

### DEVICE OVERVIEW

The ADM106x is a range of fully programmable supply sequencers and supervisors which can be used as complete supply management solutions in systems with multiple voltage supplies.

All of the features of the ADM106x devices are programmable through an SMBus interface. The devices also contain nonvolatile memory (EEPROM) so the configuration of these features can be stored on-chip and downloaded each time on power-up.

### CONTENTS OF KIT

- Main Evaluation Board:**  
 This board contains all of the circuitry necessary to active stimulate the ADM1062-69 devices and monitor its response, such as programmable supplies, ADCs, LEDs, etc.
- Daughter-card Socket:**  
 A relevant daughter-card with a device socket is also supplied. There are three different daughter-card options for the main evaluation board depending on the package option- LFCSP, TQFP or LQFP. The daughter-card plugs directly into the main evaluation board and allows all the devices in their specific layouts to be used in conjunction with the main evaluation board. The correct one will be supplied for the devices included in the kit.
- Device Samples:**  
 Some loose samples of the device to be evaluated are included in a samples box. A single device should be placed in the socket before powering up the evaluation board.
- SMBus Cable:**  
 This cable connects the main evaluation board to a standard PC parallel connector. Power must be applied to the board separately if using this cable.
- USB Cable:**  
 This cable connects the main evaluation board to a standard PC USB port. Power for the evaluation board will also be provided by the PC USB interface.

Order codes for evaluation kits are shown on this table (Pinouts and detailed package drawings can be found in the individual product datasheets):

Rev. PrB

July 2005

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Device Part #	Package	Evaluation Kit Order Code
ADM1062	TQFP-48	EVAL-ADM1062TQEB
	LFCSP-40	EVAL-ADM1062LFEB
ADM1063	TQFP-48	EVAL-ADM1063TQEB
	LFCSP-40	EVAL-ADM1063LFEB
ADM1064	TQFP-48	EVAL-ADM1064TQEB
	LFCSP-40	EVAL-ADM1064LFEB
ADM1065	TQFP-48	EVAL-ADM1065TQEB
	LFCSP-40	EVAL-ADM1065LFEB
ADM1066	TQFP-48	EVAL-ADM1066TQEB
	LFCSP-40	EVAL-ADM1066LFEB
ADM1067	TQFP-48	EVAL-ADM1067TQEB
	LFCSP-40	EVAL-ADM1067LFEB
ADM1068	LQFP-32	EVAL-ADM1068LQEB
ADM1069	LQFP-32	EVAL-ADM1069LQEB

Table 1: Main Kit Order Codes

Order codes for parts such as replacement daughter-cards sockets and cables are as follows. (Micro-Boards are explained later.)

Part	Order Code
ADM106xTQ Daughter-card	SOCKET-ADM106xTQ
ADM106xLF Daughter-card	SOCKET-ADM106xLF
ADM106xLQ Daughter-card	SOCKET-ADM106xLQ
SMBus Cable	CABLE-SMBUS-3PIN

Table 2: Socket and Cable Order Codes

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**REVISION HISTORY**

Revision PrB: Preliminary Version

**ADM1062-69 FAMILY DESCRIPTION**

These devices also provide up to ten programmable inputs for monitoring Under, Over, or out-of-window faults on up to ten supplies. In addition, up to ten programmable outputs are provided. These can be used as logic enables. Six of them can also provide up to a +12V output for driving the gate of an N-Channel FET which may be placed in the path of a supply.

The logical core of the device is a Sequencing Engine. This is a state machine based construction, providing up to 63 different states. This enables very flexible sequencing of the outputs, based on the condition of the inputs.

In addition to these functions, the ADM1062/3/4/6/9 integrate a 12-bit ADC. This allows read-back of the voltage on up to 12 rails. An extra level of UV or OV monitoring can also be provided with the ADC.

The ADM1062/6/7/9 also have 8-bit voltage output DACs. These circuits can be used to implement an open-loop margining system that enables supply adjustment by altering either the feedback node or reference of a dc/dc converter using the DAC outputs. For parts with ADC also present a more comprehensive closed-loop margining circuit can be implemented.

Temperature measurement is possible with the ADM1062/3. The ADM1062 contains one internal temperature sensor and a differential input for a remote thermal diode. The ADM1063 contains an additional differential input for a second remote thermal diode. These are measured using the 12-bit ADC.

The device is controlled via configuration data that can be programmed into an EEPROM. The whole configuration can be programmed using an intuitive GUI-based software package provided by ADI.

**Table 3. ADM106x Selection Guide (in decreasing order of functionality)**

Part Number	Inputs	Outputs	Input Accuracy	Readback	Margining	Temp Sensing	Package
ADM1062	10 (4 VPn + VH + 5 Vx)	10 (6 FET Drivers)	1%	Yes	Yes	Yes	40 LFCSP/ 48 TQFP
ADM1066	12 (4 VPn + VH + 5 Vx + 2 AUX)	10 (6 FET Drivers)	1%	Yes	Yes		40 LFCSP/ 48 TQFP
ADM1063	10 (4 VPn + VH + 5 Vx)	10 (6 FET Drivers)	1%	Yes		Yes <sup>1</sup>	40 LFCSP/ 48 TQFP
ADM1064	10 (4 VPn + VH + 5 Vx)	10 (6 FET Drivers)	1%	Yes			40 LFCSP/ 48 TQFP
ADM1067	10 (4 VPn + VH + 5 Vx)	10 (6 FET Drivers)	1%		Yes <sup>2</sup>		40 LFCSP/ 48 TQFP
ADM1065	10 (4 VPn + VH + 5 Vx)	10 (6 FET Drivers)	1%				40 LFCSP/ 48 TQFP
ADM1069	8 (4 VPn + VH + 3 Vx)	8 (6 FET Drivers)	1%	Yes	Yes		32 LQFP
ADM1068	8 (4 VPn + VH + 3 Vx)	8 (6 FET Drivers)	1%				32 LQFP

<sup>1</sup> ADM1063 has differential inputs for two external temperature sensors

<sup>2</sup> ADM1067 provides Open Loop Margining (DAC's but no ADC)

## MICRO EVALAUTION KITS

Micro-Evaluation boards are also available. Two versions of these micro-boards exist. The EVAL-ADM106xMEB is for use with devices ranging from the ADM1062 to the ADM1067 and the EVAL-ADM1068-9MEB for use with ADM1068 and ADM1069 devices.

These basic boards have the following features:

- They function like the standard evaluation board but are much simpler.
- They allow in-system evaluation of the ADM1062-9 devices. The devices are accessible as there are few external components on the board. The board also has a low profile design to allow evaluation in a rack.
- Evaluation with user power supplies and other circuitry is possible on the breadboard area.
- This board also provides a simple preprogramming module for ADM1062-69 devices. The board accepts the daughter-card socket modules from table 2 (the appropriate socket should be ordered separately as this is not included)

Part	Order Code
Micro-board for ADM1062-7	EVAL-ADM1062-7MEB
Micro-board for ADM1068-9	EVAL-ADM1068-9MEB

*Table 4: Socket and Cable Order Codes*

Note that an SMBus cable is included in each kit. These boards do not have a USB interface and therefore need external power applied to them.

## ORDERING AND SUPPORT

The order codes for any of these main kits, micro boards, adapter boards or SMBus cables etc can be found on page 1. Many of these items can be ordered online on the relevant product pages.

For help with ordering or for any other assistance please contact:

[sequencing@analog.com](mailto:sequencing@analog.com)

## CONFIGURATION TOOL

The latest version of the Configuration Tool software can be found on our website at:

[www.analog.com/sequencers](http://www.analog.com/sequencers)

The configuration tool zip file can be downloaded from this webpage. The contents of this file should be extracted once downloaded. The setup.exe can then be run. Please follow this on-screen instructions to install the tool.

Note that this tool is required to program and evaluate the ADM1062-69 devices.

**ADM106X EVAL BOARD HARDWARE**

The ADM106x Evaluation Board is designed to provide all of the necessary stimuli to the ADM106x, showing the many features of the device in a compact, self contained environment. The following pages contain a simple block diagram of the functions on the board, followed by a detailed schematic of the board and finally, the tracking, power and silkscreen layers for board.

The two main features of the board are the programmable voltage circuits and the output indicator LED's. There are eight programmable voltage circuits provided. The circuits are labeled VX1, VX2, VX3, VX4, VP1, VP2, VP3, VP4. These are programmable, via the Eval Board software, over a voltage range of 0.6V to 6V. Programming of these supplies is detailed in the software section of this Eval Note. The eight circuits provide voltages to eight of the ten inputs to the ADM106x. The inputs which do not have a programmable supply are VX5 (where a test point is available for the user for their own external input) and VH, which has 12V driving it directly (or alternatively, uses the programmable supply of VP4, if required).

The ten output indicator LED's are labeled PDO1 to PDO10. These indicate a logic high on the output pins of the ADM106x. The LED's for PDO1- 6 are dual colour LED's. This is to indicate when a PDO is being used as a logic output or as a FET driver output. Green indicates a logic output while red indicates a FET driver output.

**EVAL BOARD MANUAL SWITCHES**

The ADM106x Eval Board uses only two manual switches. All other switching functions are electronic and controlled using the ADM106x software tool. Control of all of the board functions is discussed in the software section.

The two manual switches are S1 and SW2. Details on these is provided below.

S1 allows the user to connect a supply to the drain of one of the six FET's provided on the board. This allows the user to verify the function of controlling a supply by having an N- Channel FET placed in the supply path and controlling its turn on with one of the FET drivers of the ADM106x. The default connection of the switch is closed, thus connecting it to a 5V supply on the board. When off, a supply can be connected by the user to one of the test points provided. It is not recommended that a supply greater than 5V be connected to these test points (since with a gate voltage of 12V max., it may be difficult to fully enhance the gate of a FET with  $V_D > 5V$ ). Table 3 opposite indicates the function of this switch.

Channel	On	Off	Controlling PDO
1	5V	T6	PDO1
2	5V	T7	PDO2
3	5V	T8	PDO3
4	5V	T9	PDO4
5	5V	T10	PDO5
6	5V	T11	PDO6

*Table 5. Settings for Manual Switch, S1*

The second switch, SW2, is for setting the SMBus address of the ADM106x. The format of the SMBus address for each of the devices is XXXXX A1 A0. A1 and A0 are pins on the device, allowing up to four ADM106x's to be connected to the same SMBus. The manual switch on the Eval board allows any one of these four addresses to be set. The table below shows the effect of settings these switches

Channel1	Channel2	ADM106x Address
Off	Off	XXXXX 11
Off	On	XXXXX 10
On	Off	XXXXX 01
On	On	XXXXX 00

*Table 6. Settings for Manual Switch, SW2*

## POWERING THE ADM106X EVALUATION BOARD

The ADM106x evaluation board can be powered through any one of three power inputs:-

1. A 9V power supply through J9.
2. A 9V bench supply through J11 (the 9V and GND leads need to be screwed in separately)
3. A 5V supply through the USB input provided. Note that a high current (500mA) port must be used to power the board. If only a low current (100mA) port is available, then the USB input can be used for data transfer between the Evaluation board and the host PC, but an external 9V supply will also need to be connected.

The Evaluation board can be connected to the host PC by the 3-pin header (J7) which can be connected to the parallel port of a PC using the cable provided. In such circumstances external power will need to be supplied to the board using either a 9V power supply through J9 or alternatively a 9V bench supply through J11 ( the 9V and GND leads need to be screwed on separately). Connection to the host PC can also be realized using the USB port with the cable provided. A 5V supply is not required when a high current (500mA) port is used. When a low current (100mA) port is used an external supply will be required.

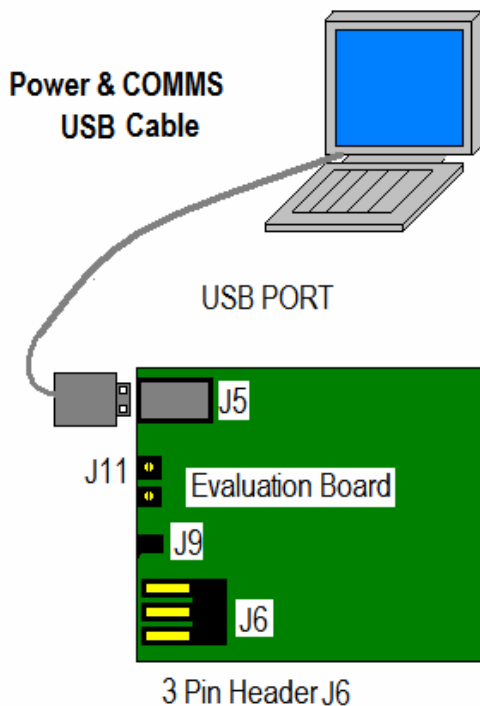


Figure 1. powering and communicating with Eval board through the USB

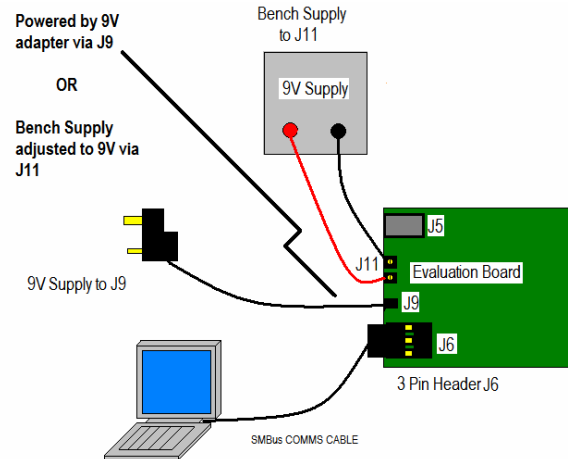


Figure 2. Communicating with EVAL board through SMBus requires external power through either J9 or J11 as illustrated.

## COMMUNICATING WITH THE ADM106x EVALUATION BOARD

Communication with the ADM106x and its evaluation board is facilitated by the Graphical User Interface (GUI) provided by ADI. The latest revision of this software is available for download at:-

[www.analog.com/sequencers](http://www.analog.com/sequencers)

The software is compatible with the following Operating Systems- Windows 98, Windows 2000, Windows XP.

Communication between a PC and the Eval board is possible through one of two interfaces:-

1. The 3-pin header (J6) can be connected to the parallel port of a PC using the cable provided.
2. The USB input can be connected to a USB port on a PC. This cable can also provide power to the board (see above)\*.

