

GammaTron™ USB Module



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GammaTron USB Module

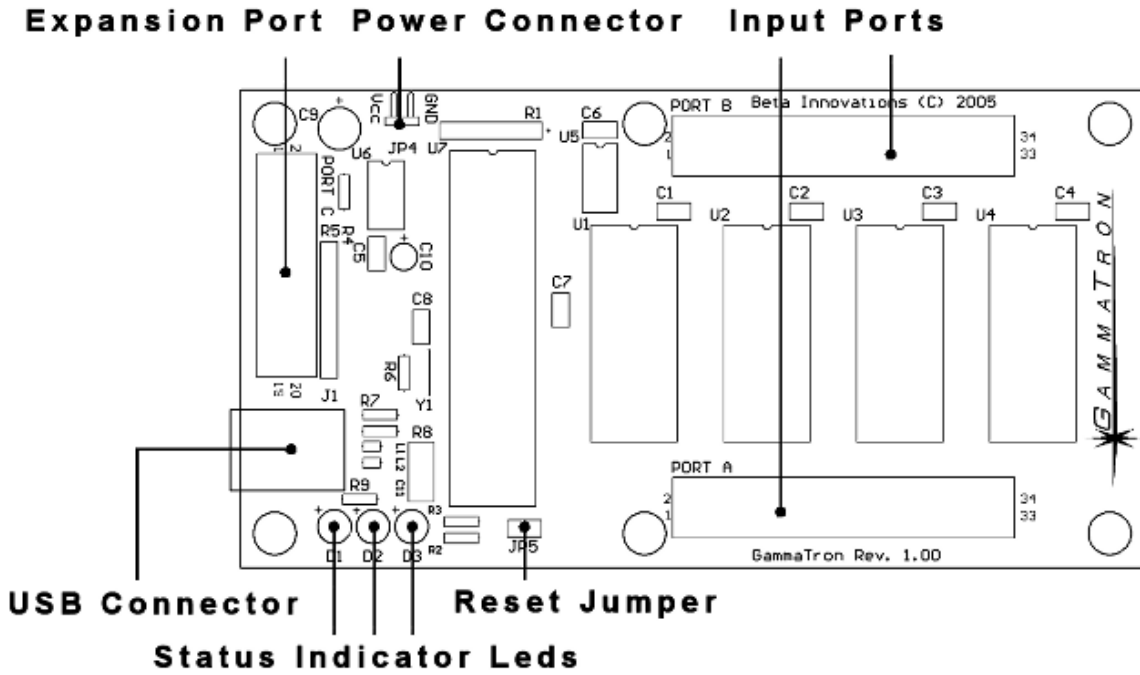


Figure 1 - GammaTron

Main Features

- **Easy installation**
The GammaTron™ is a Full Speed USB HID compliant device which employs default drivers supplied by most OS and powered by the USB Bus.
- **Digital Inputs**
64 Digital Inputs - Supports a variety of input devices including common switches: push buttons, toggles, etc. Various modes supported including master switch, rotary and toggle.
- **Rotary Encoder**
Up to 32 rotary encoders supported with integrated switches - Gray Code using 1X, 2X and 4X decoding with Push-Pull, Hold & Turn or Toggle support for integrated switches.
- **Expansion Port**
Provides expandable functionality. Currently supports the GT-X64 input card adding an additional 64 inputs.
- **Short Circuit Protection**
Up to 500 mA available on all ports for external circuitry eliminating the need for additional power supplies. Monitoring circuitry prevents component damage.
- **Software Configurable Operation**
All GammaTron™ functions are easily configurable through a fully visual interface.
- **Flash Loader Mode**
Incorporates a Flash Loader for easy firmware updates via USB.
- **Software Development Kit**
Provides easy access to communicate with device through custom applications with skeleton samples in VB6, VC++ and MFC.
- **Keyboard Emulation**
Supports software based keyboard emulation using Keyboard Studio™.

Introduction

The GammaTron™ USB module has been developed for applications requiring hardware input such as switches, rotary encoders and digital circuitry. When used with switches, the multiplexed inputs prevent phantom signals or "ghosting" and do not require individual diodes such as scan matrix designs simplifying wiring considerably.

