Application Note

BRTSYS_AN_077

Relay Controller

Version 1.0

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1 Introduction

BRTSys Relay Controllers comprise the following relay types:

- 2CH Latching Relay
- 2CH Latching Relay + iSENSE
- 2CH Non-Latching Relay
- 2CH Non-Latching Relay + iSENSE

These relay controllers provide precise control over electrical circuits and can be operated as either SPDT or SPST relays. The iSENSE variants include load current measurement capabilities, enhancing monitoring and utility. The non-latching relay feature ensures safety in the application circuit: whenever the system is powered off, the relay will reset to its initial status.

All four variants have a system status LED and an LED per channel indicating the status of the contact. For detailed electrical specifications and further information, readers are encouraged to consult the respective datasheets:

- LDSBus 2CH Relay & 2CH Relay+iSENSE Datasheet
- LDSBus 2CH NL Relay & 2CH NL Relay+iSENSE Datasheet
- Modbus 2CH Relay & 2CH Relay+iSENSE Datasheet
- Modbus 2CH NL Relay & 2CH NL Relay+iSENSE Datasheet

The Relay Controllers may be used in a variety of applications. In home automation, they can be used as lighting or appliance switches. In industrial automation, they can be used for machinery control, process automation and energy usage monitoring. As motor controllers, they may be used as gate, shutters, awning, and rain curtain controllers. They are also ideal in agriculture and aquaculture where they can be used to maintain water level and circulation, or as aeration pump controllers and controlling feeding systems.

When to use a Latching Relay?	**Keep its State even without power:** Relays should retain their state (ON or OFF) even when the power is turned off.
	Ideal for Push-On/Push-Off control: When there is a need for push-on/push-off toggle switch behavior.
	When required to maintain the load's status until another signal is received.
When to use a Non-Latching Relay	**Frequent State Changes:** the relay will be automatically returned to the default state (normally closed or open) when the power is lost, making it suitable for safety-critical applications like alarms, interlocks, or motor protection
	Fail-Safe Behavior: Ideal for applications that require frequent switching, such as home automation systems (e.g., turning lights or appliances on and off).

The following sections provide information about:

- Connection Diagrams
- Controller Configuration
- Host Integration

2 Connection Diagrams

2.1 Signal Names and Description

The 2CH Latching Relay and 2CH Latching Relay + iSENSE controllers signal names are described in the following table. The relay channel number 1 or 2 is denoted as <n> below.

Relay and Relay Position Names	Description
COM<n>	Common
NC<n>	Normally Closed terminal
NO<n>	Normally Opened terminal
IP<n>+	iSENSE input for current measurement. In DC circuits, connect the more positive input into IP<n>+.
IP<n>-	iSENSE input for current measurement. In DC circuits, connect the more negative input into IP<n>-.
COM-NC	The COM and NC pins are contacted (closed).
COM-NO	The COM and NO pins are contacted (closed)

Table 1 - 2CH Latching Relay and 2CH Latching Relay + iSENSE Controller Signal Names

The signal names for the 2CH Non-Latching Relay and 2CH Non-Latching Relay + iSENSE controllers are listed in the table below.

Relay and Relay Position Names	Description
COM<n>	Common
NC<n>	Normally Closed terminal
NO<n>	Normally Opened terminal
IP<n>+	iSENSE input for current measurement. In DC circuits, connect the more positive input into IP<n>+
IP<n>-	iSENSE input for current measurement. In DC circuits, connect the more negative input into IP<n>-
COM-NC	The COM and NC pins are contacted (closed). The relay is set to this position all the time except active signal sent to relay.
COM-NO	The COM and NO pins are contacted (closed)

Table 2 - 2CH NL Relay and 2CH NL Relay + iSENSE Controller Signal Names

2.2 Generic Switch

The following wiring diagrams illustrate the controller wired as a generic AC switch. This configuration is suitable to control the activation and deactivation of a load such as a lamp or pump.

Condition	Latching Relay	Non-Latching Relay
Power Off	Remains in last state	COM-NC connected
Power On	Remains in last state	COM-NC connected
Active Signal	COM-NO connected	COM-NO connected
Inactive Signal	COM-NC connected	COM-NC connected

Table 3 - Status comparison for Latching and Non-Latching Relay

2.2.1 2CH Latching Relay Controller

Figure 1 shows the wiring diagram for the relay controller channels. AC Live signal is connected to the COM terminal and the load is connected to the NO terminal. The NC terminal is left unconnected.

CAUTION

It should be noted that whenever COM-NC is closed, AC Live signal appears at the corresponding NC terminal. This applies to all the circuit configurations below.

Upon receiving an activation signal from the Host controller, the relay breaks the COM-NC connection and makes the COM-NO position. AC Live current flows into the load (lamp or pump) which is turned on and begins to operate. When the host controller deactivates the relay, the COM-NO circuit is broken, and the COM-NC circuit is made, and the load (lamp or pump) is turned off.

This opening and closing of the circuit make the relay operate as a SPST switch.

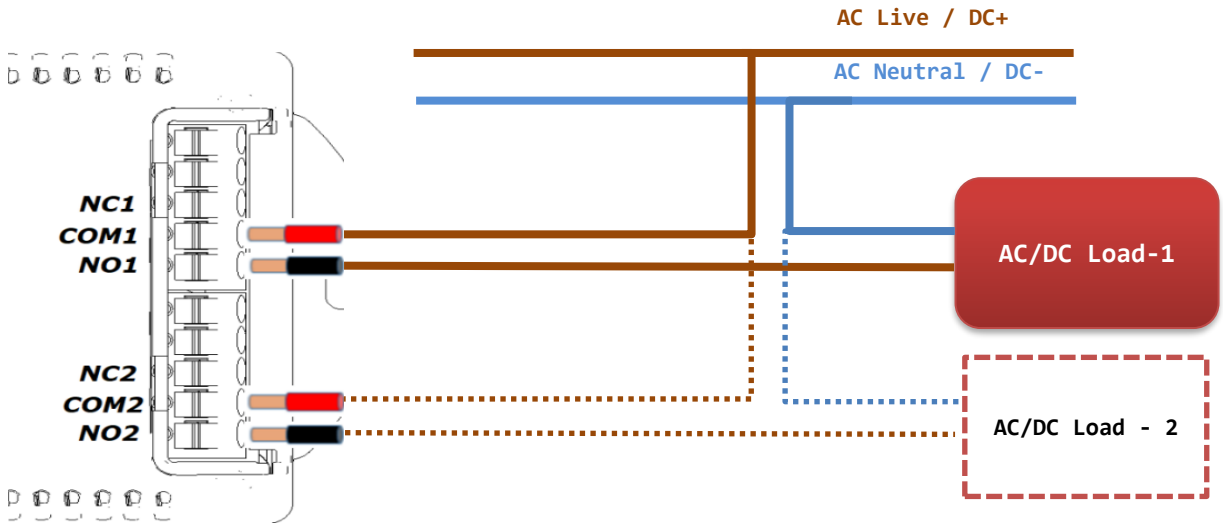


Figure 1 - 2CH Latching Relay Controller - Generic Switch Wiring Diagram

2.2.2 2CH Latching Relay Controller + ISENSE

Figure 2 shows the iSENSE version of the latching Relay Controller connected as a switch to measure the current flowing into the load. The current measurement circuit is connected in series with the load with the NO terminal connected to the IP+ terminal and the IP- terminal connected to the load. Now, when the load (lamp or pump) is turned on, the current passes through the IP+ and IP- terminals and the internal ammeter measures the current flowing in the circuit.

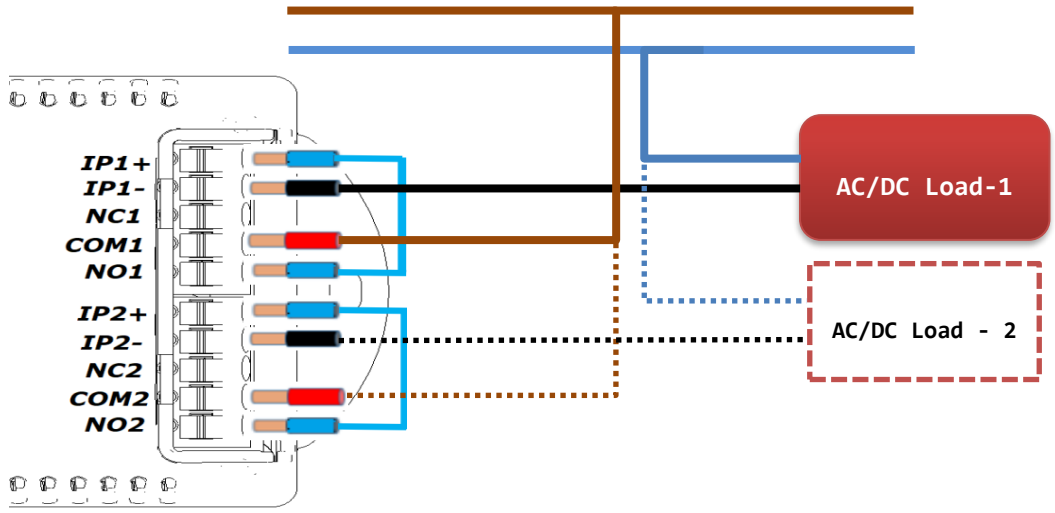


Figure 2 - 2CH Latching Relay Controller - Generic Switch Wiring Diagram with ISENSE

2.2.3 2CH Non-Latching Relay Controller

Figure 3 shows the wiring diagram for the NL relay controller channels. AC Live signal is connected to the COM terminal and the load is connected to the NO terminal. The NC terminal is left unconnected.

CAUTION

It should be noted that whenever COM-NC is closed, AC Live signal appears at the corresponding NC terminal. This applies to all the circuit configurations below.

Upon receiving an activation signal from the LDSBus Host controller, the relay breaks the COM-NC connection and makes the COM-NO position. AC Live current flows into the load (lamp or pump) which is turned on and begins to operate. When the host controller deactivates the relay or host controller is power off, the COM-NO circuit is broken, and the COM-NC circuit is made, and the load (lamp or pump) is turned off.

