

USER'S MANUAL

SCR Filtered Series

Filtered SCR, Adjustable Speed Drives
for DC Brush Motors

Models:

MM21051C

MM21151C

MM21251C


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Safety Warnings



- This symbol  denotes an important safety tip or warning. **Please read these instructions carefully** before performing any of the procedures contained in this manual.
- Reduce the chance of an electrical fire, shock, or explosion by proper grounding, over-current protection, thermal protection, and enclosure. Follow sound maintenance procedures.



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.

It is possible for a drive to run at full speed as a result of a component failure. Minarik 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 trimpots. Use approved personal protective equipment and insulated tools if working on this drive with power applied.

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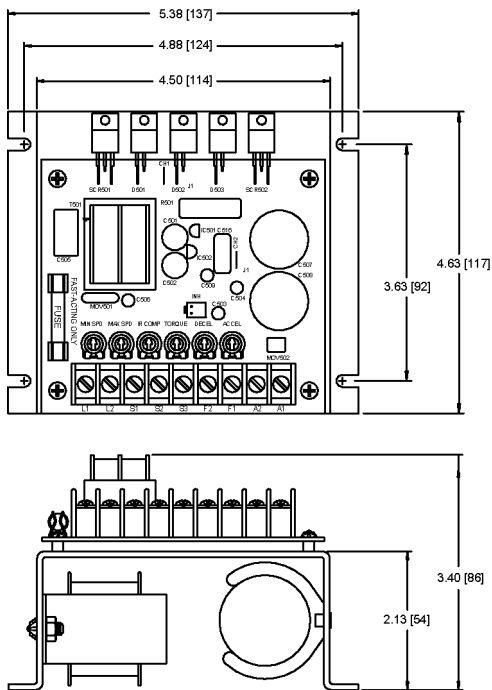
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Specifications

Model	Maximum Armature Current (Amps DC)	HP Range	AC Line Voltage Single Phase 50/60 Hz
MM21X51C	2.7	1/20–1/4	115VAC (–5%,+10%)
Armature Voltage (115 VAC Input)			0–130VDC
Form Factor			1.05 at base speed
Field Voltage		50 VDC (F1 to L1); 100 VDC (F1 to F2)	
Max. Field Current			1 ADC
Accel. Time Range (0–130 VDC Armature Voltage)			0.5 – 7 seconds
Decel. Time Range (0–130 VDC Armature Voltage)			0.5 – 7 seconds
Analog Input Voltage Range (0–130 VDC Armature Voltage)*			0 – 5.7 VDC
Input Impedance (S1 to S2)			45K Ω
Load Regulation			1% of base speed or better
Ambient Temp. Range			
MM21051C			10°C–55°C
MM21151C, MM21251C			10°C–40°C
Vibration			
			0.5 G max. (20 – 50 Hz)
			0.1 G max. (>50 Hz)
Weight			
MM21051C			2.1 lb (953 g)
MM21151C, MM21251C			3.3 lb (1.5 kg)
Style			
MM21051C			chassis
MM21151C, MM21251C			NEMA 1

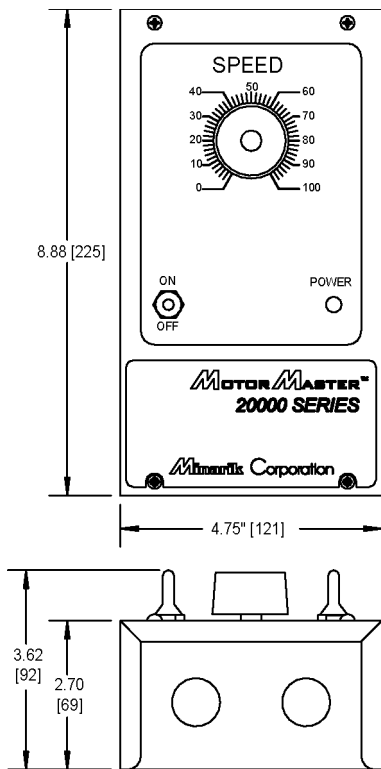
* Signal must be isolated; S1 to S2

Dimensions



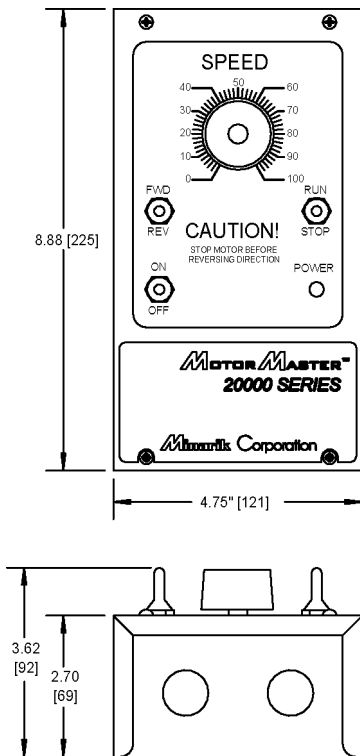
ALL DIMENSIONS IN INCHES [MILLIMETERS]
FOUR (4) MOUNTING SLOTS 0.188 [5] WIDE

Figure 1. MM21051C Dimensions



ALL DIMENSIONS IN INCHES [MM]

Figure 2. MM21151C Dimensions



ALL DIMENSIONS IN INCHES [MM]

Figure 3. MM21251C Dimensions

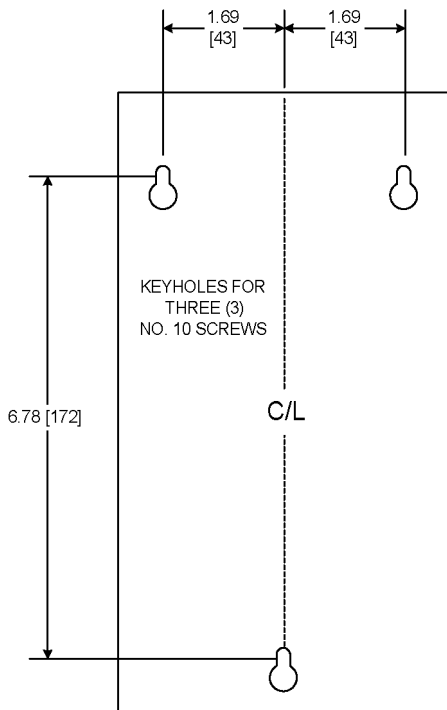


Figure 4. MM21151C and MM21251C Back View Cased Mounting Keyhole Locations

Installation



Warning

Do not install, rewire, or remove this control with input power applied. Doing so may cause fire or serious injury. Make sure you have read and understood the Safety Warnings before attempting installation.

