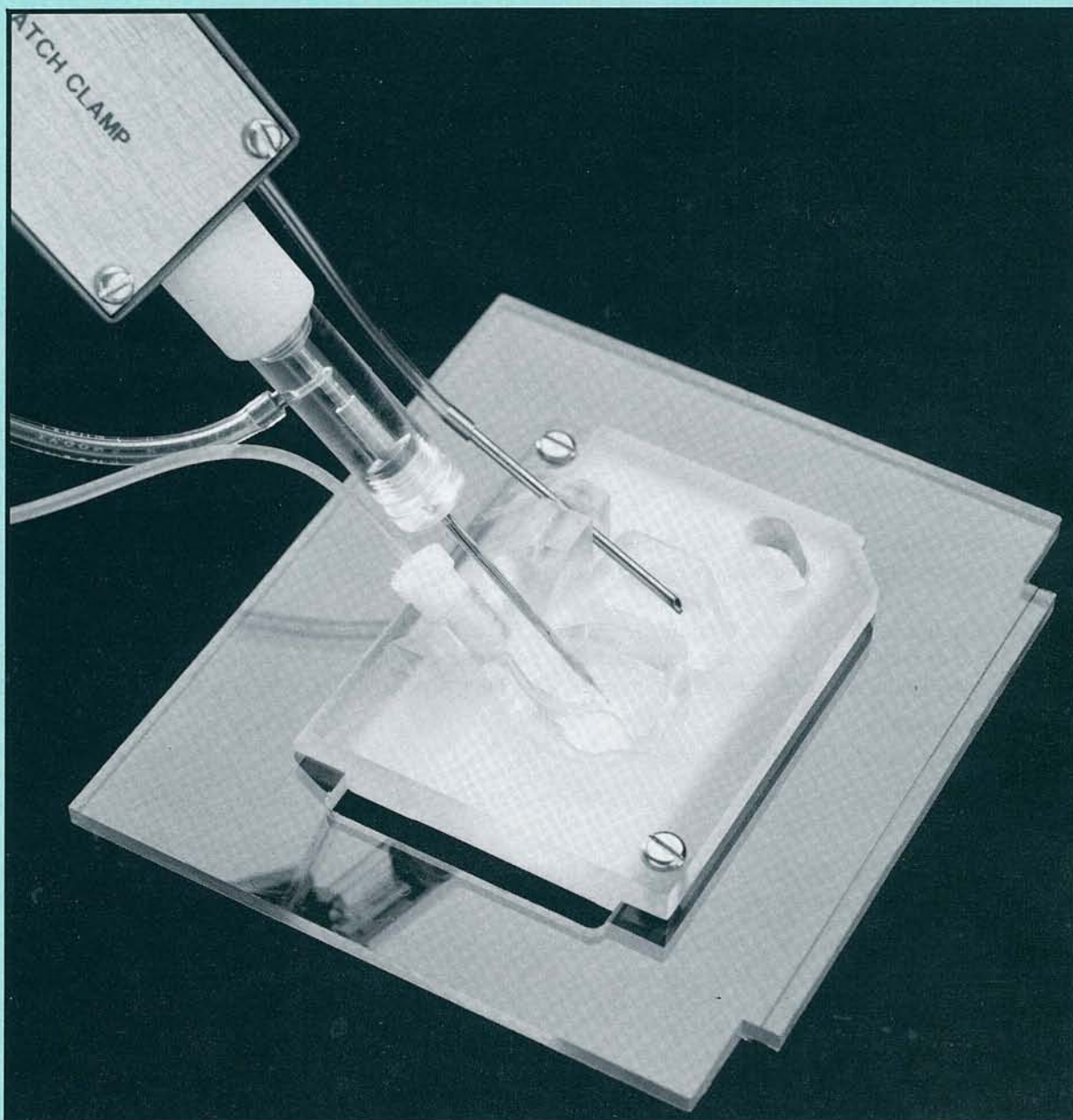


Warner Instrument Corp.



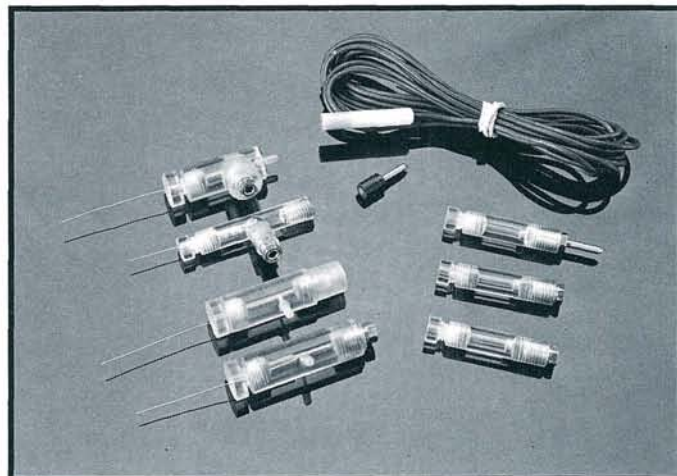
Microelectrode Recording Accessories 1991/1992

- Microelectrode & Micropipette Holders • Reference Cells
- Recording & Bilayer Chambers
- Glass Capillary Tubing

Microelectrode and Micropipette Holders, Reference Cells

Applications

- Intracellular Recording
- Microiontophoresis
- Micro Perfusion
- Patch / Whole Cell Clamp
- Ion Sensitive Measurements
- Pressure Injection



Microelectrode Holders

Microelectrode holders provide a convenient coupling between fluid filled microelectrodes and amplifier inputs. Since optimum recording is generally achieved when this coupling is as short as possible, these holders are made for direct connection to the headstage. The holders are precision machined from either cast acrylic or polycarbonate. Holders are available with selection of style, electrical coupling, mating connector, glass size, port or vent and material. Most applications involving microelectrodes are covered by the large variety of holders available.

