X-Series Heads Technical Manual

May 5, 2026

5100DR-082-03

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You've made a great choice. We expect you will be very happy with your purchase of Ross Technology.

Our mission is to:

1. **Provide a Superior Customer Experience**
   - offer the best product quality and support
2. **Make Cool Practical Technology**
   - develop great products that customers love

Ross has become well known for the Ross Video Code of Ethics. It guides our interactions and empowers our employees. I hope you enjoy reading it below.

If anything at all with your Ross experience does not live up to your expectations, be sure to reach out to us at solutions@rossvideo.com

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Ross Video Code of Ethics

Any company is the sum total of the people that make things happen. At Ross, our employees are a special group. Our employees truly care about doing a great job and delivering a high quality customer experience every day. This code of ethics hangs on the wall of all Ross Video locations to guide our behavior:

1. We will always act in our customers' best interest.
2. We will do our best to understand our customers' requirements.
3. We will not ship crap.
4. We will be great to work with.
5. We will do something extra for our customers, as an apology, when something big goes wrong and it's our fault.
6. We will keep our promises.
7. We will treat the competition with respect.
8. We will cooperate with and help other friendly companies.
9. We will go above and beyond in times of crisis. If there's no one to authorize the required action in times of company or customer crisis — do what you know in your heart is right. (You may rent helicopters if necessary.)

Technical Manual for X-Series

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US 7,034,886; US 7,508,455; US 7,602,446; US 7,802,802 B2; US 7,834,886; US 7,914,332;
US 8,307,284; US 8,407,374 B2; US 8,499,019 B2; US 8,519,949 B2; US 8,743,292 B2;
GB 2,419,119 B; GB 2,447,380 B.

Other patents may apply or be pending.

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Table of Contents

Welcome 2

- Introducing the X-Series Pan & Tilt Heads 2
- About Ross Robotics 3
- Safety Notices and Regulatory Compliance Statements 3
- Documentation Conventions 7
- Contacting Technical Support 7

Overview 9

- Introducing the X300 9
- About Ross Robotics 9

Installation 10

- Installing an X-Series Head 10
  - Unpacking an X300 or X350 11
  - Mounting and Assembling the Head 11
  - Mounting the Payload 15
  - Balancing the Payload 16
  - Cabling and Tethering 18
  - Use the Built-in Touchscreen to Configure the X350 Head Locally 21
  - Unpacking an X650 21
  - Mounting and Assembling the X650 Head 22
  - Mounting onto a Furio Column 24
  - Cabling the Head 24
  - Testing the Head 26
  - Loading and Balancing 26

Configuration 28

- Configuring X300, X35 0, and X650 Heads 28
  - Using DashBoard Walkabout to Assign Unique IP Addresses 28
  - Configuring X300, X3 50 and X650 Heads Remotely 30
  - Configuring and Operating X350 or X 650 Heads Locally 43
  - Adding Heads to a Control System 58

Control 59

- Controlling the X300, X350, and X650 Heads 59
  - DashBoard Control (PT Head Control Plugin) 59
  - SmartShell Control 60
  - Furio API Control 61

Maintenance 62

Maintenance and Troubleshooting 62

Maintenance 62

Troubleshooting 62

Technical Specifications 65

Technical Specifications 65

Drawings of the X300 Pan & Tilt Head 67

Drawings of the X350 Pan & Tilt Head 71

Drawings of the X650 Pan & Tilt Head 76

Connector Pin Assignments 79

Optional Mounting Accessories 82

Welcome

This section contains the following topics:

- **“Introducing the X-Series Pan & Tilt Heads”**
- **“About Ross Robotics”**
- **“Safety Notices and Regulatory Compliance Statements”**
- **“Documentation Conventions”**
- **“Contacting Technical Support”**

Introducing the X-Series Pan & Tilt Heads

X300 and X350

X300 and X350 robotic pan & tilt heads are compact, affordable, and perfect for robotic camera applications where no prompter is required. With a 15 lb (6.8 kg) payload capacity, they can handle practically any ENG or box camera and lens combination. Based on decades of robotic pan & tilt head design experience, the X300 and X350 offer the smooth, accurate movement that you've come to expect from Ross Robotics, while also incorporating all of the advanced motion control benefits of MotionDirector technology, including keyframed moves (when controlled by SmartShell).

Figure 1.01 shows the X350 pan & tilt head.

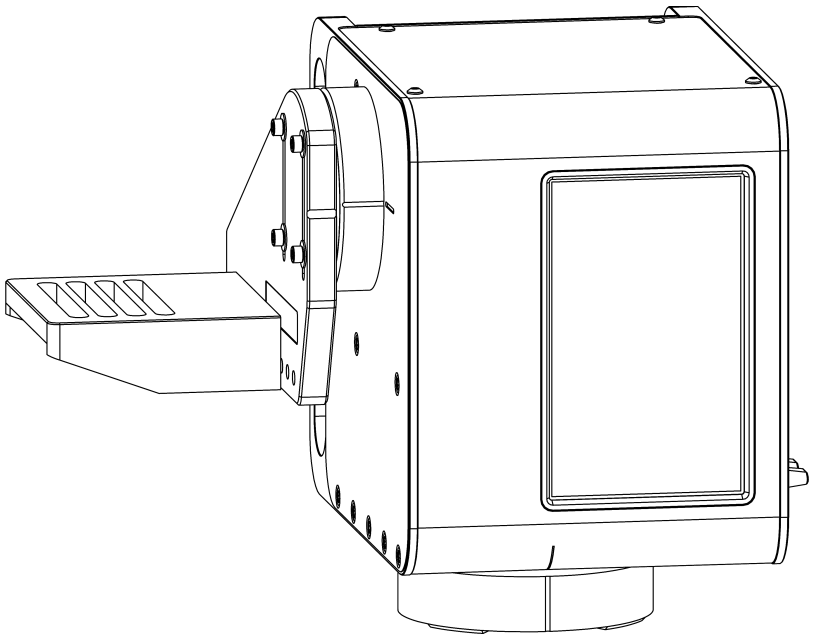


Figure 1.01 — Ross Robotics X350 Pan & Tilt Head (front view, showing touchscreen)

X650 Heads

X650 robotic pan & tilt heads are compact, affordable, and perfect for robotic camera applications. With a125 lb (57 kg) payload capacity, they can handle practically any ENG or box camera and lens combination. Based on decades of robotic pan

& tilt head design experience, the X650 offer the smooth, accurate movement that you've come to expect from Ross Robotics, while also incorporating all of the advanced motion control benefits of MotionDirector technology, including keyframed moves (when controlled by SmartShell).

Figure 1.02 shows the X650 pan & tilt head.

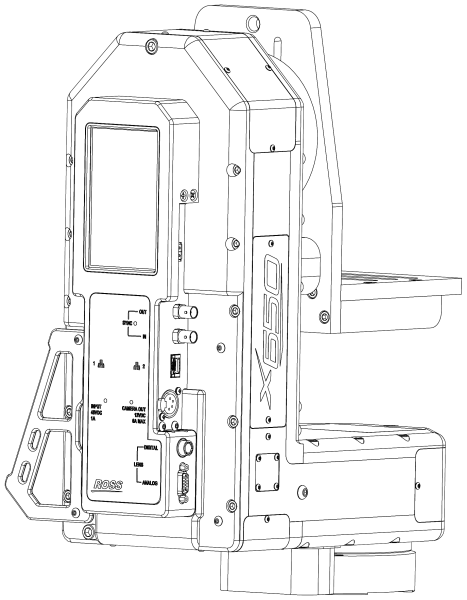


Figure 1.02 — Ross Robotics X650 Pan & Tilt Head (side view, showing touchscreen)

For detailed technical specifications and more drawings of the X-Series heads, see “Technical Specifications”.

About Ross Robotics

Ross Video has the most complete studio robotics offering available, whether you are looking for the unparalleled smoothness of a track-based system, the unbeatable flexibility of a free-roaming pedestal, or the simple efficiency of a standalone pan & tilt head. All Ross robotic systems are designed, developed and manufactured in-house, using state-of-the-art technologies that provide industry-leading accuracy, precision, and payload capacity. Ross Video designs, manufactures, and sells a wide variety of camera motion systems to suit your needs.

Safety Notices and Regulatory Compliance Statements

This section contains important safety notices and regulatory compliance notices.

Safety Notices

Please read and observe the following safety notices.

Table 1.01

	**Caution**	This equipment must be operated by trained personnel only. This equipment must be operated in a controlled and restricted environment only.
	**Warning**	The safe operation of this product requires that a protective earth connection be provided. A grounding conductor in the equipment's supply cord provides this protective earth. To reduce the risk of electrical shock to the operator and service personnel, this ground conductor must be connected to an earthed ground. Use only power cords specified for this product and certified for the country of use. Do not defeat safety purpose of the grounding-type plug. A grounding type plug has two blades and a third grounding prong. The third prong is provided for your safety. If the provided plug does not fit in to your outlet, consult an electrician for replacement of the obsolete outlet. Protect power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and points where they exit from the apparatus.
	**ESD**	**ESD Susceptibility** — This symbol on the equipment or within the equipment manual indicates that an electrical or electronic device or assembly is susceptible to damage from an ESD event.
	**Warning**	**Hazardous Voltages** — This symbol on the equipment or within the equipment manual indicates the presence of uninsulated “dangerous voltage” within the product enclosure that may be of sufficient magnitude to constitute a risk of shock to persons.
	**Warning**	**Indoor Use** —“WARNING – TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPARATUS TO RAIN OR MOISTURE” Do not use this apparatus near water. Do not block any ventilation openings. Install in accordance with manufacturer’s instructions. Do not install near heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat. Only use attachments/accessories specified by the manufacturer. Unplug this apparatus during lightning storms or when unused for long periods of time. Clean only with a dry cloth.
	**Warning**	Refer all servicing to qualified personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug damage; liquid has been spilled or objects have fallen into the apparatus; the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

	**Warning**	To reduce the risk of fire, replacement fuses must be the same type and rating.
	**Warning**	This product contains safety critical parts, which if incorrectly replaced may present a risk of fire or electrical shock. Components contained within the product's power supplies and power supply area are not customer-serviceable and should be returned to the factory for repair.
	**Caution**	Ensure that proper cable management techniques are used at all times. Bundle and wrap cables neatly, and provide adequate strain relief and slack where necessary. Test your cable installation by moving the robotic units through their entire range of motion slowly while observing the cables, to ensure that they do not become taut, or snag on anything. Avoid running cables along floors in places where they may present a tripping hazard. Clearly mark areas where cables may present a tripping hazard, and keep personnel away from such areas. Inspect cables periodically for damage, and to ensure that proper cable management is maintained.
	**Warning**	Damaged or improper cables may cause electric shock and/or fire. Ensure that all cables and connectors are of suitable type for their purpose, and that all power cable conductors are of adequate gauge for the voltage and current required. Inspect all cables periodically to check for damage. If a cable becomes damaged, turn off power to the system immediately, and then replace the damaged cable.
	**Warning**	Serious injuries can result from people tripping over equipment and cables. Methods of reducing such risks include, but are not limited to, the following: • Erect signs at studio entrances to remind people about tripping hazards and other studio hazards. • Train personnel about safety procedures and proper cable management techniques. • Show personnel and guests the locations of cables and equipment, and explain that robotic cameras and cables attached to them may move at any time. • Escort guests at all times while in the studio. • Ensure adequate lighting when working in the studio. • Mark safe paths and/or restricted areas, to keep people away from moving robots and potential tripping hazards.
	**Caution**	Loose or overtightened bolts may cause equipment damage. When servicing, tighten bolts to specified torque.

	**Warning**	Moving parts may present a pinching hazard. Keep all personnel away from robots when they are operational. When a robotic head or robotic lift column moves, fingers touching or near the unit or the payload may become pinched. When installing or adjusting the payload, ensure that power to the system is turned off.
	**Warning**	When servicing or moving equipment, always observe safe handling practices. Get help to move heavy items. Use safe lifting techniques. Follow all safety rules of your workplace.
	**Caution**	Loose payloads may slip, causing equipment damage and injury. Periodically check all fasteners that secure the payload, to ensure that they are tightened to specified torque. If the payload is loose or slips, ensure that it is properly balanced and secured before operating the robot.
	**Warning**	Improper mounting may cause equipment damage and serious injury. When mounting a robotic head to a surface or structure, use approved mounting equipment. Use fasteners that are rated for the total load, and are suitable for the material to which they are being fastened. Install safety tethers as required, to ensure that the payload and robot do not fall if the mount fails. Ensure that the mounting surface or structure is sturdy and capable of supporting the total load. Ensure that the mounting surface or structure is immobile and that it will not move when the robotic head moves.
	**Caution**	Imbalanced payloads may cause equipment damage and may present a tipping hazard. Ensure payloads are properly balanced both horizontally and vertically, around the tilt axis of the head. If you adjust a payload, always rebalance it.

Regulatory Compliance Statements

This section contains regulatory compliance statements.

FCC Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canada Class A Statement

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations

Cet appareil numérique de la Classe A Respecte toutes les exigences du Règlement sur le matérial brouiller du Canada.

CE Statement

Electromagnetic Compatibility Statement: Meets 2014/30/EU Directive

Low Voltage Directive: Meets 2014/35/EU Directive

Korea Class A Statement

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

Documentation Conventions

Special text formats are used in this manual to identify parts of the product or user interface, text that a user must type, or a sequence of menus and submenus that must be followed to reach a particular command.

Interface Elements

Bold text is used to identify a part of the physical product, or a user interface element such as a dialog box, menu item, or button. For example:

In the **Address** cell, type a unique IP address for the head.

Touch-Screen Support

This guide assumes you are using a touch-screen. The guide includes instructions to tap user interface elements. If you are using a mouse instead of a touch screen, click the mouse instead of tapping.

User-Typed Text

Courier text is used to identify text that a user must type. For example:

In the **File Name** box, type Channel02.property.

Referenced Guides

Italic text is used to identify the titles of referenced guides, manuals, or documents. For example:

Quick Start Guide for X300 and X350 (5100DR-081-xx) .

Menu Sequences

Menu arrows are used in procedures to identify a sequence of menu items that you must follow. For example, if a step reads, “ **Server** > **Save As** ,” you would tap the **Server** menu and then tap **Save As** .

Contacting Technical Support

At Ross Video, we take pride in the quality of our products, but if problems occur, help is as close as the nearest telephone.

Our 24-hour Hot Line service ensures you have access to technical expertise around the clock. After-sales service and technical support is provided directly by Ross Video personnel. During business hours (Eastern Time), technical support

personnel are available by telephone. After hours and on weekends, a direct emergency technical support phone line is available. If the technical support person who is on call does not answer this line immediately, a voice message can be left and the call will be returned shortly. This team of highly trained staff is available to react to any problem and to do whatever is necessary to ensure customer satisfaction.

- **Technical Support:** (+1) 613-652-4886
- **Toll-Free Technical Support:** 1-844-652-0645 (North America) or +800 1005 0100 (International)
- **ROSS VIDEO | HELP CENTER:** https://support.rossvideo.com/hc/en-us
- **E-mail:** techsupport@rossvideo.com
- **Website:** http://www.rossvideo.com

Overview

Introducing the X300

The X300 Pan & Tilt Head is compact, affordable, and perfect for robotic camera applications where no prompter is required. With a 15 lb (6.8 kg) payload capacity, it can handle practically any ENG or box camera and lens combination. Based on decades of robotic pan & tilt head design experience, the X300 offers the smooth, accurate movement that you've come to expect from Ross Robotics, while also incorporating all of the advanced motion control benefits of MotionDirector technology, including keyframed moves (when controlled by SmartShell).

Figure 2.01 shows the Ross X300 Pan & Tilt Head.

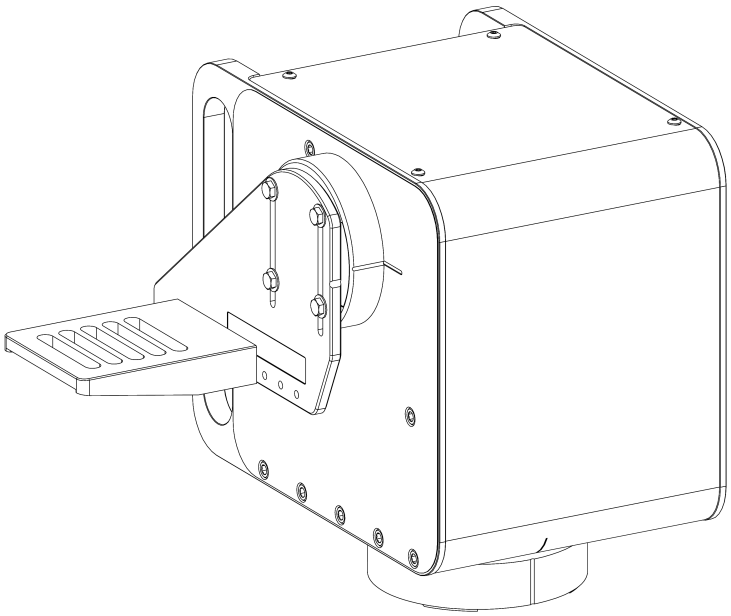


Figure 2.01 — Ross Robotics X300 Pan & Tilt Head

For detailed technical specifications and more drawings of the X300, see “Technical Specifications”.

About Ross Robotics

Ross Video has the most complete studio robotics offering available, whether you are looking for the unparalleled smoothness of a track-based system, the unbeatable flexibility of a free-roaming pedestal, or the simple efficiency of a standalone pan & tilt head. All Ross robotic systems are designed, developed and manufactured in-house, using state-of-the-art technologies that provide industry-leading accuracy, precision, and payload capacity.Ross Video designs, manufactures, and sells a wide variety of camera motion systems to suit your needs.

Installation

Installing an X-Series Head

This section describes how to install an X300, X350, or X650 robotic pan & tilt head.

Before you install any heads, we recommend you review “Site Requirements”.

> **TIP**
>
> If the head(s) you are installing are model X350 or X650, you can configure them locally as you install them, or you can configure them remotely afterwards. If you want to configure the X350 heads as you install them, you must first either configure DHCP on your network or know what static IP address you want to assign to each X350 head.

> **IMPORTANT**
>
> Perform all procedures in the order presented.

For the X300 or X350, this section includes the following topics:

- **“Unpacking an X300 or X350”**
- **“Mounting and Assembling the Head”**
- **“Mounting the Payload”**
- **“Balancing the Payload”**
- **“Cabling and Tethering”**

For the X650, this section includes the following topics:

- **“Unpacking an X650”**
- **“Mounting and Assembling the X650 Head”**
- **“Mounting onto a Furio Column”**
- **“Cabling the Head”**
- **“Testing the Head”**
- **“Loading and Balancing”**

After you install one or more heads, you must configure them. For more information, see “Configuring X300, X350, and X650 Heads”.

Unpacking an X300 or X350

Unpack the head and check that the following components are present:

- X300 or X350 robotic pan and tilt head (X300: **5110AR-372-xx** , X350: **5110AR-365-xx**)
- Camera cradle attachment (**5100AR-383-xx**)
- Kit with three 3/8-16 and 1/4-20 camera screws in multiple lengths (1/2”, 5/8”, 1”) with washers (**5110KR-203-xx** for X300, **5110KR-242-xx** for X350).
- **Note** : Use the appropriate type based on your camera’s mounting thread.
- Bag of four M5 18 mm cradle mount screws and washers (**5110KR-039-xx**)
- One of the following lens control cables, as selected when the head was ordered):
  - For digital Fujinon RD/ZD drives (10-pin at lens): Ross order code **RRB-UNI-DLF10** .

    A tag on the cable reads **5100CR-759- xx** .
  - For digital Fujinon RD/ZD drives (20-pin at lens): Ross order code **RRB-UNI-DLF20** .

    A tag on the cable reads **5100CR-029- xx** .
  - For digital Canon IASE drives (20-pin at lens): Ross order code **RRB-UNI-DLC** .

    A tag on the cable reads **900-212- xx** .
  - For analog control of Canon (KTS or compatible) or Fujinon (BMD or compatible) lenses: Ross order code **RRB-UNI-ALC** (universal analog lens control cable).

    A tag on the cable reads **5110CR-146- xx** .
- AC power adapter and line cord suitable for your location (based on shipping address or special request)

  Retain all packaging materials in case you need to ship the head later.

Mounting and Assembling the Head

X300 or X350 PT Heads

This section describes how to mount an X300 or X350 head, and attach the camera cradle.

Before you begin, record the serial number from the underside of the head (see Figure 3.01). You may need it later to configure the head.

Mount the Head

A variety of mounting accessories are available from Ross Video. For more information, see “Optional Mounting Accessories”.

The bottom of the head has four mounting holes (1/4-20, 3/4" (19 mm) maximum penetration depth). See Figure 3.01 for spacing details.

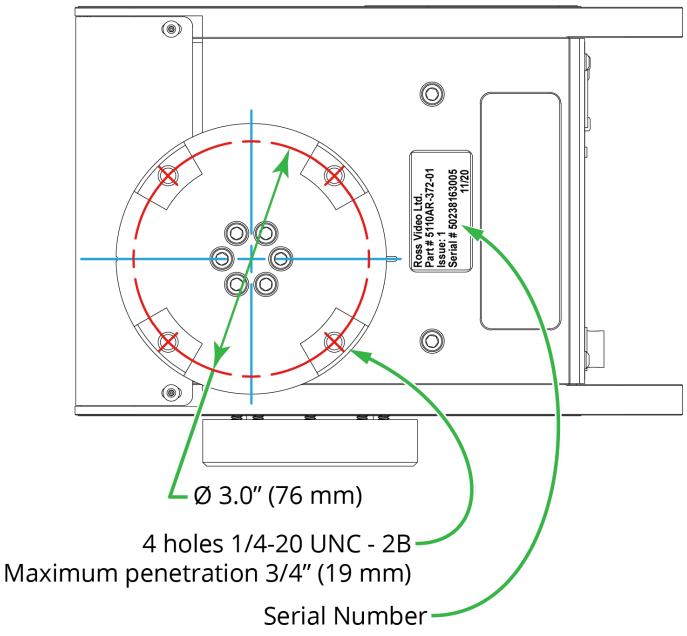


Figure 3.01 — Bottom of an X300 Head, showing Mount Hole Spacing

To mount the head:

1. Find the orientation mark on the **Pan** axis hub and note whether it is aligned with a similar mark at the front of the head (Figure 3.02). The front is the side that is opposite from the connection panel.

   If the two marks are not approximately aligned, gently and slowly turn the **Pan** axis hub by hand to align the marks. They do not need to be perfectly aligned.

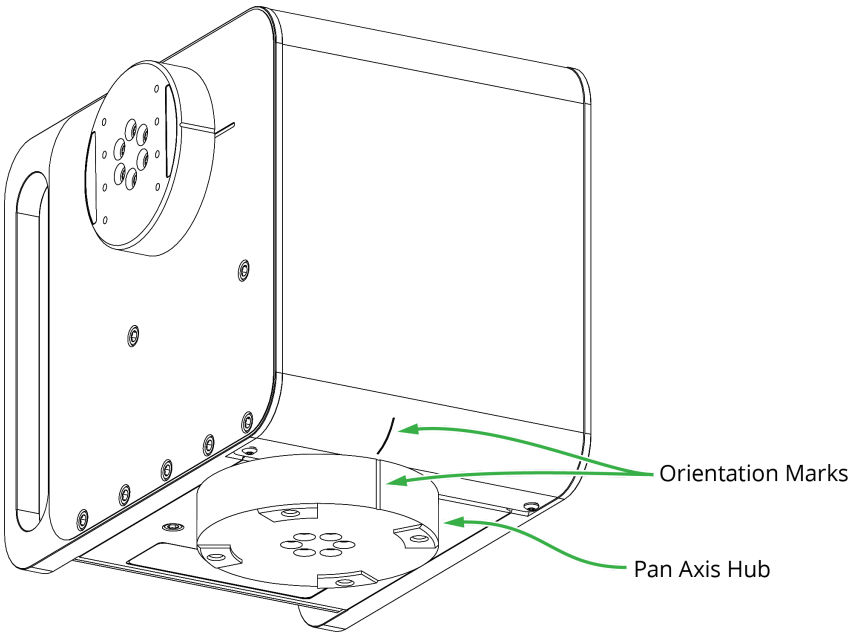


Figure 3.02 — X300, showing Pan Axis Orientation Marks

2. Fasten the head to the mount using four head mount screws (included with **PM4** or **PM8**).

   Use a 3/16“ hex key (Allen key).

