# AppIO Relay Module System User's Guide

**SPECTRUM DIGITAL** INCORPORATED

**MICROCHIP** **Authorized** Design Partner
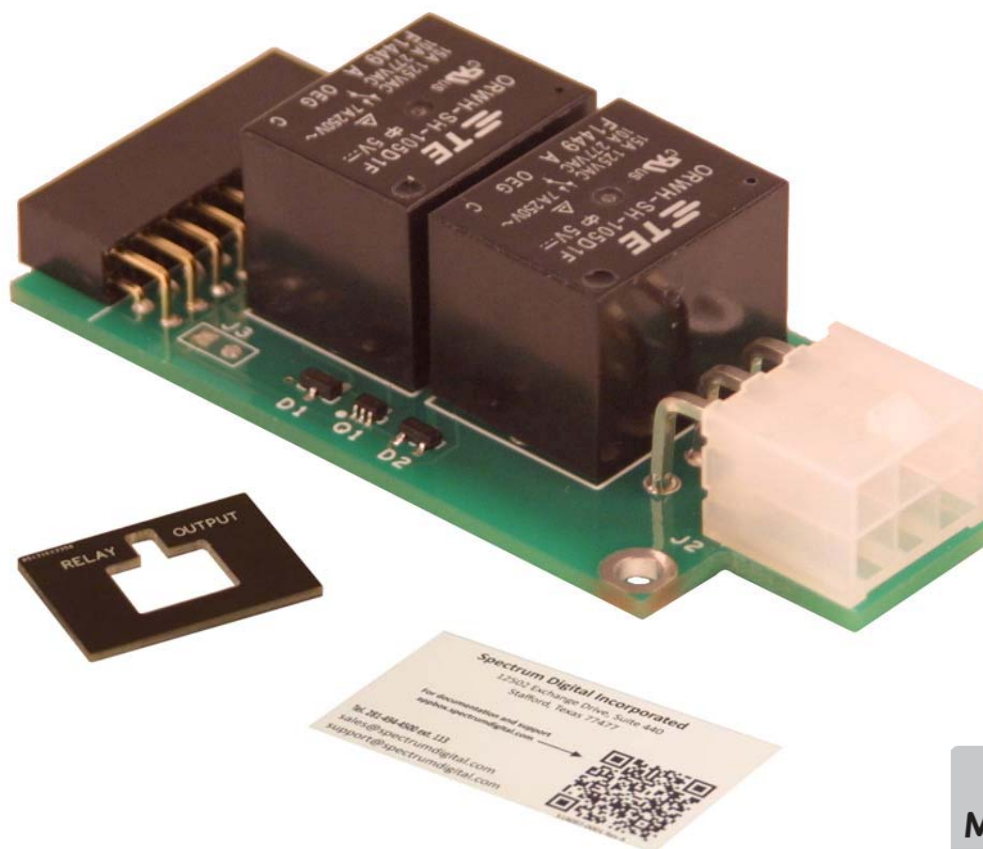
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**AppIO**

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# Table of Contents

## 1.0   Introduction

This document describes the features of the AppIO Relay Module. The AppIO Relay Module is designed to be used with a Spectrum Digital AppBox in an industrial application. The AppIO Relay Module can be plugged into any of the 3 expansion connectors on the AppBox.

## 1.1   AppIO Relay Module Features

This AppIO Relay Module has the following features:

- Provides two (2) relay outputs (SPDT, +5 volts, at 10 amps)
- Compatible with Spectrum Digital C21, D21, E54, and E70 AppBox Boards and Atmel X PLAINED processor boards
- Power provided by App Module
- Operates 0 - +70C



