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Herndon, VA 20170
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Client: AMCO Automated Systems, LLC
Model: TRACE URFI
FCC ID: G8JURF01
Standards: FCC Part 90
Report Number: 2003202 Rev 0.01

APPENDIX E: MANUALS

Please see the following pages.

TRACE®

Universal RF Interrogator

AMCO
Automated Systems

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FCC Compliance

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The TRACE transponder is governed by FCC Part 15, Subpart D and requires no licensing.

Universal RF Interrogator
INSTALLATION GUIDE

Table of Contents

Chapter One

Introduction

The TRACE® Universal RF Interrogator (URFI) is an important part of AMCO Automated Systems' portfolio of products for remote, automated meter reading (AMR). The URFI provides a convenient radio frequency (RF) interface necessary to enable AMR via an existing handheld data entry terminal.

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User Operations. For user information regarding AMR operation of the URFI-enabled handheld terminal, refer to the documentation provided by the host software developer.

Host Programming. For information necessary to develop host software to enable AMR via an existing handheld terminal, refer to American Meter's URFI Host Programming Guide.

Audience

This document is designed for utility industry meter readers and supervisory staff.

In order to establish appropriate levels of detail for the material, this document assumes the following:

- The user is an expert in reading meters of the type currently compatible with TRACE transponders and possesses all the skills necessary to conduct meter reading by conventional means.

- The user has little or no prior expertise in the TRACE radio frequency (RF) technology.

- The user is competent in the installation of simple electronic components and hardware.

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- Additional information relevant to a given instruction step may be shown in one of three ways:

    1. A bulleted item covers "how-to" and verification information.

    2. *An italicized NOTE contains relevant background information.*

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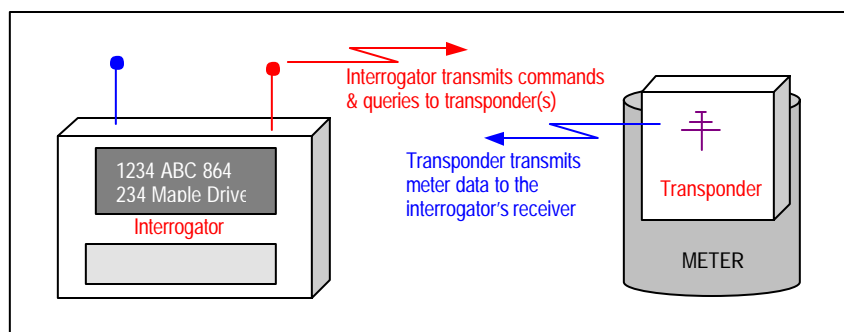
Chapter Two

Automated Meter Reading Overview

The TRACE system uses radio frequency (RF) signals to allow utility personnel to read meters from a distance while the reader is in motion. This technology is called automated meter reading (AMR). This technology greatly increases the speed at which routes can be covered with a high degree of accuracy.

Basic AMR Components

An automated meter reading system requires the following basic components:

- **Transponder**—The transponder Interfaces with meter index mechanics, translates index reading into digital signals to capture data from meter, receives commands from an interrogator and transmits meter data.

- **Interrogator**—At its simplest, the interrogator remotely reads meter data transmitted by transponders. At more sophisticated levels an interrogator may also program transponders, store route data, selectively "wake up" transponders, verify transponder conditions and data and set meter coordinates, among other functions.

- **Antennas**—Both the transponder and the interrogator use antennas to broadcast and receive RF signals. The transponder's antenna is typically located on the circuit board inside the transponder case. Some interrogators use external antennas (as shown in the illustration below), one for transmitting and one for receiving. Many handheld interrogators use a single antenna for both transmitting and receiving (antenna may be internal or external).

The interrogator sends out an RF signal to the desired transponders. Upon receiving an authorized command the transponder transmits its stored meter data.
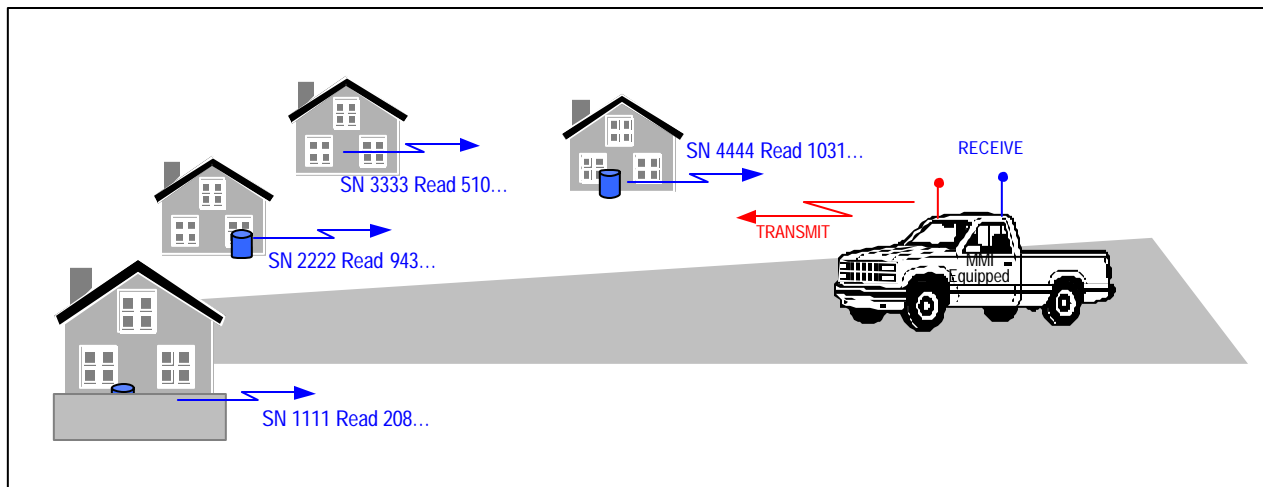
The TRACE AMR System Overview

