INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

SYMBOLS FOR SOLID STATE PROTECTIVE RELAYING

The following are standard for Westinghouse solid state protective relaying and consists of three sections: (1) Device Symbols, (2) Logic Circuits and (3) Solid State Relay Diagram terminology. Typical basic characteristics, equivalent circuits, electromechanical contact equivalents are shown where applicable to aid in understanding.

The symbols and terminology are in line with ASA Y32.2-1962 (Graphic Symbols for Electrical and Electronics Diagrams) and ASA Y32.14-1962 (Graphic Symbols for Logic Diagrams).

The current and voltage nomenclature is the same as used previously. The current arrows show the direction of current flow. All voltages are voltage drops with the (+) mark indicating the point of relative positive potential.

All possible contingencies which may arise during installation, operation, or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding his particular installation, operation or maintenance of his equipment, the local Westinghouse Electric Corporation representative should be contacted.

SUPERSEDES I.L. 41-000.1A
^Denotes change from superseded issue.

EFFECTIVE FEBRUARY 1971

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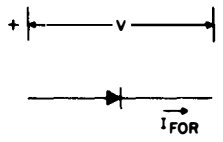
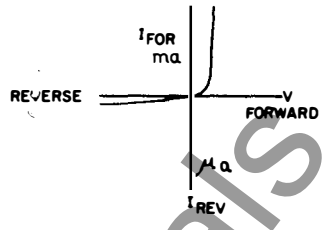
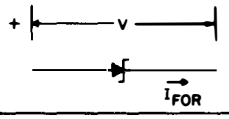
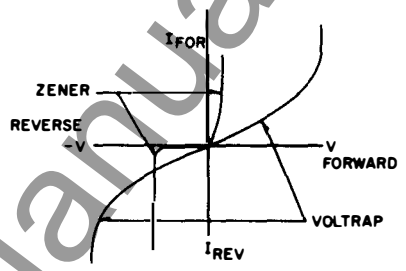
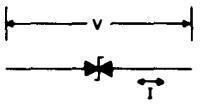
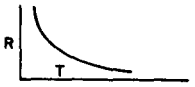
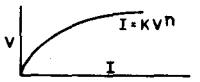
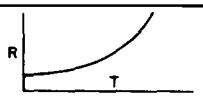
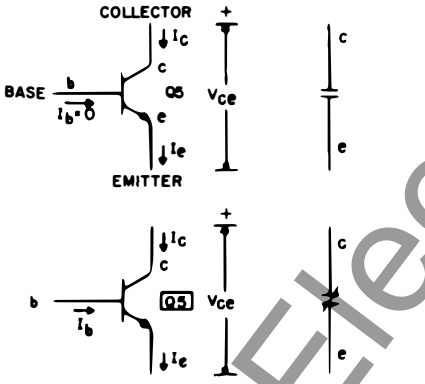
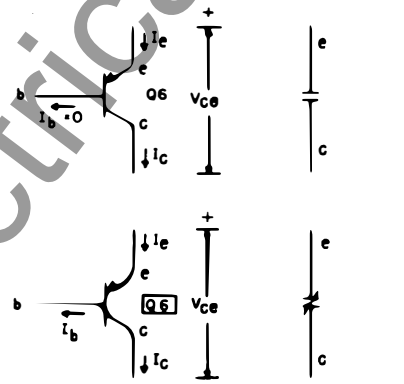
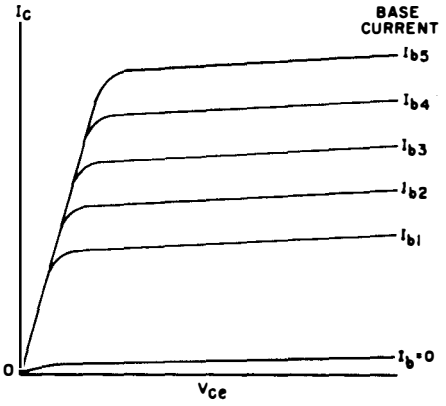
SYMBOLS FOR SOLID STATE PROTECTIVE RELAYING

DEVICE	SYMBOL	BASIC CHARACTERISTIC
DIODE		
ZENER DIODE		
SURGE SUPPRESSOR (VOLTRAP, ZENER CLIPPER, THYRECTOR)		
THERMISTOR		
VARISTOR		
SENSISTOR		
TRANSISTOR NPN TYPE SOLID STATE / EQUIVALENT ELECTROMECHANICAL 	PNP TYPE SOLID STATE / EQUIVALENT ELECTROMECHANICAL 	 BASE CURRENT I_b IS VERY MUCH SMALLER THAN THE COLLECTOR CURRENT I_C

Q5 RECTANGLE AROUND TRANSISTOR DESIGNATION DENOTES CONDUCTION IN QUIESCENT (AT REST) STATE

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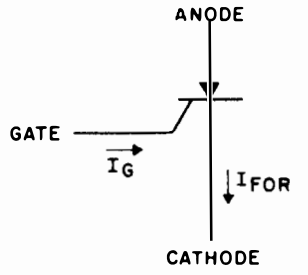
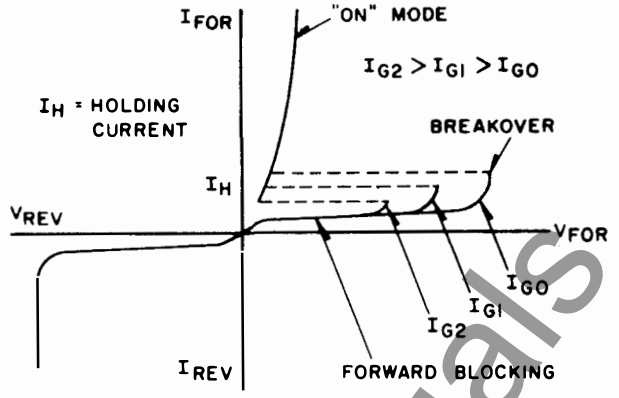
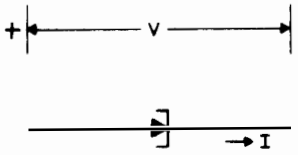
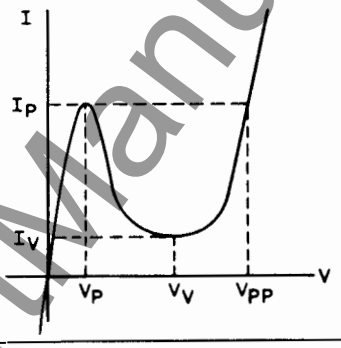
THYRISTOR
(TRINISTOR CONTROLLED RECTIFIER, SCR)



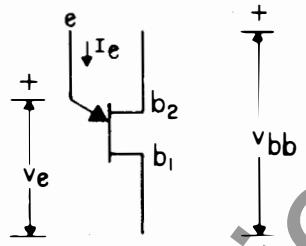


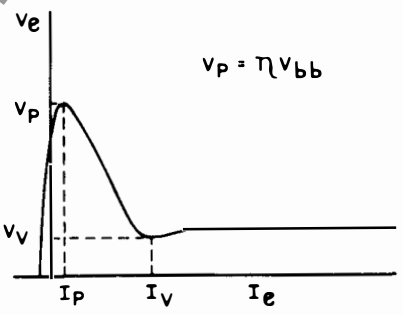
TUNNEL DIODE



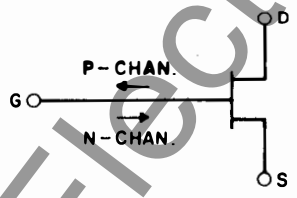


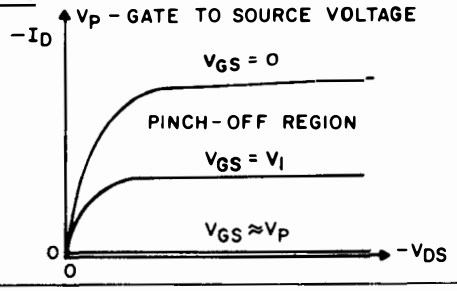
UNIJUNCTION



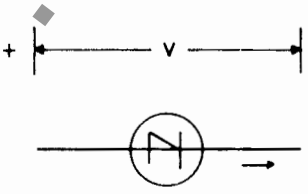


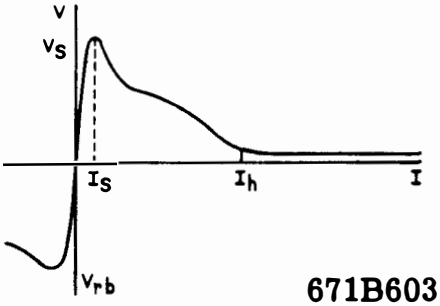
FIELD EFFECT TRANSISTOR





4 LAYER DIODE





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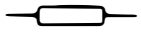
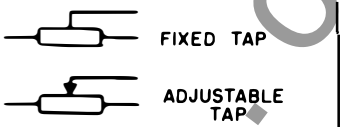
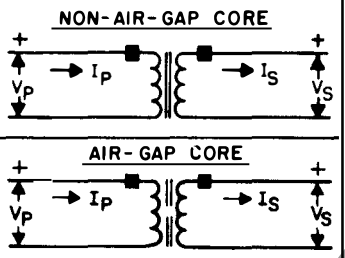
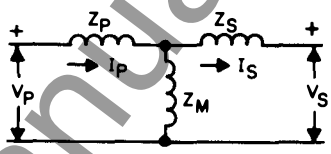
DEVICE	FIXED	VARIABLE	TAPPED
CAPACITOR			
RESISTOR RHEOSTATS, POTENTIOMETERS			 FIXED TAP ADJUSTABLE TAP
REACTOR			

Ø CURVED LINE IS NEGATIVE IN ELECTROLYTIC CAPACITORS OR OUTER FOIL FOR PAPER CAPACITOR

TRANSFORMER, COMPENSATORS

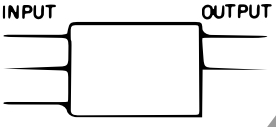


EQUIVALENT CIRCUIT



FOR TRANSFORMER, Z_M IS VERY HIGH.
FOR COMPENSATOR OR AIR-GAP TRANSFORMER, Z_M IS LOW. AIR-GAP LIMITS SATURATION.

