Smart Relay Controller

GPRS & HSRS Models

(Generation 4)

User Manual

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Introduction

WARNING: Only a qualified HVAC contractor or technician should attempt the setup and installation instructions contained in this manual. Your warranty may be voided if damage occurs due to improper installation.

This manual describes setup and configuration operations for the Kadtronix family of smart relay controllers. Please read these instructions carefully and thoroughly prior to attempting installation. The following controller models are included in this family of devices:

- General Purpose Relay Switch (GPRS)
- HVAC Smart Relay Switch (HSRS)

These controllers provide sensor-activated remote control capability for devices and equipment. An onboard relay with SPDT contacts provides switching for loads up to 5A @ 250VAC. Wired and/or wireless sensors may be employed.

Note: This instruction applies to 4th generation (i.e., GEN4) GPRS & HSRS products. GEN4 wireless sensors are not cross-compatible with prior generations as they operate on different radio frequencies. Therefore, a 4th generation controller will not accept a 3rd generation wireless sensor. Nor will a 3rd generation controller recognize a 4th generation sensor.

- *GEN1 / GEN2 – These sensors feature standard operating range (100 ft) and require two (2) AAA batteries - not included. They are auto-addressable (up to 65,000+ possible IDs) and measure 3.25" x 1.5" x 0.5". (Include foam mounting tape and screws.)*

  Note: GEN1 / GEN2 sensors do not retain the address ID when power is removed and therefore require initialization and re-registering whenever batteries are replaced.

- *GEN3 – The third generation product includes a mini-sensor with moderate transmit range. It operates on a single 3v lithium coin-cell (included) and is pre-programmed with a unique, fixed address (over 16 million possible Ids). The unit measures 2.2" x 1" x 0.25". (Includes foam mounting tape.)*

- *GEN4 – Our fourth generation product deploys a 433 MHz sensor with excellent transmit range and is powered by a single AAA alkaline battery (not included). It is pre-programmed with a unique, fixed address (over 1 million possible IDs) and includes screws and foam mounting tape.*

While the GPRS is intended for general purpose use, the HSRS is designated for HVAC applications. Information contained in this manual applies to both controllers unless stated otherwise. When describing details that are generically applicable to both controllers, the narrative refers to them in a collective sense as, "the controller".

The controller accepts wired and/or wireless switch sensor inputs. For wired sensors, most any switch device having normally open or normally closed (recommended) contacts is acceptable. Mechanical devices including reed, push-button, and toggle switches are also allowable. TTL signals may also be used (active-low) in some cases.

For applications where wire runs are not desired or simply inconvenient, a wireless option is available. Intended for use with doors and windows, these sensors can also be applied in a myriad of other uses where simple on/off detection is needed. You may even use a mix of both wired and wireless sensor types.

For HVAC applications, available sensor types include door/window switches and motion detectors. These sensors allow automatic shut-off if a door or window remains open for a preset period of time. Motion detectors permit occupancy and/or vacancy detection. For details on how to configure occupancy and vacancy modes for one or more motion detectors, refer to "Wired Sensors" and/or "Wireless Registration".

Ideal for energy management, the controller reduces overall power consumption. For instance, the controller can temporarily disable air conditioning or heating if a main entry door or window has been open for a period of time.

The controller employs 16 configuration DIP switch settings for configuration purposes. Accepting wired and/or wireless sensors, the controller can be set up to automatically switch off an external circuit based on parameters you specify. The controller unit consists of electronic printed circuit board, enclosure, and 12VDC power converter. Two converter types are available:

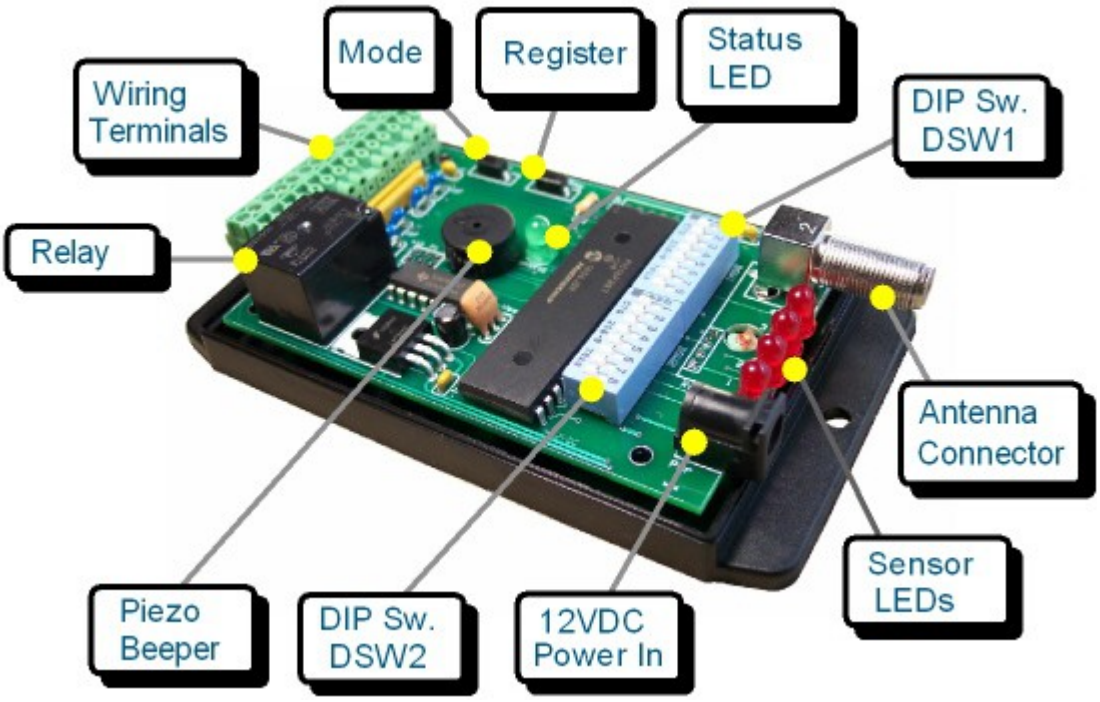
- 24VAC (for HVAC applications)
- 120 VAC (for general-purpose applications)

WARNING: The controller contains static-sensitive electronics. When handling the device, you should take proper precautions to prevent damage due to electrostatic discharge. Use an approved anti-static wrist-strap or other protective appliance.

The following is a feature summary:

- Electronic controller with intelligent micro-controller
- On-board relay with SPDT contacts rated 5A @ 250VAC
- Accepts up to 4 wired inputs which can be zones or discrete switch sensors
- Also accepts up to 8 optional wireless sensors (requires wireless option)
- Compatible with motion sensors for occupancy or vacancy detection
- Configurable activate (relay on) and deactivate (relay off) delay periods
- DIP switches for mode selection & configuring operational parameters
- Selectable activate / deactivate time periods: 0 to 10 hours (accuracy +/- 1%)
- Onboard mode and wireless registration tactile switches
- Piezo beeper with optional enable/disable DIP switch setting
- External 12VDC power converter

Subsequent sections of this manual provide details for installation and configuration. Your initial efforts will focus on the controller unit. Before continuing, you should detach the cover and review the location of DIP switches, terminal block wiring connector, and other components as shown in the following image:



Controller components

Note: Early (GEN1) designs utilized an external receiver device which has been eliminated in favor of an internally integrated receiver.

