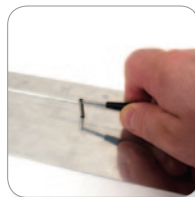


## Eddy Current Probes and Accessories



- **Rotating Scanner Probes**
- **Manual Bolt Hole Probes**
- **Surface Probes**
- **Spot Probes**
- **Weld Probes**
- **Sliding Probes**
- **Conductivity Probes and Standards**
- **Probe Kits**

# Olympus NDT

*Olympus Corporation is an international company operating in industrial, medical, and consumer markets, specializing in optics, electronics and precision engineering. Olympus instruments contribute to the quality of products and add to the safety of infrastructure and facilities.*

*Olympus NDT is a world-leading manufacturer of innovative nondestructive testing instruments that are used in industrial and research applications ranging from aerospace, power generation, petrochemical, civil infrastructure, and automotive to consumer products. Leading edge testing technologies include ultrasound, ultrasound phased array, eddy current, and eddy current array. Its products include flaw detectors, thickness gages, industrial NDT systems, automated systems, industrial scanners, pulser-receivers, probes, transducers, and various accessories. Olympus NDT is also a distributor of remote visual inspection instruments and high speed video cameras in the Americas.*

*Olympus NDT is based in Waltham, Massachusetts, USA, the company has sales and service centers in all principal industrial locations worldwide. Visit [www.olympus-ims.com](http://www.olympus-ims.com) for applications and sales assistance.*

## **Eddy Current Probes**

Olympus eddy current probes consist of the acquired brands of Nortec and NDT Engineering. We offer more than 10,000 standard and custom designed eddy current probes, standard references, and accessories. This catalog features many of the standard design probes that are available in a wide range of diameters, frequencies, and connector styles. For more information on additional probes, please visit [www.olympus-ims.com](http://www.olympus-ims.com).

Olympus also offers custom probe designs to meet specific inspection requirements. Eddy current probes may be designed to match the contours of a part or shaped to fit into a fixture for fast and accurate inspections. Contact your local Olympus representative for more details on available options.



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Olympus also offers an extensive line of innovative eddy current array probes and accessories. Learn more about them at [www.olympus-ims.com](http://www.olympus-ims.com)

# Primary Applications for Standard Probes

<p><b>Rotating scanner probes</b> are used with mechanical devices for automatically rotating the probe in the hole. Probes utilize reflection differential coils with operating frequencies of 100 kHz to 2 MHz are typical. They bear close tolerances and are highly reliable</p>	
<p><b>Manual bolt hole probes</b> have coils located at right angles to the probe direction, and are rotated by hand with the fastener removed. Standard (fractional and metric) and custom diameters are available with absolute and differential coils.</p>	
<p><b>Surface probes</b> have smaller diameter housing and coils built for higher frequencies. Applications are usually limited to surface flaws because of the higher frequency and smaller coil size. Included in this type of probe are the right angle surface probes and flexible surface probes, which are designed to reach areas inaccessible to the standard straight surface probes.</p>	
<p><b>Spot probes</b> are used for discovering flaws both on and below surfaces. Available in a broad frequency range, their diameters are usually large for accommodating lower frequencies or scanning large areas. Because spot probes contain larger coil diameters the detectable flaw size also increases and is typically limited to 1/2 the probe diameter.</p>	
<p><b>Weld probes</b> are designed to inspect ferrous welds. They provide a cost effective alternative to magnetic particle inspection, which requires the part to be prepared (cleaned) prior to inspection.</p>	
<p><b>Sliding probes</b> are designed to inspect aircraft fastener holes with fasteners in place, at higher scan rates than donut (ring) or spot probes. Common sizes and frequencies using the reflection coil techniques are often applied in major airframe inspection requirements.</p>	
<p><b>Conductivity probes</b> are designed for sorting non-ferrous metals, determining heat treatment condition or damage.</p>	

# Test and Documentation

A **Test Documentation Form** is supplied with most standard Eddy Current Probes. Each probe is tested on a sample or standard relevant to the probe diameter and frequency, for proper signal response. In addition a *Certificate of Conformance* is available upon request.



OLYMPUS NDT, 421 N. Quay St. Kennewick, WA

## TECHNICAL DATA SHEET

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**PROBE TEST DATA**

Calibration Screen

**INSTRUMENT SETTINGS**

Frequency	200 KHZ
Horiz Gain	65.0 dB
Vert Gain	75.0 dB
Phase Angle	86.8
LO Filter	100
HI Filter	OFF
Horiz	80.0%
Vert Position	20.0%
Probe Drive	MID
Sweep Mode	OFF
Display Mode	SINGLE

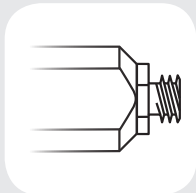
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**CALIBRATION INFORMATION**

Instrument	NORTEC500
Instrument Serial	ENG-GAMMA1
Instrument Part No.	NORTEC500
Production Order No.	032346/1
Probe Model No.	ML/100KHZ-500KHZ/A/90.5/6
Probe Serial No.	S02974
Probe Part No.	9222164
Probe Frequency	100KHZ-500KHZ
Test Standard	TB-SI
Notch Size	.020"
Date & Time Tested	4/9/2010 2:12:15 PM
Comments:	PROBE TESTED WITH .003" OF TEFLON TAPE ON STANDARD.

Technician \_\_\_\_\_ Date \_\_\_\_\_

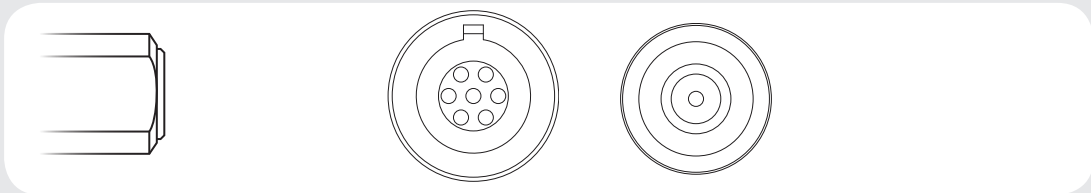
## Connector Styles



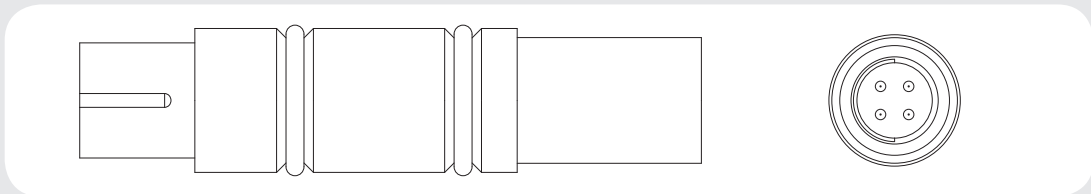
Microdot connector

Typical connector styles are shown below.

Olympus NDT also offers a variety of different connection options. Please call your local representative for available options.



