Appendix J: Manual

Please refer to the following pages for the installation manual and see also the separate user manual document.

Installation and Configuration Manual

MM-009804-001

May-06

VIDA^{MAX} Base Station

4.9 GHz Broadband Distribution System

tyco Electronics

M/A-COM

MANUAL REVISION HISTORY

REVISION	DATE	REASON FOR CHANGE
-	May 2006	Initial Release.

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CREDITS

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Repairs to this equipment should be made only by an authorized service technician or facility designated by the supplier. Any repairs, alterations or substitution of recommended parts made by the user to this equipment not approved by the manufacturer could void the user's authority to operate the equipment in addition to the manufacturer's warranty.

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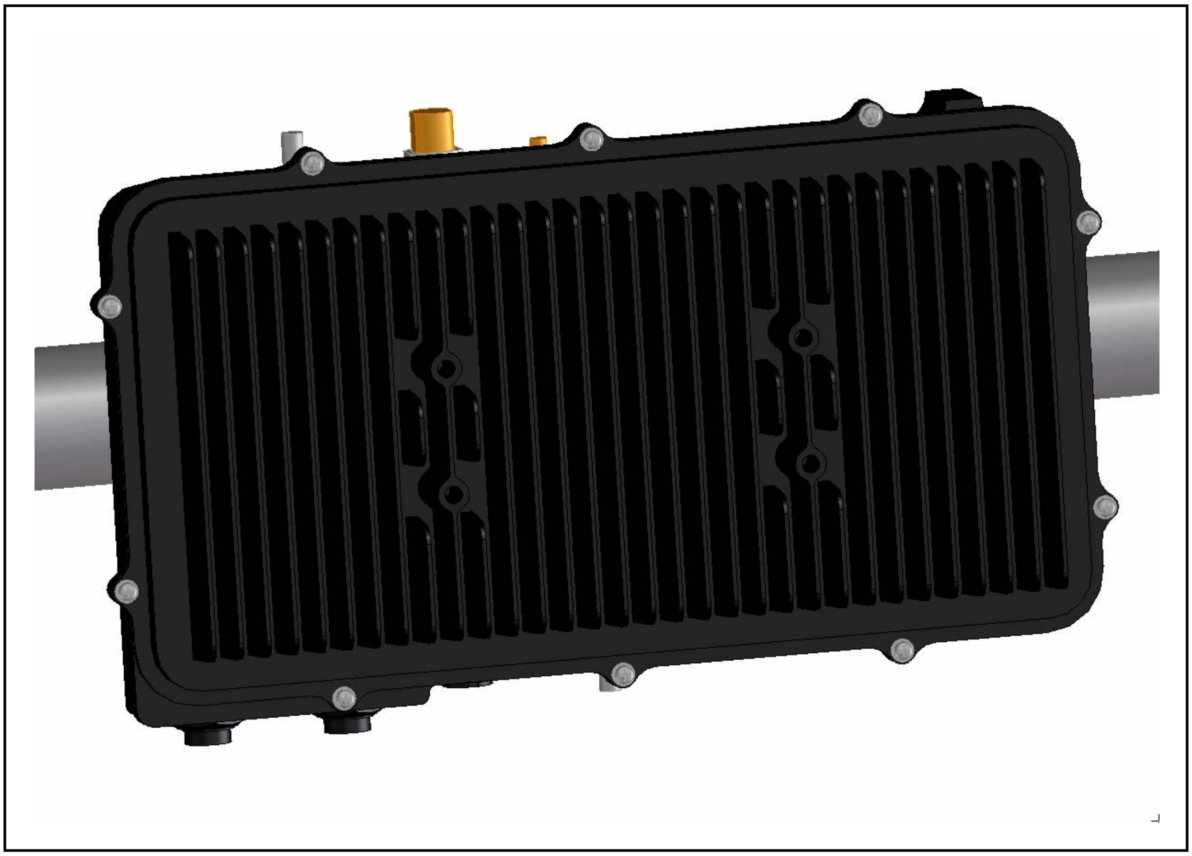


1 REGULATORY AND SAFETY INFORMATION

1.1 SAFETY CONVENTIONS

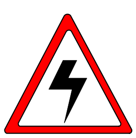
The following conventions may be used in this manual to alert the user to general safety precautions that must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. M/A-COM, Inc. assumes no liability for the customer's failure to comply with these standards.

The WARNING symbol calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING symbol until the conditions identified are fully understood or met.

The CAUTION symbol calls attention to an operating procedure, practice, or the like, which, if not performed correctly or adhered to, could result in a risk of danger, damage to the equipment, or severely degrade the equipment performance.

The **NOTE** symbol calls attention to supplemental information, which may improve system performance or clarify a process or procedure.

The **ESD** symbol calls attention to procedures, practices, or the like, which could expose equipment to the effects of **E**lectro-**S**tatic **D**ischarge. Proper precautions must be taken to prevent ESD when handling circuit modules.



The electrical hazard symbol is a WARNING indicating there may be an electrical shock hazard present.

This symbol indicates the presence of a potential RF hazard.

1.2 REGULATORY

1.2.1 Maximum Permissible Exposure Limits

DO NOT TRANSMIT with this base station and antenna when persons are within the MAXIMUM PERMISSIBLE EXPOSURE (MPE) Radius of the antenna. The MPE Radius is the minimum distance from the antenna axis that ALL persons should maintain in order to avoid RF exposure higher than the allowable MPE level set by the FCC.

FAILURE TO OBSERVE THESE LIMITS MAY ALLOW ALL PERSONS WITHIN THE MPE RADIUS TO EXPERIENCE RF RADIATION ABSORPTION, WHICH EXCEEDS THE FCC MAXIMUM PERMISSIBLE EXPOSURE (MPE) LIMIT. IT IS THE RESPONSIBILITY OF THE BASE STATION LICENSEE TO ENSURE THAT THE MAXIMUM PERMISSIBLE EXPOSURE LIMITS ARE OBSERVED AT ALL TIMES DURING BASE STATION TRANSMISSION. THE BASE STATION LICENSEE IS TO ENSURE THAT NO BYSTANDERS ARE WITHIN THE RADIUS LIMITS.

1.2.2 Determining MPE Radius

THE MAXIMUM PERMISSIBLE EXPOSURE RADIUS is unique for each site and is determined based on the complete installation environment (i.e. co-location, antenna type, transmit power level, etc.). Determination of the MPE distance is the responsibility of the VIDA^{MAX} user. Calculation of the MPE radius is required as part of the installation. The Limit for **Uncontrolled Exposure Power Density (P_d)** is 10 W/m^2 for fixed mounted device.

The M/A-COM 4.9 GHz VIDA^{MAX} Base Station is a fixed mounted radio. After installation and commissioning, the safe distance from the 9 dBi omni-directional antenna is greater than 20 cm (8-inches).

1.2.2.1 MPE Calculation for omni-directional Antenna

This MPE Minimum Distance Calculation is based on using a 9 dBi gain omni-directional antenna mounted directly to the base station RF port.

Basic M/A-COM 4.9 GHz VIDA^{MAX} Base Station specifications:

P: Maximum Peak Conducted Power = 27 dBm

G: Maximum Omni Antenna Gain = 9 dBi

Frequency Range = 4.94 to 4.99 GHz

R: Minimum Distance between User and Antenna = 0.2 m

Equation from FCC:

$$P_d = P * G / (4 * \pi * R^2)$$

$$P_d = 0.5 W * 7.94 / (4 * 3.1415926 * 0.2^2) = 7.89 W / m^2 < 10 W / m^2$$

The calculation indicates that the minimum 0.2 meter distance between user and the omni-directional antenna (directly mounted to the base station RF port) is required when operating the M/A-COM 4.9 GHz VIDA^{MAX} Base Station.

1.2.2.2 MPE Calculation for Directional Antenna

This MPE Minimum Distance Calculation is based on using a directional antenna with more than 9 dBi antenna gain.

Basic M/A-COM 4.9 GHz VIDA^{MAX} Base Station specifications:

P: Maximum Peak Conducted Power = 27 dBm;

G: Maximum Omni Antenna Gain – Cable Loss = 27 dBi – 1 dB = 26 dBi; (Use numerical G_N value for the calculation): G_N = 10 ^ (G /10)); For G = 26 dBi, G_N = 10 ^ (26 /10) = 398

Frequency Range = 4.94 to 4.99 GHz;

$\mathbf{R_{min}}$: Minimum Distance between user and antenna to comply with FCC MPE Level (10 W / m^2);

Equation from FCC:

$P_d = P * G / (4 * \pi * R_{min}^{\ 2})$

R_{min} = SQRT(0.5 W * G_N / (4 * 3.1415926 * 10))= SQRT (3.9789E-3 * G_N)

R_{min} = 1.26 m, for G =26 (i.e., G_N = 398)

The calculation provides guidelines for users to estimate the minimum safe distance when a high gain antenna is connected to the M/A-COM 4.9 GHz VIDA^{MAX} Base Station. The user should always keep a safe distance from antenna greater than 20 cm or SQRT (3.9789E-3 * G_N).

The following table lists the minimum distance for Different Effective Antenna Gain Levels (Antenna Gain – Feeder Cable Loss)

Minimum Safe Distance Calculation Based for Directional Antennas

Effective Antenna Gain (dBi)	Minimum Safe Distance (Meters)	Minimum Safe Distance (Feet)
< 9	0.20	0.65
10	0.20	0.65
11	0.22	0.73
12	0.25	0.82
13	0.28	0.92
14	0.32	1.04
15	0.35	1.16
16	0.40	1.31
17	0.45	1.47
18	0.50	1.64
19	0.56	1.84
20	0.63	2.07
21	0.71	2.32
22	0.79	2.61
23	0.89	2.92

Effective Antenna Gain (dBi)	Minimum Safe Distance (Meters)	Minimum Safe Distance (Feet)
24	1.00	3.28
25	1.12	3.68
26	1.26	4.13
>26	Reduce Transmit Power is required by FCC	

1.2.3 Safety Training Information

YOUR M/A-COM VIDA^{MAX} BASE STATION GENERATES RF ELECTRO-MAGNETIC ENERGY DURING TRANSMIT MODE. THIS BASE STATION IS DESIGNED FOR AND CLASSIFIED AS “OCCUPATIONAL USE ONLY” MEANING IT MUST BE USED ONLY IN THE COURSE OF EMPLOYMENT BY INDIVIDUALS AWARE OF THE HAZARDOUS RF ENERGY AND THE WAYS TO MINIMIZE EXPOSURE. THIS BASE STATION IS NOT INTENDED FOR USE BY THE “GENERAL POPULATION” IN AN UNCONTROLLED ENVIRONMENT. IT IS THE RESPONSIBILITY OF THE LICENSEE TO ENSURE THAT THE MAXIMUM PERMISSIBLE EXPOSURE LIMITS ARE OBSERVED AT ALL TIMES DURING TRANSMISSION. THE BASE STATION LICENSEE IS TO ENSURE THAT NO BYSTANDERS COME WITHIN THE RADIUS OF THE LIMITS

When licensed by the FCC, this base station complies with the FCC RF exposure limits when persons are beyond the MPE radius of the antenna. In addition, your M/A-COM base stations installation complies with the following Standards and Guidelines with regard to RF energy and electromagnetic energy levels and evaluation of such levels for exposure to humans:

FCC OET Bulletin 65 Edition 97-01 Supplement C, Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

American National Standards Institute (C95.1 – 1992), IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

American National Standards Institute (C95.3 – 1992), IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave.

CAUTION

To ensure that your exposure to RF electromagnetic energy is within the FCC allowable limits for occupational use, do not operate the base station in a manner that would create an MPE distance in excess of that allowable by the FCC.

CAUTION

Changes or modifications not expressly approved by M/A-COM Inc. could void the user’s authority to operate the equipment.

