

Blood Flow Probes

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100 Series

This miniature probe is for low flow measurements in small animals and rodents.

These very small probes have been used on the carotid, femoral and renal arteries of small animals, including rodents such as 300 gram rats. Excellent pulsatile and mean flow recordings have been obtained in such applications.

The 100 Series Probe is designed only for use with the CME Model 500 Series Flowmeters.

Both the acute and chronic probes are available with: (1) The cable angle as shown, (2) Right angle cable (see page 5), and (3) Side angle cable (see page 5). Please specify your choice.

Dowel slot closures for chronic probes are cut from solid silicone rods. A length of rod is provided with each probe from which several closures can be cut.

The chronic probe cable can be fabricated with: (1) A dual silicone sheath to provide maximum flexibility but with an implant life of approximately two weeks, or (2) A

dual sheath of internal vinyl and an external silicone material to make the cable slightly less flexible but with a much longer implant life. Please specify your choice. Both cables have an O.D. of approximately 2.6 mm.

Acute probes terminate in a standard PV8 Connector (see page 7). Chronic probes terminate in: (1) A miniature PSP Connector (with nylon protective cap), (2) A "Saddle Connector" which can be sutured in place at the shoulders, or (3) A specially designed connector (optional at extra cost). Please specify your choice.

A special 180 cm adapter/extension cable (CA-523) is recommended for use with all acute and chronic probes.

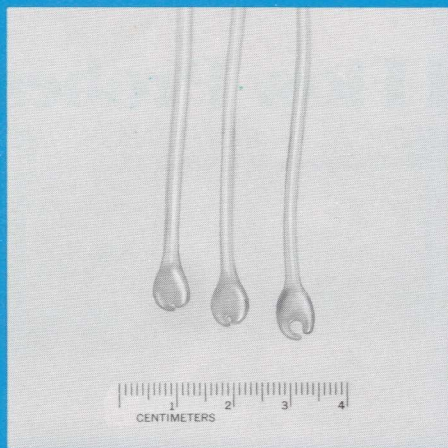
Standard Sizes for Acute and Chronic Probes:

1-4 mm internal circumference in 1/2 mm increments ONLY for CME Model 501 Flowmeter (Analog Panel Meter).
4-10 mm internal circumference in 1/2 mm increments for CME Models 501 and 501D Flowmeters.

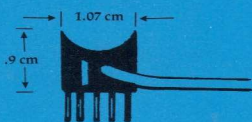
Acute cable length—60 cm.

Chronic cable length—30 cm (or to customer specifications).

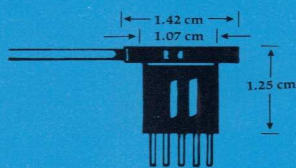
When extremely low flow measurements are encountered in acute studies, an occlusive zero may be required.



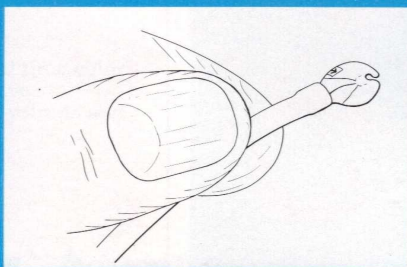
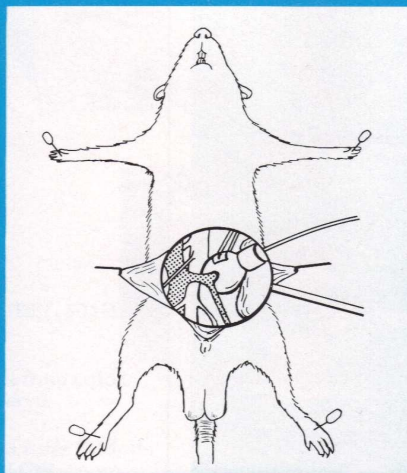
SADDLE CONNECTOR



MINIATURE PSP CONNECTOR



Actual size



200 Series

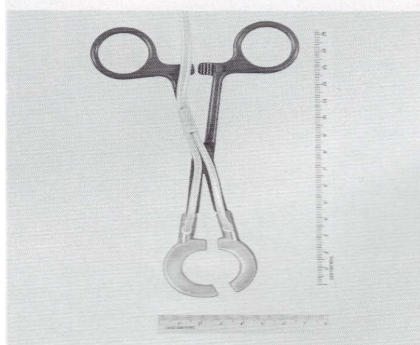
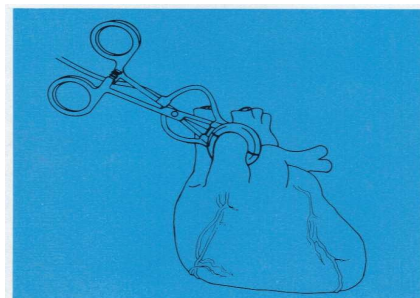
This forceps probe is for acute flow measurements in most arteries and veins. Its design makes it particularly well suited for use on diseased vessels.

The forceps probe provides good sensitivity with maximum versatility of application and removal. It may be easily rotated and positioned to obtain the best anatomical orientation, yet with minimum vessel disturbance. The probe can be hand held and gentle pressure on the finger grips will snap-lock the probe securely around the vessel. Measurements are quickly obtained with either right or left hand positioning. The handle is non-metallic and measures 12 cm (excluding the probe head).

Standard Sizes for Acute Probes:
6-20 mm internal circumference in 2 mm increments.
20-125 mm internal circumference in 5 mm increments.
Acute cable length—180 cm.

