Teletics

WOPX G4

(Wireless Off Premise eXtension)

Installation and User Guide

Rev 2.0 – August 18, 2010

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Introduction

The Teletics WOPX is a wireless telephone line extender which can provide a telephone line to a remote site at distances up to 25 miles, or 30 kilometers, (when equipped with proper antennas).

The WOPX system can be used to connect to a regular POTS telephone line, or connected to other communications systems that provide “backhaul” to the outside world, such as satellite communications, or cellular backhaul links.

The Teletics WOPX also provides an Ethernet link between the sites, for either internet or private LAN connectivity.

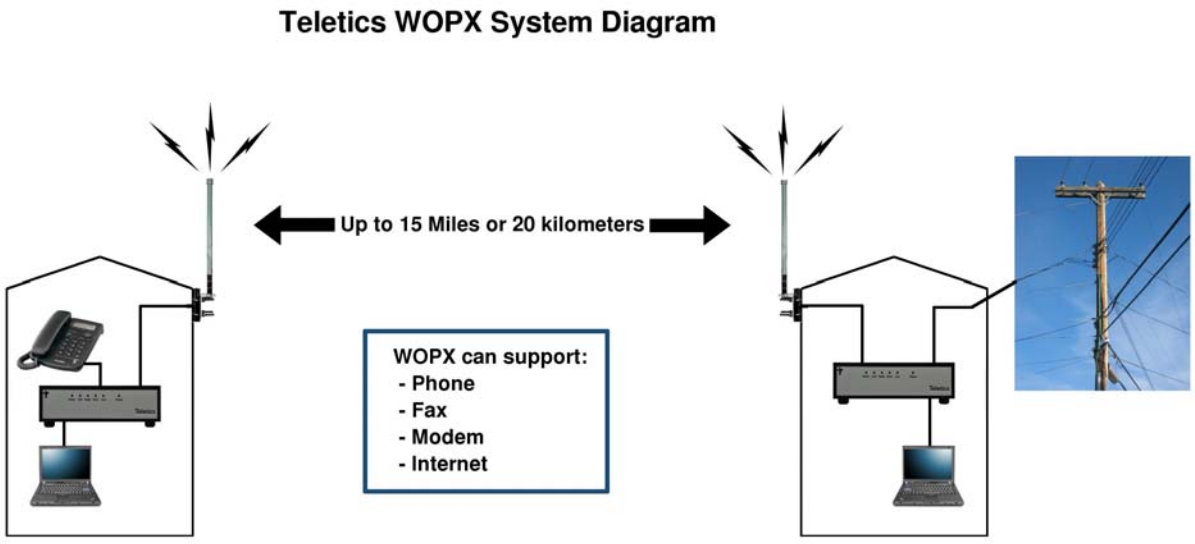
Key WOPX features:

- Each system is shipped with a unique system serial number, in order to prevent similar systems being operated close together from communicating with each other.
- Call Display feature is standard.
- +12VDC operation.
- 2.4 GHz and 5.8 GHz models available.
- Signal Strength software for antenna alignment available at no charge.
- Encrypted, spread spectrum radio technology provides security.
- Available in Voice / Fax or Modem models.

Using the Teletics WOPX

Overview

The Teletics WOPX allows one regular POTS phone line to be extended over radio up to distances of 25 miles (30 kilometers). Applications include providing temporary phone service to remote or temporary locations, remote meter reading, phone service to cabins or base camps, or wireless phone services for machine to machine communications with modems.



There are four versions of the WOPX. The WOPX comes in two frequencies; 2.4 GHz and 5.8 GHz, and there are WOPX models for voice and fax service, and WOPX models for use with modems.

The WOPX is sold as a set with both a LINE and PHONE radio. Additional accessories that are required include antennas, cables, lightning arrestors, and consumables such as self fusing rubber tape to complete the installation. These can be provided by the Teletics Distributor which sold you the WOPX.

Making a Phone Call

Once installed, the WOPX system behaves identically to having a regular phone on a regular phone line. To make a phone call, you simply pick up the phone and dial the number you wish to reach.

Receiving a Phone Call

Receiving a phone call also works identically to having a regular phone on a regular line. When someone calls you, your phone will ring until you pick it up.

