offset. In **step 2** (still with engine off) change sensitivity by small amount using **Up** or **Down** button:

-When OSD shows smaller discharge than charger, increase sensitivity factor by small amount (for bidirectional Hall sensor set bigger negative value).

-When OSD shows bigger discharge than charger, decrease sensitivity factor by small amount (for bidirectional Hall sensor set smaller negative value).

Note: For Pitlab sensors there is usually no need to recalibrate or adjust zero offset, but for Hall sensors it may be necessary to check and re-calibrate zero offset. In this case please perform full Step 1 with ammeter connected in series with battery. Zero offset should be re-calibrated when in normal flight discharge is roughly OK, but for long flights (e.g. in thermals, with long flight time without engine), OSD discharge readings significantly vary from charger readings.

Example:

After flight OSD shows 2500 mAh discharge, but charger shows 2600mAh charge (4% more than OSD).

With 3-button key open OSD menu Service->Calibrate current, in Step 1 accept existing offset without change, and in step 2 check current sensitivity value on OSD screen:

Current =x.xx A Sensitivity=200.

Press Up button to increase Sensitivity by 4%: $200 * 4\% = 12$. Set Sensitivity to $200 + 12 = 212$

Current =x.xx A Sensitivity=212.

Accept new calibration by pressing Enter button.

Theory of operation: Sensor types and characteristics

OSD cannot measure high currents directly. It uses external current sensor which converts current into proportional voltage measured by OSD. Universal calibration routines allows to use different sensor range as well as different sensor type.

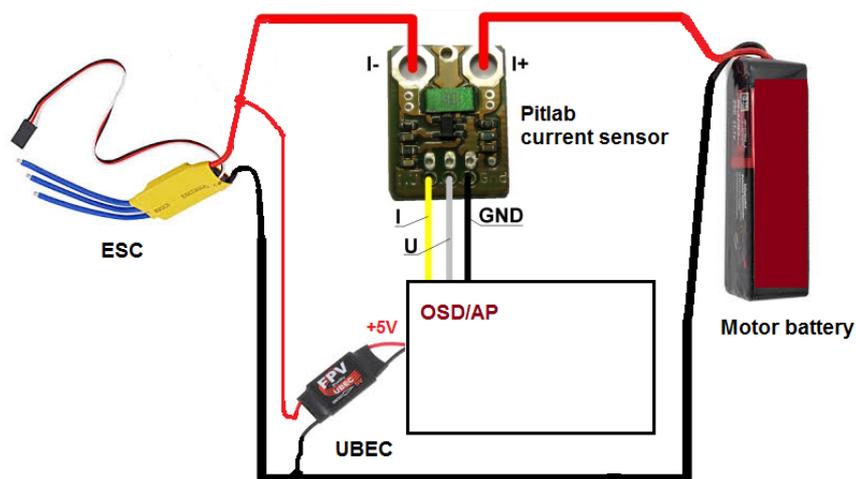
Current sensor is dedicated to measure current and capacity drawn from motor battery. There is no option for current/capacity measurement for OSD battery. Only when OSD/Camera/Video transmitter are powered from this same battery as engine (usually directly from 3S LiPo battery or from high voltage battery through dedicated 12V switching power supply), system can measure total current consumption when OSD system is connected on positive supply wire after current sensor.

Most sensors are powered from +5V supply and generates +5V output for full range current flow. Most modern systems accepts maximum +3,3V signal from sensor, which also limits maximum current properly measured by system. For example 100A sensor with +5V output may be used up to 66A for 3,3V systems ($100A * 3,3/5 = 66A$). This same apply for Pitlab sensors. Please carefully read sensor description when selecting proper sensor for airplane.

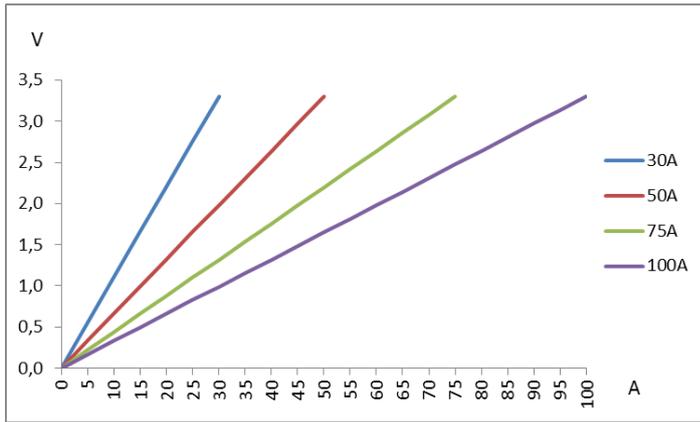
It is good idea to buy sensor capable of handling 20-30% more current than actual maximum motor current consumption. On the other hand sensors with too big range may produce less accurate measurement results for smaller currents.

Pitlab sensor

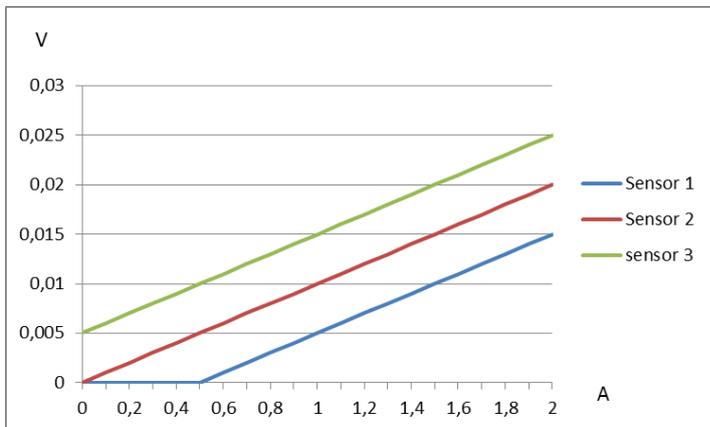
This is most popular (and default) sensor, which measures current flow on positive (+) battery wire. This sensor is unidirectional (measures current only with one direction), with nominal zero-voltage offset at no current, and positive sensitivity slope. This sensor uses small resistor and Ohm law to measure current. It introduces small (approx. 0.1V) voltage drop on sensor at maximum current load. This sensor produces also some heat at full load.



