NATIONAL CONTROL DEVICES

ProXR Enhanced Quick Start Guide

Relay Control Command Set

NOTICE:

All customers are STRONGLY ADVISED to purchase at least ONE USB Communication Module. This communication module may be used to recover a controller or to reconfigure a controller should there be an accidental loss of communications. NCD Tech support may be unable to assist customers who do not have a USB Communications Module available for troubleshooting purposes.

Purchase USB Communications Module from our website at this link: *http://www.controlanything.com/Relay/Device/ZUSB*

Table of Contents

Introduction

NCD ProXR Enhanced Series devices expand on our ProXR Relay Control Command set. Improvements have been made to include many new commands, new configuration options, including support for newer interface technologies. Base Station software was created to demonstrate the new feature set of all ProXR Enhanced controllers. Improvements in communication speed (now supporting up to 2 Million Baud), microprocessor architecture, firmware and software come together to provide the world's most powerful relay control technology.

Most ProXR Enhanced Series Controllers include an XR Expansion port, allowing you to add additional banks of relays directly to the main controller. With a few minor programming modifications, you will be controlling additional relay banks in seconds. ProXR Standard controllers allow you to control up to 32 Banks of Relays (256 total relays). ProXR Enhanced controllers support a scalable architecture, allowing you to control anywhere from 1 to 255 banks of relays (up to 2048 relays) depending on CPU. Provisions have been made to scale the available number of relay banks to the memory capabilities of the CPU.

All ProXR Series Controllers are available with several communication interface options including: RS 232, USB, Ethernet, WiFi, Bluetooth, ZB Mesh, 802.15.4, and XSC. Enhanced firmware versions offer the ability to swap between interfaces easily with a pluggable communication interface socket.

- ➢ Watchdog/Server Reboot/Keep Alive Timing Functions
- ➢ Native Support for 1 to 255 Banks of Relays Depending on CPU
- ➢ Support for High Baud Rates of 230.4K Baud to 2 Million Baud Depending on CPU
- ➢ API Communications Codec adds Checksum Validation to every command
- ➢ Supports Duration Timing Commands (turn a light on for 8 hours)
- ➢ User-Selectable Communication Rates
- ➢ E3C Compliant Command Set
- ➢ Diode Clamped Relay Driver Stage
- ➢ Busy/Ready Status LEDs

ProXR

- 12 Volt DC Operation
- User-Programmable Startup Status
- Simultaneously Set the Status All Relays
- Ask the Status of Individual or All Relays
- Protected E3C Device Numbering
- Powerful ASCII Character Code Based Command Set
- Compatible with ANY Computer or Microcontroller, Including Windows, Mac, Linux, Android, and iOS.
- Relay Grouping option allow simultaneous control of adjacent relays without complicating programming.
- ProXR Enhanced devices can be controlled from almost any Software language including but not limited to C#, C++, C, Objective C, Visual Basic, Labview, MatLab, etc.

Device Variations:

This manual covers all NCD Devices that Reference this Document. ProXR Standard firmware is covered in a separate document.

ProXR

Getting Started

Important Power Supply Requirements for All ProXR Devices

1. Use a DEDICATED Power Supply for ProXR Controllers.

2. Never share the power supply of a ProXR Controller with inductive loads such as Motor, Valves, Solenoids, Transformers, or any other device that electrically contaminates the power supply.

2. Do not use a wall wart type unregulated power supply.

3. Use only a computer grade regulated switcher supply rated at 12 Volts DC, 1.25 amps or greater.

4. Use a supply rated for more amperage when powering multiple boards.

5. DC power should never travel greater than 20 feet. A separate power supply should be used for each controller if controllers are not located within 20 feet of each other.

6. Relay coils are rated at 12 volts DC. Higher voltages will shorten the coil life. Lower voltages may cause unreliable operation, but will not damage the controller.

7. ProXR series controllers may be used in 12 volt automotive electrical systems.

8. Minimum operating voltage 9 VDC, Maximum 13.5 VDC.

Notice

Never install NCD Relay Controllers near High Power RF Transmitters, such as CB Radio and Emergency Vehicle Voice/Data Transmitters. These devices may cause all relays to turn off or other undesirable operation.

Two-Way Communication

All ProXR devices support 2 way communication. All software developed for ProXR Series Controllers MUST be capable of 2-way communications. ProXR Controllers should not be used in One-Way Communication Applications without consultation with NCD Technical Support.

Hardware Diagram

Hardware diagrams may be found in the NCD Hardware Reference Guide on our website. Use the hardware reference guide to assist you with all physical connections to your ProXR Controller. This document focuses on the ProXR Enhanced Command Set.

Mechanical Drawings

Complete mechanical drawings for each device in the ProXR Series Line can be found on the product description page of each controller at www.controlanything.com.

Base Station Software

ProXR Enhanced controllers are designed to work with NCD Base Station Software, which is used to identify and configure devices. Download the latest version of Base Station software:

http://assets.controlanything.com/Software/NCDBaseStation.zip

Base Station software is in constant development, always evolving to fit the needs of users. The software is constantly being updated, because of this you may need to download the software quite often.

Base Station software provides you with a list of command sets processed by your device. Some devices will have more command sets and some will have less. What is displayed is specific to the controller you are using.

In order to communicate with the ProXR Enhanced controller, run NCD Base Station software.

➤ Connect the device to your computer using your favorite interface technology.
➤ Run the NCD Base Station software
➤ Select the appropriate COM port or IP Address
➤ Click OK.

When the dialog box appears, select *'ProXR Enhanced Relay Control Command Set'* by clicking once. Use the control panel to send commands to the device as illustrated on the following page.
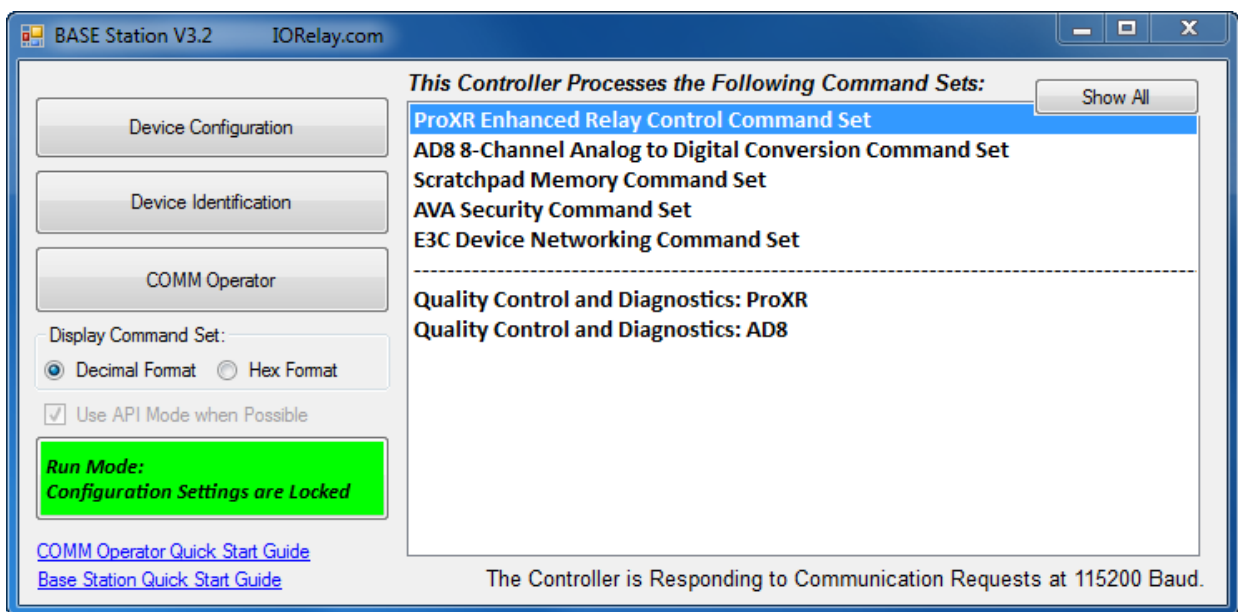
Configuring your controller:

A. Select Relay Bank commands are directed to. Note: Selecting 0 directs commands to all available relay banks.

B. Simple On/Off control of individual relay in selected bank.

C. Set status of all relays in the selected relay bank.

D. Read the status of individual relays in selected bank.

E. Turn Off Automatic Refreshing, See page 9.

F. Communication Details. This portion of the interface is visible when selecting the MORE features is labeled section G in diagram.

G. Either reads MORE or LESS. MORE shows Section F in diagram. The LESS option shrinks the windows to exclude Section F.

H. This box is recommended to stay checked so commands are directed to banks correctly.

I. Set status of all relays in bank, see page 16.

J. Read status of all relays in selected bank, see page 13.

K. See Page 9

L. See Page 9

M. See page 9

N. Store current relay status as default power up status. See page 16.

O. Bring up window for controlling individual relay.

P. Test built in ProXR Timers.

Q. Group relays to be controlled simultaneously.

R. Opens a window with all Relay Flasher settings.
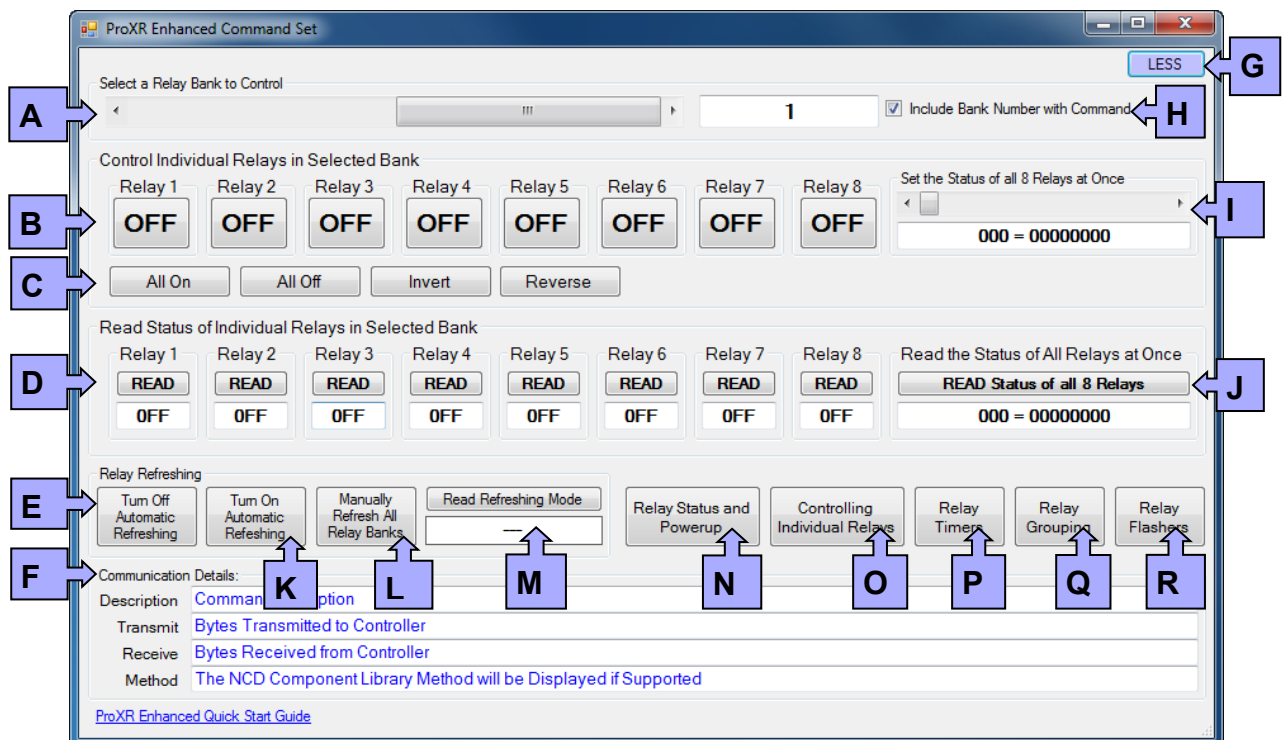
Relay Banking Commands

Relay Banking and Refreshing Commands: Introduction

Understanding Relay Banks and Basic Control Concepts

A Relay Bank is simply a group of 8 relays. The ProXR Enhanced Controllers allow you to control up to 2048 relays depending on CPU and Controller. You control which bank of relays you are speaking to at all times. It is VERY IMPORTANT that you understand that there are two ways to specify which relay bank you are talking to. These topics will be discussed in greater length later in this guide, providing you with specific instructions and program examples. This page will help prepare you for seeing two different commands that do the same thing. In this manual, you will see the word "bank". This word should be equated to a number from 0 to 255. A value of 1 speaks to relay bank 1 (the first 8 relays on the board). A value of 2 speaks to relay bank 2 (the second group of 8 relays on the board). A value of 255 speaks to the last group of 8 relays (which is connected to the main controller using the XR expansion ports). A value of 0 speaks to all banks of relays at one time. When bank 0 is selected, you can then specify a command to turn on relay 1, and relay 1 on all relay banks will be activated. There will be more examples of this and detailed information on each command.

Understanding the concept of controlling multiple relays across multiple banks is very important to your understanding how the ProXR command set is organized.

