AMERICAN CONTROL ELECTRONICS

PWM Series

USER MANUAL

PWM400-2
PWM400-5
PWM400-10
PWM401-2
PWM401-5
PWM401-10

Dear Valued Consumer:

Congratulations on your purchase of the **PWM Series** drive. This User Manual was created for you to get the most out of your new device and assist with the initial setup. Please visit www.americancontrolelectronics.com to learn more about our other drives.

Thank you for choosing **American Control Electronics®**!

Safety First!

SAFETY WARNINGS

Text in gray boxes denote important safety tips or warnings. Please read these instructions carefully before performing any of the procedures contained in this manual.

- DO NOT INSTALL, REMOVE, OR REWIRE THIS EQUIPMENT WITH POWER APPLIED. Have a qualified electrical technician install, adjust and service this equipment. Follow the National Electrical Code and all other applicable electrical and safety codes, including the provisions of the Occupational Safety and Health Act (OSHA), when installing equipment.
- Reduce the chance of an electrical fire, shock, or explosion by using proper grounding techniques, over-current protection, thermal protection, and enclosure. Follow sound maintenance procedures.

It is possible for a drive to run at full speed as a result of a component failure. AMERICAN CONTROL ELECTRONICS® (ACE) strongly recommends the installation of a master switch in the main power input to stop the drive in an emergency.

Circuit potentials are at 115 VAC or 230 VAC above earth ground. Avoid direct contact with the printed circuit board or with circuit elements to prevent the risk of serious injury or fatality. Use a non-metallic screwdriver for adjusting the calibration trim pots. Use approved personal protection equipment and insulated tools if working on this drive with power applied.

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Section 1. Specifications

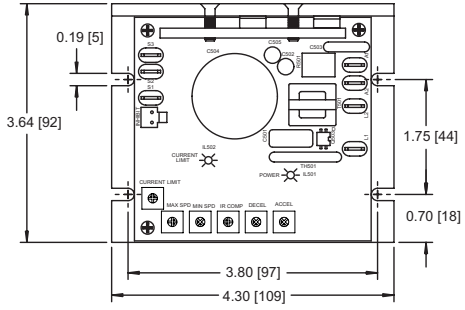
Model	*Maximum Armature Current (ADC)*	*HP Range with 130 VDC Motor*	*HP Range with 240 VDC Motor*	*Enclosure*
PWM400-2	*2.0*	*1/20 - 1/6*	*1/10 - 1/3*	*Chassis*
PWM401-2				*Chassis*
PWM400-5	*5.0*	*1/6 - 1/2*	*1/3 - 1*	*Chassis*
PWM401-5				*Chassis*
*PWM400-10**	*10.0*	*1/2 - 1*	*1 - 2*	*Chassis*
*PWM401-10**				*Chassis*

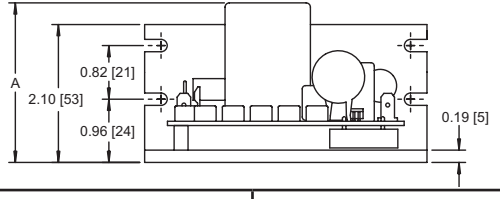
* Heat sink kit part number HSK-0001 must be used when the continuous current output is over 5 amps.

AC Line Voltage	115/230 VAC ± 10% 50/60 Hz, single phase
DC Armature Voltage	
with 115 VAC Line Voltage	0 - 130 VDC
with 230 VAC Line Voltage	0 - 240 VDC
Acceleration Time Range	0.5 - 6 seconds
Deceleration Time Range	coast to a stop - 6 seconds
Analog Input Range	
PWM400 models **(Signal must be isolated; S1 to S2)**	0 - 5 VDC
PWM401 models **(Signal may be isolated or non-isolated; S1 to S2)**	0 - 5 VDC
Input Impedance (S1 to S2)	~70K ohms
Form Factor	1.05

Load Regulation	1% base speed or better
Speed Range	100:1
Vibration	0.5G maximum (0 - 50 Hz) 0.1G maximum (> 50 Hz)
Safety Certifications	UL Recognized Component, File #E132235 CSA Certified Component, File # LR41380
Ambient Temperature Range	10°C - 40°C

Section 2. Dimensions

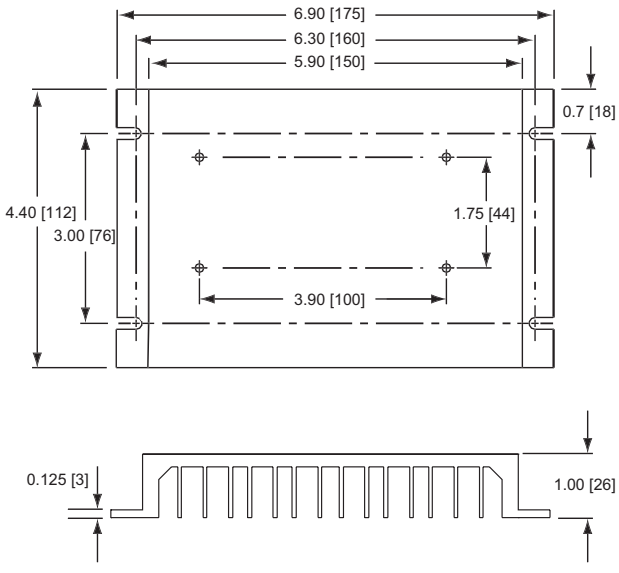




MODEL	DIMENSION "A" HEIGHT
PWM40x-2	2.50 [62]
PWM40x-5	3.20 [81]
PWM40x-10	3.90 [99]

ALL DIMENSIONS IN INCHES [MILLIMETERS]

Figure 1. PWM Series Dimensions



ALL DIMENSIONS IN INCHES [MILLIMETERS]

Figure 2. HSK-0001 Dimensions

Section 3. Installlation

Do not install, rewire, or remove this control with input power applied. Failure to heed this warning may result in fire, explosion, or serious injury. Make sure you read and understand the Safety Precautions on page i before attempting to install this product.

