

# Appendix I - AT45 Option (45 Volt Output)

## ***AT45 Option Overview***

For channels with AT45 output option, the maximum frequency is limited to 100 kHz. The pulse width can be set over the standard range of the unit with both active high and low outputs when set to high impedance mode. In low impedance mode, the pulse width is limited to a maximum of 10s and the active high output is no longer allowed. To maintain the highest possible rise time, care must be taken with cabling and termination. Low capacitance cable and 50 ohm termination will provide the fastest rise times without overshoot. The channel menu structure for the AT45 module changes are described in the table below (changes from standard outputs are in bold italics).

## ***AT45 Protection Error Messages***

When an AT45 module is present, the system performs self checks to insure the module is not damaged when attempting to over-drive, however the overdrive protection is NOT SHORT CIRCUIT PROTECTED, and caution must be taken to prevent damage to the board when driving into a short!

## **Module Errors**

If a channel on any AT45 module is over-driven, the channel will disable itself and the system will indicate an error on the module. The error will not clear until the user presses **FUNC - PERIOD** key sequence to clear the error, or power cycles the instrument. The overdriving protection is limited to low resistance errors not to direct shorts to ground. Damage to the output will occur when driving into short circuits. Module errors may occur due to any of the following:

- Over current.
- Over temperature.
- Internal hardware.

## **System Limit Error**

The system will not allow the Lo Impedance enabled AT45 channels to exceed 150V total amplitude. If this situation occurs, the "Over-Driving Unit" error is displayed and the currently adjusting amplitude is reduced to the 150V enabled channel limit.

## **Voltage Change Timing**

The channels adjustable voltage changes very quickly when adjusting from a lower voltage to a higher voltage but changes slowly when changing from a higher voltage to a lower voltage. It takes approximately 30s to change from 45V to 4.0V so caution must be taken when adjusting the voltage to a lower voltage tolerant circuit.

## AT45 Channel Menus

### Channel Output Configuration Menu

Channel Enable	Channel Enable
Output Type: High Z	Output Type: Low Z
Polarity	
Output Level	Output Level

### AT45 SCPI Command Extension Summary

Keyword	Parameter	Comments
:PULSe [1 / 2 / n]		Subsystem. Contains commands to control the output pulse generation. Valid suffix range depends on the number of channels (ChA = 1, ChB = 2, etc). Command without suffix refers to the currently selected logical instrument. See INSTRument subsystem.
:OUTPut		Subsystem. Contains command to control output mode.
:MODE	HIZ / LOZ	Selects output Amplitude mode: High Impedance or Low Impedance
:AMP	<numeric value>	Sets adjustable output level.
:MERRor	1	Command clears the last module error to allow the unit to generate pulses again. Query returns the last displayed error.

### AT45 Specifications

Amplitude	4V - 45V
Resolution	20mV
Accuracy	+/-1.5%
Rise Time	< 2ns Typical 10%-90% (Low Z) < 9ns Typical 10%-90% (High Z)
Fall Time	< 2ns Typical 90%-10% (Low Z) < 9ns Typical 90%-10% (High Z)
Frequency (Internal & External)	DC - 100kHz
Overshoot	<35% Typical Allowed for Fast Rise Time
Polarity - High Z (>10k)	Active High or Active Low
Polarity - Low Z (50 Ohms)	Active High Only
Pulse Width - High Z (>10k)	10ns to DC
Pulse Width - Low Z (50 Ohms)	10ns to 10s
Current (maximum)	35mA (High Z @10ms width) 900mA (Low Z @ 10ms width)

