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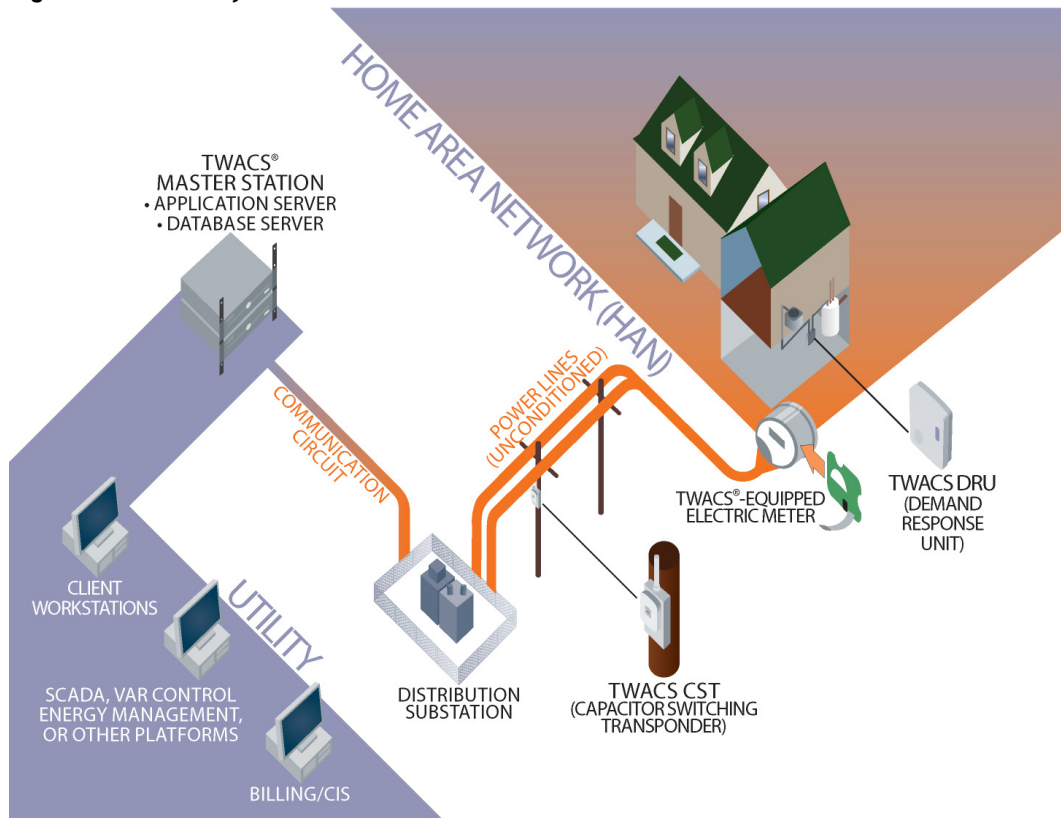
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# INTRODUCTION

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.

Figure 1.1 TWACS system overview



## Support

The TWACS Portal (<http://customer.aclaratech.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 an Aclara representative about any product or service or if you do not have a username and password to access the Portal, please contact Aclara Customer Care:

**Email:** [care@aclara.com](mailto:care@aclara.com)

**Phone:** 1-800-892-9008

**Address:** Aclara  
945 Hornet Drive  
Hazelwood, MO 63042  
USA

## Product Returns

**IMPORTANT** Before returning product to Aclara, make sure you have identified the root cause of the problem. As needed, perform troubleshooting requesting Technical Support through Aclara 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 Aclara products for repair, complete the Service & Repair RMA Request through the TWACS Portal (<http://customer.aclaratech.com>), providing as much detail about the problem as possible. If you have any questions regarding your return, please contact [rma@aclara.com](mailto:rma@aclara.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 Aclara technical publications are available through the TWACS Portal (<http://customer.aclaratech.com>).

***Manual Title (Yxxxxx-TUM)***

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In an ongoing effort to produce effective documentation, the Technical Publications department at Aclara 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@aclara.com](mailto:techpubs@aclara.com) or calling Customer Care at 1-800-892-9008.



