

# **Technical Information Manual**

Revision n. 0  
25 January 1996

**MOD. C529**  
*6 CHANNEL  
LED DRIVER*

CAEN will repair or replace any product within the guarantee period if the Guarantor declares that the product is defective due to workmanship or materials and has not been caused by mishandling, negligence on behalf of the User, accident or any abnormal conditions or operations.

**CAEN declines all responsibility for damages or injuries caused by an improper use of the Modules due to negligence on behalf of the User. It is strongly recommended to read thoroughly the CAEN User's Manual before any kind of operation.**



*CAEN reserves the right to change partially or entirely the contents of this Manual at any time and without giving any notice.*

### **Disposal of the Product**

*The product must never be dumped in the Municipal Waste. Please check your local regulations for disposal of electronics products.*



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# **1. DESCRIPTION**

## **1.1. FUNCTIONAL DESCRIPTION**

The CAEN Model C 529 6-CHANNEL LED DRIVER is a 2-unit wide CAMAC module designed to be used in a CAMAC controlled photomultipliers test chain, in order to drive the photomultipliers' exciting LEDs.

The unit is provided with 6 independent channels; each channel is capable of generating negative output pulses with programmable amplitude and width.

The output pulse amplitude of each channel can be individually set (via CAMAC) in the range from 0 V to 20 V (performances are not specified below 2 V).

The output pulse width of each channel is determined by the logical OR of two signals:

- an individual external Input, std. NIM, signal;
- an internal One-Shot common signal of preprogrammed width, selectable in the range from 5 ns to 430 ns.

In this way the output pulse width can be set either separately for each channel, with output width equal to the input one, or in common mode, with output width equal to the preprogrammed value for all channels.

A "BIAS" trimmer with a corresponding test point located on the module's front panel allows the user to set a common output offset value in the range from 0 V to -2.150 V.

The circuit is carefully designed in order to achieve low supply voltage sensitivity, low inter-channel crosstalk and low temperature dependence.

Although the pulse width is not linearly related to the digital code, this can be easily compensated by a user-written software. The final result is a very low jitter, good accuracy and relative programming resolution nearly constant through the full range.

