

PHANTOM HIGH-SPEED CAMERA

Miro C321 AIR

USER MANUAL



When it's too fast to see, and too important not to.®

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The contents of this manual are subject
to change without notification.



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PHANTOM HIGH SPEED

Miro C321 AIR User Manual

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Miro C321 AIR

1 INTRODUCTION

The Phantom C321 Airborne (C321 Air) camera is designed to meet the most stringent airborne test requirements. The C321 Air leverages the rugged and proven design of the Miro C321 cameras used in auto crash testing, and has specific features for airborne testing:

- Rugged to survive MIL STD 810H, 704, and 461 test standards
- Operating temperature range from -50C to +50C
- 16GB of RAM
- Removable CFAST capability, with latching door
- Passive cooling

The C321 Air even connects to the Miro JBox 2.0, for situations requiring up to 6 cameras to operate in sync.

The C321 Air is ideal for a variety of tests, including:

- Payload testing
- Component testing
- Testing in extreme temperatures and conditions

CAMERA CONTROL

Phantom cameras come with PCC software for Ethernet-based setup and control.

IMAGE STORAGE

The C321 AIR has 16GB of internal memory, with up to 63 partitions. It has removable Flash capability and an AutoSave feature to automatically save data onto the Flash card.

IMAGE MONITORING & VIDEO OUTPUTS

Phantom Miro C cameras have a 1.5G HD-SDI output on the front of the camera via a mini-DIN connector. A video monitor or view finder can be connected to view the image at the camera. Standard video rates up to 1080 p30 are supported.

ADDITIONAL FEATURES

Set new CSR default: Set a CSR in PCC with customer-selected settings. If settings are not changed, the camera may be powered off and on and the CSR will remain active. Camera must be set at full resolution.

Programmable I/O: Assign and define signal parameters for each Programmable I/O port. Available signals include Strobe, Ready, F-Sync, Pre-Trigger, Event, Memory Gate and several core signals. See Programmable I/O section for more information.

Data Acquisition: External sensor data imported through a compatible National Instruments DAQ model can be embedded in Cine files and visualized in PCC along with the high-speed images.

Image-Based Auto-Trigger (IBAT): Trigger the camera (or a number of connected cameras) from motion detected within the live image.

Exposure Tools: Auto-exposure, Threshold mode for the video output, PCC histogram, and a Zebra pattern overlay in PCC are all tools used to dial in the best exposure without over saturation.

Multi-Cine: Support for up to 63 partitions.

Continuous Recording: Automatically and continuously saves Cines to external storage.

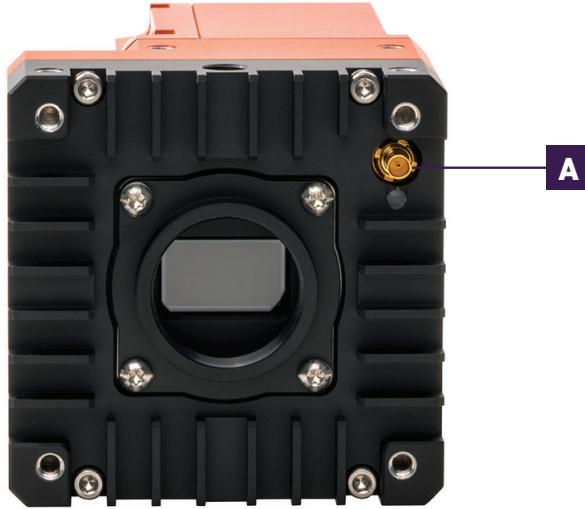
Shutter Off Mode: (also known as Exposure in PIV) turns off the shutter to maximize achievable exposure with minimal frame overhead.

Burst Mode: Generate a precise number of frames with every frame sync pulse.

DHCP: Dynamic Host Configuration Protocol enables the automatic assignment of an IP address when using a DHCP router. This method eliminates the requirement to define the PC's dedicated camera network. Automatic DHCP is an alternative to the secondary user-definable IP network available in all Phantom cameras.

HV Trigger: High Voltage (HV) trigger, when selected in PCC the camera will trigger from a +6-32V pulse.

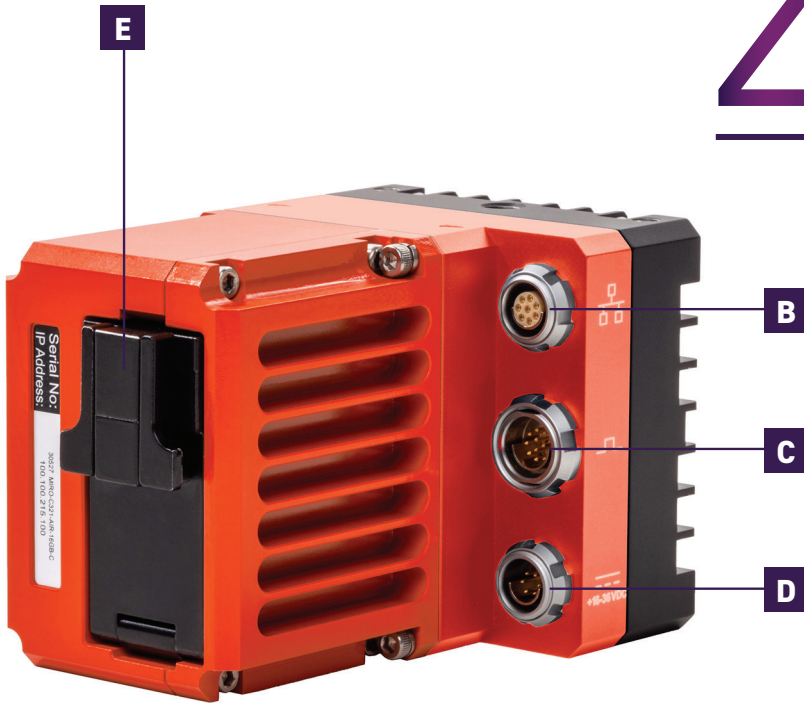
Detailed information about Phantom cameras, features, and software can be found at: www.phantomhighspeed.com



Miro C321J AIR Front View

- | | |
|--------------------|---|
| A SDI | DIN 1.0/2.3 connector for HD video. |
| B ETHERNET | Fischer connector connects GigE to a control unit computer / laptop for camera control communication. |
| C CAPTURE | Fischer connector connects to a Miro MiniBoB or standard Miro adapter cable. |
| D +16-36VDC | Fischer power connector connects to standard 40W Miro power supply. |
| E FLASH | Latching door for removable Flash. |

2 CONNECTORS



Miro C321 AIR Rear View

C321 AIR CONNECTORS



MIRO JUNCTION BOX

For multi-camera applications

- A** **READY** BNC connector; closed' for ready, 'open' for not ready; covers all cameras connected to this JBox and any JBox up-chain of this one.
- B** **TRIGGER** BNC connector; contact closure causes trigger. BNC connector also accepts TTL pulses (rising / falling edge) for trigger. There is also Trigger on System connector: isolated, <1V deassert, 3 to 24V assert.
- C** **AUX** Selectable strobe or FSYNC for synchronization with equipment such as pulsed LED lighting.
- D** **ETHERNET** Ruggedized RJ45 connector connects GigE to a control unit computer / laptop for camera control communication.
- E** **SYSTEM** Same Fischer connector as Camera port. Connects to a Camera Port on second JBox to daisy chain or branch the system for additional cameras.
- F** **POWER 20-36VDC** Independent power is required for each Junction Box.
- G** **1** Fischer connectors; each Miro JBox has six (1-6) Camera ports which carry Ethernet, power, serial, and Miro camera signals on capture connector. There are two status LEDs for each camera port – Ethernet and camera status. One port can be used to daisy chain or branch to another JBox's System port.
- H** **2**
- I** **3**
- J** **4**
- K** **5**
- L** **6**

QUICK START GUIDE

Phantom cameras are typically controlled with PCC software through a dedicated Ethernet network. PCC is compatible with the 64-bit version of Windows 10 operating systems.

The latest version can be downloaded at: www.phantomhighspeed.com/PCC

ASSIGNING A Gb CAMERA NETWORK

Connecting the camera using Gb Ethernet simply requires the computer to detect the IP address range of Phantom cameras.

PCC software includes a **Network Configuration Utility** which will launch automatically after the software is first installed, or it can be later launched from the PCC program itself.

The NetConfig Utility will show all network interfaces currently installed in the PC. Identify the one that will be physically connected to the camera (this process can be done with or without a camera connected at the time).

Click '**Config Adapter**', which will then adjust the IP Address and Subnet to the first one available within the 100.100 network that all Phantom cameras are pre-configured to work with. Once connected, the Phantom logo will appear on the lower right with the "Configured for PCC operation" message.

OPTIONAL: MANUALLY ASSIGN Gb CAMERA NETWORK

Alternatively, In the Windows '**Network and Sharing Center**,' select the camera network. Change the Ethernet IP settings by selecting '**Properties**,' then '**TCP/IPv4**' '**Properties**,' then select '**Use the following IP address**.'

Enter IP address **100.100.100.1** and Subnet **255.255.0.0**. Other settings should be blank.

POWER ON CAMERA

Connect the camera's dedicated power supply to the Primary DC input or connect via system cable to the Miro JBox. The camera is ready for operation when the red capture light of the Trigger button is illuminated.

LAUNCH PCC SOFTWARE

Double-click the PCC icon located on the desktop. Camera will be recognized immediately if connected and network settings are correct.

SELECT CAMERA FOR USE

In the **'Manager'** tab, select the Phantom camera to be used from the **'Cameras'** group folder. Click the **'Live'** tab.

DEFINE RECORDING PARAMETERS

Click **'Cine Settings'** and define the following parameters by either selecting the value from the pull-down selection list or typing a value into the respective data entry field.

1. Set **'Resolution'** to the required Width x Height.
2. Choose the required **'Sample Rate,'** and **'Exposure Time'**
3. Set **'Post Trigger'** to zero (0) by moving the **'T'** (Trigger Position) slider to the right, or enter zero (0) into the **'Last'** data entry field.