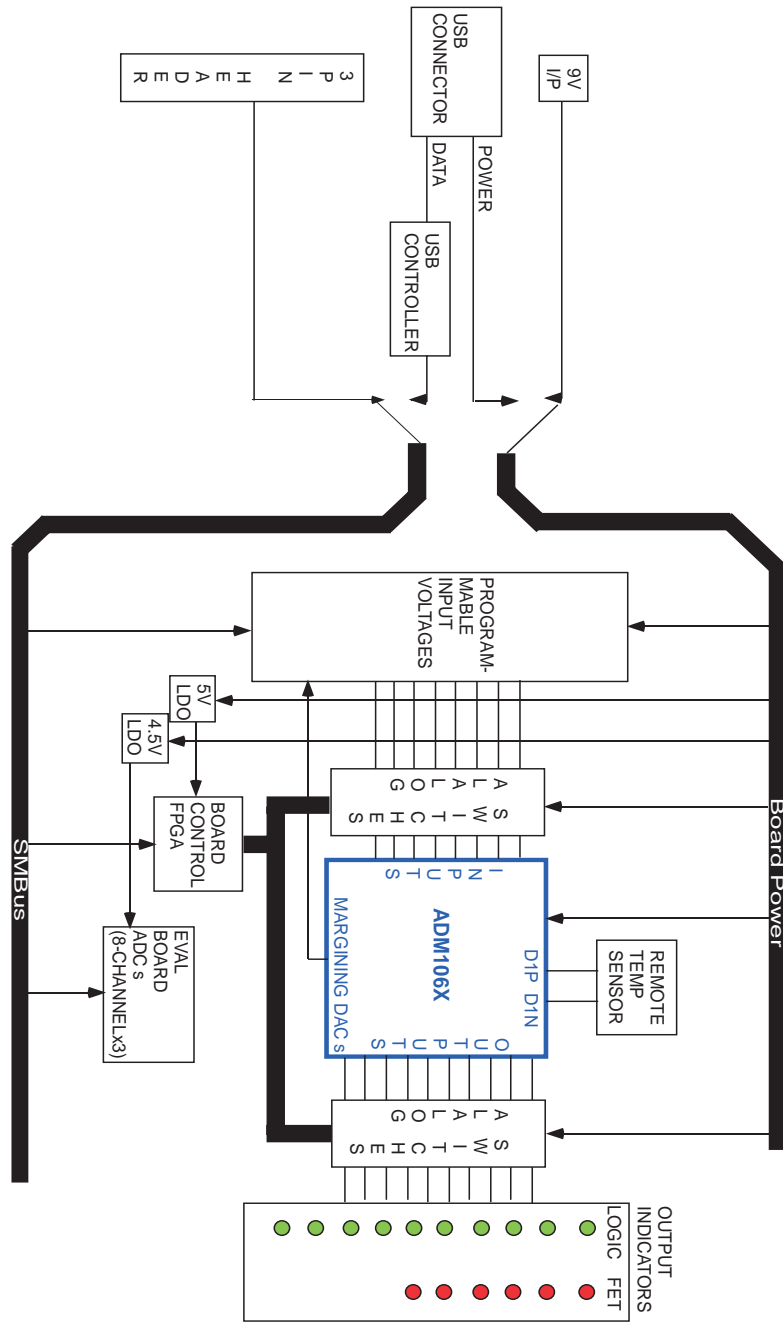


Figure 3. ADM106x Eval Board- Block Diagram

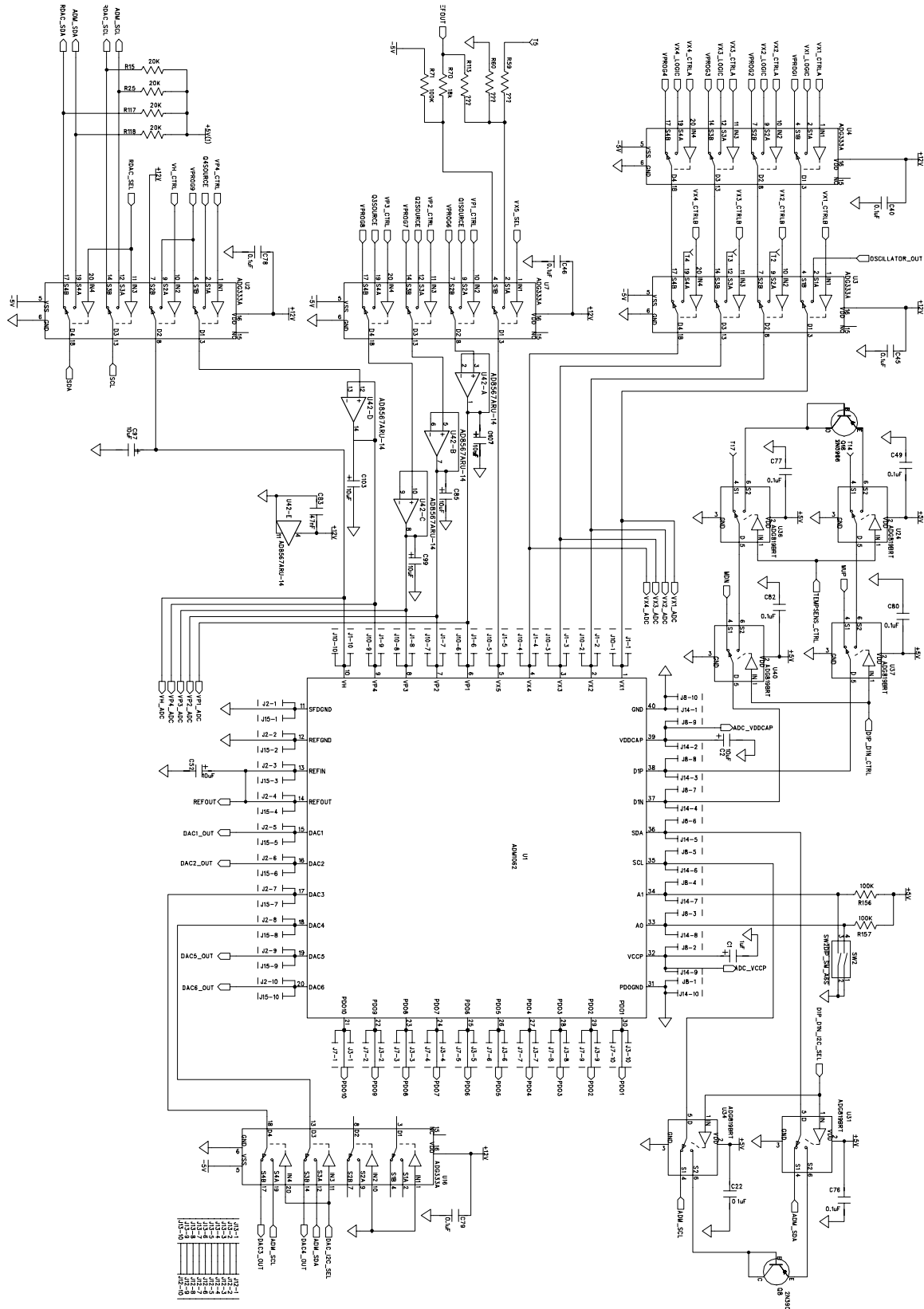


Figure 4. ADM106x Eval Board Schematic- ADM106x circuitry





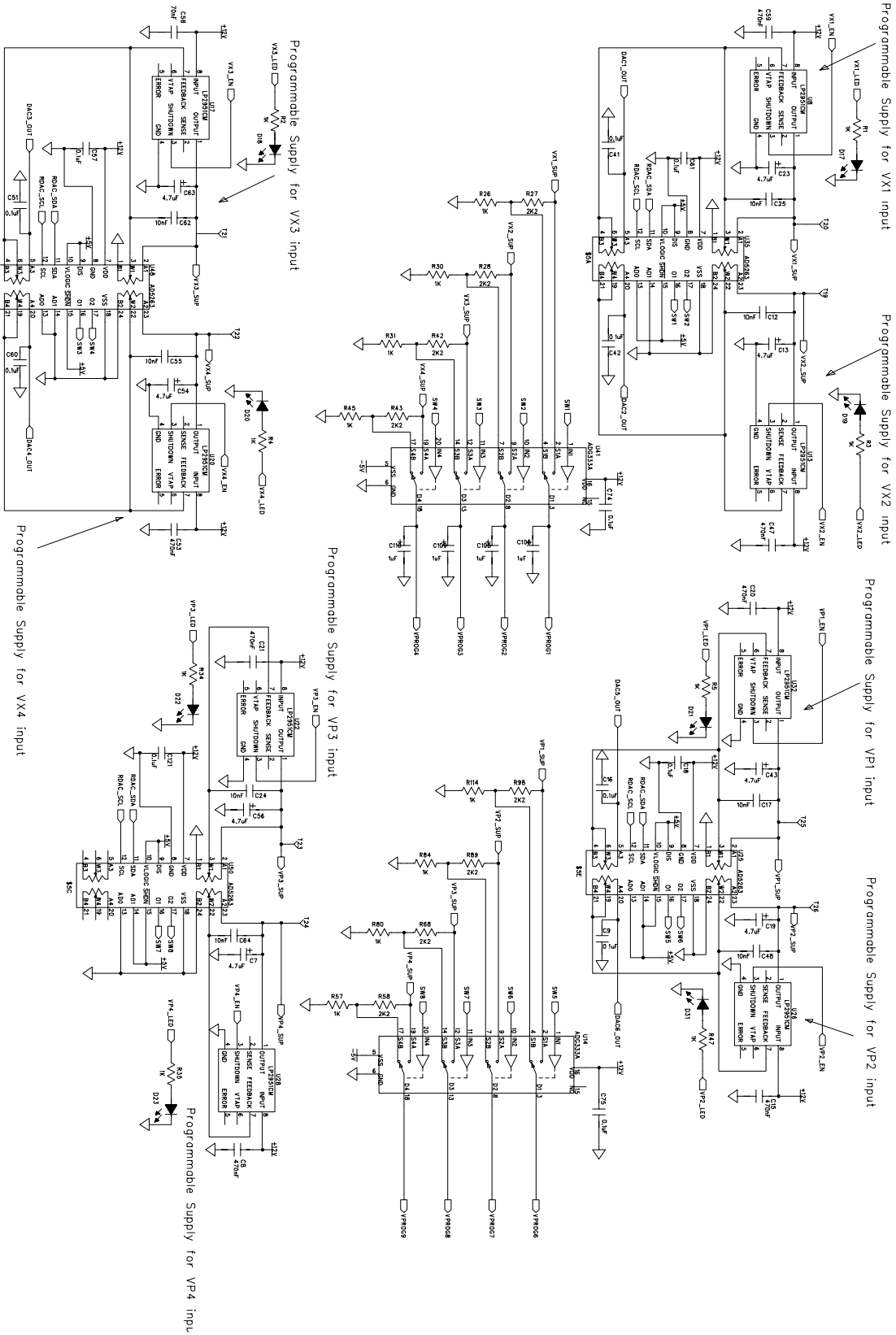


Figure 6. ADM106x Eval Board Schematic- Programmable Input Voltage circuitry

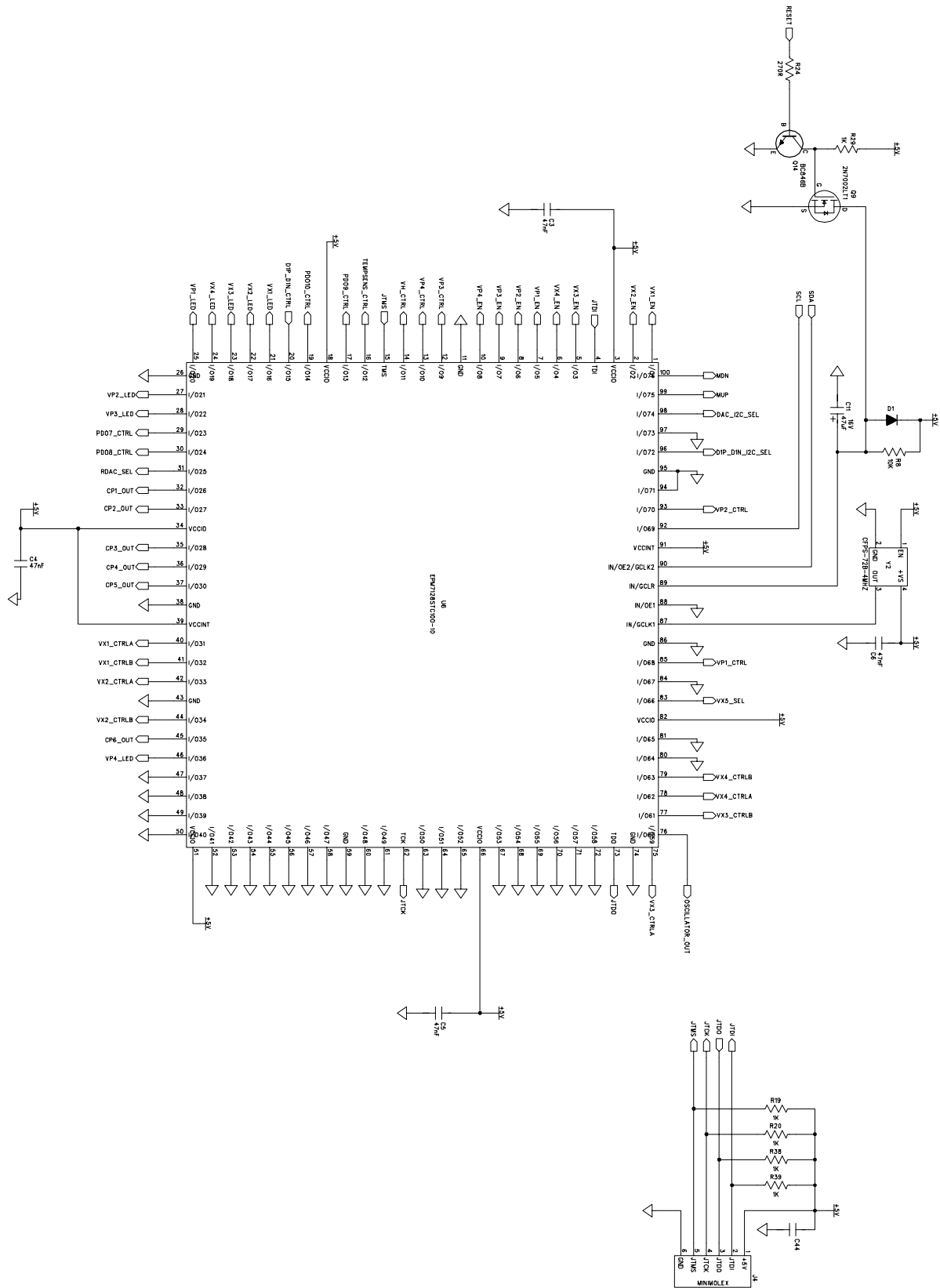


Figure 7. ADM106x Eval Board Schematic- Board Control FPGA Circuitry

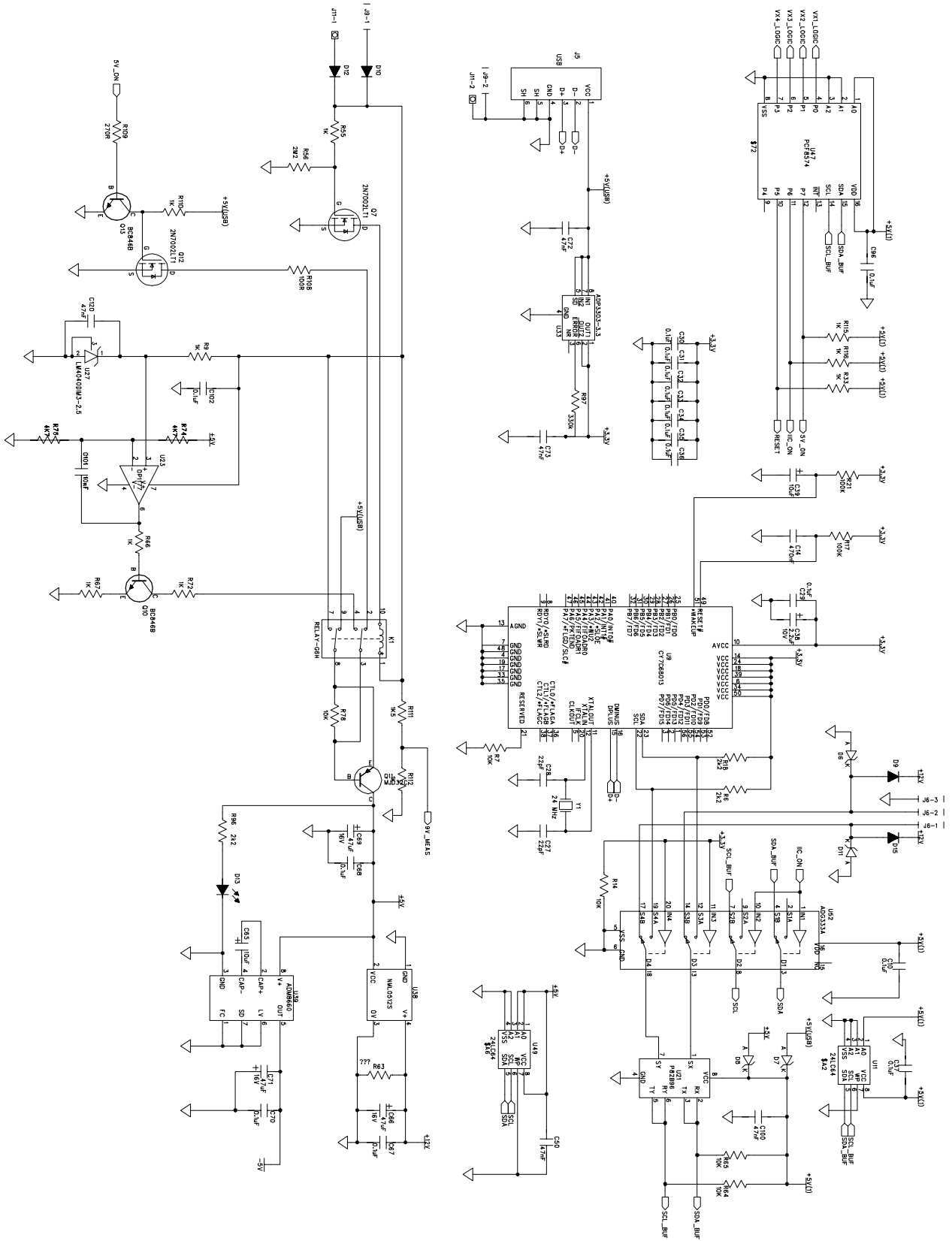


Figure 8. ADM106x Eval Board Schematic- Board Power Supply and USB Interface Circuitry



EVAL-ADM106XEB (Rev. C) – Component Side View

Silkscreen Top

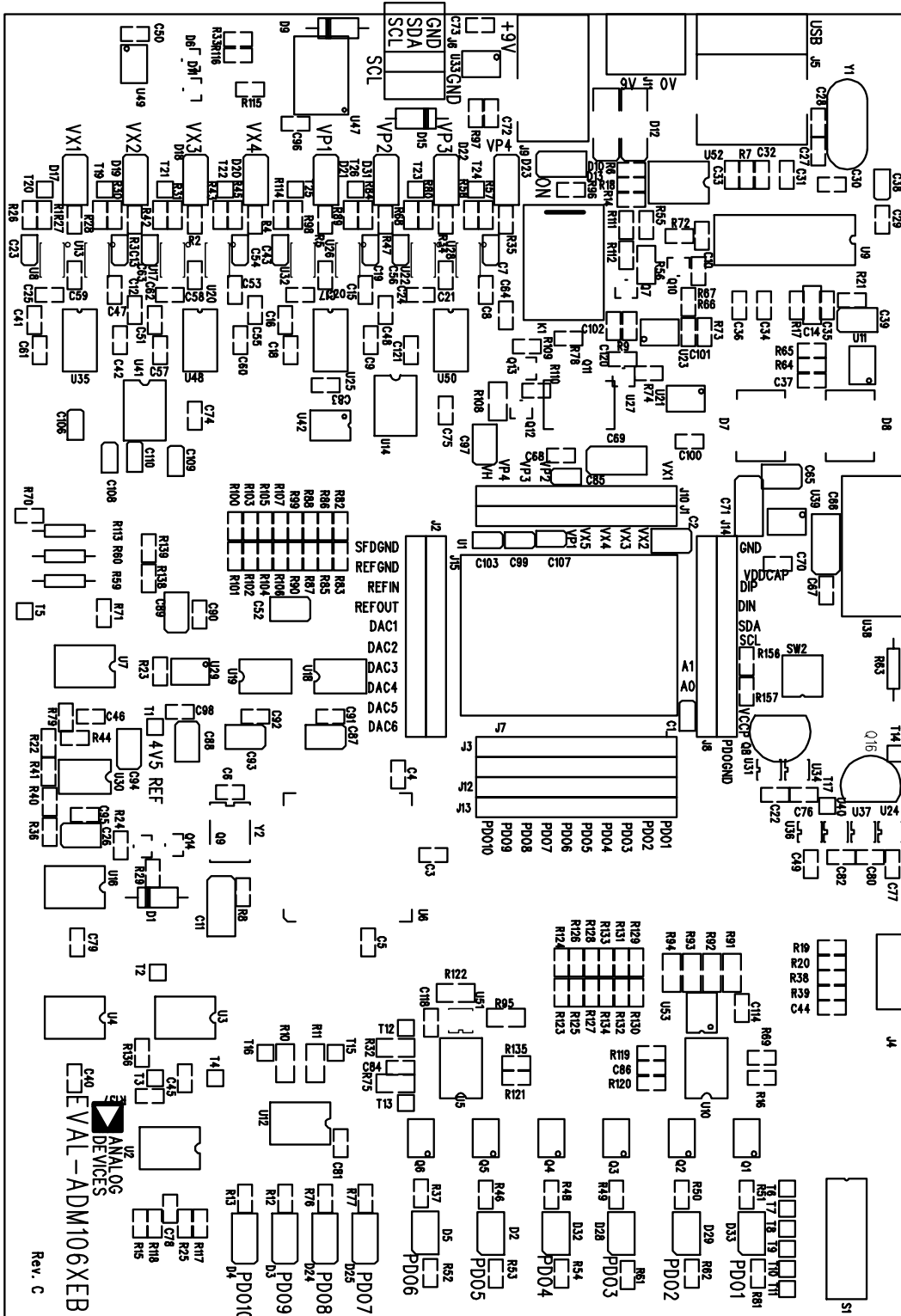


Figure 10. ADM106x Eval Board Silkscreen

## ADM106X CONFIGURATION TOOL

### INTRODUCTION

The ADM106x Configuration Tool provided by Analog Devices enables the user to program the many features of these Super Sequencers through an intuitive, GUI based interface. The Eval board then allows the user to verify their configuration before using the ADM106x in their own system application. All of the circuitry provided on the board extra to the ADM106x can also be controlled using the same software provided. The following minimum system requirements apply:

Windows 2000  
500 MHz Processor  
80 MB free disc space  
256 RAM

There are also minimum viewing requirements of 800 x 600 High colour (16 bit).

