Technical Information Manual

MOD. C 423

PRESET COUNTER
GATE GENERATOR

20th March 1992


PRESET CNT
AND GATE
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1. DESCRIPTION

1.1 FUNCTIONAL DESCRIPTION

The CAEN Model C 423 **Preset Counter** and **Gate Generator** is a 1-unit wide CAMAC module provided with one 24-bit count down channel scaler. It is presettable from 1 to 2^{24} value.
The module can be fully controlled either locally, by front panel controls, or remotely via CAMAC.

Before starting the count-down, the required initial counting value must be preset and an external or internal source of the CLOCK signal has to be selected. The frequency of the external CLOCK can vary up to 100 MHz. The internal CLOCK frequency can be selected between two fixed values: 1 KHz or 1 MHz. With a simple modification the User can obtain an internal CLOCK of 400 kHz or 40 MHz (see page 14).

The counting value can be loaded manually (by the front panel switch "LOAD") or by a NIM/TTL pulse fed to the relevant input connector, or by performing the appropriate CAMAC function. In this way the count-down starts and the OUT and the /OUT outputs become TRUE and the CLOCK signal is available at the "BRST" connector (BURST).

At the counting end, an END MARKER signal ("E.M." connector) is generated and the OUT, $\overline{OUT}$ and BURST outputs switch OFF. At the same time a LAM is generated (if enabled).

A front panel trimmer allows the END MARKER width to be adjusted in a range from about 35 ns to 850ns. In particular:
the first leading edge of the CLOCK signal (external or internal) after the LOAD signal (manual, from CAMAC, external) enables the counting. At the first trailing edge of the CLOCK signal itself the OUT becomes true. At the second leading edge of the CLOCK signal the counter starts to decrease.

The counter reaches the zero value athe END MARKER signal is generated at the trailing edge of CLOCK signal n+1 (n = preset value for the module); n+2 in test mode.

The OUT ($\overline{OUT}$) width is the time between the first and the N+1 trailing edge of the clock signal.

The output BURST is a logic AND between the CLOCK and the OUT signals.

A logic timing diagram in the case of n = 4 is shown in Fig. 1 (For std. NIM: "0" = 0 Volt, "1" = -800 mV)

