

Saturn/ISL55188 EVM Getting Started

Rev B05: 03/13/2019



This document contains information on a product under development. The parametric information contains target parameters that are subject to change.

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1 Introduction

Congratulations on your purchase of an Elevate Semiconductor Saturn/ISL55188 EVM evaluation system. Throughout the rest of this document, the Saturn/ISL55188 will just be referred to as Saturn. You will find that it serves as an invaluable development platform to help get your product to market in the shortest possible time. The Saturn EVM and Graphical User Interface (GUI) allow the customer to demonstrate and evaluate the Saturn performance and functionality.

This document provides the instructions to install, setup, and operate the Saturn EVM. Refer to the *Elevate EVM User's Guide* for a detailed description of the FVMI and Motherboard.

1.1 Unpacking - Saturn EVM Contents

Please check the contents of the Saturn/ISL55188 shipping carton to make sure you have received all of the items listed in Table 1. The system is already configured for the best setup, except for connections to the power supply, PC controller, and test equipment.

Table 1: Saturn EVM Contents

Qty	Description
1 ea.	Saturn/ISL55188 System (3 boards: Motherboard, FVMI Board, ISL55188 Loadboard)
1 ea.	Saturn-EVM Getting Started (this document)
1 ea.	EVM Contents List
1 ea.	Elevate User Interface Program Installation Thumb Drive
1 ea.	USB A/B Cable

1.2 Recommended Test and Measurement Setup

1.2.1 Power Supply

Table 2 provides the required power supplies and current rating. The power supplies are connected using standard banana plugs. The customer needs to provide the power supply cables.

The Saturn/ISL55188 VCC and VEE are gated by the VDD supply so it is safe to set the Saturn/ISL55188 VCC/VEE voltages before powering up the EVM and running the software.

Table 2: Power Supply Requirements

Module	Supply	Current Rating
EVM	+20V ⁽¹⁾	0.5 A
EVM	+5V	0.2 A
EVM	-15V	0.5 A
Saturn VCC ⁽⁴⁾	+15V ^(2, 3)	0.5 A
Saturn VEE ⁽⁴⁾	-5V ^(2, 3)	0.5 A

- 1) The EVM +20V could also be used as the Saturn VCC
- 2) The Saturn VCC – VEE voltage should not exceed 34V. Refer to the ABS max section in the datasheet.
- 3) Once the EVM operation is verified, the customer can adjust the VCC/VEE supplies.
- 4) The program does not have the ability to measure the Saturn VCC and VEE currents

1.2.2 PC Controller

To use the Saturn/ISL55188 User Interface Program (UIP), a PC with the following configuration is required:

- Windows XP, Windows 2007, Windows 2008, Windows 2010
- USB Port (a USB cable is provided)

1.2.3 Test Equipment

- 50 MHz differential pulse generator
- 200 MHz Oscilloscope
- Voltage and/or Current Meter
- Voltage and/or Current Source

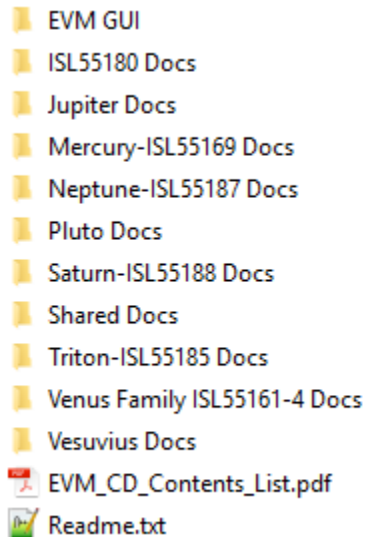
1.3 Software Installation

There are 2 steps to install the Saturn/ISL55188 demonstration program.

1. Install the Saturn EVM UIP from the Flash Drive.
2. Install the USB driver.

Figure 1 illustrates the default directory structure. The user may change the <root dir> during the installation.

Figure 1: Installation Directory Structure



1.3.1 Saturn EVM UIP Installation

To install the Saturn/ISL55188 software package, run the SETUP program on the distribution Flash Drive and follow the prompts. The **ElevATE.exe** executable will be installed in the **EVM GUI** sub-directory. In addition, a short cut will be installed onto the desktop and in the **Start->Programs** folder. The **Start->Programs** folder also contains links to the different EVM User's Guide, and documentation folders.

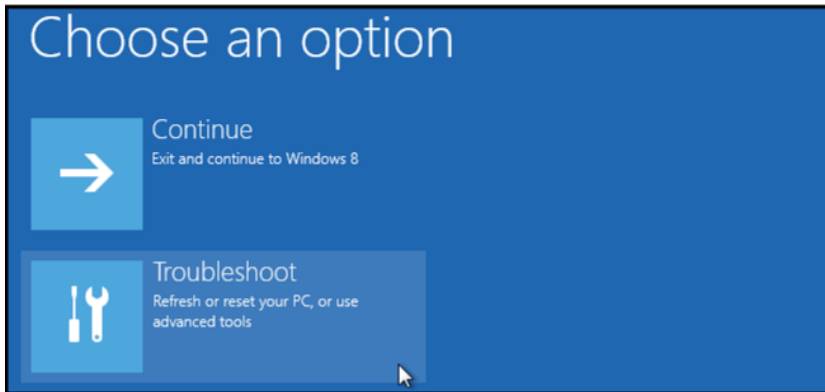
1.3.2 USB Device Driver Installation

Follow section 1.3.2.1 for installation instructions on the Windows 10/8 operating systems, section 1.3.2.2 for instructions for Windows 7, or section 1.3.2.3 for Windows XP

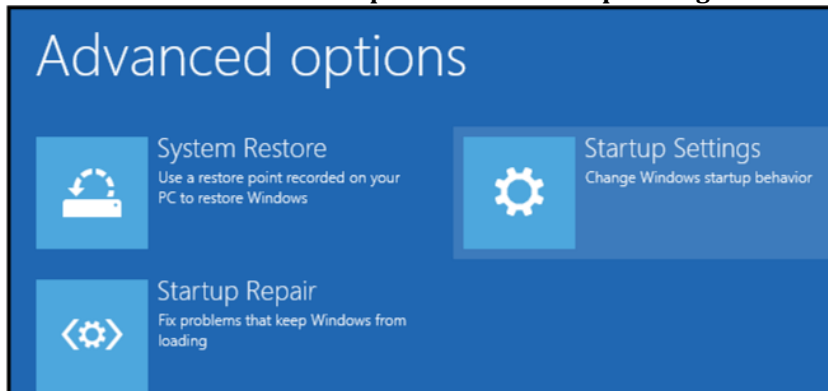
1.3.2.1 Window 10/8

To install the USB driver on Windows 10/8, the Driver Signature Verification needs to be disabled. This is accomplished using the following method.

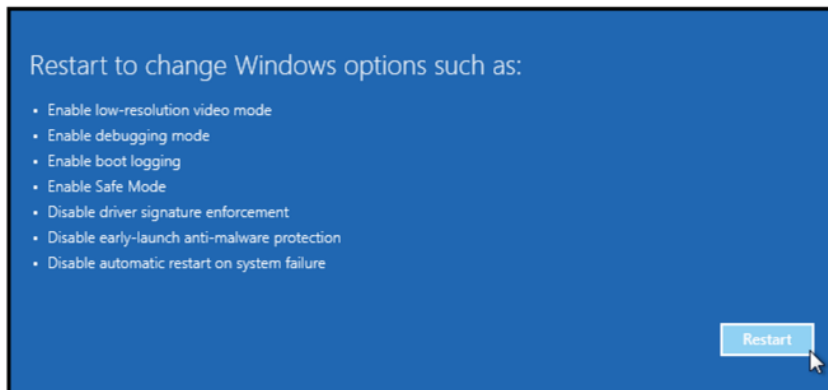
- 1.3.2.1.1 **Enter the Troubleshoot menu. Click "Restart" from the power options menu and hold down the "Shift" key at the same time. Once the computer has rebooted, you will be able to choose the Troubleshoot option.**



