PHANTOM Miro C210 / Miro C210J / Miro JBox

PHANTOM

VISION RESEARCH

AMETEK®
MATERIALS ANALYSIS DIVISION

MANUAL

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

ZDOC, MIRO C210 & C210J GETTING STARTED MANUAL ZDOC-64106-MA-0001 Rev 3

www.**phantom**highspeed.com

PN: ZDOC-64106-MA-0001 Rev 3
Last Updated: 15 AUG 2016

VISION RESEARCH

PHANTOM

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

Miro C210J/C210 Camera

MANUAL

AMETEK®
MATERIALS ANALYSIS DIVISION

100 Dey Road
Wayne, NJ 07470 USA
+1.973.696.4500

www.**phantom**highspeed.com

www.phantomhighspeed.com

Written and produced by the Marketing Department at Vision Research.

PN: ZDOC-64106-MA-0001 Rev 3
Last Updated: 15 AUG 2016

Contents

specifications

- Maximum 1,800 fps at full resolution of 1280 x 1024; 67,140 fps at reduced resolution of 64 x 8; Minimum 100 fps at all resolutions
- 8GB or 16GB high-speed internal RAM; 128GB non-removable internal CineFlash
- 2.3Gpx/second throughput
- 1.3 Megapixel; 2/3 inch CMOS sensor (9.18mm diagonal)
- 12-bit pixel depth
- 5.6 µm pixel size
- ISO 5,000T; 2,500D Monochrome 640T; 640D color (adjustable)
- Continuous Adjustable Resolution in 64 x 8 pixel increments
- 5 µs min. exposure standard
- Straddle time: 2 µs minimum
- Hi-G: 170G (IAW MIL-STD 202G -Shock); 24Grms (IAW MIL-STD-202G - Vibration)
- Operating temperature: 0˚ C to 50˚ C
- HD-SDI available through DIN 1.0 / 2.3 connector on front of the cameras
- Trigger Options: Dedicated BNC (via capture port), or via Phantom PCC software
- Modular: Connect to Miro Junction Box for multi-camera configurations (required for Miro C210J)
- Power: Camera: 16-32 VDC, 12W (18W while battery is charging). 100-240 VAC power supply included with C210 camera; Rechargeable battery backup; Junction Box: 20 - 32 VDC (each camera port accepts 2 AMPS)
- Gb Ethernet for control and data (C210J: Ethernet is accessed through the system cable; C210: Ethernet is accessed through an ethernet cable with a fischer connector)
- Multi-Cine: Partition internal memory into segments and make shorter recordings back-to-back without missing any action (63 maximum)
- 1" C-lens mounts (reversable to accept 2/3" CS lenses)

1 Introduction

Miro C210J & Miro C210

Camera Capabilities

The Miro® C210J & C210 are built on the same platform, each with distinguishing features to maximize their utility. Miro C-Series cameras can be used individually or grouped together with a Miro Junction Box to create almost any multi-camera configuration imaginable. They are complimentary to the Phantom Miro camera family and accessories, further expanding the configuration possibilities.

The Miro C210J is designed for tough and difficult situations, such as automotive on-board applications. It uses just a single cable to connect to the Miro Junction Box (JBox).

The Miro C210J & C210 digital high-speed cameras are just larger than 3-inch cubes (C210J: 73 mm x 79.5 mm x 82.5 mm; C210:73 mm x 73 mm x 82.5 mm) and weigh just 1.2 lb. (0.54 kg), but are rugged enough to withstand shocks of 170G and vibration of 24 grms. With strategically placed mounting holes, these cameras can fit in the most difficult places.

The Miro C210 is ideal for single camera applications requiring a small, light, and rugged camera. With three connections for Ethernet, Power, and Capture, it is compatible with all cables for Miro cameras, and comes with a power supply and MiniBoB to connect to the Capture connector. Alternatively, the camera may also connect directly to a computer via Ethernet.

Both the Miro C210J and Miro C210 digital high-speed cameras are capable of capturing 2.3 Giga-pixels per second (Gpx/s) of data from the CMOS sensor. At full resolution (1280 x 1024), the camera can capture 1,800 frames-per-second (fps); at reduced resolution 64 x 8 the camera can capture 67,140fps.

Image Storage

Both cameras incorporate 8GB or 16GB of internal high-speed memory, and an internal (non-removable) 128GB CineFlash.

Sensor Characteristics

The Miro C-Series cameras use a CMOS sensor available in color or monochrome.

Their 5.6 micron (µm) pixels provide a sensitivity, measured using the ISO 12232 SAT method, of ISO 5,000T; 2,500D for monochrome cameras, and 640T; 640D for color cameras (adjustable).

Each pixel has a bit-depth of 12-bits yielding 4,095 gray levels with high dynamic range.

Sensor resolution is 1280 x 1024 pixels “wide-screen” format. The rectangular shape of the 1.3 Mpx sensor allows the user to keep moving objects in the frame longer and is compatible in aspect ratio with modern display technology. The physical size of the sensor is 7.168 mm x 5.7344 mm (9.18mm diagonal).

Both Miro C-Series cameras have global electronic shutters, with minimum exposure times of 5µs.

Battery Backup

The Miro C has an internal, non-removable battery designed to provide back-up power to complete operation and safely save a cine in the event of power loss to the camera. The battery is UNDOT 38.3 qualified.

Advanced Features

Multi-Cine: The internal memory of the Miro C-Series cameras can be partitioned into as many as 63 segments for shorter recordings, back-to-back, without missing any action.

Continuous Recording: Automatically save cines from internal camera memory to internal, non-volatile storage, without user intervention.

Memory Gate: An input signal which, when activated, prevents the storage of the sensor produced image-data, by disabling write-access to memory.

Event Marking: Primarily used to tag events of significance during recording, to make it easier to jump from one event to the next during playback, along with easing the process of performing timing measurements of a recorded Cine.

Battery: In the event of AC power loss, the internal battery (standard) provides backup power to protect the data as it saves to the CineFlash. Saving 8GB of data from RAM to the internal CineFlash requires only 90 seconds.

Lensing

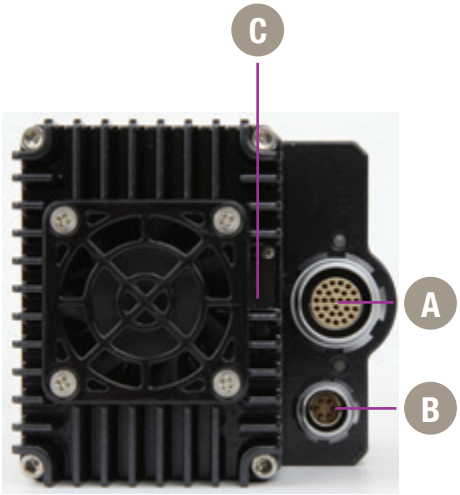
The Miro C210J and C210 have 1" C-lens mounts that can be reversed to accept 2/3" CS lenses.

Command & Control

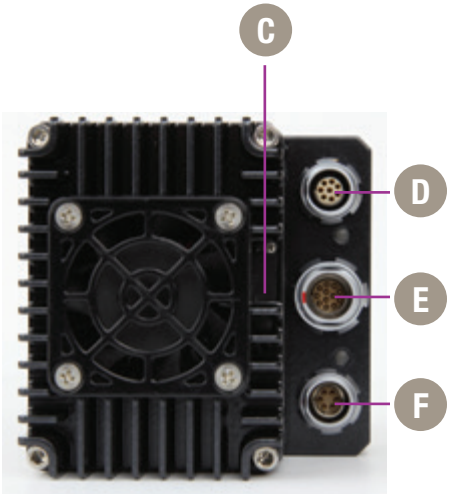
Control is possible with Phantom PCC software or a hand-held Phantom Remote Control Unit (RCU).

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

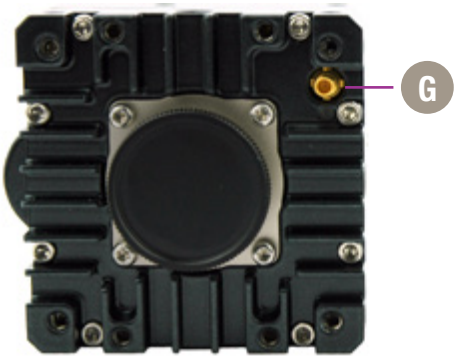
camera connectors



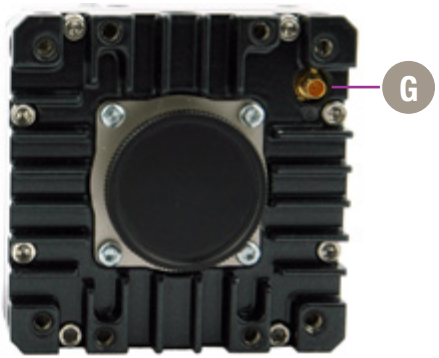
Miro C210J Rear View



Miro C210 Rear View



Miro C210J Front View



Miro C210 Front View

2 Connectors

System	A	Fischer connector connects to a Camera Port on a Miro Junction Box (J-Box).
Remote	B	Fischer connector connects to the Remote connector on the rear of a Remote Control Unit (RCU).
Battery Reset	C	Recessed push-button turns battery power off.
Ethernet	D	Fischer connector connects GigE to a control unit computer / laptop for camera control communication.
Capture	E	Fischer connector connects to a Miro Mini BoB (PN:VRI-MINIBOB), or standard Miro capture cable (PN:VRI-2MA5017-01)
+16-32VDC	F	Fischer power connector connects to standard 65W Miro Power supply (PN:VRI-PWR-SUPPLY-65W-INT). Also connect to the Remote Control Unit (RCU)
SDI	G	DIN 1.0/2.3 connector for HD video.

miro junction box

Ready — A: BNC connector; closed' for ready, 'open' for not ready; covers all cameras connected to this JBox and any JBox up-chain of this one.

Trigger — B: 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.

AUX — C: Selectable strobe or FSYNC for synchronization with equipment such as pulsed LED lighting.

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

System — E: Same Fischer connector as Camera port. Connects to a Camera Port on second JBox to daisy chain or branch the system for additional cameras.

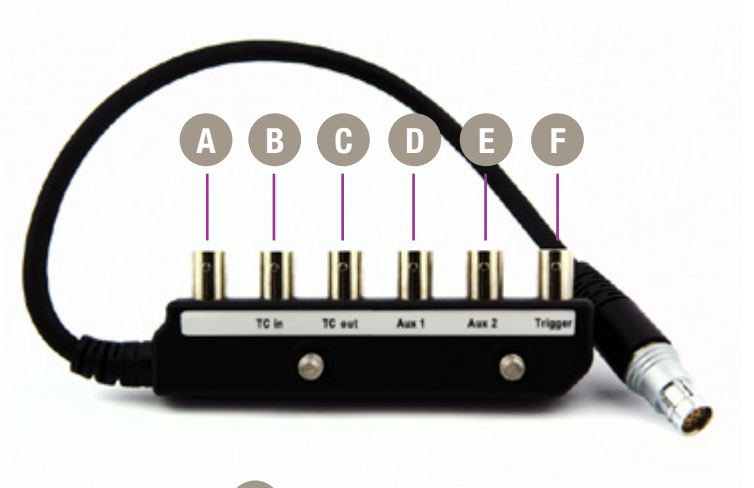
Power 20-32VDC — F: Protected for reverse polarity, overcurrent (10A), undervoltage and overvoltage to 50V. Independent power is required for each Junction Box.

1 G
2 H
3 I
4 J
5 K
6 L

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.

The first JBox, daisy chained or branched together, gets its input from the System cable.

miro mini bob



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

TC In **B** BNC connector input accepts a modulated or unmodulated signal to drive the camera's frame rate from an IRIG receiver.

TC Out **C** BNC connector outputs an IRIG signal to a second Phantom camera, to drive the camera's frame rate.

Aux 1 **D** BNC connector switchable between: STROBE (an output signal (low) for the duration of each frame's exposure), EVENT (an input signal that when active (low), frames are tagged with an Event marker (as metadata)). MEMGATE (an input signal that is active (low) the camera stops recording into it's internal memory (frames are discarded)), or F-SYNC (a signal that inputs / outputs to an external source, including the F-Sync from a second Phantom camera, to drive the camera's frame rate.

Aux 2 **E** BNC connector switchable between: READY (outputs a signal (high) to indicate that the camera is in capture mode. Signal can be set to go low at trigger or at the end of recording) and STROBE (an output signal (low) for the duration of each frame's exposure).

Trigger **F** BNC connector; contact closure causes trigger. There is also Trigger on System (Miro C210J) and Capture (Miro C210) connector: isolated, <1V deassert, 3 to 24V assert.

