Telecast Fiber Solutions

CopperHead Pro User Guide

M4013-9900-102

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grass valley
A BELDEN BRAND

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Warranty information is available in the Support section of the Grass Valley Web site (www.miranda.com).

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Part Number	M4013-9900-102
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1 About CopperHead Pro

This chapter provides an overview of the CopperHead Pro and includes the safety and warranty information about it.

About CopperHead Pro

The CopperHead System is a fiber optic transmission system that enables camcorders to be used in live, multi-camera production environments.

The system uses a fiber optic cable to transport a variety of signals between a Camera Unit and a Base Station.

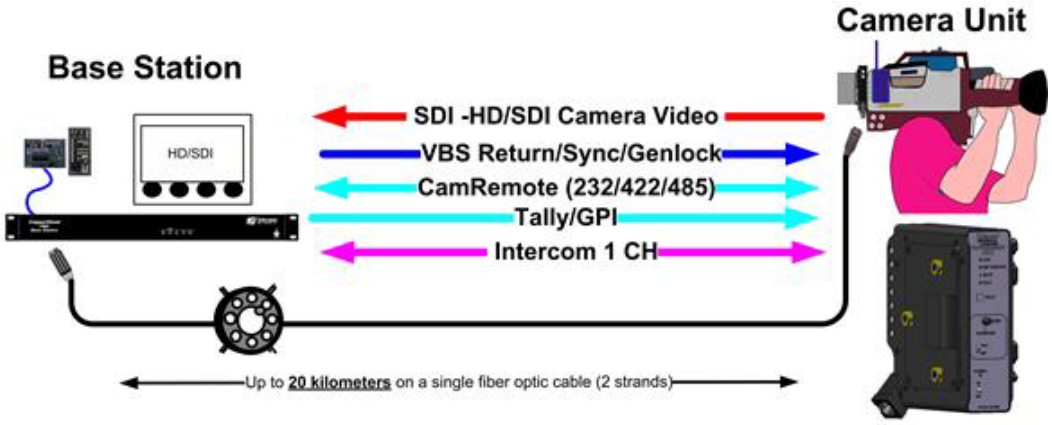


Fig. 1-1: CopperHead Pro Signal Paths

The CopperHead Pro Camera Unit is typically mounted to a camera that is placed in a studio, theatre, sports venue, or other live-event location. The system's Base Station is usually located in a truck, control room, or other video production control area.

When "dry" fiber is used (typically lightweight "tactical" fiber cable), the signals are transmitted bi-directionally over distances as long as 5 km or more.

When you use a hybrid fiber cable, the link also provides power to the Camera Unit and the camera itself.

CopperHead System Features

- Makes any camcorder practical for multi-camera production
- All camera signals are carried on one lightweight fiber cable
- Can be run through building or campus infrastructure on two strands of Single Mode fiber*
- Thin, lightweight, modular design
- Studio quality uncompressed HD/SDI video up to 3 Gb/s
- Multi-kilometer distance capability
- Anton/Bauer® Gold Mount and "V-Mount" battery options
- Wide temp range, low power consumption
- Durable, high reliability design
- Two fiber cable options
  - Tactical Fiber: Military Spec, battery/local power, 10+km
  - SMPTE Hybrid Fiber
    - Low voltage camera-mounted "PowerWafer": 95 watts to 300m (984 ft.)

- High-voltage camera-mounted "PowerPlus": Up to 150 watts to 2 km (1.2 miles)

Note: The CopperHead ProSystem is not readily compatible with active or passive CWDM multiplexing technologies, including Teleport or TeleThon systems.

Unpacking the CopperHead Pro

Individual items shipped with a CopperHead Pro system depend on the particular configuration.

Item Description	Part Code	CopperHead System Type		
		Tactical Fiber (local power at camera)	Hybrid Fiber - Standard Power (PowerWafer)	Hybrid Fiber - High Power (PowerPlus)
CopperHead Camera Unit	CHG3-CAM	●	●	●
CopperHead Base Station	CHG3-BS	●	●	●
AC-to-DC Power Supply	ADAP-AC	●	No	No
Panel-Mountable Fiber Extension	CH3BFC	○	○	No
Camera Remote cable	CHCR	●	●	●
Camera Signal cable	CH3CS	○	○	○
Base Station Remote cable	CHBR	●	●	●
PowerWafer w/jumper cable	CHG3-PW	No	●	No
Eternal PowerWafer Supply	CH3-MPS	No	○	No
PowerPlus	PWRPLS	No	No	●
HDX Power Supply	HDX	No	No	●
Fiber jumper(s)	various	No	No	●
Reel or coil of Tactical Fiber	CA	●	No	No
Reel or coil of Hybrid Fiber	CA	No	●	●
Operations Manual	CA	●	●	●
			● Standard	○ Optional

Consult your packing slip and purchase order to ensure that you have received all of the expected Fiber Systems components. Inspect all components for scratches and other mechanical damage, and inspect the electrical connectors for bent or damaged pins and latches. Report any missing or damaged components to Grass Valley (see Product Returns on page 4).

You must use your own video and audio cables to make connections for Video, Tally, Black Burst/Genlock, Base Station monitor, intercom, and other ancillary signals and equipment. Suggestions for these cables are discussed later in this User Guide.

Product Returns

In the unlikely event of damage to your CopperHead Pro during shipping or delivery, take note of any damage with the delivery or shipping service and document the packaging and product where you see this damage. If any component does not work correctly out of the box, contact Grass Valley (see Contact Us on page 57).

If the problem cannot be remedied through a service telephone call,you will receive an RMA number (Return of Merchandise Authorization). Take note this RMA number inside and outside of all shipping boxes and on all documentation provided with the items to be returned.

About this User Guide

This user guide is designed to cover all of the various options and so not every page in this guide will apply to your specific system.

Safety and Fiber Optic Systems

Optical Fiber Safety

Never look directly into the end of the optic fiber while either end of the system is operating.

Always use cable connector caps when the cables are not connected. This protects the connector from damage and the unlikely event of exposure to an operating optical link. Keeping the caps in place when the connectors are not in use will prevent dirt and dust from entering the connector and degrading the performance of the optical link.

Power Fuses

The CopperHead Pro Base Stations CHG3-BS-PRO-95VD-XXX-XXX are equipped with two fuses located next to the AC Power receptacle at the left rear of the unit. Refer to AC Power Input Connector- Models CHG3-BS-Pro-95VD-xxx-xxx on page 65 for specific fuse and location information.

NEVER operate the CopperHead CHG3-BS-PRO-95VD-XXX-XXX Base Station without properly installed and rated fuses. Severe electrical and heat damage could result as well as personal injury or death.

2 System Overview

This chapter provides a system overview about the Fiber Cables and the Transceiver System.

CopperHead Pro System Configurations

The CopperHead Pro system is available in a variety of configurations that maximize the advantages of either "dry" fiber cable, "hybrid" fiber cable, or a combination of the two.

Dry Fiber Systems - Locally powered cameras

CopperHead Pro systems can be run on "dry" fiber optic cable, typically tactical fiber optic cable or infrastructure fiber. These "dry" cable runs do not provide power from Base Station to Camera Unit, so the camera and CopperHead Pro Camera Unit must be powered locally, typically by a battery.

In "Dry" fiber configurations, Camera Unit, Base Station, and Tactical Fiber cable can be equipped with one of two types of fiber connectors:

Panel Connectors		**Cable Plugs**	
OpticalCON (dry)	MX	OpticalCON (dry)	MX
			

PowerWafer, Direct to Base Station

When connected directly to a Base Station using tactical fiber, the system is typically configured as shown in Figure 2-1, and uses the following components:

- **A**: Camera Unit
- **B**: DC-powered Base Station
- **C**: Battery or Local Power Source
- **D**: CHCR camera remote cable
- **E**: CHBR base remote cable
- **F**: Hybrid fiber optic cable
- **G**: ADAP 12VDC Power Supply

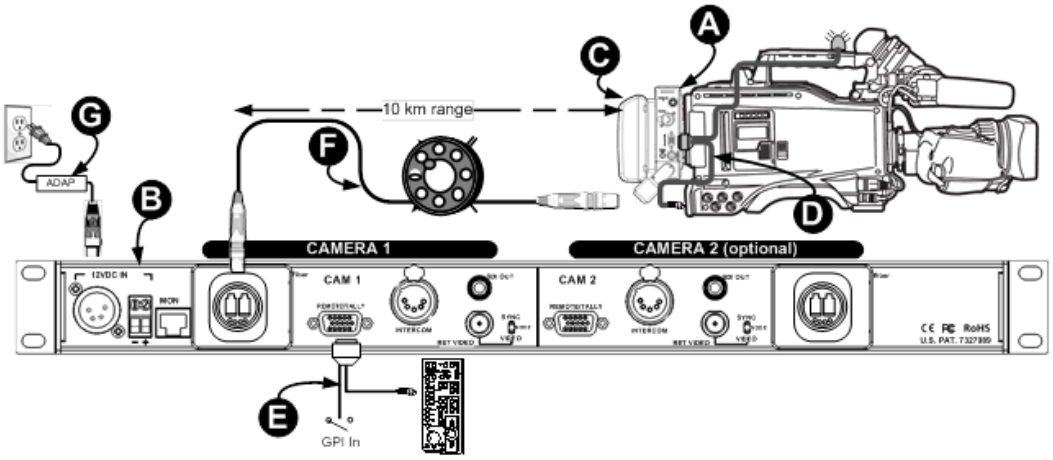


Fig. 2-1: Direct Connect to Base Station with Power Wafer

Power Wafer, Remote Panel-Mounted Fiber Connector

The hybrid fiber receptacle may be mounted a distance from the Base Station if the station is equipped with a pair of inexpensive ST fiber connectors and a Molex receptacle to carry power (Figure 2-2).You can use a breakout cable or infrastructure wiringto connect the hybrid fiber receptacle to Base Station.

- **A**: Camera Unit
- **B**: Power Wafer
- **C**: CHCR camera remote cable
- **D**: AC-powered Base Station with internal camera power supply
- **E**: CHBR base remote cable
- **F**: ST & Molex breakout cable or campus/building infrastructure
- **G**: Hybrid fiber optic cable

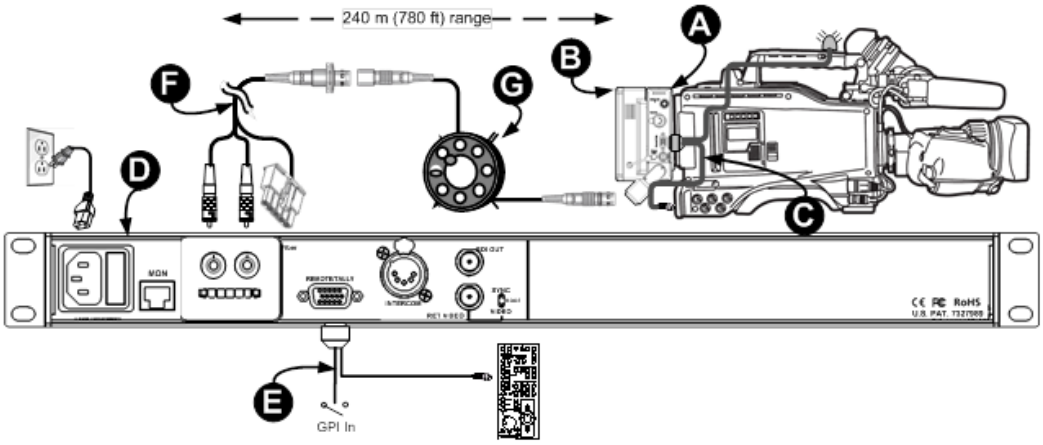


Fig. 2-2: Powered Base Station with Fiber Receptacle Extension

PowerWafer, with MPS Power Supply

Systems can be configured so that the majority of the fiber run is made via "dry" tactical or infrastructure fiber, after which a "throwdown" MPS Power Supply is placed in line to provide powered SMPTE hybrid fiber cable to the camera. In this configuration, as shown in Figure 2-3, the Base Station can be separated from the MPS power supply by more than nine kilometers (5.6 miles), where powered cable can be run to the camera for 240 meters (780 feet), providing up to 95 watts of power to the camera and accessories.

- **A**: Camera Unit
- **B**: Power Wafer
- **C**: CHCR camera remote cable
- **D**: DC-powered Base Station
- **E**: CHBR base remote cable
- **F**: Tactical fiber or Infrastructure fiber run
- **G**: MPS Power Supply
- **H**: Hybrid fiber optic cable
- **I**: ADAP 12VDC power supply

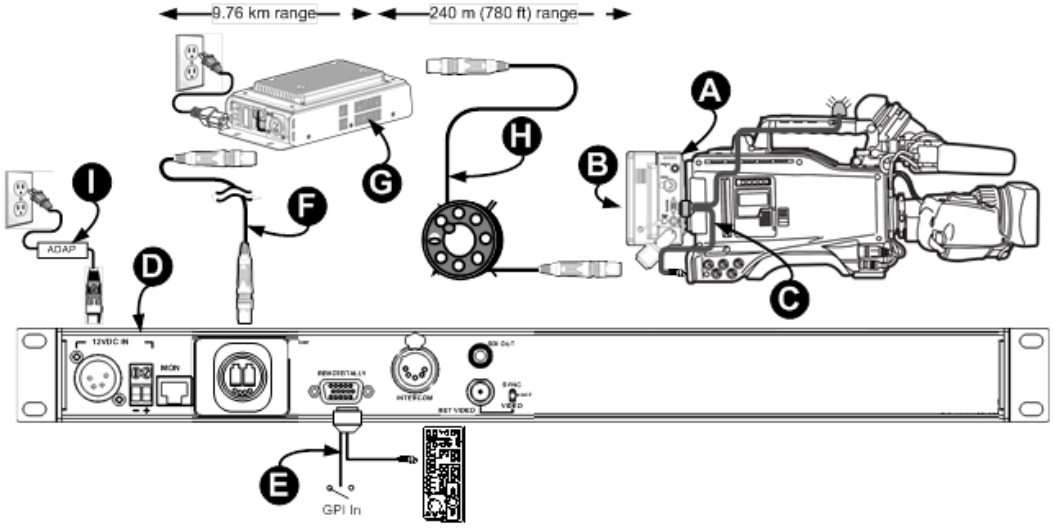


Fig. 2-3: System using MPS Power Supply

PowerPlus - High Power/Long Distance with HDX Power Supply

When power needs to be run for distances exceeding 240 meters or power requirements exceed 95 watts for the camera and accessories, the external HDX power supply and PowerPlus may be utilized. The PowerPlus can deliver up to 150 watts of power to the camera and accessories.

The first part of the fiber run can be made via "dry" tactical or infrastructure fiber, after which the HDX power supply is placed in line to provide powered SMPTE hybrid fiber cable for the camera.

Such a system is typically configured as shown in Figure 2-4 and includes the following components:

- **A**: Camera Unit
- **B**: PowerPlus
- **C**: CHCR camera remote cable
- **D**: DC-powered Base Station
- **E**: CHBR base remote cable
- **F**: Tactical fiber or Infrastructure fiber run
- **G**: HDX Power Supply
- **H**: SMPTE 311M hybrid fiber optic cable*
- **I**: ADAP 12VDC power supply

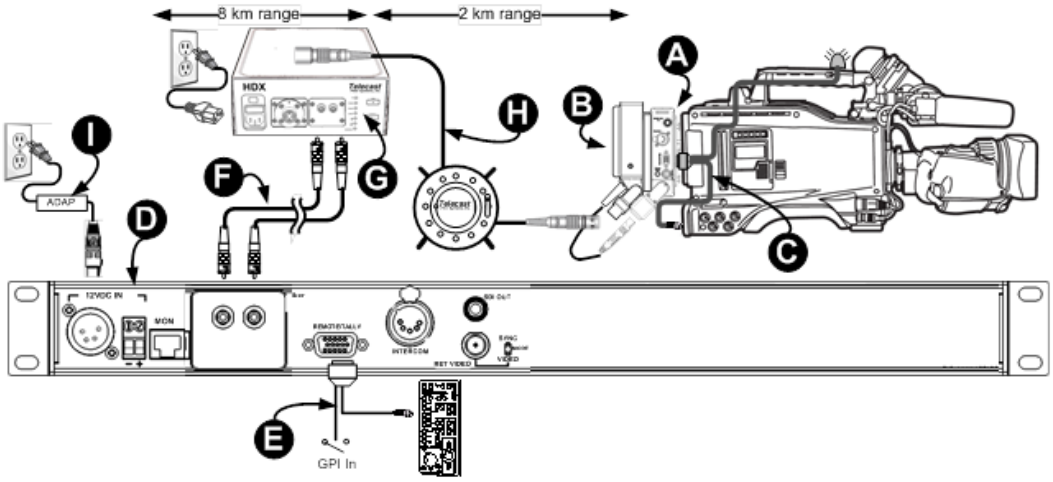


Fig. 2-4: System using PowerPlus and HDX

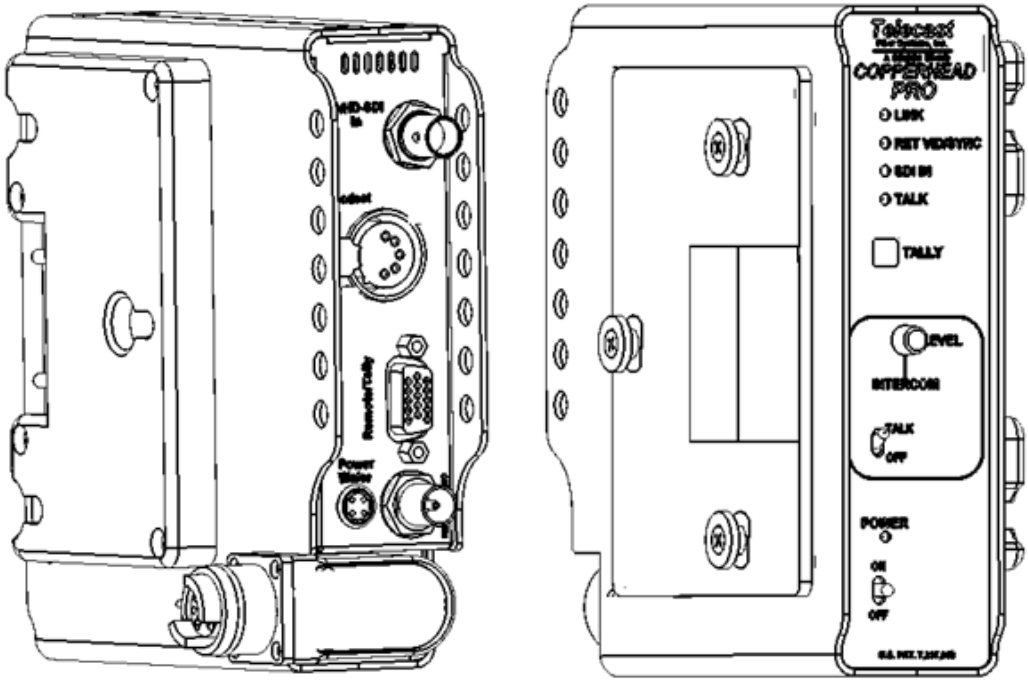
The Base Station can be separated from the MPS power supply on "dry fiber" (F) by more than nine kilometers (5.6 miles) , where powered hybrid cable (H) can be run to the camera for another two kilometers (1.2 miles).