In addition to standard automated meter reading functions, AMCO Automated Systems' TRACE portfolio of products permits the remote recording of tamper conditions and linking of meter latitude and longitude data using a Global Positioning Satellite (GPS) system. With the optional Vehicle Interactive Display, TRACE makes driver-to-meter orientation more intuitive and efficient.

TRACE interrogators transmit at 451.35 MHz and receive transponder messages at 415 MHz. (Transponders transmit at 415 MHz and receive at 451.35 MHz.)

Trace transponders, normally asleep, "wake up" and listen for an interrogation signal once every second. Only if a transponder hears its unique serial number will it transmit data back to the interrogation device, and then it goes back to sleep. Under normal circumstances transponders only send one transmission per month.

How the TRACE System Works

Utility personnel no longer have to walk up to each meter, look at its index and record its reading. Once transponders are installed on meters and programmed, meter readers simply walk or drive down each street in the route allowing the TRACE interrogator to request and record meter data automatically.

The interrogator addresses each transponder in the interrogation window individually. When the transponder "hears" its serial number and proper authorization, it transmits the current meter data. The TRACE system's frequency band allows remote reading of transponders even through walls and fences.

Acquisition of meter information begins with the transponder where data is stored continuously for later retrieval and moves to the interrogator upon command. The acquired data from a given route can be transferred to a host computer via floppy disk for processing.

The information acquisition, storage and handling process includes several basic elements:

Meter interface. Using a mechanical-to-digital interface, the TRACE transponder senses the output from the index of a utility meter, translates this into electronic form and stores it in the transponder's memory.

Transponder data acquisition. The transponder is programmed with a unique serial number at the time of manufacture. Upon installation on a meter, the current (or baseline) meter index reading is also programmed into the transponder's memory. As the meter reading advances it automatically updates transponder memory. The transponder also records changes to the tamper detection sensor.

Compensation factor. For TRACE transponders using firmware Version 9 or higher, a compensation factor can also be programmed into the transponder memory ensuring the transponder readings match the compensated mechanical index reading.

Route information loading. Route data includes meter account number, address and latitude/longitude coordinates (when available), and transponder serial number. This information, along with Guide and Start files, is downloaded to the interrogator prior to commencing automated meter reading. By also tracking the vehicle or interrogator's coordinates, a GPS-equipped system determines which transponders in the route should lie within range at any given time and transmits those serial numbers requesting meter data.

Interrogation. Once placed in an interrogation mode by the meter reader, the TRACE interrogator transmits serial number(s) of the desired transponder(s) along with a command requesting the contents of each transponder's memory. Transponders are selected for reading on the basis of route and meter location information stored in the interrogator and presence of the transponder within range of the interrogator.
Route data processing. Meter data from transponders is stored in the interrogator's memory and can be transferred to the utility's host computer for processing.

Chapter Three

Universal RF Interrogator Overview

The TRACE Universal RF Interrogator is a plug-in adapter that allows any current DOS-compatible handheld data terminal to transmit and receive data from TRACE transponders.

With the URFI, your existing investment in handheld terminals can accommodate manual reads as well as TRACE automated meter reads.

URFI Components

The URFI consists of the following components that effectively turn your existing DOS-based handheld terminal into TRACE interrogator:

- Universal RF Interrogator unit
- URFI carrying pouch
- Transmitting antenna and coaxial cable
- Receiving antenna and coaxial cable
- Antenna bracket
- Battery pack with cigarette lighter adapter and cable
- Battery pack carrying pouch
- RS232 communications cable
- A/C power adapter

How the URFI Works

When the URFI is properly interfaced to a handheld data terminal, it becomes an interrogator that stores route information in the terminal and automatically acquires meter data remotely as the meter reader walks or drives along the specified routes.

When interrogating, the URFI sends out a radio frequency (RF) signal containing the IDs of transponders in the particular route. When a transponder receives the signal containing proper authorization and its unique serial number, the transponder replies by transmitting stored meter data including index reading, tamper status and an error detection code to ensure accuracy.

Meter reads can be captured in any order by simply pressing one key on the handheld terminal's keypad as designated by your host programming.

Power

Battery pack. A detachable battery pack allows the user to keep a spare battery pack in the vehicle for extended service time.

A/C adapter. The battery may also be recharged by connecting the battery back via its A/C adapter to a normal 120 VAC outlet.

