Telenetics®

Your Communications Partner℠

MICROPASS®

4000 and 5000E Series
Installation and Operation Manual

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MICROWAVE RADIO SYSTEM
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INSTALLATION, OPERATION AND TROUBLESHOOTING MANUAL

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Document # 10075-007-05 Rev E
File Name 5KIOTS_E.PM5
PRINTED IN U.S.A.

September 2001

LIMITED WARRANTY

All TELENETICS, Inc. units are warranted against defective materials and workmanship for a period of one(1) year from date of shipment from TELENETICS's factory provided the installation, adjustment and operation are in accordance with TELENETICS instructions. During this period, TELENETICS will repair or replace the equipment returned to the factory which is determined by TELENETICS to be defective. TELENETICS assumes no responsibility for cost incurred in removing, installing or shipping new or defective units.

Customer repairs, disassembly, alterations or abusive treatment will void this warranty. TELENETICS does not warrant fuses or batteries.

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LIMITATION OF WARRANTY & REMEDY

Except as stated above, there are no other warranties, express or implied, including the warranties of merchantability or fitness for a particular purpose, applicable to this transaction and purchaser's sole and exclusive remedy against Telenetics shall be for the repair or replacement of defective parts as provided for herein, and the limited warranty as stated above is in lieu of any other warranty or remedy. In no event, whether due to a breach of any warranty or any other cause arising from the performance or non-performance of the goods sold hereunder, shall Telenetics be obligated or liable to purchaser in any manner for consequential or incidental damages, including, but not limited to, lost profits, loss of property due to theft, plant downtime, delays or suits by third parties.

RETURN FOR REPAIR PROCEDURES

A Return Authorization number must be obtained from Telenetics before any items will be accepted for return. Please contact Telenetics Customer Service to obtain this authorization.
When contacting Customer Service, you will need your Model number, Serial number, and the date of purchase. Please have this information available before you make your request for return.

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I. INTRODUCTION

TELENETICS MICROPASS MICROWAVE RADIO SYSTEM

Congratulations! You have purchased one of the most sophisticated communications products available on the market today. Whether your requirements call for voice, data, or video transmission, the Micropass microwave radio system provides you with the highest degree of reliability and efficiency.

This manual is a start-to-finish installation guide and reference tool for your future use. Remember that your Micropass system has the capacity for one simplex video channel and up to two duplex subchannels for voice, data, or control in each direction. Micropass systems are also field upgradable if you want to enhance your model's capabilities.

The purpose of this manual is to simplify the installation and application of this equipment. If you have any questions, please contact the Micropass Technical Services Department in Rocklin, CA (916) 624-7316

EQUIPMENT DESCRIPTION

The Telenetics Micropass® 4000 & 5000E microwave radio system transmits full motion, real time, color or black and white video signals using the 23GHz frequency. The system may also accommodate up to two duplex channels for camera control signals, voice or data transmission. Depending on the model installed, Micropass® systems can be used in CCTV, security surveillance, video teleconferencing, and other applications that require reliable video transmission between facilities. The basic system consists of a transmitter and receiver.

The self-contained, modular design of the 4000 & 5000E makes the system easy to maintain. Defective boards are simply replaced in the field.

INDICATORS AND CONTROLS

The following indicators and controls provide useful information when you monitor or troubleshoot the system.

Power On

This LED is located on the power supply. It should be on when power is applied.

Signal Present

This LED is located on the IF Demodulator board. When the light is on, the system is receiving an RF signal.

Loss of Subcarrier

This LED is located on the Audio/Data Demodulator board. When it is on, the subcarrier signal is absent.

AGC Meter

This meter is located on the IF Demodulator board and indicates the AGC voltage. The AGC voltage are indicated in the Installation and Operation Manual provided with the system. This voltage is an indication of received signal strength and is a rough measure of path reliability.

OPTIONS

The Micropass® 4000 & 5000E can be used with a variety of optional equipment. You should be aware of the options you have installed when trouble shooting and maintaining your system.

Antennas

Micropass systems come with a standard 17 inch antenna. Twenty-seven inch and four foot antennas are available as an option. The antenna size does not affect troubleshooting procedures. However, you should be aware that the radio is normally installed apart from the four foot antenna.

Power Supplies

An AC power supply is standard with the system. An optional AC/DC power supply is available.

Baseband Bandwidths

Three bandwidth options are available: 4.2 MHz, 6.0 MHz and 8.0 MHz. Troubleshooting procedures for these options are the same as the standard bandwidth. However, some components may differ.

II. UNPACKING AND INSPECTION

For most models, the Micropass Microwave System is shipped in two cartons, one for the transmitter and components and one for the receiver and components.

Figure 1 is an illustrated packing list for the following Models:

4003/5003E	4004/5004E	4005/5005E	4006/5006E
4007/5007E	4008/5008E	4017/5017E	4018/5018E
4020/5020E	4085/5085E	4204/5204E	4205/5205E
4206/5206E	4420/5420E	4485/5485E	

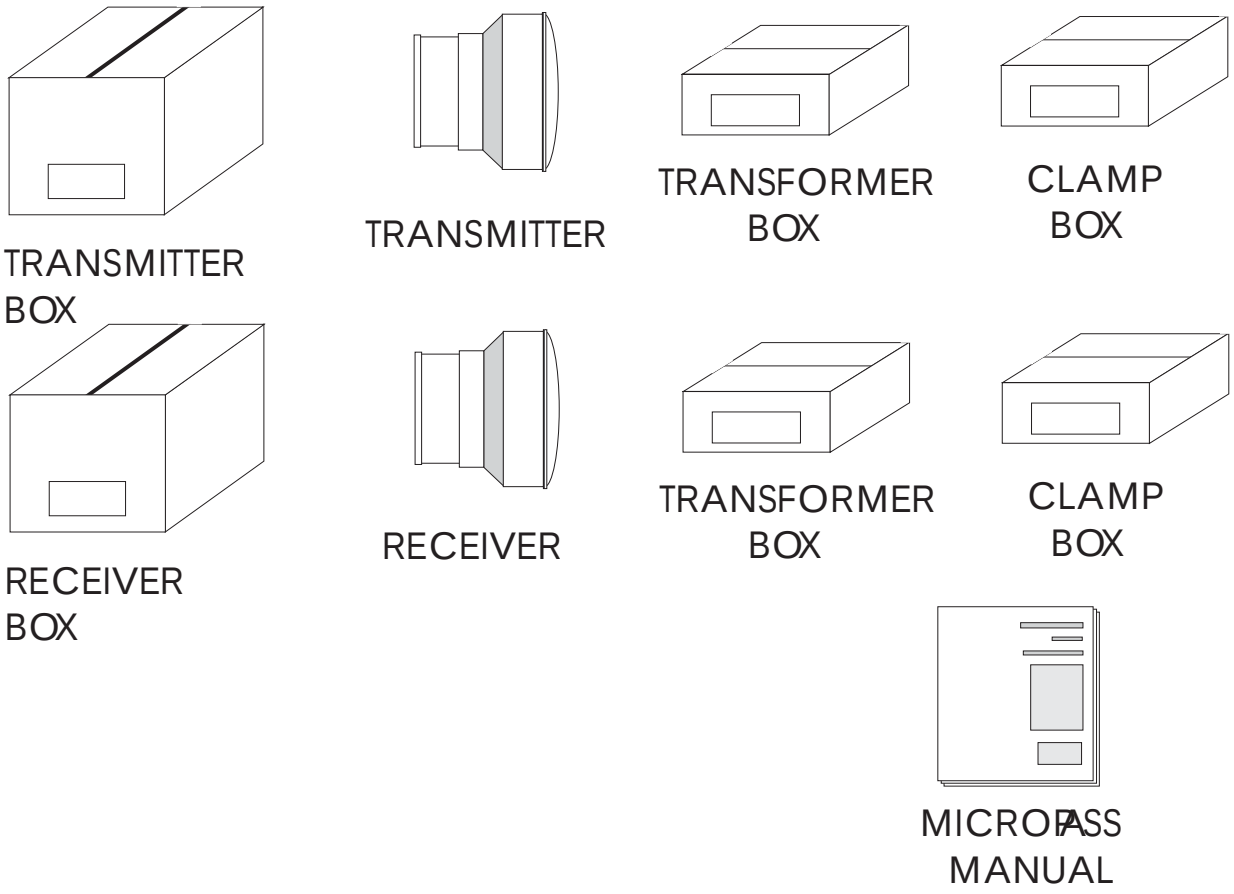


Figure 1
2-carton systems. Verify all parts have been included

The following models are shipped in three cartons as shown in Figure 2.
The additional box contains the RS232 interface units.

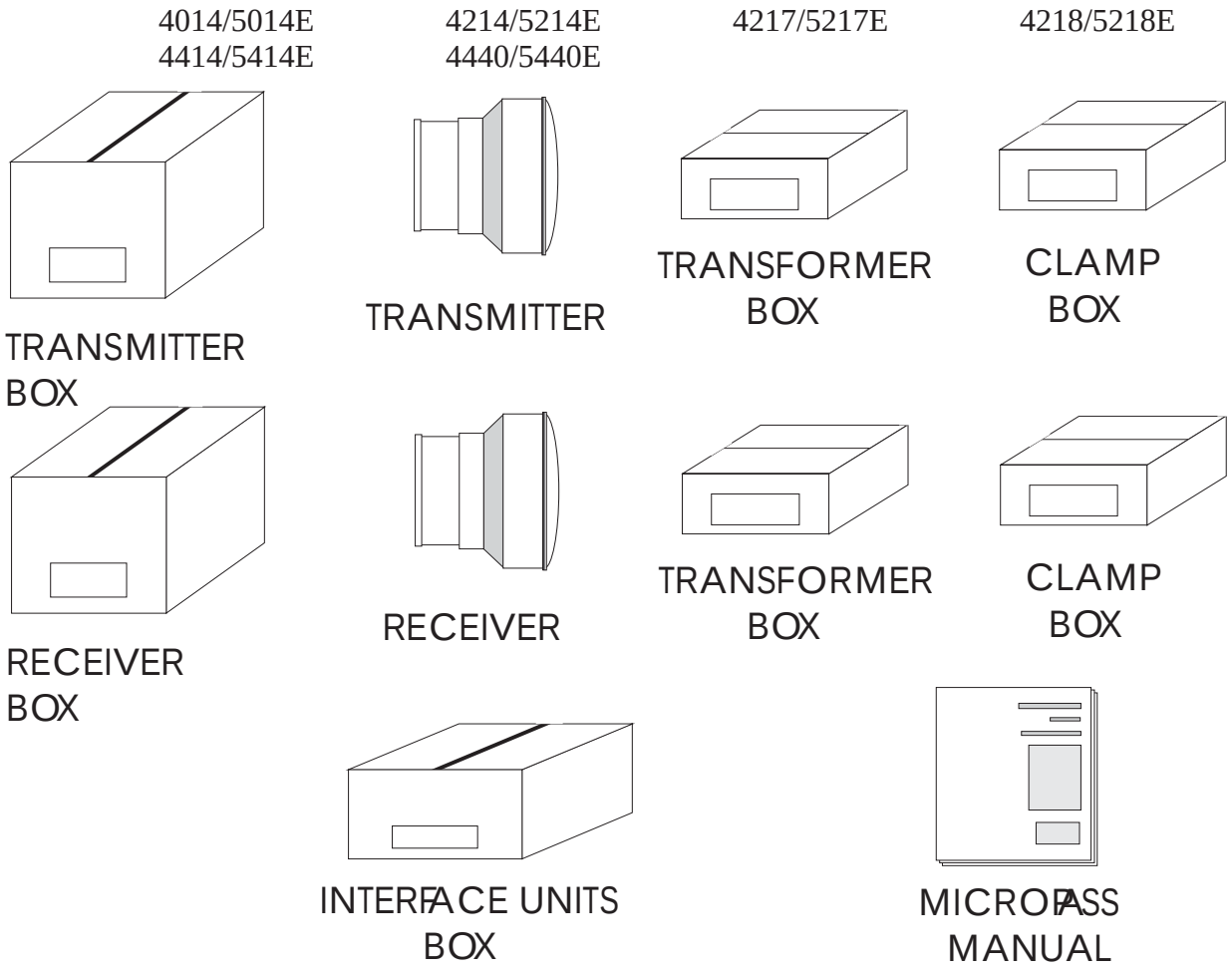


Figure 2
3-carton systems. Verify all parts have been included

Referring to the enclosed packing list and Figures 1 and 2, verify that all parts are present. If anything is missing, contact Racon.

Note: Transmitter and receiver assemblies are paired and should be installed as a system. Make sure the serial number on the transmitter is the same as the number on the receiver.

TRANSIT DAMAGE

Although the transceiver units are carefully packed, check for possible transit damage. Check shock monitor on shipping package for activation. If activated inspect for any additional signs of rough handling. If any damage has occurred in shipping, leave the entire packing carton and components intact and notify your carrier. Telenetics, Inc. is not responsible for shipping damage.

RETURN AUTHORIZATION NUMBER

If it is necessary to return equipment, you must first contact Telenetics, Inc. Customer Service for a return authorization number. To obtain the necessary return authorization number and shipping information, call 1-916-624-7313 and ask for Customer Service. Be prepared to identify the product you want to return and its serial number. Include a written description of the problem with the returned equipment.

EQUIPMENT REGISTRATION

There is no formal up equipment registration. All systems shipped are kept on file at the factory with all factory test data and original ship to/bill to customer.

III. PATH REQUIREMENTS

You must observe the path considerations described in this section or your Micropass system performance may be degraded. Review this section carefully.

Both engineering assistance and path reliability analysis can be provided. Contact Telenetics for further information.

Micropass systems require an unobstructed path between the antenna assemblies as shown in Figure 3. Make sure your beam is not obstructed by buildings, trees (allow for tree growth), billboards, or other objects.

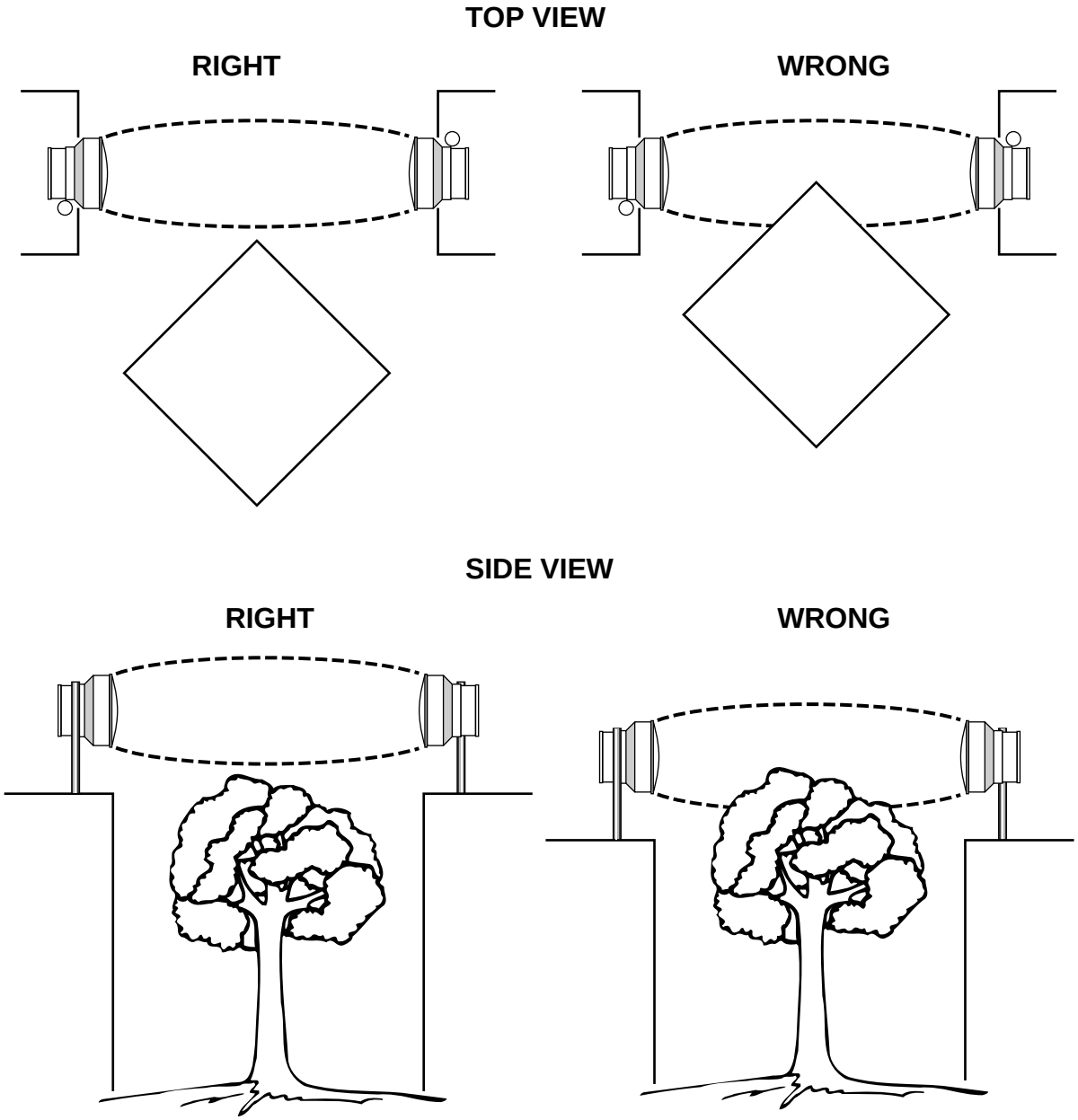


Figure 3
The microwave beam must be unobstructed.

TABLE 1. CLEARANCE FROM BEAM CENTER LINE

PATH LENGTH (MILES)	(KM)	1/4 PATH LENGTH (FT.)	(M)	1/2 PATH LENGTH (FT.)	(M)	3/4 PATH LENGTH (FT.)	(M)
0.5	0.8	6.5	2.0	7.3	2.2	6.5	2.0
1.0	1.6	9.1	2.8	10.4	3.2	9.1	2.8
2.0	3.2	12.7	3.9	14.8	4.5	12.7	3.9
3.0	4.8	15.6	4.8	18.1	5.5	15.6	4.8
4.0	6.4	18.1	5.5	20.9	6.4	18.1	5.5
5.0	8.0	20.3	6.1	23.3	7.1	20.3	6.1
6.0	9.7	22.0	6.7	26.0	7.9	22.0	6.7
7.0	11.3	28.0	8.5	33.0	10.0	28.0	8.5
8.0	12.9	34.0	10.4	40.0	12.2	34.0	10.4
9.0	14.5	40.0	12.2	47.0	14.3	40.0	12.2
10.0	16.0	47.0	14.3	56.0	17.0	47.0	14.3

Using Table 1, determine the radius of the beam that represents the beam width. This area must remain clear of any objects. For example, suppose your path length is 5.5 miles (numbers should be rounded up to the nearest mile; 5.5 is rounded to 6). At 1/4 of the path length, a clearance of 22 feet must be maintained. At midpath or 1/2 of the total path length, a clearance of 26 feet is required. Figure 4 illustrates the shape of the clearance zone. Micropass 4000 series applicable up to the 4.0 mile path length only

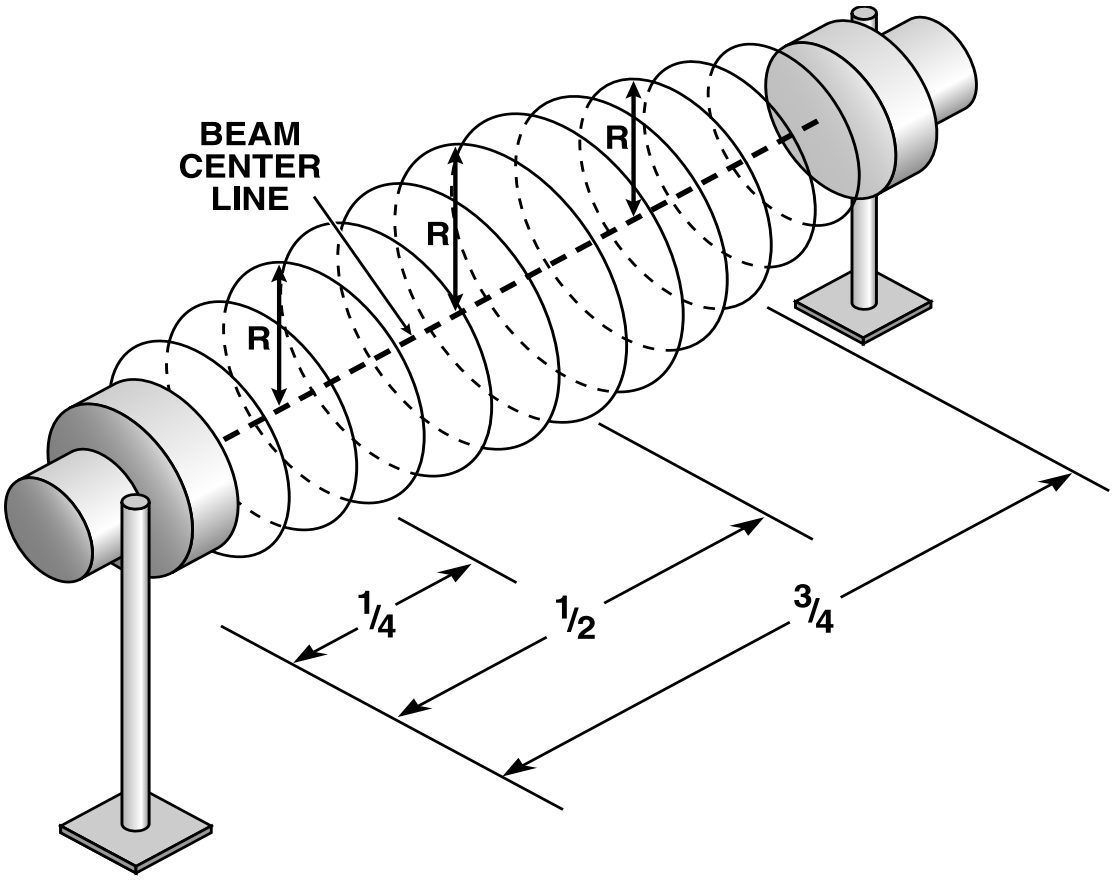


Figure 4
Determine the minimum clearance around beam center.

TABLE 2. MINIMUM ANTENNA HEIGHT OVER WATER OR SMOOTH SURFACE

TOTAL PATH LENGTH (MILES)	(KM)	MINIMUM ANTENNA HEIGHT (FEET)	(METERS)
0.5	0.8	19.0	5.8
1.0	1.6	37.0	11.3
2.0	3.2	75.0	22.9
3.0	4.8	111.0	33.8
4.0	6.4	150.0	45.2
5.0	8.0	186.0	56.7
6.0	9.7	227.0	69.3
7.0	11.3	266.0	81.2
8.0	12.9	306.0	93.4
9.0	14.5	345.0	105.3
10.0	16.0	385.0	117.5

If 50% or more of your path is over water or a very smooth surface (for example, flat grassland or pavement), your Micropass system should be mounted a minimum distance above the surface for optimum performance. Refer to Figure 5 and Table 2 to determine the minimum antenna height. Micropass 4000 series applicable up to the 4.0 mile path length only.

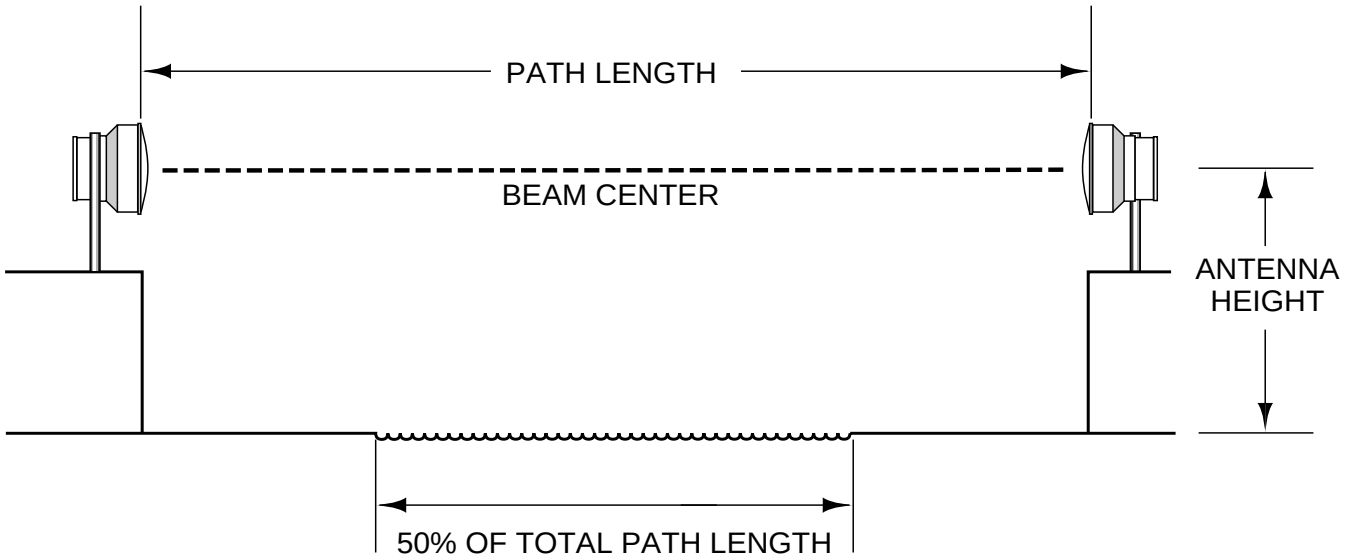


Figure 5
Paths across water require a minimum antenna height.

IV. SITE PREPARATION

After you have selected a suitable path for your system, you must prepare the site before installing the antennas. This section provides information about installing mounting poles, locating power sources, and running cables.

Micropass systems are designed to mount on a 3.0" to 4.5" O.D. pole as shown in Figure 6.

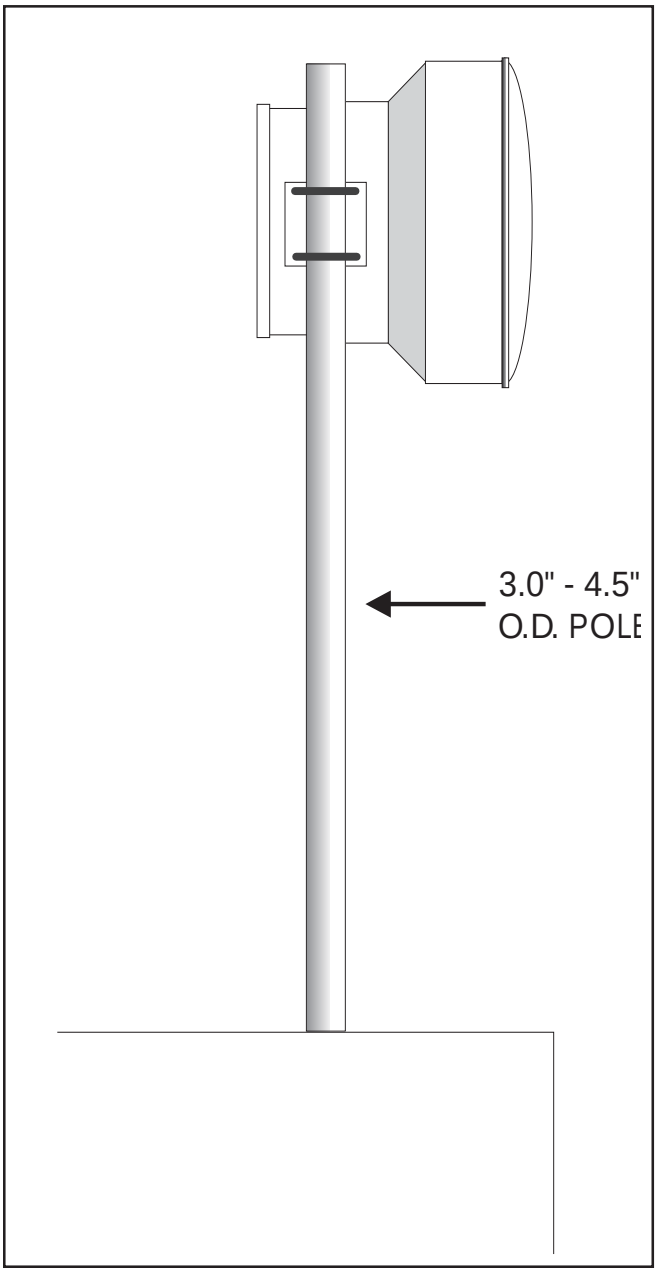


Figure 6
The antennas must be mounted on a 3.0" to 4.5" O.D. pole.

As indicated in Figure 7, the mounting pole must be rigid to prevent antenna movement when it is windy. The pole should not vibrate, sway, or twist; guy wires or solid supports may be required to stabilize the pole. (See EIA Standard EIA-195 for more information)

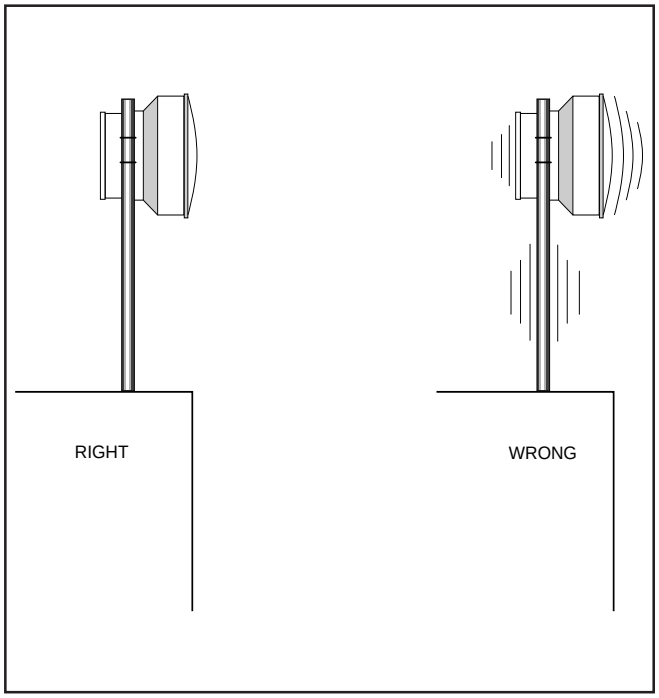


Figure 7
The mounting pole should not vibrate, sway, or twist.