CopperHead Pro Transceiver System Components

The CopperHead Pro Camera Unit fits between the battery or optional power supply and the camera. The Camera Unit is configured at time of purchase with mounting plates to accommodate the appropriate camera battery type.

The camera battery or optional power source attaches to Camera Unit, which in turn, attaches to the video camera. Batteries accommodated are Anton/Bauer Gold Mount and Sony "V" Mount. Other camera mounting plates may be available by special order. Contact Grass Valley (see Contact Us on page 57) or your authorized dealer.

The Camera Unit is equipped with a swivel-mounted fiber optic connector, which can be ordered with an OpticalCON, MX or SMPTE 304M connector. For more information, see Parts & Accessories on page 75.



Camera Unit Front (attaches to the camera)

Camera Unit Rear (attaches to battery or power supply)

Fig. 2-5: Camera Unit Front and Rear

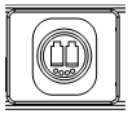
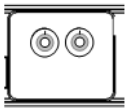
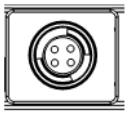
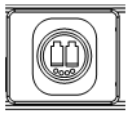
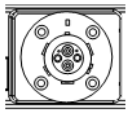
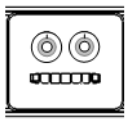
The actual appearance of your CopperHead Pro Camera Unit will vary depending on the battery mount and fiber cable connector options specified at the time of purchase.

Base Station Overview

The CopperHead Pro Base Station is a one rack-unit high device that provides all of the inputs for signals going to the CopperHead Pro Camera Unit, as well as the outputs for the signals coming from Camera Unit. Base Station is available in a variety of configurations. The options are:

<table>
<tr><th>Power Supply</th><th>Single or Double</th><th colspan="2">Fiber Connector</th></tr>
<tr><td rowspan="7">12 Volt DC Input: “Dry Fiber”
• No Internal camera power supply
• Does not supply power to Camera Unit via SMPTE hybrid fiber cable
• Is typically used with Tactical fiber cable and/or infrastructure cabling
• Available in “Dual” configuration for interface and control of two Camera Units in a single one RU device

120/220 Volt AC Input – “Powered Fiber”
• Includes internal power supply for Camera Unit
• Supplies power to Camera Unit via SMPTE hybrid fiber cable
• Not available in “Dual” configuration. Can only interface and control a single Camera Unit</td><td rowspan="7">Single Configuration
• Interface and control a single Camera Unit
• Available in 12 Volt DC and 120/220 VAC models

Dual Configuration
• Interface and control two Camera Units in a one RU device
• Available in 12 Volt DC only.
• Not available for 120/220 VAC models</td><td colspan="2">Six different fiber connectors are available for the CopperHead Pro Base Station (see Rear Panel Section B - Optical Connector on page 25 for details).</td></tr>
<tr><td>• OpticalCON (dry)</td><td>  </td></tr>
<tr><td>• Two STs</td><td>  </td></tr>
<tr><td>• MX (Expanded Beam)</td><td>  </td></tr>
<tr><td>• OpticalCON (powered)</td><td>  </td></tr>
<tr><td>• SMPTE 304M</td><td>  </td></tr>
<tr><td>• Two STs and Molex</td><td>  </td></tr>
</table>

Types of Base Stations

The actual appearance of your CopperHead Pro Base Station will vary depending on the fiber cable connectors and power option specified at the time of purchase.

Single “Dry” Station

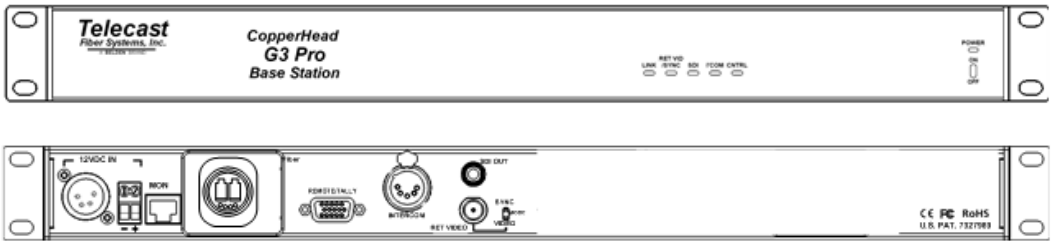


Fig. 2-6: Single "Dry" Base Station - Front Panel (top) and Rear Panel (bottom)

Dual Unpowered Base Station

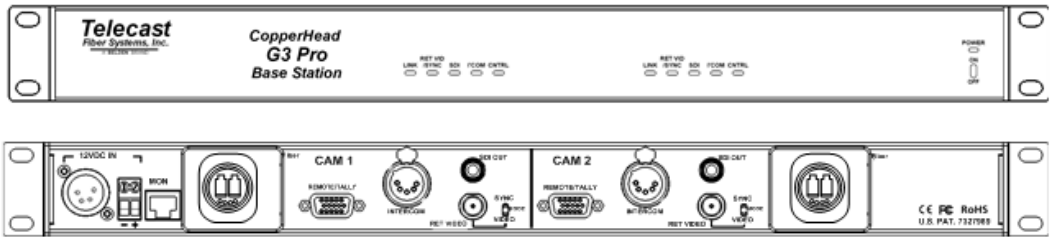


Fig. 2-7: Dual Unpowered Base Station - Front Panel (top) and Rear Panel (bottom)

Powered Base Station

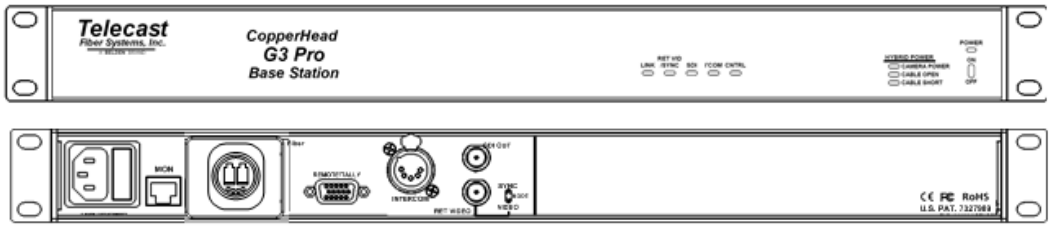


Fig. 2-8: Powered Base Station - Front Panel (top) and Rear Panel (bottom)

3 CopperHead System Components

This chapter provides descriptive information for the CopperHead Pro system components.

Camera Unit

Camera Unit - Front Side

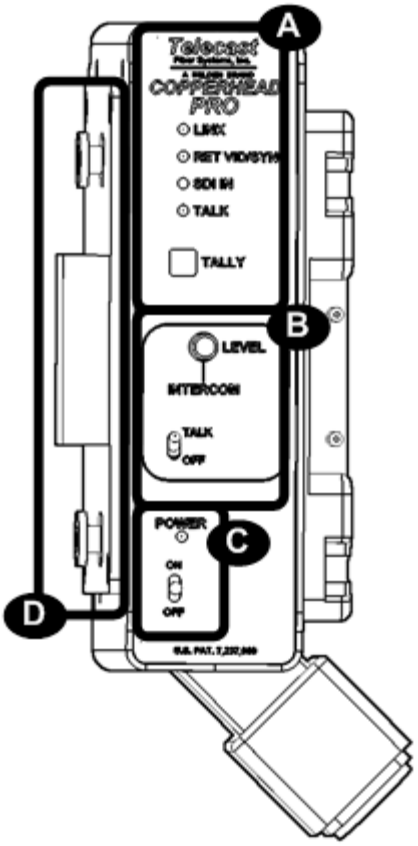


Fig. 3-1: Camera Unit - Front Side

The front of the CopperHead Pro Camera Unit has four features:

- **A: Signal Status Panel:** indicates the status of the various signals coming to and being sent from the Camera Unit (see Camera Unit - Signal Status Panel (Section A) on page 15).
- **B: Intercom Controls:** controls for intercom "talk" and "listen" functionality (see Camera Unit - Intercom Controls (Section B) on page 16).
- **C: Power Switch and Indicator:** controls for power to the Camera Unit (see Camera Unit - Power Switch & Indicator (Section C) on page 16).
- **D: Camera Mounting Plate:** mechanical mounting hardware for affixing CopperHead Camera Unit to a camera or camcorder (see Camera Unit - Camera Mounting Plate (Section D) on page 17).

Camera Unit - Signal Status Panel (Section A)

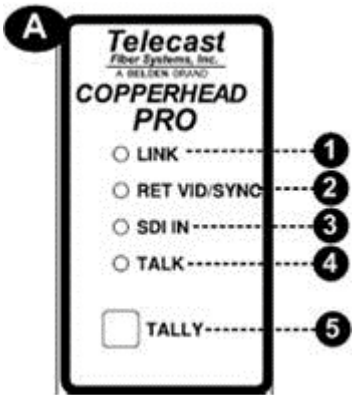


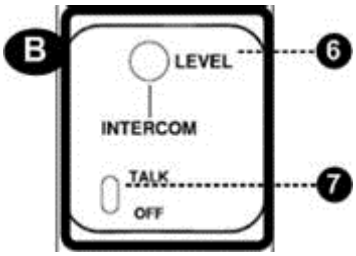
Fig. 3-2: Camera Unit Signal Status Indicators

- **1: Link:** indicates the status of the data link from Base Station to Camera Unit. This is a good indicator of a valid optical link.
  - **Green** when Camera Unit has a data "lock" with Base Station.
  - **Red** when Camera Unit is not "locked" to Base Station.

  A data lock means that the fiber link is valid and data can be exchanged securely.
- **2: Return Video/Sync:** indicates the presence of the composite video signal (VBS) sent from Base Station to Camera Unit. This VBS can be used for return "program" video or for genlock to the camera.
- **3: SDI in:** Green indicates the presence of digital SDI video at Camera Unit's input BNC.
- **4: Talk:** lights Green to indicate that the intercom **Talk** switch (see Camera Unit - Intercom Controls (Section B) on page 16) is in the **Talk** position, and that the headset mic is open.
- **5: Tally:** lights Red when GPI/Tally signal is activated at Base Stations

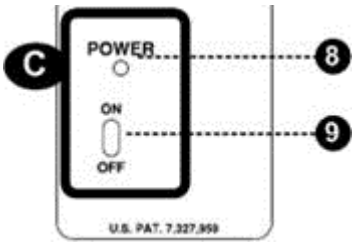
  For suggestions on connecting Tally in your system, see Connecting Base Station to Studio Infrastructure on page 42.

Camera Unit - Intercom Controls (Section B)



- **Headset Level Knob**: controls the volume of the intercom channel in the headset
- **Intercom Talk Switch**
  - **TALK** (up) opens the headset mic
  - **OFF** (down) closes the headset mic

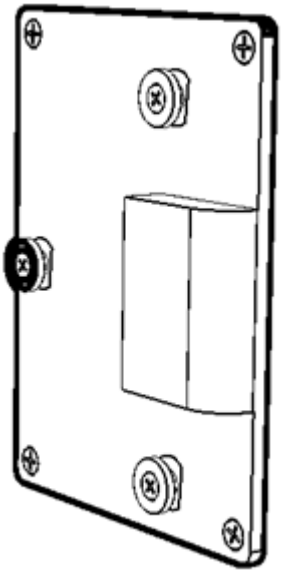
Camera Unit - Power Switch & Indicator (Section C)



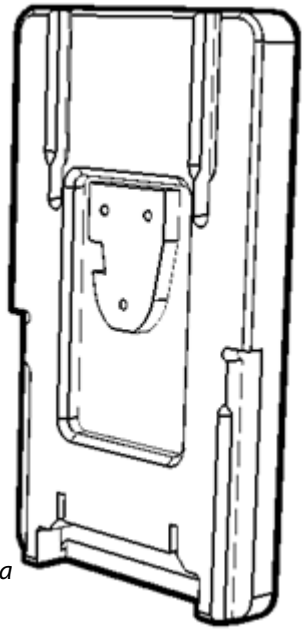
- **Power Indicator:** lights Green to indicate main power is on
- **Power On/Off:** turns the main power supply on and off

Camera Unit - Camera Mounting Plate (Section D)

This plate is used to mount the CopperHead Pro Camera Unit to a camera or camcorder. Camera Unit is typically shipped with an Anton/Bauer "Gold Mount" or Sony-style "V-Mount" camera mounting plate. Other camera mounting plates may be available by special order. Formore information, contact Grass Valley (see Contact Us on page 57) or your authorized dealer.



Anton Bauer Camera Mounting Plate



V-Mount Camera Mounting Plate

Fig. 3-3: Camera Unit: Camera-side mounting plates

Camera Unit - Rear Side

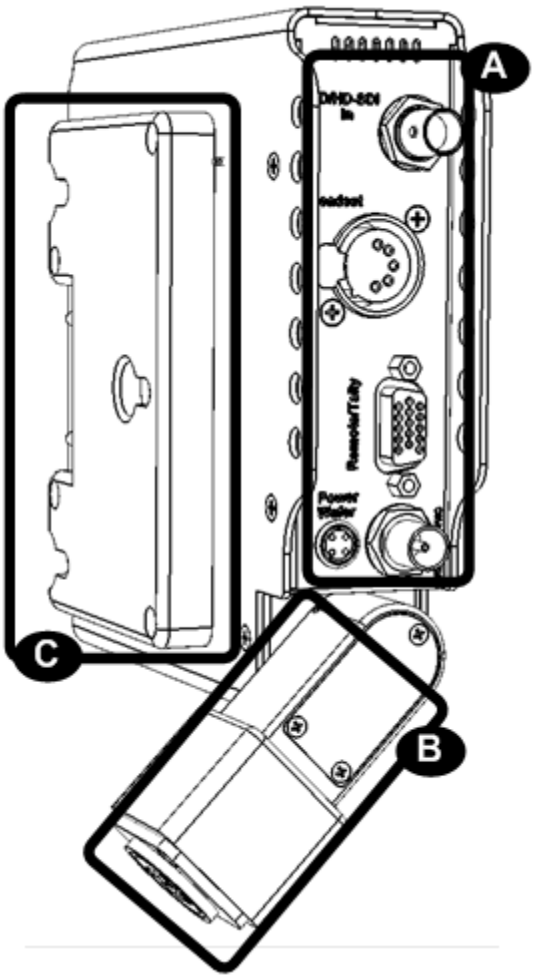


Fig. 3-4: Camera Unit Back Side

The back side of Camera Unit has three features:

- **A: Connector Panel (s**ee Camera Unit - Connectors (Section A) on page 19)
- **B: Fiber Connector/Swivel** (see Camera Unit - Fiber Connector/Swivel (Section B) on page 20)
- **C: Battery Mount** (see Camera Unit - Battery Mount (Section C) on page 20)

Camera Unit - Connectors (Section A)

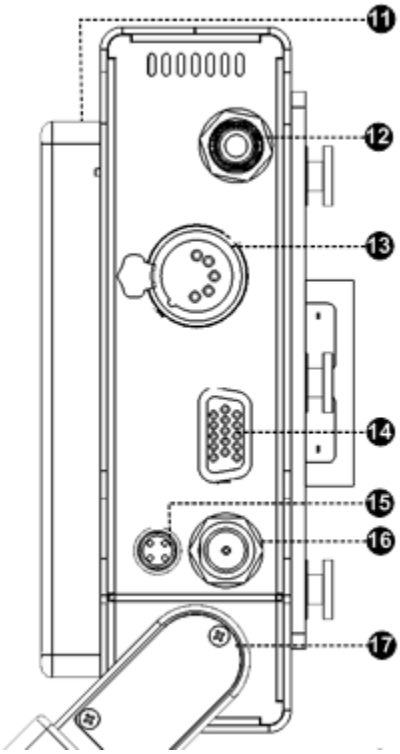


Fig. 3-5: Camera Unit Connectors

- **11: Battery Mounting Plate:** typically equipped for with Anton/Bauer or V-Mount batteries
- **12: SD/SDI or HD/SDI Input - to Base Station:** digital video input connector from camera's SDI output
- **13: Intercom Headset Jack:** connect 5-pin XLR Male intercom headset connector
- **14: Connector for CHCR cable: Camera Remote Control, Tally:** DB15HD connector for Camera Remote Control, Tally input and output. See Camera Unit & Base Station Interface Cables on page 73 for the correct cable for your camera.
- **15: PowerWafer Connector:** for use with PowerWafer when used with the AC-powered Base Station or the MPS power supply. Connect with CH3CP-INF-2FAG cable.
- **16: VBS (analog composite video) or Genlock Out - from Base Station:** connect to camera's Genlock/Sync input connector or to external VBS monitor
- **17: Fiber Connector Swivel:** attach fiber cable to connector mounted here.

Camera Unit - Fiber Connector/Swivel (Section B)

The CopperHead Pro Camera Unit is typically equipped with one of the three fiber connectors shown in Figure 3-6:

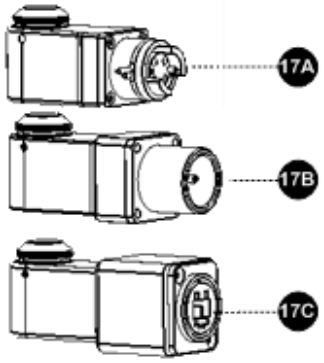


Fig. 3-6: Camera Unit Fiber Connectors

- **17A**: **MX Expanded Beam** (unpowered)
- **17B**: **SMPTE 304M** (powered)
- **17C**: **OpticalCON** (powered or unpowered)

Camera Unit - Battery Mount (Section C)

The CopperHead Pro Camera Unit can be shipped with a variety of plates to attach the unit to your camera. The Anton Bauer mount and the "V"-mount are the most common, although PAG and other battery mount systems are also available by special order. Formore information, contact Grass Valley (see Contact Us on page 57) or your authorized dealer.