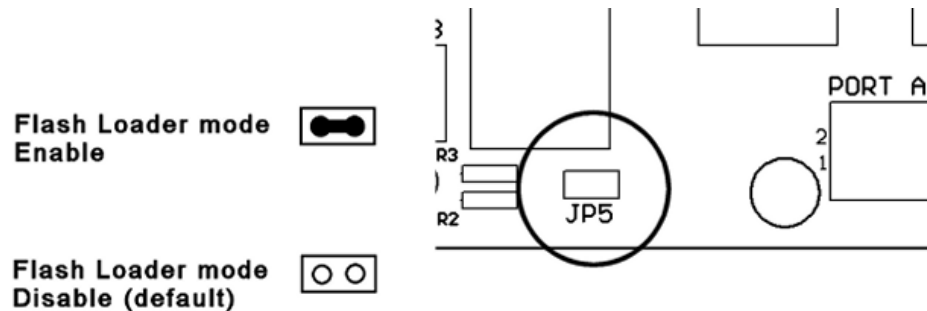
Through a simple to use software configuration utility, device firmware can be easily updated adding new features when they become available. Additionally, various parameters and many aspects of the device can be controlled, adjusted, activated or deactivated to meet individual needs. In each case the GammaTron unit will reconfigure itself in real-time. As such, the configuration settings can be altered at any time during normal operation without the need to reset the device.

Driver installation is automatic and most OS will install the required drivers without any user intervention. Note: Reset JP5 should be removed prior to plugging the device into a USB port.

Flash Loader Mode : JP5

The GammaTron™ USB module consists of 2 devices in 1. In *Flash Loader* mode, the module enumerates as a self-programming device used solely for updating the core firmware via USB. In *Standard Device* mode the unit operates as a standard HID device.

RESET Jumper JP5



RESET jumper JP5 can be used to restart the device in *Flash Loader* mode. It should remain open (disable) for normal device operation. The device can be set in *Flash Loader* mode when needed in order to update the core GammaTron firmware. The jumper must be removed after successful firmware update prior to rebooting the device. See the Device Manager utility user manual for details on firmware update procedures.

GammaTron Input Structure

Buttons Structure

Digital Inputs / Rotary Pairs	1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16
	17	18	19	20	21	22	23	24
	25	26	27	28	29	30	31	32
	33	34	35	36	37	38	39	40
	41	42	43	44	45	46	47	48
	49	50	51	52	53	54	55	56
	57	58	59	60	61	62	63	64
Decoded Rotary Push/Pull/Toggle	65	66	67	68	69	70	71	72
	73	74	75	76	77	78	79	80
	81	82	83	84	85	86	87	88
	89	90	91	92	93	94	95	96
	97	98	99	100	101	102	103	104
	105	106	107	108	109	110	111	112
	113	114	115	116	117	118	119	120
	121	122	123	124	125	126	127	128

The structure above lists the input order as seen by applications running on systems supporting USB HID compliant devices.

When digital inputs are configured as rotary encoders, decoded outputs will be in pairs as illustrated below. If push/pull or toggle functionality is activated, the output will toggle between the blue and green channels.

	Standard Mode		Push/Pull or Toggle Mode	
Decoded Rotary 1	1	2	65	66
Decoded Rotary 2	3	4	67	68
Decoded Rotary 3	5	6	69	70
Decoded Rotary 4	7	8	71	72
Decoded Rotary 5	9	10	73	74
Decoded Rotary 6	11	12	75	76
Decoded Rotary 7	13	14	77	78
Decoded Rotary 8	15	16	79	80
Decoded Rotary 9	17	18	81	82
Decoded Rotary 10	19	20	83	84
Decoded Rotary 11	21	22	85	86
Decoded Rotary 12	23	24	87	88
Decoded Rotary 13	25	26	89	90

Decoded Rotary 14	27	28	91	92
Decoded Rotary 15	29	30	93	94
Decoded Rotary 16	31	32	95	96
Decoded Rotary 17	33	34	97	98
Decoded Rotary 18	35	36	99	100
Decoded Rotary 19	37	38	101	102
Decoded Rotary 20	39	40	103	104
Decoded Rotary 21	41	42	105	106
Decoded Rotary 22	43	44	107	108
Decoded Rotary 23	45	46	109	110
Decoded Rotary 24	47	48	111	112
Decoded Rotary 25	49	50	113	114
Decoded Rotary 26	51	52	115	116
Decoded Rotary 27	53	54	117	118
Decoded Rotary 28	55	56	119	120
Decoded Rotary 29	57	58	121	122
Decoded Rotary 30	59	60	123	124
Decoded Rotary 31	61	62	125	126
Decoded Rotary 32	63	64	127	128

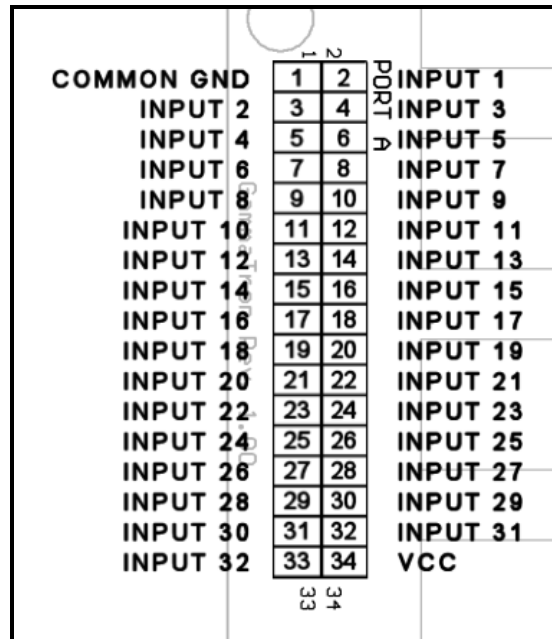
Due to the limited number of inputs, push/pull and toggle switches on rotaries limit the number of usable rotaries to 16 for push/pull mode and 21 for toggle mode.

