INSITE PACIFIC Inc.
IMAGING SYSTEMS FOR HARSH ENVIRONMENTS

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TECHNICAL MANUAL

MINI ZEUS 4K

COMPACT, 4K, HIGH DEFINITION,

UNDERWATER COLOR TELEVISION CAMERA

PUBLICATION NUMBER: 1341500-1 Rev -

Release Date: July 31, 2018

PROPRIETARY INFORMATION STATEMENT:

PRODUCT WARRANTY

INSITE PACIFIC, hereinafter referred to as the COMPANY, provides the following warranty for its products:

The COMPANY agrees to correct, either by repair or replacement, at the sole discretion of the COMPANY, any defect in material or workmanship that occurs within one year after the delivery of any standard product to the original purchaser of the equipment. This is provided that investigation and inspection by the COMPANY reveals that the equipment was used under normal operating conditions. All shipping and associated costs for sending the cameras to the COMPANY and sending them back to the Customer are to be paid for by the Customer.

Exceptions and conditions of the warranty are as follows:

a. The warranty shall be void if repairs and/or modifications are made by any persons other than COMPANY employees or duly authorized COMPANY service personnel, unless such repairs are made with the prior written consent of the COMPANY.

b. In the event of a product failure and the customer fails to take prompt reasonable action to prevent further damage to the product, the COMPANY will not be held responsible for any further damage.

c. The COMPANY does not accept any liability concerning any consequential or incidental damage of any sort that occurs as the result of the operation, repair, and/or maintenance of its products.

d. This warranty shall be governed by the laws of the state of California within the United States of America.

CUSTOMER SERVICE

This product has undergone mechanical and electrical testing to insure that all specifications have been adhered to. Should you have any difficulty regarding the operation, maintenance or repair of this camera please contact INSITE PACIFIC customer service department at the below address or one of its authorized service centers.

RETURN OF EQUIPMENT FROM FOREIGN LOCATIONS

In the event equipment is required to be returned to INSITE PACIFIC from foreign locations, the following information must be provided on all invoices and shipping documents.

The original purchase order should be provided on any shipping documents or declarations. The shipment is to be consigned to:

INSITE PACIFIC INC.
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DECLARATION

I, _____, DECLARE THAT THE ARTICLES SPECIFIED HEREIN ARE TO THE BEST OF MY KNOWLEDGE AND BELIEF, ARE THE PRODUCT OF THE UNITED STATES AND THAT THEY WERE EXPORTED FROM THE PORT OF _____ ON OR ABOUT _____ 20____; THAT THEY ARE BEING RETURNED WITHOUT HAVING BEEN INCREASED IN VALUE OR IMPROVED IN CONDITION BY ANY PROCESS OR OTHER MEANS.

INTRODUCTION:

This manual provides the necessary information for the operation of this camera. The manufacturer assumes no liabilities for repairs or adjustments made to this camera other than by duly authorized personnel.

The information in this manual is believed to be accurate and reliable. The manufacturer assumes no responsibility for its use.

INSITE PACIFIC reserves the right to change or modify designs or specifications as part of its continuing product improvement.

Mini Zeus 4K Camera Description:

The Mini Zeus Mark 4K is a compact, 4K video, high definition, color, zoom, underwater TV Camera. The camera is housed in a titanium housing with a hemispherical dome port incorporating a six lens corrective optics lens system.

The corrective optics lens system corrects for chromatic distortion, geometric distortion, radial distortion, and astigmatism as well as other optical abnormalities when using optical systems underwater.

Our proven corrective optical lens system also eliminates zoom and focus tracking errors. When the lens is properly tracking, the subject in focus at full lens telephoto (zoom in) will remain in focus on the monitor when you change the lens focal length position by zooming in and out on the same focused subject.