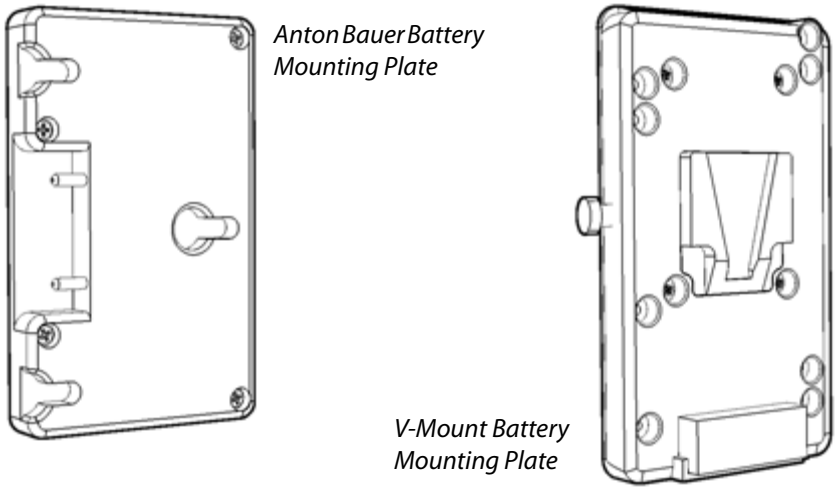


Fig. 3-7: Camera Unit - Battery side mounting plates

Base Station

The CopperHead Base Station is available with a number of options. The unit is ordered with a specified Power Module, Audio/Intercom Module, and Fiber Connector. For an overall view of component location,see Overview Diagrams on page 78.

Base Station Front Panel

Fig. 3-8: Base Station Front Panel - single unit, 120/220 VAC power w/internal hybrid power supply

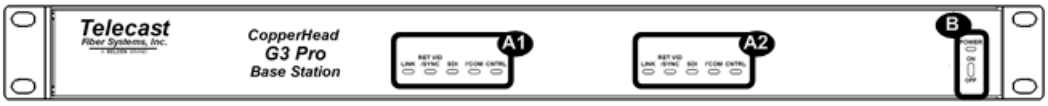


Fig. 3-9: Base Station Front Panel - dual unit, 12 VDC power

The front of Base Station has three features:

- **A**: Signal Status Indicators (see Front Panel Section A - Signal Status Indicators on page 21)

  Applies if Dual Base Station, A1 and A2. Otherwise, only A2 applies.
- **B**: Power Switch and Indicator (see Front Panel Section B- Power Switch and Indicator on page 22)
- **C**: Hybrid Power Status Indicators (see Front Panel Section C- Hybrid Power Status Indicators on page 23)

> **Note:** These indicators only appears on Base Stations equipped with internal hybrid power supply.

Front Panel Section A - Signal Status Indicators

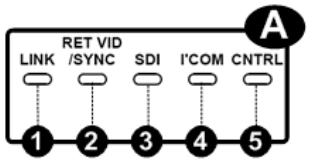


Fig. 3-10: Base Station Status Indicators

- **1: Link:** indicates the status of the data link from Camera Unit to Base Station. This is a good indicator of adequate optical link.
  - **Green** when Base Station has a data "lock" with Camera Unit.
  - **Red** when Base Station is not "locked" to Camera Unit.

  A data lock means that the fiber link is valid and data can be exchanged securely.

- **2: Return Video/Sync:** indicates the presence of the analog video signal (VBS) at Base Station's **VBS In** BNC. This VBS can be used for return "program" video or for genlock to the camera.
- **3: SDI Presence:** lights Green to indicate the presence of digital SDI video from Camera Unit. This LED stays illuminated Green as long as the Base Station is receiving adequate optical power. See A Brief Guide to Measurement of Fiber Optic Signal Strength on page 61 for more information.
- **4: Intercom:** lights Green to indicate audio activity on the Intercom channel.
- **5: Control:** lights Green when camera control data is being transmitted between Camera Unit and Base Station.

Front Panel Section B- Power Switch and Indicator

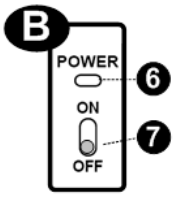


Fig. 3-11: Base Station Power Switch

- **6: Power:** indicates that power is applied to Base Station.
  - **Green** when Base Station is fully powered
  - **Red** when there is power connected to Base Station, but Base Station is not turned on
- **7: Power Switch:** switchesthe Base Station on or off. With a hybrid power system (power supplied by Base Station), this switch controls power to the camera and Camera Unit.

Front Panel Section C- Hybrid Power Status Indicators

This section is optional, and only appears on CopperHead Base Stations equipped with internal power supplies designed to work with a CopperHead Camera Unit connected to a PowerWafer.

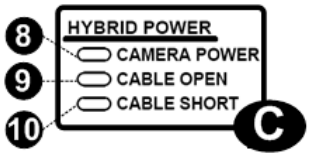


Fig. 3-12: Base Station Hybrid Power Status Indicators

- **8: Camera Power:** lights Green when high voltage is being supplied to Camera Unit.
- **9: Cable Open:** lights Red when the SMPTE hybrid cable is open or when there is no SMPTE hybrid cable connected.

  High voltage will not be applied to the hybrid connector until the open condition is corrected.
- **10: Cable Short:** lights Red when the SMPTE hybrid cable has a short circuit in it.

  High voltage will not be applied to the hybrid connector until the short-circuit is corrected or the cable is replaced.

Base Station Rear Panel

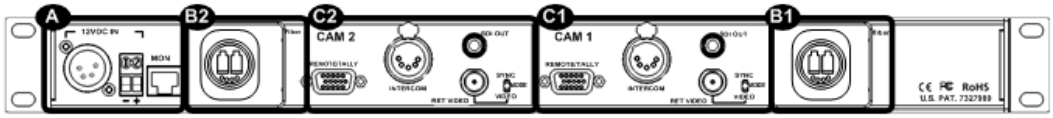


Fig. 3-13: CopperHead Pro Base Station Back Panel (Dual model shown)

- **A**: **Power Connector** (see Rear Panel Section A - Power Connector on page 24)
- **B**: **Fiber Connectors** (see Rear Panel Section B - Optical Connector on page 25)
- **C**: **Signal Connectors** (see Rear Panel Section C - Signal Connectors on page 26)

Rear Panel Section A - Power Connector

The CopperHead Base Station can be configured for DC or AC power.

12VDC Power Interface

This power interface is used on CopperHead Base Stations that are not equipped with internal power supplies. This type of Base Station is typically used with Camera Units powered locally with a battery or a local power supply at the camera.

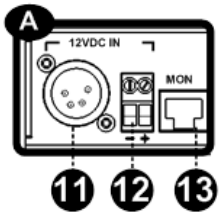


Fig. 3-14: 12VDC Power Connector

- **11: 12V DC Power input connector (XLR 4 Pin)**
- **12: 12V DC Input - terminal block:** can be used in lieu of the 4-pin XLR or in parallel as a redundant input. See Base Station Connectors on page 65 for pin-out details.
- **13: For Future Use (RJ45)**

AC Power Connector Interface

This power interface is used on CopperHead Base Stations that are equipped with an internal power supply. This type of Base Station is typically used with Camera Units powered with a PowerWafer via SMPTE Hybrid cable

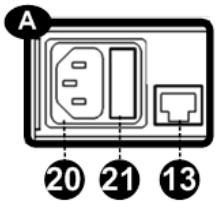


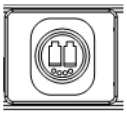
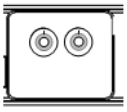
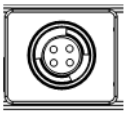
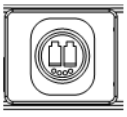
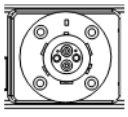
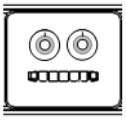
Fig. 3-15: AC Mains Connector

- **20**: **AC Power Receptacle 100-240V 50/60 Hz**
- **21**: **3.15 amp dual fuse assembly** (see Base Station Connectors on page 65 for fuse specification)
- **13**: **For Future Use** (RJ45)

Rear Panel Section B - Optical Connector

The fiber optic connector is used to connect Base Station directly to Camera Unit or to the external MPS or HDX power supply configured with your system. The type of fiber connector will vary depending on your system configuration.

Six types of fiber optic connectors are available for use with the CopperHead Base Station.

"Dry" (unpowered) fiber connectors			**Fiber Connectors with Copper for Power**		
					
A: OpticalCON (dry)	B: STs	C: MX	D: OpticalCON (powered)	E. SMPTE 304M	F. STs & Molex

Rear Panel Section C - Signal Connectors

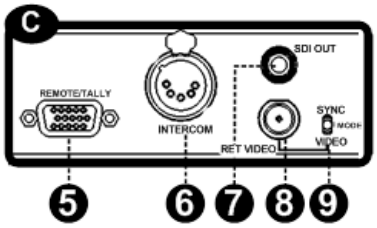


Fig. 3-16: Rear Panel Signal Connectors

- **5: Connector for Camera Remote Control Panel and Tally input (DB15HD):** connect CHBR-PRO cable here, specified for your particular Camera Remote Control Panel.

  See CHBR-PRO Base Station Remote Cable on page 74 to specify the correct cable for your Camera Remote Control Panel.
- **6: Base Station Intercom Connector: c**onnect your house intercom system here:
  - **XLR3**: Two-wire (Clear-Com or RTS)
  - **XLR5M**: Four-wire (matrix-style)

  For more information, refer to Intercom connectivity on page 43.
- **7: SD/SDI or HD/SDI Output:** digital video from camera's SDI output
- **8: VBS Return Input:** analog composite video signal sent to Camera Unit
- **9: VBS Return Input Switch:** switches the VBS Return Input connector to be optimized for one of two uses:
  - **A: Sync In**: Genlock/Sync/Tri-Level sync signal.
  - **B: Composite Video In**: typically used to send analog VBS return video to the camera or an external monitor.

PowerWafer Camera Adaptor

The CopperHead Camera Unit can be powered by the optional "PowerWafer" Camera Adaptor. The PowerWafer replaces the local camera battery and any local AC power supply adaptor. The PowerWafer gets its power from the use hybrid fiber cable and the CopperHead Base Station equipped with the internal power supply or from the MPS external power supply.

You can deliver up to 95 watts of power to the camera, Camera Unit, and camera-powered accessories. You can use up to 780 feet (240 meters) of cable when the Camera Unit is powered directly from Base Station.

The use of an external power supply can extend Base Station to Camera range and increase camera power flexibility. The MPS **Throw Down** device or Wafer Power Adaptor provides this functionality. This unit is described in MPS External PowerWafer Power Supply on page 28.

The PowerWafer replaces the battery or local battery mountable AC adaptor (shown with the Anton/Bauer "Gold Mount" option).

- **1: Heat Sink**
- **2: Battery Mounting Plate** (Anton/Bauer Gold Mont or "V-Mount")
- **3: Power Input Connector**

High voltage power is carried from Base Station to Camera Unit. A short jumper cable (CH3CP-INF-2FAG) carries the high voltage power from Camera Unit to the PowerWafer's power input connector (where it is converted to 12VDC power). The 12VDC power is delivered back to the camera via the battery mounting plate.

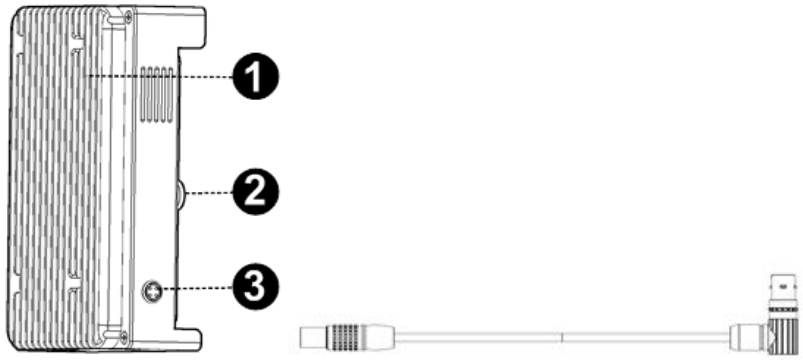


Fig. 3-17: PowerWafer Power Adaptor and Jumper Cable

MPS External PowerWafer Power Supply

The CopperHead MPS external power supply provides 95 watts of 12VDC power and fiber connectivity from Base Station to Camera Unit equipped with a CopperHead PowerWafer. Connectivity between the MPS unit to the camera can be configured using either a Hybrid OpticalCON connector or a SMPTE 304M connector. The nominal distance between them is 240 meters (780 feet).

Connectivity between the MPS unit and Base Station uses "dry" fiber and can be configured with a "dry" OpticalCON connector or two ST connectors. The MPS is powered locally with standard AC power. The unit is free-standing (see Hybrid Fiber Cable between MPS Power Unit and Camera Unit on page 46 for system configuration with the MPS Power Supply and PowerWafer).

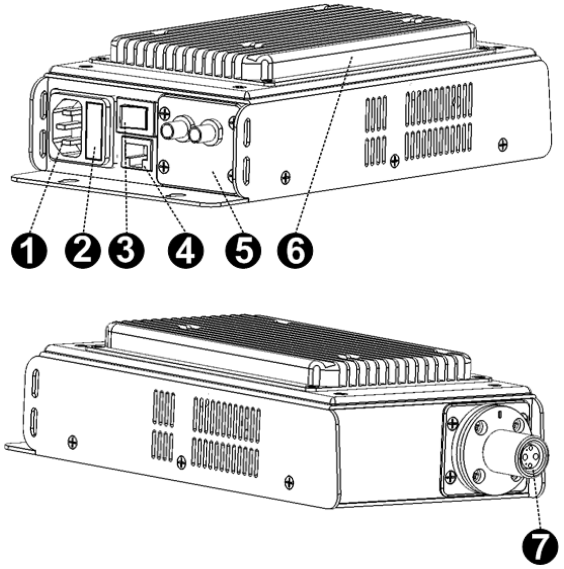


Fig. 3-18: MPS Power Supply, Front and Rear

- **1: AC Power Receptacle: 100-240V 50/60 Hz**
- **2: Fuse compartment:** see AC Power Input Connector- Models CHG3-BS-Pro-95VD-xxx-xxx on page 65 for the fuse specification.
- **3: Power Switch**
- **4: For Future Use (RJ45)**
- **5: "Dry" Fiber Optic Connection to CopperHead Base Station:** this removable plate can be equipped with two ST connectors or a "dry" OpticalCON connector (see Figure 3-19).
- **6: Heat Sink**
- **7: Powered Fiber Optic Connection to CopperHead Camera Unit:** this removable plate can be equipped with a SMPTE 304M connector or a powered OpticalCON connector. See Figure 3-20.

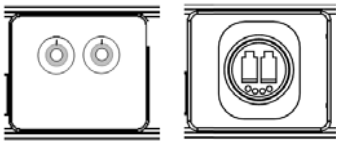


Fig. 3-19: MPS "dry" fiber connector options

The "dry" connection (#5 in Figure 3-18)to the CopperHead Base Station can be equipped with two ST connectors or a "dry" OpticalCON connector.

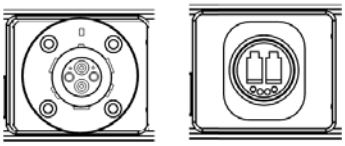


Fig. 3-20: MPS powered fiber connector options

The powered connection (#7 in Figure 3-18) to the CopperHead Camera Unit can be equipped with a SMPTE 304M connector or a powered OpticalCON connector.

Part Number	**Dry Unpowered Fiber Connection to Base Station** (#5 in Figure 3-18)	**Powered Fiber Connection to Camera** (#7 in Figure 3-18)
CH2-MPS-95VD-2ST-NEU	2 STs	OpticalCON
CH2-MPS-95VD-2ST-304	2 STs	SMPTE 304M
CH2-MPS-95VD-NEU-NEU	OpticalCON	OpticalCON
CH2-MPS-95VD-NEU-304	OpticalCON	SMPTE 304

PowerPlus 3000 - Camera Power Adaptor

The standard CopperHead PowerPlus 3000 power adaptor with standard (Low Profile) heat sink (Figure 3-21) provides 100 watts of 12VDC power and fiber cable signal connectivity from Base Station to the Camera. It also provides an external power feed of 12VDC and optionally 24VDC for external accessories. The PowerPlus unit requires the use of the HDX power supply.

The PowerPlus can be equipped with a "High Profile" heat sink (Figure 3-21) for power requirements up to 150 Watts.

The PowerPlus unit is equipped with a fixed tactical fiber "dongle" that can be terminated with either an OpticalCON plug, SMPTE 304M plug, or an MX plug. This dongle plugs into the swivel of the CopperHead Camera Unit.

The PowerPlus is connected to the HDX power supply using Hybrid fiber cable with SMPTE 304 connectors. See Mounting the CopperHead Pro Camera Unit with the PowerPlus on page 38 for details on connecting the PowerPlus.

The distance between the HDX power adaptor and the camera can be up to 2km (1.2 miles) using Hybrid fiber cable and the distance between the HDX power adaptor and Base Station can be up to 7km (4.3 miles).

