

## IS-S0108 Single Switch Solution

Revision D



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## 1. Overview

The Single Switch Solution is a compact device that can both monitor and control an industrial process independently or in conjunction with other controllers.

The 36x24 pixel LCD display is capable of displaying graphics or characters while 64 backlight color options allow for status color schemes and modes of operation. In addition to the on-board flash to hold graphic images, there are two look up fonts (5x7 and 7x10) on board to create images based on characters. Up to 3 lines of 6 characters in font 5x7 or up to 2 lines of 4 characters in font 7x10 can be displayed.

There are eight connections that can be digital input/output. Six of the connections can be analog input. The analog inputs can be used to check status of gauges such as temperature, pressure, voltage, amperage, oil level, gas level...etc.

The digital inputs can be used to check the ON/OFF statuses of a devices or count frequency of an event.

The digital output can be used to signal to turn ON or OFF a device based on preset values of the inputs.

The digital input/output can also be used for communication with another device.

The switch presses can be used for toggling between the statuses and pressing and holding the switch can be used for setting up or selecting an option.

## 2. Applications

The Single Switch Solution is a plug and play controller/indicator device for use in an application with little to no technical or engineering know-how needed to install and operate.

The customer would list what images, labels and actions they want to see. The device would then be programmed and preloaded with the images, actions and responses ready to be used. The customer would simply need to install the device into their application. Please contact NKK Switches with your application. If the current product does not meet your application, we can design a device to meet your requirements.

### Examples:

A Single Switch Solution is hooked up to a device that drops jellybeans into a bag and a counting sensor. When the Single Switch Solution counts out a fixed number of beans it sends signals to stop the jellybeans from dropping, move the bag out of the way, seal the bag and get the next bag.

A Single Switch Solution is used to monitor two voltages and two currents. Pressing the switch steps through displaying the status of each of the four measurements. When the voltages or currents exceed a preset warning range the display blinks to warn the operator. When the voltages or currents reach a danger range not only does the display turn red it also sends signals to shut down the system. The warning and shut down values for each measurement is user defined and can be modified by pressing and holding the switch while displaying the measurement.

A Single Switch Solution is hooked up to engine sensors to display fuel, water, oil, and temperature. Pressing the switch steps through and displays the four statuses.

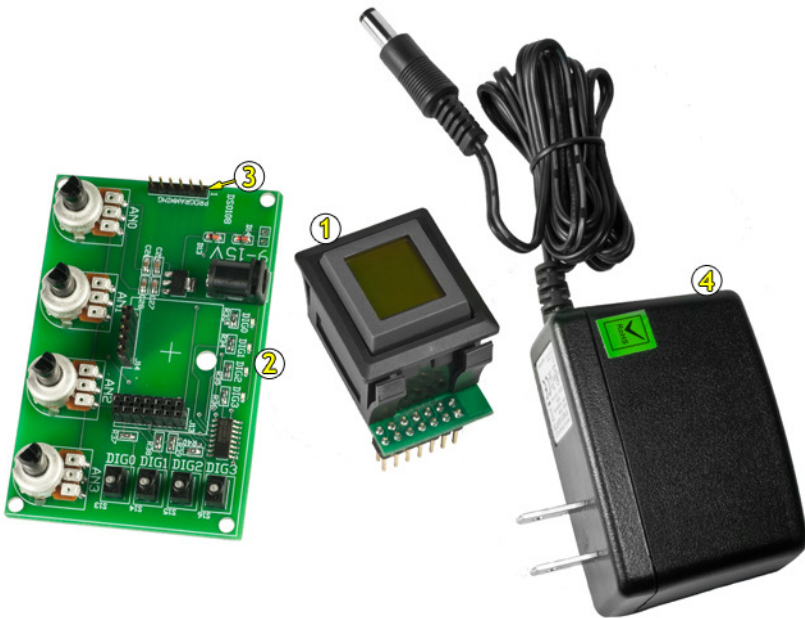
When any of the statuses are outside normal the display blinks amber to warn the operator. When any of the statuses are in the danger range the display blinks red.

### 3. How to Order

Single Switch Solution is custom programmed for each application so a custom part number is assigned for each application.

An evaluation kit can be ordered to get the process started. The evaluation kit part number is “**IS-S0108DEM**” and includes:

1. One Single Switch Solution.
2. A demonstration board that has 4 potentiometers for analog input, 4 switches for digital input and 4 LED's for digital output.
3. A programming connector for reprogramming the Single Switch Solution (Require a Pickit3 from Microchip for programming).
4. A power supply.



The evaluation kit **IS-S0108DEM** comes preprogrammed for demonstrating the Single Switch Solution capabilities.

**The suggested retail price for evaluation kit is USD\$99.00 F.O.B Arizona.**

The information on the evaluation kit is at the end of this document.

