TWACS®- ORION® FOR CENTRON® METER

USER GUIDE   Y10426-TUM

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USING THIS MANUAL

This section contains information that helps you understand and use this manual.

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Purpose

This *TWACS® - ORION ®for CENTRON® Meter User Guide* contains theory of operation, pre-installation considerations, hardware installation procedures, and instructions for using an Hand Held Transceiver - Low Power (HHTR-LP) tool to establish the communication link between the ORION® and EMTR-2.

Warnings

⚠ DANGER

Electrical equipment contains hazardous voltages. May cause death, serious personal injury or equipment damage.

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.

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.

Icon Definitions

Icon	Definition
HAZARD	Indicates electrical equipment hazards and resulting death or serious injury from misuse.
WARNING	Indicates a potentially hazardous situation which - if precautions are not taken - could result in death or serious personal injury.
CAUTION	Indicates a potentially hazardous situation which- if precautions are not taken - may result in minor or moderate injury.
IMPORTANT	Provides information that is important, but will not result in physical injury if not followed.
NOTE	Provides additional information or tips on the process.

Related Documentation

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

- *Electronic Metering Transponder for CENTRON Meter User Guide* (Y10317TM)
- *TNS End User Guide* (Y10285TM)
- *Returned Merchandise Packing Requirement Service Advisory* (Y10377TM)
- *Stationary RCE Test Unit Technical Manual* (Y103018-1TM)
- *Portable RCE Test Unit Technical Manual* (Y10327-3TM)
- *CENTRON Meter Technical Reference* (RES-CEN-0025-08.02)
- *Pit ORION Installation Data* (ORI-I-36)
- *Universal 1 Tranamitter Installation Data* (ORI-I-39)
- *Recordall Transmitter Register Remote ORION 3-Wire Installation Data* (ORI-I-35)
- *ORION Integral Transmitter for Gas Meters Installation and Operation Manual* (ORI-IOM-39)
- *ORION Equipped Gas Meters Using the Badger-Radix Programming Tool Installation and Operation Manual* (ORI-IOM-40)
- *ORION Programming Software Installation and Operation Manual* (ORI-IOM-38)

Support

Please address your questions to Customer Care as follows:

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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.

INSTALLATION AND OPERATION

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-2, HHTR-LP, and ORION transmitter. It is useful for installers and personnel who would benefit from an overview of the entire system.

System Overview

The TWACS - ORION system utilizes radio frequency (RF) transmission communication between a RF-enabled auxiliary meter and a RF-enabled CENTRON meter. Data relative to energy usage from auxiliary gas, water, or another electric meter can be gathered and retrieved in this manner. The system provides selectable Total Consumption data and Present Consumption data based on the hourly interval meter reading.

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-2)
- Hand Held Transceiver - Low Power (HHTR-LP)
- Electronic Metering Transponder (EMT-3C-MP)

NOTE   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.

RF communication links the ORION (located at the auxiliary meter) to the EMTR-2 (located inside a nearby electric meter.) This communication enables successful operation of the Automatic Meter Reading (AMR) system.

AUXILIARY
METER

ELECTRIC
METER

RF
COMMUNICATION
UP TO 400 FEET
LINE-OF-SIGHT

ELECTRIC
METER
TRANSCEIVER
(EMTR)
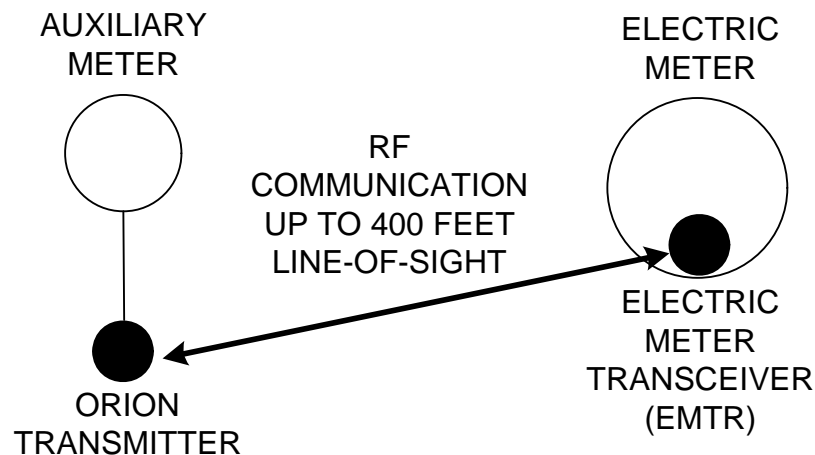
ORION
TRANSMITTER

Theory of Operation

The DCSI TWACS® - ORION® system operates within the 916.450 MHz UHF radio frequency range on channel 43A. This unlicensed frequency band is known as the ISM (Industrial, Science, and Medical) band. All components in the DCSI TWACS® - ORION® system comply with FCC (Federal Communications Commission) rules and regulations for radio devices operating in this frequency range.

This band provides up to 79 channels; the TWACS® - ORION® system uses 51 of these channels. A channel is defined as a pair of adjacent frequencies used for transmission and for reception. Refer to the note below.

Because the FCC limits the amount and duration of channel energy that can be emitted during RF transmission, the TWACS® - ORION® system employs transmission Frequency Shift Keying (FSK). This modulation and frequency hopping technology serves to:

- Comply with FCC regulations
- Reduce potential interference to and from other devices operating in the same band
- Reduce the potential for eavesdropping
- Minimize the effects of signal reduction

NOTE   Frequency hopping employs an algorithm that provides a half duplex (one transmission direction at a time [send or receive]), pseudo-random sequence of frequencies for the two-way radio link.

Frequency Shift Keying modulation controls data transmission by "frequency shifting" between two frequencies (a channel). One frequency is used to represent the logical "1" and a different frequency represents the logical "0".

Five channels provide link acquisition with the HHTR-LP while the remaining 45 channels are used for data transmission after a successful link is established. The one remaining channel is used for TWACS-ORION communication.

