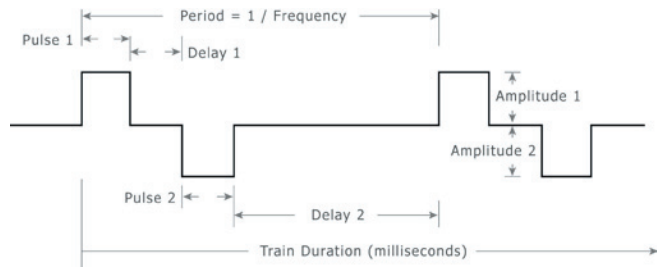


INTRACRANIAL SELF STIMULATION (ICSS)

Programmable ICSS Stimulator	2-3
Response Wheels	4
Controller + Cables	5
Commutator + Arm	6
Software	7





INDEPENDENT VARIABLE	DESCRIPTION	DEFAULT VALUE	RANGE
Step Size	Amount the current will be changed during testing	10 µA	-
Pulse Width 1	Duration of Pulse 1	500 µs	60 – 32,000 µs
Pulse Amplitude 1	Intensity of Pulse 1	200 µA	1 – 1,000 µA
Pulse Delay 1	Delay between Pulse 1 and 2	500 µs	60 – 32,000 µs
Pulse Width 2	Duration of Pulse 2	500 µs	60 – 32,000 µs
Pulse Amplitude 2	Intensity of Pulse 2	200 µA	1 – 1,000 µA
Pulse Delay 2	Time between the end of pulse and start of another	(*1)	60 – 500,000 µs
Frequency	Frequency of stimulations	100 Hz	1 – 2,000 Hz (*2)
Pulse Train Duration	Entire duration of stimulations	5,000 ms	(*3)
Pulse Amplitude Stim 2	Used for Detection.MPC only	80 µA	-
Starting Block Type	Start with descending (0) or ascending (1) trial blocks	0	-
Response Time	Time window for response to Stim 1	7.5 s	-

Notes:
1) Not directly adjustable, automatically set by the formula:
(1,000,000 / Frequency) – (Pulse 1 + Delay 1 + Pulse 2)

2) Limited by the pulse and delay parameters
3) Must permit a minimum of one cycle
4) Must correspond with module setting

PACKAGE CONTENTS				
A = MED-ICSS		B = MED-ICSS-ADD		
#	SKU	DESCRIPTION	A	B
1	DIG-729USB	USB High Speed Serial Microcontroller	A	
1	PHM-152/2	Dual Programmable ICSS Stimulator	A	B
2	PHM-155C/CAB	Female BNC / Banana Binding Post Adapter, ^M / _F , 5.2' (1.6 m)	A	B
1	PHM-155D	Output Cable, BNC, ^M / _M , 2' (0.6 m)	A	
1	SG-219G-10	Shock Output Cable, DB-9, ^M / _F , 10' (3 m)		B
1	SG-219ST	DB-9 to DB-15HD Control Cable, ^M / _F , 25' (7.62 m)	A	
1	SOF-PHM-15X	Constant Current Stimulation Software	A	
1	PHM-152SC-10K	ICSS Substitution Cable, BNC, 10k ohm, ^M / _M , 25' (7.62 m)	A	

ICSS STARTER PACKAGE

MED-ICSS MOUSE+RAT

Everything you need to add ICSS to your setup.

NOTE: commutator and balance arm not included (see page 6)

ICSS ADD-ON PACKAGE

MED-ICSS-ADD MOUSE+RAT

For the addition of multiple stimulators in one system.

NOTE: Up to 16 stimulators from one interface

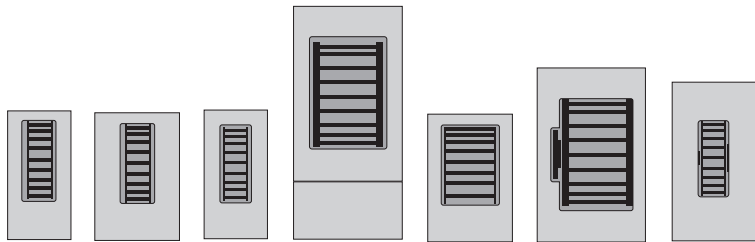
PROGRAMMABLE ICSS STIMULATOR w/MONITOR OUTPUT

PHM-152 MOUSE+RAT SINGLE

- Parameters include:
 - Pulse amplitude
 - Pulse duration
 - Pulse frequency
 - Train duration
- BNC connectors to provide an optically isolated output
- Constant current square wave stimulator
- Designed for intracranial self-stimulation (ICSS)
- Higher voltage and improved regulation circuitry produces reliable wave forms with higher impedance electrodes
 - Maximum current is related to the impedance of the electrode
 - 250 µA with a 160k ohm electrode

