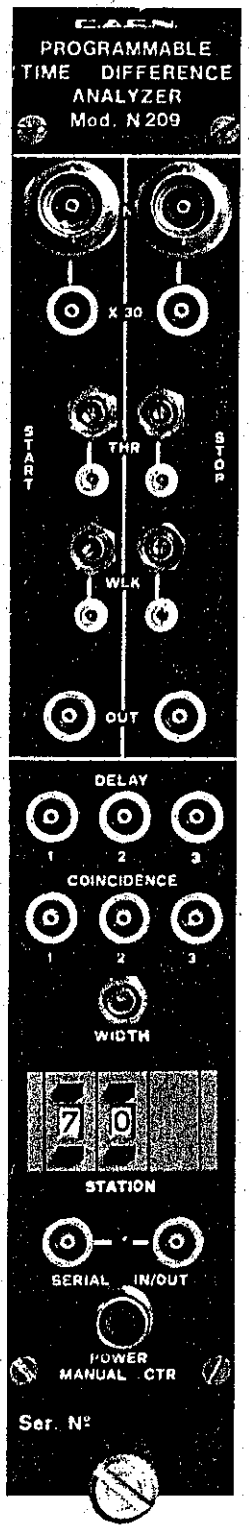
Technical Information Manual

MOD. N 209

PROGRAMMABLE TIME DIFFERENTIAL ANALYSER

21st February 1991


CAEN
PROGRAMMABLE
TIME DIFFERENCE
ANALYZER
Mod. N 209
X 30
START
THR
STOP
WLK
OUT
DELAY
1
2
3
COINCIDENCE
1
2
3
WIDTH
7
0
STATION
SERIAL IN/OUT
POWER
MANUAL CTR
Ser. N°

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.

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WARNING

It has been discovered that when a module, which has a crate number equal to 0, is present in a CAENET network controlled by the Mod. C 117B, Mod. V 288 or Mod. A 303, H.S. CAENET Controllers, the communications may not work correctly.

This could happen in particular cases so **it is advisable not to use the crate number 0** in the network.

1. DESCRIPTION

The Model N 209 "PROGRAMMABLE TIME DIFFERENCE ANALYSER" is a single NIM unit which measures the time interval between a START and a STOP signal.

The measure is performed by verifying the coincidence between the STOP signal and a GATE signal which is delayed in respect to the START signal. Both the delay and the width of the GATE are programmable. The coincidences are available with three independent GATE signals.

The START and STOP signals are amplified and discriminated according to the technique of the "constant fraction"; the threshold voltages are programmable manually with the trimmer and relative test point situated on the front panel; also the fine adjustment of the zero crossing is foreseen on the front panel through the test point and trimmer.

The output signals from the amplifiers and discriminators are available as well as the three GATE signals and the three coincidence signals; these last signals are also available on the rear panel.

The module identification (station number), to be inserted in the HIGH SPEED CAENET network is obtained by the thumb-wheel switch placed on the front panel (valid numbers from 0 to 99). Two LEMO 00 connectors are foreseen by the H.S. CAENET network; one LED indicates that the module has been addressed.

All the programmed parameters are memorised in a non-volatile memory and are automatically reloaded at power-on.

2. SPECIFICATIONS

2.1 EXTERNAL COMPONENTS

Input connectors:

1, START", BNC connector type, 50 Ω impedance, AC coupled
1, "STOP", BNC connector type, 50 Ω impedance, AC coupled

Output connectors:

2, "x30", LEMO 00 type, 50 Ω impedance; for linear amplified (30x) START and STOP signals.
2, "OUT", LEMO 00 type, 50 Ω impedance, std. NIM level START and STOP signals.
3, "DELAY1, 2, 3", LEMO 00 type, 50 Ω impedance, std. NIM level; GATE signals (delay adjustment)
delay: programmable from 0 to 400 ns in steps of 2 ns;
width: programmable from 5 ns to 33 ns in steps of 2 ns.
3, "COINCIDENCE 1, 2, 3", LEMO 00 type, std. NIM level, 50 Ω, coincidence signals common width via WIDTH trimmer.

Trimmer adjustments:

2, "THR", one for the START, one for the STOP signal discrimination threshold.
2, "WLK", "zero crossing" levels for START and STOP signals discrimination.
1, "WIDTH", common width of COINC. 1, 2, 3 coincidence signals (20 ns to 1 μs).

Test points:

2, "THR", one for the START, one for the STOP signal discrimination threshold.
2, "WLK", "zero crossing" levels for START and STOP signals discrimination.