Non-standard probe sizes and cable lengths are available. Please contact factory

Recommended Starter Sets for CME 701D Flowmeter (CLINIFLOW II):
Peripheral Set: SF218, SF220, SF225, SF230 and SF235.
Thoracic Set: SF270, SF275, SF280, SF285 and SF290



300A Series

An extracorporeal probe for flow measurement in bypass or perfusion applications.

It is an improved version of a time- tested design which has been used clinically and in research for many years with excellent results. The new version has reduced mass and weight for increased durability. For ease of installation into the flow line, the tubing connectors are of the threaded, self-clamping type. (The 1/16" size has a non-threaded cannula.)

Extracorporeal probes provide maximum signal and stability because the blood makes direct contact with the sensing electrodes.

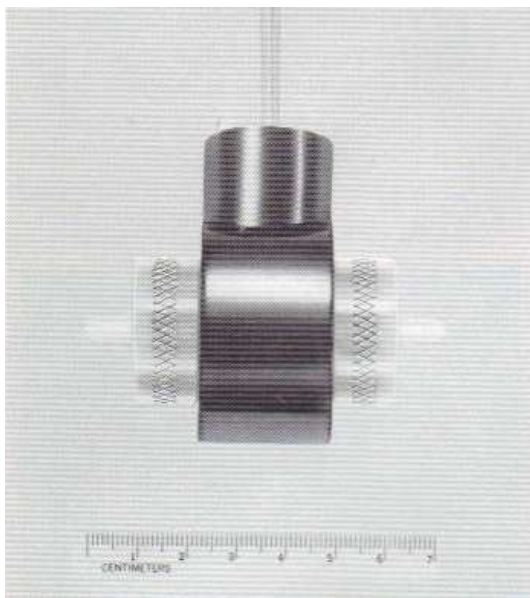
Calibration curves indicate significantly less variation in sensitivity attributable to blood hematocrit change than is experienced with extravascular probes. Many researchers use an extracorporeal probe as a reference probe in calibrating and standardizing the extravascular probes.

Measurements as low as 1 ml/mm are possible using the 1/16" I.D. size under optimum conditions. This indicates the high degree of stability and sensitivity provided by this type of probe. The tubing connectors are made from a single piece of smooth bore nylon. Sizes are specified according to the I.D. of the tubing connectors (cannula).

Standard Sizes	1/16"	1/8"	1/4"	3/8"	1/2"
Cannula I.D.	1/16" 1.6 mm	1/8" 3.2 mm	1/4" 6.4 mm	3/8" 9.5 mm	1/2" 12.7 mm
Nominal Cannula Length	2 3/4" 7 cm	2 3/4" 7 cm	2 3/4" 7 cm	2 3/4" 7 cm	2 3/4" 7 cm
Nominal Flow Range Per Minute	5 ml To 150 ml	25 ml To 500 ml	100 ml To 1 L	500 ml To 10 L	500 ml To 20 L

Non-Standard sizes are available. Please contact factory.

Cable length – 180 cm.



300AP Series

This extracorporeal probe is the same as the 300A Series, plus pressure ports. It is recommended where pressure measurements, withdrawal of blood samples or injections are required.

An outstanding feature is the probe permits monitoring blood flow and pressure simultaneously from essentially the same measurement site.

The probe is available with single (P1) or dual pressure ports (P2). Unless otherwise designated, a single pressure port will be on the inflow side of the probe. Dual ports permit measuring a differential pressure across the point of flow. The nominal interluminal distance between the dual ports is 5-10 mm. The stainless steel pressure port has an inside diameter of .063 inch (equivalent to a 13 gauge needle) and connects to a standard male Becton Dickinson Luer-Lok fitting. Caps are supplied for sealing the ports when they are not in service.

Sizes:

See 300A Series.

Cable length — 180 cm.



400 Series

The configuration and size make it desirable for most acute and chronic flow studies.

Minimum physical size and mass, consistent with good sensitivity, enhance the versatility of this design. This type of probe is the most popular of all series and is used with large and small vessels including the ascending aorta and coronary arteries.

A bibliography of scientific papers reports a wide variety of applications in research, teaching, laboratory and clinical requirements.

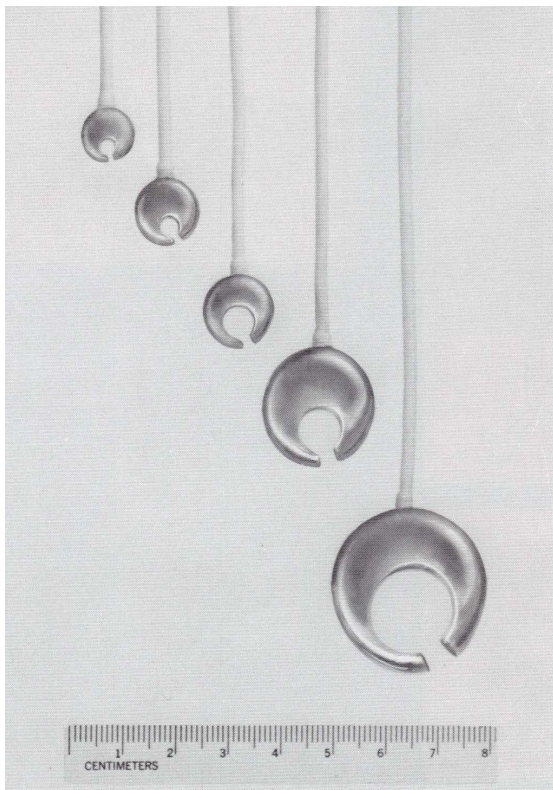
Recent reports cover such diverse applications as measurement of cardiac output (ascending aorta and pulmonary artery) in evaluating prosthetic valve function, flow measurement in selective arteriolization of the coronary vein, and determination of regurgitant fraction in aortic insufficiency studies.

