Iteris Vantage Wireless System

Installation Guide

4931005
~~Version 2.0~~

This device complies with part 15 of the FCC Rules: Operation is subject to the following conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference that may cause undesired operation.

4931005, Version 2.0, June 2000, Made in USA.

FCC STATEMENT

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

This equipment has been verified to comply with the limits for a class B computing device, pursuant to FCC Rules. Operation with non-approved equipment is likely to result in interference to radio and TV reception.

The user is cautioned that changes and modifications made to the equipment without the approval of manufacturer could void the user's authority to operate this equipment.

INDUSTRY CANADA STATEMENT

This device has been designed to operate with an antenna having a maximum gain of 2.15dBi. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than the required for successful communication.

Operation is subject to the following two conditions:

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

Contents

Introduction

Purpose of This Guide

This guide was written for installers of the ITERIS Vantage wireless camera system.

This guide is intended to supplement the installation and user guide for your Vantage video image detection system. This guide describes installation of the Vantage wireless camera system only; refer to your Vantage system installation and user guide for information about installation and setup of the Vantage processor.

If You Need Assistance

For technical assistance regarding Vantage video image detection systems, contact:

ITERIS
~~1515 South Manchester Avenue~~ 1700 CARNEGIE
~~Anaheim, CA 92802-2907 USA~~ SUITE 100
SANTA ANA, CA 92705
USA

~~In California:~~

Phone	(888) 254-5487
	~~(714) 780-7201~~ ~~(949) 270-~~
	~~(714) 780-7255~~
~~Pager~~	~~(888) 362-2457~~

In Texas:

Phone	(806) 463-5704
Pager	(888) 760-0521

Overview of Wireless Video Image Detection

Any major city that relies on vehicle detection for its signal control system eventually experiences damage to traditional inductive loops due to roadway construction or pavement failure. Damage to inductive loops from road widening or re-surfacing projects can compromise the reliability of vehicle detection. Maintaining optimum traffic flow during construction can be difficult due to temporary striping and lane closures.

Adverse weather conditions also impede repair of inductive loops and at times may delay repair activities for several months. During such times, intersections that rely on a failed inductive loop may go into max-recall for the duration.

The use of wireless video transmission facilitates rapid deployment for permanent and temporary applications while maintaining superb vehicle detection where inductive loops or other vehicle detection methods cannot be deployed or repaired.

Benefits of Standard and Wireless VIDS

Although wireless video communications technology is not new, its application in vehicle detection provides enormous benefits.

Video image detection systems (VIDS) in general provide flexibility in the placement of vehicle detection zones. Temporary lane closures and lane markings can be easily accommodated by moving the detection zones of the video image processor.

At intersections with a high volume of heavy vehicles, the constant abuse of the roadway surface from heavy vehicles requires inductive loops to be replaced every year. For these types of locations, VIDS is an excellent alternative detection method.

Utilizing wireless video transmission between the VIDS camera and video image processor provides additional flexibility where quick and low cost deployment is required. At many locations, running high-quality coaxial cable may be difficult or impossible because existing conduits are filled to capacity, blocked with debris, or even frozen. Wireless video technology provides cable-free live video from the VIDS camera to the controller cabinet, where the video image processor is housed.

2.4 GHz FM Video Transmission

The ITERIS Wireless Vantage System utilizes the license-free 2.4 GHz band to transmit live video from the VIDS camera to the controller cabinet. A wireless transmitter is integrated into the camera and has no external components other than a 3-inch “rubber ducky” antenna. The video transmitter is FCC compliant and does not require the end user to have an operator license from the FCC.

The wireless transmission system uses frequency modulation (FM) techniques to transmit the video. This modulation scheme, unlike spread spectrum transmission where data is digitized prior to transmission, uses analog methods to modulate the video signal. Digital transmission typically requires higher bandwidths than FM-based systems.

There are several reasons why the 2.4 GHz band was selected. Video transmissions in the 902-928 MHz unlicensed band require too much bandwidth, and the 5.8 GHz unlicensed band encounters signal reflections common to higher frequency devices at locations where several obstructions and radio wave reflectors exists. Since wireless video transmission devices are mounted at lower elevations, signal poles, mast arms, signal heads, and even vehicles may cause havoc with multipaths and reflections, resulting in image ghosting, image shifting, and possibly even image cancellation. The 2.4 GHz band avoids these problems.

Benefits of Using FM-Based Video Transmission

The question arises: How can multiple intersections use wireless VIDS if they use the same frequency? This is possible because of the nature of FM communications.

Frequency modulation receivers detect and use the strongest signal they receive. Wireless Vantage video transmitters are low-power devices. Signal strengths of adjacent intersection video transmitters are significantly lower than local transmitters and do not cause interference, provided that adjacent intersections are at least 250 feet away.

Other benefits of FM-based video transmission:

- Proven video transmission technology.
- Ease of deployment.
- Lower maintenance costs (does not require expensive digital test equipment).

Camera Power

The portability of the Wireless Vantage VIDS hinges upon how power is provided to the camera. Since the recommended mounting location of the Vantage wireless camera is on the safety light arm above the signal head, the luminaire circuit supplies the camera power. The only requirement is that the luminaire head be controlled by its own photocell.

In this manner, power for the camera can be tapped prior to the photocell by hardwiring in the power cable or by using a photocell power adapter or power take-off (PTO) placed between the photocell and its receptacle (see Figure 1). The photocell can still provide nighttime switching capabilities while providing continuous 24-hour power to the camera.

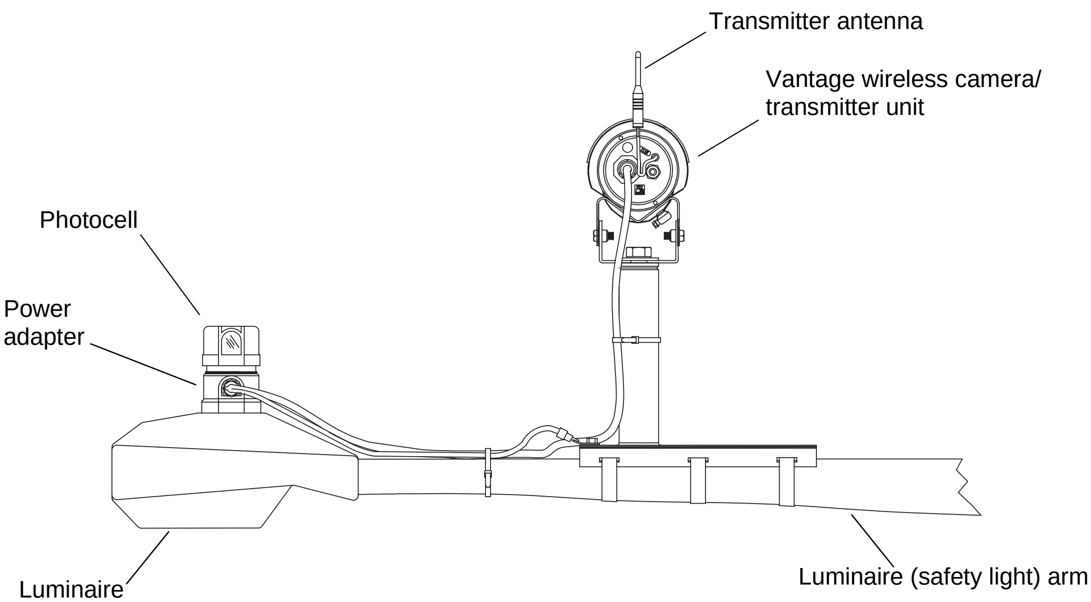


Figure 1. Vantage Camera Power

Receiver Antenna Type and Location

The wireless video receiver is located in the controller cabinet, and its baseband video output provides full-motion video to the Vantage VIDS. Getting clean, optimum radio waves to the video receiver takes careful planning prior to system installation. As with any wireless transmission, radio wave reflections, multipaths, and obstructions can degrade signal quality.

For optimum radio wave signal reception, the receiver antenna should be placed as high as possible to eliminate reflections from ground level objects, such as pedestrian signal heads and moving objects (high-profile vehicles, for example). The receiver antenna height also dictates the amount of signal degradation induced from pedestrians. A minimum height of 20 feet is recommended for most applications. Some sites may require additional receiver antenna height if direct line-of-sight between the transmitting antennas and receiver antenna cannot be achieved.

A linear-polarized directional patch antenna for receivers provides the best results in most applications. This type of antenna typically has a 60–90 degree angle of reception and is designed for vertical or horizontal polarization. A linear-polarized antenna rejects reflected radio waves since polarization of reflected signals is typically shifted in some manner. In addition, a patch-type directional antenna provides rejection of reflected radio waves by rejecting signals coming from behind the patch antenna.

Other Applications

Other applications for wireless VIDS are construction management activities during road widening, intersection improvements, or temporary lane closures. Locations where road surfaces are continually damaged by heavy vehicles or severe weather can also benefit from the use of wireless VIDS. At these locations, permanent installations of the wireless system significantly reduces recurring maintenance costs and headaches.

Mid-block vehicle detection can benefit from the use of wireless VIDS by eliminating the need to install conduit and cabling from the mid-block detection location to the intersection controller cabinet. A higher-gain Yagi receiver antenna can be used to extend reception distance to more than a mile.

The use of wireless technology in VIDS applications expands the flexibility for deployment. Coaxial cable and other hard wiring are no longer limiting factors. ITERIS has integrated their proven Vantage VIDS with wireless video transmission to provide a more flexible VIDS product that accommodates almost any intersection and mid-block configuration.

Single-Channel vs. Multi-Channel Receivers

The single-channel receiver is designed for applications requiring a single camera. The single-channel receiver is shown in Figures 2 and 3.

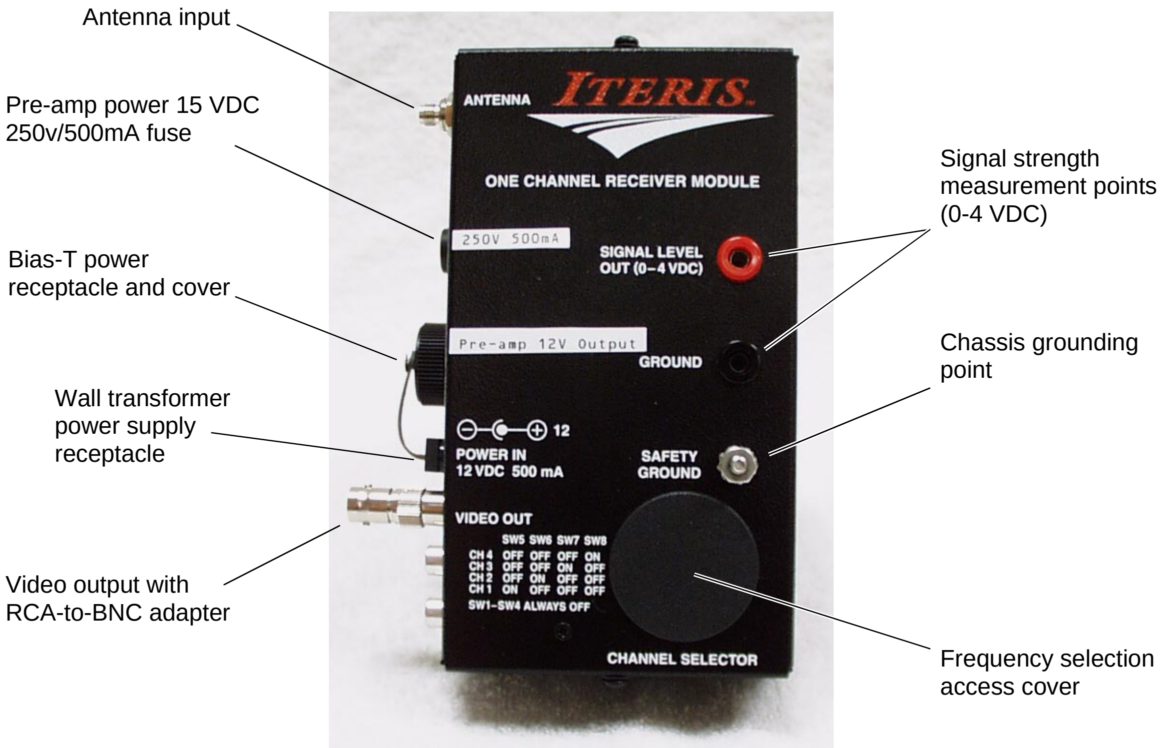


Figure 2. Single-Channel Receiver (Front View)

