

# PM2Relay Power Multiplexer



## PM2R Overview

The PM2Relay (PM2R) is a 16 channel multiplexer for delivering powered and unpowered signals to a device. When coupled to a power amplifier such as the SA1, the PM2R can transfer several watts of power to standard four ohm and eight ohm speakers.

The PM2R is designed to be used as a “de-multiplexer”, that is, one input switched to 16 possible outputs. However, it can also be used as a straight multiplexer (16 inputs to one output). This is accomplished by sending signals in to the 16 “signal out” channels. The selected channel will be output on the “signal in” channel. Users that are doing this should be very careful, as it is easy to exceed the maximum input values when sending in 16 input signals. **The aggregate input of all signals should never exceed two amps, or 15 Volts, because severe damage can be caused to the module.**

Each RP2 can control up to four PM2R devices and each PM2R can have one active channel. Therefore, a maximum of four signals can be played out simultaneously when using four PM2Rs.

To connect to a System 3 module, attach the 25-pin, blue ribbon cable from the RP2 device to the PM2R. Connect your powered signal source to the Signal In and connect the signal out to the RP2 connection on the PP16, or your own connectors. The channel outs on the PP16, from the left to right, correspond to the 16 channels (0-15) on the device.

### Power

The device is powered via the System 3 zBus (ZB1PS). No PC interface is required.

## PM2R Features

The PM2R uses a bit pattern code to control the output of a powered signal to one of sixteen output channels. The powered signal can come from any power amplifier such as the SA1 (Stereo Amplifier) or the HB7 (Headphone Buffer). The PM2R is

designed to use a bit-code pattern from an RP2 Real-Time Processor or RV8 Barracuda Processor.

## RP Control Input

The male DB25 connector on the left is the interface to the RP2. A blue ribbon connector is used to directly connect the RP2 and the PM2R. The PM2R uses all the bit outputs from the RP2. If you require additional bit outs, TDT recommends purchasing an RV8.

In addition, any System 3 processor that has at least eight digital outputs, including the RX family of devices, can be used to control the PM2R (a special connector may be required).

## Signal In

The BNC connector is the powered signal input. The maximum power input is a two amp, 15 Volt continuous signal or approximately 30 watts of continuous power.

## Signal Out

The female DB25 connector on the right is the interface for the powered signal output. Users can also connect the PM2R output to the patch panel (PP16) connector labeled for the RP2 for easy BNC access to the powered signal.

## Channel...

Sixteen LEDs indicate which channel is active. One channel can be active at a time. It is also possible to inactivate all channels.

# PM2R Bitcode Pattern

The bitcode pattern from the RP2 consists of an 8-bit word that contains the following information; the device ID, the channel ID, and a set-bit. A final bit shuts off all channels. To control the PM2R, generate the bitcode pattern associated with the device and channel then send out the set-bit to change the channels. Be aware that the relays on the PM2R have a transition time of around one millisecond.

<b>Bits 0 - 3</b>	identify the channel number. Integer 0, or bitpattern (xxxx 0000), is channel 0 and integer 15, or bitpattern (xxxx 1111), is channel 15.
<b>Bits 4 and 5</b>	identify the device number. Integer value 0, or bit pattern (xx00xxxx), is device number 0 and integer value 48, or bit pattern (xx11xxxx), is device number 3. The device number is set internally for each PM2R and allows for an RP2 to control up to four PM2R modules. If only one PM2R is being used, it should have device number 0.
<b>Bit 6</b>	is the set-bit. When this bit is set high, the channel and device from the previous six bits is activated.
<b>Bit 7</b>	deactivates all channels across only the specified device.

The chart below shows the bit ID, its integer value, and its function.

