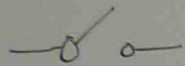
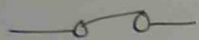


## MECHANICAL SWITCHES, RELAY LOGIC AND SWITCH DEBOUNCER

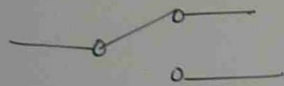
SWITCHES ARE ELECTRO MECHANICAL DEVICES USED TO MAKE (OR) BREAK AN ELECTRIC CIRCUIT BY MANUAL (OR) MECHANICAL OPERATION



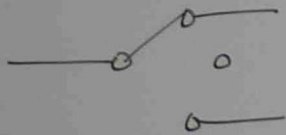
(a) NORMALLY OPEN, SINGLE POLE, SINGLE THROW (NO, SPST)



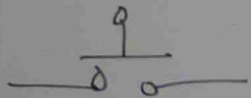
(b) NORMALLY CLOSED, SINGLE POLE, SINGLE THROW (NC, SPST)



(c) SINGLE POLE, DOUBLE THROW (SPDT)



(d) SINGLE POLE, DOUBLE THROW WITH CENTRE OFF



NO SPST

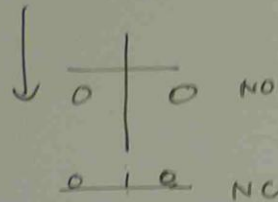


(NC SPST)

(e) PUSH BUTTON SWITCHES.

TOGGLE SWITCH. ENERGY SAVING LOW POWER LIGHTING.  
LOW POWER ELECTRONIC

PUSH BUTTON SWITCH -  $\rightarrow$  MOMENTARY CONTACT  
 $\searrow$  MAINTAINED CONTACT



### KNIFE SWITCH

THE KNIFE SWITCH IS USED EXTENSIVELY FOR  
CONTROLLING MAIN POWER CIRCUITS.

### ROTARY SELECTOR SWITCH

THE ROTARY SWITCH IS OFTEN USED ON  
TEST EQUIPMENT AND OTHER MULTI FUNCTION  
LOW POWER EQUIPMENTS.

## MANUAL MOTOR STARTERS

THE MANUAL STARTER IS USED TO START (OR) STOP AC & DC MOTORS.

## LIMIT SWITCHES

LIMIT SWITCHES HAVE TWO BASIC USES.

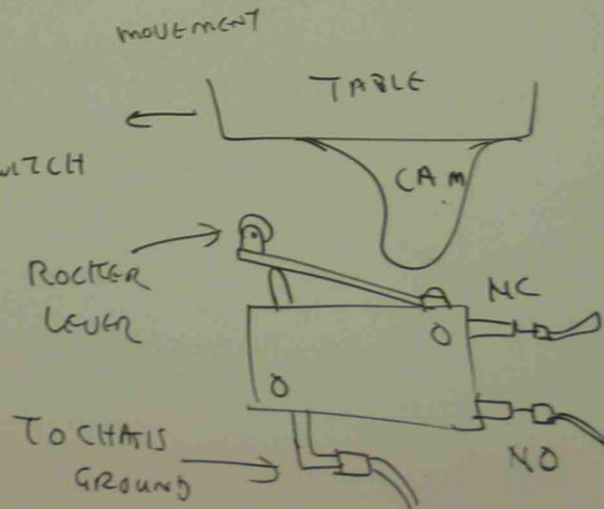
FIRST THEY SERVE AS SAFETY DEVICES TO KEEP OBJECTS BETWEEN CERTAIN PHYSICAL BOUNDARIES

SECOND, LIMIT SWITCHES ARE USED TO CONTROL INDUSTRIAL PROCESSES THAT USE CONVEYORS OR ELEVATORS.

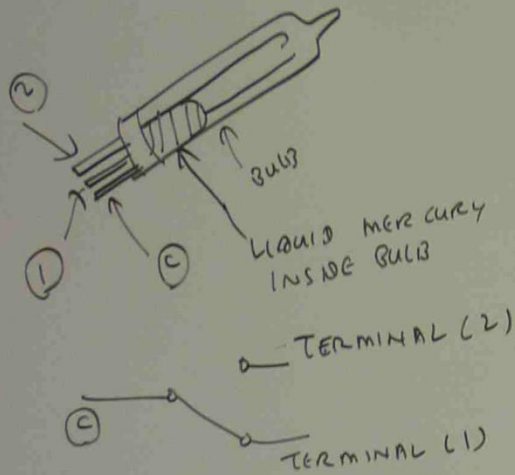
CONTROL SYSTEM.

