

PZ5 NeuroDigitizer

Hardware Reference



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PZ5 NeuroDigitizer

PZ5 Overview



The PZ5 is a multi-modal NeuroDigitizer suitable for recording a broad range of biological potentials. Its analog input boards combine the functionality of the PZ2 and PZ3 amplifiers in a single device that can be used for both high and low impedance input signals simultaneously. The PZ5 may also include digital input boards for inputting signals from TDT's **ZD** or **OD** Intan-based digitizing headstages, or an **Intan RHD2000 amplifier board** with up to 128 channels.

Analog input boards oversample the signal with very fast instrumentation grade converters. TDT's custom hybrid A/D circuit yields 28 bits of resolution and unparalleled dynamic range. Optional DC coupling offers zero phase distortion across the signal bandwidth. Sampling rate and down-sampling filters can be optimized on each logical amplifier for the intended input type to optimize signal fidelity. The ± 500 mV input range is large enough to accept any biological potential and most stimulus artifacts without saturating.

The PZ5 analog inputs are organized into 16-channel banks. Each bank is electrically isolated, meaning the ground and reference channels are not inherently shared between banks. Multiple banks can be grouped into a single logical amplifier that shares the same settings and ground/reference among each bank in the logical amplifier. There are several different referencing modes; each logical amplifier can use the ground as a reference, use a shared reference, use a unique reference on each bank or implement full per-channel differential referencing.

Digital inputs are used exclusively with RHD2000 series amplifier boards and SPI Interface Cables, available from Intan Technologies. Each input serves as a bank of channels and may be up to 128 channels, depending on the connected amplifier board. Each digital board can be its own logical amplifier, isolated from the other boards, or be grouped with other digital boards in a larger logical amplifier configuration.

A touchscreen interface provides immediate preview of inputs, impedance checking and real-time control and configuration options for each amplifier bank.

The PZ5 is available in 32, 64, 96, or 128 analog channel models. The PZ5 is also available with 2 or 4 digital inputs and models that combine 32 or 64 analog input channels with 2 or 4 digital

inputs. The PZ5 can support a total of up to 128 analog channels or up to 256 digital channels or up to 256 mixed channel types. The total number of channels is generally reduced to 128 at higher sampling rates, up to 50 kHz. See [Sampling Rate and Digital Input Channels](#) for more information.

 **Note**

To record at ~50 kHz on 128 or more channels, see [PZ5 Software Control](#) for more information.

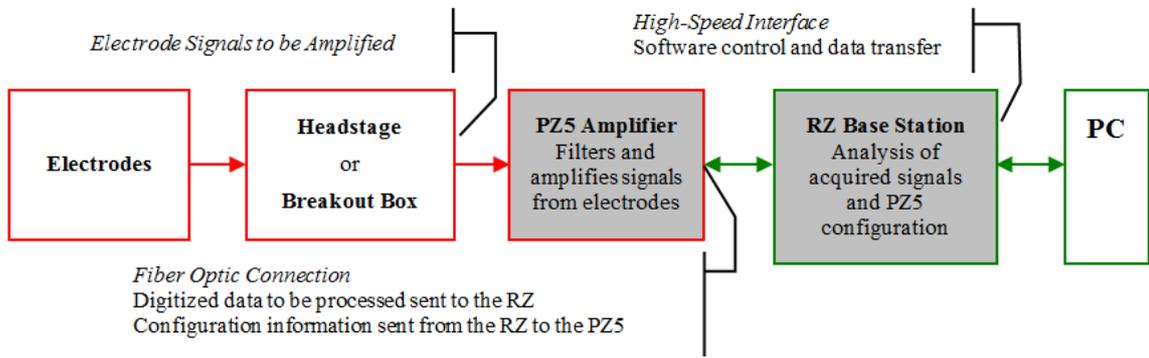
System Hardware

The PZ5 accepts inputs from a variety of electrode/headstage combinations via the back-panel. Each analog board has a mini-DB26 connector that accepts 16 recording channels (or 8 differential channels) along with ground and reference. Digital boards have a 12-pin Omnetics connector for Intan headstages and can accept up to 128 digital channels each. The PZ5 can return at most 256 recording channels to the RZ base station.

Analog signals are digitized and transmitted to the RZ base station for further processing via a single fiber optic connection. Configuration information is also sent from the RZ to the PZ5 across the fiber optic connection. The PZ5 can connect to the 'PZ Amplifier' input on an RZ2 base station, or directly to any RZDSP-P card or optical QZDSPO quad card on any RZ base station.

A standard recording configuration includes electrodes appropriate to the input signals, a breakout box or one or more Z-Series headstages (such as ZC32), a PZ5 and an RZ base station.

The diagram below illustrates this flow of data and control information through the analog system.



PZ5 Data and Control Flow Diagram

Hardware Setup

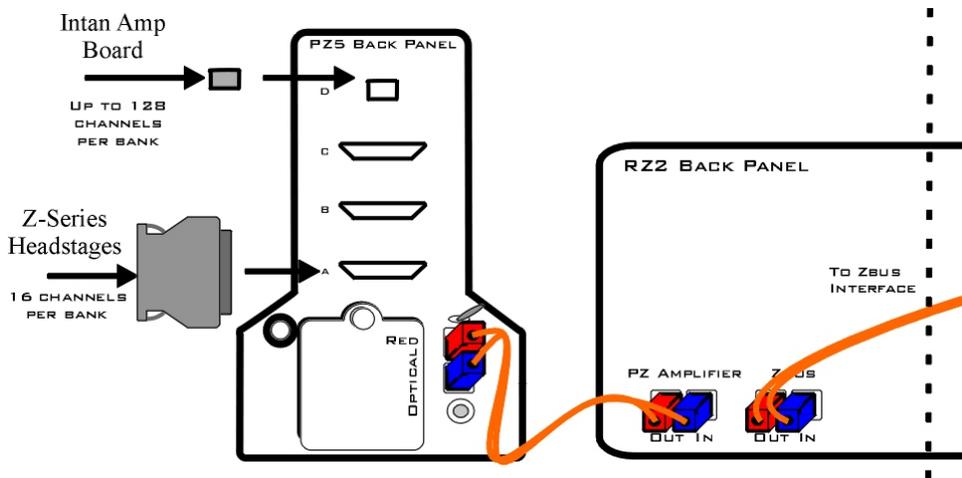
TDT recommends fully charging the PZ5 before use. The PZ5 battery charger connects to the round female connector located on the back panel.

