1/6 through 5 HP
Adjustable Speed DC Motor Controllers

- 1/6 through 5 HP
- 115 or 230V, Single Phase
- Isolated Speed Reference
- High Speed Response
  25 Hz Bandwidth
- Solid State Reversing
- Regenerative Braking
- Configurations
  – Chassis
  – NEMA 3, 4 and 12
- UL and cUL Listed

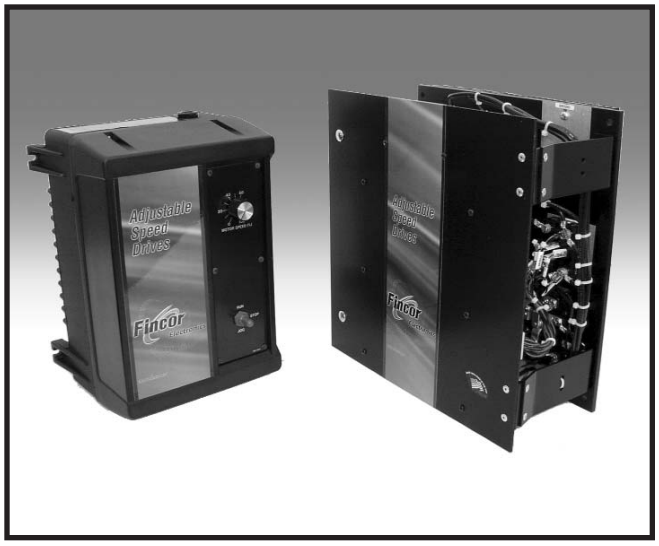


FIGURE 1. Series 2200 Controllers

PRINCIPLES OF OPERATION

Regenerative adjustable speed drives, also known as four-quadrant drives, are capable of controlling not only the speed and direction of motor rotation, but also the direction of motor torque. This is illustrated by Figure 2.

The term regenerative describes the ability of the drive under braking conditions to convert the mechanical energy of the motor and connected load into electrical energy which is returned (or regenerated) to the AC power source.

When the drive is operating in Quadrants I and III, both motor rotation and torque are in the same direction and it functions as a conventional nonregenerative unit. The unique characteristics of a regenerative drive are apparent in Quadrants II and IV. In these quadrants, the motor torque opposes the direction of motor rotation which provides a controlled braking or retarding force. A high performance regenerative drive, such as the Series 2200, is able to switch rapidly from motoring to braking modes while simultaneously controlling the direction of motor rotation.

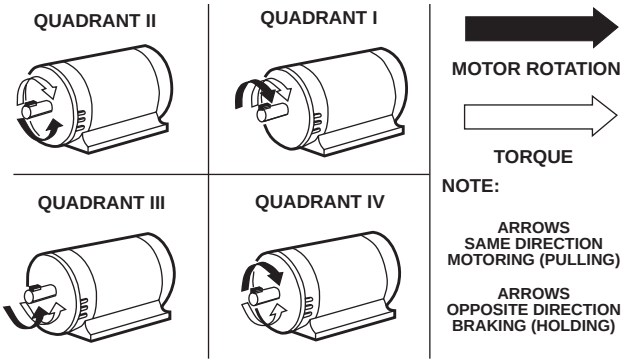


FIGURE 2.

TABLE 1: CHASSIS MOUNT UNITS MODEL 2200S

HP	Line Voltage	Model Number
1/6	115	2200S01611A
1/4	115	2200S02511A
1/3	115	2200S03311A
1/2	115	2200S05011A
3/4	115	2200S07511A
1	115	2200S10011A
1	230	2200S10013A
1-1/2	230	2200S15013A
2	230	2200S20013A
3	230	2200S30013A
5	230	2200S50013A

TABLE 2: NEMA 12 ENCLOSED UNITS MODEL 2200P (WITHOUT OPERATOR CONTROLS)*

HP	Line Voltage	Model Number
1/6	115	2200P01611A
1/4	115	2200P02511A
1/3	115	2200P03311A
1/2	115	2200P05011A
3/4	115	2200P07511A
1	115	2200P10011A
1	230	2200P10013A
1-1/2	230	2200P15013A
2	230	2200P20013A

* Remote control stations are shown on page C-12.

DESIGN FEATURES AND FUNCTIONS

1. **Construction** — 2200P models feature a totally enclosed, nonventilated NEMA Type 3, 4 and 12 enclosure, constructed of rugged, die-cast aluminum alloy. Hinged cover includes a draw latch that tightly compresses the gasket to exclude contaminants. Conduit entry is provided by four 3/4-14 NPT tapped holes on 3 sides. Back surface is deeply finned for maximum heat transfer. See Figure 5 for Series 2200P dimensions.