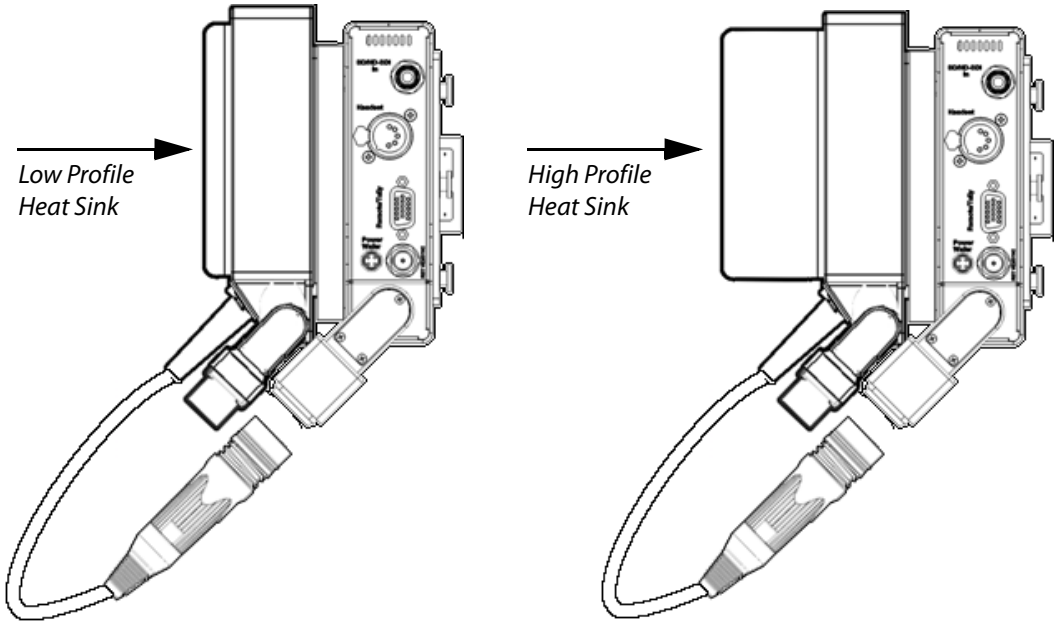


Fig. 3-21: PowerPlus 3000 with Low and High Profile Heat Sink mounted to CopperHead Pro

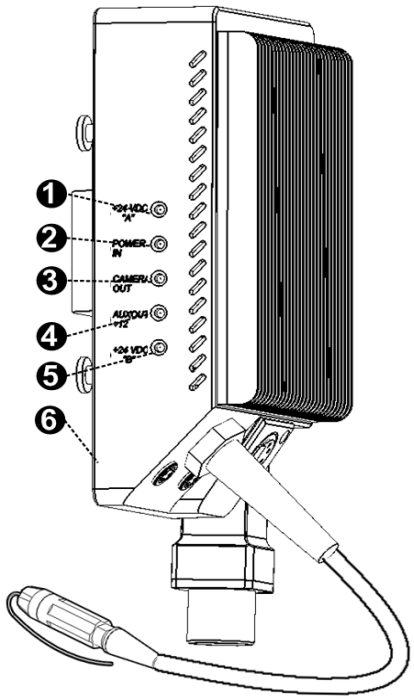


Fig. 3-22: PowerPlus 3000 LED Indicators

- **1: +24 Volt DC "A":** lights up when 24 Volts is available on connector X
- **2: Power In:** indicates that power is being received from the HDX power supply
  - **Red** - initial safety handshaking in progress, full power not engaged.
  - **Green** - safety handshaking completed, full power being received from HDX power supply.
- **3: Camera Out:** indicates that 12VDC is being supplied to the battery plate
- **4: Auxilliary +12 Volt Output:** indicates 12 Volt is being supplied to the 4-pin XLR connector(#7 on Figure 3-23)
- **5: +24 Volt DC "B":** lights up when 24 Volts is available on connector(#10 on Figure 3-23)
- **6: Battery Plate:** used to mount the PowerPlus to the CopperHead Camera Unit (Anton/Bauer or V-Mount)

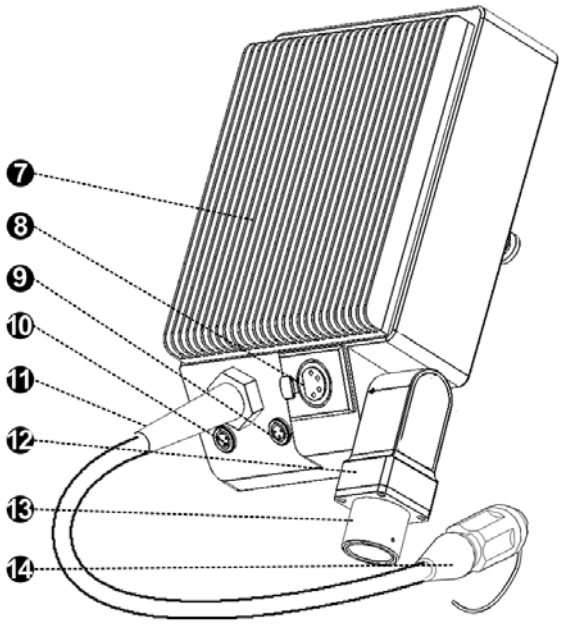


Fig. 3-23: PowerPlus 3000 Connectors

- **7: Heat Sink**
  - **LP**- Low Profile Heat Sink rated for 100 Watts (shown)
  - **HP** - High Profile Heat Sink rated for 150 Watts
- **8: 12 Volt Auxiliary Output:** 4-Pin XLR output connector for 12 Volt accessories
- **9: 24 Volt Auxiliary Output B:** 3-pin connector for 24 Volt accessories.
- **10: 24 Volt Auxiliary Output A:** 3-pin connector for 24 Volt accessories.
- **11: Tactical Fiber Dongle:** fixed tactical fiber cable connects to the CopperHead Camera Unit.
- **12: SMPTE Swivel:** adjustable swivel for SMPTE 304M receptacle am.
- **13: SMPTE 304M Hybrid Fiber Receptacle:** connect the SMPTE hybrid cable here. This cable connects to the PowerPlus.
- **14: Tactical Fiber Connector (MX shown):** dry fiber connector at the end of the dongle. This should match the connector on the swivel of the mating CopperHead Camera Unit. Available with the following termination:
  - MX plug (shown)
  - OpticalCON Connector ("dry")
  - SMPTE 304M plug ("dry")

HDX Power Supply

The HDX Power Supply Unit is required when using the PowerPlus Camera Adaptor. The HDX can be used as a free-standing unit or rack mounted, using the HDX-FR-2 for mounting two HDX units.

The unit sends power via a SMPTE hybrid fiber cable to the PowerPlus, where it is converted to 12VDC and optionally to 24VDC). For details on connecting the HDX to a CopperHead system, see @PowerPlus - High Power/Long Distance with HDX Power Supply on page 9 .

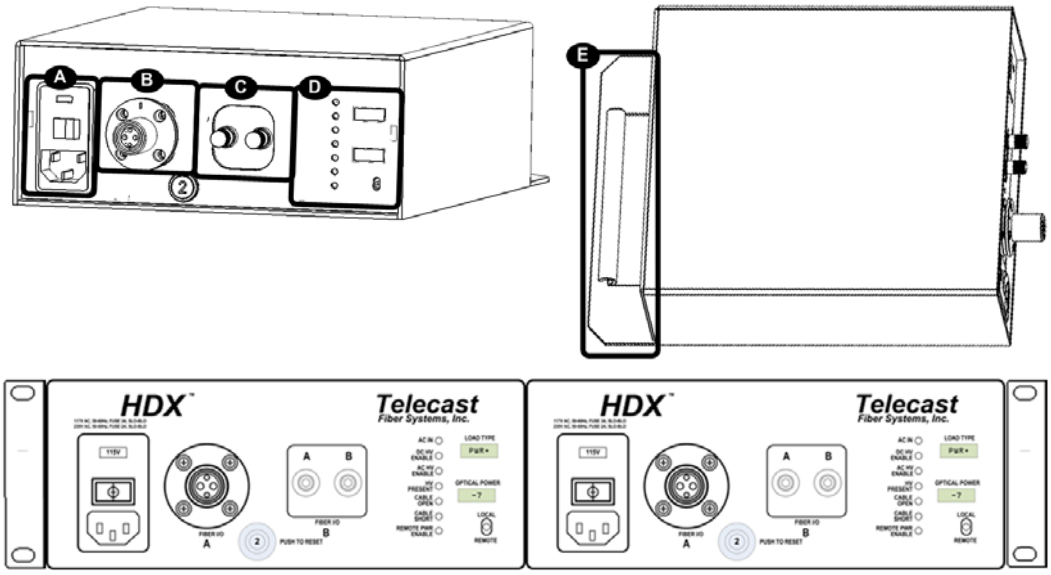


Fig. 3-24: HDX device setups

The HDX has five features:

- **A: AC Power Input Module and Switch:** power switch and connector for AC Mains
- **B: "Wet" SMPTE 304M Hybrid Fiber Connector:** the SMPTE hybrid cable is connected here. This cable connects to the PowerPlus at the camera. This mating connector pair always uses SMPTE 304M connectors.
- **C: "Dry" Fiber connector(s)**: connect the CopperHead Base Station. This interface can be equipped with a variety of fiber connectors:
  - Two ST connectors
  - MX connector
  - OpticalCON connector
- **D: Status Indicators:** these indicators show the status of the HDX's power system (see HDX Status Indicators on page 34 for more details)
- **E: HDX Integrated Handle:** stand-alone unit can be carried or hung from this robust handle

HDX Status Indicators

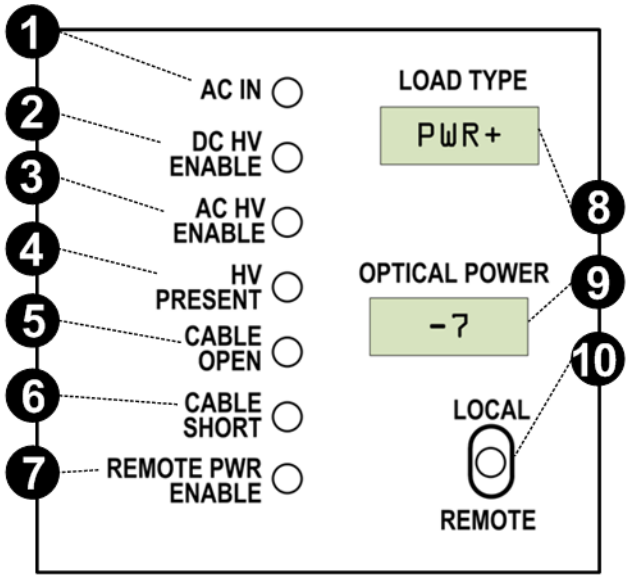


Fig. 3-25: HDX Displays

- **1: AC IN - MAINS:** AC Input power is present
- **2: DC HV ENABLE:** DC "Sense" voltage from PowerPlus is present
- **3: AC HV ENABLE:** AC "Sense" voltage from PowerPlus is present
- **4: HV Present:** AC or DC voltage is available on Hybrid connector
- **5: CABLE OPEN:** no camera cable connected
- **6: CABLE SHORT:** camera cable non-functional due to a short
- **7: REMOTE PWR ENABLE**
  - **Red:** if local/remote sw in remote position and opt power <= -27 dBm
  - **Green:** if local/remote sw in remote position and opt power >= -24 dBm gates HV power
- **8: LOAD TYPE:** indicates the type of load or camera being used:
  - N/A - No load detected
  - PWR+ - PowerPlus detected
- **9: Optical Power:** not used with PowerPlus.
- **10: Local Remote:** not Used With PowerPlus.

4 Camera Unit and Power Supply Installation

This chapter explains how to install the Camera Unit and Power Supply components.

Mounting the Copperhead Camera Unit with the PowerWafer

When mounting the CopperHead Camera Unit, always position the camera so that the battery mounting plate at the rear of the camera is easy to access. Ensure that the camera is well-supported and stable. If a battery is mounted remove it and put it to one side.

Installing the CopperHead Camera Unit typically involves one of the following three configurations.

- CopperHead Pro Camera Unit with a battery (see Mounting the CopperHead Pro Camera Unit with a battery on page 36)
- CopperHead Pro Camera Unit with the PowerWafer (see Mounting the CopperHead Pro Camera Unit with the PowerWafer on page 37)
- CopperHead Pro Camera Unit with the PowerPlus (see Mounting the CopperHead Pro Camera Unit with the PowerPlus on page 38)

Mounting the CopperHead Pro Camera Unit with a battery

When the camera is powered locally at the camera position, either by a battery (as shown) or by a local power source, tactical fiber is typically the preferred connection to Base Station.

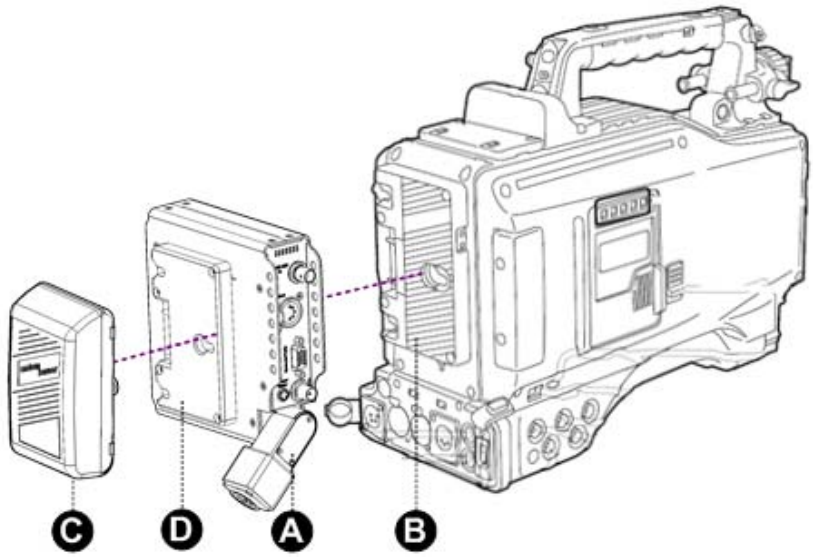


Fig. 4-1: Mounting the CopperHead Pro Camera Unit to the Camera

1. Attach the CopperHead Pro Camera Unit A to the camera battery mounting plate B. The mounting is mechanically identical to attaching a battery.
2. Mount the battery C to the CopperHead Pro Camera Unit battery mounting plate D exactly as you would mount the battery to the camera.
3. Instructions for attaching the required cables between the camera and Camera Unit can be found in Connecting Camera Unit to a Camera or Camcorder on page 40 .

Mounting the CopperHead Pro Camera Unit with the PowerWafer

The PowerWafer allows the camera and Camera Unit to be powered via hybrid fiber cable, which is powered from the CopperHead Pro Base Station or MPS External Power Supply.

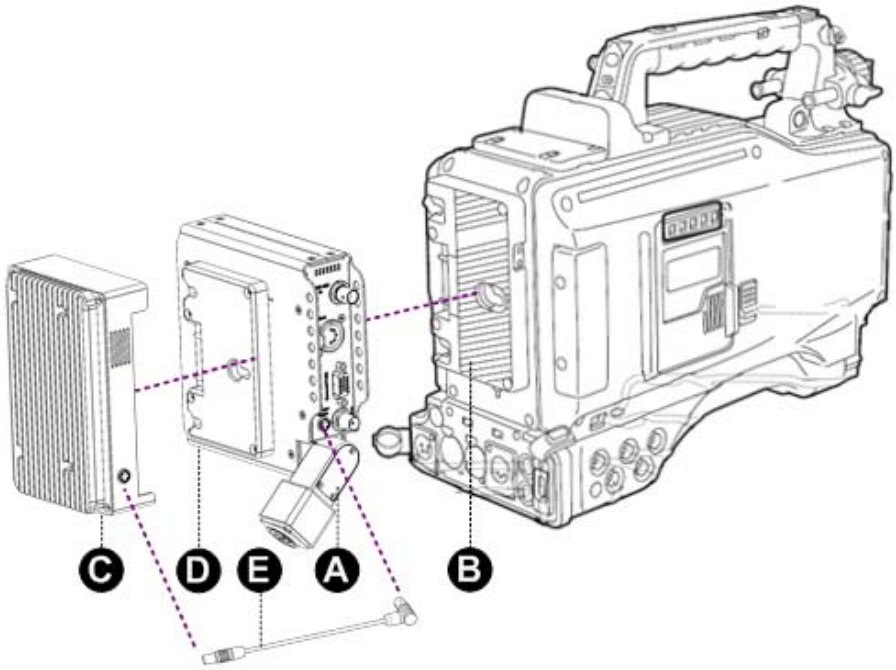


Fig. 4-2: Mounting the PowerWafer Unit to the CopperHead Pro Camera Unit

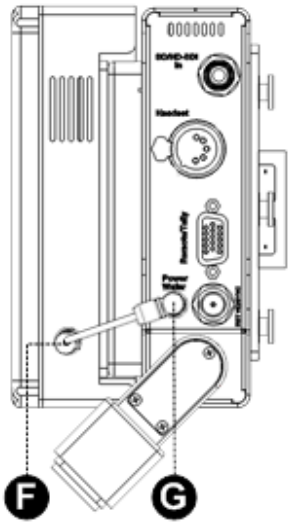


Fig. 4-3: Attaching the PowerWafer Cable

1 Attach the CopperHead Pro Camera Unit **A** to the camera battery mounting plate **B**. The mounting is mechanically identical to attaching a battery. Instructions for attaching the required cables between the camera and the Pro Camera Unit can be found in Connecting Camera Unit to a Camera or Camcorder on page 40.

2 Mount the PowerWafer **C** to the CopperHead Pro Camera Unit battery mounting plate **D** exactly as you would mount the battery to the camera.

3 Connect the supplied PowerWafer connector cable **E**. (model CH3CP-INF-FAG2) between the PowerWafer **C** and the PowerWafer connector on Camera Unit **A**.

4 For best results, plug the straight connector **F** into the PowerWafer and the connector with the Right Angle **G** into the Copperhead Camera Unit.

Mounting the CopperHead Pro Camera Unit with the PowerPlus

The PowerPlus allows the camera and Camera Unit to be powered via hybrid fiber cable for extra-long distances at higher power than the PowerWafer. The PowerPlus is powered via the hybrid fiber cable from the HDX Power Supply.