COMPOSITE NETWORKS - SEQUENCE FILTERS



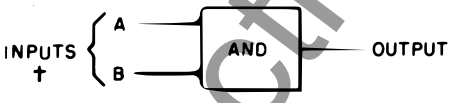
THREE PHASE A-C CURRENT OR VOLTAGE

SINGLE PHASE VOLTAGE PROPORTIONAL TO:
I_1, I_2, $3I_0$ OR I_0, E_1, E_2, $3E_0$ OR E_0
AND COMBINATIONS $K_1 I_1 + K_2 I_2 + K_0 I_0$

THESE STATIC NETWORKS PROVIDE LESS COMPLEX FAULT SENSING THAN IS AVAILABLE DIRECTLY FROM THE THREE PHASE POWER SYSTEM.

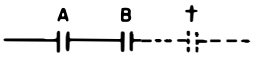
LOGIC CIRCUITS

AND



INPUTS A	INPUTS B	OUTPUT
0	0	0
0	1	0
1	0	0
1	1	1

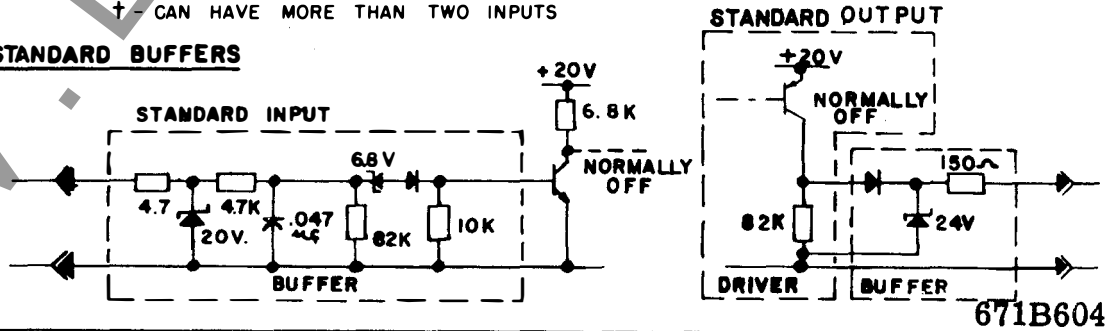
ELECTROMECHANICAL CONTACT EQUIVALENT



SIGNAL ON ALL INPUTS REQUIRED TO PROVIDE AN OUTPUT

NOTES : 1- ACTIVE STATE OF A SIGNAL (MAY BE DEFINED AS POSITIVE OR NEGATIVE VOLTAGE OR CURRENT)
0- INACTIVE STATE OF A SIGNAL (REFERENCE)
† - CAN HAVE MORE THAN TWO INPUTS

STANDARD BUFFERS



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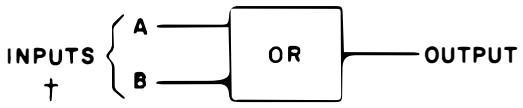
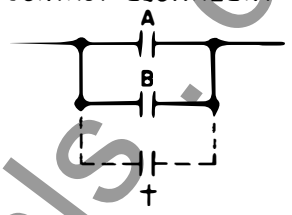
LOGIC CIRCUITS - CONTINUED

INCLUSIVE OR



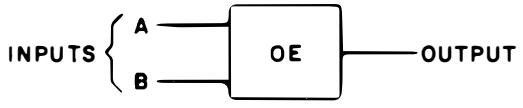
INPUTS		OUTPUT
A	B	
0	0	0
0	1	1
1	0	1
1	1	1

ELECTROMECHANICAL CONTACT EQUIVALENT



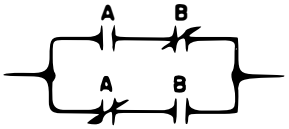
SINGLE INPUT WILL PRODUCE AN OUTPUT
ALL INPUTS PRODUCE AN OUTPUT

EXCLUSIVE OR



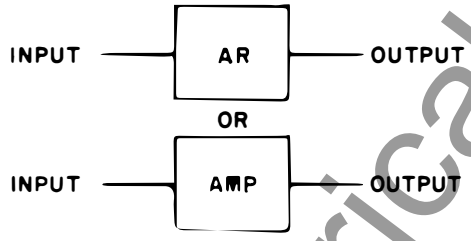
INPUTS		OUTPUT
A	B	
0	0	0
0	1	1
1	0	1
1	1	0

ELECTROMECHANICAL CONTACT EQUIVALENT



SINGLE INPUT WILL PRODUCE AN OUTPUT
ALL INPUTS SIMULTANEOUSLY PRODUCE NO OUTPUT

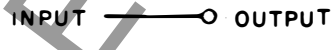
AMPLIFIER



INPUT	OUTPUT
0	0
1	1

INPUT SIGNAL PRODUCES OUTPUT

NEGATION (NOT)



INPUT	OUTPUT
0	1
1	0

ABSENCE OF INPUT SIGNAL PRODUCES OUTPUT

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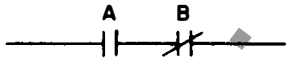
EXAMPLE OF LOGIC NEGATION

INPUTS		OUTPUT
A	B	
0	0	0
0	1	0
1	0	1
1	1	0

ELECTROMECHANICAL CONTACT EQUIVALENT



SIGNAL AT A AND NOT AT B PRODUCES OUTPUT

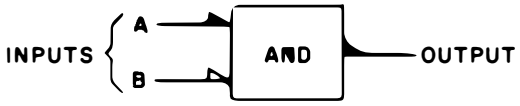
MIXED LOGIC

WHERE IT IS DESIRED TO REPRESENT SIGNAL POLARITY, OPEN AND CLOSED ARROWS MAY BE USED

A ONE INPUT (OR OUTPUT) TO A CLOSED ARROW IS MORE POSITIVE THAN A CORRESPONDING 0 INPUT (OR OUTPUT)

A ONE INPUT (OR OUTPUT) TO AN OPEN ARROW IS MORE NEGATIVE THAN A CORRESPONDING 0 INPUT (OR OUTPUT)

AS AN EXAMPLE :



INPUTS		OUTPUT
A	B	
0	0	0
0	1	0
1	0	0
1	1	1

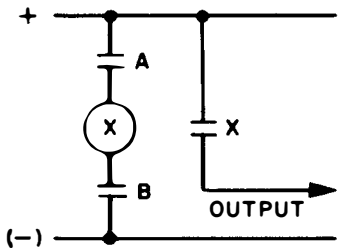
1 INPUT AT A IS MORE POSITIVE THAN 0 INPUT

1 INPUT AT B IS MORE NEGATIVE THAN 0 INPUT

1 OUTPUT IS MORE POSITIVE THAN 0 OUTPUT

INPUT AT A AND B PRODUCE OUTPUT

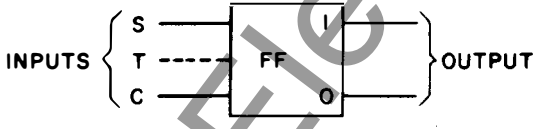
ELECTROMECHANICAL CONTACT EQUIVALENT



THE USE OF POSITIVE LOGIC IS PREFERRED WHEREVER IT CAN REASONABLY BE USED

ARROWHEADS WILL BE OMITTED AT POSITIVE LOGIC INPUTS WHERE LOGIC IS PREDOMINATELY POSITIVE

FLIP FLOP



S = SET

C = CLEAR (RESET)

T = TRIGGER

SET SIGNAL YIELDS 1 AT 1, 0 AT 0 OUTPUT

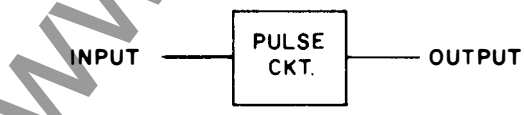
CLEAR SIGNAL YIELDS 1 AT 0, 0 AT 1 OUTPUT

