



Model 673B01

Echo® Receiver, 916 MHz

Installation and Operating Manual

**For assistance with the operation of this product,
contact the PCB Piezotronics, Inc.**

Toll-free: 800-959-4464

24-hour SensorLine: 716-684-0001

Fax: 716-684-3823

E-mail: imi@pcb.com

Web: www.imi-sensors.com



Repair and Maintenance

PCB guarantees Total Customer Satisfaction through its “Lifetime Warranty Plus” on all Platinum Stock Products sold by PCB and through its limited warranties on all other PCB Stock, Standard and Special products. Due to the sophisticated nature of our sensors and associated instrumentation, **field servicing and repair is not recommended and, if attempted, will void the factory warranty.**

Beyond routine calibration and battery replacements where applicable, our products require no user maintenance. Clean electrical connectors, housings, and mounting surfaces with solutions and techniques that will not harm the material of construction. Observe caution when using liquids near devices that are not hermetically sealed. Such devices should only be wiped with a dampened cloth—never saturated or submerged.

In the event that equipment becomes damaged or ceases to operate, our Application Engineers are here to support your troubleshooting efforts 24 hours a day, 7 days a week. Call or email with model and serial number as well as a brief description of the problem.

Calibration

Routine calibration of sensors and associated instrumentation is necessary to maintain measurement accuracy. We recommend calibrating on an annual basis, after exposure to any extreme environmental influence, or prior to any critical test.

PCB Piezotronics is an ISO-9001 certified company whose calibration services are accredited by A2LA to ISO/IEC 17025, with full traceability to SI through N.I.S.T. In addition to our standard calibration services, we also offer specialized tests, including: sensitivity at elevated or cryogenic temperatures, phase response, extended high or low frequency response, extended range, leak testing, hydrostatic pressure testing, and others. For more information, contact your local PCB Piezotronics distributor, sales representative, or factory customer service representative.

Returning Equipment

If factory repair is required, our representatives will provide you with a Return Material Authorization (RMA) number, which we use to reference any information you have already provided and expedite the repair process. This number should be clearly marked on the outside of all returned package(s) and on any packing list(s) accompanying the shipment.

Contact Information

PCB Piezotronics, Inc.
3425 Walden Ave.
Depew, NY14043 USA
Toll-free: (800) 828-8840
24-hour SensorLine: (716) 684-0001
General inquiries: info@pcb.com
Repair inquiries: rma@pcb.com

For a complete list of distributors, global offices and sales representatives, visit our website, www.pcb.com.

Safety Considerations

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the precautions required to avoid injury. While our equipment is designed with user safety in mind, the protection provided by the equipment may be impaired if equipment is used in a manner not specified by this manual.

Discontinue use and contact our 24-Hour Sensorline if:

- Assistance is needed to safely operate equipment
- Damage is visible or suspected
- Equipment fails or malfunctions

For complete equipment ratings, refer to the enclosed specification sheet for your product.

Definition of Terms and Symbols

The following symbols may be used in this manual:



DANGER

Indicates an immediate hazardous situation, which, if not avoided, may result in death or serious injury.

**CAUTION**

Refers to hazards that could damage the instrument.

**NOTE**

Indicates tips, recommendations and important information. The notes simplify processes and contain additional information on particular operating steps.

The following symbols may be found on the equipment described in this manual:



This symbol on the unit indicates that high voltage may be present. Use standard safety precautions to avoid personal contact with this voltage.



This symbol on the unit indicates that the user should refer to the operating instructions located in the manual.



This symbol indicates safety, earth ground.



PCB工业监视和测量设备 - 中国RoHS2公布表

PCB Industrial Monitoring and Measuring Equipment - China RoHS 2 Disclosure Table

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
住房	0	0	0	0	0	0
PCB板	X	0	0	0	0	0
电气连接器	0	0	0	0	0	0
压电晶体	X	0	0	0	0	0
环氧	0	0	0	0	0	0
铁氟龙	0	0	0	0	0	0
电子	0	0	0	0	0	0
厚膜基板	0	0	X	0	0	0
电线	0	0	0	0	0	0
电缆	X	0	0	0	0	0
塑料	0	0	0	0	0	0
焊接	X	0	0	0	0	0
铜合金/黄铜	X	0	0	0	0	0
本表格依据 SJ/T 11364 的规定编制。						
0：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。						
X：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。						
铅是欧洲RoHS指令2011/65/ EU附件三和附件四目前由于允许的豁免。						

CHINA RoHS COMPLIANCE

Component Name	Hazardous Substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Chromium VI Compounds (Cr(VI))	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
Housing	O	O	O	O	O	O
PCB Board	X	O	O	O	O	O
Electrical Connectors	O	O	O	O	O	O
Piezoelectric Crystals	X	O	O	O	O	O
Epoxy	O	O	O	O	O	O
Teflon	O	O	O	O	O	O
Electronics	O	O	O	O	O	O
Thick Film Substrate	O	O	X	O	O	O
Wires	O	O	O	O	O	O
Cables	X	O	O	O	O	O
Plastic	O	O	O	O	O	O
Solder	X	O	O	O	O	O
Copper Alloy/Brass	X	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364.

O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

X: Indicates that said hazardous substance contained in at least one of the homogeneous materials for this part is above the limit requirement of GB/T 26572.

Lead is present due to allowed exemption in Annex III or Annex IV of the European RoHS Directive 2011/65/EU.

Echo[®] Wireless Receiver User's Manual

Model 673B01(916 MHz) / Model 673B02 (868 MHz)



Table of Contents

FCC NOTICE – Model 673B01 Only	3
FCC ID: ZOC-IMI673A01	3
INDUSTRY CANADA (IC) NOTICE – Model 673B01 Only.....	3
IC: 9732A-IMI673A01	3
Introduction.....	4
Proper Handling	4
Receiver Connections	5
Connection A – Waterproof Ethernet	6
Connection B – MIL Connector	6
Connection C – N Antenna Connection.....	6
Locating and Installing the Receiver	7
Configuring the Receiver	8
Setting a Static or Dynamic IP Address.....	8
Band Selection	10
Serial Port Output Window.....	11

FCC NOTICE – Model 673B01 Only

FCC ID: ZOC-IMI673A01

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.

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

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

INDUSTRY CANADA (IC) NOTICE – Model 673B01 Only

IC: 9732A-IMI673A01

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Introduction

The Echo[®] Model 673B01 Receiver is a one-way wireless communication receiver operating in the 902-928 MHz unlicensed ISM Band. The Echo[®] Model 673B02 Receiver is identical but operates at 868 MHz. Both use an exclusive Extended Range RF technology, and both receive wirelessly transmitted vibration data from Echo[®] Wireless Vibration Sensors and EchoPlus[®] Wireless Junction Boxes with matched frequency transmitters. The receivers output the received accelerometer measurements to a computer or server running Echo[®] Monitoring Software through a standard Ethernet TCP/IP connection on port 10000. The data is stored in a Microsoft[®] SQL database and can be displayed with the Echo[®] Data Presentation portion of the Echo[®] Monitoring software. For details on system and software installation, see the *Echo[®] Wireless Vibration System Reception Survey and Installation Manual* and the *Echo[®] Monitoring Software User's Manual*.

Proper Handling

Proper handling and location of the Echo[®] Receiver is critical to correct operation and preventing damage. The box is rated at MIL-STD-810, Method 506.4 Procedure I and MIL-STD-810, Method 510.4 Procedures I and II. While it can be used in areas where there is some contact with water and the elements, it is not recommended that it be placed in an area where it will be subjected to heavy sprays or harsh weather. The receiver has an operating temperature range of -25° to +120° F (-32° to +49° C). Exposure to temperatures outside of this range may result in incorrect operation. It has a storage temperature range of -28° to +160° F (-33° to +71° C). Exposure to temperatures outside this range may result in damage to the electronic circuits.

Warning: Do not attempt to remove the cover of the Echo[®] Receiver. There are no customer serviceable components inside. Removing the cover will void the warranty.

