Transient Data Acquisition System, TAS 4-40

Potential-free measurement of fast rise pulses:

High precision measurement of fast rising voltages and currents causes considerable problems in many spheres of technology, e.g. high-voltage test technique, power electronic, plasma technology and pulse physics. Electromagnetic interference during capturing and transmission of the measuring signal as well as the low resolution of digital scopes limit the accuracy of the signal waveform captured.

The Transient Data Acquisition System, TAS 4-40, eliminates these problems and allows capturing of pulse signals in µs-range up to mains frequency voltages and current in up to now not known quality

Features

- **Integrated attenuator up to 2 kV, without external divider/probe**
- **Potential-free input**
- **Sample rate up to 40 MHz**
- **Vertical resolution 12 Bit**
- **Rise time < 20 ns**
- **Optically isolated data transmission over several hundred meter**
- **Stand-alone impulse measuring system,**

The optically isolated Transient Data Acquisition System, TAS 4-40, consists of an analogue-to-digital converter with 12-bit resolution, an optical transmission channel and control and evaluation software, which runs on a standard personal computer

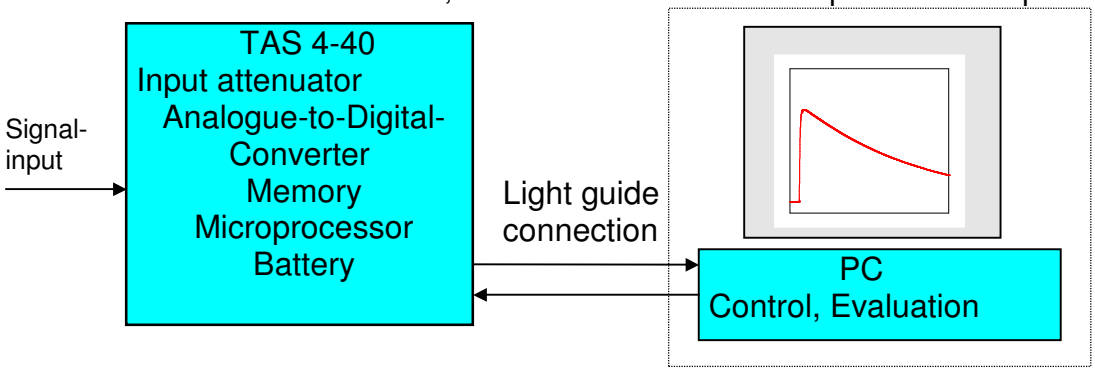


Fig 1: Optically isolated Transient Data Acquisition System, schematic

The main part of the TAS 4-40 is the analogue-to-digital converter, ADC, which converts the analogue signal to digital values with 12-bit resolution. The sample rate is 40 MHz max. The converted values are stored in a memory. Four memory banks with 4 k capacity are available.

An adjustable input attenuator is arranged in front of the DAC. The full-scale sensitivity can be set to 2V up to 2000 V in 1-2-5-sequence. In the field of pulse testing it is possible to measure any high voltage or current using an external high-voltage divider or current viewing resistor. In the field of power electronics most of the occurring amplitudes can be connected directly to the input. Using an external probe is possible too.

A microprocessor controls all functions of the Transient Data Acquisition System. A light-guide transmits control commands and captured data values. A battery provides for power supply.

There is no galvanic connection between the reference potential of the measured voltage and earth potential or protective earth potential. This is an isolated measuring system; the reference point of the input voltage can be connected to high potential. The maximum isolation voltage depends only on the dielectric properties, the length and the laying of the light guide. By this feature, all unwanted effects of cable shied currents are eliminated. This feature offers advantages for applications in the field of pulse testing as well as power electronics.

The software for control of the Transient Data Acquisition System is running on a standard personal computer. The TAS 4-40 is operated by mouse-click like a scope.

