Fusion Digital Power Designer GUI 7.0 for the UCD90xxx Sequencer

User's Guide

Texas Instruments

Literature Number: SLVUB51
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Contents

Introduction

1.1 Overview

The UCD90xxx family of digital power-supply sequencers from TI, also known as *system health monitors*, are flexible and powerful enough to meet user's sequencing, monitoring, margining, and other needs. The TI Fusion Digital Power Designer is a dedicated graphical user interface (GUI), tool which helps users configure and monitor UCD90xxx sequencers/health monitors without coding knowledge. This document is targeted for Fusion Digital Power Designer 7.0 or newer. It can be a useful reference for the older 2.0.xxx Fusion GUI, but the layout and interface may not be the same as described in this document.

The TI Fusion Digital Power Designer has the following features:

- Windows®-based application, supports Windows 7
- Design, configure, and monitor TI digital-power controllers and sequencers/health monitors using a TI USB adapter
- Supports multiple devices in the same bus in online (connected to live devices), offline (file-base virtual devices), and hybrid mode (combination of online and offline mode)
- Exports the configuration of the device to different file formats for third-party programming
- Supports command line tools for scripting and automation

The entire family of devices is designed to have similar behavior, with different numbers of rails or some minor features. Users need only to learn how to use the device once, and then they can seamlessly switch to other devices within the family that best fit future designs. This document is a reference guide to give users a jump start, and applies for all UCD90xxx devices (except UCD9080 and UCD9081).

Installation

2.1 Fusion Digital Power Designer

Click here for the latest Fusion Digital Power Designer software. Perform the following steps to install the software (see Figure 2-1).

1. Double-click TI-Fusion-Digital-Power-Designer-7.0.x.exe to run the install.
2. Accept the License Agreement and click the Next button.

NOTE: By default, the software is installed in C:\Program Files (x86)\Texas Instruments\Fusion Digital Power Designer. However, you can relocate it to a different folder so that each version of the fusion digital power designer is separately installed.

3. Select the option to create a shortcut on Start Menu.
4. Select the option to create more shortcuts for other tools and add the Fusion GUI directory in the system PATH. TI recommends checking both the SAA Debug Tool and UCD3xxx UCD9xxx Device GUI.

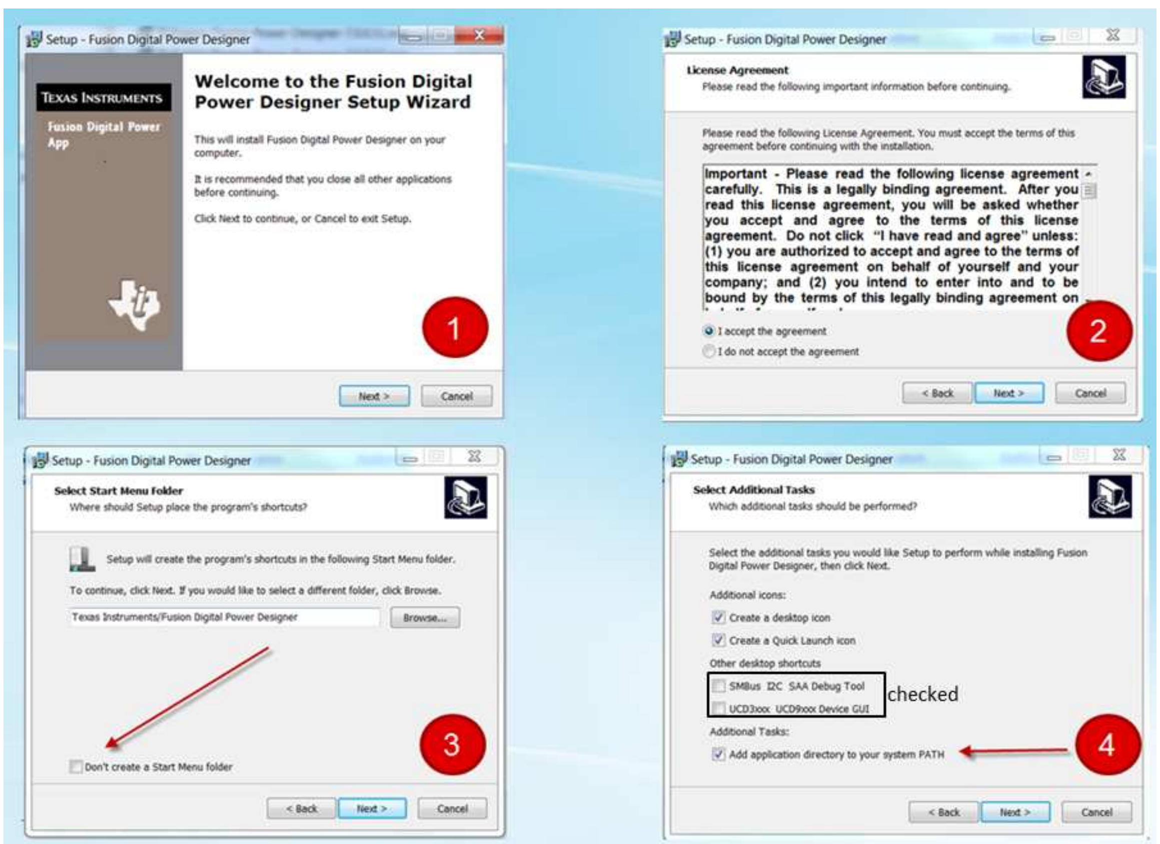

Figure 2-1. Fusion GUI Installation

If this is your first time using the Fusion GUI, a pop-up introduction window will appear (see Figure 2-2). Click OK to proceed to using the Fusion GUI.

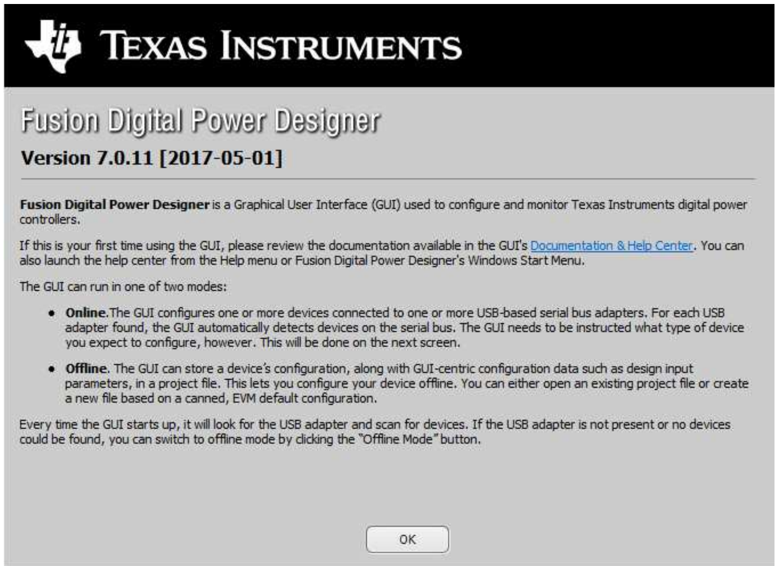

Figure 2-2. GUI Mode Options

2.2 USB Adapter Firmware

Currently, the Fusion GUI supports the TI USB-to-GPIO adapter. The adapter can be added as an individual dongle (see Figure 2-3) or built into some of the EVM boards, shown in the following images.

For the USB adapter as a dongle, the USB cable is connected on one end to the PC on the USB port, and on the other end it is connected to the dongle. The 10-pin ribbon is connected to the dongle and to the EVM 10-pin header. For some UCD90xxx EVMs, the USB adapter is built in with the EVM. Remove the dongle, then connect the USB cable directly to the USB connector on the EVM board.

Figure 2-3. USB-to-GPIO Adapter

The Fusion GUI supports the TI USB-to-GPIO adapter, firmware version 1.0.x. If however, the firmware version on the USB adapter is not 1.0.x, you can download the USB adapter firmware by launching the USB Adapter Firmware Download Tool and selecting Start Menu → All Programs → Texas Instruments → Fusion Digital Power Designer → Tools → USB Adapter Firmware Download Tool (see Figure 2-4). TI recommends using version 1.0.13 because it supports up to 58 bytes of data package, which is required by UCD90320 devices (see Figure 2-5).

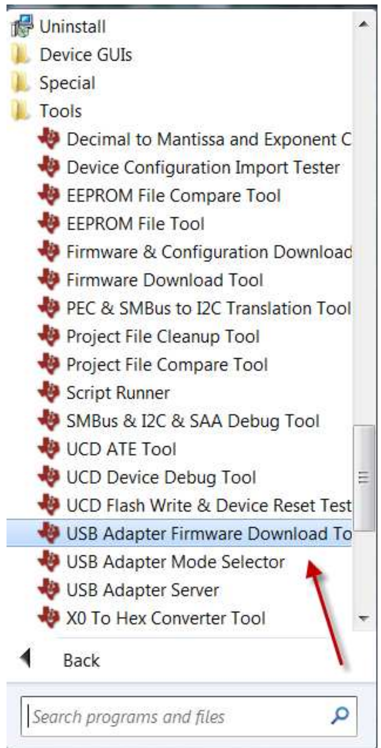

Figure 2-4. Adapter Firmware Download Tool (1/2)

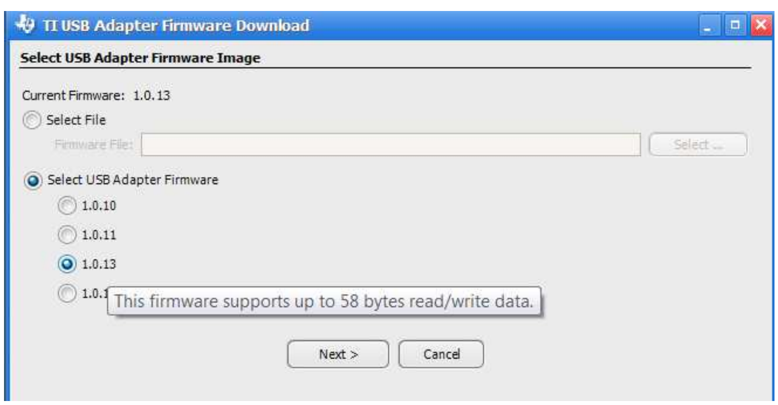

Figure 2-5. Adapter Firmware Download Tool (2/2)

Chapter 3

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Fusion GUI Mode

The Fusion GUI supports online, offline, and hybrid mode for various applications (see Figure 3-1). As the term suggests, a live device is required for online mode and hybrid mode.

Figure 3-1. Typical GUI Application

3.1 Fusion GUI Offline Mode

The Fusion GUI can store the configuration of a device, along with GUI-centric configuration data, such as design input parameters, in a project file (see Figure 3-2). This lets users design the power system without real devices. Users can launch offline mode by selecting Start menu → Texas Instruments → Texas Instruments Fusion Digital Designer → Fusion Digital Power Designer Offline Mode.

Figure 3-2. Fusion Digital Power Designer Offline Mode

When the offline GUI is launched, you can choose one of two options to start the design (see Figure 3-3).

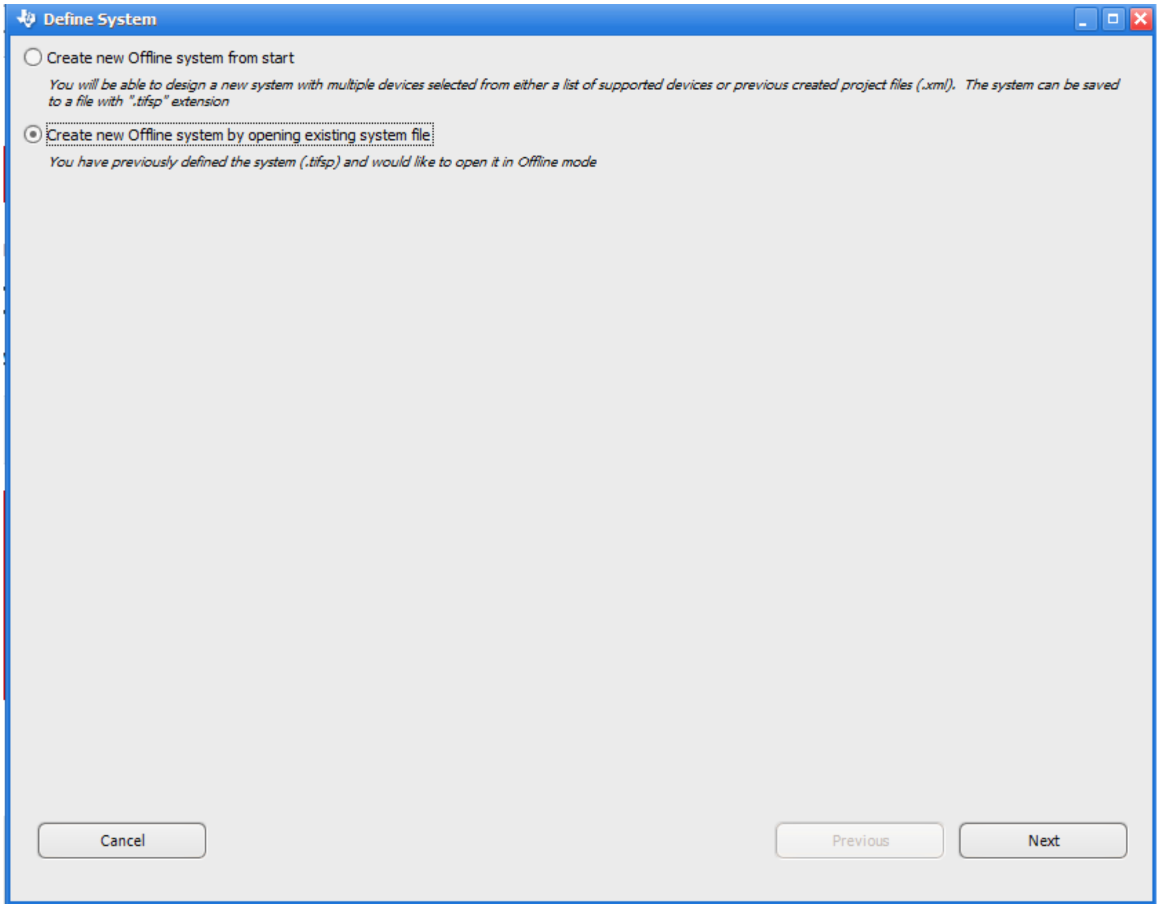


Figure 3-3. GUI Offline Project Start Options

3.2 Fusion GUI Online Mode

The Fusion GUI online mode can be launched by selecting Start menu → Texas Instruments → Texas Instruments Fusion Digital Power Designer → Fusion Digital Power Designer. The GUI will discover one or more devices connected to one or more USB-to-GPIO adapters.

3.2.1 No Adapter Found

If no USB adapter is connected to the PC, the screen in Figure 3-4 appears. Either connect the USB adapter and try again or go to Offline mode.

Figure 3-4. No Adapter Found Message

3.2.2 No Device Found

If a USB adapter is connected to the PC but no device is found (see Figure 3-5), it may be due to one of the following reasons:

- No devices are connected to the other end of the adapter.

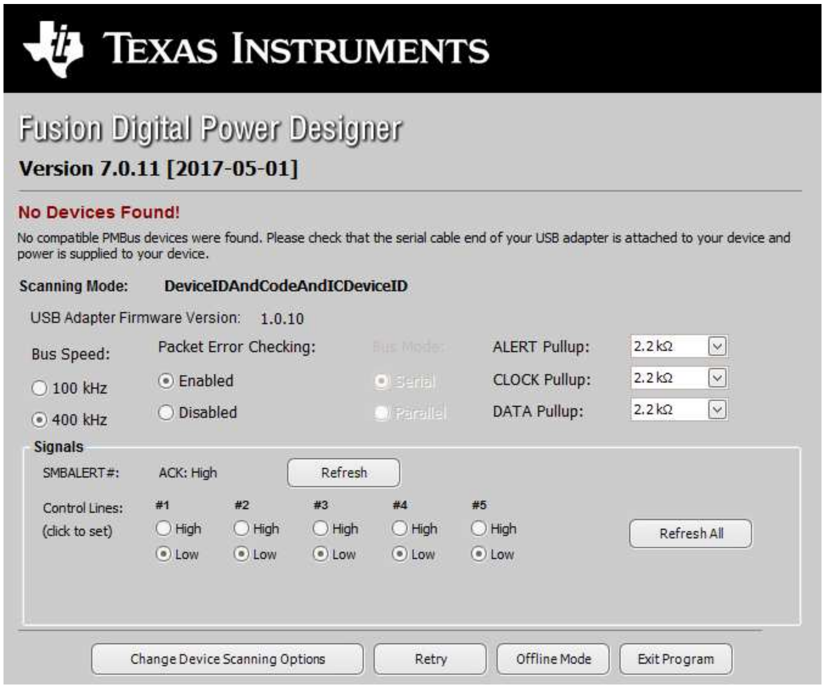


Figure 3-5. No Device Found Message

To detect the presence of supported TI devices on the PMBus, the Fusion GUI sends a list of known PMBus commands (supported by the devices) to address 1 to 127 (skip 12). The Fusion GUI sets the IDs of the devices based on the response from the devices. These known PMBus commands are called Device Scan Mode in GUI. Users can select to scan for a specified address (or addresses) by skipping all other addresses using the Device Scan Mode setting. Users can also select which command (or commands) to send to the address to scan for devices (see Figure 3-6).

Different device scan modes are used to discover devices on the bus, as follows:

– DEVICE_ID (0xFD): Most UCD92XX and UCD90XX devices use this mode.
– DEVICE_CODE (0xFC): Most TPSxxxx devices use this mode.
– IC_DEVICE_ID (0xAD): Devices supporting PMBus 1.2 use this mode.
– Custom scan mode: some devices use PMBUS_REVISION (ReadByte 0x98) or MFR_MODEL (ReadBlock 0x9A) as a way to identify themselves on the bus. Click the Scan for Device button to customize the scan mode (see Figure 3-7).

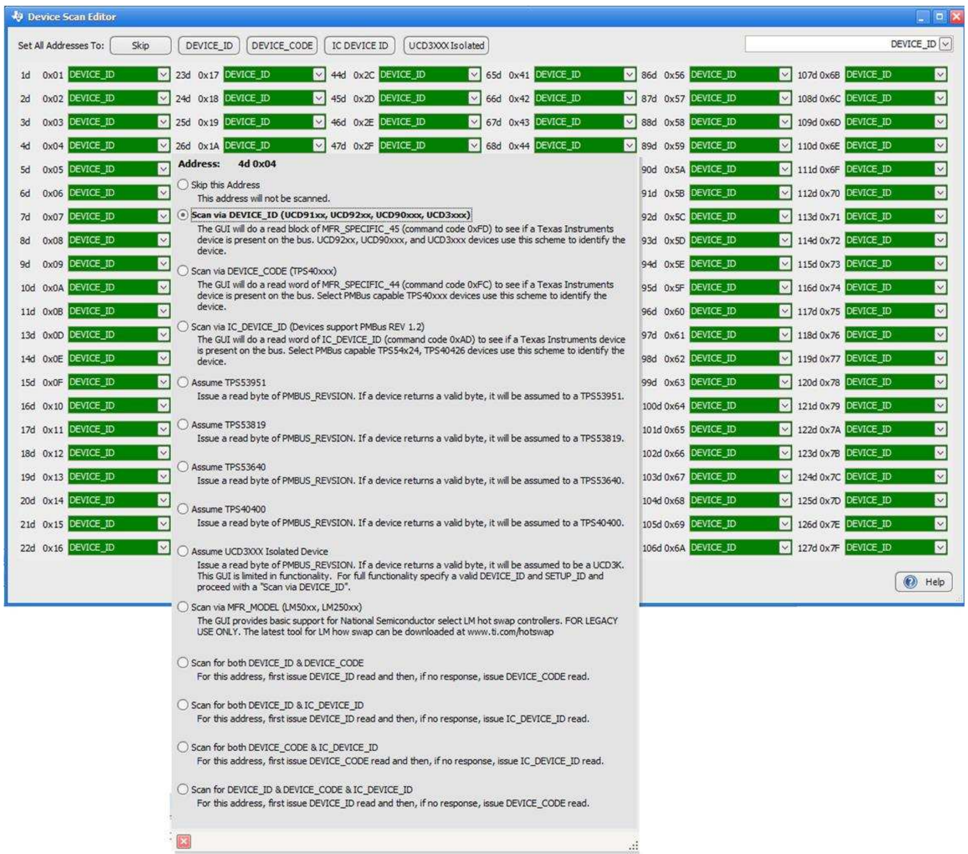


Figure 3-6. Device Scan Editor

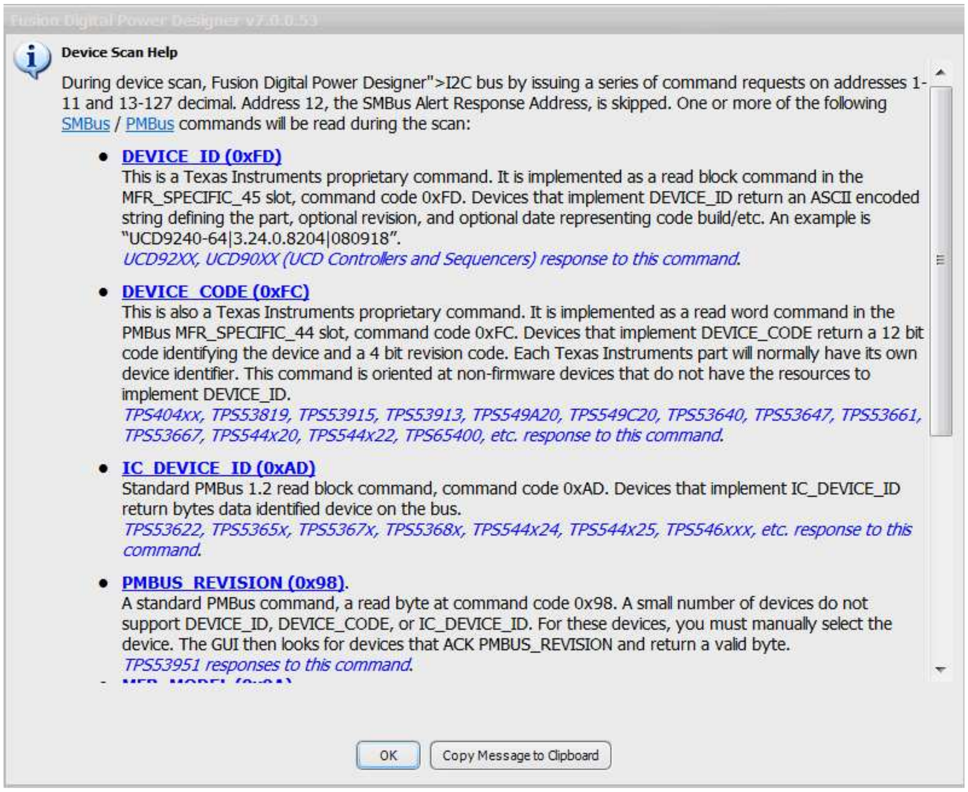


Figure 3-7. Device Scan Help

- Bus speed: the device may not support the bus speed setting, try a different speed (100 kHz and 400 kHz).
- Packet error checking (PEC): the device may not support PEC. Try enabling and disabling PEC.
- Pullup resistor needs adjusting
- Check the resistor on the PMBUS_ADDR1 and PMBUS_ADDR2 pin to ensure they are compliant with the data sheet requirement.

Fusion GUI Layout

Figure 4-1 shows the Fusion GUI work flow.