Data Connections

Each WOPX also has an Ethernet port for use with a computer. This Ethernet connection is similar to what is called 10BT Ethernet, both in performance and how it connects to your computer or network.

The Ethernet connection provided by a WOPX system is completely transparent to anything else being sent over the network. You should simply treat it as a "wireless wire". The data speed for the WOPX system is 12 Mbps. This is similar to standard office Ethernet speeds on 10BT Ethernet, and this connection is always faster than the internet connection backhaul provided by satellite or cellular that is provided to most sites.

You will have an RJ45 LAN connection on the cable modem or DSL modem provided by your Internet Service Provider (ISP), you can directly connect to your ISPs modem with a WOPX system.

Additionally, the Ethernet port of the WOPX can be used with a laptop and the Teletics signal strength software TRadio that can be downloaded from the Teletics website for doing antenna alignment. This is typically only required in installations where there is a significant distance between the LINE and PHONE radios.

Modems

The WOPX Modem product is suitable for use with Modems. Baud rates of up to 9600 can be accomplished over the WOPX link.

The WOPX system supports either Modem devices or standard phones. This is a WOPX system wide setting, meaning that one installation cannot have a mixture of phones and modems in one system. If a system is programmed for Modem operation, it will have a noticeable echo at one end of the telephone conversation. This is required for modem operation and is normal.

Range

The WOPX System can provide service across distances as far as 30 kilometers or 25 miles.

Five things affect the distance you can get with these units. They are:

1. The length of antenna cable between the WOPX unit and the antenna.
2. The type or quality of antenna cable used between the WOPX unit and antenna.
3. The type of antennas used.
4. Solid material of any kind (trees, buildings, power lines) in between the two antennas.
5. Antenna height.

Your distributor can help you determine the type of antenna kits you will require for any specific installation.

Install the two antennas where there is as much of a clear path in between them as possible.

Radio power at the antenna is greatly reduced by long antenna cables. Therefore, shorter antenna cables are much better than long ones, and should be used whenever possible. It is always better to run longer phone cables and shorter antenna cables.

Recommended Accessories, Cabling and Antennas

The number one support issue we encounter is with choices of antennas, cabling, and proper installation practices. One installation practice that is absolutely critical to a successful installation is for the installer to seal all RF connectors to prevent water getting inside the RF connectors. For longer range installations, understanding the type of antenna required for the installation is also critical to a successful installation.

Teletics recommends a good quality RF cable capable of 6GHz or better operation, with losses of less than 10dB per hundred feet. Many of our installations have only 3 dB cable loss between the WOPX and antenna. Our customers have had great success with LMR-400 and LMR-400 ultraflex in colder climates, on sites with less than 25 feet of cable between the WOPX radio and the outdoor antenna.

Another common failure is custom RF cables with cheap connectors, badly installed connectors, or cable assemblies that are not swept to ensure proper operation at the frequencies which the WOPX radio operates. It is highly recommended that any custom RF cables purchased or used with any Teletics equipment is tested at the frequency it will be used with, either 2.4 GHz or 5.8 GHz operation.

A qualified RF designer can quickly determine cable and antenna types for a good quality link. When in doubt, our Teletics distributors can assist you with antenna and cable selection.

Once again, we would like to emphasize that in all cases, a self fusing rubber tape should be applied to all RF connectors exposed to the elements, as well as proper “drip loops” need to be installed where the cable enters the trailer or building wall.

Proper Antenna Mounting

There are many types of antennas, but generally you will be using a directional antenna of some sort with the WOPX. It is crucial that the two antennas can "see" each other, **without any kind of object between them**.

In all cases, it is better to run longer telephone cables and shorter RF cables. If you are installing the WOPX in a building, the WOPX should be located as close to the antenna as practically possible, and the remaining distance to the phone or line connection run using cat3 cable, since the limitation on cat3 cable is over 5,000 feet, versus the maximum antenna distance from the WOPX to the antenna will be dictated by the RF cable chosen, but generally distances of more than 100 feet are not practical. Added to this is the cost. Good RF cable runs in the dollars per foot. Cat 3 cable is a fraction of that cost.