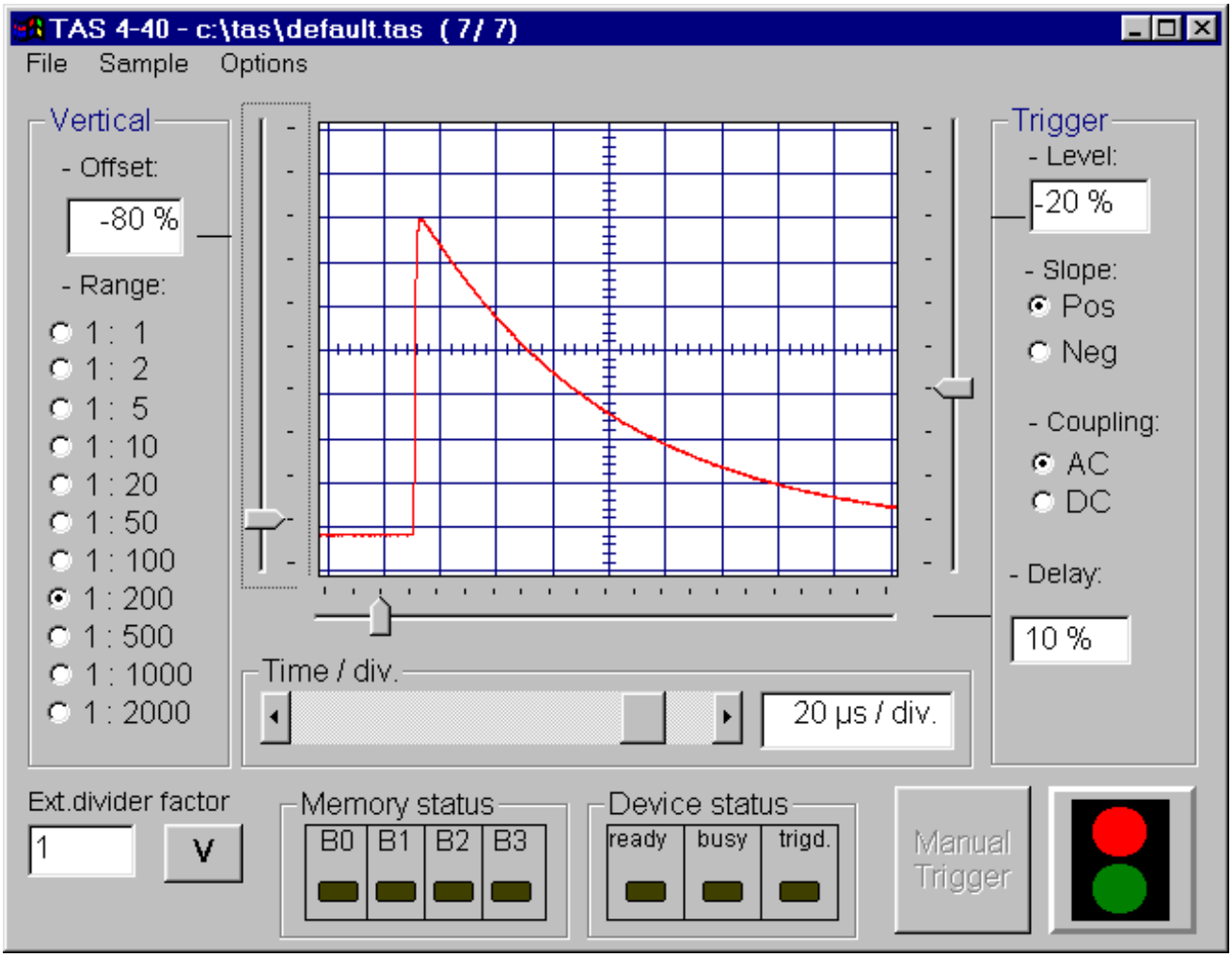
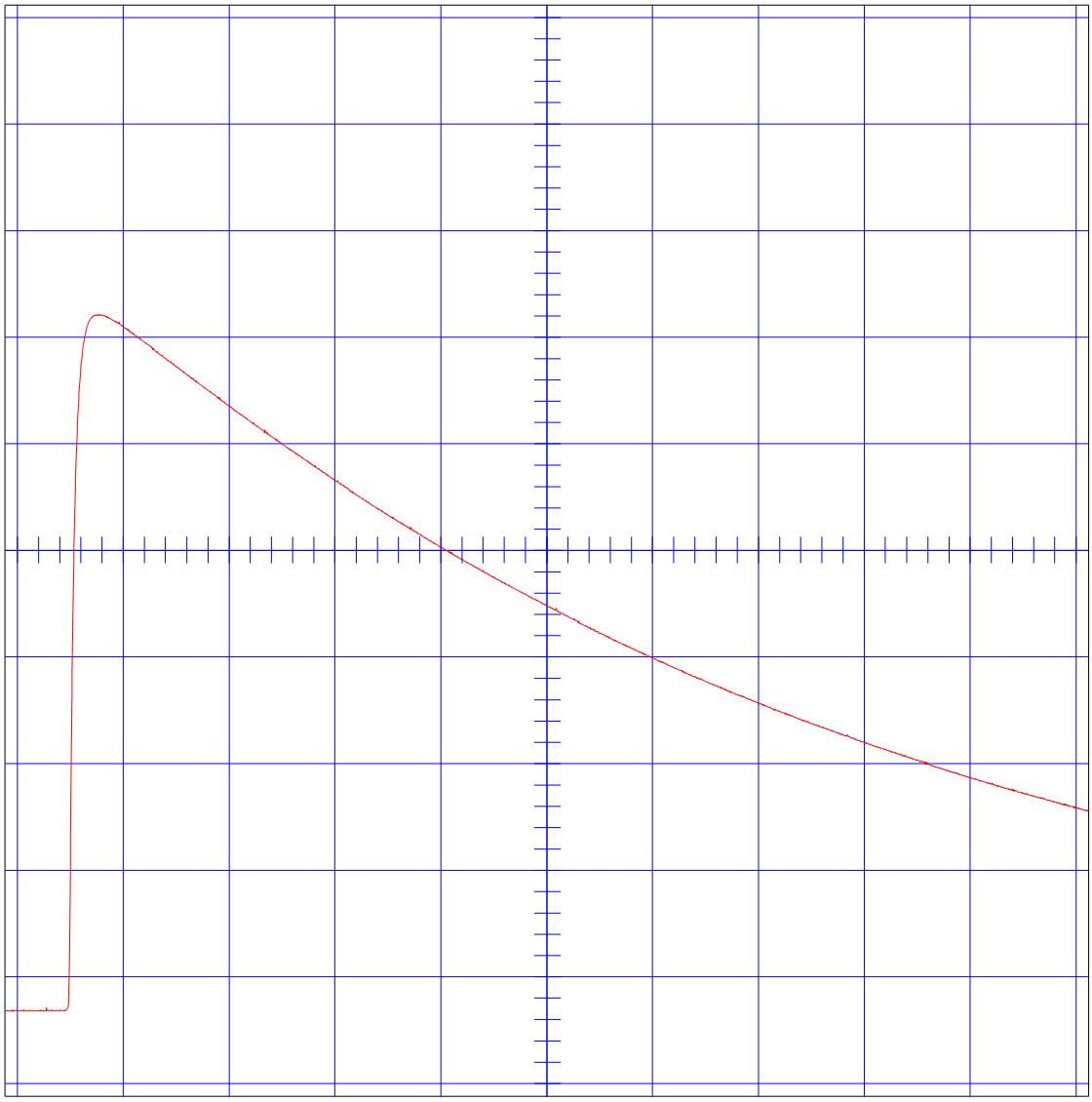


