PRODUCT BULLETIN
SB-8504B

# MARINE PROPULSION CONTROL

## ELECTRONIC LOGIC AND CONTROL PANEL

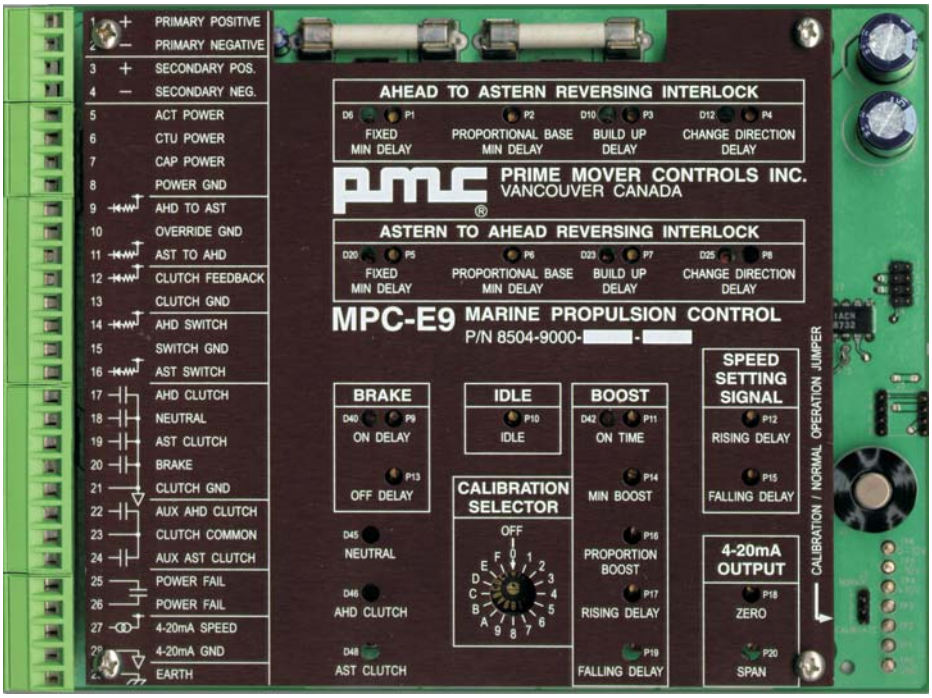
## Type MPC-E9 Control Panel

## APPLICATION

Propulsion controls for small and large vessels with fixed pitch propellers, reversing gears and hydraulic, or pneumatic clutches.

## FEATURES

- Compact Size
- Easy Installation
- Controlled Engine Acceleration
- Separate Clutch Pressure Interlock
- Fixed and Proportional Timed Reversing Interlock
- Signal for Brake Control
- Proportional Power Boost




**PRIME MOVER CONTROLS INC.**
VANCOUVER, BC, CANADA

DESIGN MANUFACTURE AND SERVICE OF MARINE AND INDUSTRIAL CONTROL COMPONENTS AND SYSTEMS

Electronic - Pneumatic - Hydraulic - Mechanical

SB-8504B

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## SPECIFICATIONS

| | |
|---|---|
| Input Voltages | 20 to 32 $V_{DC}$, 24 $V_{DC}$ nominal |
| Current Drawn | 1 Amp nominal, 4 Amps peak (when using 3380 Actuators) |
| Protection (power inputs) | 120 $V_{AC}$ and reverse 24 $V_{DC}$ |
| Fusing (power inputs) | Two MDA-2 Amp slow blow fuses |
| Operating Temperature | -10 to +50°C |
| Storage Temperature | -55 to +70°C |
| Mounting | Snap track mounting |
| Relay Contacts | 1 Amp @ 24 $V_{DC}$ |

## 1. GENERAL DESCRIPTION

The MPC-E9 electronic panel is a compact and modular design that provides propulsion control for vessels with fixed pitch propellers, reversing gears and hydraulic or pneumatic clutches. The MPC panel contains all necessary logic, interlocks and timing to ensure that the engine and reverse gear operate properly, smoothly and safely. An electric signal for operating a shaft brake is also provided. All timing settings are pre calibrated to predetermined specifications, and documented at PMC prior to shipment.

