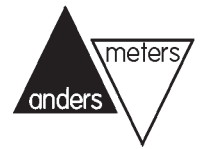


# Battery application circuits using mini meter indicators



## Example 1

6V battery voltage indicator using SP11 minimeter

SP11 Specification

Fullscale current = 1mA

Coil resistance = 345 Ohms

The current flowing in the whole circuit at 6V must be 1mA to give a full scale reading on the meter.

$$\text{Total circuit Resistance} \quad R_t = \frac{\text{Circuit voltage}}{\text{Circuit current}}$$

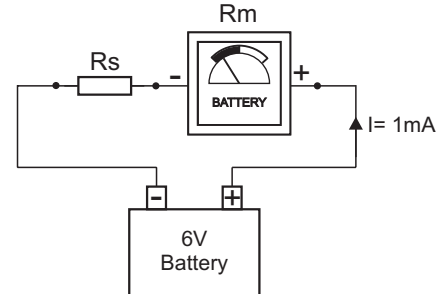
$$R_t = \frac{6V}{1mA} = 6000 \text{ Ohms}$$

But  $R_t = R_s + R_m$

Where  $R_m$  = meter resistance and  $R_s$ =series resistance therefore the series resistance  $R_s$  is found by:-

$$R_s = R_t - R_m = 6000 - 345 = 5655 \text{ Ohms}$$

A standard resistor value available (preferred value) is 5K6 Ohms



## Example 2

9 to 15VDC battery indicator using SP11 minimeter

SP11 Specification

Fullscale current = 1mA

Coil resistance = 345 Ohms

To create the zero scale reading at 9V use a temperature stabilised 9V zener diode (Standard value is 9.1V) in series with the meter as shown.

The voltage across the meter and series resistor becomes:-

$$V_s = V_t - V_z \\ 15V - 9.1V = 5.9V$$

The current flowing in this circuit at 5.9V must be 1mA to give a full scale reading on the meter.

$$\text{Total circuit Resistance} \quad R_t = \frac{\text{Circuit voltage}}{\text{Circuit current}}$$

$$R_t = \frac{5.9V}{1mA} = 5.9 \text{ KOhms}$$

The total circuit resistance (ignoring the the small resistance of the zener diode) is :-

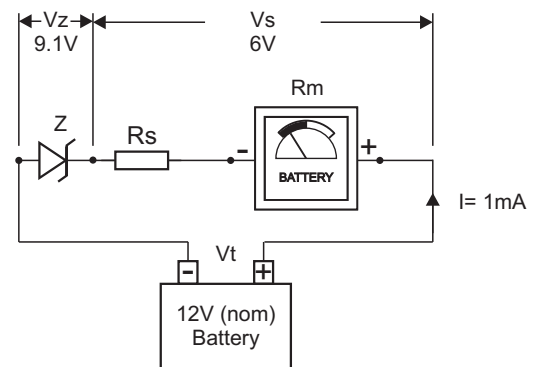
$$R_t = R_s + R_m$$

Where  $R_m$  = meter resistance and  $R_s$  = series resistance.

Therefore the series resistance  $R_s$  is found by:-

$$R_s = R_t - R_m = 5900 - 345 = 5555 \text{ Ohms}$$

In this case the meter resistance is small compared to the series resistance so a 5K6 Ohm resistor could be used. For higher accuracy, use a 5K resistor in series with a 1K Ohm variable resistor (Pot) and calibrate the meter circuit against a known voltage input.



### Example 3

9 to 15VDC battery indicator using R365BT minimeter

R365BT Specification  
 Fullscale current = 250µA  
 Coil resistance = 650 Ohms

To create the zero scale reading at 9V use a temperature stabilised 9V zener diode (Standard value is 9.1V) in series with the meter as shown.

However, in this case, 250µA may not be enough to drive the diode sufficiently to maintain 9.1V and the meter could appear non-linear. Hence the need for a higher current circuit as shown. Chose a current limit within the normal operating range of the zener diode. In this case 1mA.

The voltage across the meter (and shunt) resistor becomes:-

$$\begin{aligned} V_m &= I_m \times R_m \\ &= 250\mu\text{A} \times 650 \text{ Ohms} \\ &= 0.163 \text{ V} \end{aligned}$$

If the current flowing in the whole circuit at 15V must be 1mA (1000µA) then the current in the shunt resistor Rsh must be

$$I_{sh} = I_t - I_m = 1000 - 250 = 750 \mu\text{A}$$

The shunt resistor value Rsh is then found by :-

$$R_{sh} = \frac{V_m}{I_{sh}} = \frac{0.163\text{V}}{750\mu\text{A}} = 217 \text{ Ohms (Use 220R)}$$

The voltage across the circuit series resistor Rs will be :-

$$\begin{aligned} V_s &= V_t - V_z - V_m \\ &= 15 - 9.1 - 0.163 \\ &= 5.74\text{V} \end{aligned}$$

Hence the resistance of Rs will be

$$R_s = \frac{V_s}{I_t} = \frac{5.74\text{V}}{1\text{mA}} = 5.74\text{KOhms}$$

Use a 5K6 Ohm resistor

If calibration is required use a 5K1 Ohm resistor in series with a 1K Ohm variable resistor for calibration.

