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## HDI Advance Setup and Training Manual

Congratulations on your purchase of our HDI Advance 3D scanning system! This 3D scanning solution provides you with the ability to gather high quality 3D scans at three different fields of view, which are based on camera position.

The purpose of this manual is to provide you with the basic setup and training information that you will need to produce professional 3D scan data.

## Training Manual Outline

## I. Unboxing

Items included in your HDI Advance 3D scanner box:

| | |
|---|---|
| 1 | HDI Advance Scanner Frame |
| 2 | Cameras |
| 3 | Lenses |
| 4 | Tripod |
| 5 | Tripod Head |
| 6 | Calibration Board |
| 7 | Photogrammetry Dots |
| 8 | License Dongle *Delivered upon full payment |
| 9 | Wiring Harness |
| 10 | Camera Mounting Screws |

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# II.  Initial Setup of your System

A.  First, attach your scanner to the tripod and tripod head. Then, attach your cameras to the bridge using the camera mounting knobs. When installing the wiring harness to your HDI Advance 3D scanner and your desktop or laptop, it is important to make sure that the standard USB 3.0 end of the cable is towards the computer, and that the Micro A USB end is towards the scanner, which plugs into the back of the cameras.  Now would also be a good time to plug in the projector power to both the wall and projector.

Before plugging the USB cable into the computer, verify that the computer has (2) USB 3.0 ports and an HDMI port.  The USB 3.0 ports will be used for the cameras, and the HDMI will come from the projector.

> Note: If you have a USB hub, you must be using a powered USB 3.0 hub to extend the length of the wiring harness.  The supplied USB 3.0 cables are the longest distance that USB 3.0 will travel without additional power.

Here is an example of a USB 3.0 port:



B.  Note: A USB 3.0 port has either a blue tab on the inside, or has "SS" written outside the port.

Depending on the size of object that you are looking to scan, you can use different camera positions and lenses to scan different sized objects.

| Outer Camera Position Large Area Scanning | 12mm Lenses 8mm Lenses | 20" parts and up 25/55mm Calibration Board |
|---|---|---|
| Middle Camera Position Medium Object Scanning | 12mm Lenses 16mm Lenses | 2" to 20" parts 15/10mm Calibration Board |
| Inner Camera Position Small Object Scanning | 12mm Lenses 25mm Lenses | 2" parts and smaller 3mm/5mm Calibration Board |

**\*\*Different lens/calibration board combinations can be purchased through the reseller who you purchased your system from.**

B1.  The standard camera and lens configuration is to place the cameras in the middle position with 12mm lenses attached to the camera body.  This will give you a field of view that will allow for scanning a range of objects up to a shoe-box in size and down to a car key.  This is also the configuration that we will use to demonstrate the scanner calibration in section IV of this manual.

C.  Now that you have the wiring harness connections made, you can verify that the harness is installed properly by turning on the projector power, and checking to see if the two cameras have an orange or green light illuminated on the rear face of the camera body. If these two lights do not come on, make sure that your computer is turned on.

D.  For the remainder of this manual, you will need to make sure that FlexScan3D is installed properly on your computer.  If you did not receive the email deliverable for this software, please contact Metron3D support at the following contacts:

Phone: 434-946-9887

Email:  support@metron3d.com

# III. Calibration Setup

Once you have your scanner connected, projector power turned on, and FlexScan3D has been installed, you can begin the calibration process for your system!  As mentioned previously the calibration process that will be shown later will be conducted with the cameras in the middle position, with 12mm lenses.  This is considered to be the "medium" field of view. Open up FlexScan3D, and go to the scanners tab.  Click "Remove", then click "Add".  In the dialog box, you can select "Create new HDI Advance", or if there is a scanner listed you can select that scanner, then press "OK".  **The following process for calibration setup and procedure will remain the same regardless of your field of view.  The only thing that will change is your calibration board size, your lens size, and your camera position.

A.  The first step is to place the calibration board in front of the cameras, approximately 24" away from the front of the scanner.   This will give you a reference to set your camera lens and exposure to.   After this, look at the top left hand corner of FlexScan3D where you will see a place to add new cameras.  Add the two cameras where the box says "None".
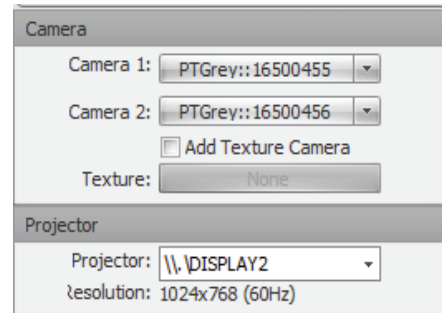


B.  On your lenses, you will see two knurled set screws.  You will need to loosen these to adjust the focus and exposure of each lens.

Focus Adjustment:  When adjusting the focus on the lens, you can take the mouse and hover over the camera feed to magnify the calibration board so you can get a better idea of when the lens is in-focus.  Once you can clearly see the grid through the camera feed, your cameras are properly focused.