Mounting

- Drive components are sensitive to electrostatic discharge. Avoid direct contact with the circuit board. Hold the drive by the chassis or heat sink only.
- Protect the drive from dirt, moisture, and accidental contact.
- Provide sufficient room for access to the terminals and calibration trim pots.
- Mount the drive away from heat sources. Operate the drive within the specified ambient operating temperature range.
- Prevent loose connections by avoiding excessive vibration of the drive.
- Mount the drive with its board in either a horizontal or vertical plane. Six 0.19" (5 mm) wide slots in the chassis accept #8 pan head screws. Fasten either the large base or the narrow flange of the chassis to the subplate.
- The chassis should be earth grounded. Use a star washer beneath the head of at least one of the mounting screws to penetrate the anodized surface and to reach bare metal.

Heat Sinking

The PWM series drives PWM400-10 and PWM401-10 require an additional heat sink when the continuous armature current is above 5 amps. Use ACE heat sink kit part number HSK-0001. All other chassis drives have sufficient heat sinking in their basic configuration. Use a thermally conductive heat sink compound (such as Dow Corning® 340 Heat Sink Compound) between the chassis and the heat sink surface for optimum heat transfer.

Speed Adjust Potentiometer

WARNING!

Be sure that the potentiometer tabs do not make contact with the potentiometer's body. Grounding the input will cause damage to the drive.

Mount the speed adjust potentiometer through a 0.38 in. (10 mm) hole with the hardware provided (Figure 3). Install the circular insulating disk between the panel and the 10K ohm speed adjust potentiometer.

Twist the speed adjust potentiometer wires to avoid picking up unwanted electrical noise. If the speed adjust potentiometer wires are longer than 18 in. (46 cm), use shielded cable. Keep the speed adjust potentiometer wires separate from power leads (L1, L2, A1, A2).

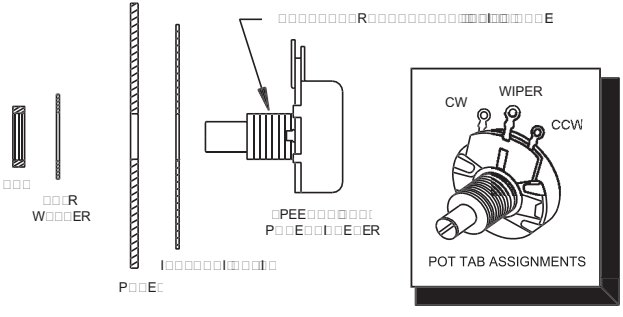


Figure 3. Speed Adjust Potentiometer

Wiring

Do not install, rewire, or remove this control with input power applied. Failure to heed this warning may result in fire, explosion, or serious injury.

Circuit potentials are at 115 or 230 VAC above ground. To prevent the risk of injury or fatality, avoid direct contact with the printed circuit board or with circuit elements.

Do not disconnect any of the motor leads from the drive unless power is removed or the drive is disabled. Opening any one motor lead while the drive is running may destroy the drive.

- Use 18 - 24 AWG wire for logic wiring. Use 14 - 16 AWG wire for AC line and motor wiring.

Shielding Guidelines

Under no circumstances should power and logic level leads be bundled together. Induced voltage can cause unpredictable behavior in any electronic device, including motor controls.

As a general rule, AMERICAN CONTROL ELECTRONICS® (ACE) recommends shielding of all conductors. If it is not practical to shield power conductors, ACE recommends shielding all logic-level leads. If shielding of all logic-level leads is not practical, the user should twist all logic leads with themselves to minimize induced noise.

It may be necessary to earth ground the shielded cable. If noise is produced by devices other than the drive, ground the shield at the drive end. If noise is generated by a device on the drive, ground the shield at the end away from the drive. Do not ground both ends of the shield.

Shielding Guidelines (continued)

If the drive continues to pick up noise after grounding the shield, it may be necessary to add AC line filtering devices, or to mount the drive in a less noisy environment.

Logic wires from other input devices, such as motion controllers and PLL velocity controllers, must be separated from power lines in the same manner as the logic I/O on this drive.

Line Fusing

ACE drives should be fused for protection. Use fast acting fuses rated for 250 VAC or higher and 150% of maximum armature current. Fuse HOT L1 only when the line voltage is 115 VAC. Fuse both L1 and L2 when the line voltage is 230 VAC. Table 1 on page 10 lists the recommended line fuse sizes.

Table 1. Recommended Line Fuse Sizes

90 / 130 VDC Motor Horsepower	*180 / 240 VDC Motor Horsepower*	*Maximum DC Armature Current (amps)*	*AC Line Fuse Size (amps)*
1/20	*1/10*	*0.5*	*1*
1/15	*1/8*	*0.8*	*1.5*
1/8	*1/4*	*1.5*	*3*
1/6	*1/3*	*1.7*	*3*
1/4	*1/2*	*2.5*	*5*
1/3	*3/4*	*3.5*	*8*
1/2	*1*	*5.0*	*10*
3/4	*1 ½*	*7.5*	*15*
1	*2*	*10*	*15*

ACE offers fuse kits. See Section 10: Accessories and Replacement Parts on page 41 for fuse kit part numbers.

Connections

Do not connect this equipment with power applied. Failure to heed this warning may result in fire, explosion, or serious injury.

ACE strongly recommends the installation of a master power switch in the voltage input line, as shown in Figure 4 (page 12). The switch contacts should be rated at a minimum of 200% of motor nameplate current and 250 volts.

Power Input

Connect the AC line power leads to terminals L1 and L2. ACE recommends the use of a single-throw, double-pole master power switch. The switch should be rated at a minimum of 250 volts and 200% of motor current. Refer to Figure 4 on page 12.

Motor

ACE drives supply motor armature voltage from A1 and A2 terminals, where A1 is positive with respect to A2. If the motor does not spin in the desired direction, remove power and reverse the A1 and A2 connections.