Once the customer decides on the features required for their application the requirements are evaluated by NKK and functional features are documented and send for approval by the customer. Then the firmware is written and the custom part number is issued. The customer can place order and receive the preprogrammed Single Switch Solution for their application.

The cost of writing the firmware is **USD\$300.00**.

During firmware development the customer is required to get a PIC programmer PICKit 3 (cost about \$49.00).

The firmware is emailed to the customer. The evaluation kit IS-S0108DEM can be used to reprogram the Single Switch Solution as well as to be used for testing and verifying the new firmware.

## IS-S0108 Single Switch Solution

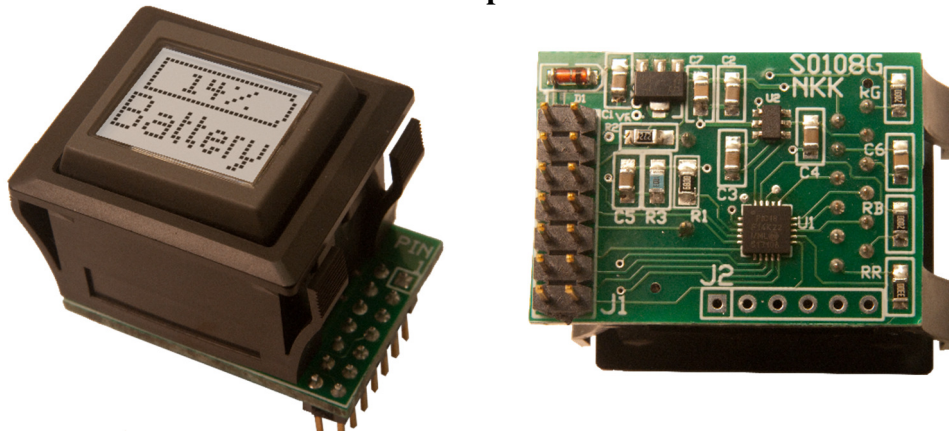
### 1. General System Features

The Single Switch System is useful in many applications where complex information needs to be displayed while minimizing design and installation time and complexity. The firmware is written based on customer requirements. **Contact Hassan Sajadi at 877-228-9655 or [engineering@nkkswitches.com](mailto:engineering@nkkswitches.com) for application consultation.**

Features:

- 36x24 pixel graphic LCD.
- Can display 3 lines of 6 characters in Font 5x7, 2 lines of 4 characters in Font 7x10 or graphic.
- 15 backlight colors (RGB) for various mode of operation.
- Panel Mount for easy installation.
- Single pole momentary switch.
- Firmware is written based on customer requirements.
- The connection to application is via 2x7 header (0.1"x0.1").
- Up to 8 digital input/outputs.
- Up to 6 analog to digital converters.
- I2C, SPI, or UART configurations are available upon request.

**S0108 photos**



**Part Number Attributes: IS-S0108XXX.** Each application would have a unique part number.

IS-S0108	XXX
Base part number	Unique for each application

## 2. Backlighting Options

There are two backlighting states: "ON cycle" and "OFF cycle". The duration time of OFF cycle is about 500 mS. The ON cycle is two times of duration of the OFF cycle. Both the duration of the OFF cycle and the multiple of the ON cycle to the OFF cycle can be specified by the customer. Each of the ON cycle and OFF cycle have 8 color option. The 64 backlight options are achieved by combination of ON cycle and OFF cycle. Below are the options for ON and OFF cycle:

Available color for ON cycle and OFF cycle				
	Color	Red	Green	Blue
1	OFF	OFF	OFF	OFF
2	Red	ON	OFF	OFF
3	Green	OFF	ON	OFF
4	Blue	OFF	OFF	ON
5	Amber	ON	ON	OFF
6	Light Blue	OFF	ON	ON
7	Magenta	ON	OFF	ON
8	White	ON	ON	ON

## 3. Hardware

**WARNING:** These products are ESD sensitive. The ESD handling procedures must be followed.

The Single Switch System incorporates an IS15BBFP4RGB in a Panel Mount Housing soldered to a small controller PCB.

