



TWACS[®] - ORION[®] For UMT Products

USER GUIDE

Y20100-TUM (Rev B)

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CHAPTER

1

INTRODUCTION

This chapter contains general information about this manual, important safety warnings to observe when using this product, contact information to receive support, and an overview of the TWACS system.

Safety Warnings and Symbols

	<div style="background-color: red; color: white; padding: 5px; text-align: center;">  DANGER </div> <p>Electrical equipment contains hazardous voltages. May cause death, serious personal injury or equipment damage.</p> <p>Always de-energize and ground the equipment before maintenance. Maintenance should be performed only by qualified personnel. The use of unauthorized parts in the repair of the equipment or tampering by unqualified personnel will result in dangerous conditions which will cause severe personal injury or equipment damage. Follow all safety instructions contained herein.</p>
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IMPORTANT

The information contained herein is general and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. DCSI reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawing or supplementary material or both, the latter shall take precedence.

QUALIFIED PERSON

For the purpose of this manual a qualified person is one who is familiar with the installation, configuration, or operation of the equipment and the hazards involved. In addition, the person has the following qualifications and **is trained**:

- a) **and authorized** to de-energize, clear, ground, and tag circuits and equipment in accordance with established safety procedures.
- b) in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc. in accordance with established safety practices.
- c) in rendering first aid.

The following symbols are used in this manual.

Symbols and Warnings



WARNING: Indicate a risk of injury, possible death, and equipment damage.



WARNING: Indicates a risk of electric shock, causing possible injury, death, and equipment damage.

Support

The TWACS Portal (<https://portal.twacs.com/>) provides a wide range of information that can serve as a starting point when you have a question. The Portal contains information such as:

- User Guides
- Service Advisories
- Training Registration
- Certified Partner Information
- Current News
- FAQs
- Customer Discussion Threads
- Upcoming Events
- User Group Conference Information
- *The Power Line* Newsletter

If, at any time, you would like to speak with a DCSI representative about any product or service or if you do not have a username and password to access the Portal, please contact DCSI Customer Care:

Email: care@twacs.com

Phone: 1-800-892-9008

Address: Distribution Control Systems, Inc.
945 Hornet Drive
Hazelwood, MO 63042
USA

Product Returns

IMPORTANT Before returning product to DCSI, make sure you have identified the root cause of the problem. As needed, perform troubleshooting requesting Technical Support through DCSI Customer Care when additional assistance is required. It is critical to identify the root problem to avoid shipping hardware for repairs when the problem lies elsewhere.

To return DCSI products for repair, complete the Service & Repair RMA Request through the TWACS Portal (<https://portal.twacs.com/>), providing as much detail about the problem as possible. If you have any questions regarding your return, please contact rma@twacs.com or call 1-800-892-9008 and choose the Service and Repair option.

Related Documentation

The following publications are referenced in this manual. The documents listed below plus the latest version of all other DCSI technical publications are available through the TWACS Portal (<https://portal.twacs.com/>).

HHTR-PC Application Help

Provides all the necessary details for transferring Intelligent End Device (IED) installation and removal data from an HHTR-3 unit to a PC and formatting that data for export to the Master Station (MS) or to a utility's Meter Data Management (MDM) system. Access the Help through the HHTR-PC Application software interface. The Help is not available through the TWACS Portal.

Meter Shop Test System Help

Provides all the necessary details required for testing TWACS-enabled devices with the Meter Shop Test Tool software. Access the Help through the Meter Shop Test Tool software interface. The Help is not available through the TWACS Portal.

Meter Shop Test System Set-Up Guide (Y10030TM)

Provides information that enables you to test TWACS-enabled devices for TWACS signaling response, read select transponder registers, zero select transponder registers, and perform various other transponder functions.

Portable RCE Test Unit Technical Manual (Y103127-3TM)

Ships with the Portable RCE Test Unit. Includes detailed product specifications and operating instructions.

TNS End User Guide (Y10285TM)

Serves as a companion manual to the TNS Operational Process Guide. While the TNS Operational Process Guide provides high-level process and procedure recommendations for obtaining optimum results from your TWACS system, the TNS End User Guide provides the detailed procedures, and form field and application definitions, that enable you to perform the functions found in the process manual.

TNS Operational Process Guide (Y10352TM)

Presents high-level procedures and processes for operating your TWACS system, through the TNS interface. These processes and procedures span a number of application sets, and are organized around functions such as reading meters, substation setup, and operating TNS.

Transponder Type and Model Matrix (Y10598-TEB)

Provides a listing of transponders, transponder types, and applicable meter models.

TWACS® Network Gateway Operational Process Guide

Includes procedures and processes for operating your TWACS system through the TWACS® NG interface. The information spans a number of application sets, and are organized around functions such as reading meters, substation setup, and operating TWACS NG.

TWACS® NG System Help

Built into the TWACS® NG interface, topic and index-searchable online system help is available. Access the Help through the software interface. The Help is not available through the TWACS Portal.

Universal Metering Transponder for FOCUS® Meter User Guide (Y10574-TUM)

Provides a functional description, as well as troubleshooting information and technical specifications for the UMT-FOCUS transponder.

Universal Metering Transponder for kV2c Meter User Guide (Y10577-TUM)

Provides a functional description, as well as troubleshooting information and technical specifications for the UMT-C-KV transponder.

Let Us Know How We're Doing

In an ongoing effort to produce effective documentation, the Technical Publications department at DCSI welcomes any feedback you can offer regarding this manual.

Please relay feedback, including suggestions for improvement or to alert us to corrections, by sending an email to techpubs@twacs.com or calling Customer Care at 1-800-892-9008.

TWACS System Overview

The TWACS system is a fixed network, utility communication system. Running at a centralized location, the TWACS operating software communicates with end points, such as meters, by way of existing power lines. The TWACS system allows full two-way access to and from the consumer's meter, providing communication and control features for the Utility.

The TWACS system consists of three levels of components (see *Figure 1.1*):

- Master Station (MS)

The Master Station TWACS operating software, either TWACS Net Server (TNS) or TWACS® Network Gateway (TWACS NG), is the chief component of the entire Two-Way Automatic Communication System (TWACS). The Master Station software manages all collected metering and interval data as well as the connection between the utility and the consumer's premises. TNS is DCSI's standard solution while TWACS NG is available for very large deployments requiring a high volume of readings for time-of-use or critical peak pricing programs.

The primary functions of TNS and TWACS NG are:

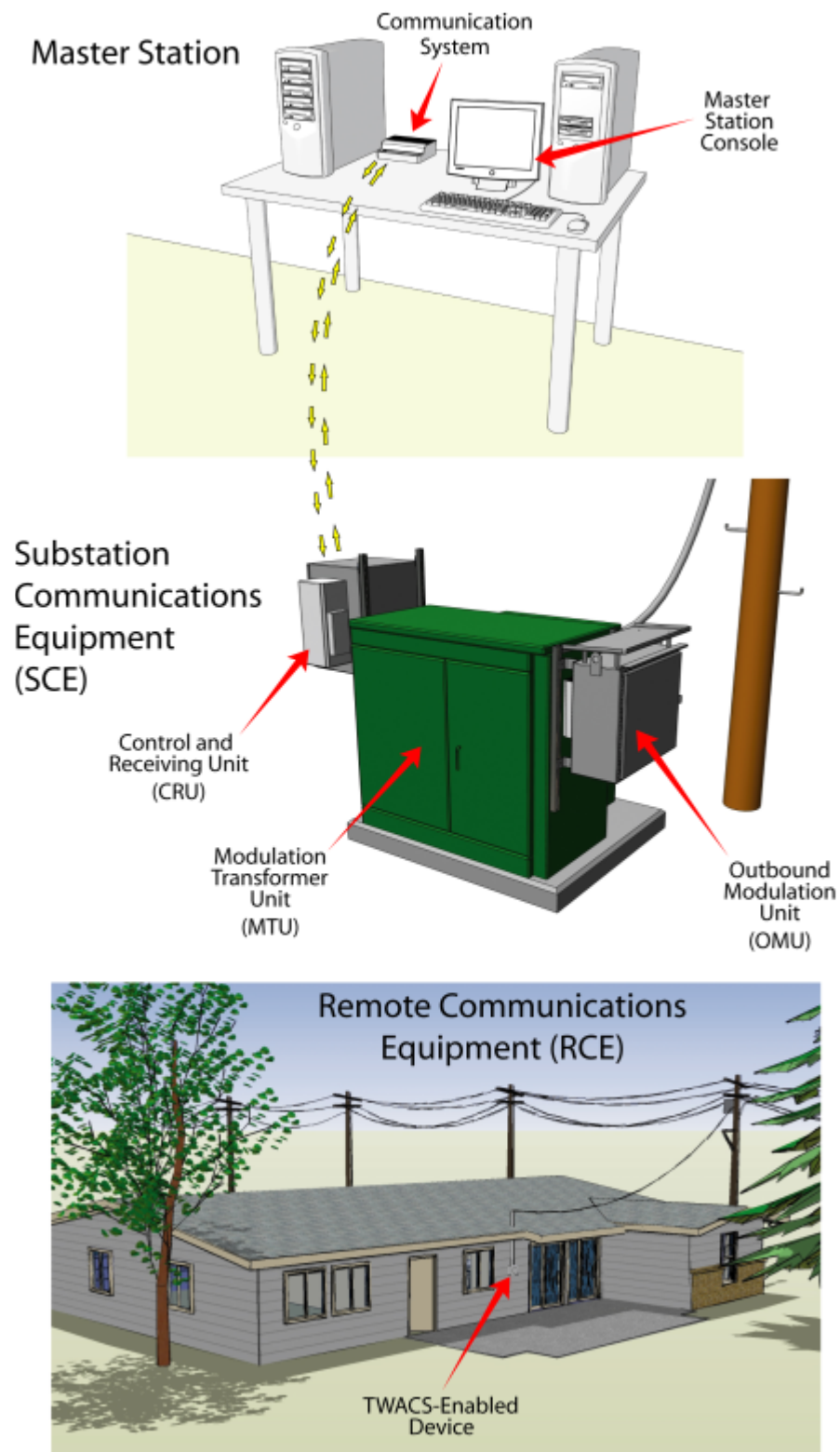
- Managing the TWACS system communication network.
- Supporting applications such as metering, troubleshooting, outage detection, and load control.
- Collecting remote meter data for the database server, which forwards the data to a third-party utility software application.

TNS and TWACS NG are part of the corporate enterprise network. The system is based on the Oracle® database, which is an open system, meaning it can interact and inter-operate with other applications on local and remote systems, on a variety of hardware platforms, and in a number of software environments. The system provides the user interfaces for configuring the necessary parameters to retrieve and send data.

- Substation Communications Equipment (SCE)
- Remote Communications Equipment (RCE)

This is the level at which the meter transponder resides within the electric meter.

As shown in *Figure 1.1*, outbound messages originate in the Master Station and pass through the substation to the transponder (RCE). Inbound meter data is sent from the transponder to the SCE, where it is decoded and then sent to the Master Station for analysis or bill file creation.

Figure 1.1 TWACS system

FUNCTIONAL DESCRIPTION

This chapter provides a brief overview of the TWACS® - ORION® system, explains how the TWACS® - ORION® system interfaces with the TWACS system, and describes the functions of the EMTR-3, HHTR-3, and ORION® transmitter.

System Overview

The TWACS® - ORION® system utilizes radio frequency (RF) transmission communication between an RF-enabled auxiliary meter and an RF-enabled meter. Data relative to energy usage from auxiliary gas, water, propane, or other Intelligent End Device (IED) can be gathered and retrieved in this manner.

Information is retrieved across the Two-Way Automatic Communication System (TWACS) network by the TWACS Net Server (TNS) located at the utility company.

The TWACS® - ORION® system solution is comprised of the following RF devices:

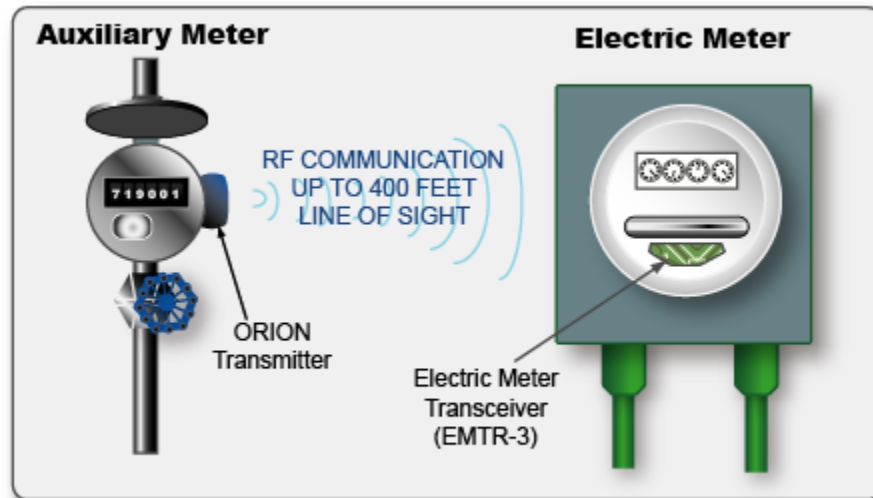
- Electric Meter Transceiver (EMTR-3; throughout this document EMTR-3 refers to both the EMTR-3 and EMTR-3-KV)
- Hand Held Transceiver (HHTR-3)
- Universal Metering Transponder (UMT; throughout this document UMT refers to both the UMT-R-F MP and UMT-C-KV MP)

NOTES Also part of the system, but not provided or installed by DCSI, is the Badger Meter, Inc. ORION transmitter that is installed at the auxiliary meter and converts the meter information into electronic signals.