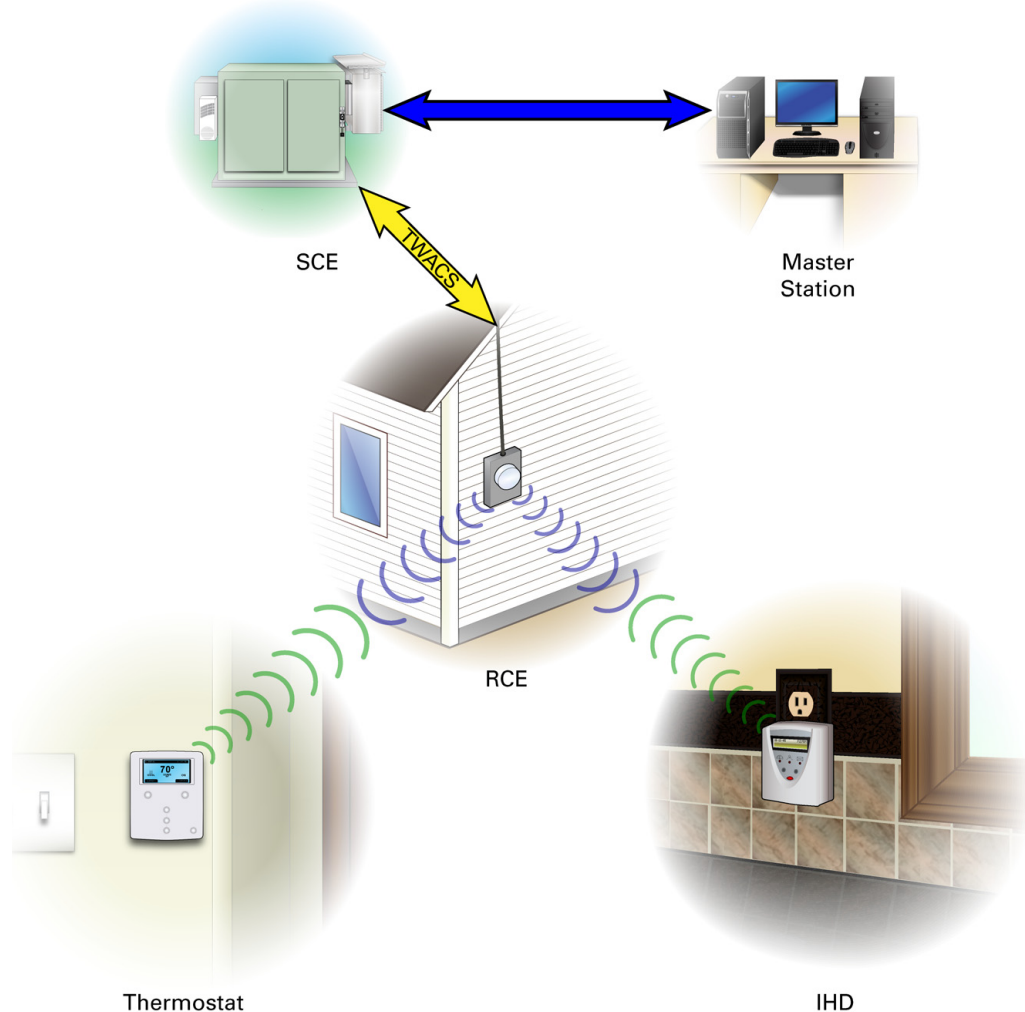


# HOME AREA NETWORK OVERVIEW

Home Area Networks (HANs) are the next step toward the goal of smart grid distribution. The Aclara HAN is designed to supply end-users with the current demand, consumption data, and pricing information necessary for demand side energy management. Providing real time consumption and pricing feedback encourages consumers to self-regulate energy usage which will ultimately help balance the load across both peak and off-peak periods. In addition, the HAN gives the utility to perform direct load control events, if necessary, to prevent power disruption.

The Aclara HAN consists of an Aclara integrated meter, a ZigBee® enabled In Home Display (IHD), and a ZigBee enabled programmable thermostat.

Figure 2.1 HAN overview



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Each of these demonstration units (IHD, programmable thermostat, and RCE) are delivered in matched sets to facilitate installation and intercommunication. Each matched set is coded with a particular set number (see for set number identification), and components from sets are not interchangeable. (e.g. An IHD from set #2 may not be used with the programmable thermostat from set #1.)

