MARWAY
POWER SOLUTIONS

RCM Technical Note — Custom EPO Wiring Schemes

Custom Field Wiring of Marway's PDU EPO Connectors with Optima RCM Networked PDUs when Not Using one of Marway's Commander UCP Panels

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Table of Contents

Introduction

This document describes how the Remote Panel Control System (a.k.a EPO system) in Marway Optima power distribution units (PDU) can be wired using buttons provided by the end user.

The remote panel connector (a.k.a. EPO connector) has been designed primarily to interface with Marway's Commander UCP Remote Control Panels. There are two models that provide the option to utilize either a simple two-button solution, or a full-featured solution with On, Off, Reset, EPO, audio alarm, and more.

However, for those preferring to create their own circuits, or needing to adapt to existing circuits, the PDU wiring for the remote panel connector is designed for external dry contact interfaces. This allows for customized external wiring. This document addresses using only buttons to fulfill the remote On/Off and EPO functionality. More complex circuits can offer additional features emulating the full features available on the Commander, but that's beyond the scope of this document.

The remote panel control system evolved to allow for a variety of configurations regarding normally open vs. normally closed, and maintained vs. momentary signals. While this document explains multiple configurations, some of these configurations come from legacy requirements.

Applicable Models

Marway has a wide variety of models which share the Optima™ product brand and the Optima RCM™ networking hardware and software. These models can be categorized into two groups:

- Standard models, which are pre-designed and listed in Marway's Standard Products Catalog (these will have part numbers beginning with MPD 820, 833).
- Custom models, which are either modified versions of standard models, or completely unique designs for specific customers, but which have the Optima RCM networking hardware and software. Model numbers start with MPD, but then have a variety of possible numbers.

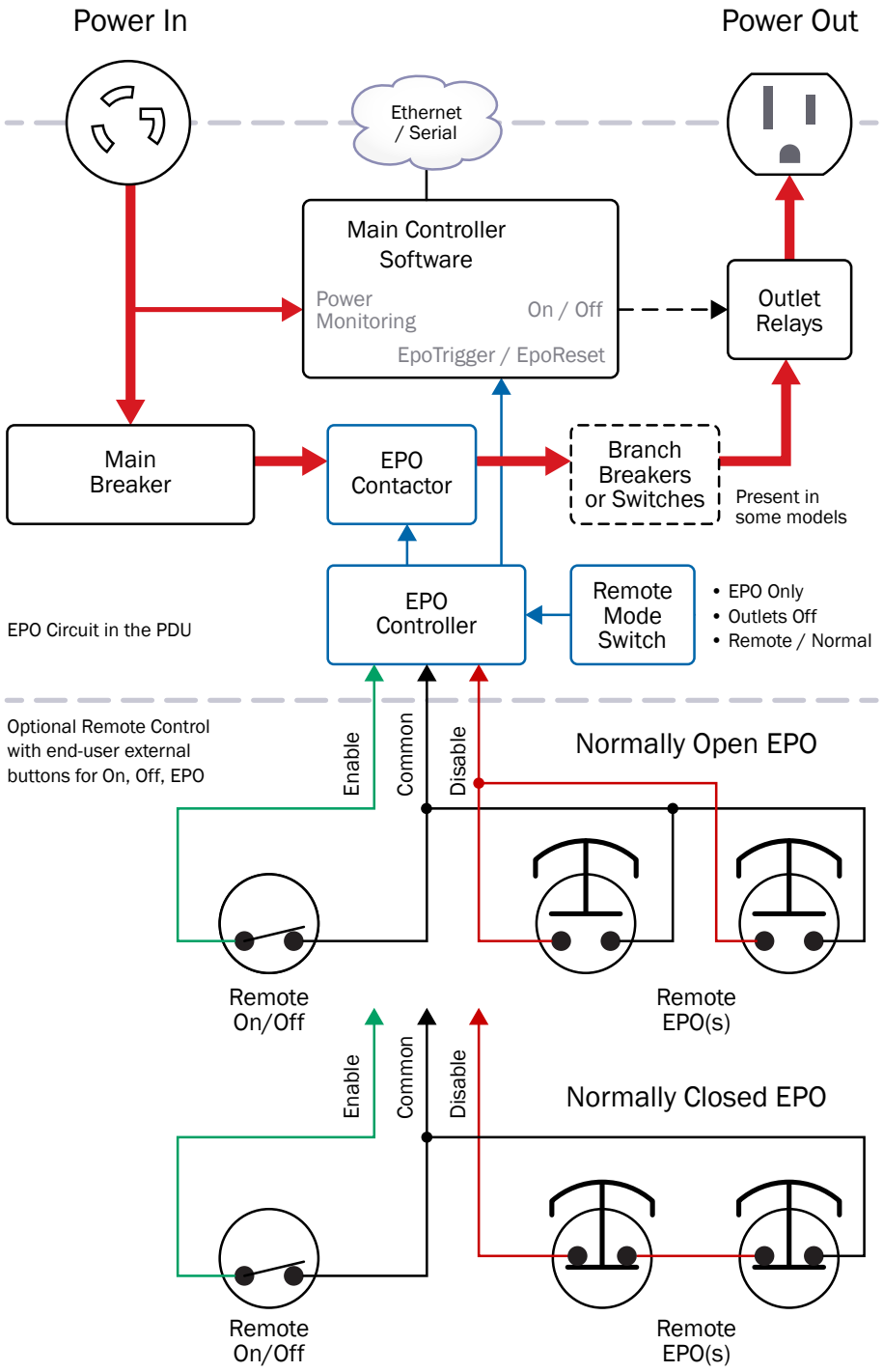
This document applies to all Marway Optima PDU products with the RCM networked control system whether standard or custom.

Operating With and Without Networking

The most common use of an Optima RCM PDU involves operating the product while connected to a network, and using one of the software interfaces (web browser, command line, RESTful API, or SNMP) to monitor power and manage outlet control. However, there are scenarios where end users may be using the PDU not connected to a network. This affects some considerations for the EPO circuit, and software configuration options which are addressed in this document as well.

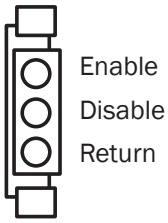
Block Diagram

Use this diagram as a companion for the descriptions on the following pages. The upper section is the PDU's main power control elements including the software controlled outlet relays. Below that are two wiring examples of buttons which can be wired to the EPO connector. There are several EPO configuration options and wiring options. As the document progresses, alternative wiring schemes will be shown to match specific EPO configurations. (Note that the remote mode switch has used varying labels over the years, but the functions of the up/middle/down positions have remained the same.)