AC or DC power must be located within 300 feet (92 meters) of each antenna assembly as shown in Figure 8. (Refer to Table 3 for cable types.) Micropass systems are powered by a 24VAC transformer included with each antenna.

Micropass systems also may be powered by ±24VDC or -48VDC power using the optional 24VDC or -48VDC power supply.

WARNING

Do not power more than one Micropass antenna assembly with a single transformer. Use only transformers supplied by Telenetics.

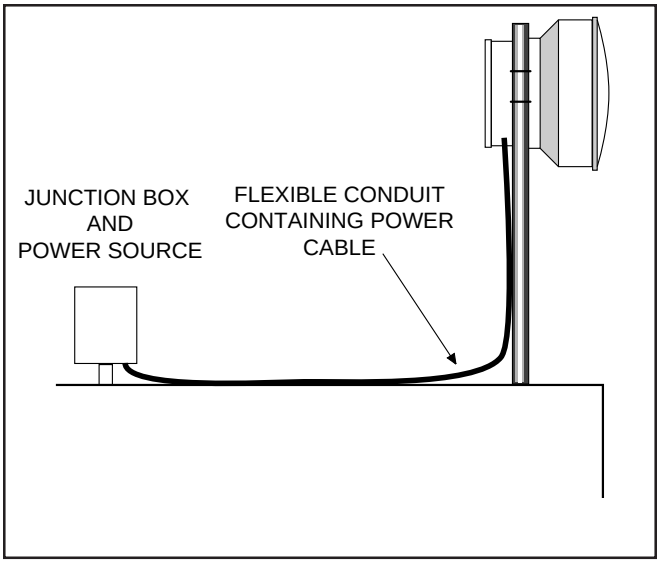


Figure 8
AC or DC power must be located within 300 feet of the antenna.

Source power should originate from a dedicated circuit, free from heavy loads generated by equipment such as elevator motors or air conditioning motors. Uninterruptable power systems and surge protectors are recommended to reduce the possibility of interrupted operation due to fluctuating power levels.

Make sure that the video, audio or data signal sources are located within the cable driving abilities of the Micropass system as illustrated in Figure 9. (Refer to Table 3 for cable types and maximum distances.) Telenetics recommends using ground loop isolators to eliminate any possibility of hum-related problems.

NOTE: The maximum video cable length is the combined distance from the camera to the transmitter and the receiver to the monitor. For example, using RG-59 coaxial cable, the maximum distance is 300 feet. If the distance from the camera to the transmitter is 200 feet, the distance from the receiver to the monitor may be 100 feet.

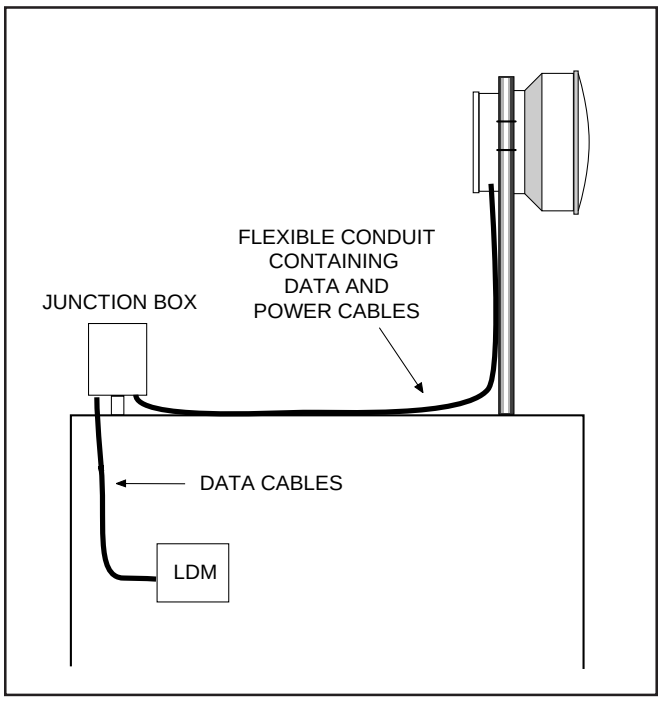


Figure 9
Data signal sources must be within Micropass limits.

TABLE 3. RECOMMENDED CABLE TYPES

	TYPE	DESCRIPTION	MAXIMUM DISTANCE
Video Cables (All models)	Belden 9274	RG-59 75 ohm coax	300 ft. * (92 m.)
	Belden 9290	RG-6 75 ohm coax	500 ft. * (153 m.)
	Belden 8238	RG-11 75 ohm coax	1000 ft. * (305 m.)
Audio/RS422 [1]	Belden 9729	24 AWG (2 pair)	1000 ft. (305 m.)
Audio/RS422 [2]	Belden 9730	24 AWG (3 pair)	1000 ft. (305 m.)
Audio/RS422 [3]	Belden 9731	24 AWG (6 pair)	1000 ft. (305 m.)
Power Cables [4]	Belden 8720	14 AWG	200 ft. (61 m.)
	Belden 8718	12 AWG	300 ft. (92 m.)

* Combined distance between camera to transmitter and receiver to monitor

[1] Models 5004, 5006, 5007, 5008, 5017, 5018,5085

[2] Models 5005, 5014, 5020, 5204, 5206

[3] Models 5205, 5414, 5420, 5485

[4] All models - transformer to antenna

Use 1 1/4" weatherproof flexible conduit to protect the power and data cables from weather, electromagnetic and radio frequency interference. Micropass systems are designed to be mounted on the left side of the pole when viewed from the back as shown in Figure 10. If mounting on the right side of the pole is necessary, the existing weep holes must be sealed and new weep holes drilled in the bottom of the antenna assembly.

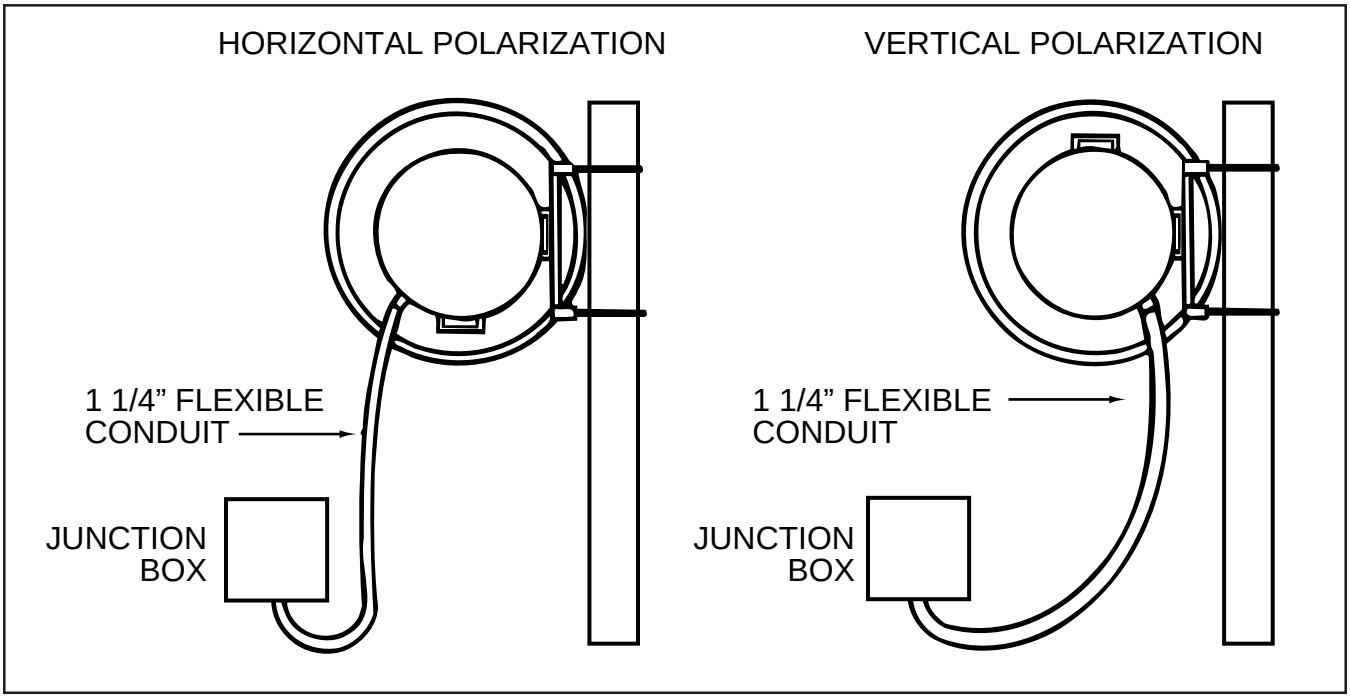


Figure 10
Mount the antenna on the left side of the pole and use flexible conduit to protect cables.

Lightning protection should be considered. As illustrated in Figure 11, the lightning rod is mounted on top of the mounting pole and connected to earth ground. Surge protectors on the power and signal cables are also appropriate.

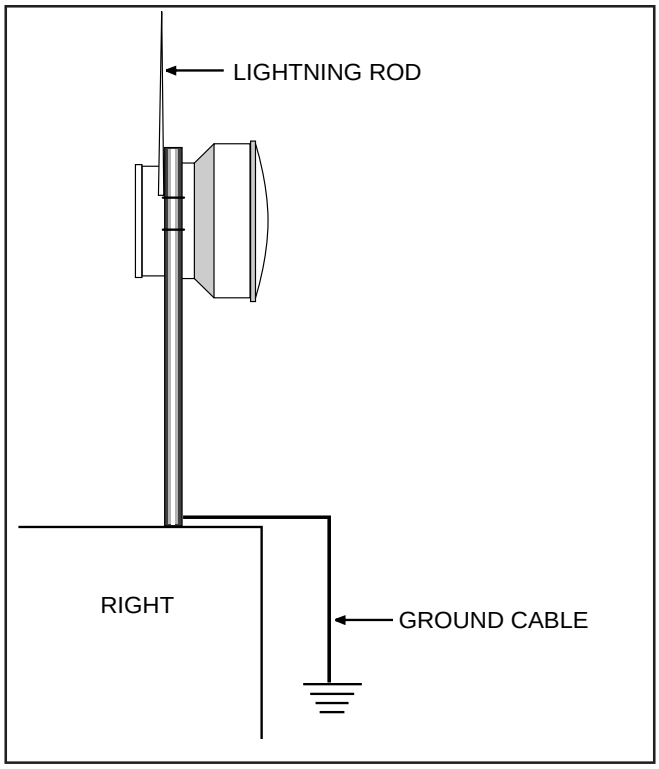


Figure 11
A lightning rod is recommended.

V. INSTALLATION

Micropass systems are easy to install. Figure 12 shows the tools required to install the antenna assemblies. Before installation, make sure your path and site meet the requirements described in the previous sections of this manual.

NOTE: Input signals are not required for antenna installation and alignment.

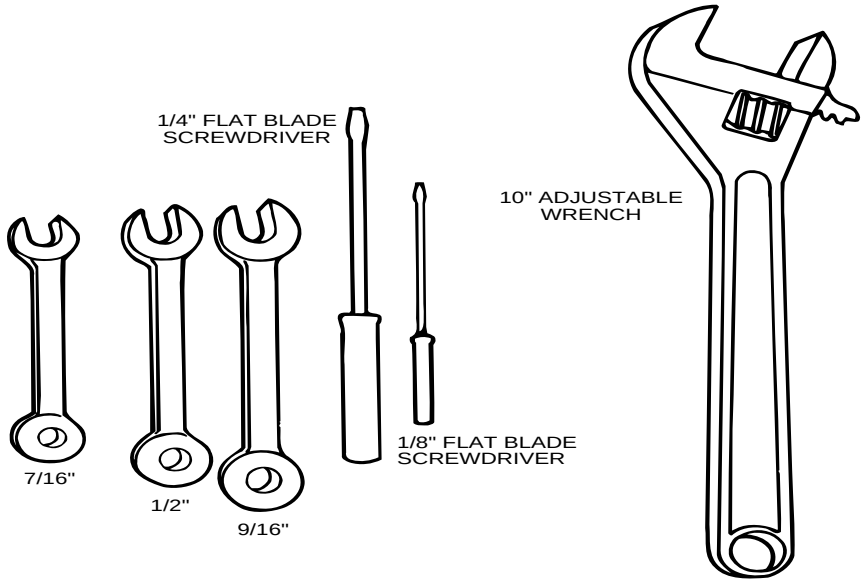


Figure 12
These tools are required to install the Micropass system.

INSTALLING THE TRANSFORMERS

Remove the transformers and wiring instrucitons from the box as shown in Figure 13. Transformers should be installed by qualified personnel following local electrical wiring codes. Use the wiring instructions for your particular model to install the transformers.

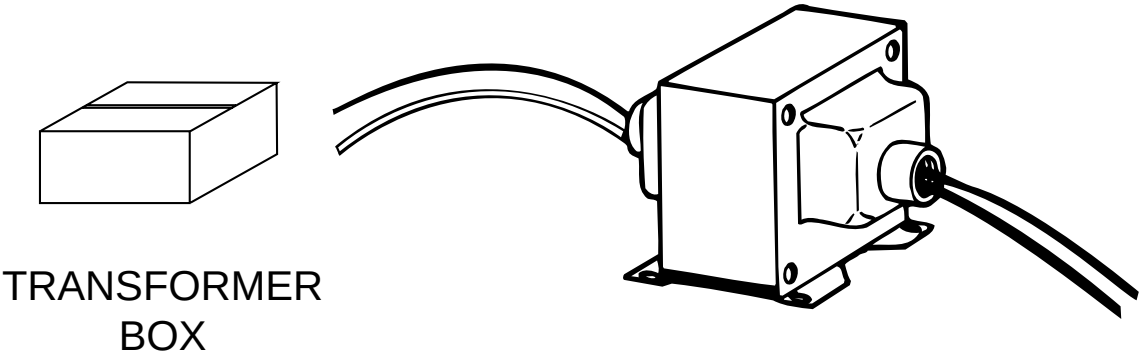


Figure 13
Unpack the transformer boxes.

WARNING
The connections should be made with main power (120/220/240 VAC) power disconnected.

If the transformer is mounted outdoors, use a weatherproof electrical box as illustrated in Figure 14.

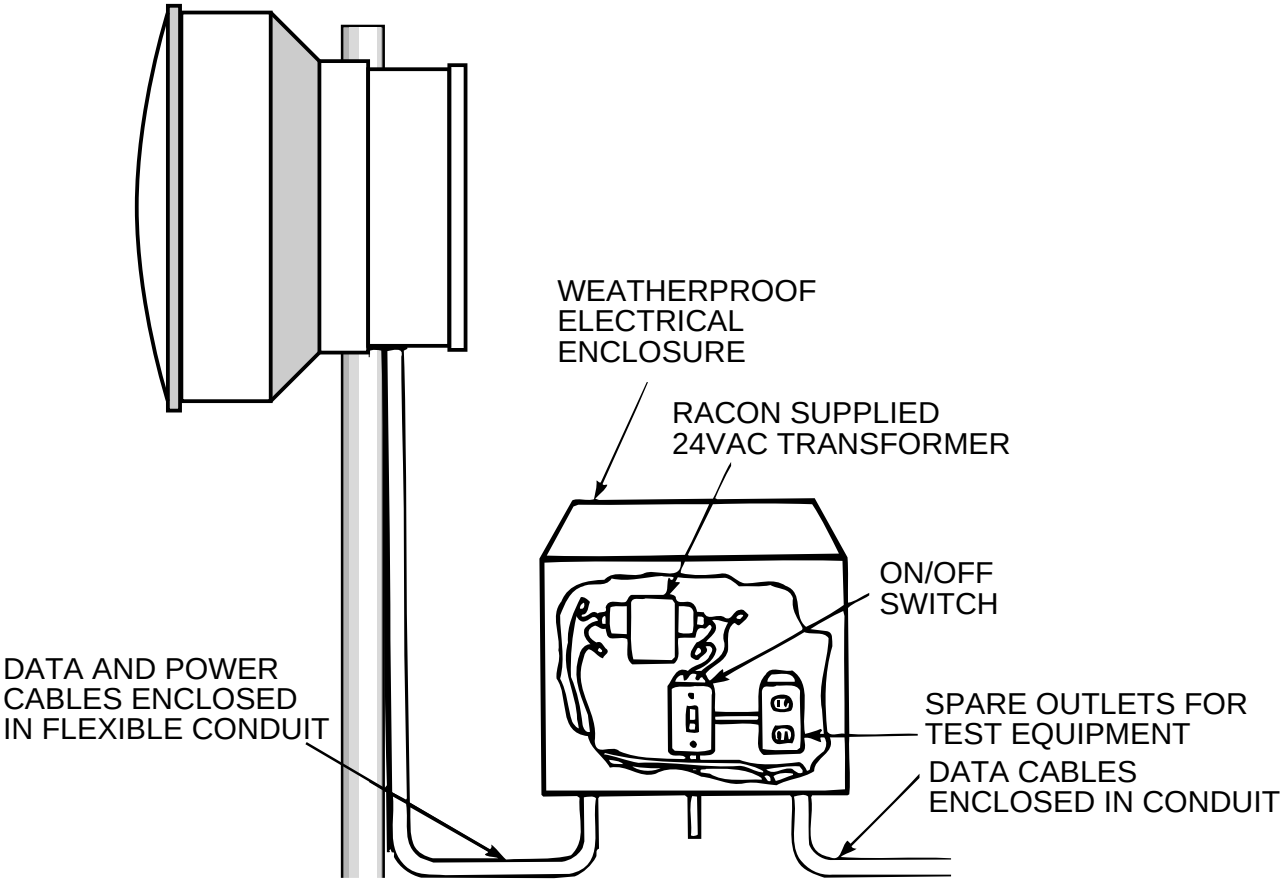


Figure 14
Typical transformer installation. (Illustrative purposes only.)

ASSEMBLING THE MOUNTING HARDWARE

Remove the contents from the clamp boxes. Refer to Figure 15 and verify that all parts are present.

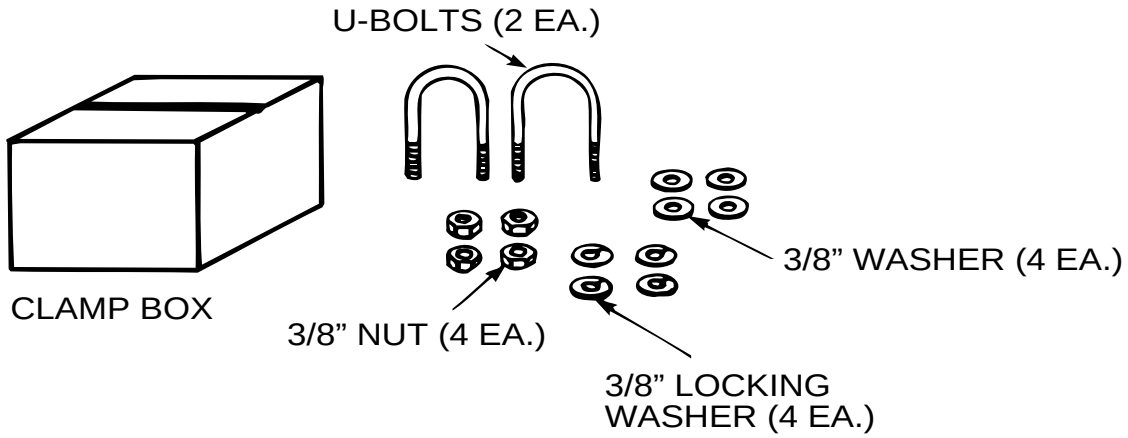


Figure 15
Unpack the clamp boxes.

Using your FCC license(or equivelent), determine whether your system will operate on vertical or horizontal polarization. Verify that the frequency of the Micropass system is the same as the frequency shown on your license. Look for the frequency of your Micropass system on the label located in the cable connection compartment.

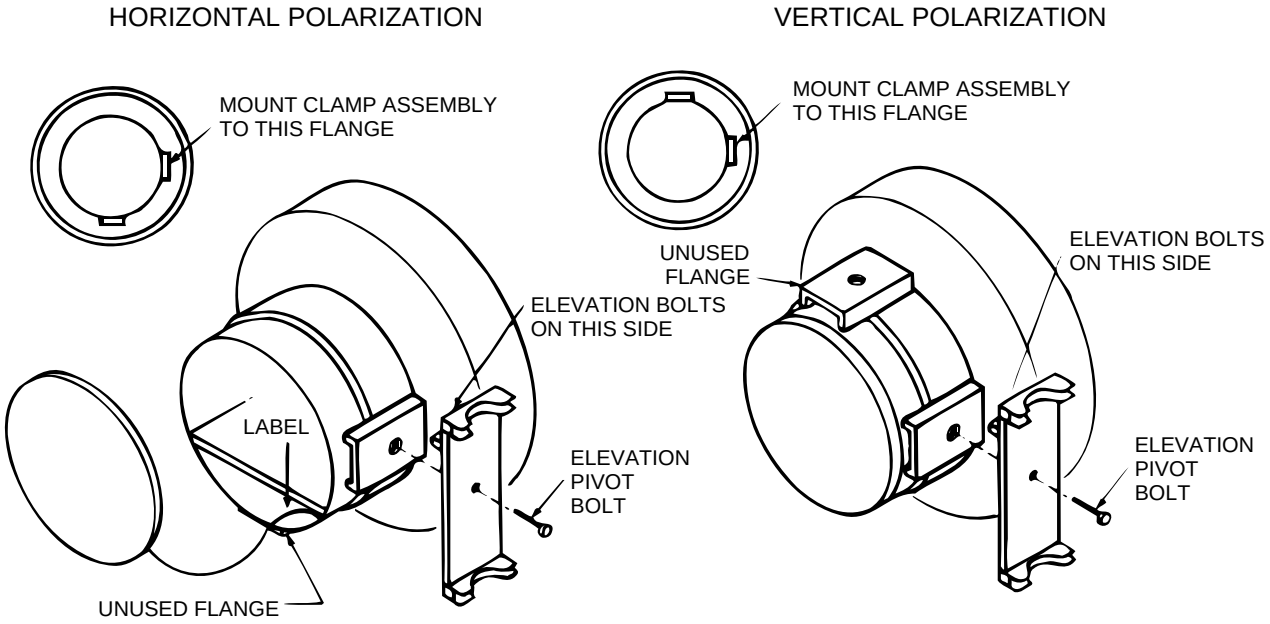


Figure 16
Attach the clamp assemblies to the transmitter and receiver.

Referring to Figure 16, attach the clamp assemblies to the appropriate mounting flange. The clamp assemblies may be relocated by removing the pivot bolt. If the receiver and transmitter are not installed with the same polarization, system performance will be degraded.

Remove the U-bolts from the clamp assembly. Referring to Figure 17, clamp the Micropass antenna assembly to the pole so that the antennas are pointed toward one another. The antenna assemblies must be located on the left side of the pole as viewed from behind.

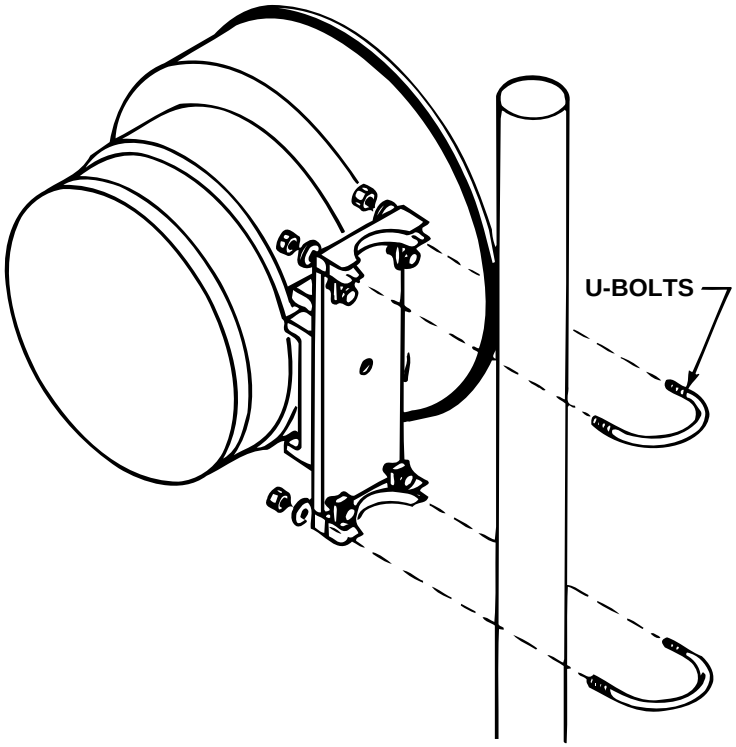


Figure 17
Attach the antenna assemblies to the mouting poles

Insert the cables and the flexible conduit through the conduit hole on the antenna assembly and tighten the conduit nut as shown in Figure 18. Refer to the APPENDIX section of this manual and connect the cables to the appropriate terminals for your Micropass model.

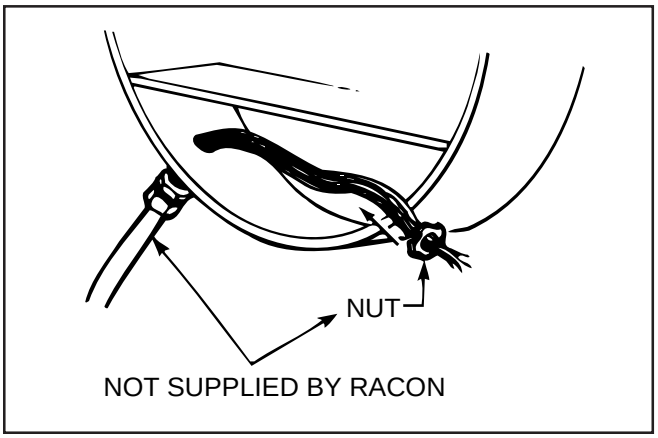


Figure 18
Connect flexible conduit to the antenna assemblies.

ALIGNING THE ANTENNAS

Loosen the elevation and azimuth pivot bolts. Adjust the elevation and azimuth adjust bolts on both transceivers until the antenna assemblies are pointed toward each other as shown in Figure 20 on the next page. If you are using the OAK-II optical alignment kit, follow the instructions provided with the kit.

NOTE: Video, audio or data signals are not required to align the antenna assemblies.

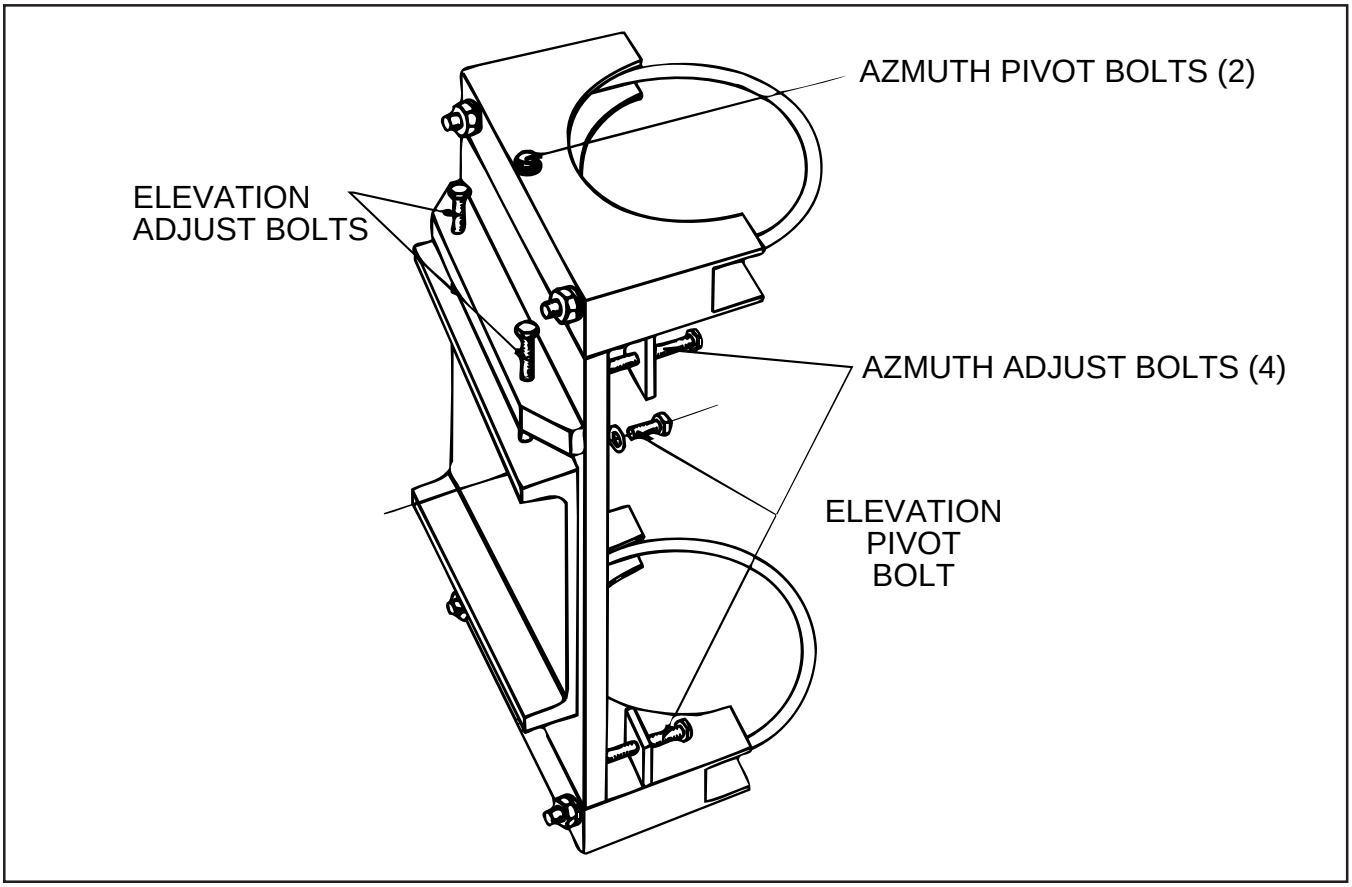


Figure 19
Use the elevation and azimuth adjust bolts to aim the antennas at each other.