Connect a DC motor to terminals A1 and A2 as shown in Figure 4 on page 12. Ensure that the motor voltage rating is consistent with the drive's output voltage.

Speed Adjust Potentiometer

Use a 10K ohm, 1/4 W potentiometer for speed control. Connect the counter-clockwise end of the potentiometer to S1, the wiper to S2, and the clockwise end to S3. If the potentiometer works inversely of the desired functionality (e.g. to increase motor speed you must turn the potentiometer counterclockwise), power off the drive and swap the S1 and S3 connections. Refer to Figure 4 on page 12.

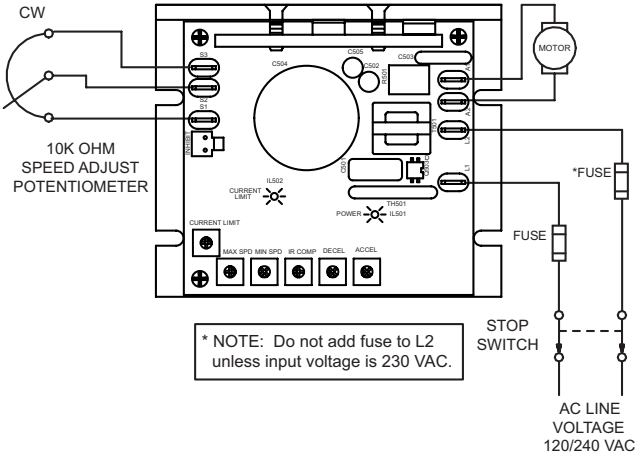


Figure 4. Chassis Drive Connections

Analog Input Signal

Instead of using a speed adjust potentiometer, PWM400 drives may be wired to follow an analog input voltage signal that is isolated from earth ground. PWP401 drives may be wired to follow an analog input voltage signal that is either isolated or non-isolated from earth ground (Figure 12). Connect the signal common (–) to S1. Connect the signal input (+) to S2. Make no connection to S3. A potentiometer can be used to scale the analog input voltage. An interface device, such as ACE model ISO202-1, may be used to scale and isolate an analog input voltage.

An analog input voltage range of 0–5 VDC is required to produce an armature voltage range of 0–130 VDC with 115 VAC line voltage, or 0-240 VDC with 230 VAC line voltage.

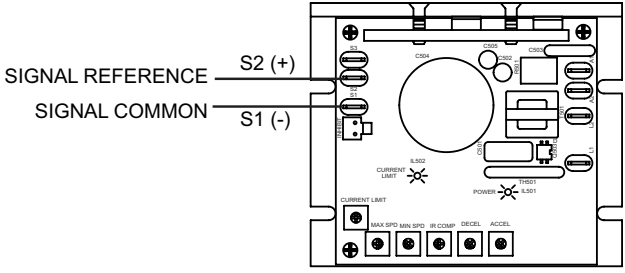


Figure 5. Analog Input Signal Connections

Section 4. Operation

Dangerous voltages exist on the drive when it is powered. BE ALERT. High voltages can cause serious or fatal injury. For your safety, use personal protective equipment (PPE) when operating this drive.

If the motor or drive does not perform as described, disconnect the AC line voltage immediately. Refer to the Troubleshooting section, page 38, for further assistance.

Before Applying Power

1. Verify that no foreign conductive material is present on the printed circuit board.

Startup

1. Turn the speed adjust potentiometer full counterclockwise (CCW) or set the input voltage signal to minimum.
2. Apply AC line voltage.
3. Slowly advance the speed adjust potentiometer clockwise (CW) or increase the input voltage signal. The motor slowly accelerates as the potentiometer is turned CW or as the input voltage signal is increased. Continue until the desired speed is reached.
4. Remove AC line voltage from the drive to coast the motor to a stop.

Starting and Stopping Methods

Dynamic braking, coasting to a stop, or decelerating to minimum speed is recommended for frequent starts and stops. Do not use any of these methods for emergency stopping. They may not stop a drive that is malfunctioning. Removing AC line power (both lines) is the only acceptable method for emergency stopping.

For this reason, ACE strongly recommends installing an emergency stop switch on both AC line inputs (see Figure 4 on page 12).

Frequent starting and stopping can produce high torque. This may cause damage to motors, especially gearmotors that are not properly sized for the application.

Automatic Restart Upon Power Restoration

All drives automatically run to set speed when power is applied and the inhibit is not active.

Line Starting and Stopping

Line starting and stopping (applying and removing AC line voltage) is recommended for infrequent starting and stopping of a drive only. When AC line voltage is applied to the drive, the motor accelerates to the speed set by the speed adjust potentiometer or analog signal. When AC line voltage is removed, the motor coasts to a stop.

Dynamic Braking

Wait for the motor to completely stop before switching back to RUN. This will prevent high armature currents from damaging the motor or drive.

Dynamic braking may be used to rapidly stop a motor (Figure 6 on page 17). For the RUN/BRAKE switch, use a two pole, two position switch rated for at least the armature voltage rating and 150% of the armature current rating. For the dynamic brake resistor, use a 40 watt minimum, high power, wirewound resistor.

Sizing the dynamic brake resistor depends on load inertia, motor voltage, and braking time. Use a lower-value, higher-wattage dynamic brake resistor to stop a motor more rapidly. Refer to Table 2 on page 17 for recommended dynamic brake resistor sizes.

Table 2. Minimum Recommended Dynamic Brake Resistor Values

Motor Armature Voltage	*Dynamic Brake Resistor Value*
130 VDC	*15 ohms*
240 VDC	*30 ohms*

For motors rated 1/17 horsepower and lower, a brake resistor is not necessary since the armature resistance is high enough to stop the motor without demagnetization. Replace the dynamic brake with 12-gauge wire.

