Aemulus

AM430e

Specifications

Version 1.1, 12-2013

Table of Contents

TABLE OF CONTENTS 1

SECTION 1: SPECIFICATION CONDITIONS 2

SECTION 2: DEVICE CAPABILITIES 3

SECTION 3: SPECIFICATIONS 4

3.1 VOLTAGE PROGRAMMING AND MEASUREMENT ACCURACY 4

3.2 CURRENT PROGRAMMING AND MEASUREMENT ACCURACY 4

3.3 NOISE AND RESOLUTION VS. MEASUREMENT APERTURE 5

SECTION 4: SUPPLEMENTAL SPECIFICATIONS 6

4.1 TYPICAL STEP RESPONSE 7

SECTION 5: TRIGGERS 14

5.1 TRIGGER INPUTS 14

5.2 TRIGGER OUTPUTS 14

SECTION 6: OTHERS 15

SECTION 7: REVISION HISTORY 16

SECTION 8: CONTACT US 17

Section 1: Specification Conditions

This document contains the specifications and supplemental information of AM430e four-channel source-measure unit (SMU).

Specifications are the standards against which the AM430e SMU is tested. Upon leaving the factory the AM430e SMU meets these specifications. Supplemental and typical values are non-warranted, apply at 23°C, and are provided solely as useful information.

The source and measurement accuracies are specified at the terminals under the following conditions:

1. Ambient temperature 23°C ± 5°C
2. After 30 minutes warm-up
3. 1 PLC aperture time, unless otherwise stated
4. Remote sense operation
5. Calibration period: 6 months

Section 2: Device Capabilities

The following table and figure illustrate the voltage and the current source and sink ranges of the AM430e SMU.

Channels	DC Voltage Ranges	DC Current Source and Sink Ranges
0 through 3	±1 V	1 uA
	±2 V	10 µA
	±5 V	100 µA
	±10 V	1 mA
		10 mA
		100 mA

Table 1: DC Voltage Ranges and DC Current Source and Sink Ranges

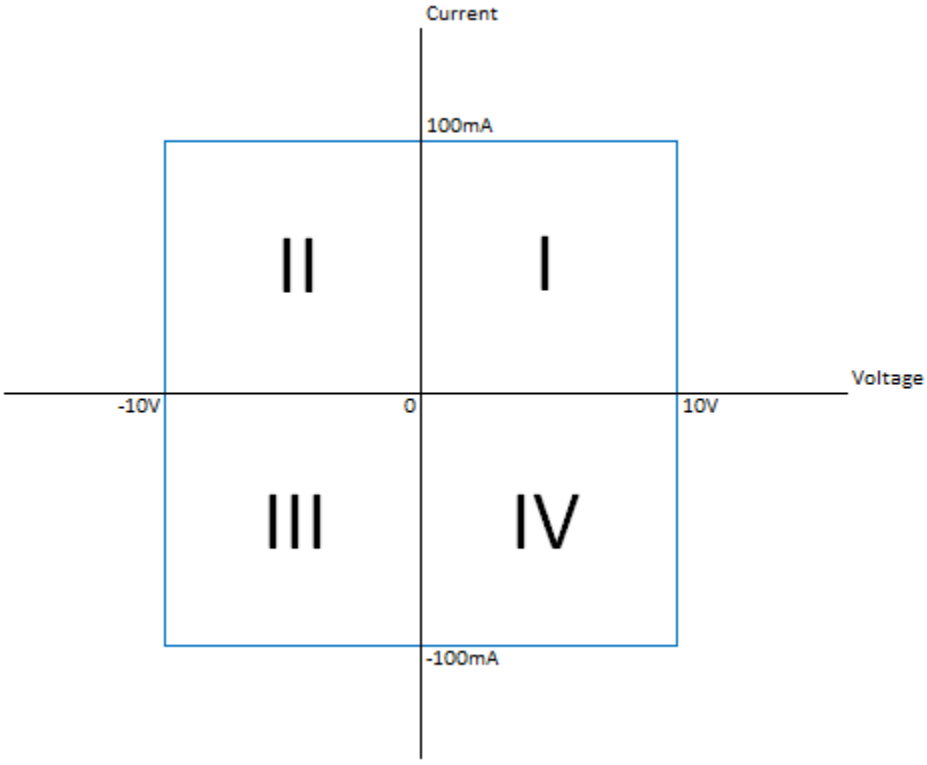

Figure 1: Voltage vs Current Envelope

Note:

1. Channels 0 through 3 are isolated from earth ground but share a common LO.

Section 3: Specifications

3.1 Voltage Programming and Measurement Accuracy

Range	± (% of Voltage + Offset)	Temperature Coefficient ± (ppm of Voltage + ppm of Range) / °C	Resolution
	Tcal ± 5 °C	13 °C to 33 °C	
1 V	0.05 % + 500 uV	25 + 21	20 uV
2 V	0.05 % + 1 mV		10 uV
5 V	0.05 % + 2.3 mV		25 uV
10 V	0.015 % + 600 µV	25 + 6	80 uV

Table 2 : Voltage Programming and Measurement Accuracy

3.2 Current Programming and Measurement Accuracy

Range	± (% of Voltage + Offset)	Temperature Coefficient ± (ppm of Voltage + ppm of Range) / °C	Resolution
	Tcal ± 5 °C	13 °C to 33 °C	
1 uA	0.1% + 1 nA	11 + 120	10 pA
10 uA	0.03% + 1.5 nA	10 + 10	20 pA
100 uA	0.03% + 15 nA	28 + 5	200 pA
1 mA	0.03% + 150 nA	15 + 5	2 nA
10 mA	0.03% + 1.5 µA	25 + 5	20 nA
100 mA	0.03% + 15 µA	28 + 8	1 uA

Table 3 : Current Programming and Measurement Accuracy

Note:

1. Tcal is the temperature recorded by the SMU at the completion of the calibration
2. Resolution is noise-limited. Specifications are valid for an aperture time of 2 PLCs. See SMU Noise/Resolution vs. Measure Speed for typical performance at higher sample rates.

3.3 Noise and Resolution vs. Measurement Aperture

The following figure illustrates typical noise and resolution as a function of measurement aperture for the SMU.

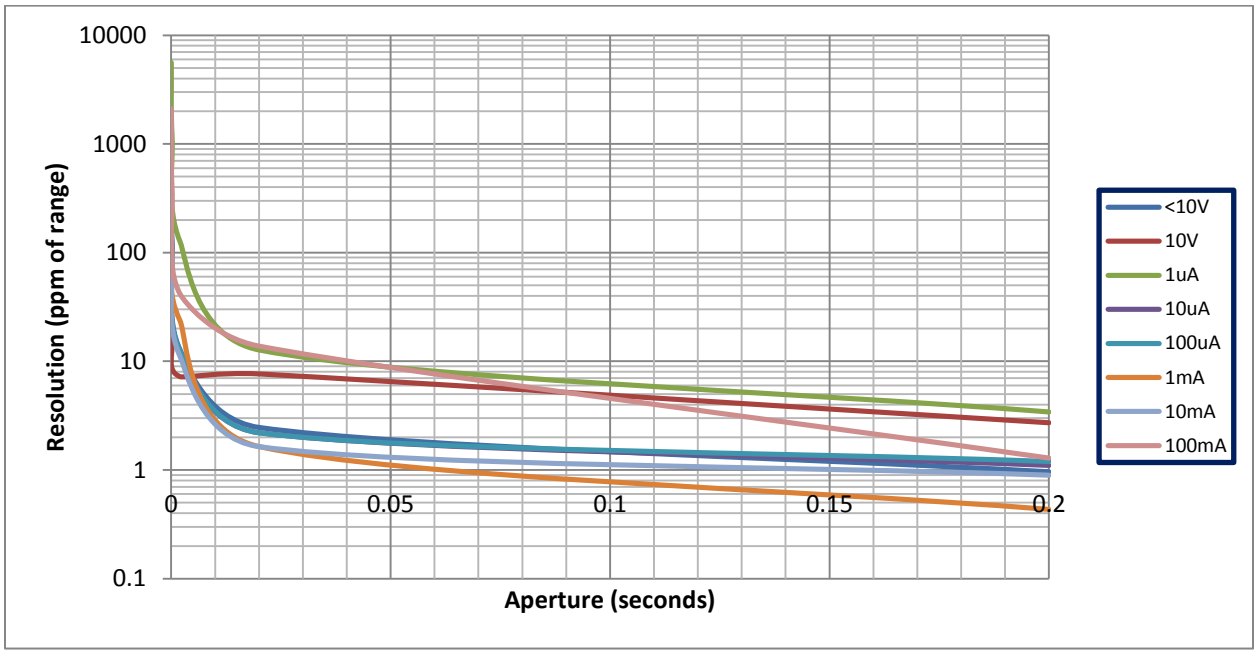

Figure 2: Resolution VS Aperture

To derive a resolution in absolute units from the previous figure, complete the following steps:

- Select a voltage or current range.
- For a given aperture time, find the corresponding resolution.
- To convert resolution from ppm of range to absolute units, multiply resolution in ppm of range by the selected range.

