VXU Operator's Manual

Invensys RadioRead System

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1. Components of the VXU System:

The components that make up your vehicle read system are the following:

1. **VXU (Vehicle Transceiver Unit)**. This is the big gray box with the cooling fins and two handles on the front.
2. **Laptop computer**. The model of your laptop may vary, but Invensys currently supplies the Dell™ Latitude laptop computer with the VXU system.
3. **Laptop Power Supply and cables**. The laptop will have two power supply options. One set of charging cables plugs into a standard wall outlet, and the other set is a special converter box and cable that connects directly to the VXU chassis. For general charging when the VXU is not in use, use the standard wall outlet charger. To keep the laptop charged while using the VXU, use the converter and cable that connects directly to the VXU chassis.
4. **Magnetic mount antenna**. This antenna connects directly to the VXU and can be mounted on the top of your vehicle.
5. **Serial Cable**. The serial cable connects the VXU and laptop computer, and is used to transfer data between the VXU and laptop.
6. **Attenuator cap**. This cap is supplied to fit on the Antenna connector on the VXU chassis when the VXU is not in use.
7. **VXU Carrying Case**. This case is designed to protect your VXU from damage during transit, and has room for the other components in the system. The VXU should be stored in its case, in a dry, well-ventilated place when not in use.

Note: *It is important to always begin your vehicle reading process with a fully charged laptop battery. For this reason, it is advisable to keep your laptop plugged in to a wall outlet, using the supplied charging pack, whenever it is not being used for meter reading. By doing so, you can ensure that the laptop always has a full charge when you begin the reading process. The laptop does get power from the VXU when it is properly connected to the VXU, but often the vehicle itself cannot supply enough power to run the VXU, the laptop, and charge the battery at the same time. By starting with a fully charged laptop battery, you can significantly lower the risk of your laptop shutting off due to a low battery.*

2. Setting up the VXU for Reading:

Note: *It is important to always begin the reading process with a fully charged laptop battery. The VXU system is designed to keep your laptop charged while in use, but often times the vehicle electrical system is unable to supply enough current to adequately run the VXU, the laptop, and charge the laptop battery at the same time. For this reason, it is recommended that you keep the laptop plugged in to a wall outlet with the supplied charging cables, when it is not being used for meter reading. At very least, plug in the laptop to a wall outlet for several hours prior to reading meters, to allow time for the battery to become fully charged. This will greatly reduce the chances of losing readings due to a laptop failure during the reading process.*

Setting up the Vehicle Read system is a relatively simple process, and involves just a few cable connections. There are a couple of important things to remember when setting up the system, however:

A. **NEVER** run the VXU (interrogate or read meters) without first connecting the antenna cable to the VXU chassis. This can seriously damage the VXU transmitter, and may result in the VXU becoming inoperable. To avoid such a possibility, always connect the antenna cable to the VXU chassis **FIRST**, and the power to the VXU chassis **LAST**.

B. Place the VXU chassis in the vehicle so that the cooling fan hole (on the right side) and the cooling fins (on the back) are not obstructed.

1. To begin setting up the Vehicle Read system, place the VXU chassis in a convenient location inside the vehicle. Keep in mind that the power cables will need to reach the power port on the vehicle. It is helpful for the operator to be able to see the face of the VXU chassis when operating the system.

2. Connect the Antenna cable to the connector on the VXU chassis. This is clearly marked with a red warning label reminding you to do this before applying power to the VXU.

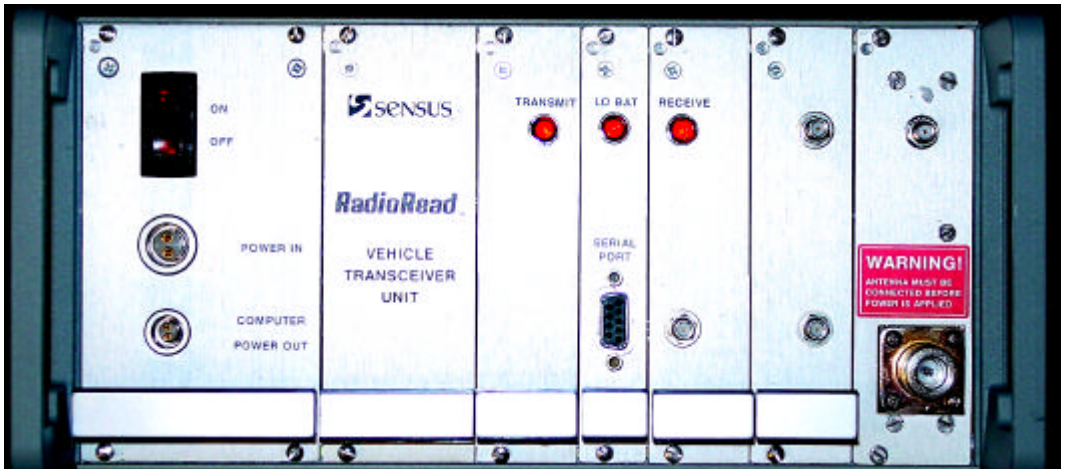
3. Connect the Serial cable to the VXU and laptop computer. The cable should only fit one way to the VXU chassis (the male end to the VXU, the female end to the laptop). Secure the cable with the twist screws on each side of the plug to prevent the cable from becoming dislodged during use.