This opening and closing of the circuit make the relay operate as a SPST switch.

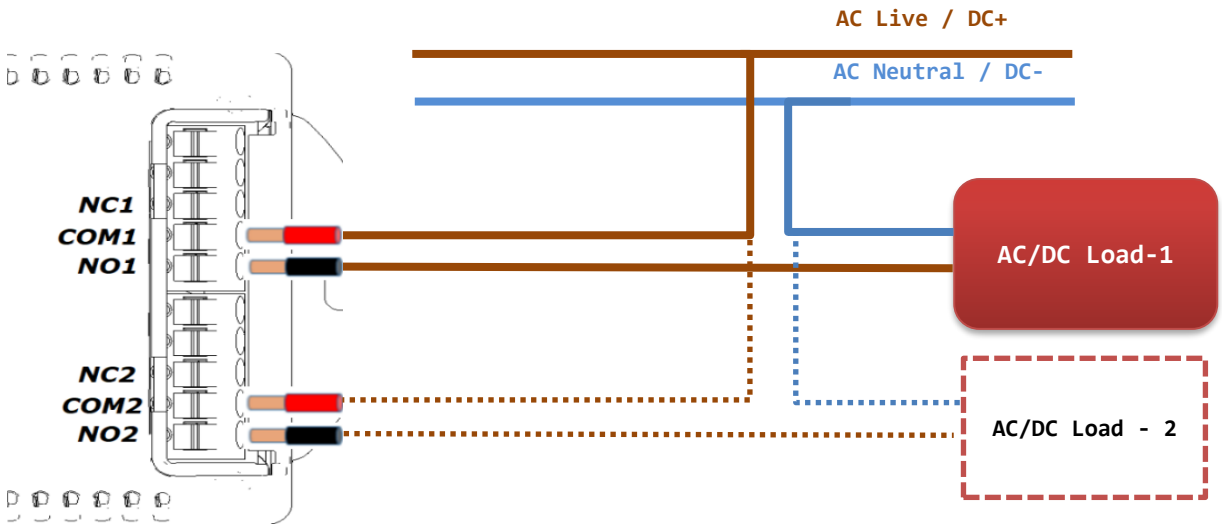


Figure 3 - 2CH Non-Latching Relay Controller - Generic Switch Wiring Diagram

2.2.4 2CH Non-Latching Relay Controller + ISENSE

Figure 4 shows the iSENSE version of the non-latching Relay Controller connected as a switch to measure the current flowing into the load. The current measurement circuit is connected in series with the load with the NO terminal connected to the IP+ terminal and the IP- terminal connected to the load. Now, when the load (lamp or pump) is turned on, the current passes through the IP+ and IP- terminals and the internal ammeter measures the current flowing in the circuit.

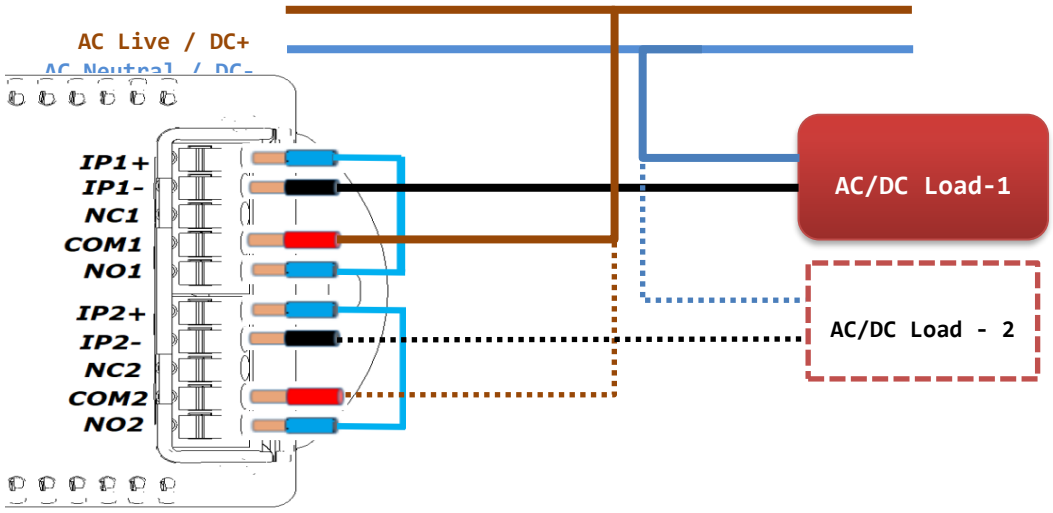


Figure 4 - 2CH Non-Latching Relay Controller - Generic Switch Wiring Diagram with ISENSE

2.3 3-wire or 4-wire AC/DC Motor using Latching Relay

Figure 5 shows the wiring diagram for a 3-wire AC/DC motor that can be switched on to rotate in the forward direction or reverse direction.

A 4-wire AC/DC motor has separate return (AC Neutral or DC-) signals instead of a common return. Both relay channels are used to control a single 3-wire motor. Channel 1 is used for the AC Live or DC+ signal control in SPST fashion and Channel 2 is used in SPDT fashion to route the AC Live or DC+ signal to the forward and reverse direction terminals of the motor.

When the device is powered on, COM1-NC1 and COM2-NC2 are closed (made) and COM1-NO1 and COM2-NO2 are opened (broken) and no current flows into the COM2 terminal. Whenever COM1-NO1 is opened, no current flows in the circuit and the motor stops.

For the motor to turn in the forward direction, COM2-NC2 must be first closed followed by closing COM1-NO1 and for the reverse direction, COM2-NO2 must be first closed followed by closing COM1-NO1. This sequence ensures the safe operation of the motor.

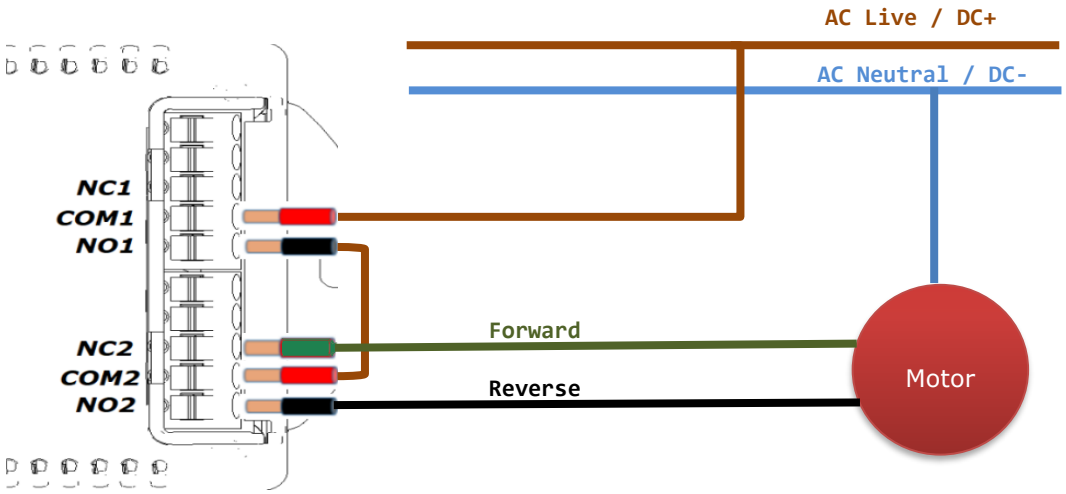


Figure 5 - Latching Relay - 3-Wire/4-Wire Bi-directional Motor Connection Diagram

2.4 3-wire or 4-wire AC/DC Motor using Non-Latching Relay

Figure 6 shows the wiring diagram for a 3-wire AC/DC motor that can be switched on to rotate in the forward direction or reverse direction.

A 4-wire AC/DC motor has separate return (AC Neutral or DC-) signals instead of a common return. Both NL relay channels are used to control a single 3-wire motor. Channel 1 is used for the AC Live or DC+ signal control in SPST fashion and Channel 2 is used in SPDT fashion to route the AC Live or DC+ signal to the forward and reverse direction terminals of the motor.

When the device is powered off or deactivated signal sent to NL relay, COM1-NC1 and COM2-NC2 are closed (made) and COM1-NO1 and COM2-NO2 are opened (broken) and no current flows into the COM2 terminal. Whenever COM1-NO1 is opened, no current flows in the circuit and the motor stops.

For the motor to turn in the forward direction, COM2-NC2 must be first closed followed by closing COM1-NO1 and for the reverse direction, COM2-NO2 must be first closed followed by closing COM1-NO1. This sequence ensures the safe operation of the motor.

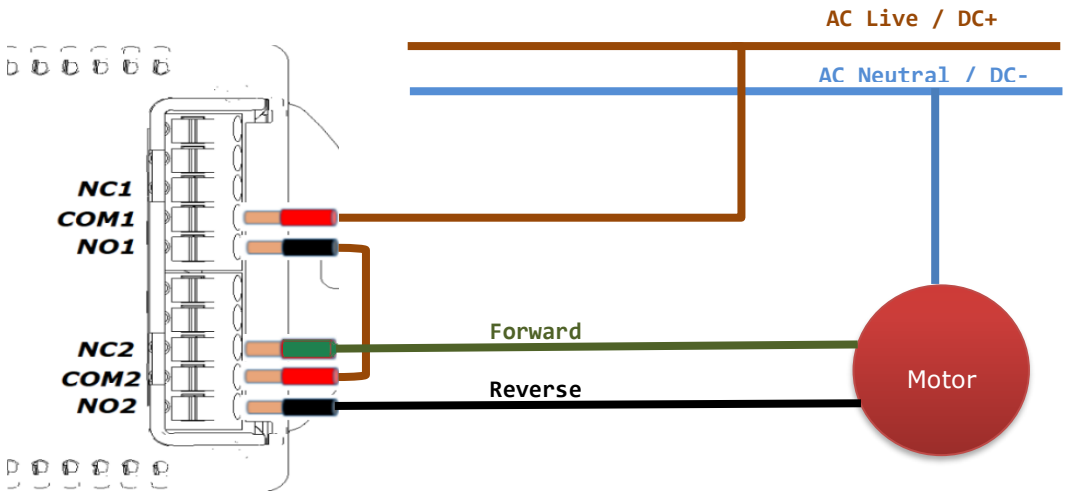


Figure 6 - Non-Latching Relay – 3-Wire/4-Wire Bi-directional Motor Connection Diagram

Note: The wire colors depicted in the connection diagrams are for illustrative purposes only. For the actual motor wiring, please refer to the motor specifications to determine the appropriate wire color codes for both power and direction control.