Bank Directed Commands:

a) Specify a relay bank (there is a command you will send just for this purpose).

All subsequent Commands will be directed to the previously specified relay bank.

b) Specify a different relay bank.

All Subsequent Commands will be directed to the new relay bank you have specified.

Bank Specified Commands:

a) Specify a relay bank with every command.

While this method is slightly slower, it ensures commands are always directed to the correct relay bank.

This is the recommended method of communications.

Understanding Relay Bank Refreshing: Controlling Multiple Banks

Under normal operation, you will send a command to the relay controller, and the relay controller will respond to your command by activating or deactivating a relay. This system works well if you only need to control 1-8 relays, but it does not necessarily work very well if you are taking advantage of the XR Expansion port, allowing you to control up to 2048 relays (255 relay banks depending on controller). In these cases, you may want to set the status of all relays at the exact same time. The easiest way to do this is to turn off automatic relay refreshing. Once turned off, you can use the relay control command set to activate relays, but the commands will not appear to have any effect. The effects will not be seen until you manually refresh the relay bank. Rest assured, when auto refreshing is off, your relay control commands are working, the processor memory is copied to the physical relay bank memory when you manually refresh the relays.

Follow this methodology to set the status of lots of relays at one time across multiple banks:

a) Turn Off Auto Refreshing.

b) Use Relay Control Command to activate different relays on different banks.
These commands will not appear to work; they will only modify internal memory.

c) Send the Manual Refresh Command to update all relays at one time.

NOTE: Relay Banking and Relay Refreshing are two of the most important concepts in understanding how ProXR Series Controllers function.
We do not advise skipping the information found on this page.

Introduction

The ProXR Series Controllers allow you to control up to 2048 relays depending on your controller model. Relays are divided into groups of 8 called banks, and are addressed by their bank number. For instance, a ProXR series controller with 32 on-board relays has four on-board banks, the on-board relays respond to bank values of 1-4. If you use the XR Expansion port to add another bank of 24 relays, then you will need to specify bank values of 5-7 to control the extra relays. The firmware doesn't actually know how many relays are attached to the relay controller, it is up to the user to define how many relays are attached to the controller using Base Station Software. The ProXR CPU will assume you have connected the maximum number of supported relays to your controller.

In this manual, you will see two commands that appear to do the same thing, for example:

254 0-7   Turn Off Individual Relays

254 100-107 Bank#   Turn Off Individual Relays in Bank

254 8-15   Turn On Individual Relays

254 108-115   Turn On Individual Relays in Bank

254 16-23   Get the Status of an Individual Relay

254 116-123 Bank#   Get the Status of an Individual Relay in Bank

While the outcome is the same, these commands function in slightly different ways.

For instance:

254 8   Turn On Relay 1

To make this command work, you will send a 254, then a 8 to activate a relay. By default, relay bank 1 will be affected by this command. However, you can redirect this command to a different relay bank using the following command:

254 49 2   Direct Commands to Relay Bank 2

Then you can send:

254 8   Turn On Relay 1 in Bank 2

Here are a few more Bank Specified Examples:

254 49 1	Direct Commands to Relay Bank 1
254 8	Turn On Relay 1 in Bank 1
254 49 2	Direct Commands to Relay Bank 2
254 8	Turn On Relay 1 in Bank 2
254 9	Turn On Relay 2 in Bank 2
254 10	Turn On Relay 3 in Bank 2
254 49 3	Direct Commands to Relay Bank 3
254 8	Turn On Relay 1 in Bank 3
254 11	Turn On Relay 4 in Bank 3
254 12	Turn On Relay 5 in Bank 3
254 13	Turn On Relay 6 in Bank 3
254 14	Turn On Relay 7 in Bank 3
254 49 0	Direct Commands to All Relay Banks
254 8	Turn On Relay 1 in All Relay Banks

This command structure has the advantage of being very fast and efficient. However, if power to the controller is ever lost, commands will automatically be directed to bank 1 when power to the controller has been restored. This command methodology is generally advisable for ProXR controllers with 8 or fewer relays. When working with more than 8 relays, we generally advise users to use Bank Directed commands as shown in the following pages.

Sample Overview

Turns Off Relays in the Currently Selected Relay Bank

This command will control the Off status of specified relays in the Currently Selected Relay Bank. This command has optional parameters <1-7> for controlling the Off status of the remaining relays, 1 being the next relay in sequence, 2-7 being all possible subsequent relays in the selected relay bank. A value of 0 refers to the first relay in the specified relay bank, 7 being the 8th and final relay of the selected Relay Bank. This command sends byte value 85 back to the user when the operation has been completed.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:
Function:	Command	Command	Optional Parameters
Decimal Values:	254	0-7	1-7
Hex Values	0xFE	0x00 - 0x07	0x01 - 0x07

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 0 7   Turn Off Relay 0 in the Currently Selected Relay Bank. Turn Off the next 7 relays in Currently Selected Relay Bank.

254 7   Turn Off Relay 7 in the Currently Selected Relay Bank.

254 2 1   Turn Off Relay 2 in the Currently Selected Relay Bank. Turn Off the next relay (Relay 3) in Currently Selected Relay Bank.

NCD Component Library Command Method:

Not Yet Implemented

Turns On Relays in the Currently Selected Relay Bank

This command will control the On status of specified relays in the Currently Selected Relay Bank. This command has optional parameters <1-7> for controlling the On status of the remaining relays, 1 being the next relay in sequence, 2-7 being all possible subsequent relays in the selected relay bank. A value of 0 refers to the first relay in the specified relay bank, 7 being the 8th and final relay of the selected Relay Bank. This command sends byte value 85 back to the user when the operation has been completed.

Send Bytes:	*Byte 1:*	*Byte 2:*	*Byte 3:*
Function:	Command	Command	Optional Parameters
Decimal Values:	254	8-15	1-7
Hex Values	0xFE	0x08 - 0x0F	0x01 - 0x07

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 8 15   Turn On Relay 0 in the Currently Selected Relay Bank. Turn On the next 7 relays in Currently Selected Relay Bank.

254 15   Turn On Relay 7 in the Currently Selected Relay Bank.

254 10 1   Turn On Relay 2 in the Currently Selected Relay Bank. Turn On the next relay (Relay 3) in Currently Selected Relay Bank.

NCD Component Library Command Method:

Not Yet Implemented

Read the Status of Relays in the Currently Selected Relay Bank

This command will report the On/Off status of Relays 0-7 in the Currently Selected Relay Bank. This command sends byte value of 0 of 1 back to the user when the operation has been completed, 0 reporting an Off status and 1 reporting an On status.

Send Bytes:	Byte 1:	Byte 2:
Function:	Command	Command
Decimal Values:	254	16-23
Hex Values	0xFE	0x10 - 0x17

Receive Byte:	Decimal:	0 or 1
	Hex:	0x00 or 0x01

COMM Operator Examples:

254 16 -- 1   Report On/Off status of Relay 1 in the Currently Selected Relay Bank. Reported On status.

254 20 -- 0   Report the On/Off status of Relay 5 in the Selected Relay Bank. Reported an Off status.

254 23 -- 1   Report the On/Off Status of Relay 8 in the Currently Selected Relay Bank. Report an On status.

NCD Component Library Command Method:

Not Yet Implemented

General Control Commands

Report the Status of 8 relays in the Currently Selected Relay Bank.

Reports the Current Status of 8 Relays in the Currently Selected Relay Bank. If the Bank Value equals 0, then 32 bytes will be returned by this command representing the status of the first 32 relay banks. Each byte returned from the controller will have a value from 0-255. Convert this value to binary to see the On/Off status of each relay in the relay bank.

Send Bytes:	**Byte 1:**	**Byte 2:**
Function:	Command	Command
Decimal Values:	254	24
Hex Values	0xFE	0x18

Receive Byte:	Decimal:	0-255
	Hex:	0x00 - 0xFF

COMM Operator Examples:

254 24

NCD Component Library Command Method:

Not Yet Implemented

Turn On Automatic Relay Refreshing

This command will turn ON Automatic Relay Refreshing. When a relay control command is sent to the controller, the controller will refresh the state of all relays in every bank. This command has been modified from the original version, it no longer stores the refresh status in EEPROM. Use Device Configuration to change how the controller functions on startup.

Send Bytes:	**Byte 1:**	**Byte 2:**
Function:	Command	Command
Decimal Values:	254	25
Hex Values	0xFE	0x19

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 25   Turn ON Automatic Relay Refreshing.

NCD Component Library Command Method:

Not Yet Implemented

ProXR

Turn Off Automatic Relay Refreshing

This command will turn OFF Automatic Relay Refreshing. When a relay control command is sent, the relay will not change state. This allows you to use the complete ProXR command set to manipulate relay status. When you need the relays to change state, you will send a manual refresh command. This command no longer stores the refresh status in EEPROM. Use Device Configuration to change how the controller functions on startup.

Send Bytes:	**Byte 1:**	**Byte 2:**
Function:	Command	Command
Decimal Values:	254	26
Hex Values	0xFE	0x1A

Receive Byte: Decimal: 85

Hex: 0x55

COMM Operator Examples:

254 26   Turn Off Automatic Relay Refreshing.

NCD Component Library Command Method:

Not Yet Implemented

ProXR Bank Directed Commands

Turn Off All Relays

This command will turn OFF all relays in the Currently Selected Relay Bank. If the currently selected relay bank is 0, then all relays will be turned off in all relay banks.

Send Bytes:	Byte 1:	Byte 2:
Function:	Command	Command
Decimal Values:	254	29
Hex Values	0xFE	0x1D

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 29   Turn off all relays in the specified bank of relays.

NCD Component Library Command Method:

Not Yet Implemented

Turn On All Relays

This command will turn ON all relays. If the currently selected relay bank is 0, then all relays will be turned on in all relay banks.

Send Bytes:	Byte 1:	Byte 2:
Function:	Command	Command
Decimal Values:	254	
Hex Values	0xFE	0x1E

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 30   Turn On all relays in the specified bank of relays.

NCD Component Library Command Method:

Not Yet Implemented

Invert the Status of All relays in the Currently Selected Relay Bank

This command inverts the status of all relays in the currently selected relay bank. All relays that are Off will turn On. All relays that are On will turn Off. If a bank value of 0 is selected, all relays in all relay banks will be inverted.

Send Bytes:	**Byte 1:**	**Byte 2:**
Function:	Command	Command
Decimal Values:	254	31
Hex Values	0xFE	0x1F

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 31   Inverts the status of relays in the currently selected relay bank.

NCD Component Library Command Method:

Not Yet Implemented

Reverse the Status of All Relays

This command reverses the status of all relays in the currently selected relay bank. This command effectively swaps the status of all relays like a mirror:

The status of Relay 1 is copied to Relay 8
The status of Relay 2 is copied to Relay 7
The status of Relay 3 is copied to Relay 6
The status of Relay 4 is copied to Relay 5
The status of Relay 5 is copied to Relay 4
The status of Relay 6 is copied to Relay 3
The status of Relay 7 is copied to Relay 2
The status of Relay 8 is copied to Relay 1
If a bank value of 0 is selected, all relays in all relay banks will be reversed.

Send Bytes:	Byte 1:	Byte 2:
Function:	Command	Command
Decimal Values:	254	32
Hex Values	0xFE	0x20

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 32   Reverse the status of all relays in the currently selected relay bank.

NCD Component Library Command Method:

Not Yet Implemented

ProXR

Test 2-Way Communications

This command, Test 2-Way Communications is used to verify the controller is properly communicating. This command will respond with one of the following responses based on the current mode of the device:

85 is returned if the controller is in run mode
86 is returned if the controller is in configuration mode
87 is returned if the controller is in security lockdown mode

Send Bytes:	Byte 1:	Byte 2:
Function:	Command	Command
Decimal Values:	254	33
Hex Values	0xFE	0x21

Receive Byte:	Decimal:	85, 86, or 87
	Hex:	0x55, 0x56, or 0x57

COMM Operator Examples:

254 33 - -85   Test 2-Way Communications. Returned byte of 85 indicates the controller is in Run Mode.

254 33 - -86   Test 2-Way Communications. Returned byte of 86 indicates the controller is in Configuration Mode.

254 33 - -87   Test 2-Way Communications. Returned byte of 87 indicates the controller is in Lockdown Mode.

NCD Component Library Command Method:

Not Yet Implemented

ProXR

Return the Currently Selected Bank

This command returns the currently selected relay bank.

Send Bytes:	**Byte 1:**	**Byte 2:**
Function:	Command	Command
Decimal Values:	254	34
Hex Values	0xFE	0x22

Receive Byte:	Decimal:	0-255
	Hex:	0x00-0xFF

COMM Operator Examples:

254 34   Return the Currently Selected Relay Bank. Will send a response of 0-255, to indicate the relay bank.

NCD Component Library Command Method:

Not Yet Implemented

Report the Current Status of Automatic Relay Refreshing

This command reports the current status of automatic relay refreshing. This command will return a 0 or 1 indicating if refreshing is off or on.