The Remote/EPO Connectors

Every PDU with the remote panel system has at least one connector with three pins, usually mounted vertically. The three pins are labeled Enable (top), Disable (center), and Return or Common (bottom). The connector provides On/Off and EPO control, but it is often referred to simply as the **EPO Connector**.



One vs. Multiple Connectors

Some units, particularly the 1U models, have only one of these connectors. Many models will have multiple connectors with some on the back panel, and/or some on the front panel. Whenever there is more than one connector, they are all wired in parallel (all Enable pins connected, etc.).

An external On/Off and EPO circuit would be wired to just one connector (even if there are multiple EPO buttons). The additional connectors are intended to daisy chain out to additional PDUs so they can all be controlled from the same circuit It doesn't matter which PDU the remote panel buttons are wired to. All PDUs will get the signals.

Before wiring the **EPO Connector**, be sure to know the EPO Controller configuration.

Enable Pin

The Enable pin is essentially the On/Off control for the **EPO Contactor**. The **EPO Controller** of the PDU primarily uses the Enable state to switch the **EPO Contactor** On and Off, enabling power to be applied to the outlets (assuming there is not an active EPO condition).

In a basic (non-networked) PDU this pin would be used as the primary Outlet On/Off control. With Marway's RCM smart PDUs, the Enable signal would normally remain On while the individual **Outlet Relays** would be used for the primary outlet power On/Off control with one of the software interfaces.

The Enable input can be configured to require a maintained signal, or a momentary signal. However, unless there's a specific reason (usually legacy compatibility), we don't recommend using a momentary Enable signal for most systems. Reasons for that are discussed below.

Maintained Enable

With a maintained signal, the contacts between Enable and Return must be maintained closed in order to keep the **EPO Contactor** switched **On**. With a rocker, toggle, or similar SPST maintained switch, this creates a single On/Off master outlet control switch from a remote location.

A triggered EPO condition will ignore the state of the Enable signal even if it is On to ensure the **EPO Contactor** is Off.

Momentary Enable

With a momentary signal, the contacts between Enable and Return do not have to be maintained in order to keep the **EPO Contactor** switched **On**. A momentary button can be used to briefly create a closed circuit, that otherwise is normally open.

However, a momentary Enable button provides only an On signal. It cannot generate an Off signal. The Disable button (which is usually the EPO button) has to be used to switch the **EPO Contactor** Off.

Both OSHA and NFPA have rules declaring that the EPO button must be distinct from the Off button, and that the EPO button is not to be used for day-to-day Off operation. This can be compensated for by adding a second (non-mushroom) button on the Disable line with the EPO button to perform the Off function.

Still, using a momentary Enable even with a separate Off button does not allow for an EPO Reset action separate from the general On action that restores power to the outlets. Here, again both OSHA and NFPA have rules declaring a preference for separate actions. An EPO Reset should not immediately restore power, which is what happens with a momentary Enable button.

With the combination of downsides and side effects with a momentary signal, we suggest that when using only a button (without additional relay logic) to interface to the Enable signal, that it be a maintained type of button.

Disable Pin

The Disable pin is activated to create an active EPO condition which switches the **EPO Contactor** Off denying power to all outlets (or most outlets in some PDU designs). When Disable is activated, Enable is overridden (essentially ignored).

Normally Open vs. Closed

The Disable input can be configured for normally open or normally closed operation.

Normally Open means the connection between Disable and Return pins are an open circuit (the two are normally not connected). To trigger an active EPO state, the two pins are connected (via button or relay contacts).

Normally Closed means the connection between Disable and Return pins are a closed circuit (the two are normally connected). To trigger an active EPO state, the two pins are disconnected (by a button or relay contacts). This option is considered a fail safe design in that any accidental severing of the wire (e.g. loose connection) will cause an active EPO state, and is the preferred option for modern installations.

Maintained vs. Momentary

The Disable input can be configured to require a maintained signal, or a momentary signal.

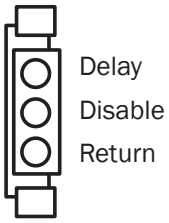
With a maintained signal, the contacts between Disable and Return must be maintained (whether open or closed) in order to keep an active EPO state engaged.

With a momentary signal, the normal state (open or closed) has to be changed for only a brief moment to trigger the EPO state and keep it engaged. If configured this way, the **EPO controller** needs an explicit Reset signal to clear the EPO condition. This is done by activating then deactivating the Enable input (or toggling the **Mode Switch** to Off). The momentary Disable option has a small advantage in that it does not rely on a sustained signal to keep the EPO state engaged, and therefore is more resilient in conditions where the EPO button may bounce or the wiring is compromised.

Return (a.k.a Common)

Both the Enable and Disable inputs are to be wired back to the Return pin. The external wiring to activate or deactivate the inputs are to run through dry contacts, whether they're switches or relay contacts.

Delay Connector



Some systems will have a modified version of the **EPO Connector** which has a Delay pin in place of the Enable pin. If present, this connector is always in addition to the standard **EPO Connector**. This connector is designed as an output to daisy chain directly to another PDU. It is not designed for external button input connections.

Consider a set of three PDUs connected together through the **EPO Connectors**, One PDU, we'll call the primary PDU, has the On/Off and EPO buttons wired to it. When the On/Off button of the primary PDU triggers the Enable pin, all other Enable pins on other connectors are triggered at the same time. All PDUs will switch their **EPO Contactors** on at the same time, and thus applying power to outlets at the same time across all PDUs.

There may be a reason, perhaps inrush control, to stagger the switching on of each subsequent PDU in the daisy chain. With the **Delay Connector,** the activation of the Delay pin is delayed by the **EPO Controller** for some number of seconds. The delay is preconfigured at the factory—two seconds is typical for standard PDUs, up to 16 is possible for custom PDUs. By daisy chaining a second PDU with the **Delay Connector**, the second PDU is powered a few seconds after the primary PDU. A third PDU could be daisy chained off the primary PDU or the second PDU and use the standard **EPO Connector** or the **Delay Connector** based on the need for a delay or not.