> **IMPORTANT**
>
> Point the front of the head towards the set or the scene you want to record on video.

Figure 3.03 illustrates how to mount the head on a PM8 Pedestal Riser (RRB-UNI-PM8).

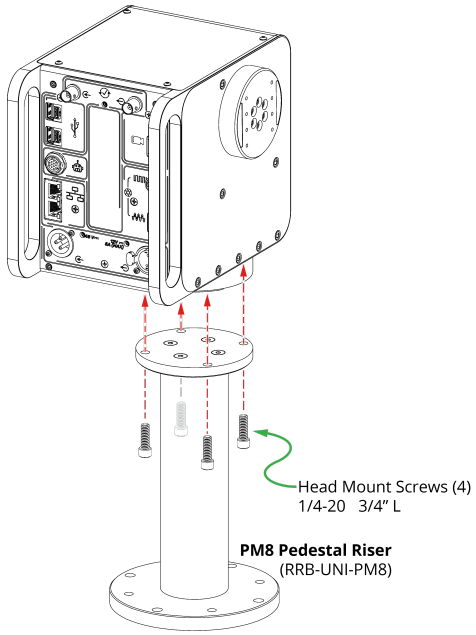


Figure 3.03 — Mounting an X350 Head on a PM8 Pedestal Riser

3. If the head is an X350, ensure that the Ross logo badge on the side of the head is upright. Rotate it if necessary.

   The badge clicks into place.

   The position of the badge controls the orientation of the X350 touch-screen display.

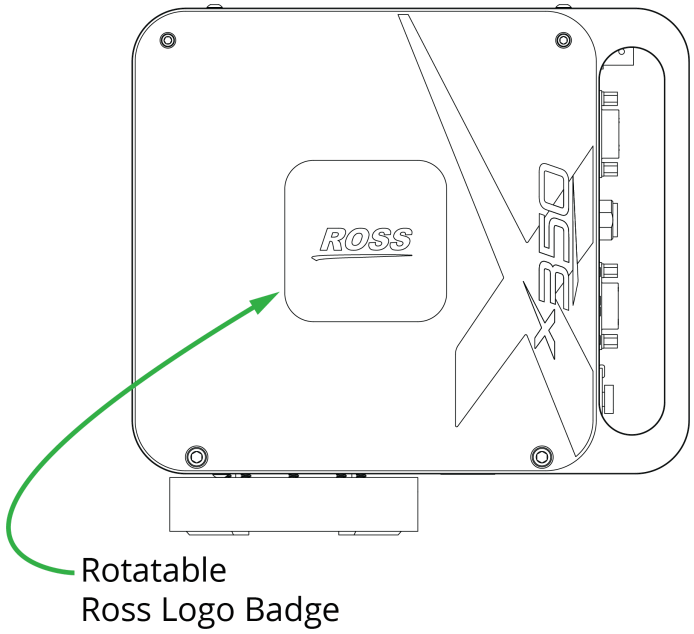


Figure 3.04 — Side View of an X350 Head, showing the Ross Logo Badge

Attach the Camera Cradle

The camera cradle attached to the Tilt hub of the X300 or X350 head.

To attach the camera cradle:

1. Find the orientation mark on the **Tilt** axis hub and note whether it is aligned with a similar mark pointing towards the front of the head (Figure 3.05). The front is the side that is opposite from the connection panel.

   If the two marks are not approximately aligned, gently and slowly turn the **Tilt** axis hub by hand to align the marks. They do not need to be perfectly aligned.

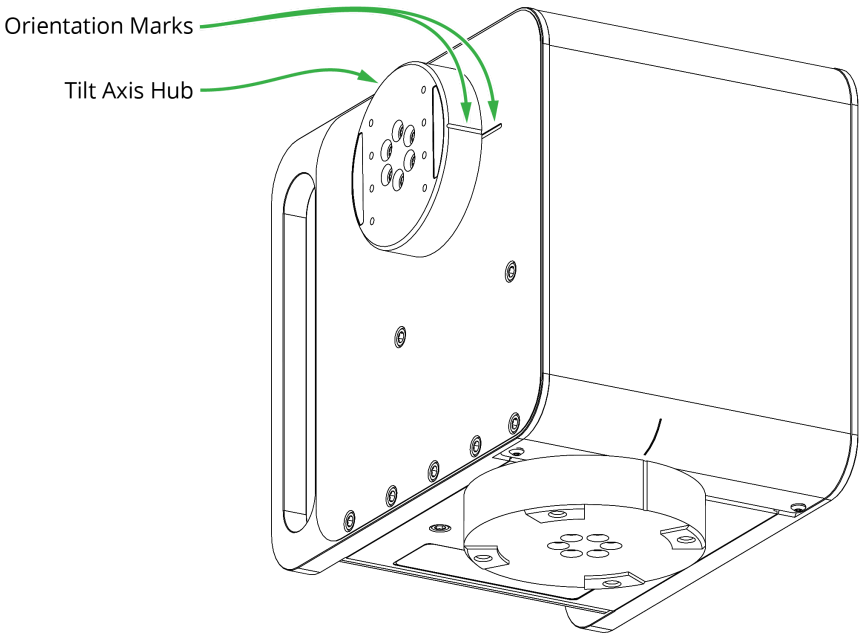


Figure 3.05 — X300, showing Tilt Axis Orientation Marks

2. Fasten the camera cradle to the head using four cradle mount screws and washers (bag **5110KR-039- xx**).

   Use an 8 mm flat wrench to drive the screws.

   Figure 3.06 illustrates how to attach the camera cradle.

> **TIP**
>
> The exact camera cradle position is not critical. You may need to adjust it later to balance the payload.

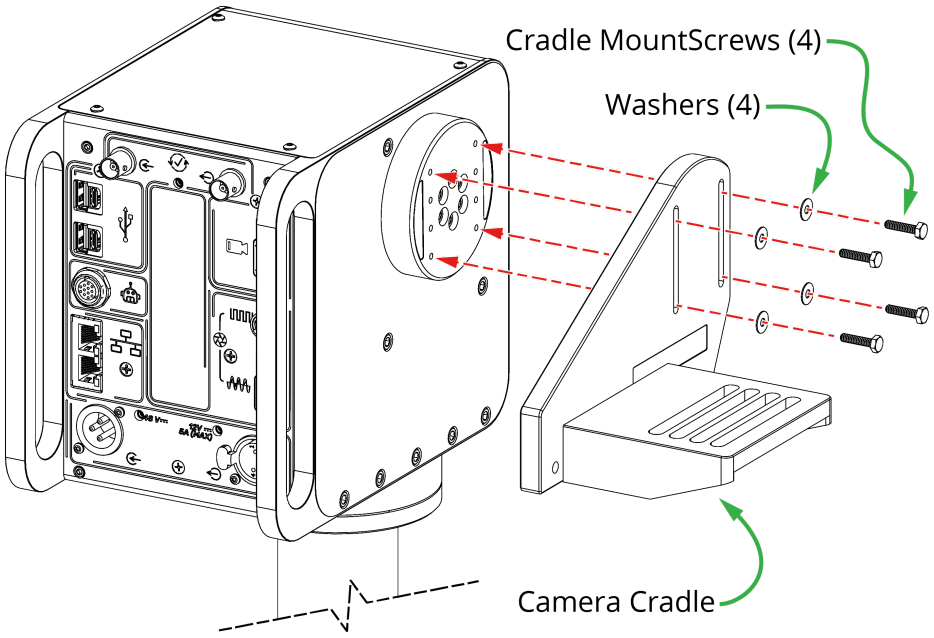


Figure 3.06 — Attaching the Camera Cradle

Mounting the Payload

This section describes how to assemble the payload and mount it on the camera cradle.

To assemble and mount the payload:

1. Attach the lens and other payload components to the camera.
2. Check the total payload weight.

> **IMPORTANT**
>
> Maximum payload is 15 lbs (6.8 kg).

3. Fasten the camera to the camera cradle using two camera screws and washers, depending on your camera's mounting thread.

Use the 1/4-20 screws (5110KR-040-xx) with a 3/16" hex key (Allen key), or the 3/8-16 screws (5110KR-030-01) with an 5/16” hex key.

Figure 3.07 illustrates how to mount the payload.

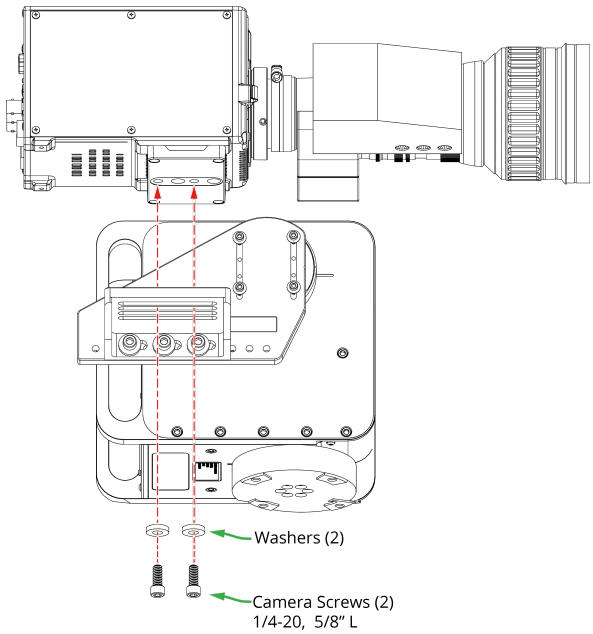


Figure 3.07 — Mounting the Payload

4. **IMPORTANT** : After you mount the payload, you must balance it! For more information, see **“Balancing the Payload”**.

Balancing the Payload

For best performance, and to reduce wear on the head’s drive train, you must ensure that the payload’s center of gravity is aligned with the tilt axis. You must balance the payload horizontally, and then vertically.

This section describes how to balance the payload. Perform the procedures in this section when installing a new X300 or X350 head, and whenever you replace, add, or reposition any payload components.

The head and camera cradle are designed to make balancing easy. Figure 3.08 illustrates the following payload balancing adjustment features:

- Three screws along the bottom edge of the camera cradle fasten the cradle pieces together, and allow for horizontal adjustment (forwards / backwards):
    - A series of threaded holes allow the screws to be repositioned for major horizontal adjustments.

> **TIP**
>
> When repositioning the screws, be careful to avoid losing washers.

- Slots allow for horizontal fine-tuning.

IMPORTANT

Be sure to tighten the three screws that fasten together the camera cradle pieces. These screws are shipped partially-loose.

- Four M5 screws that join the camera cradle to the head (8 mm flat wrench required) allow for vertical adjustment (up / down):
    - A series of threaded holes allow the screws to be repositioned for major vertical adjustments.

TIP

When repositioning the screws, be careful to avoid losing washers.

- Vertical slots on the camera cradle allow for vertical fine-tuning.

IMPORTANT

Always use four screws to fasten the camera cradle to the head (two per slot).

IMPORTANT

An overweight or improperly balanced payload can cause permanent damage to the head.

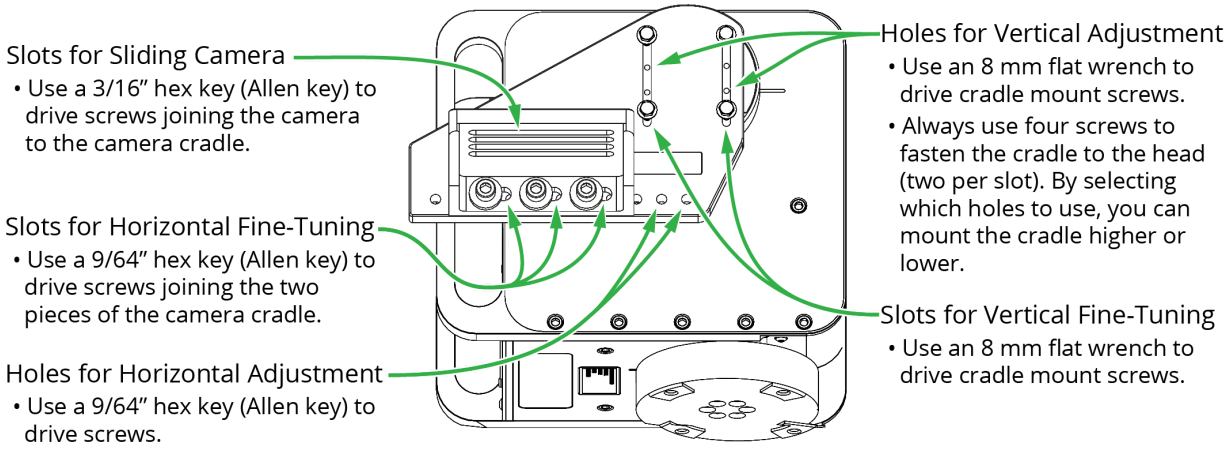


Figure 3.08 — Payload Balancing Adjustment Features

To balance the payload horizontally:

1. Ensure that power to the head is disconnected.
2. Manually tilt the payload so that it is horizontal, and then release it.
3. If the payload does not tilt, it is horizontally balanced. Skip the remaining steps, and proceed to the next procedure.

4. Use the horizontal adjustment features (see Figure 3.08) to move the payload away from the direction it tilted, and then test again.
5. Continue adjusting and testing until the payload is horizontally balanced.

> **TIP**
>
> After you balance the payload horizontally, use a grease pencil or marker to mark the position of the payload on the camera cradle.

To balance the payload vertically:

1. Manually tilt the payload approximately 40° (but not as far as it can go), and then release it.
2. If the payload does not move, it is vertically balanced. Skip the remaining steps in this procedure.
3. Based on the direction the head tilts, note whether it needs to be raised or lowered:
   - If the payload tilts back towards horizontal, it is mounted too low, and must be raised.
   - If the payload continues tilting away from horizontal, it is mounted too high, and must be lowered.
4. Use the vertical adjustment features (see Figure 3.08) to raise or lower the payload as required, and then test again.

> **TIP**
>
> If you cannot easily access the vertical adjustment screws, you may need to temporarily remove the payload from the camera cradle. Be sure to return it to its original horizontal position.

5. Continue adjusting and testing until the payload is vertically balanced.

> **TIP**
>
> After you balance the payload vertically, use a grease pencil or marker to mark the position of the cradle mount screws on the cradle.

Cabling and Tethering

Connect and dress cables, and then attach safety tethers.

Figure 3.09 illustrates cable connections on the X350 head. The X300 is similar, but with fewer connectors, as noted.

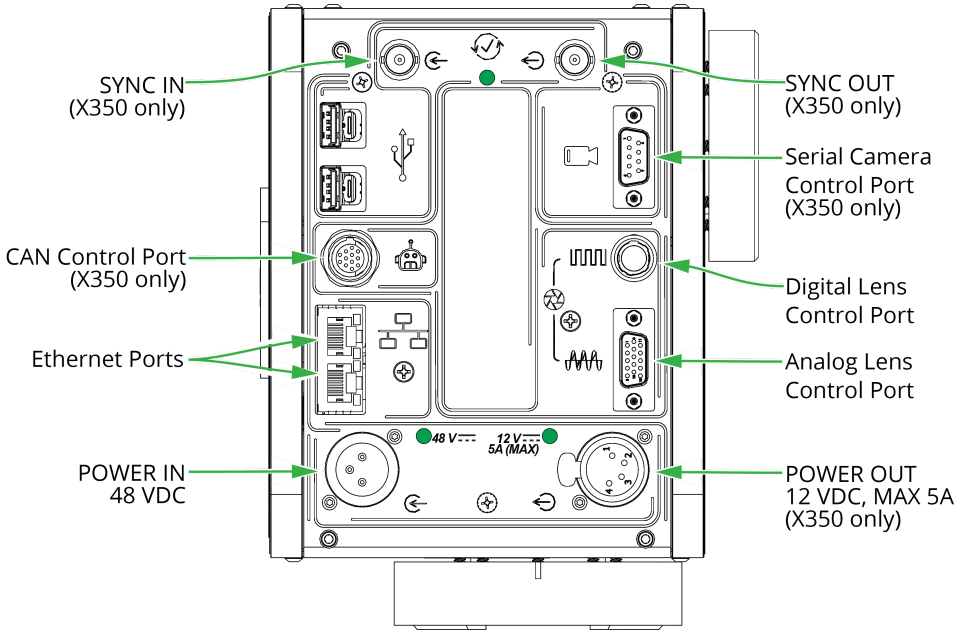


Figure 3.09 — Cabling the X350 Head

To cable an X300 or X350 head:

1. Connect a CAT5E cable from the Ethernet network to one of the two **Ethernet Ports** on the head.
   To reduce EMI, install the provided ferrite core (manufacturer part number 74271131) on the Ethernet cable as close as possible to the port on the head.
2. If camera control over IP is required, connect a CAT5E cable from an **Ethernet Port** to the camera.

> **TIP**
>
> If the camera can be controlled both over IP and through a serial digital connection, and you want to cascade the network connection from head-to-head, use the **Serial Camera Control Port** for camera control. This leaves both Ethernet ports available for daisy-chaining the network connection.

3. If there is a vacant **Ethernet Port** and you want to cascade the network connection from head to head, connect a CAT5E cable between the **Ethernet Port** and an **Ethernet Port** on the next head.
4. If the head is a model X350 and is mounted on a Furio dolly, Furio SkyDolly, or Furio BlackBird pedestal, connect a CAN data cable from the control network to the **CAN Control Port** on the X350 head.

> **TIP**
>
> The control network connection is typically via the connection panel of a Furio Dolly, SkyDolly, or BlackBird pedestal).

> **NOTE**
>
> CAN bus communication requires **firmware v6.0.200** (minimum) to be installed on the X350 head.

5. If lens control is analog, connect a suitable lens control cable from the **Analog Lens Control Port** to the lens.

6. If lens control is digital, connect a suitable lens control cable from the **Digital Lens Control Port** to the lens.
7. If the head is a model X350 and serial camera control is required, connect a suitable serial cable from the **Serial Camera Control Port** to the camera.
8. If the head is a model X350 and a sync signal is available, connect the sync cable to the **SYNC IN** port (standard BNC).

> **TIP**
>
> You can also provide the sync signal to another device, such as a camera or robotic head, via the **SYNC OUT** port (standard BNC).

9. If the head is a model X350 and you want to provide 12 VDC power from the head to the camera, connect the camera's power cable to the **POWER OUT** port on the head. Maximum current is 5 Amps. Maximum power is 60 Watts.
10. Connect the power adapter cable to the **POWER IN** port on the head.
11. Dress all cables carefully to
    - allow the full range of pan & tilt motion without snagging, or obscuring the camera lens.
    - prevent strain on cable connections, by attaching cables to the head's handles (Figure 3.10). Minimize drag by tying cables to a fixed support close to the head, and by keeping the unsupported cable swag short.

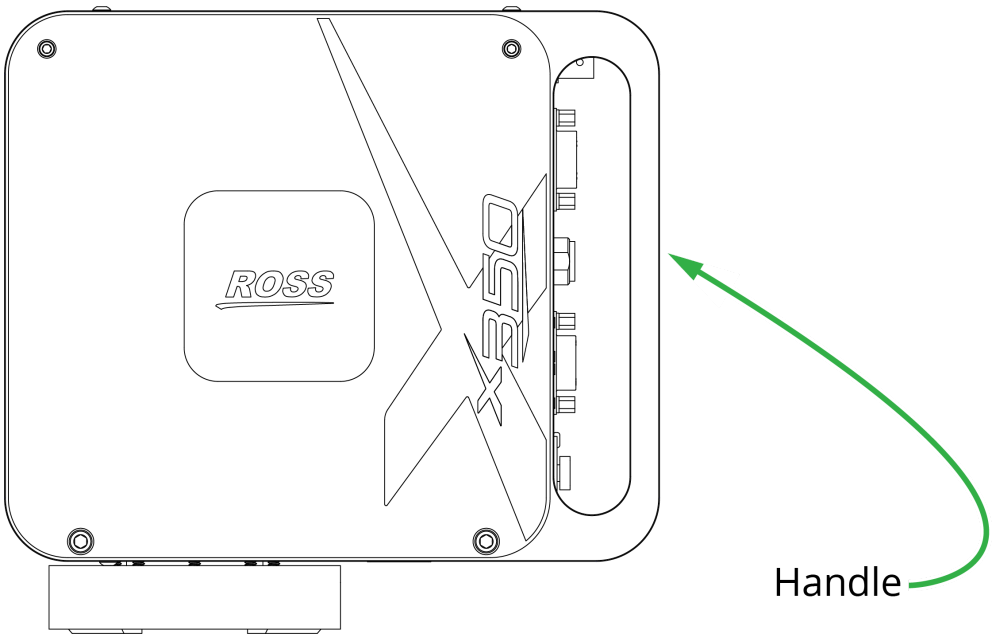


Figure 3.10 — Side View of an X350 Head, showing a Handle

- prevent physical damage to the cables, such as can be cause by foot traffic, rolling equipment, etc.
- prevent risk to personnel such as can be caused by tripping over poorly-dressed cables.

1. Attach any required safety tethers, looping them through both handles or through only the handle on the payload side of the head (preferred).

   Ensure all tethers allow full pan & tilt motion without excess slack, and without obscuring the camera lens.

Do not dress (bundle or zip-tie) safety tethers!

2. Connect the line cord to the power adapter, and then plug it into a suitable electrical socket.

> **IMPORTANT**
>
> Whenever you disconnect power to the X300 head, wait at least 20 seconds before reconnecting it. Otherwise, the head may not start properly.

Use the Built-in Touchscreen to Configure the X350 Head Locally

The X350 head features a built-in touchscreen interface that enables you to configure network connectivity and set axis limits locally.

If you plan to use DHCP to assign IP addresses dynamically, or you know the static IP address you want to assign to each X350 head, you can configure network connectivity settings for the heads as you install them. You can also set persistent and temporary axis limits.

Alternatively, you can perform configuration tasks remotely, using DashBoard and a web interface.

For more information about using the X350 touchscreen, see “Configuring and Operating X350 or X650 Heads Locally”.

Unpacking an X650

Unpack the head and check that the following components are present:

- X650 robotic pan and tilt head (X650: **5110A R-09 6-xx)**
- 600 Series Cradle Kit (**5 1 1 0 K R-066-xx**).
- Head mounting kit with four 3/8-16 x 1-1/4 screws (**5110KR-100-01**).
- Kit for the 48V 160W power supply (**5110KR-217-01**).
- Furio Mounting Kit: Contains V3 Coupling for mounting (**5110KR-100-xx**).
- Bag of 5/8-16 x 1” camera mount screws and washers (**511 0KR-030-x x**)
- One of the following lens control cables, as selected when the head was ordered):
  - For digital Fujinon RD/ZD drives (10-pin at lens): Ross order code **RRB-UNI-DLF10** .

    A tag on the cable reads **5100CR-759- xx** .
  - For digital Fujinon RD/ZD drives (20-pin at lens): Ross order code **RRB-UNI-DLF20** .

    A tag on the cable reads **5100CR-029- xx** .
  - For digital Canon IASE drives (20-pin at lens): Ross order code **RRB-UNI-DLC** .

    A tag on the cable reads **900-212- xx** .

- For analog control of Canon (KTS or compatible) or Fujinon (BMD or compatible) lenses: Ross order code **RRB-UNI-ALC** (universal analog lens control cable).

  A tag on the cable reads **5110CR-146- xx** .

