

# User's Guide for the Insect Digitisation Line

Quick Guide, version 1.4 (f). Translated and updated from version 1.1.

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## ***Safety first!***

The Insect Digitisation Line includes conveyors driven by powerful electrical motors. Any particles that might land in their gears will be sucked in. Therefore, anybody coming closer than 2 meters to the line must not wear any strong wraps. This includes ties, scarfs, key hangers, meeting name tags, etc. There are warning signs posted on the wall about this.

The line operators must visually inspect all visitors, point them to the warning signs, explaining the potential dangers, and see that these instructions will be obeyed to. If not so, the line operator must stop the system immediately, until the normal order is restored.

Any visitors coming closer than 2 meters of the line must be advised of the available emergency buttons, and be told not to hesitate hitting them if there is any sign of trouble.

## ***Equipment of the digitisation line***

1. Five **Belt Conveyors**
2. Four **Sensors** and their reflectors
3. **Control Centre**, including power supply and motor drivers (large box)
4. **Connection Box** (small box)
5. Instrument **Stand**, holding the camera(s) and light(s)
6. Four LED **Light** units
7. **Imaging Computer** (Linux Ubuntu 17.10.1)
8. **Control Computer** (Windows 10) with two Gigabit network cards and one wireless network card
9. Gigabit **Ethernet Switch** (private network of the digitisation equipment)
10. Remote **Server** for post-processing and data storage

More details of the equipment, such as brands, models, and acquisition / support contact information are listed in the Delivery Note.

## ***Starting the equipment***

The equipment can be left running all time, but in order to save energy, it could be turned off each night. At least the lights, displays and cameras should be turned off when not in use.

When starting operations, check and turn on the following:

1. Check that all the equipment is connected to 230V mains power.
2. Check that the network cables from the two Computers and the Control Centre are connected to the Ethernet Switch, which are in the private network. The Control

Computer should also connect to your company's network with the access of the remote server for data processing and storage.

3. Turn on the Control Centre from its main switch (large red switch in the middle of its cover). (The Connection Box is always on after installation.)
4. Turn on the Control Computer and its display.
5. Turn on the Imaging Computer and its display.
6. Check that all the cameras are connected with USB cables to the Imaging Computer (USB 3 recommended) and to power supply. Turn on the camera(s).
7. Turn on the Lights from their power bar.
8. Swipe away dust from the colour and millimetre bar (dust may be invisible).

Any time power on the Control Centre, Connection Box, or the Control Computer has been turned off, the components of the Control Centre must be initiated again. Do this by logging on to the Control Computer and start the *NIMax* application. When the application has started, select from its left-hand-side panel (Figure 1) the item *Devices and Interfaces* → *Network Devices* → *NI cDAQ...* Wait for the Status to show *Connected – Running*. Then run *Self-Test* from the upper bar at right. This should remove the red tags from the three items under *NI cDAQ...*, and open a message box reporting the result of the successful self-test.

