INSTRUCTION MANUAL

Models: 604A, 604A-LS

A/D Interface

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1.0 Introduction

The 604A A/D Interface was designed to enable physiology researchers to easily interface a series 300B muscle lever system to a National Instruments PC-based A/D card. The 604A A/D Interface consists of a 1U (1.75") high, 19" wide, rack-mount case with BNC connectors on the front and a ribbon cable connector on the back. Also included are two rack mount handles along with 4 screws for attaching the handles to the 604A and an R6868 ribbon cable. The front-panel connections are separated into 3 main groups, A/D inputs, D/A outputs and digital I/O.

There are eight (8) analog-to-digital (A/D) inputs labeled Length In, Force In, and Aux 1 through 6. The inputs accept analog signals in the range of –10 volts to +10 volts. All inputs are connected in a differential mode.

There are two (2) digital-to-analog (D/A) outputs labeled Length Out and Force Out. The outputs can generate analog voltages in the range of –10 volts to +10 volts.

There are six (6) digital input/output (Digital I/O) connectors labeled Trg In 1, Trg In 2, Stimulator, Inhibit, Trg Out 1 and Trg Out 2. Trg In 1 and 2 are input triggers that allow external devices to trigger the A/D software. Trg Out 1 and 2 are output triggers that allow the A/D software to trigger some external device. These output triggers can also be configured to allow the software to switch a relay on or off. The Stimulator connection is used to connect the A/D software to an external stimulator. Depending on the stimulator being used the output from the Stimulator connector may simply trigger the stimulator to perform a pre-set stimulation routine or the program can be used to control pulse width, pulse frequency, frequency duration, train, train frequency, and train duration. The Inhibit connection is a digital output that can be connected to the Inhibit connection on the 300B instrument. When activated the inhibit function causes the lever to center itself and only generate low forces.

Exiting from the back of the 604A A/D Interface is a ribbon cable that allows the Interface to be connected to a National Instruments PC-based A/D card in a PC.

The model 604A-LS 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 604A-LS also includes electrical isolation between the input and output connectors. This isolation is provided by an opto-coupler.

The 604A-LS 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.

2.0 Connecting the Interface

2.1 Connecting the 604A to a Series 300B Muscle Lever System

Connect the 604A A/D Interface to a series 300B muscle lever system as follows.

604A Interface	Series 300B
Length Out	Length In
Force Out	Force In
Length In	Length Out
Force In	Force Out
Optionally	
Inhibit	Digital Input Inhibit

Please see drawing AS604-C01 at the end of this manual for an interconnection diagram.

We recommend that any unused A/D inputs on the model 604C 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 604C be connected to a 300B lever system using BNC to BNC patch cables. BNC terminators and patch cables are available from Aurora Scientific or a local electronics supplier.

2.2 Connecting the 604A to a High Speed Length Controller and a Force Transducer

Connect the 604A A/D Interface to a high-speed length controller and a force transducer as follows.

604A Interface	High Speed Length Controller	Series 400A Transducer
Length Out	Length In	
Force Out	no connection	
Length In	Length Out	
Force In		Force Out

Please see drawing AS604-C02 at the end of this manual for an interconnection diagram.

Once again we recommend that any unused A/D inputs on the model 604A A/D Interface be shorted using 50-ohm BNC terminators. We also recommend that the 604A be connected to the high-speed length controller and force transducer using BNC to BNC patch cables. BNC terminators and BNC patch cables are available from Aurora Scientific or a local electronics supply store.

2.3 Connecting the 604A to a Model 700A or 701A Stimulator

Connect the 604A A/D Interface to a 700A or 701A Stimulator as follows.

604A Interface	700A Stimulator	701A Stimulator
Stimulator	Gate	External Trigger

Please see drawing AS604-C03 at the end of this manual for an interconnection diagram.

2.4 Connecting the 604A to a National Instruments A/D Card

Connect the ribbon cable that exits from the back of the 604A 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.

2.5 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 700A or 701A stimulator.

To utilize the 604A-LS Level Shifter 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 604A-LS. Connect the Stimulator output BNC of the 604A to the trigger input of the stimulator. If the AC adapter is not plugged into an AC power source and also into the back panel of the 604A-LS then no stimulator trigger signals will be present at the Stimulator BNC connector on the front panel.

The DMC/DMA program can be configured to trigger a stimulator. When using the level shifter circuit the program would normally be set to Single Pulse mode.

The 604A-LS 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 model 604A-LS comes factory set with the level shifter circuit active and an 18-volt output on the Stimulator trigger line. If an ASI stimulator, or other stimulator that accepts 5-volt trigger levels, is to be used then the jumpers should be set to the Normal position. To change the jumpers open the 604A-LS 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 Normal position indicated on the circuit board. The jumpers remove the level shifter circuit and allow the 5-volt trigger signal from the A/D card to be directly connected to the Stimulator BNC connector located on the front panel of the interface. Disconnect the AC adapter from the interface since it is not required when the level shifter circuit is not being used.

3.0 Reversing the Polarity of Length In and Force In

The 604A and 604A-LS signal interfaces include two 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 604A 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 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 but since the A/D card has a differential input these signals can be reversed without damage to either the A/D card or the length controller or force transducer. 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

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

604A Interface	Internal Connector	Connector Name
Length In	J68	ACH0
Length In Ret	J34	ACH8
Force In	J33	ACH1
Force In Ret	J66	ACH9
Aux 1	J65	ACH2
Aux 1 Ret	J31	ACH10
Aux 2	J30	ACH3
Aux 2 Ret	J63	ACH11
Aux 3	J28	ACH4
Aux 3 Ret	J61	ACH12
Aux 4	J60	ACH5
Aux 4 Ret	J26	ACH13
Aux 5	J25	ACH6
Aux 5 Ret	J58	ACH14
Aux 6	J57	ACH7
Aux 6 Ret	J23	ACH15
Length Out	J22	DAC0OUT
Length Out Ret	J55	AOGND
Force Out	J21	DAC1OUT
Force Out Ret	J54	AOGND
Trg In 1	J17	DIO1
Trg In 1 Ret	J50	DGND
Trg In 2	J49	DIO2
Trg In 2 Ret	J15	DGND
Stimulator Trg	J40	GPCTR1_OUT
Stimulator Trg Ret	J7	DGND
Inhibit	J47	DIO3
Inhibit Ret	J13	DGND
Trg Out 1	J20	DIO4
Trg Out 1 Ret	J53	DGND
Trg Out 2	J51	DIO5
Trg Out 2 Ret	J18	DGND

Drawings

This section consists of the following drawings:

1. 604A/604C PCB Silkscreen AS604-010
2. 300B/604A Interconnection AS604-C01
3. 308B/400A/604A Interconnection AS604-C02
4. 700A/604A Interconnection AS604-C03
5. 701A/604A Interconnection AS604-C04