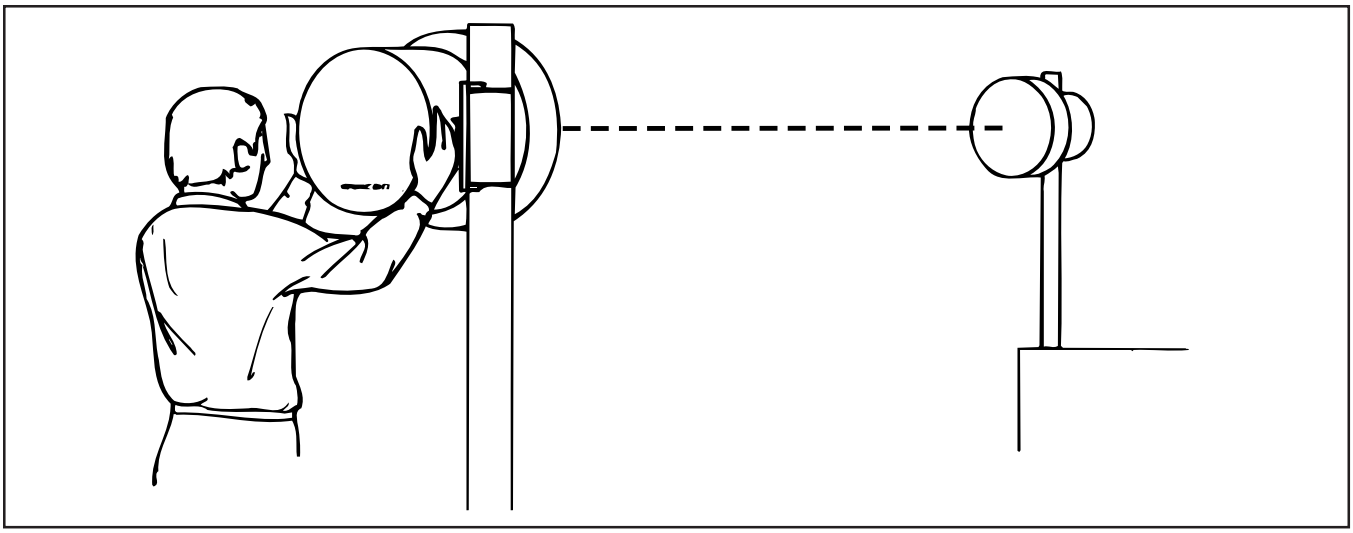


Figure 20

Apply main power (120/220/240VAC) power to the 24VAC transformers on both antenna assemblies. A green *Power On* LED should be lit as shown in Figure 21. Allow 10 minutes warm-up time before aligning the antenna assemblies.

Micropass® 4000 and 5000E systems can be aligned by one person; however, alignment with two people is much more efficient as illustrated in Figure 22. Two-way radios or telephones are also recommended. Alignment may be started at either antenna assembly. Select which antenna assembly you will align first.

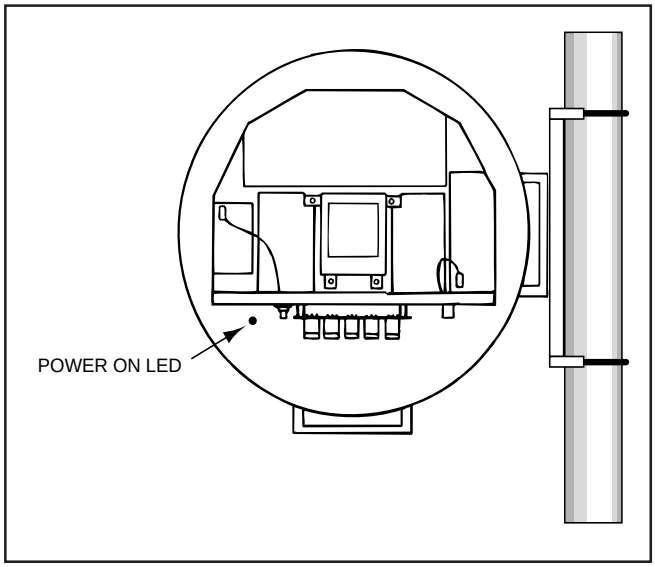


Figure 21
The Power On LED should be on when power is applied to the transformers.

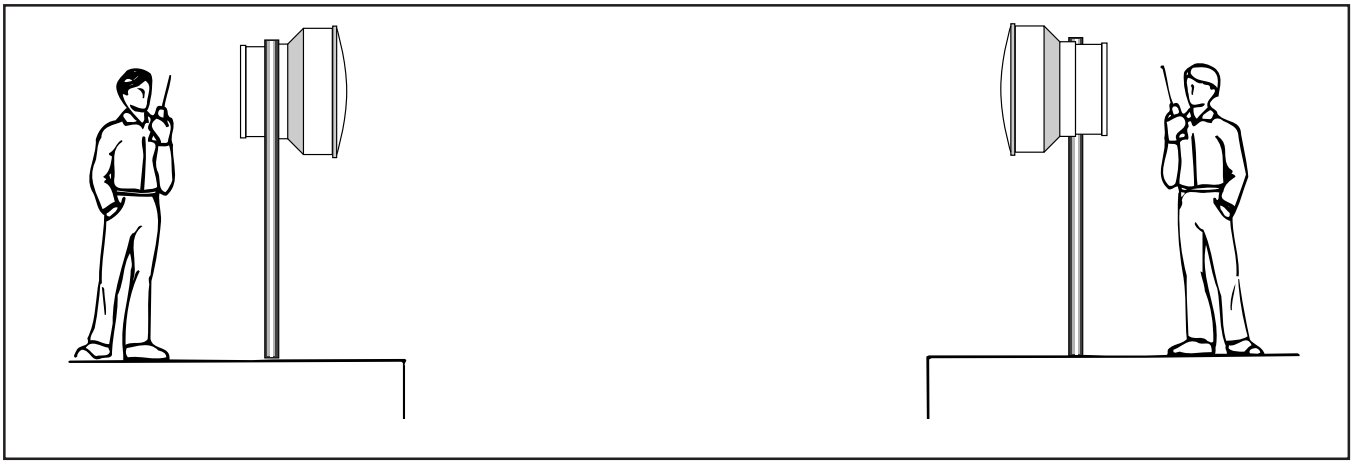


Figure 22
Two people are recommended for best alignment of the antenna assemblies.

At the receiver, the *Signal Present* LED should be lit as shown in Figure 23. If not, re-aim the antenna assemblies toward each other. If the *Signal Present* LED remains off, refer to the Troubleshooting section of this manual.

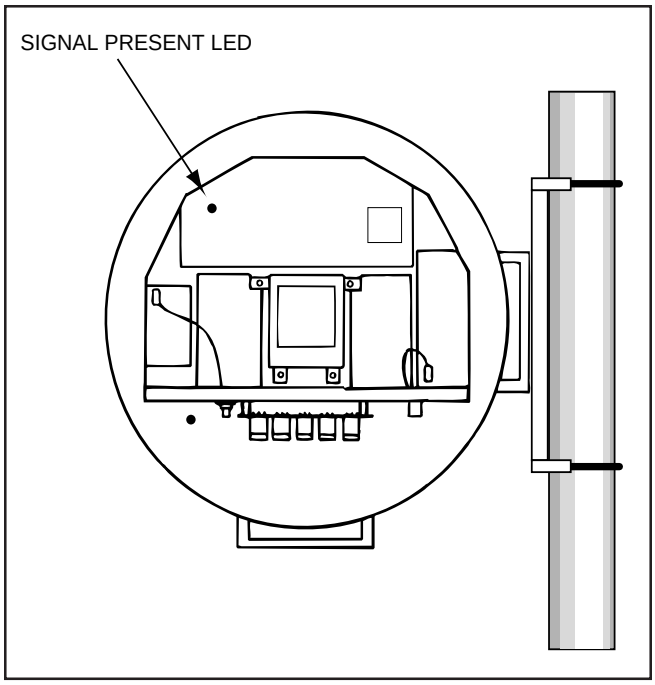


Figure 23
The Signal Present LED in the transceiver should be on when the antennas are aimed at each other.

At the receiver, monitor the AGC meter and adjust the elevation and azimuth adjust bolts for a maximum AGC voltage reading as shown in Figure 24. There are three AGC voltage peaks in both the elevation and azimuth planes. Be sure to align your system on the peak that provides the greatest AGC voltage reading.

Verify the AGC voltages on both the receiver and transmitter are within .5VDC of indicated values. If the proper AGC voltage cannot be obtained, refer to the troubleshooting section of this manual.

Use the Maintenance Records on page 62 and 63 or those provided inside the radio rear covers to record all pertinent data. These Records should be updated every 6 months. The Maintenance Records with updated information should be FAXed to Telenetics at:

916-624-5943

before placing a call to Telenetics Microwave Group Technical Support.

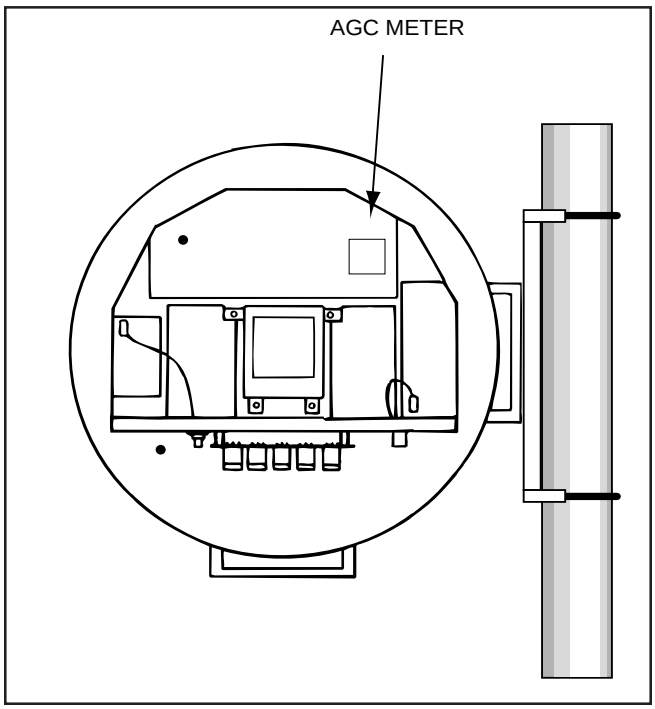


Figure 24
Using the AGC meter, adjust the antenna for the maximum AGC voltage reading.

The person at the transmitter antenna should adjust the elevation and azimuth adjust bolts for the maximum AGC reading at the receiver. As illustrated in Figure 25, the person at the receiver can read the AGC voltage readings over the radio or telephone to the person adjusting the transmitter assembly.

For systems with reverse subchannels requiring only one person for alignment, monitor the AGC meter on the transmitter assembly. When you have achieved optimum alignment of the transmitter, align the receiver one more time.

Figure 25
Adjust the transmitter for a maximum AGC voltage reading at the receiver

On both antenna assemblies, tighten the elevation and azimuth pivot bolts. Then, tighten the adjust bolts and lock nuts.

Make sure the AGC voltage values have not changed. If the AGC voltage changes, realignment of the antennas is required.

COMPLETING THE INSTALLATION

Place the covers on the back of the antenna assemblies as shown in Figure 26. Make sure the cable strap is completely inside the antenna assembly.

Your Micropass system is now ready for operation. All that remains is to connect your data equipment to the appropriate cables already connected to the Micropass system. When completed, your entire communications system will be in operation.

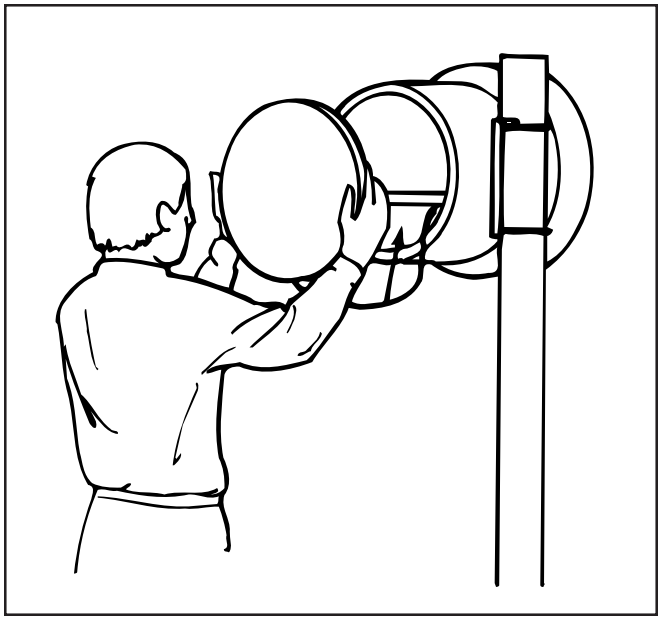


Figure 26
Replace the cover on the back of both antennas.

VI. SPECIFICATIONS

SYSTEM SPECIFICATIONS

Modulation
FM

System Gain (5000 series)

With 17" antenna:	169 dB nominal
With 27" antenna:	175 dB nominal
With 48" antenna:	183 dB nominal
With 72" antenna:	195 dB nominal

System Gain (4000 series)

With 17" antenna only:	148 dB nominal

Frequency Band
21.2 to 23.6 GHz
Common Carrier (Part 21): All Channels
Business (Part 94): All Channels

Channel Capacity
1 video channel plus up to two (full duplex) audio/data/control subchannels

FCC Equipment Authoriztion

Type Number:	B2N9CL10050
Type accepted:	Both Part 21 and 94
Emission designator:	33800F9

Power Consumption
75 watts nominal power on
50 watts nominal operational @ 25°C

Input Voltage
120VAC 50/60HZ, input to UL listed 24VAC 150VA remote transformer (included). No Charge Option: 240VAC 50/60HZ, input to UL listed 24VAC remote transformer. Optional: -48VDC, -24VDC, +24VDC power supplies

Temperature Range
Operating: -30°C to +55°C (-22°F to 122°F)
Storage: -40°C to -60°C (-40°F to 140°F)

Material
All-weather aluminum coated to MIL C 5541 with stainless steel hardware.

Shielding
Built-in conducted and radiated RFI shielding

Mounting
Universal hardware for mounting to vertical pipe between 3.0" (7.6 cm) and 4.5" (11.6 cm) O.D.

Alarm
Loss of Subcarrier Alarms:
Alarm @ 10-15VDC
No Alarm @ 2VDC
Impedance: 1,000 ohms, unbalanced
Connector: Terminal Block
Loss of RF Alarms:
Alarm @ 2VDC
No Alarm @ 10-15VDC
Impedance: 1,000 ohms, unbalanced
Connector: Terminal Block

TRANSMITTER SPECIFICATIONS

RF Source
Gunn Diode

Power Output (4000 Series)
Minimum: 3mW (+ 5dBm)
Typical: 5mW (+ 7dBm)
Maximum: 10mW (+ 10dBm)

Power Output (5000E Series)
Minimum: 40mW (+ 16dBm)
Typical: 65mW (+ 18dBm)
Maximum: 100mW (+ 20dBm)

Frequency Stability (-30°C to 55°C)
Better than ±.03% of carrier frequency

RECEIVER SPECIFICATIONS

Type
Superheterodyne

IF Bandwidth
33 MHz

Threshold

5000E Series	-77dBm
4000 Series	-65dBm

Signal to Noise Ratio
63dB

Signal to Hum Ratio
53dB

Local Oscillator
Gunn Diode

Noise Figure
22dB nominal

VIDEO INTERFACE SPECIFICATIONS

Video Format
NTSC, PAL or SECAM monochrome or full color

Video Bandwidth
4.2 MHz standard.
Optional 6MHz or 8MHz available.

Input Impeadance
75 ohms

Output Impeadance
75 ohms

Input level
1 Vp-p

Output Level
1 Vp-p (Adjustable)

Connectors
BNC

ANTENNA SPECIFICATIONS

Size
Shrouded 17" (43 cm) outside diameter standard. Optional 27 inch or four foot antenna available.

Gain
17": 38 dBi minimum
27": 42 dBi minimum
48": 46 dBi minimum
72": 50 dBi minimum

Polarization
Vertical or horizontal

Beamwidth (3dB)
17": 1.7° 27": 1.3°
48": 0.7° 72": 0.6°

Alignment
Includes coarse and fine elevation and azimuth adjustment.

Radome
Formed ABS radome supplied with 17 inch and 27 inch antenna. Designed for rugged environmental applications.

SUBCHANNEL SPECIFICATIONS

Audio Subchannel Interface
Audio Bandwidth
Models 4004 & 5004E: 15 KHz
Models 4005 & 5005E: 15 KHz
Models 4006 & 5006E: 15 KHz
All other models: 3KHz

Input Impeadance
600 ohms balanced line

Output Impeadance
600 ohms balanced line

Input Level
0dBm maximum

Output Level
0dBm maximum

Connection
Screw Terminal

RS232 Subchannel Interface
(converted to RS422 for transmission over radio)

Data Rate
Up to19.2 Kbps asynchronous

Connection
25 pin D subminiature

RS422 Subchannel Interface
Data Rate
Up to19.2 Kbps

Connection
Screw Terminal

Manchester & Biphase

Data Rate
Up to 56,000 Bps

Connection
Screw Terminal

NOTE:
Specifications are subject to change without notice. Performance figures and data must be confirmed in writing before they become applicable to any contract or order.

VII. SYSTEM THEORY OF OPERATION

SYSTEM OVERVIEW

A Micropass® system consists of two antenna assemblies, capable of transmitting and receiving radio frequency (RF) signals. Each transceiver contains an RF assembly which generates the RF output signal, modulates it, and produces the intermediate frequency (IF).

For duplex communication, the RF output signals are offset by 45MHz. The antenna assembly where the baseband is transmitted is tuned 45MHz above the antenna assembly where the baseband is received. The RF assemblies then provide a 45 MHz signal to the receiver boards for amplification and demodulation.

When a signal is applied to the baseband transmitter, it is preemphasized and then modulates the RF signal. It is then transmitted to the other antenna. At the other antenna, the RF signals are hetrodyned at its RF assembly to produce the intermediate frequency (IF). The IF signal is then demodulated and de-emphasized to the baseband receive out.

Audio/data signals are transmitted via subcarriers. The audio/data signal is frequency modulated on a 7.4MHz subcarrier (in the same direction as the baseband signal) or a 6.2MHz subcarrier (in the opposite direction as the baseband signal).* The subcarriers are also applied to the modulator of the RF assemblies. Each subcarrier is filtered to receive the appropriate subchannel signal.

* Except for 4004/5004E, 4204/5204E (7.4MHz in opposite direction of baseband signal), and 4018/5018E (6.2MHz same direction of baseband signal).

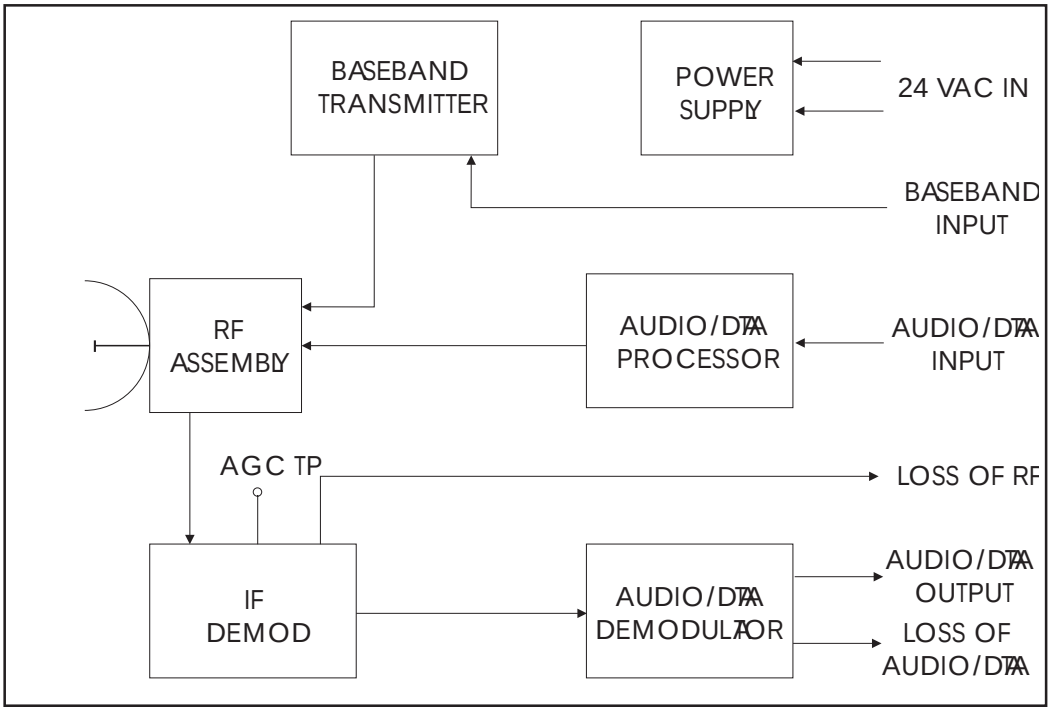


Figure 27 Transmitter Functional Block Diagram

TRANSMITTER

Figure 27 is a block diagram of the transmitter (the antenna assembly where the baseband is transmitted). A functional description of each block follows.

POWER SUPPLY

The power supply accepts 24VAC (or optional +24VDC) input voltage from the Racon-supplied transformer. The voltage is rectified, regulated, and distributed to all circuit boards. A 4 amp fuse located

on the power supply board protects the circuitry from excess current draw.

BASEBAND TRANSMITTER

The baseband (video) signal connects directly to the baseband transmitter board. This board filters and pre-emphasizes the baseband signal and directs it to the modulator on the RF assembly.

AUDIO/DATA PROCESSOR

The audio/data signals connect to this board. They are filtered, pre-emphasized, and frequency modulated on a 7.4MHz subcarrier. The subcarrier is directed to the modulator on the RF assembly.

RF ASSEMBLY

The RF assembly produces the radio frequency output (21.2 to 23.6GHz), contains the frequency modulator, and provides the IF signal output. The RF output is generated by a gunn diode which oscillates in a high Q cavity. The modulator is a varactor diode which frequency modulates the RF output when a varying signal is applied. Both the baseband and subcarrier signals are applied to the modulator.

The mixer diode provides a difference signal (45MHz) generated by the beating of the RF output signals from each antenna assembly. The 45MHz IF is connected to the IF demodulator board.

IF DEMODULATOR

The 45MHz signal is filtered, amplified, and demodulated. The subcarrier (6.2MHz from the receiver) is directed to the audio/data demodulator board. The IF demodulator provides an AGC signal which is used during antenna alignment. A green Signal Present LED located on the IF demodulator board indicates the RF signal is present.

AUDIO/DATA DEMODULATOR

The subcarrier signal (6.2MHz) is filtered and demodulated. The audio/data signal is then de-emphasized and amplified to provide the appropriate signal to the output. The audio/data demodulator also provides a Loss of Subcarrier alarm which indicates the absence of the 6.2MHz subcarrier. (See the specifications for output voltage levels.) A red Loss of Subcarrier LED is located on the audio/data demodulator board.

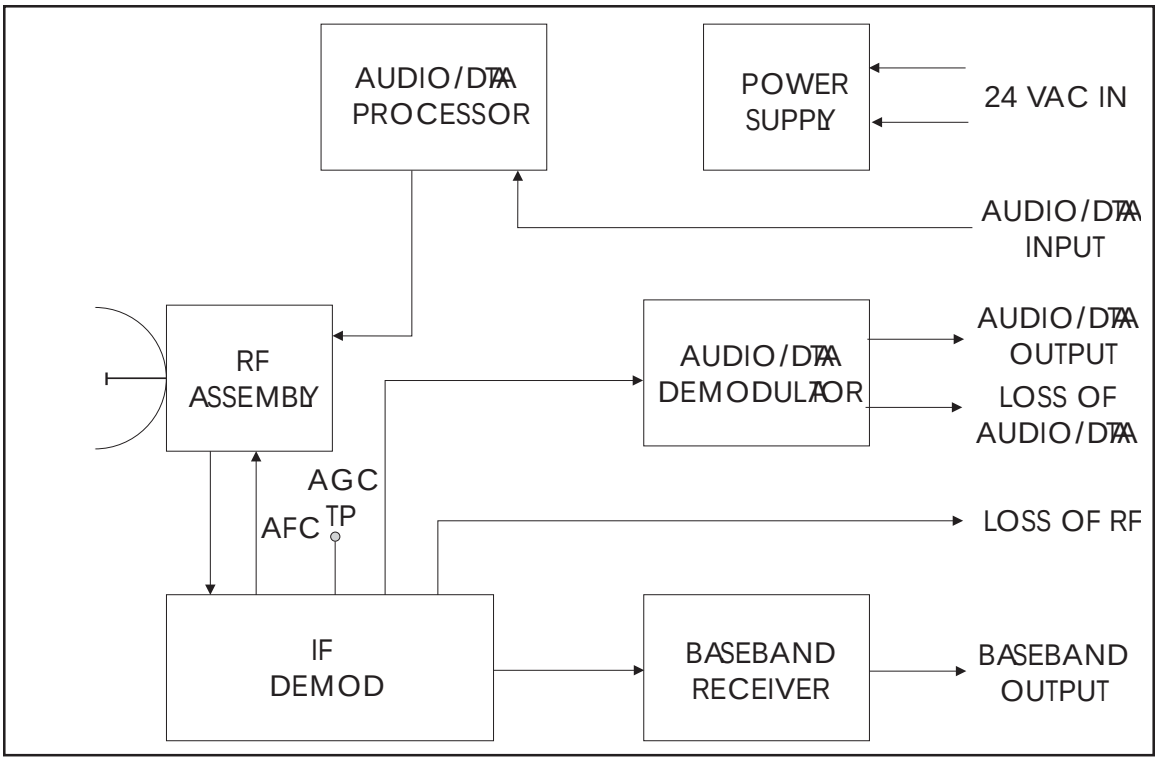


Figure 28 Receiver Functional Block Diagram

RECEIVER

Figure 28 is a block diagram of the receiver (antenna assembly where the baseband is received). A functional description of each block follows.

POWER SUPPLY

The power supply accepts 24VAC (or optional +24VDC) input voltage from the Racon-supplied transformer. The voltage is rectified, regulated, and distributed to all circuit boards. A 4 amp fuse located on the power supply board protects circuitry from excess current draw.

AUDIO/DATA PROCESSOR

The audio/data signals connect to this board. They are filtered, pre-emphasized, and frequency modulated on a 6.2MHz subcarrier. The subcarrier is directed to the modulator on the RF assembly.

RF ASSEMBLY

The RF assembly produces the radio frequency output (21.2 to 23.6 GHz), contains the frequency modulator, and provides the IF signal output. The RF output is generated by a gunn diode which oscillates in a high Q cavity. The modulator is a varactor diode which frequency modulates the RF output when a varying signal is applied. Both the baseband and subcarrier signals are applied to the modulator. The mixer diode provides a difference signal (45MHz) generated by the beating of the RF output signals from each antenna assembly. The 45MHz IF is connected to the IF demodulator board.

IF DEMODULATOR

The 45MHz signal is filtered, amplified, and demodulated. The demodulator also contains automatic frequency control circuitry which supplies an error correction voltage to the RF assembly to maintain a 45MHz IF. The subcarrier (7.4MHz from the transmitter) is directed to the audio/data demodulator board. The IF demodulator provides an AGC signal which is used as an alignment aid. A Loss of RF alarm is provided to indicate a failure in either RF assemblies. (See the specifications for output voltage levels.) A green Signal Present LED located on the IF demodulator board indicates the RF signal is present.

BASEBAND RECEIVER

The baseband receiver filters, de-emphasizes, and amplifies the baseband (video) signal.

AUDIO/DATA DEMODULATOR

The subcarrier signal (7.4MHz) is filtered and demodulated. The audio/data signal is then de-emphasized and amplified to provide the appropriate

signal to the output. The audio/data demodulator also provides a Loss of Subcarrier alarm which indicates the absence of the 7.4MHz subcarrier. (See the specifications for output voltage levels.) A red Loss of Subcarrier LED is located on the audio/data demodulator board.

TECHNICAL INFORMATION

This section describes signal flows for all models of the 5000E Series.

Power Supply AC 10076-131-02

Twenty-four volt AC is applied to TB1 pins 1 and 2 from Racon supplied 150VA transformer. The AC supply is rectified and regulated to provide the following voltages:

TP-1 to TP-4	+24VDC to +34VDC unregulated
TP-2 to TP-4	+15VDC ± .3VDC regulated
TP-6 to TP-7	+5VDC ± .15VDC regulated
TP-8 to TP-7	-5VDC ± .15VDC regulated

The power supply voltages go through the RF filter J2 to the mother board connector J1. On the mother board the following power supply test points are provided:

TP-1	Ground
TP-4	+15Vdc
TP-5	+5Vdc
TP-6	-5Vdc
TP-7	+24Vdc to 34Vdc

Power Supply AC/DC 10075-121-01

Same as Power Supply AC 10075-131-01, except the input is either +24VDC or 24VAC

Baseband Signal Flow

The baseband signal is connected to the BNC connector labeled “Baseband Input”. This goes through coaxial cable to J2 on baseband transmitter board 10075-129-01. A 1Vp-p baseband signal is measured at TP-1. The baseband transmitter board then preemphasizes the baseband signal which appears at TP-2 as a 1Vp-p pre-emphasized signal. It goes out the baseband transmitter board at P1-1 through the mother board to the RF assembly P2-5. It is then amplified to the proper signal level for the given varactor sensitivity of the RF assembly. This will be between 1Vp-p to 3Vp-p as measured at E2 on the varactor/pre-amp board 10075-122- XX. This is then transmitted to the receiver.