**Power input:** 7.5V to 15V at maximum of 70 mA

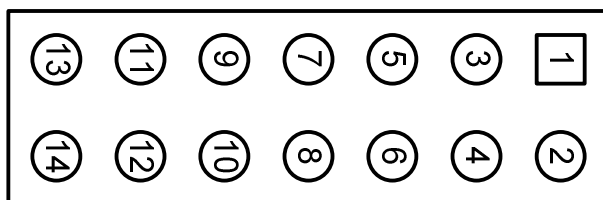
**Controls Overview:**

**J1: Application Interface Header** is a 7x2 header .1”x .1” for application connections (Table 1).

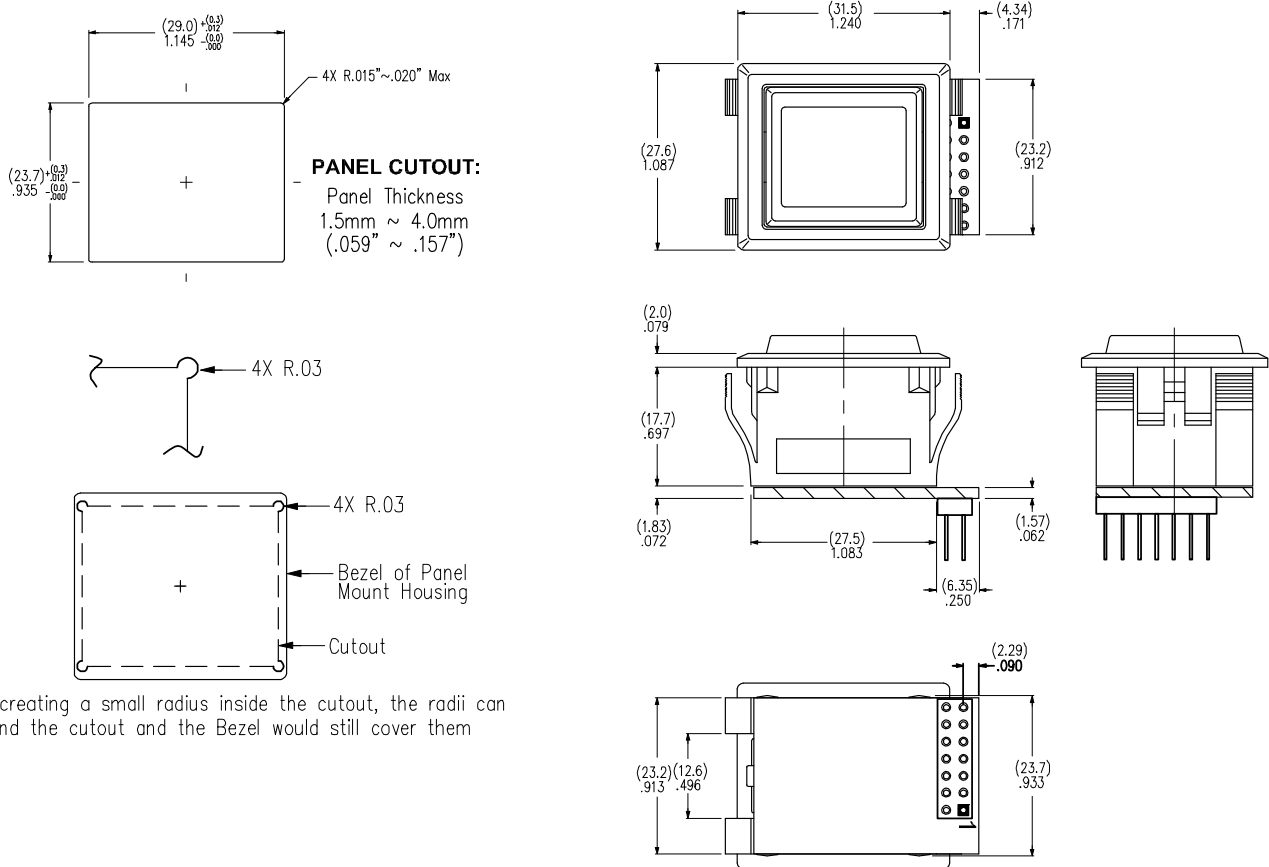
## Application Interface Header (J1) pin-outs:

**Table1**

Pin#	Pin Name	Pin Function				Notes
1	Power	Input voltage 7.5V to 15V				
2	Power	Input voltage 7.5V to 15V				
3	Ground	Ground				
4	Ground	Ground				
5	5V	5V output.				It is generated by the onboard voltage regulator. The maximum current drawn cannot exceed 10 mA.
6	DG0	Digital I/O	Analog IN			
7	DG1	Digital I/O		TX USART		Has a 4.7 KOHM pull down resistor on the board.
8	AN1	Digital I/O	Analog IN	ss of SPI		
9	AN0	Digital I/O	Analog IN	SDO of SPI		
10	SWRD					Switch pin connected to MC pin with a weak pull-up. The other switch pin is connected to Ground
11	DG2	Digital I/O	Analog IN	RX USART		
12	DG3	Digital I/O		SCK of SPI	SCL of I2C	
13	AN3	Digital I/O	Analog IN	SDI of SPI	SDA of I2C	
14	AN2	Digital I/O	Analog IN			



## Dimensions:



## 4. Connecting to applications

All the I/O pins are directly connected to the microcontroller pin. There is no safety circuit due to lack of space. If the application signals are not stable appropriate safety measures should be implemented.