2 SPECIFICATIONS

2.1 GENERAL SPECIFICATIONS

Physical Characteristics:

Electrical Power:	+24 ±3 VDC or 110 VAC +/- 15%, 50-60 Hz
Power Consumption:	60 Watts nominal
Size (H x W x D):	14.5 in. x 8.0 in. x 4.25 in. (36.8 cm x 20.3 cm x 10.8 cm)
Weight:	13.5 lbs (6.12 kg)

Environmental Specifications

Operating Temperature:	-22 - +140 F (-30 to +60 C)
Storage Temperature:	-40 - +185 F (-40 to +85 C)
Environmental:	NEMA4
Altitude:	15000 ft

System Interfaces

Data Plane:	100Base-FX (RJ-45)
Management:	100Base-FX (RJ-45)
4.9 GHz RF Connector:	Type N (F) into 50 ohms
GPS RF Connector:	SMA (F) into 50 ohms
Power:	110V VAC

Security Features

Authentication:	X.509 Digital Certificate
Authorization:	RSA Public Key Encryption
Encryption:	DES, 3-DES, AES 128 bit

Network Features

Management:	SNMP
Convergence:	IPv4 over IEEE 802.3/Ethernet
	IEEE 802.3/Ethernet
Configuration:	DHCP, TFTP

PHY Characteristics

PHY:	OFDM 256 FFT
Channel Bandwidth:	5 MHz
Modulation Rates:	BPSK, QPSK (1/2, 3/4),
	16QAM (1/2, 3/4), 64QAM (1/2, 3/4)
Duplexing:	Time Division Duplexing (TDD)
Frame Durations:	2.5 msec, 5 msec, 10 msec, 20 msec
CP:	1/32, 1/16, 1/8, 1/4
Throughput:	4-19 Mbps

MAC Characteristics

Duplexing:	Time Division Duplexing (TDD)
Service Classes Supported:	Real-Time Polling Service (rtPS)
	Non-Real-Time Polling Service (nrtPS)
	Unsolicited Grant Service (UGS)
	Best Efforts (BE)
Payload Header Suppression:	Supported
Automatic Repeat Request (ARQ):	Supported
Connections/Client:	Up to 16

2.2 TRANSMITTER

Frequency Band:	4940 - 4990 MHz
Channel Step Size:	1 MHz
Channel Bandwidth:	5 MHz
Frequency Stability (-30 to 60 C):	1.5 PPM over temperature range
Output Power into a 50 Ω Load:	0.5 Watts (27 dBm) Maximum
Power Adjustment:	0.5 – 0.005 W (27 to 7 dBm adjustable with 1 dB step)
Duty Cycle:	50% Maximum
Emission Designator:	5M00X7D
Spurious and Harmonic Emissions:	FCC Part 90
PHY:	OFDM 256 FFT
Available Modulation Mode:	BPSK, QPSK (1/2, ¾), 16QAM (1/2, ¾), 64QAM (1/2, ¾)
Duplexing:	Time Division Duplexing (TDD)
Spectrum Mask:	FCC Mask M (90.210)

2.3 RECEIVER

Frequency Band:	4940 - 4990 MHz
Channel Step Size:	1 MHz
Channel Bandwidth:	5 MHz
Frequency Stability:	1.5 PPM
Sensitivity at BER 10^{E-6}:	
BPSK -1/2	-96 dBm
QPSK -3/4	-91 dBm
16QAM – 3/4	-85 dBm
Max RX Input Power:	-30 dBm
1ST Adjacent Channel Selectivity:	20 dBc Minimum
2nd Adjacent Channel Selectivity:	50 dBc Minimum

3 INTRODUCTION

3.1 ABOUT THIS MANUAL

This manual is written for the communications professional responsible for maintaining the VIDA^{MAX} Base Station equipment installed as part of a VIDA^{MAX} 4.9 GHz Broadband Network.

This manual provides an overview and description of the VIDA^{MAX} Base Station equipment used in the network, equipment specifications, and instructions for installing VIDA^{MAX} Base Stations and auxiliary equipment.

3.2 CUSTOMER SERVICE

3.2.1 Technical Support

M/A-COM's Technical Assistance Center (TAC) resources are available to help you with overall system operation, maintenance, upgrades, and product support. TAC is your point of contact when you need technical questions answered.

Product specialists, with detailed knowledge of product operation, maintenance, and repair, provide technical support via a toll-free telephone number (in North America). Support is also available through mail, fax, and e-mail.

For more information about technical assistance services, contact your sales representative, or call the Technical Assistance Center directly at:

North America:	800-528-7711
International:	434-385-2400
FAX:	434-455-6712
e-mail:	tac@tycoelectronics.com

3.2.2 Customer Resource Center

If any part of the system equipment is damaged on arrival, contact the shipper to conduct an inspection and prepare a damage report. Save the shipping container and all packing materials until the inspection and the damage report are completed. In addition, contact the Customer Resource Center to make arrangements for replacement equipment. Do not return any part of the shipment until you receive detailed instructions from a M/A-COM representative.

Contact the Customer Resource Center at:

North America:

Phone Number:	800-368-3277 (toll free)
Fax Number:	800-833-7592 (toll free)
E-mail:	customerfocus@tycoelectronics.com

International:

Asia Pacific:	434-455-9223
Latin America & Middle-East:	434-455-9229
Europe:	434-455-9219
Fax Number:	434-455-6685
E-mail:	InternationalCustomerFocus@tycoelectronics.com

4 DESCRIPTION

The VIDA^{MAX} system delivers public safety grade wireless broadband data services for mission critical applications, such as video surveillance, broadband hot spots, remote precinct connectivity, and LMR backhaul.

M/A-COM's new VIDA^{MAX} broadband network applies the open standard IEEE-based wireless broadband communications protocol of 802.16 to the 4.9 GHz band, thereby providing true Quality-of-Service (QoS) while operating on contention-free licensed frequencies.

The VIDA^{MAX} Base Station provides hardened, public safety grade base station infrastructure for M/A-COM's 4.9 GHz VIDA^{MAX} broadband network.

4.1 VIDA^{MAX} SYSTEM OVERVIEW

VIDA^{MAX} provides integrated public safety grade wireless broadband video and data services for mission-critical applications. VIDA^{MAX} combines the security of the licensed 4.9 GHz public safety frequency band with robust 802.16 technology to create a true public safety broadband network. With this state-of-the-art network, public safety customers can implement applications such as streaming video, web applications, economical licensed LMR backhaul, and other bandwidth intensive applications. Since the network provides guaranteed Quality of Service (QOS), it is especially suited for applications such as video surveillance, perimeter control, and mobile command. VIDA^{MAX} is integrated with M/A-COM's VIDA network allowing seamless sharing of network management and administration.

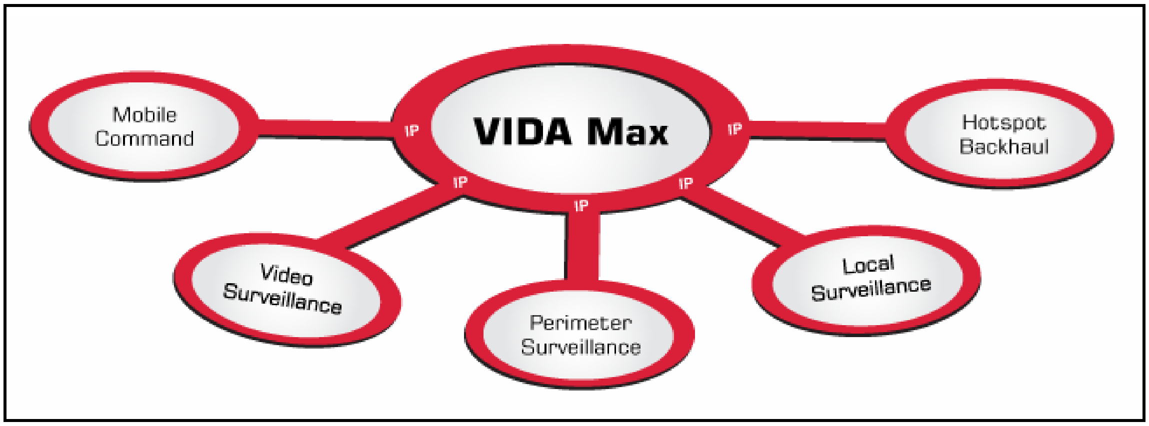


Figure 4-1: VIDA^{MAX} Wireless Broadband Video and Data Services

4.2 THE VIDA NETWORK SOLUTION

By leveraging advances in standards-based Information Technology, M/A-COM has developed a unique IP-based network solution to solve the many challenges that critical communications users are confronted with. These challenges include delivering different types of information reliably, ensuring technology does not become quickly obsolete, and being able to acquire equipment from multiple vendors.

VIDA^{MAX} addresses these challenges and is part of a total network solution called VIDA (Voice, Interoperability, Data, and Access). VIDA^{MAX} is fast, secure and standards based and will allow critical communications customers to obtain access to information that its users need today and into the future.

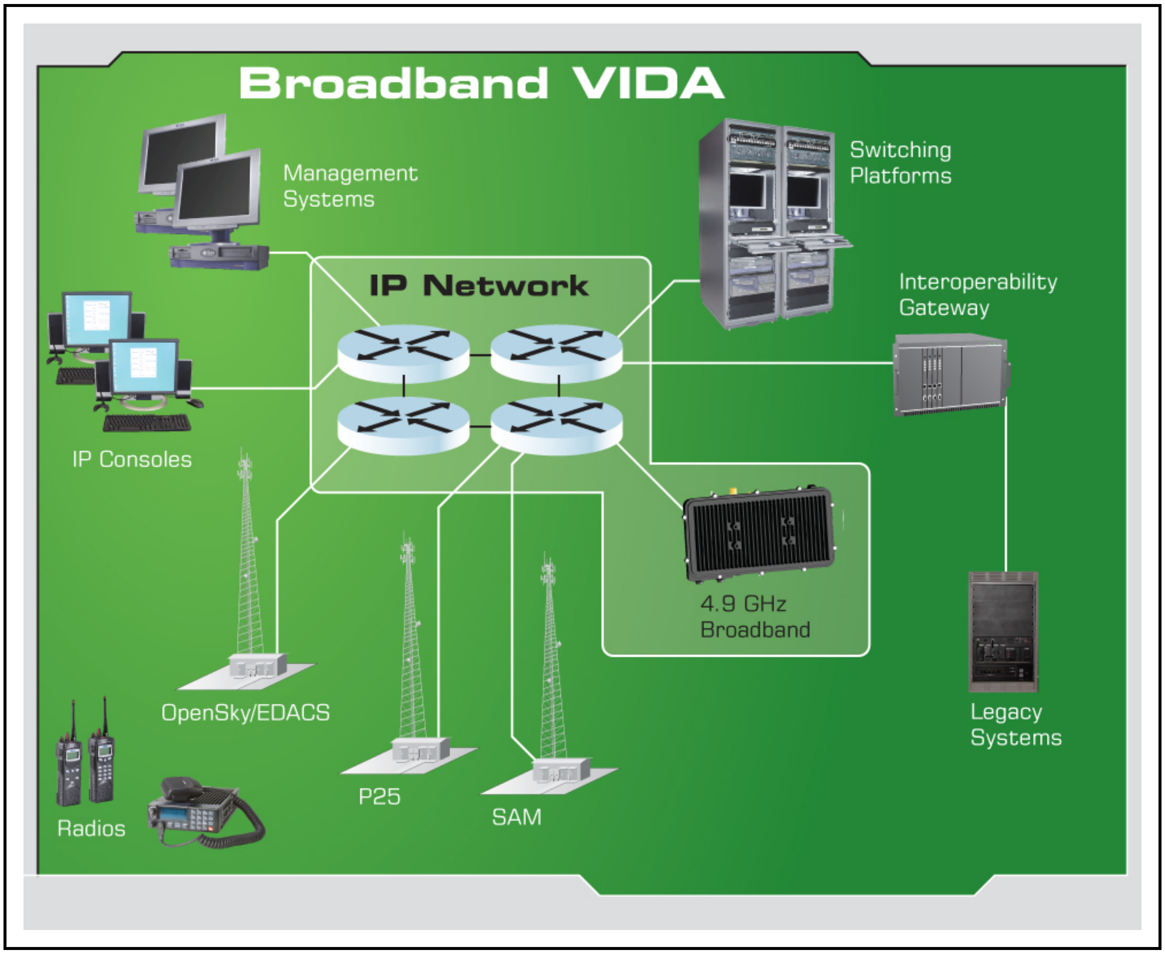


Figure 4-2: VIDA Network Solution

Figure 4-2 depicts a picture of the VIDA Network Solution and how many different communications systems are built on the solid foundation of a wide-area IP network. This provides an open architecture for the integration of public safety voice and data airlink protocols including OpenSky, EDACS, and P25^{IP}. This open architecture enables mission critical communications customers to have one integrated solution to meet numerous voice and data needs.