   2200S models feature an open chassis with a dead back and front construction. Front access is provided to all components by a hinged, latched front cover which forms a mounting surface for the main control circuit board. The entire base is a finned alloy extrusion for maximum heat transfer. See Figure 4 for Series 2200S dimensions.

2. **Full-Wave Power Conversion** — Dual full-wave converter configuration, consists of two back-to-back bridges of four SCR's each, provides optimum form factor for best motor performance and long service. Power bridges are an integrated, encapsulated component.

3. **Voltage Transient Protection** — Metal oxide suppressor across the AC line and RC snubbers across the power bridge modules minimize the effect of high voltage spikes from the AC power source.

4. **AC Line Protection** — AC line fuse(s) provide instantaneous protection from peak loads and fault currents.

5. **Motor Contactor** — A two-pole DC magnetic contactor provides positive disconnection of the motor armature from the rectified power source. Action of the contactor is sequenced with the SCR regulator to ensure that the power circuit is "phased-off" before the contactor is opened. This ensures that only "dry switching" occurs for improved contactor longevity.

6. **Control Transformer** — A 24-volt secondary transformer isolates all magnetic control and logic from the AC power source for operator protection.

7. **Counter EMF Voltage Feedback with IR Compensation** — Adjustable for individual motor characteristics.

8. **Trigger Circuit** — Fast rise, hard firing with repetitive 25 microseconds wide-shaped pulses at a 10 kHz rate to ensure reliable conduction and minimize di/dt degradation of the SCR's. Gate isolation is standard.

9. **Field Supply** — Transient protected, full-wave power supply.

10. **Paint Finish** — Durable silicone reinforced enamel in an attractive two color finish. Cover is Fincor "Dyna-Orange" (to OSHA color code standards) with a "Thermo-Black" base.

11. **DC Loop Protection** — Fast acting, current limiting fuse provides protection from inverting faults.

12. **Undervoltage Protection** — By motor contactor.

13. **Isolated Regulator** — Internal DC circuits are isolated from the AC power circuitry for operator and equipment safety and for simplified application. The control reference input common may be grounded or connected without additional isolation to other drive units or grounded output process controllers. Isolation eliminates the common condition of line voltage to ground potentials being present on the MOTOR SPEED potentiometer.

14. **Feedback Isolation Networks** —

    (a) Current Feedback – Current transformer in the AC line.
    (b) Voltage Feedback – High impedance circuit: 115V units – two megohms, 230V units – four megohms.

15. **Static Reversing** — Electronic reversal of motor armature. No reversing contacts to burn, arc or wear.

16. **Static Braking** — Provides smooth regenerative braking of the DC drive motor. Braking is effective under the following conditions:

    (a) Overhauling Load – Whenever the speed of driven load attempts to exceed the speed set by the reference signal.
    (b) Speed Reference Change — Whenever the speed reference is reset to command a reduction in speed or change in the direction of motor rotation.
    (c) Stop Function — Motor will brake to minimum speed before the motor contactor opens. Stop command can originate from a pushbutton or compatible external logic.

17. **Safety Features** — Isolated regulator • Low voltage operator control • Mandatory restart after power interruption • High interrupting capacity AC line fuses • Two-pole armature contactor • High visibility paint finish.

18. **General Features** — Rugged construction • Lightweight • Compact Dimensions • No heavy centertap transformers or DC inductors required.

19. **Two Button Stop** — Normal STOP initiates Static Braking (See 16c), EMERGENCY STOP provides coast-to-stop unless DB is selected (See Option 1039).

20. **Sync Shift** — Ensures that regenerated energy from motor CEMF is properly synchronized with the AC line. In the regenerative mode this unique circuit automatically shifts the SCR firing angle ±30° regardless of other control commands to precisely transfer energy back to the power source. This provides smooth, controllable regenerative braking, minimum dead band and super fast response.