Important

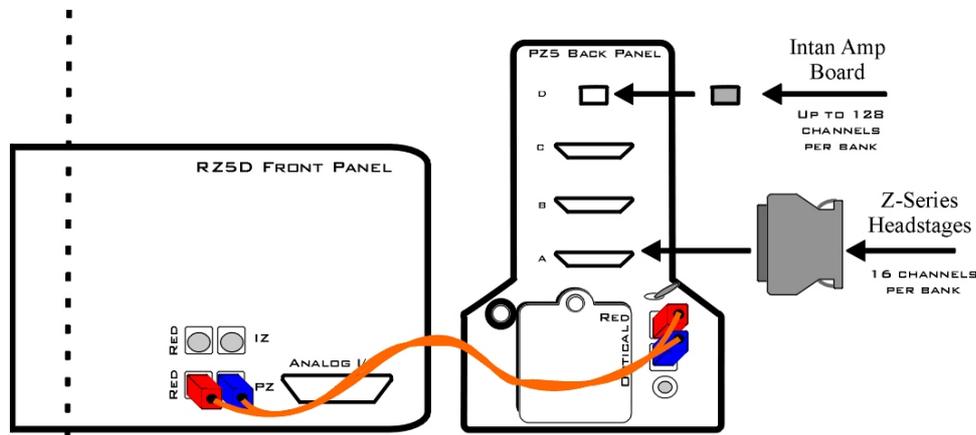
To avoid introducing EMF noise, DO NOT connect the charger to the PZ5 while collecting data.

A 5-meter paired fiber optic cable is included to connect the PZ5 to the base station. The connectors are color coded and keyed to ensure proper connections.

The diagram below illustrates the connections necessary for PZ5 operation.



System Connection Diagram for PZ5 with RZ2



System Connection Diagram for PZ5 with RZ5D

Connecting Headstages and Electrodes

Analog signals are input via multiple mini-DB26 connectors on the PZ5 back panel. For high impedance recordings, one or more Z-Series headstages can be connected to the input connectors on the PZ5 back panel. For low impedance recordings, an S-BOX input splitter or LI-CONN low-impedance connector can be used. Alternately, custom connectors and a breakout box with a male mini-DB26 connector can be used. If using custom connectors, see [Pinout Diagrams](#).

Digital signals are input via Intan connectors on the PZ5 back panel.

Powering ON/OFF

To turn the PZ5 on, move the toggle switch located on the back panel of the PZ5 to the ON position.

Physical Amplifier

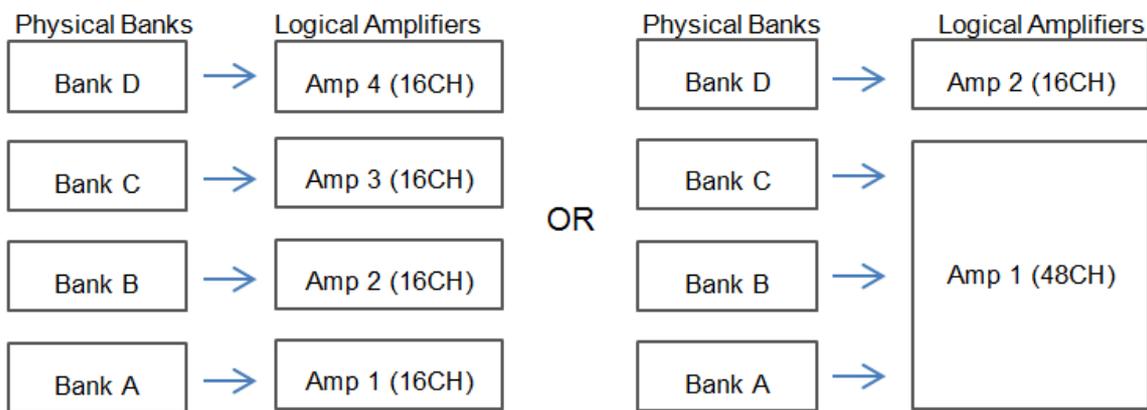
All PZ5 analog input channels are organized into groups of 16 channel banks, with each bank corresponding to a rear panel headstage connector (labeled alphabetically from bottom to top) and a front panel LED display.

Digital input channels are associated with a digital board corresponding to a rear panel digital input connector (labeled from bottom to top following, alphabetically, any analog input connectors). Each digital board is a bank that can comprise 16, 32, 64, 96, or 128 channels, depending on the connected Intan amplifier board(s).

Each bank is electrically isolated and can be independently configured or grouped with other banks and defined as a logical amplifier. Analog and digital boards cannot be combined together.

Logical Amplifiers

Though each bank has its own ground and reference, a single ground and reference can also be defined and shared across all banks of the logical amplifier. See [Analog Recording Reference Modes](#) for analog input banks.

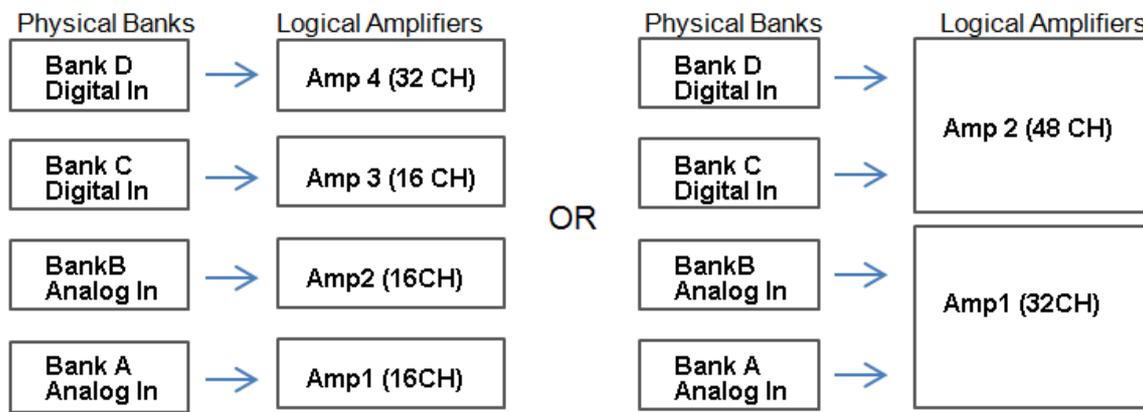


Two Possible Logical Amplifier Configurations for a PZ5-0-64 64 Channel (all analog input)

Digital boards can be configured individually or grouped to share a single ground and use common filter settings and sampling rate.