Antenna height is the most significant issue when trying to get ranges of 1 mile (1 kilometer) or greater. The following chart will give you some indication of minimum heights you must have the antennas above ground and any natural obstructions in order for the system to operate:

2.4 GHz Antenna Heights					
Distance between antennas	***Kms*** ***Miles***	***1*** ***(.63)***	***5*** ***(3.1)***	***10*** ***(6.2)***	***25*** ***(15.5)***
MINIMUM Antenna	Meters	6	13	18	28
Height	Feet	(19)	(41)	(58)	(92)

5.8 GHz Antenna Heights					
Distance between antennas	***Kms*** ***Miles***	***1*** ***(.63)***	***5*** ***(3.1)***	***10*** ***(6.2)***	***25*** ***(15.5)***
MINIMUM Antenna	Meters	4	9	12	18
Height	Feet	(12)	(27)	(38)	(60)

For example, a WOPX 5.8 GHz installation with a LINE and PHONE 5 kilometers apart would require that the antennas be 13 meters (41 feet) above any obstructions in between, such as trees, buildings, etc.

Antennas must also be of suitable specifications, based on power output and radio receiver sensitivity specifications provided in the specifications section of this manual.

Your distributor can assist you with proper antenna selection for your particular installation.

Connections

The WOPX **Phone** unit back connector panel looks like this:

Connectors are (Left to Right):

ANTENNA is for use with an external antenna and RF cable rated for 2.4 GHz or 5.8GHz operation. Please contact your Teletics distributor for antenna and RF cable assemblies made to your requirements.

DATA (RJ-45) is for connection to either a computer or a computer network. The DATA ports on all units in a WOPX system act like a computer hub. There is no routing between them, and each unit has equal priority. This port has automatic Ethernet cable detection, so it does not matter if the Ethernet cable you are using is a “straight thru” or “crossover” type of cable.

PHONE (RJ-11) is where the phone plugs in. Any standard phone capable of being used on a POTS line (like your phone at home) may be used with the WOPX. Additionally, this PHONE jack can be wired in parallel with a number of third party ringing devices, such as horn relays, or to multiple phones.

+12VDC is for providing power to the unit. If you look closely, you will notice that the pins inside this connector are numbered. +12VDC is required on pin 4, and ground is pin 1. Although the power consumption of the unit is 8W, it is highly recommended to use at least a 2A power supply, similar to the power adapter provided by Teletics. If you are using a power supply other than the unit supplied by

Teletics, it is strongly recommended that you use a commercial grade power supply suitable for the power situations that the unit might encounter and having a 2A current rating.

LINE units have a beige colored **LINE** RJ-11 connector in place of the **PHONE** connector. Otherwise, the connections are identical to a **Phone** WOPX unit. The **LINE** connector should be connected to a standard telephone (POTS) LINE, or to other communications equipment that provide an analog phone line plug. Examples include FXO ports on VSAT terminals, or interfaces that allow the use of a standard phone with cellular phones or two way radio systems.

WOPX LINE Radio Unit:

Warning !! – Possible Damage to Equipment !!

Powering up a WOPX unit without having an antenna connected will damage it! You MUST connect an antenna to the unit before powering it up!

Step by Step Installation Instructions:

(Refer to the wiring diagram on Page 4)

1. Determine the best installation location for the antennas at all locations. The higher, the better, and try to get the best visual line of sight without overhead lines, trees, light standards, etc. in between the two units.

2. You need to secure the antennas in some fashion on the buildings, so that they point directly at each other. You should also be aware that there is not only a front and back to an antenna; there is also a horizontal and vertical way of mounting them. Whether you mount them horizontally or vertically does generally not matter, as long as you mount them BOTH with the same orientation. For instance, if you have antennas that have rows of tines or spikes like in the wiring diagram (these are called yagi antennas) you should either mount both antennas with these spikes in line with the horizon, or both with the spikes running up and down. If you have another type of antenna, similar rules apply. Orient both antennas facing each other in the same up/down or side to side direction.

3. Once you have the antennas installed, connect the antenna cables to them and run these cables from the antennas to the location where you are mounting the WOPX Units. The WOPX Units require a weatherproof environment for their operation. Telco panels or communications rooms being a typical installation location, or inside an NEMA enclosure. Remember to provide a "drip loop" on the lowest part of the cable, or just prior to where it enters the building, to prevent rain from running along the cable and indoors.