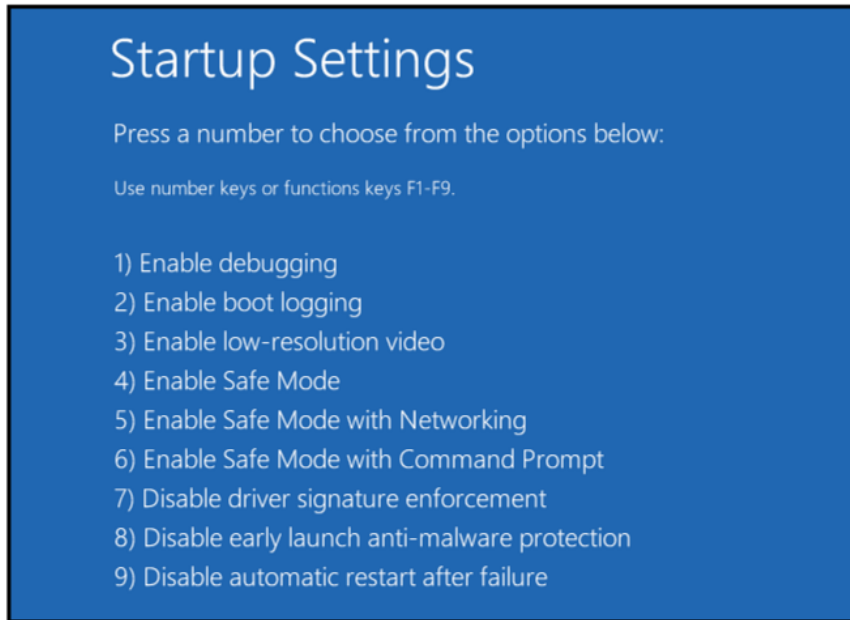
1.3.2.1.2 Select “Advanced options” and “Startup Settings”.



1.3.2.1.3 You need to restart your computer one last time to modify boot time configuration settings.



1.3.2.1.4 You will be given a list of startup settings, including “Disable driver signature enforcement”. To choose the setting, you need to press the “F7” key. This will disable the driver signature enforcement until the computer is rebooted.

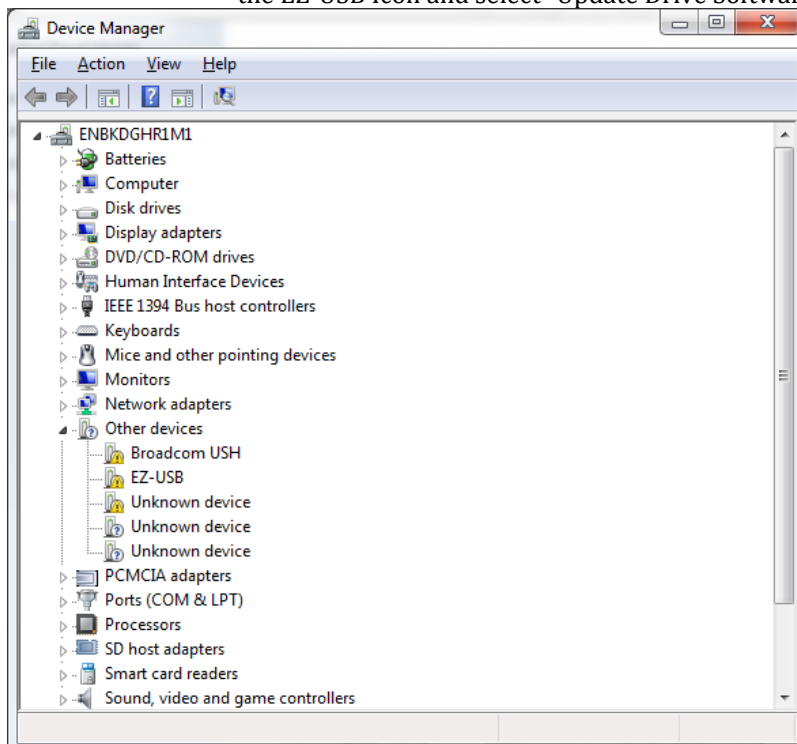


1.3.2.1.5 Continue with section 1.3.2.2 to finish installation of USB driver except choose the windows 10 or windows 8 folder for the driver.

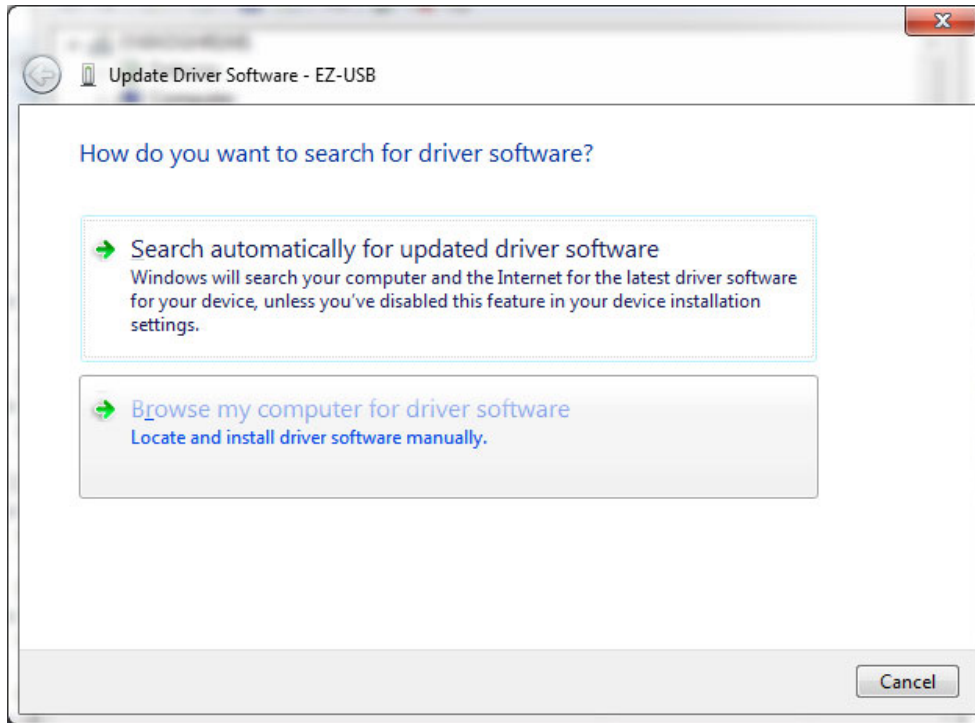
1.3.2.2 Windows 7

To install the USB device driver on a Windows 7 system, connect the “USB FX2 to Parallel” board to a USB port using the included USB A/B cable. The “USB FX2 to Parallel” board does not need any external power or need to be connected to any other board for the device driver installation.

1.3.2.2.1 After connecting the USB cable from the PC to the “USB FX2 to Parallel” board, navigate to the Device Manager screen on your computer and look for the EZ-USB Icon. Right-Click on the EZ-USB Icon and select “Update Drive Software...”

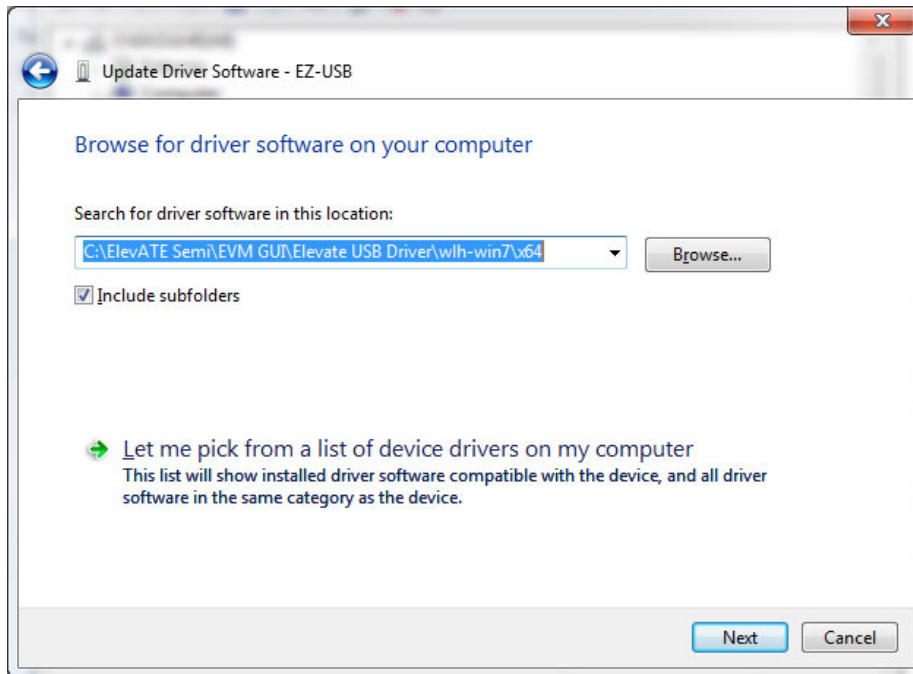


1.3.2.2.2 Select “Browse my computer for driver software”.



1.3.2.2.3 Install driver from the newly installed folder on your computer:
Windows 7: `\\ElevATE Semi\EVM GUI\Elevate USB Driver\wlh-win7\`(x64 or x86)
Select x64 for a 64-bit system.
Select x86 32-bit system.