Changes not expressly authorized by DCSI, Inc. could void the user's authority to operate the equipment.

RF communication links the ORION (located at the auxiliary meter) to the EMTR-3 (located inside a nearby electric meter.) This communication enables successful operation of the Automatic Meter Reading (AMR) system.

Figure 2.1 ORION transmitter and EMTR-3 transceiver

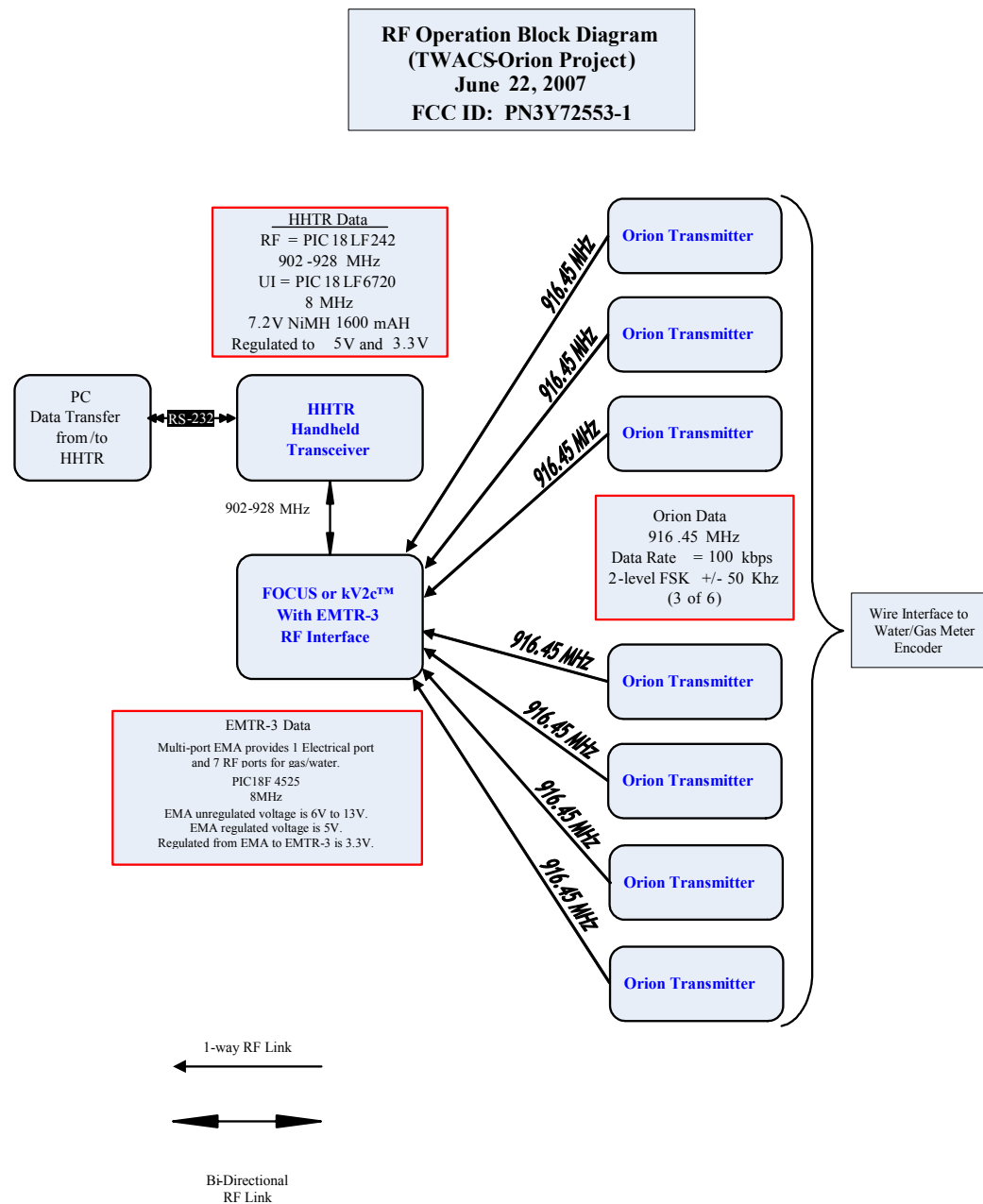


The TWACS[®] - ORION[®] system operates in the 902 - 928 MHz Industrial/Scientific/Medical frequency band. The Badger ORION devices periodically transmit bursts of digital data containing meter reading information on a frequency of 916.45 MHz. These are one way transmissions, sent as a two millisecond burst every four to five seconds, and are field strength limited under section 15.249 of FCC regulations. The EMTR-3 devices are manufactured by DCSI and receive transmissions from any ORION devices within range that have been assigned to that EMTR-3. The EMTR-3 then passes the data to the UMT-R-F MP or UMT-C-KV MP TWACS transponder. When requested by the utility, the meter data is returned using the TWACS power line communications system.

The HHTR-3 is a tool used by an installer to set up and configure the EMTR-3 to listen for transmissions from specific ORION devices. It also maintains a record of installation activities which may be downloaded to a PC via hardware link at the end of the day.

The following block diagram summarizes the interfaces and communications between the system components.

Figure 2.2 RF operation block diagram



During the installation and configuration process, the HHTR-3 and EMTR-3 use one or more of 51 channels spaced 322 kHz apart in the 902-928 MHz band to intercommunicate with each other. Control commands and data are input to the HHTR-3 via the keypad by the installation operator and passed to the EMTR-3 over the RF link. The EMTR-3 acknowledges transmissions from the HHTR-3 and can read back internally stored data for confirmation of receipt. EMTR-3 transmission occurs only when data is sent or requested by the HHTR-3. Frequency channel selection is controlled by the HHTR software and is not operator selectable. Both the HHTR-3 and EMTR-3 operate as intentional radiators under Section 15.249 of FCC regulations, with transmitted field strengths limited to less than 94 dBuV/meter. These units use frequency shift-keyed digital data at 9600 bps to communicate, and no subcarriers are used. The occupied bandwidth of the EMTR-3 or HHTR-3 transmissions is 200 kHz. Both the HHTR-3 and the EMTR-3 devices have permanently attached integral antennas and use single integrated circuit RF transceivers.

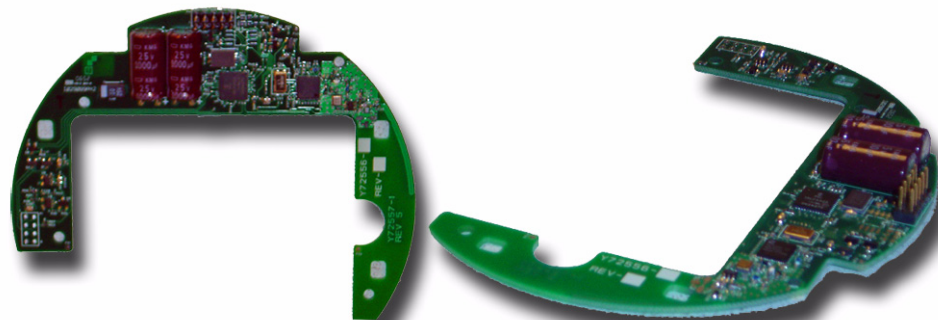
Electric Meter Transceiver (EMTR-3)

The EMTR-3 is an electronic module assembly (EMA) that is installed in a TWACS-enabled meter. The EMTR-3 is connected to the UMT transponder during meter/transponder integration. The EMTR-3 adds functionality to the host UMT. It does not communicate over the power line but provides data on-command to the UMT when queried.

The EMTR-3 can communicate with up to seven ORION[®] transmitters. Data from the ORION[®] transmitter is relayed to the EMTR-3 at each communication session. This data is relayed upon request to the UMT via I²C communication and is accessed by the TNS across the TWACS network.

The EMTR-3 listens (for 2.5 seconds) for communication from an ORION[®] transmitter. Then, for 2.5 seconds the EMTR-3 listens for an HHTR-3. This pattern cycles continuously.

Figure 2.3 Electric Meter Transceiver (EMTR-3)



**REGULATORY
DATA**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: reorient or relocate the receiving antenna, increase the separation between the equipment and receiver, connect the equipment into an output on a circuit different from that to which the receiver is connected, consult the dealer or an experience radio/TV technician for help.

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.

Badger Meter, Inc. ORION[®] Transmitter

The DCSI RF TWACS System and the Badger Meter, Inc. ORION[®] transmitter are capable of data communication. The ORION[®] module uses the RF bubble-up broadcast mode to communicate (one way) from the auxiliary meter to the electric meter. The ORION[®] transmitter sends customer usage data (at 100Kbps) every five seconds on the 916.450 MHz frequency channel. The RF TWACS system receives and processes this data via the EMTR-3 where it relays on request to the UMT module. Then it can be retrieved by the utility across power distribution lines.

Figure 2.4 ORION transmitters for water, gas, and remote

**WATER
ORION**

**GAS
ORION**



Specifications:**Table 2.1** ORION transmitter specifications

ORION	
Specification	Description
Power	3.6 VDC embedded battery
Functional Life Expectancy	Minimum: 10 years Expected: 15 years
Frequency	916.450 MHz
Data Communications	Burst mode fixed length packet, simplex
Data Format	3-of-6
Data Rate	100 Kbps \pm 1 Kbps
Data Encryption	None
Modulation	Frequency Shift Keying (FSK)
Packet Encoding	Non Return to Zero (NRZ)
Channels	Single channel (43A)
Range	400 ft. clear line of sight - affected by installation and conditions; less if pit installed

Hand Held Transceiver - 3 (HHTR-3)

The DCSI Hand Held Transceiver - (HHTR-3) is used to configure and setup the EMTR-3 (installed in the electric meter). The HHTR-3 is used to establish the communication link between the EMTR-3 and the ORION[®] transmitter and can be used to test the radio link.

RF Hardware Installation

This section provides instructions for installing the RF hardware on-site. A functioning network can be created and its functionality verified before leaving the site.

Pre-Installation Field Survey

The field survey is used to review the environmental conditions present at any particular location and lay out the system to maximize performance. DCSI recommends that you conduct a field survey before performing the actual hardware installation.

As with all RF devices, certain environmental conditions must be present to optimize RF communications. Be aware of the factors that affect the radio transmission between the ORION and the EMTR-3 when performing the field survey, such as:

- Metal objects
- Thick walls or foliage
- Local radio interference
- Position of the ORION and/or EMTR-3

Factor in all environmental conditions when planning the location of the meter/EMTR-3 assembly.

NOTE A clear line of sight between the ORION transmitter and receiver is preferred, but is not always attainable.

The following section discusses the environmental conditions that may affect RF transmissions between the ORION and EMTR-3.

Environmental Conditions

Optimal RF communication between the ORION and the EMTR-3 is affected by many environmental conditions. Vehicular traffic, parked vehicles in the signal path, weather conditions, construction, and even the growth of foliage may affect or degrade RF communication.

Gradual loss of communication from the ORION (caused by an aging battery for example) can be detected through system checks by the TWACS Net Server (TNS) Master Station. Persistent loss of communication may indicate environmental interference and require a site visit to determine the cause.

NOTE Sites that continue to experience persistent loss of communication may require a Badger Meter, Inc. repeater or wired solution to ensure reliable operation.

The following environmental factors or conditions may affect RF transmission between the ORION[®] unit and the EMTR-3 located at the electric meter.

- Metal Objects

Metal objects significantly reduce the strength of the signals reaching the receiver. Ensure that no metal cladding, cabling, mirrors, water tanks, refrigerators, pipes, etc. are near the ORION[®] or EMTR-3. The straight-line path between both units should be as unobstructed as possible.

NOTE A small, single item, such as a pipe situated half-way between the transmitter and receiver, is less likely to have any affect on the signal strength than a larger item(s).

- Thick walls or foliage

Thick walls or foliage between the transmitter and receiver can reduce the signal strength. Brick, aluminum siding, thick stone walls, and concrete can impede signal reception.

Avoid dense foliage between the RF units and, when possible, provide a reserve “growth” clearance to accommodate the growth of foliage on bushes and trees during spring and summer.

