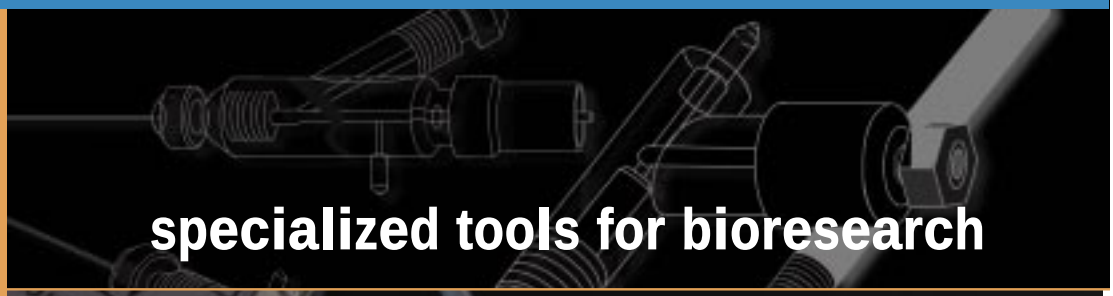
Microelectrode/Micropipette Holders
Capillary Glass Tubing
Reference Cells & Ag-AgCl Electrodes
Silver Wire, Plugs & Jacks



specialized tools for bioresearch

Applications

- Patch Clamp
- Patch Clamp Microperfusion
- Intracellular Recording
- Extracellular Recording
- Microiontophoresis
- Pressure Applications
- Non-electrical Pressure Applications

WARNER INSTRUMENTS
A Harvard Apparatus Company

Microelectrode/Micropipette Holders

Applications

- Patch clamping
- Intracellular and extracellular recording
- Iontophoresis and ion specific measurements
- Microinjection and perfusion
- Dual channel holders for theta glass

Features

- Bored to fit glass OD
- Straight, 45° and 90° body styles
- Replaceable coupling elements
- Custom designs available

Warner Instruments precision-made holders are ideal for any applications which use fluid-filled glass microelectrodes and micropipettes. They provide the important link between live cells and high impedance amplifiers in applications such as patch clamp recording, intracellular and extracellular recordings, iontophoresis and ion specific measurements. Non-electrical micropipette holders are used for microinjection.

Our standard microelectrode holders are available in numerous choices of body style, electrical coupling, and ports and venting. We also can design and fabricate custom microelectrode holders for any specialized application.

Please contact our sales department for further information.

Holder Materials

The highest quality materials are used in the fabrication of Warner electrode holders. Holder bodies and caps are machined from either acrylic or polycarbonate, and are annealed and vapor polished. Acrylic is generally preferred for its optical quality which is particularly important for the detection of air bubbles in holders filled with electrolyte. Acrylic is the standard material for E, ME and MP Series Holders.

Q and PE Series Holders are most often used in patch clamp applications and are made from polycarbonate. Studies have shown that polycarbonate holders exhibit lower noise levels in these critical applications. Connector pins are gold-plated and connector insulators are made from Teflon® or polycarbonate.

Body Styles

Holders that attach directly to a headstage are available with choice of body style (position of the microelectrode relative to the headstage connector). Bodies may be straight (axial), right angle or 45°. Straight holders are used most often, but in setups with multiple electrodes or other space limiting factors a right angle or 45° holder may work better.

Glass Size

To ensure a good fit, holders are bored for specific glass sizes. Standard bore sizes are 1.0, 1.2, 1.5, 1.7 and 2.0 mm but any size between 1.0 and 2.0 mm may be specified. The bore is made 0.1 mm oversize to accommodate small variations in glass diameters. Tightening the threaded end cap compresses a silicone rubber gasket providing a good seal around the glass.

Headstage Connections

Competitively priced holders are available for virtually any commercially available headstages in use. This includes headstages made by Warner, Axon, Heka, List, Dagan and others.

Electrical Coupling

The electrical signal is “coupled” between the microelectrode and the headstage with one of three replaceable elements.

Ag/AgCl Pellet

The molded pellet assembly is installed inside the holder. Both holder and pipette are filled with electrolyte before assembly and any trapped air bubbles removed. Holders with pellets are ready for use (no chloriding needed) and provide small offset potentials and low drift. E and ME Series holders are available with pellets.

Ag Wire

Silver wire holders are generally for patch clamp recording or measurements with ion selective electrodes where only the pipette is filled. The silver wire extends approximately 25 to 30 mm from the front end of the holder to be inserted into the pipette. The portion of the wire in contact with the electrolyte must be chlorided before use. The silver wire coupling is available with any Warner microelectrode holder.

Hybrid

Q Series holders are available with the optional hybrid coupler. It combines the advantages of a Ag/AgCl pellet (no chloriding) and Ag wire. A 1 mm diameter Ag/AgCl pellet sits at the end of a 70 mm long Ag wire external to the holder. The wire is insulated with Teflon® tubing and sealed with wax. The pellet end is inserted into the fluid-filled microelectrode. Hybrid couplings can only be used with straight body styles (QS) and glass tubing ID’s greater than 1 mm.

Port or Vent

Holders can include a port to apply pressure or suction or a vent to equalize internal pressure. Standard ports are 2 mm diameter (polycarbonate) for connection to 1/16" ID tubing. Stainless steel ports are available by special order. Vents are 0.8 mm diameter holes in place of the port. Micropipette holders designed specifically for pressure injection are offered with a selection of ports including male and female Luer.

Pressure Models

The ME and MP Series holders are designed for applying pressure or suction to the electrode or pipette. ME Series are microelectrode holders with either a Ag/AgCl pellet or Ag wire coupling. MP Series are non-electrical for pressure injection only.

Theta Glass Holders

THS Series holders accommodate the use of theta glass.

Special Designs

Even with the large selection of holders in this catalog, we realize that your particular application may require something slightly different. Fortunately, our holder designs are easily modified. We welcome your inquiries. Please call our customer service and we will be happy to discuss your particular needs.

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E SERIES HOLDERS

Specifications

Body Material: Acrylic

Body Styles: Straight, 45°, and 90°

Connectors: 2 mm Pin or 2 mm Jack

Coupling: Ag Wire or Ag-AgCl Pellet

Port: 2 mm diameter Polycarbonate

Vent: 0.8 mm diameter Hole

Standard Glass Sizes: 1.0, 1.2, 1.5 and 2.0 mm

Applications

Intracellular Recording

Microiontophoresis

ESP-FxxN

ESW-MxxP

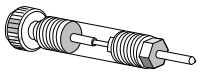
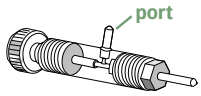
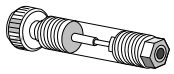
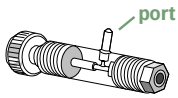
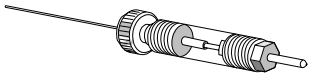
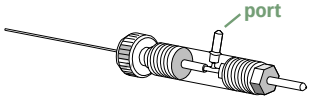
E45-MxxP

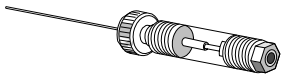
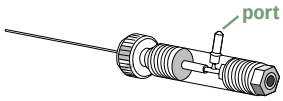
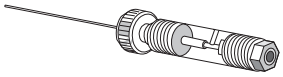
E45-FxxN

ERP-MxxP

ERW-FxxN

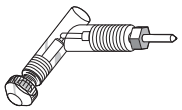
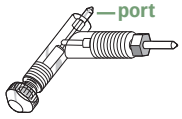
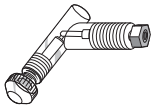
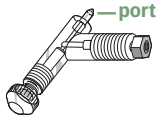
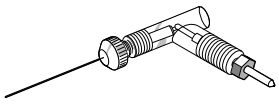
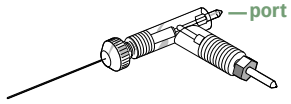
E SERIES - Straight Body Holders

Wire/Pellet	Connector	Port	Glass OD (mm)	Model	Order #	
Pellet	2 mm Pin	No	1.0	ESP-M10N	64-0992	
			1.2	ESP-M12N	64-0993	
			1.5	ESP-M15N	64-0994	
			2.0	ESP-M20N	64-1260	
		Yes	1.0	ESP-M10P	64-0995	
			1.2	ESP-M12P	64-0996	
			1.5	ESP-M15P	64-0997	
			2.0	ESP-M20P	64-0998	
	2 mm Jack	No	1.0	ESP-F10N	64-0980	
			1.2	ESP-F12N	64-0981	
			1.5	ESP-F15N	64-0982	
			2.0	ESP-F20N	64-0983	
		Yes	1.0	ESP-F10P	64-0984	
			1.2	ESP-F12P	64-0985	
			1.5	ESP-F15P	64-0986	
			2.0	ESP-F20P	64-0987	
Wire	2 mm Pin	No	1.0	ESW-M10N	64-1011	
			1.2	ESW-M12N	64-1012	
			1.5	ESW-M15N	64-1013	
			2.0	ESW-M20N	64-1014	
		Yes	1.0	ESW-M10P	64-1015	
			1.2	ESW-M12P	64-1016	
			1.5	ESW-M15P	64-1017	
			2.0	ESW-M20P	64-1018	