4.3 THE VIDA^{MAX} NETWORK

VIDA^{MAX} is the broadband extension of VIDA and as a complete broadband distribution system, can serve as the airlink to the user, as well as a wireless extension of the core IP network upon which the VIDA network is based (Figure 4-2).

VIDA^{MAX} integrates the sophisticated Quality-of-Service (QoS) and solid security of the 802.16-2004 (WiMAX) protocol with the licensed protection of the 4.9 GHz public safety band to provide public safety grade wireless broadband data services for mission critical applications.

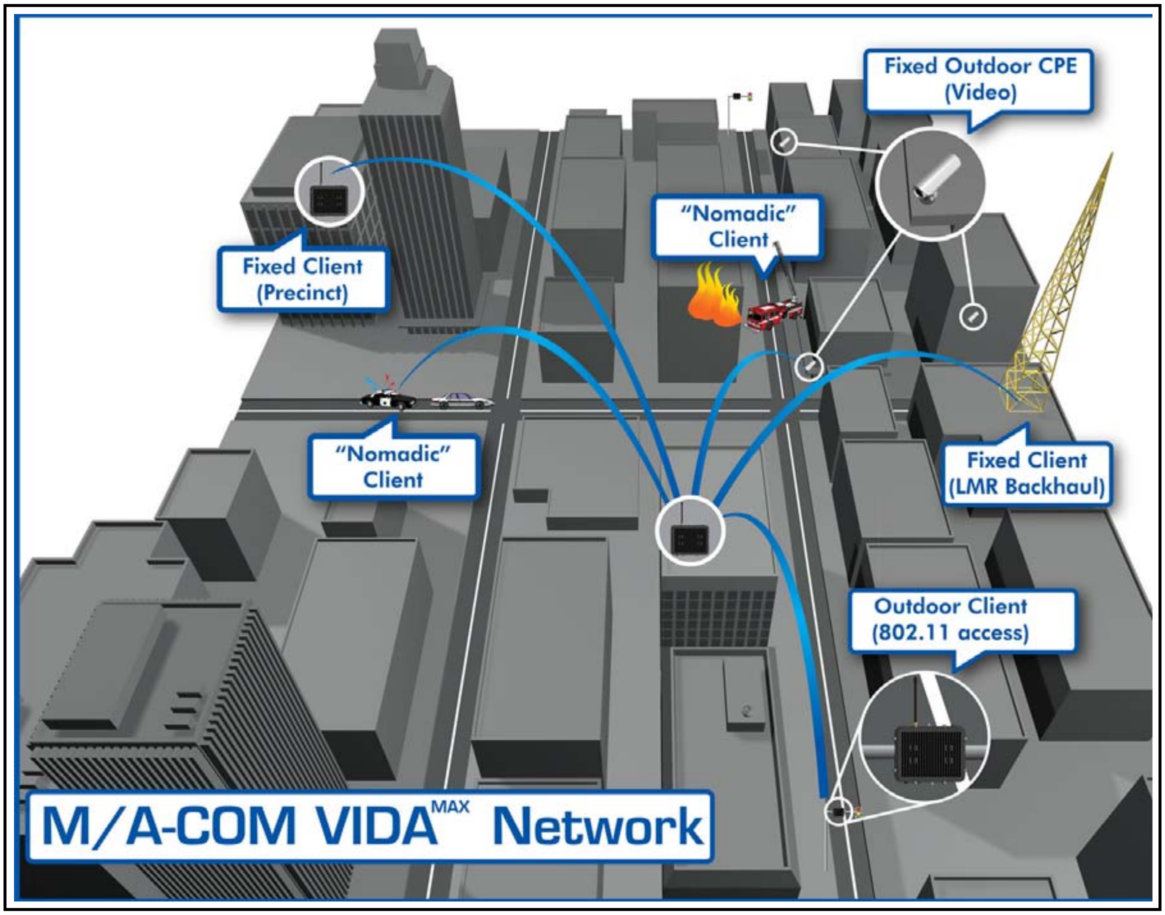


Figure 4-3: VIDAMAX Broadband Network

Figure 4-3 illustrates a typical deployment scenario of the VIDA^{MAX} 4.9 GHz broadband network. It provides secure, public safety grade broadband services to both fixed and mobile clients. Conceptually, the system can be seen as extending the enterprise WAN to remote locations using the licensed 4.9 GHz public safety band. Some common applications for this system include:

- Remote surveillance video
- Mobile broadband access to vehicles ("Hot Spots")
- Connection of remote precincts to the enterprise and/or VIDA network
- Backhaul of IP based LMR traffic

4.4 VIDA^{MAX} NETWORK COMPONENTS/FEATURES

The basic architecture of the 4.9 GHz VIDA^{MAX} network is a point-to-multipoint network. A system consists of one or more base station(s) and at least one client (Figure 4-3). There are two configurations of client devices; fixed and mobile. Fixed client devices are usually mounted outdoors with directional antennas and have a range of up to 10 miles. Mobile clients are vehicle mounted and use an omni-directional antenna. The range of a mobile client to base station is a few hundred meters.

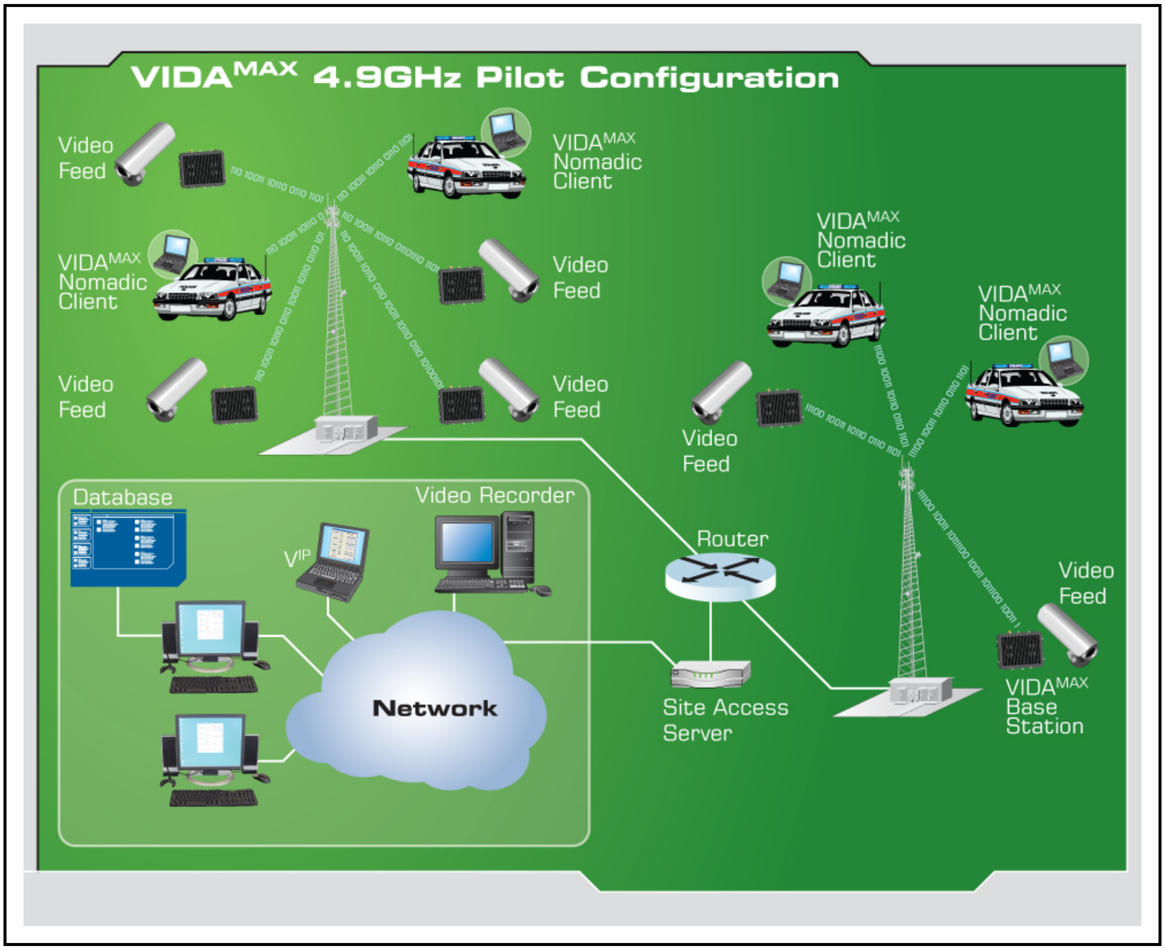


Figure 4-4: Network diagram of small VIDA^{MAX} system

The base station implements the 802.16-2004 protocol in a 5 MHz channel, delivering an over-the-air throughput from 4 to 19 Mbps. All communication over this channel is scheduled by the base station, with contention slots provided for subscriber stations to request bandwidth. This coordinated scheduling feature of the protocol provides significant advantages such as:

- Minimizes contention between clients
- Maximizes channel utilization
- Maximizes ability to coordinate frequency usage among users
- Enables guaranteed bandwidth services for critical multimedia applications.

The use of a scheduling protocol also makes the network more resilient to simple denial of service attacks that can disable other broadband networks.

To allow for great flexibility when designing a network, up to 16 "connections" can be established between the base station and each client, with a different QoS for each connection. Low priority processes (such as email) can be mapped to best effort services while high priority processes (such as streaming video or LMR backhaul) can be mapped to Unsolicited Grant Services (UGS) to provide guaranteed throughput.

4.5 4.9 GHz VIDA^{MAX} BASE STATION

The VIDA^{MAX} Base Station provides hardened, public safety grade base station infrastructure for M/A-COM's 4.9 GHz VIDA^{MAX} broadband network. The VIDA^{MAX} base station implements the IEEE 802.16-2004 protocol to deliver an over-the-air throughput from 4 to 19 Mbps. All communication over the wireless channel is scheduled by the base station, with contention slots provided for subscriber stations to request bandwidth. Up to 16 "connections" can be established between the base station and each subscriber in the network, with different QoS for each connection, allowing for great flexibility when designing a network. Low priority processes (such as email) can be mapped to best effort services while high priority processes (such as streaming video or LMR backhaul) can be mapped to unsolicited grant services (UGS) which offer guaranteed throughput. Network convergence is provided in the form of 802.16 classifier rules that ensure network level QoS over the airlink.

Base station configuration and management is provided via a browser interface to M/A-COM's Unified Administration System (UAS). The base station additionally supports localized SNMP management for single/limited site deployments. SNMP attributes are defined in the MIB II, the 802.16 and the M/A-COM using an open MIB. Base stations may optionally be configured as DHCP and/or TFTP servers. All subscriber station management can be performed over the air. The VIDA^{MAX} base station provides strong protection against unauthorized network access through the use of certificates for subscriber authentication. Authentication keys are distributed using RSA Public Key encryption. The cryptographic methods provided by the security sub layer use DES, 3-DES, and AES algorithms.

The VIDA^{MAX} Base station is housed in a hardened, outdoor enclosure that satisfies IP66 requirements for outdoor deployments. The base station is designed with flexible mounting configuration to allow for both pole mount and fixed structure mounting. To provide for flexible RF deployment configurations, the base station provides options for (1) direct mounting of an omni-directional antenna on the base station (2) direct mounting of a directional antenna on the front face of the base station and (3) remote mounting of an antenna through the connection of an RF cable to the base station. The base station comes in two power/network configurations: one with 110 VAC power and RJ-45 Gigabit Ethernet configuration and one with +24 VDC power and 100-BaseFX fiber configuration.