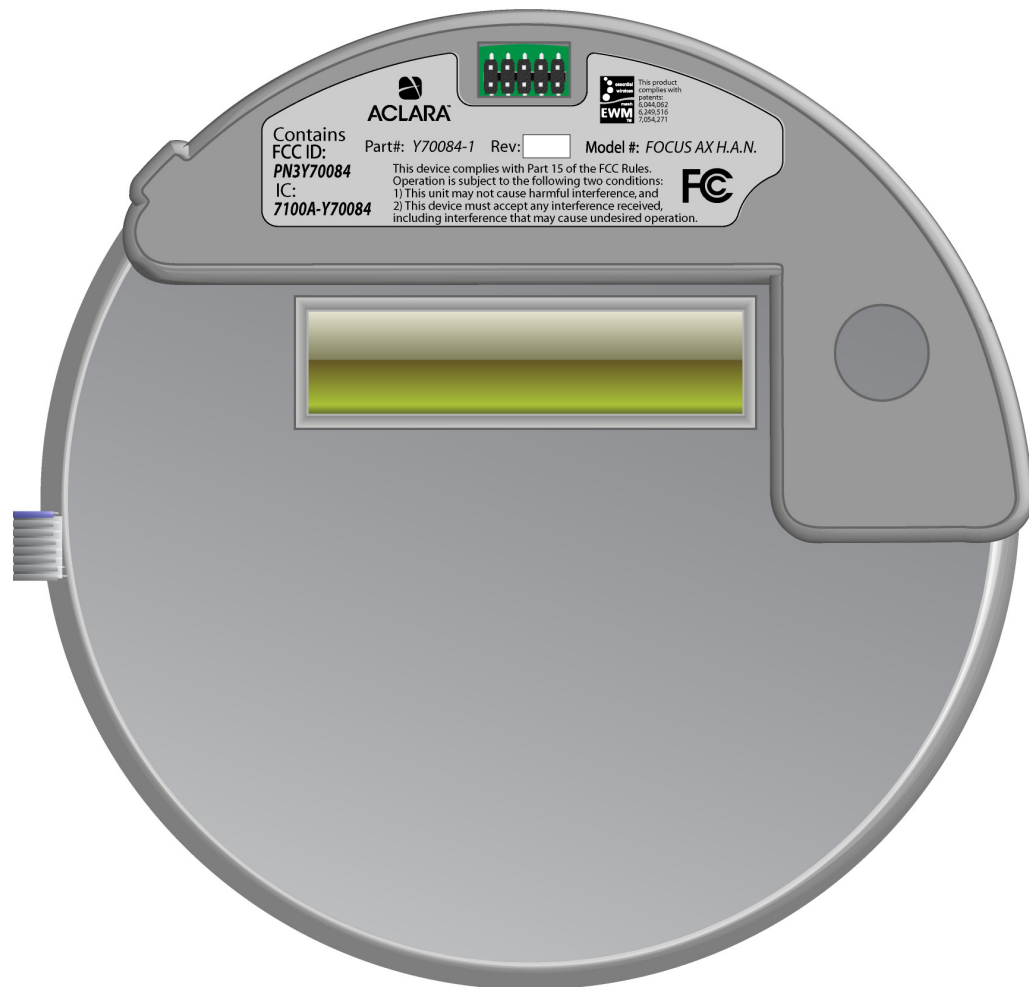
**NOTE** The matched sets are for demonstration only. All production units will be interchangeable.

## Components

### Aclara Integrated Meter

The Aclara integrated meter functions as the hub of the HAN. It receives TWACS communication from the Master Station and relays this to the IHD and programmable thermostat. Similarly, it receives communication from the IHD and the programmable thermostat, and transfers this information back to the Master Station. The Aclara integrated meter consists of a UMT-R-FX transponder and a ZigBee module integrated with an L+G FOCUS meter.

**Figure 2.2** Integrated meter



## In Home Display

The Aclara IHD is a plug-in demand response component that receives messages, alerts, billing, and account status information from the utility via the RCE. The IHD displays this information for the end user, so that he or she may plan and adjust energy consumption accordingly. The IHD plugs into a standard 120 VAC outlet.

