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1. DESCRIPTION

1.1. FUNCTIONAL DESCRIPTION

The CAEN Model C207 is a 16 CHANNEL PROGRAMMABLE DISCRIMINATOR housed in a 1-unit wide CAMAC module (a functional block diagram is shown in Fig. 1.1).

The module accepts 16 negative inputs via 16 front panel LEMO 00 type connectors (INPUTS 0 to 15) and produces 16 differential ECL outputs (with a FAN-OUT of two for each channel) that are available on two front panel flat cable connectors (OUTPUTS 0 to 15 A and B).

Each channel consists of a discriminator on a hybrid circuit and an 8-bit DAC for the threshold setting.

The Timing Stage of the discriminator works in UPDATING mode. It produces an output pulse whose width is independent from the input signal time over threshold and adjustable in two ranges via the front panel common trimmer WDT (16 internal jumpers, one per channel, allow the range setting).

The module's operations can be controlled either via CAMAC or locally. A front panel "LOC" LED indicates when lit that the module is controllable locally. A back panel switch disables the REMOTE operations and sets the module in LOCAL mode ("LOC" LED is ON).

Each channel has its own discriminating threshold programmable via CAMAC, and can be turned on or off via CAMAC by using a mask Register (Pattern of Inhibit). The thresholds can be set in a range from 0 mV to -510 mV (-2 mV step), though for proper functioning a minimum threshold of -6 mV is required.

In LOCAL mode a common threshold can be set and monitored respectively via front panel trimmer and test point. Moreover, the Pattern of Inhibit is disabled (all channels are enabled) and the CAMAC functions are ineffective.

Some operations can be also performed using two external NIM signals (indicated on the back panel connectors with "VETO" and "TEST"):

- VETO: an input signal sent through this connector allows vetoing of all channels simultaneously. A veto pulse of width T will veto the input during this time T.

- TEST: a pulse sent through this connector triggers all the enabled channels at once (all channels in LOCAL mode). This useful feature allows a complete test of the module without removing any input cable as well as it allows generation of a pattern of pulses suitable to test any following electronics.

These are high impedance inputs and each one is provided with two bridged connectors for daisy chaining.

On the front panel there is also available a Current Sum output that generates a current proportional to the input multiplicity, i. e. to the number of channels over threshold, at a rate of –1.0 mA per hit (-50 mV per hit into a 50 Ω load) ±10%.

An "OR" output signal on a front panel connector provides a global OR of the Shaped Outputs.

An "OR" LED lights up if at least one of the unmasked channels is over threshold.

