



# PRECISION AC/DC SHUNTS

## THE BEST IN AC SHUNT PERFORMANCE WITH OUR 7340 VOLTAGE BASED AND 7350 POWER BASED SHUNTS

High Stability, Precision Voltage or Power Rated AC/DC Current Calibration Standards



**GUILDLINE INSTRUMENTS** provides two series of the best performing, most compact, wide-band AC current shunts that are commercially available. Each AC Shunt Series provides unique design features that allow customers to select the AC Shunt most appropriate for their measurement application.

**PROVIDING TWO SERIES FOR AC CURRENT SHUNTS, THE 7350 POWER BASED SERIES AND THE 7340 VOLTAGE BASED SERIES. BOTH SERIES PROVIDE FOR PRECISION AC CURRENT MEASUREMENTS TO 100 A AND A WIDE 100 KHZ FREQUENCY BANDWIDTH!**

### FEATURES

- High Current Values to 100 A
- AC/DC Difference Essentially Zero at Power Frequencies, and < 10 ppm up to 10 kHz
- Phase Displacement typically 5 to 10X Better than nearest competitor from 10 kHz to 100 kHz
- Widest Available Bandwidth DC to 100 kHz
- Stable up to 2 MHz
- Excellent 1-Year Stabilities
- Low Temperature Coefficients 2.5 ppm/°C
- Both Series Provide a 4-Wire, True Non-Inductive Patented Design
- 7340 Series Provides 12 Current Values from 1 mA to 100 A with Output Voltages from 0.2 to 1.0 V
- 7350 Series Provides 6 Ohmic Values with Currents from 0.1 A to 25 A with Power up to 10 Watts
- Ruggedized EMI Shielded Enclosure
- Designed for Ease of Use and Complete Operational Safety

The 7340 and 7350 Series of four-terminal AC Current Shunts are highly accurate and stable devices designed for precise current measurements in various applications. They offer low uncertainty, minimal temperature coefficients, and negligible reactance, ensuring reliable performance.

The 7340 Series comprises 12 models, delivering output voltages between 0.2 and 1.0 Volt across a current range from 1 mA to 100 A. Additionally, an optional forced convection unit (model 73401) aids cooling for currents above 3 A. On the other hand, the 7350 Series features 6 models, capable of dissipating up to 10 Watts with current capacities from 0.1 A to 25 A and frequencies reaching 100 kHz, remaining stable up to 2 MHz.

These shunts excel in applications requiring measurement of phase relationships between currents or voltages, with phase angle displacement typically better than 4 mDeg (<70  $\mu$ rad) at 10 A. Furthermore, the lower-value shunts (below 10  $\Omega$ ) can serve as burdens for current transformers, facilitating measurement of higher currents. Their compact size, precise engineering, and EMI shielding make them stand out in the field.

# Precision AC Shunts

## 7340 Series (VOLTAGE BASED):

The 7340 Series encompasses 12 models offering current measurements ranging from 1 mA to 100 A, suitable for various AC/DC current measurement applications. Featuring a nominal impedance range from 100  $\Omega$  to 0.004  $\Omega$ , these shunts are versatile across different current levels. They maintain a frequency bandwidth of 100 kHz with stability extending up to 2 MHz, ensuring accurate measurements even at high frequencies. For low currents, a buffer amplifier enhances precision.



The output (Voltage) connector on the front face of all models within both series is a BNC type for connection to the potential measuring device. UHF Type connectors are provided for currents up to 25 A on the back face of the shunt and LC type connectors are provided for current ranges above 25 A. The shunts exhibit minimal phase shift, enabling accurate high-frequency power measurements, and faithfully reproduce current waveforms even under distorted or pulsed conditions. They excel in examining complex current waveforms, surpassing other commercially available AC shunts in performance.

Additionally, these shunts find application not only in precision AC current measurements but also in AC power and energy measurements using watt-meters or watt-hour meters. Their efficacy extends to classical measurement, standards, or calibration laboratory applications, making them a versatile choice across various fields.



## 7350 Series (POWER BASED):



The 7350 Series of four-terminal AC Current Shunts serve as a high-performance replacement for the Guildline 7320 series, offering lower uncertainty and enhanced stability. Featuring a patented non-inductive design, these shunts maintain a purely resistive nature, housed within a ruggedized and shielded enclosure to minimize reactance. Like the 7340 models, the output (Voltage) connector on the front face is a BNC type connector. UHF Type connectors are provided for currents up to 25 Amperes.

With a frequency range spanning from DC to 100 kHz and stability extended up to 2 MHz, the 7350 Series ensures high accuracy, low temperature coefficients, and excellent stability. Capable of dissipating up to 10 Watts of power and handling maximum currents of 25 A, these shunts accommodate a wide range of applications. Nominal impedance ranges from 0.01  $\Omega$  to 1000  $\Omega$ , enabling diverse AC/DC current measurement scenarios.

