

LECROY

ELECTRICAL TELECOM

PULSE MASK TESTING

SOFTWARE OPTION

OPERATOR'S MANUAL

FEBRUARY 2004



LeCroy Corporation

700 Chestnut Ridge Road
Chestnut Ridge, NY 10977-6499
Tel: (845) 578 6020, Fax: (845) 578 5985

Internet: www.lecroy.com

© 2004 by LeCroy Corporation. All rights reserved.

LeCroy, ActiveDSO, ProBus, SMART Trigger, JitterTrack, WavePro, WaveMaster, and Waverunner are registered trademarks of LeCroy Corporation. Information in this publication supersedes all earlier versions. Specifications subject to change without notice.

ET-PMT-OM-E Rev A

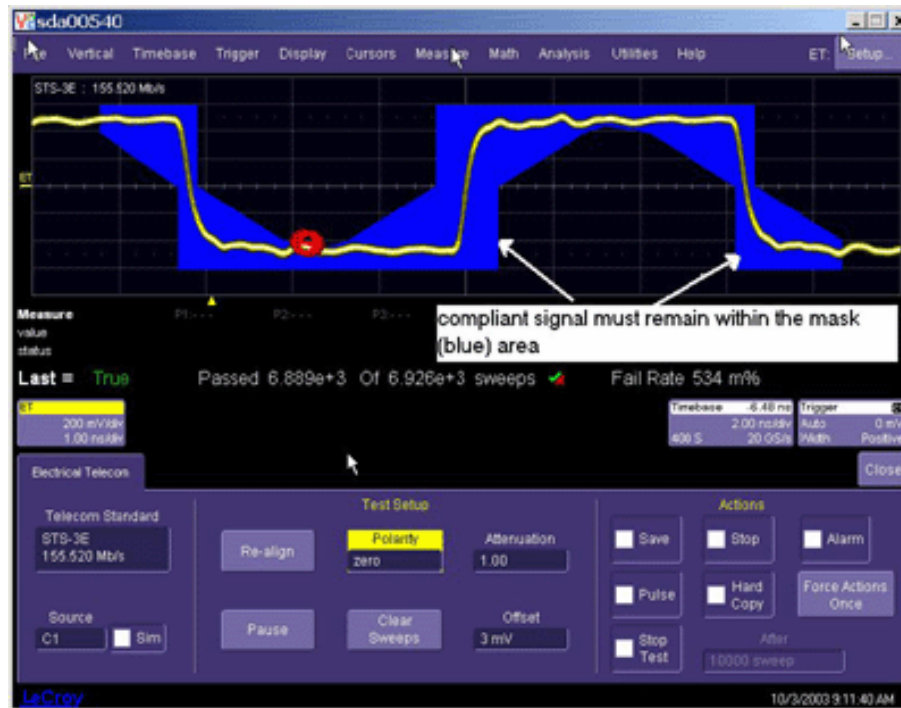
901915

INTRODUCTION.....	2
Compatibility.....	3
Probing.....	3
OPERATION.....	4
Selecting a Standard.....	4
Test Setup.....	5
Setup.....	5
Polarity.....	5
Attenuation.....	5
Offset.....	5
Clear Sweeps and Pause.....	5
Actions.....	6
Adding Measurements to a Mask Test.....	7
Setting up Parametric Measurements.....	7
Custom Pulse Mask Test Files.....	9
Absolute.....	11
Absolute + Offset.....	12
Relative.....	13
Relative Peak.....	14

ET-PMT Option

INTRODUCTION

ET-PMT is a software package that measures pulse mask compliance of electrical telecommunications signals. Pulse mask testing consists of acquiring the given signal in an oscilloscope and comparing the voltage vs. time waveform to a standard mask. The mask defines regions in V,t space where a compliant signal must remain. An example of a pulse mask is shown below.



In addition, there are often alignment criteria for each test. For example, a one level may consist of a positive-going or negative-going pulse (as in the DS1 standard). The test would then have a selection for which pulse to measure and the ET-PMT software will automatically find only those pulses.

The ET-PMT package supports the following ANSI and ITU standards.

ANSI T1	ITU-T
DS1	E1 (twisted pair)
DS3	E1 (coax)
STS-1	E2
STS-3E	E3
---	E4
---	STM-1E

In addition to these standards, It is also possible to define modified or custom pulse mask tests.