3 Quick Start Guide

Prepare Your Computer

Camera controlling computers:

1. Must have either the Microsoft Windows XP Pro, VISTA Business Edition or Windows 7 or 8 operating system installed.
2. Firewalls must be turned off. (Contact your IT Group if necessary)
3. Using the 'Windows Control Panel' set the IP address of your computer's network card to 100.100.100.1 with a 255.255.0.0 subnet mask.

   If working with a 10Gb Ethernet connection the computer's IP address should be set to 172.16.0.1 with a 255.255.0.0 subnet mask.)

Install PCC Software

Install the latest version of Phantom Camera Control (PCC) software from the accompanying CD or USB key.

Cable the Camera

Connect the 16-32VDC power supply to the camera's power connector (Miro C210), or to the power connector of a Miro JBox (Miro C210J: required / Miro C210: optional).

Attach the supplied Ethernet cable between the Phantom camera and the computer (Miro 210C), or the Miro JBox (Miro C210J: required / Miro C210: optional)

Connect a Miro MiniBob or Capture cable to the Phantom camera (Miro C210).

If an external trigger is being used to trigger the camera, connect it to the Trigger connector of the Miro MiniBob, Capture cable (Miro C210), or Control Break Out Box (Miro C210J)

Select Camera for Use

In the Manager Control Panel double mouse-click on the Phantom camera to be used from the 'Cameras' group folder.

Define Recording Parameters

Click the ‘Live’ tab.

Click ‘Cine Settings’ and define the following parameters by either the selecting the required value from the pull-down selection list, or typing the value into the respective data entry field.

Set ‘Resolution’ to the required Width x Height.

Choose the required ‘Sample Rate’ and ‘Exposure Time’.

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 camera lens first, then click on the CSR button to perform a Current Session Reference.

‘Arm’ Camera

Click the ‘Capture’ button to start recording to the camera’s internal memory (circular buffer).

Trigger

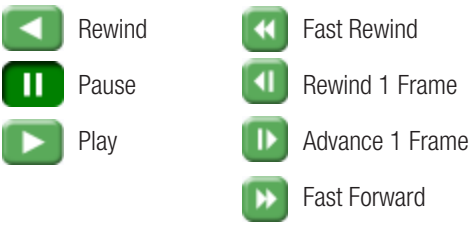
At the end of the action, click the action ‘Trigger’ button at the bottom of the ‘Live’ panel, or

Provide a switch closure or an external trigger signal (TTL pulse) via the Trigger connector.

Edit Cine

Click the ‘Play’ tab.

Using the following Video Control Buttons to locate the first image of the cine to be saved.



Locate the first image of the cine to be saved.

Click the 'Mark-In button. 

Locate the last image of the cine to be saved.

Click the 'Mark-Out' button. 

Select 'Play, Speed, & Options' and enable (check) 'Limit to Range'.

Under the Video Control Buttons click the 'Jump to Start' button. 

Review Edited Cine

Review the edited cine using the Video Control Buttons.

Click the 'Save Cine...' button at the bottom of the 'Play' panel.

Save to Computer

In the 'Save Cine' window:

Navigate to the folder where you want to save the cine file.

Enter a file name for the cine file in the 'File name:' data entry field.

From the Save as type pull-down selection list select the 'Cine Raw, *.cine' file format.

Click the Save button to begin downloading the cine file from the camera to the computer's hard drive.

Click the down-arrow of the 'Save Cine... button.

Select 'Save RAM Cine to Flash' (in popup window).

Save to Phantom CineFlash

Click the Save button to save the cine file onto the Phantom CineFlash.

Confirm cine save before deleting from internal memory

Confirm Computer Save

Click the ‘Open File’  button.

In the ‘Open Cine’ window:

Navigate to the folder containing the saved cine file.

Highlight the cine file to be opened.

Click the Open button.

Using the Video Control Buttons review the saved cine file.

Confirm CineFlash Save

Click the ‘Manager’ tab.

Double-click on the ‘Cine F#’ file under the camera used to record the cine.

Using the Video Control Buttons review the saved cine file.

via remote control unit

Connect Camera to Remote Control Unit

Connect an HD (BNC) cable to the 'Video-In' connector on the rear of the Remote Control Unit (RCU) to a DIN 1.0/2.3 cable, which connects to the SDI (DIN1.0/2.3) connector on the front of the Miro C210J or C210 camera.

Connect the Remote cable (9-pin female) to the 'Remote' connector on the rear of the RCU.

On the Miro C210, connect the Remote cable (9-pin male) to the Power connector on the camera's rear panel.

On the Miro C210J, connect the Remote cable (9-pin male) to the 'Remote' connector on the camera's rear panel.

Power Up Camera

For the Miro C210J, connect a suitable power supply (16-32VDC) to the JBox Power connector.

Connect the System cable from the Miro C210J to a JBox Camera (1-6) port.

Power Up RCU

Hold in the RCU 'Menu' button (2 seconds).

Set Recording Parameters

Gently depress the 'Setup' button, then the Acq, (Acquisition), button.

Set the'Aspect Ratio': Press the down-arrow (right of 'Aspect Ratio' field) and select an 'Aspect Ratio' from the pull-down selection list.

Define the Resolution, Frame Rate, Exposure, and Post Trigger settings using the Numerical Keypad to specify the desired setting.

To overwrite the present value:

1. Tap the entry field once, (turns entry field yellow), then
2. Tap the key pad to enter the desired value.
3. Tap the Enter key to set the value.

To append the value:

1. Tap the entry field twice, (turns entry field white), then
2. Tap the key pad to append the value.
3. Tap the Enter key to set the value.

Press the Return,  , icon (upper-left) to return to the Setup Screen.

Perform CSR

Press the 'Capture' button.

Cover the camera lens first, then tap the CSR, (Current Session Reference), button

When prompted tap the Begin button.

Perform White Balance (Color Cameras Only)

Place a white or neutral non-saturated object in front of the camera and tap the 'White Balance' button.

When prompted tap the Begin button.

'Arm' Camera

Press the Rec, (Record), button.

Trigger

Apply a trigger to the camera by depressing the hardware Trigger' button (on RCU), or apply 'Trigger-In' (TTL pulse) signal to the Trigger connector on the capture cable or Miro Mini BoB.

Edit Cine

Click the Play button.

Locate the first / last image to be saved by:

Performing a Quick Search:

Rotate the Jog/Scroll dial until desired point in cine is achieved, or

Press and hold down on 'Image Location Identifier' arrow,  , located just below the Cine Editor Bar and slide finger right to quickly advance cine, slide left to quickly rewind (present image number is displayed above).

Using Video Control buttons:

Play 

Reverse 

Pause 

Click the Mark-In  and Mark-Out  buttons to set the first / last images, respectively, of the cine to be saved.

Save to CineFlash

Tap the 'Save' button to save the edited RAM cine file to the Phantom CineFlash.

4 Phantom Software

The latest version of Phantom PCC software can be found and downloaded from the support section of the Vision Research website: ***www.phantomhighspeed.com***

Pre-Installation

Phantom control software is certified to operate with the following Microsoft Windows operating systems: Windows XP Pro, Windows VISTA Business Edition, Windows 7 and 8.

The computer and camera must be associated with the same sub-network to communicate with one another.

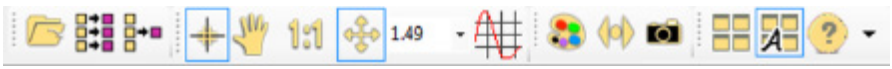
Vision Research has preset IP address (100.100.x.x) with a subnet mask (255.255.0.0) to the camera. Typically the IP address 100.100.100.1 / 255.255.0.0 is defined to the control computer. When multiple computers are used to control the same camera, each computer requires a unique IP address, for example, 100.100.100.1 (255.255.0.0), 100.100.100.2 (255.255.0.0), and so on.

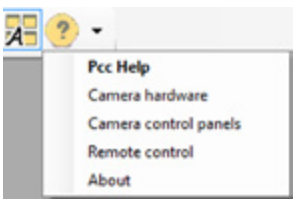
PCC (Phantom Camera Control) Application Overview

The software is built around a multi-layered work area that includes the following work areas:

Toolbar

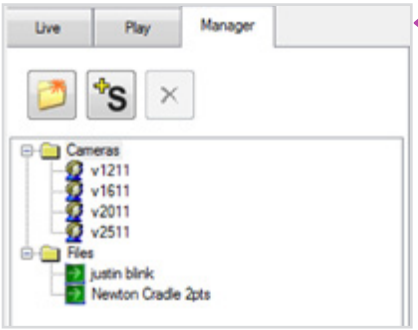
Provides quick access to the most frequently used functions. Position the mouse over a button and wait for a second to display a text box describing what it is.





Note the 'Help' buttons which provides valuable reference information on the software, including extensive documentation.

Control Tabs



The main window of PCC is divided into three tabs: Live, Play and Manager.

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

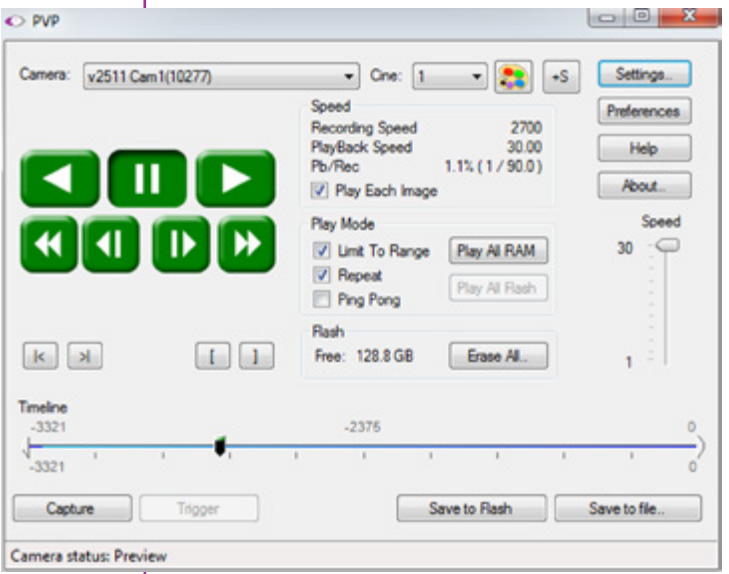
To rename, highlight then click the name of a camera. This can be useful when working with multiple cameras.

All camera control and setting of shooting parameters (frame rate, shutter, etc.) is performed in the 'Live' tab.

The 'Play' tab is used to review, edit, and save Cine files, (either from the camera or from files on the local hard drive).

PVP (Phantom Video Player) Application Overview

PVP can be launched directly from the desktop, or by clicking the 'Video Out' toolbar button in PCC. PVP controls only the camera's HD-SDI outputs as connected to a compatible SDI monitor.



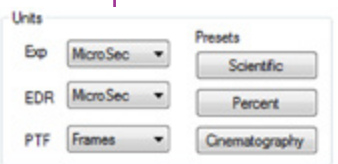
PVP, provides the ability to view, capture, review, edit, and/or save a Cine recorded into the camera's RAM to a hard drive, or internal CineFlash. PVP is extremely effective when used with the high-resolution cameras since most computers are not powerful enough to view the live or captured raw files smoothly.

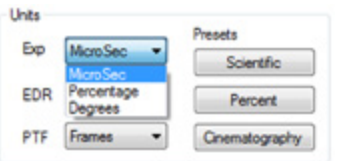
The camera's video mode and display settings are also set through PVP. Video systems will vary based on the country you are in, what kind of video monitor used, and the required display resolution. All available video settings for the connected camera can be found in the 'Settings' menu of PVP.

Camera Control via PCC

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

Units can be set to commonly used values ('Presets') or they 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. You probably will want this set to micro-seconds. The other unit to set is PTF (Post Trigger Frames) covered later in this section.

Selecting a Camera

Double-click 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.

