USER'S MANUAL V1.4
(MF24-AV/ADV/AVr/ADVr)

Instructions on how to install, configure
and operate the MultiSite system
(North American Models)

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INFORMATION TO USER

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

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

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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Buyer must obtain a Return Materials Authorization (RMA) number and shipping instructions from ComLink Group prior to returning any Product under warranty. DO NOT RETURN ANY COMLINK GROUP PRODUCT TO THE FACTORY UNTIL RMA AND SHIPPING INSTRUCTIONS ARE RECEIVED.

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If after reading this manual, you encounter any trouble installing or using any MultiSite product, please contact your local distributor. If problems are not solved, you can call ComLink Group's Customer Service for assistance during normal business hours (EST).

The fax and phone numbers are:

Ph: (450) 686-9000 (888) 494-7337 (North America)
Fax: (450) 686-0198

You may also e-mail your inquiries and comments at the following address:

techsupport@comlinkgroup.com

About this User Manual

This User's Manual covers the information and procedures on installing, configuring and using the Microflex MF24-AV/Avr/ADV/ADVr modules. This manual is also a reference for persons who must perform or coordinate the tasks associated with programming and managing a Multisite wireless network.

To control the video display and Pan-Tilt-Zoom functions in **multipoint**, you will need to read Chapter 5 to learn how to use the Pelco KBD4000™ keyboard. If you are using a point-to-point video link and do not want to take advantage of the 4 camera inputs and Quad View display of these 4 cameras, you do not require the KBD4000 and therefore do not need to read this section. You will need, however, to read Chapter 4 to learn how to program the DATA1 serial port of both video transmitter and receiver for the specific data rate of the Pan-Tilt-Zoom system you wish to use.

For customers using a RS-485/422 port, you may need to change the port to RS-232 setting if you configuration of the module is required. Please review Appendix E for converting from RS-485/422 to RS-232 and vice-versa (Appendix G for FV module)

For customers who have ordered a Line Level audio interface and plan to use a leased or dry line, please refer to Appendix G for interface assistance.

Prerequisite Knowledge

Throughout the user's manual there are explanations and procedures that presume working familiarity with radios, as well as basic digital data communication concepts and practices, and an understanding of the concepts underlying telecommunication systems.

If you are not familiar with the concepts and practices involved in these disciplines, we recommend that you familiarize yourself with them before proceeding.

Manual Conventions

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CHAPTER 1 Overview

1.1 Product

The Microflex is your solution for reliable and cost-effective point-to-point or multipoint wireless video communications. This module supports video and data and/or telephony applications.

Capabilities of the Microflex are:

- ***All digital multipoint networking using Demand Assigned TDMA/TDD access***
- ***Supports up to 16 remote video, voice and data terminals***
- ***Protocol transparent point-to-multipoint polled data port***
- ***Support of multiple point-to-point data ports (up to 16)***
- ***User-friendly PC/Windows™ based system programming and Multisite Network Management (MNM)***

1.2 Features

Microflex provides the following features:

- ***Up to four (4) video cameras per transceiver modules***
- ***One or two integrated analog telephone line interface (subscriber or telco interface) and/or line level audio***
- ***One or two asynchronous data ports (RS-232 or RS-485 levels)***
- ***Reliable polled data communications using error detection and correction algorithms***
- ***Capability to operate in PBX or DOD (direct outward dial) voice mode***

1.3 Applications

The Microflex is capable of operating in a point-to-point as well as a point-to-multipoint environment.

In a typical point-to-multipoint configuration, one Microflex must be set in *master mode* to act as a network controller (typically installed at the base). It communicates with several remote Microflex (up to 16) set in *slave mode*, on a single microwave frequency. If a single remote Microflex is used, the system becomes a point-to-point link.

Chapter 4 provides a comprehensive description of the MNM configuration software. The Microflex is typically shipped with its factory default configuration unless indicated otherwise on the configuration sheet attached. The MNM software may have to be used to configure each Microflex for the required application.

1.4 External module description

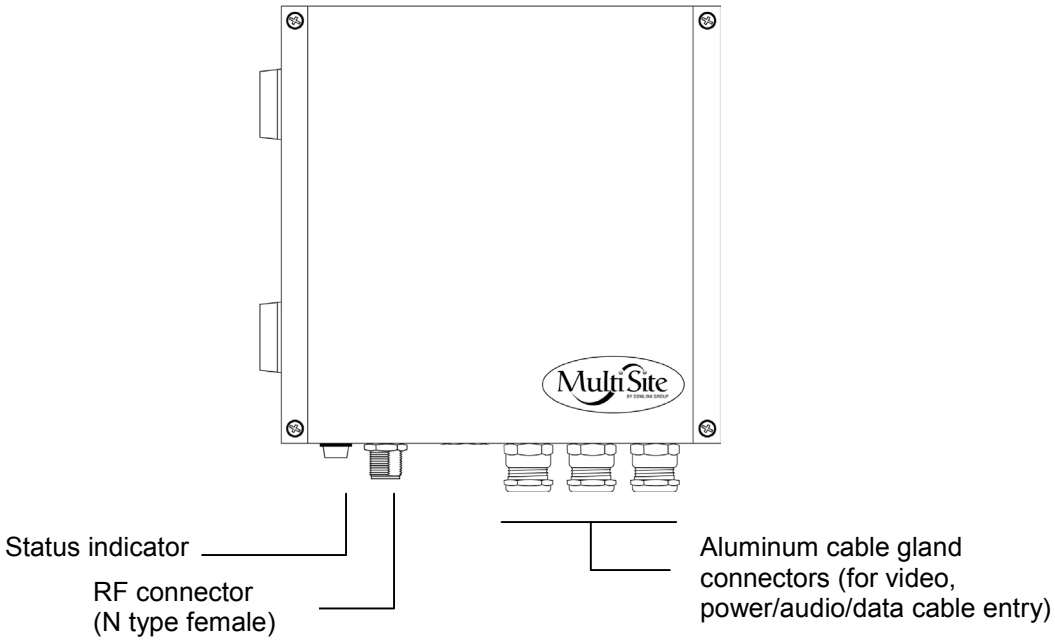


Figure 1- Microflex AVr/ADVr – External view

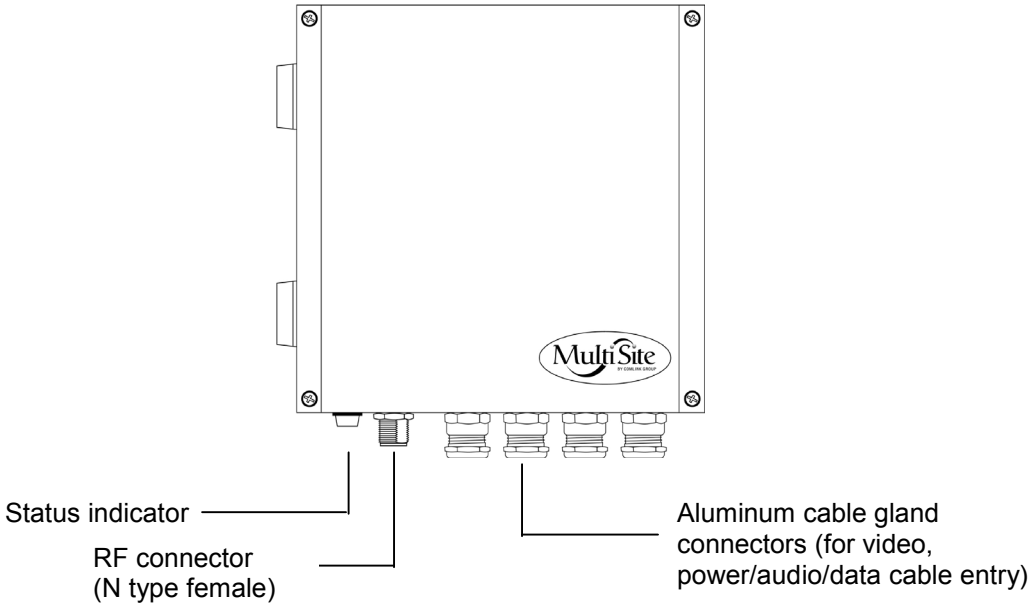


Figure 2- Microflex AV/ADV – External view

The Microflex electronics is enclosed in a weather-tight cast aluminum module. All cable entries and the indicator are mounted on the underside of the module to maintain its weather-tight properties. The underside of the Microflex integrates one (1) visual indicator with the following function:

- ***STATUS - Bi-color indicator (Green or Red)***

  This indicator illuminates **Green** when the module is operating normally and has not detected an internal fault. It will turn **Red** at power up if the module detects an internal fault. It will **flash Green** during radio firmware update (see chapter 4; configuring the network with the MNM software). **Steady off** at power up also indicates an internal failure.

1.5 Internal Description

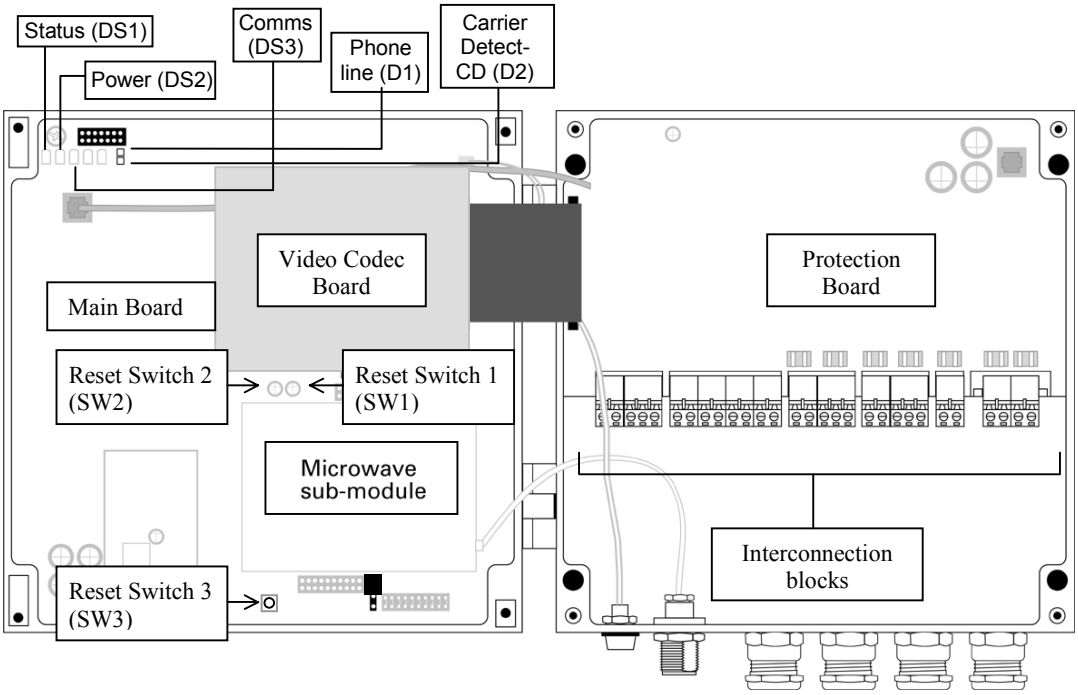


Figure 3 - Microflex – Internal description

All connections to the Microflex including power, video, data and audio cabling are made via pluggable industrial terminals. The signal description for each terminal is indicated on a cabling label inside the enclosure.

Care must be taken not to mix a Microflex FXS interface and FXO interface when connecting the audio signals. Connecting a telephone line (FXO) instead of telephone set can damage the FXS sub-module. A label at the back of the enclosure indicates the audio option selected (O for FXO, S for FXS and L for line level).

The industrial terminals are mounted on an interconnection board. This removable board integrates a two stage surge/lightning protection circuit providing industrial type protection for the main electronics.

Each surge or lightning strike weakens the protection circuitry. It is recommended in lightning prone geographical areas and as part of a maintenance program, to replace the protection board every 2 years. Please contact ComLink factory for part number and ordering procedure.

The interconnection board connects to the main Microflex board via a pluggable ribbon type cable assembly. If this ribbon needs to be disconnected for

maintenance, do not pull the ribbon as this may damage the cable assembly. Grab the connector on the main PCB side and pull carefully.

The main board integrates five (5) visual indicators for troubleshooting as well as an RF signal strength (RSSI) bargraph indicator to align the antenna and determine the signal margin available:

- ***STATUS (DS1) - Bi-color indicator (Green or Red)***

This indicator is equivalent to the external STATUS LED indicator. It illuminates **Green** when the module has not detected an internal fault and is operating normally. It will turn **Red** at power up if the module detects an internal fault. It will **flash Green** during radio firmware update (see chapter 4; configuring the network with the MNM software).

