

# iMn Multi-Function Interface

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Hardware Reference



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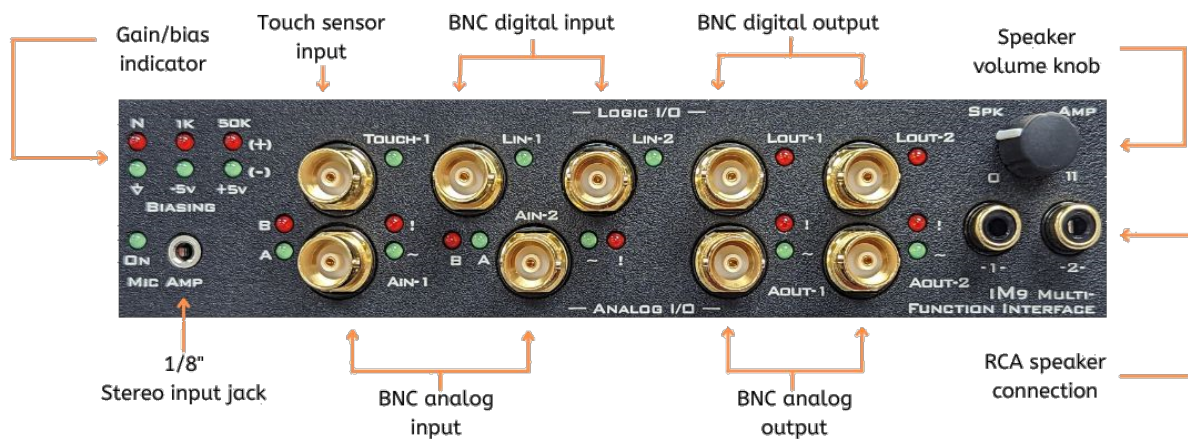
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# iMn Multi-Function Interface



The iM5, iM7, iM8, iM9, iM14, and iM15 have specialized I/O functions, including advanced audio processing critical for auditory behavioral experiments.

- Drive a speaker (e.g. MF1) directly up to 4W via an RCA connection.
- Record cage sounds via an embedded microphone amplifier.
- Connect with many common cage elements (e.g. touch sensors) via BNC ADC inputs and DAC outputs.
- Generate AM and FM stimulation (excludes iM10\*)

\* For information on the iM10, see [iM10 Multi-Function Interface](#).

## Feature Table

	Analog In	Analog Out	Digital In	Digital Out	Touch Inputs	Accessory Port
iM5	1	1	1	1	-	-
iM7	1	1	1	1	-	Medusa Amp
iM8	2	2	1	1	1	Medusa Amp
iM9	2	2	2	2	1	-
iM14	1	1	1	1	-	iH8 +28 V*
iM15	2	2	1	1	1	iH8 +28 V*

\* The +28 V logic includes four output bits and four input bits.

For information on software control of the iMn and all of its available features, see the [Synapse Manual](#).

## Digital Inputs

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The iMn has one or two +3.3 V TTL inputs.

## Digital Outputs

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The iMn has one or two +3.3 V TTL outputs that can source up to 6 mA maximum current.

## Touch Inputs (Optional)

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The iM8 and iM9 have a touch sensor input. This input has an independent ground. It uses a 750 nA current and triggers if the measured impedance between the input and ground is  $\leq 10$  MOhm.

## Analog Inputs

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The iMn has up to two  $\pm 5$  V analog inputs. The inputs have an optional microphone amplifier with 56.6 dB, 66.6 dB, or 76.6 dB gain and attack/release ratios of 1:500, 1:2000, 1:4000.

### Note

The input signals are inverted when using the microphone amp input.

The iMn analog inputs have adjustable input impedance and bias voltage. The options include:

Non-Inverting Input:

- Normal (10 kOhm to Ground)
- Positive Bias (1 kOhm to +5 V)
- Positive Bias (50 kOhm to +5 V)

### Inverting Input:

- Ground
- Negative Bias (100 Ohm to -5 V)
- Positive Bias (100 Ohm to +5 V)

#### Note

If the amplifier is enabled on an input channel, the bias setting is ignored and the defaults are used

#### Important

DO NOT connect anything to the microphone input if you aren't using it.  
Do NOT connect anything to the BNC inputs when the microphone amp is enabled.

Each analog input has two LEDs. The top LED is a clip light that flashes if the input signal is  $> \sim 4.75$  V. The bottom LED is a signal LED that will light when that processed input triggers.

The iMn input processor runs at 400 kHz, independent of the RZ / iConZ sampling rate, for increased complex waveform processing of higher bandwidth signals. See the [Synapse Manual](#) for the full list of options.

## Analog Outputs

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The iMn generates a pre-programmed waveform when triggered. This includes DC Voltage, Tone, White Noise, Pink Noise, Square, Clock, PWM signal, or a user-defined waveform. Real-time amplitude and/or frequency modulation is possible. See the [Synapse Manual](#) for the full list of options.

The iMn-generated waveforms use a  $\pm 5$  V amplitude. Apply up to 50 dB attenuation to each individual output, adjustable at run-time. The iMn onboard analog processor runs at 800 kHz, independent of the RZ / iConZ sampling rate, to achieve higher bandwidth signals than possible on the DSP.

The signals generated by Output 1 and Output 2 can be mixed to play out of a single speaker.

Each Output has two LEDs. The top LED is a clip light that flashes if the output signal is  $\geq 4.9$  V. The bottom LED is a signal LED that will light when that output is enabled.

The RCA connectors can directly drive speakers. These connectors are driven differentially to provide more power. The RCA connectors should only be connected to speakers. If you are controlling an external amplifier then use the BNC output connectors.

## Medusa4Z Input (Optional)

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The iM7 and iM8 modules have a fiber optic input for a [Medusa4Z Bioamp](#) for up to four channels of ephys data. If the iMn module is inside an iConZ, the sampling rate is limited to ~6 kHz. For an iCon, the Medusa4Z can run at up to ~25 kHz sampling rate.

## iHm Manifold Interface (Optional)

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The iM14 and iM15 modules have a DB15 port that connects to an iHm manifold. There are four +28 V outputs that map to 1-4 on the manifold and four +28 V inputs that map to 5-8 on the manifold. See [iHn High Voltage Interface](#) for more information.

## iMn Technical Specifications

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<b>Digital Inputs</b>	Up to 3 inputs
Threshold Voltage	1.7 V
Input Delay	4 samples
<b>Digital Outputs</b>	Up to 2 outputs
Output Voltage	3.3 V, 6 mA max load
Output Delay	5 samples
<b>D/A</b>	Up to 2 channels
Sample Rate	Up to ~800 kHz
Voltage Out	±5 V
Output Impedance	10 Ohms
Output Delay	7 samples
<b>A/D</b>	Up to 2 channels
Sample Rate	Up to ~400 kHz
Frequency Response	DC - $0.45 * F_s$ ( $F_s$ = sample rate)
Voltage In	±5 V
Input Impedance	100 kOhms, adjustable. See <a href="#">Analog Inputs</a>
Input Delay	6 samples