Mini USB-IO box

Technical Note

Noldus

Information Technology

Documentation: Fabrizio Grieco, Willem van der Veer, Olga Krips.

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Noldus Information Technology bv

International headquarters

Wageningen, The Netherlands

Phone: +31-317-473300

Fax: +31-317-424496

E-mail: info@noldus.nl

For addresses to our other offices, please see our web site www.noldus.com.

1 The Mini USB-IO box

The Noldus Mini USB-IO box (type number PTIO-0030) is an interface device used to control external devices such as an Atlantis platform, a shocker, etc., from the EthoVision XT video tracking software. It is a smaller and simplified version of the USB IO-box (type number PTIO-0020). It is also embedded in the DanioVision system for tracking of zebrafish tracking.

Figure 1. The Mini USB-IO box.

Ports

The Mini USB IO-box is provided with (see the top panel of the box):

- **USB** — Connects the IO box to the PC using a USB cable.
- Four **TTL control** connectors, **TTL control 1** to **4**.
- One **Multi TTL output** connector.
- The **SDI control** connector is currently used in the DanioVision system, and will be used in future applications of the stand-alone Mini USB IO-box.
- **24V in** — Connects the IO box to the Power supply via the 24V adapter.

Each of the 4 TTL control connectors can provide limited power supply (18Volt DC, max. current 100mA) available on pin 1 (ground) and 2 (+).

LEDs

- **24V On —** Switches on when the Mini USB IO-box is connected to a power source.
- **TTL control busy** — Blinks whenever the Mini USB IO-box communicates with a TTL-controlled device.
- **SDI control busy** — Blinks whenever the Mini USB IO-box communicates with a SDI-controlled device.

TTL control

With a **TTL port** you can control the following devices (one per port):

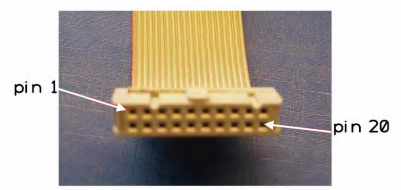
- The Med Associates Atlantis platform (ENV-595).
- The Med Associates Aversive stimulator (ENV-414).
- The Noldus Pellet Dispenser.
- Any (custom) hardware device that works with TTL logic (up to two devices per port; see page 6).

- To control a Noldus **PhenoTyper** setup, you must use the Noldus **USB-IO box** type PTIO-0020 for full PhenoTyper add-on hardware support.
- If you want to control the doors of a Med Associates 8-arm radial maze, you can use the TTL ports. However, you need a converter that splits the two TTL output lines so they reach two different doors, and converts +5V to +28 V signals. Since the Mini USB IO box has 4 TTL ports, you have in total 8 output lines, which can control all eight doors. Please contact Noldus for more information.

Multi TTL control

With the **Multi TTL output**, you can control up to 16 devices independently. This output is suitable for controlling maze doors in a 8-arm radial maze, lights or any other devices with a TTL control input.

The connector is a 20 pin IDC.



Beside these 16 outputs, also some supply voltages are provided: +5Volt, +12Volt and common ground.

There are no TTL input lines available on this connector. Because of this, you cannot use Multi TTL to control the Noldus Pellet Dispenser and any other device which requires input channels.

2 Installing the Mini USB IO-box

Installing the drivers

When you install the EthoVision XT software, the drivers of the Noldus Mini USB-IO Box are automatically installed. It is not necessary to uninstall the drivers of previous versions of the Noldus USB IO-Box or the Noldus Mini USB-IO Box. Installing the drivers from EthoVision XT 8.5 does not remove nor upgrade the drivers that were installed with EthoVision XT 7.x, or 8.0.

Connecting the Mini IO-box

1 Connect the Mini USB IO-box to a USB port on the EthoVision computer, using the USB cable that comes with the Mini USB IO-box.

   A message may appear as you plug the USB cable to the computer USB port. Please wait that the driver software is installed.

2 Connect the Mini USB IO-box to the power supply using the appropriate cable and the mains adapter. The LED **On** switched on.

3 Plug one of the ends of the modular cable in the hardware device.

4 Plug the other end of the cable in one of the ports available on the Mini USB IO-box.

- Although an RJ45 cable is used in computer networks, the signal from and to the hardware device is not a network signal. The device cannot be connected via a network hub or similar.
- The modular cable comes with the hardware device, not the Mini USB IO-box.

