# DataLab IO

## Industrial input/output devices with USB interface

# DataLab PC/IO

## Industrial computer with embedded input/output device

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# DataLab IO system

Industrial input/output devices **DataLab IO** are designed for cooperation with host computer, for which they provide measuring (reading) and setting (writing) of technological values. The **DataLab IO** devices communicate with the host PC over very fast standard Universal Serial Bus (USB). USB becomes widely accepted standard more and more replacing aged serial lines and other peripheral interfaces. It is almost impossible to buy a computer without USB interface these days, but it is rather common that modern computers are missing traditional RS-232C.

The USB brings number of advantages to users:

- At first it is already mentioned standardization, universality and wide usage.
- High transfer speed 480 Mb/s enables transferring of tens MB per second. This transfer speed is defined by the USB 2.0 standard, older USB 1.1 standard allows data transfer as 12 Mb/s (approximately 1 MB of data per second).
- Communication time between **DataLab IO** device and host computer is approximately 4 ms on USB 1.1 or 0.3 ms on USB 2.0.
- All configuration is fully automatic (Plug and Play), including driver installation. It is enough to simply plug the **DataLab IO** device to the computer using USB cable and the rest of the installation is performed by the operating system together with the device driver. It is no longer necessary to define transfer rate, parity checking, number of stop bits etc. Also device addressing is fully automatic – every device obtains its address after it is connected to the USB port.
- The USB cable contains different connectors on the PC side (USB-A connector) and on the device side (USB-B connector). This standard disables wrong connection on the physical level.

**DataLab IO** design is consistently modular. Every single unit has four (in the case of **DataLab IO$^{4}$**), two (the **DataLab IO$^{2}$**) or just one (**DataLab IO$^{1}$**) slot for I/O modules, which can be chosen according to the user needs. Individual module kinds (input or output, relay or open-collector, digital or analog etc.) may be combined within one unit. Available modules also include 8 analog inputs with 16-bit resolution, analog output with 12-bit digitization etc. The set of I/O modules is not closed – new kinds of modules are added.

It is also possible to use less than 4 modules in one device, if the application requires less I/O points than one unit provides. It is of course possible to attach multiple I/O devices to one computer when more than 32 I/O points are necessary. If the number of free USB ports of the particular PC is less than required (2 to 6 USB ports are common on todays PCs), it is possible to expand number of ports with USB hub. USB transfer speed is high enough to easily handle communication of multiple industrial units on one USB port.

# Standalone and embedded devices

The **DataLab IO** devices are available in three versions:

- Standalone **DataLab IO$^4$** devices with four modules connected with the host computer by USB cable. These devices may require external power supply from 10 to 40 V DC (it is possible to utilize the 12 V DC power output of **DataLab PC** computers if the device is used with them). Standalone devices can be connected to any PC with USB 2.0 or USB 1.1 interface.
- Standalone **DataLab IO$^2$** devices with two modules connected with the host computer by USB cable. Connection to the host PC and the possibility to use external power supply are the sames as in the case of **DataLab IO$^4$** devices.
- Standalone **DataLab IO$^1$** devices have only one slot for I/O module. These devices are powered through USB cable only.
- The **DataLab IO$^4$** with four slots can be embedded directly to the case of industrial **DataLab PC** computer. There are terminal connectors identical to standalone **DataLab IO$^4$** unit available in the computer case. Outer dimensions of the computer are not changed. The device is internally connected to the USB and also to the power supply. The result is compact computer with I/O capability built in. Because the embedded device uses internal USB port, another two or four external USB ports (depending on the particular computer model) are available for standalone **DataLab IO** or another devices (USB Flash disk etc.).

# Powering of external DataLab IO devices

The USB connector contains two data lines and two supply lines for powering of USB peripherals. There are two groups of USB devices from the power consumption point of view:

- Self-powered devices with own power supply.
- Bus-powered devices utilizing USB power lines.

  Such peripherals are divided to another two groups:

  - Low-power devices (requires maximal current 100 mA from 5 V supply).
  - High-power devices (requires maximal current 500 mA from 5 V supply).

USB ports, which are available directly on the PCs, usually support high-power devices without problems. Different situation is with USB hubs. If the hub is bus-powered, it usually consumes 100 mA for itself. It is then possible to provide 100 mA current to four devices. The hub appears as high-power device for the host and supports four low-power USB devices. But there are self-powered USB hubs, which usually provide enough current for four high-power devices.

Standalone **DataLab IO[4]** or **DataLab IO[2]** devices can work in both modes – bus-powered and self-powered. It is impossible to define if the **DataLab IO[4]** or **DataLab IO[2]** can work in bus-powered mode or requires external power due to its modular design. The device current requirement depends on connected I/O modules.

The consumption of single I/O module plugged to **DataLab IO[1]** device never exceeds maximal allowed USB current (500 mA). This is why there is no external supply available for these devices, they work only as bus-powered devices.

Bus-powered **DataLab IO** devices almost always exceed 100 mA current so they act as high-power device. If they are connected through a hub, the self-powered hub is required. There are configurations (e.g. with only one I/O module connected) with the current consumption below 100 mA, but we do not recommend to rely on it. If all four modules are plugged in, the current consumption always exceeds 100 mA.

There are two jumpers on the device PCB, which determines if the **DataLab IO[4]** or **DataLab IO[2]** requires external power supply or if it used USB power lines. So it is necessary to specify the powering method upon device ordering. How to decide which way of powering is the best?

- If there is a DC voltage between 10 to 40 V available, externally powered **DataLab IO** device will always work. If the **DataLab IO[4]** or **DataLab IO[2]** is used with **DataLab PC** computers, the 12 V DC is always available.
- The current consumption of modules with power supply 5 V from USB:

| Module | Max. consumption |
|---|---|
| CPU | 45 mA |
| AI1 | 190 mA |
| AI2 | 80 mA |
| AI3 | 65 mA |
| AO1 | 340 mA |
| AD1 | 130 mA |
| AD2 | 230 mA |
| RTD1 | 65 mA |

| Module | Max. consumption |
|---|---|
| DI1 | 65 mA |
| DI2 | 300 mA |
| DO1 | 195 mA |
| DO2 | 90 mA |
| DO3 | 135 mA |
| CNT1 | 120 mA |
| CNT2 | 120 mA |
| AIO1 | 155 mA |

## Device drivers for the host PC

There is free **DataLab IO** device driver available for all versions of ***Control Web*** process control system. Also free is the Active X component providing communication with these devices. This component can be used in any COM-aware development system, like Visual Basic etc. It is also possible to use this component even from a web page script in the Internet Explorer or in the Windows Scripting Host script.

The separate product „OPC Server for ***Control Web*** drivers“ can be used in conjunction with free **DataLab IO** drivers for ***Control Web*** to implement OPC interface for OPC clients.

## Communication speed and sampling rates

Sampling rate of analog inputs is defined by the used A/D converters and can be different among various **DataLab IO** modules.

Maximum sampling rate of digital input and output modules as well as analog output modules is defined by the communication speed between **DataLab IO** device and the host PC. Single communication time is approx. 4 ms on USB 1.1 Full-speed connections and approx. 0.3 ms on USB 2.0 High-speed connections. Resulting sampling rates are 250 Hz and 3.3 kHz. This communication time also depends on the used host PC and its USB interface and also on the current USB traffic – if the device is connected through the USB hub and another device also communicates with the PC, response time would be longer. The response time does not prolong when multiple channels of single module are communicated on the other side. Sampling rate is also influenced by the controlling software, which invokes communications and handles results.

# Manipulation with input/output modules

The **DataLab IO** devices are supplied complete including I/O modules. Adding or removing of modules can be performed when the case top cover is removed after unscrewing of four bolts.

**Unplugging the module:**

Slightly lift up the terminal connector side of the module upwards (approx. 2 mm) and pull the module out of the CPU slot.

**Plugging the module:**

Push the module connector to the CPU slot in a slight angle. When the module connector is inserted to the CPU slot, push the terminal connector side of the module slightly downwards so the module PCB can fall behind the case edge. Modules are fixed in the position when the top cover of the case is screwed in.

**Warning**

*It is possible to open the device case and to manipulate with modules only when the device is not powered and the USB cable is unplugged.*

# DataLab IO⁴ CPU module

CPU core with USB interface in the case with four available slots

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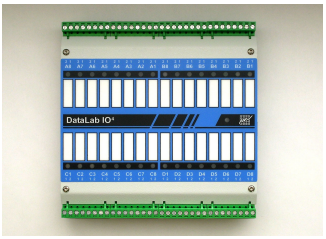
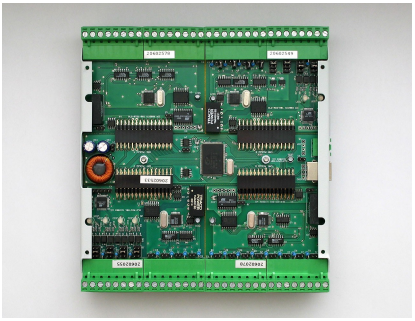
- 4 slots for input/output modules
- USB connector
- Optional external power connector
- Optional DIN rail clip

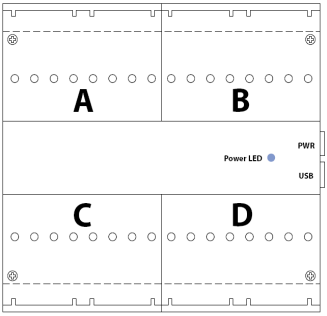



The CPU module of **DataLab IO⁴** contains USB interface, power supply connector and four slots for input/output modules. The module resides inside robust metal case, which is a base of the whole modular system.

## Module position denomination

**DataLab IO⁴** has four slots marked by letters A, B, C and D. Slot positions are as follows:



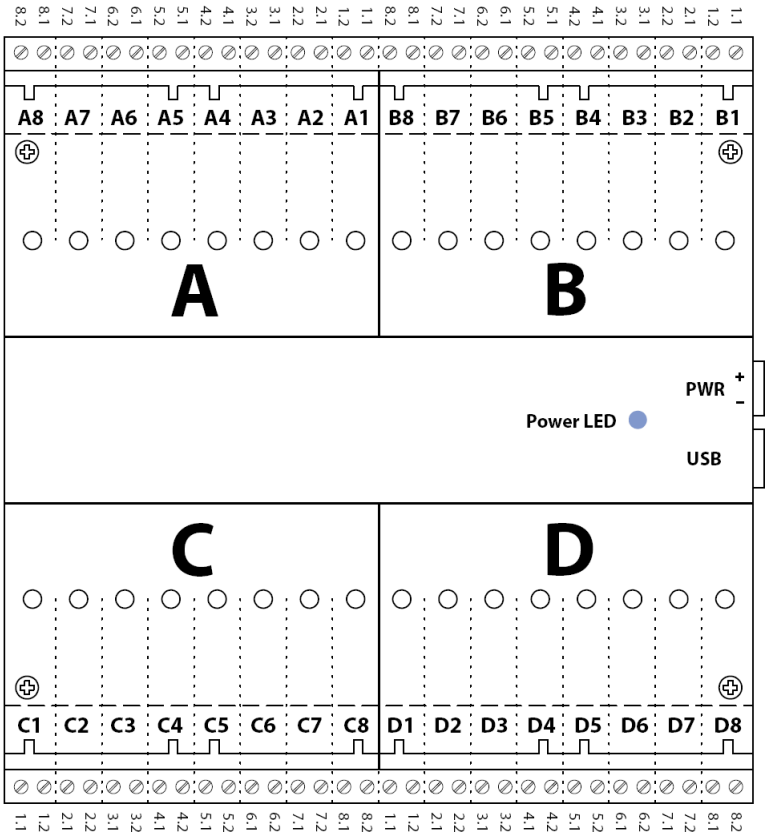



**Take care to orient the device properly –** slots A and B are on top when the blue LED (and also USB and power connector) is on the right side of the device. Slot marking letters and numbers of individual inputs are printed on the device cover.

Slot denomination is not important from the I/O modules point of view. Any module can work in any slot. The device identifies every module automatically and adapts itself to the

current configuration.

Nevertheless, when the **DataLab IO⁴** device is used in conjunction with some software system (e.g ***Control Web***), the driver parameter file contains description of modules used in slots and numbers of individual channels defined for each module. Module denomination is also important for project work – it is necessary to specify which wires should be connected to individual inputs and outputs etc.

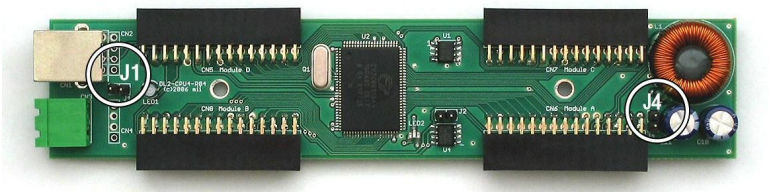



Terminal connector pin numbers

The sticker on the top of the case contains not only slot denomination (A, B, C or D) and terminal connector pair number for each module, but also white rectangles intended for user description of the particular connector pair.