- Build system: define your system in either online or offline mode. If active devices are connected to the PC, you can begin monitoring and debugging your system.
- Configure system: configure each device in your system.
- Monitor and debug system: view the system responses.
- Save system: save the system configuration to a single system file (.tifsp), or save each device configuration as individual configuration files (.xml, .csv, and .hex) for later use. If devices are online, you can save the configuration of the device to its nonvolatile memory.
- Production: import the system file (.tifsp) or the configuration file of the device saved in the previous bullet to devices using the Fusion MFR GUI, Fusion command line tools, or third-party programming.

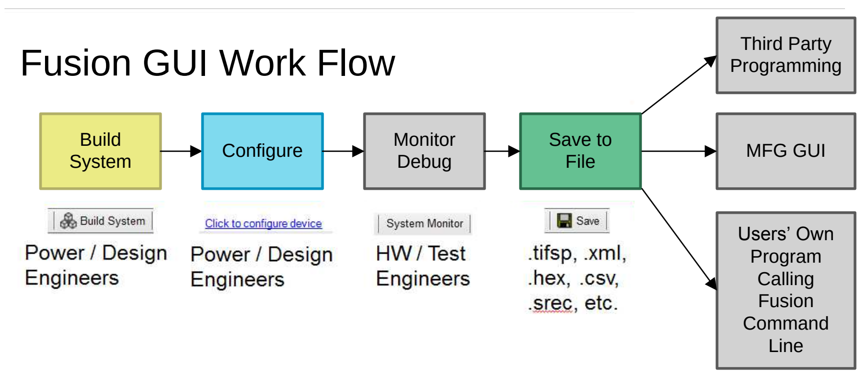


Figure 4-1. Fusion GUI Work Flow

Figure 4-2 shows the system view.

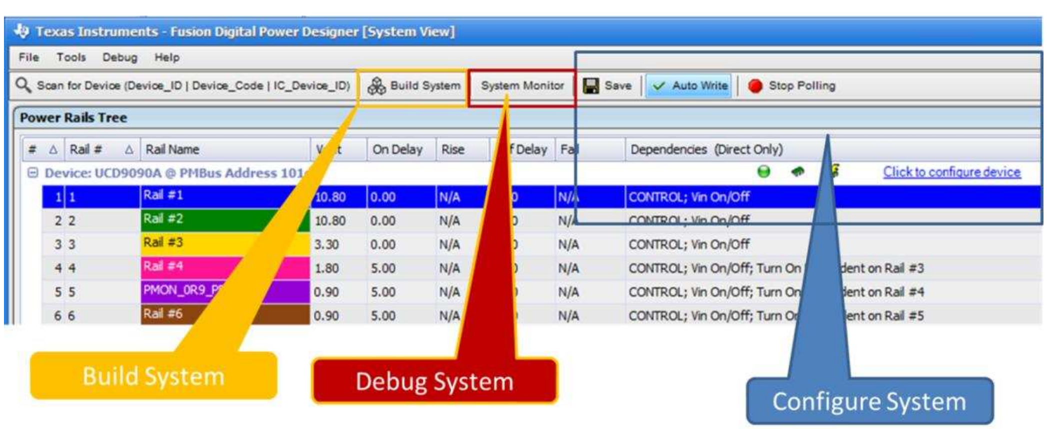


Figure 4-2. Fusion GUI – System View

4.1 Build System

Figure 4-3 shows the build mode selection. Here, you can perform the following:

- Create new Offline system from start: design a new system in off-line mode by adding one or more off-line devices at a time. Select from an existing file (.xml or . tifsp), or a list of supported devices embedded in the GUI. All devices in your system will be offline.
- Create new Offline system by opening existing system file: you have previously defined the system and saved it in the system file (.tifsp) or a single project file (.xml). All devices in your system will be off-line
- Modify existing system: add one or more off-line devices at a time by selecting from an existing file (.xml or .tifsp), or selecting from a list of supported devices embedded in the GUI. This option can be a hybrid mode, combining on-line devices from existing systems and newly added off-line devices.

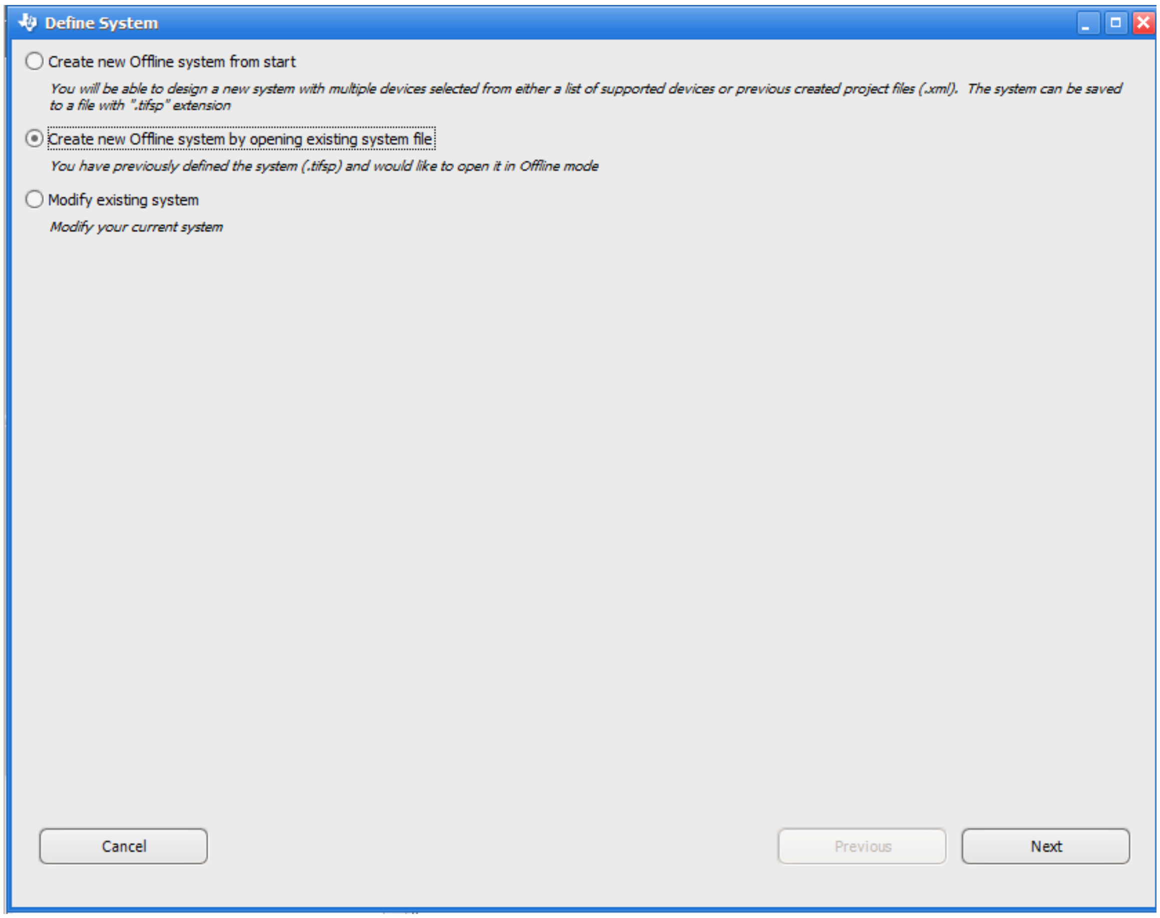


Figure 4-3. Build System Mode Selection

4.2 Debug System

System monitors provide an overview of the system (see Figure 4-4).

- Control panels: apply to all the devices and rails on the bus. If the setting is invalid for a rail or a device, or it is nonwritable, the operation is skipped for that rail or device.
- Chart views: select a rail in the system to view the response data.
- Status view: LED on the device level indicates if the device status is OK or not. The LED in the rail level indicates the status of the rail: fault, warning, or OK.
  – The green LED indicates that the device has no fault and no warning at all.
  – The red LED indicates that the device has a fault and warnings at either the rail or device level.
  – The orange LED indicates that the device has warnings at either the rail level or device level.
- PMBus Logging: log the PMBus communication.

The system monitor has another important use, which is to single-step, turns on and turn off power rails. Users can configure the On/Off Config of the rail, and toggle the Turn On and Immediate Off option to turn on or off rails individually, so that all the rails are changed manually to discover any design issues (see Figure 4-4).

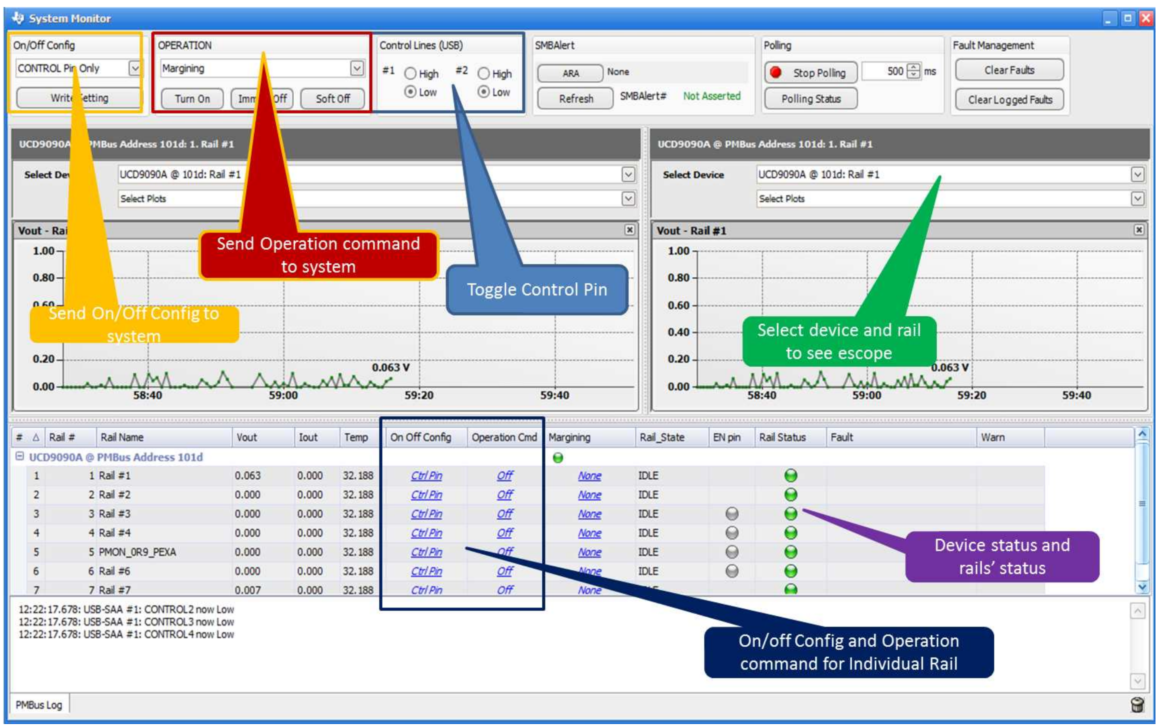


Figure 4-4. Debug System Monitor

4.3 Configure System

Figure 4-5 shows the configure system view.

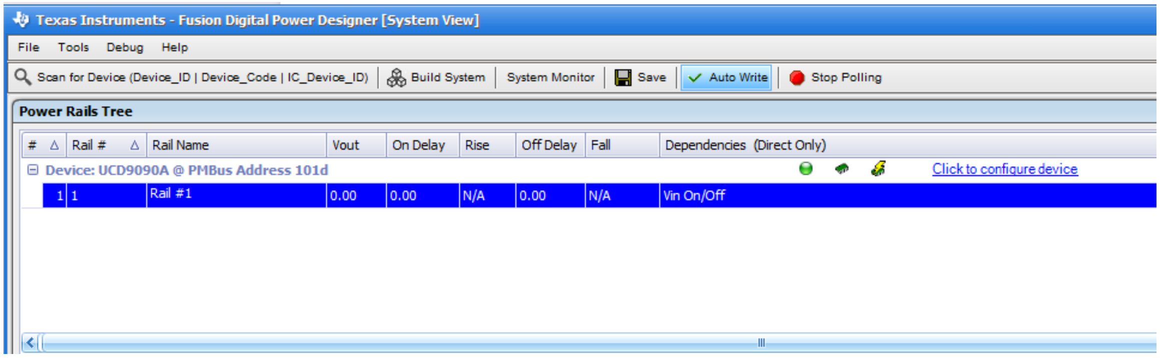


Figure 4-5. Configure System View

1. Click the *Click to configure device* link to modify the configuration of the device. Different devices have different views and tabs. See the device specification document for how to configure devices.
2. Navigate between rails (outputs): If the device supports multiple outputs, use the top-right-corner combo box to navigate between rails.
   - Online or Offline LED: device is connected (online) or device is not connected (offline)
   - Write Pending to hardware: no pending write to hardware (RAM). You made changes in the GUI but have not written to the hardware yet.
   - Write Pending to NVM: no pending write to NVM (flash). Pending write to NVM. Since launching the GUI, you made changes in the hardware (RAM) but have not stored the configuration to the nonvolatile memory yet. The changes you make will be lost if the device is power cycled.

4.3.1 Configure Task

The Configure Task provides the settings to configure the UCD90XXX device to function as designed (see Figure 4-6). The task has Hardware Configuration, Rail Configuration, and Global Configuration tabs, which are described in the following sections. Before starting the configuration, it is important to follow the design flow. Consider the following:

- Rail setup: Number of rails to monitor and type of monitoring (voltage, current, temperature)
- Rail monitoring setup: Voltage, current, and temperature set points
- Rail control setup: Rails control (how are rails turned on and turned off)
- Rail margining setup: Number of rails requiring margining as well as the frequency and duty cycle
- GPI configuration: Are there digital signals (GPI) which must be monitored?
- Rail sequencing configuration: Start-up sequence; which rails come first, and which rails depend on other rails for sequencing?
- Fault response configuration: How should the device act if a fault is detected (ignore the fault or act on the fault)? If the device should act on the fault, how (shut down fault rail and other slave rails, resequence, log the fault, and so on)?
- Logic GPO configuration: Are there output signals (LGPO) that must notify the external system?
- Other configurations: System watchdog and system reset

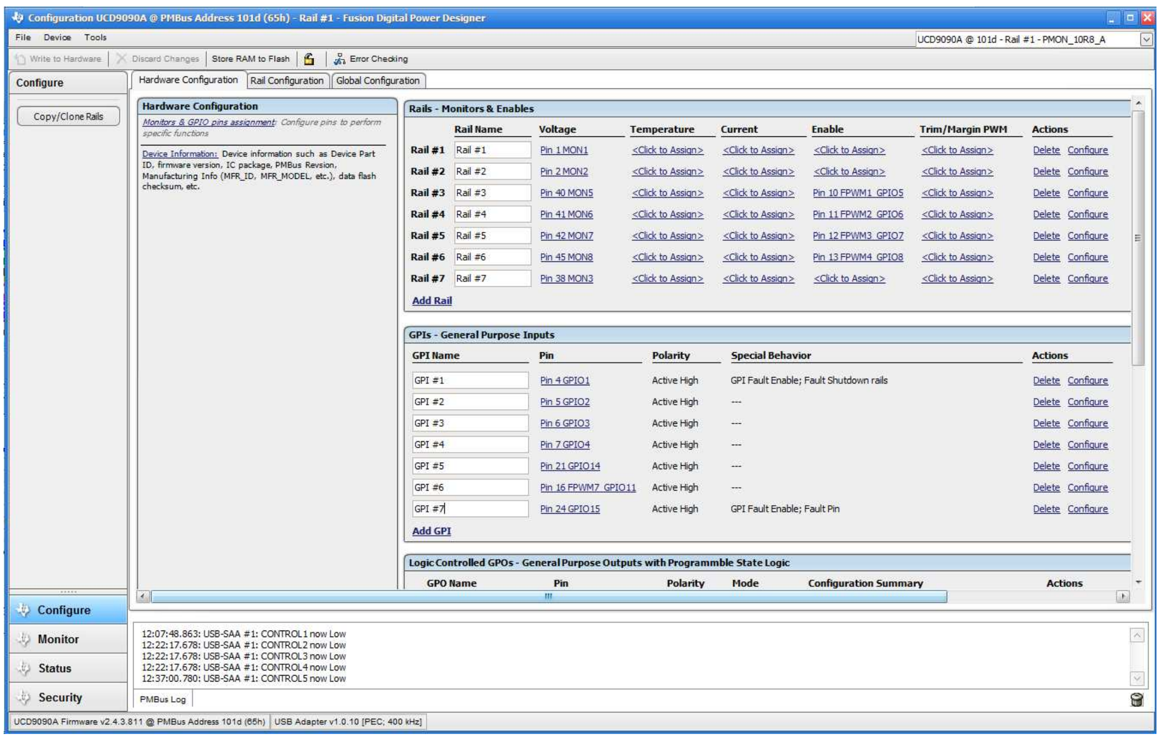
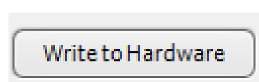
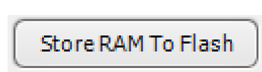


Figure 4-6. Hardware Configuration Task View

After making changes, do the following steps or the changes will be lost after the device is reset or power cycled.

1. Click the Write to Hardware button to save changes into the RAM. 

2. Click the Store RAM To Flash button to save changes into the Flash. 

4.3.1.1 Hardware Configuration

The UCD90xxx family supports various I/O capabilities (see Figure 4-7). The GUI lists the capacities at the top-right corner of each I/O function (X of Y assigned), and Y is the capacity of the particular I/O function. The Hardware Configuration tab lets users configure the I/Os as desired functions, such as monitoring, GPI, logic GPO (LGPO), margining, and more. Users must perform the hardware configuration first.

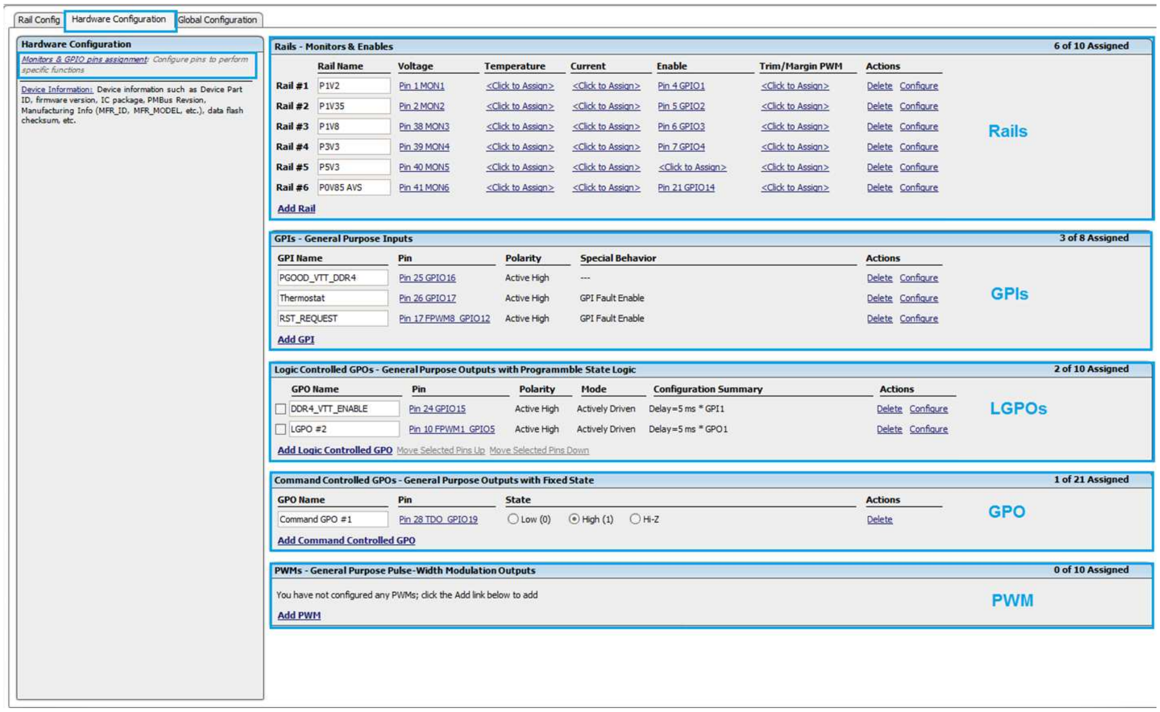


Figure 4-7. Hardware Configuration

4.3.1.1.1 *Configuring Rails – Monitoring, Enabling, and Margining*

Each rail can have up to five pins: voltage, temperature, current, enable, and trim/margin (see Figure 4-8). The voltage, temperature, and current pin assigns a monitor pin to perform voltage, temperature, and current monitoring, respectively. The enable pin is an output signal to enable and disable the downstream power supply. The trip/margin pin is the PWM output signal to margin the desired voltage rail. The user can also configure a rail with the enable pin only. A rail without any pins is forbidden.

Figure 4-8. Configure Rails

Users must click Add Rail to add a new rail, then click the Configure button, to configure the monitor type and polarity of the enable signal and margining settings (duty cycle, frequency, mode, and so on) as shown in Figure 4-9.

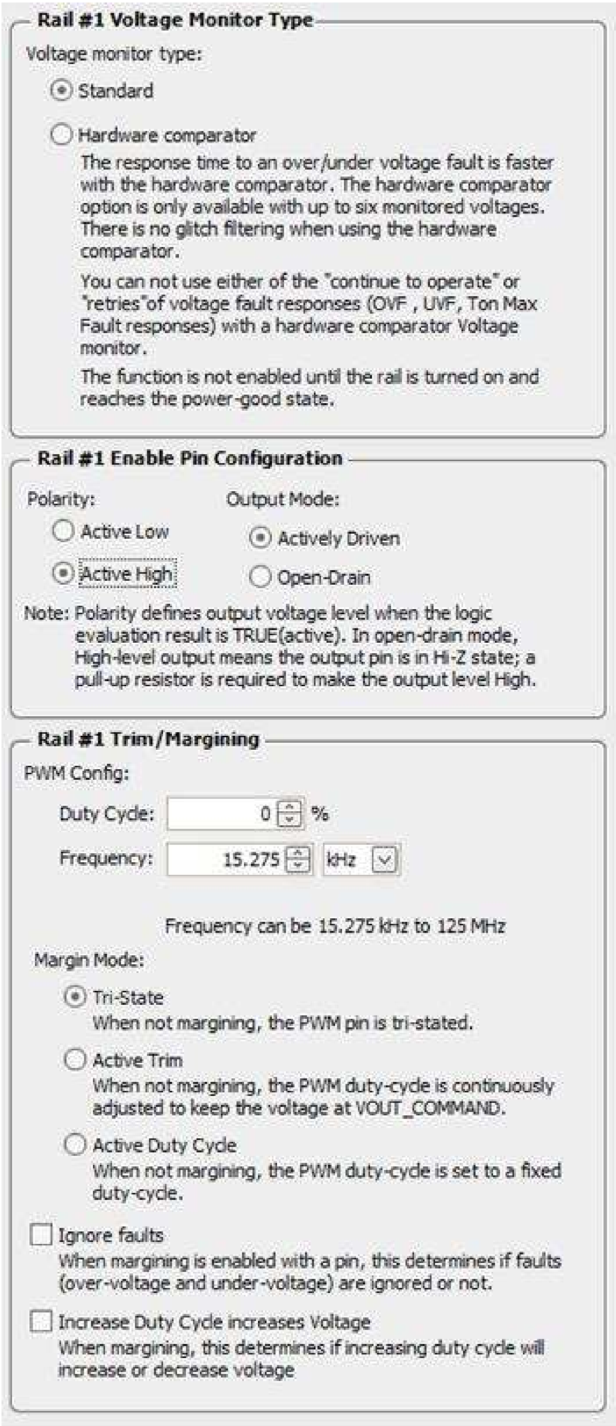


Figure 4-9. Configure New Rails

4.3.1.1.2 Configuring General-Purpose Inputs (GPIs)

GPIs are mainly used to receive signals from the external system. Click the Add GPI button to add a GPI, then click the Configure button to set the polarity and other GPI functions (see Figure 4-10). GPI functions vary by device (see Figure 4-12, Figure 4-13, and Figure 4-11). See the data sheet for function details. Moreover, the GUI provides a description next to each function to help customers understand the feature.