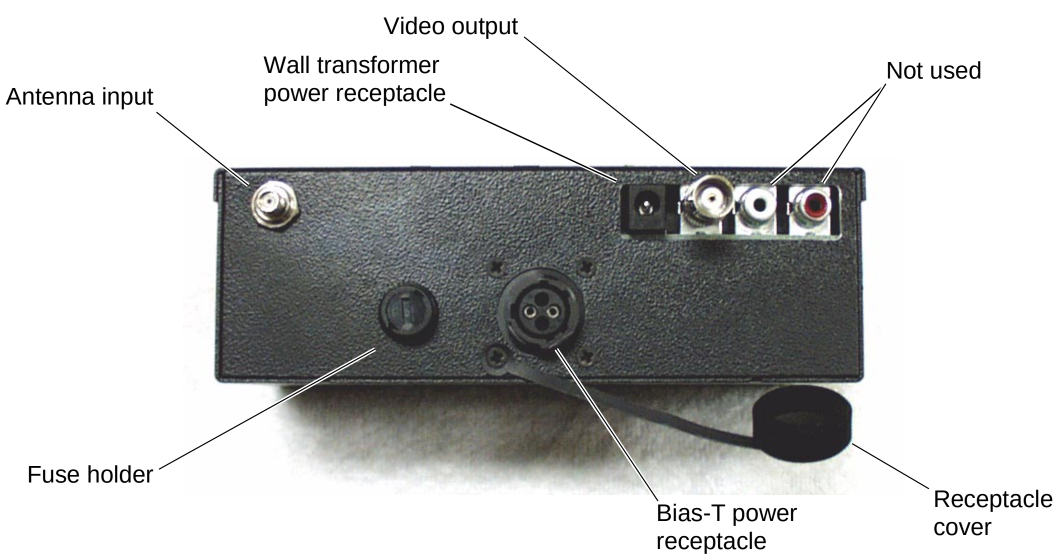


Figure 3. Single-Channel Receiver (Side View)

The multi-channel receiver is composed of two or four individual receivers combined into one unit. The external power supply and the signal splitter are not required when using a multi-channel receivers because they are already built into the unit.

A four-channel receiver is shown in Figure 4. The two-channel version has only two video outputs.

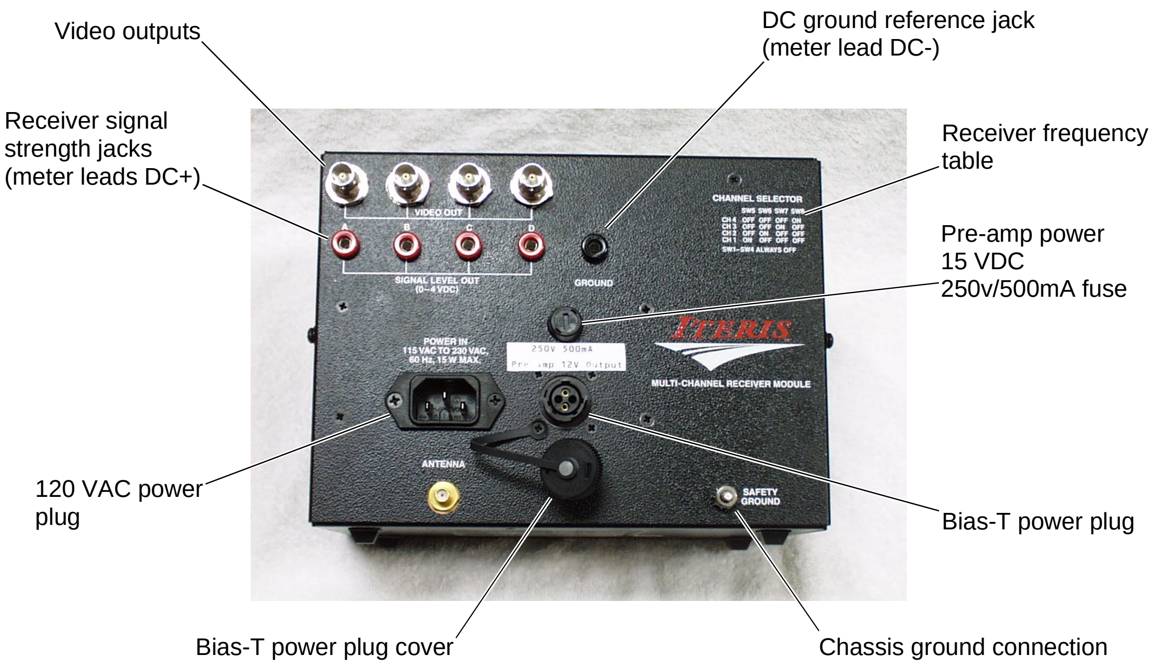


Figure 4. Multi-Channel Receiver

Tools, Equipment, and Supplies Required for Installation

Required Tools and Equipment

1. Bucket truck
2. Monitor
3. Lens Adjustment Module (LAM)
4. Volt/Ohmmeter (VOM)
5. Utility knife or coaxial stripper
6. Banding tool
7. Hammer
8. Screwdriver
9. Adjustable wrench
10. 9⁄16" and 1⅛" wrench
11. Needlenose pliers
12. Wire cutters
13. Wire strippers
14. Two-way communication equipment
15. High heat soldering iron and solder (100 Watt)
16. Meter probe adapters to male banana plug

Required Supplies

1. ½" or ¾" banding material or lag bolts (for pole bracket installations)
2. Camera bracket(s)
3. Antenna coaxial cable (use type LMR-400; see page 35 for specifications)
4. Antenna coaxial cable connectors, type N male (provided; RF Connectors distributor part no. RFN-1001-S type N male clamp and solder plug, Van Gorden manufacturer part no. N13STGP)
5. Photocell power adapter(s); also called power take-off (PTO)

6 Surge suppressor (provided; use PolyPhaser PSX, IS-MT50LN, or equivalent; see pages 36-37 for specifications)

7 N-to-SMA cable (type N on one end, type SMA on other end; provided)

8 Type N male-to-male barrel adapter (provided)

9 Signal splitter (required for installations using more than one single-channel receiver; use Mini-Circuits ZB4PD-42 or equivalent; see page 38 for specifications)

Note *The signal splitter is not required for installations using a multi-channel receiver.*

10 10 AWG green grounding wire

11 3'–6' BNC-to-BNC 75-Ohm coaxial jumper cables

12 Rubber tape, electrical tape, and ScotchKote

13 Tie wraps or hose clamps for the antenna pre-amp mounting

Installing the Camera and Receiver Unit

Basic Installation Steps

Installing the Vantage wireless camera and receiver unit requires the following steps:

1. Mounting the wireless camera/transmitter unit.
2. Connecting power to the wireless camera/transmitter unit.
3. Mounting the receiving antenna.
4. Connecting the receiving antenna pre-amp.
5. Installing the antenna coax cable.
6. Installing the antenna coax cable connectors.
7. Installing the bias-T and surge protection device.
8. Wireless receiver unit connections.
9. Determining wireless camera frequency.
10. Setting wireless receiver frequency.
11. Adjusting the antenna to obtain maximum RF signal strength.
12. Adjusting the wireless camera focus and field of view.

Mounting the Wireless Camera/Transmitter Unit

To mount the wireless camera/transmitter unit, follow the instructions for mounting a standard camera as described in your Vantage Installation and User Guide. The connections required for the wireless camera/transmitter unit are described in the next section of this guide.

Connecting Power to the Wireless Camera/Transmitter Unit

The RZ-3 wireless camera/transmitter unit can be powered using either 120 or 220 VAC. The photocell power adapter (or power take-off unit) can be used to provide 120 VAC to the camera/transmitter unit (see Figure 5.

The new photocell power adapter can be used for either 120 or 220 VAC applications as a convenient power source for the camera/transmitter unit. To use the photocell power adapter:

1. Remove the existing photocell.
2. Plug in the photocell power adapter in its place.
3. Install the original photocell into the top of the adapter.
4. Rotate the photocell as needed to orient it in the correct direction (pointing north).

In some cases, luminaires have shorting plugs installed in the photocell sockets. In this situation, the actual switching is probably occurring at the service or cabinet utilizing a single photocell and contactor relay. You can sometimes install a shorting cap at this point, remove the shorting caps on the luminaires, and install the Vantage photocell adapters along with individual photocells to avoid having to use another power source.

If you cannot use the photocell power adapter, you need to provide the camera with another source of 120 or 220 VAC. Use a three-conductor, Neoprene, type SJOW, 16-AWG power cord.

Figure 5. Photocell Power Adapter / Power Take-Off Unit (PTO)

The photocell power adapter comes with an attached Deutsch connector that plugs into the back of the camera/transmitter unit to provide power (see Figures 6 and 7).

The 10 AWG green wire needs to be attached to the camera mounting bracket and grounded to the signal pole arm (see Figure 8). When attaching the ground wire:

- Secure the ground bolt assembly to the camera bracket.
- Tighten the bottom of the bolt so that it digs into the pole and provides good electrical contact with the pole arm.

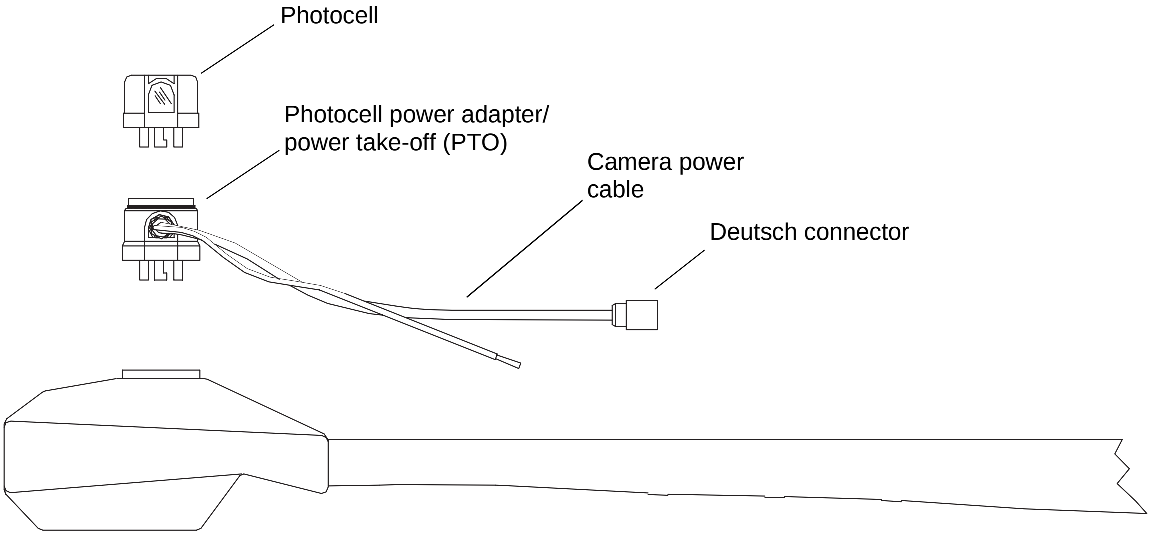


Figure 6. Power Connections Using Photocell Adapter (Exploded View)

