



PTZ-35x140™ with Foveus™



Users Guide

427-0011-00-10

Version 100



 **Cautions and Warnings:**

- Do not disassemble the PTZ-35x140™ enclosure. Disassembly can cause permanent damage and will void the warranty.
- Operating PTZ-35x140™ outside of its specified operating temperature range or voltage range can cause permanent damage and will void the warranty.
- Avoid pointing the device directly at extremely high-intensity radiation sources, such as the sun, lasers, arc welders, etc. This warning applies whether or not the system is powered.
- Only clean the lens in the manner prescribed in the Appendix of this document.
- If you have questions that are not covered in this manual, or need service, contact FLIR Support at 1-888-747-3547 for additional information.



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INTRODUCTION

The PTZ-35x140™ is a versatile, dual field of view thermal and visible imaging system that provides a high resolution thermal image with a 5° view nested inside a wider 20° view. This image presentation concept derived from human vision offers excellent situational awareness and long range threat detection, simultaneously. This advanced payload is packaged in a precision pan/tilt enclosure that will slew up to 120° per second. The system supports stand-alone or network operation with a Nexus® interface.

The PTZ-35x140™ incorporates the latest in visible and uncooled thermal imager performance with both IP networked control and video connectivity for installation into sophisticated emerging security infrastructures and serial and analog connectivity for current widely proliferated infrastructures. The Foveus™ thermal imagery is provided as continually zoomed video from 20° horizontal field of view to less than 1 degree horizontal field of view. The thermal imagery is presented in a novel blending of two thermal images to provide high resolution in the critical 5° center area while simultaneously providing medium resolution in the 20° situational awareness zone. This presentation is an application of the design of the human eye, with the foveal region of the retina employing higher density detectors than the peripheral area, thus the moniker Foveus™.

UNPACKING YOUR PTZ-35X140:

- PTZ-35x140 with Foveus 427-0011-XX
- Break-Out Connector Cable (1 DB9 RS-422 and 1 DB9 Maintenance for communication, 1 BNC for composite video, 1 RJ45 Ethernet, terminal rings for power) 308-0117-00
- Nexus® Console Software (unlimited copy rights)

Optional Accessories:

- 40 ft System Cable 308-0116-02 (shown below)
- 24V Power Supply 206-0004-01 (shown below)
- Nexus® Console Joystick 223-0017-00 (shown below)

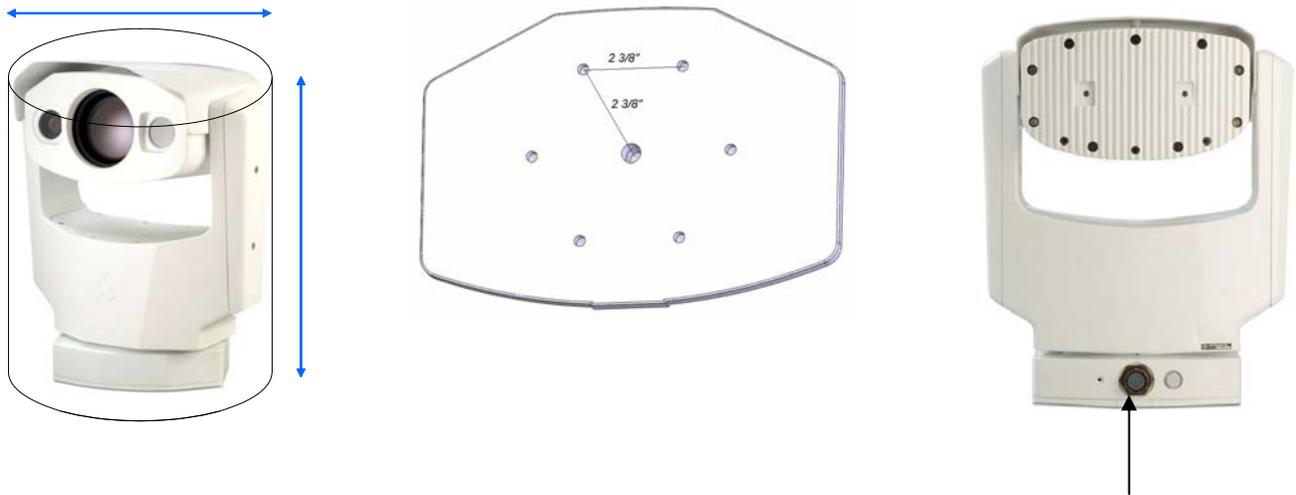




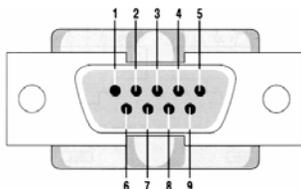
QUICK-START INFORMATION

The following instructions will get you started with basic operation of the PTZ-35x140™ with Foveus™.

1. Firmly secure camera using mounting pattern shown below to a designated frame or structure able to support and allow for device travel.