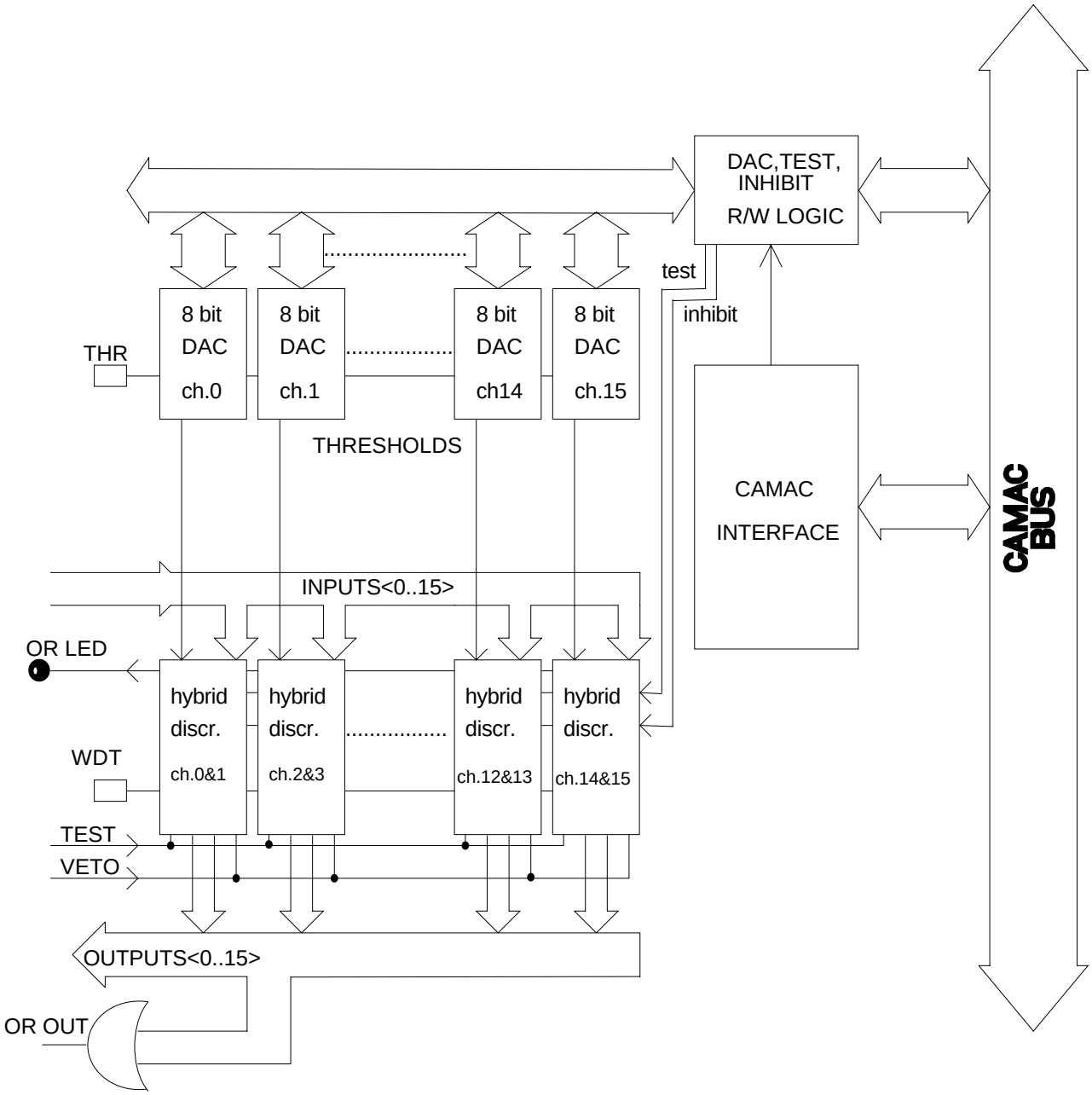

Fig. 1.1: C207 Block Diagram

2. SPECIFICATIONS

2.1. PACKAGING

1-unit wide CAMAC module.

2.2. EXTERNAL COMPONENTS

CONNECTORS:

- No. 16, "INPUT 0..15", LEMO 00 type. These are the connectors for the input signals.
- No. 2, "OUTPUTS 0..15 A, B", double row strip header, 17+17 pin. These connectors deliver the output signals.
- No. 1, "Σ", LEMO 00 type. It delivers a current proportional to the input multiplicity, i. e. to the number of channels over threshold, at the rate of -1.0 mA per hit (-50 mV per hit into 50 Ω load) ±10%.
- No. 1, "OR", LEMO 00 type. It provides a signal that is the OR of the Output shaped signals.
- No. 2, "VETO", LEMO 00 type. These are the back panel connectors for the veto input signal that can be daisy chained.
- No. 2, "TEST", LEMO 00 type. These are the back panel connectors for the test input signal that can be daisy chained.

DISPLAYS:

- No. 1, "LOC", red LED, lit up if the module is in LOCAL mode.
- No. 1, "OR", green LED, lit up if at least one channel is over threshold.