The software is laid out with a tabbed format, each tab enabling the program of a key feature of the device. Each of these tabs will be discussed in detail below.

### INSTALLING THE ADM106x SOFTWARE

The ADM106x software can be installed as follows:-

1. Download the .zip file containing the software from the website:-

[www.analog.com/sequencers](http://www.analog.com/sequencers)

2. Once downloaded, extract the files from the .zip file.
3. Double click on Setup.exe. The following window will appear:-

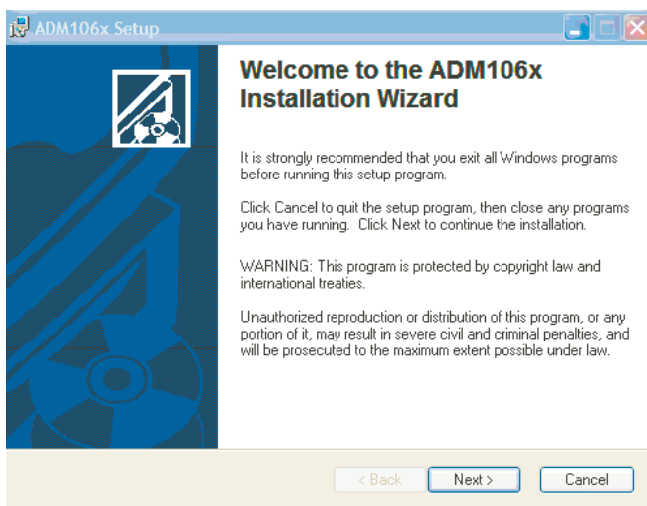


Figure 11. ADM106x Eval SW Installation Wizard

4. Click on Next>. The following window will appear:-

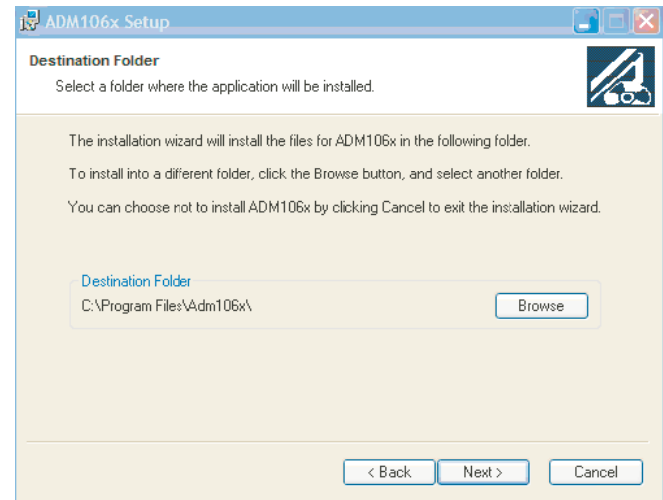


Figure 12. ADM106x Eval SW- Choosing a folder

5. Click on Next> unless you wish to change the default destination folder. If you wish to change the default folder, click on Browse and navigate to create the required destination folder. Once you click on Next>, the following window will appear:-

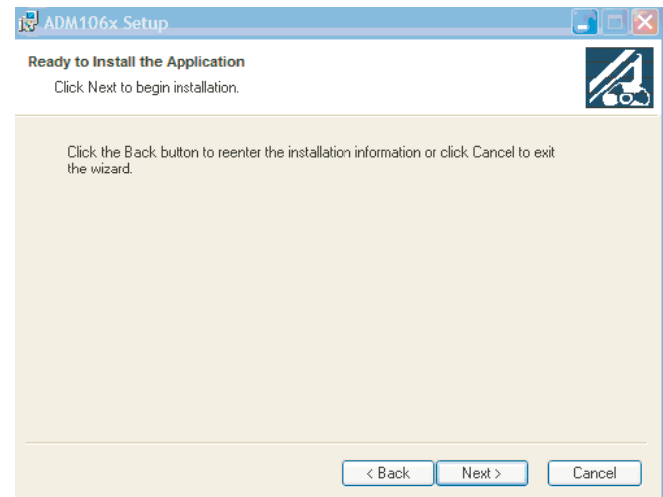


Figure 13. ADM106x Eval SW- Ready to Install

6. Click on Next>. The following window will appear:-

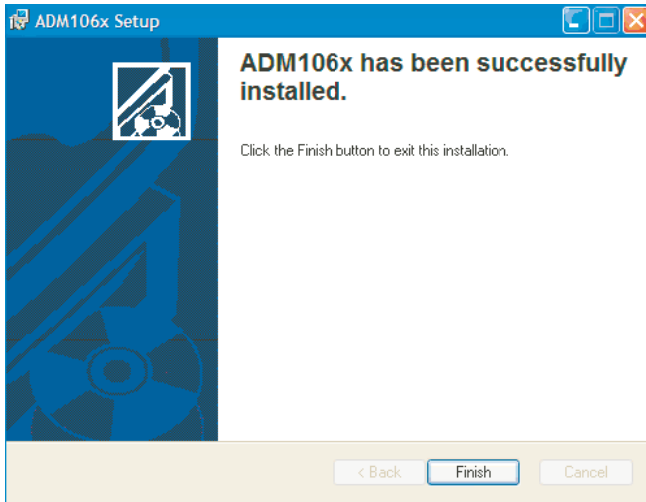


Figure14. ADM106x Eval SW- Installation Complete

7. Click on Finish.

**UNINSTALLING THE ADM106x SOFTWARE**

If you are installing an updated version of the ADM106x software, the current version on your machine must first be uninstalled. The software will automatically do this once you double click on the newly downloaded Setup.exe. When you do this, the following window will appear:-

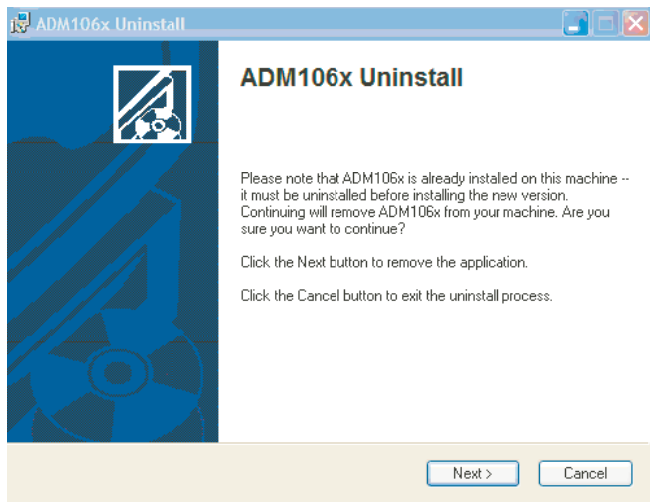


Figure15. ADM106x Eval SW- Uninstalling

Click on Next>. The software will uninstall, providing a status as it does so, and the following window will then appear:-

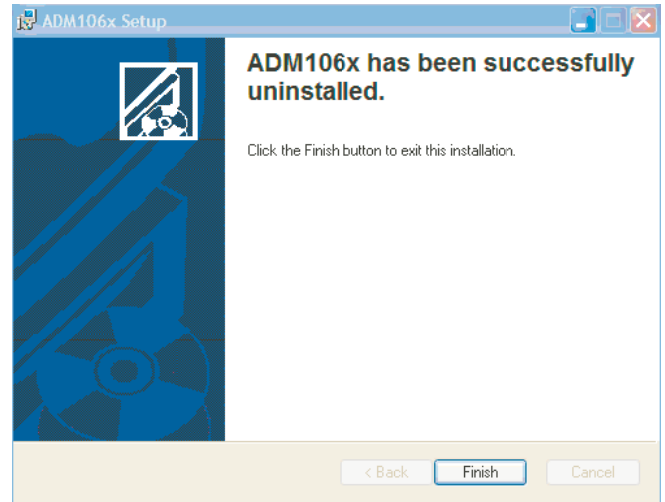


Figure16. ADM106x Eval SW- Uninstalling complete

**MANUALLY UNINSTALLING THE ADM106x SOFTWARE**

If you wish to simply uninstall the ADM106x software (without upgrading it to a newer version, you will need to:-

1. Click on Start
2. Click on Control Panel
3. Click on Add or Remove Programs. The following window will appear:-

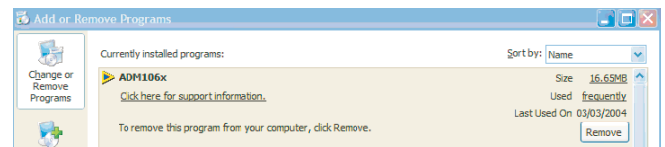


Figure17. ADM106x Eval SW- Using Control Panel to uninstall

4. Highlight the ADM106x program and click on Remove to uninstall it.

**COMMUNICATING FOR THE FIRST TIME**

When first launched windows will not recognize the external Evaluation Board and will begin installing drivers automatically. The ADM106x software should be closed and the following window in figure 18 encountered. Select install software automatically.



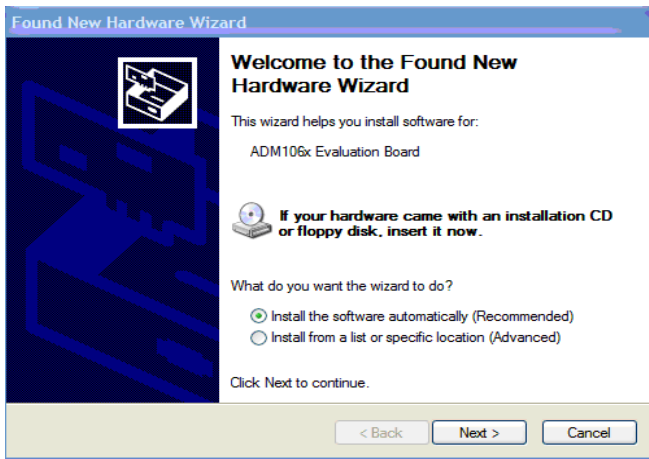


Figure18. Automatically installing drivers for Eval Board

In Windows XP a warning will be encountered indicating that the hardware has not passed Windows Logo testing to verify compatibility with Windows XP. The evaluation board has been tested and is compatible with Windows XP and to install the necessary drivers simply left click <continue Anyway> as shown in figure 19.

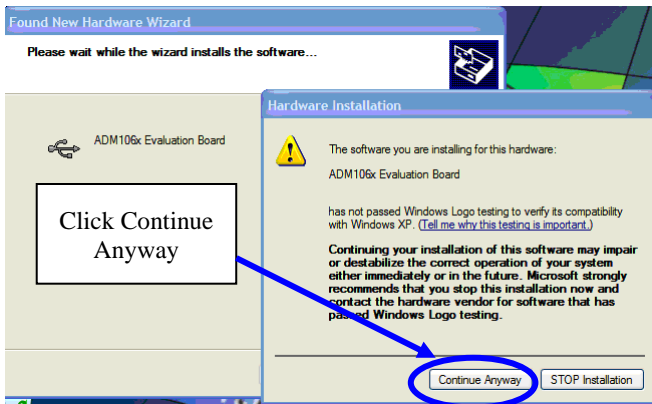


Figure 19. Windows XP compatible

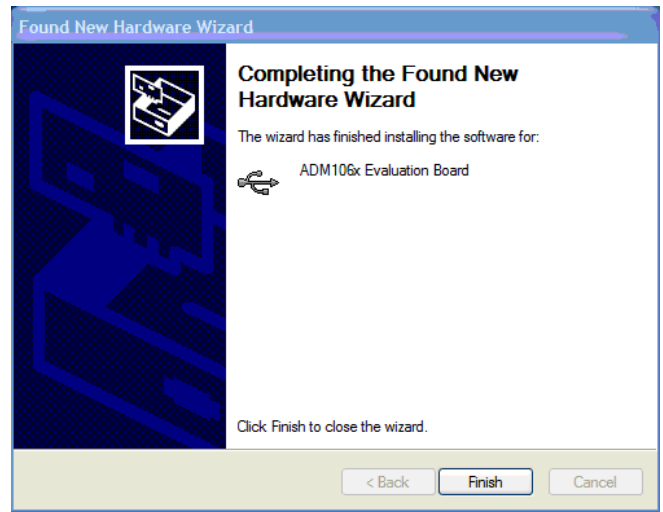


Figure20. ADM106x Evaluation Board drivers installed

Once this is completed the screen in figure 20 appears and to close the installation wizard left click finish. The software can now be opened again and run as normal.

### LAUNCHING THE SOFTWARE

Click on:-

Start> All Programs> ADM106x Configuration Software> ADM106x Configuration Software>

Once launched, one of two windows appear. The first, if the Eval board is powered up and an ADM106x is in the socket, is shown below. The highlighted address with the tick in the box, indicates that an ADM1066 has responded on the SMBus at address 01101110 (6Eh)



Figure21. ADM106x s/w launch- ADM1062 online

If no ADM106x devices are found the dialog box shown in Figure22 appears asking if the user wishes to work offline.

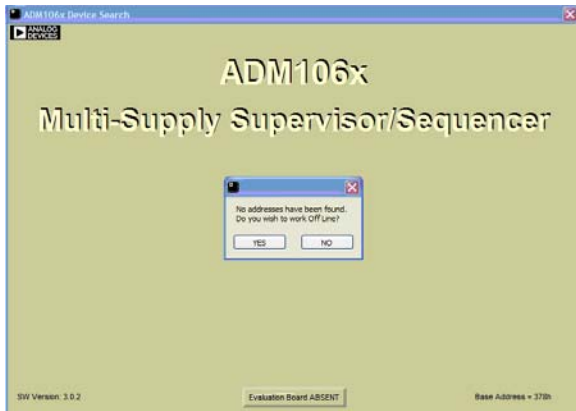


Figure 22. ADM106x s/w launch- ADM1062 offline

Click YES> in the dialog box above to operate the software in offline mode. Clicking NO> will close the software. The user can then power up an Evaluation board with an ADM106x inserted in its socket and restart the software.

Once YES> is clicked, the window shown in Figure 23 appears:-

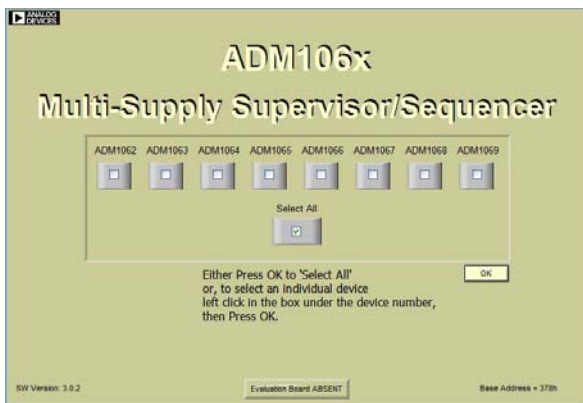


Figure 23. ADM106x s/w launch- ADM1062 offline

When starting up the software in Offline mode, the system needs to be told which device the user wishes to program, this can be selected by clicking the relevant box.

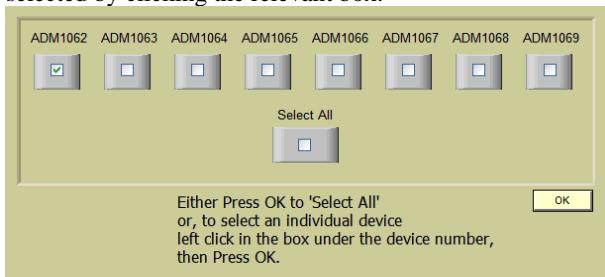


Figure 24. Selecting an ADM1062 to program offline

Click OK> to continue the software launch.

By choosing select all (as shown in figure 19) the device to be programmed can be changed at any time by left clicking a dropdown window located in the top right corner of the Top Level screen.

## VIRTUAL DEVICE

The ADM106x Configuration Tool is designed to be as functional when working without a connected Evaluation board as it is when working with a board. This is referred to as working offline or online. When working offline the only difference is that the device cannot be stimulated by the evaluation board features. However all features of the device from the sequencing engine (see later section) to the input and output configuration settings can be programmed. In essence working offline is working with a virtual device. All these settings can be saved to file and recalled later either online or offline. It is recommended to emulate operation with a connected evaluation board to observe in circuit device behavior before implementing the device to perform its intended purpose. As mentioned on Startup in offline mode the device must be specified by selecting from an option screen as shown in figure 22 Any features not available on a selected device will not be enabled in the Configuration Tool. All settings should be saved before exiting the software.