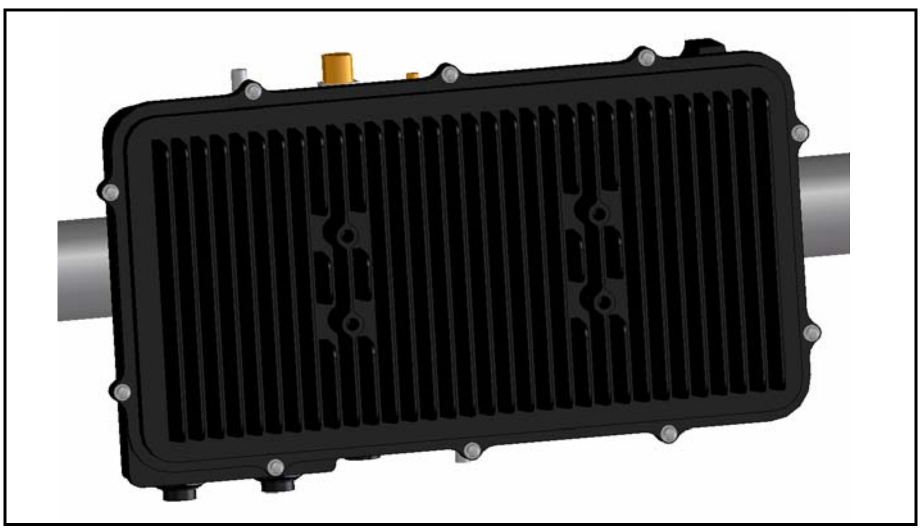


Figure 4-5: VIDA^{MAX} Base Station

4.5.1 Summary of Key Features

4.5.1.1 Airlink Features

The VIDA^{MAX} Base Station implements the 802.16-2004 protocol to deliver an over-the-air throughput from 4 to 19 Mbps. All communication over the wireless channel is scheduled by the base station, with contention slots provided for the VIDA^{MAX} Client to request bandwidth. A protocol with coordinated scheduling provides significant advantages such as:

- minimizing contention between clients
- maximizing channel utilization
- enabling guaranteed bandwidth services for critical multimedia applications.

The use of a scheduling protocol also makes the network more resilient to simple denial of service attacks that can disable other broadband networks.

Up to 16 "connections" can be established between the base station and each client in the network, with different QoS for each connection, allowing for great flexibility when designing a network. Low priority processes (such as email) can be mapped to best effort services while high priority processes (such as streaming video or LMR backhaul) can be mapped to unsolicited grant services (UGS) which offer guaranteed throughput.

4.5.1.2 Network Features

Network convergence is provided in the form of 802.16 classifier rules that ensure network level QoS over the airlink.

Network management is provided via a browser interface to M/A-COM's UAS. The base station additionally supports localized SNMP management using an open MIB. Base stations may optionally be configured as DHCP and/or TFTP servers. All VIDA^{MAX} Client management can be performed over the air.

4.5.1.3 Security Features

The VIDA^{MAX} base station provides strong protection against unauthorized network access through the use of certificates for client authentication. Authentication keys are distributed using RSA Public Key encryption. The cryptographic methods provided by the security sublayer use DES, 3-DES, and AES algorithms.

4.6 VIDA^{MAX} BASE STATION INTERFACES

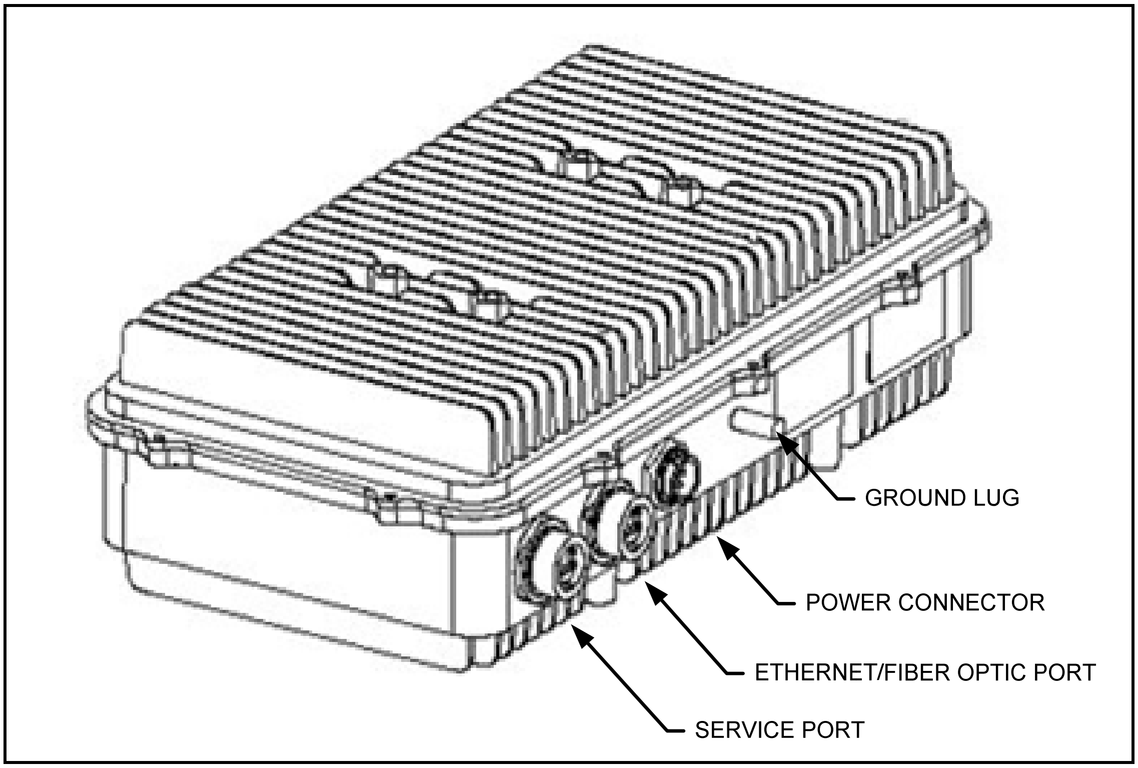


Figure 4-6: VIDA^{MAX} Base Station Interface Diagram

4.6.1 Standard Base Station (AC Powered)

RF Antenna Port:

- Connector: N-type Female
- Impedance: 50 Ohm

110 V AC Power Port:

- Industrialized 3-Pin Connector (Conxall Part No. 4180-3PG-3XX)

DATA Ports:

- Two Industrialized RJ-45 Connectors
- One port for Service only

GPS Antenna Port:

- Connector: SMA Female
- Impedance: 50 Ohm

4.6.2 Special Hardened Base Station (DC Powered)

RF Antenna Port:

- Connector: N-type Female
- Impedance: 50 Ohm
- Internal Lightning Suppressor

24 V DC Power Port:

- Industrialized 3-Pin Connector (Conxall Part No. 4180-3PG-3XX)
- Internal Lightning Suppressor

DATA Ports:

- LC Industrialized Fiber Optic Connector
- One port for Service only

GPS Antenna Port:

- Connector: SMA Female
- Impedance: 50 Ohm
- External Lightning Suppressor (optional)

4.7 VIDA^{MAX} Base Station Antenna Options

The VIDA^{MAX} Base Station allows users to choose many different antenna types to meet their application requirements. Depending on the location and site planning, a directional antenna can significantly extend the effective coverage area of the base station. For example, one can choose a high gain directional antenna to effectively cover a long strip of highway, in the meantime avoiding the area further away from the highway (where coverage is no longer needed) to reduce the total number of base stations. Another example could be using a 90-degree sectional antenna to effectively cover a town-center area while avoiding rural regions where no coverage is required. The user can directly mount an omni-directional antenna to base station RF antenna port. Additionally, four mounting holes are provided on the VIDA^{MAX} Base Station chassis to allow a directional antenna to be mounted on an optional bracket. Finally, the user can choose other industry means for mounting a directional or omni-directional antenna separate from base station. In this case, however, the total length of cable should not exceed 5 feet. Choose high quality 50-Ohm cable with the lowest loss at 5 GHz.

CAUTION

The four antenna mounting holes on VIDA^{MAX} base station can sustain a pulling force of 100 mph (160 km/h) sustained wind and survive wind gusts to 136 mph (220 km/h). It is the user's responsibility to estimate the force induced by antenna to ensure the integrity of the product.

Basic Antenna Requirements:

Omni Antenna: Vertical Polarization

9 dBi Maximum Gain

Directional Antenna: Linear Vertical

26 dBi Maximum Gain

(Reduction of Transmitter Power is required if the Effective Maximum Antenna Gain is greater than 26 dBi.)

The following antennas have been tested and approved for use with the VIDA^{MAX} Base Station:

Table 4-1: Recommended Antenna

Part Number	Manufacturer	Gain (dBi)	Polarization	Azimuth Beamwidth (Degree)	Size	Weight
MT-444003	MTI	15	Vertical	120	550 x250x17 (mm^3)	3.3 lbs (1.5 kg)
MT-466003 (Note 1)	MTI	27	Vertical or Horizontal	3	600x600x51 (mm^3)	11 lbs (5 kg)
MT-465005	MTI	21	Vertical or Horizontal	9	305x305x14 (mm^3)	3.3 lbs (1.5 kg)

Part Number	Manufacturer	Gain (dBi)	Polarization	Azimuth Beamwidth (Degree)	Size	Weight
MT-464003	MTI	15.5	Vertical	90	530x260x11 (mm^3)	5.5 lbs (2.5 kg)
MT-464002	MTI	16	Vertical	60	350x150x30	3.3 lbs (1.5 kg)
MT-462002	MTI	9	Vertical	Omni	18 in. (460 mm)	1.3 lbs (0.6 kg)
MFB49009	MAXRAD	9	Vertical	Omni	20.2 in	0.5 lbs (0.23 kg)
MP24581820PT	MAXRAD	20	Vertical	60	384x353x48 (mm^3)	3.9 lbs (1.8 kg)
MA-WA49-1X	Mars	21	Vertical	10.5	305x305x15 (mm^3)	3.3 lbs (1.5 kg)
Note 1: Based on guidelines from FCC Regulations, the MT-466003 27 dBi Directional Antenna can only be used with a cable that provides at least 1 dB of insertion loss. It is recommended that this antenna be installed with a minimum of 10 feet of LMR-400-UF antenna feeder cable (Cable Loss = 1.1 dB at 5 GHz). The effective Antenna Gain in this case will thereby be less than 26 dBi. Also, due to its size, the MT-466003 needs to be individually mounted on the pole.						

5 UNPACKING AND CHECKING EQUIPMENT

Before unpacking, installing or operating the VIDA^{MAX} equipment, read this section of the manual thoroughly. It contains detailed unpacking and handling instructions, and safety precautions to protect users and equipment.

5.1 UNPACKING EQUIPMENT

The VIDA^{MAX} equipment may be shipped in separate transit packages. The associated cabling and accessories for each unit, if any, may also be shipped in separate containers.

When unpacking the equipment, check the contents against the packing list. Contact your M/A-COM VIDA^{MAX} equipment representative and the carrier if any discrepancies are noted.

NOTE

Save the shipping cartons and packing materials in case the equipment needs to be shipped back to the M/A-COM for service.

There are no user serviceable components within the VIDA^{MAX} radio equipment assemblies. These assemblies contain ESD sensitive components and should only be serviced by M/A-COM qualified personnel.

5.2 INSPECTING AND INVENTORYING EQUIPMENT

Carefully unpack the equipment and examine each item. If there is any damage to the equipment, contact the carrier immediately and have their representative verify the damage. If you fail to report the shipping damages immediately, you may forfeit any claim against the carrier.

CAUTION

After removal from the carton, examine the VIDA^{MAX} equipment for broken, damaged, loose, or missing parts. Examine the RF connector(s), circular power connector and ground lug for cracks, bent or damaged threads, or damage to any paint or seals. If any are noted, contact the M/A-COM Customer Resource Center immediately. Any unauthorized attempts to repair or modify this equipment will void the warranty and could create a safety hazard.

