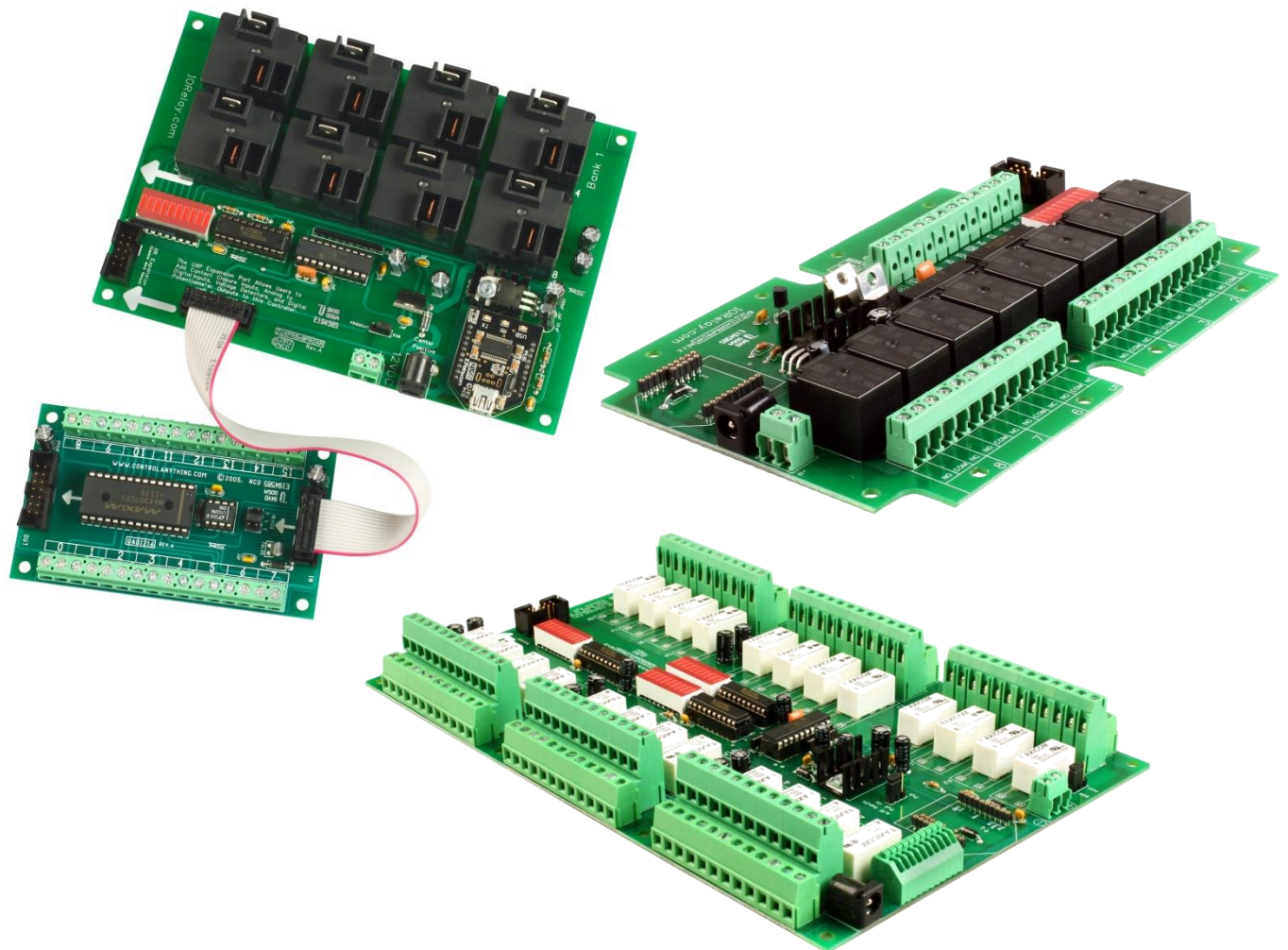


# NATIONAL CONTROL DEVICES

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## NCD Hardware Reference Quick Start Guide



