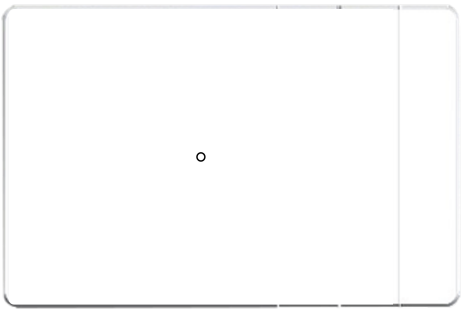
telkonet



ES Controller

Installation, Operation, & Maintenance Guide (IOM)

Contents

Updates

Revision 3: add FCC RF Exposure statement and Canadian RF Exposure Statement

Chapter 1: Overview

Intended Audience

These instructions are intended for:

- Installers who are either Telkonet certified installers or have completed a series of Telkonet micro-training courses (contact your Telkonet Project Manager for details)
- Facilities engineers who will maintain Telkonet devices

What is ES Controller?

The ES Controller is an HVAC controller. You will wire it to the HVAC system. It does not have a user screen or any buttons for an occupant to press. The screen and the buttons are on a separate user interface. The controller and user interface communicate with each other wirelessly. Telkonet thermostats are “smart”. They are typically part of a larger energy management network. We call our thermostats the “brain of the room” because they gather data about the room (like occupancy status) and send it to a central location (usually Rhapsody).

What Can the Telkonet Thermostat Do?

The Telkonet thermostat will 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 heating or more cooling. However, as the day progresses, the room will need more heating or less cooling as it moves into the shade. A Telkonet thermostat will continually monitor the room, learn its patterns, and adjust its heating and cooling profiles accordingly.

Telkonet thermostats also learn and adapt to occupant schedules. When a room is unoccupied, the thermostat 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 Telkonet Recovery Time™ technology built into each thermostat will return the room to the setpoint without the occupant noticing.

Sample Use Cases

Telkonet thermostats are available in several possible configurations, to address specific requirements of multiple applications including hotels, classrooms, university housing, military residence halls, senior living facilities, multi-dwelling units, and a wide variety of other commercial and industrial spaces.

How to Get Support

During Installation

Contact your dedicated Telkonet Project Manager if you have any installation questions.

After Installation

Contact the Telkonet Support Center at support@telkonet.com, (414) 302-2203, or the phone number you were provided at installation, based on your support subscription plan.

FCC Compliance Statement

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 outlet on a circuit different from that to which the receiver is connected.

* Consult the dealer or an experienced radio/TV technician for help.

Operation with non-approved equipment is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of the manufacturer could void the user's authority to operate this equipment.

FCC RF Exposure Statement: To comply with FCC RF exposure compliance requirements, the device must be installed to provide a separation distance of at least 20 cm from all persons.

Canadian Compliance Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada’s licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

Canadian RF Exposure Statement: This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm from the radiator and your body.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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;

2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Declaration d'exposition aux radiations: Cet equipement est conforme aux !imites d'exposition aux rayonnements IC etablies pour un environnement non controle. Cet equipement doit etre installe etre utilise avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

FCC ID

ES Controller: tbd

About This Product

This product is intended for outlet box mounting.

This product utilizes relays as the load-controlling/switching elements.

This product does not include GCFI functionality (as commonly required for systems that control in-floor radiant electric heat).

This product has a "marked off" position but have the capacity to open only one pole of the load supply circuit. Accordingly, this product is limited to the control of loads having only one ungrounded supply pole (120 or 277 V ac circuits). In the off position the ungrounded pole is opened when the thermostat is placed in the off position.

This product is not suitable for safety or limiting applications.

This product is not suitable for plenum applications/installations.

Chapter 2: Installation

Voltage Options-Summary

High Voltage Installation Option (30 V or greater)	**Low Voltage Installation Option**
There is only one installation option: 1. JBox with Vertical Mud Ring Mount: requires adapter plate.	*There are 3 options. Select based on code and desired look:* 1. Drywall mount: no conduit required; no JBox adapter plate required. 2. JBox with Vertical Mud Ring Mount: requires adapter plate . 3. JBox with Horizontal Mud Ring Mount.