- ***POWER (DS2) - Bi-color indicator (Green or Red)***

This indicator illuminates **Green** when there is at least +10VDC supplied to the interconnect board and the power supply used has an appropriate capacity (typically 1A @ 15 VDC). It will illuminate **Red** if power is below +10 VDC, if capacity is insufficient or if there is an internal problem creating excessive power consumption.

- ***COMMS (DS3) - Bi-color indicator (Green or Red)***

This indicator flashes **Red** during power-up if the radio module is not properly detected. Following power-up the LED behavior will depend on the module configuration:

(a) Master Mode Configuration:

It will **flash Green** at a rate of 2 flashes per second following powering-up sequence. It will remain in this state if it is able to communicate with a remote Microflex set in *Slave Mode*. If it cannot communicate with a slave Microflex, it will **flash Red** at a rate of 2 flashes per second. It will **flash Green** at a rate of 8 flashes per second when there is voice or data activity between the module and another Microflex or when the remote slave Microflex identifies itself (once every 30 seconds).

(b) Slave Mode Configuration:

If it is not capable of communicating with a master Microflex It will remain **off** following powering-up sequence. It will **flash Green** at a rate of 2 flashes per second if it is able to communicate with a master Microflex. It will **flash Green** at a rate of 8 flashes per second when there is voice or data activity between the module and a master Microflex or every time it transmits its ID to the master Microflex (once every 30 seconds on average but at random times).

If the three (3) LEDs, power, Status and Comms are **steady green** simultaneously, the Microflex is in its "loader mode". Proper firmware has to be downloaded in the Microflex for the module to be operational. Such download cannot be done over the RF network, it must be performed locally (see chapter 4 for further details)

- ***PHONE/LINE (D1) – Green indicator***

This indicator **flashes** 8 times per second in synch with the ring signal. The indicator illuminates steady when a telephone call is in progress.

- ***CD (D2) - Green indicator***

This is the RF carrier detect indicator. The LED behavior will depend on the module configuration:

(a) Master Mode Configuration:

It will **flash Green** with varying intensity when activity is occurring in the network (data or voice communications). The more the network is loaded, the more intense the LED will glow. If there is no activity and the remote Microflex modules can identify themselves to the master module, the LED will be **on** momentarily every time it receives an ID packet (once every 30 seconds).

(b) Slave Mode Configuration:

It will **flash green** at a rate of at least 20 times per second (almost **steady green**) when receiving a valid signal from the master module.

The CD LED will not flash green if submitted to interference from nearby transmitters operating in the same RF band. Such interference may however cause the LED to flash intermittently by corrupting valid data packets received from another Microflex. The LED may also flash intermittently if the signal received is at the limit of the receiver sensitivity. The RSSI level can be used to differentiate between the two (2) conditions.

- ***RSSI (DS7 to DS16) - Green indicators***

A ten (10) LED indicator bar graph is used to provide received signal strength (RSSI). The RSSI indicators illuminate **Green**. RSSI values are not factory calibrated and can have an error of +/- 4 dB as compared to true RSSI.

Microflex RSSI	
INDICATOR LED	RSSI (dBm)
Indicator DS16 (min)	-101 +/- 4 dB
Indicator DS15	-98 +/- 4 dB
Indicator DS14	-95 +/- 4 dB
Indicator DS13	-92 +/- 4 dB
Indicator DS12	-89 +/- 4 dB
Indicator DS11	-83 +/- 4 dB
Indicator DS10	-77 +/- 4 dB
Indicator DS9	-71 +/- 4 dB
Indicator DS8	-65 +/- 4 dB
Indicator DS7 (max)	-59 +/- 4 dB

The minimum signal level at which the Microflex can operate depends on the data rate setting. At *Medium* bit rate (384 kbps), the Microflex offers a -98 dBm receiver sensitivity (@10-5 BER). By decreasing to *Low* bit rate (384 kbps), the sensitivity increases to –101 dBm.

The bit rate should always be set to the minimum required to obtain the most robustness to interference and the best receive sensitivity. The bit rate required depends on the system load and the nature of the data transmitted. For most video applications the medium data rate setting is a good compromise between link robustness and video quality. For mixed data, audio, and video applications, the radio data rate used will depend on the number of remote stations used. It is recommended to use medium rate for mixed signals applications.

The Microflex main electronics board integrates 3 switches offering the following functions:

- ***RESET SWITCH 1 (SW1) – Reset to factory default***

A reset-to-factory-default switch (SW1) can be triggered if the Microflex fails to respond. This may be useful following the download of a corrupted or invalid program or improperly programming the module using the MNM software (see chapter 4). The switch must be held for at least 5 seconds while the power is ON for a reset to be valid. Following a reset, the Microflex will need to be programmed for proper operation in the network (see Appendix A for default factory values).

- ***RESET SWITCH 2 (SW2) – Hardware reset***

A hardware reset can be made by momentarily pressing the SW2 switch. This can be useful if the module appears not to be responding properly.

- ***RESET SWITCH 3 (SW3) – radio loader software***

RESERVED

1.6 Setting the Master or Slave Mode

The Microflex main electronic board integrates a two (2) position jumper to set the module for Master or Slave mode operation. Refer to the illustration below for proper position in both modes.

A Multisite network must have a single Master module. If one Microflex is set in Master mode, all other modules should be set in Slave mode. The Master module should ideally be installed in an accessible location, typically at the base station. The only exception to this is for a point-to-point video link. In point-to-point, it is best to set the MF24-ADV in Master Mode and the MF24-ADVr is Slave Mode. This allows a higher video data throughput (300 kbps sustained) and slightly higher quality.

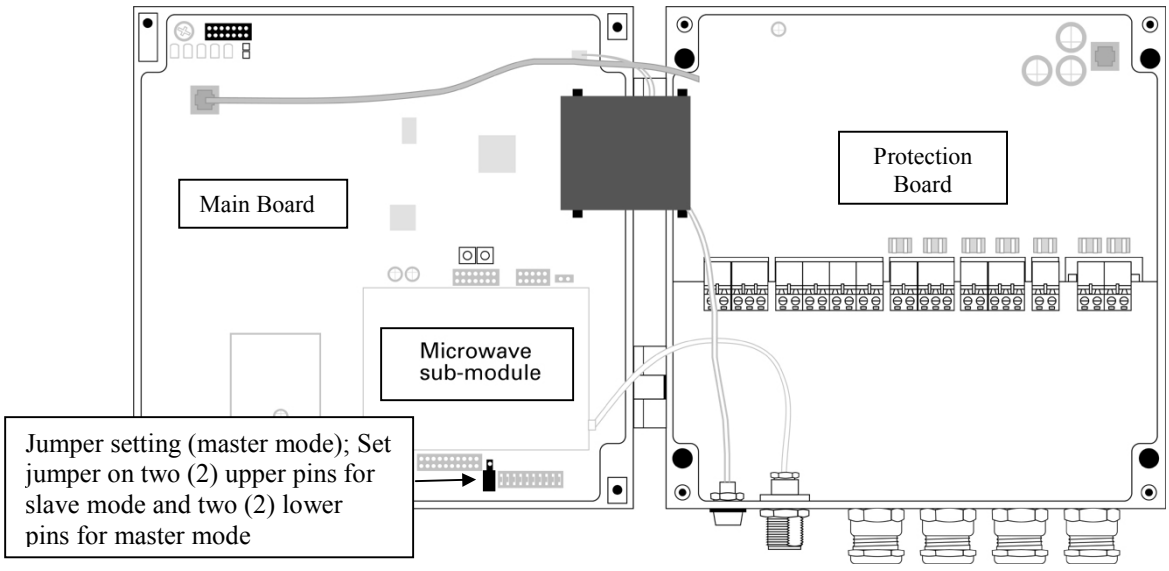


Figure 4 - Master and Slave mode selection

CHAPTER 2 Microflex installation and operation

Your Microflex shipment should contain the following items:

- ***Microflex module with requested options***
- ***Pole mounting bracket with two (2) stainless steel collars (for 0.75-2 inch poles unless an optional mount has been ordered)***
- ***15 VDC external power supply (Optional)***
- ***Antenna (Optional)***
- ***Microflex configuration sheet***
- ***User's manual (one set per system ordered)***
- ***MNM based configuration diskettes (one set per system ordered)***

Check the material against the packing list to make sure you have received everything. If something is missing or if you discover shipping damage, please contact your distributor.

2.1 Microflex Setup Guide

The MicroFlex is to be professionally installed. The guidelines in the following subsection will assist the installer in cabling and installing the Microflex.

STEP 1 Installing the Microflex module

The Microflex is shipped with a mounting bracket. This bracket is supplied with a special water-sealing gel backing. This backing **must not** be removed in order to maintain the enclosure weather-tight feature. Three (3) stainless steel screws are also supplied to install the bracket on the back of the Microflex enclosure. Mount the bracket to the back of the enclosure and align the screws with the mounting holes. Tighten the three (3) screws firmly while being careful not to strip the aluminum threads. Some gel may flow out from under the bracket while tightening. This extra gel can be removed with water and mild soap or an alcoholic solution. Using the mounting bracket and collars supplied, the Microflex can be mounted on any pole with a 18-50 mm (0.75-2.0 inch) diameter. ComLink also supplies mounting brackets for mounting on walls and larger collar size for mounting on light poles or other large diameter poles. Contact ComLink factory if you require a different mounting option than the one supplied.

STEP 2 Installing the antenna

The Microflex is designed for outdoor installation, next to the antenna. Such installation minimizes cable losses thereby maximizing link margin. Install the Microflex module with its antenna on an appropriate mast or tower. Depending on whether the antenna has a pigtail or not, you may need to install a coaxial cable jumper (with N connectors) between the Microflex and antenna. The coaxial cable recommended is an RG-142 double shield (or equivalent) with a minimum length of 1 meter and a maximum length of 3 meters to reduce cable loss (use quality type N clamp connectors to ensure a watertight setup).

Install the Microflex module at the same elevation as the antenna for best lightning protection. If the Microflex module is installed several meters lower than the antenna, a 2.4 GHz lightning arrester should be used.

Never exceed antenna gains of 11 dBi. The only exception is when you have significant cable losses. For each dB of cable loss, you can add 1dB of antenna gain.

Always install the antenna away from wires, power lines, trees and people for optimum safety and performance. For more information on antenna installation, refer to the manufacturer's documentation included with the antenna.

STEP 3 Connecting power, audio and data

Connect the power (12-15 VDC recommended), video, audio and data ports according to the label at the bottom of the Microflex enclosure (see illustration on next page). The video signal should be carried on RG-59 coaxial cable.

The power and audio signals can be carried using the same cable. This cable should contain 4 to 5 pairs **with an overall shield** and have an AWG of 20 (0.81 mm diameter) or larger for optimum performance. Use 2 pairs for the audio and 2-3 pairs to carry power (this will reduce voltage drop between the power supply and the Microflex).

The data should be carried using a low capacitance non twisted pair communications cable **with an overall shield**. A 24 gauge (0.51 mm diameter) low capacitance conductor will support long cable runs (50-80 meters) for RS-232 signals. The two (2) data ports can use a single multi-conductors cable.

If you are planning to install a long cable extension between the Microflex and the cameras, PLC/computer equipment and/or the phone equipment, it is highly recommended to protect these equipments from lightning and power transients (the Microflex is well protected and does not require additional protection). Several manufacturers provide protection equipment for video, phone and data ports. ComLink can provide a list of recommended equipment on request.