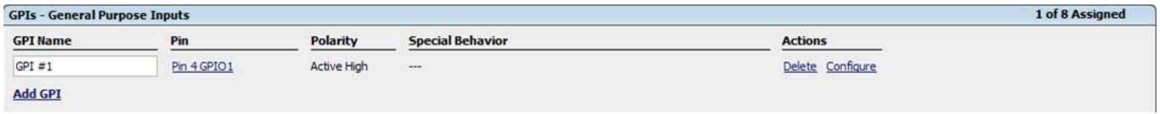


Figure 4-10. Configure GPIs

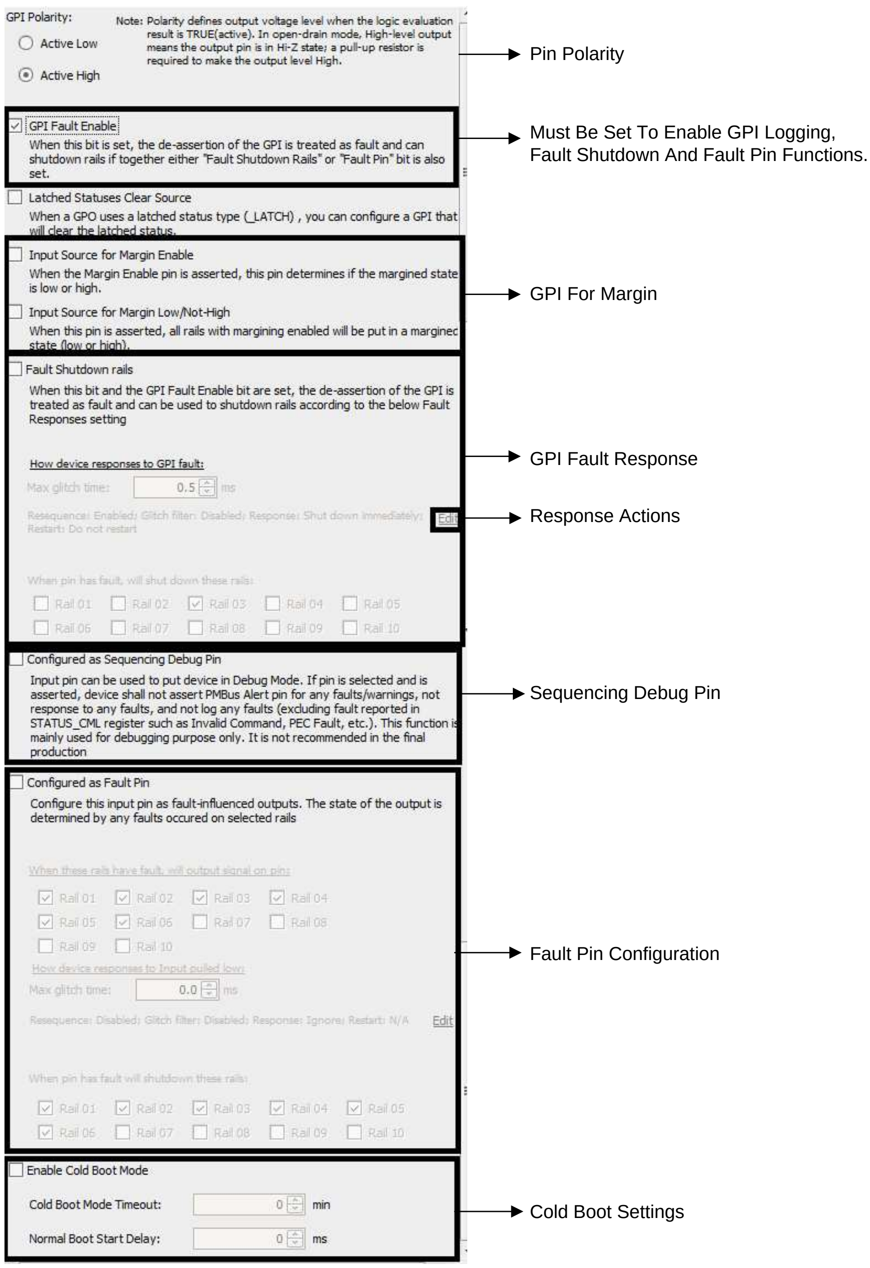


Figure 4-11. GPI Configuration for Rest UCD9090A and UCD90160A

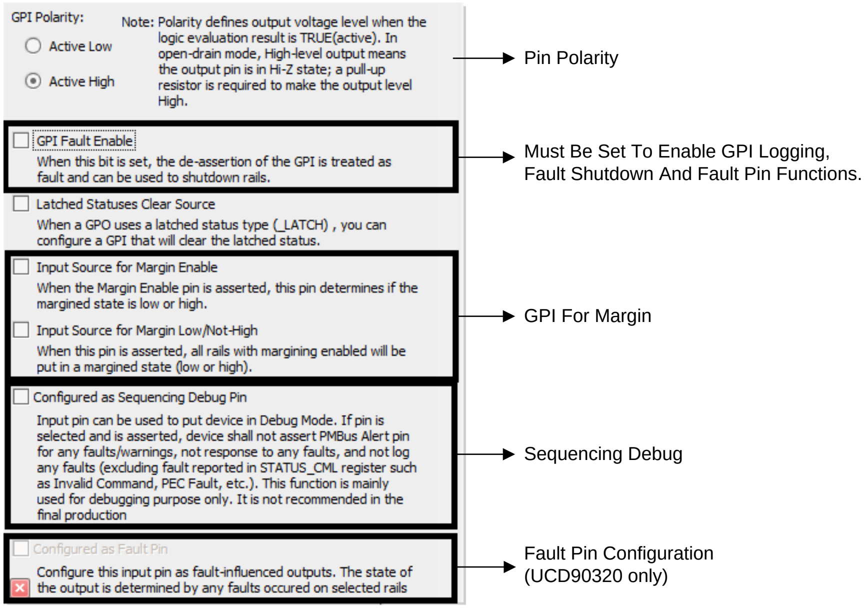


Figure 4-12. GPI Configuration for UCD90240 and UCD90320

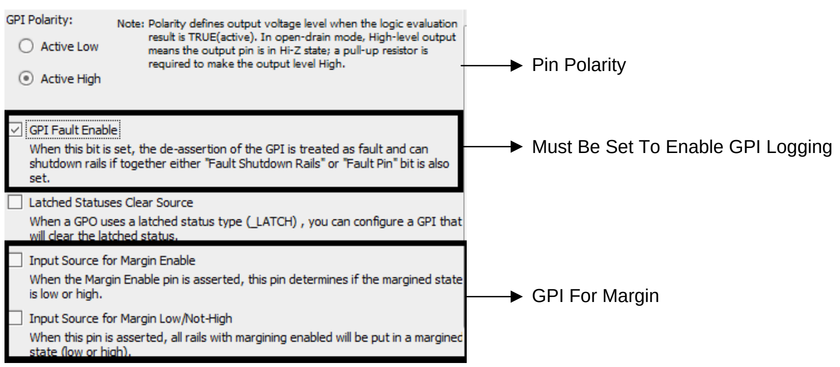


Figure 4-13. GPI Configuration for Rest UCD90xxx

4.3.1.1.3 Configuring Boolean Logic-Controlled GPOs (LGPO)

UC90xxx devices can output signals based on the combined results of Boolean logic from the GPIs state, Rails state, and other LGPOs state (see Figure 4-14). Users can also configure a LGPO without a physical output pin, a virtual LGPO. The virtual LGPO is typically used as an input for other LGPO to save a physical pin.

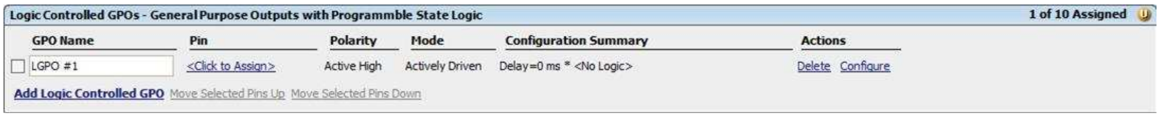


Figure 4-14. Configure Boolean Logic-Controlled LGPOs

Click the Add Logic Controlled GPO button to add a LGPO, then click the Configure button (see Figure 4-14). Each LGPO has two AND paths and one final OR gate with an inverter on each (see Figure 4-15).

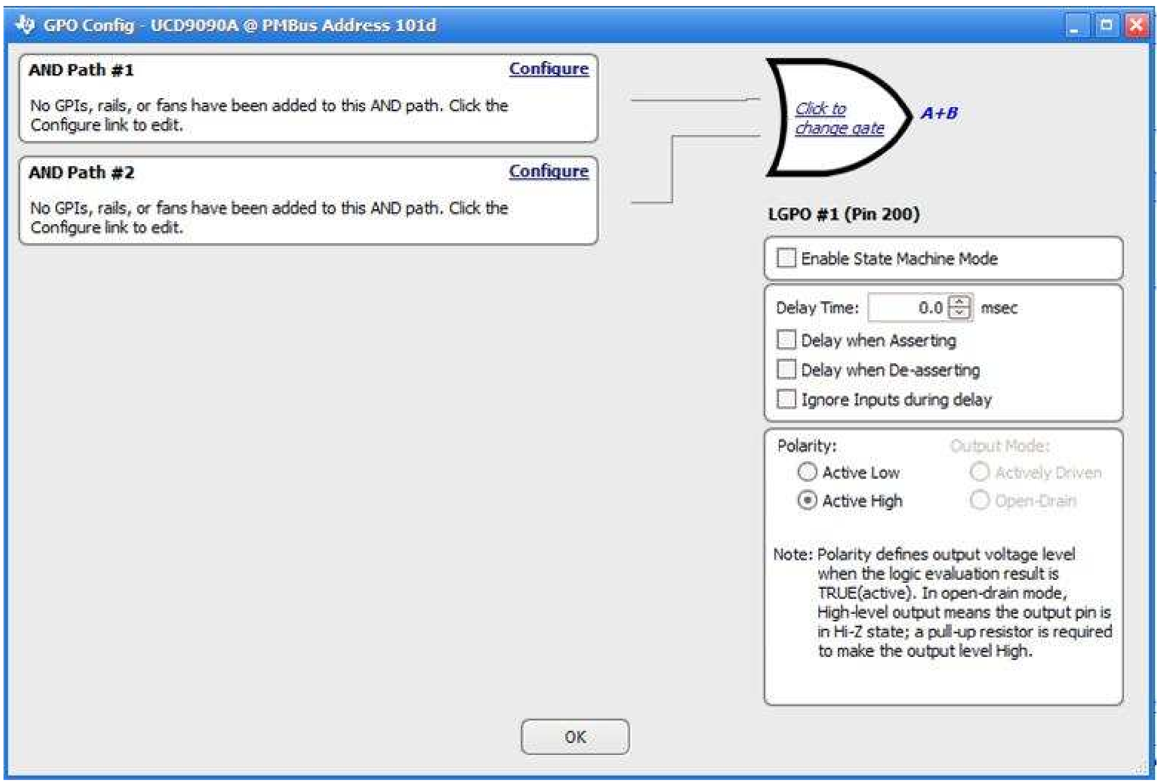


Figure 4-15. Add Logic-Controlled GPO

Users can select the combination of GPI, GPO, and Rail inputs (see Figure 4-16).

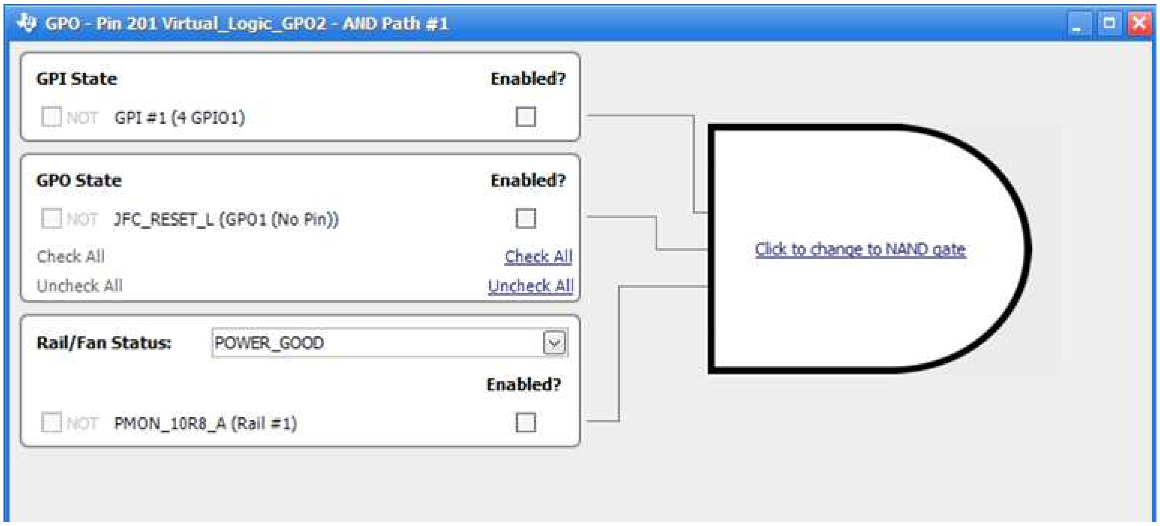


Figure 4-16. Logic GPO Input Selection

4.3.1.1.4 Configuring Command Controlled GPOs

Command Controlled GPOs are the output with a fixed state unless users issue a PMBus command to change it (see Figure 4-17).

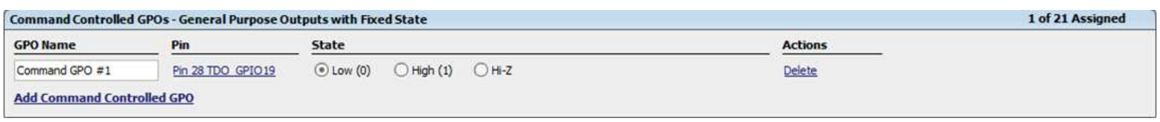


Figure 4-17. Configure Command Controlled GPOs

4.3.1.1.5 Configuration Fans

Some UCD90xxx sequencers have a built-in fan controller, enabled by combining Tach monitor inputs, PWM output, and temperature measurements (see Figure 4-18). For the details on fan control, see the data sheet.

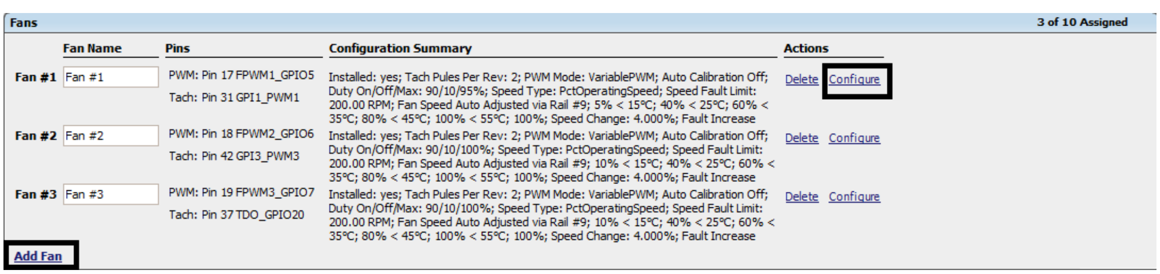


Figure 4-18. Fans

First click the Add Fan button and then click the Configure button, as shown in Figure 4-18. On the pop-up window (see Figure 4-19), customers can configure the following settings for the fan functions:

- PWM
- Speed
- Speed Type
- Duty Cycle
- Tach input
- Auto Adjust Fan Speed to Temperature
- Fault Response

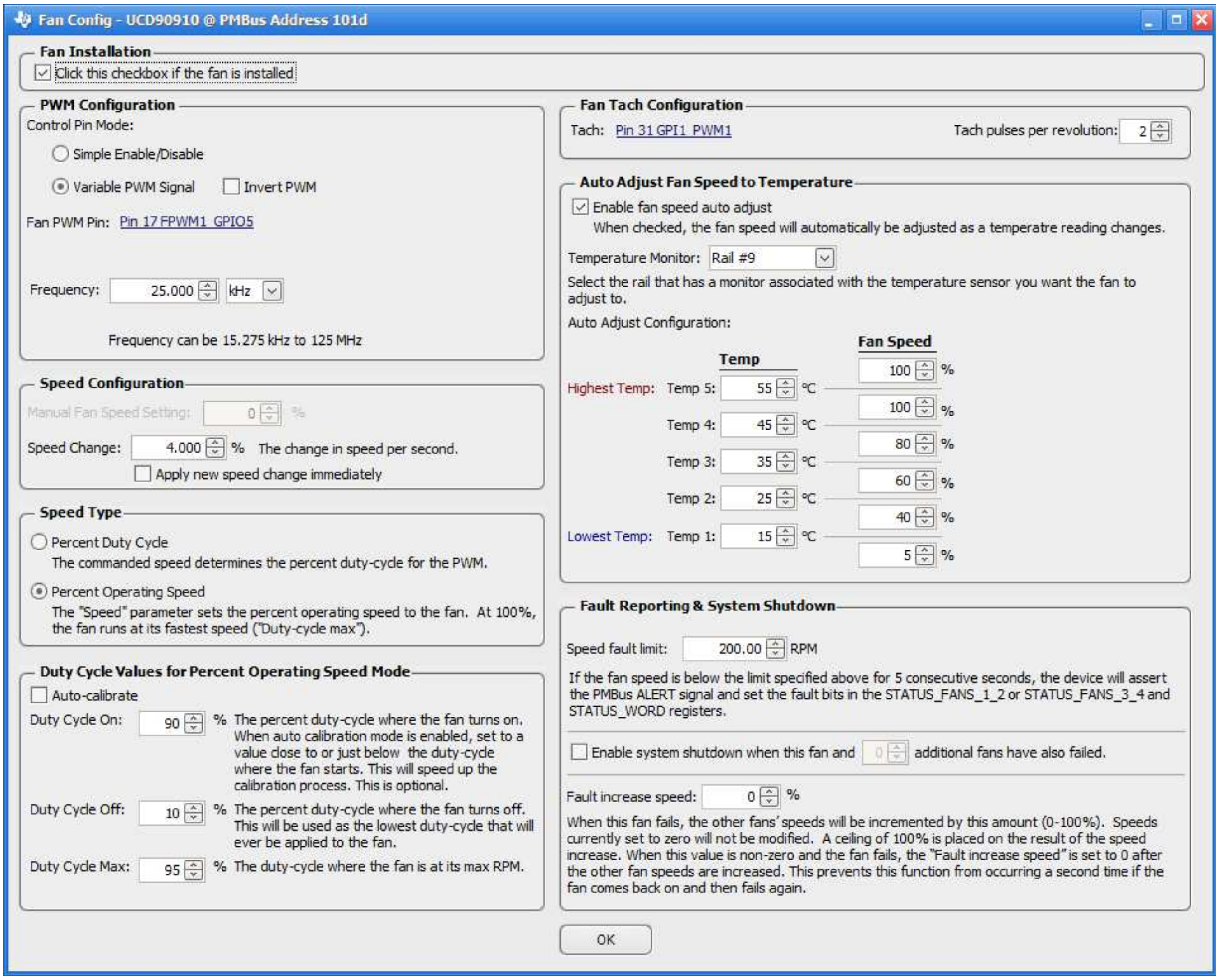


Figure 4-19. Fan Configurations

4.3.1.1.6 Configuring General-Purpose Pulse-Width Modulation (PWM)

General-purpose pulse-width modulation are the PWM output with a fixed duty cycle, frequency, and phase until users make changes with commands (see Figure 4-20).

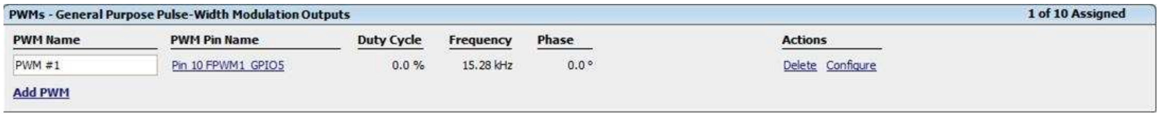


Figure 4-20. Configure General-Purpose PWM

4.3.1.1.7 Configuring Manufacturing Information

The device information includes the following:

- Device part ID
- Firmware version
- IC package
- PMBus Revision and Manufacturing Information

Among these, users can customize manufacturing information to suit their needs, such as configuration version control (see Figure 4-21).

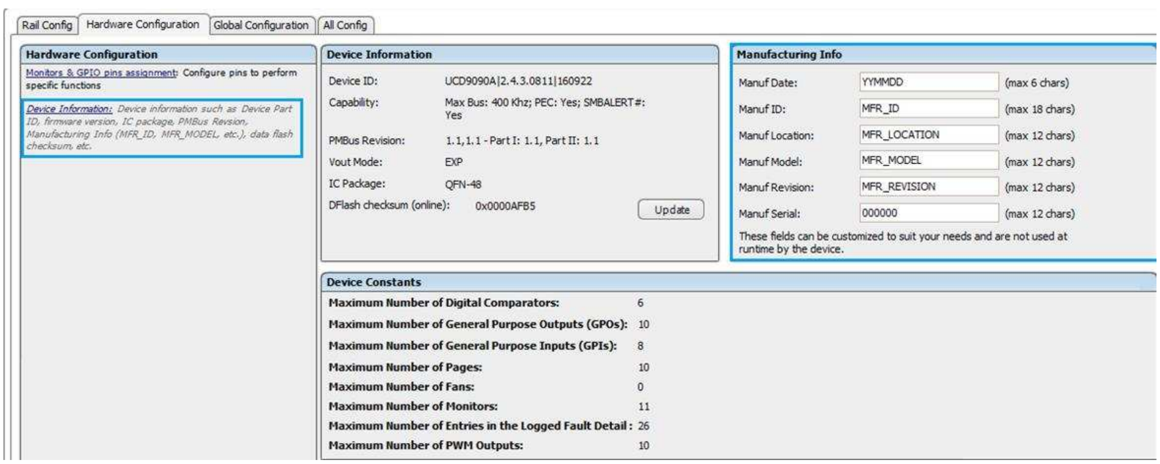


Figure 4-21. Configure Manufacturing Information

4.3.1.2 Rail Configuration

The Rail Configuration tab (see Figure 4-23) includes all the settings related to the rails including: thresholds, sequencing conditions, fault responses, and scaling. Based on the user's inputs, the GUI plots rail sequences on and off timing in real time. Moreover the GUI also provides a snapshot of rail settings; users can double click the target rail to modify it.

4.3.1.2.1 Voltage, Current, Temperature Limits, and Scaling Settings

Figure 4-22 shows how the rail jumps among different states with the settings.