7-pin LEMO (PowerLink) and Fischer/LEMO triax connectors



"Universal" scanner backshell with 4-pin Fischer connector

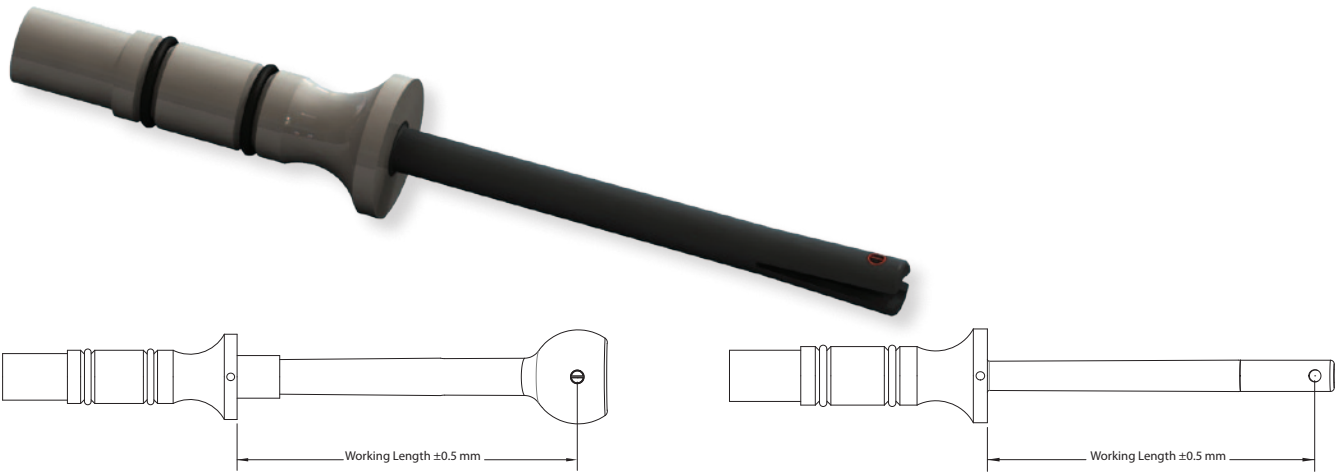
# Rotating Scanner Probes

## Bolt Hole Probes for Olympus Rotating Scanners

Rotating scanner probes are available in a variety of diameters and styles to work with Olympus rotating scanners. The SPO-5965 and SUB series probes are fitted with a 4-pin Fischer connector while the SPO-3564 series incorporate the 4-pin LEMO connector style.

The probes listed on this page are designed to be rugged and are nearly indestructible when dropped or expanded. Their probe tips have flexible plastics tips that automatically compress to their original size after being expanded to fit inside larger bolt holes (see chart below for hole size ranges). The benefit of these flexible tips is that no additional manual adjustment has to be made to the probe after a bolt hole has been reamed to a larger diameter.

Rotating scanner probes use a reflection differential type coil operating in the 200 kHz to 3 MHz range. They are suitable for aluminum structures as well as low conductivity materials.



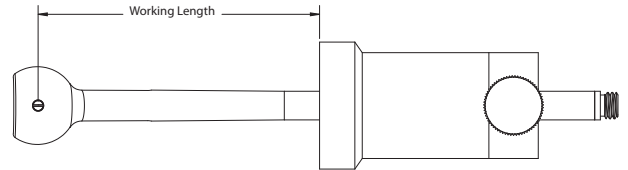
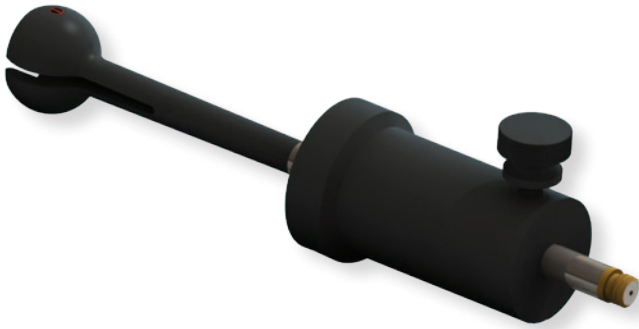
Range of Hole Size mm (in.)	Fischer Connector					LEMO Connector		
	SPO-5965*		SUB Series*			SPO-3564**		
	Part Number	Item Number	Part Number	Item Number	Working Length mm (in.)	Part Number	Item Number	Working Length mm (in.)
3.2 to 3.9 (0.125 to 0.156)	9230531	U8610280	SUB-8-10	U8600494	44.0 (1.75)	9230784	U8614109	28.0 (1.10)
3.9 to 4.7 (0.156 to 0.187)	9230061	U8610267	SUB-10-12	U8600481	44.0 (1.75)	9230078	U8614059	28.0 (1.10)
4.7 to 5.5 (0.187 to 0.218)	9219979	U8610231	SUB12-14	U8600482	44.0 (1.75)	9217153	U8614091	28.0 (1.10)
5.5 to 6.5 (0.218 to 0.250)	9219980	U8610232	SUB-14-16	U8600483	50.8 (2.00)	9217154	U8614092	28.0 (1.10)
6.5 to 7.1 (0.250 to 0.281)	9219981	U8610233	SUB-16-18	U8600484	50.8 (2.00)	9217155	U8614093	28.0 (1.10)
7.1 to 7.9 (0.281 to 0.312)	9219982	U8610234	SUB-18-20	U8600485	50.8 (2.00)	9217156	U8614094	38.0 (1.50)
7.9 to 9.5 (0.312 to 0.375)	9219983	U8610235	SUB-20-24	U8600486	50.8 (2.00)	9217157	U8614095	38.0 (1.50)
9.5 to 11.0 (0.375 to 0.437)	9219978	U8610230	SUB-24-28	U8600487	50.8 (2.00)	9217158	U8614096	38.0 (1.50)
11.0 to 12.7 (0.437 to 0.500)	9219984	U8610236	SUB-28-32	U8600488	50.8 (2.00)	9217159	U8614097	38.0 (1.50)
12.7 to 14.3 (0.500 to 0.562)	9219985	U8610237	SUB-32-36	U8600489	50.8 (2.00)	9217160	U8614098	38.0 (1.50)
14.3 to 15.9 (0.562 to 0.625)	9230156	U8610252	SUB-36-40	U8600490	50.8 (2.00)	9218785	U8614099	38.0 (1.50)
15.9 to 17.4 (0.625 to 0.687)	9230157	U8610253	SUB-40-44	U8600491	50.8 (2.00)	9218786	U8614100	38.0 (1.50)
17.4 to 19.0 (0.687 to 0.750)	9230158	U8610254	SUB-44-48	U8600492	50.8 (2.00)	9218787	U8614101	38.0 (1.50)

\* For use with MiniMite Fischer, Spitfire, and other "Universal" scanners.

\*\* For use with MiniMite LEMO, RA19, and RA2000 scanners.

# Manual Bolt Hole Probes

Manual bolt hole probes are available in an absolute (single coil) configuration with a Microdot connector or in a bridge or bridge differential configuration utilizing a Fischer/LEMO Triax connector. Standard manual bolt hole probes operate between 50 kHz and 500 kHz. Probes listed on this page incorporate a plastic probe tip and body for maximum durability. All probes have a split tip which allows for expansion from the nominal diameter range listed.

