

# **Technical Information Manual**

Revision n. 0

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**MOD. N405**  
*3 FOLD LOGIC*  
*UNIT/MAJORITY WITH*  
*VETO*

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.**

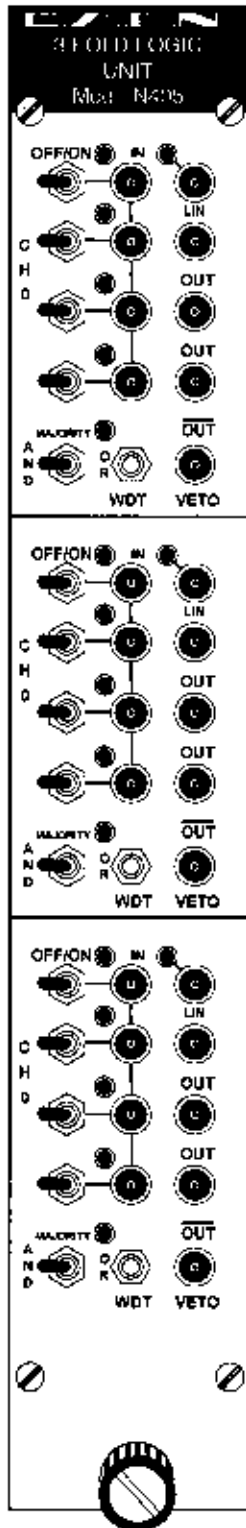


*CAEN reserves the right to change partially or entirely the contents of this Manual at any time and without giving any notice.*

### **Disposal of the Product**

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





**Mod. N405 Front Panel**

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# 1. DESCRIPTION

## 1.1 FUNCTIONAL DESCRIPTION

The CAEN Model N 405 3 FOLD LOGIC UNIT/MAJORITY with VETO is a single width NIM module equipped with three independent sections that can be used either as an AND/OR logic unit or a majority one. These two operating modes are selectable through an internal 4-jumper switch for each section.

When a section is set to operate in logic unit mode, the AND/OR function can be selected by setting the homonymous front panel switch to the appropriate position.

Each input can be enabled/disabled through the corresponding "ON/OFF" switch (ON=ENABLED; OFF=DISABLED). When only one input signal is enabled, the section acts as a logic FAN-OUT regardless of the AND/OR selected function.

When a section is set to operate in majority logic unit mode, the "ON/OFF" switches are not used for enabling or disabling the corresponding inputs but they allow the required coincidence level to be set. The "AND/OR" switch must be set to "AND" position. A yellow LED lights up signalling that the section operates as a majority logic unit.

Each section is provided with:

- four coincidence inputs ("IN" connectors);
- one VETO input ("VETO" connector);
- two normal shaped outputs ("OUT" connectors);
- one complementary shaped output (" $\overline{\text{OUT}}$ " connector);
- one auxillary output ("LIN" connector);
- an external screwdriver trimmer "WDT", which allows the shaped-outputs width to be adjusted in the ranges from 6 ns to 100 ns and from 20 ns to 800 ns according to the position of two internal jumpers.
- four 2-position lever switches "OFF/ON", which allow the coincidence inputs to be individually enabled/disabled;
- a 2-position lever switch "AND/OR", which allows the AND/OR logic to be selected;

The shaped outputs are non-retriggerable.

The "LIN" output width can be set to 3 ns (via internal jumper) independently from the input signal width. Both the input and output signals are Std. NIM level.

The functional block diagram of the N 405 is shown in Figure 1.