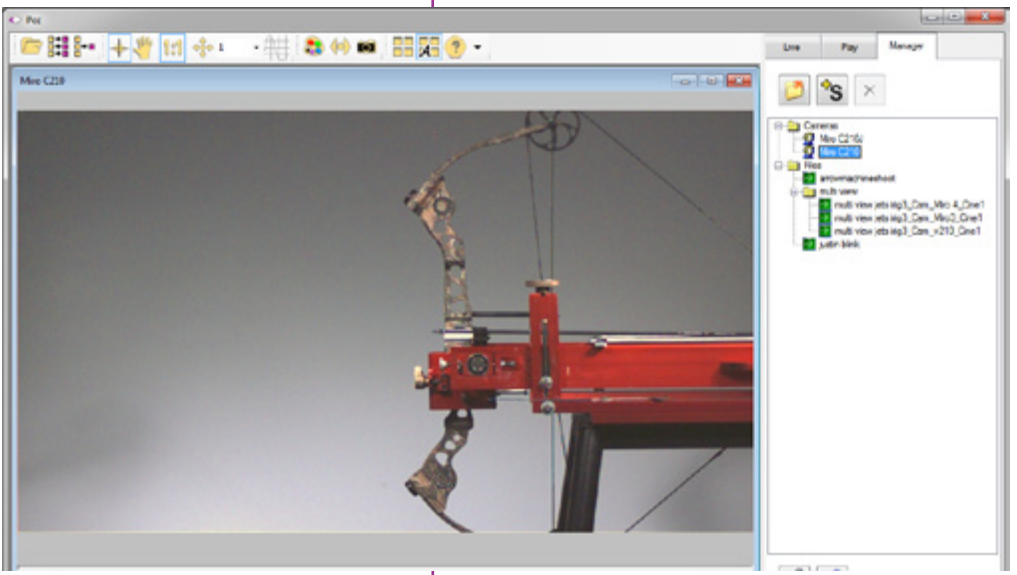
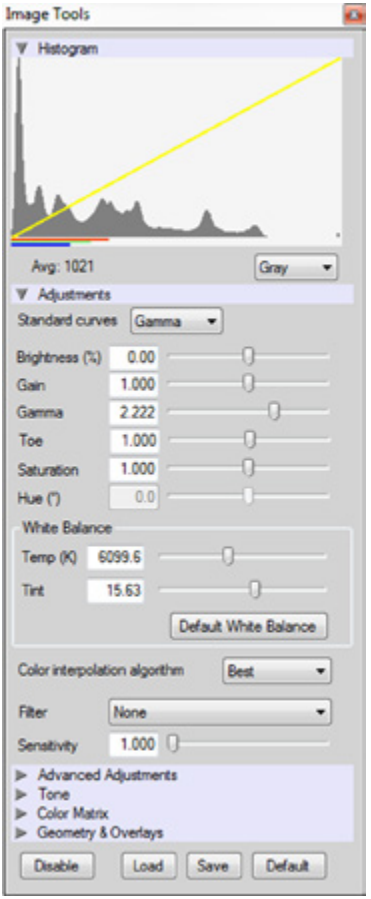


Image Processing

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. This image may differ slightly to that of the image being output over the camera’s SDI port due to display differences in the video monitor and computer screens.



You can adjust the display options by clicking on the 'Image Tools' toolbar button.

The 'Image Tools' window is used to view a 'Histogram' and change settings that affect the computer display and the video output of the camera.

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

When Log mode is selected, most of these variables are locked and can not be adjusted.

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 default (which under the most typical lighting will produce a green image).

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

Changes made only affect the metadata of the Cine file, not the raw data. If you are recording the camera's video output it is important that these be set to values that produce the image you wish to record.

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

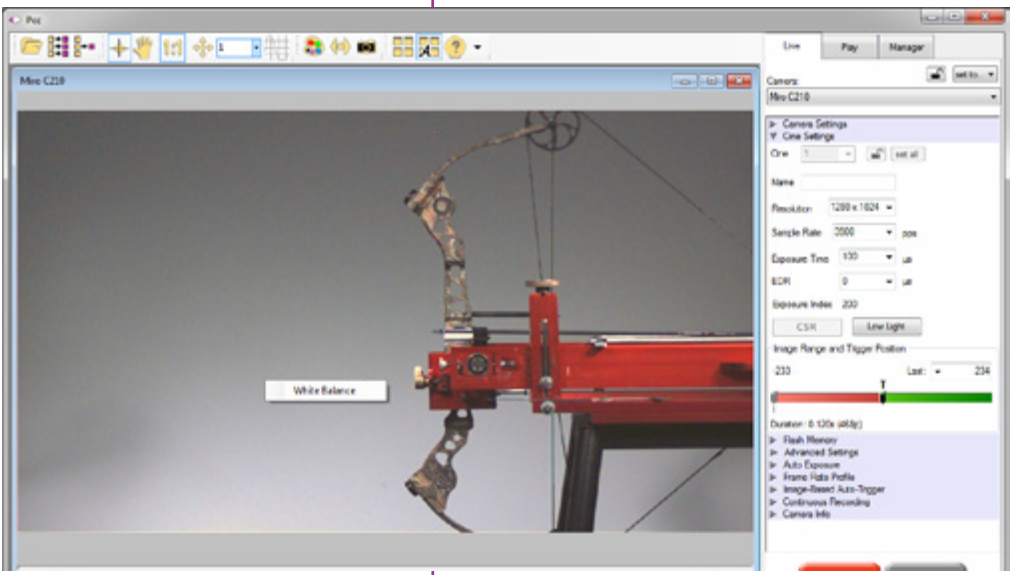
The 'Zoom Fit' toolbar button resizes the images to fit panel.

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.

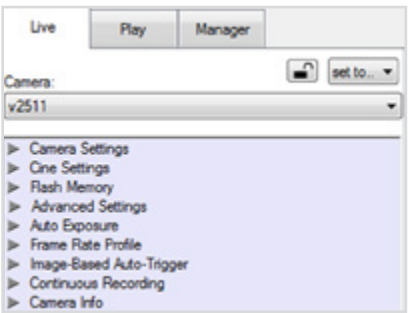
Automatic White Balance

Performing a White Balance should be the first step in color adjustment (color cameras only).

Right mouse click on area that resemble white in the image in the 'Preview' or Playback' panel, 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.



Capture Settings

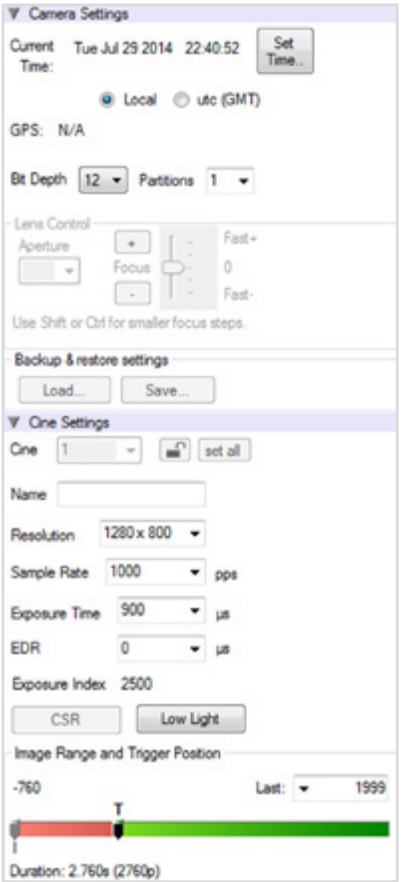


Just below the 'Camera' selector in the 'Live' tab are a series of expandable headers, which contain groups of related camera settings.

This manual will cover the most commonly used settings, see the 'Pcc Help' file for details of other settings.

Camera Settings & Cine Settings

Camera Settings are used to set and recall the overall camera system parameters. Cine Settings are used to set the capture parameters.



Set Time: Synchronizes the time stamps embedded in the recorded image data to the computer's clock or supplied IRIG-B clock.

Bit Depth: The Miro C210J and Miro C210 cameras operate in 12-bit mode only.

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: Not supported by the Miro C-Series cameras; (available for Canon EF lenses only, for control of aperture and focus).

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

Resolution: Set the the number of pixels used to capture an image. For example, if 1280 x 1024 (width x height) is set, the full sensor space is available. Smaller resolutions allow higher recording speeds. Cropped resolutions are set using the 'Crop and Resample' menu in Image Tools.

Sample Rate: Set the acquisition frame rate in frames-per-second (FPS).

Exposure Time (shutter): Set the exposure time in micro-seconds, percentage, or degrees (this depends on how the PCC preferences are set).

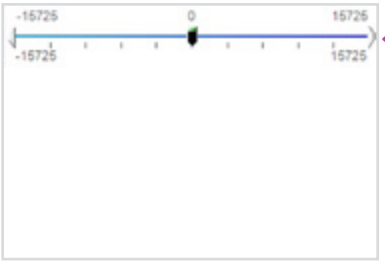
EDR (Extreme Dynamic Range): Not supported.

Exposure index: This is a reference display of the EI value in relation to the Image settings.

CSR (Current Session Reference): With the lens covered performing a CSR 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.

Key Advanced Settings

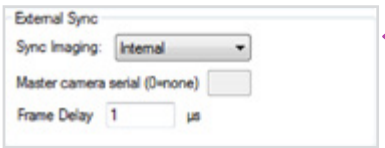


The trigger position is indicated in the 'Last' pull-down menu or as the 'T' slider along the timeline. The trigger position is the point at which the camera stops continually recording when a trigger signal is detected.

The first of these key features is the option to enable the 'Start/End of recording actions' to be performed automatically at the beginning or end of a shot. The most common ones are:

- 'Auto save to CineMag/Built-in Flash' this feature saves a user-specified portion of a clip to the internal CineFlash 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 CineFlash.
- 'Restart Recording,' when enabled, automatically restarts the recording process after the 'Auto' actions have been performed.

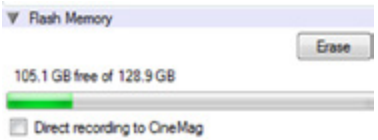
When 'Restart Recording' is enabled PCC does not provide any user confirmation before the clip is erased from RAM and starts recording again. This feature should be used with care!



'External Sync' instructs the camera to utilize one of the following three frame sync clock sources:

- Internal - instructs the camera to utilize its' internal crystal oscillator to drive the camera's frame rate.
- External - should be selected when an externally supplied frame sync clock pulse is supplied to drive the frame rate. This can be used to synchronize two cameras together via F-Sync.
- IRIG - should be selected when an IRIG-B signal is supplied to drive the camera's frame rate.
- LockToVideo - 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).

Flash Memory



Specifies the camera's operation mode: Loop (record to RAM first) or R/S (bypass RAM and record directly to CineMag). R/S mode is not supported by Miro C-Series cameras, however it does display the amount of 'Free' space and size (in Gigabytes) of the internal CineFlash.

Recording a Cine

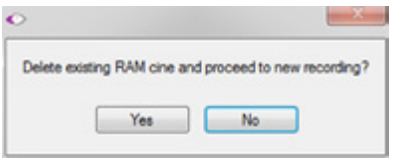
In 'Loop' mode to begin recording to the camera's RAM click the red 'Capture' button.

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 userspecified value is met.

Using an external trigger signal provides a more accurate trigger to the camera.



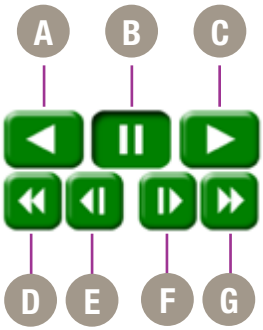
If a clip exists in the camera's memory, you will be asked if you are sure you wish to delete it before continuing. If yes, click 'Delete cine(s) and start new recording'.

Reviewing a Cine

Once the camera has completed recording a Cine in the camera's RAM or internal CineFlash 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 (also places the file under the 'Cines' group folder in the Manager tab).

The viewing option can be changed via the 'Play Speed & Options' and the Cines' metadata can be viewed in the 'Frame Info' and 'Cine Info' sections.



Use the 'Video Control' buttons to review the cine.

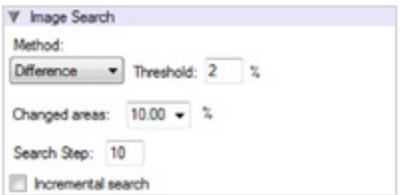
- **A** Rewind
- **B** Pause
- **C** Play
- **D** Fast Rewind
- **E** Rewind 1-Frame
- **F** Advance 1-Frame
- **G** Fast Forward

Performing a Quick Search Through a Cine

Quickly search through cine files to find the points of interest:

'Scroll' (scrub) through the clip using the 'Image Location' slider or click anywhere on the timeline to jump to points in the cine 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 difference 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 a Cine

Using the following 'Video Control' buttons locate the first image of the cine to be saved and click the 'MarkIn' button.

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

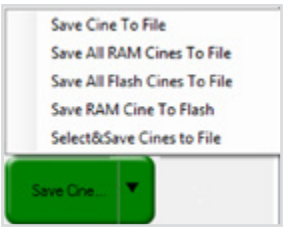
Click 'Play, Speed, & Option' and enable (check) 'Limit to Range'.

Under the 'Video Control' buttons click the 'Jump to Start' button, then review the edited cine.

Saving a 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 the internal CineFlash, click the down-arrow to the right of the 'Save Cine...' button and select 'Save RAM Cine to Flash'.



Using PVP (Phantom Video Player)

PVP (Phantom Video Player) is a streamlined application used to control the video playback of the camera, and can be used to quickly capture, review, edit and save to or from the CineFlash.

PVP can be opened directly from the desktop or by clicking the 'Video Out' toolbar button in the PCC software.

PVP Settings

Video output parameters are set by opening the 'Pvp Settings' windows. This includes control for the video system, and on-screen display parameters including production area rectangles.

