



DM483e

User Manual

Version 1.0, 08-2014

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Safety Precautions

A. General Information

- ❖ Refer to the User Manual prepared by the manufacturer for proper usage of the instrument.
- ❖ If the product is used in a manner not specified, the protection provided by the instrument warranty may be impaired.
- ❖ Return the instrument to Aemulus for service and repair to ensure that safety features are maintained.

WARNING

The **WARNING** heading explains hazards that might occur if an operating procedure, practice, or the like that, if not correctly performed or adhered to might result in personal injury or death. Always read the associated information very carefully and make sure the indicated information is met before performing the indicated procedure.

CAUTION

The **CAUTION** heading in the user documentation explains hazards that could damage the instrument. Such damage may invalidate the warranty.

B. Identification and Discouragement of Hazardous Applications

CAUTION

Main Power

- Ensure that the mains power is turned off before plugging or removing the PXI module into or from the chassis.
 - Make sure the power cord is plugged properly to the chassis before applying power.
 - The chassis that carries the instrument has to be plugged into a grounded (earthed) power outlet. By not doing so, it will defeat the power cord safety ground feature.
 - Ensure that the power is removed from the product before connecting/disconnecting the cables to the product connectors.
-

WARNING

Instrument Cables / Connectors

- Inspection of the connecting cable and test leads for possible wear, cracks, or breaks must be done before each use.
 - Make sure the cables used for the product are rated to the specified voltage and current level.
-

WARNING

Instrument Output

- Extreme caution is to be practiced when a shock hazard is present. Lethal voltage may be present on cable connector jacks.
 - When power is applied to the circuit under test, do not touch the product and test cables or test leads.
 - Do not touch the connector jacks or cables when the output of the product is turned on.
-

WARNING

Hot Surface

- If the DM483e has been in use, it might exceed safe handling temperatures and cause burns. Allow some cooling time before removing the DM483e from the chassis.

WARNING

- The fan speed of the chassis that carries the instrument has to be in HIGH speed to allow proper heat ventilation.

*Operating
Temperature*

C. Identification of Authorized Personnel

<i>End user</i>	Individual or group who is responsible for the use and maintenance of the product, as well as being responsible for ensuring that the product is operated within its specifications. Knowledge on electrical safety procedures and proper use of the product are prerequisite before operating the product.
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<i>Maintenance personnel</i>	Individual or group who is responsible for performing routine procedures on the product to keep it operating properly. Any service should only be done by qualified service personnel.
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<i>Service personnel</i>	Installation and service procedures may only be carried out by properly trained service personnel. Knowledge on working with live circuits, performing safe installations, and repairing the products are prerequisite for this individual or group.
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Section 1: Quick Start

1.1 Product Start-up Configuration

Each product is carefully inspected before it leaves the factory. Upon receipt and before unpacking the product, please inspect the unit for any obvious damage that may occur during shipment. If any damage is found, notify the instrument manufacturer immediately.

Please verify that the following items are included in the original packing of this product. Contact the instrument manufacturer immediately if any of these items are found missing.

❖ Reference / Drivers CD-ROM

The product is designed to be used in an indoor environment, an area with low condensation and a temperature of between $23^{\circ}\text{C} \pm 10^{\circ}\text{C}$. Ensure that the area where the product is installed is free from the presence of any explosive or flammable fumes or gases.

CAUTION

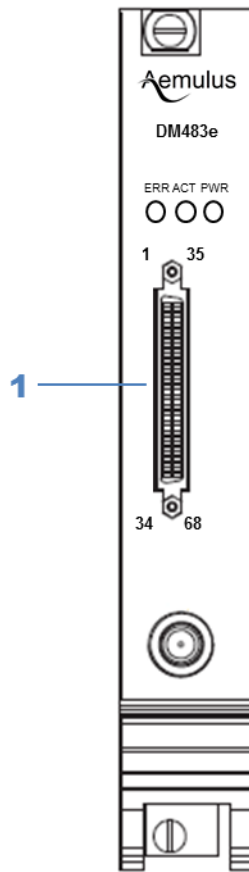
The product is shipped in materials that prevent static damage to the module. The module should only be removed from the packaging in an anti-static area ensuring that correct anti-static precautions are taken. Store all modules in anti-static envelopes when not in use.

1.2 Product Software & Hardware Installation

Refer to installation guide.

Section 2: Operation

2.1 Front Panel Connectors



- 1 OUTPUT (VHDCI, 68-Position, Receptacle)

Figure 1: DM483e Front Panel

Pin	Signal Name (Primary)	Signal Name (MIPI)	Description
1	HV3		High Voltage Driver 3
2	-		
3	HV5		High Voltage Driver 5
4	-		
5	HV4		High Voltage Driver 4
6	-		
7	PIN11_SH		Pin 11 Sense-High
8	PIN10_PIN11_L	VIO3_GND	Pin 10-11 Low
9	PIN11_FH	VIO3	Pin 11 Force-High
10	PIN8_PIN9_L	SCLK3_GND	Pin 8-9 Low
11	PIN9_FH	SCLK3	Pin 9 Force-High
12	-		
13	PIN7_SH		Pin 7 Sense-High
14	PIN6_PIN7_L	SDATA2_GND	Pin 6-7 Low
15	PIN7_FH	SDATA2	Pin 7 Force-High
16	-		
17	PIN9_SH		Pin 9 Sense-High
18	-		
19	HV1		High Voltage Driver 1
20	-		
21	EXT_TRIGINo		External Trigger Input o
22	GND		Ground
23	EXT_TRIGOUTo		External Trigger Output o
24	GND		Ground
25	PIN5_SH		Pin 5 Sense-High
26	PIN4_PIN5_L	SDATA1_GND	Pin 4-5 Low
27	PIN5_FH	SDATA1	Pin 5 Force-High
28	PIN2_PIN3_L	VIO1_GND	Pin 2-3 Low
29	PIN3_FH	VIO1	Pin 3 Force-High
30	PIN3_SH		Pin 3 Sense-High
31	PIN1_FH	SDATAo	Pin 1 Force-High
32	PINo_PIN1_L	SDATAo_GND	Pin 0-1 Low
33	PIN1_SH		Pin 1 Sense-High
34	-		