Required Equipment

Required Equipment	High Voltage	Low Voltage
Anchors: EZ-Lock plus provided screws: 4 – 50 lb. (if drywall mount)		x
Backplate (included)	x	
Drill	x	x
ES Controller (included)	x	x
Electrical tape	x	x
Flathead screwdriver	x	x
JBox (if applicable) (not included)	x	x
Level	x	x
Screw Terminal Block as applicable (included)	x	x
Pen		x
Screwdriver-Phillips Head	x	x
Screwdriver-precision set		x
Screws-four #5 ½" coarse thread (vertical JBox mount)	x	x
Screws-two #6-32 1" (vertical or horizontal JBox mount)	x	x
Speed nut (if applicable)		x
UL rated caulk or UL rated insulating tape	x	x
Voltmeter	x	x
Wire harnesses as applicable (included)		x
Wire nuts	x	x
Wire stripper	x	x

Installation - High Voltage (Non-Class 2)

CAUTION!

- High voltage installation should only be performed by a qualified heating & air conditioning contractor or licensed electrician.
- 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.

> NOTE: For all high voltage installations a single gang mud ring must be mounted on a JBox.

1. Ensure the JBox (not provided by Telkonet) has been installed with a vertical single gang mud ring.

2. Turn off power at the ES Controller or 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. Strip the LINE wire back 0.25 inches.
5. Cap the LINE wire with a wire nut or electrical tape.
6. Cut the COMMON wire so the copper is flush with the insulation.
7. Strip all wires except for COMMON back 0.25 inches.
8. Remove the safety screw from the top of the thermostat using the Phillips head screwdriver
9. Separate the backplate from the thermostat: use a flathead screwdriver to GENTLY press the tab next to the screw hole to allow the thermostat to pop open. WARNING: Using too much force can break the tab.
10. Place thermostat backplate against the JBox adapter plate. The adapter plate and backplate holes should align if both are correctly oriented.
11. Connect wires and harnesses as per the pinout tables in the Tables section.
12. Mount the ES Controller backplate on top of the JBox adapter plate, using four #5 ½" coarse thread screws (or other appropriate mounting screws).
13. Feed wire harnesses through the applicable holes in the backplate.
14. Connect the harnesses to the ES Controller.

REMINDER: Wiring to the screw terminal block must exit the enclosure at Opening A of the backplate. Wiring to all other connectors must exit the enclosure at Opening B of the backplate.

Class 2 and Non-Class 2 wiring must not be mixed within a junction box or conduit run.

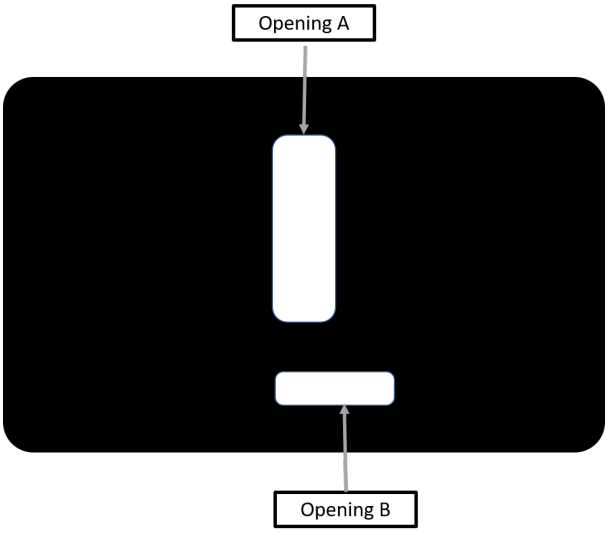


FIGURE 2-1: Backplate Openings A and B, Separate High, Low Voltage Wire

> NOTE: For variable output connections: see Proportional Valve Control; Analog Output.

15. Line up the hinges on the thermostat to the notches on the backplate.
16. Press the top of the thermostat tightly against the backplate.
17. Slowly lower the bottom side toward the wall. Use care not to force the faceplate closed. If you encounter resistance, check to make sure no wires are pinched between components.
18. Return the electrical circuit to operation. Remove all lockouts or tags from the circuit breaker and enable any disconnects.
19. Verify the thermostat display is active.
20. Test all components to make sure that you can engage both the heat and cool, and all supported fan settings (high, low, etc.). Wiring is complete.
21. Once the thermostat has been snapped onto the back plate, use a Phillips head screwdriver to insert the safety screw.

