Model CO4020
Quad 4-Input Logic Unit
Operating and Service Manual

Advanced Measurement Technology, Inc.
a/k/a/ ORTEC®, a subsidiary of AMETEK®, Inc.

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Quality Control
Before being approved for shipment, each ORTEC instrument must pass a stringent set of quality control tests designed to expose any flaws in materials or workmanship. Permanent records of these tests are maintained for use in warranty repair and as a source of statistical information for design improvements.

Repair Service
If it becomes necessary to return this instrument for repair, it is essential that Customer Services be contacted in advance of its return so that a Return Authorization Number can be assigned to the unit. Also, ORTEC must be informed, either in writing, by telephone [(865) 482-4411] or by facsimile transmission [(865) 483-2133], of the nature of the fault of the instrument being returned and of the model, serial, and revision ("Rev" on rear panel) numbers. Failure to do so may cause unnecessary delays in getting the unit repaired. The ORTEC standard procedure requires that instruments returned for repair pass the same quality control tests that are used for new-production instruments. Instruments that are returned should be packed so that they will withstand normal transit handling and must be shipped PREPAID via Air Parcel Post or United Parcel Service to the designated ORTEC repair center. The address label and the package should include the Return Authorization Number assigned. Instruments being returned that are damaged in transit due to inadequate packing will be repaired at the sender's expense, and it will be the sender's responsibility to make claim with the shipper. Instruments not in warranty should follow the same procedure and ORTEC will provide a quotation.
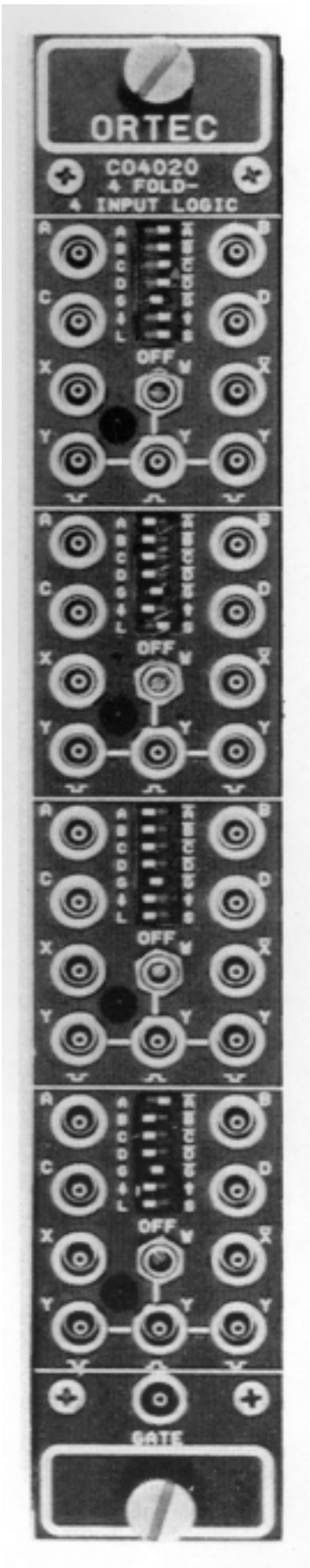
Damage in Transit
Shipments should be examined immediately upon receipt for evidence of external or concealed damage. The carrier making delivery should be notified immediately of any such damage, since the carrier is normally liable for damage in shipment. Packing materials, waybills, and other such documentation should be preserved in order to establish claims. After such notification to the carrier, please notify ORTEC of the circumstances so that assistance can be provided in making damage claims and in providing replacement equipment, if necessary.

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1. DESCRIPTION

The ORTEC Model CO4020 Quad 4-Input Logic Unit has the flexibility to satisfy the logic requirements of most coincidence experiments without additional logic modules. The logic functions it can perform are: coincidence (AND), anti-coincidence (veto), fan-in (OR), fan-out, fast negative NIM-to-TTL conversion, and pulse lengthening. The Model CO4020 contains four identical, independent channels of 4-input logic in a single-width NIM module.

Each of the four inputs (A, B, C, and D) accepts NIM fast negative logic pulses. Front-panel, three-position slide switches select the logic requirements separately for each input. The various combinations of logic functions that can be implemented are illustrated in Fig. 1 and in the specifications for the control switches.

