



**OPERATION MANUAL**  
**FOR**  
**SERIES 7350**  
**AC CURRENT SHUNTS**

**NOTICE**

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# Table of Contents

1.0	Introduction	1-1
1.1	Unpacking and Inspection	1-1
1.2	Warranty	1-2
1.3	To Obtain Warranty or Calibration and Repair Service	1-3
1.4	Safety Information	1-4
2.0	7350 Product Overview	2-1
2.1	Operational Notes	2-2
3.0	Specifications	3-1
3.1	General Specifications	3-2
4.0	Options	4-1



## List Of Figures

FIGURE 1 - MECHANICAL OUTLINE.....	2-3
FIGURE 2 - 73401 INSTALLED ON 7350.....	2-4
FIGURE 3 - SCHEMATIC DETAIL.....	2-5



## 1.0 INTRODUCTION

This manual provides an overview of the 7350 Series of AC/DC Current Shunts. General product information, description of case styles and performance specifications are also included.

This manual applies to all models of the 7350 Series unless otherwise noted.

The phone number in the USA and Canada to obtain Product Support, Calibration Service or Replacement Parts is (800) 310-8104.

To Contact Guildline Instruments, the following information is provided.

USA and Canada Telephone: (613) 283-3000

USA and Canada Fax: 1-613-283-6082

Outside US and Canada Telephone: + [0] [1] 613 283-3000

Outside US and Canada Fax: + [0] [1] 613 283-6082

You can also contact Guildline Instruments Limited via their Email or Websites.

Email is: [sales@guildline.com](mailto:sales@guildline.com)

Website is: [www.guildline.com](http://www.guildline.com)

### 1.1 Unpacking and Inspection

Every care is taken in the choice of packing material to ensure that your equipment will reach you in perfect condition. If the equipment has been subject to excessive handling in transit, the fact will probably be visible as external damage to the shipping carton.

In the event of damage, the shipping container and cushioning material should be kept for the carrier's inspection.

Carefully unpack the equipment and check for external damage to the standard. If the shipping container and packing material are undamaged, they should be retained for use in return shipments. If damage is found notify the carrier and Guildline immediately.

### 1.2 Warranty

Guildline Instruments warrants its products to be free of defects in manufacture and normal operation for a period of two (2) years from the date of purchase, except as otherwise specified. This warranty applies only in the country of original purchase and only to the original purchaser, who is also the end user. Equipment, which is defective or fails within the warranty period, will be repaired or replaced at our factory without charge at the discretion of Guildline Instruments.

In addition, standards and systems manufactured by Guildline Instruments are warranted to be free of defects in overall system operation for a period of two (2) years from the date of receipt by the original purchaser.

Third party system components purchased by Guildline carry the warranty of the original equipment manufacturer and will be accepted for claim by Guildline Instruments at our factory only after warranty authorization by the original manufacturer.

#### **Limitation of Warranty**

Warranty coverage does not apply to equipment which has failed due to misuse, neglect, accident or abnormal conditions of operation or if modifications or repairs have been made without prior written authorization of Guildline instruments.

Temperature probes are not warranted against failure due to mechanical shock.  
Fuses, lamps and non-rechargeable batteries are not warranted against breakage.

#### **Damage in Shipment to Original Purchase**

Shunts should be thoroughly inspected immediately on receipt for visible damage. Any damage should be reported to the carrier and further inspection and operational tests should be carried out if appropriate to determine if there is internal damage. Contact Guildline Instruments before returning for repair. The Customer or purchaser must complete all final claims with the carrier.

Regular charges will apply to non-warranty service. External service charges and expenses will be billed at cost plus handling.





## Section 1

### 1.3 To Obtain Warranty or Calibration and Repair Service

**Call for a Return Material Authorization (RMA) number. RMA's are required for all Warranty Returns and/or Calibration and Repair Service Requests.** Telephone, Fax and email addresses to contact Guildline are provided previously.

Guildline Instruments will pay for all warranty costs including shipping from Guildline to the original shipment point. However, if the instrument is purchased within one country and shipped to another, Guildline will only pay for shipping to the original ship to country or customer point. The customer is responsible for paying for the shipping costs to return an item to Guildline.