Exposure Adjustment:  You will either see an underexposed image (blue and black coloring) or an overexposed image (bright red).  The ideal exposure is when you have just come out of the overexposure and there is no longer any red being displayed on the calibration board.

Here are exampled of over, properly, and under exposed camera feeds:

**Over Exposed**     **Properly Exposed**     **Under Exposed**
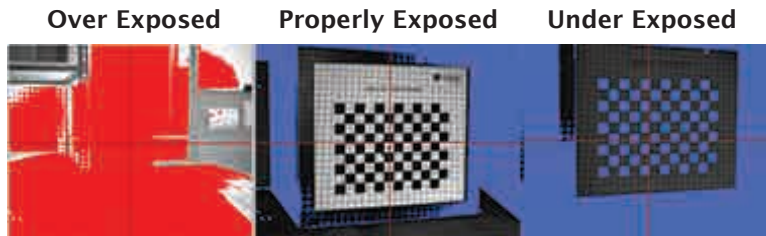


C.  To set the projector focus and zoom, look on the right hand side of the screen and you will see a  drop down menu beside "Projector".  Select "Focus".  This should change what the projector is displaying to what FlexScan3D recognizes as a focus pattern.   If you are using a laptop, then may need to extend your displays to display the correct image.
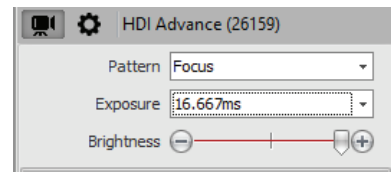


D.  You can now adjust the image of the projector by using the focus and zoom knobs on the projector until the image is being clearly displayed onto the calibration board which should be placed about 24" from the scanner with this FOV.  You can also check through the camera feed to ensure that the lenses are properly focused.  Make any adjustments necessary to the camera and projector focus and exposure, then you may begin taking calibration images!

Note:  If the projector was exceptionally cold when it is plugged in and powered on, the bulb will warm up and it will increase the brightness of the projector past what you may have already set the lenses to.  You may need to reduce the exposure of the lenses if this is the case.

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# IV. Calibration Procedure

The calibration procedure follows a few simple steps and scanner positions, but can be daunting the first few times that it is completed. After a few successful calibrations, you will be able to complete this process quickly and efficiently to produce a high quality calibration.

The purpose of this calibration is to build a Field Of View (FOV) so that the cameras will understand where they are in relation to each other in 3D space. Because the scanning process displays a pattern from the projector which is picked up by the two separate cameras, these cameras need to be referenced to each other to build highly accurate 3D models. Since the camera positions being referenced to each other is built into the calibration, it is very important to not make any adjustments to the cameras once the calibration is completed. The goal of the calibration procedure is to build a scanning volume that will represent the size of object that you are scanning.

Once the calibration setup has been completed, you can begin taking calibration images. The process that will be explained in this manual will take approximately 30 images, which Metron3D has found to be an ideal number of images to produce a high quality calibration while keeping the working time short for both the scanner operator and the computer.

The first set of 10 images will be taken with the center of the calibration grid aligned to the middle of the cross-hairs of the camera feed. If your images do not mirror each other, you may need to move the calibration board away from or closer to the scanner to refine this alignment. With this set properly, you can begin to slide the board to the edge of the camera views. For this example, we will begin with the left edge. Once the edge of the calibration grid is lined up with the edge of the camera feed, this is when you will take your first calibration image by clicking the "Capture" button on the left hand side of FlexScan3D. While keeping the board perpendicular to the scanner, begin to move the calibration board towards the right hand side of the view. You are going to take four more images while moving the board towards the right, so divide up the distance into five separate positions.

Here is an example of the calibration board positions for the five images:
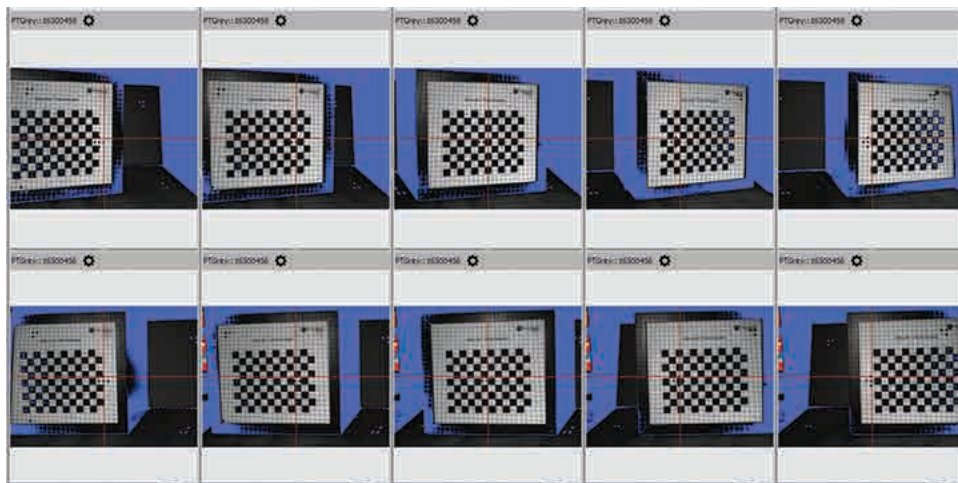
# IV. Calibration Procedure, cont.