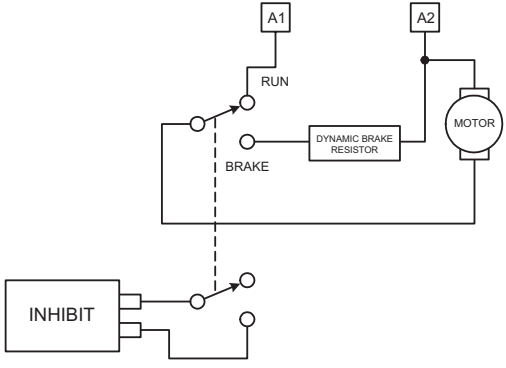


Figure 6. Dynamic Brake Wiring

Inhibit Terminals

Short the INHIBIT terminals to coast the motor to minimum speed (see Figure 7 for INHIBIT terminal location). Open the INHIBIT terminals to accelerate the motor to set speed.

Twist inhibit wires and separate them from power-carrying wires or sources of electrical noise. Use shielded cable if the inhibit wires are longer than 18 inches (46 cm). If shielded cable is used, ground only one end of the shield to earth ground. Do not ground both ends of the shield.

ACE offers two accessory plug harnesses for connecting to the INHIBIT terminals: part number KTW-0001 [plug with 18 in. (46 cm) leads]; and part number KTW-0002 [plug with 36 in. (91 cm) leads].

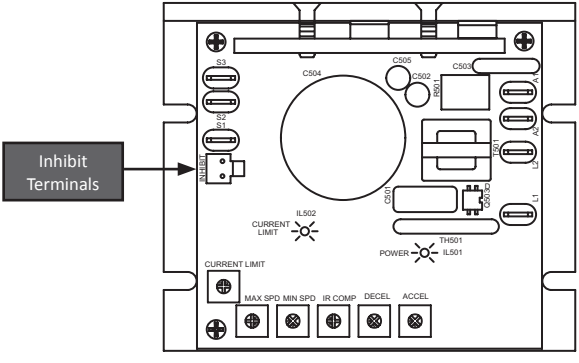


Figure 7. Inhibit Terminals

Decelerating to Minimum Speed

The switch shown in Figure 8 may be used to decelerate a motor to a minimum speed. Closing the switch between S1 and S2 decelerates the motor from set speed to a minimum speed determined by the MIN SPD trim pot setting. If the MIN SPD trim pot is set full CCW, the motor decelerates to zero speed when the switch between S1 and S2 is closed. The DECEL trim pot setting determines the rate at which the drive decelerates. By opening the switch, the motor accelerates to set speed at a rate determined by the ACCEL trim pot setting.

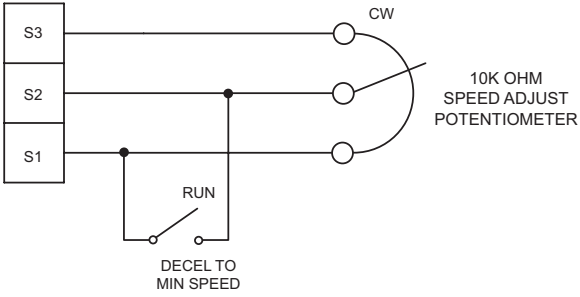


Figure 8. Run/Decelerate to Minimum Speed Switch

Section 5. Calibration

Dangerous voltages exist on the drive when it is powered. When possible, disconnect the voltage input from the drive before adjusting the trim pots. If the trim pots must be adjusted with power applied, use insulated tools and the appropriate personal protection equipment. **BE ALERT.** High voltages can cause serious or fatal injury.

PWM series drives have user-adjustable trim pots. Each drive is factory calibrated to its maximum current rating. Readjust the calibration trim pot settings to accommodate lower current rated motors.

All adjustments increase with CW rotation, and decrease with CCW rotation. Use a non-metallic screwdriver for calibration. Each trim pot is identified on the printed circuit board.

Minimum Speed (MIN SPD)

The MIN SPD setting determines the minimum motor speed when the speed adjust potentiometer or input voltage signal is set for minimum speed. It is factory set for zero speed.

To calibrate the MIN SPD:

1. Set the MIN SPD trim pot full CCW.
2. Set the speed adjust potentiometer or input voltage signal for minimum speed.
3. Adjust MIN SPD until the desired minimum speed is reached or is just at the threshold of rotation.

Maximum Speed (MAX SPD)

The MAX SPD setting determines the maximum motor speed when the speed adjust potentiometer or input voltage signal is set for maximum speed.

To calibrate MAX SPD:

1. Set the MAX SPD trim pot full CCW.
2. Set the speed adjust potentiometer or input voltage signal for maximum speed.
3. Adjust MAX SPD until the desired maximum speed is reached.

Note: Check the MIN SPD and MAX SPD adjustments after recalibrating to verify that the motor runs at the desired minimum and maximum speed.

Torque (CURRENT LIMIT)

CURRENT LIMIT should be set to 150% of motor nameplate current rating. Continuous operation beyond this rating may damage the motor. If you intend to operate beyond the rating, contact your ACE representative for assistance.

The CURRENT LIMIT setting determines the maximum torque for accelerating and driving the motor. To calibrate CURRENT LIMIT, refer to the recommended CURRENT LIMIT settings in Figures 9 through 11 (pages 24 through 26) or use the following procedure:

1. With the power disconnected from the drive, connect a DC ammeter in series with the armature.
2. Set the CURRENT LIMIT trim pot to minimum (full CCW).
3. Set the speed adjust potentiometer or input voltage signal to maximum speed.
4. Carefully lock the motor armature. Be sure that the motor is firmly mounted.
5. Apply line power. The motor should be stopped.
6. Slowly adjust the CURRENT LIMIT trim pot CW until the armature current is 150% of motor rated armature current.
7. Turn the speed adjust potentiometer CCW or decrease the input voltage signal.
8. Remove line power.
9. Remove the stall from the motor.
10. Remove the ammeter in series with the motor armature if it is no longer needed.