# Choosing between bus-powered and self-powered modes

If the power requirements of **DataLab IO⁴** device exceeds capabilities of USB port (for instance if the low-power port is used or the whole device current exceeds 500 mA), external power supply must be used. Two jumpers J1 and J4 on the module PCB determines if the device will be self-powered or bus-powered.



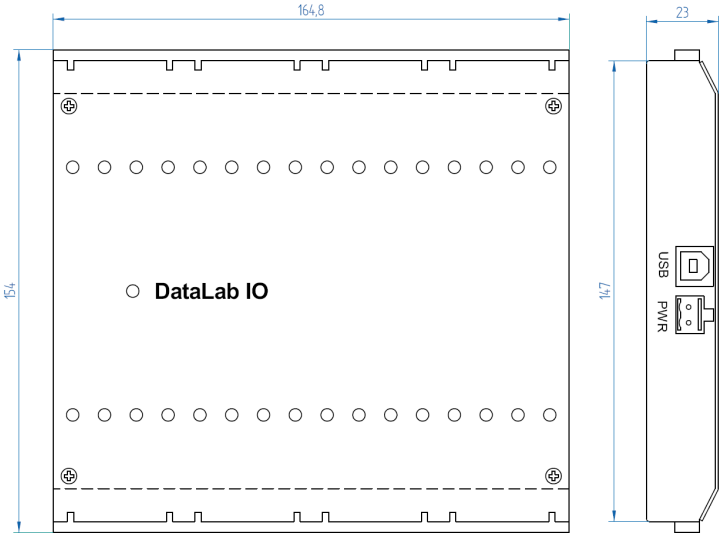

Jumpers J1 and J4 on the CPU PCB

| | J1 | J4 |
|---|---|---|
| For bus-powered device | closed | open |
| For self-powered device | open | closed |

Power selection jumpers positions

The polarity of external power supply is stated on the sticker close to the PWR connector.

# Device dimensions




The **DataLab IO⁴** device dimensions in mm

# Technical specification

| | |
|---|---|
| **Power supply:** | USB bus (in bus-powered mode)<br>10 to 40 V DC external power supply (self-powered mode) |
| **Consumption:** | 45 mA without modules, power supply 5 V (USB) |
| **Dimensions:** | width × height × depth = 165 × 154 × 23 mm (without DIN clip) |
| **Operating temperature:** | 0 to +50° C |
| **Weight:** | 450 g without modules<br>650 g with four relay digital output modules |

# Ordering codes

| | |
|---|---|
| **DL–CPU4** | **DataLab IO⁴** CPU module – with DIN-rail clip |
| **DL–CPU4 S** | **DataLab IO⁴** CPU module – desktop variant |

# DataLab IO² CPU module

CPU core with USB interface in the case with two available slots

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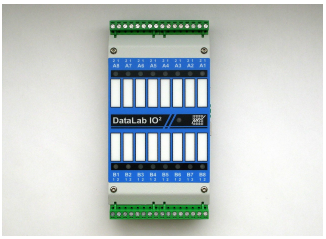
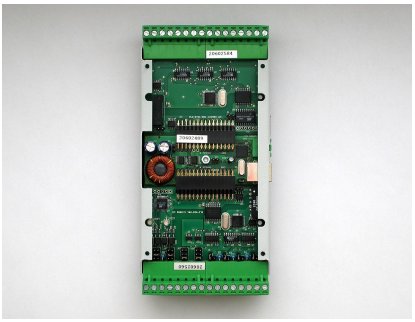
- 2 slots for input/output modules
- USB connector
- Optional external power connector
- Optional DIN rail clip

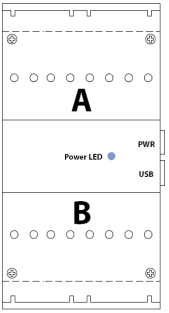



The CPU module of **DataLab IO²** contains USB interface, power supply connector and four slots for input/output modules. The module resides inside robust metal case, which is a base of the whole modular system.

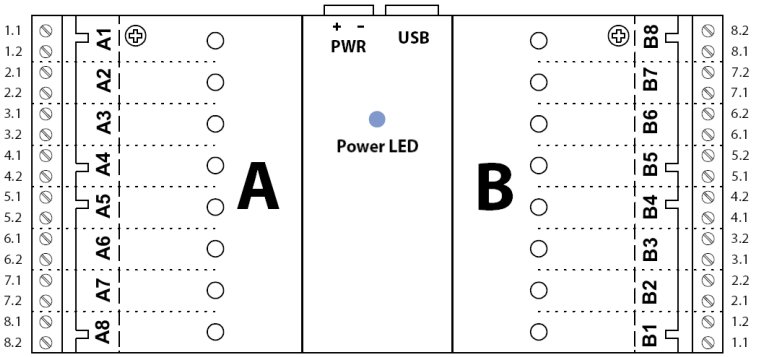
## Module position denomination

**DataLab IO²** has two slots marked by letters A and B. Slot positions are as follows:






The **DataLab IO²** devices can be powered from USB cable as well as by separate power supply. It is not possible to state that the USB cable provides enough power for all **DataLab IO²** configurations due to the **DataLab IO** modular design – the power consumption depends on the connected modules.

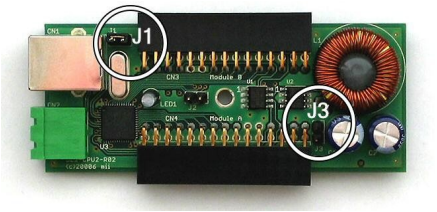



Terminal connector pin numbers

The sticker on the top of the case contains not only slot denomination (A or B) and terminal connector pair number for each module, but also white rectangles intended for user description of the particular connector pair.

## Choosing between bus-powered and self-powered modes

If the power requirements of **DataLab IO²** device exceeds capabilities of USB port (for instance if the low-power port is used or the whole device current exceeds 500 mA), external power supply must be used. Two jumpers J1 and J3 on the module PCB determines if the device will be self-powered or bus-powered.



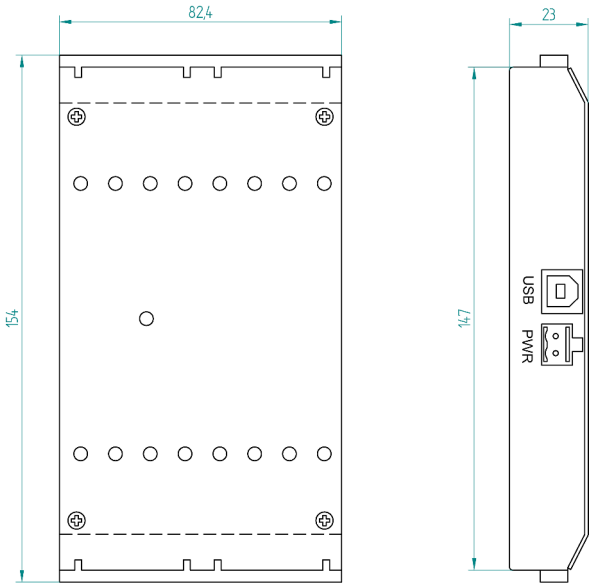

Jumpers J1 and J4 on the CPU PCB

| | J1 | J3 |
|---|---|---|
| For bus-powered device | closed | open |
| For self-powered device | open | closed |

Power selection jumpers positions

The polarity of external power supply is stated on the sticker close to the PWR connector.

# Device dimensions




The **DataLab IO²** device dimensions in mm

# Technical specification

| | |
|---|---|
| **Power supply:** | USB bus (in bus-powered mode)<br>10 to 40 V DC external power supply (self-powered mode) |
| **Consumption:** | 45 mA without modules, power supply 5 V (USB) |
| **Dimensions:** | width × height × depth = 83× 154 × 23 mm (without DIN clip) |
| **Operating temperature:** | 0 to +50° C |
| **Weight:** | 340 g without modules<br>480 g with two relay digital output modules |

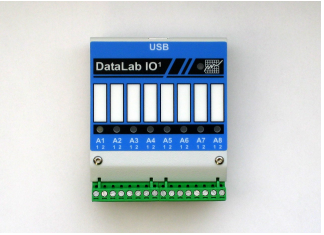
# Ordering codes

| | |
|---|---|
| **DL–CPU2** | **DataLab IO²** CPU module – with DIN-rail clip |
| **DL–CPU2 S** | **DataLab IO²** CPU module – desktop variant |

# DataLab IO[1] CPU module

One slot version of CPU core with USB interface

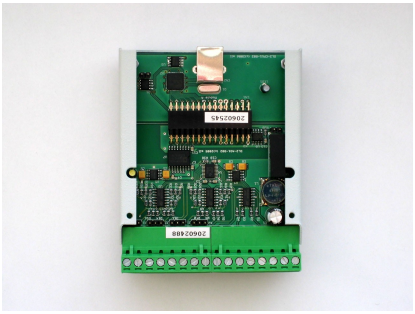
- 1 slot for I/O module
- USB connector
- Optional DIN rail clip

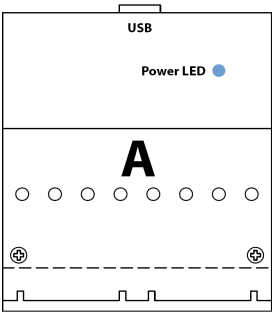



The CPU module of **DataLab IO[1]** contains USB interface and one slot for input/output module. The module reside inside robust metal case. The single slot version does not provide external power connector, it works in bus-powered mode only.

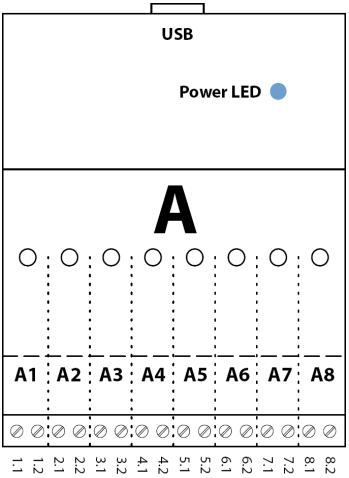
## Module position denomination

There is only one slot marked A available in **DataLab IO[1]**.





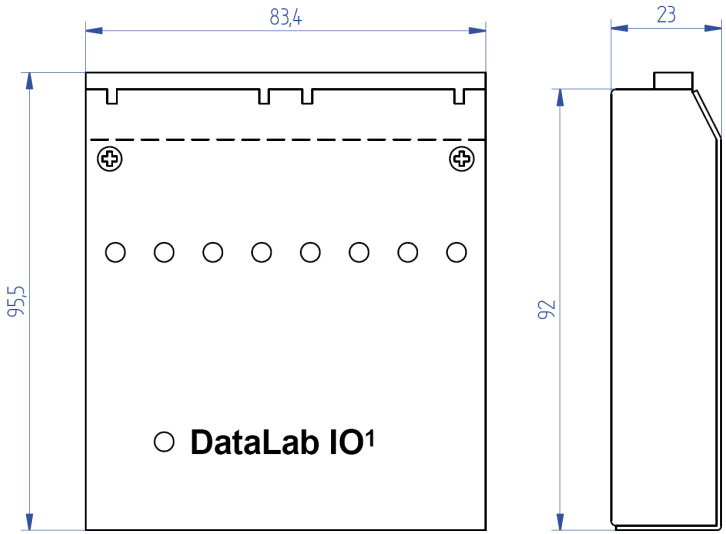

Because there is no single **DataLab IO** module with power requirements exceeding USB limit 500 mA, **DataLab IO[1]** devices do not contain power connector and it must be always powered from USB.



Terminal connector pin numbers

The sticker on the top of the case contains not only terminal connector pair number for each module, but also white rectangles intended for user description of the particular connector pair.

## Device dimensions




The **DataLab IO**[1] device dimensions in mm

## Technical specification

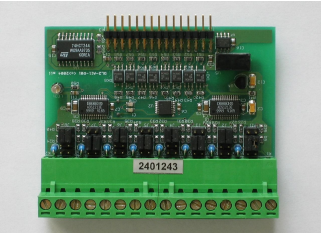
| | |
|---|---|
| **Power supply:** | USB bus (bus-powered mode) |
| **Consumption:** | 45 mA without modules, power supply 5 V (USB) |
| **Dimensions:** | width × height × depth = 84× 96 × 23 mm (without DIN clip) |
| **Operating temperature:** | 0 to +50° C |
| **Weight:** | 180 g without modules<br>230 g with relay digital output module |

## Ordering codes

| | |
|---|---|
| **DL–CPU1** | **DataLab IO**[1] CPU module – with DIN-rail clip |
| **DL–CPU1 S** | **DataLab IO**[1] CPU module – desktop variant |

# AI1–Analog input module

8 isolated differential 16-bit analog inputs

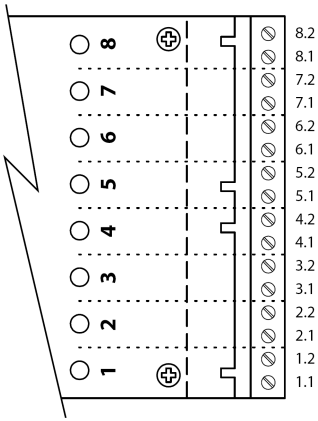



- 8 analog input channels
- 16-bit delta-sigma converter
- Bipolar differential inputs
- Isolated signal part
- Input ranges ±0,625 V to ±20 V, ±20 mA

The AI1 module provides eight differential analog inputs. Jumpers on the PCB enable settings of voltage or current mode for each input individually.

