

Package Contents

- 0-10V Relay Module

Tools Required

- Screwdriver
- Wire nuts

Product Description

The LED relay zone controller uses wireless technology to communicate with other self-powered EnOcean based products and provides an amazingly simple solution for dimming control of LED lighting.

The compact size enables flexible installation inside of or next to electrical boxes and fixtures so it can be easily wired out of sight using standard wiring practices.

Simply link the module to an EnOcean-based motion sensor, light level sensor or rocker switch and experience levels of efficiency and convenience that can only be achieved through wireless controls.

It is also possible to link TWR-D10 to a central controller or via a gateway to building automation systems like BACnet.

Features Include:

- Enables wireless dimming of a single fixture or a zone of multiple daisy chained LED fixtures (e.g. 20 each 30W or 10 each 60W).
- Supports California Title 24 daylight harvesting scenarios, occupancy control and manual dimming with input from self-powered wireless switches and sensors. Implements load shedding initiated by separate Demand Response controllers
- Installs inside or mounts to electrical box using threaded connector
- Supports wireless remote commissioning to link devices and set parameters

Specifications

Power Supply	120V - 277V VAC, 60 Hz
Maximum Load	General Purpose: 16A @ 120/277VAC Resistive: 16A @ 120/277VAC Tungsten: 960W @ 120VAC Ballast: 600W @ 120VAC
0-10V output	Tolerances +3%/-4% (1-10V range) Current sinking 35mA*, sourcing 4mA <small>* For high sinking current and dim values below 10%, the output voltage may exceed the selected output value and reach 1V max.</small>
Power Consumption	1.1W full load, 500mW quiescent
Surge Protection	3kV line to line, exceeding IEC61000-4-5 installation class 4
Inputs/Outputs	<ul style="list-style-type: none"> Flying-lead style wires 2 power input wires 1 switched output wire 2 output wires for 0-10V control
Configuration Interface	2 Buttons, 1 LED for device configuration & manual control
RF Standard	EnOcean 902 MHz
Transmission Range	80 ft. (25 m)
EnOcean Equipment Profile	D2-40-00 for remote commissioning with Navigan™
Interoperable Products / EEPs (EnOcean Equipment Profiles)	<ul style="list-style-type: none"> Rocker Pad Switch (F6-02-02) Occupancy Sensor (A5-07-01) Occupancy Sensor (A5-07-02) Occupancy Sensor (A5-07-03) Light Level Sensor (A5-06-02) Light Level Sensor (A6-06-03) Central Controller (A5-38-08) Demand Response (A5-37-01)
Dimensions	2.78" H x 1.65" W x 1.1" D (73mm x 42mm x 28mm)
Weight	3.2oz. (90g)
Mounting	<ul style="list-style-type: none"> Install inside standard electrical box Connect to electrical boxes and fixtures using threaded nipple
Environment	<ul style="list-style-type: none"> Indoor use only 32° to 104° F (0° to 60° C) 20% to 85% relative humidity (non-condensing)
Agency Compliance	ETL, FCC, IC, UL2043 Plenum Rated

1) Planning

Take a moment to plan for the module's successful operation and optimal communication with other system components.

- Always use a qualified installer
- Install in an appropriate location

- Take care not to damage the radio antenna, the orange wire that runs in a groove on the outside of the module that runs in a groove on the outside of the module
- Consider the construction materials in the space and obstacles that may interfere with RF signals

2) Installing

Read and understand instructions completely before starting.