Select “Next”. The USB driver will be installed.



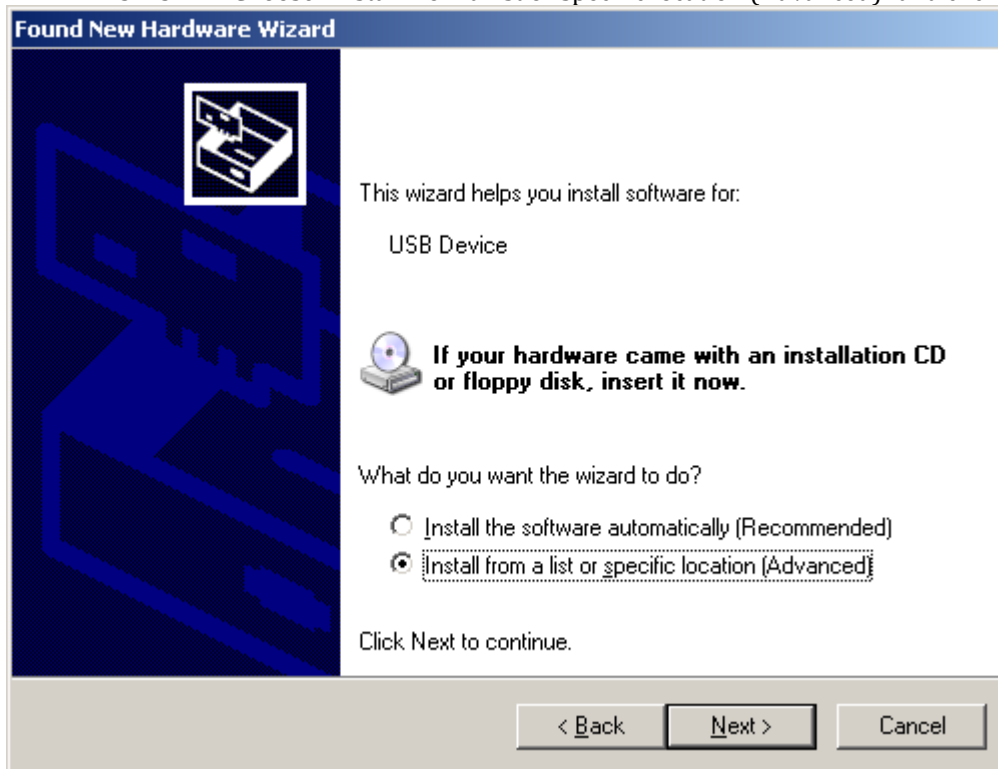
1.3.2.3 Windows XP

To install the USB device driver on a Windows XP system, connect the “USB FX2 to Parallel” board to a USB port using the included USB A/B cable. The USB FX2 to Parallel board does not need any external power or need to be connected to any other board for the device driver installation.

- 1.3.2.3.1 After connecting the USB cable from the PC to the “USB FX2 to Parallel” board, the following window appears. Select “No, not this time” and click Next.



1.3.2.3.2 Choose “Install from a list or specific location (Advanced)” and click Next.



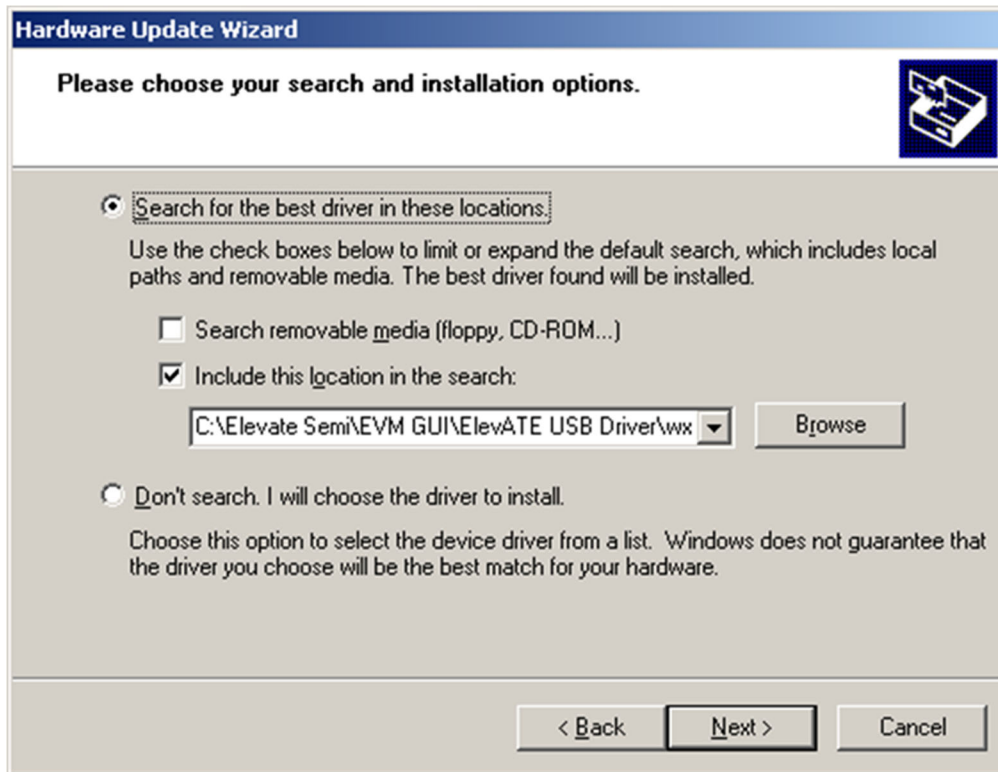
1.3.2.3.3 Select the top radio button, and check “Include this location in the search.” Type the following path into the text box.

Windows XP: **\\ElevATE Semi\EVM GUI\Elevate USB Driver\wpx**(x64 or x86)

Select x64 for a 64-bit system.

Select x86 32-bit system.

Select “Next”. The USB driver will be installed.



1.3.3 Reboot Machine

After the Saturn EVM and USB software is installed, it is recommended to re-boot the machine.

1.3.4 Launching the Planet ATE Program

The user can launch the Planet ATE GUI from the desktop, **Start->Programs** folder, or **EVM GUI** sub-directory.

1.3.5 Software Un-Installation

The Planet ATE demonstration program may be un-installed using the **Add/Remove Program** from the Windows Control Panel.

2 Getting Started

The Saturn EVM is shipped in a pre-configured state that allows a customer to evaluate the Driver and PMU modes.

Note: Any external equipment providing digital signals into the Saturn device should only be enabled after the Saturn EVM is enabled. Also, the external equipment should be disabled prior to disabling the Saturn EVM.

2.1 Quick Start Instructions

1. Disable external power supply
2. Connect the power supplies cables (not provided) from the power supply to the Elevate EVM Motherboard and Saturn loadboard; refer to Figure 3.
3. Connect the USB cable (provided) from the PC to the USB port on the USB FX2 to Parallel board.
4. Connect the EVM to any external equipment; refer to Section 2.2.
5. Setup Motherboard Jumpers; refer to Section 2.3
6. Set external power supply voltages and current limits.
7. Enable external power supply.
8. Run the Elevate GUI software; refer to Section 1.3.4 for details.
9. At the Force Voltage – Measure Current dialog box (refer to Figure 2 below):
 - a. Select the **EVM Setup** option based on the desired configuration, see Section 2.2
 - b. Select the **Enable Supplies** check box
 - c. Hit the **Apply** button to power up the device.
 - d. The software will also measure the current consumption. Figure 2 illustrates the expected current readings.
10. At this point, the device should be outputting the desired signal.