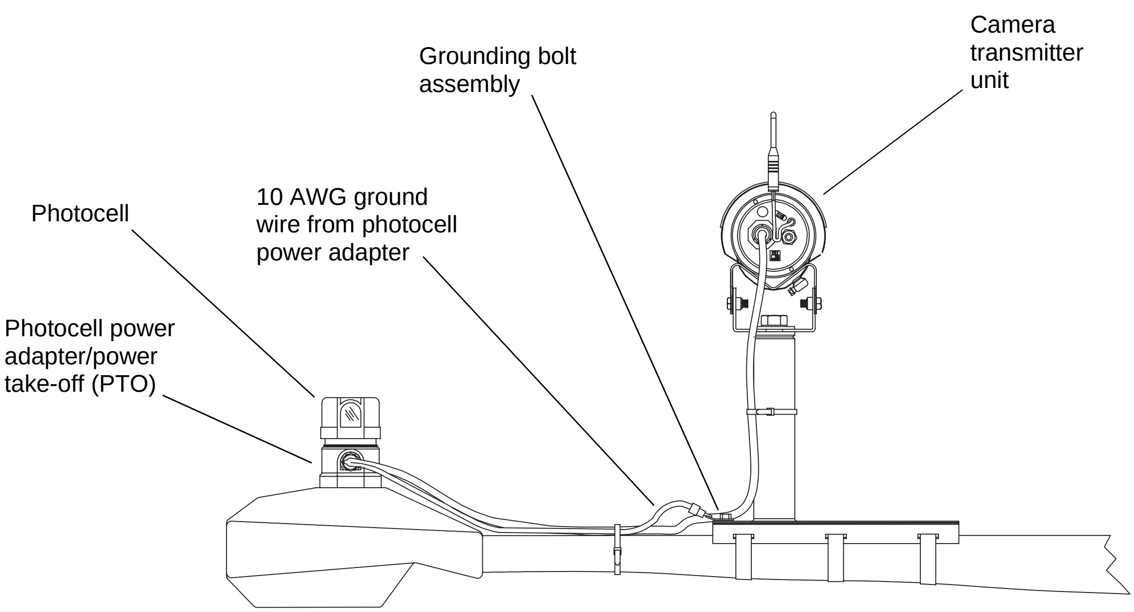


Figure 7. Power Connections Using Photocell Adapter

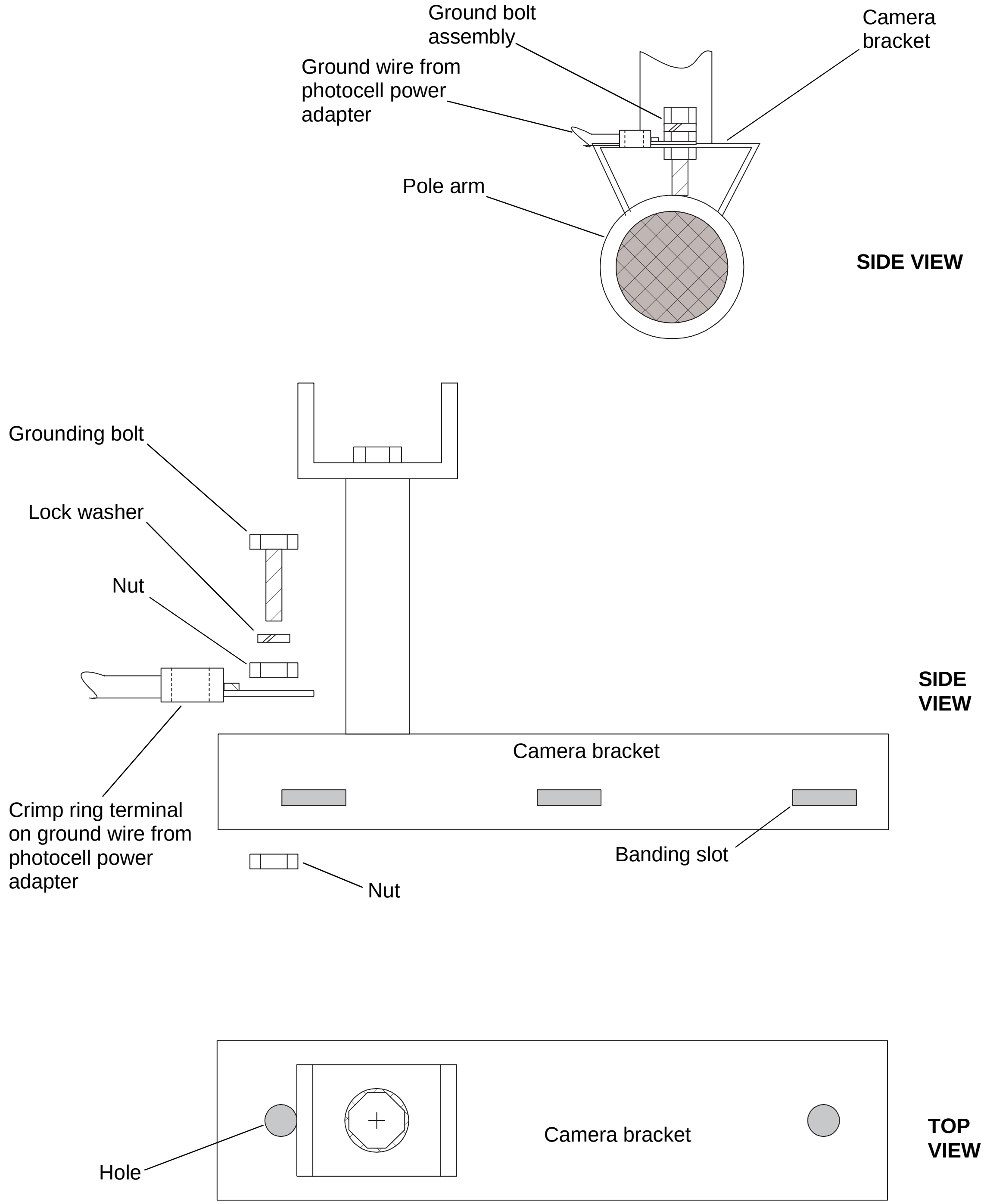


Figure 8. Grounding the Photocell Power Adapter

Mounting the Antenna

Mount the antenna using the antenna bracket as shown in Figure 9. The bracket can be mounted to the side of a pole using ½" or ¾" banding material. For a wooden pole, lag bolts can be used to secure the antenna mounting bracket to the pole instead of banding material.

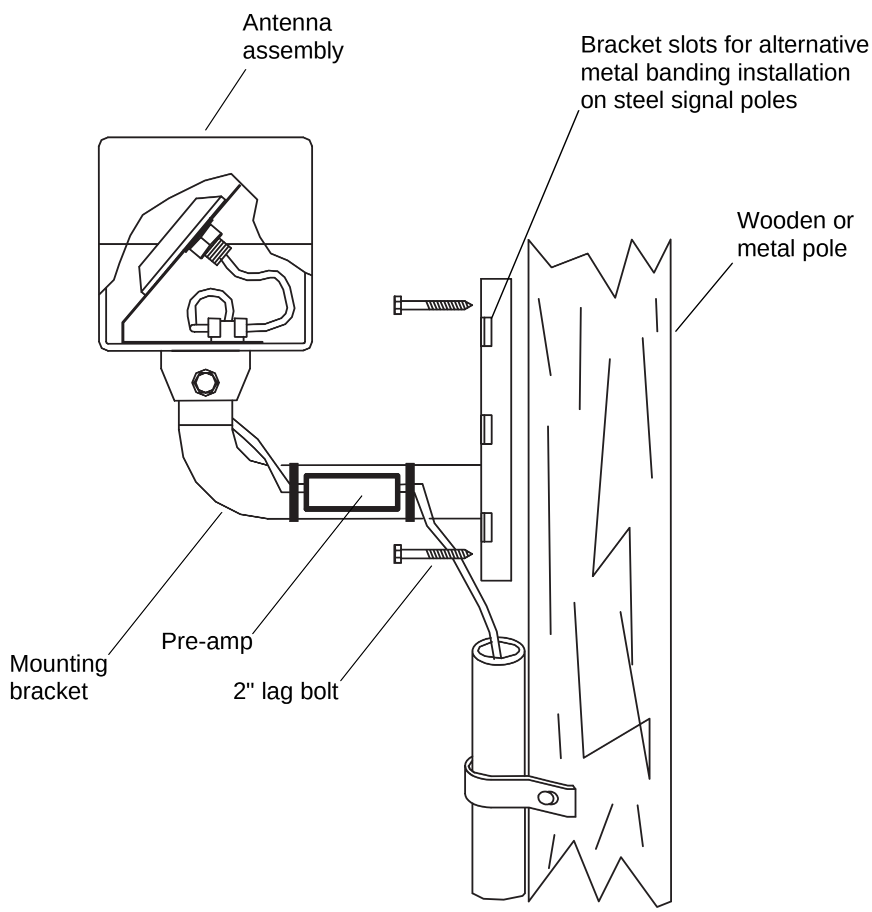


Figure 9. Antenna Mounting Location

Connecting the Antenna Pre-Amp

The antenna pre-amp is connected between the LMR-400 coaxial cable run to the cabinet and the receiver antenna.

Figure 10. Antenna Pre-Amp

The pre-amp should be connected as shown in Figure 11. When connecting the pre-amp:

- Do not mount the pre-amp in the cabinet.
- The pre-amp should be mounted as close to the antenna as possible.
- Make sure the bias-T and pre-amp are correctly oriented.
- For optimal performance, the total LMR-400 coax cable run from the antenna to the receiver should not exceed 150 feet.

To connect the pre-amp:

1. Connect the end of the antenna coax cable to the IN side of the pre-amp. See Figure 12.
2. Connect LMR-400 coax cable to the OUT side of the pre-amp and run the cable back to the cabinet.

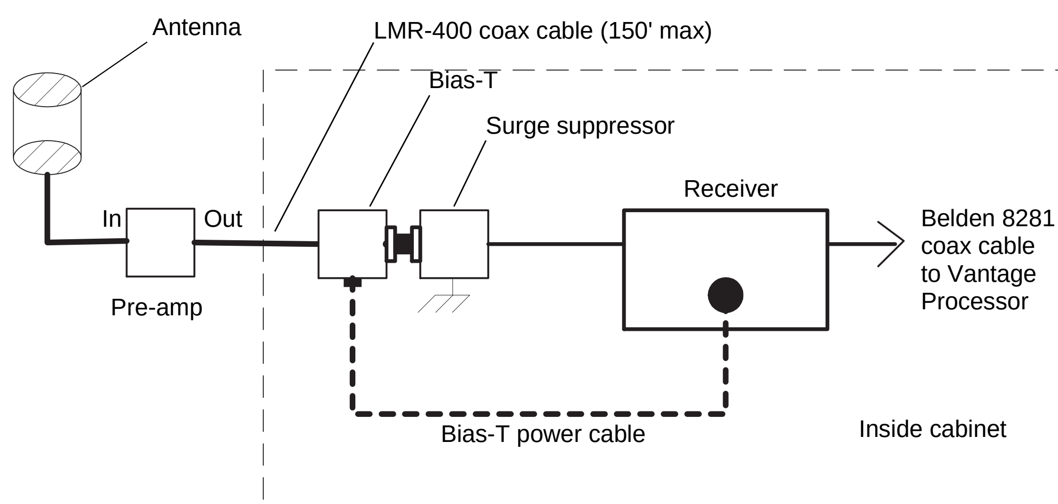


Figure 11. Pre-Amp Installation

Figure 12. Antenna and Pre-Amp

3 Connect the cabinet end of the LMR-400 cable to the RF DC side of the bias-T.

4 Properly weatherproof both pre-amp connections and any other external coax cable connections as shown in Figure 13.

To weatherproof coax cable connections:

a Wrap the connection with a layer of rubber tape.

b Wrap the connection with another layer of electrical tape.

c Cover the connection with a generous coating of 3M ScotchKote™.

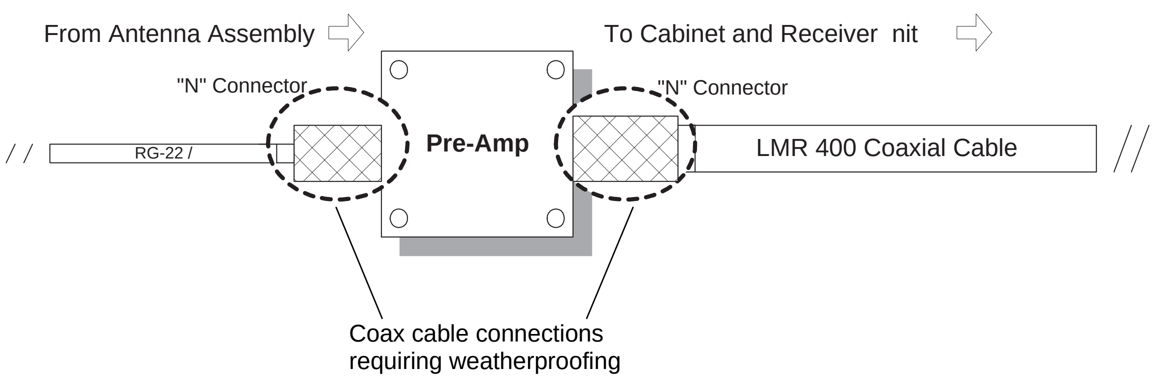


Figure 13. Weatherproofing Coax Cable Connections

5 Secure the pre-amp to the antenna mounting bracket arm using tie-wraps or stainless steel hose clamps (see Figure 14).

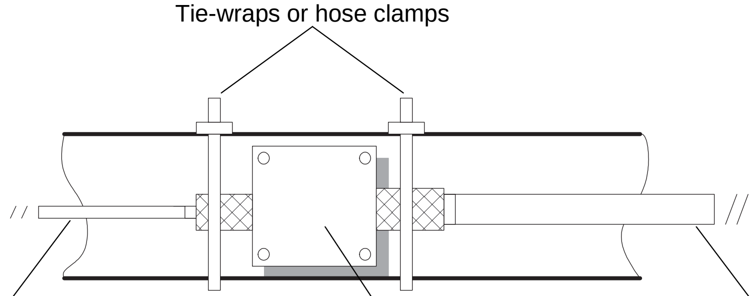


Figure 14. Securing the Pre-Amp

Installing the Receiver Coax Cable

CABLE TYPES

Although it depends on your installation configuration, coax cable must be pulled from the receiving antenna to the traffic control cabinet. Use type LMR-400 coax cable to connect from the receiving antenna to the cabinet. Coax cable specifications are on page 35. The coax cable run should not exceed 150 feet.