3 Inductive Loads

Relays connected to inductive loads, including motors, solenoids, transformers, or coils, are susceptible to transient voltage effects. The inductive nature of these loads can lead to large voltage spikes during switching and can potentially cause damage to the relays and downline circuit components. High transient voltages can cause relay contacts to weld together through arcing or cause pitting in the contacts and degrade the reliability and performance of the relay. To protect the relays and downline circuit components, a transient voltage suppressor is required.

Using a Metal Oxide Varistor (MOV) is a common and effective way to protect relays from transient voltage spikes. A MOV is usually applied across the relay contacts to suppress the transient voltage and dissipate excess power as heat.

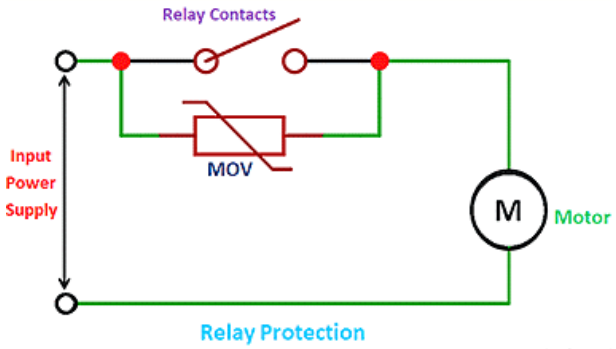


Figure 7 - Example application of a MOV across an inductive load

In the following diagram (Figure 8), a two-wire inductive motor load is connected to Channel 1. A Metal Oxide Varistor (MOV) has been added across the COM1 and NO1 terminals to suppress transient voltages that occur when switching the motor on and off. At initial conditions, the COM1-NO1 is not connected and no current flows in the circuit. The voltage across the MOV is zero and the MOV is non-conductive. When COM1-NO1 is closed, current begins to flow across COM1-NO1 and the inductance in the motor causes a large transient voltage to develop across COM1-NO1. When the transient voltage exceeds the MOV's rated voltage, the MOV becomes conductive, clamps the voltage, and dissipates the transient power as heat. Once steady state is achieved, the MOV returns to its non-conductive state. Similarly, when the circuit is opened, the inductance causes a reverse transient voltage spike and the MOV becomes conductive again and clamps the transient voltage.

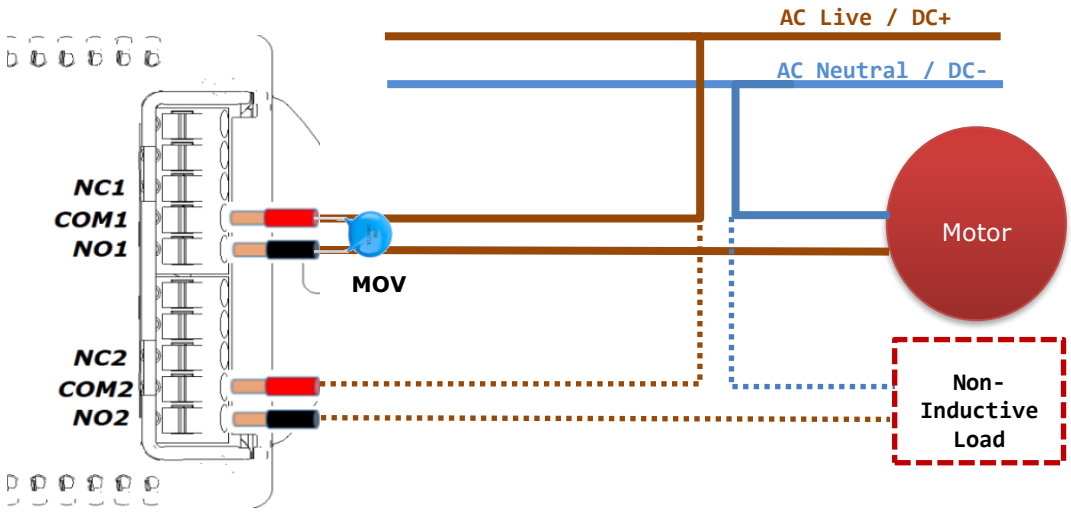


Figure 8 - Latching Relay Controller - Generic Switch Wiring Diagram for Inductive Load

In the following diagram (Figure 9), a two-wire inductive motor load is connected to Channel 1. A Metal Oxide Varistor (MOV) has been added across the COM1 and NO1 terminals to suppress transient voltages that occur when switching the motor on and off. At initial conditions, the COM1-NO1 is not connected and no current flows in the circuit. The voltage across the MOV is zero and the MOV is non-conductive. When COM1-NO1 is closed, current begins to flow across COM1-NO1 and the inductance in the motor causes a large transient voltage to develop across COM1-NO1. When the transient voltage exceeds the MOV's rated voltage, the MOV becomes conductive, clamps the voltage, and dissipates the transient power as heat. Once steady state is achieved, the MOV returns to its non-conductive state. Similarly, when the circuit is opened, the inductance causes a reverse transient voltage spike and the MOV becomes conductive again and clamps the transient voltage.

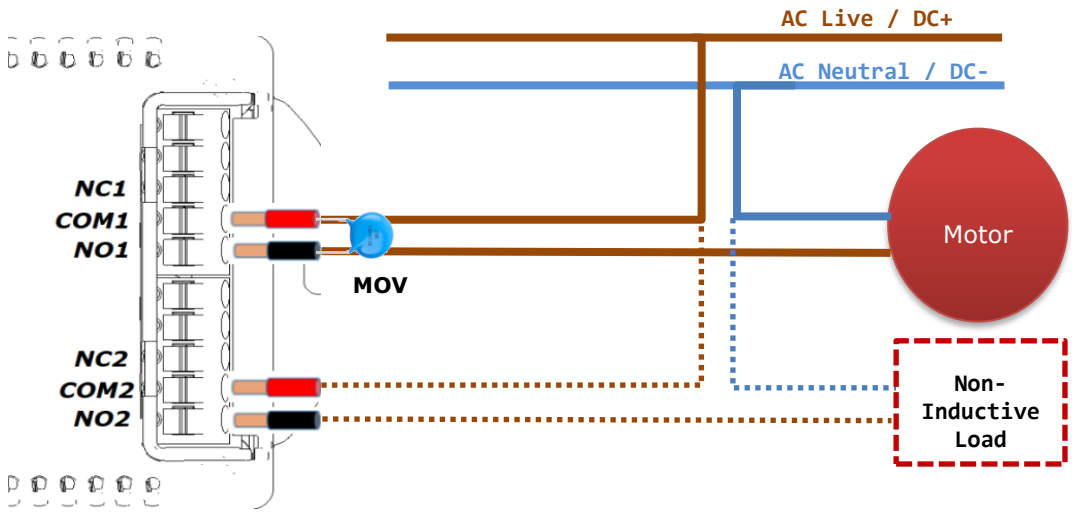


Figure 9 - NL Relay Controller - Generic Switch Wiring Diagram for Inductive Load

3.1 MOV Selection

In this section, we provide an example of how to select a Metal Oxide Varistor (MOV) for a 230V/1.5A AC induction motor application.

Given the following parameters –

Nominal Operating voltage: 230V AC

Operating current: 1.5A

Current rise time: 1ms

Step 1: Calculate the Maximum Continuous Operating Voltage (MCOV)

Peak voltage calculation:

V (Peak) = √2 x Nominal Operating Voltage
V (Peak) = √2 x 230 VAC
V (Peak) = 325 VAC

Adding a safety margin between 25% to 50% in the peak voltage.
Peak Voltage with Margin: 406~487 VAC

Maximum Continuous Operating Voltage (MCOV) should be at least higher than 406VAC with 487VAC being preferred.

Step 2: Calculate transient voltage

Transient Voltage, V(T) for the Induction AC motor is:

V(T)= L(dI/dt) ……. where L is the Inductance and dI/dt the rate of change of current.

Rate of change of current dI/dt calculation based on the load operating current (1.5A) and relay contact switching time (1mS).

dI/dt = (1.5A-0.0A)/0.001s

dI/dt = 1500 A/s

Given that L=1H and dI/dt are 1500 (Based on Operating current)

Transient Voltage V(T) = 1x1500
Transient Voltage V(T) = 1500V

Step 3: Calculate the Energy Rating(E)
The energy stored in the inductance and released during the transient event,

$E = ½ LI^2$

$E = 0.5 \times 1 \times 1.5^2$

E = 1.125 J

Look for an MOV that can absorb a lot of energy without getting damaged. Higher energy ratings mean better protection. Based on IEEE C62.41.2 industries standard, assume that the surge current to be 3000A under category B.

Adding a 50% margin and get 4500A surge current.

We have calculated all the information to select a MOV to protect our circuit.
For a 230V, 1.5A induction motor with 1H inductance:

The calculated transient voltage V(T) = 1500V.

The energy to be dissipated, E = 1.125J.

MCOV = 406~487 VAC

Peak Current Rating: 4500A

A suitable MOV would be the Bourns MOV-14D431K with the following specifications:

MCOV: 430V

Max. Clamping Voltage: 710V

Energy Rating: 100J

Peak Current Rating: 4500A

This MOV would be suitable for the application. However, we have made assumptions about the power factor and motor breakdown voltage. We have also added a liberal safety factor to the energy rating. It is important to always consult the specific motor's specifications for its surge withstand capability and consider the MOV's lifetime and the expected frequency of transients in the end application. For critical applications, consult with the MOV manufacturer and conduct laboratory tests to ensure the protection is adequate.