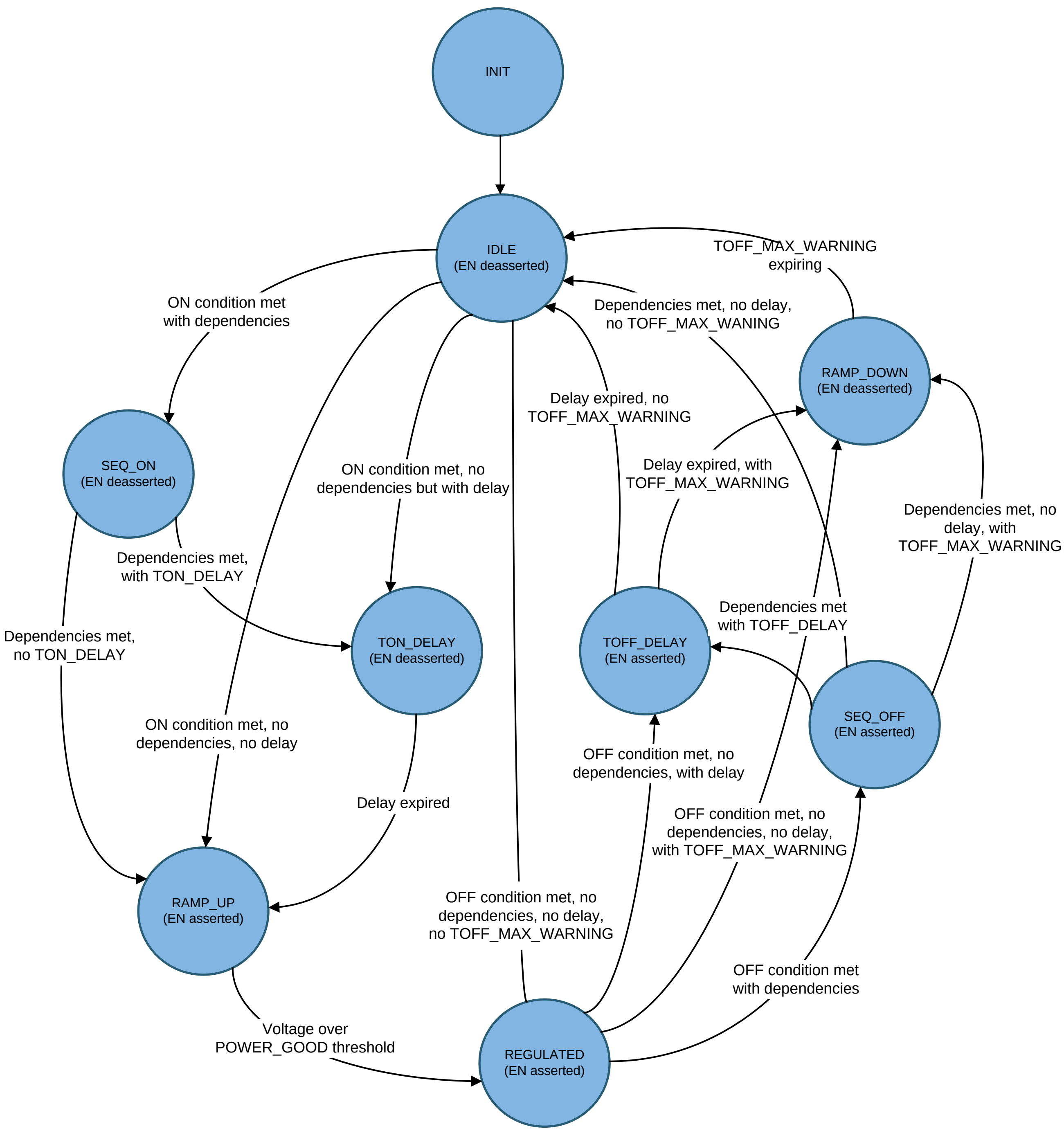


Figure 4-22. State Machine

Figure 4-23 shows the Rail Configuration screen.

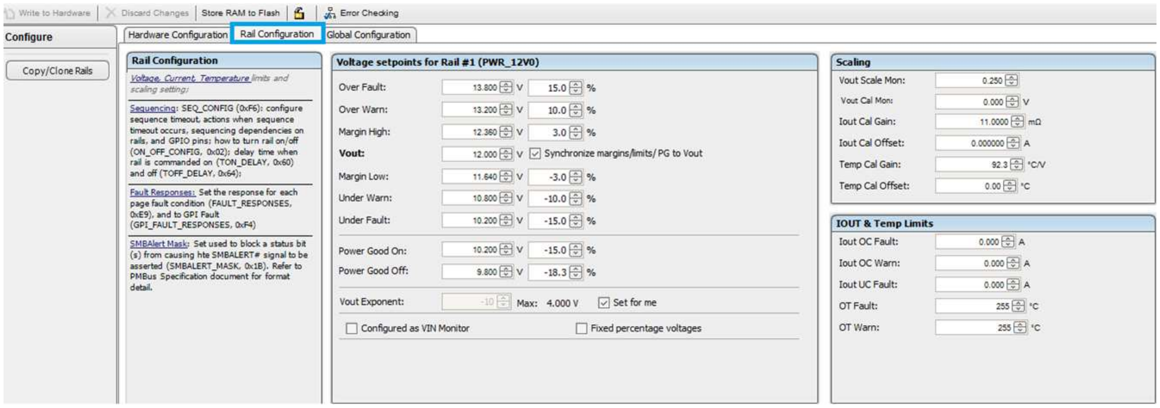


Figure 4-23. Rail Configuration Tab

4.3.1.2.1.1 Setting Voltage Setpoint, Margin, and Limits

Each rail can have up to nine different thresholds for each voltage rail, as follows:

- OVER_VOLTAGE_FAULT
- OVER_VOLTAGE_WARNING
- UNDER_VOLTAGE_FAULT
- UNDER_VOLTAGE_WARNING
- MARGIN_HIGH
- MARGIN_LOW
- POWER_GOOD_ON
- POWER_GOOD_OFF
- VOUT

The GUI can help to synchronize the margins, limits, and PG to the VOUT, to save the user's inputs (see Figure 4-24). The Vout Exponent defines the maximum value the device can detect. When the *Set for me* checkbox is selected, the GUI automatically adjusts the Vout Exponent based on the user's inputs to achieve the best resolution. If the thresholds are larger than the maximum value allowed by the Vout Exponent, 0 V is returned by the device. All of these thresholds are the results after the scaling factor and offset defined in Section 4.3.1.2.1.2.

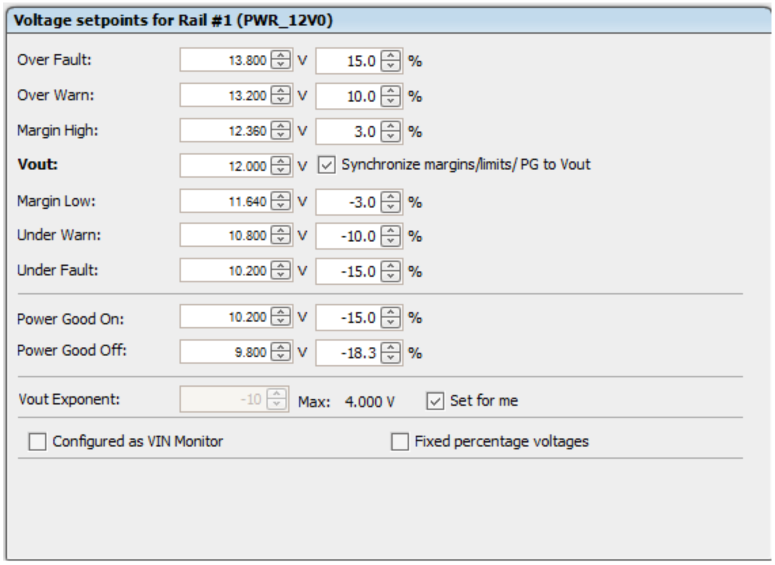


Figure 4-24. Voltage Setpoint, Margin, and Limit Setting for Rest UCD90xxx

The UCD90320 device supports up to 4 profiles (each profile has 9 thresholds) per rail, to support different CPU skews. Users can click the Edit Rail Profile link to add, delete, or modify existing profiles (see Figure 4-25).

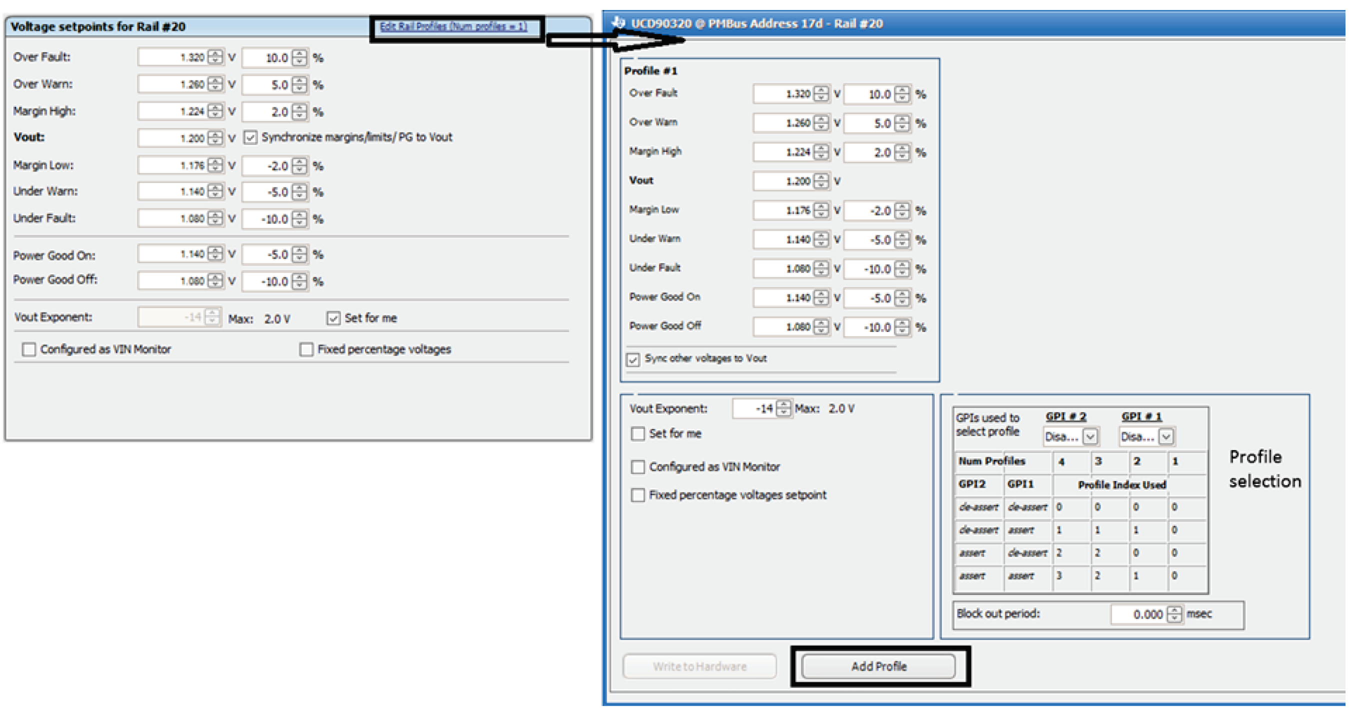


Figure 4-25. Voltage Setpoint, Margin, and Limit Setting for UCD90320

4.3.1.2.1.2 Setting Scaling Factors

Each rail has its own scaling factor and offset for voltage, current, and temperature. Set the scaling factors based on the hardware design. The thresholds set in Section 4.3.1.2.1.1 are after scaling factor and offset. The Vout Scale Mon is normally the ratio of the external voltage divider if applicable. For example, a 12-V rail is down-scaled to 2 V using a divider connected on the Mon pin. The Vout Scale Mon must be set to 2/12 (1/6) and all the thresholds set in Section 4.3.1.2.1.1 shall be based on the 12 V instead of the 2 V.

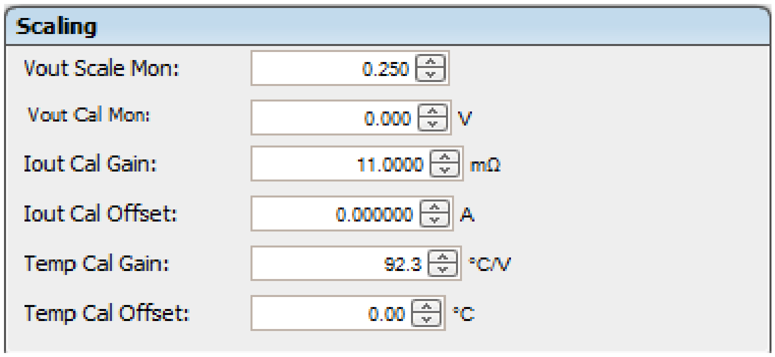


Figure 4-26. Scaling Factors Setting

4.3.1.2.1.3 Setting Current and Temperature Limits

When rails are configured to monitor current and temperature, limits can also be set (see Figure 4-27).

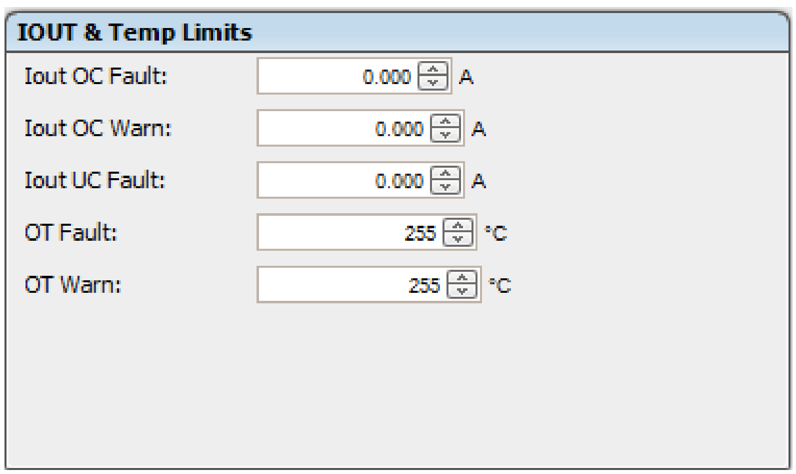


Figure 4-27. Current and Temperature Limits Setting

4.3.1.2.2 Sequencing

4.3.1.2.2.1 Turning Rails On and Off

Each rail has an On/Off Config setting, the Turn On/Off Delay and the Max Turn On/Off, to meet different power-up requirements (see Figure 4-28). The Turn On/Off Delay is the delay time to assert or deassert the enable signal after the On/Off condition is met. Max Turn On sets an upper limit, in ms, on how long the power supply can try to power up the output without reaching the POWER_GOOD_ON voltage level. Max Turn Off sets an upper limit, in ms, on how long the power supply can try to power down the output without reaching 12.5% of the output voltage programmed.

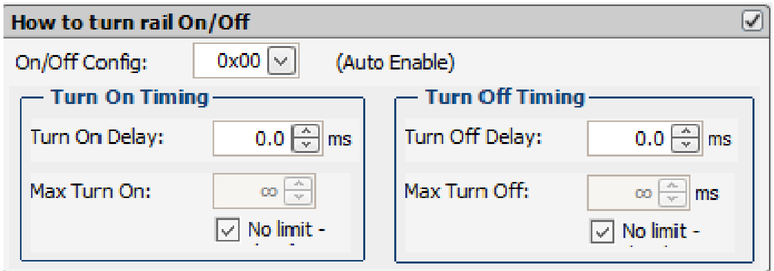
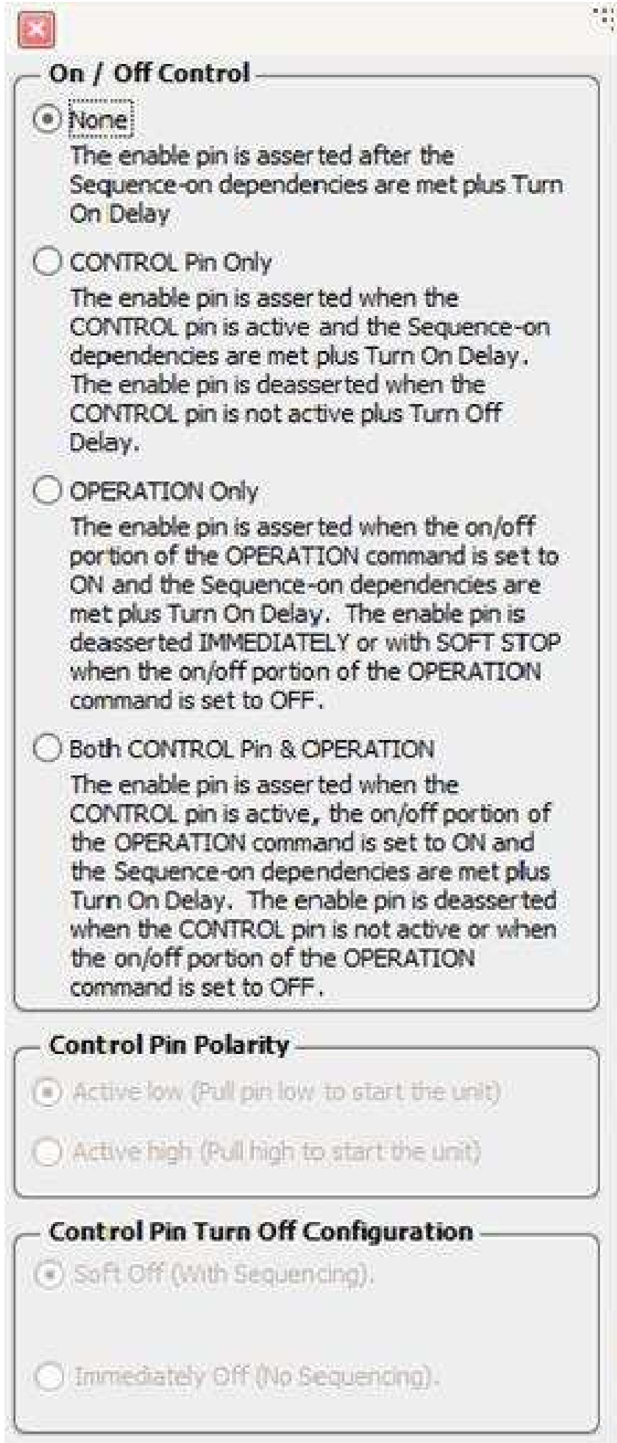


Figure 4-28. Rail On/Off Config Setting (1/2)

Figure 4-29 shows the Rail On/Off Config options.



(1) None (auto enable): the rail automatically tries to turn on when the UCD90xxx device is out of reset. In auto mode, the rail does not tries to turn off.

(2) CONTROL Pin Only: the rail tries to turn on or off when the CONTROL pin state is toggled.

(3) OPERATION Only: the rail tries to turn on or off when it receives an OPERATION command. If the PIN SELECTED RAIL STATE (PSRS) feature is used, the rail must be configured as OPERATION.

Figure 4-29. Rail On/Off Config Setting (2/2)

4.3.1.2.3 Setting Sequencing Time-Outs and Dependencies

Sequencing is very critical for the modern power system. Which rails should be on first? Are there any dependencies? Which rail should be off last? UCD sequencers provide very flexible configuration for the sequencing (see Figure 4-30). A rail can have dependencies on other rails, GPIs, and logical GPOs, to meet various sequencing conditions (see Table 4-1). To prevent the dead loop case, users can set a proper time-out value to decide what action to take: wait forever, turn on, or resequencing when the time-out expires.

Table 4-1. Sequencing Dependencies Events

Event	Rail	GPI	LGPO[(1)]
Sequence On condition met	Voltage monitoring: Above POWER_GOOD threshold Other monitoring: EN signal is asserted.	Asserted[(2)]	The logic output is TRUE.
Sequence Off condition met	Voltage monitoring: Below POWER_GOOD_OFF threshold Other monitoring: EN signal is deasserted.	Deasserted[(2)]	The logic output is FALSE.

(1) LGPO dependencies are available only on UCD90320, UCD90160A, and UCD9090A devices.
(2) The input signal is asserted if it matches the defined polarity, otherwise it is deasserted.

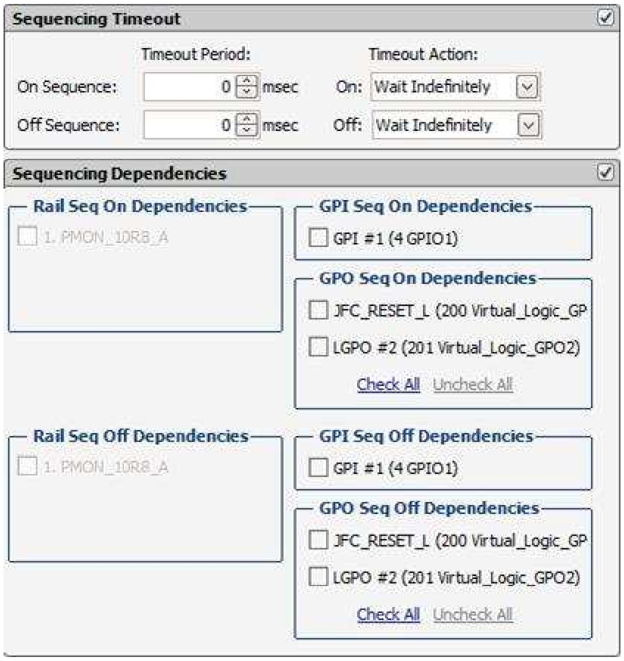


Figure 4-30. Sequencing Time-Out and Dependencies Setting

4.3.1.2.3.1 Using Fault Shutdown Slaves

Fault shutdown slaves are the slave rails of the faulted rail. Each rail can have its own fault slave rails (as shown in Figure 4-31). When a fault occurs on the master rail, if its response is to shut down, all slave rails are also shut down. If retries are specified for the master rail, the slave rail (or rails) remain running until all retries are exhausted. For the UCD90120 and UCD90124 devices, the slave pages are shut down in the same way as the master page. For devices other than the UCD90120 and UCD90124, the slave pages are shut down using sequence off dependencies and TOFF_DELAY. The slave pages do not perform any retries during the fault slave shutdown. After being shut down, slave rails are latched off as if they had experienced the fault. A status bit is set in their MFR_STATUS word indicating the reason they are latched off. If a resequence is enabled on the fault response of the master rail, the fault shutdown slaves are resequenced along with master rail.

If the fault response of master rail is set to ignore and continue operation, the fault shutdown slaves are meaningless.

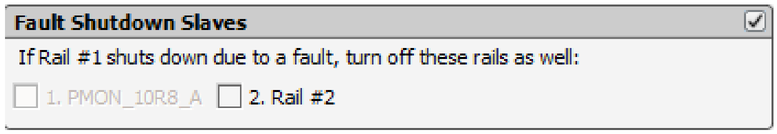


Figure 4-31. Fault Shutdown Slaves

4.3.1.2.4 Setting Fault Responses

This section describes how to set up fault responses to protect the system when faults are detected. The GUI provides a convenient way to configure the fault response. Figure 4-32 and Figure 4-33 show a snapshot of the fault responses. By clicking the *Edit in larger window* link, the user can configure each fault individually.