The MPC-E9 can work with several of PMC's other electrical products such as the: 8502-9000 power supply, 8502-9011 driver amp, 8502-9013 clipper amp, 8502-9017 control transfer unit By combining the MPC-E9 with other PMC products virtually any system configuration can be easy produced, calibrated, and tested.

## 2. FEATURES

### The MPC-E9 contains the following features:

### 2.1. Fixed or Proportional Power Boost:

Provides an increase in engine speed during clutch engagement. If a proportional power boost is required, then the magnitude of the boost is proportional to the magnitude and duration of the previous engine rpm setting. The proportional boost signal builds on top of an adjustable minimum boost. The Proportional boost gain, on time, and rising/falling delays, are all independently adjustable.

### 2.1. Clutch Pressure Interlock:

Assures clutch lock-up before the engine rpm can be increased from any remote control station, preventing excessive wear of clutches. This is accomplished by blocking the governor speed setting signal, except for the power boost, until the monitored hydraulic clutch pressure reaches a predetermined level during engagement. If the clutch pressure drops below the pre-set value, the interlock again blocks the governor speed setting signal and minimizes potential clutch damage due to clutch pressure failure.

### 2.2. Controlled Engine Acceleration/ Deceleration

This feature limits rate of speed setting signal increase and decrease for efficient operation.

### 2.3. Fixed and Proportional Timed Reversing Interlock

Provides a reversing time delay by maintaining neutral position for a predetermined time, depending on the previous maneuver. Even though the Remote Control Lever is shifted directly through neutral. The time delay before reversing ensures that the propeller rpm has decreased to an operational level, or to a complete stop if a shaft brake is used.

The **Fixed Timed Reversing Interlock** determines the minimum reversing time delay. Timing is independently adjustable from ahead to astern and from astern to ahead. The fixed time reversing adjustments do not interfere with the proportional timed reversing interlock.

The **Proportional Timed Reversing Interlock** provides a reversing time delay proportional to the magnitude and duration of the previous engine RPM setting. The base delay, delayed build-up, and change of direction delay of the proportional reversing interlock timing are independently adjustable from ahead to astern and from astern to ahead. Whichever of either the Fixed, or Proportional timed reversing interlocks has a longer time will be in effect.

This arrangement gives fast maneuvering when reversing in the low power range, where stalling of the engine is unlikely. The time delay in neutral automatically becomes proportionately higher in the high power range maneuvers. The duration of the reversing time delay is not affected by the control lever being held in neutral during a reversal. There is no time delay when moving the remote control lever into neutral and then back into the same direction as the previous maneuver.

### 2.4. Shaft Brake Control:

Provides a signal for shaft brake activation while both clutches are disengaged. The MPC-E9 uses the clutch feedback pressure to synchronize the brake release with clutch engagement. There are also additional adjustments for the delay of brake application and/or release. This is to improve the synchronization of the brake and the clutch to avoid any overlaps or under laps that may cause excess wear, or excess propeller rotation in the opposite direction due to early brake release.

### 2.5. AHD TO AST and AST TO AHD Override (Twin propeller synchronizing):

Override is used with a dual shaft system to synchronize the reverse interlock timing of the Port and Stbd sides, this feature is engaged automatically when maneuvering both levers from AHD to AST or AST to AHD. By synchronizing the timing the port and starboard shafts will shift simultaneously when both control head levers are moved in the same direction. Providing the build up of the proportional delay is greater then the minimum delay. This will help to prevent the vessel from turning in the water during crash reversals.

### 2.6. Dual Power Sources:

The MPC-E9 allows for two power supply inputs of which provide many different options for powering the system. The standard powering arrangement has two 24 $V_{DC}$ power supplies to power all MPC-E9 units in parallel. If both power sources to any one MPC-E9 fails, a power fail contact will close. This contact can be used to trigger an external alarm.

### 2.7. Power Supply Protection:

Each of the two power supply inputs are protected from reverse voltage and over voltage via a power protection circuit. This circuit is set to blow the protection fuses if the input voltage exceeds 38 $V_{DC}$.