The EMTR-2 retains data until new data is uploaded during an ORION session. If an ORION transmitter is removed from the Remt List table stored in the EMTR-2, the previously loaded data (for the removed ORION transmitter) is automatically deleted.

Electric Meter Transceiver (EMTR-2)

The EMTR-2 is an electronic module assembly (EMA) that is installed in a TWACS-enabled CENTRON meter. The EMTR-2 is connected to the EMT-3C-MP transponder during meter/transponder integration. The EMTR-2 adds functionality to the host EMT-3C-MP. It does not communicate over the power line, but uploads the data to the EMT-3C-MP that has power line TWACS capabilities.

The EMTR-2 can communicate with up to four ORION transmitters. Data from the ORION transmitter is relayed to the EMA. This data is accessed by the TNS across the TWACS network.

Near the top of the hour, the EMTR-2 listens (for 12.5 seconds) for communication from an ORION transmitter. Then, for 8.5 seconds the EMTR-2 listens for an HHTR-LP. This pattern cycles 35 times. No further communication occurs until the next top of the hour. The top of the hour is set in TNS. Refer to *Metering Maintenance* in the *TNS User Guide* for instructions.

Figure 1.1 Electric Meter Transceiver

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 this data and transmits it to the EMTR-2. Then it is retrieved by the utility, across power distribution lines.

Figure 1.2 ORION transmitters for water, gas, and remote

WATER
ORION

GAS
ORION

REMOTE
ORION

Specifications:

Table 1.1 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 - Low Power (HHTR-LP)

The DCSI Hand Held Transceiver - Low Power (HHTR-LP) is used to configure and setup the EMTR-2 (installed in the electric meter). The HHTR-LP is also used to create the communication link between the EMTR-2 and the ORION transmitter and can be used to test the radio link.

Figure 1.3 Hand Held Transceiver keypad functions
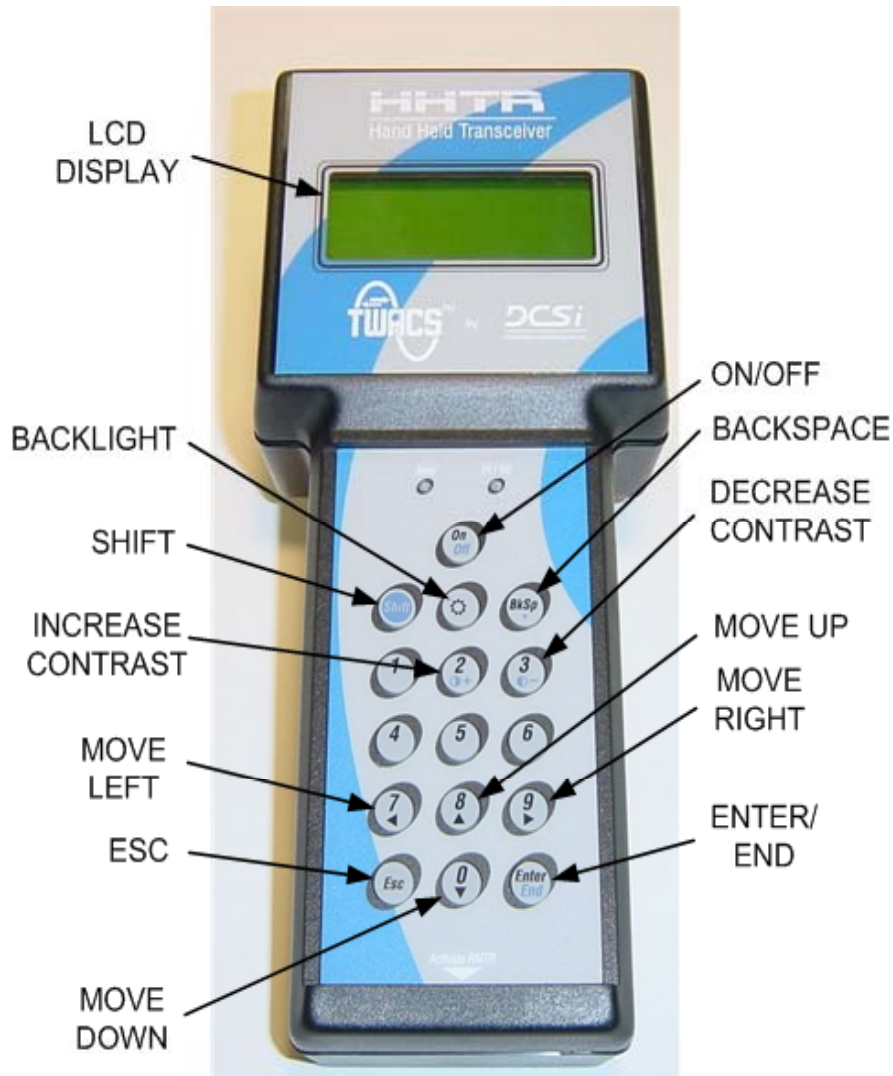
Navigating the HHTR-LP Screens

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

Table 1.2 HHTR-LP screen navigation buttons

Button Number	Graphic	Function
7	7 ◀	Move left
8	8 ▲	Move up
9	9 ▶	Move right
0	0 ▼	Move down

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

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.

Esc button functionality:

- Press once to end the current procedure and return to the previous menu.

- Repeatedly press to "back out" to previous menus.

HHTR-LP Menus

The following list describes the menus and selections available from the HHTR-LP.

Main Menu Item

Order - Main menu selection.

- New/Go - Presents screens that allow entry of an order number.

Remote - Main menu selection.

- Orion - Top-level Orion menu.

  - Install (See page 20).

- Com Stat - Presents configuration status screens (See page 29).This status information is read from the EMTR-2.

- RMTR - RMTR menu. Not used in the TWACS-ORION System.

EMTR - Main menu selection.

- Status - Presents EMTR-2 status data screens.

- Replace - Presents screens that enable replacement of the EMTR-2 (See page 16).

- Delete - Presents screens that enable removal of the ORION from the Remt List (See page 16).

- Remt List - Displays list of linked ORION transmitters.