6 PLANNING THE INSTALLATION

6.1 ENVIRONMENTAL EVALUATION

Before installing the VIDA^{MAX} Base Station, the System Engineer and installer should plan the site selection before attempting to install the base station. Since high frequencies do not readily pass through trees or buildings, consideration should be given to the following:

- Ensure there are no obstructions (such as buildings or trees) in the radio path between base station and fixed client units
- Ensure the any future building construction or tree growth will not obstruct the radio path
- Ensure there is sufficient clearance around the Fresnel Zone so there is minimal interference from obstacles along the radio propagation path
- Ensure the installation adheres to any local building codes and permits
- Ensure sufficient electrical power is available at the installation site
- When using directional antennas, align the base station antenna to maximize the received signal strength indication (RSSI)
- Ensure area around an omni-directional antenna is clear (at least 30 inches) so as not to distort the RF pattern
- Locate the base station away from any sources of interference that could degrade the performance of the base station
- Ensure the base station and fixed clients are within maximum coverage range of reception
- Maximum standard CAT-5 cable length connecting the base station to the Ethernet LAN is 100 meters and maximum antenna cable length is 5-feet

6.2 POLE-MOUNT INSTALLATIONS

The VIDA^{MAX} Base Station is designed to accommodate pole mounting. Typically, pole mounting means mounting the base station on a light post (horizontally) or telephone pole (vertically) as shown in Figure 6-1. A kit containing two mounting brackets and hardware for attaching the base station to a pole can be optionally purchased. The bracket accommodates mounting on a pole with a diameter in the range of one (1) to six (6) inches. The installer must provide straps necessary to secure the base station brackets to the pole.

CAUTION

When mounting the base station on a pole, the installer must ensure the mounting bands are strong enough (resistance to rotation) so the base station can withstand 100 mph (160 km/h) sustained wind and survive 136 mph (220 km/h) wind gusts.

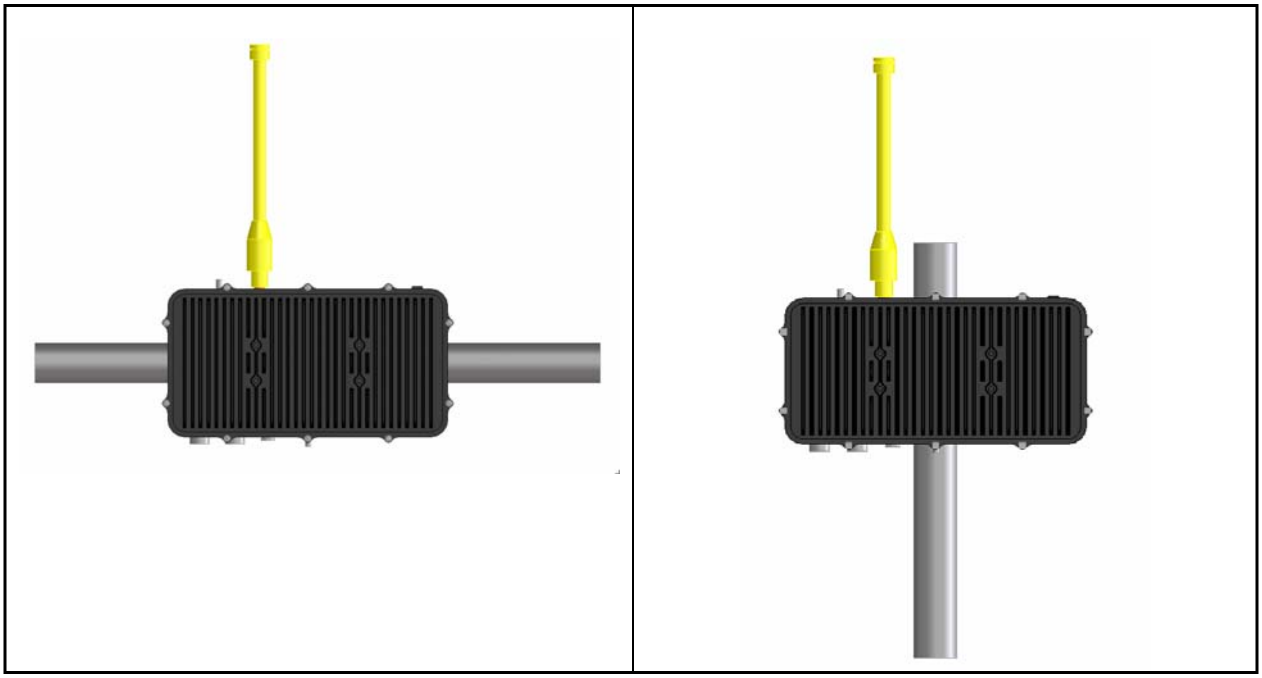


Figure 6-1: Pole Mounting the VIDA^{MAX} Base Station

6.3 ELECTRICAL POWER

There are two configurations of the base station. The AC version is configured to accept 110 VAC power from standard U.S. utility power distribution. The DC Hardened version of the base station accepts +24 VDC (negative ground) power from a power supply or battery.

6.3.1 AC Power

An AC powered VIDA^{MAX} base station requires at least 2 amperes of electrical service:

6.3.2 DC Power

A DC powered base station requires a +24-volt (nominal) DC power source. This source must have a continuous-duty current rating of at least 3 amperes. Refer to Section 2, *Specifications* for additional information.

6.4 SITE GROUNDING

Installers should review the recommended grounding procedures in the *Site Grounding and Lightning Protection Guidelines manual, AE/LZT 123 4618/1* and ensure a suitable ground is installed between the base station ground lug and earth ground. Grounding must also be in compliance with any local and national electrical codes.

7 INSTALLATION

The VIDA^{MAX} Base Station resides in a Die Casting Metal Chassis to meet tough environmental conditions. The user can choose different antenna types (omni-directional or directional) depending on the application. It is preferred that the user specifies 50-Ohm low loss (@5GHz) cable with minimum length (5-feet maximum) between the antenna connector and antenna port on the base station to avoid further loss of RF power.

The base station is available as either as +24 VDC (hardened) or 110 VAC version. The total power consumption is less than 60 Watts.

For the AC version, the radio uses weatherproof RJ-45 for connector as data and network connections. M/A-COM recommends using the DC hardened version of the VIDA^{MAX} base station in the areas that experience frequent thunderstorms. In this version, weatherproof LC fiber-optic connections are employed, and lightning protection is internally provided within the base station for the RF antenna and DC power ports. Additional external lightning protection for the GPS antenna port may optionally be installed.

NOTE

Both the RJ-45 and LC fiber-optic connectors achieve weatherproof properties only when properly mated with M/A-COM approved cabling. For the Service port, the dust cap is to be installed in normal operation.

7.1 TOOLS AND TEST EQUIPMENT REQUIRED

The following tools and test equipment are recommended for installing and testing the VIDA^{MAX} Base Station:

- Common hand tools, including screwdrivers, wire cutters, pliers, etc.
- Modular Plug Tool, 3-231652-0 (Tyco/Electronics-AMP)
  Includes; Hand Tool, 2-231652-0 and Die Set, 1-853400-0
- Digital Voltmeter (DVM), capable of measuring AC and DC voltage
- Agilent E4440A, PSA series high-performance spectrum analyzer
- Laptop Computer
  - Linux operating system

7.2 CUSTOMER SUPPLIED MATERIALS

The customer or designated installer must provide the following:

- Ethernet Cable, length as required, not to exceed 100 ft. (refer to Section 11.1.1 for cable specifications)
- RF coaxial cable (directional or remotely mounted antenna), i.e. LMR-400 Low loss coaxial cable

- Pole mounting straps, i.e. Band-It® bands and buckles
- Power source (110 VAC 50/60 Hz or 24 VDC)
- Ethernet connection to network

7.3 BEFORE BEGINNING THE INSTALLATION

Before beginning the installation, collect information from the Site Deployment Order (SDO) specific to the site access such as:

- Permission to access the site
- Important contact names and telephone numbers
- Location of and directions to the site
- Keys and/or lock combinations to access the site and equipment shelter (if any), or points of contact to obtain them
- Site entry alarm system pass-codes and/or disable keys
- Information about work practices needed to work safely at the site

Other important information that may or may not be included on the SDO includes:

- Type of mounting—metal pole, wooden pole, tower base, exterior wall, etc.
- Drawing or description of each site showing how the equipment is to be installed
- Applicable inspections completed (pole installation, electrical, local build code, etc.)

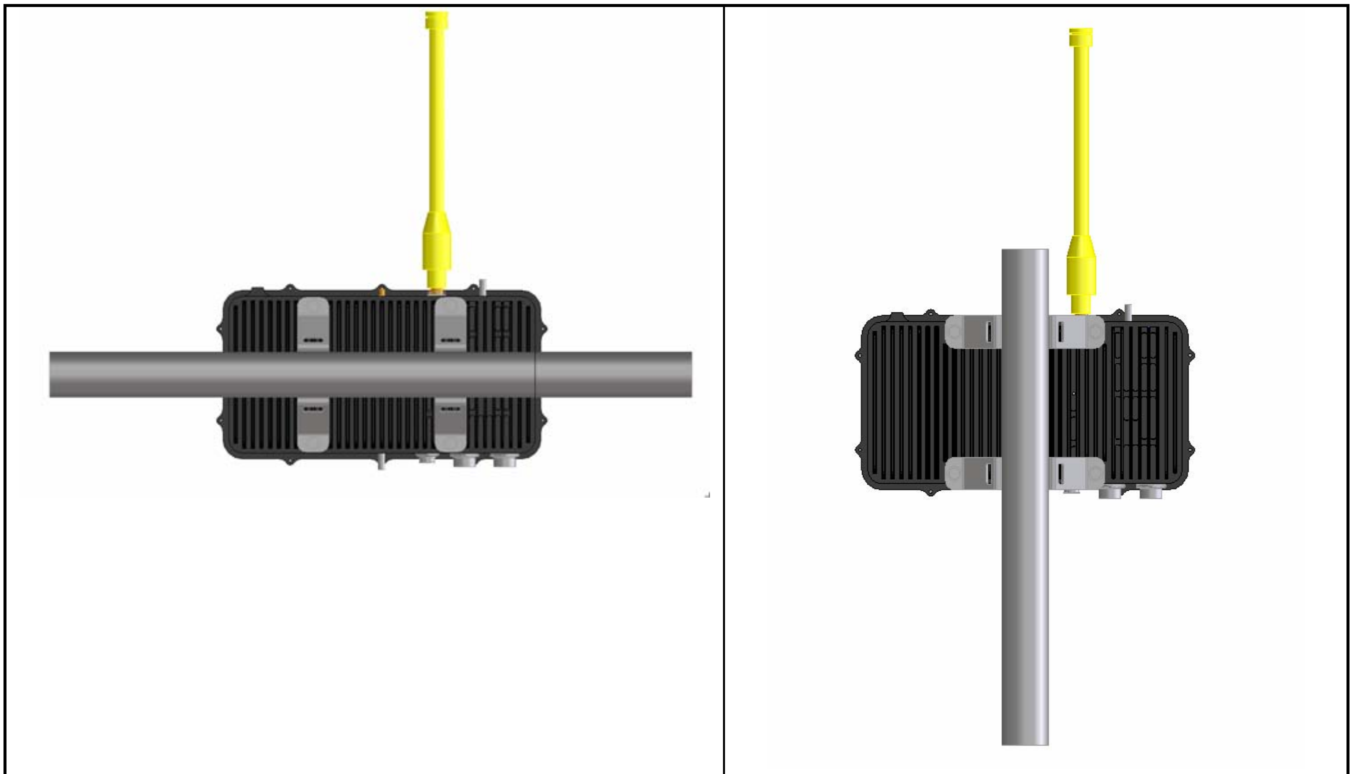
7.4 MOUNTING THE BASE STATION

As shown in Figure 7-1, pole-mounting brackets can be installed onto the mounting surface of the base station so it to be mounted (a) horizontally, for instance, on the arm of a light post, or on a vertical (b) post. In both cases, two metal straps (not included) are inserted into slots on the brackets and tightened to the pole using industry strapping equipment.

NOTE

It is important to mount the base station so that its fins are positioned vertically, as shown in Figure 7-1 (a) and (b). This gives the base station the best thermal performance, allowing air to move naturally through the fins

Mounting the base station with the fins vertically also allows the RF antenna port to be in the best position for mounting the omni-directional antenna, as shown in Figure 7-1.



a. Horizontal Mounting | b. Vertical Mounting

Figure 7-1: Mounting the VIDA^{MAX} Base Station on Horizontal or Vertical Poles

7.4.1 Attaching the Mounting Bracket

1. Orient the brackets so when the base station is mounted on a pole, the fins are vertical. This position provides the best thermal convection (vertical fins) and shields the multiple connectors from rain.