Receiver Connections

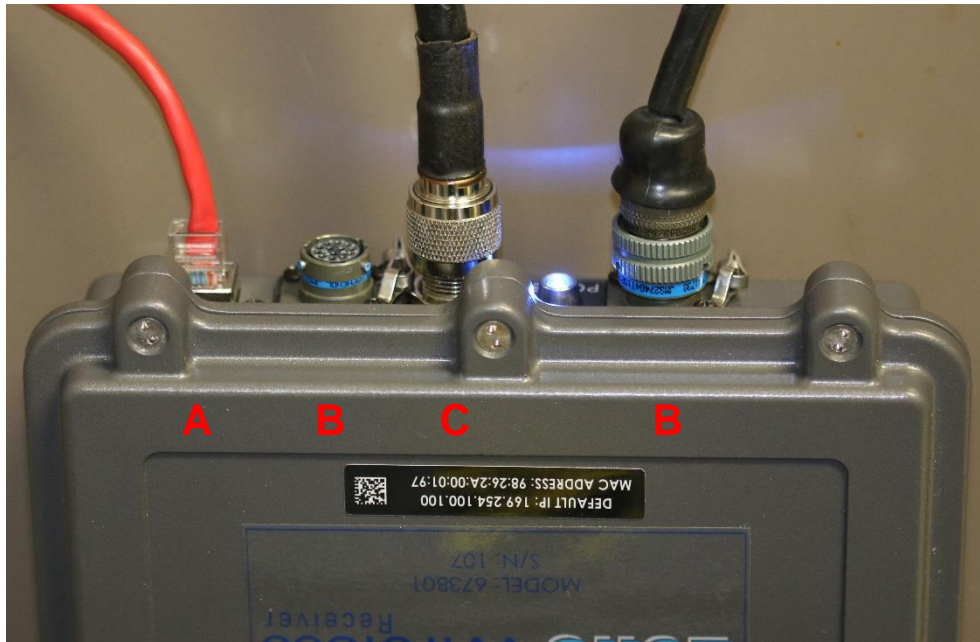
The Echo[®] Receiver has 4 connectors and an LED mounted on the side of the unit, see photo below. There are two identical and interchangeable MIL style bayonet connectors for power and RS-232 (serial cable), one RJ-45 Waterproof Ethernet connector, and 1 N-female antenna connector. Labels for these connectors are found on the bottom of the receiver.

Note: The MIL connectors can be used interchangeably for power or RS-232 serial interface.

Note: The receiver requires an optional Model 009M201 Echo[®] Receiver Serial Cable to use the serial port on the receiver.

Note: In order to be waterproof, a waterproof Ethernet cable with screw on connector must be used.

Location	Connector Type	Function	Quantity
A	RF-45, Waterproof Ethernet	Network Cable	1
B	MIL	Power Cable or Serial Cable	2
C	N-female	Antenna	1



Connection A – Waterproof Ethernet

The Ethernet connector is used to connect the receiver to a network or stand alone computer. Any standard Ethernet cable (not provided) can be used to connect the receiver to a network. However, an industrial grade waterproof Ethernet connector may also be used and may be a better choice for dirty industrial environments because the boot will provide some additional protection. **A waterproof Ethernet connector is required to maintain the IP67 rating.**

Note: If you choose to connect the receiver output directly into a stand alone computer a crossover cable is recommend in place of a standard Ethernet cable.

Connection B – MIL Connector

The use of the MIL connectors is completely interchangeable between power and the serial interface. These connectors are used for two purposes. The first is for powering the Receiver. The supplied power adaptor has a mating MIL connector. The power adapter requires 100 to 240 VAC, 47 – 63 Hz line power. It provides the receiver with 12VDC power. When power is connected to the receiver, the blue LED will illuminate indicating the unit is on. This LED also functions as a serial port activity indicator; it will blink whenever the serial port is active.

Warning: Do not apply line power directly to the receiver. Damage to the unit will occur.

Caution: It is not recommended to use a different 12 VDC power source than the supplied adaptor. If you intend to use a 12 VDC power supply other than the one supplied, contact IMI for important information.

The MIL connectors on the receiver are also used for programming and updating the Echo[®] Receiver. An optional Model 009M201 Echo[®] Receiver Serial Cable (RS232 to MIL connector) is required to connect the receiver to a computer. For specific information on how to program or update the receiver, consult the “Programming the Receiver” section of this manual.

Connection C – N Antenna Connection

The N connector is used for the antenna input. A small antenna with appropriate adaptors is supplied with the receiver. This antenna will allow you to conveniently get started with the system, run some tests, and check things out. Most applications, however, will require a higher gain antenna (not supplied) connected to the receiver with a low loss antenna cable (not supplied). For specific instructions on selecting, locating, and mounting a remote antenna, please refer to the *Echo[®] Wireless Vibration System Reception Survey and Installation Manual*.

Note: It is recommended that a low loss antenna cable (-4 dB loss / 100 ft) be used with an external higher gain antenna.

Locating and Installing the Receiver

The receiver must be located a near line power source and an Ethernet network connection. The antenna should be located centrally to the area of interest and up high. Typically, a 6dBi gain omnidirectional antenna (not provided) is a good choice, although circumstances may suggest something different, like a Yagi directional antenna. Use low loss antenna cable and keep the length as short as possible, typically less than 100 feet. A good strategy is to map out your facility and mark possible locations for the receiver(s). Based on the possible receiver locations and the required measurement point locations, run a reception survey in the plant to determine the optimal location(s) for the receiver(s). For detailed information on this process, see the *Echo® Wireless Vibration System Reception Survey and Installation Manual*.

The receiver is included with mounting hardware that can be used to secure it in place. The receiver should be physically located where it can be accessed with the programming cable should settings need to be adjusted.



You may use the short antenna provided with the receiver for testing, setup, and in cases where the sensors are close to the receiver. To improve the performance, a 6 dBi gain omnidirectional antenna is generally recommended. It should be mounted in an elevated location for the best performance. In some cases, use either a higher gain omnidirectional antenna (generally not to exceed 8 dBi) or a higher gain directional Yagi antenna. The antenna should be connected to the receiver using low loss antenna (-4 dB loss / 100 ft) cable. For specific information consult the *Echo® Wireless Vibration System Reception Survey and Installation Manual*.

Note: Proper location of the antenna can make a dramatic difference in system performance. Care should be given to determining the optimal locations for the receiver and antenna.

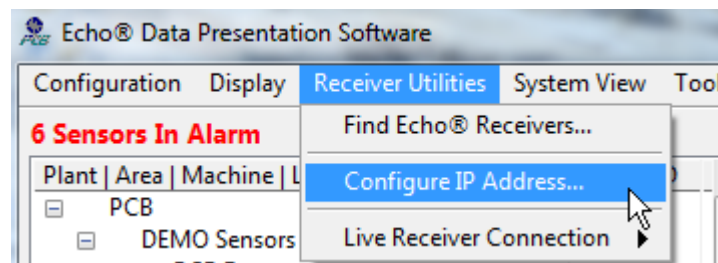
Configuring the Receiver

The receiver can be configured for a static or dynamic IP address. It can also be programmed to use one of 12 independent RF frequency bands for the 673B01 units and one of 9 independent RF frequency bands for the 673B02 units. The following equipment is required for configuring the receiver:

- Echo® Receiver
- Power supply
- Receiver programming cable
- Computer with the Echo® Monitoring Software installed