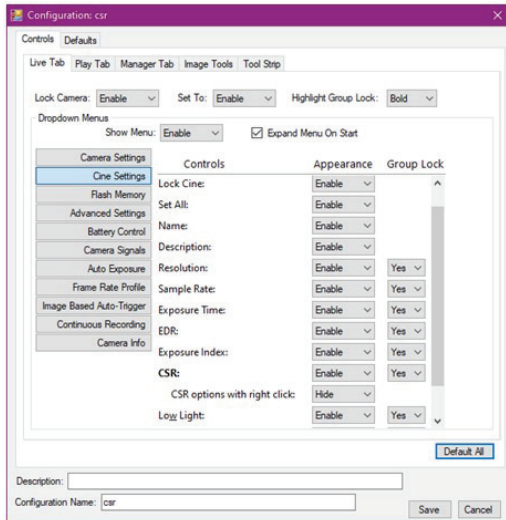
Cover the lens and click the **'CSR'** button to perform a Current Session Reference. A CSR is a black reference for that session. It is required before capturing the first cine and after changing any recording parameters.

With color cameras, perform a White Balance by right-clicking an area of the image that is neutral gray or white, as long as it is not 100 percent saturated.

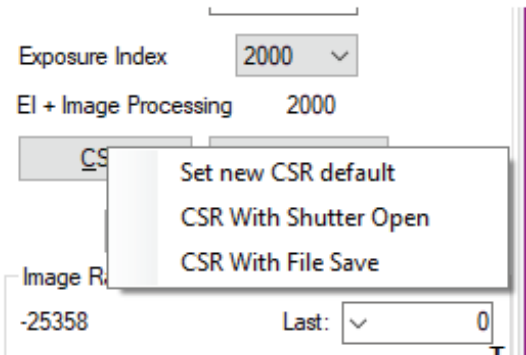
SET DEFAULT CSR

For customers that rarely change their camera settings, the **"Set new CSR default"** feature provides a convenient alternative to this process. It is available in versions of PCC 3.77 and higher. The camera must operate at full resolution, for example 1920 x 1080 for the C321. The Set Default CSR is set for the frame rate and exposure time being used. That CSR will remain through turning the camera off and on, for as long as that setting is not changed.

Step 1: Enable in PCC:



Step 2: Right click the CSR button in the live tab, and select "Set Default CSR"



FINE-TUNE SETTINGS

After CSR and White Balance are performed, adjust settings, aperture and/or lighting to get a good exposure. A CSR must be performed after any camera settings are adjusted.

'ARM' CAMERA

Click the 'Capture' button to start recording to the camera's internal RAM memory buffer.

TRIGGER

At the end of the action, click the 'Trigger' button at the bottom of the 'Live' panel provide an external trigger signal (TTL pulse) via the Trigger connector.

PLAYBACK AND EDIT CINE

Click the 'Play' tab to Scrub through the timeline or use the 'Video Control' buttons to locate the first image to be saved.

Click the 'Mark-in'  button.


Locate the last image of the Cine to be saved and then click the 'Mark-Out'  button.

SAVE TO FLASH OR COMPUTER

Click the large 'Save Cine...' button on the bottom of the 'Play' panel.

1. Navigate to the folder where you want to save the Cine file.
2. Enter a file name and from the 'Save as Type', select the 'Cine Raw, .cine' file format.
3. Click the 'Save' button to begin downloading the Cine file from the camera.

CONFIRM COMPUTER SAVE

Click the 'Open File'  button. Navigate to the folder and open the saved Cine file. Review the playback by scrubbing through the file and viewing the playback.

The latest version of Phantom PCC software can be downloaded from the Vision Research website: www.phantomhighspeed.com/pcc

This manual covers the most commonly used functions. See the 'PCC Help' file for details of other settings.



PHANTOM CAMERA CONTROL (PCC) APPLICATION OVERVIEW

TOOLBAR

The 'Toolbar' buttons provide quick access to the most frequently used functions. In the program, hover over a button to display a text box briefly describing its function.



Pcc Help
Camera hardware
Remote control
About

The 'Help' options provide valuable reference information, along with extensive documentation, relating to the software. Online tutorials can be found at www.phantomhighspeed.com/tutorials.

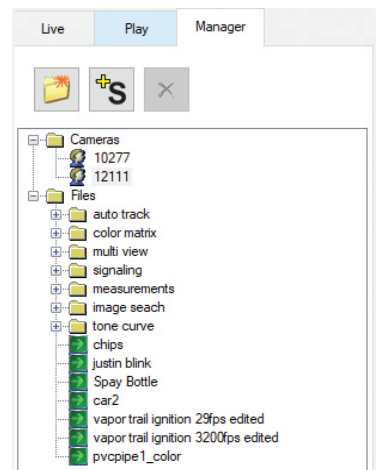
CONTROL TABS

PCC provides three control tabs: 'Live,' 'Play' and 'Manager.'

When first started, the 'Manager' tab is selected. Connected cameras are selected for use and naming in this tab. It is also used to manage saved Cine files.

All camera control and capture parameters (sample rate, exposure time, etc.) are performed in the 'Live' tab.

Reviewing, editing and saving of Cine files, either from the camera's internal RAM memory, installed Phantom CineMag V or external hard drive, are performed in the 'Play' tab.



PHANTOM VIDEO PLAYER (PVP) APPLICATION OVERVIEW

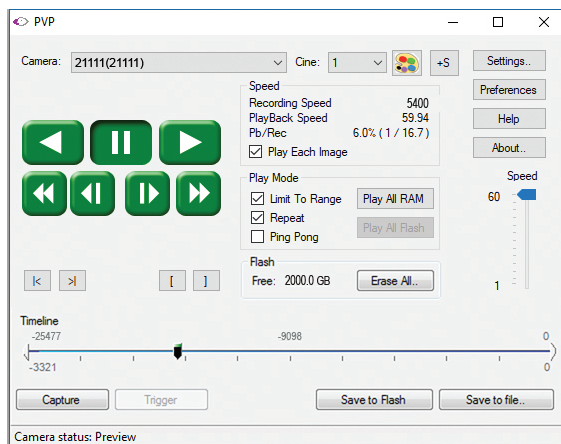
PVP can be launched directly from the desktop shortcut or by the 'Video Out' toolbar button in PCC.

PVP controls the video outputs connected to a video monitor or viewfinder only.

PVP provides the ability to view, capture, review, edit and/or save a Cine recorded into the camera's RAM, to a hard drive or installed Phantom CineMag. PVP is extremely effective when used with high-resolution cameras since most computers will not play captured raw files smoothly.

The camera's video system and display settings are also set through PVP. The best video system for the project will vary based on the country you are in, what kind of video monitor is used and the required video resolution.

All available video systems for the connected cameras can be found in the 'Settings' menu of PVP, along with production area and other video overlay controls.

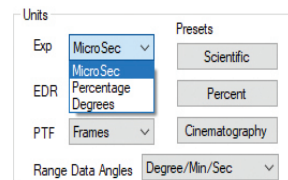
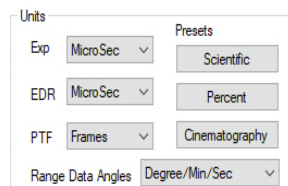


CAMERA CONTROL VIA PCC

PCC provides the ability to select units for specific camera parameters by clicking the 'Preferences' button at the bottom of the 'Manager' tab.

Units can be set to commonly used values ('Presets') or can be customized using the pull-down selection lists. First time users should use one of the three 'Presets.'

The 'Exp' unit is probably the most important unit to be set. It specifies what unit to use when setting the exposure time. The other units to set are EDR (Extreme Dynamic Range, not compatible on all models) and PTF (Post Trigger Frames) covered later in this section.



SELECTING A CAMERA

Select the camera(s) to be controlled listed in the **'Manager'** tab, or select the camera(s) from the **'Camera'** pull-down list in the **'Live'** tab.

Once a camera is selected, a **'Preview'** panel will display to the left of the control tabs showing the current image being captured by the camera.

IMAGE PROCESSING

'Image Tools' provides extensive control over the look of the image, from color and contrast settings to image orientation and crop settings. The menu is accessed by clicking on the **'Image Tools'** toolbar button (the one that looks like an artist's palette).

The top of the **'Image Tools'** window displays a **'Histogram.'** This is a graphic representation of the pixel brightness levels of the displayed image. The left represents black, the right represents white and the height represents the proportionate number of pixels at that particular value. Unlike a waveform, the histogram's shape is not representative of the content—it is simply an averaging of the brightness values.

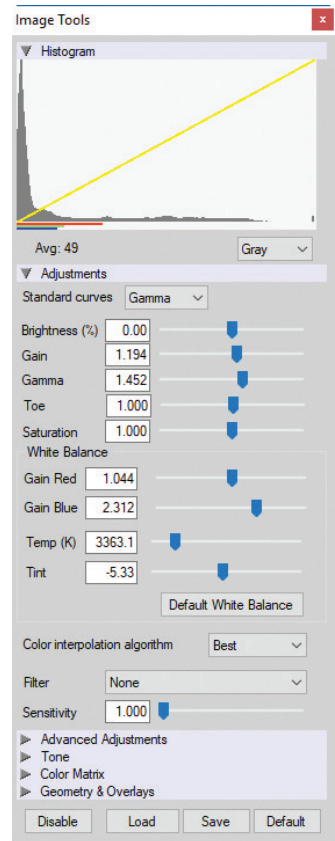
Below the histogram are controls which change image settings of the live images, recorded images and the video output.

Some of the variables include; brightness, gain, gamma, saturation, toe, white balance adjustments (Temp (K) and Tint), individual red, green and blue pedestal, gain and gamma values and tone curves.

At the bottom of the window is a **'Default'** button that restores all parameters except white balance, tone and color matrix to their default values.

The **'Default White Balance'** button restores white balance to the defaults on color cameras.

The Tone **'Reset'** button restores the image tone to the default values, and the Color Matrix **'Restore'** button returns the color matrix values to their default values.



Changes made here only affect the metadata of the Cine Raw file. They are applied in software but not "baked in."

Image Processing settings are no longer editable after saving to a format other than Cine Raw, so it is important to ensure they are set to values that produce the best looking image.

