Application Note

Title: Current sensing with an APM-AMP meter
Date: 5th September 2014
Revision: 1st

1.   Introduction:

The APM-AMP meter can measure both AC and DC currents. The APM-AMP meter performs automatic AC/DC detection. All AC currents are automatically converted to true RMS.
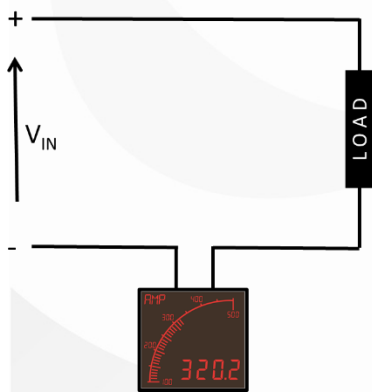
The APM-AMP meter can be connected in three different configurations:
1) Direct measurement

2) Current measurement using an external current transformer (CT)
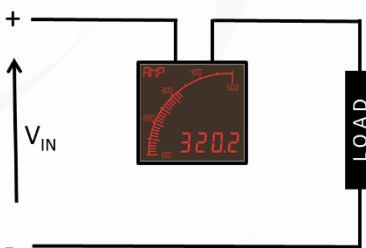
3) Current measurement using an external current shunt

The following sections discuss each configuration in more detail.
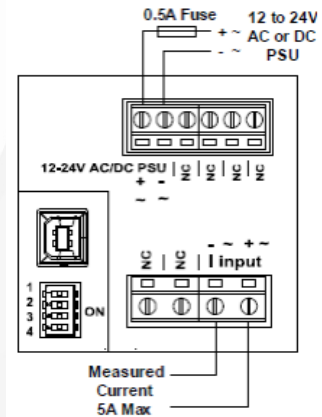
2.   Direct measurement

The APM-AMP meter is connected in series with the load as shown below. The meter can be connected on either the high side or low side of the load as shown below.
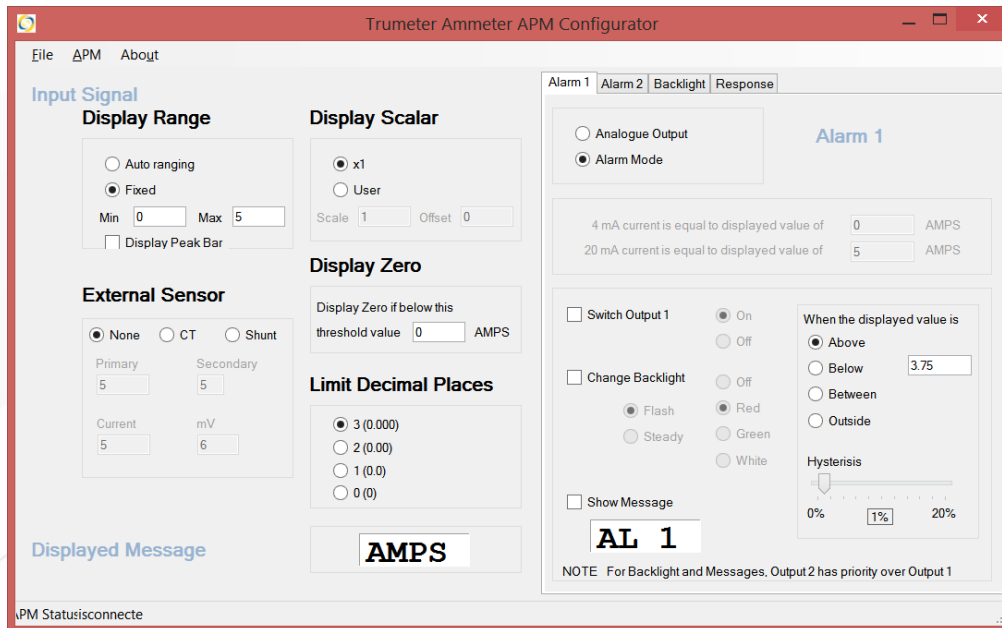