Table 1: I/O Pin-out (Pins 1-34)

Pin	Signal Name (Primary)	Signal Name (MIPI)	Description
35	HVo		High Voltage Driver 0
36	-		
37	HV2		High Voltage Driver 2
38	-		
39	PIN8_SH		Pin 8 Sense-High
40	-		
41	PIN10_SH		Pin 10 Sense-High
42	PIN10_PIN11_L	SDATA3_GND	Pin 10-11 Low
43	PIN10_FH	SDATA3	Pin 10 Force-High
44	PIN8_PIN9_L	VIO2_GND	Pin 8-9 Low
45	PIN8_FH	VIO2	Pin 8 Force-High
46	-		
47	PIN6_SH		Pin 6 Sense-High
48	PIN6_PIN7_L	SCLK2_GND	Pin 6-7 Low
49	PIN6_FH	SCLK2	Pin 6 Force-High
50	GND		Ground
51	EXT_TRIGOUT1		External Trigger Output 1
52	GND		Ground
53	EXT_TRIGIN1		External Trigger Input 1
54	-		
55	-		
56	-		
57	-		
58	-		
59	PIN4_SH		Pin 4 Sense-High
60	PIN4_PIN5_L	SCLK1_GND	Pin 4-5 Low
61	PIN4_FH	SCLK1	Pin 4 Force-High
62	PIN2_PIN3_L	VIO0_GND	Pin 2-3 Low
63	PIN2_FH	VIO0	Pin 2 Force-High
64	PIN2_SH		Pin 2 Sense-High
65	PIN0_FH	SCLK0	Pin 0 Force-High
66	PIN0_PIN1_L	SCLK0_GND	Pin 0-1 Low
67	PIN0_SH		Pin 0 Sense-High
68	-		

Table 2: I/O Pin-out (Pins 35-68)

Signal Name	Description
HVx	High voltage driver capable of generating up to 13.5V.
PINx_FH	The I/O for a pin for all operating modes (PMU, VECTOR, DIO, CLOCK, INVERTED_CLOCK). Refer to programming manual for details.
PINx_SH	The remote sense line when operating in PMU mode.
PINx_PIN(x+1)_L	The ground reference level for a pin. 2 pins (PINx and PIN(x+1)) share the same reference level, and these 2 pins can be configured as a differential pins.
EXT_TRIGOUTx	External trigger output from the module.
EXT_TRIGINx	External trigger input to the module.
SCLKx	SCLK pin for MIPI.
SDATAx	SDATA pin for MIPI.
VIOx	VIO pin for MIPI.
SCLKx_GND SDATAx_GND VIOx_GND	GND pin for MIPI. User should short all the GND pins together.

Table 3: Pin Function Description

2.2 Soft Front Panel

The soft front panel provides a graphical interface for operating the module. It is intended for testing and diagnosing, for demonstration and training, and for basic operation of the module. It represents most of the functions available in the instrument driver. It is not however a comprehensive application suitable for measurements; for this, remote programming the module.

