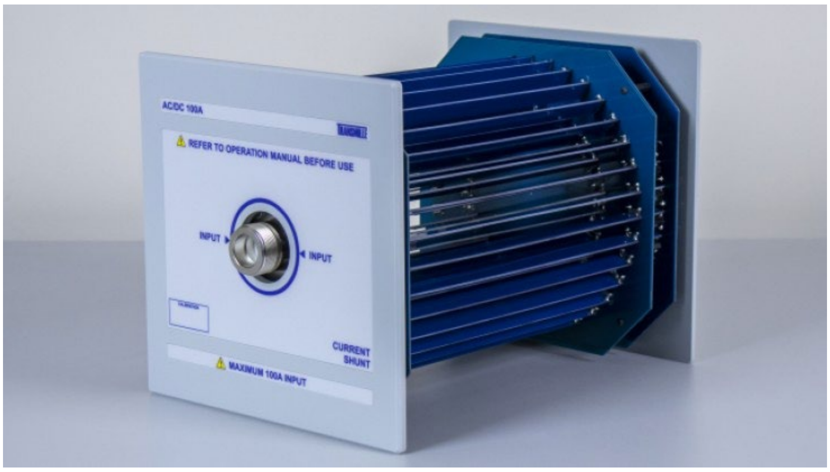
Introduction

Transmille precision coaxial AC/DC current shunts enable measurement of current from 1mA through to 100A. Each shunt develops 0.7V at nominal full scale, enabling a wide range of multimeters to be used without loss of resolution due to changing range.



Coaxial Shunt

Buffer Box

The AC/DC current shunts provide excellent DC value stability, but also a wide range in frequency allowing measurements from DC up to and beyond 30kHz. The coaxial design of these shunts reduce inductive and capacitive effects, while an open design improves heat dissipation to minimize power co-efficients.

The coaxial design offers superior accuracy and low electromagnet influences, ensuring a liner and predictable frequency response. Each shunt has a type N output connector to ensure low noise when measuring at high frequencies providing easy connections from the shunt to the measuring device.

The set of AC/DC current shunts has been designed to enable fast and efficient calibration of multiproduct calibrators and current sources under a laboratory environment. Using the AC/DC current shunts in conjunction with an 8000 series multimeter the 3000A, 4000 and 9000A multiproduct calibrators can be efficiently maintained internally, as well as supporting other manufacturers products.

- **AC/DC differences from 1PPM**
- **Superior accuracy compared to Wilkinson standard AC/DC resistors, minimising the use of correction factors for frequency response**
- **Shunt values for measurements between 1mA to 100A**
- **From DC to 30Khz & above**
- **Low inductance & capacitance flat frequency response**
- **Simplifies precision calibration of calibrators and current sources**
- **Can be used with a precision multimeter, or an AC measurement standard**

Transmille offer a total of 14 high precision shunts each with an output value of 0.7V against nominal input. These shunts come in various input values between 1ma up to 100A.

Electrical Specifications

Resistance

Shunt Nominal Current	Nominal Resistance (ohms)	Maximum deviation from nominal (± uΩ/Ω) [1]	Maximum deviation from nominal %	12-month stability (± PPM)	Temperature Coefficent (± ppm /°C
1 mA	714	0.714 Ω	0.1	20	2
10 mA	71.4	0.0714 Ω	0.1	20	2
20 mA	35	0.035 Ω	0.1	20	2
50 mA	14	0.014 Ω	0.1	20	2
100 mA	7.14	0.00714 Ω	0.1	20	2
200 mA	3.5	0.0035 Ω	0.1	20	2
500 mA	1.4	0.0014 Ω	0.1	20	2
1 A	0.714	714 uΩ	0.1	20	2
2 A	0.35	350 uΩ	0.1	20	2
5 A	0.14	140 uΩ	0.1	20	2
10 A	0.0714	17.4 uΩ	0.1	20	2
20 A	0.035	35 uΩ	0.1	20	2
50 A	0.014	70 uΩ	0.5	30	4
100 A	0.0071	35 uΩ	0.5	30	4

Maximum AC-DC Difference

Shunt Nominal Current	Maximum AC-DC Difference (± ppm) [1]					
	23 Hz	1KHz	5 KHz	10 KHz	30 KHz	100 KHz
1 mA	80	55	70	75	550	
10 mA	80	25	25	75	550	
20 mA	80	25	25	75	550	
50 mA	80	25	25	75	550	
100 mA	25	20	20	20	20	30
200 mA	25	20	20	20	25	25
500 mA	20	20	20	20	20	20
1 A	20	20	20	20	25	25
2 A	30	20	25	25	25	45
5 A	30	25	25	25	40	70
10 A	30	25	25	30	60	100
20 A	45	40	55	60	85	160
50 A	60	50	65	80	90	180
100 A	70	65	75	95	130	290

[1] Performance by design. There are no adjustments possible and physical damage will affect the AC-DC Difference permanently

Maximum Overload Current

Shunt Nominal Current	Maximum current [1] [2]	Maximum sustained current
1 mA	3 mA	2 mA
10 mA	13 mA	11 mA
20 mA	36 mA	22 mA
50 mA	65 mA	55 mA
100 mA	130 mA	110 mA
200 mA	360 mA	220 mA
500 mA	650 mA	550 mA
1 A	1.3 A	1.1 A
2 A	3.6 A	2.2 A
5 A	6.5 A	5.5 A
10 A	13 A	11 A
20 A	36 A	22 A
50 A	65 A	65 A
100 A	130 A	110A

[1] Longer than 7 seconds can cause permanent damage to the shunt. The output voltage during high levels of input of can significantly cause higher outputs.