SIMULTANEOUS SET AND CLEAR SIGNALS YIELD UNDEFINED OUTPUT

FF RETAINS PREVIOUS STATE FOLLOWING REMOVAL OF BOTH INPUTS SIMILAR TO LATCHING RELAY

WHERE T (TRIGGER) IS USED, T INPUT CHANGES OUTPUT STATE

PULSE CIRCUIT



INPUT	OUTPUT
0	0
1	Δ

Δ - OUTPUT PULSES AT OSCILLATOR RATE AS LONG AS "1" INPUT EXISTS

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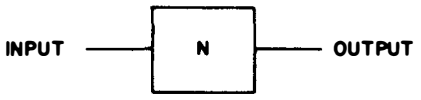
LOGIC CIRCUITS – CONTINUED

INVERSION

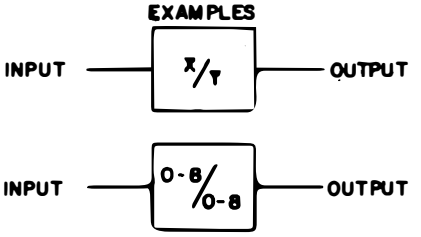


INPUT	OUTPUT
1	1
0	0

PRODUCES POLARITY INVERSION, BUT NO LOGIC NEGATION

TIME DELAY

EXAMPLES



X = OPERATE TIME IN MILLISECONDS
(TIME FOR OUTPUT TO APPEAR FOLLOWING INPUT SIGNAL)

Y = RESET TIME IN MILLISECONDS
(TIME FOR OUTPUT TO BE REMOVED FOLLOWING REMOVAL OF INPUT SIGNAL)

X & Y MAY BE ADJUSTABLE AS INDICATED FOR EXAMPLE BY 0-8

SINGLE SHOT

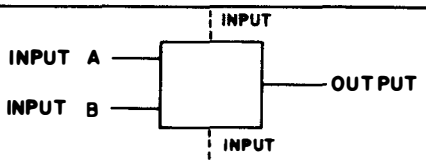
FOLLOWING APPLICATION OF SUSTAINED INPUT, SINGLE PULSE OUTPUT APPEARS

SOLID STATE RELAY DIAGRAMS

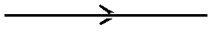
NORMAL STATES

IN COMPLEX LOGIC CIRCUITRY I'S AND O'S WILL BE SHOWN TO INDICATE THE "NORMAL" STATE OF THE INPUTS. "NORMAL" STIPULATES THAT THE RELAY HAS D.C. APPLIED, NO FAULT EXISTS, THE ASSOCIATED BREAKER IS CLOSED (IF THIS FACT IS GERMANE), AND THE RELAY IS RESET.

INPUT AND OUTPUT



INPUTS TO A LOGIC BLOCK ARE PREFERRED ON THE LEFT SIDE OF THE BLOCK. THE OUTPUT IS PREFERRED ON THE RIGHT SIDE OF THE BLOCK. IN SPECIAL CASES, WHERE CLARITY WILL RESULT, INPUTS MAY BE SHOWN ON ANY SIDE OF THE BLOCK EXCEPT THE OUTPUT SIDE ALTHOUGH THE SIDE OPPOSITE IS PREFERRED. SIGNAL FLOW AS SHOWN BELOW WILL BE USED WHERE IT WILL CONTRIBUTE TO CLARITY.



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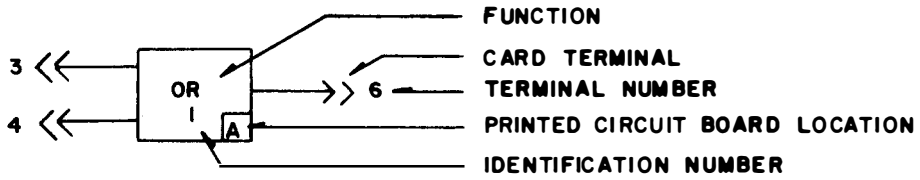
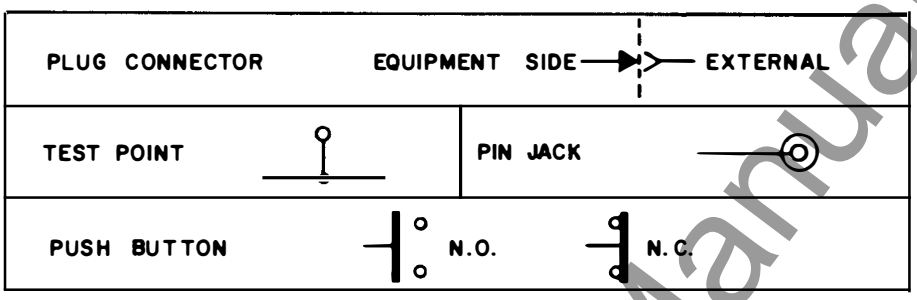
SOLID STATE RELAY DIAGRAM, CONTINUED





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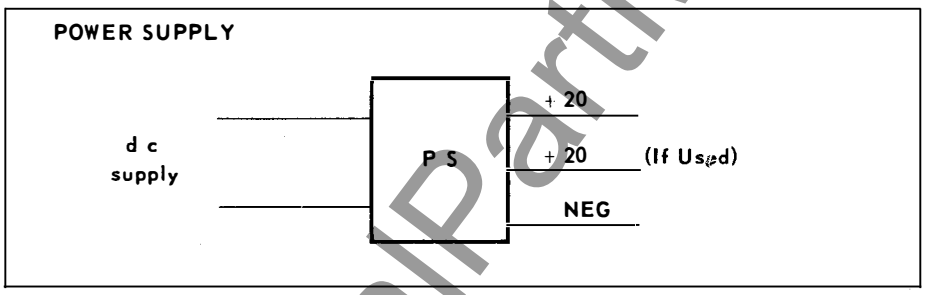

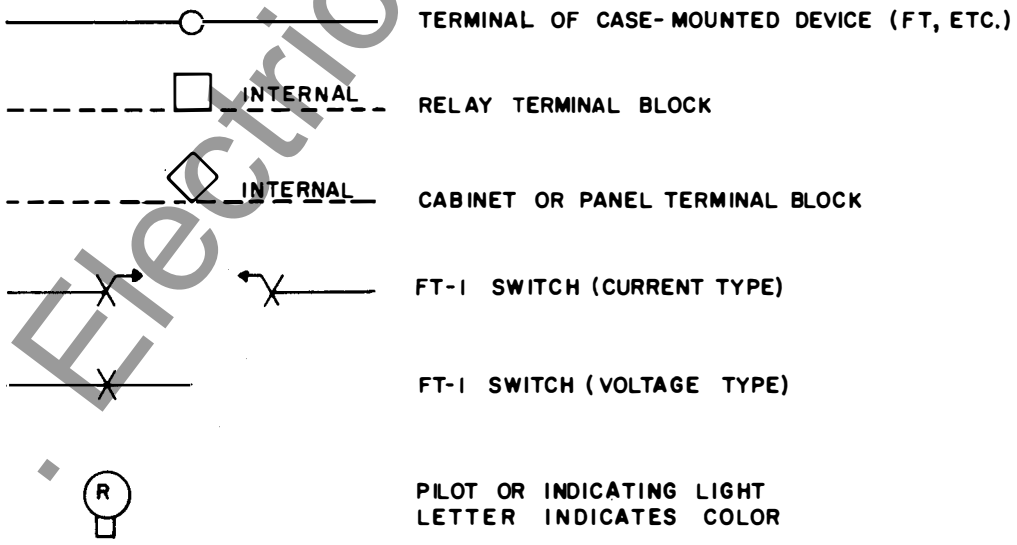

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INSTRUCTIONS

SYMBOLS FOR SOLID STATE PROTECTIVE RELAYING

The following are standard for Westinghouse solid state protective relaying and consists of three sections: (1) Device Symbols, (2) Logic Circuits and (3) Solid State Relay Diagram terminology. Typical basic characteristics, equivalent circuits, electromechanical contact equivalents are shown where applicable to aid in understanding.