Setting a Static or Dynamic IP Address

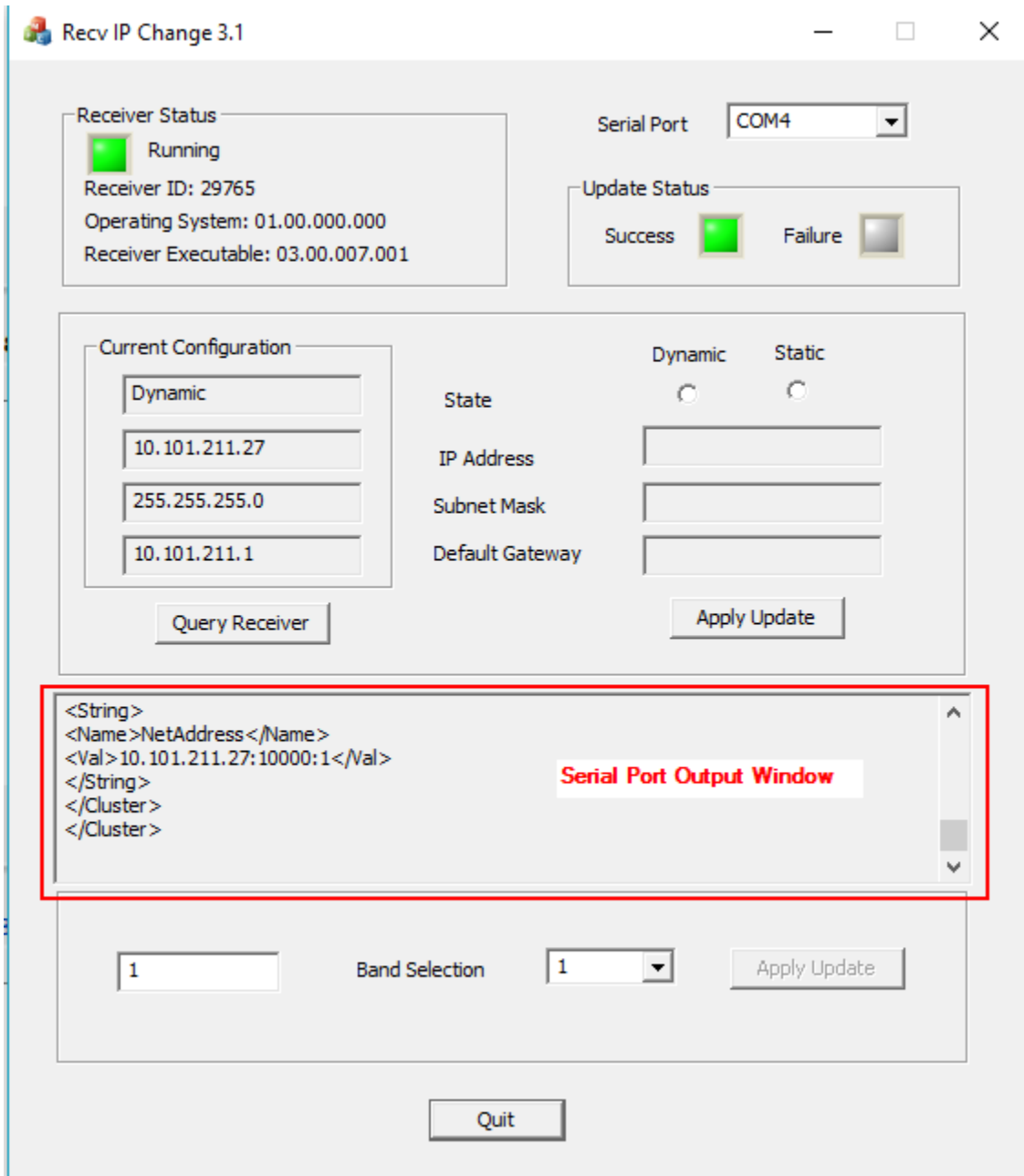
To check the status of the IP configuration, launch the Echo® Monitoring Software, click on **Receiver Utilities**, and then click **Configure IP Address**.



When activated the screen shown below will appear. If you want the DHCP server on your network to assign an IP address to the receiver automatically when the receiver powers up then select the Dynamic option shown below and activate the Apply Update

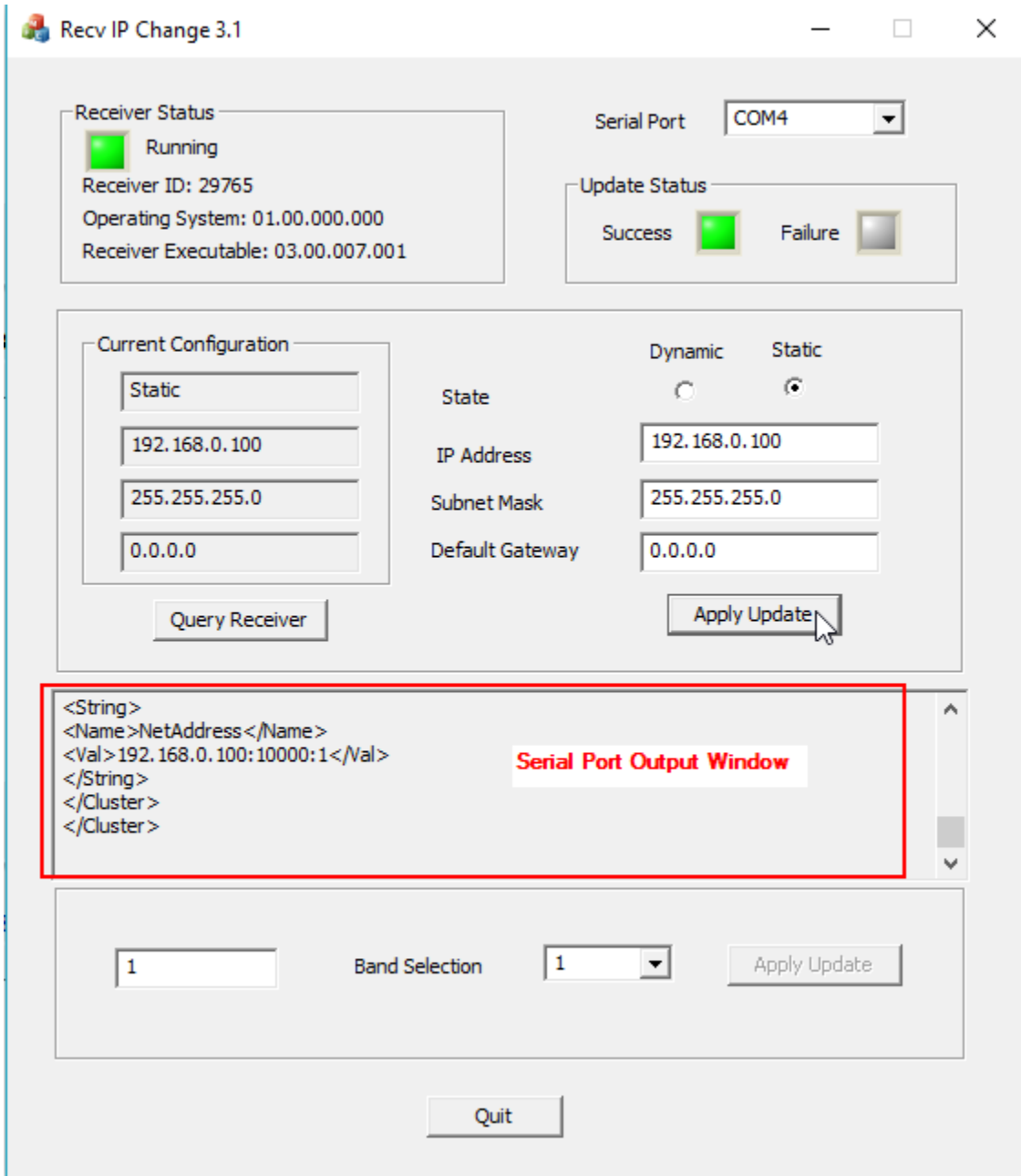
button. Changes made to the receiver will take approximately 30 seconds to complete. When complete the **Success** status light should illuminate.

Note: The center of the screen displays the output of the receiver's serial port. This can be useful for troubleshooting purposes.



To set a static IP address on the receiver (recommended) select the Static option and fill in the IP address parameters as shown below. Next, activate the Apply Update button and

wait for the assignment to complete (~30 seconds). When complete the fields on the left will reflect the new assignment and the Success light should be lit.



Band Selection

Using the Band Selection control, select the desired band:

- 1-12 for 673B01 916 MHz systems
- 1-9 for 673B02 868 MHz systems

Then click the Apply Update button to the right of the Band Selector. The new band number will show in the band indicator on the lower left side of the screen.

Serial Port Output Window

The receiver transmits Id messages (IP address and port information) and Transmission reports on its serial port as well as its LAN connection. Id messages occur every 3 seconds and transmission messages are output when they are received.

The Serial Port Output window displays any RS-232 port activity. It is useful for troubleshooting purposes. The blue power indicator LED also shows serial port activity by blinking whenever the serial port is active.

Echo[®] Wireless Vibration System Reception Survey and Installation Manual



Contents

Introduction.....	3
Reception Survey Preparation.....	3
Antenna Location.....	3
Sensors per Receiver.....	3
Plant Drawing.....	4
Install Software.....	4
Equipment Setup.....	4
Receiver Setup.....	5
Set the PC Ethernet IP Address.....	9
Collect Sensor transmissions using the Live Data Screen.....	10
Running the Survey.....	12
Antenna Placement.....	12
Baseline Measurement.....	12
Collecting the Data.....	13
Permanent Installation.....	14
Antenna and Receiver.....	14
Echo [®] Sensors.....	14
EchoPlus [®] Junction Boxes.....	15
Echo [®] Monitoring Software.....	15

Introduction

The Echo[®] Wireless Vibration System is used for unattended predictive maintenance and condition monitoring of plant equipment. Echo[®] Wireless Vibration Sensors and EchoPlus[®] Wireless Junction Boxes wake up periodically and transmit vibration data wirelessly to one or more Echo[®] Receivers that are connected to a network or directly to a computer. Vibration data are automatically compared against alarm values, machinery status displayed in an alarm panel, and alarm notifications sent via email if desired. The data can be viewed, reported, and trended using the Echo[®] Monitoring Software. This manual is intended to assist users with the initial installation of the Echo[®] Wireless Vibration System, including the determination of optimum antenna/receiver placement, and running a plant wireless reception survey. Specific instructions for setting up Echo[®] Wireless Vibration Sensors, EchoPlus[®] Wireless Junction Boxes, and Echo[®] Receivers can be found in their respective manuals.

