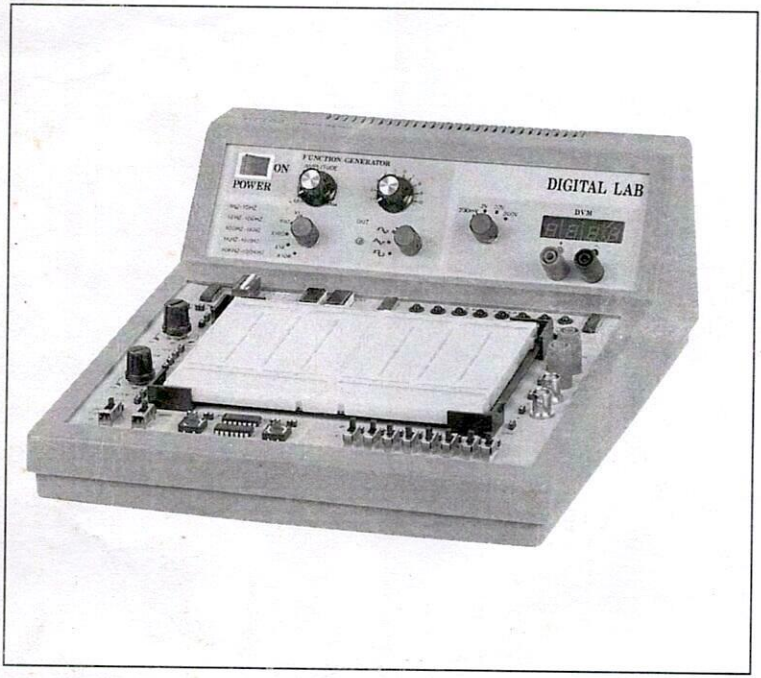
NOTRE PRIORITE

LANGLOIS

QUALITE ET SECURITE

USER'S MANUAL



ELECTRONIC TEST UNIT
REF. AT102

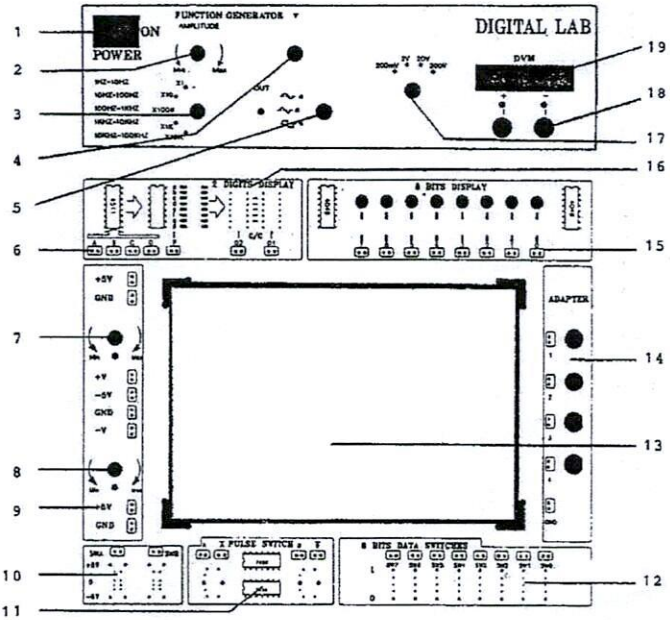
LANGLOIS

TEL : 05 56 75 13 33 - FAX service commercial : 05 56 75 56 85
FAX S.A.V. : 05 57 96 60 65 FAX service technique : 05 56 75 02 57
LANGLOIS Z.I. DU HAUT-VIGNEAU 33174 GRADIGNAN CEDEX
www.langlois-france.com info@langlois-france.com

AT102 Digital Lab is designed to accommodate digital circuits evaluators . The main purpose of this Lab is to enable the users to acquire conveniently a DC power supply, a signal generator, a digital voltagemeter, an eight bits LED display, two digital 7 segment LED displays and logical function switches.

To allow people to operate it and in order to properly connect (said interfacing) between the AT102 and peripheral instruments, the solderless breadboard is fixed on the lower part,and four point/banana socket/BNC socket exchange adapters are located at the right part of the Lab.

The details are follows :



1. POWER SWITCH WITH INDICATOR.
2. F.G. OUTPUT AMPLITUDE ADJUSTER.
3. F.G. OUTPUT FREQUENCY RANGE SELECTOR.
4. FINE TUNE OF F.G. OUTPUT FREQUENCY.
5. F.G. OUTPUT WAVE FORM SELECTOR.
6. BCD INPUT OF 7 SEGMENT DECODER.
7. DC 0 to +15 ADJUSTER.
8. DC 0 to -15 ADJUSTER.
9. FIXED DC +5V
10. FUNCTION SWITCHES, -5V/0/+5V.
11. PULSE SWITCHES.
12. DATA SWITCHES.
13. REMOVABLE SOLDERLESS BREADBOARD IN 1896 TIE POINTS.
14. POINT TIP/BANANA SOCKET/BNC SOCKET EXCHANGE ADAPTERS
15. BUFFERED SINGLE LAMP LED DISPLAYS.
16. OUTPUT OF 7 SEGMENT DECORDER.
17. RANGE SELECTOR OF DIGITAL VOLTMETER.
18. INPUT OF DIGITAL VOLTMETER.
19. DISPLAY OF DIGITAL VOLTMETER.

SPECIFICTION

1. SOLDERLESS BREADBOARD:

Interconnected nickel plated with a total of 1896 tiepoints in total, fitting all DIP sizesand components with lead and sold wire in diameter of AWG #22-30 (0.3 - 0.8mm).

2. DC POWER SUPPLY:

Variable DC power:
positive output voltage 0 to +15V.
negative output voltage 0 to - 15V.
Maximum output current 300 mA.
Line regulation < 0.05%/V (Ta=25 C).
Load regulation < 30 mV.

Fixed power supply:
Positive output voltage 5V +/- 0.25V.
Maximum output current 1 Amp.
Line regulation < 50 mV.
Load regulation < 100 mV.

Negative output voltage -5V +/- 0.25V.
Maximum output current 100 mA
Line regulation < 25 mV.
Load regulation < 30 mV.

All DC power supplies equipped with short-circuit protection.

3. FUNCTION GENERATOR:

Frequency ranges 1Hz - 10Hz
10Hz - 100Hz
100Hz - 1KHz
1KHz - 10KHz
10KHz - 100KHz

Sine wave output: 0 to 8 Vp-p variable.

Triangle wave output: 0 to 6 Vp-p fixed.

Square wave output: 0 to 8 Vp-p fixed.