2. Connect System Cable into camera base shown above. Then attach the other end of the sealed System Cable to the break-out pigtail.
3. If using the video output then plug a standard BNC cable to the connection labeled “VIDEO P2” on the break-out pigtail.
4. If you intend to use the PELCO-D Interface for remote control of the device attach a standard DB9 RS-422 cable to the connection labeled “USER P3” on the break-out pigtail. Connect the other end of the RS-422 cable to an available port on remote control device such as a KBD300. (Be sure to note that the pin settings are from the camera and must be swapped on the controller device!) Pin settings are shown here below:



| RS-422 DB9 Pin or “USER P3” | | |
|-----------------------------|------------|-------|
| COM 1 Tx A (-) | Signal OUT | Pin 2 |
| COM 1 Rx B (+) | Signal IN | Pin 3 |
| COM GND | | Pin 5 |
| COM 1 Tx B (+) | Signal OUT | Pin 7 |
| COM 1 Rx A (-) | Signal IN | Pin 8 |



5. If you intend to use the Nexus® Console Software for both the remote control of the device and video streaming attach a standard CAT5 cable to the connection labeled “ETHERNET P5” on the break-out pigtail. Connect the other end to your PC.
6. Plug in either 24+/-10% VAC rms (50/60Hz) or 24+/-10% VDC directly to the connections labeled “PTPWR” and “SYSPWR” on the break-out pigtail.
7. If purchased the Pelco WCS4-20 Master Power Supply will connect directly via connections labeled “PTPWR” and “SYSPWR” on the break-out pigtail to the converter. Connect the black leads to COM and the red leads to 24V. Next, adjust the AC Input switch to either 115VAC (standard for US) or 230VAC (standard for Europe) and apply power to the Pelco converter.
8. Now the PTZ-35x140™ is ready for use. Note that the device will immediately zero itself and return back to home position upon applying power.

PELCO-D INTERFACE

The PTZ-35x140™ accommodates control via RS422. The command protocol for serial control shall be via PELCO-D commands including the following minimum control set:

**Table 1: Pelco D Command List**

| PTZ-35x140 Function | KBD300 | Pelco D Packet | Pelco D Response |
|---------------------------|--------------|----------------------|------------------|
| Pan/Tilt Drive | Up | FF 01 00 08 VV WW CK | FF 01 00 CK |
| | Down | FF 01 00 10 VV WW CK | FF 01 00 CK |
| | Left | FF 01 00 04 VV WW CK | FF 01 00 CK |
| | Right | FF 01 00 02 VV WW CK | FF 01 00 CK |
| | UpLeft | FF 01 00 0C VV WW CK | FF 01 00 CK |
| | UpRight | FF 01 00 0A VV WW CK | FF 01 00 CK |
| | DownLeft | FF 01 00 14 VV WW CK | FF 01 00 CK |
| | DownRight | FF 01 00 12 VV WW CK | FF 01 00 CK |
| | Stop | FF 01 00 00 VV WW CK | FF 01 00 CK |
| Increments Focus closer | Near button | FF 01 01 00 00 00 02 | FF 01 00 02 |
| Increments Focus farther | Far button | FF 01 00 80 00 00 81 | FF 01 00 81 |
| Zoom In or Decreases FoV | CW Joystick | FF 01 00 20 00 00 21 | FF 01 00 21 |
| Zoom Out or Increases FoV | CCW Joystick | FF 01 00 40 00 00 41 | FF 01 00 41 |
| IR Polarity to Black Hot | 1, Aux On | FF 01 00 09 00 01 0B | FF 01 00 0B |
| IR Polarity to White Hot | 1, Aux Off | FF 01 00 0B 00 01 0D | FF 01 00 0D |
| Active Camera DLTV | 2, Aux On | FF 01 00 09 00 02 0C | FF 01 00 0C |
| Active Camera IR | 2, Aux Off | FF 01 00 0B 00 02 0E | FF 01 00 0E |
| Toggle: Plateau Values | 3, Aux On | FF 01 00 09 00 03 0D | FF 01 00 0D |
| Toggle: AGC Type | 3, Aux Off | FF 01 00 0B 00 03 0F | FF 01 00 0F |
| AutoFocus | 4, Aux On | FF 01 00 09 00 04 0E | FF 01 00 0E |
| IR FFC | 4, Aux Off | FF 01 00 0B 00 04 10 | FF 01 00 10 |
| Toggle: LUT Palette | 5, Aux Off | FF 01 00 0B 00 05 11 | FF 01 00 11 |
| Toggle: AGC ROI | 6, Aux On | FF 01 00 09 00 06 10 | FF 01 00 10 |
| Toggle: Max Gain Value | 7, Aux Off | FF 01 00 0B 00 07 11 | FF 01 00 11 |

Also, refer to the User Controls for use with a Pelco KBD300A shown on the following page:



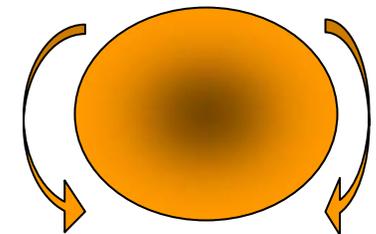
User Controls for KBD300A

To start type the Pelco Address (9,9) then CAM



| Keystrokes | Function | Toggle Values (default to first value) |
|--------------|--------------------------|--|
| Near button | Focus Near | |
| Far button | Focus Far | |
| CW Joystick | Zoom In | Increments from Wide to Tele |
| CCW Joystick | Zoom Out | Increments from Tele to Wide |
| 1, Aux On | IR Polarity to Black Hot | |
| 1, Aux Off | IR Polarity to White Hot | |
| 2, Aux On | Set DLTV as active | For both commands and video |
| 2, Aux Off | Set IR as active | For both commands and video |
| 3, Aux On | Toggle: Plateau Values | |
| 3, Aux Off | Toggle: AGC Type | |
| 4, Aux On | Autofocus | One shot Autofocus |
| 4, Aux Off | IR FFC | Internal calibration |
| 5, Aux Off | Toggle: LUT Palette | White, Black |
| 6, Aux On | Toggle: DDE Gain | Dynamic Detail Enhancement |
| 6, Aux Off | Toggle: AGC ROI | Full, Horizon, Sky, Ground, Center |
| 7, Aux Off | Toggle: Max Gain Values | |

| | | |
|------------|---|--------------|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |
| CAM | 0 | CLEAR |