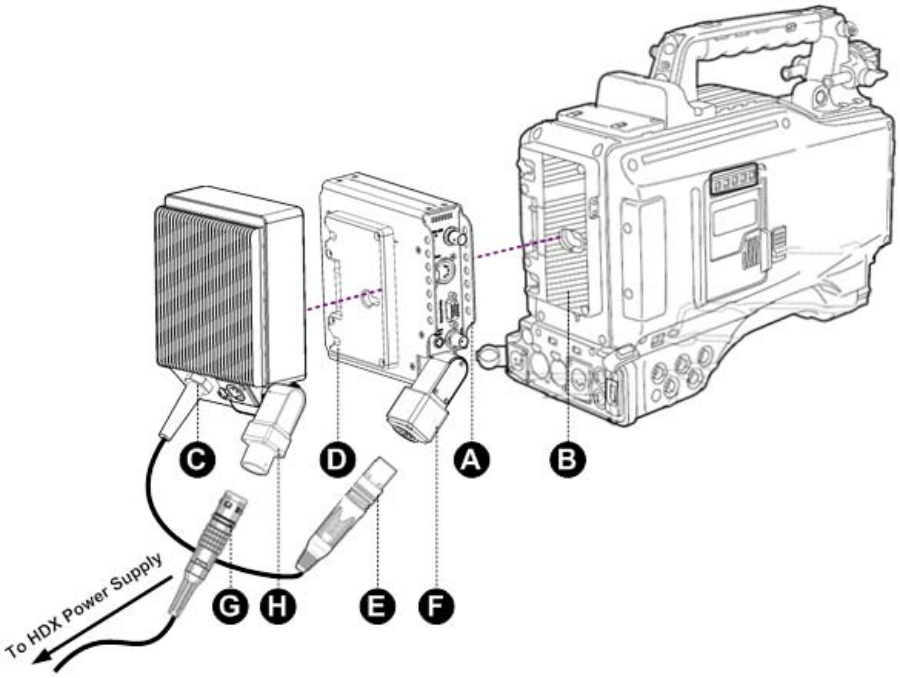


Fig. 4-4: Mounting the PowerPlus Unit to the CopperHead Pro Camera Unit

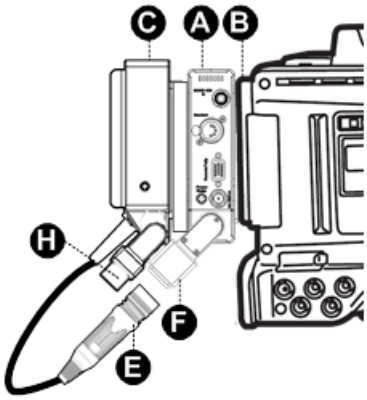


Fig. 4-5: PowerPlus on CopperHead Pro

1 Attach the CopperHead Pro Camera Unit **A** to the camera's battery mounting plate **B**. The mounting is mechanically identical to attaching a battery to the camera.

2 Mount the PowerPlus **C** to the CopperHead Pro Camera Unit battery mounting plate **D** exactly as you would mount a battery to the camera.

3 Connect the PowerPlus "dongle" **E** to the fiber optic swivel **F** on Camera Unit **A**. Connect the SMPTE hybrid cable connector **G** from the HDX to the SMPTE receptacle **H** on the PowerPlus.

Connecting the CopperHead Pro System

The CopperHead Pro system is designed to integrate seamlessly into virtually any production environment. Prior to connecting your system,ensure that each of the required cables and accessories is available.

Connecting Camera Unit to a Camera or Camcorder

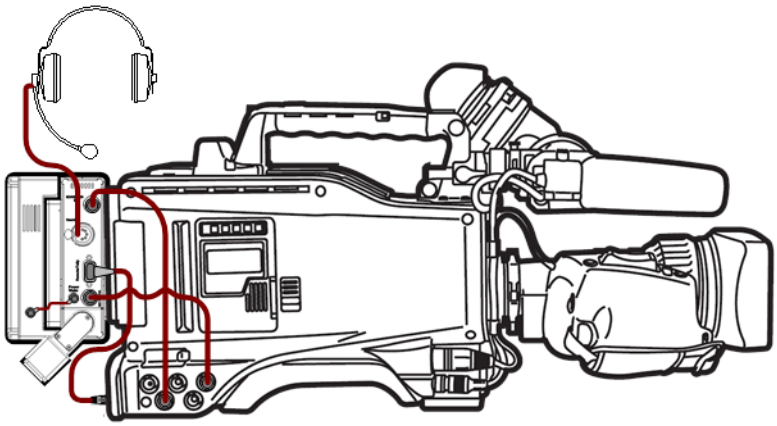


Fig. 4-6: Camera with CopperHead Pro and cables

Connecting the CopperHead Camera Unit requires the following:

- Two short BNC-terminated coax cables
- CHCS-Pro cable
- Headset
- External Tally light (optional)
- Fiber cable to Base Station

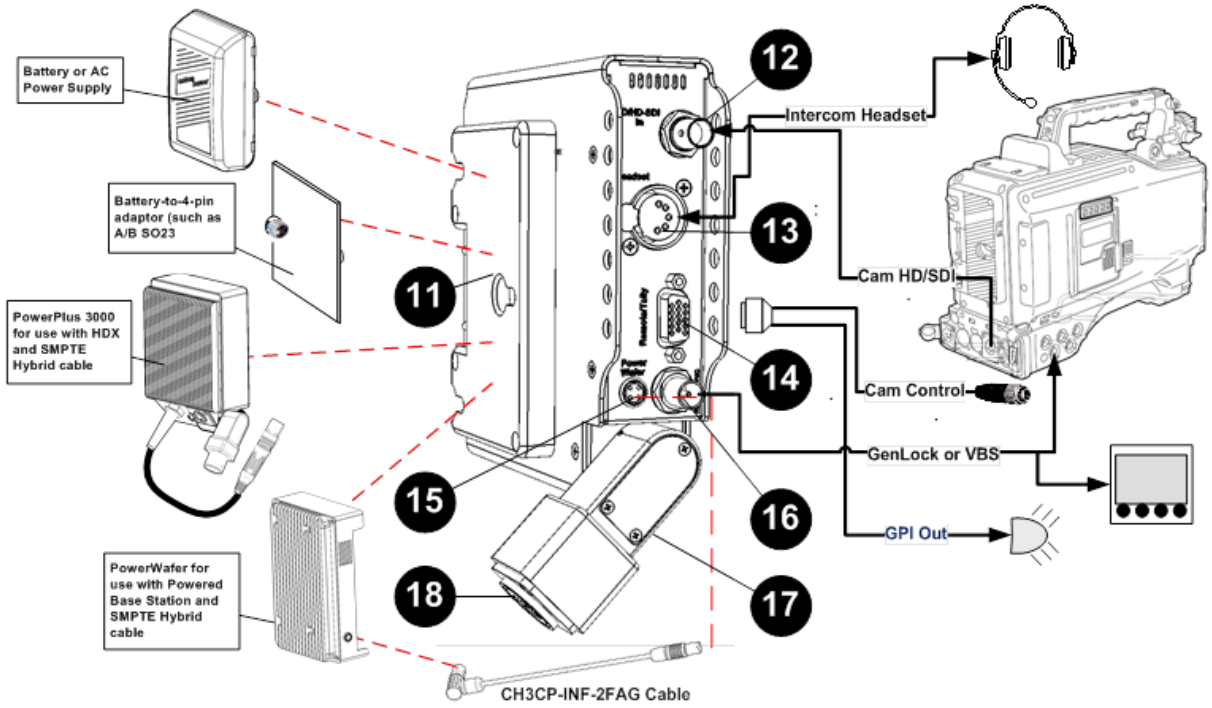


Fig. 4-7: Camera Unit to Camera Connections

- **11: HD/SDI Input:** connects to the camera's HD/SDI or SD/SDI output signal
- **12: Headset:** receptacle for intercom headset
- **13: Remote/Tally:** connect to CHCR-PRO cable. This cable connects to the **Remote** connector of the camera, as well as to an external Tally light (customer supplied). See Camera Unit on page 79 for details.
- **14: PowerWafer:** connect to the PowerWafer using cable CH3CP-INF-2FAG. Powered Base Station or MPS Power Supply required. See Parts & Accessories on page 75.
- **15: VBS Out:** two options:
  - **Genlock**: connect to the genlock input of your camera
  - **Return Video**: connect to an external analog VBS monitor
- **16, 17: Fiber:** swivel with fiber connector: MX, OpticalCON, or SMPTE 304M

Connecting Base Station to Studio Infrastructure

Connecting the CopperHead Base Station requires the following:

- Two BNC-terminated coax cables to connect to your infrastructure
- CHBR-Pro cable
- Camera Remote Panel
- XLR cable to connect to your intercom system (see Intercom connectivity on page 43)
- Access to your video switcher's tally outputs (optional)
- Fiber cable to Camera Unit

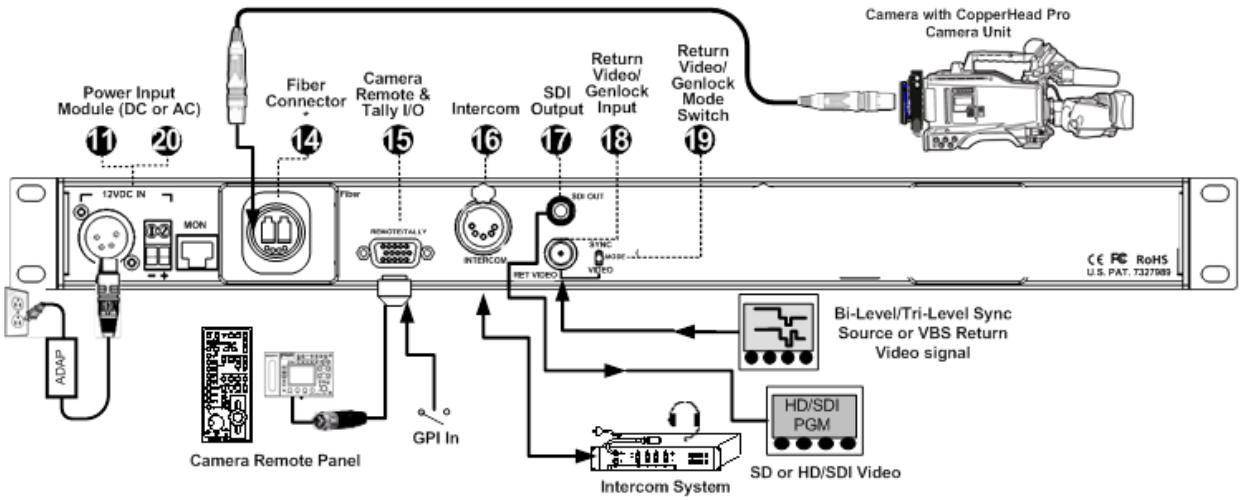
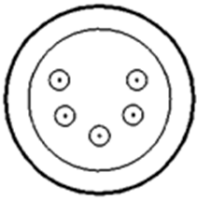


Fig. 4-8: CopperHead Pro Base Unit Connections

- **11: 12 VDC Input:** connects to 12VDC power supply
- **20: 120/220 VAC Input:** connects to AC mains
- **14: Fiber:** connect fiber cable to CopperHead Camera Unit
- **15: Remote/Tally:** connects to CHBS-PRO cable. This breakout cable connects to a Camera Remote Control Panel. The pigtail connects to the tally output of a switcher or to a studio Tally system. See CHBR-PRO Base Station Remote Cable on page 74 for details.
- **16: Intercom:** connects to the house intercom system is connected here (see Intercom connectivity on page 43)
- **17: SDI Out:** connects to the digital video output (HD/SDI-SDI) from your camera is found here
- **18: Return Video In:** connects to the house genlock/sync or return VBS analog video
- **19: Return Video Mode Switch:** switches to optimize the return video path (18) for Genlock/Sync or analog return VBS video

Intercom connectivity

The CopperHead Pro Base Station is delivered pre-configured for compatibility with either "Two-Wire" or "Four-Wire" intercom systems, which can be identified by the XLR connector:

	Two Wire		**Four Wire**
Intercom	RTS	Clear-Com	Universal/Matrix
	(switchable: see below)		
Connector	XLR3 Female		XLR5 Male
			
Pin-outs	See Camera Unit Connectors on page 63.		

- **Four-Wire Interface**: connects a Base Station to four-wire intercom systems (ex. matrix-style systems).
- **Two-Wire Interface - RTS or Clear-Com** (switchable): connect the CopperHead Pro Base Station to a two-wire intercom system like any other intercom component (such as a belt pack or station). Internal dip switches (see Figure 4-9) are used to set the two-wire intercom configuration.

  The system is delivered from the factory configured as requested by the end-user or dealer. An adhesive label on the rear of the unit identifies the factory setting (C-C, RTS1, RTS2, 4W).

Two-Wire Intercom Configuration			
		SW1	
Mode	**Intercom System**	**A**	**B**
1	No Comms	Off (0)	Off (0)
2	RTS CH 1	Off (0)	On (1)
3	RTS CH 2	On (1)	Off (0)
4	Clear-Com		
5	Not Used	On (1)	On (1)

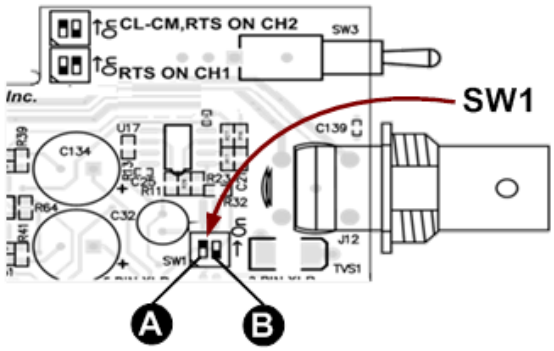


Fig. 4-9: Two-Wire Intercom Configuration Dip Switches

Fiber Connections between the Base Station and Camera Unit

The following table summarizes the various fiber cable connection options between the CopperHead Pro Base Station and Camera Unit.

Cable Type	Base Station Power	Camera Unit Power	Distance Range Between Camera and Base
Tactical Fiber	12VDC	Local Battery or AC Power	Up to 10 KM
SMPTE Hybrid Fiber	120/220VAC with Internal Camera Power Supply	PowerWafer Adaptor	240 meters
SMPTE Hybrid Fiber	External MPS Power Supply 95 Watts1	PowerWafer Adaptor	5 KM between base and power supply 240 meters between power supply and camera
SMPTE Hybrid Fiber	External HDX Power Supply - 150 Watts2	PowerPlus Adaptor	5 KM between base and power supply 3.2 KM between power supply and camera

- The external MPS power supply must be equipped with the required fiber cable connectors depending on your system requirements. See MPS External PowerWafer Power Supply on page 28 for a description of the various options.
- The external HDX Power Supply provides two ST Fiber Connectors for connection between the HDX and Base Station and a SMPTE 304M Connector for connection between the HDX and Camera Unit.

The following fiber connection scenarios do not take into account any customized cable and connector installations you may have at your facility. For assistance regarding more complex connection situations, contact Grass Valley (see Contact Us on page 57) or your local authorized dealer.

Tactical Fiber between Base Station (powered) and Camera Unit

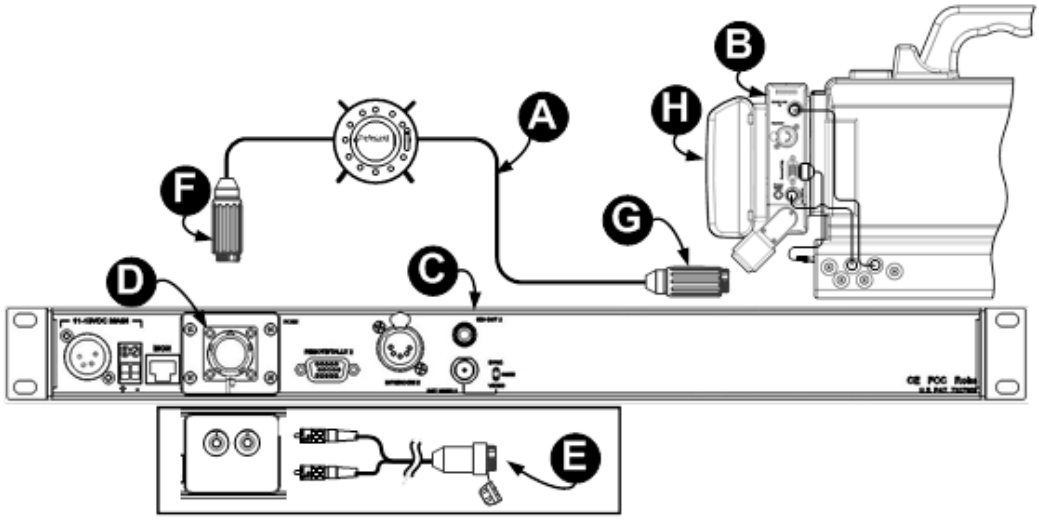


Fig. 4-10: SMPTE Hybrid Fiber between Base Station (powered) and Camera Unit

- Connect a length of tactical fiber cable **A** between Camera Unit **B** and Base Station **C**.
- At each end of the fiber cable will be either an OpticalCON or MX fiber connector (**F** and **G**).
- The camera must be powered by local power, such as a battery or a local AC power supply **H.**

SMPTE Hybrid Fiber between Base Station (powered) and Camera Unit

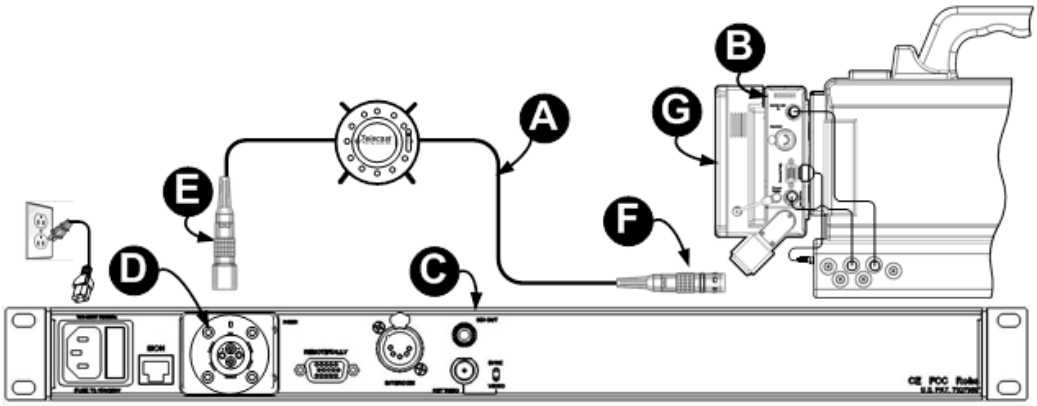


Fig. 4-11: SMPTE Hybrid Fiber between Base Station (powered) and Camera Unit

Connect a length of SMPTE Hybrid fiber cable **A** between Camera Unit **B** and the fiber receptacle **C** on the back of Base Station **D**.

At each end of the fiber cable will be either an OpticalCON or SMPTE 304M Hybrid fiber connector **E** and **F**.

The camera will be powered by the CopperHead PowerWafer Camera Power Supply **G**.