4. Connect the laptop power supply cable and transformer to the VXU and laptop. Notice that the location of this connector on the VXU is clearly marked "**Computer Power Out**". The cable provided has a special connector that will lock into place. This connector will only fit one way, and is a different size than the main VXU chassis power connector. There should be a

transformer box and cable that connects between the VXU and laptop. There will be a special end to the cable that connects to the back or side of the laptop. (It is on the back of the Dell™ Latitude). ***Note:*** *If your laptop computer does not have a power cable that connects to the "Computer Power Out" port on the VXU chassis, you should be able to purchase a cable from the computer vendor. This will allow you to connect the laptop directly to a second power port (cigarette lighter receptacle) on the vehicle. In some cases it can be beneficial to connect to a separate power port to power the laptop, especially if the vehicle electrical system is weak, or cannot supply enough current through one power port (cigarette lighter receptacle) to run the entire Vehicle Read system.*

5. Connect the main VXU chassis power cable to the VXU "**Power In**" connector, and connect it to the vehicle power port (cigarette lighter receptacle). Test the power connection by turning on the VXU at the main power switch on the face of the VXU chassis, and check that the switch glows red. This indicates if the system is receiving power. Depending on the vehicle, you may need to have the vehicle running in order to get current from the power port (cigarette lighter receptacle).

6. Power up the laptop computer, and open the AutoVu ™ application. You are now ready to retrieve the route information from the route diskette and begin reading meters.



VXU Chassis Face

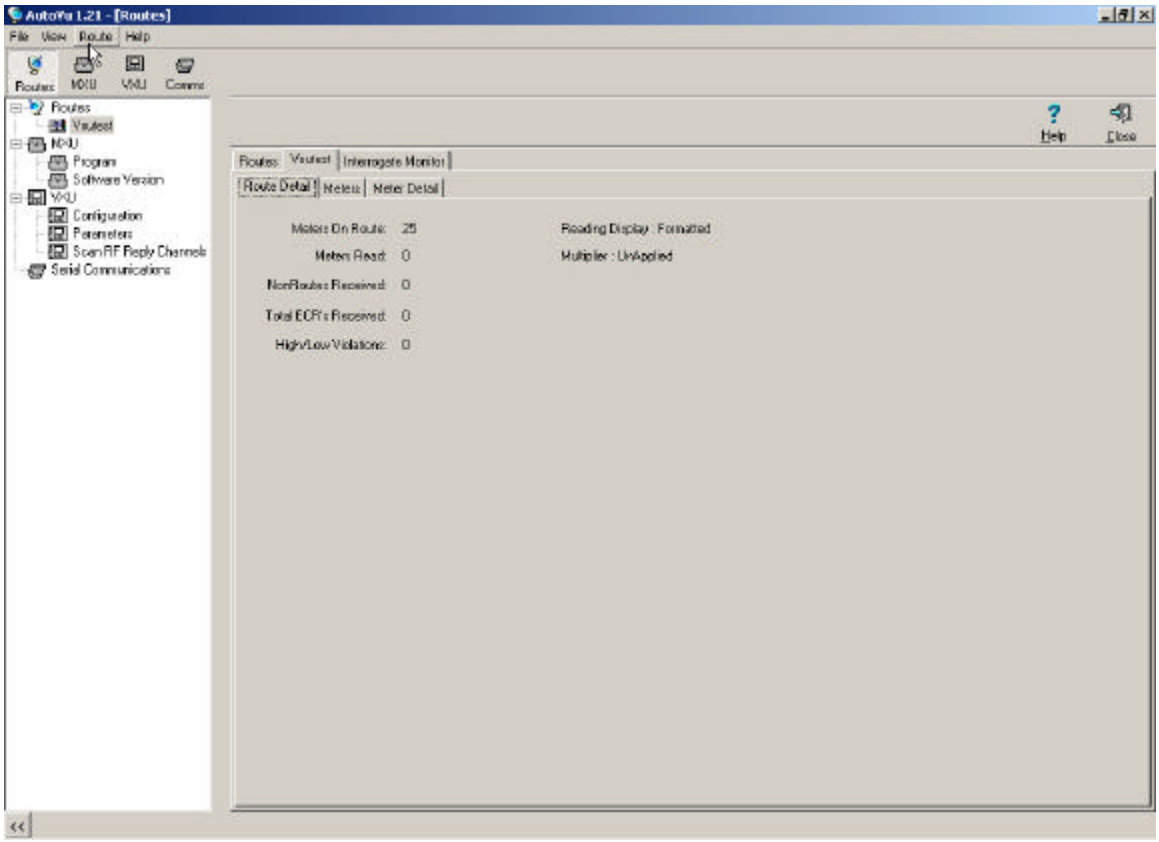
3. Instructions for AutoVu:

1. Obtain a route diskette that has been loaded with the meters that need to be read. This diskette must be loaded from the AutoRead program.