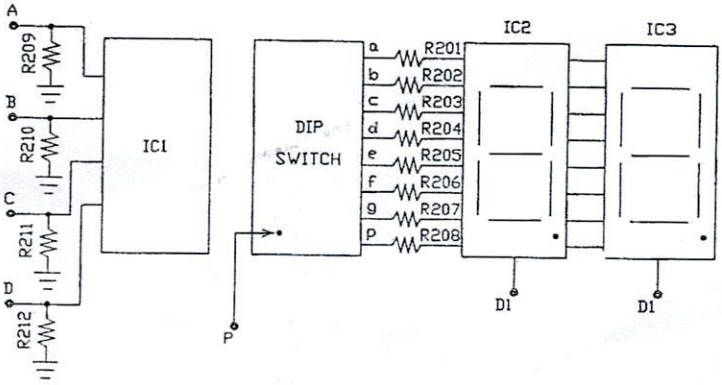
4. DIGITAL VOLTMETER (D.V.M.):

3 1/2 digits LED display.

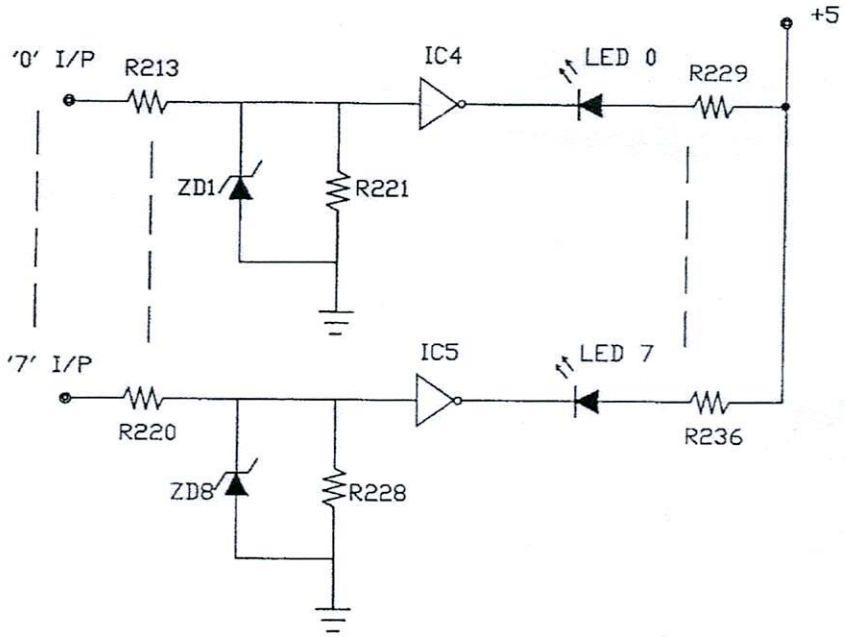
4 ranges: 0 - 199.9V full scale.
0 - 19.99V full scale.
0 - 1.999V full scale.
0 - 199.9mV full scale.

Input impedance: 10 Meg. ohm for any range.

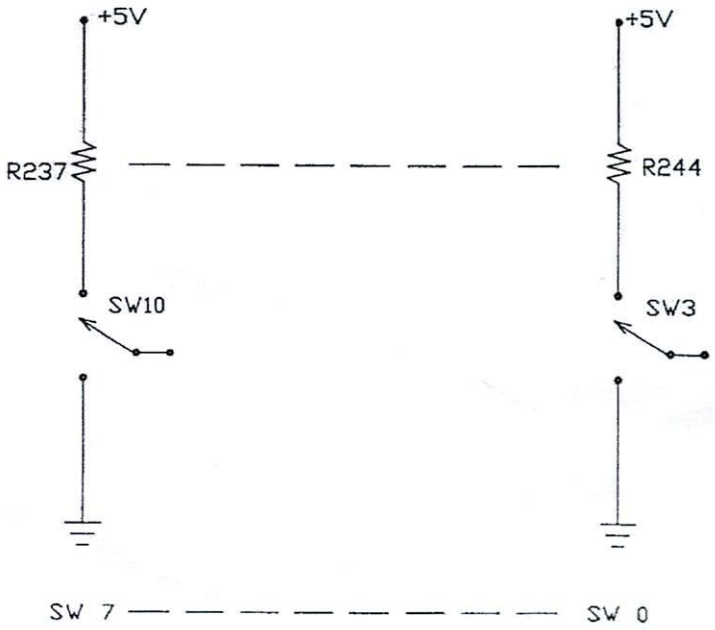
5. TWO DIGITS OF 7 SEGMENT LED DISPLAY: Common cathode operation.



6. EIGHT BUFFERED LED DISPLAYS:



7. EIGHT DATA SWITCHES:



PARTS LIST

AT102 PARTS LIST
DC POWER SUPPLY P.C.B.

SYMBOL	MODEL	QUANTITY
R107,R108	100 ohm 1/4W	2
R101,R102	330 ohm 1/4W	2
R105,R106	3.3K ohm 1/4W	2
R103,R104	3.9K ohm 1/4W	2
SVR1,SVR2	SVR332(5x5)	2
VR1,VR2	VR10K	2
C108	0.1uF Mylar	1
C105,C106,C017	10u/50V Electro	3
C102,C103,C104	1000u/35V Electro	3
C101	4700u/16V Electro	1
D1 - D6	Diode 1N4148	6
BRD1,BRD2,BRD3	Bridge R.D :RB153	3
IC1	LM7805(T)	1
IC2	LM7905(T)	1
IC3	LM317(T)	1
IC4	LM337(T)	1

PARTS LIST

AT102 PARTS LIST
DC POWER SUPPLY P.C.B.

SYMBOL	MODEL	QUANTITY
R107,R108	100 ohm 1/4W	2
R101,R102	330 ohm 1/4W	2
R105,R106	3.3K ohm 1/4W	2
R103,R104	3.9K ohm 1/4W	2
SVR1,SVR2	SVR332(5x5)	2
VR1,VR2	VR10K	2
C108	0.1uF Mylar	1
C105,C106,C017	10u/50V Electro	3
C102,C103,C104	1000u/35V Electro	3
C101	4700u/16V Electro	1
D1 - D6	Diode 1N4148	6
BRD1,BRD2,BRD3	Bridge R.D :RB153	3
IC1	LM7805(T)	1
IC2	LM7905(T)	1
IC3	LM317(T)	1
IC4	LM337(T)	1

PARTS LIST

AT102 PARTS LIST
DATA INPUT/OUTPUT AND LED DISPLAY P.C.B.

