Micro infusion pump

iPRECIO®

Implantable, Programmable and Refillable

www.iprecio.com

Micro infusion pump

iPRECIO®

SMP/IMS-310R Model

The World's First, Smallest, High precision, Wirelessly controlled, Programmable Implantable Micro Infusion Pump for Mice

The World's First Totally Implantable, Programmable Micro Infusion Pump for Mouse Animal Model Infusion

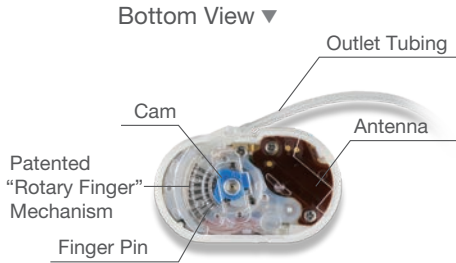**Micro Infusion Pump for mice or larger** [SMP/IMS-310R Model]

This implantable infusion pump uses a patented, microprocessor controlled peristalsis mechanism for accurate controlled flow. It is the only implantable and programmable pump for mice. iPRECIO® can infuse fluids continuously at accurate low flow rate via software programming and it can be refilled via a percutaneously accessible port.
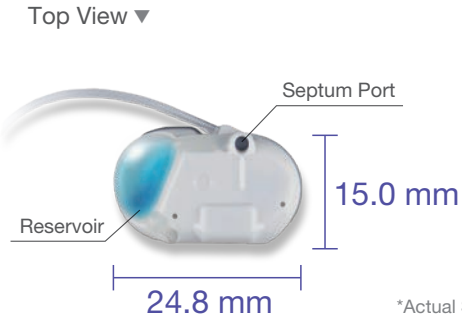
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SMP-310R Pump's Structure

Bottom View ▼

- Outlet Tubing
- Cam
- Antenna
- Patented "Rotary Finger" Mechanism
- Finger Pin

Top View ▼

- Septum Port
- Reservoir

15.0 mm

24.8 mm

*Actual Size

H: 7.4 mm   Weight: 3.4 g   Volume: 2.26cc

iPRECIO® SMP-310R Key Features

- **Accurate patented Rotary Finger Method**
  - Every pump is factory tested and calibrated
  - Better than +/-5% accuracy
  - 0 µl/hour to 10.0 µl/hour in 0.1µl/hour steps
    101 discreet infusion flow-rates
  - Programmable infusions protocols (simple and complex)

- **Totally implanted in subcutaneous space**

- **Refillable (reservoir) percutaneously via refill port with re-sealable septum**

- **With iPRECIO® catheters, test your drug's effects nearly anywhere**

- **Easy to use state of the art software for infusion protocol programming using profiles**

Precision

The technology driving the infusion is a patented "Rotary Finger" method. This method is a unique form of peristalsis. The precise "micro-stick" pushes a rubber tube in the pump in a uniform and sequential manner. The accuracy of iPRECIO is +/-5%.
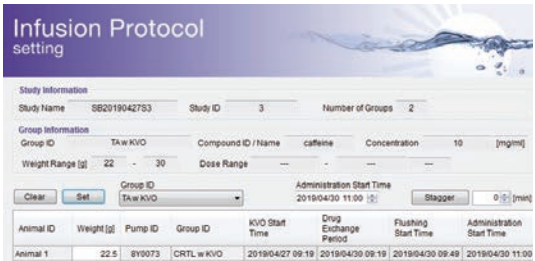
Wireless

Wireless programming allows all pumps to be conveniently detected, assigned, programmed and monitored via our IMS-310R iPRECIO Management system. Once completely programmed wirelessly, the iPRECIO SMP-310R Pumps will independently infuse as programmed until completed or aborted without any further communications with the IMS-310R.

In ideal conditions* with a small number pumps, SMP-310R Micro Infusion Pump allows in-vivo re-programming for maximum flexibility. If no effect is detected, pump may be re-programmed to infuse at a higher flow rate. A higher concentration drug/TA may also be used. Communications Availability (Comms Avail) of SMP-310R may be programmed to maximize battery life or maximum responsiveness. Options are provided in Infusion Profile (Group ID) settings.