## TOP LEVEL

Depending on whether the software is being run in on-line or off-line mode, one of the two following windows will appear:-

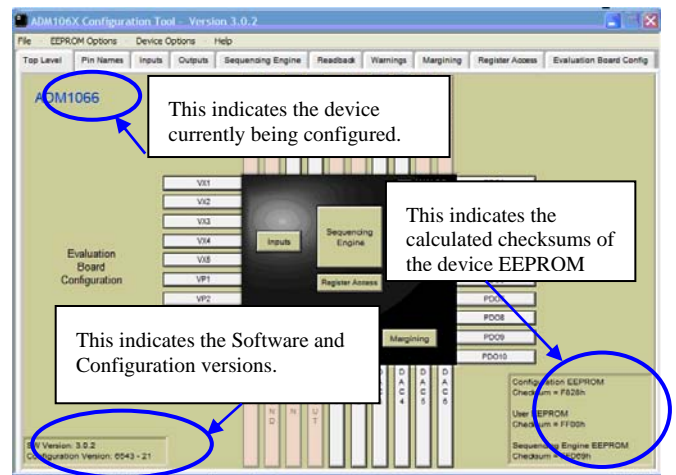


Figure 25. ADM1062 Top Level, device online

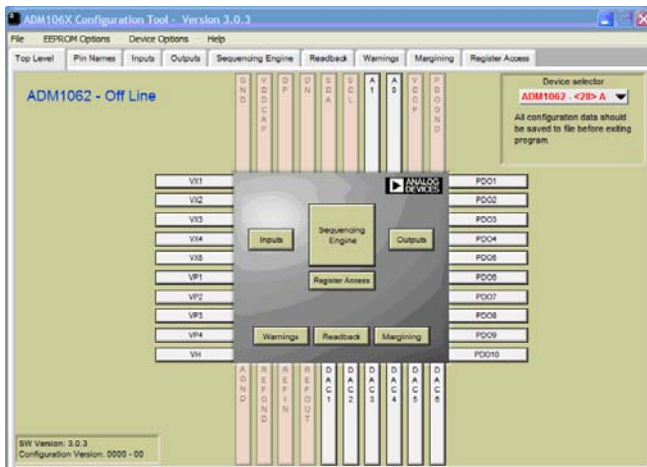


Figure 26. ADM1062 Top Level, software in offline mode

The Top Level provides a diagrammatic representation of the ADM106x and its functions. Depending on which of the ADM1062 to ADM1069 is selected, the features and pinouts will change accordingly. Note that the body of the diagram is greyed out in offline mode, indicating no device is connected.

This window is useful in showing where the relevant pins of the device reside. It also shows all of the pin names, which can be renamed (See rename pins section). In addition to pressing the tabs at the top of the page, the user is also able to navigate to other pages using the labeled buttons in and around the graphical representation of the ADM106x. For example pressing the button labeled 'Sequencing Engine' will navigate to that page.

Note that when switching between different devices the software recalls the configuration settings and Sequencing Engine program for each until the software is shut down. For example if the ADM1062 is selected and an SE program written and Pin names changed, after which a different device, say the ADM1069, is selected and programmed with a different sequencing engine and different pin names are entered, the software will recall the relevant SE program and Pin names when ADM1062 is selected and when the ADM1069 is selected. The sequencing engine and pin names are just mentioned as an example, in practice all configuration settings for each are recalled when the device is selected.

However it should be noted that all this information will be lost if the configuration settings for each device are not individually saved. This warning is present under the device select drop down menu and is also encountered when exiting the program. Again it must be stressed that configuration settings for each individual device should be saved as desired by explicitly selecting each device and saving these to separate files.

To save settings left click file on the top menu and left click <save offline settings to file>. Recall settings from file is just below this. It should also be noted that a warning is issued when the user

attempts to recall settings saved for one device when another device is currently selected. This is so because different devices do not all have the same properties or functionality. Therefore it is recommended to combine the device number in the name of each saved configuration file to aid in easy loading of configuration settings.

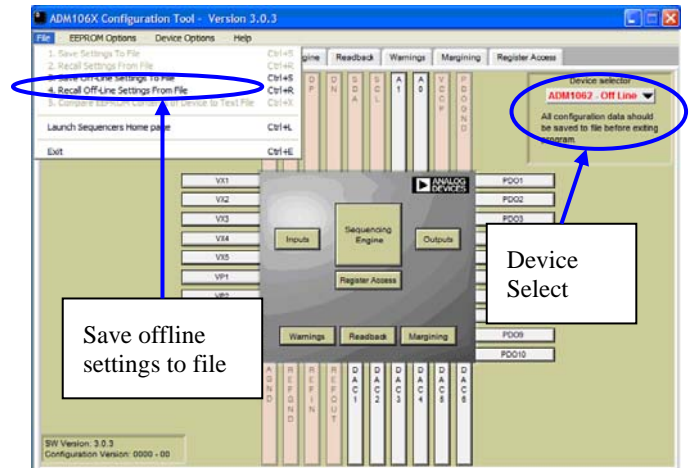


Figure 27 Selecting all devices and saving individual settings

If some of the devices configuration settings are modified but not saved on exit then these particular settings will be lost. Therefore settings for all modified devices should be saved individually. When only one device is selected, as illustrated in figure 26 where the ADM1062 is selected in offline mode, a similar situation exists for each of the four selectable addresses. If different configuration settings for different device addresses are entered then these configuration settings should be saved to files as required.

### MULTIPLE DEVICE SESSION

It may be required to use a number of devices simultaneously. Although this is not possible with the main evaluation board it is possible to cascade a number of Micro-Evaluation Boards together (see table 4 on page 4). When using devices in this manner over the SMBus it is important to set each device with a different address. The address is set by switch S2 on the Micro-Evaluation Boards. When the Configuration Tool is started with multiple devices connected the first window appears like this with connected devices appearing as a green box indicating the address of each.

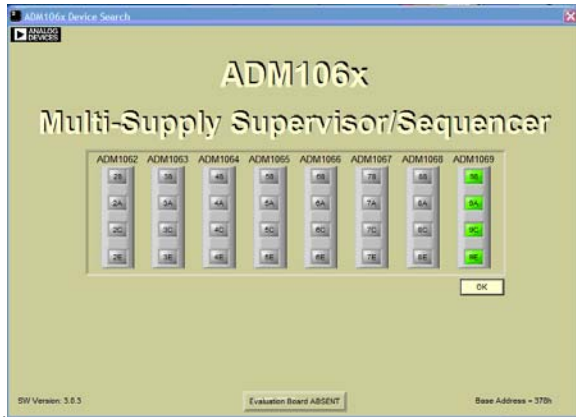


Figure 28 four ADM1069 devices at addresses 98 9A 9C and 9E

As with working in offline mode devices can be toggled using the device select drop-down menu in the Top level. When another device is selected none of the other devices on the SMBus are reset. This allows the user to program one device and allow this to run while using the configuration tool to interact with another device.

## COMMUNICATIONS STATUS

In all the windows in the software except the SE window, Pin names and Top level there is a comms status area at the bottom right hand corner of the window. In normal operation the Analog Devices symbol will spin indicating a successful SMBus transaction. However, if the comms are lost the red indicator will appear as shown in *figure 29* below. If the comms cable has become disconnected, plugging it back in will resolve the problem with no loss of data. (Parallel port operation only). However, the same message will be displayed if there is a loss of power to the ADM106x but it must be remembered that if the power to the ADM106x is cycled the data that was last saved to EEPROM will be uploaded to the software.

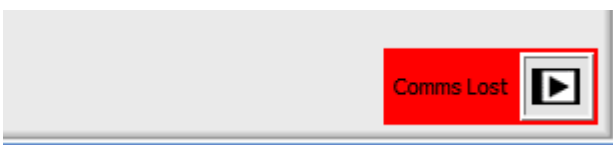


Figure 29. Lost Comms indicator

## CHECKSUM INFORMATION

To verify data integrity, the ADM106x software reports the checksum of the two EEPROM's on board. The checksum window is displayed in the bottom right corner of the Top Level screen in online mode. It splits out the information into four, reporting a value for :-

1. The configuration Registers checksum which holds the

checksum of the current configuration in use

2. The Configuration EEPROM which is stored on the device. While the configuration register checksum will change as settings are modified within the configuration tool the configuration EEPROM will only change when the current configuration is copied to the device.
3. The User EEPROM is 256 bytes of space accessible via the SMBus where the user can store data. The User EEPROM checksum reflects the current data in the device and this will again only change when data is copied from the configuration tool down to the device. Even if the User EEPROM is modified in the configuration tool via the Registers Tab and then saved to file the checksum will still reflect the contents of the device. The saved file will contain a checksum which reflects this modified data.
4. The Sequencing Engine EEPROM (stores the sequencing/monitoring configuration of the device) will reflect the current SE program in the device and will only change if a new SE program is copied to the device. Again if changes are made and saved to a file but not copied to the device then the displayed checksum will not be modified even though the appropriate checksum of the SE program in the configuration tool will be saved in the file.

The figure below shows how these values are reported:-

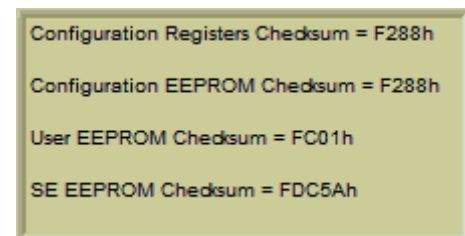


Figure 30. ADM1062 Top Level, software in offline mode

The values reported are directly out of EEPROM registers on the device. The actual checksum calculation takes place when the user selects <Copy Entire configuration to EEPROM> or when saving to file when a dialog box will ask the user if they want the controlling registers saved to EEPROM. The configuration registers checksum will indicate the checksum for the current configuration tool settings (input, output etc) however the configuration EEPROM checksum, User checksum and SE EEPROM are representations of what is currently in the device (i.e. when power is first applied to the device in its current configuration this is what will be present). In offline mode the checksum window is not displayed.

## PIN NAMES

The ADM106x provides the facility to rename the pins of the device, thus altering them from their default, datasheet names. This allows the user to have meaningful references to the inputs and outputs in their own board design. For example, if the pin VP1 was being used to supervise a 5V supply, the pin could be

renamed to 5V\_IN. All references to the VP1 pin in the software are then updated with the new name. However, pressing the 'Reset Pin Names To Default Names' Button will reset all pin names throughout the program to the names as shown in the data sheet. The pin name update window is shown in Figure 30 below:-

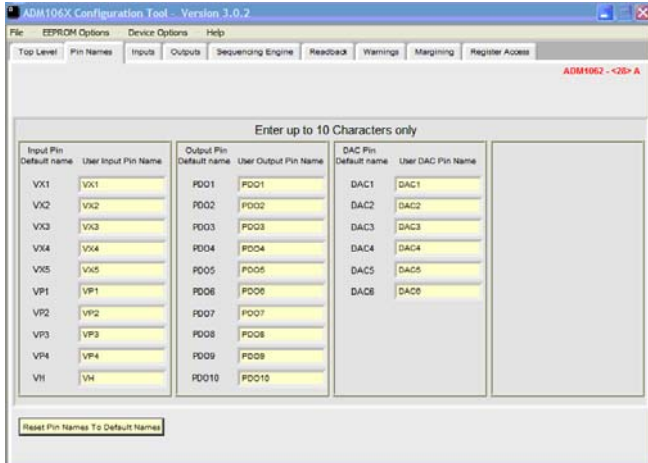


Figure 31. Pin Names window- default pin names

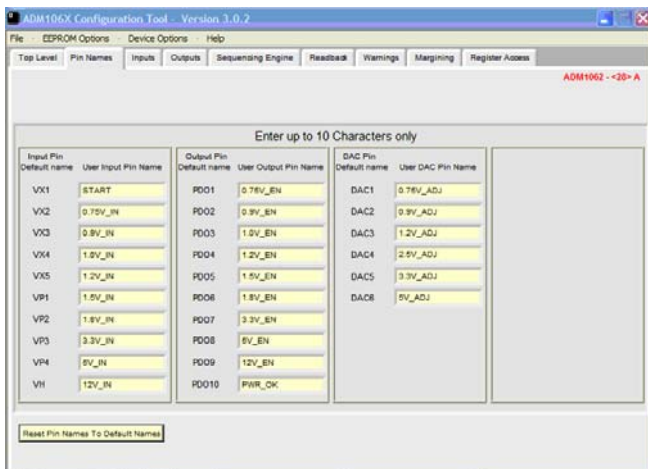


Figure 32. Pin Names window- altered pin names

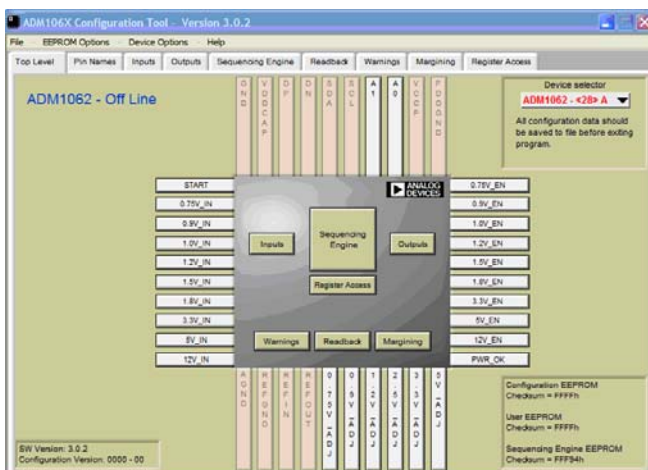


Figure 33. ADM1062 Top Level- revised pin names

**SUPPLY FAULT DETECTOR INPUTS**

The ADM106x features ten supply fault detector inputs (eight inputs in the case of ADM1068/9). These supply fault detectors (SFD) inputs are highly programmable circuits which provide the following features:-

1. Under AND Over-voltage detection or more specifically under-voltage (UV), over-voltage (OV) and out of window detection (UV & OV)
2. Programmable UV and OV threshold
3. Adjustable Hysterisis on every threshold
4. Up to 100us glitch filter to provide supply noise immunity

The inputs can be categorized in two groups- the VX pins and the VP/VH pins. The VP/VH pins are analog fault detectors only. The VX pins have a dual (analog and digital) input function. The software configuration of both types of inputs is described below.

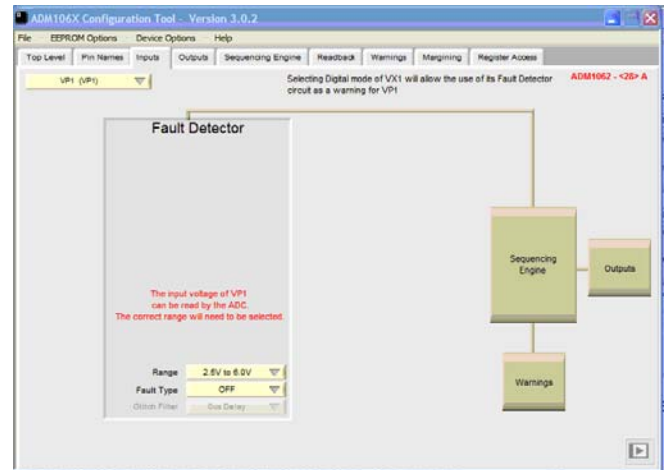


Figure 34. Inputs window- nothing programmed

**SELECTING THE INPUTS**

Any one of the ten inputs (eight for ADM1068/9) can be selected by left clicking in the drop down box shown below. Once selected, all of the functions altered in the window effect only the selected input. To configure another input simply select another one from the drop down box:-

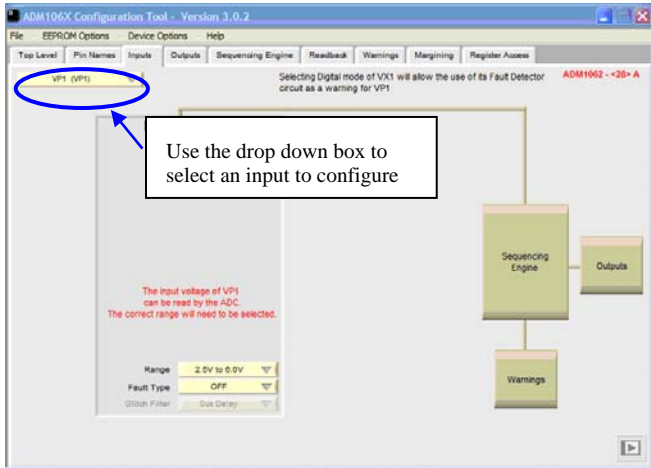


Figure 35. Selecting an Input

**SELECTING A FAULT TYPE**

One of three fault types can be selected for each input:-

1. Under-voltage:- the input must fall below the programmed threshold before a reset is generated
2. Over-voltage:- the input must rise above the programmed threshold before a reset is generated
3. Out-of Window:- either an under-voltage or over-voltage fault occurs.

The fault type is selected as shown in figure 35 below:-

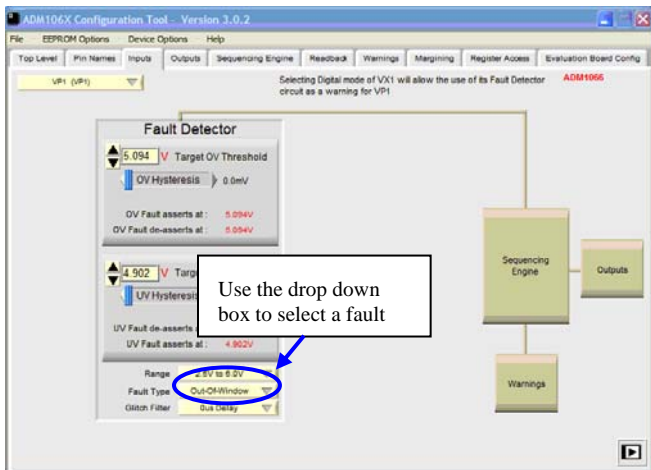


Figure 36. Selecting an Out- of Window Fault

**SELECTING A VOLTAGE RANGE**

The input pins of the ADM106x can monitor supplies over a wide range- from 0.573V to 14.4V. Not all inputs can monitor over this range- the GUI shows over what range a given input can detect faults. In order to maximize the resolution of the programmed threshold, each input has a number of ranges. These ranges overlap to ensure that any threshold can be programmed over the full range of an input. The following table shows the different ranges available at the inputs. Note that different devices may have a different number of each input however the range for each type of input will be the same. These ranges are important when monitoring a supply and an appropriate range for that supply should be selected to provide maximum resolution.

<u>INPUT</u>	<u>RANGE</u>
VX1-VX5	0.573V – 1.375V
VP1 – VP4	0.573V – 1.375V
	1.25V – 3.0V
	2.5V – 6.0V
VH	2.5V – 6.0V
	6.0V – 14.4V

Table 5 Input voltage ranges

VX1-VX5 are true High impedance inputs therefore a voltage divider can be used to monitor voltages outside the specified range. A voltage divider could also be employed at the VP inputs however an input buffer would also be required.

