SW-16-v2

Version 2.0 – July 5, 2017

General Description:

SW-16 boards are used to deliver switch state information in a pinball machine to a master device, such as a P^3-ROC board, over an RS-485 serial bus.

SW-16 Details:

The SW-16 has two banks of 8 switch inputs. Each input has a 6v comparator circuit, which determines the state of the switch connected to the input. If the voltage is below 6v, the state of the switch is '0'. Otherwise the state of the switch is '1'. Each input also has a pull-up resistor, forcing the state to '1' when nothing is connected to the input.

In addition to the switch input circuits, The SW-16 has a bidirectional RS-485 transceiver, 6 address dipswitches, and a complex programmable logic device (CPLD). The RS-485 transceiver converts RS-485 signals to digital logic signals (and vice versa) so the CPLD can communicate on the RS-485 bus. The CPLD responds to host-initiated commands when the command's address matches the value set on the 6 address dipswitches. The only commands currently supported are register read commands.

Connectors:

J1	Power	Required
3-pin Molex: 0.156” spacing		
1	KEY	N/A
2	12V	I
3	Ground	I

J2	Bank A Switch Inputs	Required if using Bank A
10-pin Molex: 0.100” spacing		
1	12V	O
2	Bank A – Switch 0	I
3	Bank A – Switch 1	I
4	Bank A – Switch 2	I
5	Bank A – Switch 3	I
6	Bank A – Switch 4	I
7	Bank A – Switch 5	I
8	Bank A – Switch 6	I
9	Bank A – Switch 7	I
10	Ground	O

J3	Serial Data In	Required
3-pin Molex: 0.100” spacing		
1	Ground	I
2	Serial Data +	I
3	Serial Data -	I

J4	Serial Data Out	Not Required
3-pin Molex: 0.100” spacing		
1	Ground	O
2	Serial Data +	O
3	Serial Data -	O

J6	Bank B Switch Inputs	Required if using Bank B
10-pin Molex: 0.100” spacing		
1	12V	O
2	Bank B – Switch 0	I

3	Bank B – Switch 1	N/A
4	Bank B – Switch 2	I
5	Bank B – Switch 3	I
6	Bank B – Switch 4	I
7	Bank B – Switch 5	I
8	Bank B – Switch 6	I
9	Bank B – Switch 7	I
10	Ground	O

Addressing:

In order to receive the correct data from the P-ROC, each board's address needs to be set appropriately. The following table describes how to use the dipswitches to set the board address:

Dipswitch	Meaning
1	Address bit 0*
2	Address bit 1*
3	Address bit 2*
4	Address bit 3*
5	Address bit 4*
6	Address bit 5*
7	ID bit 5

*On=1, Off=0

Board ID:

The board ID is a value that can be read by software, and it is configurable via the following dipswitch and resistor placement options:

ID bit	Resistor (for 0/1)
0	R84 / R90
1	R86 / R91
2	R87 / R92
3	R88 / R93
4	R89 / R94

Serial Chain Termination:

The last board in the physical chain (not necessarily the highest address) needs to be set to terminate the serial chain. This is done by setting dipswitch 8 on.

Status LEDs:

LED	Meaning
D5	12V
D6	3.3V
D8	CPLD Operational

Dipswitches:

Switch	Meaning*
1	Address bit 0
2	Address bit 1
3	Address bit 2
4	Address bit 3
5	Address bit 4
6	Address bit 5
7	ID bit 5
8	Terminate serial bus

On=1, Off=0

Registers:

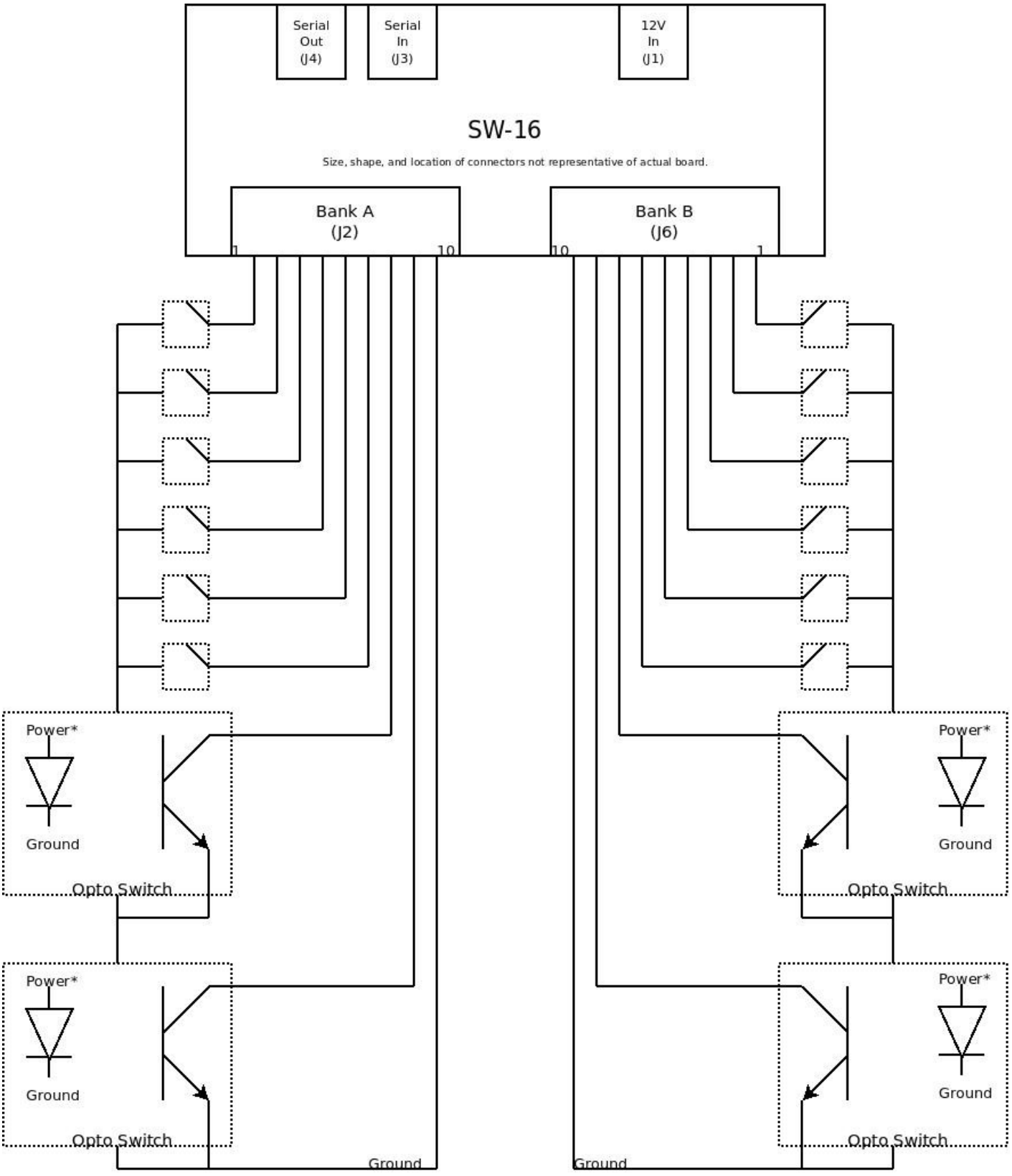
Device Type		Address 0x0
Bits	**Field**	**Default**
7:0	Device Type	0xA3

Board ID		Address 0x1
Bits	**Field**	**Default**
7:0	Board ID (configurable - see Board ID section above)	N/A

Bank A Switches		Address 0x2
Bits	**Field**	**Default**
7:0	Board A Switch States	0xFF

Bank B Switches		Address 0x3
Bits	**Field**	**Default**
7:0	Board B Switch States	0xFF

Example Usage:



*Power for the transmitter in an opto switch need not be the same power that powers the SW-16 board.
Opto transmitters typically require incoming current to be limited with an appropriately sized resistor.

Getting Started:

Hardware

- Mount the board using the 4 mounting holes (M3 or 4-40 screws).
- Connect a 12V supply to J1.
- Connect J3 to the previous board in your chain using a 2-wire cable. If the boards are separated by more than a few feet, a shielded & twisted pair is recommended. For short runs, any 2-wire cable should suffice.
- If using Bank A:
    - Connect your Bank A switches to J2.
- If using Bank B:
    - Connect your Bank B switches to J6.

Software

- If using a P3-ROC:
    - Once configured, the P3-ROC can automatically scan the SW-16 board for switch state changes. Switches map to P3-ROC switch numbers according to the following equations:
        - Bank A switch: P3-ROC switch # = SW-16 address * 16 + Bank A switch input #
        - Bank B switch: P3-ROC switch # = SW-16 address * 16 + 8 + Bank B switch input #
    - SW-16 registers can also be read directly from software. Refer to the P3-ROC FPGA Specifications for more details.