

MACHCAM 71MP

*MACHINE VISION CAMERA INSTALLATION
AND APPLICATION GUIDE*

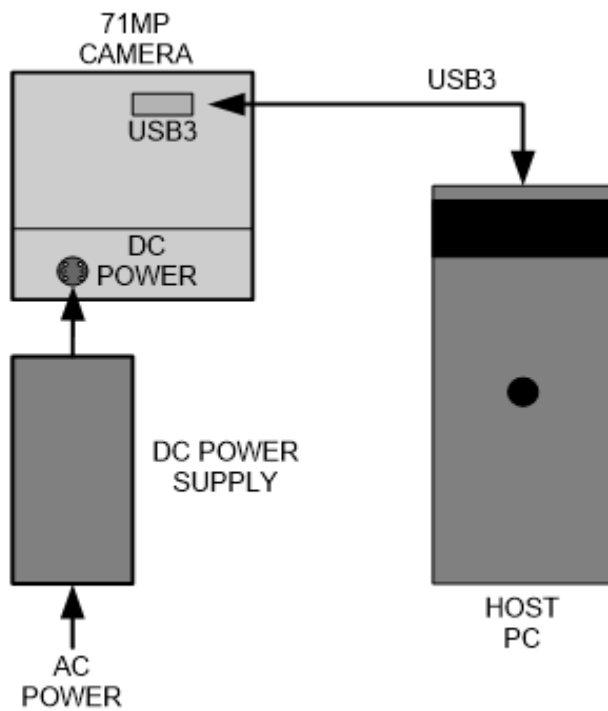


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INSTALLATION DIAGRAM



DEVICE IDENTIFICATION

71MP Camera	Camera Power Supply	USB3 Cable
		

DRIVER/SOFTWARE INSTALLATION

The software is compatible with Windows 64bit or 32bit.