Serial Com - Not used.

TWACS - Main menu selection.

- HRTS - Enables configuration of meter auxiliary ports.

- TWACS Modem - Not used.

HHTR Config - Main menu selection.

- Setup - Presents screens that enable selection of HHTR-LP options.

- Status - Not used.

- Power - Presents screens that enable selection of Power options.

- Diags - Presents screens that enable selection of Diagnostic options.

RF Hardware Installation

This section provides instructions for installing the RF hardware onsite. 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-2 when performing the field survey, such as:

- Metal objects
- Thick walls or foliage
- Local radio interference
- Position of the ORION and/or EMTR-2

Factor in all environmental conditions when planning the location of the meter/EMTR-2 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-2.

Environmental Conditions

Optimal RF communication between the ORION and the EMTR-2 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 wired solution to ensure reliable operation.

The following environmental factors or conditions may affect RF transmission between the ORION unit and the EMTR-2 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-2. 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 interferences are present.

- Position of the ORION and/or EMTR-2

  These are important factors in RF deployment. The ORION antenna is omni-directional. The signal radiates 360 degrees. The EMTR-2 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-2 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.

Installing a New EMTR-2 Module

This procedure installs an EMTR-2 module by installing an RF-equipped CENTRON meter.

Technicians must install this equipment in accordance with all National and Local Code provisions.

WARNING   WARNING - EXPLOSIVE HAZARD - Substitution of components may impair suitability for Class I, Division 2.

CAUTION   Wear all safety equipment according to your utility rules before opening the meter base: hard hats, safety face shield, fire retardant clothing, high voltage rated gloves, safety rated shoes.

WARNING   Any work on or near energized meters, meter sockets, or other metering equipment can present a danger of electrical shock. Such shock could cause serious injury or death.

To field install a new EMTR-2-equipped CENTRON meter, refer to the *Electronic Metering Transponder for CENTRON Meter User Guide* (Y10317TM).

To complete the installation process, the meter must be configured into the TNS (refer to the *TNS End User Guide* for directions). In order to complete this next step in the installation process, record the location of the meter by collecting the following information:

- **TWACS Serial number (required)**
- **Substation (required)**
- Bus
- Feeder
- Phase
- Detection
- Signal

The TNS operator uses this location information to search for the meter. The more pieces of location information available, the less time TNS will take to search for the meter.

Refer to the *TNS End User Guide* for data retrieval instructions.

ORION Equipment Installation

Follow the Badger Meter, Inc.equipment installation instructions to install the ORION transmitter.

Installers must install the ORION equipment in accordance with all National and Local Code provisions.

ORION Equipment Replacement

Follow the Badger Meter, Inc.equipment instructions to remove and replace an existing ORION transmitter.

Installers must perform these procedures in accordance with all National and Local Code provisions.

Installing a Replacement EMTR-2 Module

This procedure is the same as installing a new EMTR-2-equipped meter.

NOTE   Previous usage data must be retrieved and ORION/EMTR-2 linkage information must be reassigned to the replacement EMTR-2.

1. Refer to *Installing a New EMTR-2 Module* on page 15 for installation instructions.

2. Refer to *ORION and EMTR-2 Communication Setup* on page 20 for linkage assignment instructions.

   Refer to the *TNS End User Guide* for data retrieval instructions.

Replace the Remt List In the EMTR-2

This procedure downloads the Remt List from the existing EMTR-2 to the HHTR-LP so the Remt List can be uploaded to the replacement EMTR-2.

Two important conditions apply to this procedure:

1. The existing EMTR-2 must be able to communicate with the ORION for the Remt List to be downloaded to the HHTR-LP to simplify reinstalling applicable ORIONs.

NOTE   If communication is not possible, this procedure can not be performed. Replace the existing meter according to your utility procedures, and perform *Install the ORION (Linking the ORION and EMTR-2)* on page 20 to install the individual ORION transmitters.

2. This procedure requires the physical removal of the existing installed meter and installation of a replacement meter/EMTR-2 combination.

Perform the following procedure to replace an EMTR-2.

If you pressed the HHTR-LP On/Off button at the end of any previous procedure, begin with step 1.

-OR-

If you pressed the Esc button, begin with step 2.

1. Press the On/Off button on the HHTR-LP.

```
              Main Menu
  → Order          Serial Com
    REMOTE         TWACS
    EMTR           HHTR Config
```

2. Press the down arrow button to position the cursor in front of the REMOTE option.

```
              Main Menu
    Order          Serial Com
  → REMOTE         TWACS
    EMTR           HHTR Config
```

3. Press the down arrow button to position the cursor in front of the EMTR option.

```
              Main Menu
    Order          Serial Com
    REMOTE         TWACS
  → EMTR           HHTR Config
```

4. Press the Enter button. The EMTR menu appears.

```
              EMTR Menu
    Select
  → Replace        Delete
     Status        Remt. List
```

5. Press the Enter button. The following screen appears.

```
         EMTR: Replacement
    Select:
  → Read Old EMTR
     Write New EMTR
```

6. Press the Enter button. The following screen appears.

```
        EMTR: Replacement
         Verify Order #
              XXXXX
       ESC: No, Enter: Yes
```

7. Enter an Order number if different from that displayed and press Enter to Accept.

The following screen appears.

```
        EMTR: Replacement
       Enter Serial Number
       Old S/N: _____
       Enter To Accept
```

8. Press the Enter button. The following two screens appear.

```
        EMTR: Replacement
       EMTR S/N 1234567890


       Receiving Remote Lst,
```

```
        EMTR: Replacement
       EMTR S/N 1234567890


            Success!
```

NOTE At this point in the procedure, the technician must replace the "old" utility meter with a replacement integrated meter/EMTR-2 combination. Refer to *Installing a New EMTR-2 Module* on page 15.

