UNIVERSITÀ DEGLI STUDI DI PAVIA

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 systems

- 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
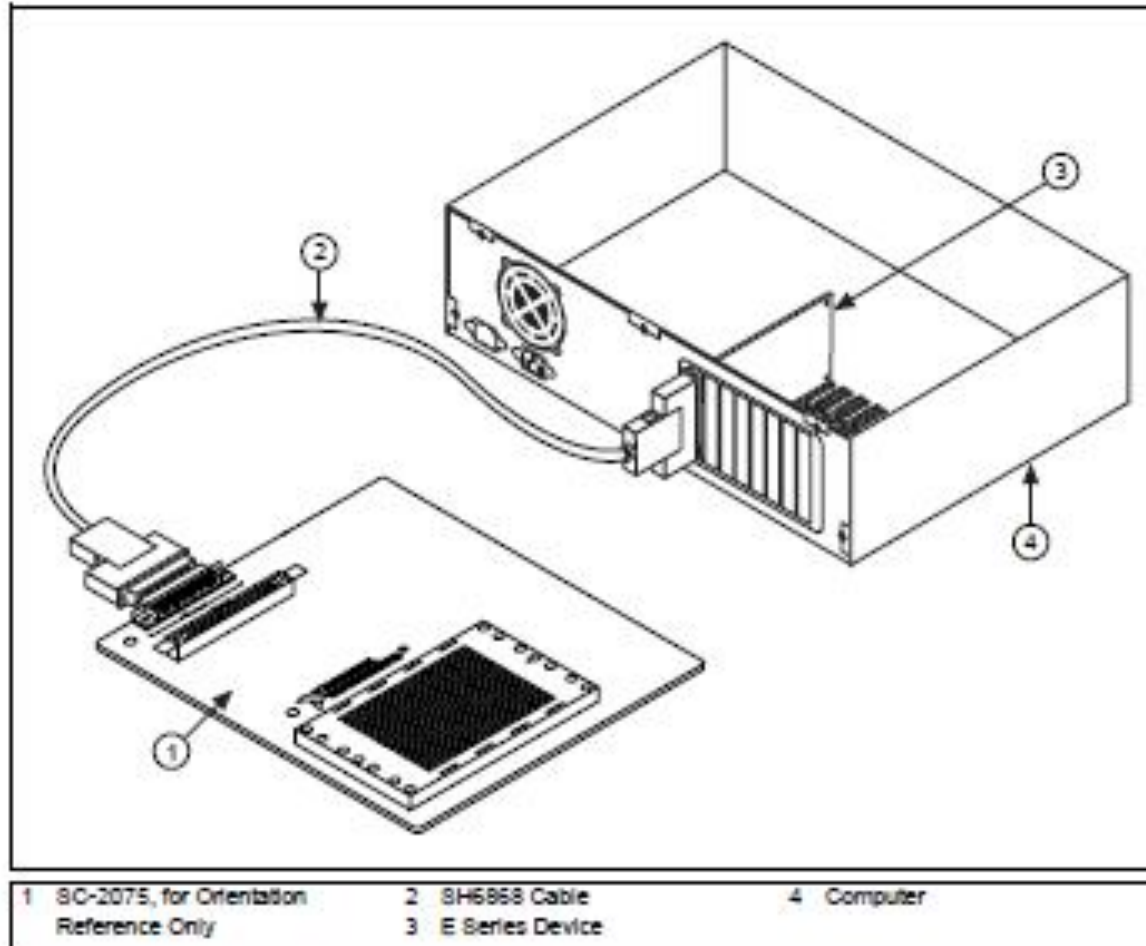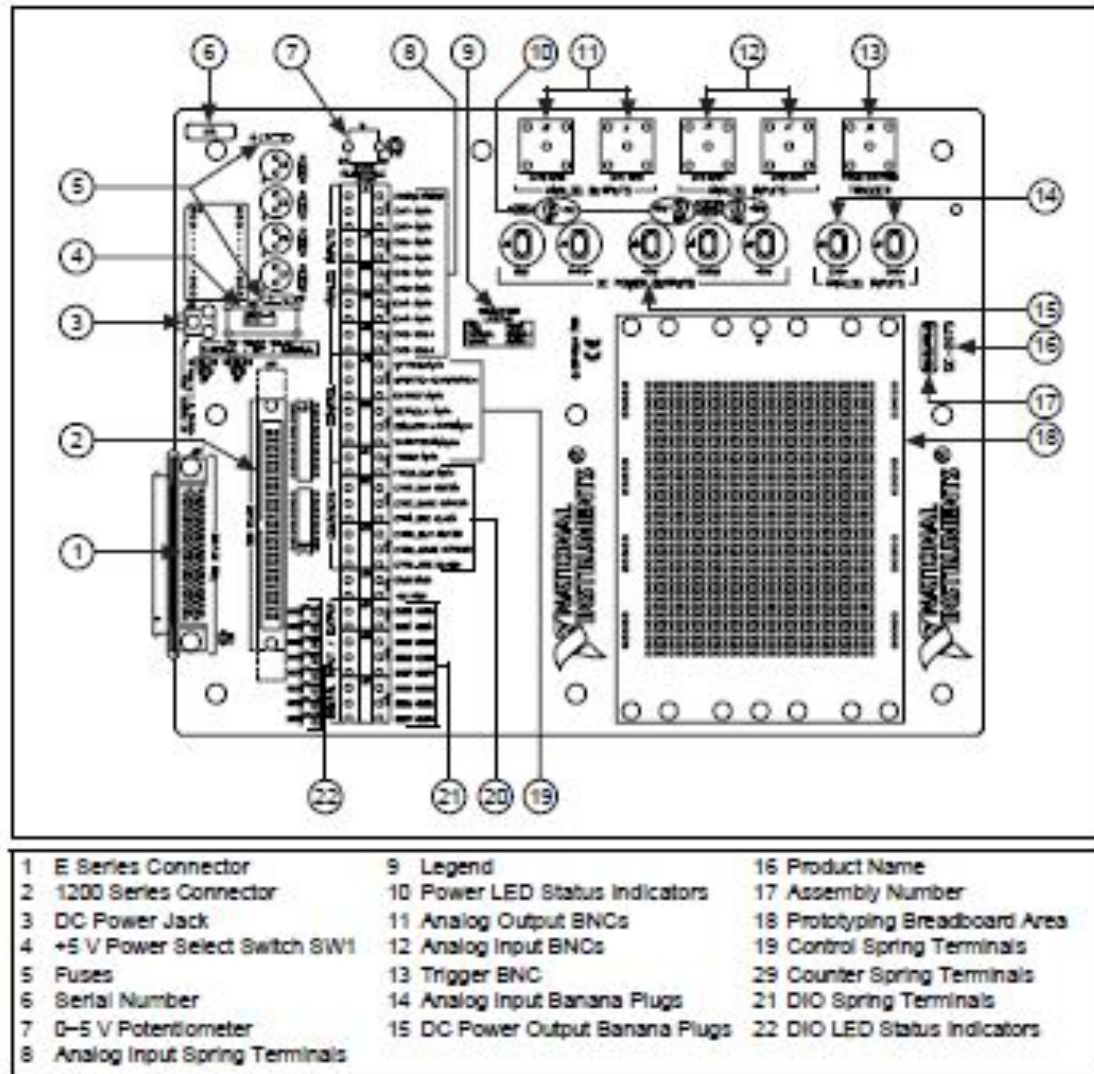