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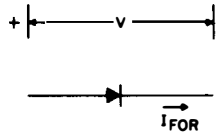
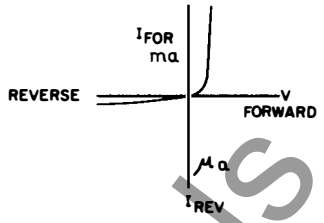
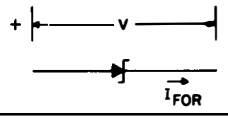
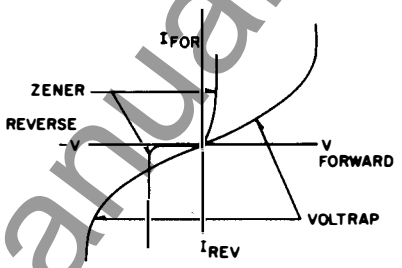
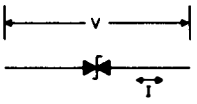
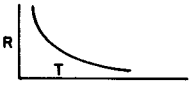
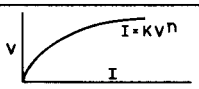
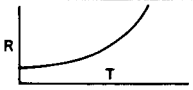
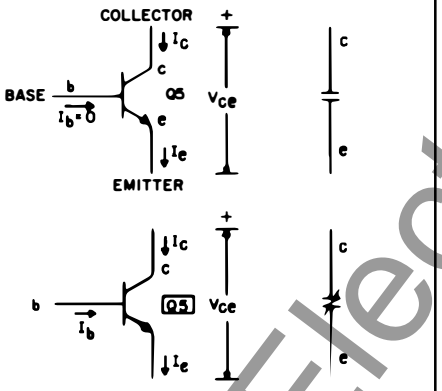
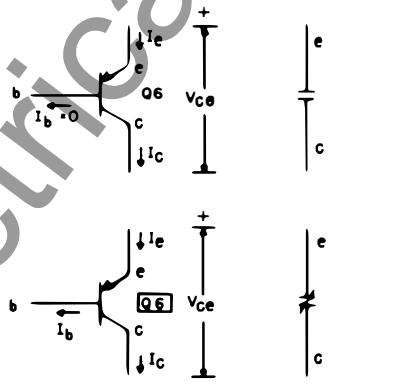
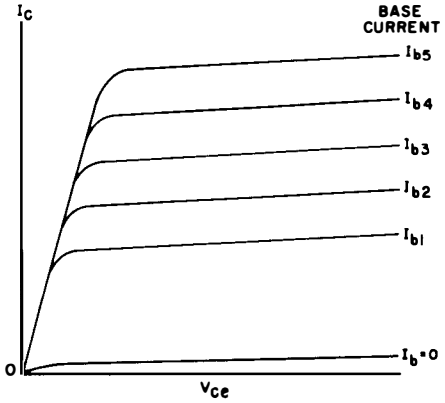
SUPERSEDES I.L. 41-000.1A
*Denotes change from superseded issue.

EFFECTIVE FEBRUARY 1971

SYMBOLS FOR SOLID STATE PROTECTIVE RELAYING

DEVICE	SYMBOL	BASIC CHARACTERISTIC
DIODE		
ZENER DIODE		
SURGE SUPPRESSOR (VOLTRAP, ZENER CLIPPER, THYRECTOR)		
THERMISTOR		
VARISTOR		
SENSISTOR		
TRANSISTOR NPN TYPE SOLID STATE / EQUIVALENT ELECTROMECHANICAL PNP TYPE SOLID STATE / EQUIVALENT ELECTROMECHANICAL	 	 BASE CURRENT I_b IS VERY MUCH SMALLER THAN THE COLLECTOR CURRENT I_C

Q5 RECTANGLE AROUND TRANSISTOR DESIGNATION DENOTES CONDUCTION IN QUIESCENT (AT REST) STATE

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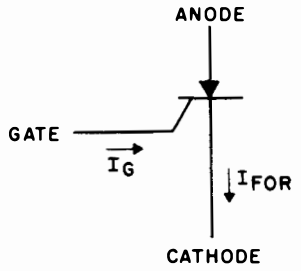
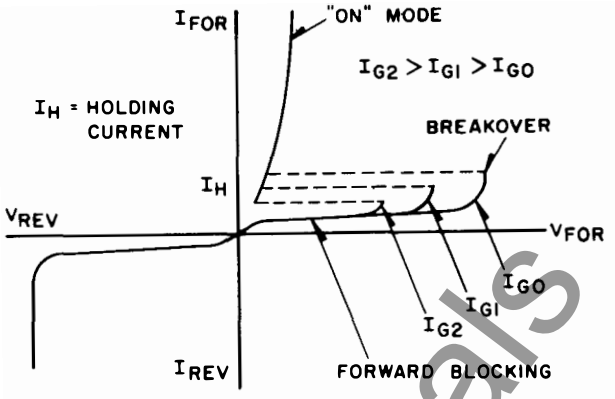
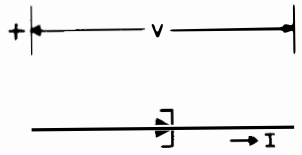
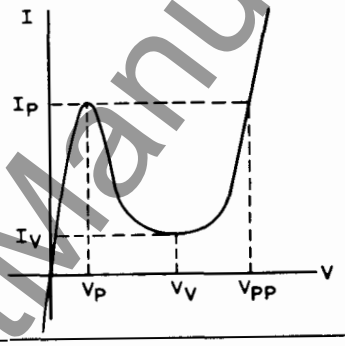
THYRISTOR
(TRINISTOR CONTROLLED RECTIFIER, SCR)



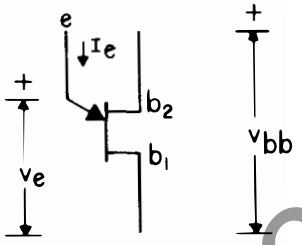


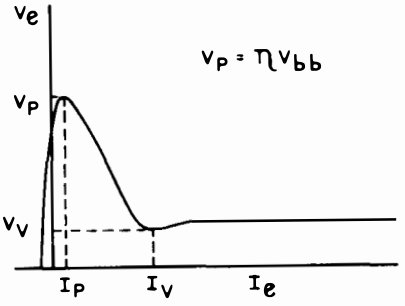
TUNNEL DIODE



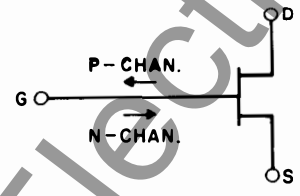


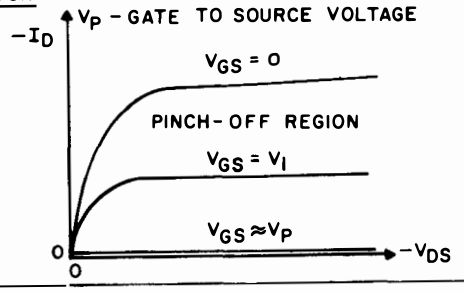
UNIJUNCTION



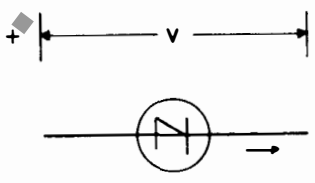


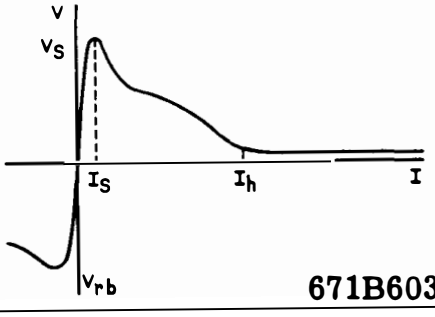
FIELD EFFECT TRANSISTOR





4 LAYER DIODE





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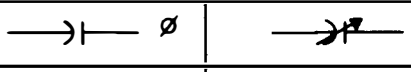
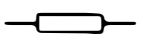
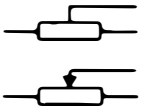
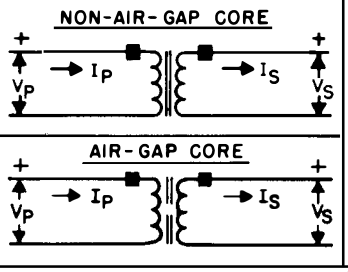
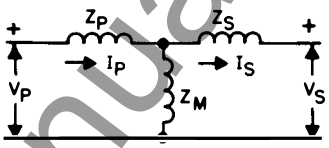
DEVICE	FIXED	VARIABLE	TAPPED
CAPACITOR			
RESISTOR RHEOSTATS, POTENTIOMETERS			 FIXED TAP ADJUSTABLE TAP
REACTOR			

Ø CURVED LINE IS NEGATIVE IN ELECTROLYTIC CAPACITORS OR OUTER FOIL FOR PAPER CAPACITOR

TRANSFORMER, COMPENSATORS



EQUIVALENT CIRCUIT



FOR TRANSFORMER, Z_M IS VERY HIGH.
FOR COMPENSATOR OR AIR-GAP TRANSFORMER, Z_M IS LOW. AIR-GAP LIMITS SATURATION.

COMPOSITE NETWORKS - SEQUENCE FILTERS

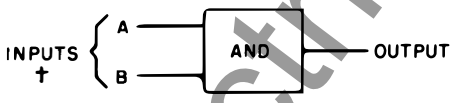
THREE PHASE A-C CURRENT OR VOLTAGE

SINGLE PHASE VOLTAGE PROPORTIONAL TO:
I_1, I_2, $3I_0$ OR I_0, E_1, E_2, $3E_0$ OR E_0
AND COMBINATIONS $K_1 I_1 + K_2 I_2 + K_0 I_0$

THESE STATIC NETWORKS PROVIDE LESS COMPLEX FAULT SENSING THAN IS AVAILABLE DIRECTLY FROM THE THREE PHASE POWER SYSTEM.