SYMBOL	MODEL	QUANTITY
R201 - R208,R229 - R236	330 ohm 1/4W	16
R245 - R250	470 ohm 1/4w	6
R213 - R220,R237 - R244	1K ohm 1/4W	16
R209 - R212,R221 - R228	100K ohm 1/4W	12
ZD1 - ZD8	Zener Diode 5.1v	8
LED0 - LED7	LED	8
C201,C202	47U/16V (E.C)	2
IC1	CD4511	1
IC2,IC3	7 Segment LED (C.C)	2
IC4,IC5	CD4049	2
IC6,IC7	7414	2

PARTS LIST

AT102 PARTS LIST
FUNCTION GENERATOR P.C.B

SYMBOL	MODEL	QUANTITY
R318	47 ohm 1/4 W	1
R315	68 ohm 1/4 W	1
R314	100 ohm 1/4 W	1
R313	510 ohm 1/4 W	1
R310	1K ohm 1/4 W	1
R307	1.2K ohm 1/4 W	1
R321	1.5K ohm 1/4 W	1
R320	2.2K ohm 1/4 W	1
R301,R302,R312	3.3K ohm 1/4 W	3
R311	3.6K ohm 1/4 W	1
R305,R306	5.6K ohm 1/4 W	2
R303,R308,R309,R316,R317	10K ohm 1/4 W	5
R319	22K ohm 1/4 W	1
R304	9M ohm 1/4 W	1
SVR3	SVR501 (5x5)	1
SVR7	SVR102 (5x5)	1
SVR4,SVR8 - SVR11	SVR332 (5x5)	5
VR3	VR 5K ohm	1
VR4	VR 500 ohm	1
C309	420 PF	1
C308	0.0047uF Mylar	1
C307	0.047uF Mylar	1
C306	0.47uF Tantalum	1
C305	4.7uF Tantalum	1
C301,C302	0.01uF Mylar	2
C303	0.1uF Mylar	1
ZD9,ZD10	Zener Diode 12v	2
Q1,Q3	Transister 9013	2
Q2	Transister 9012	1
Q4	Transister 5551	1
	3 Bound Switch	1
	5 Bound Switch	1
IC10	8038	1
IC11	TL071	1
SVR5,SVR6	SVR104 (5x5)	2

PARTS LIST

AT102 PARTS LIST
DIGITAL VOLTMETER P.C.B

SYMBOL	MODEL	QUANTITY
R411	330 ohm 1/4 W	1
R405	1K ohm 1/4 W	1
R409	2.2K ohm 1/4 W	1
R410	10K ohm 1/4 W	1
R406	47K ohm 1/4 W	1
R408	100K ohm 1/4 W	1
R407	1M ohm 1/4 W	1
R401	10K ohm 1% 1/4 W	1
R402	90K ohm 1% 1/4 W	1
R403	900K ohm 1% 1/4 W	1
R404	9M ohm 1% 1/4 W	1
P1	VR 1K ohm 10 TURN	1
C403,C404,C407	0.01uF Mylar	3
C408	0.1uF Mylar	1
C409	0.22uF Mylar	1
C405	100 pF Ceramic	1
C406	0.47uF Tantalum	1
C401	10u/50V Electro	1
C402	470u/50V Electro	1
ZD11	Zener Diode 2.1 V	1
ZD12	Zener Diode 5.1 V	1
BRD4	Bridge RB153	1
IC12	7107	1
IC13	LM 7805(T)	1
	4 Bound Switch	1