Coax cable connections inside the cabinet are described in *Making Connections Inside the Cabinet* on page 21.

If you are not using the photocell power adapter, the power cable for the camera should be an SJOW-type, three-conductor, 16-gauge cable.

INSTALLING COAX CONNECTORS

Coax cable specifications are listed on page 35.

To install a coax connector, follow these steps:

1 Use a sharp utility knife to strip the end of the coax cable as shown in Figure 15. Be careful not to score or nick the shield, dielectric, or center conductor.

2 Insert the end of the coax cable into the connector body as shown in Figure 16. Thread the connector body onto the outer sheath of the cable.

Note *If there is foil on the dielectric, make sure the foil does not make contact with the center conductor.*

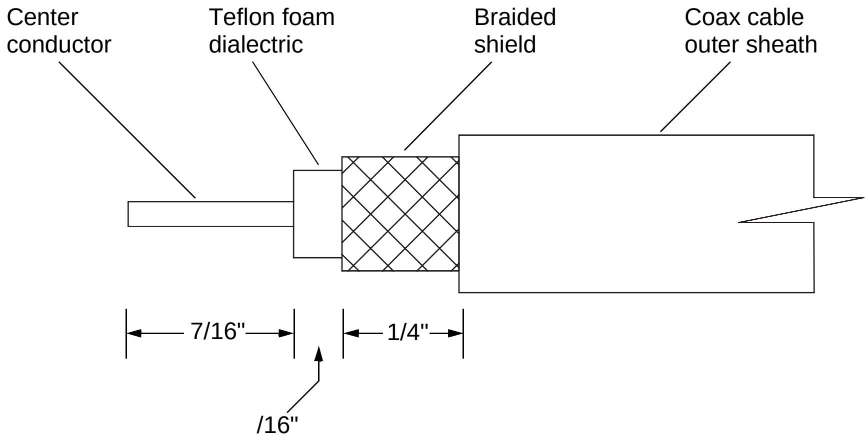


Figure 15. Stripping the Coax Cable

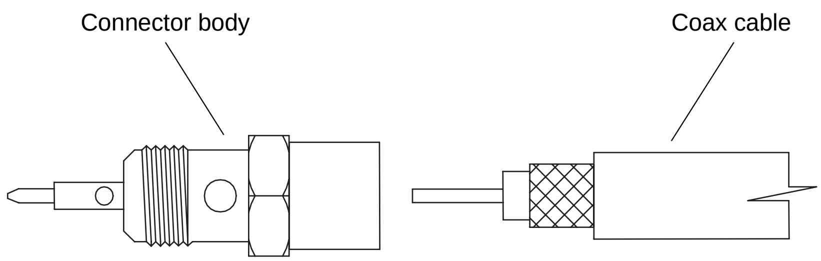


Figure 16. Attaching the Coax Connector Body

3 Check the connector for shorts as shown in Figure 17.

a Set your multimeter to the continuity or resistance setting (ohms).

b Place one meter test lead so it touches the connector center pin. Place the other test lead so it makes contact with the connector body. With both ends of the coaxial cable disconnected from any equipment, you should have infinite resistance between these points (no continuity).

If you do have a low resistance (continuity), there is a short somewhere in the coax cable or connector. It is most often at the connector due to improper assembly. Examine the coax for cuts or tears. If there is no visible damage, remove and re-install the connector.

Measure the connector again after it is removed from the cable. If the short disappears, the problem is in the connector. If there is still a short, the problem is with the cable.

Fix any problems before proceeding.

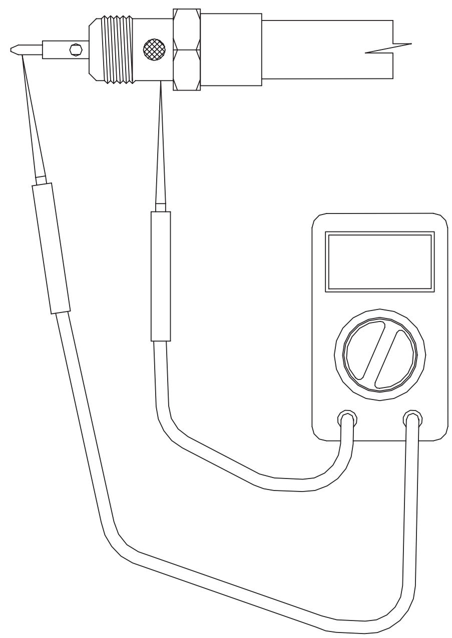


Figure 17. Checking the Coax Connector for a Short

4 Solder the cable to the connector body at the points indicated in Figure 18.

   a Make sure the soldering gun tip is clean and well tinned.

   b Make sure you can visibly see the braided shield and the copper center conductor through the holes in the connector body.

   c Heat the connector body with the soldering gun until solder flows into the holes for the center conductor and the braided shield. Repeat this process for the holes on both sides of the connector.

   Establish a good electrical connection between the coax braided shield and connector body, and between the center pin and coax center conductor. The solder connections should be bright and shiny, not dull and pitted (which results from cold solder).

   A low power soldering iron will not have the wattage to adequately heat up the connector to allow the solder to flow properly. Make sure you are using a high heat soldering gun with a rating of at least 100/140 watts.

CAUTION ***Do not overheat the connector. Overheating can cause the dielectric to melt and allow it to create a short between the center conductor and the shield.***

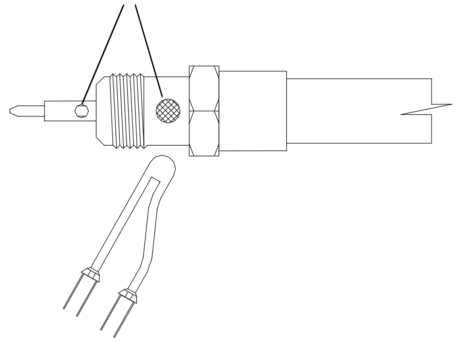


Figure 18. Soldering the Coax Cable and Connector Body

5 After soldering the center conductor in place, check the connector again for shorts as described in step 3.

6 Perform an additional test for continuity. To perform this test, take a jumper clip lead and short the center pin on one of the connectors to the connector body. Go to the other non-jumpered connector and measure from the center pin to the connector body. You should measure a low resistance (continuity).

If the resistance is over 10 ohms (no continuity), there is a problem. It could be a broken center conductor in the coax cable or (most likely) a poor or improper connection at the coaxial connectors. Isolate the problem as described in step 3b.

Note *Poor connections on the receiver coax cable can result in poor signal strength. Make sure these critical connections are done correctly. If you are not familiar with proper soldering techniques, consult another reference on the topic.*

7 After verifying that there are no shorts, screw the connector body and connector shell together as shown in Figure 19. Use two adjustable wrenches (one to hold the connector, the other to tighten it).

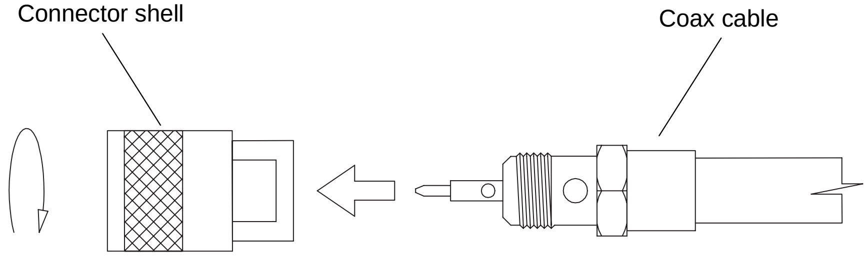


Figure 19. Assembling the Connector Body and Shell

Making Connections Inside the Cabinet

INSTALLING THE BIAS-T AND SURGE PROTECTION DEVICE

1 Attach the bias-T to the LMR-400 coax cable that you pulled into the cabinet from the antenna and pre-amp. Orient the bias-T so that the RF-DC side goes to the antenna and the RF side goes to the surge protector and receiver unit. See Figure 20.

⚠ **CAUTION** ***The bias-T must be oriented correctly and located between the pre-amp and surge protection device. Improper installation will result in poor operation and may also blow the receiver power supply fuse and damage the pre-amp, bias-T, and receiver unit.***

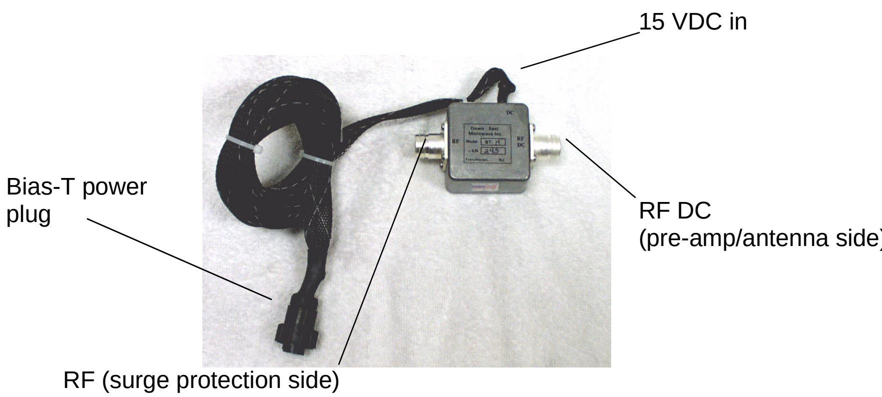


Figure 20. Bias-T

2 Plug the power cord from the bias-T into the 15 VDC receptacle on the receiver unit.

In addition to providing power to the bias-T, power is supplied to the pre-amp from the bias-T through the coax cable without interference to the video signal and without requiring additional wiring.

3 Install the male-to-male barrel adapter to the RF side of the bias-T, and connect the SURGE side of the surge protection device to the other end of the barrel adapter.

4 Assemble the surge protection device as shown in Figures 21 and 22. (Use a PolyPhaser IS-MT50LN, PSX, or suitable equivalent. See page 36 for specifications.)

- Be sure to install the orange “O” ring into the groove on the suppressor body.
- Properly ground the bracket using 10 AWG green wire.