Maximal sampling rate 20 Hz is determined by the conversion speed of the used A/D converter. The communication between host PC and the device is much faster (less than 4 ms), but it does not take sense to sample inputs faster than at 20 Hz.

## Terminal connector description




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | IN 1 + | POWER | 5.1 | IN 5 + | |
| 1.2 | IN 1 - | | 5.2 | IN 5 - | |
| 2.1 | IN 2 + | | 6.1 | IN 6 + | |
| 2.2 | IN 2 - | | 6.2 | IN 6 - | |
| 3.1 | IN 3 + | | 7.1 | IN 7 + | |
| 3.2 | IN 3 - | | 7.2 | IN 7 - | |
| 4.1 | IN 4 + | | 8.1 | IN 8 + | |
| 4.2 | IN 4 - | | 8.2 | IN 8 - | |

**Remark**

*The module returns positive value if the voltage on pin marked + is greater than voltage on pin marked –. Inputs are differential.*

# Input settings

Inputs can work in one of three modes, which are defined individually for each input by jumpers on the PCB.

**Voltage mode, BIAS on**

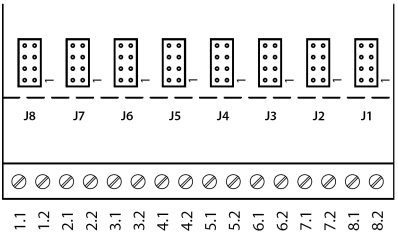

BIAS is on. Voltage range is multiplied by factor 4.

**Voltage mode, BIAS is off**


BIAS is off. Standard input voltage range.

**Current mode**


The voltage drop on 120 Ω resistor is measured. Input current 0 – 20 mA, causes. 0 – 2,4 V voltage drop.




Jumpers location on module PCB

| BIAS | Mode | Max. voltage between inputs | Full range |
|---|---|---|---|
| 1 | 0 | ±20 V | 40 V |
| 1 | 1 | ±10 V | 20 V |
| 1 | 2 | ±5 V | 10 V |
| 1 | 3 | ±2,5 V | 5 V |
| 0 | 0 | ±5 V | 10 V |
| 0 | 1 | ±2,5 V | 5 V |
| 0 | 2 | ±1,25 V | 2,5 V |
| 0 | 3 | ±0,625 V | 1,25 V |

Input voltage ranges of analog input module

The „BIAS“ column represents BIAS jumper positions on the module PCB. The „Mode“ column is a mode number defined in the application.

Values „Max. voltage between inputs“ and „Full range“ need a brief explanation:

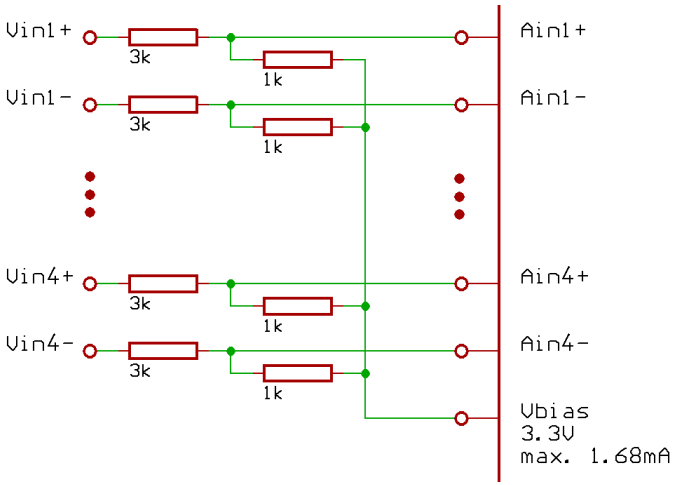
- No one terminal connector pin is grounded so it does not matter if the input voltage is −20 V and 0 V, −10 V and +10 V or 0 V and +20 V. his is why the maximal voltage between inputs is defined instead simply symmetrical difference. The maximum difference causes reading of the maximum number from the ADC 32767 ($2^{15}-1$).
- Inputs are fully bipolar so when we switch the input polarity, negative numbers will be read. After connecting 0 V and −20 V number −32768 ($-2^{15}$). will be read. Although the maximal voltage between pins is 20 V, both polarities creates full input range 40 V.

**Remark**

*The module has low power consumption and it is powered from single +5 V power supply. It is also insulated from USB interface. The voltage divider with the $V_{bias}$ offset voltage is used on each input achieve up to 40 V input range (see the schematic diagram on the picture) can be used to. If the symmetrical input voltage is connected to the inputs, the current on both input pins is the same, only with negative direction. But if the input voltage is not symmetrical (e.g. multiple inputs has common ground), there is a limitation of the maximum current 1.68 mA, which can be provided by the $V_{bias}$ voltage output (note one $V_{bias}$ output is common for 4 inputs). If this current limit is exceeded, the measurement error increases and also the error current through the common pins of individual inputs generates error voltage. This means input voltages on different inputs can influence each other.*

*Note that using of the BIAS jumpers to increase input voltage also lowers the input impedance of the module.*

*If the BIAS jumpers are off, the above described behavior does not occur.*




Schematic diagram of dividers used on analog inputs

Input range can be changed during application runtime, but always for all 8 inputs.

## Module parameters

| **Current mode** | |
|---|---|
| **Input resistance** | 120 Ω |
| **Input range** | 20 mA |
| **Voltage mode** | |
| **Input resistance** | 1,25 MΩ |
| **Input range** | see table „Input voltage ranges of analog input module“ |

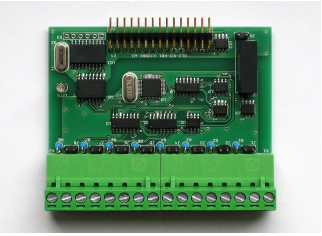
| **Conditions** | |
|---|---|
| **Operating temperature:** | 0 to +50° C |

## Ordering codes

| | |
|---|---|
| **DL–AI1** | **DataLab IO** analog input module |

# AI2–Analog input module

8 isolated differential 16-bit analog inputs



- 8 analog input channels
- 16-bit delta-sigma converter
- Bipolar differential inputs
- Isolated signal part
- Voltage ranges ±1,25 V to ±10 V
- Current ranges ±10,4 mA to ±20 mA

The AI2 module provides eight differential analog inputs. Jumpers on the PCB enable settings of voltage or current mode for each input individually. The module allows input range setting for individual inputs and switching each input off. Skipping of particular input speeds up the sampling frequency of remaining inputs.

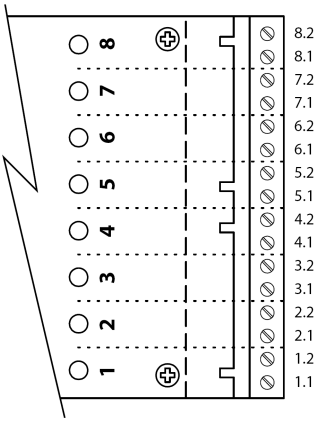
The module is able to sample data at frequency 50 Hz (50 samples per second) on one channel. If all 8 channels are measured, the sampling speed is 6.25 Hz. If it is for instance necessary to sample data 10 times per second, only 5 channels can be turned on, remaining 3 channels must be turned off.

It is not necessary to wait for the digital filter to settle down when only one channel is measured and the input multiplexer is not switched. The data sampling frequency is then 200 Hz. But keep on mind that the A/D converter is not able to pass the step over the full input range to its output at this speed. If the input voltage changes e.g. from −10 V to +10 V, the converter needs 4 cycles to propagate the step to the output. So the sampling frequency is again 50 Hz.

**Remark**

*The USB interface of* ***DataLab IO*** *devices can transfer data much faster than the AI2 module can measure them. But faster communication with the device does not bring any advantages. More frequent read requests only causes more frequent communication of the same data.*

# Terminal connector description




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | IN 1 + | POWER | 5.1 | IN 5 + | |
| 1.2 | IN 1 - | | 5.2 | IN 5 - | |
| 2.1 | IN 2 + | | 6.1 | IN 6 + | |
| 2.2 | IN 2 - | | 6.2 | IN 6 - | |
| 3.1 | IN 3 + | | 7.1 | IN 7 + | |
| 3.2 | IN 3 - | | 7.2 | IN 7 - | |
| 4.1 | IN 4 + | | 8.1 | IN 8 + | |
| 4.2 | IN 4 - | | 8.2 | IN 8 - | |

**Remark**

*The module returns positive value if the voltage on pin marked + is greater than voltage on pin marked –. Inputs are differential.*

# Input settings

Inputs can be switched to voltage or current mode. Mode is defined by the jumper on the module PCB. The jumper inserts precision 120 Ω resistor to the input.

| | **jumper J1–J8** |
|---|---|
| Voltage mode | open |
| Current mode | closed |

Input ranges can be defined for every input channel independently by the application program. Table below shows available measure range codes. Range code **0** is reserved and means that the input is switched off.

| Range code | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Voltage mode | inactive | ±10 V | ±5 V | ±2,5 V | ±1,25 V |
| Current mode | inactive | – | – | ±20,8 mA | ±10,4 mA |

Input ranges of AI2 analog input module

## Module parameters

| **Current input** | |
|---|---|
| **Input resistance** | 120 Ω |
| **Input range** | ±10 mA to ±20 mA (see table) |
| **Voltage input** | |
| **Input resistance** | 20 MΩ |
| **Input range** | ±1,25 V to ±10 V (see table) |
| **Sampling frequency** | |
| **Two and more inputs** | 50 Hz |
| **Single active input only** | 200 Hz |

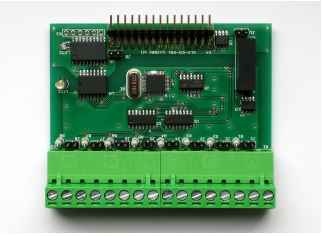
| **Conditions** | |
|---|---|
| **Operating temperature:** | 0 to +50° C |

## Ordering codes

| **DL–AI2** | **DataLab IO** analog input module |
|---|---|

# AI3–Analog input module

8 isolated differential 16-bit analog inputs



- 8 analog input channels
- 16-bit delta-sigma converter
- Bipolar differential inputs
- Bipolar and unipolar read modes
- Isolated signal part
- Voltage ranges ±0,1 V to ±10 V
- Current ranges ±1 mA to ±20 mA

The AI3 module provides eight differential analog inputs. Jumpers on the PCB enable settings of voltage or current mode for each input individually. The module allows input range setting for individual inputs and switching each input off. Skipping of particular input speeds up the sampling frequency of remaining inputs.

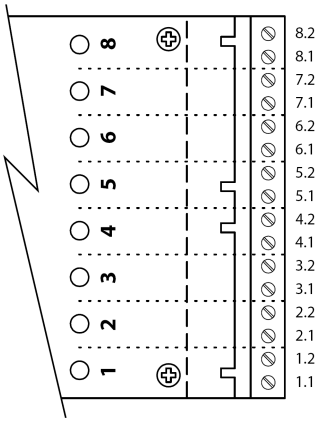
The module is able to sample data at frequency 50 Hz (50 samples per second) on one channel. If all 8 channels are measured, the sampling speed is 6.25 Hz. If it is for instance necessary to sample data 10 times per second, only 5 channels can be turned on, remaining 3 channels must be turned off.

It is not necessary to wait for the digital filter to settle down when only one channel is measured and the input multiplexer is not switched. The data sampling frequency is then 200 Hz. But keep on mind that the A/D converter is not able to pass the step over the full input range to its output at this speed. If the input voltage changes e.g. from −10 V to +10 V, the converter needs 4 cycles to propagate the step to the output. So the sampling frequency is again 50 Hz.