NATIONAL CONTROL DEVICES

# **NCD Hardware Reference**

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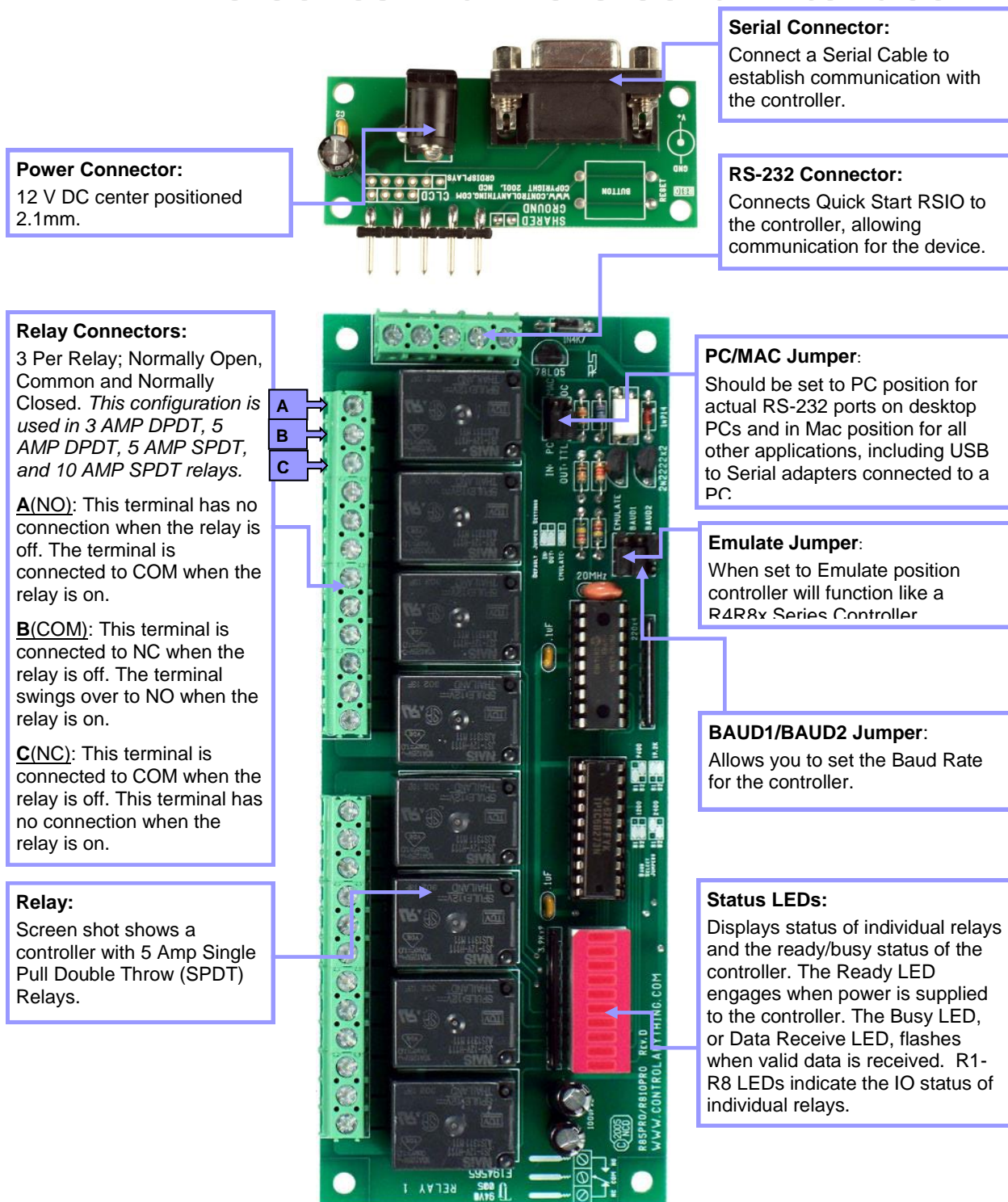
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Notice: Portions of this manual require internet access.

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## PRO Series with RSIO Serial Interface



Elements of this diagram may be useful for other devices we offer. We have not included photos of every controller we offer in this manual; instead, we have detailed the significant variations. Our controllers contain many common elements in different combinations.



## Key Fob Reactor Series

### Relay Connectors:

Controller shown has Single Pull Double Throw (DPDT) Relay Connectors.

### Relay:

Screen Shot Shows a controller with 10 Amp Single Pull Double Throw (SPDT) Relays.

### Communication Module:

Modular Interface Support allows you to use about any kind of standard computer interface available.

### Pull Up/Down Jumper:

**Up** Position pulls inputs high to plus 5 VDC (used for contact closures or variable resistance signals).

**Down** position pulls inputs low to ground (used for reading external 0-5 VDC signals).

### DIP Switches:

All switches must be turned on to ensure the Key Fob receives commands. See next page for DIP Switch Settings according to baud rate.

### Wireless Receiver:

Key Fob antennae mount. Antennae connects directly to the controller.

### Busy/Ready LED Lights:

Indicates CPU activity. Under normal operation you will see the BUSY LED flash as it computes and processes commands.

### Program/Run Jumper:

Used to change operating modes. For daily use always set to *RUN* position.

### Power Connector:

12 V DC center positioned 2.1mm.

### Key Fob/External AD Jumper:

Determines how the device receives commands.

### Analog Input Channels:

Do Not Exceed +5VDC. Do Not apply voltage to this input while controller is powered down.

### Status LEDs:

Displays status of individual relays and the ready/busy status of the controller. The Ready LED engages when power is supplied to the controller. The Busy LED, or Data Receive LED, flashes when valid data is received. R1-R8 LEDs indicate the IO status of individual relays.

Elements of this diagram may be useful for other devices we offer. We have not included photos of every controller we offer in this manual; instead, we have detailed the significant variations. Our controllers contain many common elements in different combinations.

## DIP Switch Settings

<p>38.4K Baud Configuration Mode allows you to Store Device Parameters.  On Power Up, All Relays are Tested in Configuration Mode.  DIP Switch settings have no effect until the controller has been power cycled.</p>			
DIP Switch Settings			
Switch:	1	2	3
<b>*38.4K</b>	Off	Off	Off
<b>2400</b>	On	Off	Off
<b>4800</b>	Off	On	Off
<b>9600</b>	On	On	Off
<b>19.2K</b>	Off	Off	On
<b>38.4K</b>	On	Off	On
<b>57.6K</b>	Off	On	On
<b>115.2K</b>	On	On	On

## ProXR Series

### Power Connector

+12 Volt DC center position 2.1 mm.