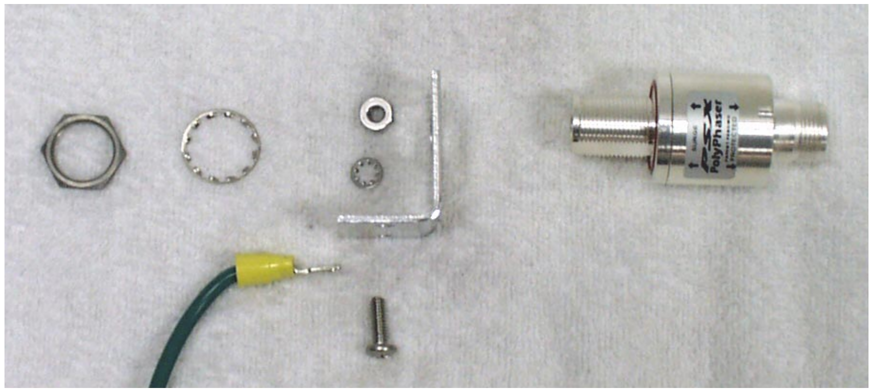


Figure 21. Surge Protection Device (Exploded View)

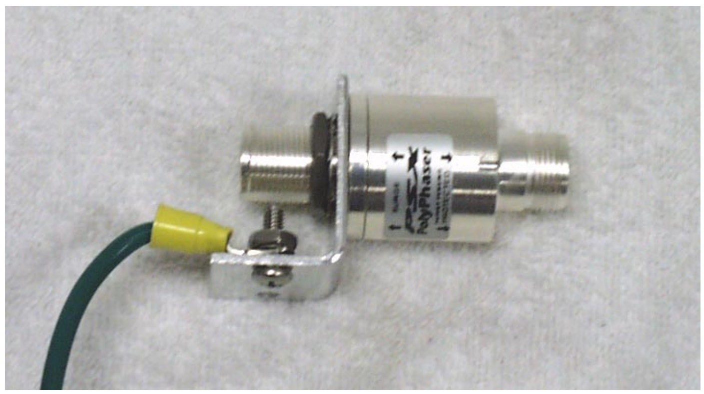


Figure 22. Surge Protection Device (Assembled)

5 Use the N-to-SMA adapter cable (see Figure 23) to connect the surge protection device to the receiver unit. The N connector side of the cable connects to the PROTECTED side of the surge protector, and the SMA side of the cable connects to the ANTENNA input connector on the receiver.

Figure 24 shows the bias-T, surge protection device, and receiver properly connected.

Figure 23. N-to-SMA Adapter Cable

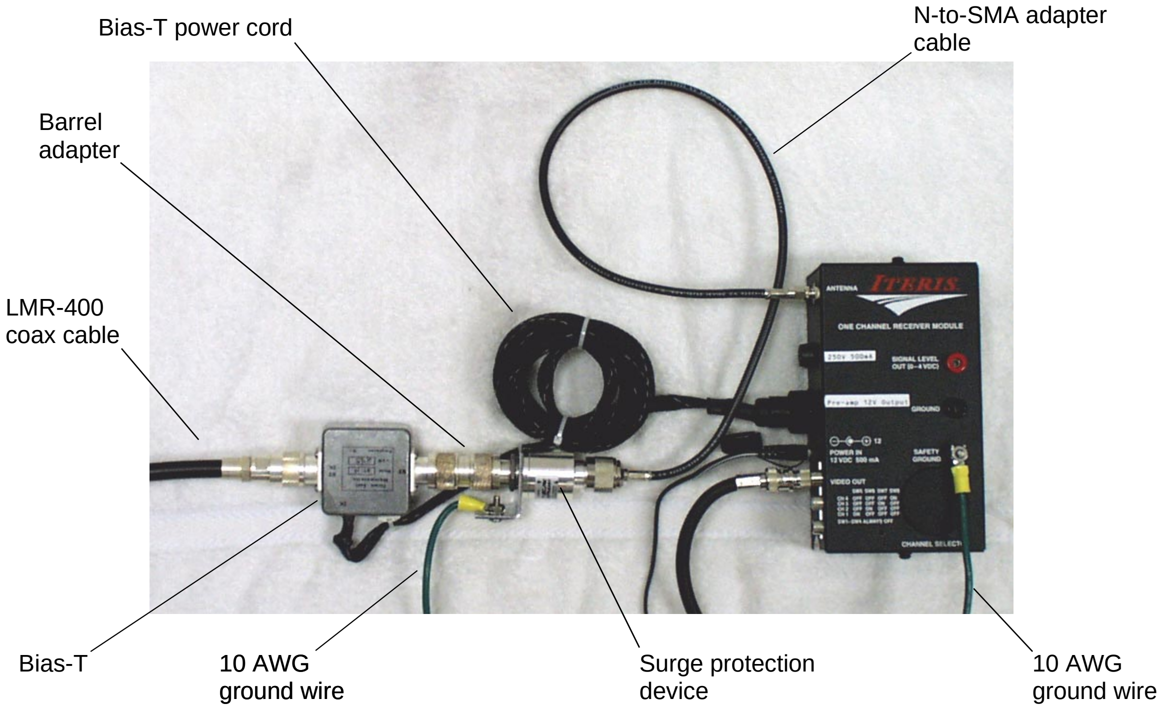


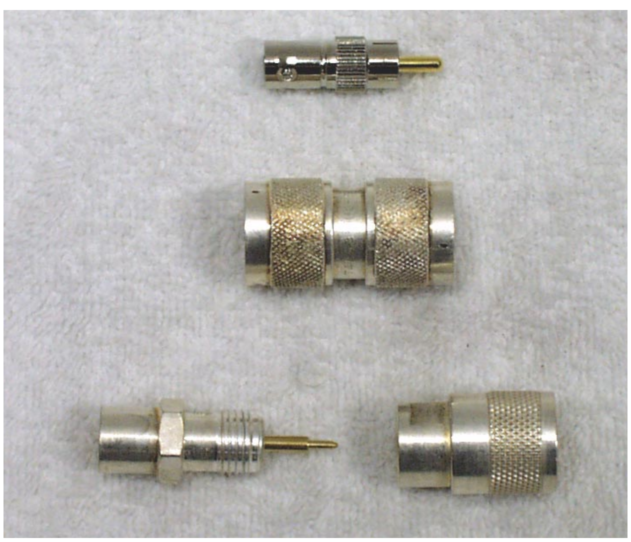
Figure 24. Bias-T, Surge Protection Device, and Receiver Correctly Connected

RECEIVER UNIT CONNECTIONS

Receiver units require several connections:

- The receiver unit requires a power source. Single-channel receivers have a plug-in wall transformer power supply that runs off 120 VAC. Multi-channel receivers have a detachable power cord that needs to be plugged into a 120 VAC outlet.
- As described previously, the bias-T power cord must be plugged into the 15 VDC receptacle on the receiver unit in order for the pre-amp to operate properly.
- The SMA side of the N-to-SMA adapter cable must be connected to the SMA antenna input on the receiver.
- A short BNC-to-BNC jumper cable of Belden 8281F must be attached from the video output to the Vantage unit video input. Single-channel receivers require an RCA-to-BNC adapter to adapt the RCA-type video output to a BNC-type output connector.
- The receiver chassis must be grounded by attaching a green 10 AWG wire to the chassis grounding lug and running the wire back to the cabinet grounding buss.

Figure 25 shows some of connectors and adapters that may be needed when making these connections.



RCA-to-BNC adapter

Male-to-male barrel connector

N-type connector for
LMR-400 coax cable

Figure 25. Connectors and Adapters

INSTALLING A SIGNAL SPLITTER

If you have multiple cameras and single-channel receivers, you also need to install a signal splitter. Specifications for the signal splitter are on page 38.

Note *A separate signal splitter is not necessary with a multi-channel receiver, which has a signal splitter inside the unit.*

In this configuration, connect a jumper cable between the surge protector and the input on the signal splitter, and then connect a jumper cable between an output on the signal splitter and each receiver unit. See Figure 26.

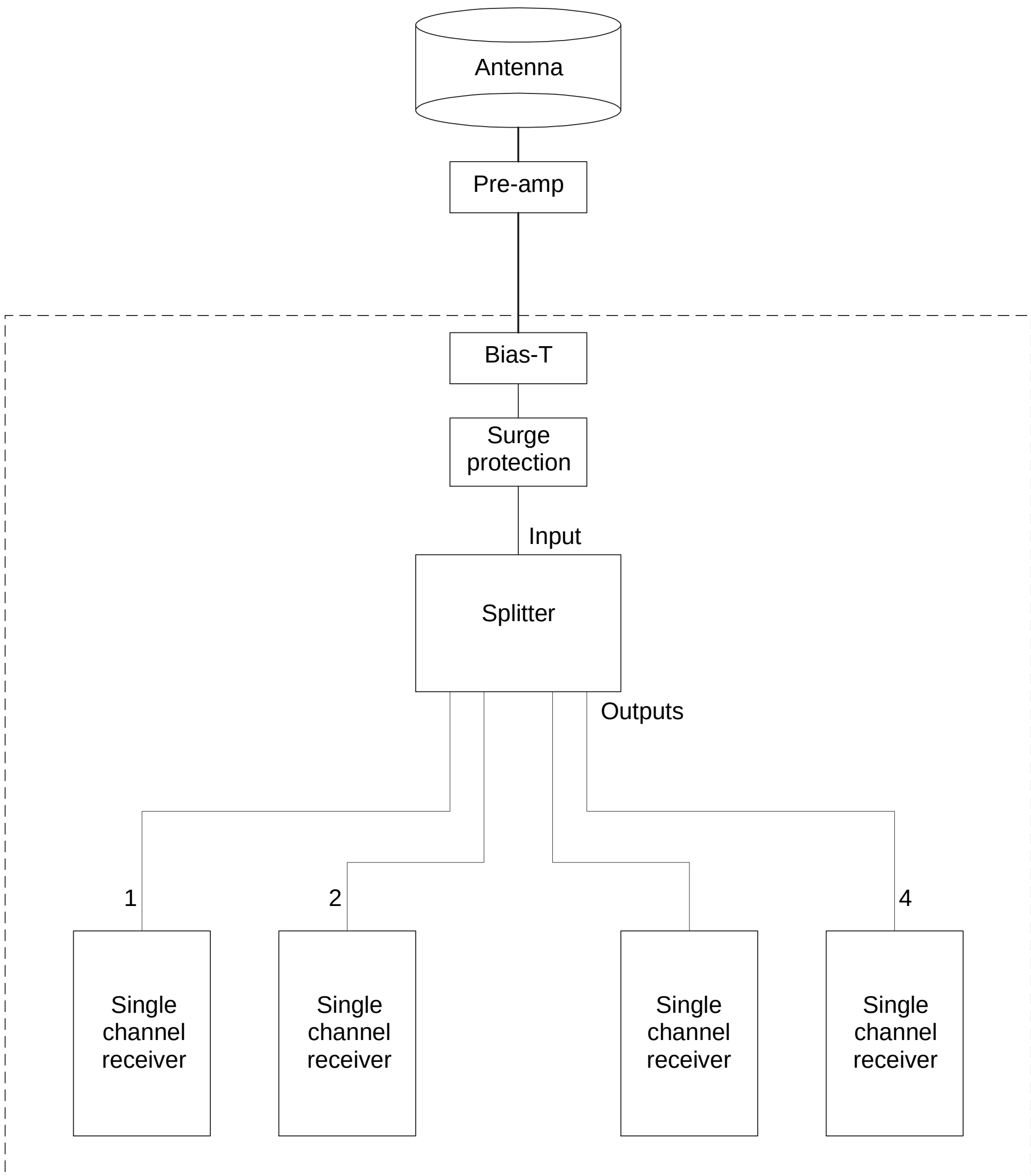


Figure 26. Signal Splitter Connections

Determining the Camera Transmitter Frequency

The camera transmitter frequency is determined by the number on the front face of the camera (see Figure 27.)

Note *If you have multiple wireless cameras at the location, each camera must be a different frequency.*

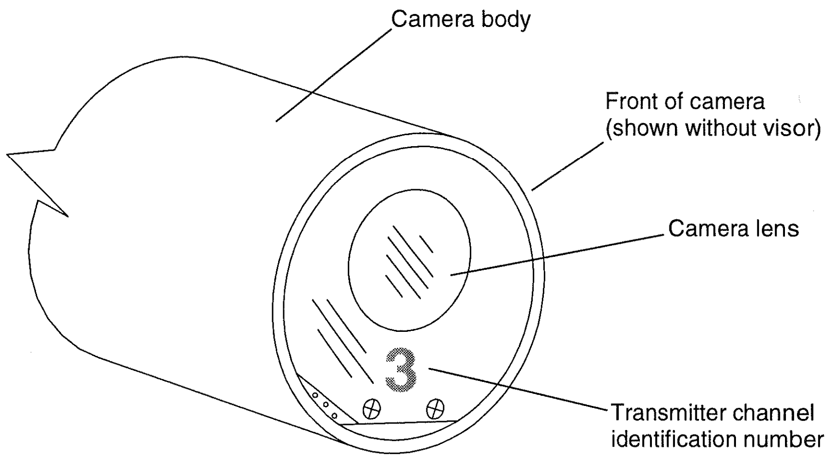


Figure 27. Camera Transmitter ID Number

Camera transmitter frequencies are listed in Table 1.