NOTE Radio signals can pass more easily through plasterboard walls, fiberglass, and wood paneling than the previously listed materials.

- Local radio interference

The close proximity of a cell phone mast, a taxi operator's base station, or large electrical equipment may provide strong radio interference. The AMR radio devices should be relocated if these objects of interference are present.

- Position of the ORION[®] and/or EMTR-3

These are important factors in RF deployment. The ORION[®] antenna is omni-directional. The signal radiates 360 degrees. The EMTR-3 antenna alignment is parallel to the front cover of the electric meter, and is the most sensitive RF reception surface.

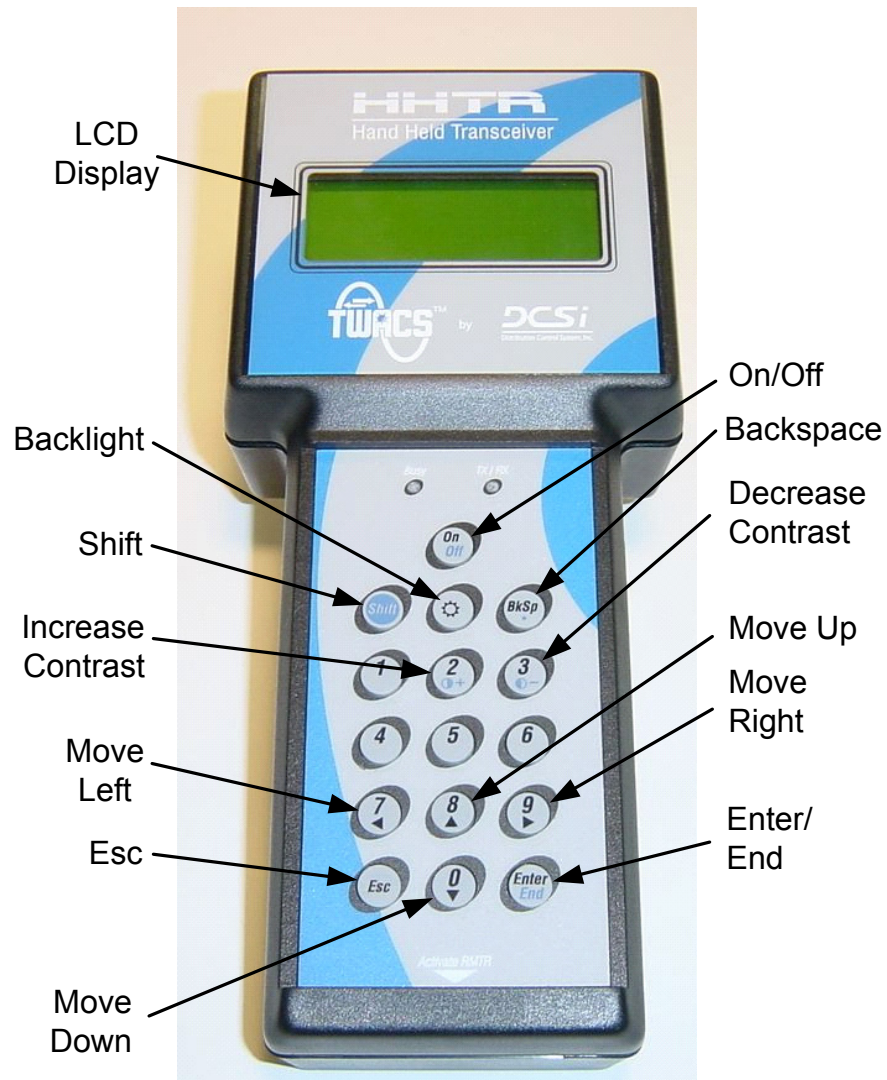
Face the front of the meter/EMTR-3 toward the ORION[®] transmitter when possible; even on opposite sides of a building. This allows maximum communication surface and distance between the units. Allow for some additional power margin in the signal strength to accommodate seasonal or other changes in environmental conditions.

In the future, after installation, the site owner should inform you of any alterations to the site that could affect radio performance.

Hand Held Transceiver-3 (HHTR-3) Keypad

This section describes the HHTR-3 keypad and its use for screen navigation.





Figure 2.5 Hand Held Transceiver keypad functions



Navigating the HHTR-3 Screens

Use the arrow buttons to navigate through the HHTR-3 screens.

Table 2.2 HHTR-3 screen navigation buttons

Button Number	Graphic	Function
7		Move left
8		Move up
9		Move right
0		Move down

NOTE When pressing the 7, 8, 9, or 0 numeric button, the HHTR-3 automatically determines whether the numeric or scroll functionality of the button is required.

Display Contrast

Adjust the display contrast by using the number **2** and **3** buttons as follows:

- Increase the contrast - Hold down the **Shift** button and repeatedly press the number **2** button.
- Decrease the contrast - Hold down the **Shift** button and repeatedly press the number **3** button.

Escape Button Functionality

The Escape key in general is used to cancel an action or go to a previous menu.

- Press the **Escape** key once to end the current procedure and return to the previous menu.
- Press the **Escape** key repeatedly to “back out” to previous menus.

The Escape key provides the menu navigation as defined in the following table.

Table 2.3 Escape key - menu mapping

Starting Menu Screen	Ending Menu Screen
EMTR3 Menu	Main Menu
Waiting for PC	Main Menu
Select EMTR S/N	EMTR3 Menu
Enter Time & Date	Select EMTR S/N

Table 2.3 Escape key - menu mapping

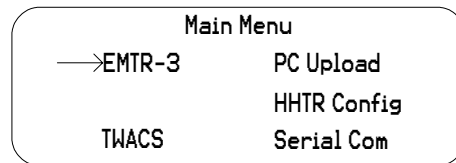
Starting Menu Screen	Ending Menu Screen
Manage IEDs	Select EMTR S/N
Starting Listening Mode	Manage IEDs
Listening List	Select EMTR S/N
Port List	Select EMTR S/N
RCE Change Out Menu	Select EMTR S/N
Port List Verification	RCE Change Out Menu
Port Number Menu	Listening List
Service Type Menu	Port Number Menu (if Listening List)
	Select IED S/N (if Port List)
Select IED S/N	Port List

HHTR-3 Menus

Below is a list of the menus and selections available from the HHTR-3.

Main Menu and Sub-Menu Items

- EMTR3
 - Manage IEDs
 - RCE Change Out
 - EMTR-3 Status
- PC Upload
- HHTR Config
 - Setup
 - Power
 - Status
 - Diags
- TWACS
 - HRTS
 - TWACS Modem
- Serial Com
 - Baud Rate
 - Display



NOTE If question marks (???) display instead of data, simultaneously pressing the **Backspace** button and pressing **0** clears the screen.

Turning On the HHTR-3

1. Press the **On/Off** button on the HHTR-3 keypad to turn on the HHTR-3 and view the Splash Screen.

DCSI: HHTR
Yxxxxx-xxx
Firmware Y.y
www.twacs.com

The Splash screen appears momentarily displaying the software version number. Firmware Y.y is replaced with the firmware version number installed in the HHTR-3.

The Main Menu screen appears.

Main Menu	
—→EMTR-3	PC Upload
	HHTR Config
TWACS	Serial Com

- NOTE** If an HHTR-3 serial number has not been entered, the Initialization Menu will display as shown below. Enter the serial number found under the barcode on the back of the HHTR-3.

(Check back of HHTR)
Please Enter the
HHTR S/N_____

Enter to Accept

2. Use the Left (7), Right (9), Up (8), and Down (0) keys to move the cursor to a desired selection on the Main Menu.

Main Menu	
EMTR-3	—→PC Upload
	HHTR Config
TWACS	Serial Com

EMTR3 Menu

The Electric Meter Transceiver 3 (EMTR-3) contains the equivalent of network routing tables that must be maintained. The EMTR-3 maintains a routing table that is built upon its port list, which reserves a given port for a given Intelligent End Device (IED). The HHTR-3 can be used to manually create, modify, or remove these port list assignments.

There are two options for inserting an IED into the EMTR-3's port list: Listen Mode and direct access to the Port List. Both options provide the same installation with different aspects of the process being automated. Whether automated or manual, the process gathers the IED serial number, service type, and desired port location for installation.

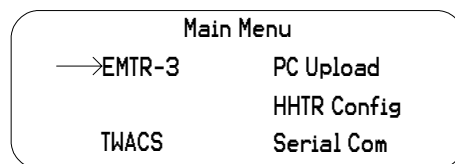
The user must know the serial number of the EMTR-3 and manually enter it into the HHTR-3 to establish a communication link with the EMTR-3.

NOTES When entering an ORION gas or water IED serial number for installation, if the serial number is less than 79,999,999, drop the first digit, "7", and enter the seven remaining digits. For all ORION gas and water IEDs with serial numbers equal to or greater than 80,000,000, enter all digits of the IED, which will be from 8 to 10 digits.

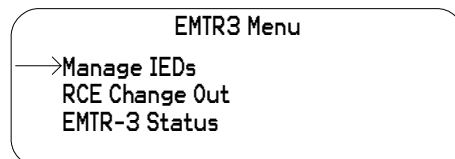
There is no direct communication between the Intelligent End Device (IED) and the HHTR-3.

Use the following procedures to navigate the EMTR3 menu screens.

1. On the Main Menu use the navigational keys to place the cursor to the left of EMTR-3.



2. Press the **Enter** key to view the EMTR3 menu.



3. Use the Up or Down navigation keys to select any item, and then press **Enter** to view the Select EMTR S/N screen.

Select EMTR

Enter Serial Number

EMTR S/N_____

Enter to Accept

4. Enter the EMTR serial number using the HHTR-3 keypad and press **Enter**.
 - a Upon power-up the HHTR-3 date and time are cleared. The HHTR-3 will automatically gather and update date and time information from the EMTR-3 with which it is communicating.
 - b While the HHTR-3 and EMTR-3 exchange date and time information you will see the following screen:

Select EMTR

Enter Serial Number

EMTR S/N_____

Please Wait...

- c If the EMTR-3 fails to give date and time information to the HHTR-3, you will see the following screen:

Enter Time & Date

Date: 20yy/mm/dd

Time: hh:mm:00

Enter to Accept

Enter the current Date and Time.

Press **Enter** to accept the Date and Time.

After the time and date acquisition process has been performed, the next menu screen is displayed based on the initial selection from the EMTR-3 menu screen.

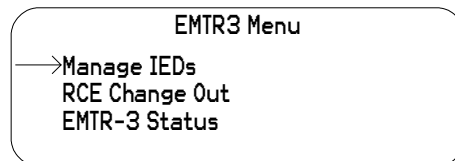
Manage Intelligent End Devices (IEDs)

This section describes how to insert an IED into the EMTR-3's port list using the Manage Listen Mode or the Manage Port List.

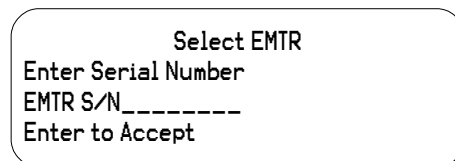
Manage Listen Mode

Use the following procedure to view the EMTR-3's port assignments using Manage Listen Mode.

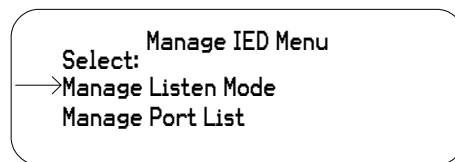
1. From the EMTR3 menu use the Up or Down navigation keys to select Manage IEDs.



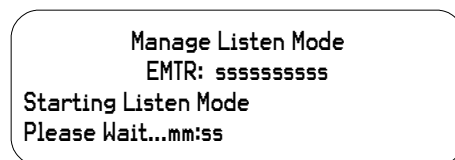
2. Press **Enter** to view the Select EMTR screen.



3. Enter a serial number using the keypad.
4. Press **Enter** to accept the serial number and view the Manage IED Menu.



5. Use the Up or Down Navigation keys to select Manage Listen Mode, and press **Enter** to view the Starting Listen Mode screen.



Wait to view the Reading Listen Data screen.

```

Manage Listen Mode
EMTR: ssssssssss
Reading Listen Data
Please Wait...

```

Wait to view the Listening List.

```

IED xx/xx P SR Cnt
→ ssssssssss X GT ccc
  ssssssssss X GT ccc
  ssssssssss X GT ccc

```

The Listening List and Port List have two main parts. The first line consists of the column headings. The remaining three lines are actual list items.

```

IED xx/xx P SR Cnt ← Column Headings
→ ssssssssss X GT ccc ← List Items
  ssssssssss X GT ccc
  ssssssssss X GT ccc

```

The column headings, their meanings, and the values for the list items are shown in the following table.

