



Green Thermostat & Energy Monitor System Specification and Submittal



General

Wellspring designs and manufactures a family of submetering and control products which employ an open protocol 2-way radio that complies with IEEE 802.15.4 and ZigBee Pro radio standards.

The Wellspring Energy Monitor marries this radio with a microprocessor, firmware, and a serial link, or wired inputs and/or outputs to track, record, and report heating and cooling consumption. The Energy Monitor can be mounted at the heating or cooling equipment (or the boiler control valve), sensing temperatures delivered and time of use.

When used in conjunction with Robertshaw's "i" series thermostats, Wellspring's Energy Monitor also tracks apartment temperatures and (optionally) can over-ride resident set-points to reduce electrical demand or limit energy use. Residents can track their energy use on the thermostat display, and program temperatures to change up to 6 times each day. The result is a "Green Thermostat", which minimizes energy use by providing both the financial incentive and the means to conserve and control heating and cooling consumption, and lower peak demand.

Billing to the resident is always based on the visible energy register at the thermostat, calibrated in hours and minutes. On the invoice, your billing company can show the resident how long their unit operated on heating and cooling (which agrees with the thermostat display). Then the invoice show multiplies the hours of use by the capacity of his heating (or cooling) unit in BTU/Hour, to obtain the therms used. Then they

apply the billing rate in \$ per therm, and the billed amount results. (Sample Invoice is attached)

Competitors do not display energy use, and cannot bring this credibility to the bill. If the resident does not understand how the billed amount was calculated, or does not believe they "could have possibly used that much energy", then controversy and collection problems follow – and some residents will move out rather than renew when their lease comes due.

The purpose of metering consumption is to bring credibility to the invoice, and diffuse controversy. A visible display of energy use that ties to your resident invoice is critical to achieve this result. So is providing the resident with a tool they can use to lower their energy use.

Frankly, we cannot imagine how other monitoring systems without these features can possibly work without a lot of controversy, collection problems and move-outs.

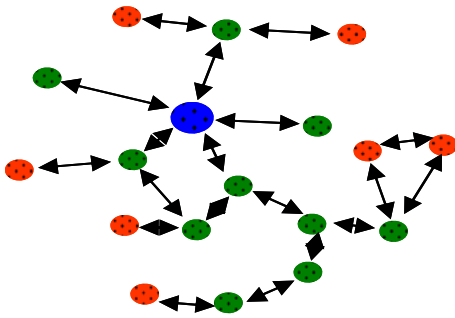
Robertshaw "i-2" Thermostats

The world is filled with thermostat choices – Wellspring chose this family of thermostats for many reasons. This line can handle most residential and commercial applications, with up to 2 cooling, and 4 heating stages, humidity sensing and control, remote sensor response, and importantly – a robust serial port that now ties directly to Wellspring's Energy Monitor. To learn more about this exciting Thermostat, go to www.about-i-series.com.

ZigBee Radio Network

All Wellspring products communicate wirelessly using the same open protocol ZigBee-Pro compliant mesh operating on one of 16 channels between 2.405 and 2.485 GHz. The network is managed by Wellspring's network application software (WS-NAS), which is self configuring and self healing. One gateway within your community or neighborhood acts as network coordinator, which automatically selects the network channel frequency where interference is lowest. Mesh routers and end nodes (including thermostats) scan all 16 channels looking for the gateway, and join the network, choosing the most efficient route.

Typical ZigBee Mesh



Green means “Good to go”

All Wellspring nodes can be tested by your maintenance staff. While standing at the Energy Monitor or Green Thermostat, they can force communication with the gateway. Each message is acknowledged, and they get an indication - green flashes means success - red indicates failure. Feedback happens right at the metering node, saving time and money. (Competitors have to look at their computer screen to see communication - we feedback to the technician in real time, enabled by use of two-way radios at each node.)

If the chosen radio route ever fails to produce a return message acknowledgment, the sending node will immediately cure the failure by switching routes, and (if required) scanning for a new frequency channel until an acknowledgment is received.

Control Limits Tied to Sensor Inputs

Building managers located on site or off site can download set-points and schedules to assist the resident in their effort to reduce energy use, or boost comfort levels. Limits on resident set-points may also be set, to prevent excessive heating or cooling, or to base set-point control on other sensed parameters, such as outdoor air temperature, occupancy status, light levels or door/window status. Owners of apartment communities may also disable the thermostat keypad except for set-point adjustment - or

disable the key-pad completely and drive set-points from a remote location via Wellspring's two-way wireless ZigBee network.

Demand Response

Multi-family communities can also lower electrical demand on-peak by issuing global commands to groups of Green Thermostats, changing set-points for a defined period of time to curtail electrical use. This strategy may be used to generate revenue from the utility grid authority by selling load shedding capacity. It may also be used to lower electrical demand charges at the master meter.

Temperature Logs

Historical temperature logs are maintained at each thermostat, and transferred with each data packet. These can be used to diagnose comfort complaints, identify failed or failing HVAC equipment or compute the “degree-day” consumption of each apartment unit by matching the log against a similar log of outdoor temperatures.

Other Applications

Wellspring offers ZigBee based sub-metering of water, domestic hot water energy, electric and gas, as well as centrally metered heating and cooling systems. All these submetering applications feed data across a single mesh network.

Since this is an open protocol ZigBee compliant network, other ZigBee compliant devices may join Wellspring's network. One network can do many jobs as new ZigBee based applications emerge.

In other words, you can deploy monitoring and control products from other companies that use the ZigBee open protocol, and they can send data across the Wellspring network. What applications?

