

NHL IN-NET GOALCAM



User's Manual

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Overview

The In-Net GoalCam 60GHz wireless technology is a customizable solution that fits the most demanding sports needs. This one-of-a-kind wireless technology delivers fully uncompressed video with no bit or resolution manipulation. Utilizing a 60 GHz wireless platform, the GoalCam offers uncompressed and un-coded broadcast quality video at a competitive price. The RF transmitter and camera are integrated into a custom ruggedized extruded aluminum housing with polycarbonate shock resistant domes on each end. In addition, an integrated safety and quick release positive registration bracket is included that adjusts to all mounting applications.

For mobility, the GoalCam incorporates internal lithium-ion batteries that support up to 5 hours of operation per charge. The receiver unit mounts overhead to receive the 1.5 G HD-SDI signal which is available through two buffered BNC re-clocked HD-SDI outputs on the rear panel. The purpose of the GoalCam system is to capture and record live video of the goal line to support officials in reviewing disputed calls during every game.

- 60 GHz wireless In-Net Goal Camera System
- Zero frame delay
- Zero interference
- No channel coding
- Ruggedized and water resistant enclosure
- Integrated 720p 60 camera
- Maximum 150 ft. wireless transmission distance
- Uncompressed 1.5G HD-SDI video
- Flexible safety and quick release bracket
- Shock resistant and shatterproof domes
- No external RF antennas
- Internal lithium-ion batteries
- Local monitoring and testing
- Water resistant connections
- Software controls for easy transmitter & camera set-up
- Camera Pan, Tilt, Zoom, Focus, and Aperture are controlled via 5 servos
- RF Transmitter Horn Antenna is positioned Left, Right, Front and Back via 2 servos
- Output RF power less than 1mW typical
- A Red Laser is attached to the Horn Antenna to aid in RF alignment

GoalCam-TX Kit Contents

1x Pelican 1510 case with custom die cut foam
1 x GoalCam-TX Transmitter
1 x External 16VDC UltraLife Lithium-ion Battery Charger for GoalCam-TX
1 x GoalCam Padded Protective Sleeve
1 x Mounting Bracket
3 x Pipe-clamps to mount bracket
2 x Fixed ball lock pins
2 x Safety release spring ball plungers
1 x Data Port Cable
1 x Battery Extension Cable, 6 feet
1 x Auxiliary Lead-acid Battery with 3 Amp Automotive Fuse
1 x PowerSonic Lead-acid Battery Charger
1 x Dome Net Minder Ring
1 x Removal Tool for Dome Net Minder
1 x User Manual & Control Software (Pending Web Download)

GoalCam-RX Kit Contents

1 x White Corrugated Box with custom die cut foam
1 x GoalCam-RX Receiver
1 x Power Supply for GoalCam-RX
1 x AC Extension Cord
1 x User Manual & Control Software (Pending Web Download)

Additional Items Required for GoalCam Installation

1 x Notebook PC Computer with 2 USB 2.0 ports
1 x USB to RS232 Converter Adapter with Drivers for Notebook OS.
Suggest <http://plugable.com/products/PL2303-DB9/>
1 x 5/16 Nut Driver
1 x 6 foot Right Angle/Straight BNC HD-SDI Coaxial Cable
1 x HD-SDI Monitor, Battery Powered
1 x White Electrical Tape
1 x White Hockey Tape
1 x Double Sided Tape

Cloud Based File and Document Sharing with Dropbox

Visit the Dropbox share folder GoalCam Installation. There are subfolders for Venues, Software, User's Manual and more. Please email jimj@vidovation.com or questions@vidovation.com to receive Dropbox access.

PLEASE RETAIN THE ORIGINAL SHIPPING PELICAN CASE AND BOX. If you need to return the transmitter or receiver unit for service or upgrade it is STRONGLY recommended that you use the original case for the GoalCam-TX and carton with inserts for the GoalCam-RX, which were specifically designed to protect them from damage while in transit. IF RETURNED IN SOMETHING OTHER THAN ORIGINAL PACKAGING, A FEE WILL BE ASSESSED FOR THE USE OF NEW SHIPPING MATERIALS WHEN RETURNED.

Maintenance

The In-Net GoalCam system has been built to meet the demands of a sporting environment; however, the hardware is subject to the same susceptibility to static discharge as any other electronic device. Use care when connecting or disconnecting cables.

Important: Take care not to introduce any moisture into the system units. Electronic assemblies are sensitive to static electricity, due to the electrostatically sensitive devices used within the circuitry. If you experience any problems with the unit please call the field service technicians first. DO NOT ATTEMPT to repair or modify the unit as this may cause further damage, which could void your warranty. A technician can determine whether your problem is caused by a faulty component, and determine whether you need to return it for evaluation and/or repair.

Cleaning: The exterior should only require dusting with a soft cloth.

Safety

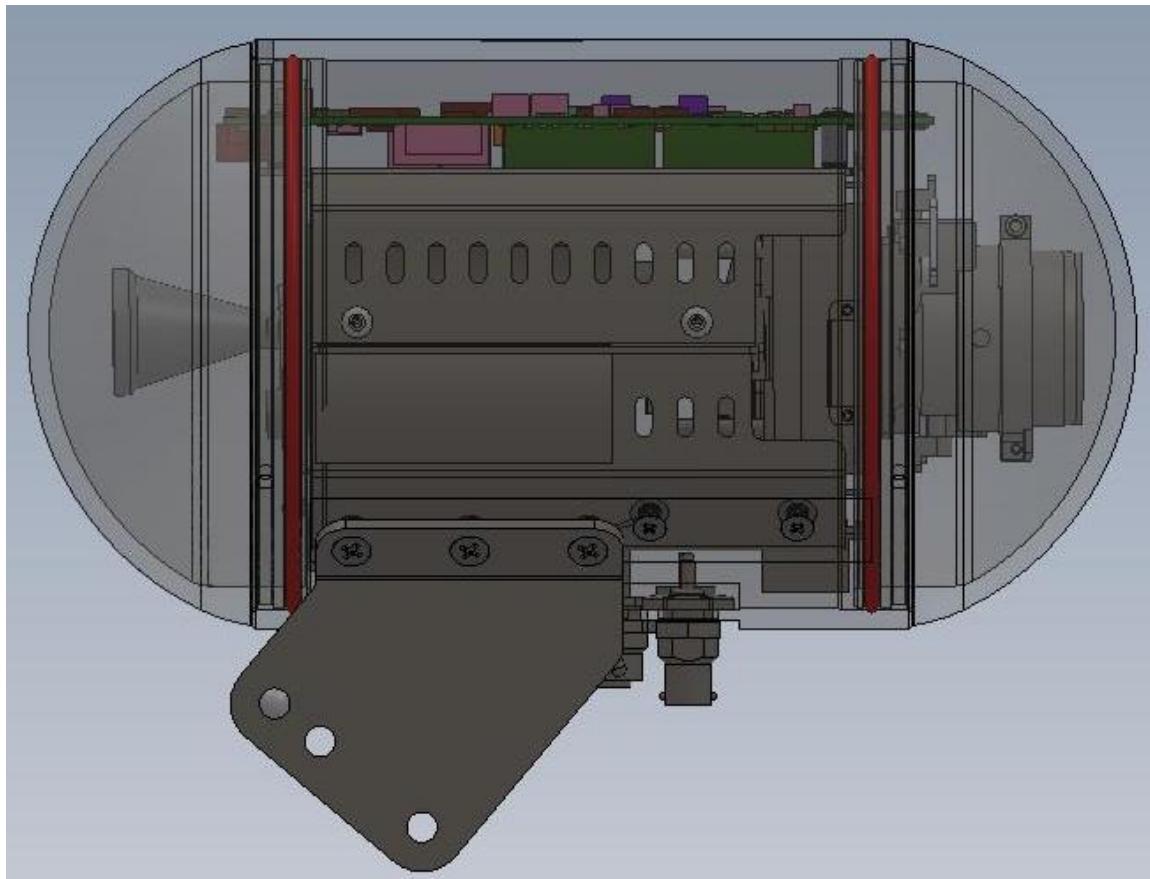
Please avoid direct eye contact with the laser for the alignment of the RF horn antenna located at the top dome of the GoalCam.