**AppIO Relay Module Block Diagram**
(Plugged into EXT1 on AppBox CPU Board)
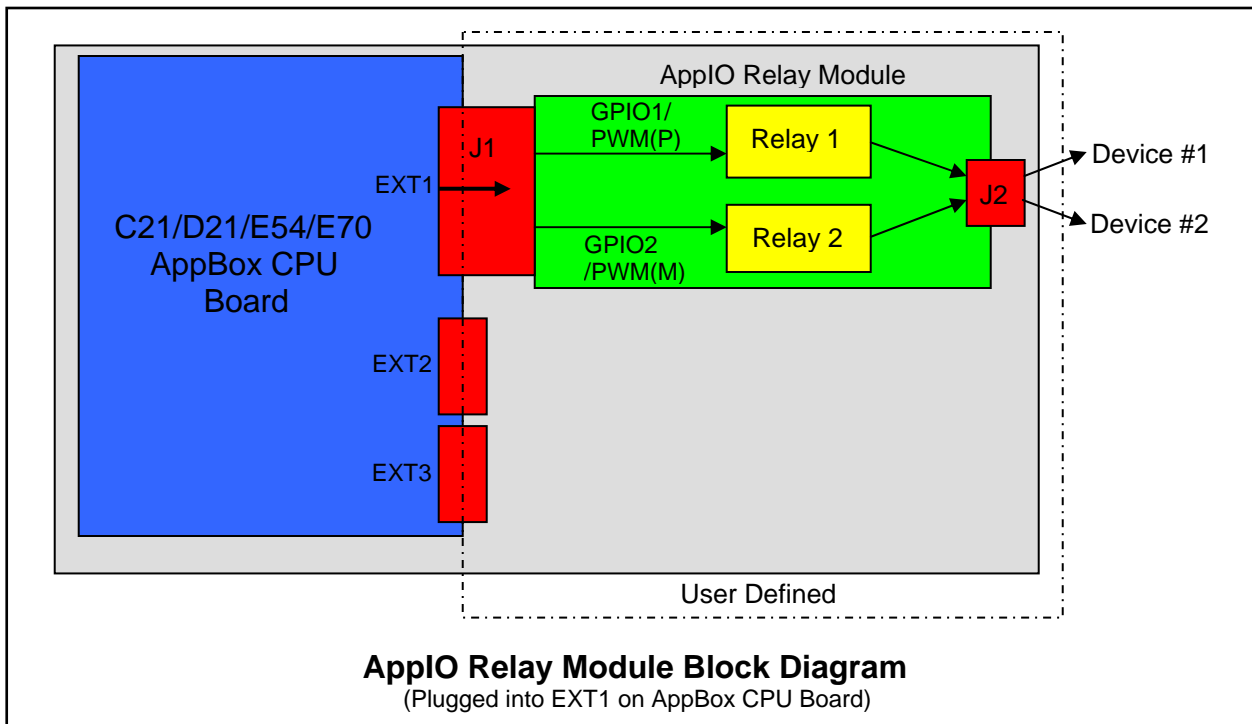
## 1.2   AppIO Relay Module Applications

The AppIO Relay Module can be used in the following applications:

- Control DC circuits in an industrial control system
- Up to 6 relays per AppBox can be configured
- Brings relays into IoT applications, new edge devices

## 1.3   AppIO Relay Module Product Contents

The following items are contained in the AppIO Relay Module (Part/SKU #: 703916-0001) product:

- AppIO Relay Module
- Relay connector mating connector
- Knock out panel for relay output connector
- 2 mounting screws
- Product information card

## 1.4   AppIO Relay Module Accessories

The following AppBox products can be used with the AppIO Relay Module and ordered from Spectrum Digital or authorized resellers:

| Accessory Description | Part/SKU Number |
|---|---|
| AppBox C21 | 703909-0001 |
| AppBox D21 | 703910-0001 |
| AppBox E54 | 703919-0001 |
| AppBox E70 | 703911-0001 |

## 2.0   Installation

## 2.1   Installation of the AppIO Relay Module

Listed below are the steps to install the AppIO Relay Module in an AppBox C21/D21/E54/E70:

1. Remove **ALL** power to the enclosure
2. Remove all interface connections attached to the installed AppIO Modules
3. Remove the connections (CAN/RS-485/LIN/USB/Enet) to the AppBox CPU Board
4. Turn the AppBox over and remove the 2 screws from the bottom of the enclosure as shown below