2.2.1 General Functions

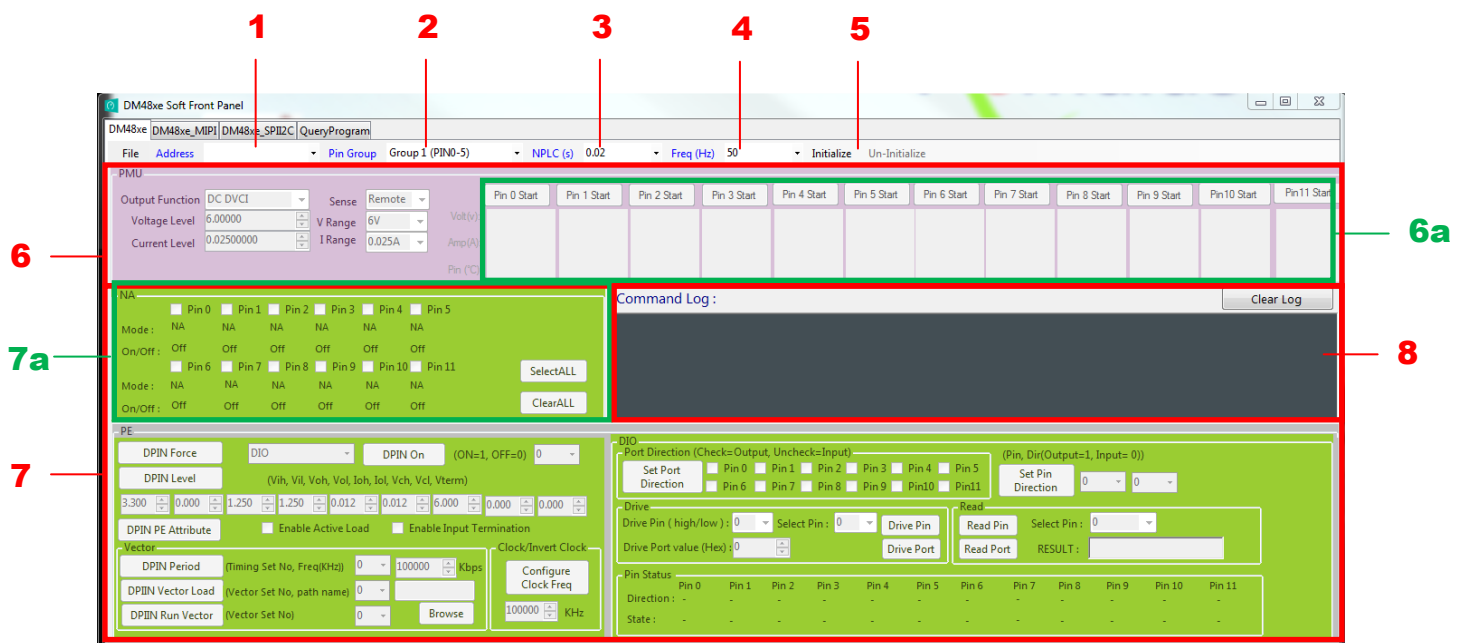


Figure 2: DM483e Soft Front Panel

Item	Description	
1	Select the PXI address of the module. A list of addresses is shown for all detected modules in the chassis.	
2	Select the pin group.	
3	Set the number of power line cycle, in second.	
4	Set the frequency of the power line (50Hz or 60Hz).	
3	Initialize the selected module. This includes opening a session to communicate with the module, and then reset the module in its default state	
5	Un-initialize the selected module. This includes closing the current communication session to the module.	
6	Per Pin Parametric Measurement Unit (PPMU) function:	
	a	Output Function <i>DC DVCI</i> : Drive-Voltage Clamp-Current operation. Continuous mode. <i>DC DICV</i> : Drive-Current Clamp-Voltage operation. Continuous mode.
	b	Voltage Level Voltage level
	c	V Range Range of the voltage level
	d	Current Level Current level (Current level setting is not required in DVCI mode. "I Range" will decide the compliance value)
	e	I Range Range of the current level
	f	Sense Select either <i>Remote</i> or <i>Local</i> sense connection
6a	Click the "Start" button for the selected pin to execute PMU commands. The button will immediately turn to "Stop". Press it to exit from PMU functions. Following results are shown for each pin: a. Voltage (V) b. Current (A) c. On-board temperature	

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Pin Electronics (PE):			
Generic Setting:			
a	DPIN Force	Sets the operation mode:	
		Mode	Description
		VECTOR	Vector engine
		DIO	General purpose I/O
		CLOCK	Drive clock signal
		INVERTED_CLOCK	Drive inverted clock signal. This is when 2 pins are selected as differential outputs
b	DPIN Level	Set the levels for each pin.	
c	DPIN On	Turn on/off the selected pin.	
d	DPIN PE Attribute	Enable/disable active load and input termination	
Vector:			
a	DPIN Period	Specifies the timing set to be used, as well as its period setting	
b	DPIN VecLoad	Load the specified vector set in the vector file to the module	
c	DPIN RunVec	Run the specified vector set.	
Clock/Invert Clock:			
a	Configure Clock Frequency	Configure the clock frequency when mode "CLOCK" or "INVERTED_CLOCK" is selected.	
DIO:			
a	Set Pin Direction	Specifies the direction of the selected pin.	
b	Set Port Direction	Specifies the direction of the selected pin group.	

	<div data-bbox="337 197 358 224">c</div> <div data-bbox="407 197 553 224">Drive/Read</div> <table border="1" data-bbox="440 275 1159 747"> <tr> <td>Select Pin</td><td>Specifies the pin</td></tr> <tr> <td>Drive Pin Value</td><td>Specifies the logic level of the pin to be driven</td></tr> <tr> <td>Drive Port Value</td><td>Enter the port value (in HEX) if you want to drive to the whole pin group</td></tr> <tr> <td>Select Function</td><td> Select from a list of available DIO functions: - Drive Pin - Drive Port - Read Pin - Read Port </td></tr> </table> <p data-bbox="407 789 1344 905">Click the "Start" button for the selected pin to execute the command. The results for read functions for each pin will be displayed as either "H" (logic high), "L" (logic low) or "Z" (undefined).</p>	Select Pin	Specifies the pin	Drive Pin Value	Specifies the logic level of the pin to be driven	Drive Port Value	Enter the port value (in HEX) if you want to drive to the whole pin group	Select Function	Select from a list of available DIO functions: - Drive Pin - Drive Port - Read Pin - Read Port
Select Pin	Specifies the pin								
Drive Pin Value	Specifies the logic level of the pin to be driven								
Drive Port Value	Enter the port value (in HEX) if you want to drive to the whole pin group								
Select Function	Select from a list of available DIO functions: - Drive Pin - Drive Port - Read Pin - Read Port								
8	Display the actions taken in the background.								

Table 4: Soft Front Panel Control

Quick steps to configure the module:

1. Select PXIe address of the targeted module from the drop-down list.
2. Select the targeted pin group. In this example, select "All Groups (PINo-11)".
3. Press "Initialize".
4. The module is set to drive 1V and its current compliance is set to 25mA, in DVCI mode.
5. Press "Start" to execute the commands. The button will immediate to "Stop".
6. Both voltage and current are measured.
7. Press "Stop" to exit from PMU mode.
8. Press "Un-Initialize" to turn off the whole module.