North American UL Rating Schedule – Non-Class

Inputs

J1 Input Table

J1		
Pin	**Signal**	**Type**
1	Dry Contact #1	Input
2	Dry Contact #2	Input
3	RS485 #1P (VDA)	UART
4	RS485 #1N (VDA)	UART
5	RS485 #2 P (General)	UART
6	RS485 #2 N (General)	UART
7	Analog Output #1	Output (0-10V)
8	Analog Output #2	Output (0-10V)
9	3.3V Output	Output
10	Ground	

J2 Input Table

J2		
Pin	**Signal**	**Type**
1	Dry Contact #3	Input
2	Dry Contact #4	Input
3	NTC - Probe #1	Input
4	NTC - Probe #2	Input
5	NTC Probe Ground (shared)	Input
6	CT Input A1	Input
7	CT Input A2	Input
8	CT Input B1	Input
9	CT Input B2	Input
10	Ground	

Screw Terminal Block Table

Screw Terminal Block (Wire Gauge 12-28)		
Pin	**Signal**	**Type**
1	(C) - Power In - Common	Input
2	(Aux) - Auxillary	Output
3	(W1) - Heat	Output
4	(R) - Power In	Input
5	(Y1) - Cool	Output
6	(G)- Fan	Output
7	(O) (G2) - Changeover / Med Fan	Output
8	Switched Power 2 (G / O / W2)	Input
9	(W2) (Y2) (G2)(G3) - Multi-speed	Output

Other Inputs Table

Other Inputs	
J5	Console Port
J9	External module for Salto/Saflok

Outputs

Output Table

Position Relay	Terminal	Ratings			
		Current/Power	Voltage	Load Type	Action Type Design
RLY1, RLY2, RLY3	RLY1: STB* (R) and STB (AUX) RLY2: STB (W1/Y1) and STB (W1) RLY3: STB (W1/Y1) and STB (Y1) See note 1	5A	125/250/277 V ac	General Use	Operating 1.C
RLY5, RYL7	RLY5: STB (G/O/W2) and STB (G) See Note 3 RLY7: STB (G/O/W2) and STB (O) See Note 3 See Note 1	10A 8A	125 V ac 277 V ac	General Use General Use	Operating 1.C
		1/10HP 1/6HP	125 V ac 250 V ac & 277 V ac	Motor Motor	
RLY8	STB (G/O/W2) and STB (W2) See Note 3 See Note 1	11A	277 V ac	Resistive (including Fixed Electric Space Heating) See Note 2	Operating 1.A See Note 2
		1HP	250 V ac	Motor	
		1HP	277 V ac	Motor	
		1/2 HP	125 V ac	Motor	

**STB: Screw Terminal Block*

Note 1: STB (R), STB (W1/Y1), and STB (G/O/W2) – must be connected to the same pole of the same supply circuit. Relay contacts must be connected in a same polarity fashion.

Note 2: Relay RLY8 is the only output device rated for the control of fixed electric space heating equipment. This relay will de-energize when the On/Off switch is adjusted to the "OFF" position. RLY8 only interrupts one pole of the supply circuit. Accordingly, the thermostat/relay is restricted to controlling fixed electric space heating loads with a single ungrounded conductor – such as loads connected to a 120 or 277 V ac circuit.

Note 3: The total connected load of Relays 5, 7, and 8 should not exceed 16 Amps (through common terminal J3-9STB).

Note 4: Wiring to STB must exit the enclosure at Opening A of the backplate. Wiring to all other connectors must exit the enclosure at Opening B of the backplate. Class 2 and Non-Class 2 wiring must not be mixed within a junction box or conduit run.

Installation - Low Voltage (Class 2)

Always ensure power has been turned off before starting installation.

