Relay1 Module

P/N: 81P-0120

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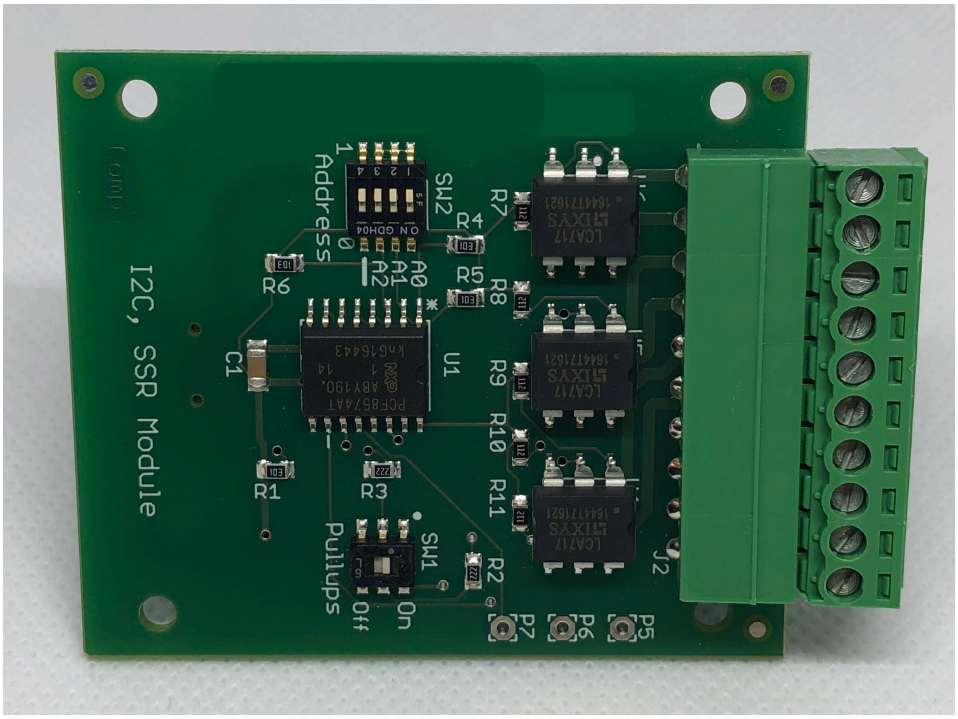
Graves Electronics, LLC



Symbols used in this manual:

CAUTION: This indicates a situation where if certain requirements are not followed, damage or unsafe conditions may occur.

WARNING: This indicates a situation where if certain requirements are not followed, damage or unsafe conditions WILL occur.

If you are having problems getting the board to work properly, BEFORE calling the factory, please visit the FAQ page at http://www.graveselectronicsapps.com/faqs.html, and/or throughly read section 9.0 of this manual. If you are still having problems, please download the test code from http://www.graveselectronicsapps.com/downloads-.html and run the code. If you are still having issues after reading the help section and trying the test code, please contact the factory. We kindly ask that you please e-mail us at graveselectronics@gmail.com. Please clearly state your problem along with a call back phone number. One of our technicaians will call you after we have reviewed your issue and have come up with some solutions.

This manual, as well as test code, can be downloaded at http://www.graveselectronicsapps.com/downloads-.html.

Contact Information:

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Warranty & Legal:

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1.0 Overview

The Relay1 module is an easy to use relay module that increases the functionality of the 81 controller board. It plugs into either of the module ports on the 81 controller board. The Relay1 module uses the I²C bus to communicate with the microcontroller on the 81 board. It has DIP switches which enable address selection, as well as to engage or disengage pull-up resistors for the I^2C bus. The module interfaces to the outside world via the 10-position pluggable terminal block.

2.0 The I/O Chip

Relay1 uses NXP's PCF8574A chip for the I/O functions. The chip contains eight, quasi-bidirectional ports, three addressing ports, and an active LOW interrupt output. For a further, in-depth explanation of the PC8574A chip, including its operation, how to read and write to the ports, how the interrupt output functions, and for timing diagrams, please consult the PC8574A datasheet.

2.1 I/O

Each I/O pin from the PCF8574A is connected to the -C pin on the relay. Table 2.1 shows how the port pins are mapped.

The -C is the ground pin of the relay. To keep the relay off, keep the -C pin HIGH. To turn the relay on, make the -C pin go LOW.

Table 2.1.

I/O Pin	Relay
P0	U2
P1	U3
P2	U4
P3	U5
P4	U6
P5	N.C
P6	N.C.
P7	N.C.

N.C. Stands for Not Connected.