**Remark**

*The USB interface of* ***DataLab IO*** *devices can transfer data much faster than the AI3 module can measure them. But faster communication with the device does not bring any advantages. More frequent read requests only causes more frequent communication of the same data.*

# Terminal connector description




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | IN 1 + | POWER | 5.1 | IN 5 + | |
| 1.2 | IN 1 - | | 5.2 | IN 5 - | |
| 2.1 | IN 2 + | | 6.1 | IN 6 + | |
| 2.2 | IN 2 - | | 6.2 | IN 6 - | |
| 3.1 | IN 3 + | | 7.1 | IN 7 + | |
| 3.2 | IN 3 - | | 7.2 | IN 7 - | |
| 4.1 | IN 4 + | | 8.1 | IN 8 + | |
| 4.2 | IN 4 - | | 8.2 | IN 8 - | |

**Remark**

*The module returns positive value if the voltage on pin marked + is greater than voltage on pin marked –. Inputs are differential.*

# Input settings

Inputs can be switched to voltage or current mode. Mode is defined by the jumper on the module PCB. The jumper inserts precision 100 Ω resistor to the input.

| | **jumper J1–J8** |
|---|---|
| Voltage mode | open |
| Current mode | closed |

Input ranges can be defined for every input channel independently by the application program. Table below shows available measure range codes. Range code **0** is reserved and means that the input is switched off.

| Range code | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Voltage mode | ±10 V | ±5 V | ±2 V | ±1 V | ±0,5 V | ±0,2 V | ±0,1 V |
| Current mode | – | – | ±20 mA | ±10 mA | ±5 mA | ±2 mA | ±1 mA |
| Accuracy | 0,1 % | 0,1 % | 0,1 % | 0,1 % | 0,2 % | 0,3 % | 0,5 % |

| Range code | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|
| Voltage mode | 0-10 V | 0-5 V | 0-2 V | 0-1 V | 0-0,5 V | 0-0,2 V | 0-0,1 V |
| Current mode | – | – | 0-20 mA | 0-10 mA | 0-5 mA | 0-2 mA | 0-1 mA |
| Accuracy | 0,1 % | 0,1 % | 0,1 % | 0,1 % | 0,2 % | 0,3 % | 0,5 % |

Input ranges of AI3 analog input module

# Module parameters

| **Current input** | |
|---|---|
| **Input resistance** | 100 Ω |
| **Input range** | ±1 mA to ±20 mA (see table) |
| **Voltage input** | |
| **Input resistance** | 20 MΩ |
| **Input range** | ±0,1 V to ±10 V (see table) |
| **Sampling frequency** | |
| **Two and more inputs** | 50 Hz |
| **Single active input only** | 200 Hz |

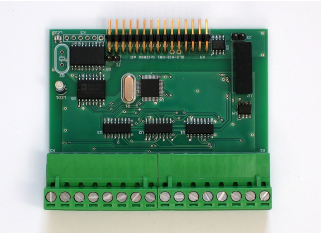
| **Conditions** | |
|---|---|
| **Operating temperature:** | 0 to +50° C |
| **Offset drift** | ±10 µV/° C |
| **Gain error drift** | ±30 ppm/° C |

## Ordering codes

| | |
|---|---|
| **DL–AI3** | **DataLab IO** analog input module |

# RTD1–Module for Resistive Temperature Detectors

4 inputs for Pt and Ni Resistive Temperature Detectors



- 4 inputs for Pt100, Pt1000 and Ni1000 detectors
- 16-bit delta-sigma converter
- Isolated signal part
- Two-wires of three-wires connection

The module is intended for temperature measurement using Resistive Temperature Detectors (RTD). Supported RTDs are Pt100, Pt1000 and Ni1000. It is possible to connect detectors with various Temperature Coefficient of Resistance (TCR) according to the IEC751, DIN60751 and DIN43760 standards. Detectors can be connected using two or three wires. Temperature range for Pt100 detectors is -50°C to +400°C. Temperature range for Pt1000 and Ni1000 detectors is -50°C to +200°C. The temperature range can be set for every input independently. Ranges are set by software using the provided **DataLab IO** device driver.

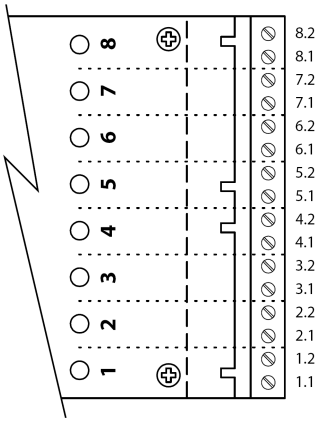
The module is able to sample data at frequency 50 Hz (50 samples per second) on one channel. If all 4 channels are measured, the sampling speed is 12,5 Hz.

It is not necessary to wait for the digital filter to settle down when only one channel is measured and the input multiplexer is not switched. The data sampling frequency is then 200 Hz. But keep on mind that the A/D converter is not able to pass the step over the full input range to its output at this speed. If the input voltage changes e.g. from −10 V to +10 V, the converter needs 4 cycles to propagate the step to the output. So the sampling frequency is again 50 Hz.

**Remark**

*The USB interface of **DataLab IO** devices can transfer data much faster than the RTD1 module can measure them. But faster communication with the device does not bring any advantages. More frequent read requests only causes more frequent communication of the same data.*

# Terminal connector description

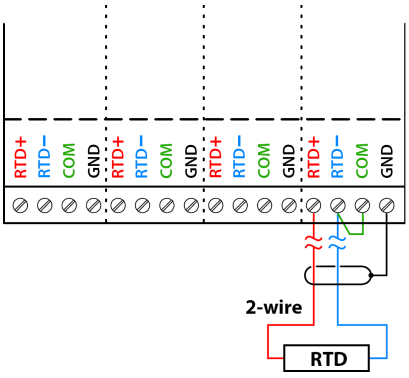



| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | RTD1 + | POWER | 5.1 | RTD3 + | |
| 1.2 | RTD1 - | | 5.2 | RTD3 - | |
| 2.1 | COM1 | | 6.1 | COM3 | |
| 2.2 | GND | | 6.2 | GND | |
| 3.1 | RTD2 + | | 7.1 | RTD4 + | |
| 3.2 | RTD2 - | | 7.2 | RTD4 - | |
| 4.1 | COM2 | | 8.1 | COM4 | |
| 4.2 | GND | | 8.2 | GND | |

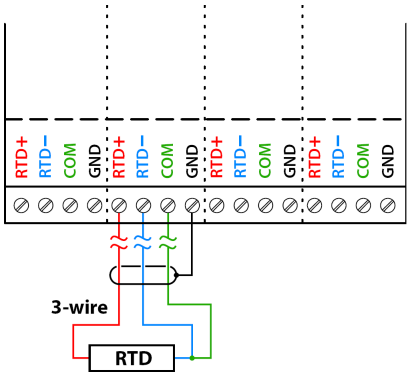
**Remark**

*The Resistive Temperature Detectors are independent on the voltage polarity. The + and – signs on the terminal connector only indicate the voltage polarity on individual connector pins.*

Temperature detectors connecting:




Two-wire connection




Tree-wire connection

The following table summarizes temperature ranges for various temperature detectors and their temperature coefficients (TCR). Numbers in brackets with the "H" letter suffix are in hexadecimal format. Range code **0** is reserved and can be used for switching off of the particular input measurement.

| Detector | TCR | Temperature range | | | | |
|---|---|---|---|---|---|---|
| | | -50 to +150°C | 0 to +100°C | 0 to +200°C | 0 to +400°C | -50 to +50°C |
| | | Range code | | | | |
| Pt100 | 3850 | 1 | 2 | 3 | 4 | 5 |
| | 3750 | 17 (11H) | 18 (12H) | 19 (13H) | 20 (14H) | 21 (15H) |
| | 3911 | 33 (21H) | 34 (22H) | 35 (23H) | 36 (24H) | 37 (25H) |
| | 3926 | 49 (31H) | 50 (32H) | 51 (33H) | 52 (34H) | 53 (35H) |
| Pt1000 | 3850 | 6 | 7 | – | 8 | 9 |
| | 3750 | 22 (16H) | 23 (17H) | – | 24 (18H) | 25 (19H) |
| | 3911 | 38 (26H) | 39 (27H) | – | 40 (28H) | 41 (29H) |
| | 3926 | 54 (36H) | 55 (37H) | – | 56 (38H) | 57 (39H) |
| Ni1000 | 5000 | 70 (46H) | 71 (47H) | – | 72 (48H) | 73 (49H) |
| | 6180 | 86 (56H) | 87 (57H) | – | 88 (58H) | 89 (59H) |
| | 6370 | 102 (66H) | 103 (67H) | – | 104 (68H) | 105 (69H) |
| | 6720 | 118 (76H) | 119 (77H) | – | 120 (78H) | 121 (79H) |

Codes of RTD1 module measure ranges

Table of resistance ranges for various temperature ranges and various sensor types:

| Detector | General temperature range | | | | |
|---|---|---|---|---|---|
| | -50 to +150°C | 0 to +100°C | 0 to +200°C | 0 to +400°C | -50 to +50°C |
| | Reference resistance range | | | | |
| Pt100 | 75 to 160 Ω | 91 to 150 Ω | 91 to 180 Ω | 91 to 240 Ω | 75 to 130 Ω |
| Pt1000 | 680 to 2000 Ω | 910 to 1800 Ω | – | 910 to 2500 Ω | 680 to 1300 Ω |
| Ni1000 | 680 to 2000 Ω | 910 to 1800 Ω | – | 910 to 2500 Ω | 680 to 1300 Ω |

Resistance ranges of RTD1

## Module parameters

| Temperature Coefficient of Resistance (TCR) | |
|---|---|
| **Pt100, Pt1000** | 3750, 3850, 3911, 3926 |
| **Ni1000** | 5000, 6180, 6370, 6720 |
| **Temperature Ranges** | |
| **Pt100** | -50 to +150°C, 0 to +100°C, 0 to +200°C, 0 to +400°C, -50 to +50°C |
| **Pt1000, Ni1000** | -50 to +150°C, 0 to +100°C, 0 to +200°C, -50 to +50°C |
| **Resistance Ranges** | |
| **Pt100** | 75 to 160Ω, 91 to 150Ω, 91 to 180Ω, 91 to 240Ω, 75 to 130Ω |
| **Pt1000, Ni1000** | 680 to 2000Ω, 910 to 1800Ω, 910 to 2500Ω, 680 to 1300Ω |

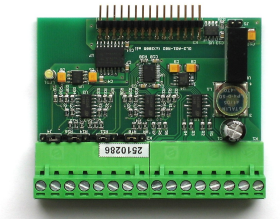
| Conditions | |
|---|---|
| **Operating temperature:** | 0 to +50° C |
| **Offset drift** | ±10 µV/° C |
| **Gain error drift** | ±30 ppm/° C |
| **Accuracy** | 0,3 % |

## Ordering codes

| | |
|---|---|
| **DL–RTD1** | **DataLab IO** module for resistive temperature detectors |

# AO1–Analog output module

8 of 12-bit isolated voltage or current analog outputs

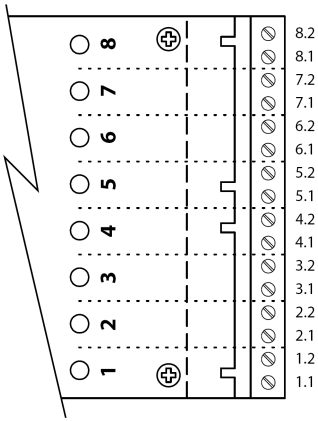


- 8 analog outputs with common ground
- Voltage outputs 0 to 10 V
- 4 outputs can be configured as current outputs 0 to 20 mA
- Isolated signal part
- 12-bit D/A converter

The AO1 module contains eight analog voltage outputs. First four of eight outputs can be configured as current outputs with range from 0 to 20 mA.

Limiting sample rate approx. 200 Hz is defined by the communication speed between host PC and **DataLab IO** device.

## Terminal connector description




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | OUT 1 + | POWER | 5.1 | OUT 5 + | |
| 1.2 | COM | | 5.2 | COM | |
| 2.1 | OUT 2 + | | 6.1 | OUT 6 + | |
| 2.2 | COM | | 6.2 | COM | |
| 3.1 | OUT 3 + | | 7.1 | OUT 7 + | |
| 3.2 | COM | | 7.2 | COM | |
| 4.1 | OUT 4 + | | 8.1 | OUT 8 + | |
| 4.2 | COM | | 8.2 | COM | |

# Output settings

Analog output module provides 8 voltage analog outputs with the range 0 to +10 V. D/A converter has 12-bit resolution. Each D/A converter count equals to 2,5 mV output voltage change.

**Remark**

*Because 12-bit resolution provides 4096 counts, 2,5 mV per count equals 10,24 V. If the output must not exceed 10 V, the software must not write value greater than 4000 to the output channel. When the driver is configured to use physical units (volts), such problem does not occur. For instance writing 10 to the output channel means the 10 V appears on the output pins.*

First four of eight outputs can be configured as current outputs with range from 0 to 20 mA using jumpers on the module PCB. Due to the high resolution of the DAC, the 4 to 20 mA range is implemented by software limitation of 0 to 20 mA range.