IMAGE DISPLAY

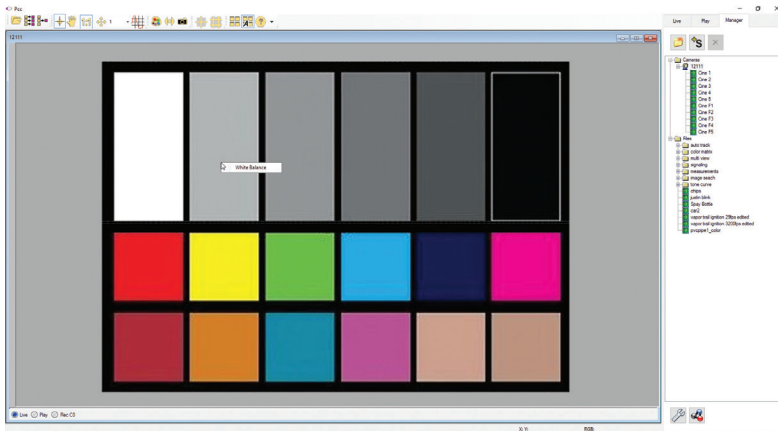
The **'Zoom Actual Size'** toolbar button resizes the images being displayed in the **'Preview/Playback'** panel to their actual size.

The **'Zoom Fit'** toolbar button resizes the images to fit the panel. Images can also be zoomed to a specific magnification ratio by selecting a number from the pull-down list to the right of the **'Zoom Fit'** button.

WHITE BALANCE (COLOR CAMERAS)

Performing a **'White Balance'** should be the first step in color adjustment. White Balance not applicable to monochrome cameras.

Right click on an area that resembles white or neutral area in the image, then click on the **'White Balance'** pop-up window. It is not necessary to fill the frame with white—a small target can be used.



It is recommended to perform the White Balance after a CSR and on a white or gray object that is not fully saturated.

CAPTURE SETUP: CAMERA & CINE SETTINGS

Set Time: Synchronizes the timestamps embedded in the recorded image data to the computer's clock.

Bit Depth: Most Phantom cameras operate in 12-bit mode only.

Mode: Select the desired mode, binning or standard mode.

Partitions: Select the number of desired partitions (evenly divided memory segments) from the **'Partitions'** pull-down menu. For basic camera setups, this should be set to one.

Lens Control: Available for Canon EF lenses only, for control of aperture and focus.

Backup & Restore: Allows for user and factory settings to be saved and recalled from the camera's memory.

Resolution: Sets the camera's acquisition resolution. There are several options in the pull-down menu. Alternatively, type in a value and the closest valid resolution will be set.

Sample Rate: Sets the acquisition frame rate in frames-per-second (fps).

Exposure Time (shutter): Sets the exposure time in degrees, microseconds or percentage (this depends on how the PCC preferences are set).

Exposure Index: Sets the exposure index (Effective ISO) of the image by loading preset tone curves. Adjusting gamma, gain and other settings will contribute to the overall EI value, and this combined value is what should be used to determine lighting.

CSR (Current Session Reference): Closes the camera's internal shutter and resets the black point of every pixel for optimal image quality.

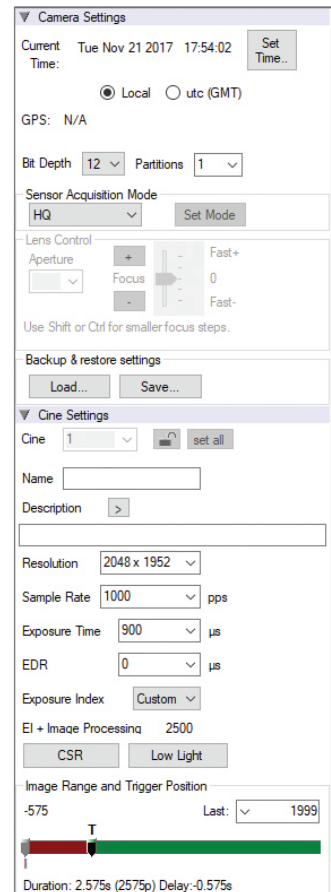
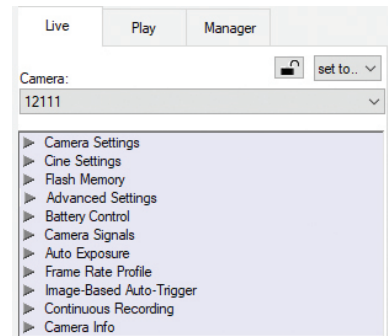
Image Range and Trigger Position: The slider represents the memory buffer, with the 'Duration' indicated in seconds and the total number of frames available.

The trigger position is indicated in the 'Last' pull-down menu and as the 'T' slider along the timeline. The trigger position is exactly when the trigger signal will be detected in the Cine.

KEY ADVANCED SETTINGS

The "Start/End of Recording Actions" section provides options of actions that can automatically be performed at the start or end of each shot, including:

- **Auto save to CineMag Flash:** This feature saves a user-specified portion of a clip to the Flash immediately after recording.
- **Auto play Video Out:** Begins playback after recording. The range marked under 'Auto play Video Out' affects both playback and saving to the internal Flash.
- **Restart Recording:** When enabled, automatically restarts the recording process after the 'Auto' actions have been performed.



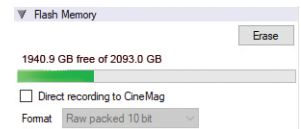
'External Sync' instructs the camera to use one of the following options:

- **Internal:** Camera uses its internal crystal oscillator to drive the frame rate.
- **External:** Camera uses externally supplied frame sync clock pulse to drive the frame rate. This can be used to synchronize two cameras together via F-Sync.
- **IRIG:** Camera uses an IRIG-B signal is supplied to drive the frame rate.
- **Lock to Video:** Frame rate is driven by the camera's current video rate. Fps will jump to the closest multiple of the current video rate (23.98, 24, 25, 29.97 or 30).
- **Sync to Trigger:** Instructs the camera to adjust its frame clock, upon detection of a trigger signal, to ensure all post trigger frames occur at the same moment in time from trigger when repetitive tests are required.

When using External Sync it is important to limit the top frame rate by ~1% to ensure the sync period is larger than $1/\text{max_frame_rate} + 0.1\%$ or 200ns (whichever is larger), to account for frequency tolerance and jitter.

FLASH MEMORY

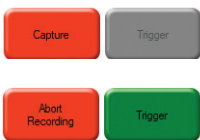
This displays the amount of free space and size (in Gigabytes) of the flash.



RECORDING A CINE

To begin recording to the camera's RAM click the red 'Capture' button.

The red 'Capture' button changes to 'Abort Recording' and the green 'Trigger' button is enabled when the camera is recording. The 'Abort Recording' button instructs the camera to stop recording, leaving the camera's RAM empty.




TRIGGERING THE CAMERA

Selecting the 'Trigger' button instructs the camera to immediately stop recording when the 'Trigger Position' is set to zero. If a value greater than zero is set, the camera will continue to record 'post-trigger' frames until the user-specified value is met.

Using the camera's external trigger signal provides a more accurate trigger to the camera. This is also referred to as a 'hardware trigger.'

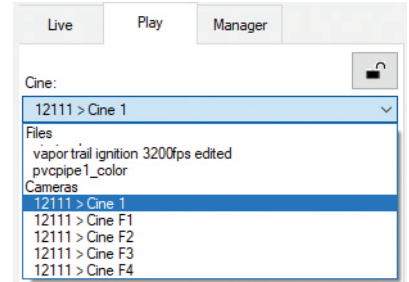
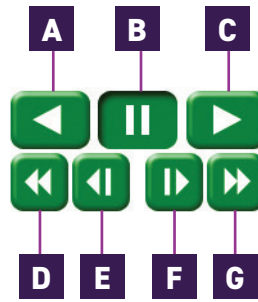
REVIEWING A CINE

Once the camera has completed recording a Cine in the camera's RAM or CineMag, it can be reviewed by selecting it from the 'Cine' pull-down selection list in the PCC 'Play' tab.

A previously saved Cine stored on the computer's hard drive can be opened using the 'Open File'  toolbar button. (When used, it also places the file under the 'Cines' group folder in the 'Manager' tab.)

Use the 'Video Control' buttons to review the Cine:

- A** REVERSE PLAY
- B** PAUSE
- C** PLAY
- D** FAST REVERSE
- E** REVERSE 1-FRAME
- F** ADVANCE 1-FRAME
- G** FAST FORWARD



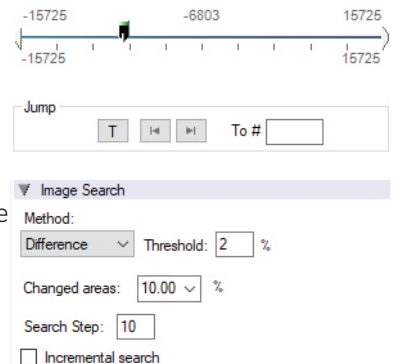
PERFORMING A QUICK SEARCH THROUGH A CINE

Quickly find the points of interest:



'Scroll' (scrub) through the clip using the slider or click anywhere on the timeline to jump to that point quickly.

'Jump' to the trigger frame by clicking on the 'T' button, or jump to specific frames by entering the frame number into the jump '#' data entry field, then hit the enter key.

'Image Search.' The goal is to search or find an image change in the recording, based on the differences between image content. Right-click on the 'Play' button to begin the image search. Besides image content changes, 'Image Search' can also look for images that are tagged as 'Event' images.



EDITING AND SAVING A CINE

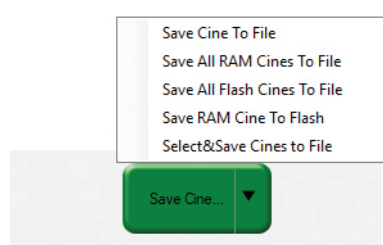
Using the following **'Video Control'** buttons, locate the first image of the Cine to be saved and click the **'Mark-In'**  button. Locate the last image of the Cine to be saved and click the **'Mark-Out'**  button.

Click **'Play, Speed & Option'** and enable (check) **'Limit to Range.'**

Under the **'Video Control'** buttons, click the play button and review the edited Cine.

Click the **'Save Cine...'** button to save the edited Cine to the computer's hard drive.

If you wish to save the clip to an internal Flash, click the down arrow to the right of the **'Save Cine...'** button and select **'Save RAM Cine to Flash.'**



WORKING WITH CINE FILES

The images recorded on the camera's RAM or Phantom CineMag are stored in a Vision Research proprietary RAW (uncompressed) file structure called a **'Cine'** file.

These Cine files can be converted to industry standard formats (ProRes, H264, DPX, DNG, TIFF, JPEG and more) with PCC software provided by Vision Research.

Phantom PCC and PVP software are compatible with Windows operating systems. There are third party solutions available for working with Phantom cameras in Mac OS X.