Figure 2: Expected Current Readings

Force Voltage - Measure Current (FVMI) Configuration

Revision: Saturn Rev6, LB SN = 103, FVMI SN = 146

Reset: Must issue whenever power is cycled on board. Will put system into default state.

PLL Freq (MHz): PLL_CK = 50.000, CLK_REF = 25.000

Device Options: Calibrate DAC, Calibrate Levels to Enabled state

EVM Setup: **Three-State (High-Z)** (dropdown menu open showing: Hardware Reset, Three-State (High-Z), Real-Time Data, Ring Oscillator, Ch#1 Single-Ended to Diff, PMU FV)

Power Amplifier: Enable Supplies

Channel	Force Voltage (V)	Measured Voltage (V)	Current (mA)	Power (mW)
Chan 1 (-10.0 to +15.0)			-2.4	0.0
Chan 2 (VCC) (+3.3 to +25.0)	20.000	20.004	150.8	3016.4
Chan 3 (VDD) (0.0 to +5.0)	3.300	3.298	193.2	637.2
Chan 4 (VEE) (-25.0 to +0.0)	-5.000	-4.995	166.7	832.6
Chan 5 (VOH) (+1.0 to +3.3)	3.000	3.000	-2.0	6.1
Chan 6 (VOL) (-0.5 to +1.0)	0.000	0.001	-1.9	0.0
Chan 7 (VREF) (+2.5 to +3.5)	3.000	3.000	0.0	0.0

Total Power: 4502.3

Perform Range Check, Servo Supplies

The **Reset System** will put the EVM and Saturn device into the default state. The **Reset System** should be issued whenever the power supply is powered OFF then ON. The **Reset System** is automatically performed when the program is initially launched.

2.2 Default Configuration Setup Options

The EVM has several default options for providing a DATA stream and/or configuring for PMU mode.

Table 3: Saturn Default Configuration Options

Mode	See Section #	Brief Description
Hardware Reset	N/A	All registers default to the hardware default state.
Three-State (High-Z)	N/A	Puts Device in three-state (high-Z). Opens all switches.
Real-Time Data	2.2.1	50 Ohm Driver Mode. Use motherboard DATA# SMA connectors
Ring Oscillator	2.2.2	Use Saturn's internal Ring Oscillator
Single Ended to Differential Converter	2.2.3	Use Channel #1 to perform a single-ended to differential translator
PMU FV	2.2.4	Configures PMU into FV mode outputting 1.5V

2.2.1 Real Time Data

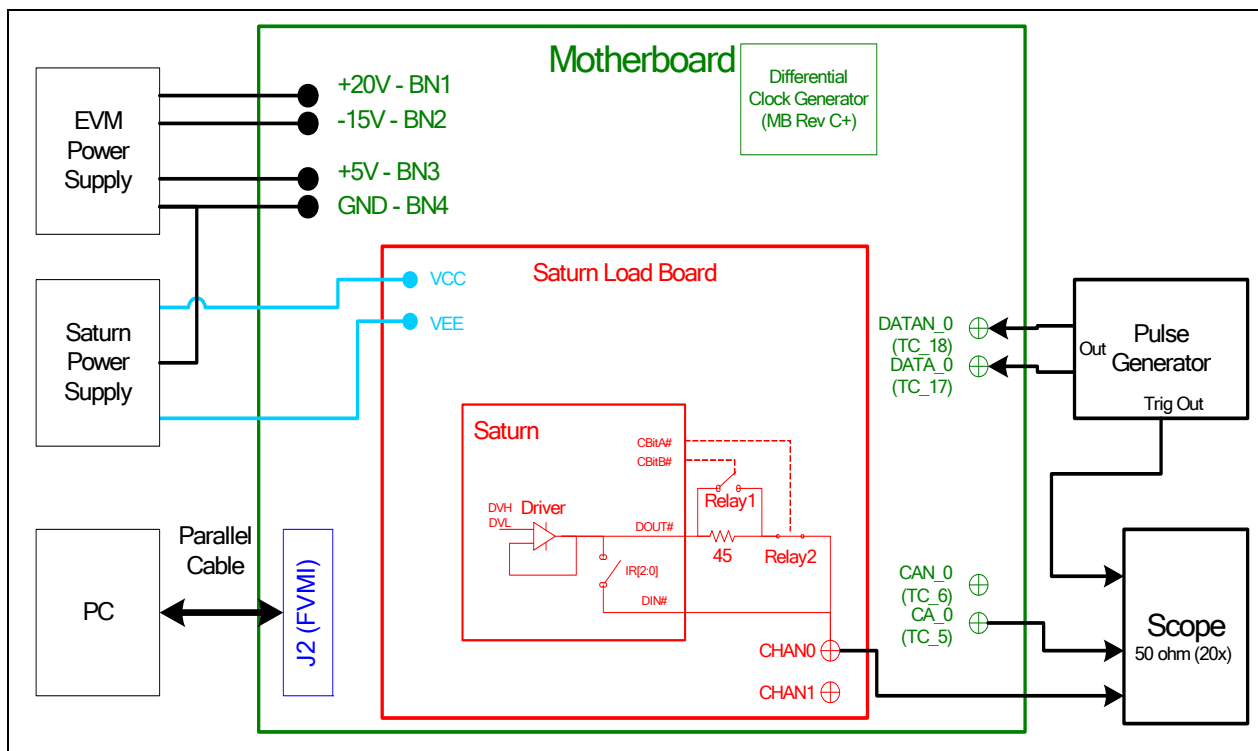
Figure 3 illustrates the recommended EVM configuration. This option sources the DATA# from the motherboard SMA connectors. The ENABLE# is set to CPU Control and high (always enabled). The DATA# input term is set to 100 Ohm. This option works best if the customer has a differential pulse generator with at least a 200mV swing.

- Channel #0: Short E3 & E4 (on Motherboard) between Pin 2-3 (towards front of board)
- Channel #0: Connect differential pair to DATA_0 & DATAN_0 SMA connectors (on Motherboard)
- Set the desired **Data Input Termination** (*Device->Channel 0->Driver Path Config* dialog box).

Note: Channel #1 could be configured in a similar fashion, not shown in diagram.

If the customer only has a single ended pulse generator, then the DATAN# can be tied to 1.0V (VBB) and set to pulse generator to a 0.0V to 3.0V swing. The DATA# input term should be set to NONE. Alternately, refer to Section 2.2.3 to use Channel #1 as a single-ended to differential converter.