2. Set up the VXU in the vehicle, and **remember to connect the Antenna wire first**, and the power last. Transmitting (trying to read meters) with the antenna wire **not** connected to the VXU will damage the transmitter on the VXU.

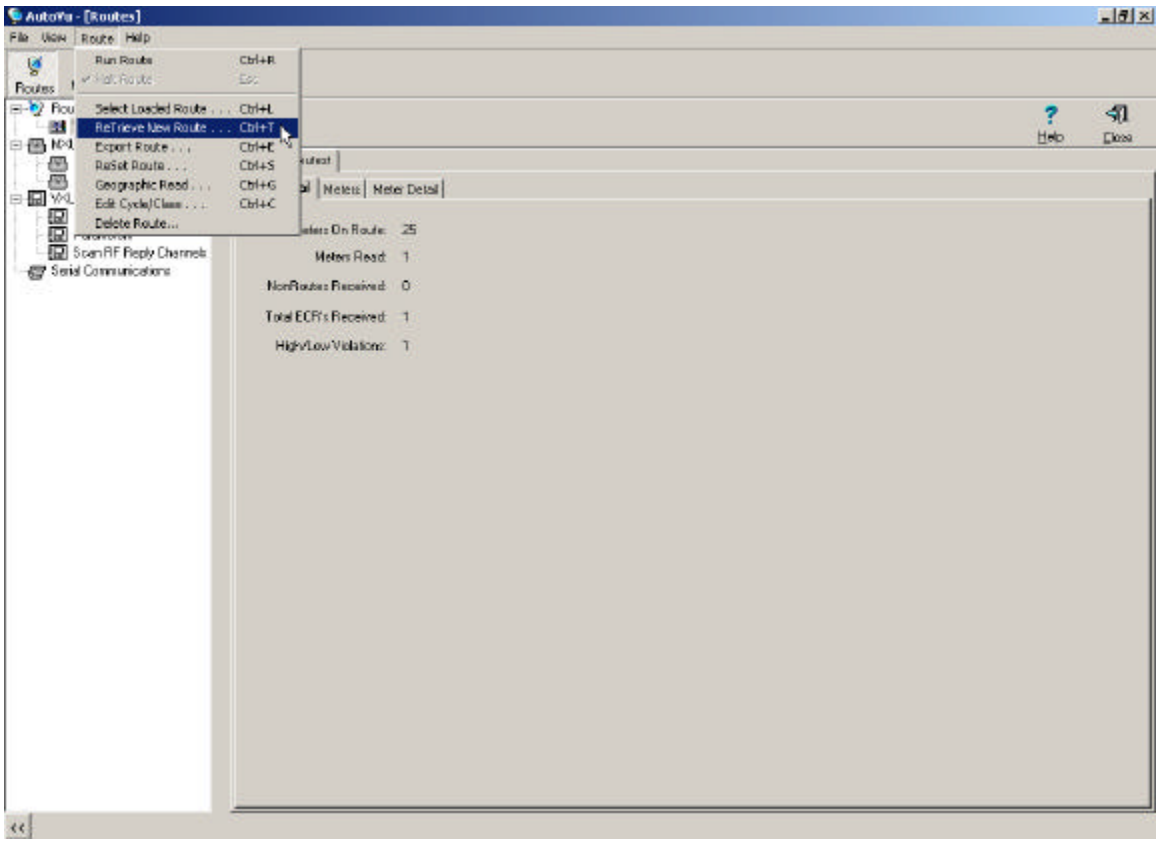
3. Connect the laptop computer to the VXU with the serial cable. Also connect a power source to the computer to keep it fully charged while reading meters. It is possible to connect the laptop to the VXU for power, or in some cases, a separate power source on the vehicle is preferable. It is a good idea to fully charge the laptop computer from an AC outlet inside before beginning the reading process.