COMPATIBILITY WITH VIDEO EDITING PROGRAMS

Several popular video editing programs, such as DaVinci Resolve, have incorporated the Phantom Cine Raw file format into their software. This means Cine files do not have to be converted and no additional software is required.

Please test the footage with the program you choose before committing, as updates to the program or Cine file format can sometimes break compatibility. For this reason, it is important to know how to properly convert Cine Raw files using PCC.

CONVERTING CINE RAW FILES

Single Cine files can be converted by selecting the desired format from the **'Save as Type'** selection list in the **'Save Cine'** dialogue window.

The file formats above the separator line in the **'Save as Type'** selection list are **'movie-like'**

Re-saving a clip in the Cine Raw format can be useful for creating sub-clips with no loss in image quality or metadata.

formats (meaning the entire clip will be saved as a single file), while the formats below the line are image formats (meaning each frame of Cine will be saved as a sequence of images).

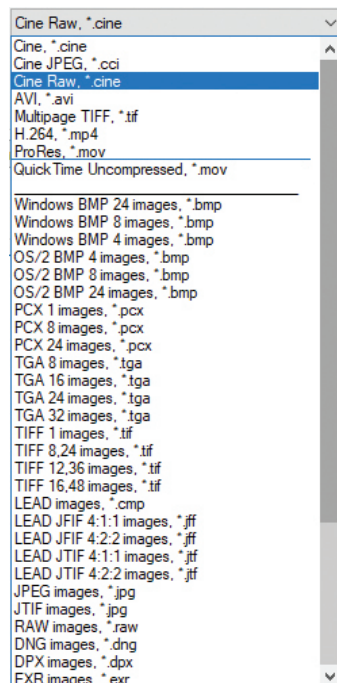
To convert a Cine to a 'movie-like' format, select the desired format from the list, navigate to the destination folder, assign a file name to the clip and save.

Some valuable parameters can be found in the 'Advanced Settings' window, such as the particular codec.


Other formats, like .avi and .mp4, allow the compression ratio to be entered. The lowest compression is the default.

CONVERTING TO A SERIES OR STACK OF IMAGES

Beginning with PCC software version 3.5, the autoname functionality eliminates the need to add a special character to create a sequence of images. Use one of the presets in the save dialogue. Vision Research also recommends setting a project name, in the 'Auto-name settings' menu found in the top bar pull-down arrow next to the snapshot functions.



BATCH CONVERT

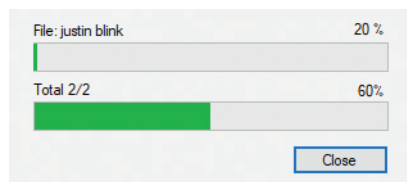
The 'Batch Convert Files'  toolbar button can be used to convert a single saved Cine file, or multiple saved Cine files, into any one of the supported file formats.

Use the shift and/or control keys to select the Cine files you wish to convert in the 'Open Cine' dialogue window, then click the 'Open' button.

Navigate to the destination folder in the 'Multifile Convert Destination' dialogue window and select the file format.

PCC creates a separate folder for each Cine file, assigns the original file name and appends the appropriate image number and extension to each image.

Once the 'Convert' button is clicked, a progress window appears for the duration of the conversion process. Each converted Cine will be placed in its own folder named after the original Cine file.





PROGRAMMABLE I/O

INTRODUCTION TO SIGNALS

Phantom cameras incorporate multiple hardware signals to interface to external devices.

Ports on Phantom Miro C321 Airborne are programmable. The equipment to access these ports – the MiniBoB, – has ports that are either fixed or programmable. The Programmable I/O ports have a default setting which will be set after a factory reset or by using the 'signal default' function in PCC.

Port Map for Programmable I/O Access

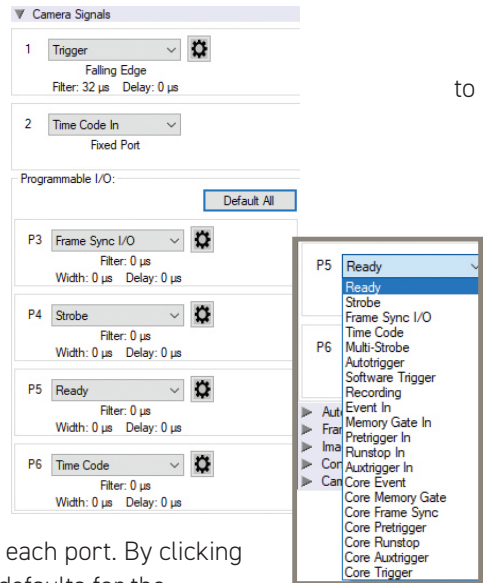
MINIBoB			
Port Label	Default setting	Programmable I/O Capability	Programmable IO Port in PCC
Trigger	Trigger	Fixed	Port 1
TC In	TC In	Fixed	Port 2
TC Out	TC Out	Prog. I/O	Port 3
Aux 1	Strobe	Prog. I/O	Port 4
Aux 2	Ready	Prog. I/O	Port 5

Programmable I/O incorporates a pulse processor. In addition to assigning different signals, the signal characteristics can be modified better interface with external devices. In most cases, the signal polarity, filter time, delay and pulse width and edge (rising versus falling) can be set. Setting these characteristics is referred to as 'Pulse Processor Control.'

PCC INTERFACE

The 'Camera Signals' menu, located in the 'Live' tab, provides access to and control over these Programmable I/O signals.

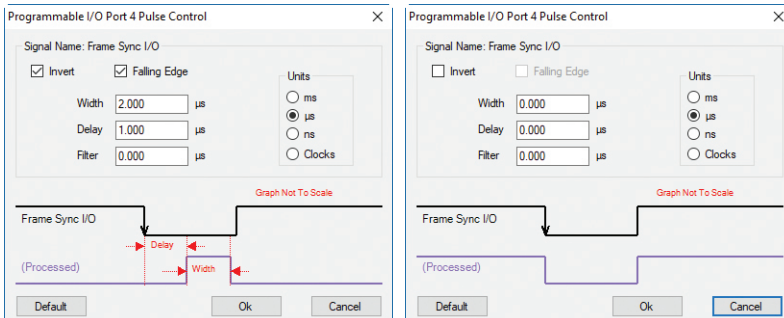
A summary of the current signal settings can be found under the pull-down menu associated with each port. By clicking 'Default All,' PCC will reassign the factory-assigned defaults for the Programmable I/O signals.



PULSE PROCESSOR CONTROL

After selecting the signal assignment, further configuration is possible by clicking the gear symbol next to each port. The 'Pulse Control' menu is opened, as shown on the next page.

A graphic representation of the signal behavior is also displayed. However, this is **not to scale** and should be used as reference only. Use of this feature requires an oscilloscope to truly visualize the signals and the subsequent changes with each adjustment.



Input: When a signal is generated by the camera, it serves as an input to the 'pulse processor.' In this context, the term 'input' does not represent an externally generated signal.

SUMMARY OF PULSE PROCESSOR SETTINGS

Invert: Inverts the signal at the output of the pulse processor.

Falling: Selects 'Falling Edge' mode for the pulse processor. This mode is only relevant if the 'Width' is also specified. When the 'Falling' token is present together with 'Width,' the pulse processor will generate a negative pulse, triggered from the negative edge of the input signal.

Width (Pulse Width): When a 'Width' token is present, a defined-length pulse is generated, which starts after the specified 'Delay' and after the active edge of the 'input' signal. The length of the pulse is specified in microseconds (as a floating point number) and internally converted to pixel clock units. The maximum pulse width is at least 10 seconds. However, if the period of the 'input' signal is lower than the selected width, the latter is dynamically clamped to the signal period. The minimum pulse width is one pixel clock.

Delay: Delays the output pulse by the specified time in ms, μ s or camera clock multiples. If the 'Width' token is not present, both edges of the signal are delayed by the same amount. If present, the delay is measured from the rising edge of the input* signal unless the 'Falling' token is present, in which case the delay is measured from the falling edge of the input. The delay time is specified in microseconds and is internally converted to pixel clock units.

Filter (Filter Time): When a 'Filter' token is present, the 'input' of the pulse processor is filtered through an edge filter of the specified time. The time of the filter can be between 0 and 1 second. In order for the output of the filter to be asserted, the 'input' signal must be continuously de-asserted for the same duration. The edges of the 'input' are thus delayed by the specified filter time (for a 'clean' input pulse). Filtering is applied before and independently of the delay and duration. The filter time is specified in microseconds and is internally routed to pixel clock units.

Pixel Clock: The period of the pixel clock is the basic time interval for all camera timing.

Please note that pulse processors can sometimes generate pulses too short for the output drivers to switch and the processed signal should be verified with an oscilloscope before use.

PROGRAMMABLE SIGNALS & DESCRIPTIONS

The settings as described are the signal's default state prior to processing.

Ready: An isolated open collector output with 1k pull-up signal (active high). 'Ready' is asserted when the camera goes into 'Capture' mode and is de-asserted either when the Cine is triggered or when recording is completed. 'Ready' changes synchronously with frame capture (at the end of each exposure), so in 'External Sync' mode it will not change until F-Sync pulses are received.

Strobe: An isolated open collector output signal with 1k pull-up. When asserted (low) 'Strobe' indicates that the electronic shutter is open. Strobe is low for the duration of the exposure.

F-Sync: The only signal can be set as an output or input. By default, it is output (sync-internal). Output signal is a frame sync pulse from the camera's frame rate generator. A short (few hundred

ns depending on camera model) negative pulse with the falling edge is used as timing reference. Input signal is active on falling edge. (Default state is high.)

TC-Out: A positive polarity time code signal. Normally an unmodulated (dc-shifted) IRIG-B (at RS-232 levels) which follows the internal time base of the camera. It is recommended not to process the 'TC-Out,' since a processed signal will not represent an accurate time code.

Auto-Trigger: Used to output a hardware trigger signal or pulse with the duration.

Software Trigger: An active high-output signal (pulse) generated as a result of the trigger protocol command.

Recording: An active high-output signal indicating active recording into a RAM partition.

Event In: If the input is sampled low at the end of an exposure, an 'E' (Event) bit in the frame's timestamp is set.

Memory Gate In: If the input is sampled low at the end of an exposure, the corresponding frame is skipped from storage to RAM.

