Keeler

Ophthalmic Instruments

Technical Description - Cryomatic Probes

Keeler Cryomatic II Probes are a family of reusable devices intended for the treatment of specific ophthalmic conditions. The shape and configuration of the probe tip varies depending on the specific application.

The following variants are available:

1. Standard Retinal Probe
2. Extended Retinal Probe
3. Glaucoma Probe
4. Mid Reach Retinal Probe
5. Curved Cataract Probe
6. Trichiasis Probe
7. Intravitreal Probe
8. Classic Retinal Probe

Keeler
Ophthalmic Instruments

Specification

Performance Characteristics

Probe Type	Minimum Ice-ball Size*		Pressure (PSI)	Flow Rate (LPM)	Defrost Time (seconds)
	Ø(mm)	L (mm)			
Standard Retinal Probe	5.0mm	5.0mm	500	10-15	2-4
Classic Retinal Probe	5.0mm	5.0mm	500	10-15	2-4
Extended Retinal Probe	5.0mm	5.0mm	500	10-15	2-4
Mid- Reach Retinal Probe	N/A	2.5mm	500	10-15	2-4
Glaucoma Probe	5.0mm	5.0mm	500	10-15	2-4
Trichiasis Probe	N/A	2.5mm	500	10-15	<10
Curved Cataract Probe	4.0mm	4.5mm	500	10-15	2-4
Intravitreal Probe	2.0mm	2.0mm	500	7-12	2-4
Disposable Retinal Probe	5.0mm	5.0mm	550	6-12	2-4

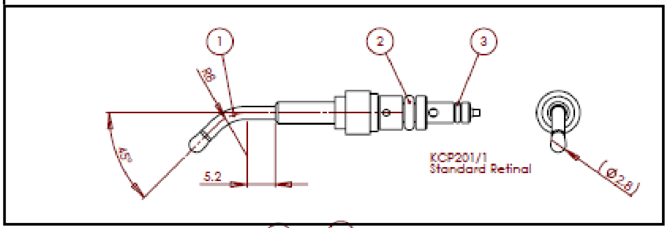
Cryogenic media: Carbon Dioxide or Nitrous Oxide