Avoid Direct Eye Exposure

Max Output <5mW
WAVELENGTH 650nm+-10
Class IIIa Laser Product

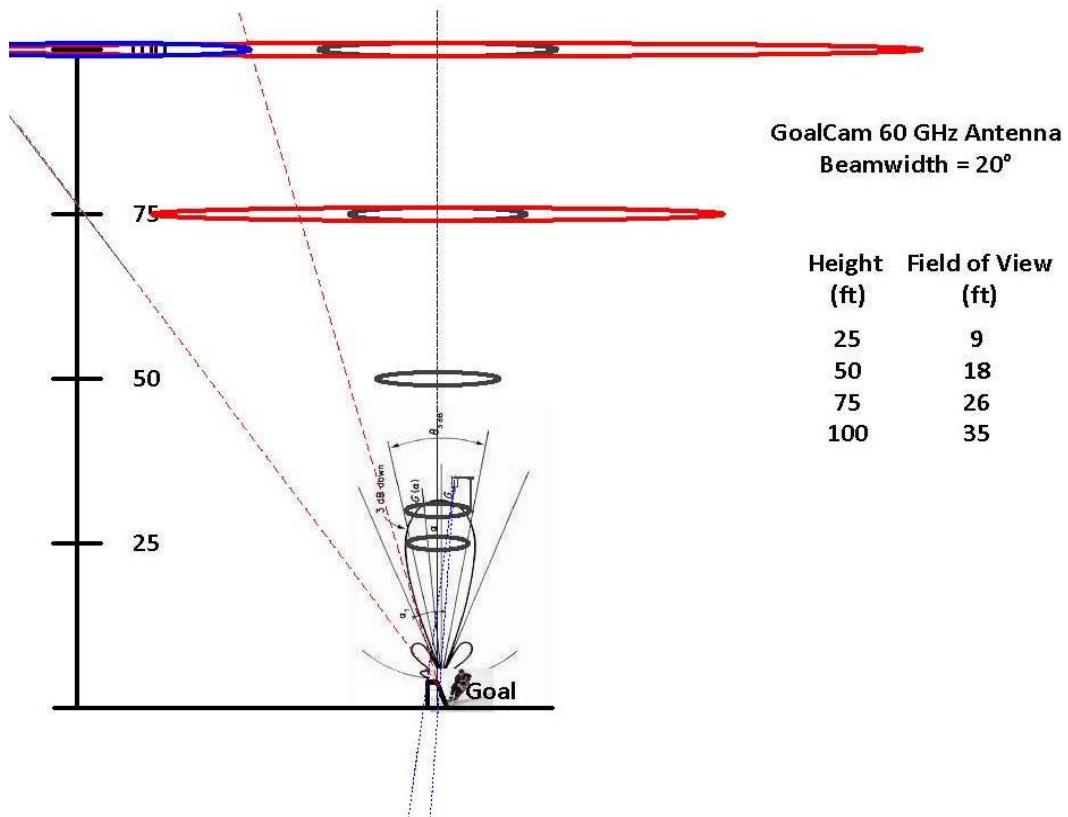
GoalCam-TX Transmitter



1. 60 GHz Uncompressed HD Transmitter: sends the uncompressed video signal to the receiver.
2. Ruggedized Aluminum Enclosure: the housing is an extruded aluminum tube.
3. Transparent Lexan Dome: Camera lens and internal components are protected by the lower (front) and upper (rear) domes. Domes are polycarbonate shock resistant which will withstand shock and impact from a 105 mph hockey puck and prohibit condensation.
4. Camera HD-SDI 720p: Captures video which is sent to the transmitter. The camera incorporates a broadcast quality 720p 60 signal using a variable focal length, wide angle, 2.2 to 6mm lens.
5. Li-ION Battery Pack: Supports up to 5 hours of operation per charge.
6. External Battery Back-up Connection: Water resistant 12 VDC 4 pin XLR input allows for external battery back-up for up to 6 hours. The battery is a PowerSonic PS-1270F1 12 Volt at 7 Amp-hour. (see page for installation instructions).
7. HD-SDI Video Output Connection: Water resistant BNC connection is used for local monitoring and testing
8. LED Status Light: Power on indication and battery life.
9. Control Connection: Water resistant data port controls camera functions, RF alignment servos, camera alignment servos and RF alignment laser

GoalCam-RX Receiver

The receiver units are to be mounted overhead to receive and decode the 1.5 G HD-SDI signal.



The receiver units are to be mounted within a 3.5 degree cone, vertically oriented axis and cone apex referenced to the top of the camera/transmitter unit. The receiver units shall be within a 50-150 foot line of sight distance to the goal.

Professional rigging equipment and safety lanyards are to be used at the responsibility of the National Hockey League to safely and securely mount the GoalCam-RX

1. HD-SDI Video Output Connection: Receiver unit has 2 BNC reclocked HD-SDI outputs.
2. AC Power: Includes external AC power supply with 12 VDC 4 pin XLR connector and detachable AC line cord.
3. LED Status Light: Green LED indicates Power. Blue LED indicates Signal Lock or Coarse System Alignment. Red LED indicates CRC Errors or Fine System Alignment.
4. Polarization and Alignment: The handles on the back of the GoalCam-RX Receiver should be aligned parallel to the Red Goal Line for proper polarization. (See installation instructions)

Installing GoalCam Receiver

The GoalCam-RX Receive has a wide array of mounting holes for $\frac{1}{4}$ -20 and 3/8 -16 hardware. All safety and rigging procedures are to be followed according to local building codes and building regulations and procedures. Safety lanyards are to be used on all equipment mounted and installed over-head. The proper installation of the GoalCam-RX is the responsibility of the National Hockey League. VidOvation recommends the use of at least two mounting screws. Please see the diagram below.

Power and Signal Outputs:

The GoalCam-RX includes two BNC HD-SDI outputs. Connect the HD-SDI output to your video display or distribution equipment.

Connect power to the XLR Power Input Connector with the Included Power Supply and Line cord.

LED Status LEDs:

Green LED indicates Power. Blue LED indicates Signal Lock or Coarse System Alignment. Red LED indicates CRC Errors or Fine System Alignment.