Figure 3: Saturn EVM Simplified Block Diagram

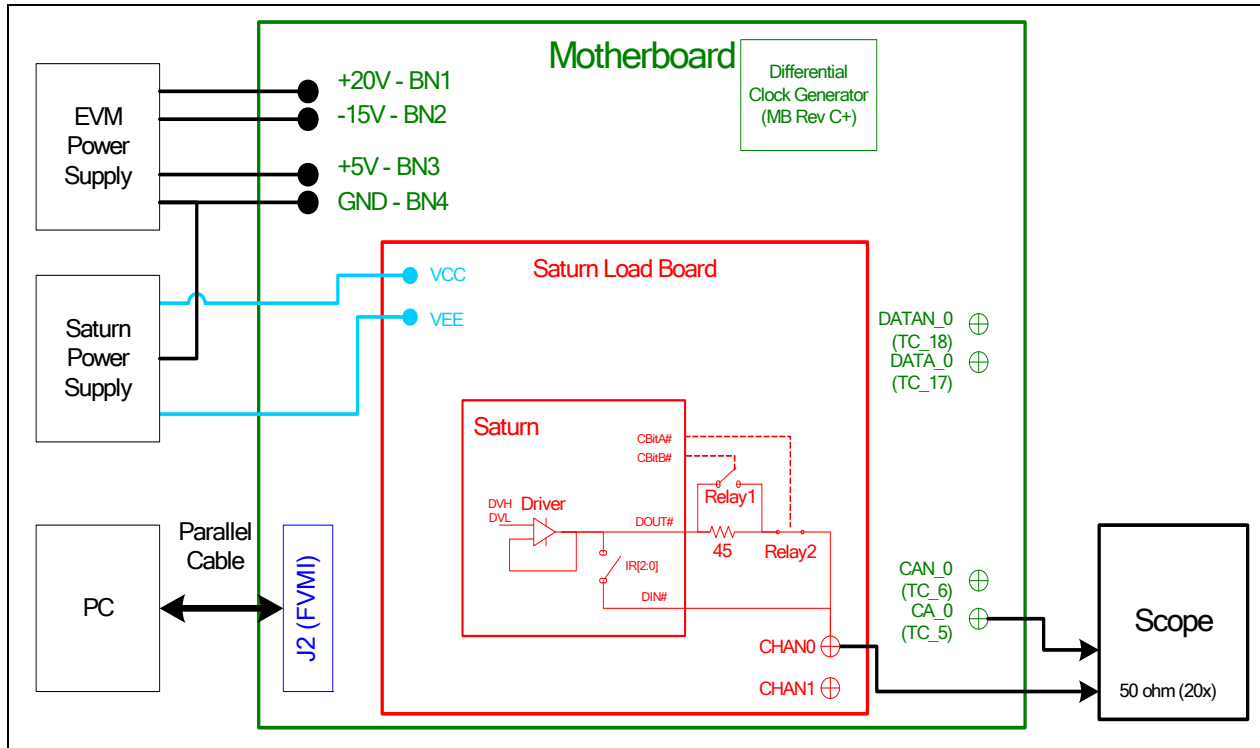


2.2.2 Ring Oscillator Mode (No Pulse Generator)

Figure 4 illustrates the recommended configuration for customers without any pulse generator. This option uses Saturn's Ring Oscillator feature to generate a ~20 MHz pulse with a ~15 nS period.

- Short E3 & E4 (on Motherboard) between Pin 1-2 (towards back of board)

Figure 4: Ring Oscillator Block Diagram

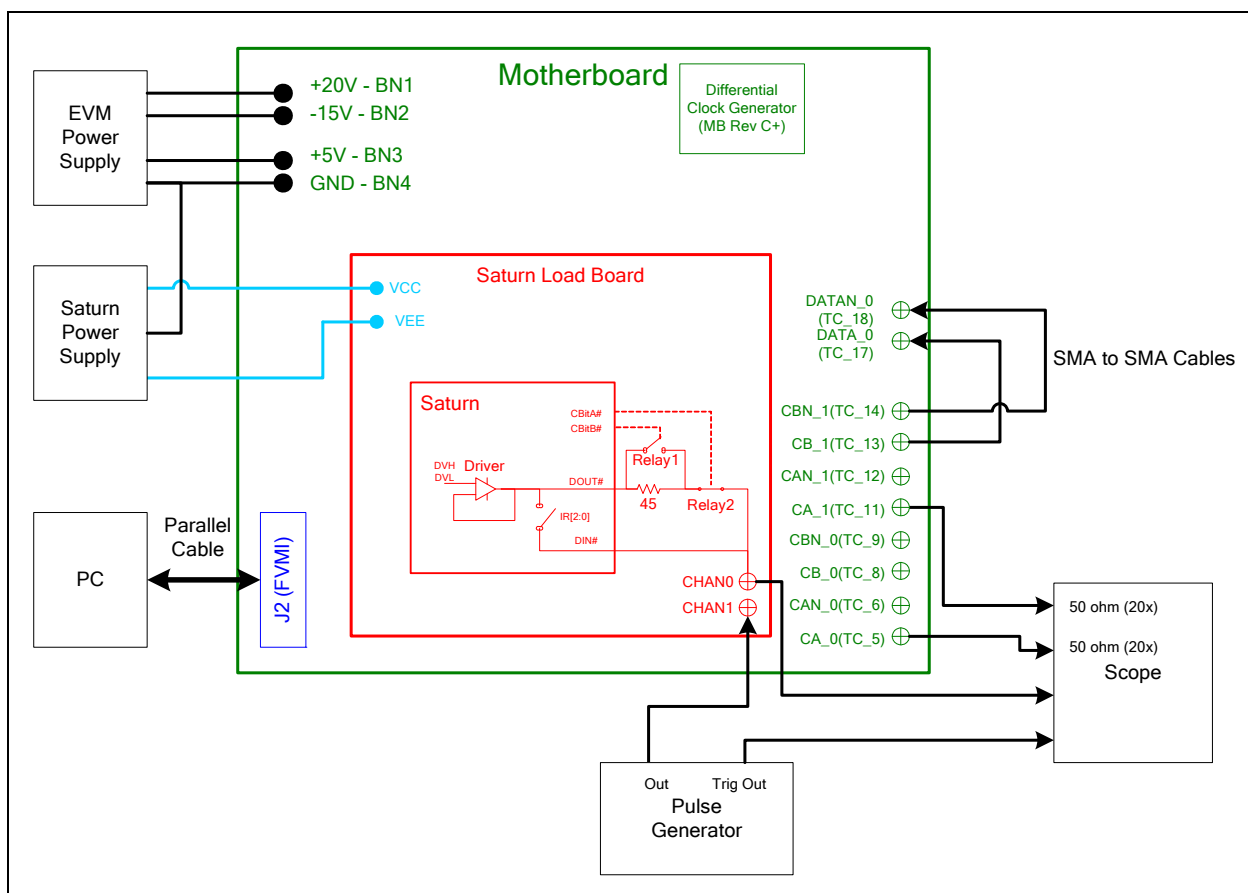


2.2.3 Channel #1 as Single-Ended to Differential Converter

Figure 5 illustrates a possible configuration for customers with only a single-ended pulse generator. This option uses the channel #1 to create a single-ended to differential converter. The comparator outputs are feed into channel DATA0 inputs.

- Short E3 & E4 (on Motherboard) between Pin 2-3 (towards front of board)
- Using SMA cables; connect COMP_B_1 to DATA_0 and COMP_BN_1 to DATAN_0.
- Connect COMP_A_1 to scope, this is used to evaluate the channel 1 comparator path as well as provide a trigger for the channel 0 DATA path.
- Connect single-ended pulse generator to DOUT_1. Saturn will be set to Active Loads to terminate the signal (50 Ohm termination). The pulse generator should be set to 0.0V to +2.0V swings as the Saturn comparator thresholds are set to 1.0V. If other levels are required, change the Saturn channel 1 comparator thresholds as required.

