



*Electronic Instrumentation for Nuclear,
Astroparticle Physics and Industrial Electronics.*

Time to amplitude converter.

Model **NCB238.**

WARRANTY

NAICAM S.R.L. warrants this product to be free from defects in material and workmanship for a period of 1 year from date of shipment from headquarter in Italy.

NAICAM SRL warrants the following items for one year from the date of shipment: probes, cables, and documentation of specified equipment.

During the warranty period, we will, at our option, either repair or replace any product that proves to be defective.

To exercise this warranty, write or call your local NAICAM SRL representative, or contact NAICAM SRL headquarters in Italy. You will be given prompt assistance and return instructions. Send the product, transportation prepaid, to the indicated service facility. Repairs will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period.

LIMITATION OF WARRANTY

This warranty does not apply to defects resulting from product modification without NAICAM SRL express written consent, or misuse of any product or part.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE. THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES.

NAICAM srl, NOR ANY OF ITS EMPLOYEES SHALL BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF ITS INSTRUMENTS AND SOFTWARE EVEN IF NAICAM SRL, HAS BEEN ADVISED IN ADVANCE OF THE POSSIBILITY OF SUCH DAMAGES. SUCH EXCLUDED DAMAGES SHALL INCLUDE, BUT ARE NOT LIMITED TO: COSTS OF REMOVAL AND INSTALLATION, LOSSES SUSTAINED AS THE RESULT OF INJURY TO ANY PERSON, OR DAMAGE TO PROPERTY.



1. GENERAL DESCRIPTION.....	5.
1.1 DESCRIPTION.....	5.
1.2 CIRCUIT LOGIC AND FUNCTIONAL BLOCK DIAGRAM.....	5.
1.3 PERFORMANCE	6.
2. TECHNICAL SPECIFICATIONS.....	7.
2.1 FRONT PANEL CONTROLS.....	7.
2.2 INPUT/OUTPUT CONNECTIONS AND SIGNAL CHARACTERISTIC.....	7.
2.3 OPERATING INSTRUCTIONS.....	9.
2.4 INTERNAL HARDWARE SETTINGS.....	14.
2.5 POWER REQUIREMENTS.....	15.
2.6. DIMENSION AND WEIGHT.....	16.

1. GENERAL DESCRIPTION.

1.1 DESCRIPTION.

The module NCB238 Time-to-amplitude converter (TAC) measures the time interval between start-stop pulses and generates an analog output pulse proportional to the measured time. The module has two switches: first determines the range and second multiplier factor. Total time measurement ranges can be set from 50 ns to 2 ms. Valid Start and Valid Conversion outputs are provided for each accepted start and stop inputs. The duration of the Start output indicates the interval from the accepted start until the end of reset.

1.2. CIRCUIT LOGIC AND FUNCTIONAL BLOCK DIAGRAM.

The Conversion of time to Amplitude has strong logic to avoid invalid conversion. The START and STOP inputs are disabled during conversion time to avoid a pileup. The input GATE open gate time for the start circuit and this input can be operated in an anticoincidence or a coincidence mode. Each time measurement is analog charging the high stability capacitance with current and is stored on the capacitance until a linear gate is opened by an internal strobe. The internal strobe can be obtained only from combination the START and the STOP input pulses.

To avoid wrong data acquisition there are two signal on the rear panel of the module: VAL.START and VAL.CONV. The VAL.START is present if present only START signal. If was both signals START and STOP, The VAL.CONV. signal is continued until the leading edge of a reset. The VAL.CONV. output present after internal conversion delay time and is continued until the leading edge of a reset.

If no stop input is accepted before an over-range condition is sensed, the measurement will be aborted and no output signals for the TAC will be generated.

The OUTPUT of Time to Amplitude Converter always is gated by strobe signal. The source of the strobe selected from the internal signal or from an external signal. Standard solution is internal strobe, the strobe occurs after a delay that has been adjusted by trimmer on the front panel. The output delay control can be set from 0.5 μ s to 5 μ s after the leading edge of the signal.