The input range is selected in the software as shown in figure 36 below:-

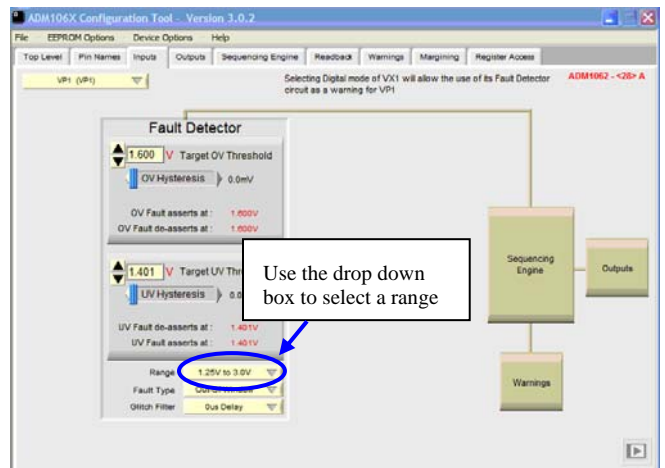


Figure 37. Selecting an input range

**PROGRAMMING AN INPUT THRESHOLD**

The Under-voltage and over-voltage thresholds are programmed by simply typing the required value in the input box indicated below and pressing <ENTER> on the keyboard. Once the user has entered a value the software will snap to the closest value that the resolution of the ADM106x's threshold DAC will allow. The target threshold is displayed in volts along with the values that the fault will assert and de-assert. The user can refine the value of the threshold on a per code basis using the Up/Down buttons to the left of the input window highlighted in the picture below. If the user inputs a value outside of the range selected, then the software will automatically snap back to the closest allowable value (e.g.) entering 4V on the 1.25V to 3V range will snap back to 3V. Also in Out-of-window mode the software will detect if the user is attempting to set the UV threshold higher than the OV threshold and will issue a warning as shown in figure 39

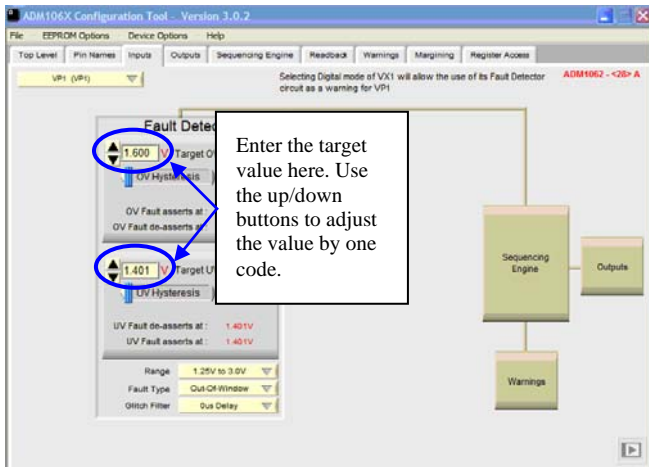


Figure 38. Entering a voltage threshold

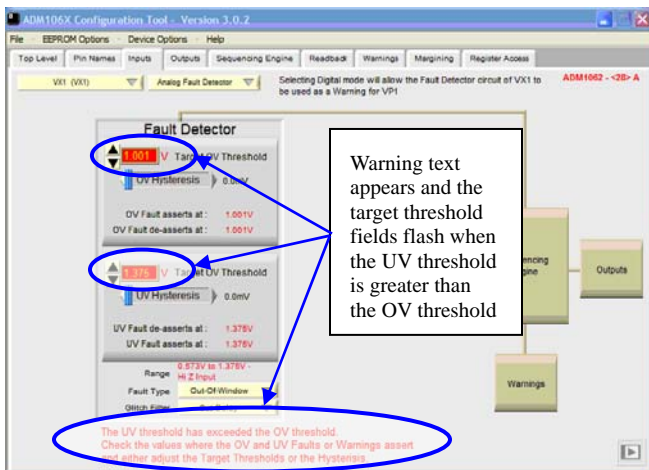


Figure 39. Warning when UV threshold is greater than the OV Threshold.

**PROGRAMMING HYSTERESIS ON THE INPUT THRESHOLD**

Hysteresis can be digitally programmed on the input selected. Hysteresis can be programmed on both the over-voltage and under-voltage detectors. In the case of the over-voltage detector, programming the hysteresis to, say, 50mV means that if an over-voltage fault occurs, the input voltage being supervised must drop 50mV below the programmed over-voltage threshold before the fault is de-asserted. In the case of the under-voltage detector programming the hysteresis to 50mV means that if an under-voltage fault occurs, the input voltage being supervised must rise 50mV above the programmed under-voltage threshold before the fault is de-asserted. The GUI displays the voltage at which a fault will de-assert once hysteresis is accounted for.

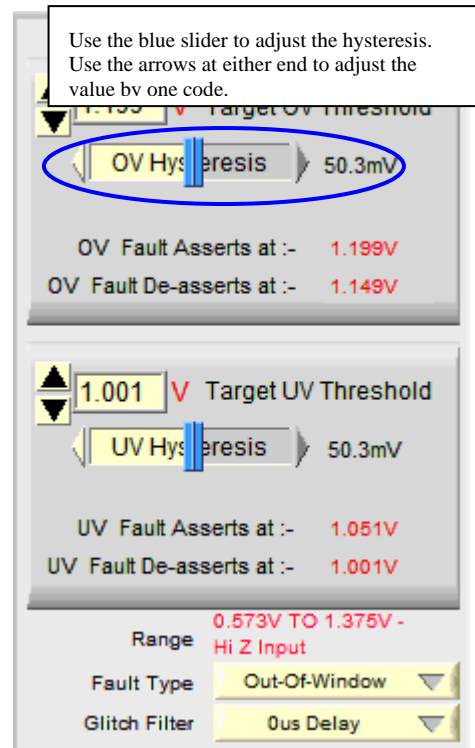


Figure 40. Programming Hysteresis

**GLITCH FILTERING**

The glitch filter is a useful function where the configuration tool can set the device to ignore any signal on the input for a specified period of time. Implementing such glitch filtering in software avoids the need for filtering capacitors in hardware. The delay can be selected from a dropdown menu by the user with delays of 0, 5µS, 10µS, 20µS, 30µS, 50µS, 75µS and

100µS available.

input pins. Once selected as a secondary detector, the analog circuit is programmed exactly the same way as the primary circuit. This is shown in the window below.

**THE VX PINS AS DIGITAL INPUTS**

VX1-5 have dual functionality. As analog inputs, they can be programmed as described above. The only difference to the VP/VH inputs is that there is only one range to be selected and offer a true high impedance input.

VX1-5 can also be programmed as digital inputs and these digital inputs are CMOS/TTL compatible. The features of the inputs in this mode are as follows:-

1. Can be programmed to detect either a level or an edge
  - If selected to edge detect, then the digital block can be programmed to output a pulse of width programmable up to 100ms
2. Can be programmed to respond to either a rising or falling level/edge
3. A weak pull-down to GND is available on each input, so that if the pin is left floating, it can be driven to a known state.
4. A glitch filter (the same as that provided for the analog inputs) is available to provide noise immunity/ signal de-bouncing.

Programming of VX1-5 in digital mode is shown below.

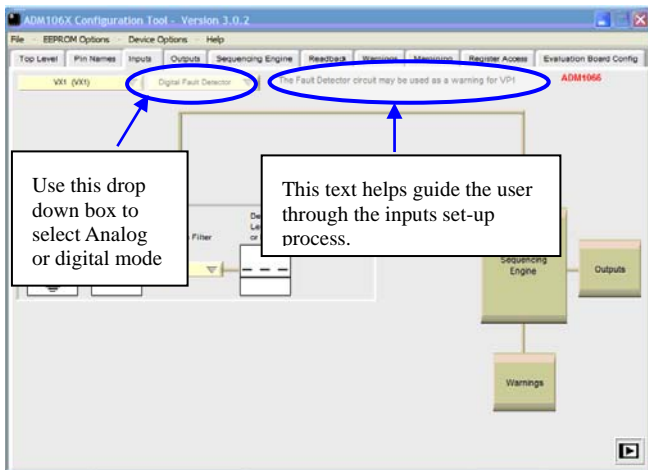


Figure 41. Programming a VX pin in digital mode

When used in digital mode, the analog detector circuit, although disconnected from the VX input pin, is still available for use. The circuit can be mapped to one of the other inputs to provide a second detector on that pin. VX1 is mapped to VP1, VX2 is mapped to VP2 etc. VX5 is mapped to VH. (The text as indicated in figure 42 helps the user with this process). This allows the user to set up an ALARM and FAULT window on a supply without using up extra

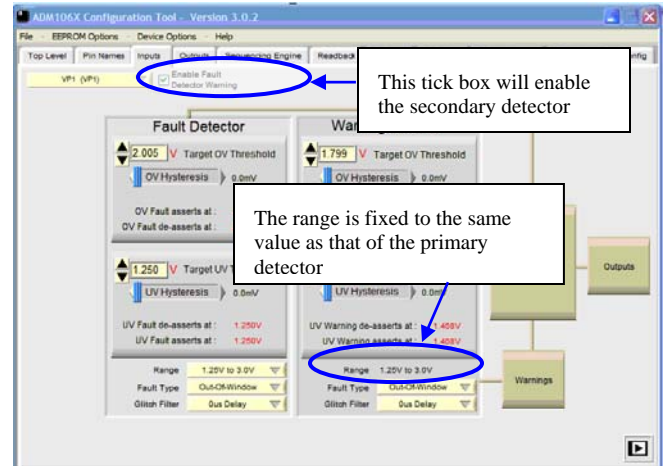


Figure 42. Using the secondary detector on VP1

From the inputs window it is also possible to navigate to the sequencing engine, outputs or warnings page by simply left clicking in one of the boxes indicated in figure 43.

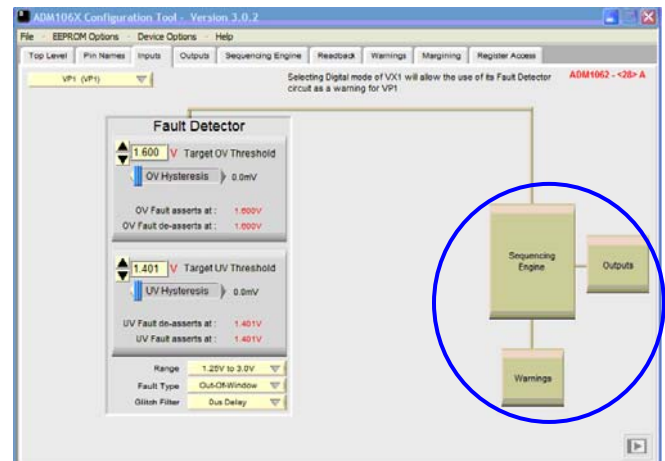


Figure 43. Navigating to other windows using the flow boxes



### PROGRAMMABLE DIRECT OUTPUTS (PDO)

The ADM106x features ten PDOs (eight inputs in the case of ADM1068/9). These outputs can be used to control the turn-on/off of supplies. The outputs are highly configurable. They can be programmed to pull- up to a number of different options. The outputs can be programmed as follows:-

- Open Drain (allowing the user to connect an external pull-up resistor)
- Open Drain with weak pull-up to VDD
- Push Pull to VDD
- Open-drain with weak pull-up to VPn
- Push-pull to VPn
- Strong pull-down to GND
- Internally charge- pumped high drive (12V- Available on PDO 1- 6 Only)

The data driving each of the PDO's can come from one of three sources. These are:

- An output from the Sequencing Engine (normal operation- where the ADM106x independently controls the sequence of supplies).
- Directly from the SMBus. A PDO can be configured so that the SMBus has direct control over it. This enables software control of the PDO's. Thus, a microcontroller could be used to initiate a software power-up/power-down sequence.
- An On- Chip Clock. A 100KHz clock is generated on the device. This clock can be made available on any of the PDO's. It could be used to clock an external device such as a LED, for example.

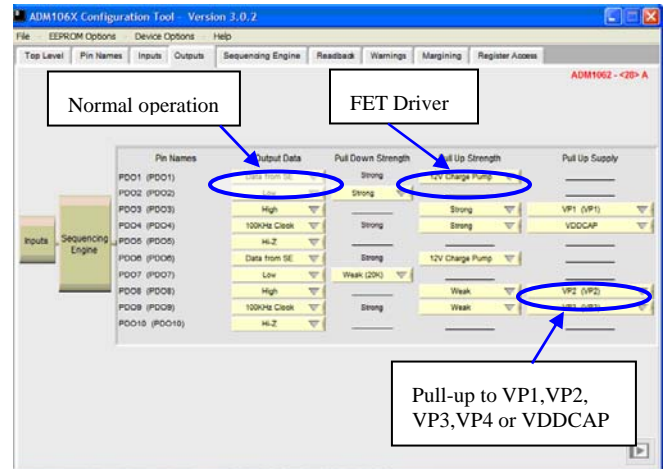


Figure 44. Programming outputs on ADM106x

### SEQUENCING ENGINE

The logical core of the ADM106x is the Sequencing Engine. This is a state machine based architecture which determines how the ADM106x reacts to events as they occur. These “events” could be a supply coming in to tolerance, a supply failing, a digital input being asserted etc. The ADM106x provides 63 states, allowing the device to control the sequence of up to 63 events. The ADM106x's control of the outside world is through its programmable outputs, so their logical status can be set in each state. For instance, the first state could be set up to check that a supply is in tolerance. Once this is the case, the sequencing engine can proceed to the next state where the next supply is enabled by driving its controlling PDO high. A diagram of a state cell is shown below.

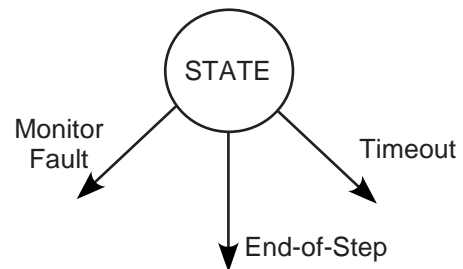


Figure 45. ADM106x State Cell

The diagram shows that once a state is entered, there are three possible ways to leave that state:-

1. **End of Step-** This is the primary way to leave a state. The user can choose a single event (e.g.) an input signal going high- to allow the engine to progress to the next state. By selecting the end of step condition in a number of states, the user defines the sequence in which event must happen (i.e.) the sequence in which supplies are turned on/off.
2. **Timeout-** This provides a safety net if an End-of Step

fails to occur. The user can set a time limit on how long it can take for the End-of Step to occur. If the event does not happen, then the user can take the decision to take some remedial action (e.g.) if a supply fails to come into tolerance after 100ms, it is likely that there is a fault on that supply and the user may wish to shut all supplies down.

3. **Monitor**- While the End- of Step function focuses on a single event, the Monitor function provides the ability to ensure that any/all previous events are still valid (e.g.) if the ADM106x is about to turn on supply number 6, it can check that supplies 1-5 are still in tolerance. It does this by simply OR'ing the status of selected blocks together. If any one of these events fails then the Monitor function will exit to a state that takes remedial action (e.g.) to shut off all of the supplies.

The ADM106x software Sequencing Engine window provides the facility to edit each state individually, then report the configuration of all of the states together, so that the user can easily read the flow of events that need to occur. The Sequencing Engine window is shown in *figure 46*:-

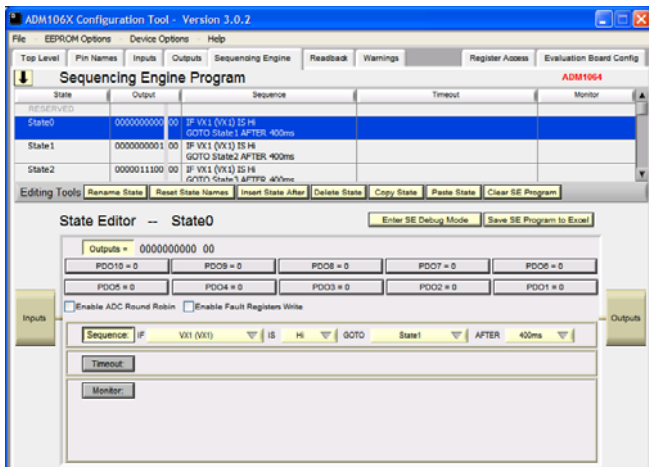


Figure 46. ADM106x Sequencing Engine programming window

**PROGRAMMING THE PDO'S**

The State editor allows the user to program each state individually. The program flow from top to bottom of the state editor is:-

1. PDO's
2. Sequence (or End of Step)
3. Timeout
4. Monitor

When programming a state, the user should consider what events need to happen in the order suggested by the software. The first thing to consider when entering a state is what should the outputs of the ADM106x be doing. For instance, in the first state, the user may want to wait for the ADM106x to detect that a digital input has been asserted before anything is enabled, in which case, all of the PDO's

should remain low (0).

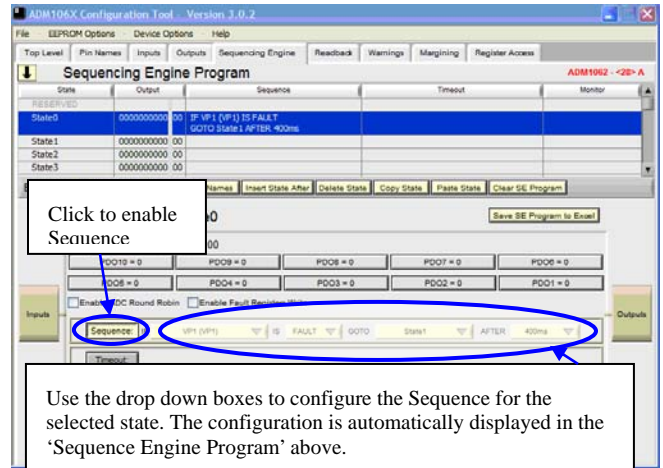


Figure 47 Entering a Sequence

**PROGRAMMING THE SEQUENCE FUNCTION**

To enable the Sequence function, click the Sequence> button. Programming the Sequence function is formatted into an "IF event occurs, then GOTO State X after Yms" statement. The drop-downs force the user to configure the Sequence in a valid format. The first drop-down box lists the events that could progress the sequence. They are:-

**1. The inputs**

A valid condition on these (e.g.) a supply in tolerance, a digital input asserted- could dictate the sequence.

**2. Warning**

Warning is a signal from a wide OR gate which can be used to dictate the sequence. The inputs to this OR gate are:-

- i. The output from the secondary detectors on VP1-4 and VH
- ii. The status of the ADC channels on the inputs (i.e.) whether the value read exceeds the value set in the limit register (see section on Read-back)
- iii. The status of the ADC channel on the internal temp sensor and D1P/D1N (ADM1062/3) and D2P/D2N (ADM1063 only)
- iv. The status of the ADC channels on AUX1 and AUX2 (ADM1066 only).