### 2.8. Power Output Terminals:

Three power output terminals are provided:

**Actuator Power:** This terminal is used to supply power to external clutch and governor speed setting actuators. A switch-over relay automatically switches from the primary power supply to the secondary power supply during primary power failures.

**Control transfer unit power:** This terminal is used to supply power to external Control Transfer Unit's and relays on multi-station systems. The terminal is designed so that two or more MPC-E9s can be connected directly together. This way the power from all of the connected MPC-E9s will power the control transfer system.

**Storage capacitor power:** This terminal is used to supply power to an external 33,000 µF @ 63 V capacitor. The capacitor is only used if the system is required to go to neutral on complete power failure, and PMC 3380 actuators are used. This is accomplished by switching the capacitor power to the direct actuator control on the 3380-1100 actuator with an external power fail relay to drive it to zero speed. Capacitor power is also switched to the normal power inputs of the 3380-1300 actuator with an external power fail relay to allow the 3380-1300 to move the reverse gear to neutral.

## 3. OPERATING SEQUENCE

The following is the sequence of events that will occur when the operator moves the remote control lever from ahead to astern and from astern to ahead:

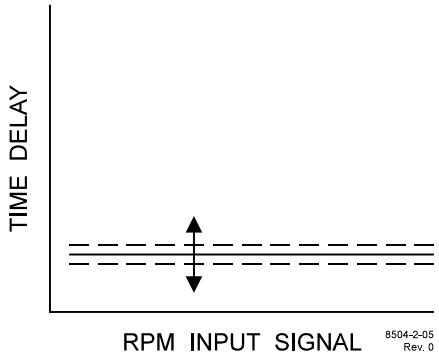
- Governor speed setting ramps to minimum rpm
- Clutch is disengaged
- Governor speed setting signal is blocked
- Shaft brake is applied
- Reverse gear remains in neutral and propeller shaft remains stopped. This duration is relative to the length of time, and amplitude of the previous maneuver
- Shaft brake is released
- Clutch signal is applied
- Power boost is applied with a magnitude relative to the length of time, and amplitude of the previous maneuver, and for a predetermined duration
- Clutch is in full lock up
- Governor speed setting signal is enabled
- Governor ramps up to the correct rpm.

## 4. ADJUSTMENTS

All of the above features are adjustable and are individually set and tested at the factory before

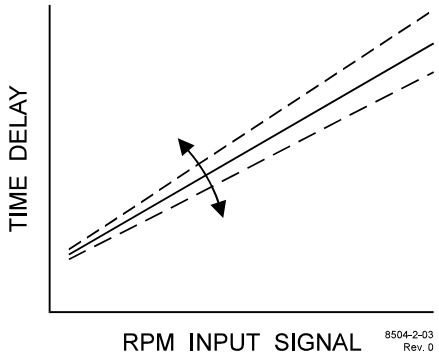
shipping. The following adjustments make up the timed reversing interlock operation of the MPC-E9. Independent adjustments are provided for ahead to astern and from astern to ahead. See figure 1 for an illustration of the following adjustments.

### 4.1. Reversing Interlock Fixed Minimum Ahead/Astern Delay Adjustment



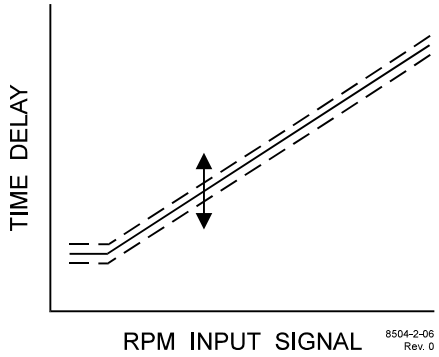

Adjusts, independently the AHD and AST fixed minimum time delay for low speed maneuvering. This adjustment has no effect on the proportional time delay.

### 4.2. Reversing Interlock Change of Direction Delay Adjustment



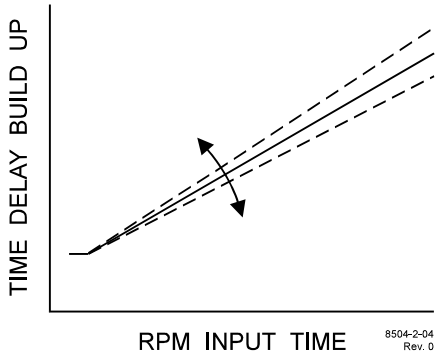

Adjusts the amount of time required to go from AHD to AST or AST to AHD.