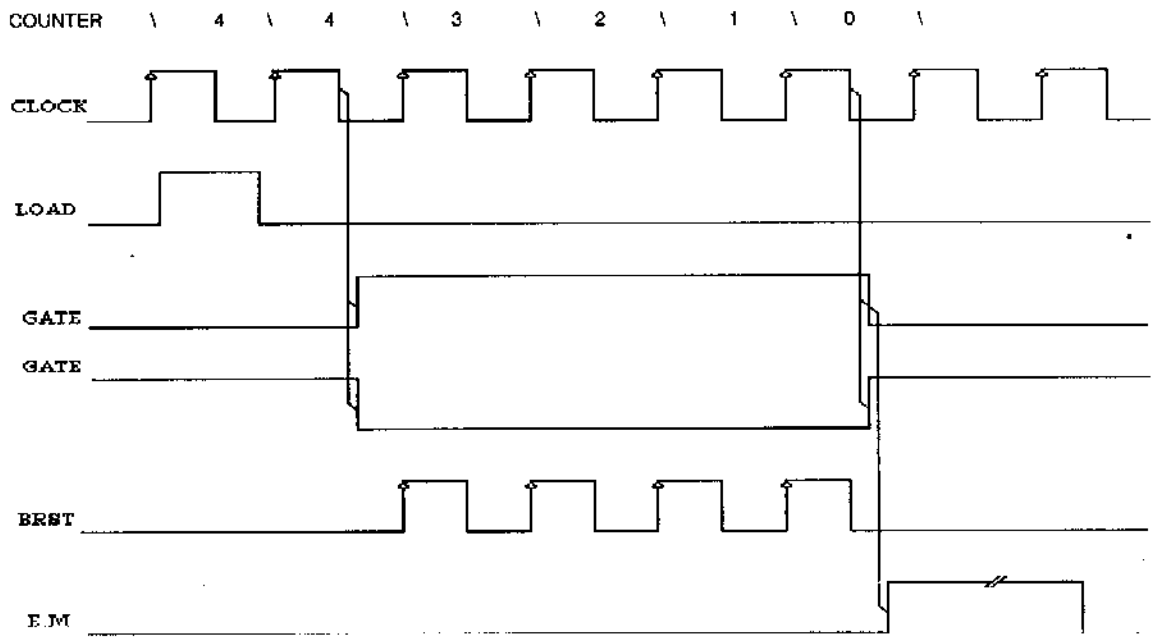

Figure 1.

The functional block diagrams of the module in the case of LOCAL and REMOTE operating mode are shown in Fig. 2 and Fig. 3 .