If the expansion port is activated, all additional button inputs will appear as inputs 129 to 192.

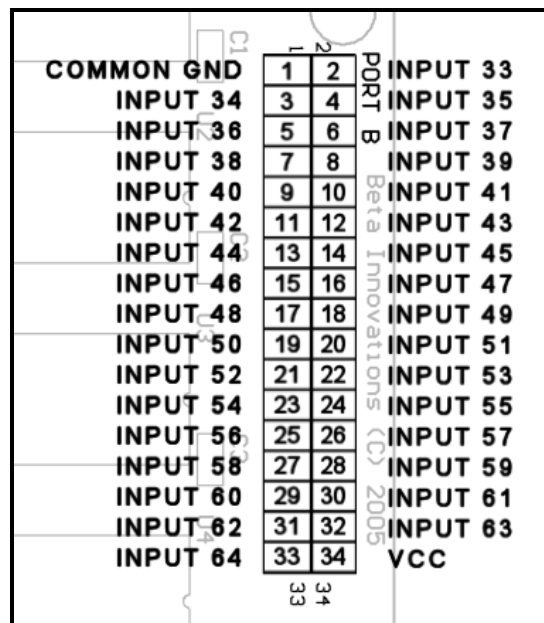
GammaTron Pin-Out

Digital Mode Pin-Out

Port A Pin-Out



Port B Pin-Out

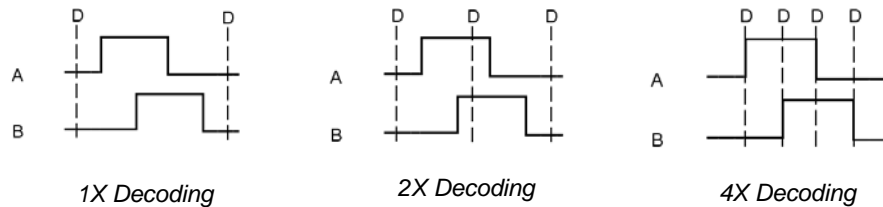


Rotary Mode Pin-Out

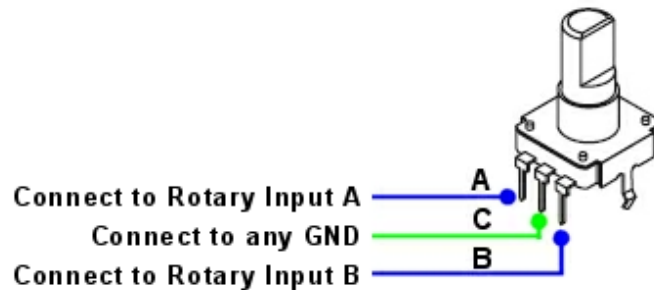
Any input pair can be configured for rotary encoder support. Typical rotaries consist of 3 pins. Pin "A" & "B" are the encoded outputs and one common middle pin "C". Rotary encoder pins A & B are connected to any input pair for decoding.

Mechanical / Optical Rotary Encoders

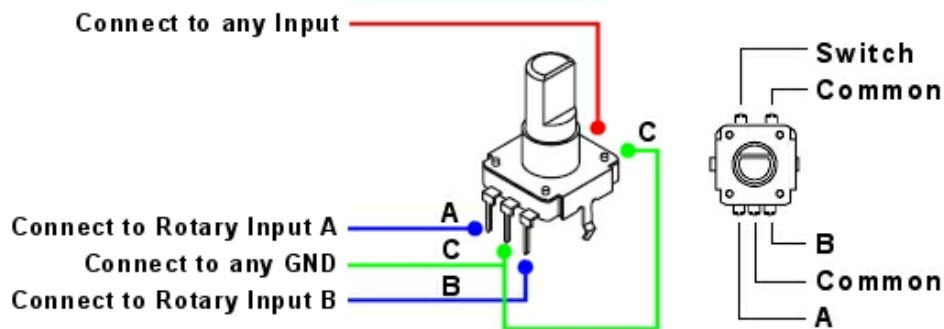
Typically rotary encoders require a decoder circuit in order to convert the output signals into a usable form by software applications in order to distinguish between CW and CCW rotation. Any input pair on the GammaTron can be configured for rotary encoder support whereby all decoding is done in firmware eliminating the need for external decoding circuitry. Supported rotary encoder output signals can be Gray code 1:1, 1:2 or 1:4 decoding.