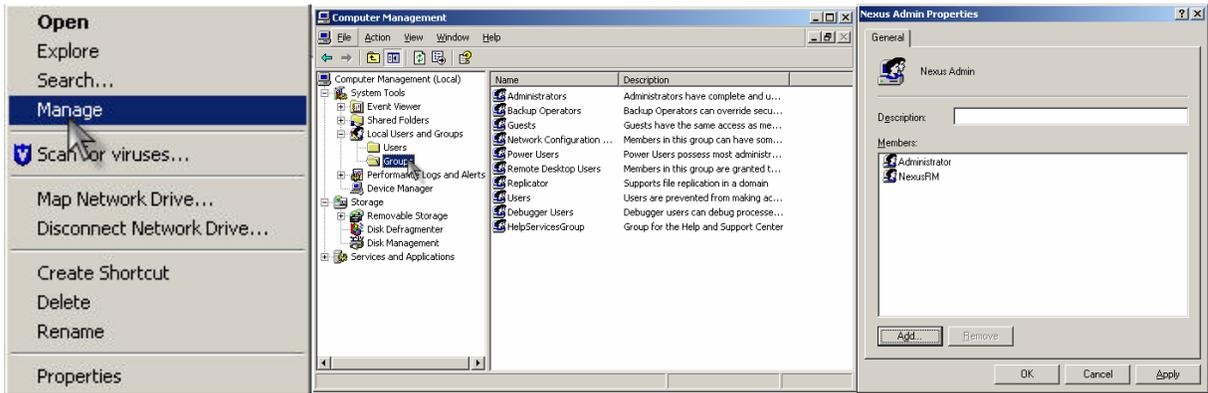


Note: Must have the appropriate active camera to use associated camera functions.

NEXUS® CONSOLE INTERFACE

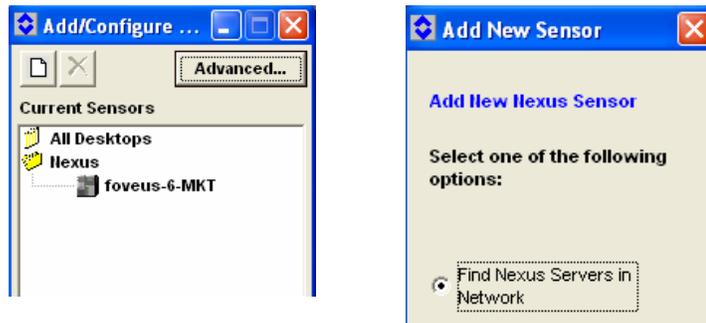
First install the Nexus® Console Software on your PC. The software installation procedure along with PC hardware requirements is described in the README provided on the CD.

Next, create the proper Windows LOCAL User Group called Nexus Admin then assign the group to the User you have logged in as (NOTE: Be sure to login and setup as LOCAL account User versus a Guest setup for a domain or contact your System Administrator.) This is shown below:



Below are the steps to remote control and stream video using the Nexus® Console:

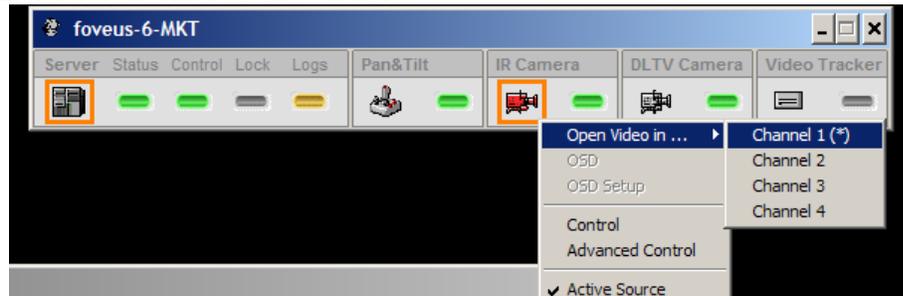
1. Double click on Nexus® Icon on desktop and launch Nexus®.
2. Be sure to verify the IP address of the camera (Default is 192.168.250.116) and that your PC and the camera are on the same subnet or have been routed correctly.
3. Select from the top menu pull-down Sensors->Add/Configure->Nexus Sensors.
4. Choose the white icon to “Add New Server Connection” then follow the options as shown here below then select “ACCEPT”.



5. Once you have selected the corrected device then you can open the camera from the top menu pull-down Sensors->Nexus->Open->”Camera Name” to view the following:



6. Be sure to select the "Control" (highlighted above) to establish control.
7. Next assign the joystick by selecting the Server Icon and right-click to "Assign Joystick". A orange rectangle box will appear on the Server Icon as shown below.
8. Next open a video channel by selecting the IR Camera Icon and right-click to open Channel 1 for thermal as shown here:



9. Next do the same for DLTV Camera to open Channel 2 for daylight.
10. Now you are ready to use the PTZ-35x140 with the Nexus® Console!

You have now completed the basic steps for setup of the PTZ-35x140. However, it is recommended that you read the rest of this User's Guide.

For further instructions on Nexus® please refer to the Nexus® User's Guide (Doc#428-0004-00-10) or contact FLIR Support at 1-888-747-3547.

PTZ-35X140™ PHYSICAL INTERFACE

DIMENSION DRAWINGS The following figures show a dimensioned drawing of the PTZ-35x140™.

Remember to firmly secure unit and allow for device travel.