Uninstalling the drivers

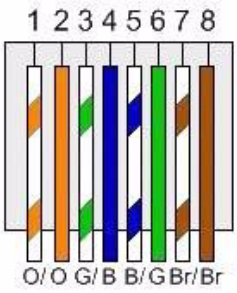
It is not necessary to uninstall the drivers of previous versions of the Noldus USB IO-Box or the Noldus Mini USB-IO Box. However, if you want to uninstall the drivers, open the **Control Panel** and go to **Programs and Features**. Select **Noldus_Hardwareinterface_IObox** or **Noldus_Hardwareinterface_MiniIObox** and click **Uninstall**.

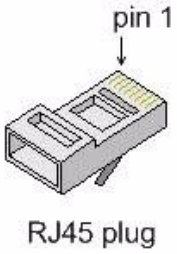
3 Connecting custom hardware

TTL control connectors

Whenever you want to connect your own device to a **TTL control** connector of the Mini USB-IO box, you should do this according the information below.

The TTL connector will provide supply (18VDC) and TTL output and input to your device. It is a standard RJ45 modular type. Pinning and cable wire colors for the mating patch cable are shown in the figure below.



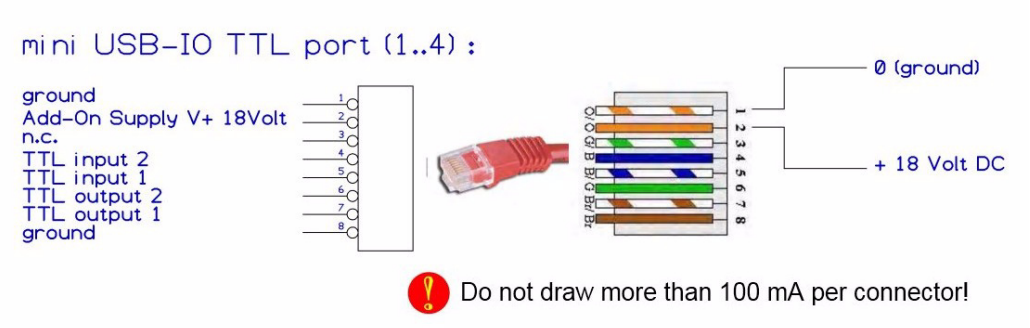


Powering a device

+18 Volt power supply can be provided via pin **2** (orange). Common ground for both power and TTL on pin **1** and **8** (orange/white-brown).

Max. overall current for all TTL ports should not exceed 0.5 A!

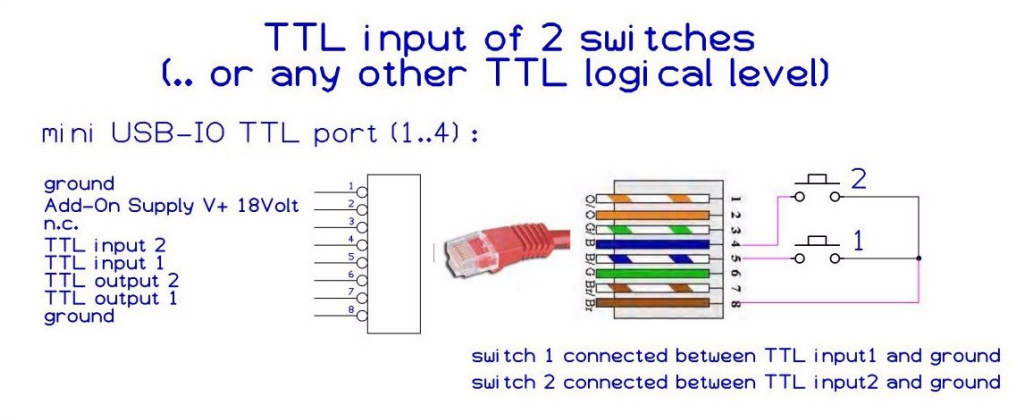
Whenever the device to be connected need some other (lower) supply voltage, you must use some regulator in between or connect a separate power adapter to it.



Input of a TTL device

Two input lines are available for each TTL-connector, TTL-1 and TTL-2, connected to line **5** (white/blue) and **4** (blue) respectively.

In the example below, two switches send inputs to EthoVision via a TTL port.



You can use the TTL input to monitor the status of devices connected to those input connections.

Inside the Mini USB-IO box, all TTL input lines are forced high to the +5Volt TTL logic level by a pull-up resistor. This enables open collector interfacing from your device into the Mini USB-IO box or you can just connect a simple switch between it and ground.

However, you can also connect any TTL logic level signal (0 Volt/5 Volt) to the input.