- AC power adapter and line cord suitable for your location (based on shipping address or special request)

Retain all packaging materials in case you need to ship the head later.

Mounting and Assembling the X650 Head

This section describes how to mount an X650 head, and attach the camera cradle.

Before you begin, record the serial number from the underside of the head (see Figure 3.01). You may need it later to configure the head.

Attaching the Camera Cradle

1. Fasten the cradle to the head using the four bolts and four washers provided.
2. The head has eight holes. Fasten two bolts into the top two holes, and two bolts into the bottom two holes. Do not over tighten.

   See Figure 3.01 for spacing details.

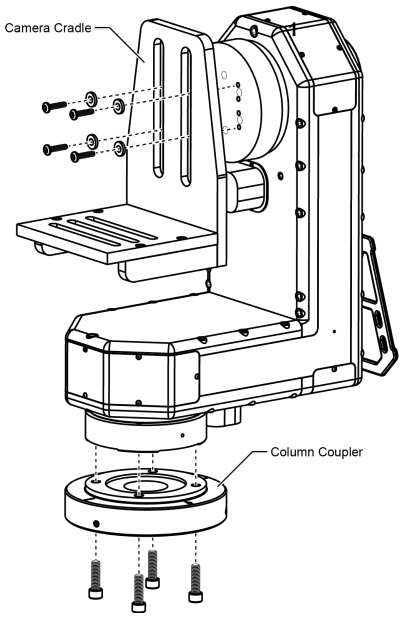


Figure 3.11 — Attaching an X650 to the camera cradle

Attaching the Furio Column Coupler

If you are using the X650 with a Furio column, attach the provided column coupler to the head.

1. Align the orientation mark on the coupler with the drilled orientation hole on the base of the head.

2. Fasten the coupler to the head using the four bolts provided. Do not overtighten.

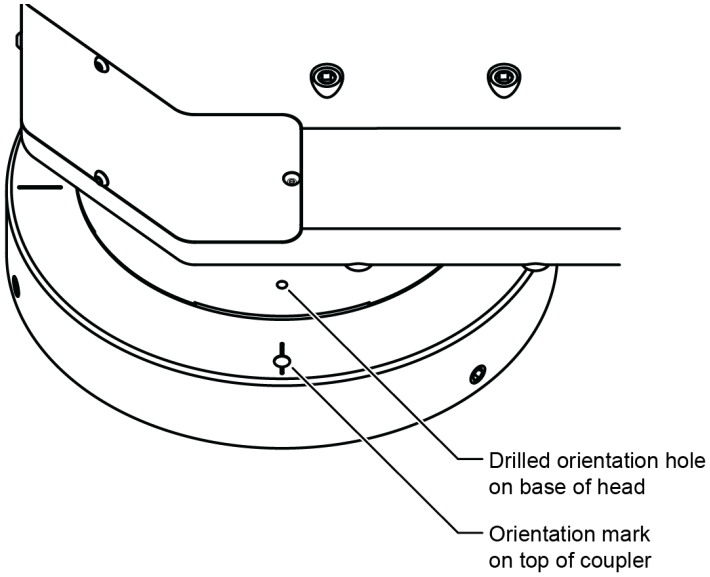


Figure 3.12 — Attaching an X650 to the Column Coupler

3. **IMPORTANT** : The coupling has two orientation marks (one for BlackBird Pedestal and the other for Furio Dollies). Ensure the X650's homing position faces in the direction of travel for the pedestal and perpendicular to the travel of the dolly.

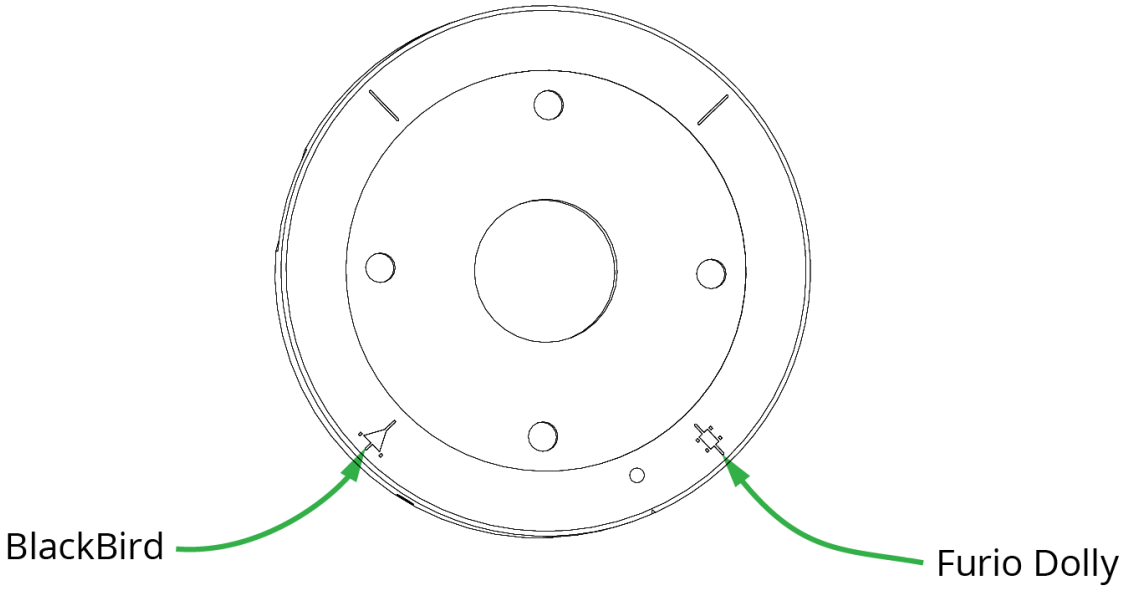


Figure 3.13 — Column Coupler Orientation Marks

Mounting onto a Furio Column

SAFETY NOTICE: Two people are required to lift and mount the head. The head is heavy and can cause injury and/or be damaged if dropped.

1. If the column is a lift column, lower it completely and turn off power to the system.
2. Note the orientation recess on the top of the column, and the corresponding flange on the bottom of the column coupler. These must align when you mount the head.
3. Keeping the head level at all times, lift the head onto the column.
4. Rotate the head until the orientation recess on the top of the column engages with the corresponding flange on the bottom of the column coupler. Ensure that the head is well seated on the column and does not rock.
5. Fasten the column coupler to the column by tightening the three set screws embedded in the edge of the coupler. Do not overtighten.

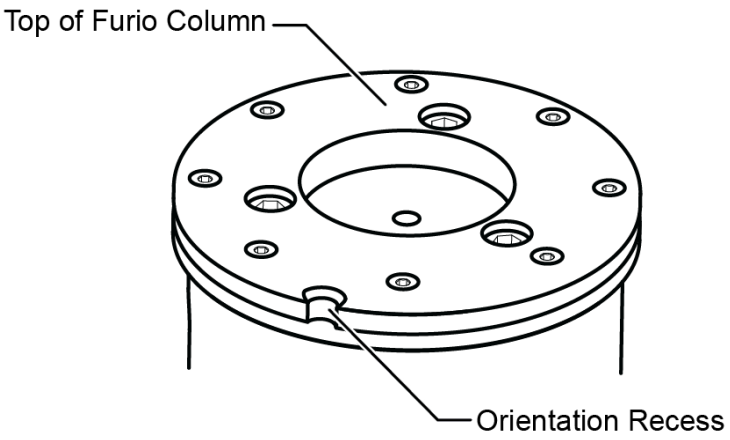


Figure 3.14 — Mounting an X650 onto a Furio Column

Mounting without a Furio Column

SAFETY NOTICE: Two people are required to lift and mount the head. The head is heavy and can

cause injury and/or be damaged if dropped.

1. Mount the head to the support apparatus using four bolts (3/8" 16 UNC) of suitable length.
2. Bolt penetration into the head is to be minimum 0.625" [16mm] and maximum 1.125" [29mm].

Cabling the Head

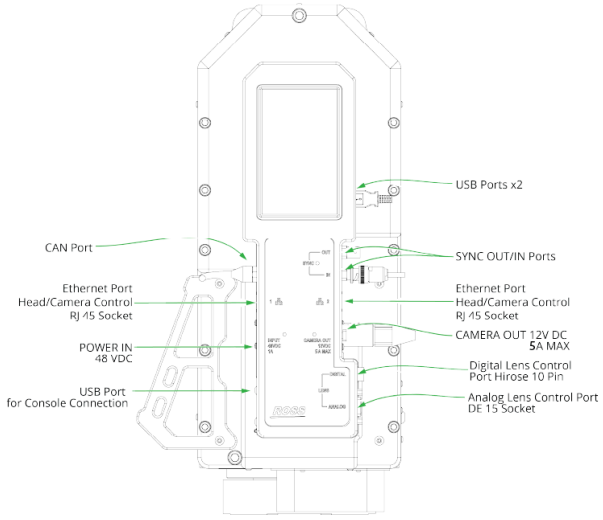


Figure 3.15 — Labeled Connections on an X650 PT Head

Positioning Track Data (Optional)

The X650 head emits synchronized position tracking data, which is used for virtual reality and augmented reality applications. The data can be synchronized with an external reference signal at 50Hz or 60Hz. If no external signal is provided, the head generates an internal 50Hz sync pulse and emits tracking data at a rate of 50 times per second (50Hz).

If you want the head to generate tracking data synchronized to an external reference signal, connect the reference signal to the **VIDEO SYNC** connector on the head.

Lens Control

1. If lens control is digital, connect a suitable lens control cable from the **Digital Lens Control Port** to the lens.
2. If lens control is analog, connect a suitable lens control cable from the **Analog Lens Control Port** to the lens.

Network

1. If you are using a Furio dolly, connect a Furio data cable between one of the **NETWORK** connectors on the head, and the middle **CAN** connector on the dolly.
2. Connect an Ethernet cable to the **ETHERNET** connector on the head, and to the network.
   To reduce EMI, install the provided ferrite core (manufacturer part number 74271131) on the Ethernet cable as close as possible to the port on the head.

Power

Connect the head to the FRU power cable.

> **NOTE**
>
> The head does not have an **ON/OFF** switch. It starts when connected to power.

Testing the Head

Configuring the IP Address

1. Turn on the power supply to the head, and then turn on the SmartShell computer.
2. On the SmartShell computer, open Internet Explorer and navigate to http://10.42.3.64.
   The head configuration interface appears.
3. On the IP Settings tab, specify a new, unique IP address for the head.
4. Click Save and Reboot.

Testing the Head

1. On the SmartShell computer, start SmartShell by double-clicking SmartShell.exe.
2. Click the head's camera name at the top of the window, and then click Operate.
   SmartShell enables and homes the axes. This may take up to 30 seconds. If any fail to home, note the problem and click **SKIP** .
3. Using SmartShell and the Joystick Panel, test each axis of the head.

Loading and Balancing

Prearing and Mounting the Payload

SAFETY NOTICE : Two people are required to lift and mount the payload. The payload is heavy

and can cause injury and/or be damaged if dropped.

1. Turn off power to the head, and then assemble the payload, including everything that will be mounted on the head.
2. Lift the load onto the head and fasten it down. Attach all cables. Bundle and fasten them to the cable bracket, allowing enough slack for head movement. Encase them in a suitable sleeve.

Balancing the Payload

To ensure optimal performance and reduce wear on the head's drive train, the payload must be properly balanced. This includes both horizontal (front to back) and vertical (height) alignment with the tilt axis. Perform this procedure whenever a new payload is installed or when components are added, removed, or repositioned.

Start by checking the horizontal balance to confirm that the payload's center of gravity aligns with the tilt axis. Gently tilt the cradle until the payload is horizontal, then release it. If the cradle does not begin to tilt, the load is balanced horizontally. Otherwise, adjust the payload position until it is balanced. Once balanced, mark the payload's position precisely.

Next, check the vertical balance to ensure the payload remains stable at an angle. Gently tilt the cradle to about 30 degrees, then release it. If the cradle does not move, the load is balanced vertically. If it does, remove the payload, loosen the cradle bolts, raise or lower the cradle as needed, retighten the bolts, then remount the payload and check again.

Additional Guidance and Safety Notes

The X650 uses a heavy-duty tilt cradle designed to accommodate a wide range of professional camera configurations. Balancing is achieved by repositioning the payload—no fine-adjustment slots are present on the cradle.

Horizontal Balancing

- Ensure the head is powered off.
- Gently tilt the cradle until the payload is horizontal, then release it.
- If the cradle tilts, reposition the payload forward or backward using its mounting interface (e.g., dovetail plate or quick-release system).
- Repeat until the cradle remains level. Mark the balanced position.

Vertical Balancing

- Manually tilt the cradle to about 30°, then release it.
- If it swings back toward horizontal, the payload is too low and must be raised.
- If it continues tilting away, it is too high and must be lowered.
- Remove the payload and loosen the cradle mounting bolts.
- Adjust the cradle height using alternate mounting holes, risers, or shims.
- Retighten all fasteners and retest.
- Mark the final cradle mount position if needed.

IMPORTANT

An overweight or improperly balanced payload can cause permanent damage to the head.

WARNING

The X650 tilt cradle is heavier than standard models. Always support the cradle during adjustment and disconnect power before working on the head.

Configuration

Configuring X300, X35 0, and X650 Heads

This section describes how to configure X300, X350, and X650 heads. Each head must be configured before it can be used.

Each X300, X350, and X650 head provides a web-based remote configuration interface (web interface) you can access over the IP network, using a web browser. The web interface enables you to configure network (IP) settings, set axis limits, view status and logging information, configure position tracking data output, perform firmware upgrades, and create and restore data backups.

Additionally, the X350 and X650 head features a local configuration touchscreen interface that enables you to configure network (IP) settings, set axis limits, and operate (move) axes.

If you installed multiple X300, X350, or X650 heads, they all have the same IP address by default. Each robotic head must be assigned a unique IP address before it can be configured or controlled.

This section includes the following topics:

- **“Using DashBoard Walkabout to Assign Unique IP Addresses”**
- **“Configuring X300, X350 and X650 Heads Remotely”**
- **“Configuring and Operating X350 or X650 Heads Locally”**
- **“Adding Heads to a Control System”**

Using DashBoard Walkabout to Assign Unique IP Addresses

If you installed multiple X300, X350, and X650 heads, they all have the same IP address by default. Each robotic head must be assigned a unique IP address before it can be controlled.

> NOTE
>
> If you are configuring X350 heads and you have already either turned DHCP **ON** or assigned each head a unique IP address, skip this section.

This section describes how to use DashBoard Walkabout to detect all robotic heads on the IP network, and to configure the netmask, gateway, and IP address of each head to make them accessible on the network.

DashBoard Walkabout can detect and list multiple devices that have identical IP addresses. After all heads have been assigned unique IP addresses, you do not need to use DashBoard Walkabout to modify their network settings. You can instead use each head’s remote web interface, or alternatively for X350 or X650, use the head’s local touchscreen interface.

Before you begin, you need a list of the heads and their serial numbers. The serial number appears on a label on the bottom of the head. See Figure 4.03.

To configure network connectivity for X300 heads, you need a computer running Ross Video DashBoard, connected to the same physical network segment as the heads.

DashBoard is available as a free download from the following location on the Ross Video website, under **Downloads** > **Software** :

www.rossvideo.com/products-services/management-systems/automated-production-control/dashboard

To configure network connectivity for an X300, X350, or X650 head:

1. In DashBoard, tap **File** > **Show Walkabout** . The **Walkabout** utility appears (see Figure 4.01).

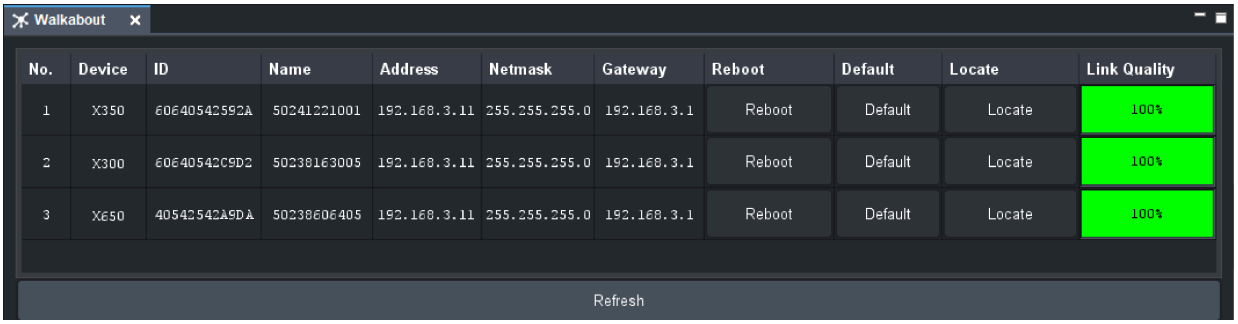


Figure 4.01 — DashBoard Walkabout Utility, showing Network Settings for X300, X350, X650 Heads

2. In Walkabout, tap the **Refresh** button. The list of network devices updates.
3. In the list, find the row in which the **Device** value lists the correct head type (**X 300** , **X350 , or X650**), and the **Name** cell value is the serial number of the head you want to configure.

   You will edit cells in this row to configure the head.

   If none of the **Name** cells display the head's serial number, the head is not connected to the network. Check power and network cables, and the network switch. For more information, see "Troubleshooting".
4. In the **Address** cell, type a unique and valid IP address for the head.

   Record the IP address. You will need it when you configure the control system to recognize the head.
5. In the **Netmask** cell, if a different netmask is required, type the correct netmask for your network.
6. In the **Gateway** cell, type the correct gateway for your network.
7. Tap **Refresh** , and then confirm that the IP **Address** , **Netmask** , and **Gateway** values are correct.
8. Tap **Reboot** .

   The head reboots. Wait approximately 20 seconds, and then tap **Refresh** .
9. If you want to configure network settings for another head, go to **Step 3**.
10. Close DashBoard.

Configuring X300, X3 50 and X650 Heads Remotely

Each X300 or X350 head provides a web-based remote configuration interface (web interface), which you can access over the IP network using a web browser.

This section describes how to configure heads remotely, and includes the following topics:

- **“Accessing the Web Interface”**
- **“Configuring IP Settings (Network Settings)”**
- **“Setting Persistent Axis Limits”**
- **“Status and Logging”**
- **“Configuring Tracking Data Output”**
- **“Applying a Firmware Upgrade File”**
- **“Downloading and Restoring a Data Backup File”**
- **“Changing the On-Air or Preview Image for SmartTally”**

> IMPORTANT
>
> Do not modify any settings except as described in this section. Some other settings in the web interface may adversely affect performance or render the head inoperable.

Accessing the Web Interface

To access the web interface for an X300, X350, or X650 head, you need a computer connected to the same IP network as the head.

You also need to know the IP address of the head.

To obtain the IP address, if unknown:

- If the head has been added to DashBoard, hover over its **Slot** node in the DashBoard tree.

  The IP address appears, in brackets.

- If the head is an X350 or X650, tap its touchscreen.

  The IP address appears at the bottom of the screen.

- Use DashBoard Walkabout to detect the head and obtain its IP address.

  Walkabout detects all Ross Video devices on the network, including X300, X350, and X650 heads. It shows the IP address (**Address** column), and serial number (**Name** column) of each head. For more information, see **“Using DashBoard Walkabout to Assign Unique IP Addresses”**.

To access the web interface:

- In a web browser, type the IP address of the head.

> **TIP**
>
> The default IP address is **192.168.3.11** .

The web interface appears (Figure 4.02).

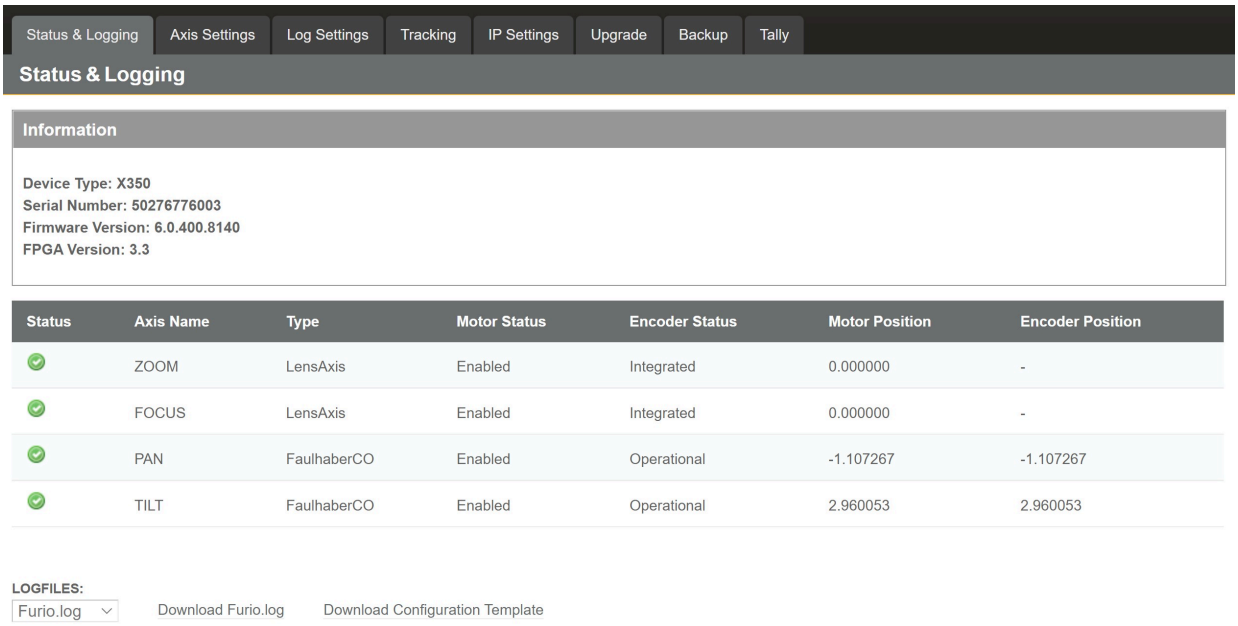


Figure 4.02 — Web Interface for X350 (Status & Logging Tab shown)

Configuring IP Settings (Network Settings)

You can use the web interface to view and modify the **IP Address** , **Netmask** , and **Gateway** settings for a head. You can also view the head's unique **MAC Address** .

If you modify IP settings, be sure to provide valid and appropriate values so the head is accessible to all devices that you want to control the head.

To view and/or modify IP settings:

1. On the **IP Settings** tab of the web interface, view the following settings and modify them as required:

   - **IP Address**

     The factory default value is **192.168.3.11** .

   - **Netmask**

     The factory default value is **255.255.255.0** .

   - **Gateway**

     The factory default value is **192.168. 3.1** .

2. View the **MAC Address** (read only).

3. If you modified any settings and want to apply them to the head, click the **Save and Reboot** button.

   The **Device is Rebooting** message appears (Figure 4.03).

> **IMPORTANT**
>
> Do not reload or refresh the web page during reboot. Doing so would cause the head to reboot again.

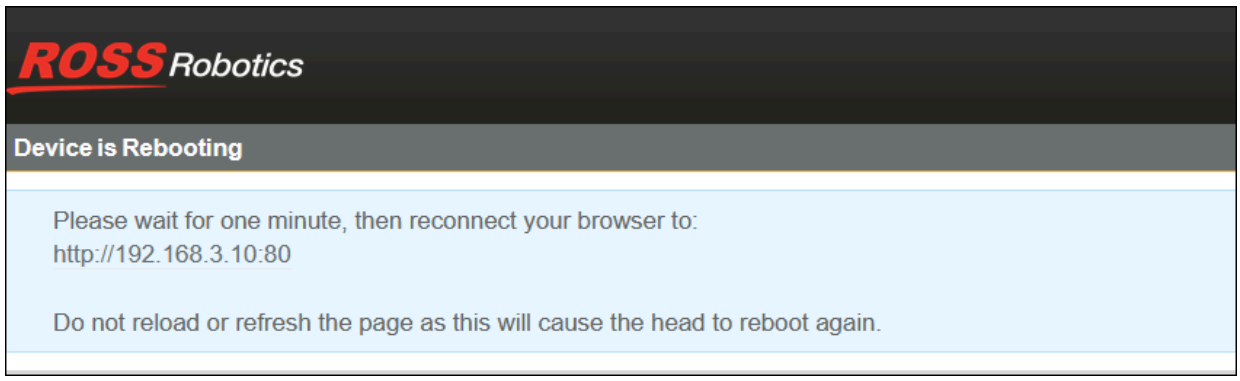


Figure 4.03 — Device is Rebooting Message

4. Wait for one minute, and then click the IP address link shown.

   The web interface appears.