RATINGS AND CHARACTERISTICS

RATINGS

1. **Horsepower Range** ..... 1/6-5 HP
2. **Power Source** ..... 115 or 230V, single-phase, 50 or 60 Hz
3. **115V Unit Output (1/6-1 HP)**
   (a) Armature..... 0-90VDC
   (b) Field..... 100 VDC
4. **230V Unit Output (1/2-5 HP)**
   (a) Armature..... 0-180 VDC
   (b) Field..... 200 VDC
5. **Service Factor**..... 1.0
6. **Duty** ..... Continuous
7. **Overload Capacity** (Armature circuit) ..... 150% for 1 minute
8. **Reference Power Supply**..... ±10VDC
9. **Run Speed Potentiometer**..... 10K ohms, 1/2 W

ADJUSTMENTS

1. **Current Limit**..... 50-150% full-load torque (Common forward and reverse circuits)
2. **Maximum Speed**..... 60-100% of motor base speed (Common forward and reverse circuits)
3. **IR (load) Compensation**..... 0-100% of rated load
4. **Gain (motor stability, factory set)**..... Adjustable for individual motor characteristics
5. **Phase Shift (factory set)** ..... Adjustable for individual motor characteristics

OPERATING CONDITIONS

1. **Line Voltage Variation**..... ±10% of rated
2. **Line Frequency Variation** ..... ±2 Hz
3. **Ambient Temperature (1)** ..... 0 to 40°C (32°F to 104°F)
4. **Altitude (standard)** ..... 3300 feet(1000 meters) maximum

NOTE: (1) Series 2200S Models are designed for panel mounting where the internal temperature of the enclosure does not exceed 55°C (131°F).

PERFORMANCE CHARACTERISTICS

1. **Controlled Speed Range** – Zero to motor base speed. Speed range with respect to specified regulation is as listed in Table 3. See Catalog Section E for continuous duty application limitations of DC Motors.
2. **Speed Regulation** – (See Table 3) - Regulation percentages listed are of motor base speed under steady-state conditions. Normal operation will result in performance equal to or better than specified.
3. **Efficiency** (rated speed/rated load)
   (a) Controller SCR regulator 99%
   (b) Complete drive, controller with motor (typical)..... 85%
4. **Displacement Power Factor** (1).....87%
5. **Acceleration Control** (standard) .....By current limit
   Linear acceleration is optional
6. **Controller Bandwidth (Responsiveness)** .....25 Hz (60 Hz line)
   21 Hz (50 Hz line)
7. **Current Ripple Frequency** .....120 Hz (60 Hz line)
   100 Hz (50 Hz line)

NOTE: (1) At motor base speed and rated load.

TABLE 3. SPEED REGULATION CHARACTERISTICS

Regulation Method	Variable				Speed Range
	Load Change 95%	Line Voltage ±10%	Field Heating Cold/Normal	Temperature ±10°C	
Standard Voltage Feedback with IR Compensation	2%	±1%	5-12%	±2%	50:1
Optional Speed (Tach) Feedback (1061D) with 5 PY DC Tach	0.5%	±1%	0.2%	±2%	200:1

TABLE 4. TYPICAL APPLICATION DATA

COMPONENT			RATINGS									
Rated Horsepower (HP)			11/6	1/4	1/3	1/2	3/4	1	1-1/2	2	3	5
Rated Kilowatts (kW)			0.124	0.187	0.249	0.373	0.560	0.746	1.120	1.492	2.238	3.730
1-PHASE AC INPUT (FULL-LOAD)	Line Amps	115V Unit	3.9	5.0	6.0	8.7	12.4	15.8	—	—	—	—
		230 Unit	—	—	—	4.2	5.9	8.8	12.6	17.0	22.0	35.0
	KVA		.48	.58	.71	1.0	1.4	2.0	3.0	4.0	5.0	8.0
DC OUTPUT (FULL-LOAD)	Motor Armature Amps	90V	2.0	2.8	3.5	5.4	8.1	10.5	—	—	—	—
		180V	–	–	–	2.6	3.8	5.5	8.2	11.6	15.1	24.0
	Motor Field Amps (max)	100V	1.0	1.0	1.0	1.0	1.0	1.0	—	—	—	—
		200V	—	—	—	1.0	1.0	1.0	1.0	1.0	1.0	1.0
FULL-LOAD TORQUE (Lb-ft) with 1750 RPM – Base Speed Motors			0.5	0.75	1.0	1.5	2.2	3.0	4.5	6.0	9.0	15.0
CONTROLLER WEIGHT		P	11.5 lbs. (5.2 kg)									
		S(1/6-2 Hp)	12.5 lbs. (5.7 kg)									
		S (3-5 HP)									17.0 lbs. (7.7 kg)	

DIMENSIONS

OPERATOR CONTROLS

Table 5 lists the standard operator control stations for use with the Series 2200 controllers. All remote operator control stations are NEMA Type 1 TENV with industrial rated components. The dimensions are shown in Figure 3.