Send Bytes:	**Byte 1:**	**Byte 2:**
Function:	Command	Command
Decimal Values:	254	36
Hex Values	0xFE	0x24

Receive Byte:	Decimal:	0 or 1
	Hex:	0x01 or 0x01

COMM Operator Examples:

253 36   Report the current status of Automatic Relay Refreshing.

NCD Component Library Command Method:

Not Yet Implemented

Manually Refresh All Relays in All Relay Banks

Manually refresh all relays in all relay banks. Use this command to set the status of all relays at the exact same time. Use in combination with Relay Refreshing commands

Send Bytes:	**Byte 1:**	**Byte 2:**
Function:	Command	Command
Decimal Values:	254	37
Hex Values	0xFE	0x25

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

253 37 Manually refresh relays in All Relay Banks.

NCD Component Library Command Method:

Not Yet Implemented

Set the Status of All Relays in the Currently Selected Relay Bank

Sets the status of all relays in the currently selected relay bank. This command requires a parameter value of 0-255. This parameter sets the status of all relays to the Binary equivalent value. 254, 40, 0 turns off all relays. 254, 40, 255 turns on all relays. 254, 40, 85 turns off every other relay. If a bank value of 0 is selected, this will set the command status of all relays in all relay banks.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**
Function:	Command	Command	Parameter
Decimal Values:	254	40	0-255
Hex Values	0xFE	0x28	0x00 - 0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 40 0 Turn Off All Relays in the Currently Selected Relay Bank.
254 40 255 Turn On All Relays in the Currently Selected Relay Bank.
254 1 85 Turns Off every other Relay in the Currently Selected Relay Bank.

NCD Component Library Command Method:

Not Yet Implemented

ProXR

Stores the Current State of All Relays as the Power-up Default State

This command stores the current state of all relays as the power-up default state. 254, 42, 0 stores all relays in all banks. 254, 42, 1 stores the current status of bank 1 only. The maximum possible value depends on how many relay banks are attached. If your controller supports 255 relay banks, then 255 may be used.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**
Function:	Command	Command	Parameter
Decimal Values:	254	42	0-255
Hex Values	0xFE	0x2A	0x00 - 0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 42 0   Stores the Current State for All Relays in All Relay Banks.

254 42 1   Stores the Current State for All relays in Bank 1 only.

NCD Component Library Command Method:

Not Yet Implemented

Report the Power-up Default Status of Relays in the Selected Relay Bank

This command reports the power-up default status of relays in the selected relay bank. If bank 0 is selected (254,43,0) then the controller reports the status of the first 32 relay banks. The maximum value for this command will depend on the ATBanks (attached relay banks supported by your controller). This command reports a value of 0-255 indicating the power-up default status of the selected bank.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**
Function:	Command	Command	Command
Decimal Values:	254	43	0-255
Hex Values	0xFE	0x2B	0x00 - 0xFF

Receive Byte:	Decimal:	0-255
	Hex:	0x00 - 0xFF

COMM Operator Examples:

254 43 0   Reports the status of the first 32 Relay Banks.

NCD Component Library Command Method:

Not Yet Implemented

ProXR

Read the Status of a Selected Relay

This command will read the status of a selected relay. This command provides a quick way to read the status of a single relay using a relay number. Since the communication bus is limited to 8 bits, this command can accept a byte to read the status of the first 256 relays, or it can accept a word, to read the status of more than 256 relays. The optional parameter <0-255> is usually a value of 0 or 1 for many controllers, 0 indicating the first 256 relays, 1 indicating the next 256 relays. The actual maximum value for this command will depend on the number of relays supported by your controller.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**	**Byte 4:**
Function:	Command	Command	Command	Optional Parameter
Decimal Values:	254	44	0-255	0-255
Hex Values	0xFE	0x2C	0x00 - 0xFF	0x00 - 0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

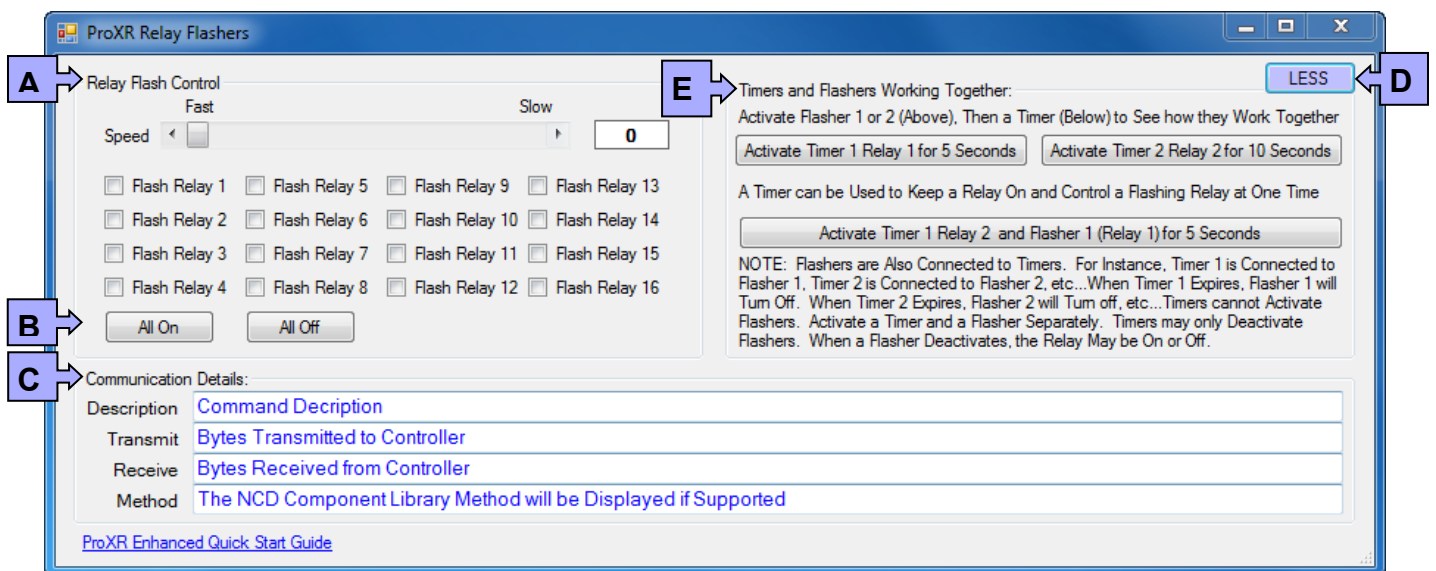### _COMM Operator Examples:_

Coming soon.

NCD Component Library Command Method:

Not Yet Implemented

ProXR Relay Flashers Command Set

Controlling Relay Flashers in Base Station

A. Relay Flash Control. Here you can control Flasher speed and specify the relay.

B. All On/Off. Controls all relays with one command.

C. Communication details. This portion of the interface is visible when selecting the MORE feature labeled as section E in diagram.

D. Either reads MORE or LESS. MORE shows section C in diagram. The LESS option shrinks the window to exclude section C.

E. Timers and Flashers Working Together. These buttons combine Relay Flasher and Relay Timer commands.

A — Relay Flash Control

Fast   Slow

Speed ◄ ▢ ▶   **0**

Flash Relay 1   Flash Relay 5   Flash Relay 9   Flash Relay 13
Flash Relay 2   Flash Relay 6   Flash Relay 10   Flash Relay 14
Flash Relay 3   Flash Relay 7   Flash Relay 11   Flash Relay 15
Flash Relay 4   Flash Relay 8   Flash Relay 12   Flash Relay 16

B — All On   All Off

E — Timers and Flashers Working Together:

Activate Flasher 1 or 2 (Above), Then a Timer (Below) to See how they Work Together

Activate Timer 1 Relay 1 for 5 Seconds   Activate Timer 2 Relay 2 for 10 Seconds

A Timer can be Used to Keep a Relay On and Control a Flashing Relay at One Time

Activate Timer 1 Relay 2 and Flasher 1 (Relay 1) for 5 Seconds

NOTE: Flashers are Also Connected to Timers. For Instance, Timer 1 is Connected to Flasher 1, Timer 2 is Connected to Flasher 2, etc...When Timer 1 Expires, Flasher 1 will Turn Off. When Timer 2 Expires, Flasher 2 will Turn off, etc...Timers cannot Activate Flashers. Activate a Timer and a Flasher Separately. Timers may only Deactivate Flashers. When a Flasher Deactivates, the Relay May be On or Off.

D — LESS

C — Communication Details:

Description   Command Decription
Transmit   Bytes Transmitted to Controller
Receive   Bytes Received from Controller
Method   The NCD Component Library Method will be Displayed if Supported

ProXR Enhanced Quick Start Guide

Set the Flash Rate for All Relay Flashers

Sets the Flash Rate of all Relay Flashers. A relay flasher turns relays on and off in the background automatically. A speed value parameter is required from 0-255. This parameter controls the flash rate where 0 is the fastest and 255 is the slowest allowed speed.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:	Byte 4:
Function:	Command	Command	Command	Speed Parameter
Decimal Values:	254	45	0	0-255
Hex Values	0xFE	0x2D	0x00	0x0 - 0XFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

Coming soon.

NCD Component Library Command Method:

Not Yet Implemented

Controls the On/Off Status Relay Flashers

Controls the On/Off Status of each of the 16 possible relay flashers. There are two optional parameters for this command. 1-16 chooses a relay flasher to control, a value of 0 or 1 turns the flasher off or on.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:	Byte 4:
Function:	Command	Command	Parameter (Optional)	Parameter (Optional)
Decimal Values:	254	45	1-16	0 or 1
Hex Values	0xFE	0x2D	0x01 - 0x10	0x00 or 0x01

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 45 1 1   Turn On Relay Flasher 1.
254 45 16 0   Turn Off Relay Flasher 16.
254 45 8 0   Turn Off Relay Flasher 8.

NCD Component Library Command Method:

Not Yet Implemented

Safe Break Before Make Relay Switching

This command turns off all relays, pauses for a short duration, then activates the selected relay. Since the communication bus is limited to 8 bits, this command can accept a byte to control the status of the first 256 relays, or it can accept a word, to control the status of more the 256 relays. The optional parameter <0-255> is usually a value of 0 or 1 for many controllers, 0 indicating the first 256 relays, 1 indicating the next 256 relays. The actual maximum value for this command will depend on the number of relays supported by you controller.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:	Byte 4:
Function:	Command	Command	Parameter	Parameter (Optional)
Decimal Values:	25	46	0-255	0-255
Hex Values	0xFE	0x2E	0x00 - 0xFF	0x00 - 0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

Coming soon.

NCD Component Library Command Method:

Not Yet Implemented

ProXR Enhanced Command Set

Turn Off the Selected Relay

Turns off the selected relay. Since the communication bus is limited to 8 bits, this command can accept a byte to control the status of the first 256 relays, or it can accept a word, to control the status of more than 256 relays. The optional parameters <0-255> is usually a value of 0 or 1 for many controllers, 0 indicating the first 256 relays, 1 indicating the next 256 relays. The actual maximum value for this command will depend on the number of relays supported by your controller.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**	**Byte 4:**
Function:	Command	Command	Parameter	Parameter (Optional)
Decimal Values:	254	47	0-255	0-255
Hex Values	0xFE	0x2F	0x00 - 0xFF	0x00 - 0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

Coming soon.

NCD Component Library Command Method:

Not Yet Implemented

Turns On the Selected Relay

This command turns on the selected relay. Since the communication bus is limited to 8 bits, this command can accept a byte to control the first 256 relays, or it can accept a word to control the status of more than 256 relays. The optional parameter of <0-255> is usually a value of 0or 1 for many controllers, 0 indicating the first 256 relay, 1 indicating the next 256 relays. The actual maximum value for this command will depend on the number of relays supported by your controller.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:	Byte 4:
Function:	Command	Command	Parameter	Parameter (Optional)
Decimal Values:	254	48	0-255	0-255
Hex Values	0xFE	0x30	0x00 - 0xFF	0x00 - 0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

Coming soon.

NCD Component Library Command Method:

Not Yet Implemented

ProXR

Select A Relay Bank To Control

This command selects a relay bank to control. This command is used to set the relay bank number. When you set the relay bank number to 1, all relay control commands will be directed to relay bank 1, to control the first 8 relays on the controller. When the bank is set to 2, relay control commands will be directed to Relay Bank 2 (the second group of 8 relays). A bank value of 0 directs relay control commands to All Relay Banks. Values from 0 to 255 are valid bank values, however, most controllers support less than 255 relay banks, so the maximum value for this parameter will be limited to the total number of relay banks supported by your particular controller.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:
Function:	Command	Command	Parameter
Decimal Values:	254	49	0-255
Hex Values	0xFE	0X31	0x00 - 0xFE

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

Coming soon.