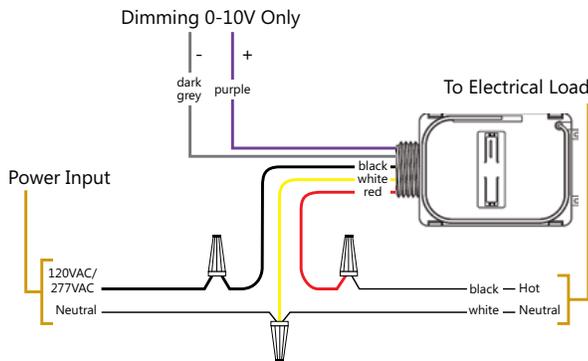
	<p>ELECTRICAL SHOCK HAZARD</p> <p>High Voltage. This device must be installed by a qualified installer or electrician. Follow all applicable electrical codes for installation.</p>
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1. Turn off power at the circuit breaker or fuse and test that power is off before wiring the device.

NOTE: Use a non-metal electrical enclosure for best wireless communication performance.

2. Identify the wiring connection at the installation site to coordinate with the following wiring diagram.

NOTE: For display purposes, white wire is shown as yellow.



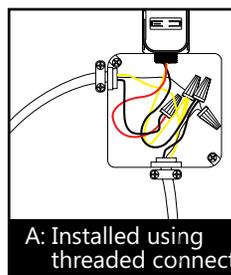
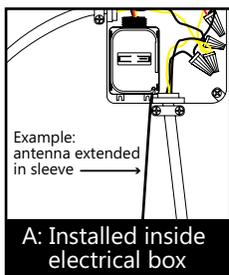
3. Determine which of the two installation methods is most appropriate:

A. Installed inside the electrical box.

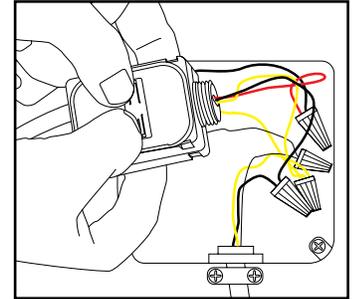
NOTE: For best performance, remove the antenna from its slot and elongate it outside and away from the box and conduit. Install tubular sleeve (included) over antenna and slide into relay housing.

B. Installed using the threaded connector:

- i. Insert the threaded connector through a 1/2" trade size (7/8" diameter) knockout.
- ii. Thread the 5 module wires inside the electrical box and through the lock nut.



4. Connect the wires using wire nuts and cap any bare wires. **NOTE:** After the module is linked and configured, you can secure it in the installed location, see step 8.
5. Fold the wires neatly and either place the module in the box or secure the threaded connector with the lock nut.
6. Position the module so that the setup interface and antenna face forward (out). **TIP:** If the RF reception is poor, use the antenna sleeve provided to extend the antenna.
7. Restore power to the circuit.
8. Use the setup interface to link devices and configure settings (refer to the "Linking" & "Configuring" sections).



Warning: Remove the module from the electrical box to use the setup interface.

3) Device Configuration

The LED controller can be configured in two ways:

- By user input to the local setup interface
This approach is used for basic setup tasks
- Remotely using the remote commissioning interface
This approach is used for advanced configuration tasks

Local Setup Interface

The local setup interface has two buttons, LRN (O) and DIM.

LRN (O) has a corresponding 2-color LED (green, red). This simple interface is used to link and unlink transmitters, to dim up and down manually and to set the minimum dimming value.

To use the local setup interface, hold the module so both thumbs can click the buttons without obscuring the LED.

<p>LRN (O) button</p> <p>Press short to start or end linking/unlinking mode. Press long (>10s) to delete all linked transmitters.</p>	<p>DIM (I) button</p> <p>When the button is pressed shortly (<0.5s), the connected load is switched ON/OFF. If pressed longer, the 0-10V output starts dimming up and down the connected load. If pressed simultaneously with the LRN (O) button the current 0-10V output value will be stored as minimum dimming level. When shortly (<0.5s) pressing the button while in learn mode, TWR-D10 will transmit a teach-in telegram.</p>
<p>LRN (O) LED → </p> <p>The LED will toggle red/green every 2 seconds, while in linking/unlinking mode. After linking (unlinking) a device it will stay green (red) for 4 seconds. The connected load will toggle between 10% and 90% dimming level, respectively.</p>	

Remote Commissioning Interface

The LED controller provides a wireless remote commissioning interface for all commissioning tasks.