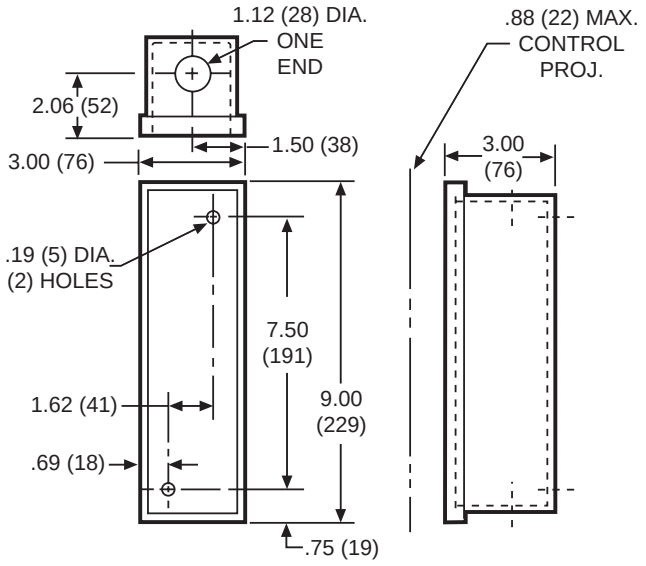


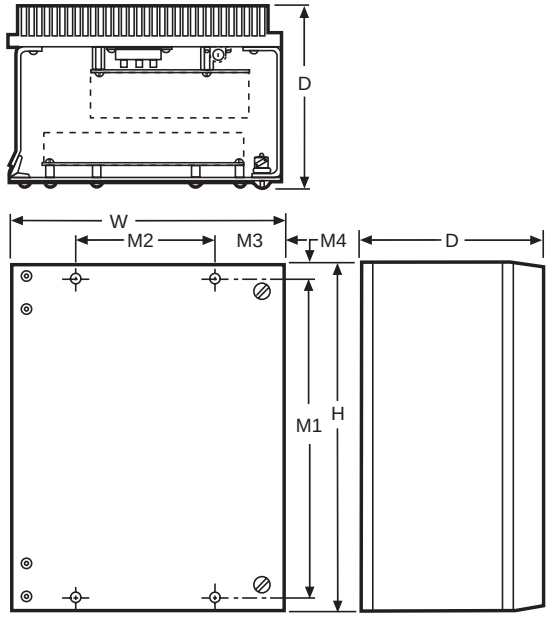
FIGURE 3. Operator Control Station Dimensions

TABLE 5. OPERATOR CONTROL STATIONS (1)

CATALOG NUMBER	USE WITH OPTION NO.	CONTROL ELEMENTS		
		Push-Buttons	Toggle Switch	Potenti-ometer
SCS171	Basic Controller	Run, Stop Emerg. Stop	—	Motor Speed 100-0-100
SCS172	1001A	Run, Stop Emerg, Stop	—	Motor Speed 0-100
SCS173	1021A(2)	Run, Stop Emerg. Stop	Run-Jog	Motor Speed 100-0-100
SCS174	1001A(2) 1021A	Run, Stop Emerg. Stop	Run-Jog	Motor Speed 0-10
SCS175	1022	Run, Stop Emerg. Stop	Run-Jog	Motor Speed 100-0-100 Jog Speed 30-0-30
SCS176	1001A 1022	Run, Stop Emerg. Stop	Run-Jog	Motor Speed 0-100 Jog Speed 0-30
SCS177	1001A 1048A	Run, Stop Emerg. Stop	Fwd-Rev	Motor Speed 0-100
SCS178	1058A	—	Manual/ Follower	Ratio 0-100

NOTE: (1) A TORQUE ADJUST potentiometer can be added to all operator control stations except SCS175 and SCS176 if Option 1190 (TORQUE TAPER) or Option 1064 (EXTERNAL TORQUE LIMIT CONTROL) is selected. When ordering any of the above operator control stations, please specify if you require the addition of this torque ADJUST potentiometer.

(2) Jog at Run Speed.



