

Lindsey Sensors

High Accuracy

Medium Voltage Sensors & Accessories
for Overhead & Underground Distribution



LINDSEY
SYSTEMS

Hallmarks of Lindsey Systems' Sensors

Reliable & Safe

> 10,000 Years

Lindsey sensors have demonstrated a 10,000 year MTBF over the past 35 years.

<1mA

Most voltage and current sensors produce an output of only 10V and less than 1mA of current to ensure safe handling.*

0.2%

High Accuracy Sensors™ offer 0.2% voltage accuracy, the best in the industry.

*Not applicable to sensor models with 1A or 5A current outputs, or where the specified voltage output is greater than 10V at rated line current.

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Voltage and Current Sensors by Lindsey Systems

For over 35 years, voltage and current sensors by Lindsey Systems have served a crucial role in medium voltage distribution networks. Well-known for exceptional reliability and long life, they are depended upon for their accuracy in voltage and current monitoring applications. Sensors by Lindsey Systems are the number one choice for substation, overhead, pad-mount, submersible, SF6 or OEM applications.

Sensing Elements

All Lindsey Systems' sensors use one or more of the following voltage and current sensing elements. With the exception of window CT-based sensors, the output current of all sensing elements is typically limited to <1mA to ensure exceptionally low energy levels in the event of contact during installation.

Voltage Sensing

High precision resistive voltage divider networks are used in all voltage sensors to provide exceptionally accurate analog voltage outputs. For overhead applications, Lindsey High Accuracy Sensors™ offer the industry's highest accuracy at 0.2%, with 0.5% accuracy standard for less demanding applications.

All ElbowSense™ voltage sensors for pad-mount and underground applications are available with 0.3% metering and 0.5% standard accuracy versions.

All voltage sensor outputs are linear with the primary voltage level applied. High ratio ($\geq 1400:1$) sensors have flat frequency response through the 20th harmonic with zero phase shift providing excellent harmonic performance.

Current Sensing

Two different current sensing methods are used depending on the actual product.

MultiCore current sensing

Two current sensing coils are used to measure current. This technique produces an accurate (1%) voltage output proportional to the primary current, typically 10V secondary at 600A primary.

The output of MultiCore sensors is linear with input current, making them ideal to accurately represent fault current magnitudes.

MultiCore current sensors are not recommended for harmonic current measurement applications as their frequency response is non-linear outside of rated fundamental frequency.

Window CTs

Iron core window CTs produce a higher accuracy measurement (to 0.3%) as well as flat frequency response through 3 kHz ($\pm 2\%$ @ 3kHz) making them ideal for harmonic measurement applications.

Both 1A and 5A output versions are available.

Overhead Sensors

Overhead line sensors are available in a variety of configurations. The accuracy of Lindsey Systems' voltage sensors have made them the gold standard for Volt Var Optimization (VVO) and Conservation Voltage Reduction (CVR) applications.

The construction of line post and standoff sensors meet all the electrical and mechanical requirements of equivalent insulators providing endless installation options.

Underground Sensors

Lindsey Systems offers the widest range of voltage and current sensors for underground and pad-mount applications, including:

- Elbow and tee-body voltage sensors for 200A IEEE cable systems
- Plug-style voltage sensors for 600A IEEE cable systems
- Split-core and ring type current sensors
- Voltage sensors for SF6 switchgear
- Voltage sensing bus standoff insulators

Note: Sensor accuracy is the variation from the as-tested output ratio (as stamped on each sensor's nameplate) across the stated accuracy temperature range. For more information, refer to Lindsey Systems' publication number 09R-017 SENSOR ACCURACY.

Introduction to Lindsey Sensor Family

Lindsey Systems' Sensor Family Quick Reference

Overhead Voltage Sensors



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Clamp-top
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Elbow
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Tee-Body
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Current Sensors



Split-core
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Ring
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Neutral
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Power Supply

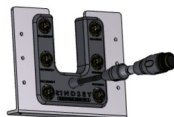


Underground
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Cable & Junction Boxes



Cables
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CasTite Junction Boxes
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GEN2 Sensors

The Accuracy you need. The Reliability you want. For over 35 years, Lindsey current and voltage sensing post insulators have been the standard for smart grid applications. Lindsey GEN2 line post sensors feature hydrophobic cycloaliphatic epoxy construction, providing superior performance in high pollution and wet environments.

Standard or High Accuracy GEN2 Sensors

Lindsey's standard GEN2 sensors offer 0.5% voltage accuracy and no phase shift. High Accuracy Sensors™ offer 0.2% accuracy from $-40/+55^{\circ}\text{C}$; the industry's best.*

These sensors are ideal for feeder voltage control based on Volt/VAR Optimization (VVO) or conservation voltage reduction (CVR) applications, which rely on accurate voltage measurements. Greater accuracy allows for finer control of the voltage profile and maximizes the economic benefit which can be realized by these programs.

GEN2 sensors are completely passive designs. No external power source is required to power sensor electronics.

All GEN2 Sensors Include:

- 1% current accuracy with no phase shift
- Voltage and current accuracy independent of weather and conductor diameter
- Hydrophobic cycloaliphatic epoxy construction provides superior performance in high pollution and wet environments
- Physical construction that meets all the electrical and mechanical requirements of post insulators

Lineman Friendly Features

- Less than 1/2 the weight of Lindsey Systems' Polysil insulation based sensors
- Touch-friendly outputs. Low voltage, low current sensor outputs eliminate the risk of high voltages as may be found with conventional CT-based sensors. This allows GEN2 sensors to be installed on energized lines.
- Glove friendly cables use bayonet-style waterproof connectors that "snap" when closed, eliminating over-and under-tightening (Figure 1).



Figure 1: Bayonet-Style Waterproof Connector

*High Accuracy Sensors require the use of Lindsey Systems' High Accuracy gold-line cables to ensure accuracy across the entire temperature range.

Hot Stick Friendly Conductor Keepers

Conductor keepers establish the connection between the conductor and the sensor's internal sensing circuits. Lindsey provides two patent pending hot stick friendly versions.

Standard Hot Stick Keeper

This keeper design** is attached to the sensor via one through-bolt which acts as a hinge. This allows the conductor to be placed in the sensor saddle while the keeper is left open (see Figure 2).

The ring on the keeper provides a convenient point of connection to a hot stick for the purpose of pushing the keeper into the closed position (see Figure 3).

The bolts may then be tightened to finish the connection.



Figure 2:
Standard Hot Stick Keeper
Shown Open



Figure 3:
Standard Hot Stick Keeper
Shown Closed

Trunnion Keeper

The trunnion clamp keeper** is a full trunnion style conductor clamp adapted to fit Multicore style sensors. (see Figure 4).

The trunnion clamps are affixed to either side of the sensor on the ground. Once in the air, the conductor is placed through the opened clamps and into the conductor saddle. The clamps' keepers are closed by turning the ring from below and away from the sensor using a hot stick. This allows the lineman to be located at a suitable distance from the line during final installation.



Figure 4: The Trunnion Keeper

**US & International patents pending

GEN2 Voltage and Current Sensors by Lindsey Systems

Electrical Ratings

Insulation Class	15 kV	25 kV	35 kV
Impulse (BIL)	110 kV	150 kV	200 kV
Leakage Distance (in./mm)	19.9/505	29.4/747	37.5/953
Dry Arc Distance (in./mm)	8.8/223	11.9/302	16.1/410
Overall Height (A) (in./mm)	12.4/315	15.5/395	19.8/502
Height to Conductor Saddle (B) (in./mm)	9.4/238	12.6/319	15.8/400
Withstand* (60HZ, 1 min.)	34 kV	40 kV	50 kV
Corona (extinction)	11 kV	19 kV	26 kV
Operating Temperature	-50° C to +80° C		
Stated Accuracy Temperature	-40° C to +55° C		
Conductor Diameter	Two-sided keeper accommodates 0.18" - 1.25" (4.6-32 mm) diameter		
Construction	Hydrophobic cycloaliphatic epoxy		

NOTE: Calibration of current and voltage signals is virtually unaffected by conductor material, size, temperature, armor rod, adjacent phases, line angle or insulator contamination.

*Withstand test is not performed on sensors with voltage sensing. Specify 50 HZ or 60 HZ.