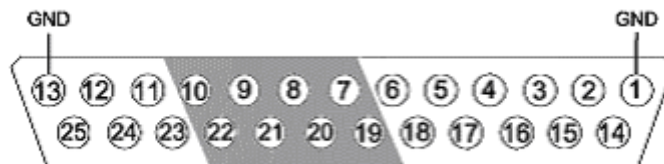
Bit Number	Integer Value	Function
0	1	Least significant bit of channel number
1	2	Bit 2 of channel number
2	4	Bit 3 of channel number
3	8	Most significant bit of channel number
4	16	Least significant bit of device number
5	32	Most significant bit of device number
6	64	Turns on the channel of the specified device
7	128	Turns off all channels on specified device only

**Note:** Make sure to put a delay of one sample between setting the channel number and turning the channel on. Trying to do both at the same time will not work correctly. For example, send "00000111" to select channel 7, and then send "01000000" one sample later to turn the channel on.

## PM2R Technical Specifications

Switching Mode	Single 1-to-16/16-to-1
Switching Time	2 mSec
Input/output Level	+/- 15 Volts
Channel Cross-Talk	< -80 dB
S/N (typical)	90 dB
Maximum Allowable Current	2 Amps continuous

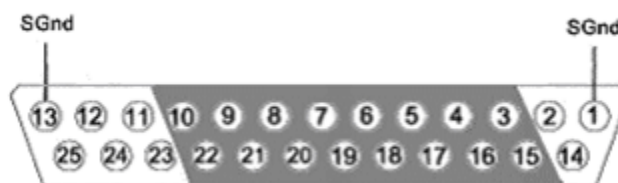
### RP Control Input - DB25 Pinout



Digital Input Diagram

Pin	Name	Description	Pin	Name	Description
1	GND	Ground	14	NA	Not Used
2	NA	Not Used	15	NA	
3	NA				
4	NA				
5	NA				
6	NA				
7	D1		Digital Input Channels	19	D0
8	D3	20		D2	
9	D5	21		D4	
10	D7	22		D6	
11	NA	Not Used	23	NA	Not Used
12	NA		24	NA	
13	GND		Ground	25	

### Signal Output - DB25 Pinout



Analog Output Diagram

Pin	Name	Description	Pin	Name	Description
1	SGND	Signal Ground	14	NA	Not Used
2	NA	Not Used	15	A0	Analog Output Channels
3	A1	Analog Output Channels	16	A2	
4	A3		17	A4	
5	A5		18	A6	
6	A7		19	A8	
7	A9		20	A10	
8	A11		21	A12	
9	A13		22	A14	
10	A15		23	NA	Not Used
11	NA	24	NA		
12	NA	25	NA		
13	SGND	Signal Ground			

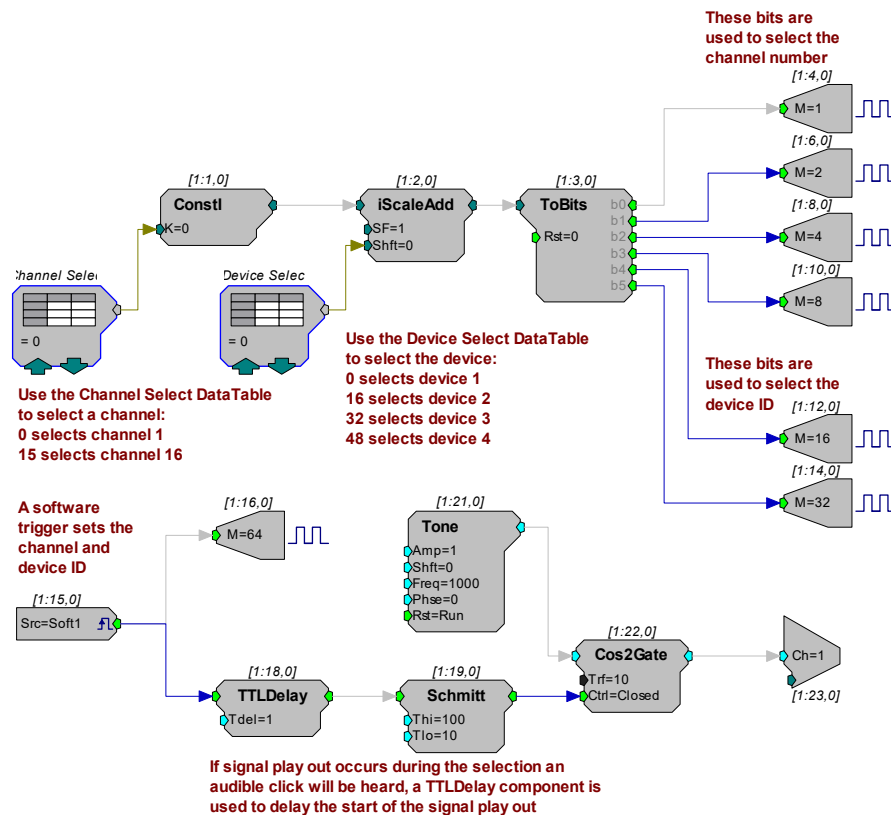
# PM2R - Controlling Signal Presentation