Compatibility

The functions of ET-PMT described here are compatible with the following oscilloscopes from LeCroy:

- WavePro 7100, 7200, and 7300
- WaveMaster 8620, 8600A, 8500A, and 8300A
- WaveRunner 6035 (except E4, STS-3E, STM-1E), 6050, 6100, 6200
- SDA 6020, 6000A, 5000A, and 3000A (included as standard on all SDA models)

Note: ET-PMT is standard on all SDA model serial data analyzers. The Serial Data Mask package (SDM) also includes the functions of ET-PMT.

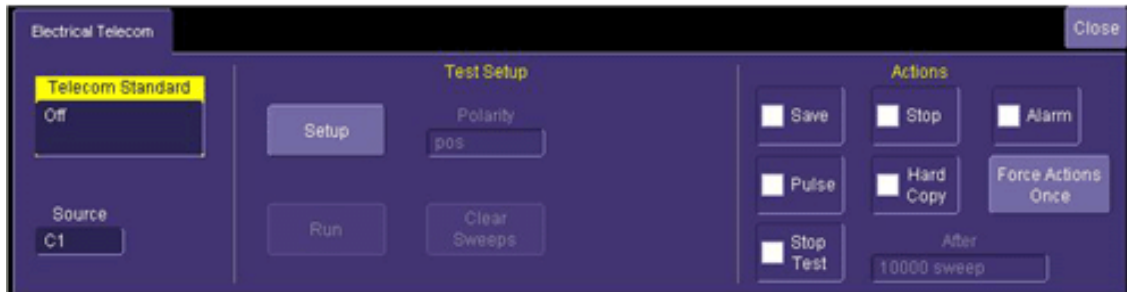
Probing

Telecommunications signals require specific load impedance for compliance testing to be accurate. The twisted pair standards require 100 ohm (DS-1) and 120 ohm (E-1) terminations, and the other standards require 75 ohm terminations. A set of adapters (test fixture) for this purpose is available from LeCroy (part number TF-ET). These adapters require the use of an LPA-BNC ProLink adapter if they are being used with a WaveMaster or SDA.

OPERATION

Selecting a Standard

1. To invoke Pulse Mask Testing, touch **Analysis** in the menu bar, then **Electrical Telecom** in the drop-down menu. The Electrical Telecom dialog will appear at the bottom of the oscilloscope display:



2. Touch inside the **Telecom Standard** field to select the desired standard. Selecting a standard from this menu sets the bit rate, mask, and pulse isolation criteria for the measurement.
3. Touch inside the **Source** control to select the channel to which the signal is connected. Specific terminations are required for each standard according to the table below. The Electrical Telecom adapters listed in the table are available from LeCroy in the TF-ET test fixture kit.

Telecom Standard	Required Termination	LeCroy Adapter
E1 TP	120 ohm	AP120
E1 coax	75 ohm	PP090
E2	75 ohm	PP090
E3	75 ohm	PP090
E4	75 ohm	PP090
STM-1E	75 ohm	PP090
DS-1	100 ohm	AP100
DS-3	75 ohm	PP090
STS -1	75 ohm	PP090
STS-3E	75 ohm	PP090

Test Setup

Setup

The **Setup** button applies the appropriate settings to the oscilloscope for testing the selected standard. Different standards require a particular termination, and an error message will appear at the bottom of the oscilloscope screen if the wrong (or no) adapter is present. However, this error will not prevent the instrument from making the measurement; that is, measurements can be made without the specific adapters. But if the signal is out of range for the standard, the setup operation will generate an error message and the **Run** button will be grayed out. The signal will appear on the screen, but no testing will be possible.

Before the **Setup** button is pressed, the **Run** and **Clear Sweeps** buttons appear grayed out. These buttons become available (not grayed out) upon successful completion of a setup. At that time, a **Re-Align** button will replace the **Setup** button.

Polarity

In many electrical standards, such as DS-1, alternate “ones” are inverted. Each time a one is transmitted it is either a positive or negative going pulse depending upon the polarity of the previous one. This type of coding is referred to as AMI (alternate mark inversion). The **Polarity** control allows you to select which polarity (positive or negative) pulse to test.