Mounting

Drive mounting (General)

- Drive components are sensitive to electrostatic fields. Avoid direct contact with the circuit board. Hold the drive by the chassis only.
- Protect the drive from dirt, moisture, and accidental contact. Provide sufficient room for access to the terminal block and calibration trimpots.
- 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.

Drive mounting (Chassis drives)

- Mount the drive with its board in either a horizontal or vertical plane. Eight 0.188 inch (4.8 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 drive must be earth grounded for noise suppression. Connect earth ground to the earth ground terminal on the drive's bottom board (see Connections).

Drive mounting (Cased drives)

Cased drives come with 0.88 inch (22 mm) conduit holes at the bottom of the case. The units may be vertically wall mounted or horizontally bench mounted using the three keyholes on the back of the case. See Figure 4 (page 5) for mounting hole locations.

1. For access to the keyholes and the terminal strip, remove the two screws from the front of the case by turning them counterclockwise. Grasp the front cover and lift it straight out.
2. Install the mounting screws in the three keyholes.
3. Install conduit hardware through the conduit holes at the bottom of the case. Connect external wiring to the terminal block.
4. Reinstall the front cover. Avoid pinching any wires between the front cover and the case.
5. Replace the two screws to the front cover. Turn the screws clockwise to tighten.
6. Set the POWER switch to the OFF position before applying AC line voltage.

Wiring



Warning



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

Circuit potentials are at 115 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 may destroy the drive.

- Use 18 AWG wire for speed adjust potentiometer wiring. Use 16 AWG wire for AC line (L1, L2) and motor (A1, A2) wiring.

Shielding guidelines



Warning

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

As a general rule, Minarik recommends shielding of all conductors.

If it is not practical to shield power conductors, Minarik recommends shielding all logic-level leads. If shielding 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.

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.

Heat sinking

All MM21X51C drives have sufficient heat sinking in their basic configurations. No additional heat sinking is required.

Line fuses

All drives have line fuses installed (see *Replacement Parts* section for installed line fuse size). Line fuses are rated for maximum rated current.

Table 1. Recommended Line Fuse Sizes

MOTOR HP	FUSE SIZE (AMPS) @115 VAC INPUT
1/20	5
1/8	8
1/4	8

Use 16 AWG wire to connect the field output to a shunt wound motor. Table 2 lists the field output connections.

Field output



Warning

The field output is for shunt wound motors only. Do not make any connections to F1 and F2 when using a permanent magnet motor.

Table 2. Field Output Connections

Approximate Field Voltage (VDC)	Connect Motor Field To
50	F1 and L1
100	F1 and F2

Screw terminal block

Connections to these drives are made to a screw terminal block (Figure 5). The chassis model (MM21051C) has 9 screws on the terminal block. The cased models (MM21151C, and MM21251C) have 7 screws on the terminal block. Using a screwdriver, turn the terminal block screw counter-clockwise to open the wire clamp. Insert stripped wire into the wire clamp. Turn the terminal block screw clockwise to clamp the wire.

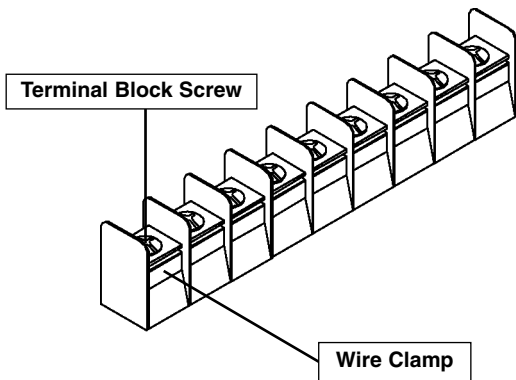


Figure 5. Screw Terminal Block

Speed adjust potentiometer installation



Warning

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

Install the circular insulating disk between the panel and the 10K ohm speed adjust potentiometer. Mount the speed adjust potentiometer through a 0.38 inch (10 mm) hole with the hardware provided (Figure 6). Twist the speed adjust potentiometer wire to avoid picking up unwanted electrical noise. If potentiometer leads are longer than 18 inch (457 mm), use shielded cable.

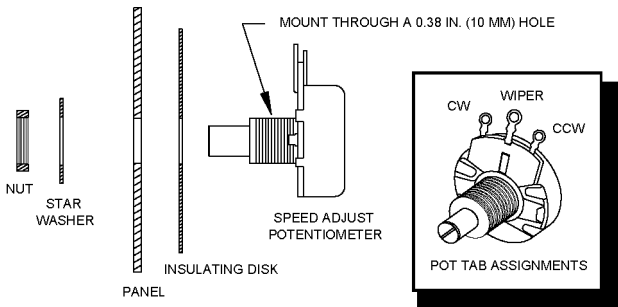


Figure 6. Speed Adjust Potentiometer

Connections



Warning

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

Minarik strongly recommends the installation of a master power switch in the line voltage input, as shown in Figure 7, page 15 (chassis drives only). The switch contacts should be rated at a minimum of 200% of motor nameplate current and 250 volts.