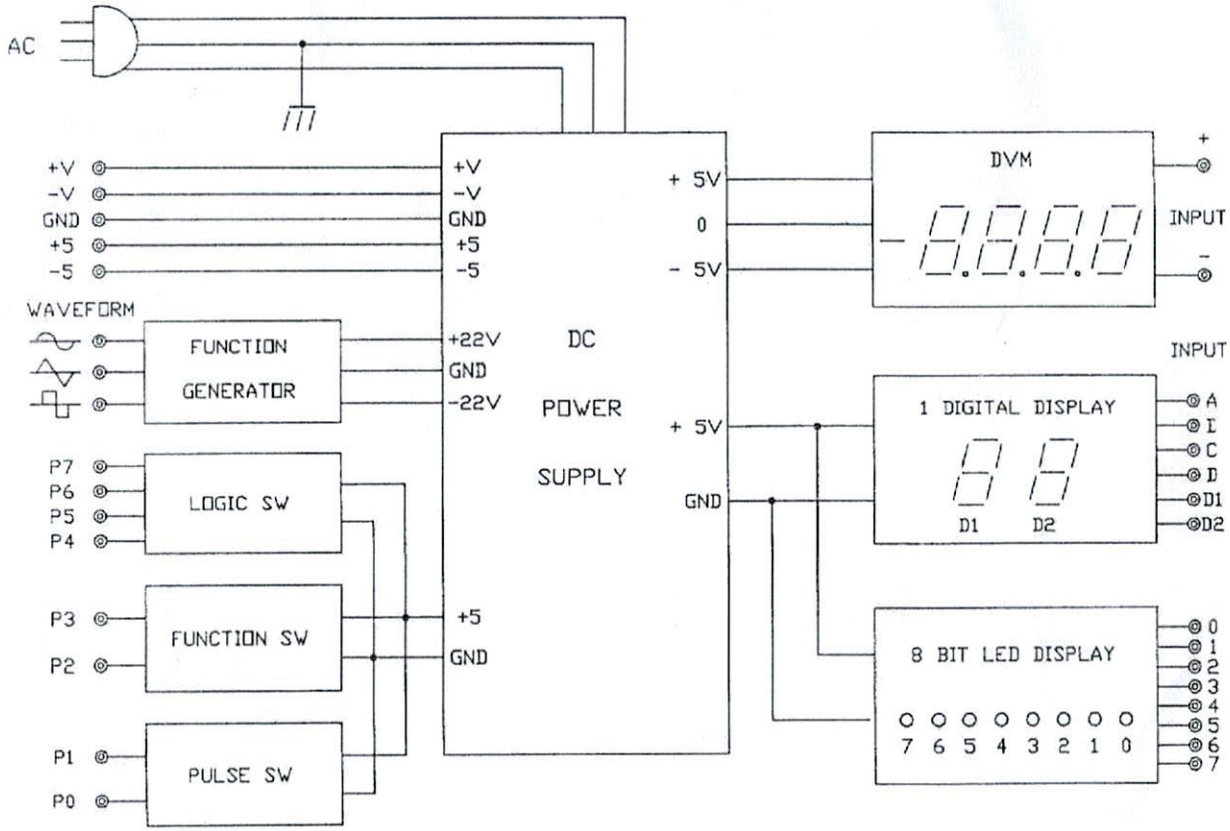


Fig. 1 Block Diagram Of AT102

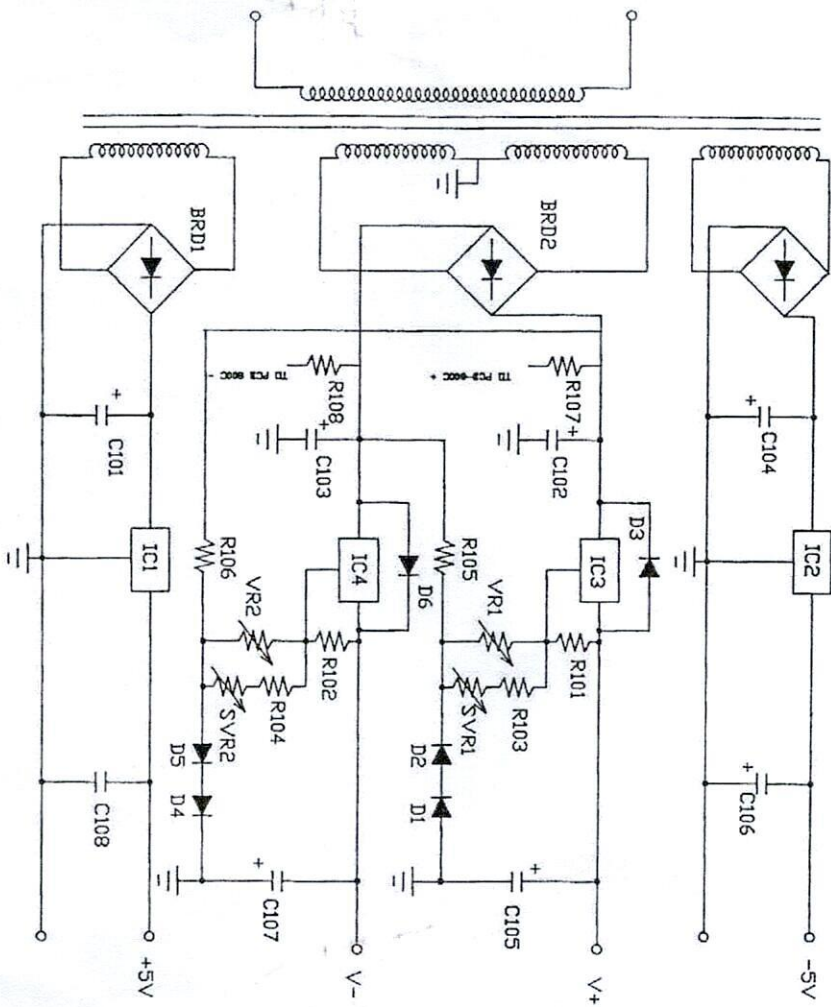


Fig. 2 Circuit Diagram Of Power Supply

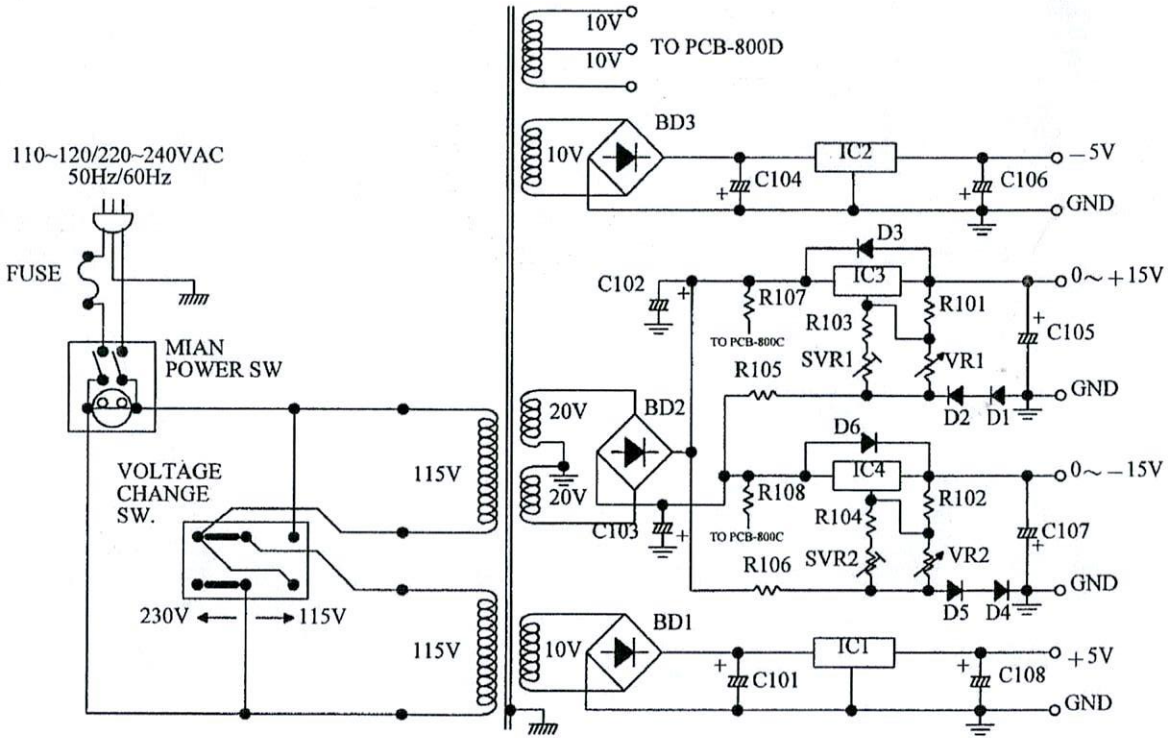


Fig. 3 Circuit Diagram of Power Supply

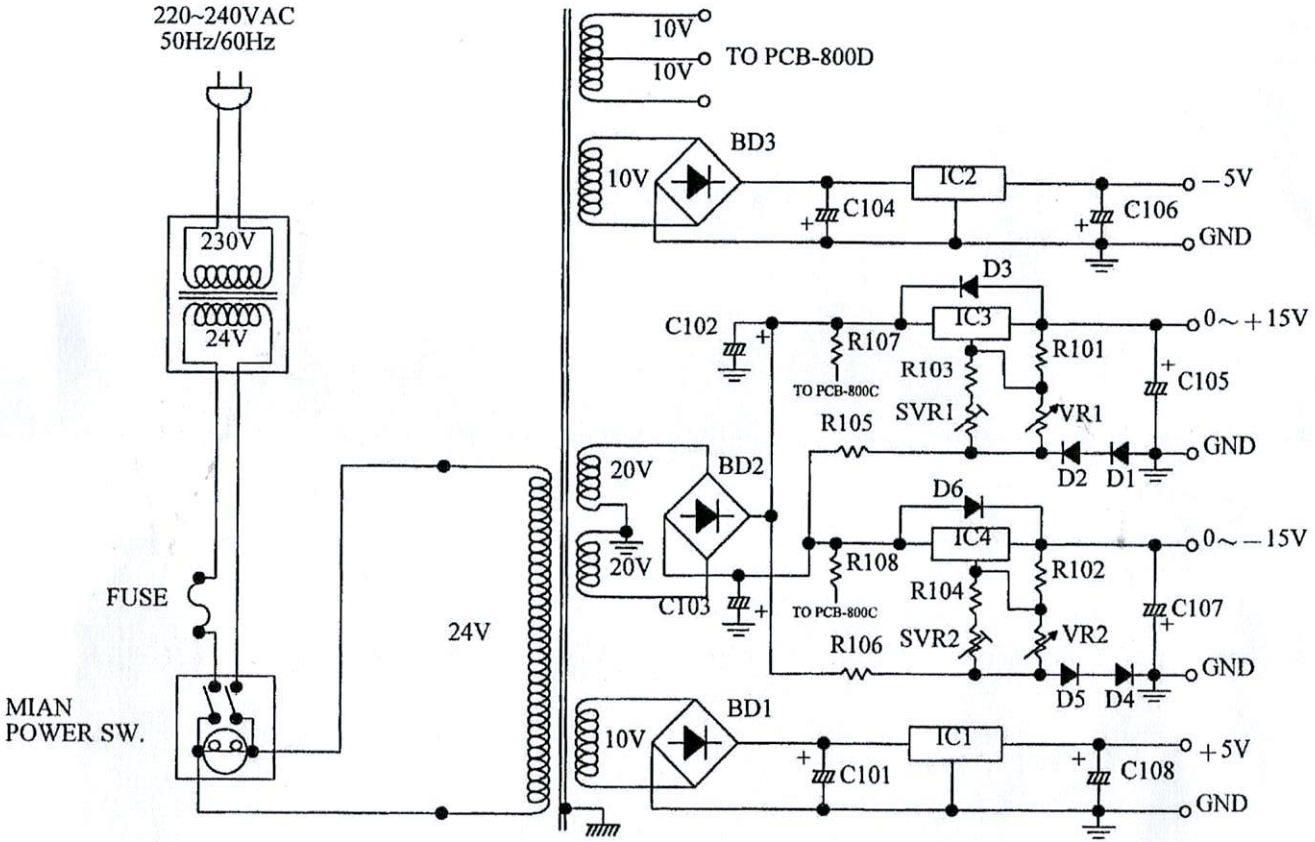


Fig. 4 Circuit Diagram of Power Supply for LVD design

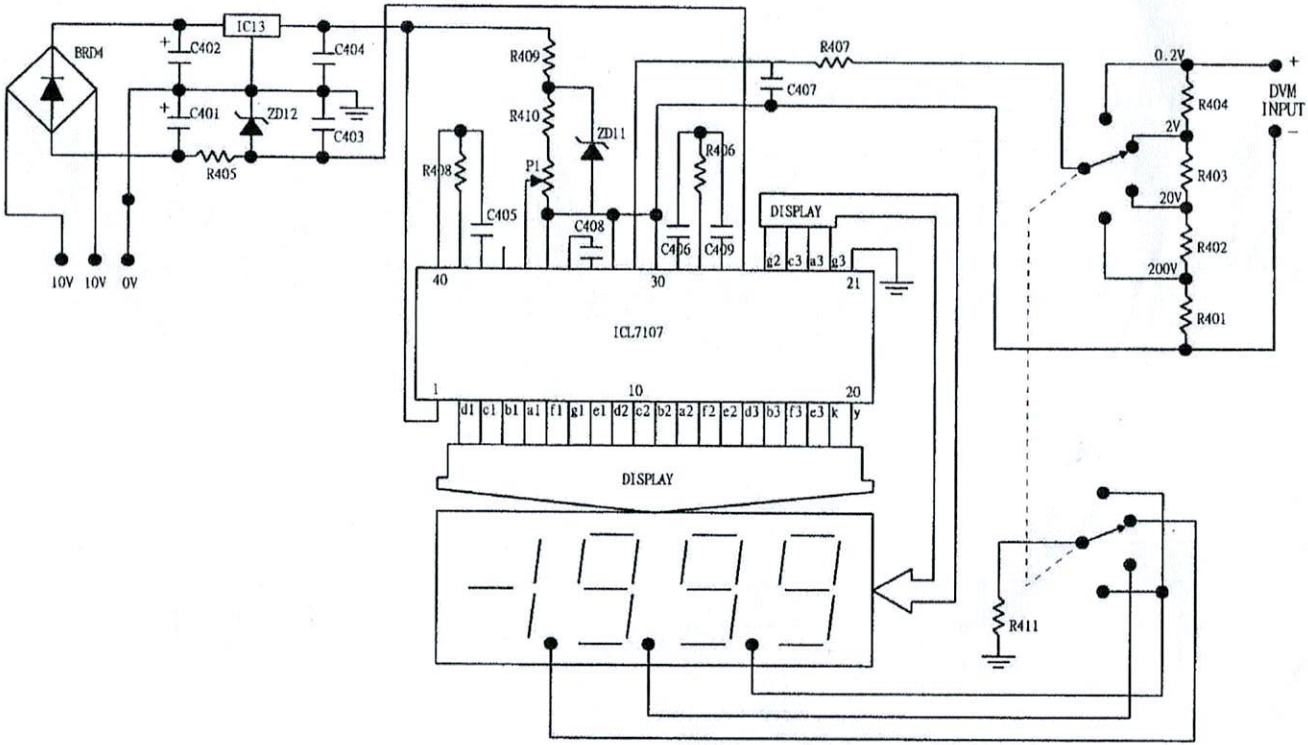