Receiver Rough Alignment:

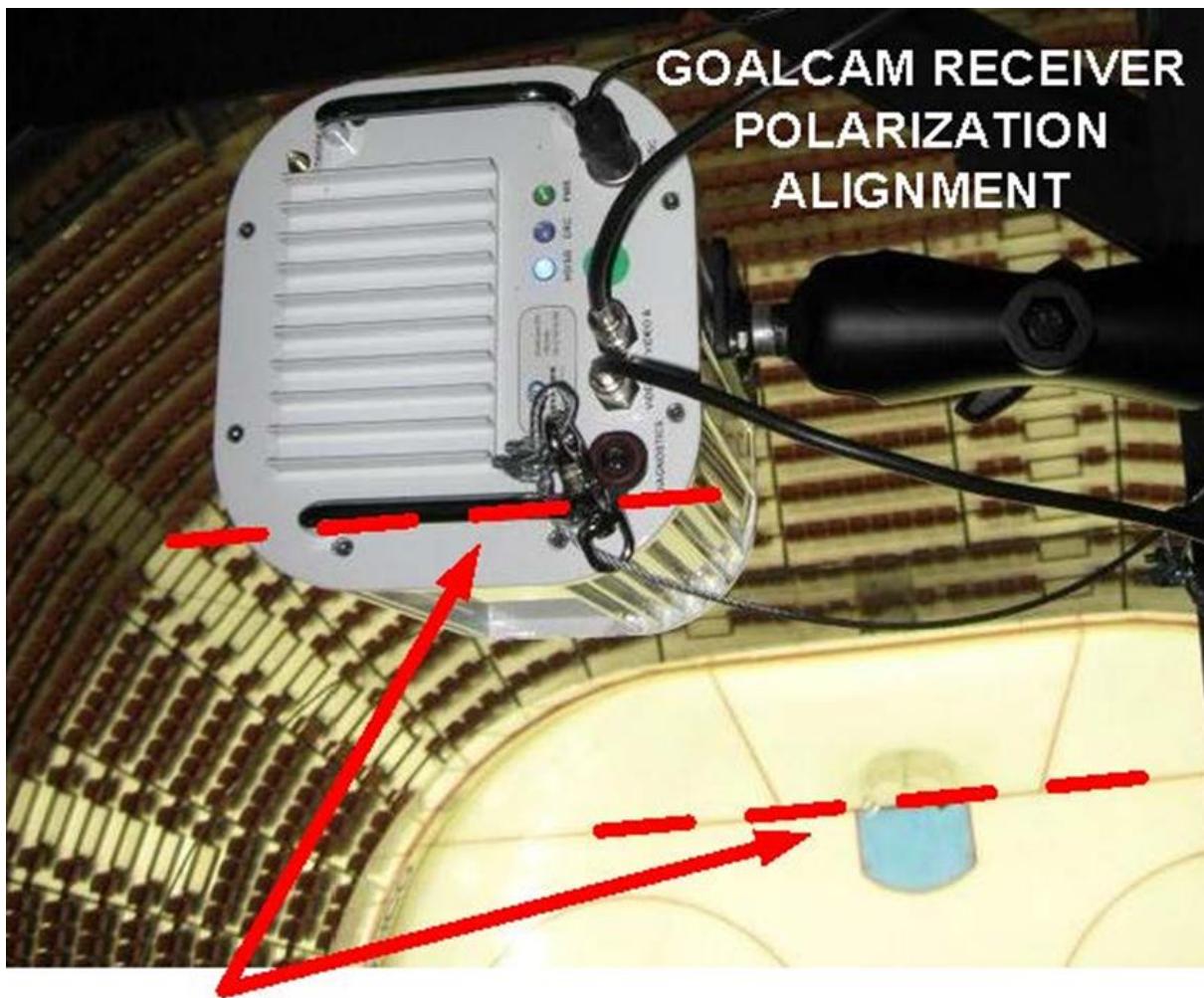
The Receiver is to be roughly aligned to the GoalCam-TX position in the net. The left and right axis can be aligned by sighting the goal down the flat left and right sides of the receiver. The up and down axis is aligned by sighting the goal down the flat top and bottom sides of the receiver.

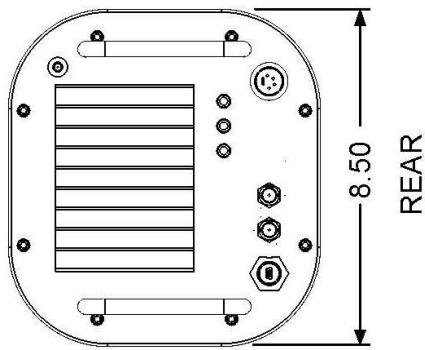
Receiver Fine Alignment:

Fine adjustments to the GoalCam-RX receiver should be performed after the GoalCam-TX Transmitter is installed in the goal and the RF antenna horn is aimed at the GoalCam-RX Receiver. Fine adjust is to be made by making small adjustments in the left/right axis and up/down axis to find the center or sweet spot of the RF signal from the goal. The Blue Lock LED will act as a coarse adjustment indicator and the Red CRC as a fine adjustment indicator. The receiver is perfectly aligned when the Blue LED is SOLID and the Red LED is OFF. A flashing RED LED requires more fine adjustments. A brief RED LED flash at intervals of greater than 60 seconds is acceptable for a high quality RF link.

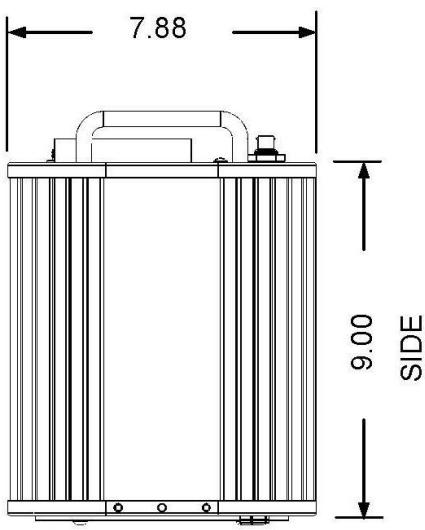
Polarization Alignment:

The handles on the back of the GoalCam-RX Receiver should be aligned parallel to the Red Goal Line for proper polarization as shown below.

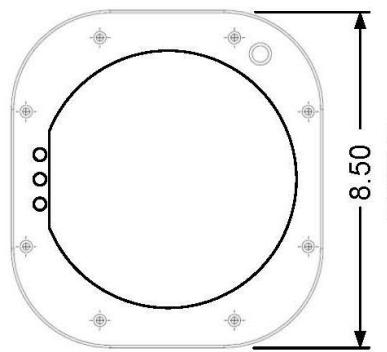




REAR



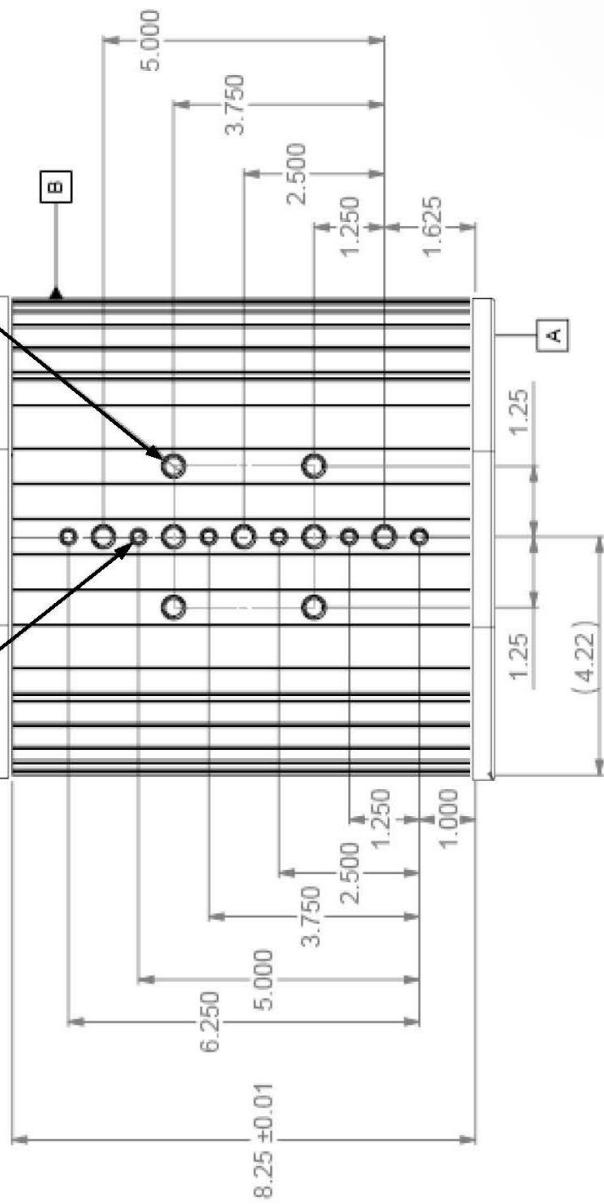
SIDE



FRONT

6X 1/4 - 20

9X 3/8 - 16



BOTTOM
HOLE MOUNTING PATTERN



GoalCam-RX Receiver Mounting Holes



Mounting Bracket on GoalCam-RX Receiver



Mounting Bracket Arm on Receiver



Mounting Bracket Base on Receiver



Installing Safety Lanyard on Receiver

Installing GoalCam Transmitter Mounting Bracket

Custom mounting bracket assembly to attach camera/transmitter unit to the top of the rear center goal post is included. This bracket was customized to include a quick release mechanism for easy installation and impact release. The bracket assembly includes the bracket and three pipe clamps.