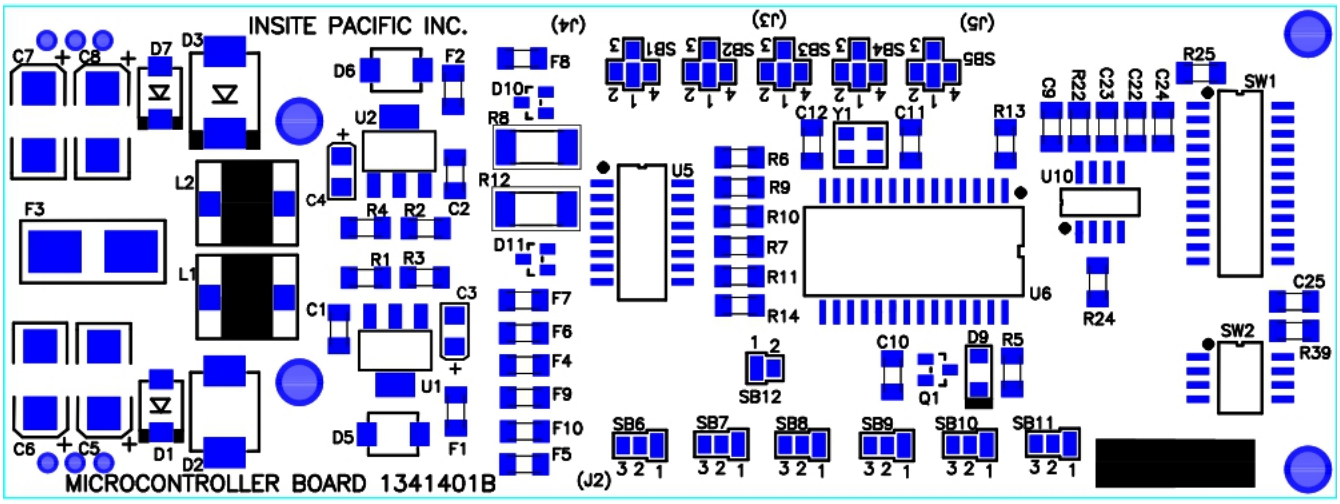
The Mini Zeus Mark 4K Camera is capable of outputting HD-SDI, 3G-SDI, and 6G-SDI video all out of the same camera. The camera can be configured for either an electrical or fiber optic HD-SDI, 3G-SDI, or 6G-SDI video output.

The Mini Zeus Mark 4K Camera can be configured for various video output formats, focus/iris/zoom control voltages, white balance settings, and RS232 or RS485 communication.

Mini Zeus 4K Camera:

Many of the circuit board settings are made with Solder Jumpers. All of the Solder Jumper and Switches are located on the top side of the circuit board.

Shown below is the top side of the Camera Microcontroller Board.



1.) Focus, Iris, and Zoom Command Voltages (Solder Jumpers SB2, SB3, SB4, SB5, & SB6)

These jumper settings are used when single wire focus, iris, and zoom control voltages of 0Vdc/12Vdc, 0Vdc/24Vdc, +6Vdc/-6Vdc, and +12Vdc/-12Vdc are applied. These single wire control voltages are with respect to ground/0Vdc. They apply a reference voltage to the optoisolator input when two wire control isn't used. Do not install any of these jumpers when two wires are used for focus, iris, and zoom control. These jumpers are not necessary when the camera is controlled through either an RS232 or RS485 serial link.

	Solder Jumper Settings				
Control Voltages	SB2 (Focus)	SB3 (Zoom)	SB4 (Focus A/M)	SB5 (Iris)	SB6 (Iris A/M)
0Vdc & +12Vdc	1 - 3	1 - 3	1 - 3	1 - 3	1 - 3
0Vdc & +24Vdc	1 - 2	1 - 2	1 - 2	1 - 2	1 - 2
+6Vdc & -6Vdc	1 - 4	1 - 4	1 - 4	1 - 4	1 - 4
+12Vdc & -12Vdc	1 - 4	1 - 4	1 - 4	1 - 4	1 - 4

2.) RS232, RS485, and DC Voltage Signal Routing (Solder Jumpers SB7, SB8, SB9, SB10, SB11, & SB12)

These jumper settings are to configure the input and output path of the microcontroller depending on whether RS232 or RS485 comm's are used or if DC voltages are used for focus, zoom, and iris control.

