The THERMOSTAT

THE EVOLUTION OF CAPABILITIES INTO A PLATFORM FOR ENERGY MANAGEMENT

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Thermostat Functions

The Basics

- Measure Room Temperature
- Provide User Controls
- Information Display
 - Temperature
 - Setpoints
 - Mode
- Control HVAC System
- Run Schedules

New Functions

- Fresh Air Ventilation Control
 - Outside Temp Sensor
 - Vent Damper Control
- > Work with Enhanced HVAC Systems
 - Multistage
 - Variable Speed Fan Control
 - Additional System Sensors
 - Monitor System Performance

New Functions

- > Add Communications
 - Remote Monitoring
 - Remote Control and Download
 - Messaging
 - Direct Intersystem Data Exchange
 - Automation System Interface
 - Energy Management System Interface
 - Meter/Utility Interface
 - PV Systems Interface

Enhanced Hardware

- > Universal Display
 - Graphical LCD
 - Provide Basic Functions
 - Allow New Functions Display/Control
 - Host Other Application's Display/Control
 - Energy Management
 - Utility Interface
 - > PV Interface

Enhanced Hardware

Expanded HVAC System Control

- Added Sensors
- Added HVAC Outputs
 - Multistage
 - Variable Speed
- Vent Damper Control

Enhanced Hardware

- Wired
- Powerline
- RF

Basic Thermostat



> Advanced Thermostat









TR40 Thermostat

Wall Display Unit





Vent Damper

HVAC

System



- Traditional "Thermostat" Look
- Temperature Sensor
- Graphical Display
- User Controls

Key Feature: The Graphical Display Allows Many Information Screens and Dynamic Control of Functions, *including external systems.*

The HVAC Control Unit



- HVAC Control Outputs
- New Outputs
 - Vent Damper
- New Inputs
 - Outside Temp Sensor
 - HVAC System Monitors
- Communications Port

Key Feature: Location At The HVAC System Allows For Power, Added Inputs, Outputs And Communications Wiring To Be Easily Installed And Requires No New Wires To The "Thermostat" (WDU)

A Word About Power

Legacy HVAC System Design Problem



Typical Thermostat Wiring Does Not Provide The WDUDDESTGetTPoweredat! From The HVAC Control Unit



The HVAC Control Unit Gets Power From The HVAC System (24V Common and 24V Return)

KEY FEATURE: Big Benefit! We now have power at the WDU that allows for more functions and the better display.

> Minimized Screen



Main Thermostat Screen



> Main Menu Screen



Smart Vent Screen



> Messaging Screen



HVAC Control Unit

- HVAC Control Outputs
 - Standard Heat (W1), Cool (Y1) and Fan (G) Outputs
 - 2 Stage Outputs (W2 and Y2)
 - Heat Pump System Outputs (O/B)
- Advanced HVAC Control Outputs
 - Dual Fuel System Outputs
 - Radiant Heating System Outputs
 - Variable Speed Fan Outputs (PWM)
 - Pump Control for Hydronic Systems
- Other Outputs
 - Vent Damper Output (Zone Dampers Also)

HVAC Control Unit

Other Inputs

- Outdoor Temperature and Humidity Sensors
- HVAC Mechanical System Monitoring
 - Leaving Air Temperature Sensor
 - Power Monitor (Indoor and Outdoor Units)
 - Refrigerant Temperature Sensors

HVAC Control Unit

- Wired
 - SERIAL RS232/485
 - ETHERNET (ALSO BPL AND WIFI)
- Powerline
 - X10
 - UNIVERSAL POWERLINE BUS (UPB)
 - LONWORKS
- RF
 - · ZWAVE
 - ZIGBEE
 - CELLULAR

- Communications Allows Connection to:
 - Internal Networks
 - External Networks
 - Energy Management Systems
 - Automation Systems
 - Meters
 - Utility Gateways
 - PV Systems

- Communications Allows New Functions
 - Remote Monitoring
 - Remote Control and Download
 - Other Systems Control
 - Intersystem Data Exchange
 - Acquire Data for Display
 - Utility Interface

Advanced Applications

Energy Usage Display

- Acquire data from HVAC System
- Acquire data from Meter
- Acquire data from Energy Monitoring System
- Display data graphically on WDU
 - Current Usage
 - Daily/Monthly Displays
 - KWH and Cost

Daily HVAC Energy Usage Line Graph



Weekly HVAC Energy Usage Bar Graph



Monthly HVAC Energy Usage Bar Graph



> HVAC Energy Usage KWH



> HVAC Energy Usage Cost



> Total Energy Usage KWH



> Total Energy Usage Cost



Advanced Applications

> Utility Interface

- Receive Load Shed/Emergency commands
- Receive Price Tier data
- Receive Real Time Price data
- Receive Utility Text Messages
- Send Acknowledgements
- Send Load Reduction Info
- Send Equipment/Load Status

Utility Interface

> Utility Tier Cooling Setpoints



Utility Interface

> Utility Tier Rates

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Easy Upgrade to Zoning



Key Feature: Zoning increases energy savings 25-35% and VENT DAMPER helps DR by reducing the effects of load sheds or setbacks.

The Thermostat Evolves...

Fundamental Benefits

- A foundation device that is always present.
- A familiar device to the users.
- Avoids "another" device on the wall.
- Provides a single point of interface.

 Already is connect to and controls the largest energy consuming device.

...Into the Energy Manager...

Increased Energy Savings

- Advanced HVAC system support.
- Advanced energy saving functions.
- Maintains system efficiency
- > Robust User Interface
 - Supports enhanced features
 - Supports advanced applications

...and Beyond...

- Enabling Communications
 - Connects to any other device, gateway, system or network.
 - Collects data need to support applications.
 - Shares data with all other systems.
 - Provides an overall "Whole House" solution.
 - Compatible with other Home Systems.
 - Security/Lighting/AV/Computers

Cost Effective Solution

- Basic device has key fundamental hardware necessary.
- Low cost to expand into other applications.
- > Avoid duplicating systems and user interfaces.
- An integrated approach to an Energy Management and Demand Response System.

An Alternative WDU