Table 2.4 Listening list & port list column headings and list item values

Column Heading	Description	Values
IED	IED serial number	Any valid 10 digit IED serial number, or the term “Empty” on the Port List only to denote ports with no IED assignment.
xx/xx ¹	List Item Indicator - Indicates the number of the currently selected IED out of the total number of IEDs in the list	Ex: 32 IEDs total, cursor highlighting IED #14, “14/32”.
P	Port/Installation Indicator	1-7 = Port on the current EMTR-3 on which the IED is installed. I = IED marked installed in HHTR-3 records, but not installed on current EMTR-3. <blank> = if neither of above conditions are met.

Table 2.4 Listening list & port list column headings and list item values

Column Heading	Description	Values
S	Service Type Indicator	W = Water G = Gas P = Propane O = Other <blank> = if unknown or port is empty.
R	Remote Type Indicator	O = Orion (only remote type currently supported) <blank> = if unknown or port is empty.
Cnt ²	RF Counts	Up to three digits of RF counts.

¹ xx/xx is not an actual column heading, however it is presented here since it is included on the column heading line.

² There is no RF Counts field for the Port List.

The Listening List holds up to 39 lines of IED information. Since only three IEDs fit on the screen at any time, the Listening List may contain more list items than can fit on the display. Consequently the lists are scrollable.

- When the list first displays, the cursor highlights the first item on the list. Press the **down arrow** key to move the cursor through the list.

NOTE When you reach the third list item, you can push the down arrow again to view any items below it, but the cursor stays at the bottom of the display while the entire display shifts down.

Listen List Installation Setup

The installation process begins when you press the **Enter** key on a non-installed IED in the Listening List. The Port Number menu screen gathers the desired port number for installation. If that port number is already occupied by another IED, the IED status is gathered. If the port number is not already occupied, you will be prompted to select a service type.

Use the following procedure to install an IED using Manage Listen Mode.

- Follow the steps in *Manage Listen Mode* on page 24 to view the Listening List.

```

IED xx/xx P SR Cnt
ssssssssss X GT ccc
ssssssssss X GT ccc
ssssssssss X GT ccc

```

2. To begin installation, press **Enter** on an IED where the Port column is blank or where the Port column displays an “I”. A blank Port column means the IED has not been installed. An “I” in the Port column means the HHTR-3 has a record indicating it has already installed that IED on another EMTR-3.

```

      EMTR: ssssssssss
      IED: ssssssssss
Enter Port Number_
Enter to Accept

```

3. Enter a port number using the keypad, and then press **Enter** to accept.
 - a In the event the Port you’ve chosen is already occupied, you’ll see the Port In Use Warning.

```

Warn: Port In Use by
IED: ssssssssss
Continue Install?
ESC: NO, Enter: Yes

```

- b Press **ESC** to return to the Port Number screen or press **Enter** to overwrite the port assignment and view the Service Type menu.

```

      IED: ssssssssss
Enter Service Type
  —>Water      Nat Gas
      Propane   Other

```

4. Use the navigation keys to select the correct Service Type, and press the **Enter** key to view the Install screen.

```

      Installing
      IED: ssssssssss

      Please Wait...

```

Manage Port List

Use the following procedures to view the Port List using Manage Port List.

1. From the EMTR3 menu use the Up or Down navigation keys to select Manage IEDs.

```
EMTR3 Menu
→Manage IEDs
RCE Change Out
EMTR-3 Status
```

2. Press **Enter** to view the Select EMTR screen.

```
Select EMTR
Enter Serial Number
EMTR S/N_____
Enter to Accept
```

3. Enter a serial number using the keypad.
4. Press **Enter** to accept the serial number and view the Manage IED Menu.

```
Manage IED Menu
Select:
→Manage Listen Mode
Manage Port List
```

5. Use the Up or Down Navigation keys to select Manage Port List, and press **Enter** to view the Reading Port List screen.

```
Manage Port List
EMTR: ssssssssss
Reading Port List
Please Wait...
```

Wait to view the Port List.

```
IED xx/xx P SR
sssssssssss X GT
sssssssssss X GT
sssssssssss X GT
```

The Port List holds 7 lines of IED information. Since only three IEDs fit on the screen at any time (one heading line and three list items) the Port List may contain more list items than can fit on the display. Consequently the lists are scrollable.

6. When the list first displays, the cursor highlights the first item on the list. Press the **down arrow** key to move the cursor through the list. For more information, see *Listening list & port list column headings and list item values* on page 25.

NOTE When you reach the third list item, you can push the down arrow again to view any items below it, but the cursor stays at the bottom of the display while the entire display shifts down.

Port List Installation Setup

When you press the **Enter** key on an empty port (no IED serial number for the selected port) in the Port List, the installation process begins. The Select IED S/N screen allows you to manually enter the desired IED serial number for installation. If that serial number is already located on another port, the Duplicate Detected Error screen displays. If the serial number is not already located on another port, you will be prompted to select a service type.

Use the following procedure to install an IED using Manage Port List.

1. Follow the steps in *Manage Port List* on page 28 to view the Port List.

IED xx/xx	P	SR
Empty	X	
Empty	X	
Empty	X	

2. Press **Enter** on an empty port to view the Select IED S/N screen.

```

      EMTR: ssssssssss
Enter Serial Number
IED S/N_____
Enter to Accept

```

3. Enter an IED serial number using the keypad, and then press **Enter** to accept and view the Service Type menu.

IED: ssssssssss

Enter Service Type

→Water	Nat Gas
Propane	Other

- a In the event the serial number you've entered is already located on another port, you'll see the Duplicate Detected Error screen.

Already Installed
On port X!

Press Any Key

Press any key to return to the Select IED S/N screen.

4. Use the navigational keys to select the correct Service Type and press the **Enter** key to view the Install screen.

Installing
IED: ssssssssss

Please Wait...

Installation Results

Whether you use the Manage Listen Mode or Manage Port List method of installing an IED into an EMTR-3 port, there are only three possible results: Success, Failure, or Unknown.

Once the installation is complete (success, failure, or unknown) you return to either a Listening List or a Port List, which depends on the original list (Listening or Port) and the outcome of the installation.

Successful Installation

Use the following procedure to navigate through the screens of a successful installation.

1. From the Install screen wait to view the Install Successful screen.

Install Successful!

IED: ssssssssss

assigned to port X.

Press Any Key

2. Press any key to view the IED Status screen.

```

      IED Status
    EMTR: ssssssssss
      IED: ssssssssss
  Reading IED Data...
  
```

3. Wait approximately 12 seconds to view the Engineering Data 1 screen.

```

      IED Status
  Reading: xxxxxxxxxx
  LeakDet: X Tamper: X
    Press Any Key
  
```

4. Press any key to return to the originating list (either Manage Listen Mode or Manage Port List) updated with the new IED.

Unknown Installation

Use the following procedure to navigate through the screens of an unknown installation.

1. From the Install screen wait to view the Install Unknown screen.

```

  Install Unknown
  Verify Install

  Press Any Key
  
```

2. Press any key to view the Reading Port List screen.

```

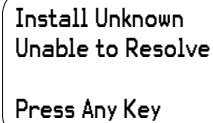
      Verify Install
    EMTR: ssssssssss
  Reading Port List
    Please Wait...
  
```

3. Wait approximately 12 seconds.
 - a If the install is successful you will see the following screen:

```

  Install Successful!
      IED: ssssssssss
  assigned to port X.
    Press Any Key
  
```

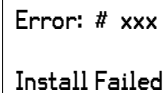
- b If the status of the installation remains unknown you will see the following screen:



Install Unknown
Unable to Resolve

Press Any Key

- c If the installation fails you will see the following screen:



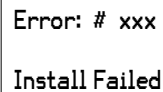
Error: # xxx

Install Failed

4. Press any key to continue.

Failed Installation

An installation that fails outright will display the Install Failed screen immediately after the Install screen.



Error: # xxx

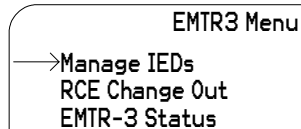
Install Failed

Press any key to return to the originating list.

IED Removal

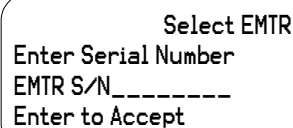
This section addresses successful, unknown, and failed IED removals.

1. From the EMTR3 menu use the Up or Down navigation keys to select Manage IEDs.



EMTR3 Menu
→Manage IEDs
RCE Change Out
EMTR-3 Status

2. Press **Enter** to view the Select EMTR screen.



Select EMTR
Enter Serial Number
EMTR S/N_____

Enter to Accept

3. Enter a serial number using the keypad.
4. Press **Enter** to accept the serial number and view the Manage IED Menu.

```

      Manage IED Menu
Select:
→ Manage Listen Mode
  Manage Port List

```

5. Use the Up or Down Navigation keys to select Manage Listen Mode or Manage Port List, and press **Enter**.
6. Wait to view the Listening List or the Port List.

```

      IED xx/xx P SR Cnt
→ ssssssssss X GT ccc
      ssssssssss X GT ccc
      ssssssssss X GT ccc

```

NOTE If you begin in the Port List, the Cnt field will not be present.

7. From the Listening List or Port List press **Backspace** on an installed IED to view the Verify Removal screen.

```

      IED xx/xx P SR Cnt
      ssssssssss P GT ccc
Verify Removal
Esc: No, Enter: Yes

```

8. Press **Esc** to return to the originating list, or press **Enter** to view the Removing screen.

```

      Removing
      IED: ssssssssss

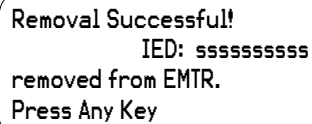
      Please Wait...

```

Successful Removal

Follow the steps detailed in *IED Removal* and use the following procedure to navigate through the screens of a successful removal.

1. Wait to view the Removal Successful screen.



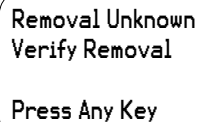
Removal Successful!
IED: ssssssssss
removed from EMTR.
Press Any Key

2. Press any key to return to the originating list (Listening List or Port List).

Unknown Removal

Follow the steps detailed in *IED Removal* and use the following procedure to navigate through the screens of an unknown removal.

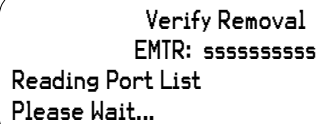
1. Wait to view the Removal Unknown screen.



Removal Unknown
Verify Removal

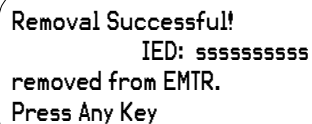
Press Any Key

2. Press any key to view the Reading Port List screen.



Verify Removal
EMTR: ssssssssss
Reading Port List
Please Wait...

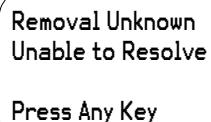
3. Wait to view the Removal Successful screen



Removal Successful!
IED: ssssssssss
removed from EMTR.
Press Any Key

-OR-

Wait to view the Unable to Resolve screen.

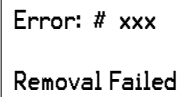


Removal Unknown
Unable to Resolve

Press Any Key

-OR-

Wait to view the Removal Failed screen.

A screenshot of a device screen with a light gray background and rounded corners. It displays two lines of text: "Error: # xxx" on the top line and "Removal Failed" on the bottom line, both in a black, sans-serif font.

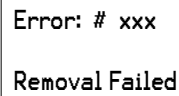
Error: # xxx
Removal Failed

4. Press any key to return to the originating list (Listening List or Port List).

Failed Removal

Follow the steps detailed in *IED Removal* and use the following procedure to navigate through the screens of a failed removal.

1. Wait to view the Removal Failed screen.

A screenshot of a device screen with a light gray background and rounded corners. It displays two lines of text: "Error: # xxx" on the top line and "Removal Failed" on the bottom line, both in a black, sans-serif font.

Error: # xxx
Removal Failed

2. Press any key to return to the originating list (Listening List or Port List).

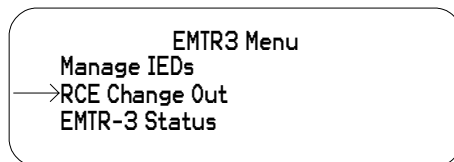
RCE Change Out

At some point an Electronic Metering Assembly (EMA), Electric Meter Transceiver-3 (EMTR-3), or both may need replacement. Assuming that the old EMTR-3 is still functional, the original port list can be downloaded to the HHTR-3 prior to removal of the old Remote Communication Equipment (RCE). After RCE replacement, the stored port list can be uploaded to the new EMTR-3 and operation may resume. This process can be carried out with the RCE Change Out menu selection. This selection allows the user to confirm proper installation and test the network.

Use the following procedures to navigate the RCE Change Out screens.