An external strobe can be used only in optional version of NCB238 module and this optional must be should be specified in order.

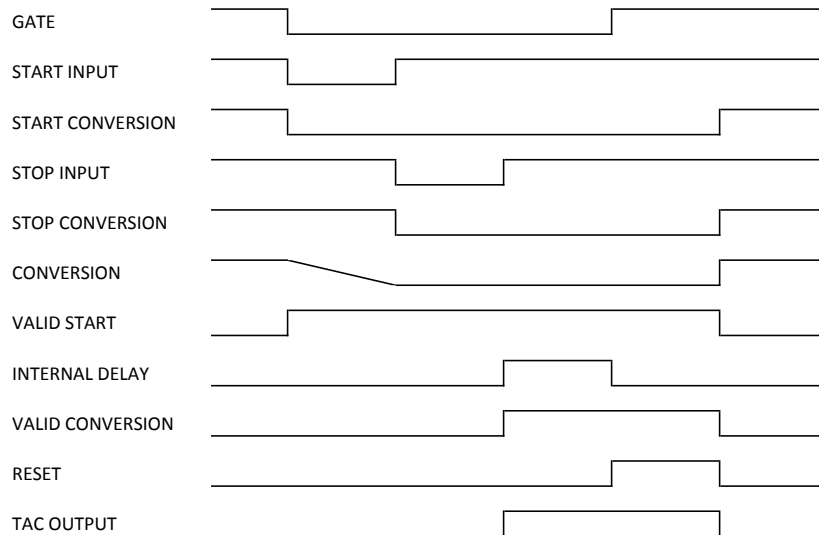


Figure 1. Time diagram of Time Amplitude conversion circuit

1.3. PERFORMANCE.

TIME RESOLUTION FWHM	$\leq 0.01\%$ of full scale plus 5 ps for all ranges.
TEMPERATURE INSTABILITY	$\leq \pm 0.01\%/^{\circ}\text{C}$ of full scale, in range 0 to 50°C .
DIFFERENTIAL NONLINEARITY	Typically, $< 1\%$ from 10 ns or 2% of full scale.
INTEGRAL NONLINEARITY	$\leq \pm 0.1\%$ from 10 ns or 2% of full scale.
MULTIPLIER RANGE	Fixed 1.0 μs for x1 and x10 Multipliers, fixed 5 μs for x100 Multiplier, and fixed 50 μs for x1K, and x10K Multipliers.
START-to-STOP CONVERSION TIME	Minimum ≤ 5 ns.
RESET CYCLE	Fixed 1.0 μs for X1 and X10 multipliers;

fixed 5 μ s for X100 multiplier; and fixed 50 μ s for X1k and X10k multipliers.

2. TECHNICAL SPECIFICATIONS.

2.1 FRONT PANEL CONTROLS

RANGE (ns)	Three-position rotary switch selects full-scale time interval of 50, 100, or 200 ns between START and STOP input signals.
MULTIPLIER	six-position rotary switch extends time range by a multiplying factor of 1, 10, 100, 1k, or 10k. last to position are equal and corresponds 10k.
DELAY (μ s)	10-turn screwdriver-adjustable potentiometer varies the delay of the TAC output from 0.5 μ s to 5 μ s.
GATE MODE	Two-position locking toggle switch selects Coincidence or Anticoincidence mode of operation for the Start circuit. To disable GATE input select switch GATE MODE to Anticoincidence.
STROBE MODE	(only in optional version) The Internal strobe generated after valid conversion. Two-position locking toggle switch selects either Internal or External source.