Table 1. Camera Transmitter Frequencies

ID Number	Frequency
1	~~2400 MHz~~ 2410 mHz
2	~~2427 MHz~~ 2430MHz
3	~~2454 MHz~~ 2450MHz
4	~~2481 MHz~~ 2470MHz
5	NOT USE
6	2427MHz
7	2454MHz
8	NOT USE

Setting the Receiver Frequency

SETTING THE FREQUENCY FOR SINGLE-CHANNEL RECEIVERS

The frequency on the single-channel receiver is set using DIP switches. The location of the DIP switches is shown in Figure 28.

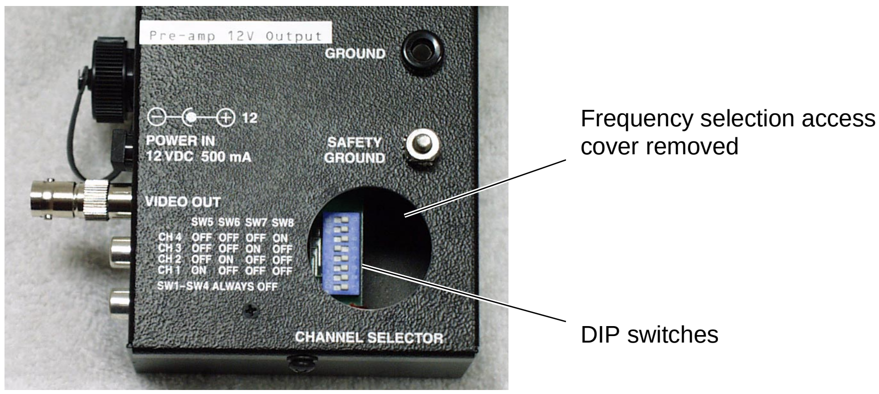


Figure 28. Single-Channel Receiver DIP Switches

To set the frequency for a receiver, carefully remove the circular access cover on the receiver unit to access the DIP switches, then set the DIP switches to the appropriate frequency as listed in Table 2 and shown in Figure 29.

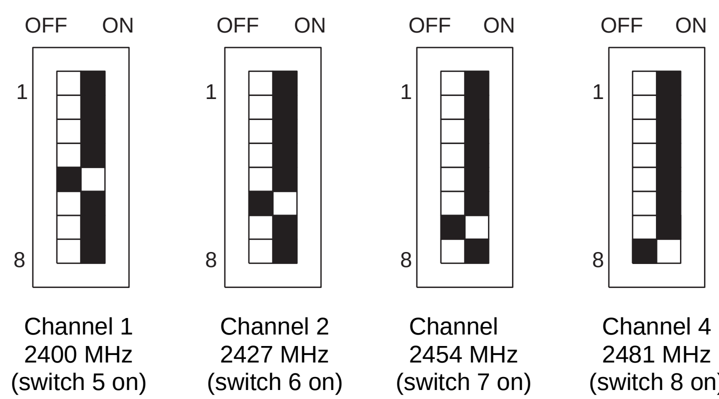


Figure 29. Receiver Frequency DIP Switch Settings

CAUTION ***Turn on the DIP switch for one frequency only, and leave all other DIP switches off. If you turn on the DIP switch for more than one frequency, you may damage the receiver.***

Table 2. Receiver Frequency DIP Switch Settings

Camera ID number	To set the receiver to this frequency...	Set this DIP switch on and leave all others off
1	2410MHz ~~2400 MHz~~ ~~NOT USE~~	DIP switch ~~5~~ 1
2	2430MHz ~~2427 MHz~~	DIP switch ~~6~~ 2
3	2450MHz ~~2454 MHz~~	DIP switch ~~7~~ 3
4	2470MHz ~~2481 MHz~~ NOT USE	DIP switch ~~8~~ 4

Setting the Frequency for Multi-Channel Receivers

Figure 30 shows a multi-channel receiver with the access cover removed from the right side of the unit to expose the frequency selection DIP switches. (Figure 30 shows a four-channel unit; a two-channel unit has only two DIP switch sets.)

To set the frequency, carefully remove the access cover on the receiver unit to access the DIP switches, then set each DIP switch set to the appropriate frequency. The frequency settings are the same as for single-channel receivers and are listed in Table 2. You can also refer to Figure 29.

Each DIP switch set should correlate to its camera/transmitter unit, and no two should be set to the same frequency.

⚠ CAUTION ***For each DIP switch set, turn on the DIP switch for one frequency only, and leave all other DIP switches off. If you turn on the DIP switch for more than one frequency, you may damage the receiver.***

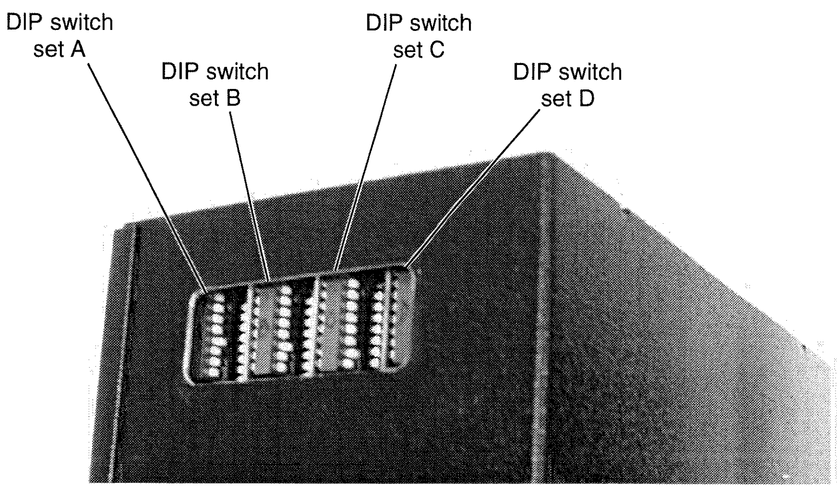


Figure 30. Multi-Channel Receiver DIP Switches

To improve performance and noise immunity, it is recommended to use the following frequency assignments on multi-channel wireless receiver units. This configuration provides maximum channel separation and helps prevent internal cross-talk.

Dip switch set A—	Channel 3 / ~~2454 MHz~~ 2450 MHz
Dip switch set B—	Channel 1 / ~~2400 MHz~~ 2410 MHz
Dip switch set C—	Channel 4 / ~~2481 MHz~~ 2470 MHz
Dip switch set D—	Channel 2 / ~~2427 MHz~~ 2430 MHz

Tuning the Receiving Antenna

After the receiving antenna has been mounted and connected, it must be adjusted to provide maximum signal strength to the receiver unit. Correct antenna adjustment is imperative for optimal system performance.

The antenna is directional, and you can identify the front by the black dot on the cylindrical antenna housing (see Figure 31). Position the antenna so that the black dot is facing the camera/transmitter units.

Make sure there are no obstacles between the camera/transmitter unit and the receiving antenna. Communication is limited to "line of sight."

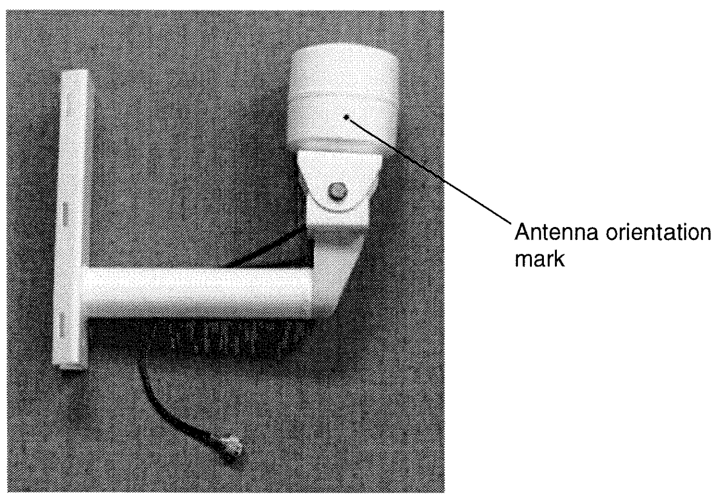


Figure 31. Antenna Orientation Mark

The receiving antenna's effective receiving window is approximately 120 degrees (see Figure 32). All cameras must be inside this operating window.

To tune the receiving antenna, rotate the antenna housing while monitoring the receiver's relative signal strength.

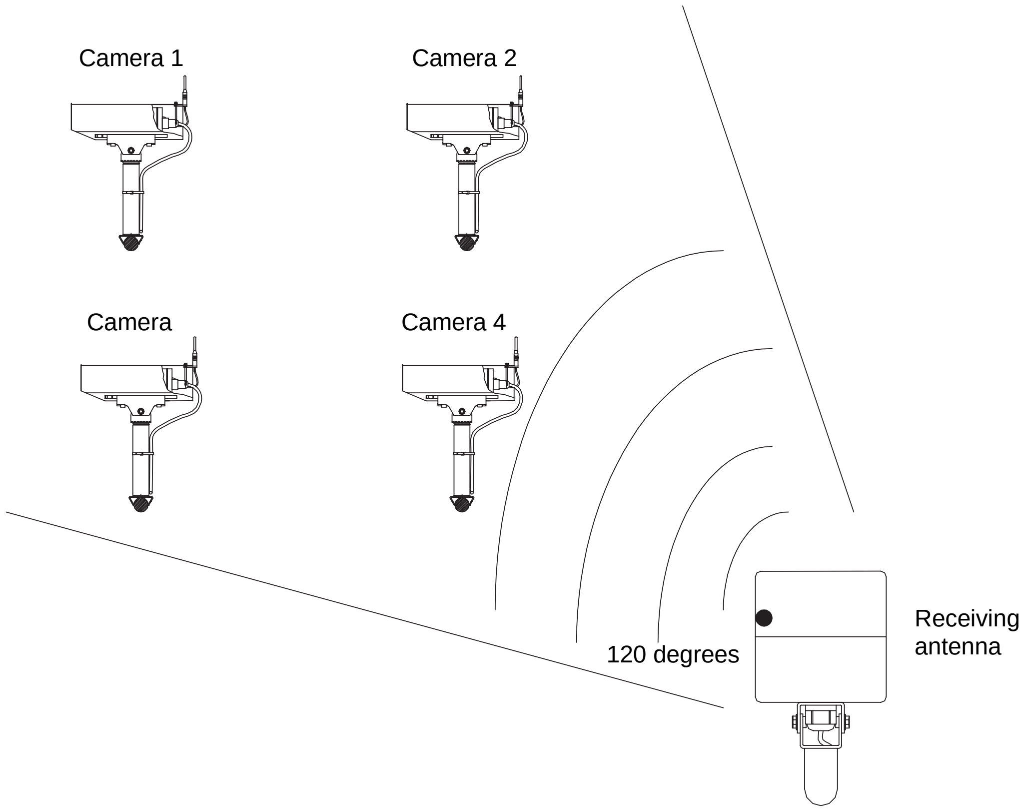


Figure 32. Tuning the Receiving Antenna

Measure the receiver signal strength using the DC measurement scale on a standard multimeter. Using banana-type jack adapters, insert the meter probes into the color-coded test points on the receiver unit to measure the DC signal strength. (For single-channel receivers, see Figure 2 on page 6 and Figure 33. For multi-channel receivers, see Figure 4 on page 7 and Figure 34.)

The signal strength should be 1–4 VDC. For optimal performance, the signal strength should exceed 1.5 VDC.

Rotate the receiving antenna until you obtain the maximum average signal strength. When you find the best position, tighten the antenna permanently into place. Make sure the coaxial cable has a drip loop, and tie-wrap it for added strain relief.

If you have multiple single-channel receivers or a multi-channel receiver, you need to obtain the highest average signal strength for each receiver or channel. Realize that adjusting the antenna to obtain a higher reading for one may degrade the signal strength of another. Adjust the receiving antenna to find a happy medium.