For example, the AM430e has a resolution of 10ppm when set to a 50ms aperture time. In the 100mA range, resolution can be calculated by multiplying 100mA by 10ppm, as shown in the following example:

100mA * 10ppm = 0.1A * 10 * 1×10–6 = 1µA

Likewise, in the 10V range, resolution can be calculated by multiplying 10V by 10ppm, as shown in the following example:

10V * 8ppm = 10V * 8 * 1×10–6 = 80µV

Section 4: Supplemental Specifications

1. Settling time, typical: < 100us to settle to 0.1% of voltage step, fast transient response
   Note: Current limit set to ≥1 mA

2. Cable guard output impedance, typical: 1kΩ

3. Remote sense

Voltage:	Add 0.1% of LO lead drop to voltage accuracy specification
Current:	Add 0.02% of range per volt of total HI and LO lead drop to current accuracy spec
Maximum lead drop:	Up to 1 V drop per lead

4. Isolation

Channel-to-earth ground:	60V
Absolute maximum voltage between any terminal and LO:	20V

5. Sampling speed

Measure sampling rate:	1MS/s
Maximum source update rate:	267kS/s

4.1 Typical Step Response

The following figures illustrate the effect of the transient response setting on the step response of the AM430e for different loads

1. 10mA Range, No Load Step Response (10V), typical

    a. Fast transient response. Settling time < 100us to settle to 0.1% of voltage step

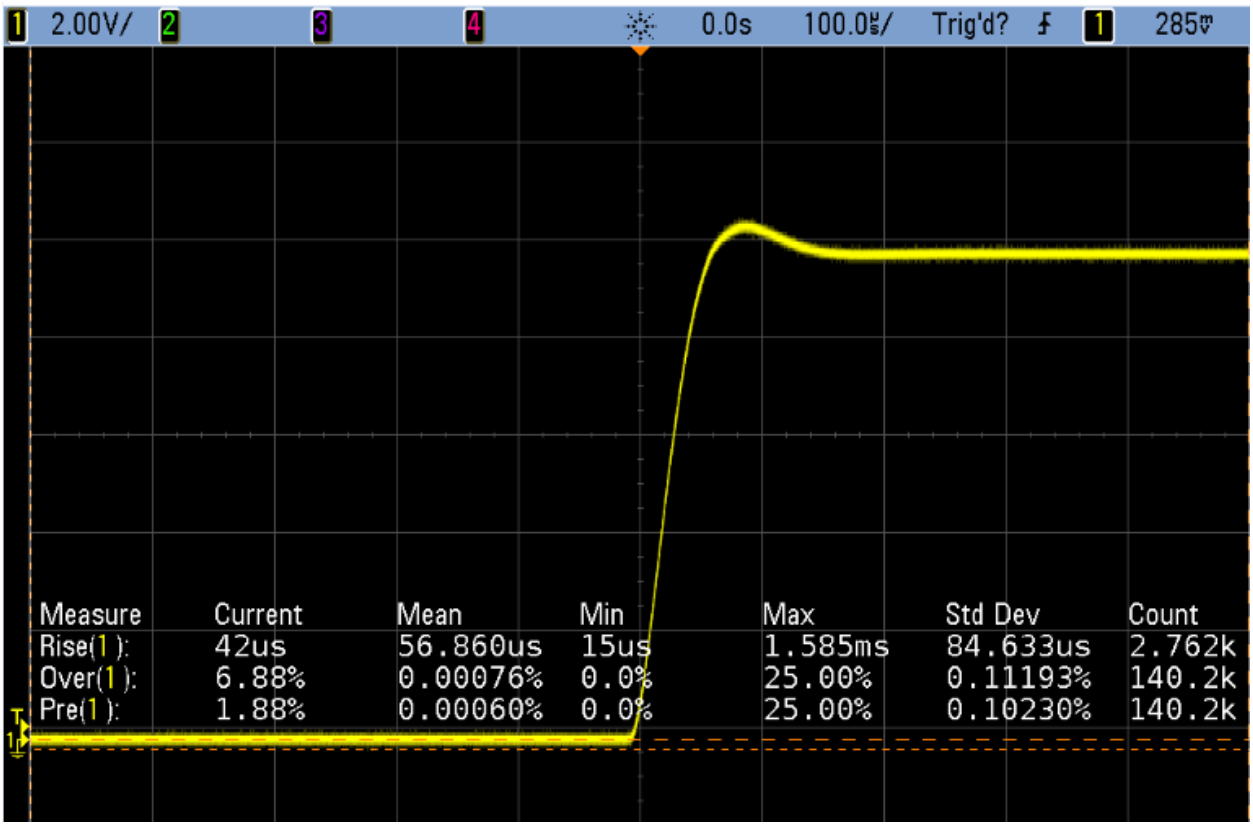

Figure 3: Fast transient response, 10mA, 10V

b. Normal transient response. Settling time < 200us to settle to 0.1% of voltage step