**3. SMBus Jump**

The sequence will enter the state where this command has been selected and wait for an SMBus Jump command to be issued by the user

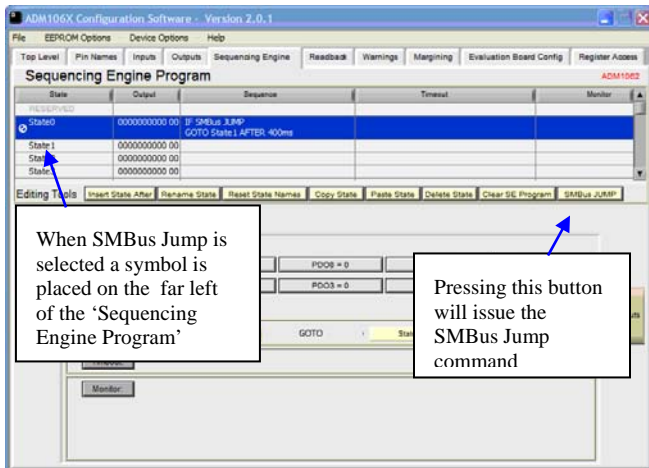


Figure 48. SMBus Jump

**PROGRAMMING THE TIMEOUT FUNCTION**

Programming the Timeout event is the opposite of programming the Sequence. It takes the format “ IF event has NOT occurred AFTER Xms THEN GOTO StateX. The software automatically generates most of the statement. The only programmable elements are the length of the timeout and the State to exit to.

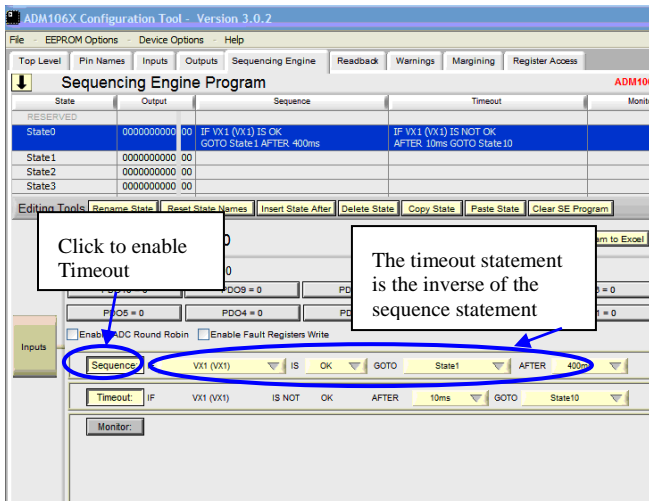


Figure 49. Programming the Timeout

The Timeout function can also be programmed independently of the Sequence function. In this case there will be an unconditional timeout before moving to the next state. The user can program this simply to put an extended delay between one event and the next occurring. The maximum timeout delay is 400ms, but if a delay longer than this is required, the user can cascade a number of states together, setting the Timeout in each state.

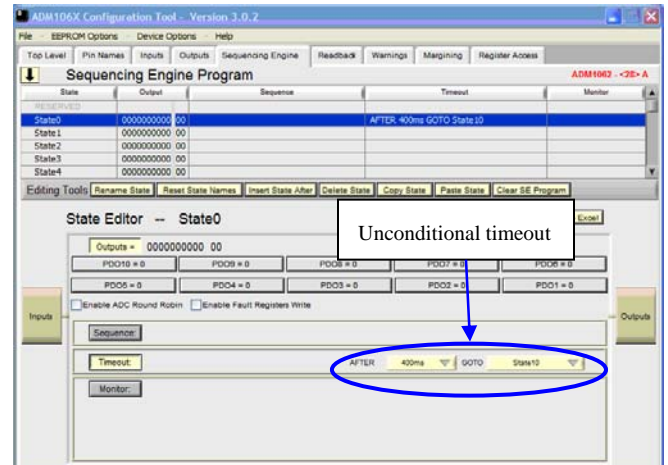


Figure 50. Programming an unconditional Timeout

**PROGRAMMING THE MONITOR FUNCTION**

The Monitor function, as described above, is a wide OR gate whose inputs are the status of all of the ADM106x’s inputs, including the ADC inputs (these are OR’ed together prior to this and output a single WARNING function). The user can select which inputs are to be monitored in a given state, and the polarity that input must assert before action is taken. The action taken is to GOTO another state. Again, the user can select which state to go to.

Note: The supply fault detectors assert a 1 when a fault is detected. When programming the Monitor function the user should select “IF <INPUT = 1>” if they want action to be taken when a supply goes out of tolerance. The software will indicate if the VXn is in digital or analog mode by displaying Hi/Lo if the VXn input is set to a digital mode and OK/FLT if it is set to analog mode.

The programming of the Monitor function is shown below.

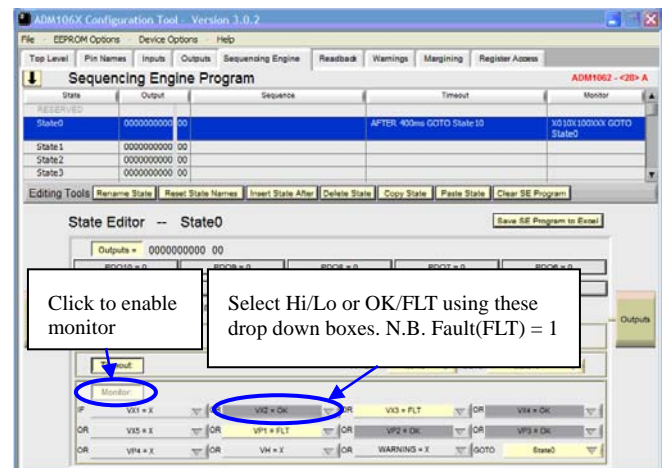


Figure 51. Programming the Monitor Function

Programming the Monitor function can also be done independently of the Sequence or Timeout function. For instance, once a power up sequence is completed, the user may

only be interested in taking action if a supply subsequently fails. In this case, only the Monitor function needs to be programmed.

**EXPANDING THE SEQUENCE SCREEN**

In most applications the sequencing engine program will become long and complex. To view the program in full screen click the up/down arrow icon left of the 'sequencing engine program' title to expand/shrink the program window. See figure 52.

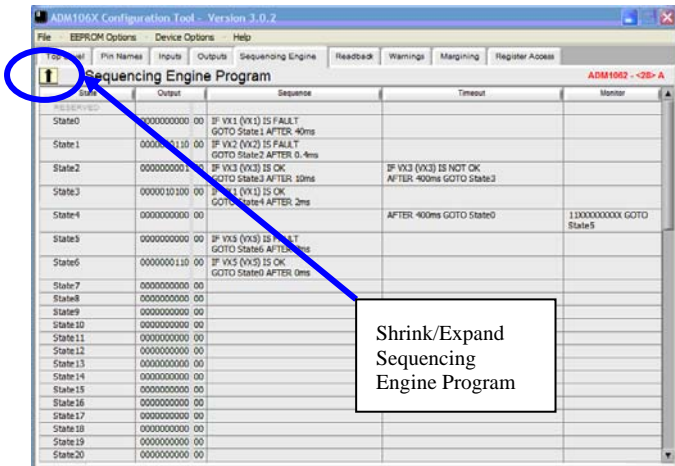


Figure 52. Expanding Sequencing engine program

**ENABLE ROUND ROBIN (ADM1062/3/4/6/9)**

The ADM1062/3/4/6/9 have an on-board, 12 bit ADC. A 12 channel (13 on the ADM1063) mux enables the ADC to measure the voltage on the input pins, the temperature sensors (ADM1062/3) and the auxiliary pins (ADM1066). The user can choose which inputs the ADC reads (see section on Read-back). Once selected, the ADC cycles around each of the selected inputs in a "Round Robin" fashion and does a conversion on each channel. The Round Robin can be enabled in each individual state. This level of control is provided since the user is unlikely to always want the ADC to be converting. A typical example would be during a power up sequence. As supplies are turning on, and have yet to reach their nominal value, measuring the voltage as they ramp up is of little meaning, since as this value is communicated across the SMBus to a processor the voltage will already have increased to a different value. Once the supplies have reached a quiescent condition, the user may wish to monitor exactly what level the supplies are at. Thus, the user could enable the Round Robin in the quiescent or POWER GOOD state.

**ENABLE FAULT LATCH**

The ADM106x contains a fault plane (consisting of a number of registers) which indicate the exact source of a fault once it occurs. A bit each in these registers is assigned to the input channels of the device. Enabling the fault latch ensures that the fault events are latched on this fault plane, allowing the user to read the fault registers in order to determine which input faulted. Again, the fault

latch can be enabled on an individual state basis. Typically the fault latch is enabled in a powerloop state to capture faulting supplies. It is not normally enabled during power up or power down sequences where many supplies would be off and register as under voltage (UV) faults. UV or over voltage (OV) faults can also be distinguished.

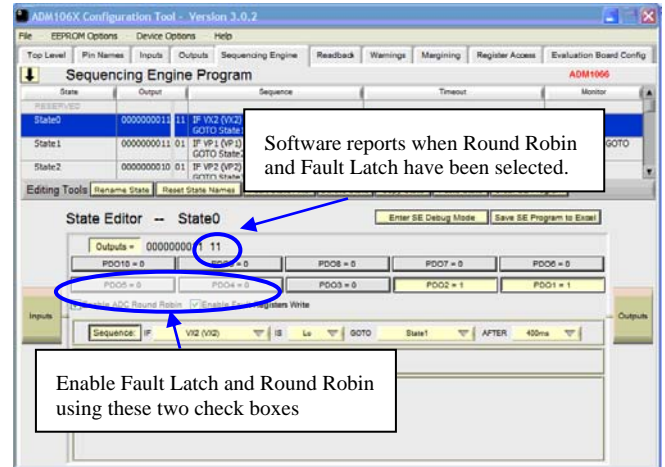


Figure 53. Round Robin/Fault Latch Enable

**SEQUENCING ENGINE PROGRAM EDITING TOOLS**

The 'Sequencing Engine Program' is a textual description of what each state is programmed to. To edit a state, click on the line in which this state appears. The contents of this state program will appear in the 'State Editor'.

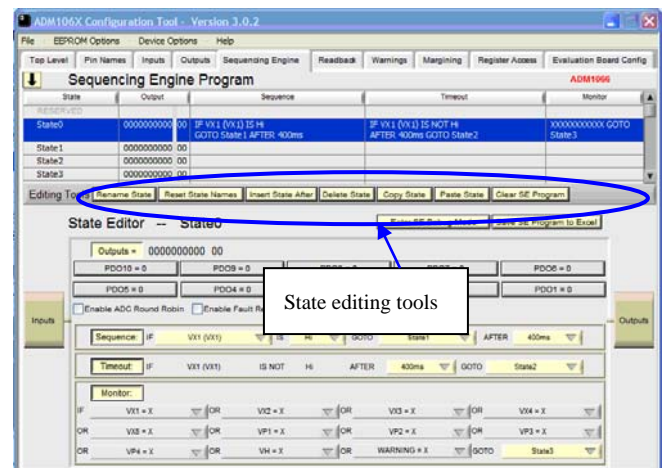


Figure 54. Sequencing Engine Program

Once a state has been programmed, the user may wish to do a number of things with it:-

**Insert a State** - Once clicked, a dialog box appears as shown in *figure 55* informing the user that a blank state will be inserted after the highlighted state.

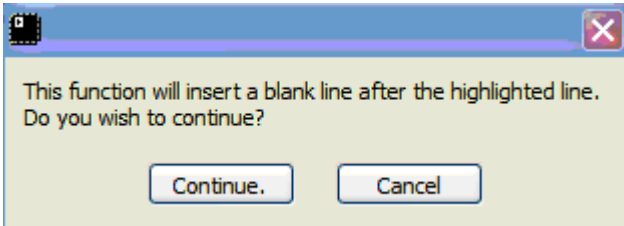


Figure 55. Insert state dialog box

By pressing <Continue> a blank state will be inserted after the highlighted state and a second window as shown in *figure 56* will be launched requesting that a State name is entered for the new state.

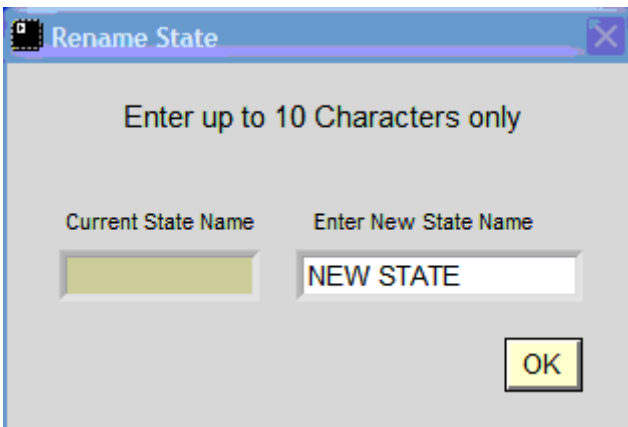


Figure 56. Rename state window

Once the new name has been entered click on <OK> The software will check that the name entered is not a duplicate name of another state. If it is a dialog box will appear as shown in *figure 57*.

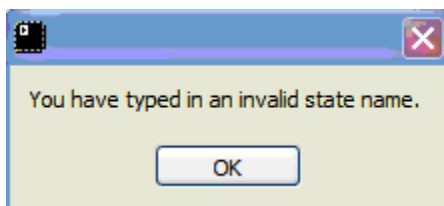


Figure 57. Invalid state name dialog box

If a valid name has been entered the software will update the Sequencing engine window. All subsequent states shuffle down, maintaining their State names. For example, if a state was inserted after state 0, State 1, although now the third state will still be called

State 1.

It must be noted that a state can not be inserted before the very first state.

**Rename a State** - The State names can be altered to make them more meaningful (e.g.) a state to check if a 3.3V supply is valid could be called CHK\_3.3V.

This function is very similar to the naming a new state as described above. The only difference is that the user is not forced into renaming the state because there is a cancel function available as shown in *figure 58*. The renamed state can be up to 10 characters long and all references to this state will be updated automatically with the new name.

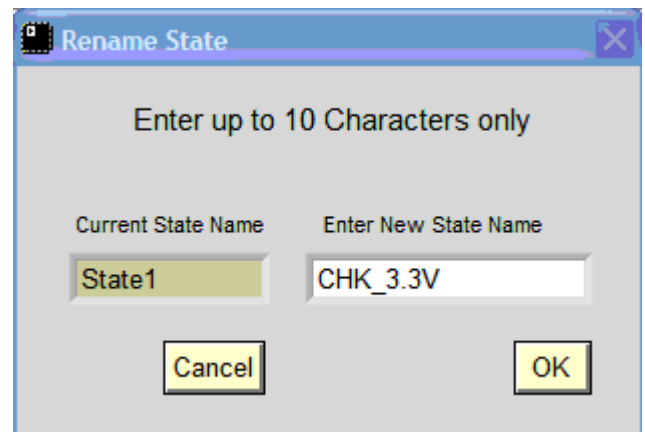


Figure 58 Rename state window with cancel function

As with the rename state function described in the Insert state section, once <OK> has been clicked the software will check that the name entered is not a duplicate name of another state. If it is a dialog box will appear as shown in *figure 56*. If a valid name has been entered the software will update the Sequencing engine window.

**Reset State Names** - This function will reset all the state names to their default names i.e. State0 - State62

**Copy/Paste a State** - The SE functions copy and paste data from one state to another.

The copy function will copy all the data of the highlighted state.

The paste function will paste the data into the highlighted state overwriting the data in that state. This function will not overwrite the existing state name and may be used in more than one state.

**Delete a State**- Because deleting a state may affect other states (Due to it referring to other states, or other states referring to it), a dialog box containing a report of the affected states as shown in *figure 59* is generated by the software.

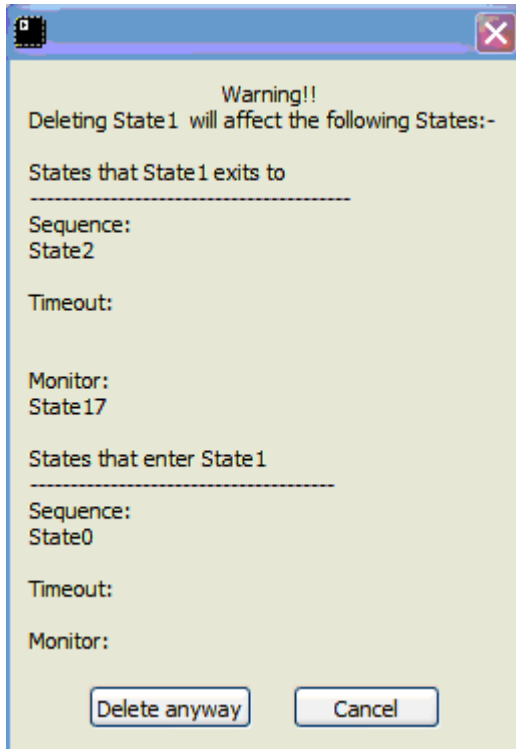


Figure 59. Delete report dialog box

The user can then choose to delete anyway or cancel. If deleted, all subsequent states will shuffle up one but all the state names are maintained. In order to still provide a total of 63 states, a blank state is appended at the bottom of the program in the first available blank state. All states that previously referred to the deleted state now refer to this new blank state.

**Clear SE Program** - This function will clear the current displayed SE program leaving the user with a default state editor. The current configuration will be lost but the data held in EEPROM will still be intact and can be displayed in the SE editor by cycling the power.

### SEQUENCING ENGINE DEBUG MODE

A Debug option is also available which allows the user to step through the Sequencing Engine program slowly to determine any potential problems. This is located just beneath the editing tools, labeled “Enter SE Debug Mode”. This mode is only available when using the evaluation board and is not enabled when working offline. When < Enter SE Debug Mode> is clicked the screen in *figure 60* appears.