Chassis drives

Motor

Minarik drives supply motor voltage from A1 and A2 terminals. It is assumed throughout this manual that, when A1 is positive with respect to A2, the motor will rotate clockwise (CW) while looking at the output shaft protruding from the front of the motor. If this is opposite of the desired rotation, simply reverse the wiring of A1 and A2 with each other.

Connect a DC motor to the drive as shown in Figure 7, page 15. Ensure that the motor voltage rating is consistent with the drive's output voltage.

Power input

For chassis drives, connect the AC line power leads to terminals L1 and L2, or to a double-throw, double-pole master power switch (recommended) as shown in Figure 7, page 15.

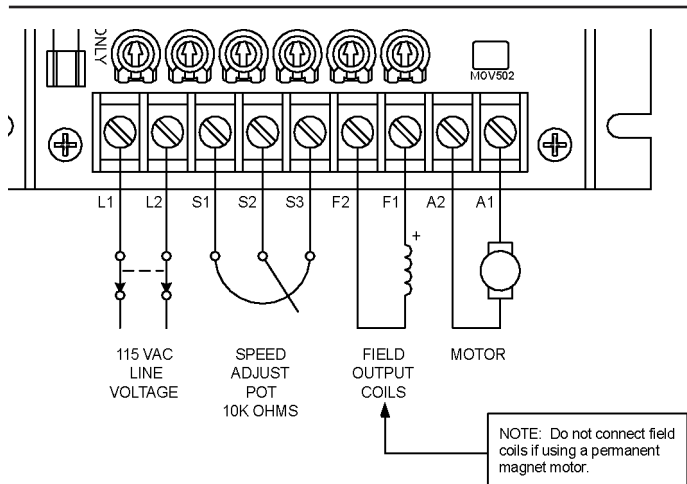


Figure 7. MM21051C Drive Connections

Cased drives

Motor

Connect a DC motor to terminals A1 and A2 as shown in Figure 8, page 16. Minarik drives supply motor voltage from A1 and A2 terminals. It is assumed throughout this manual that, when A1 is positive with respect to A2, the motor will rotate clockwise (CW) while looking at the output shaft protruding from the front of the motor. If this is opposite of the desired rotation, simply reverse the wiring of A1 and A2 with each other.

Power input

Connect the AC power line leads to terminals L1 and L2 as shown in Figure 8.

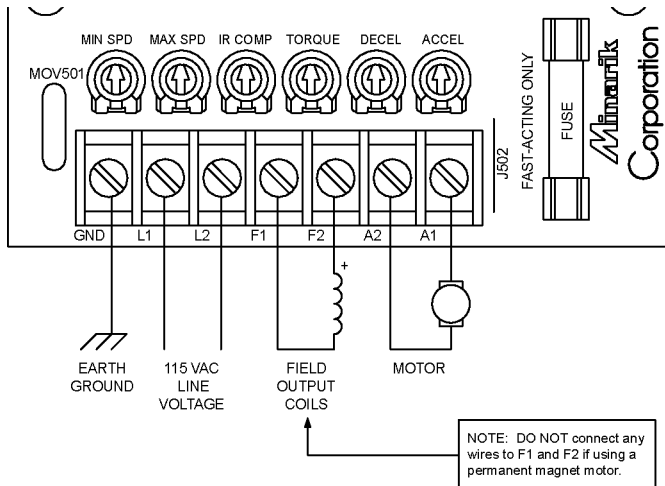


Figure 8. MM21151C and MM21251C Connections

Voltage follower (MM21051C only)

Instead of using a speed adjust potentiometer, the drive may be wired to follow an analog input voltage signal that is isolated from earth ground (Figure 9). The range of this signal is 0 - 6 VDC.

Connect the signal input (+) to S2. Connect the signal common (-) to S1. Make no connection to S3. A potentiometer can be used to scale the analog input voltage. To achieve isolation, use an interface device such as Minarik model PCM4 to scale the analog input voltage.

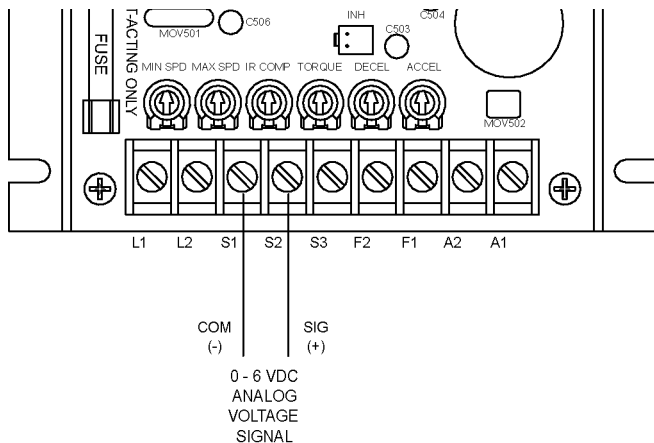


Figure 9. Voltage Follower Connections

Operation



Warning

Dangerous voltages exist on the drive when it is powered. BE ALERT. High voltages can cause serious or fatal injury.

Before applying power

1. Check connections before applying AC line voltage to the drive.
2. Check that no conductive material is present on the printed circuit board.

Startup

MM21051C

1. Turn the speed adjust potentiometer full counterclockwise (CCW), or the reference voltage to zero (if in voltage follower mode).
2. Apply AC line voltage.
3. Slowly advance the speed adjust potentiometer clockwise (CW). The motor slowly accelerates as the potentiometer is turned CW. If in voltage follower mode, increase the reference voltage. Continue until the desired speed is reached.
4. To decelerate the motor from set speed to a stop, reset the speed adjust potentiometer for zero speed, or decrease the reference voltage to zero. To coast the motor from set speed to a stop, remove the AC line voltage from the drive.