4 Device Configuration

4.1 LDSBus Devices

4.1.1 Device Settings

The Relay Controllers are factory configured for operation as generic switches and can be immediately used in an LDSBus setup. The factory defaults are:

1. LDSU ID = 126
2. Nickname = "LDSBus 2CH Relay", "LDSBus 2CH Relay + iSENSE", "LDSBus 2CH NL Relay" or "LDSBus 2CH NL Relay + iSENSE"
3. Termination = OFF
4. Application Type = None (Defaults to Generic Switch)

The LDSU ID is the address of the controller on the LDSBus and valid values are from 1 to 126. Care shall be taken to ensure that there are no duplicate IDs. The Nickname is a convenient feature to easily identify the device, especially when there is more than one relay on the bus. Change the Nickname to something meaningful, e.g., Nutrient Pump Controller. If this device is the last device on the bus, then its Termination must be set to ON, otherwise, it may be left as OFF. These factory defaults may be changed using the LDSBus Configuration Utility. Please refer to the LDSBus Configuration Utility Guide for more information. In the next section, we shall discuss the fourth parameter, Application Type.

4.1.2 Application Type

The Application Type parameter describes the application of the relay controller. The 2 main applications for a relay controller are as a "generic switch" or as a "motor controller". When an LDSBus Host reads the Application Type parameter, the host loads the appropriate driver software to operate the relays.

4.1.2.1 Generic Switch

A generic switch is an electrical switch that can open or close a circuit. An example of a generic switch is a light switch or toggle switch.

When the Application Type is set to *"None"* or *"Generic DOUT"*, it defaults to a generic switch.

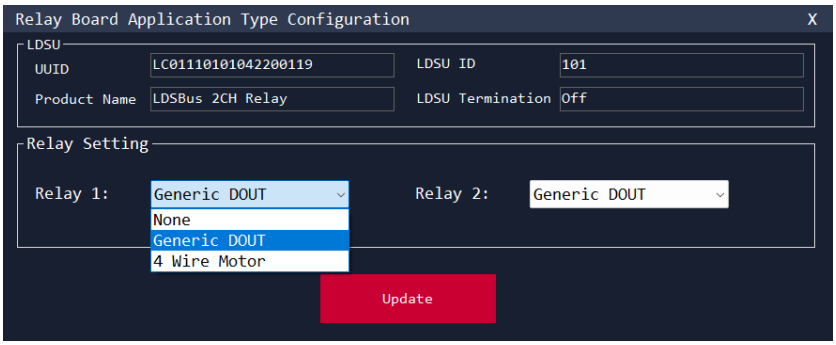


Figure 10 - Application Type Configuration for Latching Relay – Generic Switch

4.1.2.2 4 Wire Motor

In application type, 4 Wire Motor is used to control a 3-Wire/4-Wire Motor. An example of a 3-Wire /4-Wire Motor is an automated motorized curtain.

Figure 11 shows the Application Type selection for latching relay.

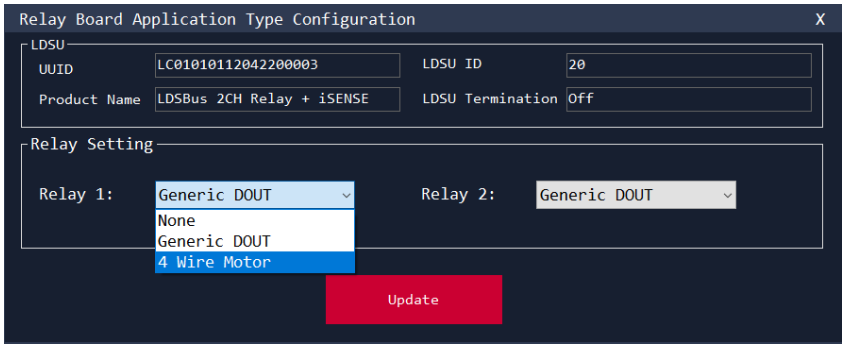


Figure 11 - Application Type Configuration for Latching Relay – Motor Controller

If a curtain is being controlled via a 4 wire motor, the settings can be configured to determine which relay (Relay 1 or 2) is responsible for power and direction (forward/reverse). Click **[Update]**.

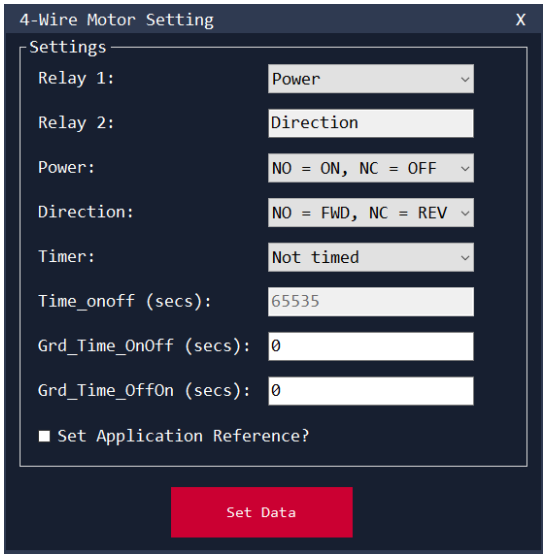


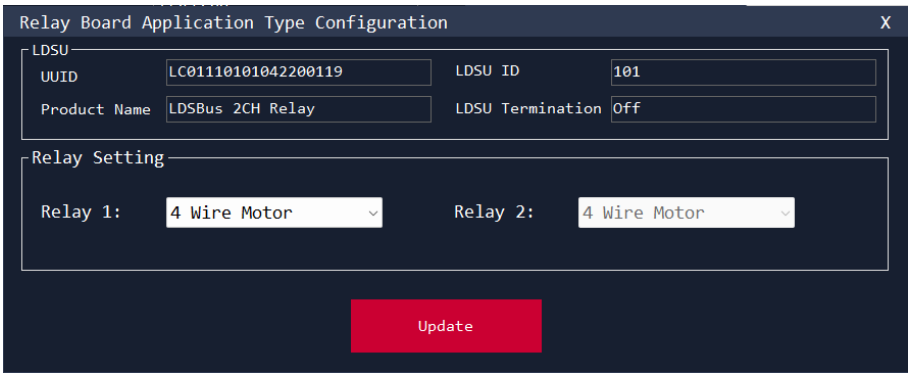
Figure 12 - 4-Wire Motor Settings

Figure 12 illustrates the user interface for configuring a **4-Wire Motor Setting** in an application. The main configuration window, labelled "4-Wire Motor Setting," contains a series of dropdowns and input fields allowing the user to set:

- **Function Mapping of Relay 1 and Relay 2:**
  - Relay 1 and Relay 2 - designed to work in coordination to manage Power and Direction control. The functional assignment is determined solely by the configuration of Relay 1:
    - If Relay 1 is configured for Power Control, then Relay 2 is automatically assigned to Direction Control.
    - If Relay 1 is configured for Direction Control, then Relay 2 will function as the Power Control relay.

- **Relay Power Control Options:**
  - The relay supports two options for controlling power using its **COMM**, **NO** (Normally Open), and **NC** (Normally Closed) terminals:
    - **NO = ON, NC = OFF (Default Mode):**
      - **Power ON** = Relay connects **COMM–NO**
      - **Power OFF** = Relay connects **COMM–NC**
    - **NO = OFF, NC = ON (Inverted Mode):**
      - **Power ON** = Relay connects **COMM–NC**
      - **Power OFF** = Relay connects **COMM–NO**
- **Direction Control Options**:
  - The relay supports two options for controlling direction using its COMM, NO (Normally Open), and NC (Normally Closed) terminals:
    - **NO = FWD, NC = REV** (Default Mode):
      - Forward (FWD) = Relay connects **COMM–NO**
      - Reverse (REV) = Relay connects COMM–NC
    - **NO = REV, NC = FWD (Inverted Mode):**
      - Forward (FWD) = Relay connects COMM–NC
      - Reverse (REV) = Relay connects COMM–NO
- **Timer Mode Functionality:**
  - The relay supports a Timer Mode to control how On/Off actions behave within a set time period.
    - If the Timer Option is set to Timed, the relay will follow the configured Time_OnOff duration.
    - During this period, any manual or external On/Off commands will be ignored.
    - Once the Time_OnOff period has completed, the relay can accept new On/Off actions again.
- **Time ON-OFF (secs)**
  - The Time_OnOff setting defines the duration (in seconds) for the timed operation mode.
  - Can be set anywhere from 0 to 65,535 seconds.
- **Guard Time ON-OFF (secs):**
  - The Guard Time ON to OFF option sets a mandatory waiting period after the relay turns ON before it can be switched OFF again.
  - During this guard time, any OFF commands will be ignored to prevent rapid toggling.
  - This ensures safe and stable operation by enforcing a minimum ON duration before turning OFF.
- **Guard Time OFF-ON (secs)**, both set to 0.
  - The Guard Time OFF to ON option sets a required delay after the relay turns OFF before it can be turned ON again.
  - Any ON commands received during this guard period will be ignored.
  - This helps prevent fast reactivation and ensures the system remains idle for a safe duration before powering back ON.

Set Application Reference is reserved for PanL Smart Living Applications.
Confirm the settings by clicking on [**Set Data**].



While configuring for a 3/4-Wire Motor application type, both channels will be utilized.

4.2 Modbus Devices

The Modbus configuration defines communication settings such as device address, termination, LED status, baud rate, and parity. These parameters must match the Modbus network setup to ensure proper communication. Termination should be enabled only for the last device on the bus. For more information refer Modbus Configuration Utility.

Application type is not applicable for Modbus devices.

5 Host Integration

The 2CH Relay controllers work with any LDSBus Host. The following devices incorporate an LDSBus Host:

- IoTPortal
- PanL Smart Living (PSL) Hubs
- LDSBus SDKs
- Modbus RTU

5.1 IoTPortal

LDSBus 2CH Relay Latching/Non-Latching Controllers are supported in the IoTPortal. To add the LDSBus 2CH Relay Controllers and its variants, follow the instructions in the IoTPortal User Guides.