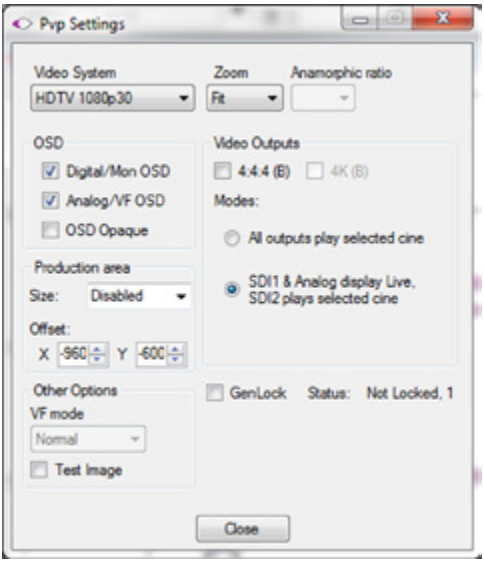
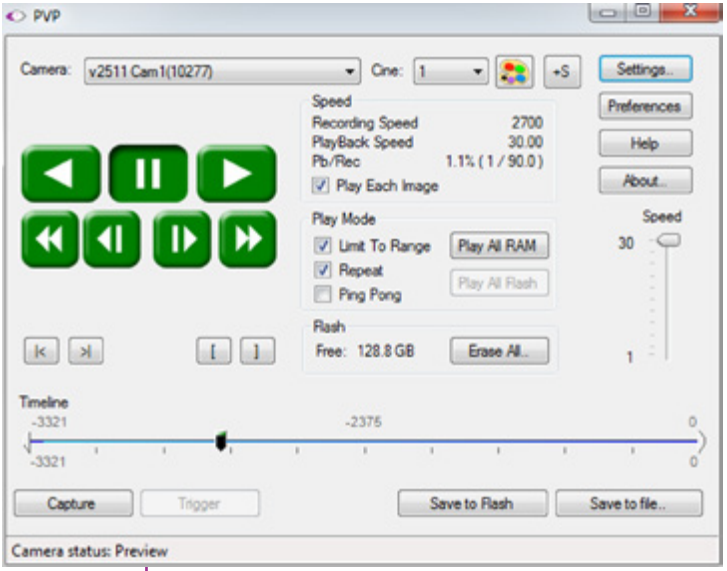


Image Tools

Click on the palette from the main PVP window to activate the 'Image Tools' menu. It is basically the same as the equivalent menu in PCC. It can be used to adjust image processing parameters including; brightness, gain, gamma, toe, saturation, white balance and more.

Any image tools adjustments will also apply to the PCC live image and the metadata in saved Cine Raw files.



The Main PVP Window

Basic capture and playback are performed from the main 'PVP' window. The 'Capture' button starts recording to RAM when the camera is in 'Loop' mode. Press 'Trigger' to stop recording.

Switch to the desired clip to view by selecting it in the 'Cine:' pull-down menu. Clips from the camera's internal CineFlash are preceded by the letter 'F'. To return to the live output, select 'Live.'

Scroll through a Cine by dragging the play head back and forth on the timeline. Use the playback controls to play forward and in reverse. Use the speed slider to change the playback speed.

Use the '[' and ']' buttons to mark in and out points. After trimming a clip, press the 'Save to Flash' button to save it to the internal CineFlash, or 'Save to File…' to download it to the computer.

It is also possible to erase the entire contents of the internal CineFlash by clicking the 'Erase All…' button.

5 Download & Image Processing

Introduction

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

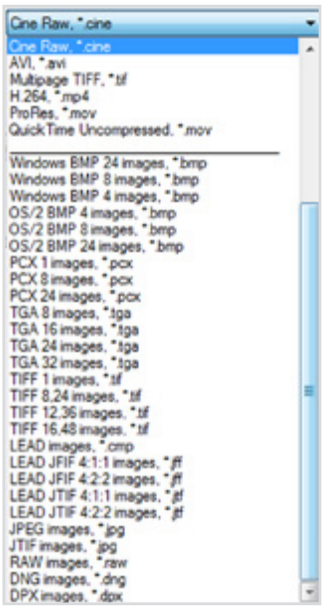
These Cine files can be converted to industry standard formats (ProRes, H264, DPX, DNG, TIFF, JPEG, and more) with PCC software provided by Vision Research. Phantom PCC and PVP software are only compatible with Windows operating systems, however there are third party solutions available for working with Phantom cameras in Mac OSX.

PCC Software Solutions

Windows-based PCC software provides the ability to convert cine files into a number of other formats.

Converting Cine 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' 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).

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

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. In the case of ProRes, the default is 4:2:2 HQ, however other options are available.

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

To convert a cine clip into a sequence of images (frames) you must add one of the following annotations to the end of the file name: '!n' or '+n (where n is the number between 1 to 8). This will assign the sequential frame numbers to the file name for each frame being created.

Example: image_!5.tif

The '!' annotator instructs the software to append the cine's image number (relative to the trigger point) to the file name. If the first frame in the clip is - 100, then the first converted frame will have the name: image_-00100.tif.

The '+' annotator will add frame numbers starting from 1.

Example: image_+5.tif

This will cause the first converted frame to have the name: image_00001.tif

Ensure all image adjustments have been applied prior to initiating the conversion process. All metadata (gain, gamma, saturation, etc.) will be embedded into the converted images.

Batch Convert

The 'Batch Convert Files' toolbar button can be used to convert a single, 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.

The ‘File Name’ will depend on the type of file format you are converting to.

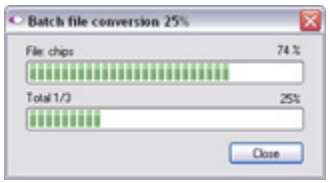
If you are converting the cine file into a ‘movie-like’ formats leave the file name as ‘All selected file.’ The software automatically assigns the original file name to the converted file and appends the appropriate file extension.

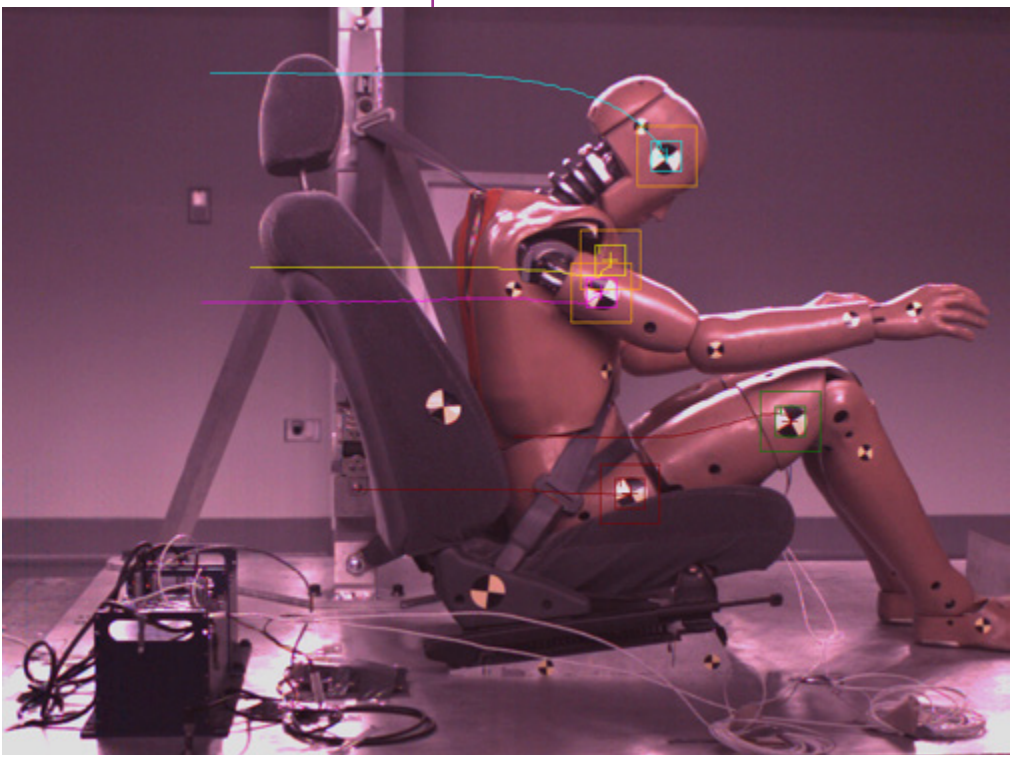
However, if you are converting the file into a sequence of images, you need to enter the annotation only detailed in the ‘Convert a Cine’ topic earlier in this chapter.

Example: +4

The software automatically creates a separate folder for each of the files being converted, assigns the original file name, and appends the appropriate image number and file extension to each image.

Once the ‘Convert’ button is clicked a progress window appears. Each converted cine will be placed in its own folder named after the original cine file.





Details on how to use the various PCC measurement tools can be found in the Phantom (PCC) Camera Control Application Help File > Step-by-Step Procedures > Play Panel Procedures > Measurements.

6 Measurements

Introduction

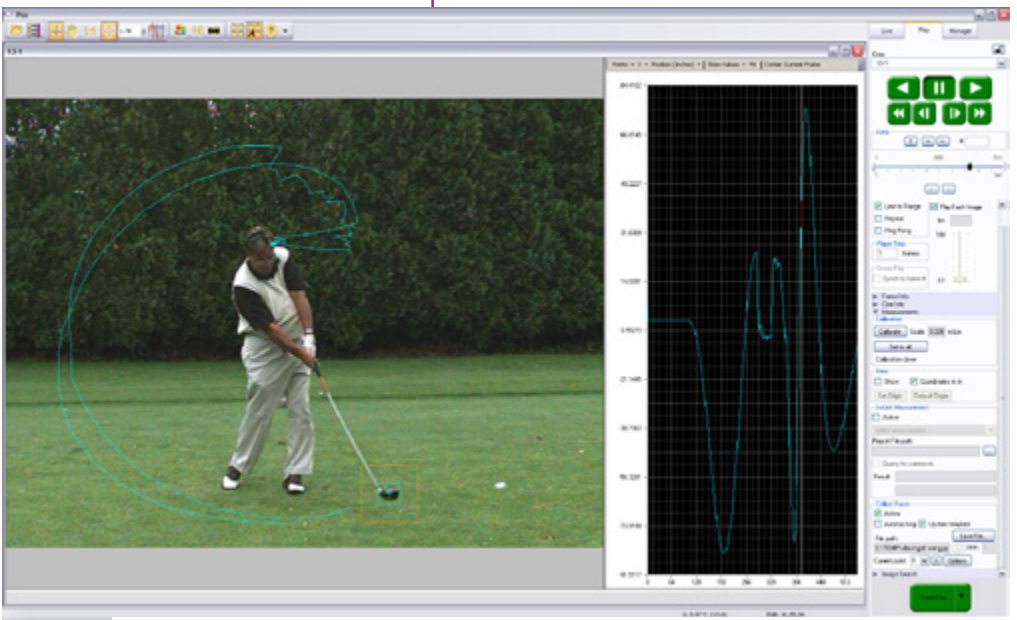
High-speed photography is as much of an engineering tool as an oscilloscope, spectrum analyzer, or logic analyzer. The photographic technique enables us to visualize and analyze motion, especially motion that is too fast for the human eye or conventional cameras to perceive.

For decades, Phantom Cine (high-speed digital video) files have been used to measure moving objects by the defense, scientific and research, and industrial communities to extract and quantify motion from a file.

As high speed digital cameras continue to make advancement in recording speeds, sensitivity and resolutions so must the motion analysis software used to extract the data they record. This data allows the defense community to examine the speed, angle and angular speed a shock wave from an explosive device.

Information automotive engineers require it to evaluate the safety and effectiveness of an airbag design by determining the time, speed, and angle it takes the airbag to deploy fully. Studies by the scientific and research community use this data when analyzing human locomotion by measuring the angle a knee joint bends and the compression the knee joint endures while running, or the speed of a lightning bolt. Not to mention manufacturers needing to measure the angular speed (Revolutions Per Minute) a new hard drive motor can spin without causing damage to the disk, or being able to measure the effect the angle of impact a golf club will have on the rotational speed of a golf ball.

The ability to analyze all of this data quickly and accurately inherently decreases product development time, and more importantly reduces research and development expenditures. Of course extracting this information from a digital high speed video is only as good as the tools used to accomplish it.



PCC Multi-Layer Graphical User Interface automatically tracks the golf club head to calculate swing speed, path, and acceleration.

2-D motion analysis tools, such as Vision Research PCC (Phantom Camera Control) software calculates this valuable data. With today's software, the end-user can perform timing, position, distance, velocity, angle and angular speed measurements, and track multiple points or objects to compute and graph their XY-coordinates, speed, or acceleration. PCC, for example, provides several edge detection algorithms and image processing tools to improve the measurement process. The measurement technology provides a motion analysis system that harmonizes measured data with images. In this chapter, we will review the various PCC measurement capabilities.

Units of Measurement

Units of Measurement specify the computing and reporting unit for distance, speed, acceleration, angle, and angular speed measurements.