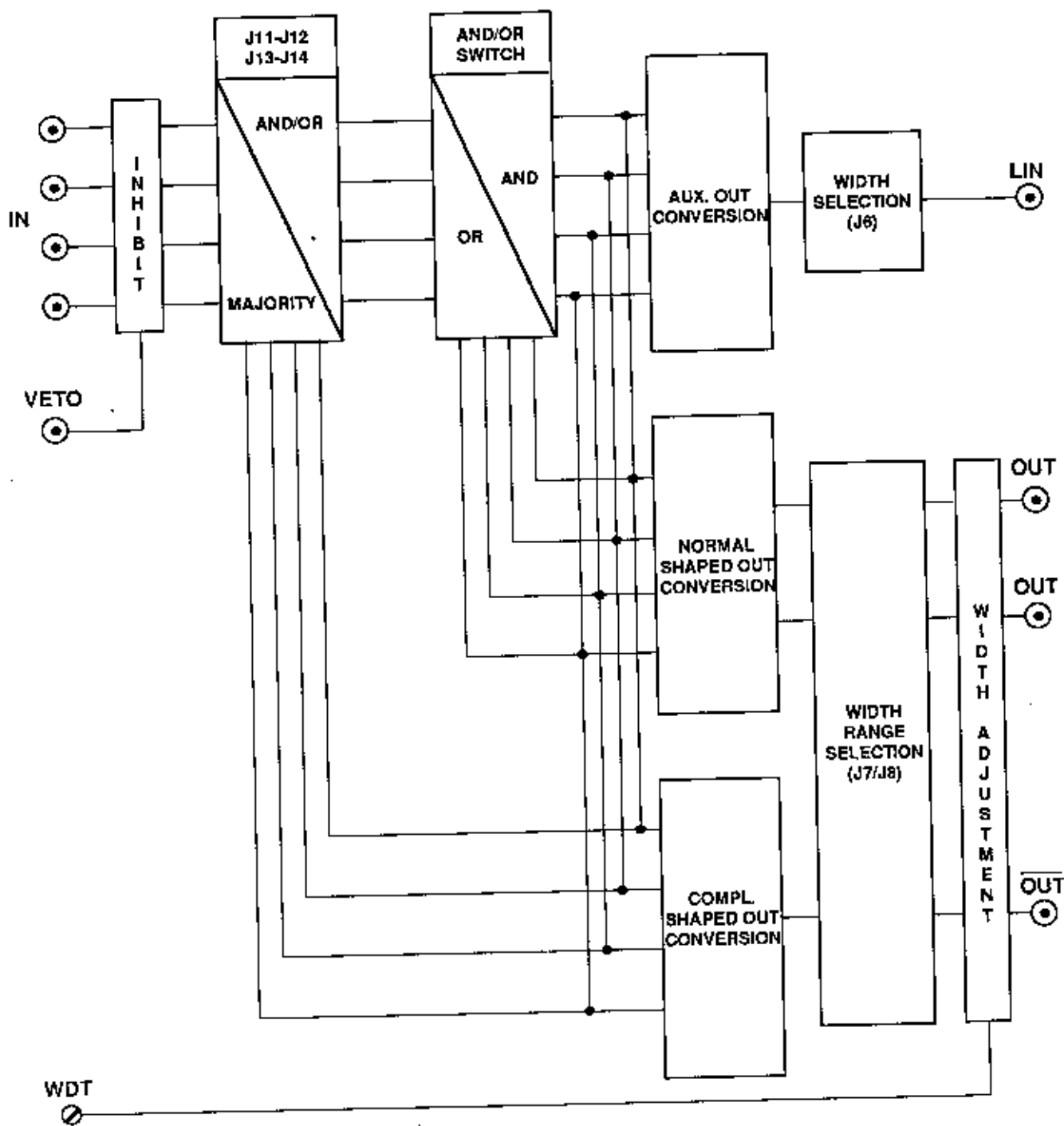


Figure 1 - Functional Block Diagram of the N 405 (One Section).

## **2. SPECIFICATIONS**

### **2.1 PACKAGING**

1-unit wide NIM module.

### **2.2 EXTERNAL COMPONENTS**

#### **CONNECTORS:**

- No. 12 LEMO 00 type "IN" (four per section). Coincidence input signal connectors.
- No. 3 LEMO 00 type "LIN" (one per section). Auxiliary output signal connectors.
- No. 6 LEMO 00 type "OUT" (two per section). Normal shaped output signal connectors.
- No. 3 LEMO 00 type " $\overline{\text{OUT}}$ " (one per section). Complementary shaped output signal connectors.
- No. 3 LEMO 00 type "VETO" (one per section). VETO input signal connectors.

#### **SWITCHES:**

- No. 12 two-position lever switches "OFF/ON" (four per section). Input channel enable/disable controls (logic unit mode) or coincidence level setting controls (majority unit mode).
- No. 3 two-position lever switches "AND/OR" (one per section). Function selection controls (in logic unit mode only. In majority mode the switches must be set to "AND" position.).