**Figure 2.3** Installed IHD

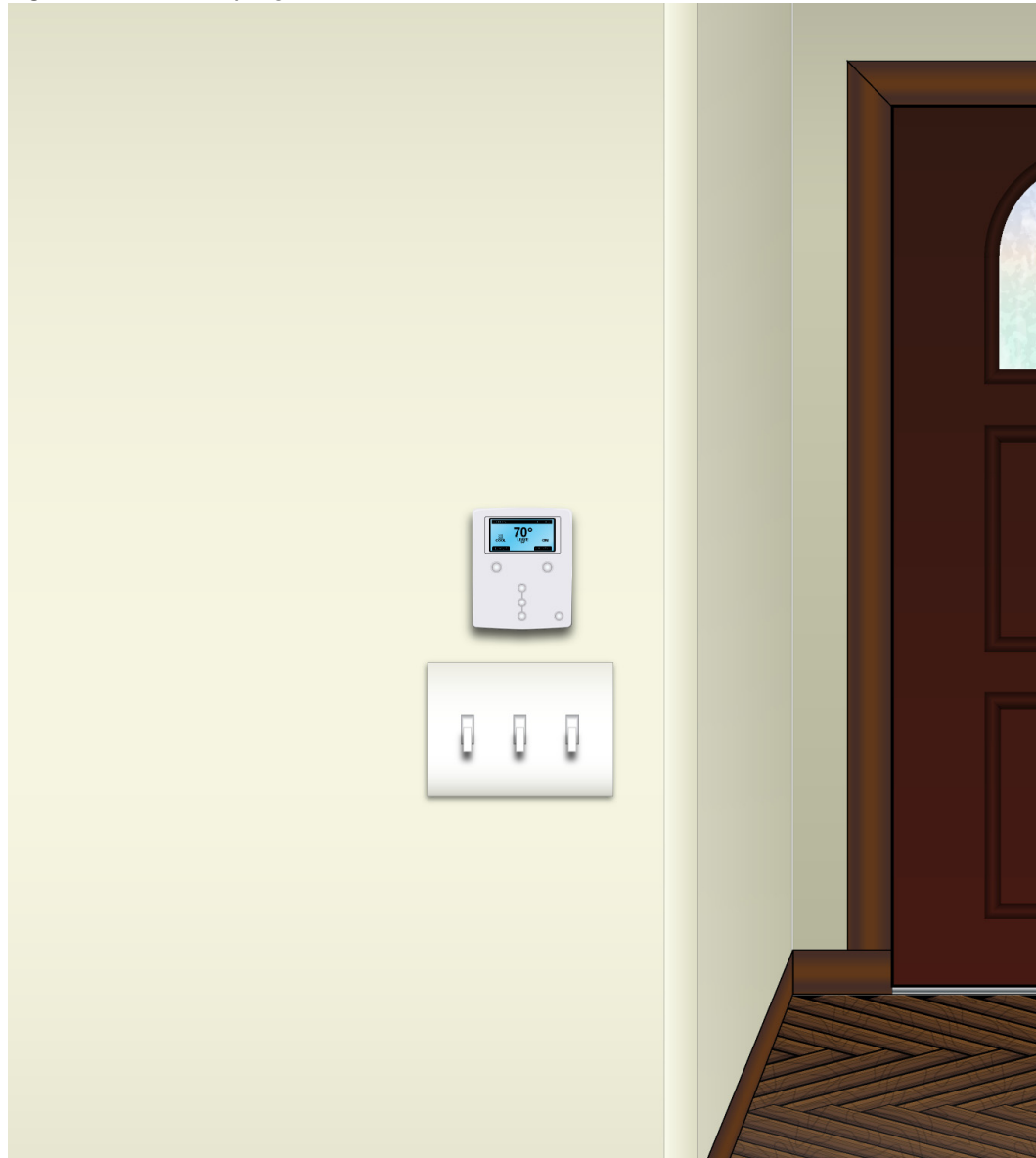


**NOTE:** Appearance of actual IHD may vary from image.

## Programmable Thermostat

The programmable thermostat allows the utility to make adjustments based on pricing or current demand. Future versions will allow end users to temporarily opt out of the program, however the present version does not allow the consumer to override the utility settings.

**Figure 2.4** Installed programmable thermostat



**NOTE:** Appearance of actual programmable thermostat may vary from image.

## Functional Description

The HAN module receives power from the host device and has its own microcontroller, RF circuitry, and permanently attached antenna. The HAN module transmits and receives RF transmissions from an IHD and a programmable thermostat.

The HAN module transmits and receives data using 16 channels spaced at 5 MHz intervals across the 2.4 GHz ISM band. The first channel used is at 2405 MHz, and the 16th channel is at 2480 MHz. The HAN module transmits to the IHD and programmable thermostat for a maximum of 10 ms in a 100 ms interval for a 10% duty cycle. The HAN module employs Offset Quadrature Phase Shift Keying (OQPSK) without use of a subcarrier.

The HAN module serves as the network coordinator and communicates with other ZigBee enabled Smart Energy devices such as thermostats and IHDs.

