

## **Sierra Radio Systems Station Controller**

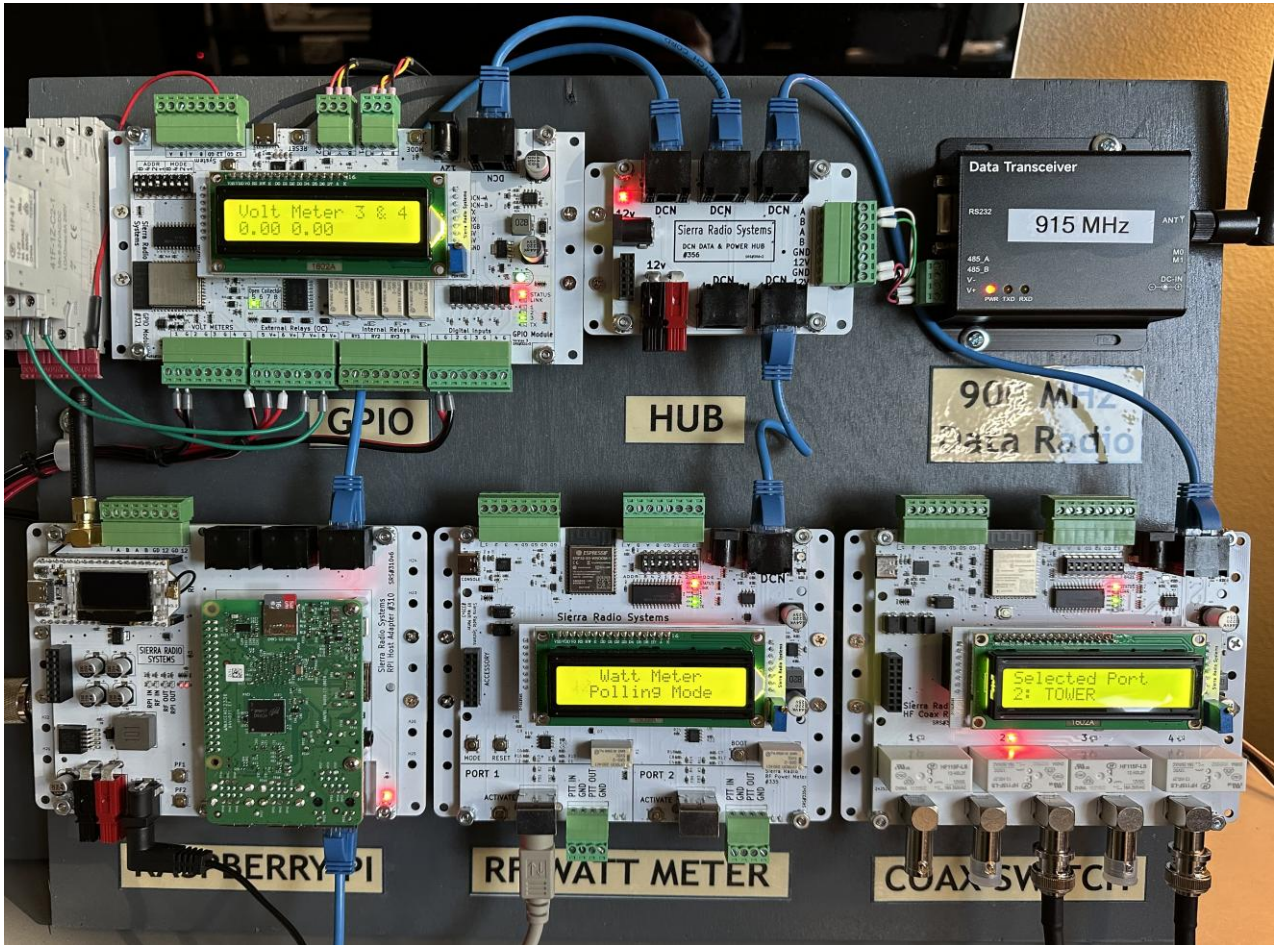
### **General Purpose I/O Module**



**sierraradio.net**

## Typical Hardware Installation

This example shows a typical system mounted to a plywood board using DIN rails and clips.