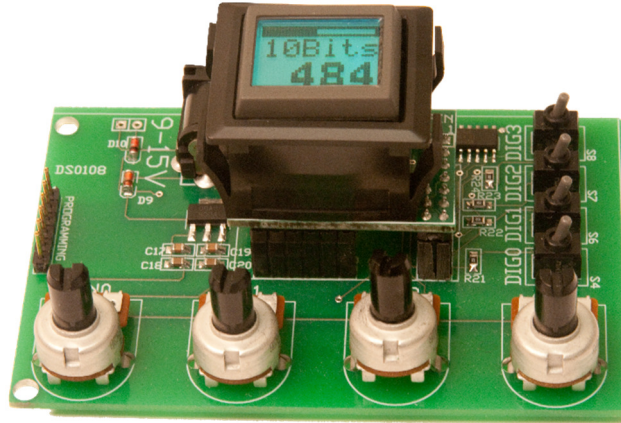
<b>Analog Resolution</b>	: 10 bits
<b>Analog Voltage</b>	: 0 to 5V
<b>Digital input Voltage</b>	: $V_{il} < 0.8V, 2V < V_{ih} < 5V$
<b>Digital output Voltage</b>	: $V_{ol} < 0.6V, 4.2V < V_{oh}$

<b>Maximum output current sourced</b>	: One I/O pin 20 mA, Total for all I/O pins 50 mA
<b>Maximum current sunk</b>	: One I/O pin 20 mA, Total for all I/O pins 100 mA

Some application require an interface board for converting the Analog input to proper voltage or turning on relays that require more current. NKK has interface boards for some application. We also entertain designing interface boards for new applications.



## IS-S0108DEM Evaluation Kit User Manual



### 1. General Features

The IS-S0108DEM is a demonstration unit for the Single Switch Solution. Below are the current features:




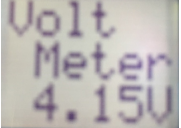



- Four potentiometers wired to Analog In to simulate various Analog input signals.
- Four toggle switches and four LED's wired to Digital In/Out to simulate digital in and digital out.
- 9 to 15V DC 2.5mm power jack.
- Programming plug.
- Hole for easy access to the Single Switch Solution LCD contrast.

### 2. Preface

The IS-S0108DEM is designed to demonstrate the features of the Single Switch Solution. It has four potentiometers, four toggles, and four LED's that simulate various inputs and outputs. It has been programmed to show some of the different ways to use the Single Switch Solution. However the firmware can be altered by NKK Switches as per customer requirements. This manual will go through the various aspects of the firmware written for demonstration of features.

## 3. Operational Overview

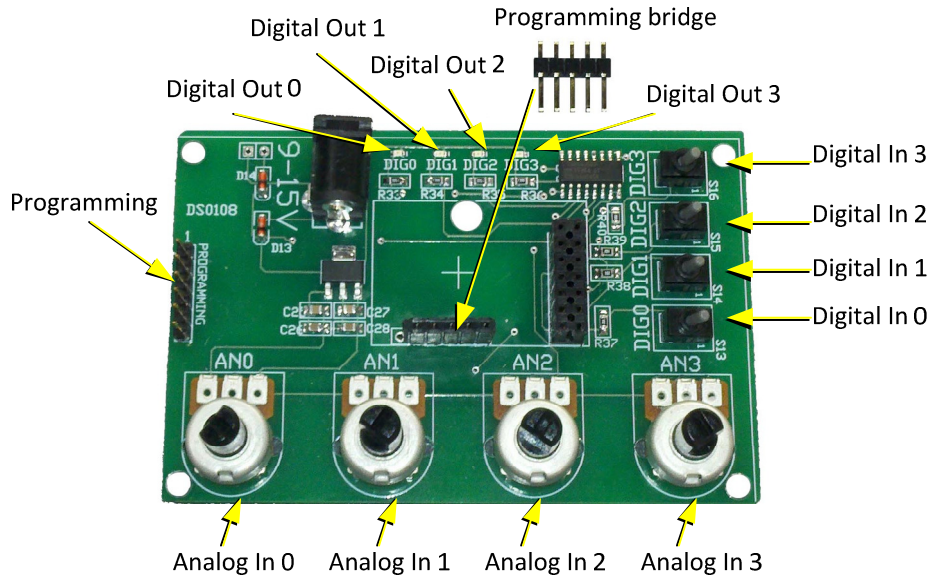
When first turned on the IS-S0108DEM will display the NKK Switches logo. After 2 seconds it will then display the battery charge image. Pressing the button steps through each of the six simulated functions. It then loops back to the beginning.