Fig. 5 Circuit Diagram of DVM

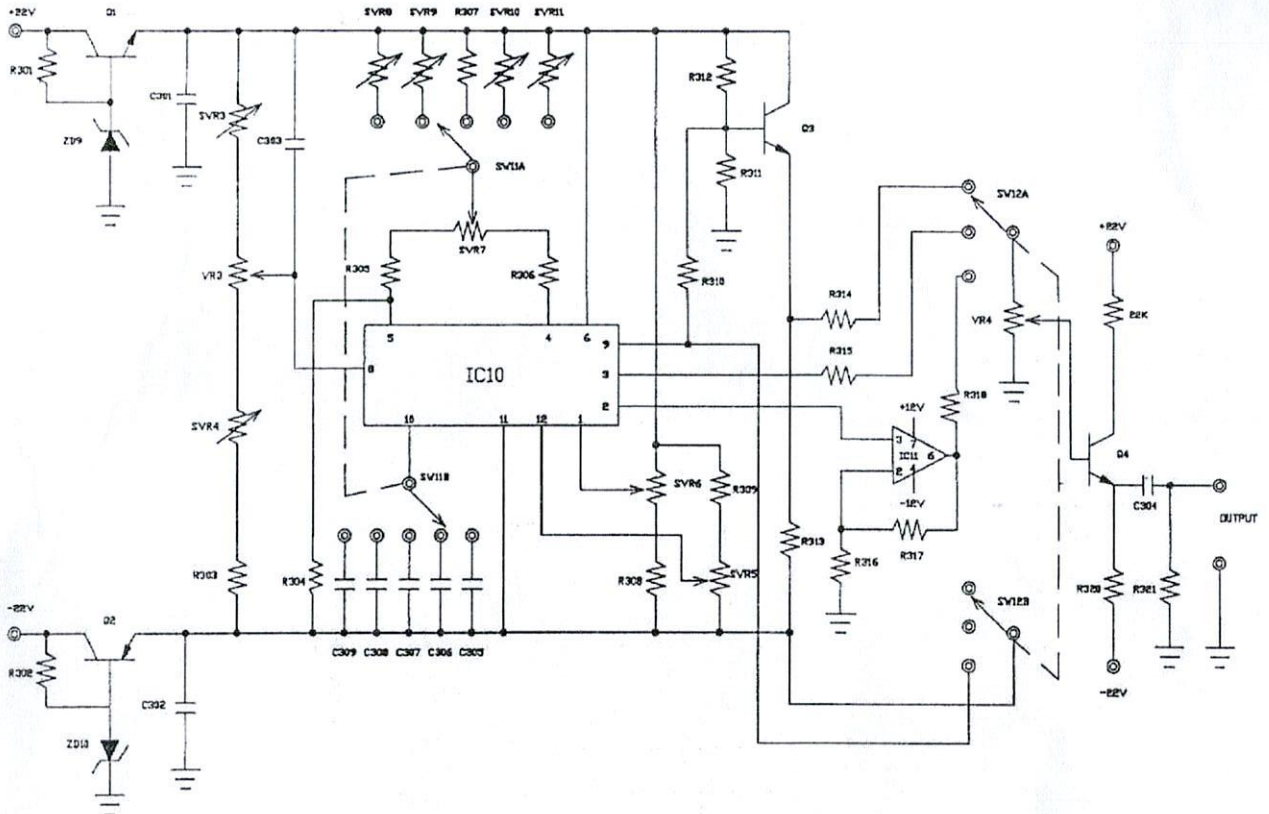


Fig. 6 Circuit Diagram Of Function Generator

CHAPTER 1: BASIC PRACTICE OF THE TTL LOGIC

A. THE PURPOSES OF THIS PROCEDURE:

1. To understand the basic function of the logic gate.
2. To understand the control feature of the logic gate.
3. To understand the features and applications of open collector gate.

