# CED5602 isolated analogue adaptor

for the BIOPAC MP160/AMI100D PPG system

## Owners' Handbook



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## Overview

The CED5602 is an add-on unit that plugs onto the analogue output connector of a BIOPAC AMI100D 16-channel transducer module to provide 12 channels of isolated output. These outputs are intercepts of the lower 12 of the BIOPAC's 16 channels.

The CED5602 is a unity-gain, analogue isolator; it has no user or computer controls. The isolated outputs are single-ended signals designed to drive a CED 1401 Intelligent Laboratory Interface or other analogue data acquisition equipment.

The standard CED5602 has a single 37-way connector to mate with the analogue output of the BIOPAC. If further add-on hardware needs to be connected, a daisy-chain connector that replicates the analogue output port of the BIOPAC module may be specified as a CED5602 hardware build option. Note that this option does not replicate the digital output port of the BIOPAC MP160.

The CED5602 requires +5V 500mA power from an external power supply that has EN60601-1 medical specification.

**WARNING**

The CED 5602 twelve-channel isolated analogue interceptor is designed to meet IEC60601-1 medical specifications, but is not yet approved by CED for use on live human subjects

## Electrical isolation

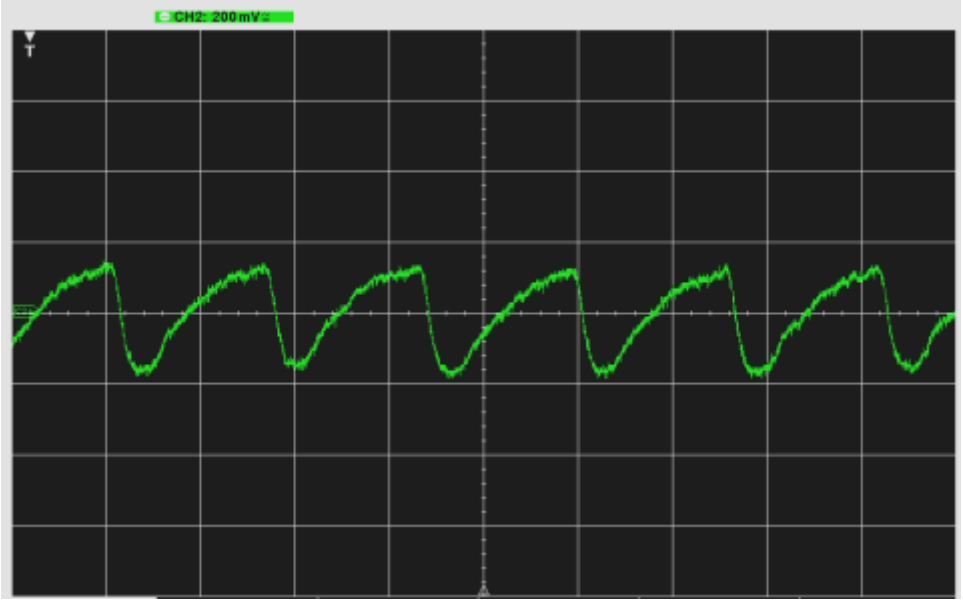
The BIOPAC MP160 analogue input signals are intercepted by the CED5602 and put through analogue isolators. They are brought out to a multi-pin rear-panel plug for onward connection to mains-grounded data acquisition hardware.

The CED5602 receives 5V d.c. power from an external medical-specification mains power supply. Inside the CED5602, 5V d.c. power is sent to the input side of the analogue isolators through isolating dc-dc converters.