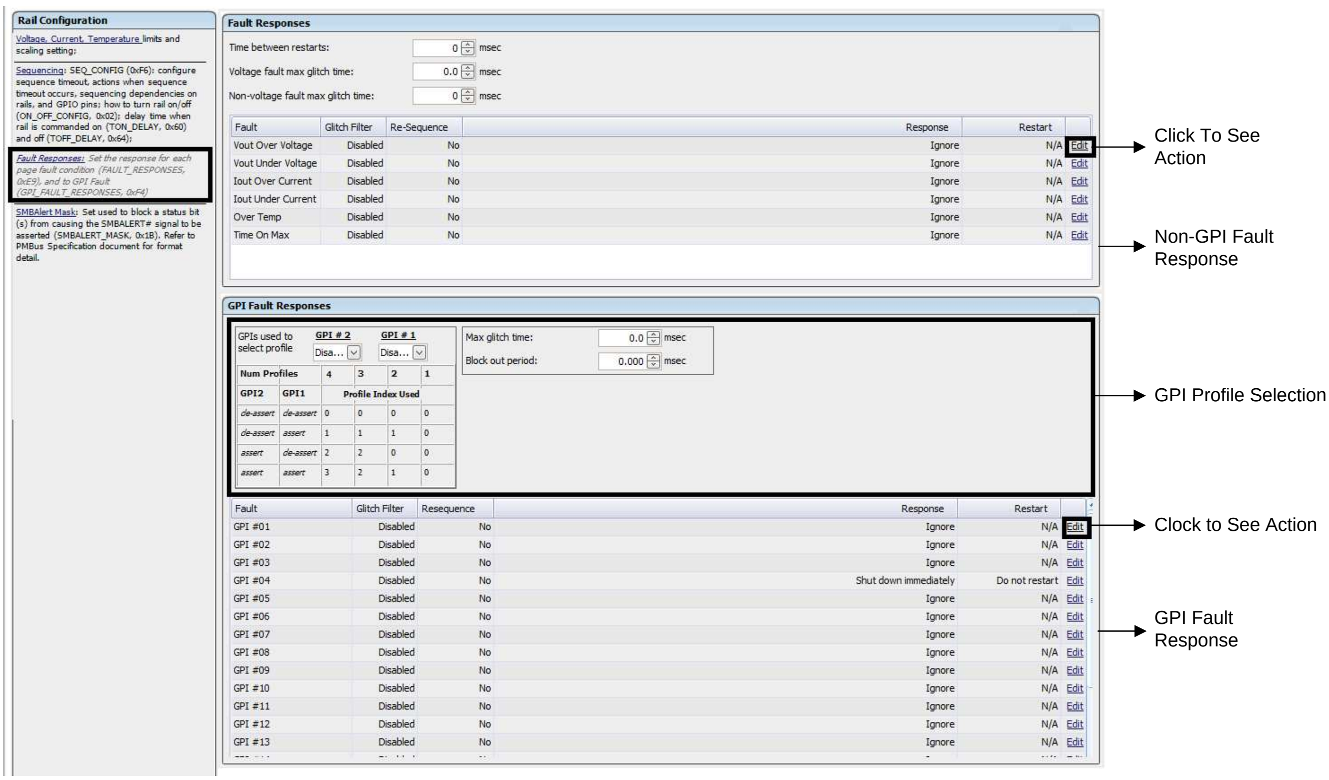
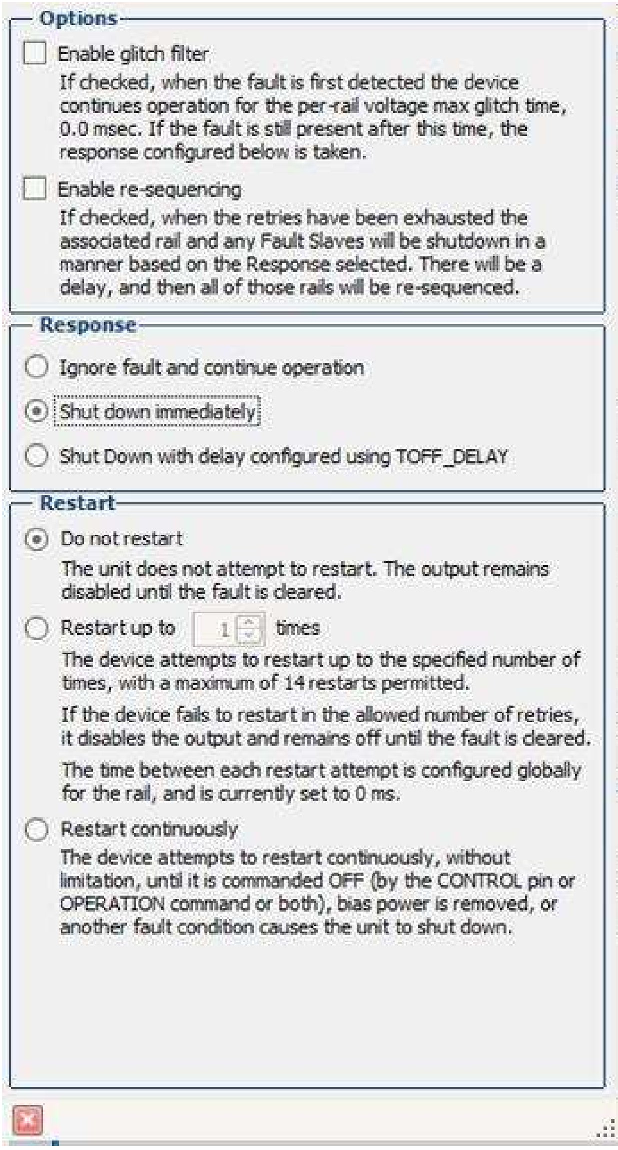


Figure 4-32. Fault Response Setting For UCD90240 and UCD90320

Figure 4-33. Fault Responses Setting For Rest UCD90xxx

For each fault, there are different actions (see Figure 4-34).



(1) Options:

- The glitch filter is used to filter out expected noise so that the response is taken on the real fault. The fault is still logged regardless of the filter.
- Resequence the faulted rail and its fault shutdown slaves after a programmable delay when the retry is exhausted. Resequence starts after the retry is exhausted.

(2) Response:

- If ignore is selected, the reset settings are ignored.
- The faulted rail is turned off immediately.
- The fault rail is turned off based on its sequencing.

(3) Restart:

- Retry settings. The retry count is reset whenever the rail stays above POWER_GOOD for a TON_MAX_FAULT_LIMIT amount of time without having a glitch. If TON_MAX_FAULT_LIMIT is set to 0, 4 seconds are used for the time. There is only one retry for the UV fault because the retry is not considered completed until the rail reaches the POWER_GOOD threshold again.

Figure 4-34. Fault Response Actions

The settings related to the resequence are detailed under the Global Configuration tab (see Figure 4-35).

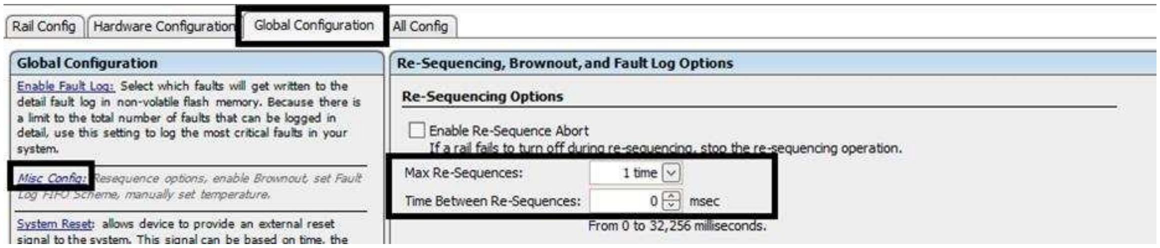


Figure 4-35. Resequence Settings

4.3.1.2.5 SMBAlert Mask

This feature prevents the SMBALERT# signal being asserted, based on the selected status bit (see Figure 4-36). Only UCD90240 and UCD90320 devices have this feature.

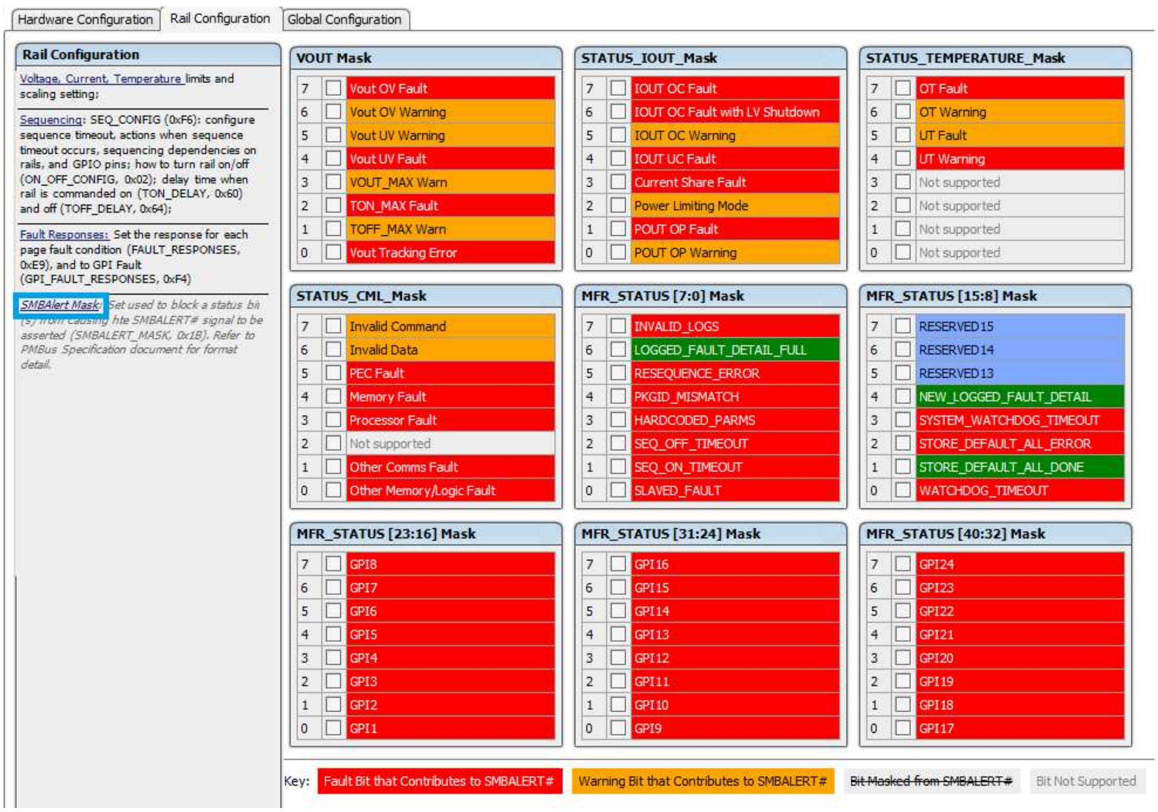


Figure 4-36. SMBAlert Mask

4.3.1.3 Global Configuration

Global Configuration is meant to configure the rest of the functions of the devices including: Enable Fault Log, Misc Config, System Reset, System Watchdog, Pin Selected Rail States, Fault Pin Config, and Run Time Clock (see Figure 4-37).

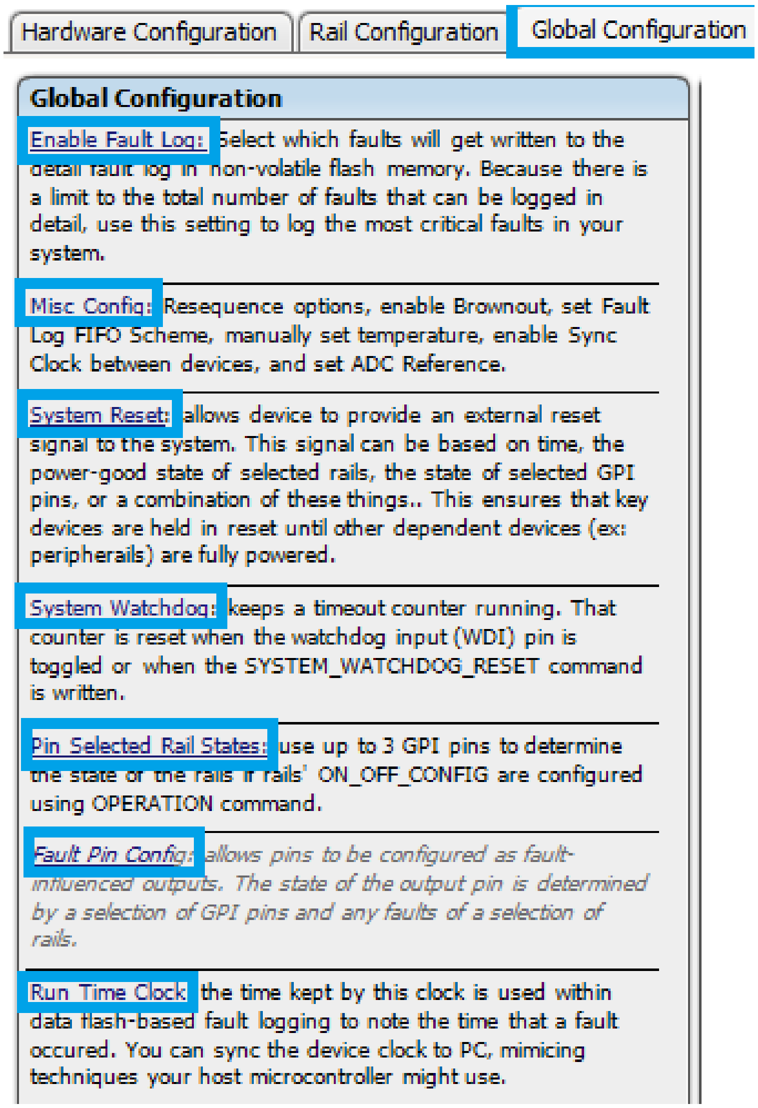


Figure 4-37. Global Configuration

4.3.1.3.1 Enabling the Fault Log

Users can configure which faults get written to the detail fault log in the nonvolatile flash memory. The checkboxes select the fault to be written (see Figure 4-38). This only affects detail fault logging. Faults are always written to the logged fault summary in the flash memory. A limited number of faults can be logged in the details; this number varies by devices.

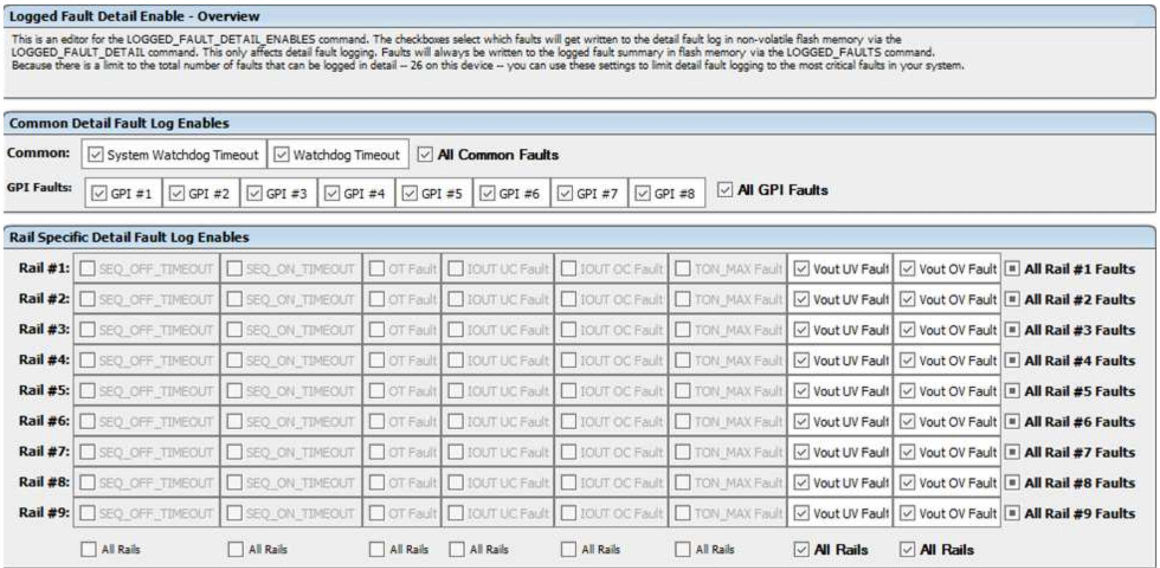


Figure 4-38. Enable Fault Log

4.3.1.3.2 MISC_CONFIG

The MISC_CONFIG function lets users configure the following features (see Figure 4-39). Features vary by device (see individual UCD90xxx data sheets for supported features).

- Resequencing
- Fault log FIFO mode
- Brownout logging
- Disable flash logging
- Fan control
- External ADC reference
- Manual temperature settings

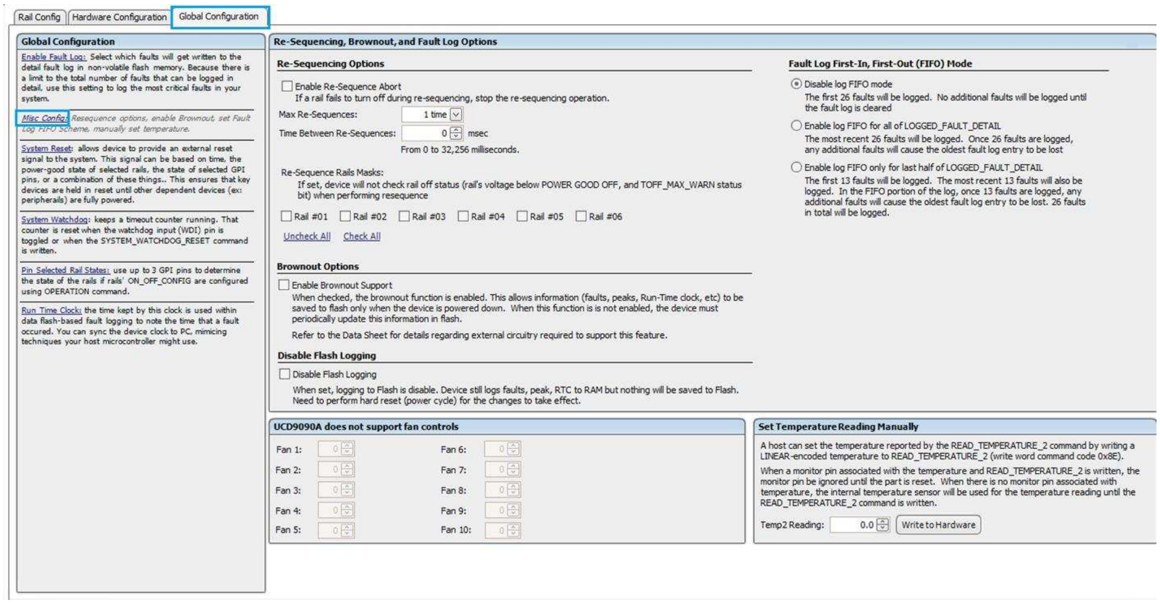


Figure 4-39. MISC_CONFIG Function

4.3.1.3.3 Configuring System Reset Output

The system reset function lets the device provide an external reset signal to the system. The signal can be based on time, the power-good state of selected rails, the state of selected GPIs, or a combination of these. This ensures that key devices (such as the CPU and FPGA) are held in reset until other dependent devices are fully powered (see Figure 4-40).

Users must select an I/O as a reset output, the polarity and mode are configurable. Select the rails or GPIs which impact the system reset signal. A reset can also be generated as a result of a system watchdog time-out if the checkbox is selected.

The GPI tracking function lets the system reset pin be more precisely influenced by a specific GPI pin. (The GPI pin may be a reset signal from another device or a pushbutton.) Whenever the GPI deasserts, the system reset immediately asserts. When the GPI asserts, the system reset is held asserted for the GPI Tracking Release Delay time. After this delay time, the system reset is deasserted.

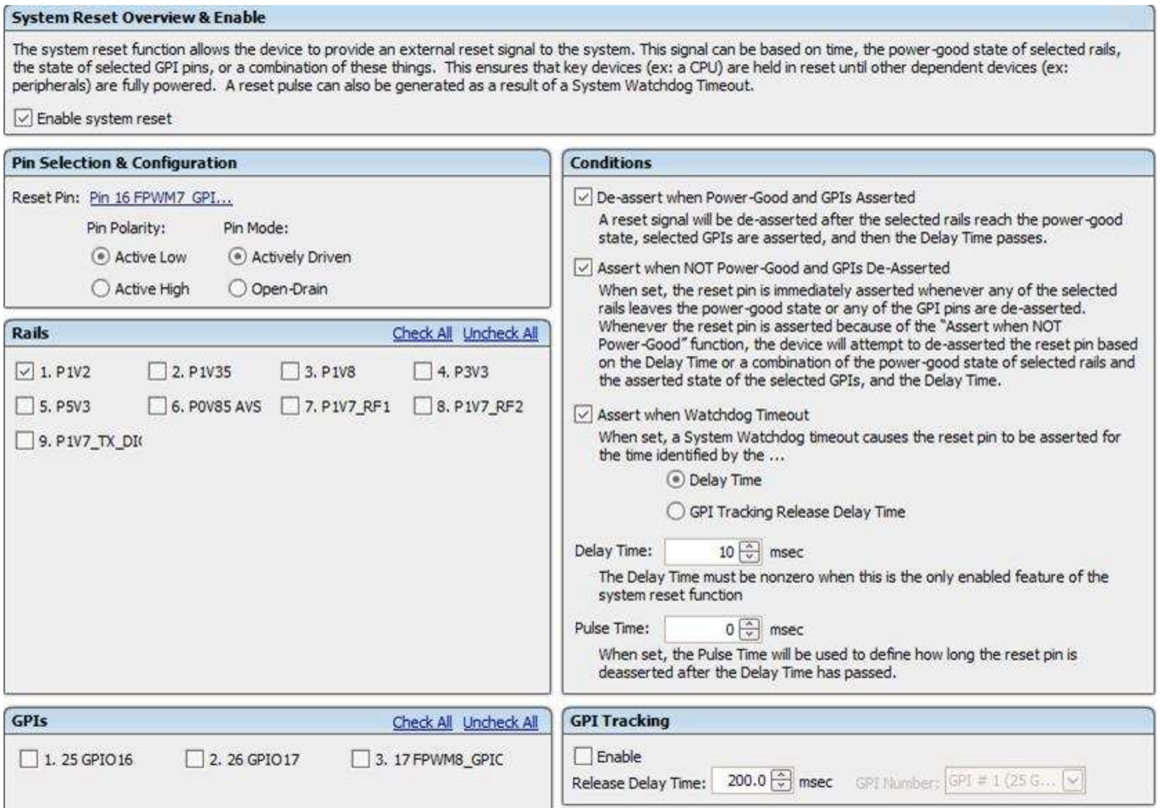


Figure 4-40. Configure System Reset Output

4.3.1.3.4 Configuring the System Watchdog

The system watchdog function keeps a time-out counter running. That counter is reset when the watchdog input (WDI) is toggled or when the SYSTEM_WATCHDOG_RESET command is written. If the counter is not periodically reset within the amount of time configured in the following reset period, the watchdog output (WDO) pin is asserted. The WDO pin stays asserted until the WDI pin is toggled or until the SYSTEM_WATCHDOG_RESET command is written. The WDI and WDO pins are optional, except for UCD90120 and UCD90124 devices (see Figure 4-41).

The start time is the time to delay before monitoring the WDI pin or command. The Watch Reset Pin and the Disable until System Reset Release options can be used to disable or enable the system watchdog function based on the system reset signal.