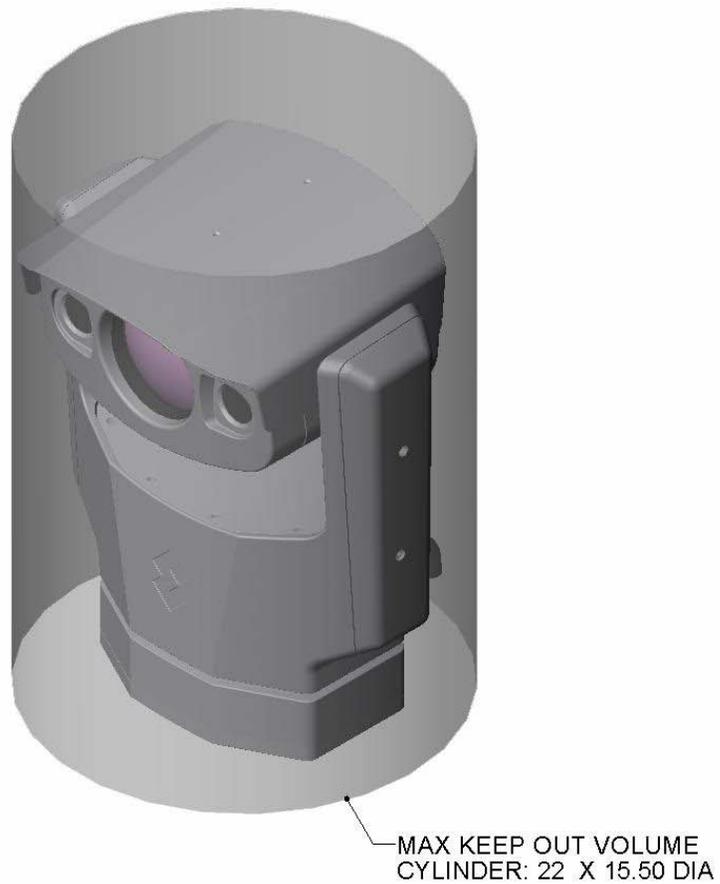


Figure 1: PTZ-35x140™ swept dimensions

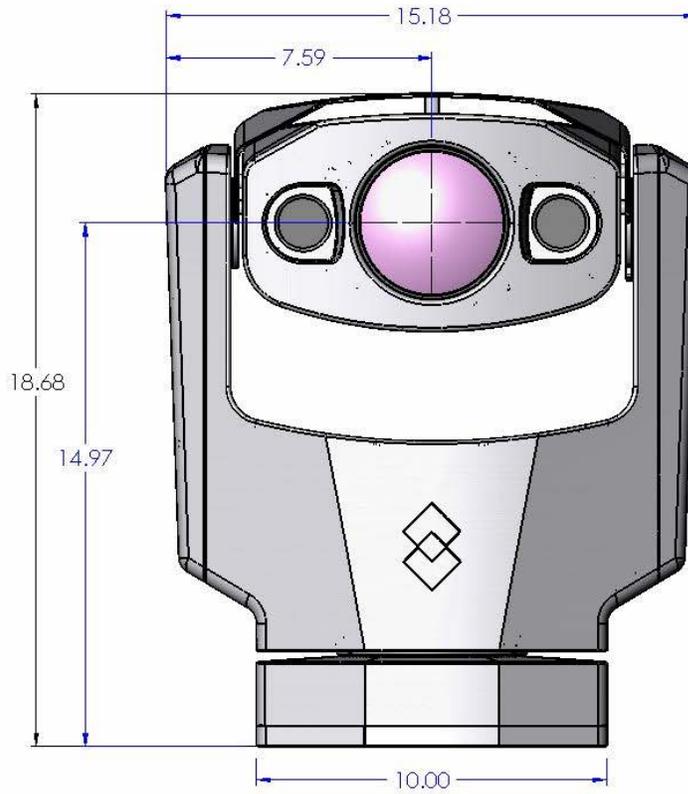


Figure 2: PTZ-35x140™ Dimension Drawing (inches)