Electrical Ratings

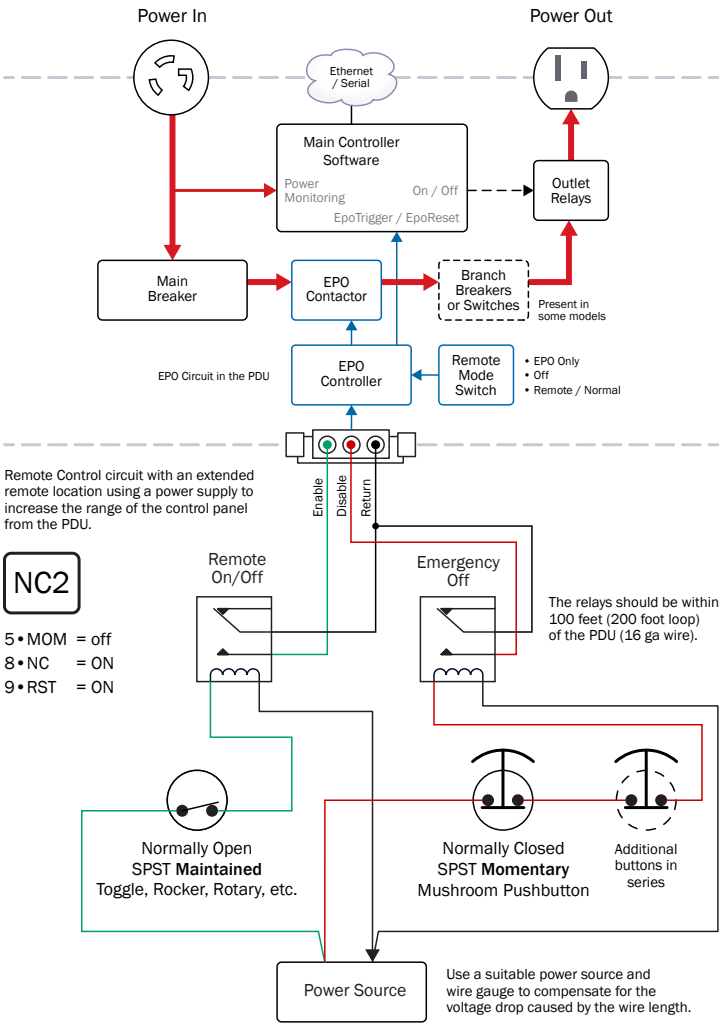
The **EPO Connector** pins have a 5 Vdc potential, are wired directly to TTL logic, and therefore have no load capacity. They cannot be used to drive lamps or relays.

We recommend that wiring should should be no more than a combined 200 feet between the Enable and Return pins, and separately between the Disable and Return pins. This allows for a remote panel approximately 100 feet away from the PDU. For these long distances, 16g wire should be used.

This length limit is based on voltage drop and EMI considerations. Long wire lengths can behave like an antenna creating false positive signals on the 5 Vdc circuit. Our experience is that up to 100 feet has worked well for thousands of installations over many years.

The Enable, Disable, Delay, and Return pins are wired directly to 5 Vdc TTL logic. They must be connected to dry contacts only. There is no capacity to drive lamps or relay coils.

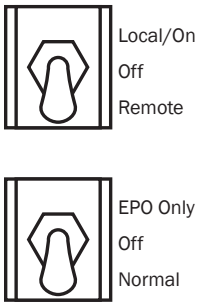
For longer distances, or if the remote wiring will be routed through an electrically noisy environment, it may be necessary to create an externally powered loop through the buttons to control relays through which the PDU's native Enable and Disable signal can be routed. A higher voltage source would be more robust against voltage drop and EMI with longer wire loops.



The diagram here is an example of one of the EPO configurations (NC2) modified as described above. The size of the wire will be based on the length of the loop, and the tolerance for voltage drop. The voltage drop should not exceed the difference between the nominal voltage and the minimum voltage the relay coils require. For example, a 24 volt coil relay might have a specification for a minimum of 18 volts (a difference of 6 volts). Therefore, the voltage drop across the wire loop should probably be no more than 4 volts to allow for some headroom. Use a voltage drop table or calculator to estimate the drop across a particular wire type and gauge for a given length of wire. The exact voltages and details will depend on the end user's safety requirements, and other standards applicable to the application.

The Remote/EPO Mode Switch

Every PDU with the remote panel system has a **Remote Mode** switch. The switch is usually a shrouded mini toggle with three positions. The labeling of the switch, and the three positions have changed over time, but the three positions themselves always do the same thing.



When there is a remote panel connected to the PDU:

- `Remote` (down position) is the normal operating mode. Outlets are subject to the remote panel On/Off/EPO controls (and, of course, the internal software-controlled relays).
- `Off` (center position) causes the **EPO Contactor** to disengage power from outlets. Note that some PDUs have outlets not affected by this. The PDU will ignore the On/Off/EPO commands of the remote panel. Therefore, `Off` disconnects power to the controlled outlets even if the main breaker is switched `On`, and even if the RCM **Outlet Relays** are switched `On`.
- `Local/On` (up position) causes the PDU to ignore the On/Off controls (the `Enable` signal) of the remote panel. The EPO (`Disable`) signal is still allowed.

When there is <u>not</u> a remote control panel connected:

- `Local/On` (up position) is the normal operating mode. Effectively, this is a Local Control mode.
- `Off` (center position) causes the **EPO Contactor** to disengage power from outlets. Note that some PDUs have outlets not affected by this. The PDU will ignore the On/Off/EPO commands of the remote panel. Therefore, `Off` disconnects power to the controlled outlets even if the main breaker is switched `On`, and even if the RCM **Outlet Relays** are switched `On`.
- `Remote` (down position) will behave like `Off`. (With no remote control panel connected, this label may be a bit of a misnomer as this would not be the normal position.)

Note that it is possible to use this switch to do an EPO `Reset`. Toggle the switch to the `Off` (center) position for second or two, then back to the desired mode (usually the up position).

EPO Controller Configuration

The **EPO Controller** can be configured for a variety of switching arrangements and a few other options. However, these configurations are set at the factory, and are generally not changeable as the PDU is a sealed system, and opening it voids the warranty.

Still, in order to wire the PDU's remote panel On/Off and EPO circuits correctly, the EPO Controller configuration must be known. Contact Marway for model documentation if needed.

Standard Optima 8 Series

For the standard Optima 8 Series (820, 833), the last three digits of the model number are used to indicate the EPO configuration — if the EPO Controller is included in the model. Check Marway's Standard Products Catalog for model numbers which include the remote panel / EPO capability.

- –000 = NO EPO (maintained enable, normally open EPO, no reset required)
- –001 = NC EPO (maintained enable, normally closed EPO, no reset required)

Custom PDUs

For custom PDUs, the original specs and/or design discussions would have established the EPO related options. If the original documentation is not available, Marway can always reference it's internal documents based on the model number.