*ideal conditions: every minute communication availability, low external wireless interferences, pumps close to programming station, etc. Contact Primetech Corporation (iprecio@primetech.co.jp) to discuss in more detail in-vivo requirements.

Implantable

The pump can be completely implanted in small laboratory animals subcutaneously. Thus, the animal moves freely without any restrain (i.e. tethering) during drug infusion. Additionally, infection risk is reduced, and the animal is likely to be significantly less stressed than in a tethered infusion model.

Refillable

You can replenish any medical fluid in the pump via percutaneous access to the pump refill septum and reservoir after implantation of the pump. Therefore, long-term drug infusion can continue until the installed battery life has run out. The reservoir is elastic and configured in such a geometry as to allow gentle palpation to confirm an approximate level of fluid in the reservoir.

Programmable

Using the easy to use state of the art iPRECIO® software, header information along with infusion profile details are entered and ultimately downloaded to the pump's memory. Start Time, End Time, Flow-rate (0.0µl/hour to 10.0µl/hour), and infusion profiles may be programmed. These profiles include sustained release, modified release, chrono release and pulsatile release. A total of 15 steps with repeat function allows both complex and simple infusion profiles to be programmed.

Programmable

Micro infusion pump
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15 steps for flow rate or dose programming : 0.0 - 10.0 ul/hr

Each flow profile may contain up to 15 doses or flow rate steps. A single step would mean a fixed continuous dose or flow-rate for the study duration.
A more complex infusion profile will contain more than 1 step and may contain up to 15 steps.

In addition to the 15 steps, Repeat Mode may be used. Repeat Mode allows more complex infusions like circadian rhythm, modified release, chrono release and pulsative release to be programmed for daily/weekly/etc repeats.
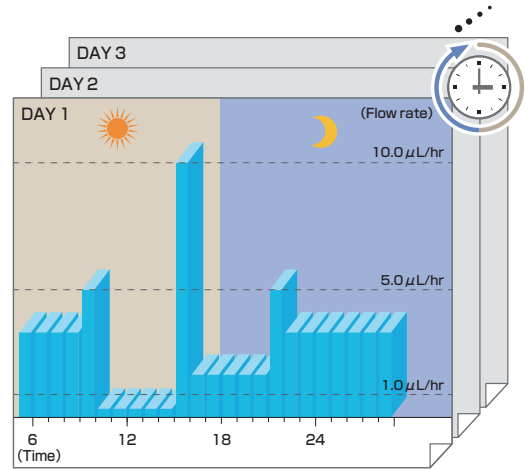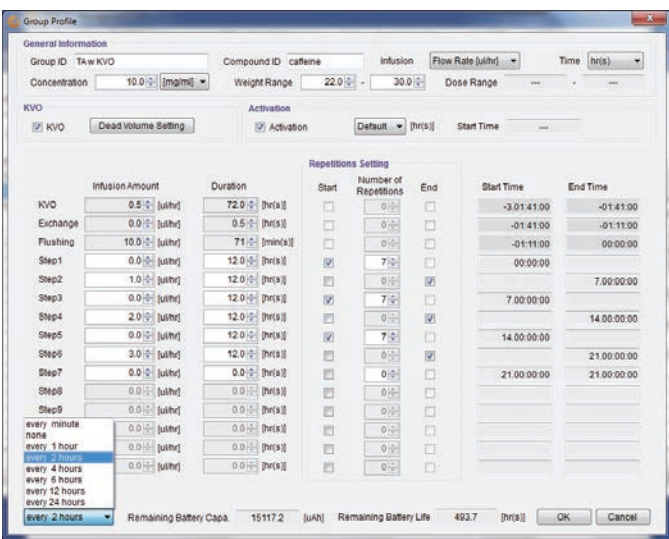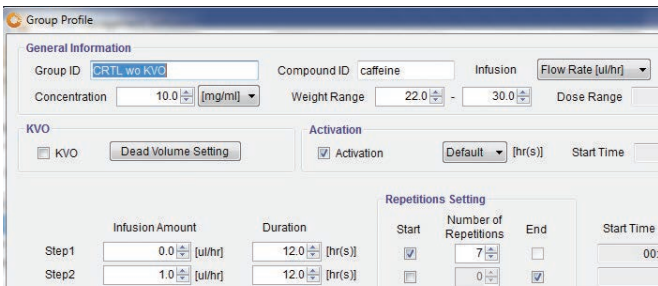

Keep Vein Open (KVO), Dead Volume Calculation and Flushing

KVO checkbox and Dead volume setting.