#### **USA Warranty Return Address.**

USA Customers should use the following address to return instruments for warranty service or calibration support.

Guildline Instruments Limited  
C/O AN Deringer  
835 Commerce Park Drive  
Ogdensburg, NY 13669

Mark on the outside of the box:

RMA # \_\_\_\_\_

Model # \_\_\_\_\_

Serial # \_\_\_\_\_

The Statement: "Canadian manufactured goods being returned for repair."

#### **For all other countries, including Canada please ship to:**

Guildline Instruments Limited  
21 Gilroy Street, PO Box 99  
Smiths Falls, ON K7A 4S9

Mark on the outside of the box:

RMA # \_\_\_\_\_

Model # \_\_\_\_\_

Serial # \_\_\_\_\_

The Statement: "Canadian manufactured goods being returned for repair."

### 1.4 Safety Information

**WARNING: Use caution when working with voltages above 30 V ac rms, 42 V ac peak, or 42 V dc. These voltages pose a shock hazard.**

The 7350 AC/DC Current Shunts are designed to work within specifications up to 10 W depending on the model. Applying more than the recommended power or voltage will damage the unit and voids the warranty.

Do not use the Current Shunts in wet environments.

Never use the Current Shunt with the cover removed or the case open.

When making electrical connections, connect the voltage test lead before connecting the live current test lead; when disconnecting, disconnect the live current lead before disconnecting the voltage test lead.

Inspect the Current Shunt for damage such as cracked connectors prior to use. If unit has a burned smell or smoke is visible during use, discontinue use immediately.

If test equipment used with Current Shunts overloads or trips, this could be a sign that the Current Shunt requires repair.

Inspect all test leads used with the Current Shunt for damaged insulation or exposed metal. Check all test leads for continuity.

Ensure all test leads are correctly connected prior to applying current or voltage.

Do NOT use Current Shunts around explosive gas, vapor or dust.

### 2.0 7350 PRODUCT OVERVIEW

The Guildline model 7350 series of four-terminal AC CURRENT SHUNTS are designed as higher accuracy and more stable (i.e. lower uncertainty) replacements for the older model 7320 shunt series. The 7350 series is constructed with a ruggedized and shielded enclosure and uses a very low reactance resistive element design.

They can be used as working standards or very reliable transportable standards. They are extremely useful for the calibration of ac current ranges of multi-function calibrators and high accuracy digital multimeters, as well as being used in more classical standards and calibration laboratory applications. The lower resistance value shunts may be used as burdens for current transformers and for AC power and energy measurements. The very low phase shift of the shunts makes accurate higher frequency power measurements practical. The output voltage of the shunts faithfully reproduces the current waveform even under highly distorted current conditions.

The shunts are designed to operate at up to 10 W or 25 S, whichever is less, at frequencies from DC up to 100 kHz, although they are stable at frequencies up to 2 MHz. They are specified with natural cooling. For the best performance when used up to the higher limit of 10 W, the model 73401 Forced Convection Unit is recommended to provide forced air cooling and a stabilized environmental temperature for the shunt. Resistance values from 0.01  $\Omega$  to 10 k $\Omega$  in decade values are standard models.

There are two connectors. The UHF type connector on the back face of the shunt is for connection to the current source to be measured. The BNC connector on the front face is for connection to the voltmeter or other potential measuring device. The enclosure is isolated from the input and output connector shells and a separate binding post is provided for connection to an earth ground or a guard potential. Alternately the enclosure may be connected to either input or output connector shell by removing the isolating washer on one of the connector screws.

Figure 1 details mechanical outline. Figure 3 shows schematic detail. A series adapter is available for connecting the shunts in series with a device to be calibrated.

Maintenance of the shunt consists of routinely inspecting the unit for physical damage and cleanliness. The screws around the circumference of the enclosure and the connectors should be checked for tightness periodically. Cleaning with a clean cloth is recommended. Do not use any liquid cleaning solutions including water for cleaning purposes.