The STS-3E and STM-1E standards use CMI (code mark inversion) pulse coding. In CMI coding, a one remains high for the full bit period while a zero has a transition to the low state in the middle of the bit period. The Polarity control allows you to select whether a 1 or 0 is to be tested.

Attenuation

The **Attenuation** control allows you to enter an attenuation value to be applied to the test signal. This control allows for amplitude correction for cable or other systematic losses. The attenuation value can be set from 0.5 to 1 in steps of 0.01, with 1 meaning “no external attenuation” and 0.5 corresponding to an amplitude reduction of 50%. If a cable with 3 dB of loss were being used to couple the signal under test to the instrument, for example, the attenuation value should be set to 0.708.

Offset

The offset control allows for the correction of DC offsets in the signal under test. This control can be varied from -50 mV to 50 mV.

Clear Sweeps and Pause

The **Clear Sweeps** button allows you to reset the sweep count and start testing over again. The **Pause** button, which suspends testing without resetting the sweep count, becomes a **Run** button once it is pressed. Pressing the **Run** button, in this case will start the test from where it was last suspended.

ET-PMT Option

Actions

The Actions section contains a set of check boxes that determine what actions are taken when a test fails. Actions are selected by checking the appropriate box; multiple actions are possible for each failure. The available actions are:

Save -- Stores the failed waveform in a file. When this option is selected, the **Save Waveform** tab appears in the main dialog. Touch this tab to set the file name and storage location.

Stop -- Stops testing on the first failure.

Alarm -- Generates an audible alarm on each failure.

Pulse -- Generates a pulse at the auxiliary output BNC connector on the front panel of the instrument. When this option is selected, the **Aux Output** tab appears. Touch this tab to set the type of pulse.

Hardcopy -- Prints a hard copy image of the failed mask test. Hard copies can be sent to any valid printer (either networked or directly connected to the instrument). It is also possible to print to file or email the image. When this option is selected, the **Hardcopy** tab appears. Touch this tab to set the format and devices.

Stop Test -- Gives you the ability to stop the test after a predetermined number of sweeps have been completed. When this option is selected, the **After** field alongside the checkbox becomes active. Touch inside the **After** field to set the number of sweeps, by means of the pop-up keypad.

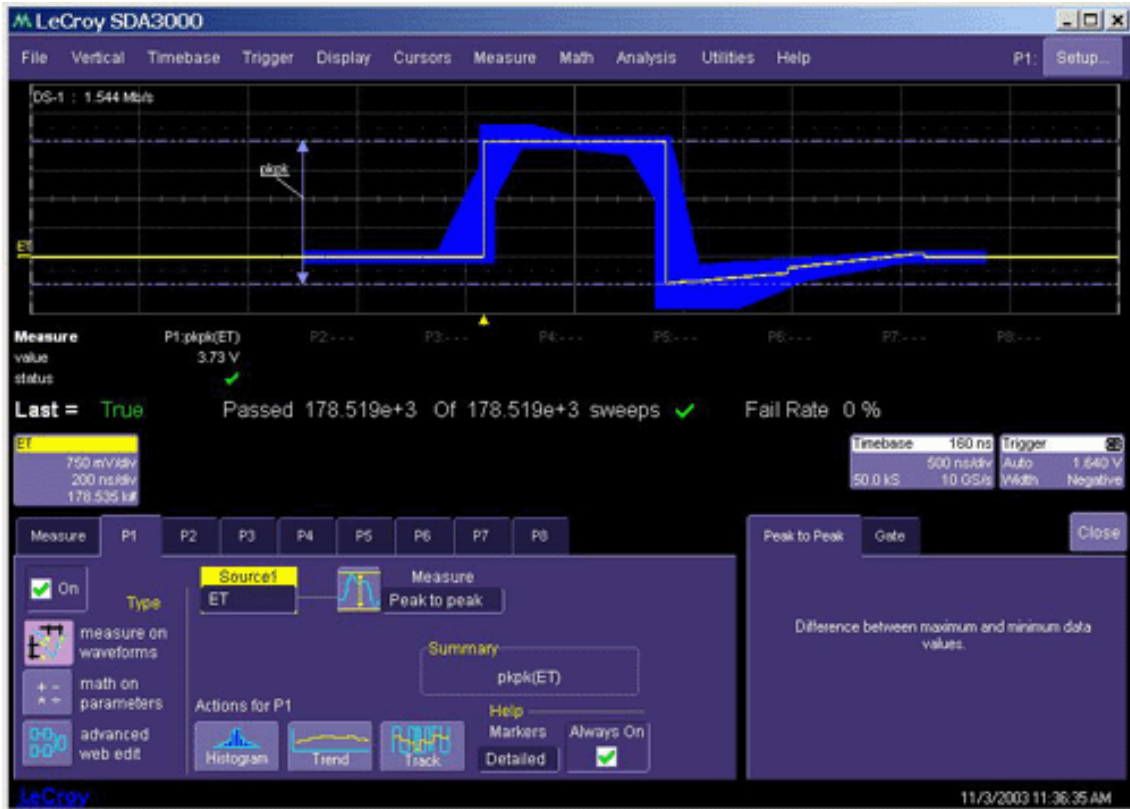
The **Force Actions Once** button immediately executes all of the selected actions when it is pressed.