A recovery period may be programmed into the flow profile using the KVO checkbox and Dead Volume Setting Options. KVO function where saline or vehicle is infused to ensure patency of the catheter. During this time, the animal recovers from the implant surgery.

When using KVO, a function of the software allows to calculate the total dead volume of the catheter and pump to ensure that the test article (TA) or drug hits the animal at the programmed start time. Flushing of the dead volume may be programmed by the user and the software automatically calculates when to exchange saline/vehicle to TA/drug.
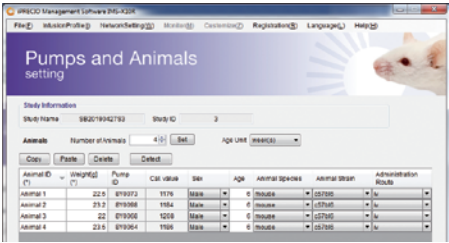

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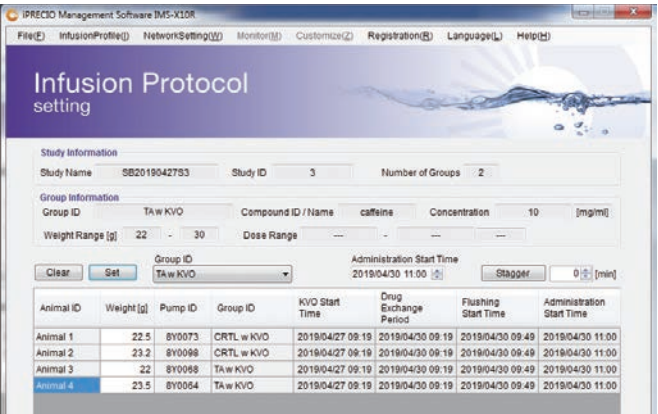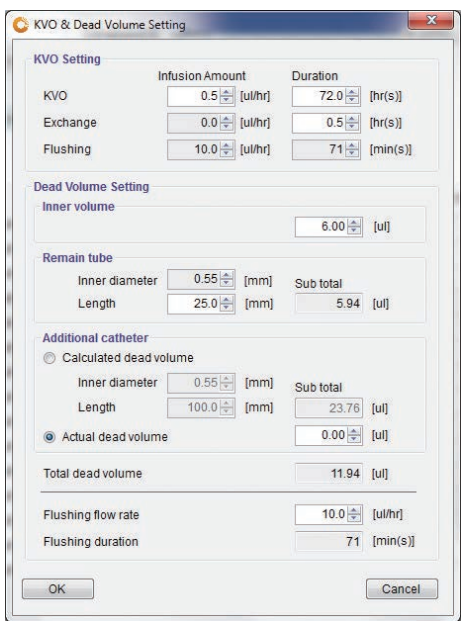
Programmable

Programming Workflow

STEP 1 Start of Study Design :

Study name, ID, user and date are input and saved.

STEP 2 Pumps and Animal Setting :

Here, total number of animals for study are entered and associated with an animal ID. Information including weight, sex, species, strain, administration site may be entered and saved.
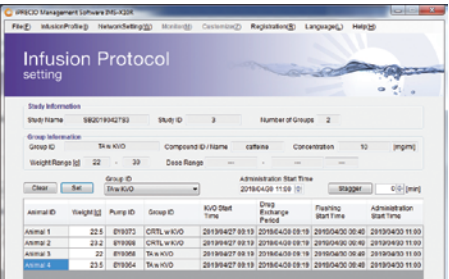

STEP 3 Infusion Profile (Group ID) Programming including Keep Vein Open (KVO) Setting

When requiring a recovery period following surgery, KVO setting may be used to maintain catheter patency and also program a dead volume flush as a next step. Following these steps, Drug Administration Protocol may be programmed – continuous, intermittent, circadian & bolus. Everything required is programmed into the Infusion Profile (Group ID).
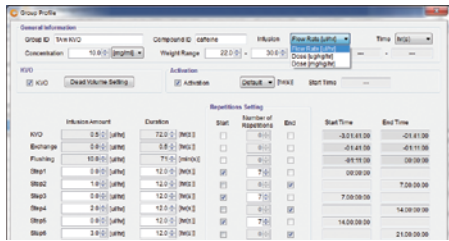
**STEP 4** Infusion Protocol Setting

This is to program the TA or drug administration start time. If programmed, it also includes the parameters for flushing the dead volume and pump start time based on calculated dead volume, flushing flow-rate and exchange stop time.