2.2 Address

The PCF8574A has three ports dedicated to addressing it. The module provides an easy method of addressing by way of DIP switch SW2. On one side of the switch is V_{DD} (+5V), labeled as "1" and the other side is V_{SS} (GND), labeled as "0". A0, A1, and A2 are the three addressing ports and are labeled. SW2 is a four position DIP switch with the fourth position not being connected to anything. Table 2.2 shows the hexadecimal address obtained by the various address switch combinations.

Table 2.2.

Switch SW2			Address Byte Value	
A0	**A1**	**A2**	**Write**	**Read**
0	0	0	0x70	0x71
1	0	0	0x72	0x73
0	1	0	0x74	0x75
1	1	0	0x76	0x77
0	0	1	0x78	0x79
1	0	1	0x7A	0x7B
0	1	1	0x7C	0x7D
1	1	1	0x7E	0x7F

2.3 I^2C

The module communicates with the 81 board microcontroller via the I^2C bus. The SCL and SDA lines are mapped to J1, located on the underside of the module. Table 2.3 shows the pin configuration of J1. For more information on the I^2C bus, please consult NXP document UM10204.

Table 2.3.

J1	Function	J1	Function
1	V_{DD} (+5V)	6	N.C.
2	V_{SS} (Ground)	7	N.C.
3	N.C. (No Connect)	8	SDA
4	SCL	9	N.C.
5	/INT	10	N.C.

2.3.1 I^2C Pull-Up Resistors

In order for the I^2C bus to work correctly, it must have pull-up resistors on the SDA and SCL lines. The module makes that easy through the use of switch SW1. When the switch is in the "On" position (as labeled on the module), two 2.2K Ohm resistors are switched in to the I^2C bus; one on the SDA line and one on the SCL line. When the switch is in the "Off" position, the pull-up resistors are switched out of

the circuit. If only one module is being used, it must have the pull-up resistors switched on. If two modules are being used, only one module needs to have the I^2C pull-up resistors switched on. It does not matter which module has the resistors switched on.

CAUTION: Failure to switch on the I^2C pull-up resistors could result in erratic operation of the I^2C bus, and consequently, erratic operation of the module!

CAUTION: If using two modules, switching on the I^2C pull-up resistors on BOTH modules could result in erratic operation of the I^2C bus, and consequently, erratic operation of the module! When using two modules, switch on only ONE I^2C pull-up!

3.0 Interrupt Output Pin (/INT)

The PCF8574A has an open-drain output interrupt (/INT) pin that is mapped to pin 5 on J1 (see Table 2.3). This output is active LOW. It is held high by a 10K Ohm pull-up resistor on the module. Table 3.0 shows how pin 5 is mapped to the 81 board microcontroller.

Table 3.0.

Module Port	Microcontroller Port
Module 1	RC3
Module 2	RC2

4.0 Relays

The module uses a SPST-NO solid-state relay. The relay is capable of driving a maximum 2A load, either AC or DC, up to 30V, with an on-resistance of 0.15 ohms maximum.

The "coil" of the relay is across the +C and -C pins. The +C pins are tied to V_{DD} through a 1.1K Ohm pull-up resistor. The -C pins are tied to the I/O port pins of the PCF8574A expander chip. See Table 2.1 for pin assignments.

The output pins are L1 and L2, and are connected to pluggable header J2. The polarity of the load does not matter. Table 4.0 shows how L1 and L2 are mapped to J2.

Table 4.0.

Relay	Pin	J2	Relay	Pin	J2
U2	L1	1	U5	L1	7
	L2	2		L2	8
U3	L1	3	U6	L1	9
	L2	4		L2	10
U4	L1	5			

	L2	6

5.0 Installing the Module

Installation of the Relay1 module is extremely easy. First, decide which module port on the 81 board the module will plug into. The module communicates over I^2C to the microcontroller, so for communications purposes, it does not matter which module port is utilized. Pick the port that is most convenient for mechanical or aesthetic reasons. Remove the black protective header cap off of the header on the main board. Carefully align J1 of the module with the header on the module port. Push down until the module is fully seated onto the header. The module is fully seated when the module is touching the four standoffs on the module port. Use the four 4-40 x ¼ Philips pan head screws supplied with the module to secure the module. The tightening torque is a minimum of 2.6 in-lbs. and a maximum of 16.6 in-lbs. **DO NOT EXCEED 16.6 IN-LBS!**

