ECOsmart™

EcoSmart VRF Controller

Firmware Version 2.x

Installation, Operation & Maintenance Guide

Use this guide along with the EcoAir or EcoTouch+ IOM as applicable.

⚠

CAUTION!

- **Failure to understand and follow all instructions carefully before installing or operating this device could cause personal injury and/or property damage.**
- **All wiring must conform to local and national electrical ordinances and codes.**
- **Prevent electrical shock, personal injury, and equipment damage: prior to installation or service, disconnect system's electric power at main fuse or circuit breaker box.**

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The EcoSmart Energy Management System

The EcoSmart Energy Management System reduces HVAC energy consumption without interfering with occupant comfort.

EcoSmart thermostats such as the EcoAir/EcoTouch automatically learn and adapt to the heating and cooling patterns of each room. For example, a room on the east side of a building will receive direct sunlight in the morning and will either need less HVAC heating or more HVAC cooling. However, as the day progresses, the room will need more HVAC heating or less HVAC cooling as it moves into the shade. An EcoSmart thermostat will continually monitor the room, learn its patterns, and adjust its heating and cooling profiles accordingly. EcoSmart thermostats also learn and adapt to occupant schedules. When a room is unoccupied, the EcoAir/EcoTouch will enter an energy saving mode, allowing the room to drift away from the desired set point. During this drift period, the thermostat will operate the HVAC unit less often, reducing energy costs. When the room becomes occupied again, the RecoveryTime™ technology built into each EcoAir/EcoTouch will return the room to the set point without occupant interaction.

The EcoWave is available in several configurations to address specific requirements of multiple applications including hotel, classroom, office, university dormitory, military residence hall, retail, public area, convention center, and a wide variety of commercial and industrial spaces.

The firmware of standalone EcoWave thermostats is identical to the firmware of networked versions. Standalone Thermostats can be networked by adding a network module to the base units at any time. Programming features used during installation, maintenance, and troubleshooting are available in the on-screen Maintenance Menu.

Regulatory Compliance & FCC Notice

Warning: Any changes or modifications made to this product not expressly authorized by the manufacturer could void the user's right to operate this device.

The device complies with part 15 of the FCC Rules as well as Industry Canada Rules and Regulations license-exempt RSS standard(s). 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.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

A separation distance of at least 20 centimeters should be maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

Afin de se conformer aux exigences d'exposition RF MIC / FCC / ISED, cet appareil doit être installé pour fournir au moins 20 cm de séparation du corps humain en tout temps.

FCC ID: XV6SS6600

EcoWave Remote Thermostat/Controller Package

The EcoWave Remote Thermostat/Controller Package is comprised of two hardware components: the wireless EcoAir/EcoTouch battery powered display unit and the EcoSource+ HVAC controller. The EcoSource+ is placed in the HVAC unit for physical control of the system. The EcoAir/EcoTouch display can be placed in the optimum location for both temperature measurement and ease of occupant use. There are no restrictions based on where existing thermostat wire has been run or if there are enough conductors.

The EcoWave Package can be configured for many different HVAC scenarios. It can control multiple HVAC systems, each equipped with an EcoSource+, but all directed by a single EcoAir/EcoTouch display unit. This type of installation reduces the complexity of running multiple HVAC units in a single large space and eliminating the potential of opposing modes forcing equipment to compete against each other.

The EcoSource+ can accept associations with up to 15 total EcoSmart and other compatible wireless devices, such as multiple occupancy sensors and door switches. Each compatible wireless device may be associated to more than one EcoSource+.

The EcoWave adds functionality, increased usability, extra efficiency, and component cost savings to conference rooms or large room suites. Multiple

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EcoAir/EcoTouch thermostats in different areas of a building give each individual area the ability to make setpoint changes to control a single EcoSource+.

Together, the EcoWave package forms a wireless programmable controllable thermostat with over 125 configurable settings used to control the efficiency of HVAC systems. It can be easily installed on packaged terminal air conditioners, fan coils, heat pumps, split systems, and more. With software-based relay control and fan speed configuration, programming setup is simple and fast.

Wiring follows industry-standard conventions whenever possible. Telkonet can develop specific wiring diagrams, if a complete specification is provided for the HVAC unit(s) in use at the site. The pin allocations of the EcoSource+ are below. The wiring interface conforms to industry standards.