Overall probe length: 2.3m

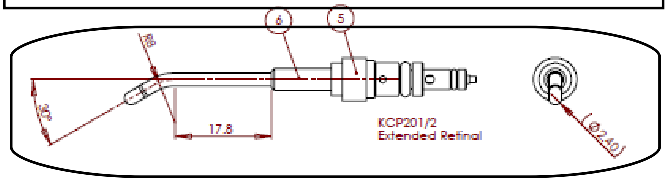
Keeler

Ophthalmic Instruments

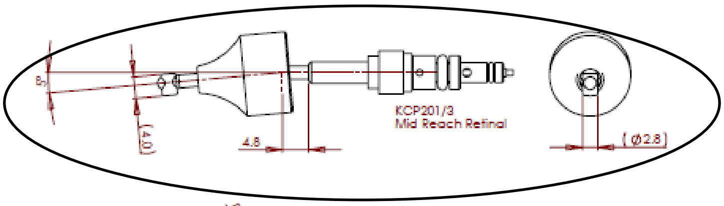
Tip Profiles



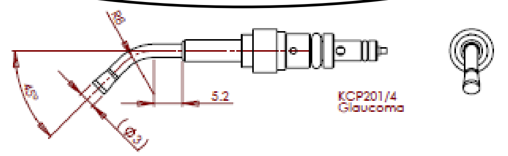
Standard Retinal Probe



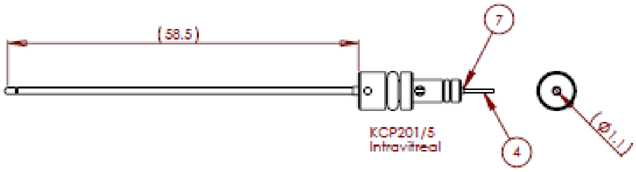
Extended Retinal Probe



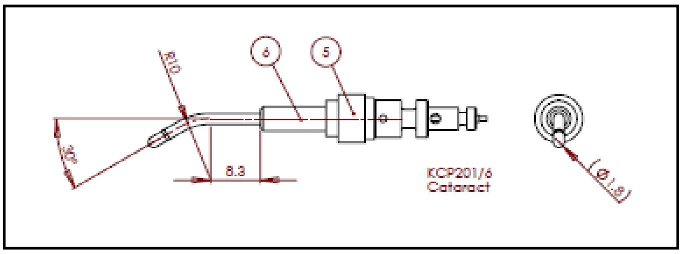
Mid Reach Retinal Probe



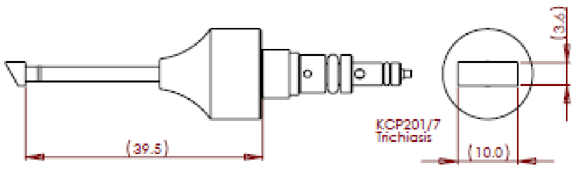
Glaucoma Probe



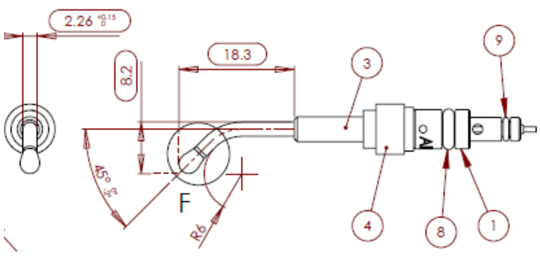
Intravitreal Probe



Curved Cataract Probe



Trichiasis Probe

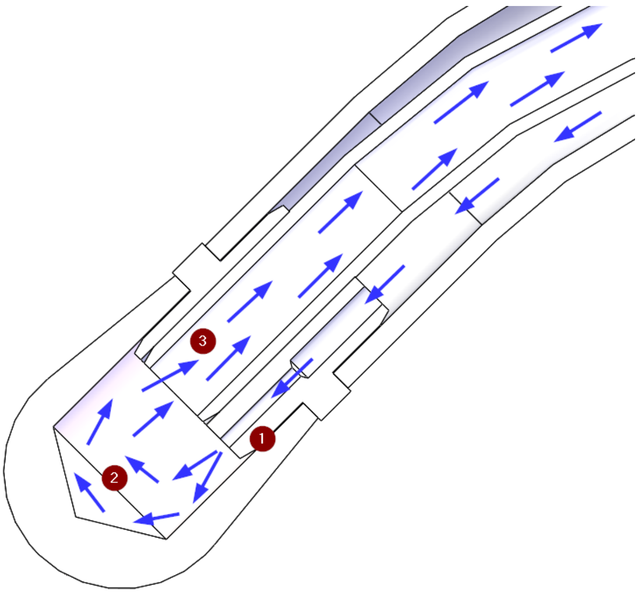


Classic Retinal Probe

Basic Principle of Operation

The Joule Thomson effect describes how the temperature of a high pressure gas decreases rapidly when expanded through a small orifice to a region of low pressure.

As a gas expands, the average distance between molecules grows. Because of the attractive part of the intermolecular force, expansion causes an increase in the potential energy of the gas. If no external work is extracted in the process and no heat is transferred, the total energy of the gas remains the same because of the conservation of energy. The increase in potential energy thus implies a decrease in kinetic energy and therefore in temperature.



The direction of gas flow is shown by the arrows in the sectional diagram. High pressure gas flows into the probe tip and is forced through the micro orifice (1). It rapidly expands in the tip chamber (2) and circulates back through the exhaust path (3). The exhaust path is effectively connected to atmospheric pressure.

The temperature of the gas within the tip chamber will be very low depending on the gas used.

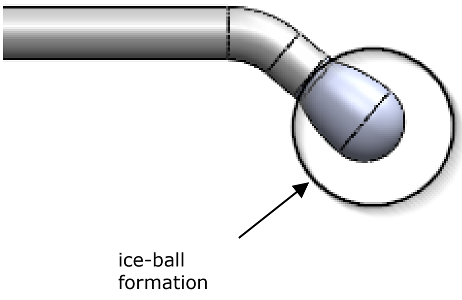
In order to cool the tip down energy needs to be transferred to the metal. The amount of energy transferred is dependent on the temperature of the gas but also the amount of gas flowing through the tip area.