9. Press the Esc button once and the following screen appears.

```
        EMTR: Replacement
       Select:
         Read Old EMTR
       → Write New EMTR
```

10. Press the Enter button. The Order Number screen appears.

```
        EMTR: Replacement
         Verify Order #
              XXXXX
       ESC: No, Enter: Yes
```

11. Enter the order number and press the Enter button. The following screen appears.

```
    EMTR: Replacement
    Enter Serial Number
    New S/N: _____
    Enter To Accept
```

12. Press the Enter button. The following two screens appear.

```
     EMTR: Replacement

     Verifying New EMTR,
     Please Wait...
```

```
     EMTR: Replacement
     EMTR S/N 1234567890

          Success!
```

13. Press the Esc button three times to return to the Main Menu screen.

-OR-

Press the On/Off button.

ORION and EMTR-2 Communication Setup

This section describes the steps required to use the HHTR-LP to configure, link, and remove/replace an ORION or EMTR-2.

RF equipment setup procedures consist of configuring the EMTR-2 and making the RF communication link between the ORION and EMTR-2. You may also view the communication statistics (Refer to *Field Troubleshooting* on page 28), or test the link between the ORION and EMTR-2 by reading the Total Consumption register for the applicable port and verifying the reading on the auxiliary meter dials.

Install the ORION (Linking the ORION and EMTR-2)

Complete the following steps to link the ORION to a nearby EMTR-2.

1. Press the **On/Off** button on the HHTR-LP. The "flash" screen appears momentarily displaying the software version number. Firmware Vn.n is replaced with the firmware version number installed in your HHTR-LP.

```
      DCSI: HHTR-LP
       Y72160-301
      Firmware Vn.n
      Www.twacs.com
```

The Main Menu screen appears.

```
         Main Menu
→ Order         Serial Com
  REMOTE        TWACS
  EMTR          HHTR Config
```

2. Press the **down arrow** once to position the arrow cursor in front of the REMOTE option.

```
         Main Menu
   Order         Serial Com
→ REMOTE        TWACS
   EMTR          HHTR Config
```

3. Press the **Enter** button.

```
        Remote Menu
   Select:
 → ORION
```

4. Press the **Enter** button to accept the default selection.

```
        Orion Menu
   Select:
 → Install
   Com Stat
```

5. Press the Enter button to accept Install.

```
      Orion Install Menu
   Enter Serial Number
   Orion S/N 123456
   Enter To Accept
```

6. Enter the ORION serial number in the spaces provided, if it is not automatically entered for you.

NOTE The EMTR recognizes only 6-digit numbers. ORION serial numbers (from BadgerMeter, Inc.) may have more than 6 numbers in the serial number. Enter only the last 6 digits of the serial number or the EMTR will NOT recognize the ORION transmitter.

7. Press the Enter button.

```
      Orion Install Menu
   Select:
 → Water          Nat Gas
   Propane        Electric
```

8. Press the Enter button.

```
      Orion Install Menu
   Enter Serial Number
   EMTR S/N 123456
   Enter To Accept
```

9. Press the Enter button.

```
      Orion Install Menu
   EMTR S/N 123456
   Orion S/N 123456
   EMTR checking tables
```

```
      Orion Install Menu
   EMTR S/N 123456
   Orion S/N 123456
   EMTR writing tables
```

```
     Orion Install Menu
     EMTR S/N 123456
     Orion S/N 123456
     EMTR trying Orn. Acq.
```

```
     Orion Install Menu
     EMTR S/N 123456
     Orion S/N 123456
     EMTR checking EnrTbl
```

```
     Orion Install Menu
     EMTR S/N 123456
     Orion S/N 123456
          Success!
```

10. Press any key and the following screen displays.

```
     Orion Install Menu
          Success!
     Reading: 01234567890
     RSSI: 255
```

11. Press the Esc button to return to the ORION Menu.

If you receive a message from the Error Codes list, press the Esc button, then repeat steps 5-9. Refer to *HHTR-LP Displayed Error Codes* on page 32 for error code description and resolution.

NOTE   Your previously selected options will appear on the screens when you repeat steps 5-9. Make new selections or entries, or press the Enter button to accept each correct entry.

Confirm ORION Installation

You may confirm that the ORION transmitter was successfully installed by performing a Remote List query.

No ORION Data Received During the Install

If you receive the following message after step *9.* of the Install procedure...

```
     Orion Install Menu
     EMTR S/N 123456
     Orion S/N 123456
     SSI=0 Esc:OK Ent:Rpt
```

12. Press the Enter button to recheck. The EMTR-2 attempts to reacquire the ORION signal. If the EMTR-2 is successful, the "success" screen shown in step 9 displays.

13. Press the ESC button and the following two screens display.

```
        Orion Install Menu
    EMTR S/N 123456
    Orion S/N 123456
    Warn: No Orion Data
```

```
        Orion Install Menu
    Warn: No Orion Data
    Reading: 0
    RSSI: 0
```

14. Press the ESC button to return to the ORION Menu

Refer to *Troubleshooting and Error Messages* on page 28.

Delete the ORION from the Remt List

If your ORION and EMTR-2 are not communicating, or if you need to replace a malfunctioning ORION module, this procedure provides the instructions to delete the ORION from the Remt List stored in the EMTR-2.

Complete the following steps to delete the ORION from the EMTR-2.

1. Press the On/Off button on the HHTR-LP.

```
            Main Menu
    → Order        Serial Com
      REMOTE       TWACS
      EMTR         HHTR Config
```

2. Press the down arrow button twice to position the cursor in front of the EMTR option.

```
            Main Menu
      Order        Serial Com
      REMOTE       TWACS
    → EMTR         HHTR Config
```

3. Press the Enter button.

```
            EMTR Menu
     Select
       Status    →Delete
       Replace    Remt List
```