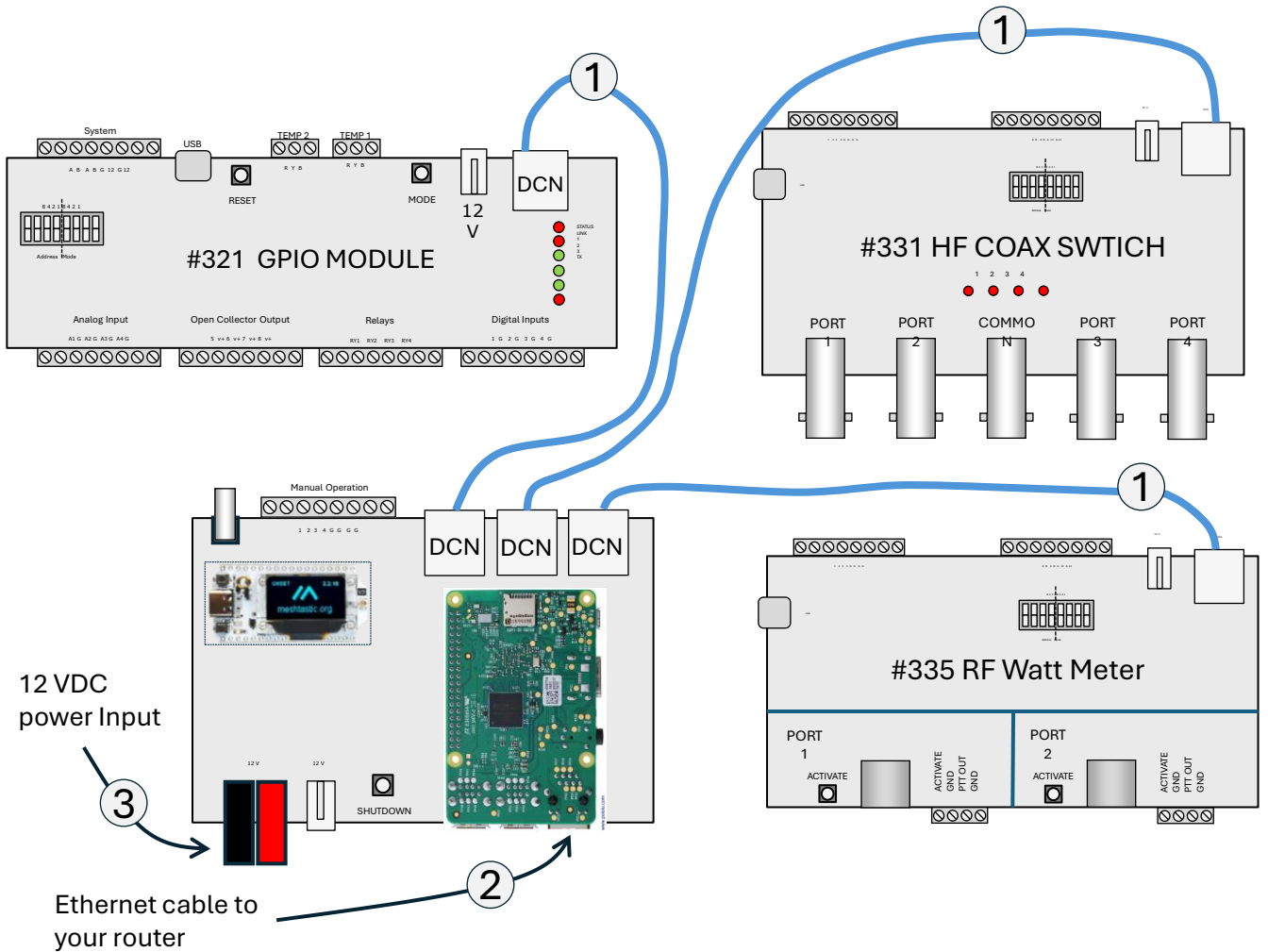


In the example pictured above you can see a full system including from top left:

- Optional 6A slim DIN rail mount SPDT relays
- GPIO Module
- Optional 5 port DCN power and data hub
- Optional 900 MHz DCN data radio

On the bottom row from the left:

- Raspberry Pi Module
- RF Watt Meter Module
- Coax Relay Module

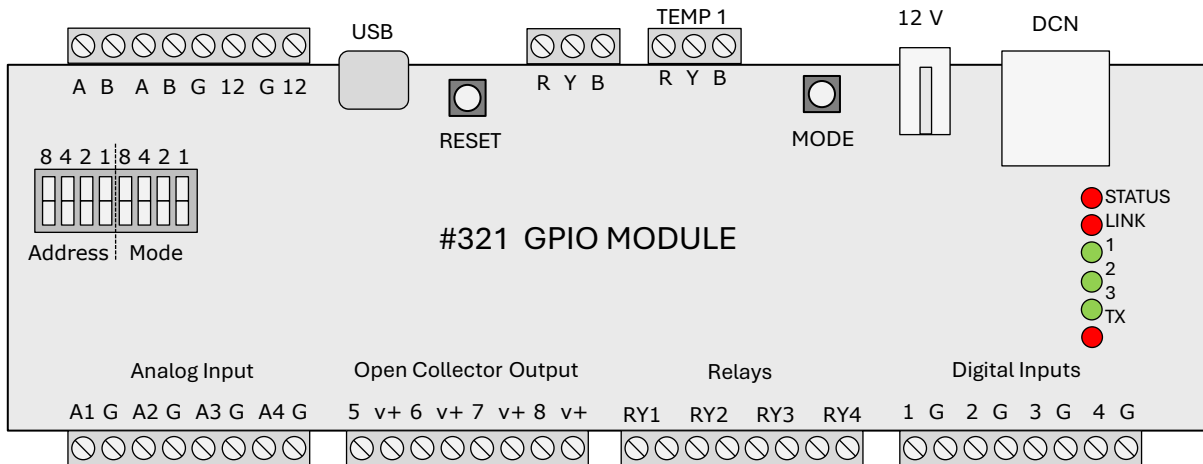
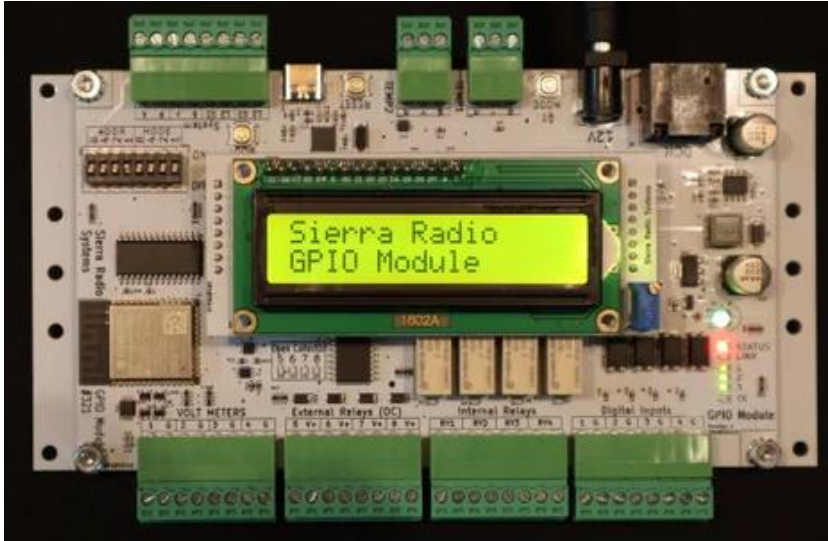


**In this example, you only need three connections to get your system up and running.**

- ① CAT6 cables between the Raspberry Pi host adapter module and each of the control modules. These provide power and data to the control modules.
- ② Ethernet cable from your router to the network jack on the Raspberry Pi
- ③ 12 VDC power input to the powerpole or 2.1mm barrel jack.

# General Purpose I/O (GPIO) Module

## Physical Connections



The GPIO Module has 6 terminal block connectors that connect to various points to control or measure data. Here is a quick summary of what the connections do.

### Analog Input – DC Volt Meters

The analog input terminal block is a set of 4 DC volt meters. The range of the measurement is between 0 and 50 VDC. Each input is labeled A1...A4 and G.

A1 - DC Volt meter #1  
G - Ground

A2 - DC Volt meter #2  
G - Ground

A3 - DC Volt meter #3  
G - Ground

A4 - DC Volt meter #4  
G - Ground

## Open Collector Outputs

The open collector outputs are used to actuate external 12 VDC relays. When the channel is in the active (on) state, the open collector pin will be pulled to ground.

Next to each of the open collector outputs is a pin labeled "V+". This is a source of 12 VDC for the external relay coil if no other source of 12 volts is available. This makes it easy to run a piece of two conductor wire to the relay terminals.

Note that a reverse protection diode is already installed between each open collector output and +12 VDC. These 4 outputs map to the control system relays number 5, 6, 7, and 8.