For the next five images, you will need to keep the same process of aligning the edge of the grid with the edge of the camera feed, but you will angle the calibration board away from the scanner to add some depth to the FOV.

Repeat the same process as before, but keep the board angled away.

Here are examples of what this should look like:
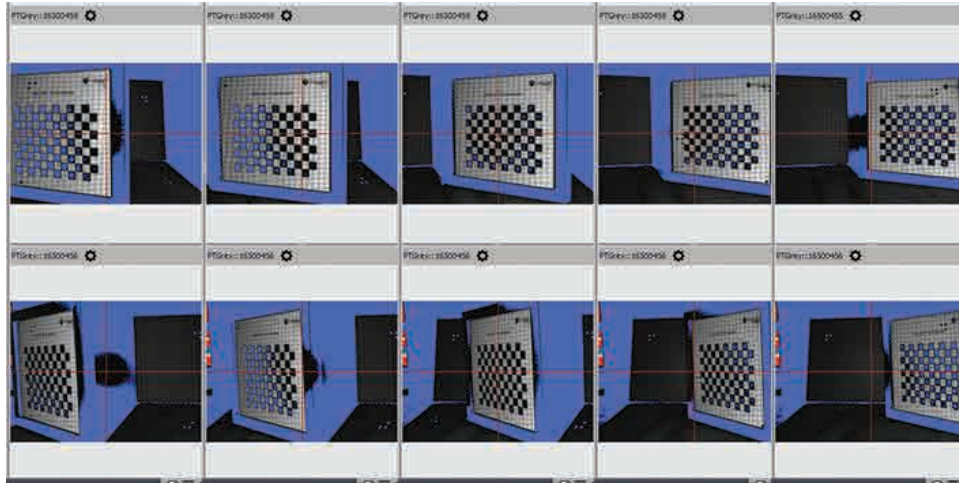


Note: After taking these 10 images, you may notice that the software will tell you that the scanner is ready to calibrate mounton the left hand side. While the software does only require 10 images, you will need more to create a higher quality calibration. Please continue to the next page for additional calibration steps.

In keeping with the same process of moving the calibration board from left to right to collect 5 calibration images per pass, we will now adjust the tripod head that the scanner is mounted to so that the top of the calibration board grid lines up with the top of the camera feed. You will then take your 5 perpendicular images and five angled images, just like the first set.
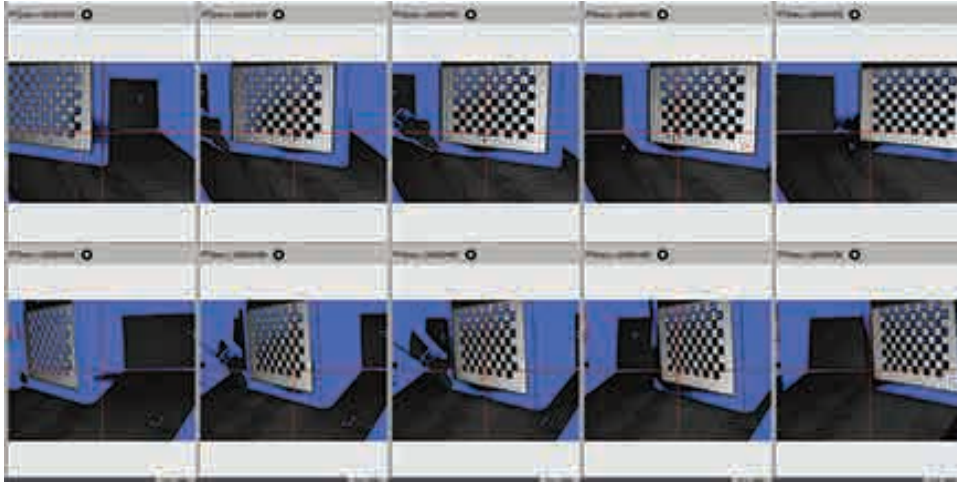
Here is what your images should look like:



Note: When taking the angled images here, you may need to slightly adjust the scanner up or down to keep the grid at **the top of the camera feed**.

# IV.  Calibration Procedure, cont.

Angled Top View Example:



The last set of images will be just like the previous set of images, but you will align the bottom of the calibration board grid with the bottom of the camera view.

Here are examples of this:



Bottom Angled View Examples:

# IV. Calibration Procedure, cont.

After you have completed all 30 images, make sure that the calibration grid size reflects the same as listed on your board, then press "Calibrate".

Once the calibration has been completed, you will be given a result of your calibration.  We recommend that your calibration range be above 85%.  This is an easily achievable number after completing the process as it has been explained.

Once this has been completed, you will be ready to begin scanning!  Please reference the FlexScan3D Training Manual for continued assistance with using these systems.