H.S. CAENET Connectors:

2, "SERIAL IN/OUT", LEMO 00 type, for the communication line.
1, "POWER MANUAL CTR.", coaxial female plug (RCA type) to power the H.S. CAENET Manual Controller.

LED:

1, signalling that the module has been addressed by a H.S. CAENET Controller.

2.2 CHARACTERISTICS OF THE SIGNALS

START, STOP	0 -35 mV, 30 MHz BW.
x30	0 -1 V, drives 50 Ω load.

2.3 POWER REQUIREMENTS

+24 V 50 mA
+12 V 250 mA
-12 V 250 mA
+6 V 500 mA (900 mA with the Manual Controller)
-6 V 1.1 A

3. OPERATING MODES

The Mod. N 209 is provided with a HIGH SPEED CAENET interface through which it can be controlled by the following H.S. CAENET CAEN modules:

Mod. A 250 - H.S. CAENET Manual Controller;
Mod. C 117 B - H.S. CAENET CAMAC Controller
Mod. V 288 - H.S. CAENET VME Controller
Mod. A 303 - H.S. CAENET PC Controller.

NOTE: the address number (station number on the thumb-wheel switch) must be the only one in the line in which you wish to insert the module. Due to high transmission speed of the data in line it is necessary to terminate this line on a 50 Ω impedance at the end to avoid reflections.

For each Mod. N 209, three channels are at your disposal. Each channel has two programmable parameters called "Delay" and "Gate" respectively.

3.1 USING THE H.S. CAENET MANUAL CONTROLLER (Mod. A 250)

Connect the Manual Controller to the Mod. N 209 using a 50 Ω coaxial cable to insert into one of the connectors present on the front panel of the module and called SERIAL IN/OUT, connecting the other connector to the existing network or terminating it on a load of 50 Ω; the supply of the Manual Controller CAENET can be effected through the suitable connector still present on the front panel and called POWER MANUAL CTR.

Once supplied the Manual Controller will show:

```
CAEN     A 250    1.0
Select Cr          * *
```

the indication 1.0 refers to the software release installed in the controller itself.

Digitise the address number of the module previously set through the thumb-wheel switch on the front panel of the module itself, and confirm the module choice with the key "#".

The display will show:

```
MM   Ch1  Del   ddd
N 209     Gate  gg
```

where MM is the selected address number, ddd and gg are the delay and gate values actually set on channel 1.

Pressing repeatedly the key "#" you can move the flashing cursor, in this moment under the MM field, onto the various display fields on which it is permitted to operate (MM, Ch1, ddd, gg)).

By positioning the cursor on the channel's selection field and then by pressing the "ROLL" key the selected channel and its relative parameters will be displayed.

To modify the programmed values on a channel:

- select the desired channel;
- position the cursor onto the data field of the parameter you wish to modify;
- press the key "ENTER".

The display modifies itself in the following way:

MM	Ch2	Del	* * *
N 209		Gate	gg

MM	Ch2	Del	ddd
N 209		Gate	* *

Digitise the new value for the delay or gate confirming the data by pressing the key "#".

The accepted values of the Manual Controller are 0 to 400 ns in steps of 2 ns for the delay, and 5 ns to 33 ns in steps of 2 ns for the gate.

NOTE: In trying to programme a value outside the allowed limits the manual controller reacts by inserting the limit nearest to the digitised value.

To modify the number of the module with which you wish to communicate:

- position the cursor onto the MM field by pressing the key "#";
- press the ENTER key; the MM field modifies itself showing 2 asterisks;
- digitise the number of the new module with which you wish to communicate;
- confirm this choice by pressing the key "#".

3.2 USING THE H.S. CAENET CAMAC CONTROLLER (Mod. C 117 B)

The Mod. N 209 can be controlled via CAMAC through the Mod. C 117 B H.S. CAENET CAMAC Controller.

The standard CAMAC functions listed in table 1 allow the user to perform the required control and setting operations according to the typical MASTER/SLAVE communication protocol, where the CAMAC controller assumes the MASTER function.

TABLE 1 Mod. C 117 B CAMAC FUNCTIONS	
F(0) N	Reads the data stored in the Mod. C 117 B DATA buffer. Q response until the buffer contains data.
F(8) N	Tests the LAM line. Q response if LAM is true.
F(9) N	Resets the Mod. C 117 B (clears buffer and LAM; disables the LAM line).
F(16) N	Stores the data into the Mod. C 117 B DATA buffer. Q response until the buffer is full (256 16-bit words).
F(17) N	Transfers data to the serial line.
F(24) N	Disables the LAM line.
F(26) N	Enables the LAM line.
C, Z	Same as F(9) N.