MM21151C

1. Turn the speed adjust potentiometer full counterclockwise (CCW).
2. Apply AC line voltage
3. Set the POWER switch to the ON position.
4. Slowly advance the speed adjust potentiometer clockwise (CW).
The motor slowly accelerates as the potentiometer is turned CW.
Continue until the desired speed is reached.
5. Set the POWER switch to the OFF position to coast the motor to a stop.

MM21251C

1. Set the RUN/STOP switch to the STOP position.
2. Turn the speed adjust potentiometer full counterclockwise (CCW).
3. Apply AC line voltage.
4. Set the POWER switch to the ON position.
5. Set the FWD/REV switch to the desired direction of rotation.
6. Set the RUN/STOP switch to the RUN position.
7. Slowly advance the speed adjust potentiometer clockwise (CW).
The motor slowly accelerates as the potentiometer is turned CW.
Continue until the desired speed is reached.
8. To stop the motor set the RUN/STOP switch to the STOP position.
9. To reverse direction:
 - a. Set the RUN/STOP switch to the STOP position.
 - b. Set the FWD/REV switch to the desired direction of rotation.
 - c. Set the RUN/STOP switch to the RUN position.

Starting and stopping methods



Warning

For frequent starts and stops, short the inhibit terminals, decelerate to a minimum speed, or apply a dynamic brake to the motor. Do not use any of these methods for emergency stopping. They may not stop a drive that is malfunctioning.

Removing AC line power (both L1 and L2) is the only acceptable method for emergency stopping.

Minarik strongly recommends the installation of an emergency stop switch. The switch contacts should be rated at a minimum of 250 volts and 200% of maximum motor current.

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

Line starting and line stopping

Line starting and line 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. When AC line voltage is removed, the motor coasts to a stop.

Automatic restart upon power restoration

All drives automatically run to set speed when power is applied. Wiring a latching relay into the AC line is one way to prevent automatic restarting following a power outage.

Inhibit circuit (MM21051C ONLY)



Warning

The inhibit circuit is used for frequent starts and stops. It must never be used as an emergency stop. It may not stop a drive that is malfunctioning. Removing AC line power (both L1 and L2) is the only acceptable method for emergency stopping. **Minarik strongly recommends the installation of a STOP/START switch for emergency stopping.**

Maintaining a connection between the inhibit pins causes the motor to coast to zero speed. Removing the connection between the inhibit pins allows the motor to accelerate to the speed set by the speed adjust potentiometer (Figure 10).

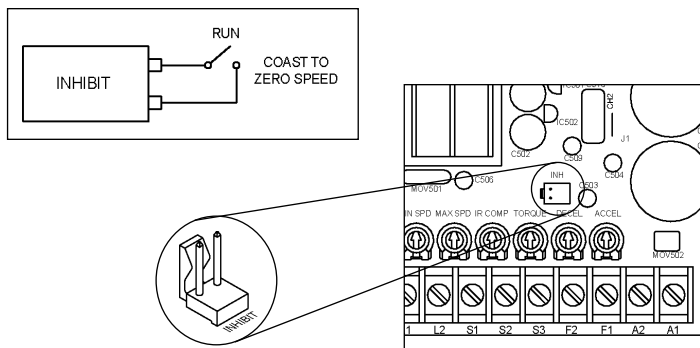


Figure 10. Inhibit Circuit Connections (MM21051C only)

Inhibit terminal accessories

Minarik Corporation offers two accessory plug harnesses for the INHIBIT terminals, as shown in Table 3.

Table 3. Inhibit Plug Part Numbers

Minarik Part Number	Description
201-0024	Inhibit plug with 18 in. (46 cm) wires
201-0079	Inhibit plug with 36 in. (91 cm) wires

Twist inhibit wires and separate them from other power-carrying wires or sources of electrical noise. Use shielded cable if the inhibit wires are longer than 18 in. (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.

Decelerating to minimum speed

The circuit shown in Figure 11 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 trimpot setting. If the MIN SPD trimpot is set full CCW, the motor decelerates to zero speed when the switch between S1 and S2 is closed. The DECEL trimpot 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 trimpot setting.

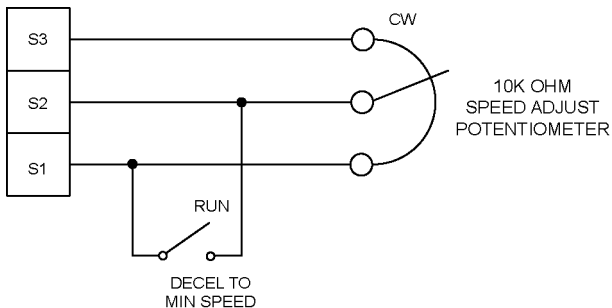


Figure 11. Run/Decelerate to Minimum Speed Switch

Dynamic braking



Warning

For frequent starts and stops, use coasting to a stop (shorting inhibit terminal to each other – MM21051C only), decelerating to minimum speed (shorting S2 and S1 to each other), or dynamic braking. Do not use any of these methods for emergency stopping. They may not stop a drive that is malfunctioning. Removing AC line power (both L1 and L2) is the only acceptable method for emergency stopping.

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 12 (page 25). For the RUN/BRAKE switch, use a three pole, two position switch rated for at least 125 VDC, 6 Amps. The dynamic braking resistor should be ceramic encased, and a minimum of 25 ohms, 10 watts. The motor stops less rapidly with higher brake resistor values.

Certain Minarik drives coast to minimum speed when the inhibit terminals are shorted to each other. IR COMP and TORQUE are still active while the drive is in the inhibit mode.

NOTE: Model MM21251C is equipped with dynamic braking.