Voltage Signal Output

Ratio	By catalog number
Output Impedance	Calibrated for a 1 MΩ load
Accuracy**	GEN2: +/- 0.5% High Voltage Accuracy GEN2: +/- 0.2%
Phase Shift	0 degrees for sensors with ratios of 1400:1 or greater, - 2 degrees per 10 feet of cable for lower ratios

Mechanical Ratings

Insulation Class	15 kV	25 kV	35 kV
Cantilever Strength (lbs./kg)	2800/1270	2800/1270	2800/1270
Weight (lbs./kg)	18/8.2	20/9.1	24/10.9
Shipping Weight (lbs./kg)	20/9.1	22/10.0	26/11.8

Current Signal Output

Ratio	600A : 10 Volts
Output Burden/Load	Calibrated for 100 kOhm or greater load
Accuracy**	+/- 1%
Phase Shift	0 degrees nominal, +/- 1.5 degrees
Open Circuit Voltage	10V at 600A line current

**Accuracy guaranteed only when used with Lindsey supplied cables. GEN2 High Accuracy Sensors™ require the use of gold-line High Accuracy cables.

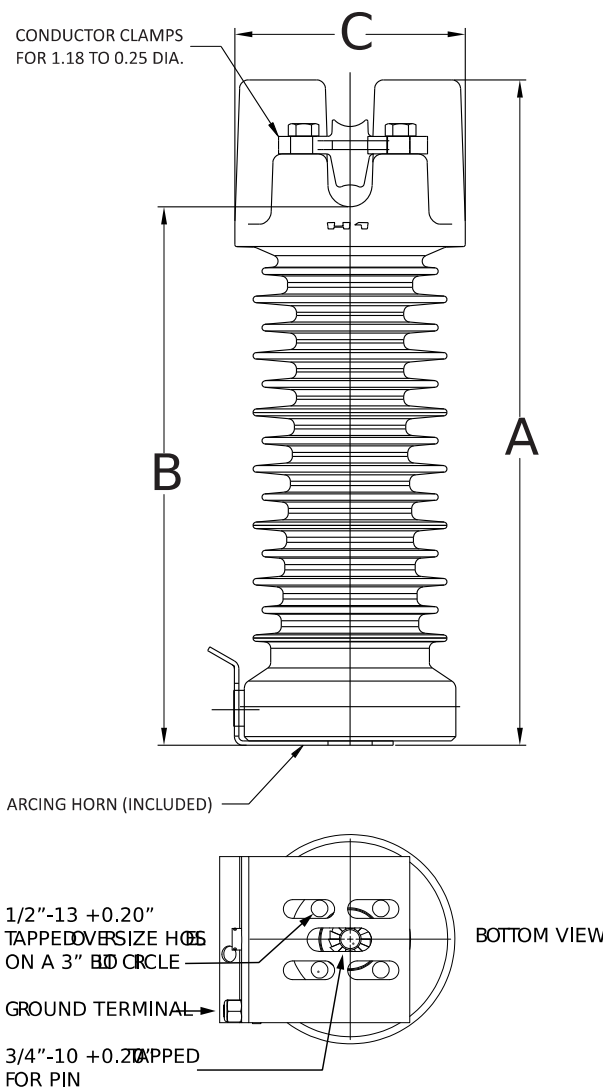


Figure 5: Dimension Drawing of GEN2 Sensor

OVERHEAD: GEN2 Sensors

GEN2 Ordering Table

Part Number Sequence: A B C / D E 0 F G

A		B		C			/	D		E		F	G	
Family		Voltage Class		Leakage Distance				Current Output		Voltage Divider Ratio			Frequency	
9E6	GEN2			0	Standard Leakage			E0	None	0	None		Blank	60 HZ
9EHA6	GEN2 High Accuracy	5	15 kV		GEN2	GEN2 High Accuracy		E1	600A : 10V	1	1400:1		/50 HZ	50 HZ
		6	25 kV					2	2200:1					
		7	35 kV	15 kV			19.9 in. (505 mm)	29.4 in. (747 mm)	3	3300:1				
					25 kV	29.4 in. (747 mm)	29.4 in. (747 mm)			4	10,000:1			
					35 kV	36.5 in. (927 mm)	36.5 in. (927 mm)			5^	60:1			
										6^	120:1			
										7^	166:1			
										8^	200:1			
										x	Special			
					2	High Leakage								
					15 kV	29.4 in. (747 mm)	36.5 in. (927 mm)							
					25 kV	36.5 in. (927 mm)	36.5 in. (927 mm)							
					35 kV	N/A	N/A							
					3	Extra High Leakage								
					15 kV	36.5 in. (927 mm)	N/A							

Polysil Overhead Line Post Voltage & Current Sensors

Accurate, Real-Time Measurement. Lindsey Systems’ line post sensors have provided exceptionally reliable and highly accurate voltage and current monitoring for substation, overhead and pad-mount distribution applications since 1982. These sensors are constructed out of Polysil, an advanced silica/resin composite insulation material developed in conjunction with EPRI.

Line post sensors are available in various sensor configurations and in four different physical packages. All sensors can be used in place of any vertical or horizontal line post insulator. This provides great flexibility both in installation and in applications.

Sensing Configurations

- Voltage-only sensing using precision resistive divider sensors providing 0.5% accuracy.
- Current-only sensing using either Lindsey Systems MultiCore or window CT sensors. MultiCore sensors offer fundamental frequency accuracy of 1%. Window CTs provide up to 0.3% accuracy and flat frequency response through the 40th harmonic.
- Voltage and current sensors, incorporating a combination of the above sensors.
- Calibration of current and voltage signals is virtually unaffected by conductor material, size, temperature, armor rod, adjacent phases, line angle or insulator contamination.



Voltage Signal Output	
Ratio	By catalog number
Output Impedance	Calibrated for a 1 MΩ load
Accuracy*	+/- 0.5% from -40° C to +55° C
Phase Shift	0 degrees for sensors with ratios of 1400:1 or greater, -2 degrees per 10 feet of cable for lower ratios

Current Signal Output				
	MultiCore	Window CT		
Accuracy*	+/-1%	1%	0.3%	2%
Phase Shift	0 degrees nominal, +/- 1.5 degrees	0 degrees nominal, +/- 0.5 degrees		
Operating Temperature Range	-45° C to +80° C	-45° C to +80° C		
Stated Accuracy Temperature	-40° C to +55° C	-40° C to +55° C		
Ratio	600A : 10 Volts	600A : 5A	600A : 1A	300A : 5A
Burden	Calibrated for 100 kOhm or greater load	0.9 Ohms, Max.	22.5 Ohms, Max.	0.22 Ohms, Max.
Open Circuit Voltage @600A	10V at 600A line current	14.5	88	8
*Accuracy guaranteed only when used with Lindsey supplied cables.				

OVERHEAD: Polysil Sensors

Physical Configurations

MultiCore

The MultiCore style design allow the conductor to be placed into the sensor's central saddle, eliminating the need to cut the conductor or make a jumper. This style sensor is ideal for live line installation.

MultiCore style sensors are only available with Lindsey Systems' MultiCore style current sensor with a 600A:10V output ratio.



MultiCore

Substation/Busbar

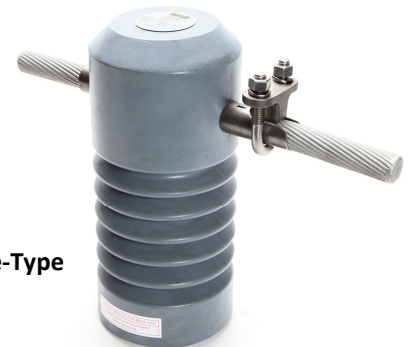
This style sensor uses higher accuracy window CT current sensors. Both 2-hole (600A) and 4-hole (1200A) NEMA pad versions are available. This style sensor is ideal for substation or pad-mount applications. The ability to make a fixed connection also makes this style of sensor suitable for use as a component in automated, overhead switches.



Substation/Busbar

Tube-Type

The tube-type design provides a path for passing a conductor through the sensor body and then clamping to the integral stainless steel tube. This design uses higher accuracy window CT current sensors. This design is practical for many switchgear and substation applications.