4. Use the arrow buttons to select Delete.

5. Press the Enter button. The Remote Menu appears.

```
          Remote Menu
    Select:
  → ORION
```

6. Press the Enter button.

```
      EMTR: Delete Orion
  Enter Serial Number
  EMTR S/N:_____
  Enter To Accept
```

7. Enter the serial number of the EMTR-2 in the EMTR-2 S/N field, if it is not automatically entered for you.

8. Press the Enter button.

```
      EMTR: Delete Orion
  Enter Serial Number
  Orn. S/N:_____
  Enter To Accept
```

9. Enter the Orion serial number in the Orn. S/N field, if it is not automatically entered for you.

10. Press Enter to accept.

    The following two screens display briefly.

```
      EMTR: Delete Orion
  EMTR S/N 123456
  Orion S/N 123456
  Receiving Remote List
```

```
      EMTR: Delete Orion
  EMTR S/N 123456
  Orion S/N 123456
  Found Orion, Del'ing
```

The Success! screen displays, indicating that the ORION has been successfully removed from the Remt List table stored in the EMTR-2.

```
EMTR: Delete Orion
EMTR S/N 123456

    Success!
```

11. Press the Esc button twice to return to the Main Menu screen.

DRAFT

TESTING, TROUBLESHOOTING, AND MAINTENANCE

This chapter explains how to test and manage typical TWACS-ORION system problems. It is useful for installers and meter shop personnel.

Troubleshooting and Error Messages

The following troubleshooting information can be used to determine the cause of improper operation of the TWACS-ORION system.

TNS Troubleshooting

The TNS system can be used to check module and meter communication. The TNS system includes error flags in returned messages that aid in issue identification.

For error codes, refer to the *Troubleshooting* chapter in the *TNS End User Guide*.

For information about TNS Trouble Server Applications, refer to the *Trouble Server Applications* in the *TNS End User Guide*.

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 the *Meter Shop Test System* section of this chapter for information regarding use of this system.

The EMTR-2 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 (HHTR can not communicate with Orion)

- Query the EMTR for a remote installed list

- Delete Orion from the EMTR installed list

- Check EMTR status (Hardware & Firmware version, and RCE Type & Model)

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

- Serial Number

- 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)

- RSSI (snapshot-from last check in)

- Acquisition Failures

- 24 Hr Acq Log

If there is a problem, the applicable error code is displayed. For RF communication, and HHTR-LP or user error codes, refer to *HHTR-LP Displayed Error Codes*.

Configuration/Installation Status

You can view additional information about configuration and link status by selecting Com Stat from the ORION Menu screen. Although this information is read from the EMTR-2, check the RF Link Data: Acq Log (refer to step *16.* of this procedure) to verify recent successful ORION/EMTR communication.

Complete the following steps to view configuration and link status data.

1. Press the On/Off button on the HHTR-LP. The "flash" screen appears momentarily displaying the software version number. Firmware Vn.n is replaced with the firmware version number installed in your HHTR-LP.

```
    DCSI: HHTR-LP
     Y72160-301
    Firmware Vn.n
    Www.twacs.com
```

The Main Menu screen appears.

```
          Main Menu
→ Order        Serial Com
  REMOTE       TWACS
  EMTR         HHTR Config
```

2. Press the down arrow once to position the arrow cursor in front of the REMOTE option.

```
          Main Menu
  Order        Serial Com
→ REMOTE       TWACS
  EMTR         HHTR Config
```

3. Press the Enter button.

```
         Remote Menu
  Select:
→ ORION
```

4. Press the Enter button to accept the ORION default selection.

```
        Orion Menu
   Select:
 → Install
    Com Stat
```

5. Press the **down arrow** once to position the arrow cursor in front of the Com Stat option.

```
        Orion Menu
   Select:
    Install
 → Com Stat
```

6. Press the **Enter** button.

```
      Orion Com Status
   Enter the Serial #,
   Orn S/N:_____
   Enter To Accept
```

7. Enter the ORION serial number in the spaces provided.

8. Press the **Enter** button.

```
      Orion Com Status
   Enter the Serial #,
   EMTR S/N:_____
   Enter To Accept
```

9. Enter the EMTR-2 serial number in the spaces provided.

10. Press the **Enter** button.

The following two screens appear.

```
      Orion Com Status
   Collecting data from
   EMTR.
   Please Wait...
```

```
      Orion Com Status
    EMTR S/N _____
   Orion S/N _____
         Success!
```

11. Press the **down arrow** or the **Enter** button.

The following status screen appears.

```
        Orion Com Status
      Reading: 1234567890
      Battery: N/A
      N/V Memory: N/A
```

- Reading: displays the number on the ORION. A correct number (0000000000-9999999999) here verifies proper equipment operation.

12. Press the **down arrow** or the **Enter** button.

```
        Orion Com Status
    Meter Com: N/A
    Hist MTR Com: N/A
    LeakDet: N      Tamper: N
```

- Ignore Meter Com.

- Ignore the Hist MTR Com entry for installation purposes.

- LeakDet options are Y or N (Water only). If Y, a site visit is required to locate the leak. Clear error and reset the meter onsite after correcting the leak.

  Leak detect trips at the meter if total consumption is continuously incremented. After no continuous consumption for a period of time (determined by the meter manufacturer) the meter will automatically reset.

- Tamper options are Y or N. Clear error and reset the meter onsite after correcting tamper source.

13. Press the **down arrow** or the **Enter** button.

```
        Orion Com Status
         RF Link Data:
     PA: N/A        RSSI: 123
      Link: N/A
```

- RSSI (Received Signal Strength Indicator) displays the received signal strength. The range is 0-255 with 255 being the highest strength.

14. Press the **down arrow** or the **Enter** button

```
        Orion Com Status
          RF Link Data:
    Last Ch: N/A
    Acq Failures: 0
```

Ignore this screen for installation purposes.

15. Press the **down arrow** or the **Enter** button

```
        Orion Com Status
          RF Link Data:
Lnk Abandonment: N/A
Error Code: N/A
```

Ignore this screen for installation purposes.

16. Press the **down arrow** or the **Enter** button

```
         Orion Com Status
RF Link Data: 24 Hr
Acq Log:00000000
        00000000 00000000
```

The Acq Log displays 24 bits (in three groups of eight) representing the hourly check-in for the last 24 hours. A one (1) indicates that the hourly check-in was successful and a zero (0) indicates that it was not. The least significant bit (bottom right) indicates the past hour check-in status. Each hour the bits are shifted one position to the left. In the example below, the ORION successfully checked in the past hour, but did not for each of the previous three hours.

```
 Acq Log:  11111111
11111101 1111 0001
```

17. Press the **On/Off** button to turn the HHTR-LP **Off**.

HHTR-LP Displayed Error Codes

The following table lists the error code number and error message text that the HHTR-LP displays when the specific error is encountered while using the HHTR-LP to communicate with the TWACS-ORION system.

