

Service Manual

PhenoTyper®

Noldus
Information Technology

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For EthoVision XT version 18.0

Noldus Information Technology BV

International headquarters

Wageningen, The Netherlands

Phone +31-317-473300

E-mail info@noldus.nl

For addresses of our other offices and support,
please see our web site www.noldus.com

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1.1 About this manual

WHEN YOU NEED THIS MANUAL

This manual is intended for users of PhenoTyper and Noldus trainers and support who need more technical information about the functioning of PhenoTyper and its accessories than is covered in the PhenoTyper - EthoVision XT 18 - Reference Manual.

Check regularly the Noldus download page at my.noldus.com for the most recent version of this manual.

USING THIS MANUAL

Some information in this manual may or may not apply to your setup depending on the devices you work with.

- For PhenoTyper 1 (analog camera): All chapters apply.
- For PhenoTyper 2 (digital camera): All chapters except **The Top Unit Interface** apply.
- For the USB-IO box: All chapters apply.
- For the Nortio system: All chapters except **The Top Unit Interface**. Lickometer and PhenoWheel can only work if they are of recent versions and configured based on the instructions.

1.2 Other documentation

MANUALS

You can find the following manuals on your computer after you have installed EthoVision XT. From the Windows **Start** menu, select **All Apps > Noldus > EthoVision XT 18 Other Documentation**.

- The **EthoVision XT Help** (press **F1** to open it in EthoVision XT). This browser-based Help contains extensive information about EthoVision XT.
- The **PhenoTyper - EthoVision XT 18 - Reference Manual**. For how to assemble PhenoTyper, design experiments and analyze data in EthoVision XT.

- The **EthoVision XT 18 - Quick Start Guide - English**. A small manual with a summary on how to use EthoVision XT. This is also available in several different languages.
- The **EthoVision XT 18 - Application Manual**. This manual contains information about different standard tests, including conditioning tests carried out with PhenoTyper.
- The **EthoVision XT 18 - Trial and Hardware Control- Reference Manual**. Open this manual if you are looking for information about the USB-IO box and the TTL tester, or you want to know more about complex Trial Control protocols.

You can also find the manuals on the downloads section of the Noldus web site my.noldus.com.

SAMPLE EXPERIMENTS

Furthermore, you can find example of applications with PhenoTyper in the EthoVision XT sample experiments that you can download from my.noldus.com. Note that you have to log in or register first. Next, choose **Downloads > EthoVision XT > Sample Experiments**.

1.3 Technical Support

HELP DESK

Contact the Help Desk

If you run into problems of any kind, please let us know. You can contact us via our web site my.noldus.com.

Please check this manual carefully before contacting Noldus.

Send your data

If you need to send EthoVision XT data by e-mail, please use the Backup procedure (**File > Make Backup**) to make a copy of your experiments, and send them as attachments. For more information on how to use the **Backup** and **Restore** functions, see the EthoVision XT Help.

REPLACEMENT OF COMPONENTS

If any component breaks or wears out, please contact our Technical Support Department to have it sent back to us. Please note that in any case you must send it to our international

headquarters (Wageningen, The Netherlands) no matter where you are. Broken components will be fixed or replaced with new ones.

IMPORTANT Plastic components (such as the cage walls) will only be replaced or repaired free of charge if they are broken due to a defect of workmanship and the damage is reported within one month of shipment. Other components are covered by a one year guarantee; to claim under guarantee you must report the damage within one year of shipment. It is possible that you may have a service contract entitling you to free replacement of parts for a longer period, please contact the support department if you are not sure. In any case we can still fix or replace the parts, but it may be necessary to levy a charge. The guarantee is only valid if you treat the PhenoTyper as described in this manual. In any case, shipping broken parts is at your expenses, while sending repaired or replacing parts back to you will be at our expenses.

IMPORTANT If you connect the PhenoTyper to any third-party products, such as video tracking system other than EthoVision XT, Noldus Information Technology is not responsible for maintenance of that product, or for damage done to the PhenoTyper by that product.

To order spare parts of PhenoTyper, see the **Appendix A** of the PhenoTyper - EthoVision XT 18 - Reference Manual. There you find a list of the parts available. Please contact your Noldus representative to send your order.

The PhenoTyper Camera

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The camera is integrated in the PhenoTyper 1 Top Unit.	
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The camera is mounted on the Top Plate of the PhenoTyper 2 Top Unit.	

For issues related to the camera image, see **Troubleshooting** in the EthoVision XT Help.

2.1 PhenoTyper 1 (analog camera)

CAMERA FOCUS AND ORIENTATION

Adjust the camera focus

If the camera image is out of focus:

1. The camera is in the center of the Top Unit's covering plate. Remove the ring around the lens, so you can easily access the focus ring on the lens.
2. Rotate the focus ring in either direction.



3. Put the test subject, or an object of approximately the same height, in the cage.
4. Put the Top Unit back on the cage. Turn PhenoTyper on and check in EthoVision XT that the test animal/object is on focus.
5. Repeat steps 2 to 4 until the image is sharp enough.

Notes

- If you have a NTSC Top Unit with serial number below 01000, you have to remove the Top Unit covering plate. Turn off PhenoTyper, unscrew the covering, and loosen a small screw on the lens, then rotate the focus ring.
- **IMPORTANT** When closing the Top Unit, do not over-tighten the first screws! Doing so may make it difficult to put the remaining ones in the right place. Instead, insert first two or three screws on different sides of the plate, and turn them 2-3 times. The separation plate should be still free to move at this stage. Move the plate so that the remaining screws can fit in the corresponding holes.

Adjust the camera orientation

If the camera does not point to the center of the cage bottom, and some parts of the cage like the feeder are not visible enough, you can change the orientation of the camera.

The information below applies to PhenoTyper top units manufactured after March 2011. In top units from previous batches, it was not possible to adjust the camera orientation. If you want to upgrade an older unit, please contact your sales person for a quote.

You will need the following tools:

- A 2.5 mm Allen key (also known as a hex or Inbus key).
- A small flat-head screwdriver.
- A straight edge of ca 40 cm.
- Marker pen with washable ink.
- Post-it stickers.

Procedure

1. Remove the top unit from the PhenoTyper cage.
2. Carefully remove the four black caps next to the camera (if necessary, use the screwdriver).



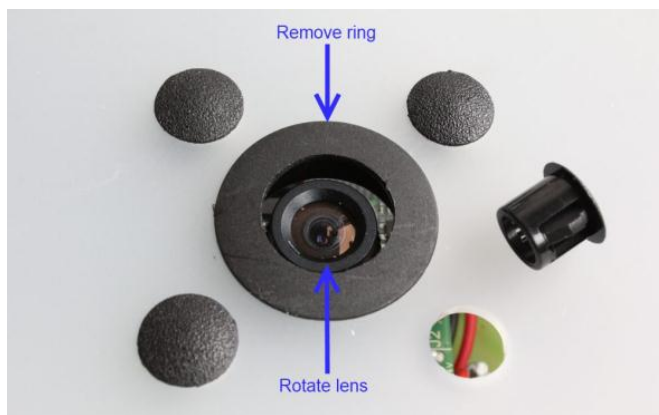
3. Remove one wall of the PhenoTyper cage.

4. On the base of the PhenoTyper cage, draw lines between each corner, so that they intersect precisely in the center of the floor plate. If the base is black, you can tape paper to it and draw on the paper. Alternatively, tape an image to the floor plate to make focusing easier (see page 112).

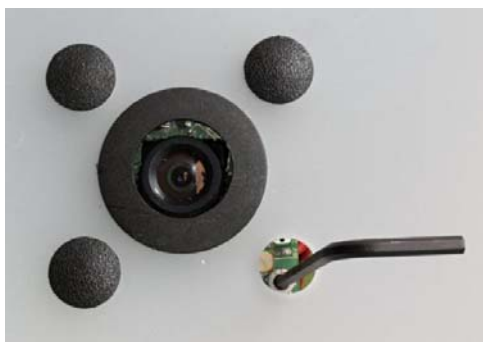


5. Place the top unit upside-down and the cage on top of it (so the entire setup is upside down).
6. Connect the camera connection of the PhenoTyper Top Unit to your computer, so that you can view the image.
7. Determine the center point of your computer monitor:
 - a Open this document in a PDF viewer (e.g. Adobe Reader) and go to page 112.
 - b Maximize the PDF viewer window.
 - c View in Full Screen mode (press **Ctrl+L**).
 - d Zoom to Fit Width (press **Ctrl+2**). The image is now centered horizontally.
 - e Scroll until the image is centered vertically.
6. Mark the center point, for example with two stickers.
Do not write on the monitor screen!

7. If necessary, focus the camera. To do so, remove the ring next to the camera lens and rotate the lens. If you have an NTSC Top Unit camera, you have to remove the plastic plate and loosen a small screw on the lens.



8. Insert the Allen key into each of the holes and turn until the image from the camera is centered on the cross you have drawn on the cage base.



9. If necessary, re-focus the camera (see page 13).
10. When the image quality is satisfactory, put the caps bck in place, remove the lines you have drawn or the test sheet and reassemble the cage.

If you need assistance with this procedure, please contact your nearest Noldus support center: see my.noldus.com.

CAMERA SETTINGS

When do I need to adjust the camera settings?

Since the PhenoTyper Top Unit camera is optimized for video tracking with EthoVision XT, it will not be necessary to adjust the camera settings under most conditions. However, there may be exceptions. For example, when you track a white rat on dark bedding material, the animal's body may appear overlit due to automatic gain adjustments. You can change the camera settings based on the instructions below. If you still have questions, contact Noldus Support for guidance (my.noldus.com).

A common scenario that may require adjustment of the camera settings is when the image of the animal is too bright. When you carry out video tracking only, it is usually no problem if the animal is overlit. However, if you need to know details of the behavior, for example for manual scoring, you need an image with good contrast and details of the animals' body. And when you use the Mouse or Rat Behavior Recognition Module, it is essential that details of the animal's body and fur are visible and sharp.

In such situations, do not decrease the infrared light level in the PhenoTyper, since this will only cause the camera to compensate more. Switch off the automatic gain control and adjust the shutter speed (see page 19). To reset the camera to its default settings, see page 20.

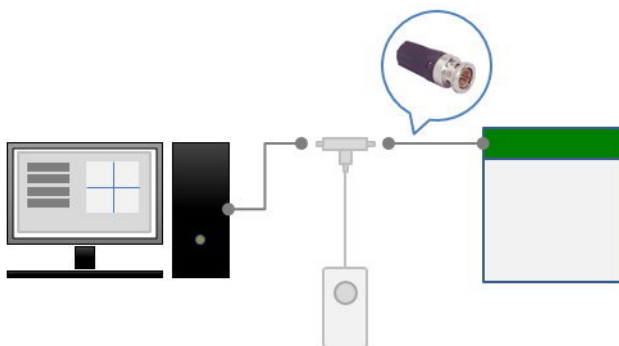
The camera on-screen menu

To access the camera on-screen menu for PhenoTypers with serial number 001471 and higher (from 2018 up to now), you need the **UTC-100** on-screen device (OSD). Please contact Noldus if you do not have this device.



Connect the OSD between PhenoTyper and a monitor (or PC video encoding board) as shown in the following figure.

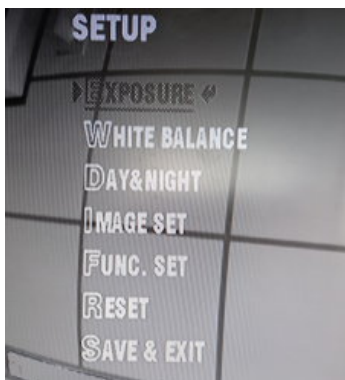
Use video cables with BNC connectors, just like you do when connecting PhenoTyper to the PC. For details, see the PhenoTyper - Reference Manual.



- Press the central button to enter a menu or confirm a selection.
- Press the **Down** button to navigate the menu, and the **Left/Right** buttons to switch between options. Note that **Move Up** does not have any effect.
- Remember to select **Save and Exit** to confirm.

To open the camera settings menu:

1. Start EthoVision XT, and in the Experiment Settings click the video icon in the row of your camera under **Video Source**. The live image from the PhenoTyper Top Unit camera appears.
2. Press the central button of the OSD. The on-screen menu appears.



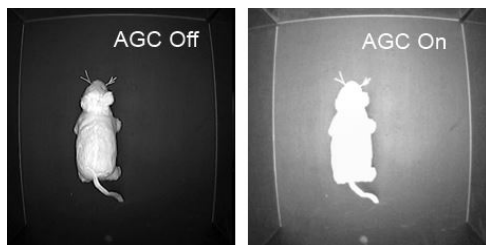
3. By default, the first menu item, **EXPOSURE**, is selected.

Important camera settings

- **AGC (Automatic Gain Control).** Switch this off when the image of the animal is overlit.
- **Shutter.** Adjust this if the image of the animal is overlit. But first switch off Automatic Gain Control (see AGC below).
- **Flicker.** Adjust this depending on whether you have PAL or NTSC Top Unit cameras.
- **Adjust.** Only adjust this if switching off Automatic Gain Control and adjusting the Shutter Speed does not result in an image with good contrast.
- **Save & Exit.** To save the new settings and exit the menu.

AGC (Automatic Gain Control)

Using AGC means that weaker video signals receive more gain and stronger signals receive less gain or none at all. For a white animal on a dark background, it is beneficial to turn the AGC **off**, so that the subject does not appear overlit. For a dark animal on a bright background, the effect of AGC is less evident.



Another disadvantage of setting AGC to On is that with a high gain the noise is also increased, and with it the file size of the resulting video. This is because a noisy video contains a lot of unpredictable movement (the noise) that has to be encoded and increases file size.

1. Select **EXPOSURE**, then **AGC**.
2. To disable AGC, press the **Left/Right** button to select **OFF**.
3. Connect the PhenoTyper Control Unit to increase the infra-red light to maximal (see the PhenoTyper - EthoVision XT 18 - Reference Manual). Then adjust the Shutter time (see below).

SHUTTER

The shutter time influences the brightness of the picture.

1. Select **EXPOSURE**, then **SHUTTER**.
2. Press the **Left/Right** button until **1/120** is selected.

If the subject image is overlit, first switch off the Automatic Gain (see above). Then set the shutter to a value as small as possible. The subject should contrast well with the background and the image should have enough lighting. In most cases, **1/100** or **1/120** will work well.

FLICKER

1. Select **EXPOSURE**, then **FLICKER** and press the central button to confirm.
2. Depending on which TV standard your Top Unit camera is, choose **50** for PAL and **60** for NTSC.

WHITE BALANCE

White balance is not crucial for a black and white camera like that of PhenoTyper. Adjusting settings will hardly result in a different image. We recommend to leave the settings to the default.

IMAGE & SETUP

Select **IMAGE SET** then press the central button to confirm.

- **CONTRAST**. Adjust the image contrast by pressing the **Left/Right** button.
- **SHARPNESS**. Adjust the image sharpness by pressing the **Left/Right** button.

SAVE & EXIT

1. Select **SAVE & EXIT** then press the central button to confirm.
2. Select **YES**, then press the central button to confirm. Select **No** to exit the menu without saving the settings.

RESET

This option resets the camera settings back to its default settings that are optimal for the PhenoTyper.

1. Select **RESET** then press the central button to confirm.
2. Under **Factory mode**, select **YES** and press the central button to confirm.

For more information refer to the documentation that comes with the UTC-100 control device.

2.2 PhenoTyper 2 (digital camera)

The PhenoTyper 2 camera is a Basler acA1300-60gm GigE Vision monochrome camera.

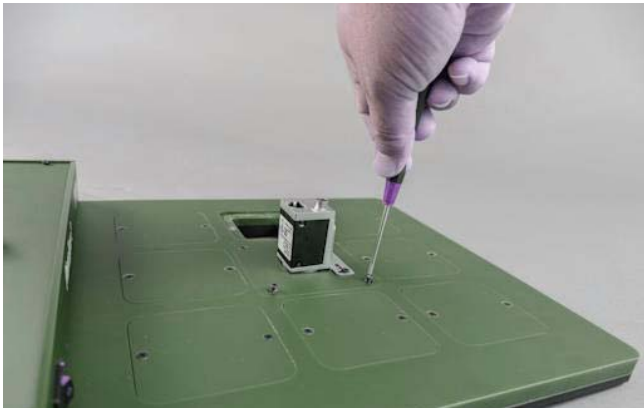
- To install and configure the camera, see one or more of the following:
 - The section **Camera Installation** in the EthoVision XT Help (F1).
 - The video **Set Up your Camera** in the EthoVision XT Video Tutorial (Help menu).
 - The PhenoTyper - EthoVision XT 18 - Reference Manual.

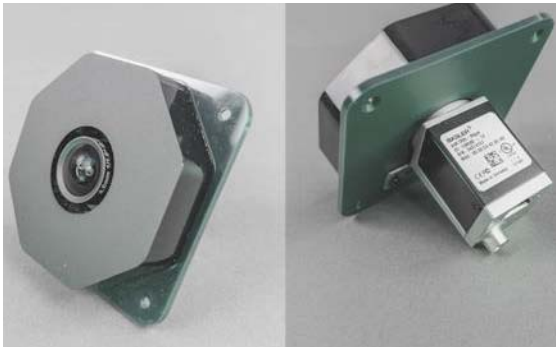
PACKAGE CONTENTS

- Basler acA1300-60 gm.
- Evetar 4 mm lens.
- IR filter (already mounted on the camera).
- CS to S-mount adapter.
- Camera bracket.
- 4 x M3 4 mm bolts for fixing the camera to its bracket.
- 2 x M3 6 mm bolts for fixing the bracket to the PhenoTyperTop Plate.

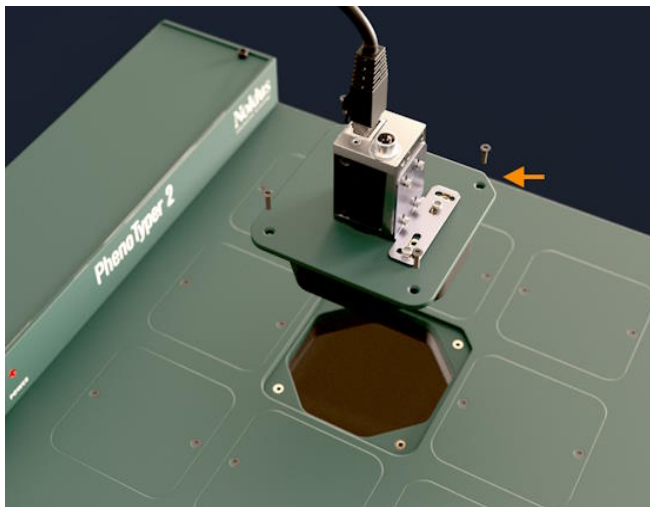
CAMERA MODULE

You can fit the camera module in the central slot of the Top Plate. To insert or remove the camera module, use the four screws at its corners.





The margin of the camera module is made in such a way that there is only one possible orientation - with the bracket facing opposite the Control Unit and the PhenoTyper logo.

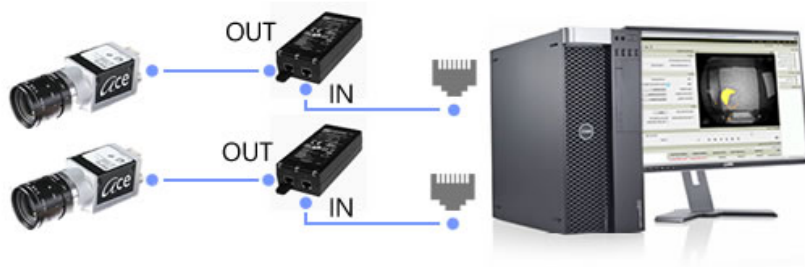


Power up the camera

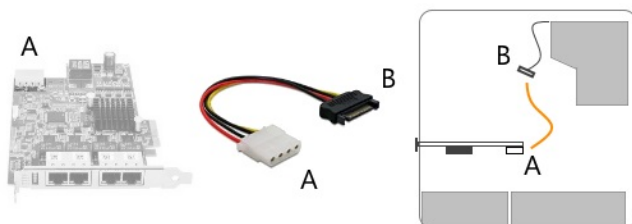
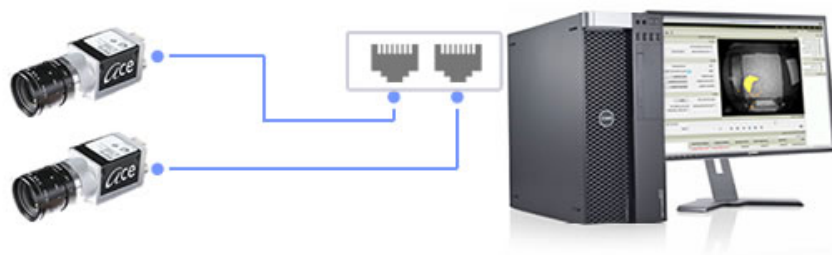
The PhenoTyper 2 camera gets power through the network cable that connects to the PC.

You can power up the camera in two ways, depending on whether the Ethernet interface board received power from the PC:

- If the Ethernet interface board does not receive power from the PC, you must use Power over Ethernet (PoE) injectors. This usually is the case for one- or two-ports boards (see the next figure).



- If the Ethernet interface board on the PC can receive power from the PC, like in the case of a 4-port board provided by Noldus, you can connect the camera directly to the board, but you must provide power to that board using an additional power cable connection inside the PC (see the figure below). For details, see the topic **Install and Ethernet board for the GigE camera** in the EthoVision XT Help. If the board has been installed by Noldus, the board is already powered so you just need to connect the cameras.



CAMERA FOCUS AND ORIENTATION

Camera focus

The lens of the PhenoTyper 2 camera is a F1/8 f4 mm fixed focal length, fixed iris lens. The focus of the lens has been optimized for the PhenoTyper cage.

NOTE The lens is a S-mount type lens. It is therefore provided with a CS-mount to S-mount adapter to fit on the camera. Always make sure that the camera has this adapter attached when, for any reason, you remove the lens from the camera and then you put it back.

Camera orientation

The orientation of the digital camera has been carefully set at production. There is no need to adjust it.

CAMERA SETTINGS

The main camera settings can be adjusted in the Pylon Viewer dedicated software after the camera has been configured and connected to the PC. Alternatively you can adjust camera settings like Exposure and Frame rate in EthoVision XT.