2.2. INPUT/OUTPUT CONNECTIONS AND SIGNAL CHARACTERISTIC

INPUTS:

GATE	Front panel BNC connector provides an external means of gating the start circuitry in either Coincidence or disabled state with the START input signal (Fig 4). Minimum time between edges GATE and START is 10 ns. Factory-set in accepting the NIM standard signals.
START	Front panel BNC connector initiates time conversion when Start input signal exceeds threshold (Fig 4). Factory-set in accepting the NIM standard signals.
STOP	Front panel BNC connector terminates time conversion when

Stop input signal exceeds threshold. (Fig 4). Factory-set in accepting the NIM standard signals.

STROBE

(only in optional version)

Front panel BNC connector provides an external strobe signal for output signal (Fig 4). Factory-set in accepting the NIM standard signals.

The GATE, START, STOP and STROBE input circuits accept positive or negative NIM-standard signals. Each of these input circuits is jumper selectable. Input impedance of 50 Ω for negative signals or >1 k Ω for positive signals is intended. The positive input circuits accept positive signal from 4 volt up to 10 Volt .

The polarity of inputs signals should be changed before installation in Bin crate. On the picture N1 the position of jumpers are shown.

The rise time of input signals has been less than 10 ns to reduce jitter effect of inputs signals.

FRONT PANEL OUTPUT**TAC OUTPUT**

Front panel BNC connector provides unipolar pulse.

Amplitude 0 V to +10 V (without termination) proportional to Start/Stop input time difference. The end of output signal corresponding reset time of conversion in Internal Strobe mode. The output can be terminated to 50 Ω .

Output signal width is adjustable by potentiometer on PCB from 1 μ s to 5 μ s.

Output impedance $Z_o = 100 \Omega$.

Rise Time 260 ns.

Fall Time 260 ns.

REAR PANEL OUTPUTS.**VAL.START TTL**

Rear panel BNC connector, Output signal is TTL standard signals that can be terminated to 50 Ω .

Rise /Fall Time 5 ns.

VAL.START NIM.

Rear panel BNC connector. Output signal is NIM standard signals.

Rise /Fall Time 2,5 ns.

VAL CONV TTL

Rear panel BNC connector, Output signal is TTL standard signals that can be terminated to 50 Ω . Time and Width from end of internal delay after STOP to end of reset.

Rise /Fall Time 5 ns.

VAL CONV NIM

Rear panel BNC connector. Output signal is NIM standard

signals. Time and Width from end of internal delay after STOP to end of reset.

Rise /Fall Time 2,5 ns.

Output signal NIM is intended NIM standard signals. This output has been terminated to 50 Ω .

Output signal TTL is intended TTL standard signals. This output can be terminated to 50 Ω .

2.3 OPERATING INSTRUCTIONS

TIME-TO-AMPLITUDE CONVERSION SCALE SET

There are two switches to set maximum conversion scale of NCB238 module: RANGE and MULTIPLIER.

RANGE control (ns) Three-position rotary switch selects full scale time interval of 50, 100, or 200 ns between accepted START and STOP input signals.

MULTIPLIER control is five-position rotary switch extends time range by a multiplying factor of 1, 10, 100, 1K, or 10K.

The RANGE (ns) and MULTIPLIER switches determine the full-scale conversion time. The combinations can be selected as follows table 1.

Table 1.

Switch Settings		Full-Scale Time Limit
Range (ns)	Multiplier	
50	X1	50 ns
100	X1	100ns
200	X1	200ns
50	X10	500ns
100	X10	1 μ s
200	X10	2 μ s
50	X100	5 μ s
100	X100	10 μ s
200	X100	20 μ s
50	X1K	50 μ s
100	X1K	100 μ s
200	X1K	200 μ s
50	X10K	200 μ s

100	X10K	1ms
200	X10K	2 ms

For example:

The Range switch set at 100 and the Multiplier switch at X10, the full-scale time range is 1 μ s. After the START signal any STOP input signal that arrive during 1 μ s time generate valid conversion signal.

OUTPUT WIDTH ADJUSTMENT

Potentiometer that is located on the PCB, adjusts the TAC output pulse width (Fig 5). The potentiometer value determines the output pulse width from 1 μ s to 5 μ s. The width can be adjusted to customer requirements; factory-set at 2 μ s.