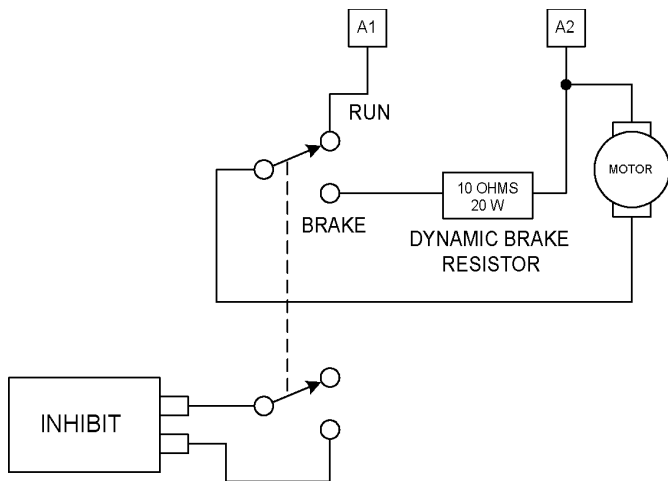


Figure 12. Dynamic Braking Circuit Connection

Calibration

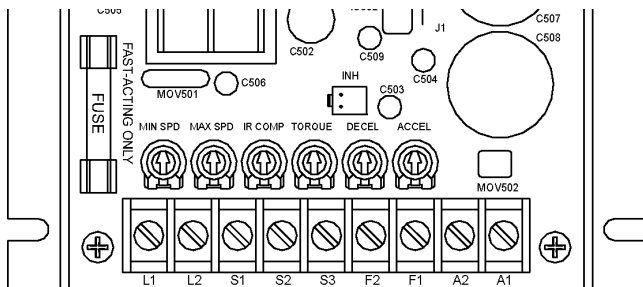


Warning

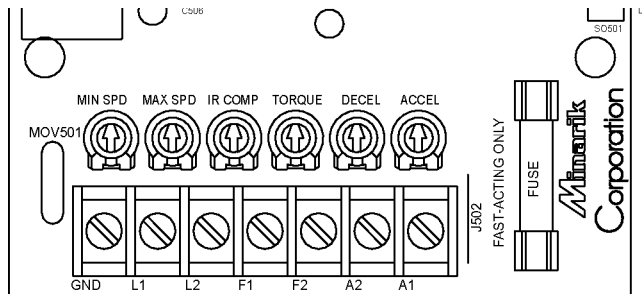
Dangerous voltages exist on the drive when it is powered. When possible, disconnect the voltage input from the drive before adjusting the trimpots. If the trimpots must be adjusted with power applied, use insulated tools and the appropriate personal protection equipment. **BE ALERT.** High voltages can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

MM21X51C SERIES drives have six user adjustable trimpots: MIN SPD, MAX SPD, IR COMP, TORQUE, DECEL, and ACCEL. Each drive is factory calibrated to its maximum current rating. Readjust the calibration trimpot settings to accommodate lower current motors.

All adjustments increase with clockwise (CW) rotation, and decrease with counterclockwise (CCW) rotation. Use a non-metallic screwdriver for calibration. Each trimpot is identified on the printed circuit board.



MM21051C



MM21151C/MM21251C

Figure 13. Calibration Trimpot Layouts

Minimum Speed (MIN SPD)

The MIN SPD setting determines the minimum speed when the speed adjust potentiometer is turned full CCW. It is factory set to zero speed.

To calibrate, set the speed adjust potentiometer full CCW. Adjust the MIN SPD trimpot until the motor has stopped, or is running at the desired minimum speed.

Maximum Speed (MAX SPD)

MAX SPD setting determines the maximum motor speed when the speed adjust potentiometer is turned full CW. It is factory set for maximum rated motor speed.

To calibrate, set the MAX SPD trimpot full CCW. Turn the speed adjust potentiometer full CW. Adjust the MAX SPD trimpot until the desired maximum motor speed is reached.

Acceleration (ACCEL)

The ACCEL setting determines the time the motor takes to ramp to a higher speed, within the limits of available torque. The ACCEL setting is factory set for its fastest acceleration time.

Turn the ACCEL trimpot CW to increase the acceleration time, and CCW to decrease the acceleration time.

Deceleration (DECEL)

The DECEL setting determines the time the motor takes to ramp to lower speed, within the limits of available torque. The DECEL setting is factory set for its fastest deceleration time.

Turn the DECEL trimpot CW to increase the deceleration time, and CCW to decrease the deceleration time.

IR Compensation (IR COMP)

The IR COMP setting determines the degree to which motor speed is held constant as the motor load changes. It is factory set for optimum motor regulation.

Recalibrate the IR COMP setting when using a lower horsepower motor. Refer to the recommended IR COMP settings in Figure 14, page 31, or recalibrate using the following procedure:

If the motor does not maintain set speed as the load changes, gradually rotate the IR COMP trimpot CW. If the motor speed oscillates (overcompensation), the IR COMP trimpot may be set too high (CW). Turn the IR COMP trimpot CCW until the motor speed stabilizes.

TORQUE








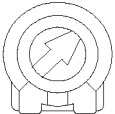
Warning

Although TORQUE LIMIT is set to 120% of motor nameplate current rating, continuous operation beyond that rating may damage the motor. If you intend to operate beyond the rating, contact your Minarik representative for assistance.

The TORQUE setting determines the maximum armature current output of the drive. It is factory set at 120% of rated motor current.

Recalibrate the TORQUE setting when using a lower horsepower motor. Refer to the recommended TORQUE settings below, or recalibrate using the following procedure:

1. With the power disconnected from the drive, connect a DC ammeter (0-15 A minimum scale) in series with the armature.
2. Set the TORQUE trimpot to minimum (full CCW).
3. Lock the motor armature. Be sure that the motor is firmly mounted.
4. Connect power to the drive. The motor should remain stopped.
5. Set the speed adjust potentiometer to maximum (full CW).
6. Adjust the TORQUE trimpot CW slowly until the armature current is 120% of motor rated armature current.
7. Set the speed adjust potentiometer to minimum.
8. Remove power from the drive.
9. Remove the stall and ammeter from the motor.