Connecting Mechanical Rotary Encoders

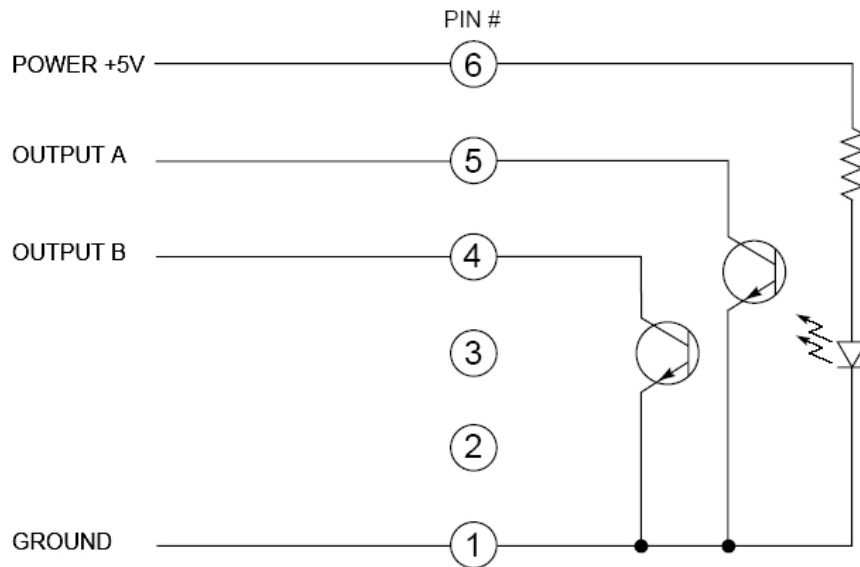
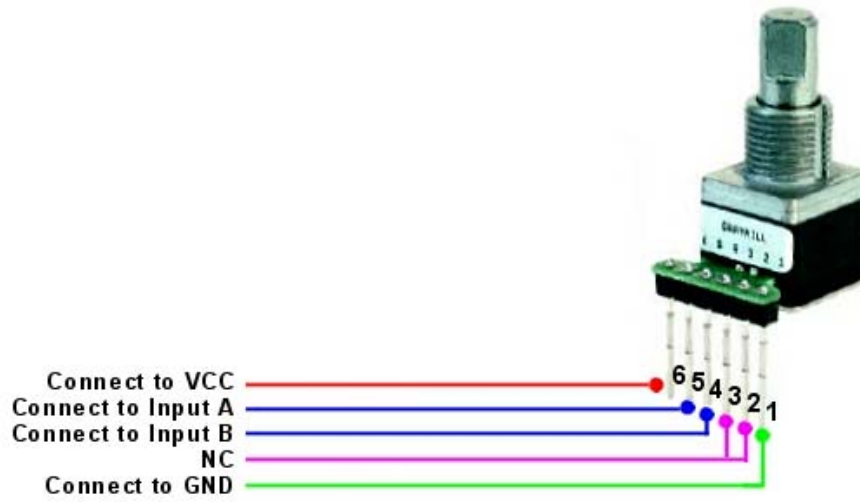


Connecting Mechanical Rotary Encoders with Pushbutton Switch

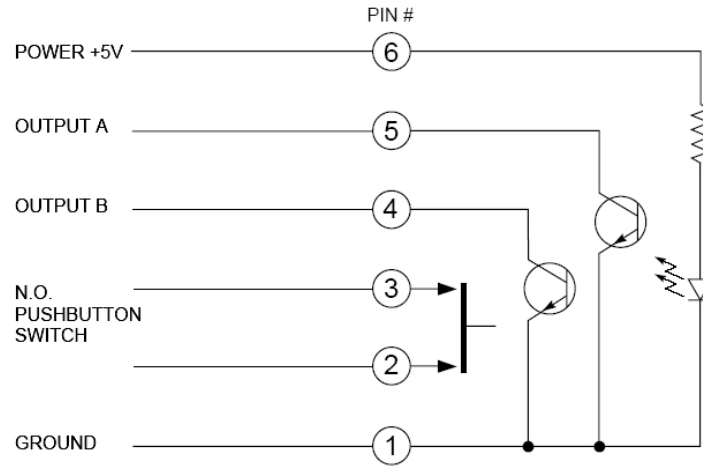
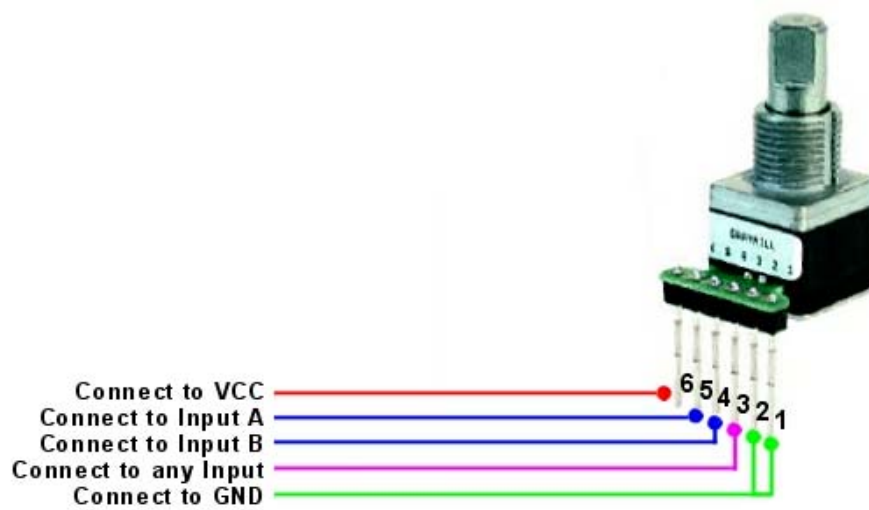