Adding Measurements to a Mask Test

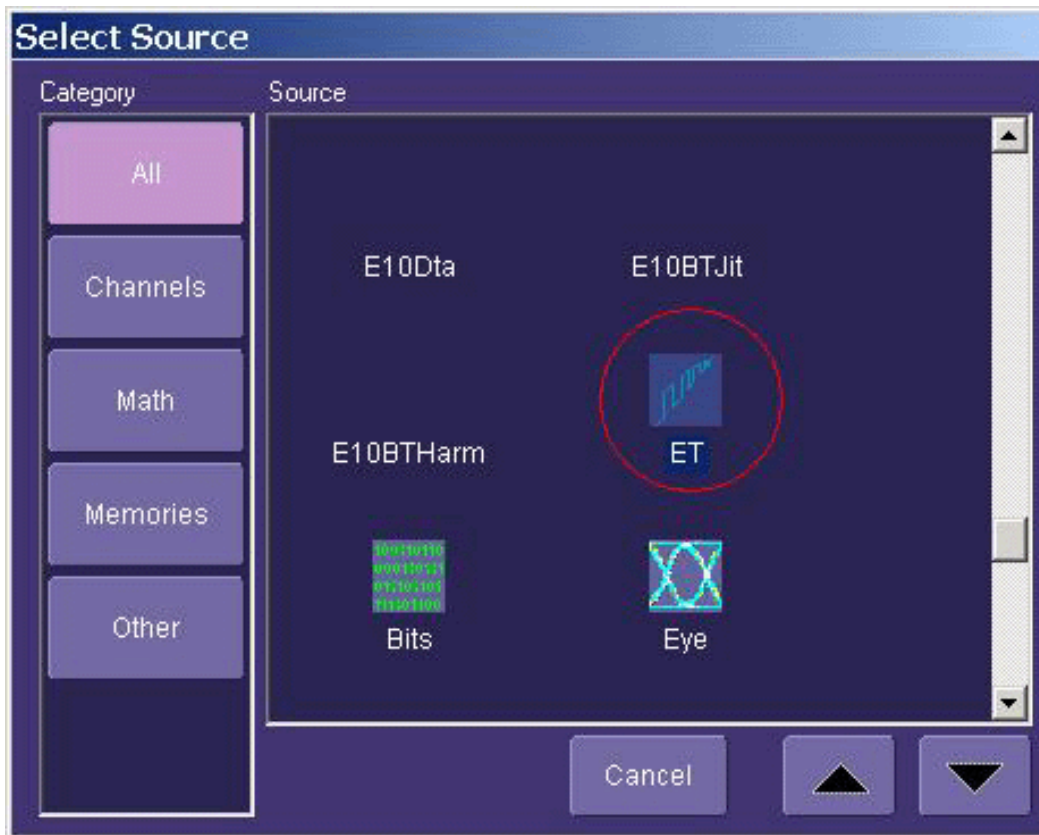
In addition to measuring pulse compliance relative to a given mask, parametric measurements are also available. A full set of measurements including amplitude, overshoot and rise time are available from the oscilloscope's **Measure** menu. Measurements are made on the displayed waveform as it appears on the mask test screen.