IR Compensation (IR COMP)

The IR COMP setting determines the degree to which motor speed is held constant as the motor load changes.

Use the following procedure to recalibrate the IR COMP setting:

1. Set the IR COMP trim pot to minimum (full CCW).
2. Increase the speed adjust potentiometer or input voltage signal until the motor runs at midspeed without load (for example, 900 RPM for an 1800 RPM motor). A handheld tachometer may be used to measure motor speed.
3. Load the motor armature to its full load armature current rating. The motor should slow down.
4. While keeping the load on the motor, rotate the IR COMP trim pot until the motor runs at the speed measured in step 2. If the motor oscillates (overcompensation), the IR COMP trim pot may be set too high (CW). Turn the IR COMP trim pot CCW to stabilize the motor.
5. Unload the motor.

See Figures 9 through 11 (pages 24 through 26) for recommended IR COMP settings.

MODELS PWM400-2, PWM401-2

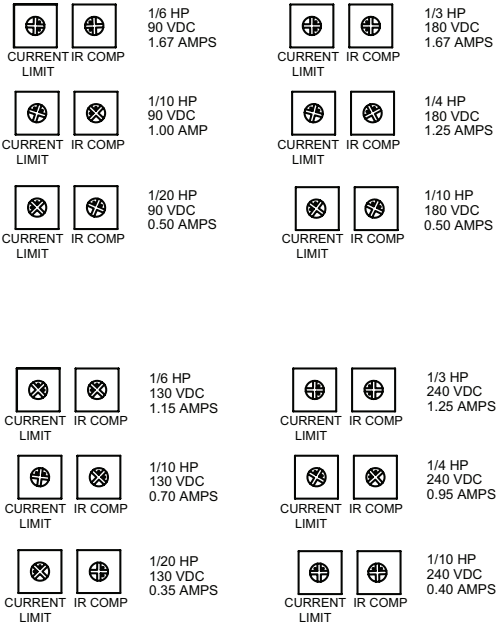


Figure 9. Recommended CURRENT LIMIT and IR COMP Settings for models PWM400-2 and PWM401-2 (actual settings may vary with each application)

MODELS PWM400-5, PWM401-5

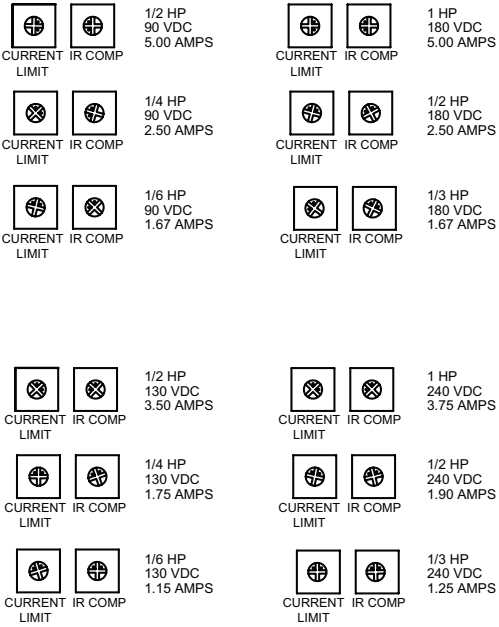


Figure 10. Recommended CURRENT LIMIT and IR COMP Settings for models PWM400-5 and PWM401-5 (actual settings may vary with each application)

MODELS PWM400-10, PWM401-10

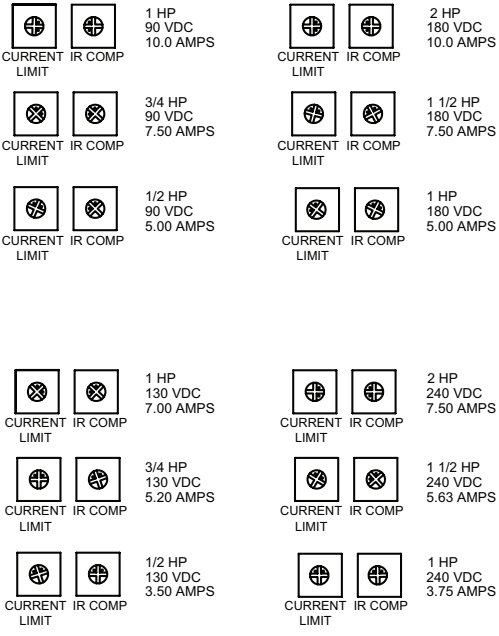


Figure 11. Recommended CURRENT LIMIT and IR COMP Settings for models PWM400-10 and PWM401-10 (actual settings may vary with each application)

Acceleration (ACCEL)

The ACCEL setting determines the time the motor takes to ramp to a higher speed. See Specifications on page 1 for approximate acceleration times. ACCEL is factory set for the shortest acceleration time (full CCW).

To set the acceleration time:

1. Set the speed adjust potentiometer or input voltage signal for minimum speed. The motor should run at minimum speed.
2. Set the speed adjust potentiometer or input voltage signal for maximum speed. Measure the time it takes the motor to go from minimum to maximum speed.
3. If the time measured in step 2 is not the desired acceleration time, turn the ACCEL trim pot CW for a longer acceleration time or CCW for a shorter acceleration time. Repeat steps 1 through 2 until the acceleration time is correct.

Deceleration (DECEL)

The DECEL setting determines the time the motor takes to ramp to a lower speed. See Specifications on page 2 for approximate deceleration times. DECEL is factory set for the shortest deceleration time (full CCW).

To set the deceleration time:

1. Set the speed adjust potentiometer or input voltage signal for maximum speed. The motor should run at maximum speed.
2. Set the speed adjust potentiometer or input voltage signal for minimum speed. Measure the time it takes the motor to go from maximum to minimum speed.
3. If the time measured in step 2 is not the desired deceleration time, turn the DECEL trim pot CW for a longer deceleration time or CCW for a shorter deceleration time. Repeat steps 1 through 2 until the deceleration time is correct.