The circuits described here use typical techniques for controlling the signal presentation when using a PM2R. These circuits have been designed as tutorials and will need to be modified to meet the needs of the individual researcher.

## Controlling the PM2R with BitOuts:

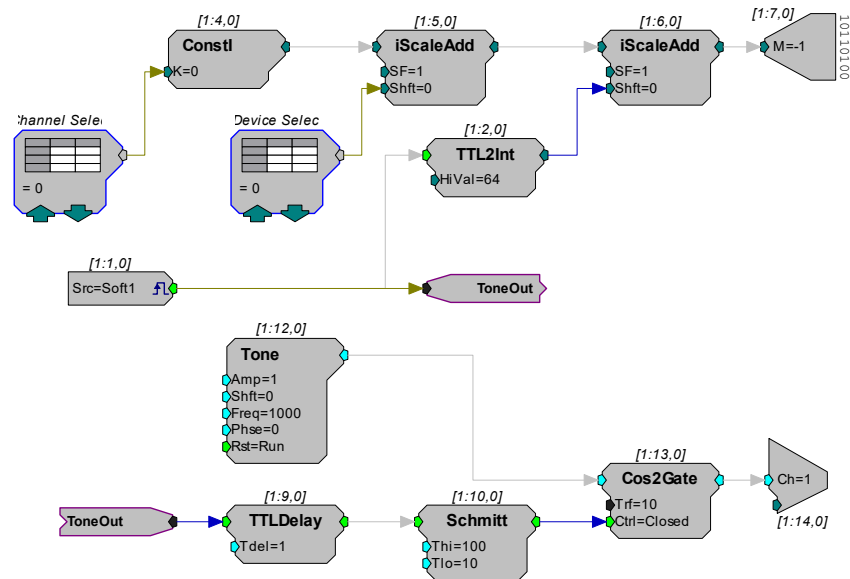
In this example several BitOuts are used to control the PM2R (via an RP2.1) from within RPvdsEx. The bit pattern is generated by two DataTable components. DataTables are commonly used to send values from the PC to the RP devices. While working in RPvdsEx, the selection can be changed by clicking the green up and down arrows near the bottom edge of the components. The first DataTable (Channel Select) stores the values for the channel number. Channel numbers start at zero and go to fifteen. Each RP2.1 is capable of controlling up to four PM2R devices. The second DataTable (DeviceSelect) stores the values for the device ID. The values in the table are 0 (device 0), 16 (device 1), 32 (device 2), and 48 (device 3). The iScaleAdd is used to add the integer values from both tables and the ToBits component changes the resulting integer to the bitcode pattern. The first four bits are used to select the channel number and the last two bits are used to select the device ID.

A software trigger is used to change devices and initiate a tone burst of 100 milliseconds duration. The software trigger causes the Schmitt trigger to open a gate for 100 milliseconds. The Schmitt trigger is delayed by one millisecond relative to the channel select. This removes the transient associated with the relays.



## Controlling the PM2R with WordOut:

In this example a WordOut is used to control the PM2R (via an RP2.1) from within RPvdsEx. This simplified format decreases cycle usage. An additional iScaleAdd is required because the BitOut and WordOut components function differently and should not be used in the same circuit. As before, a software trigger initiates the start of the stimulus presentation. The triggered signal adds 64 to the output to change the channel.



## Controlling the PM2R from a run-time application:

The examples described here could easily be modified to allow control from run-time applications. Parameter tags can be included and used in other applications such as BioSigRP or OpenEx.