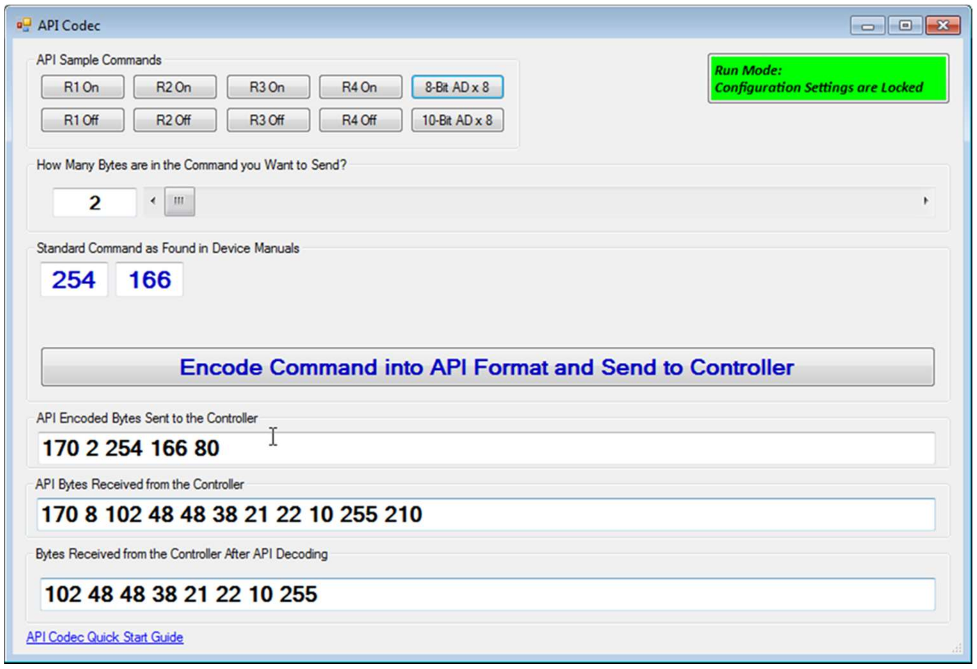
Control Anything...Anywhere.

NATIONAL CONTROL DEVICES

API Codec Quick Start Guide



Run Mode:
Configuration Settings are Locked

How Many Bytes are in the Command you Want to Send?
2

Standard Command as Found in Device Manuals
254 166

API Encoded Bytes Sent to the Controller
170 2 254 166 80

API Bytes Received from the Controller
170 8 102 48 48 38 21 22 10 255 210

Bytes Received from the Controller After API Decoding
102 48 48 38 21 22 10 255

NATIONAL CONTROL DEVICES

API Codec Quick Start Guide

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Chapter

1

Introduction

What is the API Codec?

The API Codec is a faster, more reliable method of communicating to NCD devices, particularly when working with network- or wireless-based devices. The API Codec makes communications more resilient to errors and eliminates timeout requirements of standard communication methods. While you will benefit from speed and reliability, data must be encoded and decoded to fully support the API Codec.

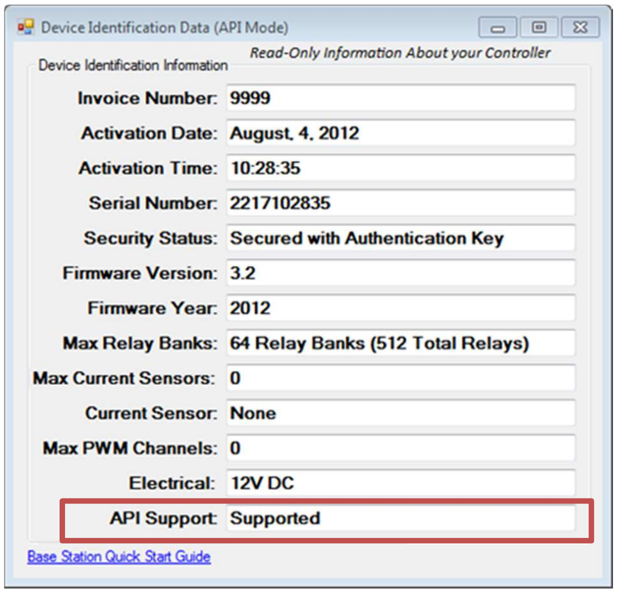
If you are working with TCP/IP or Wireless communications, you might want to consider using the API Codec to handle all communication functions. The API Codec will "wrap" standard commands with a Header, Byte Counter, and a Checksum, which eliminates the need for timeout command processing (the standard method of communications which stalls processing of commands).

