fischertechnik h4 AN

AND-NAND

Electronic-Module
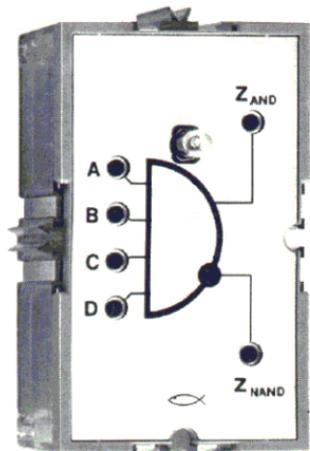
Technical Data:

Rated Operating Voltage	9 Volt DC $\pm 20\%$
Signal Voltage (nominal)	0-Signal: $\geq 3V$ 1-Signal: $\leq 2V$
Max. Load capacity of the Outputs	20mA
Signal Lamp	6V, 20mA
Current Consumption (nominal) $Z_{AND} = $ "1" $Z_{AND} = $ "0"	 $\approx 27mA$ $\approx 21mA$
Signal Transition from "0" to "1" Time from "1" to "0"	$\approx 35\mu s$ $\approx 5\mu s$
Max. Input Frequency	$\approx 15kHz$

With this block a maximum of 4 electronic modules can be used as inputs, e.g. Building blocks with connected photo-resistors, mono-flops or flip-flops, to a new input signal.

Before starting, please carefully insert one of the two signal lamps supplied into the socket. The AND-NAND module is automatically connected to power by attaching the module to a rectifier or other module and inserting the enclosed red connector.

Note: because the maximum permissible output current is 20mA, all fischertechnik electronics modules can be controlled with the AND-NAND module, but lamps, motors and similar devices cannot be connected directly, but only by using the relay module.

The operation of the AND-NAND module is best understood by means of a simple test. The following signal definitions apply to the entire fischertechnik electronics system:

0-Signal	The corresponding socket carries the Voltage $V \geq 3V$
1-Signal	The corresponding socket carries the Voltage $V \leq 2V$
dynamic 1-Signal	Signal change from "0" to "1", e.g. Switching from "+" to "−" ("0"-"1" transition)

Under no circumstances should the 0-signal be confused with a missing signal (= input terminal not connected).

The AND-NAND module has 2 outputs Z_{AND} and Z_{NAND}. Output Z_{NAND} is the inverse of Z_{AND}. This output therefore provides the opposite signal to Z_{AND}.

The signal lamp indicates the state of the output Z_{AND}. It lights up when $Z_{AND} = 1$ and it goes out when $Z_{AND} = 0$.

The AND-NAND module has 4 inputs: A-B-C-D. The AND condition requires the 1-signal to appear at the output Z_{AND} if a 1-signal is present at **all** of the inputs: A-B-C-D. This condition is then fulfilled, and the lamp is lit, when all inputs are connected to "−". A 1-signal is then present at all inputs.

Conversely, the signal lamp must go out and a 0-signal is produced at the output Z_{AND}, even if only one of the 4 inputs is connected with "+", that is, a 0-signal is present.

Note: When an input is not used, it is as if a 1-signal is present on it. This has the advantage that the module works correctly with only 2 or 3 inputs used, without the need to make connections to the unused inputs.

If less than 4 inputs are required for a control circuit, only the required ones are connected. A non-connected input acts as if it had a 1-signal. This allows you to use this module as a universal AND-NAND circuit with 2 to 4 inputs.

Perhaps you will notice that the signal light is lit when input A **and** input B **and** input C **and** input D are connected with "−" or are not connected. It does not light up if at least one input is connected with "+" (a 0-signal).

Further explanations and suggestions for model building can be found in the hobby experiment and model book, volume 4-4.