Note

Channel numbering on digital input banks can be non-sequential when sampling at 50 kHz. See [Sampling Rate and Digital Input Channels](#).



Two Possible Logical Amplifier Configurations for a PZ5-64-2 (with two digital inputs)

Logical amplifier configurations can be defined using the front panel interface (see [PZ5 Touchscreen](#)), in Synapse, or in RpvdsEx using the PZ5_Control macro. The PZ5-0-32 model can have a maximum of two logical amplifiers configured. All other PZ5s can have a maximum of four logical amplifiers.

Analog Recording Reference Modes

The PZ5 supports four referencing modes for each analog input logical amplifier: Local, Shared, None and Differential. See [Pinout Diagrams](#).

Reference Mode	Description
Local	Each bank of channels in a logical amplifier uses its own reference input (pin 5) as the reference for that bank
Shared	The reference (pin 5) of the first bank of the logical amplifier acts as a reference for all banks in the logical amplifier
None	The references for all banks of a logical amplifier are tied to the Ground (pins 13, 15, and 16).
Differential	The inputs in each bank of the logical amplifier are paired; odd channels serve as recording (+) channels and each even channel is used as an individual reference (-) channel for the preceding odd channel. No connections should be made to pin 5.

Sampling Rate and Onboard Filters

The sampling rate of each logical amplifier is adjustable (max 50 kHz, min 750 Hz) and should be set to a value appropriate for the signal of interest. Reducing the sampling rate when acquiring low-frequency analog signals yields higher bit resolution and improved signal-to-noise. Use the [Amp Type Presets](#) as a guide for determining what sampling rate to use for each logical amplifier.

The onboard down-sampling filters are used to further reduce the noise from frequencies above the band of interest and can be set to a percentage of the sampling rate (max 45%, min 10%). Adjusting the sampling rate and filter for each logical amplifier to match your desired signal gives you the best possible signal fidelity.

Sampling Rate and Digital Input Channels

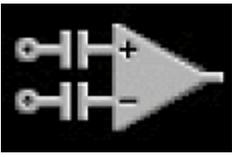
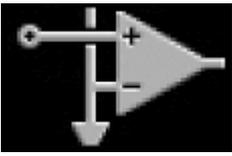
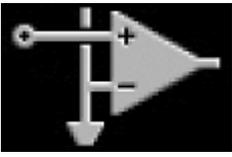
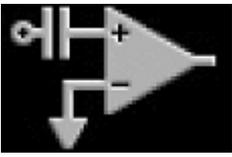
When a logical amplifier contains digital inputs, the sampling rate should be set to a value appropriate for the connected Intan amplifier board. Sampling rates at or above 50 kHz reduce the number of channels available on the amplifier boards.

At 50 kHz the 32 channel amplifier board is limited to 20 channels and the 64 and 128 channel boards are limited to 40 channels, at the time of this writing. The maximum aggregate number of channels is 256 channels at up to 25 kHz, or 128 channels at up to 50 kHz.

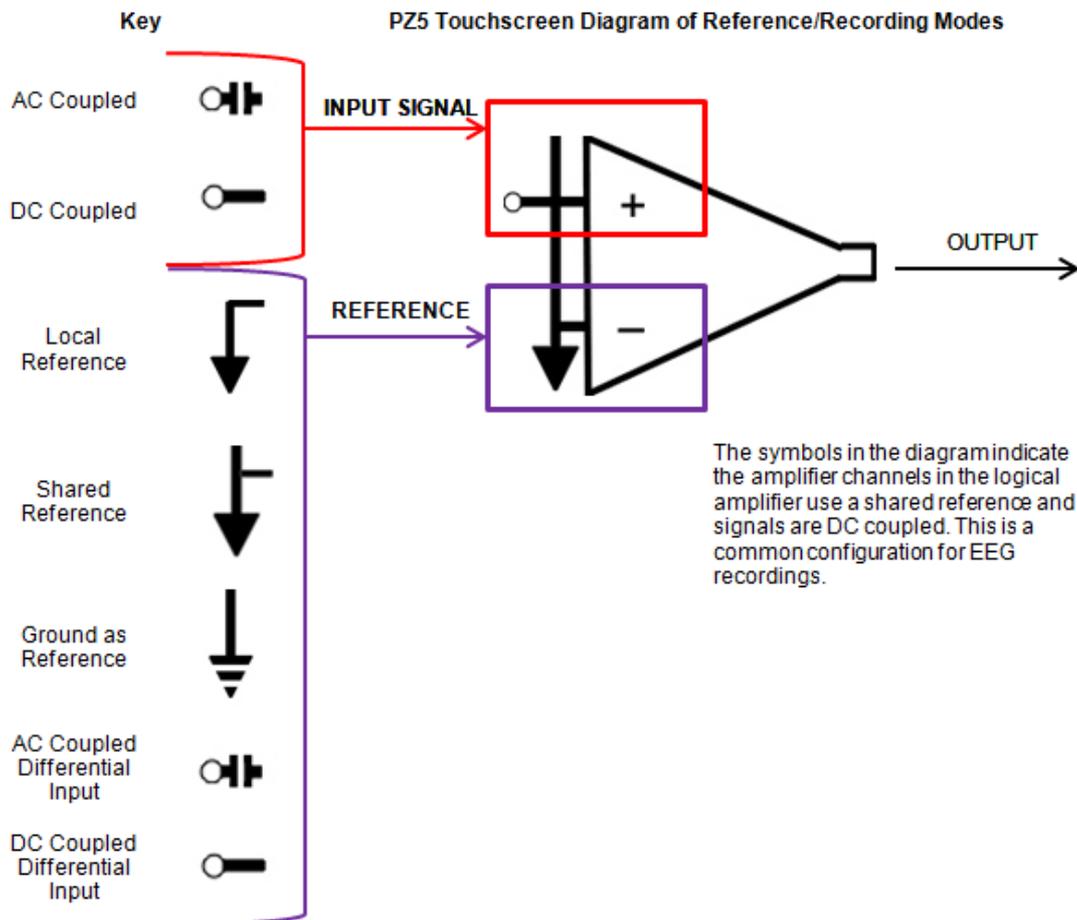
It is also important to note that, while the Intan board channel numbers are normally sequential and offset by the number of analog inputs in the amplifier, sampling at or above 50 kHz may also affect channel numbering.