### Communication Module:

Modular Interface Support allows you to use about any kind of standard computer interface available.

### Relay Connectors:

Screen Shot shows a controller with Single Pull Double Throw (SPDT) Relay Connectors.

### Relay:

Screen shot shows controller with 10 Amp Single Pull Double Throw (SPDT) relays.

### Program/Run Jumper:

Used to change operating modes. For daily use always set to *RUN* position.

### Pull Up/Down Jumper:

**Up** Position pulls inputs high to plus 5 VDC. (used for contact closures or variable resistance signals)

**Down** position pulls inputs low to ground (used for reading external 0-5 VDC signals.)

### Analog Input Channels:

Do Not Exceed +5VDC. Do Not apply voltage to this input while controller is powered down.

### +5VDC Input

### Temperature Sensor\*

AD Input 8

AD Input 7

AD Input 6

AD Input 5

Ground

AD Input 4

AD Input 3

AD Input 2

AD Input 1

Ground

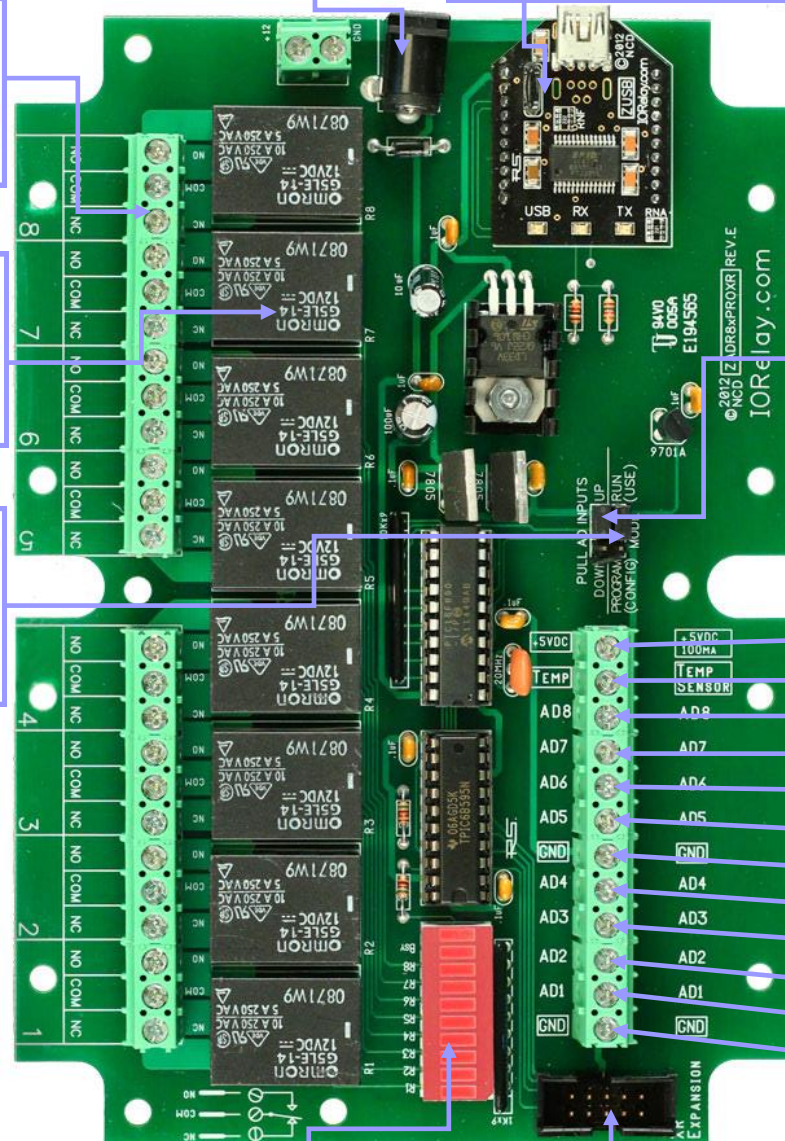
**\*Temperature Sensor Output**  
Connect to A/D Input.

### Status LEDs:

Displays status of individual relays and the ready/busy status of the controller. The Ready LED engages when power is supplied to the controller. The Busy LED, or Data Receive LED, flashes when valid data is received. R1-R8 LEDs indicate the IO status of individual relays.