Publications also report probe implantations in man for monitoring internal carotid blood flow during graded occlusion for aneurysm, and for monitoring flow after reconstructive surgery of the arteries of the lower limb. A comprehensive range of sizes and a number of optional features are available to meet the wide ranging requirements of individual users.

Standard Sizes for Acute and Chronic Probes:

4-20 mm internal circumference in 2 mm increments.
20-125 mm internal circumference in 5 mm increments.
Acute cable length—180 cm.
Chronic cable length—30 cm.

Non-standard probe sizes and cable lengths are available. Please contact factory.



400H Series

Handle type for vein grafts and similar acute applications. Features wide slot with a sliding closure.

The opening for the vessel is easily closed by a sliding mechanism on the handle. This type is well suited for saphenous vein grafts and other procedures involving transplanted vessels where external support of the probe during measurement is often desirable. An outstanding feature of this probe is that it permits rapid measurement of blood flow in evaluating a revascularization procedure where time may be a pressing factor.

The 12cm handle provides a convenient means of support and additional physical stability during flow studies. The wider slot, in most sizes, facilitates applications involving atherosclerotic vessels. In use, one simply retracts the slider and places the probe around the vessel, then returns the slider to the closed position. The sliding mechanism may be completely removed for cleaning; no tools are required.

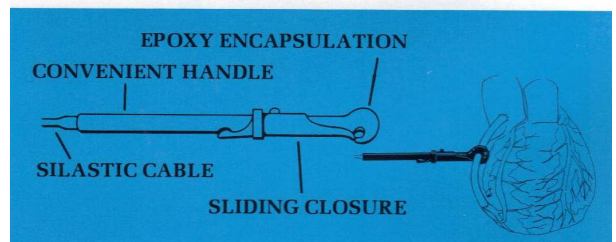
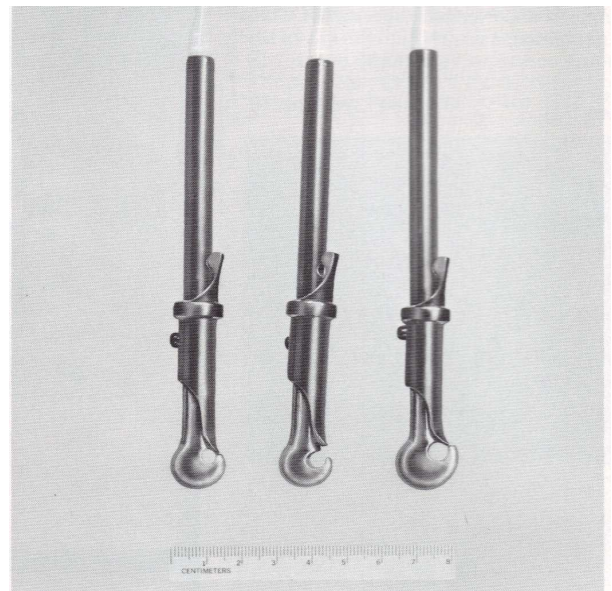
Standard Sizes for Acute Probes:

6-20 mm internal circumference in 2 mm increments.
20-35 mm internal circumference in 5 mm increments.

Acute cable length—180cm.

Non-standard probe sizes and cable lengths are available. Please contact factory.

Recommended Coronary Starter Set for CME 701D Flowmeter (CLINIFLOW II): SF408H, SF410H, SF412H, SF414H and SF416H.



Options

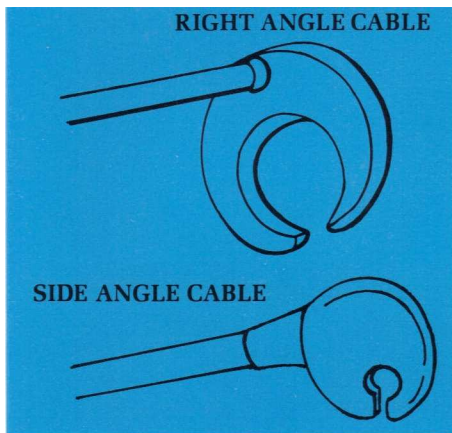
Right Angle Cable

For application where the anatomical situation makes it desirable that the probe cable be parallel with the vessel.

The probe is positioned at a right angle to the cable which will be parallel to the vessel after the probe is in place. This enables flow measurement from a vessel that would otherwise be inaccessible or difficult with other cable positions. It has proved successful in many species of animals when used as an implantable probe. Most researchers prefer this series for use on the dog's aorta, carotid and femoral vessels. On subcutaneous vessels the right angle cable facilitates easier placement of the cable to a desirable location some distance away from the original incision. This permits better healing and is convenient for connecting an adapter cable from the flowmeter.

Other cable angles may be available upon request. Special coronary artery probes for use in research applications have been constructed as illustrated.

Acute cable length—180 cm.
Chronic cable length—30 cm.