Image	Function	Operation
	NKK Logo Splash Screen	Only seen when first turned on. Stays on only for a few seconds.
	Battery Charge *	AN0 input is represented/displayed from 0% to 100% with green backlight. ---The warning level at which point in addition to the amber/Green backlight blink a signal is sent to DIG0. --- The Danger level at which point in addition to the red backlight blink a signal is sent to DIG1.
	10 Bits Stepper	AN1 input is represented/displayed from 0 to 1023 steps indicating the 10 bits analog resolution.
	0-5 Volt Meter	AN2 input is represented/displayed from 0 to 5.00V.
	Rotary Stepper	AN3 input is represented/displayed in 16 steps 1/16 to 16/16.
	Timer	Turns on and off by Dig 2 toggle control. Green when running and amber when stopped.
	Counter	Counts each time the Dig 3 toggle is actuated. Resets to zero when power is off.

\* To select warning and danger level press and hold the switch while it is displaying “Batt Charge” till the display show “Amber”. Then release the switch followed by press/releases to get to the desire choice (None, 25% to 55%). After 5 seconds of inactivity the danger setting appear when the display shows “RED”. Pressing and releasing the switch cycles through choices (None, 5% to (Amber choice -5%)). After 5 seconds of inactivity the chosen values are saved and status of Battery charge function accordingly.

## 4. Hardware

### Controls Overview



**Note: Improper installation of the Single Switch Solution could damage the units.**

The **Analog In** has four potentiometers that simulate analog input signals.

Pin	Function
Analog 0	Battery
Analog 1	10 bit
Analog 2	Volt Meter
Analog 3	Stepper

The **Digital In/Out** has four on/off toggles that simulate digital input signals and four LED's that simulate digital output signals. Note that the Digital In and Digital Out are connected so the pin can only be used for one or the other. Digital 0 and 1 are used for output. Digital 2 and 3 are used for input.

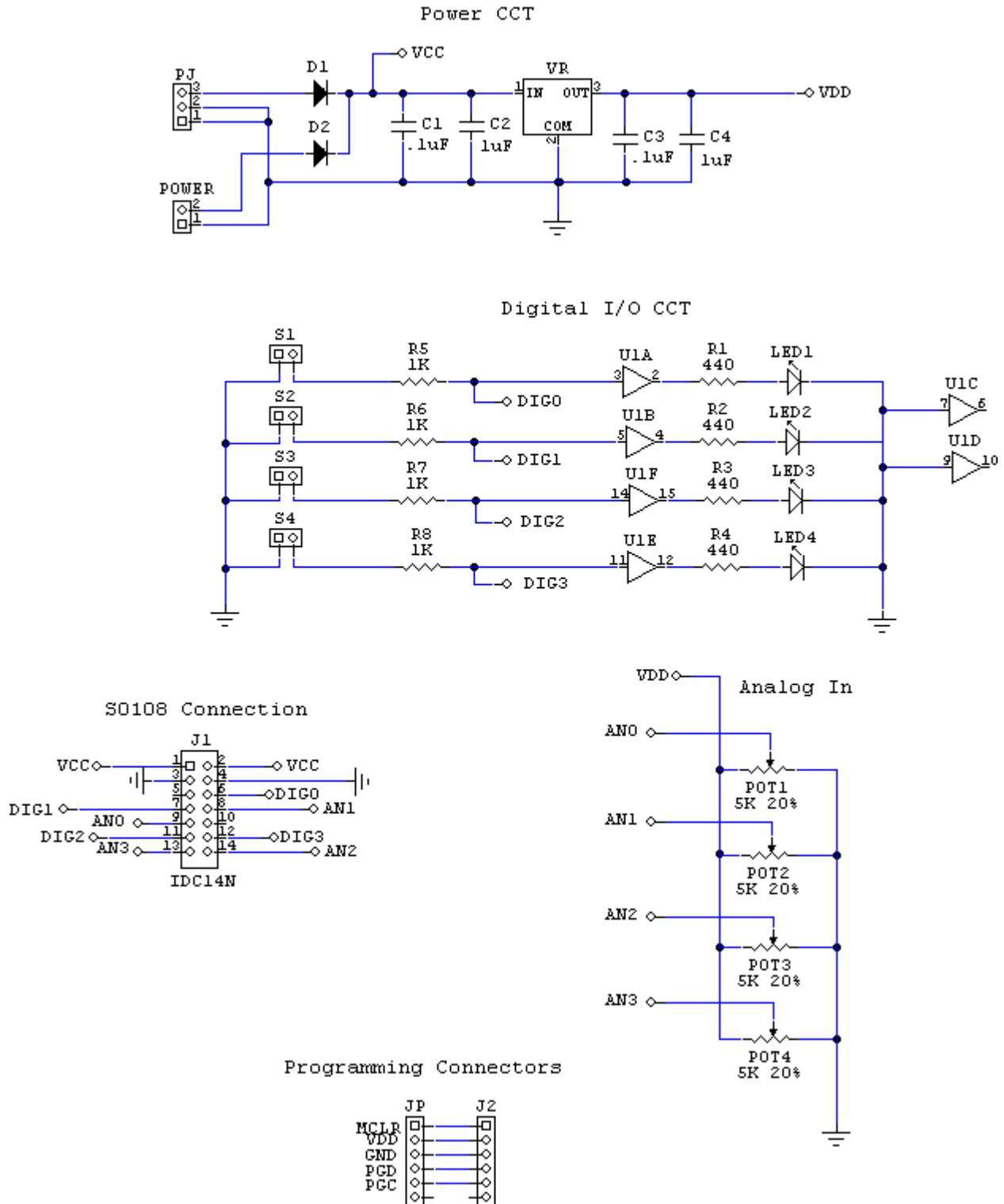
Pin	Input or Output	Function
Digital 0	Output	LED lit when AN0 is below warning level and higher than danger level.
Digital 1	Output	LED lit when AN0 is lower than danger level.
Digital 2	Input	ON/OFF the timer
Digital 3	Input	Counter