Establishing a measurement scale is required to set a specified number of pixels in the image equal to a scale unit size, such as millimeters, meter, inches, feet, or pixels.

To define a measurement scale, the analyst needs to select two points on the image with a known scale, then specify that scale size. Once created, all measurements are computed and displayed using the scale unit. If no measurement scale exists, the default scale will be 1 pixel = 1 pixel.

Timing

To perform timing measurements accurately, a time stamp (date and time) is embedded into every frame captured. The PCC software function, for example, calculates the time difference between two event frames (start / end of an event) or from the captured image being displayed to the trigger (t0) frame automatically.

Coordinate

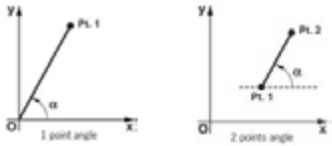
Coordinate measurements are calculated from an Origin point pixel, by default the top-left corner of the image; however, the Origin can be changed when performing measurements. Each coordinate consists of two numbers (x1, y1) indicating the position of a pixel in the image on the two-dimensional plane from the Origin point.

Distance, Angle, Speed

Using 'Distance and Angle and Speed' instant measurement tools makes analyzing launch speed, angle, and angular speed or the revolutions of a rotating object extremely simplistic.

They allow engineers developing large caliber weaponry to analyze the effect the design of the shell has on the projectile trajectory based on launch speed and angle to determine the optimal performance, or manufacturers of scientific equipment like anemometers to determine the best size and type motor to enhance their product by performing angular speed (rotational measurements) on the motors used to generate an electric current as they rotate.

PCC measures the distance from the Origin point to a selected point, and the angle made by the Origin and Ox axis of the selected point using the Distance and Angle and Speed: Origin + 1 Point instant measurement tool.



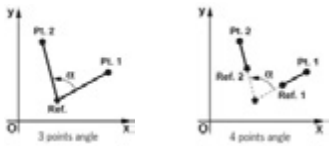
Given the coordinates of two points on the image plane, the distance (d) between the points is calculated using the following formula: $d=\sqrt{((x2-x1)2) + (y2-y1)2)}$.

If the Origin and the selected point are on the same image, PCC will calculate distance and angle only; however, if the Origin and the selected point are on different frames, the software also calculates speed and angular speed.

Speed (s) is calculated using the formula: $s = d/dt$, where d = measured distance, and dt = [time of the point frame] – [time of the origin frame] if point and origin are on different frames.

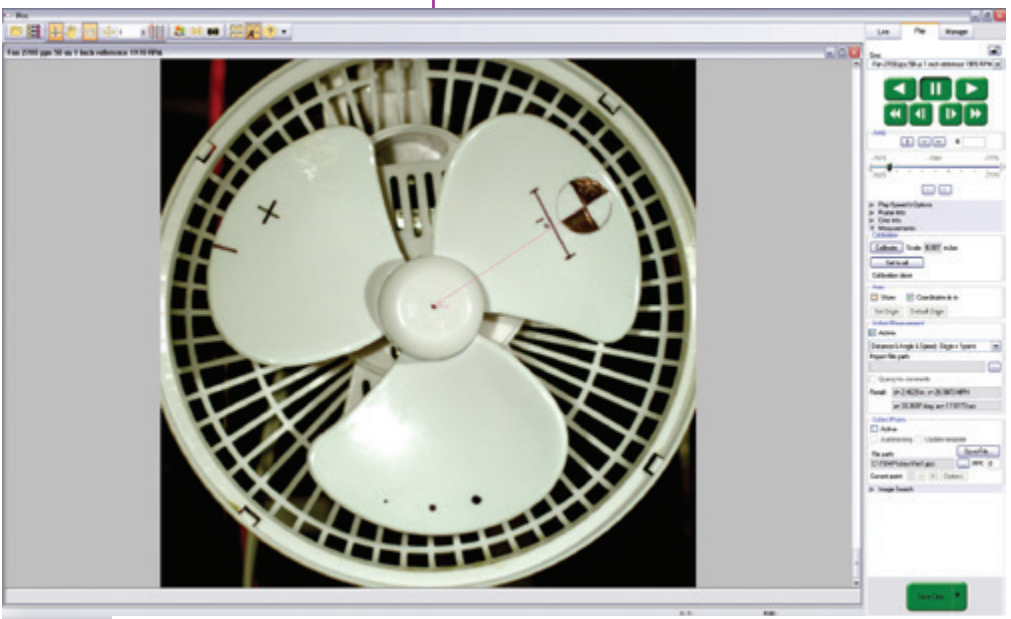
Angular speed is calculated using the formula: as=a/dt, where a = measured angle, and dt = [time of the point frame] – [time of the origin frame] if point and origin are on different frames.

The 'Angle and Angular Speed: 3 Points' instant measurement tool from PCC calculates the angle made by three points (two lines with a common reference point) while the Angle and Angular Speed: 4 Points calculates the angle formed by four points [Pt.1 Ref.1 and Ref.2 Pt.2]; two lines without a common reference point.



If all the points are in the same image when performing three or four-point measurements, the software only calculates the angle. In order to compute angular speed the first point and the reference point must be on the same image while the second point (three-points measurements) or reference point 2 and point 2 (four-point measurements) must be on different images.

Angular speed is calculated using the formula:
as = a/dt, where a = measured angle, dt = [time of the last point frame] – [time of the first point frame] if first and last points are on different frames.



PCC calculates speed (mph) and angular speed (rpm) of the fan motor using Distance, and Angle, and Speed: Origin + 1 Point measurement tool.

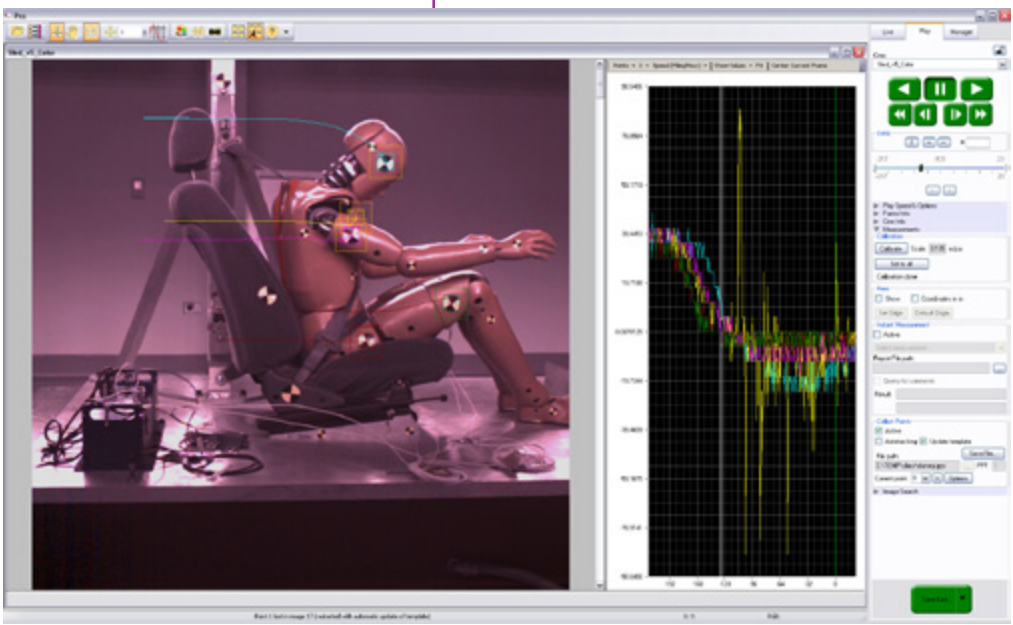
These measurement tools are exceptional when analyzing a rotating object.

The ability to measure an object, like a projectile rotating in mid-air, to determine its angular speed can be applied to other sciences, for example, the way a 2 x 4 board could tumble in hurricane-force winds can be applied

by manufacturers who develop unbreakable glass windows, or engineers developing stabilizers for aircraft.

Collect Point (Tracking)

PCC also provides a Collect Point (tracking) tool to compute the position, speed, acceleration, and / or generate motion graphs of a point (or object) or multiple points (up to 99), with respect to the image plane, over time. The analyst can use one of two methods to track 2D motion (Automatic or Manual).



Example of three points being tracked. The graph plots and displays, by default, the x-axis coordinate of all points / targets from the Origin point.

With Automatic Tracking, the analyst needs to define a rectangle (width and height in pixels) around a template image region (the point being tracked). The analyst defines a second rectangle that the tracking algorithm should search in (how large of an area to search) for the previously tracked point. A value equal to the track point indicates that the tracking algorithm should search in a region as large as the initial region size.

Larger values will result in greater search areas, which will take a longer time to search. Typically this parameter is set two to three times the size of the initial image template (defined in pixels). When initiated, the software will automatically find and track the template region as it progresses through each frame.

Manual Tracking requires the analyst to select every point being tracked for each frame. With either method all tracked points are logged to a measurement file that can be used to generate a coordinate, speed, or acceleration spreadsheet easing report generation.

Data Acquisition

To investigate the effect environmental conditions may have on the recorded data, a National Instruments™ USB- or M- Series Data Acquisition (DAQ) module can also be used to acquire data from a wide range of sensors, and synchronize it with slow-motion video images recorded on a Phantom camera, using Phantom Camera Control (PCC) software.

SDK (System Developer Kit)

Phantom camera control, and Cine playback, analysis and measurements can be customized to meet specific test protocols using the Phantom System Developer Kit (SDK) for LabVIEW (Laboratory Virtual Instrument Engineering Workbench) or MATLAB (matrix laboratory) drivers.

The LabVIEW SDK contains visual instrument (VI) files needed to call Phantom SDK functions from LabVIEW, various utilities, and demo applications. This SDK uses the LabVIEW interface to shared libraries to call functions from Phantom libraries.

The MATLAB SDK contains header files needed to call Phantom SDK functions from MATLAB, function wrappers, a simple object-oriented layer and demo scripts. This SDK uses the MATLAB interface to shared libraries to call functions from Phantom libraries.

SDKs allow, for example, automotive manufacturers to create command line scripts to control a Phantom camera directly from a computer or run in a Graphical User Interface specifically designed to perform or analyze airbag tests with having to use PCC. Anyone who wishes to have more control over their Phantom camera or the Cine files record would benefit using one of these Phantom System Developer Kits.

Conclusion

Digital high speed video has been and continues to be a useful test and measurement tool.

Along with PCC software the need to use calculators or slide rules to perform complicated mathematical calculations to compute distance, speed, angle, angular speed, or acceleration measurements of single or multiple points from 2D images has been eliminated.

The ability to perform these calculations with just a few clicks of a mouse button allows engineers, scientists and researchers, and developers to significantly reduce research and development time thereby increasing productivity.

These tools provide them with the ability to conduct even more precise and accurate analyses of ballistics, explosions, weapon's development, trajectory, biomechanics, sport performance, flow analysis, crash, combustion, and stress studies, just to mention a few.