Low side   **High side**   **APM-AMP connections**
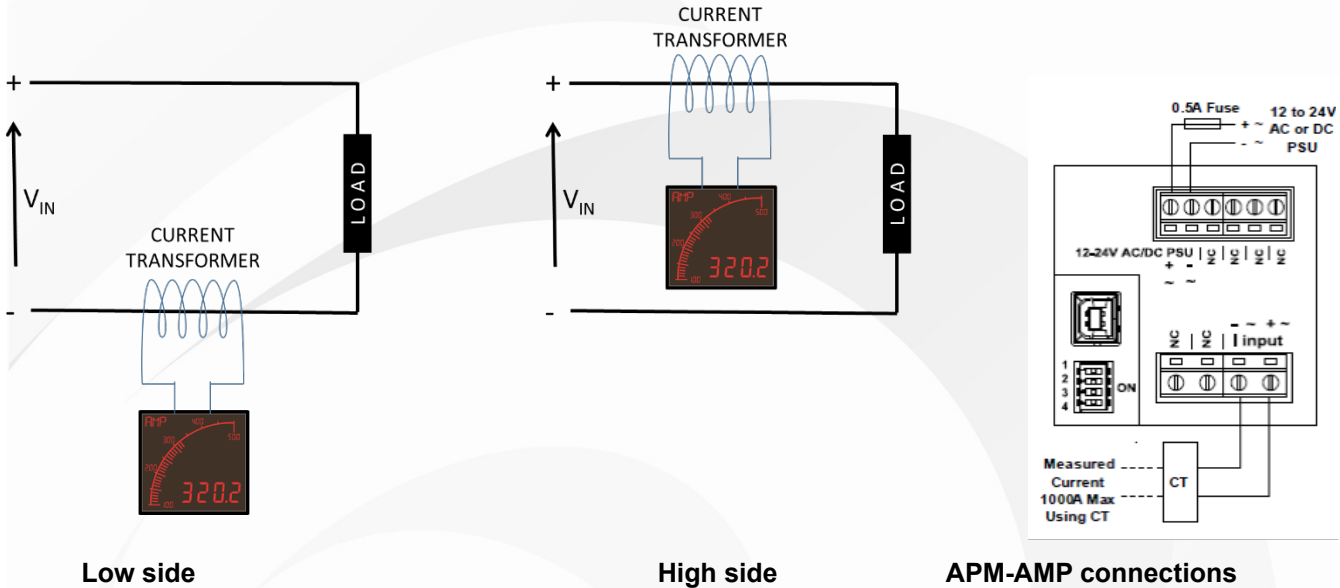
NOTE: The APM-AMP meter is rated for a maximum input current of 5A and must never be directly connected directly to a mains circuit. Applying currents in excess of 5A can permanently damage the meter.
In the APM Configurator application make sure that the external sensor is set to none.

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Make sure that the switches on the back of the APM-AMP meter are all switched off (i.e. switched to the left)

3. Current measurement using an external current transformer (CT)

The APM-AMP meter is connected to an external current transformer as shown below. The CT can be placed on either the high side or low side of the load as shown below:


| Low side | High side | APM-AMP connections |

In the APM Configurator application make sure that the external sensor is set to 'CT' and then enter the primary and secondary currents of the CT that you are using. The APM-AMP meter will then automatically scale its display accordingly.
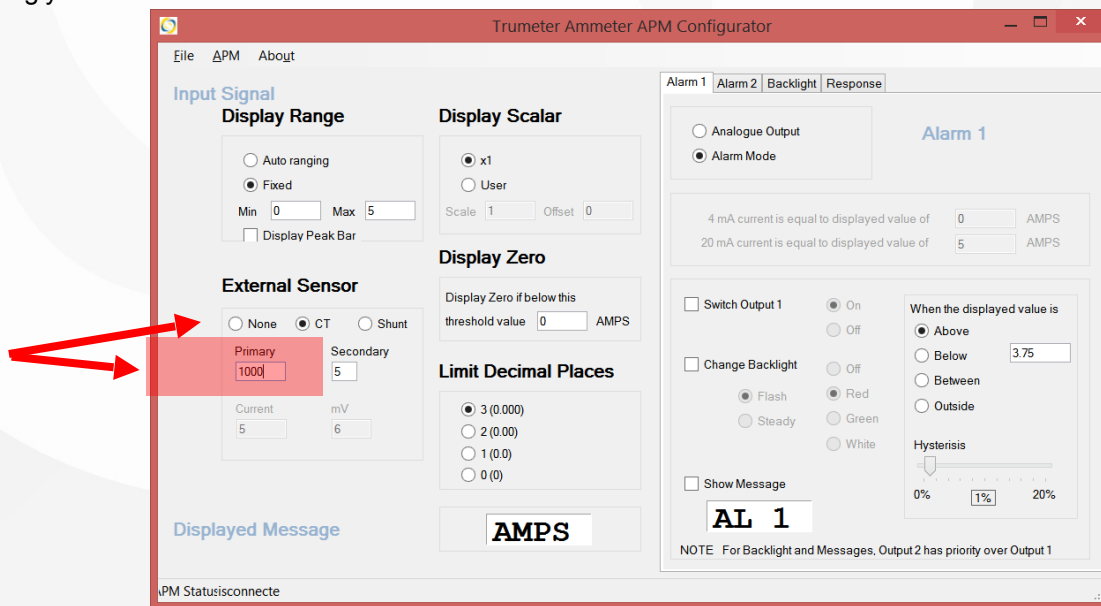

Make sure that the switches on the back of the APM-AMP meter are all switched off (i.e. switched to the left)
NOTE: The APM-AMP meter is rated for a maximum input current of 5A. Please select your CT to ensure that the secondary (output) current never exceeds 5A. Applying currents in excess of 5A can permanently damage the meter.