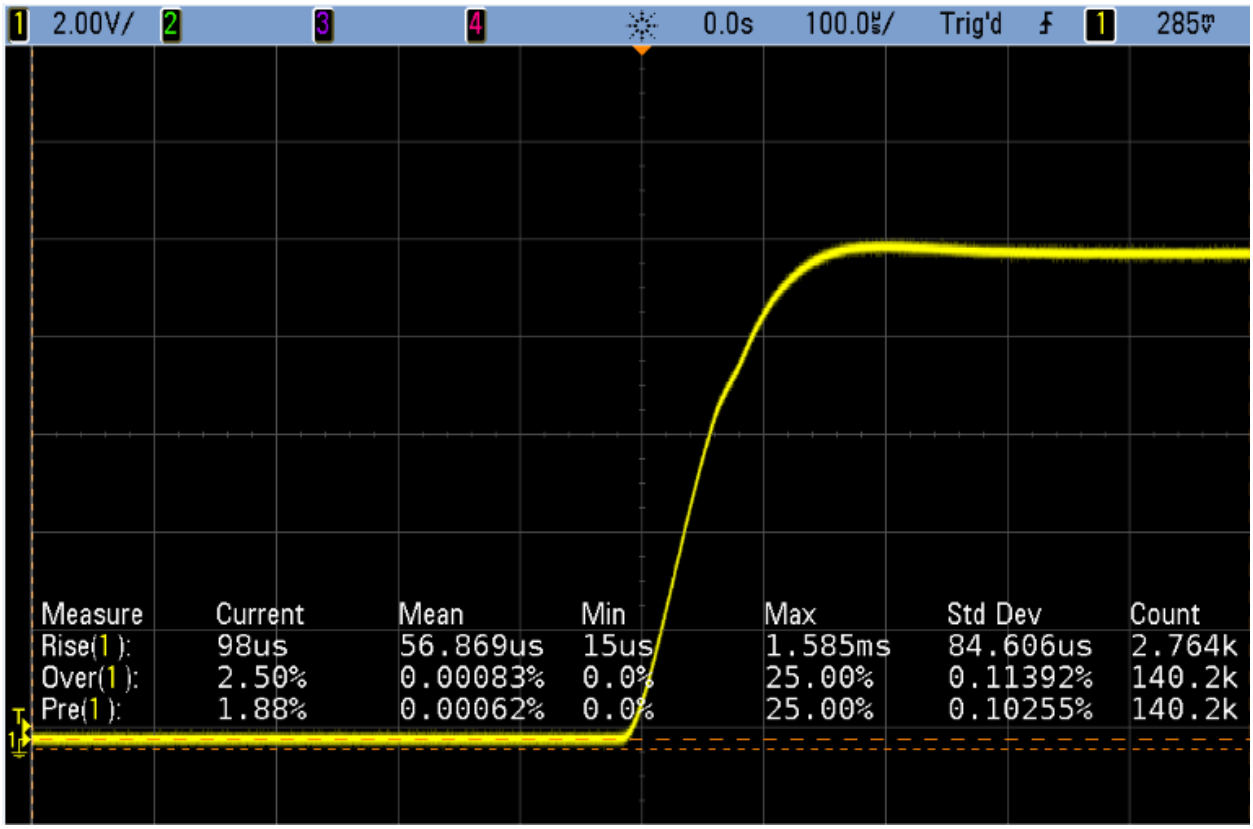

Figure 4: Normal transient response, 10mA, 10V

c. Slow transient response. Settling time < 500us to settle to 0.1% of voltage step