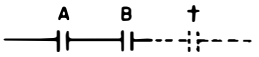
LOGIC CIRCUITS

AND



INPUTS A	INPUTS B	OUTPUT
0	0	0
0	1	0
1	0	0
1	1	1

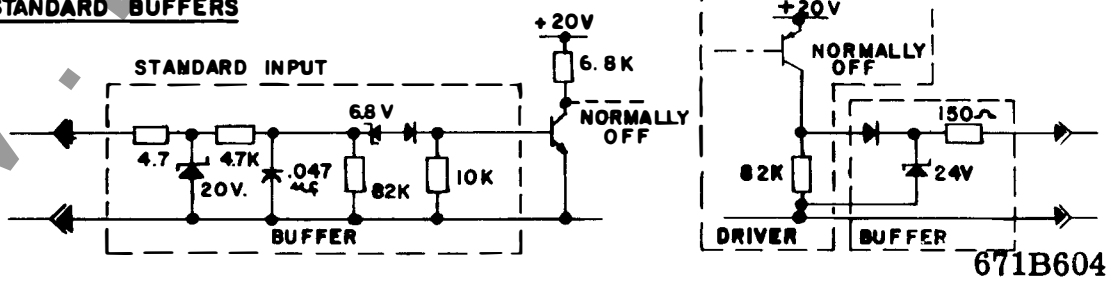
ELECTROMECHANICAL CONTACT EQUIVALENT



SIGNAL ON ALL INPUTS REQUIRED TO PROVIDE AN OUTPUT

NOTES : 1 - ACTIVE STATE OF A SIGNAL (MAY BE DEFINED AS POSITIVE OR NEGATIVE VOLTAGE OR CURRENT)
0 - INACTIVE STATE OF A SIGNAL (REFERENCE)
† - CAN HAVE MORE THAN TWO INPUTS

STANDARD BUFFERS



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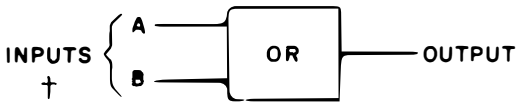
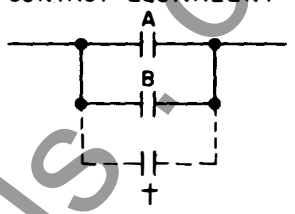
LOGIC CIRCUITS – CONTINUED

INCLUSIVE OR



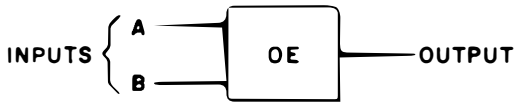
INPUTS		OUTPUT
A	B	
0	0	0
0	1	1
1	0	1
1	1	1

ELECTROMECHANICAL CONTACT EQUIVALENT



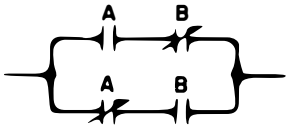
SINGLE INPUT WILL PRODUCE AN OUTPUT
ALL INPUTS PRODUCE AN OUTPUT

EXCLUSIVE OR



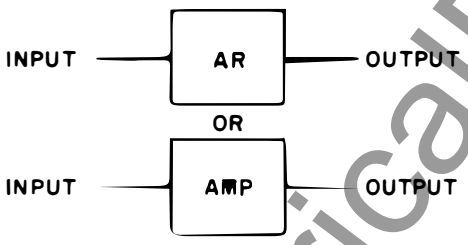
INPUTS		OUTPUT
A	B	
0	0	0
0	1	1
1	0	1
1	1	0

ELECTROMECHANICAL CONTACT EQUIVALENT



SINGLE INPUT WILL PRODUCE AN OUTPUT
ALL INPUTS SIMULTANEOUSLY PRODUCE NO OUTPUT

AMPLIFIER



INPUT	OUTPUT
0	0
1	1

INPUT SIGNAL PRODUCES OUTPUT

NEGATION (NOT)

INPUT	OUTPUT
0	1
1	0

ABSENCE OF INPUT SIGNAL PRODUCES OUTPUT

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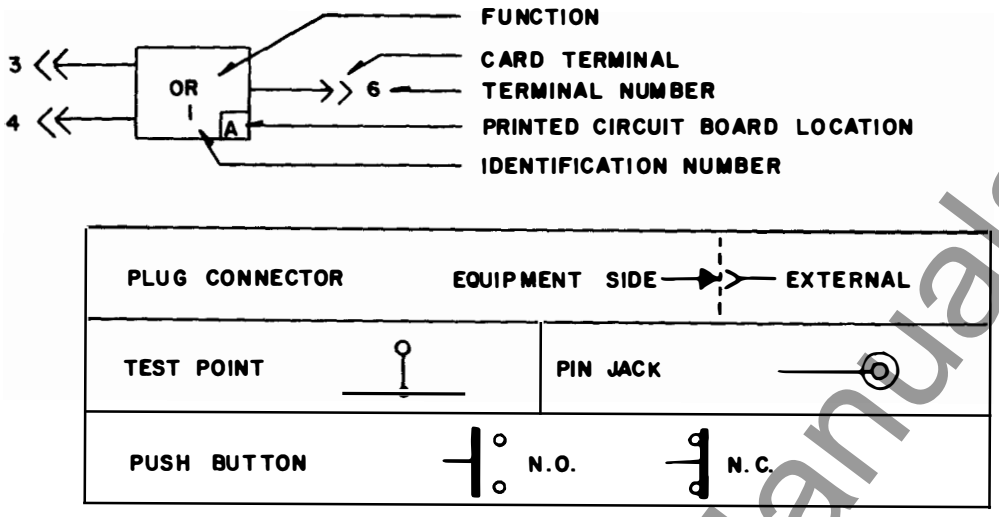
SOLID STATE RELAY DIAGRAM, CONTINUED



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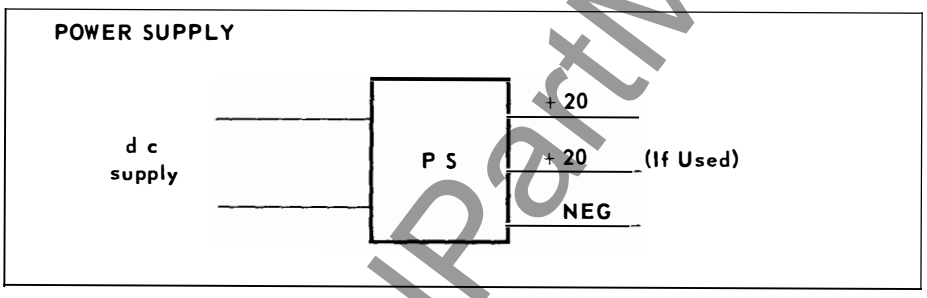

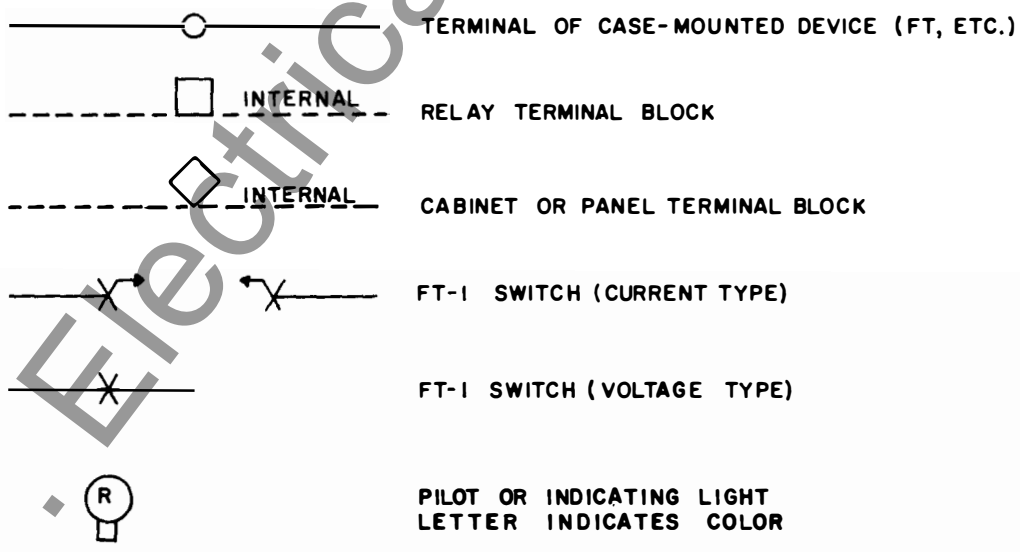

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*Denotes change from superseded issue.