OUTPUT DELAY ADJUSTMENT

Potentiometer that is located on the front panel, adjusts the TAC delay of VALID_CONVER (Fig 1). The potentiometer value determines the delay of VALID_CONVER pulse from 0,5 μ s to 2,5 μ s. The width can be adjusted to customer requirements; factory-set at 0,5 μ s.

OUTPUT OFFSET

Output offset voltage regulation potentiometer located on the PCB (Fig 5), adjusts the TAC output offset from -100 mV to +100 mV. To set right level output offset remove the START and STOP signals from the TAC input. Measure the offset voltage at the TAC output connector with a voltmeter. Adjust potentiometer until the offset voltage is 0 mV \pm 1 mV.

GATE MODE

Two-position locking toggle switch selects Coincidence or Anticoincidence mode of operation for the Start circuit. Coincidence mode means the GATE signal polarity must be standard NIM signal. Anticoincidence mode means the GATE signal is disabled.

STROBE MODE

(only in optional version).

This Switch permit select internal or external strobe of output signal.

If the EXT position is selected on the STROBE switch, the logic signal supplied by the user on the STROBE input will control the timing of the TAC output.

EASY TEST STARTE:

1. Set GATE MODE switch to anticoincidence position.

2. Set RANGE switch to 50 ns.
3. Set Multiplier switch to the 1.
4. Connect the NIM signal from FAN UNIT (for example NCB211) to START input.
5. Connect other the NIM signal from FAN UNIT to input switchable DELAY unit (for example NCB233).
6. Connect the signal from output DELAY unit to STOP input.
7. Connect TAC OUTPUT to scope input. Input impedance of scope 1 Mega Ω .
8. Set delay time about 20 ns and observe the output amplitude of the module NCB238. Output signal should be about at 2 μ s width and amplitude will be changed after changing delay time by DELAY unit. Note that the length of cable is significant parameters of this set up because of the delay 50 Ω . coaxial cable is 5 ns for one meter. The amplitude of signal must be proportional of time of delay switch about 200 mV for a 1 ns.