The X output is a NIM fast negative logic pulse whose width is determined by the width and overlap of the active input pulses. The complement of the X output is available at the $\bar{X}$ output. The updating Y outputs can be set to trigger on either the leading edge or the trailing edge of the X output pulse. The width of the Y outputs can be adjusted from 40 ns to 40 μs in two selectable ranges. Two of the Y outputs provide NIM fast negative logic pulses. The third Y output delivers a positive TTL logic pulse that is suitable for gating ADCs and multichannel analyzers. Front-panel LEDs indicate which channel is generating an output.
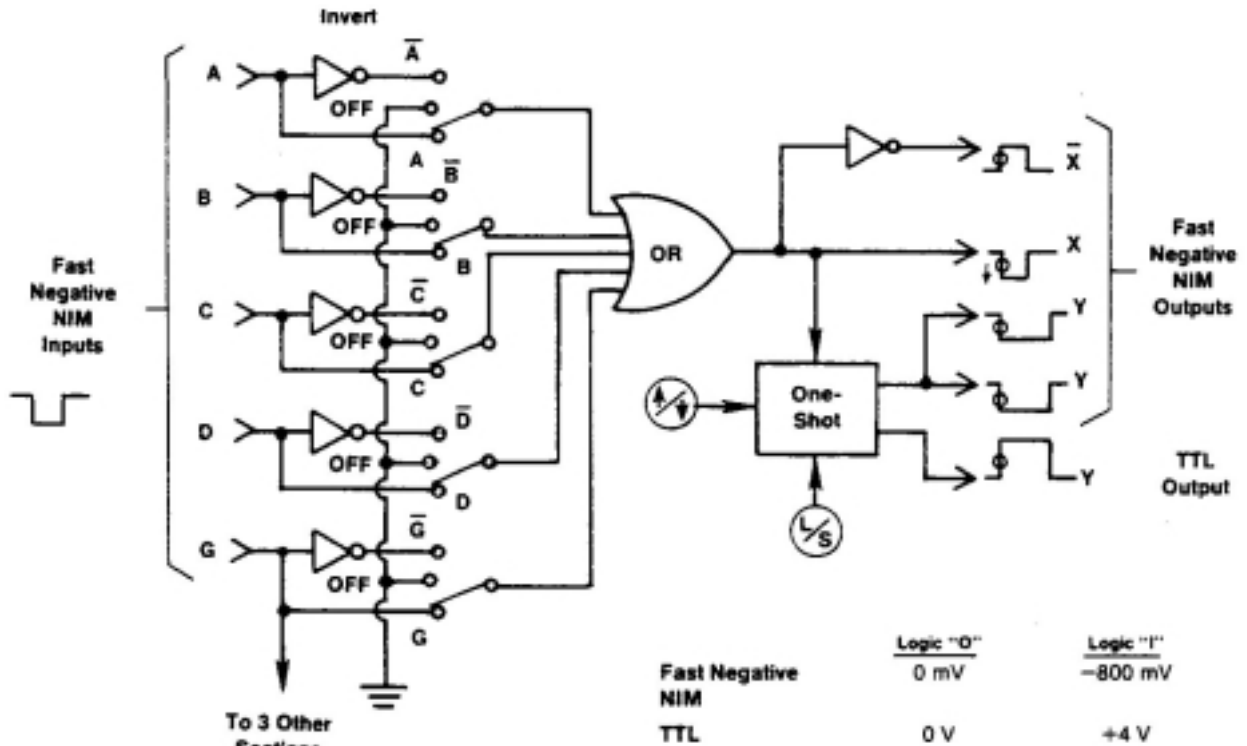

Fig. 1. Block Diagram of the CO4020 Quad 4-Input Logic Unit.

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2. SPECIFICATIONS

The Model CO4020 incorporates four separate channels with identical functions. The specifications apply to each of the four channels unless stated otherwise.

2.1. Performance

NUMBER OF IDENTICAL CHANNELS   4.

MAXIMUM COUNT RATE
X and $\bar{X}$ Outputs   100 MHz.
Y Outputs   1/(1.1 × width).

MINIMUM PULSE OVERLAP   3 ns.

PROPAGATION DELAY
Input to X, $\bar{X}$ <8 ns.
Input to Y (Neg)   <13 ns.
Input to Y (Pos)   <20 ns.