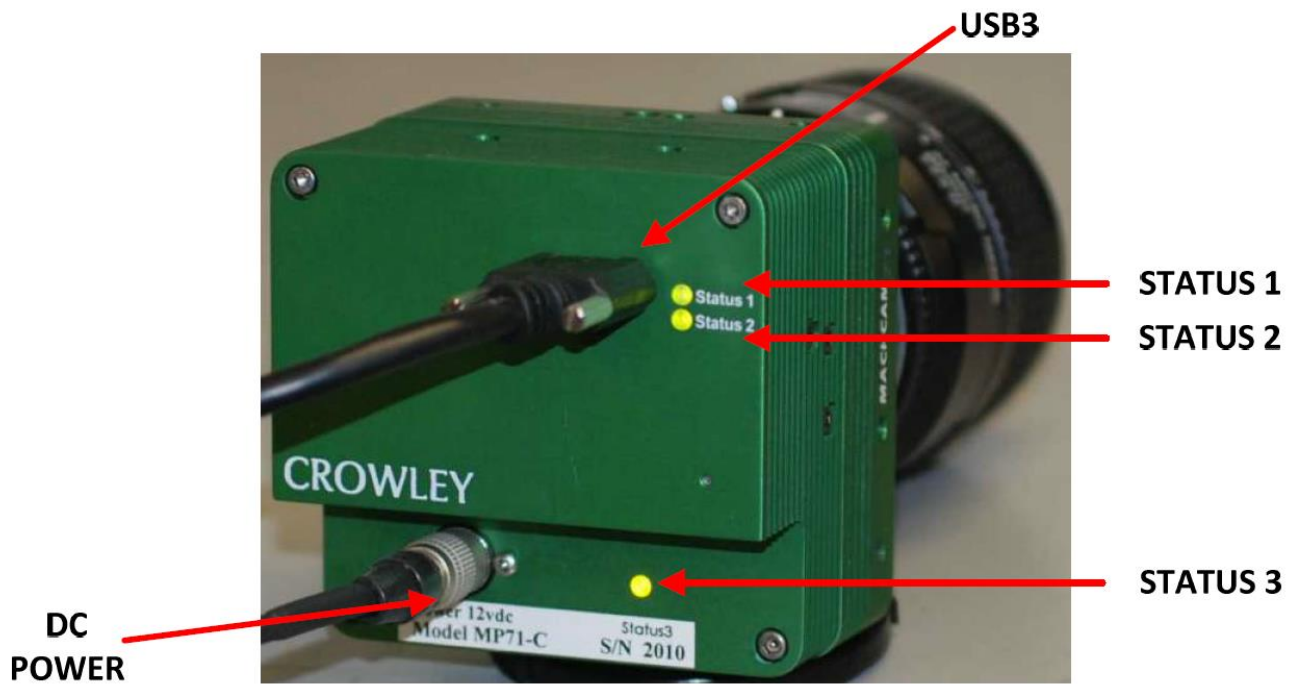
STEP ONE

Locate file "ebus_runtime_64.bit.4.1.6.3809.exe" included in provided thumb drive's Directory for 64 bit Windows. Double click on file to install necessary drivers and runtime files.

STEP TWO

After installation, locate the file "MACHCAMDemoV024.exe" included in provided thumb drive's Directory. Run the MACHCAMDemo installation.



















HARDWARE INSTALLATION



71MP Rear layout

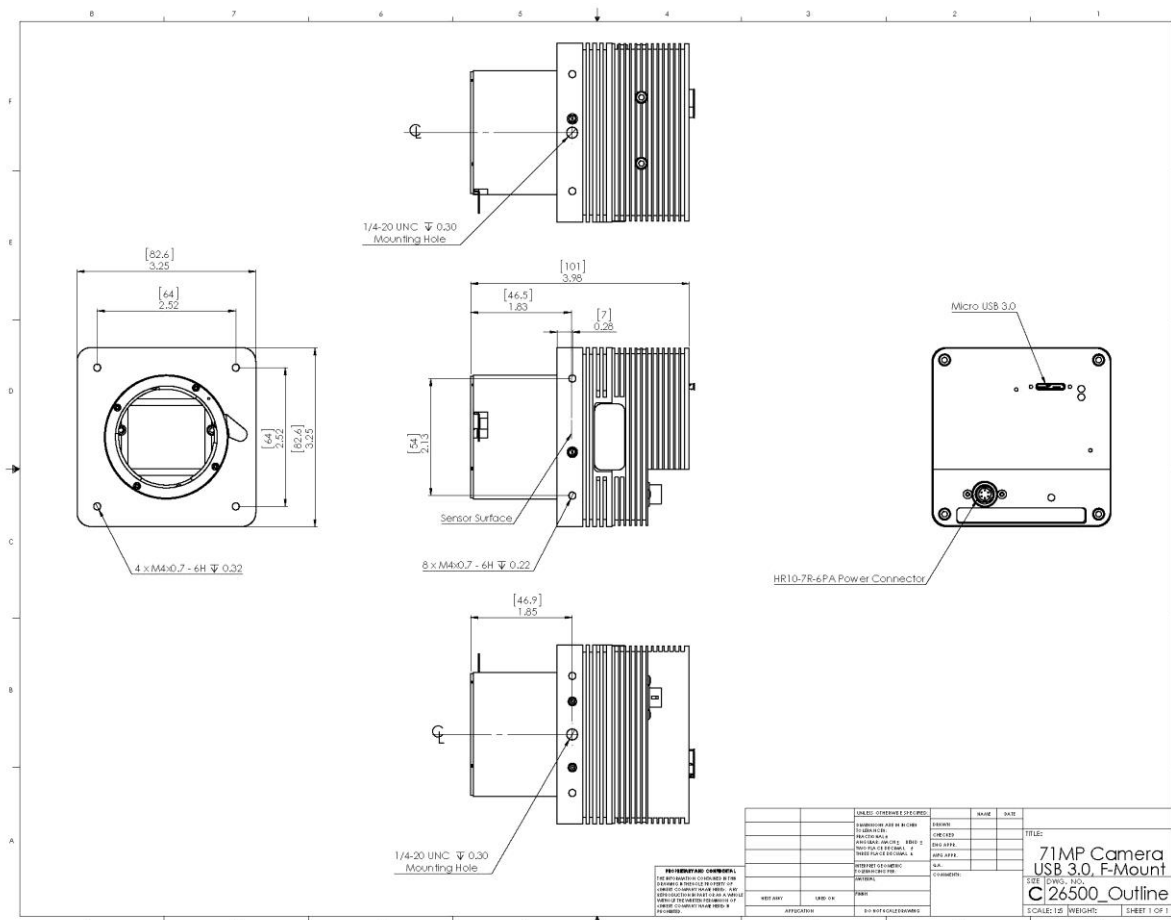
1. Assemble 71MP camera with a compatible F-Mount lens.
2. Connect DC power adaptor to camera
3. Connect USB3 cable from Host computer to camera.