On/Off control. On/Off control of the URFI is done by the handheld terminal to maximize battery performance.

Communications

The URFI's belt-mount design interfaces via RS232 serial link to a handheld computer or, where required, a laptop PC.

NOTE: For the purposes of this document, from this point forward the handheld/laptop computing device will be referred to as simply the handheld terminal.

Data Processing

No route data is stored at the URFI level. All field processing and storage of route data is managed by the handheld terminal.

Software. TRACE ReadIt™ is the software used in the selected handheld or laptop computer to provide for both manual and automated meter reading functions. This dual-mode functionality allows a utility the convenience of automating any route in stages.

Route data. Routes are loaded into the handheld terminal or laptop memory using your own route management system or via Pantheon Route Manager, AMCO Automated Systems' host software package. Stored route data includes customer name, address, account number, meter number, unique transponder ID, hi/lo warning limits, time and date of read, utility-definable trouble codes and alphanumeric messages, along with the meter reading itself.

Data transfer from handheld. At the end of a shift, stored meter reading information is transferred from the handheld terminal to the host package for ultimate use in billing systems for processing.

Transmission Accuracy

Data accuracy is assured by a three-part process:

1. Patented TRACE technology ensures that a transponder is triggered to respond *only* when it receives a properly authorized transmission of its unique serial number from the URFI (or any other AMCO Automated Systems interrogator).

2. The transponder then calculates an error-detection code which must be verified by the handheld terminal before the transponder data can be acquired and stored.

3. The ReadIt software compares the current meter reading with hi/low audit values (established by the billing department and entered into the route file prior to reading meters) and it looks for readings that fall outside those limits. The handheld terminal can be programmed to issue audible or visual warnings when a read value exceeds preset limits, regardless whether the read was acquired manually or automatically via RF.

RF Signals and Conditions

URFI Range. As a rule, transponders within approximately 300 feet of the URFI (with no obstructions between URFI and transponder) should receive interrogation signals and respond appropriately. Indoor meters can be read through most walls from a distance of up to 100 feet.

Obstructions. Line-of-sight provides the optimum transaction range. Although the URFI can read transponders through walls and fences, any obstacles between the URFI and transponder may reduce the range at which successful transactions may be conducted. Metallic obstacles (vehicles, trash cans, metal sheds, etc.) in the path will severely impede or block the transmission of RF signals.

Transaction Capacity. The URFI can interrogate and acquire transponder data in less than two seconds per transponder.

URFI Specifications

The following table shows the URFI specifications:

Power	UL approved, high-capacity sealed lead-acid battery. Vehicle cigarette lighter/accessory adapter included for mobile use.
RF Transmitter	Frequency: 451.35 MHz, 2W peak power
RF Receiver	Frequency: 415 MHz, 4 MHz narrow band, single channel
FCC Compliance	The URFI has been type accepted by the FCC for use under Part 90
FCC ID	G8JURF01
Weight	2 lb.
Dimensions	6.2″ x 4.3″ x 1.9″ (L-W-H)
Operating Temperature	-22°F to +158°F (-30°C to +70°C)
Storage Temperature	-40°F to +185°F (-40°C to +85°C)
Shock Resistance	Withstands 2 foot drop to concrete
Water Resistance	Resistant to driving rain

Battery Specifications

Battery Voltage	12 Volts nominal, 2.0 Amp Hour
Battery Charger	UL approved, mobile charger with male cigarette adapter plug + 500mA UL/CSA AC wall charger (120 V)
Charge Time	6-8 hours from complete discharge
Charge Retention	(Shelf life at 65°) 1 month = 97%, 3 months = 91%, 6 months = 85%
Standby Life Expectancy	3-5 years
Weight	30 oz. (approx.)
Dimensions	3.5″ x 1″ x 6.5″
Operating Temperature	-4°F to +140°F

URFI Maintenance

The URFI has no user-serviceable parts or adjustments.

Chapter Four

Preparation and Installation

The URFI is easy to install and connect to your handheld terminal or laptop PC. For wearable use, the URFI and battery back come with durable fabric pouches that may be worn on the belt or over the shoulder.

Unpacking URFI Components

Verify you have received all the following components and that they are in good condition:

- Universal RF Interrogator unit
- URFI carrying pouch
- Transmitting antenna and coaxial cable
- Receiving antenna and coaxial cable
- Antenna bracket
- Battery pack with cigarette lighter adapter and cable
- Battery pack carrying pouch
- RS232 communications cable
- A/C power adapter/charger

Assembling URFI Components

The URFI/handheld terminal interrogator system will take about five minutes to assemble using the procedures described below. No special tools are required.