Enclosure and wall-mounting

WARNING: The controller contains static-sensitive electronics. Please take proper precautions to prevent damage due to electrostatic discharge. When handling sensitive electronics, you should use an approved anti-static wrist-strap and/or similar protective equipment.

The controller is housed in a plastic enclosure with mounting tabs and screw holes for attaching to a wall or other surface. Locate a suitable space for installing the device. The selection should be free from moisture, weather, vibration, excessive temperature, and other hazards. It should also be easily accessible to allow for occasional adjustments such as DIP settings changes and/or wireless sensor registration updates. Use suitable screws (not included) to attach unit to the desired surface.

IMPORTANT: Do not mount the system on an air handler unit or other (grounded) metal surface. Also, be careful to avoid screw contact with metal wall studs as they may be grounded. If installing the wireless system, establish maximum possible separation of the antenna away from any metal equipment.

HVAC Compatibility

The HSRS is compatible for use in most HVAC applications. However, you should be aware of possible issues including those listed below:

- Variable refrigerant flow (VRF) systems are not particularly compatible for external (third-party) shut-off control as they do not utilize a traditional 24v thermostat. Instead, these systems employ a control method that relies on a digital communication protocol.

  However, some VRF manufacturers may offer a 24v interface (add-on) option that allows the use of a traditional thermostat. In this instance, the HSRS would be easily compatible for use.

  Other VRF systems may provide a user-accessible connection input for “external on/off” control. This input usually accepts a simple contact closure via a length of wire, permitting shut-off control by a third-party device such as the HSRS.

- Mini-split, PTAC and window a/c units do not typically use a 24v thermostat, although some manufacturers may provide built-in and/or add-on interface options for shut-off control by third-party devices.

- Some HVAC systems may not permit the use of a third party shut-off system with their equipment. To avoid warranty issues with your HVAC equipment, please consult the manufacturer prior to installing the HSRS. (We accept no liability or responsibility for issues or disputes with your HVAC supplier or the manufacturer.)

Setup for HVAC and similar applications

Begin by disabling power to the HVAC equipment. Then, remove the enclosure's detachable cover by extracting four (4) retaining screws. The controller contains on-board 14-pin screw-terminal wiring block for connecting your HVAC equipment and any hardwired door/window sensor(s). (Refer to "Terminal Block Wiring Connections" for details.) Connect the wires as required, noting proper terminal designations and polarities.

Configure DIP switches as necessary to suit your application. (Refer to "DIP Switch Settings" for details.)

IMPORTANT: To use wired sensors in your application, you must ensure that this mode has been properly enabled at configuration DIP switch: DSW1, no. 8. Refer to "DIP Switch Settings" for more information.

The controller requires a 12VDC power source. If your equipment does not provide this voltage, you will need a compatible power converter module. Two selections are available: 120VAC for general purpose use or 24VAC for HVAC applications.

If you have purchased the wireless option, refer to "Wireless RF Option" for setup instructions. Refer to the remainder of this manual for additional details concerning setup and operation.

Once you have completed setup and configuration, double-check your wiring and DIP switch configurations. Then, re-attach the cover. Restore HVAC power to turn on the equipment and to power on the controller.

Notes:

- "Sample HVAC Application" illustrates wiring details for a split system HVAC. For these applications, you have the option of wiring the controller to shut off the entire system or only the condensing unit (i.e., compressor), allowing the indoor fan coil unit to continue to run.
- To protect the compressor, you may wish to consider a minimum delay of 3 to 5 minutes before re-starting the system after shut-off. Refer to sub-section, "Deactivate Mode" in "DIP Switch Settings" for additional information.

LED Indicators

The controller has a total of five visible LED indicators:

- Green (x1)
- Red (x4)

The green LED indicates operational status while the red LEDs indicate sensor state. When the controller is powered on, the green status LED flashes at a periodic rate, indicating the firmware is operational. The green LED indicates the specific operational state of the controller as listed in the table below:

LED On/ Off Rate:	Operational state:
• Slow, periodic	Normal operation
• Double-flash	Switch sensor triggered
• Solid On	Wireless sensor registration mode

Each of the four red LEDs indicates open/closed status of a door, window, or zone. For instance, LED #1 illuminates when the respective door opens. It then extinguishes when the door is closed. When a red LED is on continuously (i.e., not flashing), it indicates the corresponding sensor is active, but a trigger activation (i.e., equipment shutdown) has not yet occurred.

Note: For a motion detector in occupancy or vacancy mode, a red sensor LED will be on continuously when the sensor detects motion and will extinguish when motion is no longer detected. When a LED is on in vacancy mode, trigger is not imminent.

When a red LED is flashing, it means that a trigger activation has occurred due to detected violation in either a door/window sensor or motion detector. (Trigger activation engages the onboard relay, shutting off the device or equipment under control.)

Note: A violation is defined as a door/window that has remained open or occupancy/vacancy that has extended beyond the pre-defined time period.

The four red LEDs may be configured to represent either wired or wireless sensors, as described in "DIP Switch Settings". (Note: If you are using the wireless RF option and have more than four wireless sensors, only the first four will be represented. Any additional sensors will not be shown by the LEDs.)

DIP Switch Settings

There are two primary DIP switches: DSW1 and DSW2. DSW1 defines operational mode, sensor activation states, and trigger activation configurations. DSW2 defines trigger deactivation modes and configurations. In general, DIP switch settings changes should be made only when the controller device has been powered off. **Do not attempt to make DIP settings adjustments while the device is powered on.**

```
-------------------------
Legend : 1=ON, 0=OFF
Default: All switches OFF
-------------------------
```

The following lists define available DIP switch settings:

```
-------------------------------------
Trigger / Activation Settings (DSW1):
-------------------------------------
---------------    -----------
1 2 3 4 5 6 7 8    Description
---------------    -----------
x x x x x x x 1    Wired-sensor disable
x x x x x x x 0    Wired-sensor enable

x x x x x x 1 x    Sensor activation trigger state =
                    CLOSED (normally-open)
x x x x x x 0 x    Sensor activation trigger state = OPEN
                    (normally-closed)
```

Note: For vacancy mode, the "OPEN" trigger state is required (normally-closed contacts). Note that the recommended use of switch contacts is reversed. For the OPEN trigger state, trigger will occur when normally-closed contacts remain closed. For details on configuring a wired motion detector for vacancy mode, refer to "Wired Sensors". For wireless motion detectors, refer to "Wireless Motion Detectors".

x x x x x 1 x x	Piezo/beeper disabled
x x x x x 0 x x	Piezo/beeper enabled
x x x x 0 x x x	The 4 LEDs indicate wired sensor states
x x x x 1 x x x	The 4 LEDs indicate wireless sensor states

Sensor-active Period:

The sensor-active (ON) period below indicates the amount of time that a sensor must be in the active state before a trigger occurs. ("Trigger" means sensor is active & the relay is energized, activating or deactivating the external customer circuit via relay contacts.) For HVAC applications, this setting can be used to provide a pressure stabilization delay for the compressor.