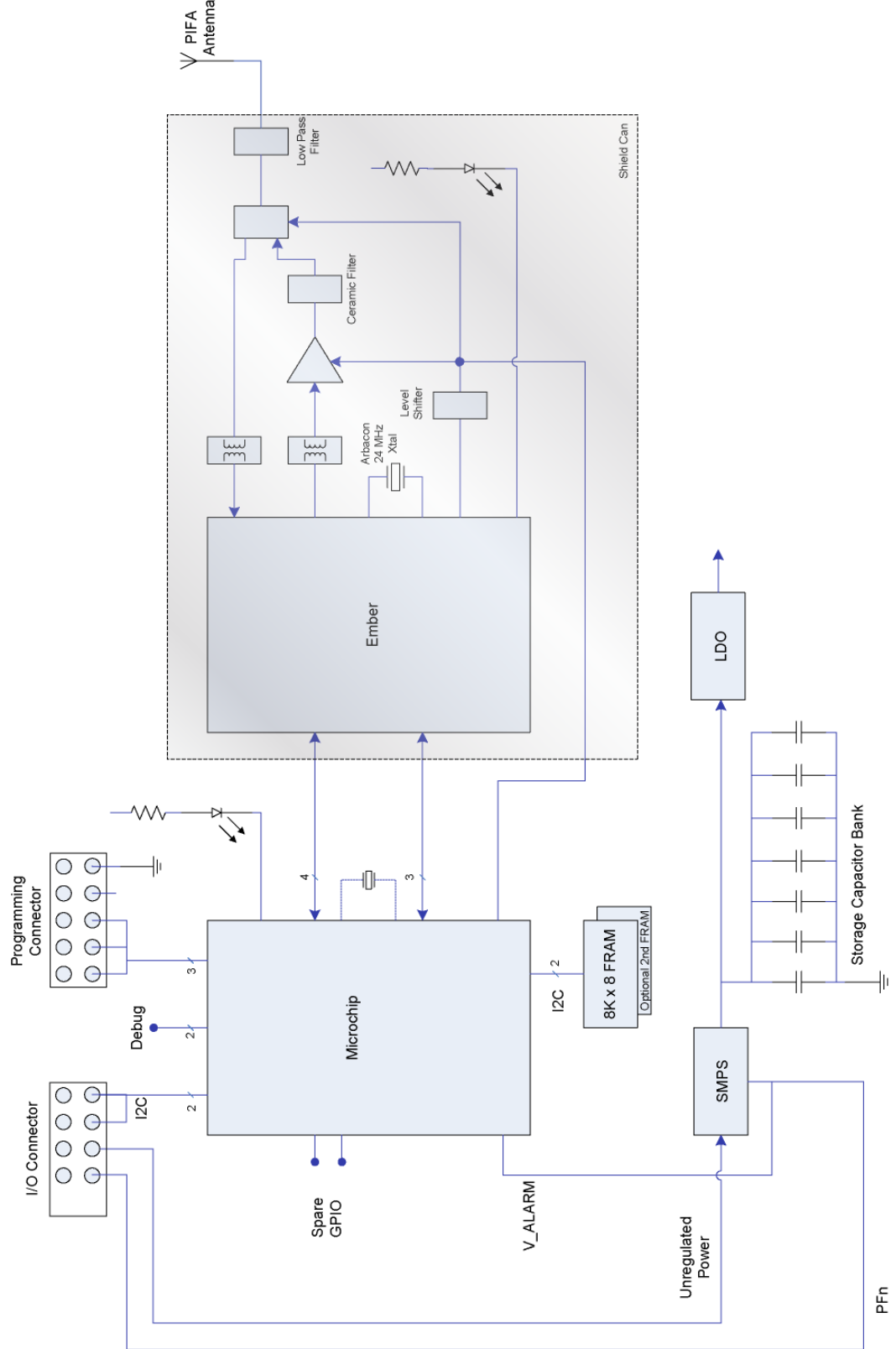
### REGULATORY DATA

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.

Any changes to these components that are not expressly approved by Aclara may void the user's authority to operate this equipment.

Figure 2.5 RF operation block diagram



## Messaging

The TNS HAN software is capable of sending 59 bytes of text to either the IHD or the thermostat. The number of bytes a HAN device will receive, however, may vary. The TNS operator has the option of specifying a display time duration, message importance, and/or requesting confirmation for each message. The message will appear in the HAN device display until the display time elapses, the message is cancelled, or a new message is sent.