The following illustration uses the Portal Web Application interface to view a connected relay controller. The same actions can also be performed using the IoTPortal mobile applications.

In the below example, the LDSBus 2CH NL Relay is connected to LDSBus Port 1. Ensure that the LDSBus 2CH NL Relay is reachable.

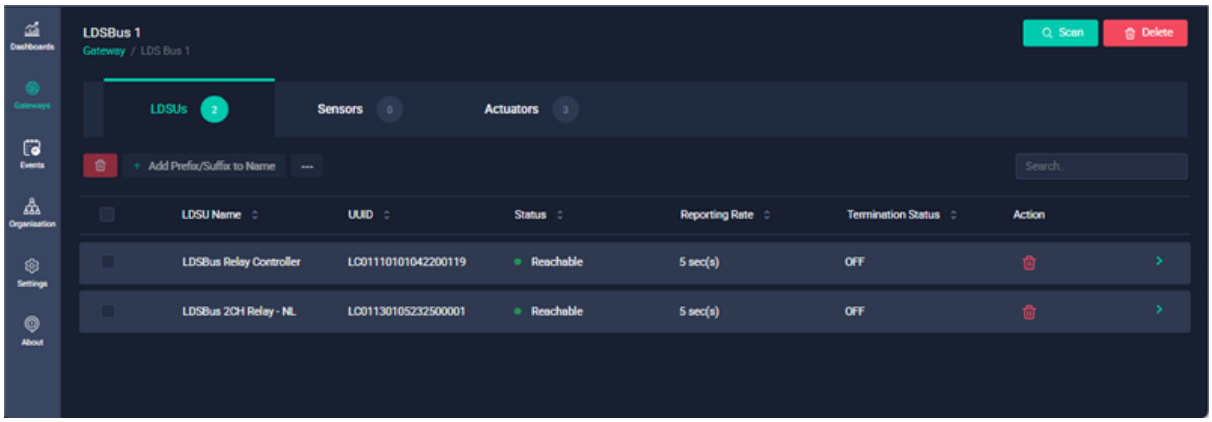


Figure 13 - LDSU List

The actuator's list can be viewed by clicking the **Actuators** tab. Relay Channel 1 and Relay Channel 2 along with the application type will be listed.

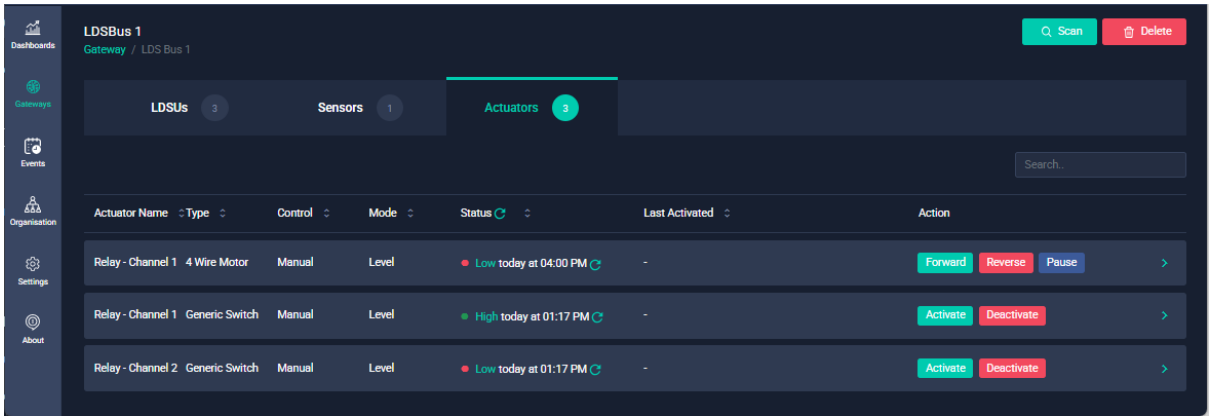
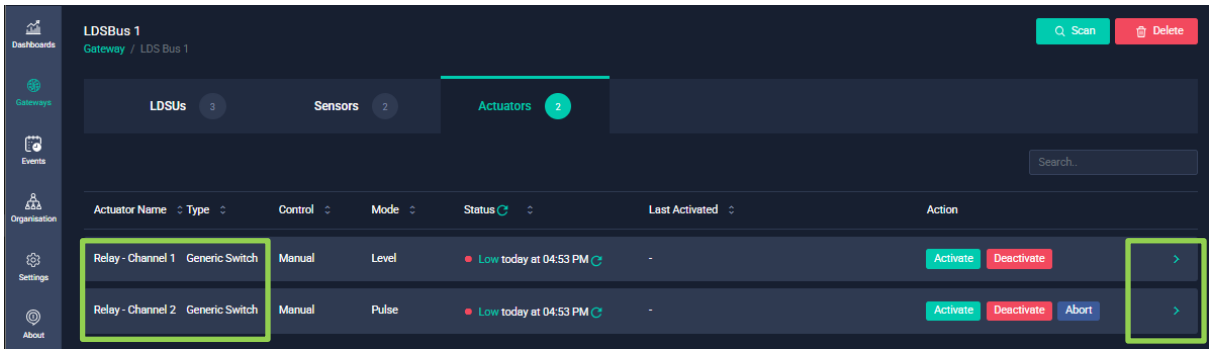


Figure 14 - Actuators List

5.1.1 Generic Switch

For illustration purpose, Relay-Channel 1 with Application Type – *"Generic Switch"* is used.

Click on Actuator Name (i.e. Relay-Channel 1) or **>** to access the Relay-Channel 1 configuration interface.



The Configuration interface is displayed.

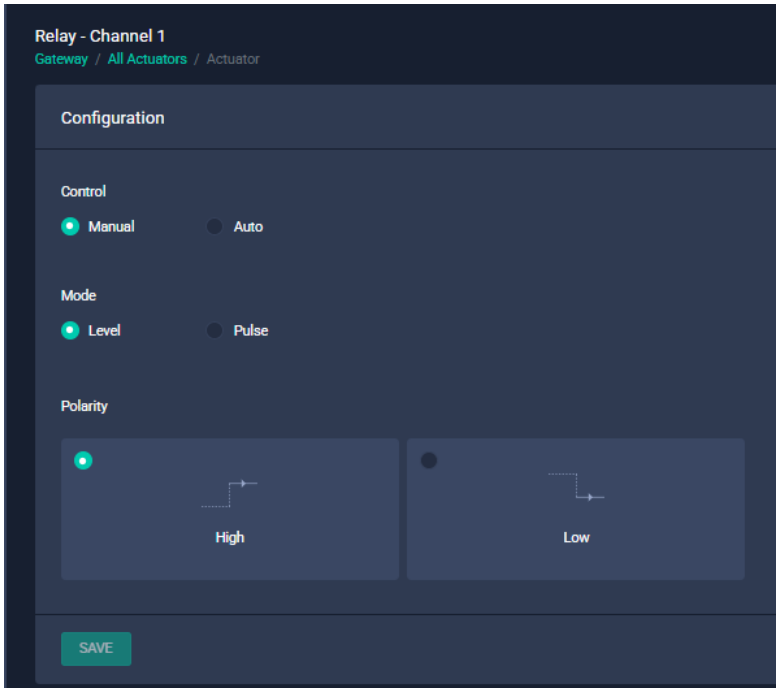


Figure 15 - LDSBus Relay Channel Configuration – Level Mode

There are two types of **Control**, namely "Manual" and "Auto".

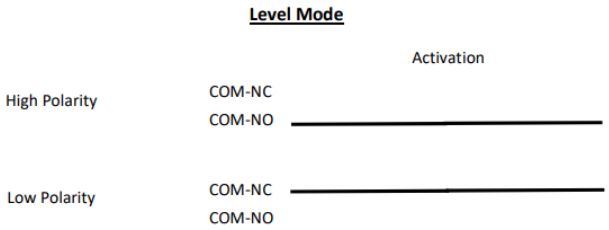
Manual: This mode allows user to activate and deactivate relay channels manually.

Auto: This mode operates autonomously, with the system managing the activation and deactivation of the relay channel automatically. In this mode, predefined events or conditions determine when the relay channel is activated or deactivated. These events could include specific times of the day, environmental triggers, or inputs from other systems. The system executes these actions based on programmed instructions without requiring manual intervention, enabling automated operation, and reducing the need for constant oversight.

There are two types of **Mode**, namely "Level" Mode and "Pulse" Mode.

Level Mode: In Level mode, the functionality operates similarly to a standard switch mode commonly found in various electronic devices. Once a channel is activated, meaning the relay is turned on, it remains in that state until the user manually intervenes to deactivate it. This mode provides a straightforward and intuitive way of controlling the relay, offering stability and consistency in maintaining the relay's state until a deliberate action is taken by the user to change it.

Polarity *(High or Low)*



High: In the High (default) configuration, the relay operates with the channel contact closed between the Common (COM) and Normally Open (NO) terminals for activation. Upon deactivation, the channel contact switches to close between the Common (COM) and Normally Closed (NC) terminals.

Low: In the Low configuration, the relay operates in the opposite manner compared to the High configuration. Upon activation, the channel contact closes between the Common (COM) and Normally Closed (NC) terminals. Then, upon deactivation, the channel contact switches to close between the Common (COM) and Normally Open (NO) terminals. These two configurations provide flexibility in adapting the relay to different load connection requirements, ensuring compatibility with a wide range of applications and allowing users to select the configuration that best suits their specific needs.

Pulse Mode: In pulse mode, the functionality mirrors that of automatic doors. Upon activation, the channel remains active for a predefined period, denoted as T1. During this time, the relay maintains its active state, allowing the load to be powered or controlled as required. This duration typically corresponds to the time required to perform a specific task or operation associated with the load. Following the completion of the T1 period, the channel automatically deactivates. The duration of this inactive period is denoted as T2 and is adjustable based on the application requirements.