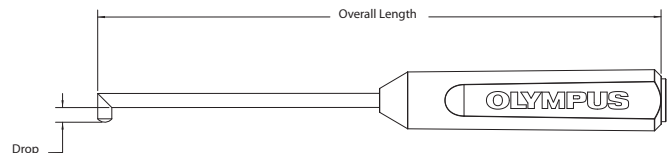


Range of Hole Size mm (in.)	Microdot Connector		Triax Fischer/LEMO Connector				Working Length mm (in.)
	Part Number	Item Number	Bridge		Bridge Differential		
3.2 to 3.9 (0.125 to 0.156)	BPM-8	U8600033	BPM-8-TF	U8600564	BPMD-8-TF	U8600570	28.0 (1.10)
3.9 to 4.7 (0.156 to 0.187)	BPM-10	U8600001	BPM-10-TF	U8600005	BPMD-10-TF	U8600571	28.0 (1.10)
4.7 to 5.5 (0.187 to 0.218)	BPM-12	U8600003	BPM-12-TF	U8600005	BPMD-12-TF	U8600572	28.0 (1.10)
5.5 to 6.5 (0.218 to 0.250)	BPM-14	U8600352	BPM-14-TF	U8600565	BPMD-14-TF	U8600573	28.0 (1.10)
6.5 to 7.1 (0.250 to 0.281)	BPM-16	U8600007	BPM-16-TF	U8600008	BPMD-16-TF	U8600574	50.8 (2.00)
7.1 to 7.9 (0.281 to 0.312)	BPM-18	U8600010	BPM-18-TF	U8600566	BPMD-18-TF	U8600036	50.8 (2.00)
7.9 to 9.5 (0.312 to 0.375)	BPM-20	U8600011	BPM-20-TF	U8600014	BPMD-20-TF	U8600575	50.8 (2.00)
9.5 to 11.0 (0.375 to 0.437)	BPM-24	U8600017	BPM-24-TF	U8600567	BPMD-24-TF	U8600576	50.8 (2.00)
11.0 to 12.7 (0.437 to 0.500)	BPM-28	U8600018	BPM-28-TF	U8600020	BPMD-28-TF	U8600577	50.8 (2.00)
12.7 to 14.3 (0.500 to 0.562)	BPM-32	U8600022	BPM-32-TF	U8600023	BPMD-32-TF	U8600038	50.8 (2.00)
14.3 to 15.9 (0.562 to 0.625)	BPM-36	U8600024	BPM-36-TF	U8600568	BPMD-36-TF	U8600578	50.8 (2.00)
15.9 to 17.4 (0.625 to 0.687)	BPM-40	U8600025	BPM-40-TF	U8600458	BPMD-40-TF	U8600579	50.8 (2.00)
17.4 to 19.0 (0.687 to 0.750)	BPM-44	U8600459	BPM-44-TF	U8600569	BPMD-44-TF	U8600580	50.8 (2.00)

# Surface Probes

## Detachable Metal Shaft Surface Probes

Metal shaft surface probes are general purpose probes used for surface or near surface crack detection. They are also used for conductivity and coating thickness measurements. Configured with absolute (Microdot connector) or bridge coils (Fischer/LEMO triax connector). Reference coils are internal to the probe in the bridge configuration probes (Fischer/LEMO triax connector), insuring the best match to the test coil without an external adapter. Probes are detachable with either Microdot or Fischer/LEMO triax connectors.



Frequency Range	Microdot Connector		Triax Fischer/LEMO Connector		PowerLink Connector (7-pin LEMO)		Overall Length mm (in.)
	Part Number	Item Number	Part Number	Item Number	Part Number	Item Number	

### Straight Probes

50 kHz to 500 kHz	MP-40	U8620067	MTF-40	U8623038	9403359	U8629526	101 (4)
200 kHz to 1 MHz	MP-40-200K-1M	U8620069	MTF-40-200K-1M	U8610675	9403403	U8629527	101 (4)
1 MHz to 3 MHz	MP-40-1-3M	U8620068	n.a.	n.a.	n.a.	n.a.	101 (4)
1 MHz to 6 MHz	n.a.	n.a.	MTF-40-1-6M	U8623039	9403404	U8629528	101 (4)

### Right Angle Shaft, 0.03 in. (0.76 mm) Drop

50 kHz to 500 kHz	MP9003-60	U8620348	MTF9003-60	U8623070	9403405	U8629529	152 (6)
200 kHz to 1 MHz	MP9003-60-200K-1M	U8620397	MTF9003-60-200K-1M	U8620401	9403406	U8620399	152 (6)
1 MHz to 3 MHz	MP9003-60-1-3M	U8620398	n.a.	n.a.	n.a.	n.a.	152 (6)
1 MHz to 6 MHz	n.a.	n.a.	MTF9003-60-1-6M	U8629521	9403407	U8620400	152 (6)

### Right Angle Shaft, 0.20 in. (5.08 mm) Drop

50 kHz to 500 kHz	MP902-60	U8620167	MTF902-60	U8623083	9403360	U8629530	152 (6)
200 kHz to 1 MHz	MP902-60-200K-1M	U8623342	MTF902-60-200K-1M	U8623085	9403408	U8629531	152 (6)
1 MHz to 3 MHz	MP902-60-1-3M	U8620168	n.a.	n.a.	n.a.	n.a.	152 (6)
1 MHz to 6 MHz	n.a.	n.a.	MTF902-60-1-6M	U8623084	9403409	U8629532	152 (6)

### Right Angle Shaft, 0.50 in. (12.7 mm) Drop

50 kHz to 500 kHz	MP905-60	U8620200	MTF905-60	U8623108	9403410	U8629533	152 (6)
200 kHz to 1 MHz	MP905-60-200K-1M	U8610518	MTF905-60-200K-1M	U8623312	9403411	U8629534	152 (6)
1 MHz to 3 MHz	MP905-60-1-3M	U8620201	n.a.	n.a.	n.a.		152 (6)
1 MHz to 6 MHz	n.a.	n.a.	MTF905-60-1-6M	U8623111	9403412	U8629535	152 (6)

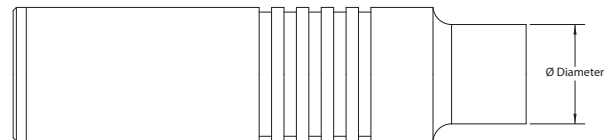


# Spot Probes

## Bridge Probes, Reflection Probes, Corrosion Probes

Detachable surface probes are available in a variety of diameters and frequency ranges. They are shielded to provide maximum sensitivity and are used for crack detection, thickness measurement, conductivity, and coating thickness measurements. These probes include a Fischer/LEMO triax or 7-pin LEMO PowerLink quick release connector.

Corrosion probes (SPO-532x series) are specifically balanced to find loss of material in aluminum structures and are configured with reflection absolute coils.