Reception Survey Preparation

Antenna Location

Prior to installing the Echo[®] Wireless Vibration System, it is highly recommended that a wireless reception survey be run in your plant. This will help determine what coverage can be achieved in your plant and whether or not it can be covered with a single antenna and receiver. The distance between transmitters and receivers (sensors and junction boxes are transmitters) varies widely depending on the infrastructure in the plant. Typically, a 1000 to 2500 foot reception radius can be achieved although distances can be as low as 250 to 300 feet (e.g., through concrete walls) and as high as 1 to 2 miles in open areas, although these distances are less common. Since reception distance is specified as a radius from the antenna location, a central location will normally work better than corner location in a plant. If more than one antenna and receiver are used, locations can be distributed to give the best coverage. The Echo[®] System transmits and receives point-to-point; no repeaters, bridges, routers, gateways, nodes, or other intervening network devices are required.

Sensors per Receiver

The factory default transmission interval (i.e., the time between measurements) for Echo[®] Sensors and EchoPlus[®] Junction Boxes is 8-hours or 3 times per day. At this collection interval, it is recommended that the number of sensors or channels be limited to 400 per receiver. This is based on a statistical analysis where transmitters are started in an “intelligent” manner (i.e., staggered), taking into account clock drift, and assuming no more than a 1% collision rate. That means that no more than 1% of the transmissions may be lost due to too many simultaneous transmissions. Depending on the plant conditions, this number could be better. If either more than 400 channels or more than 3

measurements are required per day, multiple receivers can be used. Keep in mind that 3 measurements per day is 90 measurements per month, which is about 90 times more often than most walk around PM programs. 916 MHz Sensors, junction boxes, and receivers have 12 programmable RF Bands. 868 MHz equipment has 9 programmable RF Bands. For a 5% collision rate, up to 2000 sensors can be assigned per receiver.

Plant Drawing

Obtain a plant drawing that includes some basic overall dimensions on it. If one is not available, make a sketch of the plant (a crude sketch will work if nothing better is available) and include some overall plant dimensions as best you can. Mark the areas on the drawing where equipment is located that needs to be monitored. Also mark on the drawing where Ethernet drops are available or could be located. Generally speaking, the antenna should be located in an elevated, central, open area for best reception. A **low loss** (1 dB per 25') antenna cable will run from the antenna to the receiver. If possible, keep this run to 25' or less to reduce losses, however, up to 100' can be used if necessary. The receiver can be mounted at a convenient location but requires 120 VAC power and an Ethernet drop in reasonably close proximity.

Sequentially number points on the drawing in the various areas of the plant where equipment is located to be monitored. Pick a couple of representative points in each area and select one in the "worse case" location of each area. These are the locations where a test transmission will be made to determine reception strength. This drawing will be used to map the receiver(s) coverage and create a reception map.

Install Software

Install the Echo[®] Monitoring Software on a laptop or other computer that can be moved around the plant. Using a moveable computer is the most efficient way to run a survey and gives you the ability to easily move the antenna and receiver around the plant to find optimum locations. This does not need to be the computer that will be used for the actual monitoring system. This installation will be used temporarily for the survey. A laptop computer with the receiver directly connected to it via its Ethernet port is a very convenient way to do this. See the *Echo[®] Software User's Manual* for details on loading and operating the software. You will need administrative rights to load the software and will most likely require the help of your IT department.

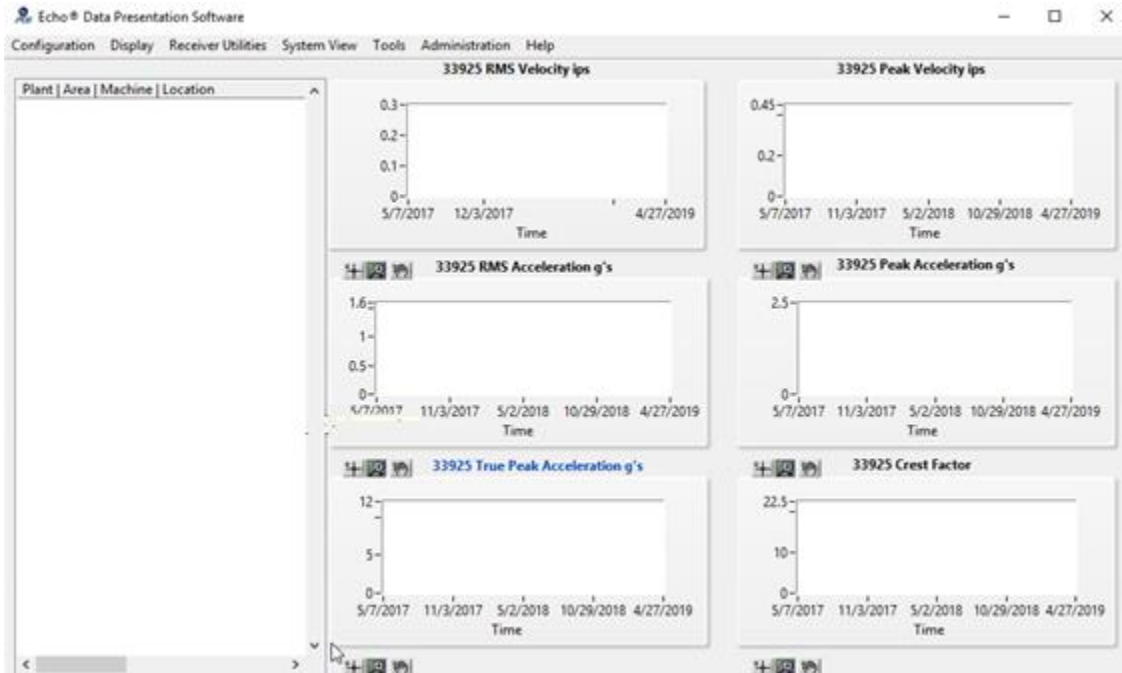
Alternatively, the software can be installed on a computer connected the local area network and the receiver connected to an Ethernet drop located in the plant, however, this is not recommended for the survey.

Equipment Setup

Receiver Setup

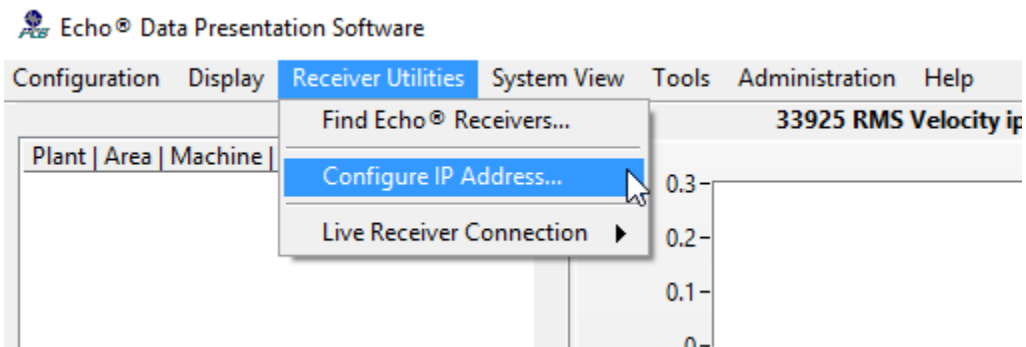
Power up the receiver and wait at least 1 ½ minutes for the receiver to boot up and initialize.

Launch the Echo® Data Presentation Software. You should see a screen similar to the one below.