NCD Component Library Command Method:

Not Yet Implemented

Bank Specified Relay Control Command Set

Relay Grouping in Base Station

A. Select a Relay Bank to control.

B. Relay 1. Allows you to group Relay 1 with 7 more relays after Relay 1.

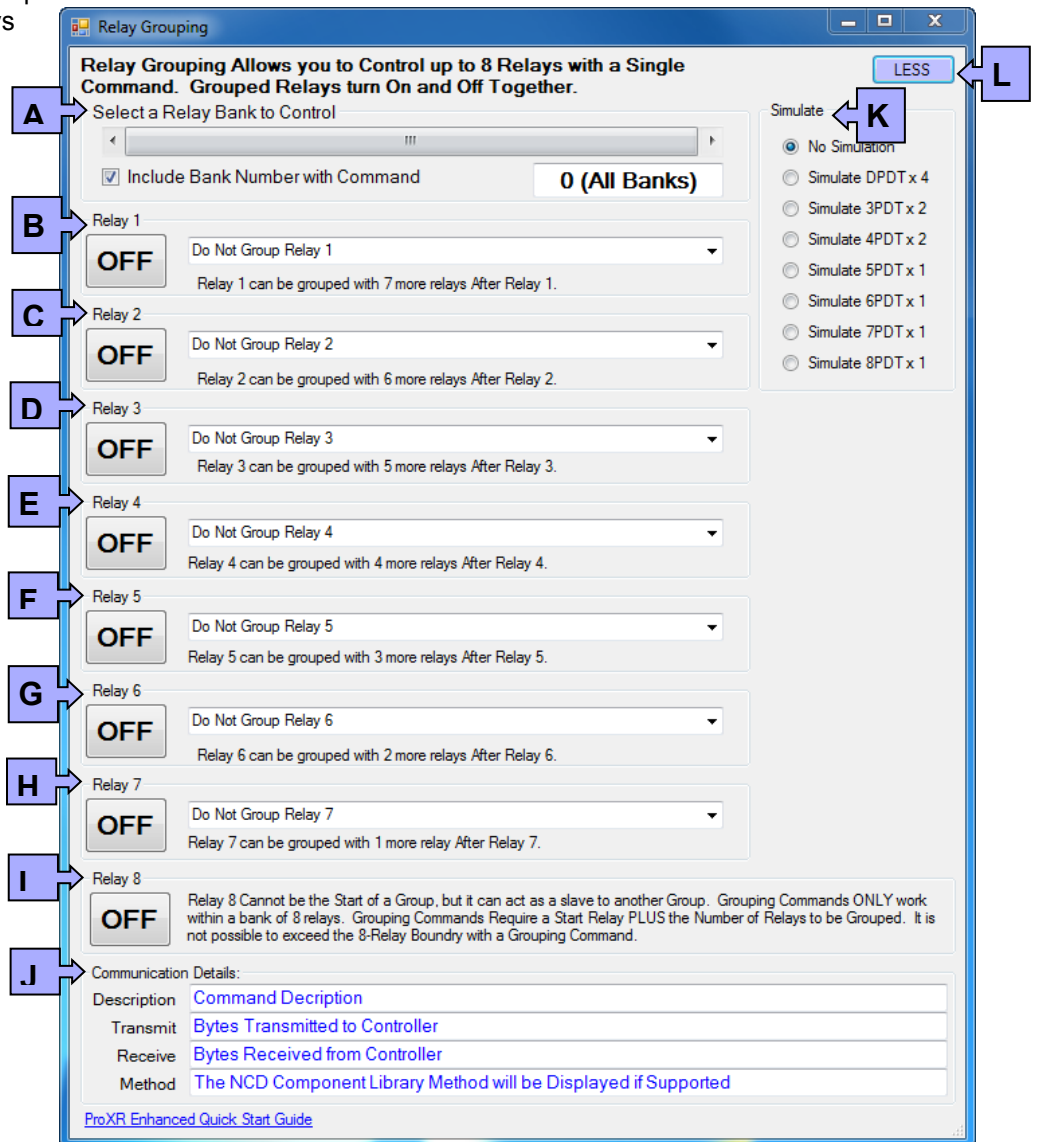C. Relay 2. Allows you to group Relay 2 with 6 more relays after Relay 2.

D. Relay 3. Allows you to group Relay 3 with 5 more relays after Relay 3.

E. Relay 4. Allows you to group Relay 4 with 4 more relays after Relay 4.

F. Relay 5. Allows you to group Relay 5 with 3 more relays after Relay 5.

G. Relay 6. Allows you to group Relay 6 with 2 more relays after Relay 6.

H. Relay 7. Allows you to group Relay 7 with 1 more relay after Relay 7.

I. Relay 8 cannot be the start of a group, but can act as a slave to another Relay group. Grouping commands only work within a bank of 8 relays.

J. Communication Details. This portion of the interface is visible when selecting the MORE feature labeled as section L in diagram.

K. Simulate. Each option creates grouping samples from the relay portion of this screen.

L. Either reads MORE or LESS. MORE shows section J in diagram. The LESS option shrinks the window to exclude section J.

Bank Specified Relay Control Commands (100 Series Commands)

Bank Specified Relay Control Commands (also known as 100 Series Commands) are the preferred method of controlling relays. These commands require a relay bank value to be specified as part of the command. This command set is preferred because there is no question as to which relay bank the controller is talking to. Bank Directed relay control commands are a little faster because you do not specify a relay bank with each command. However, if your application crashes, or if power to the controller is lost, your software must take steps to set the relay controller to the correct relay bank. This is not required when using bank specified commands because the bank number is part of the command, which keeps your controller and software in sync at all times. For highest reliability applications, we strongly suggest using Bank Specified Relay Control Commands.

Turn Off Relays in the Specified Relay Bank

This command turns Off a specified relay in a specified relay bank. If the Bank Value is 0, this command will be directed to all available relay banks. Enhanced firmware users may now specify an optional parameter of 1-7 to turn off up to 7 additional relays in the chosen relay bank.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**	**Byte 4:**
Function:	Command	Command	Command (Bank)	Parameter (Optional)
Decimal Values:	254	100-107	0-255	1-7
Hex Values	0xFD	0x64 - 0x6B	0x00 - 0xFF	0x01 - 0x07

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 100 0 7   Turn Off Relay 0 in ALL available relay banks. Turn Off the next 7 relays in all available relay banks.

254 106 1 1   Turn Off Relay 6 in Relay Bank 1. Turn Off the next relay in Relay Bank 1.

254 102 1   Turn Off Relay 2 in Relay Bank 1.

ProXR

Turn On Relays in the Specified Relay Bank

This command turns On a relay in a relay bank. If the Bank Value is 0, this command will be directed to all available relay banks. Enhanced firmware users may now specify an optional parameter of 1-7 to turn on up to 7 additional relays in the chosen relay bank.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**	**Byte 4:**
Function:	Command	Command	Command (Bank)	Parameter (Optional)
Decimal Values:	254	108-115	0-255*	1-7
Hex Values	0xFD	0x6C - 0x73	0x00 - 0xFF	0x01 - 0x07

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 108 0 7   Turn On Relay 0 in ALL available relay banks. Turn On the next 7 relays in all available relay banks.

254 1141 1   Turn On Relay 6 in Relay Bank 1. Turn On the next relay in Relay Bank 1.

254 110 1   Turn On Relay 2 in Relay Bank 1.

*Maximum Bank number of relay banks available depends on controller and CPU.

COMM Operator Examples:

254 108 1   Turn On Relay 1 in Bank 1

254 108 2   Turn On Relay 1 in Bank 2

254 109 2   Turn On Relay 2 in Bank 2

254 110 2   Turn On Relay 3 in Bank 2

254 108 3   Turn On Relay 1 in Bank 3

254 111 3   Turn On Relay 4 in Bank 3

254 112 3   Turn On Relay 5 in Bank 3

254 112 0   Turn On Relay 5 in All Relay Banks (Bank 0)

NCD Component Library Command Method:

Not Yet Implemented

Note:

By Default, Automatic Refreshing is ON and relays will change state. When Automatic Refreshing is OFF, these commands will not change the state of the relays. These commands are changing the memory pattern for the relays inside the controller. You will not see the effects of your changes until you send a Manual Refresh command. You can return to automatic refreshing at any time. Turning on automatic refreshing does NOT refresh the relays. You must send the Manual Refresh Command or Send a new relay control command to change the state of all the relays.

Read the Status of Relays in the Specified Relay Bank

This command will read the status of individual relays in the specified relay bank. A bank value of 0 is Not Valid for this command. The command will return a 1 or a 0 indicating On/Off status of the relay.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:
Function:	Command	Command (Relay)	Command (Bank)
Decimal Values:	254	116-123	0-255
Hex Values	0xFD	0x74 - 0x7B	0x00 - 0xFF

Receive Byte:	Decimal:	0 or 1
	Hex:	0x00 or 0x01

COMM Operator Examples:

254 116 1--1 Read the status of Relay 0 in Bank 1. Report On status.

NCD Component Library Command Method:

Not Yet Implemented

General Control Commands for Specified Relay Banks

Read the Status of Relays in the Specified Relay Bank

This command will read the status of individual relays in the specified relay bank. A bank value of 0 is Not Valid for this command. The command will return a 1 or a 0 indicating On/Off status of the relay.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:
Function:	Command	Command (Relay)	Command (Bank)
Decimal Values:	254	116-123	0-255
Hex Values	0xFD	0x74 - 0x7B	0x00 - 0xFF

Receive Byte:	Decimal:	0 or 1
	Hex:	0x00 or 0x01

COMM Operator Examples:

254 116 1--1   Read the status of Relay 0 in Bank 1. Report On status.

NCD Component Library Command Method:

Not Yet Implemented

Report the Current Status of 32 Banks of Relays

This command reports the status of 32 Banks of Relays. Optional Parameter <0-255> indicates the group. If this optional parameter is not used or contains 0, the first 32 relay banks will be reported. A value of 1 reports the next group of 32 relay banks. A value of 2 reports the 3rd group of 32 relay banks.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:	Byte 4:
Function:	Command	Command	Command	Parameter (Optional)
Decimal Values:	254	124	0	0-255
Hex Values	0xFE	0x7C	0x00	0x00 - 0xFF

Receive Byte:	Decimal:	0-255 (32 Bytes)
	Hex:	0x00 - 0xFF (32 Bytes)

COMM Operator Examples:

254 124 0   Report the status of the first 32 Banks of Relays (32 Bytes Returned)
254 124 0 1   Report the status of the second group of 32 Banks of Relays (32 Bytes Returned)

NCD Component Library Command Method:

Not Yet Implemented

Turn Off All Relays

This command will turn off all relays. If the currently selected relay bank is 0 then all relays will be turned off in all relay banks.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:
Function:	Command	Command	Parameter (Bank)
Decimal Values:	254	129	0-255
Hex Values	0xFE	0x81	0x00 - 0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 129 0   Turn off all relays in all available relay banks

NCD Component Library Command Method:

Not Yet Implemented

Turn On All Relays

This command will turn On all relays. If the currently selected relay bank is 0, then all relays will be turned on in all relay banks.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:
Function:	Command	Command	Parameter (Bank)
Decimal Values:	254	130	0-255
Hex Values	0xFE	0x82	0x00 - 0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 130 0   Turn on all relays in all available relay banks.

NCD Component Library Command Method:

Not Yet Implemented

ProXR

Invert the Status of All Relays in the Currently Selected Relay Bank

Inverts the status of all relays in the currently selected relay bank. All relays that are off will turn on. All relays that are on will turn off. If a Bank Value of 0 is selected, all relays in all relay banks will be inverted.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**
Function:	Command	Command	Parameter (Bank)
Decimal Values:	254	131	0-255
Hex Values	0xFE	0x83	0x00 - 0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 131 0   Invert the status of all relays in all available relay banks.

NCD Component Library Command Method:

Not Yet Implemented

Reverse the Status of All Relays in the Currently Selected Relay Bank

Reverses the status of all relays in the currently selected relay bank. This command effectively swaps the status of all relays like a mirror:

The status of Relay 1 is copied to Relay 8.
The status of Relay 2 is copied to Relay 7.
The status of Relay 3 is coped to Relay 6.
The status of Relay 4 is copied to Relay 5.
The status of Relay 5 is copied to Relay 4.
The status of Relay 6 is copied to Relay 3.
The status of Relay 7 is copied to Relay 2.
The status of Relay 8 is copied to Relay 1.
If the bank value of 0 is selected, all relays in all relay banks will be reversed.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:
Function:	Command	Command	Parameter (Bank)
Decimal Values:	254	132	0-255
Hex Values	0xFE	0x84	0x00 - 0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

253 0 0 2   Turn Off All Channels According to Buffer 4 Off Speed Setting

NCD Component Library Command Method:

Not Yet Implemented

ProXR

Set the Status of All Relays in the Currently Selected Relay Bank

Sets the status of all relays in the currently selected relay bank. This command requires a parameter value of 0-255. This parameter sets the status of all relays to the binary equivalent value. 254, 140, 0 turns off all relays. 254, 140, 255 turns on all relays. 254, 140, 85 turns off every other relay. If a bank value of 0 is selected, this command will set the status of all relays in all relay banks.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**	**Byte 4:**
Function:	Command	Command	Parameter	Parameter (Bank)
Decimal Values:	254	140	0-255	0-255
Hex Values	0xFE	0x8C	0x00 - 0xFF	0x00 - 0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 140 0 0 Turn Off All relays in All available relay banks.

254 140 255 Turn On all Relays.

254 140 85 Turn Off every other Relay.