### 2.1 Operational Notes

The Guildline 7350 Series of four-terminal AC/DC CURRENT SHUNTS are designed for ease of use in the measurement of AC current in the frequency range of DC to 100 kHz. Although no specifications are provided for operation above 100 kHz, the 7350 Series can be used at frequencies up to 2 MHz. Calibration data is provided as a DC resistance and an AC-DC Difference. Although the DC resistance may be subject to a slow drift over time the AC-DC Difference will generally be stable for many years and independent of the current magnitude. The DC resistance should be calibrated periodically (annually) to maintain specified performance.

The AC resistance can easily be determined from the calibrated DC resistance and the AC-DC Difference. The AC resistance can be calculated by subtracting the AC-DC Difference from the DC resistance. A positive AC-DC Difference indicates that the net effect of inductive and capacitive components of the AC Shunt assembly is capacitive such that the AC resistance will decrease with increasing frequency. Typical for models above a nominal 10  $\Omega$  the AC-DC Difference above 1 kHz will be positive. Models below a nominal 10  $\Omega$  will typically be more inductive at higher frequencies and will exhibit a negative AC-DC Difference. In this case the AC resistance will increase with frequencies above 1 kHz.

It is important that cable connections be kept as short as possible to reduce capacitive and inductive components to the measurement circuit. Cabling should be coaxial type wherever possible. A Buffer Amplifier, model 73404, is available to reduce the effect of the voltmeter and cable impedance on the frequency response of the shunt. The 73404 has unity gain from DC to 100 kHz with an input impedance of 10 Gohms and 5 pF Capacitance. The amplifier should be connected directly to the output side of the shunt.

A Series Adapter, model 73502-30 is also available to provide a simple means of connecting the model 7350 AC Shunt in series with a meter or another shunt that is to be calibrated. This ensures that the same current is flowing through both devices during comparison on voltages. At frequencies above 10 kHz it is recommended that the positions of the reference shunt and the test device be interchanged and the two sets of measured values be averaged so that the effect of the small parasitic capacitance in the adapter is removed from the measurement.

A Cable and Adapter Kit, model 73503 is also available that contains the following components:

- BNC Male to Double Banana Plug Cable 610 mm (24 in.) long
- UHF Male to Double Banana Plug Cable 610 mm (24 in.) long
- BNC Male to Binding Post Adapter
- UHF Female to Type N Male Adapter
- UHF Male to Double Banana Plug Adapter
- UHF Female to Binding Post Adapter
- UHF Straight Plug to Plug Adapter
- BNC Female to UHF Plug Adapter
- BNC Female to Double Banana Plug Adapter