Screws

**AppBox Bottom Screw Locations**
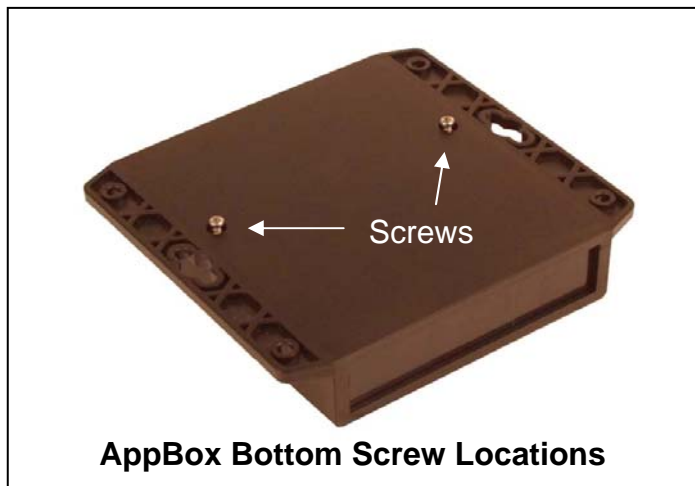
5. Turn the AppBox back over (label showing) and lift the top off the enclosure being careful not to lose the knockout panels
6. If necessary remove one or more existing AppIO Modules

7. Plug the AppIO Relay Module into an AppIO Module expansion connector (EXT1, EXT2, or EXT3)



**AppIO Relay Module Attached to E54 CPU Board**
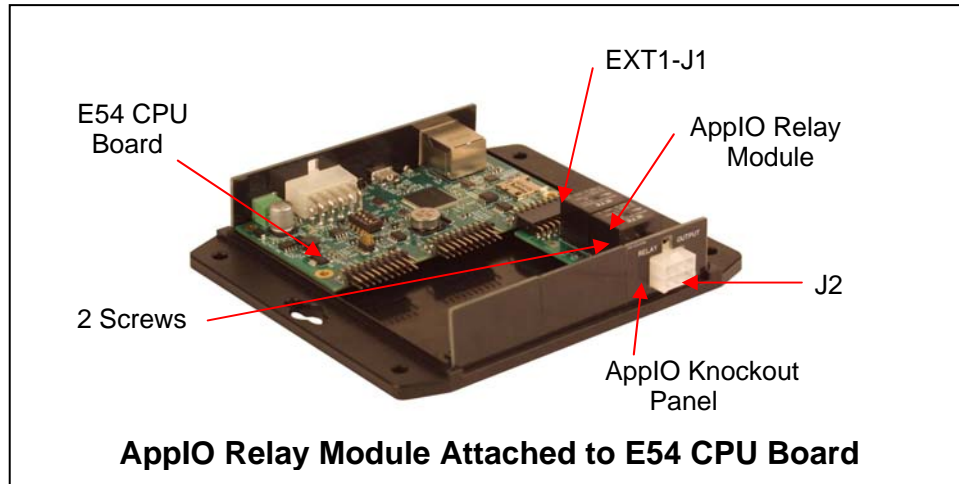
8. Insert the knock out panel associated with the AppIO Relay Module
9. Secure the AppIO Module to the AppBox base with the 2 provided screws
10. Insert the knock out panels in any unused positions
11. Place the cover back over the AppBox CPU Board and AppIO Modules. Make sure the cover closes tight on both sides
12. Turn the AppBox over and insert the 2 screws back in and tighten until snug, do not over tighten/strip the screws



**AppIO Relay Module Installed in AppBox**
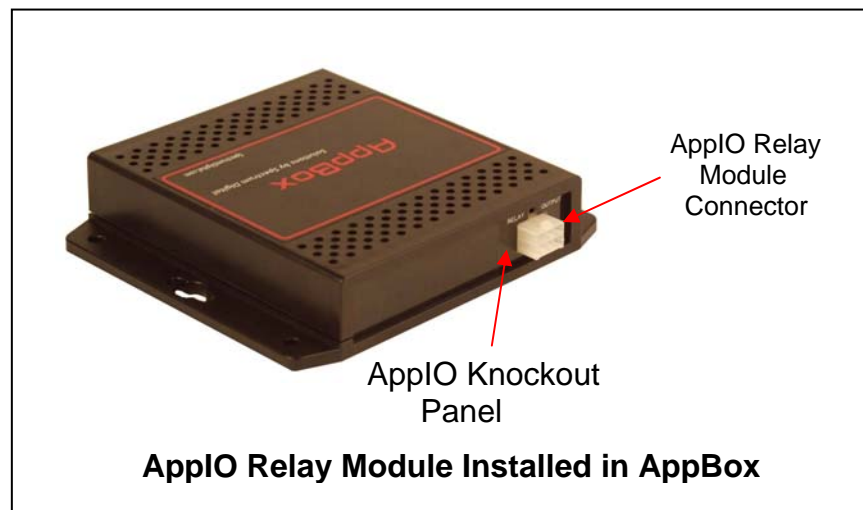
13. Re-attach the connections (CAN/RS-485/LIN/USB/Enet) to the AppBox CPU Board
14. Re-attach all interface connections to the AppIO Modules
15. Apply power to the AppBox

### 3.0 Interfaces

This section describes the interfaces on the AppIO Relay Module. These interfaces include the connectors, and jumpers.