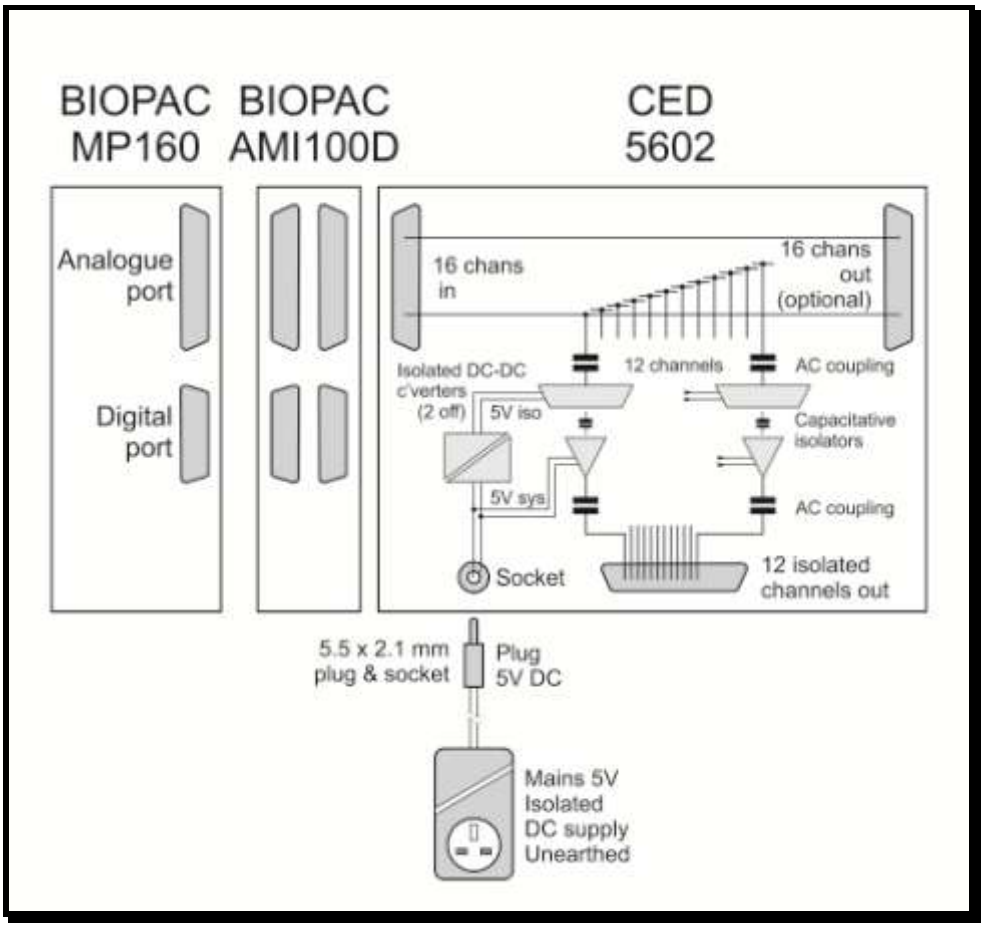
The CED5602's signal isolators and the isolated power converters are specified to a standard that meets or exceeds the requirements of IEC 60601-1. The resulting galvanic isolation ensures that the inherent subject isolation of the BIOPAC hardware is not compromised.

No mains earth connection is taken from the power supply into the CED5602. Earthing is supplied by the data-acquisition equipment connected to the output cable.

## Example PPG output from the CED5602 isolator



## Block diagram




## Live human subjects

Note that the CED 5602 Isolated Analog Interceptor is not currently certified by CED to be safe for use on human subjects. However, the isolating components are certified to a higher specification than is required for such use (IEC60601-1), and the circuit board and mechanical construction are designed to be safe for such use.

## Assembly

The BIOPAC MP160 and AMI100D modules are housed in ABS plastic boxes that stand on end, so that they are taller than they are wide or deep. Interconnections between these modules are made by D-type plugs and sockets mounted directly into the modules' broad faces. As well as transferring the electronic signals, these connectors provide the mechanical retaining force that holds the modules together. The CED5602 is also an ABS plastic box, of similar (but taller) shape. It is designed to plug into the BIOPAC MP160 data acquisition system fitted with a BIOPAC AMI100D transducer module.

## View of front panel with BIOPAC MP160

**View of rear panel with BIOPAC MP160**

## Power supply

The CED5602 requires +5V 500mA power from an external power supply that has EN60601-1 medical specification. The lead from the power supply terminates in a 5.5 mm barrel socket having a 2.1 mm centre pin as the +ve output.

The CED5602 unit is delivered with a plug-top power supply that meets the above specification. Pictured below is the Meanwell model GEM06I05-P1J, supplied with adaptors for UK, US, EU and Australian mains outlets.