0 0 0 0 x x x x	0 (instant)
1 0 0 0 x x x x	1 sec.
0 1 0 0 x x x x	5 sec.
1 1 0 0 x x x x	10 sec.
0 0 1 0 x x x x	30 sec.
1 0 1 0 x x x x	1 min.
0 1 1 0 x x x x	2 min.
1 1 1 0 x x x x	5 min.
0 0 0 1 x x x x	10 min.
1 0 0 1 x x x x	30 min.
0 1 0 1 x x x x	1 hour
1 1 0 1 x x x x	2 hours
0 0 1 1 x x x x	5 hours
1 0 1 1 x x x x	10 hours
0 1 1 1 x x x x	RESERVED
1 1 1 1 x x x x	Indefinite (relay never energizes - good for "offline" testing)

Deactivation Settings (DSW2):

1 2 3 4 5 6 7 8	Description
	Deactivate mode defines the conditions under which a trigger activation may be extinguished (cleared) and the relay de-energized.
	Deactivate Mode:
x x x x x x x 1	Pulse : time elapse only (sensor revert to inactive not required)
x x x x x x x 0	Standard: sensor must revert to & retain inactive state for elapsed time period (see below).
x x x x x x 1 x	Feature option enable (contact Kadtronix for details)
x x x x x x 0 x	Feature option disable (contact Kadtronix for details)

	Dual Timing Mode (DTM):

	Dual timing mode (DTM) is a special option that can be applied when a mix of motion detectors and other sensors (e.g., door/window, etc.) will be used. In this mode, two different activation delay periods can be invoked. Motion sensor(s) will utilize the traditional activation setting as configured at DSW1 [DIP switches 1-4]. However, other sensor types (including door/window, etc.) will derive their activation delay period at DSW2 [DIP switches 1-4]. (Note: In normal mode, DSW2 defines a deactivation delay period. DTM mode overrides this function and does not permit a deactivation delay. Instead, a default deactivation period of 0 will be applied.)
x x x x x 1 x x	Dual timing mode (see description above)
x x x x x 0 x x	Normal mode

Elapsed Time-Period:

The elapsed time (OFF) period indicates the required elapsed time period that must occur before the relay can be de-energized. (In addition, depending on the deactivate mode setting above, the sensor may also be required to be in the inactive state). (For HVAC applications, this setting can be used to provide a pressure stabilization delay for the compressor.)

0 0 0 0 x x x x	0 (instant)
1 0 0 0 x x x x	1 sec.
0 1 0 0 x x x x	5 sec.
1 1 0 0 x x x x	10 sec.
0 0 1 0 x x x x	30 sec.
1 0 1 0 x x x x	1 min.
0 1 1 0 x x x x	2 min.
1 1 1 0 x x x x	5 min.
0 0 0 1 x x x x	10 min.
1 0 0 1 x x x x	30 min.
0 1 0 1 x x x x	1 hour
1 1 0 1 x x x x	2 hours
0 0 1 1 x x x x	5 hours
1 0 1 1 x x x x	10 hours
0 1 1 1 x x x x	RESERVED
1 1 1 1 x x x x	Indefinite (relay remains energized until SC or PCR)

Definition of key terms

On-period = indicates the amount of time during which a triggered sensor must be continually active before the event will be accepted and the relay energized.

Off-period = the amount of time that must elapse before the the relay is de-energized.

PCR = Power-cycle system reset is invoked by removing power to the controller and then re-applying power. It causes the controller to reset all processing activities.

WR = Wireless registration (i.e., pairing) is the process of enrolling one or more wireless peripherals such as door/window sensors. Registration is necessary so that sensor signals will be recognized by the controller. (Signals received from non-registered sensors are ignored by the system.) WR is invoked by tactile momentary switch, “Register”.

RST = Controller reset is invoked by "Mode" tactile switch and forces an event equivalent to power-cycle.

Concept of Operation

At controller power-up, the device begins scanning sensor inputs for a trigger condition (e.g., a switch that remains open for the preset period of time). If sensor trigger occurs, the controller then determines (based on configuration) whether or not relay activation / deactivation is to occur. Again based on configuration, the controller may delay a preset time period before taking any action.

For example, assume these parameters:

- **Active = 5 min., Inactive = 1 min., Deactivate = Standard, Sensor Act.= Open**

Under these conditions, the controller will energize the relay (i.e., trigger) when it determines that a given sensor activation input remains continuously open for 5 minutes. It will then de-energize the relay if the signal remains closed continuously for 1 min. As another example, assume the following:

- **Active = 0 min., Inactive = 5 sec., Deactivate = Pulse, Sensor Act. = Closed**

Under these conditions, the controller will immediately (= 0 min.) energize the relay when it determines that a given sensor input is closed. It will de-energize the relay after 5 seconds, regardless of the input signal state.

As a last example, assume the following:

- **Active = 0 min., Inactive = Indefinite, Deactivate = either (standard or pulse), Sensor Act. = Closed**

Under these conditions, the controller will immediately (= 0 min.) trigger when it determines that a given sensor input is closed. It will not de-energize the relay until the controller is power-cycled (PCR).

Controller Reset

Controller reset is an advanced feature option that is available for troubleshooting purposes. There are two available types of reset:

- Factory reset
- Hard reset

Factory reset clears the controller of any stored wireless sensors and restores the unit to its factory configuration. Hard reset is useful for clearing a trigger activation and disengaging the relay. (Any stored wireless sensors are retained.) It can also be used to disable the controller. (Refer to hard reset below.) It is functionally equivalent to a power-cycle operation.

IMPORTANT: The controller reset feature is available as a troubleshooting measure. It should not be performed unless the equipment under control has been powered off or disabled.

To invoke a factory reset, press and hold the mode button until the beeper sounds. The four red LEDs will briefly illuminate. Press and release the mode button once. (Red LED #1 will illuminate, indicating offline reset mode.). Then press and release the register button to invoke the reset. (The four red LEDs will flash briefly, indicating the reset is underway.) The steps are summarized below for convenience:

- Press/hold mode button until beeper sounds (offline mode)
- Press/release mode once more (i.e., do not hold)
- Press/release register button; factory reset occurs within 3 seconds

A hard reset requires the use of an external switch connected at wiring screw terminals 2 (ground) and 3 (reset/disable). (Refer to "Terminal Block Wiring Connections" for details.) The reset/disable input will cancel a relay activation and reset the controller.

Apply a normally open switch (momentary, toggle, etc.) with sufficient wiring pigtail at terminals 2 & 3. (For reset, a momentary switch is recommended. For disable, a latching toggle switch is suggested.)

Notes:

- *The hard reset feature requires PCB hardware rev. 4 or higher.*
- *Wiring pigtail should be kept as short as possible to minimize susceptibility to electrical noise.*

Wired Sensors

The controller accepts up to 4 wired sensor inputs. Each input may accept a single sensor or a group (zone) of sensors wired in series (normally-closed) or parallel (normally-open). A myriad of traditional switch sensors is compatible for use with the controller including reed, push-button, toggle, limit, momentary, etc. Configuration DIP switch DSW1-7 (sensor activation trigger state) allows you to configure either normally-open or normally-closed (recommended) operation. If sensors are normally-closed, then trigger activation is presumed when the sensor is open. If sensors are normally-open, then trigger activation is presumed when the sensor is closed. (When using a motion detector in vacancy mode, trigger activation is modified. Refer to "DIP Switch Settings" for more information.) The table below summarizes sensor configurations:

Sw. / Sensor Type:	Act.State (DSW1-7):	Zone Wiring:
Normally-closed	Open	Series
Normally-open	Closed	Parallel

(Note: For HVAC applications, optional zone wiring is allowable only for detecting open doors or windows. Do not attempt zone wiring for motion detectors in vacancy mode. Use one-for-one wiring instead. That is, only one motion detector may be wired to a single sensor input at the controller.)