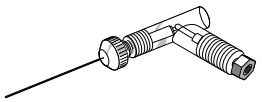
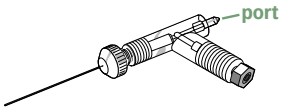
Wire/Pellet	Connector	Port	Glass OD (mm)	Model	Order #	
Wire	2 mm Jack	No	1.0	ESW-F10N	64-0999	
			1.2	ESW-F12N	64-1000	
			1.5	ESW-F15N	64-1001	
			2.0	ESW-F20N	64-1002	
		Yes	1.0	ESW-F10P	64-1003	
			1.2	ESW-F12P	64-1004	
			1.5	ESW-F15P	64-1005	
			2.0	ESW-F20P	64-1006	
		Vent*	1.0	ESW-F10V	64-1007	
			1.2	ESW-F12V	64-1008	
			1.5	ESW-F15V	64-1009	
			2.0	ESW-F20V	64-1010	

*Vented models are standard with the Warner OC-725 Oocte Clamp.

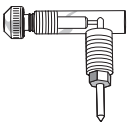
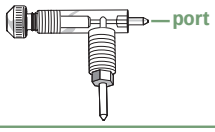
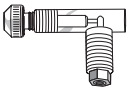
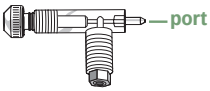
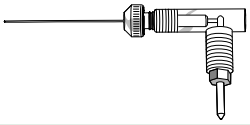
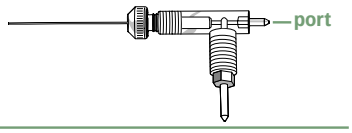
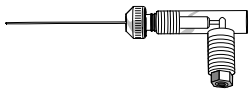
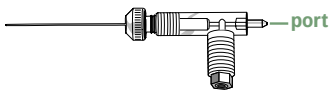
E SERIES - 45° Body Holders

Wire/Pellet	Connector	Port	Glass OD (mm)	Model	Order #	
Pellet	2 mm Pin	No	1.0	E45P-M10N	64-0908	
			1.2	E45P-M12N	64-0909	
			1.5	E45P-M15N	64-0910	
			2.0	E45P-M20N	64-0911	
		Yes	1.0	E45P-M10P	64-0912	
			1.2	E45P-M12P	64-0913	
			1.5	E45P-M15P	64-0914	
			2.0	E45P-M20P	64-0915	
	2 mm Jack	No	1.0	E45P-F10N	64-0900	
			1.2	E45P-F12N	64-0901	
			1.5	E45P-F15N	64-0902	
			2.0	E45P-F20N	64-0903	
		Yes	1.0	E45P-F10P	64-0904	
			1.2	E45P-F12P	64-0905	
			1.5	E45P-F15P	64-0906	
			2.0	E45P-F20P	64-0907	
Wire	2 mm Pin	No	1.0	E45W-M10N	64-0924	
			1.2	E45W-M12N	64-0925	
			1.5	E45W-M15N	64-0926	
			2.0	E45W-M20N	64-0927	
		Yes	1.0	E45W-M10P	64-0928	
			1.2	E45W-M12P	64-0929	
			1.5	E45W-M15P	64-0930	
			2.0	E45W-M20P	64-0931	

E SERIES - 45° Body Holders *continued*

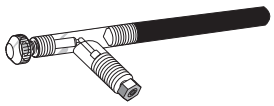
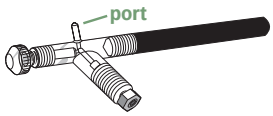
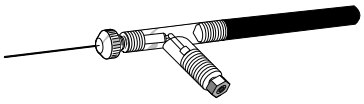
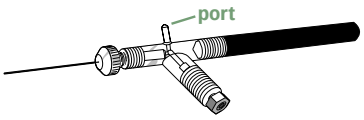
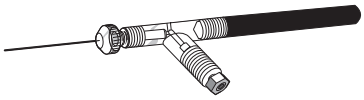
Wire/Pellet	Connector	Port	Glass OD (mm)	Model	Order #	
Wire	2 mm Jack	No	1.0	E45W-F10N	64-0916	
			1.2	E45W-F12N	64-0917	
			1.5	E45W-F15N	64-0918	
			2.0	E45W-F20N	64-0919	
		Yes	1.0	E45W-F10P	64-0920	
			1.2	E45W-F12P	64-0921	
			1.5	E45W-F15P	64-0922	
			2.0	E45W-F20P	64-0923	

E SERIES - 90° Body Holders

Wire/Pellet	Connector	Port	Glass OD (mm)	Model	Order #	
Pellet	2 mm Pin	No	1.0	ERP-M10N	64-0940	
			1.2	ERP-M12N	64-0941	
			1.5	ERP-M15N	64-0942	
			2.0	ERP-M20N	64-0943	
		Yes	1.0	ERP-M10P	64-0944	
			1.2	ERP-M12P	64-0945	
			1.5	ERP-M15P	64-0946	
			2.0	ERP-M20P	64-0947	
	2 mm Jack	No	1.0	ERP-F10N	64-0932	
			1.2	ERP-F12N	64-0933	
			1.5	ERP-F15N	64-0934	
			2.0	ERP-F20N	64-0935	
		Yes	1.0	ERP-F10P	64-0936	
			1.2	ERP-F12P	64-0937	
			1.5	ERP-F15P	64-0938	
			2.0	ERP-F20P	64-0939	
Wire	2 mm Pin	No	1.0	ERW-M10N	64-0956	
			1.2	ERW-M12N	64-0957	
			1.5	ERW-M15N	64-0958	
			2.0	ERW-M20N	64-0959	
		Yes	1.0	ERW-M10P	64-0960	
			1.2	ERW-M12P	64-0961	
			1.5	ERW-M15P	64-0962	
			2.0	ERW-M20P	64-0963	
	2 mm Jack	No	1.0	ERW-F10N	64-0948	
			1.2	ERW-F12N	64-0949	
			1.5	ERW-F15N	64-0950	
			2.0	ERW-F20N	64-0951	
		Yes	1.0	ERW-F10P	64-0952	
			1.2	ERW-F12P	64-0953	
			1.5	ERW-F15P	64-0954	
			2.0	ERW-F20P	64-0955	

E SERIES with Handle

Holders include a 6.3 mm diameter X 6.3 cm long handle for mounting in a micropositioner. Handles are screwed together except for vented models which are joined by a pin and jack for easy removal from the handle.

Wire/Pellet	Connector	Port	Glass OD (mm)	Model	Order #	
Pellet	2 mm Jack	No	1.0	E45P-F10NH	64-1023	
			1.2	E45P-F12NH	64-1024	
			1.5	E45P-F15NH	64-1025	
			2.0	E45P-F20NH	64-1026	
		Yes	1.0	E45P-F10PH	64-1039	
			1.2	E45P-F12PH	64-1040	
			1.5	E45P-F15PH	64-1041	
			2.0	E45P-F20PH	64-1042	
Wire	2 mm Jack	No	1.0	E45W-F10NH	64-1019	
			1.2	E45W-F12NH	64-1020	
			1.5	E45W-F15NH	64-1021	
			2.0	E45W-F20NH	64-1022	
		Yes	1.0	E45W-F10PH	64-1035	
			1.2	E45W-F12PH	64-1036	
			1.5	E45W-F15PH	64-1037	
			2.0	E45W-F20PH	64-1038	
		Vent*	1.0	E45W-F10VH	64-1051	
			1.2	E45W-F12VH	64-1052	
			1.5	E45W-F15VH	64-1053	
			2.0	E45W-F20VH	64-1054	

*Vented models are standard with the Warner OC-725 Oocte Clamp.