For details, see the section **Configure the digital camera** in the EthoVision XT Help (F1).

The Top Unit Interface

3.1 General information..... 26

NOTE The Top Unit Interface is used in PhenoTyper 1. You can skip this chapter if you work with PhenoTyper 2.

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3.1 General information

COMPONENTS

The Top Unit Interface is needed whenever you want to control multiple PhenoTypers with EthoVision XT. You also need the USB-IO Box.



- You can connect up to four PhenoTypers to a Top Unit interface.
- For information about the USB-IO box, see the EthoVision XT 18 - Trial and Hardware Control - Reference Manual.
- The Top Unit Interface is meant for use together with PhenoTyper 1, not Phenotyper 2.

The Top Unit Interface comes with:

- One 1-m modular cable RJ45 (green) for connecting the Top Unit Interface to the USB-IO box.



- Four 2-m modular cables RJ45 (green) with a SubD-9 adapter to connect the Top Unit Interface to the PhenoTypers' Top Unit.



- A USB extender cable (20 m), in case you need a longer distance between your computer and the PhenoTyper setup than the 3 m of a standard USB cable.
- It is possible to order longer cables, but the cable between the Top Unit Interface and the USB IO-Box should not be longer than 2 m. The cable between the Top Unit Interface and the PhenoTyper should not be longer than 5 m.

LED indicators

- Busy (yellow LED). It indicates data exchange to/from a PhenoTyper Top Unit.
- Power (red LED). It indicates power supply from the USB-IO box through the modular RJ45 cable.

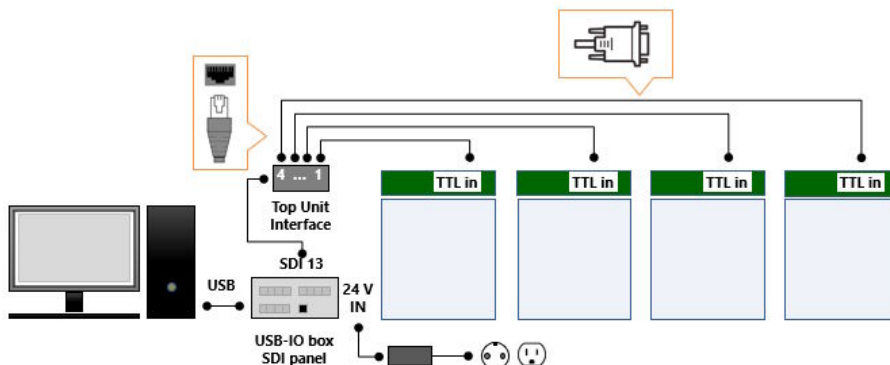
TECHNICAL SPECIFICATIONS

- Noldus type number: PTTI-001x.
- Power supply: 12V DC supplied by the USB-IO box.
- Current consumption: 40 mA.
- Connectors: 1x RJ45 8-pin modular to USB-IO box, 4x RJ45 8-pin modular to PhenoTyper Top Units.
- Dimensions: 115 x 65 x 32 mm / 4.5 x 2.6 x 1.3 inches (L x W x H)
- Weight: 100 gr.
- Cable to USB-IO box: 1x 1m modular RJ45 (green).
- Cable to PhenoTyper Top Unit: 4x 2m modular RJ45 (green) with SubD-9 adapter.

3.2 Connect the Top Unit Interface

CONNECTION SCHEME

1. Connect the **USB-IO box** port on the Top Unit Interface to the **SDI Control port 13** on the rear panel of the USB-IO box.
2. Connect the USB port on the USB-IO box to one of the USB ports of the EthoVision XT computer.
3. Make sure that the USB-IO box is powered up.
4. Connect the **PhenoTyper Top Unit 1** port on the Top Unit Interface to the **TTL in** port of the first PhenoTyper, using the network cable with a SubD connector at one end (PhenoTyper Top Unit) and a RJ45 connector at the other end (Top Unit Interface).
5. Repeat the previous step for the remaining Top Units.



Notes

- The Top Unit Interface is designed for use with PhenoTyper 1.
- For more details on how to connect PhenoTyper to the EthoVision XT computer, see the PhenoTyper - EthoVision XT 18 - Reference Manual.
- If you want to connect multiple Top Unit Interfaces to your EthoVision XT computer, you must alter the position of jumpers inside the USB-IO box. For more information how to do this, see **The USB-IO Box** in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual (see **MANUALS** on page 9).

Chapter 4 ---

The Pellet Dispenser and the Pellet Receptacle

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4.1 General information

THE PELLET DISPENSER

The Noldus Pellet dispenser is a device to deliver standard available pellets to mice or rats. It can be used in learning tests to reward the animals when they perform a task well. The Pellet dispenser can be controlled from EthoVision XT to drop pellets automatically when a condition becomes true, for instance, when the animal enters the feeder zone within 30 seconds after a light was switched on.

The Pellet dispenser consists of two parts, a pellet silo and the base part with the stepper motor (see Figure 4.1).

The Pellet dispenser is often used in combination with the Pellet receptacle (see **THE PELLET RECEPTACLE** on page 37).



Figure 4.1 Left: Pellet dispenser. Right: The pellet silo and the base part that contains the stepper motor.

Button and LED indicator

Press the button to drop one pellet (see page 47). For controlling the Pellet dispenser with EthoVision XT, see Work with the Pellet dispenser

The LED light at the front of the pellet dispenser indicates the status of the device:

- LED off: Waiting for command.
- Single blink: Receiving a pellet drop command. Single blink is also given when a pellet is dropped.
- Double blink: When connecting the power cable/RJ45 cable or resetting.
- Continuous, fast blinking: Error state.

- LED constant on: Detector is stuck.



CONTENTS OF THE PELLET DISPENSER PACKAGES

Pellet dispenser (standard)

- A Pellet dispenser PTPD-001x (see Figure 4.1).
- Additional blue carousel for 45 mg pellets.
- A gray RJ45 cable (2 meters long).
- Aluminium feed-through and silicon in-between tubing.

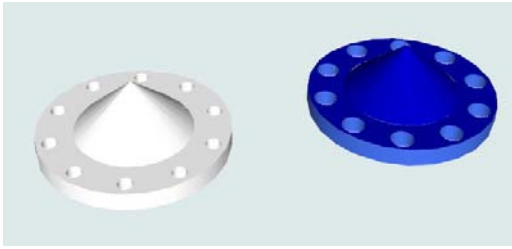
Optionally available:

- Elevated stand (PTPD-1050).
- Power supply for stand-alone use (PTPD-2010).
- RJ45 modular cable 0.5 - 3 meters, different colors.

NOTE Begin 2016 Noldus introduced the Pellet dispenser **PTPD-0011**, successor of PTPD-0010. The main differences are:

- A more accurate drop positioning system.
- Two types of carousels, both with 10 holes:
 - White carousel, for 20 mg pellets, is installed by default.
 - Blue carousel, for 45 mg pellets.

If you have a previous version of the Pellet dispenser PTPD-0010, the carousel has 12 holes. You cannot exchange carousels between Pellet dispenser versions.



Pellet receptacle

- The Pellet receptacle PTPR-001x.
- PhenoTyper wall specific for a Pellet receptacle.
- A black cable with a RJ45 connector at one end and a white 3-pin female connector at the other end (2 m long).

Accessories

- Aluminium feed-through and silicon in-between tubing.
- Silica gel pack to keep the silos dry.
- Elevated stand (not included in the standard package).



Figure 4.2 Pellet dispenser on its own elevated stand and with aluminium feed-through and silicon in-between tubing.

PELLET TYPES

The Noldus Pellet dispenser has been tested with the following pellets:

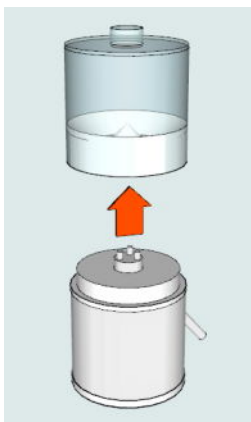
- Bio-Serv 20 mg (3.2 mm x 2.5 mm; product nr. Foo71 and Fo163).
- Bio-Serv 45 mg (3.6 mm diameter; product nr. Foo21).
- TestDiet 20 mg (3.2 mm x 2.6 mm).

See bio-serv.com and testdiet.com.

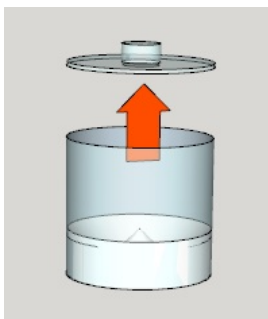
To switch between pellet types

When you receive the Pellet dispenser, it is equipped with the white carousel for 20 mg pellets. Before using pellets of different size, do the following.

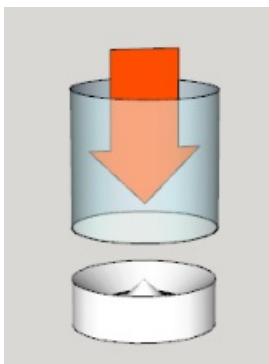
1. Remove the pellet silo from the base of the Pellet dispenser.



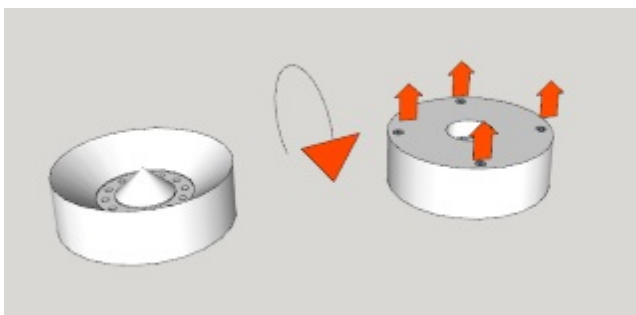
2. Remove the lid of the silo.



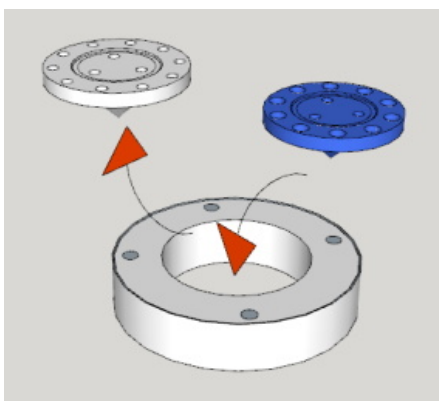
3. Gently press the white plastic insert out of the transparent silo.



4. Use the hex key to remove the carousel cover plate.

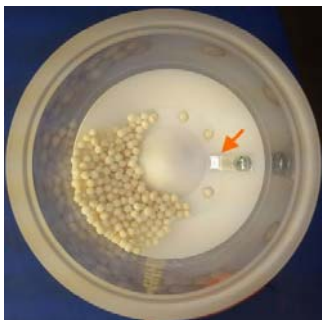


5. Replace the carousel.



6. Close the cover plate of the carousel, tighten the bolts and reassemble the silo.

7. When assembling the Pellet dispenser, make sure that the aluminium hole cover clip inside the silo is aligned with one of the holes. This makes it less likely that multiple pellets are dropped simultaneously.

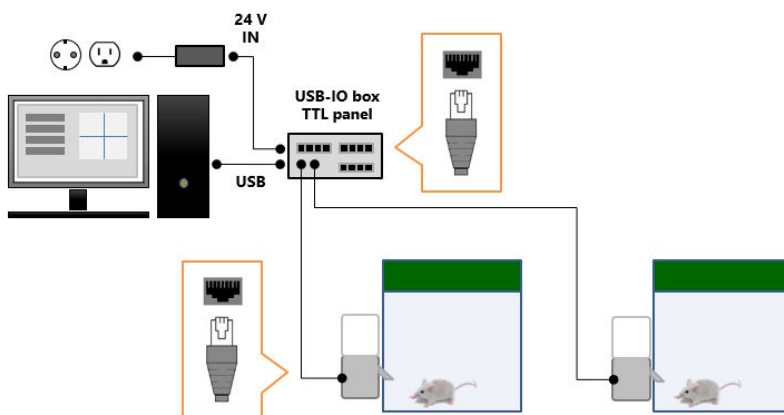


4.2 Install the Pellet dispenser

Although the network cables shown in the following schemes are used in networks, the signal from and to the Pellet dispenser is not a network signal. Do not connect the Pellet dispenser via a network hub or similar.

Connect the Pellet dispenser using the USB-IO box

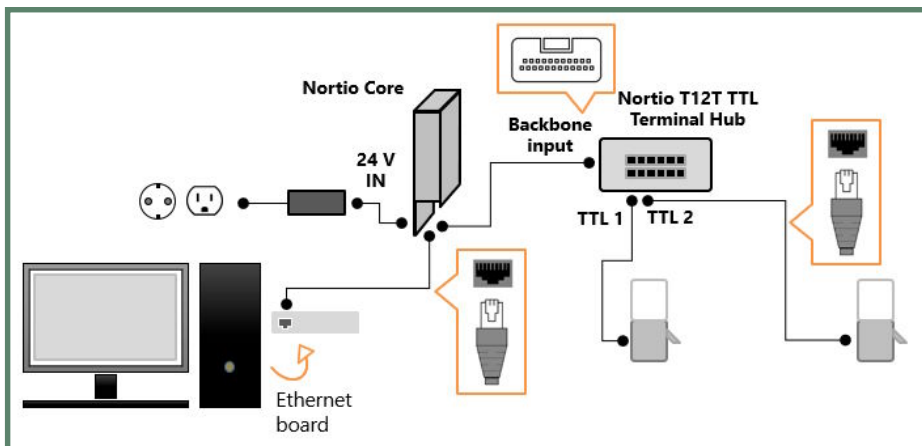
Connect the Pellet dispenser to a TTL port on your USB-IO box or Mini USB-IO box using the network cable with RJ45 connectors.



Connect the Pellet dispenser using the Nortio system

1. Connect the Nortio Core to the EthoVision XT through a network cable.
2. Connect the Nortio T12T TTL Terminal Hub to the Nortio Core using the backbone input cable.
3. Connect the Pellet dispenser to one of the TTL control ports of the Nortio T12T TTL Terminal Hub.

For how to install the Nortio system and the configure the Ethernet board on your PC, see the section **The Nortio system** in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual.



Connect the Pellet dispenser using the Mini USB-IO box

With EthoVision XT 14 and later versions, you can use the Pellet dispenser also when connected to the Mini USB-IO box. **IMPORTANT** Connect maximally two Pellet dispensers to a Mini USB-IO box.



Before connecting the devices, do the following:

1. Browse to my.noldus.com (you need to log in or register first), and choose **Downloads > EthoVision XT**. Download **EthoVision XT - Full installation disc [version number].zip**.

Unzip the file and locate the folder **Drivers ant Tools > IoBox MiniloBox Devices**. There you find the file **MiniloBox PelletDispenser**.

2. Open the folder **MiniloBox PelletDispenser** and copy one of the files depending on the language set in EthoVision XT. For Chinese, DeviceTypesNoldusChCh.xml. For English, DeviceTypesNoldusEnUs.xml.
3. Go to the following folder on your EthoVision XT computer:
C:\ProgramData\Noldus\Components\Ethovision\Noldus HardwareInterface
Minilobox\5
4. Press **Ctrl+V (Edit > Paste)**. Replace the old file version with the new one.
5. Delete the file **DeviceTypesNoldus.xml** in that folder.
6. Connect the Pellet dispenser to the Mini USB-IO box, and start EthoVision XT.
7. Create a new experiment and set up EthoVision XT. See page 41.

Attach the Pellet dispenser to objects

To attach the pellet dispenser to a stand or any other object, use the four M4 threaded holes located under the foot of the dispenser.



For more information

For more information about the interface devices, see the EthoVision XT 18 - Trial and Hardware Control - Reference Manual (see **MANUALS** on page 9).

THE PELLET RECEPTACLE

Purpose

Use the Pellet receptacle in two cases:

- To collect the pellets dropped by the Pellet dispenser (no measurement). The pellets are kept in the receptacle instead of dropping on the PhenoTyper floor.

- To record the number of times that the subject visited the receptacle. This is done with a beam break mechanism that records the nose pokes.

How nose pokes are detected

A mechanism based on an infrared beam detects the subject's nose pokes into the opening. When the subject pokes its nose into the opening of the receptacle, the infrared beam is broken. If the beam is broken for at least approx. 50 ms, a TTL signal "Low" is sent to the USB-IO box and therefore to EthoVision XT. When the beam is not broken (or broken for less than 50 ms, the TTL signal stays "High".

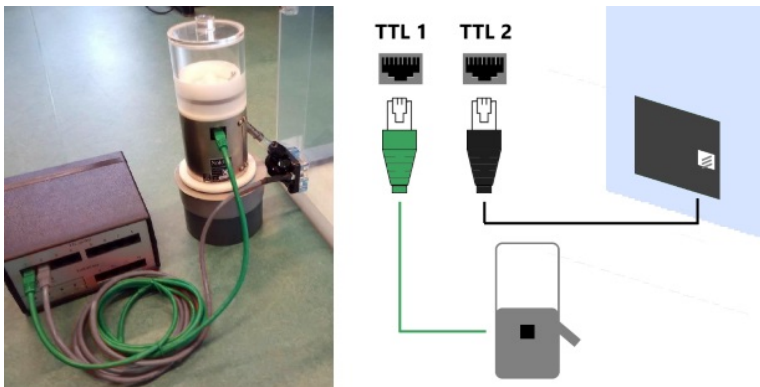
The TTL signal will stay "Low" for at least 200ms for a single nose poke. In case of multiple nose pokes shorter than 200ms, these will be merged in one "Low" TTL signal.

Connect the Pellet receptacle to the USB-IO box

The Pellet receptacle comes attached to its wall. A black network cable with a special connector is included in the package.

1. Replace one of PhenoTyper walls with the Pellet receptacle wall. Make sure that the black tube stays at the outer side of PhenoTyper. For how to assemble the PhenoTyper cages, see the PhenoTyper - EthoVision XT 18 - Reference Manual.
2. Connect the tube of the Pellet dispenser to the black tube of the Pellet receptacle. If necessary, use the transparent tube that comes with the Pellet dispenser to connect the two devices (see the figure below).
3. Connect the Pellet receptacle to one of the TTL ports of the USB-IO box. Use the special black cable that comes with the Pellet receptacle wall. In the figure below also the Pellet dispenser is connected.

Each Pellet dispenser + Pellet receptacle combination needs two TTL ports: one for sending the pellet drop command to the Pellet dispenser, and one to read the nose pokes from the Pellet receptacle.



The diagram illustrates the Nortio Core system architecture. A computer (monitor and tower) is connected to an Ethernet board. The Ethernet board is connected to the Nortio Core unit. The Nortio Core unit has a 24 V IN power input and a Backbone input. The Backbone input is connected to the Nortio T12T TTL Terminal Hub. The Nortio T12T TTL Terminal Hub has two TTL outputs, TTL 1 and TTL 2, which are connected to a large display. Callouts show the connection of an Ethernet cable to the Ethernet board and the connection of a TTL cable to the Nortio T12T TTL Terminal Hub.

- **7**, if Trial Control conditions specify that pellets from the different dispensers are delivered at the same time; for example, 5 minutes after the trial starts for all arenas.
- **12**, if pellets from the different dispensers are not delivered at the same time; for example depending on the behavior of the subject in each arena.
- CE compliant in accordance with EMC directive 2004/108/EC.
- Pellet types: 20 mg, 45 mg. See page 33.

Pellet receptacle

- Noldus device number: PTPR-001x.
- Power supply: 7-24 V DC.
- Current consumption: max. 30mA at 24V.
- Output: open collector type.
- Connector: 3 pin female KK connector.
- Dimensions: height: 7.7 cm (3 1/32"); width: 4.5 cm (1 49/64"); depth: 5.1 cm (2 1/64").
- Weight: 62 grams (2.2 oz).
- Pellet types: 20 mg (tested), 45 mg (tested), maximum diameter 10 mm.

RELIABILITY

Noldus has tested the Pellet dispenser thoroughly in order to ensure its reliability and good functioning for long periods of time. Tests have been carried out on 16 Pellet dispensers with more than 20000 pellets dropped. The pellets tested were from Bio-Serv and TestDiet.

The deviation between the number of delivered and expected pellets is always within 5%, and in any case on the positive side. This means that a few more pellets are dropped, not fewer, than expected. For example, one instance of the **Drop pellet** command in EthoVision XT results in two pellets being dropped instead of one. There may be some variation between individual Pellet dispensers.

4.3 Work with the Pellet dispenser

ETHOVISION XT - PREPARE THE EXPERIMENT

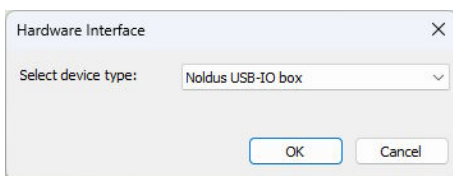
1. If you use the Mini USB-IO box, first follow the instructions under **Connect the Pellet dispenser using the Mini USB-IO box** on page 36.
2. Connect the USB-IO box / **Nortio Core** / Mini USB-IO box to the EthoVision XT computer and make sure that all devices are powered up, as described in the previous section.

For details about the USB-IO box, the Mini USB-IO box and the **Nortio Core**, see the relevant chapters in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual.

3. Start EthoVision XT and create a new experiment or open an existing one.

ETHOVISION XT - EXPERIMENT SETTINGS

1. In the Experiment Settings, select the **Use of Trial Control hardware** option, and click **Settings** next to that option.
2. In the window that opens, choose the interface device you have:
 - **Noldus USB-IO box.**
 - **Noldus Mini USB-IO box.**
 - **Noldus Nortio Core.**

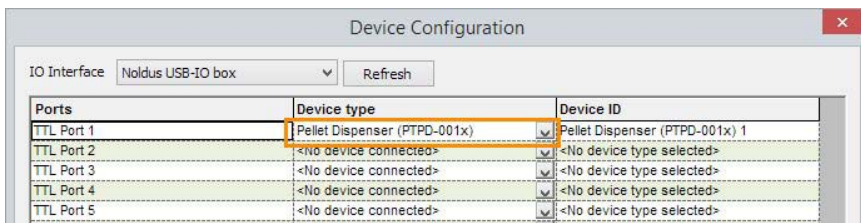


Next, click **OK**. The **Device Configuration/Nortio Configuration** window opens.