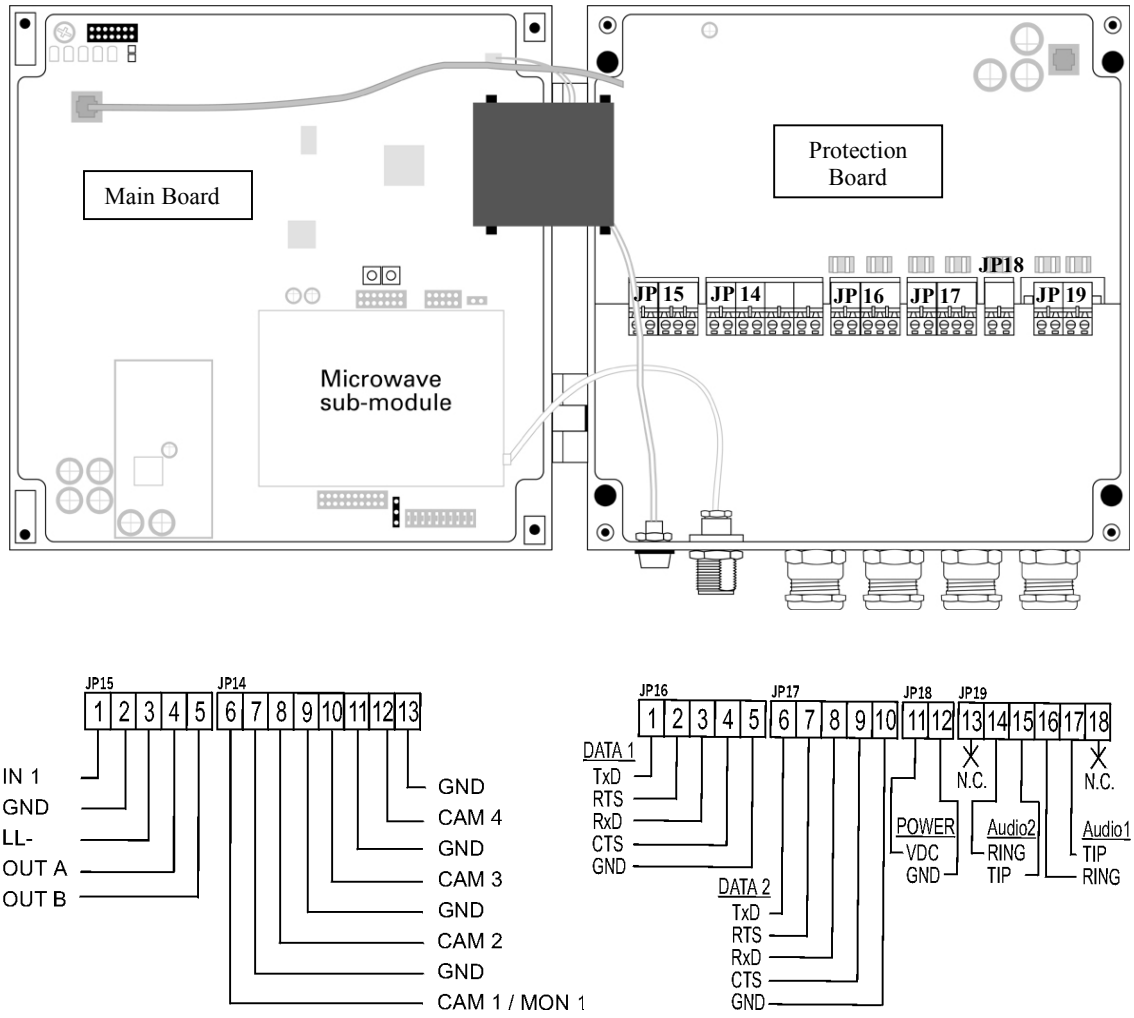


Figure 5 – Microflex ADV/ADVr cabling

STEP 4 Connecting the Microflex for programming

The Microflex Data1 port (JP16) is used for both data applications and module

programming. Both Data1 port and Data2 port are configured as DCE interfaces. They must be connected to a DTE interface for proper operation.

Connect the RS-232 TX, RX and GND signals (RTS/CTS not required) to the available COM port of your PC running the MNM software. The MNM software will automatically convert the Microflex Data port 1 to terminal mode (configuration mode) when started. The Microflex converts its Data port 1 back to its data application mode following 30 seconds of inactivity from MNM on Data port 1.

In point-multipoint applcations, DATA 1 is used to transfer PTZ commands. If you have ordered an RS-485 interface, DATA 1 is configured for RS-485 signal levels. You will not be able to communicate with the module using a computer and MNM software in such case. A RS-485 to RS-232 signal converter plug must be used to communicate between the Microflex and the computer. Such item is not expensive and available from most telecommunication equipment distributor.

STEP 5 Verifying the indicators for proper operation

Upon power up, the indicator STATUS indicator on the outside of the enclosure should turn STEADY GREEN. Review Chapter 1 to understand how the indicators on the Microflex main board should behave under normal conditions.

If the POWER or STATUS indicator turns red momentarily (2 seconds or more) or stays off at power up, there is a problem with the Microflex or the power supply. Please contact ComLink technical support team for assistance.

STEP 6 Completing the Installation

You have now completed the Microflex initial installation. Once the Microflex is properly installed it will need to be configured. Please review Chapter 5 ‘‘Using the MNM Software’’ to complete this final step.

CHAPTER 3 Proper microwave network planning

The Microflex microwave sub-module provides a standard air interface for all Multisite products. It offers a robust and highly reliable spread spectrum wireless link which can span 50 kilometers with appropriate installation.

For best operation the network must be properly planned and the antennas must be installed in such way as to obtain line-of-sight links. This chapter provides a comprehensive review of network planning and propagation principles.

3.1 RF Planning

Successful operation of a Multisite network lies on the proper installation of the wireless interface. Such installation requires five (5) phases:

1. Completing the initial network layout
2. Evaluating the system gain required for each link and selecting the appropriate antennas to use
3. Verifying the line of sight and Fresnel zone clearance for each link within the network
4. Carrying out an on-site survey (optional)
5. Completing the final system commissioning.

This section presents a step-by-step approach to completing the phases outlined above.

3.1.1 Network Planning

A Multisite network can be configured in multiple ways.

Figure 6, Figure 7 and Figure 8 present some common configurations. The first step is to establish a network plan based on initial area topology and distances between each remote station and base.

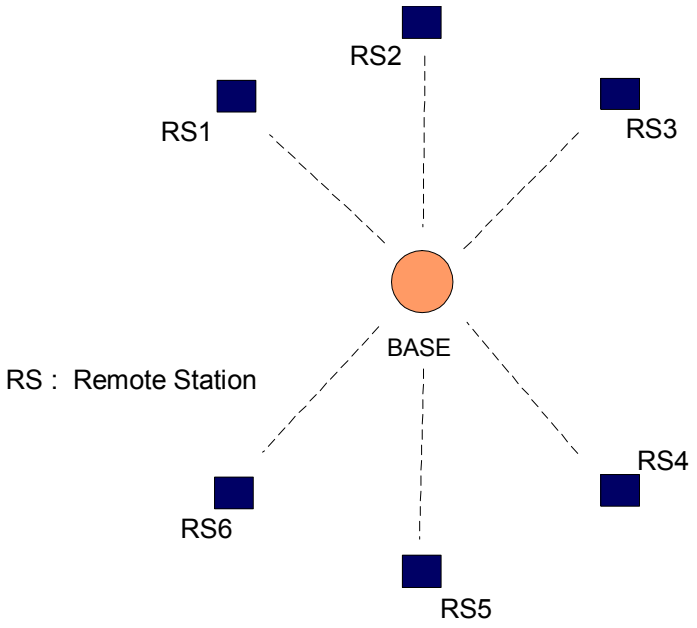


Figure 6 - Basic Multipoint Cell

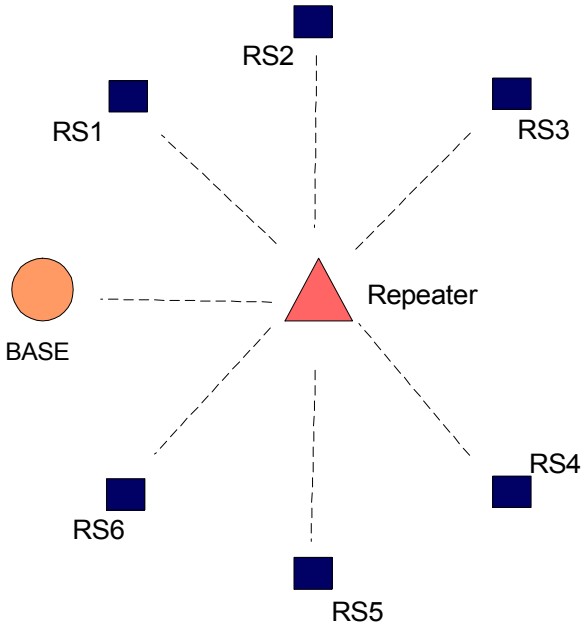


Figure 7 - Multipoint Network with Repeater

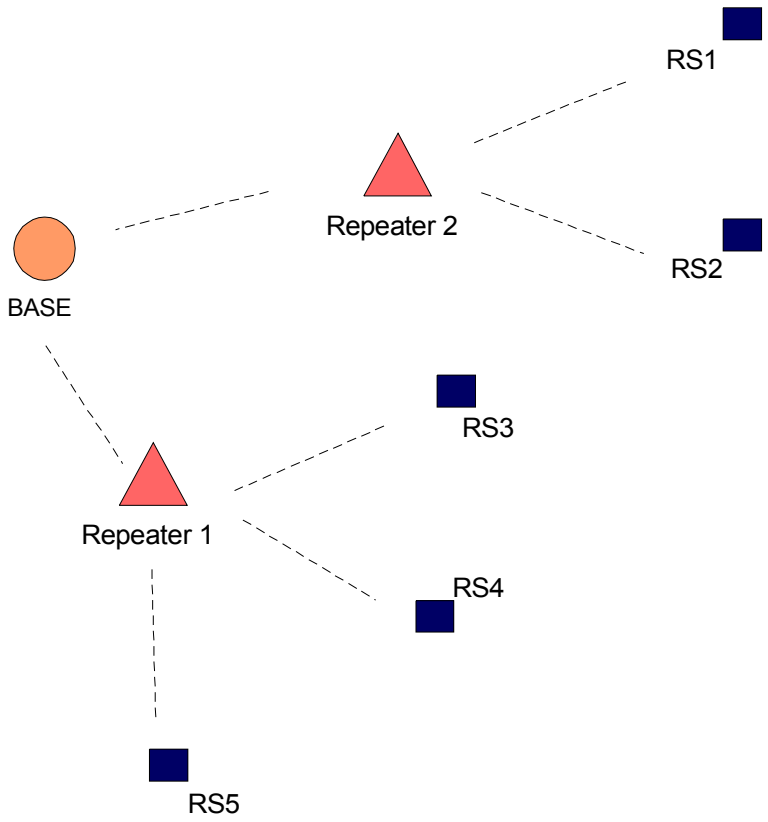


Figure 8 - Multipoint Network with Two Repeaters

In situations where there are no repeaters, the antenna installed at the base station should be elevated as high as possible to provide a clear line-of-sight with all remote stations.

To establish wireless links exceeding 10 kilometers, it may be necessary to install a telecommunication tower at the base (if none are available). A more cost-effective solution could also be to install a repeater on an existing telecommunication tower in the vicinity of the base.

To install several repeaters in the system, an adequate mast or tower height must be planned for each repeater supporting multiple links.

3.1.2 Evaluating System Gain Requirements

To establish a link between two antennas, the following requirements must be met:

Path loss < system gain (radio gain + antenna gain - cable losses).

The radio gain, at a specific bit error rate (BER), is equal to the transmission power less the radio receiving sensitivity. The radio gain provided by the Microflex depends on the power output and data rate selected via the MNM software. At maximum power and medium data rate (384 kbps), the radio gain is 122 dB. At minimum data rate (192 kbps), the radio gain is 125 dB.

The antenna gain will vary according to the model selected. ComLink offers a selection of antennas to meet the propagation specifications of various configurations (See Table 1).

Using the maximum radio gain with the maximum allowed 11 dBi antenna gain (including cable losses) at both ends, the achievable system gain is 147dB (at 192kbps data rate).

2.4 - 2.4835 GHz		
ANTENNA TYPE	**PART NUMBER**	**DESCRIPTION**
6 dBi omni	ANT-WO6-24	Antenna used at the base or repeater station to transmit 360° in a horizontal plane.
8 dBi flat panel (circular polarized)	ANT-WP8-24	Low profile directional antenna used at the remote stations.
9 dBi omni	ANT-WO9-24	Antenna used at the base or repeater station to transmit 360° in a horizontal plane.
11 dBi flat panel	ANT-WP11-24	Directional antenna used at the remote stations.
12 dBi omni	ANT-WO12-24	Antenna used at the base or repeater station to transmit 360° in a horizontal plane **(used to compensate for cable losses greater than 1dB)**

Table 1 – Antenna Gain

Since the Microflex can be installed next to the antenna, it is easy to minimize coaxial cable losses. This allows the use of smaller, lower cost antennas.

The path loss must always be lower than the system gain. The difference between the two is the path safety margin. This margin ensures the link to be functional despite changes in system gain due to heavy rain, temperature variations, antenna misalignment and overall electrical and mechanical system aging. The changes due to rain and temperature variations are presented in Table 2.

Impact of rain and temperature on Microflex	
Condition	**Reduction in system gain**
Rain	Up to 0.5 dB/10 km
T = - 40^{o} C	Up to 1.0 dB
T = + 55^{o} C	Up to 2.5 dB

Table 2 – Weather dependent ratings

Antenna misalignment does not contribute much to path loss in Multisite networks because most communications take place between an omni antenna (base or repeater) and a directional antenna (remote station). Aligning such antenna combination is not as critical when compared to the alignment of two directional antennas.