Q SERIES HOLDERS

Specifications

Body Material: Polycarbonate

Body Styles: Straight, 45°, and 90°

Connectors: 1 mm Pin, 1 mm Pin Threaded and BNC

Coupling: Ag Wire or Ag-AgCl Hybrid

Port: 2 mm diameter Polycarbonate

Standard Glass Sizes: 1.0, 1.2, 1.5, 1.7 and 2.0 mm

Applications

Patch Clamp Recording

Intracellular Recording

QSW-Bxxp

QRW-AxxN

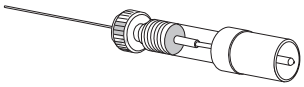
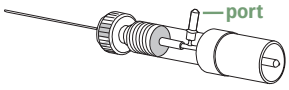
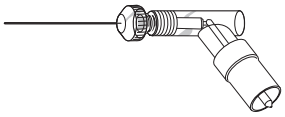
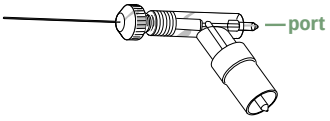
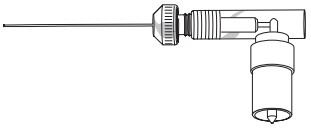
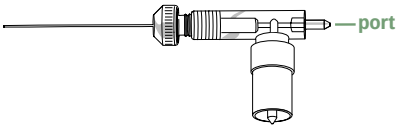
QSW-TxxP

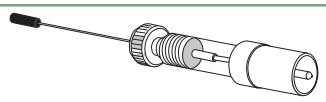
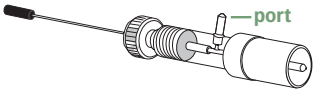
Q45W-AxxP

Q SERIES Holders with 1 mm pin

Compatible with Warner Patch Clamps PC-501 & PC-505 and Axon Patch Clamps (older style prior to 2/1/95)

NOTE: Holders without ports are not suitable for patch clamp recording.

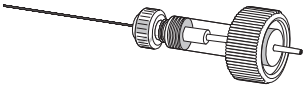
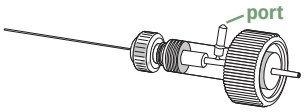
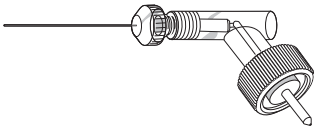
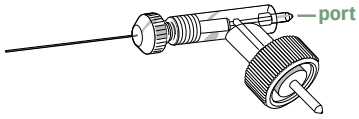
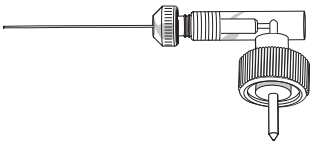
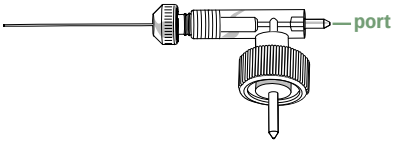
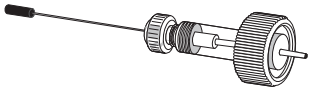
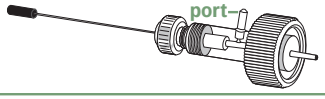
Wire/Pellet	Connector	Port	Glass OD (mm)	Model	Order #	
Wire	Straight	No	1.0	QSW-A10N	64-1105	
			1.2	QSW-A12N	64-1106	
			1.5	QSW-A15N	64-1107	
			1.7	QSW-A17N	64-0745	
			2.0	QSW-A20N	64-1108	
		Yes	1.0	QSW-A10P	64-0821	
			1.2	QSW-A12P	64-0822	
			1.5	QSW-A15P	64-0823	
			1.7	QSW-A17P	64-0978	
			2.0	QSW-A20P	64-0824	
	45°	No	1.0	Q45W-A10N	64-0841	
			1.2	Q45W-A12N	64-0842	
			1.5	Q45W-A15N	64-0843	
			1.7	Q45W-A17N	64-1098	
			2.0	Q45W-A20N	64-0844	
		Yes	1.0	Q45W-A10P	64-1055	
			1.2	Q45W-A12P	64-1056	
			1.5	Q45W-A15P	64-1057	
			1.7	Q45W-A17P	64-0968	
			2.0	Q45W-A20P	64-1058	
	90°	No	1.0	QRW-A10N	64-0861	
			1.2	QRW-A12N	64-0862	
			1.5	QRW-A15N	64-0863	
			1.7	QRW-A17N	64-1103	
			2.0	QRW-A20N	64-0864	
		Yes	1.0	QRW-A10P	64-1075	
			1.2	QRW-A12P	64-1076	
			1.5	QRW-A15P	64-1077	
			1.7	QRW-A17P	64-0973	
			2.0	QRW-A20P	64-1078	

Wire/Pellet	Connector	Port	Glass OD (mm)	Model	Order #	
Hybrid	Straight	No	1.5	QSH-A15N	64-1351	
			1.7	QSH-A17N	64-1352	
			2.0	QSH-A20N	64-1353	
		Yes	1.5	QSH-A15P	64-1354	
			1.7	QSH-A17P	64-1355	
			2.0	QSH-A20P	64-1356	

Q SERIES Holders with 1 mm pin, threaded collar

Compatible with: Axon Patch Clamps and Microelectrode Amps post 2/1/95

NOTE: Holders without ports are not suitable for patch clamp recording.

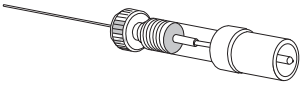
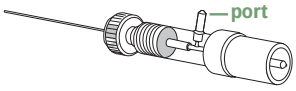
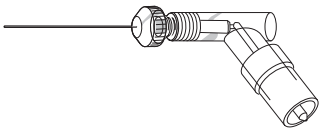
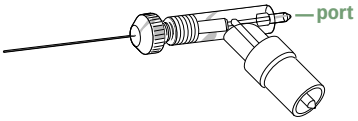
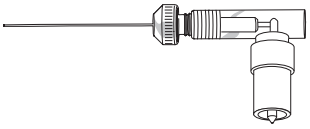
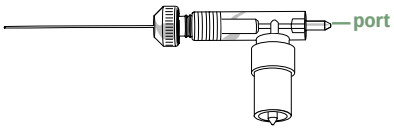
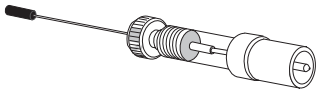
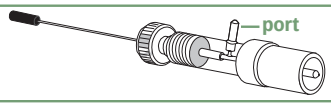
Wire/Pellet	Connector	Port	Glass OD (mm)	Model	Order #	
Wire	Straight	No	1.0	QSW-T10N	64-1121	
			1.2	QSW-T12N	64-1122	
			1.5	QSW-T15N	64-1123	
			1.7	QSW-T17N	64-0749	
			2.0	QSW-T20N	64-1124	
		Yes	1.0	QSW-T10P	64-0837	
			1.2	QSW-T12P	64-0838	
			1.5	QSW-T15P	64-0839	
			1.7	QSW-T17P	64-1097	
			2.0	QSW-T20P	64-0840	
	45°	No	1.0	Q45W-T10N	64-0857	
			1.2	Q45W-T12N	64-0858	
			1.5	Q45W-T15N	64-0859	
			1.7	Q45W-T17N	64-1102	
			2.0	Q45W-T20N	64-0860	
		Yes	1.0	Q45W-T10P	64-1071	
			1.2	Q45W-T12P	64-1072	
			1.5	Q45W-T15P	64-1073	
			1.7	Q45W-T17P	64-0972	
			2.0	Q45W-T20P	64-1074	
	90°	No	1.0	QRW-T10N	64-0877	
			1.2	QRW-T12N	64-0878	
			1.5	QRW-T15N	64-0879	
			1.7	QRW-T17N	64-0744	
			2.0	QRW-T20N	64-0880	
		Yes	1.0	QRW-T10P	64-1091	
			1.2	QRW-T12P	64-1092	
			1.5	QRW-T15P	64-1093	
			1.7	QRW-T17P	64-0977	
			2.0	QRW-T20P	64-1094	
Hybrid	Straight	No	1.5	QSH-T15N	64-1363	
			1.7	QSH-T17N	64-1364	
			2.0	QSH-T20N	64-1365	
		Yes	1.5	QSH-T15P	64-1366	
			1.7	QSH-T17P	64-1367	
			2.0	QSH-T20P	64-1368	

Q SERIES Holders with BNC connector

Compatible with: Heka, List and Dagan Patch Clamps

NOTE: Holders without ports are not suitable for patch clamp recording.