Section 6. Application Notes

Multiple Fixed Speeds

Replace the speed adjust potentiometer with a series of resistors with a total series resistance of 10K ohms (Figure 12). Add a single pole, multi-position switch with the correct number of positions for the desired number of fixed speeds.

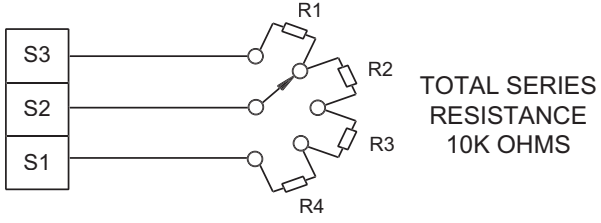


Figure 12. Multiple Fixed Speeds

Adjustable Speeds Using Potentiometers In Series

Replace the speed adjust potentiometer with a series of potentiometers with a total series resistance of 10K ohms (Figure 13). Add a single pole, multi-position switch with the correct number of positions for the desired number of fixed speeds.

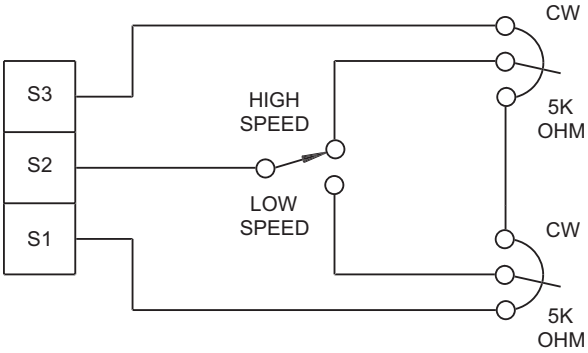


Figure 13. Adjustable Speeds Using Potentiometers In Series

Independent Adjustable Speeds

Replace the speed adjust potentiometer with a single pole, multi-position switch, and two or more potentiometers in parallel, with a total parallel resistance of 10K ohms. Figure 14 shows the connection of two independent speed adjust potentiometers that can be mounted at two separate operating stations.

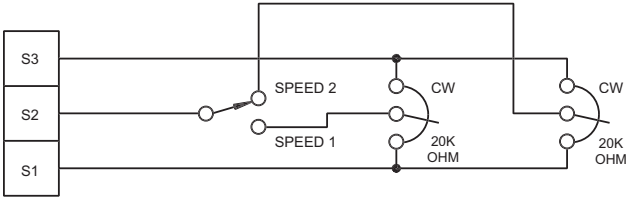


Figure 14. Independent Adjustable Speeds

RUN/JOG Switch - Inhibit Connection

Using a RUN/JOG switch is recommended in applications where quick stopping is not needed and frequent jogging is required. Use a single pole, two position switch for the RUN/JOG switch, and a normally closed momentary pushbutton for the JOG pushbutton.

Connect the RUN/JOG switch and JOG pushbutton to the inhibit plug as shown in Figure 15. The motor coasts to a stop when the RUN/JOG switch is set to JOG. Press the JOG pushbutton to jog the motor. Return the RUN/JOG switch to RUN for normal operation.

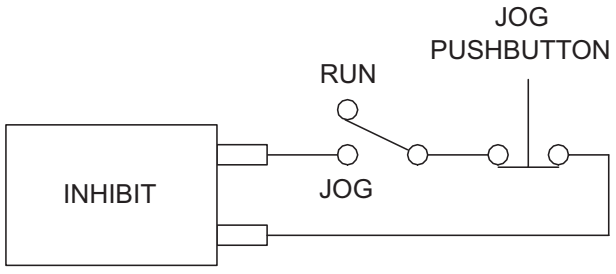


Figure 15. RUN/JOG Switch - Connection to Inhibit Plug

RUN/JOG Switch - Potentiometer Connection

Connect the RUN/JOG switch and the JOG pushbutton as shown in Figure 16. When the RUN/JOG switch is set to JOG, the motor decelerates to minimum speed (minimum speed is determined by the MIN SPD trim pot setting). Press the JOG pushbutton to jog the motor. Return the RUN/JOG switch to RUN for normal operation.

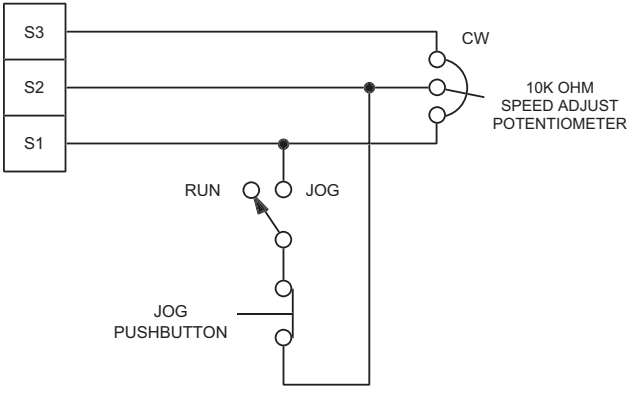


Figure 16. RUN/JOG Switch - Connection to Speed Adjust Potentiometer

Leader-Follower Application

In this application, use a ISO202-1 to monitor the speed of the leader motor (Figure 17). The ISO202-1 isolates the leader motor from the follower drive, and outputs a voltage proportional to the leader motor armature voltage. The follower drive uses this voltage reference to set the speed of the follower motor. An optional ratio potentiometer may be used to scale the ISO202-1 output voltage.

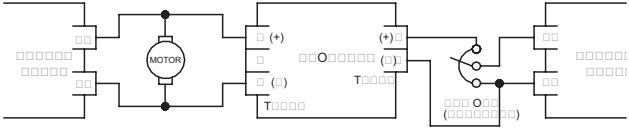


Figure 17. Leader-Follower Application

Single Speed Potentiometer Control Of Multiple Drives

Multiple drives can be controlled with a single speed adjust potentiometer using a ISO101-8 at the input of each drive to provide isolation (Figure 18). Optional ratio potentiometers can be used to scale the ISO101-8 output voltage, allowing independent control of each drive.