#### **DISPLAYS:**

- No. 12 green LEDs (four per section) signalling, when alight, that the corresponding inputs are enabled.
- No. 3 red LEDs (one per section) signalling, when alight, that the set input coincidence is true.
- No. 3 yellow LEDs (one per section) signalling, when alight, that the relevant section operates as a majority logic unit.

#### **TRIMMERS:**

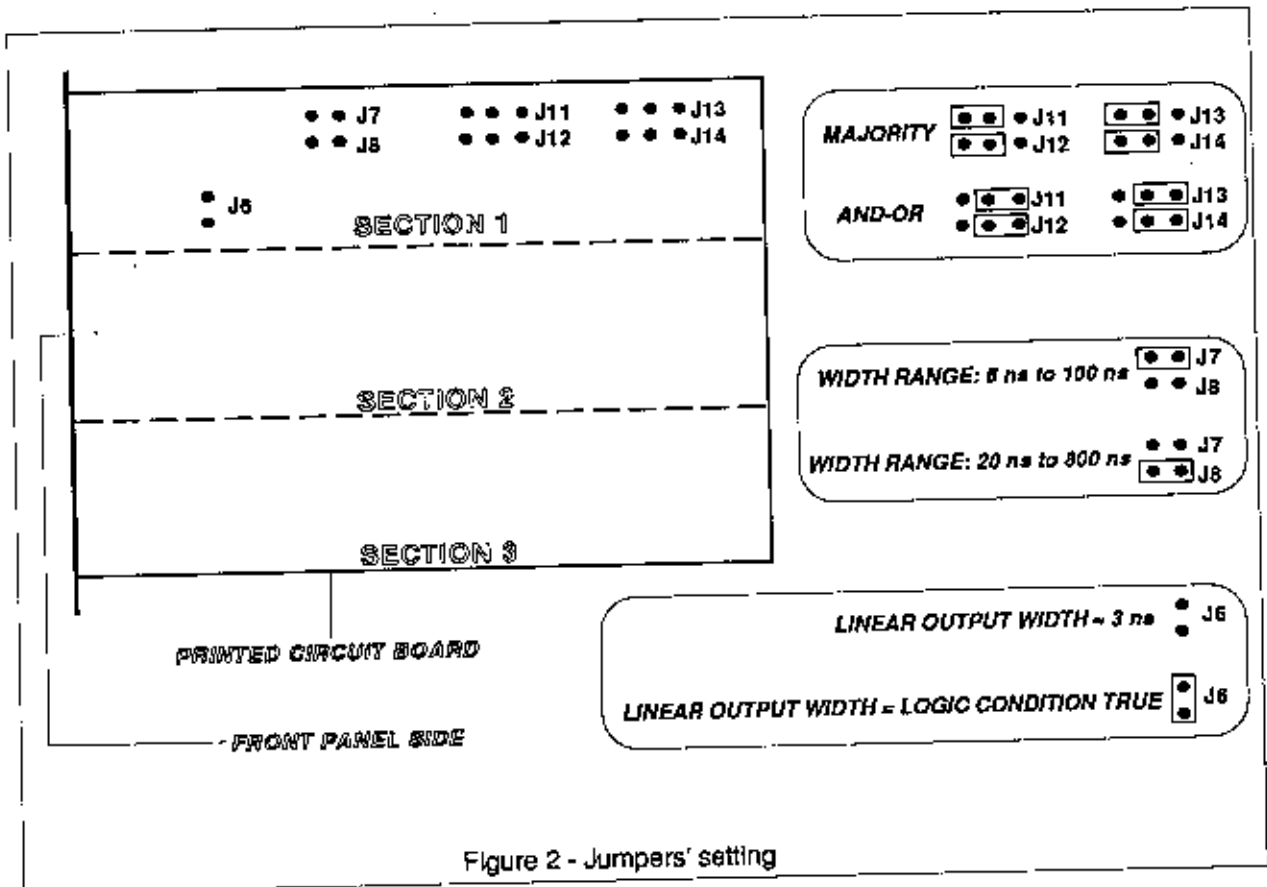
- No. 3 screwdriver trimmers "WDT" (one per channel). Width adjustment of normal and complementary shaped outputs.