The location of each of these interfaces is shown in the figure below:



**AppIO Relay Module Interfaces**
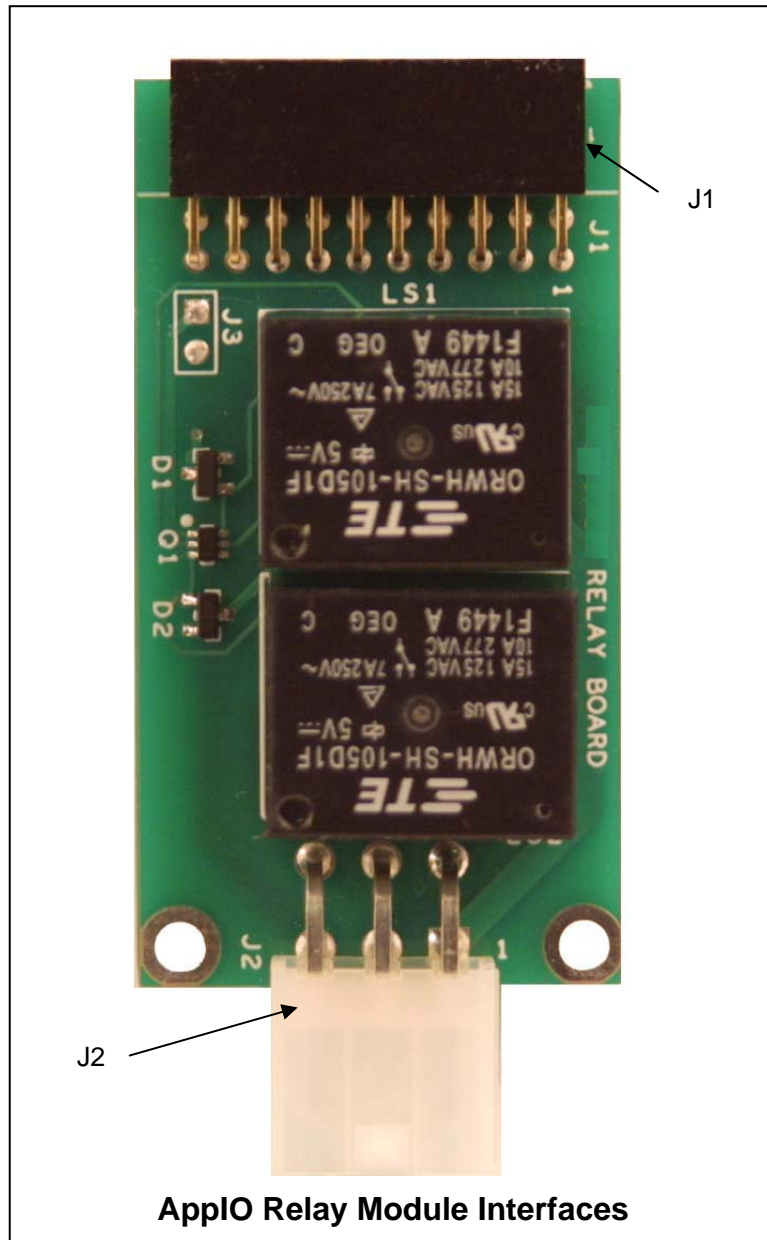
The table below lists all the interfaces on the AppIO Relay Module.

| AppIO RELAY MODULE INTERFACES ||
| INTERFACE NAME | TYPE OF INTERFACE |
| --- | --- |
| J1 | Connector to AppBox CPU Board |
| J2 | Connector to relays |
| J3 | Connector to ground VDD_5V |
| JP1 | SMT jumper(bottom) |
| JP2 | SMT jumper(bottom) |
| JP3 | SMT jumper(bottom) |
| JP4 | SMT jumper(bottom) |
| JP5 | SMT jumper(bottom) |
| JP6 | SMT jumper(bottom) |