2. Attach mounting brackets to base station using the flat washer, lock washer, and hex head bolt included with the brackets. (Ensure lock washer is closest to the bolt's head.)

Figure 7-2: Brackets attached to the VIDA^{MAX} Base Station (vertical pole mounting)

3. The preferable mounting scheme is to have omni-directional antenna pointing straight up.

7.4.2 Attaching the Base Station to a Pole

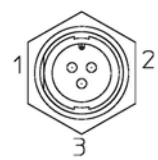
Strap the base station to pole using Band-It bands and buckles (not supplied). Follow the manufacturer's guidelines for proper equipment and techniques.

7.5 POWER CABLES

Power is supplied to the base station through a 3-pin connector. Both AC and DC base stations use the same power connector, although they require different cables, available for purchase through M/A-COM. The mating connector is Conxall Multi-Con-X® 3-pin connector #4180-3SG-3xx).

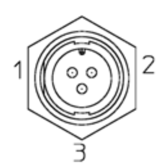
7.5.1 AC Power

The AC powered VIDA^{MAX} Base Station requires 110 VAC, 50-60 Hz power applied to the following contacts.

Connection	Pin	Wire Color	VIDA^{MAX} Base Station Connector
Ground	3	Green	
Neutral	2	White/Grey	
Hot	1	Black	

7.5.2 DC Power

A DC powered VIDA^{MAX} requires 24 ±3 VDC applied to the following contacts:

Connection	Pin	Wire Color	VIDA^{MAX} Base Station Connector
+24 VDC (PWR+)	1	Red	
Return (PWR-)	2	Black	

7.6 GROUNDING STUDS

Mounting studs for grounding the base station are located on two sides of the base station. For safety purposes, earth ground and lightning protection electrical connections should be made at either location.

7.7 NETWORK/DATA CONNECTION

The AC version of the base station connects to the network using standard Ethernet RJ-45 protocol. The DC hardened version connects to the network through a standard LC multimode fiber optic connector. The proper connection in both cases is on the port that does not have the dust cap installed.

Recommended Ethernet mating connectors:

For AC powered VIDA^{MAX} base station:

- Tyco/Electronics, Industrial Circular Ethernet Connector
  Part number: 1738607-2

For DC powered VIDA^{MAX} base station:

- Tyco/Electronics, LC multimode fiber optic connector
  Part number: 1828618-1

All connections are weatherproof, and the service port has a dust cap which is normally installed to provide the sealing. Sealing of all other ports on the base station is provided through mandatory usage connections.

7.8 ANTENNA CONNECTIONS

The omni-directional antenna should be mounted vertically directly onto the antenna port. There is also a mounting feature on the base station to support the mounting a directional antenna.

7.8.1 Installing an omni-directional antenna

The omni-directional antenna can be mounted directly to the base station using the following procedure:

1. Connect an N-type male to male RF adapter (not included) to the omni-directional antenna. Hand tighten the connector.

   Recommend using Amphenol 82-100 or RF Industries RFN-1014-1.

2. For the AC version of the base station, if external lightning protection is required, connect the optional lightning suppressor to the antenna assembly as shown in Figure 7-3.

   Recommend using M/A-COM # PT-009560.

3. Connect the completed antenna assembly to the base station antenna connector.

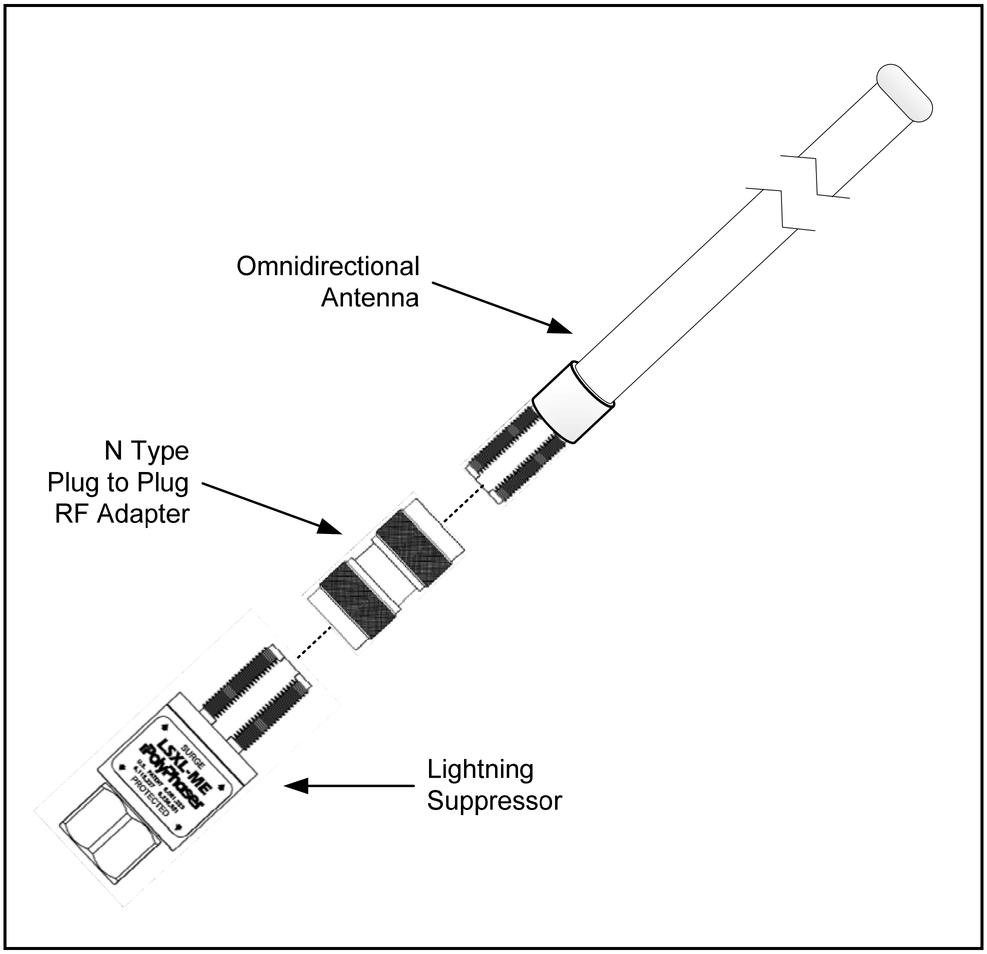


Figure 7-3: VIDA^{MAX} Base Station Antenna with External Lightning Protection

7.8.2 Installing a Directional Antenna

The directional antenna (weight less than 5 lb and size less than 350x350 mm^2) can be mounted on the base station using the universal mounting bracket. This mounting bracket is located on the antenna mounting face (cover) of the base station. The universal mounting bracket can then be adjusted to point the beam of the antenna in the direction needed for network connectivity. An antenna weighing more than 5 lb cannot be mounted directly on the base station. A separated mounting bracket is required to mount the antenna directly on the pole while an antenna feeder cable connects the base station to the antenna.

A low loss RF cable (not included) is needed to connect between the base station antenna connector and the Directional Antenna.

To mount the directional antenna to the base station:

1. Using the four bolts, lock washers and flat washers included in the optional antenna mounting kit, attach the universal antenna mounting bracket to the base station as shown in Figure 7-4.
2. Attach the antenna panel bracket assembly to the antenna panel.
3. Attach the two bracket assemblies together with the universal knuckle.

4. Attach the short RF cable between the antenna and the base station antenna port.

   Recommend using < 5 ft. long LMR-400 Low loss coaxial cable with field installable N Type Male connectors, M/A-COM # MAMROS0095.

Figure 7-4: Mounting a Directional Antenna to the VIDA^{MAX} Base Station

7.9 GPS Antenna

The Base Station performs time synchronization through GPS. An external GPS antenna connection is required. Various antennas are available in the marketplace. One offered by M/A-COM can be mounted directly onto the base station, or alternatively attached to the pole.

7.9.1 Installing Optional GPS Antenna

To connect GPS cable to base station:

Connect the SMA-type plug of the GPS antenna cable to the SMA receptacle on the base station. Route the cable to the GPS antenna location. This will be a temporary connection until the installation is complete.

To install the GPS Antenna:

The GPS antenna kit (M/A-COM # MAMROS0023) includes the GPS antenna (part number ANPC-185B-Y-180-SM) and various mounts.

Based on how the base station is physically positioned, the mounting location that is uppermost is where the antenna can be mounted in order to have best access to the satellites in the sky. Connection to the antenna port is made through the SMA female connector on the base station. Optionally, for lightning protection, a protection device can be externally installed.

After installing the antenna, dress and secure the cable.

7.10 RADIO CHASSIS AND CABLING

7.10.1 Attaching Base Station Cables

To connect power to Base Station

1. Connect the M/A-COM power cable to the proper power source.

2. Mate the other end of the power cable's connector to the 3-pin power connector on the base station by visually aligning the key and firmly push and turn the outer locking ring clockwise until it stops. A click will be sensed to confirm proper mating.

3. For added protection against long-term exposure to weather, industry techniques for sealing the data connection may optionally be performed.

To connect data cable to Base Station

1. Fabricate the Ethernet (AC base station) or Fiber Optic cable (DC base station) as described in Section 11 or the manufacturer's instructions.

2. Connect one end of the cable to the LAN connection.

3. Mate the other end of the power cable's connector to the 3-pin power connector on the base station by visually aligning the key and firmly push and turn the outer locking ring clockwise until it stops. A click will be sensed to confirm proper mating.

4. Ensure the dust cap is fully seated on the service port.

5. For added protection against long-term exposure to weather, industry techniques for sealing the data connection may optionally be performed.

CAUTION

Upon connection, verify that all cabling is not under any stress, a service loop is maintained, and the cabling is restrained according industry techniques.

8 OPERATION

To operate the VIDA^{MAX} Base Station, a Linux-based computer using Category 5 Ethernet cable is required and described in the following sections.

8.1 LOGGING INTO THE VIDA^{MAX} BASE STATION

To login to the VIDA^{MAX} Base Station:

1. Connect the base station to a Linux-based computer using a Category 5 cable.

2. Power up the base station. Once powered up, the base station takes about 2-3 minutes to boot.

3. After 2-3 minutes, begin a Telnet session to communicate with the base station by entering the following command at the prompt:

   `pico@pico:~$ telnet` *IP address of base station* ↵ **Enter**

4. This will make the following prompt appear:

   `login@`*IP address of base station*`:`

5. At the above prompt, enter the command shown below:

   `login@`*IP address of base station*`: root` ↵ **Enter**

6. With the above command, the user is logged into the base station as the root, which is seen by the prompt shown below:

   `root@`*IP address of base station*`:`

7. Enter the next step to load the necessary drivers into the digital board and run Picotools:

   `root@`*IP address of base station*`: cd /ixa` ↵ **Enter**

   `ixa@`*IP address of base station*`: ./pc102start` ↵ **Enter**

8.2 TESTING THE VIDA^{MAX} BASE STATION

To run the Test Program

1. Open a new terminal window and change the director to the working directory:

   `pico@pico:~$ cd TXRX_Test` ↵ **Enter**

2. Once in the working directory, start the test program named TXRX_Test:

   FCC_Test@pico:~$ ./TXRX_Test ↵ **Enter**

3. The program causes a menu-driven screen to appear as illustrated below:

```
    0 : Exit

    1 : Change Channel :

    2 : Transmit ON / OFF :

Enter Your Choice :
```

4. To change the channel, type “1” and at the succeeding prompt enter the desired channel number:

```
    0 : Exit

    1 : Change Channel :

    2 : Transmit ON / OFF :

Enter Your Choice : 1
```
↵ **Enter**

```
Enter Channel Number : 10
```
↵ **Enter**

5. To make the radio transmit, type “2” and at the succeeding prompt enter “1”:

```
    0 : Exit

    1 : Change Channel :

    2 : Transmit ON / OFF :

Enter Your Choice : 2
```
↵ **Enter**

```
Turn Transmit ON/OFF : 1
```
↵ **Enter**

6. When transmit is turned on, an OFDM signal is transmitted continuously.

To run the “TXRX_Test” program on a different base station

1. Power up the new base station and login as root using the new base station’s IP address.

2. Modify the “Setup.txt” file with the IP address of the new base station.

9 TROUBLESHOOTING AND SERVICING

9.1 TUNING AND CALIBRATION PROCEDURE

Every VIDA^{MAX} Base Station is fully calibrated for frequency and power before shipment to ensure compliance with FCC requirements. No further tuning is required by the customer or installer during the installation process.