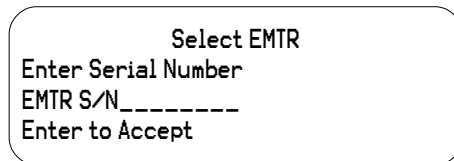
Extract Port List

1. From the EMTR3 Menu, use the Up or Down arrow keys to select RCE Change Out.



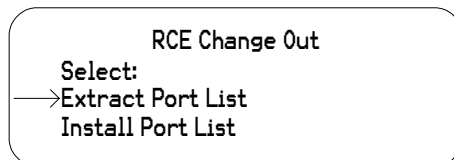
```
EMTR3 Menu
Manage IEDs
→RCE Change Out
EMTR-3 Status
```

2. Press the **Enter** key to enter the serial number of an EMTR whose Port List is to be reused (preserved).



```
Select EMTR
Enter Serial Number
EMTR S/N_____
Enter to Accept
```

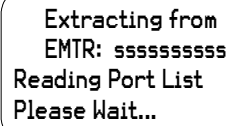
3. Press **Enter** to accept and view the RCE Change Out menu.



```
RCE Change Out
Select:
→Extract Port List
Install Port List
```

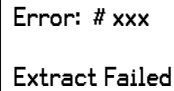
4. Use the Up or Down keys to select Extract Port List.

5. Press the **Enter** key to view the Extract Port List screen.



Extracting from
EMTR: ssssssssss
Reading Port List
Please Wait...

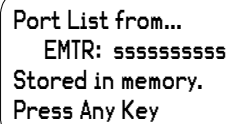
- a If the extraction fails you will see the following screen:



Error: # xxx
Extract Failed

Press any key to return to the RCE Change Out screen.

- b If the extraction is successful you will see the following screen:



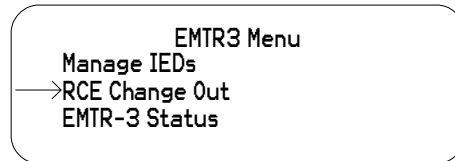
Port List from...
EMTR: ssssssssss
Stored in memory.
Press Any Key

6. Press any key to return to the EMTR3 menu.

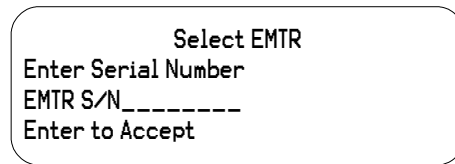
NOTE The extracted Port List will overwrite any previously extracted EMTR Port List stored on the HHTR-3.

Install Port List

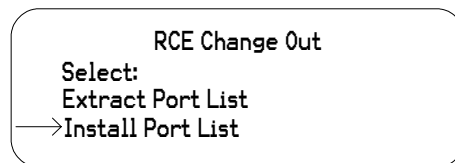
1. From the EMTR3 Menu, use the Up or Down navigation keys to select RCE Change Out.



2. Press the **Enter** key to enter the serial number of the EMTR onto which the previously extracted Port List is to be installed.



3. Press the **Enter** key to accept and view the RCE Change Out menu.

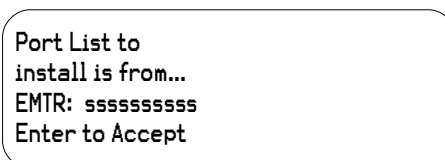


4. Use the Up or Down keys to select Install Port List.
5. Press the **Enter** key.
 - a If the Port List does not exist you will see the following screen:

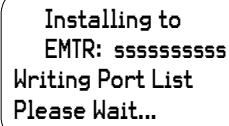


Press any key to return to the RCE Change Out menu.

- b If the Port List does exist you will see the following screen:

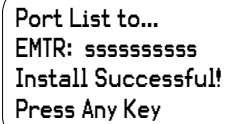


6. Press **Enter** to view the Install Port List screen.



Installing to
EMTR: ssssssssss
Writing Port List
Please Wait...

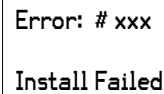
- a If the installation is successful you will see the following screen:



Port List to...
EMTR: ssssssssss
Install Successful!
Press Any Key

Press any key to return to the EMTR3 menu. The extracted list has been cleared from the HHTR.

- b If the installation is not successful you will see the following screen:



Error: # xxx

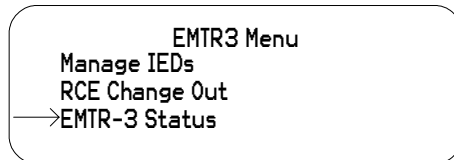
Install Failed

Press any key to return to the RCE Change Out menu.

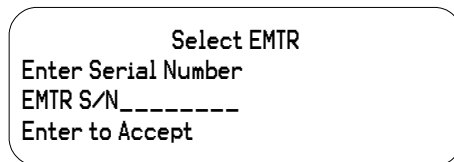
EMTR-3 Status

The HHTR-3 has the capability to check the status of the EMTR-3 via an RF link. The hardware version and firmware version information can be then be displayed. Use the following procedures to navigate the EMTR-3 Status screens.

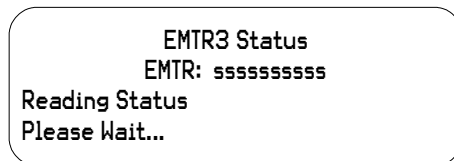
1. From the EMTR3 menu use the Up or Down navigation keys to select EMTR-3 Status.



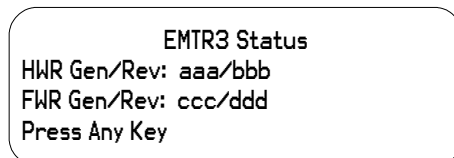
2. Press the **Enter** key to select an EMTR3.



3. Press **Enter** to view the Reading Status window.



Wait to see the status results.



4. Press any key to return to the EMTR3 menu.

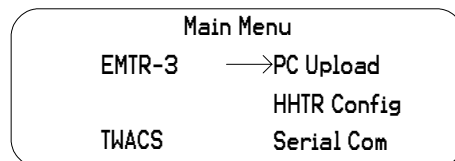
PC Upload Menu

The HHTR-3 maintains a database of the actions performed by the HHTR-3 for every installation, removal, and replacement of an Intelligent End Device (IED). It also records any IEDs detected by an EMTR-3 during a designated listening mode. All these records are maintained in an internal database. The HHTR-3 informs the user when this database becomes full and allows the user to upload the existing records prior to overwriting them.

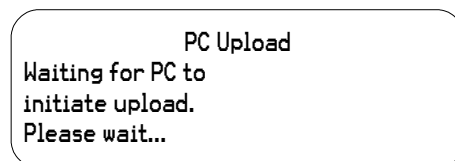
The HHTR-3 has the capability to upload the database to a personal computer (PC) that has the HHTR-PC application running on it. In addition to having the HHTR-PC application installed on the destination PC, the upload process requires the HHTR-3 to be connected to the PC via a special RS-232 serial data cable. For more information on the HHTR-PC application see the *HHTR-PC Application Help*.

To use the PC Upload feature of the HHTR-3, the HHTR-3 must be connected to a PC with the HHTR-PC application installed on it. The following procedure explains how to navigate the PC Upload screens.

1. From the Main Menu of the HHTR-3, use the navigation keys to place the cursor to the left of PC Upload.





2. Press the **Enter** key to view the PC Upload screen.



NOTE It is possible for this screen to time out. If this happens, press **Enter** to return to the Main Menu, select PC Upload, and press **Enter** to start the PC Upload again.

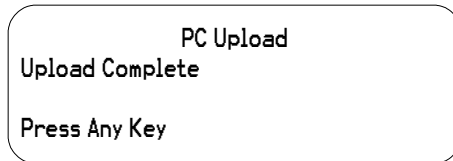
3. Start the HHTR-PC application if it isn't running on the PC.

4. Click the **Upload New**  button or the **Upload All**  button on the HHTR-PC application window.

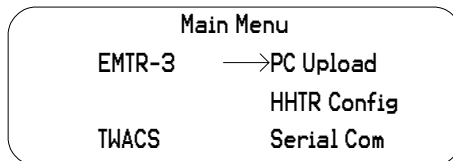
Wait to view the Uploading Database screen on the HHTR-3 display.



Wait to view the Upload Complete screen.



5. Press any key to return to the Main Menu of the HHTR-3.

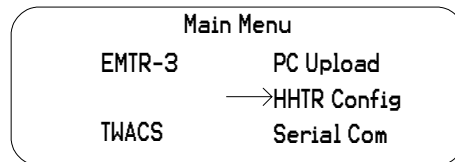


HHTR Config Menu

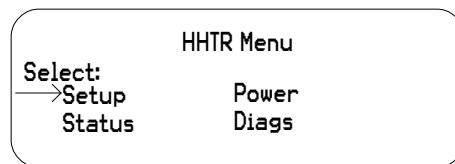
The following procedures explain how to navigate the Setup, Power, Status, and Diags screens associated with the HHTR Config menu.

Setup

1. From the Main Menu use the navigation keys to select HHTR Config.

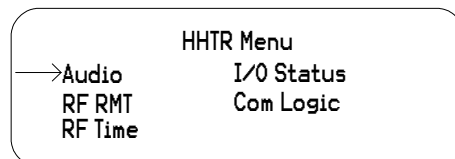


2. Press the **Enter** key to view the HHTR Menu. The default selection is Setup.

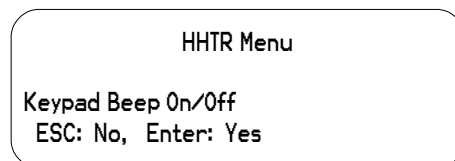


Audio

3. Press the **Enter** key to view the Setup selection options. The default selection is Audio.



4. Press the **Enter** key to view the Keypad Beep menu.

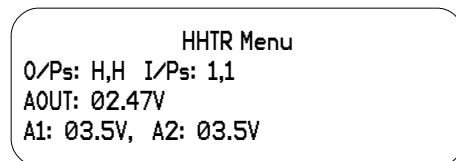


5. Press the **Esc** key to turn off the beep when keys are pressed, or press the **Enter** key to turn the beep on when keys are pressed. Pressing either the **Esc** key or the **Enter** key returns you to the Setup selection screen.



I/O Status

6. Use the navigation keys to select I/O Status.
7. Press **Enter** to view the I/O Status screen.



8. Press the **Esc** key or the **Enter** key to return to the Setup selection screen.

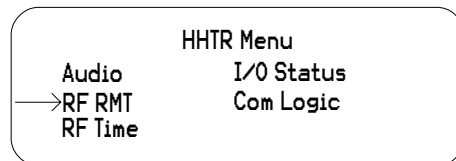


RF RMT

9. Use the navigation keys to select RF RMT.
10. Press **Enter** to view the RF Remote screen.

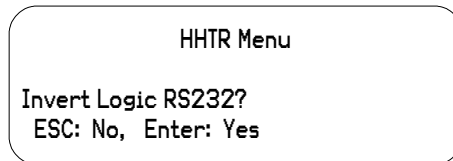


11. Press **Esc** to return to the Setup selection screen.

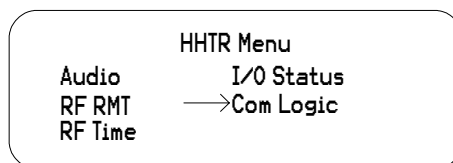


Com Logic

12. Use the navigation keys to select Com Logic.
13. Press **Enter** to view the Com Logic screen.

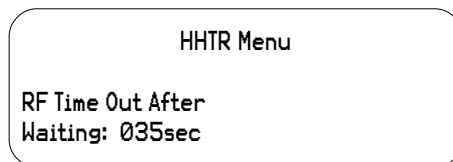


14. Press the **Enter** key to invert logic or press the **Esc** key to return to the previous screen. Pressing either **Enter** or **Esc** returns you to the Setup selection screen.



RF Time

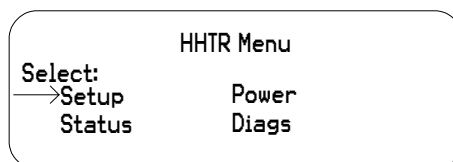
15. Use the navigation keys to select RF Time.
16. Press **Enter** to view the RF Time screen.



17. Press **Enter** or **Esc** to return to the Setup selection screen.

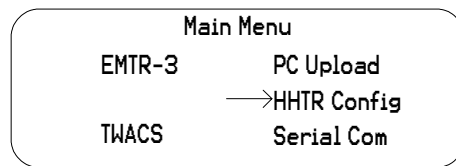


18. Press **Esc** to return to the HHTR Menu.

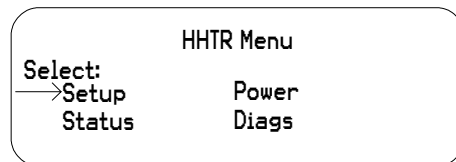


Power

1. From the Main Menu use the navigation keys to select HHTR Config.



2. Press the **Enter** key to view the HHTR Menu. The default selection is Setup.



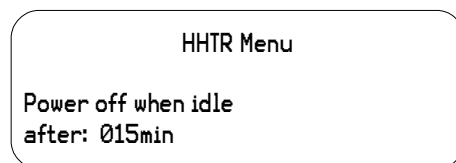
3. Use the navigation keys to select Power.