TRIMMERS, SWITCHES:

- No. 1, "WDT", screw-driver trimmer, for the common output signals width adjustment.
- No. 1, "THR", screw-driver trimmer, for the common threshold adjustment in LOCAL mode.
- No. 1, "REM/LOC", back panel switch, for the operating mode (REMOTE or LOCAL) selection.

TEST POINTS:

- No. 1, "THR", test point, for the common threshold monitoring.

2.3. INTERNAL COMPONENTS

CONNECTORS:

- No. 16, "JP1-JP16 (LTi-STi)", Jumpers, for the width range selection.

2.4. CHARACTERISTICS OF THE SIGNALS

INPUTS:

- INPUT CHANNELS: negative polarity, 50 Ω impedance;
  maximum absolute ratings: ± 5 Volts;
  input offset voltage: ± 5 mV;
  reflections < 4% for 2 ns risetime pulses.

- THRESHOLD: -6 mV to -510 mV, 2 mV step in programmable mode,
  continuous set in Local mode via front panel trimmer;
  monitor test point on front panel with range +6 mV to +510 mV.

- VETO(*): std. NIM level, high impedance;
  minimum width: 10 ns;
  veto leading edge must precede of at least 7 ns the input leading edge and overlap completely the input signal.

- TEST(*): std. NIM level, high impedance;
  maximum frequency: 125 MHz;
  minimum width: 5 ns.

(*) These inputs are at high impedance and each one is provided with two bridged connectors for daisy chaining. Note that the high impedance makes these inputs sensitive to noise, so the chains have to be terminated on 50 Ω on the last module; the same is needed also if one module only is used, whose inputs have thus to be properly matched.

OUTPUTS:

- CHANNELS: differential ECL level into 110 Ω twisted-pair;
  pulse width continuously adjustable via trimmer in two ranges:
  • 4 - 40 ns (approx.);
  • 40 - 300 ns (approx.);
  range selection via internal jumpers;
  Input/Output delay: 8 ±1 ns;
  Test/Output delay: 13 ns;
  Risetimes and Falltimes: < 3 ns.

- CURRENT SUM (Σ): high impedance current source;
  current proportional to the input multiplicity;
  rate: -1.0 mA per hit (-50 mV/hit into a 50 Ω load) ±14%
  offset: -60 mV approx. (no channel over threshold).

2.5. GENERAL

Double pulse resolution: 7.5 ns.
Maximum frequency: 125 MHz.
Interchannel isolation: better than 50 dB.
Time slewing < 400 ps for input amplitudes from 2x to 20x over threshold.

