



DLL Functional Driver User Manual



Change History

Revision	Date	Remarks
0.1.0	19 Jan 2015	First Release adapted from PEMU32.
0.2.0	28 Jan 2015	Correction of typo errors for sense lines.
1.0.0 Pre-Release	7 Feb 2015	Correction of more typo errors for sense lines. Text and paragraph formatting.
1.0.0	9 Feb 2015	Improve DPS description. Official 1.0.0 release



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1. Overview

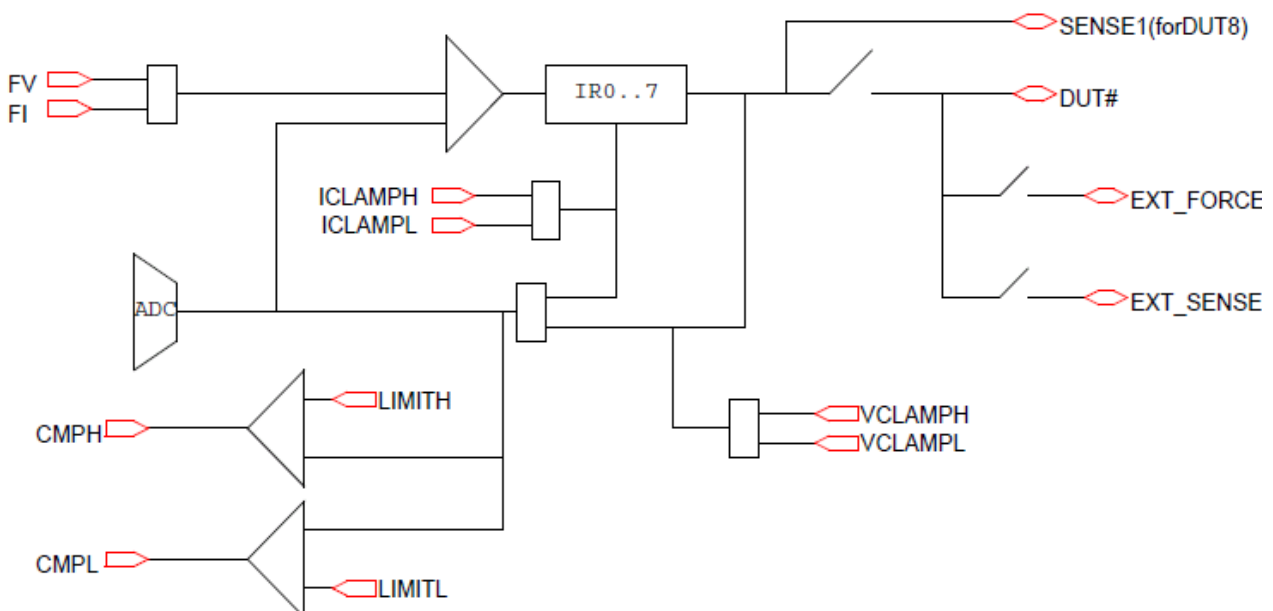
This document provides detailed description of SMU32 functions.

SMU32 is a PXI 3U DC Source and Measurement Unit with high density channel performance. SMU32 offers 32 channels of Parametric Measurement Units (PMUs). Each channel can operate as FV/MI, FI/MV, FV/MV, FI/MI. For higher power application, many PMUs can be ganged to one DPS.

2. Features

1. 32 PMUs Per Board -1 ~ +10V 16-bit 32mA (64mA in FV mode)
2. FV/MI, FI/MV, FV/MV, FI/MI operation modes
3. 8 PMU channels can be ganged to one DPS channel to support up to 512mA
4. 16-bit resolution for measure and force
5. Current Range : $\pm 2\mu\text{A}$, $\pm 8\mu\text{A}$, $\pm 32\mu\text{A}$, $\pm 128\mu\text{A}$, $\pm 512\mu\text{A}$, $\pm 2\text{mA}$, $\pm 8\text{mA}$, $\pm 32\text{mA}$

2.1 PMUx32 function block





3. DLL API Functions

3.1 PMU Functions

3.1.1 smu32_init

Definition

```
int smu32_init(void);
```

Return Value

board counts in system

Description

This function must be executed before any other functions.
If return value is 0, no smu32 detected.