At the receiver, the RF signal beats with the local oscillator frequency, which produces a 45MHz intermediate frequency. This is filtered and amplified on the varactor pre-amp board. This is connected to the IF demodulator board 10075-123-XX through P1-1 on the varactor pre-amp board to J2 on the mother board, and to P9 on the IF demod board through a short piece of coaxial cable. On the IF demod board, the IF signal is filtered, amplified and AGC-controlled to a -10dbm level at TP-10. It is then demodulated to a pre-emphasized signal, which goes to P3-6 on the IF demodulator board, and then through the mother board to the baseband receiver board P1-1. It goes through a bandpass filter to TP-1 (a 300mVp-p pre-emphasized signal), which is then amplified and deemphasized to produce a 1Vp-p baseband signal at TP-2. It then goes from J2 through the coaxial cable to the baseband output BNC connector.

Subchannel Signal Flow for 4004/5004E, 4006/5006E and 4005/5005E

The audio signal is connected to input A on the 10075-152-XX interconnect board. The signal goes from J1 on the interface board to J1 on the power supply board through the RF filter J2 to J2-1 on the audio processor board 10075-127-XX. The audio processor board pre-emphasizes and frequency modulates the audio signal onto the subcarrier. The subcarrier signal goes to P2-2, on the varactor/pre-amp board, through the mother board from P1-1 on the audio processor. The signal is then added to the baseband signal on the baseband transmitter, or goes directly to the varactor driver on the baseband receiver. It is then transmitted to the other radio, where it is received and processed by the pre-amp and IF demodulator board. The demodulated signal goes from P3-4 on the IF demodulator board through the mother board to P1-1 on the audio demodulator board 10075-125-XX. The signal goes through a subcarrier bandpass filter; it is then demodulated and de-emphasized. The audio signal goes from J3-1 on the audio demodulator board through the RF filter J2 to J1 on the power supply board. The signal then goes to J1 on the interconnect board and them to output A on the interconnect board.

All other subchannel signal flows are similar to the above, therefore only the differences will be described in the following sections.

Subchannel Signal Flow 4204/5204E, 4206/5206E, 4205/5205E

The audio signals are connected to input A and input B. They go to the duplex audio processor board 10075-154-XX J2-1 (Input A) and J2-3 (Input B). Input A and B are pre-emphasized and then Input B is frequency modulated onto a super-subcarrier. Input A and B are then added together and modulated onto the subcarrier.

On the receive side the subchannel is filtered and demodulated on the duplex audio demodulator 10075-158-XX. There are two bandpass filters one for input A and one for the super-subcarrier (Input B). Input A is then de-emphasized and appears at J3-1. The supersubcarrier is demodulated and Input B is filtered and de-emphasized and appears at J3-3. Both signals then go to the interconnect board Output A and Output B respectively.

Subchannel Signal Flow 4007/5007E, 4008/5008E, 4017/5017E, and 4018/5018E

The signal is connected to Input A on the interconnect board 10075-152-XX. The signal then goes to J2-1&2 on the wideband subcarrier processor board 10075-141-XX,where it is frequency modulated onto the subcarrier.

At the receive side the signal is processed by the wideband subcarrier demodulator board 10075-142-XX. The board filters and demodulates the subcarrier and then filters and reshapes the signal. The output signal at J3-1&2 goes to the interconnect board output A.

Subchannel Signal Flow 4014/5014E*, 4020/5020E, 4214/5214E*+, 4217/5217E+, 4218/5218E+, 4220/5220E+, 4414/5414E*, 4214/5214E, 4420/5420E, and 4440/5440E*+

The audio/FSK is connected to input A and the RS422 is connected to input B on the interconnect board. The signals then go to J2-1&2 (audio/FSK) and J2-3&4 (RS422) on the audio/RS422 processor board 10075-155-xx. The RS422 is converted to a TTL signal and then to an FSK signal. The A input is pre-emphasized and then added to the FSK signal. This combined signal is then frequency modulated onto the subcarrier.

At the receiver side the signal is processed by the audio/RS422 demodulator board 10075-159-XX. The subcarrier is filtered and then demodulated. There are two bandpass filters one for input A signal and one for the FSK signal. Input A is then de-emphasized and appears at J3-1. The FSK signal is then detected and turned into a TTL signal. Then it is converted to RS422, which appears at J3-3 and J3-4. Both signals then go to the interconnect board output A and output B respectively.

* These models have line driver/receivers provided with the system to convert RS-232 to RS-422.

+ These models have modems included to provide second data channel.

Subchannel Signal Flow 4085/5085E and 4485/5485E

The signal flow of this subchannel is the same as in the 5020E and the 5420E with the following exceptions:

1. The input and the output of the RS485 are connected to Input B.

2. The RS485 receive signal goes from J4-1&2 on the audio/RS422/485 demodulator board to J3-1&2 on the audio/RS422/485 processor board.

VIII. MAINTENANCE AND TROUBLESHOOTING PROCEDURES

This section describes maintenance procedures for all modules installed in the Micropass 4000/5000E system. Maintenance of the 4000/5000E system consists of isolating the problem to the board level and replacing the board. This section assumes the customer has checked all associated equipment.

Micropass® 4000/5000E Cross Reference

The following table lists the boards included in each 4000/5000E model. Refer to this table during trouble shooting and maintenance to determine which boards you have installed in your system.

Model Numbers	4000 Series P/N	5000E Series P/N
Model 4003/5003E	10108-100/101-03	10075-100/101-03
Model 4004/5004E	10108-100/101-04	10075-100/101-04
Model 4005/5005E	10108-100/101-05	10075-100/101-05
Model 4006/5006E	10108-100/101-06	10075-100/101-06
Model 4007/5007E	10108-100/101-07	10075-100/101-07
Model 4008/5008E	10108-100/101-82	10075-100/101-82
Model 4014/5014E	10108-100/101-40	10075-100/101-40
Model 4017/5017E	10108-100/101-32	10075-100/101-32
Model 4018/5018E	10108-100/101-33	10075-100/101-33
Model 4020/5020E	10108-100/101-40	10075-100/101-40
Model 4085/5085E	10108-100/101-84	10075-100/101-84
Model 4204/5204E	10108-100/101-35	10075-100/101-35
Model 4205/5205E	10108-100/101-36	10075-100/101-36
Model 4206/5206E	10108-100/101-37	10075-100/101-37
Model 4214/5214E	10108-100/101-49	10075-100/101-49
Model 4217/5217E	10108-100/101-41	10075-100/101-41
Model 4218/5218E	10108-100/101-43	10075-100/101-43
Model 4414/5414E	10108-100/101-47	10075-100/101-47
Model 4420/5420E	10108-100/101-47	10075-100/101-47
Model 4440/5440E	10108-100/101-50	10075-100/101-50
Model 4485/5485E	10108-100/101-85	10075-100/101-85

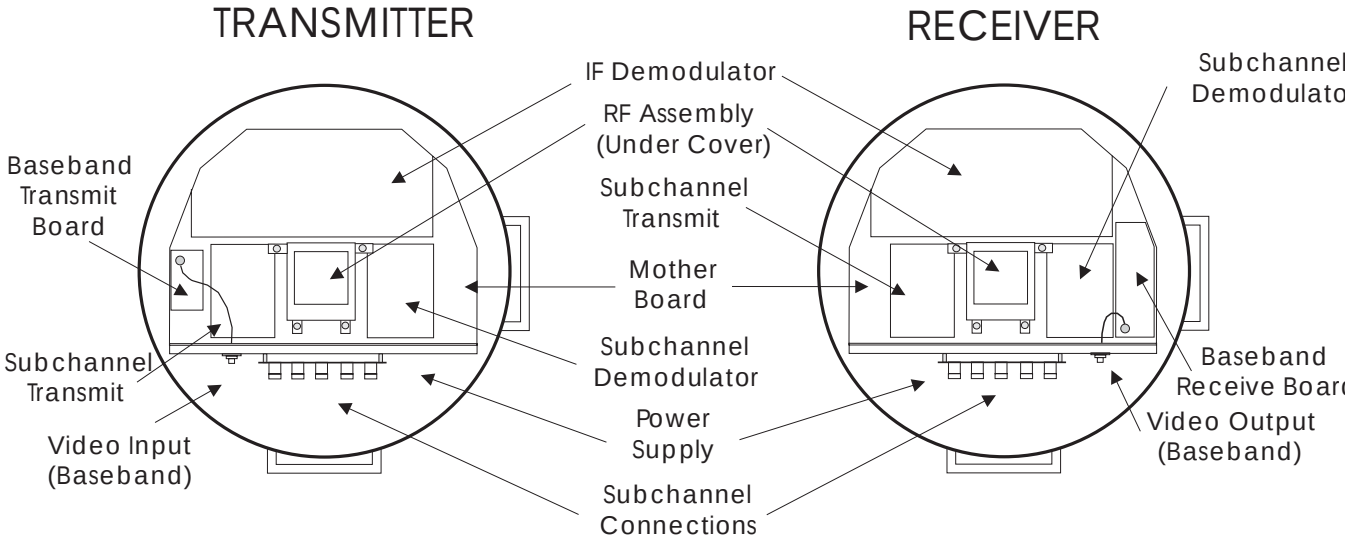


Figure 29
Board Locations

Model 4003 & 5003E Simplex Video

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
	10075-102-03	Preamp/Varactor Drive;Source/Heater (note 1)
10075-102-04		Varactor Drive;Source/Heater (note 1)
	10075-123-01	IF Demod
10075-129-07		Baseband XMTR
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
	10075-152-10	Interconnect Board

Model 4004 & 5004E Simplex Video w/ one reverse audio

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
10075-102-03	10075-102-03	Preamp/Varactor Drive;Source/Heater (note 1)
10075-123-01	10075-123-01	IF Demod
10075-125-01		Audio Demod
10075-129-07		Baseband XMTR
	10075-127-01	Audio Processor
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
10075-152-13	10075-152-14	Interconnect Board

Model 4005 & 5005E Simplex Video w/ one duplex audio

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
10075-102-03	10075-102-03	Preamp/Varactor Drive;Source/Heater (note 1)
10075-123-01	10075-123-01	IF Demod
10075-125-02	10075-125-01	Audio Demod
10075-129-07		Baseband XMTR
10075-127-01	10075-127-02	Audio Processor
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
10075-152-12	10075-152-12	Interconnect Board

Model 4006 & 5006E Simplex video w/ one forward audio

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
	10075-102-03	Preamp/Varactor Drive;Source/Heater (note 1)
10075-102-04		Varactor Drive;Source/Heater (note 1)
	10075-123-01	IF Demod
	10075-125-01	Audio Demod
10075-129-07		Baseband XMTR
10075-127-01		Audio Processor
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
10075-152-14	10075-152-13	Interconnect Board

Model 4007 & 5007E Simplex Video w/ 1 reverse manchester

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
10075-102-03	10075-102-03	Preamp/Varactor Drive;Source/Heater (note 1)
10075-123-01	10075-123-01	IF Demod
10075-129-07		Baseband XMTR
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
	10075-141-01	Wideband Processor
10075-142-01		Wideband Demod
10075-152-08	10075-152-09	Interconnect Board

Model 40017 & 50017E Simplex Video w/ 1 reverse RS422

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
10075-102-03	10075-102-03	Preamp/Varactor Drive;Source/Heater (note 1)
10075-123-01	10075-123-01	IF Demod
10075-129-07		Baseband XMTR
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
	10075-141-02	RS422 Processor
10075-142-04		RS422 Demod
10075-152-08	10075-152-09	Interconnect Board

Model 40018 & 50018E Simplex Video w/ 1 forward RS422

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
	10075-102-03	Preamp/Varactor Drive;Source/Heater (note 1)
10075-102-04		Varactor Drive;Source/Heater
	10075-123-01	IF Demod
10075-129-07		Baseband XMTR
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
10075-141-02		RS422 Processor
	10075-142-04	RS422 Demod
10075-152-11	10075-152-08	Interconnect Board

Model 4204 & 5204E Simplex Video w/ 2 reverse audio

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
10075-102-03	10075-102-03	Preamp/Varactor Drive;Source/Heater (note 1)
10075-123-01	10075-123-01	IF Demod
10075-129-07		Baseband XMTR
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
10075-152-02	10075-152-03	Interconnect Board
	10075-154-01	Duplex Audio Processor
10075-158-01		Duplex Audio Demod

Model 4205 & 5205E Simplex Video w/2 duplex audio

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
10075-102-03	10075-102-03	Preamp/Varactor Drive/Source/Heater (note 1)
10075-123-01	10075-123-01	IF Demod
10075-129-07		Baseband XMTR
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
10075-152-01	10075-152-01	Interconnect Board
10075-154-01	10075-154-02	Duplex Audio Processor
10075-158-02	10075-158-01	Duplex Audio Demod

Model 4206 & 5206E Simplex video w/ 2 forward audio

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
	10075-102-03	Preamp/Varactor Drive/Source/Heater (note 1)
10075-102-04		Varactor Drive/Source Heater (note 1)
	10075-123-01	IF Demod
10075-129-07		Baseband XMTR
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
10075-152-03	10075-152-02	Interconnect Board
10075-154-01		Duplex Audio Processor
	10075-158-01	Duplex Audio Demod

Model 4014 & 5014E Simplex Video w/1 duplex RS232
Model 4020 & 5020E Simplex Video w/1 duplex RS422

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
10075-102-03	10075-102-03	Preamp/Varactor Drive/Source/Heater (note 1)
10075-123-01	10075-123-01	IF Demod
10075-129-07		Baseband XMTR
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
10075-152-15	10075-152-15	Interconnect Board
10075-155-03	10075-155-04	RS422 Processor 9.6K
10075-159-04	10075-159-03	RS422 Demod 9.6K

Model 4414 & 5414E Simplex Video w/duplex audio/RS232
Model 4420 & 5420E Simplex Video w/duplex audio/RS422

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
10075-102-03	10075-102-03	Preamp/Varactor Drive/Source/Heater (note 1)
10075-123-01	10075-123-01	IF Demod
10075-129-07		Baseband XMTR
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
10075-152-04	10075-152-04	Interconnect Board
10075-155-01	10075-155-02	Audio/RS422 Processor
10075-159-02	10075-159-01	Audio/RS422 Demod

Model 4008 & 5008E Simplex Video w/reverse Bi-phase

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
10075-102-03	10075-102-03	Preamp/Varactor Drive/Source/Heater (note 1)
10075-123-01	10075-123-01	IF Demod
10075-129-07		Baseband XMTR
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
	10075-141-05	56K Processor 6.2 MHz
10075-142-06		56K Demod 6.2 MHz
10075-152-08	10075-152-09	Interconnect Board

Model 4085 & 5085E Simplex Video w/duplex RS485

XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
10075-102-03	10075-102-03	Preamp/Varactor Drive/Source/Heater (note 1)
10075-123-01	10075-123-01	IF Demod
10075-129-07		Baseband XMTR
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
10075-152-18	10075-152-18	Interconnect Board
10075-156-03	10075-156-04	Audio/RS485 Processor
10075-160-04	10075-160-03	Audio/RS485 Demod

Model 4485 & 5485E Simplex Video w/ duplex Audio/RS485

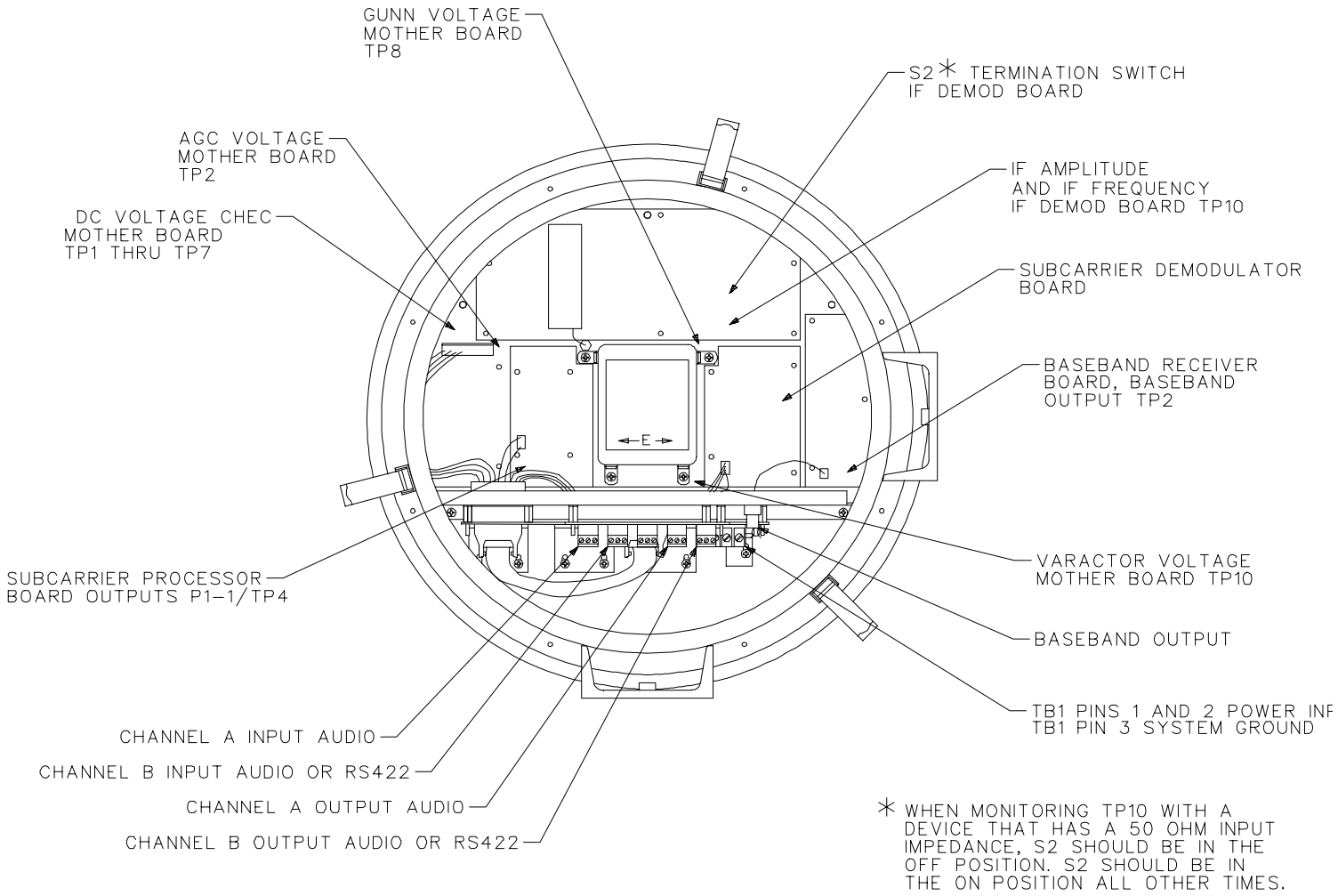
XMTR	RCVR	
10076-120-02	10076-120-02	Mother Board
10075-102-03	10075-102-03	Preamp/Varactor Drive/Source/Heater (note 1)
10075-123-01	10075-123-01	IF Demod
10075-129-07		Baseband XMTR
	10075-128-01	Baseband RCVR
10076-131-02	10076-131-02	Power Supply AC
10075-152-17	10075-152-17	Interconnect Board
10075-156-01	10075-156-02	Audio/RS485 Processor
10075-160-02	10075-160-01	Audio/RS485 Demod

NOTES:

1. For all 4000 series radios the source assembly PN's are replaced as follows:
   10075-102-03 >> 10075-102-05
   10075-102-04 >> 10075-102-06

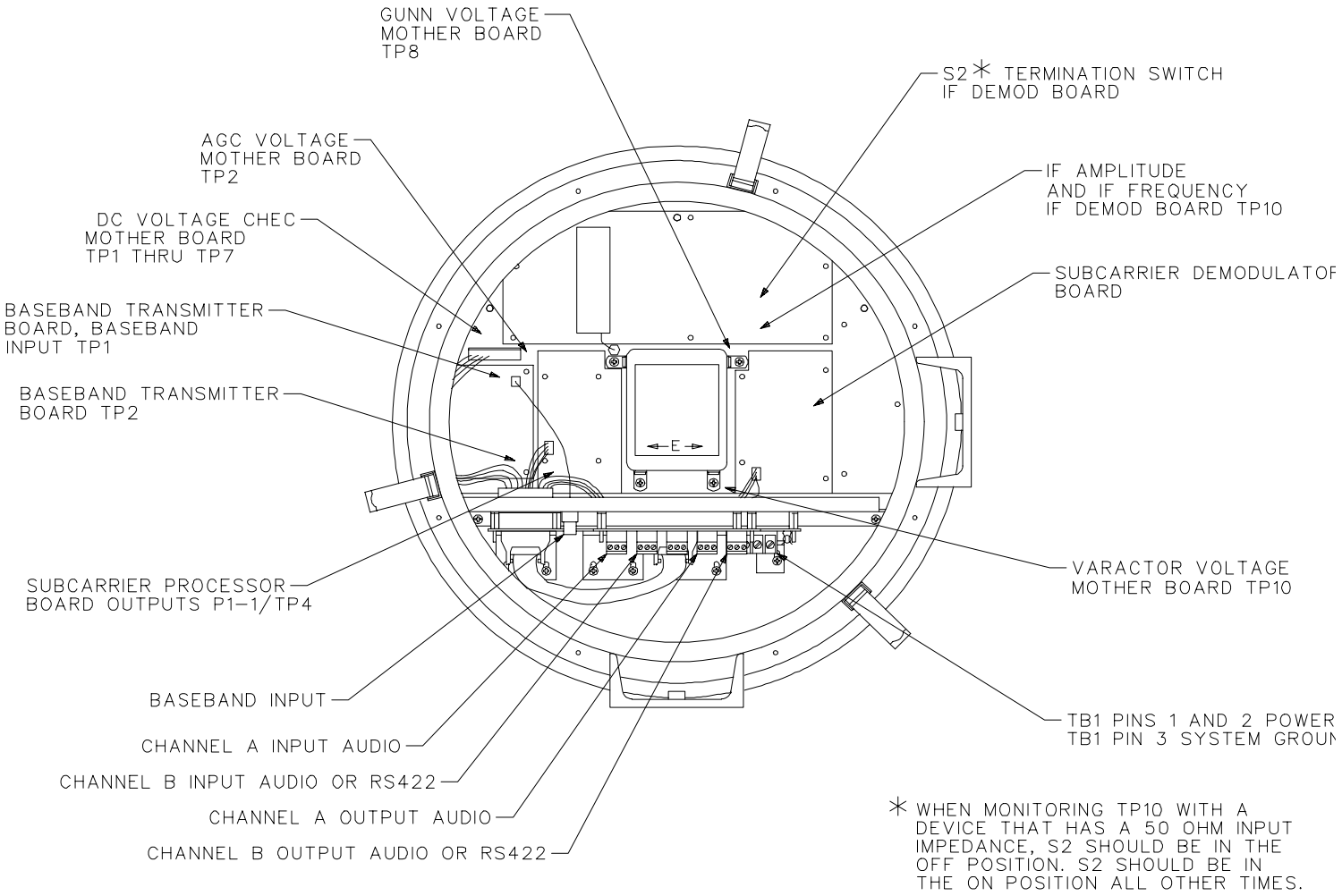
OPTIONS:

1. Power supply AC/DC	10075-121-01 (Replaces 10076-131-02)
2. Antenna configuration	10076-119-XX (choice of 17", 27", 48", 72" and others)
2. Baseband RCVR PAL	10075-145-01 w/ notch filter
Baseband RCVR PAL	10075-128-04 w/o filter (obsolete)
Baseband RCVR Wideband	10075-128-02



MODEL 4000 & 5000 RX

TEST POINT LOCATIONS



MODEL 4000 & 5000 TX

TEST POINT LOCATIONS

LIST OF EQUIPMENT

Oscilloscope	Leader LBO-518(100MHz bandpass, dual trace, 10mV/div. sens.)
Frequency Counter	Fluke 1900A (10Mhz max, stability at least 5 parts per 10E6)
Digital Multimeter	Fluke 8062A (4 1/2 digit, DC±.05%, AC±.07%)

TROUBLE ISOLATION CHART

Use the Trouble Isolation Chart to help you identify the source of a system malfunction. Locate the symptom in the left column, perform the checks described, and then go to the board trouble shooting section indicated.

TABLE IV-1 TROUBLE ISOLATION CHART

A Symptom	B Go to	C Check	D Normal Indication	E If Abnormal	F If Normal
1. Complete system down: Simplex system does not transmit in forward direction. Duplex system does not transmit in either direction.	1. Transmitter	1. Verify that the power supply is on.	Power On LED DS1 is on.	Check fuse F1 at input of power supply. Check for proper input power.	Go to transmitter check #2.
		2. Verify all power supply outputs at the mother board test points.	+24VDC To +34VDC @ TP-7 -5V±.15V@TP-6 +5V±.15V@TP-5 +15V±.5V@TP-4 +9.5 - 11.0 VDC@TP-3 (5K) +12.0 - 14.0 VDC@TP-3 (4K)	Go to Power Supply Troubleshooting.	Go to #2 Receiver.
	2. Receiver	1. Verify that the power supply is on.	Power On LED DS1 is on.	Check fuse F1 at input of power supply. Check for proper input power.	Go to receiver check #2.
		2. Verify all power supply outputs at the mother board test points.	+24VDCTo+30VDC @TP-7 -5V±.15V@TP-6 +5V±.15V@TP-5 +15V±.5V@TP-4 +9.5 - 11.0 VDC@TP-3 (5K) +12.0 - 14.0 VDC@TP-3 (4K)	Go to Power Supply Troubleshooting.	Go to Receiver check #3.
		3. Verify that the IF Demodulator is sweeping the receiver frequency.	Signal Present LED DS1 is off or flashing.	Go to IF Demodulator Board Trouble Shooting.	Go to Receiver check #4.
		4. Verify that the varactor diode voltage is sweeping.	2.5V p-p to 7.5V p-p sweep about 8VDC at varactor (TP-10 on the mother-board).	Go to receiver check #5.	Go to receiver check #6.
		5. Verify that the IF Demodulator AFC is sweeping.	6V p-p sweep at P5-3 (TP-9) centered about 5VDC.	Go to IF Demodulator Board Replacement Procedure.	Go to RF Assembly Trouble Shooting.
		6. Verify gunn diode is biased correctly.	4.5VDC to 7.0VDC on gunn diode (TP-8 on the motherboard).	Go to RF Assembly Trouble-Shooting.	Go to #3 Transmitter.

TABLE IV-1 TROUBLE ISOLATION CHART, CONTINUED

A Symptom	B Go to	C Check	D Normal Indication	E If Abnormal	F If Normal
	3. Transmitter	1. Verify that the varactor drive is providing the correct DC bias.	8 ± .5VDC on varactor diode. Tp-10 mother-board (no baseband)	Go to RF Assembly Trouble Shooting.	Go to Transmitter Check #2.
		2. Verify that the gunn regulator is operating correctly.	4.0VDC to 7.0VDC on gunn diode. Tp-8 motherboard	See RF Trouble Shooting.	Go to Transmitter Check #3.
		3. Verify that the varactor drive is amplifying the baseband signal.	1V pp to 3V pp base band signal on the varactor diode (E2).	Go to RF Trouble Shooting.	
2. System transmits subcarrier in forward direction, but no baseband. Note: When trouble shooting the baseband, it is recommended that all subcarriers be turned off.	1. Transmitter	Baseband input at Baseband Transmit board.	1V pp at J2-2 (TP-1).	Check external equipment and input cable.	Go to Transmitter Check #2.
		2. Verify Baseband Transmitter is working.	1V pp video at output P1-1 (TP-2).	See Baseband Transmitter Board Replacement Procedure.	Go to Transmitter Check #3.
		3. Verify that the varactor drive is amplifying the signal.	1V pp to 3V pp signal on varactor diode. (E2) See RF Assembly	TroubleShooting. Go to Receiver check #1.	
	2. Receiver	1. Verify that the baseband signal is present at the output of the IF Demodulator board.	300mV pp video at P3-6. Go to IF demodulator	Replacement Procedure.	Go to Receiver Check #2.
		2. Verify that the baseband receiver is working.	1V pp video output at Tp-2.	See Baseband Receiver Board Replacement Procedure.	Check output cable.
3. System transmits baseband but does not transmit subcarrier in the same direction. Note: It is recom-mended that the baseband input signal be removed during trouble shooting.	1. Transmitter	1. Subchannel inputs.	Proper audio or data signal at Input A or Input B of interconnect board.	Check external equipment.	Go to Transmitter Check #2.
		2. Verify that the subchannel input signal is also present at J2 on subchannel board.	The signal at J2-1 or J2-3 is the same as the signal at Input A or Input B. Check cables from the	interconnect board to the subchannel transmitter board.	Go to Transmitter Check #3.
		3. Verify that the subcarrier boards are transmitting.	7.4MHz or 6.2MHz, 350±75mV p-p output at P1-1.	See applicable subchannel Replacement Procedure.	Go to Transmitter Check #4.
		4. Verify varactor drive is amplifying subcarrier.	300mV p-p to 1V p-p subcarrier on varactor. (E2)	See RF Assembly Trouble-Shooting.	Go to #2 Receiver.
	2. Receiver	1. Verify that the subcarrier is preset at the output of the IF Demodulator.	200 mV p-p ±50mV at P3-4.	Go to IF demodulator board Replacement Procedure.	Go to Receiver Check #2.
		2. Verify subcarrier demodulator is working.	Proper audio signal or data signal at output of board at J3-1 or J3-3.	See appropriate subcarrier demodulator board trouble shooting.	Go to Receiver Check #3.