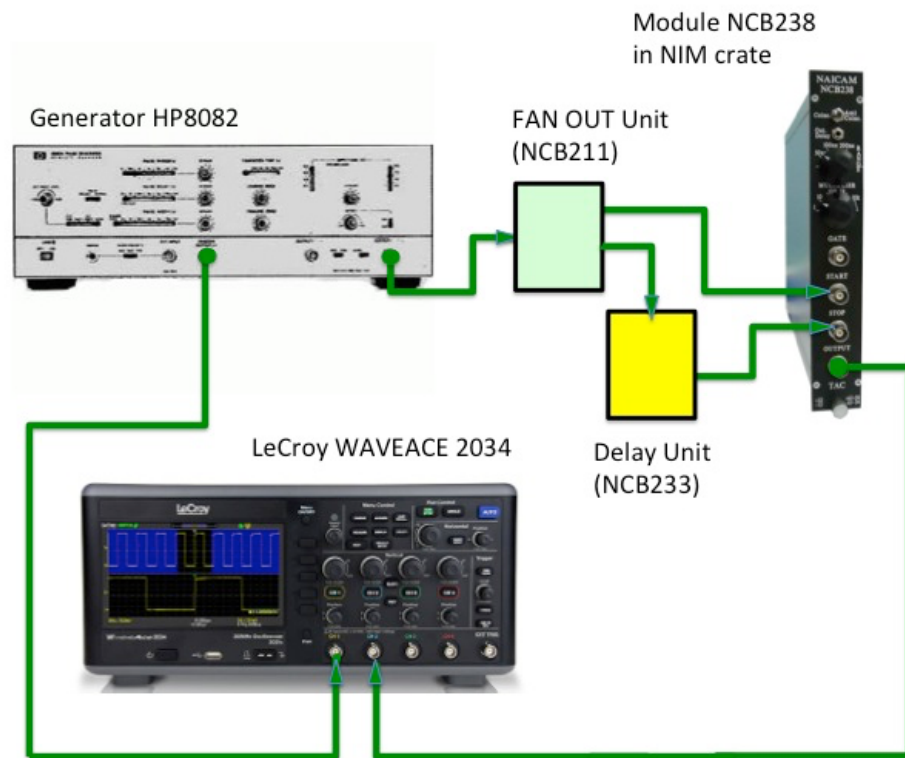


Figure 2. Easy Test block diagram.

All inputs signals in this test set up only NIM standard signals are used. Change the type of inputs signals is possible by changing jumper position (Fig.4).

SET UP EQUIPMENT

The module NCB238 can be used with different mode. Usually this module can be used for measurement Time of Fly (TOF) the particle between two detector (Fig.3). The following equipment's are recommended to build complete measurement chain. Obviously an equivalent unit may be substituted for any item in the list, providing that the function required for each specific application.