## MICRO SWITCH

SNAP ACTING SWITCH



## MERCURY SWITCHES



POSITION SENSOR  
(OPERATED BY CENTRIFUGAL  
OR) CENTRIFUGAL FORCE

4 A, 115V

## MOTOR PROTECTION SWITCHES

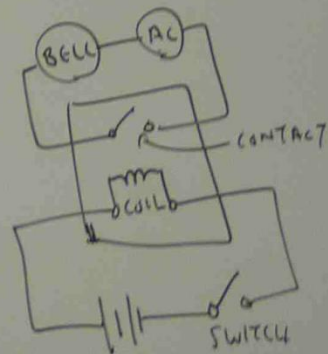
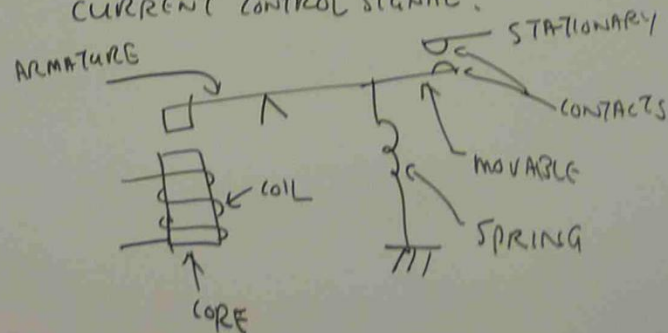
INDUSTRIAL MOTOR PROTECTION IS BASED ON TWO CONDITIONS:

- EXCESSIVE LINE CURRENT (SHORT CIRCUIT CONDITIONS)
- HIGH MOTOR TEMPERATURE.

SHORT CIRCUIT IS USUALLY PROTECTED BY FUSE (OR)  
CIRCUIT BREAKER.

RELAY 
 ELECTROMECHANICAL  
 SOLID STATE

A RELAY IS A CRITICAL COMPONENT OF MANY CONTROL  
SYSTEMS BECAUSE THEY OFFER AN INDIRECTLY OPERATED  
ELECTRICAL SWITCH THAT CAN BE USED FOR REMOTE  
CONTROL AND TO CONTROL HIGH CURRENT DEVICES WITH LOW  
CURRENT CONTROL SIGNAL.





## RELAY TYPES

- GENERAL PURPOSE — WIDE VARIETY OF USE
- LATCH IN — CONTACT LOCK IN EITHER ENERGIZED / DE-ENERGIZED POSITION (RESET MANUALLY / ELECTRICALLY)
- POLARIZED — POLARITY OF ENERGIZING CURRENT
- DIFFERENTIAL — VOLTAGE / CURRENT / POWER DIFFERENCE
- TELEPHONE
- STEPPING — CONTACTS ARE STEPPED TO SUCCESSIVE POSITIONS
- INTERLOCK — ONE OPERATION PROHIBITS ANOTHER OPERATION
- SEQUENCE — OPERATES TWO OR MORE SETS OF CONTACTS IN PREDETERMINED SEQUENCE
- TIME DELAY — TIMER
- MARGINAL — OPERATION IS BASED ON A PREDETERMINED VALUE OF COIL CURRENT AND VOLTAGE.

IN WRITING OF SPECIFICATIONS FOR CIRCUIT BREAKERS, SWITCHES AND RELAYS, THE FOLLOWING FACTS MUST BE MENTIONED

RATED COIL VOLTAGE, RATED COIL CURRENT, COIL RESISTANCE, OPERATING FREQUENCY, OPERATE VOLTAGE / CURRENT, RELEASE VOLTAGE / CURRENT, OPERATE TIME, RELEASE TIME, CONTACT BOUNCE, CONTACT CHATTER, CONTACT RATING.

VARIETY OF USE  
 EITHER ENERGIZED / DE-ENERGIZED POSITION (RESET MANUALLY / ELECTRICALLY)  
 ENERGIZING CURRENT  
 CURRENT / POWER DIFFERENCE

STEPPED TO SUCCESSIVE POSITIONS  
 WHICH PROHIBITS ANOTHER OPERATION  
 OR MORE SETS OF CONTACTS IN PRE-DETERMINED SEQUENCE

IS BASED ON A PRE-DETERMINED VALUE OF COIL  
 AND VOLTAGE.