Table 2.1   Error Code Description and Solution

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.
03 Not used		
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.

Table 2.1 Error Code Description and Solution

Error	Description	Solution
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-LP or user errors.		
101 RF PIC sends a NAK	The RFPIC isn't ready or doesn't understand the command. The RF PIC internal to the HHTR-LP has failed.	Retry the command.
102 RF PIC is busy	RFPIC is performing another operation and is currently busy. The RF PIC internal to the HHTR-LP was in the middle of another command.	Retry the command.
103 No response from RF PIC on HHTR-LP	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 RF PIC send invalid response	The RFPIC sent an invalid response to the UI. The HHTR-LP UI processor didn't recognize the response from the RF PIC.	Retry the command.
105 Operation canceled	Indicates the Esc button was pressed during an operation.	The user aborted the last command.
106 ORION-EMTR session failed	The HHTR-LP timed out waiting for the RMTR to respond back to the HHTR-LP.The HHTR-LP was unable to link to the requested EMTR-2.	Verify the serial number and retry the command.
107 No Space Available in EMTR. The Table is Full.	The EMTR is at capacity. It can not accept additional Remotess.	A Remote must be removed before adding another.
112 EMTR already has Remotes assigned	Can not program a new EMTR with the data from an old EMTR because the new EMTR already has Remotes assigned.	Remove all Remotes from the new EMTR first.
113 The New EMTR can not accept xx Number of Remotes.	Can not program a new EMTR with the data from an old EMTR because the new EMTR can not store as many Remote as the old EMTR.	
114 An order needs to be created first. Use the order menu	When replacing an EMTR, the HHTR-LP needs to store the Remt list. An "order number" needs to be assigned so that the HHTR-LP has a location to store the list.	Select "order" from the main menu, select "new" and enter a number.

Table 2.1   Error Code Description and Solution

Error	Description	Solution
208 ORION S/N Already exists in the EMTR Table.	Can not install the selected ORION because it is already installed.	
209 The Selected ORION is NOT in the EMTR Table.	Can not remove the ORION nor perform a Com Status because that ORION is not installed to the selected EMTR.	Check serial number and try again.
211 Service is Full, Can not add ORION to the EMTR List.	This service in the EMTR is at capacity. It can not accept additional Orions.	An ORION must be removed from this service before adding another.
215 The Selected Remt. is NOT an Orion.		

If you are unable to resolve a problem with the TWACS-ORION system, return the meter to your integrator or DCSI. See *Return Procedures*.

Refer to the *Electronic Metering Transponder for CENTRON Meter User Guide* (Y10317TM) Rev. A for transponder-related troubleshooting information.

Refer to the *CENTRON Meter Technical Reference Guide* for additional meter information.

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 CENTRON 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 equipments available for use with DCSI products and the configuration requirements/options, the *Meter Shop Test System Set-Up Guide* (Y10030TM), will guide you through initial equipment selection and setup for meter/module testing.

This user guide contains all the module-specific information necessary to test the RF TWACS-ORION System installed in the CENTRON meter. EMT-3C module TWACS serial number and meter-specific information is available on the meter label. Refer to *Figure 2.1*. Additional information, such as module Type and Model, can be found in Chapter 1 of this user guide.

If you are unable to resolve a problem with the TWACS-ORION System, return the meter to your integrator or DCSI. See *Return Procedures* below.

Maintenance

The TWACS-ORION system requires no maintenance.

Warranty

Refer to contract terms for warranty information.

Return Procedures

DCSI equipment which has been integrated or retrofitted by a third party, must be returned to the third party. Please do not return third party integrated equipment to DCSI. Contact the third party to obtain their "Return Authorization Number" and shipping instructions and return the equipment directly to the integrator/retrofitter.

If you are a DCSI certified integrator and the product cannot be repaired in the meter shop, remove the module and complete the following procedure.

NOTE   Before returning an item to DCSI, refer to your contract terms for warranty information. If an item is out of warranty, a diagnostic fee may apply. Please send an email to rma@twacs.com for a diagnostic estimate.

If you have any questions regarding returns, send an email to rma@twacs.com.

1. Send an email to rma@twacs.com with the information listed below. Within 24 hours, excluding weekends and holidays, you will receive an email acknowledging receipt of your request. After DCSI processes your request, you will receive a Return Material Authorization (RMA) number with the shipping instructions. **To expedite the process, be sure to include all the information requested below:**

    • Company name [Distributor name and location (city and state) if applicable]
    • Ship To name and address
    • Contact name, phone number, and email address
    • DCSI part number of each item
    • Serial number of each item
    • Description of each item
    • Total quantity (by DCSI part number) for each item
    • Specific reason for return of each item
    • Manufacturer number (number starting with A/M/V/C/W) of each RCE item

2. Once you receive an RMA number, package the IMT-XM according to the shipping instructions received and following the notes below.

IMPORTANT   Items should be properly packaged to avoid shipping/handling damage during transit. Items must be packaged in individual anti-static or static dissipative bags and packed in sturdy, appropriately sized commercial boxes with packing material (styrofoam peanuts, bubblewrap, paper, etc.) arranged to prevent movement; in single layers; with the appropriate packaging between layers. Original packaging with dividers should be retained, reused, and re-identified if possible.

IMPORTANT   Items not packaged in accordance with DCSI packing requirements will not be accepted and will be returned freight collect. Please refer to the *Returned Merchandise Packing Requirement Service Advisory* (Y10377TM) for DCSI approved methods and materials. Contact DCSI Customer Care at care@twacs.com to receive a copy of this service advisory.

3. Mark the outside of the shipping container with the RMA number on the address label as shown in the following example.