Q45-BxxP

Wire/Pellet	Connector	Port	Glass OD (mm)	Model	Order #	
Wire	Straight	No	1.0	QSW-B10N	64-1109	
			1.2	QSW-B12N	64-1110	
			1.5	QSW-B15N	64-1111	
			1.7	QSW-B17N	64-0746	
			2.0	QSW-B20N	64-1112	
		Yes	1.0	QSW-B10P	64-0825	
			1.2	QSW-B12P	64-0826	
			1.5	QSW-B15P	64-0827	
			1.7	QSW-B17P	64-0979	
			2.0	QSW-B20P	64-0828	
	45°	No	1.0	Q45W-B10N	64-0845	
			1.2	Q45W-B12N	64-0846	
			1.5	Q45W-B15N	64-0847	
			1.7	Q45W-B17N	64-1099	
			2.0	Q45W-B20N	64-0848	
		Yes	1.0	Q45W-B10P	64-1059	
			1.2	Q45W-B12P	64-1060	
			1.5	Q45W-B15P	64-1061	
			1.7	Q45W-B17P	64-0969	
			2.0	Q45W-B20P	64-1062	
	90°	No	1.0	QRW-B10N	64-0865	
			1.2	QRW-B12N	64-0866	
			1.5	QRW-B15N	64-0867	
			1.7	QRW-B17N	64-1104	
			2.0	QRW-B20N	64-0868	
		Yes	1.0	QRW-B10P	64-1079	
			1.2	QRW-B12P	64-1080	
			1.5	QRW-B15P	64-1081	
			1.7	QRW-B17P	64-0974	
			2.0	QRW-B20P	64-1082	
Hybrid	Straight	No	1.5	QSH-B15N	64-1357	
			1.7	QSH-B17N	64-1358	
			2.0	QSH-B20N	64-1359	
		Yes	1.5	QSH-B15P	64-1360	
			1.7	QSH-B17P	64-1361	
			2.0	QSH-B20P	64-1362	

PE SERIES HOLDERS

Specifications

Body Material: Polycarbonate

Body Style: Straight

Connectors: 1 mm Pin, 1 mm Pin Threaded and BNC

Coupling: Ag Wire

Port: 2 mm diameter Polycarbonate

Perfusion Port: 30° port accepts tubing up to 1 mm diameter

Standard Glass Sizes: 1.0, 1.2, 1.5, 1.7 and 2.0 mm

Applications

Microperfusion (perfusion at the pipette tip)*

PESW-BxxP

PESW-TxxP

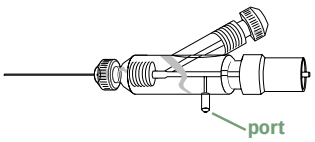
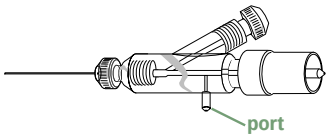
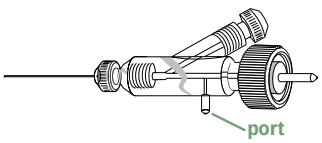
For Microperfusion (perfusing inside the micropipette)

Perfusion at the electrode tip is possible with the PE Series holders. They include an additional port at 30° to the glass bore allowing for the insertion of micro-bore tubing into the pipette. This port includes a threaded cap and seal for up to 1 mm diameter tubing. See the reports referenced below for information on the microperfusion technique.

PE SERIES Holders

Patch Clamp Compatibility

Connector	For use with
1 mm Pin	Warner Patch Clamp Models PC-501 & PC-505 Axon Patch Clamps prior to 2/1/95
BNC	List, Heka and Dagan Patch Clamps
1 mm Pin with threaded collar	Axon Patch Clamps and Microelectrode Amps prior to 2/1/95

Wire/Pellet	Body Style	Port	Connector	Glass OD (mm)	Model	Order #	
Wire	Straight	Yes	1 mm Pin	1.0	PESW-A10P	64-1144	
				1.2	PESW-A12P	64-1145	
				1.5	PESW-A15P	64-1146	
				1.7	PESW-A17P	64-1371	
				2.0	PESW-A20P	64-1147	
			BNC	1.0	PESW-B10P	64-1148	
				1.2	PESW-B12P	64-1149	
				1.5	PESW-B15P	64-1150	
				1.7	PESW-B17P	64-1369	
				2.0	PESW-B20P	64-1151	
			1 mm pin Threaded Collar	1.0	PESW-T10P	64-1160	
				1.2	PESW-T12P	64-1161	
				1.5	PESW-T15P	64-1162	
				1.7	PESW-T17P	64-1373	
				2.0	PESW-T20P	64-1163	

***References**

Nehr, E. and Eckert, R.: Fast patch-pipette internal perfusion with minimum solution flow. Grinnel, A.D., Armstrong, D. and Jackson, M.B.: Calcium and Ion Channel Modulation, Plenum Press, N.Y.

Cull-Candy, S.G., Miledi, R. and Parker, I.: Single glutamate-activated channels recorded from locust muscle fibers with perfused patch clamp electrodes. J. Physiology 32-, 195-210.

Pusch, M. and Nehr, E. (1987) Kinetics of loading small cells with various compounds by use of patch pipettes. Pflugers Archives (Spring Meeting of the Physiol. Ges.).

Tang, J.M., Wang, J. and Eisenberg, R.S. (1992) Perfusing patch pipettes. Methods in Enzymol. 207, 176-181.

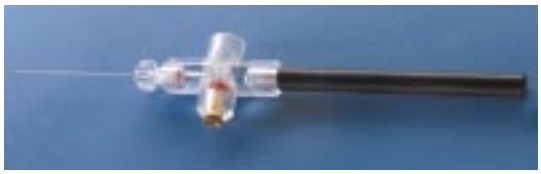
ME SERIES HOLDERS

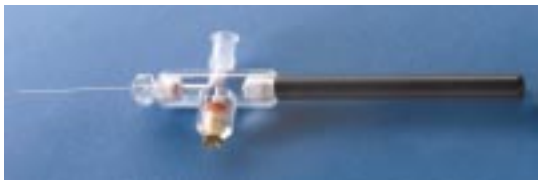
Specifications

Body Material: 9.3 mm diameter acrylic
Body Style: Straight
Connector: 2 mm jack
Coupling: Ag/AgCl pellet or Ag Wire
Standard Glass Sizes: 1.0, 1.2, 1.5 and 2.0 mm
Handle: 6.3 mm diameter x 6.3 cm long, threaded to attach to holder.

Pressure Ports:
A – Accepts 1.5 mm (1/16") tubing
B – Accepts 2.4 mm (3/32") tubing
ML – Accepts female Luer fitting
FL – Accepts male Luer fitting
T* – Accepts 1/4-28 male thread fitting

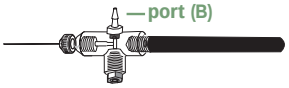
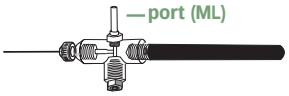
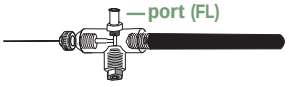
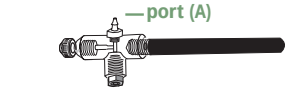
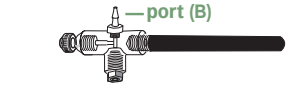
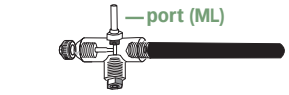
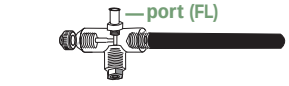
* Holders with the T port are compatible with the Picospritzer® system made by General Valve Corp.


MEW-FxxT


MEW-FxxFL

Applications

- **Intracellular and Extracellular Recording**
- **Microiontophoresis**

Body Style	Connector	Coupling	Port	Glass OD (mm)	Model	Order #	
Straight	2 mm Jack	Wire	1/16" barb	1.0	MEW-F10A	64-1220	
				1.2	MEW-F12A	64-1221	
				1.5	MEW-F15A	64-1222	
				2.0	MEW-F20A	64-1223	
			1/32" barb	1.0	MEW-F10B	64-1224	
				1.2	MEW-F12B	64-1225	
				1.5	MEW-F15B	64-1226	
				2.0	MEW-F20B	64-1227	
			male Luer	1.0	MEW-F10ML	64-1232	
				1.2	MEW-F12ML	64-1233	
				1.5	MEW-F15ML	64-1234	
				2.0	MEW-F20ML	64-1235	
			female Luer	1.0	MEW-F10FL	64-1228	
				1.2	MEW-F12FL	64-1229	
				1.5	MEW-F15FL	64-1230	
				2.0	MEW-F20FL	64-1231	
			threaded 1/4-28	1.0	MEW-F10T	64-1236	
				1.2	MEW-F12T	64-1237	
				1.5	MEW-F15T	64-1238	
				2.0	MEW-F20T	64-1239	
Straight	2 mm Jack	Pellet	1/16" barb	1.0	MEP-F10A	64-1180	
				1.2	MEP-F12A	64-1181	
				1.5	MEP-F15A	64-1182	
				2.0	MEP-F20A	64-1183	
			1/32" barb	1.0	MEP-F10B	64-1184	
				1.2	MEP-F12B	64-1185	
				1.5	MEP-F15B	64-1186	
				2.0	MEP-F20B	64-1187	
			male Luer	1.0	MEP-F10ML	64-1192	
				1.2	MEP-F12ML	64-1193	
				1.5	MEP-F15ML	64-1194	
				2.0	MEP-F20ML	64-1195	
			female Luer	1.0	MEP-F10FL	64-1188	
				1.2	MEP-F12FL	64-1189	
				1.5	MEP-F15FL	64-1190	
				2.0	MEP-F20FL	64-1191	
			threaded 1/4-28	1.0	MEP-F10T	64-1196	
				1.2	MEP-F12T	64-1197	
				1.5	MEP-F15T	64-1198	
				2.0	MEP-F20T	64-1199	

MP SERIES HOLDERS

Specifications

Body Material: Acrylic

Body Style: Straight

Port: 1/16" barbed (1/16" tubing ID), 3/32" barbed (3/32" tubing ID), male Luer, female Luer and 1/4-28 female threaded

Standard Glass Sizes: 1.0, 1.2, 1.5 and 2.0 mm

Handle: 6.3 mm diameter x 6.3 cm long, threaded to attach to holder.