NOTE: The camera can't be configured for both DC voltage and RS232/RS485 camera control at the same time. The camera must be configured for either one mode or the other.

Solder Jumper	Camera Board RS232 Comm's	Camera Board RS485 Comm's	Camera Board DC Voltage Control
SB7	2 - 3	2 - 3	1 - 2
SB8	2 - 3	2 - 3	1 - 2
SB9	1 - 2	2 - 3	2 - 3
SB10	1 - 2	2 - 3	2 - 3
SB11	1 - 2	2 - 3	OPEN
SB12	1 - 2	2 - 3	OPEN

3.) Focus and Zoom Speed (Solder Jumper SB12)

This jumper will set the Focus and Zoom Speeds to either the factory default settings or to Slow Focus & Zoom Speeds. This setting is for when using DC voltages for focus, zoom, and iris for control of the camera. This jumper setting will have no affect when the camera is controlled through either an RS232 or RS485 serial link.

Solder Jumper	SB12
Factory Default Speed	OPEN
Slow Focus & Zoom Speed	1 - 2

4.) Video Mode Switch (Switch SW1)

Switch SW1 selects the video output format of the camera module. The High Definition formats of 2160p/29.97, 2160p/25, 1080p/59.94, 1080p/50, 1080p/29.97, 1080p/25, 1080i/59.94, 1080i/50, 720p/59.94, 720p/50, 720p/29.97, and 720p/25 are selected via this switch. These switch settings are for when using DC voltages for focus, zoom, and iris for control of the camera. These switch settings will have no affect when the camera is controlled through either an RS232 or RS485 serial link. The Circuit Board in the Control Unit (if used) or the Sony Software (GUI) will set the video output format of the camera module when the camera is controlled through either an RS232 or RS485 serial link.

SWITCH POSITION	2160p /29.97	2160p /25	1080p /59.94	1080p /50	1080i /59.94	1080i /50	1080p /29.97*	1080p /25*	720p /59.94	720p /50	720p /29.97*	720p /25*
12	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
11	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
10	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
9	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
8	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
7	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
6	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
5	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
4	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

* Please note that for the Video Modes of 1080p/29.97, 1080p/25, 720p/29.97, and 720p/25 the frame rate of system in the monitoring mode is the screen update interval. For these four video formats the same image is output two times. Your TV monitor and recording equipment may think that the 1080p/29.97 signal is 1080p/59.94, the 1080p/25 signal is 1080p/50, the 720p/29.97 signal is 720p/59.94, and the 720p/25 signal is 720p/50.

Following is the procedure to make changes is the video output signal.

1.) With the Camera turned off, set Switch SW1 to the desired video output.
2.) Power up the Camera and wait for approximately 5 seconds. This loads the desired video output mode into the register of the Camera Module.
3.) Turn off power to the Camera.
4.) Finally, power up the Camera and the video output will now match the desired setting on Switch SW1.

5.) White Balance Setting (Switch SW2)

There are five different White Balance Settings that are selectable by Switch SW2. This switch setting is for when using DC voltages for focus, zoom, and iris for control of the camera. This switch setting will have no affect when the camera is controlled through either an RS232 or RS485 serial link.

Auto (AWB): This mode computes the white balance value output using color information from the entire screen. It outputs the proper value using the color temperature radiating from a black subject based on a range of values from 2500K to 7500K. This mode is the factory default setting.

One Push WB: The One Push White Balance mode is a fixed white balance mode that may be automatically readjusted only at the request of the user by momentarily pressing pushbutton switch SW2, assuming that a white subject, in correct lighting conditions, and occupying more than 1/2 of the image, is submitted to the camera. One Push White Balance data is lost when the power is turned off. If the power is turned off, reset One Push White Balance.

5800K: This setting is for lighting that is the color temperature of bright sunlight.