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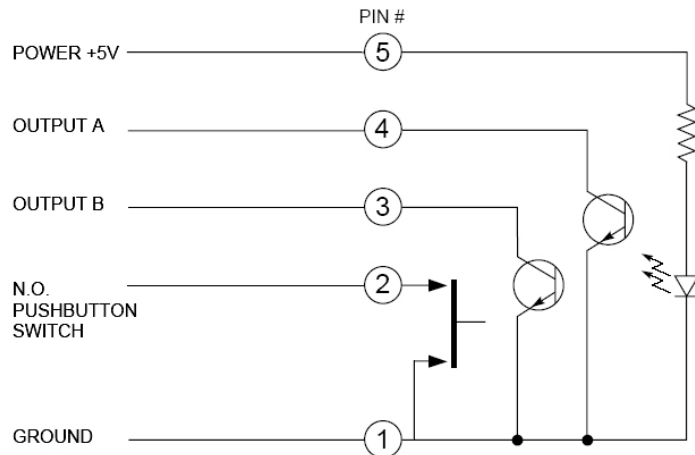
Connecting Optical Rotary Encoders



Connecting Optical Rotary Encoders with Pushbutton Switch

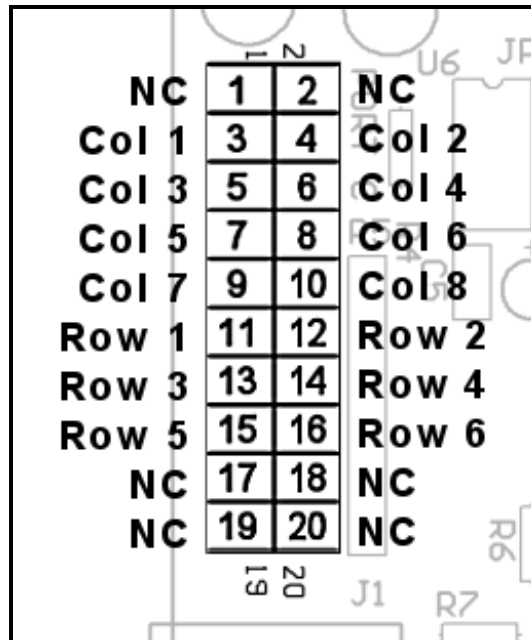


Alternate schematic for 5-pin variety of optical encoders.