STATUS INDICATION

STATUS INDICATOR	DESCRIPTION
STATUS 1  STATUS 2  STATUS 3 	<p align="center">Camera Off/Stand by or Host Computer Connection Not Detected (if DC Power is connected)</p>
STATUS 1  STATUS 2  STATUS 3 	<p align="center">Camera On USB3 (super speed) Connection Detected</p>
STATUS 1  BLINK STATUS 2  STATUS 3 	<p align="center">Camera On USB3 (super speed) Connection Detected Image Capturing/Processing</p>
STATUS 1  FAST BLINK STATUS 2  STATUS 3 	<p align="center">Camera On USB2 (high speed) Connection Detected</p>
STATUS 1  SLOW BLINK STATUS 2  STATUS 3 	<p align="center">Camera On USB2 (high speed) Connection Detected Image Capturing/Processing</p>
STATUS 1  STATUS 2  STATUS 3 	<p align="center">Connected to Host Computer No DC Power Detected (Wait 10 second after DC power is applied for status to resume)</p>

MECHANICAL DRAWING

Distance from the F-Mount to the camera sensor is 46.5 mm/1.83"



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DC: 12V DC Nominal Power Consumption: ~10 Watts Nominal

Mating connector manufacturer: HIROSE | Part Number: HR10A-7P-6S

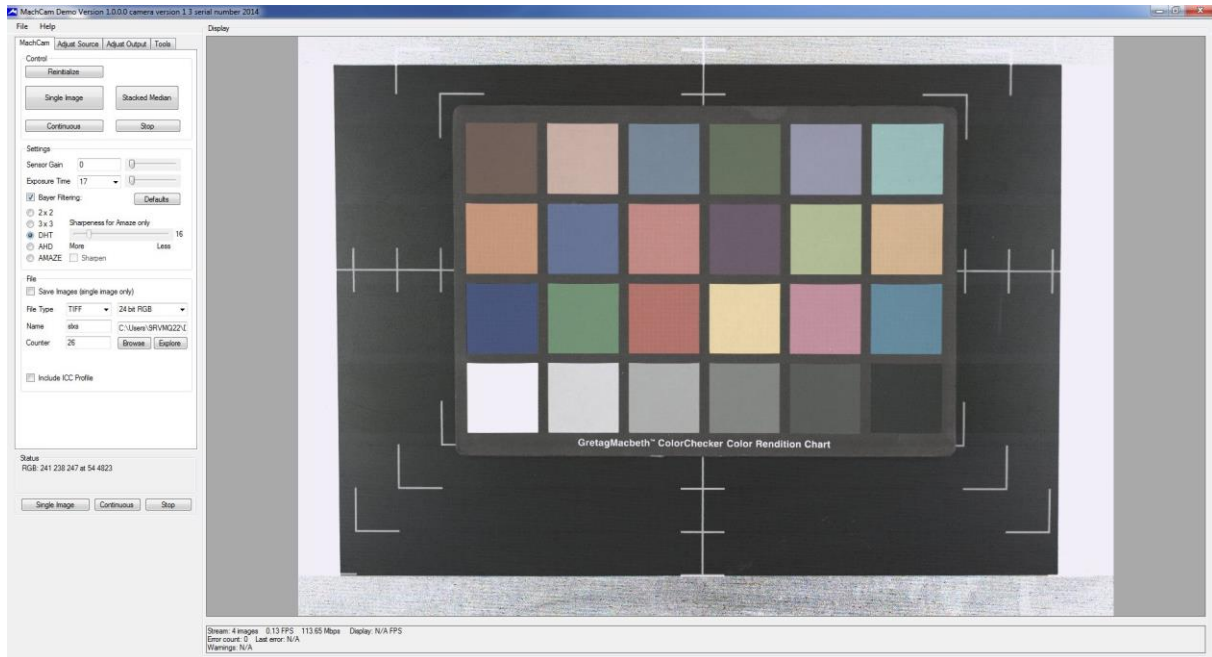
(Image taken from Hirose HR10 Datasheet)