Power Off Time

4. Press **Enter** to view the HHTR Menu. The default selection is Power Off Time.



5. Press **Enter** to view how long the HHTR-3 unit must remain idle before it turns itself off.



The default value is 15 minutes. Increase the time by pressing the



key, or decrease the time by pressing the



key.

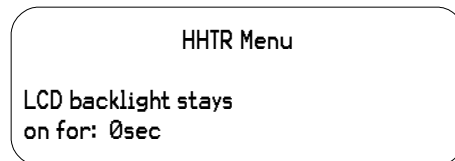
6. Press **Enter** or **Esc** to return to the HHTR Menu.



LCD Backlight Time

7. Use the navigation keys to select LCD Backlight Time.



8. Press **Enter** to view the screen indicating how long the backlight on the HHTR-3 display remains on after pressing a button.



The default value is zero. Increase the time by pressing the  key, or decrease the time by pressing the  key.

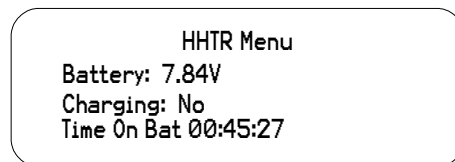
9. Press **Enter** or **Esc** to return to the HHTR Menu.

Battery Status

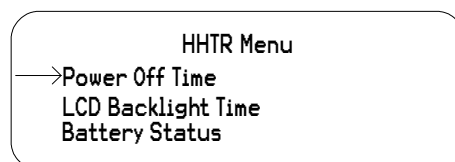
10. Use the navigation keys to select Battery Status.



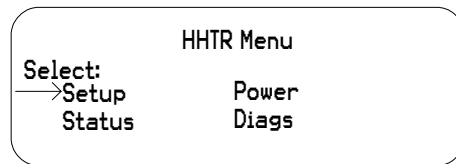
11. Press **Enter** to view the Battery Status screen.



12. Press **Enter** or **Esc** to return to the HHTR Menu.

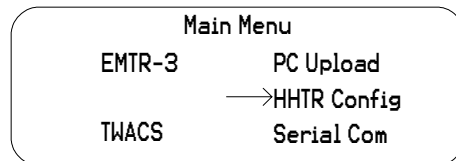


13. Press **Esc** to return to the main HHTR Menu.

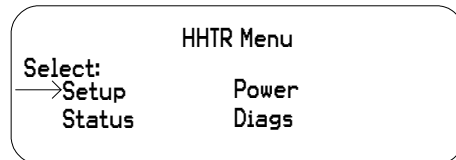


Status

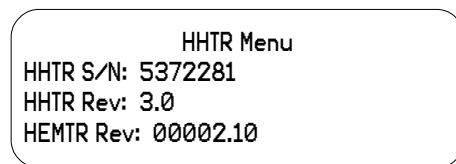
1. From the Main Menu use the navigation keys to select HHTR Config.



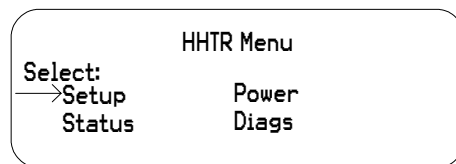
2. Press the **Enter** key to view the HHTR Menu. The default selection is Setup.



3. Use the navigation keys to select Status.
4. Press **Enter** to view the Status screen.

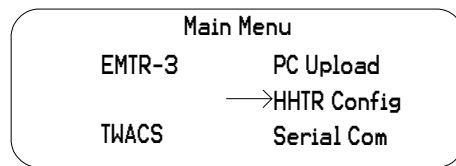


5. Press **Enter** or **Esc** to return to the HHTR Menu.

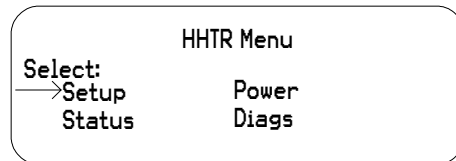


Diags

1. From the Main Menu use the navigation keys to select HHTR Config.



2. Press the **Enter** key to view the HHTR Menu. The default selection is Setup.

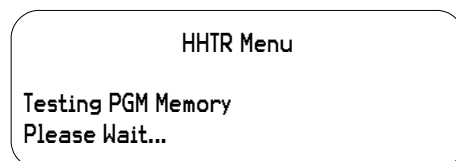


3. Use the navigation keys to select Diags.
4. Press **Enter** to view the Diags screen. The default selection is Test Memory.



Test Memory

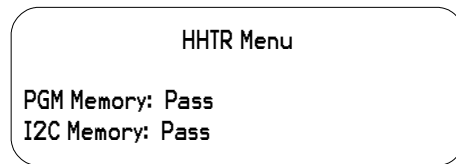
5. Press **Enter** to test PGM memory and view the screen below.



Once the PGM Memory test finishes, the I2C Memory test begins, and you will see the screen below.



Once the I2C Memory test finishes the HHTR-3 displays the results.



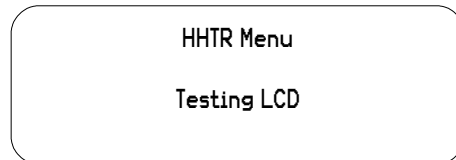
6. Press **Enter** or **Esc** to return to the Diags screen.

Test Keypad/LCD

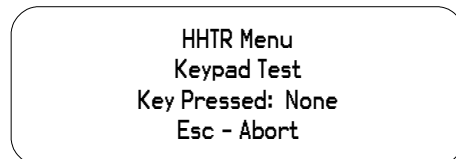
7. Use the navigation keys to select Test Keypad/LCD.



8. Press **Enter** to view the Testing LCD screen.



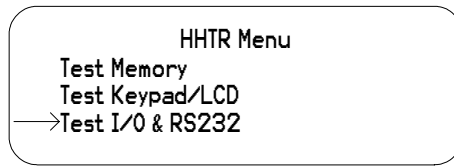
The screen briefly flashes before displaying the Keypad Test screen.



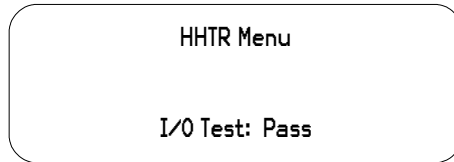
9. Press **Esc** to return to the Diags screen.

Test I/O & RS232

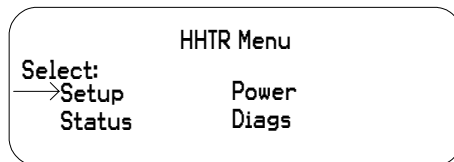
10. Use the navigation keys to select Test I/O & RS232.



11. Press **Enter** to view the I/O Test Results screen.



12. Press **Esc** to return to the HHTR Menu.

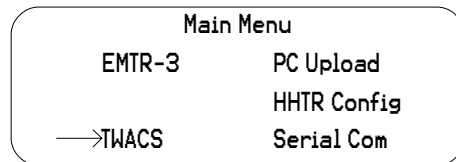


TWACS Menu

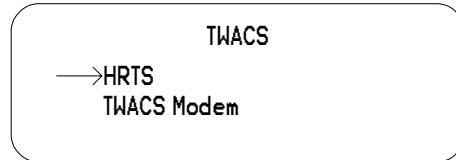
The following procedures explain how to navigate the HRTS and TWACS Modem screens associated with the TWACS menu.

HRTS

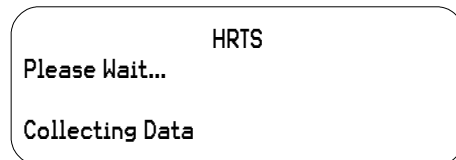
1. From the Main Menu use the navigation keys to select TWACS.



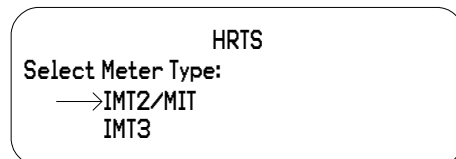
2. Press the **Enter** key to view the TWACS screen. The default selection is HRTS.



3. Press **Enter** to view the Collecting Data screen.



After a brief display the Select Meter Type screen replaces the Collecting Data screen. IM2/MIT is the default selection.



4. Press **Enter** to select IMT2/MIT or use the navigational keys to select IMT3.

HRTS
Can Not Connect...
Esc - Abort
Enter - Retry

5. Press the **Esc** key to return to the TWACS screen.

TWACS
—>HRTS
TWACS Modem

TWACS Modem

1. From the Main Menu use the navigation keys to select TWACS.

Main Menu
EMTR-3 PC Upload
 HHTR Config
—>TWACS Serial Com

2. Press the **Enter** key to view the TWACS screen. The default selection is HRTS. Use the Down (0) key to select TWACS Modem.

TWACS
HRTS
—>TWACS Modem

3. Press **Enter** to view the following screen.

This Feature is not
support yet...

Press Esc...

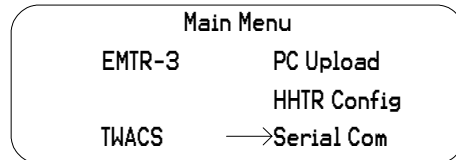
4. Press the **Esc** key to return to the TWACS screen.

TWACS
—>HRTS
TWACS Modem

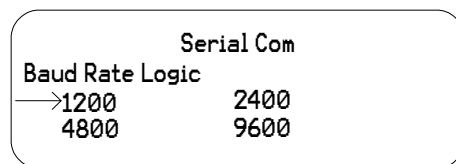
Serial Com Menu

The following procedures explain how to navigate the Baud Rate, Display, and Buffer screens associated with the Serial Com menu.

1. From the Main Menu use the navigational keys to select Serial Com.

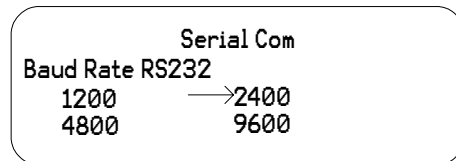


2. Press the **Enter** key to view the Baud Rate Logic screen.

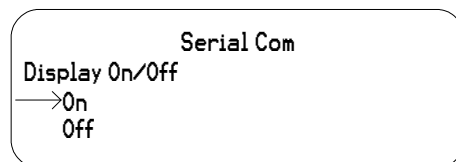


NOTE You can select 2400, 4800, or 9600 by using the navigation keys.

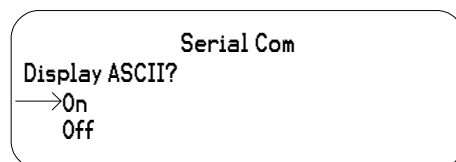
3. Press **Enter** again to view the Baud Rate RS232 screen.



4. Press **Enter** again to view the Display On/Off screen.



5. Press **Enter** again to view the Display ASCII screen.



6. Press **Enter** once more to view the Buffer screen, which shows how full the left and right buffers are.

```
Serial Com:
BufL: 0% BufR: 0%
L:
R:
```

7. Press the **Esc** key to return to the Main Menu.

```
      Main Menu
EMTR-3      PC Upload
           HHTR Config
TWACS      —>Serial Com
```

Deployment Procedure

The following procedure lists the steps required to deploy mulitport meters.

1. Install the electric meter equipped with a TWACS module and an EMTR-3.
2. Install the ORION intelligent end device (IED).
3. Use the Listen List from the HHTR-3 to determine which ORION IEDs are being heard by the selected EMTR-3.
4. Since the installer knows the ORION IED serial number, install the ORION IED using the Listen List. If you hear nothing or obtain Error Code #33 (see *Error code descriptions and solutions* on page 62) repeat this step.
5. If the ORION IED serial number is not in the Listen List, then program the IED serial number into the ORION Connect™ software in the Radix handheld device. Listen for that particular serial number from a distance of 4-5 feet from the TWACS-equipped electric meter.
6. If you still cannot detect it, walk closer to the ORION IED to check if the device is communicating.
7. If the ORION IED is heard within 4-5 feet of the EMTR-3 by the Radix handheld device, but is not in the Listen List, check for another EMTR-3 within a clear line of sight and repeat the process.

NOTES This procedure is a recommendation, but it is not a requirement. Exact installation procedures will be determined by the utility company and the installers.

Multiple IEDs such as water, gas, or propane, do not need to be installed in any particular order.

ORION water meters begin broadcasting when they detect a certain flow rate, but ORION gas meters require installers to manually turn on the radio.

TROUBLESHOOTING

This chapter explains how to test and manage typical TWACS® ORION® system problems. It is useful for installers and meter shop personnel. Foremost, it provides diagnostic information through the TNS and TWACS NG systems which give you a better assessment of problem conditions before field personnel are dispatched.