Setting Persistent Axis Limits

There are two types of axis limits; temporary limits and persistent limits:

- **Temporary limits** — These limits remain in force until they are changed or until the robotic head is restarted.

  The range of motion defined by temporary limits is always within the range defined by persistent limits. Temporary limits are always either equal to, or more restrictive than, persistent limits.

  These limits can be set by control systems such as DashBoard or SmartShell, and, if the head is an X350 or X650, they can also be set on the built-in touchscreen interface.

- **Persistent limits** — These limits remain in force until they are changed. They persist even if the robotic head is restarted or upgraded.

  The range of motion defined by persistent limits is always the same or more permissive than temporary limits. By factory default, persistent limits define the full possible range of motion.

  These limits can be set in the web interface, and, if the head is an X350 or X650, on the built-in touchscreen interface. Control systems cannot modify persistent limits, and cannot move an axis past its persistent limits.

  This section describes how to use the web interface to set persistent limits.

Each axis has a minimum and maximum persistent limit. The limit values are set individually. To set a pair of limits (minimum and maximum) for an axis, you set one limit, move the axis manually, and then set the other limit.

Before you can manually move an axis and set its limits, the axis must be enabled:

- **For X300, X350 o r X6 50** — An axis is enabled when the head is under the control of a control application such as SmartShell or DashBoard PT Head Control. You can use these applications, and/or joysticks connected to them, to manually move the axes.
- **For X350 or X6 50 onl y** — Alternatively, you can enable axes and manually move them using the built-in touchscreen interface. For more information, see **"Operating Axes Locally (X350 and X650 only)"**.

> NOTE
>
> Narrowing axis limits can adversely affect existing presets and moves. For example, if you create a preset and later set axis limits to be more restrictive, the preset destination may be outside of one or more axis limits. You may need to update existing presets after you adjust axis limits.

To set persistent axis limits:

1. In the web interface, on the **Axis Settings** tab, click the **Enable Edit** button.

   A warning message appears, asking you to confirm that you want to proceed.

2. Click **Yes** .

3. Scroll down to the **Axis Properties** area.

   The **Axis Properties** area includes status information and limit settings for each axis.

4. For the axis you want to configure, note the **Motor Position** value, if shown.

> TIP
>
> If no value is shown, repeat **Step 1** by selecting the address bar and pressing enter to reload axissettings2.html. The current **Motor Position** for the axis appears.

5. Move the axis manually slightly in one direction, and then refresh your browser:
   - If the **Motor Position** increased, you moved it towards the high limit.
   - If the **Motor Position** decreased, you moved it towards the low limit.
6. If you want to set the low limit:
   1. In the **Active Low Limit** row, click **Clear** .

      The view refreshes. The **Active Low Limit** for the axis is now at its lowest possible value.

   2. Manually move the axis to the position you want to record as the low limit, and then click **Set Current** .

      The view refreshes. The **Active Low Limit** value now matches the **Motor Position** value.

7. If you want to set the high limit:

    1. In the **Active High Limit** row, click **Clear** .

        The view refreshes. The **Active High Limit** for the axis is now at its highest possible value.

    2. Move the axis to the position you want to record as the high limit, and then click **Set Current** .

        The view refreshes. The **Active High Limit** value now matches the **Motor Position** value.

8. If you want to set persistent limits for another axis, go to **Step 4**.

Status and Logging

The web interface provides information about the head and the current status of each axis. It also enables you to view and download logs, and to set the level of detail the logs record.

This section includes the following topics:

- **“Enabling Logging and Setting Logging Detail Level”**
- **“Viewing Head Information and Axis Status”**
- **“Downloading and Saving Log Files”**

Enabling Logging and Setting Logging Detail Level

When logging is enabled, the head logs information about its activities.

These logs can be useful for diagnosing and troubleshooting problems.

> WARNING
>
> When the **Logging Detail** level is set to record more information, log files roll over faster and cover a shorter period of time with greater detail. Head performance may be affected. Unless specifically instructed to do so by Ross Video Technical Support, we recommend that you do not change the **Logging Detail** level.

To enable or disable logging, and/or set the logging detail level:

1. In the web interface, on the **Log Settings** tab, either select or clear the **Enable Logging** check box, as required.
2. If you want to change the **Logging Detail** level, from the **Logging Detail** list, select the desired logging level.

> TIP
>
> Logging data is generated only if logging is enabled.

3. If you made any changes, click **Save** .

Viewing Head Information and Axis Status

You can view information about the head, including the **Device T ype** (**X300** , **X3 50 , or X650**), **Serial Number** , **Firmware Version** , and **FPGA** (computer hardware) version.

You can also view status information about each axis.

To view head information and axis status:

- In the web interface, click the **Status & Logging** tab.

  Head information and axis status information appears (Figure 4.04).

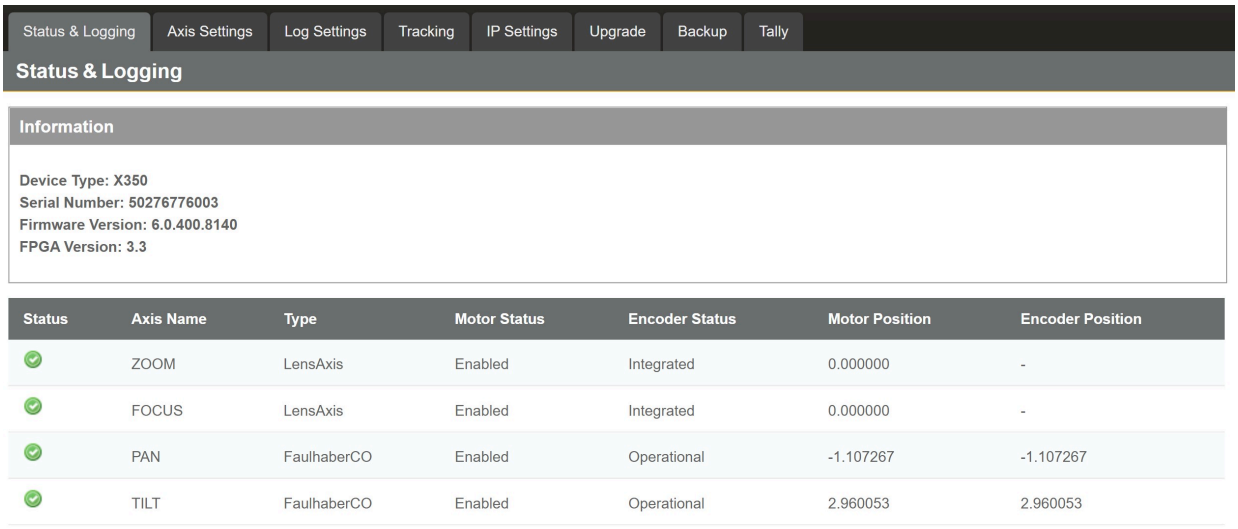


Figure 4.04 — Status & Logging Tab, sh owing Head Information and Axis Status Information

Downloading and Saving Log Files

When logging is enabled, the head logs information about its activities. These logs can be useful for diagnosing and troubleshooting problems.

This section describes how to download and save two types of log files — **Furio.log** and **Gui.log** .

Alternatively, you can save a data backup file, which contains all log files plus presets, moves and other data. If you encounter problems, Ross Video Technical Support personnel may ask you to create a data backup file and submit them it for analysis. For more information, see **“Downloading and Restoring a Data Backup File”**.

To download and save log files:

1. Click the **Status & Logging** tab of the web interface.
2. If you want to download and save a **Furio.log** file, do the following:
   1. In the **LOGFILES** list, select **Furio.log** .
   2. Click the **Download Furio.log** button.

The log data appears in a new web browser tab.

3. In your web browser, save the page as a text file with a **.log** file extension. For example, **Furio.log** .

> **TIP**
>
> The exact method of saving the page depends on which web browser you use. Alternatively, you can copy and paste the data into a text editor such as Windows **Notepad** , and save it as a text file with a **.log** file extension. For example, **Furio.log** .

3. If you want to download and save a **Gui.log** file, do the following:

    1. In the **LOGFILES** list, select **Gui.log** .

    2. Click the **Download Furio.log** button.

        You are prompted to **Open** or **Save** the file.

    3. Save the file.

        The file is named **Gui.log** , and is saved to the Windows **Downloads** folder.

Configuring Tracking Data Output

The X350 and X650 heads generate and output axis position tracking data that can be used for AR/VS (Augmented Reality / Virtual Set) applications.

> **NOTE**
>
> The X300 can also be configured to send this data, but unlike the X350 and X650, it can't be synced.

You can specify the tracking data protocol (FreeD or ORAD) and the output method(s) (UART and/or UDP).

> **IMPORTANT**
>
> You must use the X350 or X650 for AR, VS, or XR applications instead of the X300.
> Unlike the X300, the X350 or X650 can accept a sync signal.

To configure tracking data output:

1. In the web interface, click the **Tracking** tab.

    The **Tracking Setting** s appear (Figure 4.05).

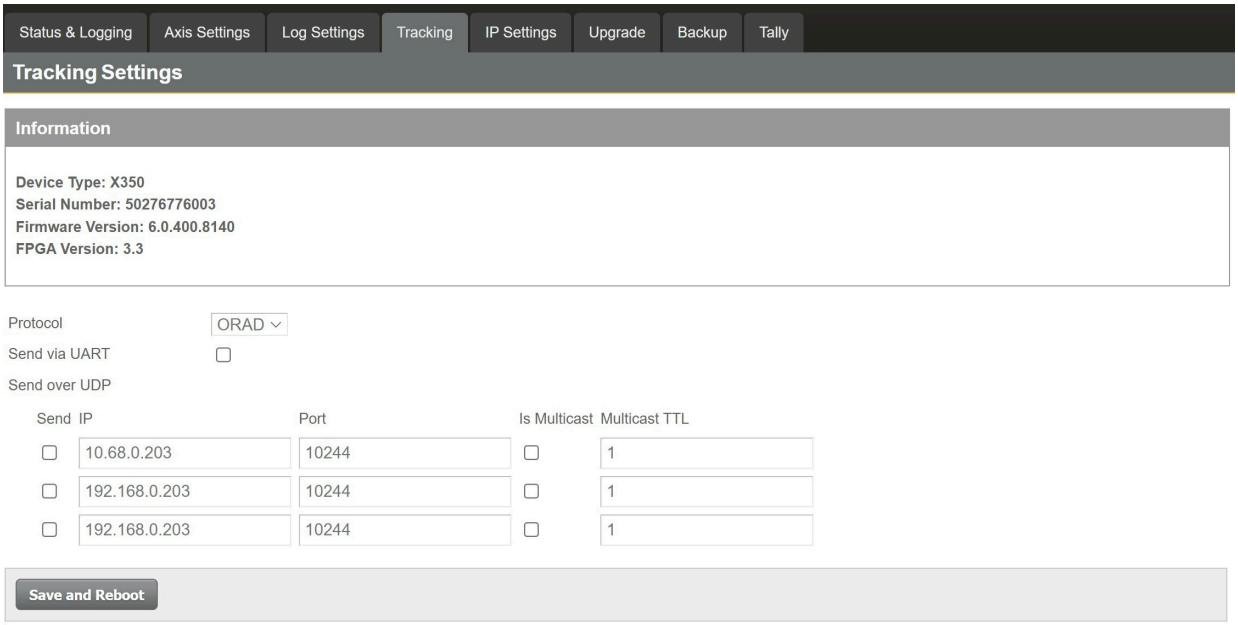


Figure 4.05 — Tracking Tab, showing Tracking Data Output Settings

2. In the **Protocol** list, select the data protocol that the recipient application requires (**FreeD** or **ORAD**).

3. If you want to transmit the tracking data over the serial port, select the **UART** check box.

4. If you want to send the tracking data to specified destinations over UDP, do the following for up to three recipients (as represented by table rows in the interface):

    1. Select the **Send** check box.
    2. In the **IP** box, type the IP address of the destination device. Multicast addresses are supported.
    3. In the **Port** box, type the port number through which the destination device will receive the tracking data.
    4. If you do not want to use Multicast transmission, clear the **Is Multicast** check box.

> **TIP**
>
> The **Multicast TTL** value is ignored when the **Is Multicast** check box is not selected.

5. If you want to override the default TTL value assigned to multicast-addressed datagrams, select the **Is Multicast** check box, and then set the **Multicast TTL** value:

    - If you want to restrict traffic to the same subnet as the head, set the **Multicast TTL** value to **1** .
    - If your tracking destination is on a different subnet, set the **Multicast TTL** value to a value higher than **1** , according to your network configuration. Consult with your network administrator.

6. Click the **Save and Reboot** button.

    The **Device is Rebooting** message appears (Figure 4.06).

IMPORTANT

Do not reload or refresh the web page during reboot. Doing so would cause the head to reboot again.

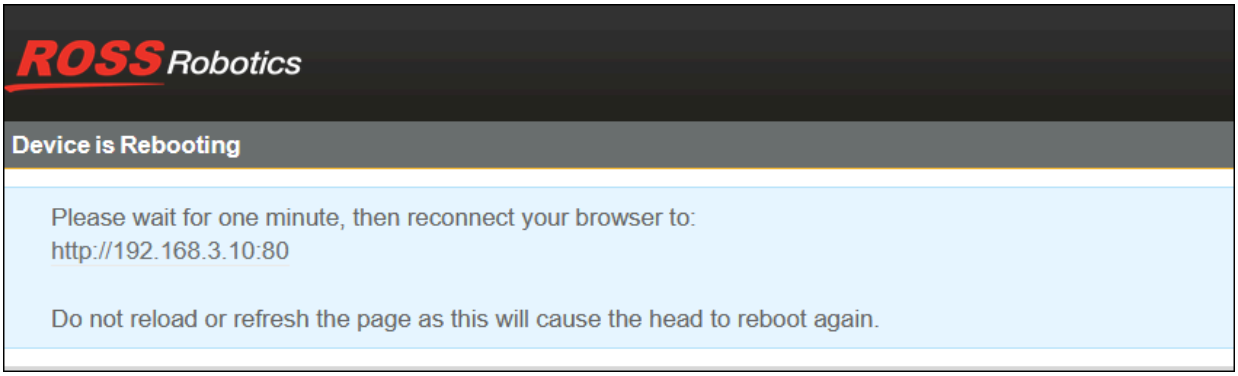


Figure 4.06

Figure 4.06 - Device is Rebooting Message

6. Wait for one minute, and then click the IP address link shown.

   The web interface appears.

Applying a Firmware Upgrade File

You can use the web interface to apply a firmware upgrade file to an X300, X350, or X650 head.

IMPORTANT

Applying a firmware upgrade file is only one step of the upgrade process. Depending on the nature of the upgrade and how your system is customized and configured, additional steps may be required before and/or after applying the file. Consult with Ross Video Technical Support to determine the correct upgrade process for your situation.

IMPORTANT

Do not apply a firmware upgrade file unless instructed to do so by Ross Video Technical Support.

IMPORTANT

Upgrading firmware erases all temporary axis limits and customizations stored on the head. Persistent axis limits are retained. You can save a data backup file, and then apply it to the head after the firmware upgrade is complete. For more information, see **“Downloading and Restoring a Data Backup File”**.

To apply a firmware upgrade file to an X300, X350 or X650 head:

1. Create an up-to-date backup of your custom configuration.
2. On the **Upgrade** tab of the web interface, click **Choose File** .

   The **Open** dialog box appears.
3. Navigate to the firmware zip file, and then click **Open** .

> TIP
>
> The filename resembles the following example: **Furio-phy-5.2.400.7674.zip** . For the X630, the filename resembles **Furio-arm64-7.4.100.xx** .

The **Open** dialog box closes, and the filename appears beside the **Choose File** button.
4. Click the **Upload File and Reboot** button.

The **Device is Rebooting** message appears (Figure 4.07).

> IMPORTANT
>
> Do not reload or refresh the web page. Doing so would cause the head to reboot again.

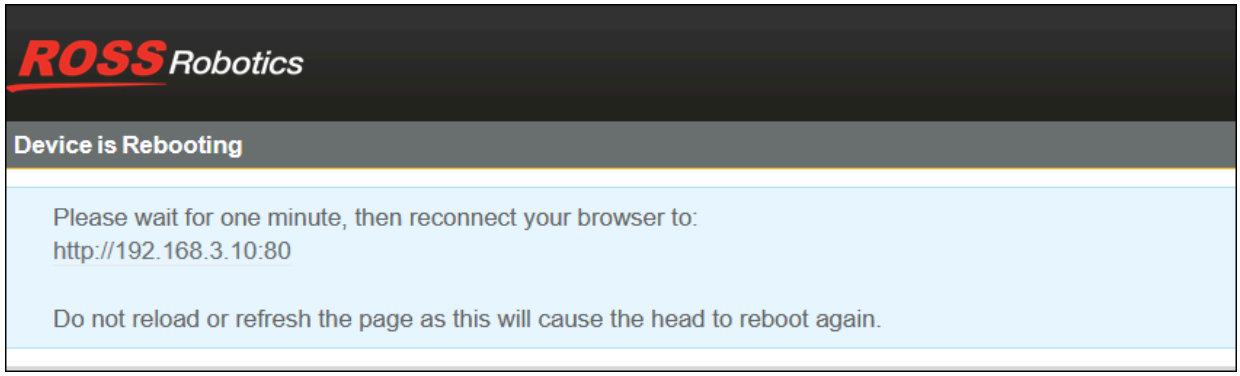


Figure 4.07

Figure 4.07 - Device is Rebooting Message

5. Wait for one minute, and then click the IP address link shown.

   The web interface appears. The **Information** area shows the current **Firmware Version** . If the head is an X350 or X650. The touchscreen display shows the current firmware version for the X350 or OS version for the X650.

Downloading and Restoring a Data Backup File

You can use the web interface to save (download) a backup copy of user data stored on an X300, X350, or X650 head, including presets, moves, temporary axis limits, and customizations. You can later apply (restore) the saved backup file to the

same head or a different one.

This section describes how to download a data backup file, and how to restore it.

> **IMPORTANT**
>
> Downloading and restoring a data backup file are often steps within the process of upgrading a robotic head. Depending on the nature of the upgrade and how your system is customized and configured, some files within the data backup may need special modifications before you restore them. Consult with Ross Video Technical Support to determine the correct upgrade process for your situation.

To download a data backup file:

1. On the **Backup** tab of the web interface, click the **Download Data Backup** button.

   The dialog box appears, prompting you to save or open the **backup.zip** file.

2. Select the option to save the file.

   The file is saved to the **Downloads** folder on your computer.

> **TIP**
>
> Rename the file to give it a more meaningful name.

To restore a previously-downloaded data backup file:

1. On the **Backup** tab of the web interface, click the **Browse** button.

   The **File Upload** dialog box appears.

2. Navigate to the downloaded data backup file, and then click **Open** .

> **TIP**
>
> By default, the file is in the **Downloads** directory, and is named **backup.zip** .

The **File Upload** dialog box closes, and the filename appears beside the **Browse** button.
3. Click the **Restore Data Backup** button.

The **Device is Rebooting** message appears (Figure 4.08).

> **IMPORTANT**
>
> Do not reload or refresh the web page during reboot. Doing so would cause the head to reboot again.

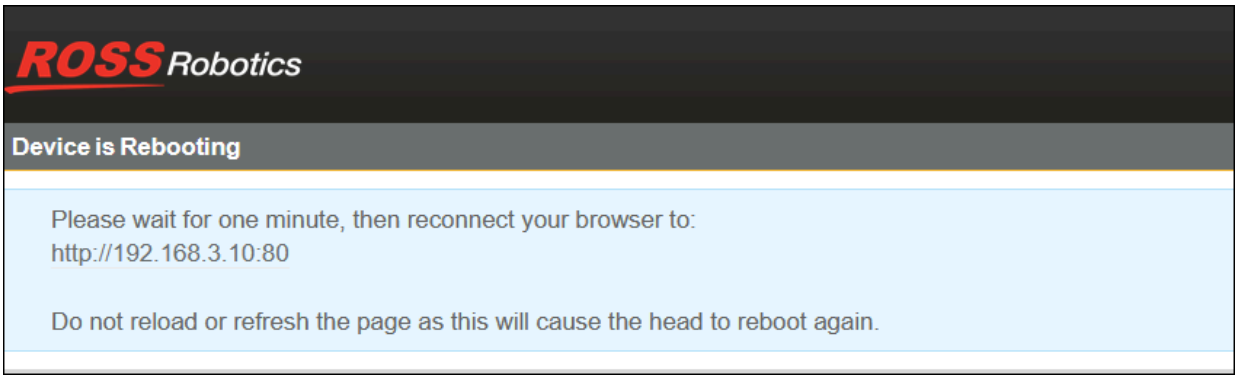


Figure 4.08

Figure 25 - Device is Rebooting Message

4. Wait for one minute, and then click the IP address link shown.

   The web interface appears.

Rebooting the Head

You can reboot (restart) the head from the web interface.

To reboot the head:

1. In the web interface, on the **Status & Logging** tab, scroll to the bottom of the page and click the **Reboot** button.

   The **Device is Rebooting** message appears (Figure 4.09).

> IMPORTANT
>
> Do not reload or refresh the web page during reboot. Doing so would cause the head to reboot again.

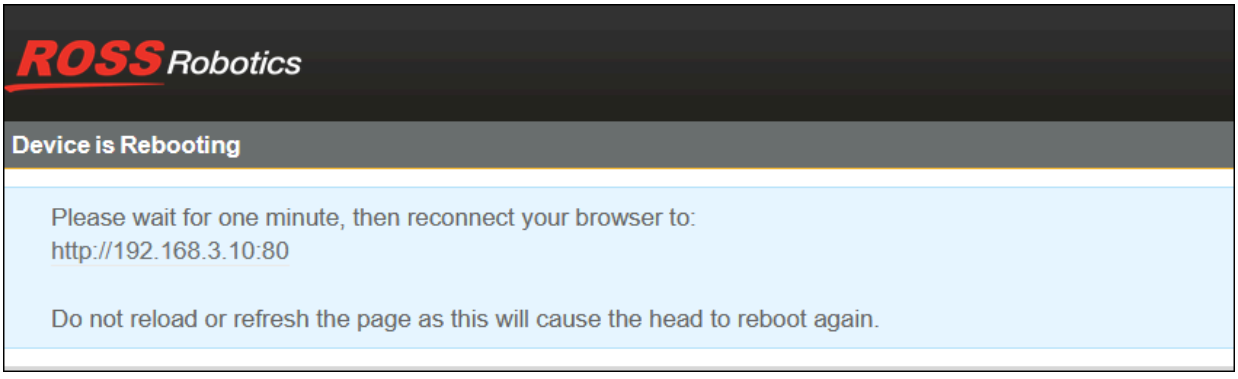


Figure 4.09

Figure 26 - Device is Rebooting Message

2. Wait for one minute, and then click the IP address link shown.

   The web interface appears.

Changing the On-Air or Preview Image for SmartTally

You can modify the **OnAir** and **Preview** SmartTally image that displays on the X350 or X650 touchscreen from the **Tally** tab in the web interface (on the X350 or X650 only).