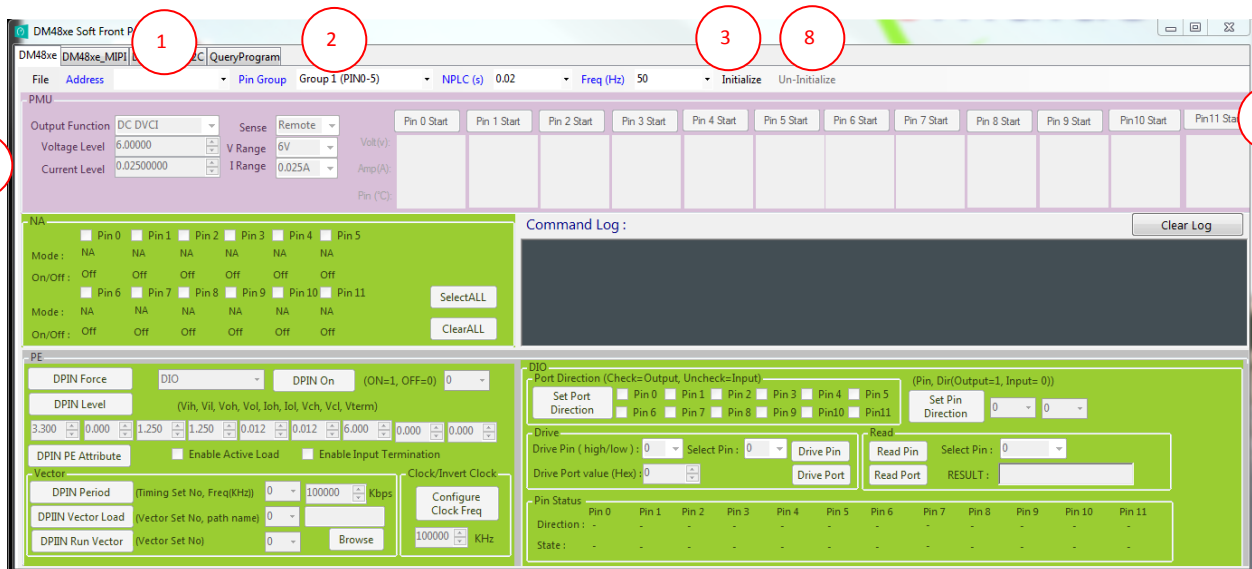


Figure 3: PMU Operation

2.2.2 MIPI Functions

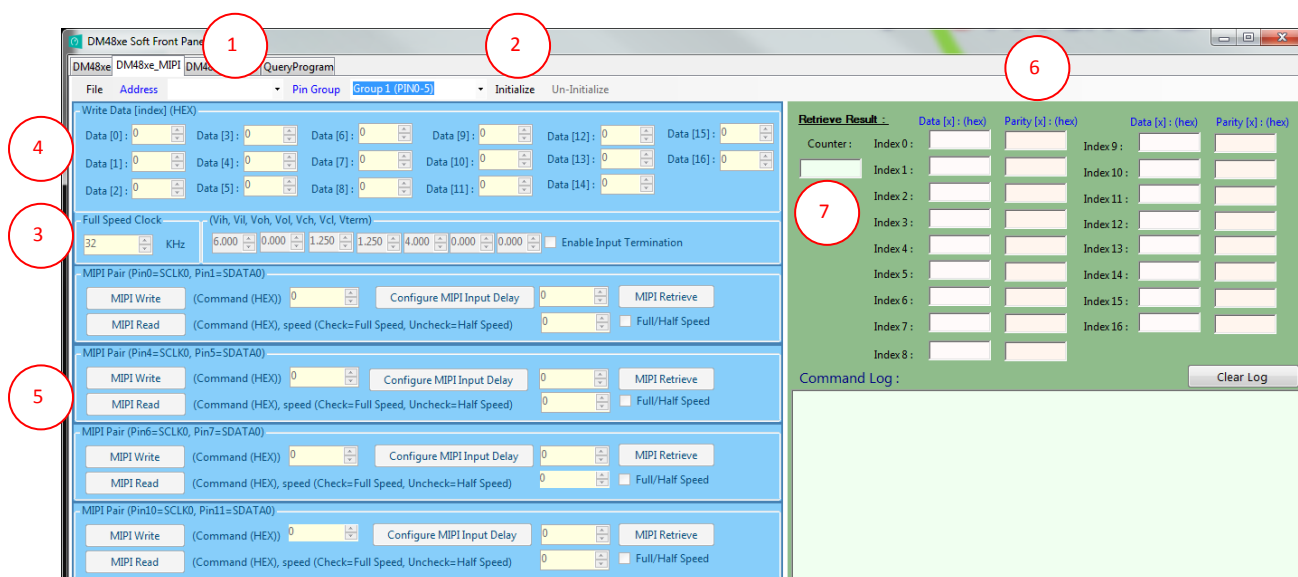


Figure 4: MIPI SFP

Item	Description
1	Display the address of the module connected. A list of addresses is shown for all detected modules in the computer.
2	Initialize or un-initialize the module
3	Set/ display the frequency and level settings of the MIPI operation
4	Data to be written into the module
5	Configure MIPI Write, MIPI Read, Configure MIPI Input Delay and MIPI Retrieve operations
6	Display the data after read operation, together with its corresponding parity check bit.
7	Counter to display the number of data byte read

Table 5: MIPI Soft Front Panel Control

Quick steps to configure the module:

1. Select PXIe address of the targeted module from the drop-down list.
2. Set the desired voltage level.
3. Set the desired frequency.
4. Press "Initialize".
5. Set desired operation from the feature in channel 0 or channel 1. For example, DM483e_MIPi_RFFE_WR.
6. Set the desired operation command, for example, 0x0202.
7. Set the data that should be written to the module at part (6). Refer to Figure 4.
8. Press "Start" to execute the command.
9. Press "Un-Initialize" to turn off the whole module.

Note:

Retrieve result and counter will be displayed after the operation of DM483e_MIPi_RFFE_RETRIEVE.

2.3 Remote Operation

Refer to programming manual.