**Remark**

*The current source generates 20 mA when the DAC value is 3846 counts. Configuring the driver to use physical units (amperes) eliminates the necessity to recalculate written values. For instance writing 0.02 to the output channel means the current source will generate 20 mA current.*

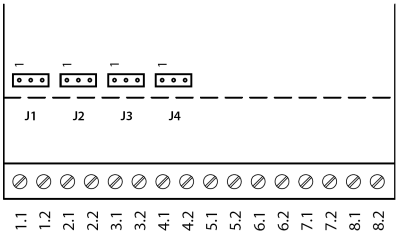
OUT 1 to OUT 4 output modes:

**Voltage output**


Jumper in position 1-2, range 0 V to +10 V.

**Current output**


Jumper in position 2-3, rang 0 mA to +20 mA.




Jumpers location on module PCB

## Module parameters

| Voltage output mode | |
|---|---|
| **Voltage** | 0 to +10 V DC |
| **Minimal resistance** | 1 kΩ |
| **Accuracy** | 1 % |
| **Offset drift** | ±50 µV/° C |
| **Current output mode** | |
| **Current** | 0 to +20 mA DC |
| **Maximal resistance** | 500 Ω |
| **Accuracy** | 5 % |
| **Offset drift** | ±0,4 µA/° C |

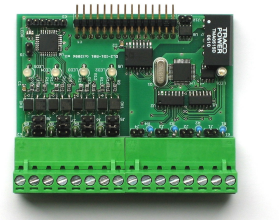
| Conditions | |
|---|---|
| **Operating temperature:** | 0 to +50° C |
| **Gain error drift** | ±40 ppm/° C |

## Ordering codes

| | |
|---|---|
| **DL–AO1** | **DataLab IO** analog output module |

# AD1–Combined analog input and digital input/output module

4 isolated differential 16-bit analog inputs, 4 isolated digital inputs/outputs



4 analog input channels

- 16-bit delta-sigma converter
- Bipolar differential inputs
- Bipolar and unipolar read modes
- Isolated signal part
- Voltage ranges ±0,1 V to ±10 V
- Current ranges ±1 mA to ±20 mA

4 digital input/output channels

- Direction selectable by jumpers
- Arbitrary polarity of all inputs
- Open-collector output transistors
- Mutual isolation of all inputs/outputs

The AD1 module provides four differential analog inputs, functionally equivalent to AI3 module. Jumpers on the PCB enable settings of voltage or current mode for each input individually. The module allows input range setting for individual inputs and switching each input off. Skipping of particular input speeds up the sampling frequency of remaining inputs.

The module is able to sample data at frequency 50 Hz (50 samples per second) on one channel. If all 4 channels are measured, the sampling speed is 12,5 Hz.

It is not necessary to wait for the digital filter to settle down when only one channel is measured and the input multiplexer is not switched. The data sampling frequency is then 200 Hz. But keep on mind that the A/D converter is not able to pass the step over the full input range to its output at this speed. If the input voltage changes e.g. from -10 V to +10 V, the converter needs 4 cycles to propagate the step to the output. So the sampling frequency is again 50 Hz.

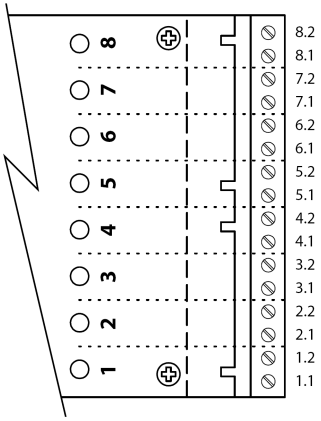
**Remark**

*The USB interface of* ***DataLab IO*** *devices can transfer data much faster than the AD1 module can measure them. But faster communication with the device does not bring any advantages. More frequent read requests only causes more frequent communication of the same data.*

The AD1 module also contains four digital input/output channels. The module contains a set of jumpers on the PCB, which allow choosing of channel direction (input or output) and channel input resistance (low voltage or high voltage) for the input direction. Every channel can be switched independently so the actual number of inputs and outputs is chosen by the user.

Digital inputs are bipolar and they can be read in two modes – DC and AC. Reading the channel in DC mode returns the actual logical value according to the voltage present on the terminal connector pins. AC inputs are evaluated the same way like in the case of digital input modules.

## Terminal connector description




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | DIO 1 + | LED 1 | 5.1 | AIN 1 + | |
| 1.2 | DIO 1 - | | 5.2 | AIN 1 - | |
| 2.1 | DIO 2 + | LED 2 | 6.1 | AIN 2 - | |
| 2.2 | DIO 2 - | | 6.2 | AIN 2 - | |
| 3.1 | DIO 3 + | LED 3 | 7.1 | AIN 3 - | |
| 3.2 | DIO 3 - | | 7.2 | AIN 3 - | |
| 4.1 | DIO 4 + | LED 4 | 8.1 | AIN 4 - | POWER |
| 4.2 | DIO 4 - | | 8.2 | AIN 4 - | |

**Remark**

- *The module returns positive value if the voltage on pin marked + is greater than voltage on pin marked – . Inputs are differential.*
- *Digital outputs have the switching transistor collector connected to the + marked pin and emitter is connected to the – marked pin.*
- *LED 1, LED 2, LED 3 and LED 4 diodes indicate states of the digital inputs/outputs. High state of digital inputs is indicated by the green light, and high state of the digital output is indicated by the yellow light.*

# Digital input/output settings

The direction and input resistance (and corresponding voltage levels for logical true and false) can be switched by the four jumpers **J5** to **J8** on the module PCB associated with each digital input/output.

**Digital input**


Input resistance 470 Ω

**Digital input**


Input resistance 5170 Ω.

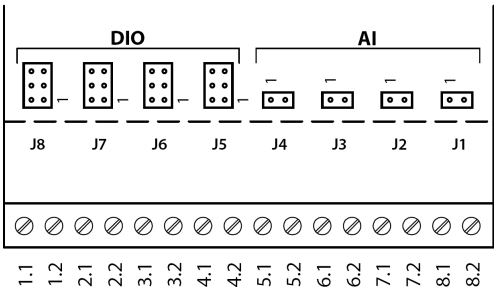
**Digital output**

# Analog input settings

Inputs can be switched to voltage or current mode. Mode is defined by the jumper on the module PCB. The jumper inserts precision 100 Ω resistor to the input.

| | **jumper J1–J4** |
|---|---|
| Voltage mode | open |
| Current mode | closed |

Input ranges can be defined for every input channel independently by the application program. Table below shows available measure range codes. Range code **0** is reserved and means that the input is switched off.




Jumpers location on module PCB

| Range code | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Voltage mode | ±10 V | ±5 V | ±2 V | ±1 V | ±0,5 V | ±0,2 V | ±0,1 V |
| Current mode | – | – | ±20 mA | ±10 mA | ±5 mA | ±2 mA | ±1 mA |
| Accuracy | 0,1 % | 0,1 % | 0,1 % | 0,1 % | 0,2 % | 0,3 % | 0,5 % |

| Range code | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|
| Voltage mode | 0-10 V | 0-5 V | 0-2 V | 0-1 V | 0-0,5 V | 0-0,2 V | 0-0,1 V |
| Current mode | – | – | 0-20 mA | 0-10 mA | 0-5 mA | 0-2 mA | 0-1 mA |
| Accuracy | 0,1 % | 0,1 % | 0,1 % | 0,1 % | 0,2 % | 0,3 % | 0,5 % |

Input ranges of AD1 analog input module

## Module parameters

| Current analog input | |
|---|---|
| **Input resistance** | 100 Ω |
| **Input range** | ±1 mA to ±20 mA (see table) |
| **Voltage analog input** | |
| **Input resistance** | 20 MΩ |
| **Input range** | ±0,1 V to ±10 V (see table) |
| **Sampling frequency of analog inputs** | |
| **Two and more inputs** | 50 Hz |
| **Single active input only** | 200 Hz |

| Low-voltage digital input | |
|---|---|
| **Input resistance** | 470 Ω |
| **Logical zero (false)** | 0 to 1 V |
| **Logical one (true)** | 2 to 5 V |
| **High-voltage digital input** | |
| **Input resistance** | 5170 Ω |
| **Logical zero (false)** | 0 to 3,5 V |
| **Logical one (true)** | 7 to 30 V |

| Digital output | |
|---|---|
| **Maximal voltage** | 350 V |
| **Maximal current** | 150 mA |
| **Maximal power dissipation** | 150 mW |

## Module parameters *(continuing)*

| Conditions | |
|---|---|
| **Operating temperature:** | 0 to +50° C |
| **Offset drift** | ±10 µV/° C |
| **Gain error drift** | ±30 ppm/° C |

## Ordering codes

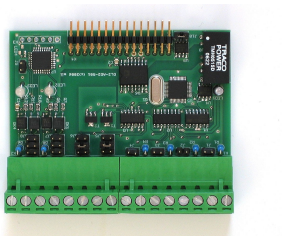
| | |
|---|---|
| **DL−AD1** | **DataLab IO** analog input and digital input/output module |

# AD2–Combined analog input/output and digital input/output module

4 isolated differential 16-bit analog inputs

2 isolated 8-bit voltage or current analog outputs, 2 isolated digital inputs/outputs

---



4 analog input channels

- 16-bit delta-sigma converter
- Bipolar differential inputs
- Bipolar and unipolar read modes
- Isolated signal part
- Voltage ranges ±0,1 V to ±10 V
- Current ranges ±1 mA to ±20 mA

2 analog outputs

- 8-bit D/A converter
- Analog outputs with common ground
- Configurable voltage or current outputs
- Isolated signal part
- Voltage outputs 0 to 10 V
- Current outputs 0 to 20 mA

2 digital input/output channels

- Direction selectable by jumpers
- Arbitrary polarity of all inputs
- Open-collector output transistors
- Mutual isolation of all inputs/outputs

The AD2 module provides four differential analog inputs, functionally equivalent to AI3 module. Jumpers on the PCB enable settings of voltage or current mode for each input individually. The module allows input range setting for individual inputs and switching

each input off. Skipping of particular input speeds up the sampling frequency of remaining inputs.

The module is able to sample data at frequency 50 Hz (50 samples per second) on one channel. If all 4 channels are measured, the sampling speed is 12,5 Hz.

It is not necessary to wait for the digital filter to settle down when only one channel is measured and the input multiplexer is not switched. The data sampling frequency is then 200 Hz. But keep on mind that the A/D converter is not able to pass the step over the full input range to its output at this speed. If the input voltage changes e.g. from -10 V to +10 V, the converter needs 4 cycles to propagate the step to the output. So the sampling frequency is again 50 Hz.

**Remark**

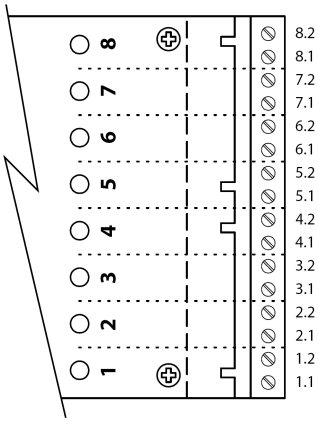
*The USB interface of* ***DataLab IO*** *devices can transfer data much faster than the AD2 module can measure them. But faster communication with the device does not bring any advantages. More frequent read requests only causes more frequent communication of the same data.*

The AD2 module has 2 analog outputs with 8-bit D/A converter. Both outputs can be switched to voltage or current mode by the jumpers on the module PCB. The voltage range is 0 to +10 V, current range is 0 to 20 mA. Maximum sampling rate is 200 Hz on the USB 1.1 Full-speed connection and 3.3 kHz on the USB 2.0 High-speed connection. The sampling rate is limited by the communication speed between the **DataLab IO** device and host PC and also by the controlling program itself.

The AD2 module also contains two digital input/output channels. The module contains a set of jumpers on the PCB, which allow choosing of channel direction (input or output) and channel input resistance (low voltage or high voltage) for the input direction. Every channel can be switched independently so the actual number of inputs and outputs is chosen by the user.

Digital inputs are bipolar and they can be read in two modes – DC and AC. Reading the channel in DC mode returns the actual logical value according to the voltage present on the terminal connector pins. AC inputs are evaluated the same way like in the case of digital input modules

# Terminal connector description




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | DIO 1 + | LED 1 | 5.1 | AIN 1 + | |
| 1.2 | DIO 1 - | | 5.2 | AIN 1 - | |
| 2.1 | DIO 2 + | LED 2 | 6.1 | AIN 2 - | |
| 2.2 | DIO 2 - | | 6.2 | AIN 2 - | |
| 3.1 | AO 1 + | | 7.1 | AIN 3 - | |
| 3.2 | AO 1 - | | 7.2 | AIN 3 - | |
| 4.1 | AO 2 + | | 8.1 | AIN 4 - | POWER |
| 4.2 | AO 2 - | | 8.2 | AIN 4 - | |

**Remark**

- *The module returns positive value if the voltage on pin marked + is greater than voltage on pin marked – . Inputs are differential.*
- *Digital outputs have the switching transistor collector connected to the + marked pin and emitter is connected to the – marked pin.*
- *LED 1 and LED 2 diodes indicate states of the digital inputs/outputs. High state of digital inputs is indicated by the green light, and high state of the digital output is indicated by the yellow light.*
- *Terminals 3.2 and 4.2 are interconnected on PCB.*

# Digital input/output settings

The direction and input resistance (and corresponding voltage levels for logical true and false) can be switched by the four jumpers **J7** and **J8** on the module PCB associated with each digital input/output.