**Figure 2.6** Text Message tab

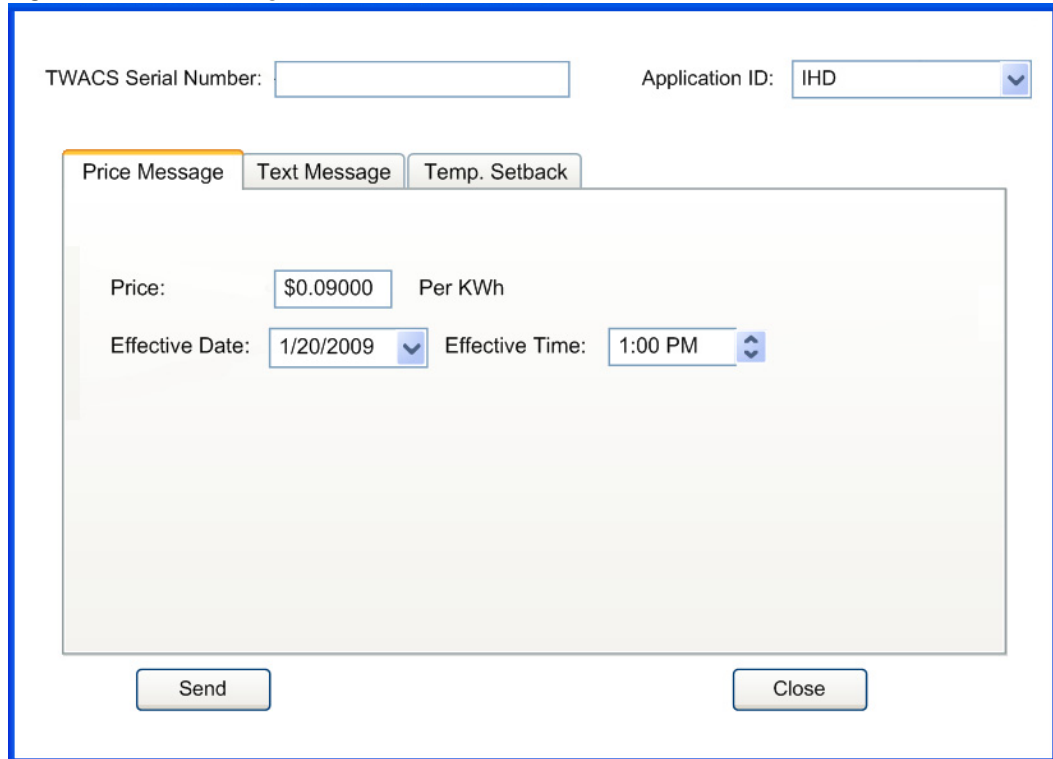
Field	Description
TWACS Serial Number:	The serial number of the RCE you would like to address.
Application ID:	The device to receive the text message. Options are either <b>IHD</b> or <b>Thermostat</b> .
Message:	The text to be sent to the device. TNS allows for a maximum of 59 characters. (End device character display may vary.)
Expiration	How long the message should be displayed. You may specify a time (from 15-3825 minutes, in 15 minute increments) or <b>Never</b> . Selecting <b>Never</b> will display the message until a new message is sent.
Importance	The <b>Importance</b> radio buttons allow the end user to see whether the message is considered <b>Low</b> , <b>Medium</b> , <b>High</b> , or <b>Critical</b> from a distance.
Confirmation Requested	Selecting the <b>Confirmation Requested</b> check box will trigger an auditory indicator that will repeat until the end user confirms they have read the message.



## Pricing

This option allows the TNS operator to send a pricing message consisting of a price value and a start time to the HAN device. A pricing message sent to the HAN device will remain active until a new pricing message is received. The HAN module will store up to 5 pricing messages.

**Figure 2.7** Price Message tab



The screenshot shows a software interface for sending a pricing message. At the top, there are two input fields: "TWACS Serial Number:" followed by an empty text box, and "Application ID:" followed by a dropdown menu showing "IHD". Below these are three tabs: "Price Message" (which is selected and highlighted with an orange border), "Text Message", and "Temp. Setback". The "Price Message" tab contains the following fields: "Price:" with a text box containing "\$0.09000" and the text "Per KWh" to its right; "Effective Date:" with a dropdown menu showing "1/20/2009"; and "Effective Time:" with a dropdown menu showing "1:00 PM". At the bottom of the form are two buttons: "Send" on the left and "Close" on the right.

**NOTE** A pricing message cannot be cancelled, but it can be replaced with a new pricing message.

## Temperature Setback

Selecting this tab allows the operator to send a Smart Energy Profile (SEP) load control command to the thermostat. These commands include the offset value, the start time and date, and command duration. Once a temperature setback command begins, it will remain active until the command duration expires or the start time of a new command is reached. The utility can also allow the customer(s) to opt out of a load control event by selecting the Opt Out Allowed check box.