A good rule of thumb in a Multisite network is to use a 15-20 dB security margin to take into account the above factors in addition to multipath fading.

The difficult part in planning a solid link is to evaluate the path loss. There are many factors that affect the overall losses. Two of these important factors include topology of the path and in-band and out-of-band interference. Short of conducting an actual on-site survey, these factors could be hard to assess. A good starting point is to establish the free space path loss for the link. Free space path loss is the predominant contributor to the total path loss of a line-of-sight radio link.

To establish the free space path loss, ComLink has prepared a reference in Table 3 combining free space path loss at 2.4 GHz to a security margin of 15 dB and 20 dB. The security margins selected are based on field experience. They are not calculated from scientific equations and should only be used as a general guideline.

Distance (kilometers)	Path loss @ 2.45 GHz (dB)	
	15 dB*	**20 dB***
5	129	134
10	135	140
12	137	142
15	139	144
20	-	146

Table 3 – Distance Vs Path Loss

As mentioned earlier, maximum system gain is 147 dB. This is achievable at a data rate of 192kbps using the maximum allowed 11 dBi antenna gain (including cable losses) at both ends.

The example below illustrate how to calculate the required system gain based on the path loss provided in Table 3.

Example: A link at 2.45 GHz must be established between a base and a remote station 10 kilometers apart. Select the appropriate antennas for the link.

a) Path loss = 135 dB (from Table 3)
b) Required radio system gain = path loss = 135 dB.
c) Assuming the system is operating at maximum power and medium bit rate:

(i) Radio gain = +24 – (–98) = 122 dB
(ii) Total antenna gain = Path loss – Radio gain
= 135 – 122
= 13 dB

For point-to-point operation between two (2) Microflex modules, two (2) 8 dBi flat panel antennas could be used.

For multipoint networking, an omni antenna must be installed at the base. A 6 dBi omni could be used at the base with an 8 dBi flat panel antenna at the remote station.

* Additional link margin

At 2.4 GHz, radio waves are highly attenuated by dense foliage. A link established in the fall or winter season may be affected adversely in the spring and summertime, if it is established below tree level.

Once the network RF gain plan has been empirically calculated, the minimum antenna elevation at each site to minimize path loss should be established. The Fresnel zone clearance, the earth's curvature (can be ignored for links shorter than 12 kilometers) and any physical obstructions along the path have to be considered.

3.1.3 Verifying Line of Sight and Fresnel Zone Clearance

Unless it is a very short link distance (typically less than 1-2 kilometers) the path between the two antennas must be free of obstacles that could disturb propagation. Such path is called a line of sight path. If there are obstacles, radio waves will be in part absorbed and in part diffracted by the obstacles (multi-path fading). Even if operating in such circumstances, links could be established. However, results are highly unpredictable.

The first requirement of a successful link is therefore a clear line of sight path. There is a second requirement related to the beam-width of a radio signal. The beam-width of a radio signal transmitted between two antennas is an elliptical area immediately surrounding the visual path (see Figure 9). It varies in thickness depending on the length of the signal path and the frequency of the signal. The region outlined by this beam-width is known as the first Fresnel zone.

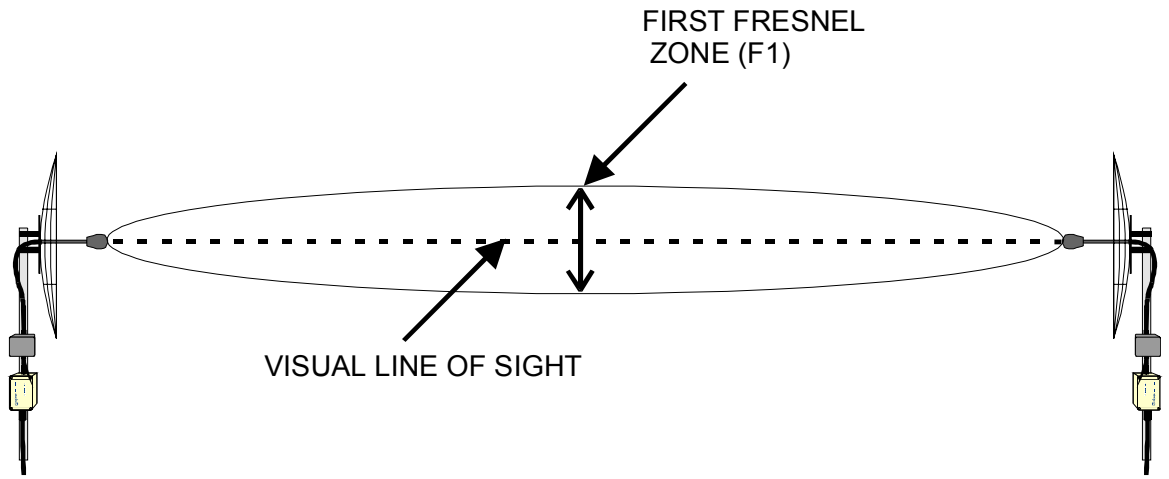


Figure 9 - Difference Between Fresnel Zone and Visual Line of Sight

The Fresnel zone is always thicker at the mid-point between the two antennas. Therefore a path that appears to be a perfect line of sight path between the base and a remote station may not be adequate for a radio signal.

In practice, it has been determined that a radio path can be considered a line of sight path if it has a clear opening through 60% of the first Fresnel zone (0.6 F1). Table 4 presents the value of 0.6 F1 for various signal path distances.

DISTANCE (Km)	0.6F1@ 2.45 GHz (meters)
5	14
10	20
20	30
30	36
40	41
50	47
60	52

Table 4 – 0.6F1 Values at Various Distances

A common problem encountered in the field and related to the 0.6F1 clearance rule is a mountain obstruction. The proposed visual path may just barely clear a mountain but the “radio line of sight” won’t. In such case, the signal will be partially absorbed and diffracted. Increasing the height of one antenna (or both) is the only alternative to reduce path loss.

3.1.4 On-Site Testing

Before finalizing the system commissioning, verify the quality of each link especially if large distances are covered (> 10 kilometers). If in-band interference is suspected, taking a spectrum analyzer on site to scan the frequency band is recommended.

To complete a site survey, first install the Microflex configured as a Master at the base station and power it up. If a repeater station is planned in the system, the Microflex can temporarily be installed at the repeater site to verify the quality of the repeater-to-remote station links.

The Microflex in master mode continuously transmits a beacon (at 10 msec intervals) to remote stations and this, whether or not, the data or audio port is active. This beacon provides a good signal for RSSI measurement at each remote station.

To conduct the remote site survey proceed as follows:

STEP 1. Install the proper antenna at the remote location proposed

STEP 2. Connect the Microflex configured as a Slave to the antenna

STEP 3. Align the antenna to obtain maximum RSSI

STEP 4. Note the RSSI value

If the RSSI bargraph does not reach the third LED indicator at low bit rate and the fourth indicator at medium bit rate, there might be insufficient margin to guarantee a continuous high quality link (BER > 10^{-5}). Considerable temperature variations and heavy rain can cause path loss variations of up to 3 dB. There are two (2) options to decrease path loss:

1) Increase the height of the base / repeater or remote antenna, or

2) Increase the gain of the antennas used (within the 11 dBi limitation, including cable losses).

If these options are not feasible, a repeater station may have to be installed strategically along the path.

3.1.5 RF Exposure Considerations

In order to comply with the RF exposure requirements of CFR47 1.1310, the S1000 must be installed in such a way as to allow a minimum separation distance of 10 cm (4 in.) between antennas and persons nearby.

3.2 Coping with Interference

In most countries, the 2.4 GHz license free band is not regulated by a government agency and this absence of frequency coordination can result in interference between various systems. Fortunately, there are existing tools that can be used to avert interference:

(1) RF channel selection
(2) PN code selection
(3) Security code
(4) Antenna selection

Interference is probably not a concern for a Multisite network installation in a rural area. In urban area, radio licenses are limited creating an increased demand for wireless products at 2.4 GHz. The potential for interference is therefore greater in urban areas. It is recommended to do a site survey with a spectrum analyzer before planning the Multisite network to identify zones of potential interference within the band.

(1) RF channel selection

At 2.4 GHz, eleven (11) non overlapping channels are available. This selection enables the co-location of eleven (11) Multisite networks in the same area without substantial performance degradation.

(2) PN code spreading and selection

The Microflex employs direct sequence spread spectrum coding. With this coding scheme, a pseudo-random sequence (PN code) is used to spread the signal over a much wider band than required by the base-band modulated data. The wider the signal is spread, the better the radio receiver is at discriminating between a valid signal and an interfering signal.

The Microflex uses 16-bit PN sequences. Some radios implement longer sequences (64 bits or more), however most unlicensed products (such as 802.11 compliant wireless LAN radios) use 11-bit PN sequences to maximize data rate within a given bandwidth. With a 16-bit sequence, the Microflex module provides sufficient interference rejection in most environments and to most unlicensed products.

The best PN codes are pseudo random, non-correlating sequences of bits. With such PN codes, two independent radio links at the same frequency will not interfere with each other. The signal isolation provided by two distinct PN codes is proportional to the PN code's length.

The Microflex module supports nine (9) non-correlating PN codes. Given sufficient antenna separation, It can be possible to co-locate nine (9) non-

interfering networks at the same frequency using 9 different PN codes with low cross-correlation. The networks must be planned such that no radio receives a signal from the co-located network at a stronger level than a signal from its own network. In practice, this may be difficult to achieve. Directional antennas would have to be used with all Microflex radios installed in close proximity to each other and belonging to different networks.

(3) Security code

A 16 bit security code is used to guarantee network security and prevent eavesdropping using another Microflex module. This security code also provides some protection against interference.

(4) Antenna Selection

To determine isolation between two antennas at selected frequency bands, three (3) critical parameters must be considered:

1) Radiation pattern (including front-to-back ratio).

2) Gain of the antenna.

3) Antenna polarization.

Strategic selection of antennas based on these parameters can significantly lower interference between co-located systems.

A multipoint network must use an antenna with a wide horizontal radiation pattern at the base (or repeater site) to communicate with all remote stations. If the remote stations are located within a localized area instead of being scattered all around the base, a common practice is to use a directional antenna with a reduced horizontal beamwidth. This will reduce interference from co-located systems installed outside the 3 dB beamwidth of the antenna. In such circumstances, good antennas to use are flat panel antennas. They typically offer up to 120°, 3 dB beamwidth and front-to-back ratios greater than 20 dB[1].

[1] A co-located radio far enough outside the 3 dB beam-width will see its signal rejected by up to 20 dB by the antenna.

CHAPTER 4 MNM Configuration Software Integration

This chapter provides information on installing and using the MNM (*Multisite Network Manager*). The MNM is a user friendly and easy-to-use Windows™ compatible software. This software configures all Multisite modules within a network. It allows you to set PABX and DOD phone connections as well as polling and point-to-point data links. The software also acts as an on-line diagnostic tool by providing the status of all network nodes.

4.1 Installing the MNM

To install the MNM, follow these steps:

Insert the MNM **Setup Disk 1** into **drive A** and select **Run** from the **taskbar.**

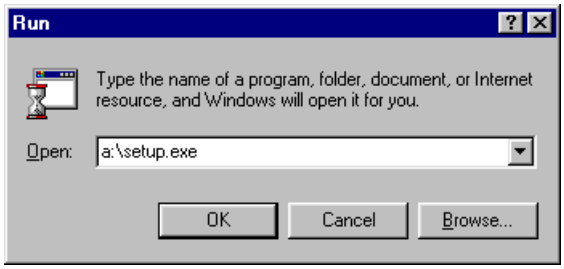


Figure 10 – Run Dialog Box

Type: **a:\setup.exe** and click OK (as in figure 1).

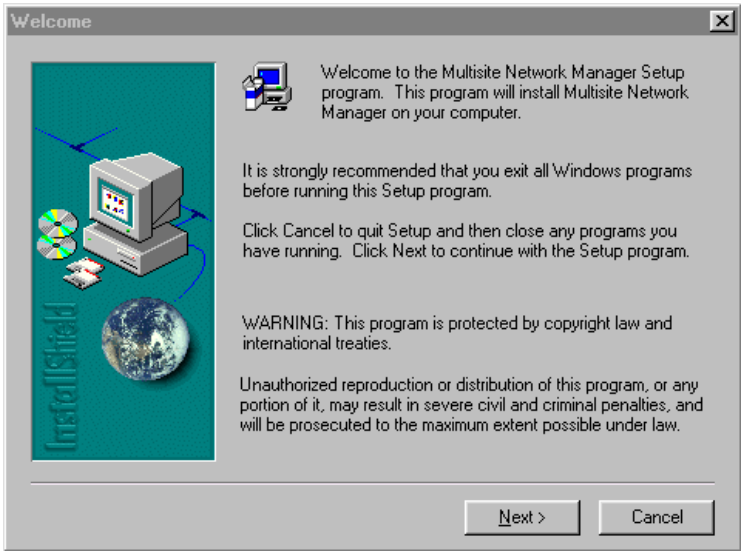


Figure 11 – Welcome Setup Dialog Box

The installation procedure might have to replace some files in use by other programs. For this reason a welcome screen prompts you to exit setup and close all

running applications (figure 2). When all applications are closed continue setup by clicking on <Next>.
Read carefully the Release Note and then press <Next>.
The installation will start and install MNM to the default path C:\Program Files\MNM\.
Once completed, you will be asked to restart your computer, choose **Yes** and click on <Finish>(figure 3).