Tube-Type

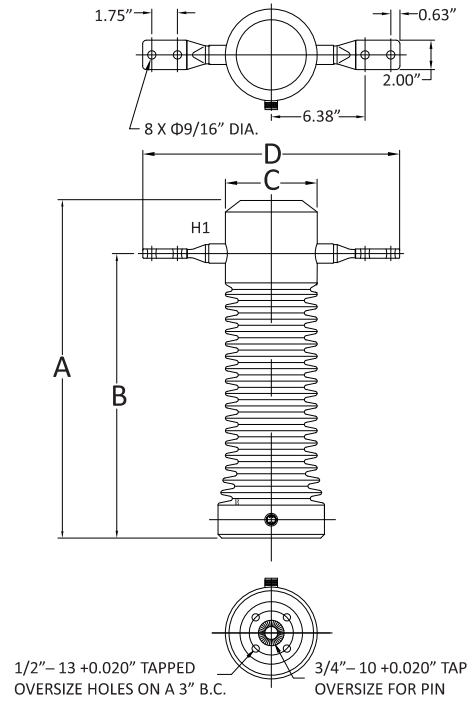
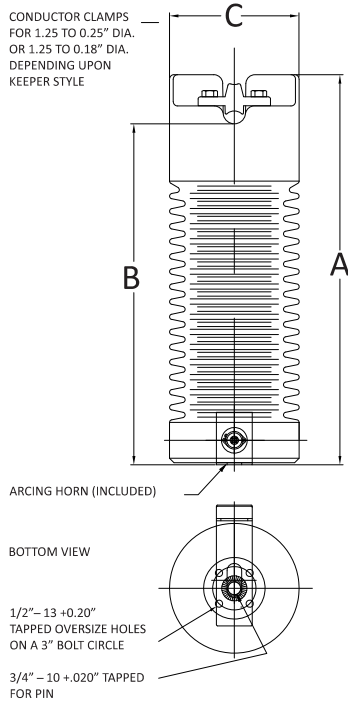
Clamp-Top

Like the MultiCore style sensor, the clamp-top design eliminates the need to cut the phase conductor. The use of window CT current sensors provides higher accuracy and harmonic current measurement capabilities than the MultiCore style unit.



Clamp-Top

Polysil Dimensions



MultiCore	Inches/mm			lb./kg
Voltage Class	A	B	C	Weight
15kV	13.4/339.7	10.6/269.9	7.3/184.2	37.0/16.8
25kV	16.8/425.5	14.0/355.6	7.3/184.2	48.0/21.8
35kV	21.9/555.6	19.1/485.8	7.3/184.2	60.0/27.2

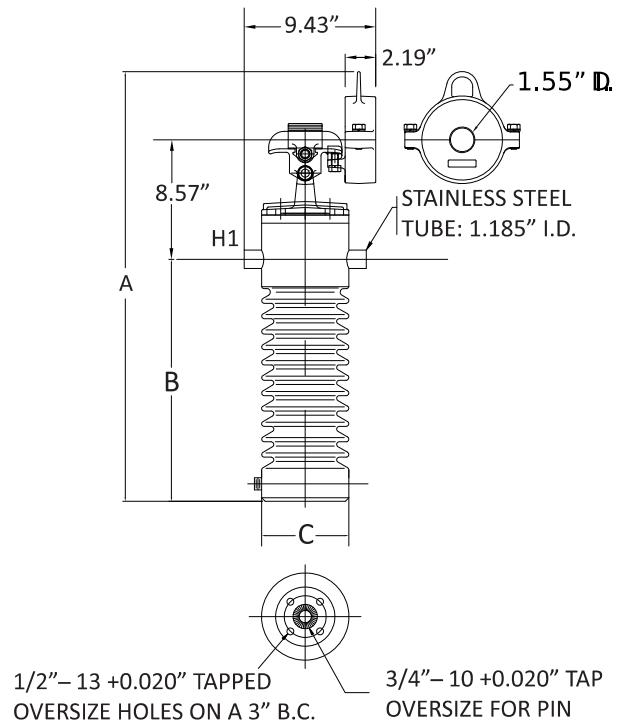
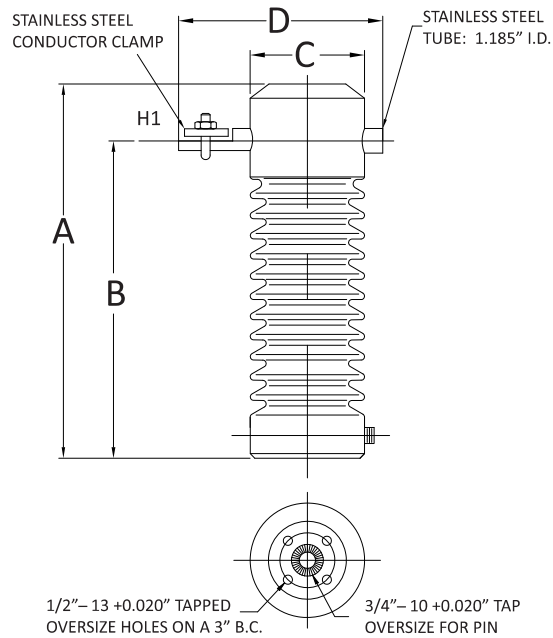
Busbar	Inches/mm				lb./kg
Voltage Class	A	B	C	D	Weight
15kV (2-hole)	14.0/355.6	10.6/269.9	6.3/158.8	17.5/444.5	29.0/13.2
25kV	16.2/411.2	12.8/325.4	6.3/158.8	17.5/444.5	33.0/15.0
35kV	20.4/517.5	17.3/438.2	6.3/158.8	17.5/444.5	43.0/19.5
46kV	23.0/584.2	19.4/492.1	6.3/158.8	17.5/444.5	65.0/29.5

Note: For sensors with 4-hole NEMA pads, add 0.5" (12mm) to D column.

Mechanical Ratings

Insulation Class	15 kV	25 kV	35 kV	46 kV
Cantilever Strength (lbs./kg)	2800/1270	2800/1270	2800/1270	2800/1270
Weight (lbs./kg):				
MultiCore	37 (16.8)	48 (21.8)	60 (27.2)	N/A
Busbar	29 (13.2)	33 (15.0)	43 (19.5)	65 (29.5)
Tube-Style	29 (13.2)	33 (15.0)	43 (19.5)	60 (27.2)
Clamp-Top	47 (21.3)	51 (23.1)	61 (27.7)	N/A

OVERHEAD: Polysil Sensors



Tube-Style	Inches/mm				lb./kg
Voltage	A	B	C	D	Weight
15kV	14.0/355.6	10.6/269.9	6.3/158.8	10.1/257.2	29.0/13.2
25kV	16.2/411.2	12.8/325.4	6.3/158.8	10.1/257.2	33.0/15.0
35kV	20.6/522.3	17.2/436.6	6.3/158.8	10.1/257.2	43.0/19.5
46kV	22.5/571.5	19.4/492.1	6.3/158.8	10.1/257.2	60.0/27.2

Clamp-Top	Inches/mm				lb./kg
Voltage Class	A	B	C	D	Weight
15kV	24.1/611.9	10.6/269.9	6.3/158.8	9.4/239.5	47.0/21.3
25kV	26.3/667.3	12.8/325.4	6.3/158.8	9.4/239.5	51.0/23.1
35kV	30.7/778.5	17.2/436.6	6.3/158.8	9.4/239.5	61.0/27.7

Electrical Ratings

Insulation Class	15 kV	25 kV	35 kV	46 kV
Impulse (BIL)	110 kV	150 kV	200 kV	250 kV
Leakage Distance (in./mm)	15/381	19.3/490	28.1/714	39.0/991
Dry Arc Distance (in./mm)	8.3/211	10.4/264	15.0/381	17.1/434
Withstand* (60HZ, 1 min.)	34 kV	40 kV	50 kV	75 kV
Corona (extinction)	11 kV	19 kV	26 kV	33 kV
Operating Temperature	-45° C to +80° C			
Stated Accuracy Temperature	-40° C to +55° C			
MultiCore Conductor Diameter				
Standard 2-sided keeper	0.25-1.25" (6.3-32 mm)			
Hot stick 2-sided keeper	0.18" - 1.25" (4.6-32 mm)			
Construction	Polysil			

*Withstand test is not performed on sensors with voltage sensing. Specify 50 HZ or 60 HZ.