## 3.1  Connectors

The following section describes the connectors on the AppIO Relay Module.

| INTERFACE NAME | TYPE OF INTERFACE |
| --- | --- |
| J1 | Connector to AppBox CPU Board, 20 position, 2 x 10 |
| J2 | Connector to relays, 6 position, 2 x 3 |

### 3.1.1  J1 Connector, AppBox CPU Board Interface

The J1 connector on the AppIO Relay Module can be plugged into any one of the 3 expansion connectors (EXT1, EXT2, or EXT3) on the C21/D21/E54/E70 AppBox CPU boards. The J1 connector is a 20 pin, 2 x 10 double row female right angle connector with centers on .1 inch (2.54 mm) centers.

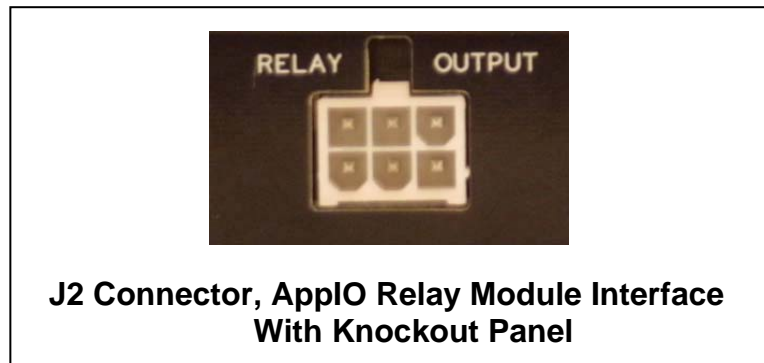The following diagram shows the physical layout of the J1 connector.



**J1 Connector, AppIO Relay Module**
**(**card edge view)
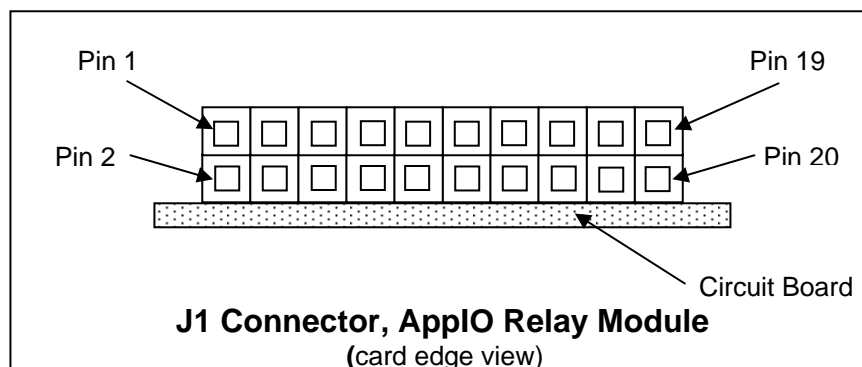
The following table shows the signals present on the J1 connector.

| | | | |
|---|---|---|---|
| **J1 Connector, AppIO Relay Module** | | | |
| **Pin #** | **Signal Name** | **Function** | **Shared Functionality** |
| 1 | VDD_5V | +5 volts from AppBox CPU Board **if** AppIO Module jumper shorted | VDD_5V |
| 2 | DGND | Ground | Ground |
| 3 | No connect | | |
| 4 | No connect | | |
| 5 | GPIO1 | General purpose I/O from AppBox CPU Board | |
| 6 | GPIO2 | General purpose I/O from AppBox CPU Board | |
| 7 | PWM(P) | PWM(P) from AppBox CPU Board | |
| 8 | PWM(N) | PWM(N) from AppBox CPU Board | |
| 9 | No connect | | |
| 10 | No connect | | |
| 11 | No connect | | |
| 12 | No connect | | |
| 13 | No connect | | |
| 14 | No connect | | |
| 15 | No connect | | |
| 16 | No connect | | |
| 17 | No connect | | |
| 18 | No connect | | |
| 19 | DGND | Ground | Ground |
| 20 | No connect | | |

### 3.1.2 J2 Connector, Relay Output Interface

This section describes J2, the relay output connector. This connector has the outputs of 2 SPDT relays. Each relay can pull a 10 amp load at +5 volts. The J2 connector is shown with it's knockout panel in the diagram below.