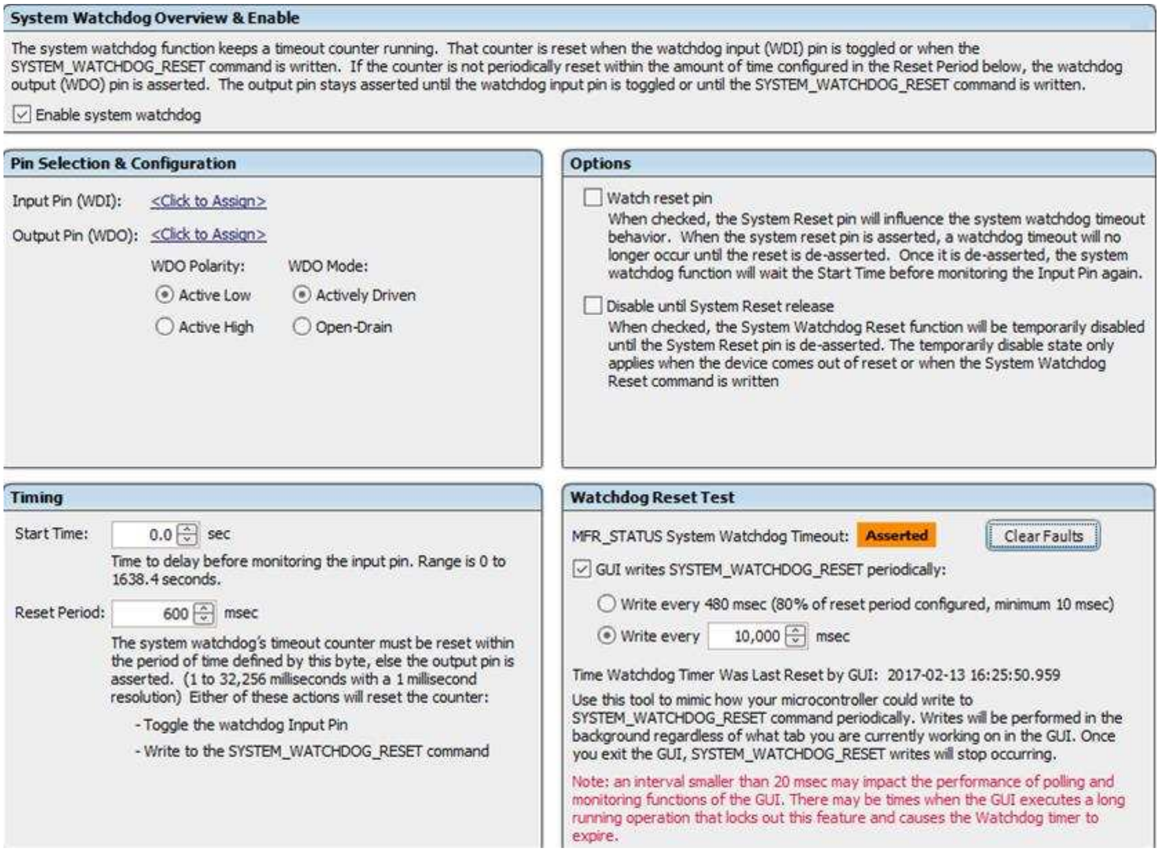


Figure 4-41. Configure System Watchdog

4.3.1.3.5 Pin Selected Rail States (PSRS)

PSRS use up to three GPI inputs to determine the state of the rails (system state) to support the ACPI (advanced configuration and power interface). With each system state, up to eight rails can be set to on or off to meet system requirements (see Figure 4-42). Only the first three GPIs are used to determine the states. The rails that are set as on or off must be configured using the OPERATION command to use PSRS.

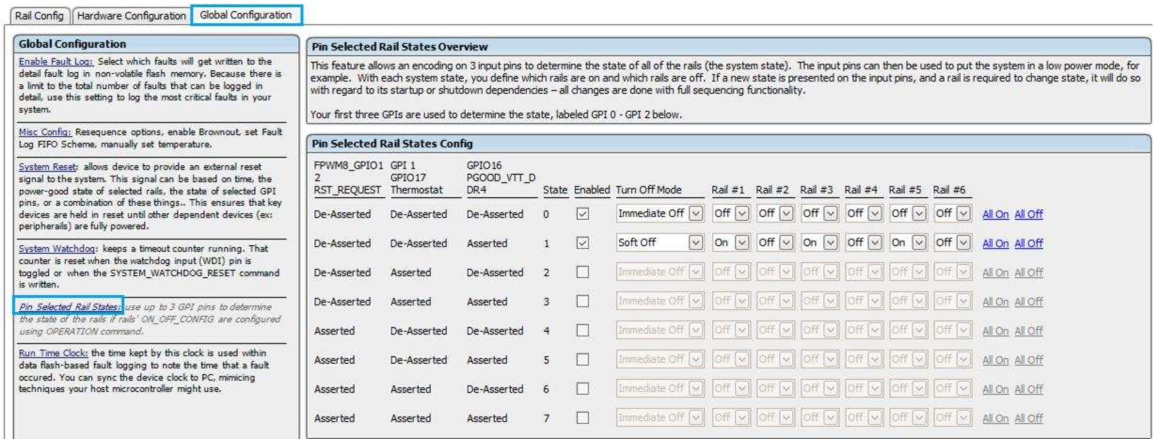


Figure 4-42. Pin Selected Rail States

When the number of GPIs used for PSRS is less than the number of configured GPIs, enable all supported states based on the number of configured GPI and configure the state based on the number of GPI for PSRS. For example, three GPIs are configured, but only the first GPI is used for PSRS. Users must enable all eight states; configure all even states the same as state 0 and configure all odd states the same as state 1. Therefore the changes on the second and third GPI do not affect the desired function.

4.3.1.3.6 Fault Pins Config

Fault Pin Config is valid only on UCD90240 and UCD90320 devices. For the UCD90240 device, users can select which pin is the Fault pin (highlighted by the black square); on the UCD90320, the fault pin selection is part of GPI pin configuration, therefore the black square is grayed-out on the UCD90320 device (see Figure 4-43). From the fault pin configure, users can configure which pages have impact on the fault pin output.

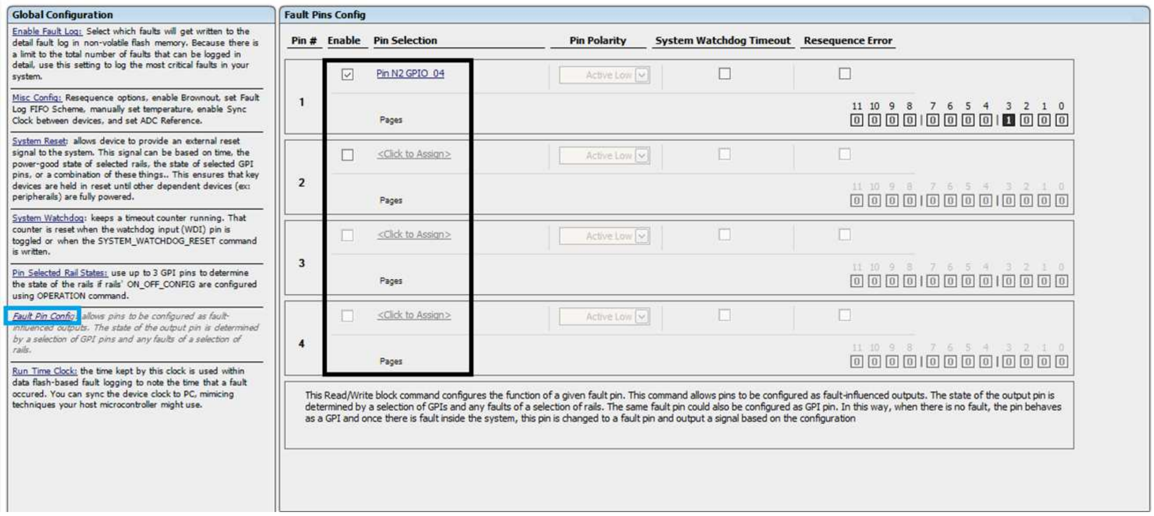


Figure 4-43. Configure Fault Pins

4.3.1.3.7 Run-Time Clock

The run-time clock is the time used within data flash-based fault logging to note the time that a fault occurred. The run-time clock starts from 0, but an external processor sets the run-time clock to real-word time. See the UCD90XXX PMBus Command Reference Guide for the details.

4.3.2 Monitor Task

The Monitor task provides a real-time status of the rails and I/Os. Using the checkboxes in the upper-left corner, users can choose which property plot (voltage, current, temperature, and GPIO) should be visible for the given rail (see Figure 4-44). Changes to Control Line, Operation, and Margining take effect immediate without clicking the Write to Hardware button. Users can choose either target rail or device from the drop-down menu at the top-right corner.

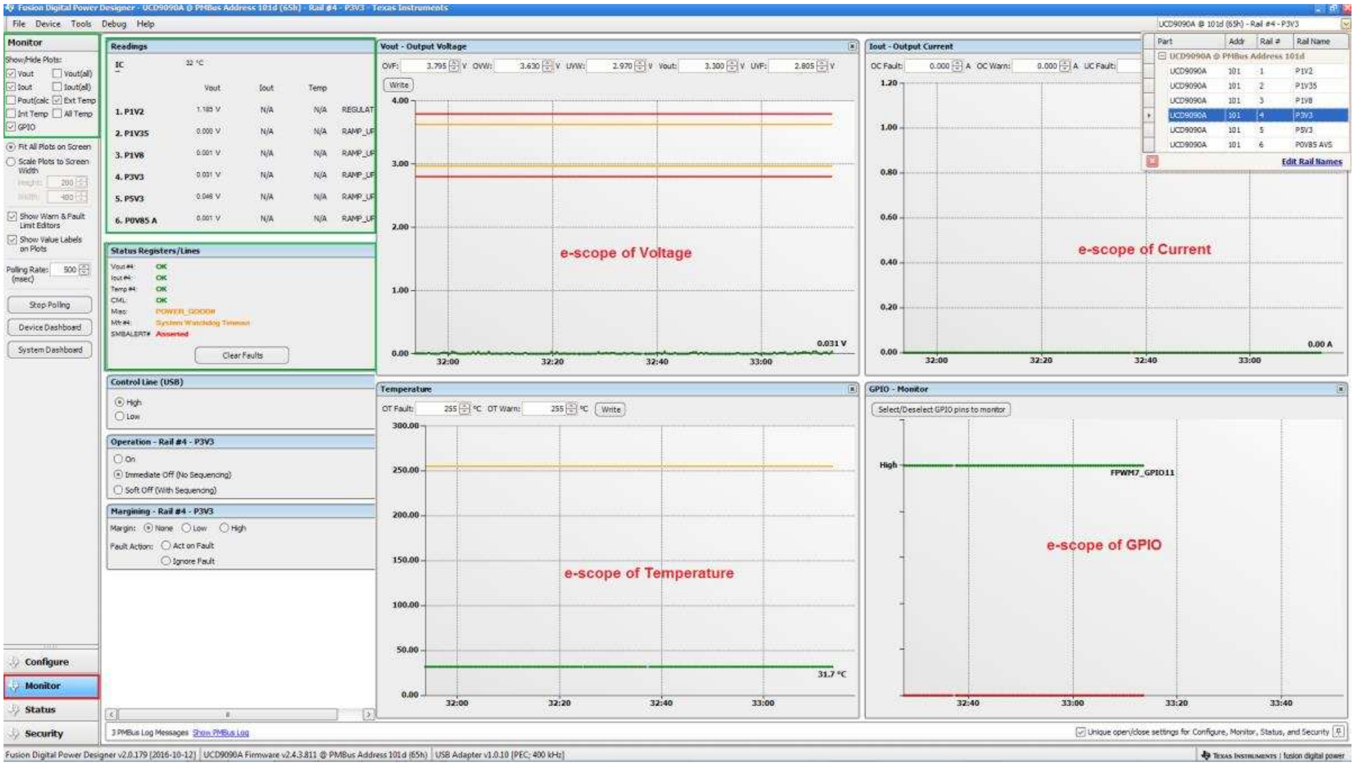


Figure 4-44. Monitor Task Screen

4.3.2.1 Device (Rail) Dashboard

The rail dashboard provides an overview of the selected rail (see Figure 4-45). The dashboard lists property values of all rails, the current rail status, and the control pin/operation command (including margining).

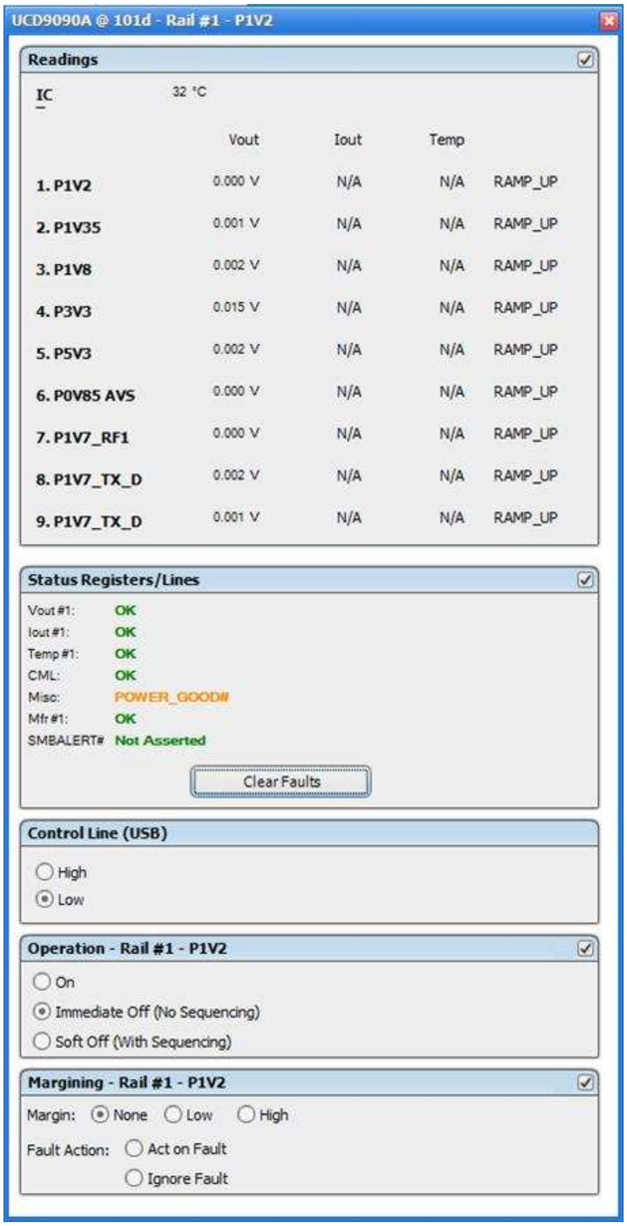


Figure 4-45. Rail Dashboard

4.3.3 Status Task

The status task shows the current status registers, fault log, peak log, misc status, and blackbox log (see Figure 4-46). Users can clear faults, logged faults, logged peaks, and blackbox using different buttons on the left-side panel. Users can read the status of different rails from the pulldown menu at the top-right corner of the status task.

- The Status Registers tab shows the status of the rail and system, where STATUS_WORD, STATUS_CML, and MFR_STTATUS are global instead of page-based.
- The Logged Faults tab shows all faults logged since the last clearing.
- The Peak Readings tab shows all peak values of all monitor rails since the last clearing.
- The Misc Status tab shows device reset tracking
- The Blackbox Info tab shows a snapshot of the system from when the first fault is detected to the last clearing (this feature is available only for UCD90240 and UCD90320 products).

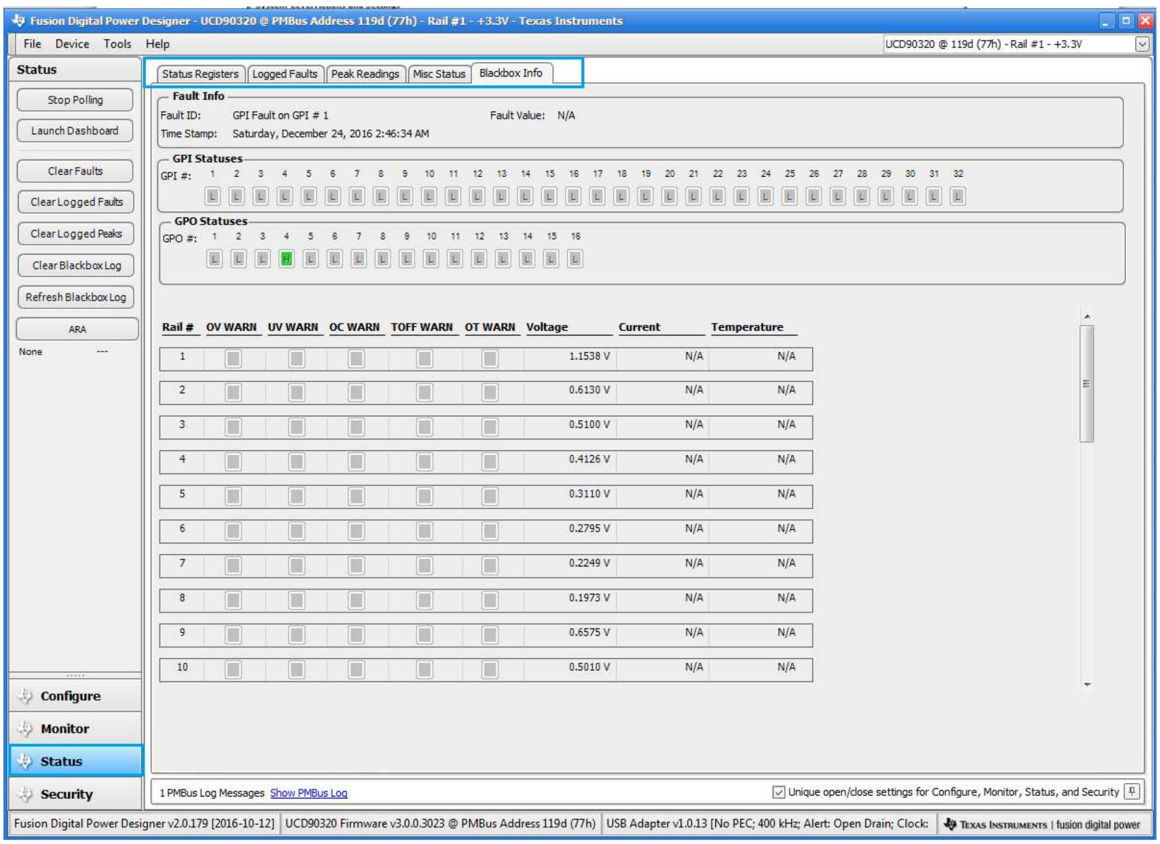


Figure 4-46. Status Task Screen

4.3.4 Security Task

The Security Task lets users prevent certain commands from being modified without authorization (see Figure 4-47). For the devices that do not support SECURITY_BIT_MASK, the protected commands are fixed. See the UCD90XXX PMBUS Command Reference Guide for details.

In the GUI, the user must input 6-character (not byte) passwords; for example, if the user enters 123456, the GUI sends the 0x313233343536 password to the device using MFR_SPECIFIC_33 (0xF1) to enable the feature. When security is enabled, the feature can be temporarily disabled by writing the password to this command. The feature can be permanently disabled by first disabling security, then setting the password to [0xFFFFFFFFFFFF], and clicking Store RAM to Flash. For security reasons, the password cannot be read back.

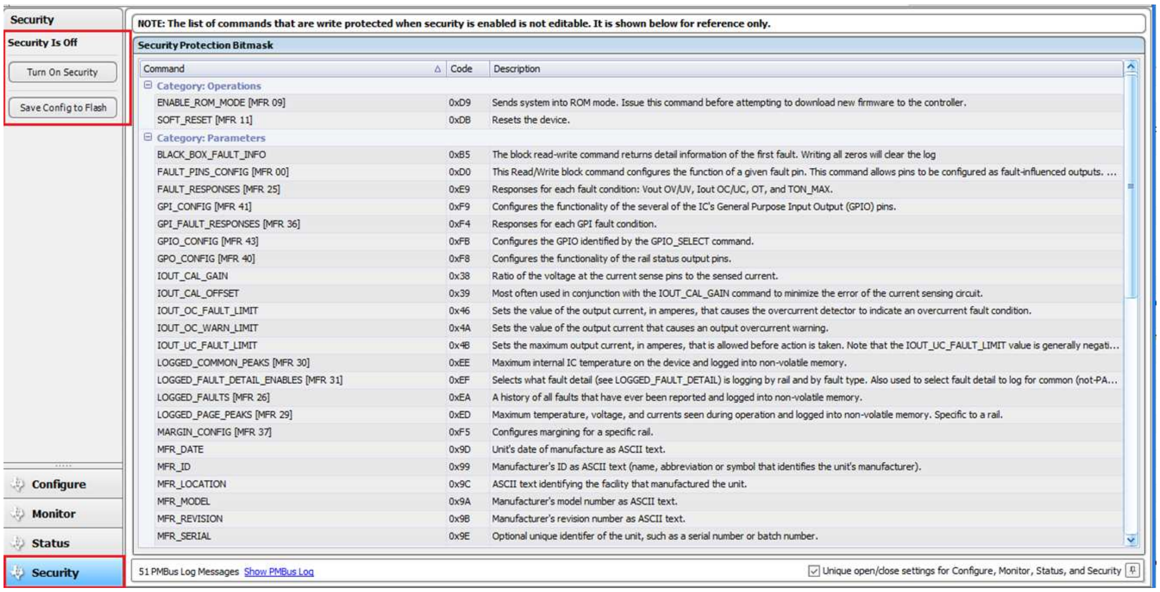


Figure 4-47. Security Task Screen

Import and Export Configurations

The Fusion GUI can import and export configurations from various formats. These configurations are done from the File Menu. The format for importing and exporting configurations differs depending on online or offline mode and also the devices. The configuration of an individual device can be saved in the project file or saved as a single system file (.tifsp). Users can choose whether to store all settings to the data flash and/or to clear the flash logs before exporting the data flash, as shown in Figure 5-1 (see the Global Options tab).

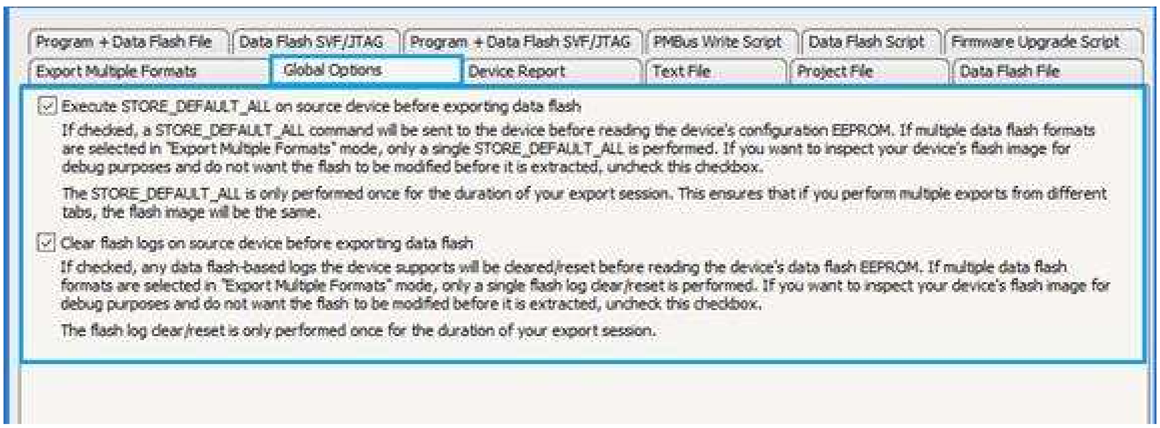


Figure 5-1. Configuration Storage Setting

5.1 File Formats

The Fusion GUI supports the following file formats (see Figure 5-2):

- Project file (.xml): used by the Fusion GUI; stores the configuration of a single device, and non-device's definition such as rail names. Project file can be saved in device's configuration window, File menu → Save Project As
- System file (.tifsp): used by the Fusion GUI; stores configurations of multiple devices. System file can be saved in the system configuration window, using the save button or File menu.
- Flash file (on-line device and device has flash): contain raw binary flash data. Flash file is a single device's configuration, and can be saved in the configuration window of the device, File menu → Export. TI recommends using the data flash (.hex) format to import into the new device.
  - Data Flash: text (.txt), Intel Hex (.hex), or S-Record (.srec)
  - Program Flash: Intel Hex (.hex), S-Record (.srec), and Tektronix Extended Format (.x0). The S-Record and Intel Hex file can be used by both EEPROM/JTAG programmers and the Fusion GUI. The Tektronix format is only for the Fusion GUI.
- Script file: Sequence of I^2C, SMBus, and PMBus commands used to configure the device. File formats are text (.txt), and Excel (.csv), and can be used by both third-party programmers and the Fusion GUI.
  - PMBus Write Script File: writes to RAM and takes effect immediately
  - Data Flash Script File: writes to Data Flash and takes effect until reset
- JTAG file(.svf): used by the external JTAG programmer; the configuration of a device from either the active device or a hex file is saved in serial vector format (SVF).