To upload a new touchscreen Tally image:

1. In the web interface, on the **Tally** tab, select the **Image Type** as either **OnAir** or **Preview** from the dropdown menu.
2. Select the **Choose File** button to upload a PNG file (Figure 4.10).

> **IMPORTANT**
>
> The X350 and X650 system only accept PNG images that are 480 x 818 px (96 DPI).

3. Select **Load Image** .

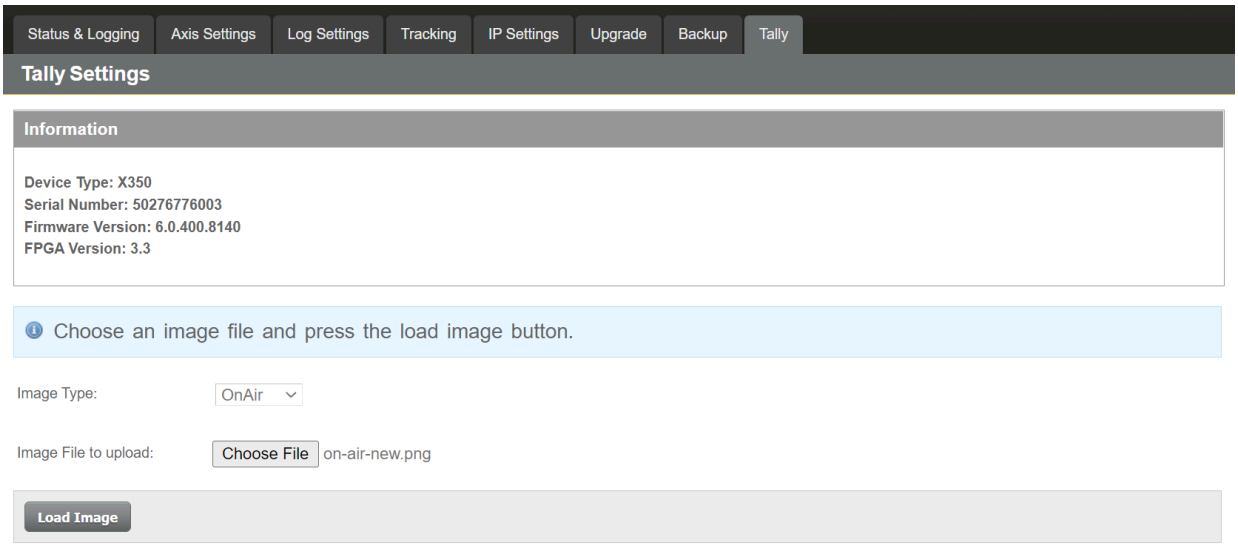


Figure 4.10 — Uploading new .png file in the Tally tab

> **NOTE**
>
> Once the default **OnAir** and **Preview** images (Figure 4.11) are overrwritten, they can only be recovered by uploading an extracted copy of ./vrone/vrone_gui/resources/images/onair.png or ./vrone/vrone_gui/resources/images/preview.png from the Furio-phy-x.x.xxx.xxxx.zip file.

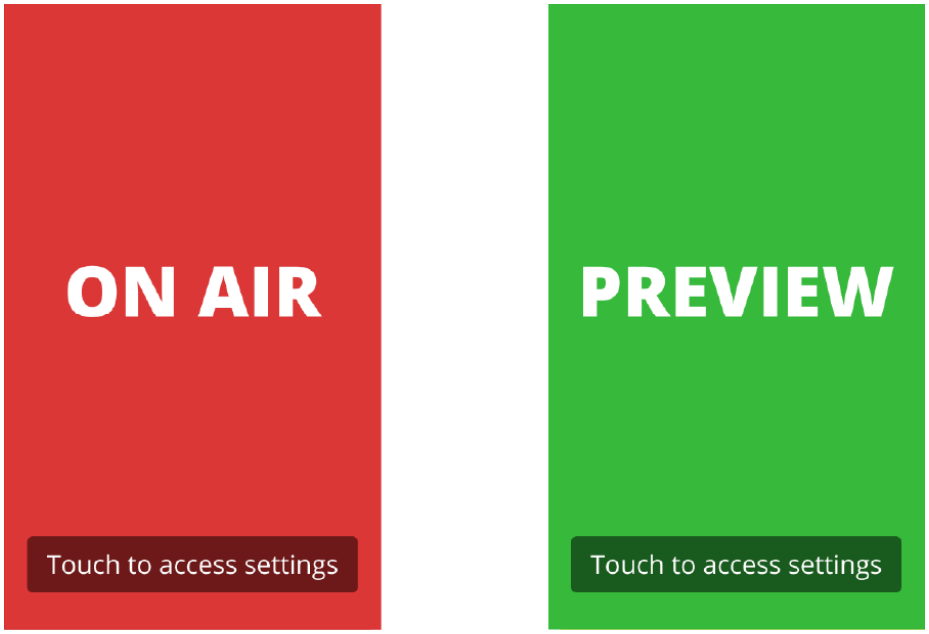


Figure 4.11 — Default OnAir and Preview images for the X350 and X650

Configuring and Operating X350 or X 650 Heads Locally

The X350 and X650 heads feature a built-in touchscreen interface that enables you to configure network settings, set axis limits, and operate (move) axes locally.

If you want to perform other X350 of X650 configuration tasks, you must use the remote web interface. For more information, see **"Configuring X300, X350 and X650 Heads Remotely"**.

This section includes the following topics:

- **"Configuring Network Settings Locally (X350 and X650 only)"**
- **"Operating Axes Locally (X350 and X650 only)"**
- **"Setting Axis Limits Locally (X350 and X650 only)"**

To access the X350 or X650 configuration interface:

1. If the screen is black, tap the screen.

   The main menu of the interface appears (Figure 4.12).

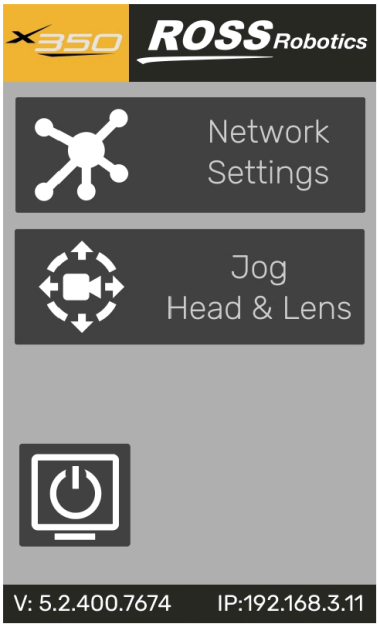


Figure 4.12 — Main Menu of the X350 Configuration Interface

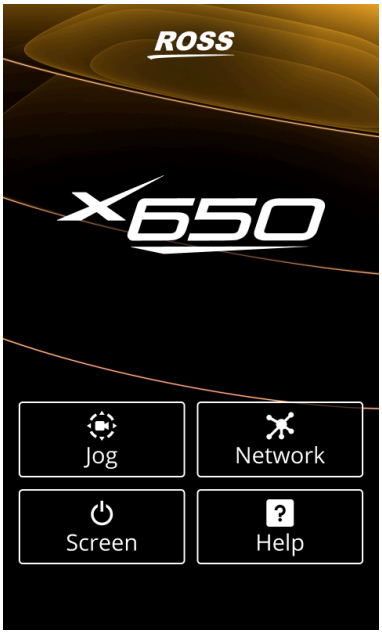


Figure 4.13 — Main Menu of the X650 Configuration Interface

2. On the X350 only, if the display is upside-down:

    1. Rotate the Ross logo badge on the side of the head (Figure 4.14).

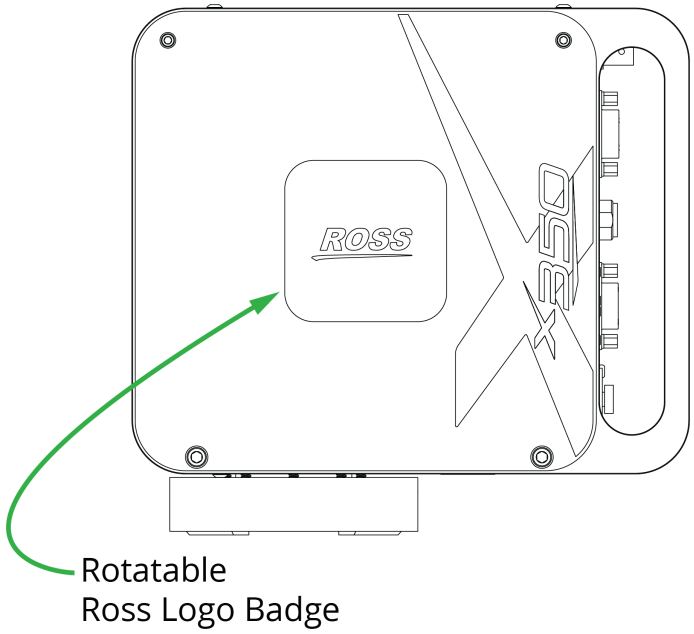


Figure 4.14 — X350 Head, showing Rotatable Ross Logo Badge

1. Disconnect power from the head.
2. Wait at least 20 seconds.
3. Reconnect power to the head.

   The interface appears.

Configuring Network Settings Locally (X350 and X650 only)

Each robotic head must have a unique IP address.

You can configure a static IP address, or configure the head to use an IP address assigned by a DHCP server on your network.

To configure network settings locally, you must first check the **DHCP** setting (**On** / **Off**) and modify it if necessary, and then configure static network settings if you are not using DHCP.

To check and modify the DHCP setting (X350 only):

1. On the touchscreen, tap the **Network Settings** button (Figure 4.16).

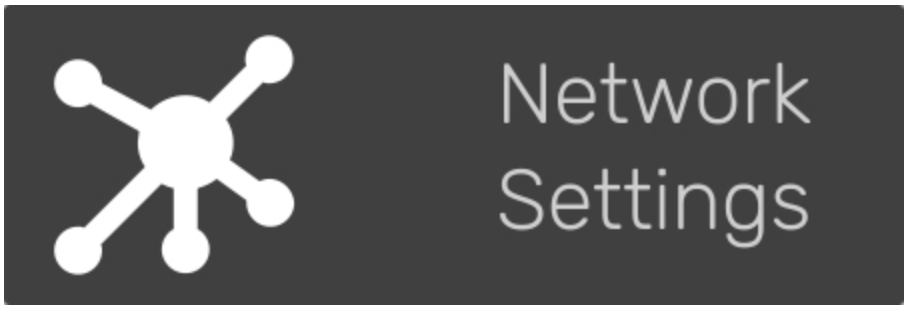


Figure 4.15 — Network Settings Button

2. The network settings appear (Figure 4.16).

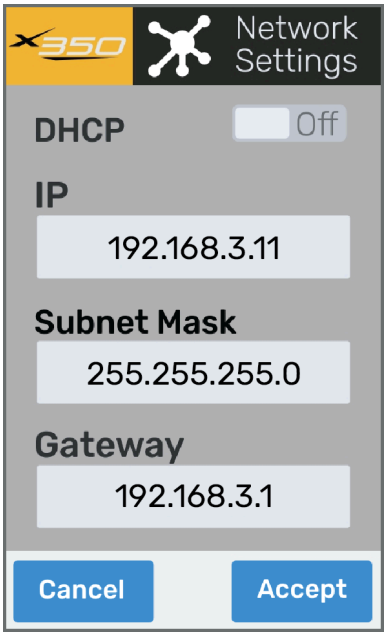


Figure 4.16 — X350 Network Settings

2. The **DHCP** button shows whether DHCP is enabled (**On**) or disabled (**Off**) (Figure 4.17).

Figure 4.17 — DHCP Button displays the Current State: Off (left), and On (right)

2. If **DHCP** is set to the desired option, skip the remaining steps in this procedure.

3. Tap the **DHCP** button to change it to the desired option, and then tap **Accept** .

   A **Warning** message appears, to inform you that the head will reboot.

4. Click **Accept** .

   The head reboots, and then the main menu appears.

To configure static network settings:

1. On the touchscreen, tap the **Network Settings** button (Figure 4.18).

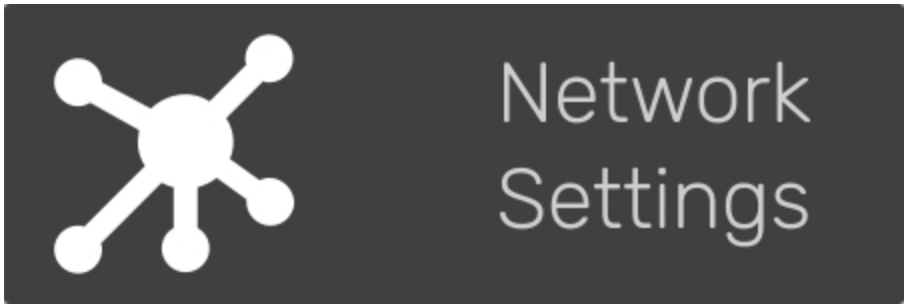


Figure 4.18

Figure 35 - Network Settings Button

2. The network settings appear (Figure 4.19).

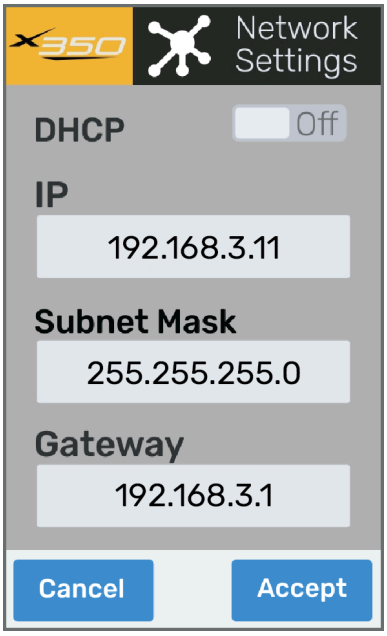


Figure 4.19

Figure 36 - X350 Network Settings

2. Tap the **IP** box, and then type a unique IP address for the head (Figure 4.20).

> **TIP**
>
> Make a note of the IP address. You'll need it when you add the head to your control system.

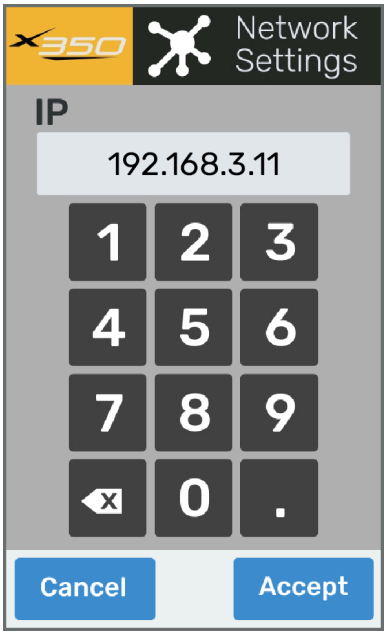


Figure 4.20 — Editing the IP Address

3. Tap **Accept** .

4. Tap the **Subnet Mask** box, and then type the correct netmask for your network.

5. Tap **Accept** .

6. Tap the **Gateway** box, and then type the correct gateway for your network.

7. Tap **Accept** .

8. Review the network settings to ensure they are correct, and then tap **Accept** .

   A **Warning** message appears, to inform you that the head will reboot (Figure 4.21).

Figure 4.21 — Warning Message (Head Will Reboot)

9. Click **Accept** .

   The head reboots, and then the touchscreen display returns.

Operating Axes Locally (X350 and X650 only)

You can use the touchscreen interface to operate (move) each axis manually, as well as track and lift.

Controls for the various axes are presented on two main tabs:

- **Head tab** — Includes sub-tabs for the **Pan** and **Tilt** axes (Figure 4.22).

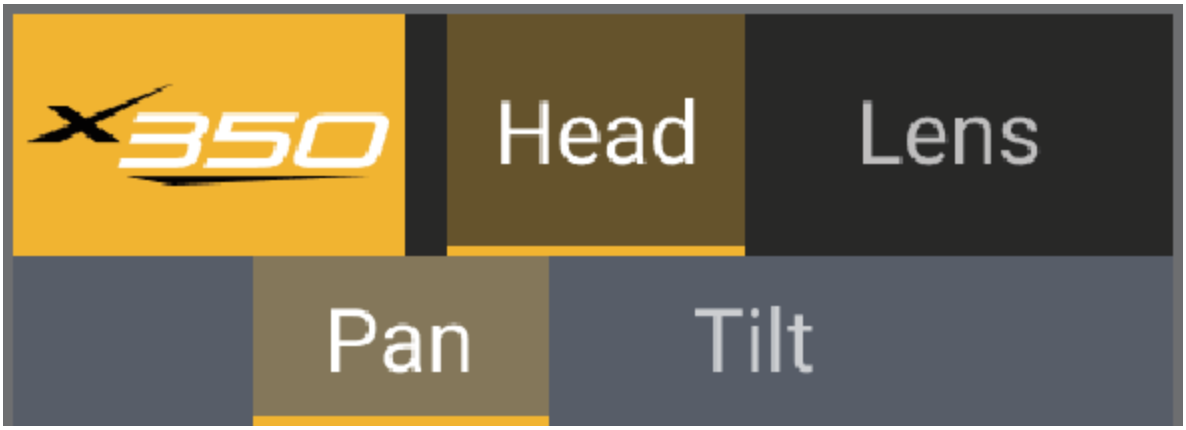


Figure 4.22 — The Head Tab, with the Pan Axis Tab Selected

- **Lens tab** — Includes includes sub-tabs for the **Focus** , **Zoom** , and **Iris** axes.

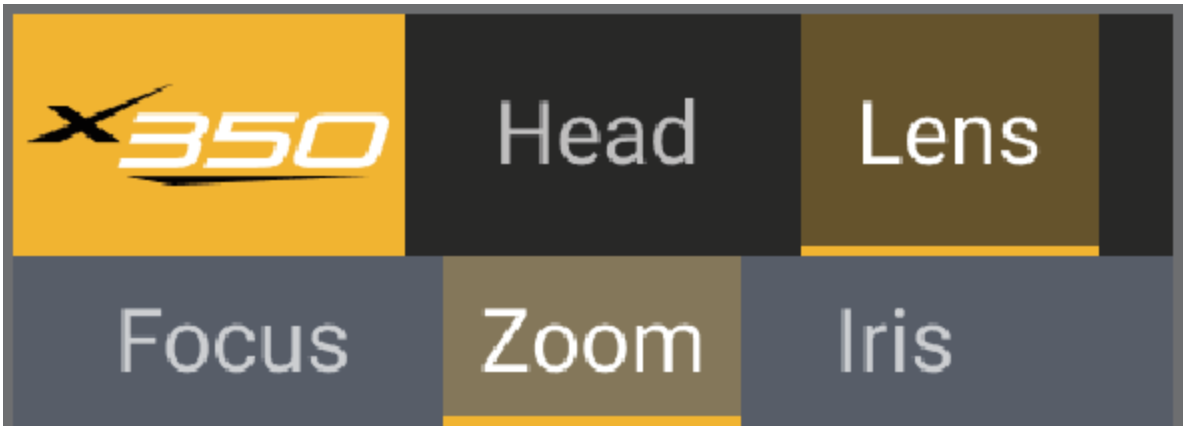


Figure 4.23 — The Lens Tab, with the Zoom Axis Tab Selected

> **TIP**
>
> The currently-selected tabs are shaded yellow.

IMPORTANT

When operating axes locally, especially if axis limits have not been set, watch the payload as it moves to ensure that it does not collide with anything, and that cables are not pulled tight. Adjust axis limits as required to avoid undesirable motion.

To operate an axis:

1. On the touchscreen, tap the **Jog Head & Lens** button (Figure 4.24).

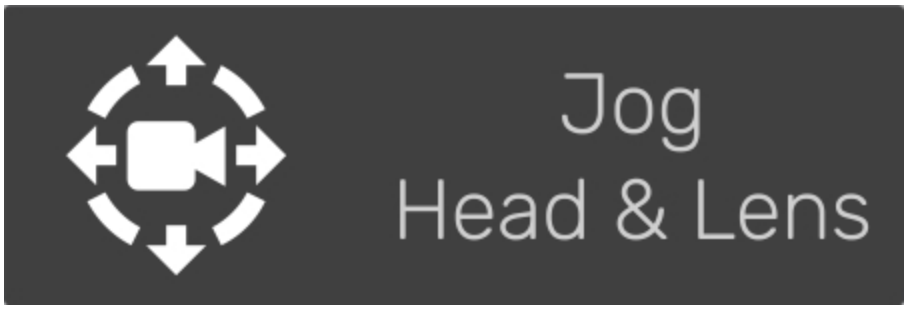


Figure 4.24 — Jog Head & Lens Button

2. Controls for the **Pan** axis appear (Figure 4.25).

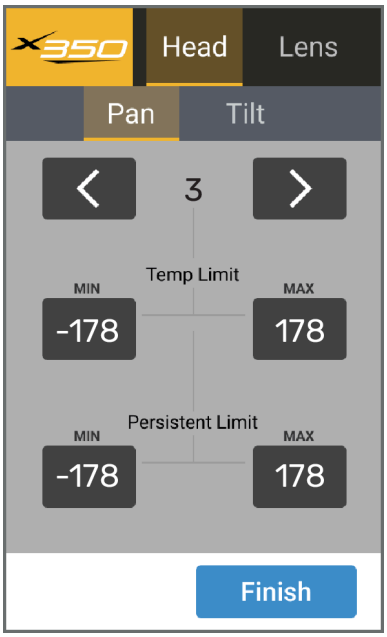


Figure 4.25 — Pan Axis Controls

2. Use the main tabs (**Head** and **Lens**) and their sub-tabs to navigate to the axis you want to operate.

   For example, **Lens** > **Zoom** (Figure 4.26).

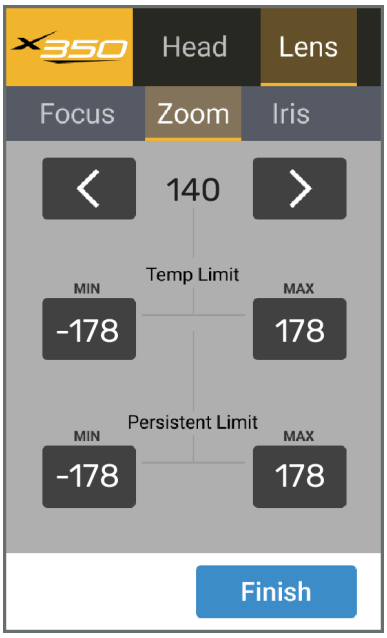


Figure 4.26 — Zoom Axis Controls

3. Press and hold an arrow button to move the axis (Figure 4.27).

> **TIP**
>
> Most sub-tabs have left and right arrow buttons. The **Tilt** axis has up and down arrow buttons.

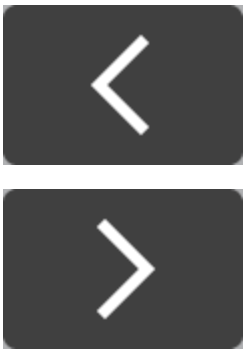


Figure 44 - Left and Right Arrow Buttons

4. If warning messages appear, indicating that the axis is not enabled and/or homed, tap **Accept** each time such a message appears (Figure 4.27.

> **NOTE**
>
> When the axis is homing, it moves. Several seconds may elapse before it stops and you can operate the axis.