Micropipette Holders

Similar in construction to the microelectrode holder, micropipette holders are non-electrical and are made for applications involving pressure injection of drugs, etc. A handle is included for mounting in a micropositioner. A choice of tubing connections is available.

Reference Cells

Reference cells are Ag-AgCl pellets encapsulated in epoxy and provided with either a wire, tip plug or tip jack for electrical connection. They are commonly employed for grounding a preparation, particularly when using a microelectrode holder with a pellet. When used in pairs in this way, junction potentials may be minimized since the typical potential difference is less than a millivolt.

General Holder Characteristics

Selection of a holder involves many choices, including:

STYLE - Style refers to the angle of the microelectrode with respect to the headstage connection. Holders are either straight (S) in-line, right angle (R) at 90°, or (45) at a 45° angle.

COUPLING - The electrical coupling between electrode and headstage connector can be a Ag-AgCl pellet (P) or Ag wire (W). Pellets or wires are replaceable. Wires must be chlorided prior to use.

CONNECTORS - To accommodate the variety of amplifier headstages in use, four choices of connector are offered:

- F - A 2mm jack to mate with standard 2mm tip plugs
- M - A 2mm pin to mate with standard 2mm tip jacks
- A - A 1mm pin connector similar to the BNC type.
- B - A BNC connector to mate with standard BNC's.

GLASS SIZE - Holders are bored for specific glass tubing diameters. Standard sizes are 1.0, 1.2, 1.5, 1.7 and 2.0 mm. Non standard sizes are available by special order. A replaceable rubber seal and threaded end cap prevent electrolyte leakage while providing good mechanical stability of the electrode. A spare seal is included with each holder.

PORT or VENT - Holders can be ordered with or without a port or vent by specifying:

- N - No port or vent
- P - With 2mm port to accept 1/16" ID tubing.
- V - With small diameter vent hole into chamber to equalize pressure*.

MATERIAL - Holders are made from either cast acrylic or polycarbonate. Refer to the holder series information on standard and optional choices.

* A vented holder has been reported to be important in relieving pressure in oocyte voltage clamp experiments. Holders supplied with our Model OC-725A (ESP-FxxV and ERW-FxxVH) now include a vent.

Microelectrode Holders (cont.)

Microelectrode holders are cataloged by the four following series:

E SERIES - E holders are generally used for, but not limited to, intracellular recording, microiontophoresis and ion sensitive measurements. They are made from 6.3 mm (1/4") diameter cast acrylic material.

E SERIES (H suffix) - The suffix H indicates the addition of a handle for mounting the holder in a micropositioner. Typical uses include stimulation, microiontophoresis and other applications where recording from the microelectrode is not required.

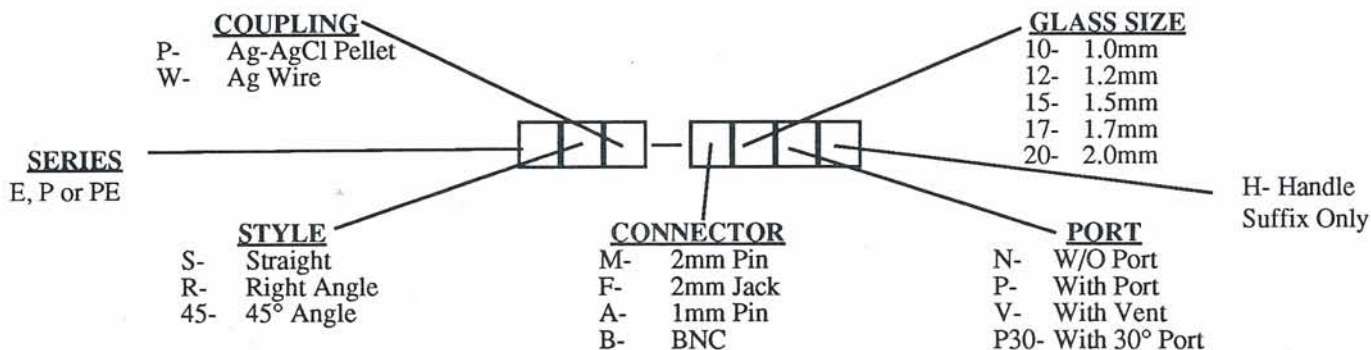
P SERIES - The larger 9.5 mm (3/8") body diameter makes for a larger selection of mating connectors. Holders ordered with the Ag-AgCl pellet, assumed to be for intracellular or other applications requiring the holder to be filled with electrolyte, are made from acrylic. Holders with Ag wire, generally used for patch clamping where only the microelectrode is filled with the electrolyte, are made from polycarbonate since its use has been reported to result in lower noise. Either material may however be specified for any P series holder.

PE SERIES - These special holders make possible perfusing solutions inside the microelectrode. An additional port enters the holder body at a 30° angle permitting the placement of a micro diameter tubing down inside the electrode. Excess fluid drains from the port.

The chart below lists the standard characteristics of each of the microelectrode series. Other variations are available by special order.