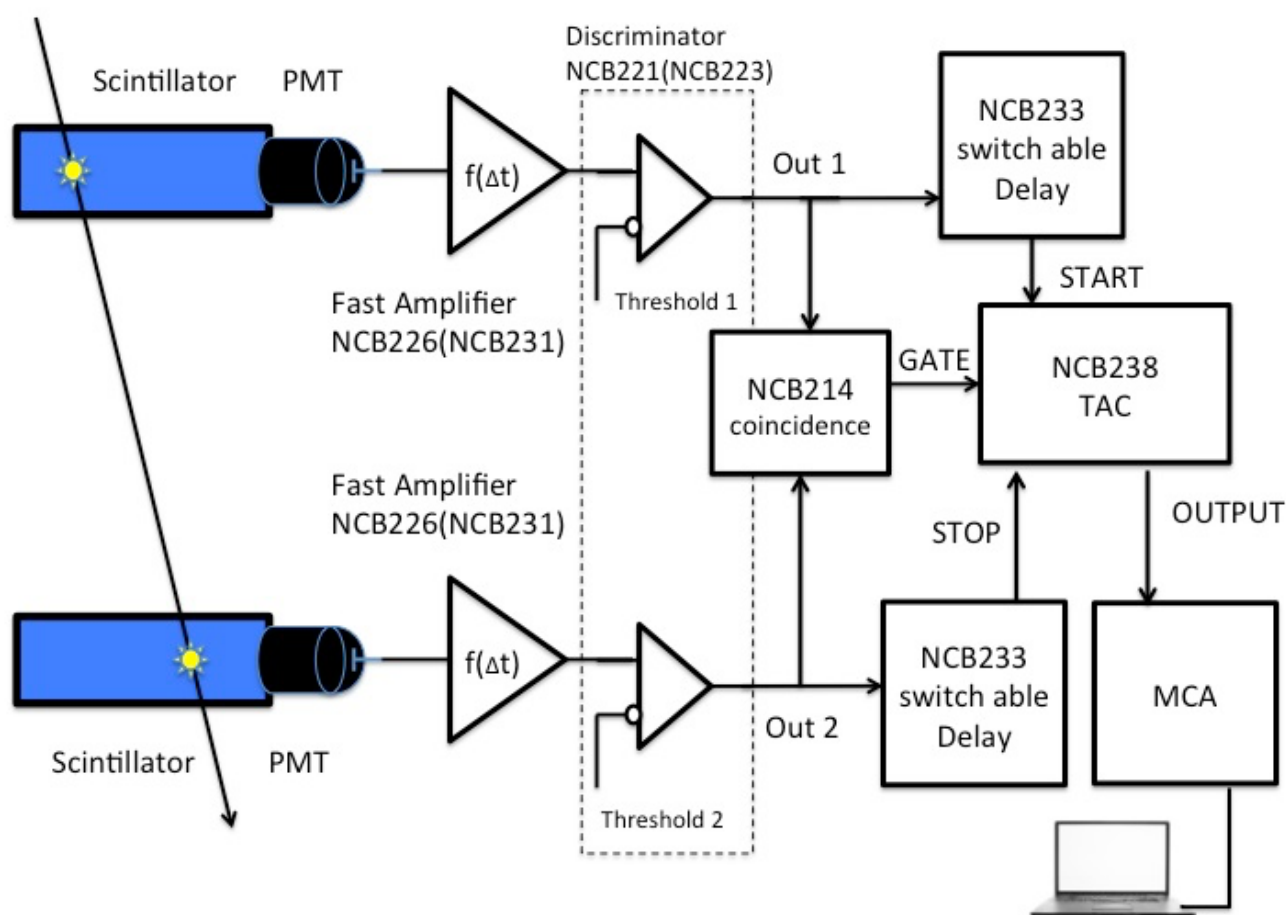


Figure 3. Using NCB238 for measurements Time of fly with two scintillators.

List of the equipment that can be used together NCB238 for Time measurement's:

1. NAICAM module NCB223 Discriminator.
2. NAICAM module NCB221 Leading edge Discriminator.

3. NAICAM module NCB237 Gate and Delay Generator
4. NAICAM module NCB233 Nanosecond Delay
5. Photomultiplier tube with scintillator.
6. MCA (Multichannel $\frac{[]}{SEP}$ Analyzer).
7. NAICAM module NCB211 NIM FANOUT.:
8. NAICAM module NCB214 Fast Coincidence.
9. NAICAM module NCB226 Fast Filter Amplifier.
10. NAICAM module NCB231 Quad Filter Amplifier.

2.4 INTERNAL HARDWARE SETTINGS

JUMPERS POSITIONS.

Positive or NIM logic can be selected for all inputs by jumpers on the top part of PCB. On the picture 3 shown the layout of PCB jumpers.