Connecting Antennas and Handheld Terminal

The URFI system will be shipped with a bracket designed specifically for your type of handheld terminal. Once connected to the handheld terminal, this bracket holds the transmit and receive antennas and the ports for connecting the coax cables from the handheld terminal to the URFI.
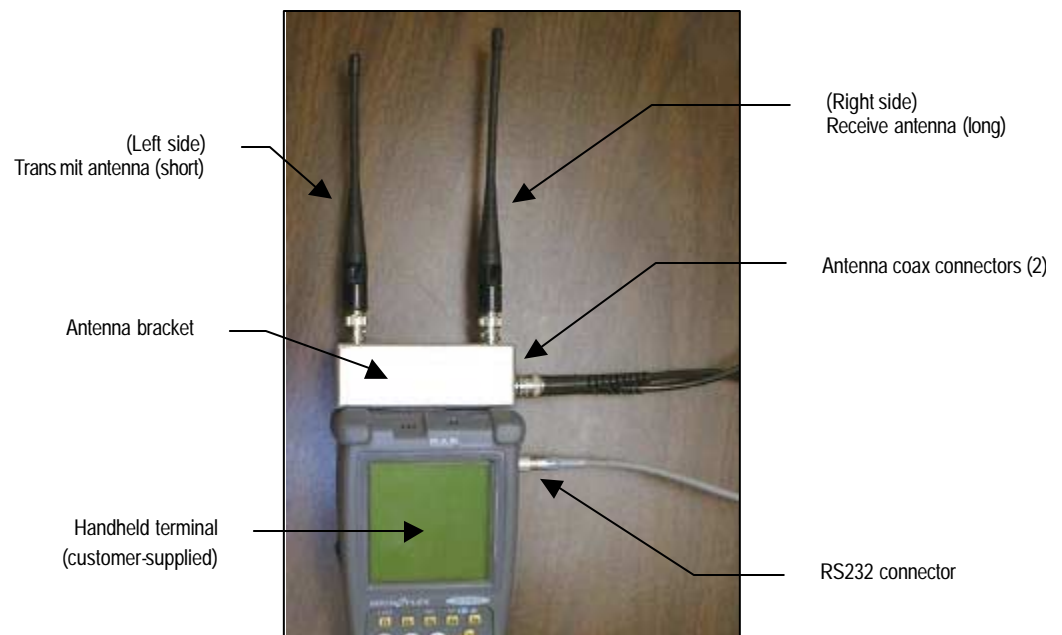
Use the following procedure to connect bracket, antennas and cables to the handheld terminal:

1. Attach bracket to the top rear of the handheld terminal by using the hardware provided.

2. Attach the transmit antenna (short) to the antenna port on the top left of the installed bracket.

   • Align the antenna connector's center pin with the center of the antenna port on the bracket and push antenna connector into port. Twist until connector locks in place.

3. Attach the <u>receive</u> antenna (<u>long</u>) to the antenna port on the top <u>right</u> of the installed bracket.

- Align the antenna connector's center pin with the center of the antenna port on the bracket and push antenna connector into port. Twist until connector locks in place.

4. Connect one end of each coax cable to an antenna port on the right side of the bracket.

- The <u>transmit</u> antenna port is nearest the <u>front</u> of the handheld terminal (top, in the photo below).

- The <u>receive</u> antenna port is toward the <u>back</u> of the handheld terminal (bottom, in the photo below).

- Align center hole of each coax cable's female end with the pin in the center of the antenna port. Push cable connector into port and twist till the connector locks in place.

RS232 serial port

Transmit antenna port

Receive antenna port
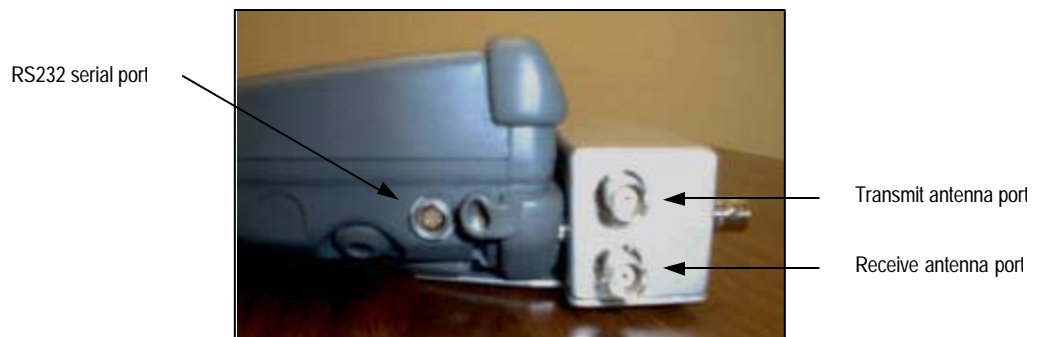
5. Connect the round end of the RS232 serial communications cable to the serial port on the right side of the handheld terminal.