Pressure Ports:
A – Accepts 1.5 mm (1/16") tubing
B – Accepts 2.4 mm (3/32") tubing
ML – Accepts female Luer fitting
FL – Accepts male Luer fitting
T* – Accepts 1/4-28 male thread fitting

* Holders with the T port are compatible with the Picospritzer® system made by General Valve Corporation.

MP-SxxB

MP-SxxT

Applications

Microinjection

Body Style	Port	Glass OD (mm)	Model	Order #	
Straight	1/16" barb	1.0	MP-S10A	64-1261	
		1.2	MP-S12A	64-1262	
		1.5	MP-S15A	64-1263	
		2.0	MP-S20A	64-1264	
	1/32" barb	1.0	MP-S10B	64-1265	
		1.2	MP-S12B	64-1266	
		1.5	MP-S15B	64-1267	
		2.0	MP-S20B	64-1268	
	male Luer	1.0	MP-S10ML	64-1273	
		1.2	MP-S12ML	64-1274	
		1.5	MP-S15ML	64-1275	
		2.0	MP-S20ML	64-1276	
	female Luer	1.0	MP-S10FL	64-1269	
		1.2	MP-S12FL	64-1270	
		1.5	MP-S15FL	64-1271	
		2.0	MP-S20FL	64-1272	
	threaded 1/4-28	1.0	MP-S10T	64-1278	
		1.2	MP-S12T	64-1279	
		1.5	MP-S15T	64-1280	
		2.0	MP-S20T	64-1281	

THETA GLASS HOLDERS

Specifications

Body Material: Acrylic

Body Style: Straight

Coupling: Ag wire (2)

Connector: 2 mm jack

Port: 2 mm diameter polycarbonate

Standard Glass Sizes: 1.5 and 2.0 mm

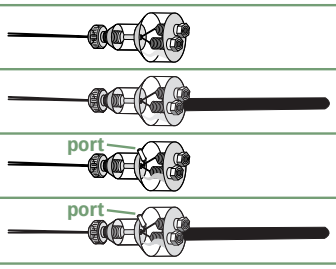
Handle: 6.3 mm diameter x 6.3 cm long, threaded to attach to holder.

THS-FxxP

Applications

Microinjection or microiontophoresis with theta glass

Port	Handle	Glass OD (mm)	Model	Order #
No	No	1.5	THS-F15	64-1164
		2.0	THS-F20	64-1165
	Yes	1.5	THS-F15H	64-1172
		2.0	THS-F20H	64-1173
Yes	No	1.5	THS-F15P	64-1168
		2.0	THS-F20P	64-1169
	Yes	1.5	THS-F15PH	64-1176
		2.0	THS-F20PH	64-1177



ELECTRODE/MANIFOLD HOLDERS MHH-25, MHH-38

Specifications

The MHH-25 and MHH-38 Holders permit convenient mounting of manifolds and electrode holders or other devices with 6.3 or 9.5 mm diameters. The holder head can be pivoted ±90° from the axial position and rotated 360° about the axis. Friction holds the head firmly in the set position. Holder head and coupler are made from Delrin®. The anodized aluminum handle is 6.3 mm diameter x 6.3 cm long and will fit most positioners.

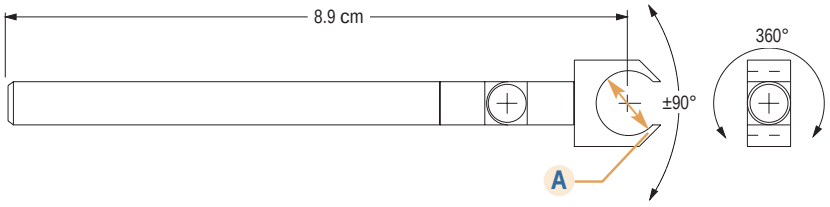
MHH-38 and MHH-25

Device Compatibility

Order #	Model
64-0218	MHH-25 E and Q Series Electrode Holders
64-0219	MHH-38 PE Series and Theta Electrode Holders MP and MPP Series Manifolds

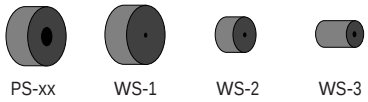
A Diameter

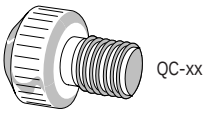
Model	Diameter
MHH-25	6.3 mm (1/4”)
MHH-38	9.5 mm (3/8”)



MICROELECTRODE HOLDER SPARE/REPLACEMENT PARTS

Order #	Model	Description	Qty/Pkg
Coupling Elements			
64-1297	SP-1M	Molded Ag-AgCl pellet assembly	3
64-1282	AG25-10	Ag wire, 0.25 mm diameter x 70 mm long	10
64-1288	HP-205	Hybrid Ag-AgCl pellet/Ag wire assembly	1
Pipette and Wire Seals			
64-1289	PS-10	Pipette seal for 1.0 mm diameter glass	10
64-1290	PS-12	Pipette seal for 1.2 mm diameter glass	10
64-1291	PS-15	Pipette seal for 1.5 mm diameter glass	10
64-1374	PS-17	Pipette seal for 1.7 mm diameter glass	10
64-1292	PS-20	Pipette seal for 2.0 mm diameter glass	10
64-1298	WS-1	Wire seal for E, ME, MP and theta holder	10
64-1299	WS-2	Wire seal for Q and PE Series holders	10
64-1300	WS-3	Wire seal for Q and PE Series holders with threaded “T” connector	10
Glass Seal Compression Caps			
64-1293	QC-10	Compression cap for 1.0 mm glass holders	2
64-1294	QC-12	Compression cap for 1.2 mm glass holders	2
64-1295	QC-15	Compression cap for 1.5 mm glass holders	2
64-1375	QC-17	Compression cap for 1.7 mm glass holders	2
64-1296	QC-20	Compression cap for 2.0 mm glass holders	2
Connector Pins and Jacks			
64-1283	HC-10M	1 mm pin for Q and PE holders with A or T connectors	3
64-1284	HC-13M	1.3 mm pin for Q and PE holders with B (BNC) connector	3
64-1285	HC-20M	2 mm threaded pin for E, ME and theta holders	3
64-1286	HC-21F	2 mm jack assembly for all series holders	3
64-1287	HC-22M	2 mm pin for Q and PE holders with M connector	3





Premium Capillary Glass

- **Ends are fire-polished to prevent damage to the rubber gaskets when inserted into electrode holders**
- **Glass is also cleaned with deionized water before being packed in dust-free containers**

Warner capillary glass is known worldwide for its consistent high quality. The glass is precision drawn to ensure reliability and consistency from batch to batch. The full line of glass capillaries listed here is stocked for fast shipment.

Standard Wall/Thin Wall

Tubing is available in two wall thickness, standard wall and thin wall. Additionally, a variety of diameters is offered to cover most needs of micropipette and microelectrode research.

Capillaries with Filament

A small diameter filament is fused to the glass inside diameter to facilitate rapid solution filling through capillary attraction. This is especially important for the very small diameter of sharp electrodes typically used for intracellular studies and microiontophoresis.

Premium Corning Type 7740 (Pyrex)

Corning 7740 Borosilicate is the most commonly used glass in electrode fabrication because of its mechanical strength, chemical durability, electrical resistivity, and its ability to withstand thermal stress. It is also easy to work with and suitable for a wide range of applications. Corning 7740 glass is offered in a choice of diameters, in standard or thin-walled format, and either with or without inner filament; they are additionally available in theta style. Single barrel glass is available in 3 lengths: 75, 100 and150 mm. Theta glass is offered in 100 mm lengths only.