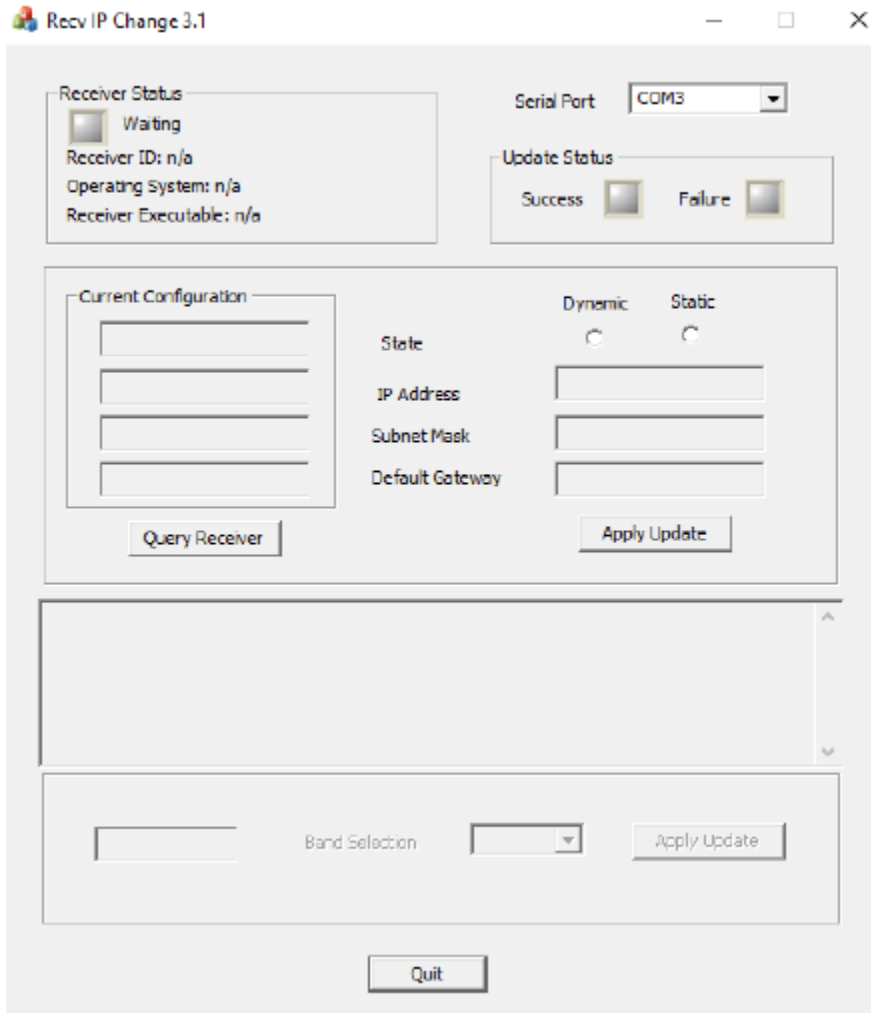


Connect the Model 009M201 Echo® Receiver Serial Cable between one of the Power/RS232 connectors on the receiver and an RS232 serial port on your computer. If you do not have an RS232 port you will need to install a USB to RS232 converter (not supplied). Also, connect a crossover Ethernet cable between the receiver and your computer.

Click on the Receiver Utilities on the menu bar. You should see a screen similar to the following, and then click on Configure IP Address.



You should see a screen similar to the following.



Select the correct Serial Port using the pull down box in the upper right hand corner of the screen. The Receiver Status Running box should change colors to green when the correct port is selected. The Current Configuration box should get filled in similar to that shown in the screen below. If the Current Configuration box does not fill in, then click on the Query Receiver button

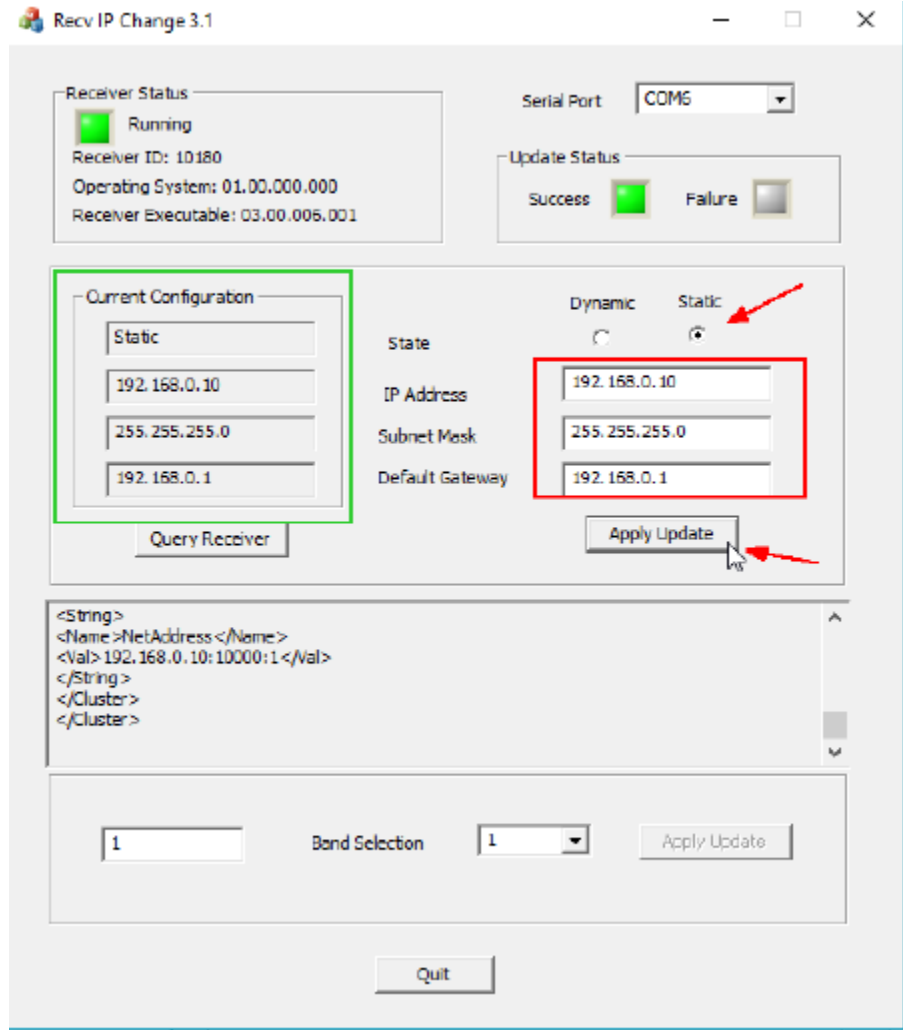
NOTE: The PC used for the survey and the Echo Receiver **MUST** be on the same Ethernet subnet to communicate. Typically for a standalone setup like this you would set the Receiver and the PC to 192.168.0.xxx addresses where xxx will be the range of 1-255 and will be only difference in their IP addresses.

For our example set the receiver to 192.168.0.10 using the fields highlighted in red below

- Select 'Static'
- Set the IP address to 192.168.0.10
- Set the subnet mask to 255.255.255.0
- Set the Default Gateway to 192.168.0.1
- Click the Apply Update button

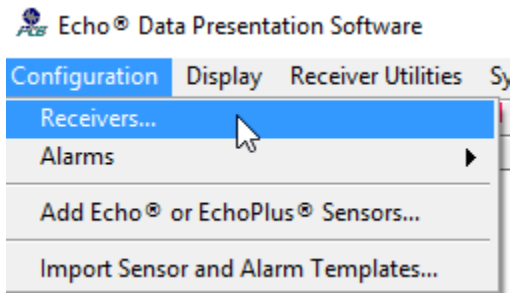
Wait ~30 seconds. The new address will display in the Current Configuration indicator (The PC will be set to 192.168.0.1)

Alternatively make a note of the IP address in the Current Configuration box and ensure the PC matches the subnet.

