TECHNICAL DATA

LeCroy
RESEARCH SYSTEMS SA

CAMAC Model 4201
High Precision, Wide Range, Fast Encoding TDC

FEATURES

- **Encoding time:** less than 1 μsec for most of the resolution ranges.
- **Time range:** up to 655 μsec.
- **Number of bits read:** up to 16 bits (out of the internal 24 bits), this number can be changed to any smaller number by CAMAC control.
- **High resolution:** 78.1 psec at a minimum, the resolution can be set to larger values by CAMAC control (16 ranges available).
- **One level of data buffer:** to derandomize input rate.
- **Symmetrical to start-stop timing:** provides positive or negative times.
- **CAMAC settable offset.**
- **Four different internal tests for calibration.**
- **Externally applicable time window of interest.**
- **Adjustable threshold discriminator on the start and stop inputs.**
- **CAMAC and LeCroy 3500 compatible.**
- **Permits customer extensions to function with histogramming memory and/or time range expansion.**
- **CAMAC settable time overflow.**

The LeCroy Model 4201 Fast Encoding, Time-to-Digital Converter is intended to cover a large class of time measurement phenomena. Housed in a single-width CAMAC module, it can be read either via CAMAC, or by a faster data acquisition system such as the LeCroy 3500.

The Model 4201 has great flexibility, permitting the customer to extend its uses to a variety of special applications requiring an interface with a histogramming memory buffer and/or where time range expansion is required.

The unique features and high quality of this TDC make it an extremely useful tool in a wide range of applications.

APPLICATIONS

- **Crystallography**
- **Mass Spectroscopy**
- **Time of flight experiments**
- **Decay phenomena in nuclear, atomic, and molecular measurements**
- **Response time measurements in bio-medical research**
- **Chromatography**
- **Astronomy**
- **Laser ranging**

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INNOVATORS IN INSTRUMENTATION

TECHNICAL SPECIFICATIONS
CAMAC Model 4201
HIGH PRECISION, WIDE RANGE, FAST ENCODING TDC

INPUT CHARACTERISTICS

Start/Stop: Two paralleled Lemo-type connectors per each function, for cascading start/stop pulses; high input impedance (>50 kΩ), unused inputs must be terminated; independent threshold on start and stop inputs adjustable by front panel potentiometers in the range of −1.5 V to +1.5 V; threshold precision ± 20 mV, two front panel test points allow a 10× threshold monitor, minimum input pulse width of 1 nsec.

A switch option permits differential drive of the start and/or stop inputs; in which case each of the input connectors receives one pulse of the differential pair as indicated on the front panel; input impedance is 50 Ω ac each input to ground; 100 Ω dc between the two inputs; common mode swing is ± 2.5 V; fixed threshold is ±10 mV; suitable for complementary ECL pulses.

A second switch option selects either the leading or trailing edge of the input pulses as start/stop.

Gate Start, Gate Stop, Clear: Two paralleled Lemo-type connectors for each; high input impedance; accept positive or negative pulses, in particular, NIM or TTL; threshold is −0.4 V for negative, +1.4 V for positive pulses.

Gate Start: Applies a time window to the start pulse; a switch option permits this input to be used as a veto; minimum pulse width is 10 nsec.

Gate Stop: Applies a time window to the stop pulse; a switch option permits this input to be used as a veto; minimum pulse width is 10 nsec.

Clear: A 10 nsec minimum width pulse, applicable at any time, clears the last event only (either the event in process or last processed); clear time is less than 1 μsec for 78.1 ps resolution, and less than 500 nsec for all other ranges.

Operation Modes: In addition to use as a normal start-stop TDC, a suitable connection to the front panel allows measurement of time intervals when the start and stop pulses are travelling on the same cable, as well as when the time interval is defined by a pulse width, or by the rise- or fall-time of a signal.

Multiple Start Capacity: Many modules may be externally interconnected so that they respond in common to a stop pulse, but individually to different start pulses traveling on the same cable, thus providing separate readouts for each start.

Acquisition Rate Speed Up: Use of several modules suitably interconnected by external cables allows the basic acquisition rate (greater than 1 MHz) to be multiplied by a factor which is proportional to the number of modules.

Data Acquisition: CAMAC and LeCroy System 3500 compatible.

Range Option: Position of internal switches permits choice of either only positive or only negative time intervals.

CAMAC COMMANDS AND FUNCTIONS

C: Clear last event.

Z: Initialize module.

I: Inhibit module.

LAM: A Look-at-me is generated as soon as the module has valid data to be read.

Q: A Q response is generated if the requested function can be executed.

F(0)·A(0-3): Read data, 16 bits.

F(2)·A(0-3): Read data at S1, reset register and LAM at S2.

F(2)·A(8): Same as F(2)·A(0-3) plus start test "0"* at S2; a following read function will read the result of the test.

F(2)·A(9): Same as above, but for test "1"*.

F(2)·A(10): Same as above, but for test "2"*.

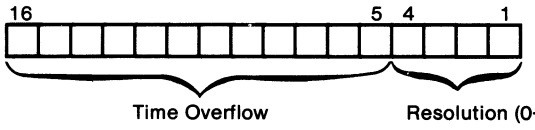
F(2)·A(11): Same as above, but for test "3"*.

F(8)·A(0-3): Test LAM, generate Q response if LAM is ON.

F(10)·A(0-3): Clear LAM and data register.

F(16)·A(0-3): Write offset register, 16 bits.

F(18)·A(0-3): Write command word with the following format:



F(24)·A(0-3): Disable module.

F(26)·A(0-3): Enable module.

OUTPUT CHARACTERISTICS

Busy: Two paralleled LEMO type connectors provide switchable option for either 32 mA, (2× NIM) outputs, or 20 mA (2× TTL) outputs; the BUSY output changes state as soon as either a start or a stop input arrives, and it stays on until the conversion is done. Delay between input and busy signals is less than 8 nsec. A BUSY LED is provided on the front panel.

Data Ready: Two paralleled LEMO type connectors provide switchable option for either 32 mA (2× NIM) outputs or 20 mA (2× TTL) outputs. The DATA READY output changes state as soon as data is ready to be read. A DATA READY LED monitor is provided on the front panel.

GENERAL

Time Range: ±655 μsec maximum. Defined by 24-bit coding; any subset may be read out by appropriate CAMAC command to redefine the maximum time range. Circuit symmetry relative to start and stop times permits negative time measurements.

Time Resolution: 78.1 psec minimum. 16 resolution values ranging from 78.1 psec (1 LSB) to 2560 nsec are CAMAC selectable.

Precision: ±2 LSB worst case for 68.5 and 156.2 psec resolution. ±1 LSB (10^{-8}) for any other resolution.

Average Conversion Time: Dependent upon resolution selected. Ranges from 0.5 μsec to 1 μsec.

Offset Register: A 16-bit CAMAC loaded offset value may be added to any measured time.

Time Overflow Setting: Time overflow value, CAMAC controlled over a range of 80 nsec to 655 μsec, in steps of 160 nsec., produces an automatic clear if no valid data has occurred within the overflow period.

Buffer Memory: One level of memory permits a second event to be acquired before the first event has been read out.

LAM Generation: A Data Ready condition causes generation of a LAM signal.

Packaging: One single-width CAMAC module without customer board; double width is required for customer board.

Power Consumption: +6 V at 1.1 A; −6 V at 2.5 A, +24 V at 30 mA, −24 V at 60 mA.