Specifications

Composition:	81% SiO_2, 13% B_2O_3, 4% Na_2O, 2% Al_2O_3
Softening Temperature:	821°C
Dielectric Constant:	4.6

Premium Standard Wall Borosilicate

Order #	Model	OD mm	ID mm	Length	Qty/Pkg
WI 64-0765	G100-3	1.0	0.58	75 mm	500
WI 64-0766	G100-4	1.0	0.58	100 mm	500
WI 64-0767	G100-6	1.0	0.58	150 mm	500
WI 64-0768	G120-3	1.2	0.69	75 mm	350
WI 64-0769	G120-4	1.2	0.69	100 mm	350
WI 64-0770	G120-6	1.2	0.69	150 mm	350
WI 64-0771	G150-3	1.5	0.86	75 mm	225
WI 64-0772	G150-4	1.5	0.86	100 mm	225
WI 64-0773	G150-6	1.5	0.86	150 mm	225
WI 64-0774	G200-3	2.0	1.16	75 mm	125
WI 64-0775	G200-4	2.0	1.16	100 mm	125
WI 64-0776	G200-6	2.0	1.16	150 mm	125

Premium Thin Wall Borosilicate

Order #	Model	OD mm	ID mm	Length	Qty/Pkg
WI 64-0777	G100T-3	1.0	0.78	75 mm	500
WI 64-0778	G100T-4	1.0	0.78	100 mm	500
WI 64-0779	G100T-6	1.0	0.78	150 mm	500
WI 64-0780	G120T-3	1.2	0.94	75 mm	350
WI 64-0781	G120T-4	1.2	0.94	100 mm	350
WI 64-0782	G120T-6	1.2	0.94	150 mm	350
WI 64-0783	G150T-3	1.5	1.17	75 mm	225
WI 64-0784	G150T-4	1.5	1.17	100 mm	225
WI 64-0785	G150T-6	1.5	1.17	150 mm	225

Premium Standard Wall Borosilicate with Filament

Order #	Model	OD mm	ID mm	Length	Qty/Pkg
WI 64-0786	G100F-3	1.0	0.58	75 mm	500
WI 64-0787	G100F-4	1.0	0.58	100 mm	500
WI 64-0788	G100F-6	1.0	0.58	150 mm	500
WI 64-0789	G120F-3	1.2	0.69	75 mm	350
WI 64-0790	G120F-4	1.2	0.69	100 mm	350
WI 64-0791	G120F-6	1.2	0.69	150 mm	350
WI 64-0792	G150F-3	1.5	0.86	75 mm	225
WI 64-0793	G150F-4	1.5	0.86	100 mm	225
WI 64-0794	G150F-6	1.5	0.86	150 mm	225
WI 64-0795	G200F-3	2.0	1.16	75 mm	125
WI 64-0796	G200F-4	2.0	1.16	100 mm	125
WI 64-0797	G200F-6	2.0	1.16	150 mm	125

Premium Thin Wall Borosilicate with Filament

Order #	Model	OD mm	ID mm	Length	Qty/Pkg
WI 64-0798	G100TF-3	1.0	0.78	75 mm	500
WI 64-0799	G100TF-4	1.0	0.78	100 mm	500
WI 64-0800	G100TF-6	1.0	0.78	150 mm	500
WI 64-0801	G120TF-3	1.2	0.94	75 mm	350
WI 64-0802	G120TF-4	1.2	0.94	100 mm	350
WI 64-0803	G120TF-6	1.2	0.94	150 mm	350
WI 64-0804	G150TF-3	1.5	1.17	75 mm	225
WI 64-0805	G150TF-4	1.5	1.17	100 mm	225
WI 64-0806	G150TF-6	1.5	1.17	150 mm	225
WI 64-0807	G200TF-3	2.0	1.56	75 mm	125
WI 64-0808	G200TF-4	2.0	1.56	100 mm	125
WI 64-0809	G200TF-6	2.0	1.56	150 mm	125

Premium Theta Glass

Order #	Model	OD mm	ID mm	Length	Qty/Pkg
WI 64-0810	TG150-4	1.5	1.0	0.2 mm	100 mm
WI 64-0811	TG200-4	2.0	1.4	0.2 mm	100 mm

Patch Clamp Glass

Choosing patch clamp glass is generally based on noise performance and the ability to form and maintain a seal. No one type of glass works best in all applications and some trial and error is usually required to find the type yielding optimum results in your experiment. Patch glass is manufactured without an inner filament. This glass is offered in both the standard and premium models. The premium glass has fire-polished ends and is cleaned with deionized water before being packed in dust-free containers.

Premium Custom 8520 Patch Glass

Now Available in Premium Line!

The custom patch glass from Clark was introduced in 1997 as a substitute for the Corning 7052 glass, a favorite amongst researchers performing patch clamping. Initial tests showed the 8520 glass to be equal to the 7052 in noise performance. More importantly, seals were formed faster and maintained for longer periods.

Specifications

Composition: >10% SiO_2, >10% B_2O_3, >1% Al_2O_3, >1% K_2O, <1% Na_2O, <1% Li_2O, <1% ZnO, <1% As_2O_3, <1% TiO_2, <1% ZrO_2

Softening Temperature: 720°C

Dielectric Constant: 4.6

Order #	Model	OD mm	ID mm	Length	Qty/Pkg
WI 64-0817	G85150T-3	1.50	1.16	75 mm	225
WI 64-0818	G85150T-4	1.50	1.16	100 mm	225
WI 64-0819	G85165T-3	1.65	1.28	75 mm	190
WI 64-0820	G85165T-4	1.65	1.28	100 mm	190

Premium Corning 8161 (Potash Rubium Lead) Patch Glass

This glass pulls at a lower temperature and is easily shaped. It is recommended for low noise recordings. However, the lead content should be considered for the intended application.

Specifications

Composition: 51% PbO, 39% SiO_2, 6% K_2O, 2% BaO

Softening Temperature: 600°C

Dielectric Constant: 8.3

Order #	Model	OD mm	ID mm	Length	Qty/Pkg
WI 64-0815	G86150T-4	1.50	1.10	100 mm	225
WI 64-0816	G86165T-4	1.65	1.20	100 mm	190

Premium Corning 7056 (Alkali Barium Borosilicate) Patch Glass

Now Available in Premium Line!

Corning 7056 glass is now offered in place of the 7052 glass, last melted in 1992 and no longer available. The 7056 formula has also been discontinued by Corning (last melt in 1995) but stocks of this material should be available for a few more years. The properties of the 7056 glass are similar to the 7052 as is its performance in patch experiments.

Specifications

Composition: 68% SiO_2, 18% B_2O_3, 9% K_2O, 3% Al_2O_3, 1% Li_2O, 1% Na_2O

Softening Temperature: 718°C

Dielectric Constant: 5.7

Order #	Model	OD mm	ID mm	Length	Qty/Pkg
WI 64-0812	G75150S-4	1.50	0.75	100 mm	225
WI 64-0813	G75150T-4	1.50	1.10	100 mm	225
WI 64-0814	G75165T-4	1.65	1.20	100 mm	190

Discounts on Quantity Purchases

Discounts only apply to single part number quantities (no mixing).

1 to 4 — none
5 to 9 — 5%
10+ — 10%

See page 20 for Clark Custom 8520 Patch Glass

Clark Capillary Glass

Harvard Apparatus Ltd. Acquires Clark Electromedical Instruments

Harvard Apparatus, Inc. announces the acquisition of Clark Electromedical Instruments by Harvard Apparatus Ltd., our UK subsidiary located in Edenbridge, England. Clark Electromedical Instruments manufactures micropipettes and microelectrodes used primarily in intracellular research. Clark Electromedical will continue to trade under the Clark brand name, however, all manufacturing, marketing and sales support has been relocated to the Harvard Apparatus Edenbridge facility.

- **High quality borosilicate glass**
- **Five outside diameters available**
- **Available with either thin or standard wall**
- **Ratio of outside to inside diameters preserved to tip**
- **Economical**

Specifications

Composition:	80.9% SiO2, 12.9% B2O3, 4.4% Na2O, 1.8% Al2O3
Softening Temperature:	815°C
Dielectric Constant:	4.7

Borosilicate Capillaries

The properties of borosilicate glass make it the most popular material among researchers for the fabrication of electrodes and micropipettes. Its low softening temperature combined with its mechanical strength, chemical durability, high electrical resistivity, and its ability to withstand thermal stress, make these capillaries the most widely used in the world. Clark Borosilicate Capillaries are offered in a variety of diameters and wall thickness (standard or thin walled) with or without an inner filament. They are available in fused multi-barrel configurations, as well as in theta style. Single barrel glass is available in 75 mm (3 in.), 100 mm (4 in.) and 150 mm (6 in.) lengths.