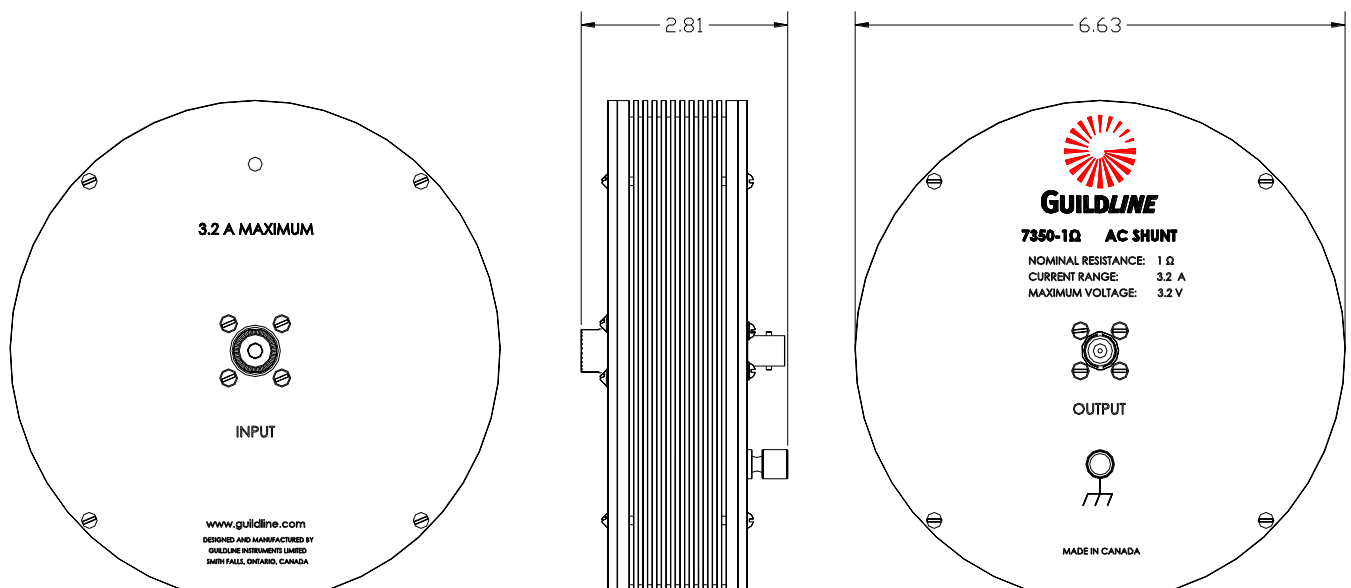


Figure 1 - Mechanical Outline