1. Clear an area in the top rear of the Hockey Goal where the back vertical bar meets the rear top horizontal bar in a "T" configuration. The goal protective foam and padding may need to be moved out of the way.
2. Open the 3 pipe clamps and position one around the top bar left and one on the top bar right. Position the third around the vertical bar.
3. Thread and partially tighten the 3 pipe clamps.
4. Position the GoalCam-TX bracket over the T section of the upper rear of goal.
5. Slide pipe clamps over the three sides of the bracket and tighten with a 5/16 nut driver
6. Bracket will universally support NHL hockey goals with tubing diameters of $\frac{3}{4}$ to 2 inches.

7. Attach the 6 foot Auxiliary Battery Cable to the goal. Thread the cable up the rear vertical bar under the padding. Have the cable exit the top of the padding near the GoalCam-TX bracket. Leave 12 inches of slack to attach cable to unit easily.

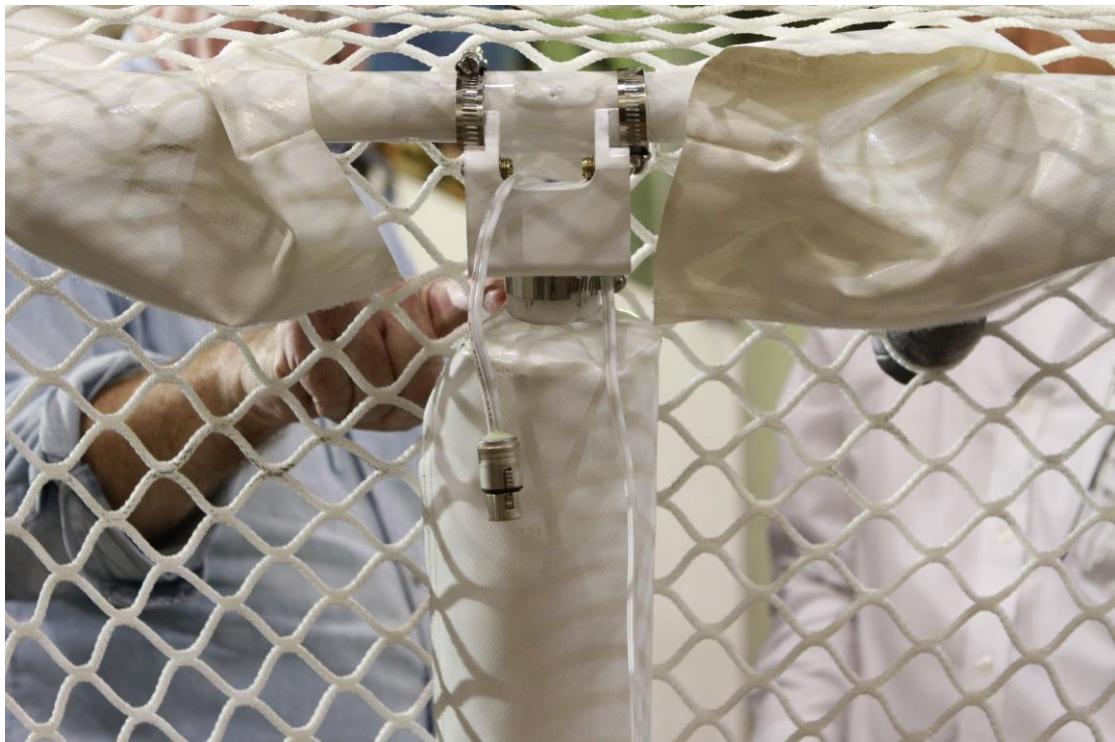
The bracket has been designed with precise positive registration which will require no adjustments and provide the goal line field of view between the goal posts. The bracket mechanism also includes a 32 pound impact release mechanism.



Installing Pipe-clamps to Goal



Installing Pipe-clamps to Bracket



Route Auxiliary Battery Cable Behind Bracket



Snip Excess Pipe-clamp



Cover Pipe-clamp with Hockey Tape



GoalCam-TX Camera/Trasnmitter IOs



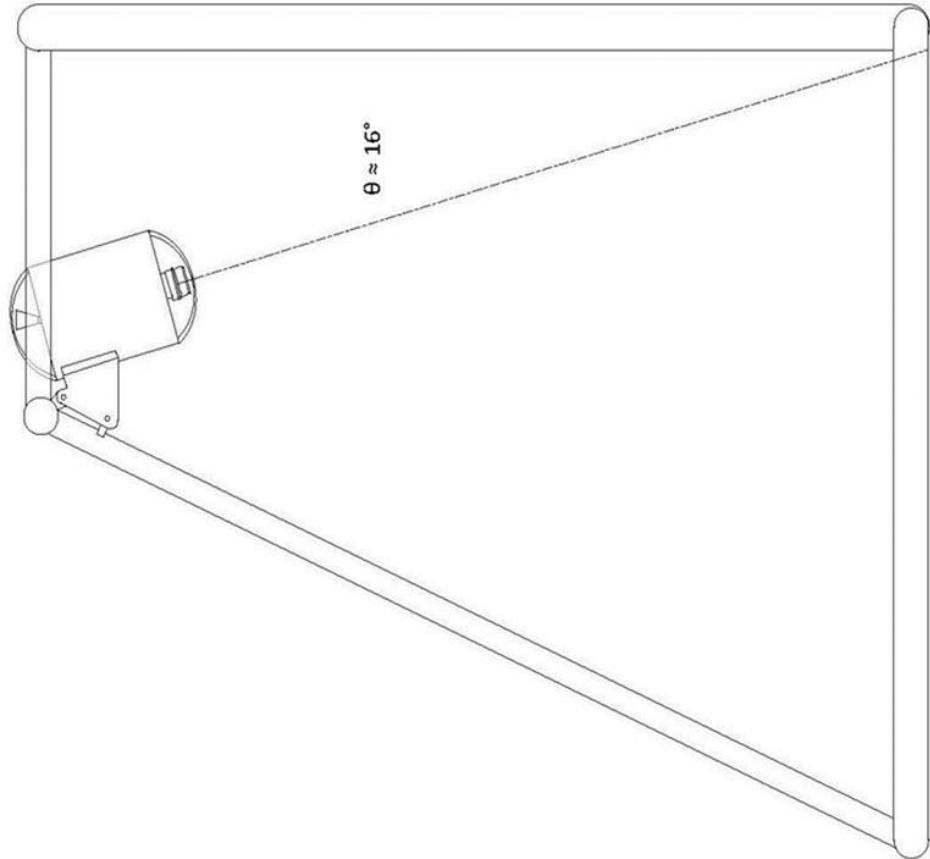
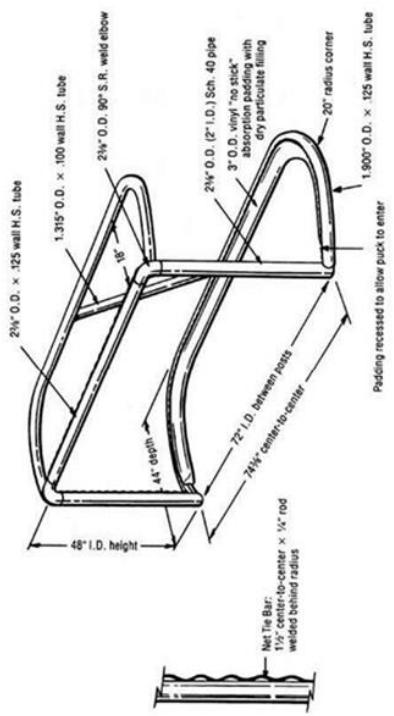
Connect Auxiliary Battery Cable and Data Cable to GoalCam-TX