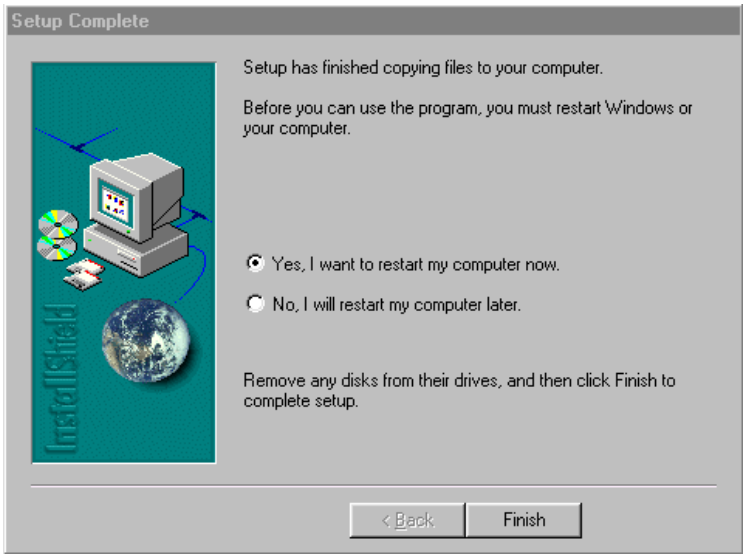


Figure 12 – Setup Complete Dialog Box

4.2 Using Multisite Network Manager (MNM)

The MNM is designed to configure a Network. It can also be used to configure each module individually before installing the network.

4.2.1 Launching the MNM Programmer

Launch Windows 95/98TM.

Connect the COMM Port used by the PC to one of the unit in the network. The connection must be done on the Data Port #1.

If you have ordered RS-485 signal level for Pan-Tilt-Zoom support, you will need a signal converter plug-in module to convert the RS-485 signals to RS-232 signals for communication with the computer on DATA 1.

From the taskbar select Start | Programs | MNM.

The MNM main window should then appear (figure 4).

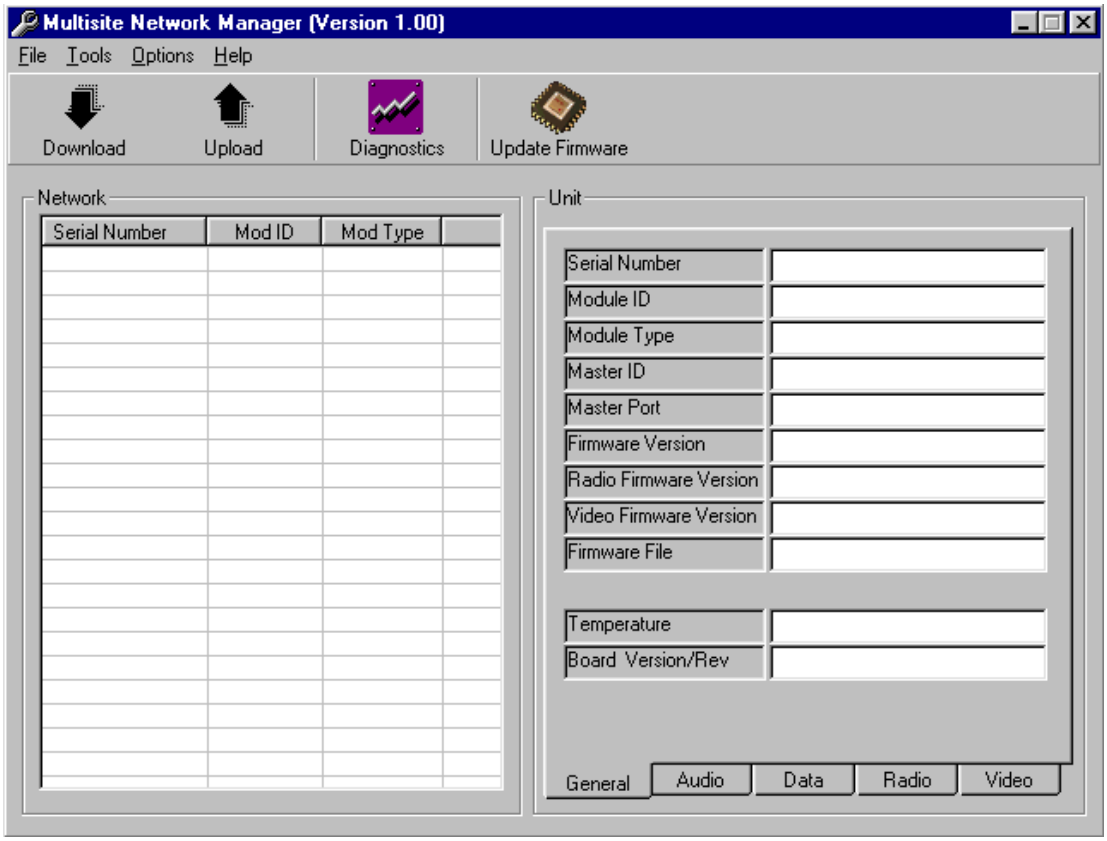


Figure 13 – MNM Main view

MNM uses (by default) ***Comm Port 2*** to communicate with the local module. To change serial port select menu **Options | Serial Port…**and select the appropriate Comm Port from the drop-down list and click OK (see figure 14).

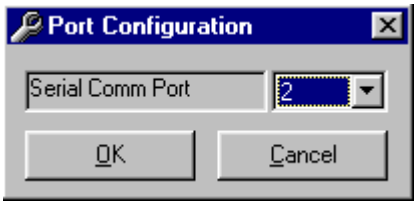


Figure 14 – Communication Configuration Dialog Box

The **Local Module** is the Multisite unit connected directly to the computer's serial communication port. The Multisite Network Manager software uses a special escape sequence that allow it to **switch automatically** the data port into a management port, whatever the baud rate or the configuration of this port. For this reason, once the computer is connected to a unit in the system, no additional manipulations are required for the communication to begin.

MNM may not work properly if two (2) or more Microflex are set in Master mode. There must be a single Microflex set in master mode before using MNM.

4.3 Main Operations

Only two simple operations are needed to configure a Multisite network: the configuration **download** and the configuration **upload**.

The configuration **download** retrieves all the properties of each unit in the network. All information is stored in a database and displayed to the user. Some configurations are read-only and some others are read-write. To meet the specifications of your application, you may modify the read-write properties as required. Once the configuration is completed, the **upload** operation will send the new configuration to each unit and save it permanently.

The MNM main window is divided into four distinct areas (figure 15): the menu bar, the tool bar, the network list and the property tabs. Each of these parts is described in the following sections.

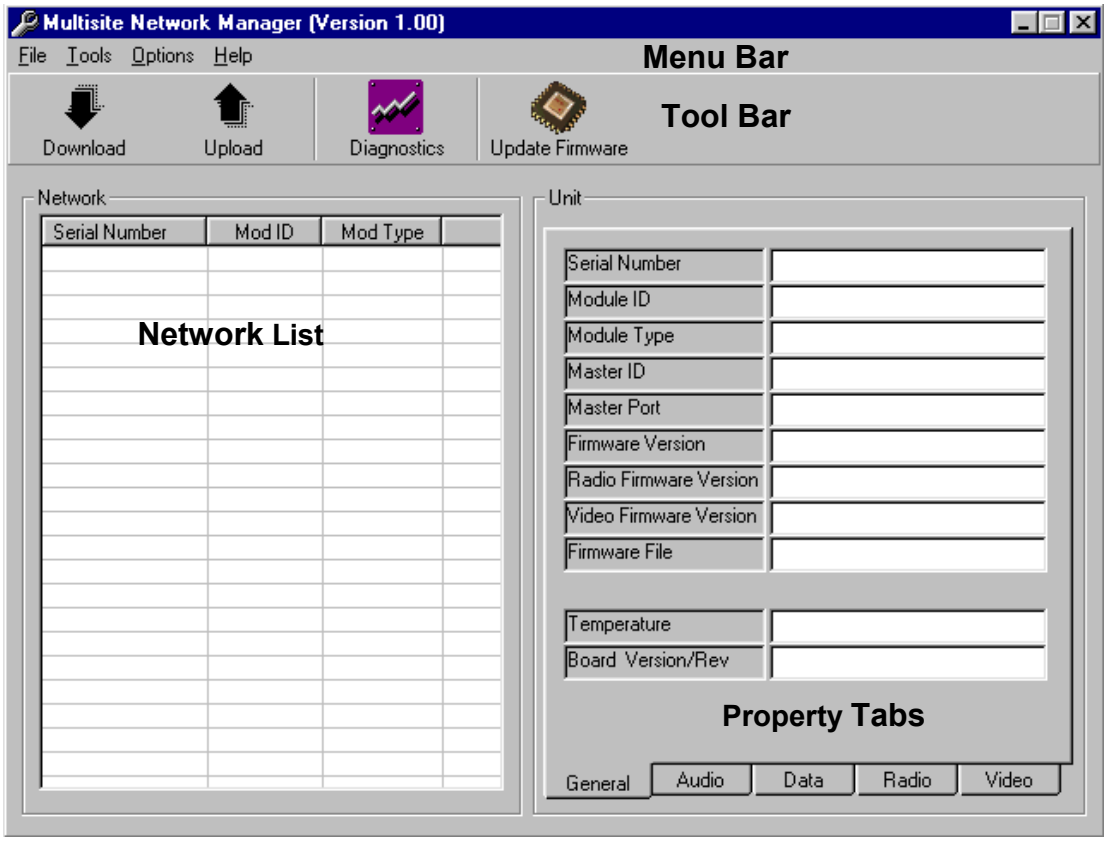


Figure 15 – MNM Main view sections

4.3.1 Network List

The Network List displays a general description of each unit present in the Multisite network. Every row of the list contains the serial number, the module identification number as well as the module type of a particular unit.

4.3.2 Unit Properties

Each unit may have its property set displayed in the property tabs. To see the properties of a particular unit, simply select the unit in the network list by clicking on it. The property tabs will automatically refresh itself.

From this point, you can browse through the different tabs related to the five different property categories: General, Audio, Data, Radio or Video. Please refer to section 4.2 for a complete description of each section.

4.3.3 Menu Bar

Four different menus are provided to help you complete your configuration:

- ***File***

Open Firmware:	Find and open firmware for download.
Exit:	Quit Multisite Network Manager application.

- ***Tools***

Download:	Retrieve the configuration of all units in the network.
Upload:	Transfer the new configuration from the computer to all the units.
Diagnostics:	Display a diagnostic window for the unit selected in the network list (refer to section 4.5).
Update Firmware:	Initiate the firmware update for the unit selected in the network list (refer to section 4.6).
Factory Reset:	Reset the properties of the selected unit to their factory values (refer to section 4.7.1).
Unit Reset:	Proceed to a software reset of the selected unit (refer to section 4.7.2).

- ***Options***

Serial Port:	Displays the communication port configuration window.

- ***Help***

Release Notes:	Displays the special notes related to the actual software release.

4.3.4 Tool Bar

The Tool Bar contains the four most important operations listed in the previous section: Download, Upload, Diagnostics and Firmware Update. Please refer to the appropriate section for additional information on those functions.

Figure 16 – MNM Tool Bar

4.4 Unit Properties

This section explains the different configuration items displayed in the four property tabs.

4.4.1 General

- ***Serial Number*** *(read-only)*

This property displays the module's embedded serial number. It is an exclusive and read-only 12-digit number.

- ***Module ID*** *(read-write)*

An exclusive number, between 1 and 254, must be assigned to each module.

All modules MUST have an exclusive and valid Module ID for normal network operation. If you change the ID of a module in a network and download the network information immediately after, not all network nodes may appear in the tree list. This is because the Master node in the network may take up to 30 seconds to refresh, within its memory, the new network architecture.

- ***Module Type*** *(read-only)*

This property indicates the module type (Microflex or other) for the selected unit:

- ***Master ID*** *(read-only)*

The module identification number of the unit's master is displayed here.