Bendable Handle

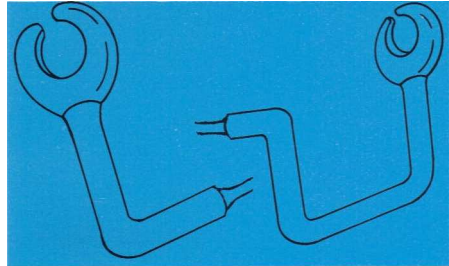
For application where flow recordings are necessary from a vessel with difficult anatomical accessibility or where some physical support of the probe is desired during measurement.

The semi-flexible handle may be bent into any desired shape or configuration. A 15 cm section of semi-rigid cable extending from the probe head permits forming while retaining significant stiffness. This assists manipulation during use somewhat similar to a conventional Handle Probe. There is a

slight increase in the diameter of the bendable handle section of the cable. The remainder of the cable is the same as other probe cables. The bendable handle was designed especially for acute applications but may be feasible for certain chronic uses.

Available on 400 Series Probes, 6 mm and larger.

Acute cable length—180 cm.
Chronic cable length—30 cm.



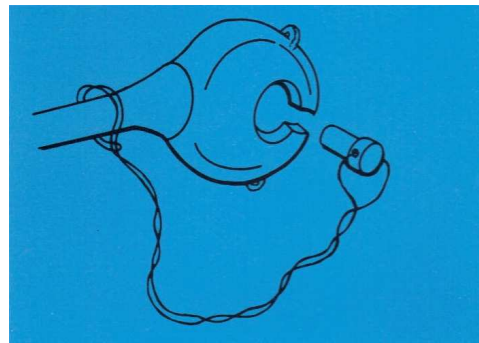
Slot Closures

Chronic probes are supplied with a slot closure. The size and series of the probe determines the type of closure. Available as an option on acute probes

The following closure types are custom fitted to each individual probe. Replacement of the closure requires returning the probe to the factory.

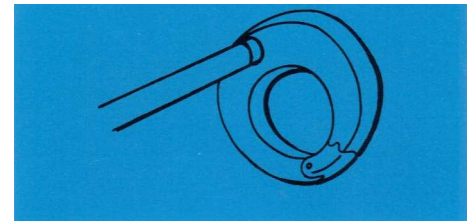
Dowel

The closure is secured by a suture to the probe cable and is wedged into place to retain the vessel. Used on small probes, sizes 4-25mm internal circumference.



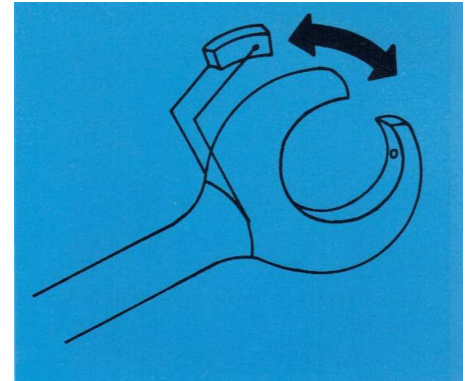
Hinged

Supplied standard on chronic probes of 30mm internal circumference and larger. Built as an integral part of the probe using a time-tested proven design. The closure is hinged to a pivot pin and securely snaps into place under light finger pressure without use of forceps or other instruments.



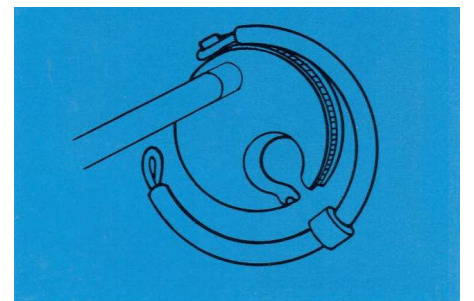
Spring Lock

The closure snaps into place under light pressure and is retained by means of a stainless steel spring. This closure allows up to a 30% larger slot opening and is available upon request for probe sizes 30-100mm internal circumference.



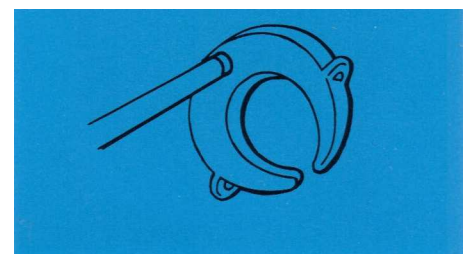
Wrap Around

This silicone, "wrap around" slot closure is pliable and very easy to apply and remove. Available only on right angle probes in sizes 10-30mm internal circumference.



Suture Eyelets

In certain applications it is desirable to attach sutures for probe stabilization. This is primarily in special chronic situations. One or more suturing eyelets can be provided on most probes. Eyelet locations must be specified when ordering.



600 Series

This probe is for IN VIVO vessel cannulation and perfusion of excised organs.

This probe is similar in appearance to the 300A Series but it is reduced in weight and mass. It utilizes a smooth bore cannula. Available in a wide range of sizes. A probe with a 6 mm lumen circumference will measure flow of 10 ml/mm. Variations of this probe can be constructed for special research requirements. One such type has been for attachment to or near a heart valve for septal defect studies. Wall thickness of the cannula is graduated from about 1 mm for the smallest size to approximately 2.5 mm for the largest size.