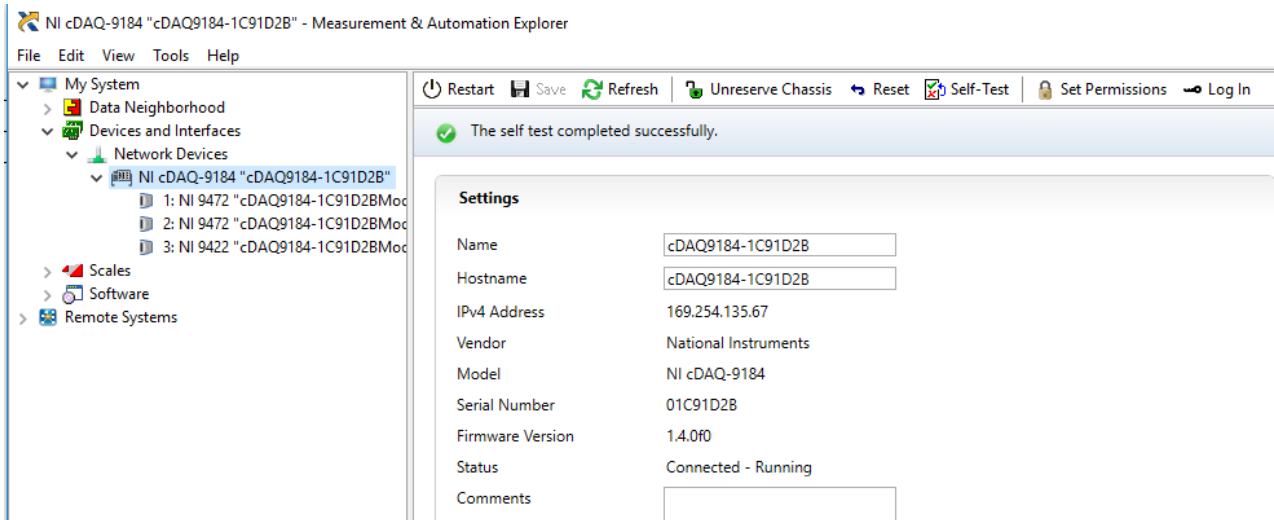


Figure 1. View from the NIMax application.

Power on the Imaging Computer. The imaging application will be run automatically.

```
/root/insect_apps/start.sh
```

In daily use, it will be easier to keep the entire system running all of the time, so that work can start sooner in the beginning of the work shift. It will be sufficient to turn off the lights, cameras, displays, and applications from the Control Computer.

## ***The applications on the Control Computer***

The operation of the digitisation line requires that two applications are running on the Control Computer:

1) *DigiConveyor*: Turn on the application from the icon on desktop. Select the Imaging Mode, which is *Insects*. Choose the *Collection* from the pull-down menu, or *Add New Collection*. (In this context, “collections” are data sets or projects. Password is needed to add new collection.) Enter the name(s) of the operator(s). (These will be automatically included in metadata.) Push the large green *Start* button (Figure 2).

The screenshot shows a window titled "Imaging Station Setup". At the top, there is a dropdown menu for "Imaging Mode" with "Insects" selected. Below this is a section labeled "Meta data" which contains a "Collection" dropdown menu, a button labeled "Add new collection", and a text input field for "Operators" with the placeholder text "FirstName LastName". At the bottom of the window is a large green button labeled "Start".

Figure 2. Starting window of the DigiConveyor application.

2) *ConveyorControlApplication*: Start the application from icon on the desktop. The different conveyor components can be seen at the left. Those operations are highlighted in green. In the little balls at the right, the current operations happening in the system can be seen.

By pushing the big square in the middle, the system gets started and will be ready to run.

When taking two images of the same pallet (insect and labels), their *Distance* can be determined by entering a number in the box. A reasonable first number is 1200. In all cases, remember to adjust the camera!

The *ConveyorControlApplication* also shows the status of the sensors, which are the little balls S31, S32, S53, and S54. This should make it easy to check whether all the sensors are in operation and properly aligned. A ball should be dark when the sensor is properly aligned and there is nothing between the sensor and its reflector.