DEAD TIME OF Y OUTPUTS   110% of width setting.

2.2. Controls and Indicators

WIDTH ADJUST (W)   Front-panel screwdriver adjustment allows width adjustment of Y outputs. Two ranges can be selected by the front-panel slide switch:

$$S \ (40-1200 \text{ ns}) \text{ or } L(1-40 \text{ } \mu\text{s}).$$

LED INDICATOR   Front-panel, red LED lights when output has been activated.

CONTROL SWITCHES Front-panel, 7- by 3-position slide switch selects logic function definition, gate operation, Y output trigger point, and Y output width adjustment range as follows:

Input Logic Switches (A/OFF/$\bar{A}$, B/OFF/$\bar{B}$, C/OFF/$\bar{C}$, D/OFF/$\bar{D}$, and G/OFF/$\bar{G}$) As defined in Fig. 1, these switches select variations of the following basic logic functions. In the OFF position, the state of that input is ignored. With switches set to the A, B, C, D, and G positions, the module performs the OR function at the X output.

$$X \ = \ A \ + \ B \ + \ C \ + \ D \ + \ G$$

Setting the switches to the $\bar{A}$, $\bar{B}$, $\bar{C}$, $\bar{D}$, and $\bar{G}$ positions provides the AND (coincidence) function at the $\bar{X}$ output.

$$\bar{X} \ = \ A \cdot B \cdot C \cdot D \cdot G$$

Changing the $\bar{G}$ switch to G implements the common-gate veto (anticoincidence).

$$\bar{X} \ = \ A \cdot B \cdot C \cdot D \cdot \bar{G}$$

See Fig. 1 to determine other possible logic combinations.

Trigger Switch for Y Outputs (↓ or ↑)   Allows either the negative transition (↓) or the positive transition (↑) of the X output to trigger the constant-width Y outputs.

Y Output Width Range Switch   Sets either to L (1-40 μs) or S (40-1200 ns).

2.3. Inputs

A, B, C, AND D INPUTS   Front-panel LEMO connectors accept negative fast-NIM logic signals.
Minimum Amplitude   -600 mV.
Minimum Width   3 ns.
Input Impedance   50Ω.

GATE INPUT (G)   Front-panel LEMO connector accepts negative Fast-NIM logic signals. The GATE input is delivered to all four sections.
Minimum Amplitude   -600 mV.
Minimum Width   3 ns.
Input Impedance   50Ω.

2.4. Outputs

X AND $\bar{X}$ OUTPUTS   Front-panel LEMO connectors provide the noninverted (X) and the inverted ($\bar{X}$) result of the logic satisfied by the input signals. Logic requirements are set by the front-panel slide switches A/OFF/$\bar{A}$, B/OFF/$\bar{B}$,C/OFF/$\bar{C}$, D/OFF/$\bar{D}$, and G/OFF/$\bar{G}$ X and $\bar{X}$ are Fast-NIM logic signals.
Amplitude   -20 mA.
Rise Time   <4 ns.
Output Width   Determined by duration of input signals and logic selection.

Y OUTPUTS (⊓ AND ⊔) Front-panel LEMO connectors provide two updating Fast-NIM logic outputs (⊔) and one updating positive TTL logic output (⊓) per channel. Output width of all three Y outputs is set by WIDTH adjustment. Y outputs are triggered by either the negative transition (↓) or positive transition (↑) of the X overlap output as selected by the front-panel slide switch.

2.5. Electrical and Mechanical

POWER REQUIRED The Model CO4020 derives its power from a standard NIM bin and power supply. The required power is +6 V, 200 mA; −6 V, 1000 mA.

WEIGHT
Net 1.3 kg (2.3 lb).
Shipping 2.2 kg (4.8 lb).

3. INSTALLATION

After carefully unpacking the Model CO4020, thoroughly inspect it for evidence of damage in shipment. If it has been damaged, refer to the Warranty section for further instructions.

The Model CO4020 operates on power from a NIM Bin/ Power Supply such as the ORTEC 4001/4002E. **Always turn off the power to the power supply before inserting or removing the module.** After all modules have been installed in the Bin, check the dc voltage levels from the power supply to ensure that no overload exists.