### XR Expansion Port:

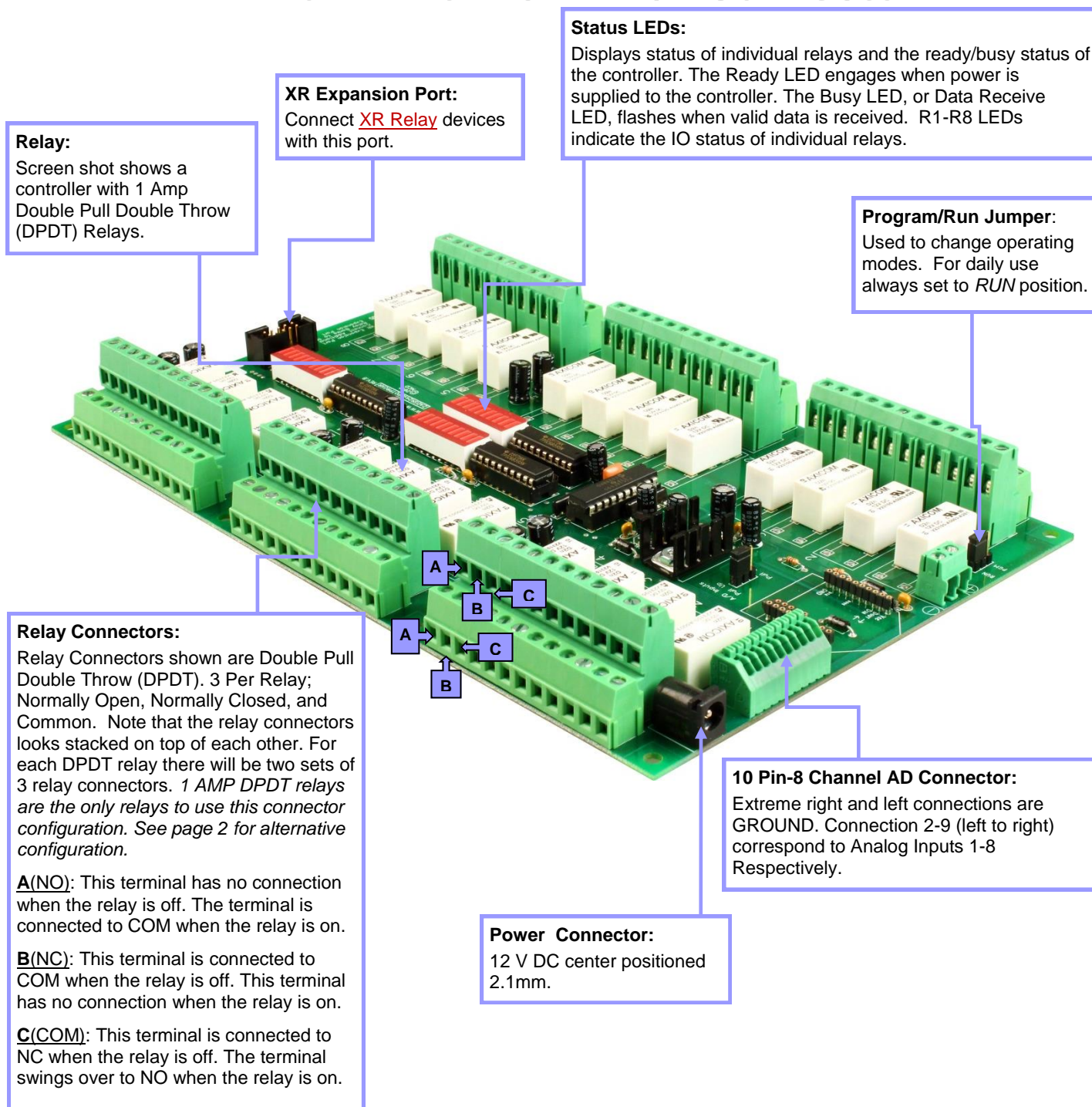
Connect **XR Relay** devices to this Expansion Port.



Elements of this diagram may be useful for other devices we offer. We have not included photos of every controller we offer in this manual; instead, we have detailed in the significant variations. Our controllers contain many common elements in different combinations.



## ProXR with 10 Pin A/D Connector



Elements of this diagram may be useful for other devices we offer. We have not included photos of every controller we offer in this manual instead; we have detailed the significant variations. Our controllers contain many common elements indifferent combinations.



## ProXR with UXP Expansion Port

### Status LEDs:

Displays status of individual relays and the ready/busy status of the controller. The Ready LED engages when power is supplied to the controller. The Busy LED, or Data Receive LED, flashes when valid data is received. R1-R8 LEDs indicate the IO status of

### Relay:

Screen shot shows a 8 Channel controller with 30 Amp Relays.

### Program/Run Jumper:

Used to change operating modes. For daily use always set to RUN

### XR Expansion Port:

Connect [XR Relay](#) devices with this port.

### Power Connector:

12 V DC center positioned 2.1mm.

### Communications Module:

Modular Interface Support allows you to use about any kind of standard computer interface

### UXP Expansion Port:

Universal Expansion Port allows you to take advantage of extended commands to speak to a growing line of I/O expansion modules.

Note: When expanding controllers be sure to maintain similar technologies. For example, controllers with contact closure cannot be expanded with boards containing A/D inputs. Choose your expansion options carefully.

### Contact Closure Inputs:

DO NOT apply voltage to these inputs. Consists of groups of 2 collector inputs, Send/Receive (Normally Open/Normally Closed).

Elements of this diagram may be useful for other devices we offer. We have not included photos of every controller we offer in this manual; instead, we have detailed the significant variations. Our controllers contain many common elements in different combinations.