Setting up Parametric Measurements

1. In the menu bar, touch **Measure**; then **Measure Setup** in the drop-down menu. The menu shown below is displayed.



2. Touch inside the **Source1** field and select “ET” as the source.

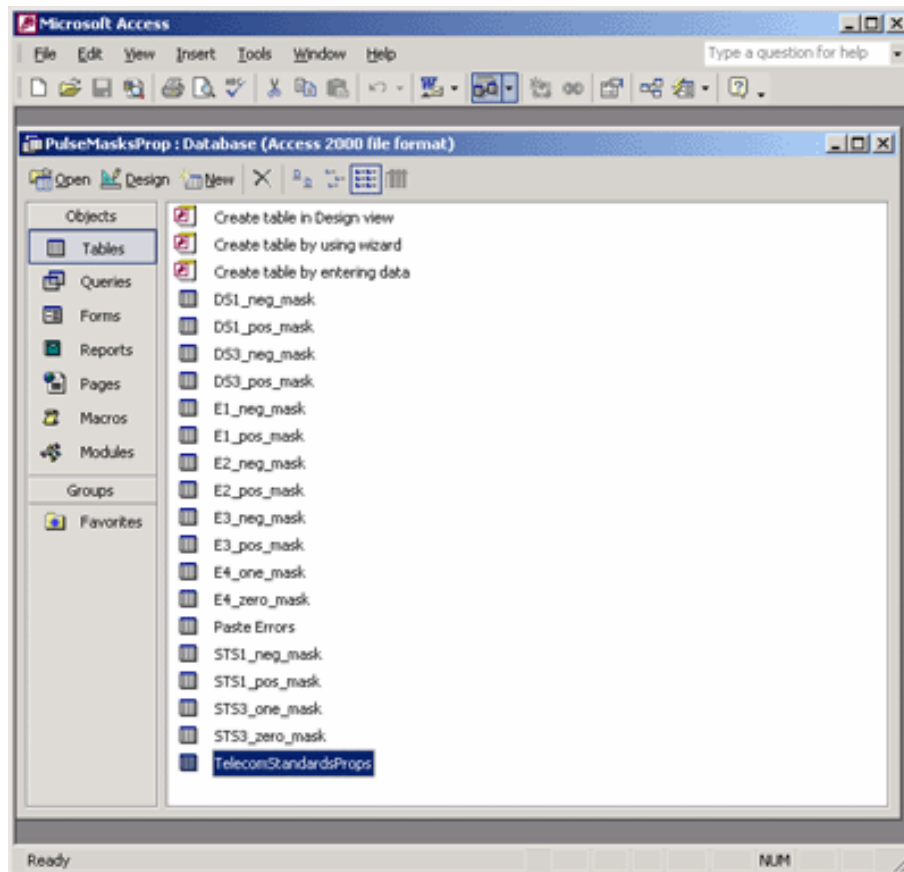


3. Touch inside the **Measure** field and select the desired measurement from the pop-up menu.
4. Touch the **Always On** checkbox in the "Help Markers" section of the dialog to display cursors on the waveform, showing exactly where the measurements are being made.

Custom Pulse Mask Test Files

The pulse mask test file included with the ET-PMT software includes the standards listed in the table. In addition to these standard pulse masks, custom masks can also be created. Custom masks include a mask, along with pulse alignment criteria and acquisition settings such as waveform averaging and persistence. You must use Microsoft Access 2000 to edit the mask definition file.

The mask properties are defined by the file "PulseMasksProp.mdb" in the "D:\Masks" directory. This Microsoft Access 2000 file is shown here:



This file contains mask tables that give the coordinates of each mask, and a table named "TelecomStandardsProps" that contains all of the information defining the test and how each mask is to be used.

The fields in this table are defined as follows:

ET-PMT Option

ID -- An index that is automatically generated. Do not enter a value in this field.

Old -- For internal use only; leave blank.

Standard -- The name of the standard to which the selected mask is associated

Legacy Standard -- Optional; not used for user defined standards

Symbol -- Defined mode within standard (pos, neg, one, zero, transmit, receive)

Bit rate -- Bit rate of signal; defines period.

Required Bandwidth -- Minimum bandwidth needed to accurately test signal.

Minimum Sample Rate -- Minimum sample rate needed to accurately test signal.

Probe -- Required probe or adapter; left blank if none.

Type -- Defines the type of signal and how it will be aligned and tested. The choices are:

- Absolute
- Absolute + Offset
- Relative
- Relative Peak

Coding -- Type of coding (CMI code mark inversion, AMI alternate mark inversion, etc.); used for information only.