5.1 Pluggable Terminal Block (J2)

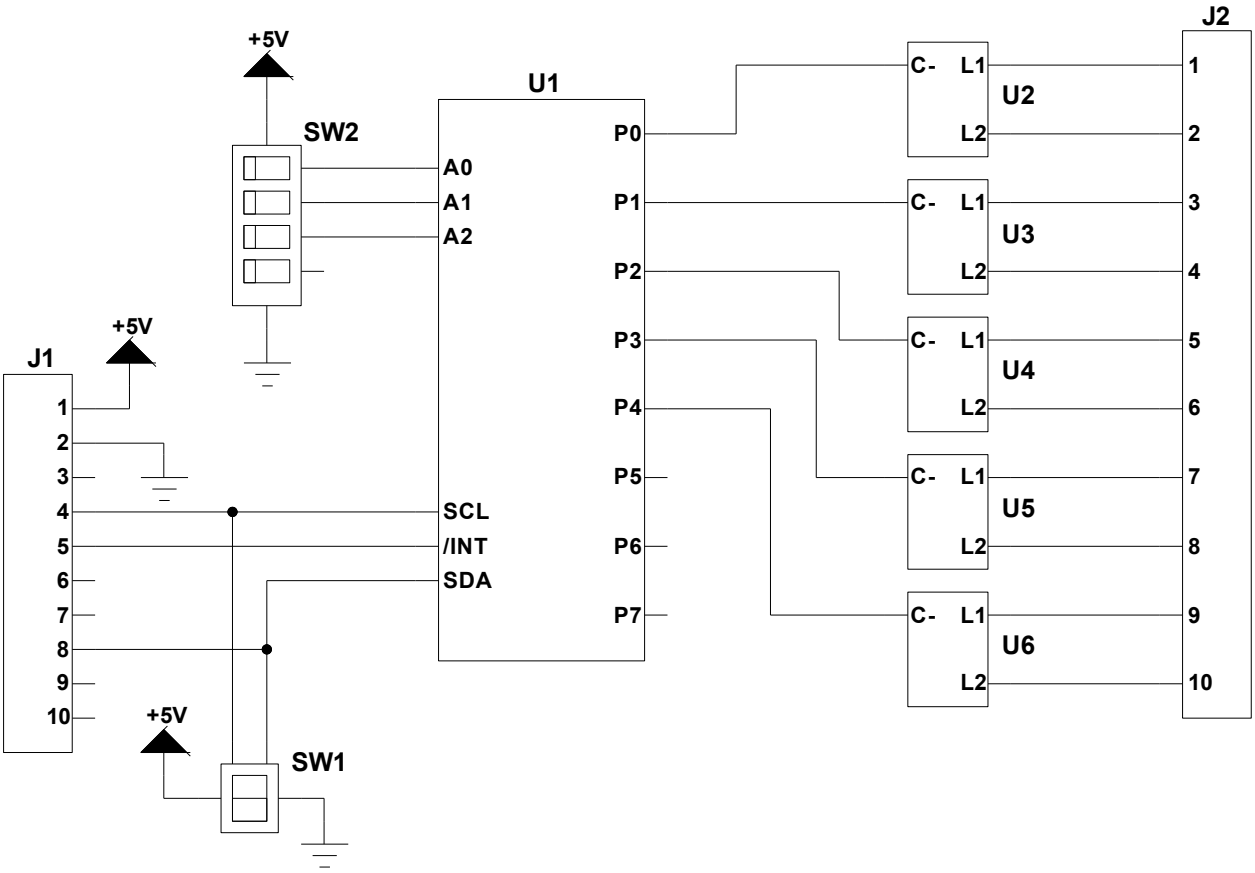
The pluggable terminal block, J2, is how the module interfaces to the outside world. The pluggable block is Phoenix Contact part number 1840447. The plug can accept wire from 30 to 14 AWG. The screw is a M2 and tightening torque is 1.95 to a maximum of 2.21 in.-lbs.

6.0 Electrical Specifications @ 25°C

Symbol	Parameter	Condition	Min	Typ	Max	Unit
I_O	Load Current, Continous	Per relay	-	-	2	A_{RMS}/A_{DC}
I_O	Load Current, Peak	t=10ms	-	-	±5	V
V_O	Load Voltage	Per relay	-	-	30	V
R_{ON}	On-Resistance	I_L = 1A	-	0.083	0.15	Ω
I_{LEAK}	Off-State Leakage Current	V_L=30V_P	-	-	1	µA
t_{ON}	Switching Speed – On	I_F=5mA, V_L=10V	-	0.92	3	ms
t_{OFF}	Switching Speed – Off		-	0.44	3	ms
C_{OUT}	Output Capacitance	V_L=15V,f=1MHz	-	100	-	pF
$C_{I/O}$	Input to Output Capacitance	-	-	3	-	pF
V_{ISO}	Isolation Voltage, Input-to-Output	-	-	-	3750	V_{RMS}
P_{TOTAL}[1]	Total Power Dissipation	25°C	-	-	800	mW
$TEMP_{OP}$	Operating Temperature	-	-40	-	+85	°C

[1] Derate linearly 6.67 mW/°C

7.0 Block Diagram



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