Characteristic	E SERIES	E(H) SERIES	P SERIES	PE SERIES
STYLE				
S- Straight	•		•	•
R- Right Angle	•	•	•	•
45- 45° Angle	•		•	
COUPLING				
P- AgAgCl Pellet	•	•	•	
W- Ag Wire	•	•	•	•
CONNECTOR				
A- 1mm Pin			•	•
B- BNC			•	•
F- 2mm Jack	•	•	•	•
M- 2mm Pin	•	•	•	•
PORT/VENT				
N- No Port/Vent	•	•	•	
P- With Port	•	•	•	•
V- With Vent	•	•		
MTG. Handle				
		•		
MATERIAL				
Acrylic	•	•	•	•
Polycarbonate			•	

Microelectrode Holder Part Number Construction Chart



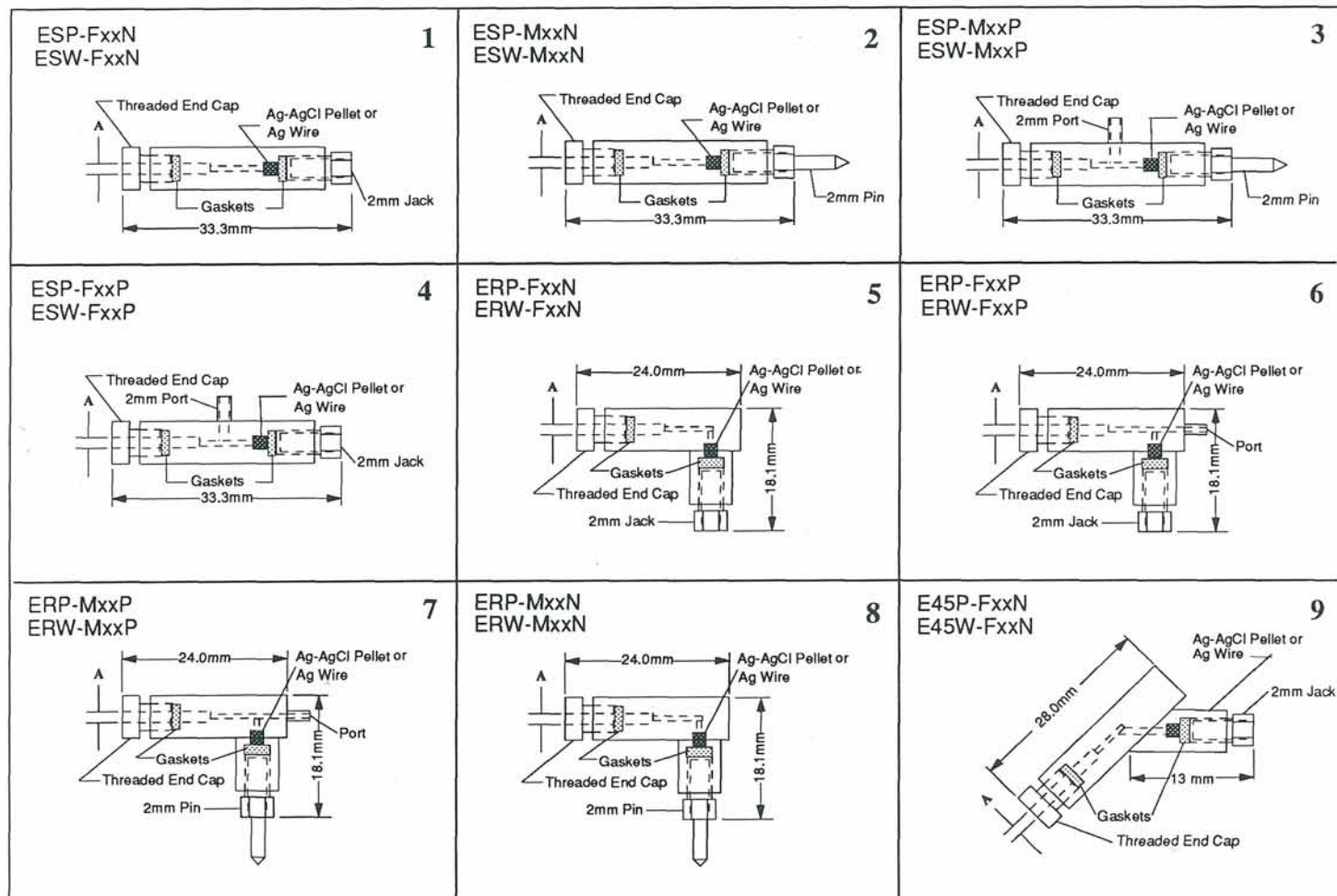
Example: Catalog No. ESP-M12N is a straight holder with Ag-AgCl pellet, 2mm pin, no port and bored for 1.2 mm diameter glass capillary.

E Series Holders

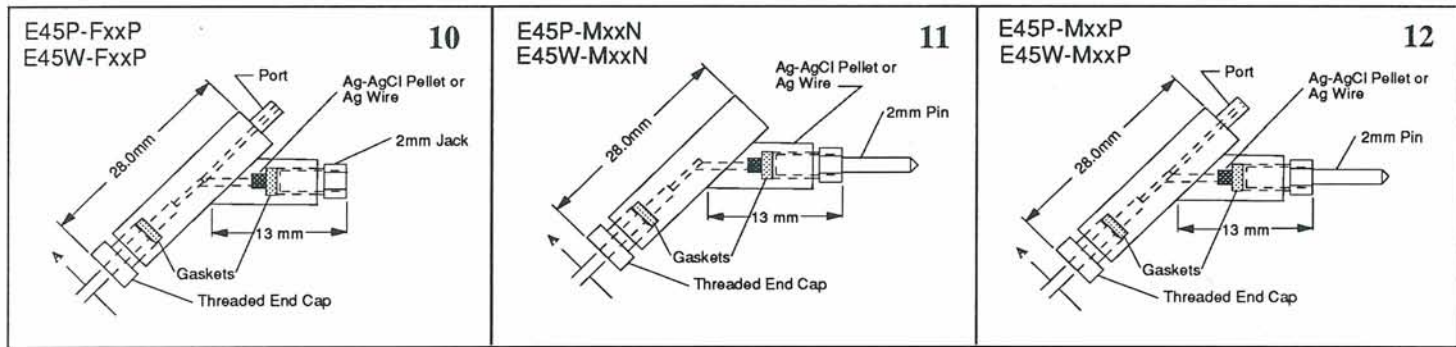
For Intracellular, Ion Sensitive and Microiontophoretic Applications

