



<b>12-Channel Preamplifier Interface</b>	<b>ND3PIF</b>
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**Multi-channel Preamplifier Interface for Neural Recording**

- 12 microelectrode circuits
- 4 buffered monitor circuits
- 3 stimulus circuits
- 5 isolated motor control circuits
- Automatic signal clamp during motor operation
- Internal bipolar preamplifier power supply
- Rack mount 1U height chassis



**Ordering Information**

Configuration	Part Number
12-channel preamp interface <sup>1</sup>	ND3PIF-1
Replacement external 5 VDC adapter	ND3PDC-1

**Absolute Maximum Ratings**

Characteristic	Symbol	Min	Typ	Max	Unit
Input DC Supply Voltage	$V_{DC}$	-0.3	5.0	5.5	V
Input DC Supply Isolation to Ground	$V_{SISO}$	700			V
Inactive Motor Circuit Isolation	$V_{MISO}$	750			$V_{RMS}$
Motor Circuit Current	$I_{MOT}$			1	A
Output Short-Circuit to Ground Duration	$t_{SC}$			$\infty$	sec
Operating Temperature	$T_A$	-40		85	°C
Storage Temperature	$T_S$	-40		85	°C
Pass Through Current	$I_{PT}$			100	mA
Microelectrode Input Voltage	$V_{MEI}$	$V_{Neg}-2$		$V_{Pos}+2$	V
Stimulus Input Voltage	$V_{SI}$	$V_{Neg}-2$		$V_{Pos}+2$	V

<sup>1</sup> A prototype is pictured here. See “Panel Layouts” for panel features of current version.

## Specifications

At  $T_A = +25^\circ\text{C}$ ,  $V_{DC} = 5\text{V}$ , unless otherwise noted.

Characteristic	Symbol	Min	Typ	Max	Unit
Input DC Supply Voltage (in operation)	$V_{DC}$	4.5	5.0	5.5	V
Operating Supply Current	$I_S$		350		mA
POSITIVE OUTPUT SUPPLY					
Output Voltage, $I_{POS} = 40\text{mA}$	$V_{POS}$	14.4	15.0	15.6	V
Output Current	$I_{POS}$			100	mA
Line Regulation			35	250	mV
Load Regulation			35	150	mV
NEGATIVE OUTPUT SUPPLY					
Output Voltage, $I_{NEG} = 100\text{mA}$	$V_{NEG}$	-15.6	-15.0	-14.4	V
Output Current	$I_{NEG}$			100	mA
Line Regulation				45	mV
Load Regulation				125	mV
MICROELECTRODE MONITOR OUTPUTS <sup>2</sup>					
Output Voltage High	$V_{OH}$	14	14.1		V
Output Voltage Low	$V_{OL}$		-14.1	-14	V
Large Signal Voltage Gain ( $R_L \geq 2\text{K}\Omega$ )	$A_{VO}$		1.0		V/V
Output Offset Voltage	$V_{OS}$		15	75	$\mu\text{V}$
Input Voltage Range		-13.5		13.5	V
Gain Error				0.15	%
Output Load Capacitance	$C_L$			1000	pF
Output Current	$I_{OUT}$		$\pm 10.0$		mA
Short Circuit Current	$I_{SC}$		$\pm 35.0$		mA
Settling Time After Output Saturation (1mV)	$t_{Set}$		45		$\mu\text{sec}$
Output Noise, (0.1-10Hz)			0.4		$\mu\text{V p-p}$
Output Noise, (1kHz)			7.9	8.5	$\text{nV}/\sqrt{\text{Hz}}$

## Description

The ND3PIF 12-Channel Preamplifier Interface is a rack mount chassis that connects the RP Metrix ND3PA 12-Channel Differential Preamplifier to a microdrive motor controller, a data acquisition system, a signal monitoring device, stimulus sources, and a DC power supply.

Front panel controls consist of four monitor channel input selectors, a motor enable toggle push button, and an on/off push button.

The rear panel has 12 BNC connectors for preamplified microelectrode signal outputs, 4 BNC connectors for monitor channel outputs, 4 stimulus input binding posts, two DB-25 connectors wired for connection to the ND3PA preamplifier, a DB-25 connector for the motor controller, and a DC power input jack.

The ND3PIF is powered with a 5V DC adapter (ND3PDC-1) included with the interface chassis. The on/off button energizes the internal electronics and bipolar  $\pm 15\text{V}$  DC supply that powers the preamplifier.