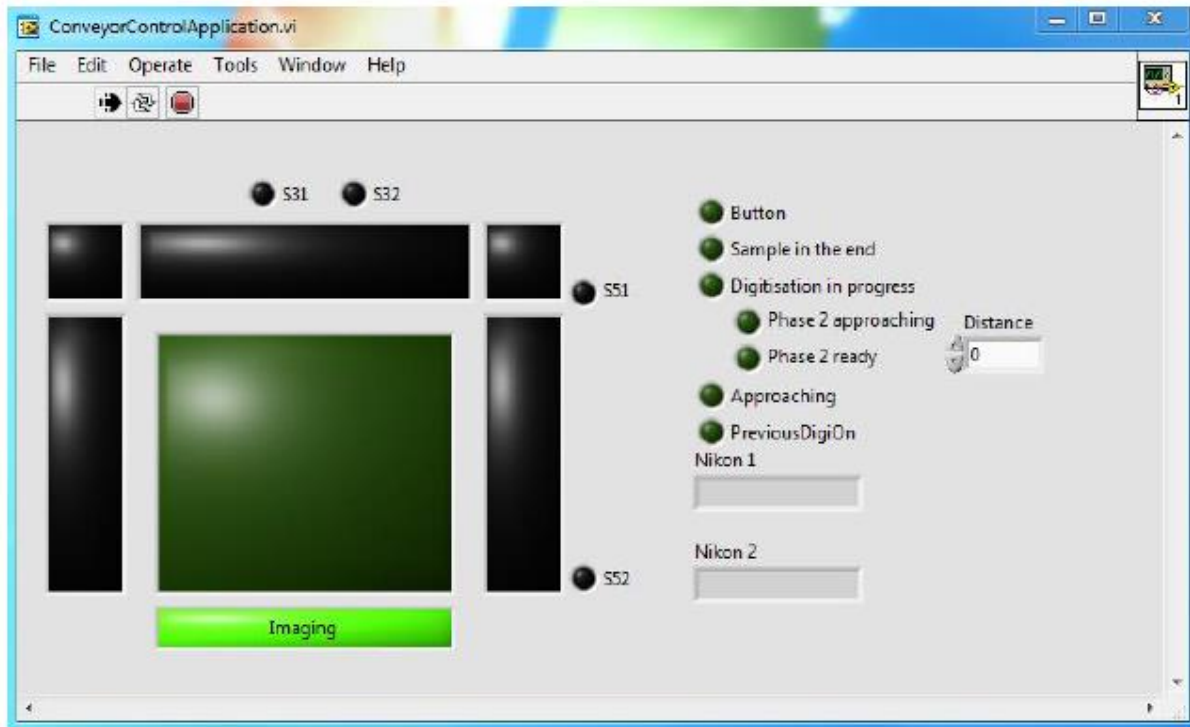


Figure 3. ConveyorControlApplication.

## ***Settings and adjustments***

The camera(s) cannot be used in their automatic mode, and almost all settings must be adjusted by hand. The optimal values for aperture, shutter speed, focus length, and anything else that affect image quality must be iteratively determined. This may take some time and experimentation in the beginning of each project and for each sample type. However, when proper values have been found, they normally need no further adjustment and remain the memory of the camera(s).

One thing that must be adjusted frequently follows from the fact that not all species are of the same size even within one genus or family. The area that will be imaged will be adjusted simply by moving the camera(s) closer or away from the specimens, and focusing the lens accordingly. In this case also the horizontal position of the camera may need to be adjusted, so that the fixed scale remains at the bottom of the imaged area.

The light units are close to the objects and very bright, so normally there should not be any problems. However, if shadows are detected, the light units may need to be moved up or down. Using a polarizing filter in the lens may improve colour saturation.

Finding a proper background for the photographs depends on the specimen type. Often a light grey background is the right choice. The background is created by attaching a sheet of paper in the pallets. The paper must be replaced periodically when it wears out, and pin holes start becoming visible in the photographs. Suitable papers can be found in hobby shops.

## Imaging

Photography is largely automatic. The operator places the specimen on the pallet, and places the labels on their place next to the specimen. The placement of the specimen may be assisted by external applications and webcams which visualise the focus area. Any metadata will be entered using the IWBF application.

First, adjust the image area according to the size and shape of the specimens. Stop the ConveyorControlApplication (CCA) by pushing the red circle at the upper bar of the application, see Figure 3. Now the pallet can be placed under the camera so that the sensors do not reach and camera(s) taking pictures. Adjust the height of the camera and focus. The CCA will start again from the arrow in the in the upper bar, see Figure 3.

