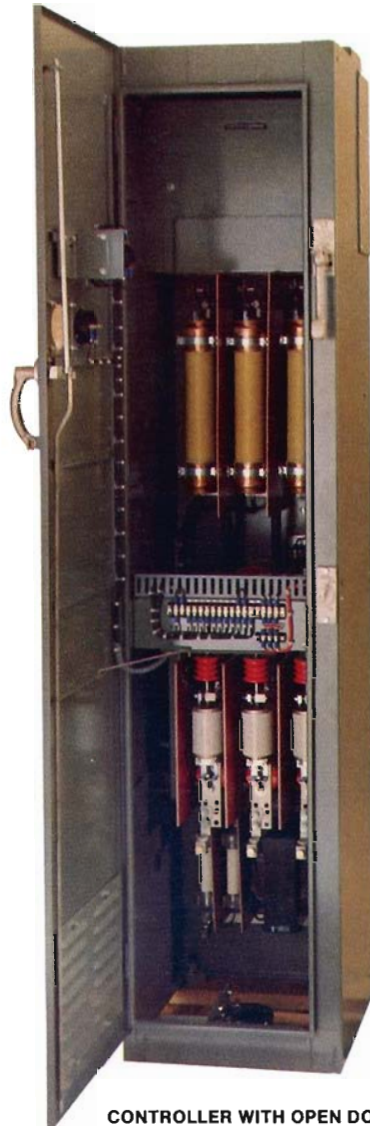


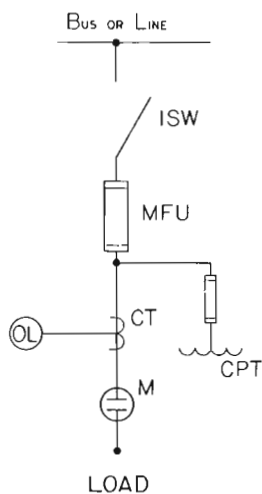


## TYPE 230 COMBINATION CONTROLLER



CONTROLLER WITH OPEN DOOR

### ONE-LINE DIAGRAM



### SCOPE AND SUMMARY

This bulletin outlines applications, design features, equipment arrangement, and space planning, for the type 230 controllers. These controllers are for the control and protection of induction motors or transformers on 2300-4160-volt systems.

Each type 230 controller is a coordinated combination of heavy-duty vacuum contactor, thermal overload relays, current transformers, and current-limiting fuses, with safety-interlocked isolating switch. The power elements are arranged vertically, for easy and safe installation and maintenance. Each controller requires only a 20" square of floor space.



## TYPE 230 COMBINATION CONTROLLER



CONTROLLER GROUP, 3-WIDE

### APPLICATIONS

**GENERAL** The 230 controller provides full-voltage, non-reversing, magnetic starting and protection for induction motors. Or it may be used to switch and protect transformers. Alternate designs are available for synchronous motor control, reduced voltage starting, and other special applications.

**SYSTEM CAPACITY** These controllers may be used on power systems capable of producing fault currents up to 80,000-amps RMS asymmetrical. On a 3-phase basis, that corresponds to 200,000-KVA at 2300-volts and 350,000-KVA at 4160-volts for symmetrical current calculations. This assumes 1.6 ratio between asymmetrical current and initial symmetrical current, for first-cycle fault interruption.

**LOCATIONS** The 230 is ideal for indoor locations. In a minimum floor space, the design provides the safety and maintainability of one-high construction. The 230 needs only 2.78 square feet of floor space with working space required only in the front of the controller.

**LOADS** The controller is made in two ratings, 180-amp and 360-amp. The 360-amp rating may be used for up to 1500-HP, 2300-V, or 2500-HP, 4160-V. These general limits are for motors with 1.15 service factor and up to a 6.5 ratio of locked-rotor current to full-load current.



## TYPE 230 COMBINATION CONTROLLER

### DESIGN FEATURES

**GENERAL** Each 230 controller is a coordinated combination of heavy-duty vacuum contactor, thermal overload relays, current transformers, and current-limiting fuses, with safety-interlocked isolating switch. These major elements, with the accessory parts, are metal-enclosed, factory assembled, and interconnected. The controller is front-connected with all parts readily accessible. The power elements are arranged vertically, for easy and safe installation, operation, and maintenance.

**OPERATION** An electromagnetically-operated vacuum contactor is the power-switching element. The contactor, through a DC master relay, is controlled by the customer's 115-VAC pushbutton or other master element. Optionally, start and/or stop control switches may be included with the controller. The contactor stays closed on momentary voltage dips but opens on prolonged loss of voltage.