SC-2075 Breadboard by NI
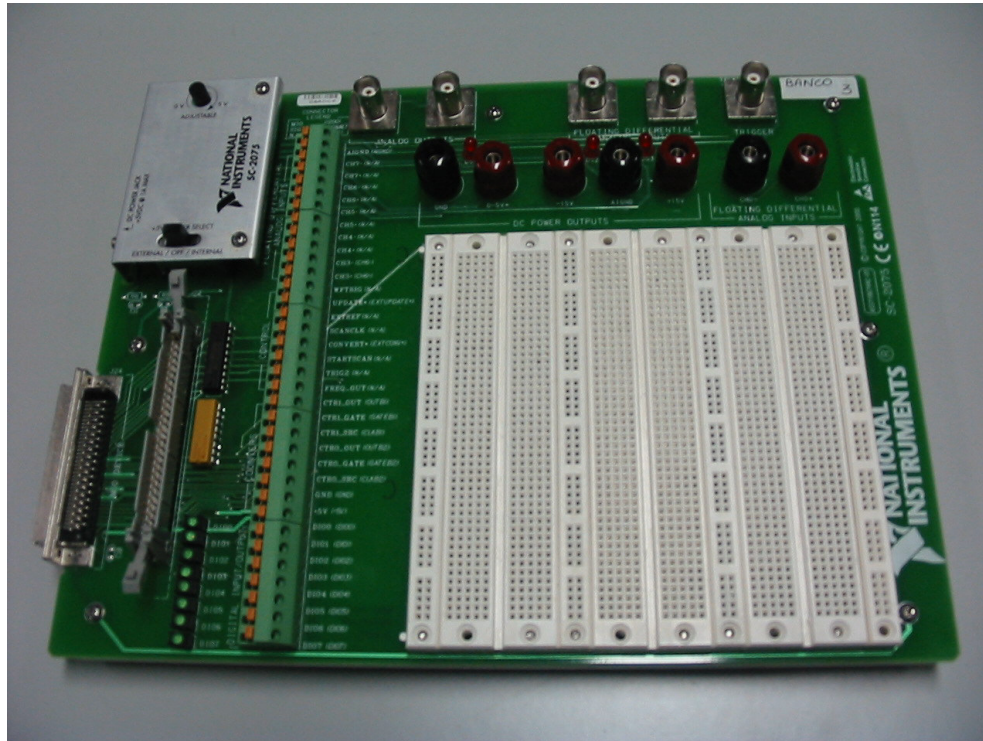
- Breadboard suitable for a direct connection to data acquisition (DAQ) boards by National Instruments (in particular DAQ boards of the E series and of the 1200 series)