Connect Auxiliary Batter Cable and Data Cable to GoalCam-TX



Mount GoalCam-TX to Mounting Bracket Using 1 or 2 Fixed Ball Lock Pins



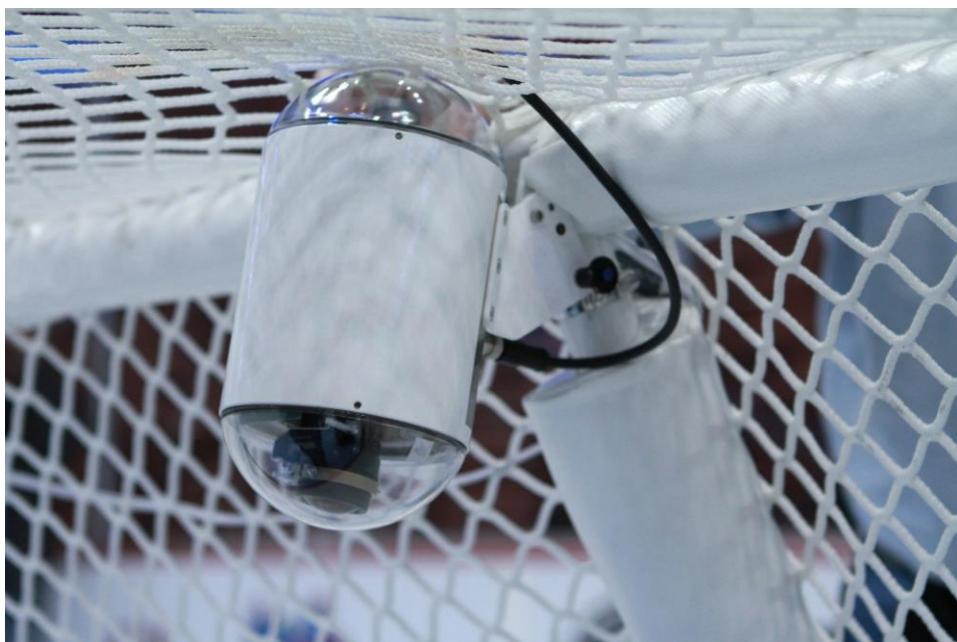
Typical GoalCam-TX Camera/Transmitter Mounting Position

Installing GoalCam Auxiliary Battery

1. Place the Auxiliary Battery at the bottom of the goal in the NHL provided bag
2. Connect the Auxiliary Battery Cable to the Battery
3. Battery is fully charged when voltage is greater than 13.5 VDC.
4. Check 3AMP battery fuse inside battery case. Use a standard automotive 3AMP ATO fuse, typically purple.

Attachment of the GoalCam-TX Transmitter to Goal Bracket

1. Connect the auxiliary battery XLR cable to the GoalCam-TX unit.
2. Take a fixed ball lock pin and the GoalCam-TX in your hands.
3. Position the GoalCam-TX mounting arms over the left and right sides of the bracket mounted previously in the goal.
4. Align the lowest set of holes on the mounting arms with the lowest set of holes on the goal mounting bracket.
5. Insert the fixed ball lock pin
6. Snap the GoalCam-TX assembly up firmly to engage the safety release spring ball plungers.

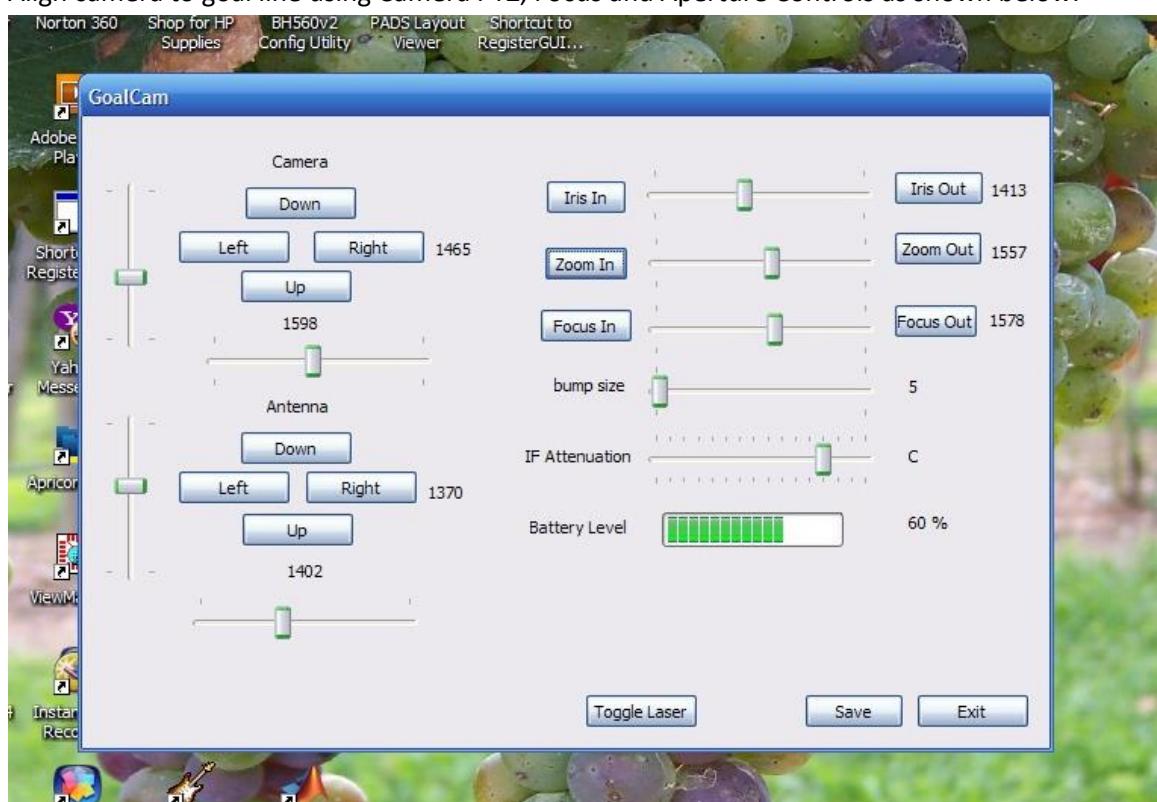


Installing External Auxiliary Battery (Transmitter)

1. Mount External Battery Pack to goal with NHL proved padded case at the bottom, rear and center of the net
2. Connect 6 ft. cable to the external battery pack.
3. Run 6 ft. cable up rear center goal post hiding with the padding
4. Connect the other XLR end of the cable to the External Axillary Battery Connection located on the transmitter
5. Slide on GoalCam Protective Sleeve

Aligning Camera (Transmitter)

1. Once the GoalCam has been mounted to the goal please follow the below instructions.
2. Connect monitor to HD-SDI Video Output BNC Connection.
3. Connect laptop to Data Port using the USB connector.
4. Turn on GoalCam via the power switch between the mounting ears.
5. Run the GoalCam-TX GUI program by double clicking the file GoalCamGUI.exe.
6. Align camera to goal line using Camera PTZ, Focus and Aperture Controls as shown below:



7. Connection of the RS232 port is only required to adjust the internal camera settings. This should not be necessary as all settings are pre-configured at the factory. Changes to the settings or an accidental FACTORY RESET will require a step by step camera reconfiguration.