TABLE IV-1 TROUBLE ISOLATION CHART, CONTINUED

A Symptom	B Go to	C Check	D Normal Indication	E If Abnormal	F If Normal
	2. Receiver (Continued)	3. Verify output is present at interconnect board.	Signal present at Output A or Output B.	Check wiring from subcarrier demodulator to interconnect board.	Check external cables from radio to equipment.
4. Duplex system transmits in the forward direction, but does not transmit in the reverse direction.	1. Receiver	1. Check subcarrier channel inputs.	Proper audio signal or data signal at Input A or Input B.	Check external equipment.	Go to Receiver Check #2.
		2. Verify subchannel transmitter boards are transmitting.	6.2MHz or 7.4Mvp-p, 350±75mV p-p output at P1-1.	See appropriate subchannel transmitter board Replacement Proceure.	Go to Receiver Check #3.
		3. Verify varactor drive is amplifying subcarrier.	300mV p-p to 1V p-p subcarrier on varactor diode. (E2)	See RF Assembly trouble shooting section.	Go to #2 Transmitter.
	2. Transmitter	1. Verify IF demodulator is receiving output from preamp.	Signal Present LED DS1 is on.	IF demodulator is faulty or mixer/preamp is faulty. See RF trouble shooting section.	Go to Transmitter Check #2.
		2. Verify IF demodulator is demodulating received signal.	Demodulated subcarrier should be 200±50mV p-p at P3-4.	See IF Demodulator Replacement Procedure.	Go to Transmitter Check #3.
		3. Verify subcarrier demodulator is working.	Proper audio signal or data signal at output of board at J3-1 or J3-3.	See appropriate subchannel demodulator trouble shooting.	Go to Transmitter Check #4.
		4. Verify outputs present at interconnect board.	Proper audio signal or data signal at Output A or Output B.	Check wiring from subchannel demodulator board to interconnect board.	

POWER SUPPLY TROUBLE SHOOTING PROCEDURE

1. Disconnect input supply.
2. Disconnect cable at J1 on mother board.
3. Connect J1-4 and J1-9 to ground with jumper.
4. Reconnect input supply.
5. Check power supply voltages on power supply board.

TP-1 to TP-4 (negative)	+24VDC to +34VDC
TP-2 to TP-4 (negative)	+15VDC ± .5VDC
TP-3 to TP-4 (negative)	+9VAC TO 11VDC
TP-6 to TP-7 (negative)	+5VDC ± .15VDC
TP-8 to TP-7 (negative)	-5VDC ± .15VDC

6. If voltages are abnormal, go to Power Supply Replacement Procedures.
7. If voltages are normal, check for shorts at power supply test points on mother board.
8. When a short is found on a test point, remove the component boards one at a time. (See Board Replacement Procedure for proper Removal Procedure) Do this until the short is removed. Replace the component board that caused the short.

RF ASSEMBLY TROUBLE SHOOTING PROCEDURE

1. Disconnect input power.

2. Remove the four screws holding down the microwave cover, which is in the center of the unit, and remove cover.

3. Check fuse F1. (Replace if bad)

4. Check resistance of Gunn diode E3 to ground. It should be between 1 to 3 ohms. If less than 1 ohm or greater than 3 ohms, go to RF Replacement Procedure.

5. Reconnect input power.

6. If fuse blows, go to RF Replacement Procedure.

7. Check E3 voltage; it should be 4.0VDC to 7.0VDC. If not, go to RF Replacement Procedure.

8. Put S1 and S2 into "T" position.

9. Check E2 voltage; it should be 8VDC ±.1VDC. If not, go to RF Replacement Procedure.

10. Put S1 and S2 back into "R" position if unit is baseband receiver;
    leave in "T" position if unit is baseband transmitter.

11. Connect digital multimeter lead to E1. Check if DSI "Signal Present" LED comes on or remains off.

12. Connect digital multimeter lead to P1-1. Check if DSI "Signal Present" LED comes on or remains off.

13. If "Signal Present" LED remains off during both steps 11 & 12, go to IF Demodulator Replacement Procedure.

14. If "Signal Present" LED remains off during step 11, but comes on during step 12, go to RF Replacement Procedure.

SUBCHANNEL DEMODULATOR TROUBLE SHOOTING

1. Put S2 on the subchannel transmit board of the bad subchannel path in the "Off" position.

2. On 10075-125-XX boards, turn R176 clockwise until DS150 "Loss of Audio" LED goes off. (All other demodulator boards disregard this step)

3. At J3-1, check for noise of at least 2 Vp-p.

4. If there is noise at J3-1, go to Subchannel Transmitter Replacement Procedure.

5. If there is no noise at J3-1, go to Subchannel Receiver Replacement Procedure.

POWER SUPPLY REPLACEMENT PROCEDURE

(all modules come from the factory pre-adjusted)

1. Disconnect input power.

2. Remove cable connected to J1 on 10075-152-XX interconnect board.

3. Remove cable connected to J2 on power supply board.
   A) Unscrew phillips head 4-40 screws
   B) Pull cable out

4. Unscrew 3/16 hex head standoffs.

5. Unscrew phillips head #6 sheet metal screw holding down power supply heat sink in bottom of unit.

6. Remove 10075-152-XX board.

7. Remove power supply board.

8. Reverse steps to put in new power supply board.

9. Reconnect power.

RF ASSEMBLY REPLACEMENT PROCEDURE

1. Disconnect power.
2. Unscrew 4 phillips head screws holding down RF assembly cover.
3. Remove cover.
4. Unscrew 2 1/4 inch hex head standoffs that are off center of RF assembly.
5. Unscrew 3 phillips head screws holding down RF assembly.
6. Gently pull RF assembly straight out.
7. Remove 4 screws holding antenna feed onto RF assembly.
8. Put antenna feed onto new RF assembly.
9. Reverse steps to put in new RF assembly.
10. Reconnect power.

IF DEMODULATOR REPLACEMENT PROCEDURE

1. Disconnect input power.
2. Disconnect SMC connector from J2 on mother board with 15/64" or 1/4" open end wrench.
3. Remove IF demodulator board from mother board by squeezing top of PCB supports with needle-nosed pliers and carefully lifting underneath board around supports. Repeat for all PCB supports.
4. Insure that the pins coming out of the mother board are not bent.
5. Reverse procedure to replace with new IF demodulator board insuring that all pins and connectors line up.

6. Reconnect input power.

BASEBAND TRANSMITTER, BASEBAND RECEIVER, SUBCHANNEL TRANSMITTER, AND SUBCHANNEL DEMODULATOR REPLACEMENT PROCEDURE

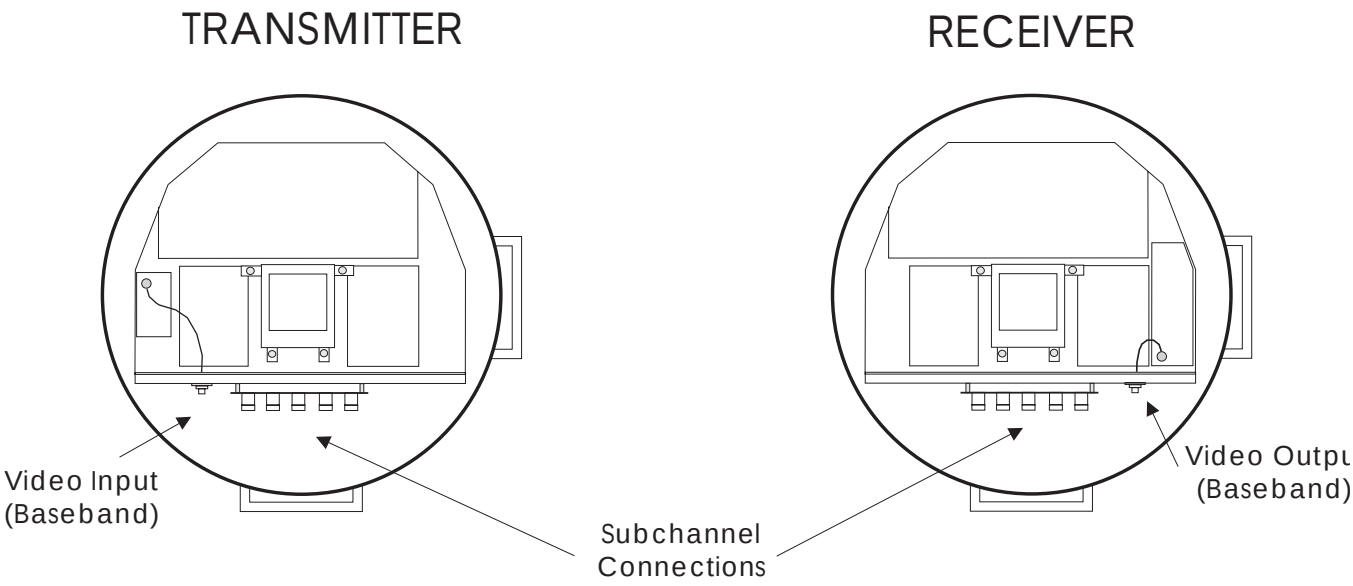
1. Disconnect power.
2. Disconnect any wires/cables from the board.
3. Remove the board from mother board by squeezing tops of PCB supports with needle-nosed pliers and carefully lifting underneath board around supports. Repeat for all PCB supports.
4. Insure that the pins coming out of the mother board are not bent.
5. Reverse procedure to replace with new board, insuring that all pins and connectors line up.
6. Reconnect input power.

IX. APPENDICES

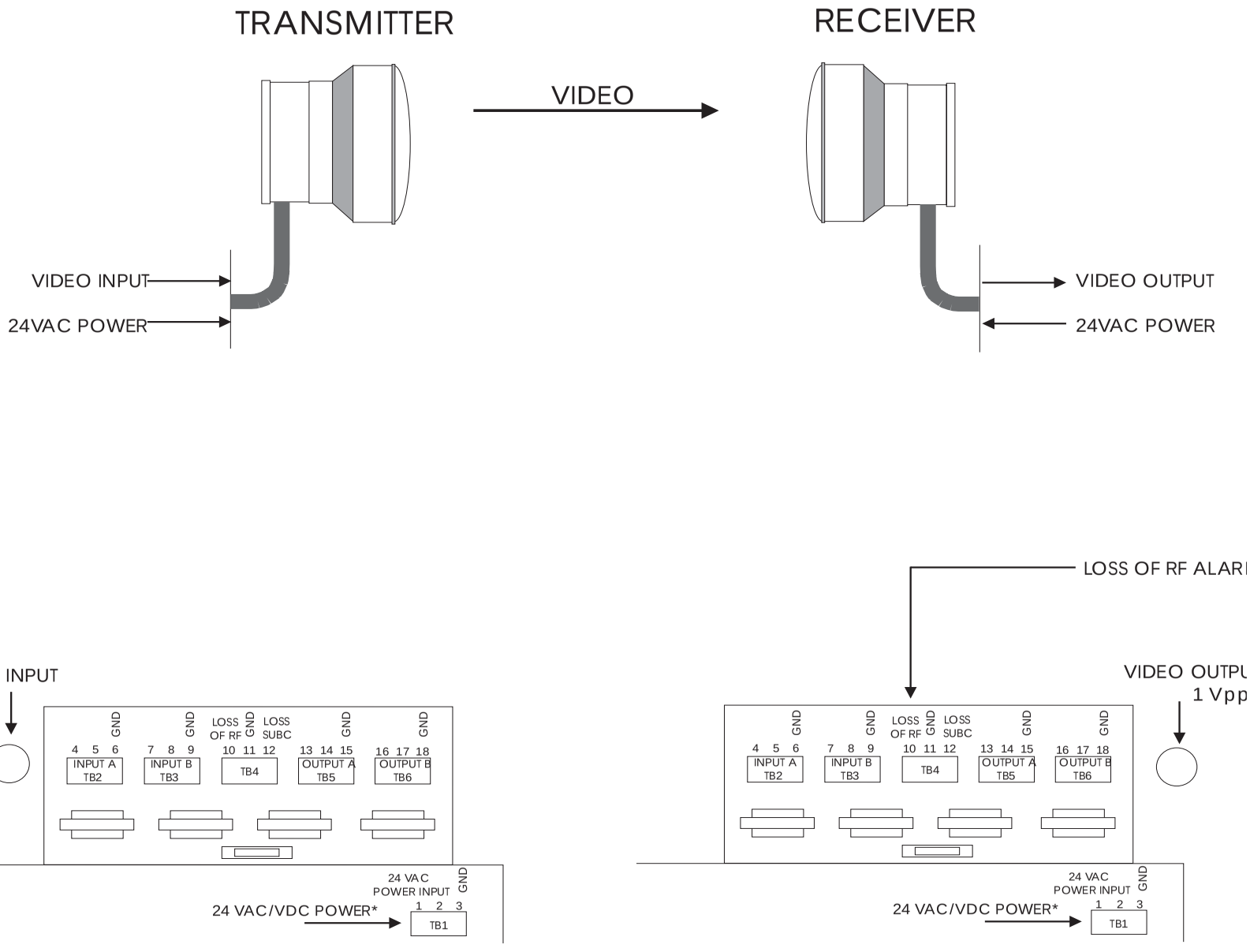
Appendix 1	Cable Connections
Appendix 2	4000/5000E Maintenance Record, Receiver
Appendix 3	4000/5000E Maintenance Record, Transmitter

CABLE CONNECTIONS

This section illustrates cable connections for each Micropass model.