Polysil Ordering Table

Part Number Sequence: A B C / D E F G H I J K

A		B	C		D	E	F
Family		Insulator Class	Leakage Distance		Style	Current Output Signal	Voltage Divider Ratio
96	Polysil	5= 15kV (BIL 110kV)	0= Standard Leakage (in./mm)		C = Clamp Top S = Busbar or Tube E = MultiCore**	0 None	<i>15kV Options</i>
		6= 25kV (BIL 150kV)	MultiCore Style	15kV: (15.8/401)		1 600A:10V	0 None
		7= 35kV (BIL 200kV)		25kV: (24.5/600)		2 600A:6V	1 1400:1
		8= 46kV (BIL 250kV)***	Other Styles	35kV: (36.5/927)		3 600A:5A	2 2200:1
				15kV: (15.8/401)		4 600A:1A	3 3300:1
				25kV: (19.3/490)		5 300A:5A	4 10,000:1
				35kV: (28.1/714)		6 300A:10V	5 60:1
				46kV: (39.0/990)		X Special	X Special
			2=High Leakage (in./mm)				<i>25kV Options</i>
			MultiCore Style	15kV: (24.5/600)			0 None
				25kV: (36.5/927)			1 1400:1
			Other Styles	15kV: (19.3/490)			2 2200:1
				25kV: (24.0/610)			3 3300:1
				35kV: (31.8/808)			4 10,000:1
			3=Extra High Leakage (in./mm)				6 120:1
			MultiCore Style	15kV: (36.5/927)			X Special
			Other Styles	15kV: (24.0/610)			<i>35kV Options</i>
				25kV: (28.1/714)			0 None
			4=Special (in./mm)				1 1400:1
			Other Styles	35kV: (39.0/990)			2 2200:1
							3 3300:1
							4 10,000:1
							7 166:1
							X Special
							<i>46kV Options</i>
							0 None
							4 10,000:1
							8 200:1
							X Special

EXAMPLE

96

5

0

/

E

1

1

Order Example: The 9650/E1104A/G is a 15kV class, standard leakage distance, MultiCore style sensor with a 600A:10V current output ratio, a 1400:1 voltage output ratio, standard conductor keepers, a cast-in Amphenol connector, and with optional ground stud. Cable must be ordered separately.

OVERHEAD: Polysil Sensors

G		H		I		J		K	
Choke for Clamp-Top		Conductor Connection		Connector		Ground Stud		Frequency	
0	None	<i>MultiCore</i>		Blank	Std. ITT Cannon Connector	Blank	None	Blank	60Hz
C	Clamp-Top Style*	4	Standard keeper	C	Cast-in cable	/G	Ground Stud	/50Hz	50 Hz
		6	Hot stick Keeper	G	20" Cable with Amphenol Connector & Strain Relief				
		<i>Busbar</i>		A	Amphenol Connector				
		2	Aluminum Bus Bar, 2 Hole Pads	B	Bayonet Connector				
		3	Aluminum Bus Bar, 4 Hole Pads						
		<i>Tube-Style</i>							
		0	1.185" I.D. SS Tube for current sensing only or clamp-top						
		1	1.185" I.D. SS Tube w/SS Bonding Clamp (required for voltage sensing)						
		<i>Clamp-Top</i>							
		0	1.185" I.D. SS Tube						

0	4	A	/G
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*Required for Clamp-top style

**Multicore only available with 600A:10V Current Signal

***46kV units are available in Substation or Tube type only

Type SVMI Voltage Sensors

Type SVMI voltage sensors are designed to be used in conjunction with overhead distribution reclosers or switches where high accuracy voltage sensing on one or both sides of the device is desired. CVR/VVO and other advanced smart grid applications where only voltage monitoring is required can also benefit from the use of these sensors.

Lindsey Systems type SMVI sensors are high accuracy (0.5%), zero-phase shift resistive voltage sensors contained in a compact insulator. Standard surge arrester mounting hardware may be used for convenient field installation of the SVMI. SVMI sensors are available up through 46kV.

SVMI sensors can also be custom ordered to withstand HiPot testing. Please contact the factory with the specific HiPot requirements.

Compact SVMI Sensors are ideal for:

- Retrofitting older reclosers without built-in voltage sensing or where only high-side voltage sensing is included.
- Replacing or upgrading low accuracy capacitive-style voltage sensors often built into reclosers.

Specifications & Dimensions

Insulation Class	15kV	25kV	35kV	46kV
Voltage Accuracy	0.5%			
Ratio	By Catalog Number			
Operating Temperature Range	-45°/+80°C			
Stated Accuracy Temperature	-40°/+55°C			
Impulse (BIL)	110	150	200	250
Leakage Distance	27/686	27/686	37.3/947	37.3/947
Dry Arc Distance	13.6/345	13.6/345	17.3/439	17.3/439
Corona (kV extinction)	11	19	26	33
Height (in./mm) (A)	17.4/442	17.4/442	21.5/546	21.5/546
Diameter (in./mm) (B)	4/102	4/102	4.5/114	4.5/114
Weight (lbs./kg)	10/4.5	10/4.5	17/7.7	17/7.7
Construction	Polysil			



OVERHEAD: Type SVMI Insulator Voltage Sensors

SVMI Ordering Table

Part Number Sequence: A B C / D E

A		B		C		D		E	
Family		Voltage Class		Ratio		External Connection		Mounting Bracket	
93	SVMI	1	15kV	1	1400:1	Blank	Standard, 20" cast-in cable with 7-pin Amphenol connector	Blank	Standard Mounting Bracket
		2	25kV	2	2200:1	Cxx	Cast-in cable, xx represents cable length in feet with pigtail cable end	/B	Heavy Duty Mounting Bracket*
		3	35kV	3	3300:1	CxxB	Cast-in cable, xx represents cable length in feet with bayonet connector cable end		
		4	46kV	4	10,000:1	/Bayonet	Cast-in bayonet connector, cable ordered separately		
				5	60:1	/Cannon	Cast-in Cannon connector, cable ordered separately		
				6	120:1				
				7	166:1				
				8	200:1				
				/X2	Special (consult factory)				

93	1	2	/	Blank	/B
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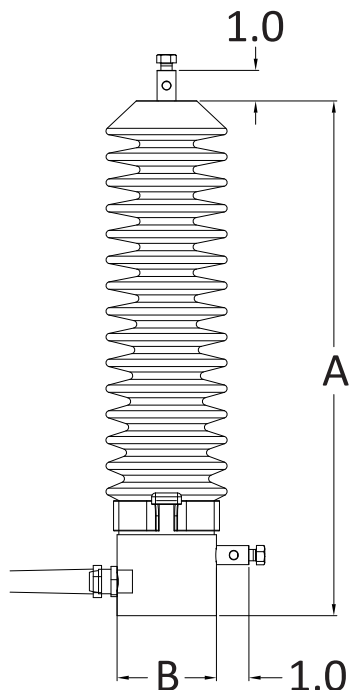


Figure 6: Dimension Drawing of SVMI Sensor.
For height and diameter, see table on page 16.

Order Example: The 9312/B is a 15kV class SVMI Sensor with 2200:1 output ration, 20" cast-in cable with Amphenol connector and heavy duty mounting bracket.

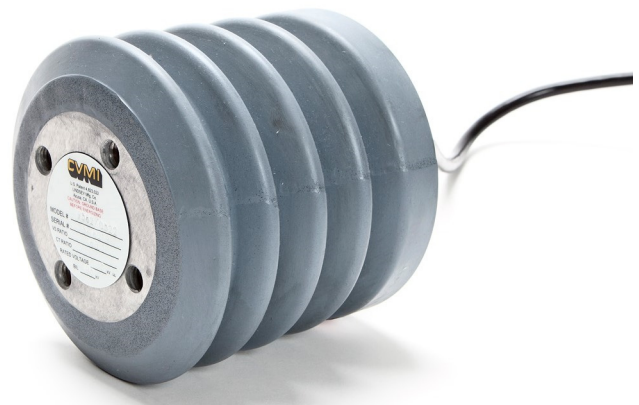
Note: All catalog numbers assume the SMVI sensors will be connected to controls, relays, etc., with a 1 MOhm input impedance. If the input impedance is not 1 MOhm, consult factory for correct part number.