NCD Component Library Command Method:

Not Yet Implemented

Store the Current State of All Relays as the Power-up Default State

This command stores the current state of all relays as the power-up default state. 254, 142, 0 stores all relays in all banks. 254, 142, 1 stores the current status of bank 1 only. The maximum possible value depends on how many relay banks are attached. If your controller supports 255 relay banks, then 255 may be used.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**	**Byte 4:**
Function:	Command	Command	Parameter	Parameter (Bank)
Decimal Values:	254	142	0-255	0-255
Hex Values		0xFE	0x8E	0x00 - 0xFF 0x00 - 0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 142 0 Stores All relays in All available relay banks.

254 142 1 Stores the current status of Bank 1 only.

NCD Component Library Command Method:

Not Yet Implemented

Report the Power-up Default Status of All Relays in the Currently Selected Relay Bank

This command reports the power-up default status of relays in the selected relay bank. If Bank 0 is selected (254, 143, 0) then the controller reports the status of the first 32 relay banks. 255 is the maximum value for this command if your particular controller supports 255 relay banks. The maximum value for this command will depend on the ATBanks (attached relay banks supported by your controller). This command reports a value of 0-255 indicating the power-up default status of the selected bank.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:	Byte 4:
Function:	Command	Command	Parameter	Parameter (Bank)
Decimal Values:	254	143	0-255	0-255
Hex Values	0xFE	0x8F	0x00 - 0xFF	0x00 - 0xFF

Receive Byte:	Decimal:	0-255
	Hex:	0x00-0xFF

COMM Operator Examples:

254 143 0   Reports the status of the first 32 relay banks.

NCD Component Library Command Method:

Not Yet Implemented

Relay Timers

Introduction

Relay Timer Commands

The ProXR Series controllers have 16 user-programmable timers. Each independent timer can be assigned to any of the first 256 relays of the ProXR controller. Timers may be programmed to hold the relay in the On state, or to pulse the relay at the end of the timer. The ProXR timing features are ideally suited for Watchdog, Keep Alive, and Server Reboot applications, as well as sprinkler systems, gate openers, and day/night lighting applications.

Relay Timing Features support two modes of operation:

Duration and *Pulse*. Duration timing is ideally suited for keeping a light on overnight, watering the lawn for a given period of time, or other applications where a device should be activated for a period of time. Pulse timing mode is designed specifically for server reboot applications, whereby, if the timer is not reset periodically by your software, the timer will run out and reboot your computer.

Interactive Timing Commands

The ProXR timing commands can be used by themselves, or in conjunction with other commands as building blocks to create some very sophisticated timing applications. The timing command set covers many aspects of relay activation/deactivation, making the ProXR series ideally suited for a broad range of timing tasks.

Limitations

Unless otherwise noted, the ProXR series controllers do NOT have an integrated real-time clock. NCD Devices are not typically stand-alone. They require computer interaction with the controller. Time scheduling is possible, but it would require a program to be written on the PC to handle the schedule. The timing features are suitable for applications where you may want a light to go on for 5 minutes, or you may want to keep a relay alive to prevent a server from automatically rebooting. The ProXR series controllers are capable of processing timing commands as long as 255 hours, 255 minutes, and 255 seconds (4 Days, 19 Hours, 19 Minutes, and 15 Seconds) + Deviation.

Timing Accuracy

The Accuracy of the relay timers is dependent on many factors, but ProXR Enhanced controllers use timer interrupts to help improve timing accuracy. However, the possibility does exist that timers may drift slightly as it is not possible to generate an exact second without additional electronics.

When a timer is already active, and you engage another timer, the duration of the previously set times may be increased by as much as one full second. You can enable all timers simultaneously if you need more accurate timing.

Best timing accuracy is achieved by setting up your timing commands and leaving the controller alone during the timing operations. Each time you communicate with the controller, you will slow down the timer (lengthening the time period the timer is set for). The more you communicate with the controller, the more you will slow down all timers. Timing accuracy tends to drift over time. The timing functions built into this controller should NOT be used if timing accuracy is critical. The timing feature are, however, very useful in applications where a little timing drift is not a big concern.

Timing Calibration

Timing is generically recalibrated for 60 seconds using 8 timers. Our test controller calibration value was 26,576. In other words, a calibration value of 26,576 equals 1 second when the controller is only processing timing tasks.

The calibration value was established on our prototype and may be off by as much as 3% based on individual resonator, processor, and temperature characteristics. Baud rate was set at 115.2K when this number was established. The calibration value may need to be changed for other baud rates, but 115.2K baud is the best choice for calibration. For best accuracy, calibration should be performed using a USB communications module (Part number ZUSB).

You can adjust the calibration value at any time, but the calibration value can ONLY be stored while in setup mode. If you need to communicate frequently with the controller while the timing functions are active, you will need to decrease the calibration value. Reasonably accurate timing can be achieved with some experimentation.

It should also be stated that you can spend a week achieving perfect calibration for your controller, and if you were to plug the calibration number into a different controller, it will likely not be accurate. We advise users once again that timers are best suited for applications where timing drift is acceptable.

In addition, the timing routines built into the firmware are huge. There are so many factors that affect timing, that even a well calibrated controller will not post consistent timing scores at all timing intervals. So you should NEVER expect to find a calibration value that works under every circumstance. It is not possible to achieve this level of accuracy without a real time clock. So before you waste hours finding a timing score for your controller that works perfectly at 10 seconds or 24 hours, then you should be warned that this is not possible.

Base Station

A. Set a timer. Set how many hours, minutes, and seconds a timer will last. Set which relay the timer will control.

B. Allows you to manually trigger and cancel Timers. The buttons along the right side of this panel will allow you to trigger checked and cancel unchecked timers, Uncheck all timers, or check all timers.

C. Communication Details. Shown when MORE option is chosen from section D in the diagram.

D. Either reads MORE or LESS. MORE shows section C in diagram. The LESS option shrinks the window to exclude section C.

E. Sends a command to determine the status a timer. See page

F. Click to Start Duration Timer.

G. Click to activate Pulse Timer.

H. Click to Setup Duration Timer.

I. Click to Setup Pulse Timer.

J. Opens a window labeled Timer Calibration.

K. Opens a window label Timer Test. Contains Timer Test Samples.
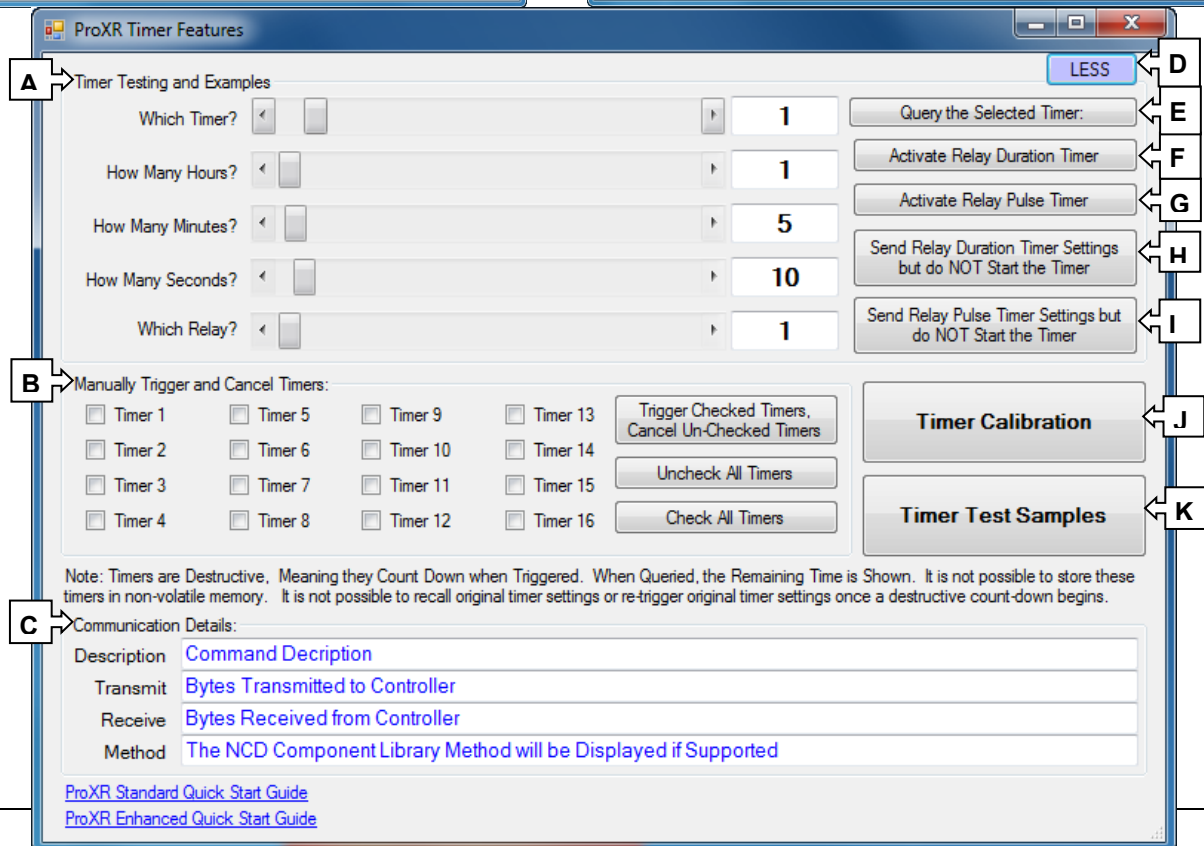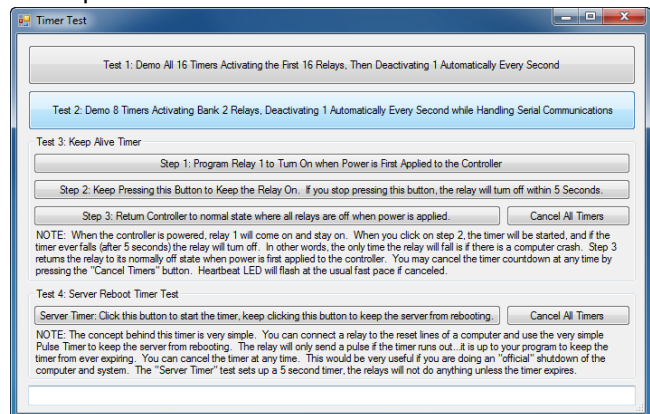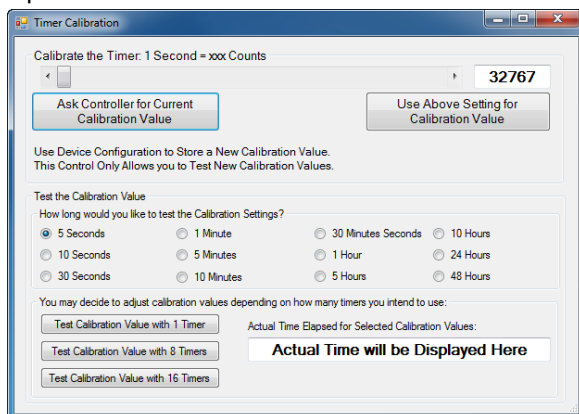
Getting Started with Simple Timers

While timing commands are pretty easy to use, simple timers are the easiest. Once you have sent a simple timer command, the timer automatically starts counting down.

There are two types of simple timers: Duration and Pulse

Simple Duration Timers

These timers activate a relay for a user specified period of time. When the timer expires, the relay turns off. Duration Timer 50-65 controls timers 0-15. The relay is active during the duration of the timer and turns off when timer counts down to 0 Hours, 0 Minutes, 0 Seconds. Relay is a value from 0-255, as timers may be applied only to the first 256 relays of the controller. Here is an example sending a simple duration timer command:

Send Bytes:	Byte 1:	Byte 2:	Byte 3:	Byte 4:	Byte5:	Byte 6:	Byte 7:
Function:	Command	Timer Setup	Timer	Hours	Minutes	Seconds	Relay
Decimal Values:	254	50	50-65	0-255	0-255	0-255	0-255
Hex Values	0xFE	0x32	0x32-0x41	0x00-0xFF	0x00-0xFF	0x00-0xFF	0x00-0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 50 50 8 10 15 0   Hold Relay 0 On for 8 Hours, 10 Minutes, 15 Seconds using Simple Duration Timer 0

254 50 51 0 0 10 1   Hold Relay 1 On for 10 Seconds using Simple Duration Timer 1

When the above two commands have been sent, both relays 0 and 1 will turn on. Relay 0 will turn off after 8 hours, 10 minutes, and 15 seconds. Relay 1 will turn off after only 10 seconds. While the timers are running, you may send other relay control commands. It is also possible to manually turn off the relays while the timers are still running. In these cases, the timers will not appear to have any effect. You can also pause the timers using other commands.

Keep in mind, you have 16 timers to work with. If you ever need this many timers, it would be prudent to assign a different relay to each timer. Assigning the same relay to 2 timers will cause the relay to turn off when the first timer expires. The second timer will appear to have no effect.