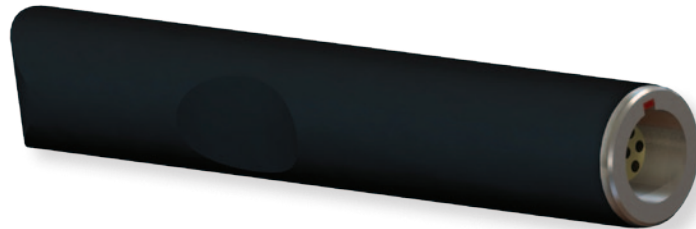


Frequency Range	Triax Fischer/LEMO Connector		PowerLink Connector (7-pin LEMO)		Diameter mm (in.)
	Part Number	Item Number	Part Number	Item Number	
<b>Standard Bridge</b>					
5 kHz to 100 kHz	9213546	U8623001	9222196	U8626007	6.3 (0.25)
100 kHz to 500 kHz	9216541	U8623011	9222308	U8623194	6.3 (0.25)
1 kHz to 50 kHz	9213012	U8630003	9222161	U8626004	7.9 (0.31)
500 Hz to 40 kHz	9213547	U8623002	9222456	U8626012	11.2 (0.44)
400 Hz to 30 kHz	9219548	U8629536	9222457	U8629298	12.7 (0.50)
300 Hz to 10 kHz	9213011	U8630002	9222193	U8626006	15.7 (0.62)
100 Hz to 2 kHz	9213549	U8623004	9222192	U8626005	19.0 (0.75)
<b>Standard Reflection</b>					
2 kHz to 200 kHz	9213550	U8623005	9222201	U8626011	6.3 (0.25)
700 Hz to 80 kHz	9213551	U8623006	9222200	U8626010	7.9 (0.31)
400 Hz to 60 kHz	9213552	U8623007	9222199	U8626009	11.2 (0.44)
300 Hz to 40 kHz	9213553	U8623008	9222198	U8626008	12.7 (0.50)
100 Hz to 20 kHz	9213554	U8623009	9222160	U8626003	15.7 (0.62)
100 Hz to 5 kHz	9213555	U8623010	9222458	U8626013	19.0 (0.75)
<b>Corrosion Probes</b>					
2 kHz to 200 kHz	9218204	U8629537	9230395	U8629538	6.3 (0.25)
700 Hz to 80 kHz	9217896	U8633004	9222343	U8633012	7.9 (0.31)
500 Hz to 60 kHz	9218108	U8633005	9230403	U8629157	11.2 (0.44)
300 Hz to 40 kHz	9218203	U8629128	9230404	U8633001	12.7 (0.50)

# Weld Probes

## Straight, Right Angle

Weld probes offer a cost effective method to inspect in-service ferrous welds. The inspection method is a clean, non-hazardous alternative over magnetic particle inspection, which does not require the removal of coatings such as paint or oxidation. Weld probes offer sensitivity to flaws in varying orientations and may also be used as a general purpose surface probe on any ferrous material.



Frequency Range	4-pin LEMO Connector		PowerLink Connector (7-pin LEMO)		Fischer/LEMO triax Connector		Description	Tip Diameter mm (in.)	Overall Length mm (in.)
	Part Number	Item Number	Part Number	Item Number	Part Number	Item Number			
100 kHz to 600 kHz	WLD-5-63	U8690018	9403362	U8629270	WLD-5-63-TF	U8690046	Straight weld probe	5.0 (0.196)	6.1 (2.4)
100 kHz to 600 kHz	WLD-8-55	U8690019	9403356	U8690033	WLD-8-55-TF	U8690047	Straight weld probe	8.0 (0.314)	5.5 (2.16)
100 kHz to 600 kHz	WLD90I-5-50	U8690022	9403373	U8629539	WLD90I-5-50-TF	U8629542	Right angle weld probe	5.0 (0.196)	5.0 (1.96)
100 kHz to 600 kHz	WLD90I-8-50	U8690023	9403374	U8690038	WLD90I-8-50-TF	U8690048	Right angle weld probe	8.0 (0.314)	5.0 (1.96)
100 kHz to 1 MHz	n.a.	n.a.	9231109	U8629540	9231110	U8629184	NECP-1152 SS W/ 45° probe tip	7.9 (0.312)	14.0 (5.5)
100 kHz to 1 MHz	n.a.	n.a.	SPO-4376L	U8629541	9218631	U8629543	SPO-4376 Straight weld probe	8.3 (0.330)	8.2 (3.25)
100 kHz to 600 kHz	NEC-2236	U8690035	9403361	U8629269	NEC-2236-TF	U8629544	Paint thickness probe	6.35 (0.25)	10.1 (4.0)

## Weld Probe Kits, Cables, and Reference Standards



### Weld Probe Kits

Part Number	Item Number	Probe Connector	Description
NEC-8196	U8670016	4-pin LEMO	Probe kit containing 1 each; NEC-2236, WLD-5-63, WLD-8-55, CN16-4L-6, SRSM-51020S-WLD, WLD-SAMPLE, Shipping/transport case
NEC-8196L	U8670018	7-pin LEMO	Probe kit containing 1 each; 9403361, 9403362, 9403356, SRSM-51020S-WLD, WLD-SAMPLE, Shipping/transport case

### Cables

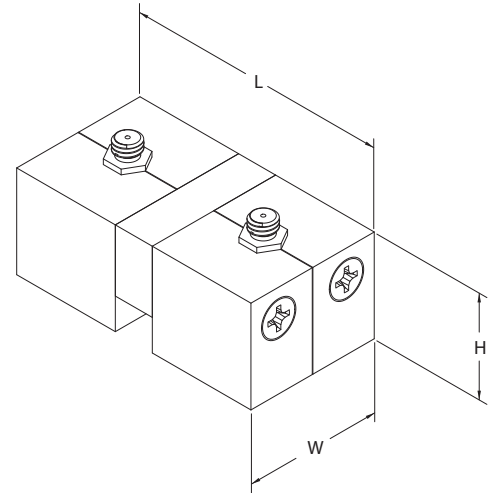
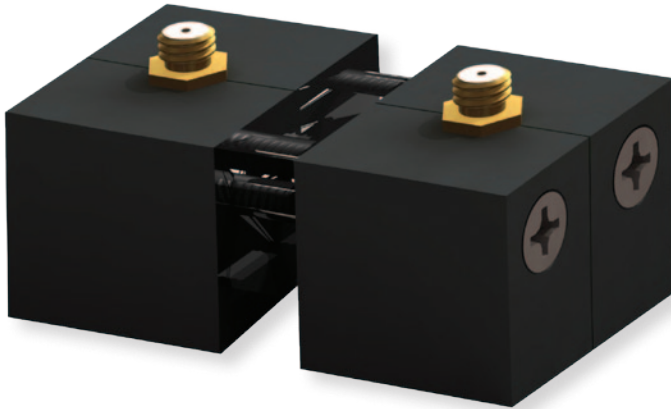
Part Number	Item Number	Description
CN16-4L-6	U8800276	16-pin LEMO instrument connector to 4-pin LEMO probe connector
9122083	U8800073	16-pin LEMO instrument connector to 7-pin LEMO probe PowerLink connector (CL/SC/6)
9122244	U8800091	16-pin LEMO instrument connector to Fischer/LEMO triax probe connector