To better understand why the API Codec was created, it is important to understand standard timeout based communications. Timeout based communications means you send your command to the controller, the controller waits until you stop sending data, times out, processes your command, and reports data back to the host computer. The API Codec eliminates the Timeout (and delay) from the standard protocol. Because the API Codec includes a checksum, invalid data is automatically discarded to prevent false processing of commands.

The API Codec does not interfere with standard communications in any way. If you send a standard command to an API capable controller, you will get a standard response. If you send an API Encoded command to an API capable controller, you will get an API Encoded response. So any controller that supports the API Codec is 100 percent backward compatible with standard communication protocols. The API Codec should be thought of as a new layer of communications that operates 100 percent independent of standard communication protocols. Your software may be written with a mix of API and Standard communication functions. Commands that require optimal reliability can be sent using API communications while standard communications can be used to preserve compatibility with older portions of your software.

Device Identification

Not all controllers support the API Codec. Click Device Identification and look at the API Support status field. All NCD devices with firmware version 3.2 or later will support API Communications. If your controller supports the API Codec, the word "Supported" will be displayed as shown below:



Device Identification Data (API Mode)

Read-Only Information About your Controller

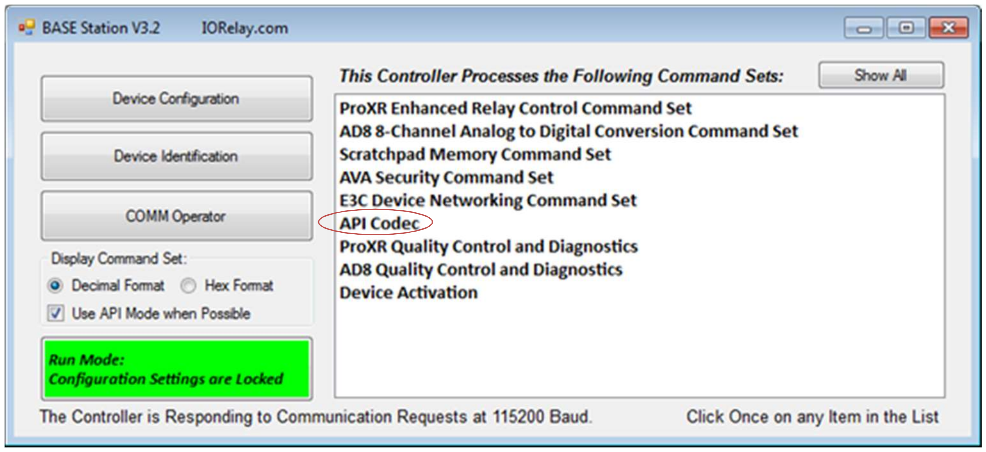
Device Identification Information

Invoice Number:	9999
Activation Date:	August, 4, 2012
Activation Time:	10:28:35
Serial Number:	2217102835
Security Status:	Secured with Authentication Key
Firmware Version:	3.2
Firmware Year:	2012
Max Relay Banks:	64 Relay Banks (512 Total Relays)
Max Current Sensors:	0
Current Sensor:	None
Max PWM Channels:	0
Electrical:	12V DC
API Support:	Supported

Base Station Quick Start Guide

API in Base Station

Beginning with Version 3.2 of Base Station, the Base Station software attempts to communicate all commands in API format if API mode is supported. The "Use API Mode when Possible" check box will be checked by default and all subsequent portions of Base Station will communicate in API mode when possible.