This interface allows configuring all device parameters wirelessly using a laptop computer equipped with Navigan Wireless Commissioner (TWC-USB), consisting of a USB stick and software.

4) Linking

Linking is the process by which different devices are configured to work with each other in a system. Sometimes this process is also called Teach-in or Learn-in.

The LED controller can work together with two types of devices:

- Transmitters (switches and sensors) can provide input data to the LED controller.
- Transceivers (Gateways or controllers) can exchange data and commands with the LED controller.

There are two basic types of devices in the system; transmitters and transceivers:

Transmitters (Transmit-only)

Transmitters are energy-harvesting devices that send RF messages to communicate a condition, level, or state. The following transmitter types can be linked to the LED controller:

- Switches
- Occupancy Sensor
- Light Level Sensor (only in addition to switches and occupancy sensors, not alone)

Transmitters can only be linked to transceivers, not to other transmitters.

Transceivers (Transmit & Receive)

The LED controller is a transceiver. Transceivers are controlling devices that send as well as receive RF messages. They also process relevant control logic, and actuate the appropriate outputs (switching a light ON or OFF for example).

The LED controller can be linked to other transceivers if desired. The following other transceiver types are supported:

- Demand Response Controller
- Central Controller

Linking to transmitters (sensors or switches)

To link the LED controller with a transmitter, the LED controller must be powered, within wireless range of the transmitter it is to be linked to, and set to linking mode to accept links.

Once these conditions are met, the desired transmitter is triggered to send a special link message.

The LED Controller receives this link message and stores the link parameters permanently so that the two devices can interact to provide a variety of intelligent control options.

Link / unlink procedure

1. Shortly press the LRN (O) button to enter linking / unlinking mode.
The LRN (O) LED starts toggling red / green indicating that linking / unlinking mode is active. In addition, the connected load will toggle between 10% and 90%.
Once activated, this mode stays temporary active to provide

time to link / unlink multiple devices. The mode will stop after 30 seconds if no LRN (O) telegram is received.

2. For the transmitter to be linked, do one of the following according to the type of device:
 - A. Sensor: click the designated link button.
 - B. Rocker Pad: click the "I" button (top button marked on the switch plastic or "I" symbol on the back of the switch) 3 times quickly.
3. If the device has been linked successfully, the LRN (O) LED will display solid green for 4 seconds. The LED controller is now ready to accept new links.

NOTE: After a device is linked, additional learn telegrams received in operating mode (not in linking / unlinking mode) from that device will cause the connected load to toggle once between 10% and 90%, if the EnableLinkChecker parameter is set to ON.
This allows quickly checking the connection between this device and the LED Controller.
4. For a linked transmitter to be unlinked, please use the same action as described in point 2 above.
5. If the device has been unlinked successfully then the LRN (O) LED will display solid red for 4 seconds and the load will be switched to a dimming level of 10% for 4 seconds.
6. To exit linking / unlinking mode and return to normal operation, wait 30s without sending new LRN (O) telegrams, or shortly press the LRN (O) button again.

Clear all linked transmitters

In order to clear all linked devices press and hold the LRN (O) button for 10 seconds. After that the LRN (O) LED will display solid red for 10 seconds.

Linking to Transceivers (gateways or controllers)

1. Set the other device into linking mode
2. Shortly press the LRN (O) button.
The LRN (O) LED starts toggling indicating that linking / unlinking mode is active. The connected load will toggle between 10% and 90%.
3. Shortly press the DIM (I) button. This will cause the LED Controller to transmit a teach-in message identifying the status message EEPROM used by it.
4. Shortly press the LRN (O) button again to return to normal operation.