### Reference Standards

Part Number	Item Number	Description	Calibration Certificate
SRSM-51020S-WLD	U8860571	Weld reference standard, steel, 0.5 mm, 1.0 mm, and 2.0 mm deep EDM notches plus paint thickness guides	Yes
WLD-SAMPLE	U8860581	Weld sample with four EDM notches, 0.17 mm wide x 0.5 mm deep, various lengths	No

# Sliding Probes

Sliding probes are specifically designed to inspect rows of fasteners. They operate in the reflection mode (Driver/Pickup coils) and are used to find surface and near-surface flaws. Available in two different types; adjustable types (as shown in picture below) include shims that allow the probe to be adjusted to accommodate different fastener sizes and include microdot connectors. Fixed types are capable of finding the same flaws as the adjustable but usually are procedure specific due to coil size and frequency range. The fixed versions typically include the Fischer/LEMO triax connector and the underside of the probe is relieved to allow the probe to easily slide over raised fastener heads.



Part Number	Item Number	Type	Frequency Range	Dimensions mm (in.)						
				Height		Length		Width		Connector
LTW0419-1	U8633025	Adjustable	100 Hz to 5 kHz	25.4	(1.00)	85.1	(3.35)	19.1	(0.75)	
LTW2018-1	U8633056	Adjustable	500 Hz to 10 kHz	25.4	(1.00)	44.7	(1.76)	25.4	(1.00)	(2) 1-pin Microdot
LTW0423-1	U8690009	Adjustable	500 Hz to 10 kHz	25.4	(1.00)	44.5	(1.75)	25.4	(1.00)	(2) 1-pin Microdot
LTW5010-1	U8690010	Adjustable	1 kHz to 20 kHz	25.4	(1.00)	25.4	(1.00)	25.4	(1.00)	(2) 1-pin Microdot
LTW1022	U8633026	Adjustable	5 kHz to 100 kHz	25.4	(1.00)	38.1	(1.50)	19.1	(0.75)	(2) 1-pin Microdot
NEC-4039	U8636053	Fixed	1 kHz to 100 kHz	25.4	(1.00)	38.1	(1.50)	20.3	(0.80)	Fischer/LEMO Triax
NEC-4039-1	U8633054	Fixed	1 kHz to 100 kHz	25.4	(1.00)	38.1	(1.50)	20.3	(0.80)	2-pin Microdot
NEC-4039-2	U8633055	Fixed	1 kHz to 100 kHz	25.4	(1.00)	38.1	(1.50)	20.3	(0.80)	4-pin Fischer
NEC-4039-3	U8629545	Fixed	1 kHz to 100 kHz	25.4	(1.00)	38.1	(1.50)	20.3	(0.80)	(2) 1-pin Microdot
NEC-4039-7L	U8633027	Fixed	1 kHz to 100 kHz	38.1	(1.5)	58.4	(2.3)	30.4	(1.2)	7-pin LEMO

# Conductivity Probes and Standards

Olympus conductivity probes with PowerLink technology are designed to be used with Nortec 500 series instruments\*. They are designed for sorting metals and alloys, determining heat-treatment condition or finding damaged areas. The Nortec 500 series instruments allow measurement of conductivity displayed in a digital readout in either %IACS or MS/m while at the same time measuring a coating or liftoff factor in inches or millimeters.

Conductivity probes are available in frequencies of 60 kHz or 480 kHz and are supplied with a 16-pin LEMO connector for PowerLink.

\*Not compatible with base model Nortec 500 – requires Nortec 500C, 500S, or 500D model for operation.

\*Also compatible with Nortec 2000 series.



## Conductivity Probes

Part Number	Item Number	Type	Frequency kHz	Dimensions mm (in.)			Connector
				Height	Length	Width	
9222340	U8690027	Right Angle	60	19.1 (0.75)	25.4 (1.00)	n.a.	16-pin LEMO
9222341	U8690028	Right Angle	480	19.1 (0.75)	25.4 (1.00)	n.a.	16-pin LEMO
9222360	U8690029	Straight	60	7.9 (0.31)	69.9 (2.75)	n.a.	16-pin LEMO
9222361	U8690030	Straight	480	7.9 (0.31)	69.9 (2.75)	n.a.	16-pin LEMO

## Conductivity Standards

Part Number	Item Number	IACS% Value #1 (tolerance)	IACS% Value #2 (tolerance)	IACS% Value #3 (tolerance)	IACS% Value #4 (tolerance)	IACS% Value #5 (tolerance)
CREF2-04100	U8861784	4.6 (±0.4)	100.0 (±10)	n.a.	n.a.	n.a.
CREF2-1742	U8861881	17.2 (±1.5)	42.7 (±4.4)	n.a.	n.a.	n.a.
CREF2-2932	U8861830	29.3 (±3)	32.0 (±3.3)	n.a.	n.a.	n.a.
CREF3-0129100	U8861910	1.5 (±0.1)	29.3 (±3)	100.0 (±10)	n.a.	n.a.
CREF3-172942	U8861675	17.2 (±1.5)	29.3 (±3)	42.7 (±4.4)	n.a.	n.a.
CREF3-172959	U8861822	17.2 (±1.5)	29.3 (±3)	59.9 (±6)	n.a.	n.a.
CREF3-294259	U8861924	29.3 (±3)	42.7 (±4.4)	59.9 (±6)	n.a.	n.a.
CREF4-17294259	U8861629	17.2 (±1.5)	29.3 (±3)	42.7 (±4.4)	59.9 (±6)	n.a.
CREF4-173259100	U8861982	17.2 (±1.5)	32.0 (±3.3)	59.9 (±6)	100.0 (±10)	n.a.
CREF5-01293242100	U8861902	1.5 (±0.1)	29.3 (±3)	32.0 (±3.3)	42.7 (±4.4)	100.0 (±10)
CREF5-04174559100	U8861929	4.6 (±0.4)	17.2 (±1.5)	45.7 (±4)	59.9 (±6)	100.0 (±10)

# Probe Kits

Probe kits are specially designed to allow for maximum application support in one, easy to carry, package. Kits are available in general or specific purpose configuration. The general purpose kits include a combination of surface, spot, bolt hole and sliding probes along with cables for connecting to a current Nortec series instrument as well as reference standards that may be used with the included probes. Scanner probe kits are available in the common connector styles of 4-Pin LEMO or Fischer Triax with a variety of common sizes.