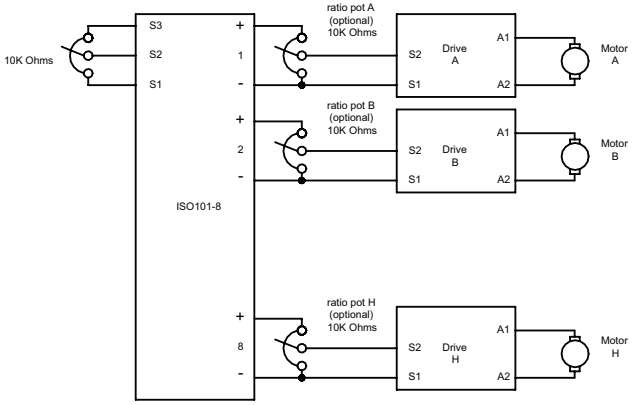


Figure 18. Single Speed Potentiometer Control of Multiple Drives

Reversing

A dynamic brake may be used when reversing the motor direction (Figure 19). Use a three pole, three position switch rated for at least the maximum DC armature voltage and maximum braking current. Wait for the motor to stop completely before switching it to either the forward or reverse direction. See the Dynamic Braking section on page 17 for recommended dynamic brake resistor sizes.

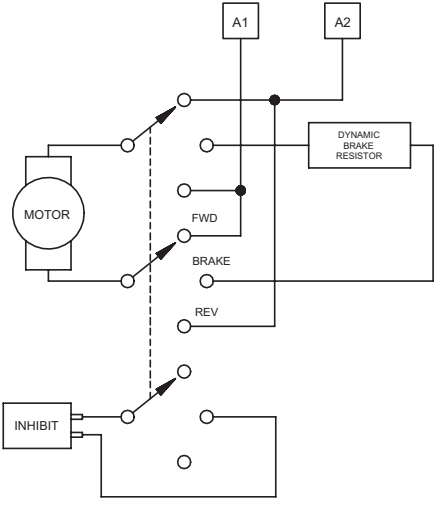


Figure 19. Reversing Circuit Wiring

Reversing with a CLD100-1 Controller

A CLD100-1 controller can be used in a reversing application. The CLD100-1 must be inhibited while braking. If the inhibit feature is not used, the CLD100-1 will continue to regulate. This will cause overshoot when the motor is reconnected to the drive. Figure 20 shows a wiring diagram of the reversing circuit using a PWM series drive and a CLD100-1.

Note: Only one feedback device (Optical Encoder or Magnetic Pickup) may be connected to a CLD100-1 at a time.

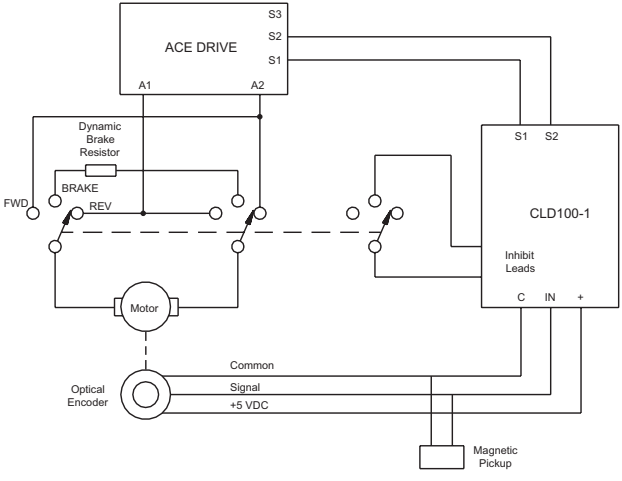


Figure 20. Reversing with a CLD100-1

Section 7. Diagnostic LEDs

PWM series drives are equipped with one or two diagnostic LEDs:

- Current Limit (CURRENT LIMIT): Red LED lights whenever the drive reaches current limit.
- Power (POWER): Green LED lights whenever AC line voltage is applied to the drive.

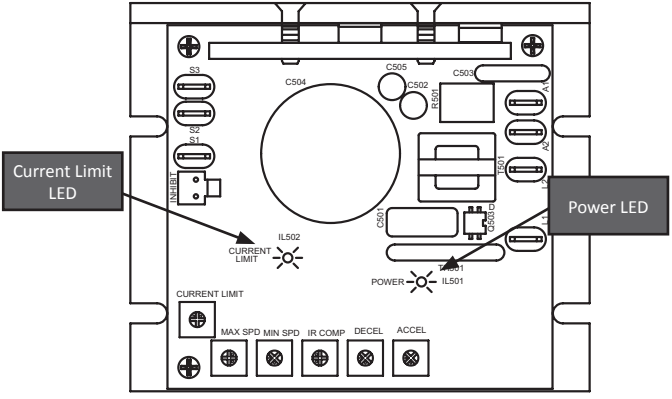


Figure 21. Diagnostic LED Locations

Section 8. Troubleshooting

Dangerous voltages exist on the drive when it is powered. When possible, disconnect the drive while troubleshooting. High voltages can cause serious or fatal injury.

Before Troubleshooting

Perform the following steps before starting any procedure in this section:

1. Disconnect AC line voltage from the drive.
2. Check the drive closely for damaged components.
3. Check that no conductive or other foreign material has become lodged on the printed circuit board.
4. Verify that every connection is correct and in good condition.
5. Verify that there are no short circuits or grounded connections.
6. Check that the drive's rated armature is consistent with the motor ratings.