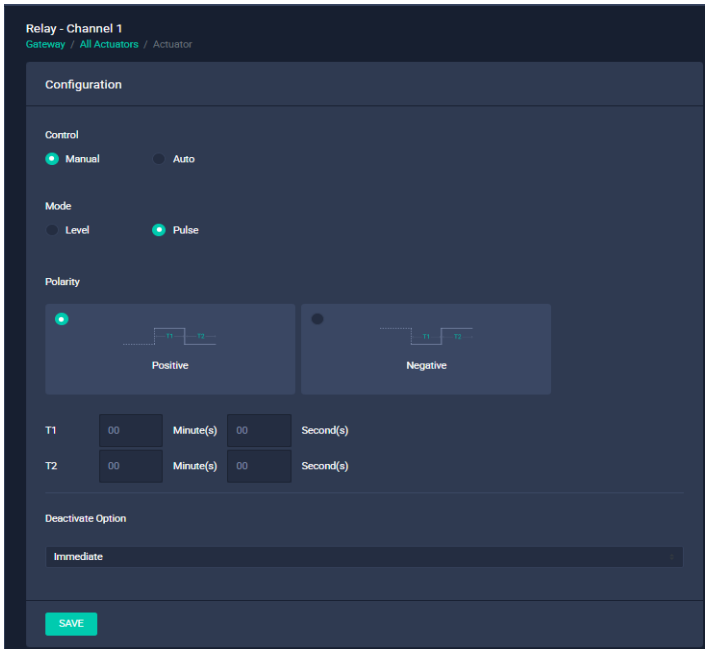
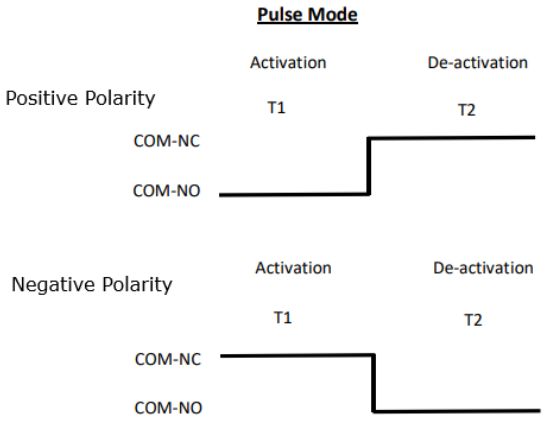


Figure 16 - LDSBus Relay Channel Configuration – Pulse Mode

Polarity *(Positive or Negative)* - Indicates whether COM-NO or COM-NC contacts are closed upon activation and opened upon deactivation.



Positive: When Polarity is Positive, activation closes COM-NO contacts and deactivation opens COM-NO contacts.

Negative: When Polarity is negative, activation opens COM-NO contacts and deactivation closes COM-NO contacts. Note that when COM-NO contacts open, COM-NC contacts are closed and vice versa.

If the selected mode is Pulse mode, then Pulse Phase needs to be added in the T1, T2 fields.

T1 and T2 indicate the first and second phase of the pulse, respectively. T1 and T2 duration must be greater than 0 seconds and (T1 + T2) duration must not exceed 1 hour.

Deactivation Mode: Deactivation mode is available only for Pulse mode. The following three distinct options are available for deactivation mode.

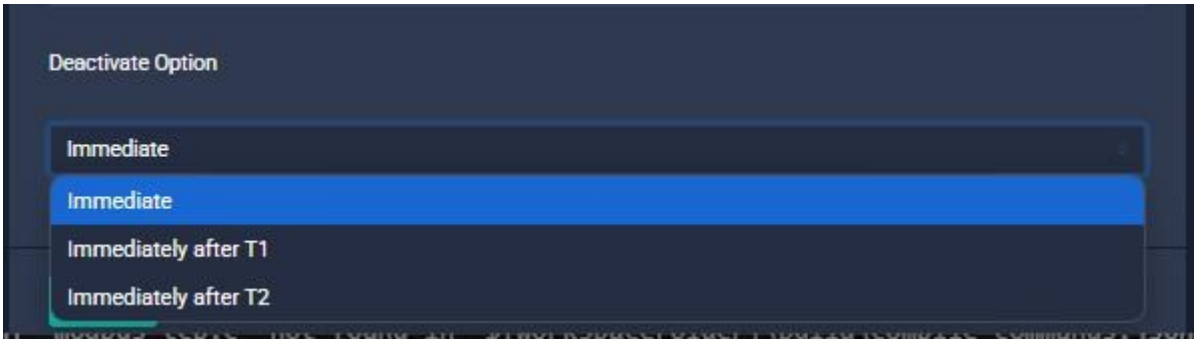


Figure 17 - LDSBus Relay Channel Configuration – Deactivate Options

- *Immediate:* When this option is selected, the channel is instantly deactivated without any delay.
- *Immediate after T1:* When this option is selected the channel returns to deactivated state after completing the T1 cycle.
- *Immediate after T2:* When this option is selected, the channel returns to deactivated state after completing the T1 and T2 cycle.

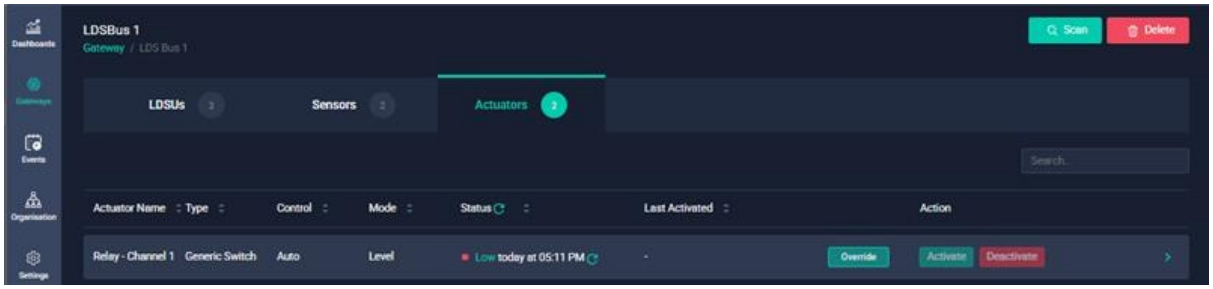
Activate/Deactivate/Abort functions

Click [Activate] to trigger the actuator into active state.

Click [Deactivate] to trigger the actuator into inactive state.

Click [Abort] to cancel the current operation and return the actuator into inactive state immediately. Note that the Abort action can be performed only for Pulse Mode.

Override action

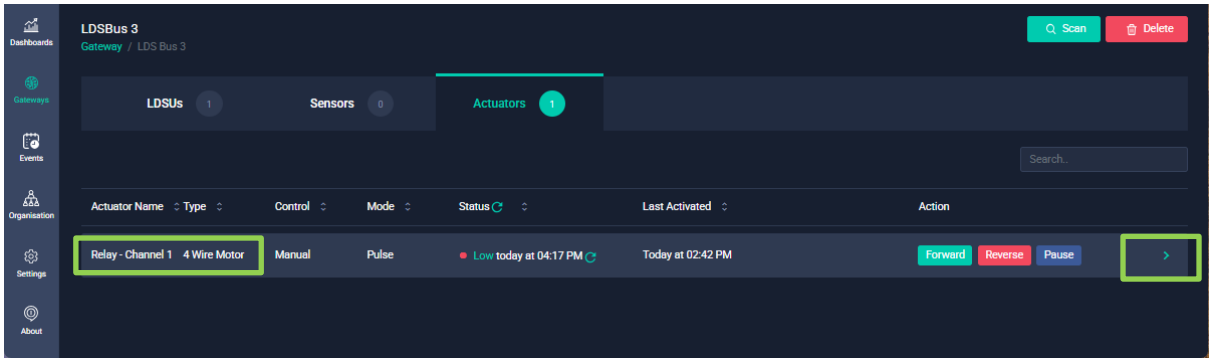


When Relay channel is in "Auto" mode, the Activate and Deactivate functions are disabled and the Override function is enabled. Click [Override] to exit the "Auto" mode.

5.1.2 4 Wire Motor

For illustration purpose, Relay-Channel 1 with Application Type – *"4 Wire Motor"* is used.

Click on Actuator Name (i.e. Relay-Channel 1) or **>** to access the Relay-Channel 1 configuration interface.



The Configuration interface is displayed.

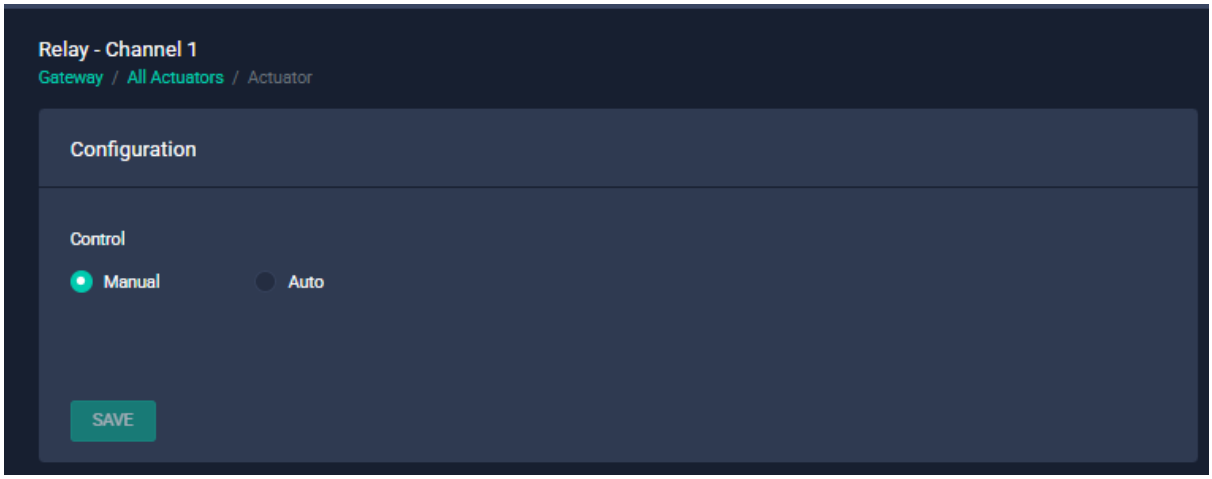


Figure 18 - LDSBus Relay Channel Configuration

There are two types of **Control**, namely "Manual" and "Auto".