Pin	Description	Pin	Description
1	+12V	4	GND
2	+12V	5	GND
3	+12V	6	GND

SOFTWARE APPLICATION GUIDE

1. Locate "MACHCAM DEMO" icon on desktop within Windows
2. MACHCAM DEMO application will open and display the following GUI:



MACHCAM DEMO Application

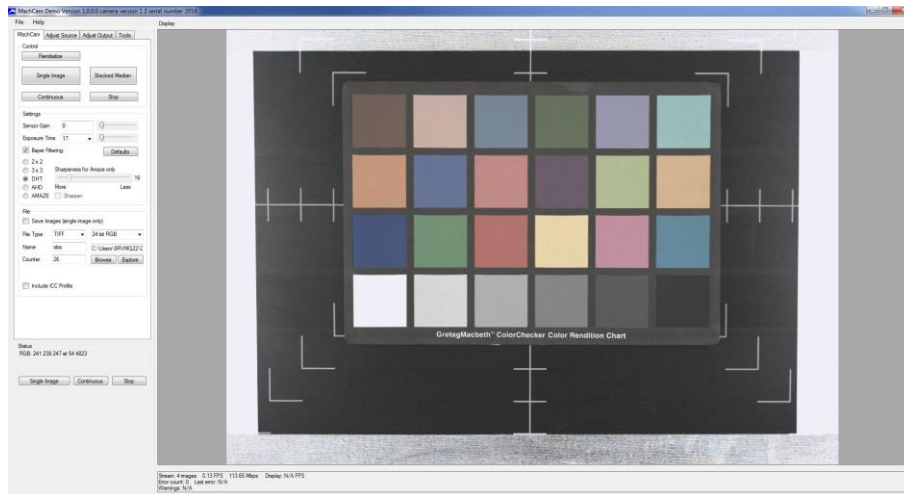
3. During application start-up, the camera (if detected) will process the following steps:

- Connecting...
- Configuring USB...
- Configuring Camera...

4. After a successful configuration, an image captured by the camera will be transferred and shown in Display area, on the right. Four tabs of user controls are available on the left.

MACHCAM TAB.

This is the main control tab where the camera is controlled, image capture is initiated, and file options are set.



Control Section

- **Re-initialize:**
To initialize or restore configuration settings in case a disconnect has occurred.
- **Single Image:**
Acquire a single image, display it in the application, and save it to disk if selected to do so in the File settings.
- **Continuous:**
Acquire continuous images into the application's Display area.
- **Stop:**
Cancel "Continuous" capturing mode.

Settings Section

- **Sensor Gain:**
Values 1 to 15; default value is 2.
- **Exposure Time:**
Values 1 to 20,000 in milliseconds; default value is 400. Also a drop down menu, able to select ¼ - 250ms and other fractions.
- **Bayer Filtering:**
Color/Grayscale camera configuration with a 2x2, 3x3, VNG, AHD, AHD Mod or Amaze filter setting. 3x3 is its default setting.
- **Defaults:**
Resets sensor gain, exposure time and the Bayer Filtering to their default value.

File Section

- **Save Images (single image only):**

When check box is selected and pressing "Single Image," the captured image will be saved in the selected file format under "File Type".