4. If there are any connectors on the antenna cable that are exposed to outdoor weather, they MUST be sealed with a proper RF grade self fusing rubber tape (NOT ELECTRICIANS TAPE!!) If you do not do this properly, the system will work fine at first, but will eventually stop working over time, due to moisture getting trapped in the RF connectors.

5. Once you have completed installing the antenna cable, mount the WOPX to the wall or telco panel.

6. Screw the antenna cable to the WOPX.

Powering up

Once all WOPX units are connected to antennas, you can power them up. You can power up the radios in any order. Additionally, even if any unit is accidentally powered down, it will return to normal operation once it is powered back on and has time to completely initialize. There is never a requirement to power up units in a particular order. This is a feature of the system design, since most remote work environments have generated power that tends to be intermittent.

In most cases, it is prudent to use some sort of power conditioning product in line with the power adapter for the WOPX. A good quality power bar that has an equipment replacement guarantee is generally a good investment, and can be used to protect the other equipment already at the site.

Warning !! – Possible Damage to Equipment !!

Powering up a WOPX unit without having an antenna connected will damage it! You MUST connect an antenna to the unit before powering it up!

Front Panel Indicators (LEDs):

The WOPX units have a number of LEDs on the front panel:

Power indicates power has been applied to the unit.

LAN indicates that there is an active **LAN** connection to the unit, ie. There is a computer connected and it is on. This is the status of the physical connection. It does not indicate that there is an active internet connection. It simply means the wiring is correct. If there is no computer connected to the **LAN** port, this LED will not be on. The WOPX may still be used for phone operation in this state, ie., this LED does not need to be on for phone calls to operate.

Radio indicates that the Radio section of the unit is powered up and appears to be working. If the **Radio** LED is not on, the WOPX will not work properly in a system. You should check that the unit has been properly programmed. If programming does not make this LED turn on, you should assume that the WOPX needs servicing.

Error will come on during power up, but should turn off about 15 seconds after power is applied. If the **Error** LED stays on during normal operation, it might be an indication of a power surge or an indirect lightning strike presented through the LINE interface, the antenna, or the power system. If the Error LED comes on longer than 30 seconds after power up, the unit must be returned to a Teletics Service Centre.

Line indicates that the WOPX **LINE** unit is in the process of making a call or receiving a call through the phone line it is connected to. The best way to think of this LED is to assume that if it lights up, the system is trying to process your call.

Phone indicates that the phone attached to the WOPX unit has gone "off hook". This shows you that the phone is correctly attached to the WOPX unit.

Instructions for Use

Once all WOPX units have power applied, and they have had about a half minute to initialize, you may pick up the phone in the system and dial a regular phone number that you wish to talk to. There is nothing different about using the WOPX than using a regular phone. You simply dial a regular phone number to call out and when someone calls the WOPX system, it just passes to call through over the wireless connection.

When you receive a call, the phone simply rings, and the callerID is displayed as the call comes in.

The data port is also identical to plugging in to your standard LAN connection. If you can get an internet connection at the LINE end, you will get one at the PHONE end as well.

Troubleshooting

It is important to know the following:

- Dial tone is locally generated at the **Phone** WOPX unit. Dial tone does not indicate a phone line is working somewhere else in the system.

- If you pick up a phone attached to a WOPX and do not get dial tone prior to dialing a number, it has not completed its power up cycle, is not properly programmed, or has a radio failure.

- When you program a WOPX system for use with Modems, you will encounter a very noticeable echo at one end of the conversation over the system. This is due to a change in echo cancellation required for proper modem operation. This is normal.

- We have not yet found a standard telephone that does not work with the WOPX. However, a phone may have the wrong settings, or may not be designed to work on a standard POTS (home) phone line.

    - Some older phones have "pulse" and "tone" settings. Almost every phone in the world today uses "tone". A phone with a "pulse" dial setting will not work.

    - Some digital phones are designed for use only with office digital PBX systems. When in doubt, check the phone in question with a standard POTS (home) phone line, or a phone line in your office dedicated for use with a FAX machine.

- The WOPX phone jack may also be used to power such things as horn relays, etc. Again, we have not encountered any of these that do not work when installed according to their manufacturer's instructions.