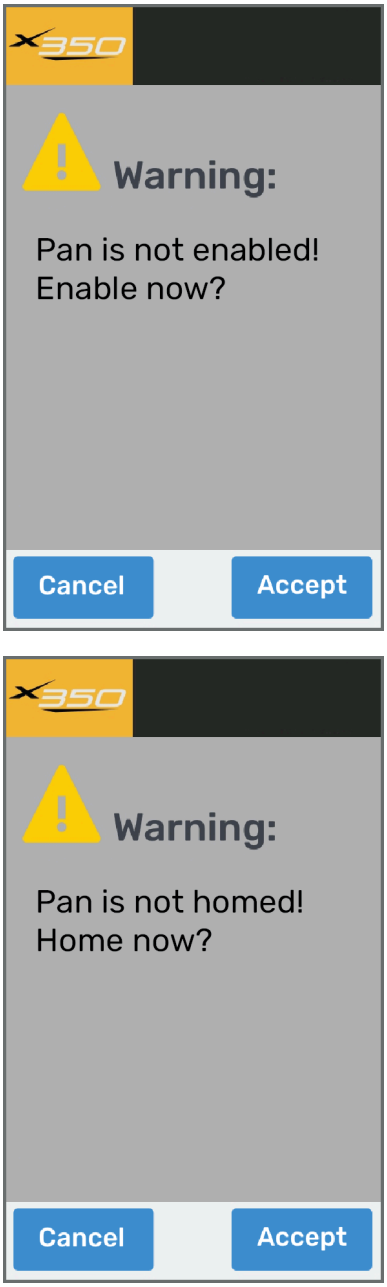


Figure 45 -Warning Messages (Pan is not enabled, and pan is not homed)

5. Press and hold the other arrow button to move the axis in the opposite direction.

> **TIP**
>
> If the axis stops moving and the arrow button is shaded yellow, the axis has reached a limit (Figure 4.27). The limit buttons for that end of the axis turn yellow. for information about using the touchscreen to set axis limits, see **"Setting Axis Limits Locally (X350 and X650 only)"**.

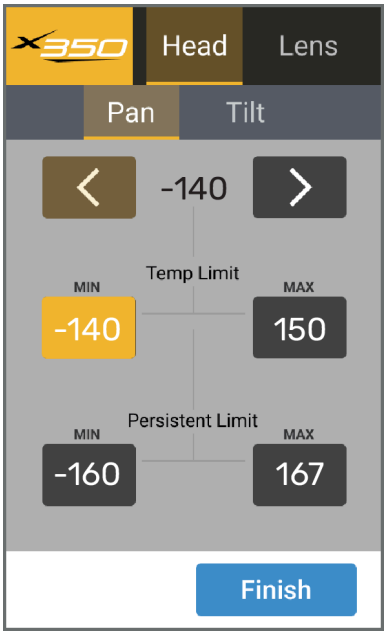


Figure 4.27 — The Pan Axis Reaches a Limit

6. If you want to operate a different axis, use the main tabs and sub-tabs to navigate to the controls for that axis, and then operate it.
7. When you are finished operating axes, tap **Finish** to return to the main menu.

Setting Axis Limits Locally (X350 and X6 50 only)

There are two types of axis limits; temporary limits and persistent limits:

- **Temporary limits** — These limits remain in force until they are changed or until the robotic head is restarted.

  The range of motion defined by temporary limits is always within the range defined by persistent limits. Temporary limits are always either equal to, or more restrictive than, persistent limits.

  These limits can be set by control systems such as DashBoard or SmartShell, and, if the head is an X350 or X650, they can also be set on the built-in touchscreen interface.

- **Persistent limits** — These limits remain in force until they are changed. They persist even if the robotic head is restarted or upgraded.

  The range of motion defined by persistent limits is always the same or more permissive than temporary limits. By factory default, persistent limits define the full possible range of motion.

  These limits can be set in the web interface, and, if the head is an X350 or X650, on the built-in touchscreen interface. Control systems cannot modify persistent limits, and cannot move an axis past its persistent limits.

  The touchscreen controls for each axis consist of two movement arrows and two sets of limit buttons:

- **Movement arrows** — Press and hold an arrow to move the axis to the position you want to set as a limit (Figure 4.28).

NOTE

Narrowing axis limits can adversely affect existing presets and moves. For example, if you create a preset and later set axis limits to be more restrictive, the preset destination may be outside of one or more axis limits. You may need to update existing presets after you adjust axis limits.

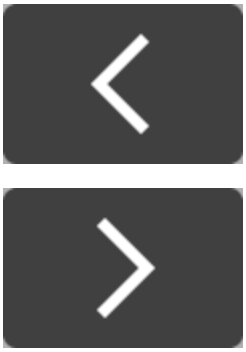


Figure 47 - Left and Right Arrow Buttons

- **Temp Limit buttons** — The **MIN** button toggles to set or clear (erase) the minimum temporary limit. The **MAX** button toggles to set or clear the maximum temporary limit. See Figure 4.28.

Figure 4.28 — Temp Limit Buttons

- **Persistent Limit buttons** — The **MIN** button toggles to set or clear the minimum persistent limit. The **MAX** button toggles to set or clear the maximum persistent limit. See Figure 4.29.

Figure 4.29

Figure 49 - Persistent Limit Buttons

You may need to clear existing limits to reach the position you want to set as a limit. When you encounter a limit, the arrow button and the limit button turn yellow (Figure 4.30).

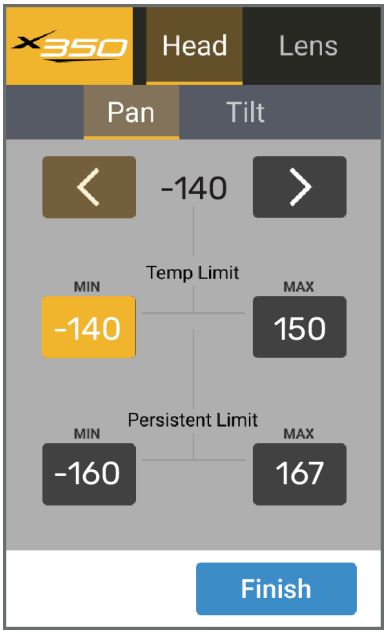


Figure 4.30

Figure 50 - The Pan Axis Reaches a Temporary Limit

Tips :

- When you set a persistent limit, the temporary limit for the same end of the axis is automatically set to the same value as the persistent limit.
- If you want to set both a persistent limit and a temporary limit for one end of an axis (**MIN** or **MAX**), you must set the persistent limit first. This is because temporary limits are always within persistent limits, so if you set the temporary limit first, you have to clear (erase) it in order to move the axis to the position you want to record as the persistent limit.

To set an axis limit:

1. Operate the axis for which you want to set a limit, moving it to the position you want to record as the limit.Figure 4.31 shows controls for the **Pan** axis.

Figure 4.31 — Controls for the Pan Axis

2. As the axis moves, note whether the axis position value, displayed between the arrow buttons, increases or decreases:
    - If the value **decreases** , the axis is moving towards the minimum (**MIN**) end of the axis.
    - If the value **increases** , the axis is moving towards the maximum (**MAX**) end of the axis.
3. If the axis stops moving and the arrow button you pressed is shaded yellow, the axis has reached a temporary limit (Figure 4.32).

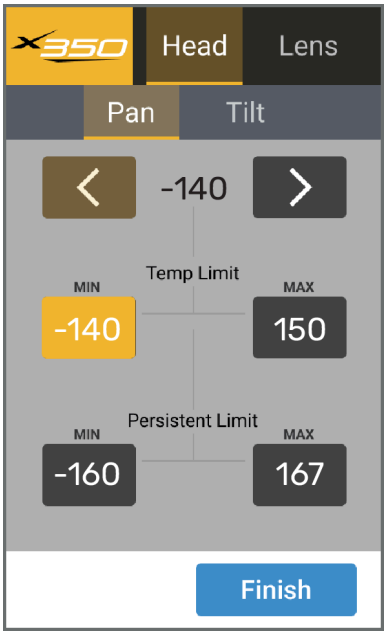


Figure 4.32

Figure 52 - The Pan Axis Reaches a Temporary Limit

4. Tap the yellow **Temp Limit** button to clear the temporary limit, and then continue moving the axis towards the position you want to record as the limit.
5. If the axis stops moving again and the arrow button you pressed is shaded yellow, the axis has reached a persistent limit.

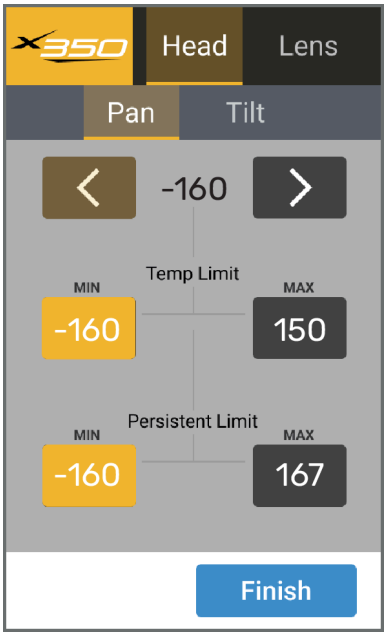


Figure 4.33 — The Pan Axis Reaches a Persistent Limit

5. Tap the yellow **Persistent Limit** button to clear the persistent limit. Continue moving the axis towards the position you want to record as the limit.

6. When the axis reaches the position you want to record as the limit do one of the following:

    - If you are satisfied with the current persistent limit and you want to set only a temporary limit, tap the **Temp Limit** button corresponding to the type of temporary limit you want to set at the current position (**MIN** or **MAX**).

    - If you want to set a persistent limit, tap the **Persistent Limit** button corresponding to the type of persistent limit you want to set at the current position (**MIN** or **MAX**).

      A **WARNING** message may appear, informing you that setting the persistent limit will clear the temporary limit. Tap **Accept** .

      The persistent limit is set, and the temporary limit is set to the same position.

7. If you want to set additional axis limits, repeat **step 1-49**. Continue to step **5** .

8. When you are finished setting axis limits, tap **Finish** to return to the main menu.

Adding Heads to a Control System

After your heads are configured, they must be added (registered) to the control system (application or device) you want to use to operate them. A head can be added to multiple control systems, but only one can control it at a time.

The method of adding a head to a control system depends on the type of control system:

- **SmartShell control application** — Adding new robots is typically done by Ross Video Commissioners. For more information contact Ross Video Technical Support.

- **DashBoard PT Head Control plugin** — See see the User Manual for PT Head Control Plugin (8351DR-019-xx). This manual is available at the following location, under **Downloads** > **Manuals** :

  https://www.rossvideo.com/products-services/acquisition-production/robotic-camera-systems/studio-robotics/

- **Other control systems** — See the user documentation for the control application or device, or contact Ross Video Technical Support.

Controlling the X300, X350, and X650 Heads

The X300, X350, and X650 can be controlled through Ross Video DashBoard, Ross Video SmartShell, and the Furio API.

DashBoard Control (PT Head Control Plugin)

The PT Head Control plugin is a free DashBoard application that enables you to control the X300, X350, and other supported robotic Pan & Tilt heads (PT heads). The PT Head Control plugin is included as part of DashBoard.

Figure 5.01 shows the DashBoard PT Head Control plugin.

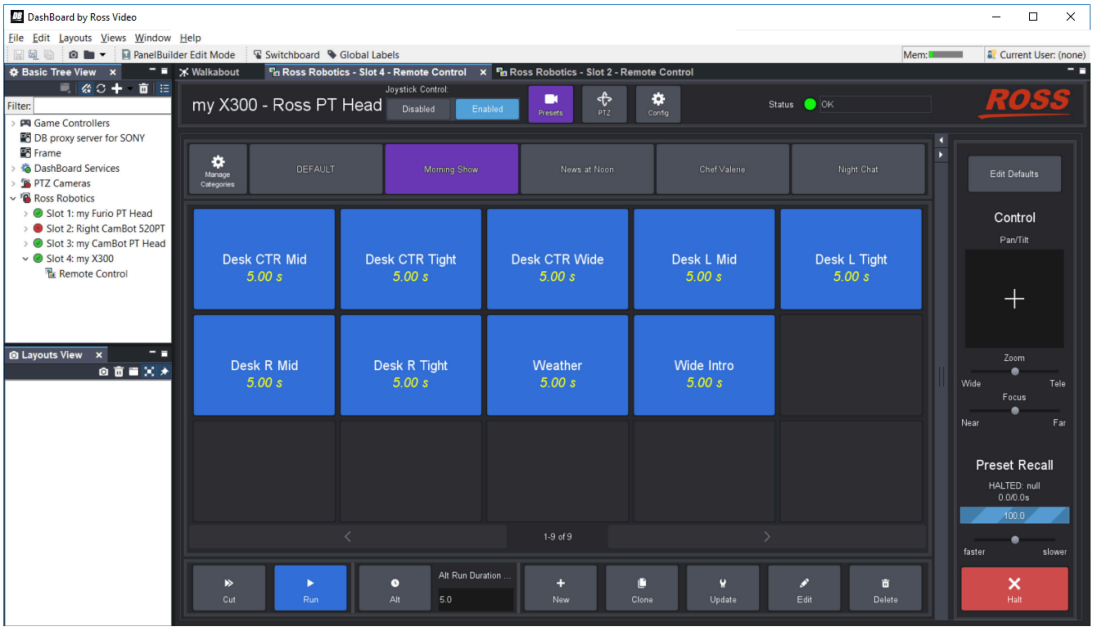


Figure 5.01 — DashBoard PT Head Control Plugin, showing controls for an X300 Head

Using DashBoard and the PT Head Control plugin, you can:

- control heads manually (pan and tilt axes)
- store and recall presets
- control lens functions (zoom, focus, iris)
- link to camera controls such as paint settings (selected cameras only). Linking to these controls enables you to control head and camera functions within a single user interface.
- add a USB joystick or other game controller to manually operate pan, tilt, zoom, focus, and iris axes. You can map buttons on the USB controller to perform camera selection and other tasks.

For detailed information about how to set up and use the DashBoard PT Head Control plugin, see the User Manual for PT Head Control Plugin (8351DR-019-xx), available on the USB drive included with the X300 (**5100USB-103- xx**). The latest edition is available from the following location on the Ross Video website, under **Downloads** > **Manuals** .

www.rossvideo.com/products-services/acquisition-production/robotic-camera-systems/studio-robotics

SmartShell Control

SmartShell is a full-featured, enterprise level control system that can control X300, X350, and X650 heads, as well as all other Ross Robotics devices, within a single user interface. SmartShell can also control selected third-party robots.

Some systems include multiple operator positions, each with its own SmartShell computer and SmartShell Joystick Panel.

For information about implementing a SmartShell control solution, contact Ross Video Technical Support.

Figure 5.02 shows the main SmartShell window, which enables you to configure axes and store and recall moves and presets.

Figure 5.02 — SmartShell Main Window, showing controls for a Furio Dolly

Figure 5.03 shows SmartShell in Matrix mode, which enables you to efficiently run moves and presets on one or more robots during a show.

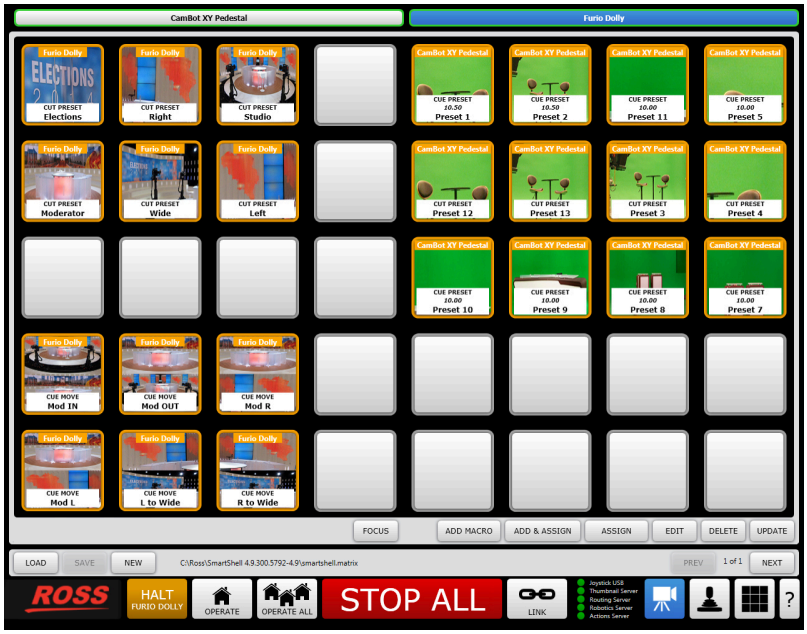


Figure 5.03 — SmartShell in Matrix Mode, showing Buttons Assigned to Recall Moves and Presets

Furio API Control

The X300, X350, and X650 heads use the Furio API, which facilitates direct control by Ross Production Switchers, OverDrive, and other third-party devices and controllers.

You can also use the Furio API to create custom control applications. For more information about implementing custom applications using the Furio API, contact Ross Video Technical Support.

Maintenance

Maintenance and Troubleshooting

This chapter describes how to maintain the X-Series Pan & Tilt Heads, and how to troubleshoot problems you may encounter. It includes the following topics:

- **“Maintenance”**
- **“Troubleshooting”**

Maintenance

Ross Video designed the X300, X350, and X650 heads to perform smoothly, accurately, and reliably for many years under full payload in demanding production environments.

These robotic heads do not require lubrication or internal maintenance. There are no user-serviceable parts inside other than the X650 drive belt, which can be serviced if authorized. Unauthorized disassembly of an X300, X350, and X650 may void product warranty.

To keep your robotic head running optimally, perform the following maintenance tasks periodically:

- Dust the unit, and/or wipe with a dry rag. Do not expose the head to water or any other liquids.
- Inspect the head and payload to ensure that:
  - All cable connections are intact, and there is no strain on cables that run to the head.
  - The payload is properly secured and has not shifted over time. Check the position of the camera cradle to ensure the screws are properly tightened and that it has not slipped.

> **IMPORTANT**
>
> If the payload has been modified or has shifted, ensure that it does not exceed the payload limit of 15 lbs (6.8 kg) for the X300 and X350, or 125 lbs (57 kg) for the X650, and that it is properly balanced around the tilt axis, both horizontally and vertically. For more information, see “Balancing the Payload”.

Troubleshooting

The section describes problems you may encounter and how to resolve them.

If you are unable to resolve the problem, contact Ross Video Technical Support for assistance. For more information, see “Company Address and Contact Information”.

Refer to Table 6.01 for troubleshooting information

Table 6.01 — Troubleshooting

Symptom	Steps to Diagnose and Resolve
Head does not start	If you disconnect power and then reconnect it too soon, the head may fail to start properly. To resolve this issue, disconnect power, wait 20 seconds, and then reconnect power. The head should start normally.
Head does not move at all	• Check for green power LED beside power connector. If the power LED is not illuminated green, check that the power cable and power adapter are plugged in, and that the power supply circuit is live. • Check network cable connections, and network data connectivity. Beside each Ethernet port (RJ45 jack) on the head, there is a green LED which indicates network connectivity: ◦ **OFF** — There is no network connection. ◦ **ON SOLID** — Head is connected to the network. ◦ **ON FLASHING** — Head is connected to the network, and data is currently being transmitted to and/or from the head. • Check that the network switch is operating properly. • Check for control connectivity by using the control computer to do one of the following: ◦ If you are using DashBoard PT Head Control, find the head in the DashBoard tree. If the status dot is green, DashBoard can communicate with the head. ◦ In a web browser, launch the head's web interface by navigating to the head's IP address. If the web interface launches, the computer has network connectivity with the head. ◦ If you cannot connect to the web interface, or if you do not know the head's IP address, use DashBoard Walkabout to view and configure network connectivity settings. For more information, see "Using DashBoard Walkabout to Assign Unique IP Addresses". • Check for obstructions or tight cables that may impair head motion. Remove all obstructions, and dress cables properly. For more information, see "Cabling and Tethering". • If the Ethernet connections for multiple heads are cascaded (daisy-chained) from head-to-head, ensure that all heads in the chain are powered. Each head has a 1x2 Ethernet switch that must be powered to operate. • If the head is a model X350 and it is configured to use DHCP, check the IP address in the bottom right corner of the touchscreen. If there is no IP address shown, the DHCP server failed to assign an IP address.
Head moves jerkily, or stops responding to commands, or tilts freely	• If the payload has been modified or components of the payload may have shifted, it may be overweight and/or out of balance. Check that all payload components are properly secured to each other, and to the camera cradle. Check that the camera cradle is properly secured to the head. If you suspect that the payload may have shifted, rebalance the payload. Ensure that it does not exceed the payload limit of 15 lbs (6.8 kg) for the X300 and X350, 125 lbs (57 kg) for the X650, and that it is properly balanced around the tilt axis, both horizontally and vertically. For more information, see "Balancing the Payload".

Symptom	Steps to Diagnose and Resolve
	• If the head has been abused by overloading or by operating with an imbalanced payload, an internal drive belt may be damaged. If you suspect this may be the case, contact Ross Video Technical Support for assistance.

Technical Specifications

This chapter contains drawings and technical specifications for X-Series Pan & Tilt Heads. It also describes mounting accessories that are available from Ross Video.

This chapter includes the following sections:

- **“Technical Specifications”**
- **“Drawings of the X300 Pan & Tilt Head”**
- **“Drawings of the X350 Pan & Tilt Head”**
- **"Drawings of the X650 Pan & Tilt Head"**
- **“Connector Pin Assignments”**
- **“Optional Mounting Accessories”**

Technical Specifications

Table 7.01 contains technical specifications for the X300, X350, and X650 Pant Tilt Heads.

Table 7.01 — Technical Specifications

Feature / Property	X300	X350	X650
Product name and ordering code	Ross Video X300 Robotic Pan & Tilt Head Ordering code RRB-X300-PT	Ross Video X350 Robotic Pan & Tilt Head Ordering code RRB-X350-PT	Ross Video X650 Robotic Pan & Tilt Head Ordering code RRB-X650-PT
Physical dimensions	Approximately 5 7/8” W x 7 3/8” H x 7 3/4” D (150 mm W x 190 mm H x 135 mm D)		Approximately 17” x 111” x 7” (432 mm x 279 mm x 178 mm).
Maximum payload	15 lbs (6.8 kg)		125 lbs (57 kg)
Pan axis range	±178° (356° total)		
Tilt axis range	±78° (356° total)		+/- 90°
Pan and tilt speed range	0.1° to 45° per second		0.1° to 90° per second
Maximum pan and tilt acceleration rate	60°/sec^2		
Positional accuracy and repeatability	±0.5°		<0.02°

Feature / Property	X300	X350	X650
Drive train gear type	Anti-backlash gears in the drive train ensure smooth motion suitable for on-air shots		
Digital lens control	Digital control of a wide variety of Canon and Fujinon full servo serial lenses (zoom, focus, iris).		
Analog lens control	Zoom, Focus, and Iris		
Serial digital camera control	N/A	Serial digital camera control over RS232 and RS422	
Remote configuration interface	Web-based configuration interface. Default IP address is 192.168.3.11.		
Local configuration interface	N/A	Built-in 5” touchscreen interface	Built-in 5” touchscreen interface
Control interface (user interface)	Fully controllable through any and all of the following: • The PT Head Control Plugin, a free control application included with Ross Video DashBoard. The plugin enables you to create and recall presets, and use a third-party USB joystick or other game controller. • Ross SmartShell, a full-featured enterprise-level control system that can control all Ross Robotics devices within a single user interface. Includes joystick panel with camera selection buttons. • The Furio API, which enables direct control by Ross Production Switchers, OverDrive, and other third-party devices and controllers.		
Axis encoders and position tracking data for AR/VS	The X300 has axis encoders, but the X350 is recommended for AR/VS applications instead of the X300, because unlike the X300, the X350 can accept a sync signal.	FreeD and ORAD tracking data output via UART and/or UDP (up to three destinations)	
Video SYNC IN/OUT	N/A	Yes (Standard BNC connectors)	
Compatible with Furio Dolly, SkyDolly, and BlackBird Pedestal	N/A	Yes (control through CAN bus)	
Approximate net weight	11 lbs (5.0 kg)		21 lbs (9.1 kg)

Feature / Property	X300	X350	X650
Power input and power adapter specifications	See “Power and Networking Requirements”		
Storage temperature, operating temperature, and operating humidity	See “General Studio Requirements”		

NOTE

The maximum prompter size supported by the X650 is 19”.