**Digital input**


Input resistance 470 Ω

**Digital input**


Input resistance 5170 Ω.

**Digital output**

# Analog input settings

Inputs can be switched to voltage or current mode. Mode is defined by the jumper on the module PCB. The jumper inserts precision 100 Ω resistor to the input.

| | **jumper J1–J4** |
|---|---|
| Voltage mode | open |
| Current mode | closed |

Input ranges can be defined for every input channel independently by the application program. Table below shows available measure range codes. Range code **0** is reserved and means that the input is switched off.

| Range code | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Voltage mode | ±10 V | ±5 V | ±2 V | ±1 V | ±0,5 V | ±0,2 V | ±0,1 V |
| Current mode | – | – | ±20 mA | ±10 mA | ±5 mA | ±2 mA | ±1 mA |
| Accuracy | 0,1 % | 0,1 % | 0,1 % | 0,1 % | 0,2 % | 0,3 % | 0,5 % |

| Range code | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|
| Voltage mode | 0-10 V | 0-5 V | 0-2 V | 0-1 V | 0-0,5 V | 0-0,2 V | 0-0,1 V |
| Current mode | – | – | 0-20 mA | 0-10 mA | 0-5 mA | 0-2 mA | 0-1 mA |
| Accuracy | 0,1 % | 0,1 % | 0,1 % | 0,1 % | 0,2 % | 0,3 % | 0,5 % |

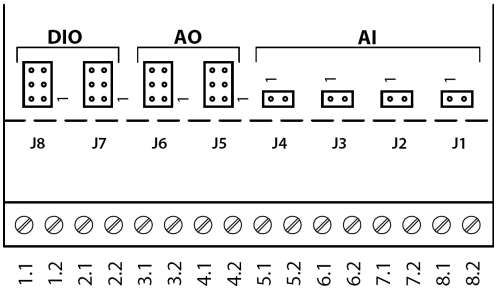
Input ranges of AD2 analog input module

# Analog output settings

Both outputs can work in voltage or current mode. Mode is selected by the jumpers **J5** and **J6** on the module PCB independently for both outputs.

**Voltage output 0 to 10 V**


**Current output 0 to 20 mA**


Jumpers location on module PCB

**Remark**

*Because 8-bit resolution provides 256 counts, 41,5 mV per count equals 10,625 V. If the output must not exceed 10 V, the software must not write value greater than 241 to the output channel. When the driver is configured to use physical units (volts), such problem does not occur. For instance writing 10 to the output channel means the 10 V appears on the output pins.*

*The maximum D/A converter value (255) corresponds to 21,25 mA in the current mode (one D/A converter step corresponds to 0,083 mA). So it is necessary to write output value 241 to generate 20 mA output current.*

## Module parameters

| **Current analog input** | |
|---|---|
| **Input resistance** | 100 Ω |
| **Input range** | ±1 mA to ±20 mA (see table) |
| **Voltage analog input** | |
| **Input resistance** | 20 MΩ |
| **Input range** | ±0,1 V to ±10 V (see table) |
| **Sampling frequency of analog inputs** *(limited by speed of A/D converter)* | |
| **Two and more inputs** | 50 Hz |
| **Single active input only** | 200 Hz |

| **Voltage analog output** | |
|---|---|
| **Voltage** | 0 to +10 V DC |
| **Minimal resistance** | 1 kΩ |
| **Accuracy** | 5 % |
| **Current analog output** | |
| **Current** | 0 to +20 mA DC |
| **Maximal resistance** | 500 Ω |
| **Accuracy** | 5 % |
| **Analog output sampling rate** *(limited by communication speed)* | |
| **USB 1.1** | 200 Hz |
| **USB 2.0** | 3,3 kHz |

## Module parameters *(continuing)*

| Low-voltage digital input | |
|---|---|
| **Input resistance** | 470 Ω |
| **Logical zero (false)** | 0 to 1 V |
| **Logical one (true)** | 2 to 5 V |
| **High-voltage digital input** | |
| **Input resistance** | 5170 Ω |
| **Logical zero (false)** | 0 to 3,5 V |
| **Logical one (true)** | 7 to 30 V |

| Digital output | |
|---|---|
| **Maximal voltage** | 350 V |
| **Maximal current** | 150 mA |
| **Maximal power dissipation** | 150 mW |

| Conditions | |
|---|---|
| **Operating temperature:** | 0 to +50° C |
| **Voltage offset drift** | ±50 µV/° C |
| **Current offset drift** | ±0,4 µA/° C |
| **Gain error drift** | ±40 ppm/° C |

## Ordering codes

| | |
|---|---|
| **DL−AD2** | **DataLab IO** analog input/output and digital input/output module |

# AIO1–Combined analog input/output

4 isolated differential 16-bit analog inputs

4 isolated 12-bit voltage or current analog outputs

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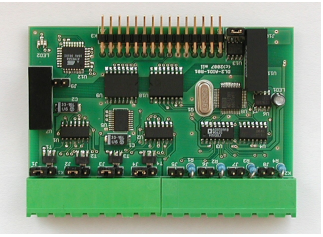


4 analog input channels

- 16-bit delta-sigma converter
- Bipolar differential inputs
- Bipolar and unipolar read modes
- Isolated signal part
- Voltage ranges ±0,1 V to ±10 V
- Current ranges ±1 mA to ±20 mA

4 analog outputs

- 8-bit D/A converter
- Analog outputs with common ground
- Configurable voltage or current outputs
- Isolated signal part
- Voltage range 0 to 10 V
- Current range 0 to 20 mA

The AIO1 module provides four differential analog inputs, functionally equivalent to AI3 module. Jumpers on the PCB enable settings of voltage or current mode for each input individually. The module allows input range setting for individual inputs and switching each input off. Skipping of particular input speeds up the sampling frequency of remaining inputs.

The module is able to sample data at frequency 50 Hz (50 samples per second) on one channel. If all 4 channels are measured, the sampling speed is 12,5 Hz.

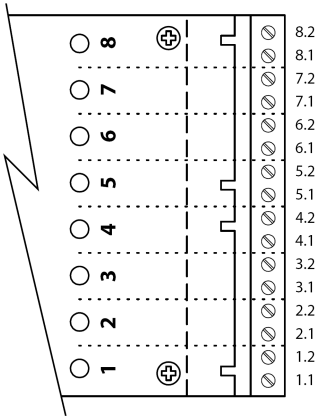
It is not necessary to wait for the digital filter to settle down when only one channel is measured and the input multiplexer is not switched. The data sampling frequency is then 200 Hz. But keep on mind that the A/D converter is not able to pass the step over the full input range to its output at this speed. If the input voltage changes e.g. from -10 V to +10 V, the converter needs 4 cycles to propagate the step to the output. So the sampling frequency is again 50 Hz.

**Remark**

*The USB interface of* ***DataLab IO*** *devices can transfer data much faster than the AIO1 module can measure them. But faster communication with the device does not bring any advantages. More frequent read requests only causes more frequent communication of the same data.*

The AIO1 module has 4 analog outputs with 12-bit D/A converter. All outputs can be switched to voltage or current mode by the jumpers on the module PCB. The voltage range is 0 to +10 V, current range is 0 to 20 mA. Maximum sampling rate is 200 Hz on the USB 1.1 Full-speed connection and 3.3 kHz on the USB 2.0 High-speed connection. The sampling rate is limited by the communication speed between the **DataLab IO** device and host PC and also by the controlling program itself.

# Terminal connector description




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | AO 1 + | | 5.1 | AIN 1 + | |
| 1.2 | AO 1 - | | 5.2 | AIN 1 - | |
| 2.1 | AO 2 + | | 6.1 | AIN 2 - | |
| 2.2 | AO 2 - | | 6.2 | AIN 2 - | |
| 3.1 | AO 3 + | | 7.1 | AIN 3 - | |
| 3.2 | AO 3 - | | 7.2 | AIN 3 - | |
| 4.1 | AO 4 + | | 8.1 | AIN 4 - | POWER |
| 4.2 | AO 4 - | | 8.2 | AIN 4 - | |

**Remark**

- *The module returns positive value if the voltage on pin marked + is greater than voltage on pin marked – . Inputs are differential.*
- *Terminals 1.2, 2.2, 3.2 and 4.2 are interconnected on PCB.*

# Analog input settings

Inputs can be switched to voltage or current mode. Mode is defined by the jumper on the module PCB. The jumper inserts precision 100 Ω resistor to the input.

| | **jumper J5–J8** |
|---|---|
| Voltage mode | open |
| Current mode | closed |

Input ranges can be defined for every input channel independently by the application program. Table below shows available measure range codes. Range code **0** is reserved and means that the input is switched off.

| Range code | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Voltage mode | ±10 V | ±5 V | ±2 V | ±1 V | ±0,5 V | ±0,2 V | ±0,1 V |
| Current mode | – | – | ±20 mA | ±10 mA | ±5 mA | ±2 mA | ±1 mA |
| Accuracy | 0,1 % | 0,1 % | 0,1 % | 0,1 % | 0,2 % | 0,3 % | 0,5 % |

| Range code | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|
| Voltage mode | 0-10 V | 0-5 V | 0-2 V | 0-1 V | 0-0,5 V | 0-0,2 V | 0-0,1 V |
| Current mode | – | – | 0-20 mA | 0-10 mA | 0-5 mA | 0-2 mA | 0-1 mA |
| Accuracy | 0,1 % | 0,1 % | 0,1 % | 0,1 % | 0,2 % | 0,3 % | 0,5 % |

Input ranges of AIO1 analog input module

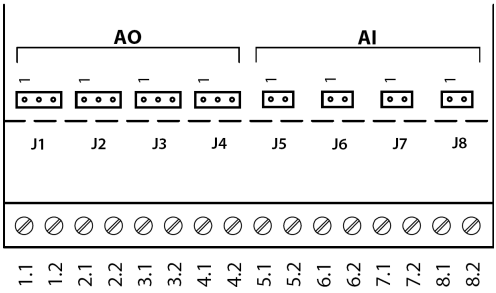
# Analog output settings

The AIO1 module has 4 voltage or current output channels. The voltage output range is 0 to 10 V, current output range is 0 to 20 mA. The resolution of D/A converter is 12 bits. One D/A converter step corresponds to 2,5 mV on voltage output and 0,005 mA on current output.

Both outputs can work in voltage or current mode. Mode is selected by the jumpers **J1** to **J4** on the module PCB independently for both outputs.

**Voltage output 0 to 10 V**


**Current output 0 to 20 mA**


Jumpers location on module PCB

**Remark**

*Because 12-bit resolution provides 4096 counts, 2,5 mV per count equals 10,24 V. If the output must not exceed 10 V, the software must not write value greater than 4000 to the output channel. When the driver is configured to use physical units (volts), such problem does not occur. For instance writing 10 to the output channel means the 10 V appears on the output pins.*

*The maximum D/A converter value (4095) corresponds to 20,48 mA in the current mode (one D/A converter step corresponds to 0,005 mA). So it is necessary to write output value 4000 to generate 20 mA output current.*

# Module parameters

| **Current analog input** | |
|---|---|
| **Input resistance** | 100 Ω |
| **Input range** | ±1 mA to ±20 mA (see table) |
| **Voltage analog input** | |
| **Input resistance** | 20 MΩ |
| **Input range** | ±0,1 V to ±10 V (see table) |
| **Sampling frequency of analog inputs** *(limited by speed of A/D converter)* | |
| **Two and more inputs** | 50 Hz |
| **Single active input only** | 200 Hz |

| **Voltage analog output** | |
|---|---|
| **Voltage** | 0 to +10 V DC |
| **Minimal resistance** | 1 kΩ |
| **Accuracy** | 1 % |
| **Current analog output** | |
| **Current** | 0 to +20 mA DC |
| **Maximal resistance** | 500 Ω |
| **Accuracy** | 2 % |
| **Analog output sampling rate** *(limited by communication speed)* | |
| **USB 1.1** | 200 Hz |
| **USB 2.0** | 3,3 kHz |

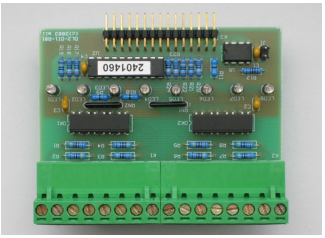
| **Conditions** | |
|---|---|
| **Operating temperature:** | 0 to +50° C |
| **Voltage offset drift** | ±50 µV/° C |
| **Current offset drift** | ±0,4 µA/° C |
| **Gain error drift** | ±40 ppm/° C |

## Ordering codes

| | |
|---|---|
| **DL–AIO1** | **DataLab IO** analog input/output and digital input/output module |

# DI1–Digital input module

8 isolated independent digital inputs



- 8 digital input channels
- Arbitrary polarity of all inputs
- Mutual isolation of all inputs

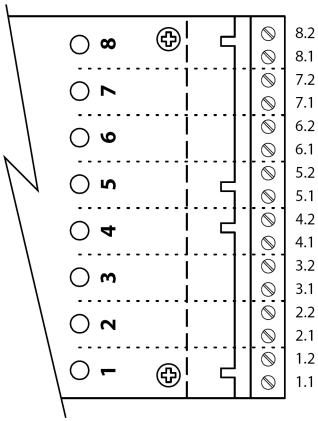
The DI1 module contains 8 mutually isolated digital inputs. LED indicates logical “true” on particular input.