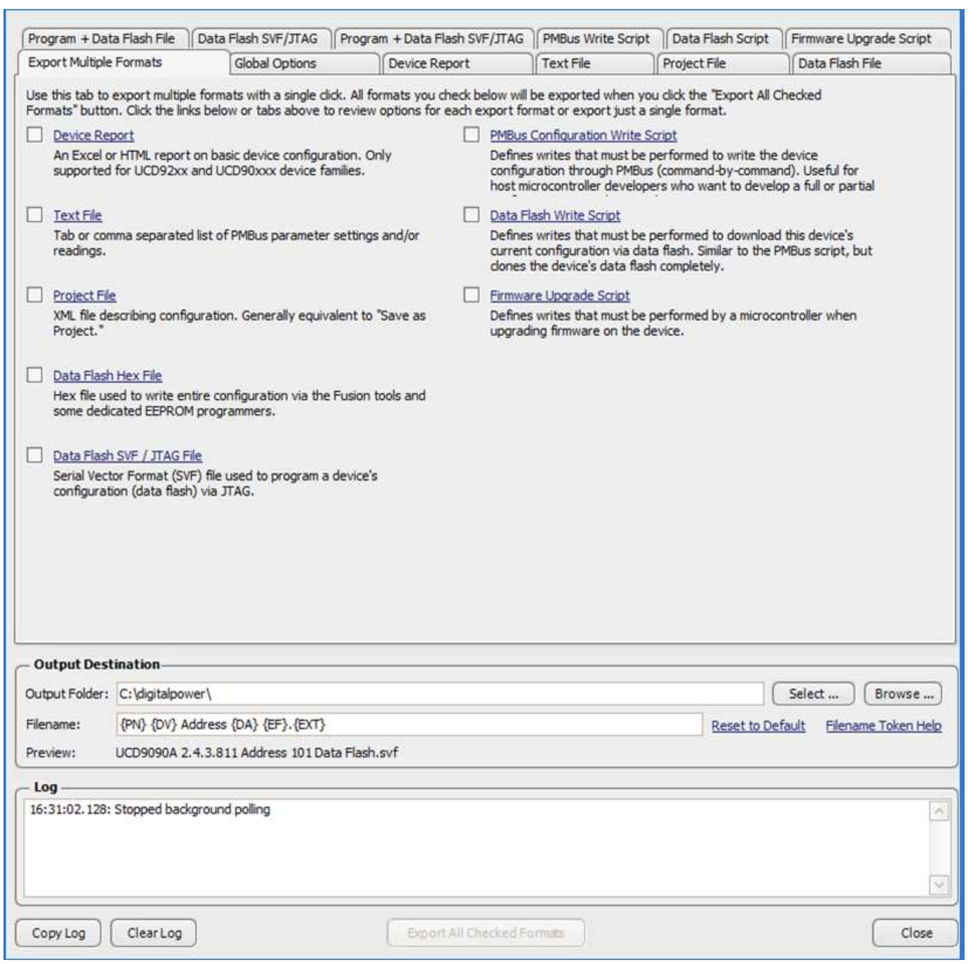


Figure 5-2. Supported File Formats

5.2 Device Report

The Fusion GUI can generate a file (Excel or HTML format) to report the basic configuration of the device. The report file can be generated using the Device Report tab (see Figure 5-3).

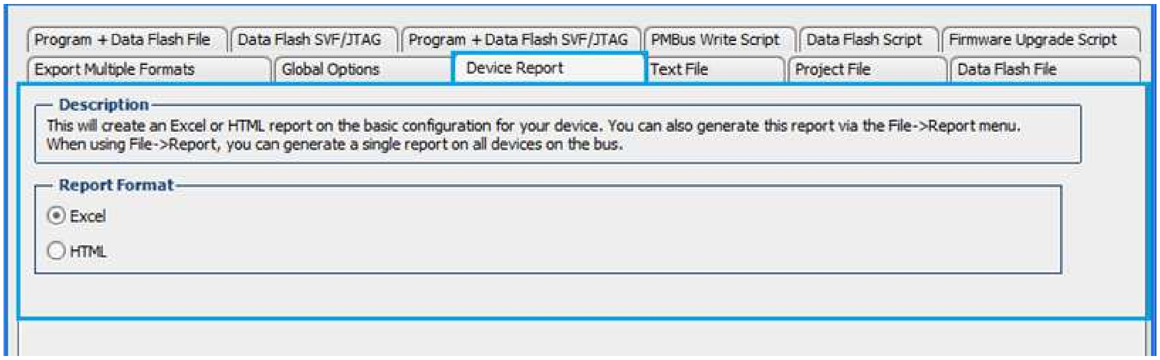


Figure 5-3. Device Report (1/2)

The file gives users a complete view of the entire configuration of the rail (PINs, threshold/limits, dependencies, timing, and fault response). Currently, the file does not include other settings, such as GPI, LGPO, and global configurations (see Figure 5-4).

Device	Address	Rail		Nominal Voltage	Over Voltage				Under Voltage				Margining			
					OV Warn		OV Fault		UV Warn		UV Fault		Margin High		Margin Low	
UCD9090A	101d 0x65	1	P1V2	1.200	1.320	10.0%	1.380	15.0%	1.080	-10.0%	1.020	-15.0%	1.260	5.0%	1.140	-5.0%
		2	P1V35	1.350	1.485	10.0%	1.553	15.0%	1.215	-10.0%	1.148	-15.0%	1.418	5.0%	1.283	-5.0%
		3	P1V8	1.800	1.980	10.0%	2.070	15.0%	1.620	-10.0%	1.530	-15.0%	1.890	5.0%	1.710	-5.0%
		4	P3V3	3.300	3.630	10.0%	3.795	15.0%	2.970	-10.0%	2.805	-15.0%	3.465	5.0%	3.135	-5.0%
		5	P5V3	5.300	5.830	10.0%	6.095	15.0%	4.700	-11.3%	4.500	-15.1%	5.565	5.0%	5.035	-5.0%
		6	P0V85 AV	0.850	0.935	10.0%	0.977	14.9%	0.765	-10.0%	0.722	-15.1%	0.893	5.1%	0.808	-4.9%
		7	P1V7_RF1	1.600	1.760	10.0%	1.840	15.0%	1.440	-10.0%	1.360	-15.0%	1.680	5.0%	1.520	-5.0%
		8	1V7_TX_D	1.600	1.760	10.0%	1.840	15.0%	1.440	-10.0%	1.360	-15.0%	1.680	5.0%	1.520	-5.0%
		9	1V7_TX_D	1.600	1.760	10.0%	1.840	15.0%	1.440	-10.0%	1.360	-15.0%	1.680	5.0%	1.520	-5.0%

Rail	On/Off Config		Vout Exponent		Power Good On		Power Good Off		Fault Shutdown Slaves	On Depend		Off Depend		Turn On Delay (ms)	Max Turn On (ms)	Turn Off Delay (ms)
			EXP	Max (V)						Rail	GPI	Rail	GPI			
1	0x00	Auto Enable	EXP -14	2.000	1.080	-10.0%	1.020	-15.0%	Rail #2,3,4,5,6,7,8,9	None	None	None	None	6.0	No Limit	2.0
2	0x00	Auto Enable	EXP -14	2.000	1.215	-10.0%	1.148	-15.0%	Rail #1,3,4,5,6,7,8,9	None	None	None	None	7.0	No Limit	1.0
3	0x00	Auto Enable	EXP -13	4.000	1.620	-10.0%	1.530	-15.0%	Rail #1,2,4,5,6,7,8,9	None	None	None	None	4.0	No Limit	4.0
4	0x00	Auto Enable	EXP -12	8.000	2.970	-10.0%	2.805	-15.0%	Rail #1,2,3,5,6,7,8,9	None	None	None	None	2.0	No Limit	5.0
5	0x00	Auto Enable	EXP -12	8.000	4.770	-10.0%	4.505	-15.0%	Rail #1,2,3,4,6,7,8,9	None	None	None	None	0.0	No Limit	0.0
6	0x00	Auto Enable	EXP -14	2.000	0.765	-10.0%	0.722	-15.1%	Rail #1,2,3,4,5,7,8,9	None	None	None	None	8.0	No Limit	0.0
7	0x00	Auto Enable	EXP -13	4.000	1.440	-10.0%	1.360	-15.0%	Rail #1,2,3,4,5,6,8,9	None	None	None	None	0.0	No Limit	6.0
8	0x00	Auto Enable	EXP -13	4.000	1.440	-10.0%	1.360	-15.0%	Rail #1,2,3,4,5,6,7,9	None	None	None	None	0.0	No Limit	6.0
9	0x00	Auto Enable	EXP -13	4.000	1.440	-10.0%	1.360	-15.0%	Rail #1,2,3,4,5,6,7,8	None	None	None	None	0.0	No Limit	6.0

Figure 5-4. Device Report (2/2)

Fusion GUI Useful Tools

6.1 Preferences

Go to File menu → Preferences… (see Figure 6-1).

- Show or hide the All Config tab.
- Enable or disable the protected feature (need password to show the protected feature).
- Delete all application preferences.
- Show warnings or confirmation dialog messages: some warnings and confirmation dialog pop-ups from the GUI are discarded and not shown again by the users selection. Clicking this button enables these pop-up dialog boxes again.
- Configure Device Scan Mode and Address.
- Delete all application preferences when the Fusion GUI closes. The GUI does not keep the user preferences each time it is launched. The GUI treats each as first-time users.
- Delete rail names and pin names when the GUI closes (only rail names and pin names are deleted).

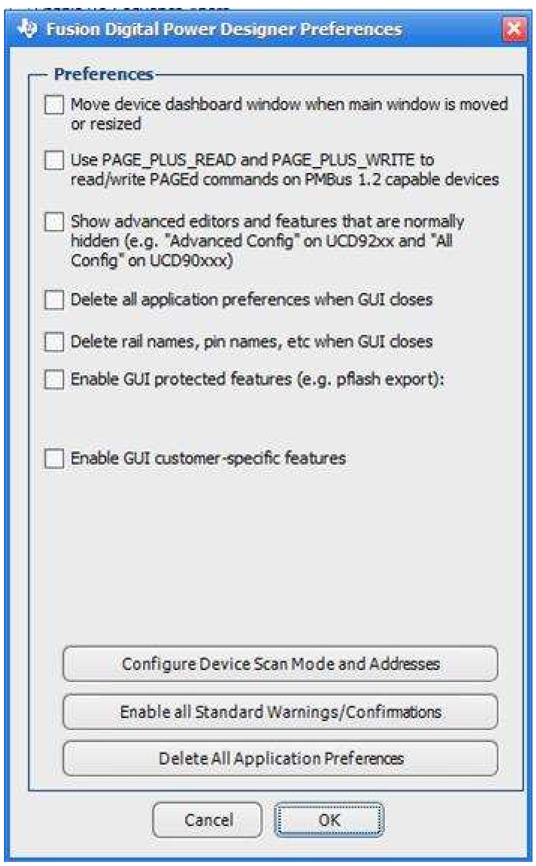


Figure 6-1. Preferences

6.2 Background Polling

By default, the GUI polls various information from devices, and updates this information in the GUI (for example, plots). This feature can be seen turned on and off, as shown in Figure 6-2.

Figure 6-2. Background Polling [System View]

Or the feature can be turned on and off using the system monitor toolbar (see Figure 6-3).

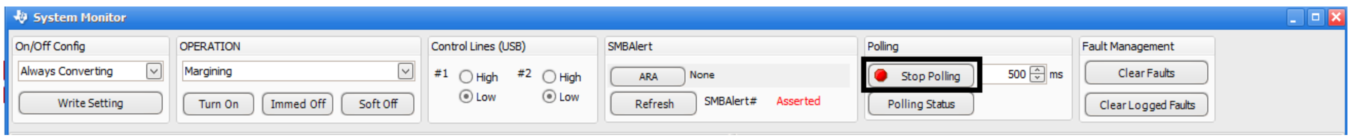


Figure 6-3. Background Polling [System Monitor]

NOTE: Background polling should be disabled if other hosts have access to the device.

6.3 Polling Status

Figure 6-4 and Figure 6-5 show on-screen displays of the polling status for the system and for each device.

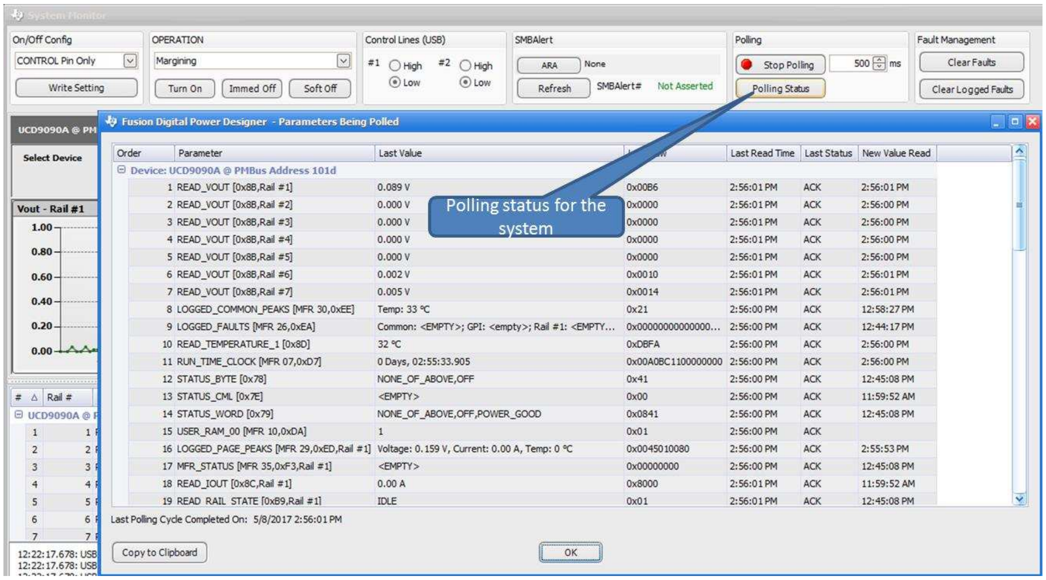


Figure 6-4. System Polling Status

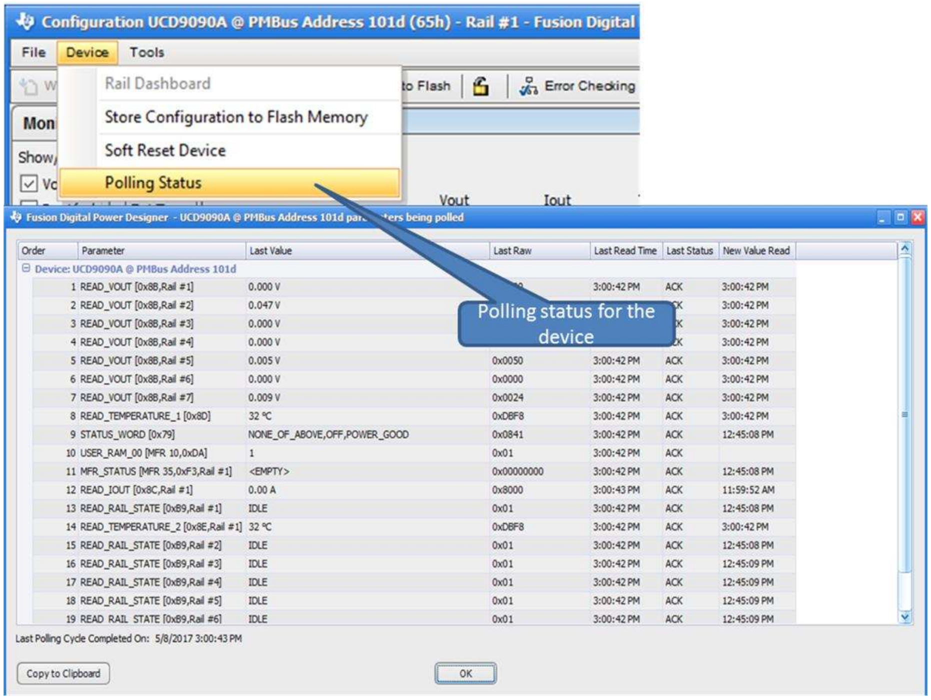


Figure 6-5. Device Polling Status

6.4 Copy or Clone Rails

The Clone and Copy features (select File → Tools → Copy/Clone Rails …) help users copy the following settings of a sourcing rail: Voltage Parameters, Fault Responses, Turn On and Turn Off Timing, Sequence ON and OFF Timing, Sequence ON and OFF GPI pin, Enable Pin Setup, Margining Pin Setup, On Off Config, Fault Logging, as well as Current and Temperature Parameters (see Figure 6-6).

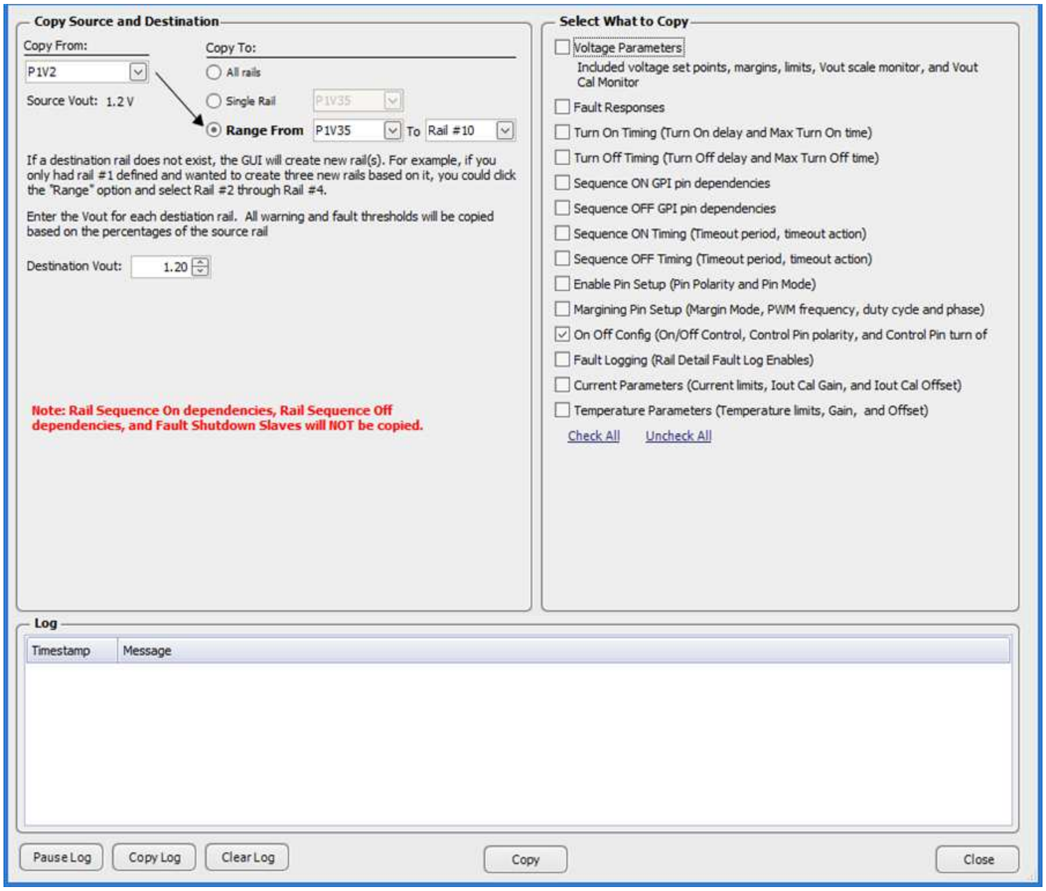


Figure 6-6. Copy or Clone Rails Screen

6.5 PMBus Logging

The Fusion GUI can save all the PMBus commands from the USB adapter host to a local file if these are required for debugging purposes (see Figure 6-7). This feature is only available in online mode.

Figure 6-7. PMBus Logging

6.6 Data Logging

Data logging is used to turn on the poll for a selected command, and the values are logged to one or more text files (see Figure 6-8). Unlike the PMBus logging utility, this feature enables polling of selected commands always, even if the monitor task has never been selected.

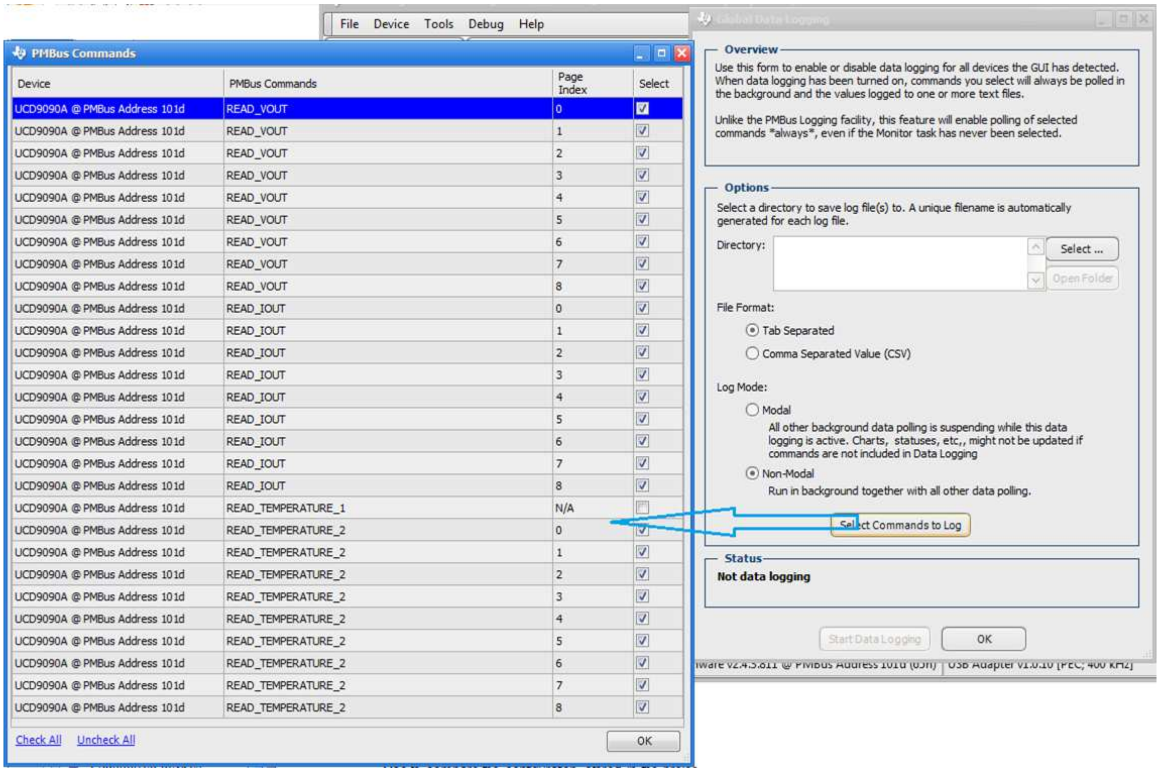


Figure 6-8. Data Logging

6.7 Device and Project Configuration Comparison

Users can compare the configuration stored in the project file (.xml) and the current configuration loaded on the device (online or offline), or compare the configurations between project files (see Figure 6-9).