3. For the **TTL Control** port which you connected the Pellet dispenser to, select **Pellet Dispenser (PTPD-001x)** as the **Device/Device type**.

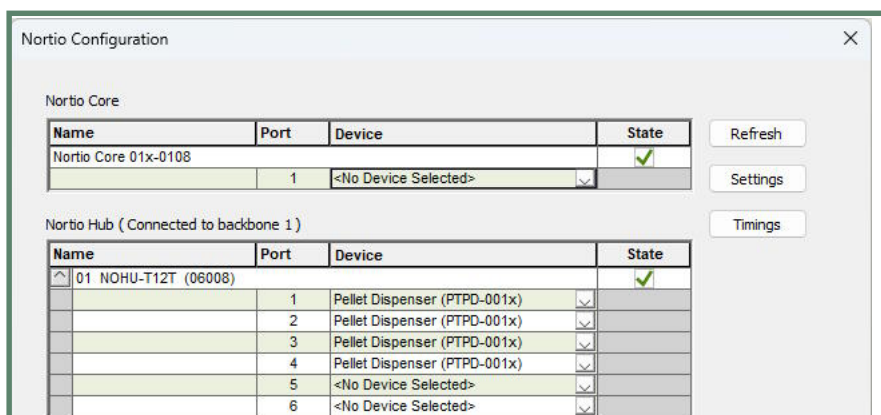
Repeat this step for each Pellet dispenser connected to TTL ports.

Example for when using the USB-IO box (one Pellet dispenser):



Example for when using the Nortio system (four Pellet dispensers connected to TTL ports 1-4 of the Nortio T12T TTL Terminal Hub):

- Under **Nortio Hub**, expand the item that applies. A list appears with the TTL ports available.
- Under **Device**, select the Pellet dispensers connected to each port.



- If your Pellet dispensers are connected to two or more USB-IO boxes, you must repeat the step above for the Pellet dispensers connected to the remaining interface devices.
 - If you use the USB-IO box: From the **IO Interface** list select a new USB-IO box, then repeat the step above.
- When ready, click **OK**.

For more information, see **Setting the port connections** in one of the following sections in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual, depending on which interface device you use:

- The USB-IO box and the Mini USB-IO box.
- The Nortio system.

ETHOVISION XT - ARENA SETTINGS

1. In the Arena Settings, define the arenas. For more information on this step, see **Arena Settings** in the EthoVision XT Help.

If you have only one arena, you can skip the following steps. The hardware is automatically assigned to the arena. You can skip this section.

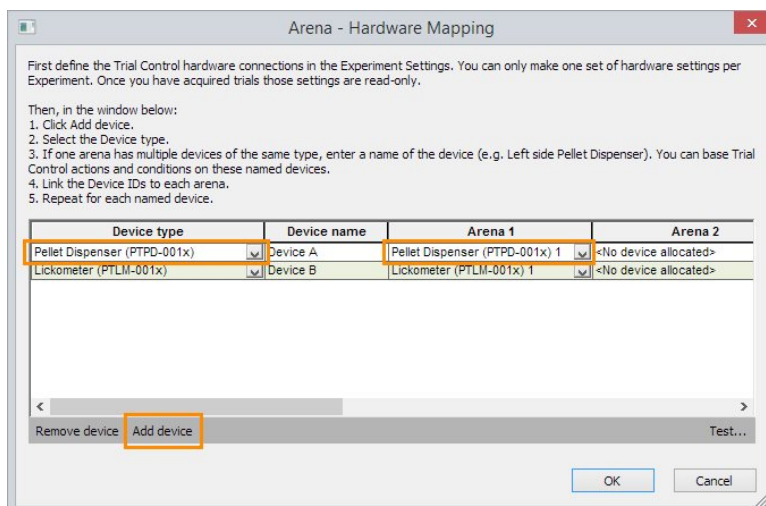
If you have more than one arena, do the following:

2. Click the **Arena - Hardware mapping** button in the **Arena Settings** window.
3. Under **Device type**, you should see **Pellet dispenser (PTPD-001x)**. If that is not the case, click **Add device** and under **Device type**, select **Pellet Dispenser (PTPD-001x)**.
4. Under **Device name**, accept the default name or type in a name, for example, **Pellet dispenser**.
5. Assign a Pellet dispenser to each arena. To do so, select the physical device **Pellet Dispenser (PTPD-001x) [n]** under the name of the arena it belongs to.

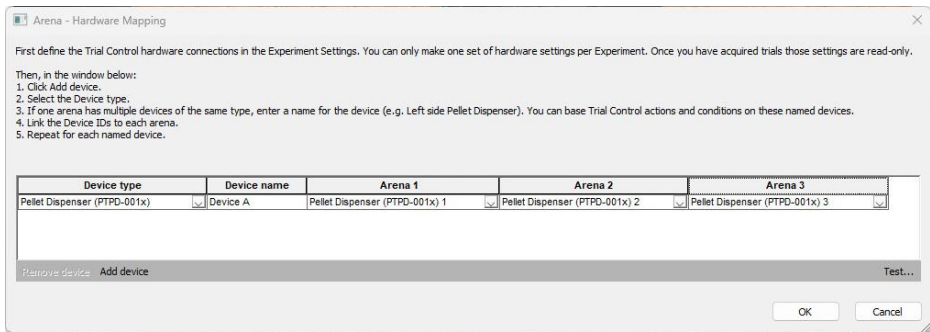
IMPORTANT Make sure that each physical device is assigned to only one arena!

6. To test the Pellet dispenser, see page 45.
7. Click **OK** to close the **Arena - Hardware mapping** window.

Example with one Pellet dispenser and one Lickometer assigned to the same arena:



Example with three Pellet dispensers, assigned to three arenas:



For more information on this step, see **Assign devices to arenas** in the EthoVision XT - Trial and Hardware Control - Reference Manual. For more information on the Arena Settings, see the section **Arena Settings** in the EthoVision XT Help.

ETHOVISION XT - TRIAL CONTROL SETTINGS

You can control the pellet dispenser by defining Trial Control Settings in EthoVision XT. As the pellet dispenser is mostly used in learning tests, you will probably need to define a sub-rule that is repeated a number of times, for a specified duration or indefinitely in order to teach the animal what the rule is. For instance, drop a pellet every time the mouse is in the trigger zone and repeat this indefinitely (see Figure 4.3).

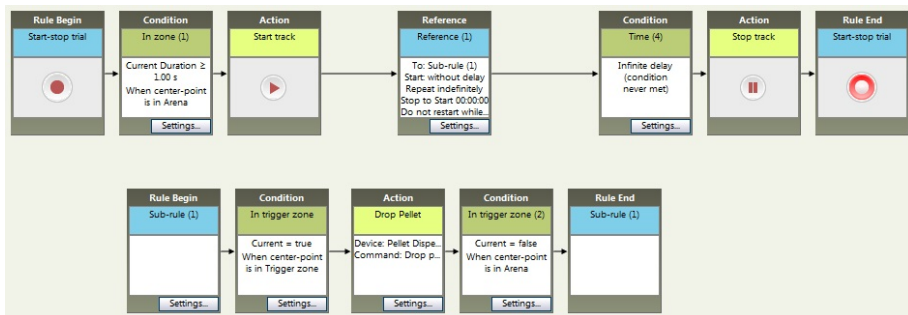


Figure 4.3 Trial Control Settings in EthoVision XT to control a pellet dispenser.

You can define a maximum trial duration to stop the trial or stop it manually.

CHECK THAT THE PELLET DISPENSER WORKS

The pellet drop detector

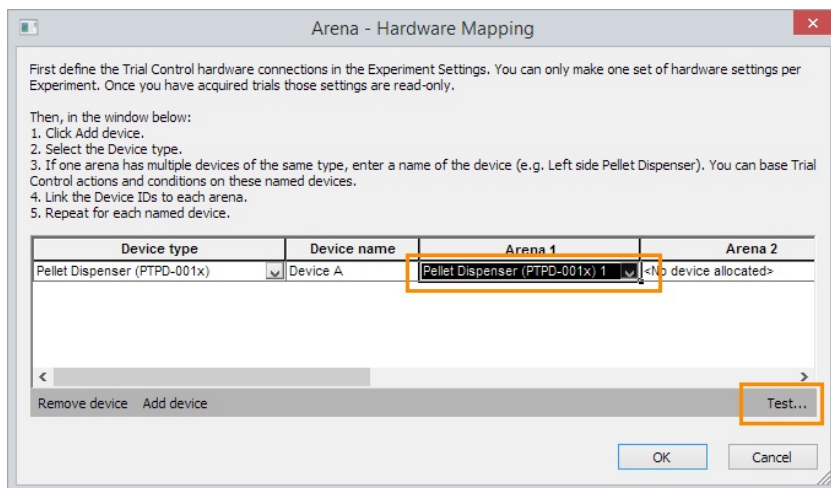
An infrared photo beam detector senses whether a pellet is dropped after a “drop pellet” command has been given (either manually by pushing the blue button at the front or with the USB-IO box and EthoVision XT). When no pellet is detected, the stepper motor moves the carousel within the silo one step further. If, even after a full rotation, no falling pellet was detected, the system considers the silo to be empty. The pellet dispenser goes into error mode and the LED at the front of the pellet dispenser blinks continuously. Fill the silo with pellets and press the blue button at the front of the pellet dispenser to reset the device. It is then ready to be used again.

Make sure that there are enough pellets in the silo before you start your experiment. If the silo is almost empty, it may take some time before a pellet is dropped. It can also be that no pellet is dropped because there is an obstruction in the falling path of the pellet caused by fragments of pellets.

Use one of the following options to check whether your pellet dispenser works and whether your Trial Control Settings do what you want them to do:

Checking before running a trial

1. Choose **Setup > Arena Settings**. Open the Arena Settings you defined earlier.
2. In the **Arena Settings** window, click the **Arena - Hardware mapping** button.
3. In the **Arena - Hardware mapping** window, select the pellet dispenser and click **Test**.



4. A new window appears. The following message should appear: **Number of drops: 0; In error state? false.**

Signal	Value	Unit
Number of drops:	0	
In error state?	false	

5. Click the **Test** button and check that a pellet is dropped. You can also view the result in the window, the number of drops increases by 1.

Signal	Value	Unit
Number of drops:	1	
In error state?	false	

NOTE When you click the **Test** button for the first time after power-on, the pellet dispenser delivers one pellet after some delay. This is due to the mechanism that operates to calibrate the drop position. This delay does not occur in the following test actions.

Checking while the trial is running

Check the LED indicator at the front of the Pellet dispenser. The LED blinks two times in a rapid sequence:

1. Single blink when the Pellet dispenser receives a Drop pellet command from EthoVision XT.
2. Single blink when a pellet is dropped.

CONTROL THE PELLET DISPENSER MANUALLY

With EthoVision XT

You can have the Pellet dispenser drop a pellet every time you press a key of the keyboard. For this, you must use EthoVision XT.

1. In the Manual Scoring Settings, define a fictitious behavior, for example, *Pellet* of type **Point event**. Assign a key to this behavior. For more information, see **Manual Scoring Settings** in the EthoVision XT Help.

Behaviors				Keys
Behavior Name	Type	Description	Initially Active	Subject 1
Pellet	Point event			p

2. In the Trial Control Settings, create a subrule that contains the following conditions and actions:

[Rule Begin] > [Condition: Frequency (Pellet)>=1] > [Action: Drop pellet] > [Rule End].

Make sure that the **Reference** box for this Subrule specifies **Repeat indefinitely**.

3. During acquisition, in the Manual Scoring tab, to drop a pellet click the button or press the key for the behavior **Pellet**.

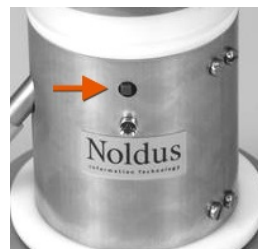
Analysis Results and Scoring		
Trial Status	Dependent Variables	Manual Scoring
Trial	Acquisition status	Pellet
No trial planned		p

4. In the Analysis profile, define the variable **Pellet** to visualize for example the total number of pellets dropped.

With the Pellet dispenser button

When using the pellet dispenser as a stand-alone device, you must connect it to a mains socket using the power supply for stand-alone use (PTPD-2010). Push the button at the front to drop a pellet.

NOTE When you press the blue button for the first time after power-on, the pellet dispenser delivers one pellet after some delay. This is due to the mechanism that operates to calibrate the drop position. This delay does not occur in the following drop actions.



WORK WITH THE PELLET RECEPTACLE

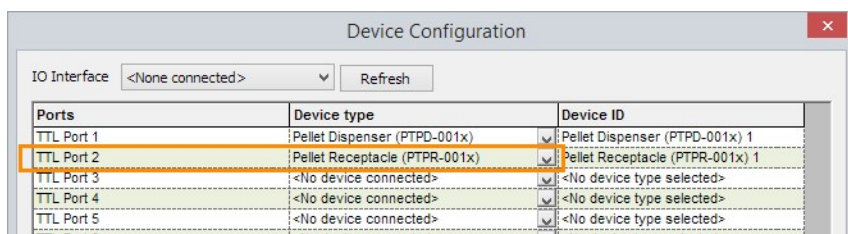
Make sure that the USB-IO box is connected to the EthoVision XT computer, and that the Pellet receptacle is connected to a TTL port of the USB-IO box (page 38).

Experiment Settings

1. In the Experiment Settings, select the **Use of Trial Control hardware** option, and click **Settings** next to that option.
2. In the window that opens, select **Noldus USB-IO box** or **Noldus Nortio Core** and click **OK**.
3. For the **TTL Control** port which you connected the Pellet receptacle to, select **Pellet Receptacle (PTPR-001x)** as the **Device/Device type**.

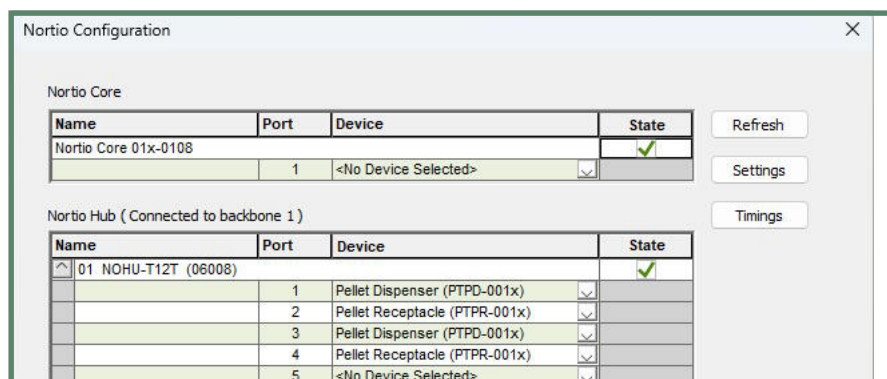
Repeat this step for each Pellet receptacle connected to TTL ports.

Example for when using the USB-IO box (one Pellet dispenser and one Pellet receptacle):



Example for when using the Nortio system (two Pellet dispensers and two Pellet receptacles are shown here):

- Under **Nortio Hub**, expand the item that applies. A list appears with the TTL ports available.
- Under **Device**, select the Pellet receptacle connected to each port.



4. If your Pellet receptacles are connected to two or more USB-IO boxes / **Nortio Hubs**, you must repeat the step above for the Pellet receptacles connected to the other interface devices.
 - If you use the USB-IO box: From the **IO Interface** list select a new USB-IO box, then repeat the step above.
 - If you use the Nortio system: Under **Nortio Hub**, expand a new Hub item, then repeat the step above.
5. When ready, click **OK**.

For more information, see **Setting the port connections** in one of the following sections in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual, depending on which interface device you use:

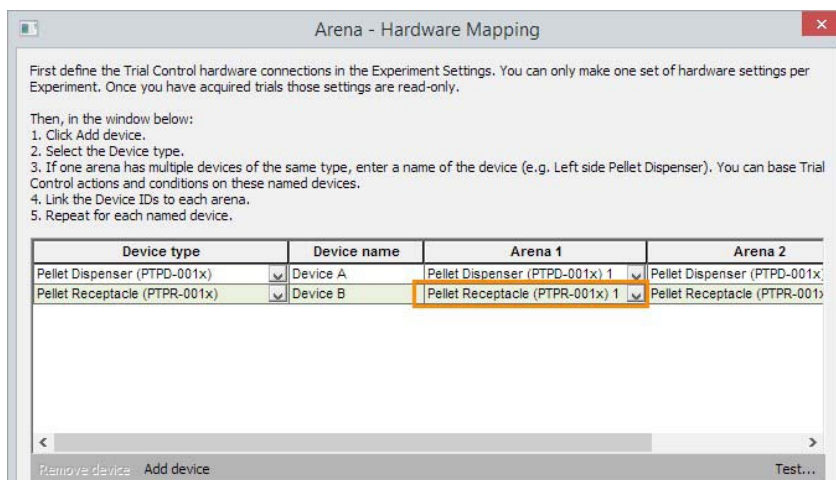
- The USB-IO box and the Mini USB-IO box.
- The **Nortio** system.

Arena Settings

If you have only one arena, you can skip the following steps. The hardware is automatically assigned to the arena.

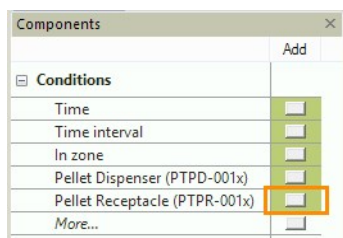
If you have more than one arena, do the following:

1. In the Arena Settings, click the **Arena - Hardware mapping** button and click **Add device**.
2. Under **Device type**, select **Pellet Receptacle (PTPR-001x)**.
3. To assign a Pellet receptacle to a specific arena, select **Pellet Dispenser (PTPD-001x)** in the corresponding column. When finished, click **OK**.



Trial Control Settings

1. Choose **Setup > Trial Control Settings**.
2. Under **Conditions**, you find **Pellet Receptacle (PTPR-001x)**.



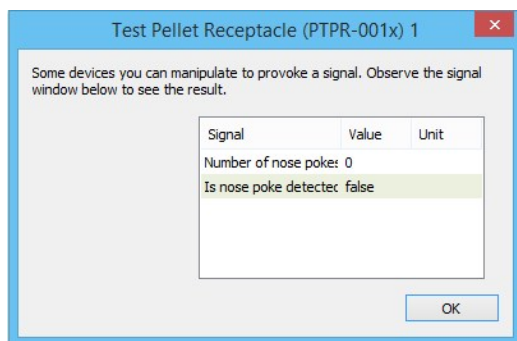
3. Click the button next to it to add a condition based in the number of pokes. For example, to stop tracking when the number of nose pokes has reached a certain value.

For more details on conditions, see also the EthoVision XT 18 - Trial and Hardware Control - Reference Manual.

TEST THE PELLET RECEPTACLE

To test the Pellet receptacle

1. Choose **Setup > Arena Settings**. Open the Arena Settings you defined earlier and click the **Arena - Hardware mapping** button.
2. In the Arena - Hardware Mapping window, select the pellet receptacle and click **Test**.
3. A new window appears with the following messages: **Number of nose pokes: 0; Is nose poke detected?: false**.



4. Click the **Test** button and insert a pen tip in the Pellet receptacle.

5. View the result in the window; the message should say **Number of nose pokes: 1** and **Is nose poke detected?: true**.

NOTE The green LED at the outer side of the receptacle switches off every time a poke occurs.

Troubleshoot the Pellet receptacle

If the pellet receptacle is not responding, do the following:

1. Check that the cable is not defective.

To do so, replace the cable from the Pellet receptacle to the USB-IO box, and between the USB-IO box and EthoVision XT (if you suspect that it may be defective too). Then repeat the test described above.

2. Check if the TTL port on the USB-IO box/[Nortio TTL Terminal Hub](#) works.

- Connect the TTL Port tester to the same port of the USB-IO box that was connected to the Pellet receptacle. As a result, the TTL-power LED of the TTL Port tester should switch on.
- Press the **IN-1** button, this should be detected by EVXT. If that happens, then the TTL port works to support the Pellet receptacle.

TIP For information about the TTL Port tester, see the EthoVision XT 18 - Trial and Hardware Control - Reference Manual.

3. Connect the Pellet receptacle to the TTL port on the USB-IO box/[Nortio TTL Terminal Hub](#) that you have just tested.

- During power-up, the green LED on the Pellet receptacle near the cable connector should blink two times and then it should stay on.
- Whenever the infrared beam in the receptacle is interrupted (e.g. when inserting the tip of a pen), the green LED shall switch off. If that does not happen, the receptacle may be defective (provided that all cables have been checked; see above), and must therefore be replaced.



Green LED on



Green LED off

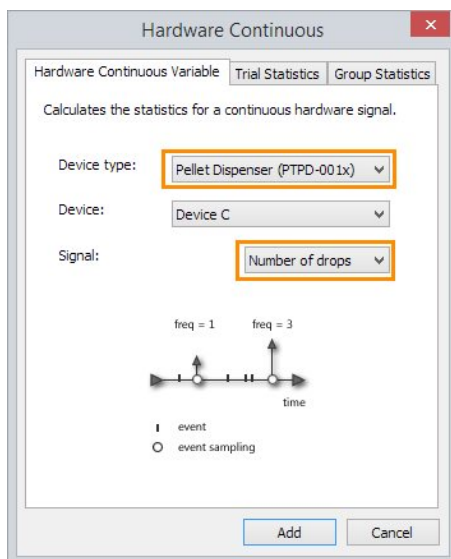
4.4 Calculate the statistics for the Pellet dispenser

ANALYSIS PROFILE

You can create an analysis profile to calculate the number of pellets dropped.

Procedure

1. Choose **Analysis > Analysis Profile > New**.
2. From the **Dependent Variables** list, under **Hardware**, click one or more of the following:
 - **Hardware continuous** or **Hardware command** if you want to calculate the total number of pellet drops, or visualize the pellet drops on a timeline.
 - **Hardware State** if you want to visualize and calculate when the number of pellets dropped exceeded a certain number.
3. Whatever option you choose, next to **Device type**, select **Pellet Dispenser (PTPD-001x)**.
Next to **Device**, select the correct device if you have more than one pellet dispenser connected.