3.1.2 smu32_reset

Definition

```
void smu32_reset(int bdno);
```

Description

Reset hardware of SMU32. If bdno=0, reset all boards.

3.1.3 smu32_pmufv

Definition

```
void smu32_pmufv(int bdno, int pno, double rv, double clih, double cilil);
```

Description

Set PMUFV to **rv** for board **bdno** and pin **pno**. If bdno=0, set all boards, if pno=0, set all pins.
Set current clamp (I clamp) between **clih** (mA) and **cilil** (mA). The value of cih and cil will define the current range (I range) automatically. Maximum (I clamp) can be 3 times of I range. Maximum I clamp value is 96mA.



3.1.4 smu32_pmufvr

Definition

void smu32_pmufvr(int bdno, int pno, int rng, double rv, double clih, double cil);

Description

Set PMUFV to **rv** with current range **rng** for board **bdno** pin **pno**.

If bdno=0, set all boards. If pno=0, set all pins.

rng = 0..7 (2uA, 8uA, 32uA, 128uA, 512uA, 2mA, 8mA, 64mA)

Set current clamp (I clamp) high and low values to **clih** (mA) and **clil** (mA). The value of cih and cil will define the current range (I range) automatically. Maximum I clamp can be 3 times of I range. Maximum I clamp value is 96mA.

3.1.5 smu32_pmufi

Definition

void smu32_pmufi(int bdno, int pno, double ri, double clvh, double cvl);

Description

Set PMUFI to **ri** mA for board **bdno** pin **pno**.

If bdno=0, set all boards. If pno=0, set all pins.

Set voltage clamp (V clamp) high and low values to **cvh** and **cvl**. The value of ri will define the current range (I range) automatically.

3.1.6 smu32_pmufir

Definition

void smu32_pmufir(int bdno, int pno, int rng, double ri, double clvh, double cvl);

Description

Set PMUFI to **ri** mA with current range **rng** for board **bdno** pin **pno**.

If bdno=0, set all boards. If pno=0, set all pins.

rng = 0..7 (2uA, 8uA, 32uA, 128uA, 512uA, 2mA, 8mA, 32mA)

Set voltage clamp (V clamp) high and low values to **cvh** and **cvl**. The value of ri will define the current range (I range) automatically.

3.1.7 smu32_pmucv

Definition

void smu32_pmucv(int bdno, int pno, double cvh, double cvl);

Description

Set PMU compare voltage limit high and low values to **cvh**(PPMU-CH) and **cvl**(PPMU-CL) for board **bdno** pin **pno**.

If bdno=0, set all boards. If pno=0, set all pins.

3.1.8 smu32_pmuci

Definition

void smu32_pmuci(int bdno, int pno, double cih, double cil);

Description

Set PMU compare current limit high and low values to **cih/cil** for board **bdno** pin **pno**.

If bdno=0, set all boards. If pno=0, set all pins.

3.1.9 smu32_con_pmu

Definition

void smu32_con_pmu(int bdno, int pno, int onoff);

Description

Connect/disconnect PMU to DUT for board **bdno** pin **pno**.

If bdno=0, set all boards. If pno=0, set all pins.

If **onoff**=1, enable the connection. If onoff=0, disable the connection.

3.1.10 smu32_con_esense

Definition

void smu32_con_esense(int bdno, int pno, int onoff);

Description

Connect/disconnect EXT_SENSE to DUT for board **bdno** pin **pno**.

If bdno=0, set all boards. If pno=0, set all pins.

If **onoff**=1, enable the connection. If onoff=0, disable the connection.