Smaller holes and higher input pressures can provide greater cooling effect but the mass flow rate of the gas is often too low to transfer the energy to the tip effectively. Smaller holes also block more easily and therefore the overall reliability of the cryoprobe can be adversely affected.

A balance has to be made between input pressure, orifice size and flow rate in order to achieve the best performance. These optimal performance parameters are usually best determined by experimentation.

For a tip orifice between 0.15 and 0.2 mm in diameter experience has demonstrated that input pressures of 500-600 psi and exhaust flow rates of 8-12 LPM are most effective.

The tubing of the probe stem is concentric and the input gas flows down the outside to get to the probe tip. This gas is at ambient temperature and has the effect of insulating the probe stem from the exhaust gas which is at a considerably lower temperature.



The temperature drops very rapidly at the orifice which creates a distinct boundary at the edge of the freezing zone. The effect is that there is a very strong freezing effect which is limited to the tip only. The external surface of the probe stem behind the tip is much warmer and certainly above freezing point.

This type of design is called End Freeze configuration. It is much safer in use as all the freezing occurs at the tip and there are no unwanted cold spots which could affect the safety of both user and patient.

Defrosting the probe tip can be rapidly achieved by re-compressing the expanded gas in the tip. In effect this is done by closing the exhaust path which causes pressure to quickly equalise on both sides of the probe tip. The gas is now at high pressure again and the temperature very quickly increases. The surface of the probe tip defrosts almost instantly once the pressure is equalised and this is typically 2 - 3 seconds after closing the exhaust path.

The gas flow through the probe is controlled automatically by the Cryomatic console via a user operated footswitch.

Keeler
Ophthalmic Instruments

Material Specifications

All the materials specified in the design of the Cryo II probes are carefully selected to withstand the temperature and pressure ranges experienced by the device during normal use and also during reprocessing. All parts of the probe which will come into contact with the patient or the user are made from materials with known and accepted biocompatibility.

Part Number	Description	Material
KCP201/1-6	Stem Assembly	Stainless Steel 316L and 304
KCP213	006 O Stem Ring	Silicone Rubber
KCP214	606 Stem O Ring	Silicone Rubber
KCP312/1-3	Stem Spacer	Delrin/Polyacetal
KCP308	Stem Nut	Stainless Steel 303
KCP301	Handle Front Cap	Delrin/Polyacetal
KCP332	Orientation Pip	Stainless Steel 303
KCP211	Dowel Pin	Stainless Steel
KCP200	Probe Body Assembly	Stainless Steel 316L and 304
KCP300	Handle	Polyacetal
KCP302	Handle Rear Cap	Polyacetal
CSP216	Tube Spigot	Stainless Steel 303
MIS071	O Ring, 1.5 x 1.5	Silicone Rubber
CSP217	Tube Ferrule	Stainless Steel 303
CSP219	Tube Retaining Screw	Stainless Steel 303
KCP333	Warning Sleeve	Silicone Rubber
EP39-70836	Probe Plug Cover	Delrin/Polyacetal
EP39-70899	Strain Relief Collar	Delrin/Polyacetal
FAS082	M2 x 6 Pozi Csk Screw	Stainless Steel
EP39-70837	Probe Plug Body	Stainless Steel 303
EP79-70807	O Ring, BS607	Silicone Rubber
2509-P-6010	Brazed Probe Plug Assembly	Stainless Steel 316L and 304
EP79-70808	O Ring, BS610	Silicone Rubber
EP79-70811	Internal Circlip M15	Stainless Steel
EP39-70843	Filter	Sintered Bronze
EP39-70843	Probe Filter Spring Clip	Stainless Steel
EP79-70809	O Ring, BS007	Silicone Rubber
MIS073	PFA Tube 1/8" (3.2mm) OD x 1/16" (1.6mm) ID	PFA
MIS102	Outer Sleeve 8.0mm OD x 16.5mm ID	Silicone Rubber
KCP212	Stainless steel wire	Stainless Steel 304