Standard Sizes for Acute and Chronic Probes:

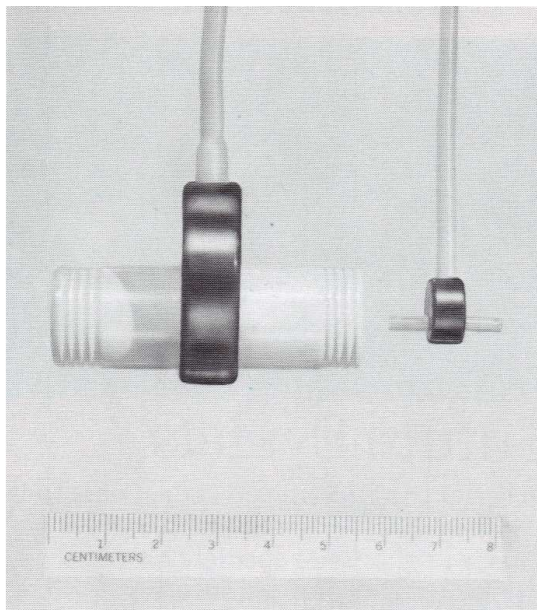
4–20 mm internal circumference in 2 mm increments.

20–125 mm internal circumference in 5 mm increments.

No-standard sizes and/or modifications for special research requirements are available. Please contact factory.

Acute cable length — 180 cm.

Chronic cable length — 30 cm.



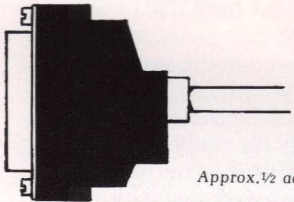

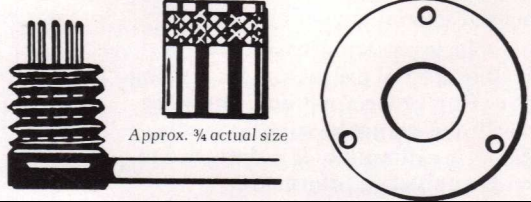
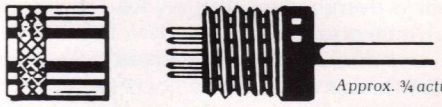
Connectors and Cables

Connectors

Carolina Medical Electronics probes come equipped with the appropriate electrical connector for the series of CME flowmeter to be used. Refer to General Ordering Information.

Non-metallic connectors are of epoxy, thus eliminating oxidation problems and minimizing moisture absorption. The junction of the connector and cable is sealed with silicone to provide increased moisture protection and added strain

relief. All electrical contacts are gold plated for maximum reliability. Since chronic probe cables are of shorter length, an adapter cable will be required to connect to the flowmeter.

CONNECTOR	DESCRIPTION	
DB17	Standard connector for acute probes to be used with CME 700 Series Flowmeters (CLINIFLOW II). Connects directly to flowmeter. Contains a PROM which automatically calibrates the flowmeter for probe gain and hematocrit sensitivity	 Approx. 1/2 actual size
PV8	Standard connector for acute probes to be used with CME 500 Series Flowmeters. Connects directly to flowmeter.	 Approx. 3/4 actual size
PSP8	Standard right angle connector for chronic probes. An adaptor cables is required to connect to flowmeter. Equipped with two screw-on, nylon, skin washers with screw-on, stainless steel cap.	 Approx. 3/4 actual size
PVT	Optional connector for chronic probes. An adapter cable is required to connect to flowmeter. Equipped with a protective, screw-on, stainless steel cap. Skin washers are not generally used but are available upon request.	 Approx. 3/4 actual size

Adapter Cables

Chronic probes require an adapter cable for connecting to the 500 Series Flowmeters. Adapter cables for CME flowmeters other than the series listed are available on special order.

FLOWMETER SERIES	LENGTH (FEET)	CABLE NUMBER
500	6	CA-504A*
500	12	CA-509A*
500	6	CA-523 **

* Used also as a probe extension cable for 500 Series Flowmeters.
 ** Recommended for use with the 100 Series Probes and Model 501 Flowmeter.

Note: Non-standard cable lengths are available. Contact factory for quotation.

Probe Extension Cables

These cables are used between an acute probe and the flowmeter when additional cable length is necessary. Probe extension cables for CME flowmeters other than the series listed are available on special order.

FLOWMETER SERIES	LENGTH (FEET)	CABLE NUMBER
500	6	CA-504A*
500	12	CA-509A*
500	6	CA-523 **
700	8	CA-701

* Used also as a probe extension cable for 500 Series Flowmeters.
 ** Recommended for use with the 100 Series Probes and Model 501 Flowmeter. Used also as an adapter cable.

Note: Non-standard cable lengths are available. Contact factory for quotation.

Ground Wire – GW-5

This is an insulated wire equipped with a plated spring clip. The standard length is twelve feet. EP and SF probes must be grounded in order to function properly. This is accomplished by connecting a ground wire as outlined in the flowmeter instruction manual. Two GW-5 Ground Wires are supplied with each flowmeter. It is recommended that a spare ground wire be kept on hand.

General Ordering Information

Preface to Ordering

- Determine flowmeter model number. This enables the factory to insure proper electrical connectors and wiring. This information is on a metal plate attached to the flowmeter and is required since all probes are not compatible with all flowmeters.
- Select the probe series having the configuration or style best suited for the intended application.
- Determine the probe size. For additional information see sections “Vessel Fit” and “Vessel Measurement” on page 10.
- Decide if the probe type should be acute or chronic. Chronic probes may be used for acute applications, however acute probes cannot be satisfactorily implanted. It is best to use probes for their intended purposes.
- Select any desired options.
- Select any required or additional cables, such as adapter and/or extension cables.
- **Please state flowmeter model number with each order.**

EP is the prefix for probes used with the CME 500 Series Flowmeters. **All EP series probes are factory calibrated.** There is no extra charge for calibration of EP probes.