- 5 - Open collector output referred to as relay #5
- V+ - This is a source of +12 VDC
  
- 6 - Open collector output referred to as relay #6
- V+ - This is a source of +12 VDC
  
- 7 - Open collector output referred to as relay #7
- V+ - This is a source of +12 VDC
  
- 8 - Open collector output referred to as relay #8
- V+ - This is a source of +12 VDC

## Relays

These are 4 small signal internal dry contact relays. SPST contacts are wired to each of two pins for each relay. These relays map to the control system relays number 1, 2, 3, 4. When the relay is in the on state, the circuit between the pair of pins is closed.

- RY1 - This is a pair of dry contact SPST switched relay contacts referred to as relay 1
- RY1 - This is a pair of dry contact SPST switched relay contacts referred to as relay 1
  
- RY2 - This is a pair of dry contact SPST switched relay contacts referred to as relay 2
- RY2 - This is a pair of dry contact SPST switched relay contacts referred to as relay 2
  
- RY3 - This is a pair of dry contact SPST switched relay contacts referred to as relay 3
- RY3 - This is a pair of dry contact SPST switched relay contacts referred to as relay 3
  
- RY4 - This is a pair of dry contact SPST switched relay contacts referred to as relay 4
- RY4 - This is a pair of dry contact SPST switched relay contacts referred to as relay 4

## Digital Inputs

There are 4 opto-isolated digital inputs. These inputs are labeled 1, 2, 3, 4. The pins with G are connected to ground. When the input is pulled to ground, that input is considered in the on state.

1 Digital input #1  
G Ground

2 Digital input #1  
G Ground

3 Digital input #1  
G Ground

4 Digital input #1  
G Ground

## Temperature Sensor Inputs

There are two 3 pin terminal block connectors for connection the two external digital temperature probes. You will notice on the temperature probe there are three wires. Black, Red and Yellow. Connect these three wires to the terminal block pins as indicated on the PCB. The pins are labeled B Y R for Black, Red and Yellow wires.

If possible, I suggest using ferrules to ensure a good connection but bare wires are OK.

## System Terminal Block

This terminal block provides an alternative point where you can connect 12 VDC power in/out of the system as well as optional DCN (Device Control Network) RS-485 A/B pins. These pins on this terminal block are the same as other connectors on the board including the RF45 connector.

The connections from left to right when holding the board so the connector is in the upper left of the board:

DCN RS-485 A  
DCN RS-485 B

DCN RS-485 A  
DCN RS-485 B

Ground  
+12 VDC in/out

Ground  
+12 VDC in/out

## **RJ45 DCN Connector**

The DCN connector is the main interconnect point between modules, Raspberry Pi board and other optional boards. The pinout of the RJ45 is:

|   |                  |
|---|------------------|
| 1 | RS-485 A         |
| 2 | RS-485 B         |
| 3 | n/c              |
| 4 | +12 Volts In/Out |
| 5 | +12 Volts In/Out |
| 6 | n/c              |
| 7 | Ground           |
| 8 | Ground           |

With the RJ45 / CAT cable connection you only need to supply power to one of the modules. The CAT cables will carry the power and data between all the other modules.

# System Configuration Features

## DIP Switches

The dip switches set the devices network address and operating mode.

## Address switches

Device address can be anything from 1-15 set through the dip switch. There is an option to set other addresses through the USB serial port.

The default addresses are:

|                      |   |
|----------------------|---|
| Main dashboard RPI   | 0 |
| GPIO Module          | 1 |
| Coax Relay Module    | 2 |
| RF Watt Meter Module | 3 |

If you add an additional module you need to select an address not already in use.

You notice most modules have the individual switches labeled “8421”. These number map to the switches. If you are setting the address to 5, for example, you would turn on switches 4 and 1 to give you an address of 5.

## Mode switches

The mode switches are normally all switched off. This will run the module in it’s normal mode. Some modules have different behaviors enabled by the switches. These will be document in the future.

An example of this is on the RF power watt meter. One of the mode switches will cause the watt meter to continuously sample the inputs every second and send that data to the DCN. This is not the usual mode because it would clog up a control channel that all the other devices need to use. However you can put the watt meter on it’s own physical channel by hooking up a USB to RS485 dongle creating a new serial port on the Raspberry Pi and thereby moving all the watt meter streaming data to it’s own connection.

## USB Port

The USB port is not normally used in typical operation of the system. It’s primary purpose is to flash new versions of firmware. The port is also a sort of “console” port that allows you to communicate with the board from a dumb terminal program like Putty. You can see the various steps that get executed as the module boots up, send it configuration commands, and other uses. Set your dumb terminal for 9600 baud, 8N1 and check out what the board is doing.

