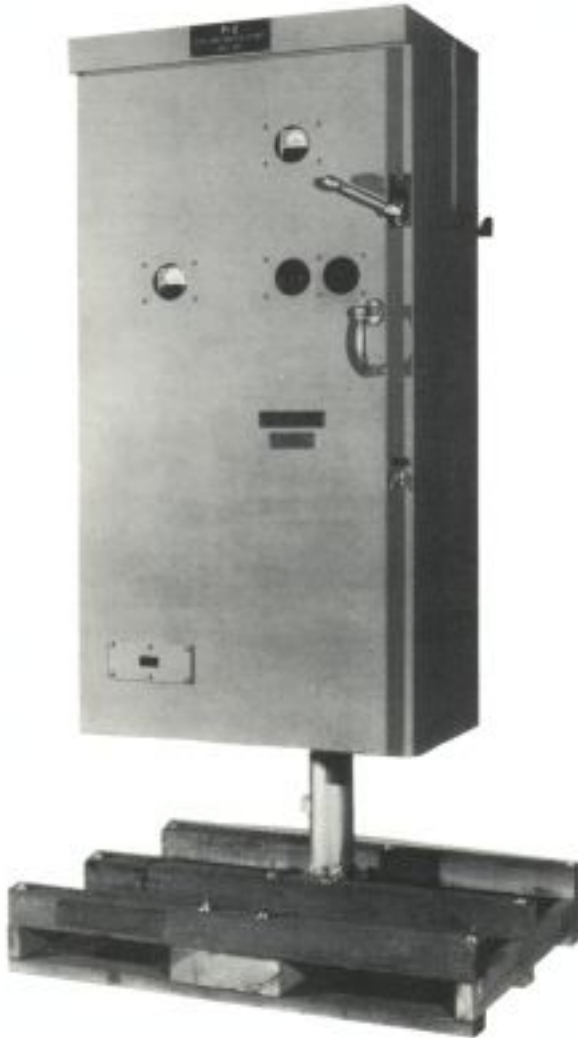




TYPE 230-PM COMBINATION CONTROLLER



Controller on Shipping Pallet

SCOPE & SUMMARY

This bulletin outlines applications, design features, construction, equipment arrangement, and space planning, for the Type 230-PM controllers. These controllers are similar to the Type 230, which were introduced in 1980, with the added feature that the Type 230-PM are outdoor type including support frame for pier-mounting, with cabinet and frame hot-dip galvanized after fabrication. These controllers are for the control and protection of induction motors or transformers on 2300-4160-volt systems.

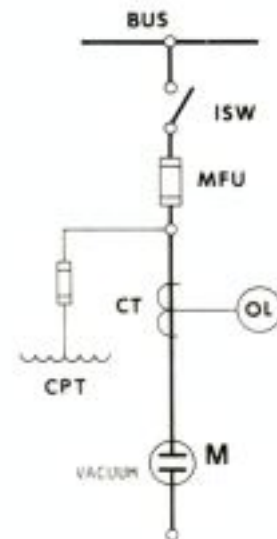
Each Type 230-PM controller is a NEMA Class E2 coordinated combination of heavy-duty vacuum contactor, thermal overload relay, current transformers, and current-limiting fuses, with safety-interlocked isolating switch. The basic design and most optional features are suitable for Class I, Division 2, T3A hazardous locations. Cabinet width is 34-inches and overall height is 90-inches.

IMPORTANT FEATURES & BENEFITS

- + Vertical Equipment Arrangement for fast and safe maintenance
- + Visible-break Isolating Switch for maximum safety
- + Vacuum-break Contactor for long contact life
- + Corrosion Resisting Design of All Components and Enclosure
- + U. L. Review and Testing to assure compliance with safety standards
- + Coordinated Design of Elliott-manufactured Components