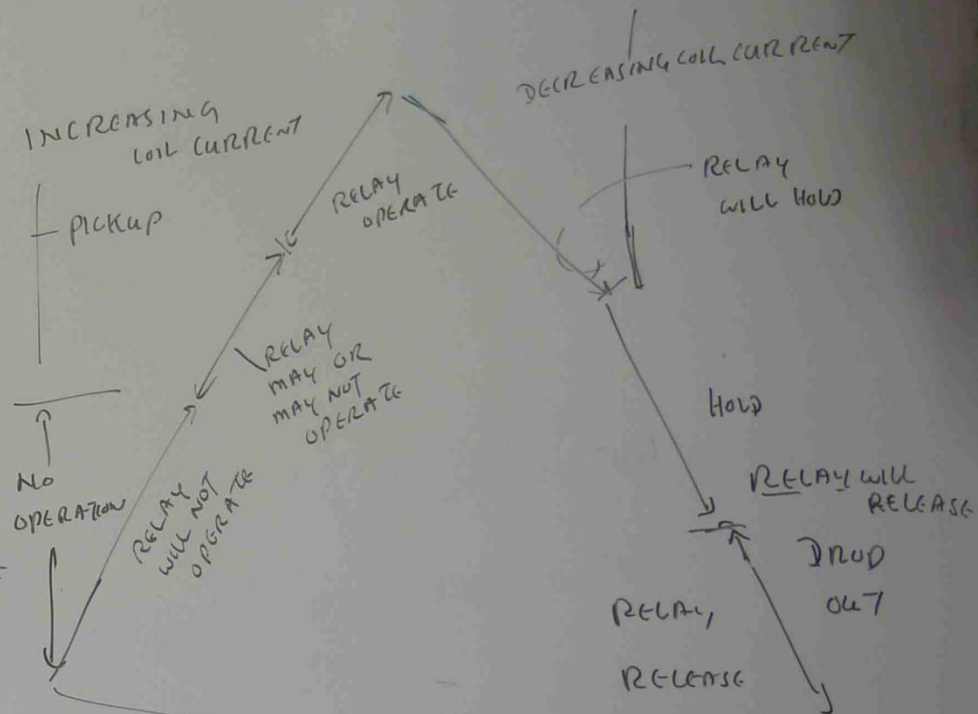
FUNCTIONS FOR CIRCUIT BREAKERS, SWITCHES AND RELAYS, THE  
 MENTIONED

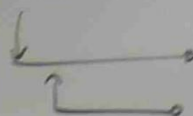
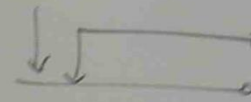
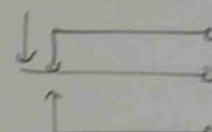
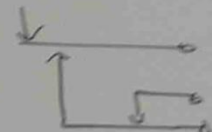

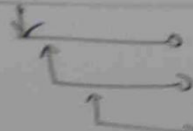
COIL CURRENT, COIL RESISTANCE, OPERATING FREQUENCY,

CURRENT, RELEASE VOLTAGE / CURRENT, OPERATE TIME,

CONTACT BOUNCE, CONTACT CHATTER, CONTACT RATING.

## CONTACTING CHARACTERISTICS



FORM (A)	DESCRIPTION	SYMBOL
A	MAKE (OR) SPST NO	
B	BREAK (OR) SPST NC	
C	BREAK, MAKE (OR) SPST (B-M)	
D	MAKE, BREAK (OR) SPST (M-B)	
E	BREAK, MAKE BREAK OR SPST (B-M-B)	
F	MAKE, MAKE (OR) SPST (M-M)	

## ELECTROMAGNETIC RELAY (EMR) AND SOLID STATE RELAY (SSR)

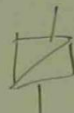
CHARACTERISTICS	EMR	SSR	ADVANTAGE
LIFE	100,000 to millions of cycle	NO MOVING PART LAST LIFE	SSR
ISOLATION	INFINITE DIELECTRIC ISOLATION	NO DIELECTRICALLY ISOLATED	EMR
EMI	EMI GENERATION	NOISE GENERATED IS NEGLIGIBLE	SSR
SPEED	MILLI SECOND	NANO SECOND	SSR
OPERATE POWER	MORE POWER	LESS POWER	SSR
CONTACT VOLTAGE DROP	LOW	HIGHER	EMR
THEIR MAX POWER DISSIPATION	LOW	HIGHER VOLTAGE DROP	EMR