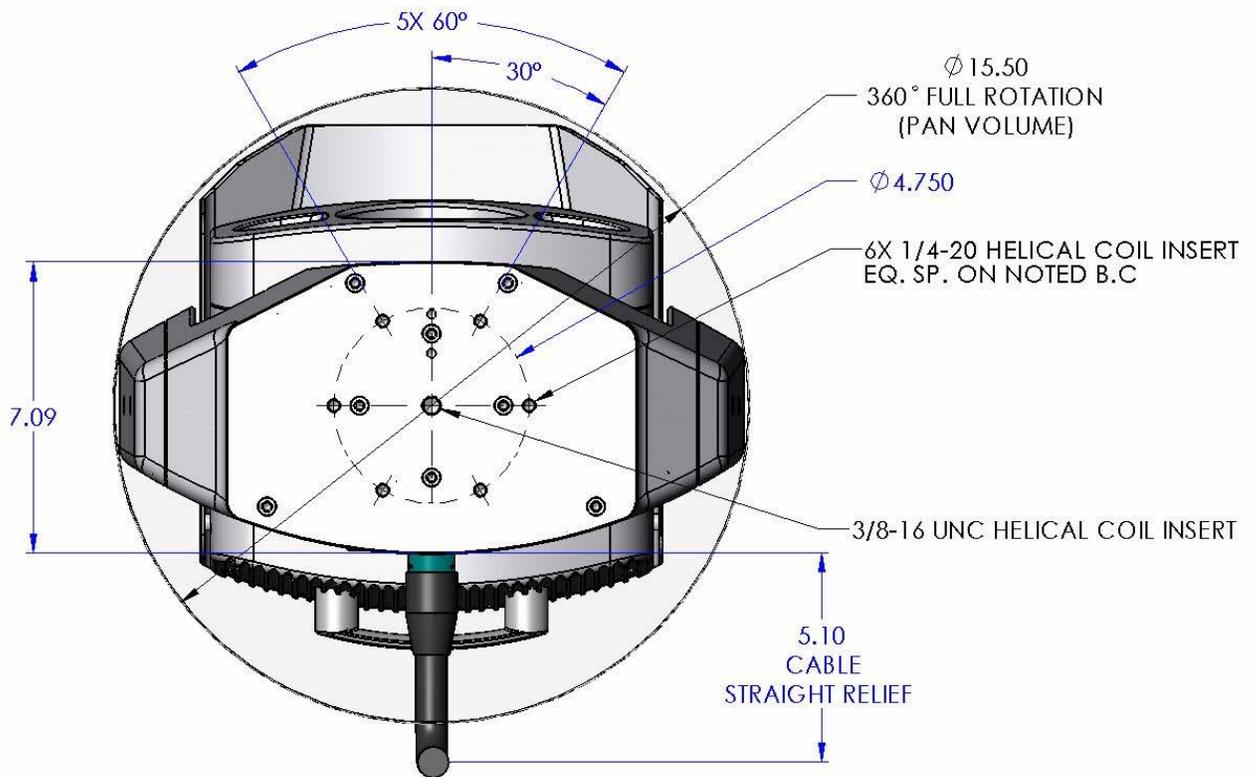
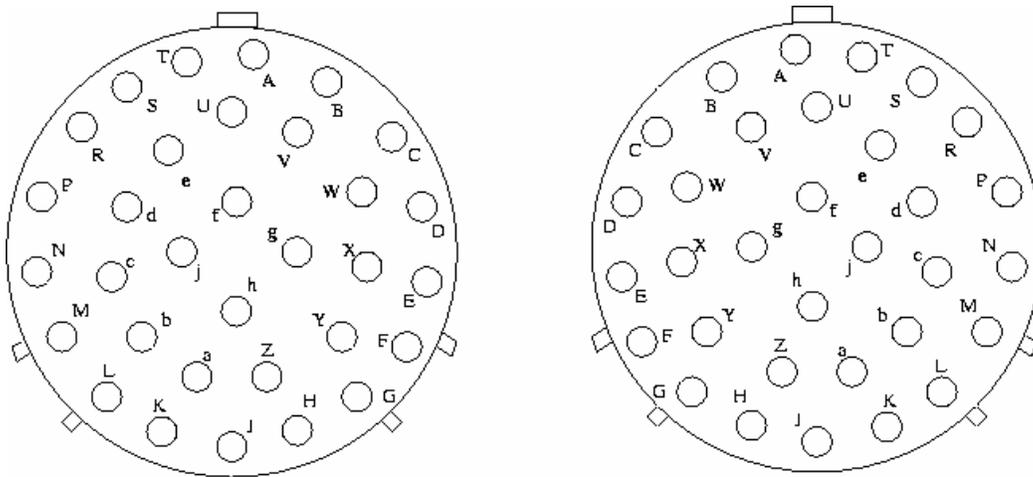


Figure 3: PTZ-35x140™ Dimension Drawing w/ hole pattern (inches)

SYSTEM INTERFACE CABLE CONNECTOR The PTZ-35x140™ uses an electrical-mechanical engagement system that requires only one integrated cable to interface with the sensor. The interface cable is 12.2 meters (40 ft) long and is terminated with a MIL-C-26482 Series 1 Connector. The table below describes the specifications:

| MIL-C-26482 Series 1 | |
|----------------------|----------------------------------|
| Shell Size | 18 |
| Insert Arrangement | 32 |
| Finish | Olive drab chromate over cadmium |
| Contacts | Pines |
| Shell Style | Cable plug |
| Insert Position | Keyring |



Interface cable connector front view (Male)

Chassis connector front view (Female)

Figure 4: PTZ-35x140™ Interface Cable Connector

| Function | Pin | Signal Name | Function | Pin | Signal Name | |
|---------------------|-----|-------------|---------------------|-------|----------------------|------------------|
| Power | j | Power In + | Comms P3 (USER) | M | Tx(+) RS-422 (COM1) | |
| | f | Power In + | | N | Rx(+) RS-422 (COM1) | |
| | g | Power In + | | c | GND RS-422 (COM1) | |
| | W | Power In + | | P | Tx (-) RS-422 (COM1) | |
| | e | Power In + | | R | Rx (-) RS-422 (COM1) | |
| Comms P4 (MAINT) | b | Power In - | Comms P4 (MAINT) | U | Maintenance COM2 | |
| | h | Power In - | | S | Maintenance COM2 | |
| | Z | Power In - | | V | Maintenance COM2 | |
| | a | Power In - | | A | Maintenance COM2 | |
| | d | Power In - | | T | Maintenance COM2 | |
| | | | | Video | K | Video Out |
| | | | | | J | Video Out Shield |

BREAK-OUT CONNECTOR CABLE The PTZ-35x140™ also includes a break-out cable that connects to the system interface cable with single terminal connectors. The break-out cable has the MIL-C-26482 Series 1 Connector on one end and 4 pig-tail connectors and power leads of the following:



Figure 5: Break-Out Connector Cable

Four terminal ring leads for power:

- ◆ Input voltage range: 24 VDC $\pm 10\%$ or 24 VAC $\pm 10\%$ rms (50/60Hz). Nominal static power consumption is $<50W$. The red are positive and the black are common ground

One BNC video connector is used for both IR and DLTV video as shown here:

- ◆ Analog video can be toggled using either the Pelco D commands or selected using the Nexus Console.