DIP Switch Reference

While these generally should not be changed in the field, the following configuration switches may come up in conversations when planning for new remote panel/EPO requirements.

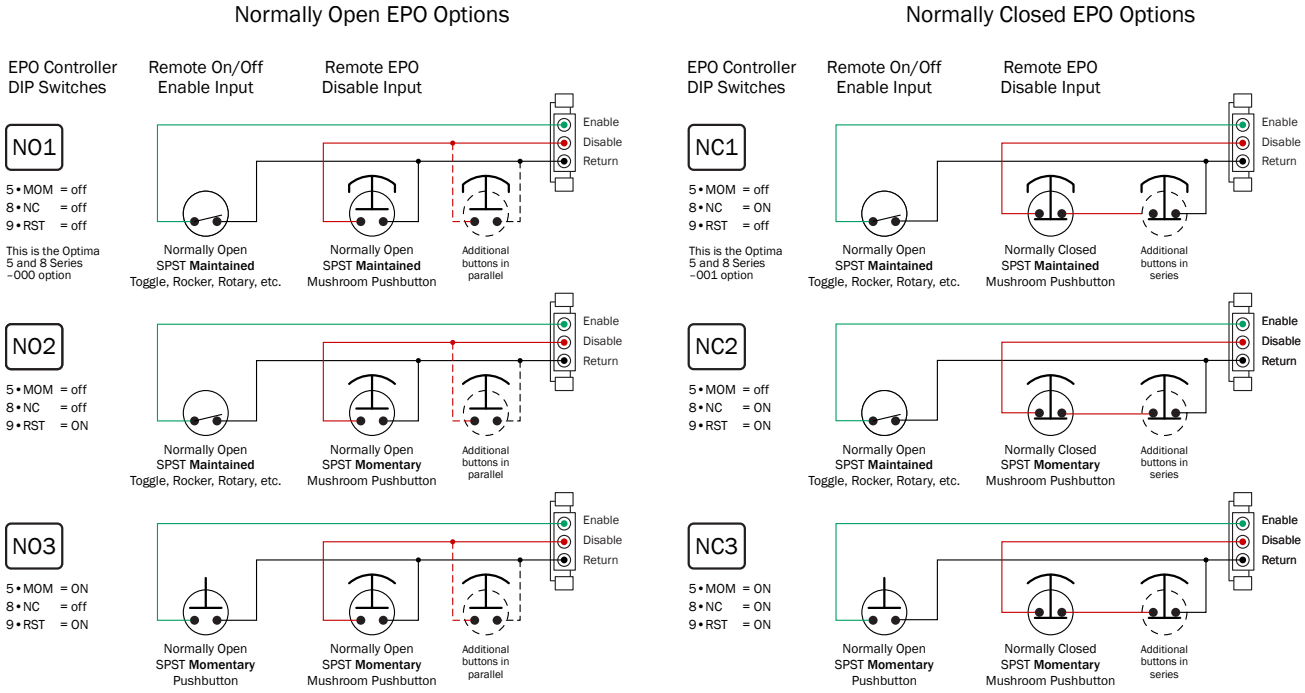
ON Purpose	Switch #	OFF Purpose
Output 2 Delay 1 Second	1 – 1SEC *	Combine the delays
Output 2 Delay 2 Seconds	2 – 2SEC *	switches for longer delays.
Output 2 Delay 4 Seconds	3 – 4SEC *	
Output 2 Delay 8 Seconds	4 – 8SEC *	
Momentary Start (Enable)	5 – MOM	Maintained Start (Enable)
Delay Output 1 at Start	6 – DLY1 *	No Start Delay
Output 1 and 2 Operate Together	7 – DLY2 *	Output 2 Delays After Outlet 1
Disable is Normally Closed	8 – NC	Disable is Normally Open
Reset Required	9 – RST	No Reset Required
Always in Remote Mode	10 – MOD	Normal Operating Toggle Switch

* The delay features are used for models which have the Delay Connector.

On/Off and EPO Button Configurations

The following chart shows the On/Off and EPO button configurations, and the EPO Controller DIP settings that correlate to the button types. In all cases, if there are to be multiple EPO buttons, the same button type is wired on the Disable circuit (N.O. buttons in parallel, and N.C. button in series). Note that if there are to be additional shutoff interlocks (typically SPST N.C.), the best option is to use a normally closed EPO circuit, and wire the interlocks in series with the EPO buttons.

As discussed in sections above, not all of these configurations are equally suited to modern safety guidelines. For installations using only buttons to engage the Enable and Disable control signals, our recommendation is to use either the NC2, NC1, NO2, or NO1 options shown below.



Note that the NO1, NC2, etc. designations are not related to PDU part numbers. They're designations used only for this documentation.

EPO Overlap with RCM Software

The system as a whole is set up at the factory assuming the PDU will be run with access to its networked software control system. The PDU can be run without a full time network connection, but it may require configuration adjustments. These will be addressed in subsequent sections.

EPO1 vs EPO2

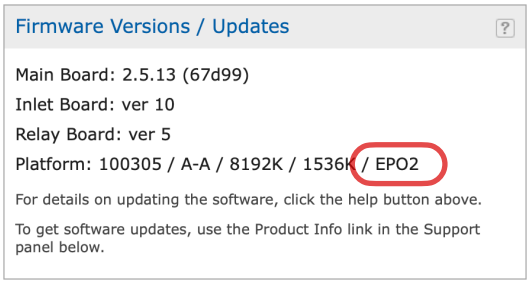
For the RCM equipped models, there are technically two possible EPO implementations. They use the exact same **EPO controller**, but it interfaces to the RCM **Main Controller** differently which results in a slightly different impact on how the software reacts to EPO events.

EPO1 is used on all standard Optima 8 Series models. EPO2 is available for custom PDU designs, but not all custom PDUs have EPO2 (many use EPO1).

What matters most about EPO1 vs. EPO2 is how the software works in response to an EPO trigger event. The technical difference between the two is that an RCM **Main Controller** with EPO1 interface (the original) detects only an `EpoTrigger` event, and does not have an `EpoReset` signal. With the updated EPO2 interface, the RCM controller detects both the trigger and the reset. How this difference manifests in the software is explained below.

How to Identify EPO Type

RCM firmware version 2.5.13 and later identifies which EPO type the system has in the System Platform description.



