How to install the ISI system from the Haider Lab – Georgia Tech

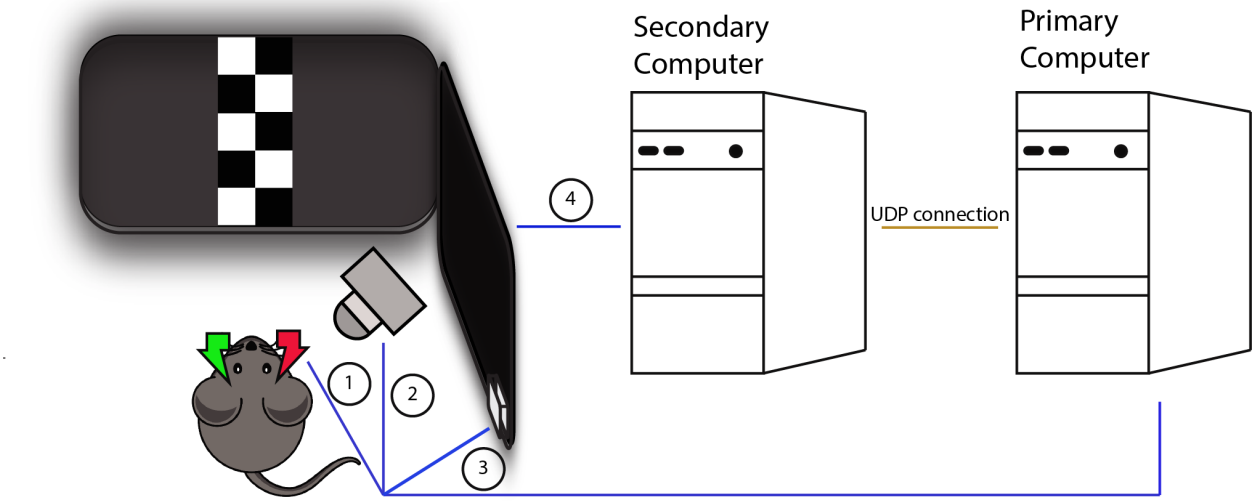
List of equipment

This list was modified from Juavinett, 2016: http://dx.doi.org/10.1038/nprot.2016.158

# ID	Equipment name	Number of items	Vendor /Manufacturer	Cat. No. / Model # / Comments
1	Photodiode		Thor Labs	PDA36A2
2	Light source with serial port communication	1	Illumination Technologies	3900e
3	Light guides	1 set	Illumination Technologies	9240HT
4	Excitation filters (510–590 nm and 610 nm)	1	Illumination Technologies/ Chroma	
5	Emission filter (525-nm bandpass filter)	1	Edmund Optics	87-801
6	Emission filter (700-nm bandpass filter)	1	Edmund Optics	88-018
7	CCD or CMOS camera	1	Teledyne Dalsa	FA-80-12M1H-00-R
8	Lens 1	1	Nikon	AI-S FX Nikkor 50 mm f/1.2 manual focus lens
9	Camera mount	1	Edmund Optics	54-123
10	Lens 2	1	Nikon	Ai 85 mm f/2 manual focus lens
11	NogaFlex Holders	2		
12	Frame-grabber	1	Matrox	RADIENT eVCL
13	DAQ	1	Measurement computing (MC)	USB - 1208FS
14	Emission filter wheel	1	Thor Labs	LCFW5
15	Camera mount	1		
16	Primary computer	1	Dell	with at least 8 GB and SSD card
17	Secondary computer	1	Dell	with Psychotoolbox

** Camera mounting base and post were made from an adapted monitor desk mount.

System setup



Primary computer: This is the main processing unit of the system. It instructs the secondary computer to start visual stimulus display [4], controls the light intensity [1], triggers the camera [2], acquires analog signal from photodiode [3].

Secondary computer: Displays visual stimulus on monitors after primary computer gives instructions via UDP connection.

Equipment setup

1. Download the ISI package from the Haider Lab GitHub (Link: https://github.gatech.edu/haider-lab/ISI/tree/main/Core)
2. Install Psychotoolbox on secondary computer, which is used for stimulus presentation. Check for specifications here: http://psychtoolbox.org/requirements/
3. Place photodiode on bottom right corner of secondary computer screen and connect it to DAQ.
4. Connect DAQ to primary computer. If the DAQ used is MC, the driver must be installed in Matlab. See section below for how to install MC in Matlab.
5. Insert frame-grabber in primary computer. It must be placed in a PCI slot.
6. Assemble camera, lenses, and emission filter wheel. (The wheel should be placed between the two lenses.
    a. Top lens must be focused at ∞ to 2.8
    b. Bottom lens must be focused at ∞ to 5.6
7. Connect camera to frame-grabber.
8. Assemble light source and connect to primary computer.

How to install MC driver in Matlab

1. Download MC driver package from Matlab (Home -> Add-Ons -> Get Hardware Support Packages).
2. Install MC DAQ drivers from the provided disc.
3. Close Matlab, and start InstaCall (This step is critical!). InstaCall is a software provided with the DAQ. It is part of the drivers installed during step 2. Once InstaCall is open, follow the steps below.
    a. Find your device in platform
    b. Start acquisition of signal
4. Close InstaCall and start Matlab again.

How to run an experiment

Note: some of these steps are specific to our setup. Adjustments may be necessary.