Section 3: Brief Technical Description

DM483e is a high speed digital waveform generator and analyzer, with integrated pin electronics (PE) and per pin parametric measurement unit (PPMU) functions.

3.1 Basic Operation

3.1.1 Per Pin Parametric Measurement Unit (PPMU) Functions

Each DM483e pin can be configured can be set up to function as a voltage source/current monitor, current source/voltage monitor:

1. Source Current, Clamp Voltage (DICV)
 - a. This configuration turns DM483e into high-impedance current source
 - b. The voltage developed is limited by compliance setting
 - c. If current is 0A, DM483e becomes a voltmeter
2. Source Voltage, Clamp Current (DVCI)
 - a. This configuration turns DM483e into low-impedance voltage source
 - b. Current flow is limited by compliance setting. Current compliance values are limited to the supported current range values. For example, if the available current ranges are 20A, 200A, 2000A, 2mA and 25mA, then the available compliance settings are 20A, 200A, 2000A, 2mA and 25mA.

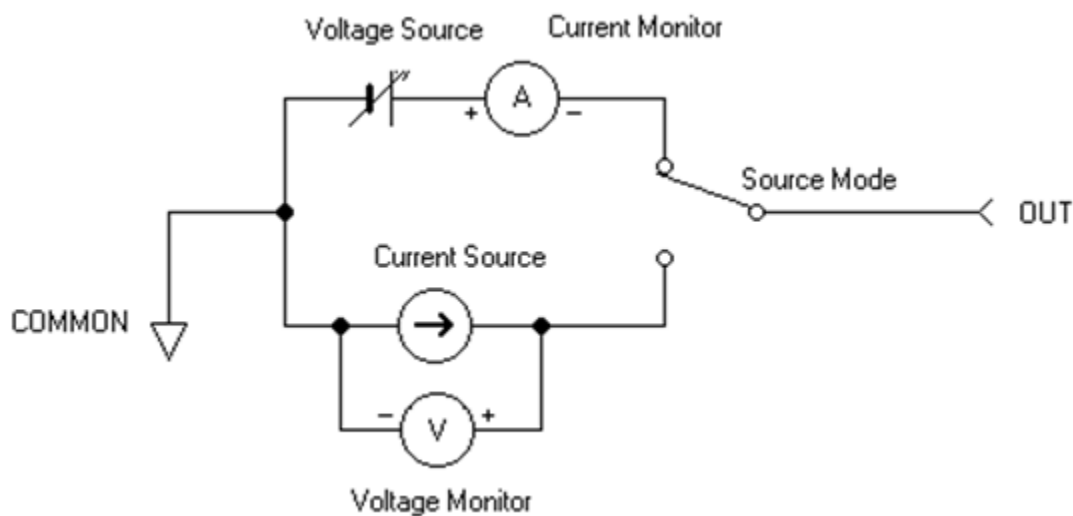


Figure 5: Typical Operation

To prevent over-voltage or over-current damage to the device-under-test (DUT), several levels of output protection, termed COMPLIANCE, is incorporated. Maximum specifiable compliance depends on the voltage or current range at which the pin is operating.

If a source pin reaches compliance during measurement, this indicates an error in the operation. Example:

1. DM483e is set to voltage source/current monitor mode; compliance of 2mA; output load is a 1kohm resistor.
2. If source voltage is 5V, the current that should flow through the resistor is $5V/1k=5mA$.
3. Due to compliance of 2mA, the source channel turns into a constant current source of 2mA. This yields a voltage of 2V across the resistor.

The measurement result is the average value of all samples taken for n^{th} number of power line cycle (PLC). For example, if the line frequency is set to 50Hz (period is 20ms), then 1 PLC equals to 20ms. The measured data is a resultant of averaged of raw samples captured by ADC on DM483e for 20ms.

NOTE

The NPLC setting of an instrument allows adjustment of the tradeoff between speed and accuracy. The greater the number of power line cycles, the greater noise rejection and better resolution the signal value will be.

3.1.2 Pin Electronics (PE) Functions

Apart from PMU, each DM483e pin can also perform the pin electronic functions of the driver, the comparator, and the active load (DCL), and DC levels for automated test equipment (ATE) applications. DM483e also contains high voltage drivers with capable of generating up to 13.5V on even-numbered pins (pins 0, 2, 4, 6, 8, and 10).