Figure 2.1 Return address label

```
TO:  DCSI
     RMA# _____
     945 Hornet Drive
     Hazelwood, MO 63042
```
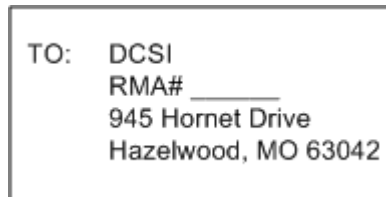
Upon shipment, send an email to rma@twacs.com with the shipping information (Carrier Name, Waybill/Pro/Tracking Number, and Date item left your facility) so DCSI can track the shipment.

SPECIFICATIONS

This chapter contains electrical, environmental, and physical specifications for the EMTR-2 and HHTR-LP.

DRAFT

Electrical Specifications

The electrical specifications include:

- Electrical ratings

- Compliance Specifications

Electrical Ratings

The following table provides the electrical ratings.

Table 3.1   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-2 is connected to the EMT-3C-MP transponder during meter/transponder integration.
Electronics isolation	Refer to the *Electronic Metering Transponder for CENTRON Meter User Guide* Y10317TM.

Compliance Specifications

The following table provides the compliance specifications.

NOTE   ANSI C12.1-2001 is the referring standard for tests listed in tables 5.2, 5.3, and 5.4.

Table 3.2   Compliance specifications

Test Title	Applicable Specification
EMI/RFI Emission conducted/radiated	ANSI C12.1-2001 Test No. 27- "Radio Frequency Conducted and Radiated Emissions" per CFR 47 Part 15, Class A and B. (See also ANSI C63.4)
EMI/RFI Susceptibility	ANSI C12.1-2001 Test No. 26- "Effect of Radio Frequency Interference"
AC line surge	ANSI C12.1-2001/IEEE C62.41-1991 Test No. 17- "Effect of High Voltage Line Surges"
Electrical fast transient	ANSI C12.1-2001 Test No. 25- "Electrical Fast Transient/Burst" (Testing at 100 and 400 KHz is required) IEC 801-4: 1988
Surge withstand capability FT and OSC	ANSI/IEEE C.37.90.1 - 2002

Table 3.2 Compliance specifications

Test Title	Applicable Specification
High voltage isolation on meter chassis	ANSI C12.1-2001 Test No. 15- "Insulation"
Voltage interruption test	ANSI C12.1-2001 Test No. 16- "Voltage Interruption"
Effect of electrostatic discharge	ANSI C12.1-2001 Test No. 28- "Effect of Electric Discharge (ESD)"
Effect of Variation of Frequency	ANSI C12.1-2001. Test #6
Effect of Variation of Voltage on the Metering Device	ANSI C12.1-2001. Test #5.

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

Environmental Specifications

The following table provides the environmental specifications.

Table 3.3 Environmental specifications

Thermal	
Effect of operating temperature	Per ANSI C12.1-2001 Test No. 30
Humidity	
Effect of relative humidity, both operational and storage	Per ANSI C12.1-2001 Test No. 31

Physical Specifications

The following table provides the physical specifications.

Table 3.4 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:
• Mechanical Shock	• Test #32, per IEC 60068 part 2-27
• Mechanical Vibration	• Test #34, per IEC 60068 part 2-6
• Transportation Drop Test	• Test #33, per ISTA Test Procedure 1A
• Transportation Vibration	• Test #35, per ISTA Test Procedure 1A

Table 3.4   Physical specifications

Parameter	Specification
Physical Tamper Protection	
Meter seal	Supported

Table 3.5   Labeling requirements

Labeling Requirements and Serial Number
HHTR-LP
Labeling per ANSI C12.10-1987 for:

- DCSI/customer name
- DCSI/customer logo
- TWACS serial number
- Barcode

Acronyms

ADLC	Asynchronous Data Link Control
AMR	Automatic Meter Reading
AP	Alternate Pathmaps
ASCII	American Standard Code for Information Interchange
BPA	Backplane Assembly
CCA	Card Cage Assembly
CCE	Central Control Equipment
CIS	Customer Information System
CLI	Command Line Interface
CMT	Commercial Meter Transponder
CPSA	CRU Power Supply Assembly
CRA	Correlation Receiver Assembly
CRMA	Correlation Receiver Multiplexer Assembly
CRPA	Correlation Receiver Processor Assembly
CRU	Control and Receiving Unit
CT	Current Transformer
DCPA	Direct Current Power Assembly
DCSI	Distribution Control Systems, Inc.
DP	Diagnostic Pending
DPA	Distribution Panel Assembly
DS	Diagnostic Set
DSI	Disconnect Switch Interbase
EMA	Electronic Metering Assembly
EMTR	Electronic Meter Transceiver
EOM	End of Message
FEP	Front-End Processor
FCC	Federal Communication Commission
FSK	Frequency Shift Keying
GUI	Graphical User Interface
HHTR-LP	Hand Held Transceiver - Low Power
IC	Incomplete IMT/CMT Data
ILS	Integrated Load Survey

IMA	Inbound Multiplexer Assembly
IMT	Integrated Metering Transponder
IP	In Progress
IPU	Inbound Pickup Unit
ISM	Industrial, Science, and Medical
KWH	Kilowatt Hours
LCT	Load Control Transponder
LS	Load Survey
MIT	Meter Interface Transponder
MS	Master Station
MSFE	Master Station Field Equipment
MTU	Modulation Transformer Unit
NA	Invalid Data
NS	Register Not Supported
ODBC	Open Database Connectivity
OFIA	Outbound Fiber Optics Interface Assembly
OK	Successful Read
OMU	Outbound Modulation Unit
OPA	Outbound Processor Assembly
PD	Partial Data
PE	Pending
PR	Pending Retry
QC	Quality Code
RC	Reasonability Check Failed
RCE	Remote Communications Equipment
RF	Radio Frequency
RI	Reset In Progress
RL	Register Length Invalid
RM	Read Meter
RMTR	Remote Meter Transceiver
RO	Retry Override
RPA	Receiver Processor Assembly
RSSI	Received Signal Strength Indicator
SCADA	Supervisory Control and Data Acquisition
SCE	Substation Communications Equipment

SCPA	Substation Communications Processor Assembly
SDC	Service Disconnect/Connect
SP	Substation Status
STS	Substation Test Set
TC	Total Consumption
TD	Total Demand
TNS	TWACS Net Server
TOU	Time of Use
TP	Tamper Pending
TS	Tamper Set
TWACS	Two-Way Automatic Communication System
UHF	Ultra High Frequency
ZC	Zero Crossing

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Glossary

American National Standards Institute (ANSI)

An independent, U.S.-based technical standards organization.