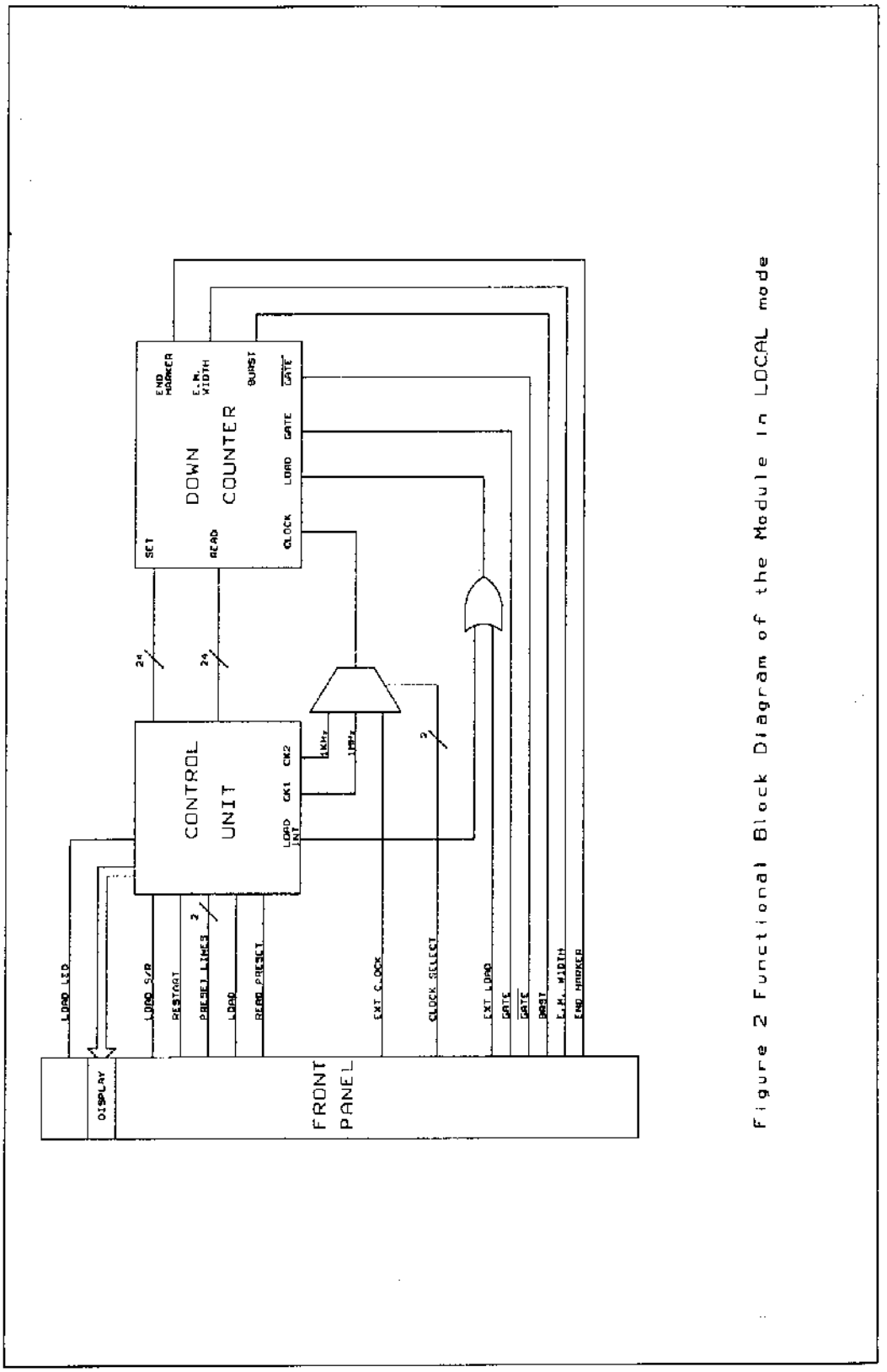

Figure 2 Functional Block Diagram of the Module in LOCAL mode

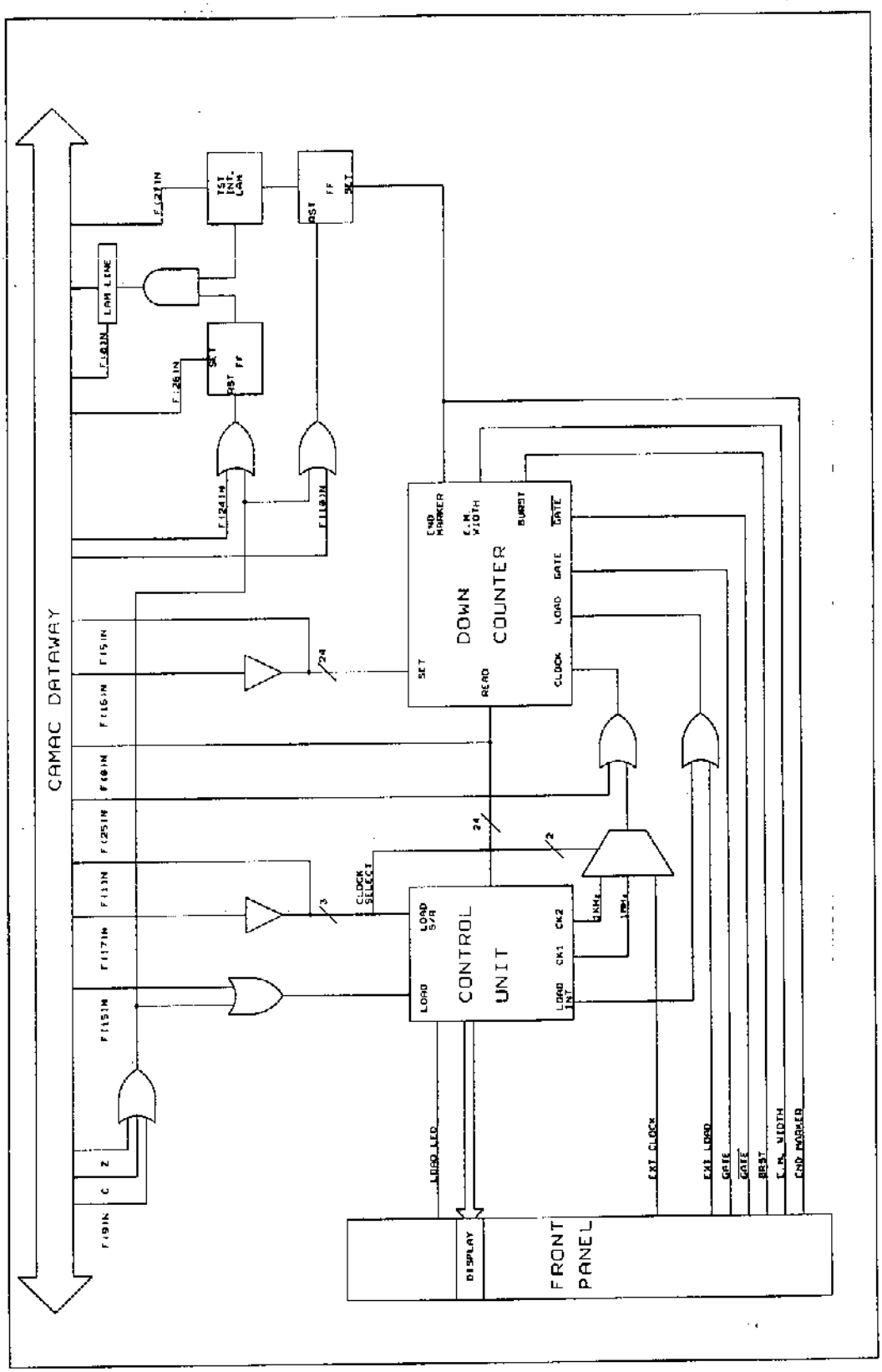

Figure 3. Functional Block Diagram of the Module in REMOTE mode.

2. SPECIFICATIONS

2.1 PACKAGING

Single width CAMAC module.

2.2 EXTERNAL COMPONENTS

CONNECTORS:

- No. 1 LEMO 00 - type "EXT LOAD" (NIM or TTL); 50 Ω impedance for NIM level and 350 Ω impedance for TTL level. External LOAD input.

- No. 1 LEMO 00 - type "EXT CLK" (NIM or TTL); 50 Ω impedance for NIM level and TTL level. External CLOCK input.

- No. 1 ECL - type "OUT" (ECL). GATE signal output.

- No. 1 LEMO 00 - type "OUT" (NIM). GATE signal output.

- No. 1 LEMO 00 - type "$\overline{\text{OUT}}$" (NIM). $\overline{\text{GATE}}$ signal output.

- No. 1 LEMO 00 - type "BRST" (NIM). BURST signal output.

- No. 1 LEMO 00 - type "E.M." (NIM). END MARKER signal output.

DISPLAYS:

- No. 1 8-digit display showing the current counting value or preset value.

- No. 1 green LED "LOAD". It lights up when a LOAD command is performed and turns off when the zero value is reached.

SWITCHES:

- No. 1 "RST/LOC/REM". A 3-position lever switch by which it is possible to select the local or remote operating mode or to reset the module.

- No. 1 "LOAD/READ". A 2-position lever switch by which it is possible, when in LOCAL operating mode, to load the preset counting value and start the count-down, or to read the last set value.

- No.1 "DGT SEL/NUM SEL". A 2-position lever switch by which it is possible, when in LOCAL operating mode, to select a display digit and set the required value.

- No. 1 "EXT/1μ/1m". A 3-position lever switch by which it is possible, when in LOCAL operating mode, to select an external or internal CLOCK and to set the internal CLOCK to a period of 1 μs or 1 ms.

- No. 1 "SNG/RPT". A 2-position lever switch by which it is possible, when in LOCAL operating mode, to select a single or repetitive LOAD.

TRIMMERS:

- No. 1 "WIDTH". Screwdriver type. END MARKER width adjustment.

2.3 INTERNAL COMPONENTS

JUMPERS

- No. 1 jumper (JP10) reserved for CAEN (see figure below).

- No. 1 jumper (JP9) to Insert/remove 50 Ω termination on the CLOCK line.

The module is supplied by CAEN with:

JP9	fitted	->	CLOCK line terminated
JP10	omitted		

FUSES

- No. 1 fuse 2 A, +6 V.

- No. 1 fuse 2 A, -6 V.