Functional Caveats

Telkonet ships equipment to customers pre-programmed based on a pre-deployment analysis and discussion with property management. Generally, command-level programming at the field level will not be needed. When a command change is needed, Telkonet will provide a detailed synopsis of the proposed changes. Arbitrarily changing command values without prior discussion with Telkonet Applications Engineering can result in suboptimal thermostat performance and a loss of energy savings. All of these can possibly impact the user interface. For this reason, such arbitrary changes do not represent a Recommended Best Practice, and any corrective actions taken by Telkonet (including consultation) are subject to Professional Services charges at prevailing rate.

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EcoSmart VRF Controller: Part of the EcoWave Remote Thermostat/Controller Package

EcoSmart VRF Controller: Part of the EcoWave Remote Thermostat/Controller Package

The EcoWave package is comprised of two hardware components as shown below. Together they form a wireless programmable controllable thermostat. With software-based relay control and fan speed configuration, programming setup is simple and fast.

EcoTouch+ (or EcoAir)	• Display unit • Place in optimum location for occupancy detection, temperature measurement and ease of occupant use
EcoSmart VRF Controller	• HVAC Controller • Install in or on HVAC unit • Accepts association with 15 total compatible wireless devices • Each compatible wireless device can be associated to multiple EcoSmart VRF Controllers

Accomodates a Variety of Configurations

The EcoWave Package can be configured for many different HVAC scenarios. For example:
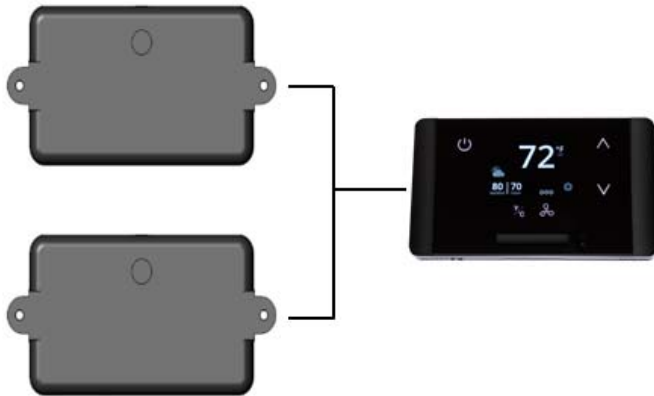
One EcoTouch+ (or EcoAir) can control multiple HVAC systems, each equipped with an EcoSource VRF, but all directed by a single EcoTouch+ (or EcoAir) display unit. This type of installation reduces the complexity of running multiple HVAC units in a single large space and eliminating the potential of opposing modes forcing equipment to compete against each other.

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EcoSmart VRF Controller: Part of the EcoWave Remote Thermostat/Controller Package

Multiple EcoTouch+ (or EcoAirs) can control one HVAC system, equipped with one EcoSource VRF.
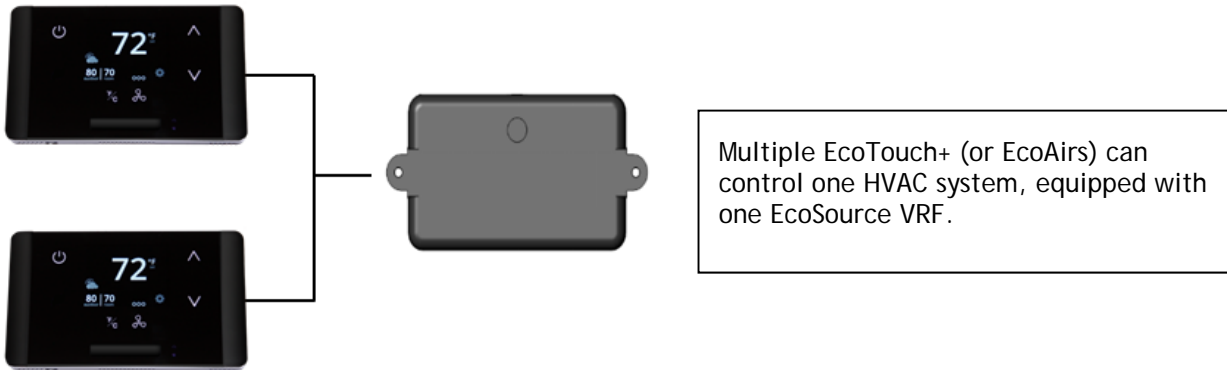
The wiring interface conforms to industry standards. Telkonet can develop specific wiring diagrams, if a complete specification is provided for the HVAC unit(s) in use at the site.