At 50 kHz the native channel numbers per board are 1-20 and 33-52. These channel numbers are then offset by the number of channels existing in the lower banks of the PZ5. Also see [Input Connectors](#).

Amp Type Presets

Amp Icon	Amp Label	Default Settings
	EMG	Electromyography Referencing: Diff (true differential) Coupling: AC Sample Rate: 750 Hz
	EEG	Electroencephalography Referencing: Shared Coupling: AC Sample Rate: 750 Hz
	LFP	Local Field Potentials Referencing: Shared Coupling: AC Sample Rate: 3 kHz
	SU	Single Unit Referencing: Local Coupling: AC Sample Rate: 25 kHz

The PZ5 touchscreen interface uses representative diagrams to enable users to identify the configuration of the amplifier at a glance. The table below explains the parts of the diagram and what each represents.



PZ5 Signal/Reference Diagram

PZ5 Software Control

All PZ5 configuration and control of data acquisition is managed through Synapse. The PZ5 object configures the analog and digital headstage recording inputs. Please see the [Synapse Manual](#) for more information.

Note

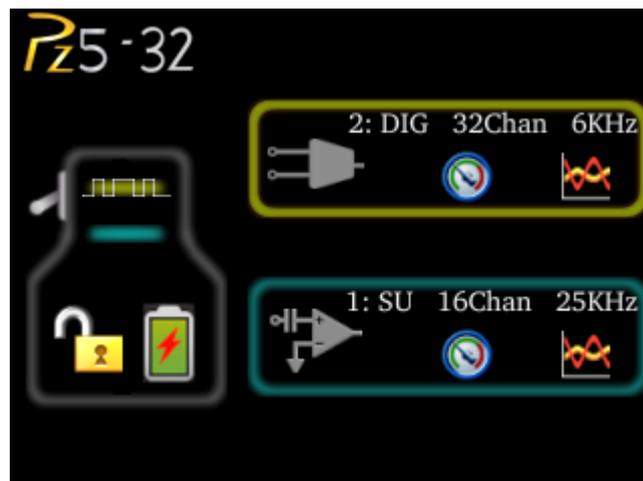
For RPvdsEx circuit design (OpenEx users), the TDT drivers installs the PZ5_Control circuit macro in `C:\TDT\RPvdsEx\Macros\Device\PZ5_NeuroDigitizer`. See the [Legacy System 3 Manual](#) for circuit design.

Recording 128 Channels at 50 kHz

Due to the PZ5's high bit resolution and recording capabilities, data should always be stored as 32-bit floating point. However, when storing 128 channels at 50 kHz sampling rate, you must use the Short (16 bits) format due to bandwidth constraints. This means the data will be scaled and converted into an integer before storage, which narrows the dynamic range of the acquired signals. In this case, all DC offsets must be removed before the data is stored. You can either filter out the DC offset with a [Neural Stream Processor gizmo in Synapse](#) or use [AC coupling](#) on the logical amplifier if you are storing the raw signal direct from the PZ5.

PZ5 Touchscreen

The PZ5 touchscreen can be used to add logical amplifiers, check impedance, preview waveforms in real-time. It also provides access to the PZ5 settings, such as the screen auto lock and auto sleep features, as well as tools for viewing system information, such as battery status, and updating the device software.



Main Configuration Screen

The main configuration screen includes the following:

Touchscreen Icon	Description
	<p>All logical amplifiers that have been defined are represented on the right side of the screen and labeled in logical order from bottom to top. For example, 2:DIG is the second logical amplifier and is configured for a digital headstage. In the illustration above, this would correspond to the back panel input connector labeled 'B'. See PZ5 Software Control.</p>
	<p>Display the System Setup Screen</p>
	<p>Toggle LED Indicators on or off. See Clip Warnings and Activity Display for more information.</p>
	<p>Display battery status information. A lightning bolt through the icon indicates that the PZ5 is charging. See Battery Status for more information.</p>
	<p>Lock to protect configuration settings. Unlock to allow changes to the configuration.</p>
	<p>Create a new logical amplifier. As logical amplifiers are added they appear on the Main Configuration screen. See Manual Configuration.</p>
	<p>PZ5 bank icons are color coded to indicate current configuration of each bank. A red outline indicates that the bank is configured as part of a logical amplifier but no headstage is currently detected on that bank. A gray bar indicates that the bank is not configured. Digital input boards are overlaid with a digital signal representation.</p>

Impedance Checking Screen

Important

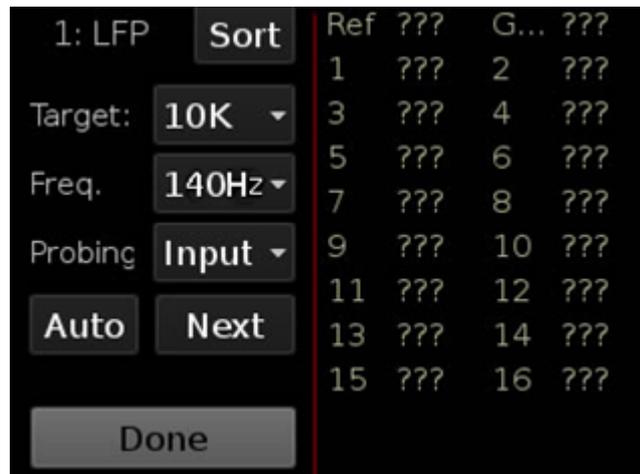
The impedance checking feature of the PZ5 can and should only be used with a passive headstage or direct connection to the electrodes.



Enter the Impedance Checking screen by touching this icon on an existing logical amplifier on the Main Configuration screen. The logical amplifier number and amp type are displayed in the top-left corner, for example 1:EEG.

Select the type of connections to measure (Probing options) and choose a target impedance value (Target) to color code the measured impedance value text. During impedance checking, All connections in the selected set are tested in parallel and the impedance is color-coded relative to the user-defined target impedance.