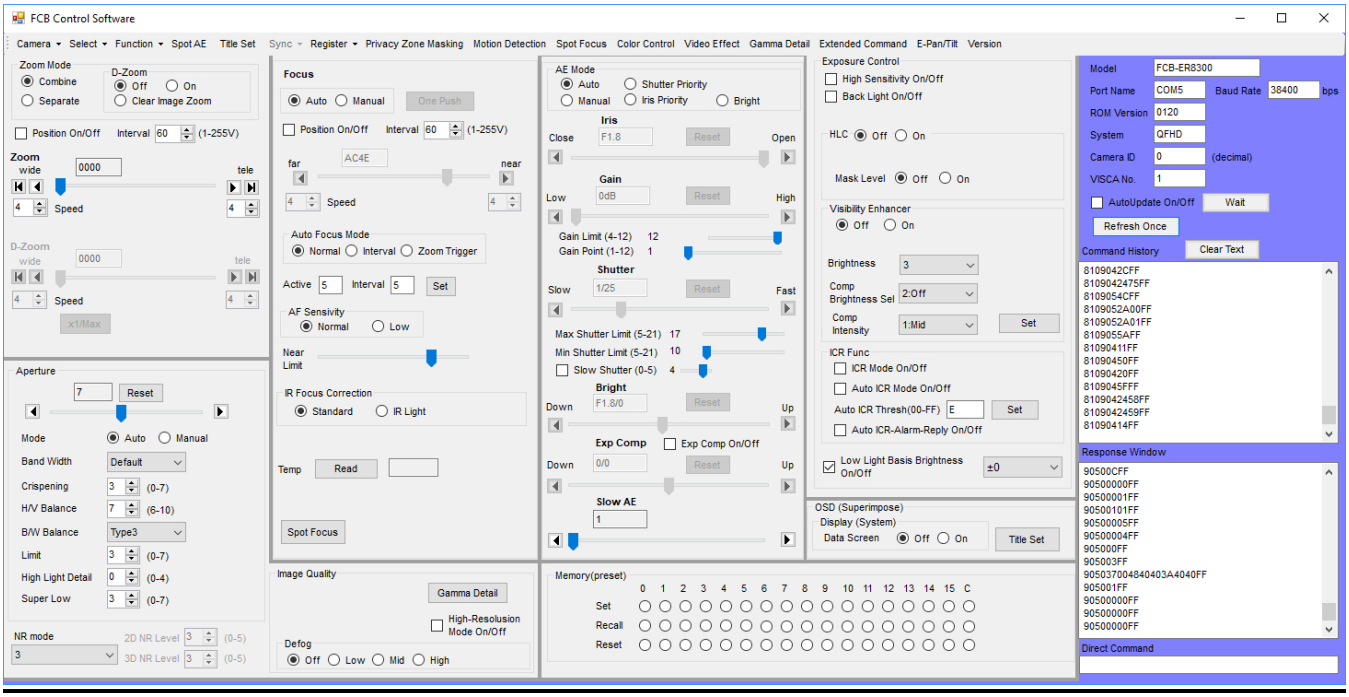
3200K: This setting is for Tungsten Halogen lighting.

Auto Tracing (ATW): Will automatically adjust the white balance using the brightest object in the scene as white. It has a range of 2000K to 10000K. Incorrect white balance settings can occur, especially if looking at scene with a single color in it such as green. The white balance will shift more towards the red.

SWITCH POSITION	AUTO (AWB)	ONE PUSH WB	5800K	3200K	AUTO TRACING (ATW)
1	OFF	ON	OFF	OFF	OFF
2	OFF	OFF	ON	OFF	OFF
3	OFF	OFF	OFF	ON	OFF
4	OFF	OFF	OFF	OFF	ON

Camera Control Using Sony's Windows Based GUI:

See the Sony Operation Manual for the FCB-ER8300 Camera Module for detailed information on various camera settings/controls and for VISCA Serial Protocol information. Below is a screen capture of Sony's GUI.