Wired sensors may be employed for a number of uses. (Wired sensor operation may be configured using DIP switches. Refer to "DIP Switch Settings".) There are several configurable modes listed below:

- Door/window (or general-purpose) sensor
- Motion (occupancy / vacancy) sensor
- Delayed relay activation trigger mode
- Priority relay activation trigger mode

Door/window mode is the default operational state. (No action is required to configure this mode.) Door/window switches and general-purpose sensors can be used.

(Note: For wiring information, refer to Detailed wiring instructions. If installing a wired motion sensor, refer to "Connecting a Wired Motion Sensor" f.)

Occupancy & vacancy modes require specialized motion sensors. You must assign the proper mode at the controller. To make this assignment for a given sensor input, press and hold the mode button for 3 seconds. The four red LEDs will illuminate and the beeper will sound, indicating offline mode. Press and release the "Register" button indicating wired sensor mode. Red LED #1 will be illuminated, indicating wired sensor input #1. (To advance the selection to different wired sensor, repeatedly press and release the "Register" button until the desired sensor LED is illuminated.)

Delayed activation trigger mode postpones relay activation and is applicable to default sensors including door/window switches (wired and/or wireless). In this mode, a trigger will not occur until the sensor returns to the idle (pre-trigger) state. It is used in situations that require the sensor state to revert back to the previous state before the relay is activated. (For proper operation, a non-zero deactivation delay time period should be configured. Refer to “DIP Switch Settings“ for additional details.)

For example, delayed triggering may be used in an automatic vent fan application for a chemical mixing room. The entry door is equipped with a magnetic reed door sensor that is connected to one of four available HSRS wired inputs. The vent fan is controlled by HSRS relay and is to be activated only if a worker enters the room and remains for at least 5 minutes (sensor-active period) with the door closed. However, the fan must not activate until he opens the door (delayed activation) and must continue to run for at least 10 minutes afterward (deactivation time period). Here are the recommended DIP switch settings:

- **Active = 5 min., Inactive = 10 min., Deactivate = either (standard or pulse), Sensor Act.= Closed**

Priority activation trigger mode results in immediate relay activation when a trigger condition exists for the specified sensor. In this mode, the sensor-active trigger period in DSW1 DIP Switch Settings is ignored. However, for deactivation, the sensor will use the deactivation time period configured in DSW2 DIP Switch Settings.

To specify **occupancy mode** for the selected sensor input, press and release the "Mode" button - two beeps will be sounded as confirmation.

To specify **vacancy mode** for the selected wired sensor input, press and release the "Mode" button once, then again – two beeps will be sounded, then three beeps.

To specify **delayed activation mode** for the selected wired sensor input, press and release the “Mode” button again – four beeps will be sounded as confirmation.

To specify **priority activation mode** for the selected wired sensor input, press and release the “Mode” button again – five beeps will be sounded as confirmation.

(Press and release a fifth time to return to the default mode (doors, windows, etc.) - one beep will be sounded).

To save & exit, press and hold the register button for one second. The steps are summarized below:

- Press/hold mode button for 3 seconds (offline mode)
- Press/release the register button to choose a wired sensor
- Press/release the mode button to invoke **occupancy mode** (two beeps are sounded)
- Press/release the mode button again to invoke **vacancy mode** (three beeps are sounded)
- Press/release the mode button again for **delayed trigger mode** (four beeps are sounded)
- Press/release the mode button again for **priority activation mode** (five beeps are sounded)
- Press/release the mode button again for the default mode (door/window)
- To exit, press/hold the register button for 1 second (3 beeps are sounded)

Notes:

- Subsequent configuration attempts will erase any previously stored settings from non-volatile memory.
- If you will be using only wireless sensors and will not be using any wired sensors, you may disable these inputs. (Refer to "DIP Switch Settings" for details.)
- If you are using wired sensors, but will not be using all 4 of the available

inputs, then it is imperative to properly handle the unused inputs. If the sensor activation trigger state DIP switch is configured "open", then any unused inputs should be wire-shorted to one of the wired sensor return terminals. If the sensor activation trigger state DIP switch is configured "closed", then unused inputs should remain unconnected.

- If you will be using no wired sensors, you may simply disable them. (Refer to "DIP Switch Settings" for details.) Once disabled, wire-shorting will not be required.
- The controller must be configured for the exclusive use of either normally-open or normally-closed switch sensors. Do not attempt to use a mix of both switch sensor types.
- If you will be using motion detectors in vacancy mode, be sure to specify the OPEN trigger state (DSW1, switch 7). Refer to "DIP Switch Settings" for details.

IMPORTANT: To use wired sensors in your application, you must ensure that wired sensor operation has been properly enabled at configuration DIP switch: DSW1, no. 8. Refer to "DIP Switch Settings" for more information.

Wireless RF Option

A wireless receiver option is available for use with compatible RF sensor transmitters. The following components are included:

- Controller (RF enabled)
- Power converter: 110VAC or 24VAC (for HVAC)
- Antenna, quarter-wave whip
- Antenna mounting bracket
- Coax antenna cable
- One or more door/window sensors

Note: The wireless option does not use Wi-Fi signals or require access to a router.

IMPORTANT: Previous versions implemented an external receiver with related interface cabling. The product now utilizes an internal receiver that streamlines & simplifies installation.

Compatible wireless transmitter devices include the following:

- Door/window sensors
- Infrared motion detectors
- Key fob transmitters

The picture below shows a complete setup for wireless operation. It includes controller, power converter, antenna, and accessories:

IMPORTANT: Power converters provide proper DC voltage to the controller. There are two available converters depending on the required supply voltage. Be sure to specify the proper device when ordering:

- *24vac-to-12vdc*
- *120vac-to-12vdc*

The list below denotes equipment for wireless operation.

A) Controller
B) Whip antenna
C) Coax cable
D) Mounting bracket
E) Door/window sensor
F) 24vac-to-12vdc power converter

Notes:

1) *The power converter provides proper voltage to the controller. There are two available converters depending on the required supply voltage. Be sure to specify the proper device when ordering:*

   - *24vac-to-12vdc*
   - *120vac-to-12vdc*

2) *Previous versions implemented an external receiver with serial interface cabling. The product now utilizes an internal receiver that eliminates the serial cable, streamlining & simplifying installation.*

Use the following procedure to install a wireless system:

- Install the whip antenna using the mounting bracket (included) and suitable screws (not included).

  IMPORTANT: Be sure to position the antenna away from metallic items, electrical equipment, phones, computers, and other possible obstructions and sources of radio interference. Do NOT install the antenna on or inside a metal cabinet as this will severely impede its efficiency.) Position the antenna vertically, and locate near the ceiling or as high as is allowable for receiving sensor signals. If possible, centrally locate the antenna so that all door/window transmitter(s) are within 50 feet. (Note that walls and other obstructions will attenuate the RF signals and limit signal range.)