*Heavy duty mounting bracket recommended for applications where the sensor will be mounted on another piece of equipment before truck transportation.

VMI Voltage Sensing Standoff Insulators

Type VMI voltage sensors are high accuracy (0.5%) voltage sensors contained within industry standard 3-inch bolt-circle post-type apparatus insulators. VMI sensors are ideal for use in air-insulated, pad-mount equipment which require the use of insulators to isolate internal buswork from a cabinet at ground potential. In this application, VMI sensors provide voltage sensing of the supported buswork without the need for additional insulators.

VMI sensors can be custom ordered to withstand the extended application of high voltages as is typical when HiPot testing of the completed switchgear is required. Please contact the factory with specific HiPot requirements.



Specifications

Voltage Accuracy	0.5%							
Ratio	By Catalog Number							
Operating Temperature Range	-45°/+80°C							
Stated Accuracy Temperature	-40°/+55°C							
Insulation Class	15kV				25kV		35kV	46kV
Impulse (BIL)	95	95	110	110	150	150	200	250
Root Part Number	9562	9563	9564	9565	9566	9567	9568	9569
Height (in./mm) (A)	6.0/152	7.5/190	10.0/254	12.0/305	14.0/356	15.0/381	18.0/457	22.0/559
Leakage Distance	10.8/274	12.3/312	17.2/437	20.2/513	25.0/635	29.3/744	37.7/958	42.0/1067
Dry Arc Distance (in./mm)	6.0/152	7.5/190	10.0/254	12.0/305	14.0/356	15.0/381	18.0/457	22.0/559
Corona (kV extinction)	11	11	11	11	19	19	26	33
Cantilever strength (lbs./kg)	1200/544	2000/907	2000/907	2000/907	2000/907	2000/907	2000/907	2800/1270
Weight (lbs./kg)	12/5.4	14/6.3	21/9.5	25/11.3	29/13.1	31/14.1	37/16.8	52/23.6
Diameter (in./mm) (B)	6.25/159							
Construction	Polysil							

OVERHEAD: VMI Voltage Sensing Standoff Insulators

VMI Voltage Sensing Standoff Insulators Ordering

Part Number Sequence: A B / 0 C D X

A	B	C	D	X			
Family	Voltage Class & Leakage (in./mm)		Ratio		External Connection*		Cable Length
956 VMI	2	15kV (10.8/274)	1	1400:1	1	Bottom mounted 4-pin Cannon connector (comes with matching cable as selected by X)	X Cast in cable where X represents cable length in 10 ft. increments. Example: If X=1, the cable length will be 10 ft.
	3	15kV (12.3/312)	2	2200:1		2	
	4	25kV (17.2/437)	3	3300:1			
	5	25kV (20.2/513)	4	10,000:1			
	6	35kV (25.0/635)	5	60:1			
	7	35kV (29.3/744)	6	120:1			
	8	46kV (18.0/457)	7	166:1			
	9	46kV (22.0/559)	8	200:1			
			X	Special (consult factory)			
<div>EXAMPLE</div>							
956	3	/ 0	1	2	2		

Order Example: 9563/0122 is a 7.5" (190mm) tall, TR202 equivalent, 95kV BIL sensor with a 1400:1 voltage ratio and a 20 ft cast-in pigtail cable.

* Note: VMI sensors are also available with bottom-exit or side-exit cast-in connectors and / or with cast-in connectorized cables. Contact the factory for ordering details.

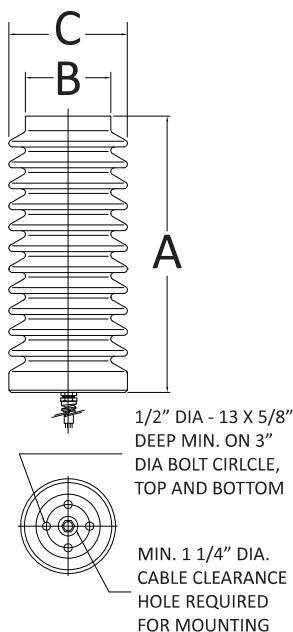


Figure 7: Dimension Drawing of VMI Sensor.
For dimensions, see table on page 18.

TR-Style Insulator Cross Reference

Voltage Class Code (See Ordering Option "B" Above)	TR2xx Equivalent Post-Type Insulator
3	TR202
4	TR205
6	TR208
8	TR210
9	TR214

Most VMI sensors correspond to the dimensional requirements of standard "TR-" number post-type apparatus insulators per ANSI C29-9. VMI sensors do not correspond to the mechanical characteristics. Check your application before use to ensure mechanical requirements are met.

ElbowSense™ Underground Voltage Sensors

Lindsey Systems offers a wide range of voltage sensors contained in familiar IEEE Std. 386 underground componentry. These sensors are suitable for pad-mount, metal-clad, submersible and underground applications. All sensors contain precision resistive voltage dividers to provide high accuracy (0.5%) voltage sensing with flat frequency response through the 20th harmonic. Sensors provides an AC voltage output proportional to phase-to-ground voltage.

Optional Metering Accuracy

All ElbowSense underground voltage sensors are also available with 0.3% voltage accuracy.

These higher accuracy sensors are ideal for metering or other applications that would benefit from higher accuracy, such as Volt/VAR Optimization (VVO).



Specifications

Voltage Accuracy	0.5% or 0.3%		
Ratio	By Catalog Number		
Operating Temperature Range	-45°/+80°C		
Stated Accuracy Temperature	-40°/+55°C		
Insulation Class	15kV	25kV	35kV
Impulse (BIL)	95	120	150
Max Line-Ground (kV)	8.3	15.2	21.1
Corona (kV extinction)	11	19	26
Weight (lbs./kg)			
Elbow Sensors	4/1.8	4/1.8	N/A
Tee-Body Sensors	4/1.8	N/A	N/A
Plug Sensors	8/3.6	8/3.6	9/4.1

The Lindsey Underground Voltage Sensor Family Includes:

- 200A Load-break Elbow Sensors
- 200A Dead-break Tee-body Sensors
- 600/900A Plug voltage Sensors

UNDERGROUND: ElbowSense™ Voltage Sensors

Physical Configurations

200A Load-Break Elbow Sensors

Available at 15kV, 25kV and 35kV, these sensors are ideal for applications where connection can be made via a spare bushing well or suitable tee-body connector. The sensors may also be applied with a reducing insert on 600A cable systems.



200A Load-Break Elbow

200A Dead-Break Tee-body Sensors

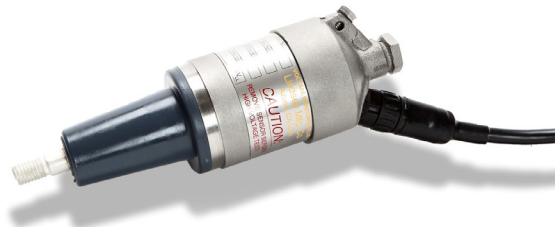
Available at 15kV, these sensors are ideal where spare bushing wells are not available and all cable circuits are already terminated with elbow connectors.



200A Dead-Break Tee-body

600/900A Plug Voltage Sensors

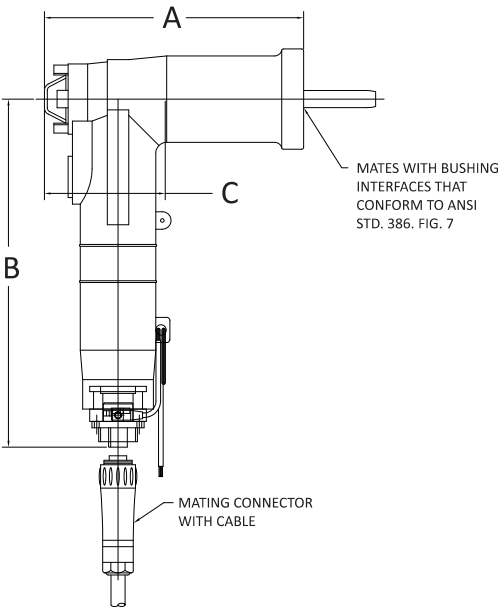
Available at 15kV, 25kV, and 35kV, these stainless-steel sensors fit standard 600/900A tee-body connectors.