Fig 2: User interface of TAS 4-40.

The input divider can be adjusted on the left side the screen. The input sensitivity can be set to +/- 1 V up to +/- 1000 V. Up to 4 measurements can be stored in memory bank 0 to 3.

The horizontal scroll bar the Time/DIV setting can be selected by varying the sample rate. On the right side of the screen the settings for the trigger unit can be selected, such as slope, coupling and single shot. The sliders around the display screen allow setting of trigger level, trigger delay and vertical offset. Upon operating the key MANUAL TRIGGER, a signal acquisition can be initiated, if the input signal does not meet the trigger condition. This is necessary for zero input or dc input.

Clicking on the key START prepares the TAS 4-40 for data acquisition. Measured values are stored continuously to the active memory bank. The pre-trigger counter is started, if the input signal meets the trigger condition selected. Data acquisition is terminated after to pre-trigger counter reaches zero. The signal lamps READY indicates that the measured samples are ready for transmission. Clicking on Button READ will start the transmission of



measured values to the computer. The waveform is displayed on the screen.

Fig 3: Picture of a surge voltage, with waveform 1.2/50µs

Due to the high memory size of each bank, it is possible to zoom the time axis by factor 20 without significant loss of display quality. It is no problem to calculate the front- and tail-time of a 1.2/50 µs waveform from one single measurement. The vertical resolution of 12 bit causes high quality display of the captured waveform, which is not comparable with the measuring result from a 8-bit scope.