AMR

See *Automatic Meter Reading*.

ANSI

See *American National Standards Institute.*

Automatic Meter Reading (AMR)

Electronic accumulation and transport of meter data.

billing demand information

Consists of the demand reset count, which increments, and the demand previous billing.

billing read

Defines the registers used during one-time scheduled reads and on-request reads.

DSHTBill read (Daily Shift Billing)

Defines the registers used during recurring scheduled reads; normally used to create billing files.

blink count

See *power-down count*.

bus identification

Identifies the substation bus to which DCSI's equipment is connect.

CCE

See *Central Control Equipment*.

Central Control Equipment (CCE)

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

CIS

See *Customer Information System.*

CMT

See *Commercial Metering Transponder*.

Customer Information System (CIS)

A computer database that utilities use to keep track of their customer information (name, address, phone, meter serial number). Often includes bill printing functionality.

Commercial Metering Transponder (CMT)

An electronic assembly integrated into a commercial application electric meter to add TWACS communications capability to the meter.

Daylight Saving Time (DST)

Daylight Saving Time is the practice of turning the clock ahead in the Spring and back again in the Fall.

delay

The number of minutes after the interval has occurred before the SCE attempts to send a time sync command to the RCE.

demand

The rate at which power is delivered over a specified period of time; the rate of consumption. Demand is expressed in kilowatts.

demand interval

The specified interval of time on which a demand measurement is based. Intervals are commonly specified as 15, 30, and 60 minutes.

demand meter

A metering device that indicates or records demand, maximum demand, or both.

detection point

Identifies the specific conductor on which the inbound signal is detected. This point is identified as either A phase, B phase, C phase, or neutral.

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.

DST

See *Daylight Saving Time*

Electronic Metering Assembly (EMA)

An electronic assembly integrated into an electric meter to add TWACS communications capability to the meter.

Electronic Meter Transceiver (EMTR)

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

EMA

See *Electronic Metering Assembly*.

EMTR

See *Electronic 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.

feeder identification

Identifies which feeders are connected to which bus(es).

firing angle

The place on the sine wave where the RTS places the TWACS signal.

frequency shift keying

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

hand held transceiver - Low Power (HHTR-LP)

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

industrial, science, and medical (ISM)

An unlicensed radio frequency band.

interval

A relatively short time period over which energy use data is recorded by the transponder. The interval may be set for 15, 30, or 60 minutes, depending on the transponder type. Interval data is recorded for each consecutive interval.

interval data

A breakdown of consumption over specific intervals of time.

ISM

See *Industrial, Science, and Medical*.

load profile

Recording, storing, and analyzing consumption data over a period of time for a particular installation.

master station

See *Central Control Equipment (CCE)*.

maximum demand

The highest demand measured over a selected period of time, such as one month.

Meter Integration and Meter Test (MIMT)

A department within DCSI that reviews utility meter programming files and determines register programming requirements.

MIMT

See *Meter Integration and Meter Test*.

nonvolatile memory

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

on-demand reads

An unscheduled command to read a register.

ORION Transmitter

A one-way (simplex) radio frequency transmitter, manufactured by Badger Meter Inc., that allows retrieval of metering data from pit-set water, water, and gas meters. It periodically broadcasts a data packet.

PCB

See *Printed Circuit Board*.

peak demand

See *maximim demand*.

phase

The current supply conductors, other than the neutral conductor of a polyphase circuit, that usually carry the designation A phase, B phase, C phase.

power-down count

A voltage interruption greater than 0.1 seconds that the module will count as a power outage and will increase the power-down count register by one. Sometimes referred to as blink count.

previous billing demand

The maximum kW, or demand, as recorded at the time of the last reset. This value is normally used for billing purposes.

previous interval demand

The demand value stored in the meter that reflects the demand prior to the last reset.

Printed Circuit Board (PCB)

A thin plate on which electronic components are placed.

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.

rate class

A rate class is a set of registers read for a particular class of customer with a particular meter model. It defines registers used for Billing and DSHTBill reads.

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.

Remote Test Set (RTS)

A TWACS communications test device used at a remote site to communicate locally, using TWACS, to a transponder over the power line.

Remote Meter Transceiver (RMTR)

An electronic communication device that transmits accumulated data using RF transmission. Not used with the TWACS-ORION System.

Remote Acquisition List

A list of Remote Meter Transceivers stored in the EMTR.

RSSI

See *Received Signal Strength Indicator.*

RTS

See *Remote Test Set.*

SCE

See *Substation Communication Equipment.*

Serial Time Unit (STU)

A 2.5 seconds interval of time and the unit of measure of DCSI's Serial Time system. The intervals of time begin at 12:00 midnight on a cyclic 24-hour basis. Example: 1:00 a.m. would in serial time:

$$1440 \frac{(60 \text{ min.} \times 60 \text{ sec.})}{2.5}$$

signal mode

Identifies the path combination used during outbound communications. This combination can be either line-to-ground or line-to-line.

STU

See *Serial Time Unit*

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 CCE and RCE.

time-of-use (TOU)

A multiple tiered billing technique based on when the consumer uses the energy.

TNS

See *TWACS Net Server*.

TOU

See *time-of-use*

transponders

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

TWACS

See *Two-Way Automatic Communication System*.

TWACS Net Server (TNS)

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.

window

The amount of time in minutes available after the delay has occurred for the SCE to send a date/time command.

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