**PROTECTION** Three main-line fuses, and two transformer-primary fuses, provide high-speed fault protection with current-limiting effect. A 3-element thermal overload relay provides running overcurrent protection. The fuses are coordinated with the overload relays, so the contactor interrupts any overcurrents up to locked-rotor current and the fuses interrupt only fault currents. Optionally, an instantaneous ground-fault current relay provides ground overcurrent protection on resistance or impedance grounded systems.

**SAFETY** The isolating switch is manually operated to isolate the controller and the circuit from the power supply. The isolating switch may be padlocked open or closed. The enclosure may be padlocked closed. A viewing window permits checking the isolating switch position, with the enclosure door closed. Mechanical interlocks prevent opening the door before opening the isolating switch or closing the isolating switch with the door open. An ammeter shows load current.

### CONSTRUCTION

**GROUPING** When grouped, each controller is in a separate enclosure, and the adjacent enclosures are bolted together. Grouped controllers are equipped with self-contained, interconnecting main-bus. Controllers may be grouped side-by-side and/or back-to-back.

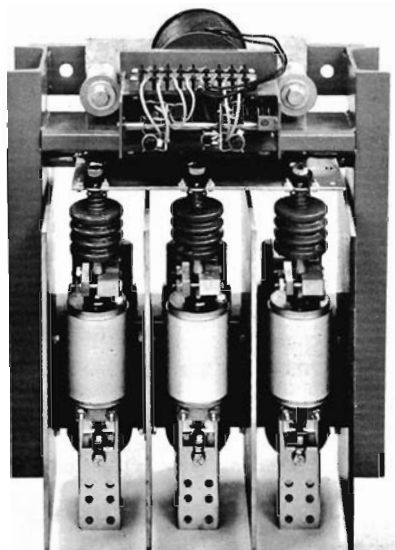
**LIVE PARTS BARRIER** When the isolating switch is open and the door may be opened, the line contacts of the isolating switch and the incoming-line terminals or bus, are the only parts still energized. These parts are at the top of the cabinet. Accidental contact with these energized parts is prevented by a vertical "Live Parts Barrier" and by a horizontal barrier.

**ISOLATING SWITCH** The safety interlocked isolating switch is 3-pole, gang-operated, with external operating handle. Contact travel is vertical, and the air-gap is easily seen when the switch is open. To prevent accidental operation under load, the isolating switch and main contactor are mechanically interlocked with a control-power switch. Unless the interlock is defeated, the isolating switch may be opened or closed only when the control-power switch is in the "stop" position and the main contactor is "open".

**FUSES** The high-voltage fuses are fixed-position, ribbon element, totally-enclosed, and non-vented. When these fuses operate, there is no noise and any pressure generated is self-contained. These fuses exhibit an increase in resistance immediately after melting, so that they have a current limiting effect on major short circuits.

**VACUUM CONTACTOR** The contactor is electro-magnetically operated and is energized through a rectifier at 115 volts from a control transformer. The contactor incorporates sealed vacuum contacts and is designed for high momentary current-carrying and reliable current-interrupting. Contacts require no maintenance, remain low and stable in resistance, and are long-life.

**OVERLOAD RELAYS** The 3-element thermal overload relay is ambient-compensated type. The current-elements are energized from current transformers. The relays are normally arranged for automatic reset when used in 3-wire control schemes. Optionally, the relays may be arranged for external, manual reset.



VACUUM CONTACTOR



# TYPE 230 COMBINATION CONTROLLER

## EQUIPMENT ARRANGEMENT

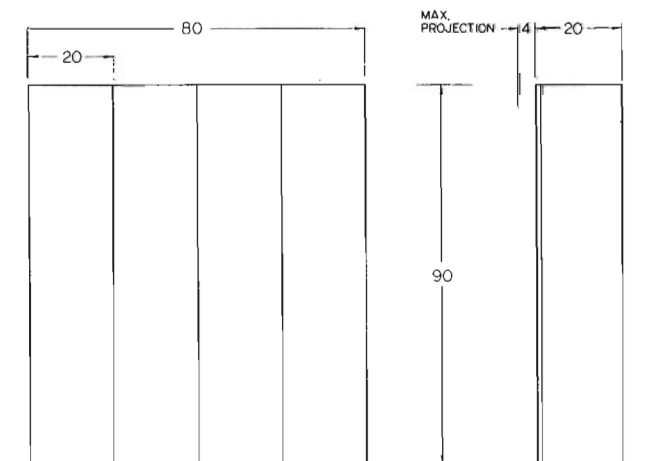
Mounted in the Control Cabinet as standard—