SF is the prefix for probes used with CME 700 Series Flowmeters (CLINIFLOW II). **These probes are factory calibrated.** There is no extra charge for calibration of SF probes.

- All orders are filled in accordance with instructions in customers purchase order. To avoid unnecessary delays and/or expense, please contact the factory if additional information is needed to specify your requirements.

PROBES	FLOWMETERS
EP Prefix	500 Series
SF Prefix	700 Series CLINIFLOW II

Ordering 100, 200, 400, 400H and 600 Series Probes

(Please see “Preface to Ordering” section first)

1. EP or SF designates the probe prefix for the flowmeter to be used. Flowmeter model must be stated on order. (The 100 Series Probe is designed only for use with the CME Model 500 Series Flowmeters.)
2. The first numeral designates the probe series. (1 for 100 Series, 2 for 200 Series, 4 for 400 Series, 6 for 600 Series.)
3. The remaining numerals designate the size of the probe in mm of internal circumference. (Example: 04 for 4 mm internal circumference, 50 for 50 mm internal circumference, 100 for 100 mm internal circumference.)
4. The model number of the probe must be followed with any required suffixes to specify desired options:
 - “C” denotes a chronic type probe, having a slot closure and a 30 cm cable length.
 - “H” denotes a handle type probe.
 - “R” denotes a right angle cable.
 - “S” denotes a side angle cable.
 - “BH” denotes a bendable handle.
5. Suturing eyelets can be provided on many probes. Eyelet locations must be specified; please include sketch.
6. You can use the Flow Probe Order Form or use the examples below to place your order for Flow Probes.

EXAMPLE: An order for a 100 Series Probe with a 7.5mm **internal circumference**, for a chronic application, right angle cable, probe cable of vinyl and silicone material, miniature PSP Connector, and one 180cm adapter/extension cable for use with a CME 501 Flowmeter, would be written as:
 (One) EP-107.5CR Probe, Vinyl/Silicone Cable, Miniature PSP Connector (For use with a CME 501 Flowmeter).
 (One) CA-523 Adapter/Extension Cable.

EXAMPLE: An order for a 400H Series Handle Probe with a 12 mm **internal circumference**, and one 8 foot extension cable for use with a CME 701D Flowmeter (CLINIFLOW II), would be written as:
 (One) SF-412H Probe (For use with a CME 701D Flowmeter).
 (One) CA-701 Extension Cable.

Ordering 300A and 300AP Series Extracorporeal Probes

(Please see “Preface to Ordering” section first)

1. EP or SF designates the probe prefix for the flowmeter to be used. Flowmeter model must be stated on order.
2. 300A designates an extracorporeal probe without pressure ports.
3. Suffix “Pi” denotes (one) pressure port. Suffix “P2” denotes (two) pressure ports.
4. The last figures ($\frac{1}{16}$ ”, $\frac{1}{2}$ ”, $\frac{3}{4}$ ”, etc.) designate the inside diameter of the probe cannula.

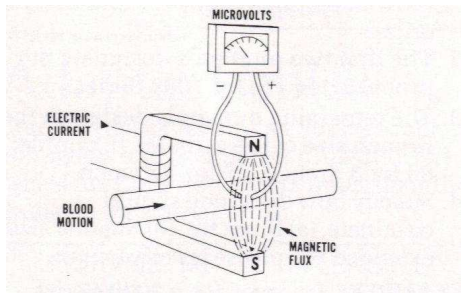
EXAMPLE: An order for a 300AP Series Probe, with two pressure ports, with a $\frac{3}{4}$ ” I.D. cannula for use with a CME 701D Flowmeter (CLINIFLOW II), would be written as:
 (One) SF-300AP2 $\frac{3}{4}$ ” Probe, (For use with a CME 701D Flowmeter).

General Probe Features

- Ferromagnetic Core for Increased Sensitivity
- Electrostatically Shielded
- Encapsulation — Evacuated Unfilled Epoxy
- Cables — Miniature, Shielded, Highly Flexible, Jacket of Medical Grade Silicone Rubber. Extension and Chronic Adapter Cables Available
- Connectors — Acute and Chronic Types, Gold-Plated Contacts
- Many Optional Features
- Complete Range of Sizes
- Factory Calibrated
- Factory repair and technical services or provided for all products manufactured by Carolina Medical Electronics, Inc.

Principle of Operation

The principle of operation is based on the induction of a voltage in a conductor (blood) moving through a magnetic field. The voltage will be induced at right angles to the direction of motion and to the magnetic field. The induced voltage's polarity depends upon the polarity of the field and the direction of the conductor's motion. Its magnitude is determined by the velocity of motion, the strength of the field and the length of the conductor (cross-section).



$$V = vBD \text{ microvolts}$$

V is the induced signal voltage

B is the magnetic flux density in gauss

D is the diameter of the vessel in cm

v is the mean velocity in meters/sec

The probe consists basically of an electromagnet to produce the field and two electrodes which pick up the flow induced signal. The electrodes in the extracorporeal (cannulating) probes make direct contact with the blood. The electrodes in the extravascular (non-cannulating) probes make contact with the outer surface of the vessel wall.