A limited set of channels are visible at any one time. Swipe vertically on the touchscreen to scroll the visible channels.



Settings include:

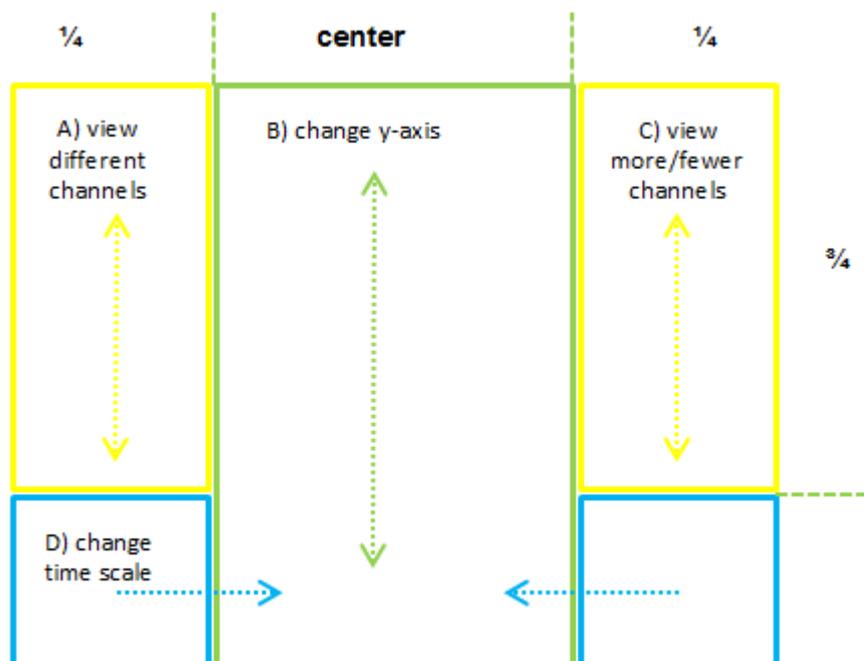
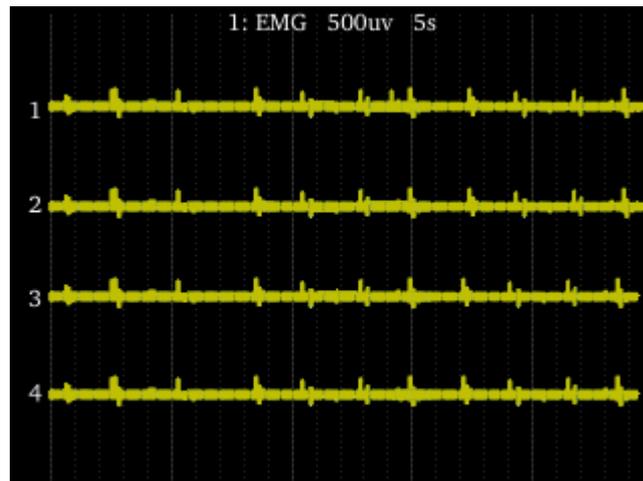
Setting	Description
Target	Select the target impedance from a drop down list (1 kOhms -100 kOhms). This is used to color the impedance value text during/after probing. Impedance values above the target are colored red, values <75% below the target are green and all other values are yellow.
Freq.	Set the probe signal frequency from a drop down list. The frequency is adjustable from 35 Hz, 70 Hz, 140 Hz, 280 Hz, 560 Hz, 1120 Hz, and 2240 Hz. This feature is only selectable in daughter board firmware v1.3 and above, and PZ5 software v1.1.1 and above. The frequency is fixed at 140 Hz in prior versions.
Probing	(Analog input amps only) Select the set of connections to measure. The available options in this list change depending on the logical amp referencing mode. See table below.
Sort Button	Toggle button that displays the channels with the largest variation from the target impedance at the top of the screen
Auto Button	Toggle button that cycles through each probing option every second
Next Button	Select to advance to the next probing option set

Ref Mode	Probing Options
Differential	Inp(+) for the positive input channels and Inp(-) for the differential channels
Local	Input for all the input channels, Ref for the reference impedance to ground, and AltRef to test the alternative reference (pin 13, see Pinout Diagrams)
Shared	Input for all the input channels, Ref for the reference impedance to ground, and Gnd to test the ground impedance
None	Input for all the input channels

Waveform Display Screen



Enter the Waveform Display screen by touching this icon on an existing logical amplifier on the Main Configuration Option screen. The displayed waveform is decimated for plotting and high pass filtered so all channels can be shown on the same voltage scale. If the logical amplifier is DC Coupled, the DC offset is displayed as a value on the right side of each plot line (in mV).



Waveform Display Touchscreen Controls

Important

To return to the Main Configuration screen, swipe three fingers across the screen in any direction. On the Main Configuration screen, a three finger swipe will turn off the display.

Manual Configuration

The logical amplifier configuration defined in Synapse is sent to the PZ5 and applied when the recording begins. However, the touchscreen interface can also be used to configure logical amplifiers on-the-fly.

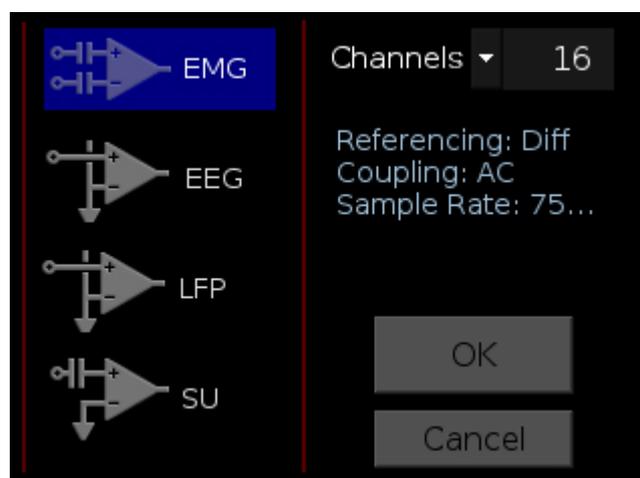


For analog amplifiers, touch the + icon to add a logical amplifier. Set the Amp Type and number of channels in the screen that follows. See [Amp Type Selection Screen](#) for more information. Adjust amplifier configuration options in the next screen. See [Configuration Options Screen](#) for more information.