Via CAMAC functions, the C 117 B module (MASTER) transmits or receives data packs composed of subsequent 16-bit words to/from the addressed Mod. N 209 (SLAVE). Up to 256 words can be stored into the mod. C 117 B DATA buffer.

The MASTER-to-SLAVE data have to be written into the DATA buffer by performing subsequent F(16) N functions as follows:

TABLE 2 MASTER-to-SLAVE DATA COMPOSITION			
ORDER	CAMAC FUNCTION	W16 TO W1	MEANING
1	F(16) N	0000000000000001	HOST COMPUTER CONTROLLER IDENTIFIER CODE
2	F(16) N	xxxxxxxxxxxxxxxx	ADDRESS NUMBER OF THE MODULE TO BE ADDRESSED
3	F(16)N	xxxxxxxxxxxxxxxx	CODE OF THE OPERATION TO BE PERFORMED (see TABLE 3).
4	F(16) N	xxxxxxxxxxxxxxxx	EVENTUAL SET VALUE

TABLE 3 BINARY CODE OF THE OPERATION TO BE PERFORMED TO CONTROL THE MOD. N 209			
OPERATION CODE	HIGH BYTE	LOW BYTE	RESULT
0	00000000	00000000	READS THE MODULE'S NAME
1	00000000	00000001	READS THE DELAY SET ON CHANNEL 1
2	00000000	00000010	READS THE DELAY SET ON CHANNEL 2
3	00000000	00000011	READS THE DELAY SET ON CHANNEL 3
4	00000000	00000100	READS THE GATE SET ON CHANNEL 1
5	00000000	00000101	READS THE GATE SET ON CHANNEL 2
6	00000000	00000110	READS THE GATE SET ON CHANNEL 3
7	00000000	00000111	READS THE MODULE PARAMETERS IDENTIFIED BY CODES 1 TO 6 IN THAT ORDER.
8	00000000	00001000	PROGRAMS THE DELAY OF CHANNEL 1
9	00000000	00001001	PROGRAMS THE DELAY OF CHANNEL2
10	00000000	00001010	PROGRAMS THE DELAY OF CHANNEL 3
11	00000000	00001011	PROGRAMS THE GATE OF CHANNEL 1
12	00000000	00001100	PROGRAMS THE GATE OF CHANNEL 2
13	00000000	00001101	PROGRAMS THE GATE OF CHANNEL 3

After the required F(16)N functions have been performed, it is necessary to carry out an F(17) N function in order to transfer the stored data to the addressed module.

IMPORTANT NOTE:

For each operation to be performed (see TABLE 3) on the Mod. N 209 it is necessary, each time, to carry out the functions indicated in TABLE 2, in that order, and afterwards an F(17) N.

The answer data coming from the Mod. N 209 or Mod. C 117 B itself are automatically stored into the mod. C 117 B DATA buffer and are read-out in Q STOP mode through the functions F(0) N.

The first word of the answer data is shown in TABLE 4.

TABLE 4 WORD 1 CONTENT

HIGH BYTE	LOW BYTE	MEANING
00000000	00000000	Successful operation
11111111	00000000	BUSY module (it has tried to effect an operation while the module is still busy registering previous data inside the EEPROM).
11111111	00000001	Code not recognised or message incorrect.
11111111	11111101	No data to be transmitted.
11111111	11111110	The H.C. Controller identifier is incorrect.
11111111	11111111	The addressed module does not exist. This message is generated after a period of 500 ms.

In the case of a successful operation, the contents of the subsequent words are the functions of the command that has been sent.

3.2.1 PARAMETER SETTING and READING

SINGLE PARAMETER SETTING

Code 8 to 13	:	Word 4	must contain the binary data corresponding to the new delay (400 ns max.) or gate (from 5 ns to 33 ns).

In trying to programme a value outside the allowed limits the manual controller reacts by inserting the limit nearest to the digitised value.

SINGLE PARAMETER READING

Code 1 to 6	:	Word 2	contains the value of the requested parameter.

MULTIPLE PARAMETER READING

Code 0	:	Word 2 to Word 5	contains on the low byte the ASCII code of the string of characters identified by the name of the module "N 209".
Code 7	:	Word 2 to Word 7	contains the data relative to the corresponding parameter in the same order as command codes 1 to 6. The values are present in the receiving buffer in the same order.

3.2.2 OPERATIONS TO BE PERFORMED

1. Insert a Mod. C 117 B H.S. CAENET CAMAC Controller into a CAMAC slot.
2. Connect the C 117 B "SERIAL LINE" connector to the "SERIAL IN-OUT" input connector located on the front panel of the Mod. N 209.
3. Turn on CAMAC crate and Mod. N 209.
4. By performing the appropriate CAMAC functions, configure the Mod. N 209 as required.

