



Dept. of Electrical, Computer and Biomedical Engineering

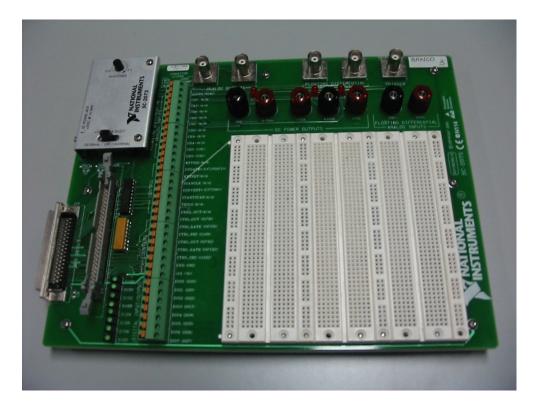
Instrumentation for the data acquisition laboratory

Purpose of the lab activity

- Design and make simple systems for data acquisition from detectors, systems for the remote control and programming of circuits and measurement equipment
- Each experiment will consist of two main parts
- design and construction of a circuit (e.g., for conditioning the signal from a transducer) on a breadboard suitable for interfacing with an acquisition board installed on the PC
- implementation of a virtual instrument (VI) in the LabVIEW programming environment serving as an interface between the measurement system and the user



SC-2075 Breadboard by NI



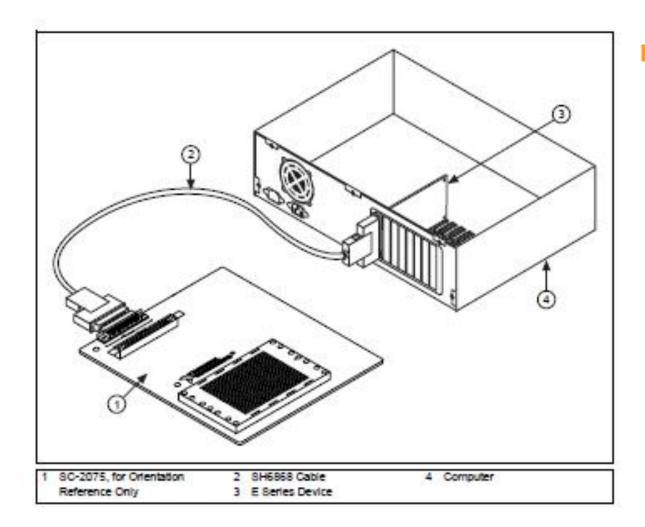
Breadboard suitable for a direct connection to data acquisition (DAQ) boards by National Instruments (in particular DAQ boards of the E series and of the 1200 series)

Makes it possible to send and acquire analog and digital signals to and from circuits built on the breadboard

Can be powered directly by the DAQ board to which the breadboard is connected (±15 V and an additional supply that can be adjusted between 0 and 5 V) or by an external power supply