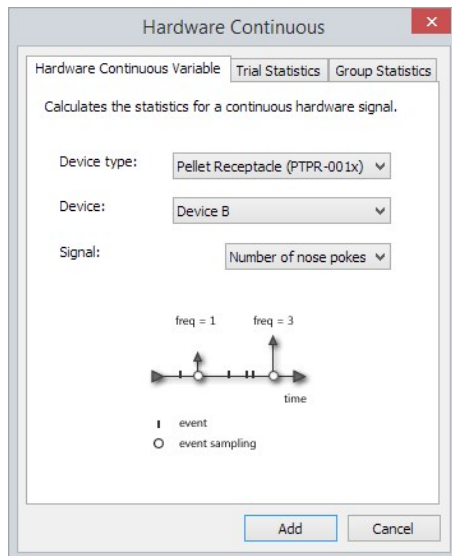


4. In the **Trial Statistics** tab, select the statistic **Total**.
5. Click **Add**. Repeat the steps from step 2 to add more variables.

Analysis profile with the Pellet receptacle

In the Analysis profile:

- To calculate the total number of pellet drops, or visualize the nose pokes on a timeline, under **Hardware** choose **Hardware Continuous**. Choose the device you want to extract the data from.

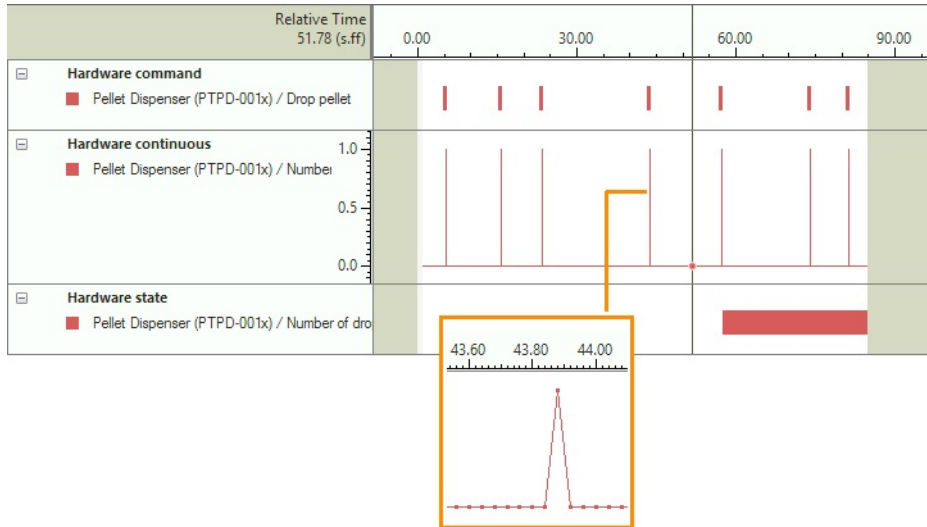


- To calculate the total duration of nose pokes, or the time that the number of nose pokes was lower or higher than a certain value, under **Hardware** choose **Hardware state**. Choose the device you want to extract the data from. Next to **Signal**, choose what you want to calculate. Choose **Is nose poke detected = true** to calculate the total nose poke time.

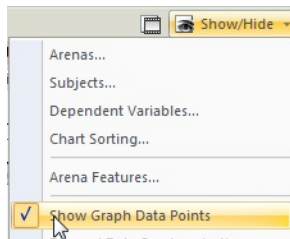
STATISTICS AND VISUALIZATION

1. Choose **Analysis > Results > Statistics & Charts**. Select the correct Data profile and Analysis profile from the lists on the toolbar and click **Calculate**.
2. To visualize the pellet drops or nose pokes on a timeline, choose **Analysis > Results > Integrated Visualization**. Select the correct Analysis profile from the list on the toolbar. You now see in the Time Event Plot when pellets were dropped.

In the figure below, from top to bottom: **Hardware command**, **Hardware continuous** (see also the inset when zooming in the timeline), **Hardware state** which was set to **Number of drops ≥ 5** , with **Cumulative** selected.

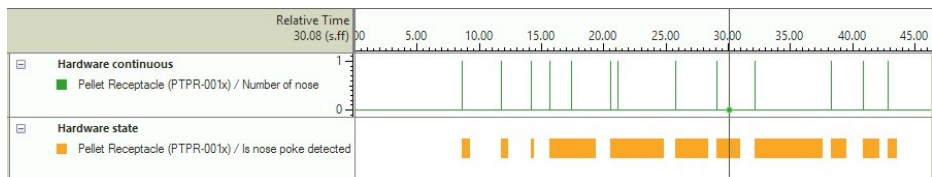


TIP For a clearer view of the data points, click **Show/Hide > Show Graph Data Points**.



Pellet receptacle

The example below shows the visualization of a Hardware continuous and a Hardware state defined as on page 53. First plot: Hardware continuous. The onset of nose pokes are plotted on the timeline. Second plot: Time that a nose poke occurred.



4.5 Maintenance and troubleshooting

CORRECT USAGE OF THE PELLET DISPENSER

How to fill the silo

Do not (re-)fill the silo while it stands on the Pellet dispenser. The procedure below prevents that a pellet falls through the hole and is crushed when you push the silo back in place.

1. Remove the silo and place it on a table. Open its lid and fill it with the pellets.
2. Close the lid. While holding the lid closed, turn the Pellet dispenser upside down and attach the silo.
3. Put the Pellet dispenser back on the table.

Only use intact pellets

If you notice dust and broken pellets in the package, carefully remove them. Use for example a sieve to divide the intact pellets from the rest.

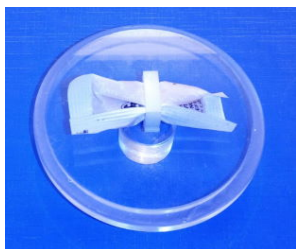
Clean the Pellet dispenser regularly

Cleaning the Pellet dispenser reduces the chance of malfunctioning.

- Clean at the end of an experiment / after 500 pellets dropped / every two days (whichever comes first).
- Replace or dry out the silica gel pack, e.g. with an oven, at the same time of cleaning. See also the section below.

Keep and use the pellets in a dry place

Make sure that you keep and use the pellets in a climate with relative humidity (RH) less than 40%. Pellets readily absorb moisture from the atmosphere. When kept in a humid climate, they absorb water and become frail. That may result in more broken pellets in the silo. We recommend to keep the silica gel pack attached to the lid of the silo.



Replace the silica gel

From mid 2022 the Pellet dispenser is provided with 2-gram sachets of RS PRO Indicating Silica Gel that can be easily replaced. This gel changes its color from yellow to green when it has absorbed the maximum moisture.



When the gel turns green, remove the sachet and attach a new or regenerated one to the lid of the silo.

Regenerate the silica gel

You can regenerate the silica gel by placing the sachet in an oven at 110°C (230°F) for three to four hours.

Do not reuse pellets

Pellets that have previously been inside the silo may weaken internally and that increases the risk that they break or produce dust during use.

CLEAN THE PELLET DISPENSER

We recommend to thoroughly clean the Pellet dispenser at regular intervals because a clean product ensures reliability and long-term use.

- Disassemble the pellet silo (see page 33) to ensure that the pellet dust can be removed easily.
- If you are going to clean a large number of Pellet dispensers, consider using an electric screwdriver to disassemble them more quickly.
- Clean the tube. Insert a dry cloth (not fraying) in the tube to pull the dust out.
- Clean the holes in the carousel. Dust cumulates in holes quite easily, which may cause pellets to get stuck.

- Usually cleaning with a dry cloth is sufficient. Do not use any liquids for cleaning purposes. Liquids can stick to the pellets or dust. Whenever liquids are used, make sure to dry all parts completely.
- Clean the upper part of the carousel, 8-10 minutes depending on the cleaning substances used.

TROUBLESHOOTING

The pellet dispenser is full of pellets, but it fails to drop a pellet.

1. Disconnect the Pellet dispenser from USB-IO box and remove the silo.
2. Manually insert a pellet into the acrylic tube (see the figure) and check whether the pellet is dropped.



3. If the pellets does not come through, there must be some material obstructing the route. Try to remove it by “poking” gently into the acrylic tube using a 3-mm Polyurethane foam swab (see the figure below), a flexible wire or a tie-wrap.

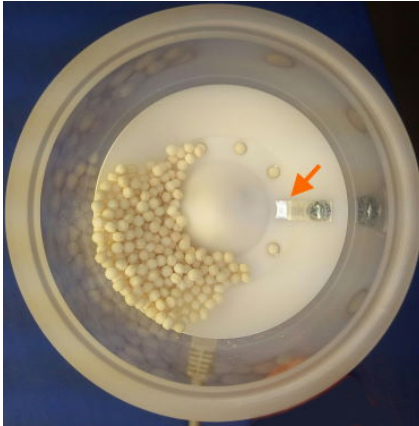


IMPORTANT Do not use any object that could cause scratches inside the tube.

4. If no obstruction is found, do the following:
 - *The IR beam detector could be defective.* Connect the dispenser to the USB-IO box in order to get power. After you press the blue button, the Pellet dispenser attempts to drop the first pellet. Manually drop a pellet into the acrylic tube. When the pellet is

detected, the device should stop rotating and the red LED should give a single blink to indicate “pellet dropped”. In that case, detection is working fine. If IR detector is not working correctly, contact Noldus to have the dispenser repaired or replaced.

- *There may be some mechanical problem.* Remove most of the pellets out of the silo, just have very few (5-8) remaining. Apply power and press the blue button. Have a look into the silo. The dispenser will search for the first pellet and drop it. If that is the case, press the blue button again and the next pellet has to be found and dropped. If that does not work, the aluminum hole cover clip may prevent pellets to fall down. You can adjust the position of the clip by somewhat unscrewing it and fasten it gently again afterwards. The optimal position of the clip also depends on the pellet type used. Some experimenting may be needed.



If none of the steps above help, the dispenser has to be checked and repaired. In case of repair, please always ship the complete unit to Noldus.

The Lickometer

5.1 General information	60
5.2 Install the Lickometer	62
NOTE If you work with the Nortio interface system, you must alter the jumper settings inside the Lickometer. This way the Lickometer can work as a TTL device connected to the Nortio TTL Terminal Hub. See page 63	
5.3 Work with the Lickometer.....	64
5.4 Calculate the statistics for the Lickometer	72

5.1 General information

THE LICKOMETER

The Noldus Lickometer is a device that measures contact between a rat or mouse and its water bottle. It consists of an electronics box with (A) a metal ground plate and (B) a clip attached to it (see Figure 5.1). Whenever a mouse or a rat contacts the spout of the water bottle, the capacitance between the clip attached to the spout and the metal ground plate changes (see Figure 5.1). This change is detected by the Lickometer. The advantage of this system is that there is no current flow through the animal. The Lickometer is designed as an add-on to the PhenoTyper.

To be able to receive information from hardware devices you need the Trial and Hardware Control module. You can control multiple lickometers with EthoVision XT (up to six per USB-IO box). For the limitations, see **Control hardware devices** in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual.

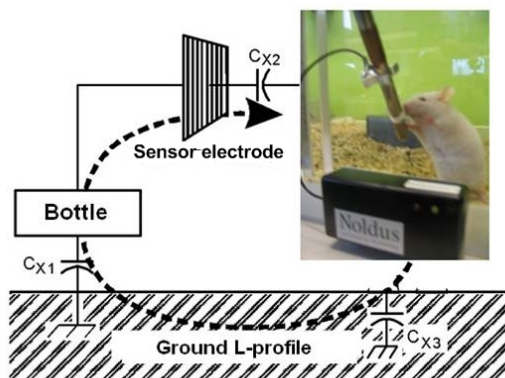


Figure 5.1 Lickometer: principle of operation.

Contents of the Lickometer package

A Lickometer package includes:

- A Lickometer PTLM-001x.

- A black network cable with RJ45 connectors, 1 meter long.



Figure 5.2 The Noldus Lickometer PTLM-001X.

Sample reference

Ho, A.L. *et al.* 2021. Accumbens coordinated reset stimulation in mice exhibits ameliorating aftereffects on binge alcohol drinking. *Brain Stimulation* 14: 330-334. doi: <https://doi.org/10.1016/j.brs.2021.01.015>.

TECHNICAL SPECIFICATIONS

- Noldus device number: PTLM-001X.
- Power supply: 12-24 V DC.
- Current consumption: standby 20 mA.
- Connector: RJ45 8 pin modular.
- Input/output: SDI type 1.
- Dimensions: 80 x 45 x 21 mm (l x w x h) (electronics box), 80 x 55 mm (ground plate).
- Weight: 200 grams.
- CE compliant in accordance with EMC directive 2004/108/EC.
- Interface: Noldus USB-IO box and Nortio T12T TTL Terminal Hub.
- Applications: The Lickometer is suitable to measure drinking behavior of both rats and mice. You do not need to change any settings when you switch between species.

5.2 Install the Lickometer

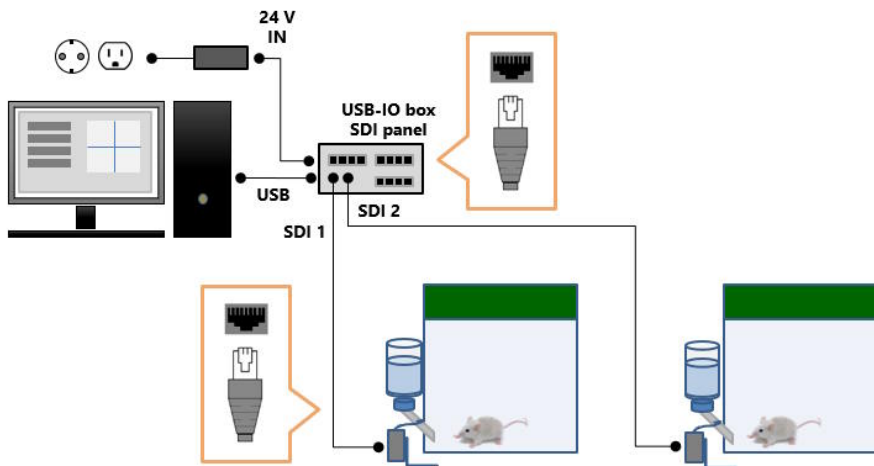
Although the network cables shown in the following schemes are used in networks, the signal coming from the Lickometer is not a network signal. Do not connect the Lickometer via a network hub or similar. Also do not connect the Lickometer to the Mini USB-IO box.

Connect the Lickometer using the USB-IO box

1. Make sure that the USB-IO box is connected to (A) your EthoVision computer and (B) a power supply.
2. Connect the Lickometer to one of the **SDI Control** ports at the backside of your USB-IO box (either one of the ports 1-12, not port 13), using the black RJ45 cable. The power supply also goes via this cable. When you connect the Lickometer, the red LED at the front of the electronics box blinks.
3. To attach the Lickometer to a PhenoTyper cage, place the metal ground plate underneath the cage.

IMPORTANT Make sure that the PhenoTyper cage is on a wooden or synthetic table, not a metal one. A metal table interferes with the capacitance.

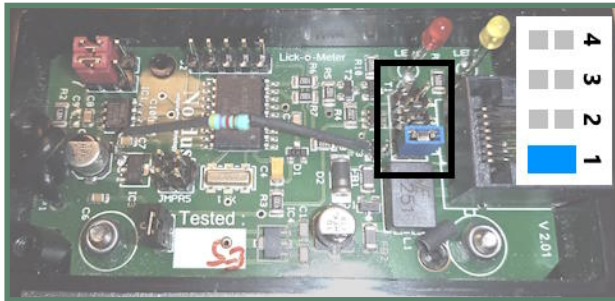
4. Connect the clip to the metal spout of the water bottle.
5. When the animal touches the spout of the water bottle, the red LED at the front of the electronics box turns on.



Connect the Lickometer with the Nortio system

IMPORTANT In order to use the Lickometer in combination with the Nortio system, you must modify the jumper settings inside the Lickometer electronics box.

1. Unscrew the cover of the Lickometer.
2. Locate the jumpers on the board, that is, the pins with the blue covers numbered 1-4.
3. Make sure that jumper position 1 is closed (that is, the two pins are covered with a blue cover) and the other jumper positions 2, 3 and 4 are open (the pairs of pins are visible).



This way the Lickometer is set to work as a TTL device.

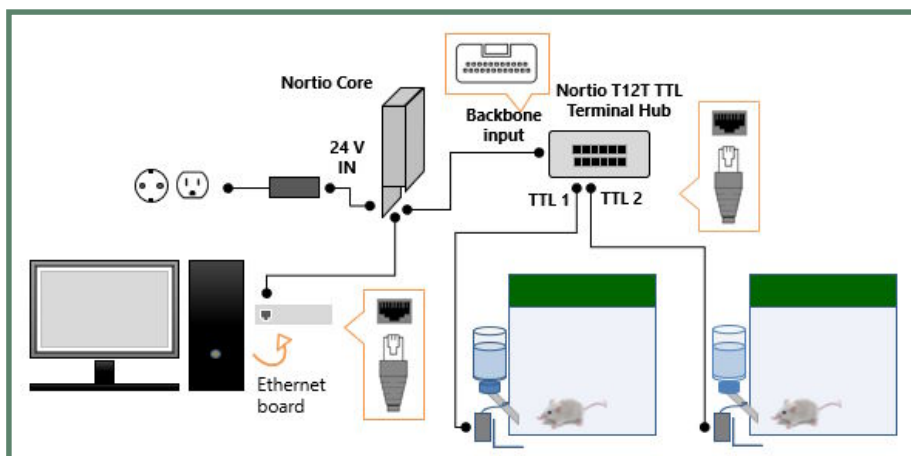
4. Close the cover of the Lickometer.

You can now connect the Lickometer to the Nortio system (see the next figure).

1. Connect the Nortio Core to the EthoVision XT computer using a network cable.
2. Connect the Nortio T12T TTL Terminal Hub to the Nortio Core using the backbone input cable.
3. Connect the Lickometer to one of the TTL control ports of the Nortio T12T TTL Terminal Hub using a network cable.
4. Make sure that the Nortio Core is connected to a power supply.
5. To attach the Lickometer to a PhenoTyper cage, place the metal ground plate underneath the cage.

IMPORTANT Make sure that the PhenoTyper cage is on a wooden or synthetic table, not a metal one. A metal table interferes with the capacitance.

6. Connect the clip to the metal spout of the water bottle.
7. When the animal touches the spout of the water bottle, the red LED at the front of the electronics box turns on.



For how to install the Nortio system and the configure the Ethernet board on your PC, see the section **The Nortio system** in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual.

Working with an older Lickometer version

The previous version of the Lickometer came with an X-keys USB Switch Interface which is no longer used. To use this older version of the Lickometer in combination with a USB-IO box, you must modify the jumper settings inside the Lickometer electronics box.

1. Unscrew the cover of the Lickometer.
2. Locate the jumpers on the board, that is, the pins with the blue covers numbered 1-4.
3. Make sure that jumper position 1 is open (that is, the two pins are visible) and jumper positions 2, 3 and 4 are closed (the two pins are covered with the blue covers).
4. Close the cover of the Lickometer.

5.3 Work with the Lickometer

ETHOVISION XT - PREPARE THE EXPERIMENT

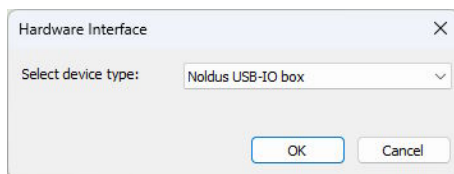
1. Make sure that you have followed the instructions in the previous section depending on which interface device you have.

2. **IMPORTANT** If you start EthoVision XT before the Lickometer set-up is fully connected it may not function properly. Also, if you disconnect and reconnect one of the cables of the Lickometer set-up while the experiment is open, the Lickometer may not function properly.
3. Start EthoVision XT and create a new experiment or open an existing one.

ETHOVISION XT - EXPERIMENT SETTINGS

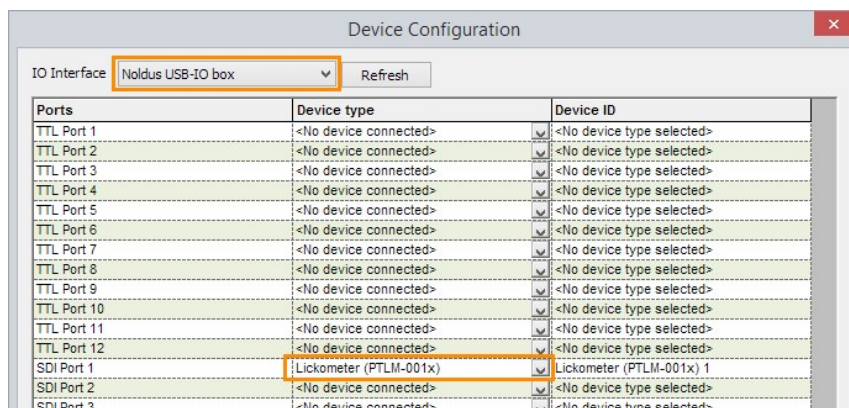
1. In the Experiment Settings, select the **Use of Trial Control hardware** option, and click **Settings** next to that option.
2. In the window that opens, choose the interface device:
 - **Noldus USB-IO box.**
 - **Noldus Nortio Core.**

NOTE The Lickometer does not work in combination with the Mini USB-IO box.



Next, click **OK**. The **Device Configuration/Nortio Configuration** window opens.

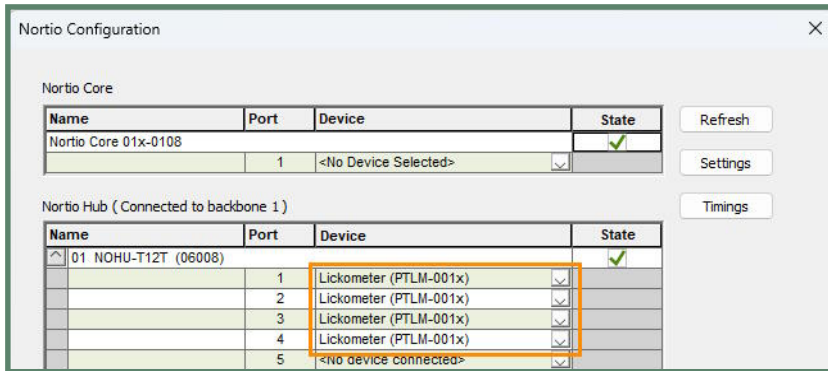
3. Do the following depending on which interface device you have:
 - If you have the USB-IO box: For the **SDI Control** port to which you connected the Lickometer, select **Lickometer (PTLM-001x)** as the **Device type**. In the example below, the Lickometer is connected to **SDI Port 1**.