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EcoSmart VRF Controller: Part of the EcoWave Remote Thermostat/Controller Package

Figure 1- EcoAir/Controller/HVAC Wiring Diagram

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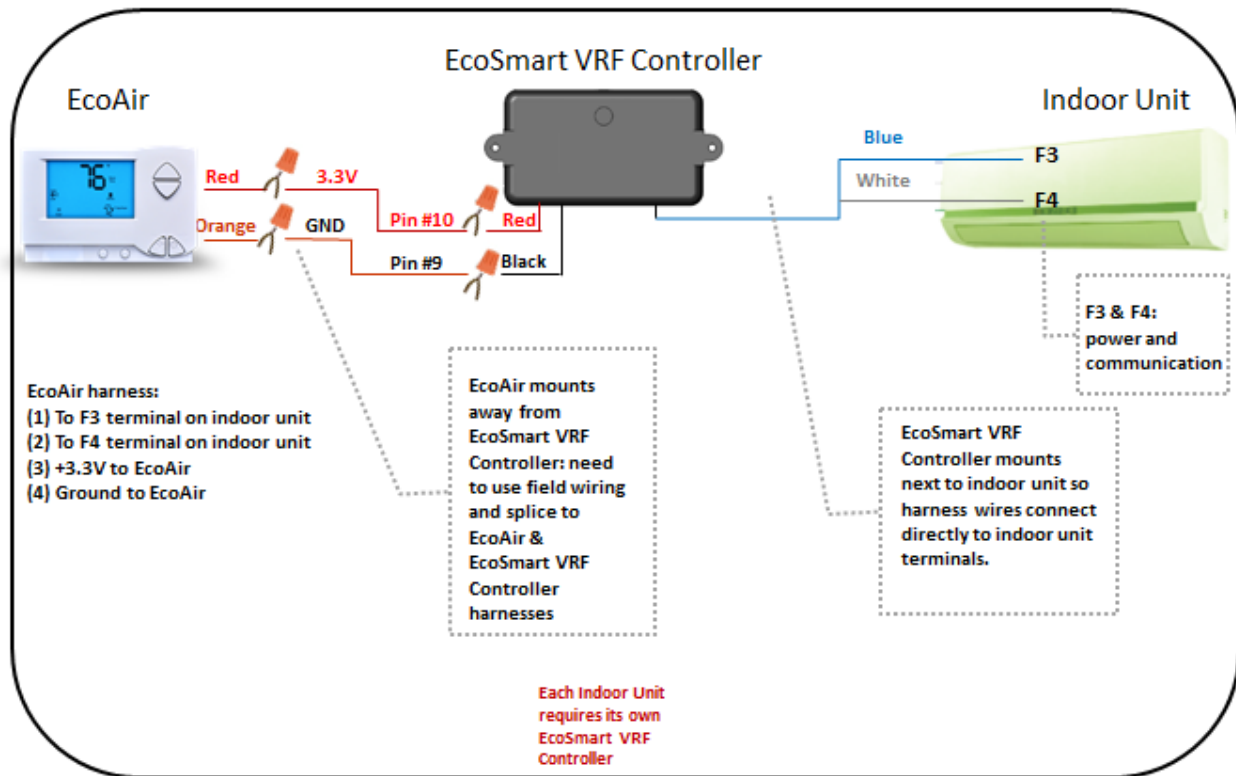
EcoSmart VRF Controller: Part of the EcoWave Remote Thermostat/Controller Package

Figure 2- EcoTouch+/Controller/HVAC Wiring

Diagram

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EcoSmart VRF Controller Required Equipment

Caution	Power to the indoor unit should be removed before connecting the EcoSmart VRF Controller.
Communication	The EcoAir and EcoTouch+ communicate with the EcoSmart VRF Controller via a 2.4GHz wireless interface.
Join & Pair	Set up the EcoAir & EcoSmart VRF Controller to talk to each other by "pairing" them. If EcoSmart products will be networked, they must first "join" the network (see steps below). Joining the network is optional but pairing the EcoSmart VRF Controller and the EcoTouch+/EcoAir is required.
Battery Power	If the EcoAir or EcoTouch+ is battery powered, no hard wired power connection to the EcoSmart VRF Controller is required.
Indoor Unit Configuration	The EcoSmart VRF Controller does not have capability to configure the indoor unit. Configuring the indoor unit must be done using a separate device.
Temp Sensor Selection	The indoor unit "Temperature sensor selection" value should be configured to "1: Wired remote control". This configures the indoor unit to use the temperature sensor in the EcoAir/EcoTouch+.