B. EQUIPMENT AND COMPONENTS TO BE PREPARED:

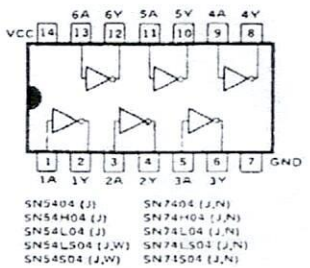
1. AT102 Digital Lab 1 set
2. IC 7400, 7402, 7404, 7408, 7432, 7486 and open collector IC 7401.
3 Some wires with a in diameter of AWG #22-30 (0.3 - 0.8 mm).

C. PRACTICE PROCEDURES AND RECORDS:

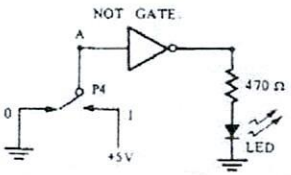
Item 1. NOT GATE EXPERIMENT

Step 1:
Referring to fig 1-1, which is marked 7404 NOT GATE IC, plug this IC in the Breadboard of AT102 and select any of a set of NOT GATE, According to the circuit in fig. 1-1(b) circuit shows, connect the INPUT "A" to Data Switch SW4, OUTPUT "Y" to LED display. (Note: Don't forget to connect the +5V to the 14th pin of IC, and the 7th pin to GND.)

Step 2:
Turn on the power of AT102 and turn Data Switch SW4 from "0" to "1" and back to "0". Observe the output situation of NOT GATE, then record it in chart 1. (Data Switch "1 " means +5V, "0" means GND, the LED will light up when input is "0", and go off when input is "1".



(a)



(b)

A	Y
1	
0	

$Y = \overline{A}$

(Chart 1)

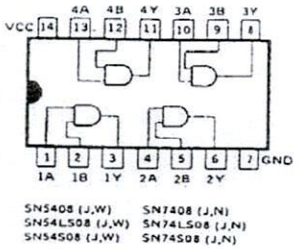
Fig. 1-1

Item 2. AND GATE EXPERIMENT

Step 1:
Observe fig. 1-2, (marked 7408 AND GATE IC). Plug the IC into the AT102 and select any of a set of AND GATE, connect it according to the circuit in fig. 1-2 (b) circuit shows. Connect the INPUT "A", "B" to Data Switch SW6,SW7, connect the OUTPUT "Y" to LED display. (Don't forget to connect the +Vcc and GND.)

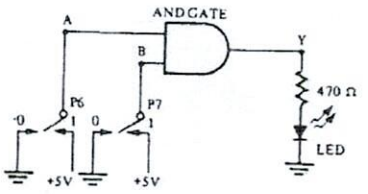
Step 2:
Change Data Switches SW6,SW7 to turn the LED light on or off (that means the OUTPUT is "1" or "0", observe the relationship between input and output ,then record it in chart 2.

Step 3:
Change the connection of INPUT "A" to the function generator square wave output port, then adjust the frequency to 1Hz. Change the Data Switch SW7 from "0" to "1" and back to "0". Observe the output situation of the LED display to understand the control feature of logical gate.



SN5408 (J,W) SN7408 (J,N)
SN54LS08 (J,W) SN74LS08 (J,N)
SN54S08 (J,W) SN74S08 (J,N)

(a)



(b)

A	B	Y
0	0	
0	1	
1	0	
1	1	

Y=A·B

(Chart 2)

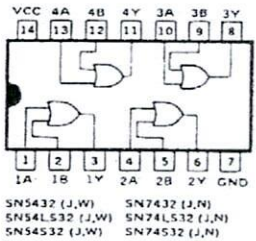
Fig. 1-2

Item 3. OR GATE EXPERTMENT

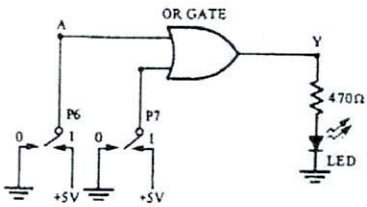
Step 1:
Observe fig. 1-3, (marked 7432 OR GATE IC), Plug it into the AT102 . Select any of a set of OR GATE and connect it. Referring to the circuit in fig. 1-3(b) circuit shows. Connect the INPUTs "A" and "B" to Data Switches SW6 and SW7 respectivel. Connect OUTPUT "Y" to the LED display. (Don't forget to connect the +Vcc and GND.)

Step 2:
Change Data Switches SW6 and SW7 from "0" to "1" and back to "0",then observe the input and output situations, Record them in chart 3.

Step 3:
Change the connection of INPUT "A" to the function generator square wave output port, then adjust the frequency to 1 Hz , Change Data Switch SW7. Observe the output situation of the LED display to understand the control feature of the logic gate.



(a)



(b)

A	B	Y
0	0	
0	1	
1	0	
1	1	

Y=A+B

(Chart 3)

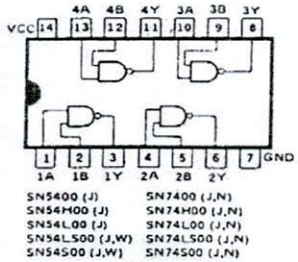
Fig. 1-3

Item 4. NAND GATE EXPERIMENT

Step 1:
See fig. 1-4, (marked 7400 NAND GATE IC). Plug it into the AT102. Select any of a set of NAND GATE and connect it according to the circuit in fig. 1-4(b) circuit shows. Connect INPUT "A" and "B" to Data Switches SW6 and SW7 respectivel. Connect the OUTPUT "Y" to the LED display. (Don't forget to connect the +Vcc and GND .)

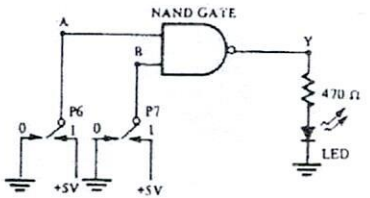
Step 2:
Change Data Switches SW6 and SW7 from "0" to "1" and back to "0", then observe the input and output situations . Record them in chart 4.

Step 3:
Change the connection of INPUT "A" to the function generator square wave output port, then adjust the frequency to 1 Hz. Change data Switch SW7. Observe the output situation of LED display to understand the control feature of logical gate.