[2] Exceeding the maximum sustained current may cause resistance value changes

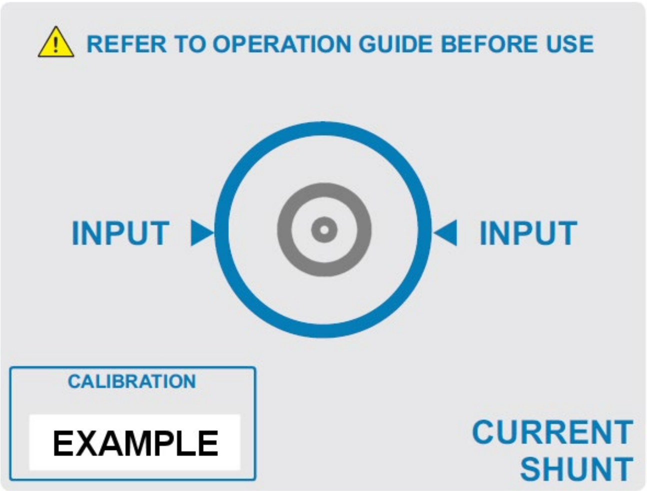
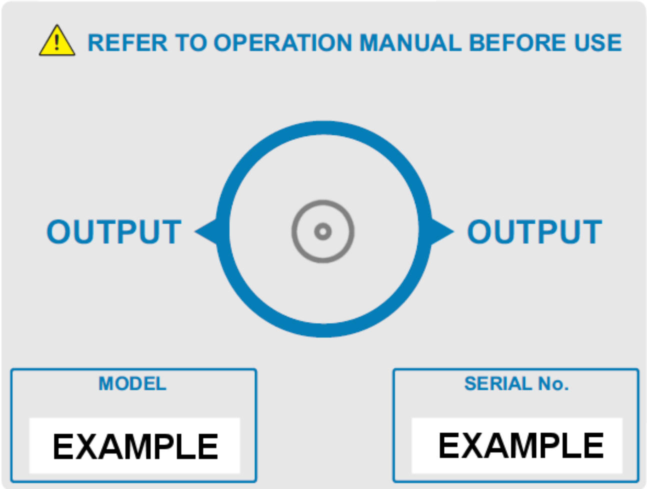
Mechanical Specifications

Dimensions

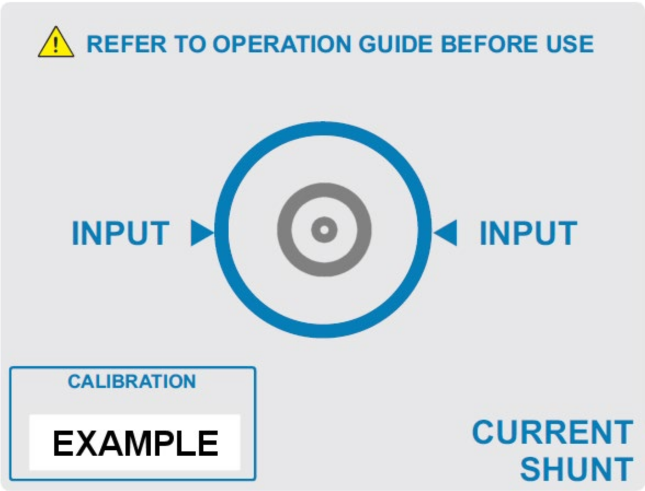
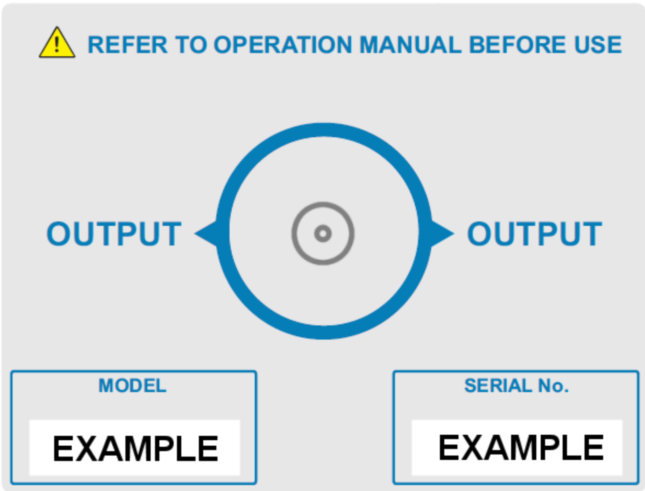
Shunt Value	Height mm	Width mm	Length mm	Weight
1 mA – 50 mA	65	65	110	0.2 Kg
100mA -2A	115	110	158	0.4 Kg
5A – 100 A	224	222	320	2.7 Kg