2.6. POWER REQUIREMENTS

- 24 V	25 mA
+ 12 V	15 mA
- 12 V	30 mA
+ 6 V	500 mA
- 6 V	3.4 A

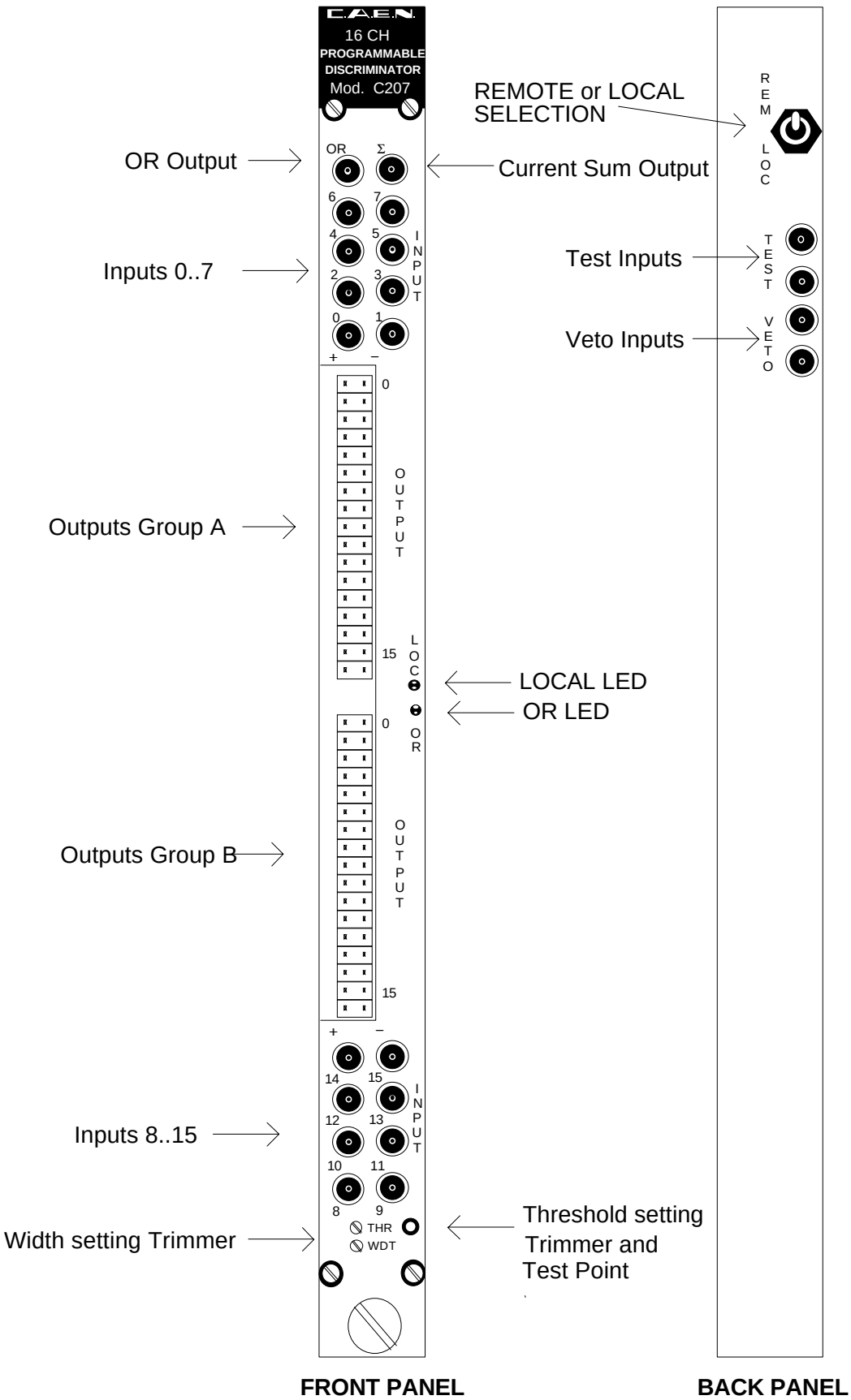

Fig. 2.1: C207 Front and Back Panels

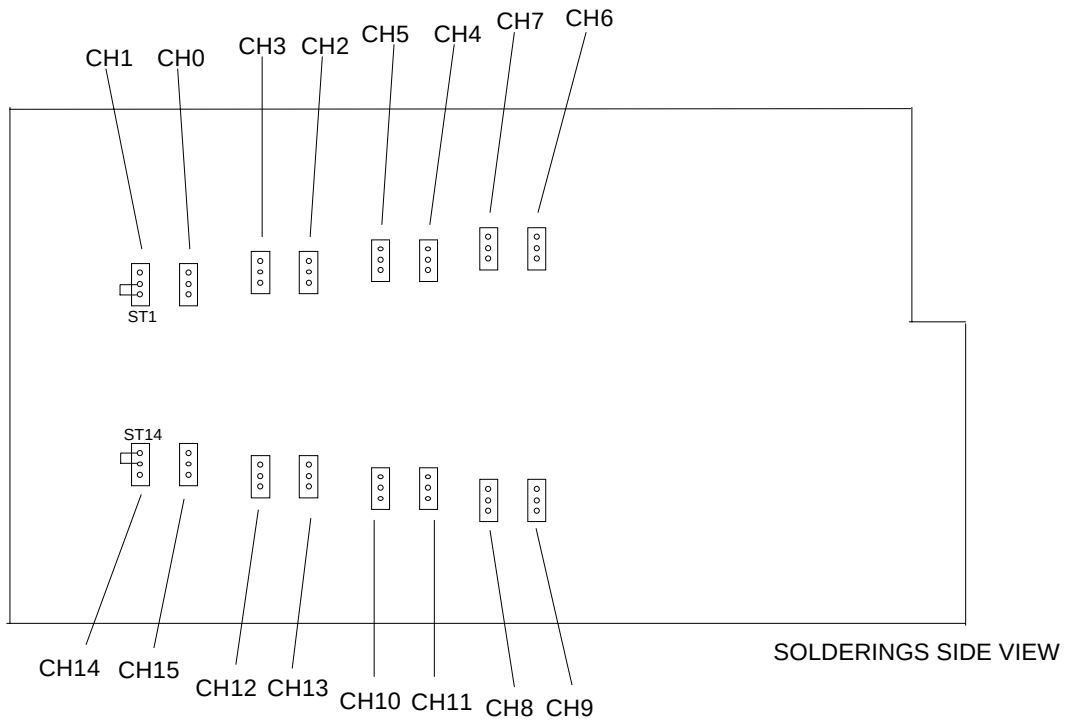

Fig. 2.2: C207 Range Selection Jumpers Location

3. OPERATING MODES

3.1. GENERAL INFORMATION

The CAEN Model C207 is a 16 CHANNEL PROGRAMMABLE DISCRIMINATOR housed in a 1-unit wide CAMAC module.

The module accepts 16 negative inputs via 16 front panel LEMO 00 type connectors (INPUTS 0 to 15) and produces 16 differential ECL outputs (with a FAN-OUT of two for each channel) that are available on two front panel flat cable connectors (OUTPUTS 0 to 15 A and B).

Paragraphs 3.2 to 3.8 describe the various operations that can be done via CAMAC in order to use the C207 module in REMOTE mode. Paragraph 3.9 describes the operations that can be done in order to use the C207 module in LOCAL mode.

3.2. MOD. C207 POWER-ON AND RESET

With the back panel switch in the "REM" position the module is in REMOTE mode. At Power-On the contents of the Pattern of Inhibit and Threshold Registers are not determined. A reset of the module and a setting of the Registers must be performed before any other operation.

It is possible to reset the C207 by performing a C, Z command or a F(9) N CAMAC Function. After this operation, the C207 is initialized; this causes the following:

- all channels are enabled (all bits of the Pattern of Inhibit are set to 1);

- the Q response on the F(2) N Function is cleared.

The RESET operation doesn’t affect the content of the Threshold Registers.

3.3. ENABLING/DISABLING OF THE CHANNELS

The User can enable or disable each of the 16 channels via CAMAC by performing a F(17) N CAMAC Function with the Write Lines W1-W16 set to 1 or 0 according to the chosen configuration (16 bit Pattern of Inhibit). A channel is enabled if the corresponding bit of the Pattern is high (e. g., bin. 0000000000001100, or hex 000C, enables channels 2 and 3 of the discriminator).

A F(1) N CAMAC Function allows to read out the Pattern of Inhibit configuration.

It is also possible to inhibit all channels via a CAMAC I (Inhibit) operation. The CAMAC Inhibit has no effect on the TEST input or the F(25) CAMAC Function.

3.4. THRESHOLDS SETTING

The discriminating thresholds can be programmed in a range from 0 mV to -510 mV in steps of –2 mV, though for proper functioning a minimum threshold of -6 mV is required. It is possible to set, via CAMAC, independent thresholds for each channel; 16 eight bit registers (T0..T15) are accessible via CAMAC for the thresholds setting and monitoring. The structure of these registers is shown in the following figure.