3.1.11 smu32_con_eforce

Definition

void smu32_con_eforce(int bdno, int pno, int onoff);

Description

Connect/disconnect EXT_FORCE to DUT for board **bdno** pin **pno**.
If bdno=0, set all boards. If pno=0, set all pins.
If **onoff**=1, enable the connection. If onoff=0, disable the connection.

3.1.12 smu32_check_pmu

Definition

int smu32_check_pmu(int bdno, int pno);

Return Value

1 when pass and 0 when fail

Description

PMU-CH/CL compare result for board **bdno** pin **pno**.
Pass is when $PMU-CL < DUT < PMU-CH$.

3.1.13 smu32_pmuch

Definition

int smu32_pmuch(int bdno, int pno);

Return Value

1 when $DUT > PMU-CH$. Otherwise returns 0.

Description

PMU-CH compare result for board **bdno** pin **pno**.



3.1.14 smu32_pmucl

Definition

int smu32_pmucl(int bdno, int pno);

Return Value

1 when DUT > CPMU-CL. Otherwise returns 0.

Description

PMU-CL compare result for board **bdno** pin **pno**.

3.1.15 smu32_vmeas

Definition

double smu32_vmeas(int bdno, int pno);

Return Value

Measured voltage value (V) of PMU for board **bdno** pin **pno**.

Description

Measure the real voltage value of PMU in FV or FI mode.

3.1.16 smu32_imeas

Definition

double smu32_imeas(int bdno, int pno);

Return Value

Measured current value (mA) of PMU for board **bdno** pin **pno**.

Description

Measure the real current loading of PMU in FV or FI mode.



3.1.17 smu32_enbDPS

Definition

```
void smu32_enbDPS(int bdno, int cno, int ganging);
```

Description

Set smu32 to DPS mode for board **bdno** chip **cno**.

If bdno=0, set all boards.

ganging = 1..8.

cno = 1..4.

In DPS mode, each chip's pin 8 will be changed to DPS pin according to the following list. Each DPS pin can be ganged with other pins to increase output current. Up to 8 pins can be ganged together to provide $8 \times 64 = 512\text{mA}$ output current.

PIN8 = DPS1 (parameter cno=1)

PIN16=DPS2 (parameter cno=2)

PIN24=DPS3 (parameter cno=3)

PIN32=DPS4 (parameter cno=4)

When ganging=2, pin 8,7 of the specified chip will be ganged. When ganging=3, pin 8,7,6 will be ganged. The ganged pins should be wired together along with SENSE pin.

3.1.18 smu32_dpsfv

Definition

```
void smu32_dpsfv(int bdno, int cno, double rv, double clih, double clil);
```

Description

set DPSFV to **rv** for board **bdno** chip **cno**.

If bdno=0, set all boards.

Set current clamp high and low values to **clih** (mA) and **clil** (mA). The value of cih and cil will define the current range (I range) automatically.

Maximum current clamp is 3 times of I range. Maximum current clamp value is 96mA.



3.1.19 smu32_dpsmi

Definition

double smu32_dpsmi(int bdno, int cno);

Return Value

Measured current value (mA) of **cno** DPS for board **bdno**

Description

Measure the real current loading of DPS .



3.2 Calibration Functions

3.2.1 smu32_cal_save

Definition

long smu32_cal_save(int bdno, char* calfile);

Return Value

1 if no error.

Description

Save calibration data to **calfile** for **bdno**.

For calfile string, use "/" instead of "\\".

Example : use "c://Path/T1.cal" for "c:\Path\T1.cal".

3.2.2 smu32_cal_load

Definition

long smu32_cal_load(int bdno, char* calfile);

Return Value

1 if no error.

Description

Load calibration data from **calfile** to smu32 board indicated by **bdno**.

For **calfile** string, use "/" instead of "\\".

Example : use "c://Path/T1.cal" for "c:\Path\T1.cal".