Figure 5: Single-Ended to Differential Converter Block Diagram

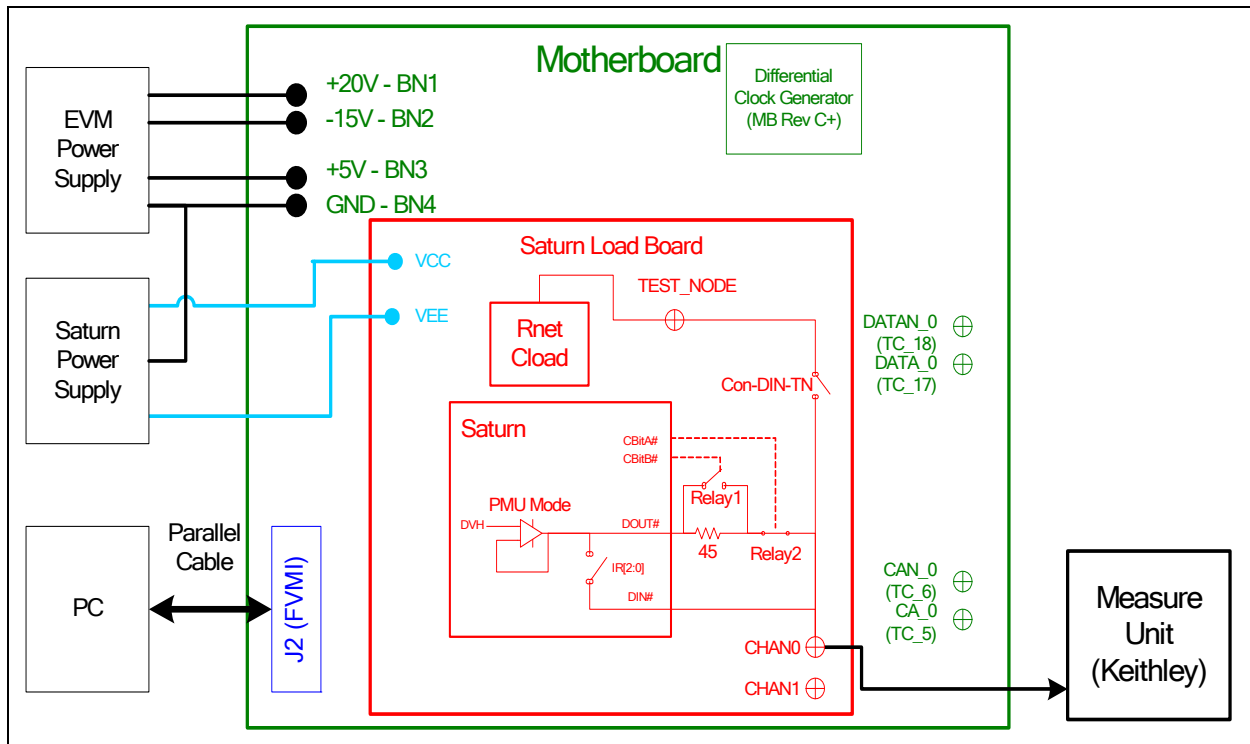


2.2.4 PMU Force Voltage or Force Current Modes

Figure 3 illustrates the recommended configuration for PMU FV/FI evaluation. The external measurement unit (MU) should be configured in the opposite mode as Saturn. After the configuration is completed, use the **Levels** dialog box to change the Saturn output levels. The user can also connect the DIN to TEST_NODE switch. The TEST_NODE can be connected to an on-board Resistor Network.

Saturn	MU
FVMI	FIMV
FIMV	FVMI

Figure 6: PMU FV/FI Block Diagram



2.3 Saturn EVM Jumper Definitions

Table 5 lists the Saturn EVM Jumper definitions.

Table 4: Saturn EVM Jumper Definitions

Jumper	Description	Configuration
E2	VCC Source	Short Pin 1 & 2. Source from Banana Plug (external Supply) Short Pin 2 & 3. Source from FVMI LT1206 (not supported yet)
E3	VE Source	Short Pin 1 & 2. Source from Banana Plug (external Supply) Short Pin 2 & 3. Source from FVMI LT1206 (not supported yet)
E12	MONITOR_0 SMA GND Source	Short Pin 1 & 2. Source from GND Short Pin 2 & 3. Source from GND_REF_0
E13	MONITOR_1 SMA GND Source	Short Pin 1 & 2. Source from GND Short Pin 2 & 3. Source from GND_REF_1

2.4 Motherboard Jumper and SMA Definition

Table 5 and Table 6 list the Motherboard Jumper/SMA definitions for the Saturn EVM.

The Saturn comparator outputs have 100 ohm termination between the Normal and Complement outputs. A 953 ohm pick-off resistor is used to route the signals to the appropriate TC_#. When connecting to an external scope, set the scope into to 50 ohm with a 20x attenuation.

Table 5: Motherboard Jumper Definitions

Saturn	TC_#	Jumper	Configuration
PLL_CK	TC_30	E12	Short Pin 1 & 2. Towards back of board
PLL_CKB	TC_29	E11	Short Pin 1 & 2. Towards back of board
Unused	TC_28	E14	Don't Care, not used
Unused	TC_27	E15	Don't Care, not used
Unused	TC_26	E2	Don't Care, not used
ENN_1	TC_25	E10	Short Pin 1 & 2. Source from MB latch Short Pin 2 & 3. Source from SMA
EN_1	TC_24	E9	Short Pin 1 & 2. Source from MB latch Short Pin 2 & 3. Source from SMA
DATAN_1	TC_23	E8	Short Pin 1 & 2. Source from MB latch Short Pin 2 & 3. Source from SMA
DATA_1	TC_22	E7	Short Pin 1 & 2. Source from MB latch Short Pin 2 & 3. Source from SMA
LATCH_RCK	TC_21	E1	Short Pin 1 & 2. Towards back of board
ENN_0	TC_20	E6	Short Pin 1 & 2. Source from MB latch Short Pin 2 & 3. Source from SMA
EN_0	TC_19	E5	Short Pin 1 & 2. Source from MB latch Short Pin 2 & 3. Source from SMA
DATAN_0	TC_18	E4	Short Pin 1 & 2. Source from MB latch Short Pin 2 & 3. Source from SMA
DATA_0	TC_17	E3	Short Pin 1 & 2. Source from MB latch Short Pin 2 & 3. Source from SMA
Unused	TC_16	E13	Don't Care, not used
Optional DUT_GND Source	TC_15	E20	Open. Source from Motherboard GND Short. Source from SMA

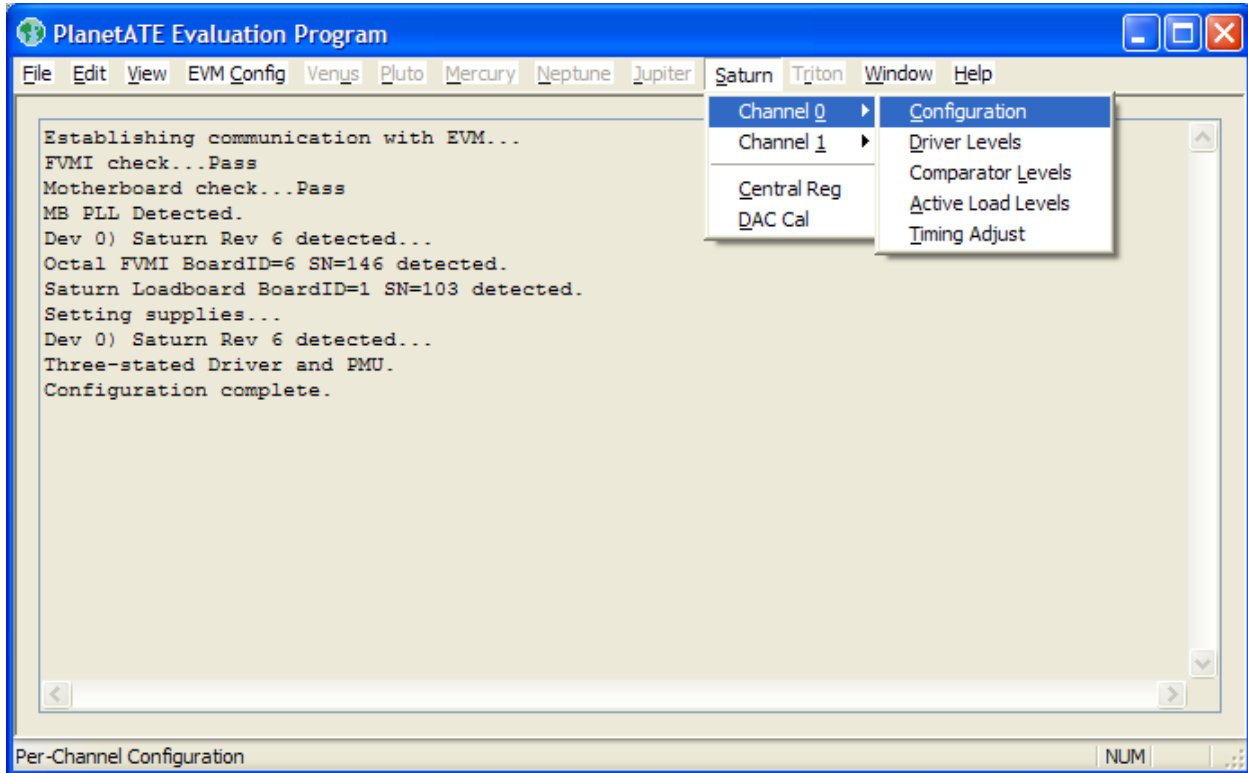
Table 6: Saturn Comparator vs. Motherboard SMA Definitions

Saturn	TC #
CBN_1	TC_14
CB_1	TC_13
CAN_1	TC_12
CA_1	TC_11
CBN_0	TC_9
CB_0	TC_8
CAN_0	TC_6
CA_0	TC_5

2.5 Saturn EVM Menu Dialog Boxes

Figure 7 illustrates the Saturn EVM menu options. These provide access to the Saturn registers.

Figure 7: Device Config Menu Options



3 Device and EVM Configuration vs. Application

Figure 8 provides a simplified illustration of the different device and EVM settings for different modes. Not all registers, muxes, switches, etc are shown; this section is trying to identify the main registers in the most common applications.