- **File Type:**

File formats available are currently TIFF, RAW, DNG, BMP, JPEG, PNG, TIFF LZW as 8 bit gray, 16 (12) bit gray / Bayer, 24 bit RGB and 48 bit RGB.

- **Name:**

Naming scheme of save file.

- **Counter:**

Used in the filenames, increments on every save.

- **Browse:**

Set the folder determining the destination for saved images.

- **Explore:**

Observe the location for saved images, allowing the user to open these files from here, within Windows Explorer.

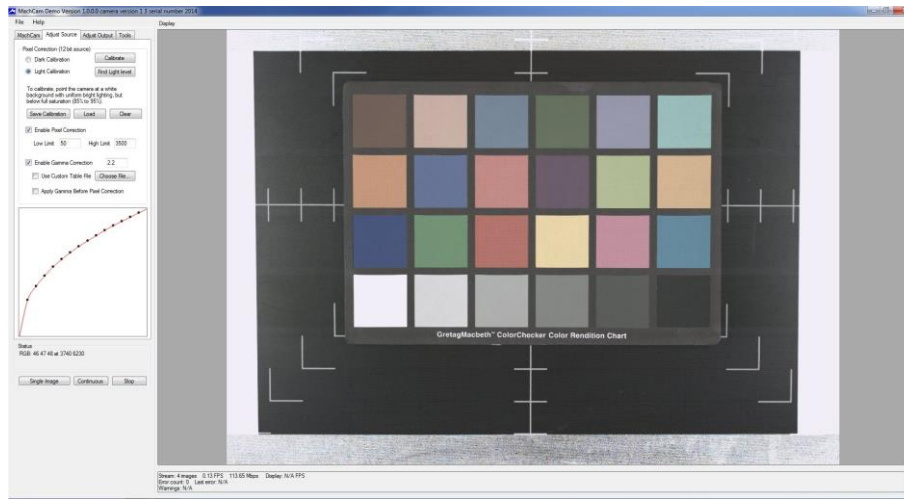
- **Include ICC Profile:**

Color profile information tells an ICC-profile color-managed imaging program what ICC color space profile should be used to interpret the image's RGB values. This can be included in the image file.

- **Stacked Median**

When clicked, an image file will be saved as a stacked median average of a total of 5 shots taken, averaged to reduce noise.

ADJUST SOURCE TAB



The adjustment controls in this tab effect the 12 bit source image pixels from the camera sensor.

Pixel Correction

Calibrate button:

Click this to carry out a dark or light calibration based on which radio button is selected. See the [Image Calibration Procedure](#) for details.

Save Calibration button:

Saves the calibration table to a file in the application folder on the disk.

Load button:

Load the calibration table from the disk into memory for use.

Clear button:

Clears the calibration table.

Enable Pixel Correction:

This checkbox enables Pixel Correction on succeeding image captures. Calibration must be done first for Pixel Correction to function. If an existing calibration table exists, it will be loaded the first time Pixel Correction is enabled.

Limit Range:

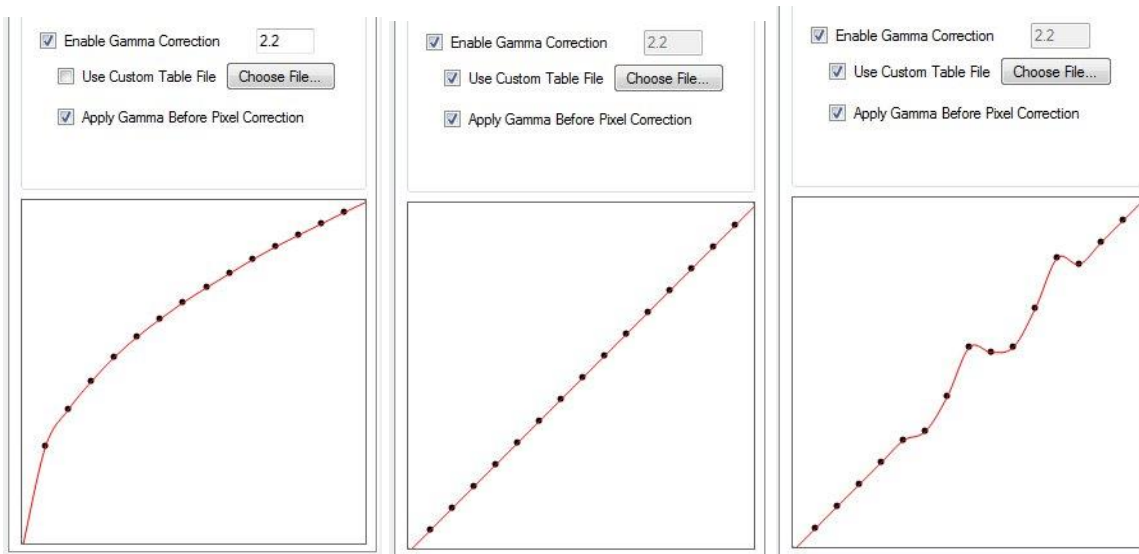
Limit range compresses the 12 bit pixel data down from its full range to what is specified in the **Low Limit** and **High Limit** textboxes. The lowest value is 0, and the highest is 4095.

Enable Gamma Correction:

With this enabled, Gamma will be applied to the pixels, either using a table generated with the Gamma value in the textbox, or the user-modified curve.

Use Custom Table File:

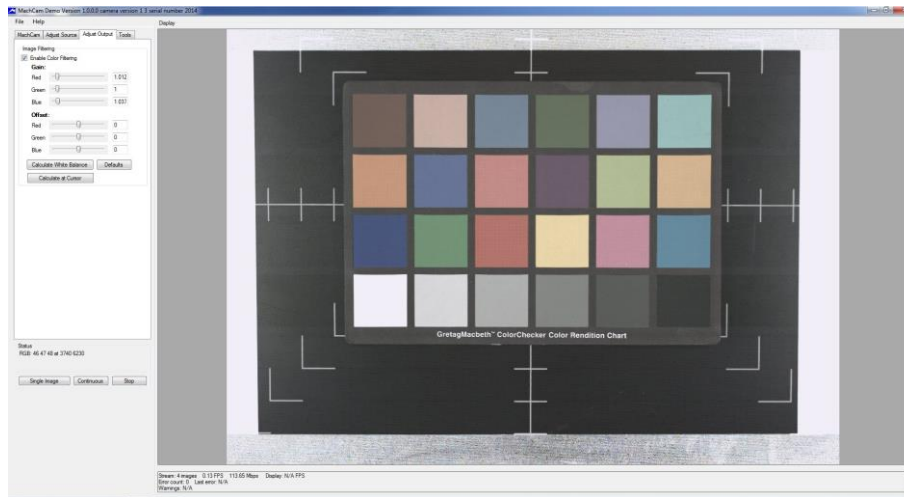
Choose File, choose a CSV file to apply different styles of Gamma Correction and modify its Gamma Correction thresholds if necessary.



Apply Gamma Before Pixel Correction:

Applies the settings in the order specified.

ADJUST OUTPUT TAB



The adjustment controls in this tab effect the post-Bayer filtered RGB color image data.

Image Filtering

Enable Color Filtering:

This enables the Gain and Offset adjustments to the color RGB pixels.

Gain:

Adjust the Red, Green, and Blue components of the color pixels. Gain is a multiplier.

Offset:

Adjust the Red, Green, and Blue components of the color pixels. Offset is an additive.

Calculate White Balance button:

This uses the entire current image to calculate and then set the RGB Offset and Gain values for a best guess for proper white balance.

Defaults:

Resets gain and offset values.

Calculate at Cursor button:

This uses a small area around the cursor to calculate the white balance values. Click the button, and then click on the area in the image you want to use.

Show display image RGB values at cursor:

With this tool enabled, as the mouse cursor is moved over the image, the RGB values under the cursor will be displayed in the Status window.