Hybrid Fiber between Base Station (powered) and Camera Unit

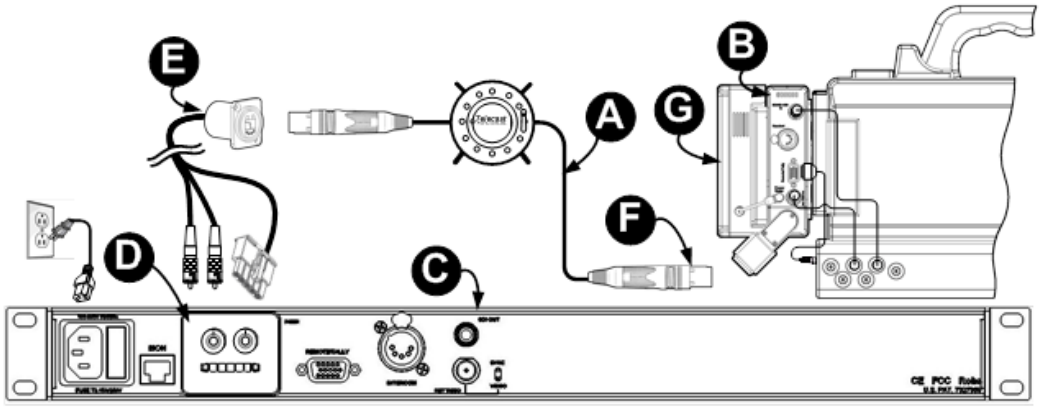


Fig. 4-12: Hybrid Fiber between Base Station and Camera Unit (Infrastructure Wiring)

A remotely-mounted fiber connector can be used for permanent installations such as communications closets, truck connector panels and within/between buildings. **A** panel **D** with two STs (fiber) and a Molex connector (power) is mounted on Base Station **C**.

Infrastructure fiber and copper wiring from Base Station connect to a remote panel-mounted OpticalCON or SMPTE 304M receptacle **E**. A standard hybrid fiber optic cable **A** connects the panel- mounted receptacle and Camera Unit **B**, equipped with a PowerWafer **G**.

Hybrid Fiber Cable between MPS Power Unit and Camera Unit

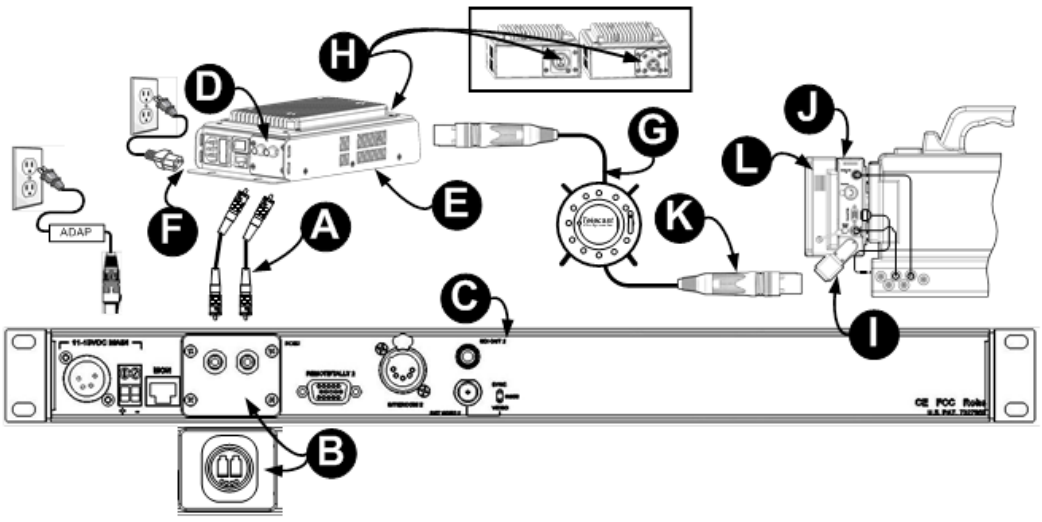


Fig. 4-13: Hybrid Fiber cable between the MPS Power Supply and Camera Unit

Dry fiber can be used between Base Station and the MPS External Power Unit, and the camera can be powered by the MPS over powered hybrid fiber.

Connect "dry" (unpowered) single mode fiber cable **A** between the fiber connector(s) **B** on Base Station **C** and the "dry" fiber connector(s) **D** on the MPS Power Supply **E**. Connect the

MPS Power Supply **E** to AC Mains **F**. Connect a length of hybrid fiber cable **G** between the powered connector **H** on the MPS Power Supply **E** and the swiveled fiber connector I on Camera Unit **J**. The hybrid fiber cable can be equipped with either OpticalCON or SMPTE 304M connectors **K**. The camera and Camera Unit will be powered via the hybrid cable by the PowerWafer **L**.

The "dry" fiber connectors D on the MPS Power Supply **E** and the "dry" fiber connector(s) B on Base Station **C** can equipped with one of two connector options:

- Two ST connectors (shown)
- OpticalCON connector

The powered fiber connectors H on the MPS Power Supply **E** and the fiber connector **I** on Camera Unit **J** be equipped with one of two connector options:

- Two ST connectors (shown)
- OpticalCON connector

Other fiber optic connectors are available by special order. Contact Grass Valley (see Contact Us on page 57) or your CopperHead dealer for more information.

SMPTE Hybrid Fiber between HDX Power Supply and Camera Unit

ST Fiber Connectors between Base Station and HDX Power Unit, camera powered by Copperhead PowerPlus.

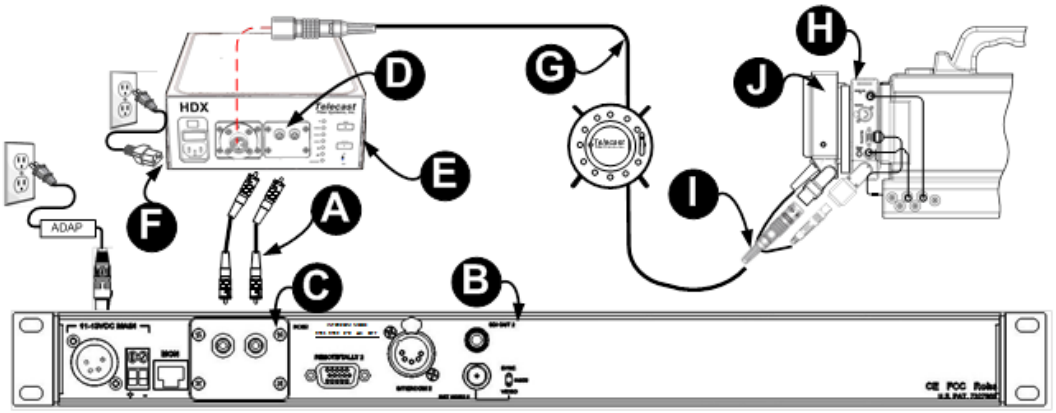


Fig. 4-14: SMPTE Hybrid Fiber between the HDX Power Supply and Camera Unit

Mount the PowerPlus **J** to the CopperHead Camera Unit **K** as shown in Mounting the CopperHead Pro Camera Unit with the PowerPlus on page 38, being sure to plug the PowerPlus' tactical fiber "dongle" **X** into the swivel-mounted fiber connector on Camera Unit **X**.

Connect dry (unpowered) fiber cable **A** between the fiber connector(s) **C** on Base Station **B** and the "dry" fiber connector(s) **D** on the HDX Power Supply **E**. Connect the HDX Power Supply **E** to AC Mains F. Connect a length of hybrid fiber cable **G** between the HDX Power Supply **E** and the swivel-mounted SMPTE 304M connector **X** on the PowerPlus **J**. The hybrid fiber cable can be equipped with either OpticalCON or SMPTE 304M connectors **I**. The camera and Camera Unit will be powered via the hybrid cable by the PowerPlus **J**.

Note: Connectors at each end of the fiber cable must be SMPTE 304M I. OpticalCON connectors cannot be used in this configuration.

Deployment of the CopperHead System

The CopperHead system features different battery mounting plates, powering options, fiber cable connectors, and intercom system interfaces. This allows for many permutations that are all slightly different. Hence, not every possible operational environment can be described.

However, the following steps are recommended:

1. Set up and test your CopperHead Pro system immediately to confirm proper operation and to provide training to you and your team prior to an actual production.
2. Do not attempt to power up the system until the fiber optic cable has been connected at both ends.
3. Install Camera Unit and battery or power supply (see Mounting the CopperHead Pro Camera Unit with a battery on page 36).
4. Connect all Camera Unit and Base Station cables as shown in Connecting the CopperHead Pro System on page 40. The order in which you connect the cables makes no difference. However, to prevent damage other sensitive electronics (such as camcorders and Remote Control Panels):
   - Make sure to connect the CHCR Camera Remote Control cable to the camera when the camera is powered off.
   - Make sure to connect the CHBR Base Remote Cable to the remote control panel when Base Station power is turned off.
5. Deploy the fiber cable and connect it.

   You should read the Using Fiber Optics Guide for information on how to manage and deploy your fiber optics cabling, safety precautions, tips & tricks, and recommendations for creating complex fiber optic networks. You can find a copy of this document on the Support portal (see Contact Us on page 57).

Insuring a Positive Fiber Link

1. Connect the fiber cable connectors at each end.
2. Power up Camera Unit and Base Station or power supply and check the LED **Link** indicators on each device.
3. Confirm that the LED **Link** indicators on Camera Unit and Base Station are both illuminated Green. If so, all signals should now be passing between Camera Unit and Base Station.

Intercom Operation

Intercom controls and indicators are found on the control panel of the CopperHead Pro Camera Unit:

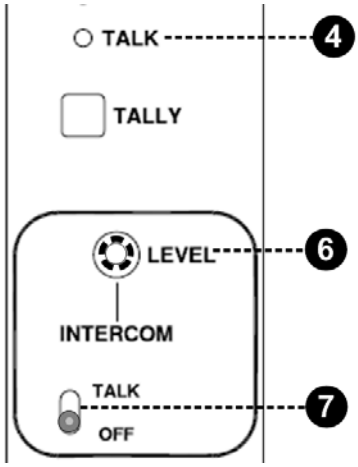


Fig. 4-15: Camera Unit Intercom Controls

- **4: TALK:** lights GREEN to indicate that the intercom TALK switch is in the "up" position, and that the headset mic is open.
- **6: Headset Volume Control Knob: c**ontrols volume ("listen level") of the intercom channel in the headset. Adjust it until the volume level is comfortable.
- **7: Intercom Talk Switch**
  - **TALK** (up) opens the headset mic
  - **OFF** (down) closes the headset mic

  To talk on the intercom line, toggle the TALK switch to the "up" position, which opens the microphone, transmitting the voice to the intercom line. When the microphone is open, the TALK indicator (x) will illuminate Green.

> **Note:** Intercom beltpacks cannot be plugged into the CopperHead Pro Camera Unit. Only an intercom headset can be plugged into Camera Unit.

The operation of your specific intercom system is beyond the scope of this User's Guide. Please see the documentation provided with your intercom or consult your intercom provider.

Shutting Down the System

When shutting down the sytem, follow these guidelines:

- ,Take special care when handling the fiber cable and to the Camera Remote Control Panel Cable.
- Power switches for the camera, Camera Unit, and Base Station may be turned off in any order.
- To prevent looking directly into an active fiber optic port or cable, turn both Camera Unit and Base Station off before disconnecting the fiber from either point.
- To prevent damaging the camera or camera remote control panel (RCP), turn both Camera Unit and Base Station off before disconnecting the CHCR remote cable from the camera or the CHBR remote cable from the RCP.
- Cap your fiber optic connectorsto keep them clean.
- Protect all cables from dirt, water entry, and from being dragged across the ground or other surfaces.
- When re-spooling the cable, avoid cable snags and crimps, and take care not to damage the connectors.
- When re-spooling the fiber cable on to the spool, guide it across the entire width of the spool so that it winds evenly,reducing the possibility of cinching or kinks.
- If Base Station is a permanent or semi-permanent installation, power off and disconnect and cap the fiber cable.

Troubleshooting

Troubleshooting any technical issues with the CopperHead Prois similar to any piece of television production gear with the obvious exception of the core Fiber Optic technology.

Keep the following tips in mind:

- Check the LINK indicators at each end of the system. They should be illuminated Green if there is good fiber optic connectivity for the non-SDI signals (VBS/sync, camera control, intercom, tally).
- Check the SDI indicator at the CopperHead Pro Base Station. It should be illuminated Green if there is good fiber optic connectivity for the SDI signal.
- If the LINK or SDI indicators are not Green, there maybe low optical power between Camera Unit and Base Station. Thefollowing are possible solutions:
  - Ensure that all fiber optic connectors are clean. Clean fiber optic connectors are a requirement for reliable connectivity between fiber optic components like your CopperHead transceivers. Any contamination in the fiber connection, even microscopic dust particles, can cause "link loss" and adversely affect the operational functionality of your CopperHead equipment. For more information on the care and maintenance of your fiber optic connectors, refer to www.miranda.com.
  - Examine the entire length of the fiber cable and see that it is in intact and has no damage or severe bends or kinks.
  - Confirm that all fiber optic connectors are connected securely.
- If optical power is good, but signals are not being received:
  - Check all of your copper cables (coax) and connectors (BNC) for damage.
  - Confirm signal type is on the proper signal path - It is possible to physically connect analog signals to digital signal paths on the CopperHead Pro.

    However, signals will not pass through the system unless they are the correct type. An SDI signal will not pass through the Analog or VBS paths and an Analog signal will not pass through an SDI path. If the wrong type of signal is incorrectly connected, the signal LED indicator may illuminate, but no signal will pass through.
- Base Station power problems:
  - **12VDC Base Station**: Check that the DC power supply is functioning correctly and connected securely.
  - **110/220 VAC Base Station**: Check the fuses. Do not try to multiplex the CopperHead Pro with other fiber optic devices. The CopperHead Pro system is not readily compatible with any active or passive CWDM technologies, including TelePort and TeleThon systems.

5 Specifications

Video, Digital (SDI)

- Interface ..... SMPTE 259M, 292M, 424M
- Data Rate ..... 270 Mb/s, 1.5 Gb/s, 3 Gb/s
- Input Level. ..... 800 mV +/-10% (peak to peak, maximum)
- Equalized cable lengths (Belden 1694A) .....
  - 270MB/s. 250m
  - 1.5 Gb/s. 230m
  - 3 Gb/s. 140m
- Input/Output Impedance. ..... 75 Ohms
- Bit-Error Rate (pathological data) 10-12
  - 270MB/s ..... -24 dBm
  - 1.5 Gb/s. ..... -22 dBm
  - 3 Gb/s ..... -20 dBm
- Jitter (SMPTE color bars) .....
  - 270MB/s & 1.5 Gb/s. ..... < 0.2 UI
  - 3 Gb/s. ..... < 0.3 UI
- Rise/Fall Times (20%-80% amplitude) .....
  - 270 Mb/s. ..... < 1.5 ns to >0.4ns
  - 1.5 Gb/s & 3 Gb/s. ..... < 135 ps

Video, Analog (VBS)

- Interface ..... RS170, NTSC, PAL

Frequency Response

- Return VBS mode .....
  - 30 Hz-4.2 MHz: ..... ±0.15 dB
  - 8MHz. ..... -3 dB
- Tri-Level Sync Mode .....
  - 4.2 MHz ..... -4 dB
  - 8 MHz. ..... -14 dB
- Video Signal to Noise Ratio ..... ≥ 80 dB
- Differential Gain ..... < 2%
- Differential Phase ..... < 1°

Intercom

- Number of channels 1
- Interface types (Base). .....
  - RTS, Clear-Com (switchable) ..... XLR 3 Female

Four-Wire ..... XLR 5 Female
Frequency Response ..... 20Hz - 20KHz +0.1/-3dB
Max Distortion (THD+N) ..... < 0.1%
Signal/Noise Ratio ..... >80dB

GPI/Tally

Direction ..... Base-to-Camera Unit
Input (Base):
On: ..... TTL Low or Short to GND
Off: ..... TTL High or Open
Output (Cam): ..... 2 pos. Form A Relay, SPST, normally open
Max Switching Voltage 125VDC, 150VAC,
Max current ..... 1 Amp

Datas

Data 1 (RS232/422/485 configurable)
Data rate - RS422 or RS485 ..... 0 to 1 Mb/s
Data rate - RS232 ..... 0 to 100 kb/s
Jitter (sample asynchronous) ..... 80 nsec
Data 2 (RS422)
Data rate ..... 0 to 1 Mb/s
Jitter (sample asynchronous) ..... 80 nsec

Electro-Optical

Operating Wavelengths .....
Camera to Base (SDI) ..... 1300 nm (Fiber A)
Camera-to-Base (Data/Comms) ..... 1300nm (Fiber B)
Base to Camera (VBS, Data, Comms) ..... 1550nm (Fiber B)
TX Laser output power ..... -6 dBm
RX Sensitivity,
270MB/s ..... -24 dBm
1.5 Gb/s ..... -22 dBm
3.0 Gb/s ..... -20 dBm
Fiber Compatibility ..... Single Mode only
Optical Connector Options - Camera Unit:
Local Power, PowerPlus ..... MX, OpticalCON, SMPTE 304M
PowerWafer: ..... SMPTE 304M or OpticalCON
Optical Connector Options - Base Station:
Unpowered (Tac fiber) ..... ST or OpticalCON
Remote Power (Hybrid fiber):
Standard Power ..... SMPTE 304M, OpticalCON, or ST/Molex

Distance Limit *see note below

Tactical Fiber (Local Power at Camera):

"Dry" fiber (1.5Gb/s) ..... 16 db optical loss (≈ 30 km*)

SMPTE 311M Hybrid Fiber.....
Standard Internal Power Supply w/PowerWafer. 240m (787 ft): 95W @ 12VDC*
Long Range: HDX w/PowerPlus .....2km (6562 ft.): 100W Cont./150W Peak*

Mechanical/Environmental

Dimensions (WxLxD)

Camera Unit .....2.5" x 6.5" x 2.2"
Base Station .....17.5" x 9" x 1.75"
PowerWafer .....5" x 6.12" x 2.2"
PowerPlus LP (100W) .....5" x 6" x 2.5"
PowerPlus HP (150W) .....5" x 6" x 3.7"
HDX.....13" x 3.5" x 8.5"
MPS Power Supply .....9.7" x 2.5" x 4.5"

Weight

Camera Unit .....1.5 lb.
Base Station. .....5.0 lb.
PowerWafer .....1.5 lb.
PowerPlus..... LP: 2.3 lb.....HP: 2.5 lb.
MPS Power Supply ..... 3.0 lb.
HDX..... 10.5 lb.