Manual: This mode allows user to manually Forward, Reverse and Pause the 4 Wire Motor.

Auto: This mode operates autonomously, with the system managing the Forward, Reverse and Pause actions for the 4 Wire Motor automatically. In this mode, predefined events or conditions determine when the 4 Wire Motor wire is forwarded, reversed or paused. These events could include specific times of the day, environmental triggers, or inputs from other systems. The system executes these actions based on programmed instructions without requiring manual intervention, enabling automated operation, and reducing the need for constant oversight.

Forward/Reverse/Pause functions

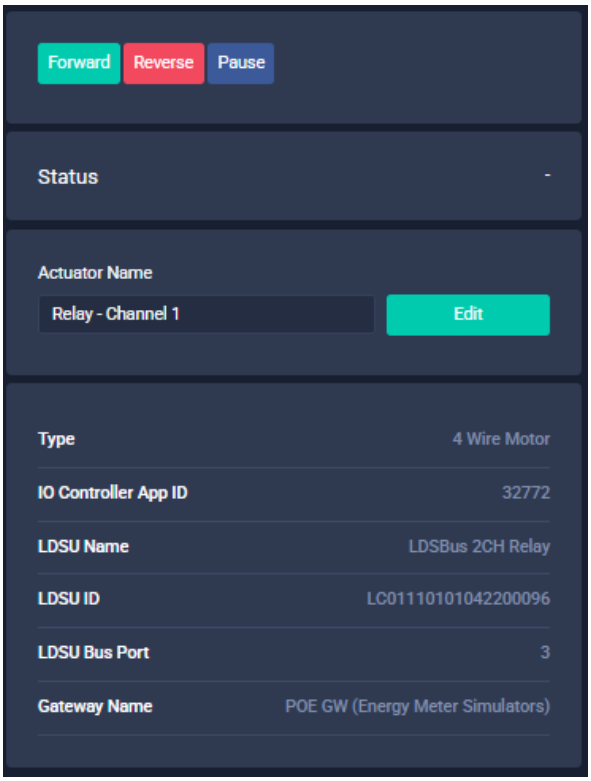


Figure 19 - Forward/Reverse/Pause Functions

Click **[Forward]** to run the 4 Wire Motor in forward direction.

Click **[Reverse]** to reverse the 4 Wire Motor direction.

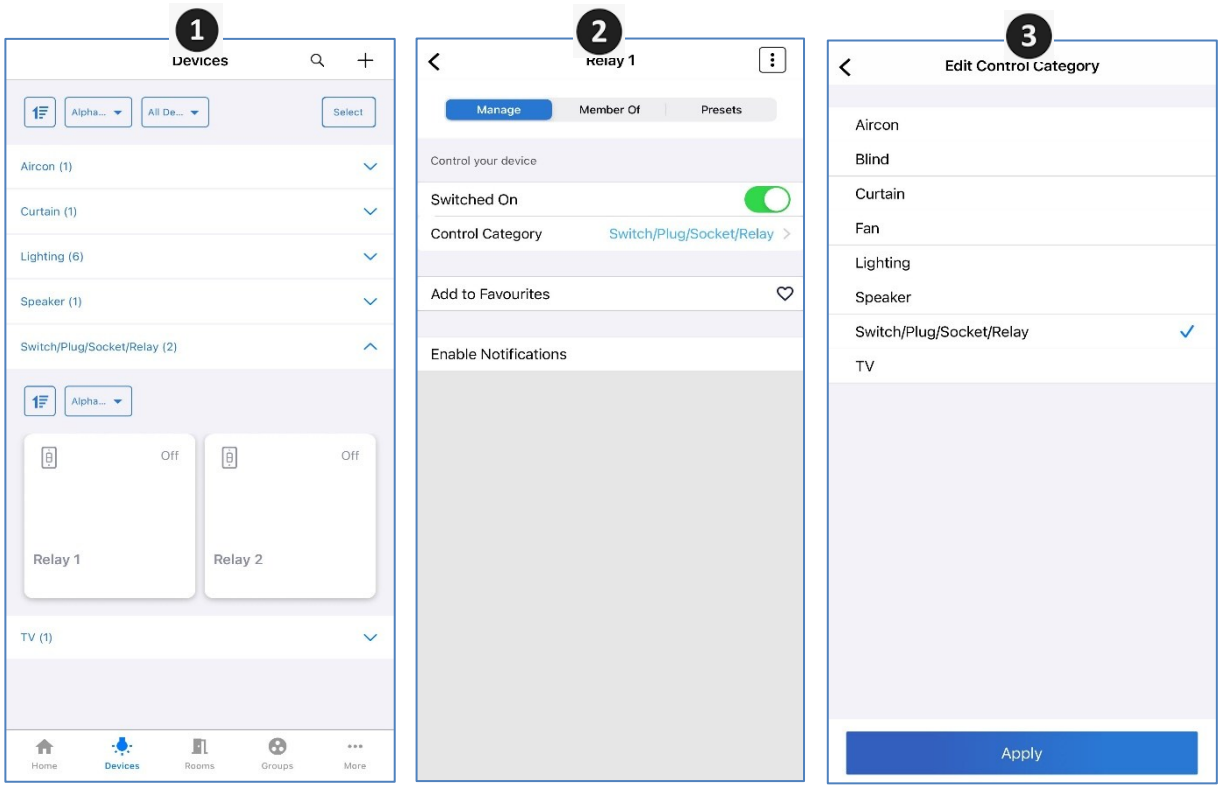
Click **[Pause]** to stop the 4 Wire Motor.

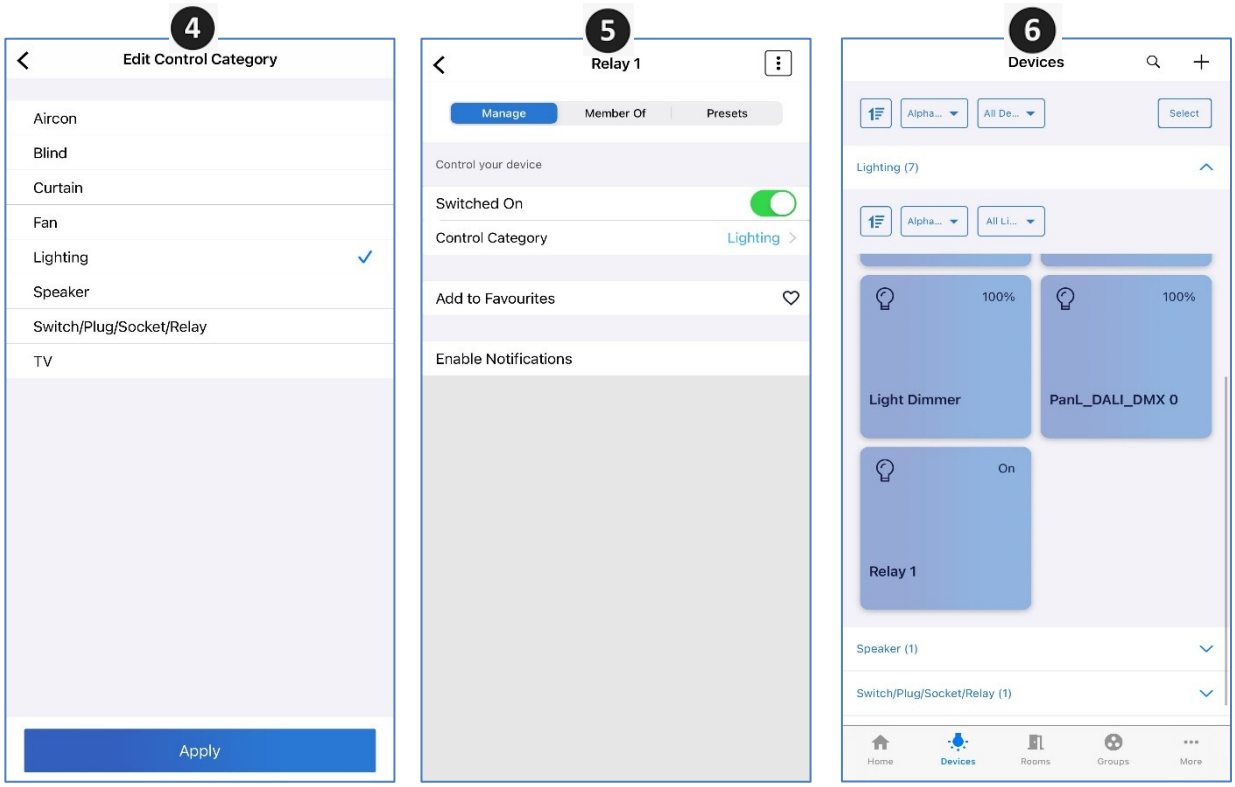
5.2 PanL Smart Living

PanL Smart Living (PSL) is designed as an all-encompassing platform to replace multiple standalone smart solutions, enabling easy access to many benefits of living the smart way in today's living spaces whether it's in a home, hotel or in an office building. For more information [Start Here - PanL Smart Living (brtsys.com).]

In the PanL Smart Living system, the LDSBus 2CH Latching/Non-Latching Relay controllers can be used as a generic switch to switch on and off non-dimmable lighting or appliances and as a motor controller to control motorized curtains, blinds, and shades. The Application Type parameter must be chosen corresponding to the above applications.

When configured as a generic switch, the two channels are discovered as 2 separate switches and the PSL mobile applications provide on/off control of the switches. Below images show how to configure a relay to control a light device.





To configure and control devices –

1. Once the relay device is successfully discovered in the PSL app, press and hold the relay device (i.e. tap for 3 or more seconds) to open the device page.