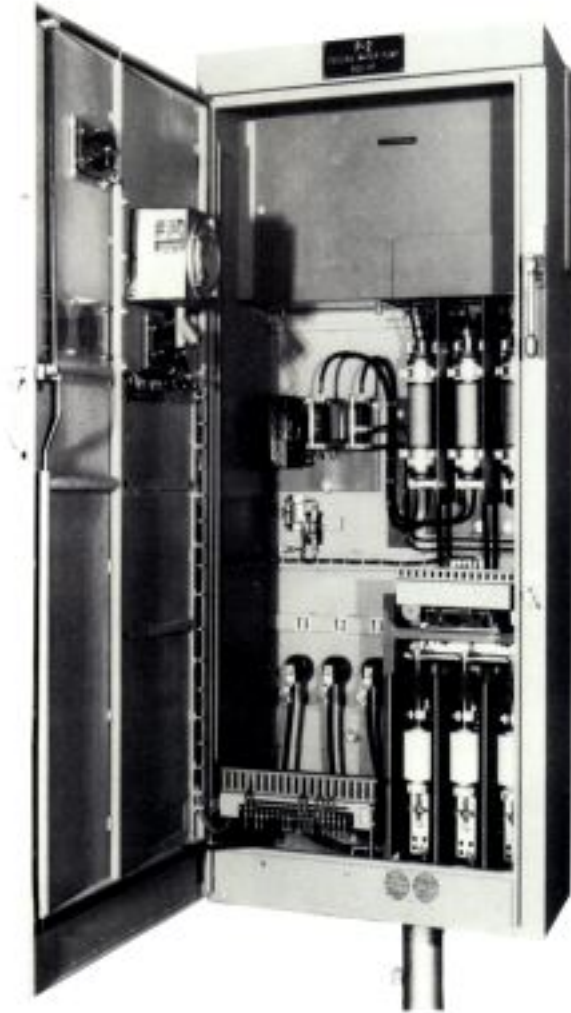
Made in U.S.A. to U.S.A. Standard.

ONE-LINE DIAGRAM





TYPE 230-PM COMBINATION CONTROLLER



CONTROLLER, CABINET DOOR OPEN

APPLICATIONS

GENERAL The 230-PM controllers are for full-voltage, non-reversing, magnetic starting and protection of induction motors. Or they may be used to switch and protect transformers. Optionally, the contactor may be mechanically "latched" for transformer or feeder applications. Alternate designs are available for reduced-voltage starting and for synchronous motor control.

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-MVA at 2300-volts and 350-MVA at 4160-volts for symmetrical current calculations. This assumes 1.6 ratio between asymmetrical current and initial symmetrical current, for first-cycle fault interruption.

LOADS The 230-PM controller is made in three continuous current ratings: 180-amp, 240-amp, and 360-amp. These ratings typically may be used for control of induction motors up to 700-HP, 1000-HP, and 1500-HP at 2300-volts or up to 1250-HP, 1750-HP, and 2500-HP at 4160-volts, or higher, depending upon service factor and locked rotor current. All controller ratings incorporate the same 360-amp contactor but differ in fuse sizes and cabinet arrangements.

LOCATION The 230-PM controllers are particularly suited to outdoor installation and to other installations where protection from dust or corrosive conditions is desirable. The basic design and most optional features are suitable for Class I, Division 2, T3A hazardous locations.



TYPE 230-PM COMBINATION CONTROLLER

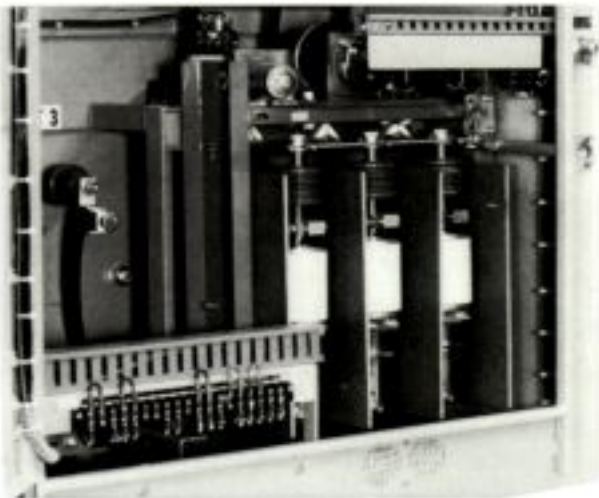
DESIGN FEATURES & CONSTRUCTION

GENERAL Each 230-PM Controller is a NEMA Class E2 coordinated combination of a heavy-duty vacuum contactor, thermal overload relay, current transformers, and current limiting fuses, with safety-interlocked isolating switch. These major elements, with the accessory and optional 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.

