TI-3222: Otomasi Sistem Produksi

Rangkaian Elektronik dan Gerbang Logika

Laboratorium Sistem Produksi
www.lspitb.org

Departemen Teknik Industri FTI-ITB

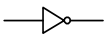
Hasil Pembelajaran

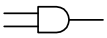
- Umum
  - Mahasiswa mampu untuk melakukan proses perancangan sistem otomasi, sistem mesin NC, serta merancang dan mengimplementasikan sistem kontrol logika.
- Khusus
  - Memahami simbol-simbol dan hukum logika serta mampu membuat rangkaian logika praktis

RANGKAIAN ELEKTRONIK DAN GERBANG LOGIKA

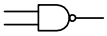
1. Dasar-dasar

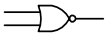
Simbol-simbol (dasar) :

Inverter 

AND 

OR 

NAND 

NOR 

Kondisi (status) :

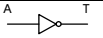
Ya	1	H (High)
Tidak	0	L (Low)

Kontaktor (penyambung)

Masuk		Keluar
1		0
0	Terbuka	1

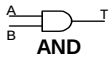
Masuk		Keluar
1		1
0	Tertutup	0

Tabel Kebenaran :



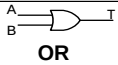
Inverter

A	*T*
1	0
0	1



AND

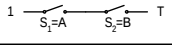
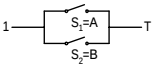
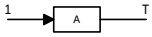
A	*B*	*T*
0	0	0
0	1	0
1	0	0
1	1	1



OR

A	*B*	*T*
0	0	0
0	1	1
1	0	1
1	1	1

2. Hukum-hukum Logika

Simbol / Operator	*Logika*	*Aplikasi*	*Rangkaian*	*Penulisan*
.	AND	Seri		T = A.B
+	OR	Paralel		T = A + B
'	Inversi	Negasi		T = A'

Hukum Inversi :
0' = 1, 1' = 0

$x + 0 = x$	$x + x = x$
$x \cdot 1 = x$	$x \cdot x = x$
$x + 1 = 1$	$x + x' = 1$
$x \cdot 0 = 0$	$x \cdot x' = 0$

2. Hukum-hukum Logika

x . y = y . X
x + y = y + x

Hukum Absorpsi
x + xy = x
x (x+y) = x
(x + y') y = xy
xy' + y = x + y
xy + y' = x + y'

x + y + z = (x + y) + z = x + (y + z)
xyz = (xy)z = x(yz)
xy + xz = x(y+z)
(x + y)(x + z) = x + yz
(x + y)(y + z)(z + x') = (x + y)(z + x')
xy + yz + zx' = xy + zx'
(x + y)(x' + z) = xz + x'y

Hukum de Morgan
(x + y + z + ...) = x'y'z'...
(xyz)' = x' + y' + z' + ...

Contoh :

Tunjukkan $x + x'y = x'y'$

$T = x + x'y$
$= x'.(x'y)'$
$= x'(x + y')$
$= x'x + x'y'$
$= 0 + x'y'$
$= x'y'$

3. Sistem Bilangan

Desimal : 0, 1, 2, 3, ..., 9 ; Banyaknya status bilangan untuk setiap digit = 10

Contoh :

6327_D : 6 ribuan = 6000 = 6×10^3
3 ratusan = 300 = 3×10^2
2 puluhan = 20 = 2×10^1
7 satuan = 7 = 7×10^0
= 6327_D

Hexadesimal : 0, 1, 2, 3, ..., 9, A, B, C, D, E, F ; Banyaknya status bilangan untuk setiap digit = 16

Contoh :

6327_H : 6 ribuan = 6×16^3 = 24576
3 ratusan = 3×16^2 = 768
2 puluhan = 2×16^1 = 32
7 satuan = 7×16^0 = 7
= 25383_D

3. Sistem Bilangan

$2A7C_H$: 2×16^3 = 8192
10×16^2 = 2560
7×16^1 = 112
12×16^0 = 12
= 10876_D

Biner : 0, 1; Banyaknya status bilangan untuk setiap digit = 2

Contoh :

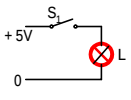
1011 : 1 ribuan = 1×2^3 = 8
0 ratusan = 0×2^2 = 0
1 puluhan = 1×2^1 = 2
1 satuan = 1×2^0 = 1
= 11_D

Contoh :

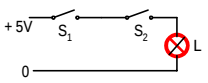
$15_D = 1111_B = F_H$
$10111111 = BF_H = 191_D$

4. Rangkaian Logika Praktis

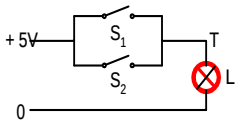
Sifat Biner :



S_1	L
0	0
1	1

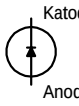


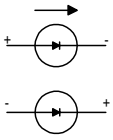
S_1	S_2	L
0	0	0
0	1	0
1	0	0
1	1	1

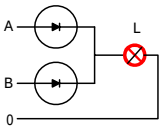


S_1	S_2	L
0	0	0
0	1	1
1	0	1
1	1	1

Logika Dioda :

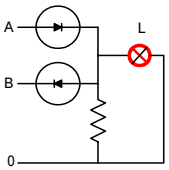






OR :

A	B	L
0	0	0
0	1	1
1	0	1
1	1	1

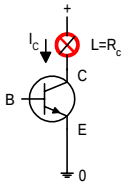


AND :

A	B	L
0	0	0
0	1	0
1	0	0
1	1	1

4. Rangkaian Logika Praktis

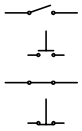
Transistor : (kontaktor) :



B = 1 (+ 0.5 V)
I_C = 1 (mengalir)
L = 1

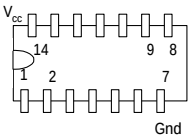
B	L	C
0	0	1
1	1	0

Switch



NO Togle Switch
NO Momentary Switch
NC Togle Switch
NC Momentary Switch

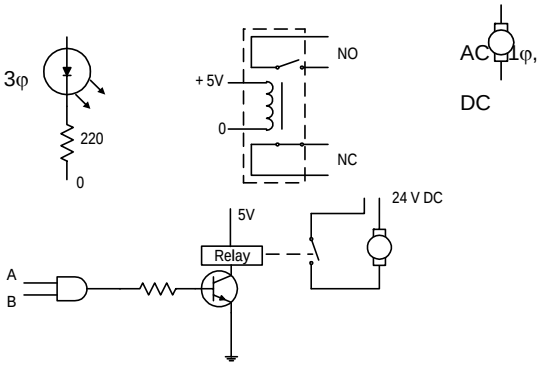
IC TTL :



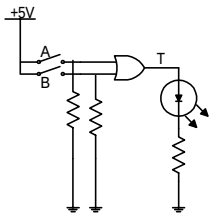
V_{CC} = + 5V DC
Gnd = 0

4. Rangkaian Logika Praktis

LED : **Relay** : **Motor** :

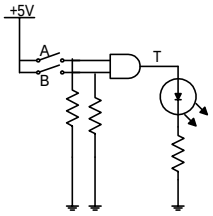


4. Rangkaian Logika Praktis



OR

A	B	T
0	0	0
1	0	1
0	1	1
1	1	1



AND

A	B	T
0	0	0
1	0	0
0	1	0
1	1	1