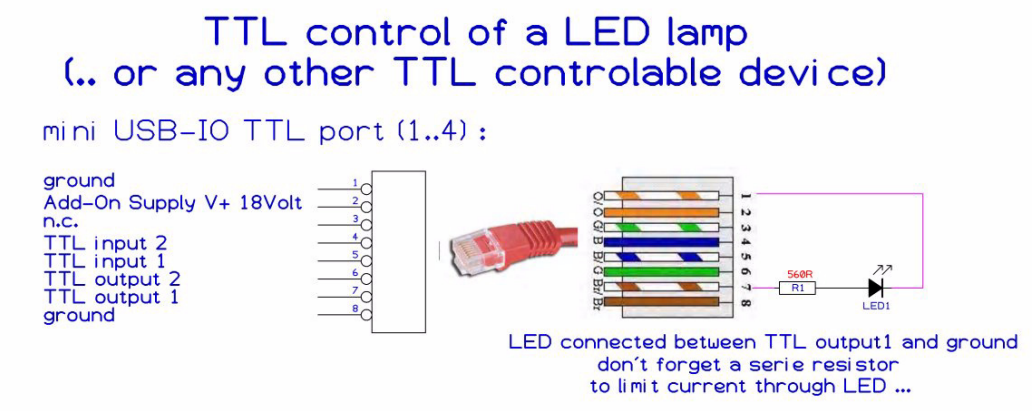
To prevent unwanted behavior of input lines caused by noise or signal spikes, inputs are protected by debounce/ESD protection circuits.

Output of a TTL device

You can use TTL output to control any external device by simple 5Volt TTL logic.

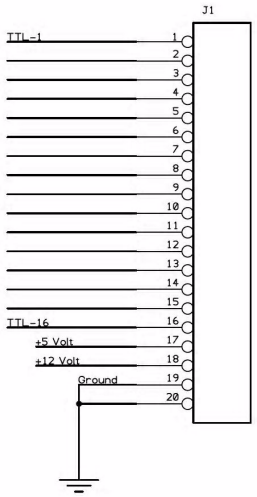
Each of the 4 TTL ports on the Mini USB-IO box is equipped with 2 TTL output lines.

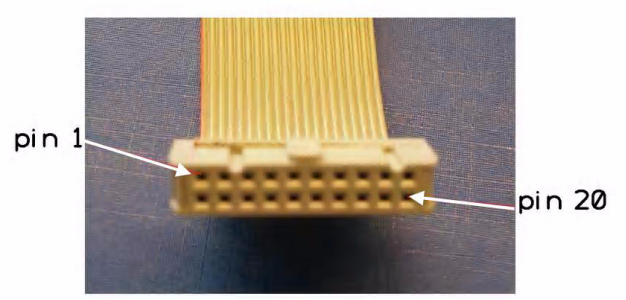
Every output line is protected with a current limiting resistor of 100 ohm. Maximum load current of the output is 10mA.



Multi TTL output connector

The Multi TTL output connector contains 16 independent output lines.





Advised connector: Assmann AWP20-7240-T-R

Pin number:

- **1-16** — 16 x TTL compatible output lines (TTL-1 ... TTL-16).
- **17** — +5 Volt reference (max load 10 mA).
- **18** — +12 Volt reference (max load 10 mA).
- **19, 20** — Ground.

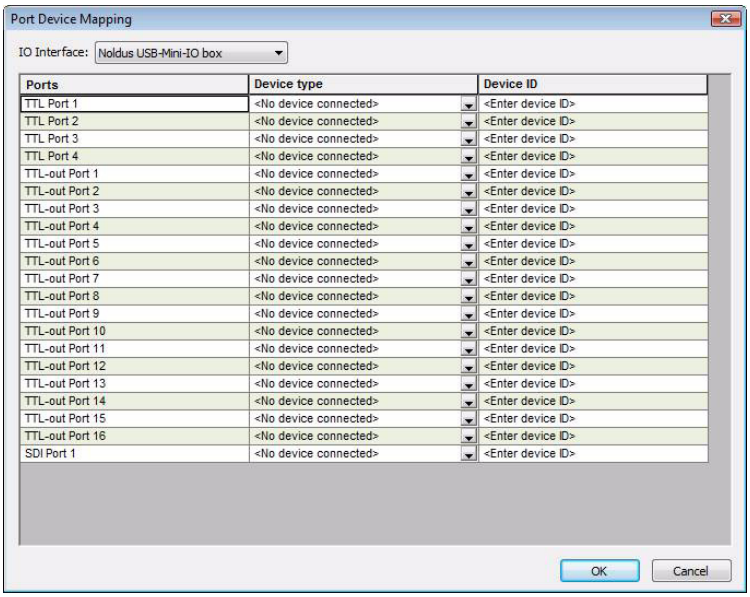
- No *TTL input* lines are available on this connector.
- To control *non-TTL* hardware, some kind of interfacing may be needed.