After starting the GUI, click on the "Refresh Once" button located on the top right side of the GUI to load the current camera settings. Failure to do so will not allow communication with the camera.

Camera Control Using the Mini Zeus 4K Camera Contrl Unit:

Insite Pacific's Camera Control Unit provides control of focus (near/far & auto/manual), iris (open/close & auto/manual), and zoom (tele/wide) as well as the white balance and video format settings via an RS232 or RS485 output from the control unit. The baud rate for camera communication is 38.4k baud and is not adjustable. Serial communication between the control unit and camera is based on Sony's Visca Protocol. The control unit can be directly replaced by a computer running Sony's Software (GUI) for the FCB-ER8300 Camera Module.

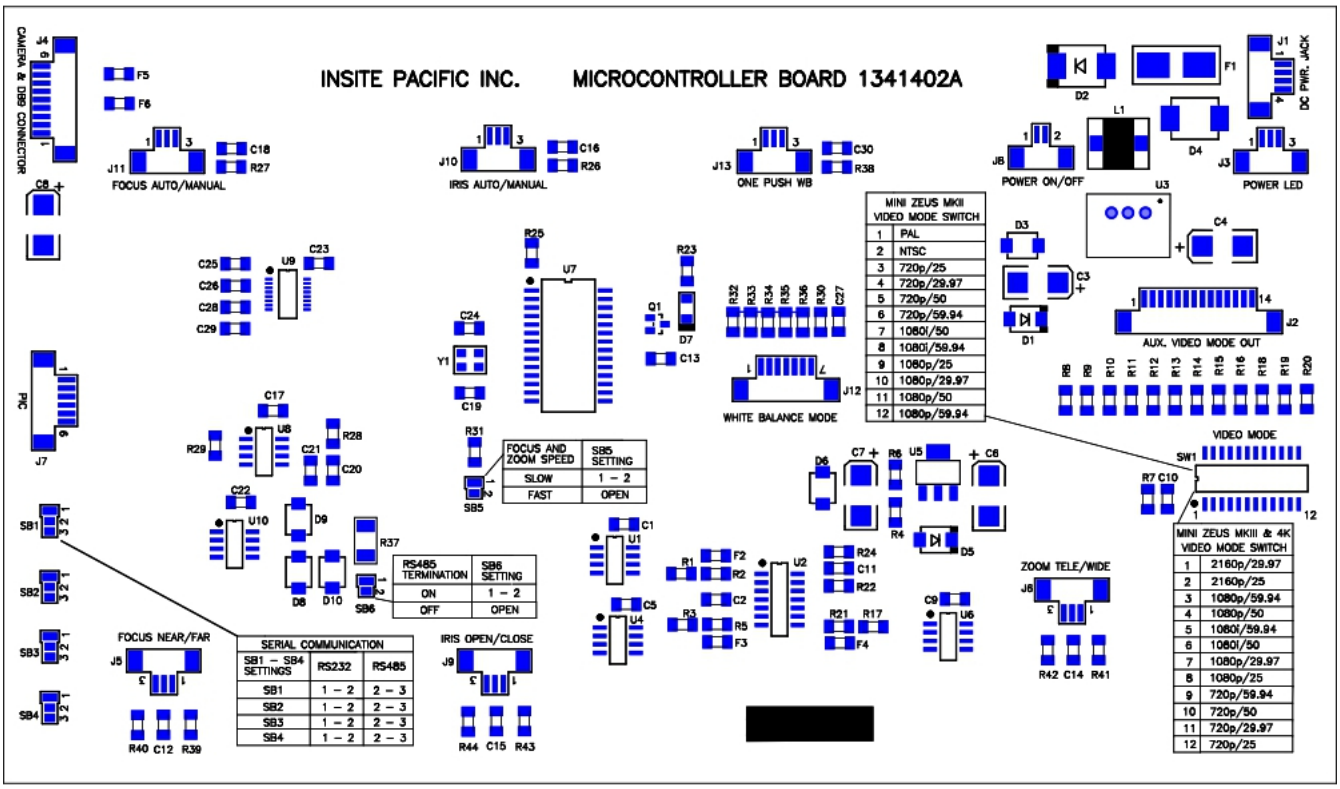
When the Camera is configured for use with the Mini Zeus 4K Camera Control Unit, the Circuit Board in the Control Unit becomes the master board. That means that Camera settings such as the Video Mode, White Balance Settings, etc. are made in the Control Unit. The Camera Housing does not need to be opened up to make any changes in settings. The output of the Control Unit will not be DC voltages, but instead will be an RS232 or RS485 signal. When the Camera is operated without Insite's Control Unit and is controlled via DC voltages for focus, zoom, and iris the Camera Housing will have to be opened to make any settings changes.