## Antennae Hardware Options

### Key Fob Antennae

Ranges 50-200 feet. Range depends on the Key Fob device you have. Key Fob devices with 1-5 buttons have a range of 50 feet. The 8 button Key Fob has a range of 200 feet. Antennae connects directly to the controller by screwing the antennae onto the Key Fob Antennae Mount.



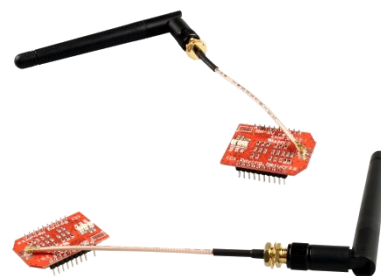
### Bluetooth Antennae

Range up to 300 feet. Connect the Bluetooth antennae to the module with a “Pigtail” antenna. The picture above shows a Bluetooth module with a pigtail antennae connected. The end of the pigtail connects with a small snap button that attaches to a node on the communications module. The opposite end of the pigtail attaches to the Bluetooth antennae.



### 802.15.4/ZB N=Mesh/ Wi-Fi Antennae

Range depends on the module installed in your controller. Range of 30 feet with regular 802.15.4 or ZB Mesh module 1 mi with 802.15.4/ZB Mesh PRO module. As with other types of antennas, these connect to communications module via a pigtail antenna. This snaps on to a node on the communications module. Attach the opposite end of the pigtail to the 802.15.4 antennae.



### **XSC Antennae**

Range up to 2 mi. Like other antennas, this connects to communications module via a pigtail antenna. The pigtail snaps on to a node on the communications module. The opposite end of the pigtail connects to the XSC Antennae.



### **15 mi Long Range Antennae**

In order to maximize XSC Long Range capabilities, and outside antennae will have to be installed. Picture above shows the outside mounted antennae. Connect to controller with provided cable.



## Breakaway Tabs

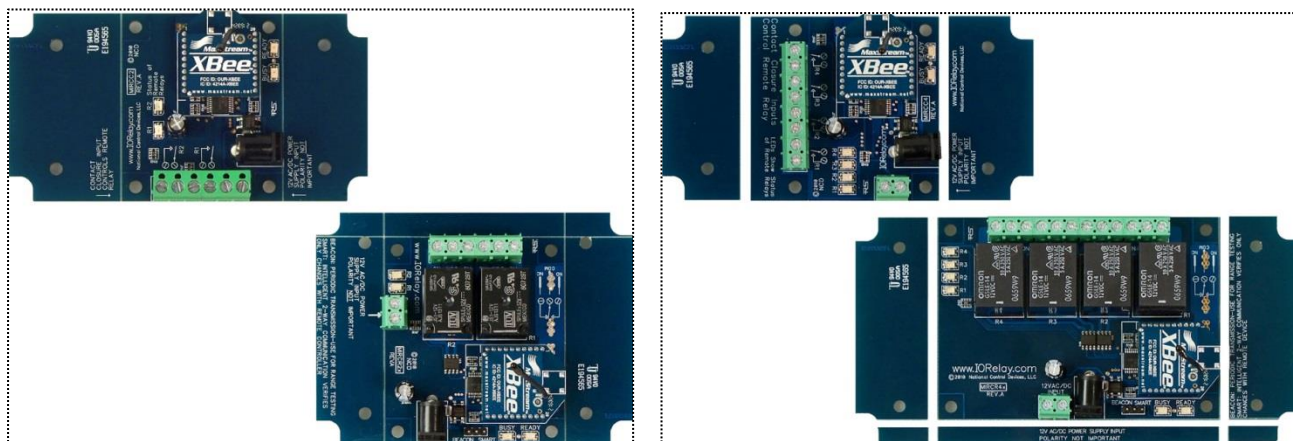
### Break Away Tabs

Physically, some controllers are actually 2 sizes. When you receive your controller, shape and size ensures it can fit into a standard enclosure. Optionally, you can make some controllers smaller by breaking away the outer tabs. Break Away tabs are useful in applications where space may be concern. This allows your controller to offer the same functionality in the smallest possible profile. Break Away tabs are unique to the NCD product line and are a standard option for most devices released in 2010 and later. Products featuring Breakaway Tabs are ProXR Lite, Reactor, Taralist, MirC, and MirX.

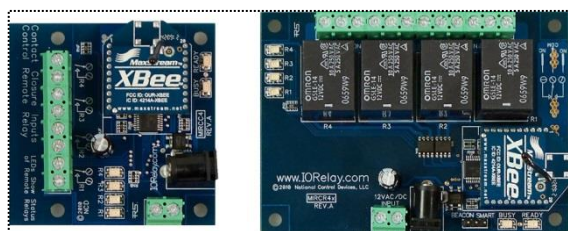
Before breaking the tabs on your controller, please be advised that your controller will not be returnable for refund or credit if the Break Away Tabs have been removed.

To break away the tabs, gently but firmly grab each break-away tab with a pair of pliers and bend the tab back and forth until it breaks away from the main circuit board. This will NOT damage the controller in any way.

Breaking the Tabs from a controller DOES NOT VOID the Warranty. Please see the [NCD return policy if you would like more information on the policies that apply to Surface Mount devices.](#)



The screen shots above depict a MirCR25 controller, one of several controllers that features Breakaway tabs. MirCR25 shown above left as shipped from National Control devices. The unusual shape accommodates a standard enclosure. As shown above right, bend the tabs to break them away from the board. Note that controllers with Broken tabs are NOT Returnable for Refund or Credit, but are still covered under or Limited Warranty.