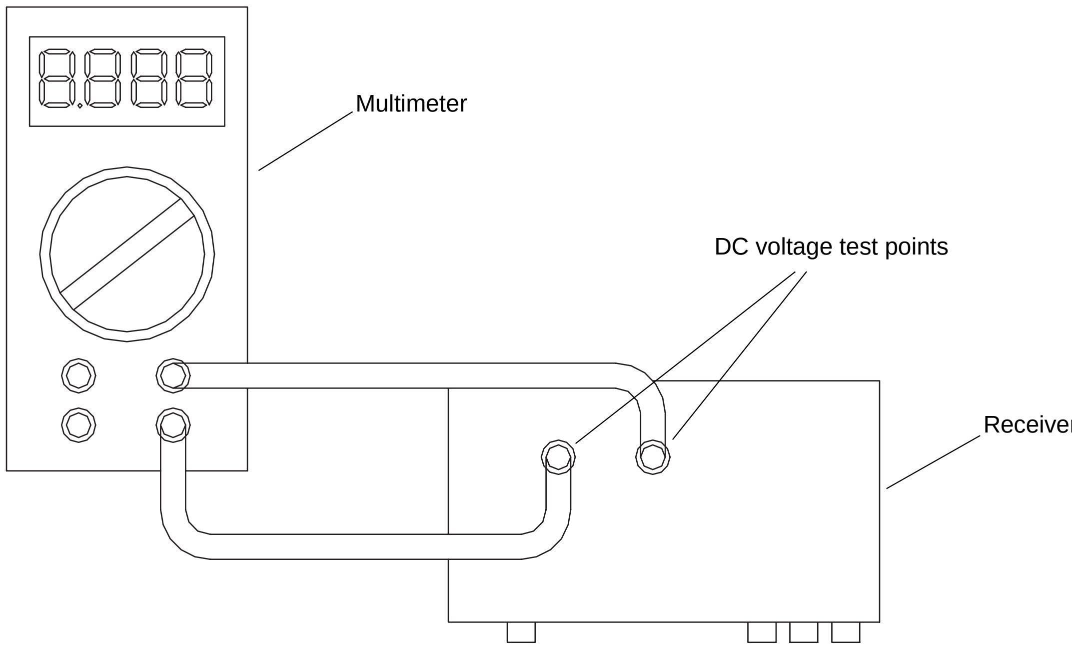


Figure 33. Measuring the Receiver Signal Strength (Single-Channel Receiver)

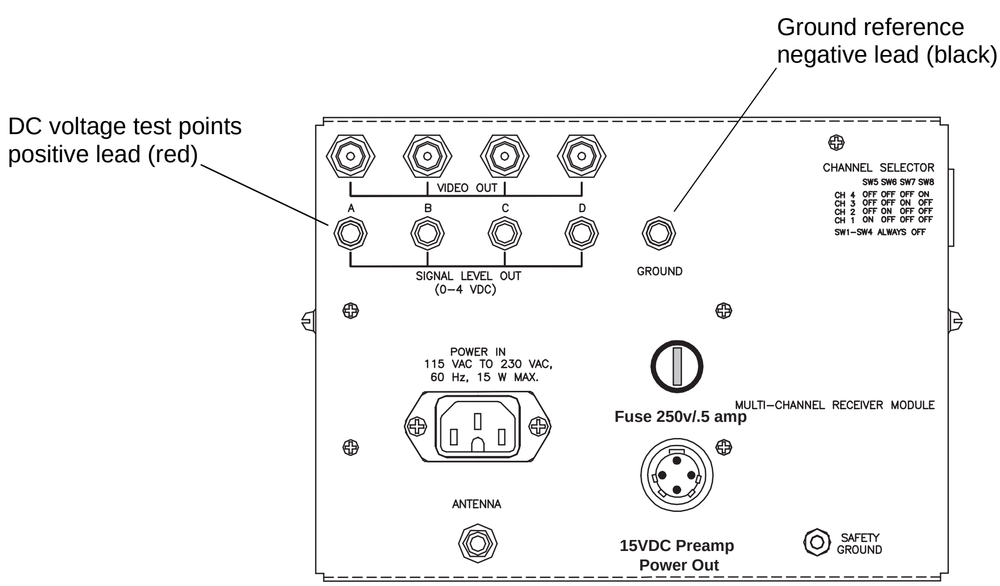


Figure 34. Measuring the Receiver Signal Strength (Multi-Channel Receiver

Adjusting the Camera Focus and Field of View

The field of view and focusing adjustment is the same for the wireless camera as for the normal Vantage video camera. Refer to your Vantage product user and installation guide for a description of how to adjust the camera focus and field of view.

To adjust the camera focus and field of view, you need to connect a Lens Adjustment Module (LAM) to the BNC connector on the back of the camera as shown in Figure 35.

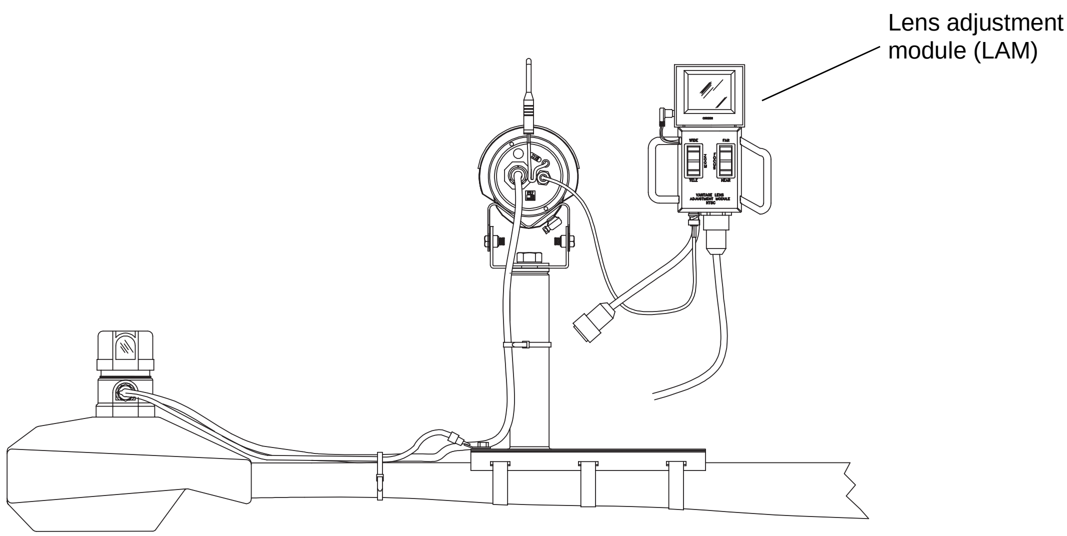


Figure 35. Connecting a LAM to the Camera

Troubleshooting

If you have no video, poor video, or low signal strength, check the following table

Table 3. Troubleshooting

Potential Problem	See Page
Are all camera/transmitter units within the 120 degree operating window of the receiving antenna?	29
Is the antenna adjusted to provide a signal strength of 1.5 VDC or greater to all camera/transmitter units?	29
Are their any obstructions blocking the receiving antennas “line of sight” path to any of the camera/transmitter units?	29
Are the pre-amp, bias-T, and surge protector connected in the correct order and orientation? • Make sure that the bias-T is in front of the surge protector (between the surge protector and the antenna pre-amp). • Make sure that the RF DC side of the bias-T is connected to the pre-amp and that the RF side of the bias-T is connected to the surge protector. • Make sure the IN side of the pre-amp goes to the antenna and the OUT side of the pre-amp goes to the RF DC side of the bias-T.	21
Make sure that the pre-amp is mounted with the receiving antenna.	15
Make sure that the pre-amp connections are correctly weatherproofed.	16
Make sure that the bias-T’s power cord is plugged into the receiver unit.	21
Check the 15 VDC fuse in the fuse holder above the bias-T power plug to make sure it is still good. Fuse is 250V 500mA.	6, 7
Check the coax cable from the cabinet to the receiving antenna: • Make sure the cable run is less than 150 feet. • Make sure that LMR-400 cable is used. • Make sure that the connectors are installed correctly.	15
Make sure the camera/transmitter rubber duck antenna is in a vertical (NOT horizontal) position.	4

Specifications

Vantage Wireless Camera Specifications

Table 4. Vantage Wireless Camera Specifications

	North America	**International**
Signal format	NTSC	PAL
Input	Composite video 1.0Vp-p, 75 ohms	Composite video 1.0Vp-p, 75 ohms
Output	Composite video 1.0Vp-p, 75 ohms	Composite video 1.0Vp-p, 75 ohms
Power source	89V-240V AC, 60Hz	215V-265V AC, 50Hz
Power consumption	17W (max)	17W (max)
Operating temperature	-31°F to 140°F	-35°C to 60°C
Operating humidity	0% to 100%	0% to 100%
Transmitter range	Up to 500 feet with clear line of sight	Up to 150 m with clear line of sight
Dimensions	5 in. (width) 5.5 in. (height) 14 in. (length)	127 mm (width) 140 mm (height) 355.6 mm (length)
Weight	5.5 lb.	2.5 kg

LMR-400 Coax Cable Specifications

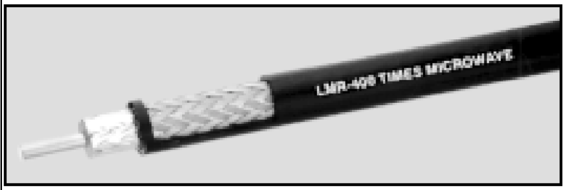
LMR-400

Flexible Communications Cable

TIMES MICROWAVE SYSTEMS
A Smiths Industries company
358 Hall Ave., Wallingford, CT, 06492-5039 U.S.A.
Phone: 203-949-8400 Fax: 203-949-8423

Ideal for…

- Drop-in replacement for RG-8/9913 Air-Dielectric type Cable
- Jumper Assemblies in Wireless Communications Systems
- Short Antenna Feeder runs
- Any application (e.g. WLL, GPS, LMR) requiring an easily routed, low loss RF cable



• **Flexible:** With a 1-inch minimum bend radius, LMR-400 cable can be easily routed into and through tight spaces without kinking. The LMR bonded-tape outer conductor provides superior flexibility and ease of bending compared to corrugated copper or smooth wall copper hard-line cables.

• **Low Loss:** LMR-400 has the lowest loss of any RG8/RG213 'type' cable. This is achieved through the use of a high velocity gas-injected closed cell foam dielectric and bonded aluminum tape outer conductor.

• **Weatherproof:** The UV protected black polyethylene jacket makes the cable rugged and resistant to the full range of outdoor environments. The DB version of the cable includes a water blocking material within the braid to protect the cable from moisture ingress and eliminate any potential for corrosion in harsh environments or should the jacket become damaged. Various jacket materials are available to address other indoor and outdoor requirements.

• **RF Shielding:** The bonded aluminum tape outer conductor is overlapped to provide 100% coverage, resulting in >90 dB RF shielding (>180 dB crosstalk) and excellent interference immunity (ingress and egress).

• **Phase Stability:** The intimately bonded structure and foam dielectric of LMR cables provide excellent phase stability over temperature and with bending. The high velocity dielectric results in superior phase stability as compared with solid and air-spaced dielectric cables.

•**Connectors and Assemblies:** Times Microwave provides ***FlexTech™*** jumper cable assemblies fabricated with LMR-400-DB watertight cable and a variety of connector interface combinations (ref: FlexTech pages). Custom assemblies with phase matching, insertion loss matching, and other special electrical or marking requirements can also be provided. A full range of connectors, including 'EZ' install (non-solder) types, is available for LMR-400 cable as shown on the next page.