### **2.3 INTERNAL COMPONENTS**

- No. 3 four-jumper switches "J11, J12, J13, J14" (one per section) for the section's operating mode selection (see figure 2).
- No. 3 jumper switches "J6" (one per section). If this jumper is open the "LIN" output width is

set to 3 ns, regardless of the input coincidence duration.

- No. 3 two-jumper switches "J7, J8" (one per section) dedicated to the selection of the width range of the shaped outputs (see figure 2).



## 2.4 CHARACTERISTICS OF THE SIGNALS

### INPUTS:

#### Coincidence inputs ("IN" connectors):

- Std. NIM level.
- Impedance: 50  $\Omega$ , DC-coupled.
- Reflection coefficient: less than 6% for Std. NIM inputs of 2 ns risetime.
- Minimum pulse width: 3.5 ns (FWHM).

#### VETO input:

- Std. NIM level.
- Impedance: 50  $\Omega$ , DC-coupled.



- Reflection coefficient: less than 6% for Std. NIM inputs of 2 ns risetime.
- Minimum width: 10 ns (FWHM). The VETO signal must precede the coincidence event by at least 3 ns.

#### OUTPUTS:

##### "OUT" and "OUT" outputs:

- Std. NIM level on 50  $\Omega$  impedance.
- Width ranges: 6 ns to 100 ns or 20 ns to 800 ns selectable via internal jumpers. Any value in each range can be set via front panel trimmer.
- Rise/Falltime: 2 ns (10% to 90%).
- Input/Output delay: 14 ns  $\pm$  2 ns.

##### "LIN" output:

- Std. NIM level on 50  $\Omega$  impedance.
- Width:
  - when the J6 internal jumper is inserted, the "LIN" output has the same width as the input coincidence duration;
  - when the J6 internal jumper is not inserted, the "LIN" output width is 3 ns.
- Rise/Falltime: 2 ns (10% to 90%).
- Input/Output delay: 12 ns  $\pm$  2 ns.

#### GENERAL:

##### AND/OR logic unit mode:

- Double pulse resolution (OR): 4.5 ns.
- Minimum coincidence overlap (AND): 3 ns.
- AND/OR function selectable via front panel switch for each section.
- Up to four inputs per section can be ANDed or ORred.
- Logic FAN-OUT when only one input is enabled.

MAJORITY logic unit mode:

INPUTS CONNECTED	FUNCTION	MAJORITY LEVEL
4 (A, B, C, D)	$A+B+C+D$	1
4 (A, B, C, D)	$A^*B+A^*C+A^*D+B^*C+C^*D+B^*D$	2
4 (A, B, C, D)	$A^*B^*C+B^*C^*D+A^*C^*D+B^*A^*D$	3
4 (A, B, C, D)	$A^*B^*C^*D$	4
3 (A, B, C)	$A+B+C$	1
3 (A, B, C)	$A^*B+C^*A+B^*C;$	2
3 (A, B, C)	$A^*B^*C$	3
2 (A, B)	$A+B$	1
2 (A, B)	$A^*B$	2
1 (A)	A	1

**2.5 POWER REQUIREMENTS**

+ 12 V	220 mA
- 12 V	140 mA
+ 6 V	350 mA
- 6 V	1000 mA

## 3. OPERATING MODES

### 3.1 GENERAL INFORMATION

The Model N 405 3 FOLD LOGIC UNIT/MAJORITY with VETO has three independent sections that can be used either as an AND/OR logic unit or as a majority one.

An internal 4-jumper switch per section (J11-J12-J13-J14) allows the user to select the required operating mode (refer to figure 2):

Each section can accept up to four input signals (Std. NIM level) through the "IN" connectors, and is provided with the following output channels:

- an auxiliary output ("LIN" connector). This output gives a Std. NIM level signal whose width equals the time in which the input signals of the relevant section satisfy the condition programmed via front panel switches. The lighting of the corresponding red LED signals that the set condition is TRUE.