Shown above, the final controller with tabs removed is physically smaller in size, but no longer fits a standard enclosure.



## Relays

The links below provide access to data sheets for each type of relay.



[1A DPDT V23105A5003A201 D2n V23105](#)



[10A SPDT Relays G5LE-14-DC12 G5LE](#)



[3A DPDT JW2SN-DC12V JW Relays](#)



[20A Relays G8P-1C4TP-DC12 G8PT Series](#)



[5A DPDT Relays G2R-24-DC12 G2R Series](#)



[30A Relays G8P-1A4TP-DC12 G8PT Series](#)



[5A SPDT Relays JS1-12V JS Relays](#)



[20AHP JTN1S-PA-F-DC12V JT-N Series](#)



[SPST Reed Relays HE721A1200 HE700](#)

## Solid State Relays

The links below provide access to data sheets for each type of relay.



[Solid State Type A - D2W Series  
D2W202F](#)



[Solid State Type B - CX Series CX240D5](#)



[Solid State Type C - CX Series  
CX240D5R](#)



[Solid State Type D - PF Series  
PF240D25R](#)



[Solid State Type E - PF Series PF480D25](#)



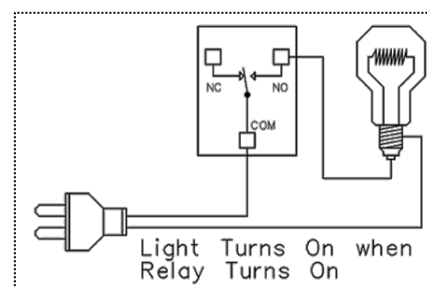
[Solid State Type F - MPDC Series  
MPDCC3](#)

## Relay Logic

The COM (Common) connection of a relay is the part of the relay that moves. When a relay is off, the COMMON is connected to the NC (Normally Closed). The NO (Normally Open) connection of the relay is not connected until the relay turns on. When the relay turns on, the COMMON move from NC to NO. Mechanical relays create a Clicking sound that indicates movement of the COMMON terminal. Not all relays have a Normally Closed Connection. For instance, 30A relays (as offered on our web site) do not have a Normally Closed connection. We do not currently offer Solid State relays with a Normally Closed connection. It is possible to use Two relays to create a Normally Closed condition.

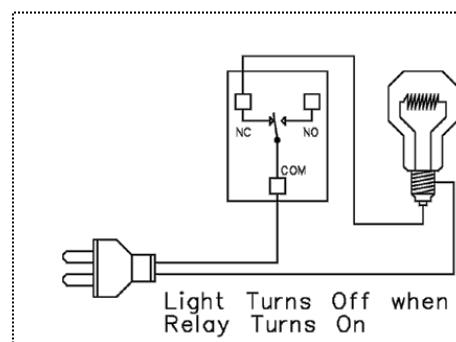
### Sample 1

The sample demonstrates how a relay can be used to activate a light bulb. When the relay turns on, the light comes on. Only one power wire is switched with the sample using the COM (Common) and NO (normally open) connections of a relay.



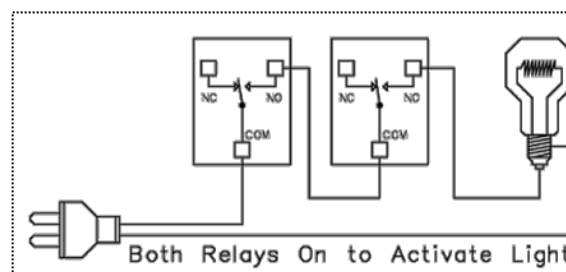
### Sample 2

This sample demonstrates how a relay can be used to turn a light bulb OFF. When the relay turns off, the light will be ON. Only one power wire is switched in this sample using the COM (Common) and NC (normally closed) connections of a relay.



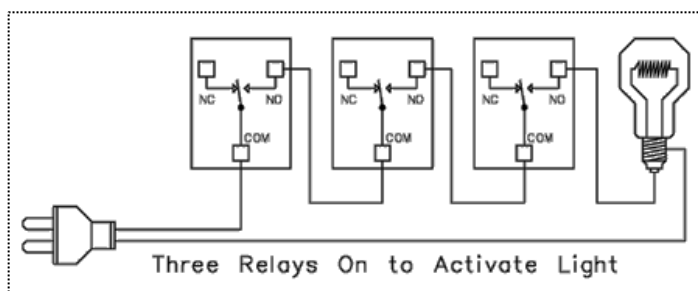
### Sample 3

This sample demonstrates how two activated relays are required to activate a light bulb. This is the same as a Logic AND function because Relay 1 And Relay 2 MUST be on to activate the light.