- 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

1	SC-2075, for Orientation Reference Only	2	SH6868 Cable	4	Computer
		3	E Series Device		

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

SC-2075 Breadboard by NI

1 E Series Connector	9 Legend	16 Product Name
2 1200 Series Connector	10 Power LED Status Indicators	17 Assembly Number
3 DC Power Jack	11 Analog Output BNCs	18 Prototyping Breadboard Area
4 +5 V Power Select Switch SW1	12 Analog Input BNCs	19 Control Spring Terminals
5 Fuses	13 Trigger BNC	29 Counter Spring Terminals
6 Serial Number	14 Analog Input Banana Plugs	21 DIO Spring Terminals
7 0–5 V Potentiometer	15 DC Power Output Banana Plugs	22 DIO LED Status Indicators
8 Analog Input Spring Terminals		

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

  - **±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

SC-2075 Breadboard by NI: power supply

LEDs

connector for external power supply

potentiometer control

GND reference for adjustable + 5V power supply

adjustable + 5V power supply

-15 V power supply

GND reference for ±15 V (AIGND)

+15 V power supply
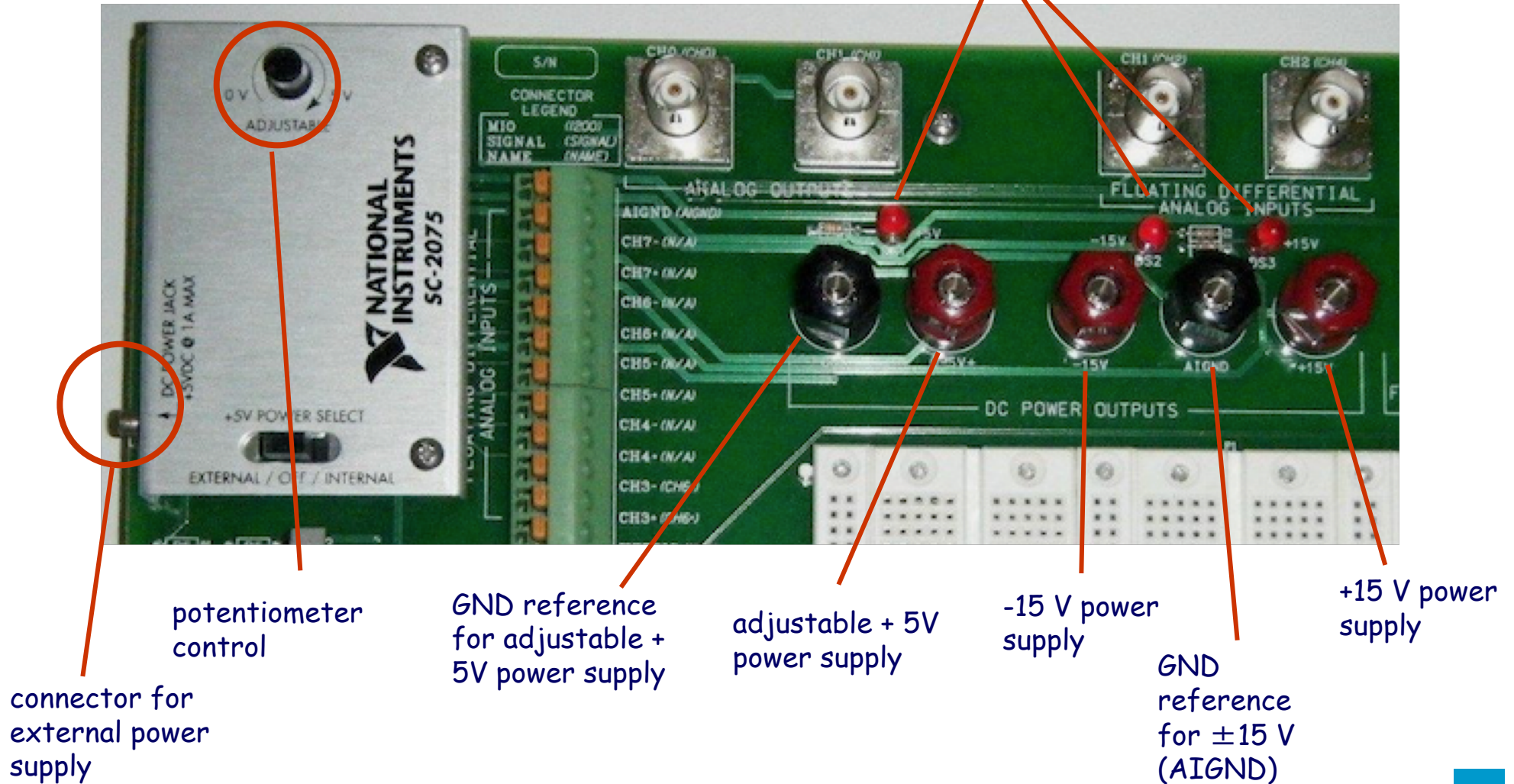
SC-2075 Breadboard by NI: analog and digital connectors

- **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, CH0 and CH1)

  - 1 connector for trigger signals (towards the DAQ board)

- Two **banana connectors** are available (CH0-/CH0+), 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 (DIO0 – 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

spring terminals
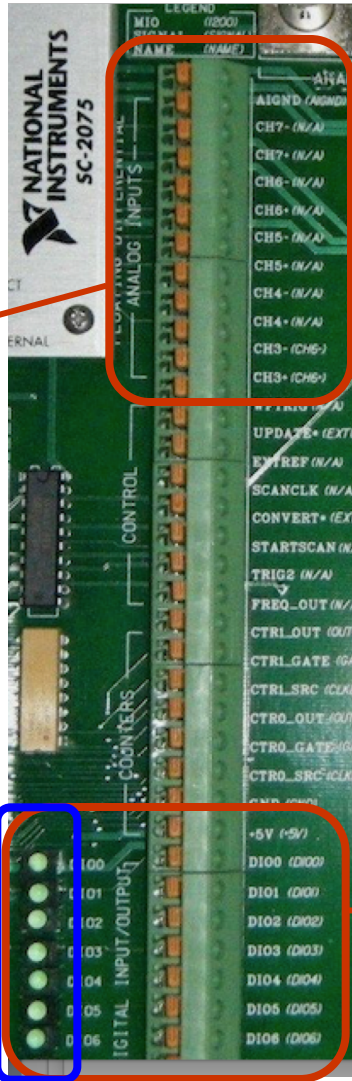
analog input
(11 channels)