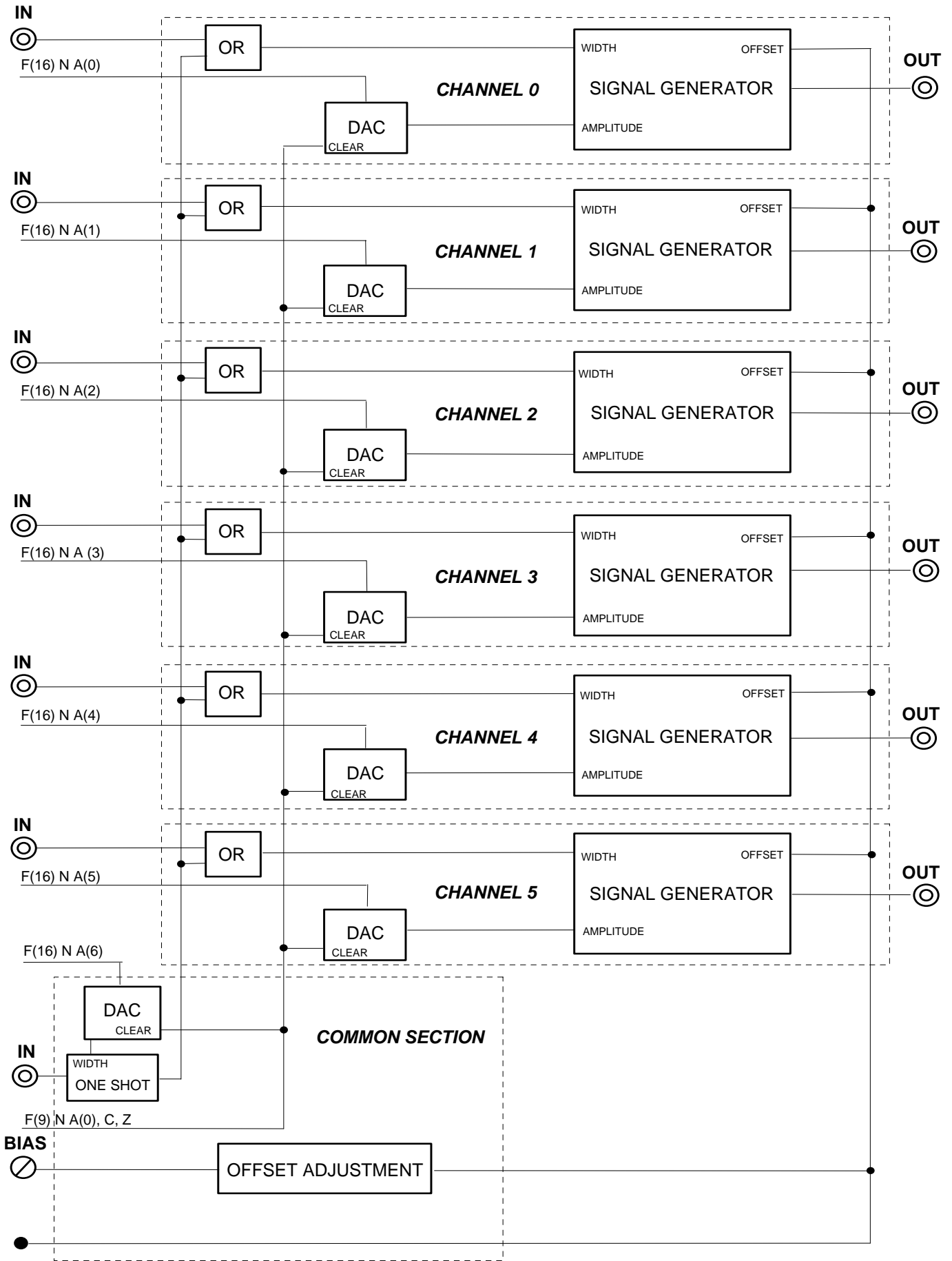


Fig. 1.1: Mod. C529 block diagram

## **2 SPECIFICATIONS**

### **2.1. PACKAGING**

2-unit wide CAMAC module.

### **2.2. EXTERNAL COMPONENTS**

#### **CONNECTORS**

- No. 6, "IN" (one per channel), LEMO 00 type connectors, 50 $\Omega$  impedance; input connectors for the input signals determining the output-pulse-width value for each channel.
- No. 1, "COMMON IN", LEMO 00 type connector, 50 $\Omega$  impedance; input connector for the input signal determining the common output pulse width for the six channels.
- No. 6, "OUT" (one per channel), LEMO 00 type connectors; output signal connectors of each channel.

#### **TRIMMERS**

- No. 1, "BIAS", for adjusting the offset value of the common output (0 V to -2.150 V, with output in high impedance).

#### **TEST POINTS**

- No. 1, "BIAS", for output offset monitoring.

### **2.3. POWER REQUIREMENTS**

Values determined with module operating in programmable mode (via CAMAC), maximum output signal amplitude, maximum output signal width and outputs loaded with 50  $\Omega$ . Non impulsive values.

|        |        |        |       |
|--------|--------|--------|-------|
| + 24 V | - 24 V | + 6 V  | - 6 V |
| 0.25 A | 0.35 A | 0.25 A | 0.6 A |