For additional assistance, contact your local AMERICAN CONTROL ELECTRONICS® distributor, or the factory direct:

1-815-624-6915 or FAX: 1-815-624-6965

PROBLEM	POSSIBLE CAUSE	SUGGESTED SOLUTIONS
Line fuse blows.	1. Line fuse is the wrong size.	1. Check that the line fuse is correct for the motor size.
	2. Motor cable or armature is shorted to ground.	2. Check motor cable and armature for shorts.
	3. Nuisance tripping caused by a combination of ambient conditions and high-current spikes (i.e. reversing).	3. Add a blower to cool the drive components, decrease CURRENT LIMIT settings, resize motor and drive for actual load demand, or check for incorrectly aligned mechanical components or "jams". See page 22 for information on adjusting the CURRENT LIMIT trim pot.
Line fuse does not blow, but the motor does not run.	1. Speed adjust potentiometer or input voltage signal is set to zero speed.	1. Increase the speed adjust potentiometer setting or input voltage signal.
	2. INHIBIT mode is active.	2. Remove the short from the INHIBIT terminals.
	3. S2 is shorted to S1.	3. Remove the short.
	4. Drive is in current limit.	4. Verify that the motor is not jammed. Increase CURRENT LIMIT setting if set too low. See page 22.
	5. Drive is not receiving AC line voltage.	5. Apply AC line voltage.
	6. Motor is not connected.	6. Remove power. Connect the motor to A1 and A2. Reapply power.

PROBLEM	POSSIBLE CAUSE	SUGGESTED SOLUTIONS
Motor does not stop when the speed adjust potentiometer is full CCW.	1. MIN SPD is set too high.	1. Calibrate MIN SPD. See page 21.
Motor runs in the opposite direction	1. Motor connections to A1 and A2 are reversed.	1. Remove power. Reverse connections to A1 and A2. Reapply power.
Motor runs too fast.	1. MAX SPD is set too high.	1. Calibrate MAX SPD. See page 21.
	2. S1 is disconnected.	2. Connect S1.
Motor will not reach the desired speed.	1. MAX SPD setting is too low.	1. Increase MAX SPD setting. See page 21.
	2. IR COMP setting is too low.	2. Increase IR COMP setting. See page 23.
	3. CURRENT LIMIT setting is too low.	3. Increase CURRENT LIMIT setting. See page 22.
	4. Motor is overloaded.	4. Check motor load. Resize the motor and drive if necessary.
Motor pulsates or surges under load.	1. IR COMP is set too high.	1. Adjust the IR COMP setting slightly CCW until the motor speed stabilizes. See page 23.
	2. Motor bouncing in and out of current limit.	2. Make sure motor is not undersized for load; adjust CURRENT LIMIT trim pot CW. See page 22.

Section 9. Accessories & Replacement Parts

Displays

Closed Loop..... CLD100-1
Open Loop.....OLD100-1

Heat sinks

Chassis..... HSK-0001

Kits

Potentiometer & Connector
10K Pot, Insulating Washer..... KTP-0001
10K Pot, Insulating Washer, 9 Insulated Tabs..... KTP-0005
9 Insulated Tabs..... KTP-0011

Fuse
2 1.5 Amp 250 V 3AG Fast-blow Glass Fuses..... KTF-0001
2 3 Amp 250 V 3AG Fast-blow Glass Fuses..... KTF-0002
2 5 Amp 250 V 3AG Fast-blow Glass Fuses..... KTF-0003
2 8 Amp 250 V 3AG Fast-blow Glass Fuses..... KTF-0004
2 10 Amp 250 V 3AB Normal-blow Ceramic Fuses..... KTF-0005
2 15 Amp 250 V 3AB Normal-blow Ceramic Fuses..... KTF-0006

Wiring
Inhibit Plug (18 in. leads)..... KTW-0001
Inhibit Plug (36 in. leads)..... KTW-0002

Logic Cards

Current Monitoring

5 Amps.....CMC100-5

20 Amps.....CMC100-20

Isolation

Uni-directional, 8 outputs.....ISO101-8

Bi-directional, 1 output.....ISO202-1

Notes

Notes

Unconditional Warranty

A. Warranty

American Control Electronics®, referred to as "the Corporation" warrants that its products will be free from defects in workmanship and material for twelve (12) months or 3000 hours, whichever comes first, from date of manufacture thereof. Within this warranty period, the Corporation will repair or replace, at its sole discretion, such products that are returned to American Control Electronics, 14300 De La Tour Drive, South Beloit, Illinois 61080 USA.

This warranty applies only to standard catalog products, and does not apply to specials. Any returns of special controls will be evaluated on a case-by-case basis. The Corporation is not responsible for removal, installation, or any other incidental expenses incurred in shipping the product to and from the repair point.

B. Disclaimer

The provisions of Paragraph A are the Corporation's sole obligation and exclude all other warranties of merchantability for use, expressed or implied. The Corporation further disclaims any responsibility whatsoever to the customer or to any other person for injury to the person or damage or loss of property of value caused by any product that has been subject to misuse, negligence, or accident, or misapplied or modified by unauthorized persons or improperly installed.

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In the event of any claim for breach of any of the Corporation's obligations, whether expressed or implied, and particularly of any other claim or breach of warranty contained in Paragraph A, or of any other warranties, expressed or implied, or claim of liability that might, despite Paragraph B, be decided against the Corporation by lawful authority, the Corporation shall under no circumstances be liable for any consequential damages, losses, or expenses arising in connection with the use of, or inability to use, the Corporation's product for any purpose whatsoever.

An adjustment made under warranty does not void the warranty, nor does it imply an extension of the original 12-month warranty period. Products serviced and/or parts replaced on a no-charge basis during the warranty period carry the unexpired portion of the original warranty only.

If for any reason any of the foregoing provisions shall be ineffective, the Corporation's liability for damages arising out of its manufacture or sale of equipment, or use thereof, whether such liability is based on warranty, contract, negligence, strict liability in tort, or otherwise, shall not in any event exceed the full purchase price of such equipment.

Any action against the Corporation based upon any liability or obligation arising hereunder or under any law applicable to the sale of equipment or the use thereof, must be commenced within one year after the cause of such action arises.

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