

# **INSTRUCTION MANUAL**

**Model 604B**

**Dual-System Signal Interface**

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## 1.0 Introduction

The 604B Dual-System A/D Interface was designed to enable physiology researchers to easily interface two series 300C muscle lever systems to a National Instruments PCI-6036E or PCI-6024E PC-based A/D card. Because there are only two (2) D/A outputs on these A/D cards the 604B Dual-System A/D Interface also includes a relay circuit board that switches the D/A control signals from lever system A to lever system B. The 604B relay board also allows the output of a stimulator to be switched between baths A and B.

The 604B consists of a 1U (1.75") high, rack-mount (19" wide) case with sixteen (16) BNC connectors on the front and a single BNC connector along with a ribbon cable connector on the back. Also located on the back is a power entry connector that accepts power from a table-mount AC adapter. The AC adapter supplies DC power to the 604B.

The front-panel connections are separated into 4 main groups, A/D inputs, D/A outputs, Digital I/O and Stimulator functions.

There are six (6) analog-to-digital (A/D) inputs labeled Length In A, Force In A, Length In B, Force In B, Aux 1 and Aux 2. These inputs accept analog signals that can range from -10 volts to +10 volts. All inputs are connected in differential mode.

There are four (4) digital-to-analog (D/A) outputs labeled Length Out A, Force Out A, Length Out B and Force Out B. These outputs can generate analog voltages in the range of -10 volts to +10 volts. The D/A outputs are switched to the appropriate lever system using a relay circuit board. The switching is controlled by a digital I/O pin on the A/D card and thus can be controlled by the DMC software.

There are three (3) digital input/output (Digital I/O) connectors labeled Trg In, Inhibit and Trg Out. Trg In is an input trigger that allows an external device to trigger the A/D software. Trg Out is an output trigger that allows the A/D software to trigger some external device. The Inhibit connection is an output that can be connected to the Inhibit connection on a 300C instrument. When activated the inhibit function causes the lever to center itself and limits the output force of the lever system.

There are three (3) Stimulator connectors on the front panel labeled Gate, Stim Out A and Stim Out B. The Gate connection is used to connect the A/D software to an external stimulator. There are two operating modes for the Gate output the first mode simply triggers a stimulator to perform a pre-set stimulation routine. The second mode provides a Gate output that controls the pulse width, pulse frequency, frequency duration, train, train frequency, and train duration of the output pulses from the stimulator. ASI stimulator model 701B operates in the second mode and the ASI DMC/DMA LabView control software allows these stimulation parameters to be controlled by the software. The 604B also includes a level shifter circuit that can be used to trigger old-style Grass stimulators. These stimulators require a trigger voltage that is greater than 18 volts. The standard trigger (Gate) voltage is 5 volts and if enabled the level shifter circuit boosts the 5 volt trigger signal to 20 volts. The Stim Out A and Stim Out B

connectors on the front of the 604B are the high-voltage/high-current output from the Stimulator that are switched between bath A and B by the relay circuit board. On the back of the 604B is the Stim In connector. This is the high-voltage/high-current output of the stimulator that is passed through the relay switching circuit before being directed to the correct bath (A or B).

### **CAUTION, RISK OF ELECTRIC SHOCK**

**Up to 125 volts at 1 ampere is present at the Stim Out A and Stim Out B connectors and at the Stim In connector on the back panel.**

**DO NOT HANDLE THE LOAD OR THE TERMINATIONS, OR REMOVE THE INPUT OR OUTPUT CABLES, WHILE THE STIMULATOR IS IN OPERATION.**

On the back of the 604B Dual-System A/D Interface is a ribbon connector that allows the 604B to be connected to a PCI-6036E or PCI-6024E A/D card in a PC.

The model 604B includes a level shifter that was designed to enable physiology researchers to trigger old-style Grass Stimulators with a TTL signal from an A/D card. Older style Grass stimulators require a trigger signal in the range of 15 to 35 volts. Since the digital outputs of all A/D cards are only capable of producing TTL signal levels (maximum voltage of 5 VDC) a device is required that will boost the 5 V output signal to be in the 15 to 35 V range. In addition to level shifting the model 604B also includes electrical isolation between the input and output connectors. This isolation is provided by an opto-coupler.