Pre-trigger: An active low-input (default high) signal. Keeping this signal low for enough time (10–500 ms or until 'Ready' signal goes high) will make the camera start recording, if it has an available RAM partition.

Aux Trigger: An input signal active on the rising edge (default high). An alternative trigger input that can be processed through the pulse processor and assigned to different ports.

THE CORE SIGNALS

Core signals are copies of externally generated signals, routed through the camera and output to assigned ports. Unless indicated otherwise, feedback is taken after any pulse processor for the input. Core signals can be pulse-processed before being output.

Core Event: Feedback output from the 'Event In' signal.

Core Memory Gate: Feedback output from the 'Memory Gate In' signal.

Core Frame Sync: Feedback output from the 'F-Sync In' signal. The feedback is taken after any pulse processor for the output, but before the delay element.

Core Pre-trigger: Feedback output from the 'Pre-trigger' signal.

Core Aux Trigger: Feedback output from the 'Aux Trigger In' signal.

Core Trigger: Feedback output from the main 'Trigger' input. The feedback is taken before the trigger signal is affected by the trigger polarity, filter or delay settings. 'Core Trigger' can be used like the 'Trigger Out' signal.

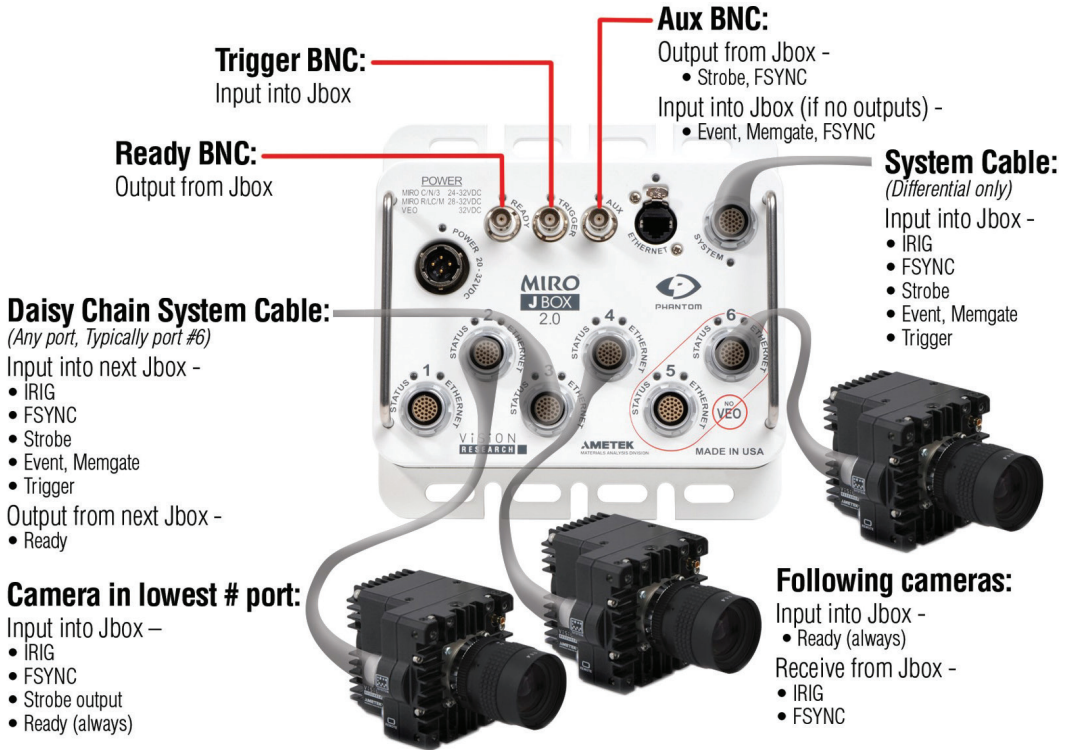


Phantom Miro Junction (JBox) Box

MIRO JUNCTION BOX 2.0 (JBOX 2.0)

For customers seeking to use up to 6 x C321 Air cameras at one time, the Miro Junction Box 2.0 (JBox 2.0) is modular and flexible solution: with six camera ports, it can host up six cameras or dedicate any port to uplink to another JBox in a daisy chain or branch to expand the number of cameras in a configuration. It is compatible with all Miro C Series, including the 321 Air, the N5, and VEOs, as well as Miro M, R, and LC Series.

JBOX



CAMERA CONTROL

The JBox offers 2 methods to control the cameras:

1. Via Gb Ethernet, controlled directly by a computer with PCC or third-party software.
2. Via the System Port and a system cable to access Trigger, IRIG, Strobe, FSYNC, Ready control, and Ethernet. The cable may be spliced or connected to a Control Break-out Box (Control BoB). More detail about the Control BoB is in the Accessories Section.

SIGNAL MANAGEMENT

PCC: Aux 2 should be set to “Ready” for all cameras; Aux 3 should be set to “IRIG” for all cameras.

Ethernet: The JBox has an RJ45 Ethernet connection

Trigger: Does not require a specific set-up in PCC. The JBox accepts a Trigger signal either through the System cable, or through the Trigger BNC.

Synchronization by IRIG: Set all cameras “Sync to IRIG” in PCC.

The JBox accepts an IRIG signal from an external source through the System cable. If no external source is present, the JBox will select one of the attached cameras as the IRIG source.

Synchronization by FSYNC: In PCC, Aux 1 should be set to “FSYNC” for all cameras.

Set all cameras except one to “Sync to External” in PCC. Set the one remaining camera to “Sync to Internal”. This one camera may be in any port.

If using a camera FSYNC do not use any external FSYNC signals.

The JBox accepts an FSYNC signal either via the system cable, or via the Aux 1 BNC, or via any camera connected to the JBox.

AUXILIARY FUNCTIONS

Strobe: In PCC, Aux 1 should be set to “Strobe” for all cameras.

The JBox automatically selects one of the cameras to emit a strobe signal. The signal is output to both the Aux BNC and the System cable. The cameras connected to the JBox capture images synchronously based on the IRIG setting.

Set the same frame rate and exposure for all cameras, to ensure they all capture images simultaneously.

It is not possible to sync via FSYNC and use Strobe at the same time.

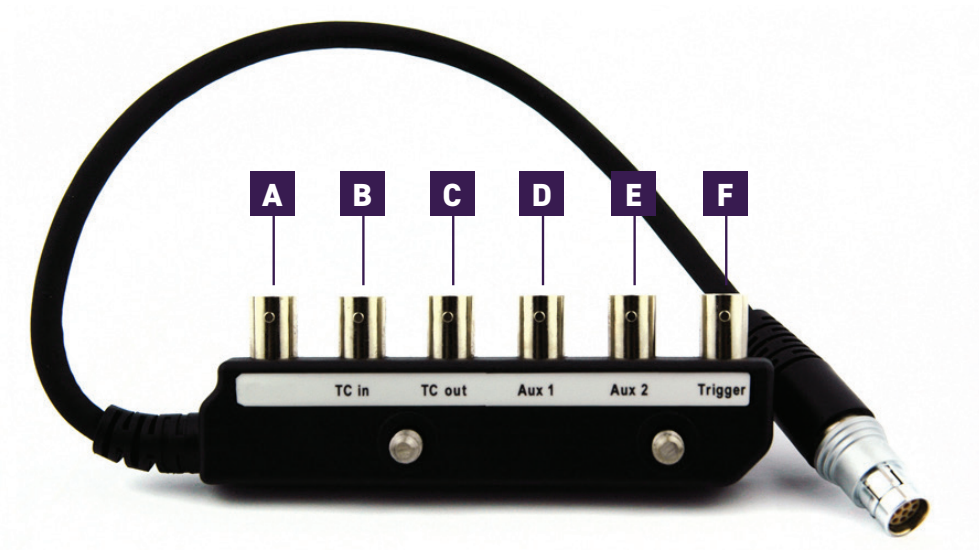
Event: In PCC, Aux 1 should be set to "Event/Memgate" for all cameras.

The Event signal may be input into either the Aux BNC or the System cable.

Ready: Aux 2 in PCC should still be set to "Ready". All cameras connected to the JBox automatically emit a Ready signal when in capture mode.

All cameras emit a Ready signal. If all cameras are Ready, a Ready signal is output to the Ready BNC and the System cable.

MIRO MINI BREAK OUT BOX



The Miro C321 Air Capture port is compatible with a Phantom Miro Mini Break Out Box (Miro MiniBoB).

A This connector is not used for the Miro C-Series.

B TC IN **TC In (input):** Connects to an IRIG receiver to accept a modulated or unmodulated signal to drive the camera's frame rate.

C TC OUT **TC Out (output):** Connect an a second Phantom camera, to drive the camera's frame rate. Use in combination with Sync: Lock to IRIG in the External Sync menu.

D AUX 1

Aux 1: (input / output switchable):

- STROBE (output): Signal goes low for the duration of each frame's exposure.
- EVENT (input): When the Event signal is active, frames are tagged with an Event marker (as metadata). These events can be searched or referenced during playback.
- MEMGATE (input): When Memgate signal is active the camera stops recording into it's internal memory (frames are discarded).
- F-SYNC (input / output): Connect an external source, including the F-Sync from a second Phantom camera, to drive the camera's frame rate. Use in combination with Sync: External in the External Sync menu.

E AUX 2

Aux: 2: (output switchable):

- READY (output) When signal is high it indicates that the camera is in capture mode. Using PCC, signal can be set to go low at trigger or at the end of recording.
- STROBE (see Aux 1 description above).