Also note that relays are assigned in numeric order of 0-255 when using the timing commands. Relay 0 is located on Bank 1, Relay 0. Relay 8 is located on Bank 2, Relay 0. Relay 255 is located on bank 32, Relay 7 *(you will have to make use of the XR Expansion port to access this relay).*

NCD Component Library Command Method:

Not Yet Implemented

Simple Pulse Timers

Pulse Timers are slightly different than duration timers. When a pulse timer is activated, the relay will not do anything until the timer has expired. Once expired, the relay will pulse for a short duration. This pulse is designed specifically to reboot a computer by connecting a relay directly to the RESET lines of a motherboard. While this may be used for other applications, the intent of the pulse timer is to reboot a computer should there be a lack of communication between the computer and the relay controller (indicative of a system crash).

Pulse Timer 70-85 controls timers 0-15. The timer counts and when it expires, the relay is pulsed. Set Hours, Minutes, and Seconds to determine how long the timer will hold the relay on. Relay is a value from 0-255, as timers may be applied only to the first 256 relays of the controller. Below is a simple example of setting up a pulse timer.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:	Byte 4:	Byte5:	Byte 6:	Byte 7:
Function:	Command	Timer Setup	Timer	Hours	Minutes	Seconds	Relay
Decimal Values:	254	50	70-85	0-255	0-255	0-255	0-255
Hex Values	0xFE	0x32	0x46-0x55	0x00-0xFF	0x00-0xFF	0x00-0xFF	0x00-0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 50 70 0 0 15 0   Pulse Relay 0 after 15 Seconds using Simple Pulse Timer 0

254 50 71 0 0 45 1   Pulse Relay 1 after 45 Seconds using Simple Pulse Timer 1

In the examples above, Relay 0 will pulse after 15 seconds and Relay 1 will pulse after 45 seconds.

NCD Component Library Command Method:

Not Yet Implemented

ProXR

Mixing Duration and Pulse Timers

You can mix duration and pulse timers as your application requires, in any combination. Care should be taken not to mix timers. For example, in our first sample, we utilized timers 0 and 1 using the commands 50 and 51. In our second sample, we utilized timers 0 and 1 using the commands 70 and 71. The commands 50 and 70 both use timer 0. Likewise, the commands 51 and 71 use timer 1. Here is a simple overlap map that will help you keep track of what commands address specific timers. The table below shows the beginning command bytes:

Timer Number	Setup and Trigger Duration Timer	Setup and Trigger Pulse Timer	Setup Duration Timer*	Setup Pulse Timer*
0	254, 50, 50	254, 50, 70	254, 50, 90	254, 50, 110
1	254, 50, 51	254, 50, 71	254, 50, 91	254, 50, 111
2	254, 50, 52	254, 50, 72	254, 50, 92	254, 50, 112
3	254, 50, 53	254, 50, 73	254, 50, 93	254, 50, 113
4	254, 50, 54	254, 50, 74	254, 50, 94	254, 50, 114
5	254, 50, 55	254, 50, 75	254, 50, 95	254, 50, 115
6	254, 50, 56	254, 50, 76	254, 50, 96	254, 50, 116
7	254, 50, 57	254, 50, 77	254, 50, 97	254, 50, 117
8	254, 50, 58	254, 50, 78	254, 50, 98	254, 50, 118
9	254, 50, 59	254, 50, 79	254, 50, 99	254, 50, 119
10	254, 50, 60	254, 50, 80	254, 50, 100	254, 50, 120
11	254, 50, 61	254, 50, 81	254, 50, 101	254, 50, 121
12	254, 50, 62	254, 50, 82	254, 50, 102	254, 50, 122
13	254, 50, 63	254, 50, 83	254, 50, 103	254, 50, 123
14	254, 50, 64	254, 50, 84	254, 50, 104	254, 50, 124
15	254, 50, 65	254, 50, 85	254, 50, 105	254, 50, 125

These timers do not automatically activate, they must be started using a different command.

Server Reboot Pulse Timers

Server Reboot Methodology

You can call it a watchdog timer, a keep-alive timer, or a server reboot timer. They can all mean about the same thing, as their goals are basically the same. The idea is simple: If the computer crashes, the computer cannot reset the timer built into the ProXR controller, so the controller reboots the computer. Implementation is not too difficult.

Implementing a Server Reboot Strategy for a Single Computer

A Server reboot system can work many ways. One possible strategy is a system whereby a server would boot up with a ProXR relay controller attached to a USB port. The relay controller would also be connected to the reset lines of server motherboard. As part of the startup items, a program would be launched to activate the pulse timer function for a period of 10 minutes (for example). The relay would do nothing since a pulse timer is used. Using this strategy, the relay controller would reboot the computer if communications is lost between the server and the relay controller. Once the timer in the relay controller has expired, it can only be restarted when the computer boots up normally. The monitoring program could be exited at any time. In which case, all timers would be cleared to prevent rebooting the computer.

Implementing a Server Reboot Strategy in a Network

The strategy above could be implemented on a single computer with an enhanced version of the software. The relay controller could be tied into the reset lines on the other computers as well. The program could be enhanced to "ping" other computers on the network. If one of them should fail to respond to your "ping", a command could be sent to reboot the computer that failed to respond. In this case, one computer *(a main server)* is protected, as well as all other computers on the network. The main server is acting as the watchdog for all the other computers on the network. The relay controller itself is acting as the watchdog for the main server computer.

While there are many other strategies that could be easily implemented, these strategies could perhaps serve as building blocks to greater, more powerful and sophisticated watchdog monitoring applications.

Duration Timers

Duration Timer 90-105 controls timers 0-15. The Relay is active during the duration of the timer. This command sets up the timer only, it does NOT begin to start. Use a separate command to control when this timer starts. The relay turns off when timer counts down to 0 Hours, 0 Minutes, 0 Seconds. Hours, Minutes, and Seconds sets the number of hours, minutes, and seconds the timer will hold the relay on. Relay is a value from 0-255, as timers may be applied only to the first 256 relays of the controller.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**	**Byte 4:**	**Byte5:**	**Byte 6:**	**Byte 7:**
Function:	Command	Timer Setup	Timer	Hours	Minutes	Seconds	Relay
Decimal Values:	254	50	90-105	0-255	0-255	0-255	0-255
Hex Values	0xFE	0x32	0x5A-0x69	0x00-0xFF	0x00-0xFF	0x00-0xFF	0x00-0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 50 91 0 0 35 1   Setup a Duration Timer on Relay 1 for 35 Seconds using Timer 1

NCD Component Library Command Method:

Not Yet Implemented

Pulse Timers

Pulse Timer 110-125 controls timers 0-15. The timer counts and when it expires, the relay is pulsed. This command sets up the timer only; it does NOT begin to start. Use a separate command to control when this timer starts. Set Hours, Minutes, and Seconds to determine how long the timer will hold the relay on. Relay is a value from 0-255, as timers may be applied only to the first 256 relays of the controller. Below is a simple example of setting up a pulse timer.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**	**Byte 4:**	**Byte5:**	**Byte 6:**	**Byte 7:**
Function:	Command	Timer Setup	Timer	Hours	Minutes	Seconds	Relay
Decimal Values:	254	50	110-125	0-255	0-255	0-255	0-255
Hex Values	0xFE	0x32	0x6E-0x7D	0x00-0xFF	0x00-0xFF	0x00-0xFF	0x00-0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 50 110 0 0 15 0   Setup a Pulse Timer on Relay 0 for 15 Seconds using Timer 0

NCD Component Library Command Method:

Not Yet Implemented

Query Remaining Time

This command will query the time remaining for the selected timer 1 through 16. This command reports 4 bytes back to the user, indicating Hours remaining (0-255), Minutes remaining (0-255), Seconds remaining (0-255), and the Relay Number the timer is assigned to (0-255).

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**	**Byte 4:**
Function:	Command	Timer Setup		Timer
Decimal Values:	254	50	130	1-16
Hex Values	0xFE	0x32	0x82	0x01-0x-10

Receive Byte:	Decimal:	0-255 (hours)	0-255 (minutes)	0-255 (seconds)	0-255 (relay)
	Hex:	0xFF	0xFF	0xFF	0xFF

NCD Component Library Command Method:

Not Yet Implemented

Halt or Resume Timers

This command is used to manually halt or resume all 16 timers. This command works with all forms of timers. The LSB and MSB are the least significant and most significant bytes in a 16-bit word. The status of each bit within the 16-bit word is used to control which timers are running. Every bit that is high in the word indicates the timer is active. Every bit that is low in the word indicates the timer is not running.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**	**Byte 4:**	**Byte5:**
Function:	Command	Timer Setup		LSB	MSB
Decimal Values:	254	50	131	0-255	0-255
Hex Values	0xFE	0x32	0x83	0x00-0xFF	0x00-0xFF

Receive Byte:	Decimal:	85
	Hex:	0x55

COMM Operator Examples:

254 50 131 3 0   Begin Countdown of Timers 0 and 1
    LSB = 3 (1 + 2 = 3   1 is for Timer 0, 2 is for Timer 1, *See Table on next page*)
    MSB = 0 (Keep all other timers off)
254 50 131 1 0   Indicates timer 1 is running, all others are off
254 50 131 3 128   Indicates timers 1, 2, and 16 are running (1+2=3 and 128 in the MSB indicates Timer 16 is running)

NCD Component Library Command Method:

Not Yet Implemented

LSB/MSB 16-Bit Value

If you understand how binary works, this is a pretty simple command. A 16 bit value is used to control which timers are active and which timers are halted. Each of the 16 bits identifies with each of the 16 timers. A binary 0 in any bit location indicates the timer is off while a binary 1 in any bit location indicates the timer is on. If you are not familiar with binary, here is a crash course:

16 Timers have 16 Bits, but we have to divide these into two 8-Bit values to communicate these data via a serial port. We call these two different bytes LSB for Least Significant Byte and MSB for Most Significant Byte.

Follow the Table below to figure LSB and MSB Values:

LSB Values   MSB Values

Timer 0 has a value of 1 on the LSB   Timer 8 has a value of 1 on the MSB

Timer 1 has a value of 2 on the LSB   Timer 9 has a value of 2 on the MSB

Timer 2 has a value of 4 on the LSB   Timer 10 has a value of 4 on the MSB

Timer 3 has a value of 8 on the LSB   Timer 11 has a value of 8 on the MSB

Timer 4 has a value of 16 on the LSB Timer 12 has a value of 16 on the MSB

Timer 5 has a value of 32 on the LSB Timer 13 has a value of 32 on the MSB

Timer 6 has a value of 64 on the LSB Timer 14 has a value of 64 on the MSB

Timer 7 has a value of 128 on the LSB Timer 15 has a value of 128 on the MSB

To Turn On timers, add up the LSB and MSB Values.

For example:

To turn on timers 0, 1, 2, and 3 we add up 1, 2, 4, and 8.
So the LSB = 15.

To turn on timers 10, 12, 14, and 15, we add up 4, 16, 64, and 128.
So the MSB = 212.

After you send the LSB and MSB timer data to the controller, the selected timers will be activated. All other timers will be halted.

Calibrate the Relay Timer

This command will calibrate the relay timer. The LSB and MSB make up a word, indicating the speed of the timer. Lower values indicate a faster timer while higher values indicates a slower timer. This command no-longer stores the calibration data into the controller. Use device configuration to store a new calibration value. This command is valuable for experimenting with other calibration values.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**	**Byte 4:**	**Byte5:**
Function:	Command	Timer Setup		LSB	MSB
Decimal Values:	254	50	132	0-255	0-255
Hex Values	0xFE	0x32	0x84	0x00-0xFF	0x00-0xFF

Receive Byte:		Decimal:	85
	Hex:	0x55	

NCD Component Library Command Method:

Not Yet Implemented

Retrieve the Timer Calibration Value

This command retrieves the Timer Calibration Value. The Timer Calibration Value controls the actual length of a second. Two bytes will be returned by this command, LSB and MSB. The Word value of the timer = LSB + (MSB*256) Decreasing this value will speed up the timer, increasing this value will slow it down. Use device configuration commands 254,53 and 254,54 to store and retrieve these data out of EEPROM.

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**
Function:	Command		
Decimal Values:	254	50	133
Hex Values	0xFE	0x32	0x85

Receive Byte:	Timer Calibrator LSB Value
	Timer Calibrator MSB Value

NCD Component Library Command Method:

Not Yet Implemented

Turn On Timing Calibration Markers

This command turns on the timing calibration markers. This command is not generally used by software developers, but is used by Base application software to help the user measure the elapsed time of the timer values.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:
Function:	Command	Timer Setup	
Decimal Values:	254	50	134
Hex Values	0xFE	0x32	0x86

Receive Byte:	Decimal:	85	90 (Start)	91 (Stop)
	Hex:	0x55	0x5A	0x5B

NCD Component Library Command Method:

Not Yet Implemented

Turn Off Timing Calibration Markers

This command turns off the timing calibration markers. This command is not generally used by software developers, but is used by Base application software to help the user measure the elapsed time of the timer values.