## Training Kits

Part Number	Item Number	Quantity	Description
<b>Basic Probe Kit - P/N 9222342 (order number: U8670043)</b>			
9222193	U8626006	1	SL/300 kHz to 10 kHz/.62 surface probe
9222161	U8626004	1	SL/1 kHz to 50 kHz/.31 surface probe
9222164	U8616093	1	ML/100 kHz to 500 kHz/A/90.5/6 right angle pencil probe
9222162	U8626024	1	PL/500 kHz to 1 MHz/A pencil probe
9222184	U8626029	1	PL/500 kHz to 2 MHz/D pencil probe
9122083	U8800073	1	CL/SC/6 Cable, straight connector, 6 foot length
1902474	U8860163	1	Sorting block set of six*
1902510	U8860189	1	TB-S1 Aluminum surface EDM reference standard
-		1	Storage/ shipping case
<b>Expanded Probe Kit - 9231075 (order number: U8670011)</b>			
9222193	U8626006	1	SL/300 kHz to 10 kHz/.62 surface probe
9222161	U8626004	1	SL/1 kHz to 50 kHz/.31 surface probe
9222164	U8616093	1	ML/100 kHz to 500 kHz/A/90.5/6 right angle pencil probe
9222162	U8626024	1	PL/500 kHz to 1 MHz/A pencil probe
9222184	U8626029	1	PL/500 kHz to 2 MHz/D pencil probe
9122083	U8800073	1	CL/SC/6 Cable, straight connector, 6 foot length
1902474	U8860163	1	Sorting block set of six*
1902510	U8860189	1	TB-S1 Aluminum surface EDM reference standard
0321004	U8779068	1	Set of non-conductive plastic shims
1902477	U8660169	1	TB-16 Aluminum hole reference standard, 0.250 in. (6.35 mm)
9222218	U8609161	1	BL/100 kHz to 500 kHz/A.250 manual bolt hole probe
9222444	U8602032	1	BL/500 kHz to 2 MHz/D.250 manual bolt hole probe
1916915	U8860199	1	SPO-3932 second layer crack reference standard (0.0625 in. over 0.0625 in.) aluminum with fasteners
9403377	U8633027	1	NEC-4039-7L sliding probe
1916914	U8860197	1	SPO-4304 thinning sample, aluminum, 0.039 in. (0.99 mm) to 0.164 in. (4.1 mm)
-		1	Storage/ shipping case

\* Sorting block does not include IACS percentages.

\*\*Other connectors available. Contact your local representative for further information.



\*MiniMite scanner sold separately.

### Scanner Probe Kits

Part Number	9230351	9230721	9231334	SUBK-8-44
Item Number	U8670003	U8670005	U8670013	U8670107
Probe Series	SPO-5965	SPO-5965	SPO-5965	SUB
Range of Hole Size mm (in.)	Included probes			
3.2 to 4.0 0.125 to 0.156			✓	✓
4.0 to 4.7 0.156 to 0.187	✓	✓	✓	✓
4.7 to 5.5 0.187 to 0.218	✓	✓	✓	✓
5.5 to 6.4 0.218 to 0.250	✓	✓		✓
6.4 to 7.1 0.250 to 0.281	✓	✓	✓	✓
7.1 to 7.9 0.281 to 0.312	✓	✓		✓
7.9 to 9.5 0.312 to 0.375	✓	✓	✓	✓
9.5 to 11.0 0.375 to 0.437	✓	✓	✓	✓
11.0 to 12.7 0.437 to 0.500	✓	✓	✓	✓
12.7 to 14.3 0.500 to 0.562	✓		✓	✓
14.3 to 15.9 0.562 to 0.625	✓		✓	✓
15.9 to 17.4 0.625 to 0.687	✓		✓	✓
17.4 to 19.0 0.687 to 0.750	✓		✓	✓
19.0 to 20.6 0.750 to 0.812			✓	
22.2 to 23.8 0.875 to 0.937			✓	
25.4 to 31.7 1.00 to 1.25			✓	
Shipping/carry case	✓	✓	✓	✓

# Eddy Current Probe Selection Information

The selection of the right eddy current probe is of great importance in the success of your inspection. In these pages, we have included useful information to help you make the right choice.

## Absolute Probes (Single-Coil Probes)

The earliest form of eddy current instruments operated with a single-coil probe that was wound to a specific value frequency. Many newer models of eddy current instruments have kept this circuitry as a popular option for users while also incorporating more sophisticated functions. When these probes are used, a balance coil is also required which may be set from within the eddy current instrument or is commonly found within the probe housing, the cable connector or in a separate adapter (see Fig. 1)..

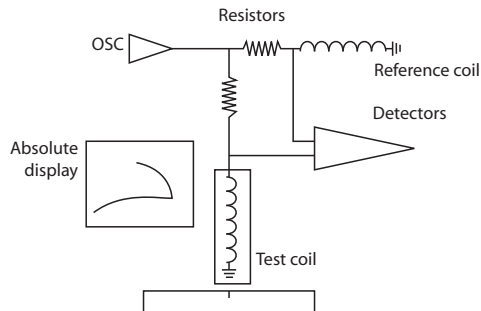


Figure 1

A problem can arise when the probe inductance value is not close enough to the value of the balance coil causing the instrument not to balance correctly. The result is poor performance (noisy or insensitive) or no response at all (signal saturation).

## Bridge Type Probes

In this configuration the probe coils are located in an electrical "bridge" (see fig. 2). The instrument balances the bridge and any change in balance is displayed as a signal. In this arrangement, the same coil produces the eddy currents and detects the impedance changes caused by the defects (or any other variables). Almost all instruments are able to operate with this type of coil arrangement.

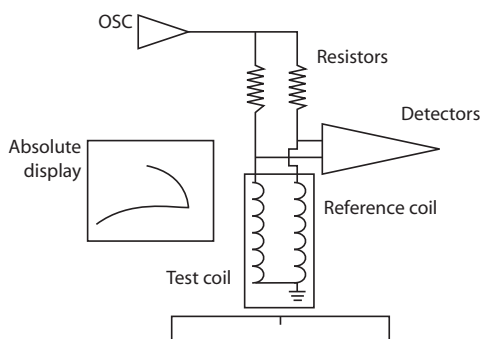


Figure 2

## Reflection Type Probe

These probes are also known as send-receive or driver-pickup. In this configuration, the eddy currents are produced by a coil connected to the instrument's oscillator (driver). The signals received back in the probe are detected by separate coils called pickups (see Fig. 3 and Fig. 4). All new impedance plane instruments and also many older models are able to operate in both bridge and reflection modes. If you are in doubt, call the manufacturer or give us a call.

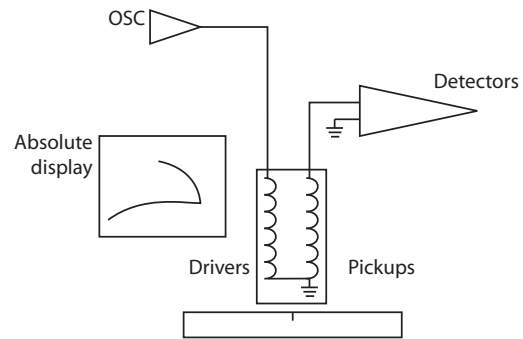


Figure 3

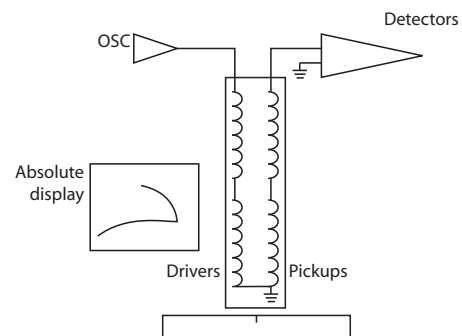


Figure 4

## Bridge or Reflection?

This is a common question asked by those involved in trying to select the best probe for an inspection. The answer is "It depends." Let us consider both systems.