SN5400 (J) SN7400 (J,N)
SN54H00 (J) SN74H00 (J,N)
SN54L00 (J) SN74L00 (J,N)
SN54LS00 (J,W) SN74LS00 (J,N)
SN54S00 (J,W) SN74S00 (J,N)

(a)



(b)

A	B	Y
0	0	
0	1	
1	0	
1	1	

$Y = \overline{A \cdot B}$

(Chart 4)

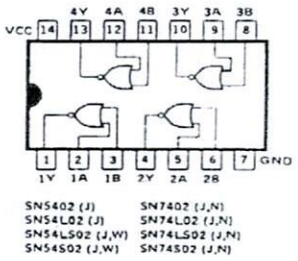
Fig. 1-4

Item 5. NOR GATE EXPERIMENT

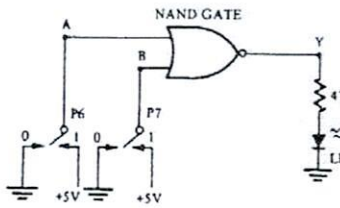
Step 1:
See fig. 1-5, (marked 7402 NOR GATE IC), Plug it into the AT102 . Select any of a set of NOR GATE and connect it as fig. 1-5(b) circuit shows. Connect the INPUT "A"and "B" to Data Switches SW6 and SW7 respectively. Connect the OUTPUT "Y" to the LED display. (Don't forget to connect the +Vcc and GND.)

Step 2:
Change Data Switches SW6 and SW7 from "0" to "1" and back to "0", then observe the input and output situation. Record them in chart 5.

step 3:
Change the connection of INPUT "A" to the function generator square wave output port,then adjust the frequency to 1 Hz. Change Data Switch SW7. Observe the output situation of the LED display to understand the control feature of logical gate.



(a)



(b)

A	B	Y
0	0	
0	1	
1	0	
1	1	

Y=A+B

(Chart 5)

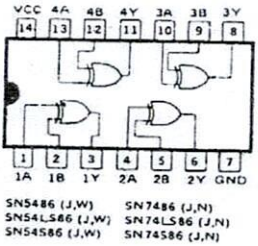
Fig. 1-5

Item 6. EXCLUSIVE OR GATE EXPERIMENT

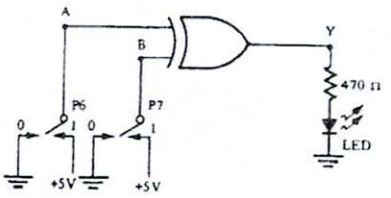
Step 1:
See fig. 1-6, which is marked 7486 EXCLUSIVE OR GATE IC, Plug it into the AT102. Select any of a set of EXCLUSIVE OR GATE and connect it as fig. 1-6(b) circuit shows. Connect INPUTs "A" and "B" to Data Switches SW6 and SW7. Connect the OUTPUT "Y" to the LED display .(Don't forget to connect the +Vcc and GND.)

Step 2:
Change Data Switches SW6 and SW7 from "0" to "1" and back to "0", then observe the input and output situation. Record them in chart 6.

Step 3:
Change the connection of INPUT "A" to the function generator square wave output port, then adjust the frequency to 1 Hz. Change Data Switch SW7. Observe the output situation of the LED display to understand the control feature of logical gate.



(a)



(b)

A	B	Y
0	0	
0	1	
1	0	
1	1	

Y=A⊕B

(Chart 6)

Fig. 1-6

Item 7. OPEN COLLECTOR GATE EXPERIMENT

There are three ways to use the open collector gate.

a. Directly connect the load to +5V in series from the output port, as in fig. 1-7 (a).

b. Connect a collector resistor to +5V from the output port. Then connect the load to output, as in fig. 1-7(b).
(Note: The collector resistor must be chosen in certain value. IF it is too small, it might destory the logical gate, if too large, it will not have enough power to support the load.)

c. Connect two or more sets of open collector gates in parallel. Choose any of gates and connect them together to complete the gate expansion, see fig. 1-7(c).

Step 1:
As seen in to chart 7.change the IC to a similar open collector gate. Connect the OUTPUT "Y" as fig. 1-7(a) circuit shows, then repeat Item 1 - 6, and record them.

Step 2:
Change the connection of OUTPUT "Y" as fig. 1-7(b) circuit shows. Then repeat Item 1 - 6 ,and record them.

Step 3:
Connect two or more sets of open collector gates in parallel, as in fig. 1-8, to complete the gate expansion.

Gates	With Collector Resistor	With Open Collector
NOT	7404	7405
OR	7432	
NOR	7402	7433
AND	7408	7409
NAND	7400	7401,7403
X'OR	7486	
X'NOR		74266

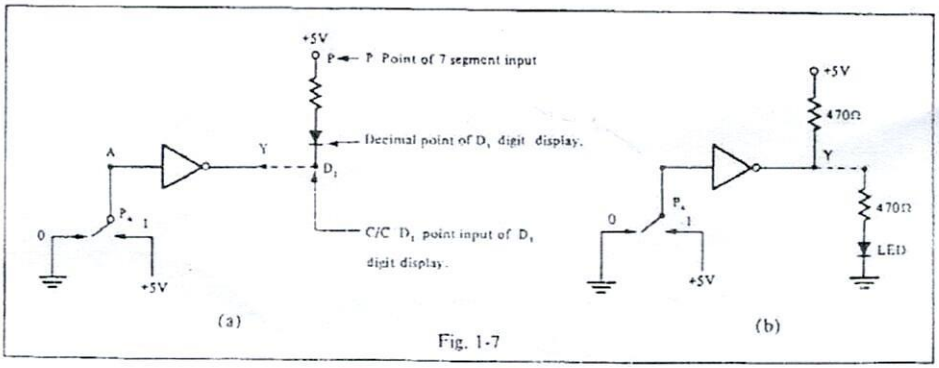


Fig. 1-7

CHAPTER 2: BASIC PRACTICE OF THE CMOS LOGIC

A. PURPOSE

a. To understand the features of the CMOS logic circuit.
b. To understand the interface processing of CMOS and TTL.
c. To understand the connection of the CMOS logic circuit.
d. TO understand the features and applications of the transmitting gate.

B. PREPARE THE FOLLOWING COMPONENTS:

a. 4001A, 4001B, 4049, 4016, 7404, 7406, 74L00 each 1 pcs.
b. 1N4148x3, 2SC9013x1.
c. 2.2Kx1, 1Kx1, 10Kx1, 100Kx1.

C. PRACTICE PROCEDURE AND RECORDING METHODS

Item 1. TTL and CMOS interface practice use the same power supply.

Step 1:
See fig. 2-1, connect the circuit.

Step 2:
Turn on the power, connect INPUT "A" to Data Switch SW7. Set SW7 to "1", and observe whether or not the LED's light is on.

Step 3:
Use D.V.M (Digital Voltmeter) to measure the voltage of points B,C,D,E,F and record them.

B(0)= Volts. C(1)= Volts.
D(0)= Volts. E(0)= Volts.
F(0)= Volts.