Pattern Isolation -- Bit pattern used to isolate the pulse under test. Syntax: bbbb/pp/aaa where bbbb is the symbol values **before** the desired **pattern** and aaa is the value of the bits **after** the desired pattern. For example, an isolated "one" would look like: 00/1/00. Bipolar pulses are defined as 1 and -1; and CMI is handled as two bits per unit interval. A CMI 0, for example, would look like: 1/01/0.

V div -- The vertical scale required for nominal amplitude in the mask. This voltage is adjusted for relative masks.

Nom Ampl -- The nominal amplitude of the pulse to be tested.

T div -- Horizontal scale to have signal in mask.

ET Delay -- The time in seconds between the center of the pulse (1/2 bit) and the edge where the trigger is set

ET Center -- The center of the mask in DIV (usually 5.0)

Base Point -- Optional (currently not used)

Offset Tol (for "Absolute + Offset" type only) -- The permitted tolerance to adjust the offset for a better mask fit

Gate Start -- The limit in DIV in the waveform data at which the mask test is started

Gate Stop -- The limit in DIV in the waveform data at which the mask test is stopped. This parameter and the one above it allow you to perform mask testing on specific pulses within a longer, more complex waveform.

Mask Data (optional) -- Hyperlink to the table that contains the mask data

Mask File Name (optional) -- Used if MaskData is not specified; file name of the custom mask (*.msk file). This file type is created by LeCroy's MaskMaker software.

The following images show graphically how the above parameters are used for the four different types of masks set in the Type field. They show how the various parameters are used to align and scale the waveforms to the mask.