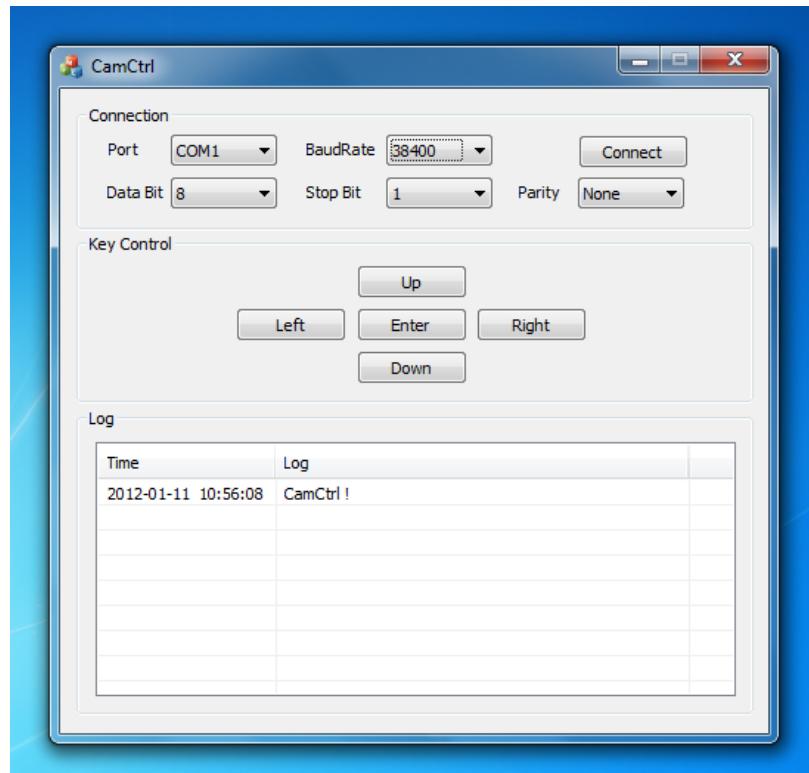
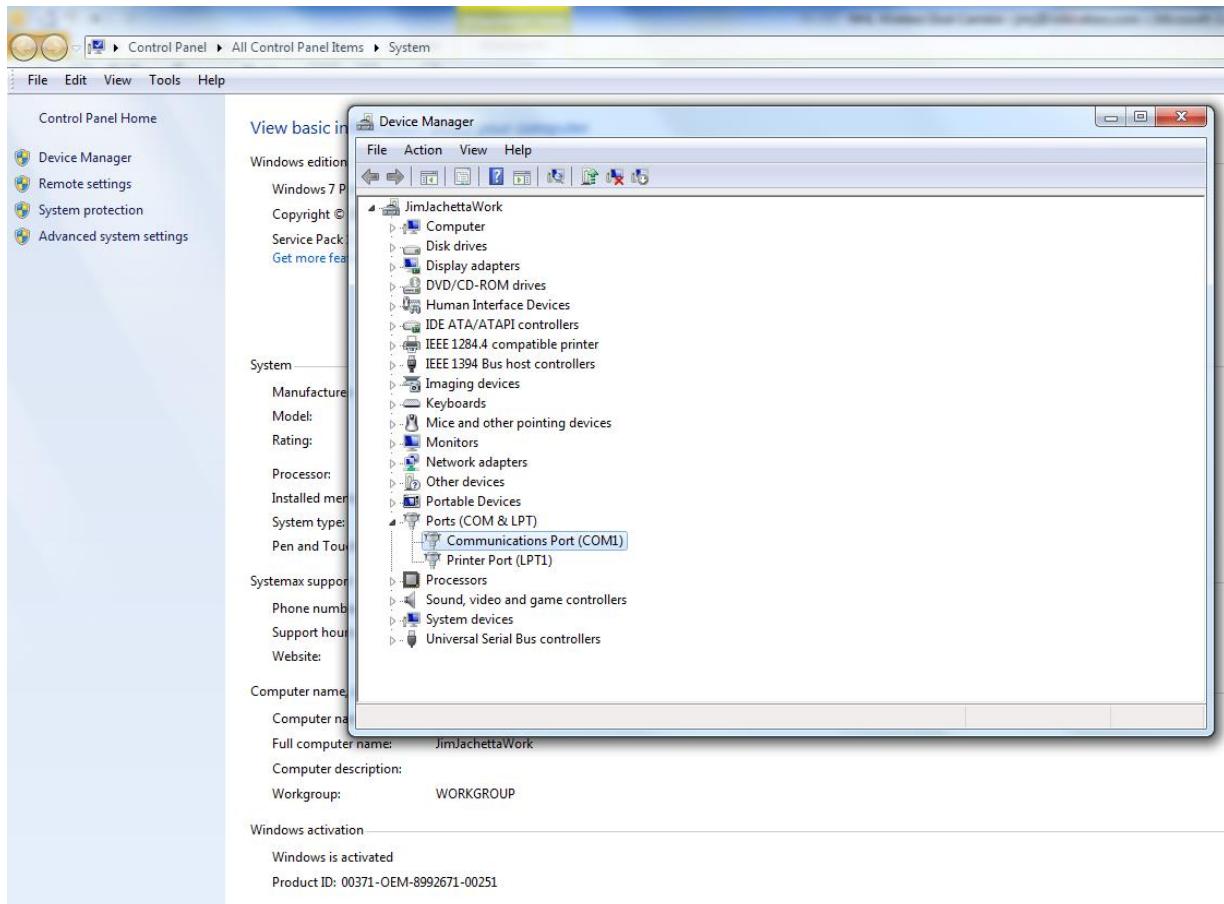
Suggested USB to RS232 adapter from Plugable.com

A USB to RS232 adapter is required. We recommend the Plugable USB to RS-232 DB9 Serial Adapter (Prolific PL2303HX Chipset) found at <http://plugable.com/products/PL2303-DB9/> and sold at Amazon.com. Drivers are available for most operating systems.



Plugable USB to RS-232 DB9 Serial Adapter

- a. Install the provided software and drivers for the RS232 to USB adapter. Be sure to select an adapter that supports the operating system of your notebook PC.
- b. Locate the COM port utilized by the adapter in the Device Manager by clicking Start>Control Panel>Device Manager.
- c. Locate entry “Ports (COM & LPT) and click Triangle to expand. Locate Communications Port (COMx) and Note the COM number. Note the example below showing COM1.
- d. Run the GoalCam-TX internal camera On-screen Display (OSD) program by double clicking the file InternalCameraCtrl.exe.
- e. Match the COM port with the above. COM1 is used in our example below.
- f. Set the Baud Rate to 38400.
- g. Other settings are defaulted to Data Bit=8; Stop Bit=1 and Parity=None.
- h. Press the Connect button to open the Camera OSD
- i. Navigate the display by using the Up, Down, Left and Right buttons. Press Enter to save an entry.
- j. Exit and Save Settings or Exit Without Saving to close the OSD
- k. **** WARNING!! Do not press FACTORY RESET!!**
- l. Press Disconnect to close camera software.