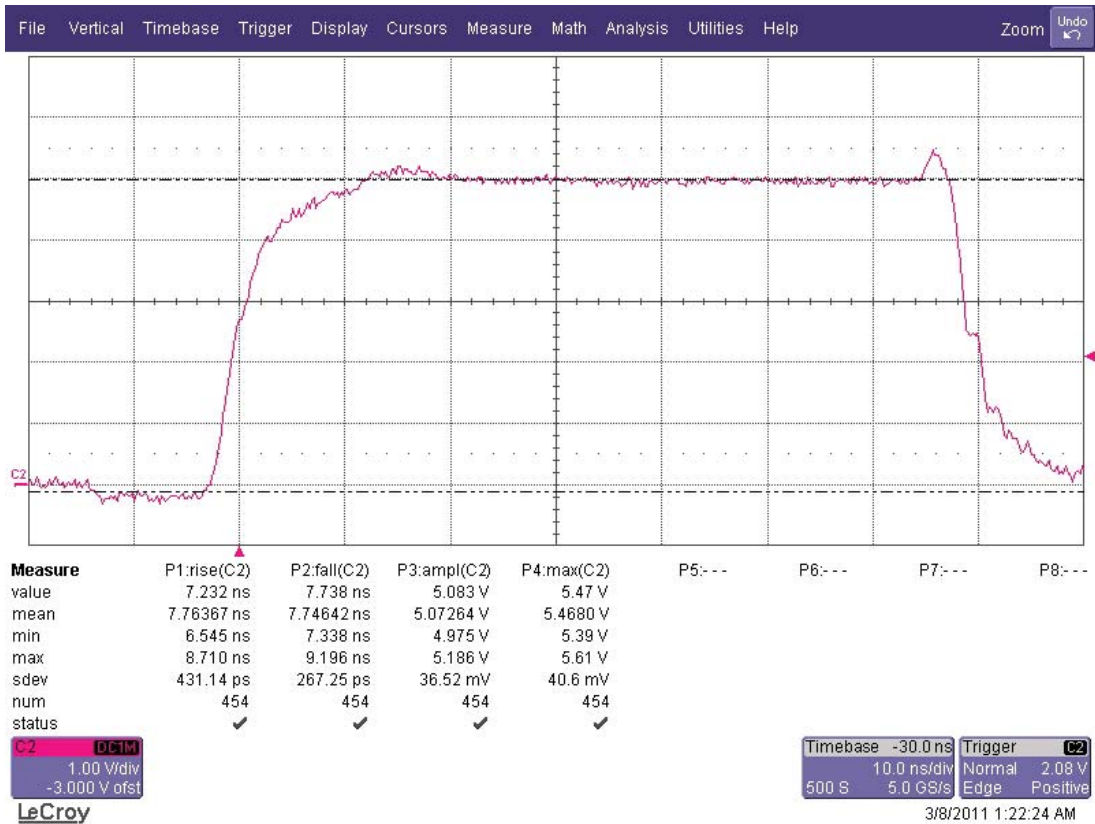


Figure 1 (High Z 5V)

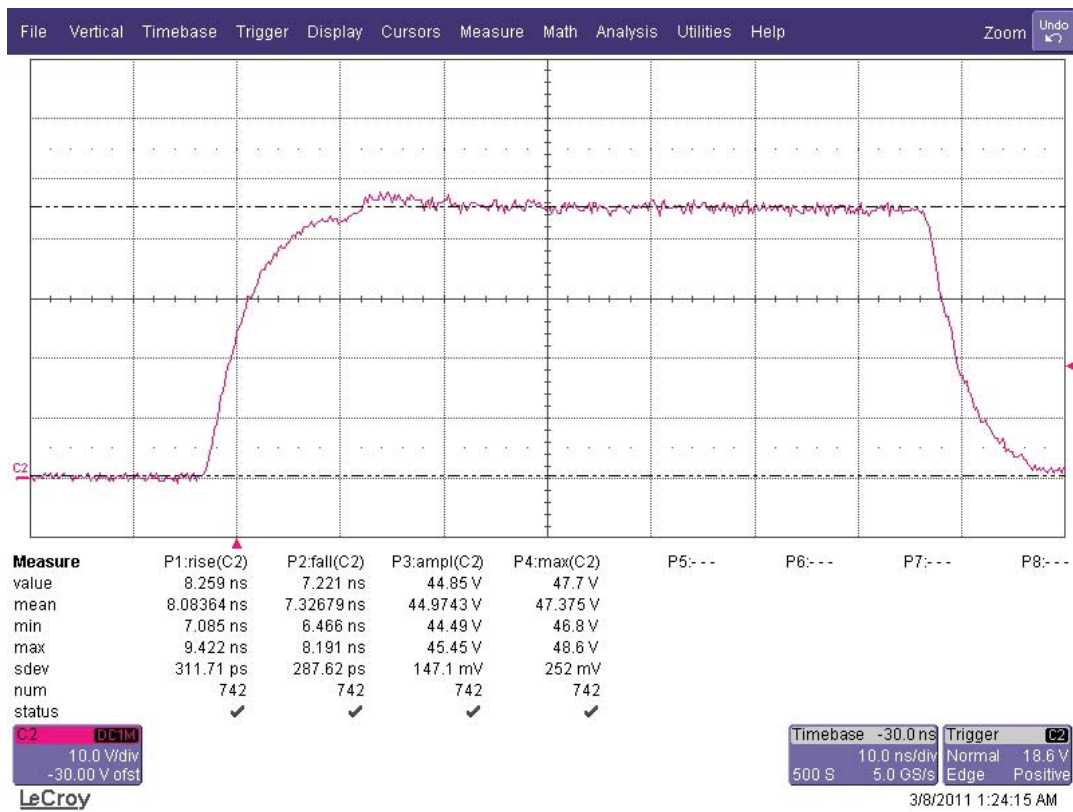


Figure 2 (High Z 45V)