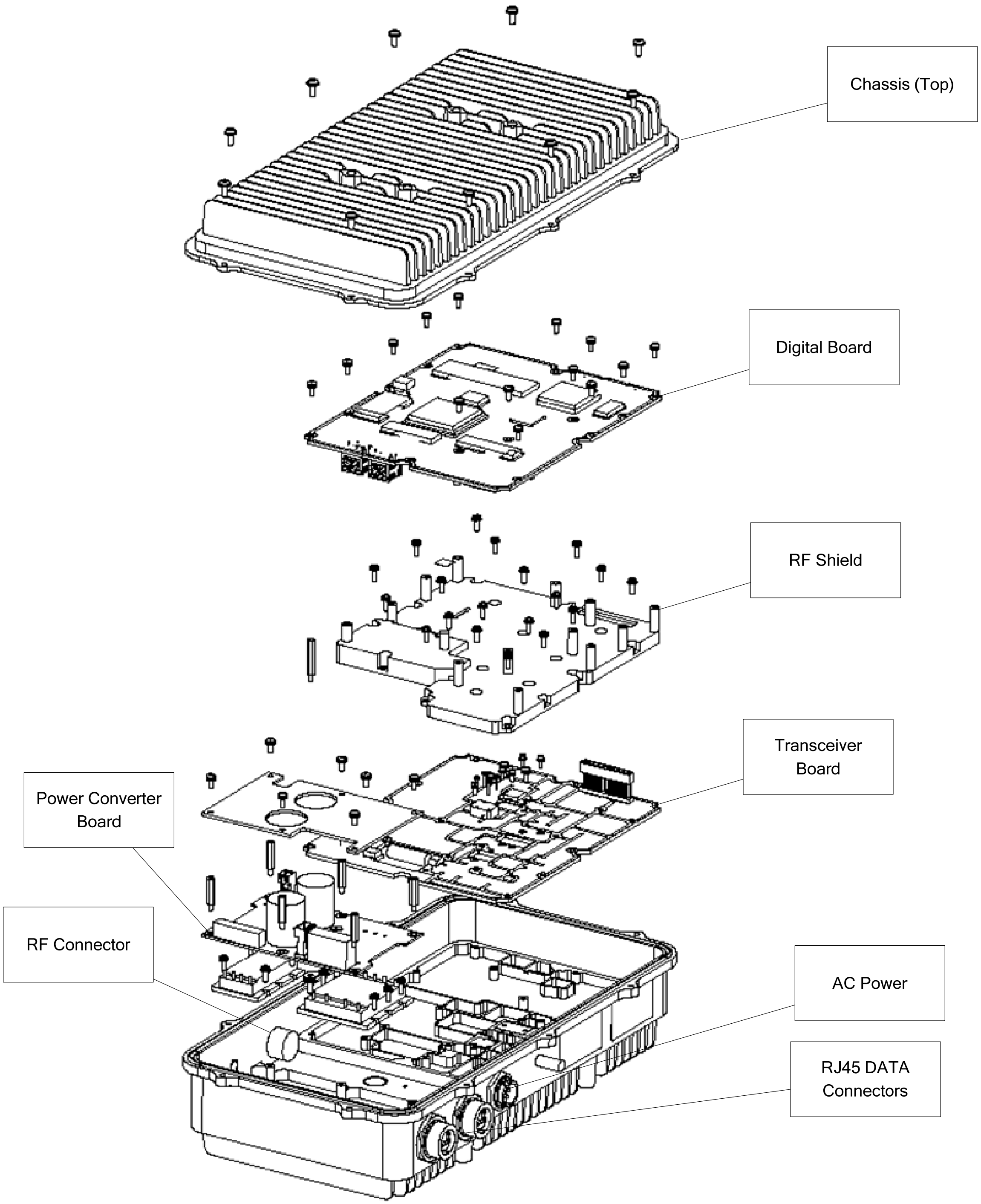
9.1.1 Transmit Frequency Accuracy Calibration

The accurate frequency setting is a key parameter for VIDA^{MAX} Base Station. Base station frequency accuracy is guaranteed by a Voltage Controlled Temperature Compensated Crystal Oscillator (VCTCXO) with 1.5 ppm frequency drift over full temperature range. The factory calibration procedures calibrate the default VCTCXO setting to minimize the frequency error. This minimizes the frequency variation from base station to base station. The base station will automatically use default value after each reboot.

9.1.2 Transmit Power Level Calibration

The power level calibration is performed at CH1, CH5, CH10 (lowest, middle, and highest) to ensure the over-band performance. An Agilent PSA E4440A under spectrum emission mask mode is used to perform the calibration. A standard baseband OFDM QPSK 3/4 Signal (Downlink Burst, 50% duty, 10 msec. frame) is used for the calibration. The on board 30 dB/ 1 dB step attenuator is used to adjust power level. The cable loss (radio antenna port to PSA input) is calibrated out so the PSA can measure channel power at the antenna port. After the TX power level calibration step, the FCC emission mask is used to check TX spectrum at CH1, CH5 and CH10 to ensure the compliance. After calibration, the base station uses the calibrated TX power as a default value to initialize the radio.

10 RADIO CHASSIS



11 CABLE FABRICATION

11.1 ETHERNET CABLE PLUG KIT

For the AC version of the base station, the Ethernet cable connected to the base station uses a RJ-45 connector protected by an Industrial Circular Ethernet plug assembly that protects the RJ-45 connector from the elements.

The Stranded Wire Plug Kit (Tyco Electronics # 1738607-2), shown in Figure 11-1, consists of an 8-position Category 5e RJ-45 plug, load bar, and plug assembly. The load bar is used to hold the cable wires for insertion into the RJ-45 plug. The RJ-45 plug must be terminated and then installed into the plug assembly. The RJ-45 plug is held in the plug assembly by the locking tab. The cable fitting holds the RJ-45 plug in the plug assembly and seals the plug at the cable end. When engaged, the connectors are held together by a locking mechanism (coupling ring and bayonet lock), which prevents accidental disconnection. The engaged connectors are sealed by the interfacial seal.

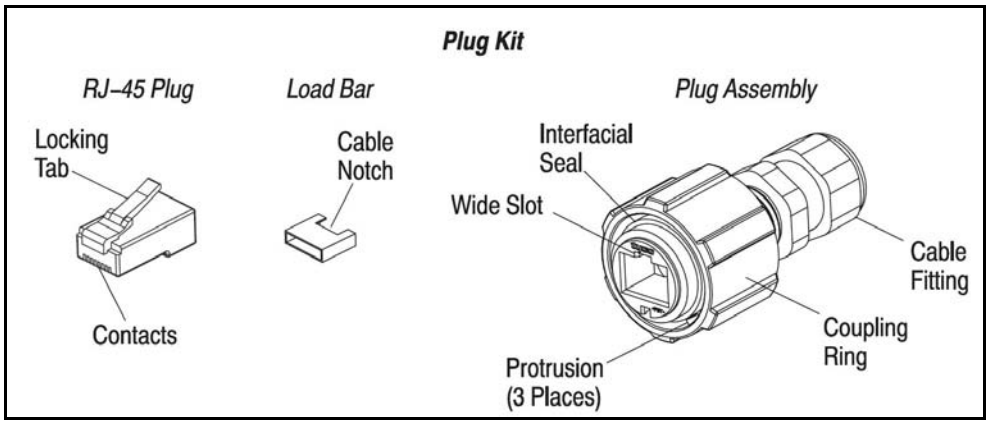
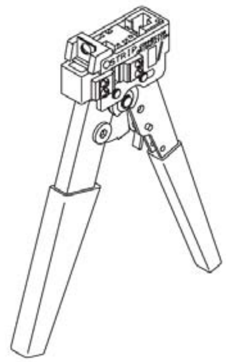


Figure 11-1: Tyco/Electronics Industrial Circular Ethernet Connector Plug Kit (1738607-2)

11.1.1 Tools Required

- Modular Plug Hand Tool, 3-231652-0 (Tyco/Electronics-AMP)
  Includes; Hand Tool, 2-231652-0 and Die Set, 1-853400-0



Modular Plug Hand Tool (Premium Grade)
2–231652–0 and Die Set 1–853400–0
(408–9767)

11.1.2 Cable Selection

The RJ-45 plug will accept Category 5e, 100–ohm unshielded round cable with the following specifications:

- Cable type: 8–conductor
- Conductor size: 24 AWG
- Conductor type: 7–strand copper
- Conductor insulation diameter: 0.039 in. (0.99 cm) maximum
- Cable jacket diameter range:

  RJ-45 plug accepts: 0.190 through 0.220 in. (4.83 through 5.59 cm) OD (single jacket)

  Cable fitting accepts: 0.18 through 0.31 in. (4.6 through 7.9 cm) OD (double jacket)

11.1.3 Cable Preparation

Prepare the cable using the following procedure:


CAUTION

Reasonable care must be taken not to scrape or nick any part of the cable during the stripping operation.

1. Slide the plug assembly (cable fitting end first) onto the cable. See Figure 11-2, Detail A.

2. Proper strip length is necessary to insert the conductors into the contact slots. The recommended strip length is given in Figure 11-2, Detail B.

NOTE

Insulation of individual conductors **must not** be cut or removed. This could result in shorted or open connections.