MODEL	HP (kW)	DIMENSIONS inches (mm)			MOUNTING DIMENSIONS inches (mm)				Hole Dia.
		H	W	D	M1	M2	M3	M4	
2200S	1/6-2 (0.124-1.492)	13.0 (33)	9.88 (251)	6.56 (167)	12.25 (311)	5 (127)	2.44 (62)	.38 (10)	.188 (5)
2200S	3-5 (2.238-3.73)	13.0 (330)	12.75 (324)	6.25 (159)	12.0 (305)	11.375 (289)	.44 (11)	.50 (13)	.281 (7)

FIGURE 4. Series 2200S Dimensions

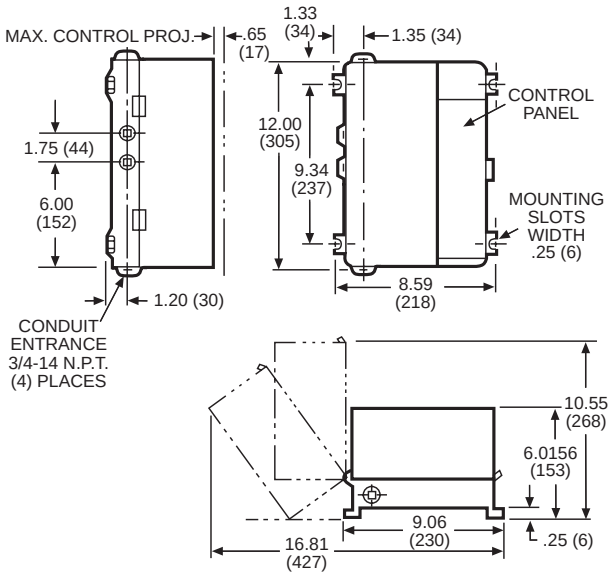


FIGURE 5. Series 2200P Dimensions

OPTIONS

The versatility of Series 2200 Controllers is further extended by selecting one or more of the following options.

Table 6 lists the allowable combinations of options as well as the section reference for a detailed description of the option.

TABLE 6. ALLOWABLE OPTIONS COMBINATIONS

Remarks	Option Group	Option Number	Option Description	Option Code 2200P	Option Code 2200S	Type
Feedback Options: Can be combined with options selected from all groups except C.	A	1037	Feedback Adapter, Interface Board	NA	XK	SP
		1061D	Feedback, Tachometer DC	XK	XK	SP
Input Options: Choice of one within this group unless Option 1037 is selected. Can be combined with options selected from all groups except C.	B	1034D	Acceleration/Deceleration, "S" Curve	XK	XK	SP
		1036	Acceleration/Deceleration, Bidirection Linear	XK	XK	SP
		1037	Input Adapter Interface Board	NA	XK	SP
		1049A	Follower, Process Instrument Controller	XK	XK	SP
		1051	Follower, MIRC	XK	XK	SP
		1055A	Follower, DC Tachometer Generator	XK	XK	SP
Input and Feedback Options: Choice of one within this group. Can be combined with options selected from all groups except A and B.	C	1064B	Torque (Current) Limit Control	XK	XK	SP(1)
		1190	Torque Taper	XK	XK	SP(1)
Jog Options: Can be combined with options selected from all groups.	D	1022	Jog, Toggle Switch Selection	K(2)	K(2)	SE
Miscellaneous Options: Choice of one or all options within this group. Can be combined with options selected from all other groups.	E	1037A	Input/Feedback Adapter, 1-Position	NA	K	SE
		1037B	Input/Feedback Adapter, 2-Position	NA	K	SE
		1039	Dynamic Braking	XK	XK	S
		1058A	Follower/Manual Mode Select (Toggle Switch)	K(2)	K(2)	SE
		1120	Control Station	K(2)	K(2)	SE
		1120A	Potentiometer, Ten-Turn Motor Speed	K	K	SE
		1120B	Potentiometer, Single-Turn Motor Speed Assembly	K	K	SE
		1138	Baseplate (W4)	NA	NA	SE
		1139C	Enclosure, W4	NA	NA	SE
		1166	Manual, Instruction	K	K	SE

CODES
X – Factory Installed
K – Field Kit
S – Standard Internal Mounted Option
SE – Standard External Mounted Option
SP – Standard Plug-In Internal Mounted Option

NOTES: (1) Potentiometer is mounted externally to the controller.
(2) Select proper operator control station.
(3) See Option Section for a complete description of all options. The Option Description Section Number indicates the section where the description is located.