Red dot on serial port

Red dot on cable end
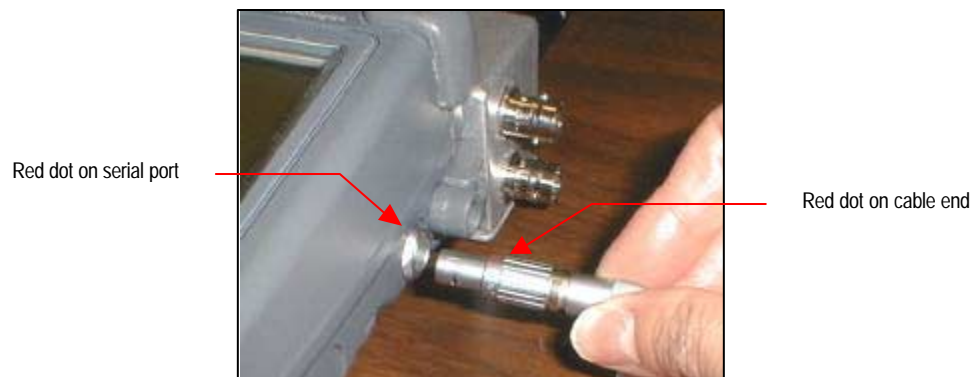
- Align the red dot on the cable connector with the red dot on the port. Push connector pins into place until snug.

Connecting Handheld Terminal to URFI

1. Slip the URFI unit into its wearable carrying pouch and snap closed.

Transmit Antenna Port   Receive Antenna Port

RS232 Serial Port   Power Port

- Ensure the serial port, power and antenna ports are properly exposed through the opening in the fabric.

2. Connect the male end of each antenna coax cable to the corresponding port on the URFI.

- Transmit antenna connects to the port on the left, receive antenna on the right.

- Align the coax connector pin with the hole in the center of the URFI antenna port. Push in and twist until connector locks into place.

3. Connect the large end of the RS232 serial cable to the serial port.

- Align the connector so that the 4-pin row on the cable aligns with the 4-hole row on the URFI serial port. Push connector till snug.

- Turn the two locking screws on either side of the connector until finger tight and the connector is secured to the URFI.

4. Connect the power cable to the URFI power port.

- Push connector into port until secure.

Connecting the Battery Power Supply and URFI

1. If not already done, slip the battery into its carrying pouch.

2. Connect the power cable (with its cigarette lighter-type plug) into the corresponding receptacle on the battery pack.

3. Connect the other end of power cable to the power jack on the URFI.

4. With the battery in its carrying pouch, attach the battery to your belt (or attach shoulder strap/waist belt).

5. With the URFI in its carrying pouch, attach it to your belt or to its shoulder strap.

URFI on belt

Battery on shoulder strap

You are now ready to interrogate TRACE transponders automatically.

Chapter Five

Using the Battery Pack

The URFI battery is part of a rechargeable battery kit that provides a portable 12VDC power source.

New Batteries

When using a new battery, always charge for about 8 hours prior to use.

Recharging Batteries

URFI batteries can be recharged using standard 120 VAC household current.

To recharge batteries:

1. Disconnect the battery from the URFI by removing the cigarette lighter-type plug from the receptacle on the battery pack.

2. Plug the AC adapter/charger's cigarette-lighter-type connector into the receptacle on the battery pack.

   - A fully discharged battery requires approximately 6-8 hours to recharge.

Safety Precautions

Observe the following to ensure proper performance of your URFI battery power pack:

- Always recharge battery after every use.

- Disconnect battery from equipment when not in use.

- Do not drop or subject to strong physical shock.

- Do not subject to temperatures above +140°F (as may occur in closed vehicles exposed to direct sunlight).

Chapter Six

Troubleshooting

There is very little the user can do to troubleshoot URFI problems.
Contact AMCO Automated Systems if you need assistance.

Symptom	Possible Cause	Solution
Unable to read transponders at more than 100 feet.	Obstacles between URFI/interrogator and transponder are limiting read range.	Move URFI or obstacle to gain line-of-sight with transponder, if possible. Use external, vehicle-mounted antennas to increase range.

TRACE®

Universal RF Interrogator

HOST SOFTWARE

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> AMCO Automated Systems
> 107 Erskine Lane
> Scott Depot, WV 25560
> Phone 304-757-3300   Fax 304-757-3388

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HOST PROGRAMMING GUIDE

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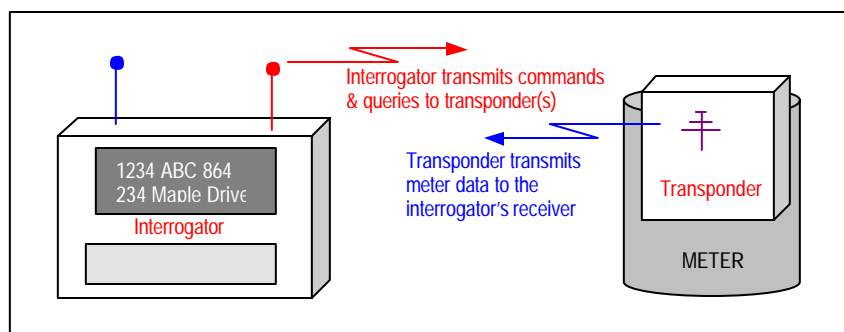
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- **Interrogator**—At its simplest, the interrogator remotely reads meter data transmitted by transponders. At more sophisticated levels an interrogator may also program transponders, store route data, selectively "wake up" transponders, verify transponder conditions and data and set meter coordinates, among other functions.

- **Antennas**—Both the transponder and the interrogator use antennas to broadcast and receive RF signals. The transponder's antenna is typically located on the circuit board inside the transponder case. Some interrogators use external antennas (as shown in the illustration below), one for transmitting and one for receiving. Many handheld interrogators use a single antenna for both transmitting and receiving (antenna may be internal or external).