### 4.3. Reversing Interlock Proportional Base Minimum Delay Adjustment



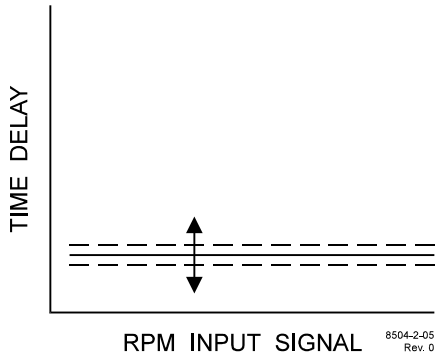

Adjusts independently the time delay over the entire range of governor speed setting signal.

### 4.4. Reversing Interlock Build Up Delay Adjustment



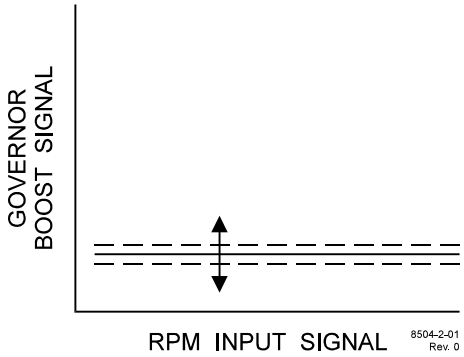

Adjusts the rate of build up for the proportional time delay.

### 4.5. Boost On Time Adjustment



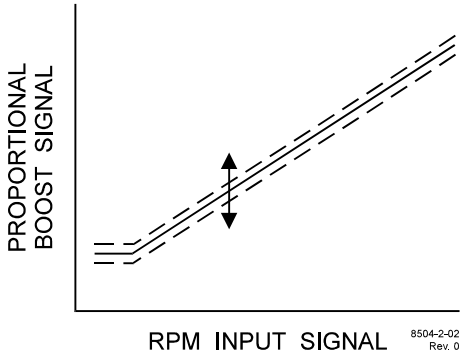

Adjusts the duration that the boost cycle remains on.

### 4.6. Boost Base Adjustment



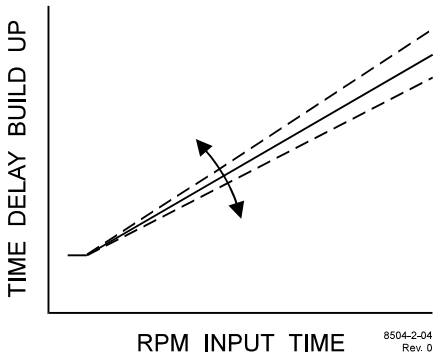

Adjusts the minimum amount of speed setting signal sent to the governor during the boost cycle. An amount of proportional boost is added on top of this boost base signal.

### 4.7. Boost Proportional Gain Adjustment




Adjusts the maximum proportional boost signal that will be added to the boost base signal. The amount of the proportional boost is a fraction of the maximum governor speed signal.

### 4.8. Boost Rising/Falling Delay Adjustment




Adjusts the rising build up, and falling discharge delay rate for the proportional boost.

### 4.9. Speed Setting Signal Rising/Falling Delay Adjustment

Adjusts the amount of delay (ramp rate) the speed setting signal will have when rising or falling.

### 4.10. Brake On/Off delay

Normally these delays are set to zero. The MPC-E9 uses the clutch feedback pressure to synchronize the brake release with clutch engagement. In most cases this will be adequate, but in some applications additional brake on/off delays are required.

The brake off delay is an additional delay which can be added to the time lag associated with the clutch feedback pressure. This prevents the shaft from speeding back up by delaying the shaft brake release an additional amount, after the clutch feedback pressure has risen. Brake on delay is used to assist in synchronizing the brake with the clutch, when the clutch is slow to release. This prevents any overlaps from stalling the engine.