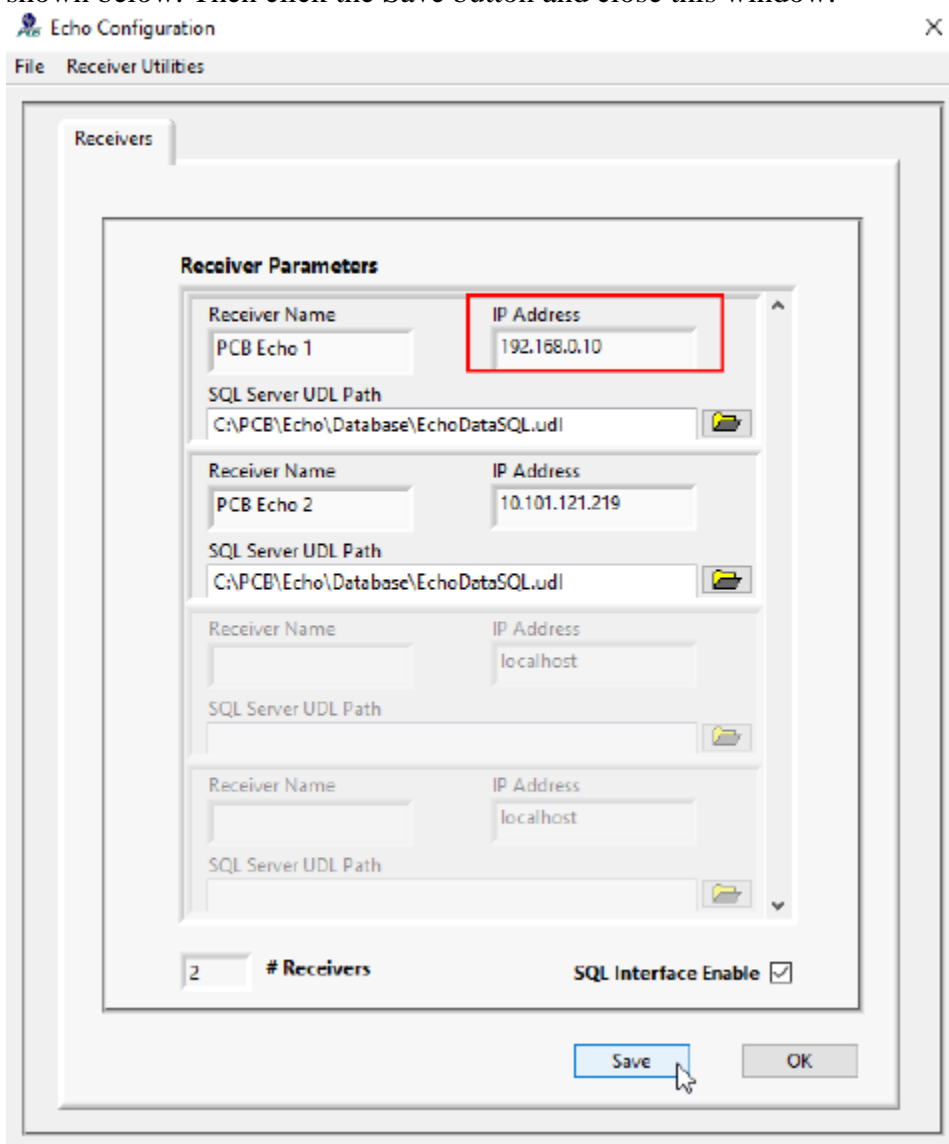


Click the Quit button to return to the Echo® Data Presentation Software.

On the main menu bar select Configuration | Receivers....



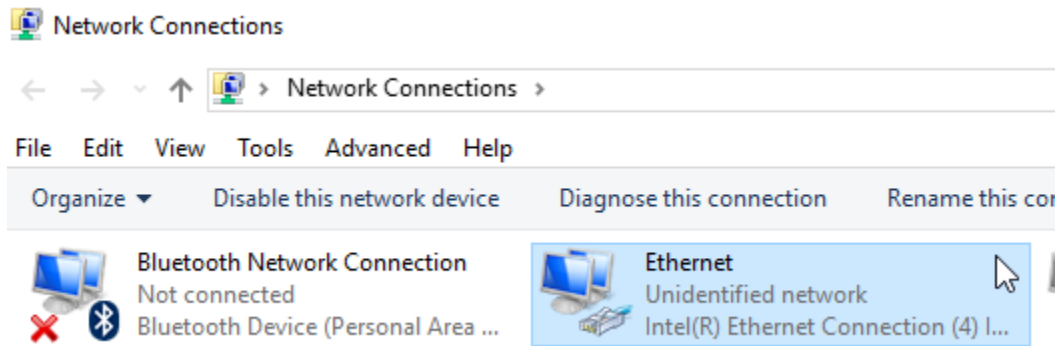
Enter the Receiver IP Address into the IP Address box on the Configuration screen as shown below. Then click the Save button and close this window.



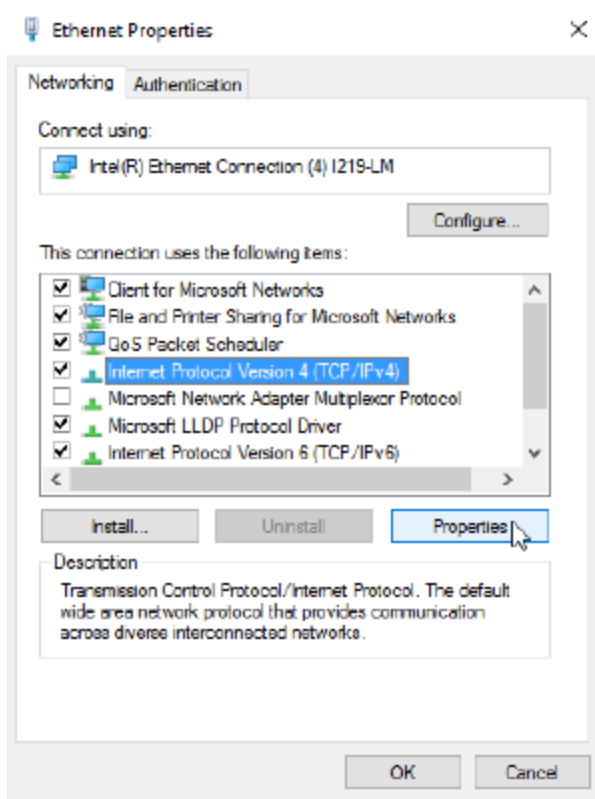
Set the PC Ethernet IP Address

This is an example of how to set a PC's Ethernet IP address to a static IP address. If your PC and receiver are already on the same Ethernet subnet then you can skip this.

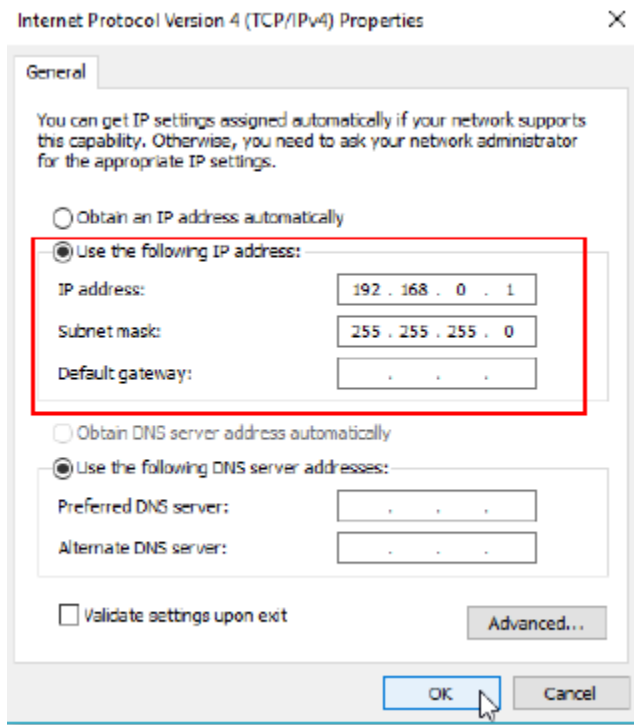
Open the Network Connection screen (rt-click the Windows Start button) and select the Ethernet Connection Item



Select the TCP/IPV4 item and click the Properties button.



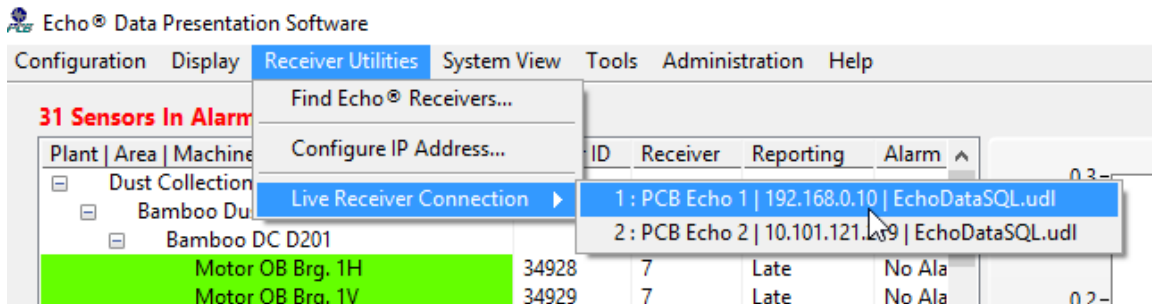
Select 'Use the Following IP Address' and enter 192.168.0.1 in the IP Address field and 255.255.255.0 in the subnet mask field and click OK



Connect the PC and the receiver using a crossover Ethernet cable. The PC and receiver should now be able to communicate.

Collect Sensor transmissions using the Live Data Screen

Select Receiver Utilities | Live Receiver Connection | <your receiver> from the Main Menu bar. The receiver list is generated dynamically and includes all configured receivers. Select the one with the IP address configured in the previous step.