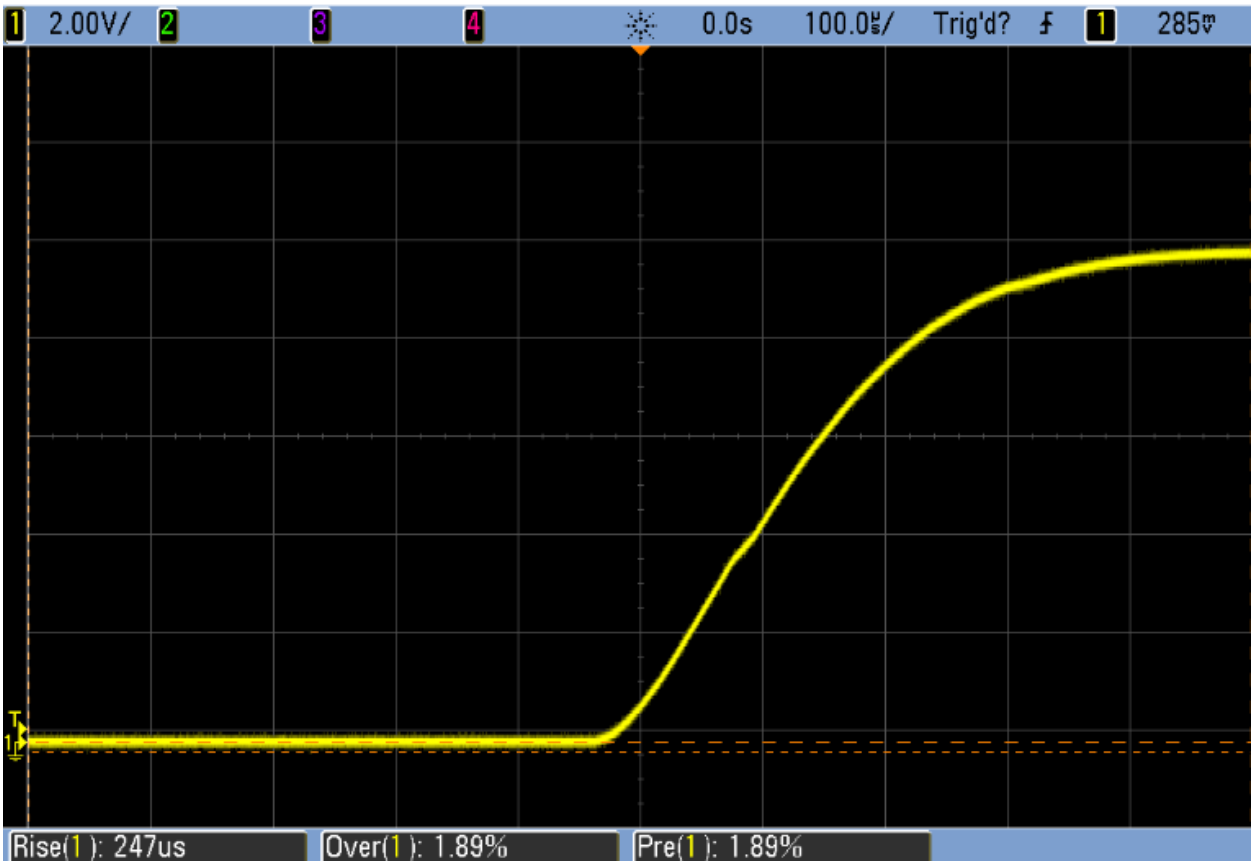

Figure 5: Slow transient response, 10mA, 10V

2. 10mA Range, 100nF Load Step Response (1V), typical

    a. Fast transient response

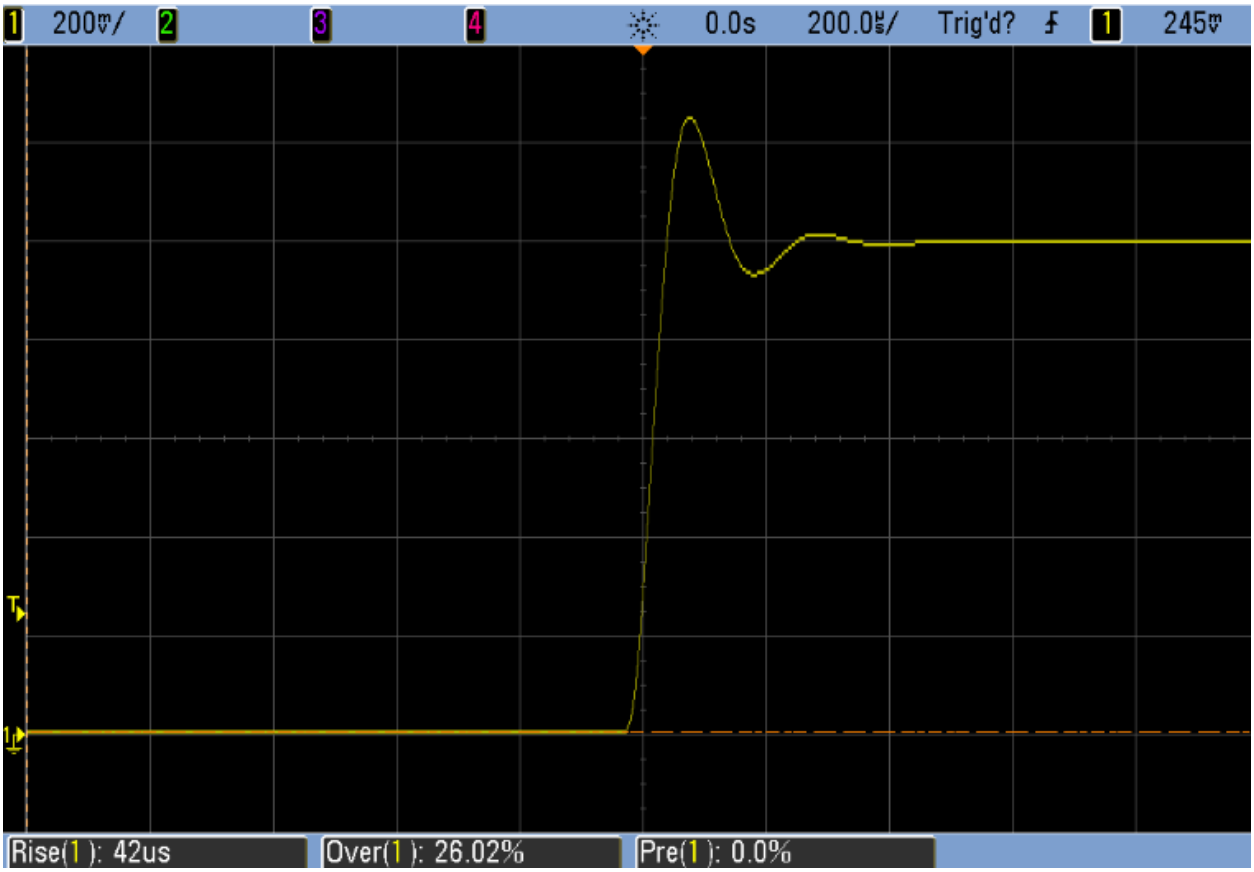

Figure 6: Fast transient response, 100nF, 1V

b. Normal transient response

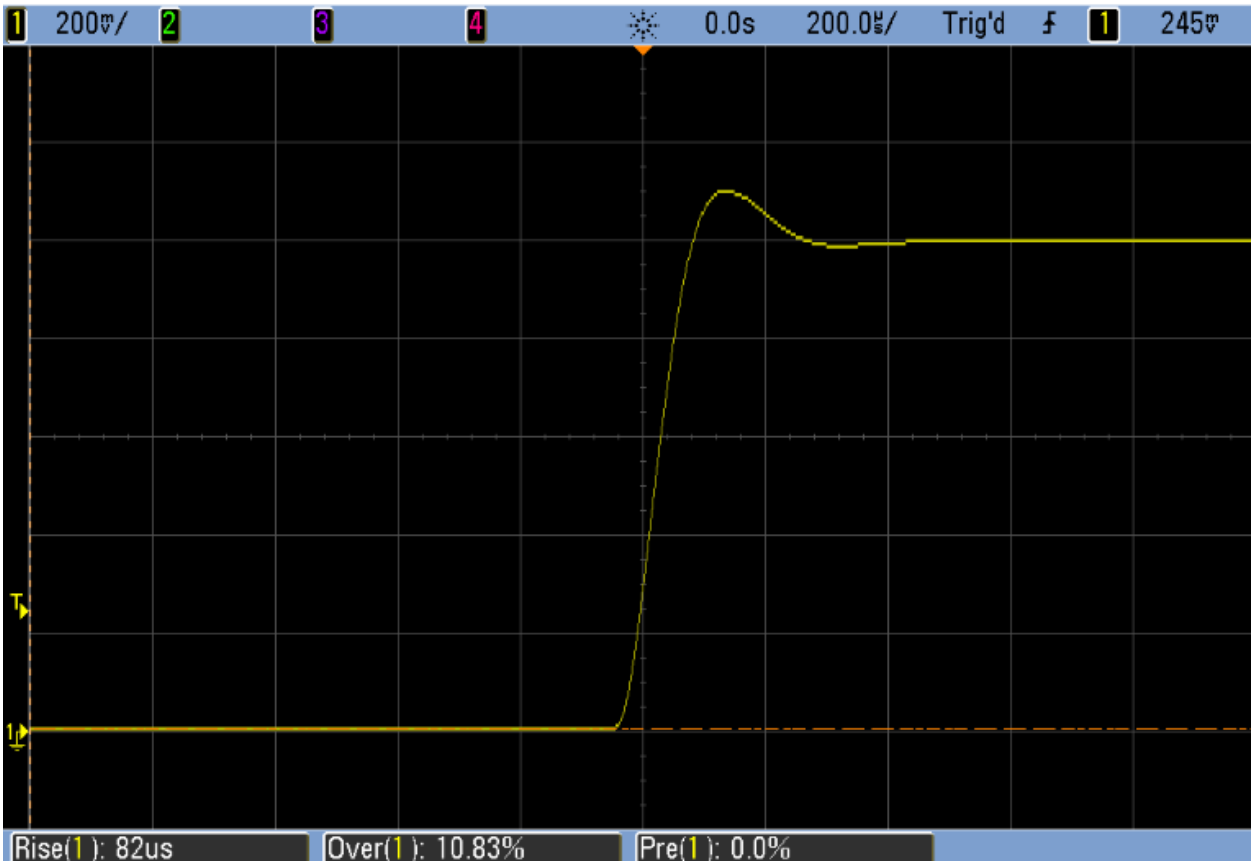

Figure 7: Normal transient response, 100nF, 1V

c. Slow transient response