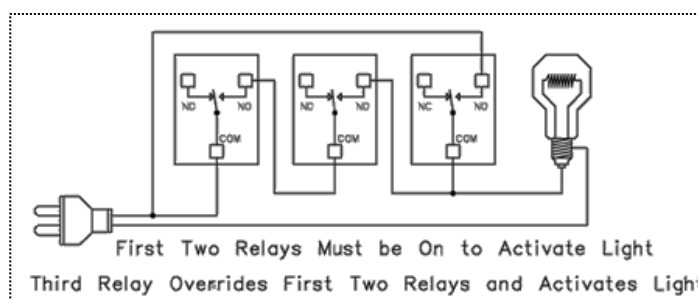
### Sample 4

This sample demonstrates how three activated lights are required to activate a light bulb. This is the same as a Logic AND function because Relay 1 AND Relay 2 AND Relay 3 MUST be on to activate the light.



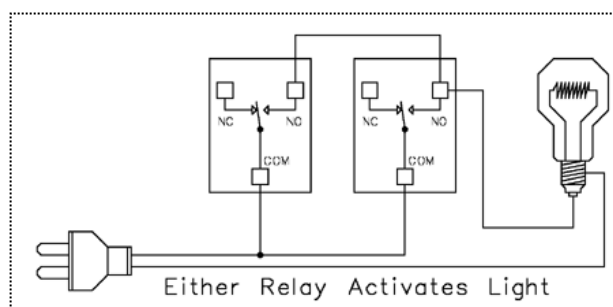
### Sample 5

This sample demonstrates the AND/OR function. The Light Bulb will be activated if Relay 1 AND Relay 2 are ON OR if Relay 3 is ON. This sample is perfect for applications that may require a Logical condition of 2 relays PLUS and Override feature. For instance. Relay 1 is a Night/Day Sensor; Relay 2 is a Moisture Sensor. If it's Dark AND the soil is Dry, Relays 1 and 2 can activate a Pump. If you want to override these conditions with a KeyFob, Relay 3 may be used.



### Sample 6

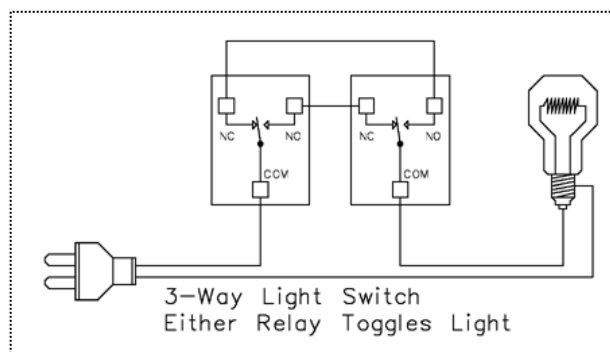
This sample demonstrates how either relay can be used to activate a light. In this sample, only one activated relay is required to activate the light. If both relays are activated, the light will be on.





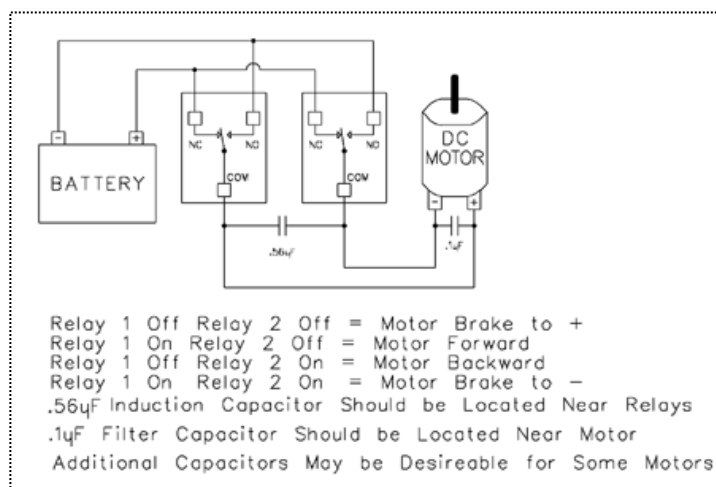
### Sample 7

This sample demonstrates how a 3-way light switch can be used to activate a light. A 3-way light switch is often found in your house where two light switches can be used to activate a single light. This sample is exactly the same as a 3-way light switch, the only difference being each physical switch is replaced by a relay. Operationally, it works with same way. Each relay activation will cause the light to toggle. Switching two relays at one time is like flipping 2 switches at one...with the same result. This sample is particularly useful since you can replace one relay (as shown in the diagram with a physical light switch). This will allow a computer. Reactor to control a light as well as manual operation of light. Properly used, this can be one of the most valuable diagrams we offer on this page.