HD 720p CAMERA SPECIFICATIONS

Image Sensor	SONY IMX035LQR CMOS, 1.3M-pixel
Scanning System	SMPTE Standard 1280x720p60 HD
Video Output	SDI
On Screen Display (OSD) Control	RS232
Lens	Fujinon High Resolution 2.2 to 6.0mm Wide Angle
Pan/Tilt/Zoom/Focus/Iris Control	Graphical User Interface (GUI) via USB

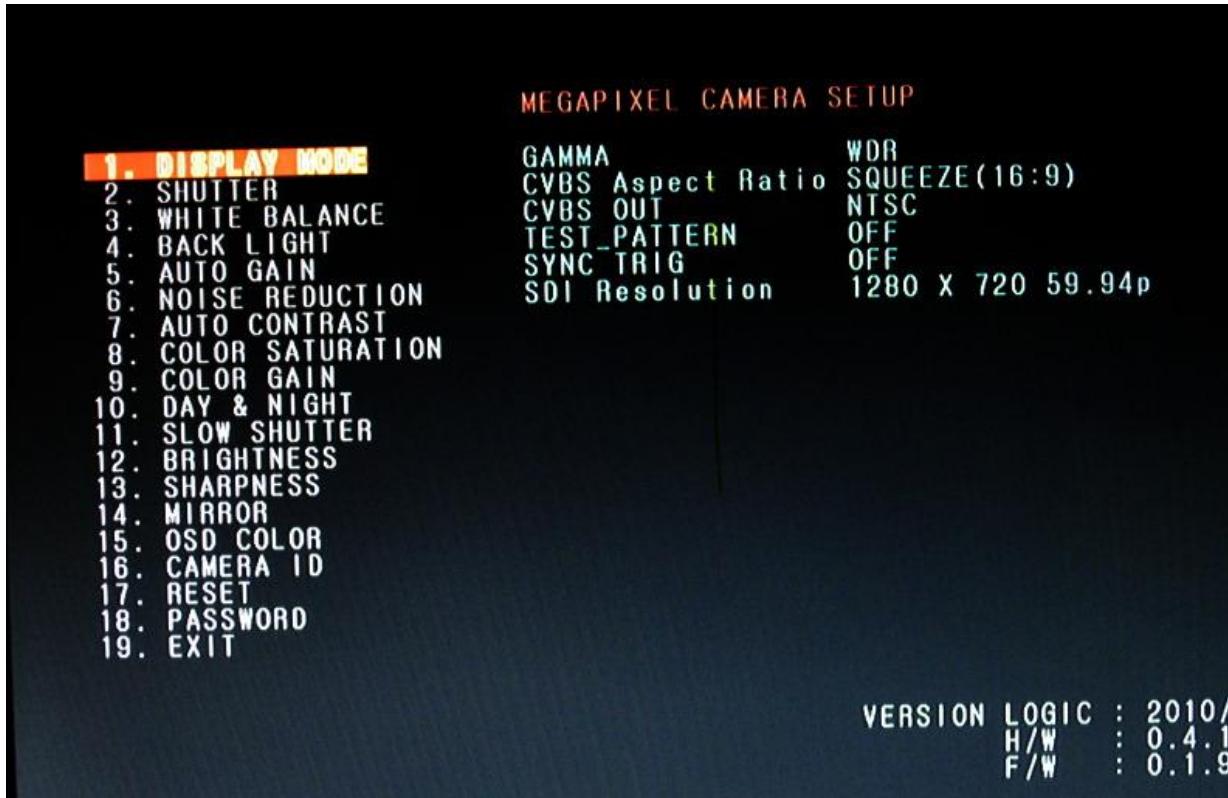
OSD CONFIGURATION CONTROL

Default Configuration Settings for GoalCam Operation

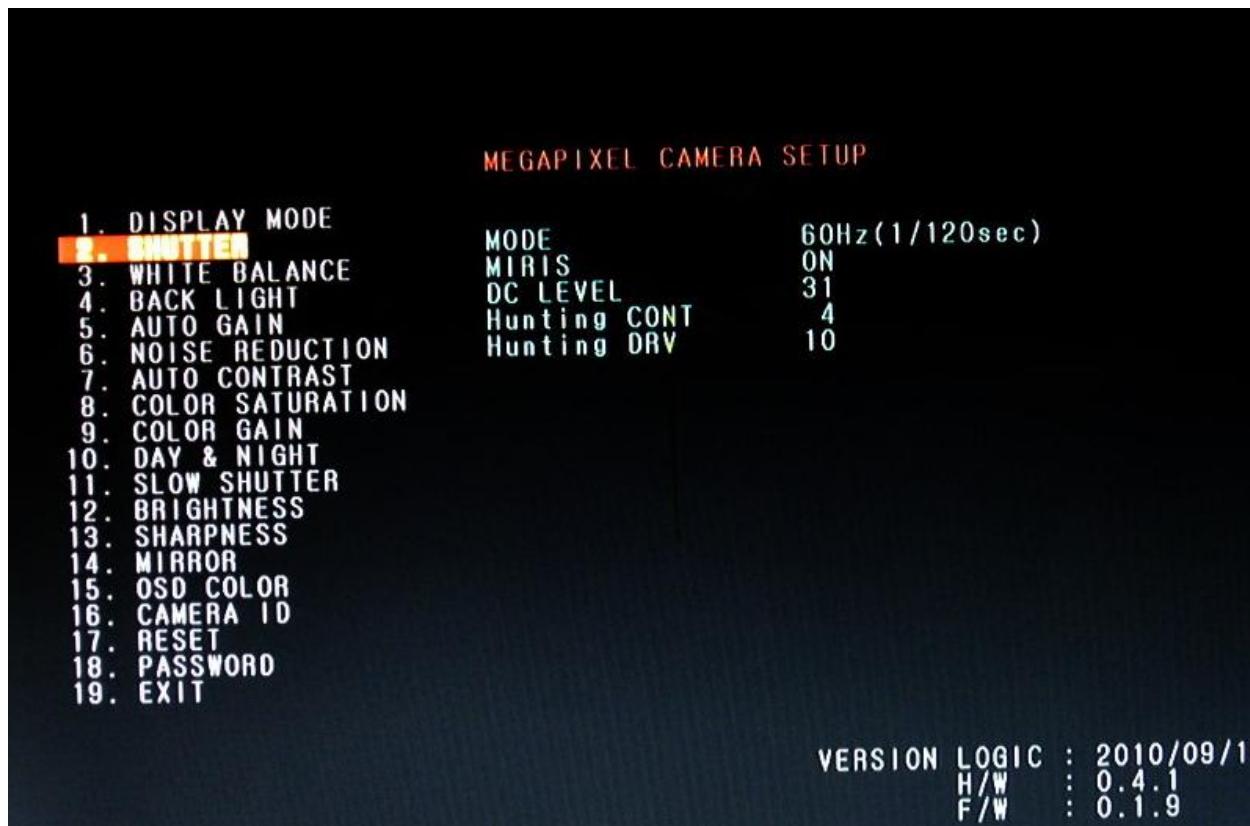
Video Output	1280x720p60
Gamma	WDR
Shutter	MIRIS
White Balance	AWB
Back Light Compensation	OFF
Auto Gain	OFF
Color Saturation	7
Color Gain (R)	31
Color Gain (B)	31
Day/Night	OFF
Slow Shutter	OFF
Brightness	35
Sharpness	44
Mirror (H/V)	OFF
OSD Color	GRAY

Camera ID	Customer Option
Factory Reset	Not Used – DO NOT RESET
Password	OFF
Exit Mode	Save/Exit or Exit Without Save

Please note the most important camera settings on the On Screen Display – OSD below. The first screen confirms firmware version 0.1.9, GAMMA at WDR, SDI RESOLUTION at 180 x 720 59.94p. The second screen confirms SHUTTER at MODE 60 Hz (1/120sec), MIRIS ON, and DC LEVEL at 31. All other screen settings are found above.