Power Consumption

Camera unit ..... 8 watts@10-18VDC
Base Station (Tac Fiber):
Power Consumption .....10 watts@10-18VDC
Power Connector..... 4-Pin XLR
Base Station (Hybrid Fiber):
Power Req ..... 110-120/220-240 VAC, 50 to 60Hz
Power Consumption ..... 250 watts max @120VAC
Temperature Range .....-25° to +55°C
Humidity Range ..... 0 to 95% RH, Noncondensing

* The maximum cable length varies due to optical loss that can depend on cable quality, dirt/dust/contamination on connectors, and the number of cable connectors. When using hybrid cable for camera power, the size of the hybrid cable, as well as the power draw of the camera, lens, viewfinder, and other accessories are also factors

Contact Us

Grass Valley Technical Support

For technical assistance, please contact the Grass Valley Technical Support center nearest you:

Americas

Office hours: 9:00 a.m. – 9:00 p.m. (EST)
Telephone: 1-800-224-7882
Fax: +1 514 335 1614
E-mail: support@miranda.com

Europe, Middle East, Africa, UK

Office hours: 9:00 a.m. – 6:00 p.m. (GMT)
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A Fiber Optic Systems

This appendix provides information on the basic concepts of Fiber Optic Systems.

Basic Concepts

Fiber optics and fiber optic cable are at the heart of the CopperHead Pro. The provide the ability to multiplex and de-multiplex a variety of video, audio, and data signals to be carried over a thin strand of fiber optic cable over long distances.

The theory and operation of Fiber Optics is beyond the scope of this document. However, it is important to understand the different types of fiber optic cable and fiber optic cable connectors.

Fiber Optic Cable

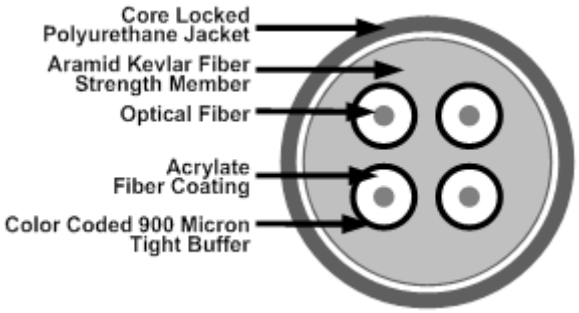


Fig. A-1: Tactical Fiber Optic Cable Cross-section (Tac-4 cable shown)

Tactical fiber cables are extremely strong, lightweight, and rugged cables designed for "harsh environment" (military and commercial) deployment & retrieval applications. The internal glass fiber optic cores are protected by a woven aramid (Kevlar) strength member, making them able to withstand a variety of environmental hazards such as being crushed or run-over. They are available in core counts of 1, 2, 4, 6, and 12.

CopperHead systems require a minimum of two cores. Using a totally non-metallic design for electrical isolation; they are impervious to noise & grounding issues. Tactical Fiber can be used in the field mounted on lightweight reels in lengths up to 2000 feet or longer

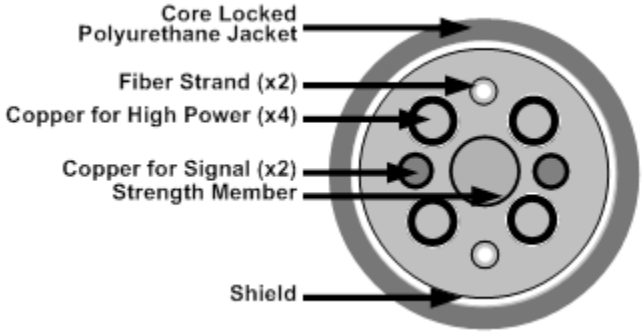


Fig. A-2: Hybrid Fiber Optic Cable Cross-section (Illustrative only)

Hybrid fiber cable has two fiber optic cores, with the addition of six copper wires, providing for the transmission of power through the cable in order to provide power to the camera. These copper wires increase the size (diameter) and weight of the cable, and make the cable more fragile than Tactical cable, as well as making them susceptible to noise and grounding issues.

Fiber Optic Connector Types

Depending on the type of fiber optic cable used, different connectors can be used. The following table summarizes the various types of connectors typically used in a CopperHead Pro configuration and the allowed Fiber optic cable usage. Each connector type is illustrated below.

Connector Type	Tactical Fiber Use	Hybrid Fiber Use	Camera Unit Use	Base Station Use	Notes
ST Fiber Connectors	Yes	No*	No	Yes	Less Expensive - not as durable as OpticalCON, SMPTE 304M or MX
ST Fiber Connectors with Molex Power Plug	No	No*	No	Yes	Used with separate Fiber and Power cables
LC Connectors	No	No*	No	No	Infrastructure and Internal Equipment Use
SMPTE 304M	No	Yes	Yes	Yes	
OpticalCON Cable Connector (Neutrik)	Yes	Yes (up to 95V)	Yes	Yes	
OpticalCON Panel Connector (Neutrik)	Yes	Yes	No	No	Infrastructure Use Only
MX Expanded Beam Connector	Yes	No	Yes	Yes	

Note: These connectors can be used to terminate individual fibers on a Hybrid fiber breakout adaptor.

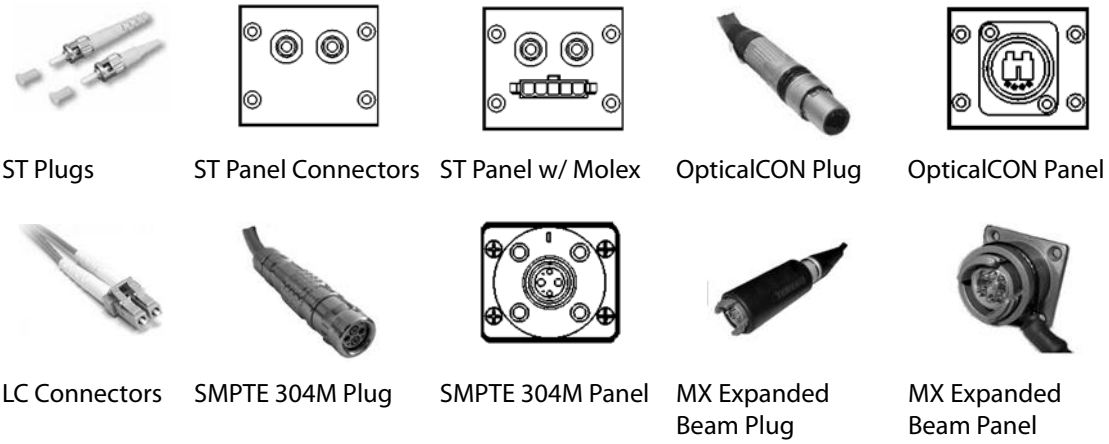


Fig. A-3: Fiber Optic Connectors

A Brief Guide to Measurement of Fiber Optic Signal Strength

The CopperHead Pro operates within a defined fiber optic link margin, based on two factors:

- Output (or "launch") power of the optical transmitter at each end of the link: typically -7dBm* (pronounced as "minus seven dee-bee-em").
- Sensitivity of the optical detector at each end of the link: typically -22 dBm.

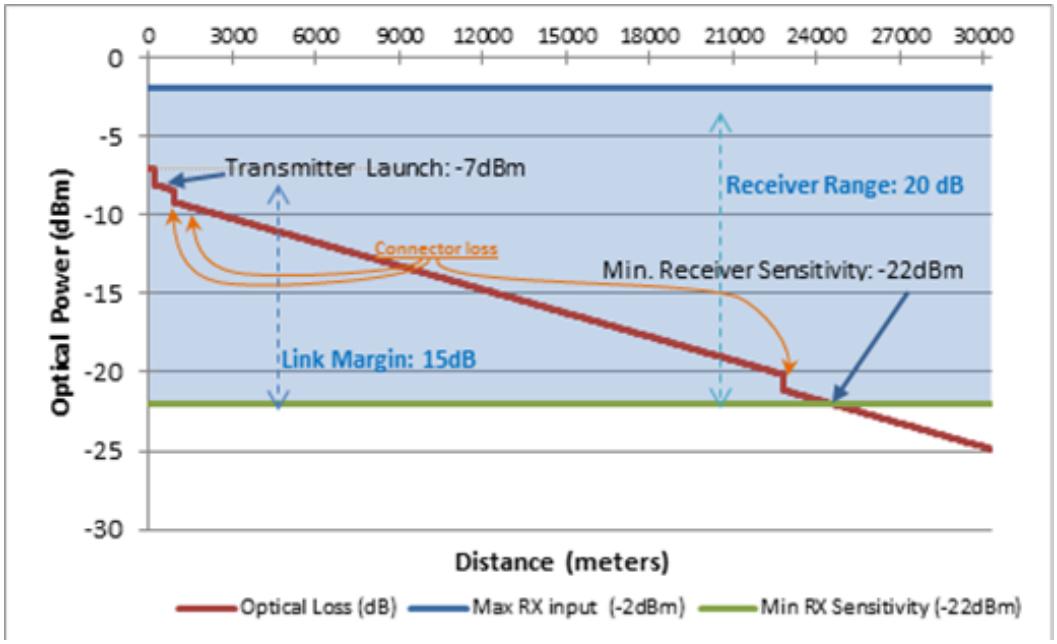


Fig. A-4: CopperHead Fiber Optic Link Margin

The overall link margin (or dynamic range) of the CopperHead Pro system (the difference between the transmitter's output power and the receiver's sensitivity) is typically 15dB.

That margin is consumed by two main factors:

- Optical loss over the length of the fiber cable: typically 0.5dB per kilometer
- Optical loss at connection points: typically 1 dB per connector

Therefore, a CopperHead Pro system can optimally work over 24 kilometers of cable (spending 12 dB of the link budget), and three connectors (spending 3 dB of the budget).

However, adding additional devices, such as the HDX or MPS power supply, or the camera-mounted PowerPlus will add connectors to the path, and therefore contribute additional connector loss.

The "SDI" indicator at the CopperHead Pro Base Station lights Green when the measured optical power at Base Station is -20dBm or better, which is the minimum power requirement for 3.0 Gb/s SDI data. See Specifications on page 53 for the optical power requirement for your particular SDI data signal.

*The unit "dBm" is an abbreviation for the optical power measured in decibels referenced to one milliwatt (mW).

B

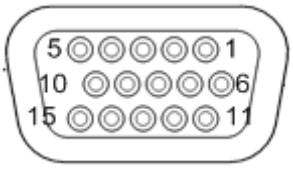
CopperHead Pro System Connectors

This appendix lists the various connectors used by the CopperHead Pro system.

Camera Unit Connectors

Reference Numbers refer to the overview diagrams in Base Station: 12Volt DC (single/dual) on page 80.

Camera Remote and Tally



Camera Unit #14

- DB15HD Female (Ext View)
- Pin 10 (Data 1 Format select)
- Floating for RS-422 or TTL
- Tied to GND for RS-232
- Tied to +12VDC for RS-485

The following table lists the Camera Unit remote DB15HD pinouts. See CHCR-PRO Camera Unit Remote Cable on page 73 for a list of Camera Remote Cables.

		Signal			
Function	**Pin #**	**RS232**	**RS422**	**TTL**	**RS485**
Data 1 (Camera Control) RS232/ 422/485	8	IN	(+) IN	IN	(+) I/O
	2	-	(-) IN		(-) I/O
	6	OUT	(+) OUT	OUT	-
	1	-	(-) OUT		-
	10	Data Format			
		Tie to GND	Float	Float	Tie to +12VDC pin 15
	5, 7	GND			
Format Bias	15	Format Bias +12VDC			
GPIs	13	GPI/Relay Output Contact A			
	14	GPI/Relay Output Contact B			
Data 2 (RS422 only)	3	N/A	(-) IN	N/A	N/A
	9	N/A	(+) IN	N/A	N/A
	11	N/A	(-) OUT	N/A	N/A
	12	N/A	(+) OUT	N/A	N/A
Not Used	4	Future			

Camera Headset

 Camera Unit #13 XLR5 Female (Ext View	The Camera Unit headset connector pinouts (RTS standard monaural headset pin-out): • **Pin 1**: MIC Ground (shield) • **Pin 2**: + MIC Input • **Pin 3**: - Earphone Output Ground • **Pin 4**: + Earphone Output • **Pin 5**: + Earphone Output

PowerWafer Connector

 Camera Unit #15 Lemo 4-pin Female (Ext View)	The Camera Unit PowerWafer Connector pinouts: • **Pin 1**: + 95VDC) • **Pin 2**: Not Used • **Pin 3**: - 95VDC • **Pin 4**: Not Used **Receptacle**: Lemo EGG.0B.304.CLL **Mating connector**: • Lemo FHG.0B.304.CLAD42 (right angle) • Lemo FGG.0B.304.CLAD42 (straight)

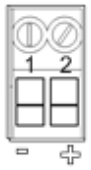
Base Station Connectors

Reference Numbers refer to the overview diagrams in Base Station: 12Volt DC (single/dual) on page 80.

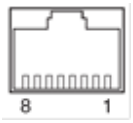
AC Power Input Connector- Models CHG3-BS-Pro-95VD-xxx-xxx

 Base Station #20 IEC C14 receptacle	**Panel Mounted IEC C14 AC Power Receptacle**: 110/220 VAC **Fuses**: • Two 3.15 amp slo-blo fuses (5 x 20mm)

12VDC Input Power Connectors - Models CHG3-BS-Pro-2ST/2MX/NEU

 Base Station #11 XLR4 Male (Ext View)	Base Station 12VDC power connector pinouts: • **Pin 1**: GND • **Pin 2**: Unused • **Pin 3**: Unused • **Pin 4**: +12 VDC In Connects to ADAP-AC-04 or a customer-supplied 12VDC power supply. This connector is wired in parallel with terminal block #12.
 Base Station #12 Terminal block (Ext View)	Base Station Terminal Block pinout test: • **Pin 1**: GND • **Pin 2**: +12VDC In **Note**: This connector is wired in parallel with XLR4 Male #11.

System Monitor (future use)

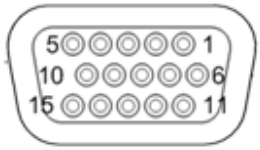
 Base Station #13 RJ45 8P8C receptacle (Ext View)	This RJ45 connector is not functional, and is reserved for future use.

95VDC output: Model CHG3-BS-PRO-95VD-STM-xxx

 Base Station #14F Mating connector: Molex 39-01-4051	Molex Connector pinouts: • **Pin 1**: +95VDC Out (White) • **Pin 2**: +95VDC Out (Black) • **Pin 5**: Ground (Green) *Tied together at terminal lug end

Base Station Remote/Tally Connector

The following table lists the Base Station Remote DB15HD connector pinouts. See Camera Unit & Base Station Interface Cables on page 73 for a list of Base Station remote cables.

			Signal			
	Function	**Pin #**	**RS232**	**RS422**	**TTL**	**RS485**
 Base Station #15 DB15HD Female (Ext View) Pin 10 (Data 1 Format select) Floating for RS-422 or TTL Tied to GND for RS-232 Tied to +12VDC for RS-485	**Data 1 (Camera Control) RS232/ 422/485**	8	IN	(+) IN	IN	(+) I/O
		2	-	(-) IN		(-) I/O
		6	OUT	(+) OUT	OUT	-
		1	-	(-) OUT		-
		10	Data Format			
			Tie to GND	Float	Float	Tie to +12VDC
		5, 7	GND			
	Format Bias	15	Format Bias +12VDC			
	GPI In	4	GPI/Relay Input			
	Data 2 (RS422 only)	3	(-) IN			
		9	(+) IN			
		11	(-) OUT			
		12	(+) OUT			
	Not Used	13	Future			
		14	Future			

4-Wire Intercom

The following table lists the Base Station 4-Wire intercom connector pinouts:

	Pin	**Function**	**Impedance**	**Signal**
 Base Station #16 XLR5 Female (Ext View)	1	Ground		
	2	+ Input	600 Ohm Input	Line: +8 dBm
	3	- Input		Mic: -32 dBm
	4	- Output	>=600 Ohm Load	+8 dBm
	5	+ Output		

Clear-Com Intercom

 Base Station #16 XLR3 Female (x2) (Ext View)	Station Clear-Com intercom connector test: • **Pin 1**: Ground • **Pin 2**: +VDC Power • **Pin 3**: Power

RTS Intercom

 Base Station #16 XLR3 Female (Ext View)	Base Station RTS intercom connector pinouts: • **Pin 1**: Ground • **Pin 2**: +VDC Power & Channel 1 Audio • **Pin 3**: Channel 2 Audio

PowerWafer Connector

PowerWafer #3
Lemo 4-pin Female
(Ext View)

The Camera Unit PowerWafer Connector pinouts:

- **Pin 1**: + 95VDC
- **Pin 2**: Not Used
- **Pin 3**: -95VDC
- **Pin 4**: Not Used

Receptacle: Lemo EGG.0B.304.CLL

Mating connector:

- Lemo FHG.0B.304.CLAD42 (right angle)
- Lemo FGG.0B.304.CLAD42 (straight)

PowerPlus Connectors

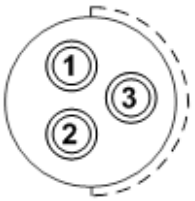
PowerPlus 12VDC Output Connector

PowerPlus #7
XLR 4-pin Female
(Ext View)

The PowerPlus 12VDC Connector pinouts:

- **Pin 1**: GND
- **Pin 2**: Not Used
- **Pin 3**: Not Used
- **Pin 4**: Power 12 VDC

PowerPlus 24VDC Output Connectors



PowerPlus # 8 & #9
Fischer 3-pin Female
(Ext View)

The PowerPlus 24VDC Connector pinouts:

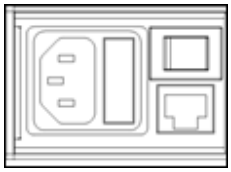
- **Pin 1**: GND
- **Pin 2**: +24VDC
- **Pin 3**: Not Used

Mating connectors:

- Fischer S-102-A-052-130 (straight)
- Fischer WSO-102-A0520130 (right angle)

MPS Power Supply Connector

AC Power Input Connector

 MPS Power Interface IEC C14 receptacle	**Panel Mounted AC Power Receptacle**: 110/220 VAC **Fuses**: • Two 3.15 amp slo-blo fuses (5 x 20mm)

C Cables, Parts, and Accessories

CopperHead Pro systems can be supplied with custom Camera Remote and Base Remote cables for specific cameras and remote control panels.

For information on these and other cable configurations, contact Grass Valley or your local CopperHead dealer (see Contact Us on page 57).