L1/3	Incoming Line Connectors
BUS	Main Bus
ISW	Isolating Switch with Interlocks
MFU	Main Line Fuse
M	Main Contactor
TFU	Transformer Primary Fuse
CPT	Control Power Transformer
CT	Current Transformer
T1/3	Load Terminal Connector
CSW	Stop-On Control-Power Switch
CFU	Control Fuse
TB	Control Terminal Block
REC	Rectifier for Contactor Coil
RES	Resistor for Contactor Coil
OL	Overload Relay
m	Auxiliary Contact on Contactor
MCR	Master Control Relay
CREC	Rectifier for MCR
AM	Ammeter

Optional Features Include—

- A C Ammeter Transfer Switch
- A C Voltmeter
- A C Voltmeter Transfer Switch\*
- Application Nameplate 3" x 8"
- Cabinet Space Heater
- Capacitors for Power Factor Correction\*
- Extra Auxiliary Contacts
- Extra Potential Transformer and Fuses\*
- Foreign Voltage Switch
- Ground Fault Current Transformer
- Ground Fault Relay
- Hand-Off-Auto Selector Switch
- Indicating Lights
- Manual-Reset of Overload Relays
- Start and Stop Control Switches
- Surge Arresters\*
- Time-Delay Reclosing Circuit
- Watt-hour Meter\*

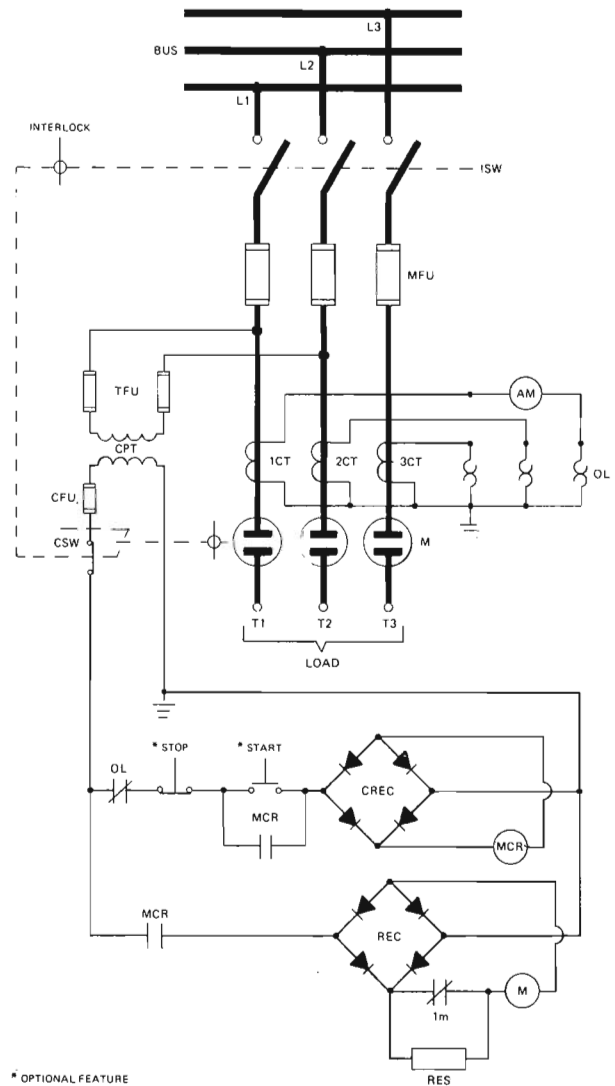
\*Feature may require auxiliary cabinet



OUTLINE DIMENSIONS FOR FOUR CONTROLLERS

DIMENSIONS IN INCHES

## SCHEMATIC DIAGRAM



\* OPTIONAL FEATURE

## SPACE PLANNING

**SPACE REQUIRED** Each controller is 20" wide by 20" deep by 90" high. When open, the door projects 17". Working space is required only in the front of the controller.

**CONDUIT ENTRANCES** The incoming-line conduit may enter from overhead or underground through an entrance box provided on the side of the controller. Load and control conduits may enter from overhead or underground. The conduit entrances are located so that all components may stay in place conveniently even when installing cables.