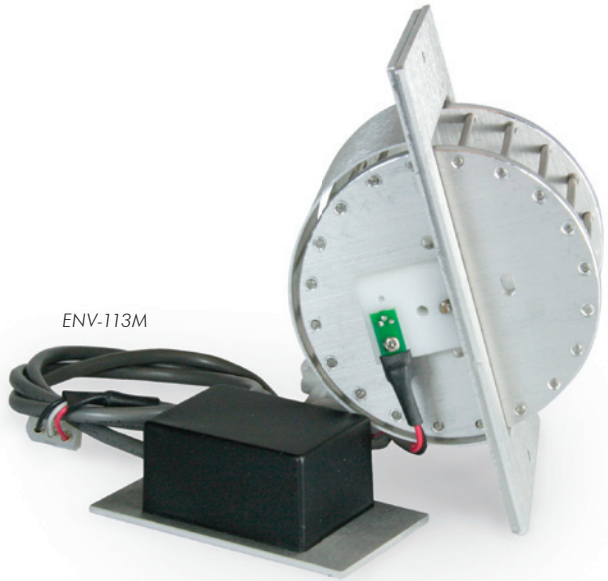
PHM-152/2 MOUSE+RAT DUAL

- Output may be connected to a conventional or storage oscilloscope or analog to digital converter to validate programmed settings as well as monitor actual subject stimulation
- When inputs are turned “off”, an internal electrical shunt is automatically placed across the output connectors, preventing any static electricity buildup to the attached intracranial electrodes
- Designed to interface with Med-PC
- Dual isolated +/- 45V power supply built-in
- Up to 16 stimulators can be daisy chained to a single interface
- The dual model (PHM-152/2) is the economical choice, compared to two single stimulators (PHM-152)
- An “electrode fault” alarm alerts the user of a cable or electrode failure



(from left) ENV-113AM, ENV-113AMW, ENV-113AS, ENV-113AW, ENV-113M, ENV-113S, ENV-113WS

	WHEEL WIDTH (L)	ROD SIZE (OD)	ROD SPACING
ENV-113AM ENV-113AMW	0.63" (1.59 cm)	0.09" (0.24 cm)	0.31" (0.8 cm)
ENV-113AS ENV-113WS	0.63" (1.59 cm)	0.09" (0.24 cm)	0.31" (0.8 cm)
ENV-113AW	1.35" (3.42 cm)	0.09" (0.24 cm)	0.31" (0.8 cm)
ENV-113M	1.56" (3.96 cm)	0.09" (0.24 cm)	0.37" (0.94 cm)
ENV-113S	1.56" (3.96 cm)	0.09" (0.24 cm)	0.43" (1.09 cm)



ENV-113M

MICRO-SWITCH RESPONSE
WHEEL

ENV-113AS	MOUSE	CLASSIC	1/2
ENV-113S	RAT	STANDARD	3/8
ENV-113WS	MOUSE	WIDE	3/4

- Stainless steel construction
- Uses a cam operated micro-switch to report a response for every 90 degrees of rotation
- Provides audible and tactile feedback to the animal

RESPONSE WHEEL

ENV-113AM	MOUSE	CLASSIC	1/2
ENV-113AMW	MOUSE	WIDE	1/2
ENV-113AR	MOUSE	STANDARD	1/2
ENV-113AW	MOUSE	WIDE	1/2
ENV-113M	RAT	STANDARD	3/8

- Stainless steel construction
- Modeled after the design by Dr. Conan Kornetsky while at Boston University
- Well suited for intracranial self stimulation, triadic learned helplessness, or any time motor performance impairing activity
- Mouse models use an optical encoder to report a response for every 90 degrees of rotation, while the rat models use a switch
- Minimal drag



DIG-729USB

USB HIGH SPEED SERIAL
MICROCONTROLLER

DIG-729USB MOUSE+RAT

- Control the stimulator (PHM-152) with Med-PC.
- Easy to install USB design can be used with either a desktop or laptop PC



PHM-155C/CAB

BNC OUTPUT CABLE

PHM-155A	MOUSE+RAT	M-M	5 FT
PHM-155B	MOUSE+RAT	M-M	10 FT
PHM-155D	MOUSE+RAT	M-M	2 FT
PHM-155E	MOUSE+RAT	M-M	15 FT

- Noise free RG-58 coaxial cable with male BNC connectors on each end.
- Connects the stimulator sites to either:
- BNC Adapter (PHM-155C/CAB)
 - Isolated monitor output to an oscilloscope input

BNC TO BANANA ADAPTER

PHM-155C/CAB MOUSE+RAT

Connects electrode leads with male banana plugs to a BNC Output Cable (PHM-155A / -155B). For use with electrode leads that are (or can be) terminated in a standard banana plug connector.

ICSS SUBSTITUTION CABLE BNC

PHM-152SC-10K MOUSE+RAT M-F 25 FT

Use to verify output by mimicking animal resistance.

CONTROL CABLE DB-9 TO DB-15

SG-219ST MOUSE+RAT M-F 25 FT

Connects the microcontroller (DIG-729USB) to the first programmable stimulator cabinet (PHM-152).

SHOCK OUTPUT CABLE DB-9

SG-219G-10 MOUSE+RAT M-F 10 FT

Use to daisy-chain programmable stimulator cabinets together.