7	6	5	4	3	2	1	0
Threshold channel n							

Fig. 3.1: Organization of the threshold registers T0..T15

The bits <7..0> show the threshold absolute value of the channels; the weight of the LSB is -2 mV.

In order to write the thresholds for each channel, the User must perform a F(16) N A(i) CAMAC Function, where subaddress i selects the i-th channel. The chosen value of the thresholds must be present on the CAMAC Write lines W1-W8.

The thresholds can be read back for each channel: the User must perform a F(0) N A(i) CAMAC Function, where subaddress i selects the i-th channel. The chosen value of the thresholds is present on the CAMAC Read lines R1-R8.

3.5. OUTPUT PULSES

The width of the output signals does not depend on the time over threshold of the input signals. The front panel trimmer "WDT" allows a common manual adjustment of the output pulses. It is possible, for each channel, to have two adjustment ranges by setting the corresponding jumpers (JP1 to JP16) as previously shown in Fig 2.2 for the short range setting.

The two selectable ranges are:

- 4 ns - 40 ns;
- 40 ns - 300 ns.

The position of the jumpers can also be deducted from the solderings side of the board: the layout of the board contains a printed pattern with indications on Short Time (ST) or Long Time (LT) setting for the i-th channel (see fig. 3.2). The jumper has to short circuit the middle pin hole with the desired external pin hole as in Figure 3.2.

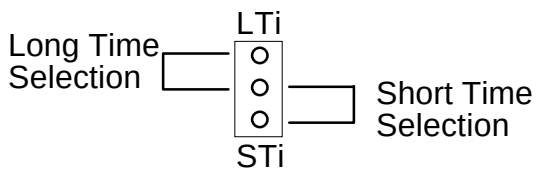

Fig. 3.2: Pattern for the Time Range setting of the i-th channel

3.6. FRONT PANEL SIGNALS

Some operations can be performed by two external NIM signals (indicated on the back panel connectors with "VETO", "TEST"):

- TEST: an input signal sent through this connector triggers all the enabled channels at once. This useful feature allows a complete test of the module without removing any input cable as well as it allows generation of a pattern of pulses suitable to test any following electronics.

- VETO: an input signal sent through this connector allows vetoing of all channels simultaneously. A veto pulse of width T will veto the input during this time T. Its leading edge must precede the input leading edge by at least 7 ns and overlap completely the input signal.

These are high impedance inputs and each one is provided with two bridged connectors for daisy chaining.

Note that the high impedance makes these inputs sensitive to noise, so the chain has to be terminated on 50 Ω on the last module; the same is needed also if one module only is used, whose inputs have thus to be properly matched.

The VETO has no effect on the TEST input or the F(25) CAMAC Function.

On the front panel there is also available a Current Sum output connector that generates a current proportional to the input signal multiplicity, i. e. to the number of channels over threshold, at a rate of -1.0 mA per hit (-50 mV per hit into a 50 Ω load) ±10%.

An OR output connector provides the Logical OR of the Output channels.

3.7. CHANNELS TEST

It is possible to obtain pulses on all channels:

- by sending a NIM pulse through one of the two "TEST" connectors located on the front panel.

- by performing a F(25) N CAMAC Function.

3.8. MODULE OPERATION

Once the thresholds are set and the desired channels are enabled via the Pattern of Inhibit Register, the module is ready to operate. All inputs exceeding the threshold value will produce an output pulse of width that can be set via front panel trimmer. A F(2) N CAMAC Function tests the activity of the module: if at least one of the unmasked channels is over threshold, this Function returns a Q=1 value (see 4.3). This Function clears automatically the status of the Q line.

3.9. LOCAL MODE OPERATION

With the back panel switch in the "LOC" position the module is in LOCAL mode ("LOC" LED is ON). At Power-On the bits of the Pattern of Inhibit and Threshold Registers are all set to 1: all channels are enabled but the thresholds of the Threshold Register are not active.