Part Description

Part Number	Designation	Jacket	Stock Code
LMR-400	Standard outdoor cable	Polyethylene	54001
LMR-400-DB	Watertight cable	Polyethylene	54091
LMR-400-FR	Fire retardant (CATVR)	Non-Halogen	54030
LMR-400-PVC	Indoor cable (CATVR)	PVC	54073
LMR-400-UltraFlex	UltraFlex cable	TPE	54040
LMR-400-LLPL	Fire Retardant (CATVP)	Plenum	54070

Mechanical Specifications

Minimum bend radius	1.0 in	25.4 mm
Bending moment	0.5 ft lbs	0.68 N-m
Weight	0.068 lbs/ft	0.10 kG/m
Tensile strength	160 lbs	72.6 kG
Flat plate crush	40 lb/in	0.71 g/mm

Construction Specifications

Part Designation	Material	Inches	mm
Inner conductor	Solid BCCAl	0.108	2.74
Dielectric	Foam polyethylene	0.285	7.24
Outer conductor	Aluminum tape	0.291	7.39
Overall braid	Tinned copper	0.320	8.13
Standard jacket	Black polyethylene	0.405	10.29

Environmental Specifications

	°F	°C
Installation temperature range	-40/+185	-40/+85
Storage temperature range	-94/+185	-70/+85
Operating temperature range	-40/+185	-40/+85

Electrical Specifications

Cutoff frequency	16.2 GHz	
Velocity of propagation	85%	
Voltage withstand	2,500 VDC	
Peak power	16 kW	
DC resistance		
Inner conductor, ohms	1.39/1,000'	4.56/km
Outer conductor, ohms	1.65 /1,000'	5.41/km
Jacket spark	8,000 VRMS	
Capacitance	23.9 pF/ft	78.40 pF/m
Inductance	0.060 uH/ft	0.20 uH/m
Shielding effectiveness	>90 dB	
Phase stability	<10 ppm/ °C	

Frequency MHz	Attenuation dB/100 ft	Attenuation dB/100 m	Avg. Power kW
30 MHz	0.7	2.2	3.3
50 MHz	0.9	2.9	2.6
150 MHz	1.5	5.0	1.5
220 MHz	1.9	6.1	1.2
450 MHz	2.7	8.9	0.83
900 MHz	3.9	12.8	0.58
1,500 MHz	5.1	16.8	0.44
1,800 MHz	5.7	18.6	0.40
2,000 MHz	6.0	19.6	0.37
2,500 MHz	6.8	22.2	0.33

Add 15% to tabulated attenuation for LMR-UltraFlex

Calculate Attenuation = $(0.12229) \cdot \sqrt{FMHz} + (0.00026) \cdot FMHz$

(interactive calculator available at http://www.timesmicrowave.com)

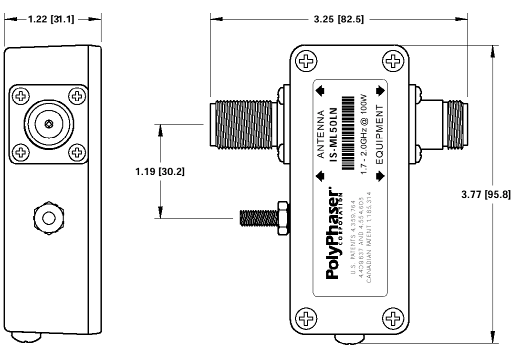
Attenuation: VSWR=1.0 ; Ambient = +25°C (77°F)

Power: VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

Surge Suppressor Specifications

dc Blocked

Model shown: IS-ML50LN, bulkhead mount



Product Dimensions: IS-ML50LN

MICROWAVE COAXIAL PROTECTORS

APPLICATION:

Lightning/NEMP protection for any frequency range from 1GHz to 3GHz for point to point links receive/transmit and broadcast to 100W.

- 50Ω models; 1GHz to 3GHz
- Multi-strike capability
- Low strike throughput energy
- Bulkhead mounting/grounding *(flange mount adapter, page 50)*
- Not weather resistant
- Weatherize using WK-1 *(see page 54)*
- 18-8 stainless steel hardware
- N silver shell and gold center pin

Mil Specs: Many — call with requirements

SPECIFICATIONS:

Surge: 20kA IEC 1000-4-5 8/20µs waveform 138 Joules

Turn-on: 600Vdc ±20%

Turn-on Time: 2.5ns for 2kV/ns

Insertion Loss: ≤0.1dB *VSWR:* ≤1.1 to 1 *Power:* 100W

NEMP Peak Throughput Voltage: 56Vp typical for 3/250ns waveform

Temperature: -45°C to +85°C Storage/Operating +50°C

Vibration: 1G up to 100Hz

ORDER INFORMATION: N CONNECTORS/BULKHEAD

IS-MR50LN for 980MHz to 1.8GHz, Throughput Energy: 4.0µJ*

IS-ML50LN for 1.7GHz to 2.0GHz, Throughput Energy: 15.0µJ*

IS-MH50LN for 2.0GHz to 2.3GHz, Throughput Energy: 4.0nJ*

IS-MT50LN for 2.1GHz to 2.6GHz, Throughput Energy: 4.0nJ*

IS-MU50LN for 2.4GHz to 3.0GHz, Throughput Energy: 32.0nJ*

Add suffix: ***-MA*** *for male antenna port connector*
-ME *for male equipment port connector*

** Typical*
Energy based on 6kV/3kA 8/20µs waveform.

PSX SERIES*

Features

- Industry's Best RF Performance
- Compact, Integrated Connector Housing
- Fully Weatherized
- Bellcore TA-NWT-000487
  120 mph wind driven rain
- dc Blocked
- Industry's Lowest Throughput Energy
- Maintenance Free
- Multi-Strike Capability

*Patent Pending

Technical Specifications

(per Qualification Testing)

Surge:
20kA IEC 1000-4-5 8/20μs Waveform

VSWR: ≤1.1 to 1

Insertion Loss: ≤0.1dB

Frequency Range: 1.2 to 2.8GHz

Power: 300W continuous

Operational Temperature Range: -40°C to +85°C

Vibration: 1G @ 5Hz to 100Hz

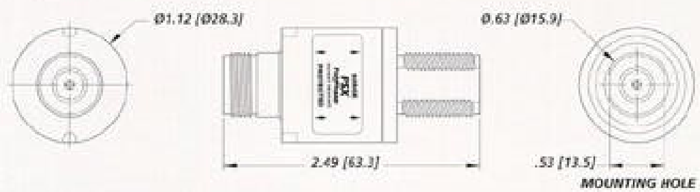
Throughput Energy:

≤0.5μJ for 3kA @8/20μs Waveform

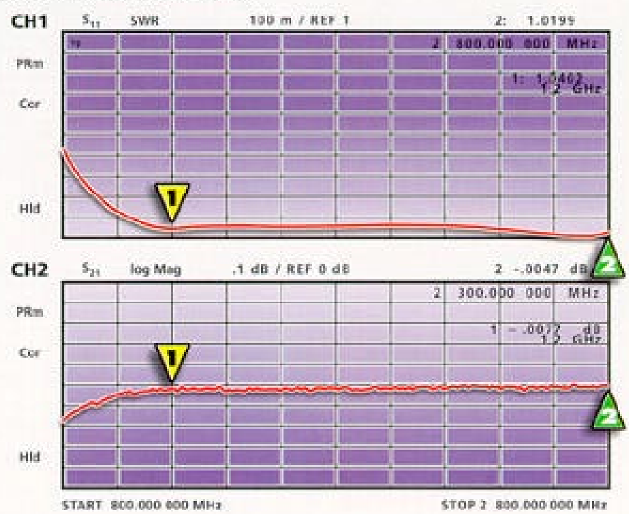
Let-Through Voltage:

≤ ±3 volts for 3kA @8/20μs Waveform

Dimensional Drawing



VSWR & Insertion Loss



ISO 9001 CERTIFIED

PolyPhaser

P.O. Box 9000, Minden, Nevada 89423-9000 USA • Tel (800) 325-7170 (775) 782-2511 • Fax (775) 782-4476 • www.polyphaser.com

Signal Splitter Specifications

∗ Model no. ZB4PD-42.

Mini-Circuits®

Coaxial

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M° Typ.	M° Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 6 dB L Typ.	L Max.	M° Typ.	M° Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M° Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M° Max.	U Max.	VSWR (:1) S Typ.	S Max.	OUT Typ.	OUT Max.	CAPD DATA	CASE STYLE Note B	CONNECTION
ZA4PD-2	1000-2000			25	16					0.3	1.0				6			0.70		see Performance Data and curves					DD52	bh
ZA4PD-4	2000-4200			25	16					0.5	1.0				16			0.80							DD52	bh
ZB4PD-1750-75	875-1750			30	20					0.4	0.8				3			0.40		1.08	1.50	1.25	1.50		UU188	bh
∗ ZB4PD-42	1700-4200			23	16					0.5	1.4				8			0.80						FOR	Z54	bh
ZB4PD-4	3700-4200			24	15					0.6	1.1				8			0.80							Z54	bh
ZB4PD-6.4	5400-6800			25	18					0.6	1.2				9			0.90		1.15	1.30	1.10	1.30	DATA	UU188	bh
ZB4PD1-500	5-500	34	20	34	20	28	20	0.4	1.0	0.5	0.9	0.9	1.5	1	3	6	0.2	0.2	0.4						UU188	bh
ZB4PD1-500-75	5-500	34	20	34	20	30	20	0.45	1.0	0.6	0.9	1.0	1.5	1	3	6		0.20						SEE	UU188	bh
ZB4PD1-930	850-930			30	20					0.3	0.5				5			0.25		1.10	1.25	1.09	1.25		UU188	bh
ZB4PD1-930W	725-1050			22	15					0.3	0.8				5			0.40		1.20	1.80	1.10	1.30	YONI	UU188	bh
ZB4PD1-2000	800-2000			25	18					0.6	1.2				--			0.30		1.20	1.60	1.10	1.30		UU188	bh
ZB4PD1-5.8	4600-5800			25	16					0.4	0.9				5			0.40		1.10	1.60	1.15	1.55	ON OUR	UU188	bh
ZB4PD1-8.4	6700-8400			29	18					0.5	1.3				9			0.90		1.12	1.50	1.27	1.50	WEBSITE	UU188	bh
NEW ZC4PD-18	1000-1800			32	18					0.3	0.8				6			0.40		1.05	1.55	1.08	1.45		Z184	bh
ZC4PD-900	800-900			30	20					0.3	0.6				3			0.20		1.08	1.25	1.17	1.30		Z184	bh
ZN4PD-920	800-920			30	20					0.25	0.5				2			0.20		1.08	1.25	1.07	1.25		UU182	bh
ZN4PD-920W	670-1000			22	15					0.3	0.6				3			0.20		1.20	1.60	1.07	1.25		UU182	bh
ZN4PD-20	1800-2000			31	20					0.3	0.7				4			0.50							UU182	bh

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

NSN GUIDE

MCL NO.	NSN
ZBSC-413(SMA)	5985-01-370-6145
ZFSC-4-1	6625-01-303-4623
ZFSC-4-1(SMA)	6625-01-303-4623
ZFSC-4-1A	5825-01-227-6681
ZFSC-4-1W(SMA)	5985-01-372-6418
ZFSC-4-1WB(SMA)	5985-01-364-1944
ZFSC-4-3B	5985-01-253-2843
ZMSC-4-1B	4935-01-229-3228
ZMSC-4-1BR	5895-01-451-0601
ZSC-4-1B	5820-00-270-3056
ZSC-4-1B(BNC)	6625-00-270-3056
ZSC-4-1B(TNC)	6625-01-109-3707
ZSC-4-1-75	5998-01-228-8995
ZSC-4-2BR	6625-01-357-2227
ZSC-4-2B(BNC)	5820-01-120-5238
ZSC-4-3B	6625-01-038-8553

coaxial connections

see case style outline drawing

PORT	bh
SUM PORT	S
PORT 1	1
PORT 2	2
PORT 3	3
PORT 4	4

991227

105

ITERIS

Vantage Customer Satisfaction Survey

Dear Valued Customer:

We are providing this form to give you an opportunity to tell us how satisfied you are with our Vantage products and our product support. We appreciate any comments or suggestions that you might have that would help us to improve our Vantage products and product support efforts.

Thank you for taking the time to complete the form. Our mailing address, fax number, and phone number are listed at the bottom of the form.

Your Vantage Dealer: ______________________

Your Dealer Representative: ______________________

Agency: ______________________

Name: ______________________

Title: ______________________

Phone number: ______________________

E-mail address: ______________________

Mailing address:

____

1 How satisfied are you with the performance of your Vantage products?

☐ Very satisfied ☐ Adequate / could improve ☐ Very dissatisfied

Comments:

2 How satisfied are you with the service and support provided by your Vantage Dealer?

☐ Very satisfied ☐ Adequate / could improve ☐ Very dissatisfied

Comments:

ITERIS 1515 S. Manchester Avenue, Anaheim, CA 92802-2907 (714) 780-7255

ITERIS

Vantage Customer Satisfaction Survey

3 How easy was the installation and setup of your Vantage product?

☐ Very easy ☐ Adequate ☐ Difficult

Comments:

4 How thorough was the Vantage User Guide?

☐ Very thorough ☐ Adequate ☐ Needs improvement

Comments:

5 What improvements or enhancements would you most like to see in the Vantage products?

6 Do you plan to continue purchasing Vantage products in the future?

☐ Yes ☐ No

Comments:

7 Would you like to be contacted by an ITERIS Customer Support / Sales Representative?

☐ Yes ☐ No

Comments:

Mail to: ITERIS
Customer Support Dept.
1515 S. Manchester Avenue
Anaheim, CA 92802-2907

or

Fax to: (714) 780-7246 Attn: Customer Support