The **9-15V DC Power** jack mates with a 2.5mm cylinder power connector with a center positive.

The **Programming Connector** links the Single Switch Solution to the firmware programmer such as the PICKit 3 by Microchip. The unit must have power to program. Also the five pin programming bridge should be installed into the 5x1 female header so the unit is connected to the Single Switch Solution. It should be removed after programming to prevent stray signals.

	1	2	3	4	5	6
Program	MCLR	VDD	GND	PGD	PGC	

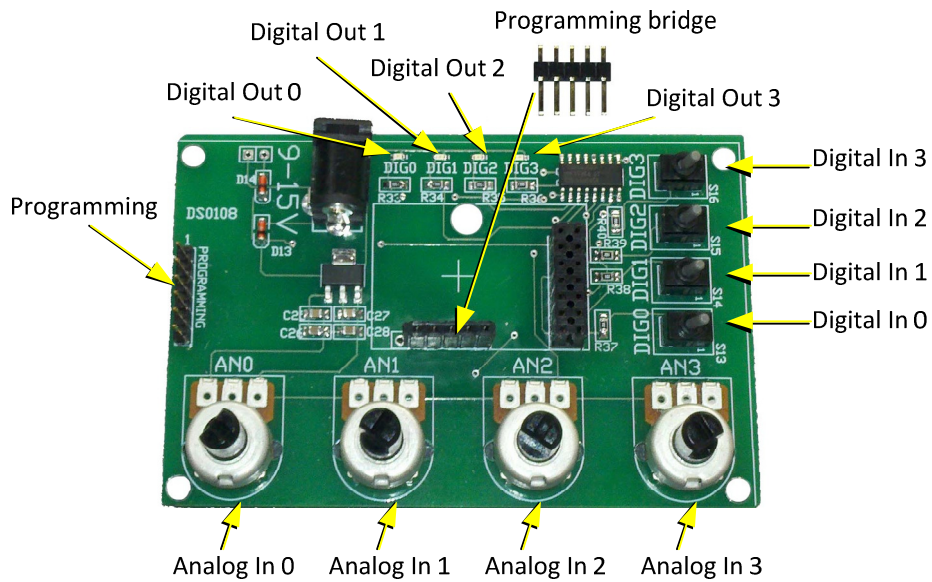
## 5. IS-S0108DEM Schematic



# IS-S0108DEM Programming Procedure

## 1. Purpose

The purpose of this document is to give instructions on programming and testing the Single Switch Solution and variations using the IS-S0108DEM board.