For digital amplifiers, the + icon has a square wave through it. Set the number of digital boards to include in the logical amplifier and the amplifier configuration options in the screen that follows. See [Configuration Options Screen](#) for more information.

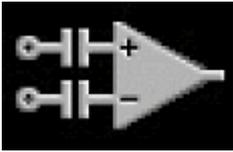
Amp Type Selection Screen

Enter the Amp Type Selection screen by touching the + icon on the Main Configuration screen or by touching the **Amp Type** button on the [Configuration Options Screen](#) for an existing logical amplifier.



Select the Amp Type and set the number of channels in the logical amplifier (by banks of 16 channels for analog amplifiers).

Configuration Options Screen



Enter the Configuration Options screen after selecting the Amp Type when adding a new logical amplifier, or by touching the Amp Icon on an existing logical amplifier on the [Main Configuration screen](#).



Analog Input Amp Settings

Each Amp Type includes preset values for each setting. The Configuration Options Screen lets you modify them.

Setting	Description
Coupling	Choose AC or DC. AC coupling implements a high pass filter with ~ 0.4 Hz cutoff frequency
Ref Mode	Choose Local, Shared, None, or Differential Reference Mode. See Analog Recording Reference Modes for more information
Samp Rate	Set the Sampling Rate to match the desired frequency band of your incoming signals (or leave at 'System Rate' if you are unsure). Options include: 750 Hz, 1.5 kHz, 3 kHz, 6 kHz, 12 kHz, 25 kHz, 50 kHz. By default, the sampling rate matches that of the RZ.
Filtering	Select a cutoff frequency for the anti-aliasing filter, as a percentage of the sampling rate. Choose from a list of values: 45%, 35%, 25%, 15%, or 10%
Ext. Ground	Press 'More' button to access this. Set to Yes to connect this logical amplifier ground to the external ground plug on the physical PZ5 device. Caution: When using multiple sub-amps make sure they aren't all sharing the External Ground connection or else they won't be isolated!

Digital Input Settings

Setting	Description
Ext. Ground	Set to Yes to connect this logical amplifier ground to the external ground plug on the physical PZ5 device. Caution: When using multiple sub-amps make sure they aren't all sharing the External Ground connection or else they won't be isolated!
HP Filt	Select a cutoff frequency for the highpass filter
Samp Rate	Choose a sampling rate from a list of values. Auto means it runs at whatever the RZ sampling rate is
LP Filt	Select a cutoff frequency for the lowpass filter. Auto means it is matched to the sampling rate automatically. See table below.

PZ5 Sampling Rate	LP Auto Filter
750 Hz	300 Hz
1.5 kHz	750 Hz
3 kHz	1.5 kHz
6 kHz	3 kHz
12 kHz	5 kHz
25 kHz	10 kHz

Battery Status



Press the Battery Status icon to display battery information:

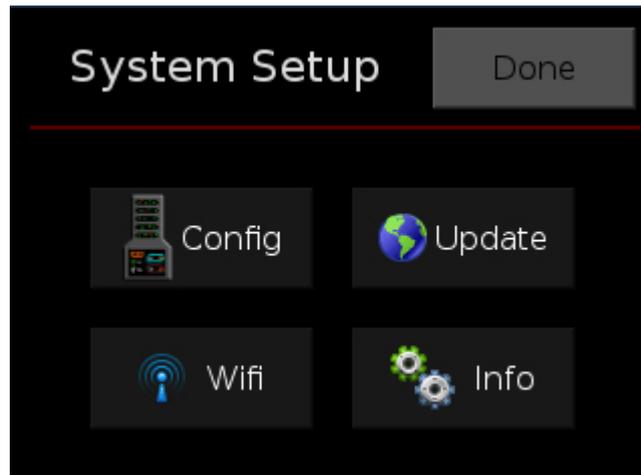
Setting	Description
Charging	Indicates if the charger is plugged into the PZ5 (Yes/No)
Voltage	Current voltage level of the battery pack
Level	% battery life remaining.
Endurance	Estimated time of battery life remaining

Note

The Battery Level is also mirrored on the RZ2 LCD display when the PZ5 is connected to the PZ Amplifier port on the back of the RZ2.

System Setup Screen

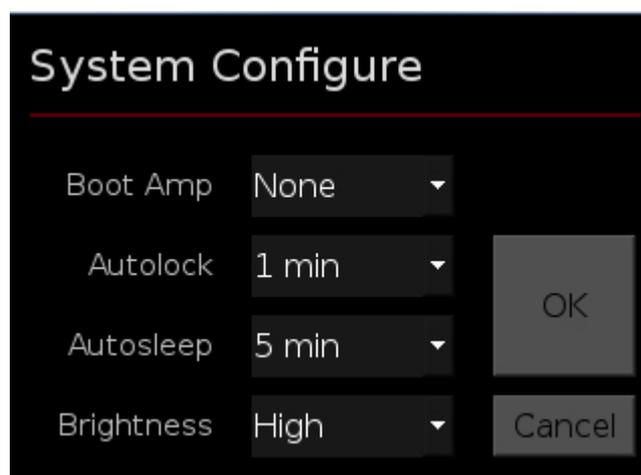
The System Setup screen is displayed by touching the PZ5 logo on the top-left of the Main Configuration screen.



Button	Description
Config	Open the System Configure screen
Update	Update onboard software over the Internet
Wifi	Connect to a wireless network for system updates
Info	Open the device System Info screen to view version numbers for various hardware, software and firmware components

System Configure Screen

The System Configure screen is displayed by touching Config on the System Setup screen.



Setting	Description
Boot Amp	Select the default logical amplifier settings when the PZ5 is first powered on. See table below.
Autolock	Select an option to lock the configuration screen after 1, 2 or 5 min of screen inactivity or select Never to turn off autolocking
Autosleep	Select an option to turn off the screen after 5, 10 or 30 min of screen inactivity or select Never to turn off autosleep
Brightness	Select High, Medium, or Low to set touchscreen brightness
Wireless	Enable/disable the wireless connection

Boot Amp	Description
None	Boots with no logical amplifiers specified
PZ2	All banks configured as one Single Unit amplifier
PZ3	All banks configured as one EEG amplifier
PZ3 Diff	All channels configured as one EEG amplifier in differential referencing mode
Last	Reboots into the last used configuration
Smart	Does not overwrite any existing logical amplifier configuration on boot. For example, if you configure the logical amplifiers in Synapse before the PZ5 boots then the PZ5 will NOT overwrite that configuration. If the PZ5 boots and NO logical amplifiers are configured it will behave the same as Last.