Borosilicate Thin Wall without Filament

Order #	OD mm	ID mm	Length	Qty/Pkg
WI 30-0037	1.0 mm	0.78 mm	75 mm	500
WI 30-0035	1.0 mm	0.78 mm	100 mm	500
WI 30-0036	1.0 mm	0.78 mm	150 mm	500
WI 30-0049	1.2 mm	0.94 mm	75 mm	350
WI 30-0047	1.2 mm	0.94 mm	100 mm	350
WI 30-0048	1.2 mm	0.94 mm	150 mm	350
WI 30-0064	1.5 mm	1.17 mm	50 mm	225
WI 30-0065	1.5 mm	1.17 mm	75 mm	225
WI 30-0062	1.5 mm	1.17 mm	100 mm	225
WI 30-0063	1.5 mm	1.17 mm	150 mm	225

Borosilicate Standard Wall without Filament

Order #	OD mm	ID mm	Length	Qty/Pkg
WI 30-0018	1.0 mm	0.58 mm	75 mm	500
WI 30-0016	1.0 mm	0.58 mm	100 mm	500
WI 30-0017	1.0 mm	0.58 mm	150 mm	500
WI 30-0043	1.2 mm	0.69 mm	75 mm	350
WI 30-0042	1.2 mm	0.69 mm	100 mm	350
WI 30-0041	1.2 mm	0.69 mm	150 mm	350
WI 30-0056	1.5 mm	0.86 mm	75 mm	225
WI 30-0054	1.5 mm	0.86 mm	110 mm	225
WI 30-0053	1.5 mm	0.86 mm	100 mm	225
WI 30-0055	1.5 mm	0.86 mm	150 mm	225
WI 30-0073	2.0 mm	1.16 mm	75 mm	125
WI 30-0070	2.0 mm	1.16 mm	100 mm	125
WI 30-0071	2.0 mm	1.16 mm	150 mm	125
WI 30-0127	3.0 mm	1.62 mm	75 mm	55
WI 30-0080	3.0 mm	1.62 mm	100 mm	55
WI 30-0081	3.0 mm	1.62 mm	150 mm	55

Discounts on Quantity Purchases

Discounts only apply to single part number quantities (no mixing).

1 to 4 — none
5 to 9 — 5%
10+ — 10%

Borosilicate with Filament


Standard Wall


Thin Wall

- **Easy filling**
- **Available in standard or thin wall configurations with selection of three outside diameters**
- **Exceptionally low tip impedance (less than 50 MΩ)**
- **Good for patch clamp pipettes and microinjection needles**

Order #	OD mm	ID mm	Length	Quantity
Borosilicate Standard Wall with Filament				
WI 30-0034	1.0 mm	0.50 mm	75 mm	500
WI 30-0032	1.0 mm	0.50 mm	100 mm	500
WI 30-0033	1.0 mm	0.50 mm	150 mm	500
WI 30-0021	1.0 mm	0.58 mm	75 mm	500
WI 30-0019	1.0 mm	0.58 mm	100 mm	500
WI 30-0020	1.0 mm	0.58 mm	150 mm	500
WI 30-0046	1.2 mm	0.69 mm	75 mm	350
WI 30-0044	1.2 mm	0.69 mm	100 mm	350
WI 30-0045	1.2 mm	0.69 mm	150 mm	350
WI 30-0060	1.5 mm	0.86 mm	75 mm	225
WI 30-0057	1.5 mm	0.86 mm	100 mm	225
WI 30-0058	1.5 mm	0.86 mm	150 mm	225
WI 30-0076	2.0 mm	1.16 mm	75 mm	125
WI 30-0074	2.0 mm	1.16 mm	100 mm	125
WI 30-0075	2.0 mm	1.16 mm	150 mm	125
WI 30-0084	3.0 mm	1.62 mm	75 mm	55
WI 30-0082	3.0 mm	1.62 mm	100 mm	55
WI 30-0083	3.0 mm	1.62 mm	150 mm	55
Borosilicate Thin Wall with Filament				
WI 30-0040	1.0 mm	0.78 mm	75 mm	500
WI 30-0038	1.0 mm	0.78 mm	100 mm	500
WI 30-0039	1.0 mm	0.78 mm	150 mm	500
WI 30-0052	1.2 mm	0.94 mm	75 mm	350
WI 30-0050	1.2 mm	0.94 mm	100 mm	350
WI 30-0051	1.2 mm	0.94 mm	150 mm	350
WI 30-0068	1.5 mm	1.17 mm	75 mm	225
WI 30-0066	1.5 mm	1.17 mm	100 mm	225
WI 30-0067	1.5 mm	1.17 mm	150 mm	225
WI 30-0128	2.0 mm	1.56 mm	75 mm	125
WI 30-0077	2.0 mm	1.56 mm	100 mm	125
WI 30-0078	2.0 mm	1.56 mm	150 mm	125

Borosilicate Double Barrel Special

- **High quality borosilicate glass**
- **Special two barrels - one barrel with filament, one without**
- **Ratio of outside to inside diameter preserved to tip**

Order #	OD mm	ID mm	Length	Quantity
WI 30-0004	1.5	0.86 mm	75 mm	100
WI 30-0005	1.5	0.86 mm	100 mm	100
WI 30-0006	1.5	0.86 mm	150 mm	100

Borosilicate Theta Glass

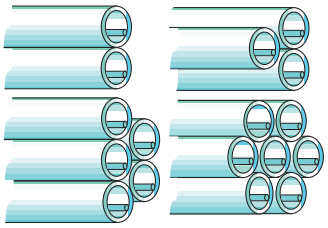
- **Easy to fill**
- **Two channels in a single diameter**

Order #	OD mm	Wall	Septum	Length	Quantity
WI 30-0116	1.5 mm	0.23 mm	0.17 mm	75 mm	100
WI 30-0114	1.5 mm	0.23 mm	0.17 mm	100 mm	100
WI 30-0115	1.5 mm	0.23 mm	0.17 mm	150 mm	100
WI 30-0119	2.0 mm	0.30 mm	0.22 mm	75 mm	100
WI 30-0117	2.0 mm	0.30 mm	0.22 mm	100 mm	100
WI 30-0118	2.0 mm	0.30 mm	0.22 mm	150 mm	100

Clark Capillary Glass *continued*

Borosilicate Multi-Barrel

- **High quality borosilicate glass**
- **Two, three, five and seven barrel configurations with filament**
- **Capillaries fused along their full length**



Order #	OD mm	Wall	Septum	Barrels	Quantity
WI 30-0003	1.5 mm	0.86 mm	75 mm	2	100
WI 30-0001	1.5 mm	0.86 mm	100 mm	2	100
WI 30-0002	1.5 mm	0.86 mm	150 mm	2	100
WI 30-0007	1.2 mm	0.69 mm	100 mm	3	100
WI 30-0008	1.2 mm	0.69 mm	150 mm	3	100
WI 30-0012	1.2 mm	0.69 mm	100 mm	5	65
WI 30-0013	1.2 mm	0.69 mm	150 mm	5	65
WI 30-0014	1.0 mm	0.58 mm	100 mm	7	60
WI 30-0015	1.0 mm	0.58 mm	150 mm	7	60

Aluminosilicate Capillaries

In recent years there has been a developing interest in fabricating micropipettes from aluminosilicate glass. Like silicon, aluminum combines with oxygen to form tetrahedral networks and the Al-O bonds are very strong. In comparison with borosilicate glass, aluminosilicate provides increased hardness, improved chemical durability, reduced electrical conductivity and a lower coefficient of thermal expansion. Also, while the original ratio of a borosilicate capillary's inner to outer diameter will remain unchanged over its total taper length, aluminosilicate glass demonstrates a marked tendency to thin out as it is drawn to a tip. This behavior allows extremely fine tips to be formed.

For more information, see:

1. Na/H Exchange, Vaughan-Jones, RD.; Grinstein Press, Ch.1 p.8;
2. Effects of intracellular and extracellular pH on contraction in isolated mammalian cardiac muscle, Bountra, C. & Vaughan-Jones, R.D.; Journal of Physiology Volume 418 (1989).

Specifications

Composition:	51.9% SiO_2, 22.0% Al_2O_3, 7.8% P_2O_5, 7.7% MgO, 6.9% CaO, 2.1% B_2O_3, 1.4% BaO and 0.2% As_2O_3
Softening Temperature:	950°C
Dielectric Constant:	6.2

Borosilicate Glass Rod

- **High quality borosilicate glass**
- **Available in two diameters**

Order #	OD mm	Length	Quantity
WI 30-0087	1.0 mm	75 mm	500
WI 30-0085	1.0 mm	100 mm	500
WI 30-0086	1.0 mm	150 mm	500
WI 30-0088	2.0 mm	100 mm	125

Aluminosilicate Capillaries with Filament

Order #	OD mm	ID mm	Length	Quantity
WI 30-0110	1.0 mm	0.53 mm	75 mm	500
WI 30-0108	1.0 mm	0.53 mm	100 mm	500
WI 30-0109	1.0 mm	0.53 mm	150 mm	500

Clark Custom 8520 Patch Glass

Order #	Model	OD mm	ID mm	Length
WI 30-0091	1.2 mm	0.93 mm	75 mm	350
WI 30-0089	1.2 mm	0.93 mm	100 mm	350
WI 30-0090	1.2 mm	0.93 mm	150 mm	350
WI 30-0094	1.5 mm	1.16 mm	75 mm	225
WI 30-0092	1.5 mm	1.16 mm	100 mm	225
WI 30-0093	1.5 mm	1.16 mm	150 mm	225
WI 30-0097	1.65 mm	1.28 mm	75 mm	190
WI 30-0095	1.65 mm	1.28 mm	100 mm	190
WI 30-0096	1.65 mm	1.28 mm	150 mm	190

Reference Cells & Ag-AgCl Electrodes

Why Silver-Silver Chloride (Ag-AgCl)?