It is very important that the Control Unit is powered up either at the same time as the Camera or after the Camera has been powered up. The microcontroller in the Control Unit sends initial Camera settings only once, when the Control Unit is powered up.

Please note that the configuration of the Camera is the same whether it is controlled by the Mini Zeus 4K Camera Control Unit or Sony's Software (GUI). The Camera's configuration is different when using DC voltages for focus, zoom, and iris for control of the Camera.

The enclosure has a top half and a bottom half and they slide together (see the images below).

Shown below is the top side view of the Control Unit Microcontroller Board. There are no components on the bottom side of the board. To gain access to the Circuit Board you will need to remove the four screws on each side of the enclosure and then remove the black plastic side covers. Next you will need to unplug the connector that mates with the “CAMERA & DB9 CONNECTOR” (Connector J4). Then you will have to unplug the connector that mates with the “DC PWR. JACK” Connector (Connector J1). At the same time slide the top half of the enclosure, along with the circuit board, out of its retaining grooves in the bottom half of the enclosure. Leave the remaining wire harnesses connected to the top half of the enclosure as you are sliding out the circuit board.



1) RS232 and RS485 Signal Routing (Jumpers SB1, SB2, SB3, SB4.)

These jumper settings are to configure the input and output path of the microcontroller depending on whether RS232 or RS485 comm’s are used for focus, zoom, and iris and white balance control.

Solder Jumper	RS232 Comm’s	RS485 Comm’s
SB1	1 - 2	2 - 3
SB2	1 - 2	2 - 3
SB3	1 - 2	2 - 3
SB4	1 - 2	2 - 3

2) Focus and Zoom Speed (Jumper SB5)

This jumper setting is not used and needs to be set to the factory default setting of not being installed.

3) RS485 Termination (Jumper SB6)

This solder jumper setting is used to either connect or remove the RS485 termination resistor (R37) that is connected across the RS485+ and RS485- serial communication lines. The default setting is for the RS485 termination to be set to the Open setting.

Solder Jumper	RS485 Termination On	RS485 Termination Off
SB6	1 - 2	Open

4) Video Mode Switch (Switch SW1)

Switch SW1 on the Circuit Board selects the video output format of the camera module. The High Definition formats of 2160p/29.97, 2160p/25, 1080p/59.94, 1080p/50, 1080p/29.97, 1080p/25, 1080i/59.94, 1080i/50, 720p/59.94, 720p/50, 720p/29.97, and 720p/25 are selected via this switch. This switch setting is for when the camera is controlled through either an RS232 or RS485 serial link.

SWITCH POSITION	2160p /29.97	2160p /25	1080p /59.94	1080p /50	1080i /59.94	1080i /50	1080p /29.97*	1080p /25*	720p /59.94	720p /50	720p /29.97*	720p /25*
12	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
11	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
10	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
9	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
8	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
7	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
6	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
5	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
4	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

* Please note that for the Video Modes of 1080p/29.97, 1080p/25, 720p/29.97, and 720p/25 the frame rate of system in the monitoring mode is the screen update interval. For these four video formats the same image is output two times. Your TV monitor and recording equipment may think that the 1080p/29.97 signal is 1080p/59.94, the 1080p/25 signal is 1080p/50, the 720p/29.97 signal is 720p/59.94, and the 720p/25 signal is 720p/50.