1. Turn off power at the ES Controller mounting location using a disconnect switch or breaker lockout/tag out on appropriate breaker panel.
2. Test that power is off by using a voltmeter.
3. Remove the safety screw from the left side of the thermostat using the hex wrench.
4. Separate the back plate from the thermostat: Use a flathead screwdriver to GENTLY press the tab next to the screw hole to allow the thermostat to pop open. WARNING: Using too much force can break the tab.
5. For drywall mounting instructions, see below. For JBox vertical installation instructions: see See JBox Using Vertical Mud Ring Instructions on page 13

Drywall Mounting Instructions (Low Voltage)

> **NOTE:** Requires four 50 lb. EZ-Lock anchors and screws

6. Strip the LINE wire back 0.25 inches.
7. Cap the LINE wire with a wire nut or electrical tape.
8. Cut the COMMON wire so the copper is flush with the insulation.
9. Strip all wires except for COMMON back 0.25 inches.
10. Verify the wiring now looks similar to this:

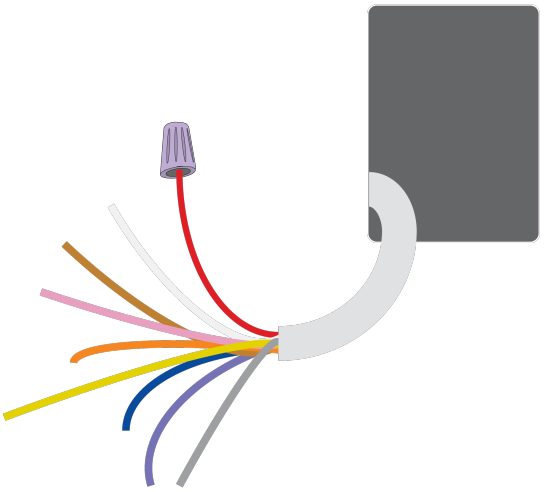


FIGURE 2-1: Drywall Mount Wiring

11. Ensure the appropriate wires are jumped between R and SW2 (assuming they are controlling all fan and modes from the same voltage as powering the

thermostat). If installing on a heat pump, ensure that Y1 and W1 are jumped together.

12. Connect wires and harnesses as per the tables.
13. Verify each wire is secure by gently tugging on it.
14. Hold backplate against wall at appropriate height. Using a pen, level-mark your holes.
15. Use appropriate drill for anchor and insert anchors into holes.
16. Screw backplate to the wall and into the anchors. Re-check that it is still level.
17. Screw the wires to the screw terminal block.
18. Next: See Steps Common to all Low Voltage Installation Methods on page 14.

JBox Using Vertical Mud Ring Instructions

> NOTE: Requires Telkonet JBox Adapter Plate and two #6-32 1" screws.

19. Strip the LINE wire back 0.25 inches.
20. Cap the LINE wire with a wire nut or electrical tape.
21. Cut the COMMON wire so the copper is flush with the insulation.
22. Strip all wires except for COMMON back 0.25 inches.
23. Determine which end of the adapter should be situated on top, and which end should be situated on the bottom.
24. Mount the ES Controller mounting plate to the mud ring with two #6-32 1" screws.
25. Mount theES Controller backplate on top of JBox adapter plate, using four #5 ½" coarse thread screws.
26. Screw down each wire to the matching screw terminal on each block. (If controlling proportional valve or ECM fan, any unused wires must be capped according to NEC standards.)

> NOTE: For variable output connections: See Analog Outputs on page 18.

27. Connect all other wires and harnesses.
28. Mount the Controller backplate on top of JBox adapter plate, using four #5 ½" coarse thread screws.
29. Feed wire harnesses through the applicable holes in the backplate. High and low voltage wires must be fed through separate holes.
30. Connect the harnesses to the ES Controller.
31. Ensure backplate has appropriate jumpers between R, SW1 and SW2. If installing on a head pump, ensure there is a jumper between Y1 and W1.

Steps Common to all Low Voltage Installation Methods

33. Hook the thermostat to the hinges on the top of the backplate.
34. Line up the hinges on the thermostat to the notches on the backplate. Press the top of the thermostat tightly against the back plate.
35. Slowly bring the top down as shown. Use care not to force the faceplate closed. If you encounter resistance, make sure no wires are pinched between components and that no pins are bent.
36. Once the thermostat has been snapped onto the back plate, use a Phillips head screw driver to insert the safety screw.
37. Remove all lockouts or tags from the circuit breaker.
38. Return the electrical circuit to operation.
39. Test all components to make sure that you can engage both the heat and air conditioning, and all supported fan settings (high, low, etc.). Wiring is complete.