Ag-AgCl electrodes have long been recognized for their superiority in sensing bioelectric signals. The electrochemical properties of Ag-AgCl are such that biopotential waveforms are faithfully reproduced. The main feature that makes them superior to other metals is their low offset potential. In a biomedical situation, the offset potential may be unstable or unpredictable. Long-term changes in offset potential appear as baseline drift, and short-term changes as noise on the trace.

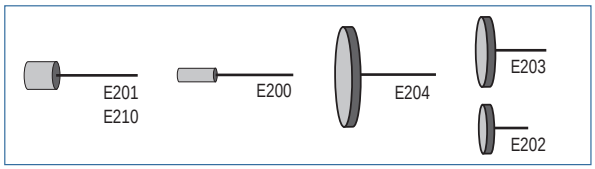
Thus, it is desirable that this potential be as low as possible. The electrode that shows minimum offset is the Ag-AgCl electrode. As the silver chloride is ionized, chloride ions from the electrode are exchanged for similar ions in the tissue or electrolyte. The silver chloride is relatively stable regardless of the direction of the polarizing current flow.

To a great extent, the performance of Ag-AgCl electrodes depends on their formulation. Our electrodes are made from very high purity materials. A careful proprietary process results in a fine grain, homogeneous mixture of silver and silver chloride. A careful sintering process strengthens and stabilizes the entire electrode assembly.

Typical values of the key parameters, measured in 0.9% saline, between pairs of electrodes the same size are:
1) DC Offset Voltage: 180 µVolts
2) Drift: 25 µVolts/hour
3) Noise: 1 µVolt peak-to-peak (0.1-1000 Hz with 50/60 Hz eliminated).

Ag-AgCl Pellet and Disc Electrodes

These six electrodes are ideally suited for making custom assemblies of skin electrodes and other bioelectric recording and stimulation apparatus. All have a pure silver wire (.25 mm diameter x 7 mm) embedded in the Ag-AgCl matrix. This wire can be easily soldered or twisted to other wires.



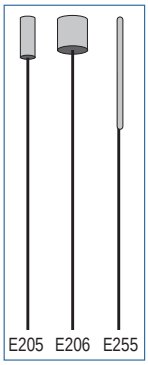
Order #	Model	Product
WI 64-1304	E200	Pellet 1.5 x 3 mm (D x Thick)
WI 64-1305	E201	Pellet 2.0 x 4 mm (D x Thick)
WI 64-1313	E210	Pellet 2.0 x 2 mm (D x Thick)
WI 64-1306	E202	Disc 4.0 x 1 mm (D x Thick)
WI 64-1307	E203	Disc 8.0 x 1 mm (D x Thick)
WI 64-1308	E204	Disc 12.5 x 1 mm (D x Thick)

Ag-AgCl Pellet and Wire Electrodes

Pellet electrodes have cylindrical pellet embedded on .25 x 70 mm (D x L) wire.

Wire electrodes have a uniform coating of Ag-AgCl over the last 10 mm of a 0.25 x 70 mm (D x L) wire. Maximum diameter of the Ag-AgCl matrix is 0.8 mm.

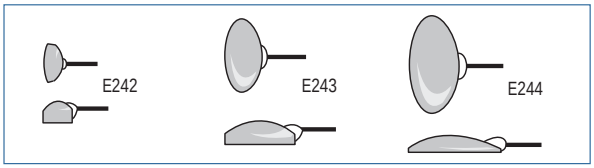
Note: All electrodes suitable for probing tissues.



Order #	Model	Product
WI 64-1309	E205	Pellet Electrode 1.0 mm D
WI 64-1310	E206	Pellet Electrode 2.0 mm D
WI 64-1317	E255	Wire Electrode 0.8 mm D

Disc Electrodes With Lead Wires

These disc-type electrodes are made with a flexible 20 cm lead wire attached to the back. The connection is encapsulated so that only the surface and edges of the electrode can make contact. These electrodes can be used as direct-contact skin electrodes, or subcutaneously in temporary applications on research animals.

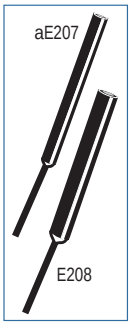


Order #	Model	Product
WI 64-1314	E242	Disc Electrode 4.0 mm D
WI 64-1315	E243	Disc Electrode 8.0 mm D
WI 64-1316	E244	Disc Electrode 12.5 mm D

Flat Tip Probes

Ag-AgCl cylinders, encapsulated in sturdy, insulating epoxy tubes; these probes are ideal for use in ionic solutions. They can be resurfaced frequently with fine sandpaper. Terminated with a 2 mm tinned copper wire for connection to your leads.

Order #	Model	Product
WI 64-1311	E207	Sensor Tip 2 x 4 mm (D x Thick) Epoxy Tube 3.5 x 25 mm (D x L)
WI 64-1312	E208	Sensor Tip 2 x 4 mm (D x Thick) Epoxy Tube 5 x 50 mm (D x L)

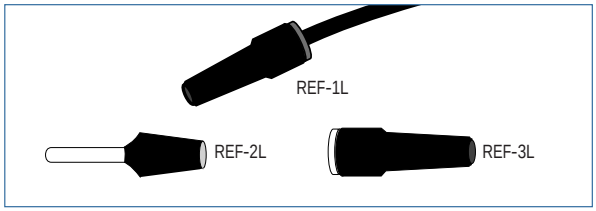


Reference Cells, Ag Wire & Ag-AgCI Electrodes *continued*

Reference Cells

Ag-AgCI electrodes are epoxy encapsulated in a plastic shell. They can be used as preparation reference or ground electrodes. Around 4.5 mm D, they are available with 2 mm pin, 2 mm jack and wire connection. All have a Luer taper for convenient mounting in chambers and other devices.

Order #	Model	Product
WI 64-1301	REF-1L	Reference Cell with 2 m L Wire
WI 64-1302	REF-2L	Reference Cell with 2 mm Pin
WI 64-1303	REF-3L	Reference Cell with 2 mm Jack



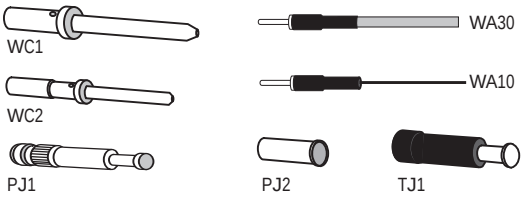
Silver Wire

Made of annealed silver 99.99% pure. Supplied for the convenience of researchers to fashion their own electrodes.

Order #	Model	Product
WI 64-1318	AG8W	Silver Wire 0.20 mm (.008") D, 2 m L, No Insulation
WI 64-1319	AG10W	Silver Wire 0.25 mm (.010") D, 2 m L, No Insulation
WI 64-1320	AG15W	Silver Wire 0.37 mm (.015") D, 2 m L, No Insulation
WI 64-1321	AGT10W	Silver Wire 0.25 mm (.010") D, 2 m L, Teflon® Insulation

Plugs and Jacks

An assortment of gold-plated 1 mm plugs and jacks, with or without wires. Useful for grounding, shielding, etc.



Order #	Model	Product
WI 64-1325	WC1-10	1 mm Pin, pkg. of 10
WI 64-1326	WC2-5	2 mm Pin, pkg. of 5
WI 64-1322	PJ1-10	1 mm Jack, Uninsulated, pkg. of 10
WI 64-1323	PJ2-5	2 mm Jack, Uninsulated, pkg. of 5
WI 64-1324	TJ1-3	1 mm Jack, Teflon® Insulated, pkg. of 3
WI 64-1328	WA30-5	1 mm Pin with 30 cm L, 26 ga. Insulated Wire, pkg. of 3
WI 64-1327	WA10-5	1 mm Pin with 10 cm L, .25 mm D Bare Silver Wire, pkg. of 2

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Printed in USA July 2003

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