**J2 Connector, AppIO Relay Module Interface
With Knockout Panel**

This is a 6 position (2 rows by 3 pins each) male connector. The bottom row of pins (1, 2, and 3) have the signals for the relay #1. The top row of pins (4, 5, and 6) have the signals for relay #2. The diagram below shows the physical layout of the J2 connector.



**J2 Connector, AppIO Relay Module Interface
(**card edge view)
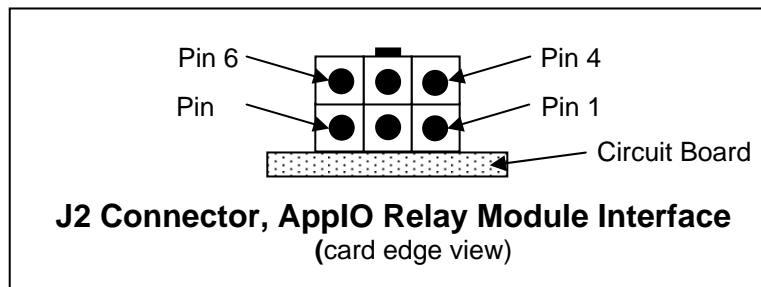
The following table shows the signals present on the J2 connector.

| J2 Connector, Relay Output Interface ||
| --- | --- |
| **Pin number** | **Signal name** |
| 1 | NO1 |
| 2 | NC1 |
| 3 | CO1 |
| 4 | NO2 |
| 5 | NC2 |
| 6 | CO2 |

## 3.2  Jumpers

This section describes the jumpers on the AppIO Relay Module. All jumpers are located on the bottom side of the Module. All jumpers are surface mount jumpers. The figure below shows the location of each  jumper.



**AppIO Relay Module Jumper Locations**
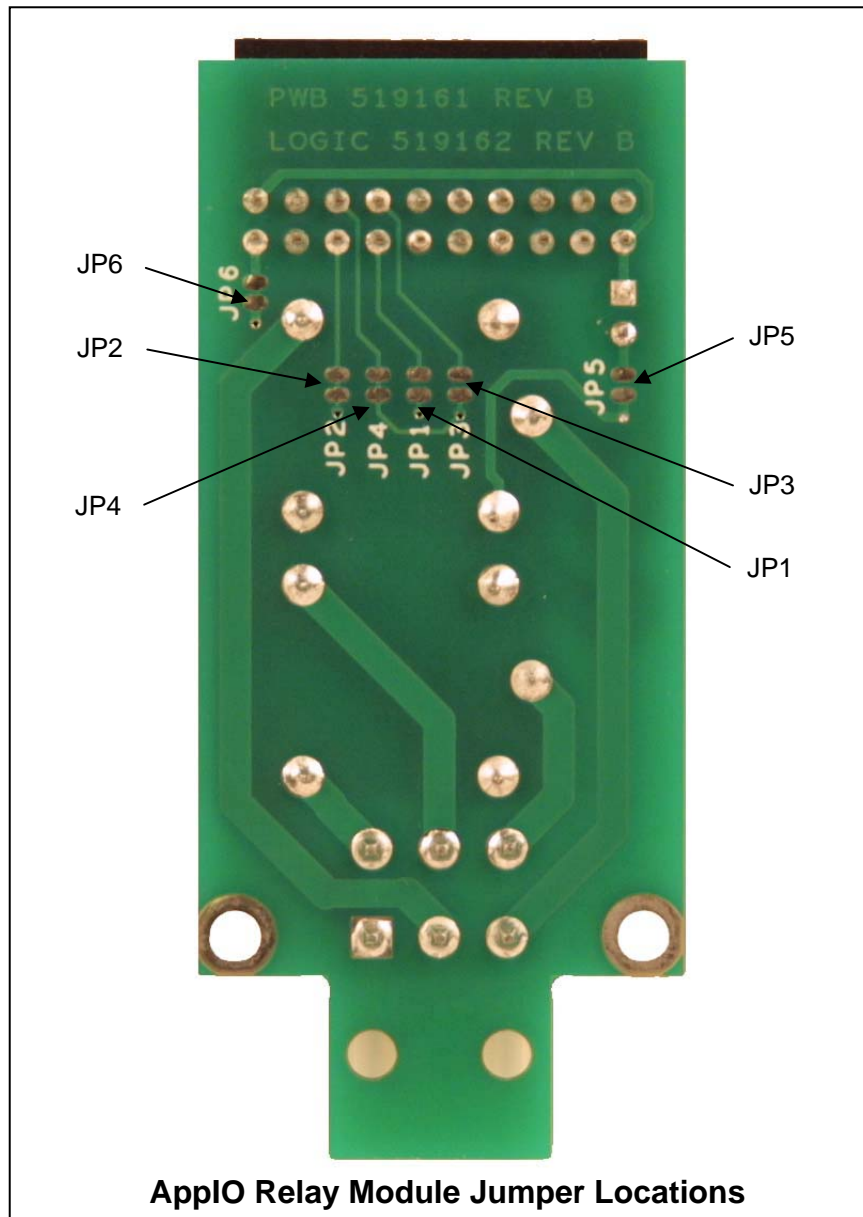
The table below describes the jumpers on the AppIO Relay Module.