STANDARDS & TESTING The Type 230-PM Controllers are made in U.S.A. to U.S.A. standards, especially NEMA ICS 2-324 and UL-347. The basic design and many optional features have been submitted for "third party review" to Underwriters Laboratories (U.L.) to assure compliance with design and safety standards. Detailed test reports are available. U.L. Inspection and Labels are available optionally for many applications and arrangements.

OPERATION A heavy-duty vacuum contactor is the power-switching element. It is controlled through a DC master relay by the customer's 115-VAC pushbutton or other master element, with control power from a self-contained transformer. Optionally, start and stop control switches may be included in the controller. The contactor stays closed on momentary voltage dips but opens on prolonged loss-of-voltage.

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



CONTACTOR WITH POSITION INDICATOR

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, when the cabinet door is 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.

ENCLOSURE & MOUNTING The controller enclosure consists of a control cabinet mounted on a support-frame. The cabinet is gasketed, weather-resistant, and ventilated dusttight, with space heater. A unique cabinet and door arrangement makes the cabinet raintight in a 65-mph wind even if the door gaskets are removed. Grouped controllers are equipped with self-contained, interconnecting main-bus and are mounted on a common support-frame 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, grounded "Live Parts Barrier" and by a horizontal barrier. A maintenance shutter is available for added safety when working near the live parts.

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 the main contactor are mechanically interlocked with a control-power switch which is externally operated. 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 main-line fuses are ribbon element, totally enclosed, and non-vented, mounted in fixed position with bolted-in fuse-clamps. When these fuses interrupt, there is no noise and any pressure generated is self-contained and sealed. These fuses exhibit an increase in resistance immediately after melting, so that they have a current limiting effect on major fault currents. For Class I, Division 2 applications, these fuses are completely sealed (without operation indicators).

CONTACTOR The heavy-duty vacuum contactor is solenoid operated, and the solenoid is energized through a rectifier at 115-volts. The contactor is designed and tested for high momentary current-carrying and reliable current-interrupting. Auxiliary contacts are hermetically-sealed. Optionally, the contactor includes a position indicator with viewing window.

OVERLOAD RELAY The thermal-overload relay is ambient compensated type, 3-element. The current-elements are energized from current transformers. The relay may be arranged for automatic reset when used with 3-wire control circuit. Optionally, the relay may be equipped with an external, manual reset.

FINISH The cabinet and support-frame are hot-dip galvanized after fabrication. External hardware, shafts, pins, and springs, are stainless. Current-carrying contacts and connections are hermetically-sealed or specially plated for maximum corrosion resistance.