Setting the minimum output voltage level

It is possible to configure the minimum output voltage (MinVoltageLevel) of the LED Controller via its button interface. This level is typically set to avoid flickering and will be the minimum level the load starts at when it is switched on. It will not be possible to dim the output below this value.

Use the following steps to configure this minimum dimming value:

1. Press and hold the DIM (I) button.
The load will start dimming up and down.
2. Release the button when the desired minimum output voltage (dimming value) is reached.
3. Shortly press DIM (I) and LRN (O) button simultaneously to store this value.

5) Operating Modes

The LED Controller supports the following operation modes based on different types of connected devices:

Mode	Default Action	Title 24 Compliance
Switches only	Manual DIM or ON/OFF	No
Occupancy sensors only	Auto ON/ Auto OFF (default Auto OFF after 15 minutes)	No
Occupancy sensors and switches	Manual DIM or ON, Auto OFF Can be configured to Auto ON / Auto OFF via remote commissioning. (default Auto OFF after 15 minutes)	Yes
Additional light level sensor	Continuous dimming based on 5 supporting points or two level dimming	Yes
Additional central controller	Dimming via central controller overriding sensor and switch input	Yes
Additional demand response controller	During a demand response event output will be reduced to the value specified in the command. After the demand response time out the system will switch back to the previous state.	Yes

Behavior of the different components is described in detail subsequently.

A wide range of configuration parameters can be modified using the remote commissioning tool Navigan Wireless Commissioner (TWC-USB). These configurable parameters are marked as italic in the following chapter.

6) Functional Behavior

0-10V Interface

The minimum output voltage is *MinVoltageLevel* (default 2.0V); the maximum output voltage is *MaxVoltageLevel* (default 10.0V). Dimming below *MinVoltageLevel* or above *MaxVoltageLevel* is not possible.

Level and ramp percentage levels refer to the interval between *MinVoltageLevel* (1%) and *MaxVoltageLevel* (100%). An output level of 0% equals OFF state.

Switches Only

Short click (<0.7s) on “I” button of the rocker switch: Light comes ON at last dimming value stored before device was switched off. At first usage or after a reset, it will be switched to *MinVoltageLevel* (default 2.0V).

Double click (<0.7s) on “I” button: Light is switched ON immediately at *MaxVoltageLevel* (default 10.0V).

Short click (<0.7s) or double click (<0.7s) on “O” button (*Bottom button marked on switch or “O” symbol on back of switch*): The light is switched OFF, the current dimming value is stored.

Press and hold “I” or “O” button: Light is brightened or dimmed until button is released or *MinVoltageLevel* / *MaxVoltageLevel* is reached.

Ramp up (*RockerSwitchRampUpSpeed*) and down (*RockerSwitchRampDownSpeed*) speeds for rocker operation are configurable (default 20% per second).

Light can be automatically switched OFF automatically in absence of an occupancy sensor after time-out of *RockerSwitchAutoOffTimer*. This feature can be disabled by setting *RockerSwitchAutoOffTimer* = 0.

This feature is automatically disabled if an occupancy sensor is present. In this case, automatic switch OFF of the light will be performed based on the input from the occupancy sensor as described below.

Occupancy Sensors Only

If at least one sensor detects motion, light is set to *OccAutoOnLevel* (default 100%). If none of the sensors detects motion, light is set to *OccAutoOffLevel* (default 0%), after *OccAutoOffTimer* (default 15min) has elapsed.

Ramp up (*SensorRampUpSpeed*) and ramp down (*SensorRampDownSpeed*) speeds are configurable (default 20% per second).

Occupancy Sensors and Switches

Light can be switched ON / OFF manually, function as described above. Once *OccAutoOffTimer* (default 15min) has elapsed the light will be set to *OccAutoOffLevel* (default 0%).

Light will be automatically turned back ON at the last state, if occupancy is detected within the *OccGraceTimer* period (default 45s) after an occupancy sensor Auto OFF event.