**Mains power supply (UK)**

## Output cable

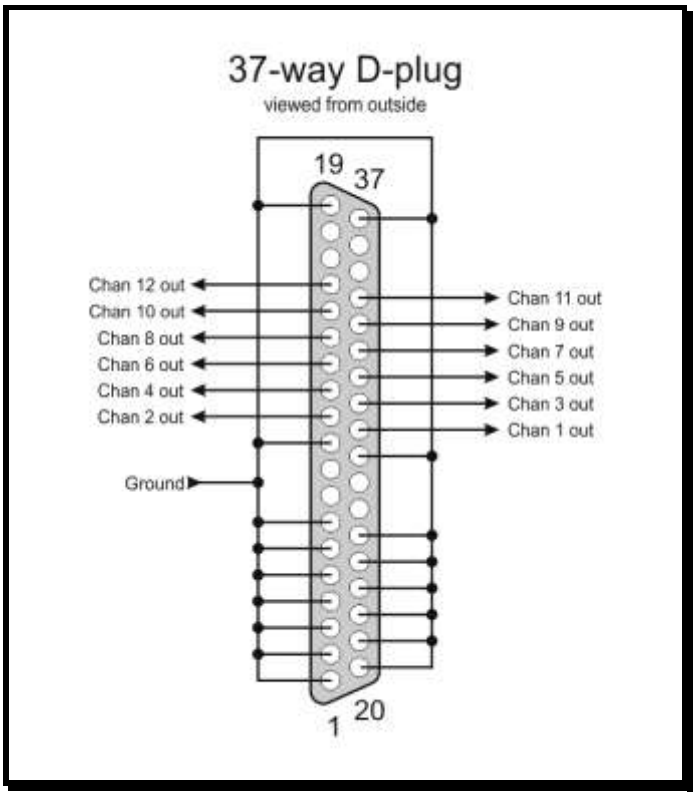
The CED5602 is supplied with an output cable consisting of 12 coaxial leads fitted with BNC plugs at one end and a 37-way D-socket at the other. The D-socket mates with the corresponding plug on the rear panel of the CED5602, and the cable conveys analogue signals via the BNC plugs from the BIOPAC PPG interface to the data capture equipment.

## Output connector pinout

| Signal | Pin | Signal ground | Pin |
|---|---|---|---|
| Channel 1 input | 29 | Each coaxial braid, which carries a channel signal return, must be wired to one of the pins listed on the right.<br>It does not matter which braid is wired to which pin; wire the braids as is most convenient. | 1 |
| Channel 2 input | 11 | | 20 |
| Channel 3 input | 30 | | 2 |
| Channel 4 input | 12 | | 21 |
| Channel 5 input | 31 | | 3 |
| Channel 6 input | 13 | | 22 |
| Channel 7 input | 32 | | 4 |
| Channel 8 input | 14 | | 23 |
| Channel 9 input | 33 | | 5 |
| Channel 10 input | 15 | | 24 |
| Channel 11 input | 34 | | 6 |
| Channel 12 input | 16 | | 25 |
| Extra grounds | | Pins 7, 28, 10, 37, 19 | |
| Other pins | | DO NOT CONNECT | |

Note: The channel numbers are shown in BIOPAC numbering. The pin numbering is the same for both the 37-way D-type plug and the mating socket.

**Output plug diagram**




**Wiring coax braids**

Note that the coaxial cable braids, carrying the signal returns, may each be connected to whichever of the grounded pins, shown in the diagram above, is most convenient. These are pins:

1, 2, 3, 4, 5, 6, 7; 10; 19; 20, 21, 22, 23, 24, 25; 28; 37.

Pins 8, 9, 17, 18, 26, 27, 35 & 36 must be left unconnected.

## Specification

| | |
|---|---|
| Function: | To pass analogue signals from the patient isolated section of a BIOPAC MP160 system to a system-grounded data acquisition unit without compromising the electrical safety of a subject |
| Isolation standard: | Designed to meet IEC60601-1 |
| Number of channels: | 12 |
| Input voltage: | 5 V pk-pk A.C. coupled |
| Safe overload: | ± 10V |
| Input impedance: | > 1 MOhm \|\| 10 pF |
| Voltage gain: | 1.00 ± 2% (1 MOhm load) |
| Output voltage: | ± 2.5 V |
| Noise voltage: | < 2 mV pk |
| Frequency response: | –3 dB at 0.3 Hz and 1.5 kHz |
| External power input: | +5 V 250 mA medical |
| Power connector: | Barrel type 5.5 × 2.1 mm, centre +ve |
| Power overvoltage: | Clamp at +5.5 V approx. |
| Output cable: | 12 off BNCs, 2m cable |

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