Example with two lickometers:

SDI Port 1	Lickometer (PTLM-001x)	Lickometer (PTLM-001x) 1
SDI Port 2	Lickometer (PTLM-001x)	Lickometer (PTLM-001x) 2
SDI Port 3	<No device connected>	<No device type selected>
SDI Port 4	<No device connected>	<No device type selected>

- If you have the Nortio system: Under **Nortio Hub**, expand the item that applies. A list appears with the TTL ports available. Under **Device**, select the Lickometers connected to each port.



- If the Lickometers are connected to two or more USB-IO boxes, you must repeat the step above for the Lickometers connected to the remaining interface devices.
 - If you use the USB-IO box: From the **IO Interface** list select a new USB-IO box, then repeat the step above.
- When ready, click **OK**.

For more information, see **Setting the port connections** in one of the following sections in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual, depending on which interface device you use:

- The USB-IO box and the Mini USB-IO box.
- The Nortio system.

ETHOVISION XT - ARENA SETTINGS

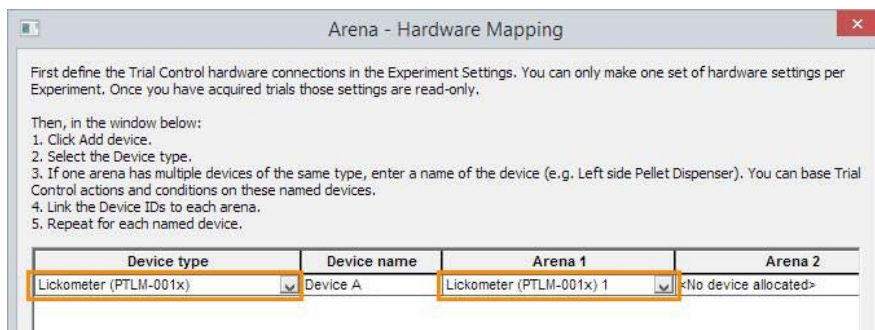
- In the Arena Settings, define the arenas.

If you have only one arena, the hardware is automatically assigned to the arena. You can skip this section.

If you have more than one arena, do the following:

2. Click the **Arena - Hardware mapping** button in the **Arena Settings** window.
3. Under **Device type**, you should see **Lickometer (PTLM-001x)**. If that is not the case, Click **Add device**, and under **Device type** select **Lickometer (PTLM-001x)**.
4. Accept the default name under **Device name** or type in a name, for example, **Lickometer**.
5. Assign a Lickometer to each arena. To do so, select **Lickometer (PTLM-001x)** under the name of the arena it belongs to. Do this for all lickometers.

IMPORTANT Make sure that each physical device is assigned to only one arena!



For two arenas:

Device type	Device name	Arena 1	Arena 2
Lickometer (PTLM-001x)	Device A	Lickometer (PTLM-001x) 1	Lickometer (PTLM-001x) 2

6. Click **OK** to close the **Arena - Hardware mapping** window.

For more information on this step, see **Assign devices to arenas** in the **EthoVision XT - Trial and Hardware Control - Reference Manual**. For more information on the **Arena Settings**, see the section **Arena Settings** in the **EthoVision XT Help**.

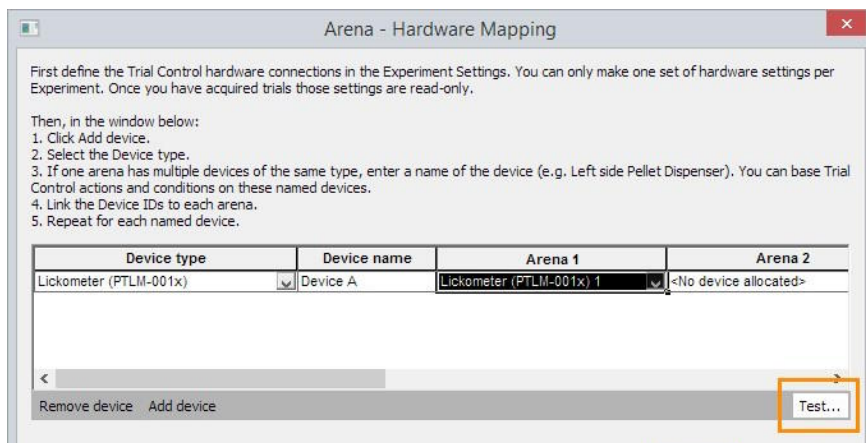
CHECK THAT THE LICKOMETER WORKS

IMPORTANT Before you start **EthoVision XT**, make sure that the USB-IO box is connected to (A) your **EthoVision** computer and (B) a power supply, and that the Lickometer is connected to the USB-IO box/**Nortio T12T TTL Terminal Hub**. If you start **EthoVision XT** before the Lickometer set-up is fully connected, it may not function properly. Also, if you disconnect and reconnect one of the cables of the Lickometer set-up while the experiment is open, the Lickometer may not function properly.

Use one of the following options to check whether your Lickometer works:

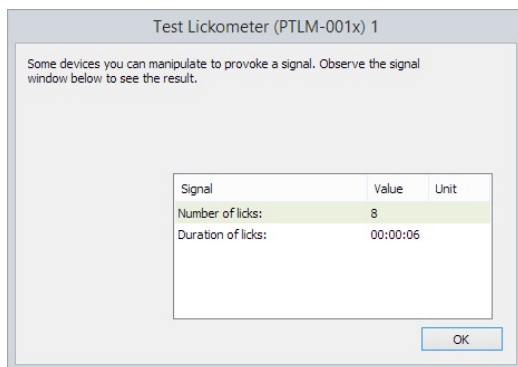
Before running a trial

1. Open the Arena Settings in which you have mapped the Lickometers.
2. In the **Arena Settings** window, click the **Arena - Hardware mapping** button.
3. In the **Arena - Hardware mapping** window, click the Lickometer under **Arena** and click **Test**.



4. The **Test Lickometer** window appears. Touch the Lickometer's clip and check the result in the window.

Every time you touch the clip, the number of licks and the duration of licks should increase.



If you notice unusually high numbers of licks during this test, the Lickometer set-up has been connected after you opened the experiment. To solve this, close and re-open the experiment. Test the Lickometer again. It should now work properly.

While a trial is running

Check the red and yellow LEDs at the front of the Lickometer's electronics box.

- The red LED is on when the animal touches the water bottle spout.
- The yellow LED blinks periodically. This indicates that EthoVision XT requests information from the Lickometer.

After the trial has been acquired

- Export your data in a hardware log. The hardware log gives you an overview of the hardware events that occurred during the trial. See page 71.
- Make a Time Event plot. See page 72.

ACQUIRE THE DATA

EthoVision XT and the Lickometer are now configured. Follow the usual steps to define the detection settings and acquire the data.

For more information, see the EthoVision XT Help (F1).

Lickometer data acquired with the USB-IO box

Every two seconds the USB-IO box collects data from the Lickometer and sends it to EthoVision XT. These time points are marked by a blink of the yellow LED on the electronics box. After each reading, the Lickometer is reset. EthoVision XT counts:

- The number of touch events since the last reading.
- The cumulative touch duration since the last reading (with a 10 msec resolution).

The example in Figure 5.3 explains how the data collection works.

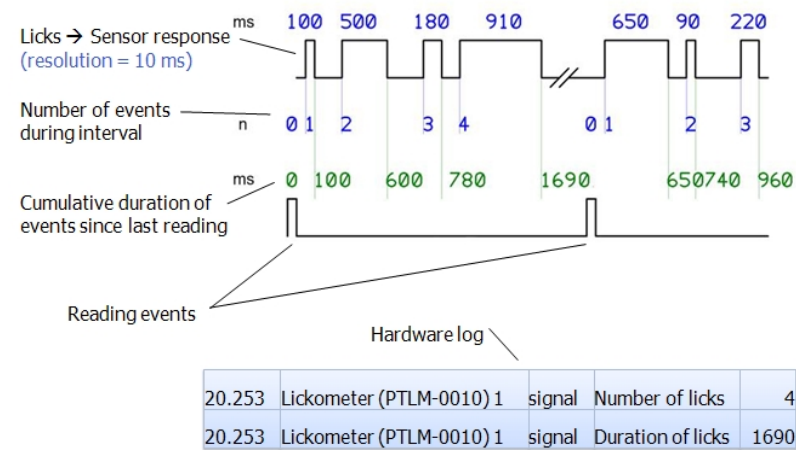


Figure 5.3 Diagram explaining how the Lickometer data collection works.

In the plot at the top, you can see that the animal touches the water bottle spout a number of times. The duration varies (indicated with the numbers above the plot). When the USB-IO box/EthoVision requests information (reading events), the Lickometer reports that there were 4 touch events since the last reading and that the cumulative touch duration was 1690 msec. This information is added to EthoVision XT's hardware log. After each reading, the Lickometer is reset and counting starts from 0.

NOTE The reading events are not in sync with the trial start and stop. This means that:

- The data of the first reading event *after* the trial start also includes some time *before* the trial start (< 2 s). This time is included in the results.
- The data between the last reading event and the stop of the trial is **not** included in the results. This time is again < 2 s depending on when the trial stopped.

In most cases the two discrepancies have no effect on your data when the trial lasts at least a few minutes, like in typical PhenoTyper tests.

TIP If you want a device to have a different sample rate, contact Noldus. See **User-defined hardware devices** in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual.

Lickometer data acquired with the Nortio system

The Lickometer data are of the same type whether you use the USB-IO box or the Nortio system. However, an important difference is that with the Nortio system the lick events are recorded real-time, not at regular intervals. While the USB-IO box reads the Lickometer data every two seconds, in such a way that lickometer data are stored at two-seconds time

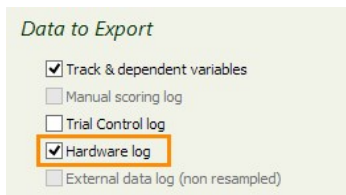
resolution, the Nortio system makes it possible to record the lickometer data as true TTL signals associated with a specific sample time. The latter ensure higher timing accuracy. The sequence of events is as follows:

- The Lickometer sends the sensor signal to the Nortio T12T TTL Terminal Hub.
- The Nortio T12T TTL Terminal Hub sends the signal to the Nortio Core.
- The Nortio Core evaluates the signal every 5 ms and counts the number of licks and the cumulative duration of the licks.
- EthoVision XT receives the data from the Nortio Core. Data are assigned to a specific sample time. Note that this differs from what occurred when using the USB-IO box, where data were associated with a 2-second interval.

VIEW THE DATA IN THE HARDWARE LOG

The hardware log lists the hardware events that occurred during the trial (see Figure 5.4 for an example). The feedback signal sent by the Lickometer to EthoVision is **Number of licks** and **Duration of licks**.

To export a hardware log, choose **Analysis > Export > Track Data** and under **Data to Export** select the option **Hardware log**.



In the next figure you find an example of a hardware log with Lickometer data.

	A	B	C	D	E	
1	Time	Device	Command/Signal	Name	Value	
2	6.12	Lickometer (PTLM-0010) 1	signal	Number of licks	1	
3	6.12	Lickometer (PTLM-0010) 1	signal	Duration of licks	850	
4	8.12	Lickometer (PTLM-0010) 1	signal	Number of licks	1	
5	8.12	Lickometer (PTLM-0010) 1	signal	Duration of licks	1550	
6	30.16	Lickometer (PTLM-0010) 1	signal	Number of licks	1	
7	30.16	Lickometer (PTLM-0010) 1	signal	Duration of licks	730	
8	32.16	Lickometer (PTLM-0010) 1	signal	Number of licks	1	
9	32.16	Lickometer (PTLM-0010) 1	signal	Duration of licks	1980	
10	34.16	Lickometer (PTLM-0010) 1	signal	Number of licks	1	

Figure 5.4 Hardware log with the number and duration of licks. The sample time is indicated in column A. The type of data (either number of licks or duration of licks) is marked in column D. The value read at the end of the corresponding sampled interval is shown in column E.

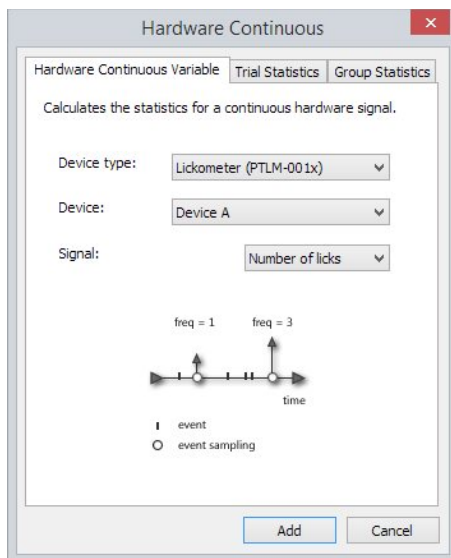
5.4 Calculate the statistics for the Lickometer

ANALYSIS PROFILE

You can create an analysis profile to calculate the number of licks or the duration of licks, or visualize and calculate the time that the number or duration of licks exceeded a specific value.

Procedure

1. Choose **Analysis > Analysis Profile > New**.
2. From the **Dependent Variables** list, under **Hardware** choose one or more of the following options:
 - **Hardware continuous** if you want to calculate the total number of licks or the total duration of licks, or visualize the raw data on the timeline.
 - **Hardware state** if you want to visualize the time when the number of licks or the duration of licks is higher or lower than a specific threshold.
3. In the window that opens, next to **Device type**, select **Lickometer (PTLM-001x)**.
4. Next to **Device**, select the device you want to analyze. The names reported here were defined in an earlier step (see page 66).
5. Next to **Signal**, select **Number of licks** or **Duration of licks**.



If you select **Hardware state**, and then **Duration of licks** as Signal, specify the threshold time in microseconds. For example, 1000000 for one second.

6. In the **Trial Statistics** tab, select the statistics you want to calculate. For example:

- For a Hardware continuous variable: To calculate the total number of licks (Hardware continuous - Number of licks), select **Total** if you collected the data with the USB-IO box. However, if you collected the Lickometer data with the Nortio system, select **Maximum**.
- For a Hardware state variable: To calculate the time taken before a certain duration of licks has been reached (Hardware state - Duration of licks > ... seconds), select **Latency to First**. If you want to calculate the time after the threshold has been reached, select **Cumulative Duration**.

7. Click **Add**. Repeat the procedure from step 2 to add another variable.

The Cumulative value option

The **Cumulative value** option is available when you choose a variable of type Hardware state. How you use this option depends on which interface system you use between EthoVision XT and the Lickometer.

- Select **Cumulative value** if you want to mark the time that the cumulative value of number (of duration) of licking events has reached a specific threshold. For example, **Cumulative value of Duration of licks \geq 10000000** (10 seconds). At each sample, the value of cumulative number (or duration) taken from all the previous sampled intervals is compared with the threshold value.

- Keep **Cumulative value** de-selected if you want to mark the time that the number (of duration) of licking events has reached a threshold within the sampled interval. In the example below, we want to mark the time that the duration of licks exceeded 1 second in each sampled interval of the Lickometer, which lasts two seconds.

Device type: Lickometer (PTLM-001x) ▼

Device: Device B ▼

Signal: Duration of licks ▼

Value: >= ▼ 1000000

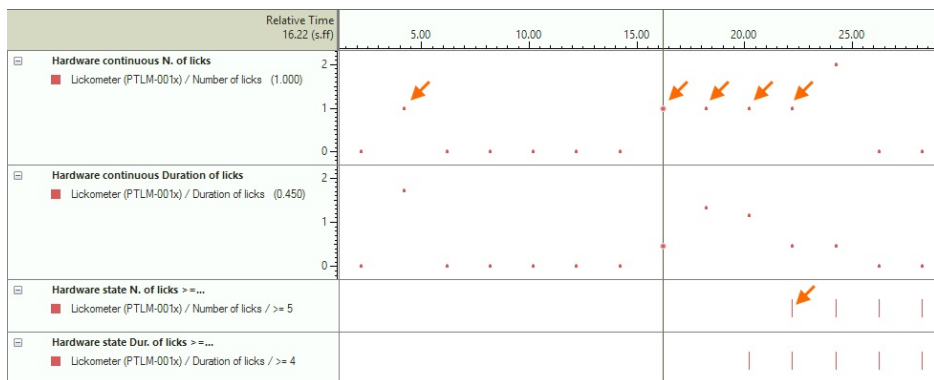
☐ Cumulative value

- If you work with the Nortio system:
 - For Number of licks, keep **Cumulative value** selected.
 - For Duration of licks, keep the **Cumulative value** de-selected.

STATISTICS AND VISUALIZATION

1. Choose **Analysis > Results > Statistics & Charts**. Select a Data profile and an Analysis profile from the lists on the toolbar and click **Calculate**.
2. To visualize the number of licks and their durations, choose **Analysis > Results > Integrated Visualization**. Select the correct Analysis profile from the list on the toolbar. You now see in the Time Event Plot when licks took place.

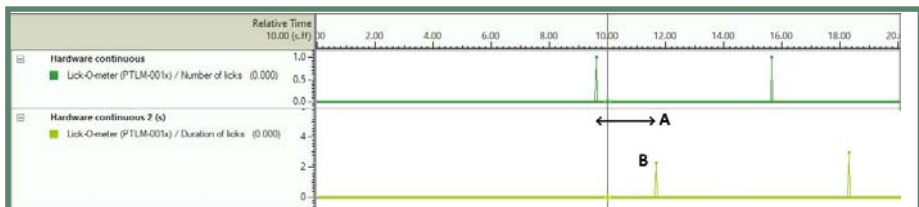
Lickometer data acquired with the USB-IO box



- First plot: **Hardware continuous** set to **Number of licks**. The arrows indicate the first five lick events. These are marked with dots when the variable **Hardware continuous** (Number of licks) has value 1 in each sampled interval. Because the sampled interval is of two seconds, the time distance between two subsequent dots is always two seconds. When there are no lick events, the value of the variable is zero.
- Second plot: **Hardware continuous** set to **Duration of licks**. Each dot represents the duration of licks in each sampled interval. Because this interval lasts two seconds (see page 70), the values of lick duration range between zero and two seconds.
- Third plot: **Hardware state** set to mark the time that the **Number of licks** exceeds five. The option **Cumulative** was selected in the variable settings. For this reason, the variable is active when **Hardware continuous** (**Number of licks**) gets the value 1 for the fifth time. The arrow indicates that moment (see also the first plot).
- Fourth plot: **Hardware state** set to mark the time that **Duration of licks** ≥ 4000000 s (four seconds), with the option **Cumulative** selected. This variable becomes active for the first time when the sum of the values of the variable **Hardware continuous** - **Duration of licks** (see the second plot) exceeds four seconds. The option **Cumulative** allows to sum up the values of duration (as in the second plot) and compare the sum with the specified threshold.
- **TIP** If the plots of the **Hardware continuous** variable appear empty, click **Show/Hide > Show Graph Data Points** and zoom in the plot to show the dots larger.

Lickometer data acquired with the Nortio system

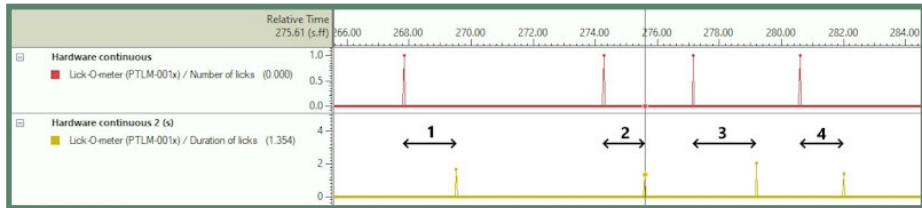
For **Hardware continuous** variables:



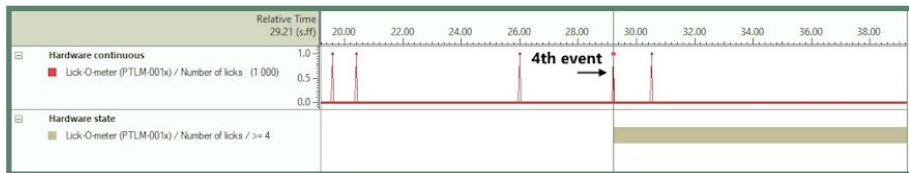
- First plot: **Hardware continuous** set to **Number of licks**. The lick events can occur at any sample time, not at regular intervals as it is the case for lickometer data collected with the USB-IO box (see above). The start of a lick event is scored as 1. The rest is scored as zero. The figure above shows two lick events.

Second plot: **Hardware continuous** set to **Duration of licks**. The color line is made of dots that represent the duration of licks at the current time. In the beginning the duration is always zero. The first lick event occurs just before 10:00 and lasts about two seconds. The duration of the lick event (A) is shown in this plot, at the end of the lick event (B).

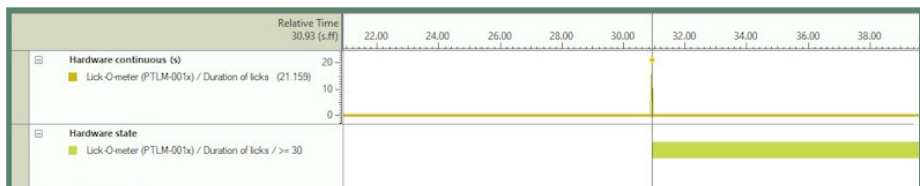
Note that each spike of **Duration of licks** comes after a spike of **Number of licks**. The distance between the two spikes is the duration of that lick event. The total duration of the lick events 1, 2, 3... is the sum of the height of the spikes in the second plot.



For **Hardware state** variables:



- First plot: Number of licks displayed with the variable **Hardware continuous**.
- Second plot: **Hardware state** set to mark the time that the **Number of licks** exceeds 4. The option **Cumulative value** was selected in the variable settings. The variable **Hardware state** is active when the cumulated number of lick events reaches 4.