Fig. 4: picture of a surge voltage, waveform 1.2/50µs with a 8-bit Scope, type TDS 380

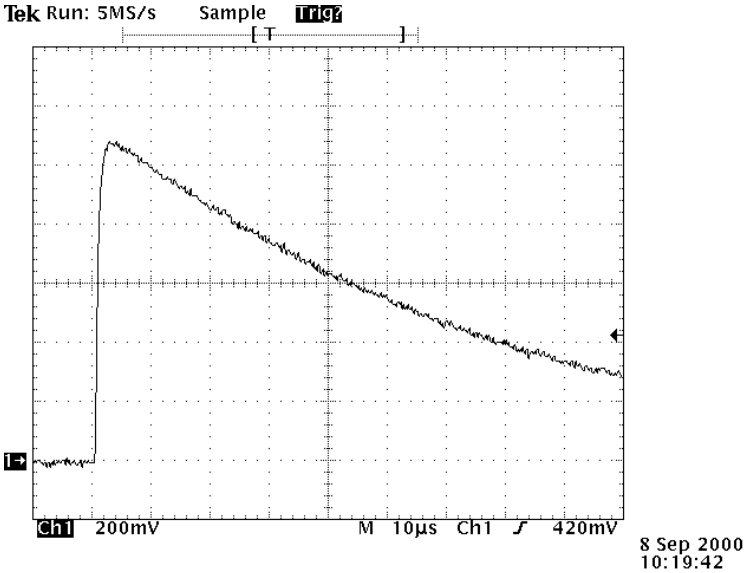


Fig 5 shows the distribution of the samples around the real value for the Transient Data Acquisition System, TAS 4-40, and the digital storage scope TDS 380. The greater accurateness of TAS 4-40 is obviously

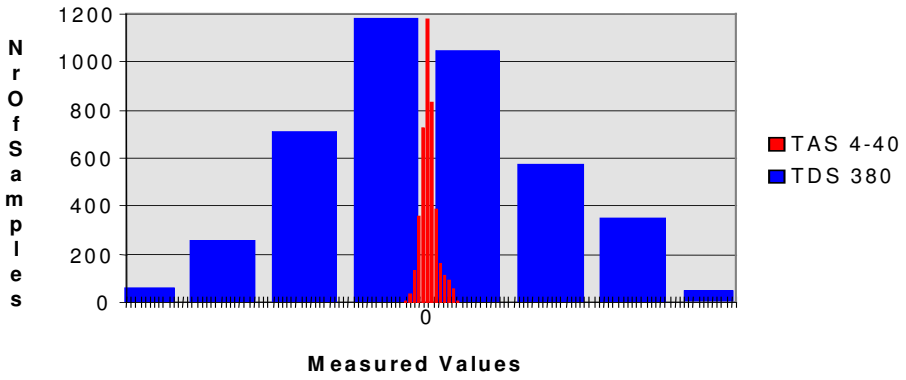


Fig. 5: Histogram over 4000 samples, measuring input short-circuited.

The software allows the display of the measured values on the screen. Storing the samples to a file or print out of the waveform is possible.

Moreover, evaluation of the captured waveform is available. Waveform parameters: peak value, front time and tail time, acc. to IEC 60, are calculated from the samples.

For oscillating pulses or pulses with overshot the software calculates a approximation trace, which is used for calculating the waveform parameters. The algorithms used for these calculations meet the accuracy requirements for the sample test pulses specified in IEC 1083.

IEC 1083	Parameter Ts / µs	Tolerance range Ts / µs	Parameter Tr / µs	Tolerance range Tr / µs
Case 3	1,67	1,60...1,70	46,79	45...49
Case 4	1,05	1,00...1,10	49,70	48...52
Case 8	1,68	1,60...1,70	46,68	45...49
Case 9	1,04	1,00...1,10	49,80	48...52
Case 11	1,10	1,07...1,19	84,50	82...91
Case 13	3,59	3,40...3,76	58,40	56...62
Case 14	1,99	1,85...2,05	44,40	43...47

Technical specification

Sample rate	40 MHz
Resolution	12 bit
Input voltage range	min.: -1 V to +1 V max.: 2000 V
Input impedance	1 MΩ || 35 pF
Noise margin at fs = 40 MHz	66 dB
Memory size, 4 banks	4 k Samples each
Accuracy	< 1 % for all attenuator settings
Analogue bandwidth	< 20 MHz
Rise time (10 % - 90 %)	< 20 ns
Vertical offset, adjustable	-100% to +100%
Trigger delay, adjustable	0% to 100%