| JUMPER NAME | POSITION DESCRIPTION | FACTORY SHIPPED POSITION |
|---|---|---|
| JP1 | Installed = PWM(P) drives relay #1 | Open – see warning 1 |
| JP2 | Installed = GPIO1 drives relay #1 | Installed – see warning 1 |
| JP3 | Installed = PWM(M) drives relay #2 | Open – see warning 2 |
| JP4 | Installed = GPIO2 drives relay #2 | Installed – see warning 2 |
| JP5 | Not used | Open |
| JP6 | Installed = connects VDD_5V from App Module to the AppIO Relay Module | Installed |

## WARNING 1 !

! Jumpers JP1 and JP2 are used in the same circuit. Only 1 should be installed. If both are installed the circuit could be damaged.

## WARNING 2 !

! Jumpers JP3 and JP4 are used in the same circuit. Only 1 should be installed. If both are installed the circuit could be damaged.

## 4.0  Physical Characteristics

The physical characteristics of the AppIO Relay Module are described below:

AppIO Relay Module (without connectors):  L: 2.25 in. (57.15 mm.) x W: 1.20 in. (30.48 mm.)

AppIO Relay Module (width with connectors): L: 2.75 in. (69.85 mm.)

AppIO Relay Module (maximum height): H: 0.75 In. (19.05 mm.)

Weight of Relay Module:  0.96 oz. / 0.027 kg

Operating Temperature:  -0C to +70C

Storage Temperature: -40C to +85 C

Relative Humidity: 0 to 90% (non-condensing)