  WARNING: Avoid contacting the antenna and/or its mounting bracket with a grounded circuit as this may result in short-circuit.Also avoid contact with grounded wall studs.

- For wall-mounting, locate the "L" bracket at a suitable location on the wall. Mark the location and attach the bracket using compatible screws (not included). Then, attach the antenna to the bracket. Next, attach one end of the coax antenna cable to the whip antenna and the other to the controller. Route the cable so that it is out of the way, being careful to avoid damage due to scrapes, twists, or sharp bends.

Wireless Door/Window Sensor

The wireless door/window sensor is a transmitter device that is compatible with 4th generation GPRS and HSRS controllers:

- Model #KD-DS-3700
- Extended signal transmission range
- 1 x AAA alkaline battery (not included) delivers 2 to 3 years of battery life
- Requires no initialization sequence
- Pre-programmed with unique, permanent address ID
- Sends periodic status update signal every 60 minutes
- Includes screws and double-sided foam tape

These sensors emit RF message signals anytime the corresponding door (or window) is opened or closed. (They also send periodic status update signals every 60 minutes.)

Sensors must be appropriately registered (i.e., paired) with the controller. Refer to "*Wireless Registration*" for details.

Notes:

- Battery replacement does not affect operation (i.e., re-registering is not required)
- Up to 8 wireless sensors may be registered to a single HSRS controller.

To install, follow these steps:

- Detach cover from the transmitter unit.
- Insert 1 x AAA alkaline battery (not included).
- Attach transmitter unit to a stationary wall or frame adjacent to the door or window being monitored. Position the unit as high as possible and secure with screws or mounting tape (included).
- Next, mount the magnet on the door or window, being sure to align with the transmitter unit.
- Re-apply the cover.

IMPORTANT: When installing the sensor, mount the magnet on the door or window and the transmitter unit to the stationary frame. This configuration minimizes mechanical shock to transmitter electronics.

Batteries should be replaced every two to three years on average, or more frequently as needed. (Following battery replacement, it is **not** necessary to re-register the sensor(s).

Wireless Motion Detector

Wireless motion detector(s) may be employed for occupany / vacancy detection.

- *Note: There is no available GEN4 compatible wireless motion detector at this time.*

Refer to "Wireless Registration" for additional setup details concerning wireless sensors and motion detectors.

Wireless Registration

Wireless registration is the procedure that pairs the controller with compatible wireless transmitter devices (i.e., sensors, fobs, etc). It guarantees that signals from nearby non-registered transmitters will be excluded from recognition. (Signals received from non-registered devices will be ignored and dismissed during normal operation.) This processing is essential for error-free behavior in environments where multiple controllers may be in use. Examples of such venues include neighboring residences, apartment buildings, hotels, etc.

For each registered transmitter, its unique address identifier code is memorized. This enables the controller to identify and recognize only signals from those device(s) which are designated for use. Registration is a prerequisite for using any compatible wireless transmitter(s) and must be performed when any of the following conditions occur:

- New installation
- Applying additional transmitter(s)

Compatible wireless transmitter devices include door/window sensors, key fobs, motion detectors, etc. The controller may accept up to 8 wireless sensor/transmitter devices during registration.

IMPORTANT:

- *It is imperative to avoid interference. Wireless systems such as cell phones, wi-fi routers, and alarm systems should be kept away from the controller and antenna as they may impede signal reception.*
- *When applying additional sensor(s) to an existing installation,* all *sensors must be registered, including those already existing and registered at a prior time.*
- *Registration is necessary when adding new transmitters but is NOT necessary in the event that power has been lost to the controller. This is because the controller stores (memorizes) registered transmitters, and simply recalls the information on the next power-up sequence.*

If you have not already done so, insert batteries for each sensor/transmitter you wish to register. (Be sure to observe the prescribed polarity.) Before continuing, ensure that the controller is powered off. Next, connect the whip antenna to the appropriate connector using the supplied coax cable and mounting bracket. Now, detach the cover from the enclosure housing by removing the four (4) retaining screws. (Detaching the cover is necessary for accessing the “Register” pushbutton.)

Now, power on the controller. The green LED indicator at the controller should flash on and off at a slow, periodic rate. You are ready to initiate the registration procedure. Note that there are two available registration modes:

- Unverified
- Verified

Unverified registration is the legacy method and is the faster of the two implementations. However, this method is not recommended when there are active, pre-existing sensors within operating range of the controller unit. (Pre-existing sensors are devices that are applicable to other systems and/or registered to other controller(s). Since sensors can issue auto-transmitted status messages, unverified registration may inadvertently accept one or more pre-existing sensor devices.)

Verified registration is preferred when there are pre-existing compatible transmitter device(s) nearby. This method prevents inadvertent registration by requiring multiple transmissions for each sensor/transmitter before accepting the device as registered.

Unverified Registration:

At the controller, locate the on-board tactile pushbutton switch labeled, "Register". Press-and-hold the button until the beeper sounds. (The green LED will remain on steady, i.e., no flashing, and the 4 red LED indicators will be extinguished.) The controller is now in unverified wireless registration mode. Obtain a wireless transmitter/sensor device to be used in your application. Next, perform a test transmission. For door/window sensors, the simplest method is to move the magnet toward or away from the sensor. This causes the unit to initiate a wireless transmission, as evidenced by LED activity (see note). For a motion detector, initiate a test transmission by waving your hand in front of the device. If using a key fob or other hand-held device, perform the test transmission by pressing any available button on the unit.

While in registration mode, the controller awaits signal reception. When a wireless transmission is received from a compatible device, the controller's green status LED will briefly flicker, and one of four red LED indicators will be illuminated. This indicates the transmitter device has been detected, registered, and memorized. (If the sensor is a motion detector that you wish to use for occupancy detection, press-and-release the "Mode" button. The beeper will sound two times. If vacancy detection is desired instead, press/release the "Mode" button again. The beeper will sound three times.) The steps associated with unverified wireless registration are summarized below:

- Press-and-hold the register button until the unit beeps (the unit enters offline unverified wireless registration mode)
- Activate the sensor/transmitter. (For a door/window sensor, bring the magnet in close proximity to the transmitter or separate them. For a motion sensor, wave your hand in front of the device.)
- Confirm that a red LED illuminates at the controller and there is an accompanied audible beep.
- If motion detector, **occupancy mode**, press/release the mode button (green LED flashes & beeper sounds twice)
- If motion detector, **vacancy mode**, press/release the mode button once, then press again. (green LED flashes & beeper sounds three times).
- Repeat the previous four steps for each additional wireless sensor/transmitter device.
- To exit wireless registration, press-and-release the register button

Verified Registration:

Locate the controller's on-board tactile pushbutton switches labeled, "Register" and “Mode”. Press-and-hold both buttons concurrently until the beeper sounds. (The green LED will remain on steady, i.e., no flashing, and the 4 red LED indicators will be extinguished.) The controller is now in verified wireless registration mode.