### 4.11. Idle Adjustment

The governor speed setting signal is driven from the greater of either the Boost, Control Head Input Signal, or Idle Signal. Adjustments to the idle only effect the output speed signal when the boost is off and the control head input signal is at a minimum level.

### 4.12. 4-20mA Output Zero & Span

Control head signals are converted internally to 4-20 mA. This is to provide a speed setting signal to drive an electronic governor directly, or to drive a PMC 3380-1100 speed setting actuator.

**Figure 1. MPC-E9 Face Plate.**

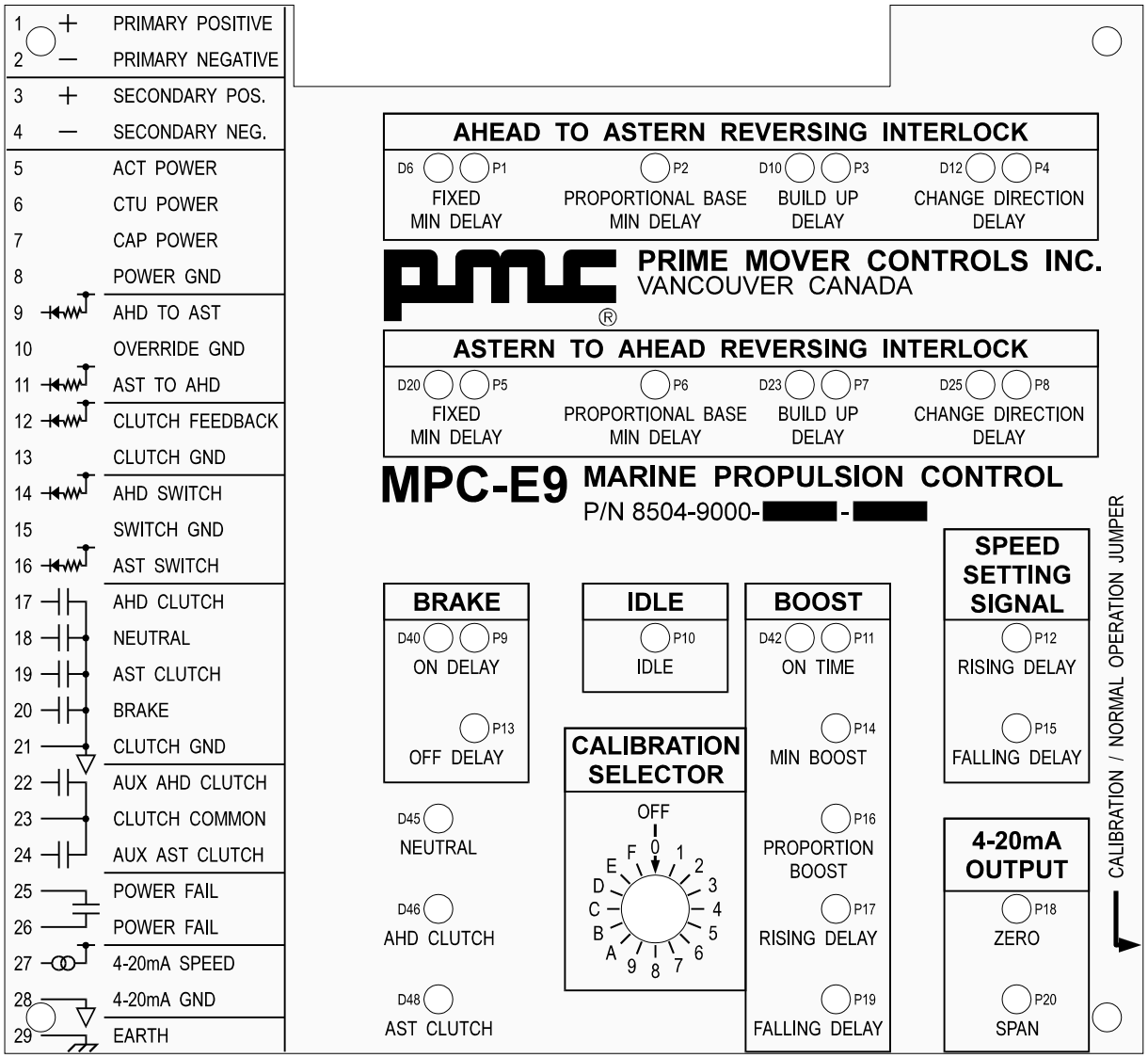
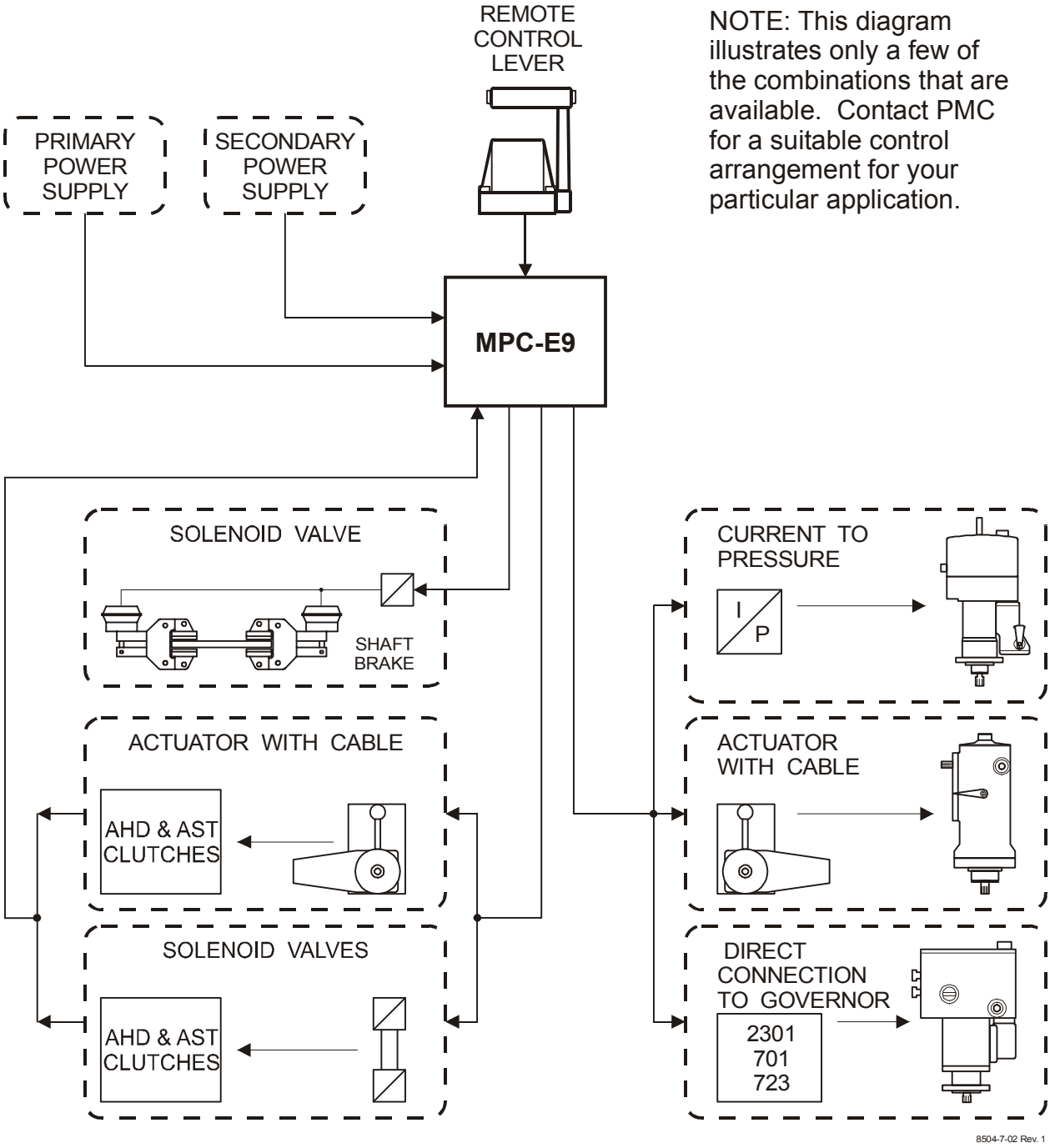


**Figure 2. Typical MPC-E9 Connection.**

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