- First plot: Duration of licks displayed with the variable **Hardware continuous**. A previous event of about 10 seconds is not shown. The current event lasts more than 20 seconds, so the cumulative duration of licks at the current time exceeds 30 seconds.
- Second plot: **Hardware state** set to mark the time that **Duration of licks** ≥ 3000000 microseconds (30 seconds). The option **Cumulative** was selected in the variable settings. The variable **Hardware state** is active when the cumulated duration of licks reaches 30 seconds.

Notes

- To know the time taken for the number or duration of licks to reach the specified value, in the Analysis profile re-open the variable settings window and in the Statistics tab select the statistic **Latency to First**.

PhenoWheel

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6.1 General information

PHENOWHEEL

PhenoWheel is a PhenoTyper add-on for measuring activity in a running wheel in a PhenoTyper cage. PhenoWheel consists of:

- A specially prepared cage wall (type PTC3-RW01) for the PhenoTyper 3000 cage.
- A running wheel (type PTRW-0150) with a 15-cm diameter (see Figure 6.1 below).



Figure 6.1 PhenoTyper cage with a mounted PTRW-0150 running wheel. On the back side, the counter module.

To use PhenoWheel you also need:

- EthoVision XT with the Trial and Hardware Control module.
- As interface device: the Noldus USB-IO box or the Noldus Nortio system.
- The **PTCN-001x** Phenocount module (see Figure 6.2).
 - **PTCN-0010** for use in combination with the USB-IO box (SDI mode only).
 - **PTCN-0011** for use in combination with the USB-IO box (SDI mode, or TTL mode) or with the Nortio system (TTL mode only).

You find the version number on the back of the device (see Figure 6.2).

- The PhenoTyper 3000 cage for mice.

NOTE The Med Associates Activity Wheel for rats can be used with the USB-IO box.



Figure 6.2 The PhenoCount counter module.

NOTE The working modes TTL and SDI specify how data re sent out to EthoVision XT.

- In TTL mode (default factory mode in PTCN-0011), each wheel turn results in a TTL pulse being sent to EthoVision XT.
- In SDI mode, each wheel turn results in an increase of the internal counter by 1. The current number of turns is read by EthoVision XT at regular intervals.

Contents of the PhenoWheel package:

- Cage wall (type PTC3-RW01) for PhenoTyper 3000 series.
- Running wheel (type PTRW-0150) of diameter 15 cm (5 29/32 inches).
- PhenoCount module.
- A network cable with RJ45 connectors, 1 meter long.

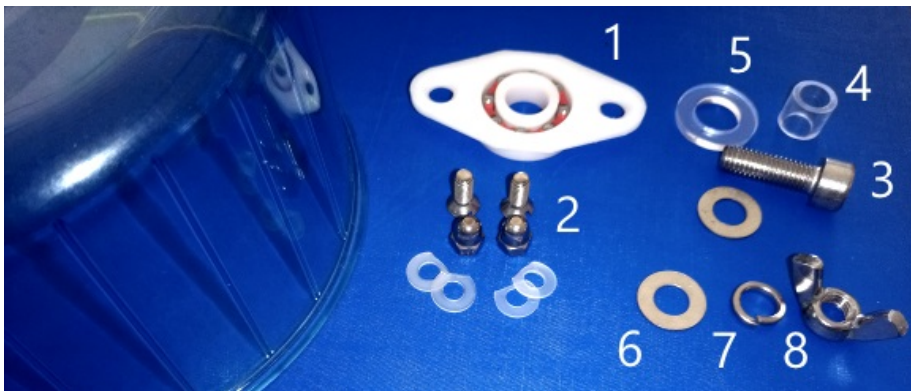
TECHNICAL SPECIFICATIONS

- Noldus device number: PTCN-0011.
- Power supply: 12-24 V DC.
- Current consumption: standby 20 mA.
- Connectors:
 - To USB-IO box, **Nortio**: RJ45 8 pin modular.
 - TO magnetic sensor: Molex 2 pin MiniFit jr.

- Input/output: SDI type 1, TTL (select by jumpers).
- Dimensions: electronics box 80 x 45 x 21 mm; 3 5/32 x 1 49/64 x 53/64 inches (l x w x h), ground plate 80 x 55 mm; 3 5/32 x 2 11/64 inches.
- Weight: 200 grams.
- CE compliant in accordance with EMC directive 2004/108/EC.
- Interface: Noldus USB-IO box and Nortio T12T TTL Terminal Hub.
- Applications: PhenoWheel is suitable to measure running wheel activity in mice.

6.2 Install PhenoWheel

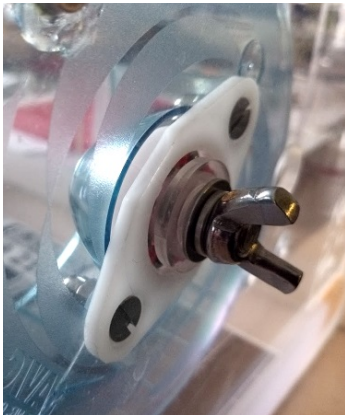
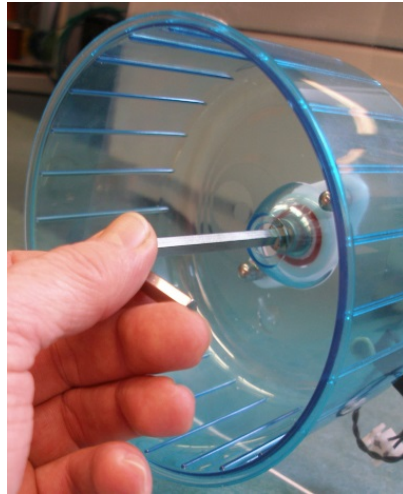
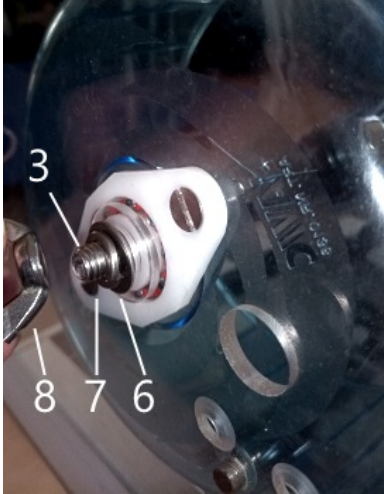
COMPONENTS



PROCEDURE

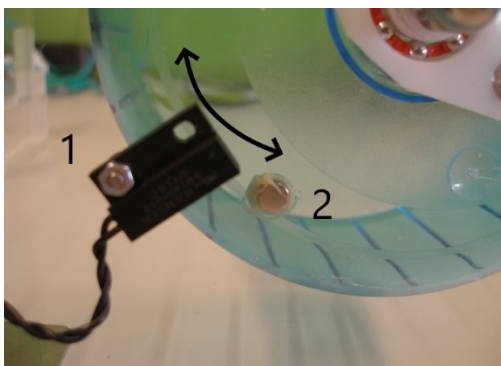
1. If this step is not done yet, insert the larger bolt (3) in the white plastic holder (1) with the head at the opposite side of the ball bearing; then place the large washer (4) around the bolt. Next, attach the white holder to the wheel using the bolts with dome nuts and their washers (2); all four washers should be placed at the inner side of the wheel). The dome nuts should face the inner side of the wheel. Before fixing the wheel to the wall, make sure that the washer with the larger diameter (5) is placed between the holder and the PhenoTyper wall. This way the wheel can rotate freely.

2. Mount the running wheel to the wall; place the plain washer (6), the spring washer (7) and the finally fasten using the wing nut (8) on the outside (back of the PhenoTyper wall), while keeping the large bolt firm using an hexagonal key from the inside.



IMPORTANT Use limited force when fastening the bolt!

3. Attach the magnetic sensor (1) to the wall with the small bolt. Adjust the position of the magnetic sensor, by rotating it, so the magnet on the running wheel (2) 'passes' the outside edge of the sensor.



4. Connect the magnetic sensor to the **PTCN-001x** counter module.
5. You can now check whether the magnetic sensor is in the right position relative to the magnet on the running wheel. Rotate the wheel; each time the magnet passes the sensor, the **Active** LED on the counter blinks.



6. Follow the next section to connect PhenoCount to the interface device you have.

Although the network cables shown in the following schemes are used in networks, the signal from and to the Pellet dispenser is not a network signal. Do not connect the Pellet dispenser via a network hub or similar.

Connect PhenoWheel through the USB-IO box

1. If you have PhenoCount version PTCN-0010, the device only works in SDI mode. You can skip this step.

If you have PhenoCount version PTCN-0011, you can set this device to work as TTL device (default factory mode) or as SDI device, like in previous versions of PhenoCount (see page 80). Unscrew the cover of the PhenoCount, and locate the jumpers on the board.

Adjust the jumpers based on the working mode you have chosen. Next, close the cover of the PhenoCount module.

You can find the PhenoCount version number on the back of the device.

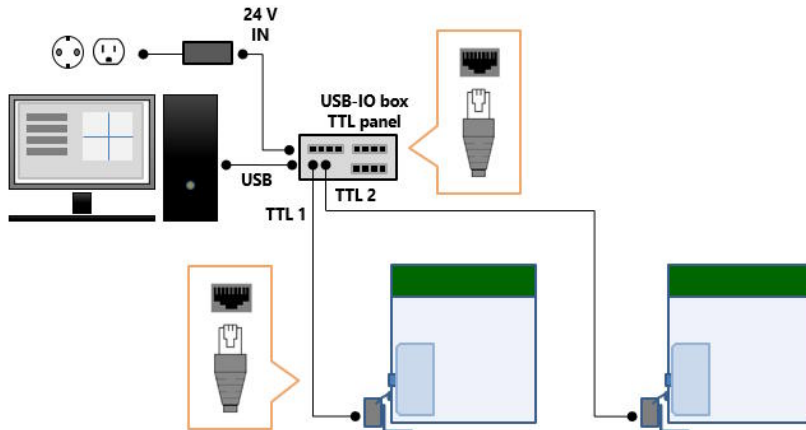


SDI mode
(USB-IO box)

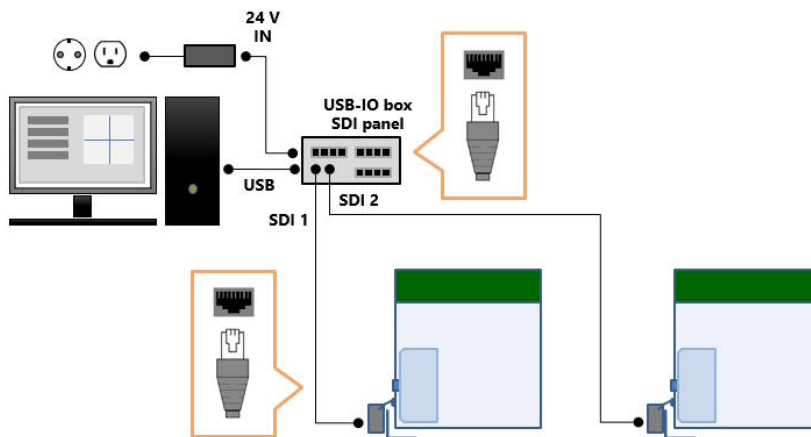


TTL mode
(USB-IO box or Nortio TTL Hub)

2. Connect the USB-IO box to the EthoVision XT through a USB cable.
3. If the PhenoCount module is set to TTL mode (default in PTCN-0011), connect the PhenoCount to one of the **TTL Control** ports on the USB-IO box, using a network cable:



If the PhenoCount module is set to SDI mode, connect the PhenoCount to one of the **SDI Control** ports on the USB-IO box, using a network cable:



Connect PhenoWheel through the Nortio system

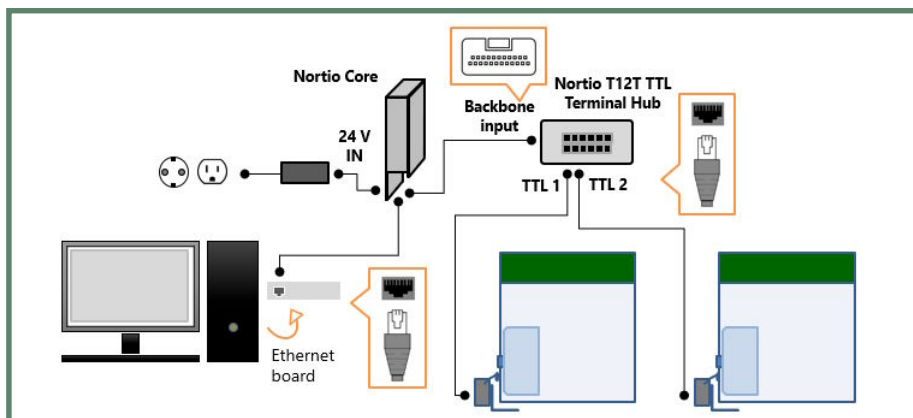
IMPORTANT In order to use PhenoWheel in combination with the Nortio system, the PhenoCount module version must be **PTCN-0011** (see Figure 6.2 on page 80) and the jumper settings inside the PhenoCount module must be as shown below. This makes PhenoCount work as a TTL device.

1. Unscrew the cover of the PhenoCount module.
2. Locate the jumpers on the board. These are pins with the blue or red covers numbered 1-4.
3. If you want to use PhenoCount with the Nortio system, place the red jumper in position 1 as shown on the right in the figure below.



4. Close the cover of the PhenoCount module.

You can now connect the PhenoCount module to the Nortio system (see the next figure).



1. Connect the Nortio Core to the EthoVision XT computer using a network cable.
2. Connect the Nortio T12T TTL Terminal Hub to the Nortio Core using the backbone input cable.
3. Connect the PhenoCount module (version **PTCN-0011**) to one of the TTL control ports of the Nortio T12T TTL Terminal Hub using a network cable.
4. Make sure that the Nortio Core is connected to a power supply.

For how to install the Nortio system, see the section **The Nortio system** in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual.

Notes

- The **Read** yellow LED indicates when EthoVision XT reads the number of rotations since the last reading event.
- For more information on the USB-IO box and the Nortio system, see the EthoVision XT 18 - Trial and Hardware Control - Reference Manual (see **MANUALS** on page 9).

6.3 Work with PhenoWheel

ETHOVISION XT - PREPARE THE EXPERIMENT

1. Make sure that you have followed the instructions in the previous section. Also, make sure all devices are powered up.

2. Start EthoVision XT and create a new experiment or open an existing one.

IMPORTANT Do not disconnect PhenoWheel while the experiment is open.

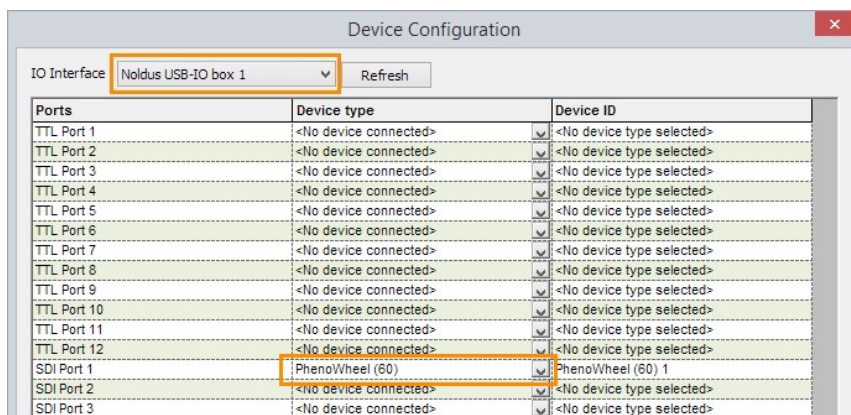
ETHOVISION XT - EXPERIMENT SETTINGS

1. In the Experiment Settings, select the **Use of Trial Control hardware** option, and click **Settings** next to that option.
2. In the window that opens, choose **Noldus USB-IO box** or **Nortio Core** depending on the interface device you have.

NOTE PhenoWheel only work in combination with the Nortio system when its version number is PTCN-0011 or later.

Next, click **OK**. The **Device Configuration** window opens.

3. Do the following depending on which interface device you have:
 - If you have the USB-IO box: For the **SDI Control** port to which you connected the PhenoCount module, select **PhenoWheel** as the **Device type**.
In the example below, the PhenoWheel is connected to **SDI Port 1**.

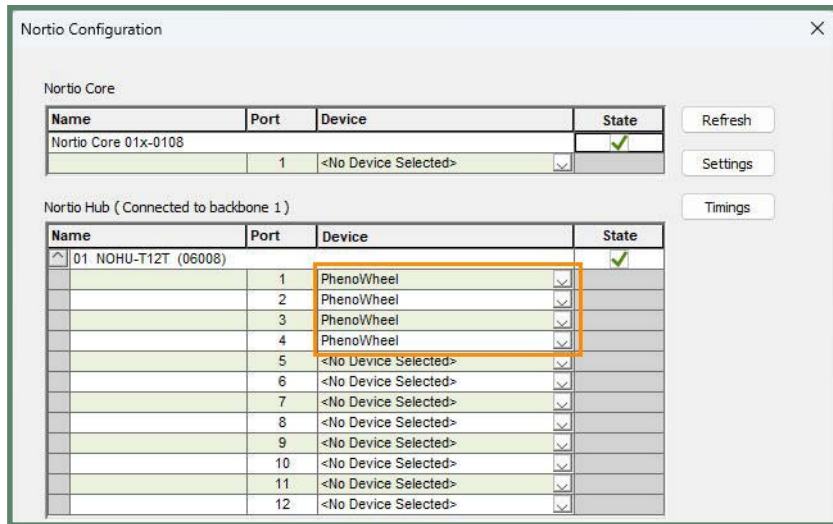


Example with two PhenoWheels:

SDI Port 1	PhenoWheel (60)	PhenoWheel (60) 1
SDI Port 2	PhenoWheel (60)	PhenoWheel (60) 2
SDI Port 3	<No device connected>	<No device type selected>
SDI Port 4	<No device connected>	<No device type selected>

- If you have the Nortio system: Under **Nortio Hub**, click the arrow button to show the list of the TTL ports available.

Under **Device**, select **PhenoWheel** for each port connected to a PhenoCount box.



4. If the PhenoWheels are connected to two or more USB-IO boxes, you must repeat the step above for the PhenoWheels connected to the remaining interface devices.

To do so, from the **IO Interface** list in the Device Configuration window select a new USB-IO box, then repeat the previous step.

5. When ready, click **OK**.

For more information, see **Setting the port connections** in the chapter **The USB-IO box and the Mini USB-IO box** in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual.

ETHOVISION XT - ARENA SETTINGS

We assume that you have drawn the arenas and the zones in the arena Settings.

- If you have only one arena, the hardware is automatically assigned to the arena. You can skip this section.
- If you have more than one arena, follow the steps below:
 1. Click the **Arena - Hardware mapping** button in the **Arena Settings** window.

2. Under **Device type**, you should see one row with **PhenoWheel/PhenoWheel (60)**. If that is not the case, Click **Add device**, and under **Device type** select **PhenoWheel/PhenoWheel (60)**.
3. Under **Device name**, accept the default name or type in a name, for example, **PhenoWheel**.
4. Assign one PhenoWheel device to each arena. To do so, select the physical device **PhenoWheel [n]** under the name of the arena it belongs to. For example:
 - **PhenoWheel 1 for Arena 1**
 - **PhenoWheel 2 for Arena 2.**

Do this for all PhenoWheels.

IMPORTANT Make sure that each physical device is assigned to only one arena!

First define the Trial Control hardware connections in the Experiment Settings. You can only make one set of hardware settings per Experiment. Once you have acquired trials those settings are read-only.

Then, in the window below:

1. Click Add device.
2. Select the Device type.
3. If one arena has multiple devices of the same type, enter a name of the device (e.g. Left side Pellet Dispenser). You can base Trial Control actions and conditions on these named devices.
4. Link the Device IDs to each arena.
5. Repeat for each named device.

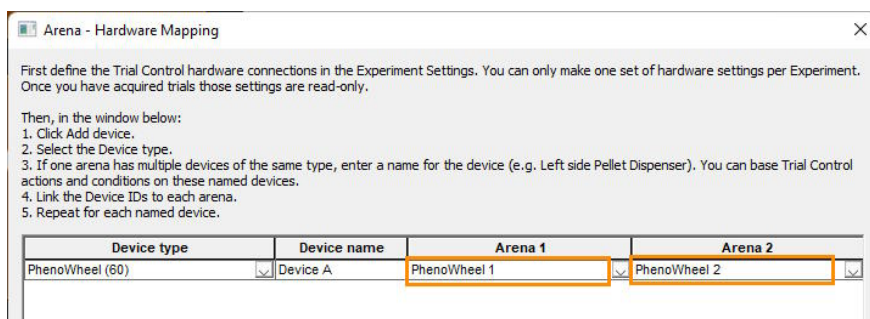
Device type	Device name	Arena 1	Arena 2
PhenoWheel (60)	Device A	PhenoWheel (60) 1	<No device allocated>

< >

Remove device Add device Test...

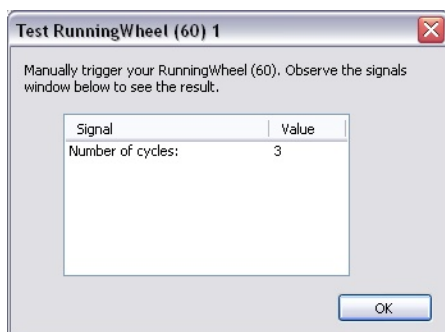
OK Cancel

For two arenas:



5. To test the counter, click **PhenoWheel** in one of the **Arena** columns and then click the **Test** button.

When you rotate that running wheel, the number of cycles is displayed under **Value**. Note that this number is read out at regular intervals of 60 seconds.



6. Click **OK** and repeat the previous step for the remaining wheels.
7. Click **OK** to close the **Arena - Hardware mapping** window.

ACQUIRE THE DATA

EthoVision XT and PhenoWheel are now configured. Follow the usual steps to define the detection settings and acquire the data.

For more information:

- PhenoTyper - EthoVision XT 18 - Reference Manual.
- EthoVision XT Help (F1).

PhenoWheel data acquired with the USB-IO box

The way data are collected depends on whether the PhenoCount module is set to work as a SDI device (standard in PTCN-0010) or as a TTL device (optional in PTCN-0011).