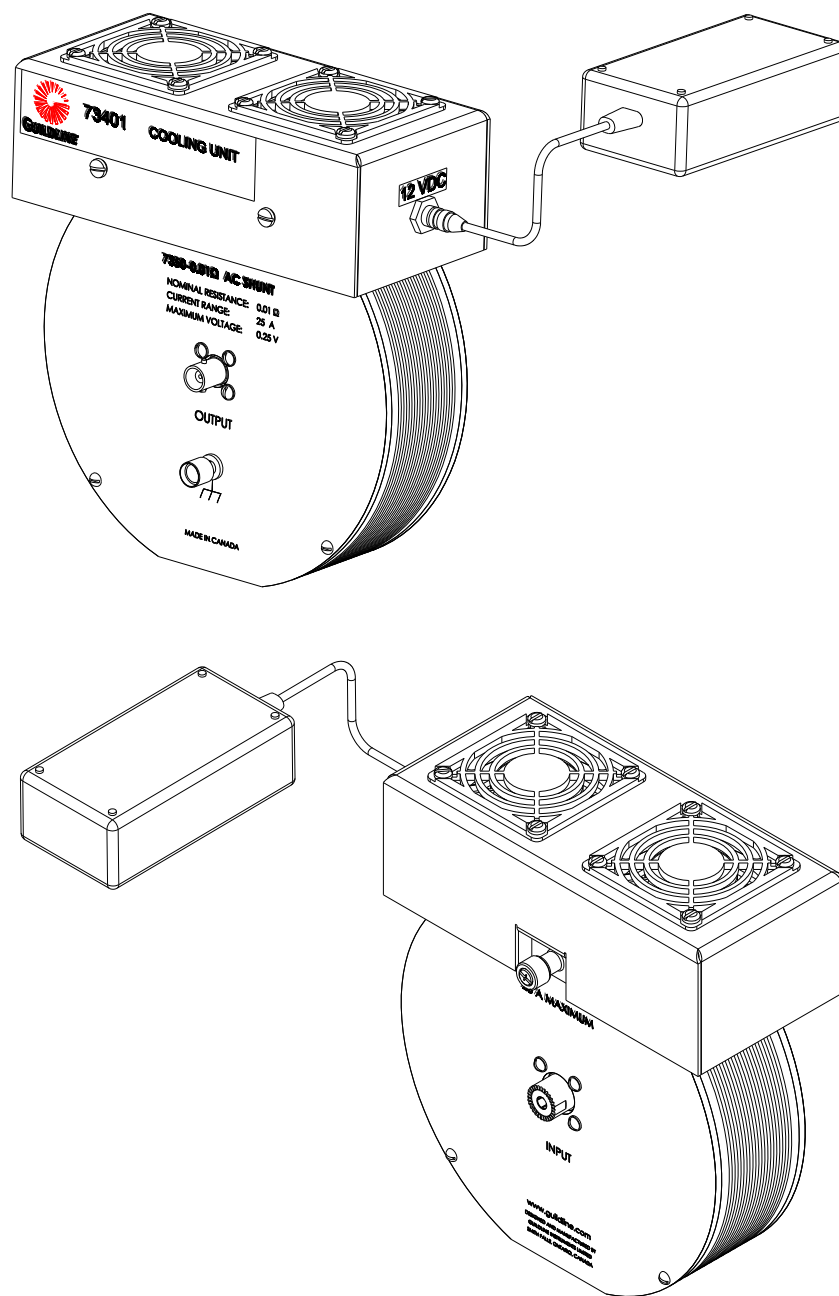
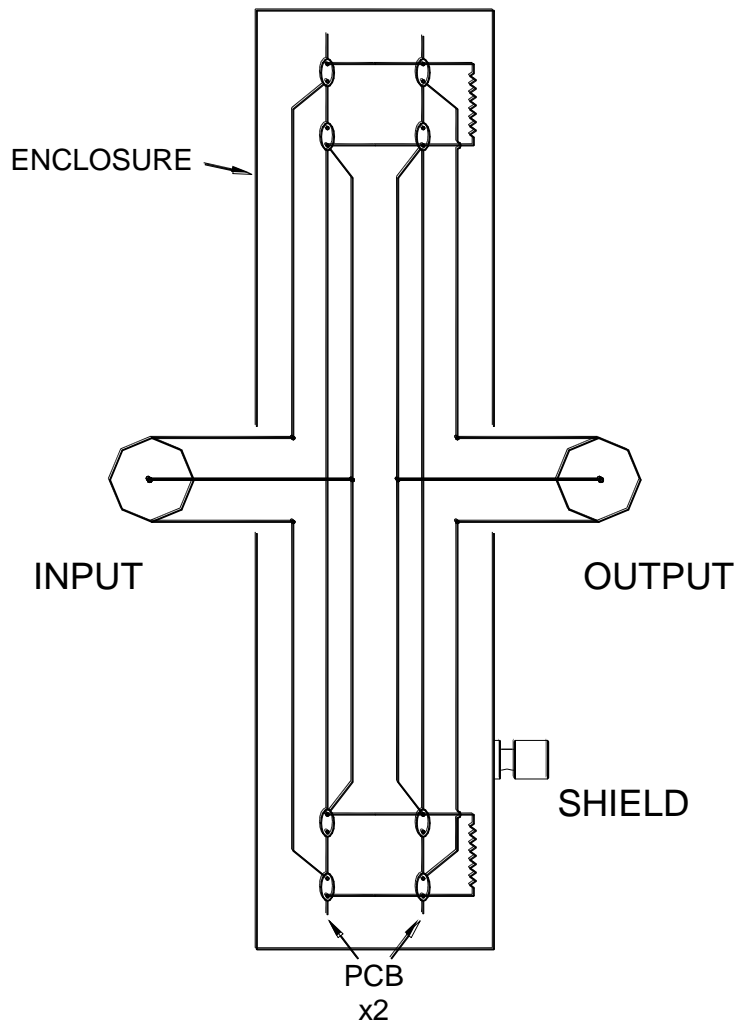