Applications include precise AC current measurement, calibration of AC shunts and clamp-on meters, calibration of current ranges of multi-function calibrators, accurate readings with high accuracy DVMs and transconductance amplifiers. Moreover, they provide a traceable current signal using a traceable voltage standard across the DC to 100 kHz frequency range.

## AC Shunt Design and Specifications

The NMI measured values for 3 Guildline's 7340 Series AC Current Shunts reveal unparalleled performance in AC-DC transfers, positioning them as the top choice among commercial wideband AC Shunts. These results shown to the right, obtained from shunts utilized in customer laboratories over three years, underscore the exceptional quality, operational safety, ease of use, EMI protection, and ruggedized compact casing of Guildline's products. The expanded uncertainty listed in the previous calibration certificate is the actual uncertainty of the NMI that performed the calibration on these shunts.

For high currents, below are test results from two different NMI's that calibrated two different 7340-100 A Models. Note that you will see there can be a difference in NMI's expanded uncertainty and capabilities that have an impact on the AC-DC Transfer Uncertainty. That said, the results of these two 100 A models show the superior performance of Guildline's 7340 AC Shunts, even at currents up to 100 A with frequencies to 100 kHz.

Shunt 7340-1A		SN:		
input current	frequency	ac-dc transfer difference in $\mu\text{A/A}$	expanded uncertainty in $\mu\text{A/A}$	
1 A	100 Hz	0	4	
1 A	1 kHz	0	4	
1 A	10 kHz	0	4	
1 A	100 kHz	+12	10	

  

Shunt 7340-3A		SN:		
input current	frequency	ac-dc transfer difference in $\mu\text{A/A}$	expanded uncertainty in $\mu\text{A/A}$	
3 A	100 Hz	0	5	
3 A	1 kHz	0	5	
3 A	10 kHz	-1	5	
3 A	100 kHz	-32	20	

  

Shunt 7340-10A		SN:		
input current	frequency	ac-dc transfer difference in $\mu\text{A/A}$	expanded uncertainty in $\mu\text{A/A}$	
10 A	100 Hz	+1	20	
10 A	1 kHz	0	20	
10 A	10 kHz	-2	20	
10 A	100 kHz	-65	75	

Shunt 7340-100A				
input current	frequency	ac-dc transfer difference in $\mu\text{A/A}$	expanded uncertainty in $\mu\text{A/A}$	
100 A	100 Hz	-5	40	
100 A	1 kHz	0	40	
100 A	10 kHz	-40	40	
100 A	100 kHz	-249	160	

Guildline Model 7340-100 A					
Frequency Hz	AC-DC Difference ( $\mu\Omega/\Omega$ )		Expanded Uncertainty ( $\mu\Omega/\Omega$ )		
	50 A	85 A	Frequency Hz	50 A	85 A
100	-2	-2	100	28	28
1000	-5	-5	1000	28	28
10000	-17	-17	10000	28	25
50000	-27	-23	50000	33	30
100000	-99	-91	100000	39	39

Similarly, the 7350 Series maintains this level of performance, as evidenced by NMI results for the 7350-0.01 $\Omega$  Model tested at currents up to 30 A, 20% above the maximum recommended current. Even under such over-current conditions, the measurement performance remains excellent, further highlighting the reliability and versatility of Guildline's AC Current Shunts.

Frequency Hz	Model 7350-0.01 AC-DC Difference ( $\mu\Omega/\Omega$ )			
	15A	20A	25A	30A
50	1	0	0	1
100	0	-1	-1	-2
500	0	0	0	1
1000	0	-1	0	0
10000	-1	-3	-3	-3
50000	-50	-49	-47	-48
100000	-141	-139	-139	-143

# Precision AC Shunts

## AC Shunt Accessories

Guildline provides a complete line of accessories for the 7340 and 7350 Series. This includes adaptors required for calibration, gender changing and different types of connections. We can provide Forced Air Cooling Units, precision cables with different connectors, and even user specified connectors (if available). Please reference the AC Accessories Datasheet on our web site. Transit cases are also available to protect your investment. Contact Guildline with any question you have about accessories.



## Performance Specifications

There are 2 levels of performance specifications listed for the 7340 and the 7350 Series. The absolute specifications are based on the internal calibration capabilities from Guildline, and the calibration capabilities and uncertainties of a National Measurement Institute (NMI) which can provide low uncertainties for AC/DC Difference.