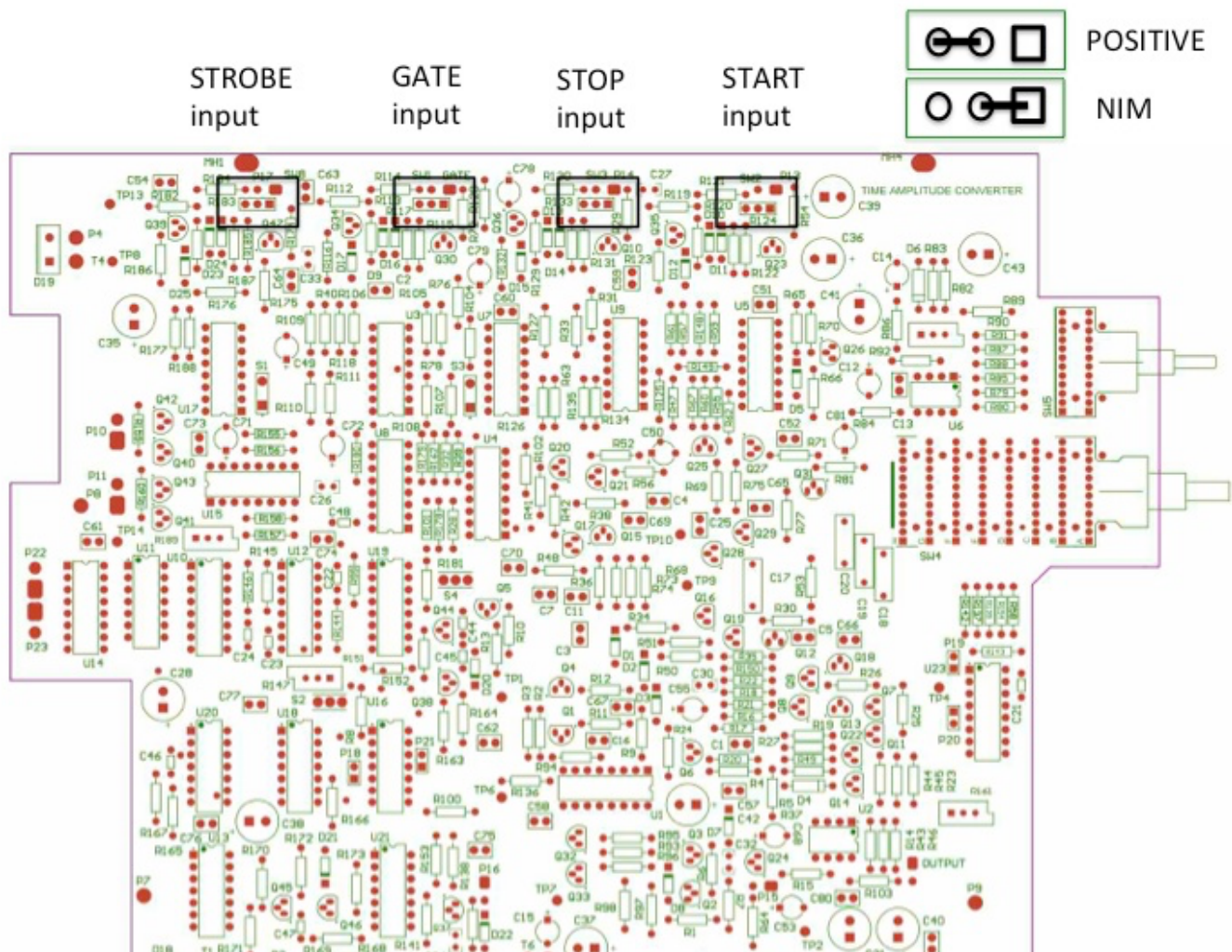


Figure 4. Jumpers positions on the Printed circuit board.

TRIMMER POSITIONS.

There are 3 trimmers on the board: fine gain conversion regulator, output width regulator and Output voltage offset trimmer.