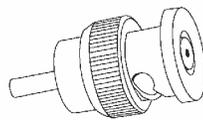


Figure 6: IR/DLTV Video Output

One RJ45 connector is for Ethernet communication and streaming MPEG4 video:

- ◆ Ethernet connection for use with the Nexus® provides both communications and streaming video.

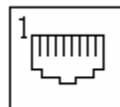


Figure 7: RJ45 Ethernet Connector

- Streaming video can also be viewed using an off-the-shelf player such as Quicktime or VLC from VideoLAN. Open a Network Stream then select RTSP and type the camera IP address followed by the stream name (nfov = narrow field of view, wfov = wide field of view and vis = visible) as follows: EX: rtsp://192.168.250.116/nfov

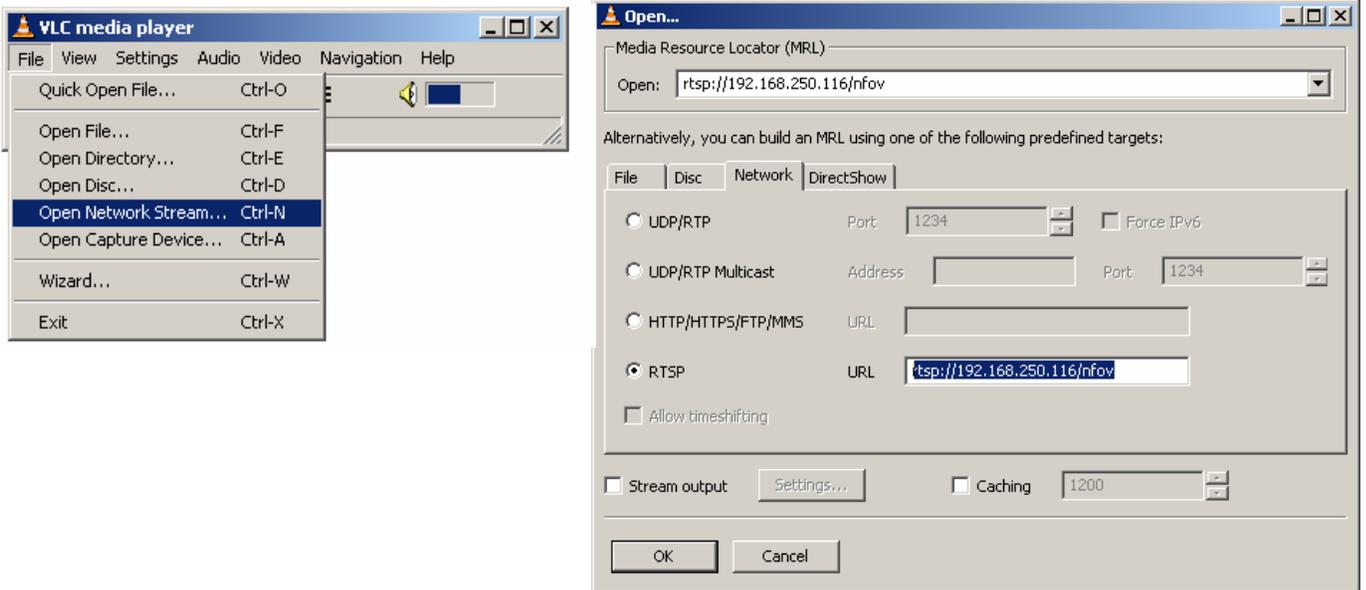


Figure 8: Video Streaming using VLC

Finally, two DB9 connectors are used for communication as shown here:

- Communication via RS-422 with the connector labeled “P3” and the other is for maintenance labeled “P4”. The protocol on “P3” is 422/Pelco D (see functions listed in Table 1: Pelco D Command List)

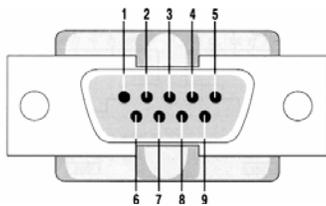


Figure 9: RS-422 DB-9 (USER P3)

| RS-422 DB9 Pin or “USER P3” | | |
|-----------------------------|------------|-------|
| COM 1 Tx A (-) | Signal OUT | Pin 2 |
| COM 1 Rx B (+) | Signal IN | Pin 3 |
| COM GND | | Pin 5 |
| COM 1 Tx B (+) | Signal OUT | Pin 7 |
| COM 1 Rx A (-) | Signal IN | Pin 8 |

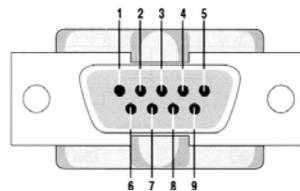


Figure 10: DB-9 (Maintenance)

PTZ-35X140™ SPECIFICATIONS

- Power/Weight :

| | |
|--------------------------|--|
| Input Voltage Range: | 24 VDC ±10 % or 24 VAC ±10 % VAC rms (50/60Hz) |
| Sensor Weight w/o cable: | 20411 g (45 lbs) |

- Pan/Tilt Specifications:

| | Pan | Tilt |
|---------------------------|---------------|---------------|
| Motion Range (°) | Continuous | ± 60 |
| Angular Velocity (°/sec.) | 0.1 to 120 | 0.1 to 120 |
| Resolution (°) | < 0.01 | < 0.01 |
| Accuracy (°) | <0.1, 2 sigma | <0.1, 2 sigma |
| Settling time (seconds) | < 0.25 | < 0.25 |