GammaTron Expansion Port

Scan Matrix Mode Pin-Out

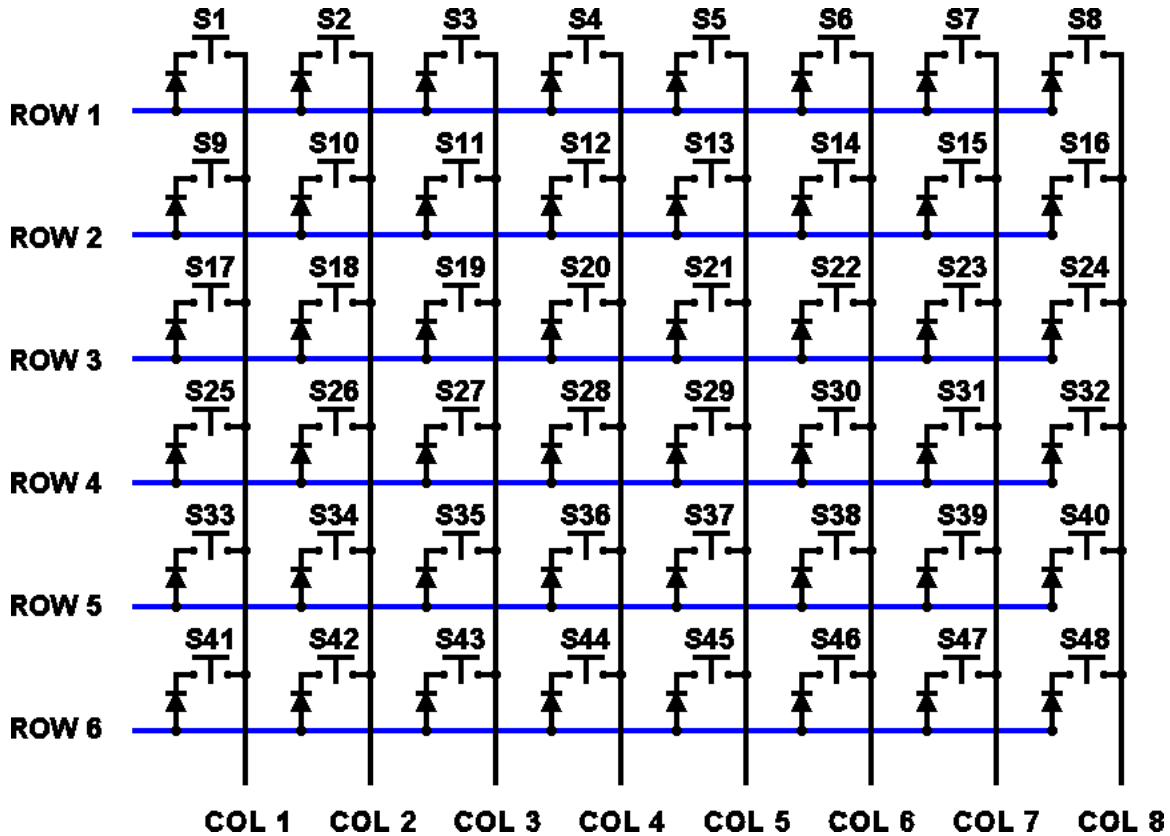


6 x 8 Scan Matrix Wiring

In scan matrix mode, the GammaTron expansion port (Port C) will organize the inputs in 6 x 8 fashion (6 rows by 8 columns). GND or VCC pins must not be used in this mode in order to avoid shorting the matrix pins.

In order to avoid ghosting (false inputs signals), diodes are required if using toggle switches or if multiple switches are to be turned on at the same time. Any suitable rectifier diode may be used such as the 1N4148. These can be eliminated if only momentary switches are used and only one switch is pressed at a time.

All scan matrix inputs will appear as 48 additional inputs starting at 129 through to 176.



IMPORTANT: When activating Scan Matrix mode, disconnect all switches wired to ground pins in order to avoid short circuit conditions, possibly causing permanent damage to the GammaTron module port pins. No grounds should be connected to any of the pins in this mode.

GT-64X Mode

Refer to the GT-64X user manual for connection details.

Connecting Various Switches

The GammaTron module main ports do not use a scan matrix type of input layout. As such diodes are not required since it does not suffer from phantom signals when activating several switch inputs at the same time. This in turn simplifies wiring considerably as illustrated in figure 2.

Simplified Wiring

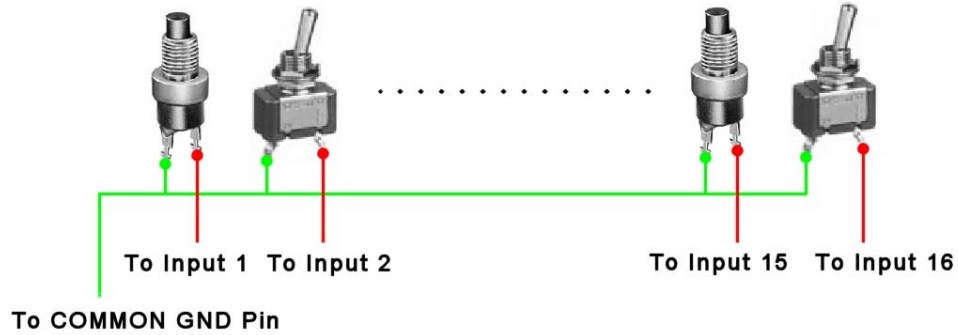
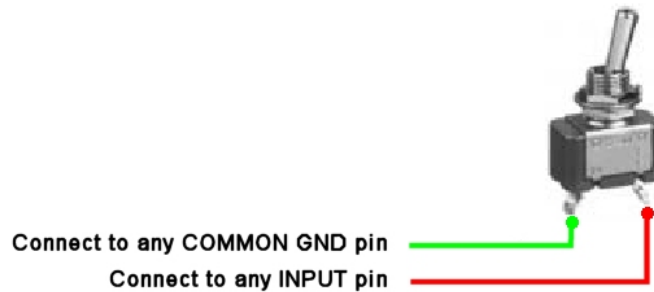
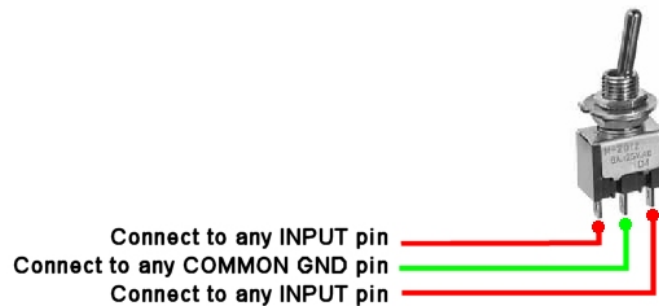