- Security monitoring
- Appliance monitoring for maintenance
- Pest monitoring
- Mold monitoring
- Utility metering
- Electrical Load Control
- Irrigation control

Wellspring is aware of other companies who are developing products for these applications that make use of the ZigBee protocol to transfer alarms and monitored data. Over 175 companies are members of the ZigBee Alliance, all working on new uses for this exciting two-way protocol. <http://zigbee.org/About/OurMembers/tabid/191/Default.aspx> lists these members.

Typical Resident Invoice Using Wellspring's Green Thermostat & Energy Monitor



AllianceData Multifamily Services

Acct. #: 0999000001.03

Billing Period: 3/1/2008 thru 3/31/2008

Customer Care: 1(800) 466-6668
View your account at www.cbsi.cc

3/31/2008 0999000001.03
ALLEN, MICH & CHRIS
5454 WEST CRENSHAW STREET APT 1
TAMPA FLORIDA 33634

Internet User ID 0999000001.03
Internet Password 5378

Messages:

Service Address:
5454 WEST CRENSHAW STREET 1

Prev. Read	Curr. Read	Usage	Description of Service	Amount	Total
9000	9072	72	Hours of use, Heating Unit X Heater Capacity of 0.86 therms/hr. X Gas rate per therm of \$1.26 =	\$78.02	
1000	1065	65	Hours of use, Domestic Hot Water Htr. X Heater Capacity of 0.40 therms/hr. X Gas rate per therm of \$1.26 =	\$32.76	
			Gas billing flat charges	\$ 3.45	
			Current Charges 4/25/2008		\$114.23

Therms = measured hours of use x actual capacity of your heating unit
1 therm = 100,000 BTU
A furnace with nameplate capacity of 80,000 BTU/H input, is equal to 0.8 therms per hour
A boiler system heating unit capacity varies with boiler water temperature,
which is measured for your heater whenever your heat is on, and used to
calculate average capacity of your heater during the billing period.

Billing \$ = Therms used x Gas billing rate per therm from the gas utility for the most recent billing period

DETACH AND RETURN THIS PORTION WITH YOUR PAYMENT. PLEASE DO NOT USE STAPLES.

A late fee of \$10.00 will be assessed if payment is not received prior to May 1, 2008

Please do not send cash.
Por favor no enviar dinero en efectivo.

ALLEN, MICH & CHRIS
5454 WEST CRENSHAW STREET APT 1
TAMPA FLORIDA 33634

Payment Due:	5/1/2008
Acct. #:	0999000001.03
Amount Due:	\$114.23
Amount Enclosed:	

Remember to Include Your Account Number on Your Check!
View your account at www.cbsi.cc
We now accept payments by phone.

ALLIANCE DATA
PO Box 628329
Orlando, FL 32862-8329

09990000010350000048124

The following table provides a brief comparison of Wellspring to the competition.

	<u>Wellspring Green Thermostat</u>	<u>Competition</u>	<u>Why does this matter?</u>
Communication			
Method	2-way radio	Wired or 1-way radio	Wires invite tampering
Messaging Protocol	Message acknowledgment & cure Open protocol	No cure for message failure Proprietary	Redundancy = less data loss Don't get locked into one vendor
Applicability	Any ZigBee product	One application only	Leverage your network investment
Data access	Web + e-mail	On-site computer	Better to access from anywhere
Measurement	Heat/Cool Relay + Temp	Temperature only	Relay sensor makes run times accurate
Resident Support	Thermostat displays run time Thermostat is programmable Bill tracks display	No display No thermostat offered No explanation on invoice	Residents need to understand, track use control use and ultimately believe that they are being fairly treated
Largest System	Unlimited	512 sensors	Scalable and transportable is better

Installation and Operation Instructions

Wellspring Energy Monitors, when installed separately from the Green Thermostat, are documented on Wellspring's web site library.

See <http://www.wellspringwireless1.com/pdfs/library/EnergyMonitorSpecSheet.pdf>

Invensys - Robershaw provides excellent documentation for their thermostats, which is posted on the Wellspring web site in the reference library. You can find these documents at www.wellspringwireless.com under the reference library tab – look for “Green Thermostat” documentation. Invensys also offers a web-based tutorial which can be found at www.about-i-series.com.

Please note that this thermostat MUST have a 24 volt power supply (both legs of the 24 volt circuit) at the thermostat. It cannot operate on batteries.

The Wellspring ZigBee Energy Monitor is attached inside the Robertshaw thermostat to deliver thermostat functionality to a remote terminal, to limit set-points, control demand and extract energy use data that can be used in support of a billing program. Wellspring radio networks are self-forming, self-healing, and require no special set-up.

Radio connectivity status can be tested by simultaneously pressing both arrow keys. This triggers a health packet, or a join command, If an acknowledgement is received, the right (HEAT) LED will flash four times. If no acknowledgment is received, the middle (FAN) LED will flash, then the unit will re-set (both LED's light), followed by the result. Success triggers the right, or HEAT LED to flash four times. Failure triggers the FAN and HEAT lights to flash sequentially 4 times. Full documentation for Wellspring's radio network is also published in our reference library at www.wellspringwireless.com.

Next Steps

If you have interest in the Wellspring Green Thermostat and Energy Monitor system, please contact us to discuss your needs, or request a quote. You may also request a quote on our web site. We are here to serve your needs, and look forward to hearing from you.



For more information, contact Wellspring at 215-788-8485, or e-mail us at thermostat@wellspringwireless.com
Wellspring has a policy of continuous product improvement and reserves the right to change design and specifications without notice.