Input / Output Connections

Small Form Factor AC/DC Current Shunt

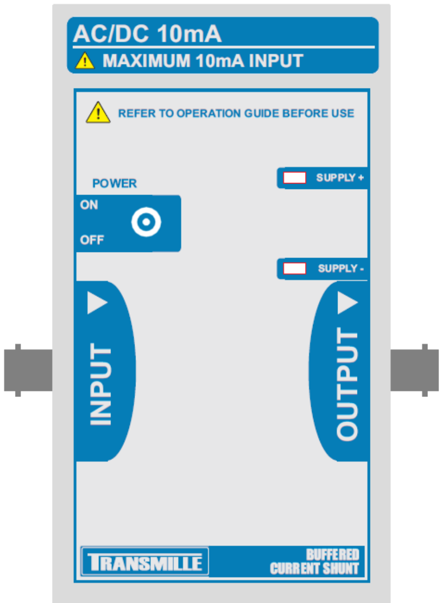
Size	**115mm x 110mm x 158mm**
Weight	**0.4kg**
Input Current Connection	**Type 'N' Connector**
	
Output Voltage connection	**BNC Connector**
	

Large Form Factor AC/DC Current Shunt

Size	**224mm x 222mm x 320mm**
Weight	**2.7kg**
Input Current Connection	**Up to 10A : Type 'N' Connector** **20A, 50A & 100A : LC Connector**
	
Output Voltage connection	**BNC Connector**
	

Battery Powered Buffered AC/DC Current Shunt

Size	**65mm x 65mm x 110mm**
Weight	**0.2kg**
Controls	**On / Off Switch**
Indicators	**Supply + : Supply – LED Indicators**
Internal Power	**2x 9V replaceable / non rechargeable PP3 Type**
Input Current Connection	**BNC Connector**
Output Voltage connection	**BNC Connector**



Operational Considerations

- **Avoid exceeding the maximum current rating of a shunt as this may cause tracks on the PCB (printed circuit board) to be damaged**
- **Check casing, PCB and terminals for any signs of damage or missing / broken material before use**
- **Take care not to damage shunts by operating beyond their specifications**
- **Use suitable test leads rated for the measurements being taken.**
- **Do not use test leads with any signs of damage – check test leads if necessary.**
- **High Voltages are NOT generated across the shunt unless excess current applied (even at 100A the voltage developed across the shunt is < 1V RMS**
- **High Current shunts will become warm during use, especially input connectors. Allow shunts to cool before handling**
- **Connects to shunts should be finger tight only. Using tools to tighten BNC, Type N or Type LC connectors could damage the shunt connectors, which are non replaceable.**
- **The shunts contain no user serviceable parts – refer servicing to qualified service personnel.**
- **Only use shunts in dry non-combustible environments**

Operational Overview

Warning

Ensure all equipment is powered off before connecting shunt to circuit.
Always connect the shunt in series with the circuit.

Before and during using the precision shunts, refer the specifications and ensure any maximum capabilities are not exceeded at any time.

Current Measurement Overview

1: Check the circuit being tested and determine :

- **Current in circuit**
- **Frequency of current in circuit**

2. Select a current shunt suitable for the current level as measured in circuit

3. Remove power from circuit before connecting shunt and connect shunt in circuit ready to use
Note : If using a buffered current shunt, ensure it is switched on before use.

4. Energise circuit when connection has been verified and measure voltage output from shunt

5. Use the voltage measurement to calculate current flowing in the circuit.

Use of Buffered Current Shunts

The buffered shunts (1mA, 10mA, 20mA and 50mA) contain a buffer circuit to minimise the effects of loading from low impedance measurement devices such as TVC's which draw a lot of current and will affect the effective resistance of the shunt.

For example, the impedance of the 1mA Shunt is 714 Ohms, and the typical impedance of a Multimeter on the 1V AC range is 1 MOhm. A Parallel resistance calculation results in an error of approximately 0.07%, far exceeding both the resistance error of the shunt as well as the AC/DC Difference

To minimise the loading error, the buffer circuit creates a high impedance buffer between the shunt and the measuring device.

To have a wide frequency range and high current drive for driving TVC's, there is an inherent trade off with both the frequency response at higher frequencies as well as the DC offset of the buffer circuit.

When using the buffered current shunts for DC Measurements, the measurement device should be connected with the shunt powered on with no current input connected and the DC Offset nulled out prior to use.

If using a TVC to perform the measurement, both positive and negative polarities should be measured prior to comparing against the unknown AC Current.

As the buffered shunts are active devices unlike the passive shunts, the shunts should be powered up for 10 minutes prior to use to allow the active circuitry to stabilise to operating temperature and minimise any warmup drift.

The charge state of the batteries are indicated by two LED's on the top of the case, and the batteries should be changed when these LED's are not lit.

Changing the batteries has no affect upon the calibration of the unit