Figure 2.8 Temp. Setback tab

The screenshot shows a web-based interface for configuring a temperature setback. At the top, there are two input fields: "TWACS Serial Number:" followed by an empty text box, and "Application ID:" followed by a dropdown menu showing "IHD". Below these are three tabs: "Price Message", "Text Message", and "Temp. Setback", with the latter being the active tab. The main content area contains the following fields:

- "Heating Temp. Change (-):" with a text box containing "5" and "°F" to its right.
- "Cooling Temp. Change (+):" with a text box containing "5" and "°F" to its right.
- "Effective Date:" with a dropdown menu showing "1/20/2009".
- "Effective Time:" with a dropdown menu showing "1:00 PM".
- "Duration:" with a dropdown menu showing "30" and "Min." to its right.
- An unchecked checkbox labeled "Opt Out Allowed".
- A button labeled "Cancel All Temp. Setbacks" centered below the fields.

At the bottom of the interface, there are two buttons: "Send" on the left and "Close" on the right.

## Meter Data

## Interval Data

# INSTALLATION

This chapter provides details about setting up the Aclara HAN. Follow the procedure in the order listed to ensure every the installation step is completed.

## Prerequisites

Aclara personnel will help search the RCE into TNS, however there are steps that must be performed prior to Aclara's arrival. If, at any time, you would like to speak with an Aclara representative about these instructions, please contact Aclara Customer Care at (800) 892-9008 or [care@aclara.com](mailto:care@aclara.com).

1. Upon receipt of the HAN product groups, Meter Shop personnel should acquaint themselves with the interaction of the components by performing functions such as:
  - Messaging -
  - Pricing -
  - Load Control -
  - Retrieve Meter Data -
  - Retrieve Interval Data -

Please refer to the *Meter Shop Test Tool* chapter on page 19 for details on setting up and using the MSTT with the HAN devices.

2. The TNS patch must be installed prior to equipment installation.
3. The programmable thermostats must be installed and working prior to Aclara setup.
4. The locations chosen by the utility must provide access to the interior of the house at the time of installation.
5. Installers should be equipped with a GPS receiver. This will facilitate the installation and search-in procedure.

These steps are described in more detail in the following sections.

## TNS Patch

Follow these steps to install the HAN TNS patch.

## **Residence Access**

Please ensure that the installation locations allow access to the interior of the residence during the time of installation. This is necessary to ensure the programmable thermostat and IHD are installed and operating correctly.

# Installation

## IHD Installation

The IHD must be installed in the residence prior to the programmable thermostat.

## Programmable Thermostat Installation

The programmable thermostats must be installed prior to Aclara's arrival. Please refer to the operating and installation manual included with the programmable thermostat.



# **METER SHOP TEST TOOL**

## **Setup**

1. Insert the integrated meter into an appropriate meter socket.
2. Plug the IHD into a standard 120 VAC outlet.
3. Connect the Meter Shop Test Tool to the integrated meter.

Once connected and powered up, proceed through the following functions of the HAN.

## **Messaging**

## **Pricing**

## **Load Control**

## **Meter Data**

## **Interval Data**





# SPECIFICATIONS

The HAN module was designed in accordance with the IEEE 802.15.4 protocol. This section contains general, electrical, environmental, and physical specifications for the HAN module.

## Electrical Specifications

**Table 5.1** HAN module electrical ratings

Parameter	Rating
Input Voltage	11 to 17 VDC
Quiescent Current	$\leq 15$ mA @ 13 VDC
Current while transmitting RF	$< 30$ mA @ 13 VDC
Power Supply	DC energy is provided by the host.

## Compliance Specifications

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

**Table 5.2** HAN module compliance specifications

Test Title	Applicable Specification
EMI/RFI Emission Conducted/Radiated	ANSI C12.1 Test No. 27 - CFR 47 Subparts A & B - Radio Frequency Conducted and Radiated Emissions. Class B Digital Device. Tested to EN55022 in order to meet both Canadian and US requirements.
EMI/RFI Susceptibility	ANSI C12.1 Test No. 26 - "Effect of Radio Frequency Interference", 200 kHz - 10 GHz at field strength of 15V/m.
Occupied Bandwidth	75 MHz
RF Output Power	$\leq +22$ dBm
Carrier Frequency Stability	$\pm 98$ kHz-40 ppm
This product complies with FCC OET Bulletin 65 radiation exposure limits set forth for an uncontrolled environment.	