Step 4:
Set SW7 to "0". Observe whether the the LED's light has goneout .
Use D.V.M to measure the voltage of points B,C,D,E and F.

B(1)= Volts. C(0)= Volts.
D(1)= Volts. E(1)= Volts.
F(1)= Volts.

Step 5:
Check the results of steps 3 and 4, to see whether the TTL input meets the TTL logic level when points D,E and F are in the "1" or the "0" state ?

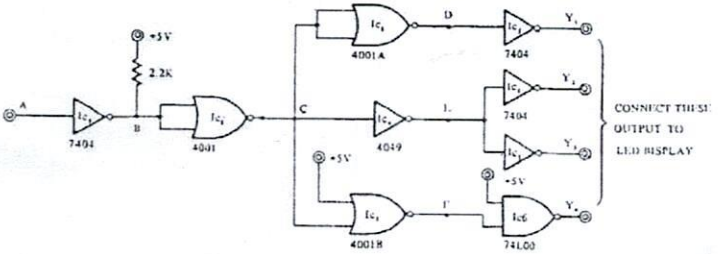
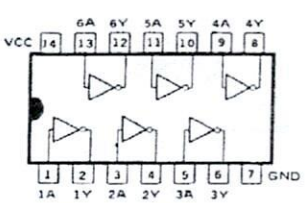
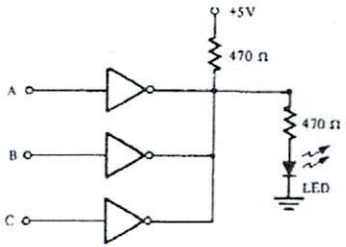


Fig 2-1 Interface transmission under the same power supply.



SN5404 (J) SN7404 (J,N)
SN54H04 (J) SN74H04 (J,N)
SN54L04 (J) SN74L04 (J,N)
SN54LS04 (J,W) SN74LS04 (J,N)
SN54S04 (J,W) SN74S04 (J,N)

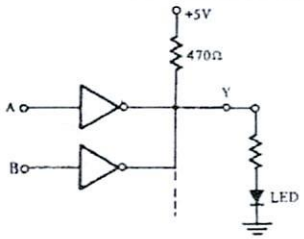


A	B	C	Y
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

$Y = \overline{A} \cdot \overline{B} \cdot \overline{C}$

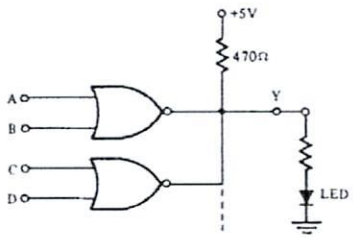
(Chart 7)

Fig. 1-7 (c)



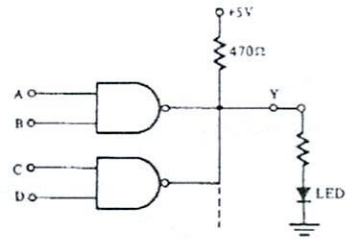
A	0	0	1	1
B	0	1	0	1
Y				

= 2 INPUTS _____ GATE



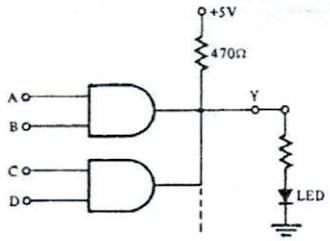
A	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
B	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
C	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
D	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Y																

= 4 INPUTS _____ GATE



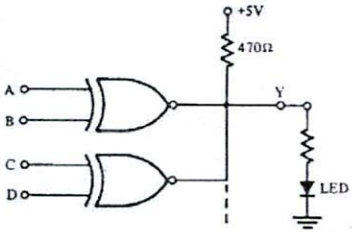
A	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
B	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
C	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
D	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
Y																

= 4 INPUTS _____ GATE



A	0 0 0 0	0 0 0 0	1 1 1 1	1 1 1 1
B	0 0 0 0	1 1 1 1	0 0 0 0	1 1 1 1
C	0 0 1 1	0 0 1 1	0 0 1 1	0 0 1 1
D	0 1 0 1	0 1 0 1	0 1 0 1	0 1 0 1
Y				

= 4 INPUTS _____ GATE



A	0 0 0 0	0 0 0 0	1 1 1 1	1 1 1 1
B	0 0 0 0	1 1 1 1	0 0 0 0	1 1 1 1
C	0 0 1 1	0 0 1 1	0 0 1 1	0 0 1 1
D	0 1 0 1	0 1 0 1	0 1 0 1	0 1 0 1
Y				

= 4 INPUTS _____ GATE

Fig. 1-8

Item 2. TTL AND COMS INTERFACE OPERATE UNDER DIFFERENT POWER SUPPLY.

Step 1:
Connect the circuit according to fig. 2-2, then plug +5V in 7404,4049,7406 and +12V in 4001A.

Step 2:
Turn on the power and set Data Switch SW7 to "0". Observe whether the LED1,LED2 is lighted .

Step 3:
Measure the voltage of points B,C,D and E.
B(1)= Volts. C(0)= Volts.
D(1)= Volts. E(0)= Volts.

Step 4:
Set Data Switch SW7 to "1" and measure the voltage.
B(0)= Volts. C(1)= Volts.
D(0)= Volts. E(1)= Volts.

Step 5:
Check whether or not the input amplitude can meet the input requirement .

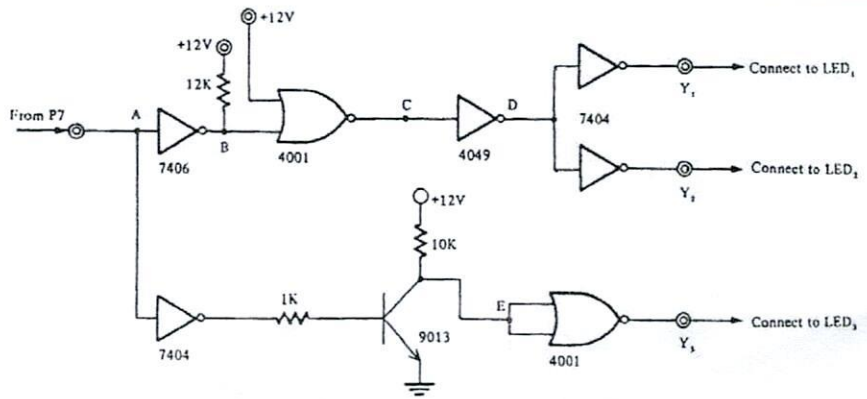


Fig. 2-2 Interface Transmission under the high voltage power supply.

DECLARATION OF CONFORMITY
CE mark

Declares that the product AT102/IDL800 has been manufactured to the technical specifications of the product and conforms in all respect to the relevant standards and regulations in force and especially to CEI1010 and 73/23/CEE.

Gradignan FRANCE

M.LABORDE
Technical manager

LANGLOIS
Z I du Haut Vigneau
33174 GRADIGNAN CEDEX
FRANCE
Téléphone : (0033) 05 56 75 13 33
Fax : (0033) 05 56 75 56 85