4. After the VXU and other components are connected, boot up the computer and open the AutoVu application. It should open to the screen shown below:

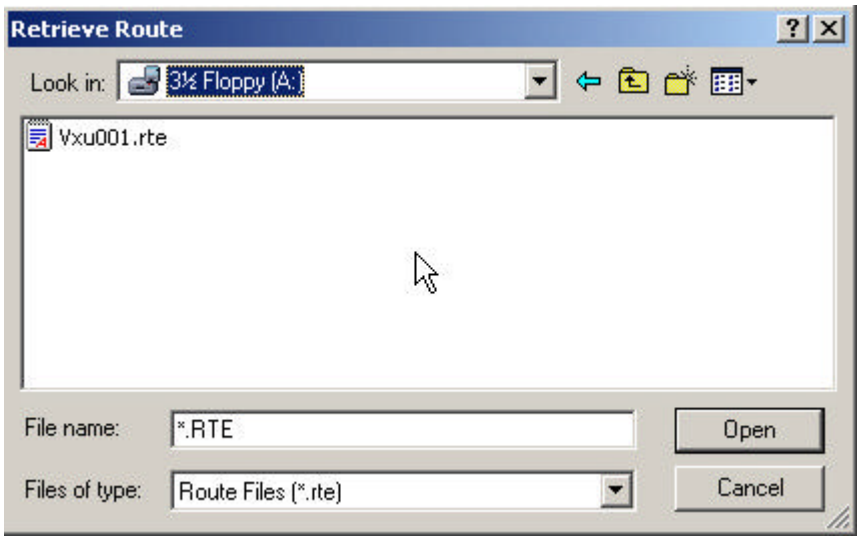


5. Your particular screen may not display the "Vxutest" route. This is a route that is used for testing AutoVu. You can ignore this route.

6. Place the route diskette into the laptop and move the pointer up to the menu item labeled "**Route**". A drop down menu will appear. Choose "**Retrieve New Route**" from this menu. The screenshot below illustrates this.