The Bin and Power Supply is designed for relay rack mounting. If the equipment is rack mounted, be sure that adequate ventilation is provided to prevent any localized heating of components used in the Model CO4020. The temperature should not exceed 50°C.

4. OPERATING INSTRUCTIONS

The ORTEC Model CO4020 is a Quad 4-Input Logic that can be used for coincidence, anticoincidence, fanout, and to convert from a NIM-standard fast negative logic signal to a positive TTL signal. The four channels are identical, and the logic functions for each channel can be independently selected by the programming switches provided on the front panel in the form of a 7-section, 3-position, miniature slide switch. See Fig. 1 for logic function details.

4.1. Coincidence Mode ("AND" Function)

For coincidence mode operation, the slide switches corresponding to the inputs that must be in coincidence must be placed to the "overlined" position (i.e., $\bar{A}$, $\bar{B}$, $\bar{C}$, $\bar{D}$, or $\bar{G}$), and the overlap output signal taken from the $\bar{X}$ output LEMO. Switches for unused inputs must be placed in the "OFF" position. If an anticoincidence condition is required for an input, place the switch for that particular input to the position which is not overlined (i.e., A, B, C, D, or G). For example, if an output is desired when a signal is present on inputs A and B and C, and no signal on D,

the switches must be set to $\bar{A}$, $\bar{B}$, $\bar{C}$, and D. All outputs can be gated by a NIM-standard fast negative logic signal applied to the common "Gate" input. The effects of the Gate input can be independently set for each channel by selecting the anti-coincidence, OFF, or coincidence position for the G/OFF/$\bar{G}$ switch. The output signal must be taken from the $\bar{X}$ output if a NIM-standard fast negative signal is needed. If any switch is set to the "overlined" position, the output becomes the "AND" logic function of the inputs, and the $\bar{X}$ output must be used. When placed in the OFF position, switches representing the inputs disable the respective inputs so that they have no effect on the output signal.

4.2. "OR" Function

When an "OR" function is needed, the switches representing the active inputs must be placed in the non-overlined position (A, B, C, D, and G) or to the OFF position if not used. The output signal must be taken from the "X" output LEMO.

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4.3. Outputs

In addition to the overlap outputs (X), there are three outputs (Y) for each channel. Two are NIM-standard fast negative outputs (⊔), and one is a positive TTL output (⊓). The width of the "Y" output pulse is independently adjustable for each channel. The outputs may be triggered on the leading or trailing edge of the "X" output. The active trigger edge is selected by the ↑ /OFF/↓ slide switch. Since the polarity of the "X" output changes depending on the mode selected for the logic, the polarity of the leading and trailing trigger will also change. When operating in the coincidence (AND) mode, the polarity of the leading edge will be positive, but when operating in the OR mode, the polarity of the leading edge will become negative. The "OFF" position is equivalent to the positive going edge.

The width of the "Y" outputs is adjustable by a front-panel potentiometer (W) in two ranges selected by the L/OFF/S slide switch. In the "S" position the width is adjustable from 40 to 1000 ns. In the "L" position the width is adjustable from 1 to 40 μs. The "OFF" position is equivalent to the "S" range.

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BIN/MODULE CONNECTOR PIN ASSIGNMENTS
FOR STANDARD NUCLEAR INSTRUMENT
MODULES PER DOE/ER-0457T

Pin	Function	Pin	Function
1	+3 volts	23	Reserved
2	-3 volts	24	Reserved
3	Spare Bus	25	Reserved
4	Reserved Bus	26	Spare
5	Coaxial	27	Spare
6	Coaxial	28*	+24 volts
7	Coaxial	29*	-24 volts
8	200 volts dc	30	Spare Bus
9	Spare	31	Spare
10*	+6 volts	32	Spare
11*	-6 volts	33*	117 volts ac (Hot)
12	Reserved Bus	34*	Power Return Ground
13	Spare	35	Reset (Scaler)
14	Spare	36	Gate
15	Reserved	37	Reset (Auxiliary)
16*	+12 volts	38	Coaxial
17*	-12 volts	39	Coaxial
18	Spare Bus	40	Coaxial
19	Reserved Bus	41*	117 volts ac (Neut.)
20	Spare	42*	High Quality Ground
21	Spare	G	Ground Guide Pin
22	Reserved		

Pins marked (*) are installed and wired in ORTEC's 4001A and 4001C Modular System Bins.