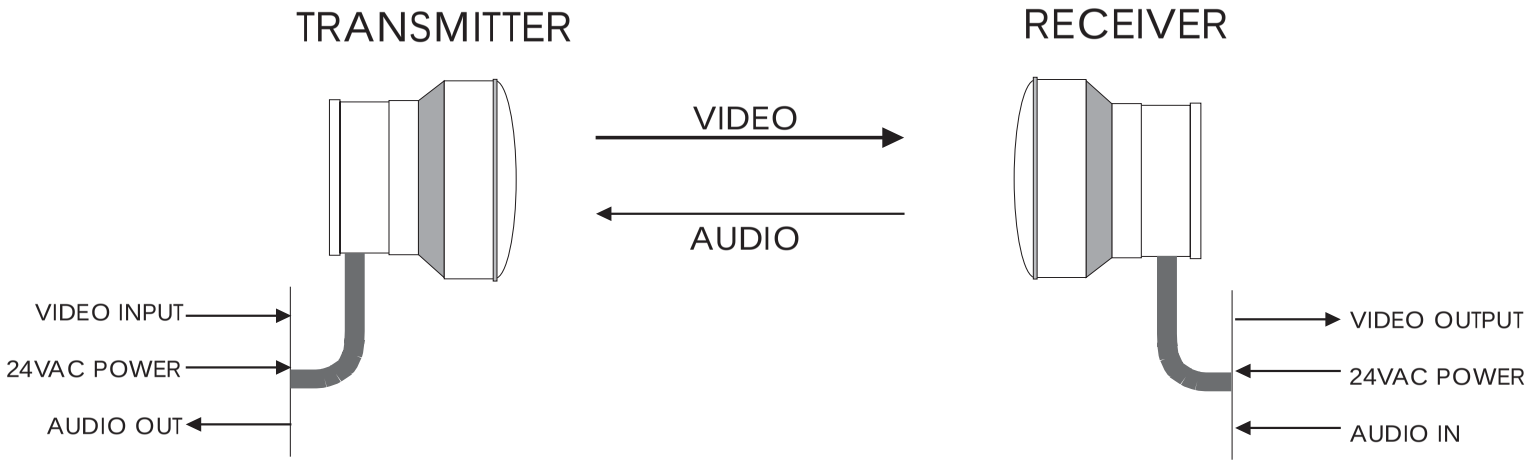


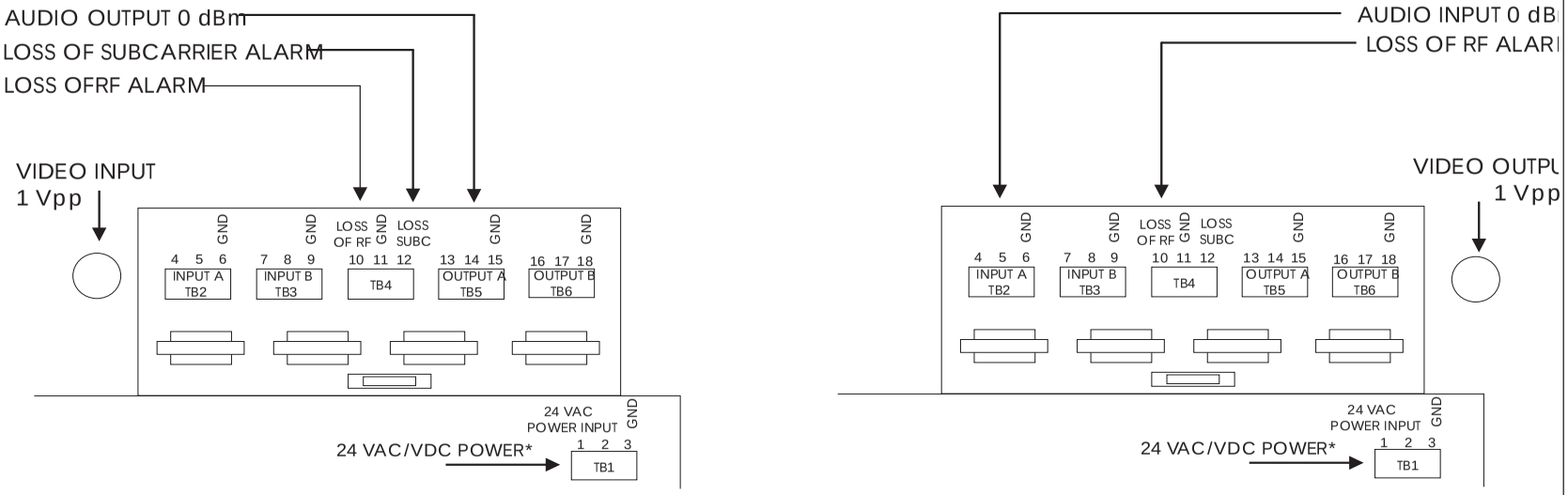
MODEL 4000 & 5003E



* 24 VDC WITH DC OPTION

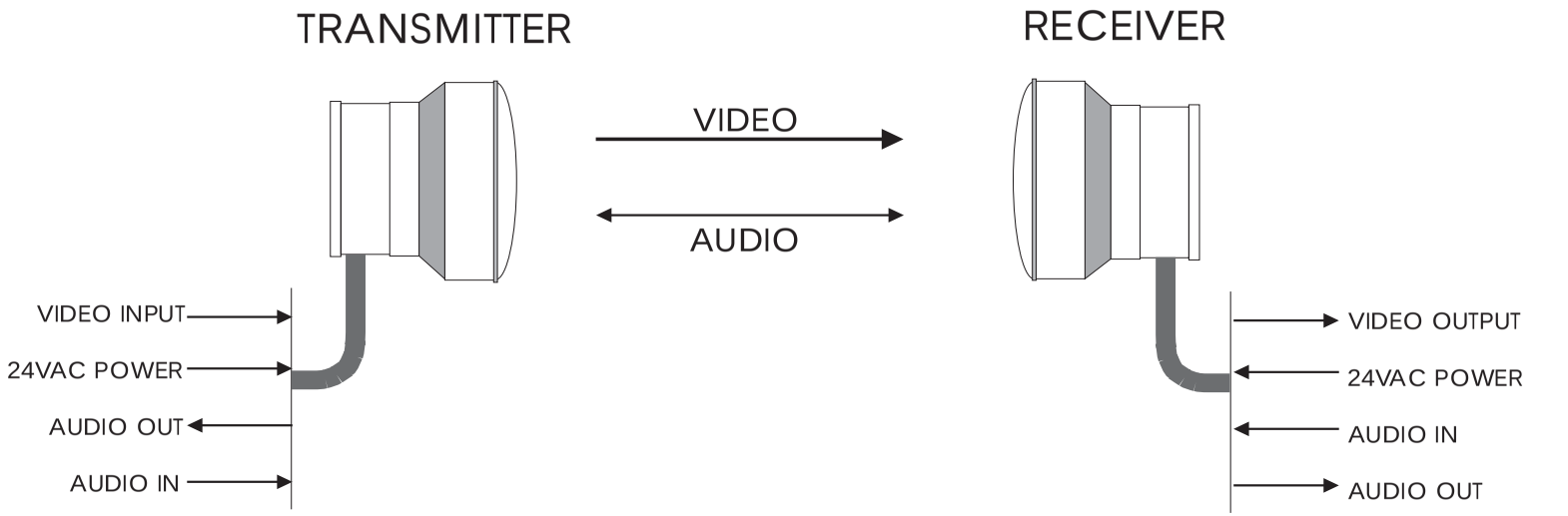
MODEL 4004 & 5004E

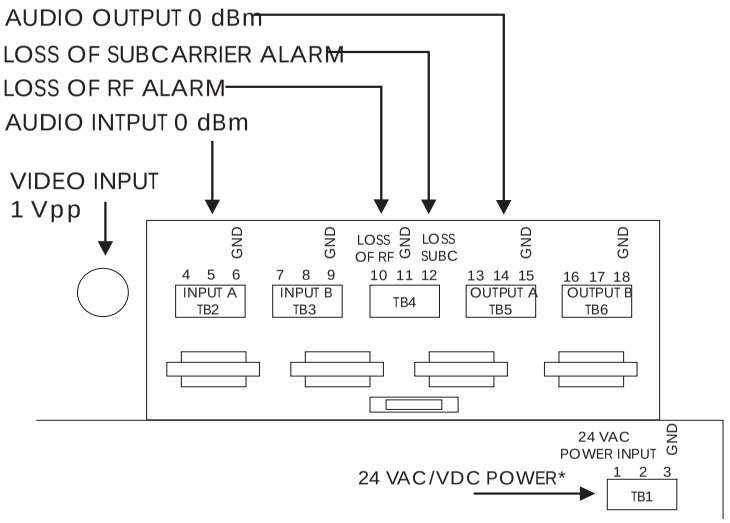


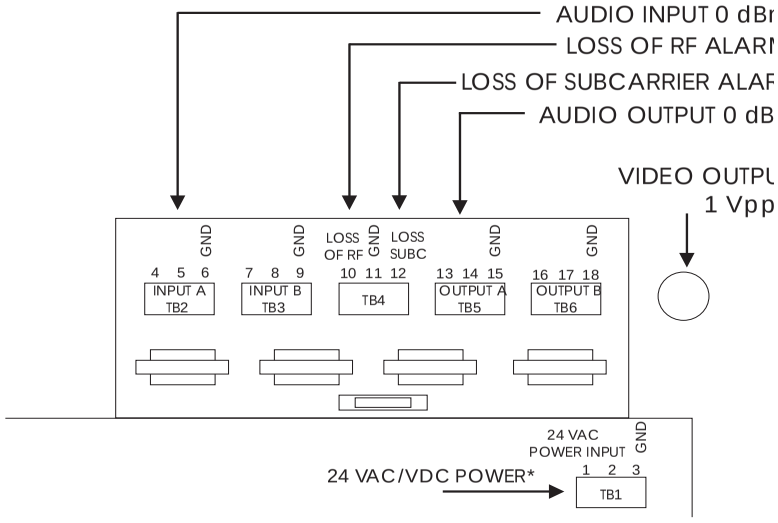


* 24 VDC WITH DC OPTION

MODEL 4005 & 5005E

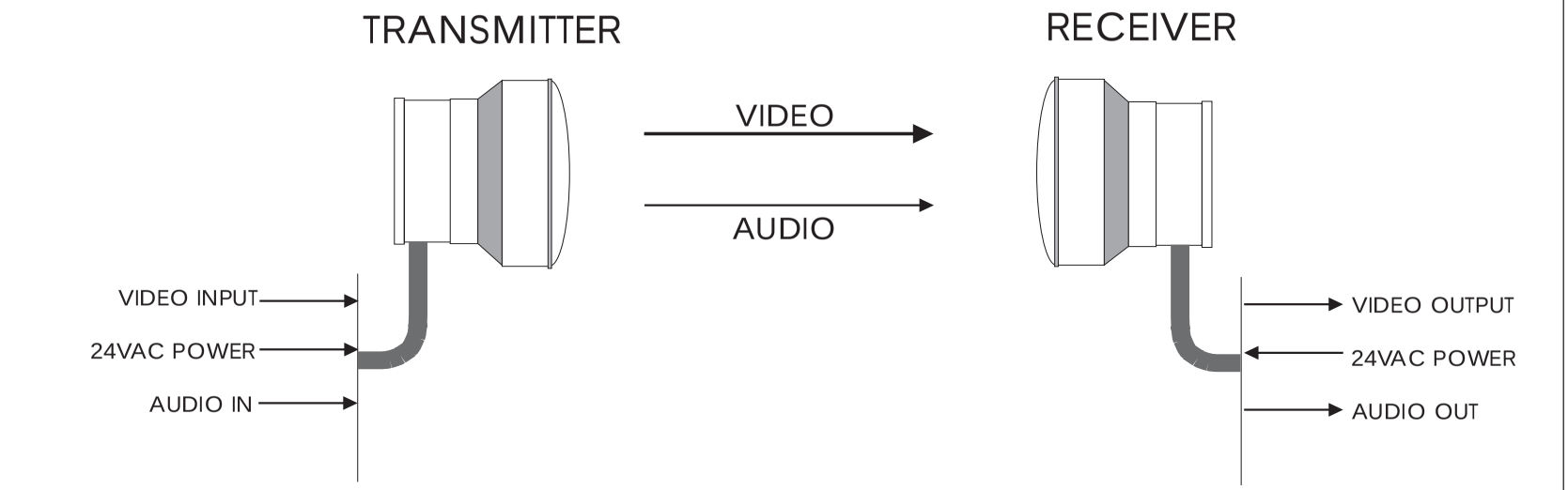


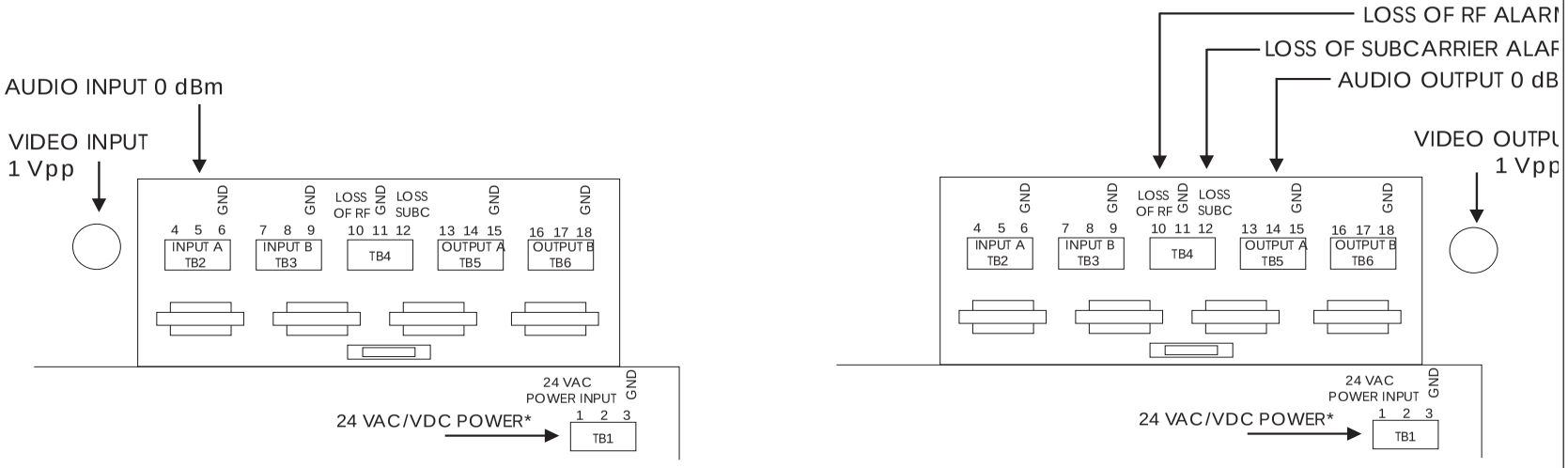




* 24 VDC WITH DC OPTION

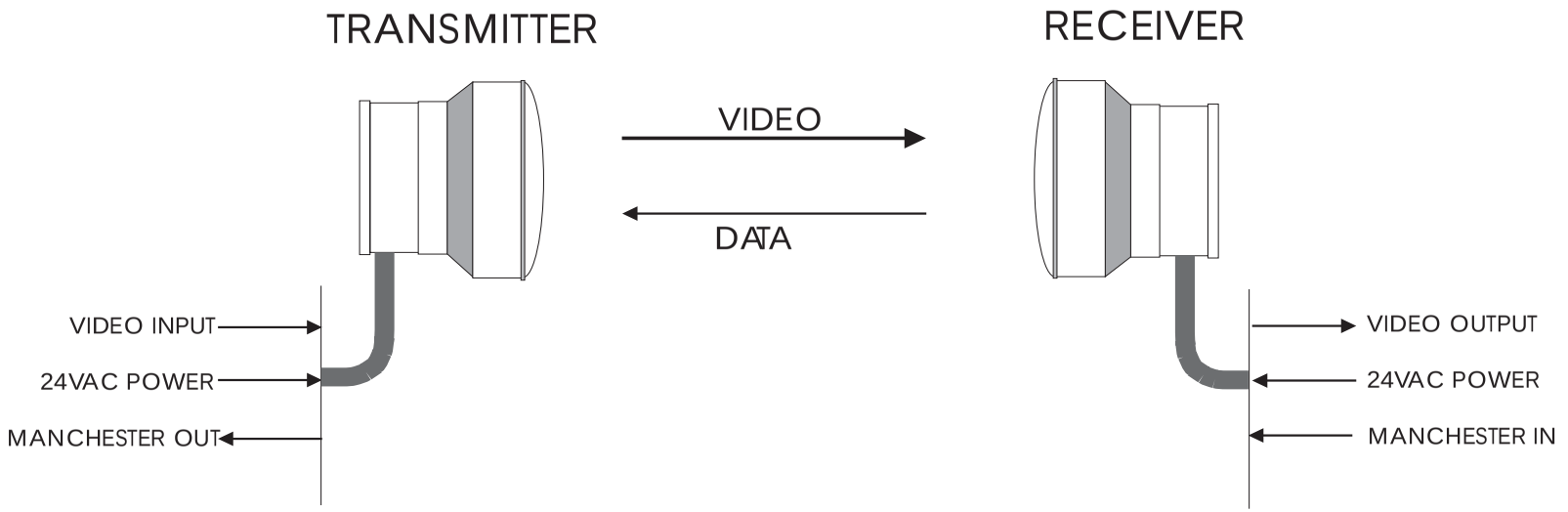
MODEL 4006 & 5006E

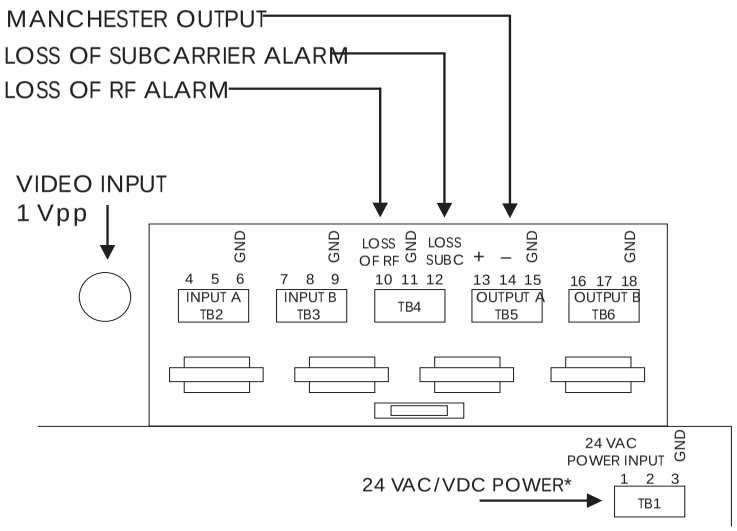


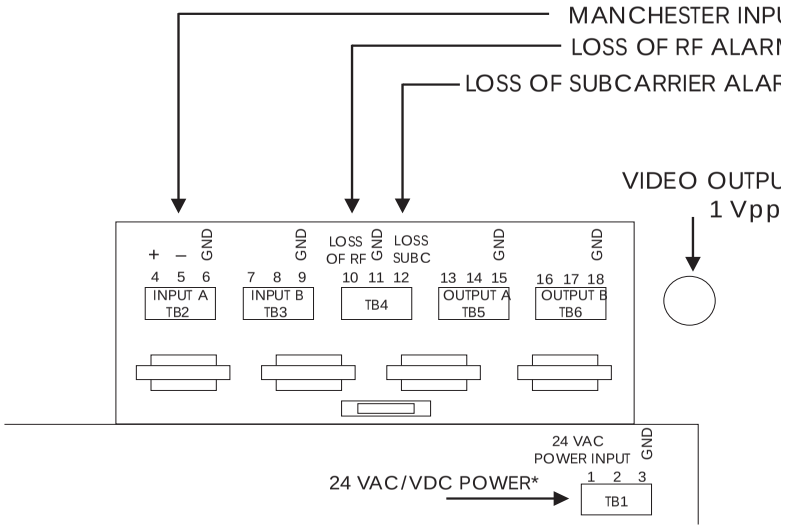


* 24 VDC WITH DC OPTION

MODEL 4007 & 5007E

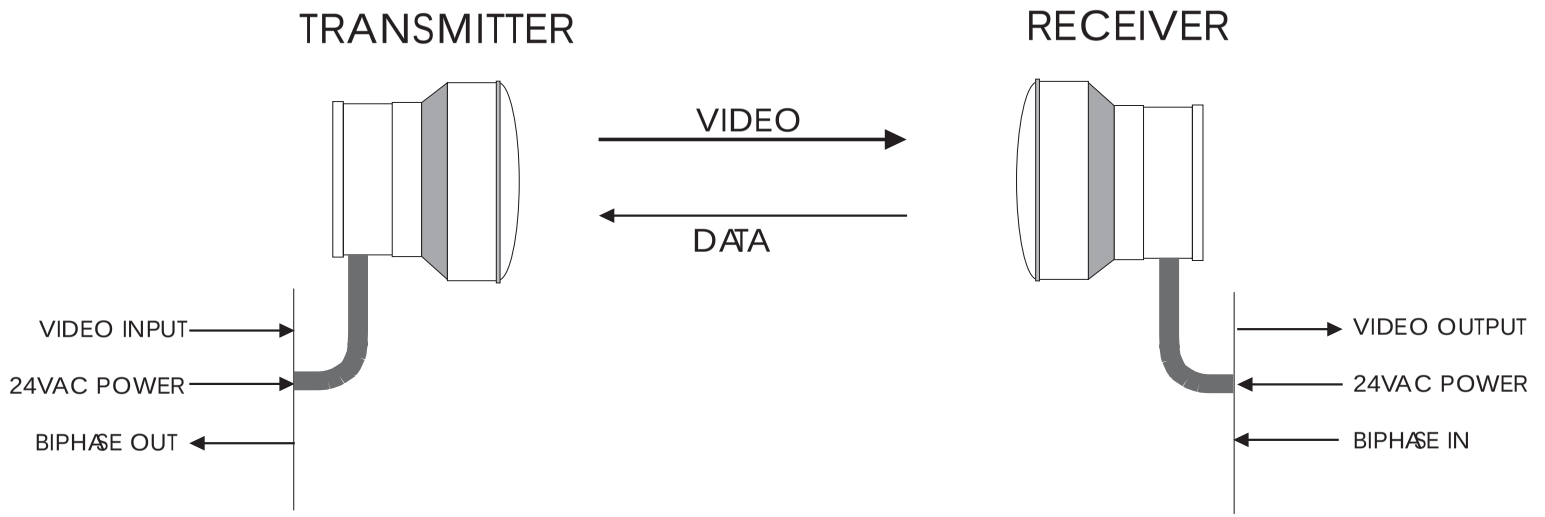


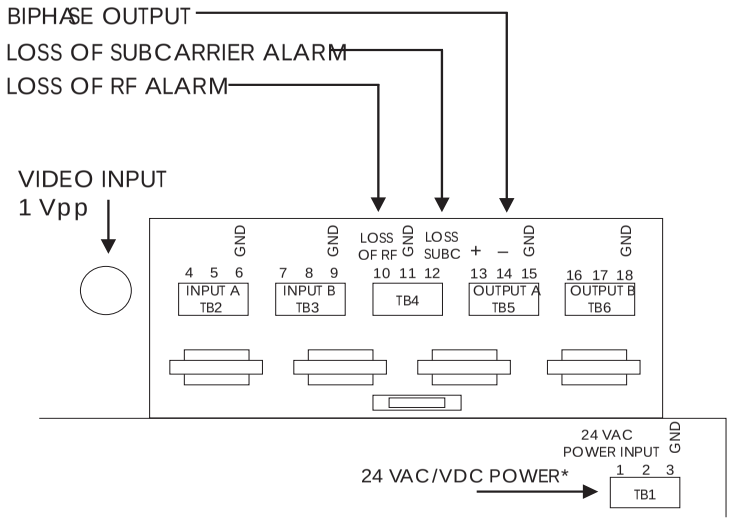


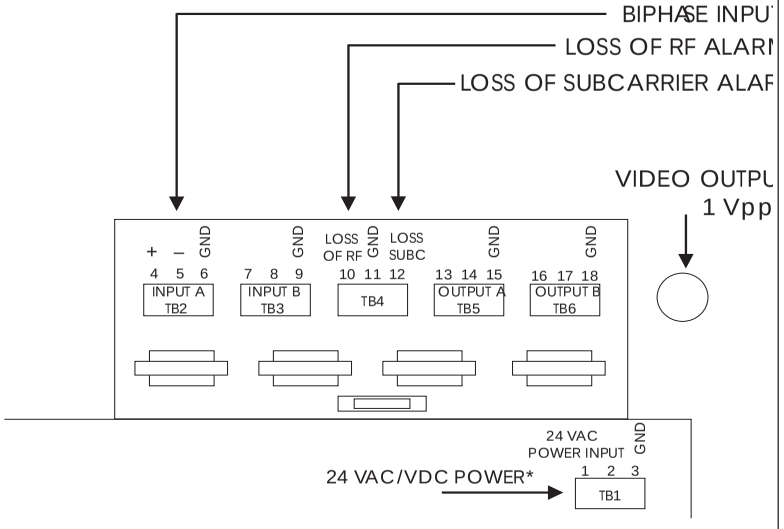


* 24 VDC WITH DC OPTION

MODEL 4008 & 5008E

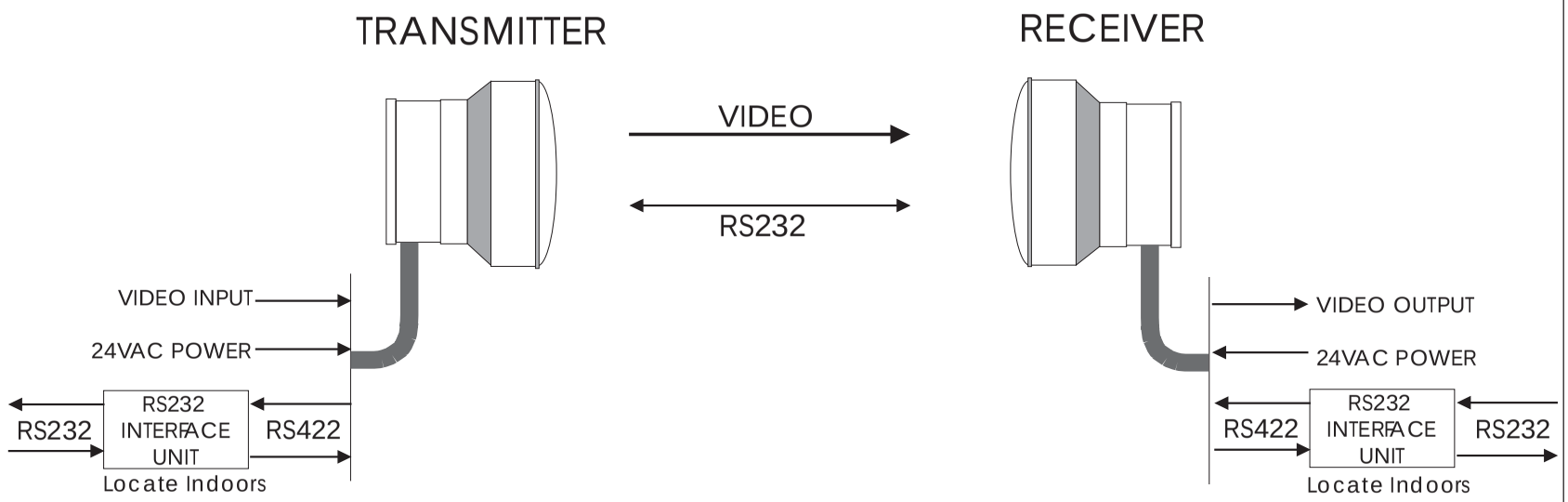


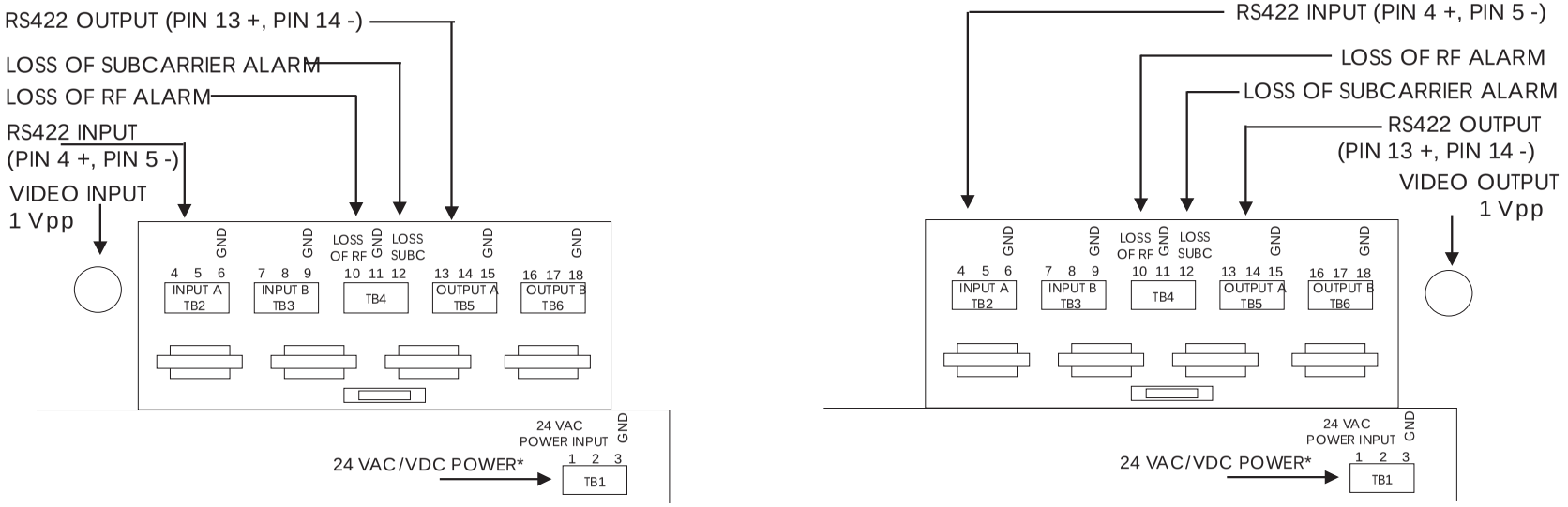




* 24 VDC WITH DC OPTION

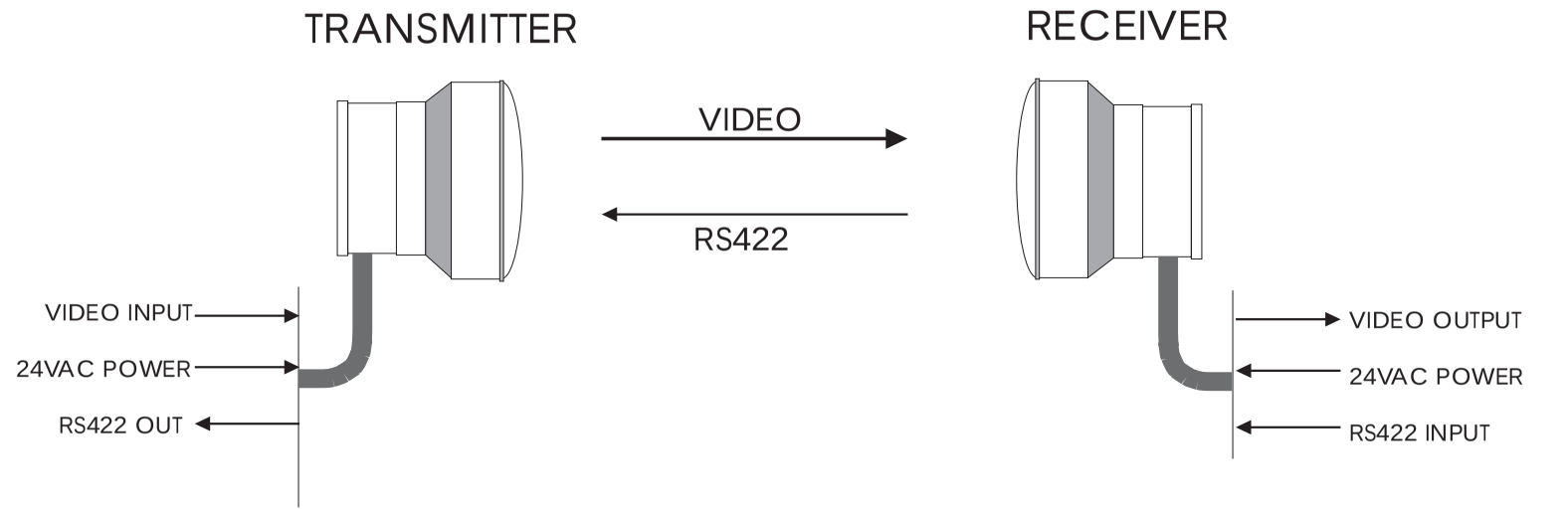
MODEL 4014 & 5014E

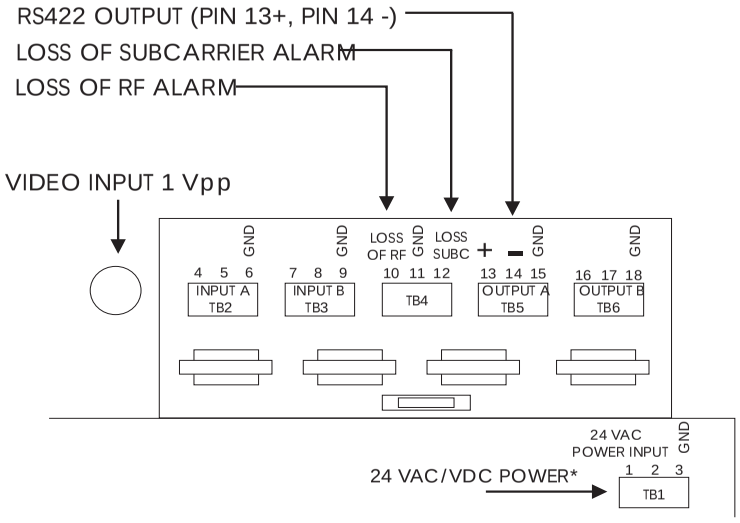


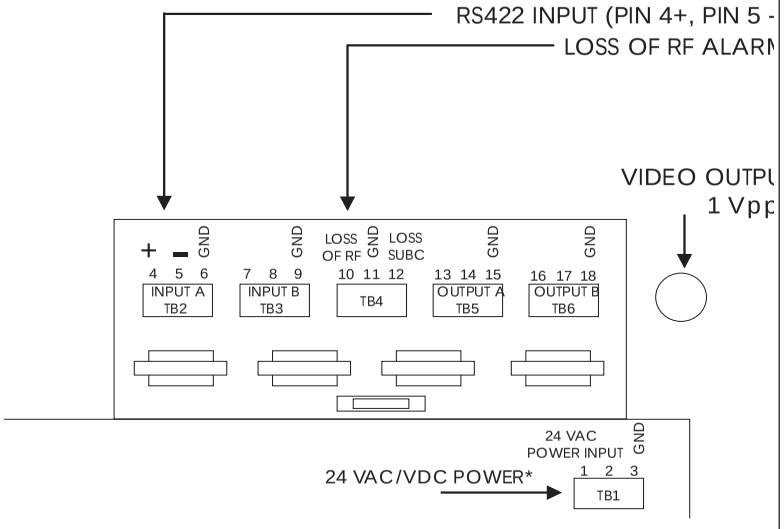


* 24 VDC WITH DC OPTION

MODEL 4017 & 5017E

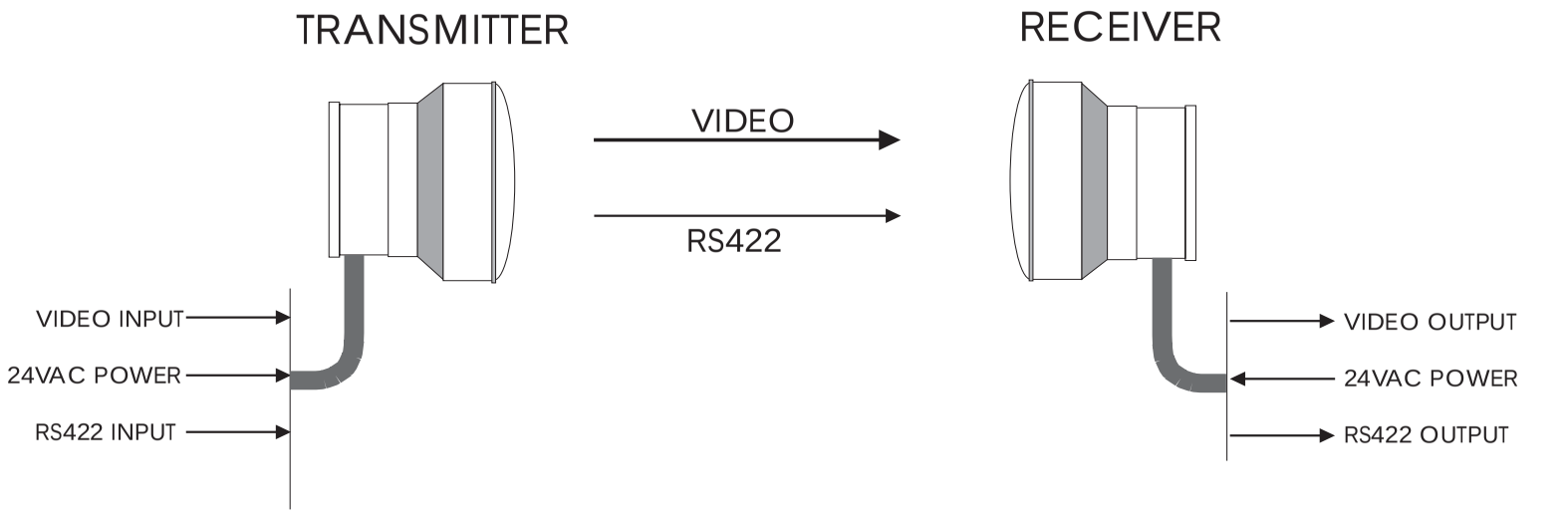


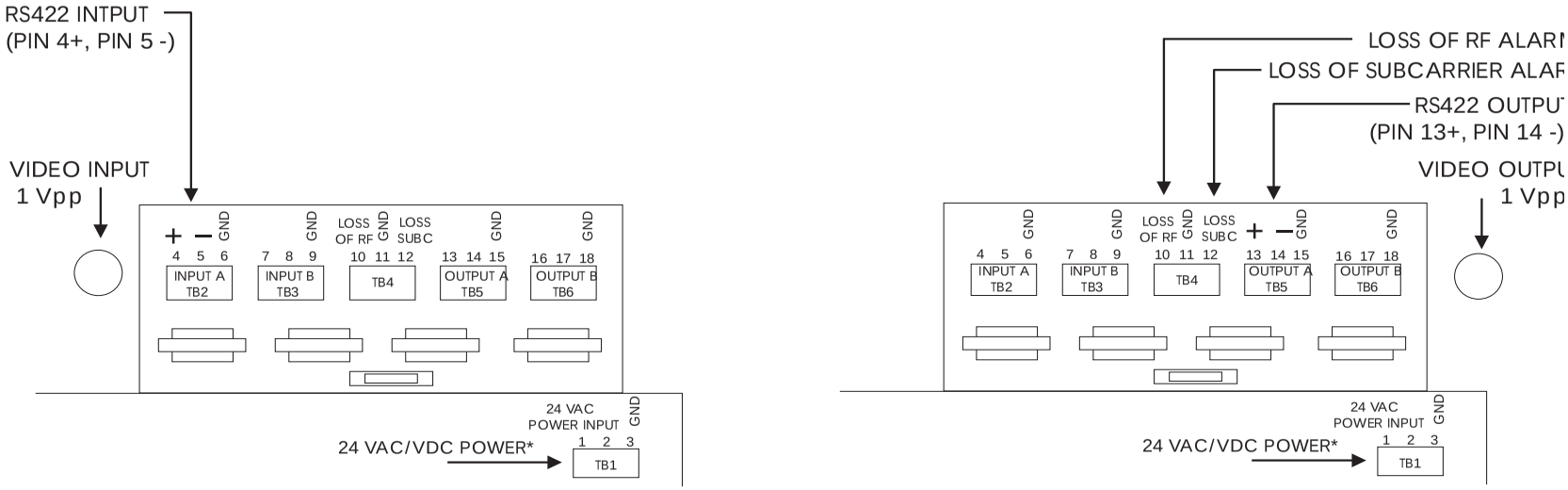




* 24 VDC WITH DC OPTION

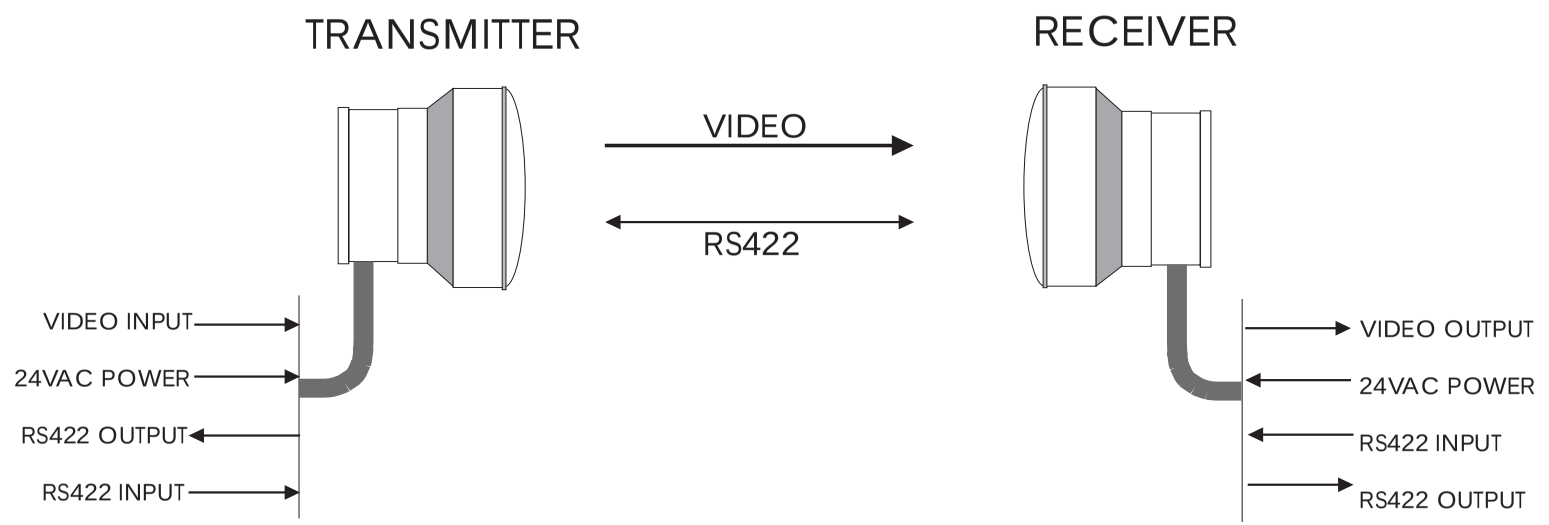
MODEL 4018 & 5018E

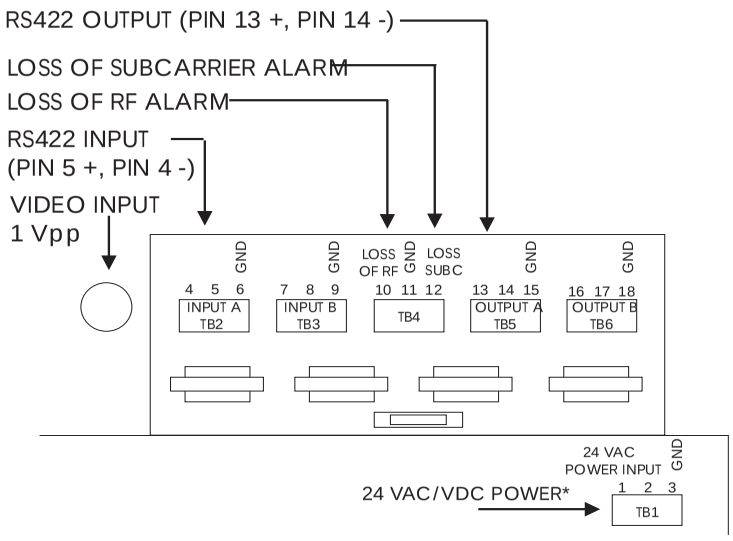


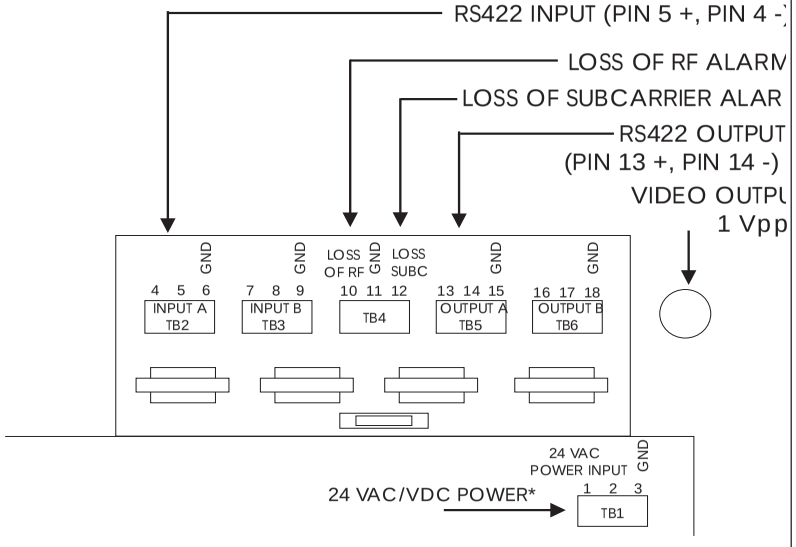


* 24 VDC WITH DC OPTION

MODEL 4020 & 5020E

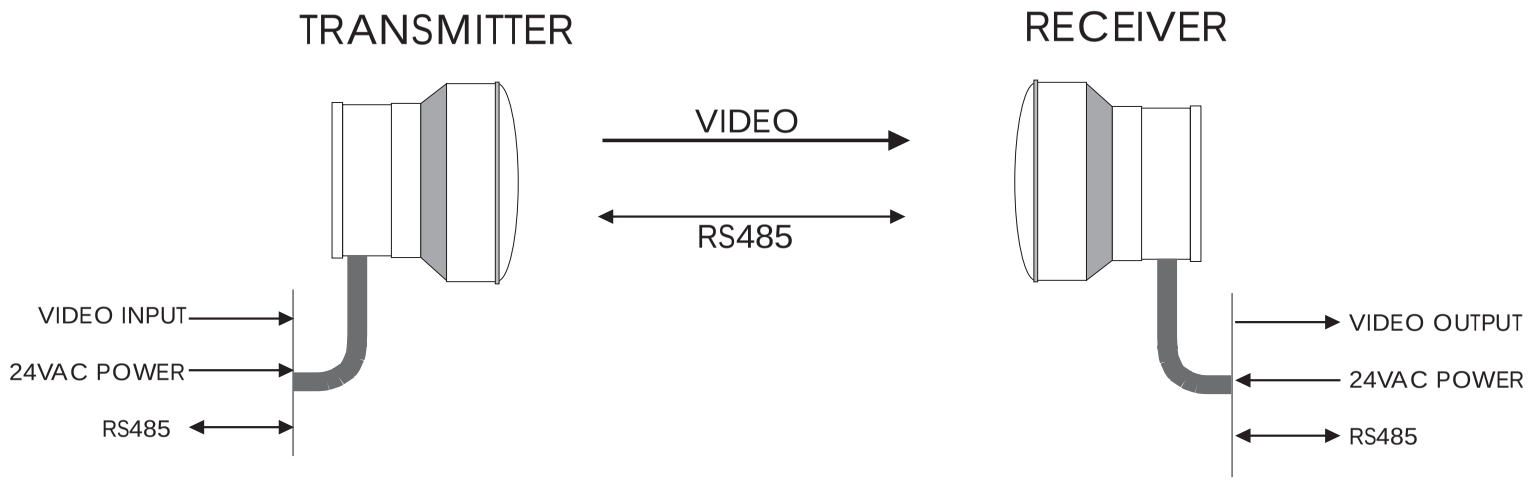


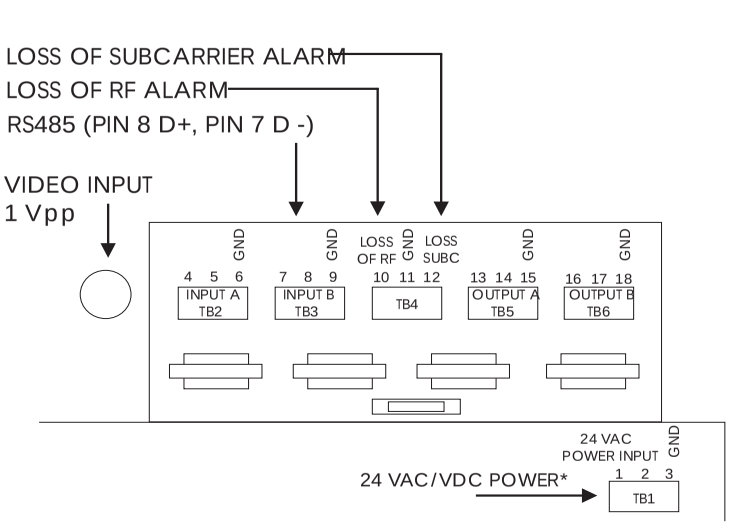


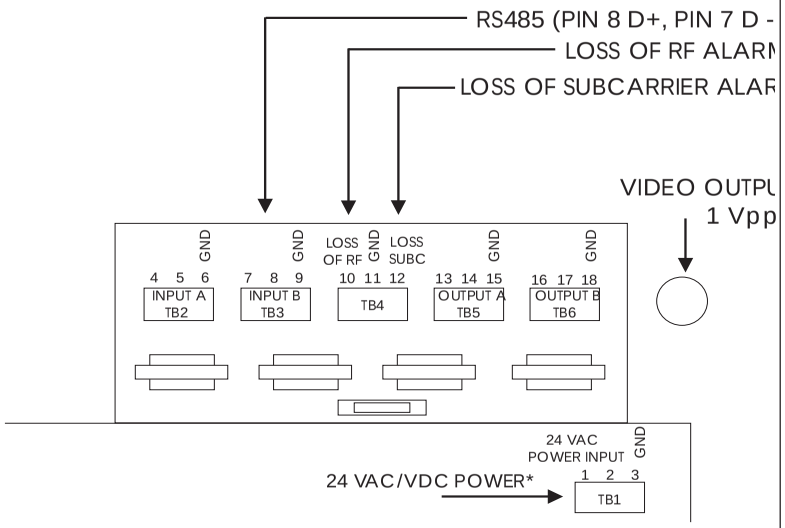


* 24 VDC WITH DC OPTION

MODEL 4085 & 5085E

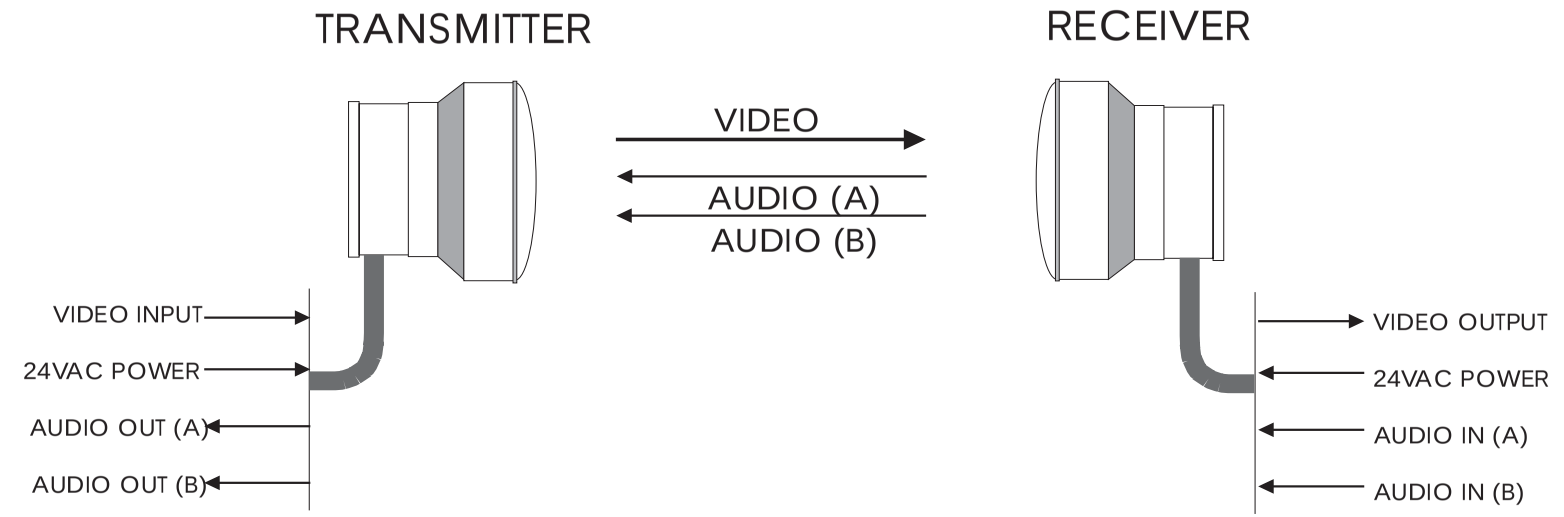


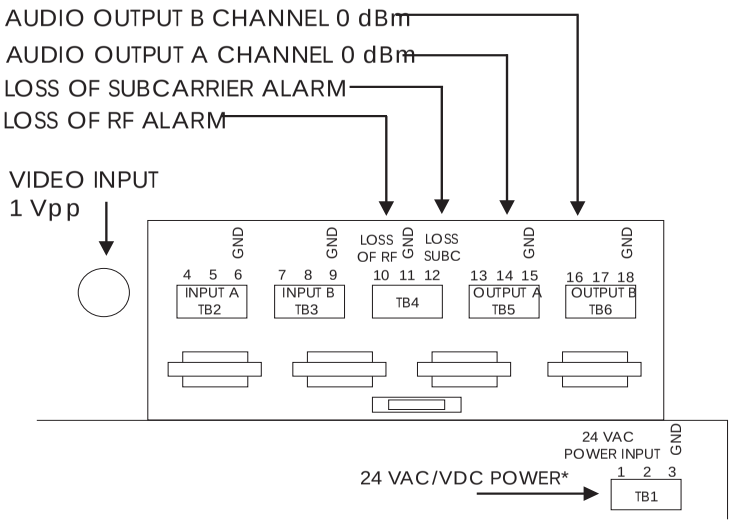


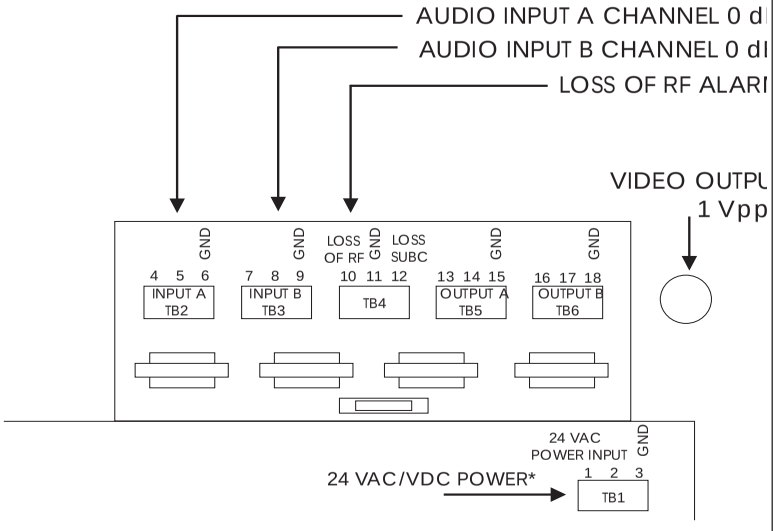


* 24 VDC WITH DC OPTION

MODEL 4204 & 5204E

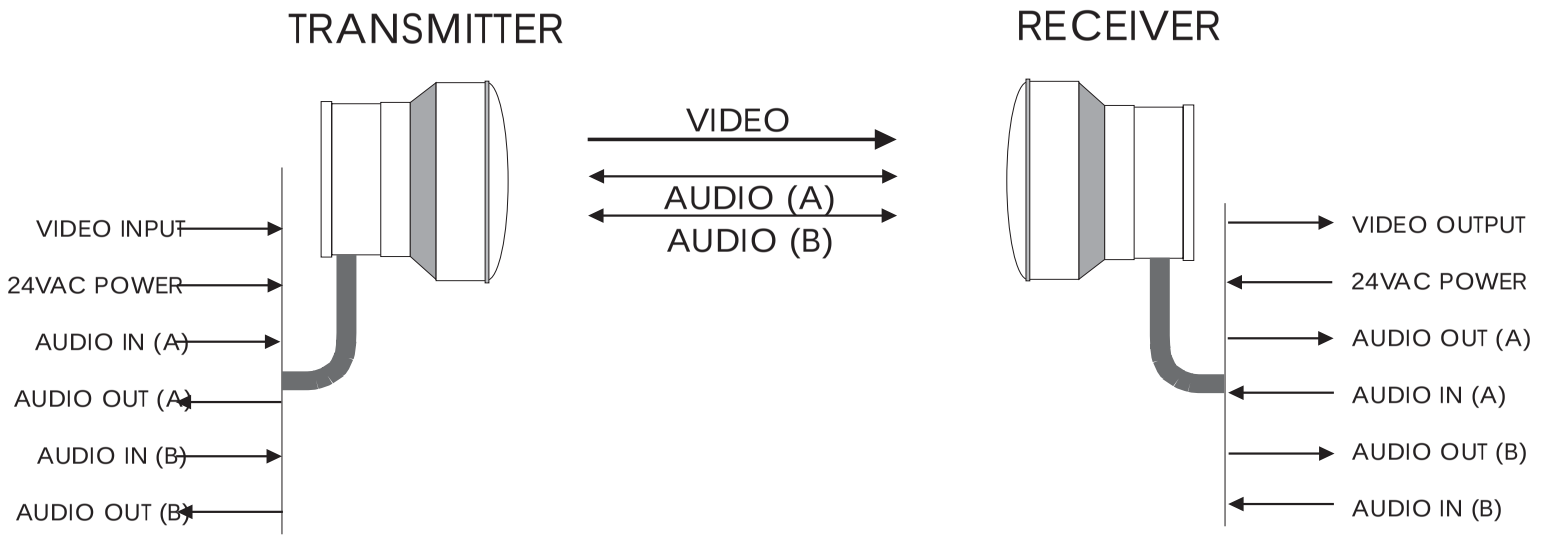


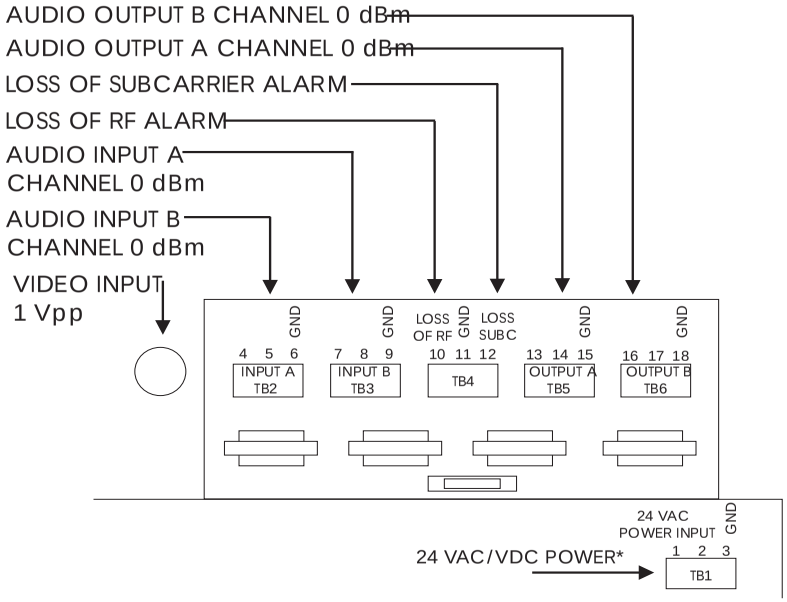


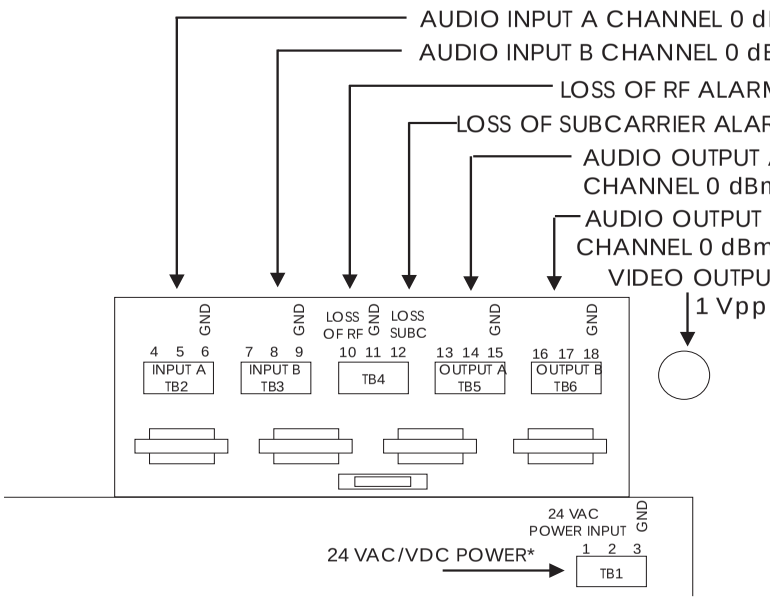


* 24 VDC WITH DC OPTION

MODEL 4205 & 5205E

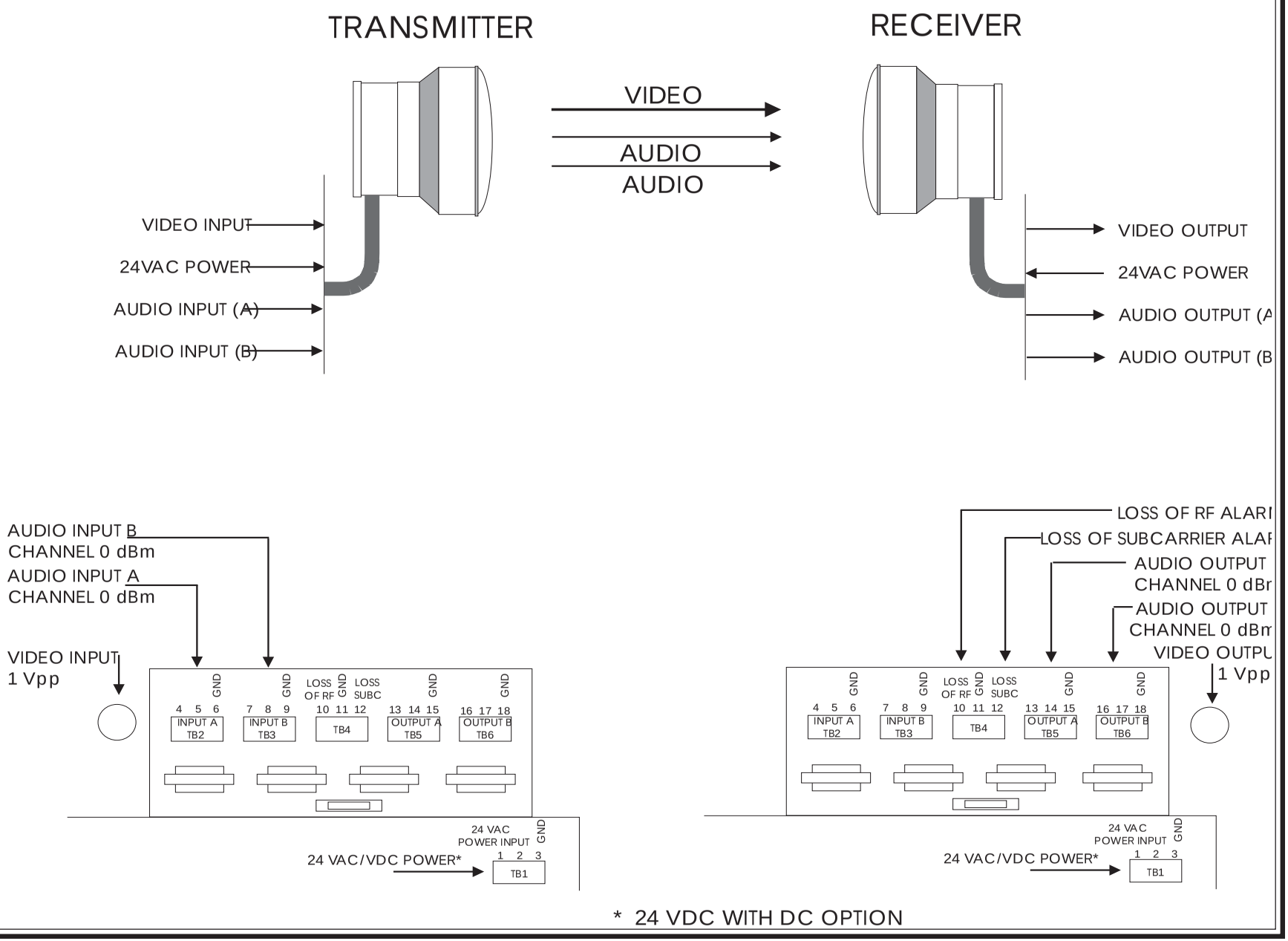






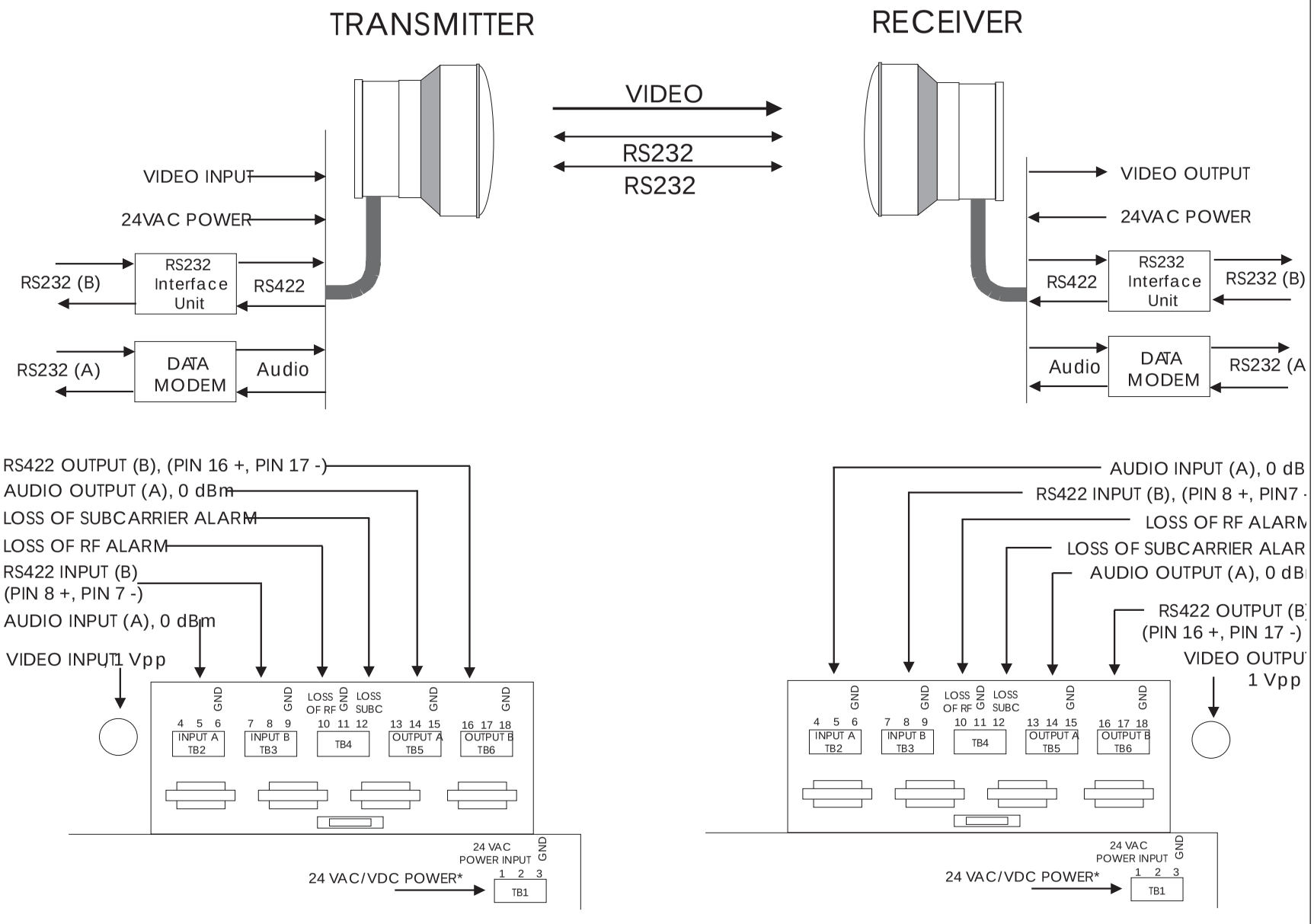
* 24 VDC WITH DC OPTION

MODEL 4206 & 5206E



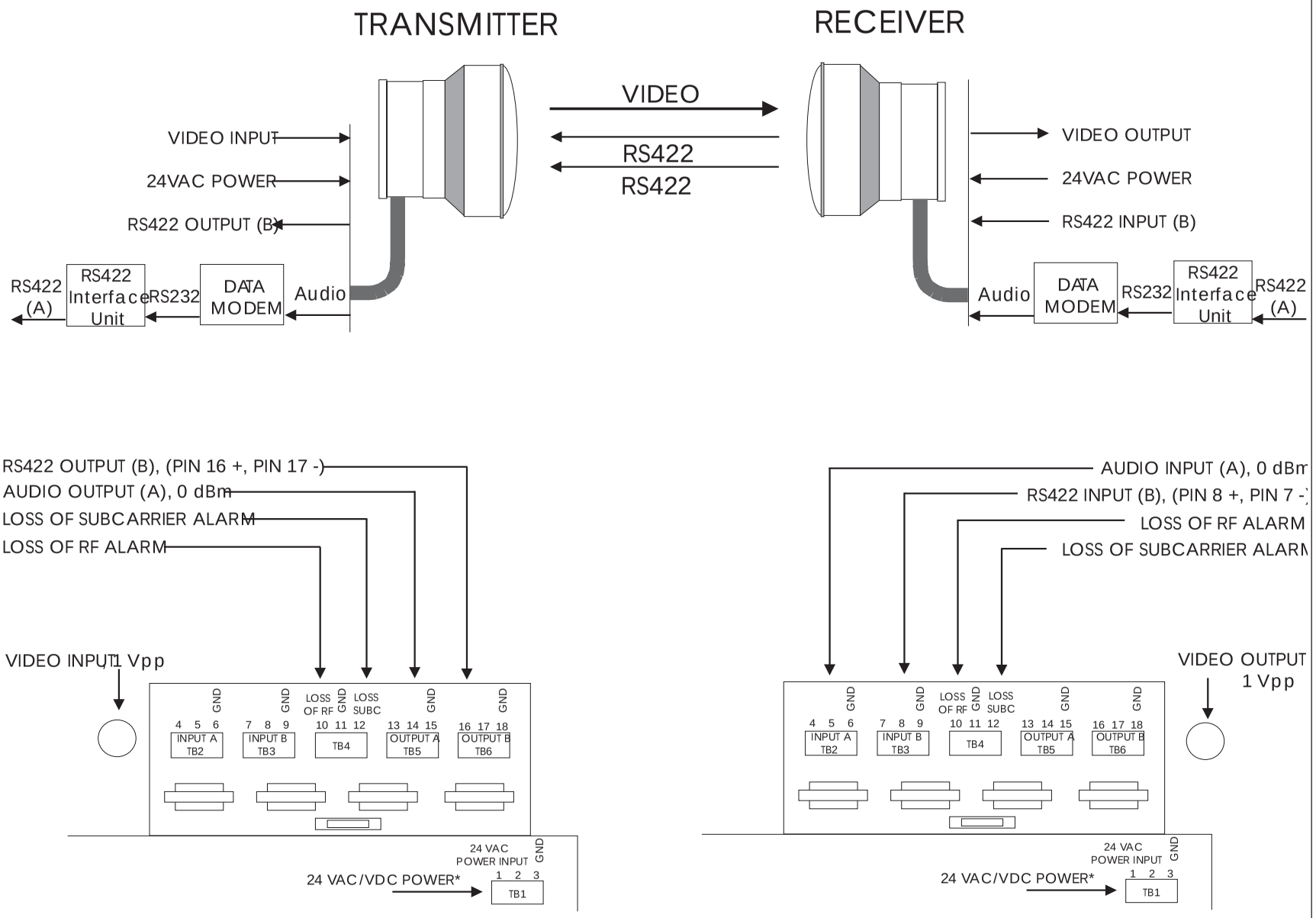
* 24 VDC WITH DC OPTION

MODEL 4214 & 5214E



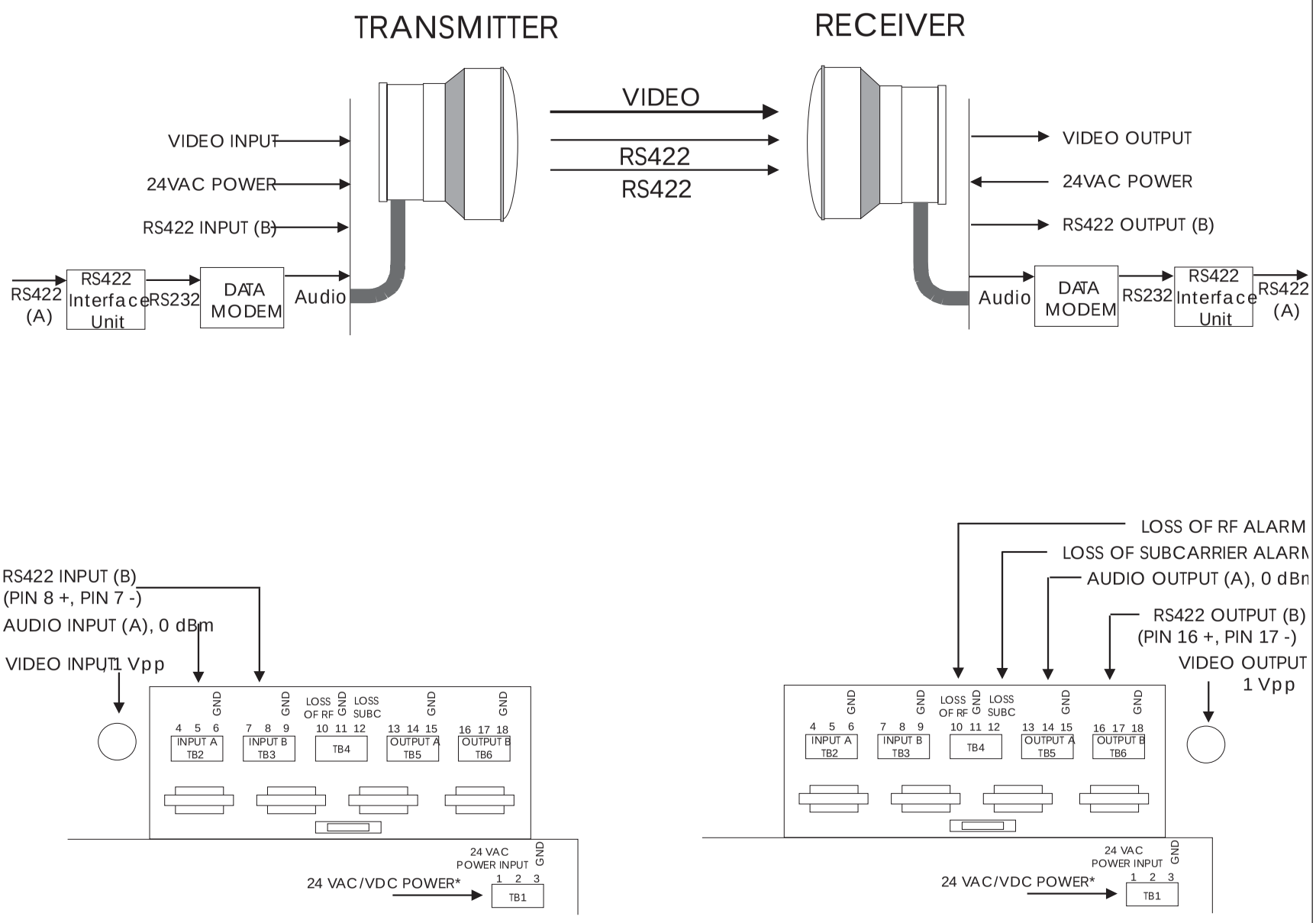
* 24 VDC WITH DC OPTION

MODEL 4217 & 5217E



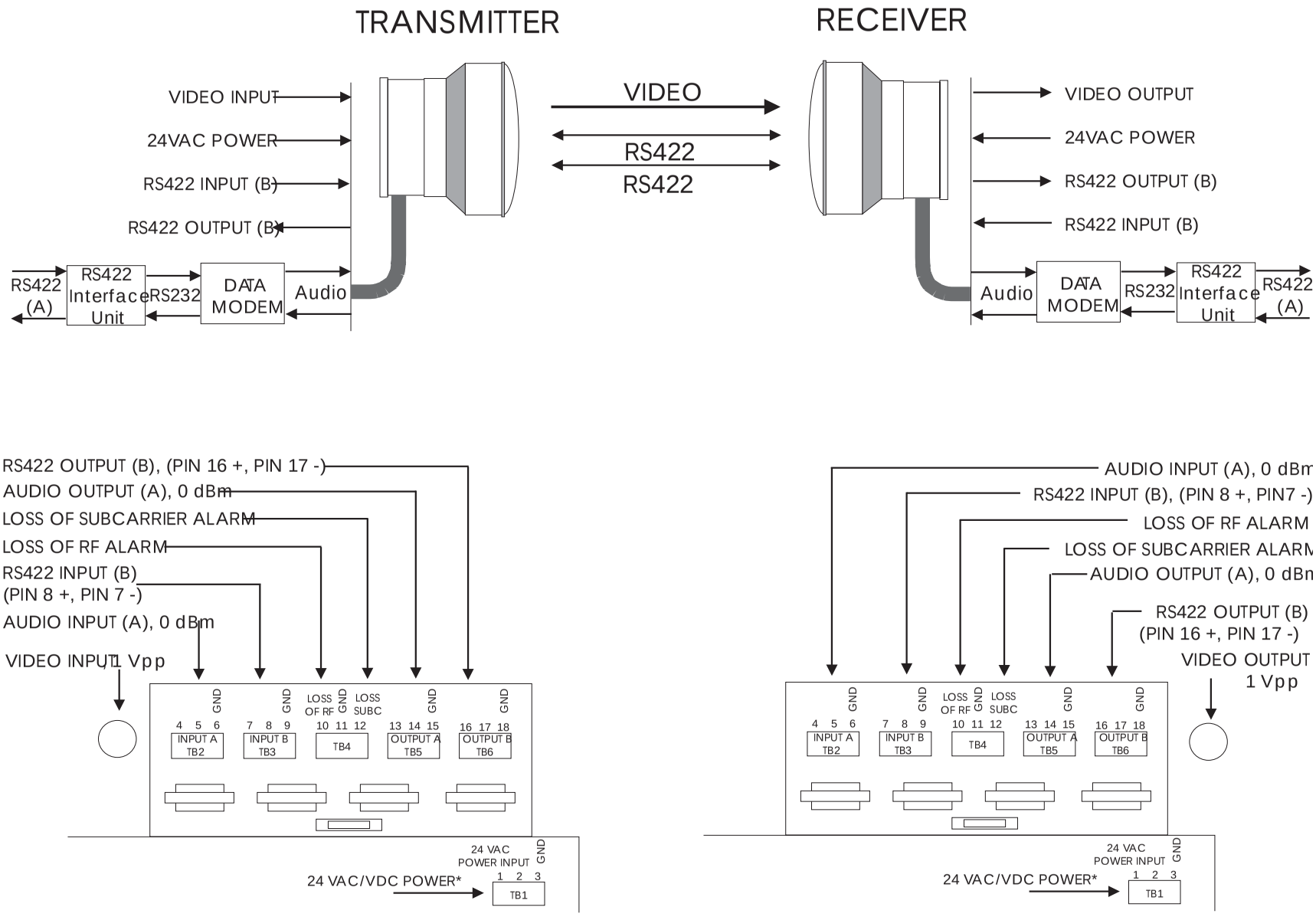
* 24 VDC WITH DC OPTION

MODEL 4218 & 5218E



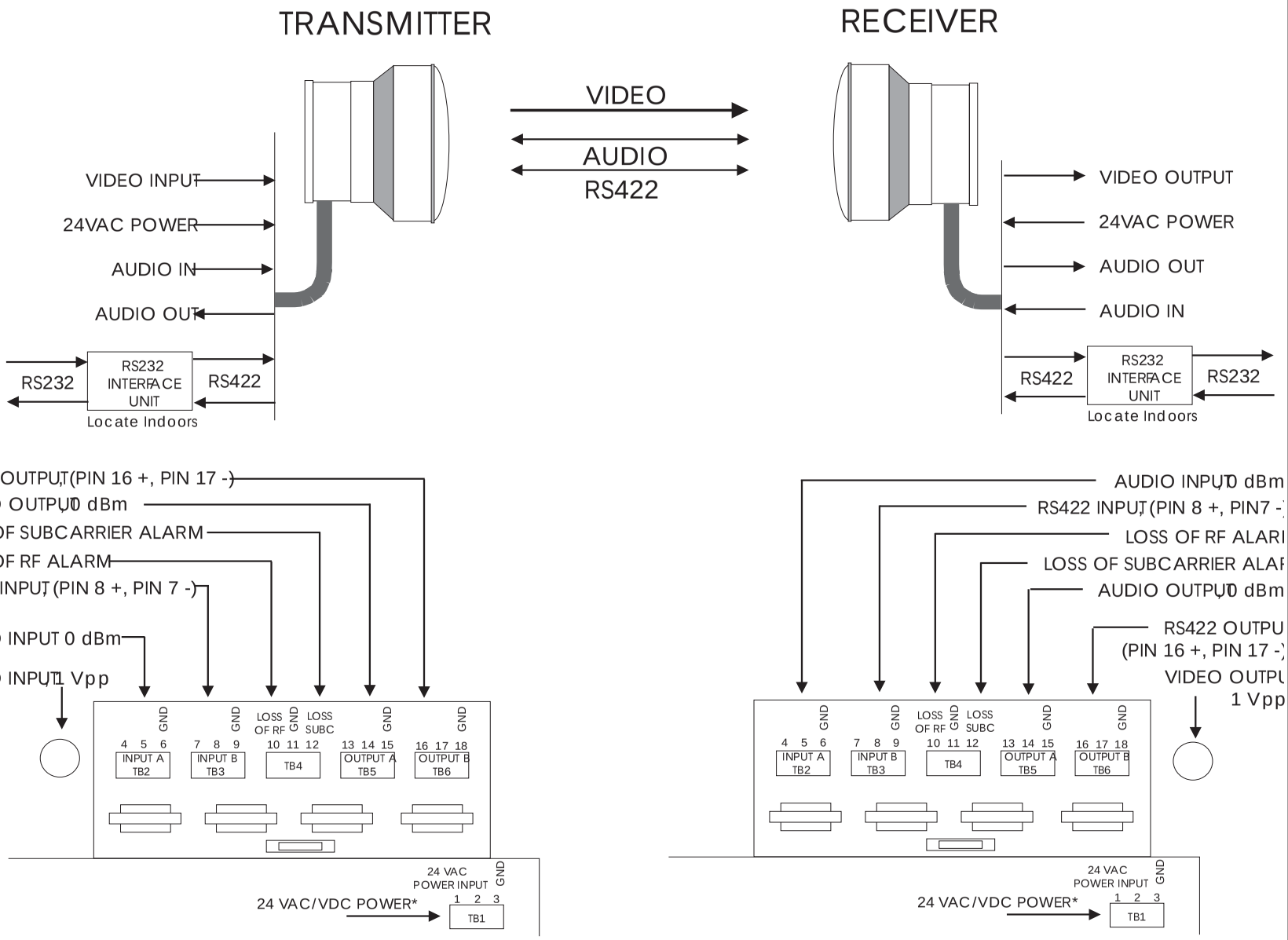
* 24 VDC WITH DC OPTION

MODEL 4220 & 5220E



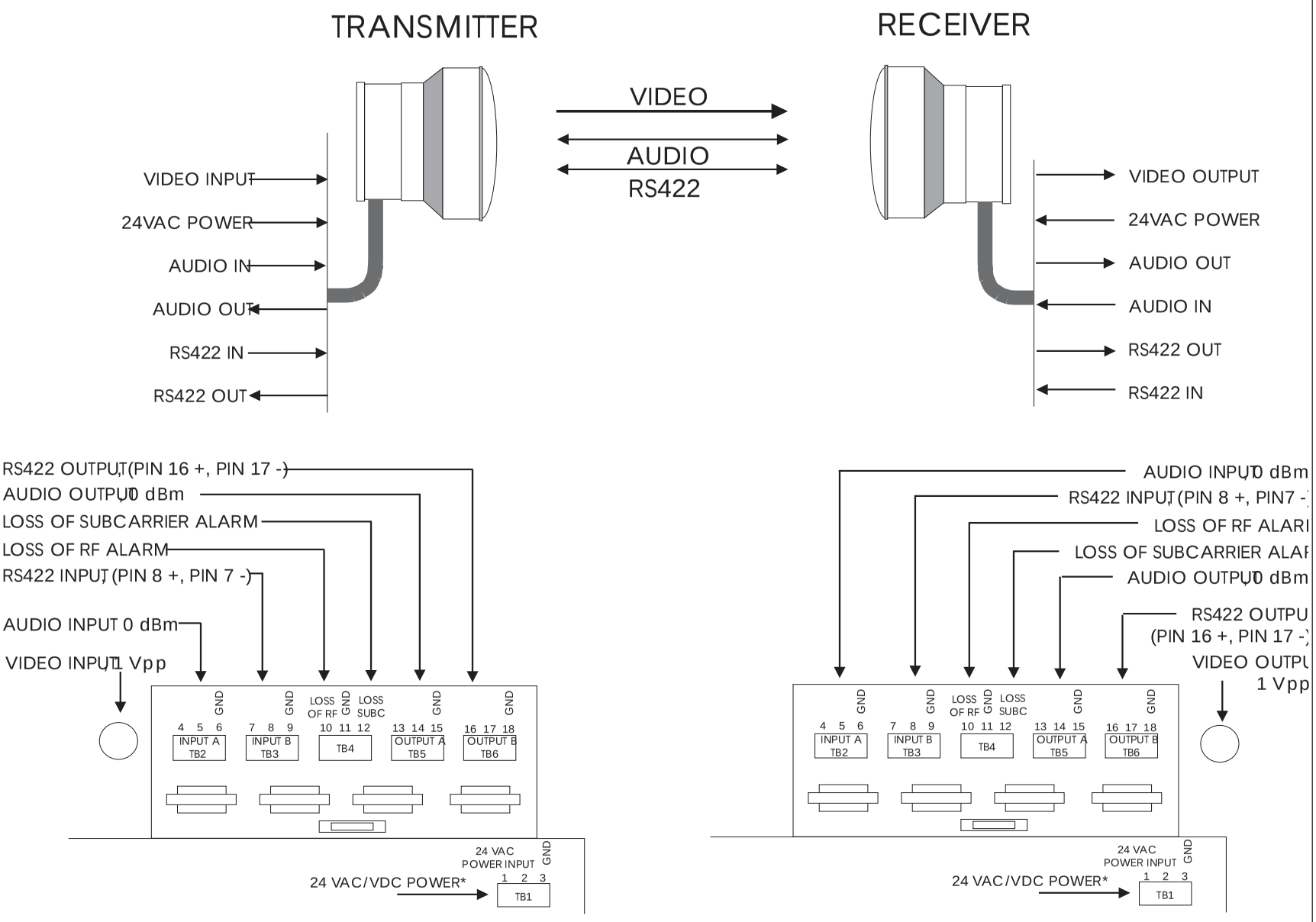
* 24 VDC WITH DC OPTION

MODEL 4414 & 5414E



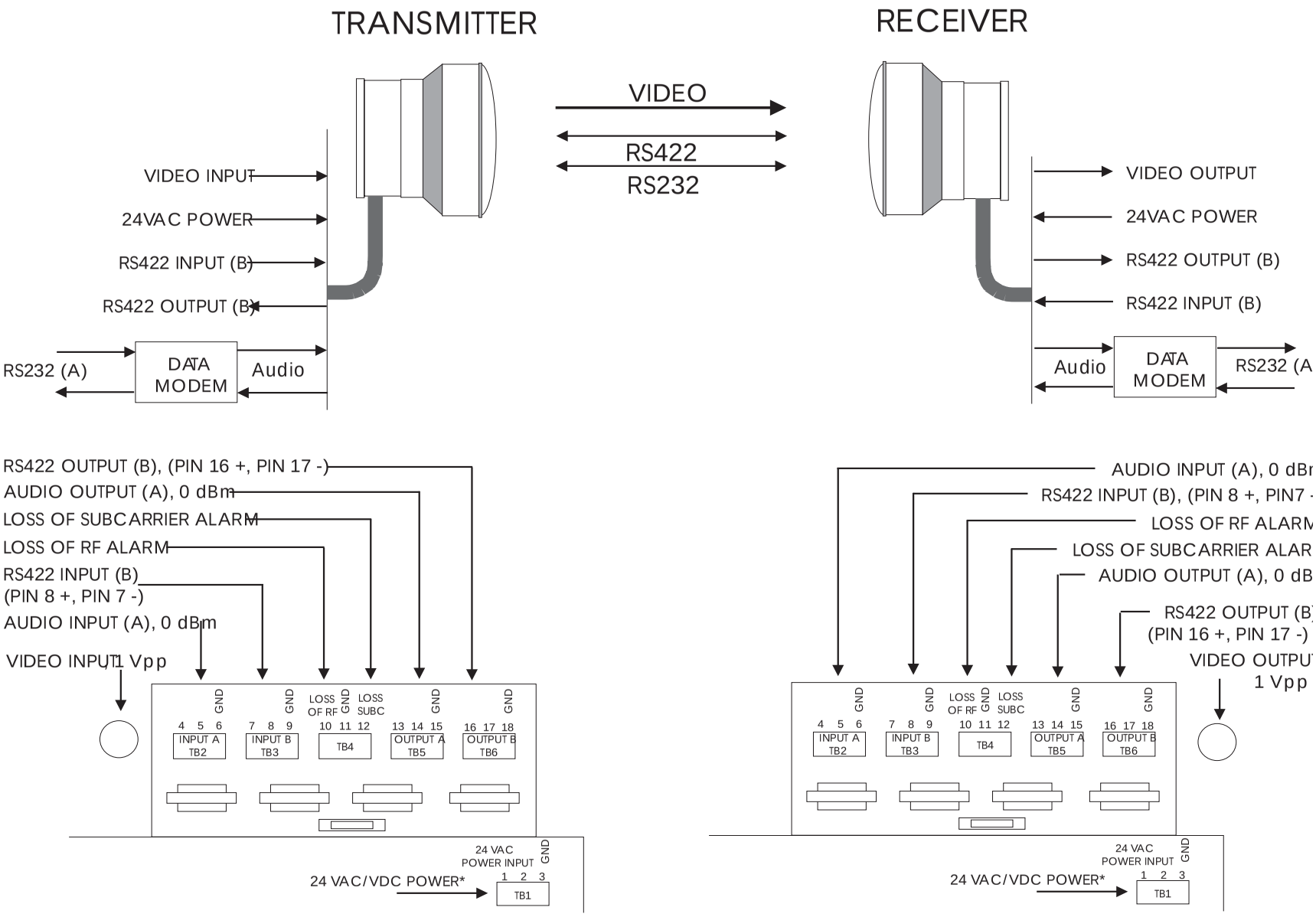
* 24 VDC WITH DC OPTION

MODEL 4420 & 5420E



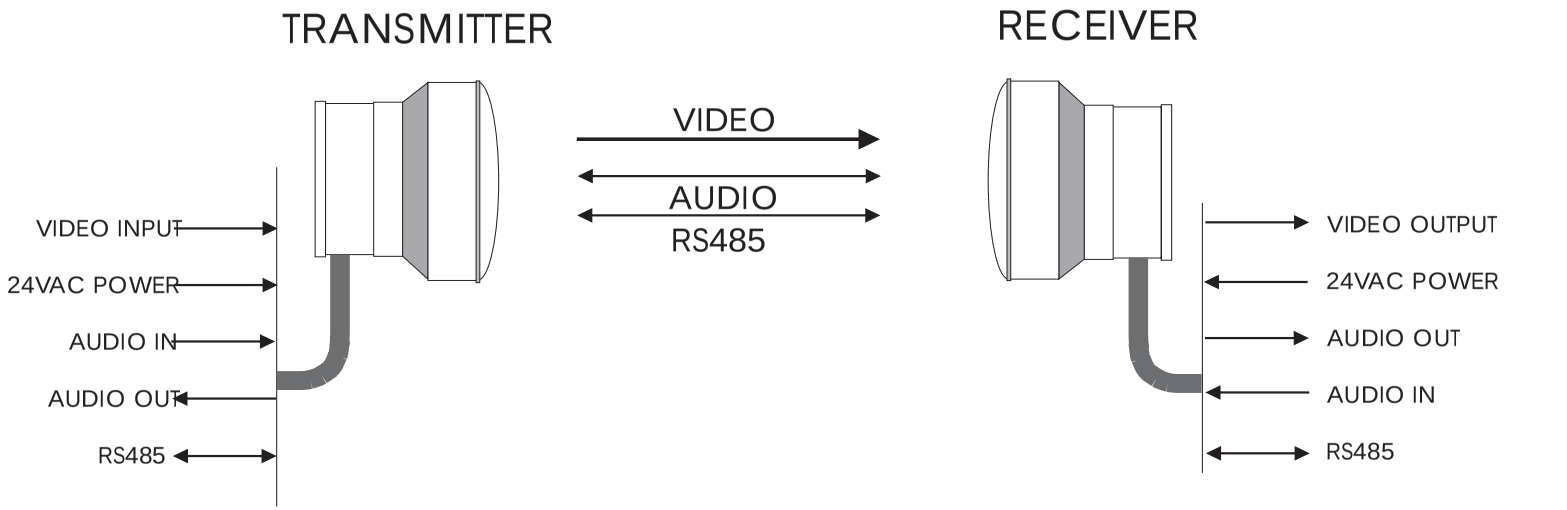
* 24 VDC WITH DC OPTION

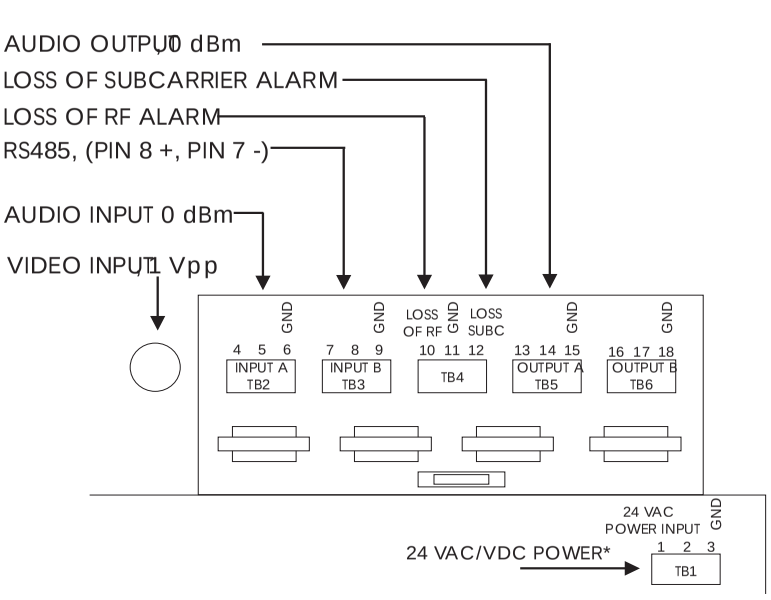
MODEL 4440 & 5440E

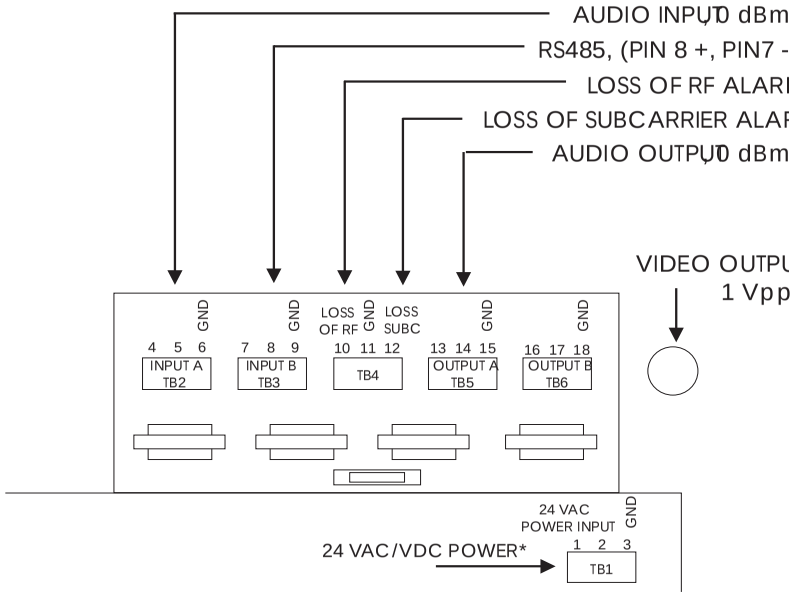


* 24 VDC WITH DC OPTION

MODEL 4485 & 5485E







* 24 VDC WITH DC OPTION

4000 MAINTENANCE RECORD - RECEIVER

Customer: _____ Model: _____ S/N: _____ Data Rate: _____ (If Applicable)

Test Point	Description	Specification	Factory Data	Install Data	Customer Data	Customer Data	Customer Data	Customer Data	Customer Data	Customer Data	Customer Data
System Data (* Indicates Test Point on Mother Board, ** Indicates Test Point on IF Demod Board)											
TP-1	Ground	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TP-2*	AGC	(See Chart Provided)									