FACTORY SETTING		
		1/4 HP 130 VDC 1.8 ADC
TORQUE	IR COMP	
		1/8 HP 130 VDC 1 ADC
TORQUE	IR COMP	
		1/12 HP 130 VDC 0.71 ADC
TORQUE	IR COMP	

**Figure 14. Typical TORQUE and IR COMP Settings
(actual settings may vary with each application)**

Application Notes

Multiple fixed speeds

Replace the speed adjust potentiometer with series resistors with a total series resistance of 10K ohms (Figure 15). Add a single pole, multi-position switch with the correct number of positions for the desired number of fixed speeds.

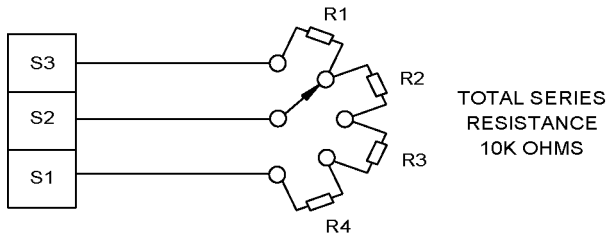


Figure 15. Multiple Fixed Speeds

Adjustable speeds using potentiometers in series

Replace the speed adjust potentiometer with a single pole, multi-position switch, and two or more potentiometers in series, with a total series resistance of 10K ohms. Figure 16 shows a connection for fixed high and low speed adjust potentiometers

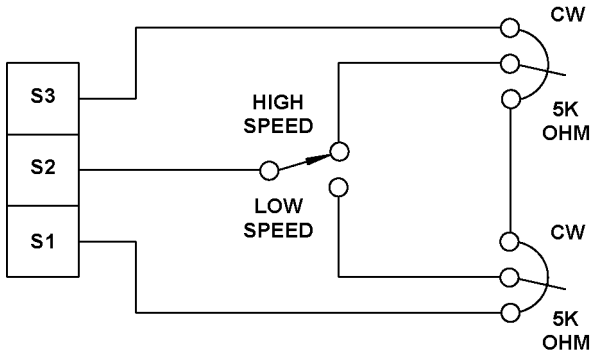


Figure 16. Adjustable Fixed Speeds Using Potentiometers in Series

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 17 shows the connection of two independent speed adjust potentiometers that can be mounted at two separate operating stations.

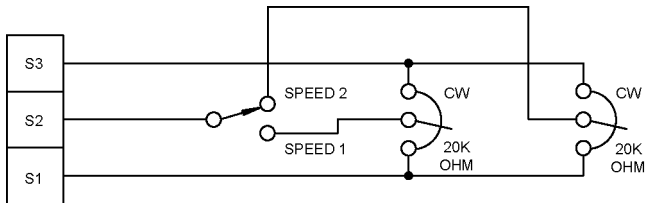
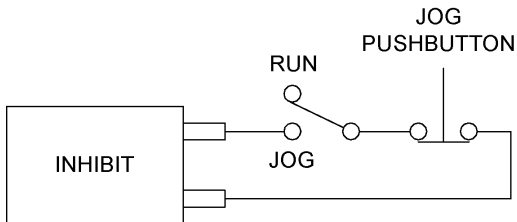


Figure 17. Independent Adjustable Speeds

RUN/JOG switch

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 single pole, normally closed, momentary operated pushbutton for the JOG pushbutton.

In the first wiring option, connect the RUN/JOG switch and JOG pushbutton to the inhibit plug as shown in Figure 18. 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 18. RUN/JOG Switch Connection to Inhibit Plug
(1st wiring option)**

In the second wiring option, connect the RUN/JOG switch and the JOG pushbutton as shown in Figure 19. When the RUN/JOG switch is set to JOG, the motor decelerates to minimum speed (minimum speed is determined by the MIN SPD trimpot setting). Press the JOG pushbutton to jog the motor. Return the RUN/JOG switch to RUN for normal operation.

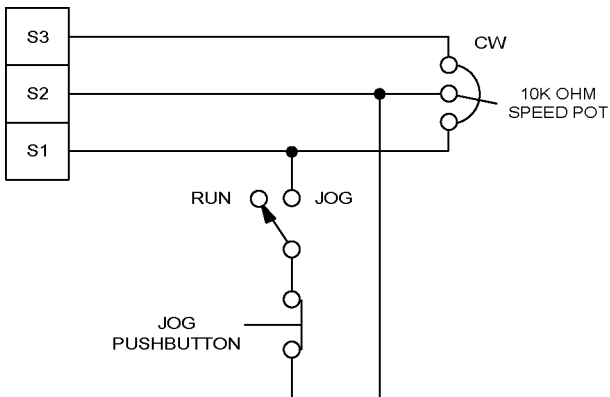


Figure 19. RUN/JOG Switch Connection to Speed Adjust Potentiometer (2nd Wiring Option)

Reversing

A dynamic brake may be used when reversing the motor direction (Figure 20). For the RUN/BRAKE switch, use a four pole, three position switch rated for at least 125 VDC, 6 Amps. The dynamic braking resistor should be ceramic encased, and a minimum of 25W, 10 watts. The motor stops less rapidly with higher brake resistor values. Wait for the motor to stop completely before switching it to either the forward or reverse direction.