Communications Available (Comms Avail) is also programmed in Infusion Profile(Group ID).

Monitoring Function

Monitoring Function allows the user to follow the infusion profile in detail. Refill dates/exchange dates and alarms are also managed and displayed here.
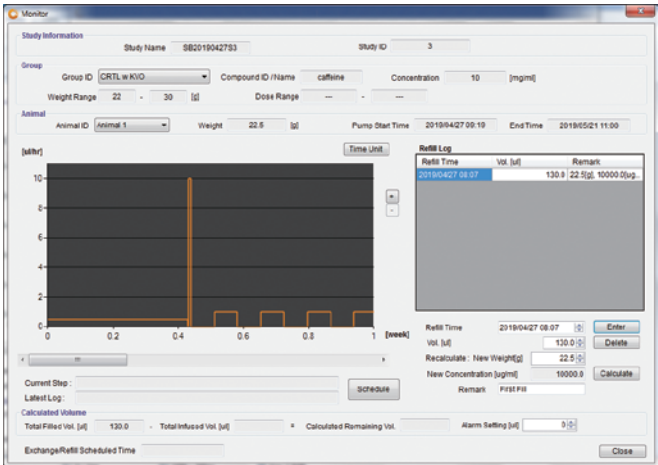
Battery Life

The battery life is up to 67 days at a flow rate of 0.1μL/hr continuously. Battery life is calculated and estimated in iPRECIO® Software and this is dependent on pump switch on date, infusion profile including KVO and communication availability selected. These specifications are subject to change for product improvements. Exact durations and calculations will be managed by the iPRECIO® Software. When used in preprogrammed (None/no communication) mode, battery life is maximized. When communications availability is set to 1 minute, maximum responsiveness is selected and this gives the lowest battery life.

Communications availability does not mean that there will always be data or connection every minute. Actual data will be dependent on wireless environment and infusion protocol.

Communication availability/ Logging interval	Per minute		Every 2 hours		Every 6 hours		Every 24 hours*		None*	
Flow rate (μL/hr)	Drive time (hours)	Driving days (days)	Drive time (hours)	Driving days (days)	Drive time (hours)	Driving days (days)	Drive time (hours)	Driving days (days)	Drive time (hours)	Driving days (days)
0.1	157	6.5	528	22.0	1063	44.3	1542	64.3	1628	67.8
0.5	155	6.5	476	19.8	887	37.0	1214	50.6	1266	52.8
1.0	153	6.4	428	17.8	742	30.9	959	40.0	991	41.3
5.0	137	5.7	263	11.0	344	14.3	357	14.9	362	15.1
8.0	127	5.3	207	8.6	243	10.1	243	10.1	245	10.2
10.0	121	5.0	178	7.4	196	8.2	200	8.3	201	8.4

* Depending on wireless environment, infusion protocol programmed, communication availability/logging interval, pump logs may be overwritten before being collected.

** Table above outlines the maximum battery life for the programmed protocol and pump switch on time. Exact battery life will be dependent on pump switch on time, programmed infusion protocol, and selected communication availability. iPRECIO Management software helps the user calculate battery life for selected programming.

***Not all communication availability options shown in table. Full options: Every minute, None, every hour, 2 hours, 4 hours, 6 hours, 12 hours and 24 hours in Application Software.