Following is the procedure to make changes is the video output signal.

1.) With the Camera and Control Unit turned off, set Switch SW1 to the desired video output.
2.) Power up the Camera and Control Unit and wait for approximately 5 seconds. This loads the desired video output mode into the register of the Camera Module.
3.) Turn off power to the Camera and the Control Unit.
4.) Finally, power up the Camera and the Control Unit and the video output will now match the desired setting on Switch SW1.

5) White Balance Mode Switch

There are five different selectable White Balance Settings.

Auto (AWB): This mode computes the white balance value output using color information from the entire screen. It outputs the proper value using the color temperature radiating from a black subject based on a range of values from 2500K to 7500K. This mode is the factory default setting.

One Push WB: The One Push White Balance mode is a fixed white balance mode that may be automatically readjusted only at the request of the user by momentarily pressing the pushbutton switch, assuming that a white subject, in correct lighting conditions, and occupying more than 1/2 of the image, is submitted to the camera. One Push White Balance data is lost when the power is turned off. If the power is turned off, reset One Push White Balance.

5800K: This setting is for lighting that is the color temperature of bright sunlight.

3200K: This setting is for Tungsten Halogen lighting.

Auto Tracing (ATW): Will automatically adjust the white balance using the brightest object in the scene as white. It has a range of 2000K to 10000K. Incorrect white balance settings can occur, especially if looking at scene with a single color in it such as green. The white balance will shift more towards the red.

6) One Push WB Trigger Switch

To use the One Push White Balance function, the White Balance Mode Switch must be set to the "ONE PUSH WB" setting. The One Push White Balance mode is a fixed white balance mode that may be automatically readjusted only at the request of the user by momentarily pressing down on the pushbutton switch, assuming that a white subject, in correct lighting conditions, and occupying more than 1/2 of the image, is submitted to the camera. One Push White Balance data is lost when the power is turned off. If the power is turned off, reset One Push White Balance.

7) Power On/Off Switch

This switch will turn off and on the power going to the Microcontroller Board inside of the Control Unit as well as the 24Vdc power going to the Camera Connector on the rear panel of the Control Unit.

8) Focus Near/Far Potentiometer

The focus near/far control is defined as positional control. The dc voltage generated by the focus slider potentiometer control corresponds to a particular focus setting on the camera's lens.

9) Focus Auto/Manual Switch

The focus auto/manual switch is a toggle switch. It is used to put the camera into either the Auto Focus or Manual Focus mode of operation.

10) Zoom Tele/Wide Potentiometer

The zoom control is defined as rate control. The further that the joystick is pressed in either the tele or wide direction, the faster the lens will zoom in or out.

11) Iris Open Close Potentiometer

The iris open/close control is defined as positional control. The dc voltage generated by the iris slider potentiometer corresponds to a particular iris setting on the camera's lens.

12) Iris Auto/Manual Switch

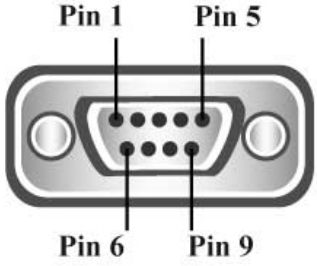
The iris auto/manual switch is a toggle switch. It is used to put the camera into either the Auto Iris or Manual Iris mode of operation.

13) Serial Out Connector

This connector is located on the rear panel of the Control Unit. RS232 and RS485 serial outputs are available on this DB9 male connector. The serial connections on this connector are wired in parallel with the serial connections of the Camera Connector. When the Control Unit is configured for RS232 serial communication, the pinouts on the DB9 male connector match that of an RS232 serial port on a PC computer, which allows you to easily switch connections from the Control Unit to an RS232 serial port on a PC. The Digi-Key part number for the mate connector/pigtail for the Serial Out Connector is p/n: 602-1413-ND and can be found at the link https://www.digikey.com/products/en?keywords=602-1413-ND.