COMMUTATOR BALANCE ARM

PHM-110P1 RAT STANDARD 1/4

- Installation options:
 - Walls of modified top chambers that are pre-drilled (ENV-007-CT, ENV-008-CT)
 - Modular panel mount (rat chambers only)
 - NOTE: for use with mouse chambers, contact our Sales department for mounting options
- Modified for use with commutators (PHY-015-X) to position it over the center of the chamber
- Adjustable post with a pivot arm and dual action gimbals
- Adjustable counter-balance weight maintains sufficient tension to keep the leash assembly away from the animal

Post height: 0" - 8" (0 - 20.3 cm) above chamber

COMMUTATOR

PHY-015-2 MOUSE+RAT 2 CHANNEL
PHY-015-6 MOUSE+RAT 6 CHANNEL

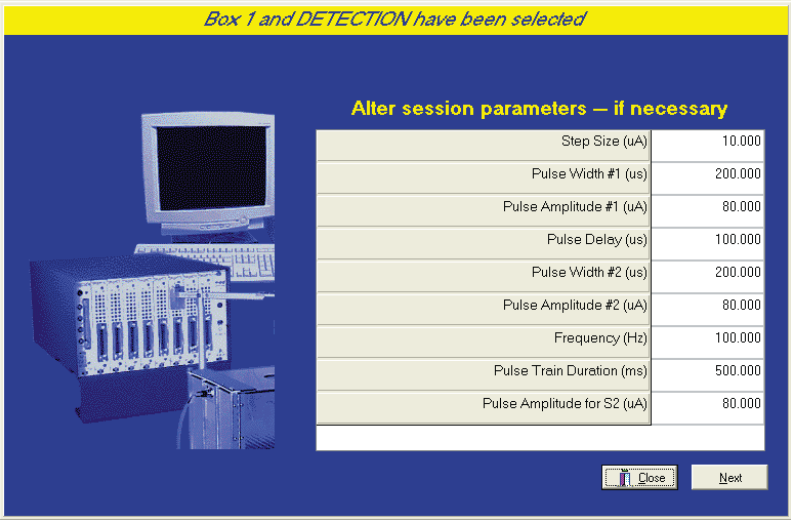
- Also known as "electric swivels" or "slip rings"
- Opening through the center for tubing from a leash assembly to pass through
- Designed to be low current, low voltage, low noise, and environmentally safe
- Tested to levels of 100 V and 0.08 A
- All single plug commutators are supplied with a live plug (red) and a dummy plug (white) for even rotation of the rotor
- Electrical signal conduction mechanism consists of brushes and rings
 - Double brushes for unbroken continuity

NOTE: single brush can be requested to reduce torque for mice applications

SPECIFICATIONS

Resistive Load: < 150 ohms/channel
Contact Resistance: < 10 ohms
Insulation Resistance: > 2000 ohms
Through-Signal Distortion: 0.02%
Insertion Loss: -47 dBm @ 500 KHz
Parallel Channel Cross Talk: -68 dB induced
Mechanical Break Away Torque (BAT):
2 channel: 0.35 in oz.
6 channel: 1.06 in oz.

Note: running torque is ~80% of BAT



ICSS UTILITY

SOF-700RA-5 MOUSE+RAT

- Software controls:
 - Pulse amplitude
 - Pulse duration
 - Delay duration
 - Frequency
 - Train duration
- This source code may be used as is, or modified by the user to meet specific research demands

CORE PROCEDURES

REWARD.mpc*

- ICSS threshold measurement
- Five trial blocks are presented in descending order until the animal meets an established criteria followed by five trial blocks in ascending order. The default number of columns run in this manner is four, contingent and non-contingent stimulations are equal.
- NOTE: Written originally for Dr. Conan Kornetsky, Boston University, School of Medicine.
- DETECTION.mpc*
 - Holds the rewarding or response-contingent stimulation constant.

*NOTE: Kornetsky, Conan and Bain, George, Modern Methods in Pharmacology, Vol. 6, Testing and Evaluation of Drugs of Abuse, Brain-Stimulation Reward: A Model for Drug-Induced Euphoria, pp. 211-231.

VARIANT PROCEDURES

1. Stepwise titration of frequency
 - Similar to the FR1 schedule described by J.L. Moreau¹ (et al)
 - Holds current constant while frequency steps from 70 Hz to 30 Hz and back again in 10 Hz steps every two minutes.
 - ¹ J.L. Moreau, F. Jenck, J.R. Martin, P. Mortas and W.E. Haefely, European Neuropsychopharmacology, 2, (1992), pp. 43-49
2. Autotitration of current
 - Similar to what was described by Mumford² (et al).
 - Holds frequency constant
 - This procedure requires two active levers. Starting current is set individually for each animal. One lever delivers stimulation that decreases 3 μ A following every fifth reinforcement. The second lever resets the amplitude value back to the original starting current.
 - ² Geoffrey K. Mumford, Darryl B. Neill, and Stephen G. Holtzman, Brain Research, 459 (1988), pp. 163-167



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