The 604B also includes a table-top AC adapter used to power the level shifter circuit. The AC adapter accepts input voltages from 100 to 240 VAC and has an output of 24 volts DC. The relay switching and the level shifter will not function if the AC adapter is not plugged in. When the power is off the D/A signals are routed to the Length Out A and Force Out A connectors and the Stimulator pulses are routed to Bath A.

## 2.0 Connecting the Interface

### 2.1 Connecting the 604B to two Series 300C Muscle Lever Systems

Connect the 604B A/D Interface to two series 300C muscle lever systems as follows.

<u>604B Interface</u>	<u>300C Series System A</u>	<u>300C Series System B</u>
Length In A	Length Out	
Force In A	Force Out	
Length In B		Length Out
Force In B		Force Out
Length Out A	Length In	
Force Out A	Force In	
Length Out B		Length In
Force Out B		Force In

Please see drawing AS604B-C01 at the end of this manual for an interconnection diagram.

We recommend that any unused A/D inputs on the model 604B A/D Interface be shorted using 50-ohm BNC terminators. These look like a BNC connector without a cable attached. We also recommend that the 604B be connected to a 300C lever system using BNC to BNC patch cables. BNC terminators and patch cables are supplied with the 604B signal interface. Extra terminators/cables are available from Aurora Scientific or a local electronics supplier.

### 2.2 Connecting the 604B to a Model 701B Stimulator

Connect the 604B A/D Interface to a 701B Stimulator as follows.

<u>604B Interface</u>	<u>701A/B Stimulator</u>
Gate	External Trigger
Stim In (Rear Panel)	Pulses Out
Stim Out A – connect to tissue bath A	
Stim Out B – connect to tissue bath B	

Please see drawing AS604B-C03 at the end of this manual for an interconnection diagram.

## 2.3 Connecting the 604B to a National Instruments A/D Card

Connect the ribbon cable that exits from the back of the 604B A/D Interface to the mating connector on the National Instruments A/D card located in the PC. Turn the PC off before making the connection to the A/D card. Ensure that the connectors are aligned correctly before mating the connections. Note the connector housings have a “D” shape. Align the connectors correctly and then mate the connectors.

## 2.4 Connecting the AC Adapter to the 604B

Connect the AC adapter to an appropriate AC outlet (100 to 240VAC, 50-60 Hz.) using the power cord provided. Plug the low-voltage connector from the AC adapter into the power jack on the back panel of the 604B. If the AC adapter is not plugged into an AC power source and also into the back panel of the 604B then only Length Out A and Force Out A will be active. Likewise only Stim Out A will be active if the AC adapter is not connected. Also if the Level Shifter circuit is to be used then the AC adapter must be connected.

## 2.5 Using the Level Shifter Circuit

The level shifter circuit should only be used with old-style Grass stimulators that require a trigger level between 15 and 30 volts. Do not use the level shifter circuit when using an ASI model 701B stimulator.

The 604B signal interface includes two jumpers mounted on the circuit board inside the interface. These jumpers can be used to select normal or level shifted Stimulator trigger output. The 604B is factory set with the level shifter circuit disabled and a 5-volt output on the Stimulator trigger line (Gate). If an ASI stimulator, or other stimulator that accepts 5-volt trigger levels, is to be used then the jumpers should be left in the Normal position. To change the jumpers open the 604B interface by first removing the two Philips head screws located at the top edge of the box on the back panel. Once the screws are removed simply slide the cover backwards and remove it. You will now see two jumpers located near the Stimulator BNC connector. Remove both jumpers and reposition them to the Level Shifted position indicated on the circuit board. The jumpers enable the level shifter circuit and cause the 5-volt trigger signal from the A/D card to be level shifted to about 20 volts.