A common threshold must be set via front panel trimmer. A front panel test point provides a monitoring of the threshold in a range +6 mV to +512 mV.

Once the threshold is set the module is ready to operate. All inputs exceeding the threshold value will produce an output pulse of width that can be set via front panel trimmer.

In LOCAL mode the CAMAC readout of the Pattern of Inhibit and Threshold Registers (F(0) N A(0-15), F(1) N Functions) is active (all bits must be 1, otherwise the module is not working correctly).

If the User switches the module from REMOTE to LOCAL while it is still powered, the module will behave as above: the bits of the Pattern of Inhibit and Threshold Registers are all set to 1.

If the User switches the module from LOCAL to REMOTE while it is still powered, the module will maintain its registers configuration, i. e., the bits of the Pattern of Inhibit and Threshold Registers are still set to 1 and need to be set again via CAMAC.

4. CAMAC FUNCTIONS

The standard CAMAC Functions listed in Table 4.1 allow the user to perform the required control and readout operations on the C207 module.

X response is generated for each valid function.

Q response is generated in REMOTE Mode only for each valid function unless otherwise specified.

Table 4.1: Mod. C207 CAMAC Functions

F(0) N A(0-15) *	Reads the Discriminator Thresholds on R1..R8.
F(1) N *	Reads the Pattern of Inhibit on R1..R16.
F(2) N	Tests the module activity and clears the Q line. Q response if at least one channel is over threshold.
F(16) N A(0-15)	Writes the Discriminator Thresholds on W1..W8.
F(17) N	Writes the Pattern of Inhibit on W1..W16.
F(25) N	Common Test.
I	Vetoes the channels via CAMAC.
F(9) N, C, Z	Resets the module

*: Q response also in LOCAL mode.

4.1. F(0) N A(0-15) FUNCTION (Read Discriminator Thresholds)

This CAMAC Function reads the 8 bit Threshold Register (on read lines R1-R8); subaddresses 0 through 15 select the different channels (0 through 15). For each channel the Threshold Register contains the value of the threshold set via CAMAC. Read lines R9-R16 are set to 1.
In LOCAL mode the R1-R16 lines are all set to 1.

4.2. F(1) N FUNCTION (Read Pattern of Inhibit)

This CAMAC Function reads the 16 bit Pattern of Inhibit Register (on read lines R1-R16); each bit set to 1 corresponds to an active Discriminator channel. In LOCAL mode the R1-R16 lines are all set to 1.

4.3. F(2) N FUNCTION (Test Activity)

This CAMAC Function tests the status of the Q line. The Q response is generated and held if at least one channel is over threshold. The Q line is cleared with the F(2) N Function.

4.4. F(16) N A(0-15) FUNCTION (Write Discriminator Thresholds)

This CAMAC Function writes in the 8 bit Threshold Register (via write lines W1-W8); subaddresses 0 through 15 select the different channels (0 through 15). For each channel the Threshold Register contains the value of the threshold and it can be read via CAMAC (F(0) N A(0-15)Function).

4.5. F(17) N FUNCTION (Write Pattern of Inhibit)

This CAMAC Function writes the 16 bit Pattern of Inhibit Register (via write lines W1-W16); each bit set to 1 corresponds to an active Discriminator channel.

4.6. F(25) N (Common Test)

This CAMAC Function allows the testing of the module; it triggers all discriminator outputs at once.

4.7. I (Veto All Channels)

This CAMAC Function vetoes all channels. It has no effect on the TEST input or the F(25) N Function.

4.8. F(9) N, C, Z (Reset Module)

This CAMAC Function resets the module; this causes the following:

- the Pattern of Inhibit bits are set to 1 (all channels enabled);
- the Q response on F(2) N is cleared.

APPENDIX A: ELECTRICAL DIAGRAMS

CAEN will repair
declares that the
caused by misp
conditions or obe