Obtain a wireless transmitter/sensor device to be used in your application. (You may wish to detach the sensor's cover as this will enable its internal LED indicator for visual confirmation of transmitted signals.) Next, perform a test transmission. For door/window sensors, the simplest method is to move the magnet toward or away from the sensor. This causes the unit to initiate a wireless transmission, as evidenced by LED activity. For a motion detector, initiate a test transmission by waving your hand in front of the device. If using a key fob or other hand-held device, perform the test transmission by pressing any available button on the unit.

Verified registration requires three separate and identical transmissions before accepting the sensor as a registered device. When the required number of verified transmissions have been detected, one of the four red LED indicators at the controller will be illuminated, indicating that the transmitter device has been detected, registered, and memorized. (If the sensor is a motion detector that you wish to use for occupancy detection, press-and-release the "Mode" button. The beeper will sound two times. If vacancy detection is desired instead, press/release the "Mode" button again. The beeper will sound three times.) The steps associated with verified wireless registration are summarized below:

- Press-and-hold rthe egister & mode buttons concurrently until the unit beeps (the unit enters offline verified wireless registration mode)
- Activate the sensor/transmitter. (For a door/window sensor, bring the magnet in close proximity to the transmitter or separate them. For a motion sensor, wave your hand in front of the device.)
- Repeat sensor activation several times – until a red LED illuminates at the controller and there is an accompanied audible beep.
- If motion detector, **occupancy mode**, press/release the mode button (green LED flashes & beeper sounds twice)
- If motion detector, **vacancy mode**, press/release the mode button once, then press again. (green LED flashes & beeper sounds three times).
- Repeat the previous four steps for each additional wireless sensor/transmitter device.
- To exit wireless registration, press/release the register button

Note:

- Registered sensor/transmitter devices remain memorized at the controller until the next registration attempt which erases all previously stored sensor/transmitter devices from memory. (Loss of power at the controller does not necessitate re-registration as the sensors/transmitters are memorized in non-volatile storage.)

Occupancy / Vacancy Detection

Motion detectors are frequently used in applications where occupancy or vacancy determination is needed. Wired and/or wireless devices may be employed. While both types yield the same basic functionality, they differ in their method of issuing detection notifications to the controller. Wired sensors offer a limitless number of detection opportunities to the controller and are therefore able to detect motion at any time.

Wireless motion detectors, on the other hand, are designed with a “transmission lockout” feature in the interest of power conservation. Transmission lockout preserves battery life by limiting the number of wireless RF signal notifications. As RF transmissions consume significant power, the lockout feature limits or “throttles” these notifications. Following a detected motion event, transmission lockout disables any subsequent (new) detection notification for a period of 3 minutes.

Note: Transmission lockout does not apply to walk test mode. (Refer to Wireless Motion Detector for walk test mode details.)

Two awareness modes are available:

- Occupancy
- Vacancy

In occupancy mode, trigger activation (e.g., equipment shut-off) occurs when ANY detector discovers motion. (Refer to "Wired Sensors" and/or "Wireless Registration" for information describing how to configure occupancy mode.)

In vacancy mode, trigger activation occurs when ALL detectors are idle (i.e., sensing no motion activity). This mode s particularly useful in HVAC applications. Vacancy is assumed when there has been no detected motion by ANY motion detector for a preset period of time. Thus, when this mode is invoked, trigger activation occurs only when ALL vacancy-configured sensors have detected vacancy.

Trigger release (i.e., equipment re-activation) occurs when ANY detector discovers occupancy (i.e., motion). The vacancy mode feature is useful for shutting down equipment when all rooms have been unoccupied for a preset period of time. The equipment can be re-activated when any motion sensor detects occupancy (i.e., movement). (Refer to "Wired Sensors" and/or "Wireless Registration" for information describing how to configure vacancy mode.)

Note: If desired, the equipment can be automatically reactivated after a preset delay. (Automatic reactivation requires “Pulse” deactivation mode.) This can be useful for maintaining an adequate comfort level in the space. For details on configuring time delay periods, refer to "DIP Switch Settings".

For example, consider a vacation rental property requiring HVAC shut-off when the space has been vacant for a period of time. To properly implement vacancy detection, motion sensors should be provided in primary areas including kitchen, living room, and bedrooms. In addition, it is necessary to allow sufficient detection time to minimize the possibility of false vacancy determination.

Note: Night time occupancy/vacancy status can be difficult to ascertain once occupants have gone to bed. It is imperative to avoid false vacancy determination. Therefore, when installing a detector in a bedroom, consider locating the device so that it is able to detect any subtle movements by sleeping occupants. This can be effectively accomplished by placing the unit on an opposing wall in front of the bed and at a height of approximately 6 to 8 feet above the floor. Configure a sensor-active period of 2 hours or more to prevent false vacancy determination. (Refer to the sensor-active period described in the "DIP Switch Settings" section for details.)

For information describing how to configure vacancy mode for one or more motion detectors, refer to "Wired Sensors" and/or "Wireless Registration".

In some situations, a single detector may not be sufficient for monitoring a larger room or space. In these instances, a dual detector solution may be required. In a large bedroom, for instance, a ceiling-mounted detector can be applied above the headboard for night monitoring while a second wall-mounted device is placed at another location within the room to monitor daytime activity.

IMPORTANT: Infrared motion sensing devices can detect many different heat sources. To prevent false detections, avoid facing sensors directly into these sources:

- *Dryers*
- *Heaters*
- *Sunlight*
- *Furnace vents*
- *Kitchen appliances*
- *High wattage lighting*
- *Windows*

For wireless motion detectors, you can also adjust the detection sensitivity. Refer to "Wireless Motion Detector" for more information.

Controller Testing

(IMPORTANT: Prior to performing testing, you should deactivate the equipment under control. For an HVAC unit, this can be done by shutting off the system at the thermostat. Or, you may detach wires at controller terminals 12, 13, 14.)

- Begin by powering off the controller and ensuring that all sensors are inactive (e.g., doors and windows closed).
- Next, power on the controller and examine the LED indicators. The green system status LED should be flashing on and off at a steady rate. The four red LEDs should be off.
- Now, invoke an activation by "tripping" a sensor (e.g., open a door or window). After a pre-defined delay (as defined by your DIP Switch Settings), the relay will engage and the beeper will briefly sound (if enabled).
- Reset the sensor back to its normal (non-triggered) state. After a pre-defined delay (as defined by your DIP Switch Settings), the relay will disengage and the beeper will briefly sound (if enabled).
- Repeat the prescribed test sequence for each additional sensor.

When you have completed testing, you may re-enable the equipment under control.