When evaluating the Driver Waveforms, the output is routed to the CHAN SMA which is connected to a scope.

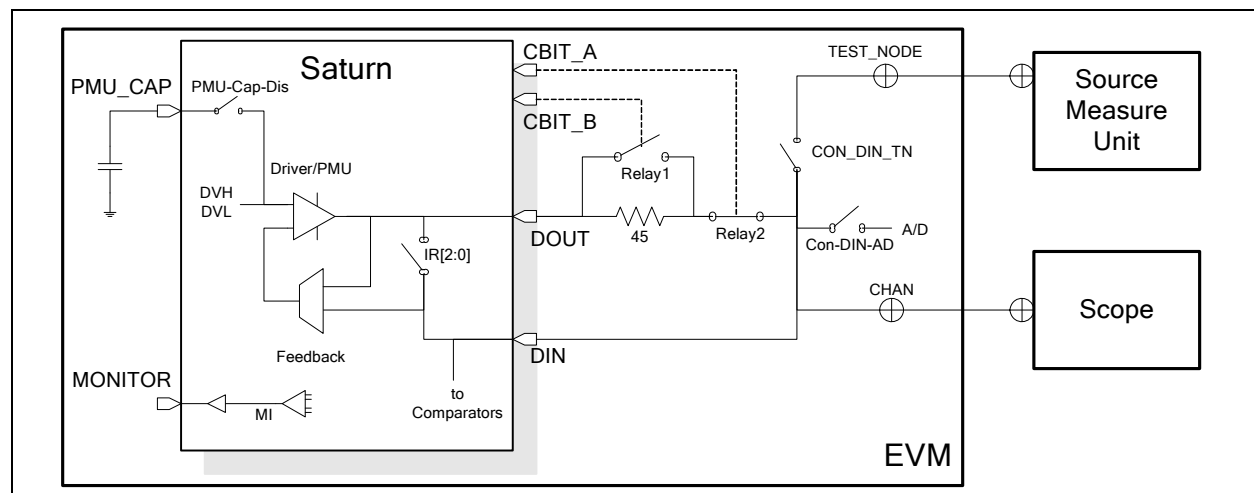
When evaluating the PMU, the output is routed to the TEST_NODE which is connected to a Source Measure Unit (i.e. Keithley). The Relay1, Relay2, and IR[2:0] settings are dependant on the current range. The Keithley could optionally be connected to the CHAN SMA but the TEST_NODE is preferred since that can be routed to both channels.

Notes:

- 1) The PMU_CAP is application and possibly current range specific.
- 2) This table doesn't identify any sequencing that may be required.

Control Bit(s)	50 Ohm Driver (IR3)	Low-Imped Driver (IR4)	PMU IR0	PMU IR1	PMU IR2	PMU IR3	PMU IR4
IR[2:0]	0 (open)	0 (open)	IR[0] = 1	IR[1] = 1	IR[2] = 1	0 (open)	0 (open)
Feedback	Sel-FB=0 (Tight)	Sel-FB=0 (Tight)	Sel-FB=3 (DIN)	Sel-FB=3 (DIN)	Sel-FB=3 (DIN)	Sel-FB=3 (DIN)	Sel-FB=3 (DIN)
Sel-MI+	3	3	0	1	2	3	3
Sel-MI-	2	3	0	1	2	2	3
CBitB (Relay1)	Open	Closed	Open	Open	Open	Open	Closed
CBitA (Relay2)	Closed	Closed	Open	Open	Open	Closed	Closed
PMU-Cap-Dis	1 (disconnect)	1 (disconnect)	0 (connect)	0 (connect)	0 (connect)	0 (connect)	0 (connect)
CON_DIN_TN	Open	Open	Closed	Closed	Closed	Closed	Closed

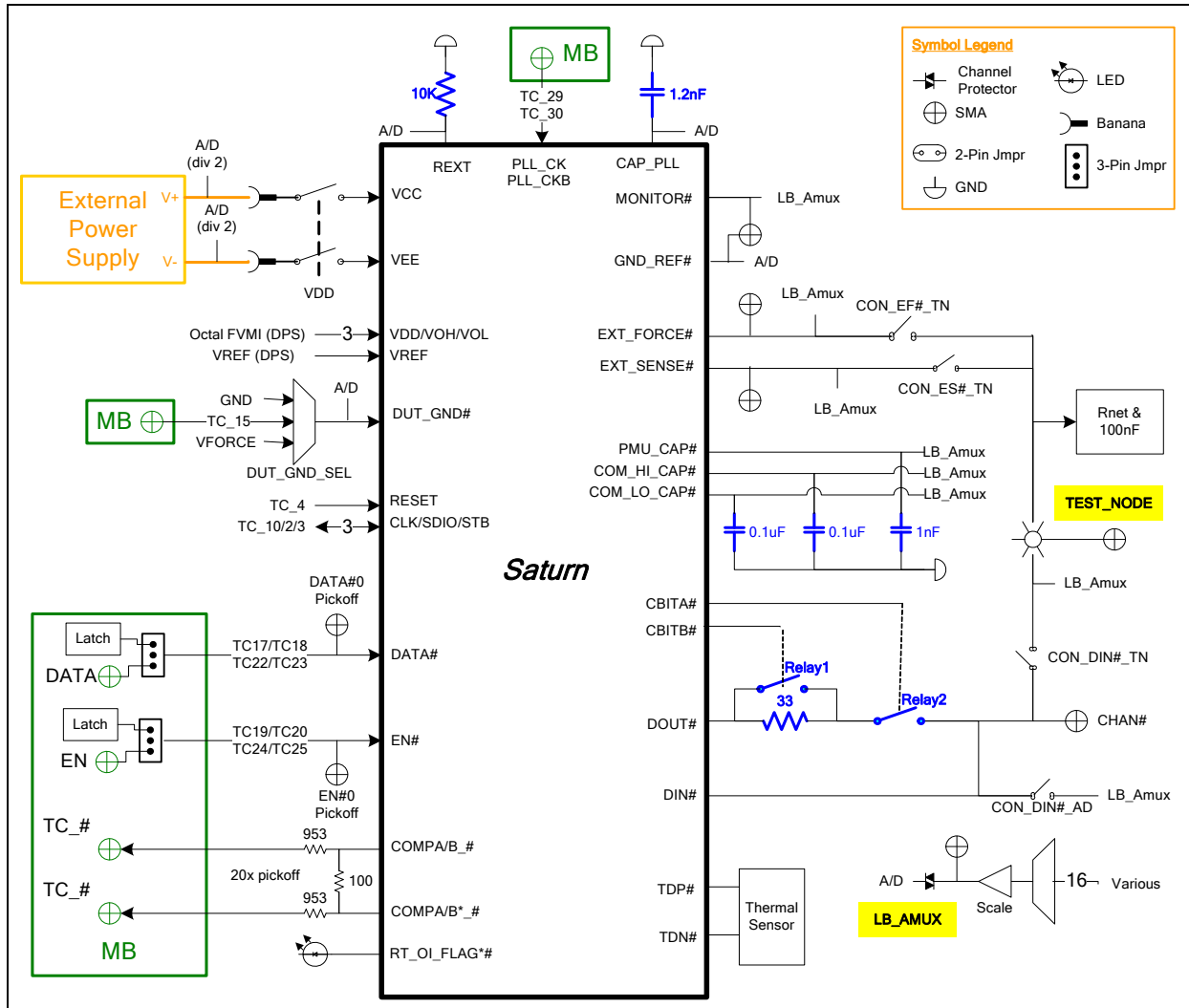
Figure 8: Saturn Application Configurations (50 Ohm Driver Configuration shown)



4 Saturn EVM Loadboard Detailed Description

Figure 9 illustrates the Saturn EVM loadboard. The components highlighted in blue would be used in a customer system. The other circuitry is used to test, validate & characterize on the bench and ATE environment.

Figure 9: Saturn EVM Detailed Block Diagram



4.1 Capacitor and Resistor Network Definitions

Figure 10 illustrates while Table 7 and Table 8 list the Saturn EVM capacitor/resistor load network definitions. Any capacitor or resistor combination can be switched in.