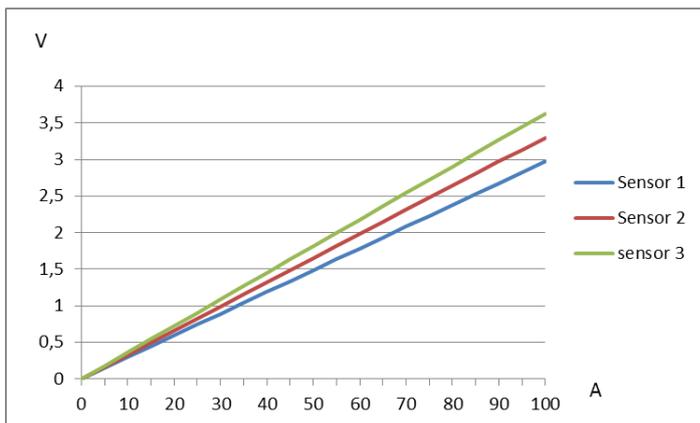
Note: Current sensor sold with system kit is factory calibrated and works properly out of the box. Additional/replacement sensors bought separately needs to be calibrated, even when they have this same range as factory calibrated sensor from kit (due to technology tolerance of sensor components). Hall sensors or sensor from other producers always require full calibration procedure before use.



Picture 2 Different sensitivity for different range Pitlab sensors



Picture 3 different zero offset for similar range Pitlab sensors

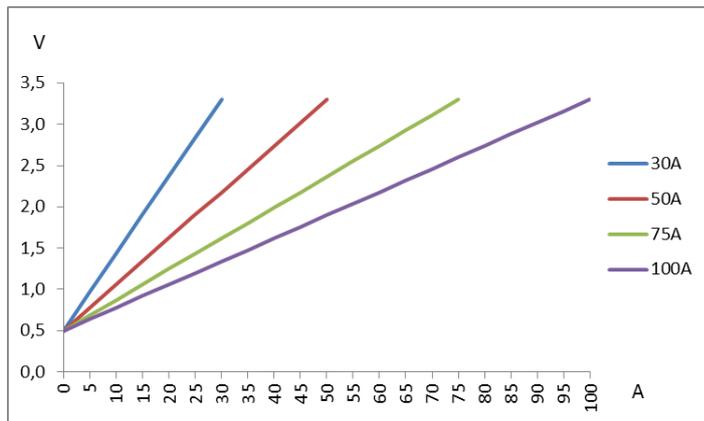


Picture 4 Different sensitivity (slope) for similar range sensors

Unidirectional Hall sensor

Unidirectional Hall sensor (e.g. based on ACS chip) uses magnetic field to measure current. This type of sensor do not introduce voltage drop on power line and do not produce heat at full load. This is

very good alternative for very high current measurement. This type of sensors has significant zero offset output voltage (typically 0.5V for ACS sensors), and positive sensitivity slope

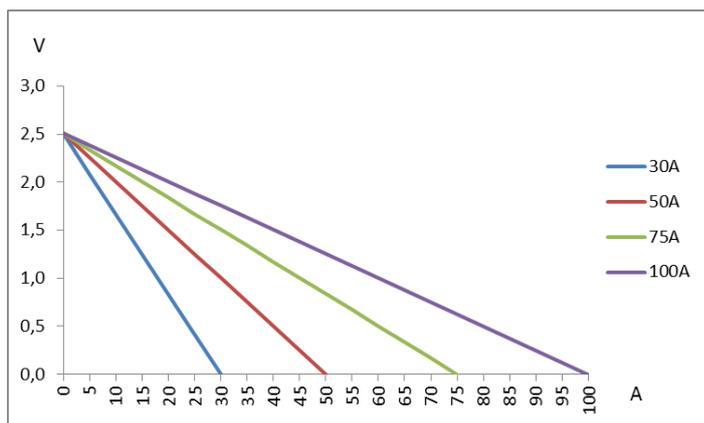


Picture 5 Unidirectional Hall sensor offset and sensitivity (for different sensor range)

This type of sensors require full calibration before use. This relatively high zero offset may change (drift) with temperature and time, so it is recommended to check zero offset when external temperature changes significantly.

Bidirectional Hall sensor

Bidirectional Hall sensor (e.g. based on ACS chip) uses magnetic field to measure current. This type of sensor do not introduce voltage drop on power line and do not produce heat at full load. This is very good alternative for very high current measurement. This type of sensors has zero offset output voltage equal half power supply (typically 2.5V for ACS sensors). Although sensor itself can measure current bi-directionally, when used in FPV system it measures current in one direction using negative slope. This kind of sensors are less convenient to use (due to very high zero offset and lower output range), but some types of bidirectional sensors has extremely high current range (>100A).



Picture 6 Bidirectional Hall sensor offset and sensitivity (for different sensor range)

This type of sensors works on negative slope and need negative sensitivity calibration factor.