There are three essential sources of diagnostic information:

- The Intelligent End Device (IED) status, including leak detection, tamper detection, and port assignment.
- Among the four bytes of total consumption readings are specific bits of data for port-specific status information.
- The EMTR-3 diagnostic indicators.

Performing Remote Analysis (TNS)

Complete the following steps to determine if a field visit is required for an unresponsive meter. You can end the procedure at any step and correct the problem when a cause of failure is determined.

1. Check the AMRCOMMFAIL table for TWACS serial numbers that have excessive AMR Communication Failure counts. This enables you to identify meters that are consistently failing AMR.

If the meter fail count in the AMRCOMMFAIL table is equal to or greater than the MaxFailCnt in the TNSDEFAULTS table, the Quality Code (QC) will be set to RO (Retry Override). When the quality code is RO, the meter unit map will have changed in the AMRCMDLST2WAY table. The meter will be attempted the first time, but will not be issued subsequent retries and must be read manually.

2. Determine if any error messages have occurred during AMR by checking the SCE Notification log for any associated hardware issues for the meters that are not communicating.

NOTE The Notification log contains important information about the status of equipment and is automatically updated by TNS and the SCE. For detailed information about the Notification log and error messages, see the *Notification Log* section of the *SCE Logs* chapter in the *TNS Operational Process Guide* and the *Notification Log* section in the *SCE Maintenance* chapter of the *TNS End User Guide*.

3. Check for TNS errors that may have occurred because of commands time-out, or any software related issues in TNS that may have prevented AMR commands processing.

For more information on time-out issues, see the *Encode Command Parameters* section in the *TNS System Maintenance* chapter of the *TNS End User Guide*.

4. Perform an On-Request AMR command to determine if the unit communicates. (This command communicates to the unit by serial number to eliminate a two-way addressing issue.)

For more information about On-Request meter reads, refer to the appropriate sections in the *TNS End User Guide* and the *TNS Operational Process Guide*.

A site visit is not required, and you may stop this procedure if the meter communicates. If the meter communicates, check two-way addressing. (For more information on two-way addressing, see the *Function-Group Addressing* chapter of the *TNS Operational Process Guide* and the *Two-Way Addressing* section in the *TNS Generic Applications* chapter of the *TNS End User Guide*.)

5. Check for other TWACS meters that are reading on the same distribution transformer, or a nearby meter to narrow the communication problem area.
6. Check the Customer Information System for a disconnected status that may not have updated in the TNS database. If the meter was disconnected, no action in TNS is required, but you may want to change the cycle number.

The TNS Operator must have some process for dealing with a meter that no longer provides a read. The TNS Operator might consider setting up a special cycle (e.g. cycle 99) for disconnects and continue reading the meters. Having the disconnected meters in a special cycle allows the TNS Operator to isolate meters to scan for usage. If a Customer Service Representative re-activates the service and the notification fails to reach the TNS Operator, or if a customer tampers with the meter and reconnects the service, the TNS Operator can quickly identify a successful read in a group of meters where reads should normally fail. Using this configuration, the TNS Operator can quickly investigate the reason for the successful read of a supposedly disconnected meter.

7. Check for switching events which may have occurred in the system that possibly changed the communication path of the meter. (A communication path may have changed due to a physical move or a temporary switch to a different substation, phase, or other path component.) If the communication path has changed, you can use *Pathmaps* to update the TNS database.

For more information on communication paths, see the *Adding Meters Interactively* section in the *Searching Meters* chapter of the *TNS Operational Process Guide*. For more information on *Pathmaps*, see the *Alternate Pathmaps Search* chapter in the *TNS End User Guide* and the *Building and Searching Alternate Paths* chapter in the *TNS Operational Process Guide*.

8. Check the Alternate Substation tables for up-to-date information on Alternate Substations that can feed the primary sub.

For more information on Alternate Substation tables, see the *Adding Alternate Substation Information* section in the *SCE Maintenance* chapter of the *TNS End User Guide*. Also see the *Alternate Substation Mapping* and *Creating and Using Alternate Path Tables* sections in the *Building and Searching Alternate Paths* chapter of the *TNS Operational Process Guide*.

Port Specific Status Information

There is one byte within the Total Consumption reading (present or frozen) which contains data that may be invaluable for diagnosing and troubleshooting issues prior to rolling a truck.


Total Consumption (TC) registers (Present and Frozen Daily) on the EMTR-3 contain a three byte TC value and a one byte TC status. The Hour of Reading and Configuration field in the TC status is used to establish a desired level of validity for the TC reading. This five bit field also serves as a quick alternate method for time stamping the data.

The Master Station (MS) has the capability to decide the quality of a TC reading based on the Hour of Reading and Configuration field in the status byte of the Total Consumption registers. TNS reflects the status of the TC reading in the TNS field of the MIT On Request window.

Use the following procedure to access the MIT On Request window.

1. Follow the menu path ***Start > All Programs > TNS Metering Maintenance > TNS Metering Maintenance*** to view the Metering Maintenance toolbar.



2. Click the **MIT on Request**  button to view the MIT On Request window.

3. Click the drop-down arrow to the right of the Serial Number field.
4. Click a serial number to select it and populate the remaining fields.
5. Double-click the TNS field for a description of the TNS status code.

The following table presents common TNS status codes along with brief descriptions of those codes.

Table 3.1 TNS status codes

TNS Field Displays:	Short Description
1037	No IED installed
1038	No date
1039	Invalid date/time
1040	Stale data - the time and date stamp for the data is more than twenty for hours old
1041	Assignment list change
1042	Leak detected
1043	Tamper
1044	No EMTR is present

Performing Remote Analysis (TWACS NG)

Complete the following steps to determine if a field visit is required for an unresponsive meter. You can end the procedure at any step and correct the problem when a cause of failure is determined.

1. If communication fails to the transponder, check the path and search state of the transponder by following the path ***System Monitoring > Edit Path > Search States***.
2. Type in the serial number of the transponder and click **Lookup**.
If the transponder is currently in the New, Lost or Tentative path state, the TWACS NG will need to search the transponder. The TWACS NG Operator will need to be sure that it is in a search state of Ready. The search batch job should automatically pick up the transponder for search when the next job runs.
3. If the transponder is in a Good/Done state, the TWACS NG Operator may issue a ping to the transponder by following the path ***System Monitoring > Test Transponder***.
4. Type in the serial number or Meter/End Device ID and click **Ping**.
If the ping is successful, communication to the transponder is successful and has been verified. If the transponder is still not functioning as expected, a field visit will most likely be necessary.
5. The TWACS NG Operator may also want to check the notifications to verify if any have been received for the transponder in question. For more information regarding notifications, refer to the *Notifications* section of the *TWACS® Network Gateway Operational Process Guide*.
6. If the previous steps determine that the meter has “Failed”, see *Product Returns* on page 3 to return the meter.

NOTE For additional information regarding remote troubleshooting, contact DCSI Customer Care (email care@twacs.com or call 1-800-892-9008) to speak with a Technical Support Engineer.

EMTR-3 Diagnostic Indicators

The following table lists the error code number and error message text that the HHTR displays when the specific error is encountered while communicating with the EMTR-3.

Table 3.2 Error code descriptions and solutions

Error	Description	Solution
The following error codes are RF communication errors.		
01 RF Error	General error.	Retry the command.
02 Service Not Supported	Service is not supported.	Retry the command.
04 Operation Not Possible	RF error.	Retry the command.
05 Inappropriate Action Requested	RF error.	Retry the command.
06 RF Device Busy	RF error.	Retry the command.
07 Data From Device Not Ready	RF error. (Usually memory)	Retry the command.
31 RF Device Sent NAK	RF error	Retry the command.
32 Can not acquire an RF Link	RF error	Retry the command.
33 Operation Timed Out	Operation time expired without success.	Retry the command.
The following error codes are internal HHTR-3 or user errors.		
101 RFPIC sends a NAK	The RFPIC isn't ready or doesn't understand the command. The RF PIC internal to the HHTR-3 has failed.	Retry the command.
102 RFPIC is Busy!	RFPIC is performing another operation and is currently busy. The RF PIC internal to the HHTR-3 was in the middle of another command.	Retry the command.
103 No response from RFPIC on HHTR	The RFPIC isn't responding to the UI. No Response from the RF PIC. The RF PIC didn't respond to the UI processor.	Retry the command.
104 RFPIC Sent Invalid Response...	The RFPIC sent an invalid response to the UI. The HHTR-3 UI processor didn't recognize the response from the RF PIC.	Retry the command.
105 Operation Cancelled	Indicates the Esc button was pressed during an operation.	Continue to desired action.
221 Install Failed	The HHTR was unable to install the IED.	Retry the command
222 Removal Failed	The HHTR was unable to remove the IED.	Retry the command

Table 3.2 Error code descriptions and solutions

Error	Description	Solution
223 Extract Failed	The HHTR was unable to extract the port list from EMTR.	Retry the command
230 PC Upload Incomplete	The PC upload operation was aborted by the operator or there was a communication timeout.	Resolve any communication errors. Check cable. Ensure PC application is functional. Retry the command.

If you are unable to resolve a problem with the TWACS® ORION® system, return the meter to your integrator or DCSI. See *Product Returns* on page 3 for instructions.

Record Overwrite Warning

The Record Overwrite Warning displays when you attempt to install or delete an IED, perform an RCE Change Out, or select Manage Listen Mode when there are an insufficient number of database records available.

There are two Record Overwrite Warnings. The first Record Overwrite Warning can be seen below.

Warn: Database Full
Upload Data to PC

Press Any Key

Press any key to view the second Record Overwrite Warning.

Warn: Database Full
Continue Operations &
Overwrite Records?
ESC: No, Enter: Yes

Press **ESC** to return to the originating list, or press **Enter** to continue the operation and overwrite the existing records.

Field Troubleshooting

Distribution Control Systems, Inc. has developed various software and hardware products for testing TWACS-enabled devices in the field and the meter shop. See *Meter Shop Test System* on page 66 of this chapter for information regarding use of this system.

The EMTR-3 has no field serviceable parts. It can only install, delete, or query installed ORION transmitters.

When necessary, the HHTR can be used to -

- Install the Orion transmitter

NOTE The HHTR can not communicate with the Orion transmitter.

- Query the EMTR for a remote installed list
- Delete Orion from the EMTR installed list
- Check EMTR status (Hardware & Firmware version)

A remote list query by the HHTR gives port-specific information for each installed Orion transmitter as follows:

- Serial Number & Service Type
- Acquisition Failures
- 24 Hr. Acq Log
- Orion Status
 - Present Total Consumption (not current total consumption, but rather last RF communication total consumption, usually < 1 hr. old)
 - Leak Detect (tripped by water meter, will reset on its own, or can be manually reset in the field; see the meter manufacturer documentation for trip and reset conditions)
 - Tamper Detect (must be field reset at water meter)

If there is a problem, the applicable error code is displayed.

Addressing Common Field Problems

Three problems often encountered in the field are: an EMTR-3 that doesn't communicate, an EMTR-3 that doesn't knit, and an HHTR-3 unit that displays a "time out" message. The following sections focus on these errors.

EMTR-3 Does Not Communicate

You must first determine whether or not the ORION[®] Intelligent End Device (IED) is communicating. Verify this using the ORION Connect[™] software in the Radix handheld device or the drive-by device.

NOTE ORION water meters begin broadcasting when they detect a certain flow rate, but ORION gas meters do not.

If the ORION is communicating, then you must determine if the EMTR-3 is communicating. You can do this by taking a visual reading from the ORION Intelligent End Device (IED) and comparing it to the EMTR-3 reading obtained with the HHTR-3. If the readings are the same, the EMTR-3 is communicating. If the readings are not the same, verify the serial number of the EMTR-3 is correct. If it is, then place the HHTR-3 directly in front of the EMTR-3 to insure a clear radio frequency (RF) link. If the EMTR-3 reading still does not match the reading on the ORION, then check TNS. If the reading in TNS does not match the visual reading taken from the ORION IED, you may need to make an adjustment in the Meter Conversion table of TNS.

If the EMTR-3 reading does not match the reading on the ORION IED after these steps, the EMTR-3 is not communicating. Call DCSI Customer Care.

EMTR-3 Does Not "Knit"

Knitting is the association of an EMTR-3 with an Intelligent End Device (IED). This can be achieved using the Manage Listen Mode or the Manage Port List on the HHTR-3. If you can access the Manage Listen Mode or the Manage Port List, then the radio link between the EMTR-3 and the IED is good.

If you use the Listen List to associate an EMTR-3 with an IED and you get the message "Install Unsuccessful" or "Install Unknown", wait awhile and try again. The EMTR-3 may not be able to hear the ORION at that moment.

If you use the Manage Port List to associate an EMTR-3 with an IED and you get the message "Install Failed", verify the serial number is correct. If you get the message "Install Unknown" the EMTR-3 may not be able to hear the ORION at that moment. Wait awhile and try again.