Send Bytes:	Byte 1:	Byte 2:	Byte 3:
Function:	Command	Timer Setup	
Decimal Values:	254	50	135
Hex Values	0xFE	0x32	0x87

Receive Byte:	Decimal:	85
	Hex:	0x55

NCD Component Library Command Method:

Not Yet Implemented

ProXR Command Set Summary

The ProXR Command Set Data Collection and Control

By now, you have seen ProXR all over our website. Just about every controller we currently make is a ProXR controller. You will find ProXR in relays, inputs, outputs, potentiometers, analog to digital conversion, and much more. Put simply, ProXR is a standardized set of commands. When you choose a ProXR controller, you can upgrade that controller without having to re-write your software. One of the greatest benefits to ProXR is that you can develop your software to work with (for instance) an RS-232 device. Later on, you may find you don't want to use RS-232 anymore. Maybe you want to talk to the device wirelessly, or maybe use an Ethernet, Wi-Fi, USB, or Bluetooth interface. No Problem. You don't have to re-write your program. You can simply use the communication technology that most benefits your application WITHOUT having to redevelop your software.

The purpose of the following section is to give you a convenient location to review a summary of ProXR commands. This list will only grow as our products evolve. This list is divided into 4 simple categories: Input, Parameters, Description, and Output. Please consider the following information as a quick reference guide, which is not designed to replace detailed descriptions found elsewhere in this guide.

Reading the Table	
Command	These are the bytes that you send to the controller. These bytes are shown in decimal format, and can be converted to HEX if you prefer. We use the comma character to separate our bytes, but you should NOT send the comma character to the device. Also, you do NOT need to send a enter or return to complete the command. The controller knows when the command is complete.
Parameters	Some commands need parameters, such as hours, minutes, and seconds. Other parameters include a Bank value, which indicates which group of relays you will be speaking to. Some parameters are optional, these will appear between < > symbols.
Command Description	While there is no substitute for reading the ProXR manual, these descriptions give you a basic guideline of what to expect from the command.
Response	ProXR controllers will respond to most commands that you send. Under normal operation (when the controller is in runtime mode) the controller will respond with an 85 for most commands. If the controller happens to be in configuration mode (a jumper setting on the controller), the controller will respond with 86. Some commands, such as Analog to Digital Conversion, report 8-bit values from 0-255. In some cases, 2 or more bytes are sent back to the user. These will be noted in the Response column.

Turns Off Relays in the Currently Selected Relay Bank

Transmit	Command Description	Receive
254 0 <1-7>	Turns off Relay 0 in the Currently Selected Relay Bank. An optional parameter of 1 turns off the next relay. An optional parameter of 7 turns off the next 7 relays.	85
254 1 <1-6>	Turns off Relay 1 in the Currently Selected Relay Bank. An optional parameter of 1 turns off the next relay. An optional parameter of 6 turns off the next 6 relays.	85
254 2 <1-5>	Turns off Relay 2 in the Currently Selected Relay Bank. An optional parameter of 1 turns off the next relay. An optional parameter of 5 turns of the next 5 relays.	85
254 3 <1-4>	Turns off Relay 3 in the Currently Selected Relay Bank. An optional parameter of turns off the next relay. An optional parameter of 4 turns off the next 4 relays.	85
254 4 <1-3>	Turns off Relay 4 in the Currently Selected Relay Bank. An optional parameter of 1 turns off the next relay. An optional parameter 3 turns off the next 3 relays.	85
254 5 <1-2>	Turns off Relay 5 in the Currently Selected Relay Bank. An optional parameter of 1 turns off the next relay. An optional parameter of 1 turns off the next relay. An optional parameter of 2 turns off the next 2 relays.	85
254 6 <1>	Turns off Relay 6 in the Currently Selected Relay Bank. An optional parameter of 1 turns off the next relay.	85
254 7	Turns off Relay 7 in the Currently Selected Relay Bank.	85

Turns On Relays in the Currently Selected Relay Bank

Transmit	Command Description	Receive
254 8 <1-7>	Turns on Relay 0 the Currently Selected Relay Bank. An optional parameter of 1 turns on the next relay. An optional parameter of 7 turns on the next 7 relays.	85
254 9 <1-6>	Turns on Relay 1 in the Currently Selected Relay Bank. An optional parameter of 1 turns on the next relay. An optional parameter of 6 turns on the next 6 relays	85
254 10 <1-5>	Turns on Relay 2 in the Currently Selected Relay Bank. An optional parameter of 1 turns on the next relay. An optional parameter of 5 turns on the next 5 relays.	85
254 11 <1-4>	Turns on Relay 3 in the Currently Selected Relay Bank. An optional parameter of 1 turns on the next relay. An optional parameter of 4 turns on the next 4 relays.	85
254 12 <1-3>	Turns on Relay 4 in the Currently Selected Relay Bank. An optional parameter of 1 turns on the next relay. An optional parameter of 3 turns on the next 3 relays.	85
254 13 <1-2>	Turns on Relay 5 in the Currently Selected Relay Bank. An optional parameter of 1 turns on the next relay. An optional parameter of 2 turns on the next 2 relays.	85
254 14 <1>	Turns on Relay 6 in the Currently Selected Relay Bank. An optional parameter of 1 turns on the next relay.	85
254 15	Turns on Relay 7 in the Currently Selected Relay Bank.	85

Read the Status of Relays in the Currently Selected Relay Bank

Transmit	Command Description	Receive
254 16	Report the On/Off Status of the Relay 1 in the Currently Selected Relay Bank	0 or 1
254 17	Report the On/Off Status of the Relay 2in the Currently Selected Relay Bank	0 or 1
254 18	Report the On/Off Status of the Relay 3 in the Currently Selected Relay Bank	0 or 1
254 19	Report the On/Off Status of the Relay 4 in the Currently Selected Relay Bank	0 or 1
254 20	Report the On/Off Status of the Relay 5 in the Currently Selected Relay Bank	0 or 1
254 21	Report the On/Off Status of the Relay 6 in the Currently Selected Relay Bank	0 or 1
254 22	Report the On/Off Status of the Relay 7 in the Currently Selected Relay Bank	0 or 1
254 23	Report the On/Off Status of the Relay 8 in the Currently Selected Relay Bank	0 or 1

General Control Commands

Transmit	Command Description	Receive
254 24	Reports the Current Status of 8 Relays in the Currently Selected Relay Bank. If the Bank Value equals 0, then 32 bytes will be returned by this command representing the status of the first 32 relay banks. Each byte returned from the controller will have a value from 0-255. Convert this value to binary to see the On/Off status of each relay in the relay bank.	0-255
254 25	Turn ON Automatic Relay Refreshing. When a relay control command is sent to the controller, the controller will refresh the state of all relays in every bank. This command has been modified from the original version; it no longer stores the refresh status in EEPROM. Use Device Configuration to change how the controller functions on startup.	85
254 26	Turn OFF Automatic Relay Refreshing. When a relay control command is sent, the relay will not change state. This allows you to use the complete ProXR command set to manipulate relay status. When you need the relays to change state, you will send a manual refresh command. This command no longer stores the refresh status in EEPROM. Use Device Configuration to change how the controller functions on startup.	85
254 29	Turn OFF all relays. If the currently selected relay bank is 0 then all relays will be turned off in all relay banks	85
254 30	Turn ON all relays. If the currently selected relay bank is 0 than all reals will be turned on in all relay banks	85
254 31	Inverts the status of all relays in the currently selected relay bank. All relays that are off will turn on. All relays that are on will turn off. If a bank value of 0 is selected, all relays in all relay banks will be inverted.	85
254 32	Reverses the status of all relays in the currently selected relay bank. This command effectively swaps the status of all relays like a mirror: The status of Relay 1 is copied to Relay 8 That status of Relay 2 is copied to Relay 7 The status of Relay 3 is copied to Relay 6 The status of Relay 4 is copied to Relay 5 The status of Relay 5 is copied to Relay 4 The status of Relay 6 is copied to Relay 3 The status of Relay 7 is copied to Relay 2 The status of Relay 8 is copied to Relay 1 If a bank value of 0 is selected, all relays in all relay banks will be reversed.	85

General Control Commands Continued…

254 33	Test 2-Way Communications is used to verify the controller is properly communicating. This command will respond with one of the following responses based on the current mode of the device: 85 is returned if the controller is in run mode 86 is returned if the controller is in configuration mode 87 is returned if the controller is in security lockdown mode	85 (Run) 86 (Config.) 87 (Lockdown)
254 34	Returns the currently selected relay bank.	0-255
254 36	This command reports the current status of automatic relay refreshing. This command will return a 0 or 1 indicating if refreshing is off or on.	0 or 1
254 37	Manually refresh all relays in all relay banks. Use this command to set the status of all relays at the exact same time. Use in combination with Relay Refreshing commands	85
254 40 0-255	Sets the status of all relays in the currently selected relay bank. This command requires a parameter value of 0-255. This parameter sets the status of all relays to the Binary equivalent value. 254, 40, 0 turns off all relays. 254, 40, 255 turns on all relays. 254, 40, 85 turns off every other relay. If a bank value of 0 is selected, this will set the command status of all relays in all relay banks.	85
254 42 0-255	This command stores the current state of all relays as the power-up default state. 254, 42, 0 stores all relays in all banks. 254, 42, 1 stores the current status of bank 1 only. The maximum possible value depends on how many relay banks are attached. If your controller supports 255 relay banks, then 255 may be used.	85
254 43 0-255	This command reports the power-up default status of relays in the selected relay bank. If bank 0 is selected (254,43,0) then the controller reports the status of the first 32 relay banks. The maximum value for this command will depend on the AT Banks (attached relay banks supported by your controller). This command reports a value of 0-255 indicating the power-up default status of the selected bank	0-255
254 44 0-255 <0-255>	Reads the status of a selected relay. This command provides a quick way to read the status of a single relay using a relay number. Since the communication bus is limited to 8 bits, this command can accept a byte to read the status of the first 256 relays, or it can accept a word, to read the status of more than 256 relays. The optional parameter <0-255> is usually a value of 0 or 1 for many controllers, 0 indicating the first 256 relays, 1 indicating the next 256 relays. The actual maximum value for this command will depend on the number of relays supported by your controller.	0 or1

254 45 0 0-255	Sets the Flash Rate of all Relay Flashers. A relay flasher turns relays on and off in the background automatically. A speed value parameter is required from 0-255. This parameter controls the flash rate where 0 is the fastest and 255 is the slowest allowed speed.	85
254 45 1-16 0-1	Controls the On/Off Status of each of the 16 possible relay flashers. There are two optional parameters for this command. 1-16 chooses a relay flasher to control, a value of 0 or 1 turns the flasher off or on.	85
254 46 0-255 <0-255>	Turns off all relays, pauses for a short duration, then activates the selected relay. Since the communication bus is limited to 8 bits, this command can accept a byte to control the status of the first 256 relays, or it can accept a word, to control the status of more the 256 relays. The optional parameter <0-255> is usually a value of 0 or 1 for many controllers, 0 indicating the first 256 relays, 1 indicating the next 256 relays. The actual maximum value for this command will depend on the number of relays supported by you controller.	85
254 47 0-255 <0-255>	Turns off the selected relay. Since the communication bus is limited to 8 bits, this command can accept a byte to control the status of the first 256 relays, or it can accept a word, to control the status of more than 256 relays. The optional parameters <0-255> is usually a value of 0 or 1 for many controllers, 0 indicating the first 256 relays, 1 indicating the next 256 relays. The actual maximum value for this command will depend on the number of relays supported by your controller.	85
254 48 0-255 <0-255>	Turns on the selected relay. Since the communication bus is limited to 8 bits, this command can accept a byte to control the first 256 relays, or it can accept a word to control the status of more than 256 relays. The optional parameter of <0-255> is usually a value of 0or 1 for many controllers, 0 indicating the first 256 relay, 1 indicating the next 256 relays. The actual maximum value for this command will depend on the number of relays supported by your controller.	85
254 49 0-255	Select a Relay Bank to control. This command is used to set the relay bank number. When you set the relay bank number to 1, all relay control commands will be directed to relay bank 1 to control the first 8 relays on the controller. When the bank is set to 2, relay control commands will be directed to relay bank 2 (the second group of 8 relays). A bank value of 0 directs relay control commands to all relay banks. Values from 0 to 255 are valid bank values; however, most controllers support less than 255 relay banks, so the maximum value for this parameter will be limited to the total number of relay banks supported by your particular controller.	85

254 50 136	Command Removed: See Commands 254, 53 and 254, 54	No Response
254 50 137 1-255	Command Removed: See Commands 254, 53 and 254, 54	85
254 50 138	Command Removed: See Commands 254, 53 and 254, 54	No Response
254 50 139	Command Removed: See Commands 254, 53 and 254, 54	85
254 50 140	Command Removed: See Commands 254, 53 and 254, 54	No Response
254 50 141	Command Removed: See Commands 254, 53 and 254, 54	85
254 50 144	Command Removed: See Commands 254, 53 and 254, 54	85
254 50 145	Command Removed: See Commands 254,53 and 254, 54	85
254 50 146	Command Removed: See Commands 254, 53 and 254, 54	85
254 50 147	Command Removed: See Commands 254, 53 and 254, 54	85

ProXR

Bank Directed Relay Control Commands (100 Series Commands)

Bank Directed Relay Control Commands (also known as 100 Series Commands) are the preferred method of controlling relays. These commands require a relay bank value to be specified as part of the command. This command set is preferred because there is no question as to which relay bank the controller is talking to. Previous relay control commands are a little faster because you do not specify a relay bank with each command. However, if your application crashes, your software must take steps to set the relay controller to the correct relay bank. This is not required when using bank directed commands because the bank number is part of the command, which keeps your controller and software in sync at all times. For highest reliability applications, we strongly suggest using Bank Directed Relay Control Commands.