Figure 2 – Simplified Wiring

SPST Toggle Switches (On-Off)

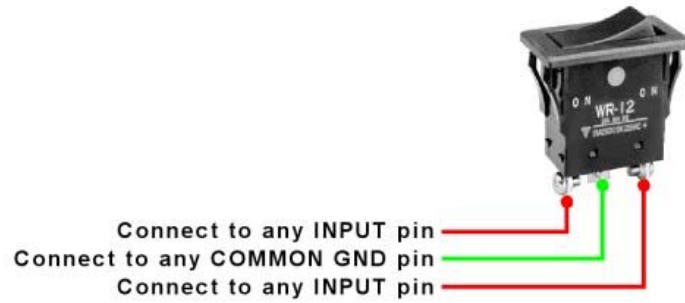


SPDT Switches (On-On)

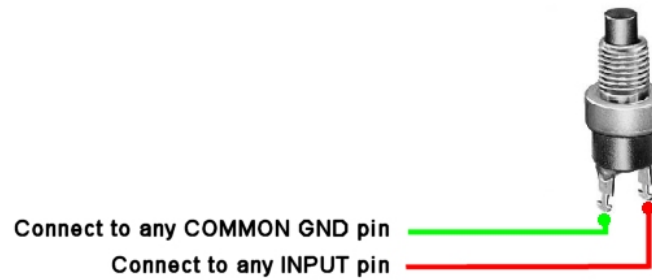


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Rocker Switches (On-Off-On)

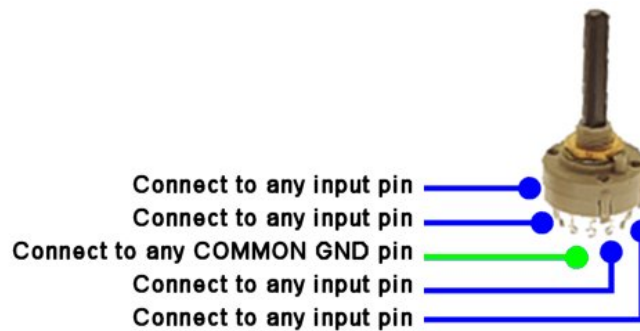


Push Button Switches



Multi-Position Rotary Switches

Multi-Position Rotary Switches come in many configurations, but the most important thing to note is that they all share one or several common pins. These common pins must be connected to any one of the common GND pins found on the GammaTron unit. All other pins can be connected to any one of the inputs as required.



Hardware Specifications

All inputs on the GammaTron are active low, which means you must ground an input in order to register a high "ON" signal at the output.

Most operating systems will detect and load the appropriate HID driver for your device and do not require that a custom device driver be installed.

Maximum power consumption is 2.5W (500 mA) and is powered by the USB bus. You do not need to use an external power supply for this device when connecting several optical encoders or circuitry to the onboard power pins (+5 Vcc) specifically added for this purpose. It is imperative that these devices not consume more than 500 mA. Doing so will trip the short circuit protection which will shut down all power to external devices and circuitry. When this happens, the yellow LED D3 will turn off.

DO NOT EXCEED 100 mA when connecting the GammaTron to a bus-powered USB HUB.

The USB HUB will not be able to provide sufficient current. This will lead to one of several outcomes depending on the design:

- GammaTron will fail to enumerate and will not function.
- The HUB will shut down until current drain falls below 100 mA.
- The HUB will continue to operate but devices connected to this HUB may display erratic behavior or fail entirely.