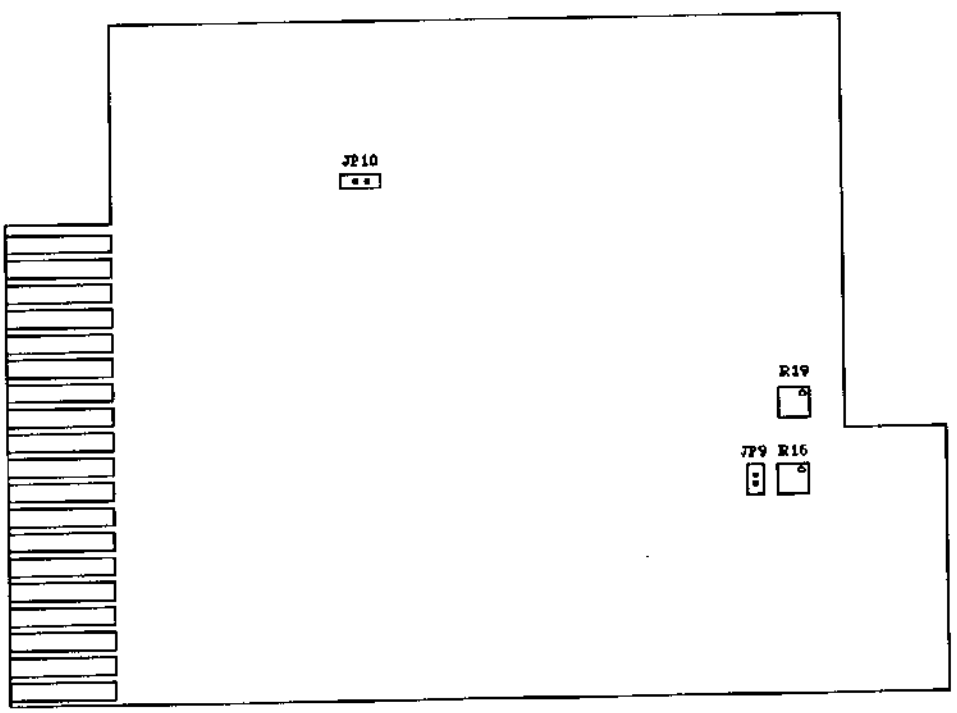

Figure 4

2.4 CHARACTERISTICS OF THE SIGNALS

INPUTS

- EXT CLOCK: **(See note 1)**	NIM	. -600 mV into 50 Ω. Direct coupled Reflections <10% with 2.5 ns risetime. . Min. width 5 ns FWHM. Rise and fall time ≤2 ns. . Min. interval between 2 pulses measured at half-height 5 ns. Rise and fall time ≤2 ns. . Max. frequency 100 MHz. Rise and fall time ≤2 ns.
	TTL	TTL level into 50 Ω. (30 KΩ min. when JP9 is not inserted - **see note 2).** Direct coupled. Reflections <10% with 3 ns risetime. . Min. width 5 ns FWHM. Rise and fall time ≤2 ns. . Min. interval between 2 pulses measured at half-height 5 ns. Rise and fall time ≤2 ns. . Max. frequency 100 MHz. Rise and fall time ≤2 ns.
- EXT LOAD:	NIM	. -600 mV into 50 Ω. Direct coupled Reflections <10% with 2.5 ns risetime. . Min. width 30 ns FWHM. Rise and fall time ≤2 ns.
	TTL	TTL level into 350 Ω. Direct coupled. Reflections <10% with 3 ns risetime. . Min. width 30 ns FWHM. Rise and fall time ≤2 ns.

OUTPUTS

- END MARKER:	. NIM; quiescently 0 mA, -16 mA during output. Rise and fall time ≤3 ns. The width of this signal is adjustable from 40 ns to 700 ns.
- OUT:	. ECL level. Rise and fall time ≤2 ns. **(See note 3).**
- OUT:	. NIM; quiescently 0 mA, -16 mA during output. Rise and fall time ≤2 ns.
- $\overline{\text{OUT}}$:	. NIM; quiescently -16 mA, 0 mA during output. Rise and fall time ≤2 ns.
- BURST:	. NIM; quiescently 0 mA, -16 mA during output . Rise and fall time ≤2 ns.

NOTE 1:

The CLOCK signal enters into a High Speed double comparator whose thresholds are fixed at -400 mV for the NIM signals and at +2 V for the TTL signals.Since these thresholds can be changed via the 2 trimmers, R16 and R19 (see fig 4), the Module C 423 can also function with a CLOCK signal which does not re-enter into the NIM or TTL standards.