**Gain:** Reflection probes will give a higher gain, particularly if they are "tuned" to a specific frequency, but normally the difference is on average about 6 dB. It is true that this doubles the signal, but if you consider that the instruments are able to give this increase of gain easily, it is not so important. Nevertheless, in critical applications this increase is very welcomed.

**Frequency range:** Reflection probes do not need to balance the driver to the pickup coils. This means that they will give a wider frequency range. As long as the driver produces eddy currents, the pickup will detect them and some signal will be displayed. This may not provide good information at certain frequencies, but the probe is still working!

Bridge type probes used to give a limited frequency span in the older instruments, as these had to balance an electrical bridge using its other arms (X and R controls). In modern instruments, the bridge is normally formed with fixed precision resistors, or a fixed transformer inside it. The signals detected in this manner are electronically processed without any "mechanical" adjustments, and this means a greater ability to balance over a wider frequency range.

**Drift:** Probe drift is mostly caused by temperature change in the coils. This may be caused by varying

ambient temperature, or the heat produced by the oscillator current, or both. There are design parameters that can be optimized to reduce drift, such as wire diameter and ferrite selection, but reflection probes are normally a good choice to avoid this problem



even more.

In a reflection probe, the driver current does not flow through the pickup coils; in fact, the magnetic field received back from the specimen is normally much smaller and, consequently, the current flowing in the pickups is also reduced. Most probe types (pencil, spot, ring, bolt hole, etc.) can be made as bridge or reflection. Keep in mind that a reflection probe is almost invariably more difficult to manufacture and therefore more expensive.

### Absolute, Bridge and Differential Probes

This is an area where some confusion exists. Many users have called a probe "differential" when the signal displayed gives an up and down movement or a figure 8 type signal. This is caused by the two coils sensing the defect in sequence. When both sensing coils are on the probe surface, they compensate for lift-off and as a result no line is visible (see Fig. 5).

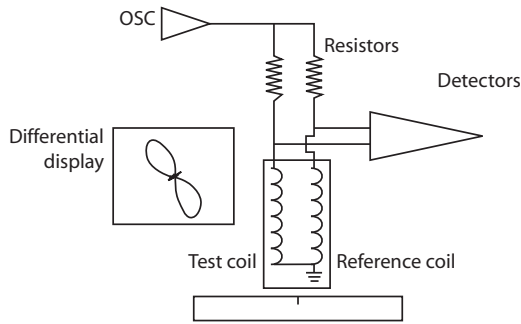


Figure 5

In contrast, an absolute or bridge display is produced by a single sensing coil (see Fig. 1 through Fig. 4), giving a single, upward movement with a near horizontal lift-off line. Others have called a probe "differential" simply when the coils were connected differentially such as in a bridge circuit. The problem with this definition is that probes can be connected differentially in a reflection system as well as when using two pickups (such as most scanner-driven bolt hole probes). In this case, the two pickup coils are positioned close to one another and contained within a driver coil (see Fig. 6).

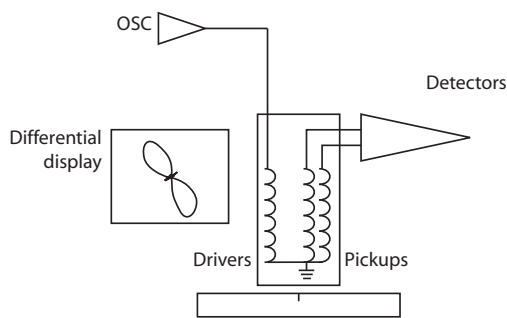


Figure 6

The best way out of this confusion is often to specify the probe as absolute, bridge, reflection, bridge differential or reflection differential as needed. It makes more sense to qualify the description according to the displayed signal, since this is what really matters and not many people are concerned as to how the coils are connected internally.

### Shielded and Unshielded Probes

Probes are normally available in both shielded and unshielded versions; however, there is an increasing

demand for the shielded variety. Shielding restricts the magnetic field produced by the coils to the physical size of the probe. A shield can be made of various materials, but the most common are: ferrite (like a ceramic made of iron oxides), Mumetal, and mild steel. Ferrite make the best shielding because they provide an easy path for the magnetic field but has poor conductivity. This means that there is little eddy current loss in the shield itself. Mild steel has more losses but is widely used for spot probes and ring probes due to its ease of machining when ferrite is not available in certain sizes or shapes. Mumetal is sometimes for pencil probes as it is available in thin sheet; however, it is less effective than ferrite.

Shielding has several advantages: first, it allows the probe to be used near geometry changes, such as edges, without giving false indications; next, it allows the probe to touch ferrous fastener heads with minimal interference; last, it allows the detection of smaller defects due to the stronger magnetic field concentrated in a smaller area.

On the other hand, unshielded probes allow somewhat deeper penetration due to the larger magnetic field. They are also slightly more tolerant to lift-off. Unshielded probes are recommended for the inspection of ferrous materials (steel) for surface cracks, and in particular with meter instruments. The reason for this is that the meter response is too slow to allow the signal from a shielded probe to be displayed at normal scanning speeds due to the smaller sensitive area.

### Adapters

To connect a probe with a connector different from the type used on the instrument, it is necessary to use an adapter. An adapter consists of two different connectors joined and wired to match the inputs and outputs as necessary. It is normally housed in a short body that can be positioned at the instrument's input. Sometimes, it is also possible to have a "cable adapter," which is made to match a connector located at the probe body. Depending on the instrument's wiring, it may be possible to have a single adapter for both bridge and reflection probes. In other cases, it is necessary to have two separate adapters or use a switchable type.

# Probe Types and Their Usage

## Pencil Surface Probes

These are the probes normally used for surface crack detection, also known as High Frequency Eddy Current probes (HFEC). They have a small coil that can be made shielded or unshielded. Most are absolute types, although they can be made with the balance coil built into the probe body to ensure good balance and increased frequency range. There are many types available, both in straight and angled versions, to match any requirements. They are also available with flexible shafts that can be adjusted to different shapes.

Pencil probes can be designed to operate at various frequencies, depending mostly on the material to be tested. For aluminum, 100 kHz is the most popular, allowing use of up to 200 kHz or more, depending on the balance coil and the instrument used. The higher frequencies will give better angle to lift-off, although as the probe approaches 500 kHz it becomes more lift-off sensitive and will not penetrate as much material. Because of this, it is normally preferable to stay at lower frequencies.