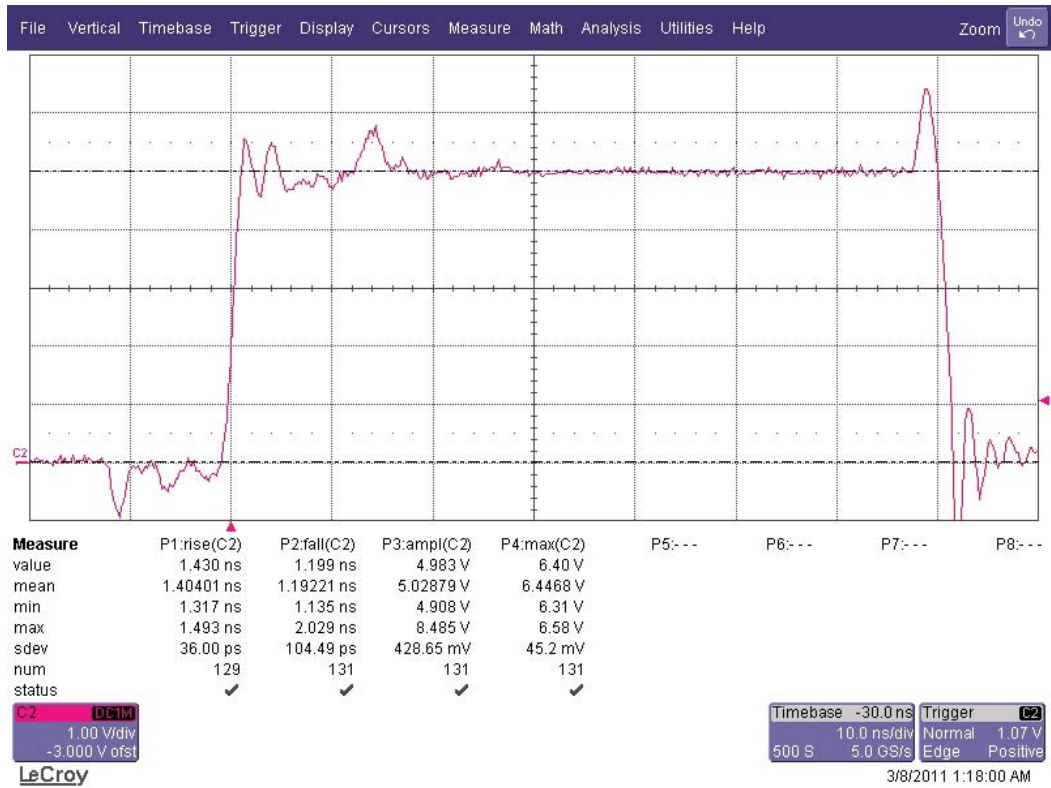


Figure 3 (Low Z 5V)