- ***Master Port*** *(read-only)*

The way the unit is connected to its master is provided with this property as follows:

1) **Drop & Insert**: the unit is connected to the drop-and-insert (cabled) port of its master

2) **RF #x**: the unit is connected to the RF port number **x** of its master.

- ***Firmware Version*** *(read-only)*

This label contains a string indicating the firmware version downloaded in the selected unit.

- ***Radio Firmware Version*** *(read-only)*

This label contains a string indicating the Radio firmware version downloaded in the selected unit.

- ***Video Firmware Version*** *(read-only)*

This label contains a string indicating the Video firmware version downloaded in the selected unit.

- ***Firmware File*** *(read-write)*

Before performing a firmware update, the complete path of the firmware file must be provided here.

- ***Temperature*** *(read-only)*

This property indicates the temperature of the selected Microflex

- ***Board Version/Rev*** *(read-only)*

This label contains a string indicating the Board Version and the Revision of the selected unit (Ex: 1.0/A).

4.4.2 Audio

The following properties are provided for each available audio channels of a selected unit.

- ***Module*** *(read-only)*

NONE when module does not support audio, FXS for 2-wire loop-start subscriber, FXO for 2-wire loop-start line interface and Line Level for line level audio hardware configuration.

- ***Compression*** *(read-write)*

The type of audio compression can be selected.

(a) LOW compression: ADPCM (32 kbps)
(b) MEDIUM compression: G.729 (8 kbps), voice activity detection and comfort noise

- ***Extension*** *(read-write)*

Valid audio extensions between 1 and 899 must be assigned.

The Module ID number DOES NOT CORRESPOND to a telephone extension number. Phone line extension numbers are assigned in the audio configuration tab of the properties.

- ***Connection Extension*** *(read-write)*

In DOD mode (Direct Outward Dial) the extension of the paired phone line appears in this window. In PABX and Auto Line Search modes, it is unused.

- ***Connection Type*** *(read-write)*

Three connection modes are available:

PABX: All phones (FXS modules) are accessible by dialing their own extension. To reach an external line (FXO module), you have to dial '9'. This mode is an emulation of a basic PBX phone system.

DOD: The DOD (Direct Outward Dial) mode is an emulation of a standard POTS line. In this mode you have to connect a subscriber (FXS module) to a line interface (FXO module). When this mode is selected, you must ensure that the *Connection Extension* property is set properly for both connected units.

Auto Line Search: In this mode, the subscriber unit (FXS modules) connects to the first available line interface (FXO module) as soon as placed off-hook.

To ensure that a DOD connection is valid, be sure that the two connected units refer to each other in their Connection Extension properties.

4.4.3 Data

The following properties are provided for each available data channels of a selected unit.

- ***Type*** *(read-only)*

  (a) NONE when module does not support data transfer (all Multisite modules support data except Linx).
  (b) ASYNCHRONOUS for asynchronous transmissions
  (c) SYNCHRONOUS for synchronous transmissions (not supported at this time)

- ***Connection (Unit, Port)*** *(read-write)*

Displays the Module ID of the paired module when in point-to-point mode as well as the port it is connected with. Select the connection from drop-down list or simply write it down manually. The connection property MUST respect the (Unit, Port) format.

- ***Baud Rate*** *(read-write)*

Select the required port data rate from the drop-down list. Maximum rate is 115200 bps for both data ports.

- ***Correction*** *(read-write)*

Enables or disables the error corrections feature. Error correction will only take effect if both modules are, in a point-to-point link.

- ***Handshake*** *(read-write)*

Enables or disables hardware handshaking (RTS / CTS).

- ***Parity*** *(read-write)*

Enables or disables Data Parity (None / Odd / Even).

- ***Genex mode*** *(read-write)*

Enables or disables a Video Receiver Unit to emulate a Genex multiplexer. (Off / On). This option must be selected for the MF24-ADVr when using the Microflex in point-to-multipoint.

- ***PTZ Protocol*** *(read-write)*

Select the protocol between a Video Transmitter Unit and a Dome camera or PTZ controller. This option must be selected only for Video Transmitter (MF24-ADV) when using the Microflex in point-to-multipoint (or Genex mode ON).

Note: (Only available on data port 1)

In continuous data transmission application (non-stop stream), we strongly recommend to configure user's equipment connected on the data ports with two (2) stop-bit to avoid buffer overflows over a long period of time. Flex and Microflex modules, are configured

with one (1) stop bit on their data ports.

4.4.4 Radio

- ***Selection*** *(read-write)*

NONE if no radio is present

RADIO 1 (INTERNAL) if one radio is present

- ***Status*** *(read-only)*

Not Detected if no radio is present

Detected if one radio is present

- ***Frequency*** *(read-write)*

Frequencies can be selected from the drop-down list or can be entered manually.

Frequency range is 2405 - 2484 MHz.

- ***PN code*** *(read-write)*

PN code can be selected from the drop-down list. Depending of the Bit Rate selected the PN code list will change.

- ***Security code*** *(read-write)*

The Security code is a 4 characters Hexadecimal number (16 bit) , a value between 0000 and FFFF must be assigned. The security code must be set to the same value for all Multisite modules in a single network.

- ***Power*** *(read-write)*

You can select the radio output power from the provided drop-down list.

- ***Bit Rate*** *(read-write)*

You can select the radio bite rate from the provided drop-down list.

- ***RSSI Mode*** *(read-write)*

Select the appropriate RSSI display mode from the drop-down list:

MODE 1: Continuous RSSI

MODE 2: RSSI on valid receptions only

MODE 3: Continuous RSSI with maximum hold

MODE 4: RSSI on valid receptions with maximum hold

(ALWAYS SELECT MODE 2 under normal operation.)

- ***RSSI*** *(read-only)*

The value of the RSSI (Receive Signal Strength Indicator) when the “Download” command was executed.

- ***Firmware Update*** *(read-write)*

When set to 'On' and Uploaded, this will update the firmware of the radio. It will automatically return to 'Off' after the firmware update. This needs to be done only one time after a Microflex radio firmware update.

Once the radio settings of a unit have been modified, it may not be capable to communicate within the network. Always change the settings of all remote radios before changing the settings of the base station.

4.4.5 Video

- ***Status*** *(read-only)*

<Not Detected> if no video sub-module is detected

<Detected> if the video sub-module is detected

- ***Video mode*** *(read-only)*

Displays the mode of the video module: 'Transmitter', 'Receiver' or 'Unknown' if the video module was not detected by the Microflex.

4.5 Diagnostics

When installing a Multisite network, an important thing to check is the RF reliability. To assist with this part of the installation process, a diagnostic window is provided in MNM. To use it, simply select the unit to test in the network list and choose the "Diagnostics" tool either in the menu bar or in the tool bar.

The following information will be displayed:

- ***Module ID***

The identification number of the unit under test

- ***Serial Number***

The unique serial number of the unit under test

- ***RSSI***

The RSSI (Receive Signal Strength Indicator) of the RF signal

- ***Transmitted Packets***

The number of transmitted packets in the packet error rate test

- ***PER (Packet Error Rate)***

The error rate (number of errors / total number of packets) expressed in a scientific format

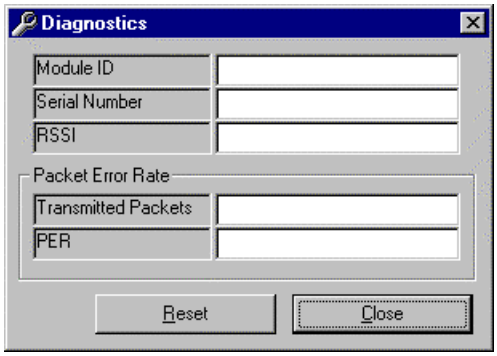


Figure 17 – Diagnostic window

At any time, the test can be reset by clicking the "Reset" button or aborted by clicking the "Close" button.

The diagnostic is not available on a Microflex in Master mode. A Microflex in Slave mode must be selected to enable the diagnostic feature.

4.6 Firmware Update

MNM supports Microflex upgrades anywhere in the network. The Microflex A/AD must have the following firmware modules loaded to be fully functional:

Microflex main program:	Most recent version
Audio application program:	Most recent version
Audio G.729AB CODEC:	Most recent version
Radio main program:	Most recent version
Radio loader program:	Most recent version

To perform a firmware update of any of these modules, follow the few steps below:

(a) Select the unit to update in the network list (local or remote).
(b) Select the appropriate firmware file in the File menu either by browsing the disk drives or by selecting a previously used filename.
(c) Proceed to the firmware update.

If the module has been set to loader mode (see Chapter 1) it will not be possible to see the Microflex in the MNM list. In this case proceed to the firmware update without a module selected. An error window will appear (figure 18). At this point, you can proceed with the update if you are locally connected to the unit in loader mode. To do so, select "Yes".

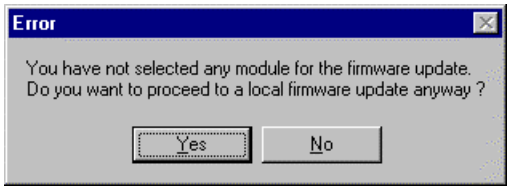


Figure 18 – Diagnostic window

4.7 Miscellaneous

4.7.1 Factory Reset (same as hardware switch SW1; see chapter 1)

This reset will bring back all factory settings including; module extension and radio frequencies. For these reasons, a module reset this way may disappear from the network list. You may need to configure this module locally. For the reset to occur, you must select 'Factory Reset' from the drop down list and then select 'Unit Reset' from this same list. Selecting 'Factory Reset' only will not reset the module.

NOTE: The video settings are not affected by the Factory Reset.

4.7.2 Unit Reset (same as hardware switch SW2; see chapter 1)

This function selected alone (not preceded by 'Factory Reset') will perform a software reset on the unit selected in the network list. Most of the time, it is going to be used in the troubleshooting procedures.

CHAPTER 5 Using the KBD4000 in a Multisite Network

This Chapter describes the installation of a Pelco KBD4000™ keyboard controller (or equivalent) in a Comlink Multisite™ video network. In a multi-point network, the keyboard must be used [2] to select cameras, views, and other options.

The Pelco KBD4000 can also be used in a point-to-point network to support Quad View display and future advanced options. Note however that in point-to-point, if a single camera is used, the data port can be made transparent to support any Pan-Tilt-Zoom protocol.

There are important facts the users should know about the utilisation of a KBD4000™ in a Multisite Network:

- The KBD4000™ must be connected to a receiver unit (**MF24-AVr/ADVr or FV**).
- The KBD4000™ must be configured in <multiplexer mode> for proper operation.
- The video receiver (**MF24-AVr/ADVr or FV**) DATA1 serial port must be set to "Genex Mode" to support the KBD4000 keyboard (see Chapter 4)

In 'Genex Mode', the MF24-Avr/ADVr (or FV) emulates a Pelco Genex™ multiplexer. The receiver is therefore interchangeably referred to as a video receiver or multiplexer throughout this Chapter.

[2] ComLink has plans to release a Windows based software which emulates the KBD4000™. Please contact our Technical support team to have an update on the release date.

5.1 Configuring the KBD4000™

The KBD4000 must be pre-configured before being operational[3]. To setup the KBD4000™, follow these steps:

Remove the DIP switch cover plate from the rear of the keyboard and set the switches to these positions:

1. Set switches 1, 2 and 3 to OFF (select the multiplexer mode of operation).
2. Set switch 4 to ON (to enable the non-polled communication mode).
3. Set switch 5 to OFF (unused).
4. Set switch 6 to OFF (to disable turbo pan feature).
5. Set switch 7 to ON (to address all cameras consecutively).
6. Set switch 8 to ON (to enable programming mode of the Multisite Video Receiver).

5.2 Configuring the Microflex Video Receiver

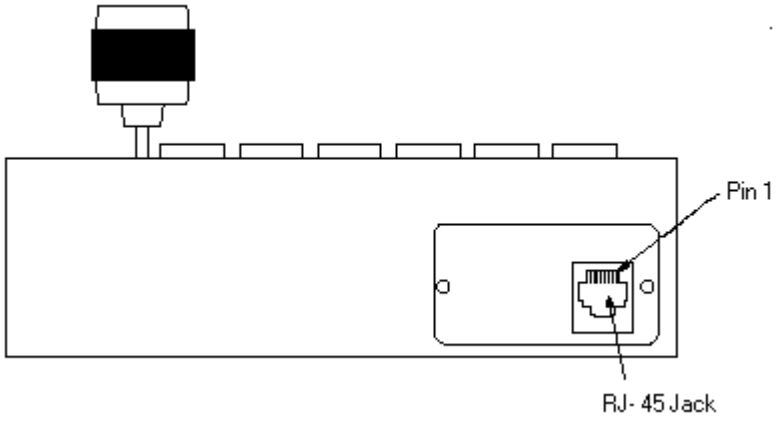
To properly interface the KBD4000™ to the Multisite video receiver, DATA1 of the Microflex video receiver must be configured properly using the MNM configuration software (see Chapter 4). To do so, follow these steps:

1. Launch the Multisite Network Manager software (MNM).
2. Select the receiver unit in the left panel.
3. Click on the Data tab and select DATA1.
4. Configure the data port as follows: Connection = “none”, baud rate = “9600bps”, Correction = ”Off”, handshake = “none”, parity = “odd”, Genex mode = “On”.
5. Press the UPLOAD button to set the receiver with this new configuration.