NOTE 2:

When JP9 is not inserted the CLOCK line is not terminated. In this situation the above stated specifications (for example Max. frequency = 100 MHz) are not guaranteed.

NOTE 3:

When the ECL GATE output is used it must be correctly terminated. Otherwise it may cause malfunctioning of the module.

2.5 POWER REQUIREMENTS

+6 V 1.1 A
-6 V 1.5 A

3. CAMAC FUNCTIONS

F(0) N	Reads the preset counting value (R1 to R24). (Zero means 2^{24}).
F(1) N	Reads the LOAD and CLOCK setting as shown in the table below: R3 = 0 -> single LOAD R3 = 1 -> repetitive LOAD (R2 = 0) and (R1 = 0) -> single internal CLOCK pulse (see F (25) N) (R2 = 0) and (R1 = 1) -> internal CLOCK period set to 1 µs (R2 = 1) and (R1 = 0) -> internal CLOCK period set to 1 ms (R2 = 1) and (R1 = 1) -> external CLOCK R4 to R24 do not have meaning.
F(5) N	Reads the current count-down value (R1 to R24).
F(8) N	Tests the LAM. Q response if the LAM is present.
F(9) N	Resets the module; the single internal CLOCK pulse and the single LOAD are set. The LAM line is disabled. The counter is loaded with 2^{24}.
F(10) N	Clears the LAM.
F(15) N	LOAD command.
F(16) N	Sets the preset counting value (W1 to W24).(In order to set 2^{24} the user must write zero).
F(17) N	Sets the LOAD and CLOCK modes as shown in the following table: W3 = 0 -> single LOAD W3 = 1 -> repetitive LOAD (W2 = 0) and (W1 = 0) -> single internal CLOCK pulse (see F (25) N) (W2 = 0) and (W1 = 1) -> internal CLOCK period set to 1 µs (W2 = 1) and (W1 = 0) -> internal CLOCK period set to 1 ms (W2 = 1) and (W1 = 1) -> external CLOCK W4 to W24 do not have meaning.
F(24) N	Disables the LAM.
F(25) N	Sends a single Internal low active CLOCK pulse. Active only if the relevant CLOCK mode is selected. The counter reaches zero after having performed n+2 F(25). (n = preset value).
F (26) N	Enables the LAM.
F(27) N	Tests the internal LAM. Q response if present.
C, Z	Same as F(9) N.

X *response for each valid function when the module is in REMOTE mode.*
Q *response for each valid function when the module is in REMOTE mode, unless otherwise specified.*

4. OPERATING MODE

The two operating modes, either LOCAL or REMOTE (CAMAC), are completely independent. This means that the preset counting value programmed in LOCAL mode can be different from that programmed in REMOTE mode and that the functioning modes selectable by the switches on the front panel (CLOCK, LOAD) can also be selected via the relative CAMAC functions in REMOTE mode.

When switching from LOCAL to REMOTE or viceversa the preset counting value becomes that relative to the new operating mode, and the value itself is loaded onto the counter.

NOTE: *In LOCAL operating mode the module can also function outside a CAMAC crate only with the requested power supply voltage.*

CAUTION: *turn OFF the CAMAC crate before inserting or removing the module.*

4.1 LOCAL OPERATING MODE

In this mode the Mod. C 423 can be configured and preset acting on the switches on the front panel.

More precisely the switches :

RST/LOC/REM	placed in the RST position determines the load of the counter with the value 0.
CLK (1μ/EXT/1m)	selects the operating mode with external CLOCK or internal CLOCK with a period of 1 μs or 1 ms.
LOAD (SNG/RPT)	selects the operating mode with a single LOAD (SNG position) or repetitive (RPT position) in which case the counter is recharged with the preset value about 2 seconds after the end of the previous counting.
DGT SEL/NUM SEL	allows the module to be preset with the desired value. In the position "DGT SEL" it is possible to select the desired digit which will begin to flash. The movement from one digit to the other occurs in cyclic mode leaving from the least significant digit. Instead, by moving the switch to the NUM SELposition it is possible to change the selected digit value from 0 to 9 in cyclic mode. The preset values are in the range from 1 to 2^{24} (to set 2^{24} you must set the zero value)
LOAD/READ	in the LOAD position, loads the preset value on the counter and consequently the flashing on the display stops. In the READ position, displays the last preset value. (zero means 2^{24}).