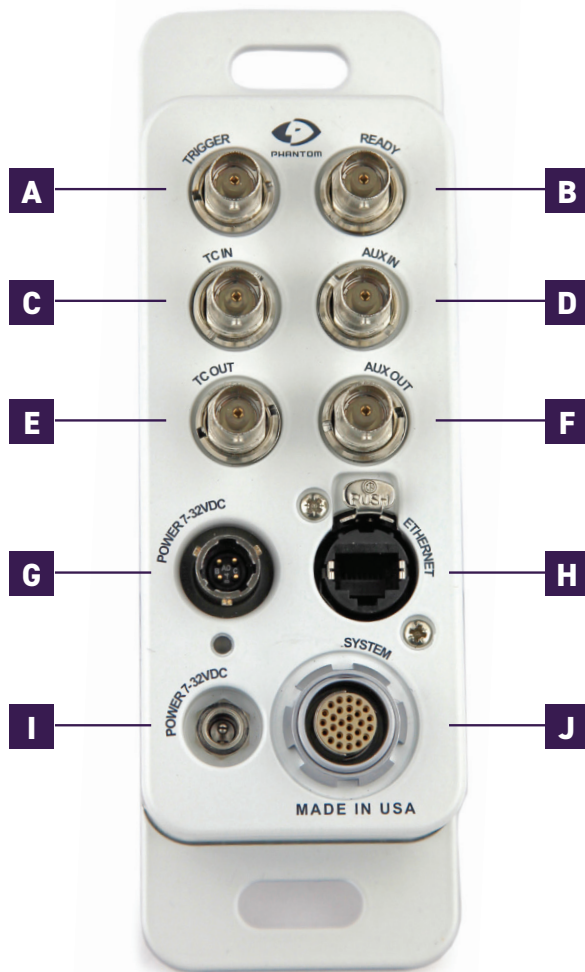
F TRIGGER

Trigger (input): When a TTL pulse (rising / falling edge) is detected, the camera trigger isolated, <1V deassert, 3 to 24V assert.

CONTROL BREAKOUT BOX

The Control Breakout Box (Control BoB) offers a sleek and simple way to connect the required signaling to a Junction Box configuration without splicing cables. With ports for IRIG, Ethernet, Ready, Strobe, and FSYNC, the Control BoB is a clean and convenient solution to manage signaling. It measures 7.4 x 2.4 inches (187mm x 60 mm).

It functions using 7-32VDC, and has two power ports. Choose either the rugged Amphenol port with a customer supplied power supply for use in rugged environments, or the barrel port with a supplied power supply for non-rugged use. Each Control BoB must have a power supply and draws 0.15Amps. The Control BoB cannot power the Junction Box or a camera.



MIRO CONTROL BoB

A TRIGGER

Trigger (input): When a TTL pulse (rising / falling edge) is detected, the camera triggers.

B READY

Ready: Outputs a TTL signal (high) to indicate that all cameras connected to the Miro JBox 2.0 are in Capture Mode. Signal can be set to go low at trigger or at the end of recording.

C TC IN

TC In (input): Connects to an IRIG receiver to accept an unmodulated signal to drive the Miro Junction Box IRIG signal generation.

D AUX IN

Aux IN: The following inputs can be used in this port:

- **EVENT (input):** When the Event signal is active, frames are tagged with an Event marker (as metadata). These events can be searched or referenced during playback.
- **MEMGATE (input):** When Memgate signal is active the camera stops recording into its internal memory (frames are discarded).
- **F-SYNC (input):** Connect an external source, including the F-Sync from a second Phantom camera, to drive the camera's frame rate. Use in combination with Sync: External in the External Sync menu.

E TC OUT

TC Out (output): Connect to a second Phantom camera, to drive the camera's frame rate. Use in combination with Sync: Lock to IRIG in the External Sync menu.

F AUX OUT

Aux OUT: The following outputs can be used in this port:

- **STROBE (output):** Signal goes low for the duration of each frame's exposure.
- **F-SYNC (output):** FSYNC output from active camera connected to the Miro Junction Box.

G POWER 7-32VDC

Power Connector: Amphenol connector for rugged applications for customer supplied power supply 7-32VDC, 500mA.

H ETHERNET

Ethernet: Ruggedized RJ45 connector connects GigE to a control unit computer / laptop for camera control communication.

I POWER 7-32VDC

Power Connector: Barrel connector for power supply 7-32VDC, 500mA.

J SYSTEM

System Connector: Same Fischer connector as System port on JBox 2.0. The Control BoB must connect to the System Port (not a Camera Port) of the JBox 2.0 to function as designed.

CABLES FOR JUNCTION BOX 2.0



*System cable, Adapter cable,
Short cable to link JBoxes*

System Cables: Phantom system cables have differential signals for signal integrity over longer distances. They are capable of transporting: Power, Ethernet, and IRIG, FSYNC, Strobe, Ready, Memgate and Event signals. They have a rugged casing and the same Fischer connect at each end, one in a 90° angle and the other in a straight format. Either end connects directly to any port on the JBox 2.0. The other end connects directly to either:

- Miro C321J, N5 N-JB Base, C320J, or C210J
- Adapter cable

Adapter Cables: Phantom adapter cables connect VEOs and non-J Miro C cameras to a System cable for connection to a JBox 2.0. The adapter cable is approximately 0.6M (2Ft) and connects to the power and capture ports of the camera and mates with a system cable. The cameras it supports are:

- All VEO S-Models
- Miro C321 AIR, C321, N5 N-B Base, C320, C210

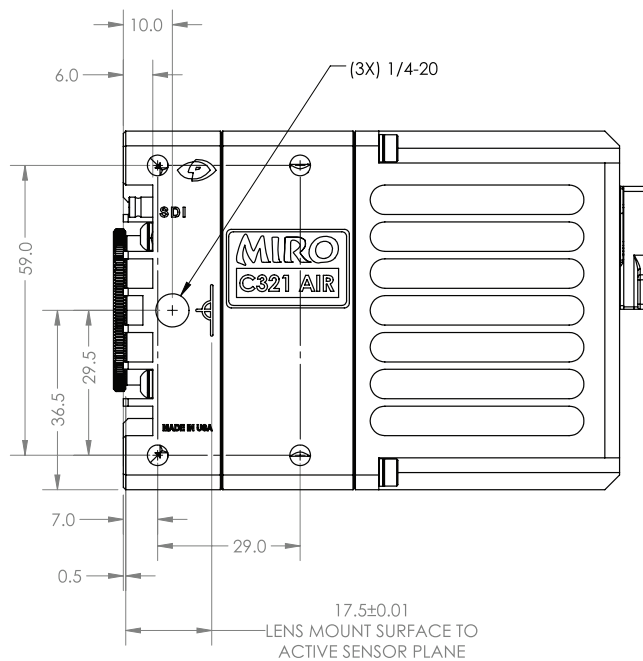
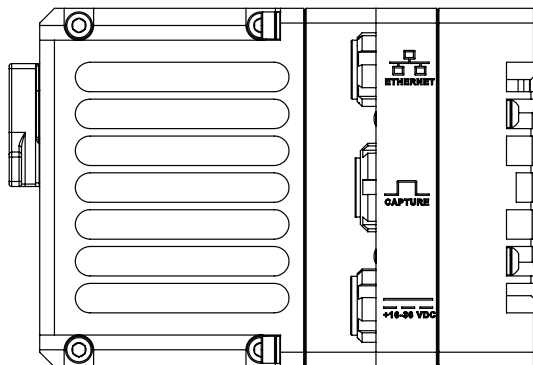
JBox Connector Cable: This small cable is perfect for connecting 2 JBoxes that are immediately next to each other. It is a System cable that is only 0.6M (2Ft) long with both connectors at 90° angles. One connector attaches to a camera port of the master JBox, and the other to the System port of the next JBox.

MOUNTING ACCESSORIES

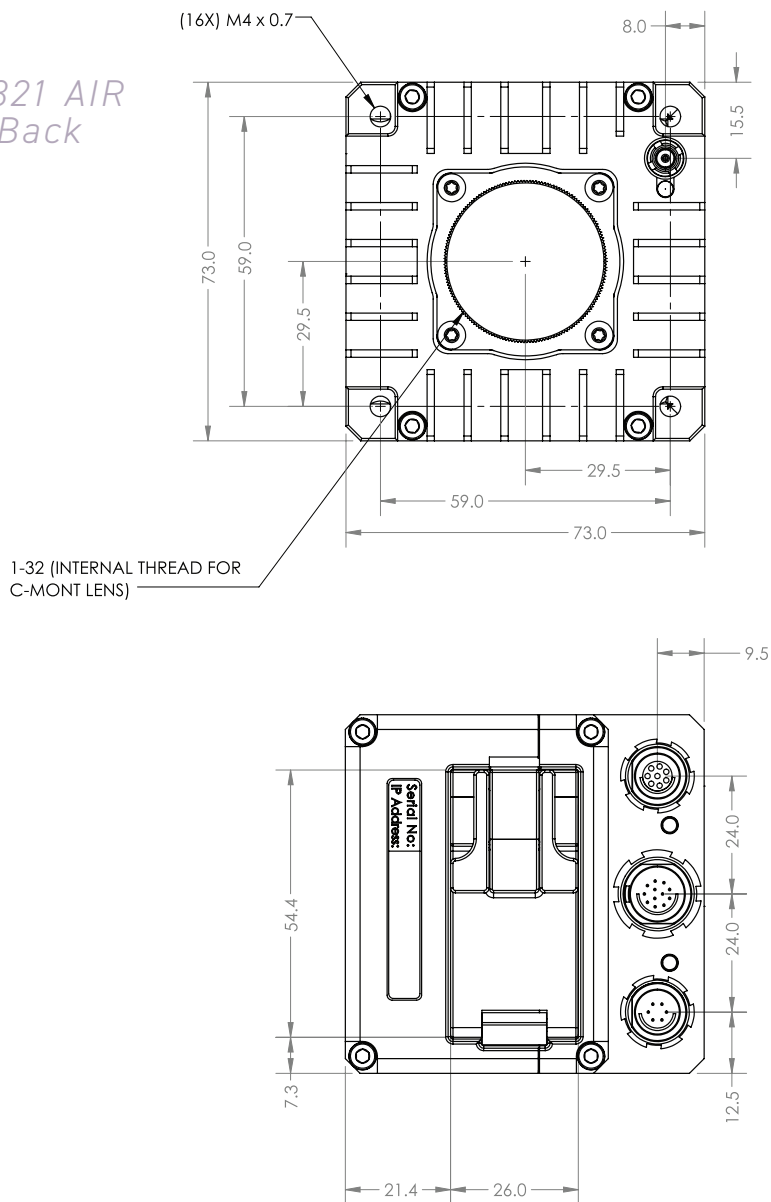


Camera / lens mount: A camera / lens mount makes mounting the camera easier and also provides stability and protection for the lens.