EcoSmart VRF Controller Required Equipment

- EcoSmart VRF Controller (P/N: SS6600)
- EcoAir (P/N: SS6550) or EcoTouch+ (P/N SS6560)
- Wire stripper
- Wire cutter
- Wire nuts

- Multi-screwdriver or Philips screwdriver
- Screw options as applicable based on mounting surface:
  - 2 Drywall screws 1¼"
  - 2 Metal screws ½ - ¾"
  - 2 Tapcon screws 1¼"

EcoSmart VRF Controller Installation

The EcoSmart VRF Controller connects to the HVAC system via standard wiring conventions, using 12VDC or 24VAC supplied by the HVAC equipment.

The EcoSmart VRF Controller accepts Molex wiring, typically 18-22 AWG (the Molex is specific to the project). Wiring conventions follow industry standards.

There are 2 options-select based on code and desired look: wall mount or side of VRF unit.

⚠	Always ensure power has been turned off before starting installation.

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EcoSmart VRF Controller Installation

1. Mount EcoSmart VRF Controller next to indoor unit so harness connects directly to indoor unit terminals (see Figure 7 & Figure 8).

Figure 3

Figure 4

2. Turn off power at EcoSmart VRF Controller mounting location using a disconnect switch or breaker lockout/tag out on appropriate breaker panel.
3. Test that power is off by using a voltmeter.
4. Using the end tabs, screw the EcoSmart VRF Controller to the wall or HVAC.
5. Wire the EcoSmart VRF Controller to the HVAC and to the EcoAir/EcoTouch+, referring to
   - Figure 1- EcoAir/Controller/HVAC Wiring Diagram,
   - Figure 2- EcoTouch+/Controller/HVAC Wiring Diagram,
   - Figure 5-J4 Molex Properly Seated and
   - Table 1-Wiring (see Figure 6).

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EcoSmart VRF Controller Installation

Figure 5-J4 Molex Properly Seated

Figure 6

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EcoSmart VRF Controller Installation

Figure 7

Figure 8

6. Install EcoAir/EcoTouch+ per EcoAir or EcoTouch+ IOM.
7. Associate devices as outlined in the Device Association Guide.
8. Test as outlined in EcoAir/EcoTouch+ IOM.

💡	For variable output connections, see Appendix B.

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ZigBee Wireless

Table 1-Wiring

J4 Connector	Wire 22AWG stranded	
PIN #	SIGNAL	COLOR
1	F3 12VDC PLC (Power 3 communication on the same wires)	BLUE *1 *2
2	F4 12VDC PLC	WHITE *1 *2
3	RS485_N2	ORANGE Friedrich VRP
	RS485_P2	YELLOW Friedrich VRP
5	GND	GREEN *2
6	NC	BLUE
7	RS485_N1	PURPLE
8	RS485_P1	GREY
9	GND (EcoAir)	BLACK (Move J5 to inside pins)
10	3.3V (EcoAir)	RED (Move J5 to inside pins)
11	SW1_IN	BROWN (Dry contact)
12	SW2_IN	RED (Dry contact)
13	SW3_IN	ORANGE (Dry contact)
14	SW4_IN	YELLOW (Dry contact)
15	SW5_IN	GREEN (Dry contact)
16	SW6_IN	BLUE Dry contact)
17	GND	BLACK (Dry contact)
18	AOUT1 (Variable output)	GREY (VO)
19	AOUT2 (Variable output)	WHITE (VO)
20	AOUT3 (Variable output)	BLACK (VO)
21	GND (Variable output)	BROWN (VO)
22	NTC A1	RED (Temp probe)
23	GND (EcoTouch+)	BLACK
24	12V (EcoTouch+)	RED
25	VACCOM (24 VAC)	GREEN (Move J5 to outside pins)
26	VAC (24VAC)	BLUE (Remove J1 & J2)

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ZigBee Wireless

ZigBee Wireless

Telkonet's suite of products—including the EcoSmart VRF Controller —rely on the ZigBee wireless communications protocol.