Chapter 3: Add Ons

About Wiring the ES Controller

The ES Controller interconnects with the existing HVAC system via standard wiring conventions, using 24-277 V ac OR 24 V dc voltage supplied by the HVAC system itself.

> NOTE: The ES Controller allows for three different control voltages.

Telkonet provides bare wire leads on all connectors. It is up to the installer to connect these leads using an appropriate method described herein. Wiring conventions follow industry standards; however, it is important to note that the relay configuration is dynamic and can be modified at the factory or in the field. It is important to always follow site-specific wire diagrams.

NTC Probe

ES Controller has two inputs. 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)

For temperature probe if not using Telkonet provided external temperature probe, a probe with a Beta R0 must match. Alternatively, a probe can be provided to Telkonet for lab calibration. Required specifications:

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.

CT Inputs

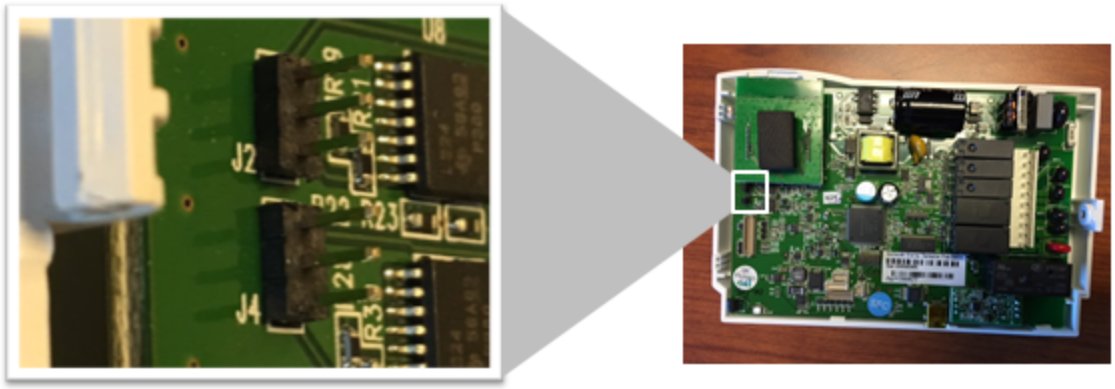
All Models have 2 inputs. The CT inputs are commonly used for monitoring/alerting on fan motors, compressors or other equipment with excessive load or for determining a failure. The CT Inputs must be used with a compatible CT and sized appropriately for the load they will be connected to.

Current Transformer (CT) approved models from Sentran Corp.:

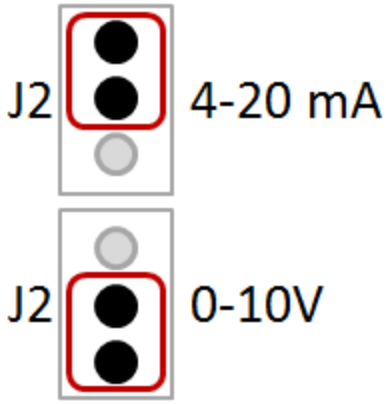
Rated loads are 100, 50, 30, 20 and 10 A respectively.
BCF-100A: 0.025A
LCF-50A: 0.025A
LCF-30A:0.025A
LCF-20A:0.025A
LCF-10A: 0.01A
Preferred operating range is between 10 and 80% of rated load.
Other models may be compatible: provide model number and specifications.
If not sized correctly the CT may damage the thermostat.

Chapter 4: Appendix

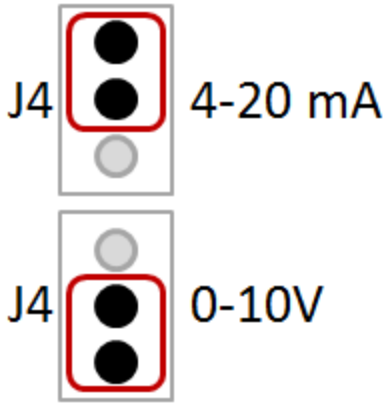
Proportional Valve Control



Pin	Signal	Color
J6-3	AOUT1	ORANGE



Pin	Signal	Color
J6-4	AOUT2	YELLOW



Analog Outputs

(Standard on Aida and ES Controller)

The Analog outputs can be used to control multiple functions. The desired function must be specified at the time of programming.

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