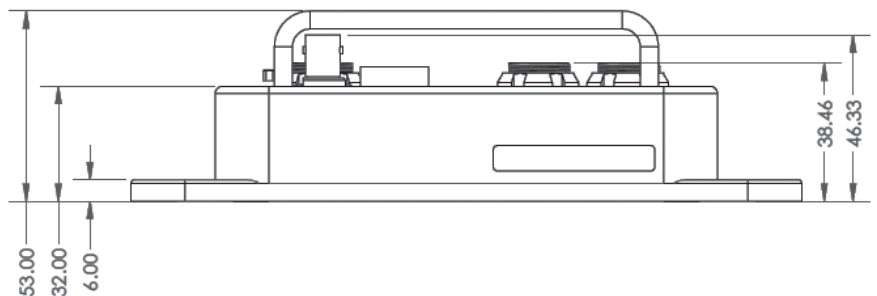
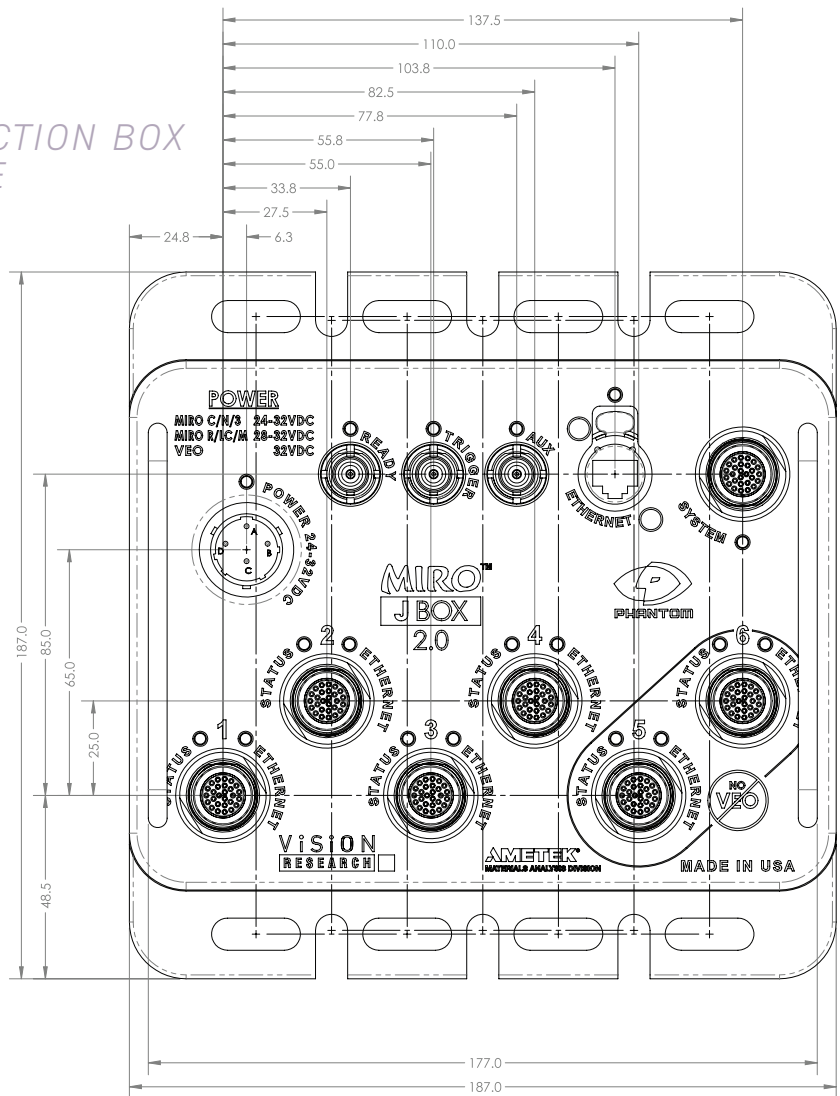
MIRO C321 AIR
Right / Left



MIRO C321 AIR Front / Back



MIRO JUNCTION BOX TOP / SIDE



Use these schematics to build custom cables at your own risk. Miswired cables can cause serious damage to the camera, which is not covered under warranty. Vision Research recommends only using cables supplied by Vision Research.

These pin-out diagrams refer to the connector on the camera or Miro Junction Box body. Part numbers indicated are for the cable's connector.

MIRO C321 AIR CAPTURE CONNECTOR

Capture port (for capture cable and MiniBoB)

12-pin Fischer Part # S-1031-Z012-130



PIN	NOMENCLATURE / FUNCTION
1	IOGND / Signal Ground
2	IOGND / Signal Ground
3	IOGND / Signal Ground
4	TRIGGER / Isolated Input. Active low. Can be activated by a switch to ground. The trigger pulse needs to be at least 3 microseconds long. Capture cable = Red
5	AUX2 (READY) / Isolated collector output with 1k pull-up. Capture cable = Green
6	AUX1 / Isolated collector output. Switchable between STROBE, EVENT, MEMGATE and F-SYNC. Capture cable = Black
7	TCIN / Timecode Input can accept IRIG-B and SMPTE standards. Capture cable = White
8	GND (reference for Pin 9)
9	Not used
10	POWER / Nominal power supply voltage is +24VDC (acceptable range is 16-36VDC)
11	POWER / (see Pin 10)
12	TCOUT / Timecode Output for IRIG-B or SMPTE timecode. IRIG Swings to RS-232 levels of +/- 9V. Capture cable = Blue

CONNECTOR PIN-OUT

MIRO C321 AIR GIGE ETHERNET CONNECTOR

Ethernet Port

8-pin Fischer Part # SS 103 A058-130



PIN	NOMENCLATURE / FUNCTION
1	ETHRXP / 10/100/1000BASE-T Ethernet Receive (positive)
2	ETHRXN / 10/100/1000BASE-T Ethernet Receive (negative)
3	ETHTXP / 10/100/1000BASE-T Ethernet Transmit (positive)
4	ETHTXN / 10/100/1000BASE-T Ethernet Transmit (negative)
5	MDI2P / 10/100/1000BASE-T Media Dependent Interface 2 (positive)
6	MDI2N / 10/100/1000BASE-T Media Dependent Interface 2 (negative)
7	MDI2P / 10/100/1000BASE-T Media Dependent Interface 3 (positive)
8	MDI3N / 100/1000BASE-T Media Dependent Interface 3 (negative)

MIRO C321 AIR +16-36VDC CONNECTOR

Power Port

6-pin Fischer Part # SS 103 Z 056 130



PIN	NOMENCLATURE / FUNCTION
1	PGND / Power Ground
2	+VINBF / The +VDC In (Battery Freed) connector provides +24VDC (Direct Current) positive power to the Phantom camera.
3	RxD1 / RS-232 Receive Data 1
4	TxD1 / RS-232 Transmit Data 1
5	UNUSED
6	GND / Ground

MIRO JBOX 2.0 POWER CONNECTOR

Power Port

4-pin Amphenol Part # PT06A-12-4S



PIN	NOMENCLATURE / FUNCTION
A	+24VB / connect to a +24VDC battery running parallel to power source
B	CHGND / Chassis Ground
C	GND / Power Ground
D	+24VDC / +24VDC (direct current) to J-Box runs parallel with an optional +24VDC battery

MIRO JBOX 2.0 ETHERNET CONNECTOR

Ethernet Port RJ-45



PIN	NOMENCLATURE / FUNCTION
1	MDI2+ / Gigabit Ethernet
2	MDI2- / Gigabit Ethernet
3	MDI3+ / Gigabit Ethernet
4	MDI3- / Gigabit Ethernet
5	MDI1+ / Gigabit Ethernet
6	MDI1- / Gigabit Ethernet
7	MDI0+ / Gigabit Ethernet
8	MDI0- / Gigabit Ethernet

MIRO JBOX 2.0 SYSTEM CONNECTOR

System Port

27-pin Fischer

Part # SS 105A 102 130



PIN	NOMENCLATURE / FUNCTION
1	GND_A / Signal ground for AUXIN and READYOUT
2	UNUSED
3	GND_B / Signal ground for IRIGIN and IRIGOUT
4	TRIGIN- / Trigger input (neg) to J-Box
5	READYOUT- / Ready / Strobe output (neg) from J-Box
6	IRIGIN- / IRIG input (negative) to J-Box
7	AUXIN+ / Strobe / Event / Memgate / Fsync input (positive) to J-Box
8	UNUSED
9	UNUSED
10	MDI2- / Gigabit Ethernet
11	MDI1- / Gigabit Ethernet
12	MDI0- / Gigabit Ethernet
13	AUXOUT+
14	TRIGIN+ / Trigger input (pos) to J-Box
15	READYOUT+ / Ready output (pos) from J-Box
16	IRIGOUT+ / IRIG output (pos) from J-Box
17	IRIGOUT- / IRIG output (neg) from J-Box
18	IRIGIN+ / IRIG input (pos) to J-Box
19	AUXIN- / Strobe / Event / Memgate / Fsync input (neg) to J-Box
20	AUXOUT-
21	UNUSED
22	UNUSED
23	MDI3+ / Gigabit Ethernet
24	MDI3- / Gigabit Ethernet
25	MDI2+ / Gigabit Ethernet
26	MDI1+ / Gigabit Ethernet
27	MDI0+ / Gigabit Ethernet

MIRO JBOX 2.0 CAMERA CONNECTOR

Camera Port

27-pin Fischer

Part # SS 105A 102 130



PIN	NOMENCLATURE / FUNCTION
1	GND / Power Ground
2	GND / Power Ground
3	GND / Power Ground
4	TRIGIN- / Trigger input (neg) to camera
5	READYOUT- / Ready / Strobe output (neg) from camera
6	IRIGIN- / IRIG input (negative) to camera
7	AUXIN+ / Strobe / Event / Memgate / Fsync input (positive) to camera
8	CBLDET / Cable detect. Connect to GND in connector.
9	PWRIN_A / +20-32 VDC input to camera
10	MDI2- / Gigabit Ethernet
11	MDI1- / Gigabit Ethernet
12	MDI0- / Gigabit Ethernet
13	AUXOUT+
14	TRIGIN+ / Trigger input (pos) to camera
15	READYOUT+ / Ready output (pos) from camera
16	IRIGOUT+ / IRIG output (pos) from camera
17	IRIGOUT- / IRIG output (neg) from camera
18	IRIGIN+ / IRIG input (pos) to camera
19	AUXIN- / Strobe / Event / Memgate / Fsync input (neg) to camera
20	AUXOUT-
21	PWRIN_B / +20-32 VDC input to camera
22	PWRIN_C / +20-32 VDC input to camera
23	MDI3+ / Gigabit Ethernet
24	MDI3- / Gigabit Ethernet
25	MDI2+ / Gigabit Ethernet
26	MDI1+ / Gigabit Ethernet
27	MDI0+ / Gigabit Ethernet