Part Number	Style	Coupling	Connector	Port/Vent	Dwg. Ref.	Price
ESP-FxxN	Straight	Ag•AgCl Pellet	2mm Jack	None	1	\$25.00
ESP-MxxN	Straight	Ag•AgCl Pellet	2mm Pin	None	2	\$25.00
ESP-FxxP	Straight	Ag•AgCl Pellet	2mm Jack	Port	4	\$27.00
ESP-MxxP	Straight	Ag•AgCl Pellet	2mm Pin	Port	3	\$27.00
ESP-FxxV	Straight	Ag•AgCl Pellet	2mm Jack	Vent	4*	\$27.00
ESW-FxxN	Straight	Ag Wire	2mm Jack	None	1	\$25.00
ESW-MxxN	Straight	Ag Wire	2mm Pin	None	2	\$25.00
ESW-FxxP	Straight	Ag Wire	2mm Jack	Port	4	\$27.00
ESW-MxxP	Straight	Ag Wire	2mm Pin	Port	3	\$27.00
ERP-FxxN	90° Angle	Ag•AgCl Pellet	2mm Jack	None	5	\$27.00
ERP-MxxN	90° Angle	Ag•AgCl Pellet	2mm Pin	None	8	\$27.00
ERP-FxxP	90° Angle	Ag•AgCl Pellet	2mm Jack	Port	6	\$29.00
ERP-MxxP	90° Angle	Ag•AgCl Pellet	2mm Pin	Port	7	\$29.00
ERW-FxxN	90° Angle	Ag Wire	2mm Jack	None	5	\$27.00
ERW-MxxN	90° Angle	Ag Wire	2mm Pin	None	8	\$27.00
ERW-FxxP	90° Angle	Ag Wire	2mm Jack	Port	6	\$29.00
ERW-MxxP	90° Angle	Ag Wire	2mm Pin	Port	7	\$29.00
E45P-FxxN	45° Angle	Ag•AgCl Pellet	2mm Jack	None	9	\$27.00
E45W-FxxN	45° Angle	Ag Wire	2mm Jack	None	9	\$27.00
E45P-MxxN	45° Angle	Ag•AgCl Pellet	2mm Pin	None	11	\$27.00
E45W-MxxN	45° Angle	Ag Wire	2mm Pin	None	11	\$27.00
E45P-FxxP	45° Angle	Ag•AgCl Pellet	2mm Jack	Port	10	\$29.00
E45W-FxxP	45° Angle	Ag Wire	2mm Jack	Port	10	\$29.00
E45P-MxxP	45° Angle	Ag•AgCl Pellet	2mm Pin	Port	12	\$29.00
E45W-MxxP	45° Angle	Ag Wire	2mm Pin	Port	12	\$29.00

*The vent is a small diameter hole in place of the port.



E Series Holders (Continued)