TYPE 230-PM COMBINATION CONTROLLER

EQUIPMENT ARRANGEMENT

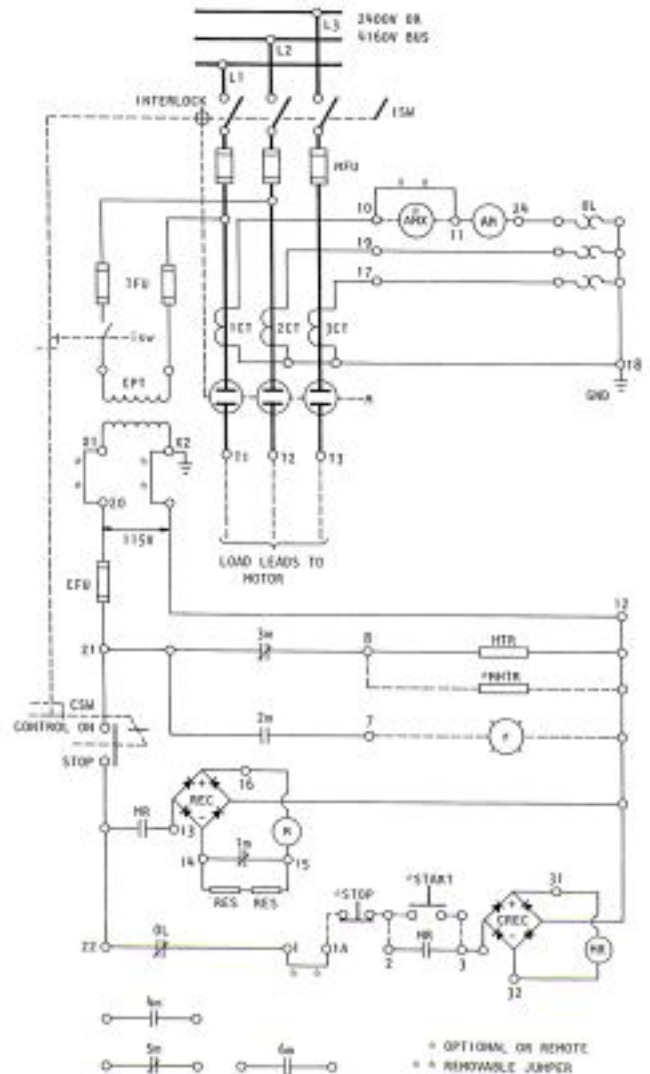
Mounted in the Control Cabinet-

L1/3	Incoming Line Connectors
BUS	Main Bus
ISW	Isolating Switch with Interlocks
MFU	Main Line Fuse
M	Vacuum-break Contactor
TFU	Transformer Primary Fuse
isw	HV Auxiliary Switch on ISW
CPT	Control Power Transformer
CT	Current Transformer
OL	Overload Relay
AM	Ammeter
T1/3	Load Terminal Connector
CFU	Control Fuse
CSW	Stop-On Control-Power Switch
REC	Rectifier for Contactor Coil
RES	Resistor for Contactor Coil
M	Auxiliary Contact on Contactor
MR	Master Control Relay
CREC	Rectifier for MR
HTR	Space Heater
TB	Control Terminal Block
-	Application Nameplate 3" x 8"

Optional Features Include—

Manual-Reset of Overload Relay
 Position Indicator for Contactor
 Ground Fault Relay
 Multi-function Protective Relay
 Extra Auxiliary Contacts
 Time-Delay Reclosing Relay
 Start & Stop Control Switches
 Hand-Off Auto Selector Switch
 A C Ammeter Transfer Switch
 Mechanically "Latched" Contactor
 Foreign Voltage Switch
 A C Voltmeter
 Indicating Lights

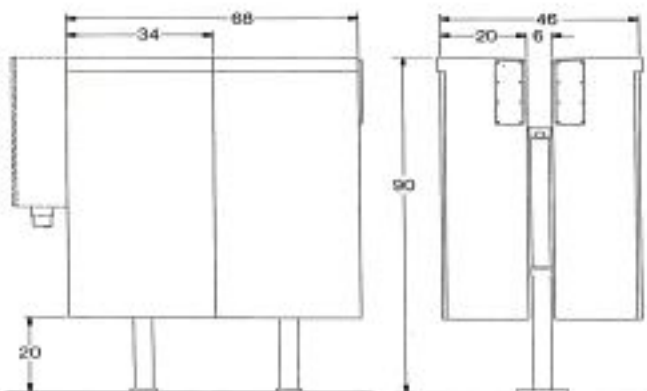
SCHEMATIC DIAGRAM



SPACE PLANNING

SPACE REQUIRED Each controller is 34-in. wide by 20-in. deep, 90-in. high overall when mounted on support-frame 6-in. deep. When grouped, the controllers are mounted side-by-side and/or back-to-back with interconnecting bus. Suggested minimum working clearance in front of each controller is 4-ft.

CONDUIT ENTRANCES Conduit entrances for the incoming-line, will be provided in an attached box for overhead or underground conduit. Conduit entrances for load and control, are standard in the bottom and (optionally) available in the top.



OUTLINE DIMENSION FOR FOUR CONTROLLERS
 DIMENSIONS IN INCHES