4.2 CAMAC OPERATING MODE

If the module is inserted in a CAMAC station and the switch RST/LOC/REM is in the position REM the module becomes completely controllable via the relative CAMAC functions (see chapter 3).

> **NOTE:** *After power-on of the module it is advisable to reset the module itself (F(9) N CAMAC Function or C or Z cycle).*

5. TEST PROCEDURE

5.1 INTRODUCTION

The following Test Procedure is intended to be a guide for the user. We do not claim it to be exhaustive and therefore the module may be tested in various other ways.

Each procedural step contains the operation to be performed and the corresponding effect or the verification to be performed.

Testing the module wastes time, therefore it is advisable to provide software in order to perform the necessary operations via computer.

5.2 SUGGESTED INSTRUMENTS

- No. 1 CAMAC crate.
- No. 1 CAEN Model C 249 CAMAC Manual Crate Controller .
- No. 1 Oscilloscope (bandwidth: min. 200 MHz).
- No. 1 Pulse Generator (100 MHz).
- No. 1 Scaler i.e. Mod. C 243, Mod. C 257 or similar (100 MHz).

5.3 PROCEDURE

CAUTION: *turn OFF the CAMAC crate before inserting or removing the module.*

> Before testing the module, verify that the power lines +6 V and -6 V are present.

1. Remove the component-side cover from the module.
2. Verify that JP10 is omitted, JP9 (see fig. 4) is fitted and SW1 (see fig. 4) is configured as supplied by CAEN (see par. 2.3).
3. Replace the cover.
4. Insert the module into a CAMAC station.

5. Place LOAD SNG/RPT switch to SNG position, the CLOCK 1µs/EXT/1ms to EXT position and the RST/LOC/REM switch to REM position .

6. Turn on the CAMAC crate; on the module's front panel, all of the eight 8-figure displays light up and the zero counting value is displayed. The green LED relative to the LOAD lights up for an instant.

7. Perform a C cycle.

8. Perform an F(0) N function: the value read on the READ Lines must be equal to 0.

9. Perform an F(1) N function: on the READ lines R1 to R3 a logic level "0" must be read, the READ Lines R4 to R24 are not significant.

10. Perform an F(5) N function: the value read on the READ Lines must be equal to 0.

11. Perform an F(27) N function and verify that X response is true and Q response is false.

12. Perform an F(8) N function and verify that X response is true and Q response is false.

13. Connect the "BRST" output to one Test Scaler input.

14. Turn on the pulse generator and connect its output (NIM or TTL max. 100 MHz) to the "EXT CLOCK" input of the module.

15. Perform and F(17)N function with the value 1 on the WRITE Lines WR1 and WR2: the counting starts; the 0 value is reached after 2^{24} CLOCK pulses and the LED turns off. The value read on the Test scaler must equal 2^{24} (16777216).

16. Perform an F(16) N function with the value 1 on the WRITE Lines (W1 to W24).

17. Perform an F(0) N function: the value read on the READ Lines must be equal to the preset value specified in step 16.

18. Clear the TEST scaler.

19. Perform an F(15) N function: the preset value is loaded, the counter reaches the 0 value after N + 1 clock pulses where N is equal to the set value specified in step 16; the value read on the TEST scaler must equal N.

20. Repeat steps 16, 17, 18, 19 twenty-three times, multiplying each time by 2 the set value at step 16. (Walking bit at logic level 1).

21. Repeat steps 16, 17, 18, 19 twenty-three times, multiplying each time by 2 and complimenting the set value at step 16. (Walking bit at logic level 0).