The pallet shall be placed on the first, **Loader Conveyor** from where it will be conveyed through the **Imaging Station** to the last, **Unloader Conveyor**. While the *Imaging Bar* is green (Figure 3), the pallets are queued to the beginning of the Unloader Conveyor until it is full (with about five pallets). The Conveyor can be unloaded by pushing a button, which causes the *Imaging Bar* to turn yellow, and the pallets are moved to the end of the Unloader Conveyor. When the last sensor, S54, is blocked, the entire conveyor system stops.

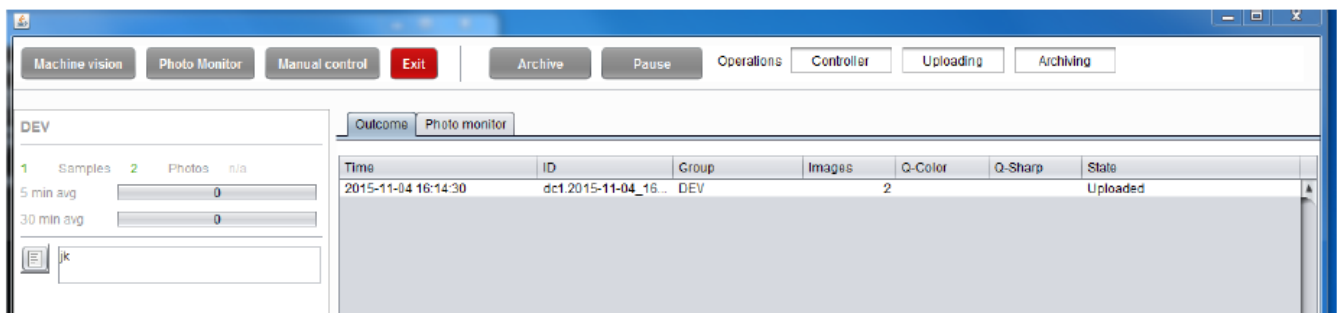


Figure 4. Runtime view of the DigiConveyor application.

So, it is the DigiConveyor application which controls imaging of samples. The *Photo Monitor* button in the upper bar opens, in a separate window, the preview picture of the latest imaged sample. By clicking the *Single / Dual View* button in the left lower corner of the window, one or two images may be shown. The metadata of the sample will be shown in the *Outcome* tab.

Uploading of data and images to the server can be done with the *Uploading* button in the lower part of the application main window. This can be done any time, such as immediately from the start of the work shift, or at the end of the work shift. Uploading may take some time, which necessitates leaving on the Imaging Computer.

The data and images are also stored on the Control Computer, in its C:\DIGI\_DATA\data folder, from where they can be moved to the C:\DIGI\_DATA\archive folder by pushing the button *Archive* in the upper bar. Also the Archive folder is located on the Control Computer. It will be necessary to empty this folder periodically, when it is certain that the images and data are safely on the Server Computer and also have been backed up. At the bottom of the application main display the available disk space is shown. It should be monitored, so that disk does not get full during imaging.

## IWBF

Some kind of label printing system is required. Many museums already have this available, which probably can be used. This section describes the system developed by Digitalium, which is an available option.

IWBF is an application which allows entering data from the samples and to enter the unique identifier of the sample. It is possible to enter the following data (also see Figure 5):

- **Operator:** The name(s) of the people operating the system in the current work shift. Names should be separated by commas.
- **Set:** The number of a batch of samples, such as number of an insect box. The number will remain as default until changed from the *Change Set* button.
- **ID:** The unique ID of the sample. This will be increased automatically for the next sample. (which necessitates use of sequential IDs also in barcodes). After click “Edit?” tick box, the ID can be manually changed. The most use-case is when an existing ID is already associated with the current specimen.
- **Genus/Species/Infra(species):** Taxon of the sample.
- **Sex:** The gender of the sample.
- **Date:** The verbatim date of the sample.
- **Verbatim:** A text field for any other data.