Using the web interface, open the System page. Look for the Firmware Versions panel and the line starting with Platform. At the end of the line is either an EPO1 or EPO2 label. If there is no EPO label, the PDU does not have an EPO controller.

From the command line, run the command `#> getSystem platform`. At the end of the response text is either the EPO1 or EPO2 label.

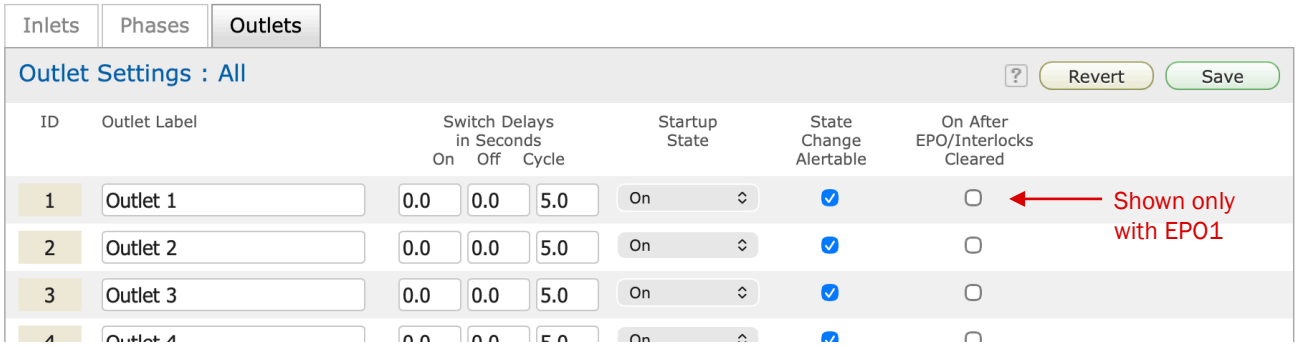
If the software is earlier than 2.5.13, a system with EPO1 will have an “Auto On” column on the Outlets page similar to the “On After EPO” column shown in the screen capture on the next page. A system with EPO2 will not have this column. (Though there are rare custom configurations where technically this column can be enabled with EPO2.)

Relevant Software Settings

There are three configurable settings which are relevant to remote panel On, Off, EPO behavior.

- Outlet `OnAfterEPO` (aka `IgnoreEPO`) is used with EPO1 only
- Outlet `OnDelay`
- Outlet `StartupState`

On the web interface, these settings are presented as seen below. The "On After EPO" column is not present when the system uses the EPO2 variant.



Outlet OnAfterEPO

This setting is available on RCM systems with EPO1. (It is not available on systems with EPO2 because it is not needed.) The main thing to keep in mind is that on RCM systems with EPO1, the initial EpoTrigger is detected by the software system, but the software is not aware of when an EpoReset occurs.

When an EPO circuit is tripped (external EPO button is pushed), the **EPO Controller** disables the **EPO Contactor** (shuts it `Off`), and also sends an `EpoTrigger` signal to the **Main Controller** (refer to the block diagram).

The **Main Controller** can be configured to respond to the `EpoTrigger` signal in one of two ways. The configuration manages whether the **Outlet Relays** will be switched `Off` in response to an `EpoTrigger`, or whether the relays remain switched `On`.

Regardless of the `On`/`Off` state of the **Outlet Relays**, in an active EPO state, the **EPO Contactor** is the primary component cutting power to the outlets. The **EPO Controller** governs that, not the **Main Controller**.

Since the software cannot detect when an EPO `Reset` occurs, it cannot invoke a response directly to that reset action. The design concern at this point is that when the EPO state is cleared, the **EPO Contactor** is switched back `On`, and power is available to the outlets. So, now it matters what state the **Outlet Relays** are in when the rest happens.

The safest thing to do is switch **Outlet Relays** `Off` so that when the EPO state is cleared, there is not an unexpected source of power to the outlets. For applications where the PDU is used to power machinery, this is the safe assumption. Therefore, this how the PDU ships from the factory — `OnAfterEPO` is `disabled` (a.k.a. `false`) so that the **Main Controller** switches the **Outlet Relays** `Off` in addition to the **EPO Contactor** having been switched off.

However, for some use cases (perhaps with IT equipment), once the EPO state has been cleared, the automatic resumption of power to outlets is the end user's preferred behavior. For these cases, the end user can configure the `OnAfterEPO` setting can be `enabled` (a.k.a. `true`).

Additionally, for cases where the PDU will not be connected to a network, it's also likely that the automatic resuming of power to the outlets after an EPO state is cleared is the preferred behavior. Otherwise, to get power back on to the outlets means the whole PDU has to be powered cycled. For Optima 8 standard PDUs, enabling the `OnAfterEPO` setting will require that the end user configure the PDU. For custom PDUs it is possible for the factory to pre-configure this setting prior to shipment.

Outlet OnDelay

When the system is powered from a cold start, outlets are switched `On` (based on the `StartupState` setting) in sequence. There's a fairly short, but noticeable delay between each outlet (enough to stagger most inrush currents). If the application needs longer delays between outlets turning on, the RCM software will have to be configured, or an external control script (written by the end user) can manage those delays with it's own sequence of outlet `On` commands.

Relevance to EPO1

For EPO1 equipped systems, `OnDelay` applies during a cold startup, or whenever the web interface is used to switch on all outlets (or multiple outlets using the Apply Action controls).

It is notable that the `OnDelay` setting is not applied with EPO1 after an EPO `Reset`. When an EPO is reset, the **EPO Contactor** is switched on and power is immediately applied to all outlets where the **Outlet Relay** has been left switched on by the `OnAfterEPO` setting.

Relevance to EPO2

For EPO2 equipped systems, the `OnDelay` setting applies to a cold startup, the web controls to switch on all (or multiple) outlets, and crucially also to an EPO `Reset`.

With the EPO2 system, when an `EpoTrigger` is detected, the RCM **Main Controller** switches all **Outlet Relays** `Off`. There is no `OnAfterEPO` setting to control that response.

Since an RCM **Main Controller** with EPO2 can detect an `EpoReset`, that signal is then used to react exactly as though the PDU was powered from a cold start. The RCM **Main Controller** sets each **Outlet Relay** state to the `StartupState` setting.

Outlet StartupState

This setting determines whether an outlet is `On` or `Off` when the PDU is powered up from a cold start. The factory default is `On` so that all outlets are switched on when the PDU is powered up. Users with network access can configure these as needed for their application.