System Info Screen

The System Info screen is displayed by touching Info on the System Setup screen. Use the scroll bar to see all of the version numbers.

Information	Description
Device	PZ5 model number (e.g. PZ5-0-32)
Software version	Currently installed version of onboard software
Firmware version	Currently installed version of firmware
Hardware version	Version of hardware
Battery	Date and capacity of last battery calibration (in mAh)

Advanced Button

Password protected settings for TDT use only at this time.

System Update Screen

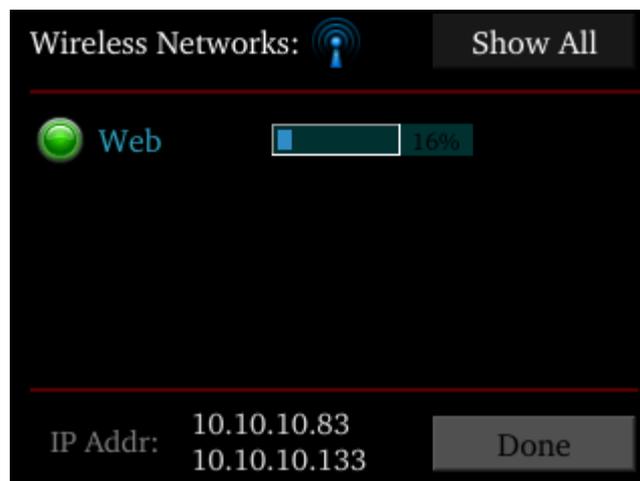
The system updater connects to a TDT server to download the latest PZ5 software and automatically update the device. This requires an active and configured Internet connection. The PZ5 provides two options for network connection: WiFi and Ethernet. The WiFi connection can be configured on the [Wireless Networks Screen](#), see below. The Ethernet port is located on the back panel.

The System Update screen is displayed by touching Update on the System Setup screen.

Important

The update process can take up to an hour to complete. Make sure the PZ5 battery charger is plugged in during the update.

Wireless Networks Screen



The Wireless Networks screen is displayed by touching WiFi on the System Setup screen. Available networks that have been used or previously configured are displayed in the main area of the screen. Selecting a network from the list displays network information and enables the user to connect to the network, forget the network, or cancel configuration of the network.



The wireless icon shows if the wireless feature is enabled or disabled. A red 'x' will appear through the icon if wireless is disabled. Enable/disable wireless through the System Configure Screen.

Setting	Description
Show All	Shows all networks, including networks that have not been previously used or configured
IP Addr	Displays current IP Address when connected to a network

PZ5 Features

Status LED

The status LED above the touchscreen indicates the PZ5 connection and charging status.

Green LED	Device Status
Solid	Connected
Slow flash (~1 every three seconds)	Connected and charging
Rapid flash (~1 per second)	Not connected

Clip Warnings and Activity Display

The front panel LEDs can be used to indicate spike activity and/or clip warning for analog input channels. They can be configured under software control using the PZ5 gizmo in Synapse, or under manual control using the toggle switch on the PZ5 touchscreen.

LED Indicators (analog)

When enabled, LEDs for each channel are lit green to indicate activity or red to indicate a clip warning. The top row indicates the odd channels (left to right). The bottom row indicates the even channels.



Green: Activity



Red: Clip Warning

 **Note**

The LED indicators are also mirrored on the RZ2 LCD display when the PZ5 is connected to the PZ Amplifier port on the back of the RZ2.

Clip Warning

Analog clipping occurs when the input signal is too large. When the input to a channel is within 3 dB of the PZ5's maximum voltage input range the LED for the corresponding channel is lit red to indicate that clipping may occur.

Activity

When configured to indicate activity, LEDs are lit green whenever a unit (spike) occurs on the corresponding channel. The sensitivity threshold for the green LED is ~200 μ V.

LED Indicators (digital)

LEDs that represent digital input boards, indicate the number of input channels with each LED indicating 16 channels. For example, four LEDs indicates 64 input channels have been detected on that connection.

External Ground

The external ground is optional and should only be used in cases where the subject occasionally contacts a metal surface that isn't tied to the animal ground, such as a lever press. When contact is made, a ground loop is formed that temporarily adds extra noise to the system. Grounding this metal surface directly to the TDT hardware removes this ground loop at the cost of raising the overall noise floor a small amount.

A banana jack located on the back of the PZ5 provides connection to common ground. Any logical amplifier configured through the PZ5 touchscreen has this shorted by default. The PZ5 gizmo in Synapse allow you to float that ground connection on individual sub-amplifiers.

An external grounding cable kit is included with the PZ5. Each kit includes: one male banana plug to male banana plug pass through and one male banana plug to alligator clip pass through. These cables also include ferrite beads to remove any potential RF noise that might travel through the cable. For best results position the ferrite bead close to the source of the RF noise.

Battery Overview

The PZ5 features a 32 Amp-hour Lithium ion battery pack.

Charging the Batteries

Operate the PZ5 with the charging cable disconnected. An external battery pack (PZ-BAT) or external charger and extra battery (PZ5-BAT) is available for longer battery life and extended recording sessions. See [PZ-BAT](#) and [PZ5-BAT](#).

PZ5 Technical Specifications

Analog Inputs

Analog A/D Input	Up to 8 cards (128 channels), hybrid
Maximum Voltage In	± 500 mV
Gain	2x
A/D Sample Rate	Up to 48828.125 Hz (adjustable in steps of approximately 750, 1500, 3000, 6000, 12000, 25000, 50000 Hz)^
Frequency Response	DC coupled: 0 Hz - $0.45 \cdot F_s$ AC coupled: 0.4 Hz - $0.45 \cdot F_s$
S/N (typical)	104 dB, single unit, $F_s = 25$ kHz, 300-7000 Hz 116 dB, differential, $F_s = 750$ Hz, 0.4-300 Hz
DC offset	$< \pm 10$ μ V
Input Referred Noise	Single Ended: 3.0 μ Vrms, 300-7000 Hz, 25 kHz Differential: 0.75 μ Vrms, 0.4-300 Hz, 750 Hz
Distortion (typical)	$< 1\%$
Input Impedance	AC coupled: 100 kOhm DC coupled: 20 MOhm

[^]Note: If recording at ~ 50 kHz on 128 channels, see [PZ5 Software Control](#) for more information.