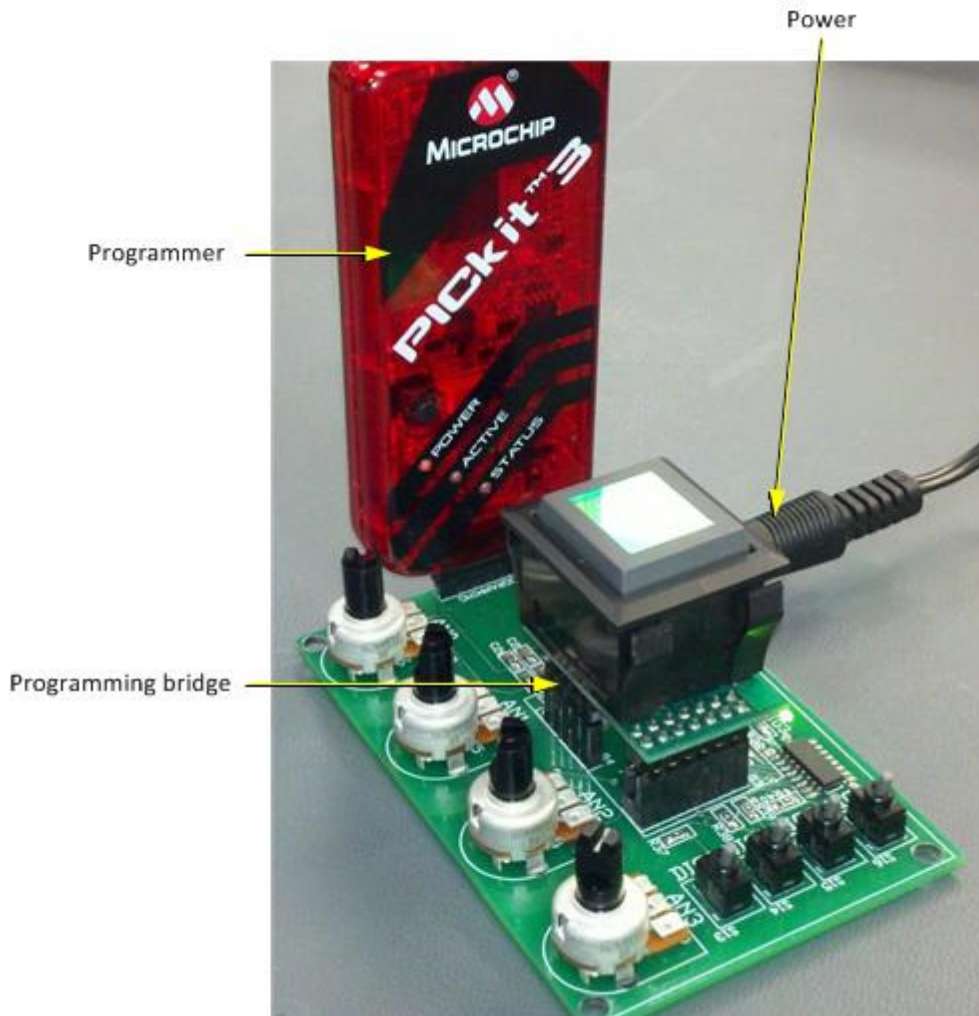
## 2. Preparing the IS-S0108DEM for Programming

The **Programming Connector** links the Single Switch Solution to the firmware programmer such as the PICKit 3 by Microchip.

1. The unit must have power to program.
2. The five pin programming bridge should be installed into the 5x1 female header so the unit is connected to the Single Switch Solution. It should be removed after programming to prevent stray signals. Make sure there is contact between the connector and pads on the bottom of the S0108.
3. Pin one on the programmer must be connected to pin one on the programming connector. Plugging it in wrong may damage the unit or the programmer or both.

	1	2	3	4	5	6
Program	MCLR	VDD	GND	PGD	PGC	

Single Switch Solution with programmer attached.



## 3. Preparing the MPLAB Program

**Note:** The steps are based on navigating the menu bar. Configure, Programmer, File being the menu items visited.

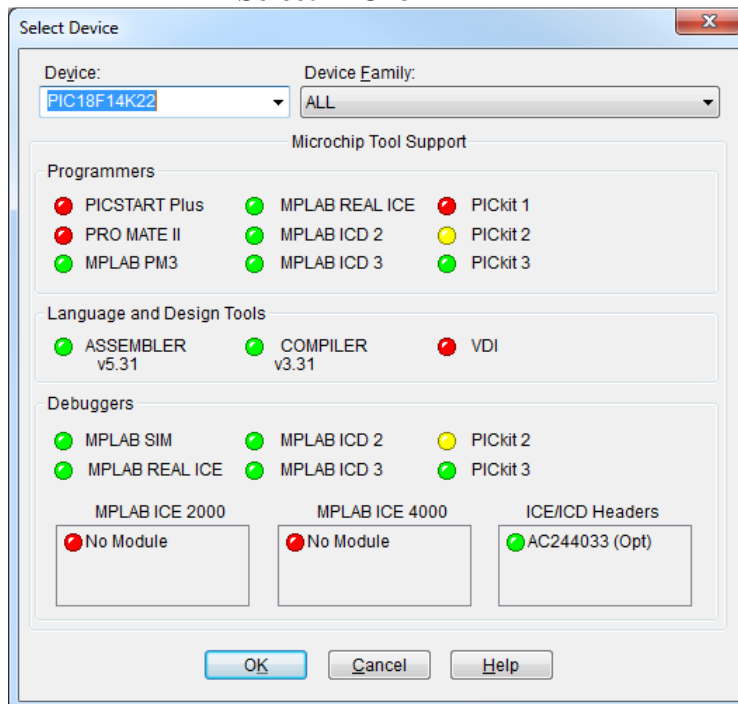
**Menu Bar for the MPLAB v8.76**



**Note:** These instructions are for MPLAB IDE v8.76. The version will change at Microchip’s discretion.

1. Open MPLAB IDE program.
2. Select the “Configure” menu item.
3. Select the “Select Device” menu item.
4. With the “Device” drop down menu select PIC18F14K22.