4. Current measurement using an external current shunt

The APM-AMP meter is connected to an external current shunt as shown below. The shunt can be placed on either the high side or low side of the load as shown below:

| Low side | High side | APM-AMP connections |
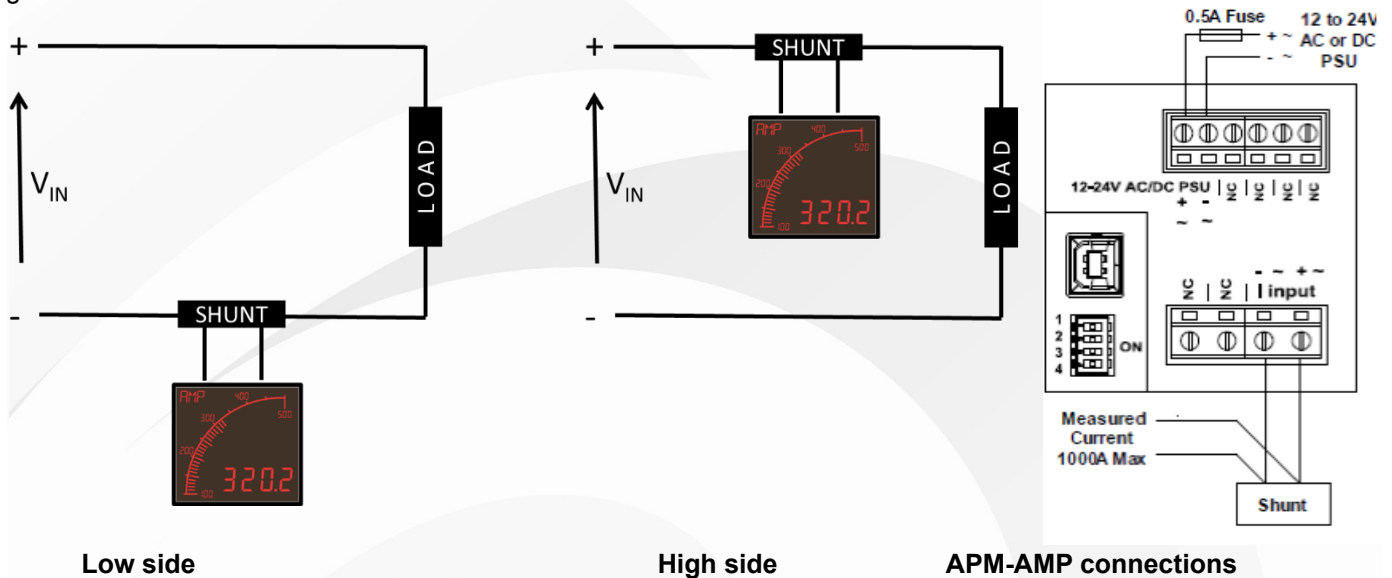
In this configuration the meter and the current shunt form a current divider. A proportion of the total current (I_{TOTAL}) flows though the current shunt (I_{SHUNT}) with the remainder flowing through the meter (I_{METER}).
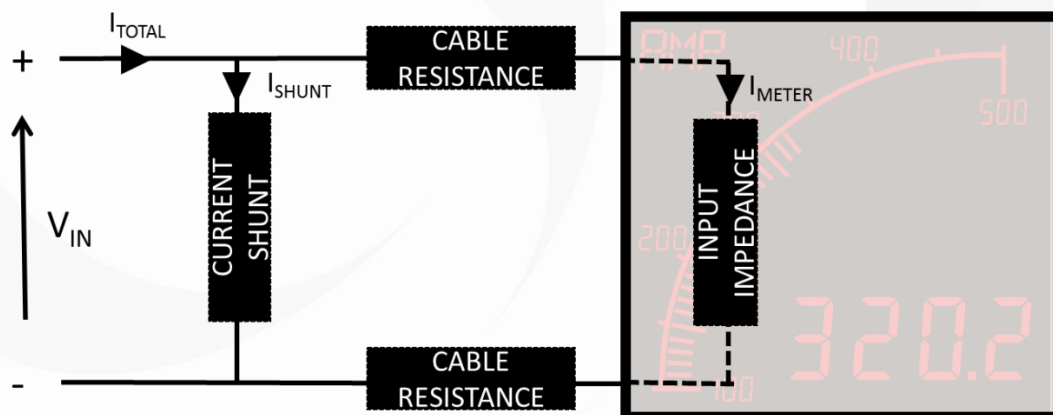
The proportion of current that flows through the meter is:

$$\frac{I_{SHUNT}}{I_{METER}} = \frac{R_{SHUNT}}{R_{SHUNT} + R_{METER} + R_{CABLE}}$$

The table below summarizes typical cable resistances for various cable sizes.