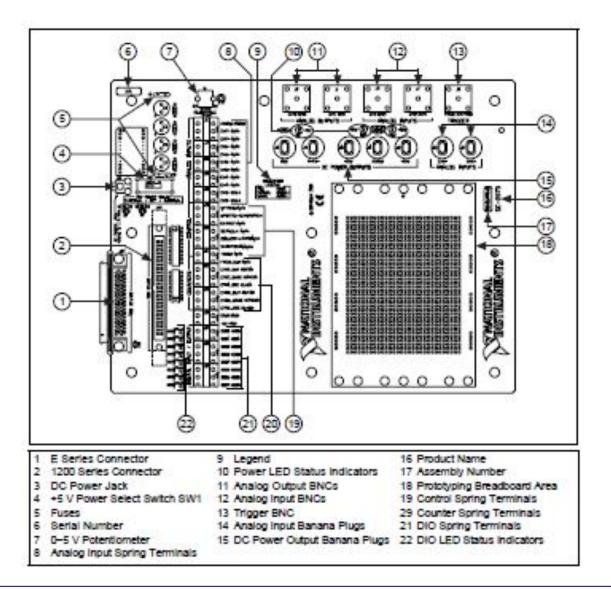
SC-2075 Breadboard by NI



The breadboard is connected to the DAQ board through an 80 pin flat cable

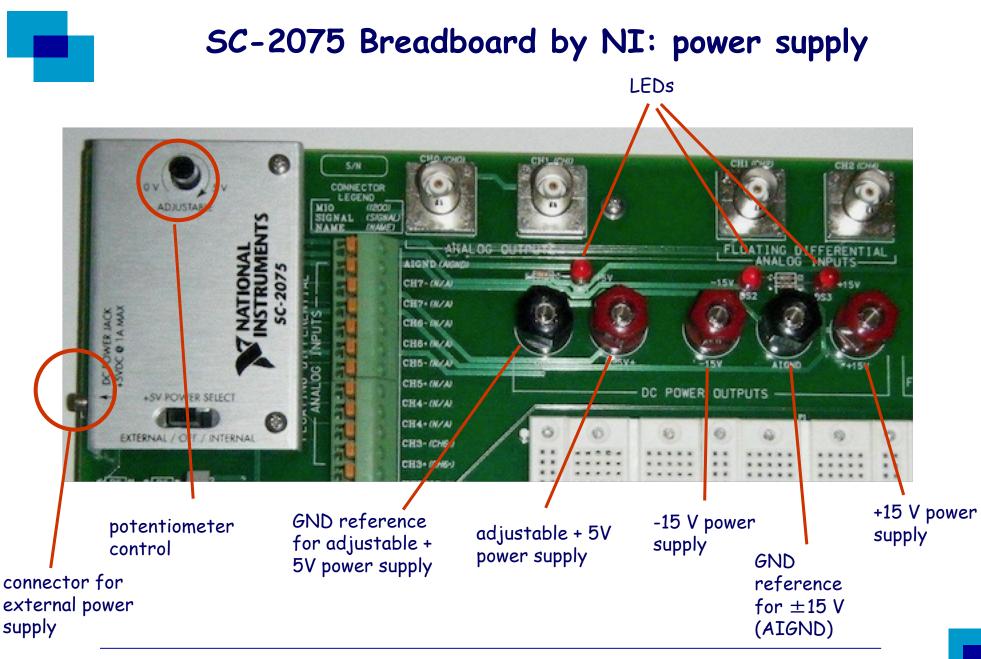
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SC-2075 Breadboard by NI



SC-2075 Breadboard by NI: power supply

- The **SC-2075 breadboard** is compatible with DAQ boards of the E series (this is the case of the DAQ board which is actually installed on the PC, look for the bold labels on the breadboard) and of the 1200 series (labels between parenthesis) by NI
- **DC power supply**: the power supply for the circuits built on the breadboard are made directly available by the breadboard itself
 - +5V: adjustable voltage, achieved on the breadboard by means of DC-DC converters and adjustable through a 100 kOhm potentiometer; is made available through a banana connector; GND is the relevant ground reference
 - $\pm 15V$: achieved on the breadboard by means of DC-DC converters and available through a banana connector; AIGND is the relevant ground reference
 - the power supply can be provided to the board also through an external source



Laboratorio di misure elettroniche

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SC-2075 Breadboard by NI: analog and digital connectors

BNC connectors: they include

- 2 connectors for analog inputs (towards the DAQ board, CH1 and CH2)
- 2 connectors for analog outputs (from the DAQ board, CHO and CH1)
- 1 connector for trigger signals (towards the DAQ board)
- Two **banana connectors** are available (CHO-/CHO+), providing a differential input for analog signals (towards the DAQ)

Spring terminals: they include



- 11 input channels for analog signals
- 8 input/output digital (TTL, L=0 V, H=5 V) channels (DIOO DIO7); each terminal is connected to a led, which is ON when the signal is high (>26 V), OFF when the signal is low (<0.4 V)
- 7 channels for analog control signals
- 7 channels for digital timing signals
- 2 terminals for TTL power supply (+5V, GND)

SC-2075 Breadboard by NI: analog and digital connectors

S/N AIGND (AG CONNECTOR LEGEND CH7- (NZA) (1200) CH7+ (N/A) GNAL CH6-IN/N ANAL OG OUTPER CH6+ (W/A ING DIFFERE TRIGGER ALGND (AIGNO CHS- MAA CHS+ (N/A) CH7- (ZA CH4-(N/A) CH7+ (VA CH4+(N/A) CH6-IVN CH3- (CH6-) analog input CH6+ / 1/10 CH3+ (CH6-) CHS- WA (11 channels) UPDATE (EX CHS- W/A ENTREP (N/A) SCANCLK (N/ trigger CONVERT. (E) signal analog output STARTSCAN (A TRIG2 (N/A) (CHO)FREO_OUT (NO differential CTRI OUT (analog input analog input input (CHO-TRI GATE analog output (CH1) (CH2)/CH0+) TRO O (CH1) LEDs CTRO_SP +5V (+5V) D100 (D100) can be used as D101 (DI00) digital I/O differential DI02 (002) (8 channels, DIO3 (DIO3) inputs DI04 (004) 0 to 7) DI05 (0105) D106 (D/06)

SC-2075 Breadboard by NI: prototyping area

Prototyping area: it includes

- 4 arrays of 2x40 holes for component lead insertion: in each 40 hole column, the holes are short circuited
- 6 arrays of 5x47 holes for component lead insertion: in each 5 hole row, all the holes are short circuited



SC-2075 Breadboard by NI: prototyping area

4 arrays of 2x40 holes - all the holes in each 40 hole column are short circuited

6 arrays of 5x47 holes - all the holes in each 5 hole row are short circuited

> 40 hole column -(8 of them)

5 hole row (282 of them)

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NI PCI-6014 Multifunction I/O board

General purpose data acquisition board by National Instrument, easy to interface with the SC-2075 breadboard – installed on the PC



NI PCI-6014 Multifunction I/O board

Some technical specifications

- 16 analog inputs sampled at a 200 kSample/s rate with a 16 bit resolution
- 2 analog outputs at a 10 kSample/s rate with 16 bit resolution
- automatic gain selection through selection of the input signal range
- input dynamic range: from ± 0.1 V to ± 10 V
- 📒 🛛 output dynamic range: ±10 V
 - input impedance: **100 GΩ/100 pF**
 - output impedance: 0.1 Ω
 - input bias current: ±100 pA
 - maximum load current: ±5 mA
 - 8 input/output digital channels (TTL, 0 V 5 V)