- When using outside lines going through a company phone system, it is important to understand how they work relative to what you expect. For instance, if you have to dial an access code or a 9 prior to dialing out on a particular phone line, you will need to put these codes into the dial sequence when using the WOPX to access the line. When in doubt, it is always best to try dialing out on the outside line with a conventional phone prior to trying it with a **LINE** WOPX unit. Any number dialed into the WOPX requires that the entire number is entered at once, without a delay of any kind. For example, if you need to put a "9" in front of a phone number to dial out, you need to dial 914035551212 all at once, not 9, and then wait for a dial tone, and then 14035551212.

- Using the WOPX with a cordless phone system of a similar frequency is not recommended. Most manufacturers of these phones do not provide specifications on the exact frequency that they use, therefore it is impossible for us to determine which channels you should program into your WOPX units.

- When you make a phone call using the WOPX, how the dial tone behaves can provide some troubleshooting information. When having problems, you should always stay on the line for at least a minute and a half once you dial the number to see if the following occurs:

    - If you can dial the number and get the other party, but the call disconnects and you immediately get another dial tone within the first minute of the call, this indicates a

poor quality radio link. There is a problem with the antennas, cables, or path between them. If this happens after the system has been installed and working for some time, the problem is either RF connectors that have moisture in them, or antennas that have been hit by an indirect lightning strike. See the information below on antenna installation issues and radio problems.

- If the line goes quiet for over one minute, and you do not ever hear a ring or busy, you should check if the LINE LED is illuminated at the **Line** WOPX unit that you are trying to call. It will most likely be on, indicating that the system has made the connection, but the cable between the LINE WOPX and the outside line is at fault.
- If you get a busy tone after about 35 to 45 seconds of silence, you need to try the call again to verify a similar result. If you get this type of response in all cases, you may have a defective set of WOPX units. You should check to see if the serial numbers of both units are identical, or if there are antenna or RF cable issues.

Radio problems generally show up as either inability to call from one WOPX to another, or the call drops within the first minute. What happens when the call drops is that either one end or both ends hears the conversation abruptly end, followed immediately by dial tone. This problem can be caused by a number of issues, including:

- Bad antenna(s)
- Water inside the antenna(s)
- Cabling related issues
    - Poor quality connectors
    - Cross threaded connector on WOPX and cable
    - Bad cable assembly practices
    - Cable assemblies not tested / rated for frequency of operation
- Bad antenna model selection for the site in question
- Questionable radio line of sight to master WOPX
- Interference in the same frequency used by the WOPX system
- A bad radio in the WOPX unit

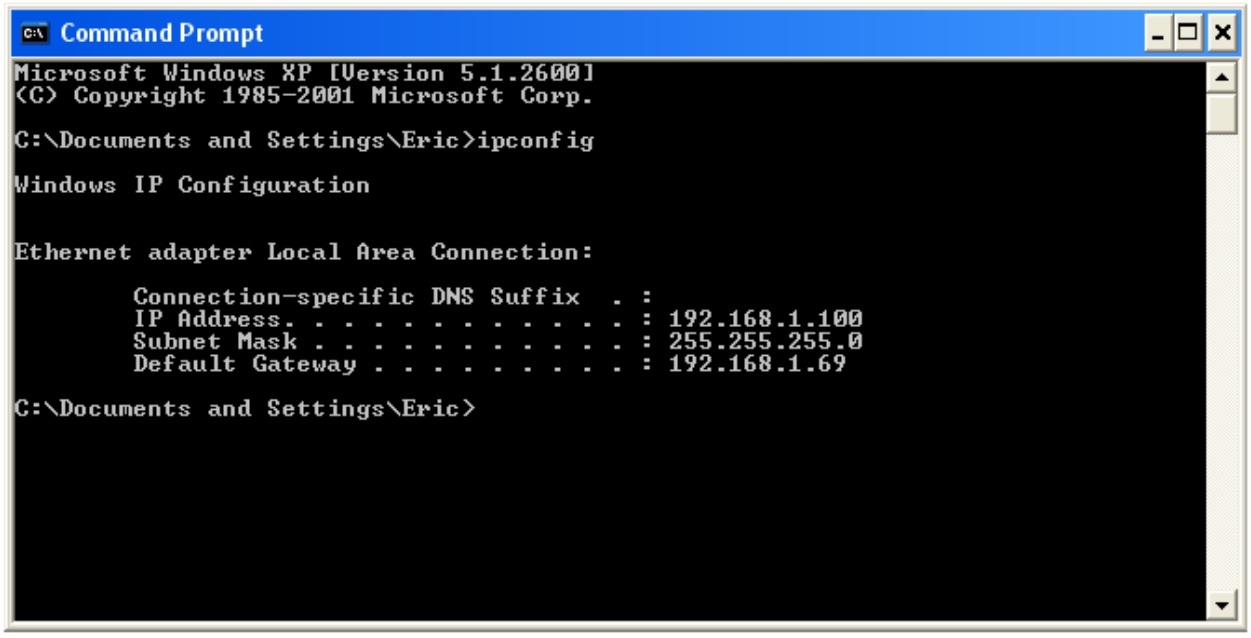
The best way to diagnose a radio path problem is to dial out from a WOPX system. If you can maintain a phone call for longer than one minute consistently over the connection, you can assume that the system is working properly.