Drawings of the X300 Pan & Tilt Head

This section contains the following drawings:

- **“Back (connection panel)”**
- **“Front”**
- **“Right Side (camera cradle side)”**
- **“Left Side”**
- **“Bottom”**
- **“Top”**
- **“Angled Views (X300 head, mounted on a PM8 pedestal riser)”**

NOTE

Drawings are not to scale. All dimensions are in inches and millimeters [mm].

Back (connection panel)

Figure 7.01 shows the back of the X300 head, including the connection panel.

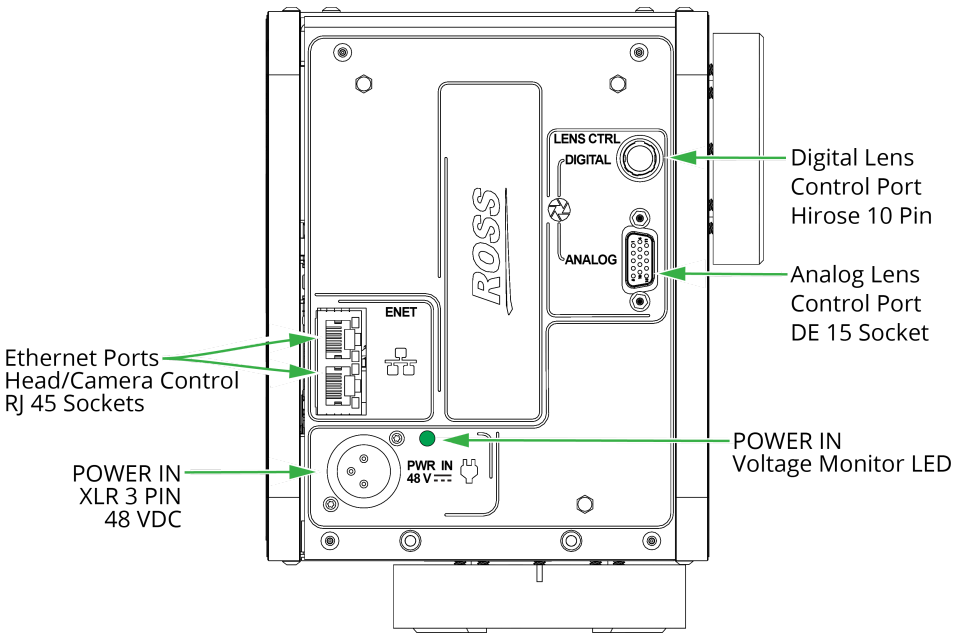


Figure 7.01 — X300 Pan & Tilt Head (back view, showing connection panel)

Front

Figure 7.02 shows the front of the X300 Pan & Tilt Head.

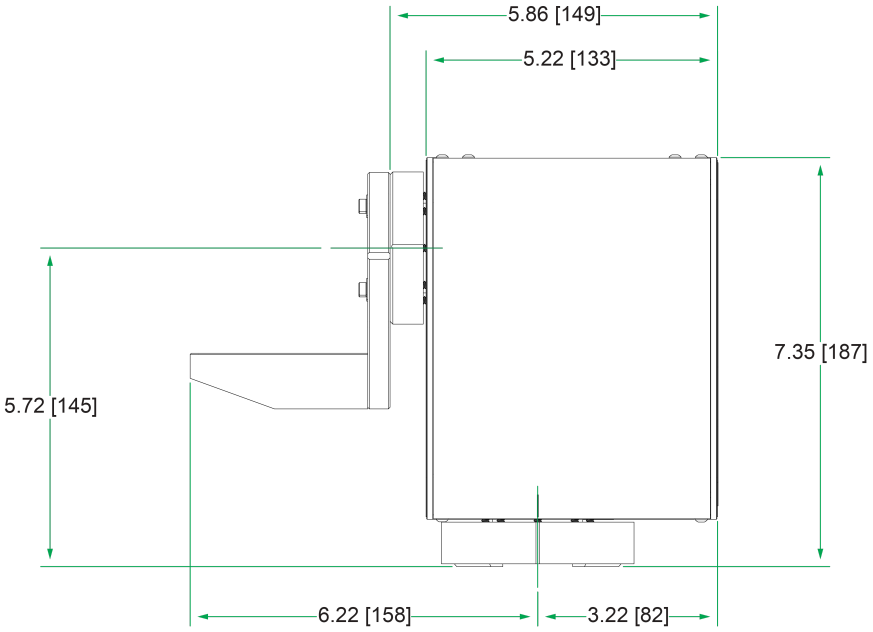


Figure 7.02 — X300 Pan & Tilt Head (front view)

Right Side (camera cradle side)

Figure 7.03 shows the right side of the X300 head.

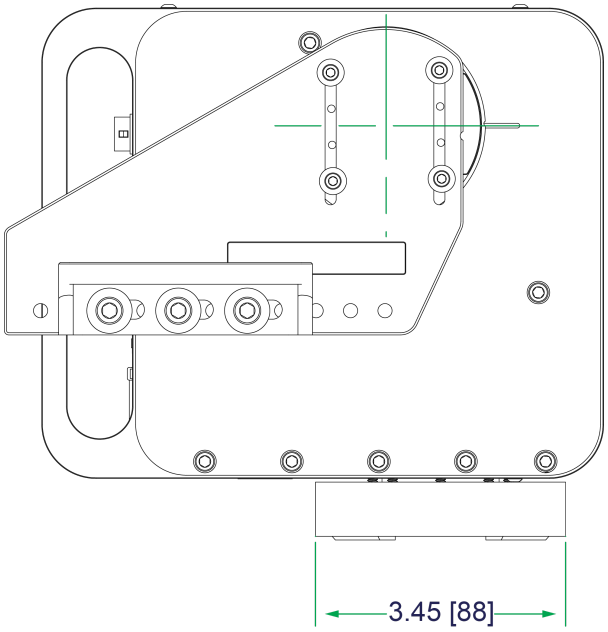


Figure 7.03 — X300 Pan & Tilt Head (right side)

Left Side

Figure 7.04 shows the left side of the X300 head.

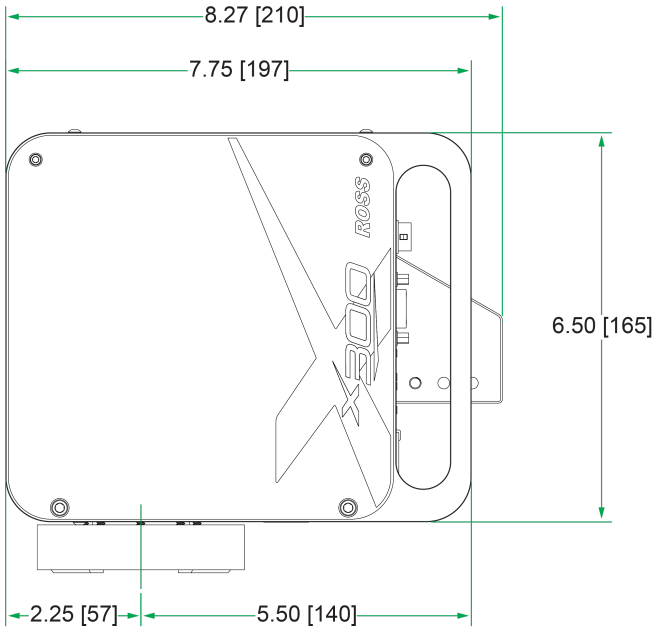


Figure 7.04 — X300 Pan & Tilt Head (left side)

Bottom

Figure 7.05 shows the bottom of the X300 head, without the camera cradle. For a drawing that shows mount hole spacing, see Figure 7.03.

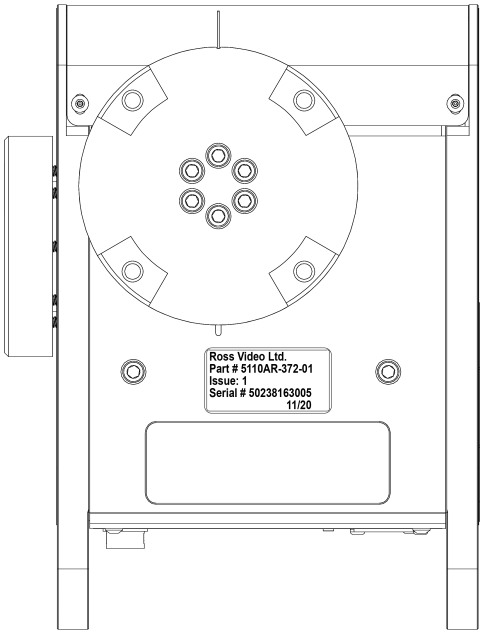


Figure 7.05 — X300 Pan & Tilt Head (bottom view, camera cradle not shown)

Top

Figure 7.06 shows the top of the X300 head.

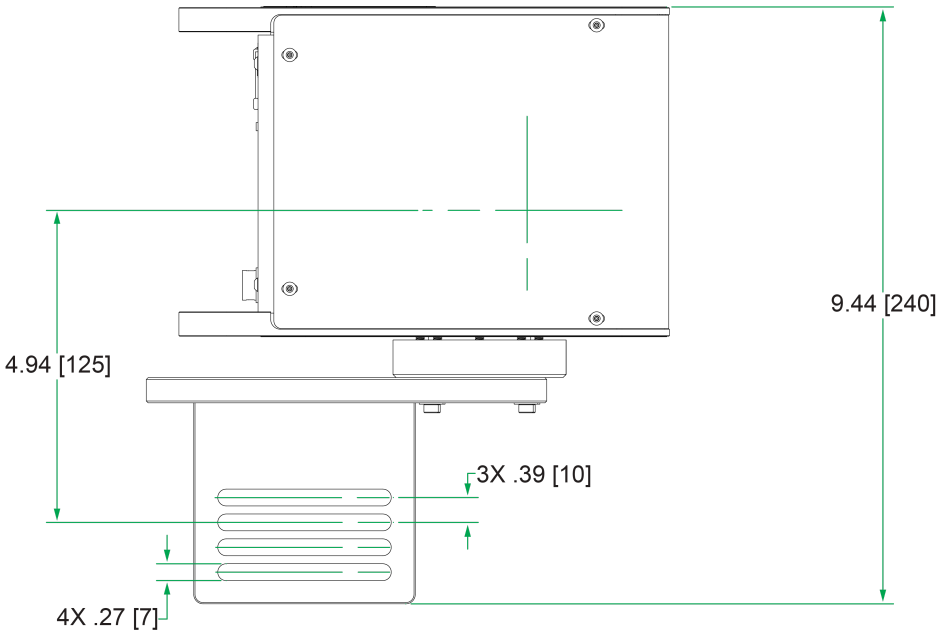


Figure 7.06 — X300 Pan & Tilt Head (top view)

Angled Views (X300 head, mounted on a PM8 pedestal riser)

Figure 7.07 shows the front of the X300 head, mounted on a PM8 Pedestal Riser.

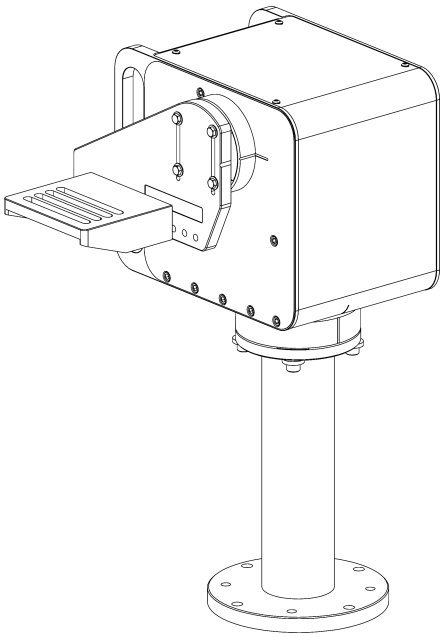


Figure 7.07 — X300 Pan & Tilt Head, Mounted on a PM8 Pedestal Riser (front angled view)

Figure 7.08 shows the back of the X300 head, mounted on a PM8 Pedestal Riser.

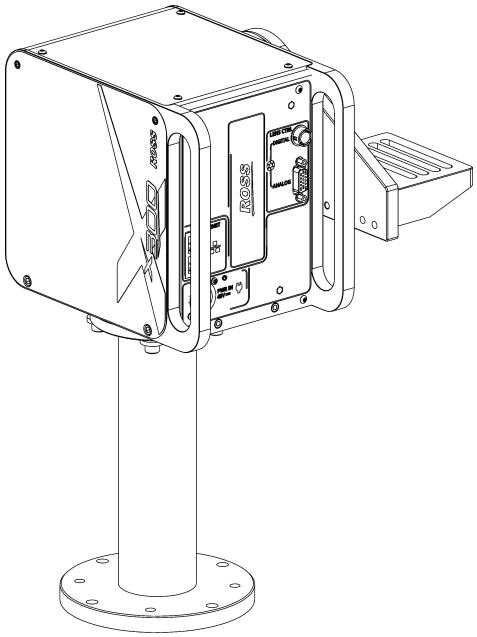


Figure 7.08 — X300 Pan & Tilt Head, Mounted on a PM8 Pedestal Riser (back angled view)

Drawings of the X350 Pan & Tilt Head

This section contains the following drawings:

- **“Back (connection panel)”**
- **“Front”**
- **“Right Side (camera cradle side)”**
- **“Left Side”**

- **“Bottom”**
- **“Top”**
- **“Angled Views (X350 head mounted on a PM8 pedestal riser)”**

> **NOTE**
>
> Drawings are not to scale. All dimensions are in inches and millimeters [mm].

Back (connection panel)

Figure 7.09 shows the back of the X350 head, including the connection panel.

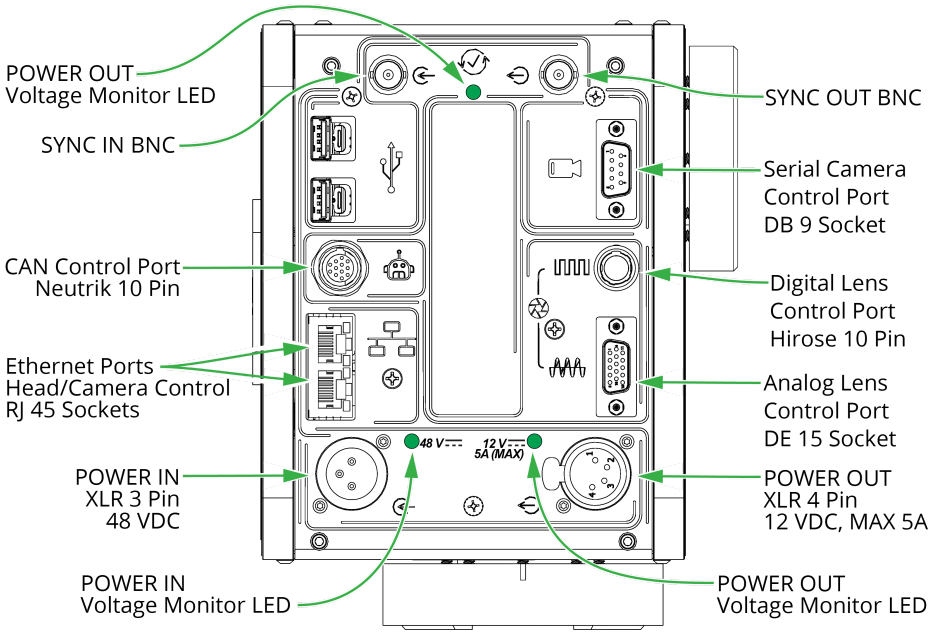


Figure 7.09 — X350 Pan & Tilt Head (back view, showing connection panel)

Front

Figure 7.10 shows the front of the X350 head.

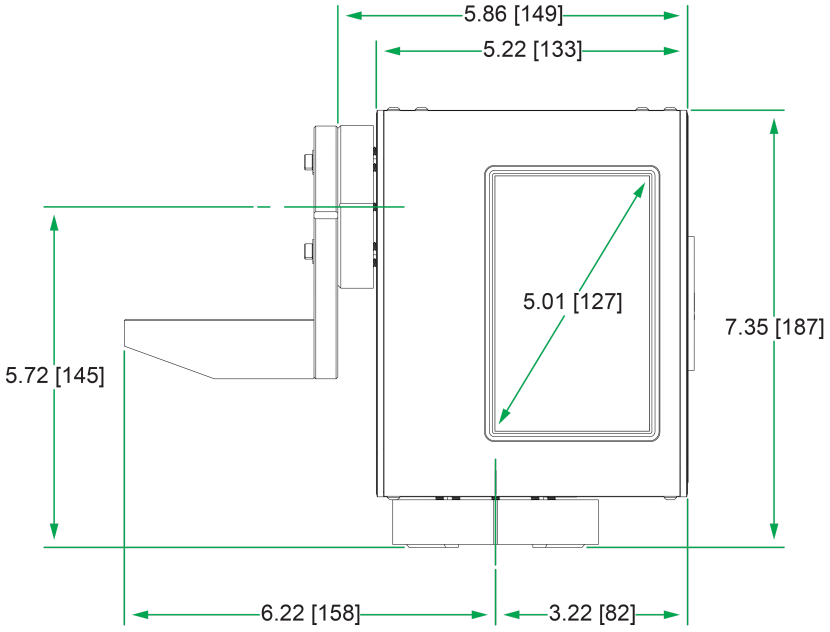


Figure 7.10 — X350 Pan & Tilt Head (front view)

Right Side (camera cradle side)

Figure 7.11 shows the right side of the X350 head.

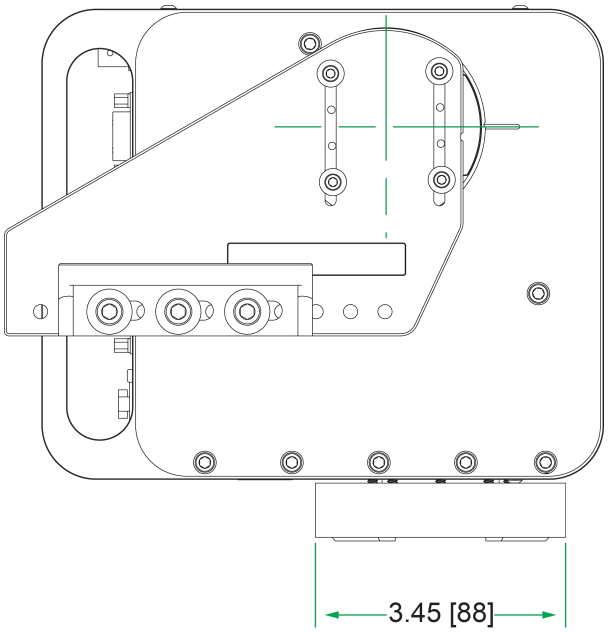


Figure 7.11 — X350 Pan & Tilt Head (right side)

Left Side

Figure 7.12 shows the left side of the X350 head.

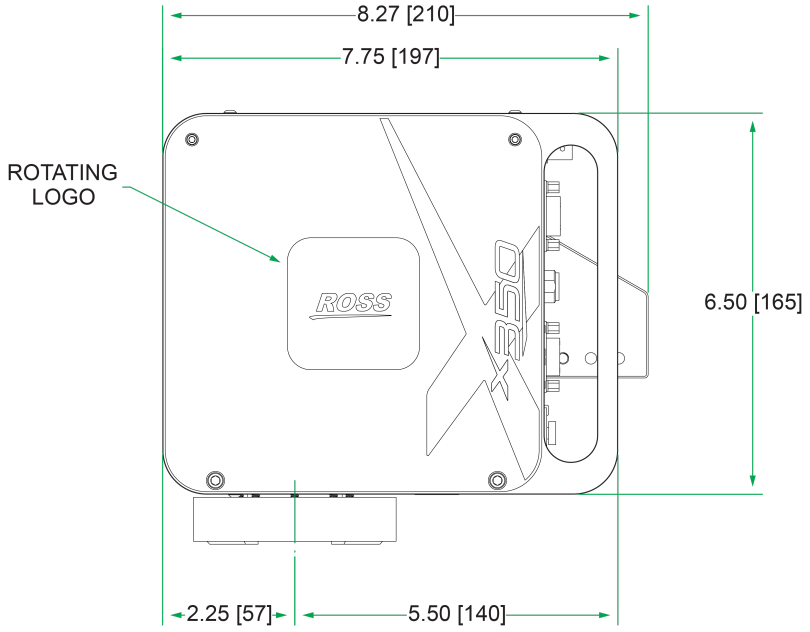


Figure 7.12 — X350 Pan & Tilt Head (left side)

Bottom

Figure 7.13 shows the bottom of the X350 head, without the camera cradle. For a drawing that shows mount hole spacing, see Figure 7.11.

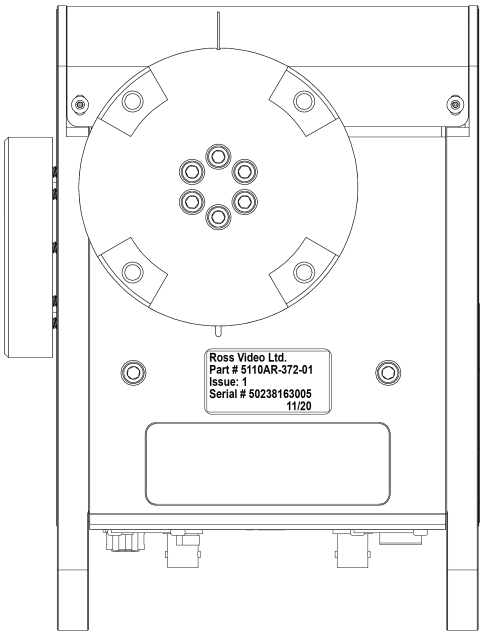


Figure 7.13 — X350 Pan & Tilt Head (bottom view, camera cradle not shown)

Top

Figure 7.14 shows the top of the X350 head.

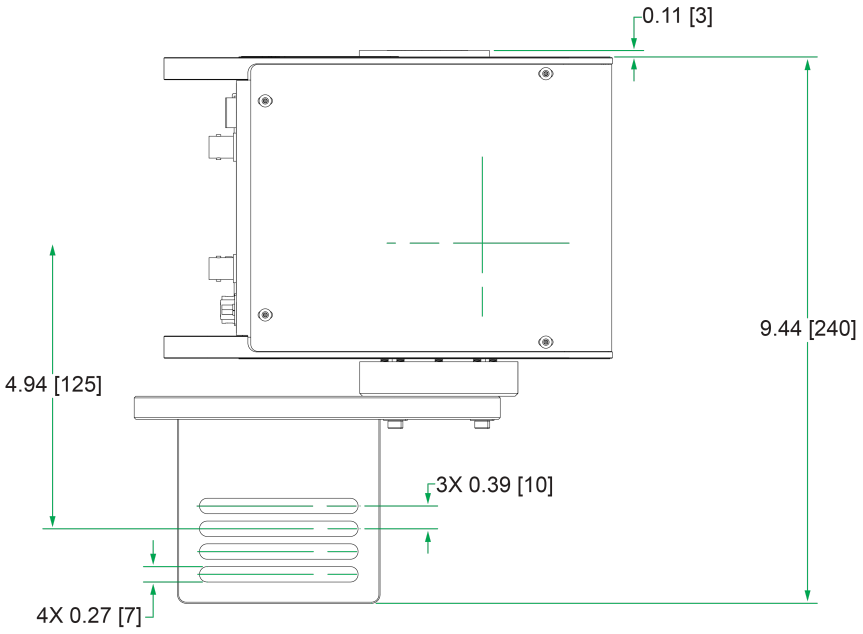


Figure 7.14 — X350 Pan & Tilt Head (top view)

Angled Views (X350 head mounted on a PM8 pedestal riser)

Figure 7.15 shows the front of the X350 head, mounted on a PM8 Pedestal Riser.