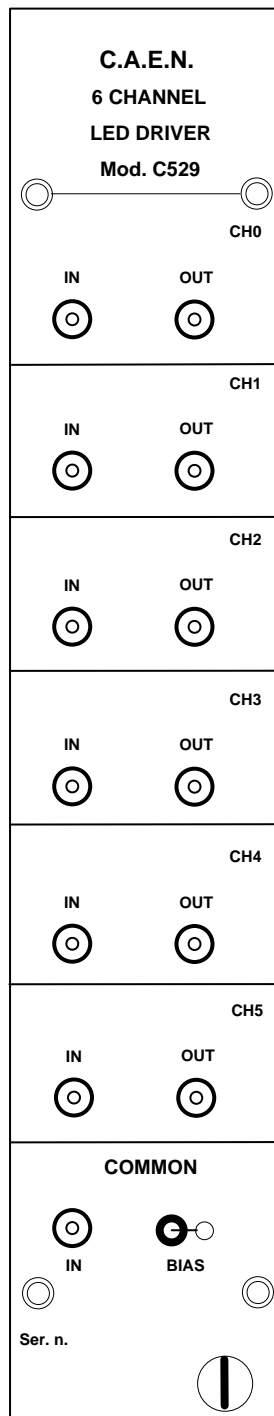
## 2.4. CHARACTERISTICS OF THE SIGNALS

### INPUTS

- CHANNEL INPUTS:
  - std. NIM level, 50  $\Omega$  impedance;
  - min. pulse width: 7 ns (at 10 V Out);
  - In/Out delay time: 20 ns max (between leading edges).
  
- COMMON INPUT:
  - std. NIM level, 50  $\Omega$  impedance;
  - min. pulse width: 2.5 ns (at 10 V Out);
  - In/Out delay time: 25 ns max (between leading edges).

### OUTPUTS

- CHANNEL OUTPUTS:  
(loaded with 50  $\Omega$ )
  - coupling: AC
  - amplitude: linearly programmable from 0 to 20 V (negative) through 8-bit digital code (performance not specified below 2 V); Resolution: better than 3% of the set value at max. width. Measurements performed with max. width setting on all channels and medium amplitude settings on channels not in measure.
  - temperature coefficient: 400 ppM/°C max.
  - rise time: 3.5 ns max. (at 10 V Out).
  - fall time: 3.5 ns max. (at 10 V Out).
  - width: equal to the input-signal width  $\pm 2$  ns (at 10 V Out); programmable in the range from 5 ns to 430 ns through 8-bit digital code with logarithmic scale (7.5 ns min. at 10 V, 20 ns min. at 20 V Out). Resolution: better than 4% of the set value in the range from 10 ns to 430 ns. Measurements performed with medium amplitude settings on all channels.



**Fig. 2.1: Mod. C529 Front Panel** Errore. Il segnalibro non è definito.



### 3. CAMAC FUNCTIONS

|   |   |
|---|---|
| F (16) N A (0 to 5)                       | Sets the output amplitude in the range from 0 to 20 V with W1 to W8 (A0 -> CH0 ... A5 -> CH5).  |
| F (16) N A (6)                            | Sets the output width in the range from 5 ns to 430 ns with W1 to W8.<br>Width (in ns) = $23.39 * [(N + 14)/(256 - N + 12)]$ ,<br>where N = data written in W1..W8 (N = 36 for 5 ns). |
| F (9) N A (0), C, Z                       | Sets the width and amplitude output values to zero which results in null amplitude and minimum pulse width.   |
| X and Q responses for each valid function |   |

NOTE: The module's station number corresponds to the slot in which the connector side of the module has been inserted (rightmost CAMAC station occupied).

## **4. OPERATING MODES**

The C529 module houses 6 independent channels that allow the user to supply up to six LEDs (in a CAMAC controlled photomultipliers test chain) with negative pulses adjustable in amplitude and width.

The pulse amplitude of each channel output can be set in the range from 0 V to 20 V by performing an F(16) N A(0 to 5) CAMAC Function with the Write Lines W1 to W8 set to the desired amplitude value, and the subaddress number corresponding to the channel to be set:

- W1..W8 content = 0..255 (decimal), where "0" corresponds to a 0 V amplitude and "255" corresponds to a 20 V amplitude;
- "A(0)" selects "channel 0", "A(1)" selects "channel 1", and so forth.