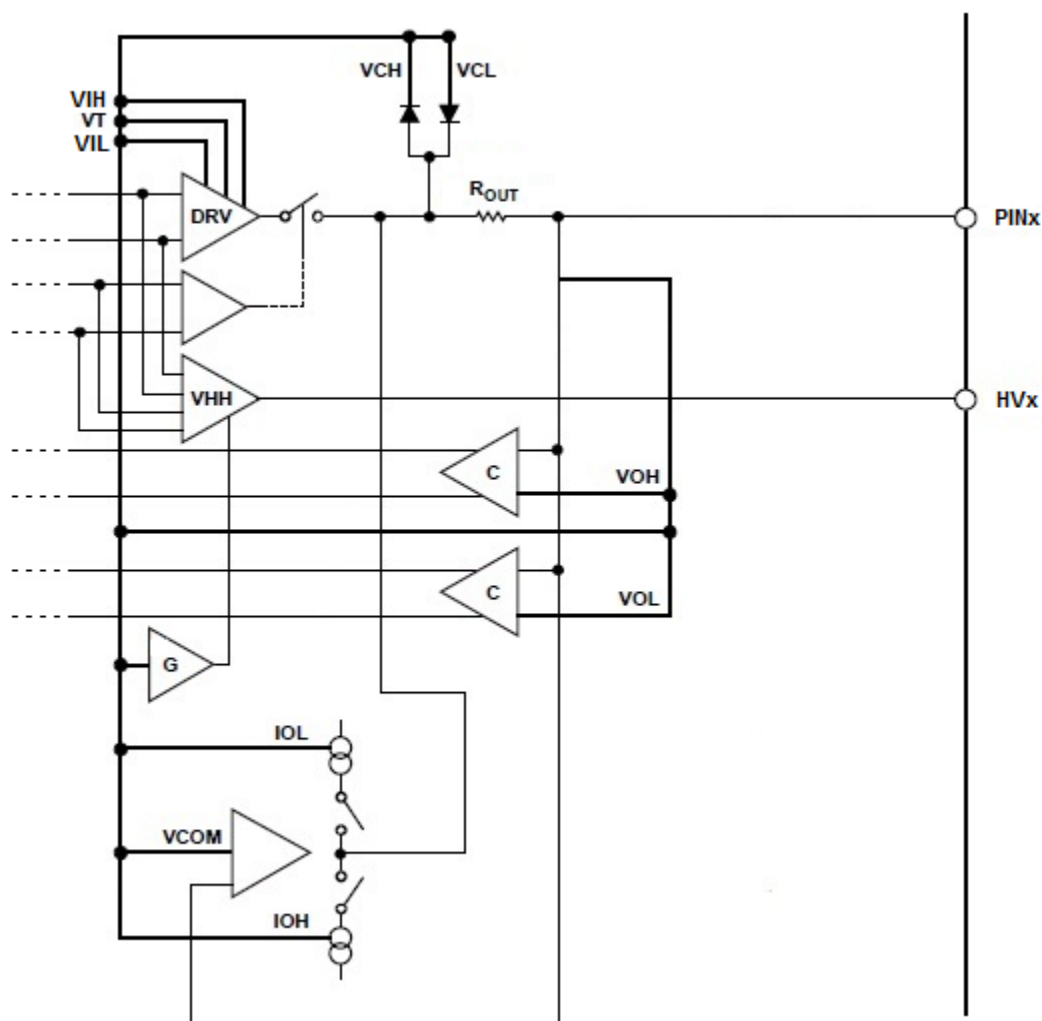


Figure 6: Pin Electronics (PE) Level Setting

Each pin consists of 9 level settings:

Setting	Description
VIH	The output driver high voltage level from the pin.
VIL	The output driver low voltage level from the pin.
VOH	The input comparator high voltage level into the pin.

VOL	The input comparator low voltage level into the pin.
VT/VCOM	The termination voltage when input termination is enabled. If input termination is disabled, driver is in high impedance.
IOH	The sink current when active load is enabled.
IOL	The source current when active load is enabled.
VCH	The reflection voltage clamp level for high range.
VCL	The reflection voltage clamp level for low range.

Table 6: PE Level Setting

When differential comparator is enabled, odd pins (pins 1, 3, 5, 7, 9 and 11) will be disabled. The voltage difference between Pin 0 and Pin 1, for example, will be fed to the comparator of Pin 0 only.

Active load termination is a constant current source. If the external output voltage (e.g. from device-under-test) is more than V_T , the pin will sink IOH current, otherwise, the pin will source IOL current.

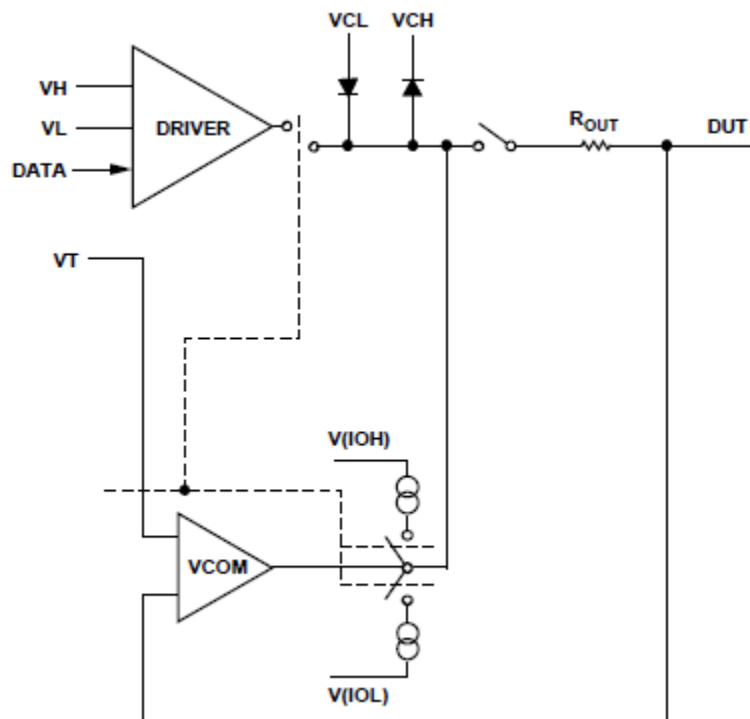


Figure 7: Active Load Block Diagram

3.1.3 Vector Engine Functions

DM483e allows user to generate or analyze user-defined patterns for each pin. Patterns are defined in a vector file (*.vec). Each vector file consists of one vector set only. Refer to specifications for the maximum number of supported vector set and timing set per DM483e.

If a pin is configured as an input-only or output-only pin, the data rate can achieve the maximum performance of DM483e. On the other hand, if a pin is configured as bi-directional pin, its maximum data rate is lower. Refer to specifications for details.