<table>
<tr><th>Option Number</th><th>Description</th></tr>
<tr><td>1039</td><td>
Dynamic Braking
Provides exponential rate braking of the DC motor armature. Braking is initiated by disconnecting the armature from the rectified power source and reconnecting it to a DB resistor. This is accomplished by normally-closed contacts which are mechanically interlocked with the normal run contacts. The DC motor, thus connected, functions as a generator with the kinetic energy of the armature and machine load dissipated as heat by the resistor. The resistor is selected to provide initial braking torque as listed in the following Table:

Component Ratings
<table>
<tr><th colspan="2">Rated Horsepower (HP)</th><th>1/6</th><th>1/4</th><th>1/3</th><th>1/2</th><th>3/4</th><th>1</th><th>1-1/2</th><th>2</th><th>3</th><th>5</th></tr>
<tr><th colspan="2">Rated Kilowatts (kW)</th><th>0.124</th><th>0.187</th><th>0.249</th><th>0.373</th><th>0.560</th><th>0.746</th><th>1.120</th><th>1.492</th><th>2.238</th><th>3.730</th></tr>
<tr><td>Braking</td><td>115V Unit</td><td>300</td><td>215</td><td>170</td><td>110</td><td>75</td><td>60</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>Torque</td><td>230V Unit</td><td>–</td><td>–</td><td>–</td><td>400</td><td>320</td><td>220</td><td>145</td><td>105</td><td>85</td><td>96</td></tr>
<tr><td>Stops per</td><td>115V Unit</td><td>9</td><td>6</td><td>5</td><td>5</td><td>4</td><td>4</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>Minute</td><td>230V Unit</td><td>–</td><td>–</td><td>–</td><td>5</td><td>4</td><td>4</td><td>3</td><td>3</td><td>2</td><td>2</td></tr>
</table>
The DB resistor is rated for stopping a typical load, a maximum number of stops per minute from top speed as shown in the table. A typical load is defined as:

1. Not exceeding rated-load torque.

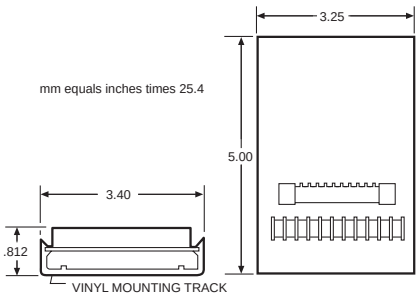
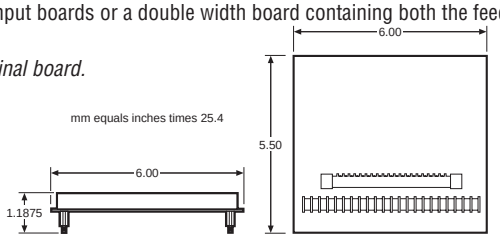
2. External load inertia (beyond the motor shaft) not exceeding that of the motor armature.

High inertia loads may extend braking times beyond the wattage rating of the DB resistor. Dynamic braking is not a holding brake; it will not prevent a motor at rest from rotating.

This option consists of a DB resistor and an antiplug relay to prevent restarting the controller until the braking cycle is complete, thereby preventing a potentially damaging electrical surge and mechanical stress.
</td></tr>
<tr><td>1138</td><td>
Baseplate (W4)
Provides a steel mounting plate for mounting a Series 2200 controller and any of the custom options selected. This option must be specified whenever custom options are utilized unless Option 1139C (Enclosure) is specified. Refer to table in Option 1139C which lists the number of square inches available for mounting options (CAF). If a larger CAF than that shown is required, consult factory.

See Catalog Section 8100 for W4 baseplate dimensions.
</td></tr>
<tr><td>1139C</td><td>
Enclosure W4
Provides a Fincor W4 NEMA Type 1 ventilated enclosure for mounting any Series 2200 controller. This enclosure includes Option 1138 which provides panel area in excess of that required by the Series 2200 controller for mounting custom optional features, custom logic or auxiliary control devices.
</td></tr>
<tr><td>1166</td><td>
Manual, Instruction
Additional instruction manuals with dimension drawings, schematic and connection diagrams will be packaged separately in addition to the manual packaged with the controller.
</td></tr>
</table>

Options that are common to the 2200 single-phase. These options are offered as field kits or factory installed. Simplified instructions are included with each option to facilitate field installation.