BASE Station V3.2 IORelay.com

Display Command Set: [✓ Decimal Format] Hex Format
[✓ Use API Mode when Possible]

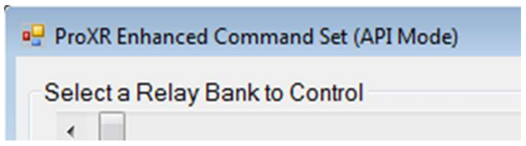
Run Mode:
Configuration Settings are Locked

This Controller Processes the Following Command Sets:

ProXR Enhanced Relay Control Command Set
AD8 8-Channel Analog to Digital Conversion Command Set
Scratchpad Memory Command Set
AVA Security Command Set
E3C Device Networking Command Set
API Codec
ProXR Quality Control and Diagnostics
AD8 Quality Control and Diagnostics
Device Activation

The Controller is Responding to Communication Requests at 115200 Baud. Click Once on any Item in the List

The top of all forms that support API will indicate (API Mode) as shown here indicating all communication is formatted in API Format.


ProXR Enhanced Command Set (API Mode)

Select a Relay Bank to Control

You may turn this off by unchecking the "Use API Mode when Possible" on the main Base Station screen.

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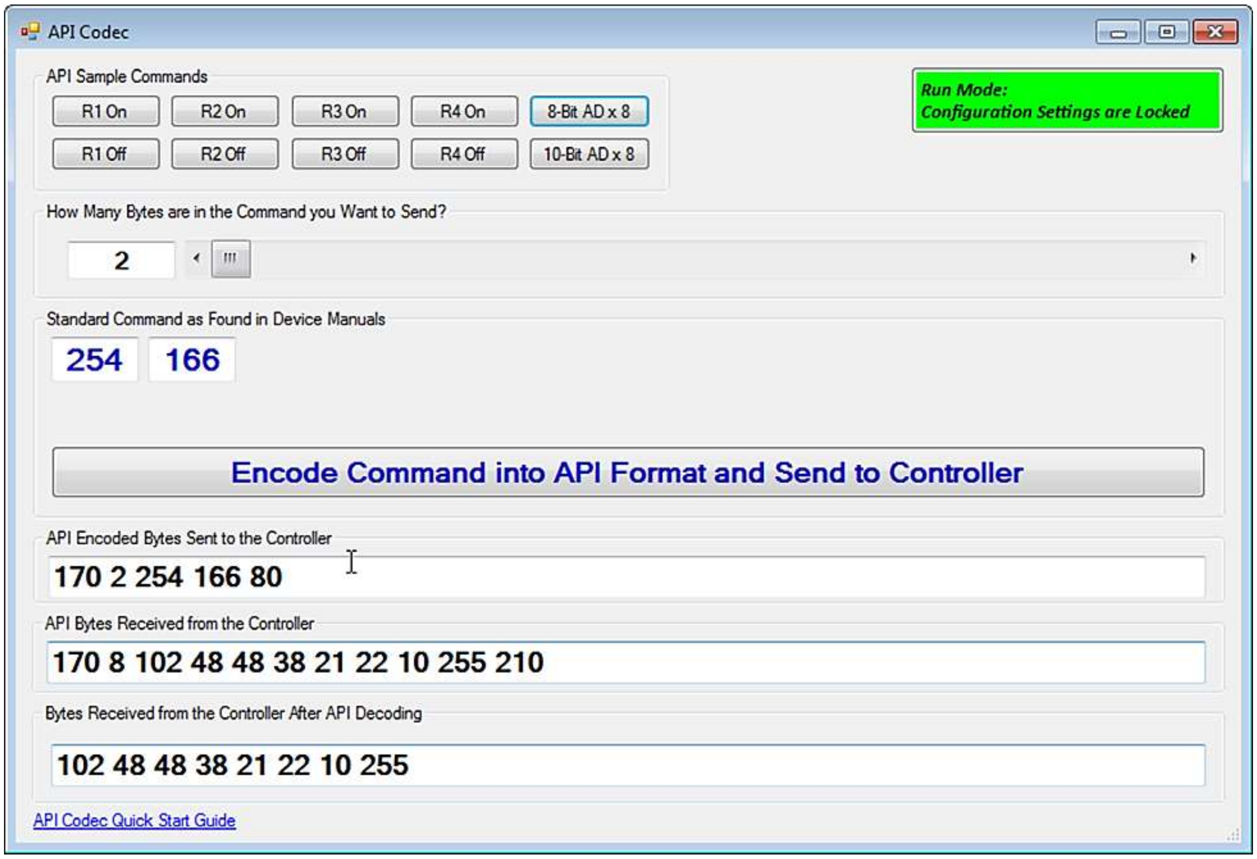
Base Station: API Codec

To help users better-understand the API Codec, a new control panel was created that allows you to enter commands in Standard Format and encode/decode the responses. This is a valuable learning tool for users who may wish to learn and troubleshoot the API Codec.