When using the level shifter the DMC program would normally be set to Single Pulse mode.

### **3.0 Reversing the Polarity of Length In and Force In**

The 604B signal interface includes four slide switches mounted on the circuit board inside the interface. These switches can be used to reverse the polarity of the Length In and Force In signals. Normally these switches will not need to be changed. However, if the polarity of either the Length In or Force In signal is opposite to that desired then the polarity can be switched. To do this open the 604B interface by first removing the two Philips head screws located at the top edge of the box on the back panel. Once the screws are removed simply slide the cover backwards and remove it. You will now see four switches located near the Length In and Force In BNC connectors. Slide the appropriate switch to change the input signal from the Normal position to the Reversed position. The switch reverses the input connections. Since the A/D card has a differential input these signals can be reversed without damage to either the A/D card or the 300C. The DMC/DMA program requires that for positive Length Out voltages the Length In signal will also be positive (if this is the case then the Length In switch would be left in the Normal position, if not change the switch). Likewise the DMC/DMA program requires that a contracting muscle generate positive force signals on the force transducer (if this is the case then the Force In switch would be left in the Normal position, if not change the switch).

## 4.0 Connection Details

There are three (3) internal connectors within the 604B case. These are listed below.

<u>Connector</u>	<u>No. of Pins</u>	<u>Function</u>
J1	2	AC power to relay board
J2	3	Stimulator Input to relay board
J4	68	Signal Cable to PC

The following tables show the internal connections between the rear connectors of the 604B and the internal circuit board.

<u>604B Rear Panel</u>	<u>Connector-Pin #</u>	<u>Name</u>
AC Power Entry	J1-1	LINE
AC Power Entry	J1-2	NEUTRAL
Stim In	J2-1	STIM IN
Stim In RET	J2-2	STIM IN RET

The following table shows the internal connections between the front-panel BNC connectors and the NI PCI A/D board.

<u>604B Interface</u>	<u>Internal Connector</u>	<u>Connector Name</u>	<u>Relay State</u>
Length In A	J68	ACH0	
Length In A Ret	J34	ACH8	
Force In A	J33	ACH1	
Force In A Ret	J66	ACH9	
Length In B	J65	ACH2	
Length In B Ret	J31	ACH10	
Force In B	J30	ACH3	
Force In B Ret	J63	ACH11	
Aux 1	J28	ACH4	
Aux 1 Ret	J61	ACH12	
Aux 2	J60	ACH5	
Aux 2 Ret	J26	ACH13	
Length Out A	J22	DAC0OUT	Normally Closed
Length Out A Ret	J55	AOGND	Normally Closed
Force Out A	J21	DAC1OUT	Normally Closed
Force Out A Ret	J54	AOGND	Normally Closed
Length Out B	J22	DAC0OUT	Normally Open
Length Out B Ret	J55	AOGND	Normally Open
Force Out B	J21	DAC1OUT	Normally Open



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Force Out B Ret	J54	AOGND	Normally Open
Trg In 1	J17	DIO1	
Trg In 1 Ret	J50	DGND	
Inhibit	J47	DIO3	
Inhibit Ret	J13	DGND	
Trg Out 1	J20	DIO4	
Trg Out 1 Ret	J53	DGND	
Stimulator Trg (Gate)	J40	GPCTR1_OUT	
Stimulator Trg Ret	J7	DGND	
Stimulator Out A			Normally Closed
Stimulator Out A Ret			Normally Closed
Stimulator Out B			Normally Open
Stimulator Out B Ret			Normally Open

## Drawings

This section consists of the following drawings:

- |                              |                                   |
|------------------------------|-----------------------------------|
| 1. 300B/604B Interconnection | <a href="#"><u>AS604B-C01</u></a> |
| 2. 700A/604B Interconnection | <a href="#"><u>AS604B-C02</u></a> |
| 3. 701A/604B Interconnection | <a href="#"><u>AS604B-C03</u></a> |
| 4. 701B/604B Interconnection | <a href="#"><u>AS604B-C04</u></a> |