Figure 10: Saturn EVM Capacitor/Resistor Network Block Diagram

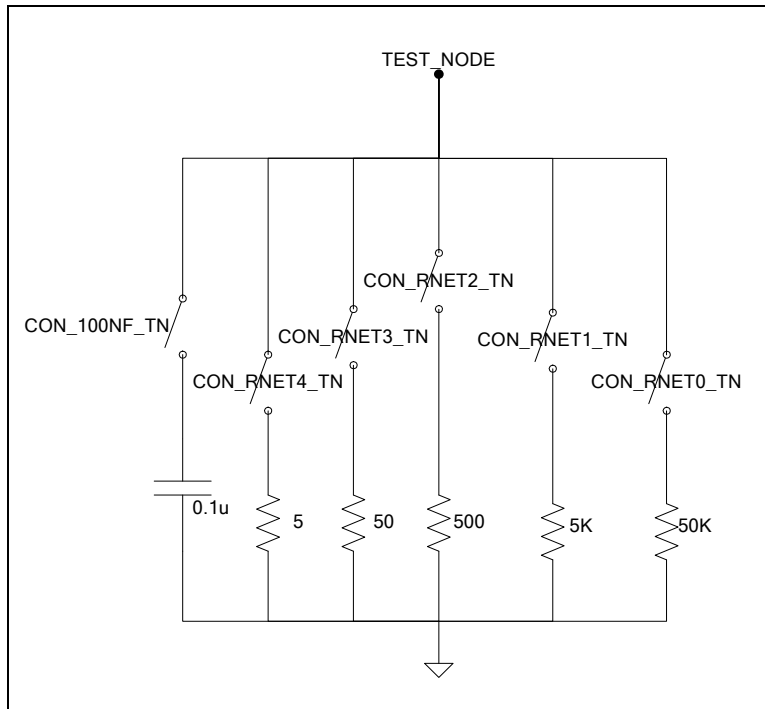


Table 7: Capacitor Network Definitions

Code	Capacitor Value
-1 or 0	Open All
1	0.1uF

Table 8: Saturn EVM Resistor Network Definitions

RNET	Code	Resistor Value
None	-1 or 0	Open All
RNET0	1	50K
RNET1	2	5K
RNET2	4	500
RNET3	8	50
RNET4	16	5

4.2 ADC and Analog Mux

The Octal FVMI contains a 24-bit ADC and analog muxes in which the usable input range is approximately -10V to +16V. The absolute input range matches the EVM supplies which are typically -15V and +20V. Table 9 lists the Saturn EVM loadboard specific mux input sources that are routed to the Octal FVMI measurement system.

Table 10 lists the Saturn EVM loadboard LB_AMUX analog mux. The LB_AMUX uses the same VCC and VEE supplies as Saturn so the loadboard can support high voltage. A divide by 2 is used to connect to the lower voltage 24-bit ADC input range. In addition, a unity scaling option is provided to provide extra resolution when measuring the Measure Current (MI) voltage. The MI voltage is defined as +/-1V for +/- I_{max}. The unity scaling would also be useful when measuring other low voltage nodes via Saturn's Diagnostic mux. The LB_AMUX scaling output is connected to TC_32 (VINP14).

Table 9: FVMI Analog Mux – VINPOS(A) & VINNEG(A) Mapping

Addr	VINP#	VINPOS(A)	VINN#	VINNEG(A)
7	VINP8	Reserved	VINN8	VREF_MON
8	VINP9	VCC_DIV	VINN9	Unused
9	VINP10	VEE_DIV	VINN10	Unused
10	VINP11	REXT	VINN11	GND_REF_0
11	VINP12	CAP_PLL	VINN12	GND_REF_1
12	VINP13	LB_AMUX_CAL	VINN13	DUT_GND_0
13	VINP14	LB_AMUX	VINN14	DUT_GND_1

Table 10: Saturn EVM Loadboard Analog Mux Definitions – LB_AMUX Mapping

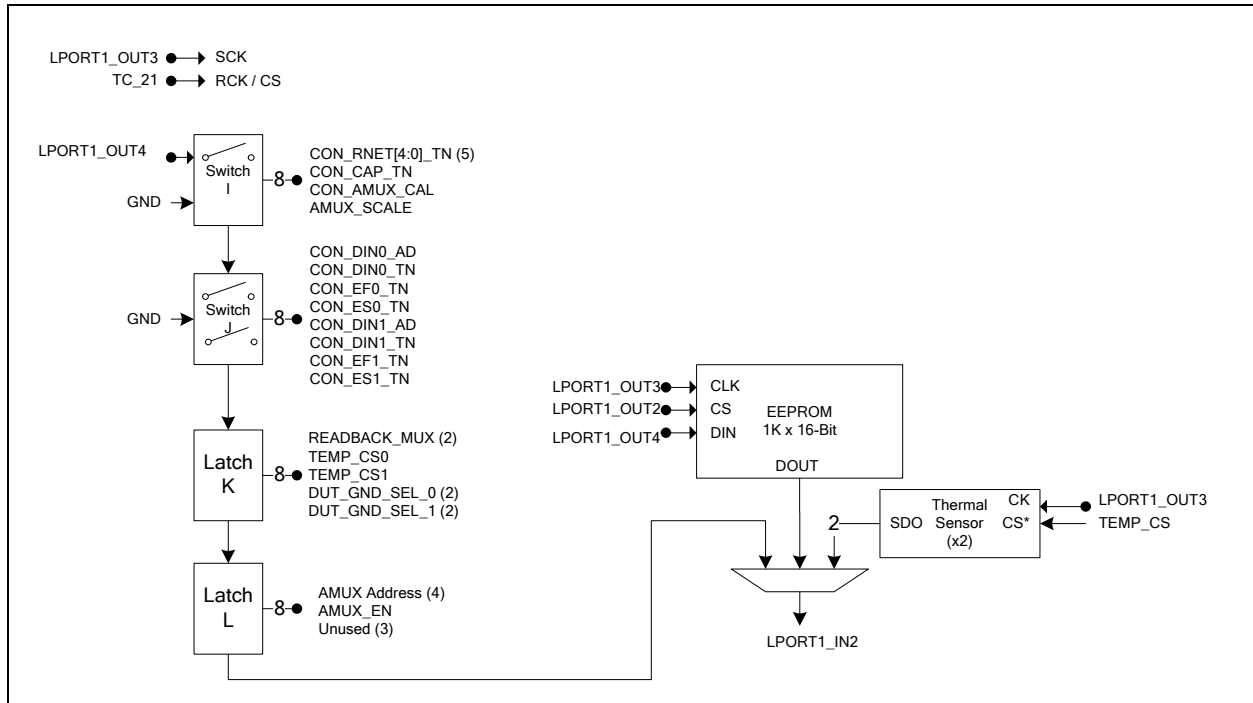
Addr	LB_AMUX
0	DIN_AD_0
1	MONITOR_0
2	EXT_FORCE_0
3	EXT_SENSE_0
4	PMU_CAP_0
5	COM_LO_CAP_0
6	COM_HI_CAP_0
7	DIN_AD_1
8	MONITOR_1
9	EXT_FORCE_1
10	EXT_SENSE_1
11	PMU_CAP_1
12	COM_LO_CAP_1
13	COM_HI_CAP_1
14	VFORCE
15	TEST_NODE

4.3 Saturn EVM Loadboard Controller

The Saturn EVM loadboard contains four 8-bit latches (registers) and a 16K EEPROM. The Cbit1 to Cbit7 are not used. Figure 11 illustrates the Saturn EVM controller section.

The latches are daisy chained together using the SDI_SCK/RCK/CS signals originating from the Motherboard. The EEPROM is controlled by the LPORT1_OUT[4:2] signals originating from the motherboard. The loadboard latches are labeled STB_I to STB_L. This was named as an extension to the REG_A to REG_H Octal FVMI / Motherboard registers.

Figure 11: Controller Section Detailed Block Diagram



5 Document Revision History

Revision	Date	Description
A01	Oct 20, 2006	Initial Draft
B01	Sept 20, 2007	Loadboard Rev B support; Rev A loadboard no longer supported
B02	May 20, 2013	Change to Elevate Semiconductor
B03	Aug 26, 2014	Updated software installation to support USB interface
B04	May 16, 2016	Added support for MB/FVMI board rev E
B05	Mar 13, 2019	Added Windows 8/10 installation instructions.