Option Number	Description
1022	**Jog, Toggle Switch Selection** Option includes a RUN-JOG selector switch and a JOG SPEED potentiometer for installation in the operator control panel. The RUN-JOG toggle switch (maintained) contacts in the operator station open the contactor seal-in circuit. Controller then jogs when the RUN pushbutton is pressed and held at the JOG SPEED potentiometer setting. Jog action is momentary, causing motor rotation only when the RUN pushbutton is depressed. This option is also suitable for reversing units where identical forward and reverse jog speeds are acceptable.
1034D	**Acceleration/Deceleration "S" Curve** Provides a smooth initial takeoff when a speed change is initiated, and a soft final approach to minimize any overshoot. The acceleration profile approximates that of an "S" curve. The time span from 0 to base speed is adjustable from 1 to 9 seconds. This option provides one potentiometer to adjust the time rate and two potentiometers to adjust the "S" curve.
1036	**Acceleration/Deceleration, Bidirectional Linear** Permits potentiometer adjustments of a desired time span to attain maximum speed from zero speed. The preset rate is effective any time there is a speed change command, not just from startup. Circuit includes four totally independent adjustable timing circuits on a plug-in circuit board as follows: 1. FWD ACCEL 2. FWD DECEL 3. REV ACCEL 4. REV DECEL
1037	**Feedback/Input Adapter, Interface Board** Signal input or feedback circuit boards plug directly into the control board of the controller. Some applications require multiple operating modes with the ability to selectively track two or more external reference signals, i.e., a tachometer signal or an external DC signal. This option provides an extender circuit board with a terminal strip which replaces the standard input or feedback board. This brings the internal regulator circuits of the control board to screw terminal connection points. The input or feedback boards are mounted externally from the controller and wired through selection logic to the external input or feedback interface terminal board
1037A	**Feedback/Input Adapter, 1-Position** Provides an assembly capable of accepting either a standard input option board of a feedback option board. *Option 1037A consists of a vinyl mounting track with P.C. socket and terminal board.* 
1037B	**Feedback/Input Adapter, 2-Position** Provides an assembly capable of accepting feedback and input boards or a double width board containing both the feedback and input function (i.e., Option 1191). *Option 1037B consists of a base with P.C. socket and terminal board.* 

Option Number	Description
1049A	**Follower, Process Instrument Controller** Provides necessary impedance matching circuitry to interface a customer supplied DC signal source with the controller reference input. Typical applications are those where motor speed must be controlled as a function of a process variable such as temperature, weight, fluid flow, pressure, etc. *In many applications, the reference signal is obtained from a process instrument controller or other commercially available transducer with a DC milliampere output. Devices of this type normally provide signal levels within the ranges listed in the table:* This option provides bidirectional operation. **Option 1049A provides suitable adjustments for linear transfer of instrument output current to motor speed. These adjustments are normally set so minimum transducer signal results in minimum or zero motor speed and maximum signal produces maximum motor speed. Also provided are adjustments to extend or compress the transducer signal output, so a 5:1 transducer output signal range, for example, could provide a 10:1 or 20:1 drive speed range.** *The controllers include internal DC isolation permitting the reference common to be directly connected to a process controller with a grounded output signal without the requirement for a signal isolator or AC line power isolation transformers. Multiple controllers may also be connected directly to a common process controller without further isolation.*
1051	**Follower, MIRC** Provides an input circuit board to interface the controller with speed reference signals transmitted by the Model MIRC101 Master Controller. The circuit board includes optical isolation, frequency to analog conversion, and impedance matching circuitry. *This option is required for each controller whenever one or more is to be controlled by the MIRC101. Option 1051 includes adjustments for minimum speed and calibration (sets frequency at which motor will run at maximum speed) as well as the separately furnished ratio/manual speed potentiometer.* **The MIRC Follower Option will control motor speed for unidirectional operation only. Motor reversal may be accomplished by a separately furnished forward/reverse toggle switch. This option also allows toggle switch selection between frequency reference input or manual speed control by the ratio/manual speed potentiometer.** *The MIRC Follower Option is suggested for use whenever multiple controllers must track a common speed reference signal. The MIRC101 Master Controller is not included as part of this option.*
1055A	**Follower, DC Tachometer Generator** Intended for single or multi-drive control systems where it is necessary for the drive(s) to follow the speed of a preceding drive unit or rotating machine coupled to a DC tachometer generator. The tach signal provides the speed reference for the “follower” drive. This option provides bidirectional operation. Option 1055A includes impedance matching circuitry and a RATIO adjustment potentiometer connected across the output of the DC tachometer generator to interface with the reference input of the drive controller(s). Controllers include internal isolation permitting the reference common to be connected directly with other drive(s) without utilizing line isolation transformers. *Operator Control Station SCS178 should be selected for use with this option.* *Option 1055A does not include the tachometer generator which must provide a minimum of 9 VDC at base speed and not exceed 180 VDC at maximum speed.*
1058A	**Manual/Follower Mode Select (Toggle Switch)** A MANUAL-FOLLOWER toggle switch in the operator control station permits the drive to operate from the standard MOTOR SPEED potentiometer when the switch is in the MANUAL position or from an external signal source fed to a RATIO adjust potentiometer when the FOLLOWER mode is selected. This option is usually used with either Option 1049A (Follower, Process Instrument Controller) or with Option 1055A (Follower, DC Tachometer). External Signal must be wired to the toggle switch. Option 1058A does not require any modification to the controller, but the correct control station must be specified. Use Operator Control Station SCS178 and one of the other standard control stations.
1061D	**Feedback, DC Tachometer** Provides impedance matching and terminals for accepting a signal from a DC tachometer generator which is directly coupled to the motor armature. This option replaces the standard Counter EMF feedback mode in the controller and improves speed regulation with respect to changes in load, line voltage variations, ambient temperatures, and motor field heating as well as other operating variables. The tachometer generator must provide 30 to 180 VDC at maximum speed. The tachometer generator is not included as part of this option.
1064B	**Follower, Current Regulator (Less Adjustments)** Provides a means of controlling motor armature current and torque by a manually adjusted potentiometer or an external 0 to 12 VDC signal. This option provides separate current reference inputs for forward and reverse torque, but operates in one motor direction only. *This option is useful in applications where load sharing of two or more drive units is required where one unit can be designated as master. The master unit would generate a 0 to 12 VDC current reference to be used by the slave drives.*
1120	**Control Station** Provides a standard model numbered operator control station for separate mounting by the user. Control elements are mounted within the station; however external wiring terminations must be completed by the user.
1120A	**Potentiometer, Ten-Turn Motor Speed** Provides a ten-turn, potentiometer which replaces the standard one-turn MOTOR SPEED potentiometer in the operator control station, or may be mounted separately.