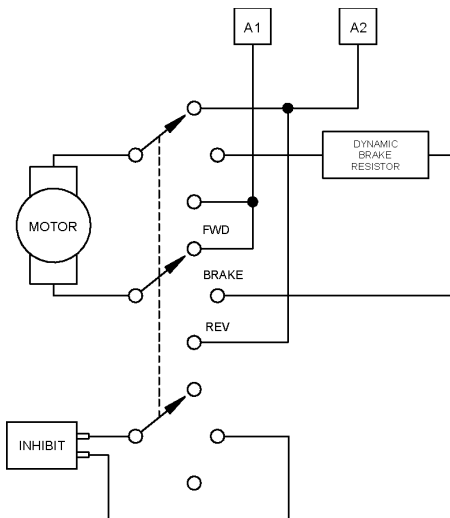


Figure 20. Reversing Diagram

Leader-Follower application

In this application, use a PCM4 to monitor the speed of the leader motor (Figure 21). The PCM4 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 PCM4 output voltage.

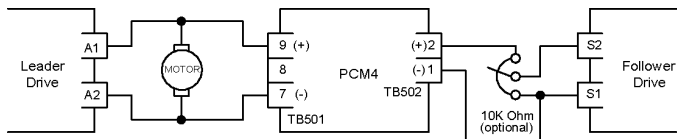


Figure 21. Leader-Follower Application

Single speed potentiometer control of multiple drives

Multiple drives can be controlled with a single speed adjust potentiometer using a PCM4 at the input of each drive to provide isolation (Figure 22). Optional ratio potentiometers can be used to scale the PCM4 output voltage, allowing independent control of each drive.

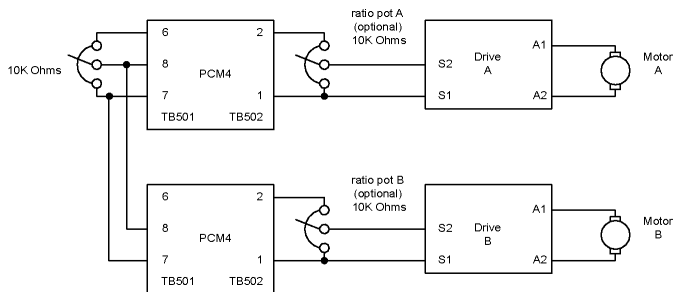


Figure 22. Single Speed Potentiometer Control of Multiple Drives

Troubleshooting



Warning

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 applying power

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 voltage selection switch settings match the AC line and output voltages.
7. Check that the drive's rated armature and field outputs are consistent with the motor ratings.

For additional assistance, contact your local Minarik distributor, or the factory direct: (800) MINARIK (phone) or (800)646-2745
(800) 394-6334 (fax)

Problem	Possible Causes	Suggested Solutions
Line fuse blows.	<ol style="list-style-type: none">1. Line fuse is the wrong size.2. Motor cable or armature is shorted to ground.	<ol style="list-style-type: none">1. Check that the line fuse is correct for the motor size (page 10).2. Check motor cable and armature for shorts.
Motor runs too fast at maximum speed setting.	<ol style="list-style-type: none">1. MIN SPD and MAX SPD settings are too high.2. Motor field connections are loose (shunt wound motors only).	<ol style="list-style-type: none">1. Recalibrate MIN SPD and MAX SPD (page 28).2. Check motor field connections and armature output voltage.

Problem	Possible Causes	Suggested Solutions
Line fuse does not blow, but the motor does not run.	<ol style="list-style-type: none"><li data-bbox="363 244 640 365">1. Speed adjust potentiometer or voltage input signal set to zero speed.<li data-bbox="363 402 640 622">2. Speed adjust potentiometer or voltage input signal not connected to drive input properly; connections are open.<li data-bbox="363 659 640 685">3. S2 is shorted to S1.<li data-bbox="363 722 640 780">4. Drive is in current limit.<li data-bbox="363 915 640 1005">5. Drive is not receiving AC line voltage.<li data-bbox="363 1042 640 1100">6. Motor is not connected.	<ol style="list-style-type: none"><li data-bbox="664 244 940 334">1. Increase the speed adjust pot or voltage setting.<li data-bbox="664 402 940 523">2. Check connections to input. Verify that connections are not open.<li data-bbox="664 659 940 685">3. Remove short.<li data-bbox="664 722 940 873">4. Verify that motor is not jammed. Increase TORQUE setting (page 30); it may be set too low.<li data-bbox="664 915 940 1005">5. Apply AC line voltage to L1 and L2.<li data-bbox="664 1042 940 1100">6. Connect motor to A1 and A2.

Problem	Possible Causes	Suggested Solutions
Motor runs too slow or too fast.	<ol style="list-style-type: none">1. MIN SPD and MAX SPD not calibrated.2. Field not operating properly.	<ol style="list-style-type: none">1. Calibrate MIN SPD and MAX SPD (page 28).2. Check motor field connections and voltage.
Motor will not reach the desired speed.	<ol style="list-style-type: none">1. MAX SPD setting is too low.2. IR COMP setting is too low.3. Motor is overloaded.	<ol style="list-style-type: none">1. Increase MAX SPD setting (page 28).2. Increase IR COMP setting (page 29).3. Check motor load. Resize the motor and drive if necessary.
Motor pulsates or surges under load.	<ol style="list-style-type: none">1. IR COMP is set too high.2. Motor bouncing in and out of TORQUE limit.	<ol style="list-style-type: none">1. Adjust the IR COMP setting slightly CCW until the motor speed stabilizes (page 29).2. Make sure motor is not undersized for load; adjust TORQUE pot CW (page 30).