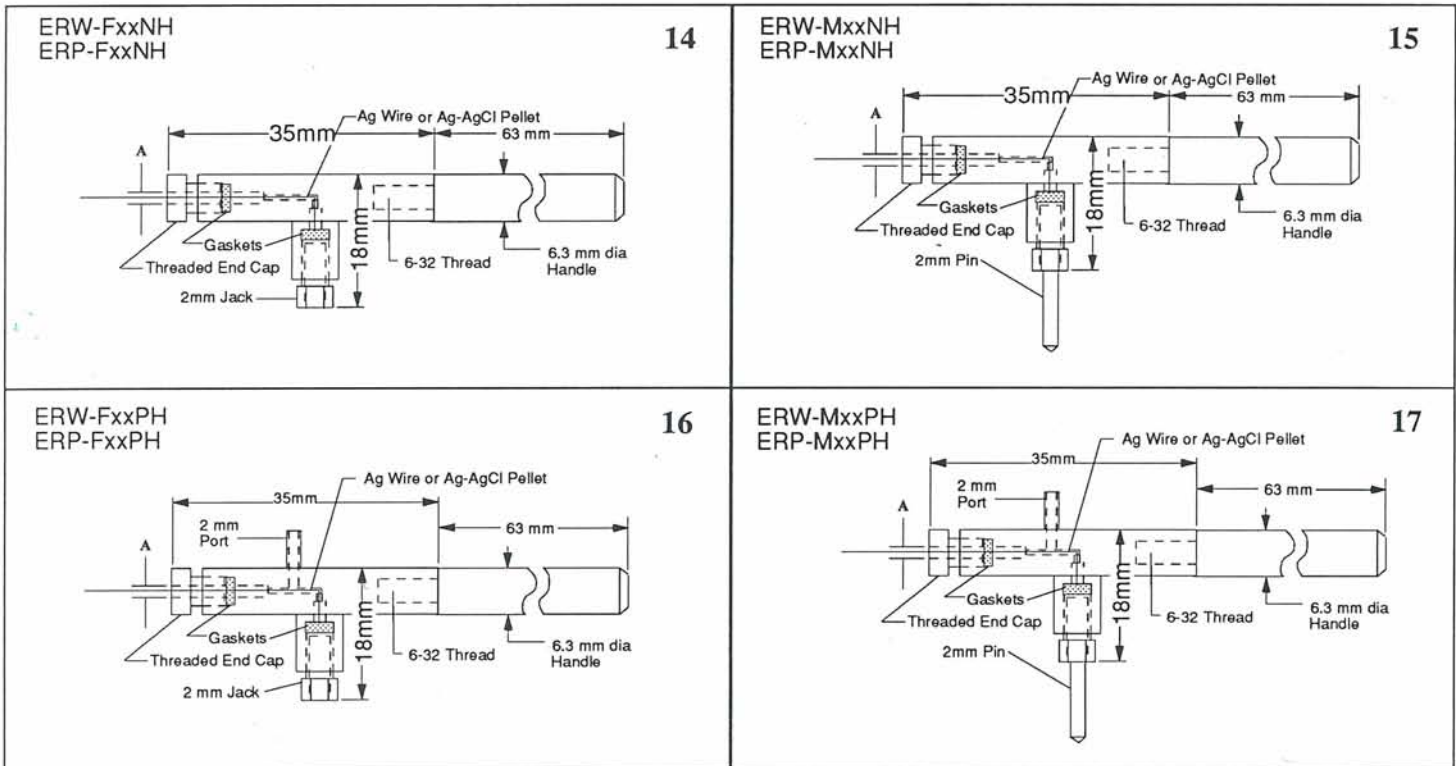


E Series Holders (Suffix H) For Stimulation & Microiontophoresis

E type holders with the addition of the "H" in the catalog number are made for mounting in a micropositioner by means of the 6.3 mm (1/4") diameter rod included. They are typically used for stimulation, microiontophoresis and other applications where the electrode is not attached directly to an amplifier headstage for recording.

Cat. No.	Style	Coupling	Connector	Port/Vent	Dwg. Ref.	Price
ERW-FxxNH	90° Angle	Wire	2mm Jack	None	14	\$30.00
ERP-FxxNH	90° Angle	Pellet	2mm Jack	None	14	\$30.00
ERW-MxxNH	90° Angle	Wire	2mm Pin	None	15	\$30.00
ERP-MxxNH	90° Angle	Pellet	2mm Pin	None	15	\$30.00
ERW-FxxPH	90° Angle	Wire	2mm Jack	Port	16	\$32.00
ERP-FxxPH	90° Angle	Pellet	2mm Jack	Port	16	\$32.00
ERW-MxxPH	90° Angle	Wire	2mm Pin	Port	17	\$32.00
ERP-MxxPH	90° Angle	Pellet	2mm Pin	Port	17	\$32.00
ERW-FxxVH	90° Angle	Wire	2mm Jack	Vent	16*	\$31.00

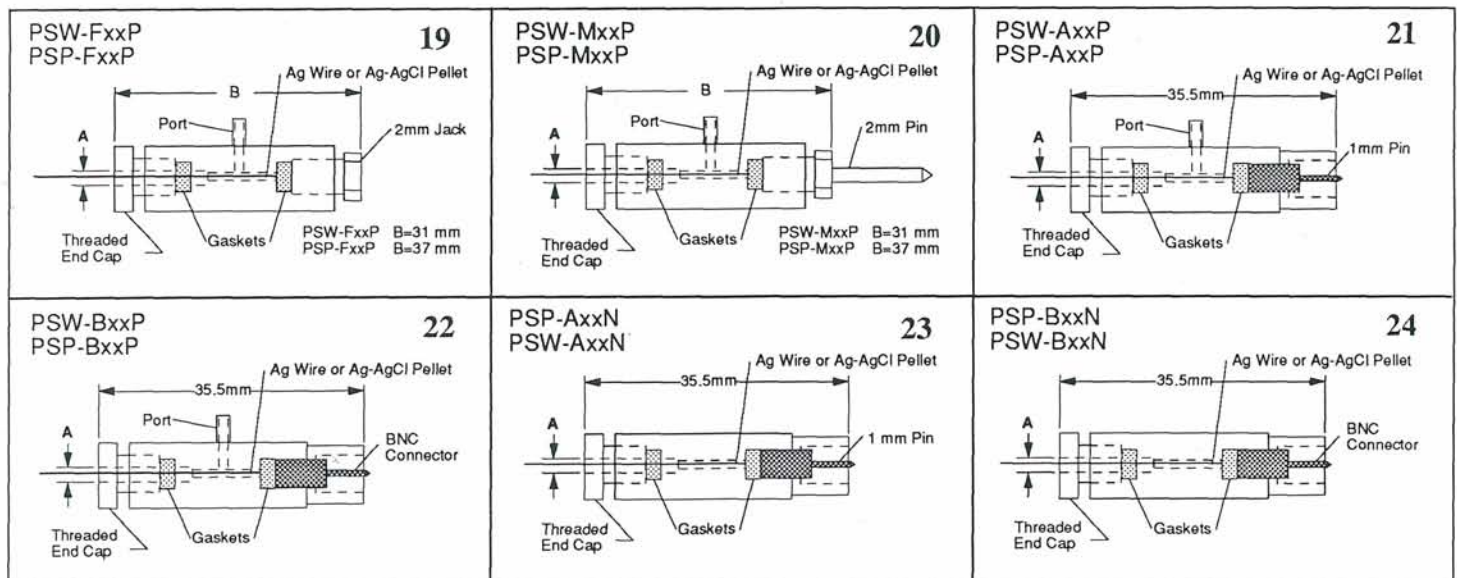
* The vent is a small hole in place of the port.