*By removing the J6 jumper (located on the printed circuit board) the signal width is set to 3 ns.*

- two non-retriggerable normal shaped outputs ("OUT" connectors). Each output gives a Std. NIM level signal (whose width is settable in the selected range by the "WDT" front panel trimmer) whenever the programmed function of the relevant section is TRUE.
- a complementary non-retriggerable shaped output ("OUT" connector). Same as the normal shaped outputs, but with a complementary signal.

A VETO input signal (Std. NIM level) can be sent to the homonymous front panel connector of each section.

*To prevent the section from responding to inputs, the VETO signal must overlap the coincidence duration.*

When a module's section is set to operate as an AND/OR logic unit, the relevant "AND/OR" switch allows the user to select the function to be performed (AND or OR), and the "IN" switches permit the corresponding inputs to be enabled (ON position) or disabled (OFF position). When an input is enabled the corresponding red LED lights up (obviously, the relevant input signal must be present).

*When only one input signal is enabled, the section acts as a logic FAN-OUT regardless of the AND/OR selected function.*

When a module's section is set to operate as a majority logic unit (the relevant "AND/OR" switch has to be set to "AND" position) the "IN" switches allow the required coincidence level to be set (see par. 2.4 - MAJORITY logic unit mode). The relevant "MAJORITY" LED is ON.

### 3.2 OPERATIONS TO BE PERFORMED

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

1. By setting the relevant 4-jumper switch "J11, J12, J13, J14" and the "AND/OR" switch to the appropriate position, select the required operating mode for each module's section (refer to figure 2).
2. By inserting or removing the relevant "J6" jumper, set the "LIN" output width of each section (refer to figure 2).
3. By using the "J7" or "J8" jumper, select one of the two possible width ranges for each section (refer to figure 2).
4. Insert the N 405 module into the NIM crate.
5. According to the selected operating mode, set the "OFF/ON" and "AND/OR" front panel switches of each section to the appropriate position.
6. Connect the signal sources to the "IN" connectors of each module's section.
7. Connect the output connectors of each module's section to the detection devices to be used.
8. Turn all the equipment devices ON.

## 4. TEST PROCEDURE

### 4.1 INTRODUCTION

The operations to be performed to test the N 405 module are listed in the procedure below and have to be carried out according to their numerical sequence. None of the procedural step can be omitted. Each procedural step contains the operation to be performed and the corresponding effect or the verification to be accomplished.

### 4.2 NECESSARY INSTRUMENTS

- No. 1 Oscilloscope (300 MHz minimum band width).
- No. 1 Signal Generator capable of producing Std. NIM level signals.
- No. 1 NIM crate.

### 4.3 PROCEDURE

*The N 405 module comes from CAEN fully tested and calibrated. This procedure allows the user to accomplish a functional test of the module.*

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

1. On the module's printed circuit board, set the jumpers of each section in such a way that the following configuration is obtained (refer to figure 2.):
  - each module's section is set to operate as an AND/OR logic unit;
  - each output ("LIN" connectors) gives a 3 ns width Std. NIM level signal whenever the set logic function is TRUE;
  - the same width range is set for each section.
2. Insert the module into the crate.
3. Turn the crate ON.
4. For each module's section, set the "AND/OR" front panel switch to "OR" position and verify the set logic function for each possible combination of the input signals.

*The green LEDs correlated with the input channels light up whenever the corresponding input signal is enabled.*

*The red LED correlated with a section lights up whenever the set logic function is TRUE.*

5. For each module's section, set the "AND/OR" front panel switch to "AND" position and verify the set logic function for each possible combination of the input signals.
6. Remove the input signal connectors from the module and turn the crate OFF.
7. Remove the module from the crate.
8. On the module's printed circuit board, set the jumpers of each section in such a way that the following configuration is obtained (refer to figure 2.):
  - each module's section is set to operate as a majority logic unit;
  - each auxiliary output ("LIN" connectors) gives a Std. NIM level signal whenever the set logic function is TRUE.
9. Insert the module into the crate.
10. Turn the crate ON.
11. For each module's section, verify all the possible majority functions (see par. 2.4 - MAJORITY logic unit mode) by setting the "OFF/ON" switches corresponding to the connected input signals to "ON" position.

THE MODULE IS TESTED AND OPERATES CORRECTLY