7340 SERIES (VOLTAGE BASED)		12 MONTH MAXIMUM AC-DC DIFFERENCE <sup>1</sup> (in ppm @ 23°C ± 2°C <50% RH)							
		National Measurement Institute (NMI) Verification				Guildline (Factory) Verification			
Model (Nominal Current)		1 kHz	10 kHz	30 kHz	100 kHz	1 kHz	10 kHz	30 kHz	100 kHz
7340-0.001A		± 15	± 50	± 60	± 150	± 25	± 75	± 90	± 200
7340-0.003A		± 15	± 30	± 40	± 130	± 25	± 50	± 60	± 175
7340-0.01A		± 10	± 10	± 20	± 80	± 25	± 25	± 50	± 100
7340-0.03A		± 10	± 10	± 15	± 40	± 25	± 25	± 45	± 60
7340-0.1A		± 10	± 10	± 10	± 25	± 25	± 25	± 30	± 35
7340-0.3A		± 10	± 10	± 10	± 20	± 25	± 25	± 30	± 35
7340-1A		± 10	± 10	± 10	± 20	± 25	± 30	± 30	± 35
7340-3A		± 10	± 15	± 20	± 50	± 25	± 30	± 30	± 70
7340-10A		± 25	± 30	± 45	± 100	± 30	± 40	± 70	± 140
7340-25A		± 35	± 40	± 60	± 140	± 35	± 60	± 80	± 160
7340-50A		± 35	± 40	± 60	± 150	± 35	± 80	± 80	± 180
7340-100A		± 40	± 60	± 110	± 250	± 40	± 100	± 140	± 300

Above uncertainties are stated at k=2 and include both relative uncertainties and complete measurement uncertainties.

7340 SERIES (VOLTAGE BASED)			GENERAL SPECIFICATIONS (@ 23°C ± 2°C <50% RH)				
MODEL (NOMINAL CURRENT)	CURRENT RANGE <sup>6</sup> (A)	NOMINAL RESISTANCE (Ω)	INITIAL TOLERANCE <sup>2</sup> (± ppm)	OUTPUT VOLTAGE RANGE (V)	DC STABILITY (± PPM)	COEFFICIENTS <sup>3</sup>	
						TEMPERATURE ± ppm/°C	POWER ± ppm/WATT
7340-0.001A	0.0003-0.001	1000	100	0.3 – 1	16	2.5	3
7340-0.003A	0.001-0.0033	300	100	0.3 – 1	16	2.5	3
7340-0.01 A	0.003 – 0.01	100	100	0.3 – 1	16	2.5	3
7340-0.03 A	0.01 – 0.033	30	100	0.3 – 1	16	3.5	3
7340-0.1 A	0.03 – 0.1	10	100	0.3 – 1	16	2.5	3
7340-0.3 A	0.1 – 0.33	3	100	0.3 – 1	16	3.5	3
7340-1 A	0.3 – 1	1	100	0.3 – 1	16	4.0	3
7340-3 A	1 – 3.3	0.3	100	0.3 – 1	16	4.0	4
7340-10 A	3 – 10	0.1	100	0.3 – 1	16	4.0	4.5
7340-25 A	10 – 25	0.03	100	0.3 – 0.75	16	4.5	5
7340-50 A	25 – 50	0.01	125	0.25 – 0.5	16	4.5	5.5
7340-100 A	50 – 100	0.004	150	0.20 – 0.4	16	4.5	6

# Precision AC Shunts

/7350 SERIES (POWER BASED)		12 MONTH MAXIMUM AC-DC DIFFERENCE <sup>1</sup> (in ppm @ 23 °C ± 2 °C <50% RH)							
		National Measurement Institute (NMI) Verification				Guildline (Factory) Verification			
Model (Nominal Resistance)		1 kHz	10 kHz	30 kHz	100 kHz	1 kHz	10 kHz	30 kHz	100 kHz
7350-0.01 Ω		± 35	± 40	± 60	± 150	± 50	±60	± 100	± 250
7350-0.1 Ω		± 25	± 30	± 45	± 100	± 40	±50	± 60	± 200
7350-1 Ω		± 20	± 20	± 35	± 50	± 30	±40	± 50	± 150
7350-10 Ω		± 20	± 20	± 40	± 140	± 30	±40	± 70	± 200
7350-100 Ω		± 40	± 100	± 400	± 1000	± 50	± 200	± 600	± 1600
7350-1000 Ω		± 45	± 200	± 800	± 4000	± 55	± 500	± 2000	± 6000

Above uncertainties are stated at k=2 and include both relative uncertainties and complete measurement uncertainties.