3.2.3 smu32_cal_reset

Definition

void smu32_cal_reset(int bdno);

Description

Reset calibration data and value to zero for SMU board **bdno**.



3.2.4 smu32_cal_load_auto

Definition

long smu32_cal_load_auto(int bdno, char* caldir);

Return Value

1 if no error

Description

Load calibration data from calfile to smu32 board **bdno** with file name: "smu32_XXXX.cal" from the folder specified by **caldir**.

"XXXX" is serial number (in Hex format) read from the board using function smu32_rd_pesno(int bdno).

If bdno=0, load all boards.

For **caldir** string, use "/" instead of "\\".

Example : use "c://Path/" for "c:\Path\".



3.3 User IO Function

3.3.1 smu32_rd_pesno

Definition

int smu32_rd_pesno(int bdno);

Description

Read 16 bits **pesno** (SMU/PE daughter board serial number) from user io port.

3.3.2 smu32_get_temp

Definition

double smu32_get_temp(int bdno, int cno);

Description

Read temperature in degree C from board **bdno** chip **cno**.



4. Pin Out Definitions

4.1 Pin Out Table

Pin Name	SMU32 VHDCI Connector (J1)
DOUT1	J1-65
DOUT2	J1-31
DOUT3	J1-63
DOUT4	J1-29
DOUT5	J1-61
DOUT6	J1-27
DOUT7	J1-59
DOUT8/DPS1	J1-25
DOUT9	J1-57
DOUT10	J1-23
DOUT11	J1-55
DOUT12	J1-21
DOUT13	J1-53
DOUT14	J1-19
DOUT15	J1-51
DOUT16/DPS2	J1-17
DOUT17	J1-49
DOUT18	J1-15
DOUT19	J1-47
DOUT20	J1-13
DOUT21	J1-45
DOUT22	J1-11
DOUT23	J1-43
DOUT24/DPS3	J1-9
DOUT25	J1-41

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DOUT26	J1-7
DOUT27	J1-39
DOUT28	J1-5
DOUT29	J1-37
DOUT30	J1-3
DOUT31	J1-35
DOUT32/DPS4	J1-1
GND	J1- 4,6,12,14,16,20,22,24,28,32,34 ,36,38,40,42,44,46,48,50,52,54 ,56,58,62,66,68
DUTGND	J1-33
EXT_FORCE	J1-64
EXT_SENSE	J1-30
SENSE1	J1-26
SENSE2	J1-18
SENSE3	J1-10
SENSE4	J1-2

SENSE1 must connect to DUT8.
SENSE2 must connect to DUT16.
SENSE3 must connect to DUT24.
SENSE4 must connect to DUT32.
DUTGND must connect to GND.



4.2 Connector Pin Out Drawing

DOUT32	1	35	DOUT31
SENSE4	2	36	GND
DOUT30	3	37	DOUT29
GND	4	38	GND
DOUT28	5	39	DOUT27
GND	6	40	GND
DOUT26	7	41	DOUT25
	8	42	GND
DOUT24	9	43	DOUT23
SENSE3	10	44	GND
DOUT22	11	45	DOUT21
GND	12	46	GND
DOUT20	13	47	DOUT19
GND	14	48	GND
DOUT18	15	49	DOUT17
GND	16	50	GND
DOUT16	17	51	DOUT15
SENSE2	18	52	GND
DOUT14	19	53	DOUT13
GND	20	54	GND
DOUT12	21	55	DOUT11
GND	22	56	GND
DOUT10	23	57	DOUT9
GND	24	58	GND
DOUT8	25	59	DOUT7
SENSE1	26	60	
DOUT6	27	61	DOUT5
GND	28	62	GND
DOUT4	29	63	DOUT3
EXT-SENSE	30	64	EXT-FORCE
DOUT2	31	65	DOUT1
GND	32	66	GND
DUTGND	33	67	
GND	34	68	GND