If the PDU is never connected to a network, this default setting means all outlets will turn `On` (after the PDU completes it's software startup) out of the box without a need to do an initial setup.

Relevance to EPO1

For EPO1 equipped systems, `StartupState` applies as described above. There are no additional considerations relevant to the EPO system.

Relevance to EPO2

For EPO2 equipped systems, `StartupState` is also automatically used to set the state of the outlets when an `EpoReset` is detected. When an `EpoTrigger` is sensed, the software sends an `Off` command to all RCM-controlled outlets. When the `EpoReset` is sensed, the software may send an `On` command to an outlet based on the `StartupState` setting. Essentially, an `EpoReset` is treated the same as a cold startup.

On/Off/EPO Configuration Reference

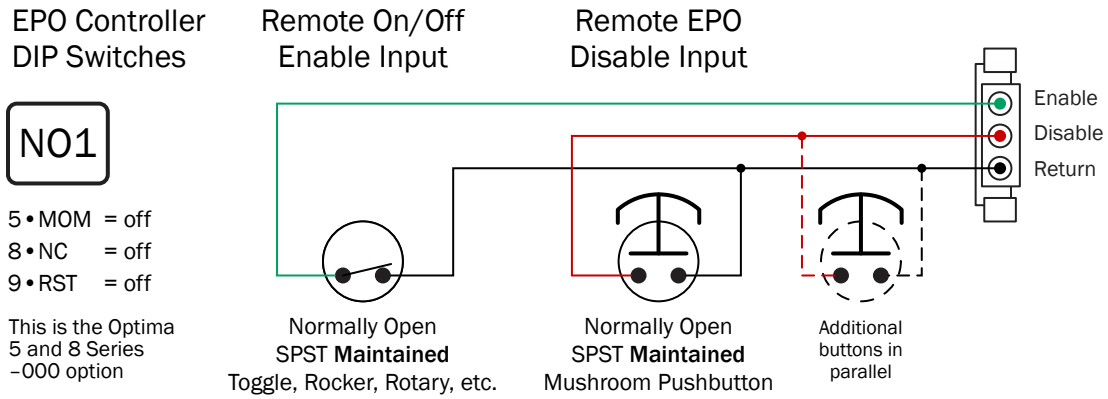
The above sections review the various hardware and software elements relevant to an external remote control panel and the EPO Connector interfaces. The following sections examine the various settings, button types, wiring, and operation of the possible configurations.

As discussed in sections above, not all of these configurations are equally suited to modern safety guidelines. For installations using only buttons to engage the Enable and Disable control signals, our recommendation is to use either the NC2, NC1, NO2, or NO1 options shown below.

NO1 • Maintained On/Off, Maintained EPO N.O.

This option is functionally equivalent to Marway's Commander UCP 4900 panel. It's the simplest design, but one could argue that NC1 or NC2 are better in that they offer a fail-safe design. The key disadvantage is that if the Enable button is still `On` when the EPO button (Disable) is released, then power is potentially restored to the outlets immediately (subject to the EPO1/EPO2 differences and software settings). A procedure where On/Off is switched `Off` before releasing the EPO button will prevent automatic power restoration. This configuration (with EPO1) is the default "Normally Open" option in standard Optima 8 RCM models (–000) for reasons of compatibility with legacy installations.

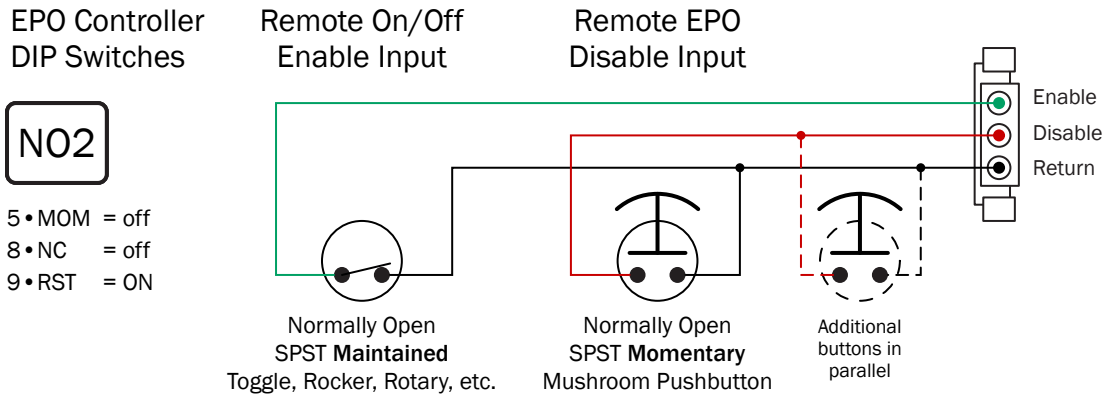
Prevent outlet power ("Off")	Trigger an active EPO (cut outlet power)
Ensure Disable is `open` Ensure Enable is `open`	Ensure Disable is `closed` The Enable state does not matter
Enable outlet power ("On")	Clear/Reset an EPO
Ensure Disable is `open` Ensure Enable is `closed`	Ensure Disable is `open` Outlets will be on if Enable is `closed`



NO2 • Maintained On/Off, Momentary EPO N.O.

This option has an advantage over NO1 in that after the EPO button (Disable) is pressed, it requires the Enable button be switched `Off` to `Reset` the EPO condition. Then, power is available to the outlets only when the button is switched back `On`. The RCM **Outlet Relays** may be switched on, but the **EPO Contactor** will be still be `Off` until Enable is `On`. With EPO1, all **Outlet Relays** which are `On` will get power at the same time. With EPO2 it is possible to stagger the **Outlet Relays** to an `On` state.