1. Turn on the camera
2. Turn on the illumination:
    - Change excitation and emission filters to allow for **GREEN** light
3. Uncap the camera lens
    - Make sure the bottom lens is focused at ∞ **to 2.8**
    - Make sure the top lens is focused at ∞ **to 5.6**
4. On the secondary computer:
    - Turn on MATLAB as an administrator
    - Add path for location of package downloaded from GitHub
    - Open "**secondary_script.m"**
    - Enter IP address of primary computer for UDP connection (masterIP)
    - Run script
5. On the primary computer:
    - Turn on MATLAB as an administrator
    - Add path for location of package downloaded from GitHub
    - Create "neurodata\AnalyzerFiles_new\xx0\u000_000\48s_00000" folders in local computer C drive. This location will store the parameters of the visual stimulus displayed.
    - Open "**primary_script.m**"
    - Enter camera interface settings to specify how frames are captured
        - An executable to acquire frames for Matrox frame grabbers and its Visual Studio solution are provided in "Core\New_Imager\MdigProcess"
            - *MIL-Lite is licensed for both application development and deployment in the presence of Matrox Imaging hardware or a supplemental license*
        - To use a custom executable, review requirements specified in the "Core\New_Imager\grabFrames.m" function
    - Enter IP address of secondary computer for UDP connection
    - Enter path where data must be stored
    - Enter whether to use old/new camera interface – Matrox Frame grabber (**.useExecutable**)
    - Enter location of Matrox camera control executable (**.exePath**)
    - Enter location for temporary storage for camera acquisition (**.tempStoragePath**)
    - Enter frame dimension (**.frameDimensions**)
    - Enter the mouse ID (**inputM.mouseID)**
    - Enter the date (**inputM.date)**

- Enter the location where acquired frames are stored (**inputM.analyzerRoot)**
- Enter the input session (**inputM.ses)**

**** Place the mouse under camera**
**** Using a Caliper, measure the length of the cranial window edges. This is important to determine the real size of areas**
**** Inject Sedative**

6. Run the primary script
    - An adjust list window will appear. Adjust light if necessary, then close window.

**** Put the green filter in the illumination box**
**** Turn the revolver between lenses to green filter**
7. A new window GUI will appear
    - Click on **Launch live**
    - Move the camera until the cranial window is visible
    - Adjust the light intensity if necessary
    - Focus lenses by adjusting height until blood vessels are visible, then slightly focus ~100 – 500 µm below vasculature
    - Click on **Capture image**
    - On the captured image (see right), select the cranial window by clicking and dragging
    - Click on **View ROI**
    - Set Frame rate to **10**
    - Close that window

** The section below was modified from link below. See documentation (Intrinsic Imaging Rig.pdf) for full description of GUI use.

Link: https://sites.google.com/site/iannauhaus/home/matlab-code

8. Three window GUIs will appear: **Main**, **Looper**, **ParamSelect**
    - Spread the GUIs around
9. In **looper**
    - Enter parameter for test run – See Intrinsic Imaging Rig.pdf for full description
    - Example:
        - In the first column, under "**symbol**", write: **ori**
        - In the second box, under "**vector**", write: **[0]**
10. In **ParamSelect**
    - Click on **Load** and load visual stimulus - See Intrinsic Imaging Rig.pdf for full description
    - Example:
        - Load Horz_F_18.param from params folder - GitHub

11. In the **Main window**, click **Run**
12. A feedback window will appear after the recording is done

** If no signal is detected, appropriate interventions may be necessary

13. After the previous run has ended
14. Change the excitation and emission filters to allow for **RED** light
15. Load visual stimulus and adjust parameters for Azimuth and Elevation stimulus display
16. In the **Main window**, click **Run**

17. A feedback window will appear after the recording is done

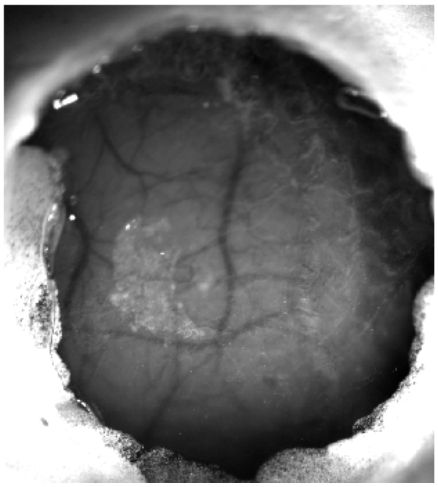
18. Repeat steps 15-16 until the number of visual stimulus display is met.

** Use post-recording toolkits for construction of average retinotopic, VFS, and eccentricity maps.

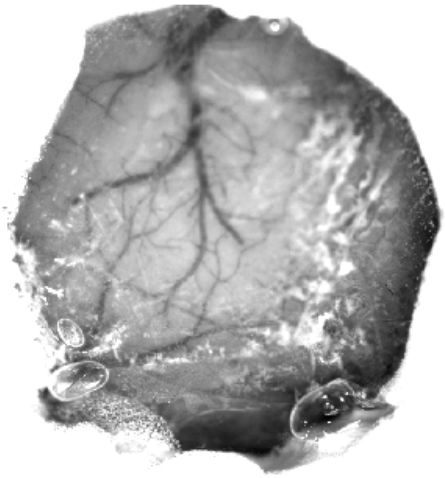
Examples:

Using **Green** light

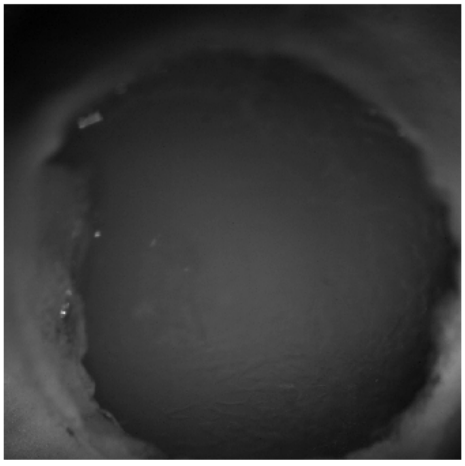
BAD green



GOOD green



BAD red



GOOD red