Figures below show the pattern format for dedicated pins and bi-directional pins.

```
.out 10 8 6 4 2 0 //define output channels
.in 11 9 7 5 3 1 //define input channels (default)

.sequence 11 10 9 8 7 6 t1 5 4 3 2 1 0 t0
.timingset 0
```

1	0	1	0	1	0	0	1	0	1	0	1	0	0
1	0	1	0	1	0	0	1	0	1	0	1	0	0
1	0	1	0	1	0	0	1	0	1	0	1	0	0
1	0	1	0	1	0	0	1	0	1	0	1	0	0
1	0	1	0	1	0	0	1	0	1	0	1	0	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
1	0	1	0	1	0	0	1	0	1	0	1	0	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
1	0	1	0	1	0	0	1	0	1	0	1	0	0
1	0	1	0	1	0	0	1	0	1	0	1	0	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
1	0	1	0	1	0	0	1	0	1	0	1	0	0
1	0	1	0	1	0	0	1	0	1	0	1	0	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
1	0	1	0	1	0	0	1	0	1	0	1	0	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
1	0	1	0	1	0	0	1	0	1	0	1	0	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0
h	1	h	1	h	1	0	h	1	h	1	h	1	0

User defines input and output pins. User has to define every pin. Undefined pins will return error. If user instantiates pin-group 0 or 1, the defined pin range is from 0 to 5.

User defines the sequence for the vector. In this example, the first column (highlighted in green) represents Pin 11 and sixth column (highlighted in yellow) represents Pin 6 and etc. tx refers to trigger output pins. Definition of its pin direction is not required.

This specifies the timing set number to be used for this vector set. The value of each timing set can only be defined using DM482e_DPINPeriod function.

There are six data formats:
 'o' : Drive Low (output only)
 '1' : Drive high (output only)
 'Z' : Tristate (output only)
 'L' : Compare Low (input only)
 'H' : Compare High (input only)
 'X' : Don't Compare (input only)

Figure 8: Vector Format for Dedicated Input-only or Output-only Pins

```
.sequence 11 10 9 8 7 6 t1 5 4 3 2 1 0 t0
.timingset 0
```

```
1 0 1 0 1 0 0 1 0 1 0 1 0 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
h 1 h 1 h 1 0 h 1 h 1 h 1 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
h 1 h 1 h 1 0 h 1 h 1 h 1 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
h 1 h 1 h 1 0 h 1 h 1 h 1 0
h 1 h 1 h 1 0 h 1 h 1 h 1 0
h 1 h 1 h 1 0 h 1 h 1 h 1 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
h 1 h 1 h 1 0 h 1 h 1 h 1 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
h 1 h 1 h 1 0 h 1 h 1 h 1 0
h 1 h 1 h 1 0 h 1 h 1 h 1 0
h 1 h 1 h 1 0 h 1 h 1 h 1 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
h 1 h 1 h 1 0 h 1 h 1 h 1 0
h 1 h 1 h 1 0 h 1 h 1 h 1 0
h 1 h 1 h 1 0 h 1 h 1 h 1 0
1 0 1 0 1 0 0 1 0 1 0 1 0 0
```

The format is same as above except that user needs not define pin direction since it is bi-directional. Hence user can use all the six data formats for a pin.

Figure 9: Vector Format for Bi-directional Pins

3.1.4 Triggers

Figure below shows the triggering signals supported by DM483e. Only external trigger outputs are supported by vector engine.

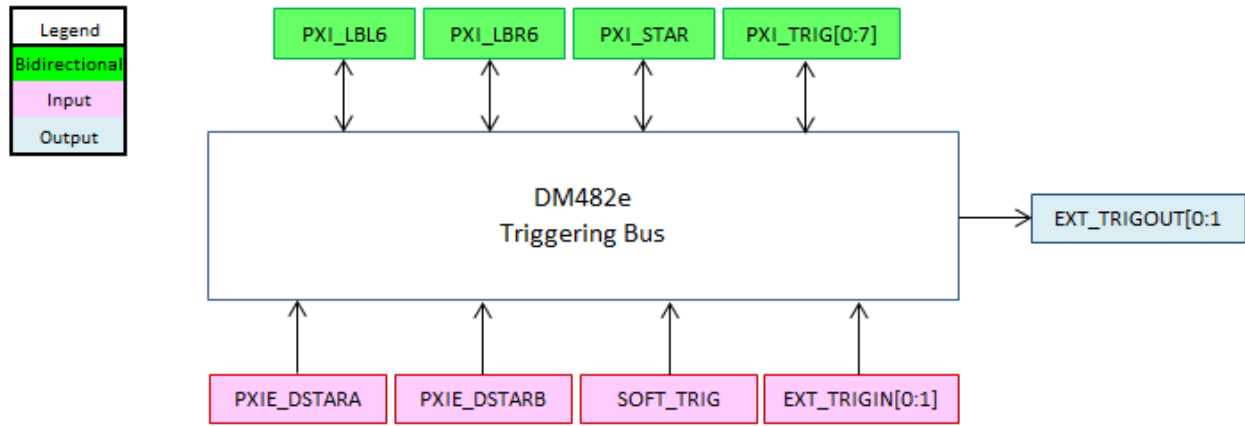


Figure 10: DM483e Trigger Bus

3.1.5 MIPI

DM483e contains MIPI controller to communicate with MIPI (Mobile Industry Processor Interface) RFFE (RF Front End) devices. It is capable of performing register read, register write, extended register write, extended register write long, register read, extended register read as well as extended register read long operations. This feature avoids the hassle of constructing MIPI SCLK and SDATA using vectors or patterns.

The MIPI RFFE Specification defines an interface between RFFE-capable devices, with one master device and up to 15 slaves on a single RFFE bus. The RFFE Interface and bus structure is illustrated below.