Display Mode Settings: Gama, SDI Resolution & Firmware

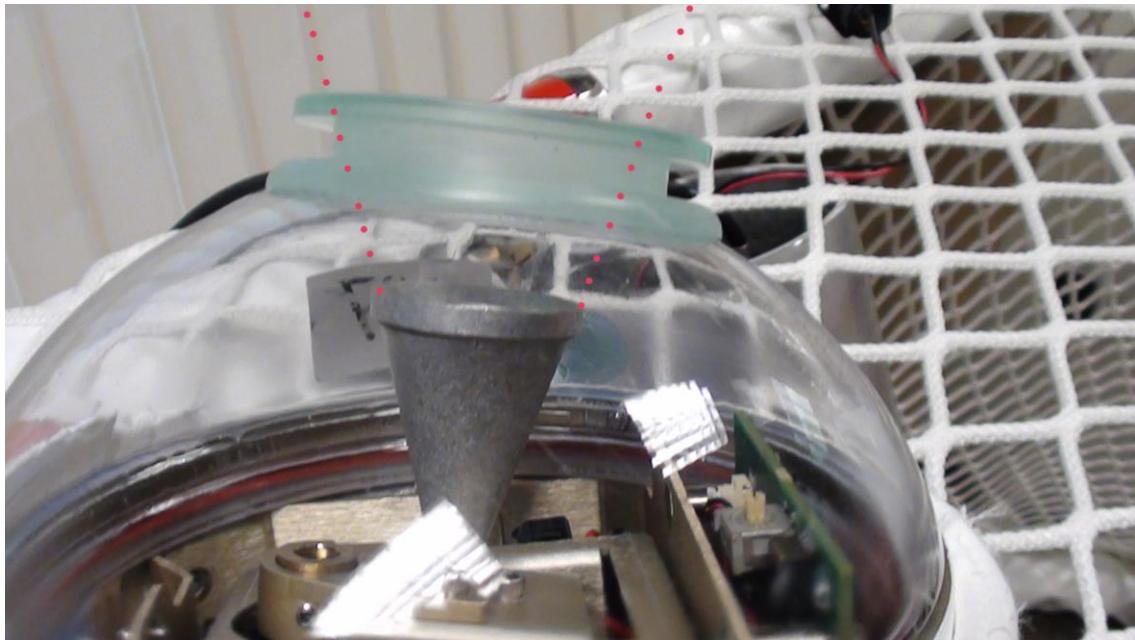


Camera Shutter Settings

Aligning Transmitter RF Signal

1. Connect laptop to Data Port
2. Open GoalCamGUI.exe software and turn on laser
3. Using the Left, Right, Up and Down controls align the GoalCam-TX Horn Antenna with the GoalCam-RX mounted in the ceiling
4. The laser is used to help target the RF signal. It is suggested to have the Venue Lights set to Working Lights Only so the laser is visible. If the laser is not visible take the following steps.
 - a. Locate the RF Antenna Horn in the top dome of the GoalCam-TX Transmitter.
 - b. Note the cone shape.
 - c. While looking from the front of the goal, follow two imaginary lines from each side of the antenna cone to bracket or target the Receiver in the ceiling above.
 - d. Visually adjust the Antenna cone so the Receiver is in the center of the cone using the Right and Left Antenna buttons.
 - e. Perform the same function while watching the RF Antenna Horn from the side of the goal.
 - f. Visually adjust the Antenna cone so the Receiver is in the center of the cone using the Up and Down Antenna buttons.

- g. The RF cone is a wide angle of 20 degrees or a 35 foot circle at a 100 foot height. This adjustment does not need to be precise. Please see below.
- h. Fine adjustments are performed at the Receiver.



RF Antenna Horn Cone Shape

Service Contract

1. VidOvation is to provide service and support to the NHL for the In-net Goal Wireless Camera Systems.
2. In the event of a failure, the faulty units are to be returned at NHL expense to VidOvation for repair. A Repair Authorization (RA) number is to be issued by VidOvation to track all units returned for repair.
3. The NHL has four (4) spare systems that are located in Hauppauge, NY at NeuLion; Jacksonville, FL IDS; Toronto Canada and Southern California at VidOvation.
4. Once units are repaired by VidOvation, the repaired units are to be returned to one of the four (4) regional spare unit facilities mentioned above.
5. VidOvation will maintain spare parts, cables, chassis, assemblies and spare cameras for quick-turn repairs.

Limited Warranty

12 – MONTH LIMITED WARRANTY

VidOvation warrants to the original purchaser that the product (Hardware and components) shall be free from defects in material and workmanship for a period of 1 year from the date of purchase, if a defect covered by this warranty occurs during this 1 year period, VidOvation will repair or replace the defective product or component, at its option, free of charge.

Warranty Limitations

THIS WARRANTY SHALL NOT APPLY IF THIS PRODUCT: (a) IS DAMAGED BY NEGLIGENCE, ACCIDENT, MISUSE, OR BY OTHER CAUSES UNRELATED TO DEFECTIVE MATERIALS OR WORKMANSHIP; OR (b) HAS HAD THE SERIAL NUMBER ALTERED, DEFACED, OR REMOVED. ANY APPLICABLE IMPLIED WARRANTIES ARE HEREBY LIMITED IN DURATION TO THE WARRANTY PERIOD DESCRIBED ABOVE. IN NO EVENT SHALL VIDOVATION. BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES RESULTING FROM THE BREACH OF ANY IMPLIED OR EXPRESS WARRANTIES. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS OR EXCLUSION OF CONSEQUENTIAL OR INCIDENTAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

This warranty gives you specific legal rights and you may also have other rights, which vary from state to state.

FCC and IC Compliance

This device complies with part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Conformité aux normes FCC Cet équipement a été testé et trouvé conforme aux limites pour un dispositif numérique de classe B, conformément à la Partie 15 des règlements de la FCC. Ces limites sont conçues pour fournir une protection raisonnable contre les interférences nuisibles dans une installation résidentielle.

Cet équipement génère, utilise et peut émettre des fréquences radio et, s'il n'est pas installé et utilisé conformément aux instructions du fabricant, peut causer des interférences nuisibles aux communications radio.

Rien ne garantit cependant que l'interférence ne se produira pas dans une installation particulière. Si cet équipement provoque des interférences nuisibles à la réception radio ou de télévision, qui peut être déterminé en comparant et en

l'éteignant, l'utilisateur est encouragé à essayer de corriger les interférences par une ou plusieurs des mesures suivantes:

- Réorienter ou déplacer l'antenne de réception.
- Augmenter la distance entre l'équipement et le récepteur.
- Branchez l'appareil dans une prise sur un circuit différent de celui auquel le récepteur est connecté.
- Consultez votre revendeur ou un technicien radio / TV pour assistance.

Les changements ou modifications à cet appareil sans expressément approuvée par la partie responsable de conformité pourraient annuler l'autorité de l'utilisateur de faire fonctionner cet équipement.

This device complies with Industry Canada license-exempt RSS standard(s).

Operation is subject to the following two conditions:

- (1) this device may not cause interference, and
- (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme avec Industrie Canada exempt de licence Rss standard(s).

Son fonctionnement est soumis aux deux conditions suivantes :

- (1) cet appareil ne peut causer d'interférences, et
- (2) cet appareil doit accepter toute interférence, y compris des interférences qui peuvent provoquer un fonctionnement indésirable du périphérique.

Glossary