The *Save* button saves the data and moves to the next sample. The *Print* button can printer individual ID if this function is enabled beforehand.

In the upper window at right the **Statistics** of the samples in one day and overall will be shown.

The screenshot displays the IWBF application interface, divided into two main sections: Data entry and Statistics.

**Data entry panel:**

- Operator:** Text input field with placeholder "Last Name, First Name".
- Set:** Text input field with placeholder "Enter set name" and a "Change set" button.
- ID:** Text input field containing "NHMD-220962" and an "Edit?" checkbox.
- Print:** A button next to the ID field.
- Genus:** Text input field.
- Species:** Text input field.
- Infra:** Text input field.
- Sex:** A dropdown menu with "Select One" as the current selection.
- Date:** Text input field.
- Verbatim:** Text input field.
- Save:** A button at the bottom right of the panel.

**Statistics panel:**

- Your score today:** 0
- Specimens in total:** 1561
- A progress bar is shown below the total specimens count.

**ID control panel:**

- Prefix:** Text input field containing "NHMD".
- Paper No.:** Text input field containing "15".
- Position:** Text input field containing "A" and "22".
- Reload from DB:** A blue button.
- Print (side 1):** A blue button.
- Print (side 2):** A blue button.

Figure 5. The IWBF application.

Using the lower window **ID Control** at the right, it is possible to print labels. Enter a *Prefix*, such an identifier for a collection. Using *Reload from DB* it is possible to reset the sequential number of samples to the lowest unused number under that Prefix.

The IWBFB application allows printing two-sided identifier labels. The two sides will be produced as JPEG previews *Print (side 1)* and *Print (side 2)* which are mirror images of each other, and must be copied and pasted for matching in Microsoft Word. In order to do that, copy and paste the side 1 image to Word, adjust its width to 8.4 cm (maintain aspect ratio). Then copy and paste the side 2 image to the next page in Word. Center the images and set the left margin 0.09 cm smaller than the right margin (for instance 1.91 cm and 2.00 cm). There also is a ready made template *Hyönteiskoodit\_template.docx* which has the needed margins setup.

The identifier labels are made as two-sided printout, where the individual labels are aligned in both sides. Of course, it is possible to produce just one-sided labels by only printing one of the sides. The default size of the identifier label is 6 by 12 mm (the 8.4 cm width above follows from 5 columns of labels, plus two margins each 12 mm.)

Moreover, individual ID can be printed with a dedicated label printer if the feature is enabled.

## ***Possible problems and their solving***

### **Camera does not take pictures:**

1. Check that the camera is on. If not, turn on, and also restart the *DigiConveyor* application.
2. If imaging still does not work, open the web browser of the link <http://169.254.3.101:50080> to see if there is the corresponding camera listed. If not, check local network connections and the Camera Computer.
3. Restarting the Camera Computer and running the initialisation command may also be needed.

**Camera takes two pictures of the same location:** In the *CameraControlApplication*, remember to add a number (1200) in the *Distance* field.

**The conveyor lines do not start:** Check that the last sensor in the unloading conveyor is not blocked (in the display, the light S52 is dark). Check that the *ConveyorControlApplication* is on, which can be seen from the arrow in the upper bar which must be dark. Check that the Emergency Button is not pushed down, so that below the red big button also the yellow ring can be seen. Check that the components of the Control Center have been initialised using the *NiMax* application.

**Pallets do not stop in proper location for imaging or at the end of line:** This can happen if the control computer processor is 100% busy. However this is an abnormal situation, as the digitisation system only uses up to 50% of processor time. The control computer is a real-time system that should NOT be used to run any other applications than those described in this document! Refer to the Admin Manual for details.

**Belt veers off the conveyor:** This can happen because of temperature changes and wear. There are screws on the side of the conveyor to adjust it. Refer to the Admin Manual for instructions how to use them.