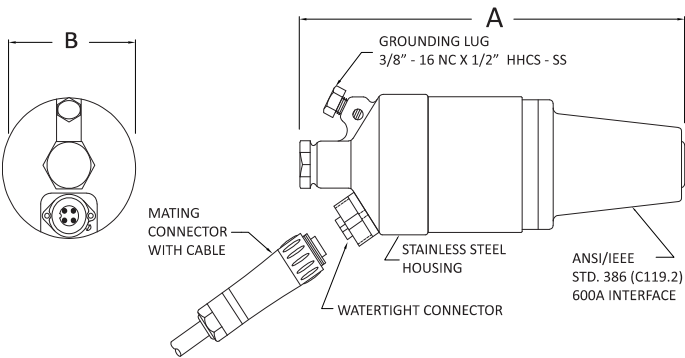
600/900A Plug Voltage

ElbowSense™ Voltage Sensor Dimensions

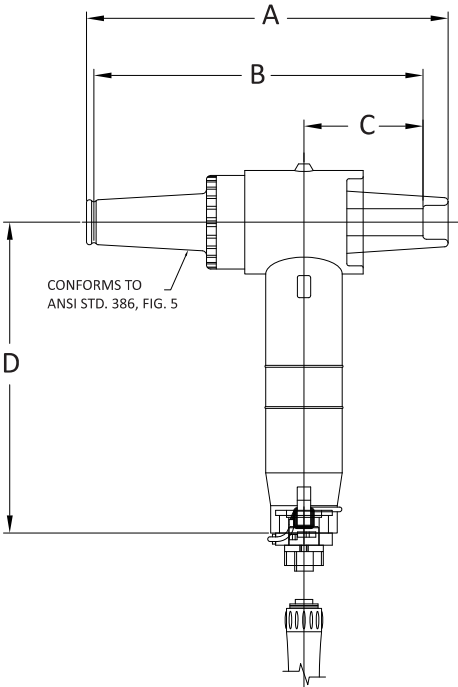
Load-Break Elbow Sensor



Plug-Style Sensor



Tee-Body Dead-Break Sensor



UNDERGROUND: ElbowSense™ Voltage Sensors

ElbowSense Voltage Sensor Ordering

Part Number Sequence: A B C / 0 D E F

A	B	C	D	E
Family	Type	Voltage Class	Ratio	Output Options
95 ElbowSense 0.5% Accuracy	3 200A Elbow	200A Elbow	1 1400:1	1 2 Contact socket for pad-mount, supplied with
95M ElbowSense 0.3% Accuracy	4 200A Tee-Body	2 15kV	2 2200:1	2 Cast in cable for vault and submersible applications
	5 600/900A Plug	3 25kV	3 3300:1	
		4 35kV	5 60:1*	
		200A Tee-Body	6 120:1*	
		2 15kV	7 166:1*	
		600/900A Plug	X Special (consult factory)	
		2 15kV		
		3 25kV		
		4 35kV		
EXAMPLE				
				F
				Cable Length
				F represents cable length in 10 ft. increments. Example: If F=1, the cable length will be 10 ft.
95	4	2	/ 0 1	2 1

Example: 9542/0121 is a 15kV class, 200A dead-break, 0.5% accuracy, T-body sensor with a 1400:1 ratio output with a cast-in 10 foot cable.

***Note:** Not available with 0.3% metering accuracy.

Sensor Dimensions	A	B	C	D
	Inches (mm)			
Elbow Sensor, 15kV	7.0 (178)	10.0 (253)	3.5 (88)	-
Elbow Sensor, 25kV/35kV	7.7 (196)	10.0 (253)	3.9 (99)	-
Tee-Body Sensor, 15kV	10.3 (263)	9.4 (239)	3.4 (86)	8.9 (226)
Plug Sensor, 15kV	9.4 (238)	3.3 (83)	-	-
Plug Sensor, 25kV	9.4 (238)	3.3 (83)	-	-
Plug Sensor, 35kV	10.6 (270)	3.5 (89)	-	-

ElbowSense™ Current Sensors

Lindsey Systems offers a variety of current sensors for use in underground, pad-mount, and specific overhead applications. All current sensors are rated 600V and are intended to be used with either insulated medium voltage conductors, or low voltage neutral conductors.

ElbowSense Ring-Style Current Sensor

This air-core CT based sensor is watertight and suitable for use in pad-mount, metal-clad, and submersible vault applications. It offers high accuracy (to 0.3%), no phase shift, and flat harmonic response through the 20th harmonic. Choose from cast-in cables or connectors. Pigtail cable is included per ordered part number.



ElbowSense Split-Core Current Sensor

This sensor incorporates the same current sensor as used in Lindsey Systems' MultiCore style overhead line sensors (see page 4 for a description). The split-core design provides installation flexibility by eliminating the need to slip the sensor over a cable's separable connector. It is suitable for use in pad-mount and metal-clad applications. The split-core sensor offers 1% current accuracy and no phase shift at fundamental frequency. It is not recommended for harmonic measurement applications.



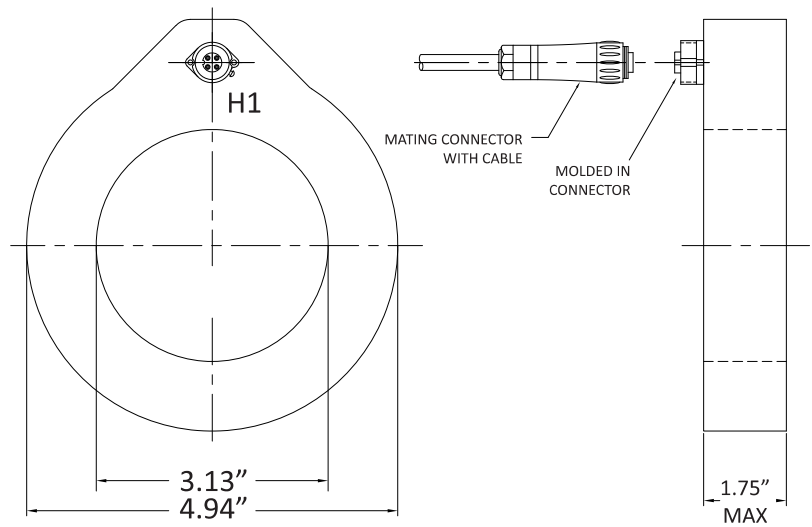
Neutral Current Sensor

The Lindsey Systems' neutral current sensor is commonly used to sense neutral-to-ground current in small capacitor banks, including both pole-mounted and pad-mount. The voltage-output sensor has a top which can be opened for easy installation around conductors up to 1.25" (30mm) in diameter. The sensor has 1% accuracy and comes standard with a 35 ft (10.5m) cast-in cable with pig-tail leads. Connectorized versions are also available. The sensor is rated IP68.