Optical isolation is independent on the signal polarity so it is possible to read also AC inputs. The rules for evaluation of logical “true” and “false” states for AC inputs are:

- Inputs are sampled at 1 kHz.
- If the voltage of any polarity occurs on the terminal connector, the logical 1 (true) value is returned from the time of the first sample, which detects it. This means logical 0 (false) can be read up to 1 ms from the time of the voltage occurrence.
- If the voltage disappears from the terminal connector, logical 1 (true) is read for the following 10 ms. When no one sample indicates voltage on the input for 10 ms, the read value becomes logical 0 (false) again. The 10 ms delay corresponds to one half-wave of 50 Hz AC signal, which means zero crossings of the 50 Hz or 60 Hz signal do not cause switch to 0.

The module is available in two variants for two input signal levels. The DI1L variant is designed for 0 to 18 V input range (input rezistance is 1000 Ω), DI1H variant is designed for 0 to 35 V input range (input rezistance is 4700 Ω).

## Terminal connector description




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | DI 1 | LED 1 | 5.1 | DI 5 | LED 5 |
| 1.2 | DI 1 | | 5.2 | DI 5 | |
| 2.1 | DI 2 | LED 2 | 6.1 | DI 6 | LED 6 |
| 2.2 | DI 2 | | 6.2 | DI 6 | |
| 3.1 | DI 3 | LED 3 | 7.1 | DI 7 | LED 7 |
| 3.2 | DI 3 | | 7.2 | DI 7 | |
| 4.1 | DI 4 | LED 4 | 8.1 | DI 8 | LED 8 |
| 4.2 | DI 4 | | 8.2 | DI 8 | |

## Module parameters

| **DI1L parameters** | |
|---|---|
| **Input resistance** | 1000 Ω |
| **Logical zero (false)** | 0 to 1 V |
| **Logical one (true)** | 3 to 18 V |
| **DI1H parameters** | |
| **Input resistance** | 4700 Ω |
| **Logical zero (false)** | 0 to 3 V |
| **Logical one (true)** | 8 to 35 V |

| **Conditions** | |
|---|---|
| **Operating temperature:** | 0 to +50° C |

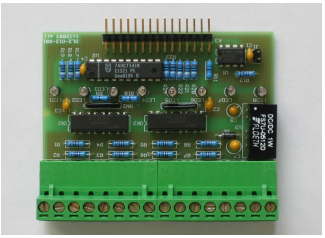
## Ordering codes

| | |
|---|---|
| **DL–DI1L** | **DataLab IO** digital input module, range 0 – 18 V |
| **DL–DI1H** | **DataLab IO** digital input module, range 0 – 35 V |

# DI2–Digital input module with common ground

8 isolated digital inputs with common ground

- 8 digital input channels
- Common ground
- Arbitrary polarity of all inputs
- Power supply for passive contacts
- Isolation of signal side

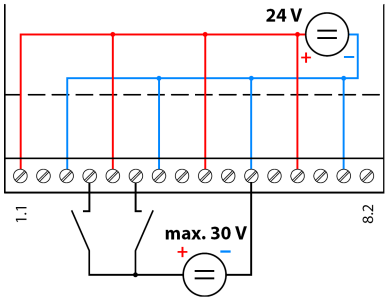


The DI2 module contains 8 digital inputs with common ground. Inputs can be used in passive mode, in which they are powered by the module's isolated power supply. The module is then capable to read inputs from passive switches. Signal part is isolated from the CPU module. LED indicates logical “true” on particular input.

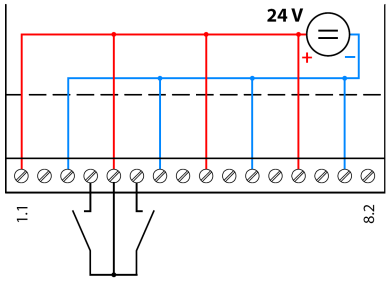
Optical isolation is independent on the signal polarity so it is possible to read also AC inputs. The rules for evaluation of AC inputs are the same as for DI1 module

The module is available in two variants for two input signal levels. The DI2L variant is designed for 0 to 18 V input range (input rezistance is 1000 Ω), DI2H variant is designed for 0 to 35 V input range (input rezistance is 4700 Ω).

Using inputs as passive or active:

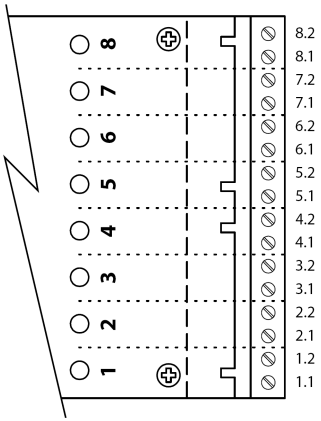



Passive mode (for active inputs)




Active mode (for passive inputs)

# Terminal connector description




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | COM + | LED 1 | 5.1 | COM + | LED 5 |
| 1.2 | DI 1 | | 5.2 | DI 5 | |
| 2.1 | GND | LED 2 | 6.1 | GND | LED 6 |
| 2.2 | DI 2 | | 6.2 | DI 6 | |
| 3.1 | COM + | LED 3 | 7.1 | COM + | LED 7 |
| 3.2 | DI 3 | | 7.2 | DI 7 | |
| 4.1 | GND | LED 4 | 8.1 | GND | LED 8 |
| 4.2 | DI 4 | | 8.2 | DI 8 | |

There is 24VDC available on COM+ pins for active mode (can be used for detection of logical state of simple switches). GND pins are connected to common ground.

Both modes of terminal wiring can be combined.

## Module parameters

| DI2L parameters | |
|---|---|
| **Input resistance** | 1000 Ω |
| **Logical zero (false)** | 0 to 1 V |
| **Logical one (true)** | 3 to 18 V |
| **DI2H parameters** | |
| **Input resistance** | 4700 Ω |
| **Logical zero (false)** | 0 to 3 V |
| **Logical one (true)** | 8 to 35 V |

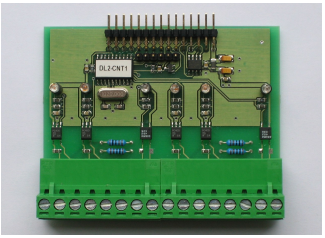
| Conditions | |
|---|---|
| **Operating temperature:** | 0 to +50° C |

## Ordering codes

| | |
|---|---|
| **DL–DI2L** | **DataLab IO** digital input module with common ground, range 0 – 18 V |
| **DL–DI2H** | **DataLab IO** digital input module with common ground, range 0 – 35 V |

# CNT1–Digital counter input module

4 isolated digital counters



- 4 isolated digital counters
- 24-bit counter range (0 to 16777215)
- 25 kHz maximal input frequency with 1:1 duty cycle
- Two counters with alarm output signaling exceeding of the predefined value
- Two counters with external counting enable (gate) signal

The CNT1 module contains 4 counters with 24-bit range (numerical range of each counter is 0 to 16777215). The first two counters have more configuration options compared to the second couple of counters (third and fourth counters functionality is limited to simple counting with the possibility to read and preset counter value). Counter modes (counting enable, logical signal levels etc.) are defined by software. Modes and configuration options are thoroughly described in the **DataLab IO** Active X and ***Control Web*** driver.

Function of the first two counters (number 0 and 1) can be enhanced:

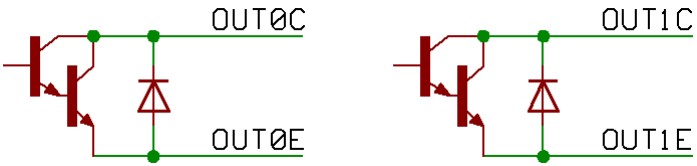
- Alarm output can be set when counter value exceeds defined value. Output logic (if active high or low) can be defined in the counter configuration.
- Counting can be enabled/disabled by the external input (gate). Gate logic (if active high or low) can be defined in the counter configuration. Inputs of the last two counters are used as gate inputs for first two counters. (counter 2 input works as gate for counter 0 and counter 3 input works as gate for counter 1).

Limit frequency ensuring error-free counting if 25 kHz when the signal has 1:1 duty cycle. If the duty cycle is not 1:1, limiting frequency is lower, because the input signal must stay in each logical state for at last 20 µs. For instance the limiting frequency is 10 kHz for the 1:4 duty cycle.

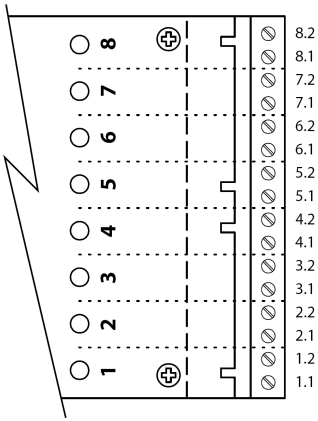
# Terminal connector description

Each logical input has assigned three pins on the terminal connector: negative pin (marked IN*x* –) and two pins with different input voltages – TTL ompatible input (marked IN*x*L +) and 24 V input (marked IN*x*H +). Note that the low-voltage input is TTL compatible from the voltage levels point of view, but it requires higher current (see the Module parameters). The negative pin is common for both input pins. Individual counter inputs are mutually isolated.

OUT0 and OUT1 alarm outputs are connected according to the following schematic diagram:




Schematic diagram of alarm outputs




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | IN 0 – | LED 1 | 5.1 | IN 1 – | LED 5 |
| 1.2 | IN 0L + | | 5.2 | IN 1L + | |
| 2.1 | IN 2 – | LED 2 | 6.1 | IN 3 – | LED 6 |
| 2.2 | IN 2L + | | 6.2 | IN 3L + | |
| 3.1 | IN 0H + | | 7.1 | IN 1H + | |
| 3.2 | IN 2H + | | 7.2 | IN 3H + | |
| 4.1 | OUT 0E | LED 4 | 8.1 | OUT 1E | LED 8 |
| 4.2 | OUT 0C | | 8.2 | OUT 1C | |

## Module parameters

| INxL parameters | |
|---|---|
| **Input resistance** | 330 Ω |
| **Logical zero (false)** | 0 to 1 V |
| **Logical one (true)** | 3 to 8 V |
| **INxH parameters** | |
| **Input resistance** | 1330 Ω |
| **Logical zero (false)** | 0 to 2 V |
| **Logical one (true)** | 8 to 30 V |
| **OUTxE and OUTxC output parameters** | |
| **Maximal voltage** | 350 V |
| **Maximal current** | 150 mA |
| **Maximal power dissipation** | 150 mW |

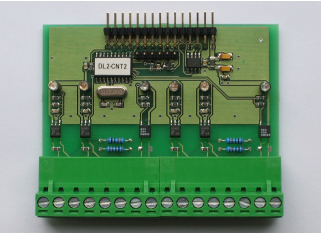
| Conditions | |
|---|---|
| **Operating temperature:** | 0 to +50° C |

## Ordering codes

| | |
|---|---|
| **DL–CNT1** | **DataLab IO** digital counter input module |

# CNT2–Incremental counter module

1 isolated incremental counter



- 1 incremental counter
- Quadrature modulation decoder
- Up/down and step/direction counting
- 32-bit range (-2147483648 to 2147483647)
- 25 kHz maximal input frequency
  with 1:1 duty cycle
- Two logical outputs signaling underflow and overflow of defined values
- Logical input for counter value preset
- Logical input for counter value capture

The CNT2 contains one incremental counter with 32-bit precision (counter numerical range is –2147483648 to 2147483647). The counter is able to decode quadrature modulation from position/angle sensors as well as to work in up/down and step/direction modes. The counter is also capable to preset counter value and capture value according to logical inputs and to signal alarm outputs if the counter value underflows low limit or overflows high limit. Modes and configuration options are thoroughly described in the **DataLab IO** Active X and ***Control Web*** driver documentation.