It is also important to understand that once you can use the WOPX to call out and receive phone calls, the data portion of the WOPX is also operating. Telephone calls use exactly the same radio path and programming that the Ethernet port on the WOPX uses. In essence, the phones are just an extension to the data network.

However, if you are experiencing problems accessing the internet try pinging one of the other computers or routers located on the same network as the WOPX system first. To do this, go to a computer on the WOPX system, and open up a command prompt window. (Usually under Start, Programs, Accessories, Command Prompt.)

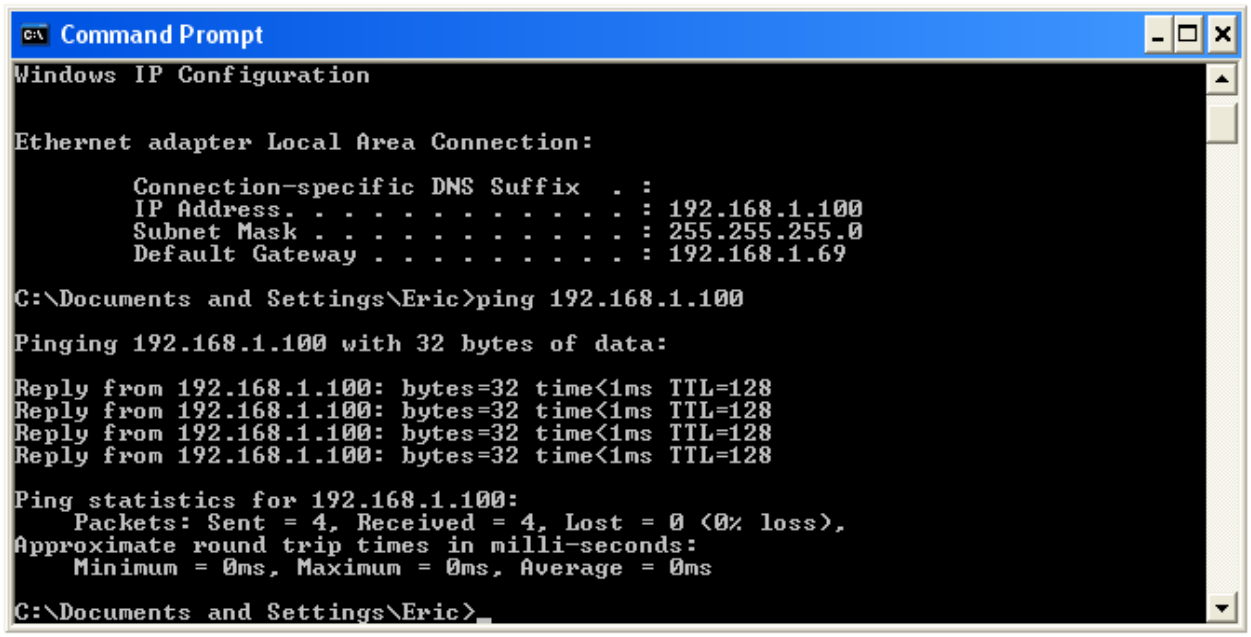
Type this command: ipconfig

Assuming that you have internet access, you should see some basic network addresses, and more importantly, something called a default gateway address:



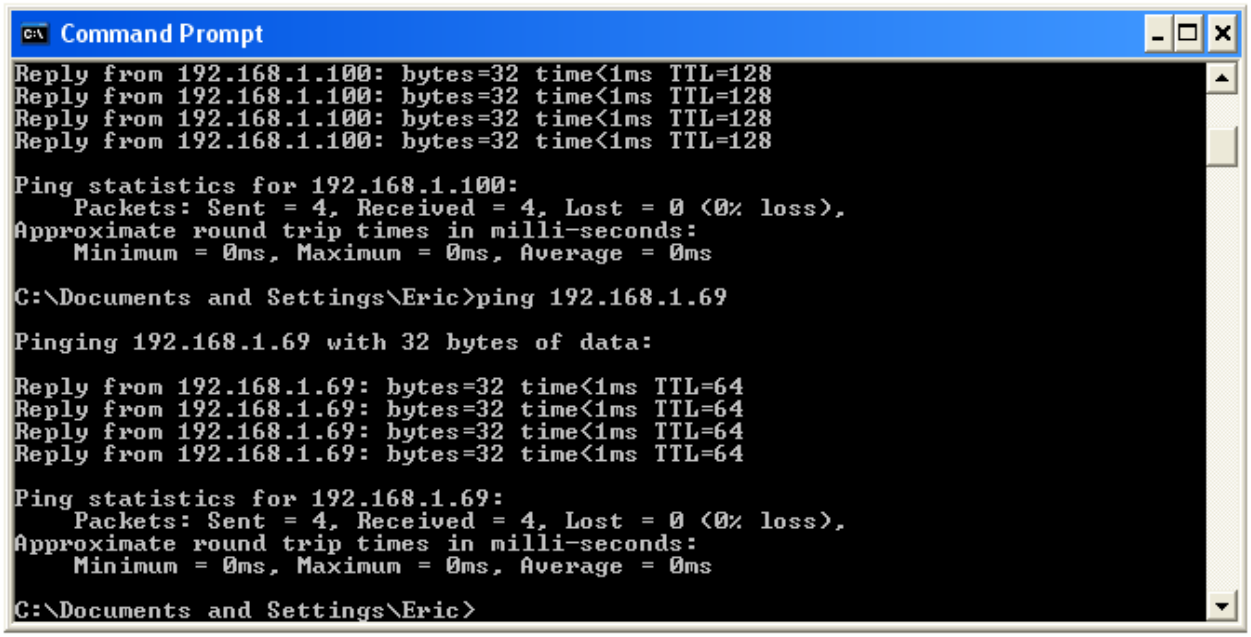
First, you should ping the IP address:

Ping 192.168.1.100 (or whatever numbers you see next to IP Address when you ran ipconfig):



If you get a reply back from the IP address, it means your network port in the computer seems to be working. Next try to ping your default gateway address:

Ping 192.168.1.69 (again, use whatever numbers are next to Default Gateway on your computer):