3.3 USING THE H.S. CAENET VME CONTROLLER (Mod. V 288)

The Mod. N 209 can be controlled remotely via VME through the Mod. V 288 H.S. CAENET VME controller.

Standard VME cycles allow the user to perform the required control and setting operations on each Mod. N 209 in the network, according to the typical MASTER/SLAVE communication protocol, where the VME controller assumes the MASTER function.

The Mod. V 288 VME interface is provided with the following registers:

TABLE 5 Mod. V 288 REGISTERS

NAME	TYPE	ADDRESS	FUNCTION
DATA BUFFER	READ/WRITE register	Base Address + 00	DATA STORAGE
STATUS REGISTER	READ only register	Base Address + 02	AFTER A H.S. CAENET OPERATION HAS BEEN PERFORMED, THIS REGISTER INDICATES WHETHER THE OPERATION IS VALID OR NOT (FFFE = VALID OPERATION; FFFF = NO VALID OPERATION)
TRANSMISSION REG.	WRITE only register	Base Address + 04	BY WRITING INTO THIS REGISTER, THE DATA BUFFER CONTENT IS TRANSFERRED TO THE ADDRESSED SLAVE
RESET REGISTER	WRITE only register	Base Address + 06	MODULE'S RESET
INTERRUPT VECTOR REGISTER	WRITE only register	Base Address + 08	INTERUPT VECTOR PROGRAMMING

By WRITE/READ cycles, the Mod. V 288 (MASTER) transmits or receives data packs composed of subsequent 16-bit words to/from the addressed N 209 (SLAVE). Up to 256 words can be stored into the mod. V 288 DATA buffer.
The MASTER-to-SLAVE data have to be written into the DATA buffer by performing subsequent WRITE cycles as follows:

TABLE 6 MASTER-to-SLAVE DATA COMPOSITION

ORDER	OPERATION	ADDRESS	DATUM	MEANING
1	WRITE	Base address + 00	0000000000000001	HOST COMPUTER CONTROLLER IDENTIFIER CODE.
2	WRITE	Base address + 00	xxxxxxxxxxxxxxx	THE ADDRESS NUMBER OF THE MODULE TO BE ADDRESSED.
3	WRITE	Base address + 00	xxxxxxxxxxxxxxx	CODE OF THE OPERATION TO BE PERFORMED (see TABLE 3. par. 3.2)
4	WRITE	Base address + 00	xxxxxxxxxxxxxxx	EVENTUAL SET VALUE

As soon as the data pack has been stored in the DATA buffer, it can be transferred to the addressed module by performing a WRITE operation on the TRANSMISSION register.

IMPORTANT NOTE:

For each operation to be performed (see codes in TABLE 3 par. 3.2) on the Mod. N 209 it is necessary, each time, to carry out the WRITE cycles indicated in TABLE 6 in the same order and afterwards a WRITE operation on the TRANSMISSION register.

The answer data coming from the Mod. N 209 or Mod. V 288 itself are automatically stored into the mod. V 288 DATA buffer. As soon as the data pack is stored in this buffer, a VME interrupt (if enabled) is generated and then the data can be read.

The first word of the answer data is shown in TABLE 4 par. 3.2.

In the case of a successful operation, the contents of the subsequent words are the functions of the command that has been sent.

See par. 3.2.1 for Parameter Setting and Reading.

3.3.1. OPERATIONS TO BE PERFORMED

1. Insert a Mod. V 288 H.S. CAENET VME Controller into a VME slot.

Make sure that the V 288 base address is set as required.

2. Connect the Mod. V 288 "SERIAL LINE" connector to the "SERIAL IN-OUT" input connector located on the front panel of the Mod. N 209.

3. Turn ON VME crate and Mod. N 209.

4. By performing the appropriate VME WRITE/READ cycles, configure each Mod. N 209 as required.

3.4 USING THE H.S. CAENET PC CONTROLLER (Mod. A 303)

The Mod. N 209 can be controlled via an IBM PC (XT, AT or 80386) or compatible through the Mod. A 303 H.S. CAENET PC controller.

This is an interface board directly insertable into a std. I/O PC slot and is mapped in the MS-DOS I/O or memory address space. Thereby it is controllable by all the languages (high level or assembly) through the proper instructions, independently from the computer type (XT, AT or 80386 family).

Dip-switches located on the printed circuit board allow the user to set the unit according to the computer to be used.

The controller is composed of a collection of registers, managing the commands acknowledged by the unit, and two memory buffers arranged in FIFO logic 512 bytes deep (see TABLE 7).