Turn Off Relays in the Specified Relay Bank

Transmit	Command Description	Receive
254 100 0-255 (Bank) <1-7>	Turn off Relay 0 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks. An optional Parameter may be included to turn off the next 1 to 7 relays.	85
254 101 0-255 (Bank) <1-6>	Turn Off Relay 1 in Specified Bank. If the Bank Value is 0, this command will be directed to available relay banks. An optional parameter may be included to turn off the next 1 to 6 relays.	85
254 102 0-255 (Bank) <1-5>	Turn Off Relay 2 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks. An optional parameter may be included to turn off the next 1 to 5 relays.	85
254 103 0-255 (Bank) <1-4>	Turn Off Relay 3 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks. An optional parameter may be included to turn off the next 1 to 4 relays.	85
254 104 0-255 (Bank) <1-3>	Turn Off Relay 4 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks. An optional parameter may be included to turn of the next 1 to 3 relays.	85
254 105 0-255 (Bank) <1-2>	Turn Off Relay 5 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks. An optional parameter may be included to turn off the next 1 to 2 relays.	85

254 106 0-255 (Bank) <1>	Turn Off Relay 6 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks. An optional parameter may be included to turn off the next relay.	85
254 107 0-255 (Bank)	Turn Off Relay 7 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks.	85

Turn On Relays in the Specified Relay Banks

Transmit	Command Description	Receive
254 108 0-255 (Bank) <1-7>	Turn On Relay 0 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks. An optional parameter may be included to turn on the next 1 to 7 relays.	85
254 109 0-255 (Bank) <1-6>	Turn On Relay 1 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks. An optional parameter may be included to turn on the next 1 to 6 relays.	85
254 110 0-255 (Bank) <1-5>	Turn On Relay 2 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks. An optional parameter may be included to turn on the next 1 to 5 relays.	85
254 111 0-255 (Bank) <1-4>	Turn On Relay 3 in Specified Bank. If the Bank Value is 0, this command will be directed all available relay banks. An optional parameter may be included to turn on the next 1 to 4 relays.	85
254 112 0-255 (Bank) <1-3>	Turn On Relay 4 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks. An optional parameter may be included to turn on the next 1 to 3 relays.	85
254 113 0-255 (Bank) <1-2>	Turn On Relay 5 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks. An optional parameter may be included to turn on the next 1 to 2 relays.	85
254 114 0-255 (Bank) <1>	Turn On Relay 6 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks. An optional parameter may be included to turn on the next relay.	85
254 115 0-255 (Bank)	Turn On Relay 7 in Specified Bank. If the Bank Value is 0, this command will be directed to all available relay banks.	85

Read the Status of Relays in the Specified Relay Bank

Transmit	Command Description	Receive
254 116 1-255 (Bank)	Read the Status of Relay 0 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a 1 or 0 indicating On/Off status of Relay.	0 or 1
254 117 1-255 (Bank)	Read the status of Relay 1 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a1 or 0 indicating On/Off status of Relay	0 or 1
254 118 1-255 (Bank)	Read the status of Relay 2 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a 1 or a 0 indicating On/Off status of the Relay.	0 or 1
254 119 1-255 (Bank)	Read the status of Relay 3 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a 1 or 0 indicating the On/Off Status of the Relay.	0 or 1
254 120 1-255 (Bank)	Read the status of Relay 4 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a 1 or 0 indicating the On/Off status of the Relay.	0 or 1
254 121 1-255 (Bank)	Read the Status of Relay 5 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a 1 or 0 indicating the On/Off status of the Relay.	0 or 1
254 122 1-255 (Bank)	Read the Status of Relay 6 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command Will return a 1 or a 0 indicating the On/Off status of the relay.	0 or 1
254 123 1-255 (Bank)	Read the status of Relay 7 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a 1 or a 0 indicating the On/Off status of the relay.	0 or 1

ProXR

Read the Status of Relays in the Specified Relay Bank

Transmit	Command Description	Receive
254 116 1-255 (Bank)	Read the Status of Relay 0 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a 1 or 0 indicating On/Off status of Relay.	0 or 1
254 117 1-255 (Bank)	Read the status of Relay 1 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a1 or 0 indicating On/Off status of Relay	0 or 1
254 118 1-255 (Bank)	Read the status of Relay 2 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a 1 or a 0 indicating On/Off status of the Relay.	0 or 1
254 119 1-255 (Bank)	Read the status of Relay 3 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a 1 or 0 indicating the On/Off Status of the Relay.	0 or 1
254 120 1-255 (Bank)	Read the status of Relay 4 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a 1 or 0 indicating the On/Off status of the Relay.	0 or 1
254 121 1-255 (Bank)	Read the Status of Relay 5 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a 1 or 0 indicating the On/Off status of the Relay.	0 or 1
254 122 1-255 (Bank)	Read the Status of Relay 6 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command Will return a 1 or a 0 indicating the On/Off status of the relay.	0 or 1
254 123 1-255 (Bank)	Read the status of Relay 7 in Specified Bank. A Bank Value of 0 is Not Valid for this command. This command will return a 1 or a 0 indicating the On/Off status of the relay.	0 or 1

ProXR

General Control Commands for Specified Relay Banks

Transmit	Command Description	Receive
254 124 0-255 (Bank)	Reports the current status of 8 relays in the Currently Selected Relay Bank. If the Bank Value equals 0 then 32 bytes will be returned by this command representing the status of the first 32 relay banks. Each byte returned from the controller will have a value from 0 to 255. Convert this value to Binary to see the On/Off status of each relay in the relay bank.	0-255
254 124 0 <0-255>	Reports the current status of 32 Banks of Relays. Optional; Parameter <0-255> indicates the group. If this optional parameter is not used or contains 0, the first 32 relay banks will be reported. A Value of 1 reports the status of the next group of 32 relay banks. Value of 2 reports the 3rd group of 32 relay banks.	0-255 (32-Bytes)
254 129 0-255 (Bank)	Turn Off All Relays. If the currently selected relay bank is 0 then all relays will be turned off in all relay banks	85
254 130 0-255 (Bank)	Turn On All Relays. If the currently selected relay bank is 0 then all relays will be turned on in all relay banks.	85
254 131 0-255 (Bank)	Inverts the status of all relays in the currently selected relay bank. All relays that are off will turn on. All relays that are on will turn off. If a Bank Value of 0 is selected, all relays in all relay banks will be inverters.	85
254 132 0-255 (Bank)	Reverses the status of all relays in the currently selected relay bank. This command effectively swaps the status of all relays like a mirror: The status of Relay 1 is copied to Relay 8. The status of Relay 2 is copied to Relay 7. The status of Relay 3 is coped to Relay 6. The status of Relay 4 is copied to Relay 5. The status of Relay 5 is copied to Relay 4. The status of Relay 6 is copied to Relay 3. The status of Relay 7 is copied to Relay 2. The status of Relay 8 is copied to Relay 1. If the bank value of 0 is selected, all relays in all relay banks will be reversed.	85
254 140 0-255 0-255 (Bank)	Sets the status of all relays in the currently selected relay bank. This command requires a parameter value of 0-255. This parameter sets the status of all relays to the binary equivalent value. 254, 40, 0 turns off all relays. 254, 40, 255 turns on all relays. 254, 40, 85 turns off every other relay. If a bank value of 0 is selected, this command will set the status of all relays in all relay banks.	85

| 254 142 0-255 0-255 (Bank)	This command stores the current state of all relays as the power-up default state. 254, 42, 0 stores all relays in all banks. 254, 42, 1 stores the current status of bank 1 only. The maximum possible value depends on how many relay banks are attached. If your controller supports 255 relay banks, then 255 may be used.	85
254 143 0-255 0-255 (Bank)	This command reports the power-up default status of relays in the selected relay bank. If Bank 0 is selected (254, 43, 0) then the controller reports the status of the first 32 relay banks. 255 is the maximum value for this command if your particular controller supports 255 relay banks. The maximum value for this command will depend on the ATBanks (attached relay banks supported by your controller). This command reports a value of 0-255 indicating the power-up default status of the selected bank.	0-255

Troubleshooting

Use the Base Station Software to diagnose any problems with your device.
Choose the option **'ProXR Quality Control and Diagnostics'** as shown below.

To diagnose any problems with the device:

A. Set number of relays to test.
B. Start Relay test sequence.
C. Select individual bank to test.
D. Set relay test sequence speed.
E. Test functionality of PGM/RUN jumper. To Pass move jumper to PGM position, then to RUN position.
F. Used as a reminder to testing staff to check functionality of all on board LEDs, click to "Pass".
G. Used by testing staff to check continuity of relays. Click to "Pass".
H. Used by testing staff to check XR Expansion Port. Click to "Pass".
I. Used by testing staff to check 3.3 vdc circuit voltage. Click to "Pass".
J. Used by testing staff to check 5 vdc circuit voltage. Click to "Pass".
K. Pause testing sequence.
L. Reset all status boxes.
M. Used by testing staff for continuity outputs.
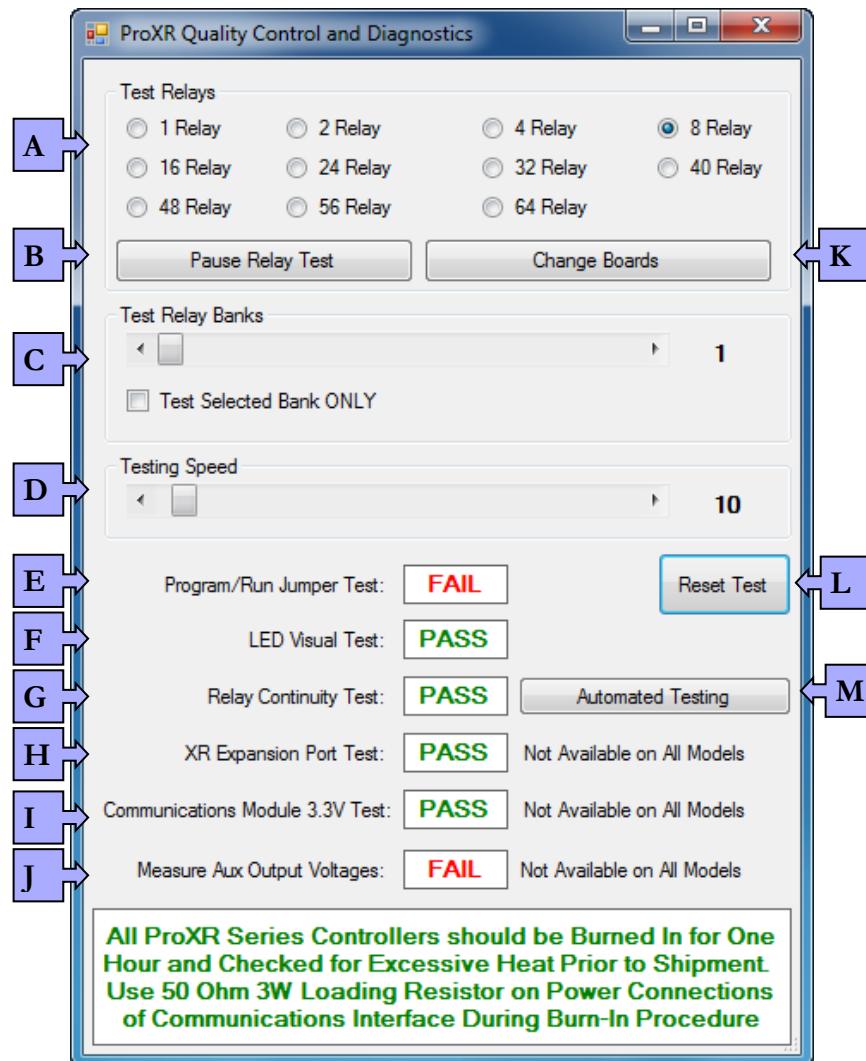
Technical Support

Technical support is available through our website, controlanything.com. **AccessNCD** is the way we connect NCD engineers to our customers.

*Click on the **AccessNCD** button located on the top right of the header of each page of our website.*

For technical support and application information, contact Travis Elliott, our technical engineer. If you feel that you have discovered a bug in the firmware of our controllers, contact Ryan Sheldon, our hardware developer. If you have programming-related questions or have discovered a bug in our software, please contact Shirui Xu, our software engineer.

Click the 'Tech Support Staff' tab and click on the appropriate engineer link for assistance. Click on our 'Forum' tab if you would like to post publicly or review problems that other customers have had and 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 **AccessNCD** first. However, for persistent problems, NCD technical support engineers will schedule a phone consultation.

Contact Information

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Open 9 a.m. - 4 p.m. CST

All orders *must* be placed online at our website, www.controlanything.com

Notice:

The only authorized resellers of NCD products are

- www.controlanything.com
- www.relaycontrollers.com
- www.relaypros.com
- www.amazon.com

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