CONTROL BREAK OUT BOX (BoB)SYSTEM CONNECTOR

System port (for J-Box)

27-pin Fischer

Part # SS-105A-102-130



PIN	NOMENCLATURE / FUNCTION
1	UNUSED
2	GND / Ground
3	UNUSED
4	TRIGIN- / Trigger input (neg) to J-Box
5	READYOUT- / Ready / Strobe output (neg) from J-Box
6	IRIGIN- / IRIG input (negative) to J-Box
7	AUXIN+ / Strobe / Event / Memgate / Fsync input (positive) to J-Box
8	UNUSED
9	UNUSED
10	MDI2- / Gigabit Ethernet
11	MDI1- / Gigabit Ethernet
12	MDI0- / Gigabit Ethernet
13	AUXOUT+
14	TRIGIN+ / Trigger input (pos) to J-Box
15	READYOUT+ / Ready output (pos) from J-Box
16	IRIGOUT+ / IRIG output (pos) from J-Box
17	IRIGOUT- / IRIG output (neg) from J-Box
18	IRIGIN+ / IRIG input (pos) to J-Box
19	AUXIN- / Strobe / Event / Memgate / Fsync input (neg) to J-Box
20	AUXOUT-
21	UNUSED
22	UNUSED
23	MDI3+ / Gigabit Ethernet
24	MDI3- / Gigabit Ethernet
25	MDI2+ / Gigabit Ethernet
26	MDI1+ / Gigabit Ethernet
27	MDI0+ / Gigabit Ethernet

CONTROL BoB POWER CONNECTOR

4-pin Amphenol

Part # 06A84S0



PIN	NOMENCLATURE / FUNCTION
A	UNUSED
D	+24VDC – Provide +24VDC positive power to Control BoB
C	PGND – Power Ground
B	UNUSED

MIRO C321 / C321J ETHERNET LED

A ETHERNET LED

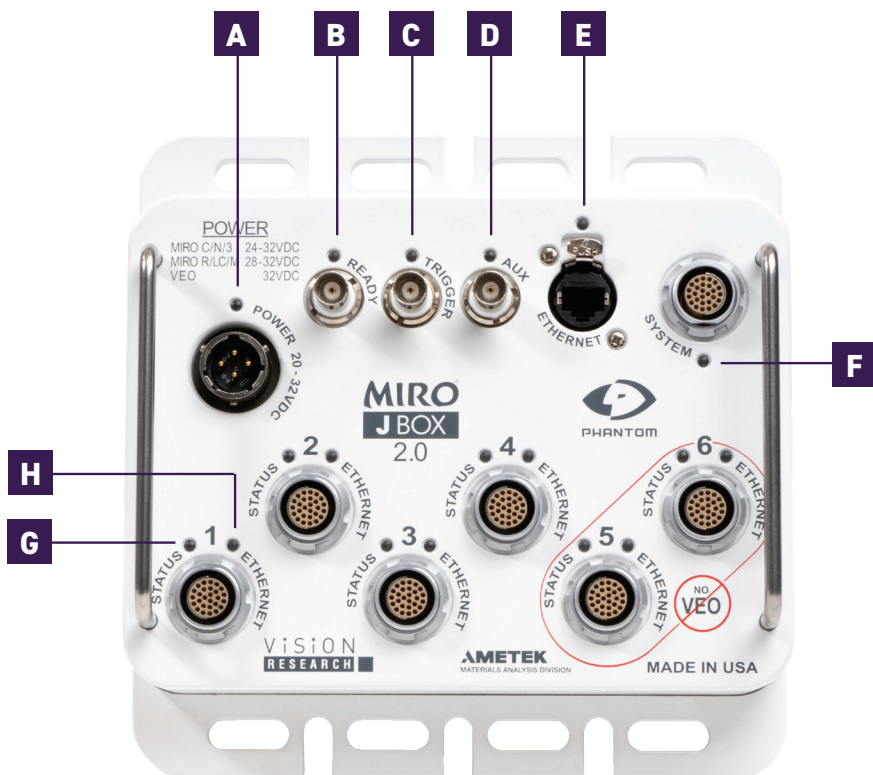
COLOR	ETHERNET STATE
Green	Ethernet Link
Amber	Ethernet Activity

MIRO C321 / C321J SYSTEM / STATUS LED

B SYSTEM / STATUS LED

COLOR	CAMERA STATE
White	Camera Booting
Green	Preview Mode
Red	Capture Mode

MIRO JBOX 2.0 STATUS INDICATORS



Miro JBox 2.0

A POWER 20-36VDC INDICATOR

COLOR	POWER STATUS
Green	Power Good
Blue	Under voltage
Red	Overvoltage or Overcurrent

B READY INDICATOR

COLOR	READY STATUS
Green	Ready
Red	Not Ready

C TRIGGER INDICATOR

COLOR	TRIGGER STATUS
Green	BNC Trigger Asserted
Blue	Uplink / Expand Trigger Asserted

D AUX INDICATOR

COLOR	AUX STATUS
Green	Output
Blue	Input

E ETHERNET INDICATOR

COLOR	CONTROLLER ETHERNET STATUS
Green	EtherLink Active
Yellow	Ethernet Activity

F SYSTEM INDICATOR

COLOR	SYSTEM STATUS
Green	EtherLink Active
Yellow	Ethernet Activity

G CAMERA STATUS INDICATOR

COLOR	CAMERA STATUS
Green	Ready
Red	Not Ready

H CAMERA ETHERNET INDICATOR

COLOR	CAMERA ETHERNET STATUS
Green	EtherLink Active
Red	Ethernet Activity

MIRO C FAQs

What is Set Default CSR?

The Miro C's do not have a mechanical shutter. This allows them to be as rugged as they are but can make a CSR for good image quality inconvenient because you need to cover the lens. When you turn the camera off, the CSR returns to the factory default.

For customers that rarely change their camera settings, the "Set new CSR default" feature provides a convenient alternative to this process. You must operate the camera at full resolution, for example 1920 x 1080 for the C321 AIR. You may then set the CSR for the frame rate and exposure time you are using. That CSR will remain through turning the camera off and on, for as long as you don't change that setting. Always run at 1000 fps and a certain exposure, for example? Set CSR once, get great image quality, and don't worry about it again, no matter how many times you turn the cameras on and off.

Can I use my F-mount lens with the Miro C-Series cameras?

Yes, with a converter. The Miro C's come with a C lens mount that can be reversed to become a CS lens mount. To use an F-mount lens, you can purchase a converter (part number VRI-FMNT-CMNT).

Does the MiniBoB work with these cameras? What signals are available?

The Miro C321J does not use a MiniBoB, because it receives signaling from the JBox 2.0 through the System cable. The Miro C321 can use the MiniBoB.

The signals available to both cameras are:

Trigger	Memgate	IRIG In	IRIG Out
F-Syn	Ready	Strobe	Event

FAQS

BASIC TROUBLESHOOTING

There are fixed black spots on the image, particularly at small apertures.

This is most likely caused by dust particles stuck on the sensor or OLPF (optical low pass filter) surface. The best way to check is to remove the lens and look at the glass surface with a bright light source. Vision Research recommends not to use canned air or cotton swabs to clean the sensor surface. It is safer to use a manual bulb-style air blower and/or sensor cleaning brush for removing loose dust particles.

Additional tips for cleaning sensors can be found in the maintenance section of this manual.

The live images look scrambled and the frame rate can't be set.

If the image is non-responsive and scrambled, the camera may be set to an external sync without a sync source connected. In the PCC > Live > Advanced Settings menu, check the External Sync setting to ensure that 'Internal' is selected.

Restoring the factory defaults.

If the camera is stuck in an unusual state it may be useful to restore the camera's factory defaults. This returns the capture parameters, image processing, video modes, and image calibration back to the original settings.

To do this, you will need to perform an 'iLoad'. For details on performing an 'iLoad' follow the 'Step-by-Step Procedures / Live Panel Procedures / Advanced Settings / Performing an iLoad (on a Ph16 Camera)' topic within the supplied PCC Help file.

TROUBLE SHOOTING

Back Focus Adjustment

Due to differences in various lenses and other mechanical tolerances it may be necessary to adjust the lens mount on the camera to obtain proper focus. In most cases, changing a lens or replacing a mount will not require adjusting the back focus, though it should be verified. When the focus distance marks on a lens do not match the measured distance between the sensor & subject, it indicates the need to adjust the back focus.

By adjusting the back focus, you are changing the distance of between the flange and the sensor plane. Shims are included to assist in both slight and coarse back focus adjustments.

MAINTENANCE

Sensor Cleaning Technical Tips

- Sensor cleaning should only be attempted by experienced imaging professionals.
- Use a small, but powerful flashlight to look at the sensor and filter, it's easier to spot the dust.
- Sensor cleaning must be done in a clean and controlled environment.
- Always have a forced-air bulb style blower and a clean sensor cloth handy for more serious dirt.
- Sensor cleaning solution (like Eclipse) should only be used if absolutely necessary, and applied with a soft wipe intended for sensor cleaning.
- Cotton swabs aren't a good idea, unless they are wrapped in a sensor wipe material. They leave behind more than they remove.
- Never use your finger to get a speck of dust off, it's going to make things much worse.
- Never blow on the sensor.
- Never put sharp objects near the surface of the sensor.
- Always keep the Phantom body cap on the camera when there is no lens attached.

MAINTENANCE

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For answers to most questions, please visit us at: **www.phantomhighspeed.com**
and search the camera product pages, tutorials, support knowledgebase and FAQs.

SUBMITTING A SUPPORT TICKET

For technical product support, operation and application information or to request an RMA, please submit a ticket by filling out a form at **www.phantomhighspeed-service.force.com** or by emailing us at **phantom-support@ametek.com**.

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REGULATORY



CE - 2019

CE Emissions CE Compliant - EN 61326-1, Class A

CE Immunity CE Compliant - EN 61326-1, Class A

FCC CFR 47, Part 15, Subpart B & ICES-003 Class A

Safety IEC 60950-1

Class A device (Broadcasting Communication Device for Office Use): This device obtained EMC registration for office use (Class A), and may be used in places other than home. Sellers and/or users need to take note of this.



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The contents of this manual are subject
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