The system can also be configured (*OccAutoOn*) to automatically switch ON the light. In this case if occupancy is detected and light is off, the light is switched to *OccAutoOnLevel*.

The period from switching OFF the light by a rocker until it can be turned on again by occupancy sensor input can be set using *OccOverrideTimer* (default 15 minutes).

Light Level Sensor

TWR-D10 supports the integration of a light level sensor in an open-loop system for daylight harvesting.

The light level sensor adjusts the light level according to incoming ambient light. The light level sensor will not switch ON the light by itself; therefore it works only in conjunction with rockers or occupancy sensors in the system.

The light level sensor should be placed at a position facing the window or skylight where it is not or only minimally influenced by light from the fixtures.

If a light level sensor is connected, the LED controller will by default activate daylight harvesting with continuous open loop dimming according to a user-defined dimming curve based on 5 configurable supporting points.

Each of these 5 supporting points defines the output light level set by the LED controller for a specific input illumination level reported by the light sensor.

In order to start dimming based on illumination the light must be switched ON either via rocker switch or by an occupancy sensor Auto ON event, depending on system configuration.

After a double click (<0.7s) on the “I” button of the light level sensor, after brightening or dimming via “I” or “O” button or after switch ON via occupancy sensor input, light will stay at the set level until switched OFF manually or by an occupancy Auto OFF event or until the LIsOverrideTimer (default 15 minutes) elapses.

Users can adapt the output level of the LED controller for the current illumination level reported by the light level sensor.

This is achieved using a fast triple click (<0.7s) on the “I” button. Doing so will replace the supporting point matching most closely the current reported illumination level reported by the light level sensor with the current light level and the current 0-10V output level.

Doing that at different daylight levels allows defining the whole curve. In addition these supporting points can also be configured by remote commissioning.

The light level sensor can alternatively be used to activate an automatic switching mode between MaxVoltageLevel and MinVoltageLevel based on light intensity.

This can be achieved by configuring DaylightingMode to 2-level via remote commissioning.

The thresholds for switching between these levels are defined by PhotoOnThres (output will be set to MaxVoltageLevel for reported values below this level) and PhotoOffThres (output will be set to MinVoltageLevel for reported values above this level).

Repeater Function

The LED controller provides the option to activate a one or two-level repeater for EnOcean radio telegrams. This function is only available via remote commissioning.

1-level repeater: If a received telegram is a valid and original (not yet repeated), the telegram is repeated after a random delay.

2-level repeater: If a received telegram is valid and original or repeated once, the telegram is repeated after a random delay.

Note: 2-level repeating function should only be activated if really needed! Otherwise the system function can be compromised by collisions of telegrams.

Status Messages

The LED controller will transmit a status message

(EEP D2-40-00) after change of its output state or after the StatusMessageTimer has elapsed.

By setting StatusMessageTimer to 0 status messages can

be switched off completely. By setting it to 0xFFFF only event based messages will be sent.

Central Controller

TWR-D10 can also be connected to a central controller (EEP A5-38-00). It supports the dimming command 0x02 of this EEP.

7) Troubleshooting

Problem	Solution Checklist
The device does not power up	<ul style="list-style-type: none"> • Check the wiring for errors • Check the circuit breaker • Use a voltage meter to confirm power
The device does not control linked load	<ul style="list-style-type: none"> • Click the DIM (I) button to open/close the relay manually • Turn off the power and then restore it
Cannot link other devices	<ul style="list-style-type: none"> • Check if linking mode can be accessed • Move closer to the device; it may be out of range • Try linking a different device • Check for environmental conditions that interfere with RF signals • Verify the maximum number of devices has not been exceeded <ul style="list-style-type: none"> - 20 switches - 10 occupancy sensors - 1 light level sensor - 1 central controller - 1 demand response controller
The device does not respond to wireless messages or selected settings	<ul style="list-style-type: none"> • Check for environment or range issues • Verify the device is linked • Check if appropriate devices are linked according to good system planning • Extend the antenna to amplify the range: remove it from the groove in the module, and straighten it.