Interrogator transmits commands & queries to transponder(s)

Transponder transmits meter data to the interrogator's receiver

1234 ABC 864
234 Maple Drive
Interrogator

Transponder

METER

The interrogator sends out an RF signal to the desired transponders. Upon receiving an authorized command the transponder transmits its stored meter data.
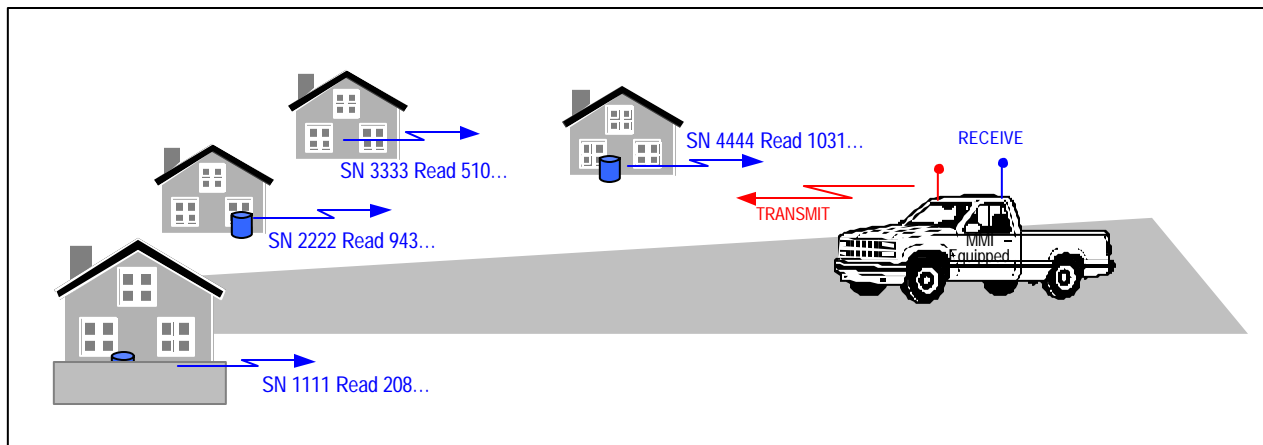
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Meter interface. Using a mechanical-to-digital interface, the TRACE transponder senses the output from the index of a utility meter, translates this into electronic form and stores it in the transponder's memory.

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Data transfer from handheld. At the end of a shift, stored meter reading information is transferred from the handheld terminal to the host package for ultimate use in billing systems for processing.

Transmission Accuracy

Data accuracy is assured by a four-part process:

1. Patented TRACE technology ensures that a transponder is triggered to respond *only* when it receives a properly authorized transmission of its unique serial number from the URFI (or any other AMCO Automated Systems interrogator).

2. The transponder then calculates an error-detection code which must be verified by the handheld terminal before the transponder data can be acquired and stored.

3. The ReadIt software compares the current meter reading with hi/low audit values (established by the billing department and entered into the route file prior to reading meters) and it looks for readings that fall outside those limits. The handheld terminal can be programmed to issue audible or visual warnings when a read value exceeds preset limits, regardless whether the read was acquired manually or automatically via RF.

4. Upon receipt of a response, the URFI checks the transmission frequency of incoming data to verify it is a valid frequency range for TRACE transponders.

RF Signals and Conditions

URFI Range. As a rule, transponders within approximately 300 feet of the URFI (with no obstructions between URFI and transponder) should receive interrogation signals and respond appropriately. Indoor meters can be read through most walls from a distance of up to 100 feet.

Obstructions. Line-of-sight provides the optimum transaction range. Although the URFI can read transponders through walls and fences, any obstacles between the URFI and transponder may reduce the range at which successful transactions may be conducted. Metallic obstacles (vehicles, trash cans, metal sheds, etc.) in the path will severely impede or block the transmission of RF signals.

Transaction Capacity. The URFI can interrogate and acquire transponder data in less than two seconds per transponder.

URFI Specifications

The following table shows the URFI specifications:

Power	UL approved, high-capacity sealed lead-acid battery.
	Vehicle cigarette lighter/accessory adapter included for mobile use.
RF Transmitter	Frequency: 451.35 MHz, 2W peak power
RF Receiver	Frequency: 415 MHz, 4 MHz narrow band, single channel
FCC Compliance	The URFI has been type accepted by the FCC for use under Part 90
FCC ID	G8JURF01
Weight	2 lb.
Dimensions	6.2″ x 4.3″ x 1.9″ (L-W-H)
Operating Temperature	-22°F to +158°F (-30°C to +70°C)
Storage Temperature	-40°F to +185°F (-40°C to +85°C)
Shock Resistance	Withstands 2 foot drop to concrete
Water Resistance	Resistant to driving rain

Battery Specifications

Battery Voltage	12 Volts nominal, 2.0 Amp Hour
Battery Charger	UL approved, mobile charger with male cigarette adapter plug +
	500mA UL/CSA AC wall charger (120 V)
Charge Time	6-8 hours from complete discharge
Charge Retention	(Shelf life at 65°) 1 month = 97%, 3 months = 91%, 6 months = 85%
Standby Life Expectancy	3-5 years
Weight	30 oz. (approx.)
Dimensions	3.5″ x 1″ x 6.5″
Operating Temperature	-4°F to +140°F

URFI Maintenance

The URFI has no user-serviceable parts or adjustments.