TP-3*	Gunn power source	12.0 to 14.0 Vdc									
TP-4*	+15 Vdc Supply	14.5 to 15.5 Vdc									
TP-5*	+5 Vdc Supply	4.85 to 5.15 Vdc									
TP-6*	-5 Vdc Supply	-4.85 to -5.15 Vdc									
TP-7*	+27 Vdc Supply	24.0 to 34.0 Vdc									
TP-8*	Rx Gunn Bias	4.0 to 7.0 Vdc									
TP-10*	AFC Bias	7.0 to 9.0 Vdc									
TP-10**	IF Signal level	-8.0 to -12.0 dBm									
TP-10**	IF Frequency	43.0 to 47.0 MHz									
Tx Freq	Transmitter Freq.	+/- Fo (see label)									
Rx Freq	Receiver Freq.	+/- Fo (see label)									
Base Band Levels (Test Points on Base Band Boards)											
TP2	Video Input Level	1.0 +/- .2 Vpp									
TP1	Video Output Level	1.0 +/- .2 Vpp									
Subchannel Levels (Test Points on Sub Channel Boards; Audio or Data based on Product Model)											
TB2	CH A Input Level	0 dBm Max or <2.0Vpp									
TB5	CH A Output Level	0 dBm Max or <2.0Vpp									
TB3	CH B Input Level	0 dBm Max or <2.0Vpp									
TB6	CH B Output Level	0 dBm Max or <2.0Vpp									
Date & Technician ID											
Date Performance Measured											
Technician performing Measurement											

Notes:

+ Factory System Threshold; AGC level should not drop below this level

Installed AGC value will vary depending upon path attenuation

4000 MAINTENANCE RECORD - TRANSMITTER

Customer: _____ Model: _____ S/N: _____ Data Rate: _____ (If Applicable)

Test Point	Description	Specification	Factory Data	Install Data	Customer Data	Customer Data	Customer Data	Customer Data	Customer Data	Customer Data	Customer Data
System Data (* Indicates Test Point on Mother Board, ** Indicates Test Point on IF Demod Board)											
TP-1	Ground	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TP-2*	AGC	(See Chart Provided)									
TP-3*	Gunn power source	12.0 to 14.0 Vdc									
TP-4*	+15 Vdc Supply	14.5 to 15.5 Vdc									
TP-5*	+5 Vdc Supply	4.85 to 5.15 Vdc									
TP-6*	-5 Vdc Supply	-4.85 to -5.15 Vdc									
TP-7*	+27 Vdc Supply	24.0 to 34.0 Vdc									
TP-8*	Tx Gunn Bias	4.0 to 7.0 Vdc									
TP-10*	Varactor Bias	7.0 to 9.0 Vdc									
TP-10**	IF Signal level	-8.0 to -12.0 dBm									
TP-10**	IF Frequency	43.0 to 47.0 MHz									
Tx Freq	Transmitter Freg.	+/- Fo (see label)									
Rx Freq	Receiver Freq.	+/- Fo (see label)									
Base Band Levels (Test Points on Base Band Boards)											
TP2	Video Input Level	1.0 +/- .2 Vpp									
TP1	Video Output Level	1.0 +/- .2 Vpp									
Subchannel Levels (Test Points on Sub Channel Boards; Audio or Data based on Product Model)											
TB2	CH A Input Level	0 dBm Max or <2.0Vpp									
TB5	CH A Output Level	0 dBm Max or <2.0Vpp									
TB3	CH B Input Level	0 dBm Max or <2.0Vpp									
TB6	CH B Output Level	0 dBm Max or <2.0Vpp									
Date & Technician ID											
Date Performance Measured											
Technician performing Measurement											

Notes:

+ Factory System Threshold; AGC level should not drop below this level — Installed AGC value will vary depending upon path attenuation

5000E MAINTENANCE RECORD - RECEIVER

Customer: _____ Model: _____ S/N: _____ Data Rate: _____ (If Applicable)

Test Point	Description	Specification	Factory Data	Install Data	Customer Data	Customer Data	Customer Data	Customer Data	Customer Data	Customer Data	Customer Data