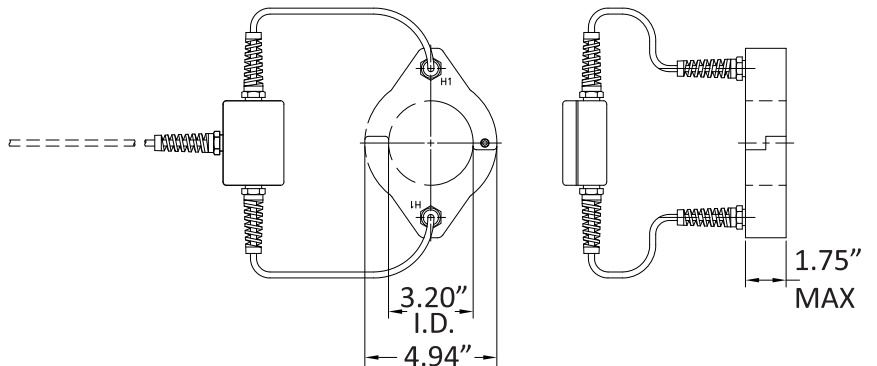


ElbowSense™ Current Sensors

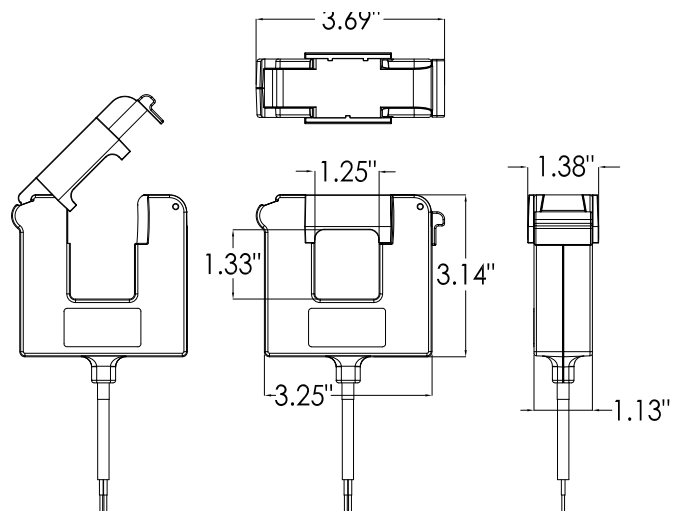
Ring Style Current Sensor



Split-Core Style Current Sensor



Neutral Current Sensor



ElbowSense™ Current Sensor Ordering

Part Number Sequence: A B 0 / C 0 D E

A	B	C	D	E
Family	Sensor Type	Current Output Signal	Connector	Cable Length
95 ElbowSense	1 Ring-Style 2 Split-Core Style	Ring-Style Options 1 600A:10V 3 600A:5A 4 600A:1A 5 300A:5A Split-Core Options 1 600A:10V	1 Cast-in connector. Matching cable of length "E" included. 2 Cast-in cable. Required for split-core sensor.	1 10 ft. (3m) 2 20 ft. (6m)
<div>EXAMPLE</div> <div>↓</div>				
95	2	0 /	1 0	2 1

Example: 9520/1021 is a split-core style current sensor, 600A:10V ratio, with 10ft. (3m) cast in cable.

Note: For other options, contact the Factory.

ElbowSense Current Sensor Specifications

Sensor Style	Ring-Type				Split-Core
Ratio	600A:5A	600A:1A	300A:5A	600A:10V	600A:10V
Burden	0.9 Ohms, MAX	22.5 Ohms, MAX	0.22 Ohms, MAX	10kOhm, MIN	1 Mohm, MIN
Max. Open Circuit Voltage @600A	14.5V	88V	8V	10V	10V
Accuracy	1%	0.3%	2%	1%	1%
Phase Shift	0 degrees nominal, +/- 0.5°				
Operating Temperature Range	-45°C / +80°C				
Stated Accuracy Temperature	-40°C / +55°C				

Neutral Current Sensor Specifications	
Accuracy	1%
Part No.	9525
Output Ratio	100A:10VAC
Insulation Voltage Class	600 VAC
Minimum Load	200 kOhm

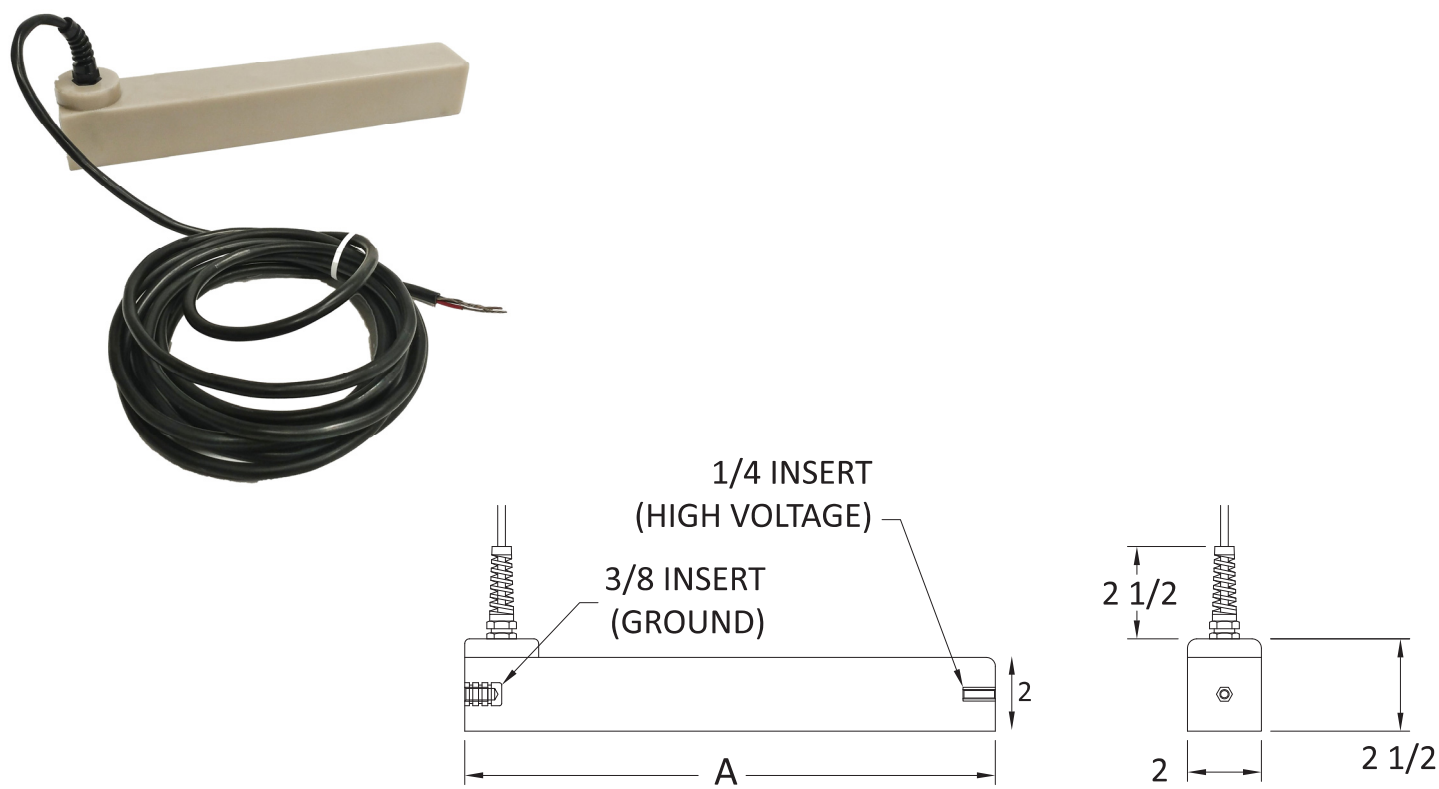
Neutral Current Sensor Ordering Table			
A	B	/	X
Family	Connector		Cable Length
9525	Blank - Pigtail		Blank– 35 ft. (10.7m)
	C (4-pin)*		X (ft.) multiples of 10 ft.
	S (7-pin)**		

*for use with Eaton CBC8000 control and most Lindsey junction boxes

**for use with SEL-734B, Beckwith M6283A, and other controls

SF6 Voltage Sensors

Lindsey Systems’ SF6 Voltage sensor provides high accuracy (0.5%) voltage sensing in a package designed for use in SF6-insulated environments. The embedded stud connectors allow for direct buswork connections and allow the sensor to be used as a standoff. All SF6 Voltage sensors come standard with a 15’ (4.6m) cast-in pigtail end cable.



Specification and Ordering		
Part No.	R-22466	R-18889
Voltage Class	15kV	25kV
BIL	95kV	125kV
60 Hz Withstand (1 min.)	30kV	60kV
Output Ratio	1400:1	1400:1
Minimum Load	1 MOhm	1 MOhm
Length (A)	10 3/8" (265mm)	14 3/8" (365 mm)
Weight	4 lbs. (1.8 kg)	6 lbs. (2.7 kg)

Underground Power Supply

Use the following formula* to determine the minimum average daily load current (I_{AVE}) required to flow through the cable to which the harvesting CT is connected. This is the amount of line current which will produce sufficient power to supply the connected control/communications equipment.

$$I_{AVE} = (I_{DC} \times 63) + 11 \text{ Amps}$$

Note that a minimum of 11A is required for charging of the battery to occur.