## STANDARD RELAY SYMBOLS



RELAY



COIL

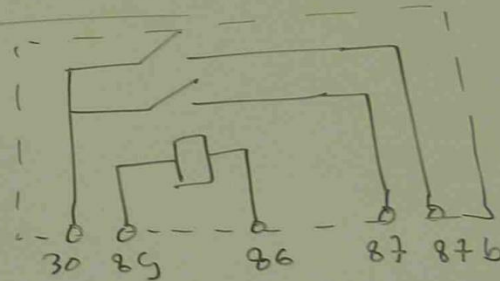


NORMALLY OPEN  
(NO)  
CONTACT



NORMALLY CLOSED  
(NC)  
CONTACT

## RELAY LOGIC



## CONNECTIONS

CONNECTION NUMBER	FUNCTION NAME
30	COMMON CONTACT
87	NORMALLY OPEN CONTACT
87a	NORMALLY CLOSED CONTACT
85	COIL WINDING (1)
86	COIL WINDING (2)

mercury  
inside bulb

TERMINAL (2)

TERMINAL (1)

IN SW 2

(OPERATED BY CENTRIFUGAL  
(OR) CENTRIPETAL FORCE

4 A, 115V

## MOTOR PROTECTION SWITCHES

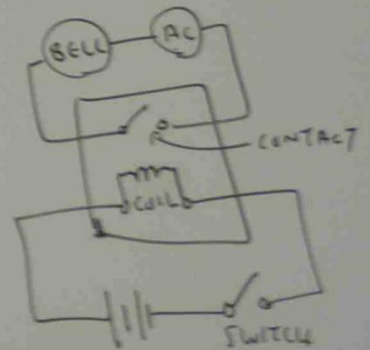
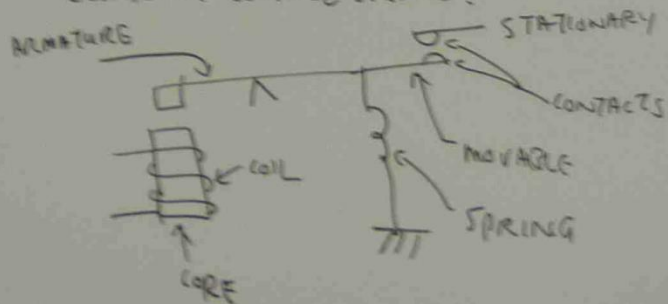
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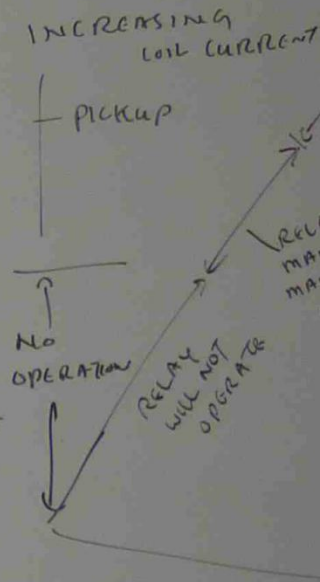


