

Exercise nr 34

ARITHMETIC-LOGIC UNIT (ALU)

Goals:

ALU does math and logic calculations on numbers and is an important part of a computer. The 74181 is an example of a 4-bit ALU in which the control lines select the operation to be performed on the inputs. The goal of this exercise is to investigate simple 4-bit Arithmetic-Logic Unit 74181 with the aid of the trainer board UNILOG-2. The other goal is to learn how the ALU functions.

1 Experiment

1.1 Using Light emitting diode (LED + resistor) check the logic states generated by the switches of the trainer board UNILOG-2.

1.2 Utilizing the facilities of the trainer board UNILOG-2 check the operation of IC 74181 module referencing to the functions given in table 1. The inputs: A(3 down to 0), B(3 down to 0) and C_o of the 74181 ALU connect to the stable switches. Outputs: F(3 down to 0), A = B and C4 connect to LED indicators.

1.3 Design and draw the connections between two 74181 IC's to get cascaded 74181 8-bit ALU.

2 Background

2.1 Logic gates and arithmetic/logic functions.

2.2 Coders, decoders, registers.

2.3 IC 74181 and other types of ALU.

2.4 Flags (Carry, zero...).

Literature

[1] W. Krasiński *Doświadczenia z podstaw techniki cyfrowej.*

[2] A. Niederliński *Mikroprocesory, mikrokomputery, mikrosystemy.*

[3] J. Pieńkos, J. Turczyński *Układy scalone TTL w systemach cyfrowych.*

[4] P. Horowitz, W. Hill, *The Art of Electronics.*

[4] Głocki W. Grabowski L. *Pracownia podstaw techniki cyfrowej.*

Selection inputs				Logic functions	Arithmetic functions
S_3	S_2	S_1	S_0	$M_C = 1$	$M_C = 0, C_0 = 0$
L	L	L	L	$F = \overline{A}$	$F = A$
L	L	L	H	$F = \overline{A \vee B}$	$F = A \vee B$
L	L	H	L	$F = \overline{A}B$	$F = A \vee \overline{B}$
L	L	H	H	$F = 0$	$F = -1$
L	H	L	L	$F = \overline{A}B$	$F = A + \overline{A}B$
L	H	L	H	$F = \overline{B}$	$F = (A \vee B) + \overline{A}B$
L	H	H	L	$F = A \oplus B$	$F = A - B - 1$
L	H	H	H	$F = \overline{A}B$	$F = \overline{A}B - 1$
H	L	L	L	$F = \overline{A} \vee B$	$F = A + AB$
H	L	L	H	$F = \overline{A \oplus B}$	$F = A + B$
H	L	H	L	$F = B$	$F = (A \vee \overline{B}) + AB$
H	L	H	H	$F = AB$	$F = AB - 1$
H	H	L	L	$F = 1$	$F = A + A$
H	H	L	H	$F = A \vee \overline{B}$	$F = (A \vee B) + A$
H	H	H	L	$F = A \vee B$	$F = (A \vee \overline{B}) + A$
H	H	H	H	$F = A$	$F = A - 1$

Table 1: Function table of 74181 ALU

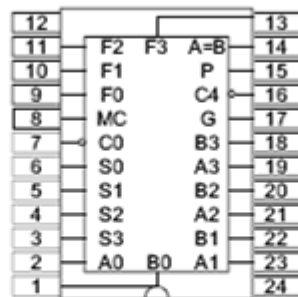


Fig. 1. UCY 74181N pin arrangement.