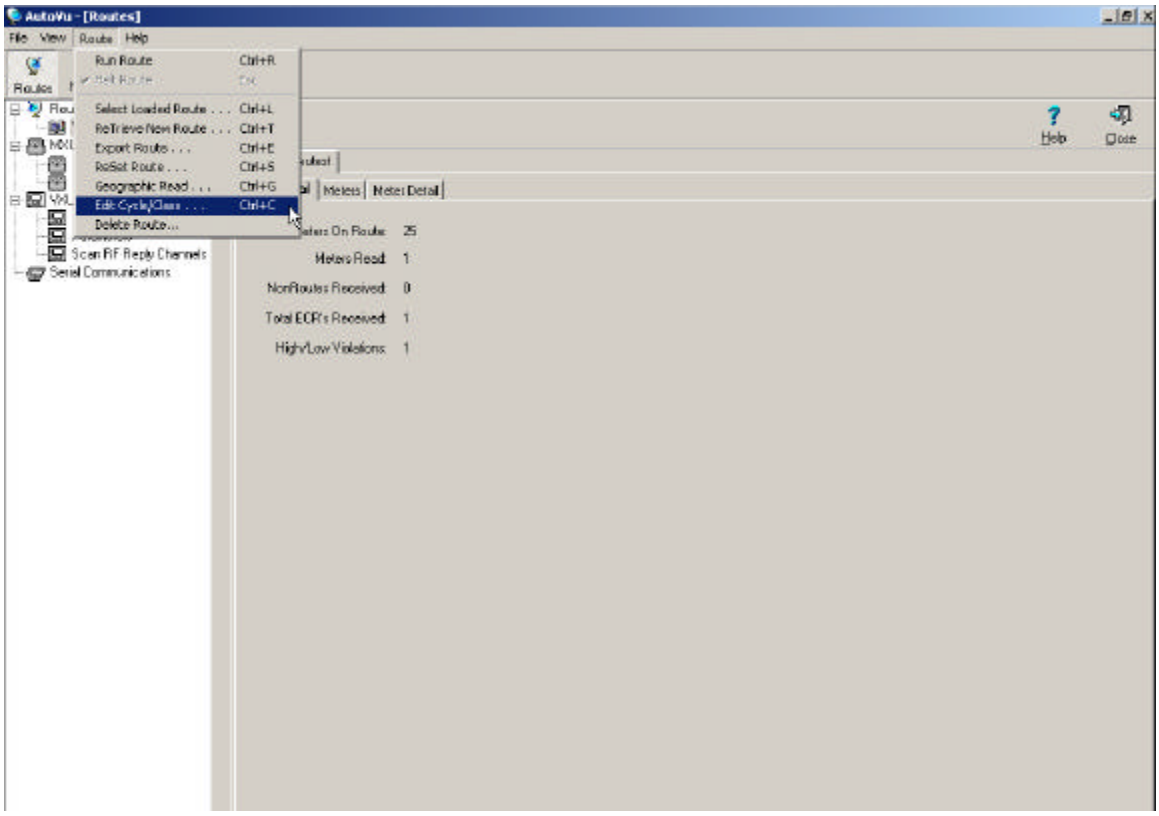


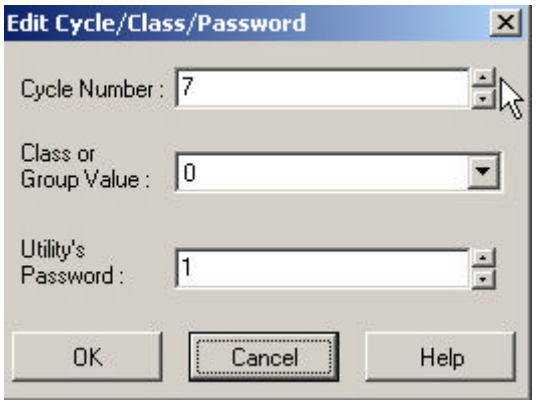
7. A window should appear which will let you choose the location and the name of the route file you wish to retrieve. The file should be found on "**3 ½ Floppy A:**". The name of the route file itself will vary, depending on the name of the route in the AutoRead program. However, the name of the route will be "**VXU001.rte**" in most cases. In any case, the file that should be selected will have an extension of ".**RTE**". See the screenshot below.



1. Double click on the proper route file, or click once on the file name to select it, and then click on the button labeled "**Open**". The route should then be retrieved from the diskette to the AutoVu database. Remember that when you retrieve a route that has been read previously with the laptop, it will erase any other readings you had taken for that route last time.

2. Once the route is retrieved, remember to change the CYCLE to something different than it was the last time the route was read. For example, if you read on Cycle 7 last month, change to Cycle 6, or Cycle 8, or any other different cycle. If the cycle is not changed, no MXUs will respond to the VXU. To change the Cycle, move the pointer up to "**Route**" again and select "**Edit Cycle/Class**". Then choose a different Cycle number, and click "**OK**" to save the change.

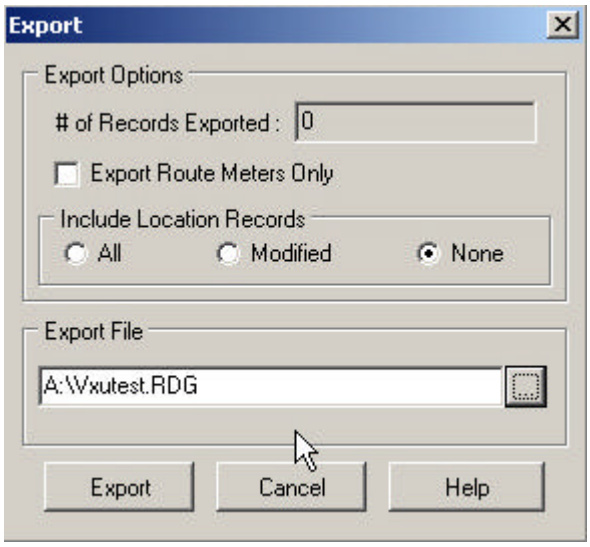




3. Once the class has been changed, make sure all connections are still good, and that the VXU itself is on, and then press "**CTRL + R**" to begin reading meters.

4. It is important to save the readings periodically while reading. Every 15 minutes is a good rule of thumb. To save the readings to disk, first halt the interrogation by pressing "**ESC**". Wait about 10 seconds until the Interrogation stops. Then press "**CTRL + E**" to export to disk. Another window will appear which prompts you to choose the location to save the file. The "**3 ½ inch Floppy A:**" should be selected. Usually, you can just press

the "**Enter**" key on the keyboard after pressing "**CTRL + E**" to save the readings to the diskette, or click the "**EXPORT**" button. After several seconds, the readings will be saved to disk and you can continue with reading meters.



5. To begin reading again, simply press "**CTRL+R**". You may also begin reading again by moving the mouse up to "**Route**" at the top of the screen, clicking, and choosing "Run Route". The interrogation will resume. Remember to repeat step 11 (to save the readings) periodically.

6. When finished reading the route, Export the readings to disk one last time, and take the disk back to the office for processing. You can do this by either pressing "**CTRL+E**" and then "**ENTER**" again, or just quit AutoVu and the Export window (shown above) should pop up automatically. After pressing "**ENTER**" or clicking on "**Export**" AutoVu will save the readings to diskette and AutoVu will close.

4. VXU System Specification and Description:

See next page.

SPECIFICATIONS

RadioRead®
For Automatic Meter Reading System①
Mobile Radio Vehicle Transceiver Unit (VXU)

invensys
Metering Systems

GENERAL

The following specifications describe the requirements for a radio-based automatic meter reading system as it relates to the mobile radio Vehicle Transceiver Unit (VXU). If meters and/or other equipment are included in the proposal or bid, that material will be covered under a separate specification.