Option Number	Description
1120B	**Potentiometer, Single-Turn Motor Speed Assembly** Provides a single-turn, potentiometer for separate mounting.
1190	**Torque Taper** Center driven winders ideally require a reciprocal speed torque relationship (constant horsepower) to maintain constant tension throughout the range of material buildup as illustrated by Figure 1. Acceptable performance can be economically achieved for many applications with an inverse-linear speed-torque relationship provided by this option. Tension control accuracy of approximately 20% can normally be maintained from empty roll to full roll at a given production machine speed. This option consists of a plug-in circuit board which inserts into the FEEDBACK AND INPUT connector of the control circuit board, and a TORQUE ADJUST potentiometer for installation in the operator control station. Independent potentiometers are provided. TORQUE ADJUST — Establishes maximum low speed torque as illustrated by Figure 2. The TORQUE ADJUST in combination with the Taper adjustments, establishes the torque available at any point throughout the operating speed range. The TORQUE ADJUST potentiometer is mounted in the operator control station. *Option 1190 can also be used for constant torque applications where conventional operation of the current limit is required and remote mounted torque (current) potentiometer is desired. When used in this manner, the Taper adjustment is set for a vertical cut-off of motor torque (current).* REV/FWD TAPER — Establishes the slope or rate of linear torque increase with decreasing speed throughout the operating range. Adjustable from 0 to 100% torque at maximum motor speed with minimum effect on low speed torque. See Figure 3. The FORWARD TAPER and REVERSE TAPER potentiometers are mounted within the controller on the option circuit board. **CAUTION — This option can only control torque in a single direction. See ISP0388 for further clarification.** **Use caution in the selection of motors for center-driven windup applications where torque loads increase in inverse proportions to motor speed.** **Web break or other process material detectors are recommended to prevent a dangerous overspeed should a break in the process material occur.** *Option 1190 normally provides acceptable performance in applications where the material being wound travels at a constant speed during winder roll buildup. This option can also be used to drive unwind stands.*

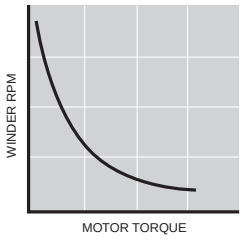


FIGURE 1. "Ideal" Constant HP Curve for a Winder Application.

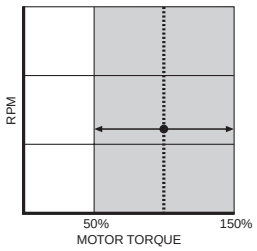


FIGURE 2. Torque Adjust with Taper Adjust at Maximum.

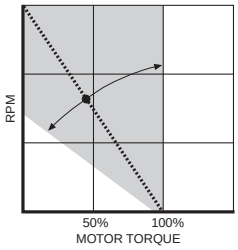


FIGURE 3. Taper Adjust with Torque Adjust at 100% Torque Setting.