EFFECTIVE OCTOBER 1968

SYMBOLS FOR SOLID STATE PROTECTIVE RELAYING

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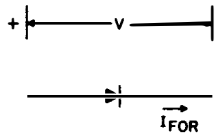
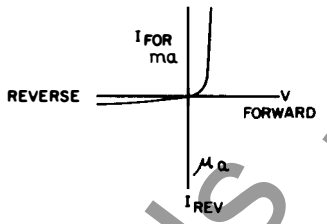
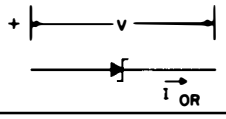
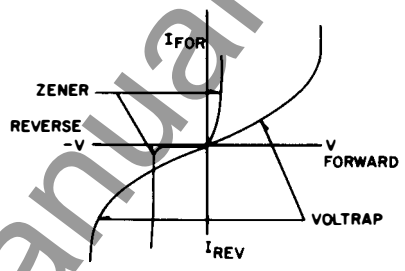
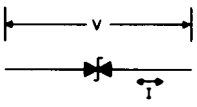
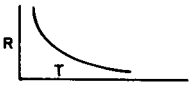
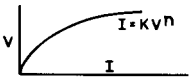
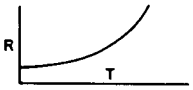
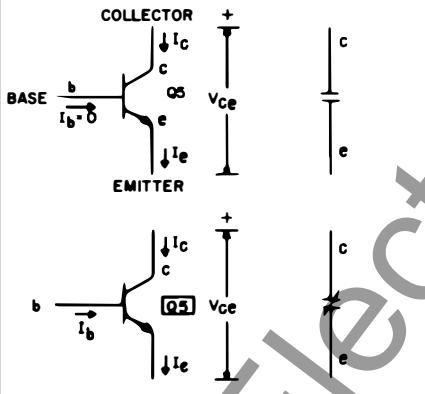
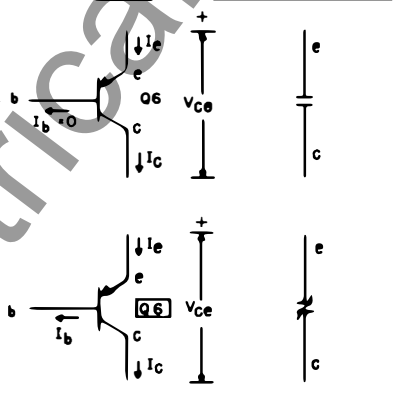
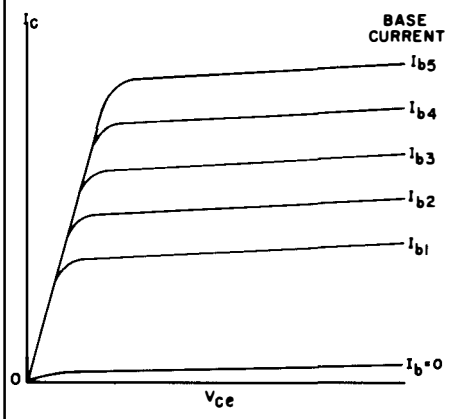
DIODE		
ZENER DIODE		
SURGE SUPPRESSOR (VOLTRAP, ZENER CLIPPER, THYRECTOR)		
THERMISTOR		
VARISTOR		
SENSISTOR		
TRANSISTOR NPN TYPE SOLID STATE / EQUIVALENT ELECTROMECHANICAL 	PNP TYPE SOLID STATE / EQUIVALENT ELECTROMECHANICAL 	 BASE CURRENT I_b IS VERY MUCH SMALLER THAN THE COLLECTOR CURRENT I_C

Q5 RECTANGLE AROUND TRANSISTOR DESIGNATION DENOTES CONDUCTION IN QUIESCENT (AT REST) STATE

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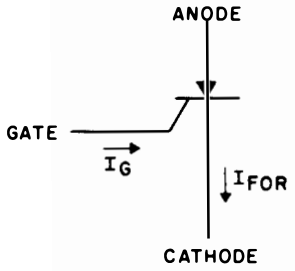
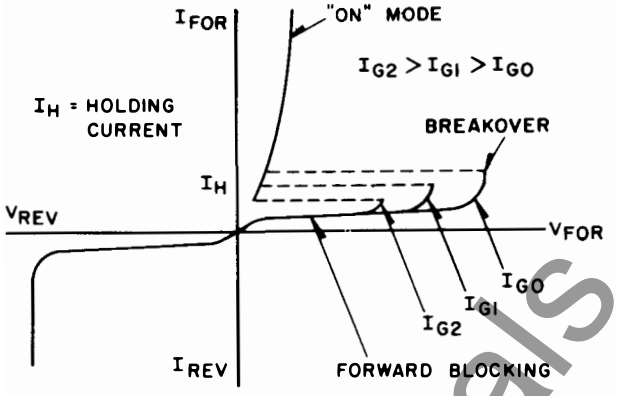
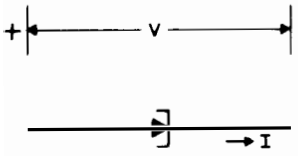
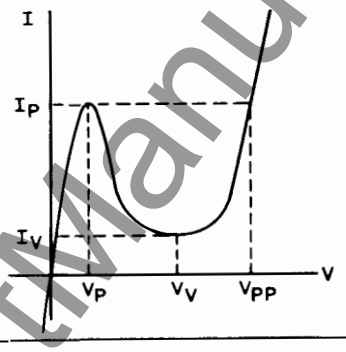
THYRISTOR
(TRINISTOR CONTROLLED RECTIFIER, SCR)



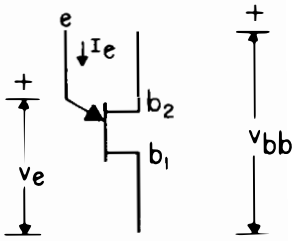


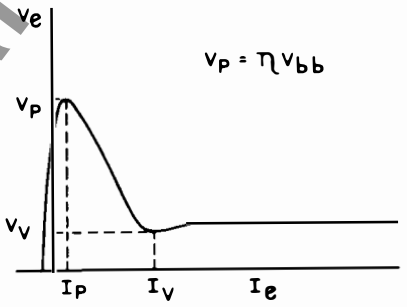
TUNNEL DIODE



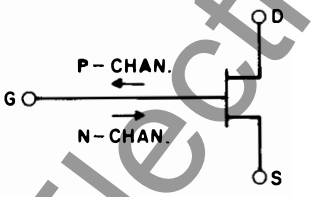


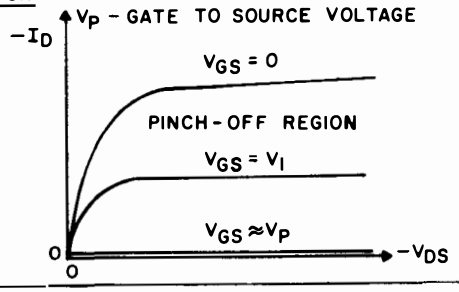
UNIJUNCTION



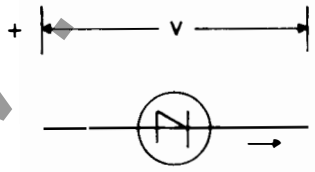


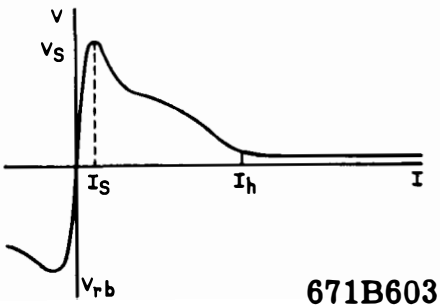
FIELD EFFECT TRANSISTOR





4 LAYER DIODE





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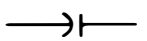
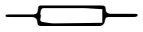
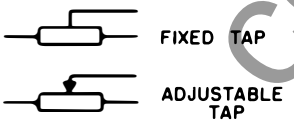
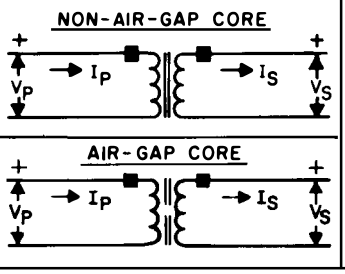
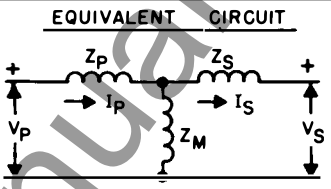
DEVICE	FIXED	VARIABLE	TAPPED
CAPACITOR			
RESISTOR RHEOSTATS, POTENTIOMETERS			
REACTOR			

Ø CURVED LINE IS NEGATIVE IN ELECTROLYTIC CAPACITORS OR OUTER FOIL FOR PAPER CAPACITOR

TRANSFORMER, COMPENSATORS

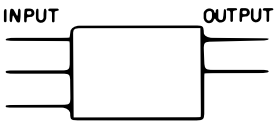


EQUIVALENT CIRCUIT



FOR TRANSFORMER, Z_M IS VERY HIGH.
FOR COMPENSATOR OR AIR-GAP TRANSFORMER, Z_M IS LOW. AIR-GAP LIMITS SATURATION.