- If the PhenoCount module is set to SDI mode, it sends data to EthoVision XT every 60 seconds. At each sample time, EthoVision XT counts the number of rotations since the last reading event. The reading events are not in sync with the trial start and stop. This means that:
 - The data of the first reading event *after* the trial start also includes some time before the trial start. This time (< 60 s) is included in the results.
 - The data between the last reading event and the stop of the trial is **not** included in the results. This time is again < 60 s depending on when the trial stopped.

In most cases the two discrepancies have no effect on your data in long trials, for example a few hours trial.

TIP If you require to work with devices with a different sampling rate, contact Noldus.

- If the PhenoCount module is set to TTL mode, wheel rotations are detected as TTL pulses in real time, not at regular intervals. Data are treated the same way as in other TTL devices (e.g. the Pellet dispenser).

PhenoWheel data acquired with the Nortio system

With the Nortio system, PhenoWheel works as a TTL device. The wheel rotations are recorded as TTL events associated with a specific time stamp, not counts read out at regular time intervals. The Nortio system therefore ensure higher timing accuracy. The sequence of events is as follows:

- The PhenoCount module sends the sensor signal to the Nortio T12T TTL Terminal Hub.
- The Nortio T12T TTL Terminal Hub sends the signal to the Nortio Core.
- The Nortio Core evaluates the signal every 5 ms and counts the number of rotations.
- EthoVision XT receives the data from the Nortio Core. The rotation event is assigned to a specific sample time.

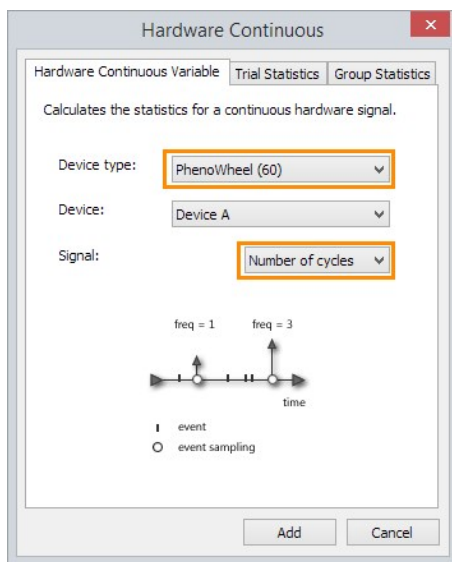
6.4 Calculate the statistics for PhenoWheel

ANALYSIS PROFILE

You can create an analysis profile to calculate the number of rotations.

Procedure

1. Choose **Analysis > Analysis Profile > New**.
2. From the **Dependent Variables** list, under **Hardware**, click **Hardware continuous**.
3. In the **Hardware Continuous** window, next to **Device type**, select **PhenoWheel (60)**.
4. Next to **Device**, select the correct device name, if you have more than one connected.
5. Next to **Signal**, select **Number of cycles**.

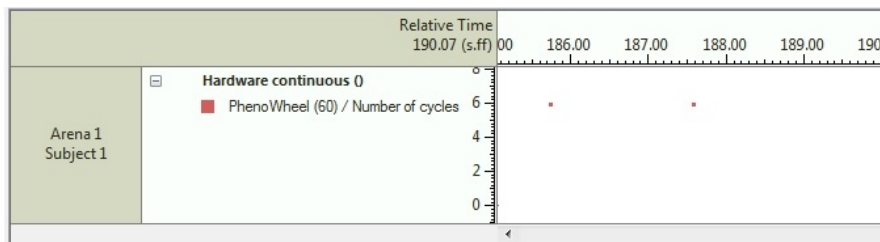


6. In the **Trial Statistics** tab, select **Total**.
7. Click **Add**.

STATISTICS AND VISUALIZATION

1. To calculate the statistics for wheel data, choose **Analysis > Results > Statistics & Charts**.
2. Select the correct Data profile and Analysis profile from the lists on the toolbar and click **Calculate**.
3. To visualize the number of rotations, choose **Analysis > Results > Integrated Visualization**. Select the correct Analysis profile from the list on the toolbar. You now see in the Time Event Plot when rotations took place.

PhenoWheel data acquired with the USB-IO box (SDI mode)



- **Hardware continuous** set to **Number of cycles** (see the figure above). A dot appears every time the counter is read out and the height of the dot indicates the number of rotations during the past interval.
- **Hardware state** set to mark the time that the **Number of cycles** exceeds a specific value. The option **Cumulative** must be selected in the variable settings.

PhenoWheel data acquired with the USB-IO box (TTL mode) or the Nortio system

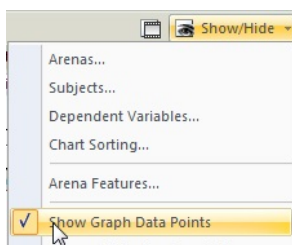
A dot appears every time a rotation event is detected. Because the signal conveys information about single rotation, the vertical axis shows 1 at every rotation.

NOTE The TTL mode of the USB-IO box is only possible in PTCN-0011 or later versions.

- **Hardware continuous** set to **Number of cycles**. The rotations can occur at any sample time, not at regular intervals as it is the case for PhenoWheel data collected with the USB-IO box in SDI mode (see above). The moment that the magnet passes the sensor is scored as 1. The rest is scored as zero.
- **Hardware state** set to mark the time that the **Number of cycles** exceeds a specific threshold. The option **Cumulative value** is selected in the variable settings.

Notes

- If the plots of the **Hardware continuous** variable appear empty, that is because the data are shown as small dots. Click **Show/Hide > Show Graph Data Points** and zoom in the plot to show the dots larger.



The Feeding Monitor

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7.1 General information

The Feeding Monitor is a system to monitor the behavior of mice based on sensors. This system can work with any compatible type of sensor.

The Feeding Monitor you can use to measure the number of times an animal inserts its nose into the feeder of a PhenoTyper cage model 3000. As such, it can count the number of times the animal is feeding. The Feeding Monitor works by detecting the interruption of an infrared beam between an infrared transmitter and a receiver installed in the IR Food Sensor in the PhenoTyper cage. The IR Food Sensor works in combination with the IR Beam Controller (PTBC-001x) which can also control an optical cue device, for example, a LED.

Contents of the Feeding Monitor package

- IR Beam Controller (**PTBC-001x**) – This box can in be used to control any type of sensor in a PhenoTyper cage. Currently, the IR Food Sensor is the only sensor available for the Feeding Monitor.



- Network (CAT5 UTP), 2-m purple cable (**PTPC-7020**) – To connect the IR Beam Controller to the USB IO-Box.
- IR Food Sensor (**PTFS-0010**) – The sensor (see **B** in the figure below) that is built in into the PhenoTyper cage model 3000.
- Food Sensor cable (**PTFS-0020**) – To connect the IR Food Sensor with the IR Beam Controller (see **C** in the figure below).
- Insert for PT3000 feeder (**PT-I-00**) – To adapt the feeder for use with the IR Food Sensor (see **D** in the figure below). Without the insert the animal cannot reach the food.

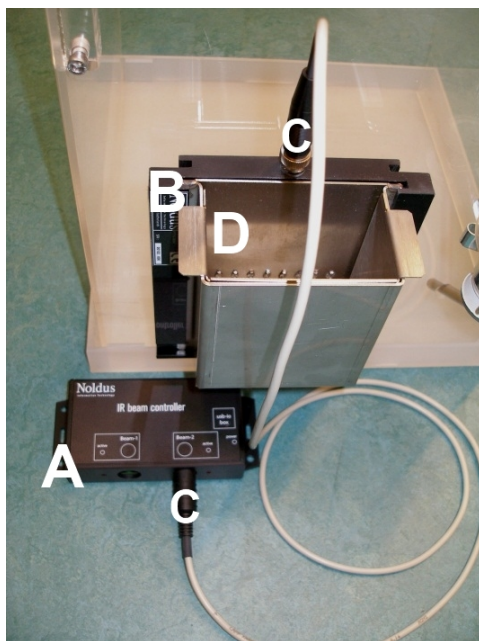


Figure 7.1 Picture of the Mouse Interaction Monitor for Food setup:
A - IR Beam Controller box,
B - IR Food Sensor,
C - Food Sensor cable,
D - Feeder insert.

Acknowledgements

The Feeding Monitor has been developed in close collaboration with Prof. Dr. Martien Kas, University Medical Center, Utrecht.

For more information about the application of an early version of the IR Food Sensor see, for example:

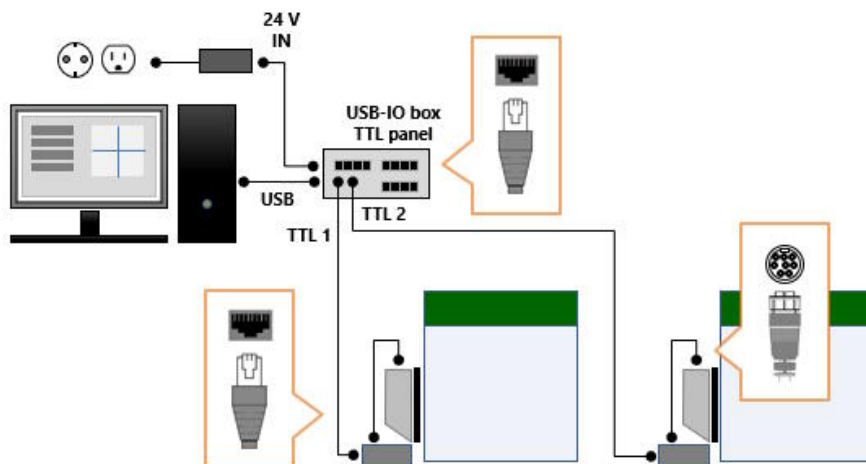
- Kas *et al.*, (2008). Differential Genetic Regulation of Motor Activity and Anxiety-Related Behaviors in Mice Using an Automated Home Cage Task. *Behavioral Neuroscience* **122**(4): 769-776.
- Kas *et al.*, (2009). High-resolution genetic mapping of mammalian motor activity levels in mice. *Genes, Brain and Behavior* **8**: 13-22.
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7.2 Install the Feeding Monitor

Although the network cables shown in the following schemes are used in networks, the signal coming from the Feeding Monitor is not a network signal. Do not connect the Feeding Monitor through a network hub or similar.

Connect the Feeding Monitor using the (Mini) USB-IO box

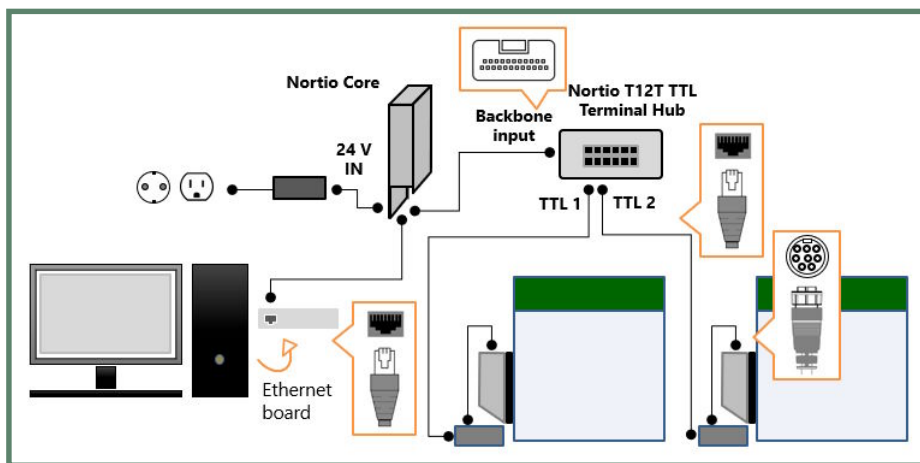
1. Remove the feeder from the PhenoTyper cage and replace it with the IR Food Sensor (B in Figure 7.1).
2. Attach the feeder to the IR Food Sensor as in Figure 7.1 and put the Insert (D) for the PT3000 feeder into the feeder.
3. Connect the (Mini) USB-IO box to the EthoVision XT PC through a USB cable.
4. Use the purple network cable to connect the IR Beam Controller box (Figure 7.1, A, **usb io-box** port) to a **TTL** port of the (Mini) USB IO-Box.
5. Power up the (Mini) USB-IO box. The **power** LED indicates 'power on'. The **active** LEDs on the IR Beam Controller box remain on until the IR Food Sensor (or any other compatible sensor) is connected. If necessary, make sure the IR Beam Controller and its LEDs are out of sight of the animal in the PhenoTyper cage.
6. Connect the IR Food Sensor to the IR Beam Controller box (Beam-1 or Beam-2 port) with the Food Sensor cable (Figure 7.1, C).



7. The 'active' LED light turns off. The LED light turns on every time the beam of the IR Food Sensor is interrupted.

Connect the Feeding Monitor using the Nortio system

1. Connect the Nortio Core to the EthoVision XT through a network cable.
2. Connect the Nortio T12T TTL Terminal Hub to the Nortio Core using the backbone input cable.
3. Use the purple network cable to connect the **usb io-box** port of the IR Beam Controller box (Figure 7.1, A) to a **TTL** port of the Nortio T12T TTL Terminal Hub.
4. Power up the Nortio Core. The **power** LED indicates 'power on'. The **active** LEDs on the IR Beam Controller box remain on until the IR Food Sensor (or any other compatible sensor) is connected. If necessary, make sure the IR Beam Controller and its LEDs are out of sight of the animal in the PhenoTyper cage.
5. Connect the IR Food Sensor to the IR Beam Controller box (Beam-1 or Beam-2 port) with the Food Sensor cable (Figure 7.1, C).
6. The 'active' LED light turns off. The LED light turns on every time the beam of the IR Food Sensor is interrupted.



Notes

For details about the USB-IO box, the Mini USB-IO box and the Nortio system, see the relevant chapters in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual.

7.3 Work with the Feeding Monitor

ETHOVISION XT - PREPARE THE EXPERIMENT

7. Connect the USB-IO box / **Nortio Core** / Mini USB-IO box to the EthoVision XT computer and make sure that all devices are powered up, as described in the previous section.

For details about the USB-IO box and the Mini USB-IO box and the **Nortio system**, see the relevant chapters in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual.

8. Start EthoVision XT and create a new experiment or open an existing one.

IMPORTANT Do not disconnect the IR Beam Controller while the experiment is open.

ETHOVISION XT - EXPERIMENT SETTINGS

1. In the Experiment Settings, select the **Use of Trial Control hardware** option, and click **Settings** next to that option.
2. In the window that opens, choose the interface device you have:
 - **Noldus USB-IO box.**
 - **Noldus Mini USB-IO box.**
 - **Nortio Core.**

Next, click **OK**. The **Device Configuration/Nortio Configuration** window opens.

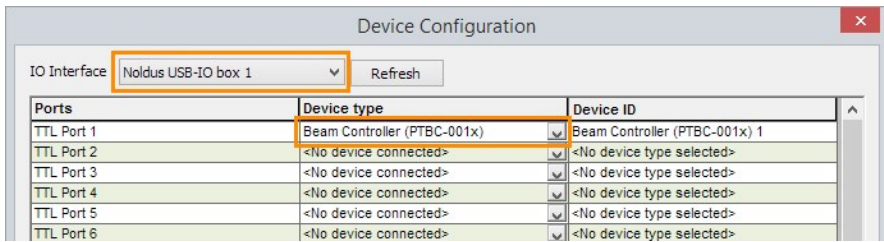
3. For the **TTL Control** port which you connected the Feeding Monitor to, select **Beam Controller (PTBC-001x)** as the **Device/Device type**.

If you work with the USB-IO box, the **Device ID** (third column) changes to **Beam Controller (PTBC-001x) 1**.

Repeat this step for each Feeding Monitor connected.

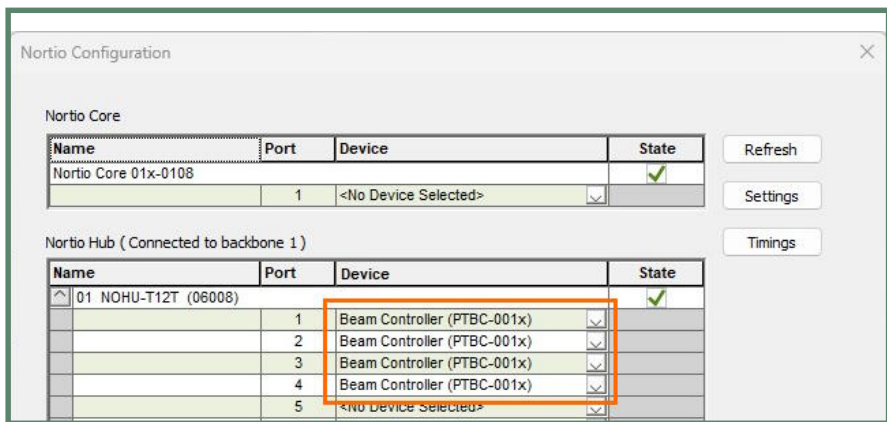
4. If you have multiple Feeding Monitors connected to two or more USB-IO boxes, from the **IO Interface** list select a USB-IO box. Repeat this and the next step for each USB-IO box.

Example of using one Feeding Monitor connected to TTL Port 1:



Example when using the Nortio system (four Feeding Monitors connected to TTL Ports 1-4 of the Nortio T12T TTL Terminal Hub):

- Under **Nortio Hub**, click the arrow button to open the list of the TTL ports available.
- Under **Device**, select Beam Controller for each port.



5. If your Feeding Monitors are connected to two or more USB-IO boxes, you must repeat the step above for those connected to the remaining USB-IO boxes. From the **IO Interface** list select a new USB-IO box, then repeat the step above.
6. When ready, click **OK**.

For more information, see **Setting the port connections** in one of the following chapters in the EthoVision XT 18 - Trial and Hardware Control - Reference Manual, depending on which interface you use:

- The USB-IO box and the Mini USB-IO box.
- The Nortio interface system.

ETHOVISION XT - ARENA SETTINGS

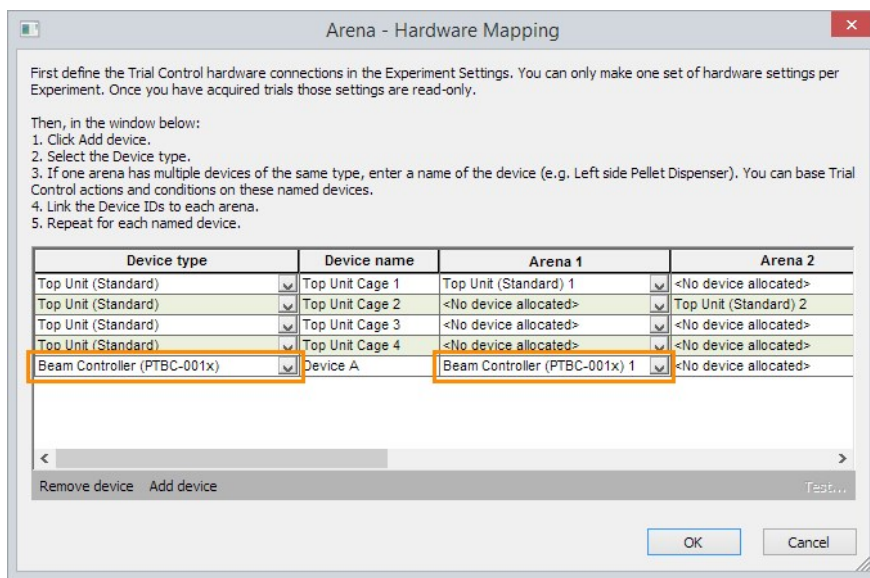
1. In the Arena Settings, define the arenas. For more information on this step, see **Arena Settings** in the EthoVision XT Help.

If you have only one arena, the hardware is automatically assigned to the arena. Skip the following steps and go to step 6.

If you have more than one arena, do the following:

2. Click the **Arena - Hardware mapping** button in the **Arena Settings** window.
NOTE The IR Beam Controller box can control two sensors. However, two sensors connected to the same IR Beam Controller box can only be used in the same Arena in EthoVision XT.
3. Under **Device type**, you should see **Beam Controller**. If that is not the case, click **Add device**, and under **Device type**, select **Beam Controller (PTBC-001x)**.
4. Under **Device name**, accept the default name or type in a name, for example, **Feeding monitor**.
5. Assign a **Beam Controller (PTBC-001x)** to each arena. To do so, select the physical device **Beam Controller (PTBC-001x) [n]** under the name of the arena it belongs to. For example:
 - **Beam Controller 1 for Arena 1**
 - **Beam Controller 2 for Arena 2.**

Do this for all Feeding Monitors.



IMPORTANT Make sure that each physical device is assigned to only one arena!

6. To test the Feeding Monitor:

- Click **Beam Controller (PTBC-001x)** in one of the **Arena** columns.
- Click the **Test** button.
- Locate the corresponding Feeding Monitor and put a finger at the other side of the feeder (that is, the inner side of the cage wall) to interrupt the beam. That simulates a feeding event.
- The value next to **is beam broken?** becomes **true** and the number of beam breaks is displayed under **Value**. If you have a LED connected to the IR Food Sensor, you can test it by selecting **Cue on** from the **Command** list.

7. Click **OK** to close the **Arena - Hardware mapping** window.

ACQUIRE THE DATA

EthoVision XT and The Feeding Monitor are now configured. Follow the usual steps to define the detection settings and acquire the data.

For more information, see the PhenoTyper - EthoVision XT 18 - Reference Manual and the EthoVision XT Help (F1).

7.4 Calculate the statistics for the Feeding Monitor

ANALYSIS PROFILE

You can create an analysis profile to calculate the number of beam breaks or select various state variables associated with the beam breaks.

1. Choose **Analysis > Analysis Profile > New**.
2. From the **Dependent Variables** list, under **Hardware**, choose one of the following:
 - **Hardware continuous** if you want to calculate the total number of beam breaks or visualize the raw data on the timeline.
 - **Hardware state** if you want to calculate the time when the number of beam breaks was higher or lower than a specific threshold, or the time that a beam was broke, or the time that a cue was on or off.
3. In the window that opens, next to **Device type**, select **Beam Controller (PTBC -001x)**.

Hardware Continuous

Hardware Continuous Variable Trial Statistics Group Statistics

Calculates the statistics for a continuous hardware signal.