Run Mode:
Configuration Settings are Locked

How Many Bytes are in the Command you Want to Send?
2

Standard Command as Found in Device Manuals
254 166

API Encoded Bytes Sent to the Controller
170 2 254 166 80

API Bytes Received from the Controller
170 8 102 48 48 38 21 22 10 255 210

Bytes Received from the Controller After API Decoding
102 48 48 38 21 22 10 255

Move the Slider to select how many bytes you would like to send. This value should match the number of bytes in the standard command. In the example above, the Standard command that we want to encode is 254, 166 (two bytes). By clicking the blue "Encode" button as shown above, these data are wrapped with a Header, Number of Bytes, and is finished with a checksum (a value of 80 shown above). When a command is sent in API format, the controller responds in API format. In this case, the controller will report back 8 bytes indicating the 8-bit A/D values of analog inputs 1-8 (not supported by all controllers). The controller will respond with a header byte of 170, followed by the number of bytes to expect (8), followed by 8 bytes of data, concluding with a checksum of 210 as shown above.

The API decoded data that you actually want to obtain and use is shown at the bottom text field (102 48 48 38 21 22 10 255).

NCD
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Chapter

2

Getting Started

Coding Commands in API Format

Coding Commands in API Format is easy. Let's take a simple command and encode it for API Communications. The command 254, 33 is used to test two-way communications. If we send this command to the controller, the device will return 85 in Run Mode, 86 in Configuration Mode, and 87 in Security Lockdown Mode.

Standard Command:

Send Bytes:	**Byte 1:**	**Byte 2:**
Function:	Test Two-Way Communications	
Decimal Value	254	33
Receive Byte:	85	

Send in API Encoded Format:

Send Bytes:	**Byte 1:**	**Byte 2:**	**Byte 3:**	**Byte 4:**	**Byte5:**
Decimal Value	170	2	254	33	203

Byte 1:	170	Enter API Encoding Format Command
Byte 2:	2	Contains the Number of Bytes in the Command that will be sent to the controller
Byte 3:	254	Standard Command (Byte 1 of 2)
Byte 4:	33	Standard Command (Byte 2 of 2)
Byte 5:	203	LSB Checksum (170+2+254+33)=459 (459 AND 255)=203

When an API Command is sent, the controller will send all responses to your commands in API Mode. You will receive the following bytes from the controller:

Receive Bytes: 170 1 86 1

Byte 1:	170	Controller will encode the Response Beginning with 170 as a Header
Byte 2:	1	Number of Bytes to expect from the Controller
Byte 3:	86	86 is the actual data byte you will receive from the controller
Byte 4:	1	LSB Checksum Value of Response (170+1+86)=257 (257 AND 255)=1

Calculating the Checksum:

In order to use the API Codec, it is important that you properly calculate the Checksum for both coding and decoding API communications. The Checksum is very easy to calculate. Simply add all bytes together (including the Header Byte 170, and the Byte that indicates of number of bytes in the packet) then use the Mathematical "AND" function to isolate the Least Significant Byte:

459 AND 255 = 203
257 AND 255 = 1

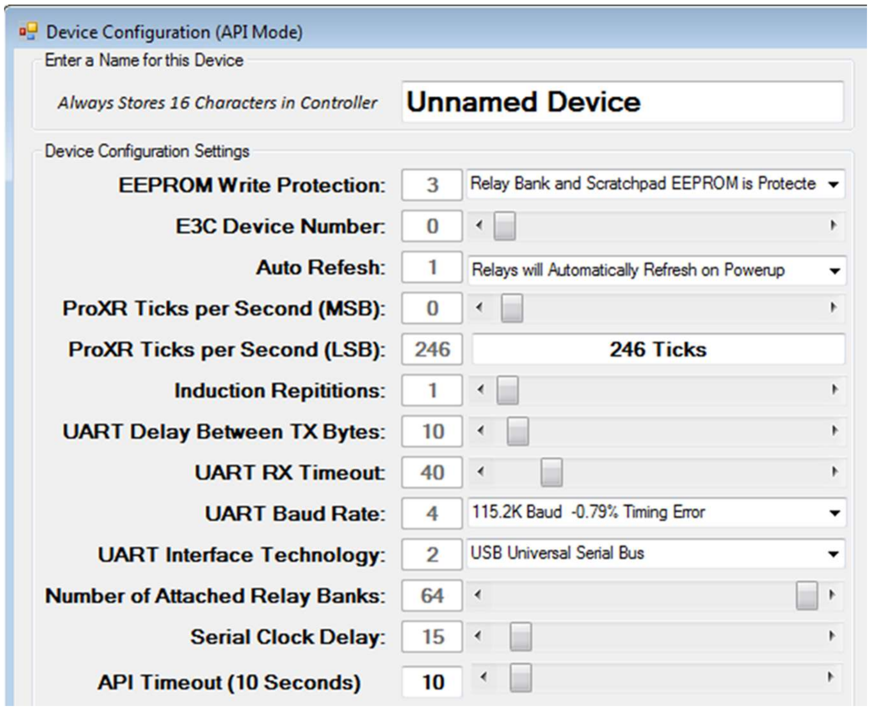
Checksum Notes:

Some standard commands (Non-API) may require a Checksum to process properly. This checksum must be wrapped into the API Codec, so essentially these commands will have two checksums. The first checksum will be required as part of the original command, the second checksum will be required by the API Codec. Make sure both checksums are included or the API Codec will not function properly.

API Codec Options:

API Timeout

There is only one important parameter that may be changed for the API Codec. The API Timeout Parameter (shown at the bottom of Device Configuration). When API Mode is entered, API mode will automatically timeout and exit if a complete API Command is not received within the default timeout period. We have chosen 10 Seconds as the API Timeout period, as this is ideal for network communications that may experience delays between packets. You may set the API Timeout to 0, which means API Mode will NEVER Timeout.



Device Configuration (API Mode)

Enter a Name for this Device

Always Stores 16 Characters in Controller: Unnamed Device

Device Configuration Settings

EEPROM Write Protection:	3	Relay Bank and Scratchpad EEPROM is Protecte
E3C Device Number:	0	
Auto Refesh:	1	Relays will Automatically Refresh on Powerup
ProXR Ticks per Second (MSB):	0	
ProXR Ticks per Second (LSB):	246	246 Ticks
Induction Repititions:	1	
UART Delay Between TX Bytes:	10	
UART RX Timeout:	40	
UART Baud Rate:	4	115.2K Baud -0.79% Timing Error
UART Interface Technology:	2	USB Universal Serial Bus
Number of Attached Relay Banks:	64	
Serial Clock Delay:	15	
API Timeout (10 Seconds)	10	

Testing for API Support

To ask the controller if API Mode is supported, read EEPROM Location 246 and Test Bit 8 (the most significant bit). If Bit 8 is High, API is supported by the controller. Please refer to the *EEPROM Quick Start Guide* for complete details.

Updated API Structure for E3C DropNet Devices

In September of 2015, an updated API Protocol was introduced to cover E3C DropNet Devices, which is included with ALL devices sold as E3C DropNet Devices. The current API Protocol is still valid, and works with all DropNet devices without interruption; however, a shortcut was introduced to consolidate device targeting and command processing as a single unified command. By using the updated API Structure, users may effectively target and control a device using one command. Older versions of firmware required two commands: One for targeting a device and one for controlling a device. Using the updated API Structure for E3C DropNet Devices, you can effectively double communication speed with minimal changes to the API Structure.