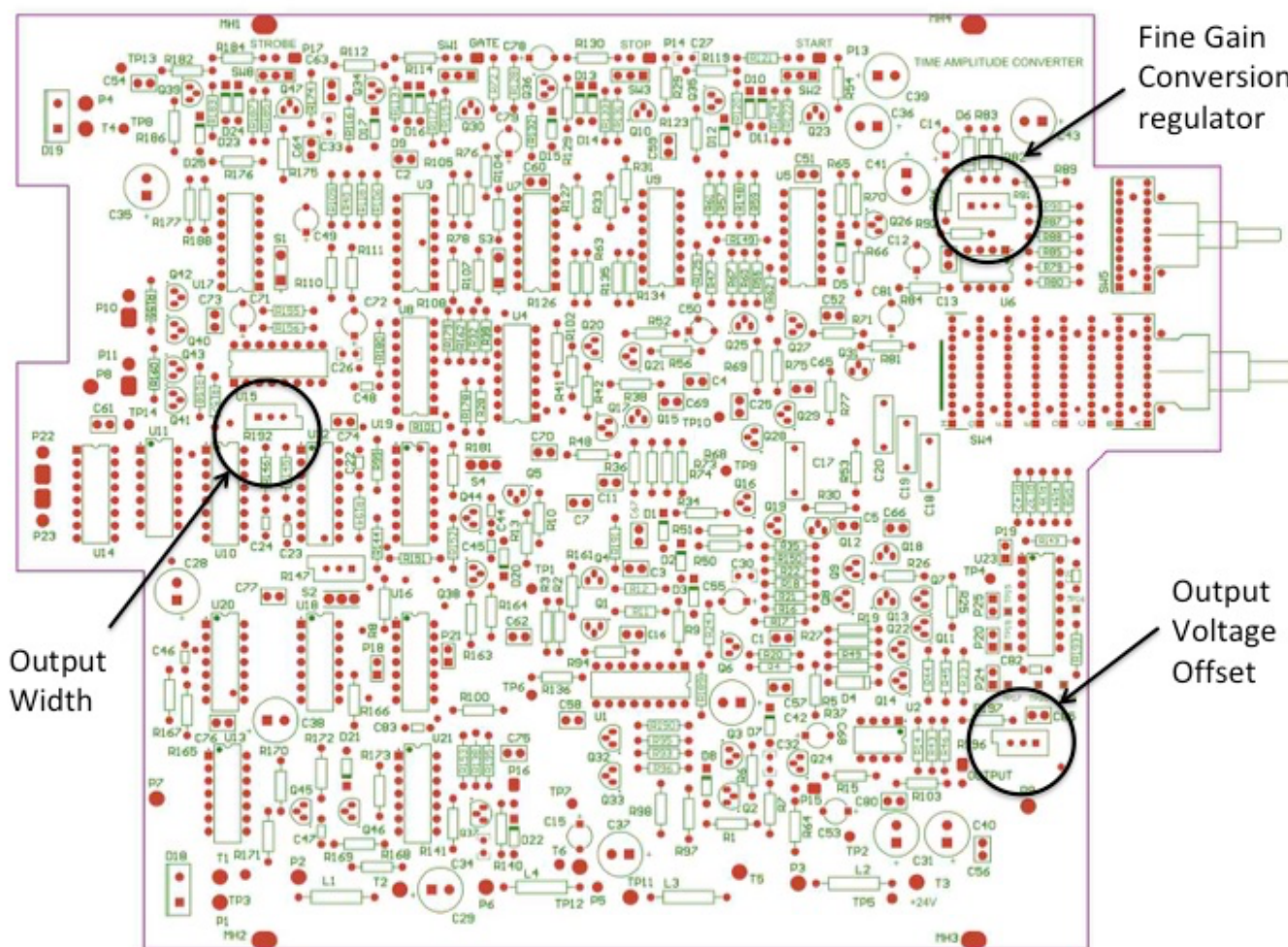


Figure 5. Trimmers positions on the Printed circuit board.

2.5 POWER REQUIREMENTS

The module NCB238 can be installed in NAICAM NC150W or NC305 Bin (or equivalent). It is very important prevent localized heating of the all circuits in the module. For safety reason always turn of the power supply before inserting or removing any modules.

The module use NIM standard power supply.

P. Voltage (V)	Current (mA)
+24	20
-24	37
+12	71
-12	102
+6	180
-6	443

NIM standard connector pin out.

PIN	Function	PIN	Function
1	+3 V	23	Reserved
2	- 3 V	24	Reserved
3	Spare bus	25	Reserved
4	Reserved bus	26	Spare
5	Coaxial	27	Spare
6	Coaxial	28	+24 V
7	Coaxial	29	- 24 V
8	200 V DC	30	Spare bus
9	Spare	31	Spare
10	+6 V	32	Spare
11	- 6 V	33	117 V AC
12	Reserved bus	34	Power return ground
13	Spare	35	Reset (Scaler)
14	Spare	36	Gate
15	Reserved	37	Reset (Auxiliary)
16	+12 V	38	Coaxial
17	- 12 V	39	Coaxial
18	Spare bus	40	Coaxial
19	Reserved bus	41	117 V AC (neutral)
20	Spare	42	High-quality ground
21	Spare	G	Ground guide pin
22	Reserved		

2.6 DIMENSION AND WEIGHT

DIMENSIONS NIM-standard single-width
module 3.43 X 22.13 cm per DOE/ER-0457T.

WEIGHT
Net 0,91 kg.

For More information on NAICAM products and applications contact your local NAICAM representative:

Europe: NAICAM s.r.l., Via Aosta 14, Padua, 35142, Italy.
Telephone: +39.049.2050437. Fax: +39.049.2050437
E-mail: info@naicam-tech.com.
Website: www.naicam-tech.com.