Device type: Beam Controller (PTBC-001x)

Device: Device A

Signal: Beam 1 breaks

freq = 1 freq = 3

time

event

event sampling

Add Cancel

4. Next to **Device**, select the correct device name, if you have more than one connected.
 5. Next to **Signal**, select the option you require.
 - For Hardware continuous, select **Beam 1 breaks**, or **Beam 2 breaks**, depending on which port on the IR Beam Controller the Food Sensor was connected to.
 - For Hardware state, you have a few options.
 - (1) Select **Beam 1 breaks/Beam 2 breaks** and then next to **Value** select the criterion you are interested in (e.g. to mark the time that the number of **Beam 1 breaks** ≥ 100).
 - (2) To mark the time that a beam was broken, select **Is beam 1 broken / Is beam 2 broken**, then next to **Value** select the criterion (e.g. **Is beam 1 broken True**).
 - (3) To mark the time that a cue was on of off, select **Is cue 1 on / Is cue 2 on**, then next to **Value** select the criterion (e.g. **Is cue 1 on False**).
- NOTE** Beam 1 breaks and Beam 2 breaks correspond to the signals of the two sensors that the IR Beam Controller can control. For each IR Beam Controller, the two sensors can only be used in the same cage (arena). To analyze both beam breaks, add the Hardware continuous twice.
6. Click **Add**.

Cue activation

With the Hardware command you can calculate statistics of and visualize the events of type “cue on/off”, provided that the IR Beam Controller box was connected to an optical cue device (e.g. a LED).

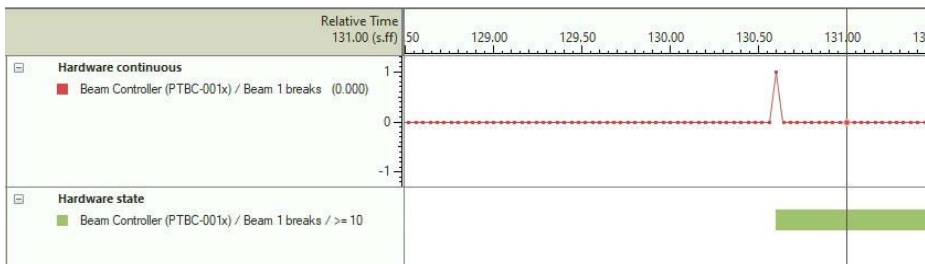
1. From the **Dependent Variables** list, under **Hardware**, click **Hardware command**.
2. In the **Hardware Command** window, next to **Device type**, select **Beam Controller (PTBC - 001x)**.
3. Next to **Device**, select the correct device name, if you have more than one connected.
4. Next to **Command**, select one of the options: **Cue 1 on**, **Cue 1 off**, **Cue 2 on**, and **Cue 2 off**.
5. Click **Add**.

STATISTICS AND VISUALIZATION

1. To calculate the statistics for the variables defined in the previous step, choose **Analysis > Results > Statistics & Charts**. Select the correct Data profile and Analysis profile from the lists on the toolbar and click **Calculate**.
2. To visualize the feeding events, choose **Analysis > Results > Integrated Visualization**. Select the correct Analysis profile from the list on the toolbar. You now see in the Time Event Plot when beam breaks took place.

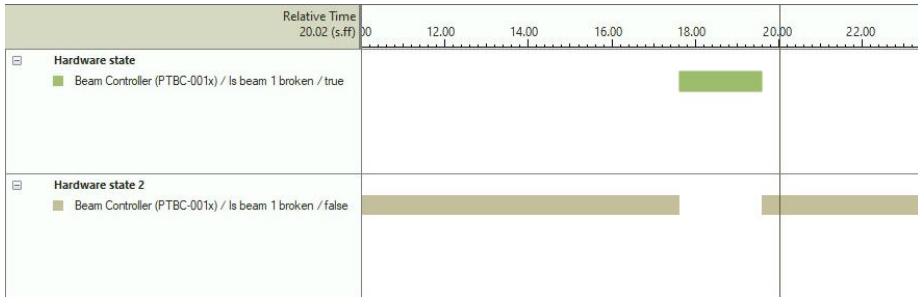
Examples

- **Hardware continuous - Beam 1 breaks.** An interruption of the IR beam is scored as one in the timeline. The remaining timeline, with no interruption of the beam, is scored as zero.
- **Hardware state - Beam 1 breaks ≥ 10 .** The state is active after the tenth feeding event occurs. This event is scored in the Hardware continuous plot.

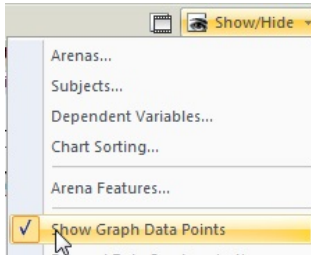


- **Hardware state - is beam 1 broken / true.** This state is active when the IR beam is interrupted.

- **Hardware state - is beam 1 broken / false.** This state is active when the IR beam is not interrupted.



NOTE If the plots of the **Hardware continuous** variable appear empty, that is because the data are shown as small dots. Click **Show/Hide > Show Graph Data Points** and zoom in the plot to show the dots larger.



Chapter 8

The TTL to 28V Interface

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8.2 Install the TTL to 28V Interface	108
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8.1 Why use the TTL to 28V Interface?

The Noldus TTL to 28V Interface (Noldus type number: PTMA-0010) provides a simple 'plug-and-play' connection between the Noldus USB-IO box / Mini USB-IO box / [Nortio T12T TTL Terminal Hub](#) and several hardware devices. You need the TTL to 28V interface when:

- You want to control one or more hardware devices, such as, doors in a radial arm maze, the Atlantis platform, and sound generators.
- You want to control the DanioVision Toplight Unit. In that case, see the DanioVision DVOC-0041 - Reference Manual.



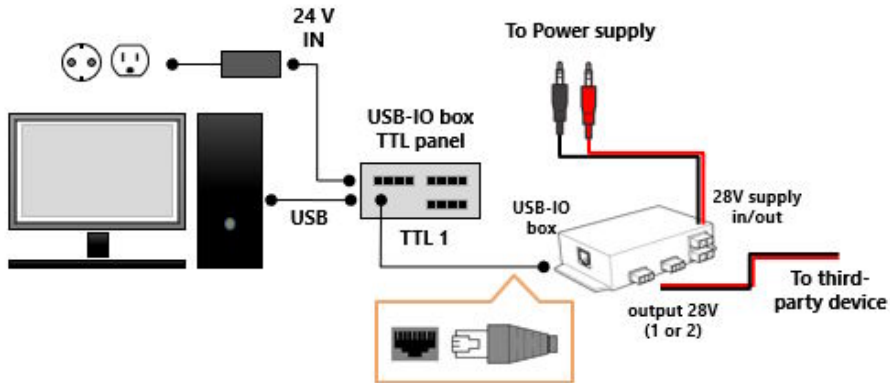
Note

The TTL to 28V Interface converts the TTL signals from one of the following devices: USB-IO box / Mini USB-IO box / [Nortio T12T TTL Terminal Hub](#) into the Med Associates standard 28-Volt control signal. Furthermore, the TTL to 28V Interface can control two Med Associates devices, so it is a good alternative for the SG-230 or SG-230R TTL-to-28V adapter supplied by Med Associates.

8.2 Install the TTL to 28V Interface

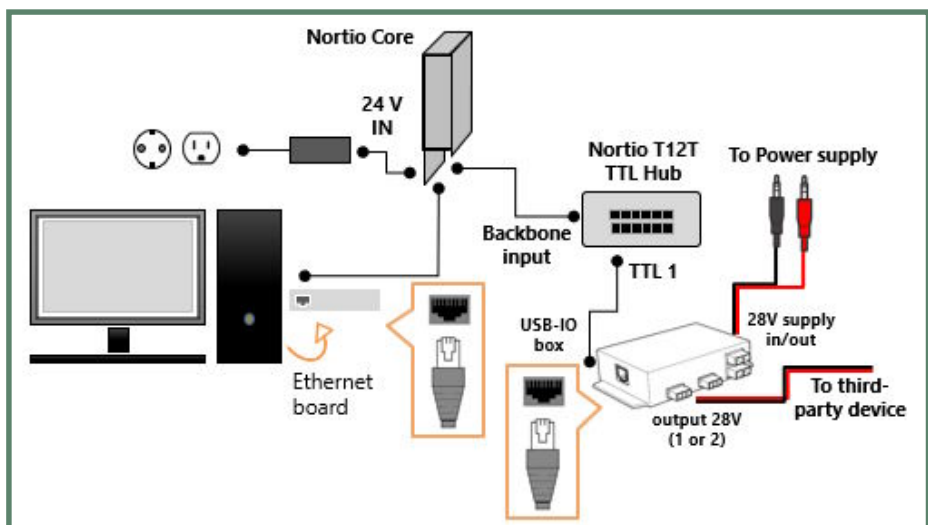
Connect the TTL to 28 V Interface using the USB-IO box / Mini USB-IO box

1. Connect a 28-V power supply to the **28V supply-in** connection on the TTL to 28V Interface. Either use a 28-V power supply or the Noldus 28-V power supply (Noldus type number: MAPS-0010).
2. Connect the **USB-IO box** connection on the TTL to 28V Interface to one of the **TTL Control** ports on the USB-IO box / Mini USB-IO box, using the supplied network cable.
3. Connect the Med Associates or third-party device to the **output 28V** port 1 or 2.



Connect the TTL to 28 V Interface using the Nortio system

1. Connect a 28-V power supply to the **28V supply-in** connection on the TTL to 28V Interface. Either use a 28-V power supply or the Noldus 28-V power supply (Noldus type number: MAPS-0010).
2. Connect the Nortio Core to the EthoVision XT through a network cable.
3. Connect the Nortio T12T TTL Terminal Hub to the Nortio Core using the backbone input cable.
4. Connect the **USB-IO box** port on the TTL to 28V Interface to one of the **TTL Control** ports on the Nortio T12T TTL Terminal Hub, using the supplied network cable.



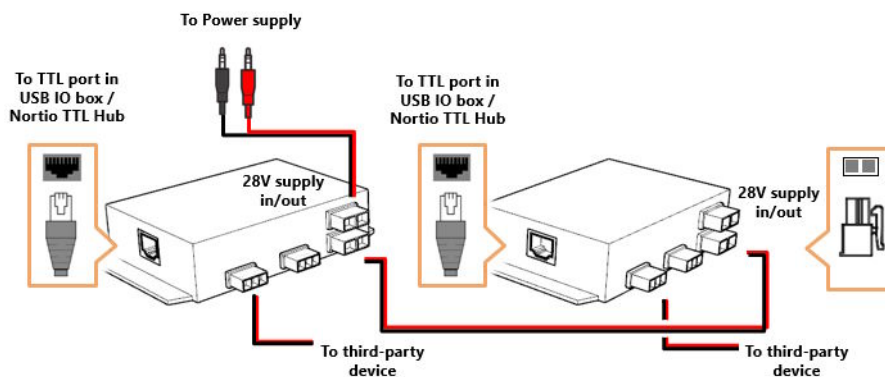
Notes

- The green LED light indicates whether a TTL signal is sent from EthoVision XT.
- An extension cable (Noldus type number: MACA-0201) is available if you need to increase the distance between the TTL Interface and the device.
- USB-IO TTL control and power are fully optically isolated from the 28-Volt Med Associates power and control circuit to prevent any unwanted interaction.

Using multiple TTL to 28V interfaces

You can use multiple TTL to 28V Interfaces with only one 28-V power supply. For this purpose, feed through the power from one of the **28V supply in/out** ports on one TTL Interface to one of the **28V supply in/out** ports on the next TTL Interface, using the power feed-through cable (Noldus type number: MACA-0101; see the next figure).

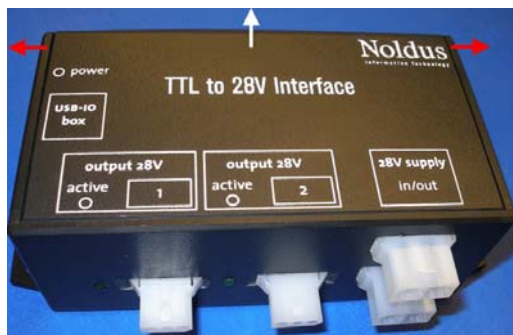
- It does not matter which **28V supply in/out** port you use to connect the two boxes; either that at the top or that at the bottom is fine.
- You can also use this solution to connect multiple light sources of the Top Light Unit of DanioVision. For the details, see the DanioVision DVOC-0041 - Reference Manual.
- **IMPORTANT** Make sure not to exceed the maximum current output (0,9 A) of the Noldus 28-V power supply! Check the technical specifications of the devices you connect.



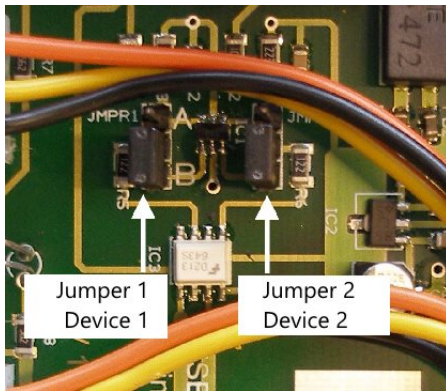
Inverted operation

If needed you can invert the output level of the controlled device by changing jumper settings inside the TTL to 28V Interface. This is useful, for example, when you want to change the default position of the doors of the radial arm maze to 'open' instead of 'closed'.

1. Open the box by pushing the left and right sides a few millimeter in the direction of the red arrow (see the figure below) to release the "click system" of the printed cover. Simultaneously, carefully slide the cover in the direction of the white arrow.



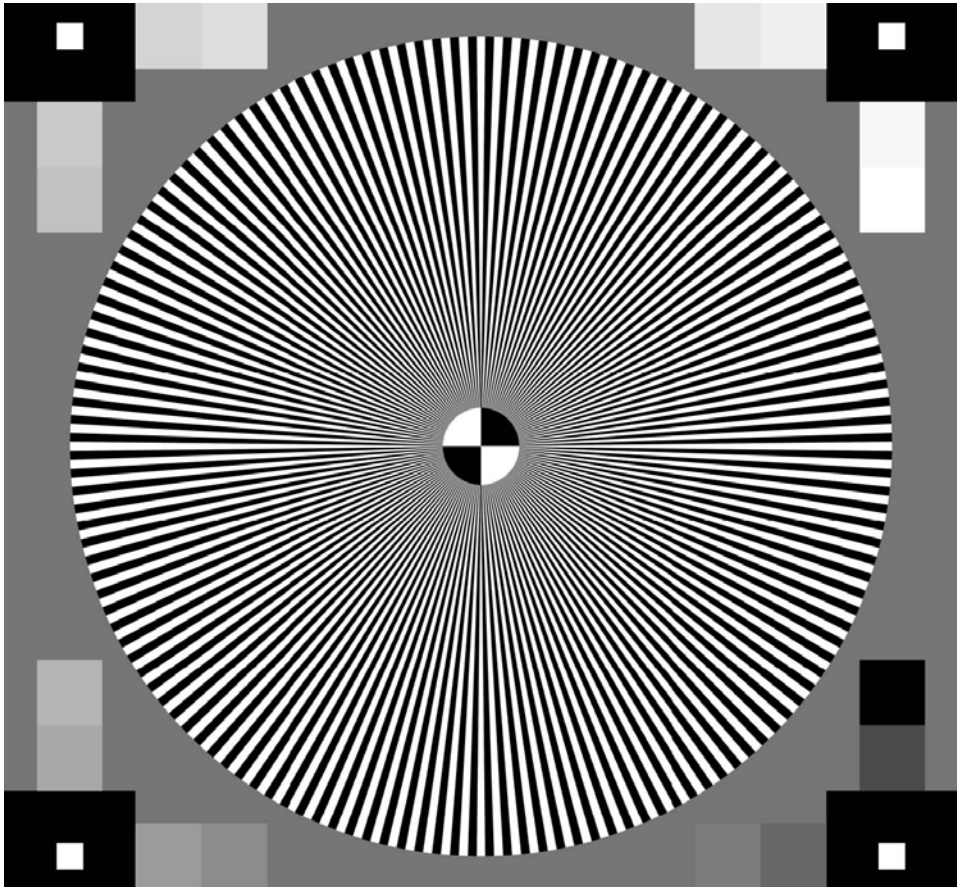
2. Lift the jumper and change the position (A or B) to set the control to inverted/not inverted. **JMPR1** does this for device 1, **JMPR2** does this for device 2 (see the next figure).



8.3 Technical specifications

Noldus Type number	PTMA-001x
Power requirements	12 to 20 VDC supplied by USB-IO box External 28 VDC power supply
Current consumption	40 mA without device connected
Weight	± 100 gr (3.5 oz).
Operating temperature	10 °C to 35 °C (50 °F to 95 °F)
Storage temperature	-40 °C to 65 °C (40 °F to 149 °F)
Rel. humidity (max.)	20% to 80% (non condensing)

Test Sheet for Focusing



Declaration of Conformity

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For the Declarations of Conformity of PhenoTyper 1 and PhenoTyper 2, see the PhenoTyper 2 - EthoVision XT 18 - Reference Manual. To access this manual, from the Windows Start menu choose **All apps > Noldus > EthoVision XT 18 Other Documentation**.



EC declaration of conformity

Manufacturer:
Noldus Information Technology
Nieuwe Kanaal 5
6709PA Wageningen
The Netherlands

Declares that the following line of products:

IR beam controller PTBC-0010 / IR food sensor PTFS-0010

Fulfills all relevant provisions of the EC EMC directive 2004/108/EC.
According the harmonized standards:

NEN-EN-IEC61000-6-3:2007

Electromagnetic compatibility (EMC) - Part 6-3: Generic Standards -
Emission standard for residential, commercial and light-industrial
environments

NEN-EN-IEC61000-6-2:2005

Electromagnetic compatibility (EMC) - Part 6-2: Generic standards -
Immunity for industrial environments

Fulfills all relevant provisions of the EC RoHS directive 2011/65/EU.
According the harmonized standards:

EN IEC 63000 : 2018

Technical documentation for the assessment of electrical and
electronic products with respect to the restriction of hazardous
substances

Fulfills all relevant provisions of the EC WEEE Directive 2012/19/EU.
Waste Electrical and Electronic Systems (WEEE)

The signatory on behalf of the manufacturer:

Date: September 30 2020

A handwritten signature in blue ink, appearing to read 'J. Kemerink', is written over a horizontal line.

Name : Jeroen Kemerink
Vice President Research & Development



EC declaration of conformity

Manufacturer:
Noldus Information Technology
Nieuwe Kanaal 5
6709PA Wageningen
The Netherlands

Declares that the following line of products:

TTL to 28V Interface PTMA-0010

Fulfills all relevant provisions of the EC EMC directive 2004/108/EC.
According the harmonized standards:

NEN-EN-IEC61000-6-3:2007

Electromagnetic compatibility (EMC) - Part 6-3: Generic Standards -
Emission standard for residential, commercial and light-industrial
environments

NEN-EN-IEC61000-6-2:2005

Electromagnetic compatibility (EMC) - Part 6-2: Generic standards -
Immunity for industrial environments

Fulfills all relevant provisions of the EC RoHS directive 2011/65/EU.
According the harmonized standards:

EN IEC 63000 : 2018

Technical documentation for the assessment of electrical and
electronic products with respect to the restriction of hazardous
substances

Fulfills all relevant provisions of the EC WEEE Directive 2012/19/EU.
Waste Electrical and Electronic Systems (WEEE)

The signatory on behalf of the manufacturer:

Date: September 30 2020



Name : Jeroen Kemerink
Vice President Research & Development



EC declaration of conformity

Manufacturer:
Noldus Information Technology
Nieuwe Kanaal 5
6709PA Wageningen
The Netherlands

Declares that the following line of products:

Lick-O-Meter PTLM

Fulfills all relevant provisions of the EC EMC directive 2004/108/EC.
According the harmonized standards:

NEN-EN-IEC61000-6-3:2007

Electromagnetic compatibility (EMC) - Part 6-3: Generic Standards -
Emission standard for residential, commercial and light-industrial
environments

NEN-EN-IEC61000-6-1:2005

Electromagnetic compatibility (EMC) - Part 6-1: Generic standards -
Immunity for residential, commercial and light-industrial environments

Fulfills all relevant provisions of the EC RoHS directive 2011/65/EU.
According the harmonized standards:

EN IEC 63000 : 2018

Technical documentation for the assessment of electrical and
electronic products with respect to the restriction of hazardous
substances

Fulfills all relevant provisions of the EC WEEE Directive 2012/19/EU.
Waste Electrical and Electronic Systems (WEEE)

The signatory on behalf of the manufacturer:

Date: September 30 2020

A handwritten signature in blue ink, appearing to be 'Jeroen Kemerink', is written over a horizontal line. Below the signature, the name and title are printed.

Name : Jeroen Kemerink
Vice President Research & Development

DECLARATION OF CONFORMITY



Name of company: CINCON ELECTRONICS CO., LTD.
Address: No. 8-1 Fu Kung RD. Fu Hsing Park, Fu Hsing Hsiang,
Chang Hua Hsien, Taiwan, R.O.C.

Declares that the product

Adapter

TRH50A120; TRH50A150; TRH50A180; TRH50A190;
TRH50A240; TRH50A280; TRH50A360; TRH50A480;
TRH70A120; TRH70A150; TRH70A180; TRH70A190;
TRH70A240; TRH70A280; TRH70A360; TRH70A480;

referred to this declaration conforms with the standard(s) or directive(s) as far as applicable:

Product Safety Standard :	EN60950-1	2006+A11+A1+A12+A2
EMC Standards :	EN55022	2010/AC; 2011 Class B
	EN55032	2012 +AC:2013
	EN55024	2010
	EN61204-3	2000
	EN61000-6-1	2007
	EN61000-6-3	2007+A1; 2011+AC; 2012
	EN61000-3-2	2014
	EN61000-3-3	2013
Directives :	Low Voltage Directive	2014/35/EU
	EMC Directives	2014/30/EU
	ErP Directives	2009/125/EU
	RoHS Directive	2011/65/EU

This product must be used within other equipment and must not operated as a stand alone product.

The company named above will keep on file for review the following technical documentation:

- Technical drawings
- Other technical documentation

Manufacturer

Signature: Johnson Cheng

Date: Mar. 03 2017

Name: Johnson Cheng / President

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