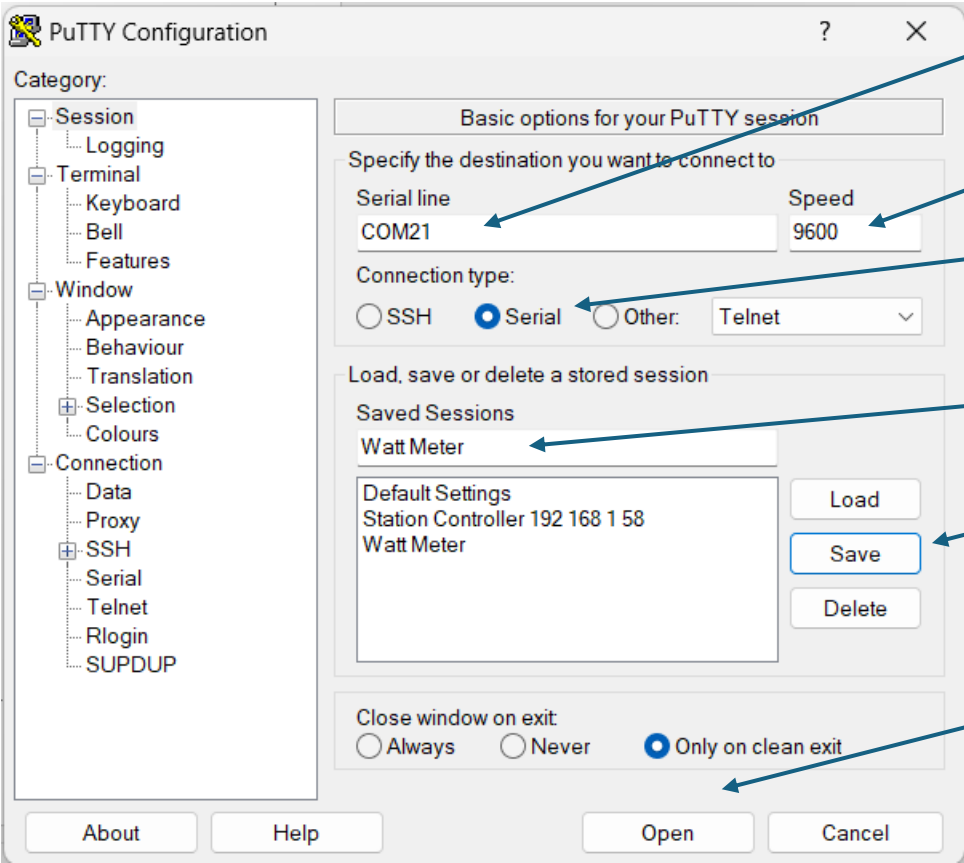
## DC Power

The modules all have their own built in 12v power supply. The system needs an input voltage between 10 and 18 volts to operate.

## LCD Display

All modules have optional LCD displays. These can be pulled off the module board when the power is off. The LCD is an option to help reduce cost and power consumption on devices that are all configured and kept out of sight. The LCD provides very convenient current status of the module in operation.

## Configuring the PuTTY session



The screenshot shows the PuTTY Configuration dialog box with the 'Basic options for your PuTTY session' category selected. The 'Serial line' field contains 'COM21' and the 'Speed' field contains '9600'. The 'Connection type' is set to 'Serial'. The 'Saved Sessions' list contains 'Watt Meter'. The 'Close window on exit' option is set to 'Only on clean exit'. The 'Open' button is highlighted.

Enter the COM port number.