COMPOSITE NETWORKS - SEQUENCE FILTERS



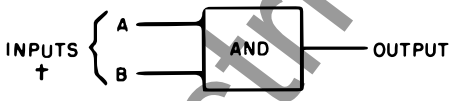
THREE PHASE A-C CURRENT OR VOLTAGE

SINGLE PHASE VOLTAGE PROPORTIONAL TO:
I_1, I_2, $3I_0$ OR I_0, E_1, E_2, $3E_0$ OR E_0
AND COMBINATIONS $K_1 I_1 + K_2 I_2 + K_0 I_0$

THESE STATIC NETWORKS PROVIDE LESS COMPLEX FAULT SENSING THAN IS AVAILABLE DIRECTLY FROM THE THREE PHASE POWER SYSTEM.

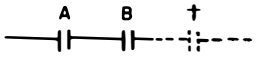
LOGIC CIRCUITS

AND



INPUTS A	INPUTS B	OUTPUT
0	0	0
0	1	0
1	0	0
1	1	1

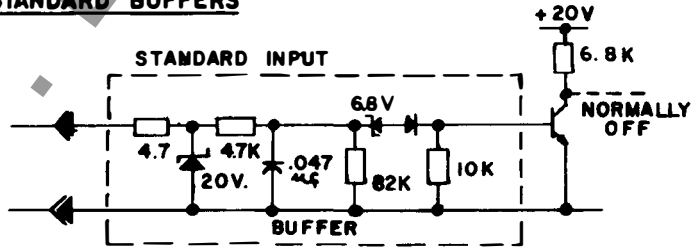
ELECTROMECHANICAL CONTACT EQUIVALENT



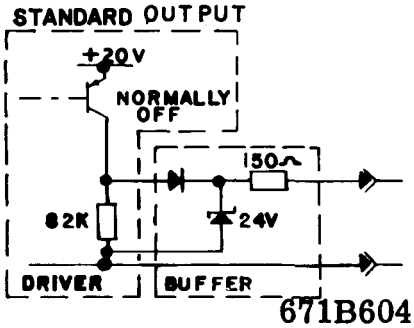
SIGNAL ON ALL INPUTS REQUIRED TO PROVIDE AN OUTPUT

NOTES: 1 - ACTIVE STATE OF A SIGNAL (MAY BE DEFINED AS POSITIVE OR NEGATIVE VOLTAGE OR CURRENT)
0 - INACTIVE STATE OF A SIGNAL (REFERENCE)
† - CAN HAVE MORE THAN TWO INPUTS

STANDARD BUFFERS



STANDARD OUTPUT



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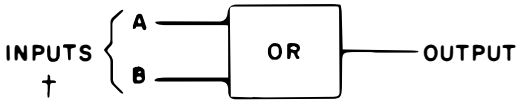
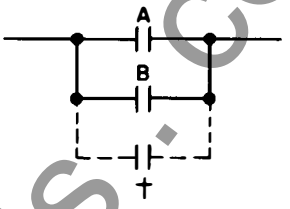
LOGIC CIRCUITS – CONTINUED

INCLUSIVE OR



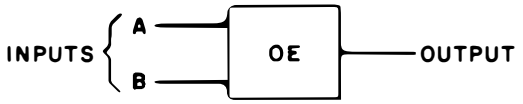
INPUTS		OUTPUT
A	B	
0	0	0
0	1	1
1	0	1
1	1	1

ELECTROMECHANICAL CONTACT EQUIVALENT



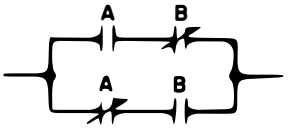
SINGLE INPUT WILL PRODUCE AN OUTPUT
ALL INPUTS PRODUCE AN OUTPUT

EXCLUSIVE OR



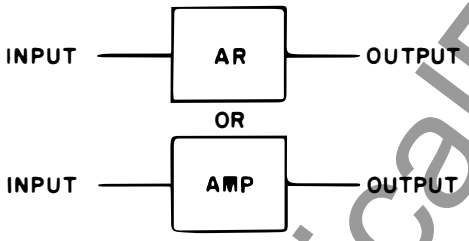
INPUTS		OUTPUT
A	B	
0	0	0
0	1	1
1	0	1
1	1	0

ELECTROMECHANICAL CONTACT EQUIVALENT



SINGLE INPUT WILL PRODUCE AN OUTPUT
ALL INPUTS SIMULTANEOUSLY PRODUCE NO OUTPUT

AMPLIFIER



INPUT	OUTPUT
0	0
1	1

INPUT SIGNAL PRODUCES OUTPUT

NEGATION (NOT)

INPUT	OUTPUT
0	1
1	0

ABSENCE OF INPUT SIGNAL PRODUCES OUTPUT

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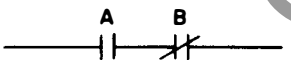
EXAMPLE OF LOGIC NEGATION

INPUTS		OUTPUT
A	B	
0	0	0
0	1	0
1	0	1
1	1	0

ELECTROMECHANICAL CONTACT EQUIVALENT



SIGNAL AT A AND NOT AT B PRODUCES OUTPUT

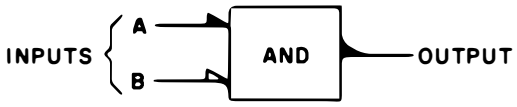
MIXED LOGIC

WHERE IT IS DESIRED TO REPRESENT SIGNAL POLARITY, OPEN AND CLOSED ARROWS MAY BE USED

A ONE INPUT (OR OUTPUT) TO A CLOSED ARROW IS MORE POSITIVE THAN A CORRESPONDING 0 INPUT (OR OUTPUT)

A ONE INPUT (OR OUTPUT) TO AN OPEN ARROW IS MORE NEGATIVE THAN A CORRESPONDING 0 INPUT (OR OUTPUT)

AS AN EXAMPLE :



INPUTS		OUTPUT
A	B	
0	0	0
0	1	0
1	0	0
1	1	1

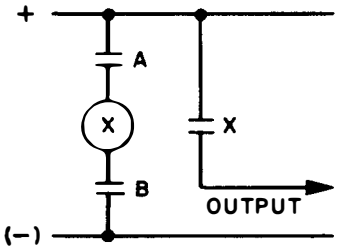
1 INPUT AT A IS MORE POSITIVE THAN 0 INPUT

1 INPUT AT B IS MORE NEGATIVE THAN 0 INPUT

1 OUTPUT IS MORE POSITIVE THAN 0 OUTPUT

INPUT AT A AND B PRODUCE OUTPUT

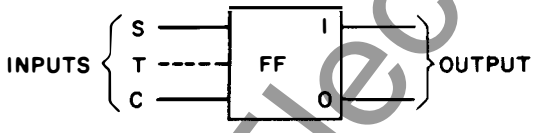
ELECTROMECHANICAL CONTACT EQUIVALENT



THE USE OF POSITIVE LOGIC IS PREFERRED WHEREVER IT CAN REASONABLY BE USED

ARROWHEADS WILL BE OMITTED AT POSITIVE LOGIC INPUTS WHERE LOGIC IS PREDOMINATELY POSITIVE

FLIP FLOP



S = SET

C = CLEAR (RESET)

T = TRIGGER

SET SIGNAL YIELDS 1 AT 1, 0 AT 0 OUTPUT

CLEAR SIGNAL YIELDS 1 AT 0, 0 AT 1 OUTPUT

SIMULTANEOUS SET AND CLEAR SIGNALS YIELD UNDEFINED OUTPUT

FF RETAINS PREVIOUS STATE FOLLOWING REMOVAL OF BOTH INPUTS SIMILAR TO LATCHING RELAY

WHERE T (TRIGGER) IS USED, T INPUT CHANGES OUTPUT STATE

PULSE CIRCUIT

INPUT	OUTPUT
0	0
1	Δ

Δ - OUTPUT PULSES AT OSCILLATOR RATE AS LONG AS "1" INPUT EXISTS

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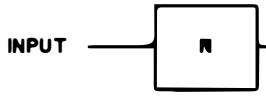
LOGIC CIRCUITS – CONTINUED

INVERSION

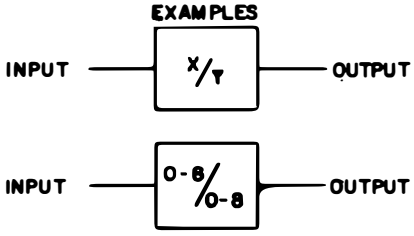


INPUT	OUTPUT
1	1
0	0

PRODUCES POLARITY INVERSION, BUT NO LOGIC NEGATION

TIME DELAY

EXAMPLES



X = OPERATE TIME IN MILLISECONDS
(TIME FOR OUTPUT TO APPEAR FOLLOWING INPUT SIGNAL)

Y = RESET TIME IN MILLISECONDS
(TIME FOR OUTPUT TO BE REMOVED FOLLOWING REMOVAL OF INPUT SIGNAL)

X&Y MAY BE ADJUSTABLE AS INDICATED FOR EXAMPLE BY 0-8

SINGLE SHOT

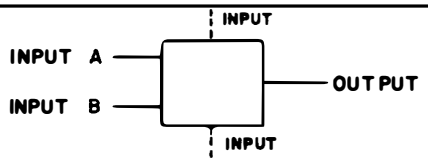
FOLLOWING APPLICATION OF SUSTAINED INPUT, SINGLE PULSE OUTPUT APPEARS

SOLID STATE RELAY DIAGRAMS

NORMAL STATES

IN COMPLEX LOGIC CIRCUITRY 1'S AND 0'S WILL BE SHOWN TO INDICATE THE "NORMAL" STATE OF THE INPUTS. "NORMAL" STIPULATES THAT THE RELAY HAS D.C. APPLIED, NO FAULT EXISTS, THE ASSOCIATED BREAKER IS CLOSED (IF THIS FACT IS GERMANE), AND THE RELAY IS RESET.