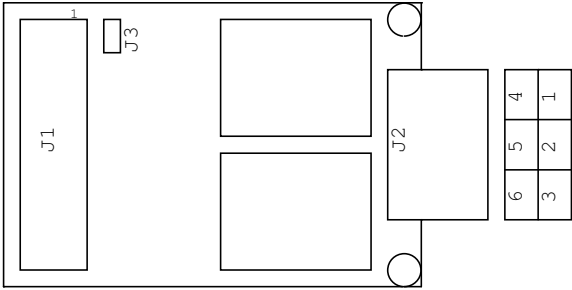Maximum power consumption of controller Module: 500 ma. at +12 volts
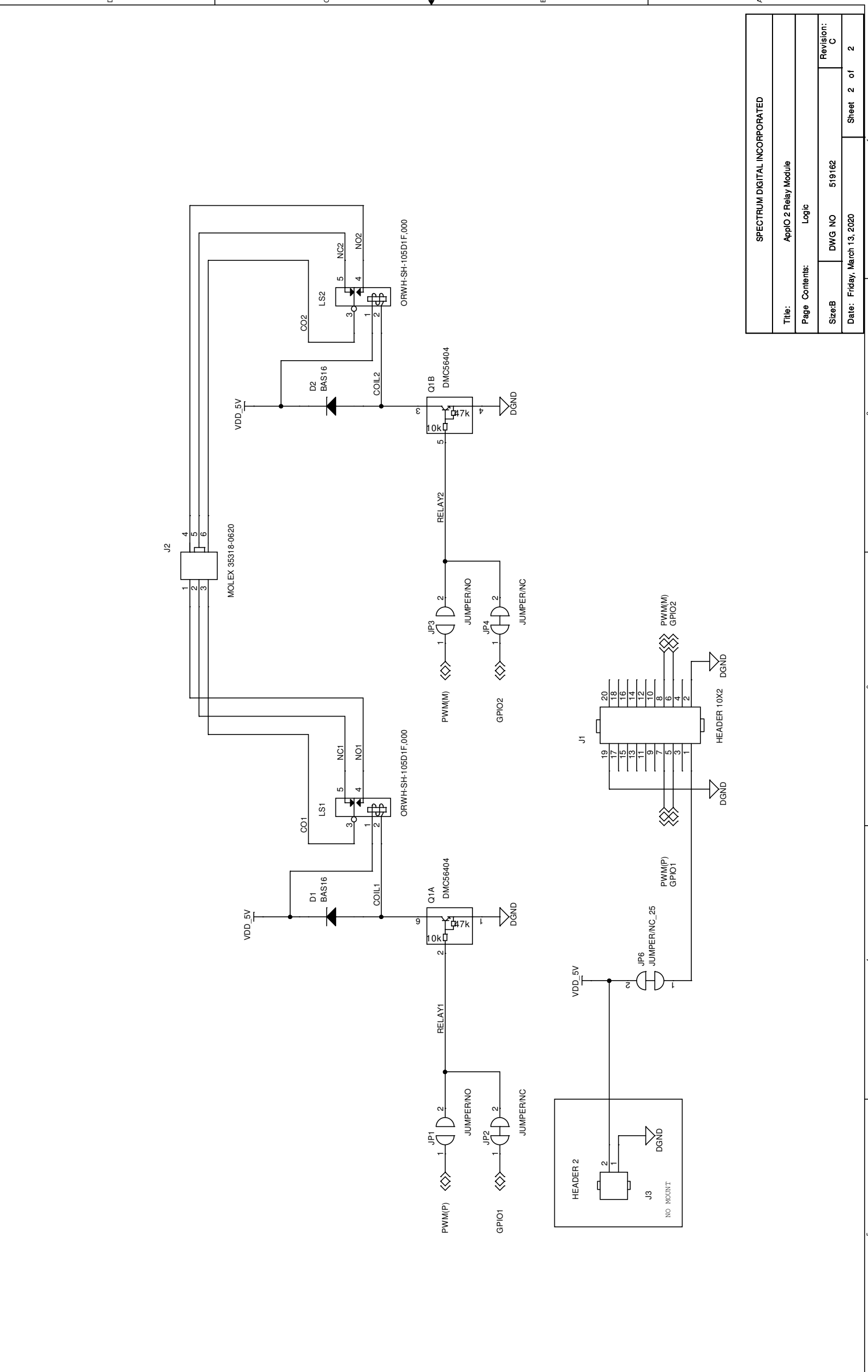
RoHS Compliant: Yes

## 5.0  Schematics

The following pages have the schematics for the AppIO Relay Module.

NOTES:

1. JUMPERS JP1,JP2,JP3,JP4,JP6 ARE ON THE BACK OF THE BOARD

2. INSTALL J3 AND CUT JUMPER JP6 FOR EXTERNAL 5V POWER

J1

1

J3

J2

| | 4 | 1 |
|---|---|---|
| 5 | 2 |
| 6 | 3 |

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Title: ApploO 2 Relay Module

Page Contents: Logic

Size:B  DWG NO  519162

Revision: C

Date: Friday, March 13, 2020

Sheet 2 of 2

J2
MOLEX 35318-0620
4
5
6
1
2
3

LS2
ORWH-SH-105D1F.000
NC2
NO2
5
4
3
1
2
CO2

VDD_5V
D2 BAS16
COIL2
Q1B
DMC56404
3
10k
47k
5
4
DGND
RELAY2

JP3
JUMPER/NO
2
1
PWM(M)

JP4
JUMPER/NC
2
1
GPIO2

LS1
ORWH-SH-105D1F.000
NC1
NO1
5
4
3
1
2
CO1

VDD_5V
D1 BAS16
COIL1
Q1A
DMC56404
9
10k
47k
2
1
DGND
RELAY1

JP1
JUMPER/NO
2
1
PWM(P)

JP2
JUMPER/NC
2
1
GPIO1

J1
HEADER 10X2
20 18 16 14 12 10 8 6 4 2
19 17 15 13 11 9 7 5 3 1
PWM(M)
GPIO2
DGND
DGND
PWM(P)
GPIO1

VDD_5V
JP6
JUMPER/NC_25
2
1

HEADER 2
J3
NO MOUNT
2
1
DGND

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