RADIO SYSTEM REQUIREMENTS

The radio AMR system must have the ability to read meters equipped with absolute encoder registers using either a hand-held or mobile interrogation unit. The encoder registers will be connected to a Meter Transceiver Unit (MXU) that will provide the radio link from the meter to the interrogation device.

The radio AMR system will utilize a true two-way (interrogate and respond) communication protocol that enhances system integrity and reliability.

Upon completion of the meter reading route, the meter reading data from the VXU will be downloaded via a PC with radio AMR software. The radio AMR software will prepare and format the meter reading data for the printing of selected management reports and the transfer of the meter reading data to the billing software for customer invoicing.

VXU BASIC FUNCTIONS

The VXU is considered the complete package that will permit the utility to read meters by using any vehicle in the utility's fleet via radio signals.

The complete VXU package, as a minimum, will include the following:

- A laptop computer connected to the VXU with the capability to handle multiple reading of radio equipped meters and the storage of meter reading data
- VXU radio operating software
- A magnetic mount antenna that connects to the VXU for optimal radio reading performance
- A power cable capable of plugging into a 12-volt cigarette lighter to power the VXU
- Applicable connector cables for the computer and VXU
- Carrying case for all VXU equipment

The VXU will have the capability to collect and store meter readings at any time on the meter reading route via radio transmission with any meter equipped with an encoder and MXU.

The VXU will send an alert signal to a MXU connected to a meter fitted with an encoder register. Upon receipt of the alert, the MXU will transmit the meter reading data to the VXU. Once this data is received and if all parameters are valid in the meter reading message, the VXU will acknowledge the MXU that the data is valid and permit the MXU to go into a power down mode. The VXU will be able to handle multiple readings from MXUs simultaneously.

The VXU software will periodically transfer the meter reading data to the hard drive of the VXU computer to maintain already read meters in case of power failure. The VXU computer will also have its own battery in case of vehicle power system failure.

The VXU will provide the capability to read the MXUs in either a geographic mode or blind mode. Geographic mode being the ability to alert and receive transmission for a specific MXU or group of specified MXUs. In the blind mode, the VXU will be able to alert and receive transmission from any MXU within range of the alert signal simultaneously.

The VXU shall also have the capability to address MXUs on a wild card alert basis. The wild card will be operator controlled from the VXU.

The VXU, in conjunction with the MXU will have the capability of utilizing a reading cycle code within the transmission protocol. The reading cycle code is utility controlled and changes with each reading cycle. Once an MXU has been successfully interrogated and powered down using a specific reading cycle code parameter, the MXU will not alert again until the code is changed.

For optimum performance, the VXU will have the capability to analyze noise levels of applicable RF channels in the area and select the optimum frequency for the MXU to transmit. It will then command through the alert signal to the MXU what frequency to transmit the meter reading back to the VXU.

The VXU shall be able to function either with or without a meter reading route. With a reading route, the VXU will be able to read the meters in either blind or geographic reading mode and post the readings to the proper account through the use of the MXU and encoder register identification number. Without a reading route, the VXU will be able to read the meters in either blind or geographic reading mode. The VXU will retain the meter readings for later posting to the billing software by matching with the proper account through the use of the MXU and encoder register identification number.

The VXU software will have the capability to address MXUs in conjunction with the MXU class code option. The class code being an optional utility defined code programmed into the MXU for meter reading.

VXU DATA TRANSFER

The VXU will be able to store the meter reading data either on the hard disk of the laptop computer or on a diskette of the computer disk drive. If stored on the computer hard drive, the meter reading data will be able to be transferred to the computer interfacing to the billing software through file transfer to a diskette. The VXU computer will also have the capability to be directly linked to the interfacing computer for computer to computer transfer. The VXU computer will have a programmable baud rate capability for the computer transfer.

VXU POWER REQUIREMENTS

The VXU will be powered from any vehicle in the utility's fleet that has a 12-volt power system. The VXU computer will have its own battery for backup in case of the vehicle system failure. The backup battery will be able to operate the VXU computer for at least two (2) hours with a fully charged battery.

VXU NAVIGATION SYSTEM

The VXU will provide for an optional navigation system. The VXU design will permit a commercially available GPS receiver to be interfaced to the VXU via an RS232 link.

SPECIFICATIONS

RadioRead®
Mobile Radio Vehicle Transceiver Unit (VXU)

FCC REGULATIONS

All equipment must comply with current Federal Communications Commission (FCC) requirements which include proper labeling of the VXU. Modifications to transceiver equipment not authorized by Invensys Metering Systems may void FCC equipment certification. .

FREQUENCY/MODULATION

The VXU will operate on the 956 MHz channel for the purposes of alerting the MXU in a licensed mode. It will utilize AM modulation for the alert tone.