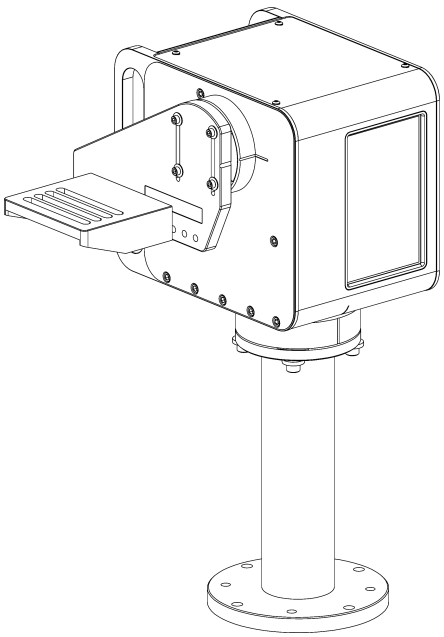


Figure 7.15 — X350 Pan & Tilt Head, Mounted on a PM8 Pedestal Riser (front angled view)

Figure 7.16 shows the back of the X350 head, mounted on a PM8 Pedestal Riser.

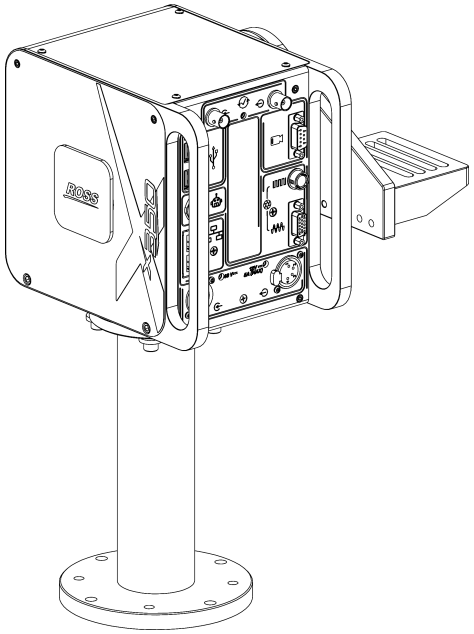


Figure 7.16 — X350 Pan & Tilt Head, Mounted on a PM8 Pedestal Riser (back angled view)

Drawings of the X650 Pan & Tilt Head

This section contains the following drawings:

- **“Back (connection panel)”**
- **“Front”**
- **“Right Side (camera cradle side)”**
- **“Bottom”**
- **“Top”**

> NOTE
>
> Drawings are not to scale. All dimensions are in inches and millimeters [mm].

Back (connection panel)

Figure 7.17 shows the back of the X650 head, including the connection panel.

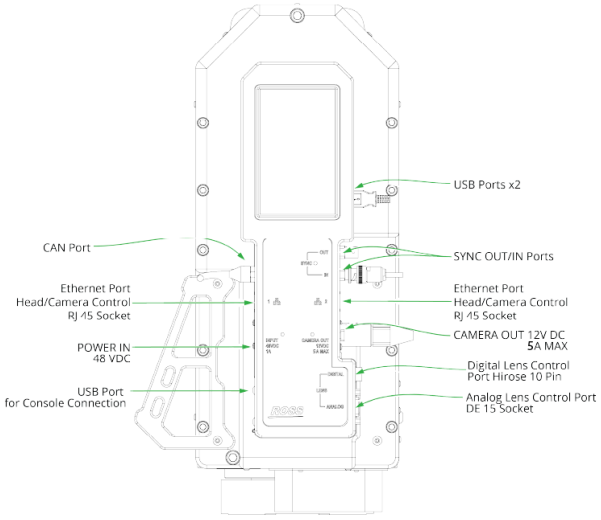


Figure 7.17 — X650 Pan & Tilt Head (back view, showing connection panel)

Front

Figure 7.18 shows the front of the X650 head.

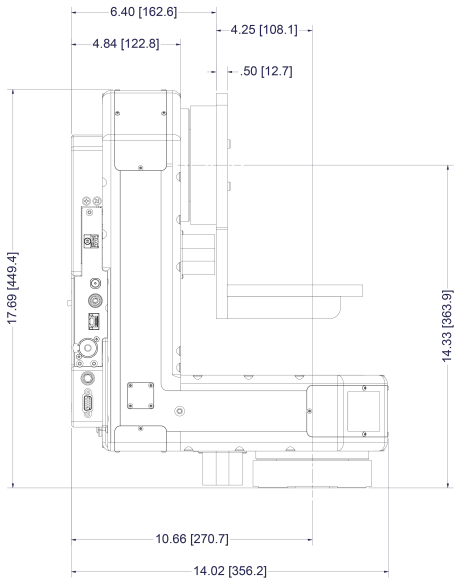


Figure 7.18 — X650 Pan & Tilt Head (front view)

Right Side (camera cradle side)

Figure 7.19 shows the right side of the X650 head.

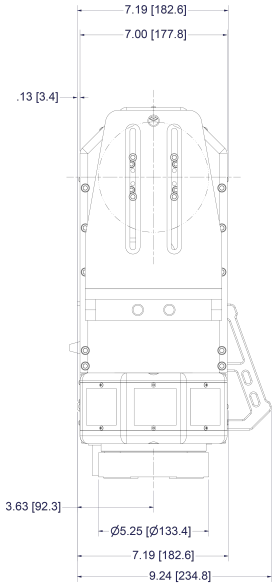


Figure 7.19 — X650 Pan & Tilt Head (right side)

Bottom

Figure 7.20 shows the bottom of the X650 head, without the camera cradle. For a drawing that shows mount hole spacing, see Figure 7.19.

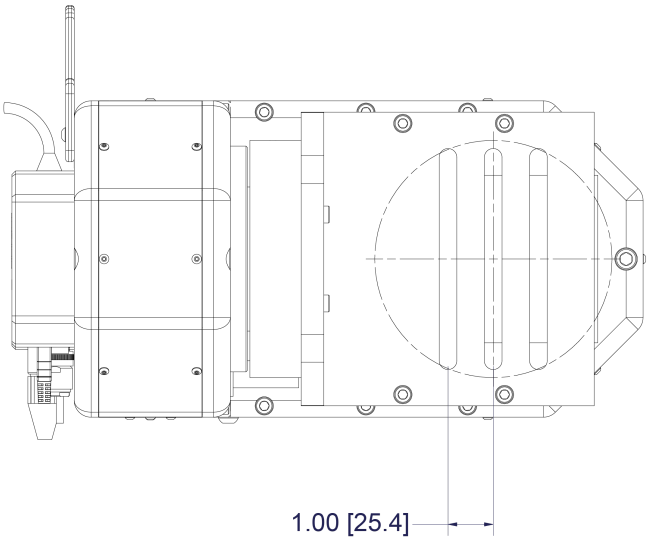


Figure 7.20 — X650 Pan & Tilt Head (bottom view, camera cradle not shown)

Top

Figure 7.21 shows the top of the X650 head.

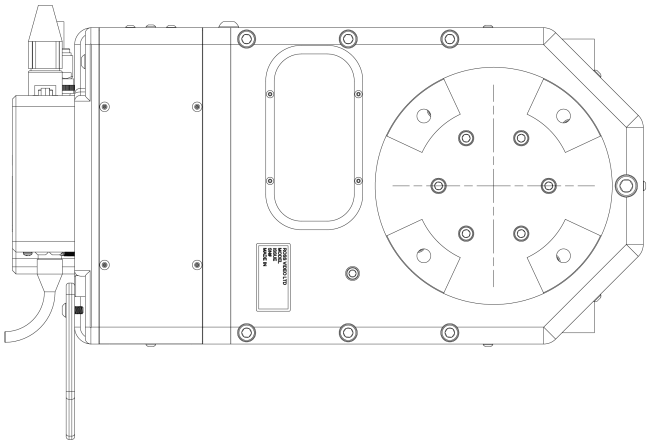


Figure 7.21 — X650 Pan & Tilt Head (top view)

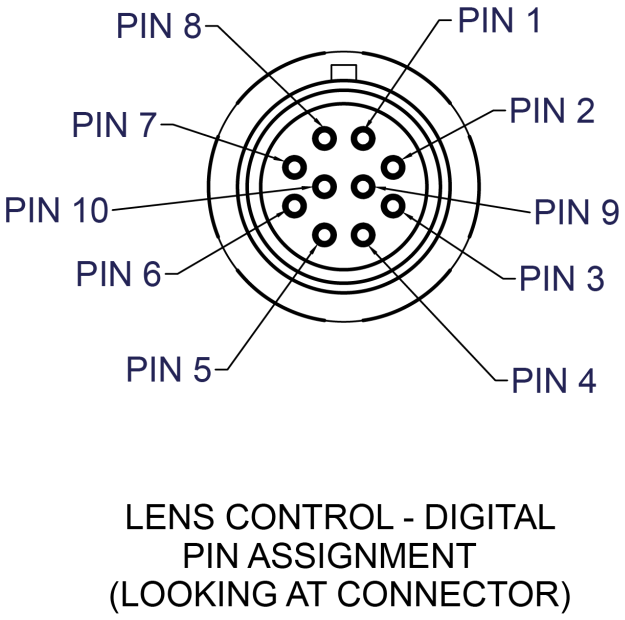
Connector Pin Assignments

This section lists pin assignments for connectors on X300, X350 and X650 heads. It includes the following topics:

- **“Digital Lens Control Port — Pin Assignments (X350 and X650 only)”**
- **“Analog Lens Control Port — Pin Assignments”**
- **“Serial Camera Control Port — Pin Assignments (X350 only)”**
- **“Power Input — Pin Assignments”**
- **“Power Output— Pin Assignments (X350 and X650 only)”**

Digital Lens Control Port — Pin Assignments (X350 and X650 only)

Figure 7.22 shows the pin assignments for the digital lens control port (10-pin Hirose connector).

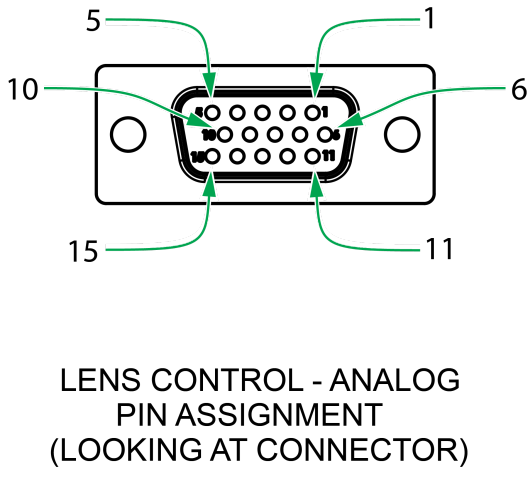


WIRING TABLE	
PIN	SIGNAL
1	RS422_TX-
2	RS232_RX
3	RS232_TX
4	RS232 DTR
5	GND
6	N/C
7	RS422_TX+
8	RS422_RX+
9	RS422_RX-
10	DETECT1

Figure 7.22 — Pin Assignments for the Digital Lens Control Port

Analog Lens Control Port — Pin Assignments

Figure 7.23 shows the pin assignments for the analog lens control port (DE 15 socket).

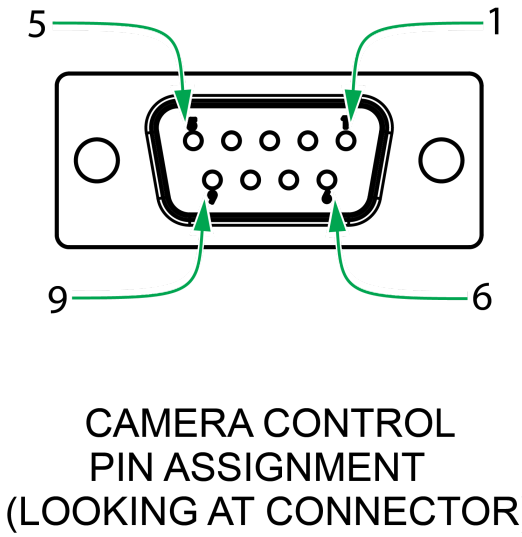


WIRING TABLE	
PIN	SIGNAL
1	V1_ZOOM
2	V2_ZOOM
3	V3_ZOOM
4	CABLE_DETECT1
5	IRIS_DEMAND
6	FOCUS_DEMAND
7	ZOOM_DEMAND
8	V1_FOCUS
9	V2_FOCUS
10	V3_FOCUS
11	IRIS C/L
12	CABLE_DETECT2
13	CABLE_DETECT3
14	CABLE_DETECT4
15	GND

Figure 7.23 — Pin Assignments for the Analog Lens Control Port

Serial Camera Control Port — Pin Assignments (X350 only)

Figure 7.24 shows the pin assignments for the serial camera control port (DB 9 socket).



WIRING TABLE	
PIN	SIGNAL
1	GND
2	RS422_TX+
3	RS422_TX-
4	RS232_TX
5	RS232_RX
6	RS422_RX+
7	RS422_RX-
8	CABLE_DETECT1
9	CABLE_DETECT2

Figure 7.24 — Pin Assignments for the Serial Camera Control Port

Power Input — Pin Assignments

Figure 7.25 shows the pin assignments for the POWER IN port (3-pin XLR)

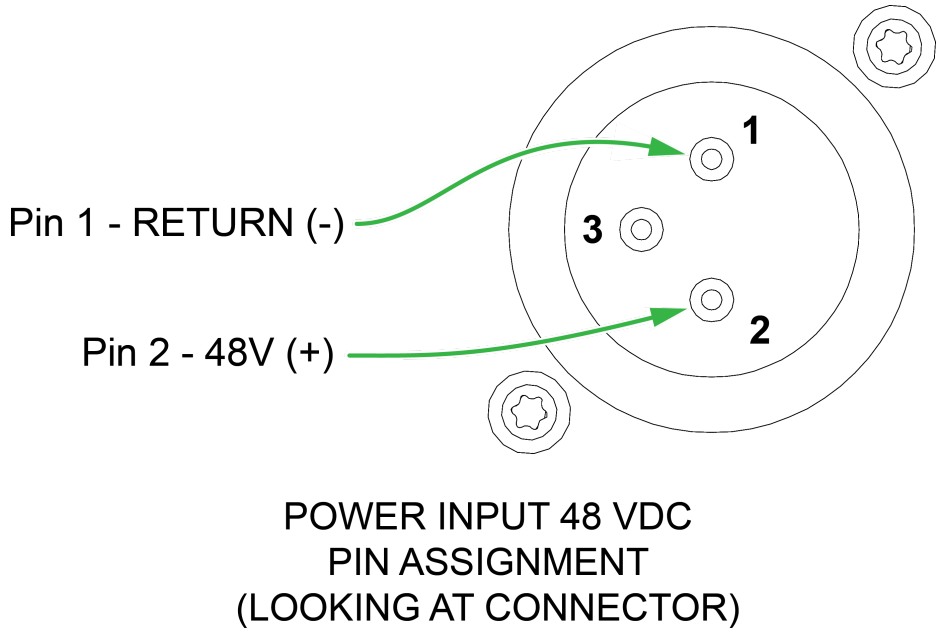


Figure 7.25 — Pin Assignments for the POWER IN Port

Power Output— Pin Assignments (X350 and X650 only)

Figure 7.26 shows the pin assignments for the POWER OUT port (4-pin XLR)

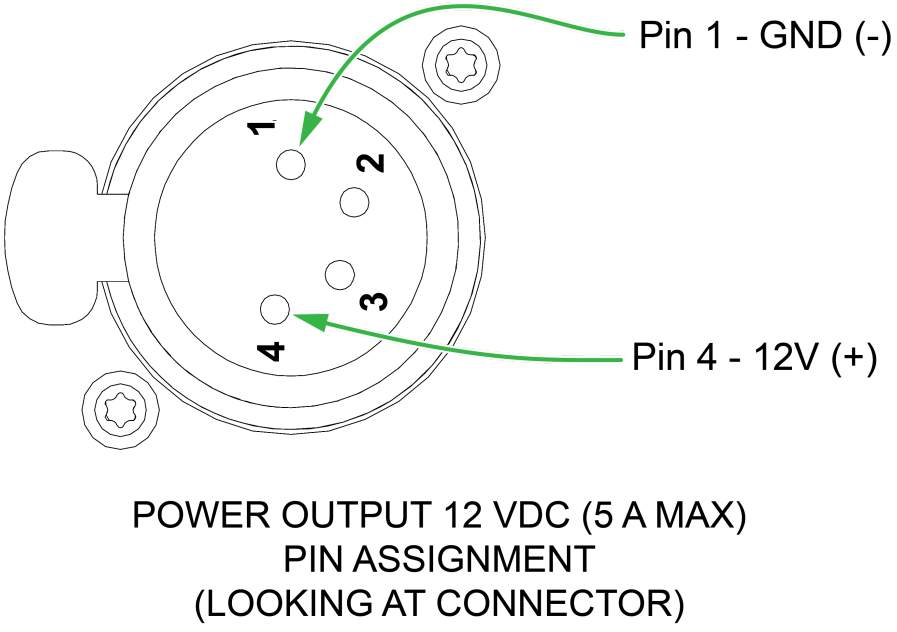


Figure 7.26 — Pin Assignments for the POWER OUT Port

Optional Mounting Accessories

This section describes the following mounting accessories and options available for the X-Series Pan & Tilt Heads. It includes the following topics:

- **“PM8 Pedestal Riser for X300 or X350 (RRB-UNI-PM8)”**
- **“Universal Ceiling Mount for X300, X350, or X650 (RRB-UNI-CLM)”**
- **“Universal Wall Mount Bracket for X300 or X350 (RRB-UNI-WMB)”**
- **“Mitchell Mount Adapter for X300, X350, or X650 (RRB-UNI-MA)”**

PM8 Pedestal Riser f or X300 or X350 (RRB-UNI-PM8)

This is an 8” (20 cm) black metal pedestal riser with a flanged base and eight mounting holes (RRB-UNI-PM8). The PM8 Pedestal Riser can be mounted to any horizontal surface that accepts fasteners.

Figure 7.27 shows how the X350 is mounted to a PM8 Pedestal Riser.

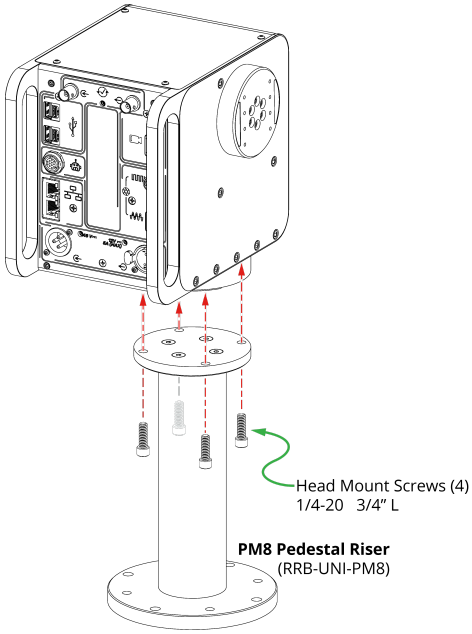


Figure 7.27 — Mounting the X350 Head on a PM8 Pedestal Riser

Universal Ceiling Mount fo r X300, X350, or X650 (RRB-UNI-CLM)

This mount clamps onto a section of lighting grid pipe, and is suitable for inverted mounting of the X300, X350, or X650 head. It is designed to accept nominal 1.5" Schedule 40 pipe, which has an outside diameter of 1.9" (48mm). The pipe outside diameter must be minimum 48mm (1.9"), maximum 51mm (2"). This sort of pipe is commonly used for lighting truss and studio lighting grids.

The Universal Ceiling Mount is used in conjunction with a PM8 Pedestal Riser, to increase clearance between the payload and the ceiling mount.

Figure 7.28 shows the Universal Ceiling Mount.

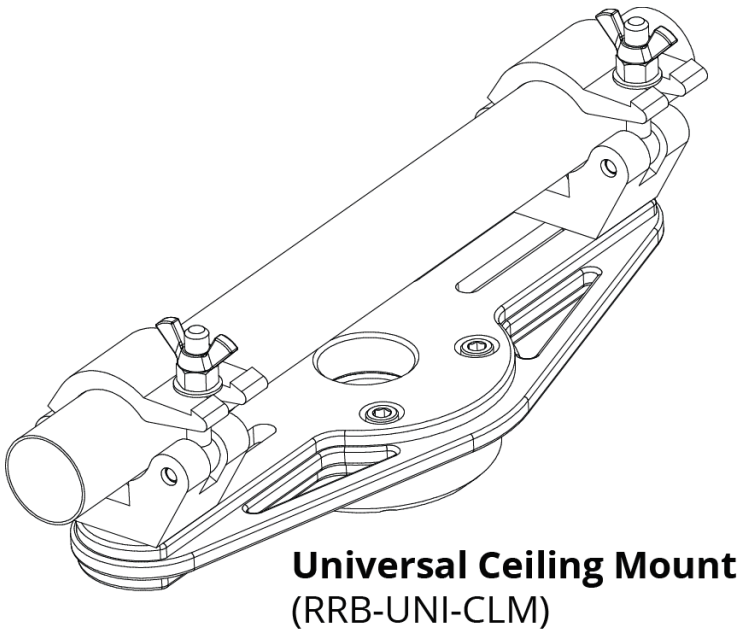


Figure 7.28 — Universal Ceiling Mount

Universal Wall Mount Brac ket for X300 or X350 (RRB-UNI-WMB)

This is a sturdy metal bracket designed to fully support an X300 or X350 head without restricting pan and tilt range (RRB-UNI-WMB). The wall mount bracket must be securely fastened to a structural member, such as a wall stud.

Figure 7.28 shows the Universal Wall Mount Bracket.

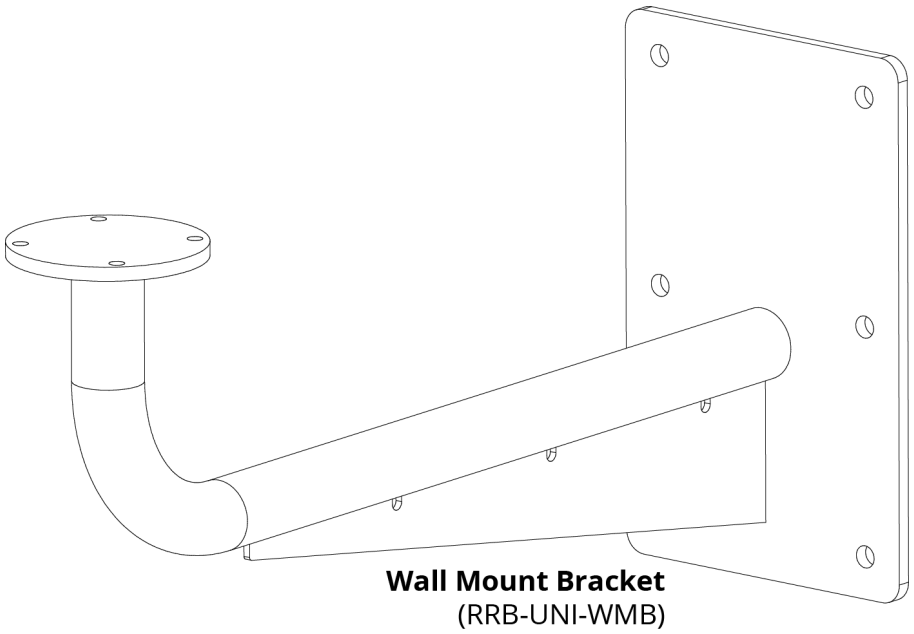


Figure 7.29 — Universal Wall Mount Bracket

Mitchell Mount Adapter for X300, X350, or X650 (RRB-UNI-MA)

This adapter is designed for use with a tripod or pedestal that has a Mitchell Mount plate.

The Mitchell Mount Adapter is used in conjunction with a PM8 Pedestal Riser, as an adapter to mate it with the X300, X3350, or X650 head.

Tripods and Pedestals

Ross Video sells a variety of Cartoni tripods and pedestals suitable for mounting our robotic pan & tilt heads. A PM8 Pedestal Riser is also required, as a mating adapter.