You should see a screen similar to the following. Note, the columns displayed and the display order are user selectable. To adjust the columns, click on Display on the main screen menu bar and then select Data Display Preferences. This will open a window that

allows both the selection of columns to display and the display order. See the *Echo[®] Software User's Manual* for details.

The 'Live' screen will show any Echo[®] sensor or EchoPlus[®] junction box transmissions that are set to the same RF Band as the active receiver. This screen will be used for the reception survey.

The screenshot shows the 'PCB Echo Receiver Client for PCB Echo 1' window. At the top left, there is a green progress bar and a 'Noise' indicator showing -145.193 dbm. To the right, the 'ID' is 10180 at IP:Port 192.168.0.10:10000:1, and 'Records Received' is 0. Below this is a table with the following columns: Date and Time, Sensor ID, Average SNR (dB), RMS Velocity (ips), Peak Velocity (ips), RMS Acceleration (g), Peak Acceleration (g), True Peak Acceleration (g), and Crest Factor. The table is currently empty. At the bottom, there is a 'Status' field showing 'Waiting for transmission', a 'Clear Table' button, and a checkbox for 'Log Transmissions to File' which is currently unchecked.

In the upper left hand corner of the display is a Noise value that updates every few seconds. This is the ongoing noise floor of the RF band we are working in. Under ideal background noise conditions, this number should reach about -155 dBm. If the actual value is higher, then the system's maximum dynamic range is reduced somewhat but the system still works. In the example above, the Noise is -145.1 dBm so the background noise is a minimum.

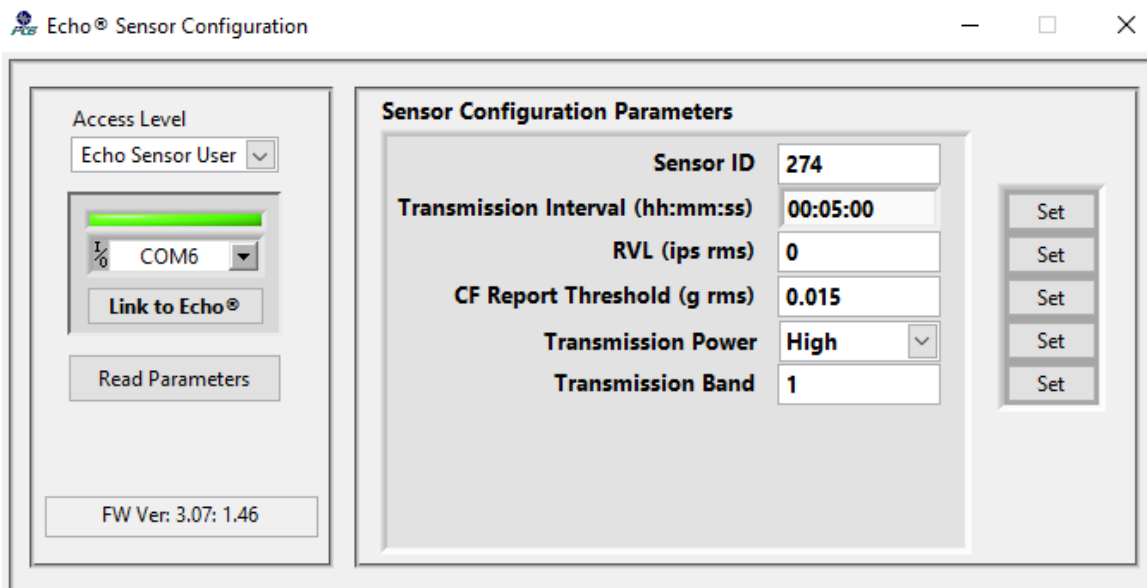
Running the Survey

Antenna Placement

Move the computer and receiver to the location to the first place in the plant that has been selected for the antenna. Use the antenna that is intended for permanent installation for the test. Do not use the small antenna supplied with the receiver unless the transmission distances are small and you intend to use it in your actual installation. In general, a 6 dBi gain antenna with a 10 to 25' low loss cable is recommended for most installations, although an 8 dBi gain antenna may also be used. Contact IMI for additional information regarding antenna options. Connect the antenna cable between the receiver and antenna and temporarily place the antenna in an elevated location. Draping it over a pipe or beam will work well for this test.

Baseline Measurement

It is highly recommended that the survey be run with a stand alone Echo[®] Wireless Vibration Sensor. Although it can be run with an EchoPlus[®] Wireless Junction Box, it will be a bit more difficult and time consuming. It will also be helpful if the sensor used for the survey is reprogrammed for a short transmission interval as shown in the screen below. Note: The transmission interval is programmable in 4 second increments. For details on programming Echo[®] sensors, see the *Echo[®] Wireless Vibration Sensor Installation and Operation Manual*.



Standing near the computer, activate the sensor with a fairly strong magnet as shown in the picture below. The LED will blink indicating that it is changing states, in this case, turning on. See the *Echo® Wireless Vibration Sensor Installation and Operation Manual*. Set the sensor down and move away from it so you don't interfere with its transmission.



The sensor will immediately make a measurement (solid blue LED) and then transmit it (solid bright blue LED). About three seconds after the bright LED goes off and if the system is setup and working correctly, an entry should appear on the top line of the Live Data spreadsheet, similar to the screen below. Write down the Average SNR (dB) value for that point. Record a couple of values for each point taken. Using the magnet, turn the sensor off. Note: If the LED has 4 seconds between blinks, it is on and waiting for the next transmission time. If the LED has 8-seconds between blinks, it is off and will not make any measurements until it is activated with a magnet.

PCB Echo® Receiver Client for: PCB Echo 1

Noise: -136.468 dbm ID: 10180 at IP-Port 192.168.0.10:10000:1 Records Received: 3

Date and Time	Sensor ID	Average SNR (dB)	RMS Velocity (ips)	Peak Velocity (ips)	RMS Acceleration (g)	Peak Acceleration (g)	True Peak Acceleration (g)	Crest Factor
12/12/2019 14:29:05	274	55.285 dB	3.175	4.490	0.000	0.000	0.000	0.000
12/12/2019 14:28:27	274	61.429 dB	2.692	3.807	0.000	0.000	0.000	0.000
12/12/2019 14:27:49	274	49.504 dB	3.013	4.261	0.000	0.000	0.000	0.000

Collecting the Data

You will need two people to do the rest of the survey. One person to walk around the plant and activate the sensor at each point included in the survey in the same manner as described above. A second person will stay at the computer and log the results. A good process for this is to use a radio or cell phone. In a noisy plant, a method that has proven to work well (if there is cell phone signal) is for the person with the sensor to text the point number to the person at the computer when they activate the sensor. The person

at the computer then texts back the SNR, which acknowledges they got it and lets the walker know the strength of the signal.

The person viewing the Live Data should create a table, similar to that below, indicating if the data was received and the signal to noise ratio (SNR) at each location. In general, a signal to noise ratio greater than 20 dB is considered a strong signal. An example table is shown below. These values can also be added to the drawing to help get a visual of the coverage.

Floor	Main Building	Received	SNR (dB)	Distance (ft)
1	Compressor Motor Drive Side	Yes	34.103	600
1	Compressor Motor Opposite Drive	Yes	34.337	600
2	Roller A	Yes	30.958	600
2	Roller B	Yes	23.056	300
2	Roller C	Yes	27.6548	750
3	Fan 6	Yes	22.675	1200

This information can now be used to locate the receiver so that all points of interest are covered. If some points were not received, determine from your map if the receiver can be moved to another location that may improve results. If all points cannot be received with a single antenna location, other locations can be tested until suitable locations are found. In some cases, multiple receivers may be required to provide full coverage of the area of interest.

Permanent Installation

Antenna and Receiver

Once a suitable location for each receiver has been found the receiver can be permanently installed. The installation will require 120 VAC power and an Ethernet drop nearby. See the *Echo® Receiver Installation and Operation Manual* for details on installing the receiver. The antenna can be mounted using the hardware provided with the antenna. In general, it does not matter if the antenna is mounted vertically (up or down) or horizontally. If possible, keep the antenna cable length to 25' or less.

Echo® Sensors

Echo® Wireless Vibration Sensors are supplied with a ¼-28 mounting stud. It is highly recommended to stud mount the sensors. It is also recommended that each sensor be programmed at the same time the database monitoring point is setup prior to mounting. This will ensure that the sensor and database parameter for a monitoring point are the same. See the *Echo® Wireless Vibration Sensor Installation and Operation Manual* for details on setup and mounting.