The arrow on conventional probes indicates the direction of flow which will produce a positive flowmeter output, when the probe switch on the flowmeter is turned to its (+) position.

There are several types of electromagnetic flowmeters. They are normally identified according to the waveshape of the energizing signal which produces a magnetic field in the probe.

CME flowmeters operate on the square-wave principle which permits effective separation of the flow signal from undesirable quadrature effects. The quality and quantity of the scientific data¹ obtained from CME flowmeters attest to the excellent results derived from this system.

Flowmeters must perform several functions for the probe. They supply an energizing signal to produce the magnetic field. They receive the flow induced signal which is then amplified and converted to a DC voltage proportional to the volumetric flow rate. This signal is then made available for visual presentation, computation or storage.

The blood flow probes listed in this brochure have been designed specifically for flowmeters manufactured by Carolina Medical Electronics, Inc.

¹ Comprehensive bibliography on blood flow studies using CME flowmeters is available upon request.

Vessel Fit

Since the probe operates on the principle of electromagnetic induction, its output is proportional to blood velocity. To measure flow volume it is necessary to fix the cross-sectional area in the probe. (Flow = Velocity X Cross-Sectional Area). *Accuracy depends on fit.* Contact between the electrodes and the vessel wall must be maintained at all times. Obviously, a probe applied to an undersized vessel cannot be accurately calibrated since it will not fix the vessel cross-section, and its electrodes will not make adequate contact to the vessel. If large changes in blood pressure are anticipated,

the probe used must be small enough to maintain good contact at the lowest pressure. Use of a probe too small will alter the arterial pulsatile flow pattern, and reduction of the cross-sectional area of approximately 50 per cent will markedly affect mean flow.

Investigators have found that area reduction up to 20 per cent does not substantially alter the pulsatile flow pattern. Caution is indicated with atherosclerotic vessels.

In chronic applications, it should be remembered that the vessel will return to its normal state after incision closure. The size of the implanted probe should be such that the vessel will not be excessively constricted postoperatively.

Chronic probes are supplied with a slot closure. The type of closure is not the same for all sizes and series of probes. When selecting a probe style, consideration should be given to physiological factors such as the length of the vessel which can be exposed, the space available around the vessel, proximity of adjacent organs and depth of vessel location. A broad selection of probes enables the investigator to accommodate variations in vessel size and thus obtain maximum results from the blood flow instrumentation. For applications which may require deviations from standard styles (i.e. cable angle, cable length, special eyelets, etc.) please contact the manufacturer.

Vessel Measurement

The probe size is specified in millimeters of internal circumference for all extravascular types. Therefore the vessel circumference must be accurately determined. One convenient method is to tie a suture around the vessel, cut the suture and measure its length with a millimeter scale.

A given vessel will vary in size, sometimes greatly, between subjects of the same species and weight. It is suggested that measurements be made in a series of subjects to determine the normal range of vessel circumference.

Adult Human Vessel Sizes

(Approximate Range in mm Circumference)

Ascending Aorta	60-80
Femoral	15-20
Iliac	25-35
Vertebral	6-8
Internal Carotid	10-15
Common Carotid	20-25
Renal	10-20
Pulmonary Artery	60-80
Subclavian	15-20
Saphenous Vein, Coronary Graft	12-20
Saphenous Vein	8-20
Axillary Artery	15-20
Popliteal Artery	12-20
Posterior Tibial	6-10
Abdominal Aorta	40-50
Internal Mammary	6-12
Brachial	15-20

Calibration

CLINIFLOW and CLINIFLOW 11 probes are factory calibrated. For maximum calibration accuracy, each probe must be calibrated by passing a measured quantity of saline through it and determining the relationship to flowmeter output. Once the calibration factor has been determined, it is a constant, and may be set into the flowmeter's probe factor dial. This provides an output indication of flow directly in either milliliters or liters per minute.

Sterilization

DO NOT STEAM AUTOCLAVE.

Sterilization is achieved by using ethylene oxide or standard germicidal solutions. Excessive or prolonged sterilization in germicidal solution may adversely affect a probe due to moisture absorption by the epoxy encapsulation.

THE TEMPERATURE SHOULD NEVER EXCEED 65°C.

Damaged probes should not be sterilized or used.

Limited Warranty

A Limited Warranty is issued by Carolina Medical Electronics, Incorporated, and includes* the following terms:

1. This Warranty covers repair or replacement of parts of products manufactured by Carolina Medical Electronics which are defective in material or workmanship. Carolina Medical Electronics will pay for parts and labor only.
2. The Warranty starts the date of shipment and lasts for 90 days on the Plow Probes.
3. CAROLINA MEDICAL ELECTRONICS MAKES NO OTHER EXPRESS WARRANTIES. ANY IMPLIED WARRANTIES, INCLUDING WARRANTIES AS TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE PERIOD SET OUT IN PARAGRAPH 2 ABOVE.
4. CAROLINA MEDICAL ELECTRONICS SHALL HAVE NO RESPONSIBILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE BREACH OF ANY WARRANTY, INCLUDING, BUT NOT LIMITED TO, INCONVENIENCE, RENTAL OR PURCHASE OF REPLACEMENT EQUIPMENT, LOSS OF PROFITS OR COMMERCIAL LOSS; SUBJECT TO THE LAWS OF YOUR STATE.
5. This Warranty is not subject to change or modification by anyone, including Carolina Medical Electronics' sales personnel and no such person is authorized to make any representations or promises on Carolina Medical Electronics' behalf.