## RELAY TYPES

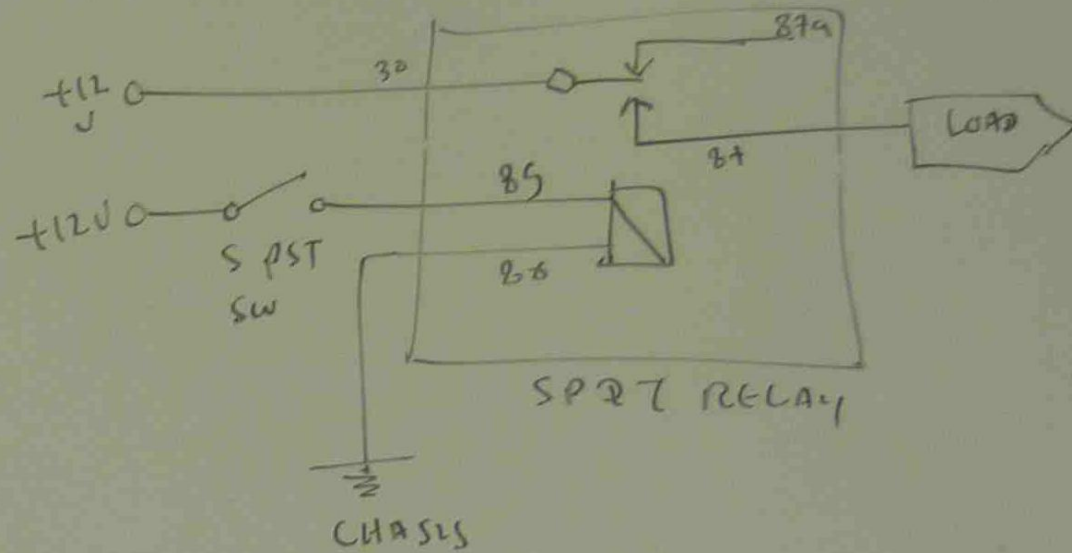
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# STANDARD BUFFER (OR) CURRENT AMPLIFIER





# ELECTRICAL CONTRACTING

## OWNER / PROJECT MANAGER

- PREPARE COMPANY LONG TERM PLAN / YEARLY PLAN
- REVIEW MONTHLY PROGRESS
- VERIFY THAT MAJOR ACTIVITY IS ASSIGNED TO PARTICULAR INDIVIDUAL
- MAKE SURE THAT EACH INDIVIDUAL MEETS THEIR RESPONSIBILITIES
- REVIEW EACH MAJOR JOB ON WEEKLY BASIS
- KEEP EVERY BODY IN THE COMPANY HAPPY AND WORKING
- STAY IN TOUCH WITH CUSTOMERS.
- MEET CONSULTANT / ATTORNEY / INSURANCE SALESMAN ONCE A MONTH
- KEEP OFFICE CLEAN AND ORGANIZED
- ASSIST ALL EMPLOYEES

## TRICAL CONTRACTING

### PROJECT MANAGER

COMPANY LONG TERM PLAN / YEARLY PLAN

MONTHLY PROGRESS

WHAT MAJOR ACTIVITY IS ASSIGNED TO  
EACH INDIVIDUAL

THAT EACH INDIVIDUAL MEETS THEIR  
OBLIGATIONS

WHAT MAJOR JOB ON WEEKLY BASIS

KEEP BODY IN THE COMPANY HAPPY AND

DEAL WITH CUSTOMERS.

CONSULTANT / ATTORNEY / INSURANCE SALESMAN  
MONTH

FILES CLEAN AND ORGANIZED

ALL EMPLOYEES

### ESTIMATOR

- PREPARE ESTIMATES AND BID NEW JOBS
- REVIEW JOB PROGRESS
- REVIEW AND VERIFY WEEKLY INVOICES
- REVIEW JOB ACCOUNTING WEEKLY.
- STAY & UPDATE NEW PRODUCTS
- WORK WITH SUPERINTENDENT AND BOOKKEEPER
- ASSIST PRESIDENT FOR FUTURE PLANNING
- ASSIST CO-WORKERS
- TEACH APPRENTICES

### SUPERINTENDENT

- VISIT EACH JOB SITE DAILY
- DISCUSS EACH JOB IN DETAIL WITH  
JOB FOREMEN
- DISCUSS EACH JOB IN DETAIL WITH  
GENERAL CONTRACTOR WEEKLY

- MAINTAIN
- TAKE CARE
- FOREMEN AND
- PREPARE
- ORDER INSP
- TAKE CARE
- MAINTAIN
- PREPARE
- TEACH APPR
- MAINTAIN

- MAINTAIN GOOD RELATIONSHIP WITH OTHER TRADES
- TAKE CARE TO MAINTAIN GOOD ATTITUDE AMONG FOREMEN AND WORKERS
- PREPARE PURCHASE ORDERS
- ORDER INSPECTIONS
- TAKE CARE OF ALL CORRESPONDENCES REGARDING JOB
- MAINTAIN GOOD RELATIONSHIP WITH INSPECTORS
- PREPARE ESTIMATES FOR JOB
- TEACH APPRENTICES
- MAINTAIN OFFICE.