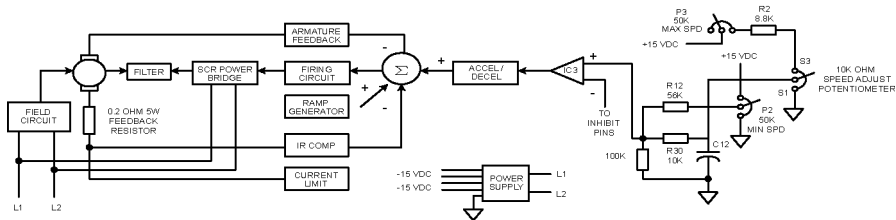


Figure 23. MM21051C, MM21151C, and MM21251C block diagram

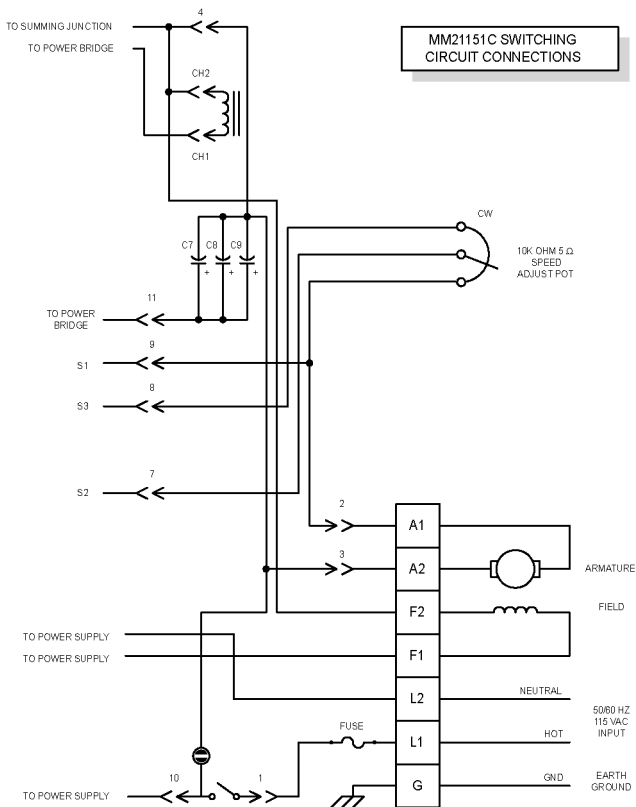


Figure 24. MM21151C switching circuit connections

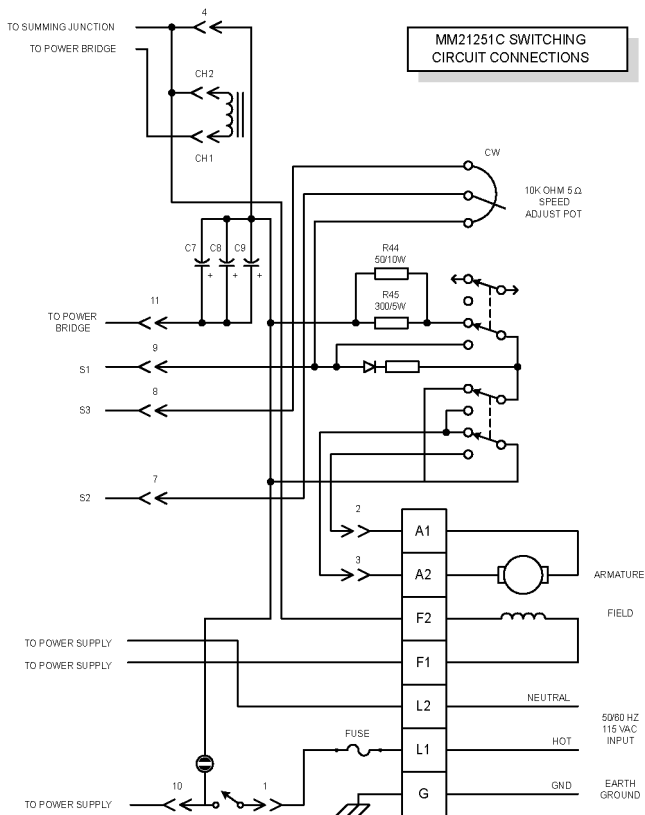


Figure 25. MM21251C switching circuit connections

Replacement Parts

Replacement parts are available form Minarik Corporation and its distributors for this drive series.

Table 4. Replacement Parts

Model No.	Symbol	Description	Minarik P/N
MM21051C	C507	470mF, 400VDC filter cap	011-0120
	D501-503	800 V, 20 A power diode	071-0039
	Fuse	8A 3AB	050-0023
	MOV501	275Vrms 4500A peak MOV	075-0011
	R501	0.2 ohm, 5W feedback resistor	032-0015
	SCR501-502	600V, 20A SCR	072-0017
	T501	3FS-324-001 transformer	230-0084
	X	Choke	240-0006
		10K ohm potentiometer kit	202-0003
MM21151C	Same parts as MM21051C except :		
	C507-509	220mF, 200V capacitor	011-0069
	IL501	Pilot Lamp	040-0035
	P1	Speed adjust potentiometer	120-0031
	SW501	DPDT toggle switch	080-0009
	Potentiometer Knob	140-0013	
MM21251C	Same as MM21151C except:		
	SW1-SW3	DPDT toggle switch	080-0009

Notes

Unconditional Warranty

A. Warranty - Minarik Corporation (referred to as "the Corporation") warrants that its products will be free from defects in workmanship and material for twelve (12) months or 3,000 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 Minarik Corporation, 901 East Thompson Avenue, Glendale, CA 91201-2011 USA.

This warranty applies only to standard catalog products, and does not apply to specials. Any returns for 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, express 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.

C. Limitations of Liability - In the event of any claim for breach of any of the Corporation's obligations, whether express or implied, and particularly of any other claim or breach of warranty contained in Paragraph A, or of any other warranties, express 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 expense 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.



901 E Thompson Avenue
Glendale, CA 91201-2011
Tel.: 1-800-MINARIK (646-2745)
Fax: 1-800-394-6334
www.minarikcorp.com

Document number 250-0100, Revision 5
Printed in the U.S.A – 7/01

North America \$10.00, Outside North America \$13.00