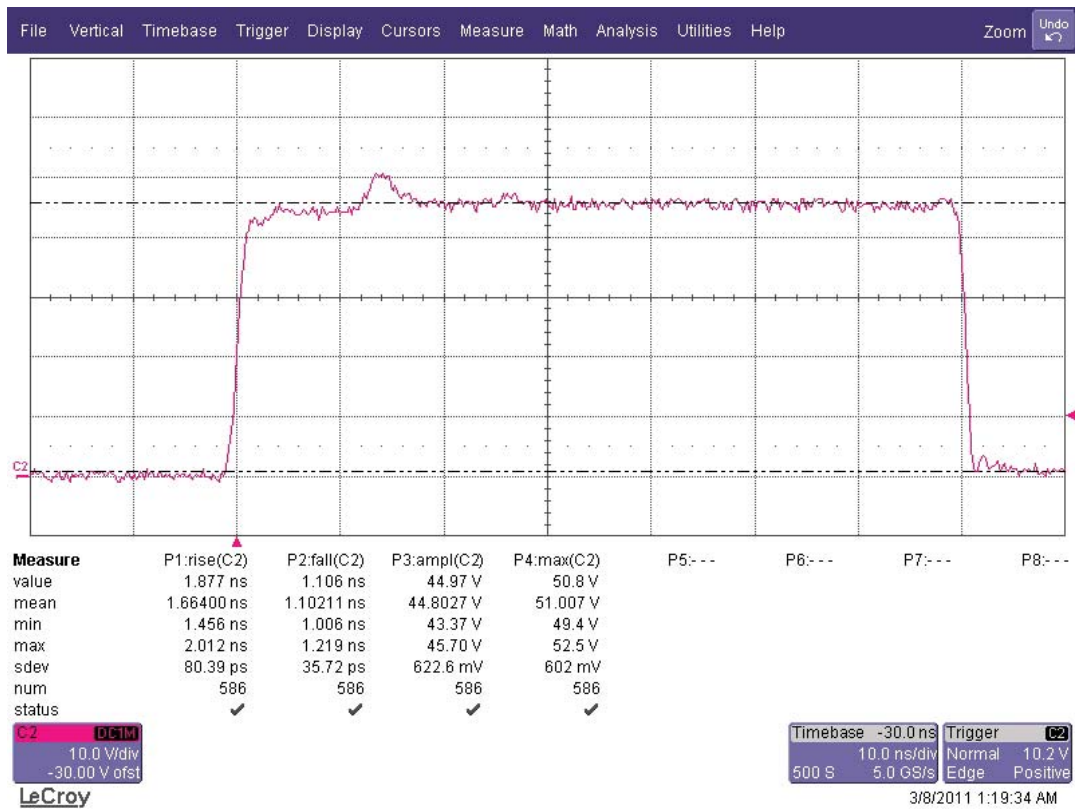


Figure 4 (Low Z 45V)

Rise time and overshoot are tuned for best response at low impedance (low Z)

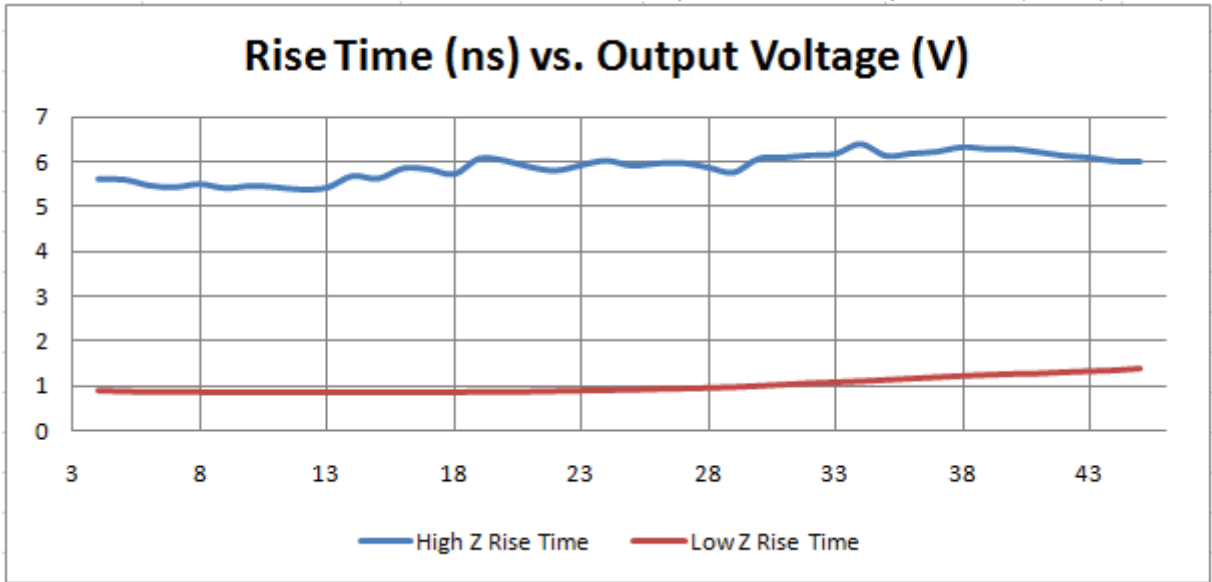


Figure 5 (Rise Time Versus Output Voltage)