Limit frequency ensuring error-free counting if 25 kHz when the signal has 1:1 duty cycle. If the duty cycle is not 1:1, limiting frequency is lower, because the input signal must stay in each logical state for at last 20 µs. For instance the limiting frequency is 10 kHz for the 1:4 duty cycle.

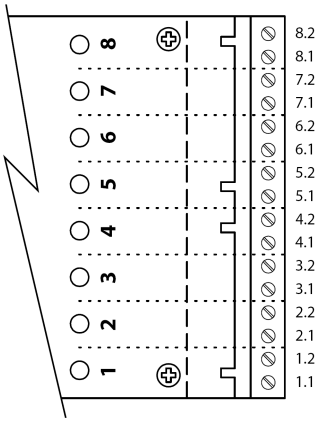
# Terminal connector description

Each logical input has assigned three pins on the terminal connector: negative pin (marked e.g. A –) and two pins with different input voltages – TTL compatible input (marked AL +) and 24 V input (AH +). Note that the low-voltage input is TTL compatible from the voltage levels point of view, but it requires higher current (see the Module parameters).

The A input increments while the B input decrements the counter value in the up/down mode. A input works as step and B input as direction in the step/direction mode.

Alarm outputs alarm_lo and alarm_hi interconnection is the same as the OUT0 and OUT1 outputs of the CNT1 counter board. See the schematic diagram in the CNT1 board description for reference.

The negative pin is common for both input pins. Individual counter inputs are mutually isolated.




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | A – | LED 1 | 5.1 | B – | LED 5 |
| 1.2 | AL + | | 5.2 | BL + | |
| 2.1 | capture – | LED 2 | 6.1 | preset – | LED 6 |
| 2.2 | captureL + | | 6.2 | presetL + | |
| 3.1 | AH + | | 7.1 | BH + | |
| 3.2 | captureH + | | 7.2 | presetH + | |
| 4.1 | alarm_lo E | LED 4 | 8.1 | alarm_hi E | LED 8 |
| 4.2 | alarm_lo C | | 8.2 | alarm_hi C | |

## Module parameters

| AL, BL, captureL and presetL parameters | |
|---|---|
| **Input resistance** | 330 Ω |
| **Logical zero (false)** | 0 to 1 V |
| **Logical one (true)** | 3 to 8 V |
| **AH, BH, captureH and presetH parameters** | |
| **Input resistance** | 1330 Ω |
| **Logical zero (false)** | 0 to 2 V |
| **Logical one (true)** | 8 to 30 V |
| **alarm_loE, alarm_loC, alarm_hiE and alarm_hiC output parameters** | |
| **Maximal voltage** | 350 V |
| **Maximal current** | 150 mA |
| **Maximal power dissipation** | 150 mW |

| Conditions | |
|---|---|
| **Operating temperature:** | 0 to +50° C |

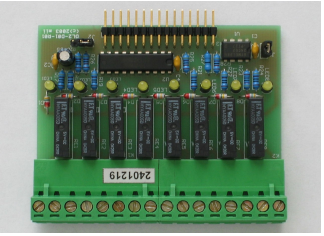
## Ordering codes

| | |
|---|---|
| **DL–CNT2** | **DataLab IO** incremental counter module |

# DO1–Relay digital output module

8 throw relay outputs

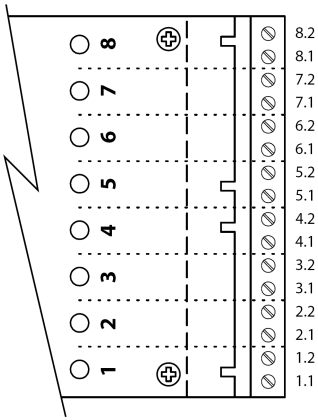
- 8 relay binary output channels
- Relays with throw contacts
- Rating (resistive) 3 A/60 V (AC), 3 A/30 V (DC)



The DO1 module contains 8 relays with throw contacts. Outputs are mutually isolated. LED indicates logical “true” on particular output.

Maximal frequency (switch on – switch off cycle) is defined by the relays. Theoretical maximal frequency is 50 Hz. The communication delay between the **DataLab IO** device and the host PC take approx. 4 ms, which can be easily ignored.

## Terminal connector description




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | RO 1 | LED 1 | 5.1 | RO 5 | LED 5 |
| 1.2 | RO 1 | | 5.2 | RO 5 | |
| 2.1 | RO 2 | LED 2 | 6.1 | RO 6 | LED 6 |
| 2.2 | RO 2 | | 6.2 | RO 6 | |
| 3.1 | RO 3 | LED 3 | 7.1 | RO 7 | LED 7 |
| 3.2 | RO 3 | | 7.2 | RO 7 | |
| 4.1 | RO 4 | LED 4 | 8.1 | RO 8 | LED 8 |
| 4.2 | RO 4 | | 8.2 | RO 8 | |

## Module parameters

| | |
|---|---|
| **Rating (resistive) – AC** | 60 V/ 3 A |
| **Rating (resistive) – DC** | 30 V/ 3 A |
| **On resistance (initial)** | 30 mΩ |
| **Life (mechanical)** | $2\times10^7$ cycles at 5 Hz |
| **Life (electrical)** | $1\times10^5$ cycles at 0,16 Hz |
| **Off resistance (initial)** | min. 1000 MΩ (at 500 V DC) |
| **Dielectric strength between open contacts** | 750 V AC for 1 minute |
| **Dielectric strength between coil and contacts** | 3600 V AC for 1 minute |
| **Surge strength** | 5080 V (1,2×50 µs) |
| **Operate time** | max. 10 ms (at nominal voltage) |
| **Release time** | max. 5 ms (at nominal voltage) |
| **Operating temperature:** | 0 to +50° C |

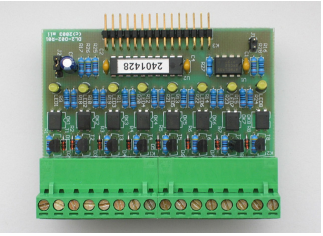
## Ordering codes

| | |
|---|---|
| **DL–DO1** | **DataLab IO** relay digital output module |

# DO2–Open-collector digital output module

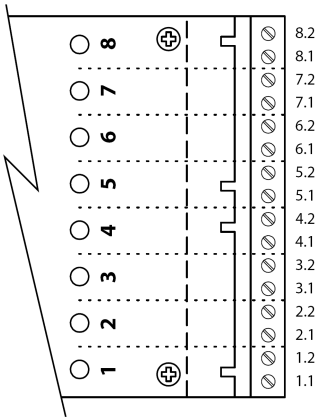
8 isolated digital outputs with open-collector

- 8 digital outputs
- Switching transistors NPN
- Mutually isolated outputs



The DO2 module contains 8 digital outputs with open-collector transistors. Outputs are mutually isolated. LED indicates logical “true” on particular output.

## Terminal connector description




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | OUT 1E | LED 1 | 5.1 | OUT 5E | LED 5 |
| 1.2 | OUT 1C | | 5.2 | OUT 5C | |
| 2.1 | OUT 2E | LED 2 | 6.1 | OUT 6E | LED 6 |
| 2.2 | OUT 2C | | 6.2 | OUT 6C | |
| 3.1 | OUT 3E | LED 3 | 7.1 | OUT 7E | LED 7 |
| 3.2 | OUT 3C | | 7.2 | OUT 7C | |
| 4.1 | OUT 4E | LED 4 | 8.1 | OUT 8E | LED 8 |
| 4.2 | OUT 4C | | 8.2 | OUT 8C | |

Emitters of switching transistors are connected to connector pins marked OUT xE and collectors are connected to pins marked OUT xC. Polarity of the output signal must be maintained, else the protection diode keeps the output continuously switched on.

## Module parameters

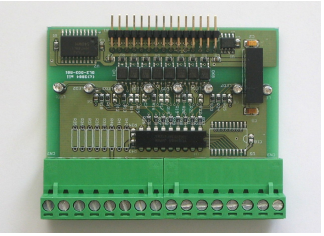
| | |
|---|---|
| **Maximal voltage** | max. 60 V DC |
| **Maximal current** | max. 250 mA DC |
| **Output protection** | protection diode |
| **Operating temperature:** | 0 to +50° C |

## Ordering codes

| | |
|---|---|
| **DL–DO2** | **DataLab IO** open-collector digital output module |

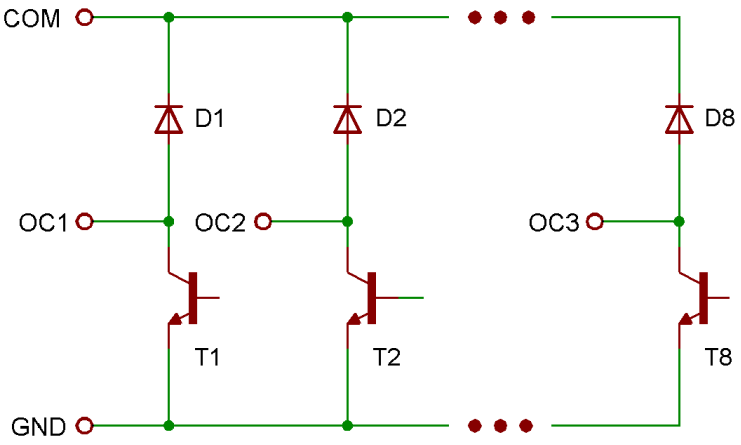
# DO3–Open-collector digital output module with common ground

8 isolated digital outputs with open-collector and common ground



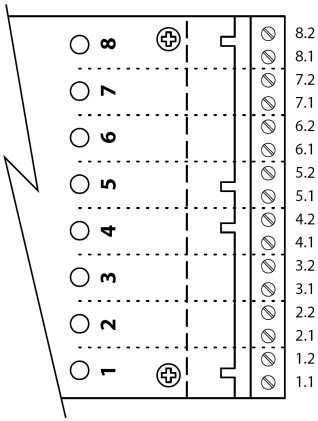
- 8 digital output channels
- Output transistors with open collector
- Common ground

The DO3 module contains 8 digital outputs with open-collector transistors. All outputs have common ground. LED indicates logical “true” on particular output. Outputs are connected according to the following schematic diagram:




Schematic diagram of module outputs

## Terminal connector description




| Pin | Meaning | Indication | Pin | Meaning | Indication |
|---|---|---|---|---|---|
| 1.1 | COM | LED 1 | 5.1 | COM | LED 5 |
| 1.2 | OC 1 | | 5.2 | OC 5 | |
| 2.1 | GND | LED 2 | 6.1 | GND | LED 6 |
| 2.2 | OC 2 | | 6.2 | OC 6 | |
| 3.1 | COM | LED 3 | 7.1 | COM | LED 7 |
| 3.2 | OC 3 | | 7.2 | OC 7 | |
| 4.1 | GND | LED 4 | 8.1 | GND | LED 8 |
| 4.2 | OC 4 | | 8.2 | OC 8 | |

## Module parameters

| | |
|---|---|
| **Maximal voltage** | max. 50 V DC |
| **Maximal current (all outputs together)** | max. 800 mA |
| **Maximal current (single output)** | max. 500 mA DC |
| **Output protection** | protection diode |
| **Operating temperature:** | 0 to +50° C |

## Ordering codes

| | |
|---|---|
| **DL–DO3** | **DataLab IO** digital module with common ground |

# DataLab PC/IO: DataLab PC with DataLab IO$^4$ device

The **DataLab IO$^4$** device embedded to **DataLab PC**

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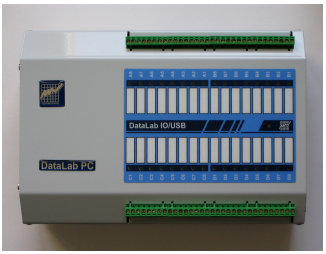


- Embedded **DataLab IO** device for **DataLab PC** industrial computers
- 4 slots for input/output modules
- Embedded operating system running from Compact Flash storage card

Because the **DataLab IO$^4$** occupies the space normally used by SATA hard drive, it is necessary to use **DataLab PC** configuration with Cfast (flash) memory card. Operating system and the application should run from CFast card. These requirements are fulfilled by the Windows Embedded operating system, which is generally compatible with Windows Professional, but extended to run on discless PCs. Many Windows desktop applications can be run under Windows Embedded, including ***Control Web Runtime*** . The presence of the **DataLab IO$^4$** unit within the computer case presents no more limitations. It is possible to connect other **DataLab IO** units, PLCs and other devices, similarly to any other standard PC.

The embedded **DataLab IO$^4$** inside the computer case is connected to the internal USB port, so it does not occupy any external USB connector. The device is also powered from the computer power supply. It is not necessary to take care about used modules' power consumption. All other features of the device and modules, except above mentioned points, are the same as in the case of standalone **DataLab IO** device.

Removing and inserting of the I/O modules requires some special procedure and we recommend to leave this procedure to authorized service.