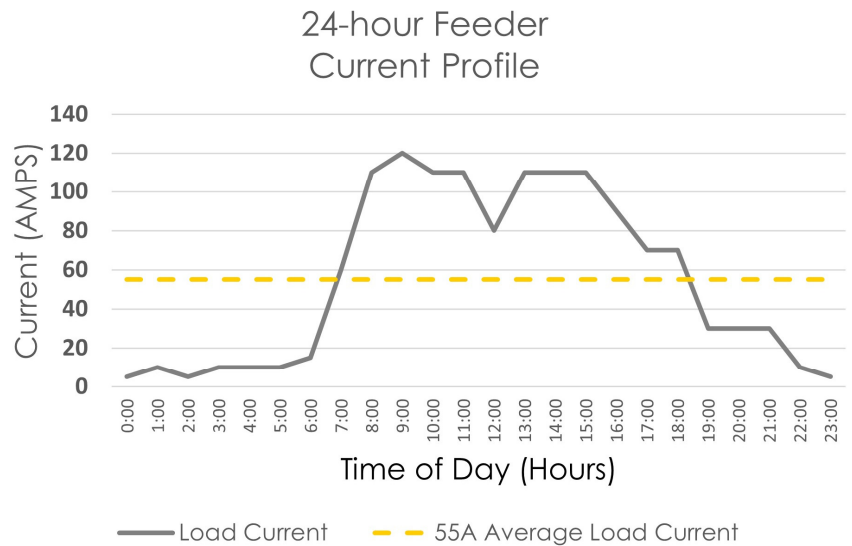
Example:

You are connecting communications and control equipment that draws a total of 700mA at 12VDC. Your feeder must have an average daily current of 55A.

An example daily load profile can be seen below.

$$I_{AVE} = (0.7 \times 63) + 11 = 55A$$

*Underground power supplies with serial numbers below 1100 follow the formula $I_{AVE} = (I_{DC} \times 66) + 27$



Specifications and Ordering

Catalog No.	9251
DC Output Voltage	12.8VDC nominal, 14.6VDC max
DC Output Current	4.0A max
Battery	12.8VDC, 4.5 or 9.0 Amp-hour
Operating Temp.	-20C to 60C (-4F to 140F)
Power Supply/CT Weight	6.8 or 7.3vkg (15 or 17 lbs.)
Mount	Magnetic (Clip mount optional)

Sensor Cables and Castite™ Junction Boxes

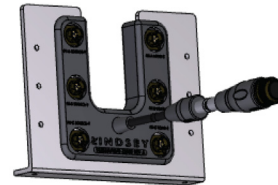
Achieving the performance and accuracy of Lindsey Systems' medium voltage sensors requires the use of cable systems which will not degrade their performance. Lindsey Systems sensor's design and calibration process includes the impedance characteristics of Lindsey Systems' cables. Lindsey Systems produces a wide range of cables ranging from single-phase, voltage-only styles, to prefabricated 4-to-1 cables encompassing all three phase plus neutral sensors. For more information and other options, refer to the Sensor Cable Assemblies catalog available on the Lindsey website.

Cable Features

- Controlled impedance across the sensor's operating temperature range.
- Proper signal segregation and shielding within the cable to eliminate crosstalk and ensure low noise.
- A selection of cable termination options.
- Gold-line cables are specifically designed to interface with High Voltage Accuracy GEN2 sensors. High-Accuracy Gold-Line cables are required to maintain the 0.2% voltage accuracy.

Castite Junction Boxes

CasTite junction boxes are fully molded, tamperproof, watertight junction boxes designed to gather outputs from multiple sensors. A molded in drop cable provides easy connection to a control cabinet located lower on a pole. Armored cable options available. Contact Lindsey for available configurations.



Cable Termination Options

Pigtail Cable End

Provides ease of connection to terminal blocks.



Bayonet Connector

A metal bayonet-style water-proof connector that "snaps" when closed, eliminating risk of over-and under-tightening. Sealed from the environment, it remains waterproof even if the connectors are left exposed to the elements.



Amphenol Connector

A plastic, threaded, water-proof connector for single-phase applications.



ITT Cannon Connector

A metal, threaded, water-proof connector for single-phase applications.



Multi-pin Connectors

Three- and four-to-one cables are available which terminate into a single 14- or 16-pin connector favored by control manufacturers including Beckwith, Eaton/Cooper, and SEL. These simplify connection of three phase sensor installations.



Sensor Cables and Castite™ Junction Boxes

Single Phase Cables

Part Number										
Sensor End		Cable End								
Connector	# Pins	Current Only	Voltage Only	Voltage & Current	Length in ft.	Pigtail	ITT Cannon	Amphenol	Bayonet	Example with 10' Cable
ITT Cannon	2	9610			/XX		N/A	N/A	N/A	9610/10
ITT Cannon	4		9614		/XX		N/A	N/A	N/A	9614/10
ITT Cannon	4			9612	/XX		N/A	N/A	N/A	9612/10
Amphenol	4	9-587A			/XX		N/A	N/A	N/A	9-587A/10
Amphenol	7		9614A		/XX		N/A	N/A	N/A	9614A/10
Amphenol	4		9-587P		/XX		N/A	N/A	N/A	9-587P/10
Amphenol	4			9-587	/XX		N/A	N/A	N/A	9-587/10
Amphenol	7			9612A	/XX		N/A	N/A	N/A	9612A/10
Bayonet****	4	9620		9620	/XX/		R-21622	9-587	N/A	9620/10 (pigtail)
Bayonet****	4		9620P		/XX/		R-21622	9-587	N/A	9620P/10 (pigtail)
Bayonet****	4	9-789	9-789	9-789	/XX/	N/A	N/A	N/A	9-793	9-789/10/9-793

3-to-1 Multi Phase Cables (All cables accommodate voltage & current signals)

Part Number					
Sensor End Connector	3-to-1	Length in ft. for Phase Cables	14-Pin Amphenol Control End Connector*	8-Pin Amphenol Control End Connector**	Example with 40' Phase Cables
ITT Cannon	9612	/XX	/R-22102		9612/40/R-22102
Amphenol	9-587	/XX	/R-22102		9-587/40/R-22102
Amphenol	R-22971	/XX		(included)	R-22971/40
Bayonet****	9620	/XX	/R-22102	/R-22978	9620/40/R-22102

4-to-1 Multi Phase Cables with Neutral Current Sensor*** Connector

Part Number							
Sensor End Connector	Neutral End Connector	4-to-1	Length in ft. for Phase Cables	Length in ft. for Neutral Cable	14-Pin Amphenol Control End Connector	8-Pin Amphenol Control End Connector	Example with 40' Phase and 35' Neutral Cables
Amphenol	7-pin Amphenol*	R-22748	/XX	,YY		(included)	R-22748/40,35
Amphenol	4-pin Amphenol**	R-22970	/XX	,YY	(included)		R-22970/40,35
Bayonet****	7-pin Amphenol*	9620	/XX	,YY	/R-22102		9620/40,35/R-22102
Bayonet****	4-pin Amphenol**	9620	/XX	,YY		/R-22978	9620/40,35/R-22978

Notes:

* This type of connector is commonly used with Beckwith and SEL controls

** This type of connector is commonly used with Eaton/Cooper controls

*** The sensor end of neutral cables will have a connector to mate to the connector on the Lindsey Neutral Sensor (P/N R-22981X). The neutral sensor cable is usually ordered to be slightly shorter than the phase cable to account for the length of cable that comes with the neutral sensor.

**** Any cables with bayonet connectors are also available with Gold Line High Accuracy conductors. Add /HA to the end of any catalog number to specify. For example, a 9620/40 cable in a high accuracy version would be part number 9620/40/HA.



About Lindsey Systems

Lindsey Systems is recognized globally as an innovator in the electric power industry. As a supplier of systems, products, and product solutions for the transmission and distribution of electricity, Lindsey enables utilities to meet the challenges of the modern-day electrical grid.

With over 75 years of experience and a reputation as a thought leader in the industry, Lindsey Systems' products are known around the world for reliability and performance.

Lindsey is ISO-9001, ISO-14001 and CSA W47.2 Certified.

For more information, visit www.Lindsey-USA.com.

Thoughtful Solutions in Medium Voltage Sensors

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Specifications subject to change without notice.