The video receiver DATA1 port supports RS-485 signal levels only (not RS-232). To program the video receiver using MNM, you will need a signal converter plug-in module to convert the RS-485 signals to RS-232 signals for communication with the computer on DATA 1.

[3] *Comlink might already have completed this pre-configuration at the factory. In this case, ignore these steps.*

5.3 Connecting the KBD4000™ to the Microflex video receiver



KBD4000™ - RJ45 Pin-out (DTE)	Microflex Receiver (DCE) Interconnect Board (JP16 or JP17)[1]
Pin 1 : TX+	Pin 1: TX+
Pin 2 : TX-	Pin 2: TX-
Pin 3 : 12 VAC/DC NON POLAR[2]	
Pin 4 : 12 VAC/DC NON POLAR[2]	
Pin 5 : GND	Pin 5: GND
Pin 6 : No Connect	
Pin 7: RX-	Pin 4: RX-
Pin 8: RX+	Pin 3: RX+

[1] For MF24-AVr/ADVr, DATA1 is referred to as JP16 on the interconnect board. For FV module, DATA1 is referred to as JP17. Note that on both interconnect board models, Pins 1-5 are counted from left to right.

[2] A 12VAC power supply on Pins 3 and 4 or a 12VDC on Pin 3 and pin 5 (ground) must be supplied.

5.4 Connecting the KBD4000™ to multiple Microflex receivers

It is possible to use a single KBD4000™ to control two (2) or more video receivers (any of three models). To support this, proceed as follows:

Select one of the video receivers (anyone) and connect it as follows:

KBD4000™ - RJ45 Pin-out (DTE)	**Microflex Receiver (DCE) Interconnect Board (JP16 or JP17)[1]**
Pin 1 : TX+	Pin 1: TX+
Pin 2 : TX-	Pin 2: TX-
Pin 3 : 12 VAC/DC NON POLAR[2]	
Pin 4 : 12 VAC/DC NON POLAR[2]	
Pin 5 : GND	Pin 5: GND
Pin 6 : No Connect	
Pin 7: RX-	Pin 4: RX-
Pin 8: RX+	Pin 3: RX+

Connect the other receivers as follows:

KBD4000™ - RJ45 Pin-out (DTE)	**Microflex Receiver (DCE) Interconnect Board (JP16 or JP17)[1]**
Pin 1 : TX+	Pin 1: TX+
Pin 2 : TX-	Pin 2: TX-
Pin 3 : 12 VAC/DC NON POLAR[2]	
Pin 4 : 12 VAC/DC NON POLAR[2]	
Pin 5 : GND	Pin 5: GND
Pin 6 : No Connect	
Pin 7: RX-	
Pin 8: RX+	

[1] For MF24-AVr/ADVr, DATA1 is referred to as JP17 on the interconnect board. For FV module, DATA1 is referred to as JP16. Note that on both interconnect board models, Pins 1-5 are counted from left to right.

[2] A 12VAC power supply on Pins 3 and 4 or a 12VDC on Pin 3 and pin 5 (ground) must be supplied.

5.5 Using the KBD4000™ in a Microflex Video Network

The KBD4000™ is an essential tool in a Multisite video network. It allows you to configure the multiplexer options (title, date, time etc.), to select the cameras to display, to perform the pan, tilt and zoom functions (if PTZ drivers are used).

The multiplexer automatically selects the most common operating parameters. However, some minimal programming may be required in order for your system to operate properly. The next sections describe all KBD4000™ functions supported by the Microflex.

5.5.1 Microflex ID's

In a Multisite video network, the unit ID must be set to a specific range.

STEP 1 — A Microflex video receiver (MF24-AVr/ADVr or FV) must have a unit ID between **1 and 16**.

STEP 2 — A Microflex video transmitter (MF24-AV/ADV) must have a unit ID between 1 and 63.

To modify the unit ID, refer to Chapter 4 (using the MNM configuration software).

5.5.2 Camera selection in Full Screen Display

To enter the Full Screen Display mode, push the < ⊡ > key once.

To select a camera in Full Screen Display mode, you must type the camera ID number, then the <CAM> key.

Example: to select camera 66, type: <66>, <CAM>.

The camera ID is calculated from the Microflex transmitter unit ID (1 to 63) and with camera input (1 to 4): **CAM ID = (UNIT ID – 1)*4 + Tx cam input**.

For example, to select the camera input 2 on the Multisite transmitter unit 17, you must use CAM ID = 66 ((17-1)*4 + 2). To select **NO CAMERA**, set CAM ID to 256: <256>,<CAM>

Since the Genex protocol supports CAM IDs between 1 and 252, **the Microflex video transmitters ID's must be between 1 and 63**. Unit ID's must be configured with the MNM configuration software.

5.5.3 Multiple Camera display

To enter the Quad View mode, press once on the < ⊞ > key. Please note that Nine and sixteen camera display mode are not supported at this time.

To select cameras in this view follow these steps:

1) In Quad View mode, hold the < ⊞ > key for 3 seconds or more. A bar will appear in the first camera location (the title of the camera in the selected display position will be blinking) indicating that you are in the Programming mode.
2) Use the joystick to move to each camera location in the quad view.
3) When the camera location that you desire is highlighted (the title is blinking), choose the desired camera by pressing its ID number followed by the <CAM> key.
4) Repeat step 2 and 3 for all display positions.
5) To exit the Programming mode, use the joystick to move the bar off the screen. You must exit the Programming mode to be able to switch to the Full Screen View mode.

5.5.4 Menus

- ***Basic Set-up menu (VIEW Key)***

The Basic Set-up Menu allows to program the main system parameters. To enter this menu, press the <VIEW> key for 3 seconds or more (you may need to type a password if one has been assigned previously). The Basic Set-up Menu will appear. The cursor (“>>” indicator) points to the currently selected menu item.

Use the joystick to move between items on the screen. When the menu item you desire is selected, press the <OPEN> key to enter the options menu.

ITEMS SUPPORTED

Time and Date

Set the current time and date. The time uses a 24-hour clock.

Time Display

ON – Display the time on the monitor.

OFF – The time is not shown on the monitor (default).

Title Display

ON – Display camera titles on the monitor (default).

OFF – Camera titles are not shown on the main monitor.

Camera setup

Go to the CAMERA SETUP menu.

Save configuration

Save the current camera configuration (view, camera number, camera name). If the system reboot, it will reboot with the last saved configuration.

Help

Go to the HELP menu.

Advanced setup

Go to the ADVANCED SYSTEM SETUP menu.

➢ *Advanced Set-up Menu*

To program the advanced parameters, enter the System Setup Menu: press the <VIEW> key for approximately three seconds (type the password if one has been assigned). The System Setup Menu appears. The cursor (“>>” indicator) points to the currently selected menu item. Use the joystick to move to the ADVANCED MENU item. Press the <OPEN> key. The Advanced System Setup menu appears.

ITEMS SUPPORTED

Date format

Set the format for displaying the date on the monitor.

Password

Enables or disables password control to access programming menu.

Exit

Return to the Basic Setup menu.

➢ *Camera Set-up Menu*

To program the camera parameters, enter the System Setup Menu: press the <VIEW> key for approximately three seconds (type the password if one has been assigned). The System Setup Menu appears. The cursor (“>>” indicator) points to the currently selected menu item. Use the joystick to move to the CAMERA SETUP MENU item. Press the <OPEN> key. The Camera Setup menu appears.

ITEMS SUPPORTED

Camera number

Select the camera you want to configure. Press the <OPEN> key and select a camera number. To select a camera, enter the camera ID number, then the <CAM> key (<1>,<CAM> for camera 1).

Camera title

Modify the title for the selected camera. Press the <OPEN> key, then select characters for your title. To select characters, move the joystick up and down. To switch between characters move the joystick left and right.

Reset values to default

Reset title to default.

Exit

Return to the Basic Setup menu.

- **Help Menu**

The Help menu is accessed from the Basic Set-up menu. Use the joystick to select HELP. Press the <OPEN> key. The HELP menu appears

5.6 Pan, tilt and zoom functionality

The keyboard allows the user to operate a PTZ controller which supports Pelco's D protocol. To connect the camera to the Microflex video transmitter (MF24-AV, MF24-ADV), follow this table.

PTZ Controller Signals (DTE)	Microflex Transmitter (DCE) Interconnect Board (JP17)[1]
TX+ (optional)	Pin 1: TX+
TX- (optional)	Pin 2: TX-
GND	Pin 5: GND
RX+	Pin 3: RX+
RX-	Pin 4: RX-

[1] DATA1 on the interconnect board of the MF24-AV/ADV is referred to as JP17. Note that on both interconnect board models, Pins 1-5 are counted from left to right.

The pan, tilt and zoom functionality is easy to use in a Multisite network. From the Full or Quad View mode, you must type the camera ID number followed by the <CAM> key. Then, just move the joystick up and down for pan control, left and right for tilt control, and twist it for zoom control.

5.7 Password

You can program the multiplexer to request a password for access to programming menus. The password is enabled in the Advanced System Setup menu (refer to the Advanced System Setup section).

The universal password is 3916 and cannot be changed. This password must be entered whenever one is requested. The password is entered from the keyboard by pressing each number followed by the CAM key: ***<3>, <CAM>,<9>, <CAM>, <1>, <CAM>, <6>, <CAM>***.

5.8 Using one KBD4000^{TM} and multiple video receivers.

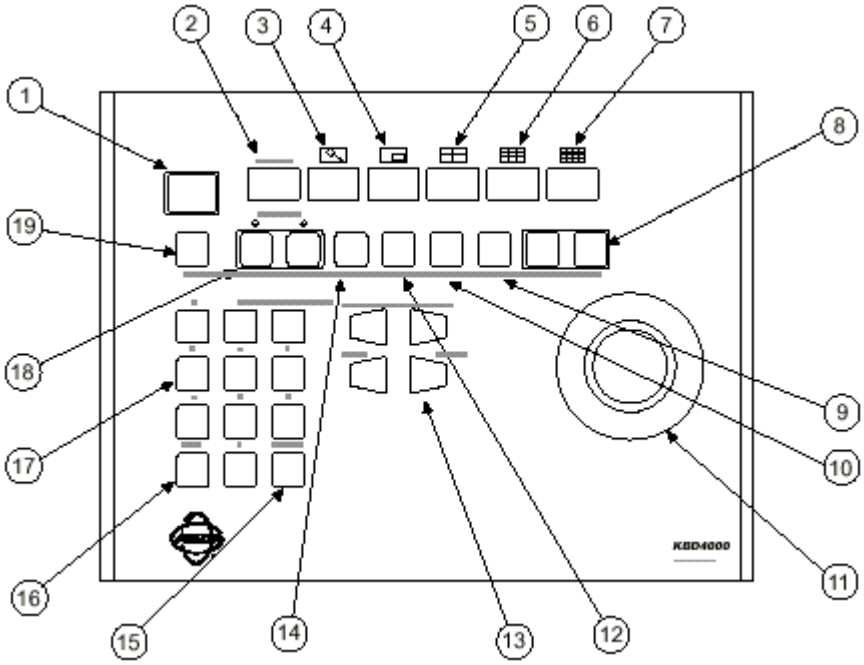
To select the receiver you want to configure: enter the receiver ID (a number between 1 and 16) and then press the UNIT key. *Ex:* ***<6>, <UNIT>***.

Once a receiver is selected, all the commands will be send to it until another receiver is selected.

To select all the receivers: enter <0> and then press the <UNIT> key.

The module ID of the Microflex video receiver (MF24-AV/Avr or FV) must be set between 1 and 16 to work properly. After a power-down sequence or software reboot all the receivers will respond to the keyboard commands.

5.9 KBD4000™ keyboard definitions



1. **LED DISPLAY**: Displays the address of the multiplexer (from 1-16) with which the keyboard is communicating. This display is only valid when addressing camera through the multiplexer. Since consecutive addressing is used for the Multisite Series, this display can be ignored.

2. **LIVE/VCR KEY**: unused.

3. **ZOOM KEY**: unused.

4. **PIP**: Press once to set the receiver view to full screen.