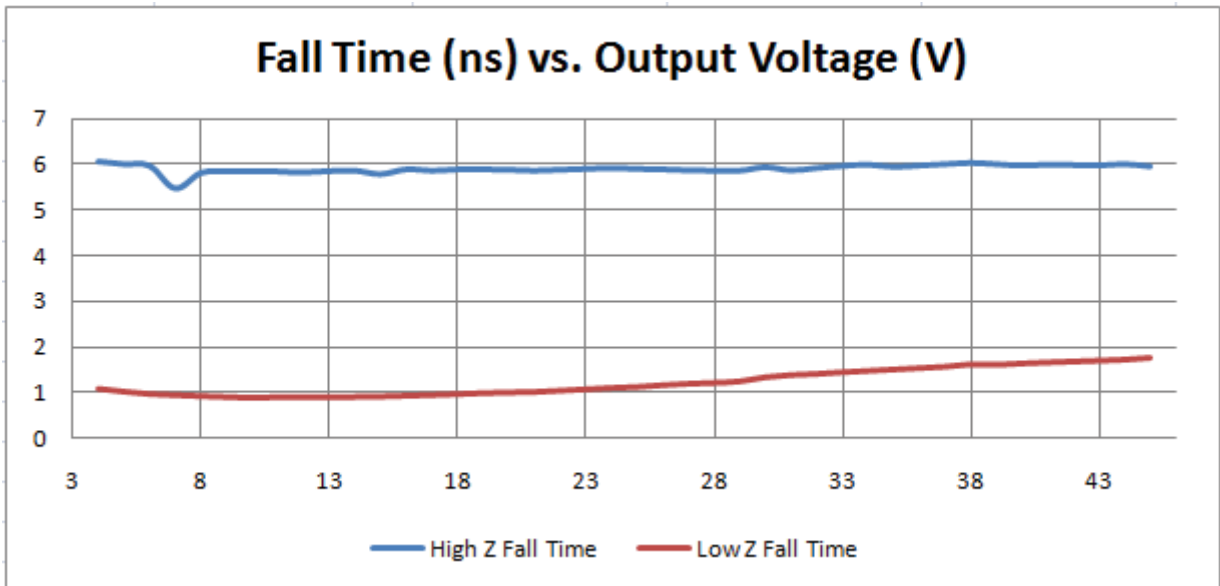


Figure 6 (Fall Time Versus Output Voltage)

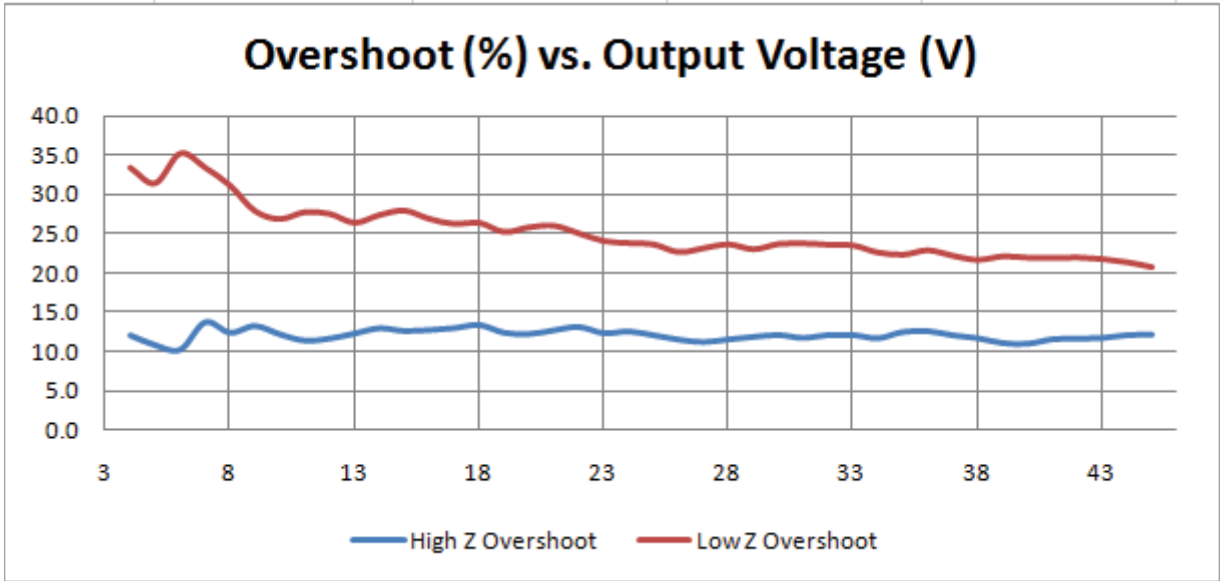


Figure 7 (Overshoot Versus Output Voltage)