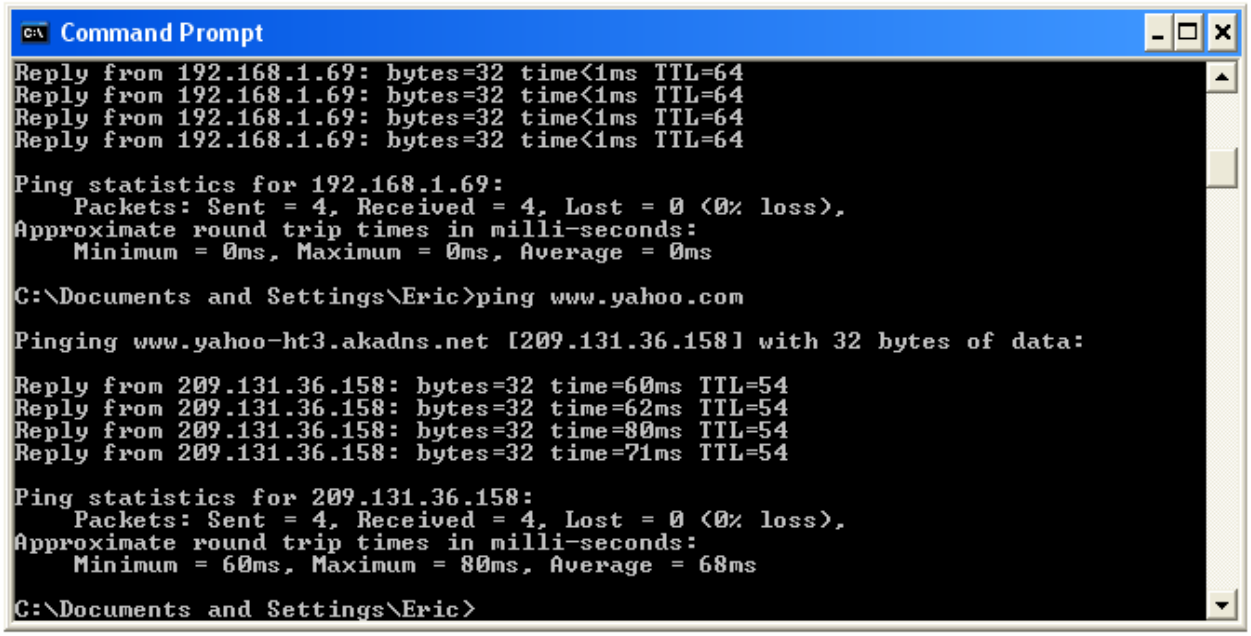


If you get a reply back, the gateway on the network is connected to the computer you are working on, and the WOPX units are working correctly. However, there are a number of other settings that you

need for each computer (and some from your internet service provider) to get to the point where you can “surf the internet”.

Assuming that everything works so far, try:

Ping www.yahoo.com:



If you get a reply back, you should be okay to assume that the internet connection is fine at the computer you are currently working on. If this ping produces an error, you can assume that there is something wrong with the DNS addresses settings in the “Network Settings” section of Windows. Your internet service provider might be able to assist you with what these settings should be.

Keep in mind that the WOPX system behaves exactly like an Ethernet cable does. Also, if you can make a phone call between all the WOPX masters and stations, any networking problems are usually the result of settings in Windows on the computers, or how the internet access and routers are programmed.

In general, if you can make a phone call with the WOPX, the next person to give you help would be the internet service provider, or whoever is providing internet access to the site, or your local company LAN administrator.

WOPX Specifications

Phone Connector	Standard RJ-11
Data Connector	Standard RJ-45
Modem Data Speed Supported	Up to 9600 Baud
Antenna Connector	N Female
Radio Type 2.4GHz	2.4 GHz DSSS License Free
Radio Output Power	1W / +30 dBm
Radio Receive Sensitivity	-89 dBm @ 10 -5 BER
Radio Type 5.8GHz	5.8 GHz DSSS License Free
Radio Output Power	400 mW / +26 dBm
Radio Receive Sensitivity	-89 dBm @ 10 -5 BER
Maximum Range	25 kms / 15 Miles
Power Required	12 VDC @ 2A
Operating Temperature Range	-40C to +55 C / -40F to +130 F
Dimensions	7.6” x 6.1” x 2.25”
Shipping Weight, including packaging	3.8 kgs / 8.4 lbs

Warranty Statement:

Teletics warrants the WOPX to be free of defects of materials and workmanship for a period of one year after purchase by the original owner.

Teletics will repair or replace, at its option, any WOPX unit that fails to perform the task it was designed for under normal use, provided the WOPX is returned, at the cost of the owner, to Teletics, or one of Teletics Authorized Repair Facilities in the United States or Canada. Items returned for repair must be accompanied with a problem description and original proof of purchase, such as an invoice.

Any operation of the WOPX outside of specified temperatures, specified input power, environment, or in a manner specified as harmful in this manual will void any warranty. Additionally, any attempted repair or dismantling of any Teletics product, in any way, will void all warranties.

In no event shall Teletics liability exceed the original purchase price of the product from direct, indirect, special, incidental, or consequential damages from the use, or misuse of this product.

Intended Use Statement:

This product is intended for industrial communications use. Installation is to be performed by qualified Radio Technicians.