Field Modifications-Functional Caveats

- Telkonet ships equipment to customers pre-programmed based on a pre-deployment analysis and discussion with Property Management. Generally, command-level programming at the field level will not be needed.
- When a command change is needed, Telkonet will provide a detailed synopsis of the proposed changes.
- Arbitrarily changing command values without prior discussion with Telkonet Applications Engineering can result in suboptimal thermostat performance and a loss of energy savings. All of these can possibly impact the user interface. For this reason, such arbitrary changes do not represent a Recommended Best Practice, and any corrective actions taken by Telkonet (including consultation) are subject to Professional Services charges at prevailing rates.

Regular Maintenance

Under normal conditions, a correctly deployed EcoSmart series will require no maintenance with the exception of replacing the EcoAir and EcoSense batteries. The estimated battery life in an EcoAir is 2 years; in EcoSense it is 4 years. Actual life will vary based on usage.

Procedure: Visual Inspection

1. Verify that components have not been tampered with, destroyed or stolen.
2. Verify that the components are securely mounted on their respective surfaces.
3. If applicable, verify that the AC power is being supplied to the HVAC system.
4. If units are hard-wired, verify that the power/data wiring between the EcoSmart VRF Controller and the EcoAir are intact and connected.
5. Check for a Service icon on the EcoSmart VRF Controller display. This icon indicates loss of association with one or more sensors.
6. If the icon appears, first check the batteries. Replace batteries if necessary.
7. If batteries are not the cause of the Service icon, re-associate all sensors per instructions in the *EcoSmart Firmware 2.x Device Association Guide.*

Procedure: Functional Inspection

1. Observe whether the HVAC system is operating (e.g. drive cycle) after entering the room.

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Regular Maintenance

	In most cases, entering the room will have initiated an HVAC drive cycle after the Sensor detected occupancy. Possible exceptions: -If the temperature in the room is within hysteresis of the HVAC setpoint, a drive cycle may not commence; -A delay may have been programmed into the EcoSmart VRF Controller thermostat, instructing the unit to wait for a particular duration before triggering a drive. (Although uncommon, this feature is sometimes requested by a property. In almost all cases, the delay is less than 3 minutes.)

2. If a drive cycle does not initiate within 5 minutes of entry, force a drive cycle by temporarily setting the thermostat to some arbitrary high or low temperature (ensure the HVAC mode is set correctly).

	EcoSmart VRF Controller thermostats default to *Occupied* status if communication with the Sensor(s) is lost for any reason. This permits the units to continue allowing the occupant to control the room temperature. However, in this state energy savings will be lost. If in doubt whether the sensors are associated, re-associate all Sensors per the *EcoSmart Firmware 2.x Device Association Guide.*

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Troubleshooting

Troubleshooting

	If the EcoSmart VRF Controller loses association to any one of its sensors, either the on-board PIR sensor or the external EcoSense or EcoContact, the thermostat will immediately revert to *Occupied* mode. This is done to ensure that sensor association loss does not affect the comfort of the room occupant. Any setpoint limits (e.g. max/min allowed temperatures) that have been assigned to the thermostat remain in force.