7350 SERIES (POWER BASED)			GENERAL SPECIFICATIONS (@ 23 °C ± 2 °C <50% RH)				
MODEL (NOMINAL RESISTANCE)	INITIAL TOLERANCE <sup>2</sup> ± ppm	DC STABILITY ± ppm	Maximum			COEFFICIENTS <sup>3,4</sup>	
			VOLTAGE (V)	CURRENT (A)	POWER (W)	TEMPERATURE ± ppm/°C	POWER ± ppm/WATT
7350-0.01 Ω	150	20	0.25	25	6.3	4	4.5
7350-0.1 Ω	125	20	1	10	10	3	4
7350-1 Ω	100	20	3.2	3.2	10	2.5	3.5
7350-10 Ω	100	20	10	1	10	2	3
7350-100 Ω	100	20	32	0.32	10	2	2
7350-1000 Ω	100	20	100	0.1	10	2	2

DIMENSIONS AND CONNECTORS								
Resistance Model	Width <sup>5</sup>		Diameter		Weight		Connector	
	inch	mm	inch	mm	lbs	kg	Output	Input
All 7350 Series Models	2.8	71.4	6.63	168.4	1.8	0.82	BNC Female	UHF Female
7340 Models 0.001 A to 1A	2.8	71.4	3.5	88.9	0.8	0.35	BNC Female	UHF Female
7340 Models 3 A to 25 A	2.8	71.4	6.63	168.4	1.8	0.82	BNC Female	UHF Female
7340 50 A & 100 A Models	3.8	115	6.63	168.4	2.6	1.2	BNC Female	LC Female

## Notes: All Specifications

Note 1: Calibrated in air at half scale and full scale to a maximum of 20 A; at 23 °C ± 2 °C; at DC, 1kHz, 10 kHz, 30 kHz and 100 kHz frequencies. For currents above 3 A there is an option to calibrate with the forced convection unit model 73401. Calibration of resistance and AC-DC Difference values are referred to the unit of resistance as maintained by a National Metrology Institute and are expressed as a total uncertainty with a coverage factor of k=2. AC-DC Difference is defined as the difference between a sinusoidal alternating current required for a given output.

Note 2: Initial Tolerance is defined as the maximum variation of resistance mean DC values as initially adjusted at the point of sale.

Note 3: Power coefficients are specified using the 73401 Forced Convection Unit for currents above 3A for the model 7340 Series.

Note 4: No Forced Air Unit is required with the 7350 Series. Shunts may be used up to maximum wattage with no cooling required.

Note 5: Width Size is case to case and does not include terminal size.

Note 6: Current shunts may be used at current levels below the specified range but with reduced output voltages.

## 7340 AND 7350 SERIES TYPICAL PHASE DISPLACEMENT

Input Current	1 kHz	20 kHz	100 kHz
1 mA – 300 mA	< 0.001 °	< 0.004 °	< 0.025 °
300 mA to 3A	< 0.002 °	< 0.008 °	< 0.050 °
3A to 25 A	< 0.004 °	< 0.010 °	< 0.060 °
25A to 100A	< 0.008 °	< 0.040 °	< 0.150 °

## ENVIRONMENTAL (APPLIES TO BOTH 7340 AND 7350 SERIES)

Operating	Temperature	Humidity	Storage	Temperature	Humidity
	18 °C to 28 °C	< 50% RH non-condensing		-20 °C to 60 °C	15% to 80% RH

Guildline Instruments provides an **industry leading two year warranty** on every 7340 and 7350 Shunt and on all associated accessories. We know that the **7340 and 7350 Shunts will work for you** out of the box and in the future... and we back it up.

## ORDERING INFORMATION

<b>7340-X</b> (X = Model Amperage)	7340 AC/DC Voltage Based Current Shunt: Amperage models available are 1 mA, 3 mA, 10 mA, 50 mA, 100 mA, 300 mA, 1 A, 3 A, 10 A, 25 A, 50 A, 100 A
Manufacture's Calibration Certificate Included	
/OM	Operator Manual Downloadable from <a href="http://www.guildline.com">www.guildline.com</a>
73401	Forced Air Convection Unit (Currents 10A and higher)
73502-100	50A and 100A Serial Connection Adapter
73502-30	30A and Below Serial Connection Adapter
73404A	AC Buffer Amplifier
73411	Adapter LC Male to N Female
73412	Adapter LC Male to LC Male
73413	Adapter LC Male TO Cable
73414	LC Female to N Female
73503	Adapter Kit
Case	Custom Transit Case
/NMI	National Measurement Institute Calibration
<b>7350-X</b> (X = Model Resistance)	7350 AC/DC Power Based Current Shunt: Resistance models available are 0.01Ω, 0.1Ω, 1.0Ω, 10Ω, 100Ω, 1000Ω
Accessories as listed above under 7340 Model	

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