Analog Input Sample Delay

Depends on PZ5 and RZ processor sample rates. All units in samples.

PZ5 rate	RZ @ 25 kHz	RZ @ 12 kHz
25 kHz	22	N/A
12 kHz	40	23
6 kHz	76	42
3 kHz	141	79
1.5 kHz	270	152
750 Hz	543	295

Digital Inputs

RHD2000 series amplifier boards and SPI interface cables are used in TDT's **ZD** and **OD** Intan-based digitizing headstages. They are available from Intan Technologies.

Important

The specifications below are dependent on the amplifier board. See [Intan RHD2000 series website](#) for latest, full performance specifications.

Digital Headstage Input	Up to 8 cards (256 channels), 1 input per card
Sampling Rates	Up to 25 kHz
Frequency Response	0.1 Hz - 10 kHz
Input Range	±5 mV with ZD, OD, and other Intan-based digitizing headstages
Allowable DC Offset	±0.4 V
Sample Delay	5 samples

General

Battery Capacity	32 Ahr
Battery	8-10 hours to charge to 95% capacity, 14 hours to fully charge. Battery life runtime: 2 active boards ~50 hrs 4 active boards ~35 hrs 6 active boards ~27 hrs 8 active boards ~22 hrs
Charger	External 12 V, 2.5 A power supply, center negative
Indicator LEDs	Up to 128 status/clip warning/digital input channel count
Fiber Optic Cable	5 meters standard, cable lengths up to 20 meters.
Ethernet Port	100 Mbps

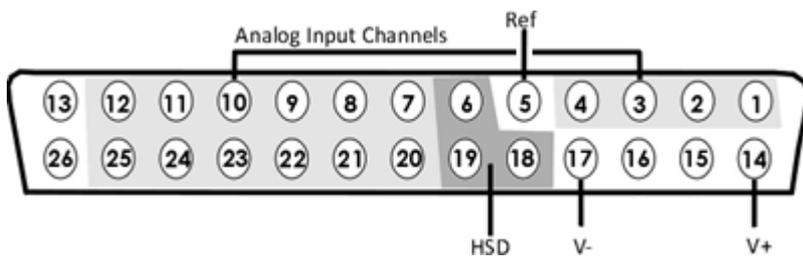
Input Connectors

The PZ5 has up to eight 26-pin headstage connectors (analog) or up to four 12-pin Omnetics nano connectors (digital) on the back of the unit. The connectors are labeled alphabetically from bottom to top. Each connector carries signal for one bank of channels with ground and reference. The corresponding channel numbers depend on 1) the reference mode configurations or number of channels in a connected digital amplifier board and 2) the position of the bank in a logical amplifier.

For simplicity sake, the diagrams below assume channels for that connector begin with channel 1. For example, A1 - A16 represent the 16 channels coming from the connected headstage. The user must increment the channel numbers by 16 (or 8 if in Differential mode) according to the mode and position of the connector. So, for the connector labeled 'A', A1 is channel 1 while on the connector labeled 'B', A1 may be channel 17.

Pinout Diagrams

Local, None or Shared Reference Mode



Pin	Name	Description	Pin	Name	Description
1	A1	Analog Input Channels	14	V+	Positive Voltage (+2.5 V)
2	A2		15	GND	Ground
3	A3		16	GND	
4	A4		17	V-	Negative Voltage (-2.5 V)
5*	Ref*	Reference*	18	HSD	Headstage Detect
6	HSD	Headstage Detect	19	HSD	
7	A5	Analog Input Channels	20	A6	Analog Input Channels
8	A7		21	A8	
9	A9		22	A10	
10	A11		23	A12	
11	A13		24	A14	
12	A15		25	A16	
13	^	See notes below	26	NA	Not Used

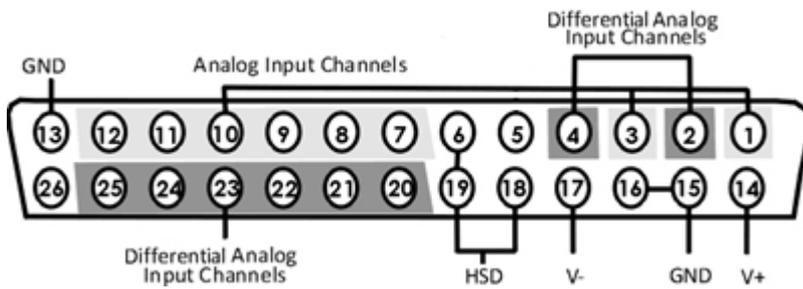
^Note

In Local reference mode, Pin 13 is AltRef. Otherwise, Pin 13 is Ground.

* In Shared reference mode, only Pin 5 of the first bank of the logical amplifier is connected. It is shared internally among the other banks of the logical amplifier.

* In None reference mode, Pin 5 is not connected.

Differential Reference Mode



Note

There are 8 (+) channels and 8 (-) channels per DB26 connector. Subsequent banks are indexed by an additional 8 channels.

Pin	Name	Description	Pin	Name	Description
1	A1(+)	Analog Input Channel	14	V+	Positive Voltage (+2.5 V)
2	A1(-)	Differential Analog Input Channel	15	GND	Ground
3	A2(+)	Analog Input Channel	16	GND	
4	A2(-)	Differential Analog Input Channel	17	V-	Negative Voltage (-2.5 V)
5	NA	Not Used	18	HSD	Headstage Detect
6	HSD	Headstage Detect	19	HSD	
7	A3(+)	Analog Input Channels	20	A3(-)	Differential Input Channels
8	A4(+)		21	A4(-)	
9	A5(+)		22	A5(-)	
10	A6(+)		23	A6(-)	
11	A7(+)		24	A7(-)	
12	A8(+)		25	A8(-)	
13	GND	Ground	26	NA	Not Used

Note

See [Tech Note 0896](#) before attempting to make any custom connections.

Digital Connectors

The digital input connector is a self-aligning 12-pin Omnetics PZN-12 polarized nano connector that mates directly to an Intan RHD2000 SPI interface cable.