2. Tap on [**Control Category**] under *Manage Tab*.

3. Default Control Category is set to Switch/Plug/Socket/Relay

4. Tap on **[Lighting]** to control a light. To confirm click **[Apply]**.

5. Control category is updated to Lighting.

6. Users can now use the relay device to control a light. It will be displayed under the light device category. Step 3, 4 and 5 are optional, but it would be intuitive for example to look at lights in the lighting category instead of Switch/Plug/Socket/Relay category.

When configured as a motor controller, the PSL system discovers the relay as curtain or blind device to reflect the real-world object. PSL mobile applications provide open, close, and stop control as shown in Figure 20.

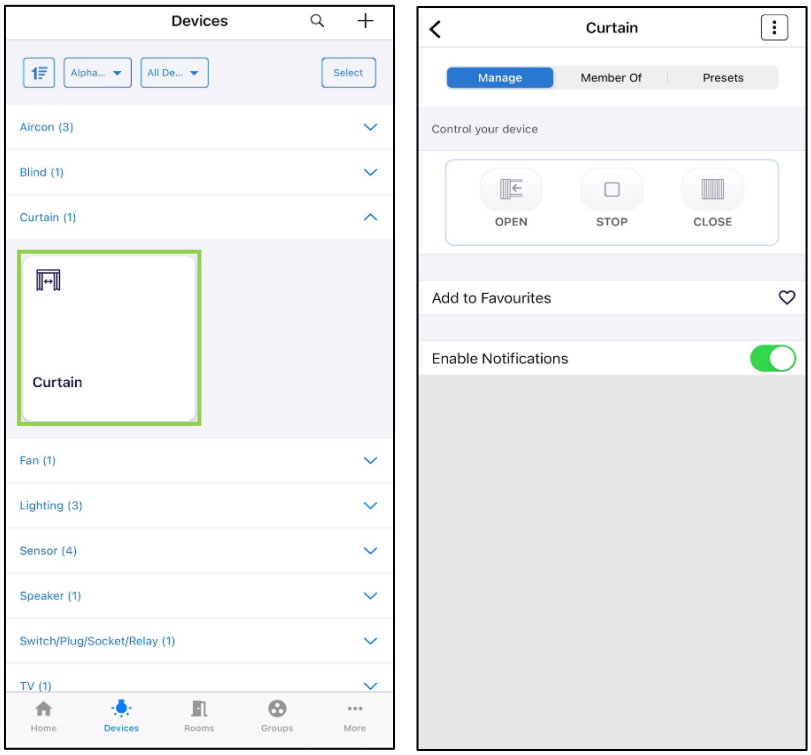


Figure 20 - Curtain Control using Long Tap

For more details, refer to the PanL Smart Living User Guides.

5.3 LDSBus SDK

The LDSBus SDKs (Python & .NET) provide software libraries for use in a variety of host operating systems (Microsoft Windows, Linux, Raspberry Pi 3/4/5 and Raspberry Pi2040). Further, the Python version of the SDK is also available, as Circuit Python library on the Bridgetek series of display panels (IDM2040-7A and IDM2040-43a). Built for customized and standalone development, the LDSBus SDKs come with several sample applications that demonstrate communication and control of LDSBus sensors and actuators. An LDSBus USB Adapter provides the physical connection between the host operating system (Microsoft Windows, Linux, Raspberry Pi 3/4/5) and the LDSBus, while the IDM2040 comes built-in with an LDSBus port.

Using the SDKs, the developer has a choice to rely on the Application Type parameter retrieved from the device or ignore it and operate the channels in unison or individually in combinations of SPDT or SPST operations.

5.4 Modbus RTU

The 2CH Relay variants are compatible with RS485 serial networks using the Modbus RTU protocol. The Modbus Configuration Utility is used to configure the device. There are two modes of operation for each relay channel, namely **Leve**l and **Pulse**.

Figure 21 - Modbus Configuration Utility Interface

As an illustration of these modes, Relay Channel 1 and Relay Channel 2 will be configured as Level and Pulse, respectively.

Relay Channel 1: Level Mode Configuration

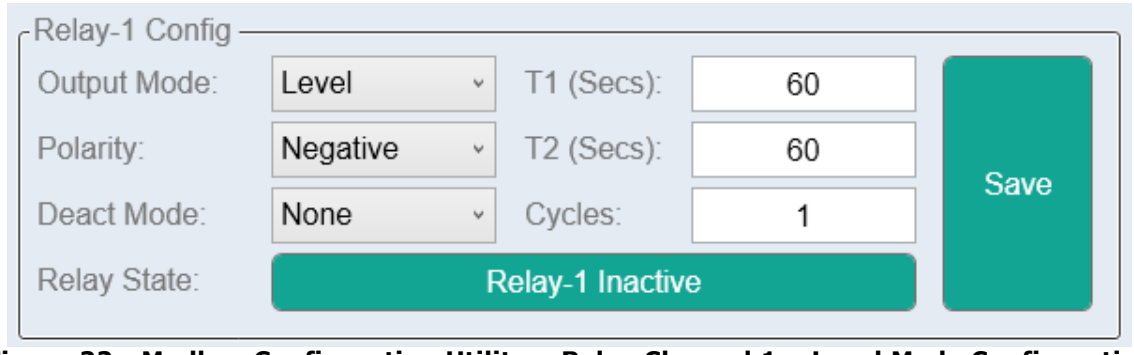


Figure 22 - Modbus Configuration Utility – Relay Channel 1 – Level Mode Configuration

Output Mode: Level mode. In this mode, the relay makes a single transition.

Polarity: Negative/Positive are selectable. When Polarity is Positive, activation closes COM-NO contacts and deactivation opens COM-NO contacts. When Polarity is negative, activation opens COM-NO contacts and deactivation closes COM-NO contacts. Note that when COM-NO contacts open, COM-NC contacts are closed and vice versa.

Deactivate Mode: Not applicable in Level mode.

T1 (Secs): Not applicable in Level mode.

T2 (Secs): Not applicable in Level mode.

Cycles: Not applicable in Level mode.

Click **[Save]** to save the relay channel configuration.

Click **[Relay State]** to Activate and/or deactivate the relay level mode operation.

Relay Channel 2: Pulse Mode Configuration

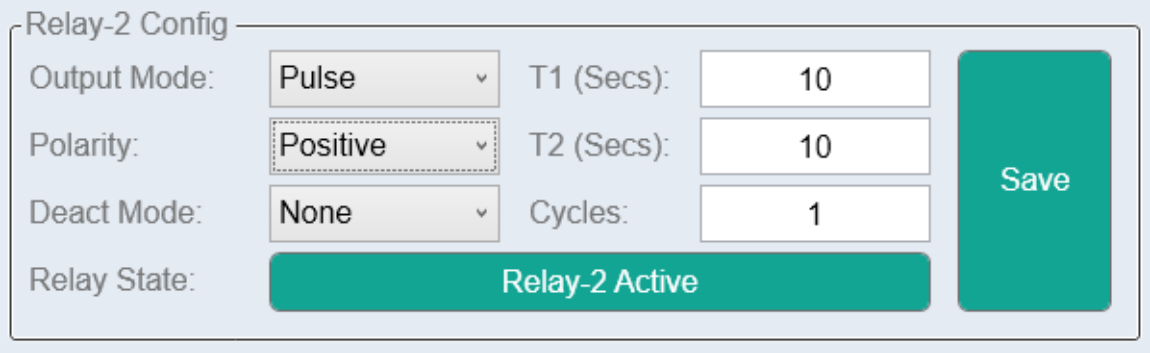


Figure 23 - Modbus Configuration Utility – Relay Channel 2 – Pulse Mode Configuration

Output Mode: Pulse mode. In this mode, the relay makes two transitions separated by timing parameters, T1 and T2.

Polarity: Negative / Positive are selectable. When Polarity is Positive, activation closes COM-NO contacts and deactivation opens COM-NO contacts. When Polarity is negative, activation opens COM-NO contacts and deactivation closes COM-NO contacts. Note that when COM-NO contacts open, COM-NC contacts are closed and vice versa.

Deactivate Mode: None/Immediate/T1/T2 are selectable. During relay operation, if Relay State button is clicked, Deactivate Mode option has the following effect:

None option: Deactivation option is not applicable

Immediate option: Deactivation occurs immediately

T1 option: Deactivation occurs after T1 transition

T2 option: Deactivation occurs after T2 transition

T1 (Secs): T1 specifies the duration of activation time in seconds.

T2 (Secs): T2 specifies the duration of deactivation time in seconds.

Cycles: Count of T1/T2 transition pairs. In Pulse mode, specify Cycles as 1.

Click **[SAVE]** to save the relay channel configuration.

Click **[Relay State]** to Activate and/or deactivate the relay pulse mode operation.

6 Contact Information

Refer to https://brtsys.com/contact-us/ for contact information.

Appendix A – References

Document References

LDSBus Configuration Utility Guide

Modbus Configuration Utility Guide

IoTPortal User Guides

- Introduction
- Portal Web Application (WMC)
- Android Mobile Application
- iOS Mobile Application

PanL Smart Living User Guides

LDSBus 2CH Relay & 2CH Relay + iSENSE Datasheet

LDSBus 2CH NL Relay & 2CH NL Relay + iSENSE Datasheet

LDSBus Python SDK V3.1.0 Guide

LDSBus .Net SDK V3.0.0 Guide

Acronyms and Abbreviations

Terms	Description
AC	Alternating Current
DC	Direct Current
MOV	Metal Oxide Varistor
MCOV	Maximum Continuous Operating Voltage
LDSU	Long Distance Sensor Unit
LDSBus	Long Distance Sensor Bus
SDK	Software Development Kit
SPDT	Single Pole Double Throw
SPST	Single Pole Single Throw
NL	Non-latching
RTU	Remote Terminal Unit

Appendix B – List of Tables & Figures

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Appendix C – Revision History

Document Title: BRTSYS_AN_077 Relay Controller
Document Reference No.: BRTSYS_000162
Clearance No.: BRTSYS#125
Product Page: https://brtsys.com/product-category/actuators/
Document Feedback: Send Feedback

Revision	Changes	Date
1.0	Initial Release	01-08-2025