LEDs

digital I/O
(8 channels,
0 to 7)

analog output
(CH0)

analog output
(CH1)

analog input
(CH1)

analog input
(CH2)

trigger
signal

differential
input (CH0-
/CH0+)

can be used as
differential
inputs

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)
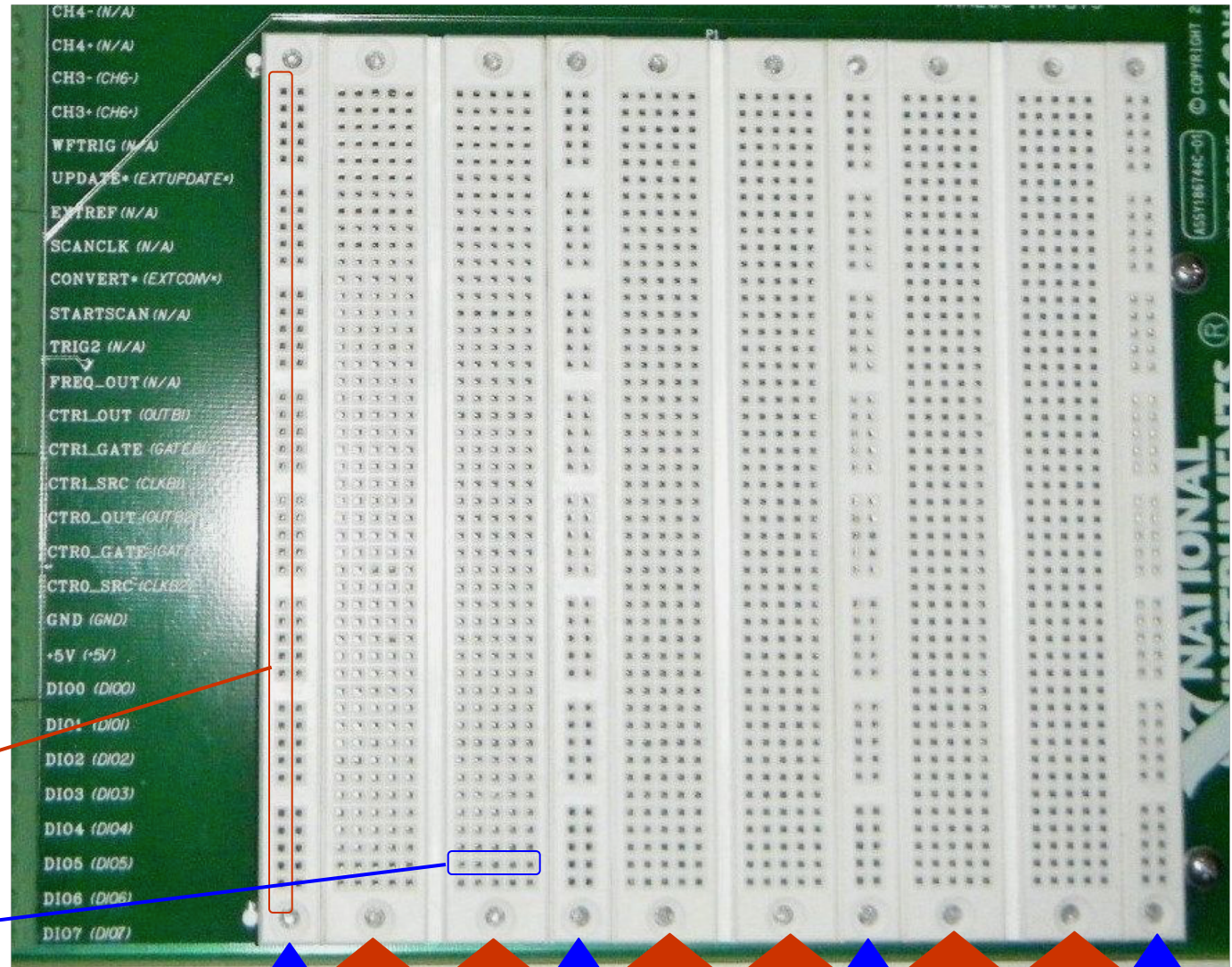
NI PCI-6014 Multifunction I/O board

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)**