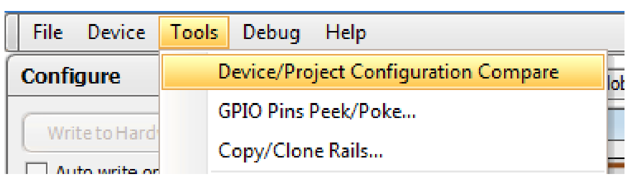
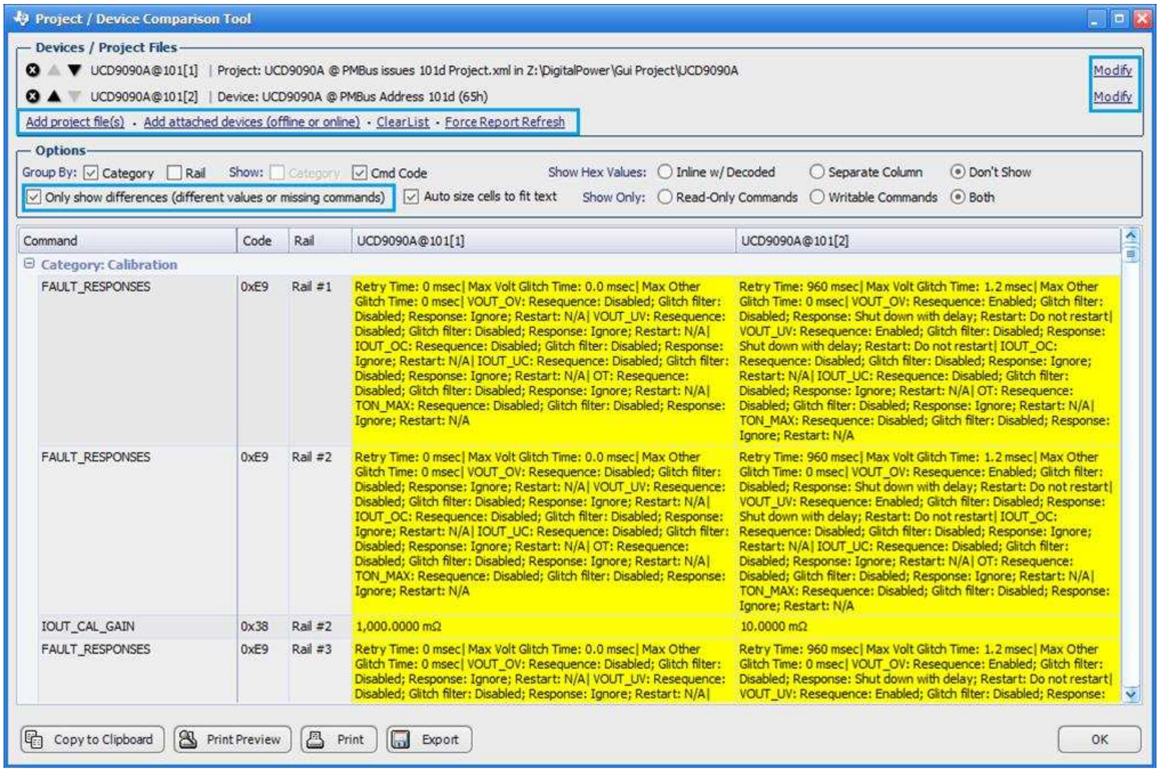


Figure 6-9. Device and Project Configuration Comparison

The tool is highly flexible when providing the combinations to compare and results to display (see Figure 6-10).



The differences in Category: Status can be ignored because the I/O status can be different.

Figure 6-10. Comparison Tool Results

6.8 UCD3xxx and UCD90xxx Device GUI

The Fusion GUI also provides a low-level GUI debug tool, which includes links to many different tools together (see Figure 6-11). This GUI cannot coexist with the Fusion GUI.

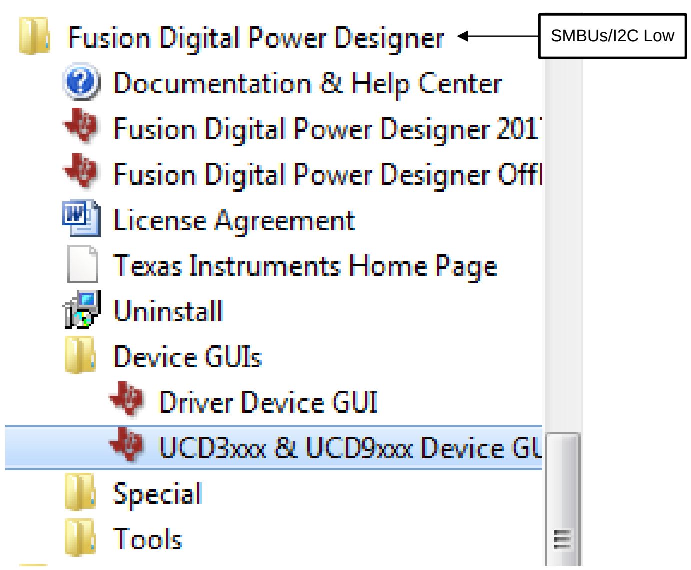


Figure 6-11. UCD3xxx and UCD90XXX Device GUI

The Device GUI can help users scan the device on the same I2C bus, download Firmware, as well as dump, export, and compare flash files and other uses (see Figure 6-12).

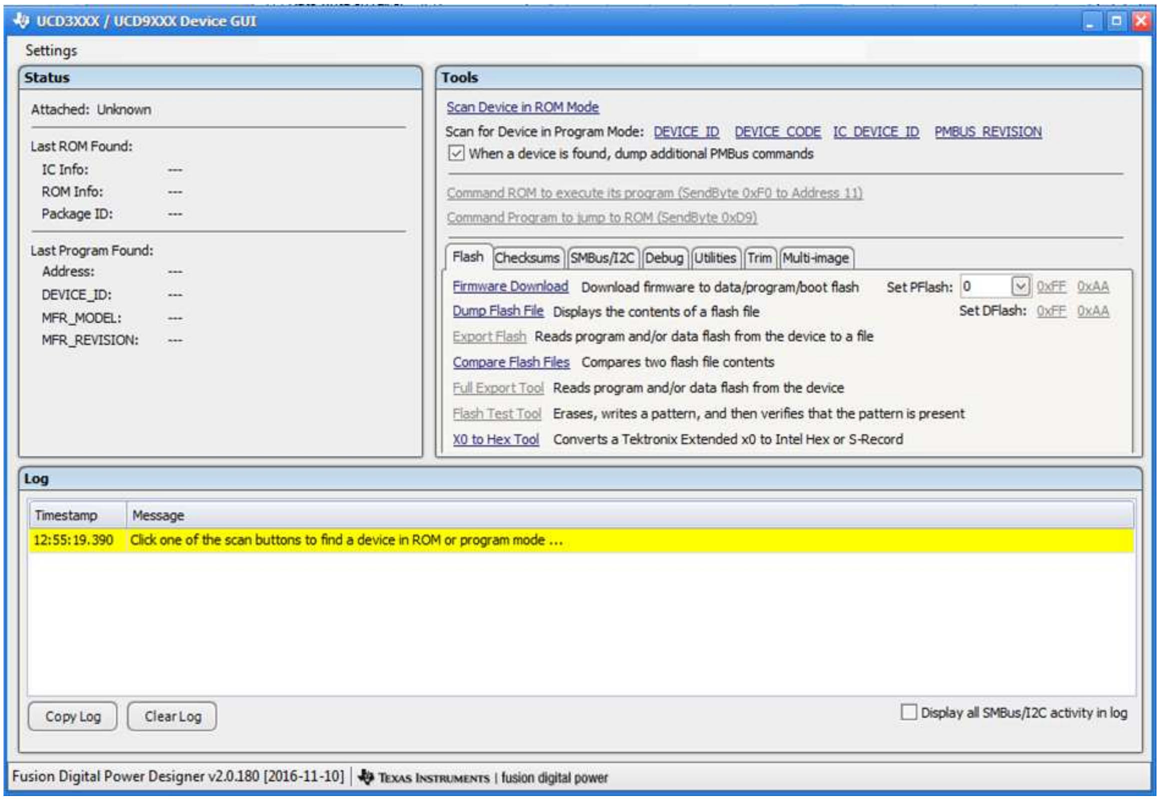


Figure 6-12. Device GUI Settings

6.9 SMBUS, I2C, and SAA Tool

The SMBUS, I2C, and SAA tool provides a very low-level I^2C utility, which can be used for any I^2C devices in addition to the UCD90xxx (see Figure 6-13). There any different ways to launch this utility. Be sure to stop the polling from the Fusion GUI if the tool is launched from there.

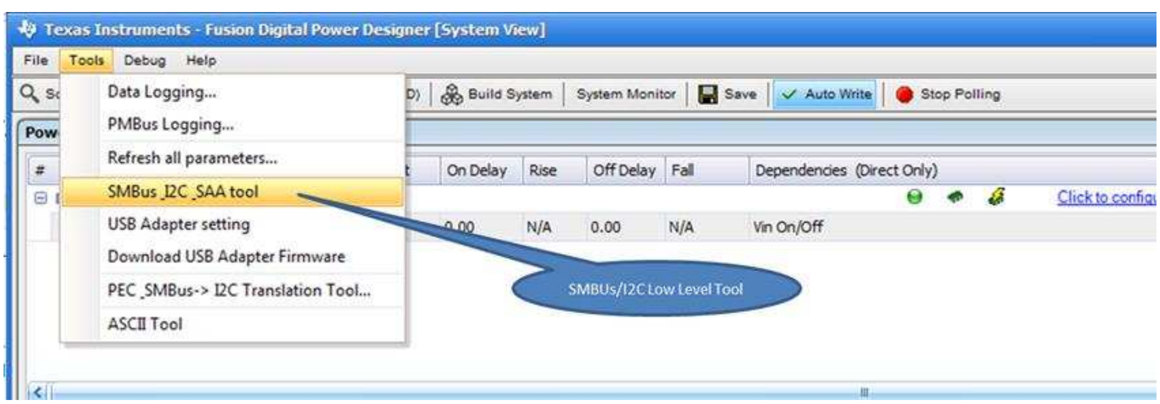


Figure 6-13. SMBUS, I2C, and SAA Toolbar Launch

The SMBUS, I2C, and SAA tool can also be launched from the Device GUI described in Section 6.8 (see Figure 6-14).

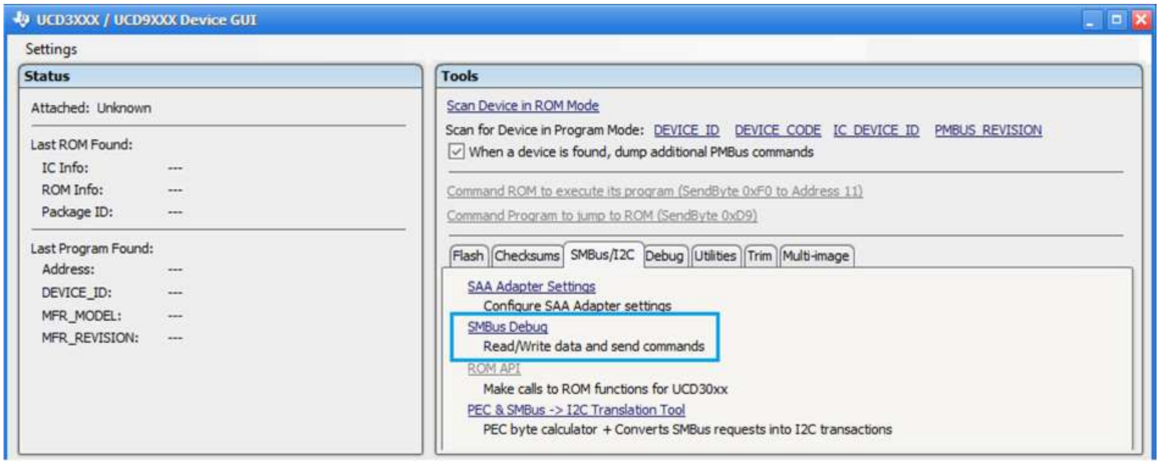


Figure 6-14. SMBUS, I2C, and SAA Tool GUI Launch

The last method to launch this tool is using the Start menu (see Figure 6-15).

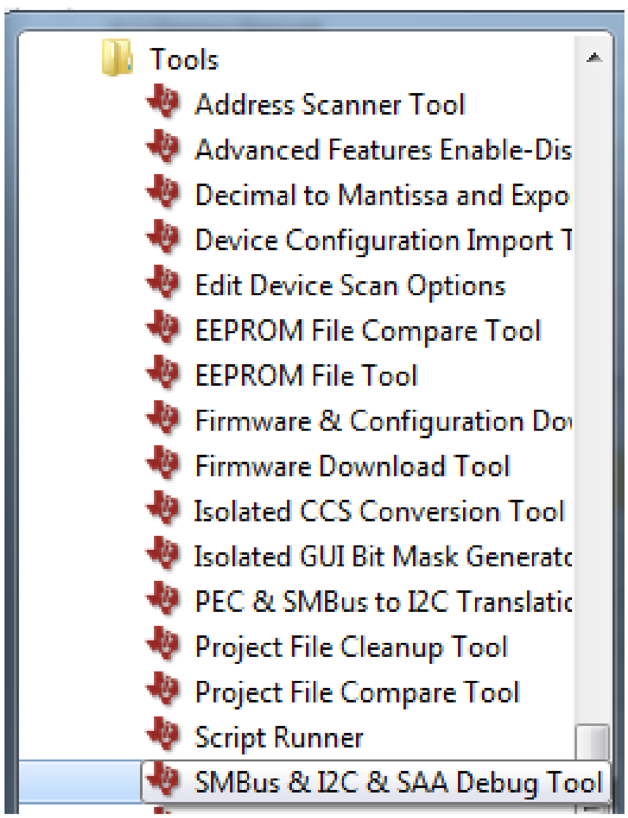


Figure 6-15. SMBUS, I2C, and SAA Tool Start Menu Launch

Users must enter the PMBus address of the device in the Device Address box before advancing further (see Figure 6-16). See the SMBus Specification, PMBus Specification, and UCD90XXX PMBus Command Reference GUI to understand the protocol and commands.

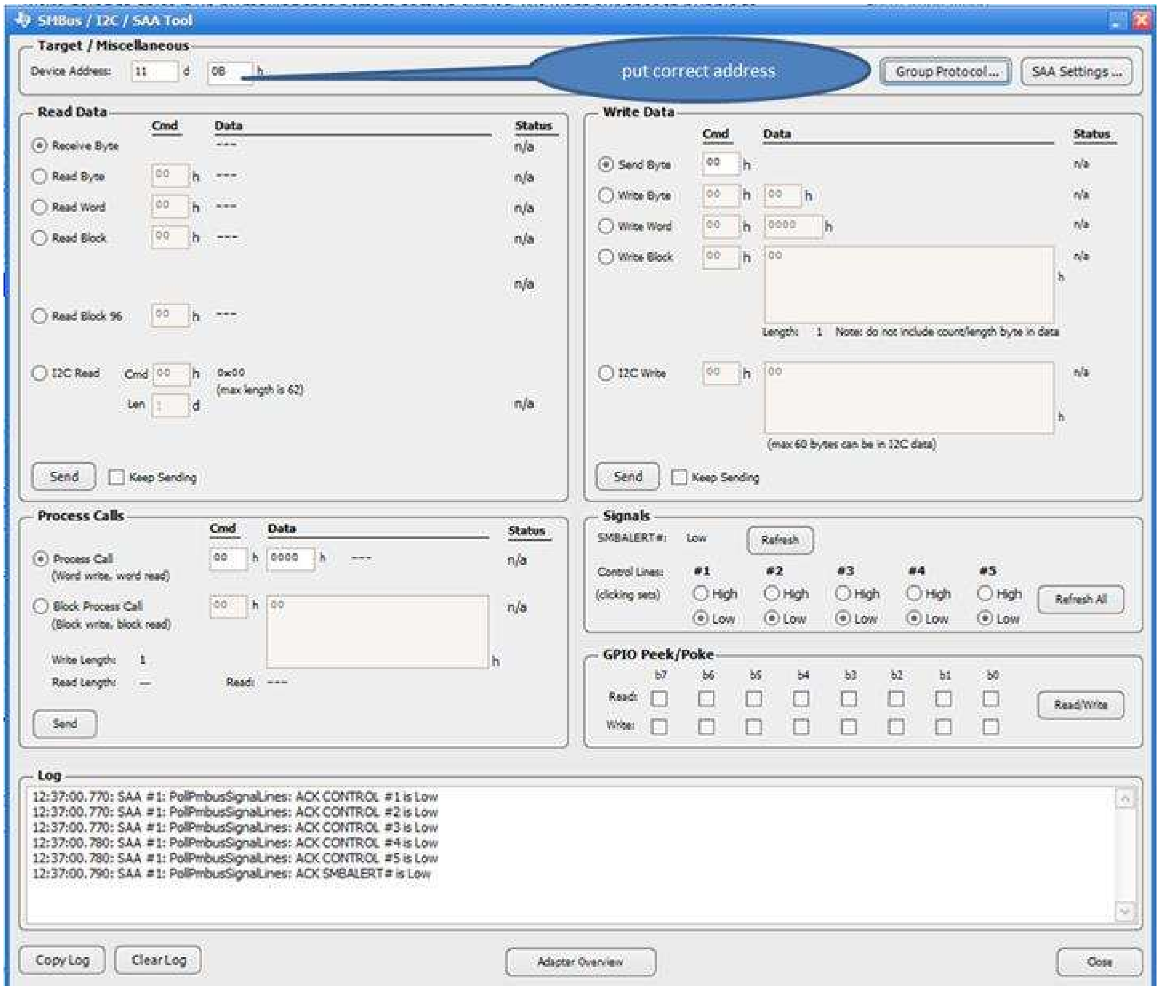


Figure 6-16. Device PMBus Address

6.10 SAA Settings

Users can configure the TI USB-to-GPIO adapter to disable or enable PEC as well as change the I²C speed and pullup resistors values. This utility can be launched from the SMBUs, I2C, SAA tool, in the top-right corner or the Tool menu (see Figure 6-17 and Figure 6-18).

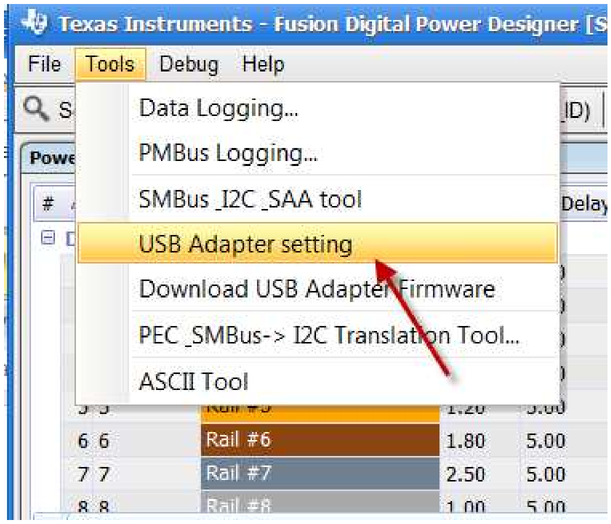


Figure 6-17. SAA Settings (1/2)

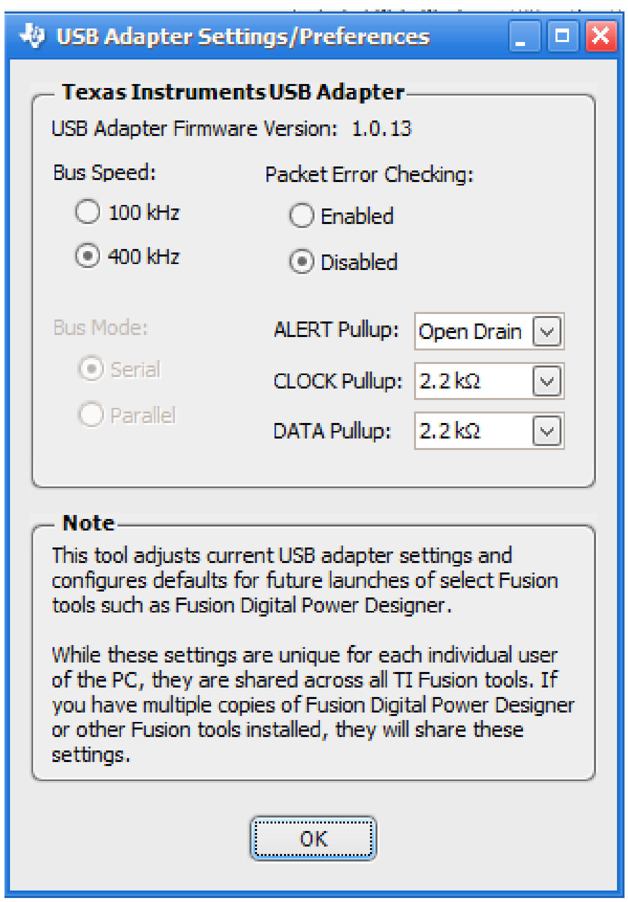


Figure 6-18. SAA Settings (2/2)

Configuration Examples

The following provides example considerations for configuring UCD90xxx devices.

7.1 Design Flow

- Rail setup:
  - How many rails must be monitored?
  - What type of monitoring (voltage, current, temperature)?
- Rail monitoring setup:
  - What are the voltage, current, and temperature set points?
- Rail control setup:
  - How are the rails controlled (turned on and turned off)?
- Rail margining setup:
  - How many rails require margining?
  - What is the frequency and duty cycle?
- GPI configuration:
  - Are there digital signals (GPI) that must be monitored?
- Rail sequencing configuration:
  - What is the start-up sequence?
  - Which rails come first?
  - Which rails depend on other rails for sequencing?
- Fault response configuration:
  - How should the device act if a fault is detected?
  - Should the device Ignore the Fault or Act on Fault?
  - If the device should Act on Fault, and which action to take (shut down fault rail and other slave rails, resequence, log the fault, and so on)?
- Logic GPO configuration:
  - Are there output signals (LGPO) that must notify external system?
- Other configurations:
  - System watchdog
  - System reset
  - Faults to log
  - Fan control
  - FIFO log mode
  - Resequencing settings

7.2 Hardware Configuration

When the previous questions are answered, go to Configure → Hardware Configuration to perform the following steps:

1. Create rails to monitor – either voltage, current, temperature, or all.
2. Assign GPIO pins to be used as the enable pin, monitoring rail status such as: rail is on, rail is off.
3. Assign PWM pins for margining.
4. Assign GPI pins to monitor the external event.
5. Assign LGPOs to output the status.
6. Configure the device information.

7.3 Rail Configuration

When all the hardware pins are assigned, go to Configure → Rail Config to perform the following steps:

1. Configure the voltage, current, temperature limit, and scaling.
2. Set the proper turnon or turnoff delay.
3. Configure sequencing (how are rails turned on and off? Which rails should turn on first? Are there any dependencies.)
4. Go to Global Configuration → PIN SELECTED RAIL STATES, if needed.
5. Configure Fault Responses (rails response to faults).

7.4 Global Configuration

When all the rails are configured properly, the last step is to go to Config → Global Configuration to see whether the following features are required.

- Enable Fault Logging: See which faults must be logged to save more important logs.
- Misc Config: Set the resequence option, brownout option, Fault logging scheme (FIFO mode, fan control and external ADC) when they are applicable and required.
- System Reset: Set the proper system reset if this feature is required.
- System Watchdog: Configure the system watchdog if this feature is required.

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