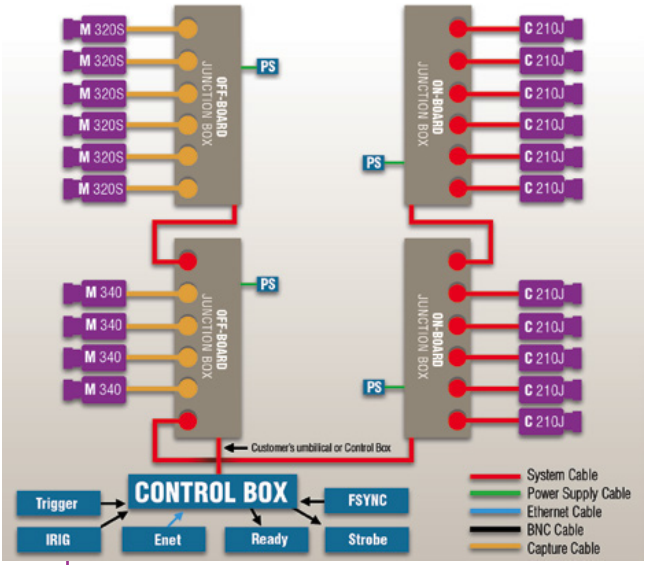
miro junction box

Phantom Miro Junction (JBox) Box

7 Miro Junction Box

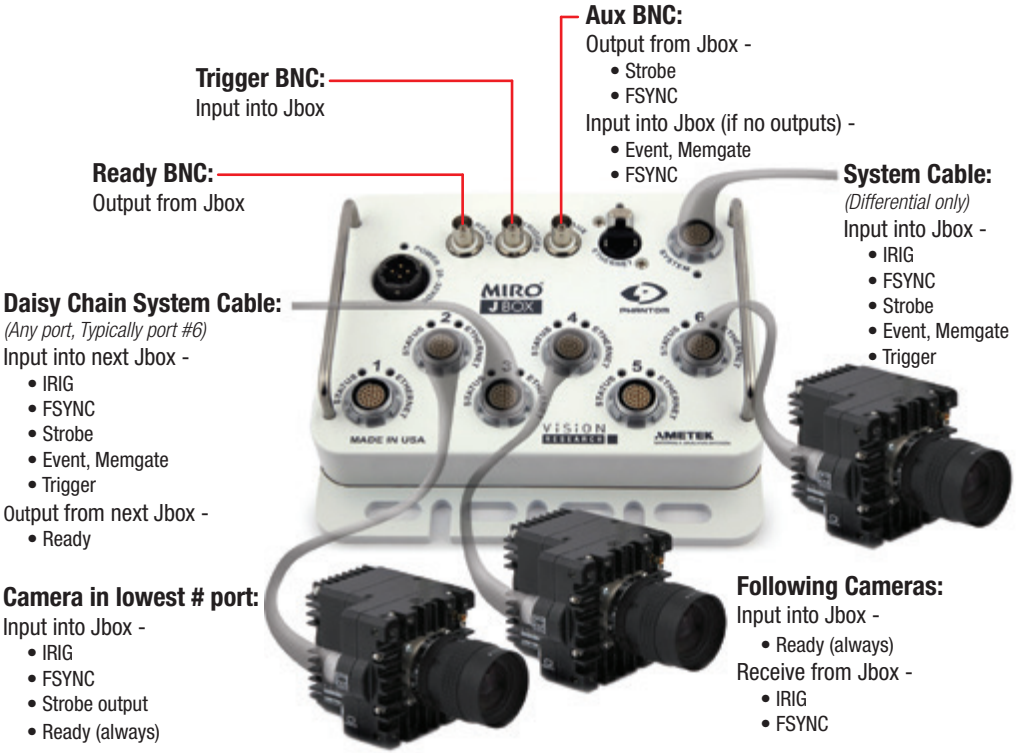
Miro Junction Box

The Miro Junction (JBox) Box is modular and flexible: with six camera ports, it can host six cameras or dedicate any port to uplink to another JBox in a daisy chain or expanding the number of cameras in a configuration.



Complex Configuration Example

It is compatible with the Miro C210J, C210, Miro M, R, and LC series, and the Miro 3 and eX4 Series. Each JBox powers the cameras via customer supplied power source. It connects the cameras to either a central control system to manage Trigger, IRIG, Strobe, FSYNC, Ready control, and Ethernet, or directly to a computer with PCC or MultiCam software via Gb Ethernet. The JBox weighs 2.8 lb (1.27 kg)



Setup

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

Power Supply: Each / Every JBox requires 20-32 VDC of power. Power may be supplied via the power sensing cable, connected to a customer power source, or through a power supply of the customer's choice.

> Cameras connected to a JBox receive power through the JBox, and should not be connected to an additional power source.

Connecting (Daisy Chain) Multiple Junction Boxes may be connected via system cables to create a "daisy chain" or "tree branch" configuration. Signals must begin in the master JBox (Closest to the control room), then flow to the other JBoxes in the configuration.

System Cables: The System cable typically brings all signals into and out of the JBox. It is connected into the System Connector. The System cable may be spliced to the customer cables, or connected to a Control BoB. All System cables carry differential signals to ensure noise immunity over long distances.

Ethernet: The JBox has an RJ45 Ethernet connection to assist in local framing and focusing, or to be controlled via a laptop in a non-Hi-G scenario.

Signal Management

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. The Trigger signal should be connected to the master JBox. It will be distributed to all local cameras and slave junction boxes.

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, connected into the System Connector, 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.

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

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.

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.

In a Daisy Chain configuration of connected JBoxes, the Ready signal flows from the slave JBoxes to the master JBox (closest to the control room). This is the opposite direction from the other signals. Only the Ready signal from the master JBox represents the entire system.

8 Accessories

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 Miro C210/C210J camera.

Miro Control BoB

Trigger (A)

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

Ready (B)

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

TC In (C)

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

AUX In (D)

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).
- MEMGATE (input): When Memgate signal is active the camera stops recording into it's 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.

TC Out (E)

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.

AUX Out (F)

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.

Power 7-32VDC (G)

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

Ethernet (H)

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

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

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

Remote Control Unit (RCU)

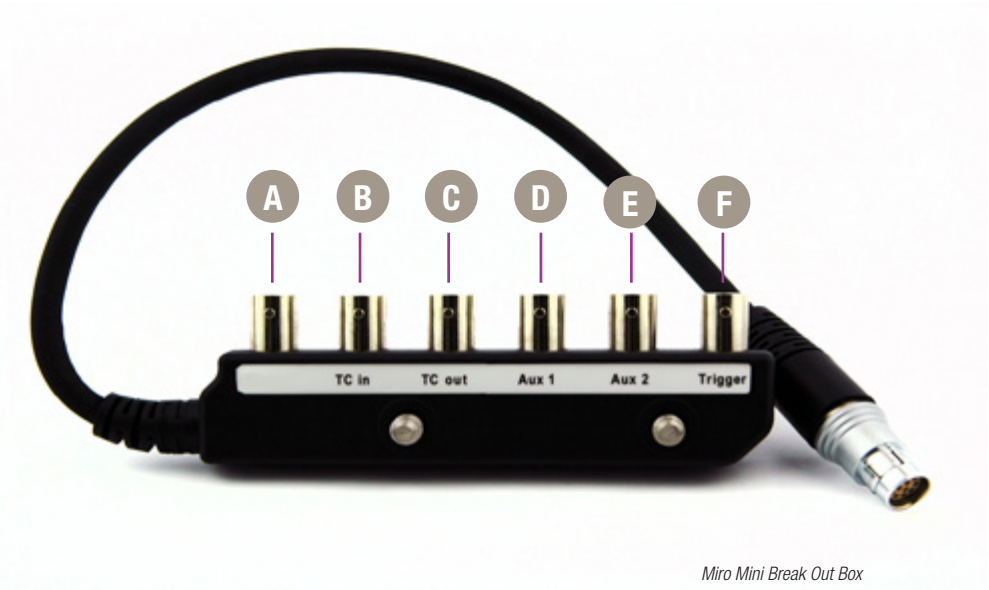
The Phantom Remote Control Unit (RCU) is a small, lightweight, hand-held controller, which allows you to adjust most settings on your camera as well as and save recorded cines to the internal CineFlash. The RCU is available in both wired and wireless versions. Both versions will connect with an included 5 meter cable direct to the back of the camera. Alternatively, the wireless model includes a Bluetooth dongle that allows for operation from up to 100 meters.

The 5” active TFT display is easy to use – even outdoors. The display can act as an HD-SDI video monitor, a full-featured touch-screen controller, or both. A DIN 1.0/2.3 and SDI cable connection cable connection is required to view the HD-SDI output of the camera on the RCU screen. Video is not transmitted via Bluetooth.

For previous Phantom RCU owners: Earlier versions of the Bluetooth dongle are not compatible with the Miro C210J or Miro C210. However, the RCU itself will be compatible after a firmware upgrade.

Miro MiniBOB

The Miro C210 Capture port is compatible with a multi-bnc capture cable and Phantom Miro Mini Break out Box (commonly known as the Miro MiniBOB). Both of these accessories provide the same functions, however the Miro MiniBOB is designed for better cable management enhancing the Miro C210's capability.



Miro Mini Break Out Box

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

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

TC Out C — 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.

Aux 1 D — Aux 1 (input / output switchable):

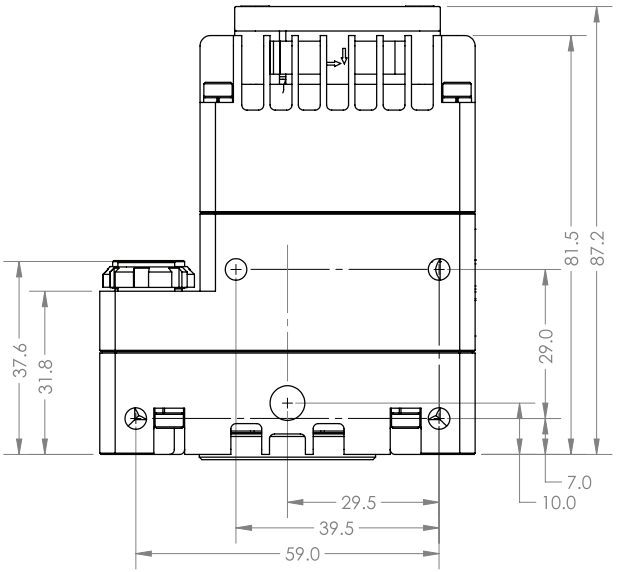
- STROBE (output): Signal goes low for the duration of each frame's exposure.
- EVENT (input): When the Event signal is active, frames are tagged with an Event marker (as meta-data). These events can be searched or referenced during playback.
- MEMGATE (input): When Memgate signal is active the camera 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.

Aux 2 E — Aux: 2: (output switchable):

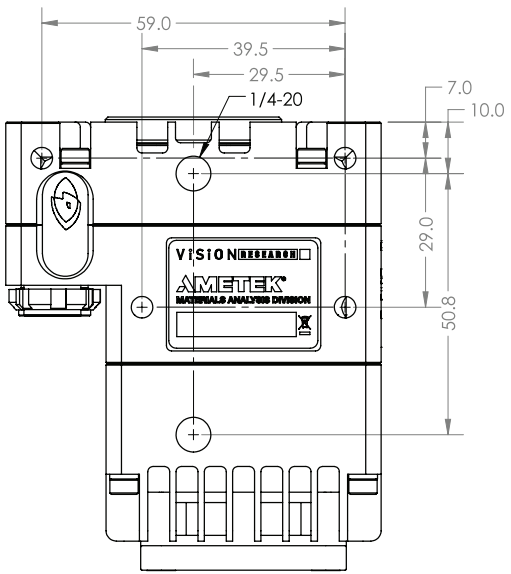
- READY (output) When signal is high it indicates that the camera is in capture mode. Using PCC, signal can be set to go low at trigger or at the end of recording.
- STROBE (see Aux 1 description above).