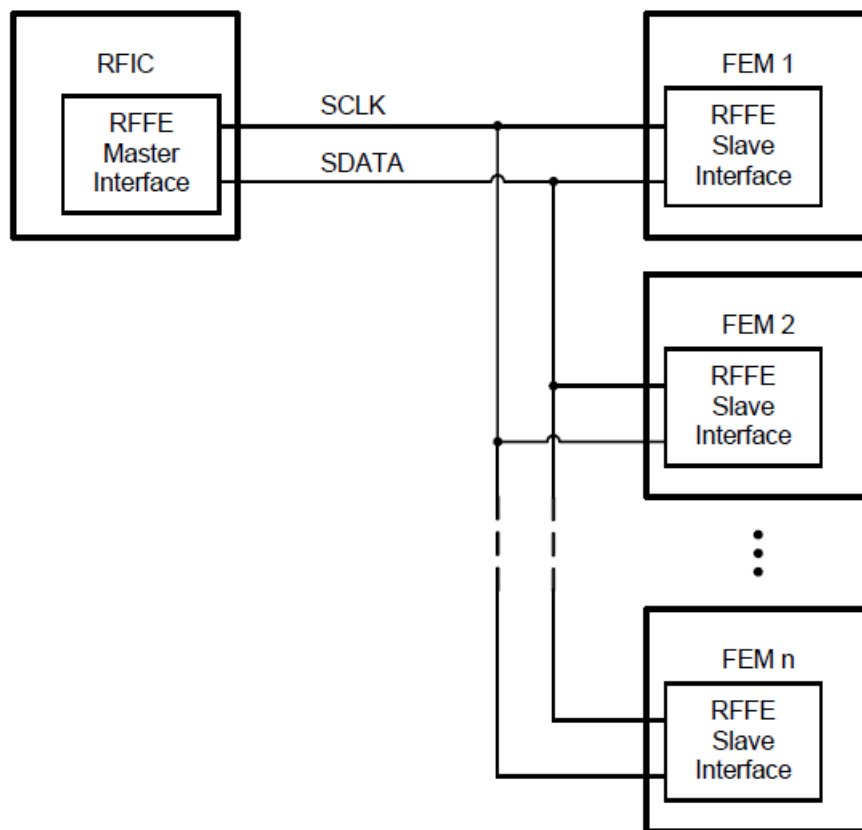


Figure 11: RFFE Interface and Bus Structure

MIPI uses two signal lines, a clock signal (SCLK) controlled by the master, a unidirectional/bidirectional data signal (SDATA), and an I/O supply/reference voltage (VIO). The choice of SDATA attribute is based on whether a slave device is write-only, or whether it supports read/write capability.

RFFE bus components are connected in parallel to the SCLK and SDATA lines of the bus. Line drivers always exist for both SCLK and SDATA in the master, whereas only slaves supporting read-back functionality need a line driver for SDATA. Each physical slave must have one SCLK input pin, one SDATA input or bidirectional pin, and a VIO pin to ensure signal compatibility between devices. Note that VIO can be supplied externally or it may be sourced from the master device.

3.2 Signal Connection

Depending on the mode of operation (PE or PMU), there are 3 leads per pin:

1. Force-High (FH)
2. Low (L)
3. Sense-High (SH)

For PMU mode, Force-High and Low signals are where voltage and current are generated during source or sink operation. Sense-High signals are high impedance paths. Connect these lines as close to the DUT terminal as possible for more accurate voltage source or measure operations. Presence of Sense lines at the DUT terminals is known as 4-wire, remote-sense, or Kelvin operation.

For PE mode, Sense-High lines do not play any role. Digital signals are travelling via Force-High and Low lines.

Section 4: Maintenance

4.1 Cleaning

Before doing any cleaning to the product, switch off the chassis and disconnect it from main power supply.

You can wipe the front panel of the module using a soft cloth moistened in water, taking care not to wet the connectors. Do not use aerosol or liquid solvent cleaners.

You can use a handheld vacuum cleaner to remove any accumulated dust on the product, if necessary.

CAUTION

Be careful NOT to be in direct contact with any circuits on the product to prevent any damages. Contaminants such as oils and salts from the human skin can affect the performance of the product.

Comply with good ESD practice when handling the product during cleaning.

4.2 Calibration

Electronic components tend to drift over time. Environmental changes, operation stresses and aging increase the measurement uncertainty. Periodic calibration is required to ensure the accuracy of the instrument.

The recommended level calibration interval for the product is 6 months.

4.3 Servicing

There are no user-serviceable parts in the product; if any attention is needed, return it to instrument manufacturer.

NOTE

Any repair that is not covered in this manual should only be performed by qualified Aemulus personnel.

Section 5: Warranty

Aemulus warrants that the product delivered will be free from defects in material and workmanship for 1 year from the date of delivery order. This warranty does not cover the product if it is damaged in the process of being installed.

This warranty does not cover replacement of products damaged by abuse, accident, misuse, neglect, alteration, repair, improper installation or improper testing. If the product is found to be defective otherwise, Aemulus, at its option, will replace or repair the product at no charge. If you ship the product, you must assume the risk of damage or loss in transit. Aemulus may replace or repair the product with either a new or reconditioned unit, and the product returned becomes Aemulus property.

Section 6: Revision History

1.0	AUG 2014	INITIAL RELEASE
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Section 7: Contact Us

To obtain service, warranty or technical assistance, please contact Aemulus.



Aemulus Corporation Berhad
Krystal Point, B-2-04, B-2-05, B-2-06 & B-2-07
303, Jalan Sultan Azlan Shah,
11900 Penang, Malaysia
Tel: +604 6446399
Fax: +604 6466799

Web: www.aemulus.com
Email: enquiry@aemulus.com

Product specifications and descriptions in this document are subject to change without prior notice.