EchoPlus® Junction Boxes

EchoPlus® Wireless Junction Boxes can be installed in convenient locations near the ICP® Sensors they are associated with. It required either 24 VDC (recommended) or a battery pack supplying between 6 and 13 VDC. It is recommended that the junction box be programmed at the same time the database monitoring points are setup prior to mounting. This will ensure that the junction box and database parameter for a monitoring point are the same Please see the *EchoPlus® Wireless Junction Box Manual* for details on setup, installation, and mounting.

Echo® Monitoring Software

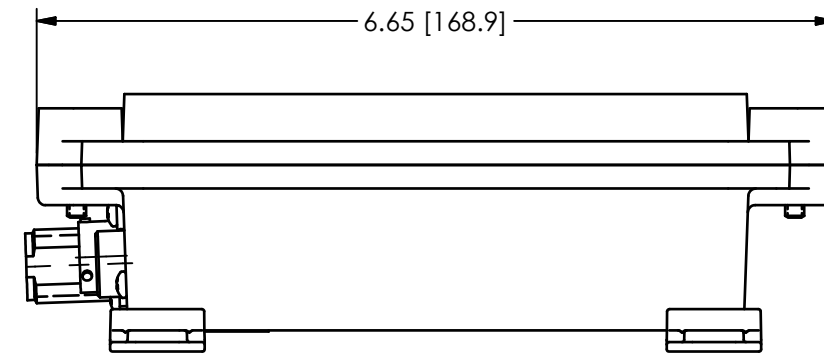
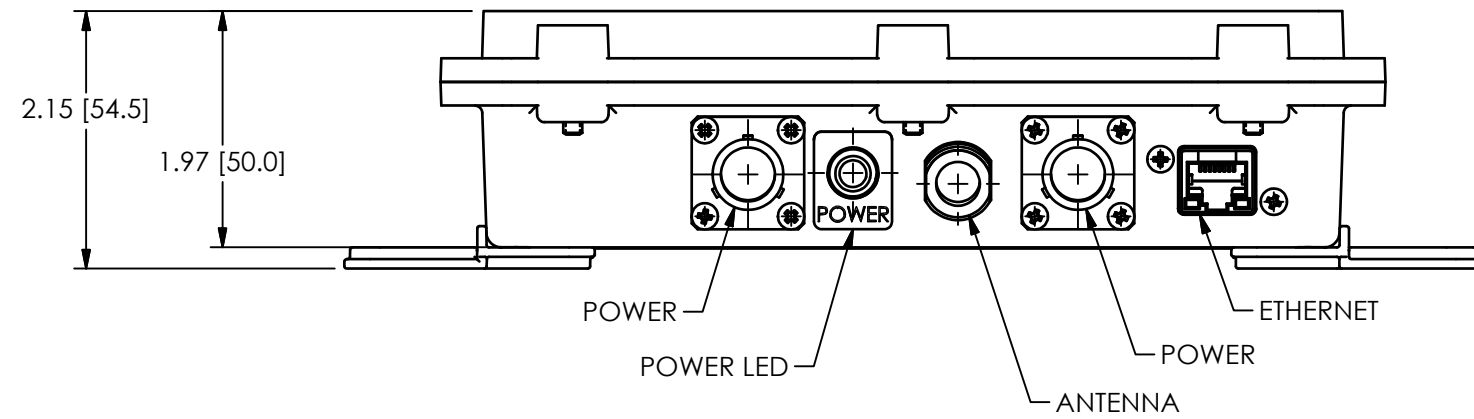
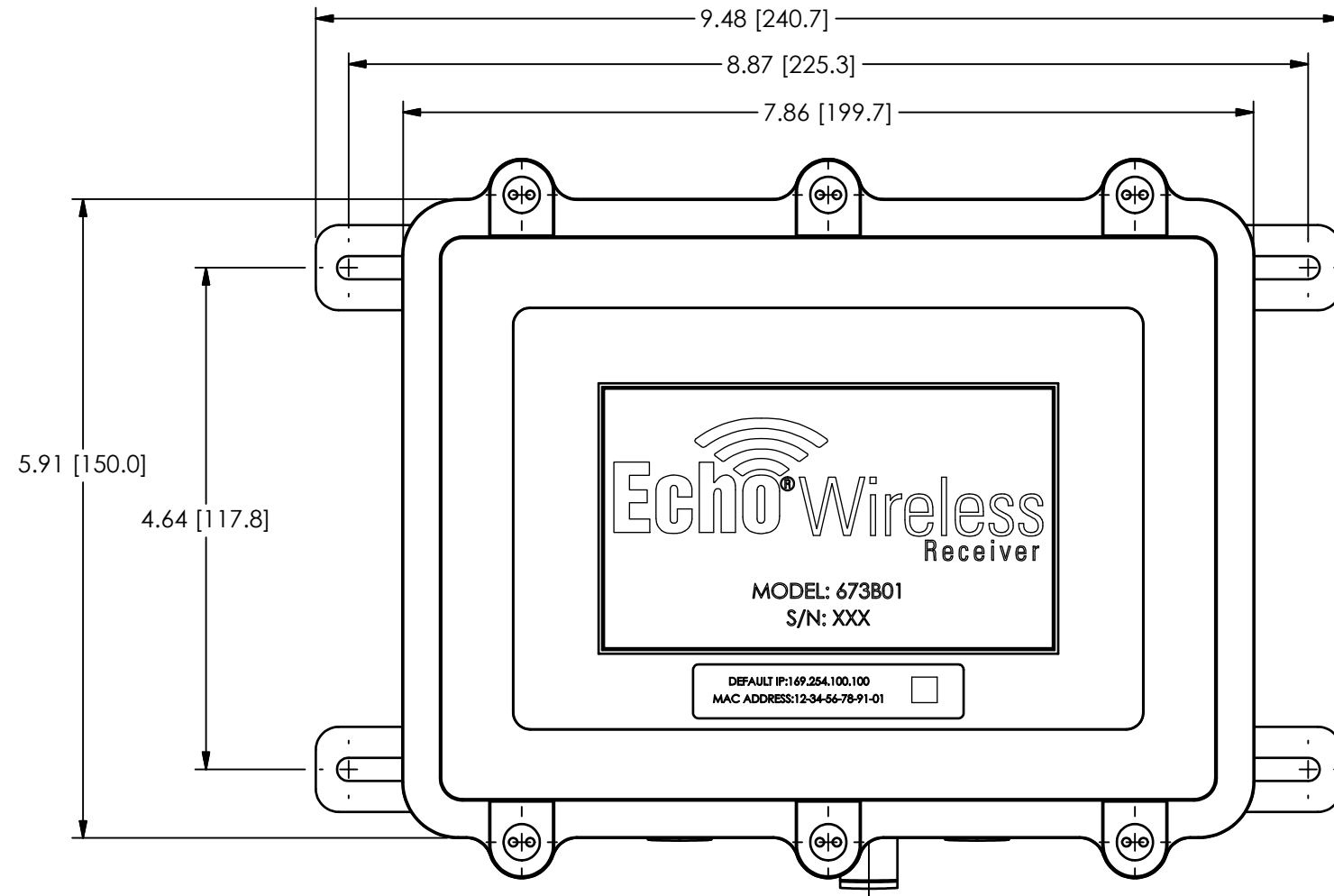
It is highly recommended that the software be loaded on a server or dedicated computer on the network. The computer must run 24/7 to collect all data sent by the receiver(s). Please see the *Echo® Software User's Manual* for specific instructions on installing the software and configuring the database. You will need administrative rights to do this and most likely, the help of your IT department.

PCB Piezotronics Inc. claims proprietary rights in the information disclosed hereon. Neither it nor any reproduction thereof will be disclosed to others without the written consent of PCB Piezotronics Inc.

72285

REVISIONS

REV	DESCRIPTION	DIN
NR	RELEASED TO DRAFTING	49974



UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN		CHECKED		ENGINEER			
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]	NJF	11/01/19	JDM	11/01/19	KJL	11/01/19		
DECIMALS XX ±.03 XXX ±.010	DECIMALS X ±0.8 XX ±0.25	TITLE OUTLINE DRAWING MODEL 673B01 ECHO WIRELESS RECEIVER						CODE IDENT. NO. 52681	DWG. NO. 72285
ANGLES ± 2 DEGREES	ANGLES ± 2 DEGREES							SCALE: .625X	SHEET 1 OF 1
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13								

PCB PIEZOTRONICS™

3425 WALDEN AVE. DEPEW, NY 14043
(716) 684-0001 E-MAIL: sales@pcb.com