Camera Unit & Base Station Interface Cables

CHCR-PRO Camera Unit Remote Cable

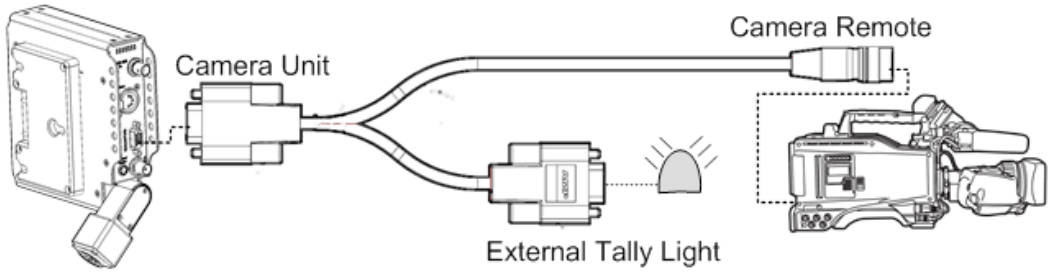


Fig. C-1: CHCR-PRO Camera Unit Remote Cable

Equipment Mfgr	Model Number	Description
Hitachi	CHCR-PRO-HIT-SK1-4-9	CopperHead Pro camera remote cable for Hitachi cameras
Ikegami	CHCR-PRO-IKE-HK2-10-9	CopperHead Pro camera remote cable for Ikegami HK2-style cameras, such as HL-59, HL-V7X, HK-398P*, HK-387P*, HL-V59**
JVC	CHCR-PRO-JVC1-6-9	CopperHead Pro camera remote cable, for JVC 6-pin "DIN" cameras, such as HD250
Panasonic	CHCR-PRO-PAN-AJ1-6-9	CopperHead Pro camera remote cable for Panasonic AJ1 and AJ2-style cameras (using EC3-control), such as HDC27 Varicam, HPX900
Panasonic	CHCR-PRO-PAN-AJ3-10-9	CopperHead Pro camera remote cable for Panasonic AJ3-style cameras (using RC10-control), such as HDX900, HPX500/2000/2700/ 3000/3700
Sony	CHCR-PRO-SON-DXC2-10-9	CopperHead Pro camera remote cable for Sony DXC2-style cameras, such as DXCD30, D35, D50
Sony	CHCR-PRO-SON-BVP3-8-9	CopperHead Pro camera remote cable for Sony BVP3-style cameras (using Series 700control), such as HDW, PDW, PMW, some DSR.

CHBR-PRO Base Station Remote Cable

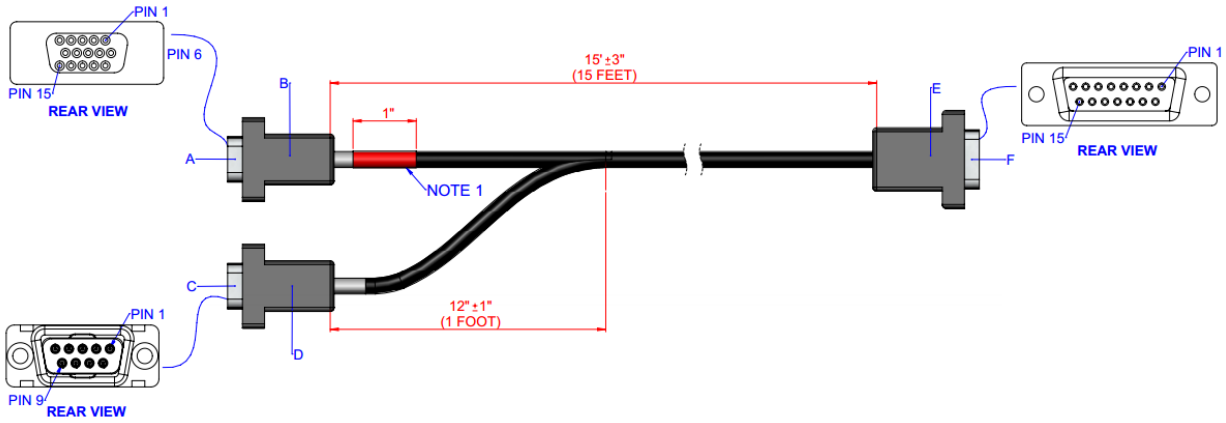
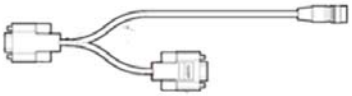
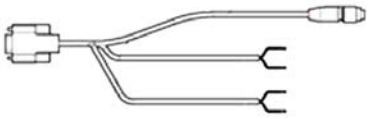
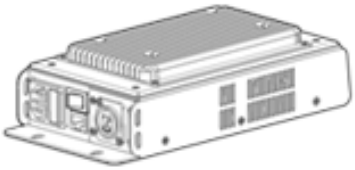
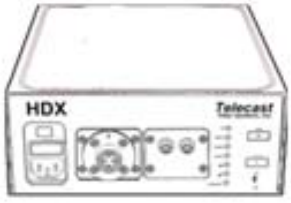
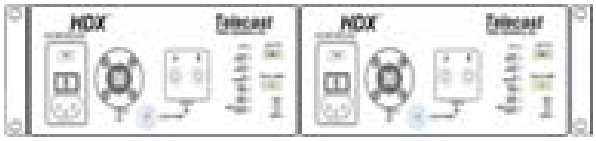


Fig. C-2: CHBR-PRO Base Station Remote Cable

Equipment Mfgr	Model Number	Description
Hitachi	CHBR-PRO-HIT-SK1-4-PIG2	CopperHead Pro base remote cable for Hitachi camera controllers
Ikegami	CHBR-PRO-IKE-HK2-10-PIG2	CopperHead Pro base remote cable for Ikegami HK2-style cameras, such as HL-59, HL-V7X, HK-398P*, HK-387P*, HL-V59**
JVC	CHBR-PRO-JVC1-6-PIG2	CopperHead Pro Base remote cable, for JVC 6-pin "DIN" camera controllers, such as RM-LP55 and RM-LP25
Panasonic	CHBR-PRO-PAN-AJ2-10-PIG2	CopperHead Pro base remote cable for Panasonic AJ1 and AJ2-style camera controller, such as AJ-EC3
Panasonic	CHBR-PRO-PAN-AJ3-10-PIG2	CopperHead Pro base remote cable for Panasonic AJ3-style camera controllers, such asAJ-RC10G and AJ-EC4
Sony	CHBR-PRO-SON-BVP3-8-PIG2	CopperHead Pro base remote cable for Sony BVP3-style camera controllers (using Series 700 control), such as RMB150/750)
Sony	CHBR-PRO-SON-BVP3-8-BNC-PIG2	CopperHead Pro base remote cable for Sony BVP3-style camera controllers (using Series 700 control), such as RMB150/750 with Video display)
Sony	CHBR-PRO-SON-DXC2-10-PIG2	CopperHead Pro base remote cable for Sony DXC2-style camera controllers, such as RCP-D50)
Telecast OCP	CHBR-PRO-OCP2040-422-PIG2	CopperHead Pro base remote cable for RCP2050 Universal Controller (RS422)

Parts & Accessories

CHCR-PRO		**CHBR-PRO**	
Camera Remote Cable (specify camera model).		Base Remote Cable, 10 foot (specify controller model)	
PWRWFR-95VD		**PWRPLS3**	
Power Wafer Camera Adaptor (for use with CH Series Pro-BS-95VD)		Long Distance "PowerPlus" Camera Adaptor for use with HDX (specify LP or HP)	
CH2-MPS-95VD		**HDX**	
External Power Supply for PowerWafer		Power Supply for PowerPlus Power Adaptor	
CH3CP-INF-2FAG		**HDX-FR-2**	
PowerWafer-to-Camera Unit jumper cable		Rack mount frame for 2 HDX units.	
CHRCP-2050A		**CHRCP-2050-LCD**	
Universal Camera Control Panel		Universal Camera Control Panel w/TFT-LCD Display	

CASM/MD/XL		**ADAP-AC-04**	
Tactical Fiber on Reel: Small (SM), Medium (MD), or Large (XL)		Base Station AC Adaptor (for CH Series Pro-BS-2ST)	
CAXX-MX		**CAXX-XT2S-NOC**	
Tactical Fiber Assembly, MX Connectors		Tactical Fiber Cable Assembly, OpticalCON Connectors	
CAXX-XSM311-NOC		**CAXX-XSM311-SMPTE**	
SMPTE 311M Hybrid Fiber Cable Assembly, OpticalCON connectors		SMPTE 311M Hybrid Fiber Cable Assembly, SMPTE 304M connectors	
MXRE		**MXRV**	
MX Receptacle Flange Mount Assembly Breakout to STs		MX Receptacle Jam Nut Assembly Breakout to STs	
CH3BFC-NOC-2ST/MOL		**CH3BFC-NOC-NOC**	
OpticalCON receptacle to STs and Molex 39-01-4051		OpticalCON receptacle to OpticalCON Plug	

CH3BFC-304M-2ST		**CH3BFC-304M-NOC**	
SMPTE Hybrid 304M plug to STs and Molex 39-01-4051		SMPTE Hybrid 304M plug to OpticalCON Plug	

D Overview Diagrams

This appendix provides overview diagrams for the Camera Unit and Base Stations.

Camera Unit

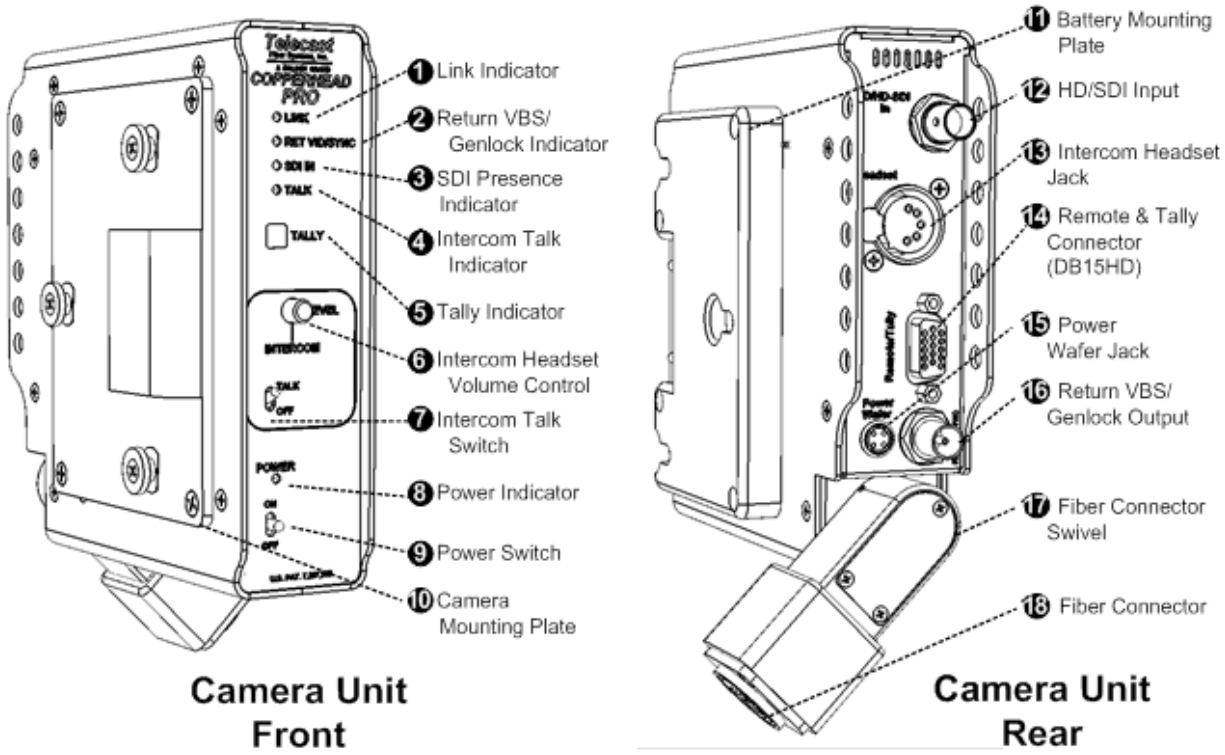
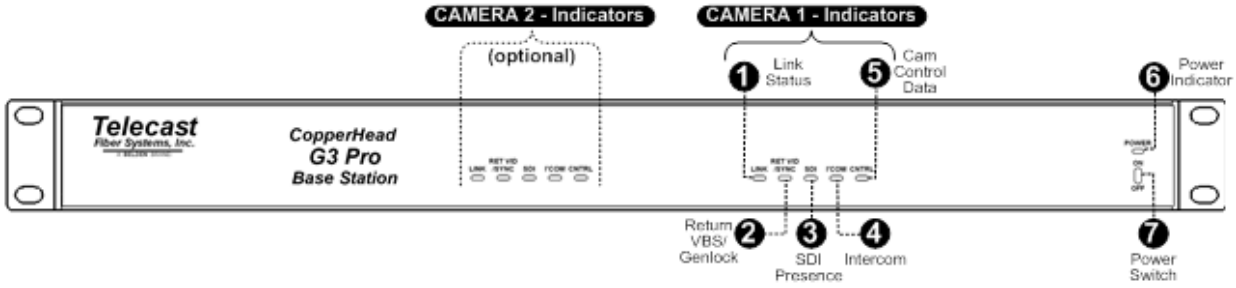


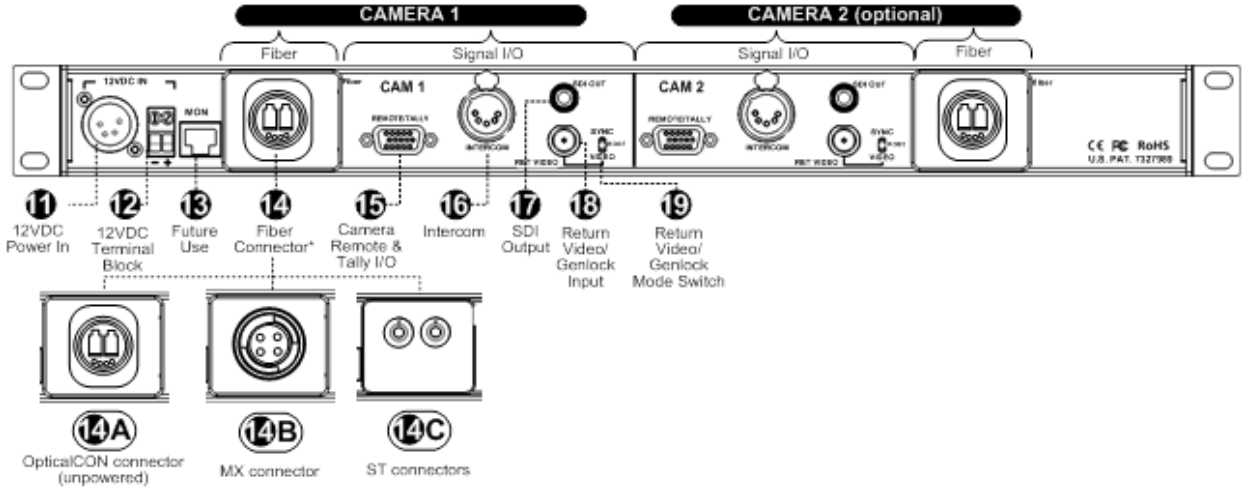
Fig. D-1: Camera Unit, Front and Rear

Base Stations

Base Station: 12Volt DC (single/dual)



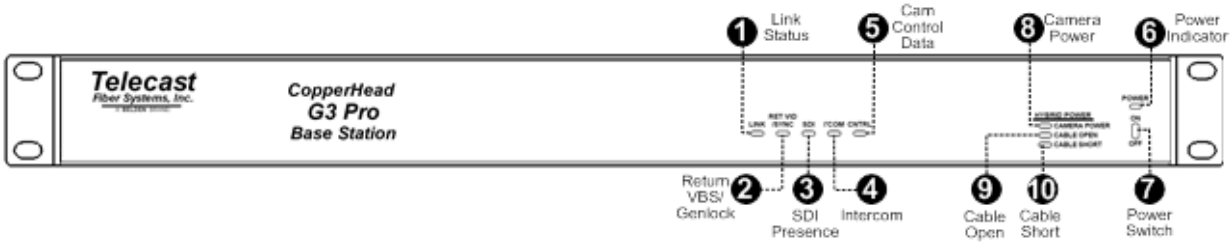
Front panel



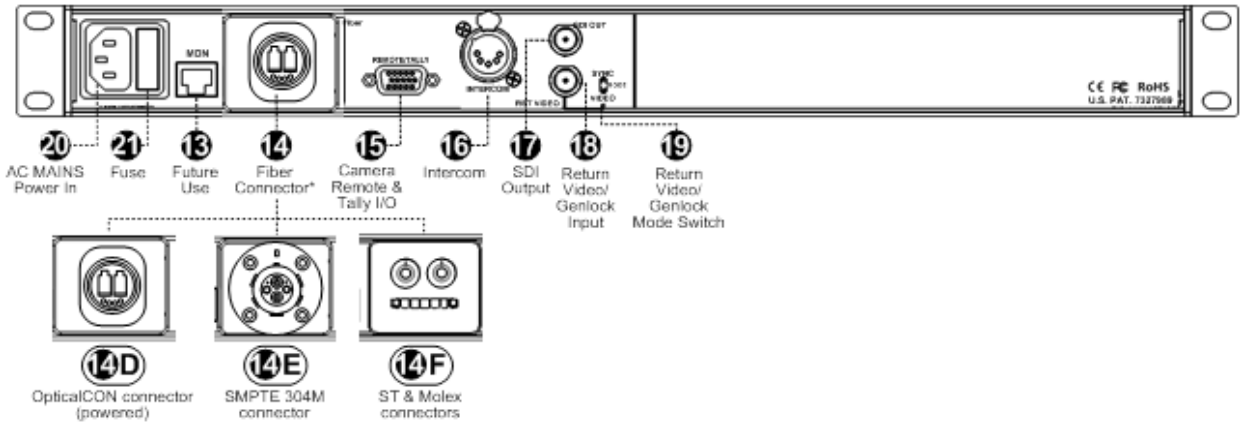
Rear panel

Fig. D-2: Base Station: 12Volt DC, Front and Rear

Base Station: 120/200 Volt AC (single only)



Front panel



Rear panel

Fig. D-3: Base Station: 120/200Volt AC, Front and Rear