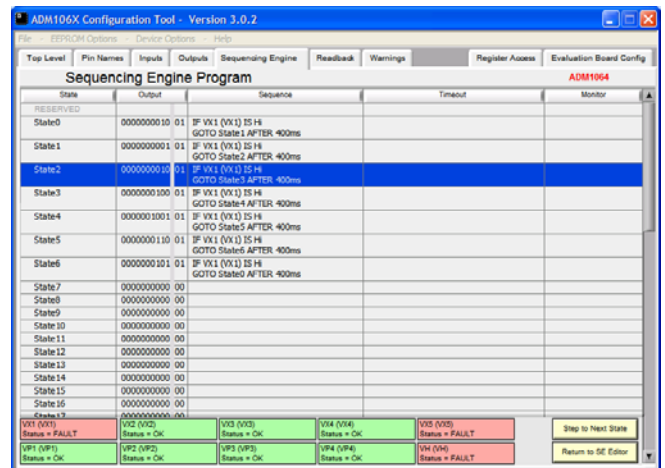


Figure 60 Sequencing Engine Debug screen

At the bottom of the screen the inputs VX1-VX5 (VX1-VX3 in the ADM 1068/9), VP1-VP4 and VH are shown, with the color indicating the current status of the input. Red indicates a FAULT while green represents an OK status when using analog inputs. For digital inputs green indicates HIGH while yellow indicates LOW. The sequencing engine program can be stepped through by left clicking <Step to Next State> at the bottom right of the screen. When completed left clicking <Return to SE Editor> will return to the previous screen where any necessary changes can be made.

### SAVING THE SE PROGRAM TO EXCEL FILE

A useful function also included is the Save SE Program to Excel option. This is located next to the Debug option beneath the Editing Tools. Left clicking <Save SE Program to Excel> brings up the “Save SE Spreadsheet” window with the file name by default set to the current time and date (*see figure 61*). This name can of course be changed to anything although using the date and time makes retrieval of different versions of a program easier. Once a name and directory for the file have been chosen the entire SE program is saved to an Excel file, divided into fields called State, Output, Sequence, Timeout and Monitor as shown in *figure 62*. This also allows for easy import/export of an SE program which can be sent as an email attachment etc.

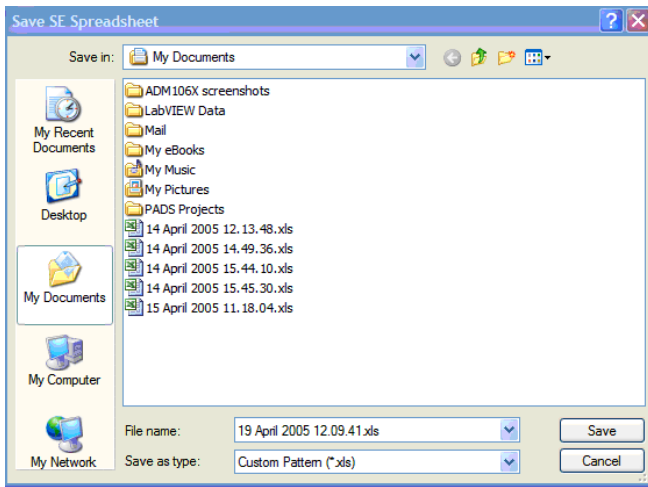


Figure 61 Save SE Spreadsheet

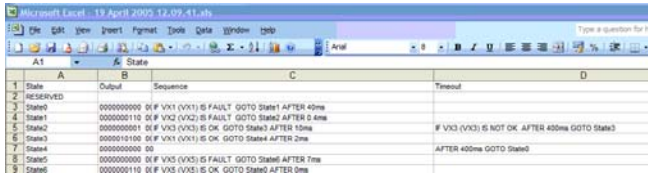


Figure 62 Save SE Spreadsheet

**READBAC (ADM1062/3/4/6/9)**

The ADM1062/3/4/6/9 have an on-board, 12 bit ADC. A 12 channel mux (13 on the ADM1063) allows the ADC to measure the voltage on the input pins, the temperature sensors (ADM1062/3) and the auxiliary pins (ADM1066). The user can choose which inputs the ADC reads by clicking the tick box of the desired input in the readback window and can also choose to 'read Once' or 'continuously read' the voted in channels. As explained earlier the software automatically detects the ADM106x device or devices on the SMBus and configures the software accordingly. If an ADM1062/3 is detected then the Readback window will display a temperature graph as can be seen in figure 63.

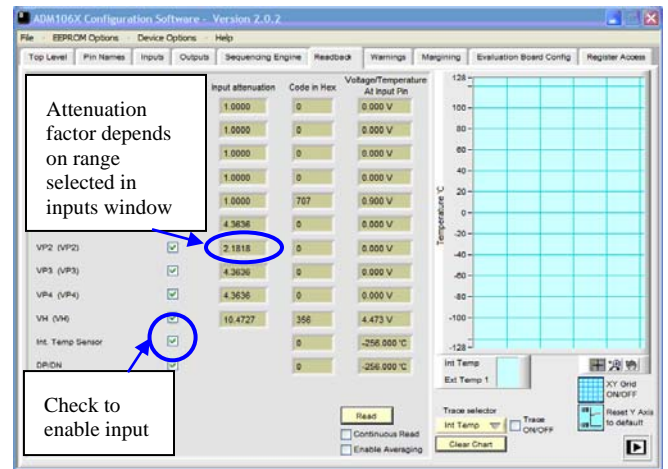


Figure 63. Readback Window

**Input Attenuation** - Selecting ranges on the input channels was discussed in the INPUTS section. By changing the range, a different attenuation network is selected, thus scaling the input voltage by a different factor. The scaling is done so that the input can be compared to the on-chip 1.2V reference. The scaling is reported in the third column and shows the user how the voltage is calculated. It also helps the user to understand the code reported in the fourth column. This is useful where the input voltage is a value which lies in the overlap region between one range and another. **Code in Hex**- This is a 12 bit hex version of the binary output from the ADC

**Voltage/Temperature**- This is the actual voltage/temperature measured at the input. The software calculates the voltage in the background, taking into consideration the attenuation factor. The readback window also incorporates a temperature chart for ADM1062 and 63 only

**Continuous read/Averaging**- A read is initiated in the software by clicking <Read> . The user can then see the Code in Hex and Voltage/temperature windows of the selected channels updating. The user can choose to do a single shot read of the selected channels or, by clicking in the <Continuous Read> tick box, have the ADC cycle around each of the selected channels until the <STOP> button is pressed.

If the user is concerned about noise on the input channel being measured, the Averaging function can be turned on by clicking the tick box. When enabled, the ADC will perform 16 consecutive measurements on a channel before returning the mean average value of these measurements.

**WARNINGS**

The WARNINGS function is a wide OR gate which is available as an input to the Sequencing Engine and can be used as condition to move out of a State. The inputs to this OR gate are the status of the secondary voltage detectors on VP1-4/VH and the status of the ADC readings relative to their limit registers.

In the WARNINGS window only the ADC inputs to the function can be programmed. The status of the secondary voltage detectors is merely reported. The WARNINGS window is shown below.

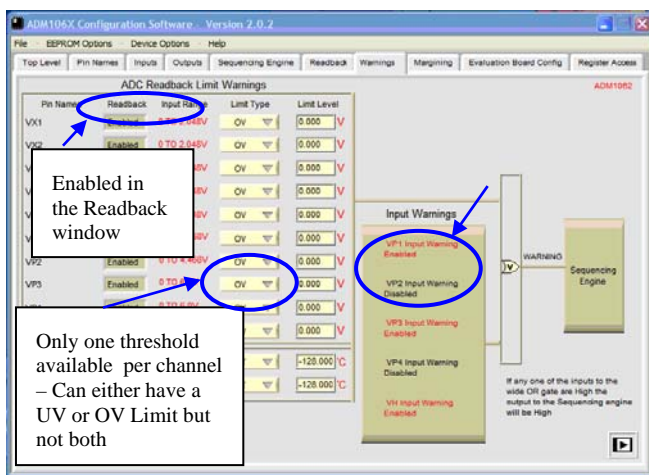


Figure 64. Warnings window

The ADC Readback Limit Warnings section of the window reports the following information:-

- Pin Names-** The inputs to the devices. These pin names are updated with any changes made in the Pin Names window (see section on Pin Names).
- Readback-** Reports if an input channel has been enabled to be read as part of the Round Robin. The channel is actually enabled in the Readback window.
- Input Range-** This shows the maximum value allowed on the input channel. This maximum value is dictated by the input range selected in the Inputs window. Note that the maximum input voltage allowable for the ADC can be higher than is allowed for the Supply Fault detector on the same input. Table 6 below shows the maximum allowable voltage for the SFD and the ADC on the same channel.

**Table 7. Max Input voltage allowed on SFDvs. ADC**

RANGE	Max SFD voltage allowed	Max ADC Voltage allowed
0.573V to 1.375V	1.375V	2.048V
1.25V to 3.0V	3.0V	4.468V
2.5V to 6.0V	6.0V	6.0V
6.0V to 14.4V	14.4V	14.4V

- Limit Type-** A fault can be indicated if the input voltage read by the ADC is higher than the value set in the limit register (an Over voltage or OV condition) or if the value read is lower than the value set in the limit register (an Under voltage or UV condition).

Note: Only one limit register is available for each ADC channel so an Out of Window fault (UV or OV) cannot be indicated.

- Limit Level-** A limit register is provided for each of the input channels to the ADC. In this register, the user can program a voltage value. This value is then compared to the ADC reading for the channel. If the reading is above or below the limit value (this is determined by Limit Type- see note 4 above) then a fault is asserted.

**MARGINING**

The ADM1062/6/7/9 have six (four on the ADM1069) voltage output DAC's. These can be used to margin up to six different supplies up or down. The DAC's on the ADM1067 operate in an open loop manner. On the ADM1062/6/9, the DAC's can be used in conjunction with the ADC to perform closed loop margining on the supplies (ie) the DAC can be used to alter the supply, the ADC can be used to measure the supply and ensure that it is at the correct value, if not then the DAC can alter the supply again etc.

The margining window is in two parts, the first window shown below in Figure 65, is the calculator window. This window guides the user through the calculation process for a give DC-DC converter output. This is achieved by simply filling in the resistor and feedback fields. The software will calculate the rest and prompt the user when limits have been exceeded. (See figure 66)



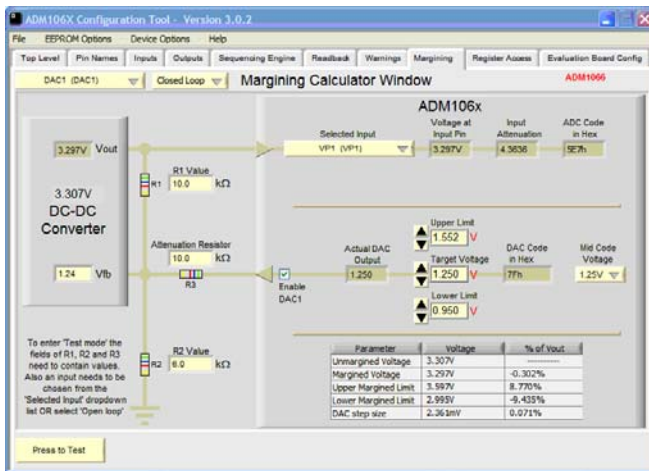


Figure 65. Margining window (Calculator)

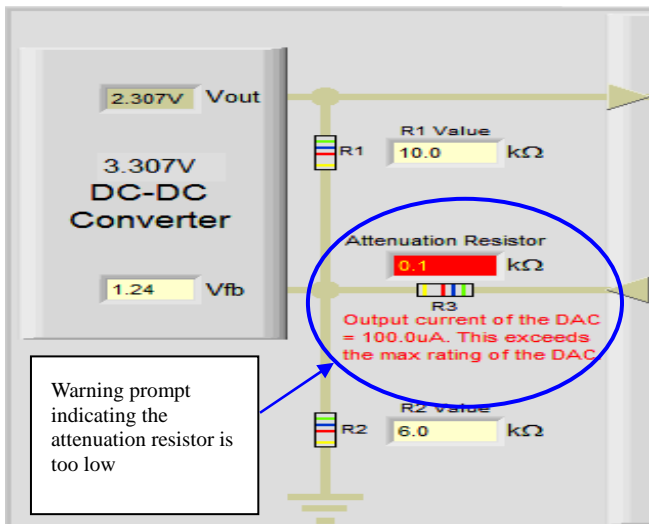


Figure 66. Margining window warning prompt

Once the calculations are complete the margining window can then be put into test mode see *Figure 67* . This button is positioned at the bottom left hand corner of the window and is only visible when all the relevant fields of the calculator have been filled with data.

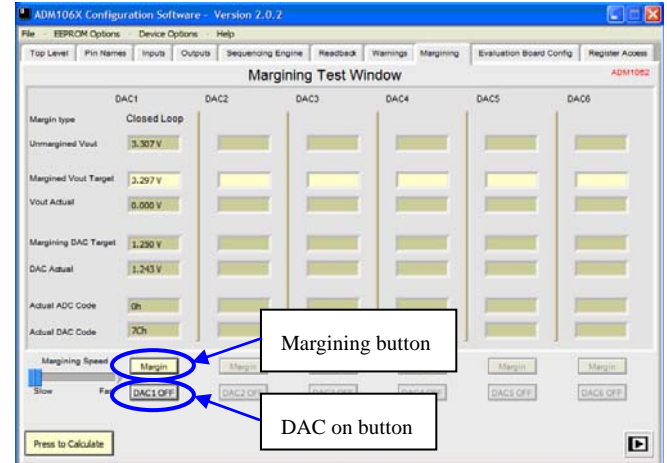


Figure 67. Margining window (Test)

The test widow allows the DAC to margin to the limits set in the calculator window. This is achieved by turning on the DAC and pressing the margining button. The software will then take control and margin up or down as is necessary. When the limit has been reached the software will continue to monitor the target voltage against the actual voltage. Any drift due to temperature or load will be detected and the software will adjust the DAC accordingly.

Any one of four mid code voltages can be selected in the software. These voltages are 0.6V, 0.8V, 1.0V and 1.25V. These four voltages are typical feedback voltages on many DC/DC Converters. The DAC's can be programmed to output a voltage range of +302mV and -300mv around these mid code voltages. There are a number of safety features built in to the DAC's.

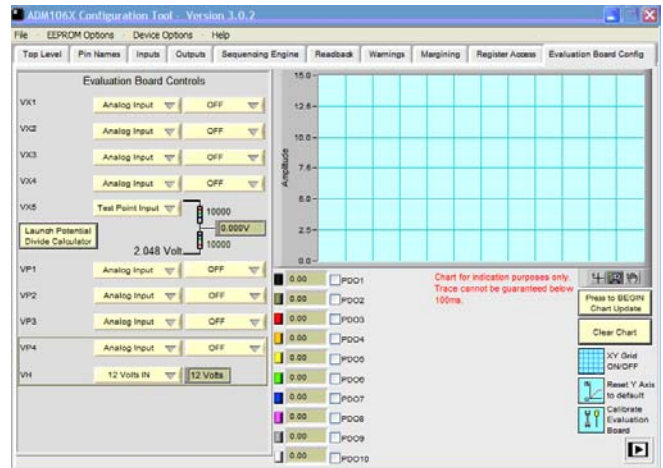
1. The DAC outputs are high impedance if not enabled (ie) they do not interfere with the feedback node of the DC/DC converter.
2. Upper/Lower limit registers are provided- once a value is programmed in these, the output voltage can never rise above/fall below these values. The Actual DAC Voltage box in the window above highlights this to the user.
3. If the Lower Limit is programmed higher than the Upper limit, the output of the DAC will go high impedance.

**EVALUATION BOARD CONFIGURATION**

The ADM106x Evaluation Board provides all of the external circuitry necessary to demonstrate the many features of the ADM106x. The circuits provided include:-

- LDO's with programmable output voltage. These can output voltage from 0.6V to 5V
- A fixed 12V available for the VH input
- Dual colour LED's for indicating the status of PDO's 1- 6. RED indicates operation in FET Driver mode. GREEN indicates operation in logic output mode.
- GREEN LED's for indicating the status of PDO's 7- 10.
- Four N Channel FET's to enable source side voltage measure- this emulates FET based sequencing on the Evaluation Board.
- An ADC to provide measurement of the PDO output voltages.
- PNP transistors- used as remote temperature sensors.
- An FPGA controls all of the switching in and out of the many features listed above.

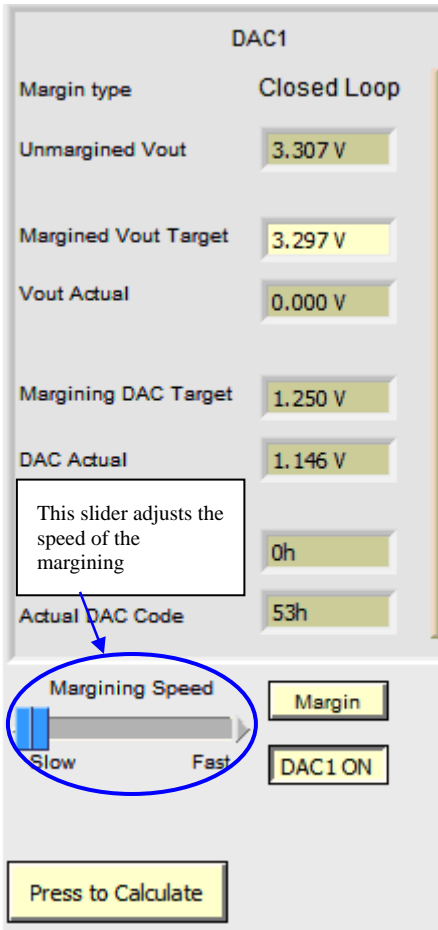
Most of the features are controlled by a single Evaluation Board window, shown below in *Figure 69*:-



*Figure 69. Evaluation Board Configuration window*

**CONFIGURING THE EVAL BOARD INPUTS**

The inputs of the ADM106x have a number of functions. The VX pins can be used as either analog or digital inputs. The VH and VPn pins can be used to look at an LDO output or at, say, the source side of a FET. The ADM106x evaluation board can be set up to provide all of these stimuli to the ADM106x.



*Figure 68. Margining window (Test)*

Only the DACs configured in the calculator window can be controlled in the test window. All the DACs that are not configured are grayed out and disabled. *Figure 68* shows an active DAC, Margined Vout target can be altered only when the margining is off. Once again the software will prompt the user when they have entered a value that is out of range.