Chapter Four

URFI Host Programming
Customer Serial Interface

This chapter provides host programming information for the TRACE Universal RF Interrogator.

Changes

The following changes have been implemented since Beta model:

Pressure Compensation

New Command for V9 support of Pressure Compensation Factors (see PC and RC)

Power On/Off

Change Power On/Off from RTS (pin 7) to DTR (pin 4) and other small corrections.

URFI Attributes and Performance Characteristics

1. **Communications.** The URFI uses a 9-pin RS232C cable connection, with a Baud rate of 19200, 8 bits, and no parity.

2. **Protocol.** The basic protocol between the Customer Application S/W (S/W) and the URFI is as Master to Slave. The S/W will originate all commands and the URFI will provide an acknowledgment within a maximum time interval (different for each command).

3. **Power-on.** The first "command" is turning on power to the URFI. This is controlled by the DTR line (pin 4) in the serial port. This will produce a cursor "URF>" when the URFI has initialized and is ready for a command (< 300 msec).

4. **Power-off.** Power-Down can be controlled the same way, the DTR line, or with the Stand By (SB) command but the DTR uses much less power (<0.5ma vs 100ma). SB can also be used as a sleep/cradle mode, in which all commands would be ignored except the Wake-Up command. This will allow the URFI to share the same serial port with other devices or multiple URFIs.

5. **Throughput enhancement.** In between a command and its reply the URFI will ignore the serial port, to reduce overhead and improve throughput. If the URFI fails to respond in the maximum time for that command the S/W can reset the URFI by toggling the serial port DTR line.

6. **URFI response.** After all replies, the URFI will resend the "URF>" cursor to acknowledge it is ready for another command. Except after the Stand-By or Power-Down commands, because it will not be ready then. Invalid command strings will return "INVALID" at the point where the error is found, and the rest of the command line is ignored.

7. **Set-up.** Setup parameters will all be saved in non-volatile memory (EEPROM) so they can be set once, at the factory or with a PC. The S/W will not be required to perform any special setup commands each time the URFI is powered up. Use the "UE" command to save the current setup to EEPROM as the new defaults.

URFI Command Conventions

1. **Command termination.** All commands end with a Carriage Return and Line Feed (not shown below).

2. **Checkum On.** When Check-Summing is on (CS+), commands and replies will be followed by a 2 digit ASCII-Hex sum as the last two characters, except for CheckSumOff ("CS-") and Help ("?").

3. **Valid serial number characters.** <sn> = a 1 to 8 digit Serial Number, with wild card digits as "?". (H, E, L, and P are also valid).

   NOTE: SN digits not supplied will be assumed to be leading 0s.

4. **Comments.** Text in { } are comments, not data.

5. **Text in Brackets.** Text in [ ] will only appear as needed. (exceptions)

6. **Option lists.** Option lists are shown as: < x | y > = x or y.

URFI Commands

The following tables detail the URFI commands and responses.

Purpose	Command	Response
Power-Up	{DTR (Pin 4)=logic1}	{CTS (Pin 8)=logic1} URF> (~ 0.25 sec)
Power-Down	{DTR line=logic0}	{CTS=logic0}
Stand-By	SB	{ignore all commands except WU[<id>]<cr>}
Wake-Up	WU[<id>]	<id><cr><lf>URF>
Where: <id> is the 5 digit Serial Number of the URFI. If none is supplied any unit will respond.		
Check-Summing	CS<+|->	{no reply, enable or disable checksums}
Update EEPROM	UE	{no reply, save current options as defaults}
The nn last used in SPnn, SOnn, and G+,nn and F1 and F2 become the power-up defaults.		
Read Meter	RM[<sn>][,T][,F<1|2>]	<Reading>[,T<S|O|B>][,C<S|R|B>],<ss>,<bat> or R<N|B|C<ch>|A|J>

Where:
    T = Send Clear Tamper with command. (if no <sn> use previous <sn>)
    F1 or F2 = use Frequency 1 or 2 (if no F use F1 at power on then last one sent)
    T = Tamper followed by either S = Short, O = Open or B = Both.
    C = Corrupted followed by S = Serial Number, R = Reading, or B = Both.
    <ss> = The received Signal Strength (>1.0v is usually good but 2.5 is a glitch)
    <bat> = Battery voltage during the Interrogation. (9 Volts =to low to transmitt)		

Or if no valid reading could be found, one of the following error messages will be sent:
    R = Reply: N = None (no data lock), B = Bad (bad BCH), A = Aborted (batt<9V or Tx>4W)
    RC<ch> =Data lock found on Channel <ch> (but not on the current channel), where:
        <ch> =-25 to +15 (0=415 MHz in 100KHz steps) (see LC command)
        (NOTE: only time to scan the current RcvCh+/-10 Channels)
    RJ = Receiver Jammed, data lock found before interrogation started, read aborted.		