TABLE 7 Mod. A 303 REGISTERS			
REGISTER/BUFFER	ADDRESS	OPERATION	DESCRIPTION
TX DATA BUFFER	Base address + 0	WRITE	FIFO Logic (512 byte max. depth)
START TX	Base address + 1	WRITE	Starts the transmission of the TX BUFFER data.
RESET CAENET INTERFACE	Base address + 3	WRITE	Clears TX and RX buffers and resets all the Interrupt signals.
RX DATA BUFFER	Base address + 0	READ	FIFO logic (512 byte max. depth)
STATUS REGISTER	Base address + 1	READ	8-bit register (see the STATUS REGISTER CONFIGURATION table)
STATUS REGISTER	Base address + 2	READ	Reads the STATUS REGISTER and resets a present interrupt.
CLEAR RX DATA	Base address + 3	READ	Reads and clears the RX buffer.

The two buffers are the TRANSMITTER (TX) data buffer and the RECEIVER (RX) one.

WRITE and READ operations allow the user to perform the required controls and settings on each Mod. N 209 in the network, according to the typical MASTER/SLAVE communication protocol, where the PC controller assumes the MASTER function.

By WRITE/READ operations, the Mod. A 303 (MASTER) transmits or receives data packs composed of subsequent 16-bit words to/from the addressed N 209 module (SLAVE). Up to 256 words can be stored into the mod. A 303 DATA buffers.

The MASTER-to-SLAVE data have to be written into the TX data buffer by performing subsequent WRITE operations as described in the table below:

TABLE 8 MASTER-to-SLAVE DATA COMPOSITION				
ORDER	OPERATION	ADDRESS	DATUM	MEANING
1	WRITE WRITE	Base address + 00 Base address + 00	Low Byte: 00000001 High Byte: 00000000	HOST COMPUTER CONTROLLER IDENTIFIER CODE.
2	WRITE WRITE	Base address + 00 Base address + 00	Low Byte: XXXXXXXX High Byte: 00000000	THE ADDRESS NUMBER OF THE MODULE TO BE ADDRESSED.
3	WRITE WRITE	Base address + 00 Base address + 00	Low Byte Oper. Code High Byte Oper. Code	CODE OF THE OPERATION TO BE PERFORMED (see TABLE 3. par. 3.2)
4	WRITE WRITE	Base address + 00 Base address + 00	Low Byte: XXXXXXXX High Byte: 00000000	EVENTUAL SET VALUE

As soon as the data pack has been stored in the TX DATA buffer, it can be transferred to the addressed module by performing a WRITE operation on the START TX register (base address + 1).

IMPORTANT NOTE:

For each operation to be performed (see codes in TABLE 3 par. 3.2) on the Mod. N 209 it is necessary to carry out the WRITE operations indicated in TABLE 8 in the same order and afterwards a WRITE operation on the START TX register.

The answer data coming from the Mod. N 209 is automatically collected into the RX DATA buffer. As soon as the data pack is stored in this buffer, the controller unit gives an interrupt (if enabled) to the CPU in the computer and then the data can be read.

The first word of the answer data is shown in TABLE 9.

TABLE 9 - WORD 1 CONTENT

HIGH BYTE	LOW BYTE	MEANING
00000000	00000000	Successful operation
11111111	00000000	BUSY module (it has tried to effect an operation while the module is still busy registering previous data inside the EEPROM).
11111111	00000001	Code not recognised or message incorrect.

NOTE: Any other error condition, which is not mentioned in the above table, must be controlled by the user.

In the case of a successful operation, the contents of the subsequent words are the functions of the command that has been sent.

See par. 3.2.1. for the Parameter Setting and Reading.

The STATUS REGISTER of the controller unit gives the current communication status as shown in TABLE 10.

TABLE 10 STATUS REGISTER CONFIGURATION		
BIT	BIT STATUS	MEANING
7	0	Transmission in progress
6	0	Reception in progress.
5	0	Transmission end. Interrupt generation.
4	0	TX FIFO empty.
3	0	RESTART in progress. In this status the module cannot accept commands.
2	0	Reception end. Interrupt generation.
1	0	The RX FIFO has been unloaded. Interrupt generation.
0	0	RX FIFO empty.

3.4.1 OPERATIONS TO BE PERFORMED

1. Set the H.S. CAENET PC Controller according to the computer type to be used, then insert it into an I/O slot.

2. Connect the Mod. A 303 output connector to the "SERIAL IN/OUT" input connector located front panel of the Mod. N 209.

3. Turn ON the computer and the Mod. N 209.

4. By performing the appropriate WRITE/READ operations, configure each Mod. N 209 as required.