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

## Environmental Specifications

**Table 5.3** HAN module environmental specifications

<b>Thermal</b>	
Effect of Operating Temperature	Aclara Specific Test -40°C to 70°C with and without solar load
<b>Humidity</b>	
Effect of Relative Humidity	Aclara Specific Test 60°C for three 24 hour cycles or 85°C for one 24 hour cycle at 95 ±4 % relative humidity, non-condensing.

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## Physical Specifications

**Table 5.4** HAN module physical specifications

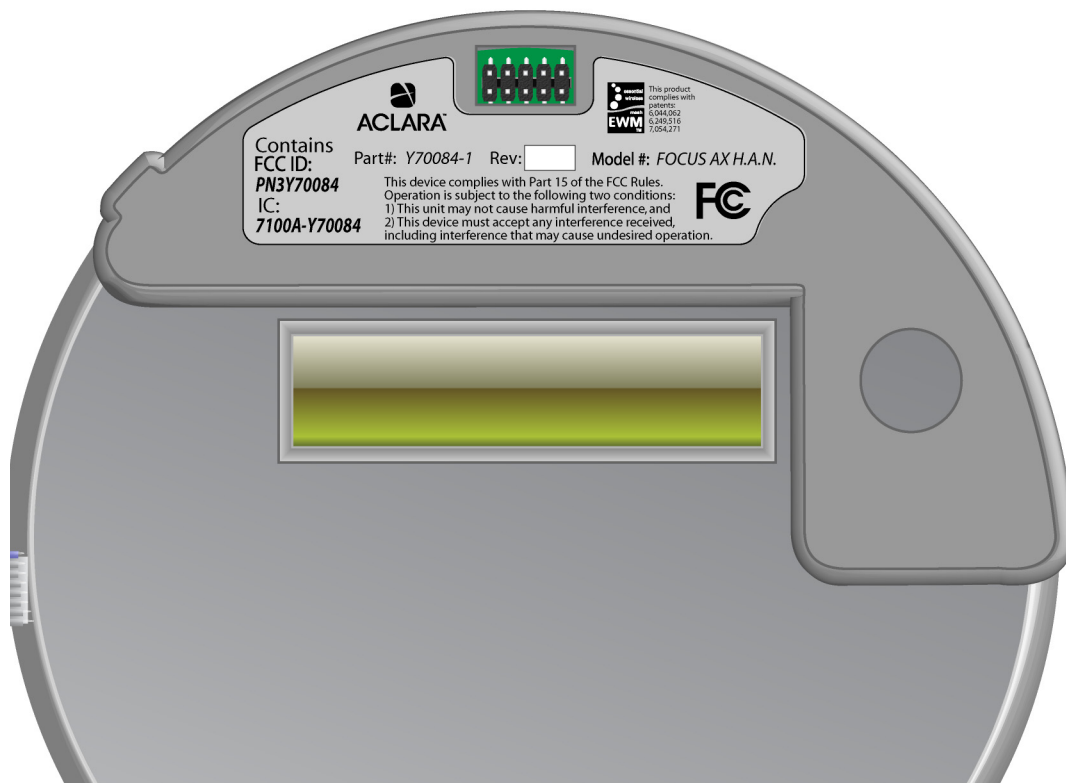
Parameter	Specification
Approximate Weight	< 1.0 oz. (28.4 g.)
Dimensions	5.3" x 2.9" x .6"

## Additional Regulatory Data

**Table 5.5** HAN module labeling requirements

Labeling Requirements
The FCC ID and IC ID numbers are located on the module label as shown in <i>Figure 5.1</i> . The Aclara serial number, which is also the MAC address, is also displayed on this label.

**Figure 5.1** HAN module label



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

**Table 5.6** HAN module regulatory data

Parameter	Specification
Disclaimer noting that operation of the device is subject to conditions and that the device may not cause harmful interference and device must accept any interference received.	Regulatory Data note on page 10.
Principles of device operation	<i>Appearance of actual programmable thermostat may vary from image.</i> on page 9
Block diagram	<i>RF operation block diagram</i> on page 11
Operating frequency	2405 - 2480 MHz
Channeling	16 channels
Internal/External data source	External
Type(s) of modulation	Offset Quadrature Phase Shift Keying per IEEE 802.15.4
Type of information transmitted	Equipment control
Occupied bandwidth	5 MHz,
RF output power	22 dBm or less. Meets FCC section 15.247 for field strength emissions
Carrier frequency stability	±98 kHz-40 ppm

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**NOTE** No subcarrier is used to modulate the carrier. Refer to paragraph 2, on page 9 for more information.

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