DB9 MALE CONNECTOR PIN #	FUNCTION
1	Not Connected
2	RS232 Txd or RS485+
3	RS232 Rxd or RS485-
4	Not Connected
5	Ground/0Vdc
6	Not Connected
7	Not Connected
8	Not Connected
9	Not Connected

Below is a face view of the Serial Out Connector as seen on the external side of the Control Unit.

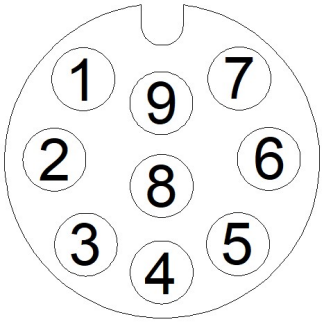


14) Camera Connector

This connector is located on the rear panel of the Control Unit. Camera Power, RS232 serial connections, RS485 serial connections, Focus Position output, Iris Position Output, and Zoom Position Output are all available on this connector. DC voltages representing actual Zoom, Focus, and Iris lens positions (supplied by the camera) are output from the control unit. Focus position has a maximum voltage range of 0VDC (= far) to 5VDC (= near). Zoom position has a voltage range of 0VDC (= wide) to 5VDC (= tele). Finally, Iris position has a voltage range of 0VDC (= close) to 5VDC (= open). Should you only wish to use either the RS232 or RS485 serial output from the Control Unit, then you may want to use the Serial Out connections from the Control Unit on the DB9 male connector. The Digi-Key part number for the mate connector for the Camera Connector is p/n: SC1228-ND and can be found at the link https://www.digikey.com/products/en?keywords=SC1228-ND.

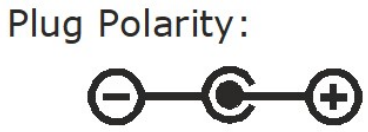
CAMERA CONNECTOR PIN #	FUNCTION
1	+24Vdc Out
2	Ground/0Vdc
3	RS232 Rxd or RS485-
4	RS232 Txd or RS485+
5	Ground/0Vdc
6	Zoom Position Output
7	Focus Position Output
8	Iris Position Output
9	Ground/0Vdc

Below is a face view of the Camera Connector as seen on the external side of the Control Unit.



15) DC Power In

This connector is located on the rear panel of the Control Unit. A range of voltage from 16Vdc to 30Vdc can be input on this connector to supply power to the Control Unit and to the Camera. Supplied with the Control Unit is an AC to DC adapter that outputs 24Vdc @ 1.5A. The Digi-Key part number for the AC to DC adapter is p/n: 102-3593-ND and can be found at the link https://www.digikey.com/products/en?keywords=102-3593-ND.



Comprehensive Specifications:

Electrical:

Image Sensor:	1/2.3 Type “Exmor R” CMOS Sensor
Picture Elements	8930K pixels
HD Video Formats:	2160p/29.97, 2160p/25, 1080p/59.94, 1080p/50, 1080p/29.97, 1080p/25, 1080i/59.94, 1080i/50, 720p/59.94, 720p/50, 720p/29.97, and 720p/25
Minimum Illumination:	0.75 Lux (1/30 sec, 50%, High Sensitivity mode ON)
	3.0 Lux (1/30 sec, 50%, High Sensitivity mode OFF)
	0.1 Lux (1/4 sec (1/3 sec), 50%, High Sensitivity mode ON)
	0.38 Lux (1/4 sec (1/3 sec), 50%, High Sensitivity mode OFF)
Recommended Illumination:	100 lx to 100,000 lx
Camera Power:	15 - 30 VDC at nominal 350mA
White Balance:	Auto, 3200K, 5800K, ATW, One Push WB

Mechanical:

Depth:	Refer to installation drawing.
Size:	Refer to installation drawing.
Housing Material:	Refer to installation drawing.
Pressure Window:	Optically Polished Hemispherical Precision Glass.
Connector:	Customer specified.

Environmental:

Operating Temp:	0°C (32°F) to 60°C (140°F)
Storage Temp:	-20°C (-4°F) to 60°C (140°F)