For more troubleshooting tips, see EcoAir IOM

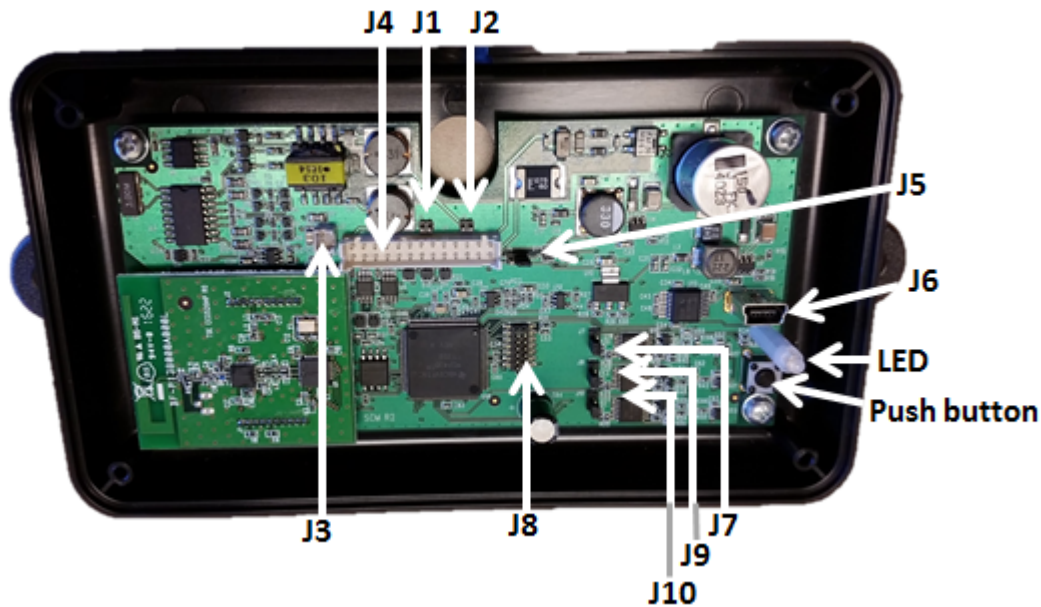| Problem	Potential Cause	Potential Solution
HVAC unit does not operate.	Main electrical failure to the unit. Many units operate on 230 or 277VAC circuits, so although power is available to the 110VAC plugs in the room, the branch circuit supplying HVAC power may be interrupted.	Dispatch maintenance. Verify mains continuity to the unit.
	GFI within the HVAC has tripped. Some models of HVAC systems (often PTAC/PTHP units) contain integral GFI (Ground-Fault Interrupt) systems. Occasionally, often after a power outage, inrush current when power returns can cause GFIs to trip. Most times, this does not indicate issues with the unit.	Check and reset units' GFI systems.
	EcoSmart VRF Controller has failed.	Remove the cover's 4 corner screws, and verify the J4 Molex connector is seated properly and facing the right direction (See Figure 5 and Table 1-Wiring). Replace the EcoSmart VRF Controller with a known-good unit as a comparison-check. If the replacement unit functions properly, contact Telkonet and begin the RMA process. If the replacement unit does not function properly, consult a local HVAC technician to inspect your HVAC unit.
	Door contact is not connected.	Ensure that all door contacts are connected.

Troubleshooting

	Window or outside door is open.	Ensure that no monitored windows or patio doors are open.

Appendix A-Anatomy of EcoSource VRF Conroller

J1   Used for power options

J2   Used for power options

J3   IR LED driver[1]

J4   Wiring Molex harness for HVAC connection

J5   Used for power options

J6   EcoSmart data jack-RS232

J7   VO output #3

J8   JTag

J9   VO output #2

J10 VO output #1

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[1] *J3: The IR LED driver is used to transmit IR signals to IR receivers (such as IR remote controlled HVAC like most mini-splits)*

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Appendix B-Additional Installation Options

NTC Probe

Temp probes can be used for multiple purposes:

1) HVAC Discharge Air temp
2) HVAC Return Air temp
3) Supply Water Temp
4) AquaStat Mode (switches thermostat's Heat/Cool)

If not using Telkonet provided external temperature probe, use a probe with a Beta R0 must match. Alternatively, a probe can be provided to Telkonet for lab calibration.

US Sensor model USP10972 or equivalent, per the following:

- Resistance at 25 degrees C = 10 000 ohms +/- 1%
- Resistance/Temperature curve = "J"
- Beta (0 to 50 degrees C) = 3892 degrees K nominal

Other models may be compatible; provide model number and specifications.

Analog Outputs

There are three analog outputs that can be used to control multiple functions. The desired function must be specified at the time of programming. Each of the analog outputs must be configured in one of the following two ways:

1) Fan Coils Variable Valve Control 0-10 or 4-20mA (both Heat & Cool)
2) ECM Fan motor variable control between speeds. (0-10VDC)

Proportional Valve Control

Number of outputs

3 outputs

Connections

Output 1: J4-18
Output 2: J4-19
Output 3: J4-20
Common: J4-21

Selecting 0-10V or 0-20mA

Jumper installed across pins 1-2 for 0-20mA
Jumper installed across pins 2-3 for 0-10V
Jumper locations are:
    Output 1: J10
    Output 2: J9
    Output 3: J7

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Appendix B-Additional Installation Options

If no jumpers installed, then there is no output.

Cooling Valve, Heating Valve, Motor

Each of the 3 outputs can be configured for any of these modes (cooling valve, heating valve, motor). Currently, firmware is built specifically for each application.

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