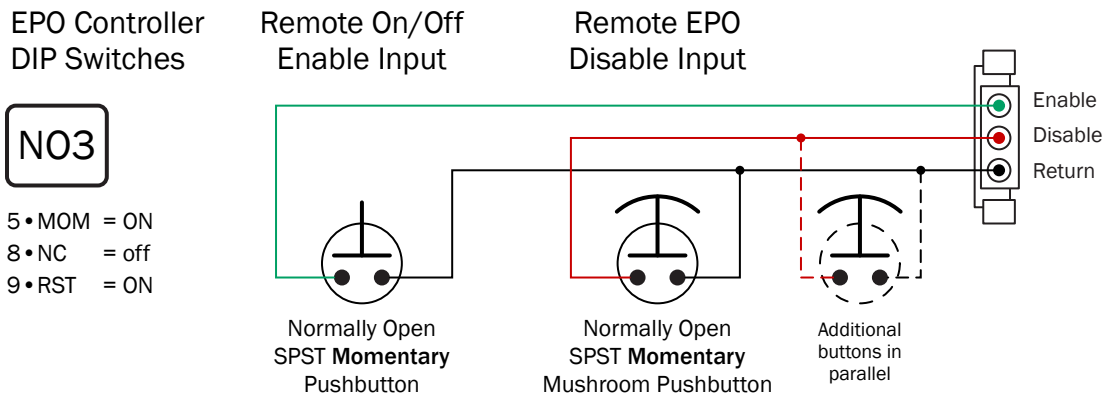
Prevent outlet power ("Off")	Trigger an active EPO (cut outlet power)
Ensure Disable is `open` Ensure Enable is `open`	Ensure Disable is `closed` at least briefly The Enable state does not matter
Enable outlet power ("On")	Clear/Reset an EPO
Ensure Disable is `open` Ensure Enable is `closed`	Ensure Disable is `open` Ensure Enable is `open` after Disable is `open`



NO3 • Momentary On, Momentary EPO N.O.

Using a momentary Enable signal does not provide a built-in `Off` capability. In a simple two-button circuit, the EPO button has to be used as an `Off` button. Adding a second, non-mushroom N.O. button in parallel as a dedicated Off button can solve that. Therefore, using a momentary Enable button may require using a three-button circuit depending on the safety standards of the installation. A downside to even the three-button circuit is that there is no separate EPO `Reset` action. Clearing the EPO trigger state is synonymous with starting power to the outlets by pressing the Enable button.

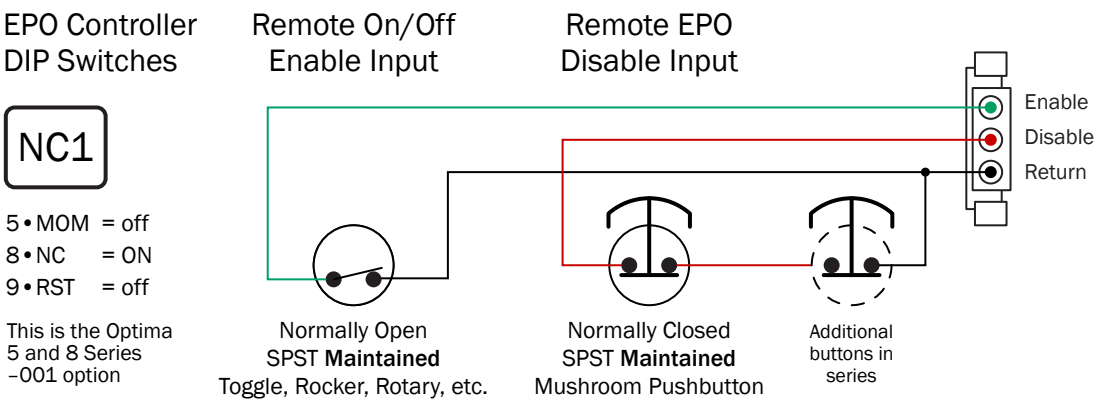
Prevent outlet power (“Off”)	Trigger an active EPO (cut outlet power)
Ensure Disable is `open` Ensure Enable is `open`	Ensure Disable is `closed` The Enable state should already be open
Enable outlet power (“On”)	Clear/Reset an EPO
Ensure Disable is `open` Ensure Enable is `closed` briefly	Ensure Disable is `open` Briefly `closing` Enable both resets and enables power



NC1 • Maintained On/Off, Maintained EPO N.C.

This is one of the two (along with NC2) most ideal configurations. It's a simple design, but one could argue that NC2 is better in that it requires a Reset prior to power being restored to the outlets. The key disadvantage of NC1 is that if the Enable button is still On when the EPO button (Disable) is released, then power is potentially restored to the outlets immediately (subject to the EPO1/EPO2 differences and software settings). A procedure where On/Off is switched Off before releasing the EPO button will prevent automatic power restoration. This configuration (with EPO1) is the default Normally Closed option in standard Optima 8 RCM models (–001) for reasons of compatibility with legacy installations.

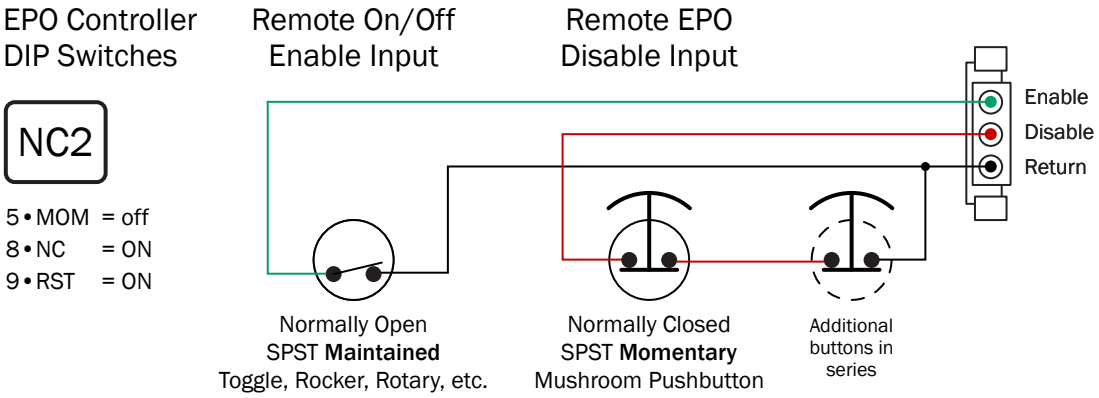
Prevent outlet power ("Off")	Trigger an active EPO (cut outlet power)
Ensure Disable is closed Ensure Enable is open	Ensure Disable is open briefly The Enable state does not matter
Enable outlet power ("On")	Clear/Reset an EPO
Ensure Disable is closed Ensure Enable is closed	Ensure Disable is closed Outlets will be on if Enable is closed



NC2 • Maintained On/Off, Momentary EPO N.C.

This is the the most ideal simple, two-button configuration. It has an advantage over NC1 in that after the EPO button (Disable) is pressed, it requires the Enable button be switched `Off`, to `Reset` the EPO condition. Then, power is available to the outlets only when the button is switched back `On`. The RCM **Outlet Relays** may be switched on, but after a reset, the **EPO Contactor** will be still be `Off` until Enable is `On`. With EPO1, all **Outlet Relays** which are `On` will get power at the same time when Enable is back `On`. With EPO2, when Enable is back `On`, it is possible to stagger the **Outlet Relays** to an `On` state.