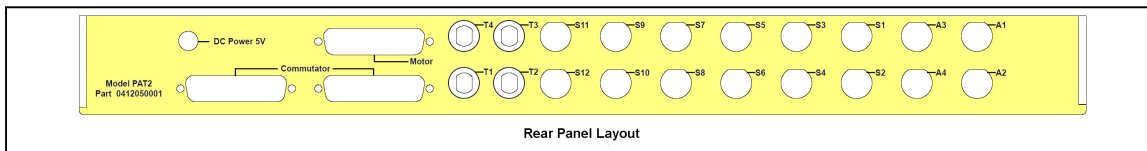
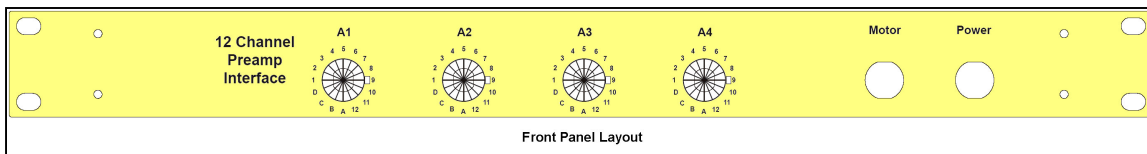
<sup>2</sup> See Analog Devices OPA2177ARM-REEL Datasheet.

During normal processing of neural signals, the preamplifier supplies 12 amplified microelectrode signals via one of the DB-25 preamplifier connectors. These inputs are direct wired to 12 BNC outputs (S1-S12) on the rear panel. These inputs are also wired to four analog multiplexers controlled by four front panel selector knobs. The multiplexer outputs pass through unity gain buffers to 4 BNC outputs (A1-A4) on the rear panel. The direct wired outputs typically drive inputs of a user supplied data acquisition system. The motor outputs typically drive inputs of a user supplied display device, such as an oscilloscope.

During operation of the motor controller, large disturbances can be induced in the neural signal channels. This problem is mitigated in two ways. The front panel motor enable button toggles internal relays on and off, so that the motor controller circuits (including ground) are only connected to the preamplifier when needed to operate the motors in the headstage. When motor control is enabled, the monitor multiplexers temporarily select a grounded input, preventing saturation of the monitor device.

Four back panel binding posts (T1-T4) provide a direct connection of stimulus signals to the preamplifier. (Note that the ND3HS-1 supports only 3 of these signals - the T4 signal, StimulusD, does not extend past the preamplifier.) The return path is through any of the BNC grounds, or the J1/J2 Ground pin. The monitor control knobs select among 16 positions: positions 1-12 select the microelectrode signals S1-S12, position A selects Ground, and positions B-D select T1-T3 respectively.

**Panel Layouts**



## I/O Information

**ND3PIF-J1 (DB-25 Male) 25-Pin Signal Output Interface Connector****ND3PIF-J2 (DB-25 Female) 25-Pin Signal Output Interface Connector**

Pin #	Signal	Input/Output	Pin #	Signal	Input/Output
1	SigIn12	Input	14	SigIn11	Input
2	SigIn10	Input	15	SigIn9	Input
3	SigIn8	Input	16	SigIn7	Input
4	VPos	Output	17	RefIn2	Input
5	MotorC	Output	18	MotorB	Output
6	StimulusC (T3)	Output	19	StimulusB (T2)	Output
7	StimulusD (T4)	Output	20	Ground	-----
8	StimulusA (T1)	Output	21	MotorCom	Output
9	MotorA	Output	22	VNeg	Output
10	RefIn1	Input	23	SigIn6	Input
11	SigIn5	Input	24	SigIn4	Input
12	SigIn3	Input	25	SigIn2	Input
13	SigIn1	Input			

**ND3PIF-J3 (5.8 mm Jack<sup>3</sup>) 2-Pin DC Power Jack Interface Connector**

Pin #	Signal	Input/Output	Pin #	Signal	Input/Output
1 (center)	V <sub>DC</sub> Supply	Input	2 (barrel)	V <sub>DC</sub> Return	Input

**ND3PIF-J4 (DB-25 Female) 25-Pin Motor Controller Interface Connector**

Pin #	Signal	Input/Output	Pin #	Signal	Input/Output
1	MotorGnd	-----	14	NC	
2	NC		15	NC	
3	NC		16	MotorAIn	Input
4	MotorComIn	Input	17	NC	
5	NC		18	NC	
6	NC		19	NC	
7	NC		20	MotorCIn	Input
8	MotorComIn	Input	21	NC	
9	NC		22	NC	
10	NC		23	NC	
11	NC		24	MotorBIn	Input
12	MotorComIn	Input	25	NC	
13	NC				

<sup>3</sup> CUI, Inc., PJ-005B