- Visible Camera Specifications:

- Array >740,000 pixels (PAL) and >630,000 pixels (NTSC)
- FOV Horizontal 54° to 2°, Optical
- Focus Automatic
- Iris Automatic
- Shutter Automatic
- Balance Automatic
- IR cut filter Automatic
- Image Stabilization
- Digital Zoom
- Spectral Response 400 to 750 nm with IR cut filter

- Infrared Camera Specifications:

| | Wide FOV 20° 35mm | Narrow FOV 5° 140mm |
|-------------------|--------------------------|--------------------------|
| Focal Plane Array | Uncooled μ bolometer | Uncooled μ bolometer |
| Format | 320 x 240 | 320 x 240 |
| Pixel Size | 38 μ m | 38 μ m |
| Aperture | f/1.4 | f/1.4 |
| Field of View | 20° HVOV x 15° VFOV | 5° HVOV x 3.7° VFOV |
| Focus | Athermalized | One touch Auto Focus |
| Temporal NEdT | ≤65 mK | ≤65 mK |
| Range (man size) | 560 meters | 2200 meters |

- Frame Rate 30 Hz
- Spectral Response 7.5 μ m to 13.5 μ m

- Environmental Requirements:

Caution: Sustained storage at high-temperature will degrade vacuum life of the camera core.

- Storage Temperature -50°C to +85°C
- Operating Temperature -32°C to + 55°C
- Moisture IP-66
- Sand/Dust MIL-STD-810E, Method 510.3, procedure II
- Vibration MIL-STD-810E, Method 514.4
- Shock (transportation) 30g, 11 msec.
- EMI/EMC
 - CE Class A
 - FCC
- Solar Thermal Loading MIL-STD-810E, Method 505.3, procedure I, paragraph 1 3.2.b1
- External Icing MIL-STD-810E, Method 521.1, 6 mm ice thickness
- Wind Load 50 mph

Note: These specifications are subject to change without notice. See the PTZ-35x140™ Specification (ISC doc. 427-0011-01-09) for detailed requirements.

APPENDIX A: MAINTENANCE

LENS CLEANING

Materials:

- Optical-grade tissue (e.g., Edmund Industrial Optics part number 52105 or any similar product)
- pure water (de-ionized or other)
- isopropyl alcohol (IPA)

Procedure:

1. Saturate a piece of the lens tissue with the water and drape it over the lens. Let the surface tension of the water pull the tissue onto the lens surface and then drag the tissue across the lens surface. Repeat several times with different pieces of tissue.
2. Repeat the same step using IPA instead of water. Drag the final piece of tissue over the lens several times to prevent pooling, which could leave a residue behind.

History of Infrared

Less than 200 years ago the existence of the infrared portion of the electromagnetic spectrum wasn't even suspected. The original significance of the infrared spectrum, or simply 'the infrared' as it is often called, as a form of heat radiation is perhaps less obvious today than it was at the time of its discovery by Herschel in 1800.



Sir William Herschel (1738–1822)

The discovery was made accidentally during the search for a new optical material. Sir William Herschel—Royal Astronomer to King George III of England, and already famous for his discovery of the planet Uranus—was searching for an optical filter material to reduce the brightness of the sun's image in telescopes during solar observations. While testing different samples of colored glass which gave similar reductions in brightness he was intrigued to find that some of the samples passed very little of the sun's heat, while others passed so much heat that he risked eye damage after only a few seconds' observation.

Herschel was soon convinced of the necessity of setting up a systematic experiment, with the objective of finding a single material that would give the desired reduction in brightness as well as the maximum reduction in heat. He began the experiment by actually repeating Newton's prism experiment, but looking for the heating effect rather than the visual distribution of intensity in the spectrum. He first blackened the bulb of a sensitive mercury-in-glass thermometer with ink, and with this as his radiation detector he proceeded to test the heating effect of the various colors of the spectrum formed on the top of a table by passing sunlight through a glass prism. Other thermometers, placed outside the sun's rays, served as controls.

As the blackened thermometer was moved slowly along the colors of the spectrum, the temperature readings showed a steady increase from the violet end to the red end. This was not entirely unexpected, since the Italian researcher, Landriani, in a similar experiment in 1777 had observed much the same effect. It was Herschel,

however, who was the first to recognize that there must be a point where the heating effect reaches a maximum, and those measurements confined to the visible portion of the spectrum failed to locate this point.



Marsilio Landriani (1746–1815)

Moving the thermometer into the dark region beyond the red end of the spectrum, Herschel confirmed that the heating continued to increase. The maximum point, when he found it, lay well beyond the red end—in what is known today as the ‘infrared wavelengths’.

When Herschel revealed his discovery, he referred to this new portion of the electromagnetic spectrum as the ‘thermometrical spectrum’. The radiation itself he sometimes referred to as ‘dark heat’, or simply ‘the invisible rays’. Ironically, and contrary to popular opinion, it wasn't Herschel who originated the term ‘infrared’. The word only began to appear in print around 75 years later, and it is still unclear who should receive credit as the originator.