Absolute

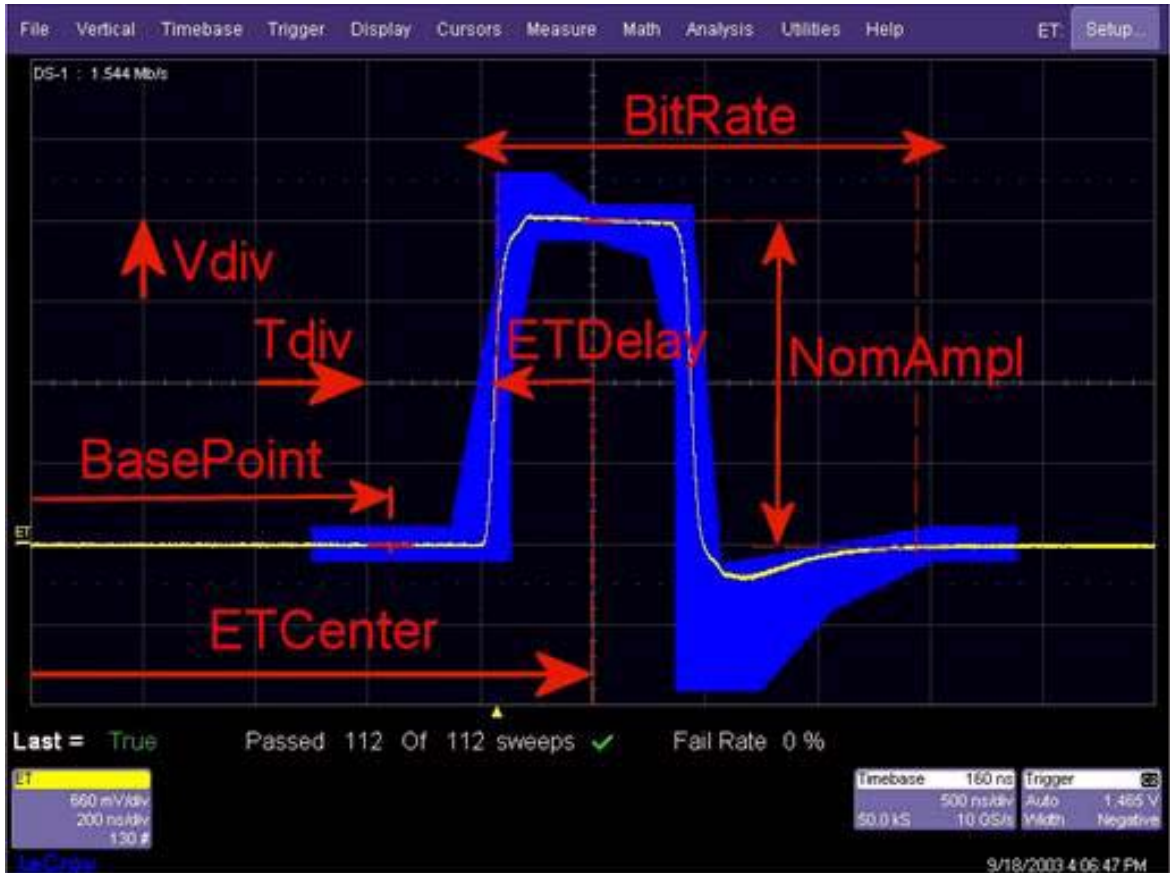


ET-PMT Option

Absolute + Offset

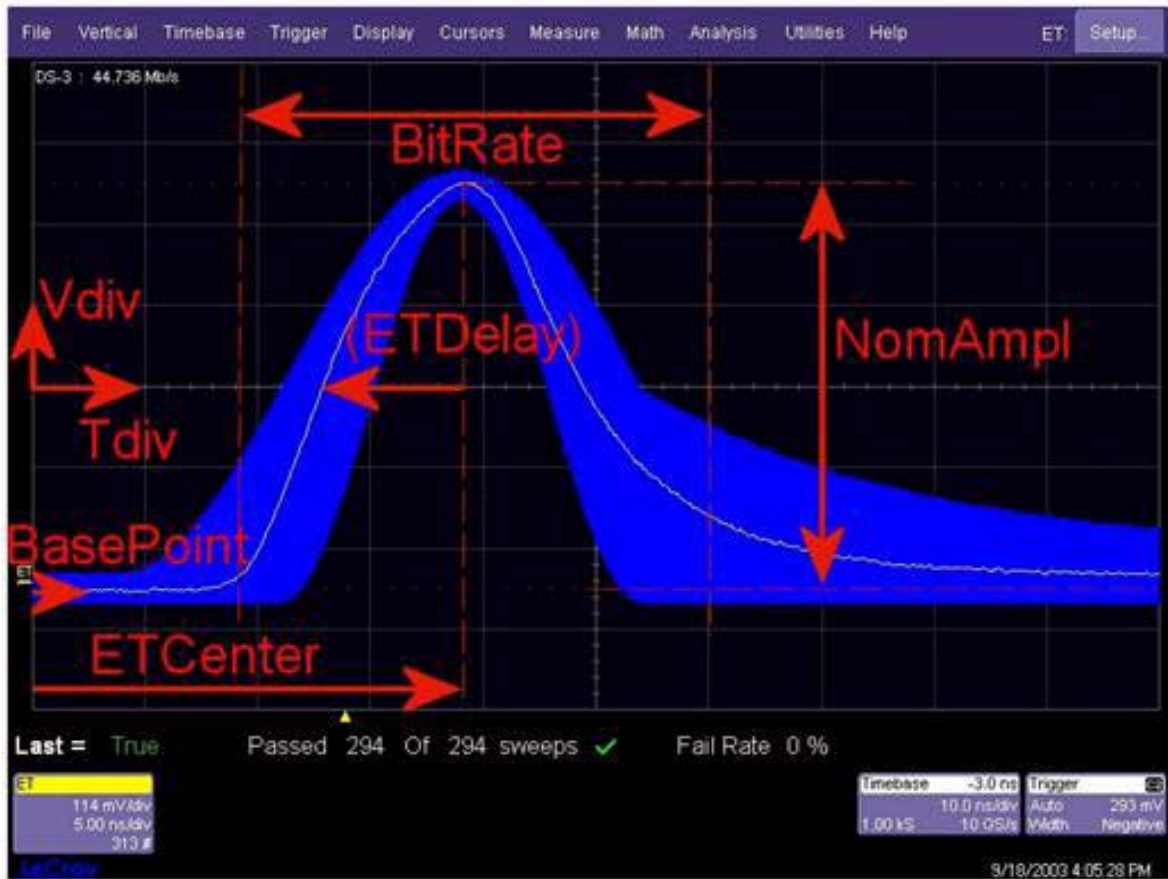


Relative



ET-PMT Option

Relative Peak



§ § §