Terminal Block Wiring Connections

The controller provides screw terminal connections for wiring purposes:

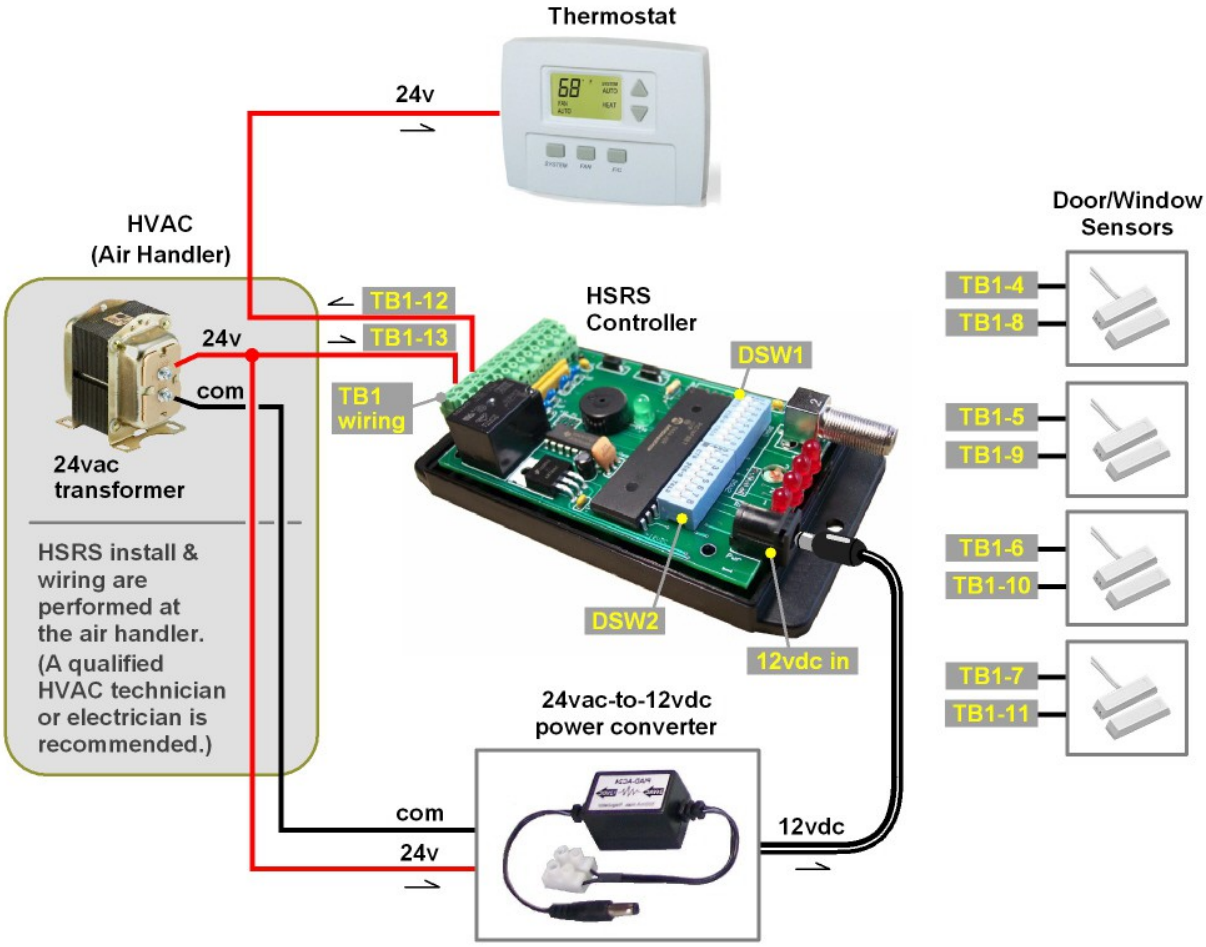
```
 1) +12VDC power in/out
 2) Ground
 3) Reset/Disable
 4) Wired Sensor #1
 5) Wired Sensor #2
 6) Wired Sensor #3
 7) Wired Sensor #4
 8) Wired Sensor return
 9) Wired Sensor return
10) Wired Sensor return
11) Wired Sensor return
12) Relay - COM
13) Relay - N/C
14) Relay - N/O
```

Notes:

- Wiring screw terminal #1 is labeled on the controller board and is located at the corner nearest the two tactile switches.
- The reset/disable input will cancel a relay activation and reset the controller. Connect a normally open switch (momentary, toggle, etc.) at wiring terminals 2 & 3. (Refer to "Controller Reset" for additional details.)
- In most instances, only a subset of the available wiring connections will be required.

HSRS Wiring Installation

Installation is straightforward, requiring 1 to 2 hours of labor by a qualified HVAC technician. The HSRS controller should be installed near the indoor air handler with appropriate low-voltage wiring for direct access to the HVAC system's 24vac power supply. The schematic below illustrates the simplicity of a typical HSRS installation:



IMPORTANT: For a wireless installation, avoid contacting the antenna or mounting bracket with any grounded metal object, including HVAC equipment, water heater, laundry equipment, metal wall studs, etc.

Detailed Wiring Instructions

The following instructions demonstrate wiring installation for a typical split system central air conditioning unit. The following items will be needed:

- screwdriver
- wire cutter / stripper
- splicing connectors
- several feet of low-voltage wiring

Caution: Although HSRS wiring is not complicated, only a qualified HVAC contractor or technician should attempt the procedure. Wiring diagrams and related instructions are provided for demonstration purposes only. We accept no liability or responsibility for possible errors, omissions, or ambiguities. The installer assumes full responsibility for a proper install and to verify all wiring. Should you encounter any issues during or after the install, contact us for free on-site phone support.

- Shut off power to the HVAC system.
- Remove front cover from the indoor air handler unit.
- Detach HSRS enclosure lid by removing retaining screws.
- Locate the low voltage 24v wire that powers the thermostat (typically red).
- Also locate the 24v common wire (typically blue or black).
- Perform necessary wiring as illustrated in the diagram above.
- Verify and double-check your completed modifications.
- Replace air handler front cover.
- Replace HSRS enclosure lid.
- Restore HVAC system power.

Note: Wired door/window switches should be connected as shown. For wired motion sensors, refer to "Connecting a Wired Motion Sensor". (For wireless door/window sensors, refer to "Wireless Door/Window Sensor".)