HHTR-3 Times Out

If the HHTR-3 times out, verify the EMTR-3 serial number is correct. If the number is correct, place the HHTR-3 directly in front of the EMTR-3 to guarantee a clear communication path, and try again. If the HHTR-3 continues to time out after trying this, RF traffic may be exceptionally heavy, and the density is preventing good communication. Wait awhile and try again. If the HHTR-3 continues to time out, there may be a problem with the HHTR-3 or EMTR-3 firmware. Call DCSI Customer Care.

Meter Shop Test System

Use the Meter Shop Test System to test TWACS signaling, read select transponder registers, zero select transponder registers, and perform various other transponder functions on a TWACS-enabled FOCUS meter. For complete details on the Meter Shop Test System, see the Meter Shop Test System Help (accessed by clicking the **Help** button on the Meter Shop Test Tool main menu) or contact your Program Manager or DCSI Customer Care at care@twacs.com or 1-800-892-9008.

Because of the various test equipment available for use with DCSI products and the configuration requirements/options, the *Meter Shop Test System Set-Up Guide* will guide you through initial equipment selection and setup for meter/module testing.

If you are unable to resolve a problem with the TWACS®-ORION® System, return the meter to your integrator or DCSI. See *Product Returns* on page 3 for instructions.

SPECIFICATIONS

This chapter contains electrical, environmental, and physical specifications for the EMTR-3 and HHTR-3.

Electrical Specifications

The electrical specifications include:

- Electrical ratings
- Compliance Specifications

Electrical Ratings

The following table provides the electrical ratings for the EMTR-3.

Table 4.1 Electrical ratings

Parameter	Rating
Voltage	6V<=V<=12V
Quiescent power	25mA approximate
Maximum input surge	100mA maximum
Internal fusing	None
Grounding	None
Electronics connection	The EMTR-3 is connected to the UMT-R-F MP or UMT-C-KV MP transponder during meter/transponder integration.
Electronics isolation	Refer to the <i>Universal Metering Transponder for FOCUS Meter User Guide</i> (Y10574-TUM) or the <i>Universal Metering Transponder for kV2c Meter User Guide</i> (Y10577-TUM).

Compliance Specifications

NOTE ANSI C12.1-3001 is the referring standard for tests listed in tables 3.2, 3.3, and 3.4.

Table 4.2 Compliance specifications

Device(s)	Test Title	Applicable Specification
HHTR-3 and EMTR-3	EMI/RFI Emission conducted/radiated	ANSI C12.1-3001 Test No. 27- “Radio Frequency Conducted and Radiated Emissions” per CFR 47 Part 15, Class A and B. (See also ANSI C63.4)
HHTR-3 and EMTR-3	EMI/RFI Susceptibility	ANSI C12.1-3001 Test No. 26- “Effect of Radio Frequency Interference”
EMTR-3	AC line surge	ANSI C12.1-3001/IEEE C62.41-1991 Test No. 17- “Effect of High Voltage Line Surges”
EMTR-3	Electrical fast transient	ANSI C12.1-3001 Test No. 25- “Electrical Fast Transient/Burst” (Testing at 100 and 400 KHz is required) IEC 801-4: 1988
EMTR-3	Surge withstand capability FT and OSC	ANSI/IEEE C.37.90.1 - 2002
EMTR-3	High voltage isolation on meter chassis	ANSI C12.1-3001 Test No. 15- “Insulation”
EMTR-3	Voltage interruption test	ANSI C12.1-3001 Test No. 16- “Voltage Interruption”
HHTR-3 and EMTR-3	Effect of electrostatic discharge	ANSI C12.1-3001 Test No. 28- “Effect of Electric Discharge (ESD)”
EMTR-3	Effect of Variation of Frequency	ANSI C12.1-3001. Test #6
EMTR-3	Effect of Variation of Voltage on the Metering Device	ANSI C12.1-3001. Test #5.
HHTR-3 and EMTR-3	Occupied Bandwidth	200 kHz. The ORION equipment transmits at 100 kilobits/second. The HHTR transmits at 9600 bits per second, but uses a wider frequency deviation so that the occupied bandwidth is still in the 200 kHz range.
HHTR-3 and EMTR-3	RF Output Power	FCC 15.249 compliant. IC RSS-210 A2.9; 2005 compliant.
HHTR-3 and EMTR-3	Design Frequency Accuracy	+/- 50 parts per million.

NOTE Per Measurement Canada, Specifications/Standards LMG-EG-07 & PS-E-09-E are used to verify compliance with Canadian criteria.

Environmental Specifications

Table 4.3 Environmental specifications

Thermal	
Effect of operating temperature	Per ANSI C12.1-3001 Test No. 30
Humidity	
Effect of relative humidity, both operational and storage	Per ANSI C12.1-3001 Test No. 31

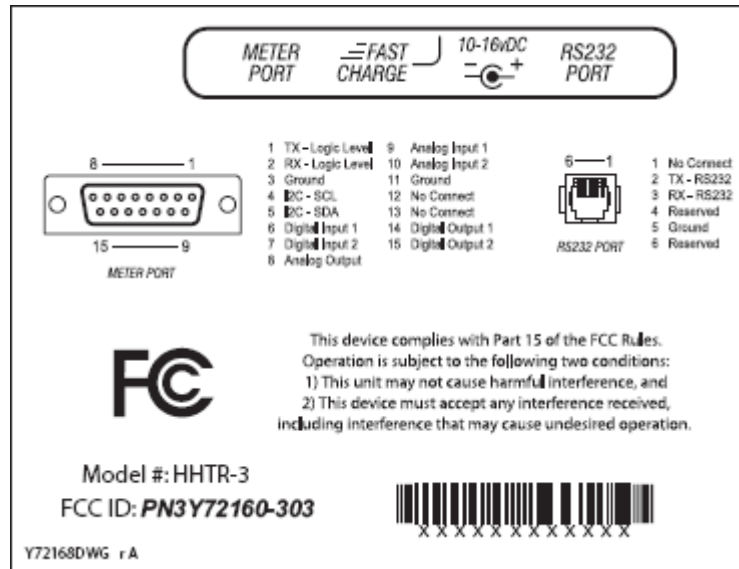
Physical Specifications

Table 4.4 Physical specifications

Parameter	Specification
Size, weight, form factor	
Integrated dimensions	Meter-specific
Installation instructions	Provided with shipping package. One per TWACS-enabled meter carton.
Compliance Testing Specifications	
Mechanical tests	Per relevant sections of ANSI C12.1 - 2001 described below: <ul style="list-style-type: none"> • Mechanical Shock • Mechanical Vibration • Transportation Drop Test • Transportation Vibration
Physical Tamper Protection	
Meter seal	Supported

Table 4.4 Physical specifications

Parameter	Specification
Labeling Requirements and Serial Number	
HHTR-3	Labeling per ANSI C12.10-1987 for: <ul style="list-style-type: none"> • DCSI/customer name • DCSI/customer logo • TWACS serial number • Barcode



Additional Regulatory Data

The following is a tabulation of regulatory data found elsewhere in this manual and is required by the regulatory agencies of some countries.

Table 4.5 Additional regulatory data

Parameter	Specification
Disclaimer noting that operation of the device is subject to conditions that the device may not cause harmful interference and device must accept any interference received.	Regulatory Data note, page 13.
Principles of device operation	All of Chapter 2.
Block diagram	Page 11.
Operating frequency	Page 10, paragraph 2.
Channeling	Page 12.
Mode of transmission	Page 12.
Internal/External data source	Page 12.
Type(s) of modulation	Page 12.
Is a subcarrier used to modulate carrier?	No, page 12.
Type of information transmitted	Digital data, page 10, paragraph 2.
Occupied bandwidth	200 kHz, page 12.
RF output power	FCC 15.249 compliant. IC RSS-210 A2.9; 2005 compliant. Page 68, second-to-last item in table.
Carrier frequency stability	+/- 50 ppm. Page 68, last item in table.

Acronyms

AMR	Automatic Meter Reading
ASCII	American National Standard Code for Information Exchange
CCE	Central Control Equipment
CFG	Configuration
CIS	Customer Information System
DCSI	Distribution Control Systems, Inc.
EMTR	Electric Meter Transceiver
FCC	Federal Communication Commission
FSK	Frequency Shift Keying
HHTR	Hand Held Transceiver
HRTS	Handheld Remote Test Set
IED	Intelligent End Device
KWH	Kilowatt Hours
MDM	Meter Data Management System
NA	Invalid Data
NS	Register Not Supported
OK	Successful Read
PA	Power Amplifier
RCE	Remote Communications Equipment
RF	Radio Frequency
RI	Reset In Progress
RL	Register Length Invalid
RMTR	Remote Meter Transceiver
RSSI	Received Signal Strength Indicator
RTC	Real-Time Clock
S/N	Serial Number
TD	Total Demand
TNS	TWACS Net Server
TWACS	Two-Way Automatic Communication System
TWACS [®] NG	TWACS [®] Network Gateway
UMT	Universal Metering Transponder
WMS	Work Management System

Glossary

AMR

See *Automatic Meter Reading*.

Automatic Meter Reading (AMR)

Electronic accumulation and transport of meter data.

CCE

See *Central Control Equipment*.

CIS

See *Customer Information System*.

Central Control Equipment (CCE)

The top level of the TWACS system hierarchy, also referred to as the Master Station or Master Controller. The CCE typically resides at the utility home office, providing system control and data storage for the TWACS system.

Customer Information System (CIS)

A utility central office application that maintains customer data. This customarily includes account, premise, and contact information.

dial encoder

A device that encodes or converts the position of metering dials (normally used in water meters) into an electrical signal for subsequent processing and transmission.

Electric Meter Transceiver (EMTR)

An electronic communication device that transmits and receives using RF transmission.

EMTR

See *Electric Meter Transceiver*.

Federal Communication Commission (FCC)

The Federal Communications Commission (FCC) is an independent United States government agency, directly responsible to Congress, and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable. Among its duties, the FCC is responsible for rating personal computers and other electronic equipment as either Class A or Class B. The ratings indicate how much radiation a particular device emits.

firmware

Programming code that is stored on a microchip within an electronic assembly that can not be changed by the user and is accessible only with special equipment.

frequency shift keying

A data transmission control method that modulates, i.e. “shifts” between two radio frequencies.

hand held transceiver (HHTR)

A control device used to set up, link, and establish communication between the EMTR and RMTR components of the TWACS RF system.

IED

See Intelligent End Device.

industrial, science, and medical (ISM)

An unlicensed radio frequency band.

Intelligent End Device (IED)

A device incorporating one or more processors with the capability to receive data from an external source or to send data to an external source.

ISM

See Industrial, Science, and Medical.

Master Station (MS) or Master Controller (MC)

See also Central Control Equipment.

MDM

See Meter Data Management System.

Meter Data Management System (MDM)

A system that manages meter reading data. Meter readings can be saved as needed for billing and historical analysis. The MDM would minimally manage configuration information for meters and maintain measurement histories.

nonvolatile memory

A physical data storage area that maintains its content when the power is turned off.

pulser

An electronic or magnetic device that generates electric pulses in a quantity that is proportional to the physical variable under measurement and which the pulses represent.

RCE

See *Remote Communication Equipment*.

received signal strength indicator (RSSI)

A value indicating the strength of the received radio frequency signal.

registers

Data storage locations on the transponder microprocessor that contain a variety of information that is retrievable by the master station. The type of data in registers includes consumption and demand data.

Remote Communication Equipment (RCE)

The base of the TWACS system hierarchy. RCEs consist of the DCSI family of transponder products. RCEs are located at customer sites and interface TWACS communication with various end devices such as meters, water heaters, and air conditioning units to enable automatic meter reading (AMR), load management, or other functions.

RSSI

See *Received Signal Strength Indicator*.

Substation Communications Equipment (SCE)

The middle tier of the TWACS system hierarchy, consisting of all TWACS substation equipment (CRU, OMU, IPU, and MTU). The SCE transmits and receives data between the Master Station and RCE.

TNS

See *TWACS Net Server*.

transponder

Two-way field device that can receive and send messages to and from the substation.

TWACS Net Server (TNS) / TWACS® Network Gateway (TWACS® NG)

Chief component of the entire Two-Way Automatic Communication System. Manages all collected metering and interval data as well as the connection between the utility and the consumer's premises.

Two-Way Automatic Communication System (TWACS)

A patented technology that allows the utility to send and retrieve information to and from meters and other devices using the utility's power lines as a communication network.

Ultra High Frequency (UHF)

A frequency range in the radio frequency spectrum between 300 MHz and 3.0 GHz.

WMS

See *Work Management System*.

Work Management System (WMS)

A utility central office application that manages the logistics of placing the necessary personnel, tools, and parts at a given location at the same time to accomplish a given task. A WMS may be able to supply the installer with an electronic copy of the list of sites to be visited on a given day, the tasks to be performed, and even a partial list of the serial numbers of the affected equipment.

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