The vendor will be responsible for assisting the utility in obtaining any required license from the FCC for operation of the equipment.

CARRYING CASE

The VXU will be supplied with a portable carrying case to permit easy storage and transportability of the VXU as one unit. The carrying case must be able to store all components of the VXU package required for vehicle meter reading via radio AMR.

INSTALLATION AND TRAINING

Complete installation and operating instructions will be included for all of the supplied hardware and software equipment.

Proposal must include any additional costs for training and assistance to install and begin operation of the VXU and operating software. The vendor will also inform the customer of what pre-installation activities are to be completed and what support materials will be needed for the initial installation.

PERFORMANCE WARRANTIES

In evaluating bid submittals, warranty coverage will be considered. The vendor shall be required to state its warranty and/or guarantee policy with respect to each item of proposed equipment. The procedure for submitting warranty claims must also be provided.

SYSTEM MAINTENANCE AND SUPPORT

In addition to initial warranty periods, vendors are required to supply information on required or optional maintenance programs beyond the warranty period for both hardware and software. Features of those programs shall also be included with any additional charges such as an hourly rate for on-site and/or remote support. The location of and procedures for obtaining such support shall be stated.

RF Exposure Notice Per FCC Rules

To meet the RF exposure requirements in 1.1307 of FCC Rules, a separation distance of at least 53 cm (21 inches) shall be maintained from all persons during operation of the transmitter.

① See additional specifications.

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RadioRead®

Invensys Metering Systems

METER READING SYSTEM VEHICLE TRANSCEIVER UNIT (VXU)

DESCRIPTION

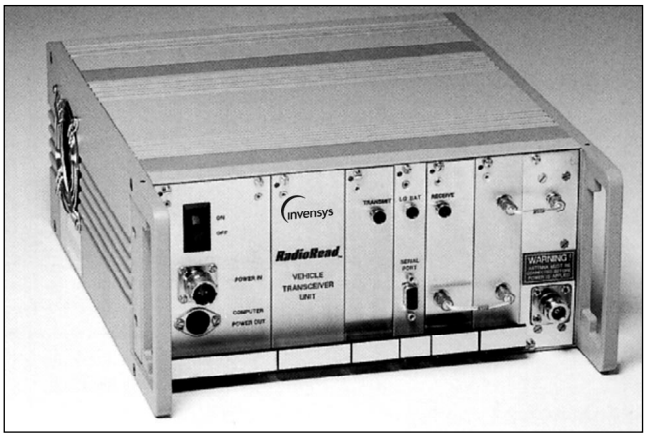
APPLICATION: The Invensys RadioRead® Vehicle Transceiver Unit (VXU) is a portable radio-based meter reading device which can be used in any vehicle providing 12-volt DC power. The operator simply sets up the system in the vehicle, loads the desired meter reading route into the computer and drives along the meter reading route in proximity to the meters to be read. The meter reading data is collected while the vehicle traverses the route. The complete VXU package includes everything needed to read meters that are equipped with Invensys Meter Transceiver Units.

RADIOREAD® OPERATION: The Invensys RadioRead system uses two-way data communications between the VXU and Meter Transceiver Units (MXU) connected to compatible utility meters. When reading meters, the VXU transmits an alert signal to the MXUs, with the operator having the option of directing the alert signal to all MXUs within range (blind reading mode), or to individual MXUs (geographic reading mode). When the alert signal is received, each MXU responds by transmitting its data in direct sequence spread spectrum modulation. The VXU receives this data and acknowledges by sending the MXU a message to return to its low power sleep mode.

SYSTEM RELIABILITY: The Invensys RadioRead system's communication architecture ensures reliable meter readings. The VXU determines clear channels in the 902-928 Mhz spread spectrum radio frequency band. When the VXU transmits the alert signal to the MXUs it also establishes the frequency to be used to transmit back this meter reading data. This signal selecting and synchronization capability provides a highly efficient meter reading process that is reliable even in a noisy radio frequency environment.

Meter reading is virtually error-free when using RadioRead to read meters equipped with Invensys absolute encoder registers. The absolute encoder registers provide readings taken from actual positions of their odometer wheels. When readings cannot be obtained due to damage, vandalism or tampering, the error condition will be indicated at the time of reading. High or low customer usage patterns can also be verified at the time of the reading.

PORTABILITY: Through the use of advanced miniaturized design, the radio electronics can be packaged in a very compact enclosure. With the addition of a portable computer, connecting cables and antenna, the complete VXU package can be stored in its handy carrying case, ready for fast and easy setup in any vehicle. This portability eliminates the need to purchase and maintain a dedicated meter reading vehicle.