Read SN	RS[<sn>][,T][,F<1|2>]	<8 SN digits>,V<ver>,<type>,<ss>,<bat> or R<N|B|C<ch>|A|J>

Where:
    If no <sn> uses the last SN or "?" is assumed. The other items are the same as in RM.
    <ver> = one digit F/W version.
    <type> = G for Gas, W for Water or E for Electric meter
    <ss> = Signal Strength
    <bat> =Battery voltage during transmit.
    R = Reply: N = None, B = Bad, C<ch> = try Channel <ch>, A = Aborted, J = Jammed.		

Purpose	Command	Response
Read Sub-Counts & P.C.F.	RC[<sn>][,T][,F<1|2>]	<count>/<divisor>,[<Num>/<Denom>,]<ss>,<bat> or R<N|B|C<ch>|A|J>
Where: *Count and divisor are 3 digit numbers, representing the fractional reading not counted yet.* *On Transponders with V9 code or later the Num/Denom is the Pressure Compensation Factor (P.C.F.) (default: 1/1, see PC).* *R = Reply: N= None, B = Bad, C<ch>= Try Channel <ch>, A= Aborted, J= Jammed.* *<u>Note:</u> This command is not valid for Gen2 (<sn> < 2,500,000).*		
Program Compensation Factor	PC[<sn>][,F<1|2>],<Num >[,|/]<Denom>	[RA] {use RC command to verify}
Where: RA = Programming Aborted. *<u>NOTE:</u> Valid only for units with V9 code or later. Use RC or RS command to verify type and programming. PC can be any fraction where Num and Denom are integers from 1 to 255. By default it is 1/1 and on units before V9 the RC command will not show any factors.*		
Program Reading	PR[<sn>][,F<1|2>][, <count>]	[RA] {use RM command to verify}
Where: RA = Programming Aborted. *<u>Note1:</u> If <sn> is Gen2 the S/W must prompt the user to use and remove the Programming Stick, before verifying the reading with an RM command. (RM won't work if the Stick is still on)* *<u>Note2:</u> wild cards are not allowed when programming. If no <count>, 00000000 is assumed.*		
Load Channel	LC<ch>	{none, URF>}
Where <ch>=-25 to +15 (+ and leading 0 optional) Sets the Rcv frequency to that Channel *Channel 0 = 415MHz and the channel spacing is 100KHz.* *At Power-on the default is Channel -5 (414.5MHz).* *When an RM, RS or RC command replies with "RC<ch>" send "LC<ch>" if you want to use this channel on the next interrogation (or to set it back to the default afterward) or record this channel in a data base for use on this SN next month.*		
System Status	SS	V:<ver>,S:<csum>,B:<Volts>,I:<Volts|0.0>,C:<Rcv Ch>, T:<Xmit F1 >,<Xmit F2>
Where: <ver>=URFI F/W version, <Xmit F1> and <Xmit F2> are the two licensed Transmit frequencies for this URF (defaults = 451. and 457.575 MHz). *<Rcv Ch>= the last channel used, (default=-5) B<volts> is the batteries current voltage and I<volts> is the voltage during the previous Interrogation (or 0.0 if the URFI has not transmitted yet).* *Note: More information is displayed when the Expanded mode, "X+", is active. (see COM2 spec.)*		

Purpose	Command	Response
Group Mode	G<+|->[,nn]	[GA]
Where: G- = Normal Interrogation mode, 1.5 seconds of Dummies before each command. *G+ = run the transmitter continuously , sending Dummy Ints. between commands. About 15 times faster, when conditions permit. (60 dummies before first Int. only)* *nn = G+ mode Time-out (in seconds), reverts back to G- mode (default=30 sec.)* *GA= Group mode Aborted, if Vbat<9V or Vcc<5V or TxPwr>~3W, and stops the Tx.* *The G+ command will wait for 5 Dummies before returning. During this time it monitors the battery, Vcc and TxPwr and returns GA if they are out of range. These items are also tested once a second when G+ is active, but no message is sent if the Tx is aborted, but the next G+ will repeat these tests and will return GA if the condition still exits.* *<u>WARNING</u>: "G+,00" will leave the transmitter on forever, but can overheat the URFI if it is not well ventilated, and will drain a battery in about 30 minutes, so use with care.* *The G+ command would be sent before the first SN in a group of meters known to be close together (such as in an apartment building or a new shipment of meters on the loading dock). Then the transmitter will be left on between commands, to keep all of the transponders awake, until the G- command is sent after the last SN in the group. This will allow the whole group to be read in a fraction of the normal time. In applications where battery life is not a concern the Group interrogate mode could be used all the time, to achieve near Van-like reading rates, but a G+ should still be sent again periodically to verify proper operation.* *Group mode is only possible when the URF is using antennas more than 3 feet apart or all transponders in the group are within 10 feet, with the supplied antennas.*		
Antenna-switch	A<E|I>	Set the Antenna switch to External or Internal. (old MURFI only)