INPUT AND OUTPUT



INPUTS TO A LOGIC BLOCK ARE PREFERRED ON THE LEFT SIDE OF THE BLOCK. THE OUTPUT IS PREFERRED ON THE RIGHT SIDE OF THE BLOCK. IN SPECIAL CASES, WHERE CLARITY WILL RESULT, INPUTS MAY BE SHOWN ON ANY SIDE OF THE BLOCK EXCEPT THE OUTPUT SIDE ALTHOUGH THE SIDE OPPOSITE IS PREFERRED. SIGNAL FLOW AS SHOWN BELOW WILL BE USED WHERE IT WILL CONTRIBUTE TO CLARITY.

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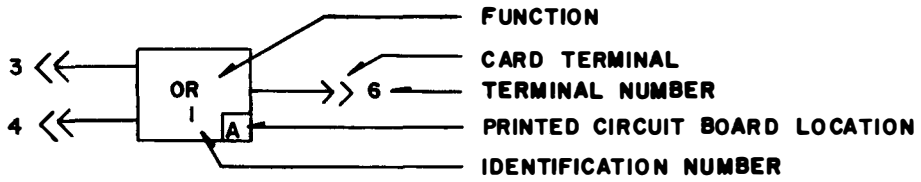
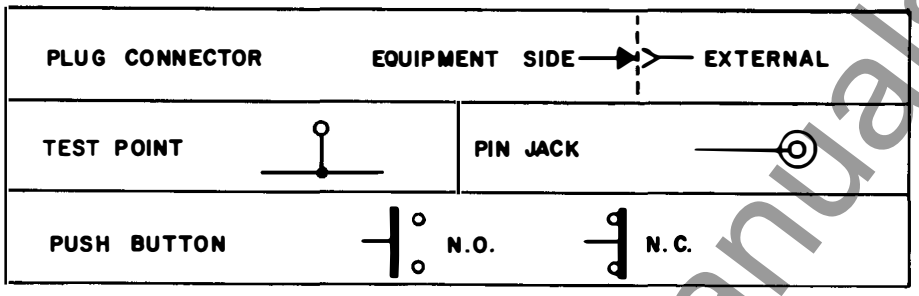
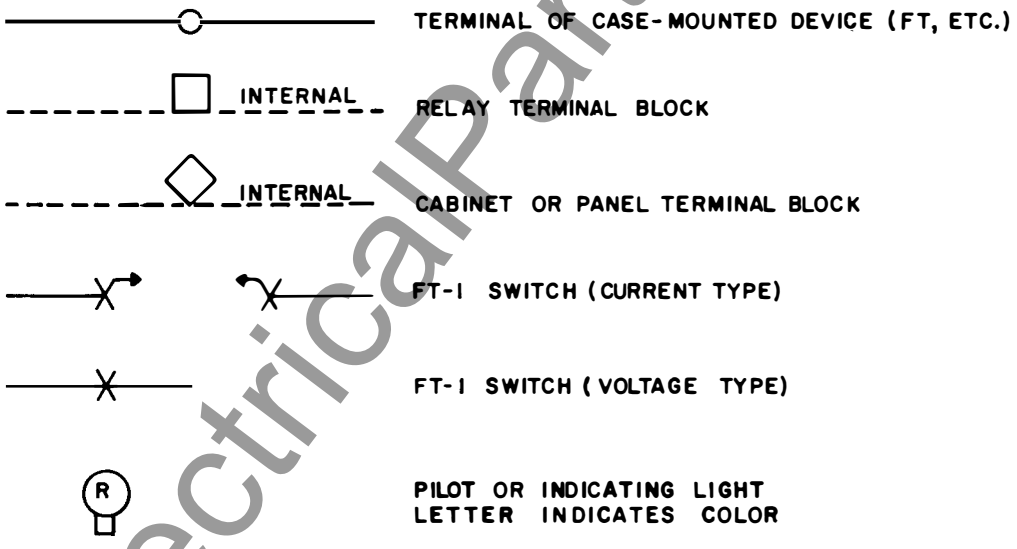
SOLID STATE RELAY DIAGRAM, CONTINUED







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WESTINGHOUSE ELECTRIC CORPORATION
RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**
Printed in U.S.A.

Westinghouse

INSTALLATION LEAFLETS ---- PROTECTIVE RELAYS

PUBLICATION	NUMBER	DATE	PAGES	PRODUCT/APPARATUS
Installation Instr.	41-000.1	Apr.,1967	1-8	Symbols for Solid State Protective Relaying
Installation Instr.	41-076D	Feb.,1965	1-10	Relays in Type
Installation Instr.	41-101M	May,1967	1-20	Type CO Overcurrent Relay
Installation Instr.	41-102B	Oct.,1965	1-23	Type COM Overcurrent Relay
Installation Instr.	41-103E	July 1967	1-18	Type CO Circuit Opening Overcurrent Relay
Installation Instr.	41-106B	Sep. 1961	1-9	Type CO-4 Step-Time Overcurrent Relays
Installation Instr.	41-109	Feb. 1958	1-4	Type CO Contact Making Ammeter
Installation Instr.	41-112A	Oct. 1961	1-5	Type COD Current Sensing Relay
Installation Instr.	41-112.1	June 1960	1-6	Type COD Current Sensing Relay 0.5-2 and 1-4 Ampere Ranges
Installation Instr.	41-116D	July 1965	1-16	Type COV Voltage Controlled Overcurrent Relay
Installation Instr.	41-131K	Oct. 1967	1-26	Directional Overcurrent Relays Types: CR, CRC, CRP and CRD
Installation Instr.	41-133G	Mar.1967	1-30	Directional Overcurrent Ground Relays Types IRP, IRC and IRD
Installation Instr.	41-133.2B	Apr.1966	1-27	Type IRQ Directional Overcurrent Negative Sequence Relay for Ground Protection
Installation Instr.	41-133.3C	Jun.,1964	1-24	Type IRV Directional Overcurrent relay for Phase Protection
Installation Instr.	41-136.1A	July,1960	1-8	Types HE and HRC Directional Overcurrent Relays
Installation Instr.	41-137G	Nov.1966	1-15	Directional Overcurrent Ground Relay Types KRP KRC and KRD
Installation Instr.	41-137.2B	Jan.1964	1-12	Type KRV Directional Overcurrent Relay for Phase Protection
Installation Instr.	41-137.3B	Mar.1968	1-12	Type KRD-4 Directional Overcurrent Ground Relay
Installation Instr.	41-151.1E	Nov.1967	1-7	Type D-3 Direct Current Relay
Installation Instr.	41-161C	July 1966	1-11	Type COQ Negative Sequence Generator Relay
Installation Instr.	41-162.2	July 1965	1-8	Type POQ Negative Sequence
Installation Instr.	41-163.2	Nov. 1963	1-27	Type CRQ Directional Overcurrent Negative Sequence Relay for Ground Protection
Installation Instr.	41-164E	May,1968	1-13	Type KRQ Directional Overcurrent Negative Sequence Relay for Ground Protection
Installation Instr.	41-176	Oct.,1956	1-9	Type HD Current Balance Relay
Installation Instr.	41-177	Sep. 1966	1-10	Type SCC Current Comparer Relay
Installation Instr.	41-181.2B	July 1966	1-8	Type CM Phase Balance Current Relay
Installation Instr.	41-201G	Oct. 1967	1-17	Type CV Voltage Relay
Installation Instr.	41-201.2A	Oct.1967	1-14	Type CV Frequency Compensated Voltage Relay
Installation Instr.	41-217.1	Dec. 1953	1-11	Type CI Synchro-Verifier
Installation Instr.	41-222.2D	Sept.1966	1-8	Type CP Reverse Phase Relay
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