System Data (* Indicates Test Point on Mother Board, ** Indicates Test Point on IF Demod Board)											
TP-1	Ground	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TP-2*	AGC	(See Chart Provided)									
TP-3*	Gunn power source	9.5 to 11 Vdc									
TP-4*	+15 Vdc Supply	14.5 to 15.5 Vdc									
TP-5*	+5 Vdc Supply	4.85 to 5.15 Vdc									
TP-6*	-5 Vdc Supply	-4.85 to -5.15 Vdc									
TP-7*	+27 Vdc Supply	24.0 to 34.0 Vdc									
TP-8*	Rx Gunn Bias	5.0 to 7.0 Vdc									
TP-10*	AFC Bias	7.0 to 9.0 Vdc									
TP-10**	IF Signal level	-8.0 to -12.0 dBm									
TP-10**	IF Frequency	43.0 to 47.0 MHz									
Tx Freq	Transmitter Freg.	+/- Fo (see label)									
Rx Freq	Receiver Freq.	+/- Fo (see label)									
Base Band Levels (Test Points on Base Band Boards)											
TP2	Video Input Level	1.0 +/- .2 Vpp									
TP1	Video Output Level	1.0 +/- .2 Vpp									
Subchannel Levels (Test Points on Sub Channel Boards; Audio or Data based on Product Model)											
TB2	CH A Input Level	0 dBm Max or <2.0Vpp									
TB5	CH A Output Level	0 dBm Max or <2.0Vpp									
TB3	CH B Input Level	0 dBm Max or <2.0Vpp									
TB6	CH B Output Level	0 dBm Max or <2.0Vpp									
Date & Technician ID											
Date Performance Measured											
Technician performing Measurement											

Notes:

+ Factory System Threshold; AGC level should not drop below this level

Installed AGC value will vary depending upon path attenuation

5000E MAINTENANCE RECORD - TRANSMITTER

Customer: _____ Model: _____ S/N: _____ Data Rate: _____ (If Applicable)

Test Point	Description	Specification	Factory Data	Install Data	Customer Data	Customer Data	Customer Data	Customer Data	Customer Data	Customer Data	Customer Data
System Data (* Indicates Test Point on Mother Board, ** Indicates Test Point on IF Demod Board)											
TP-1	Ground	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TP-2*	AGC	(See Chart Provided)									
TP-3*	Gunn power source	9.5 to 11 Vdc									
TP-4*	+15 Vdc Supply	14.5 to 15.5 Vdc									
TP-5*	+5 Vdc Supply	4.85 to 5.15 Vdc									
TP-6*	-5 Vdc Supply	-4.85 to -5.15 Vdc									
TP-7*	+27 Vdc Supply	24.0 to 34.0 Vdc									
TP-8*	Tx Gunn Bias	5.0 to 7.0 Vdc									
TP-10*	Varactor Bias	7.0 to 9.0 Vdc									
TP-10**	IF Signal level	-8.0 to -12.0 dBm									
TP-10**	IF Frequency	43.0 to 47.0 MHz									
Tx Freq	Transmitter Freg.	+/- Fo (see label)									
Rx Freq	Receiver Freq.	+/- Fo (see label)									
Base Band Levels (Test Points on Base Band Boards)											
TP2	Video Input Level	1.0 +/- .2 Vpp									
TP1	Video Output Level	1.0 +/- .2 Vpp									
Subchannel Levels (Test Points on Sub Channel Boards; Audio or Data based on Product Model)											
TB2	CH A Input Level	0 dBm Max or <2.0Vpp									
TB5	CH A Output Level	0 dBm Max or <2.0Vpp									
TB3	CH B Input Level	0 dBm Max or <2.0Vpp									
TB6	CH B Output Level	0 dBm Max or <2.0Vpp									
Date & Technician ID											
Date Performance Measured											
Technician performing Measurement											

Notes:

+ Factory System Threshold; AGC level should not drop below this level

Installed AGC value will vary depending upon path attenuation

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Document # 10075-007-05 Rev E
File Name 5KIOTS_E.PM5
PRINTED IN U.S.A.

September 2001