P Series Holders

For Intracellular & Patch Clamp Recording

Cat. No.	Style	Coupling	Connector	Port	Dwg. Ref.	Price
PSW-FxxP	Straight	Wire	2mm Jack	Yes	19	\$35.00
PSP-FxxP	Straight	Pellet	2mm Jack	Yes	19	\$35.00
PSW-MxxP	Straight	Wire	2mm Pin	Yes	20	\$35.00
PSP-MxxP	Straight	Pellet	2mm Pin	Yes	20	\$35.00
PSW-AxxP	Straight	Wire	1mm Pin	Yes	21	\$41.00
PSP-AxxP	Straight	Pellet	1mm Pin	Yes	21	\$41.00
PSW-BxxP	Straight	Wire	BNC	Yes	22	\$41.00
PSP-BxxP	Straight	Pellet	BNC	Yes	22	\$41.00
PSP-AxxN	Straight	Pellet	1mm Pin	No	23	\$39.00
PSW-AxxN	Straight	Wire	1mm Pin	No	23	\$39.00
PSP-BxxN	Straight	Pellet	BNC	No	24	\$39.00
PSW-BxxN	Straight	Wire	BNC	No	24	\$39.00
PRW-FxxP	90° Angle	Wire	2mm Jack	Yes	25	\$39.00
PRP-FxxP	90° Angle	Pellet	2mm Jack	Yes	25	\$39.00
PRW-MxxP	90° Angle	Wire	2mm Pin	Yes	26	\$39.00
PRP-MxxP	90° Angle	Pellet	2mm Pin	Yes	26	\$39.00
PRW-AxxP	90° Angle	Wire	1mm Pin	Yes	27	\$47.00
PRP-AxxP	90° Angle	Pellet	1mm Pin	Yes	27	\$47.00
PRW-BxxP	90° Angle	Wire	BNC	Yes	28	\$47.00
PRP-BxxP	90° Angle	Pellet	BNC	Yes	28	\$47.00
PRP-AxxN	90° Angle	Pellet	1mm Pin	No	29	\$45.00
PRW-AxxN	90° Angle	Wire	1mm Pin	No	29	\$45.00
PRP-BxxN	90° Angle	Pellet	BNC	No	30	\$45.00
PRW-BxxN	90° Angle	Wire	BNC	No	30	\$45.00
P45W-FxxP	45° Angle	Wire	2mm Jack	Yes	31	\$39.00
P45P-FxxP	45° Angle	Pellet	2mm Jack	Yes	31	\$39.00
P45W-MxxP	45° Angle	Wire	2mm Pin	Yes	32	\$39.00
P45P-MxxP	45° Angle	Pellet	2mm Pin	Yes	32	\$39.00
P45W-AxxP	45° Angle	Wire	1mm Pin	Yes	33	\$47.00
P45P-AxxP	45° Angle	Pellet	1mm Pin	Yes	33	\$47.00
P45W-BxxP	45° Angle	Wire	BNC	Yes	34	\$47.00
P45P-BxxP	45° Angle	Pellet	BNC	Yes	34	\$47.00
P45P-AxxN	45° Angle	Pellet	1mm Pin	No	35	\$45.00
P45W-AxxN	45° Angle	Wire	1mm Pin	No	35	\$45.00
P45P-BxxN	45° Angle	Pellet	BNC	No	36	\$45.00
P45W-BxxN	45° Angle	Wire	BNC	No	36	\$45.00



Important Ordering Information

When ordering holders be sure to specify the glass size by replacing the "xx" in the catalog number with:

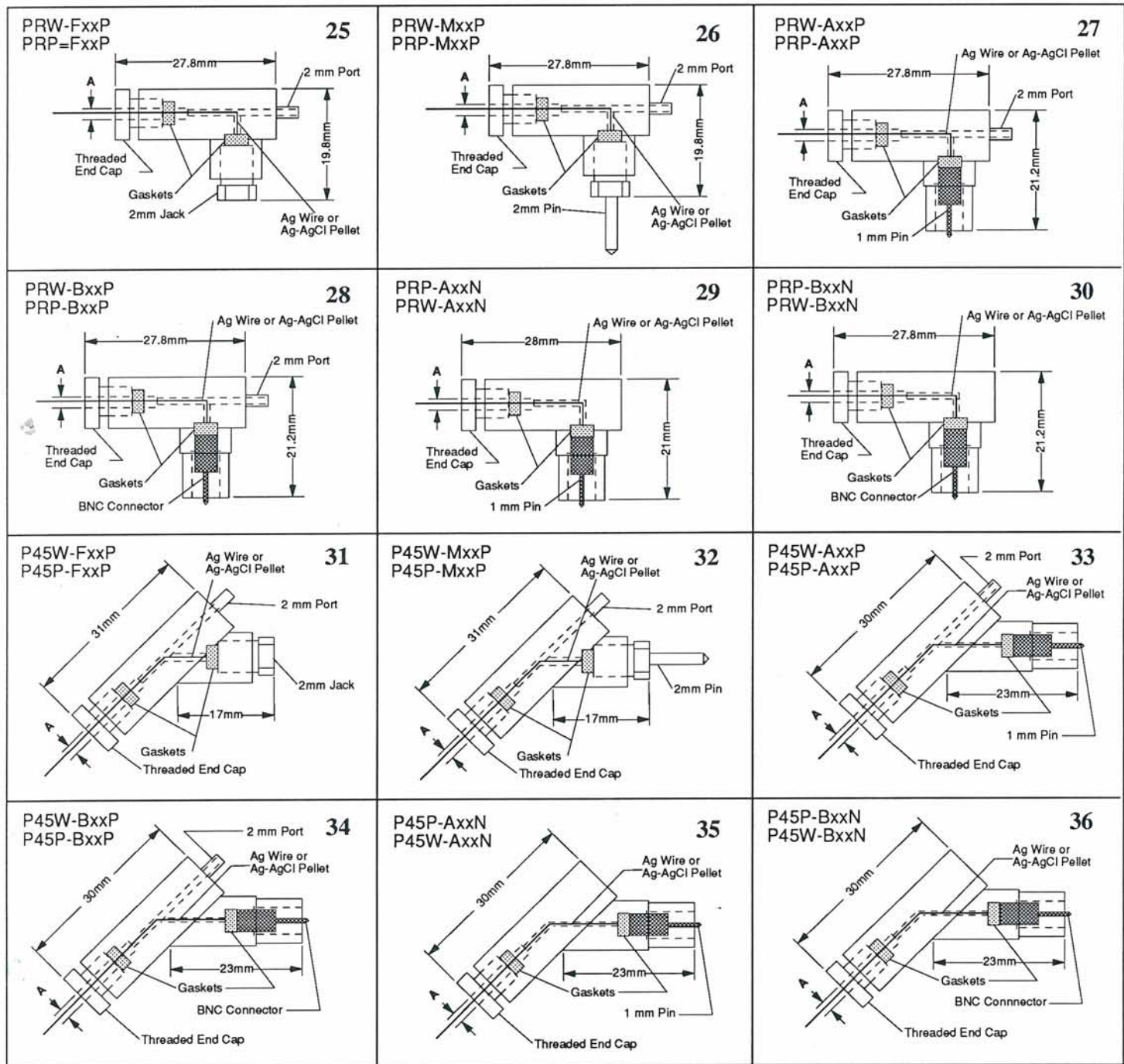
10 for 1.0 mm

12 for 1.2 mm

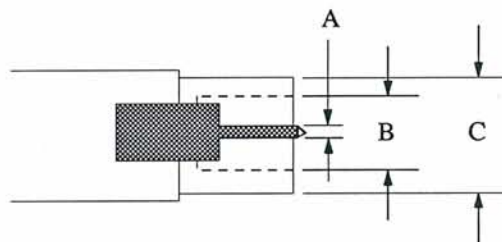
15 for 1.5 mm

17 for 1.7 mm

20 for 2.0mm



P & PE Series Connector Detail 1mm and BNC types



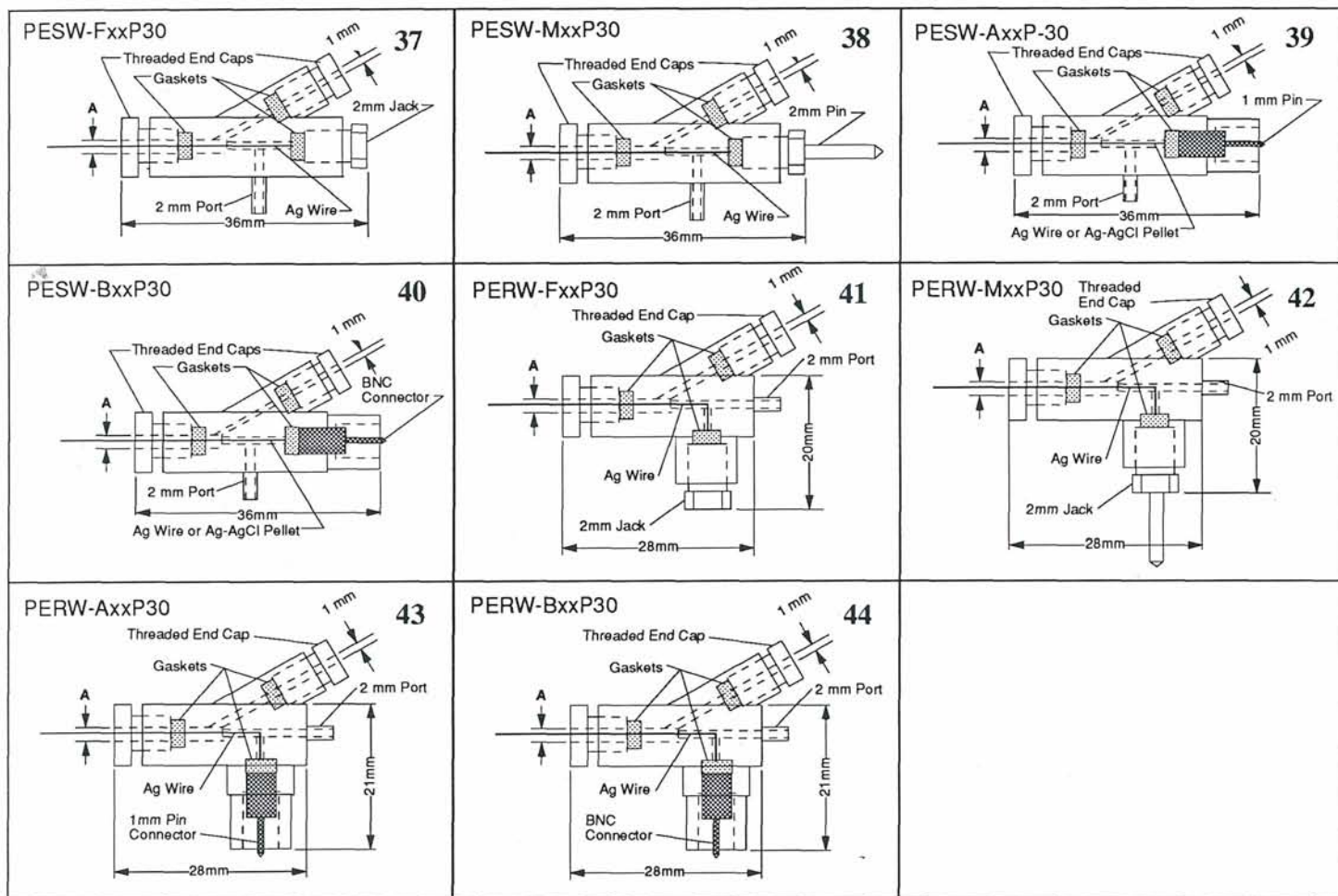
Dim.	1mm type	BNC type
A	1mm	1.4mm
B	6.3mm	4.6mm
C	8.3mm	8.1mm