Figure 2 - 73401 Installed on 7350



SHOWING 2 OF 100 OR  
MORE ARMS/PATHS OF  
THE 7350/x  $\Omega$

Figure 3 - Schematic Detail



## Section 2

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### 3.0 SPECIFICATIONS

<b>7350 SERIES (POWER BASED)</b>		12 MONTH MAXIMUM AC-DC DIFFERENCE <sup>1</sup> (in ppm @ 23°C ± 1°C <50% RH)							
<b>Model</b> (Nominal Resistance)	National Measurement Institute (NMI) Verification				Guildline (Factory) Verification				
	1 kHz	10 kHz	30 kHz <sup>2</sup>	100 kHz	1 kHz	10 kHz	30 kHz <sup>2</sup>	100 kHz	
7350-0.01 Ω	± 35	-40 ~ + 0	-60 ~ + 0	-150 ~ + 0	± 50	± 60	-100 ~ + 0	-250 ~ + 0	
7350-0.1 Ω	± 25	± 30	± 45	-100 ~ + 0	± 40	± 50	-60 ~ + 0	-200 ~ + 0	
7350-1 Ω	± 20	± 20	± 35	-50 ~ + 0	± 30	± 40	-50 ~ + 0	-150 ~ + 0	
7350-10 Ω	± 20	± 20	-0 ~ + 40	-0 ~ + 140	± 30	± 40	-0 ~ + 70	-0 ~ + 200	
7350-100 Ω	± 40	-0 ~ + 100	-0 ~ + 400	-0 ~ + <b>1000</b>	± 50	-0 ~ + 200	-0 ~ + 600	-0 ~ + <b>1600</b>	
7350-1000 Ω	± 45	-0 ~ + <b>200</b>	-0 ~ + <b>800</b>	-0 ~ + <b>4000</b>	± 55	-0 ~ + <b>500</b>	-0 ~ + <b>2000</b>	-0 ~ + <b>6000</b>	

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

<b>7350 SERIES (POWER BASED)</b>			GENERAL SPECIFICATIONS (@ 23°C ± 1°C <50% RH)				
<b>MODEL</b> (NOMINAL RESISTANCE)	<b>INITIAL TOLERANCE</b> <sup>3</sup> ± ppm	<b>DC STABILITY</b> ± ppm	Maximum			COEFFICIENTS <sup>4,5</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

7340 SERIES DIMENSIONS AND CONNECTORS								
<b>7340 MODEL</b>	Width <sup>5</sup>		Diameter		Weight		Connector	
	inch	mm	inch	mm	lbs	kg	Output	Input
All 7350 Series Models	2.8	71.4	6.36	168.4	1.8	0.82	BNC	UHF

## Notes: All Specifications

Note 1: Calibrated in air at the minimum and maximum of the current range at  $23\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$  at DC and 1kHz, 10 kHz, 30 kHz and 100 kHz frequencies. Models with currents above 3 A are calibrated 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: The unique design of the 7340's means that for higher frequencies, and dependent on the ohmic value, the AC-DC Difference will either be capacitive or inductive producing only a positive or negative difference. The final reported result could be outside these parameters (e.g. slightly positive or slightly negative) depending on the uncertainty of the laboratory performing the measurement.

Note 3: Initial Tolerance is defined as the maximum variation of resistance mean DC values as initially adjusted at the point of sale.

Note 4: Power coefficients are specified using the 73401 Forced Convection Unit for currents above 3A for the model 7340 Series.

Note 5: No Forced Air Unit is required with the 7350 Series. Shunts may be used up to maximum wattage with no cooling required.

Note 6: Width Size is case to case and does not include terminal size.

Note 7: Current shunts may be used at current levels below the specified range but with reduced output voltages.

## 3.1 General Specifications

7340 SERIES TYPICAL PHASE DISPLACEMENT			
Input Current	1 kHz	20 kHz	100 kHz
1 mA – 300 mA	$< 0.001^{\circ}$	$< 0.004^{\circ}$	$< 0.025^{\circ}$
300 mA to 3A	$< 0.002^{\circ}$	$< 0.008^{\circ}$	$< 0.050^{\circ}$
3A to 25 A	$< 0.004^{\circ}$	$< 0.010^{\circ}$	$< 0.060^{\circ}$
25A to 100A	$< 0.008^{\circ}$	$< 0.040^{\circ}$	$< 0.150^{\circ}$

ENVIRONMENTAL					
Operating	Temperature	Humidity	Storage	Temperature	Humidity
	$18\text{ }^{\circ}\text{C}$ to $28\text{ }^{\circ}\text{C}$	$< 50\%$ RH non-condensing		$-20\text{ }^{\circ}\text{C}$ to $60\text{ }^{\circ}\text{C}$	15% to 80% RH

### 4.0 OPTIONS

MODEL #	DESCRIPTION	GUILDLINE PART #
73401	Forced Air Cooling Unit (fits all standard models)	30806-01-09
73404	AC Buffer Amplifier	30829-01-05
73502-30	Serial Connection Adapter (UHF 30A)	30798-01-11
73503	Cable and Adapter Kit	31133-01-09