Cable AWG	Conductor Diameter (Inches)	Conductor Diameter (mm)	Resistance per foot (ohms)	Resistance per meter (ohms)
10	0.102	2.588	0.001	0.003
11	0.091	2.304	0.001	0.004
12	0.081	2.052	0.002	0.005
13	0.072	1.829	0.002	0.007
14	0.064	1.628	0.003	0.008
15	0.057	1.450	0.003	0.010
16	0.051	1.290	0.004	0.013
17	0.045	1.151	0.005	0.017
18	0.040	1.024	0.006	0.021
19	0.036	0.912	0.008	0.026
20	0.032	0.813	0.010	0.033
21	0.029	0.724	0.013	0.042
22	0.025	0.645	0.016	0.053
23	0.023	0.574	0.020	0.067

The APM-AMP meter is compatible with a wide range of current shunts. The table below summarizes some of the options and assumes that you have a total cable resistance of 0.021Ω (3 feet of 18AWG cable). Please select your current shunt to ensure that the current going through the meter (I_{METER}) never exceeds 5A.

SHUNT		CURRENT DIVIDER			I_{SHUNT}	I_{METER}
Current	mV	R_{SHUNT} (ohm)	R_{CABLE} (ohm)	R_{METER} (ohm)	shunt current	meter current
5	100	0.02	0.021	0.002	2.67	2.33
10	50	0.005	0.021	0.002	8.21	1.79
20	75	0.00375	0.021	0.002	17.20	2.80
50	50	0.001	0.021	0.002	47.92	2.08
100	75	0.00075	0.021	0.002	96.84	3.16
200	100	0.0005	0.021	0.002	195.74	4.26
1000	50	0.00005	0.021	0.002	997.83	2.17
1000	100	0.0001	0.021	0.002	995.67	4.33

In the APM Configurator application make sure that the external sensor is set to 'Shunt' and then enter the rated current and output voltage of the shunt that you are using. Due to differences in cable resistance and shunts you will now need to calibrate the APM-AMP. Use a calibrated meter to measure the current and then under display scalar adjust the scale until both meters read the same value.
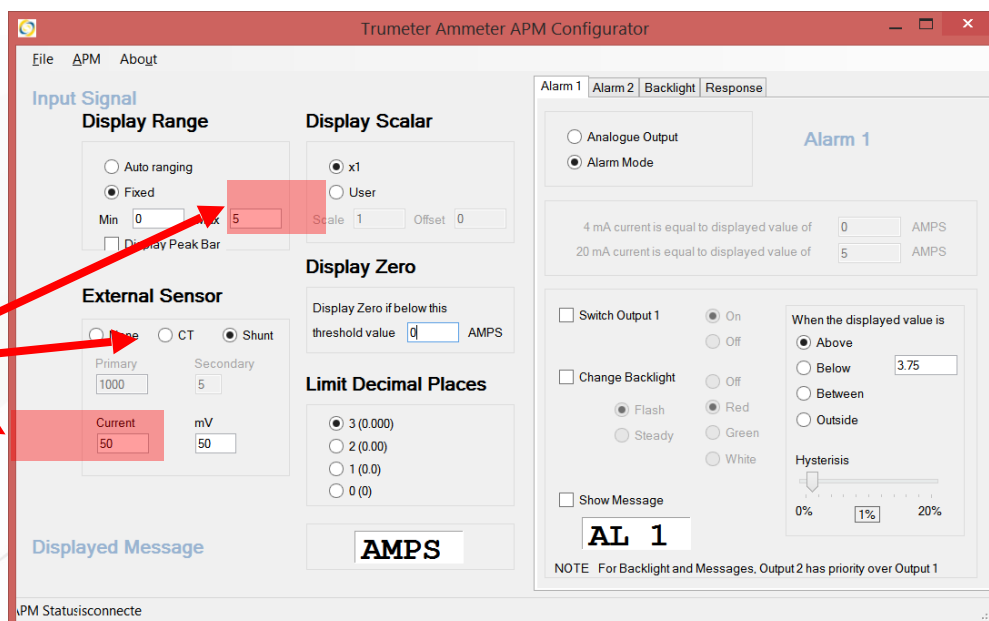
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Make sure that the switches on the back of the APM-AMP meter are all switched off (i.e. switched to the left)

NOTE: The APM-AMP meter is rated for a maximum input current of 5A and must never be directly connected directly to a mains circuit. Please select your current shunt to ensure that the maximum current flowing through the meter (I_{METER}) can never exceeds 5A. Applying currents in excess of 5A can permanently damage the meter.

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