### Sample 8

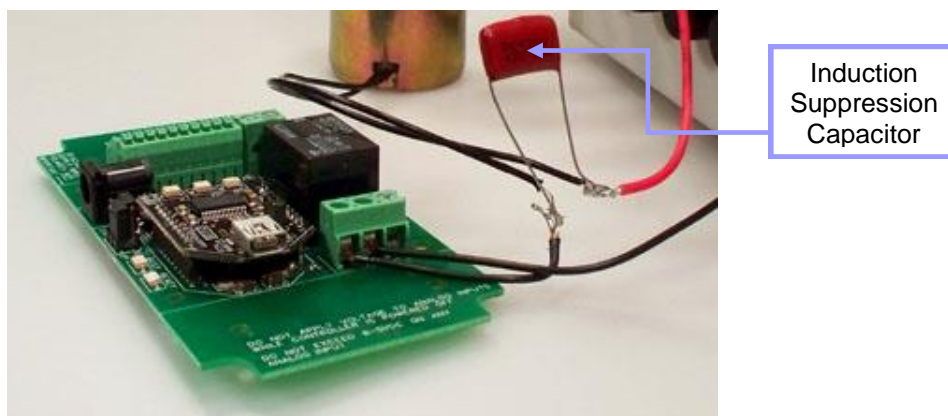
This sample demonstrates how to control the direction of a DC motor using 2 relays. Braking is accomplished by connecting both motor terminals to a common power connection (Faraday's Law). The capacitors shown may not be required for small motors, but if you experience problems with relays shutting themselves off, the induction suppression capacitor will be required. The 1uf capacitor helps suppress electronic noise if the battery were to be used by sensitive devices (such as radios/amplifiers).



# Induction Suppression

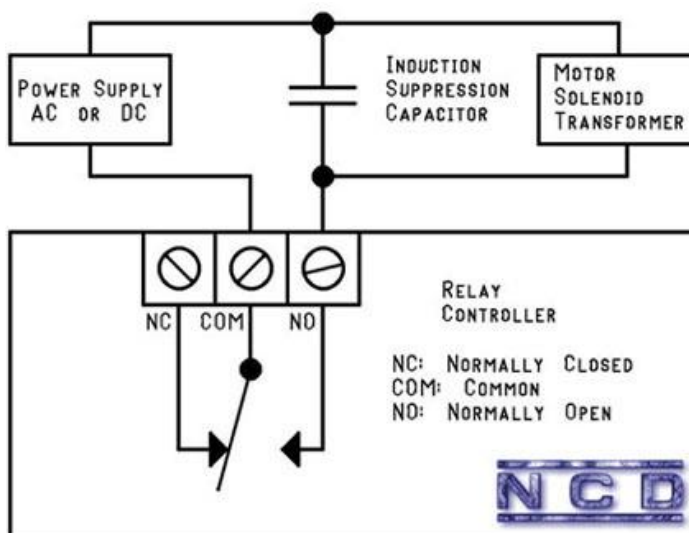
## Handling Inductive Loads

Perhaps the most overlooked aspect of relay control is proper handling of inductive loads of inductive loads. Inductive loads can best be defined as anything with a magnetic coil, such as a motor, solenoid, or a transformer. Controlling a inductive load using our relay controllers requires the use of induction suppression capacitors. The purpose of this capacitor is to absorb the high voltages generated by inductive loads, blocking them from the contacts of the relay. Without this capacitor, the lifespan of the relay will be greatly reduced. Induction can be so severe that it electrically interferes with the microprocessor logic of our controllers, causing relay banks to such themselves down unexpectedly. In the case of USB devices, customers may experience loss of communications until the device is reconnected to the USB port.



## Easy to Install

As you can see from the diagram below, an induction suppression capacitor is very easy to install. The capacitor should be located as close to the relay controller as possible, and is connected in parallel with the load you are trying to control. Induction suppression capacitors are NOT polarized, and may be used in both AC and DC applications.



## Choosing the Right Capacitor

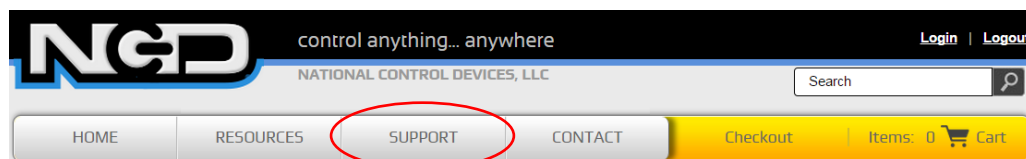
Choosing the correct induction suppression capacitor is simply a matter of choosing the maximum voltage requirement of the device you are trying to control. *Use the link above to access our webpage with all the options of capacitors available for purchase. Note warnings in red at the bottom of the page to avoid severely damaging your device.*

## Resistive Loads

Unlike inductive loads, resistive loads such as incandescent lights and element heaters (without a fan), DO NOT require an induction suppression capacitor, and will NOT benefit from its use.

## Technical Support

Technical support is available through our website, [controlanything.com](http://controlanything.com). **Support** is the way we connect NCD engineers to our customers.



*Click on the **Support** tab at the top of any page on our website to be taken to the **Forum** page. Here you can publicly post or review problems that customers have had, and learn about our recommended solutions.*

Our engineers monitor questions and respond continually throughout the day. Before requesting telephone technical support, we ask that customers please try to resolve their problems through **Support** first. However, for persistent problems, NCD technical support engineers will schedule a phone consultation.



## Contact Information

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Like “National Control Devices” on Facebook, and follow us on Twitter  
@ControlAnything.

All orders *must* be placed online at our website, [www.controlanything.com](http://www.controlanything.com)

### Notice:

The only authorized resellers of NCD products are

- [www.controlanything.com](http://www.controlanything.com)
- [www.relaycontrollers.com](http://www.relaycontrollers.com)
- [www.relaypros.com](http://www.relaypros.com)

All other websites are not authorized dealers; we have noticed some retailers offering our products fraudulently.