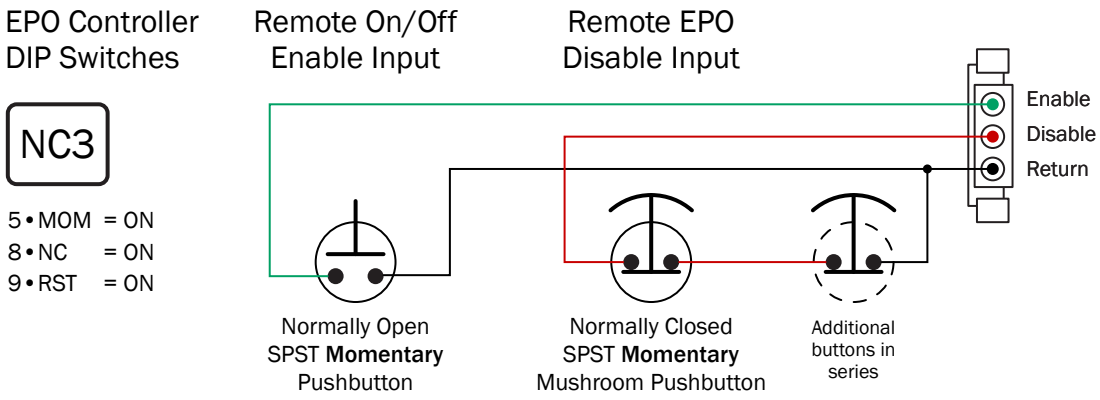
Prevent outlet power ("Off")	Trigger an active EPO (cut outlet power)
Ensure Disable is `closed` Ensure Enable is `open`	Ensure Disable is `open` briefly The Enable state does not matter
Enable outlet power ("On")	Clear/Reset an EPO
Ensure Disable is `closed` Ensure Enable is `closed`	Ensure Disable is `closed` Ensure Enable is `opened` after Disable is `closed`



NC3 • Momentary On/Off, Momentary EPO N.C.

Using a momentary Enable signal does not provide a built-in `Off` capability. In a simple two-button circuit, the EPO button has to be used as an `Off` button. Adding a second, non-mushroom N.C. button in series as a dedicated Off button can solve that. Therefore, using a momentary Enable button may require using a three-button circuit depending on the safety standards of the installation. A downside to even the three-button circuit is that there is no separate EPO `Reset` action. Clearing the EPO trigger state is synonymous with starting power to the outlets by pressing the Enable button.

Prevent outlet power (“Off”)	Trigger an active EPO (cut outlet power)
Ensure Disable is `closed` Ensure Enable is `open`	Ensure Disable is `open` briefly The Enable state should already be open
Enable outlet power (“On”)	Clear/Reset an EPO
Ensure Disable is `closed` Ensure Enable is `closed` briefly	Ensure Disable is `closed` Briefly `closing` Enable both resets and enables power

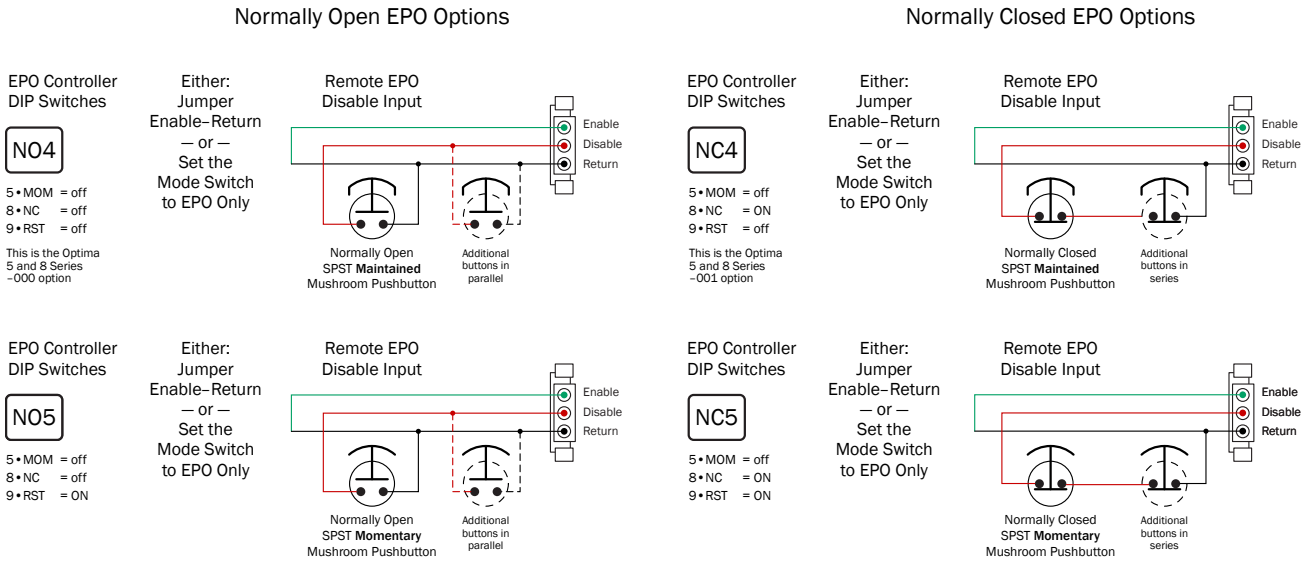


EPO Only Configuration Reference

For installations where a full On/Off/EPO control panel is not desired, it is possible to configure the PDU and EPO Connector for EPO only input.

We see this type of circuit used where the PDU and all outlets are always powered, or where the outlet control is managed directly from PDU's own control panel, but where EPO buttons at various locations are desired for safety.

Overall, there are four configurations. They mirror the settings and operation of NO1, NO2, NC1, NC2 except that there is a permanently shorted `Enable` signal (either from an **EPO Connector** jumper, or from setting the **Mode Switch** to `EPO Only`.



Change Log

R3 — Sep 18, 2026 — gw

- Added EPO Only configuration discussions.
- Added example schematic for using an external power source to increase the remote panel distance beyond what the EPO connector can support directly.

R2 — Sep 15, 2026 — gw

- Added the EPO1 vs. EPO2 discussions.
- Added Mode Switch discussion.
- Updated some of the configuration descriptions.

R1 — Sep 4, 2026 — gw

- Original release.