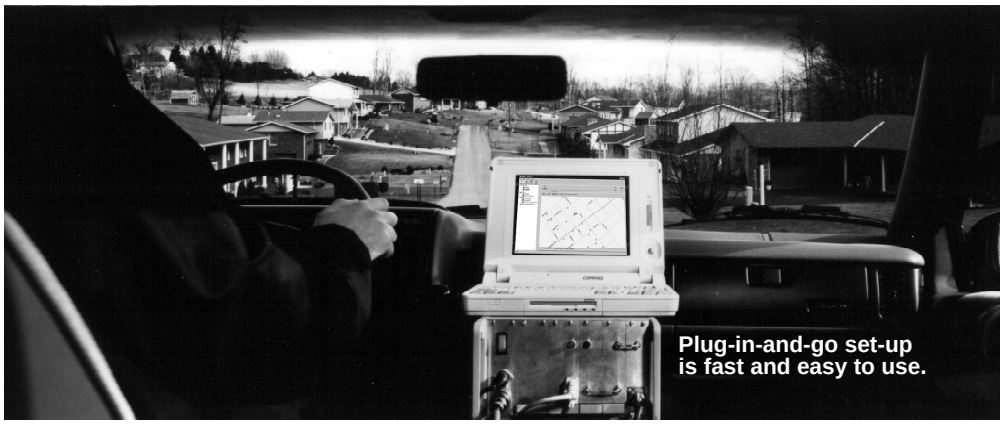
SPECIFICATIONS

SERVICE	Radio based mobile utility meter reading system
PHYSICAL CHARACTERISTICS	VXU in metal case with carrying handles. Portable computer in plastic housing. Connection cables, magnetic mount antenna and hardside component carrying case included.
DIMENSIONS **VXU**	Wide: 15.10" (383.54 mm) Deep: 11.24" (285.49 mm) High: 5.22" (132.58 mm) Weight: 21 lbs. (9.53 kg)
Computer	Wide: 11.8" (299.72 mm) Deep: 8.9" (226.06 mm) Weight: 6.64 lbs. (3.01 kg)
Carrying Case	Wide: 19.25" (488.95 mm) Deep: 13.78" (350 mm) High: 11.87" (301.49 mm) Weight: case: 11 lbs. (4.99 kg) Complete assembly: 39 lbs. (17.69 kg)
POWER **VXU with Portable Computer**	12-volt DC DC adapter through VXU (with battery back-up; computer only)
COMMUNICATIONS	Transceiver to computer: Radio Transmit: 956 Mhz (AM) Receive: 902-928 Mhz, Direct Sequence Spread Spectrum
READING RANGE	Dependent on MXU installation and RF propagation at time of reading
APPROVALS **US:** **Canada:** **Mexico:**	 FCC Industry Canada SCT
LICENSE REQUIREMENTS	Equipment licensing requirements are coordinated by Invensys for FCC, Industry Canada and Mexican SCT. Radio licensing may be required by government agencies for other countries. Users should consult their respective government agencies for licensing requirements.

RadioRead®

METER READING SYSTEM VEHICLE TRANSCEIVER UNIT (VXU)

The RadioRead VXU package in its handy carrying case is fully portable.



Plug-in-and-go set-up is fast and easy to use.

User Friendly Software: STRIPES (Invensys Interface Polling Equipment System) is a software program especially designed for operating the VXU. STRIPES features an easy to use pull-down menu system that permits convenience and simplicity for directing the meter reading process. STRIPES allows manual entries and special route notes to be made by the meter reader/operator via the portable computer's keyboard. The meter reader/operator can also easily edit configurations in the route data when necessary.

STRIPES works in conjunction with Invensys Automatic Meter Reading System (AutoRead®), a software program designed to manage utility meter reading data by interfacing with a utility's own billing software.

RadioRead® Makes Reading Utility Meters Fast, Easy and Reliable

The RadioRead System can be used to read more meters in a matter of minutes than a typical meter reader, using a manual entry system, can usually read in a day. The portable RadioRead Vehicle Transceiver Unit (VXU) plugs into a vehicle's standard 12-volt electrical system enabling it to be used in any car or truck. Coupled with a portable computer and AutoVu software, the VXU package provides utilities with maximum meter reading efficiency while requiring a minimum of operator training for operation.

Thanks to direct sequence spread spectrum modulation technology, RadioRead also provides greater meter reading reliability with fewer non-reads, range limitations and errors compared to other types of radio based meter reading systems. The system's higher reliability produces a higher number of completed meter readings to further enhance operating efficiency and minimize customer relations problems.

Because the RadioRead System works with the same absolute encoder registers used by the Invensys PhonRead® System and TouchRead® System, utilities have greater flexibility such as mixing and matching to meet specific needs or situations—or for planned migrations from one system to another without requiring the meters and registers to be exchanged. The RadioRead System is also easily upgradeable to a fixed base meter reading system.

Invensys Metering Systems

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