Enter 9600

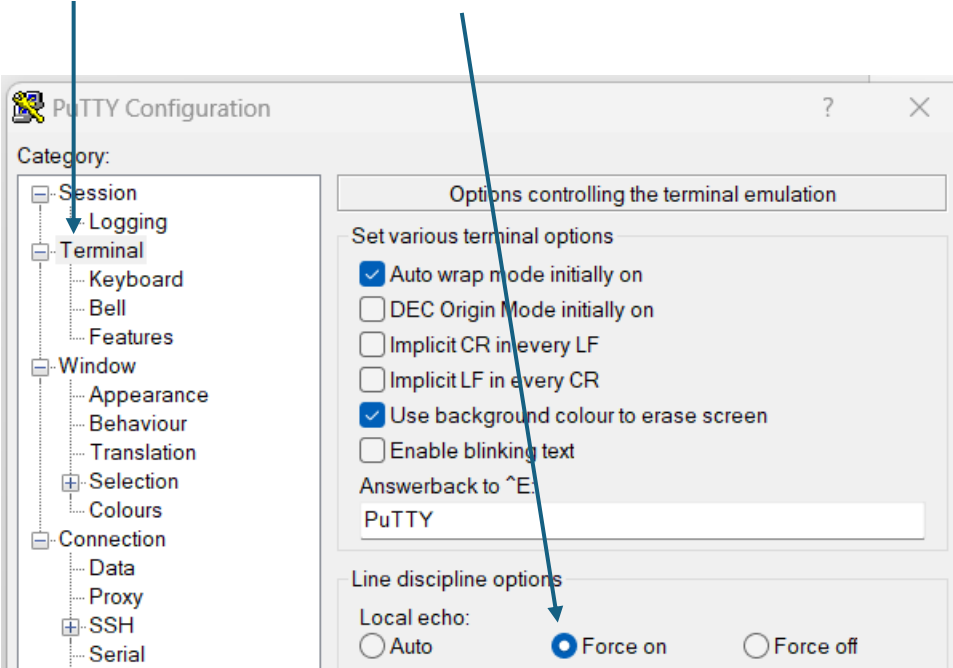
Select Serial

Enter connection name

Click save

Click open

Select the "Terminal" menu. Turn on local echo.



The screenshot shows the PuTTY Configuration dialog box with the 'Options controlling the terminal emulation' category selected. The 'Local echo' option is set to 'Force on'.

Auto wrap mode initially on

DEC Origin Mode initially on

Implicit CR in every LF

Implicit LF in every CR

Use background colour to erase screen

Enable blinking text

Answerback to ^E

PuTTY

Line discipline options

Local echo:

Auto Force on Force off

## GPIO Module Commands

When connected to the watt meter using the USB port, there is no need to format commands with the full addressed packet format that you would see on the DCN. This means all commands can be refixed with a //

### Relay Control Commands

**Command: RYx** Turn relay on/off

Syntax: //RYx,y

Where x is the relay number from 1 to 8

Where y is state. 1 = ON, 0 = OFF

**Command: RY** Turn off all relays

Syntax: //RY

**Command: RY,xxxxxxxx** Turn relays on/off

Syntax: //RY,111X00XX

Where each of the 8 positions represents the relays in order from 1 to 8. A “1” turns that relay on, “0” turns that relay off. Any other character, like an “X”, is a placeholder for that relay position and does not change the state of that relay.

**Command: RYx,T** Toggle relay

Syntax: //RYx,T

Where x is the relay number from 1 to 8

**Command: RYx,P** Pulse relay on then off\

Syntax: //RYxP

Where x is the relay number from 1 to 8

The default pulse duration is 500 ms.

**Command: RYxP,y** Turn relay on for a period of time in seconds.

Syntax: //RYx,P,y

Where x is the relay number from 1 to 8

Where y is the period of activation in seconds.

This is a non-blocking command.

Note: To cancel the pulse, you can send the command //RYx,P,0

## Digital Input Triggers DCN Send Command

The 4 digital inputs can be individually configured to trigger sending a serial data string out the DCN port. A typical use case would be to connect a switch between the selected digital input pin and ground. When the button is pressed, the GPIO module will send a specified ASCII string out the DCN port. For example pressing a button on digital input 1 can send /0003:SEL1:XX on the DCN. This would be a command to coax relay module with device address 03 and the command is SEL1 which means select port 1.

**Command:** **DISEND,x,y,z** Send message to DCN port.

Syntax: //DISENDx,y,z

Where x is the relay number from 1 to 8

Where y turns this feature on/off 1 = on, 0 = off

Where z is the string to be sent out the DCN port

Example: //DISEND,3,1,/0005:RY1,1:XX

In this example, when pulsing digital input 3 to ground, the GPIO module will send the relay 1 on command to device 05.

Note: To cancel this feature, the command is //DISEND,x,0

## Mode DIP Switch Settings

Bit 8 ON Initialize on boot  
OFF Do nothing. Normal mode.

Bit 4 ON Streaming mode ON  
OFF Streaming mode OFF

Bit 2 ON DCN set to 119200 baud rate  
OFF DCN set to 9600 baud rate

Bit 1 ON DAQ Data Acquisition mode ON  
OFF DAQ Data Acquisition mode OFF

## DIP Switch Configuration Settings

Some modules require the inversion of the address and mode DIP switch bits.

To invert the switch reading enter //DIPSW,1

Reverting to the normal default value: //DIPSW,0