22. Perform an F(27) N function and verify that X and Q responses are true.

23. Perform an F(26) N function: LAM line must be true.

24. Perform an F(8) N function and verify that X and Q responses are true.

25. Perform an F(24) N function: LAM line must be false.

26 . Perform an F(8) N function and verify that X response is true and Q response is false.

27. Perform an F(10) N function.

28. Perform an F(27) N function and verify that X response is true and Q response is false.

29. Connect "E.M." output with "EXT LOAD" input.

30. Repeat step 16.

31. Perform an F(15) N function.

32. Connect the "OUT" and "$\overline{OUT}$" outputs to the inputs of the oscilloscope with a 50 Ω impedance. Verify that the polarity is correct and that the width of the "OUT" pulse is equal to the CLOCK period in the input.

33. Connect the "E.M." output to the input of the oscilloscope and vary its width from about 35 ns to 850 ns acting on the "WIDTH" trimmer on the front panel.

34. Perform an F(17) N with the WRITE Lines W1 = 1, W2 = 0, W3 = 0: the width of the "OUT" and "$\overline{OUT}$" signals must be equal to 1 µs.

35. Perform an F(17) N with the WRITE Lines W1 = 0, W2 = 1, W3 = 0: the width of the "OUT" and "$\overline{OUT}$" signals must be equal to 1 ms.

36. Disconnect "E.M." from "EXT LOAD".

37. Perform an F(17) N with the WRITE Line W3 = 1: the preset value is reloaded about 2 seconds after the value 0 is reached.

38. Perform an F(9) N function.

39. Repeat steps 8 to 12.

40. Perform an F(25) N function twice: the value of the counter decreases by 1.

41. Perform a C cycle.

42. Repeat steps 39 and 40.

43. Carry out a Z cycle.

44. Repeat steps 39.

45. Place the RST/LOC/REM switch to LOC position.

46. Clear the TEST scaler.

47. Place the RST/LOC/REM switch to RST position for an instant: the LED lights up: the counting starts; the 0 value is reached after 2^{24} CLOCK pulses and the LED turns off. The value read on the Test scaler must equal 2^{24} (16777216).

48. Clear the TEST scaler.

49. Set the preset value1 via the appropriate switch.

50. Send a manual LOAD: the preset value is loaded, the counter reaches the 0 value after N + 1 clock pulses where N is equal to the set value specified in step 49; the value read on the TEST scaler must equal N.

51. Repeat steps 48, 49 and 50 setting all the possible preset values (step 49) which can be obtained by varying from 0 to 9 the value on the first digit (least significant digit), then varying from 0 to 9 the value on the second digit and so on until the most significant digit is reached.

52. Read the last preset value by moving the LOAD/READ switch to the READ position.

53. Move the LOAD switch SNG/RPT to RPT position.

54. Verify that the preset value is reloaded about 2 seconds after the value 0 is reached.

55. Place the LOAD switch SNG/RPT to position SNG.

56. Connect the "E.M." output to the "EXT LOAD" input.

57. Place the CLOCK 1 µs/EXT/1 ms switch to position 1 µs.

58. Repeat step 49.

59. Send a manual LOAD.

60. Connect the "OUT" output to the input of the oscilloscope with a 50 Ω impedance and verify that the signal width is equal to 1 µs.

61. Move the CLOCK 1 µs/EXT/1 µs switch to the 1 ms position.

62. Connect the "OUT" output to the input of the oscilloscope with a 50 Ω impedance and verify that the signal width is equal to 1 ms.

63. Turn OFF the crate and remove the module.

6. CLOCK MODIFICATIONS

The following modifications allow the User to operate the module at 400 kHz or 40 MHz with an internal CLOCK.

1) Remove the U28 Integrated Circuit.
2) Connect together pin 3, pin 4 and pin 13 of the U28 socket.
3) Replace U27 (10 MHz Quartz Oscillator) with a 40 MHz Quartz Oscillator.

In this way the internal CLOCK can be selected between two values:

25 ns (previously 1 µs)
2.5 µs (previously 1 ms)