Focus indicator:

Can be used to give feedback when attempting to focus your lens mounted to the MACHCAM. With any image on display, with the MACHCAM in continuous scan, figures will be shown and the focus values will rise or fall depending on your proximity to the lens focus position. Figures are generated from the center, top left, top right, bottom left and bottom right of the MACHCAM display.

Focus indicator - continuous

	Focus	Max
Cn	8015	8021
TL	8214	8233
TR	8282	8300
BL	6922	6922
BR	6977	6982

Status (Present in each TAB)

Single Image:

Acquire a single image, display it in the application, and save it to disk if selected to do so in the File settings.

Continuous:

Acquire continuous images into the application's Display area.

Stop:

Cancel "Continuous" capturing mode.

IMAGE CALIBRATION: SIMPLE PROCEDURE

1. Run MACHCAMDemo. Ensure the lens attached to the MACHCAM is focused using the [Focus Indicator](#) program, clicking “STOP” to the continuous mode of operation, leaving the camera then in **Single Image** mode. **Disable all image processing**. In the [MACHCAM](#) tab, turn off **Bayer Filtering**. In the [Adjust Source](#) tab, turn off **Enable Pixel Correction** and **Enable Gamma Correction**. In the [Adjust Output](#) tab, turn off **Enable Color Filtering**. Back in the [Adjust Source](#) tab, set the low and high limits to **0** and **4095** respectively.
2. Enable **Show Display Image RGB Values at Cursor** on the [Tools](#) tab.
3. Place a white calibration card at the image plane, ensuring that it fills the whole image area. (White vellum paper can work in a pinch).
4. Click on **Single Image** and measure the RGB values. In the [MACHCAM](#) tab, continue to adjust the **Exposure Time** until the peak RGB value is between **220** and **225**. (For monochrome only cameras, an expected value is **3533** and **3613**).
5. Cover the lens, in the [Adjust Source](#) tab, check **Dark Calibration** and click **Calibrate**. Wait until a string of numbers appear below in the status box.
6. Remove lens cover.
7. Assuming the white calibration card is still filling the whole image area, check **Light Calibration** and click **Calibrate** and wait until a string of numbers appear below in the status box.
8. In the [Adjust Source](#) tab, click **Enable Pixel Correction**, also clicking **Enable Gamma Correction**, setting its value to 2.2.
9. Using a color checker classic, in the [Adjust Source](#) tab, set the **low limit** that measures an RGB output of **60-65** on a black color patch. Now set the **high limit** that measures an RGB output of **235-240** on a white color patch. Click on **Single Image** throughout this process to obtain a fresh image for calibration. It is best to check both figures again, as one adjustment can impact on the other.
10. In the [MACHCAM](#) tab, enable **Bayer Filtering** using a desired algorithm. In the [Adjust Output](#) tab, turn on **Enable Color Filtering**.
11. Locate a gray/neutral color patch between the previously used black and white color patches from paragraph 9. In the [Adjust Output](#) tab, click on **Calibrate on Cursor** and move the cursor over the neutral patch and click. You will now see gain figures appear in the **Gain** controls.
12. This completes the image calibration procedure.

MACHCAM LENS SUGGESTIONS

To calculate the required focal length of a lens required to produce a desired Field of View use the following equations.

Desired Field of View in the Horizontal Direction

$$\text{Focal Length} = (\text{Object Distance} / \text{Desired FOV(mm)}) * 31\text{mm}$$

Desired Field of View in the Vertical Direction

$$\text{Focal Length} = (\text{Object Distance} / \text{Desired FOV(mm)}) * 22\text{mm}$$

Object distance is the distance between the lens and the object you are imaging in mm.

A lens with an MTF of above 30% at 110 lp/mm (line pairs per millimeter) will produce the best results from the camera. Please ask your lens supplier for this information when selecting a lens for the MACHCAM and your application.

MTF is a measurement of lens performance which stands for Modular Transfer Function. Since no lens is perfect in transmitting light, MTF is essential in assessing loss of both contrast and resolution.



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