*Refer to owner's manual for complete provisions. Rights of design changes and circuit modifications are reserved.

Other Conversions

To Convert	Inches	Into	Millimeters	Multiply By	25.40
	Millimeters		Inches		0.03937
	Feet		Meters		0.3048
	Meters		Feet		3.28084
	Centimeters/Sec		Meters/Sec		0.6

Circumference/ Diameter Conversion

CIR	DIA	CIR	DIA
1	0.32	25	7.96
2	0.64	30	9.55
3	0.96	35	11.10
4	1.27	40	12.73
5	1.59	45	14.32
6	1.91	50	15.92
7	2.23	55	17.51
8	2.55	60	19.10
9	2.87	65	20.69
10	3.18	70	22.28
11	3.50	75	23.87
12	3.82	80	25.46
13	4.14	85	27.06
14	4.46	90	28.65
15	4.77	95	30.24
16	5.09	100	31.83
17	5.41	105	33.42
18	5.73	110	35.01
19	6.05	115	36.61
20	6.37	120	38.20

Metric Conversion

INCHES	DECIMAL	MILLI-METERS
¹ / ₁₆	0.063	1.6
¹ / ₈	0.125	3.2
¹ / ₄	0.250	6.4
³ / ₈	0.375	9.5
¹ / ₂	0.500	12.7

French/Diameter Conversion

NUMBER	MILLI-METERS
5	1.67
6	2.0
7	2.3
8	2.7
9	3.0

French size divided by 3 = Diameter in mm.

Carolina Medical Electronics Probe Order Form

Model: EP-420-H-PV8-501

Code	Flowmeter
EP	FM501
EP	FM501D
SF	FM701D

Series: EP-420-H-PV8-501

Code	Description
1	Miniature Probe
2	Forceps Probe
3	Extracorporeal
4	Standard
6	IN VIVO

Size: EP-420-H-PV8-501

Series	Sizes (mm)	Increments (mm)
100	1 – 10	0.5
200	6 – 20	2.0
200	20 – 125	5.0
300	1.6 – 12.7	3.2
400	4 – 20	2.0
400	20 – 125	5.0
400-H	6 – 20	2.0
400-H	20 – 35	5.0
600	4 – 20	2.0
600	20 – 125	5.0

Options: EP-420-H-PV8-501

Code	Description
STD	Standard
H	Handle
R	Right Angle
S	Side Angle
BH	Bendable Handle
E	Eyelets
C	Chronic

Connector: EP-420-H-PV8-501

Code	Flowmeter
DB17	700 Series
PV8	500 Series
PSP8	Adaptor Needed
PVT	Adaptor Needed

Flowmeter: EP-420-H-PV8-501

Code	Flowmeter
501	FM501
501D	FM501D
701D	FM701D

Example Catalog # EP – 420 – H – PV8 – 501
Model Series/Size Options Connector Flowmeter

Order Catalog # _____ – _____ – _____ – _____ – _____
Model Series/Size Options Connector Flowmeter

Comments: _____

Note: Special sizes can be ordered but you must contact the factory first.

First in Flowmetry

In 1955, Carolina Medical Electronics, Inc., developed the first commercial electromagnetic flowmeter, providing physicians and medical research scientists with an accurate and practical device for extravascular measurement of blood flow in surgically exposed but non-cannulated arteries and veins.

It was a significant achievement, ranking in importance alongside the invention many years before of the sphygmomanometer, still used daily in hospitals and physicians' offices for the measurement of human blood pressure.

Until the development of the electromagnetic flowmeter, most of the knowledge of human blood circulation was based on pressure data. With the availability of an instrument to measure blood flow, the scope of cardiovascular research was broadened, leading to improved methods for evaluating circulatory problems and better patient management.

The first electromagnetic transducer consisted basically of a small electromagnet encased in plastic and shaped in a fashion as to allow it to be slipped over and around a surgically exposed blood vessel. The vessel was positioned between the poles of the magnet, which was energized by electrical current to create a square-wave magnetic field. Voltage, generated by the motion of the blood flowing through the magnetic field, was found to be proportional to the strength of the field, the velocity of the flow and the diameter of the vessel.

This principle has not changed, but the instrumentation has been consistently improved to meet the changing needs of physicians and research scientists.

CME's principal interest has remained the continuous research, development and manufacture of the best, most reliable blood flowmeters available. Our experience in the field is unequalled. CME electromagnetic flowmeters are in use in hospitals and laboratories throughout the world.

The CME Square-wave Electromagnetic Flowmeters measure volumetric blood flow in arteries and veins by intracorporeal and extravascular transducers. These instruments also are capable of measuring flows in extracorporeal systems such as pump oxygenators and perfusion equipment.

The first blood flow measurements, both animal and human, using chronically implanted transducers, were made with CME flowmeters. CME research and development produced the intravascular catheter probe for blood velocity measurement (patented).

We are proud of our international reputation for quality instruments and quality service. Our foremost concern is that users of our instruments obtain the maximum performance which their equipment has been designed to provide.

Overseas sales and service is provided through qualified technical representatives.

COMPREHENSIVE BIBLIOGRAPHY ON BLOOD FLOW STUDIES USING ME FLOWMETERS IS AVAILABLE UPON REQUEST.

Electromagnetic Blood Flowmeters



MODEL 321
(Not in Production)



MODEL 601D
(Not in Production)



MODEL 701D



MODEL 501D



MODEL 501

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