**Select PIC18F14K22**

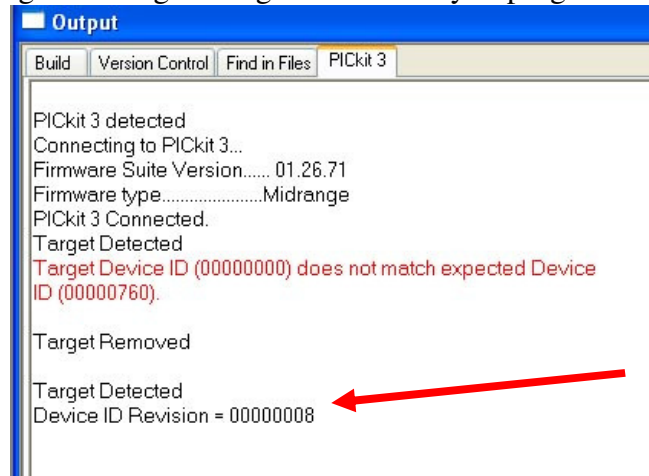


1. Click “OK” button to exit out of Select Device.
2. Select the “Configure” menu item.
3. Select the “Configuration Bits” dropdown menu item.
4. Check the “Configuration Bits set in code.” check box.



5. Close Configuration Bits window.
6. Select “Programmer” menu item.
7. Select “Select Programmer” dropdown menu item.
8. Select PICKit 3 from dropdown menu item.
9. Click “OK” button to exit Voltage Caution message box.
10. The Programmer will try to connect with the microchip on the S0108.
11. If the Programmer cannot find the device MPLAB IDE will give a warning message box and a message on the Output textbox. If it can find the device the Output textbox will say “Target Detected”.

Showing a warning message and the ready to program messages.



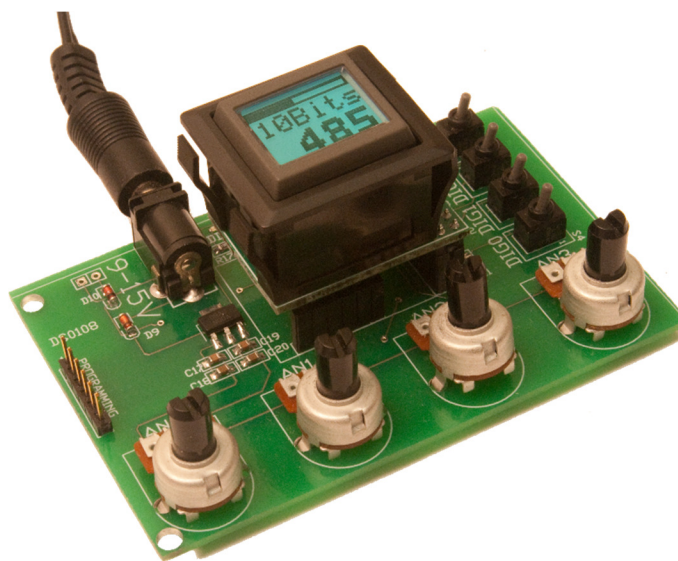
12. Select “File” menu item.
13. Select “Import” from the dropdown menu item.
14. Search for the HEX file “S08XXXX.HEX” where XXXX is the specific firmware program to be installed.
15. Once it is selected the MPLAB IDE will display a message showing that it is loaded.
16. The MPLAB IDE is ready for programming.

## 4. Programming the S0108

1. Select “Programmer” menu item.
2. Select “Program” dropdown menu item.
3. Ignore Programming warning. Click “OK” button.
4. MPLAB IDE will say:  
Programming...  
Programming/Verify complete
5. Programming complete.

## 5. Testing

1. Unplug power plug.
2. Remove PICKit 3 from unit.
3. Remove Single Switch Solution from the IS-S0108DEM board.
4. Remove programming bridge.
5. Plug in Single Switch Solution back onto IS-S0108DEM board.



6. Plug in power plug.
7. Adjust analog pots, IS pushbutton, and digital switches as necessary to verify that the unit is working as expected.

**Note: If any of the analog pins are used as digital output, make sure the corresponding potentiometer is in a middle position while programming.**

**If the pins is assigned as digital OUT and the potentiometer is all the way to one side or the other it may cause damage to the unit.**

**If the pins is assigned as digital IN the potentiometer should not be left to produce voltage between 0.6V to 2V.**