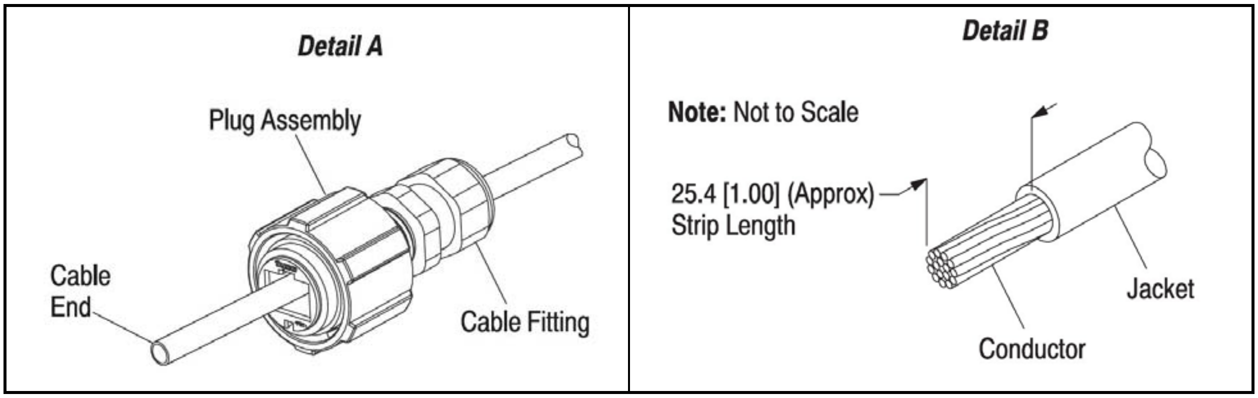


Figure 11-2: Cable Preparation

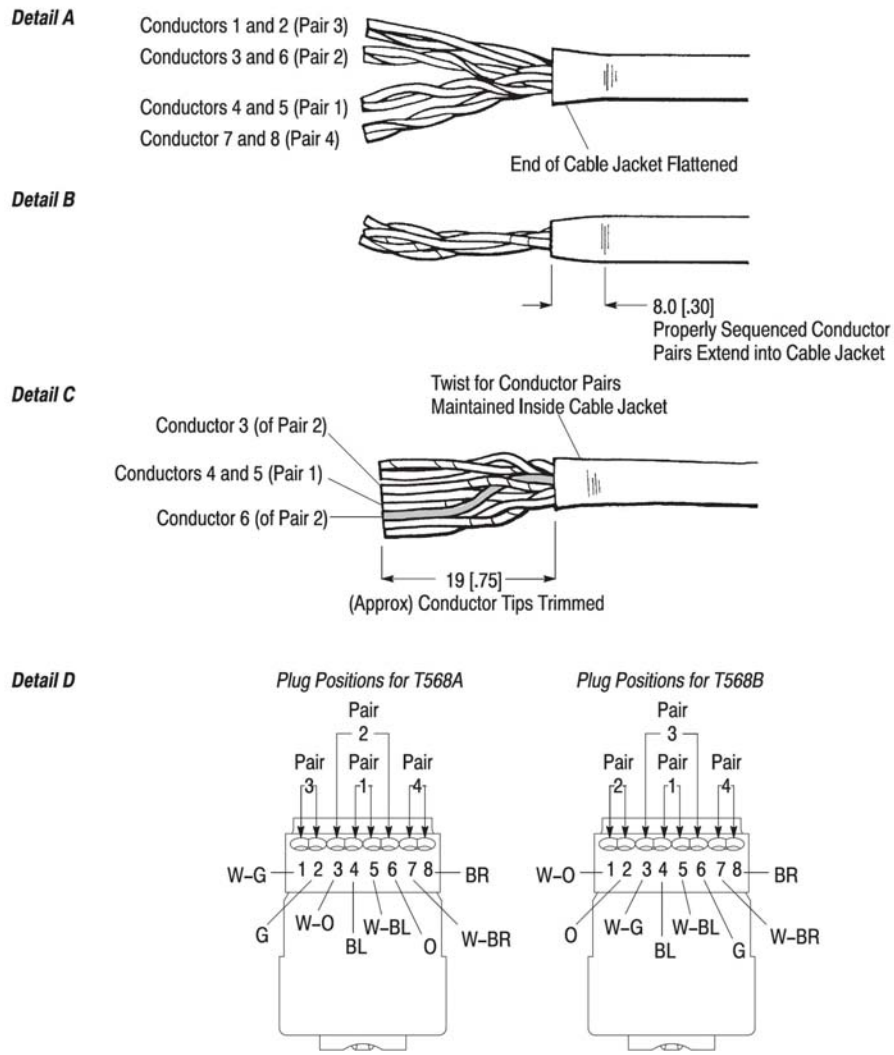
3. Conductor pairs must be oriented side–by–side in the order shown in Figure 11-3, Detail A. The end of the cable jacket must be flattened so that the conductor pairs lay side–by–side.

4. Properly sequenced conductor pairs should extend into the cable jacket to the dimension given in Figure 11-3, Detail B, creating an oblong shape.

5. The conductor tips must be trimmed evenly to the dimension shown in Figure 11-3, Detail C. Proper orientation of conductors must be maintained.

6. The conductor pairs must be untwisted and arranged according to EIA/TIA T568A or T568B (defined in Figure 11-3, Detail D). IT IS CRITICAL that the pairs are NOT untwisted inside the cable jacket.

   When arranging conductor pairs, IT IS IMPORTANT that Conductor 6 be crossed over Conductors 4 and 5 as shown in Figure 11-3, Detail C.



CONDUCTOR PAIR	CONDUCTOR PAIR For Electrical Schematic		CONDUCTOR COLOR CODE (Abbreviation)	
	T568A	T568B	OPTION 1	OPTION 2
1	4	4	Blue (BL)▪	Red (R)
	5	5	White–Blue (W–BL)	Green (G)
2	3	1	White–Orange (W–O)	Black (BK)
	6	2	Orange (O)	Yellow (Y)
3	1	3	White–Green (W–G)	Blue (BL)
	2	6	Green (G)▪	Orange (O)
4	7	7	White–Brown (W–BR)	Brown (BR)
	8	8	Brown (BR)▪	Slate (S)

▪A white marking is acceptable.

Figure 11-3: Cable Preparation Continued

11.1.4 Termination

Terminate the RJ-45 plug to the cable end using the following procedure:

1. The conductors (maintaining arrangement) must be inserted into the load bar (oriented so that the cable notch will align with the contacts) until the cable jacket rests against the cable notch. The conductor twist must not enter the front of the load bar. The conductors must be trimmed evenly and square with the front edge of the load bar to the dimension given in Figure 11-4, Detail A.

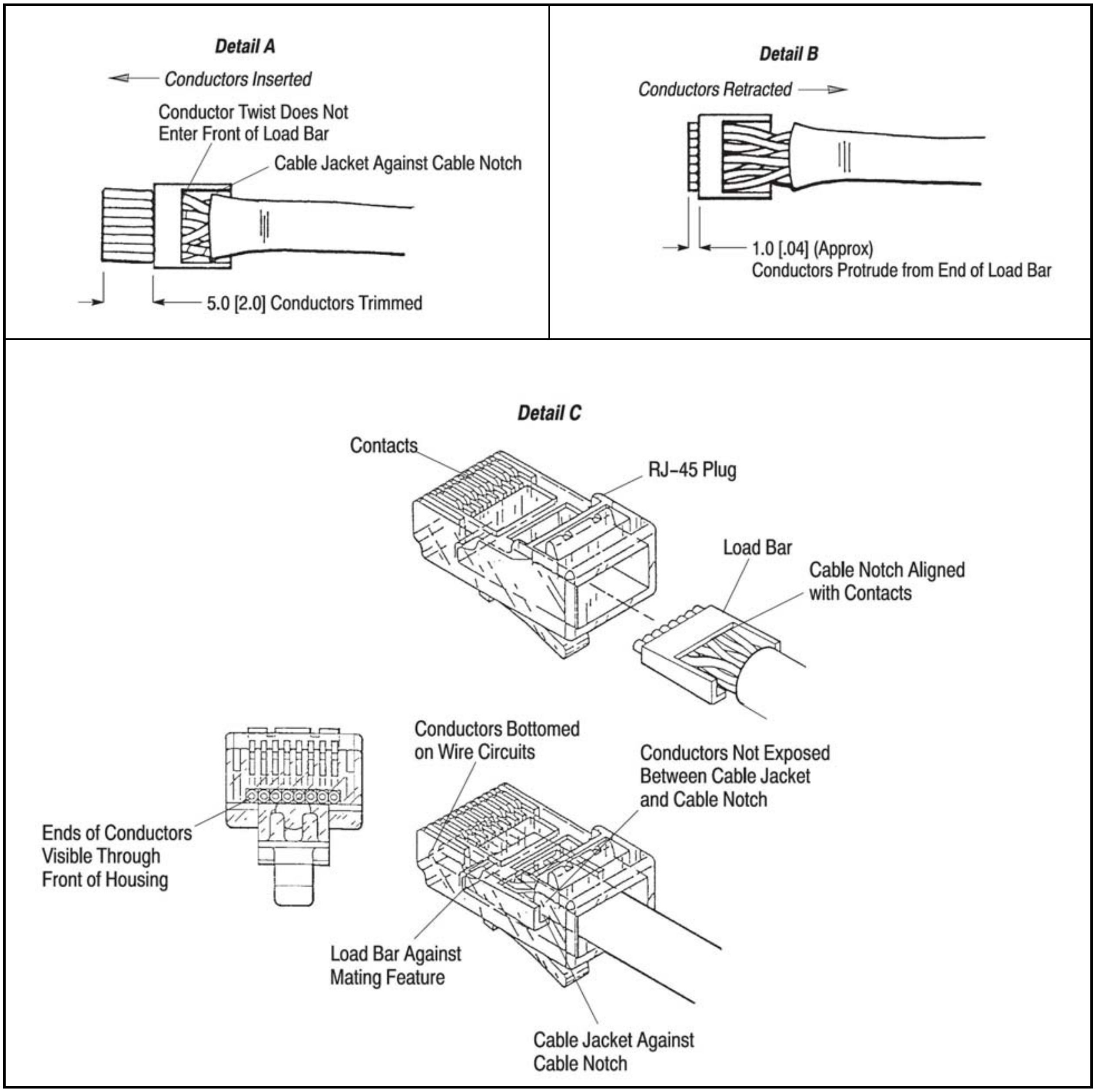


Figure 11-4: Termination Requirements

2. The conductors must be retracted from the load bar so that the conductors protrude from the end of the load bar to the dimension given in Figure 11-4, Detail B. The top of the load bar must not be deformed.

NOTE

If the load bar is deformed, the conductor twist entered the front of the load bar

3. The load bar (oriented so that the cable notch is aligned with the contacts) must be inserted into the RJ-45 plug until it butts against the mating feature of the RJ-45 plug, and the conductors are bottomed on the wire circuits. The cable jacket must be against the cable notch after the load bar is fully seated. The conductors must not be exposed between the cable jacket and cable notch. The ends of the conductors must be clearly visible through the front of the RJ-45 plug. See Figure 11-4, Detail C.

NOTE

If the conductors do not bottom on the wire circuits, they must be re-trimmed (after removing the load bar/cable assembly from the RJ-45 plug), and re-inserted into the RJ-45 plug. If the conductors are too short, the cable must be re-stripped.

4. The RJ-45 plug must be terminated to the cable according to the instructions included with the tooling.

11.1.5 Assembly

Assemble the RJ-45 connector into the plug assembly using the following procedures:

1. Align the locking tab of the RJ-45 plug with the wide slot at the front (end opposite the cable fitting) of the plug assembly. See Figure 11-5, Detail A.

2. Depress the locking tab, and insert the RJ-45 plug into the plug assembly. Gently pull the cable until the RJ-45 plug is fully seated. There should be approximately 12.7 mm [.50 in.] of the RJ-45 plug protruding from the front of the plug assembly. See Figure 11-5, Detail B.

CAUTION

To avoid damage to the connection, the cable must be pulled GENTLY when seating the RJ-45 plug.

3. While holding the RJ-45 plug in position, rotate the cable fitting as shown in Figure 11-5, Detail B until tightened to a torque of 1.13 N–m [10 lbf–in.].

NOTE

The given torque must be met in order for the cable fitting to seal the plug at the cable end.

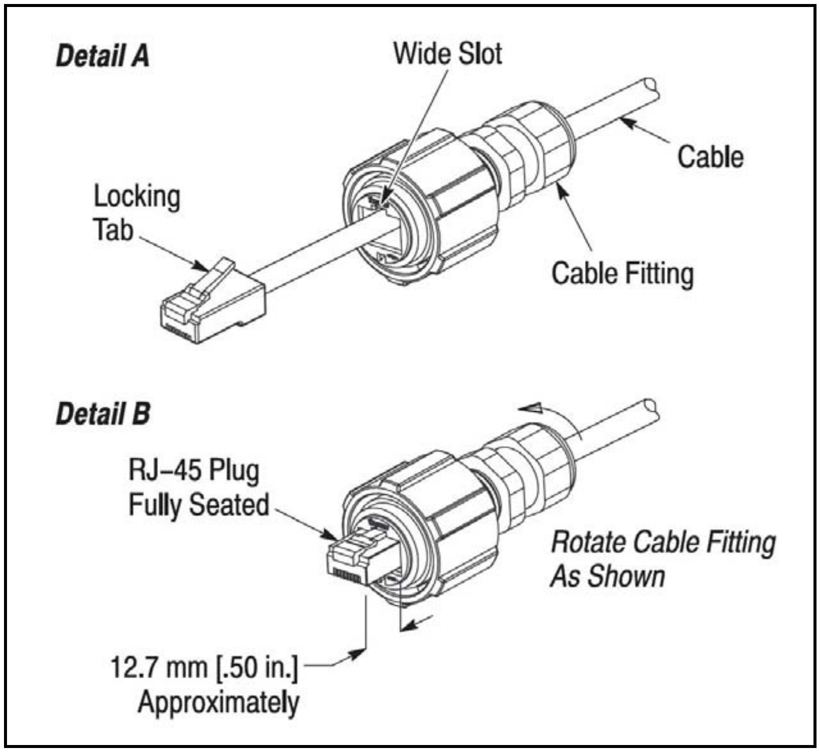


Figure 11-5: Assembly Detail

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