4 The Mini USB IO-box and EthoVision XT 8.5

Mapping the devices

Defining Hardware configuration means that you specify which communication ports of the IO box are connected to which hardware devices, and, in the case you work with multiple arenas, which individual device is assigned to which arena.

1. After connecting the hardware devices to the computer via the Mini IO-box (see page 5), start EthoVision XT.
2. Create a new experiment or open an existing one.
3. Under **Setup**, click **Experiment Settings**. Define the main characteristics of the experiment.
4. Select **Use of Trial Control Hardware** and click **Settings**.
5. In the window that pops up, select **Noldus Mini USB-IO Box**.
   Result — The **Port Device Mapping** window appears.



6. In the **Port Device Mapping** window:
   - Under **Device type**, select the type of device that is connected to that port. Leave **<No device connected>** for ports that are not connected to any device.
   - Under Device ID, enter a name for the individual (physical) device that is connected to that port, or accept the suggested name.

   Click **OK** when finished.

For more information on this step, see **Setting the port connections** in the EthoVision XT Trial and Hardware Control Manual.

7 Under **Setup**, select **Arena Settings**. Define the arenas.

For more information on this step, see Chapter 6 in the EthoVision XT Reference Manual.

If you have only one arena, you can skip step 8 and 9. The hardware is automatically assigned to the arena. If you have more than one arena, proceed with step 8.

8 Click the **Arena - hardware mapping** button in the **Arena Settings** window.

9 Click **Add device**. Under **Device type**, select the type of device for a device that you have added in step **5**, and under the Arena name select the individual device that you want to assign to that arena.

For more information on this step, see **Assigning devices to arenas** in the EthoVision XT Trial and Hardware Control Manual, which you can find on your EthoVision XT installation DVD.

Repeat this step for all the individual devices you want to assign to the arenas.

Controlling the devices

You can control all the devices connected via the Mini USB-IO box using the **Trial and Hardware Control** function in EthoVision XT, provided that the devices have been properly mapped onto the arenas.

With the Trial and Hardware Control function, you can define:

- **Actions** on the hardware device (for example, *Drop a pellet* or *Open door of arm 1*.
- **Conditions** that must be met in order for Trial Control to take actions.
- **Sub-rules** for a sequence of actions and conditions to be repeated.

1 Under **Setup**, select **Trial Control Settings**.

2 Click the button next to the element you want to add (Condition, Actions, etc.). Specify the characteristics of the element (for example, Light on for an action box).

3 Insert the box in the Trial Control rule.

4 Repeat the steps **2-3** for other elements. For repeated actions, create a sub-rule and place those actions in the sub-rule. Add a reference to this sub-rule in the Start-Stop Trial rule.

For more information on the Trial and Hardware Control function, see the EthoVision XT Trial and Hardware Control Manual, which you can find on your EthoVision XT installation DVD.

Analyzing the data

If you plan to analyze the hardware data on a computer other than that used for acquisition, it is recommended to install the drivers on that computer too. Then, make a backup of the experiment (**File**, **Make backup**), copy it to that computer and restore it (**File**, **Restore backup**).

5 Technical Specifications

Mini USB-IO box Version 1

Noldus model number	PTIO-0030
Power supply	24 V DC
Current consumption	1.0 A*
Interface to PC	USB-2
I/O connections	4 TTL control (representing 8 TTL Input lines and 8 TTL output lines) with RJ45 modular type connectors
	1 Multi TTL (representing 16 TTL output lines and external device supply) with 20 way IDC connector
	1 Special Device Interface with RJ45 modular type connector
Cables	Power supply 24V type 70 A24 with mains adaptor
	USB cable with connectors of type A and B, 3m type SB2403
Operating temperature	0 to +40 °C (+32 to +104 °F)
Storage temperature	-20 to +70 °C (-4 to +158 °F)
Operating humidity	Up to 80%, no condensation
Dimensions	175 x 81 x 30 mm / 6.9 x 3.2 x 1.2 inches (L x W x H)

*) Varies depending on the number and type of devices connected.