Connecting a Wired Motion Sensor

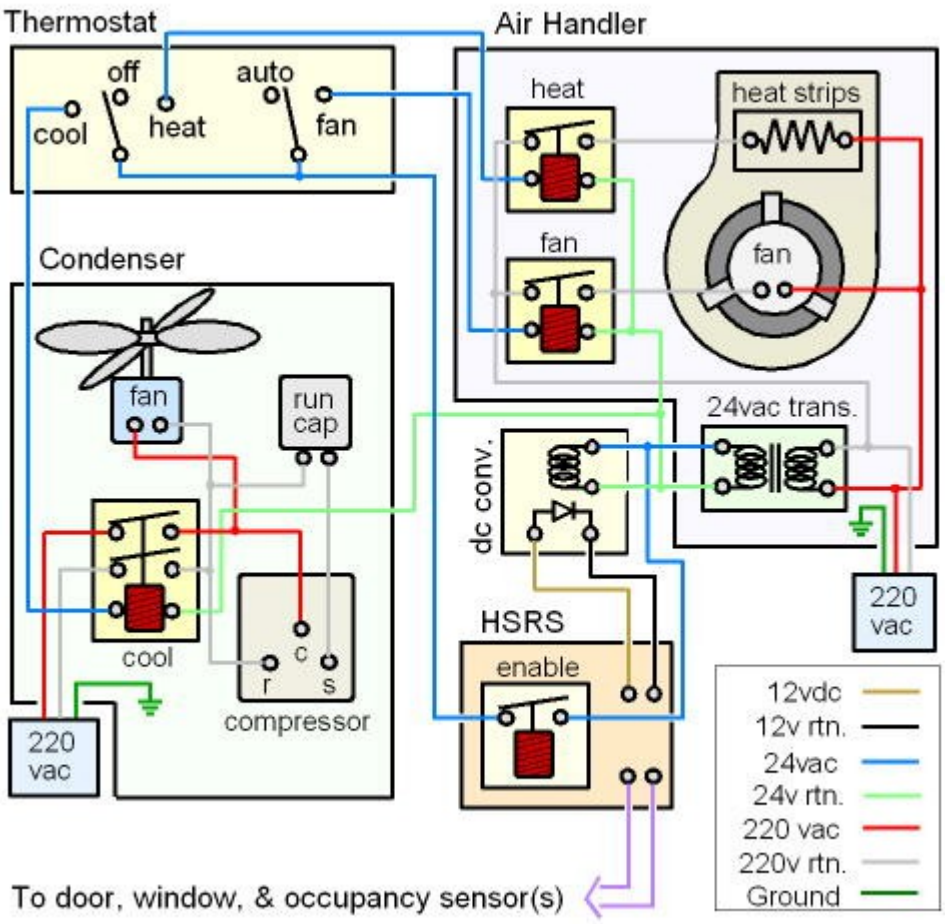
A wired motion detector requires a total of four (4) wires for installation: power (12vdc), ground, and two switch contacts (NC & C). An external 12vdc power source is required. We recommend powering the unit directly from the HSRS controller. (Or, if preferred, you may use an optional ac power adapter [i.e., "wall-wart"].) The table below summarizes the wiring connections and assumes the HSRS controller provides 12vdc power directly to the sensor.

Wiring Item	**Sensor connections**	**HSRS connections**
Switch contacts *	NC, C	“Wired Sensor” terminals (refer to Terminal Block Wiring Connections)
Power	12V, GND	Terminals 1 & 2

* - Utilize the sensor's normally-closed (NC) contact if the HSRS sensor activation trigger state = OPEN (default). Otherwise, use the sensor's normally-open (NO) contact.

Sample HVAC Application #1 - Entire System Shutoff

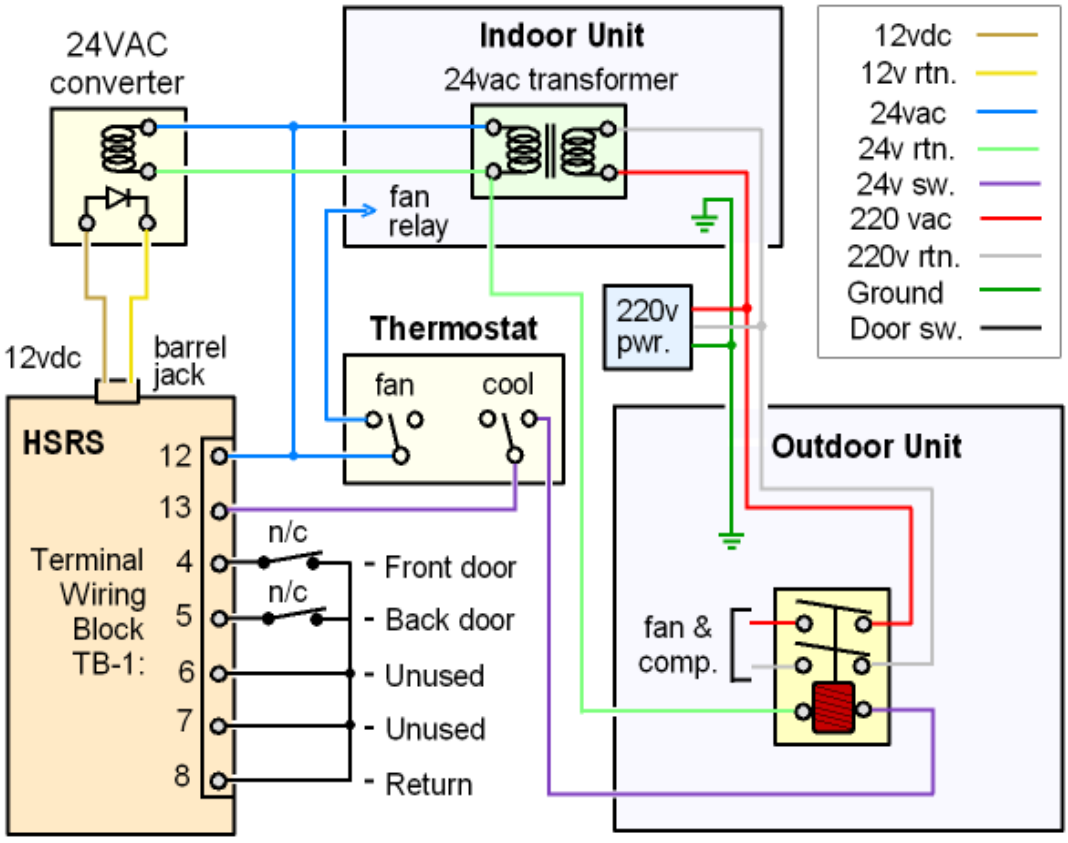
The following schematic illustrates how to wire the HSRS controller in an HVAC application with two monitored doors. When a violation occurs, the entire HVAC system will be shut off. (This sample presumes the use of normally-closed door sensors and controller activation trigger state = OPEN.)



Caution: The diagram is provided for demonstration purposes only. We accept no liability or responsibility for possible errors, omissions, or ambiguities. The installer assumes full responsibility for a proper install and to verify all wiring.

Sample HVAC Application #2 - Condenser Unit Shutoff

The following schematic illustrates how to wire the HSRS controller in an HVAC application with two monitored doors. When violation occurs, only the outdoor condensing unit (including compressor) will be shut off. (This sample presumes the use of normally-closed door sensors and controller activation trigger state = OPEN.)



Note 1: Door sensors normally-closed; HSRS act. trigger state = OPEN
Note 2: At door violation, outdoor condenser unit is switched off by the HSRS. (Thermostat and indoor fan remain enabled.)

Caution: The diagram is provided for demonstration purposes only. We accept no liability or responsibility for possible errors, omissions, or ambiguities. The installer assumes full responsibility for a proper install and to verify all wiring.

Maintenance

The product requires no special maintenance other than protection from weather, moisture, power surges, and hazardous environments.

Warranty

This product is warranted for a period of 1 year from the date of purchase and is guaranteed to be free from defects. The warranty covers the entire unit, except if any part or component has been modified or otherwise converted from its original form. The warranty does not cover damage or failure due to neglect, improper use, electrostatic discharge, unshielded exposure to moisture, power surges, hazardous environments, and the like.

Note: The customer is responsible to provide protection against over-voltage situations including power surges, spikes, and lightning strikes. The use of adequate surge protection is recommended.

Disclaimer

Neither Kadtronix nor Delahoussaye Consulting shall be held liable or responsible for incurred damage or injury which may result due to the use or misuse of the product or due to possible inaccuracies or misinterpretation of information contained in this manual.

Contact Information

Should you have any questions or comments, please contact us at:

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Revisions

Rev.	Date	Comments
5.0	06/24/20	GEN3 release, 3rd generation
6.0	07/31/26	GEN4 release, 4rd generation