This portion of the guide explains the updated API Packet Structure:

171	Header Byte for updated E3C DropNet Structure
0	Device you would like to control (0-255 Valid Range)
3	Number of Bytes to Send in the Command
254	Header Byte for Command
131	Toggle Relay Command
0	Apply Command to the first Relay
46	Checksum Calculations do NOT Change

Note: To simplify integration of this new packet structure, Checksums are calculated EXACTLY as before. The 171 does NOT recalculate the checksum, checksum is calculated as though the header byte were 170. The Device Number is NOT included in the Checksum calculations.

Note: Each E3C DropNet Device MUST be configured with a DIFFERENT E3C Device Number. Use our Base Station Software and choose: "Device Configuration" to set the device number.

Notes from NCD Developers

The API Codec has greatly improved the reliability of the NCD product line. When the API Codec was first implemented in device firmware, several small malfunctions began to appear across many versions of firmware. We discovered some firmware routines were not 100 percent independent of other unrelated routines. While bugs were never proven in standard communications despite exhaustive testing, API helped us red flag and repair all "Leaky" routines. The resulting theoretical reliability of NCD Products has taken a major step forward since the introduction of the API Codec. You will also notice the Device Configuration and Device Identification now operate much faster than before, thanks in large part to the API Codec. Base Station software was HEAVILY modified to include support for API Communications while maintaining backward compatibility with older devices. In addition, Ethernet Connect ME users will now be able to use Base Station Version 3.2 or later to DIRECTLY communicate with these devices WITHOUT the use of RealPort.

The API Codec has paved the way for future commands that will only process in API mode; in fact, Base Station currently uses a few undocumented commands that are only available in API Mode for memory alteration. Go into device configuration of your controller with API Mode turned off…then go into device configuration on your controller with API Mode turned on…the speed difference is credited to API Mode in combination with a few new special commands.

We hope all users of ProXR Enhanced and Taralist controllers will review their current version of firmware. If you are running any firmware version that does not indicate 3.2 or greater, we invite you to return your controller to us for a FREE firmware upgrade (inside the continental United States). While not required, we think you will greatly benefit from the improvements made with all versions of ProXR Enhanced, Taralist, and Base Station software.

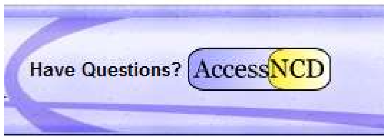
Taralist users may see a version number as high as 21. This was first generation firmware which only supported 3 digits. Version 3.2 or later is actually a newer version of firmware for these controllers as this version number actually support 6 digits.

ProXR Standard firmware is now closed and will not be modified or enhanced beyond Base Station software improvements due to memory limitations of ProXR Standard microprocessors. If you are running ProXR Standard, we are able to convert your controller to ProXR Enhanced. Please contact us for details

Chapter 3

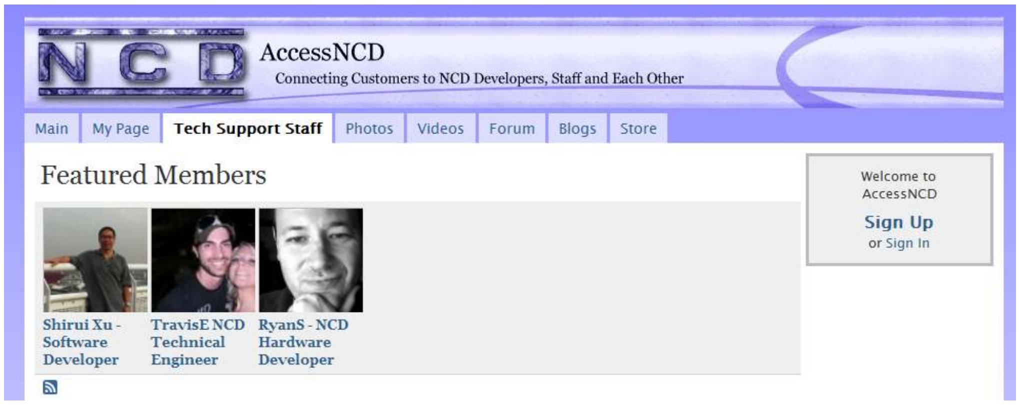
Technical Support

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.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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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- www.relaypros.com
- www.amazon.com

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