Specifications

▌ Micro Infusion Pump iPRECIO®

Infusion Method	Rotary Finger Method (patented peristalsis)
Reservoir	130μL Built-in Elastic Reservoir (Medical Grade SIBS)
Tubing	Inner Tubing ： (Material) Medical Grade SEBS
	Outer Tubing ： (Material) Medical Grade SEBS (3Fr) (Size) Inner Diameter ： 0.55mm Length ： approx. 140mm
Refill Port	φ2mm refill port is on the top of the pump.
Data Communication	Wireless (Frequency ： 923.1 MHz ＊North America / FCC) (Frequency ： 865.5 MHz ＊Europe / CE)
	Communication Distance ： 1-6 meter radius of transmitter (This is based on open field condition)
Antenna	Embedded FPC pattern antenna inside a pump
Range of Flow Rate (FR)	0.0 - 10.0μL/hr (Resolution ： 0.1μL/hr) ＊discharge volume by 1 time rotation of the cam ： 3.2μL
Accuracy	±5% (under 0 - 80cmH₂O pressure) Reservoir volume 20μL to 100μL
Battery Life	Continuous driving life : FR 0.1ul/hr : 67 days , FR 10.0ul/hr : 8 days for No-Comms mode Setting (none). FR 0.1ul/hr : 6.5days and 10.0ul/hr : 5days for Comms Avail of 1 minute.
Power On & Activation Method	Pump is switched ON magnetically. (S Pole -ON & N Pole - OFF) magnetic strength > 100mT. Pump activation is programmed in Infusion Profile (Group ID)
Size	24.8 (L) x 15.0 (W) x 7.4 (H) mm partially 8.2 (H)Max mm (not including outer catheter)
Weight	3.4g or less (including outer catheter)
Volume	2.26cc
Type of Usage	Disposable (Not designed for re-use)
Package	EO Sterilized blister package (5pcs/box)
Sterilization	2 years

● EO Sterilized Blister Package

● Pump (5pcs/box) SMP-310R

▌ iPRECIO® Management System

● Data Communication Device

Interface	Ethernet (crossed cable) Operates via intranet/internet by setting fixed IP address with the data communication device.
Communication with Pump	Wireless (Frequency ： 923.1 MHz ＊North America / FCC) (Frequency ： 865.5 MHz ＊Europe / CE) (Not broadband, individual communication between data communication device and pumps.)
Power Supply	USB adaptor inclued. [Weight] 35g [Length of cable] 1.1m [O/P] DC Output 5V 0.5A
Size / Weight	145 (L) x 95 (W) x 55 (H) mm / TBD
Accessories included	1 Ethernet cable (3m), USB DC adapter cable(1.1m)

● Data Communication Device (UCD-X10R)

● Management Software

Study Management	Study Information, Animal Information, Group Information
User Account	Register, manage user account name and password, Administrator Information
Automated Recognition of Pump	Pump's ID and Calibration Factor are recognized by wireless data communication.
Pump Programming via Software	
▶ Programmable Parameters	Start day / time, Flow rate or Dose Setting, Duration of infusion
▶ Programming Infusion Steps	Maximum of 15 steps (including KVO) of flow rate (or dose) as needed. Grouping of multiple steps and repeating such groups are available.
▶ Auto Calculation of Battery usage and infusion duration	When you input infusion protocol, it shows automatically remaining battery(time) and infusion duration (start and end time of each steps) on the window.
▶ Dead Volume Setting	Using value calculated by catheter size (diameter) and length or input measured actual volume.
▶ Flushing Setting	Available KVO Setting You can load preset default values or set dead volume and flow rate for each study.
Monitoring, Management of infusion shcedule	Manage infusion volume and schedule, Checking and record refill and replacement of infusate timing, Setting threshold of remaining volume in the reservoir, Showing alart inside the window
Log	After infusion , you can export study data and infusion log in CSV format. Infusion log is transfered to the software in order by wireless data communication during infusion.
PC OS compatible	Windows 7 Professional or higher, Windows10 Pro/Enterprise/Education Japanese and English Language with major PC manufacturer

● Management Software

Managemant Software IMS-310R

Utility BaseStation Manager

Utility Pump Database Manager

*iPRECIO® Management System is sold as IMS-310R which consists of data communication device (UCD-X10R) and Management Software, User Manual.

Research Applications

iPRECIO® is an innovative infusion pump which is used for small lab animal infusions in many different research and applications fields.

Cardiovascular   Neuroscience   Cancer   Drug Discovery

Innovative drug infusion technology for laboratory animals.