PE Series Holders

For Micro Perfusion & Recording

PE SERIES

Cat. No.	Style	Coupling	Connector	Port	Dwg. Ref.	Price
PESW-FxxP30	Straight	Wire	2mm Jack	30°	37	\$54.00
PESW-MxxP30	Straight	Wire	2mm Pin	30°	38	\$54.00
PESW-AxxP30	Straight	Wire	1mm Pin	30°	39	\$60.00
PESW-BxxP30	Straight	Wire	BNC	30°	40	\$60.00
PERW-FxxP30	90° Angle	Wire	2mm Jack	30°	41	\$58.00
PERW-MxxP30	90° Angle	Wire	2mm Pin	30°	42	\$58.00
PERW-AxxP30	90° Angle	Wire	1mm Pin	30°	43	\$64.00
PERW-BxxP30	90° Angle	Wire	BNC	30°	44	\$64.00



GENERAL HOLDER INFORMATION

Ag-AgCl Pellet Holders

The holder is first filled with a chloride medium, either KCl or NaCl solution. The pipette is filled with the solution appropriate to the experiment and inserted into the holder. Care must be taken to eliminate any trapped air bubbles which can prevent electrical coupling and act as an open circuit (infinite impedance). All Ag-AgCl pellet holders are made from cast acrylic which provides excellent visual clarity and aids in the detection of air bubbles.

Ag Wire Holders

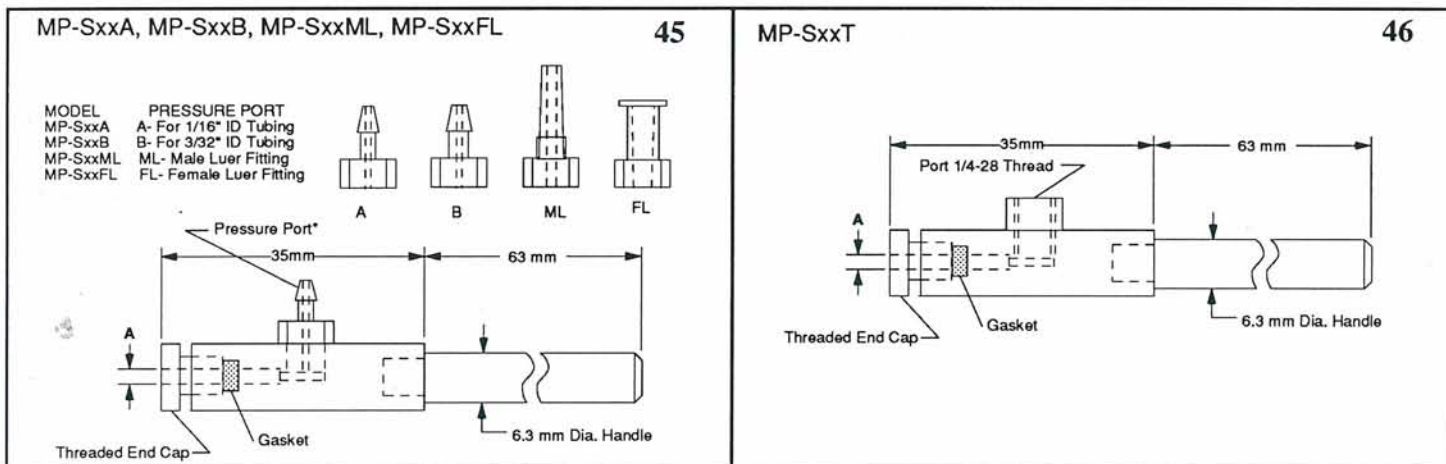
HOLDERS with silver wire coupling are not filled with electrolyte. The wire is inserted into the pipette which contains the chloride electrolyte. Before insertion, the wire must first be chlorided either by electroplating or dipping into Chlorox™ to reduce junction potentials. In applications such as patch clamping, the volume of solution in the pipette is kept as small as practical to minimize input capacitance. Care must be exercised to avoid scratching the chlorided wire when assembling the pipette and holder. Fire polishing the shank end of the pipette can help prevent this.

P Series holders ordered with the Ag wire coupling are assumed to be for patch clamping and are made from polycarbonate. Polycarbonate does not have the clarity of acrylic but is reported to result in lower noise levels. This is particularly true for headstages using the BNC type input connector. The loss of visual clarity is not a problem since the holders are not fluid filled.

MP Series Micropipette Holders

These holders are designed for pressure injection of drugs and dyes and have no electrical coupling. Body diameter is 9.5mm (3/8"). A 6.3 mm (1/4") diameter handle is included for mounting in a micropositioner. Choice of five tubing connectors is available.

Cat. No.	Pressure Port	Ref. Dwg.	Price
MP-SxxA	Accepts 1/16" ID tubing	45	\$25.00
MP-SxxB	Accepts 3/32" ID tubing	45	\$25.00
MP-SxxML	Accepts female Luer fitting	45	\$25.00
MP-SxxFL	Accepts male Luer fitting	45	\$25.00
MP-SxxT	Accepts standard 1/4-28 male threaded fitting	46	\$25.00



Reference Cells

Encapsulated Ag-AgCl pellets are widely used in a preparation reference or ground return. Five versions are offered. Two models include Luer tapers and can be conveniently mounted in a chamber.

Model	Description	Ref. Dwg.	Price
REF-1	Reference Cell with a 2 meter long wire	47	\$15.00
REF-2	Reference Cell with 2mm pin	48	\$15.00
REF-2L	Reference Cell with 2mm pin and Luer taper body	49	\$15.00
REF-3	Reference Cell with 2mm jack	50	\$15.00
REF-3L	Reference Cell with 2mm jack and Luer taper body	51	\$15.00