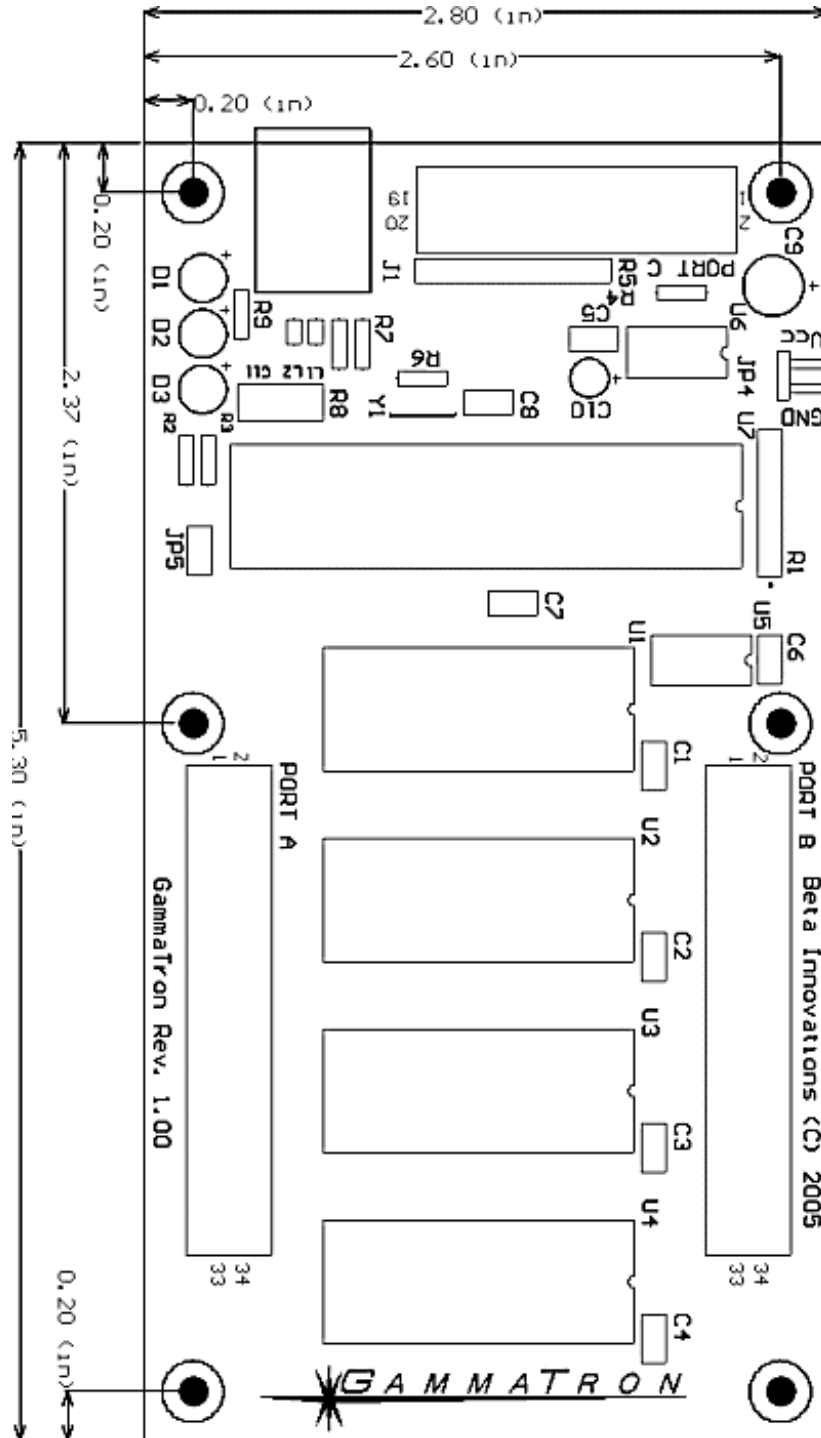
Use **self-powered** HUBs that have their own power source (wall adapter) or connect the GammaTron directly into the USB ports of your PC. As per USB specifications, PC host USB ports must be able to supply up to 500 mA per port.

NOTE: DO NOT CONNECT any of the GammaTron Vcc pins to external power supplies or voltage sources. Although common grounds can be safely connected to external grounds, it is not recommended and should be avoided whenever possible. Doing so may adversely affect performance, possibly causing strange or erratic behavior under certain conditions.

Device Status LEDs

D1	D2	Description
● Off	● Off	Device not powered, not enumerated.
● On	● On	Device configured in Flash Loader mode.
● On	● Off	Device configured in standard device mode.
●● Blinking	●● Blinking	Device in Suspend state.
● On	●● Blinking	Transmitting data to USB host (Flash Loader Mode).
●● Blinking	● On	Receiving data from USB host (Flash Loader Mode).
● On	●● Blinking	Transmitting data to USB host (Standard Mode).
●● Blinking	● Off	Receiving data from USB host (Standard Mode).
	D3	Description
	● Off	Output power turned off.
	● On	Output power active and stable.

Mechanical Specifications



Visit www.betainnovations.com for the availability of expansion modules and accessories.