5. **FOUR-CAMERA DISPLAY KEY**: Press once to display a group of four cameras on the main monitor. From the Quad View, press it 3 seconds to be able to select cameras. For more information, read section 5.5.3.

6. **NINE-CAMERA DISPLAY KEY**: unused.

7. **16-CAMERA DISPLAY KEY**: unused.

8. **AUXILIARY KEYS**: unused.

9. **PRESET KEY**: 1: Sends a camera to a preset: enter the preset number and then press this key once. 2: Programming presets: enter the preset number and then press this key for 5 seconds (Note: the PTZ controller must support **Pelco protocol D or P** preset definition)

10. **PATTERN KEY**: unused.

11. **PTZ FUNCTION JOYSTICK**: Variable-speed, bi-directional joystick for pan/tilt control. Twisting head for zoom control. Also used to move the cursor in the different menus.

12. **VIEW KEY**: Press 4 seconds to enter programming mode for the Receiver. For more information, read section 5.5.4.

13. **LENS CONTROL KEYS**: Control Camera lens, iris and focus functions. The Open key is also used to select item in the different menus.

14. **SEQ KEYS**: (not supported at this time). Starts/stop a sequence.

15. **CLEAR KEY**: Press to clear a numeric entry.

16. **CAM KEY**: Select a camera: enter the camera number (a number between 1 and 252 in consecutive addressing mode) and then press this key. **To select NO CAMERA, you must enter: <256>, <CAM> key**.

17. **NUMBER PAD**: Enter numbers.

18. **MONITOR KEYS**: unused.

19. **UNIT KEY**: This key is used to select the receiver unit you want to operate with the keyboard. For example, if you want to operate the Receiver 12 (Microflex unit ID 12), press <12> + <UNIT> key. For more info, read section 5.8.

APPENDIX A - Factory Default Configuration

If the Microflex fails to respond after programming it with the MNM configuration software, it can be reset to a factory default configuration by activating the reset switch (SW1) on the main electronics board (see Chapter 1) or by using the MNM software.

The Microflex is programmed at the factory with the following configuration (this is based on version 0.07A):

- ***Module ID*** : 000
- ***Module Type*** : Microflex

Note : The module must be set to a valid module ID to see the remaining of the configuration. Following the proper assignment of an ID (via the upload sequence) downloading the information will display the rest of the unit configuration.

- ***Firmware Version*** : Will vary
- ***Radio Firmware*** : Will vary
- ***Data Port 1 Settings***

TYPE	:	Asynchronous
CONNECTION	:	NONE
DATA RATE	:	9 600 BAUD
PARITY	:	None
HANDSHAKE	:	Disabled
ERROR CORRECTION	:	OFF
GENEX MODE	:	OFF

- ***Data Port 2 Settings***

TYPE	:	Asynchronous
CONNECTION	:	NONE
DATA RATE	:	9600 BAUD
PARITY	:	None
HANDSHAKE	:	Disabled
ERROR CORRECTION	:	OFF

- ***Audio Port 1 Settings***

MODULE	:	<FXS>, <FXO>,<Line Level> or <NONE>
(depending on option ordered)		
EXTENSION	:	000
COMPRESSION	:	LOW
CONNECTION EXTENSION	:	0
CONNECTION TYPE	:	PABX

- ***Audio Port 2 Settings***

MODULE	:	<FXS>, <FXO>,<Line Level> or <NONE>
(depending on option ordered)		
EXTENSION	:	000

COMPRESSION	:	LOW
CONNECTION EXTENSION	:	0
CONNECTION TYPE	:	PABX

- ***Radio Settings***

SELECTION	:	RADIO 1 (internal)
STATUS	:	DETECTED
FREQUENCY	:	2442 MHz
PN CODE	:	1
SECURITY CODE	:	F3A0
RADIO POWER	:	24 dBm
BIT RATE	:	LOW
RSSI MODE	:	2
FIRMWARE UPDATE	:	OFF

- ***Radio Settings***

STATUS	:	DETECTED
VIDEO MODE	:	<TRANSMITTER>,<RECEIVER> OR <UNKNOWN>

APPENDIX B - Telephone System Operation

This paragraph is a reference on how to use the Multisite telephone system under different operation mode. Each Microflex can be programmed to support one of two telephone modes; (1) PABX mode and (2) DOD (direct outward dial). It is also possible to combine these two dialing modes in a Multisite network.

- ***PABX MODE FEATURES:***

All Microflex modules programmed for PABX mode must dial “9” to obtain an external telephone line unless the auto-dial check box is selected.

When dialing “9”, the Microflex (FXS) will contact the Microflex (FXO) with the lowest ID number. If it is busy, it will contact the next Microflex (FXO) with the lowest ID number and so on until it tries all Microflex FXO extensions. If there are no extensions available a busy signal will be played back (the outside line search takes less than 1 second).

For incoming calls on the FXO line, a stutter tone is played. By dialing the correct Microflex (FXS) extension the call will be connected to the Microflex extension.l

Internal calls between Microflex (FXS) are supported without tying up external telephone lines by dialing the appropriate extension number.

- ***DOD MODE FEATURES:***

To operate in DOD mode, a Microflex (FXS) must be associated with a single Microflex (FXO or FXS).

There is no need to dial “9” from a Microflex (FXS) since it is a direct line.

All incoming call on the external FXO line are directly transferred to the associated Microflex (FXS).

APPENDIX C - Weatherproofing Coaxial Connections

The Microflex are normally mounted outside. Weatherproofing of coaxial connections is required for successful long-term operation.

Most antenna problems are caused by coaxial cable connections that loosen due to vibration, allowing moisture to penetrate the connector interface. ComLink recommends that all outdoor cable connections be weatherproofed using a procedure similar to the one described below. To facilitate the task, the sealant tape is supplied with each antenna shipped (the customer is responsible for providing the electrical tape).

STEP 1.

Beginning as shown in Figure 19, by overlapping half-width, wrap sealant tape over entire connection.

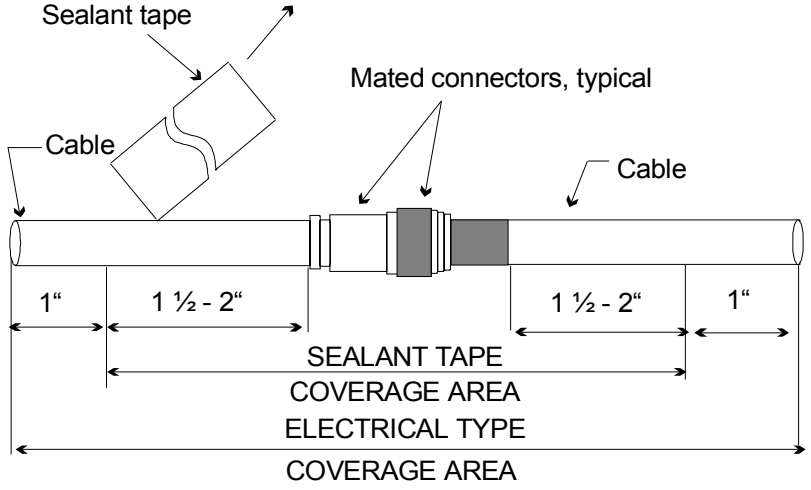


Figure 19 - Stretch to elongate sealant tape while wrapping over connection

STEP 2.

Gently press on the sealant tape, forming it to the connection, itself and the cable jackets, as shown in Figure 20.

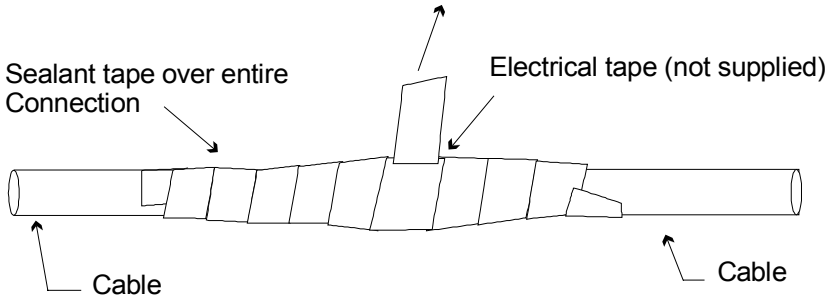


Figure 20 - Stretch to elongate electrical tape while wrapping over sealant tape

STEP 3.

By overlapping half-width, wrap electrical tape (not supplied) over the entire sealant tape connection. While stretching tape, begin at center of formed sealant tape and wrap towards one end approximately one inch beyond end of sealant tape.

Insure tight electrical tape coverage onto cable jacket. Without breaking electrical tape, reverse direction and wrap to other end, again extending approximately one inch beyond end of sealant tape. Again insure tight coverage onto cable jacket. Reverse direction again and wrap electrical tape to center of connection and stop.

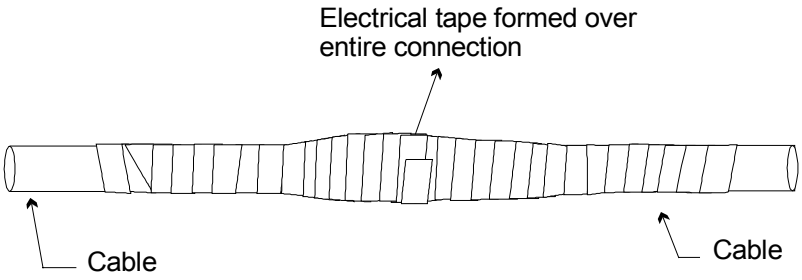


Figure 21 - Electrical tape wrapped tightly against cable jacket, typical both ends

APPENDIX E - Switching from RS-232 to RS-485 for a MF24-ADV/ADVr

If you have ordered a Microflex with an RS-485 port, DATA1 has been factory configured for RS-232 operation and 2 RS-485 chips have been shipped separately in an ANTISTATIC bag. This is because you may need to program the Microflex locally via the DATA1 port and using the MNM configuration software prior to or during installation.

Once you have completed the configuration of the Microflex, proceed as follows to switch the data port to RS-485 mode:

1. Power the unit OFF, then wait at least 1 minute.

2. Insert the 2 RS-485 chip at positions U4 and U7 on the interconnection board (see illustration on next page for exact chip location)

   NOTE: Observe STATIC PRECAUTIONS when handling the RS-485 chips

3. Change the jumpers JP4,5,7,8,9 according to the table below (see illustration on next page for exact jumper location).

4. Install jumpers at JP2 & JP3 to terminate the RS-485 receive line (jumpers are included with the RS-485 chip package).

	EIA232 Mode	EIA485 Mode	Comments
JP2	REMOVED	INSTALLED [1]	120 Ohm termination of Tx pair
JP3	REMOVED	INSTALLED [1]	120 Ohm termination of Tx pair
JP4	Position 1-2	Position 2-3	EIA232/485 SELECT
JP5	Position 1-2	Position 2-3	EIA232/485 SELECT
JP7	Don't care	1-2 = Rx always ON 2-3 = Rx keyed ON/OFF[2]	Rx Driver enable control
JP8	Position 1-2	Position 2-3	EIA232/485 SELECT
JP9	Position 1-2	Position 2-3	EIA232/485 SELECT

1 The jumpers for JP2 & JP3 are in the same bag as the RS-485 chip.
2 This position is not required unless you are using bi-directional control and multiple RS-485 modules on the same cable.

APPENDIX F - Switching from RS-232 to RS-485 for an FV module

If you have ordered an FV module, DATA1 has been factory configured for RS-485 operation. If you require to download a new video firmware in the FV module, you will need to set-up the data port in RS-232 mode to use the MNM configuration software. To do so, proceed as follows to switch the data port to RS-232 mode:

1. Change the jumpers JP7, 8, 9,11,12 according to the table below (see illustration on next page for exact jumper location).

2. Remove jumpers JP3 & JP4.

	EIA232 Mode	EIA485 Mode	Comments
JP3	REMOVED	INSTALLED	120 Ohm termination of Tx pair
JP4	REMOVED	INSTALLED	120 Ohm termination of Tx pair
JP7	Position 1-2	Position 2-3	EIA232/485 SELECT
JP8	Position 1-2	Position 2-3	EIA232/485 SELECT
JP9	Position 1-2	Position 2-3	EIA232/485 SELECT
JP11	Position 1-2	Position 2-3	EIA232/485 SELECT
JP12	Position 1-2	Position 2-3	EIA232/485 SELECT

3. When you have finished configuring your unit with MNM, Re-install all jumpers as they were before to set the unit back to RS-485 mode (see table).

APPENDIX G – Connecting to leased lines

The Line Level interface is a single ended 600 Ohms – 0 dBm interface. It is not designed to drive leased/dry lines. A 600 Ohm coupling transformer must be used for differential application.

Typical example :