It has become common to use pencil probes below 100 kHz when looking for first layer cracks that originate in the opposite side and are growing, but have not broken the surface yet (even more so with clad skins). A frequency between 20 kHz and 50 kHz will penetrate the clad and detect a defect that is only 50% through the thickness. Some standard 100 kHz probes can be run at 50 kHz provided that we compensate for this by using higher gains; however, it is better to use probes designed for the lower frequencies, even if we have to accept a slightly larger diameter.

For low-conductivity materials, such as titanium or stainless steel, it is necessary to choose a frequency of 1 MHz to 2 MHz to improve sensitivity and phase angle to surface breaking cracks. Magnetic steels are not very critical as far as frequency is concerned, although good results are often obtained at 1 MHz or 2 MHz to minimize permeability variations. When the material is cadmium-plated, lower frequencies are needed to minimize its effect and sometimes a frequency of 25 kHz to 50 kHz is the best, although a bigger probe diameter is required.

## Surface Spot Probes

Also known as Low-Frequency Eddy Current probes (LFEC), spot probes are used at low frequencies for subsurface detection of cracks and/or corrosion. They are available from 100 Hz and up (to penetrate the thicker structures), in both shielded and unshielded versions. Shielded probes are more popular as they concentrate the magnetic field under the probe and avoid interference from edges and other structures; however, they are more sensitive to small defects. Reflection types are also widely used due to the lower drift and often higher gain in the more demanding applications. Spring-loaded bodies are useful to maintain a constant pressure when needed, such as when spot testing for conductivity differences.

## Ring/Encircling Probes

These are similar to the surface spot probes, except that the center has been enlarged (and made into a hole) to accept the diameter of the fastener head/hole to be inspected. They provide greater sensitivity to cracks, as the fastener/hole interface aids the penetration. This is even more noticeable with ferrous fasteners, but permeability variations can also give problems. The probe internal diameter (ID) is the more important dimension, and should be chosen to be slightly bigger than the fastener head. The outside diameter (OD) is not normally critical but it should not overlap

other fastener heads. The probe height is not critical; however, in cases of limited access, special low-profile types are available where the test coil and balance coil sections of the probe are separated to further reduce the height of the probe.

## Bolt Hole Probes

Bolt hole probes are designed to inspect the bore of holes after the fastener is removed. They can be divided into two groups:

**Manually operated with adjustable collar.** The probe is indexed to the right depth and rotated manually. Typical coil configuration used with the manual bolt hole probes is absolute, bridge and bridge differential.

**Rotating scanner.** These are manufactured to mate with the various scanners in use, and provide the best coverage and high inspection speeds. Rotating scanner probes typically contain reflection-differential coil configurations as the differential coils are less sensitive to interface and provide better detection of defects. Reflection mode is used to maximize gain, provides a wider frequency range and minimizes drift which could be caused by heat build up in the probe as it rotates at high RPM's.

## Other Hole Inspection Probes

**Low frequency bolt hole probes.** Used inspect holes through bushings, low frequency coils are incorporated into the design of the probes. These probes use coils similar to those in the surface spot probes and typically are limited to larger diameter hole due to the larger coil size.

**Countersink probes.** These are made to fit specific fastener head shapes to inspect the open hole entrance. They can be made for manual or rotating scanner operation, with the same coil configurations used in the standard bolt hole inspections. If a large number of holes need inspection, the rotating scanner type provides a much faster coverage.

## Large Diameter Rotating Scanner Probes

For many years, large diameter holes have been inspected using manual bolt hole probes. The reason for this was that the existing probe designs were too heavy and unbalanced to rotate freely for use with standard hand-held rotating scanners. Manual scanning and indexing is not only a slow process, but it is also difficult to ensure complete coverage. In addition, large holes are often in thick parts, and that means that a large number of scans are required to cover the complete thickness.

The new large diameter probes have been designed to minimize weight and optimize mechanical balance. In this way, the comparatively small power rotating guns can drive them without excessive speed loss and shaking. Diameters in excess of 2 in. (50 mm) have been successfully tested. The adjustable diameter probe types allow for the probe to be set at the correct diameter to prevent too much friction and not lose sensitivity to small defects.

## Notes

1. Not all hand-held scanners have the same power and the larger diameter probes need more power or the inspection results will be unreliable. If in doubt about your rotating scanner, give us a call and we will advise you.

When testing large diameter holes, the coil is traveling faster over the defect. This changes the duration of the signal and means that the filter settings in the instrument may need to be reset to higher values. The high-pass filter (HPF) that normally reduces the effect of slow changing variables, such as ovality (lift-off changes), will

not be as effective and the setting will need to be increased, for example, from 100 Hz to 200 Hz or more. The low-pass filter (LPF) may cut part of the defect signal. Again try increasing the setting to avoid this, for example, from 200 Hz to 500 Hz or more. Band-pass filters (BP) are a combination of both and are available in some instruments. They also need resetting to a higher value. Always adjust the filters for the best signal-to-noise ratio. Some instruments may not have enough filter settings to take full advantage of the large diameter probes.

## Special Probes

There are many probe types that are made for specific customer requirements. Please send us a drawing or sketch of your application, and we will quote a special eddy current probe to fit your part.

## Troubleshooting

When experiencing difficulty in operating a probe, it is advisable to do some simple tests.

1. Check that the operating frequency is within the probe's range. If the probe is not balancing properly, the instrument may have entered into "saturation." This can be verified easily. If the signals produced by lift-off and defect (or an edge) superimpose on each other, there is no phase angle and saturation has occurred. The frequency may be too high, or the probe coil and the balance coil are not of the same value. Try lowering the probe drive voltage. Please note that some instruments have the capability of very high output values that may be excessive for some probes.

Try moving the cable, particularly where it joins the connector or the probe body as these are the weaker points. If it shows intermittent operation, the cable needs replacement. Also, it may be necessary to clean connector contacts. Silicon spray or an electrical contact cleaner will often help.

If the dot appears dead or the signals are small and/or distorted, look at the filter settings. Many instruments now offer a range of "high pass" and "low pass" filters. These are very useful, but if set incorrectly will cause various effects.

**High-pass filters (HPF)** will always bring the dot to the balance point and, at high settings, (as used for rotating scanners) will make the dot appears as static at the balance point. For hand operation, set the high pass filter to OFF (or 0 Hz).

**Low-pass filters (LPF)** will make the display speed dependent. The best setting for manual use is typically 100 Hz, but if the signal is too noisy it may be necessary to reduce this setting. If so, the scanning speed will need to be kept low enough as not to reduce the size of the signals.

1. Examine the probe test surface. It may be damaged or worn. Watch for exposed wires or other damage. Use Teflon tape at the probe face whenever possible. This reduces probe wear and also prevents possible contact with the ferrite that will often produce noise.

When confronted with high signal-to-noise ratios typically seen when using rotating scanner probes it is a good practice to insert a small piece of sponge or foam rubber to enhance the coil's contact with the inner surface of the hole. This technique will greatly reduce noise and increase sensitivity.

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