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

mechanical drawings

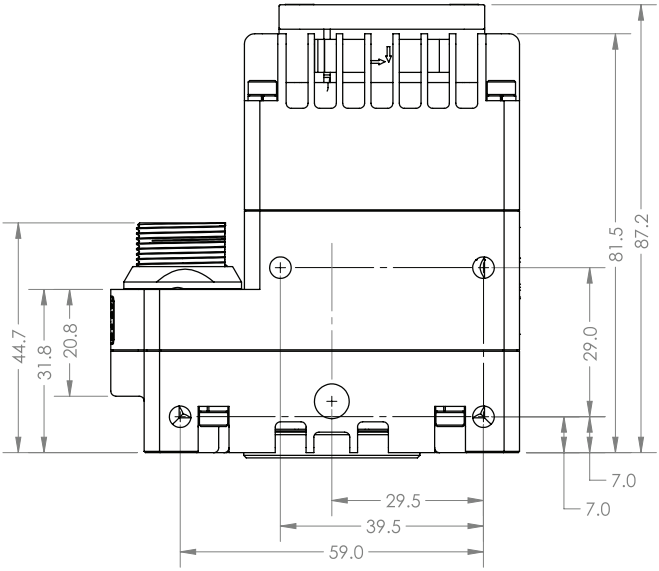


Miro C210
Top View

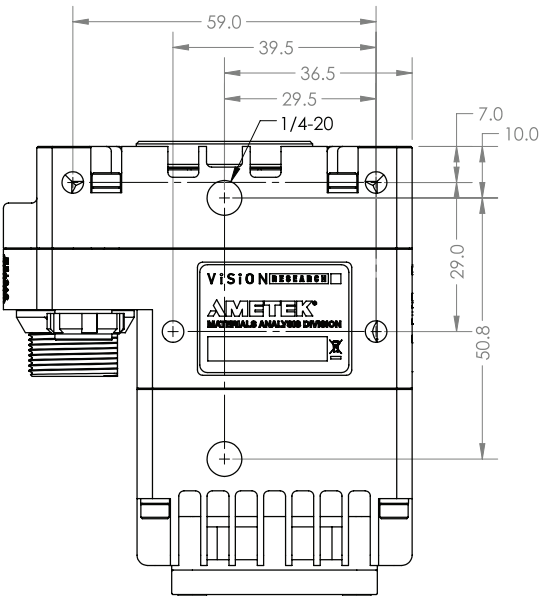


Miro C210
Bottom View

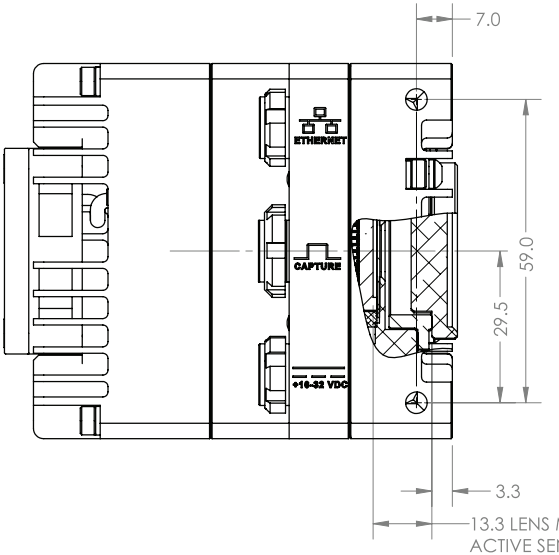
9 Support



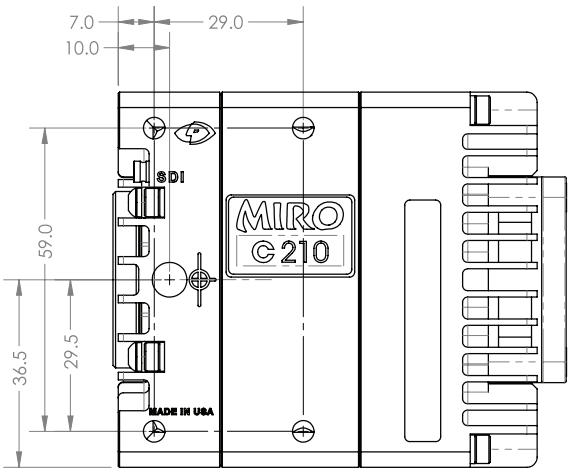
Miro C210J
Top View



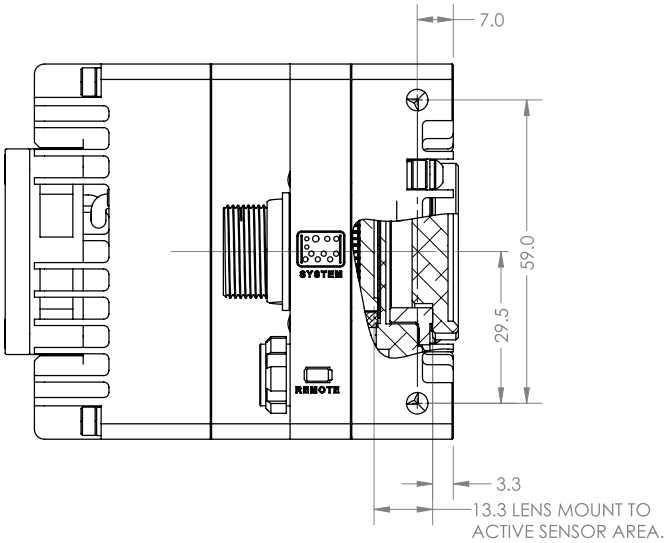
Miro C210J
Bottom View



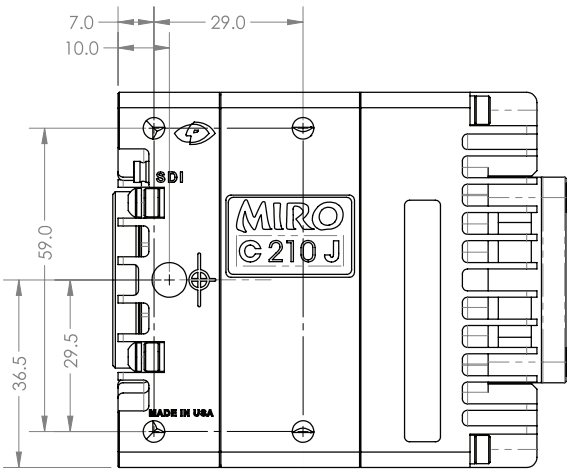
Miro C210
Right View



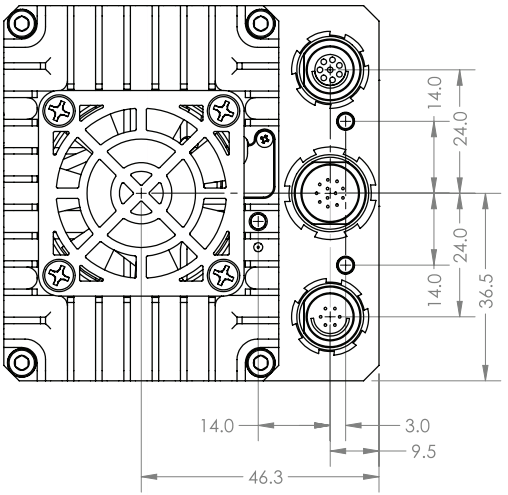
Miro C210
Left View



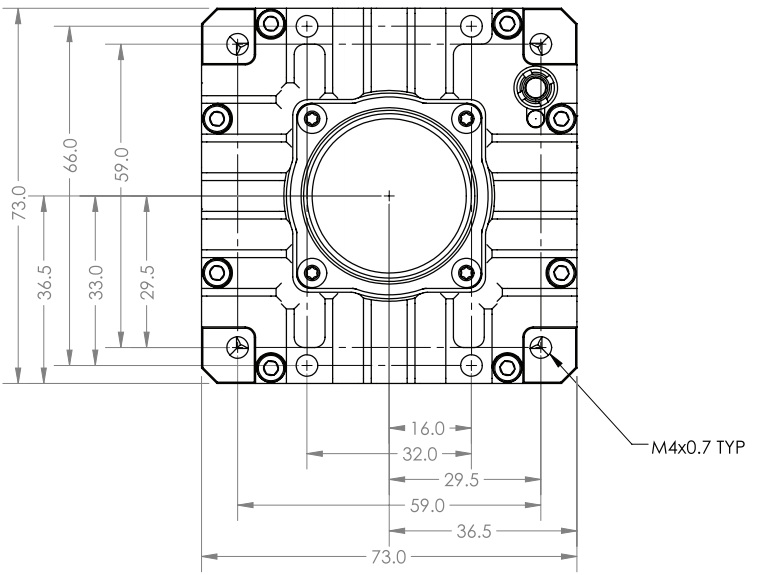
Miro C210J
Right View



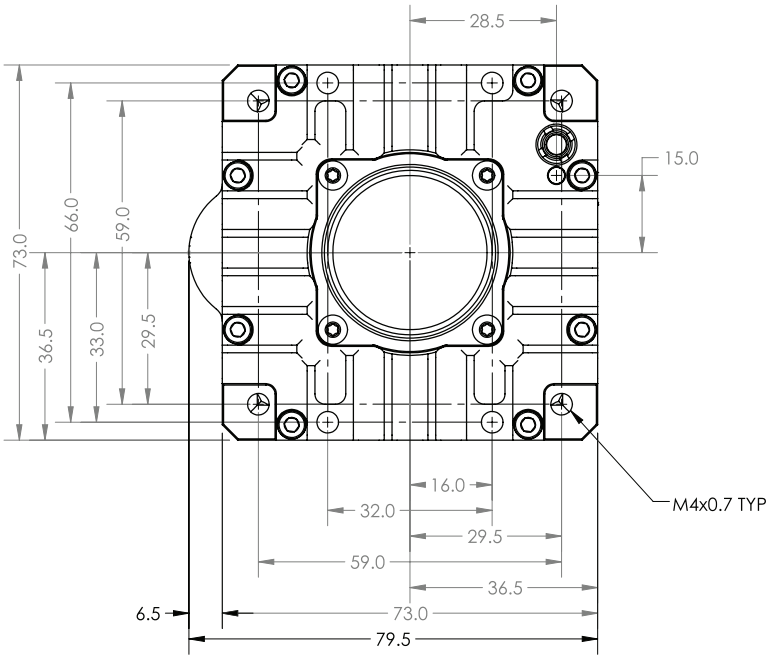
Miro C210J
Left View



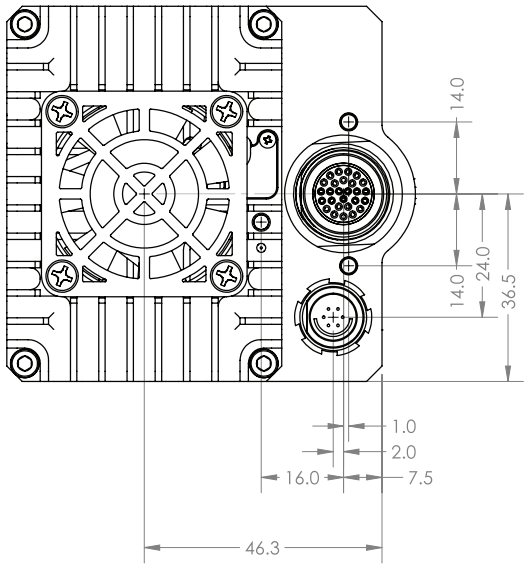
Miro C210
Front View



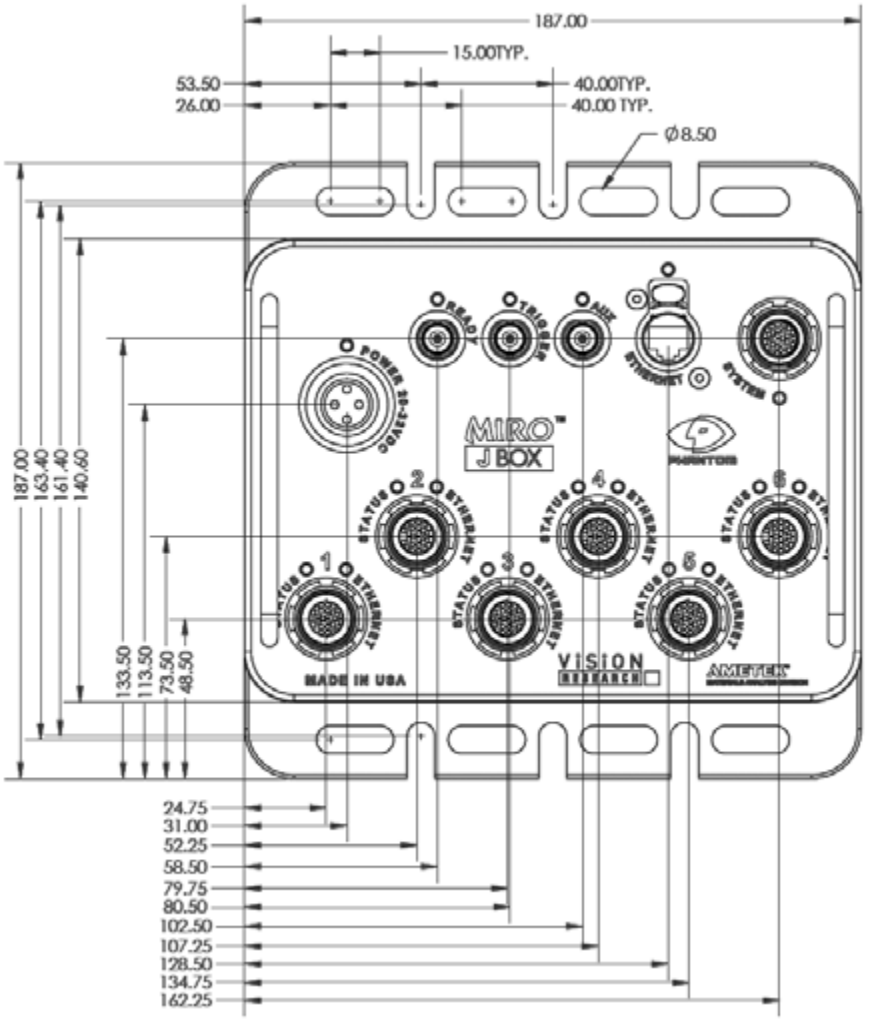
Miro C210
Back View



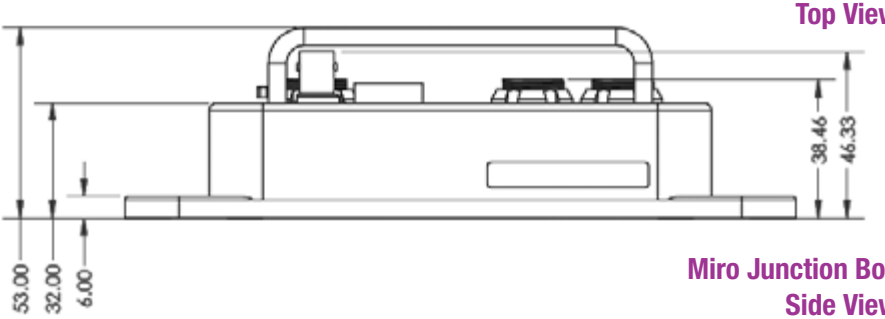
Miro C210J
Front View



Miro C210J
Back View



Miro Junction Box
Top View



Miro Junction Box
Side View

Use these schematics to build custom cables at your own risk. Mis-wired 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 C210 Capture Connector