**VX pins**

There are four possible inputs to the VX pins:-

1. **An analog input:-** The user can select any of the following voltages- 0.6V, 0.75V, 0.9V, 1.0V, 1.2V, 1.5V, 1.8V, 2.0V. 2.0V is the maximum on these pins since there is no input attenuation. The 2.0V is the Full scale value of the reference of the ADM106x's ADC.
2. **A digital input:-** Once selected in this mode, the user can drive a high or low (1 or 0) simply by clicking on the button provided.
3. **An oscillator input:-** This feature is only available on VX1 input and allows the user to input an oscillator from 1Hz to 1000Hz +/- 2.5% in thirteen predefined steps.
4. **A test point input:-** The user may wish to apply their own external source (analog or digital) to a VX pin. Note that this would have to follow the same constraints as the on-board inputs (ie) the voltage seen at the pin can be no greater than 2.0V. The user is able to apply a negative voltage to the VX inputs provided a resistor divide is used to bring the negative voltage into a positive range. This input is provided at VX5 and the user is able to add external resistors using the place holders provided. The location of these resistors on the Evaluation board is at the lower edge and are labeled R113, R60 and R59. In addition to this hardware facility there is also a software calculator provided.

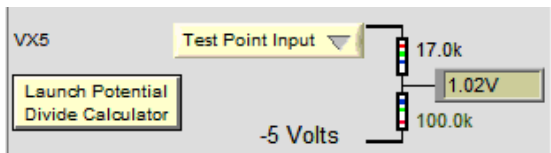


Figure 70. VX5 Test point input

The software calculator shown in Figure 70 is launched by pressing the <Launch potential divide calculator > button. The calculator allows the operator to input the voltages that are to be applied and then they can use the calculator to determine which resistors to use for the potential divide.

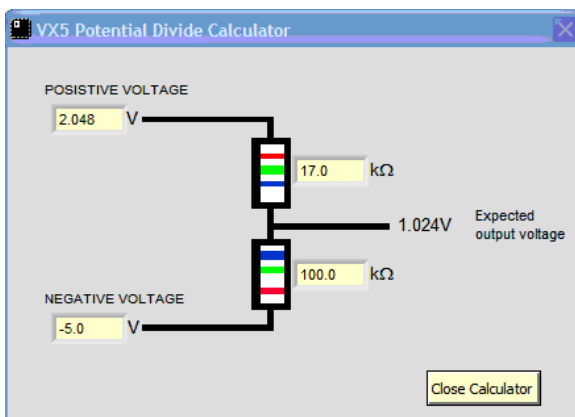


Figure 71. VX5 Test point input calculator

If the user enters any resistor or voltage values which cause the expected output voltage to be out of range a warning prompt will appear as shown in figure 72

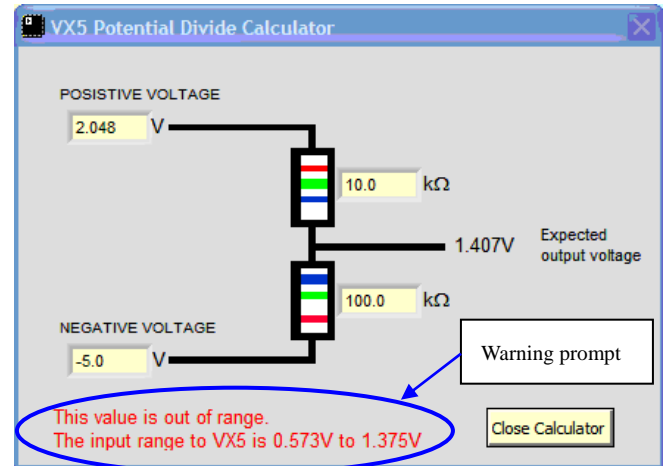


Figure 72. VX5 Test point input calculator showing warning

**VPn pins**

There are two possible inputs to the VPn pins:-

1. An analog input. The user can select any of the following voltages- 0.6V, 0.75V, 0.9V, 1.0V, 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 5.0V
2. The source of an on-board FET. This is to simulate a FET based sequence, where typically, it is the source side voltage that the user is interested in sequencing on.

**VH pin**

There are two possible inputs to the VH

1. An analog input. The user can select any of the following voltages- 0.6V, 0.75V, 0.9V, 1.0V, 1.2V, 1.5V, 1.8V, 2.5V, 3.3V and 5V Note, this analog input is the same as the one driving VP4. The software indicates this.
2. A fixed 12V- A non-adjustable 12V is provided to demonstrate the 12V capability of this pin.

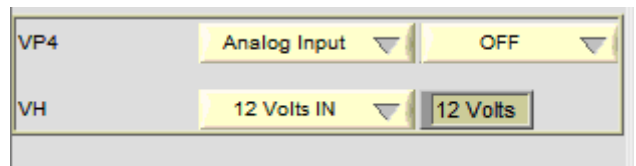


Figure 73. VPn/VH inputs Evaluation Board configuration

Note- the evaluation board software window imports the names from the pin names window for ease of reference.

**Configuring the eval board ADC for reading PDO outputs**

The ADM106x evaluation board provides a 12 channel ADC for measuring the voltage on the PDO outputs. This enables

the user to confirm the voltage output is as they programmed it to be. A running graph provides a visual representation of this. The graph also allows rough verification of a programmed sequence, although its update rate is slow and cannot accurately display the delay times between channels below 100ms delay. The PDO readback functionality is shown below:-

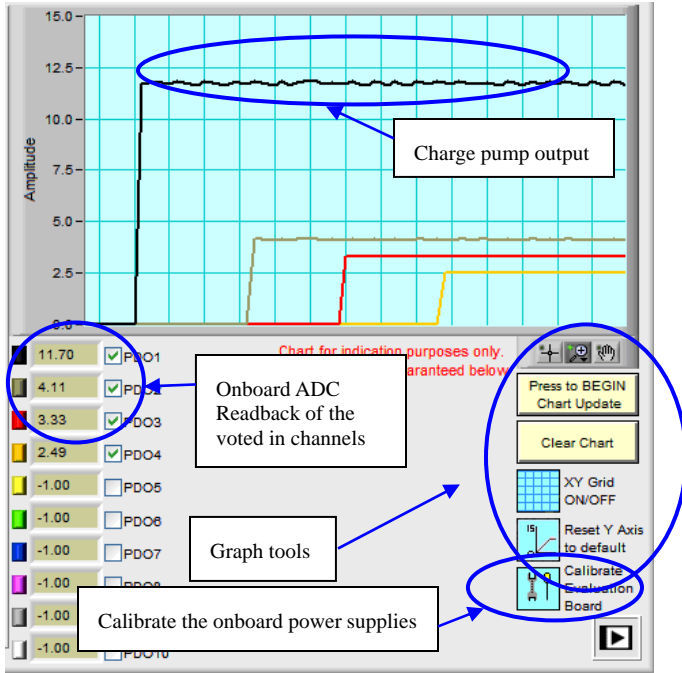


Figure 74. PDO Readback Evaluation board configuration

**Press to begin chart update:-** This button enables the chart. The voted in channels are then displayed as the chart scrolls.

**Clear chart:-** This function clears the chart history.

**XY Grid ON/OFF:-** This will turn the grid on or off.

**Reset Y axis to default:-** This will reset the Y axis to display 0 – 15V

**Calibrate Evaluation Board:-** This function will launch a program as shown in figure 75 which will individually calibrate the 72 onboard power supplies to +/- 1% accuracy.

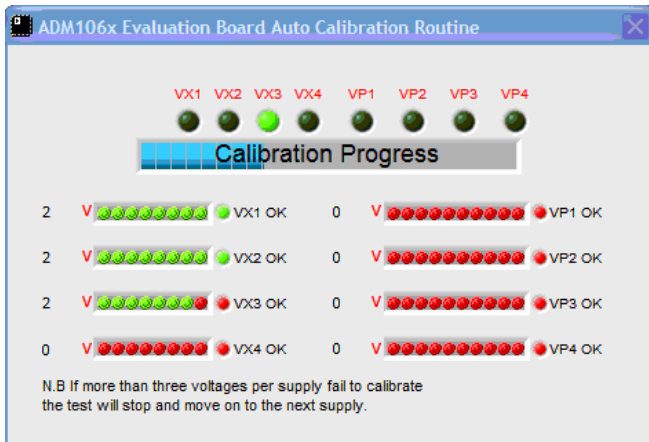


Figure 75. Onboard power supply calibration window

Similar to the inputs, the PDO pin names are imported into this window for easy reference.

**REGISTER ACCESS**

The register access window allows the user to access all the configurable locations and edit them using the buttons as indicated in figure 76. For detailed information on registers reference should be made to the AN-698 and AN-721 application notes available on the analog web page.

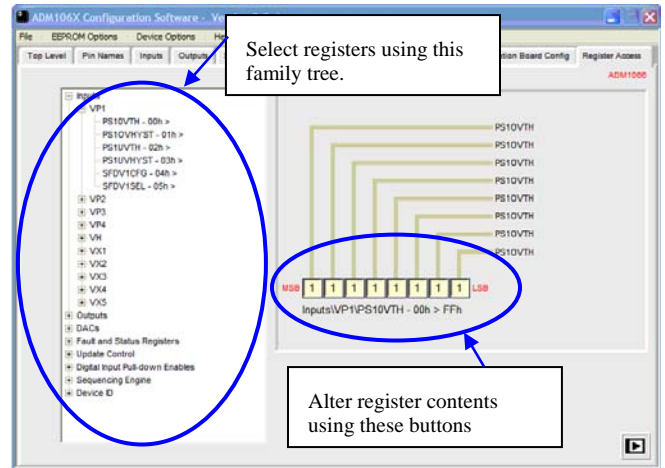


Figure 76. Register access window

**MENU BAR**

The menu bar at the top of the Configuration Tool screen provides a number of options which can be accessed at any time.

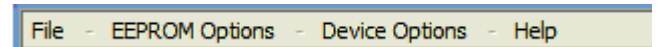


Figure 77. Menu bar

**File**

Under this heading there is a drop down list of options and their short cuts.

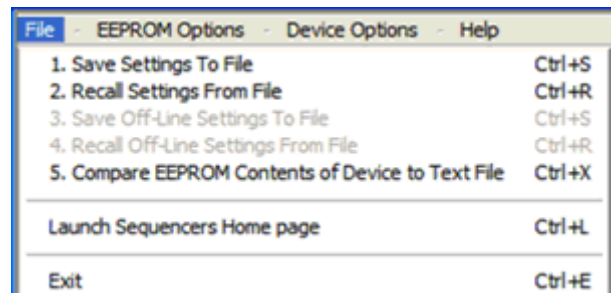


Figure 78. File sub-menu

### 1.SAVE SETTINGS TO FILE

This option launches a window shown in *figure 79* that allows the user to save the current configuration to file. There are four buttons that may be selected in this window .

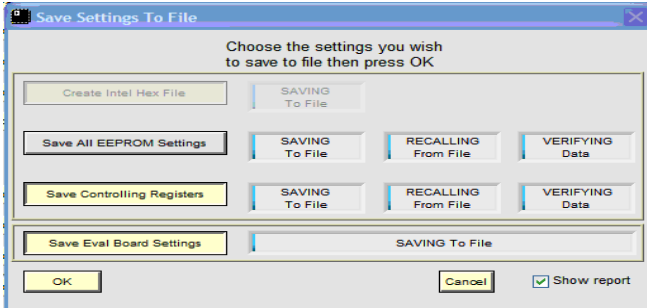


Figure 79. Save settings to file window

1. **Save eval board settings:-** This option will save the evaluation board configuration to file for the inputs to the device only.
2. **Save controlling registers:-** This option will save all the configuration register data to file. This data may be different to that of the EEPROM.
3. **Save all EEPROM settings:-** This option will save the EEPROM data to file.
4. **Create intel hex file:-** This option will create an industry standard intel hex file. This option only becomes available when the <Save all EEPROM settings> has been selected.

Once the selections have been made press <OK> . A prompt will appear as shown in *figure 80*

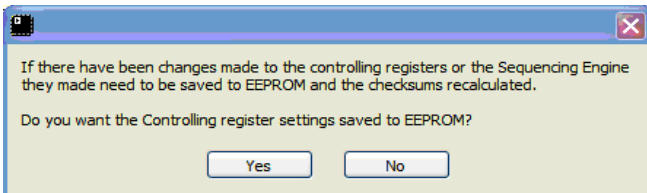


Figure 80. Save to File prompt

If <Yes> is selected then the software will save all the controlling registers data to EEPROM. If <No> is selected then the software will continue without saving the controlling registers to EEPROM.

The next window to appear will be the save to file navigator as shown in *figure 81*.

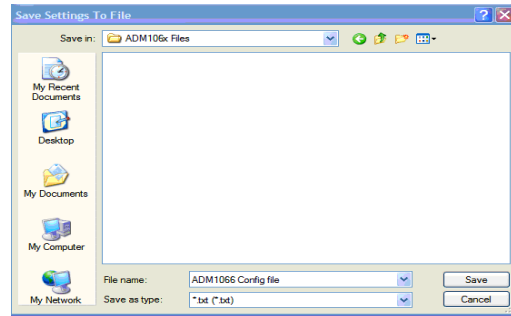


Figure 81. Save to File navigator

Using this standard windows tool the user is able to navigate to a file where they wish to save their configuration file. Once the <Save > button has been pressed the software begins a three step save process. Firstly it reads all the registers of the device, formats the data and saves it to a text file with checksums for the controlling registers and the EEPROM blocks. Secondly it recalls all the data from the saved file including checksums into an array and thirdly it re-reads all the registers of the device and compares it register by register to the data recalled from the text file. A recalculation of the checksum is performed and also compared to the checksums previously created for the text file.

A report of the save operation is then displayed as shown in *figure 81*.

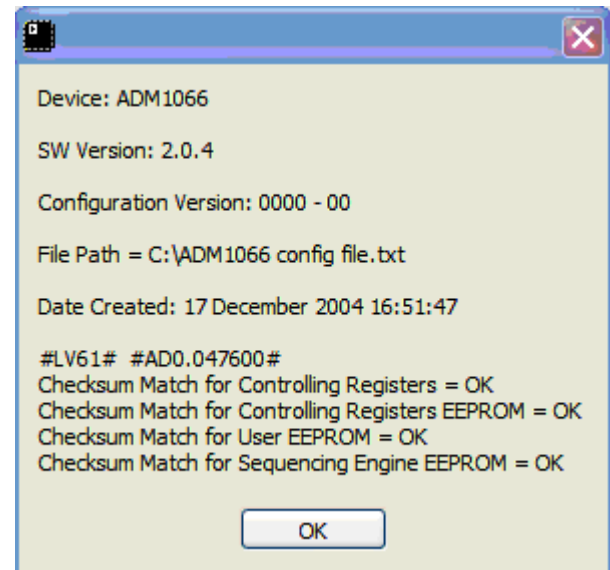


Figure 82. Save to file output report

## 2. RECALL SETTINGS FROM FILE

This option launches a window, shown in *figure 82*, that allows the user to recall a saved configuration from file. There are three buttons that may be selected in this window.

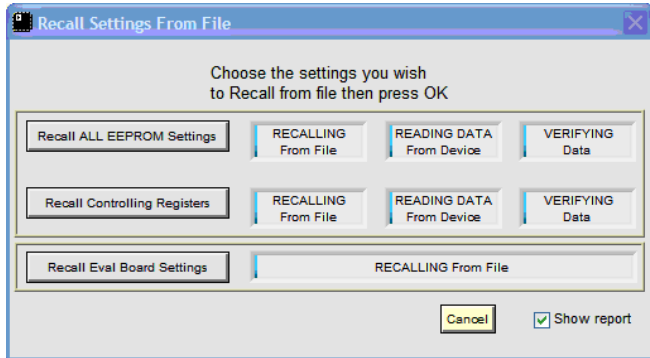


Figure 83. Recall settings from file window

1. **Recall eval board settings:-** This option will recall the evaluation board configuration from file for the inputs to the device only.
2. **Recall controlling registers:-** This option will recall all the configuration register data from file. This data may be different to that of the EEPROM.
3. **Recall all EEPROM settings:-** This option will recall the EEPROM data from file.

## COMPARING CHECKSUM TO A FILE

A user may wish to verify that the contents of the EEPROM are exactly the same as those of a file saved from a different device. This is easily done using the <Compare Device contents to Text file> option under the <File> menu. When used, the software issues the following report. This report can be saved in a text file for detailed examination:-

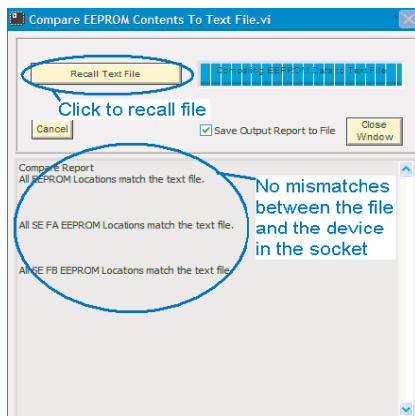


Figure 84. compare checksum to a file

## SHORTCUT KEYS

To speed up using the program the menu functions also have shortcut keys which can be availed of by holding down the Ctrl key and hitting the relevant letter. *Table 4* below shows the menu functions and the relevant shortcut keys.

Menu Function	Shortcut Key
Save settings to File *	Ctrl + S
Recall settings from File*	Ctrl + R
Save Offline settings to File*	Ctrl + S
Recall Offline settings from File*	Ctrl + R
Compare EEPROM contents of device to text file	Ctrl + X
Copy entire configuration to EEPROM	Ctrl + C
Upload device EEPROM contents to PC	Ctrl + U
Enable/Disable save configuration version to EEPROM	Ctrl + D
Change device/ cycle power *	Ctrl + Z
Erase Device	Ctrl + V
Device Search *	Ctrl + Z
Show Help	Ctrl + H
About	Ctrl + A
IBM ThinkPad Communications setup **	Ctrl + I
Launch Sequencers Home page	Ctrl + L
Exit	Ctrl + E

TABLE 8. Shortcut Keys

*\*Note: Options with the same shortcut key will not be enabled together, only one will be enabled dependant on whether one is working with an evaluation board or offline.*

*\*\* IBM ThinkPad Communications setup is a user guide to setting up the communications between the board and software in the event of the software unable to see a connected board.*