902 MHz: Contains:
FCC: SZV-STM300U
IC: 5713A-STM300U

This device complies with part 15 of the FCC rules and Industry Canada ICES-003.

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.

IMPORTANT! Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

8) Remote Commissioning Parameters

The following parameters can be set via remote commissioning, e.g. using the Navigan tool.

Parameter	Description	Default/Notes
System Parameters		
MinVoltage-Level	Minimum 0-10V output voltage level when light is switched ON	2.0V
MaxVoltage-Level	Maximum 0-10V output voltage level when light is switched ON	10.0V
0-10VRe-relayDelay	Delay between switching the relay on and starting to ramp up the 0-10V output	50ms
ModeAfterPowerLoss	ModeAfterPowerLoss (ON/OFF/LAST STATE)	LAST STATE
StatusMessageTimer	Defines, how often status messages are transmitted (seconds, 0=off, 0xFFFF=only event based)	0xFFFF
RepeaterFunction	Defines the repeater level of the device (OFF/1-Level/2-Level)	OFF
Enable-Debug-Messages	Enable or disable debug messages	OFF
EnableLink-Checker	Enable or disable link checker (if a learn telegram from a linked device is received while in operating mode, the 0-10V output will toggle once between 10% and 90%)	ON
RockerSwitch-RampUpSpeed	Ramp-up speed when change is triggered by rocker input	20%/s 0= No ramp (immediate)
RockerSwitch-Ramp-DownSpeed	Ramp-down speed when change is triggered by rocker input	20%/s 0= No ramp (immediate)
RockerSwitch-AutoOffTimer	RockerSwitchAutoOffTimer	0 (disabled)
Generic Sensor Parameters (Occupancy and Light Level)		
SensorRamp-UpSpeed	Ramp-up speed when change is triggered by an occupancy or light level sensor	20%/s 0= No ramp (immediate)
SensorRamp-DownSpeed	Ramp-down speed when change is triggered by an occupancy or light level sensor	20%/s 0= No ramp (immediate)

Parameter	Description	Default/Notes
Occupancy Sensor Parameters		
OccAutoOn	Defines if a signal from an occupancy sensor automatically switches on lights (True/False)	FALSE if at least one switch is linked, otherwise TRUE
OccAutoOn-Level	Dimming value at which light is switched on in case of Auto ON event from occupancy sensor	100%
OccOverride-Timer	Time before the occupancy sensor can switch the light back ON in Auto ON Mode after the user switched it OFF	15 min
OccAutoOff-Timer	Time after which lights will be switched to OccAutoOffLevel in case of no motion	15 min 0=disabled
OccAutoOff-Level	Dimming value to which lights will be dimmed after an occupancy sensor Auto OFF timer event	0%
OccGraceTimer	If occupancy is detected within the OccGraceTimer period after an occupancy Auto OFF event, lights are turned back ON	45 s
Light Level Sensor Parameters		
Daylighting-Mode	2-level or 5 point continuous daylight dimming	5 point
PhotoOnThres	In case of 2-level mode, light is switched to MaxVoltageLevel if light level is below PhotoOnThres	<200lux
PhotoOffThres	In case of 2-level mode, light is switched to MinVoltageLevel if light level is above PhotoOffThres	>400lux
LEV1...5	Defines 5 input light levels for open loop dimming curve (LEV1<LEV2<...<LEV5)	100, 200, 400, 600, 800 lux
OUT1...5	Defines the LED controller output values for the corresponding input light levels	100, 100%, 60%, 20%, 0%
RAMP12, 23, 34, 45	Ramp speeds between light levels 1 and 2, 2 and 3, 3 and 4, 4 and 5	1%/s
LlsOverride-Timer	Time before the light level sensor can modify the light level set by user or occupancy sensor input	15 min