Herschel's use of glass in the prism of his original experiment led to some early controversies with his contemporaries about the actual existence of the infrared wavelengths. Different investigators, in attempting to confirm his work, used various types of glass indiscriminately, having different transparencies in the infrared. Through his later experiments, Herschel was aware of the limited transparency of glass to the newly-discovered thermal radiation, and he was forced to conclude that optics for the infrared would probably be doomed to the use of reflective elements exclusively (i.e. plane and curved mirrors). Fortunately, this proved to be true only until 1830, when the Italian investigator, Melloni, made his great discovery that naturally occurring rock salt (NaCl)—which was available in large enough natural crystals to be made into lenses and prisms—is remarkably transparent to the infrared. The result was that rock salt became the principal infrared optical material, and remained so for the next hundred years, until the art of synthetic crystal growing was mastered in the 1930's.



Macedonio Melloni (1798–1854)

Thermometers, as radiation detectors, remained unchallenged until 1829, the year Nobili invented the thermocouple. (Herschel's own thermometer could be read to 0.2 °C (0.036 °F), and later models were able to be read to 0.05 °C (0.09 °F)). Then a breakthrough occurred; Melloni connected a number of thermocouples in series to form the first thermopile. The new device was at least 40 times as sensitive as the best thermometer of the day for detecting heat radiation—capable of detecting the heat from a person standing three meters away.

The first so-called 'heat-picture' became possible in 1840, the result of work by Sir John Herschel, son of the discoverer of the infrared and a famous astronomer in his own right. Based upon the differential evaporation of a thin film of oil when exposed to a heat pattern focused upon it, the thermal image could be seen by reflected light where the interference effects of the oil film made the image visible to the eye. Sir John also managed to obtain a primitive record of the thermal image on paper, which he called a 'thermograph'.



Samuel P. Langley (1834–1906)

The improvement of infrared-detector sensitivity progressed slowly. Another major breakthrough, made by Langley in 1880, was the invention of the bolometer. This consisted of a thin blackened strip of platinum connected in one arm of a Wheatstone bridge circuit upon which the infrared radiation was focused and to which a sensitive galvanometer responded. This instrument is said to have been able to detect the heat from a cow at a distance of 400 meters.

An English scientist, Sir James Dewar, first introduced the use of liquefied gases as cooling agents (such as liquid nitrogen with a temperature of -196 °C (-320.8 °F)) in low temperature research. In 1892 he invented a unique vacuum insulating container in which it is possible to store liquefied gases for entire days. The common 'thermos bottle', used for storing hot and cold drinks, is based upon his invention.

Between the years 1900 and 1920, the inventors of the world 'discovered' the infrared. Many patents were issued for devices to detect personnel, artillery, aircraft, ships—and even icebergs. The first operating systems, in the modern sense, began to be developed during the 1914–18 war, when both sides had research programs devoted to the military exploitation of the infrared. These programs included experimental systems for enemy intrusion/detection, remote temperature sensing, secure communications, and 'flying torpedo' guidance. An infrared search system tested during this period was able to detect an approaching airplane at a distance of 1.5 km (0.94 miles), or a person more than 300 meters (984 ft.) away.

The most sensitive systems up to this time were all based upon variations of the bolometer idea, but the period between the two wars saw the development of two revolutionary new infrared detectors: the image converter and the photon detector. At first, the image converter received the greatest attention by the military, because it enabled an observer for the first time in history to literally 'see in the dark'. However, the sensitivity of the image converter was limited to the near infrared wavelengths, and the most interesting military targets (i.e. enemy soldiers) had to be illuminated by infrared search beams. Since this involved the risk of giving away the observer's position to a



similarly-equipped enemy observer, it is understandable that military interest in the image converter eventually faded.

The tactical military disadvantages of so-called 'active' (i.e. search beam-equipped) thermal imaging systems provided impetus following the 1939–45 war for extensive secret military infrared-research programs into the possibilities of developing 'passive' (no search beam) systems around the extremely sensitive photon detector. During this period, military secrecy regulations completely prevented disclosure of the status of infrared-imaging technology. This secrecy only began to be lifted in the middle of the 1950's, and from that time adequate thermal-imaging devices finally began to be available to civilian science and industry.

How do Infrared Cameras Work?

Infrared energy is part of a complete range of radiation called the electromagnetic spectrum. The electromagnetic spectrum includes gamma rays, X-rays, ultraviolet, visible, infrared, microwaves (RADAR), and radio waves. The only difference between these different types of radiation is their wavelength or frequency. All of these forms of radiation travel at the speed of light (186,000 miles or 300,000,000 meters per second in a vacuum). Infrared radiation lies between the visible and RADAR portions of the electromagnetic spectrum. Thus infrared waves have wavelengths longer than visible and shorter than RADAR.

The primary source of infrared radiation is heat or thermal radiation. Any object which has a temperature radiates in the infrared portion of the electromagnetic spectrum. Even objects that are very cold, such as an ice cube, emit infrared. When an object is not quite hot enough to radiate visible light, it will emit most of its energy in the infrared. For example, hot charcoal may not give off light, but it does emit infrared radiation which we feel as heat. The warmer the object, the more infrared radiation it emits.

Infrared cameras produce an image of invisible infrared or "heat" radiation that is unseen by the human eye. There are no colors or "shades" of gray in infrared, only varying intensities of radiated energy. The infrared imager converts this energy into an image that we can interpret. Several detector technologies exist; the sensors in the FLIR ThermoVision® cameras are of the latest solid state design, offering long life and fully automatic image optimization (contrast and gain). True thermal imagers should not be confused with infrared illuminator cameras that are often presented as simply "infrared cameras." There are hundreds of low cost infrared illuminated cameras on the market at prices below \$100. These cameras do not produce the same image because they do not detect heat. They operate in wavelengths near visible, and require an IR illuminator to provide an image. IR illuminators have very short range, and require a lot of power to see beyond 5 meters.