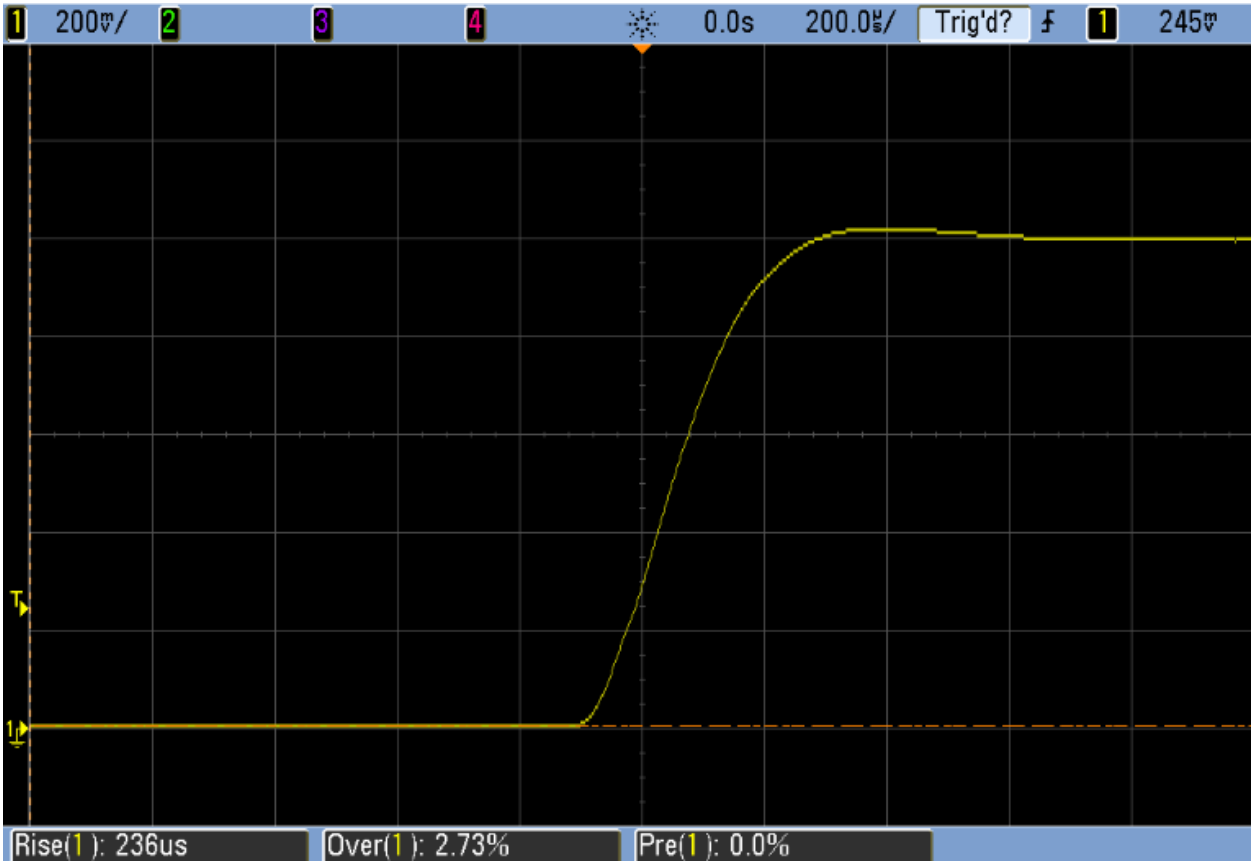

Figure 8: Slow transient response, 100nF, 1V

d. Custom transient response

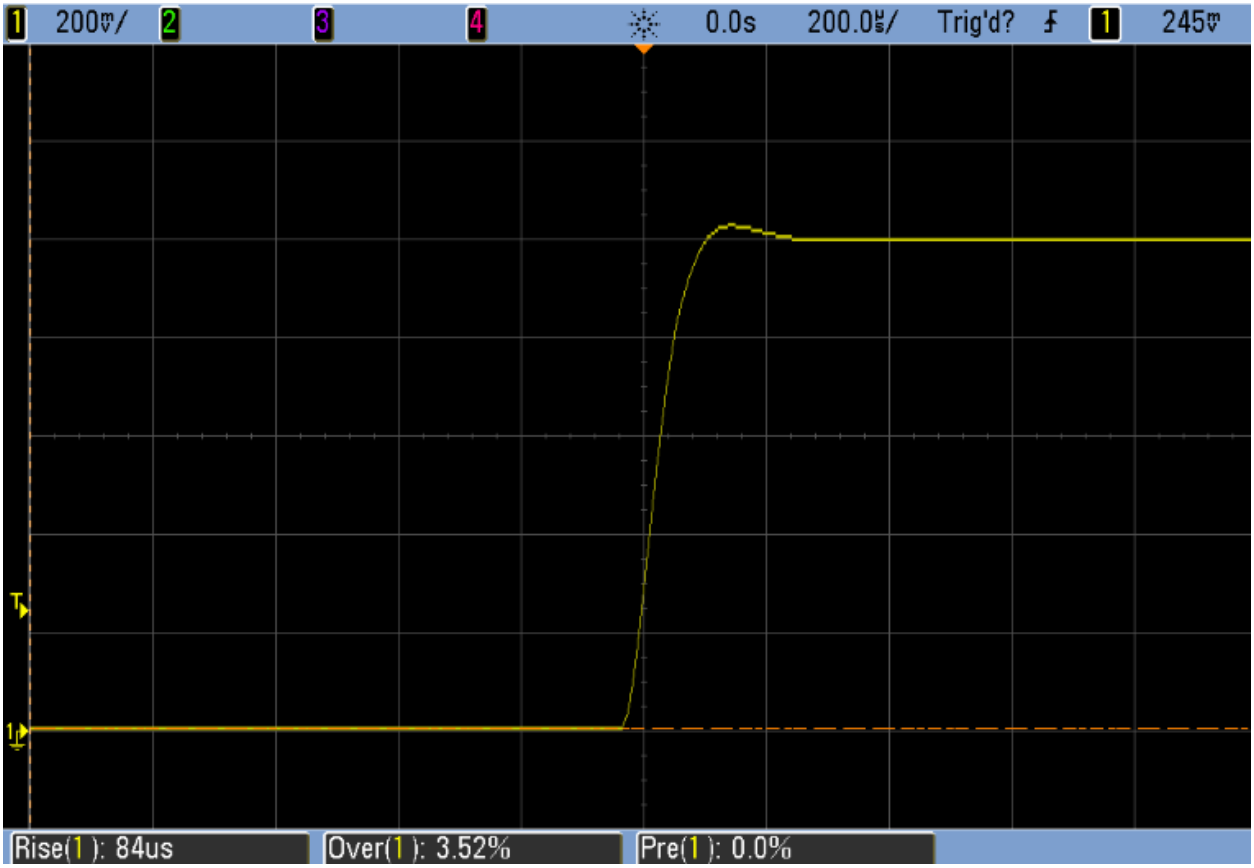

Figure 9: Custom transient response, 100nF, 1VFast transient response, 100nF, 1V

Section 5: Triggers

5.1 Trigger Inputs

Specification	Value	Comments
Sources	PXI trigger lines	PXI_TRIG[0:7]
	Software trigger	0-1
	External trigger	1
Types	Measure, Measure Array	
Polarity	High, Low, Rising, Falling	Configurable
Pulse Width	>=200ns	
Destination	PXI trigger lines 0-7, External trigger	

Table 4 : Trigger Inputs

5.2 Trigger Outputs

Specification	Value	Comments
Types	Source Complete, Measure Complete, Enter Compliance, Exit Compliance, During Source, Software Trigger[0-1]	
Polarity	Active High	
Pulse Width	Between 1us and 50ms	Configurable
Destination	PXI trigger lines 0-7, External trigger	

Table 5: Trigger Outputs

Section 6: Others

1. Output
   Signals: 5-wires (Force High, Force Low, Sense High, Sense Low and Guard)
   Front Panel Connectors: 25 position D-Sub Female; BNC Socket

2. Dimension: 3U 1-slot space

Section 7: Revision History

1.0	JULY2013	INITIAL RELEASE
1.1	DEC 2013	REVISED FORMATTING

Section 8: Contact Us

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

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