The output pulse width can be set (in the range from 5 ns to 430 ns) either to individual values for each channel or to a common value for all channels as described below:

- by supplying the "IN" connector of each channel with a std. NIM signal: this causes the pulse width of the corresponding output signal to be equal to that of the input signal;
- by performing an F(16) N A(6) CAMAC function with the Write Lines W1 to W8 set to the desired width value calculated as specified in Par. 3. CAMAC FUNCTIONS.  
In this case the "IN" connectors are unused, and the "COMMON IN" connector must be supplied with a std. NIM signal (2.5 ns minimum pulse width) to activate the channel outputs.

In case of need, it is also possible to set the width and amplitude values to zero by performing an F(9) N A(0) function or a C,Z command.

A "BIAS" trimmer with test point, located at the bottom of the module's front panel, allows the user to set a common output offset in the range from 0 V to -2.150 V, with outputs in high impedance.

## **5. TEST PROCEDURE**

### **5.1. INTRODUCTION**

The operations to be performed to test the C529 module are listed in the procedure below and have to be performed according to their numerical order. None of the procedural steps can be omitted.

### **5.2. NECESSARY INSTRUMENTS**

- No. 1 pulse generator capable of generating std. NIM signals.
- No. 1 Oscilloscope.
- No. 1 CAMAC crate with CAMAC controller.

### **5.3. PROCEDURE**

|   |
|---|
| <b>CAUTION:</b> turn the CAMAC crate OFF before inserting or removing the module. |
|---|

1. After having inserted the module into a CAMAC station, turn the CAMAC crate ON.
2. Perform a C cycle: the amplitude values of the module's outputs are set to zero and their width is set to the minimum value.
3. Set W1..W8 to 255 decimal (output pulse width = 430 ns), then perform an F(16) N A(6) function: verify that X and Q are set to 1.
4. With the pulse generator, supply the "COMMON IN" connector of the module with a std. NIM signal whose pulse width is 200 ns.
5. For each channel, carry out the following operations:
  - (a) Set W1..W8 to 255 decimal (output pulse amplitude = 20 V), then perform an F(16) N A(n) function (where n = channel number): verify that X and Q are set to 1.
  - (b). With the oscilloscope, verify that a negative signal with a 20 Vpp pulse amplitude and a 430 ns FWHM pulse width is present at the "OUT" connector of the selected channel (terminated with 50  $\Omega$ ).
  - (c) One at a time, perform nine F(16) N A(n) functions (where n = channel number) with W1..W8 set to the following decimal values: 128 (first function), 64 (second function), 32, 16, 8, 4, 2, 1, 0 (last function). After each function has been performed, verify that X and Q are set to 1 and the output pulse amplitude decreases correctly.
6. For each channel, perform an F(16) N A(n) function (where n = channel number) with W1..W8 set to 255 (decimal). Then perform an F(9) N A(0) function: verify that X and Q are set to 1 and no signal is present at each of the "OUT" connectors.
7. For each channel, perform an F(16) N A(n) function (where n = channel number) with W1..W8 set to 255 decimal (max. output-pulse amplitude).
8. Perform an F(16) N A(6) function with W1..W8 set to 255 decimal (max. output pulse width).

9. One at a time, perform nine F(16) N A(6) functions with W1..W8 set to the following decimal values: 128 (first function), 64 (second function), 32, 16, 8, 4, 2, 1, 0 (last function). After each function has been performed, verify that X and Q are set to 1 and the output pulse width decreases correctly.
10. Remove the signal cable from the "COMMON IN" connector of the module.
11. By turning the "COMMON BIAS" trimmer, verify that a voltage level adjustable in the range from 0 V to -2.150 V is present both at the "COMMON BIAS" test point and at one of the channel outputs (with oscilloscope terminated in high impedance).
12. For each channel, carry out the following operations:
  - (a) supply the "IN" connector with a std. NIM signal whose pulse width is 200 ns.
  - (b) verify that a negative signal with a 20 Vpp pulse amplitude and a 200 ns FWHM pulse width is present at the "OUT" connector.

## **APPENDIX A: ELECTRICAL DIAGRAMS**

## **APPENDIX B: COMPONENTS LIST AND LOCATIONS**