Capture port (for capture cable and Mini-BOB)
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

Miro C210
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 C210
+16-32VDC 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 C210J System Connector

System port (for Miro Junction Box)
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) from J-Box
5	READYOUT- / Ready / Strobe output (neg) to J-Box
6	IRIGIN- / IRIG input (negative) from J-Box
7	AUXIN+ / Strobe / Event / Memgate / Fsync input (positive) from J-Box
8	CBLDET / Cable detect. Connect to GND in connector
9	PWRIN_A / +20-32 VDC input from J-Box
10	MDI2- / Gigabit Ethernet
11	MDI1- / Gigabit Ethernet
12	MDI0- / Gigabit Ethernet
13	AUXOUT+
14	TRIGIN+ / Trigger input (pos) from J-Box
15	READYOUT+ / Ready output (pos) to J-Box
16	IRIGOUT+ / IRIG output (pos) to J-Box
17	IRIGOUT- / IRIG output (neg) to J-Bax
18	IRIGIN+ / IRIG input (pos) from J-Box
19	AUXIN- / Strobe / Event / Memgate / Fsync input (neg) from J-Box
20	AUXOUT-
21	PWRIN_B / +20-32 VDC input from J-Box
22	PWRIN_C / +20-32 VDC input from J-Box
23	MDI3+ / Gigabit Ethernet
24	MDI3- / Gigabit Ethernet
25	MDI2+ / Gigabit Ethernet
26	MDI1+ / Gigabit Ethernet
27	MDI0+ / Gigabit Ethernet

Miro C210J Remote Connector

Remote port (for Phantom RCU)
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 Junction Box Power Connector

Power port
4-pin Amphenol part # PT06A-12-4S

PIN	NOMENCLATURE / FUNCTION
1	+24VB / connect to a +24VDC battery running parallel to power source
2	CHGND / Chassis Ground
3	GND / Power Ground
4	+24VDC/ +24VDC (direct current) to J-Box runs parallel with an optional +24VDC battery

Miro Junction Box 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 Junction Box (J-Box) System Connector

System port (for Miro C210J)
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 Junction Box (J-Box) Camera Connector

Camera port (for Miro C210J)
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

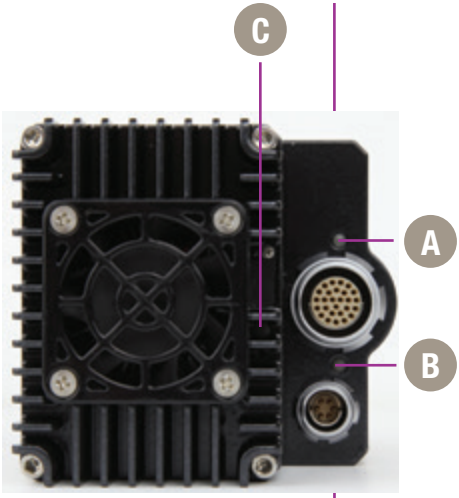
PIN	NOMENCLATURE / FUNCTION
1	UNUSED
2	GND/ Ground
3	UNUSED
4	TRIGIN- / Trigger input (neg) to J-Box
5	READYOUT- / Ready / Strobe output (neg) from J-Box
6	IRIGIN- / IRIG input (negative) to J-Box
7	AUXIN+ / Strobe / Event / Memgate / Fsync input (positive) to J-Box
8	UNUSED
9	UNUSED
10	MDI2- / Gigabit 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

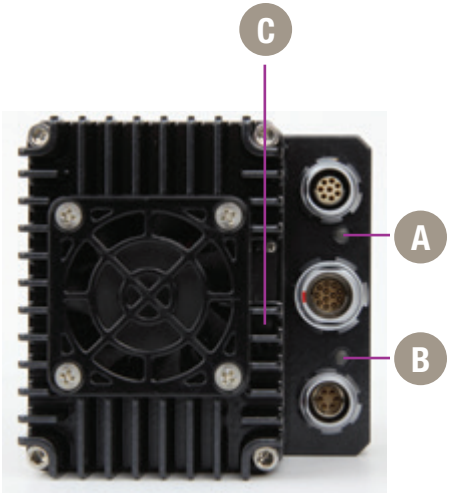
4-pin Amphenol part # 06A84S

PIN	NOMENCLATURE / FUNCTION
1	UNUSED
2	UNUSED
3	PGND – Power Ground
4	+24VDC – Provide +24VDC positive power to Control BoB

led indicators



Miro C210J Rear View



Miro C210 Rear View

Miro C210 / C210J Ethenet LED (A)

COLOR	ETHERNET STATE
Green	Ethernet Link
Amber	Ethernet Activity

Miro C210 / C210J System / Status LED (B)

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

Miro C210 / C210J Battery LED (C)

COLOR	BATTERY STATE
Off	Battery fully charged, but not armed
Green	Battery armed
Blue	Battery charging or DC power removed
Red	Battery charging fault
Cyan	Battery armed and charging or DC power removed
Purple	Battery charging or DC power removed and charging Fault
Amber	Battery armed and charging fault
White	Battery armed, charging or DC power removed, and charging fault


A
B
C
D
E
F
G
H
READY
TRIGGER
AUX
ETHERNET
SYSTEM
POWER 20 - 32VDC
MIRO
J BOX
PHANTOM
STATUS
ETHERNET
1
2
3
4
5
6
MADE IN USA
VISION
RESEARCH
AMETEK
MATERIALS ANALYSIS DIVISION

Power 20-32VDC Indicator (A)

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

Ready Indicator (B)

COLOR	READY STATUS
Green	Ready
Red	Not Ready

Trigger Indicator (C)

COLOR	TRIGGER STATUS
Green	BNC trigger asserted
Blue	Uplink / expand trigger asserted

AUX Indicator (D)

COLOR	AUX STATUS
Green	Output
Blue	Input

Ethernet Indicator (E)

COLOR	CONTROLLER ETHERNET STATUS
Green	EtherLink active
Yellow	Ethernet activity

System Indicator (F)

COLOR	SYSTEM STATUS
Green	EtherLink active
Red	Ethernet activity

Camera Status Indicator (G)

COLOR	CAMERA STATUS
Green	Ready
Red	Not Ready

Camera Ethernet Indicator (H)

COLOR	CAMERA ETHERNET STATUS
Green	EtherLink active
Red	Ethernet activity

Operation

The Miro C has an internal, non-removable battery designed to provide back-up power to complete an operation and safely save a cine in the event of power loss to the camera. The battery is UNDOT 38.3 qualified and has a total capacity of 8.4 volts. When the battery activates, it ready to provide power to the camera in the event DC power is lost, and the LED is Green. The following conditions must be met for battery to activate:

- The camera has DC power and is fully booted.
- The battery is charged to at least 8.0 volts.
- In the Battery Control Section in PCC, the box "Enable Battery" is checked (Default).

The 3 modes of operation are:

Preview Mode (Selectable): This mode provides a 2-minute window to disconnect and reposition cameras during set-up without needing to re-boot the cameras. The battery activates when the camera is placed in Preview mode. If the camera is disconnected from DC power, the battery will supply power for up to 2 minutes. If the camera is not reconnected to DC power within 2 minutes, the battery automatically deactivates and turns off the camera.

The battery operation mode does not automatically change to Capture when the camera is placed in Capture.

Capture Mode (Selectable): This mode allows the camera to operate in Capture mode for up to 10 minutes without power. The battery becomes active when the camera is placed in capture mode. In the event of DC power loss, the battery will supply power to the camera either for 3, 5 or 10 minutes (Selectable). If the camera triggers within this time span, the battery operation mode automatically switches to Trigger Mode to protect the data. (Pertains to Stand- alone C210 only! The Miro JBox automatically triggers a C210J or C210 in Capture mode in the event of power loss. This battery operation mode is disabled in the C210J)

Trigger mode (Default mode, always selected): This mode protects critical cines and ensures they are saved in the event of DC power loss. The battery activates when the camera is triggered. In the event of DC power loss, the battery will supply power to the camera until any of the following conditions are met:

- All auto save operations of Cines in RAM memory have been completed.
- All Cines in RAM memory have been deleted.
- The reset button on the back of the camera has been pressed.
- The battery voltage has reached the full discharge limit.

The camera then automatically turns off.

Charging

If the battery is not fully charged (at least 8.2 volts), it will automatically charge when the camera has DC power and is fully booted up. While charging, the camera's power draw is 18W, and the Battery LED on the back of the camera is Blue (if not armed) or Cyan (if armed).

The battery will not charge or stop charging under the following conditions:

- A battery fault is detected. In this case, the LED is Red.
- The battery will also stop charging automatically once it is fully charged. The LED light is off for a fully charged battery that is not armed.

A fully depleted battery requires 2.5 to 3 hours to fully charge.

Miro C210J Rear View

Miro C210 Rear View

Supported Resolutions

Resolution (W x H)	Max FPS[1]
1280 x 1024	1,800
1280 x 720	2,540
768 x 768	2,385
640 x 480	3,760
512 x 512	3,533
384 x 288	6,103
256 x 256	6,811
128 x 128	12,702
64 x 8	67,142

[1] *Determined by 'Resolution' (Height) setting*

miro c faqs

What is the difference between the Miro C210J and Miro C210?

The difference is in the connections. The Miro C210J must be operated through a system cable to the Miro Junction Box and does not have a separate power connector. It is the perfect, lowest cost solution for a system of multiple connected cameras. The Miro C210 has the same 3 connectors as other Miros. It can be powered and operated independently, or, with a Miro C Capture cable, it can also connect to the Miro Junction Box.

Otherwise, the Miro C210J and Miro C210 are the same.

Will my old Miro RCU cable work with the Miro C's?

The Miro RCU cable (part number VRI-CBL-MIRO-RCU) can work with the Miro C's, however it does not have a port for SDI. Therefore, to see video, you need to connect the DIN and BNC cable from the front of the camera to the RCU. The Miro C RCU cable (part number VRI-CBL-MIROC-RCU) has an additional BNC port for SDI, making the connection more convenient.

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 breakout box work with these cameras? What signals are available?

The Miro C210J does not use a Breakout box, because it receives signaling from the JBox through the System cable. The Miro C210 can use the Breakout box, and in fact comes with the Mini-Breakout box (part number VRI-MINI-BOB).

The signals available to both cameras are:

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

What is the worst case power draw of the camera?

The cameras draw 18W while the batteries are charging. Otherwise, they draw only 12W during operation.

miro junction box faqs

Which camera can I use with the Miro Junction Box?

The Miro Junction Box (JBox) accepts all Miro cameras – The Miro C210J uses a System Cable, all other Miro cameras require a Miro C Capture Cable. Please note that the Miro JBox cannot accept other Phantom cameras.

If boxes are connected together, how many power sources are needed?

Each JBox needs its own power source, such as a power supply, even if they are connected together.

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.

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.

Sensor & OLPF 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.
- The OLPF assembly is removable and located in front of the sensor. Once the lens mount is uninstalled the OLPF can be easily removed (2 screws) for cleaning (if applicable).
- 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 or OLPF.
- Never put sharp objects near the surface of the OLPF or sensor.
- Always keep the Phantom body cap on the camera when there is no lens attached.

contacting support

Global Headquarters

Vision Research, Inc. - Wayne, New Jersey

100 Dey Road
Wayne, New Jersey 07470 USA

T: +1.973.696.4500

F: +1.973.696.0560

For answers to most questions, please visit us at:
www.**phantom**highspeed.com

For general product, account, order / RMA status inquires and other non-technical questions please e-mail us at:

customer.support@visionresearch.com

For technical product support, product operation or applications support please e-mail us at:
technical.support@visionresearch.com

Live Customer and Technical Support

Serving the Americas:

M-F 8:00 AM to 5:00 PM EST (GMT-4:00)

Vision Research, Inc. - Wayne, New Jersey

T: +1.973.696.4500

F: +1.973.696.0560

Customer Support, extension 4002

Technical Support, extension 4003

Serving Europe, the Middle East and Africa:

M-F 9:00 AM to 6:00 PM GMT +3:00

Vision Research, Inc. - Bucharest, Romania

T: +40 21 210 8587

F: +40 21 210 8587

Serving Asia Pacific:

M-F 8:00 AM to 5:00 PM GMT +8:00

Vision Research, Inc. - Shanghai, China

T: 86-21- 58685111, ext:141

www.phantomhighspeed.com

Vision Research - Corporate Headquarters
100 Dey Road
Wayne, New Jersey 07470
USA
Ph: +1.973.696.4500
Toll Free: 800.737.6588
Fax: +1.973.696.0560

Vision Research Ltd. - UK
Suite F8, Bedford i-lab
Priory Business Park
Stannard Way, Bedford
MK44 3RZ, United Kingdom
Ph: +44 1234 834 850
Fax: +44 1234 834 851

PN: ZDOC-64106-MA-0001 Rev 3