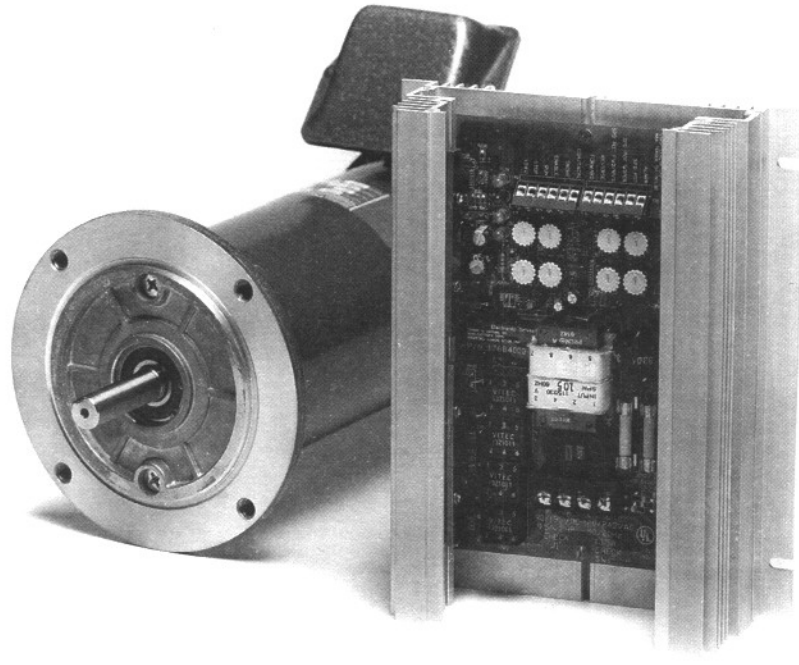
Vari Speed® R400 speed/torque control for ¼ to 2 HP DC motors

The Vari Speed® R400 is a full-wave DC regenerative control that provides high performance four quadrant speed and torque control. The R400 solid state controller converts single phase AC line power into an adjustable DC power to control 1/4 to 2 horsepower DC motors.

The R400's flexible design is easily selectable for speed or torque mode, tachometer voltage, dual voltage and for horsepower size. The R400 is designed with today's most desirable features including isolated input signals, status indicators, alarm outputs. When performing frequent directional changes, the R400 transfers excess system energy back to the AC line rather than wasting additional energy by the use of a dynamic brake resistor.

The R400 is designed, engineered and manufactured in the USA, and is UL and cUL listed.



Features

- Excellent regulation performance
- Fast acting current limit
- Starts into a rotating motor
- 50 or 60 Hz selectable
- Provides 150% load for one minute
- Two and three-wire start-stop
- Disable function

Applications

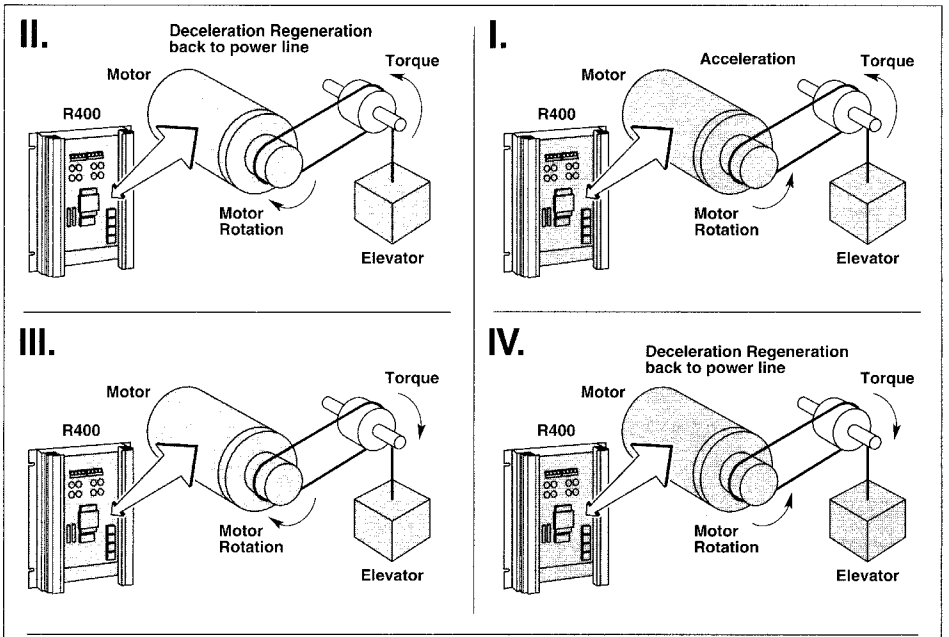
- Food and beverages
- Machinery and material handling
- Packaging and chemicals

Standard Product Feature	Application Benefit
Multiple rated unit	One unit can be used for 120 or 240 VAC operation of 1/4 to 2 HP PM or wound field DC motors
Regenerative control	Allows 4-quadrant operation to maintain complete control of motor and load
Speed or torque control	Provides proper motor control for application requirements
Excellent regulation performance	Improves overall system operation
Fast acting current limit	Can quickly react and compensate to load changes
2- or 3-wire start/stop	Provides flexibility in system logic
Isolated logic inputs	Easy connection of peripheral equipment
Alarm output	Provides remote indication of an undesirable situation
Status indicators	Visual indication of primary control status
150% load capabilities	Extra power for intermittent overloads

Regenerative (Four-Quadrant) Control

Regenerative DC drives are able to provide complete control of a DC motor's speed and torque simultaneously. A regenerative drive has the capability of producing torque in either braking or motoring modes, while operating a motor's speed in a consistent direction of rotation. The capability to provide braking torque is a result of the drive's ability to operate in all four quadrants of the motor's speed/torque curve, as described in the example below.

A four-quad DC drive's ability to operate in a regenerative mode is primarily provided by the additional power section included in the design. Four additional SCR devices are utilized in comparison to a standard NEMA Code K-type converter. These four additional components allow for the complete control of both the voltage and current flow to the armature of the DC motor, thus controlling both the speed and torque.



Quadrant I
Forward motor rotation; forward torque:
When the elevator is accelerating in an upward direction, the torque and speed are in the same direction.

Quadrant II
Reverse motor rotation; forward torque:
When the elevator is decelerating in a downward direction, the speed of the elevator is also going downward, but the torque is in the opposite direction and is braking the speed of the elevator. The motion energy from the elevator, motor and gravity are being regenerated back to the power line.

Quadrant III
Reverse motor rotation; reverse torque:
When the elevator is accelerating (faster than the gravity) in the downward direction, the torque and speed are in the same direction.

Quadrant IV
Forward motor rotation; reverse torque:
When the elevator is decelerating in an upward direction, the speed of the elevator is still going upward the torque is in the opposite direction and is braking the speed of the elevator. The motion energy from the elevator and motor are being regenerated back to the power line.

Selection

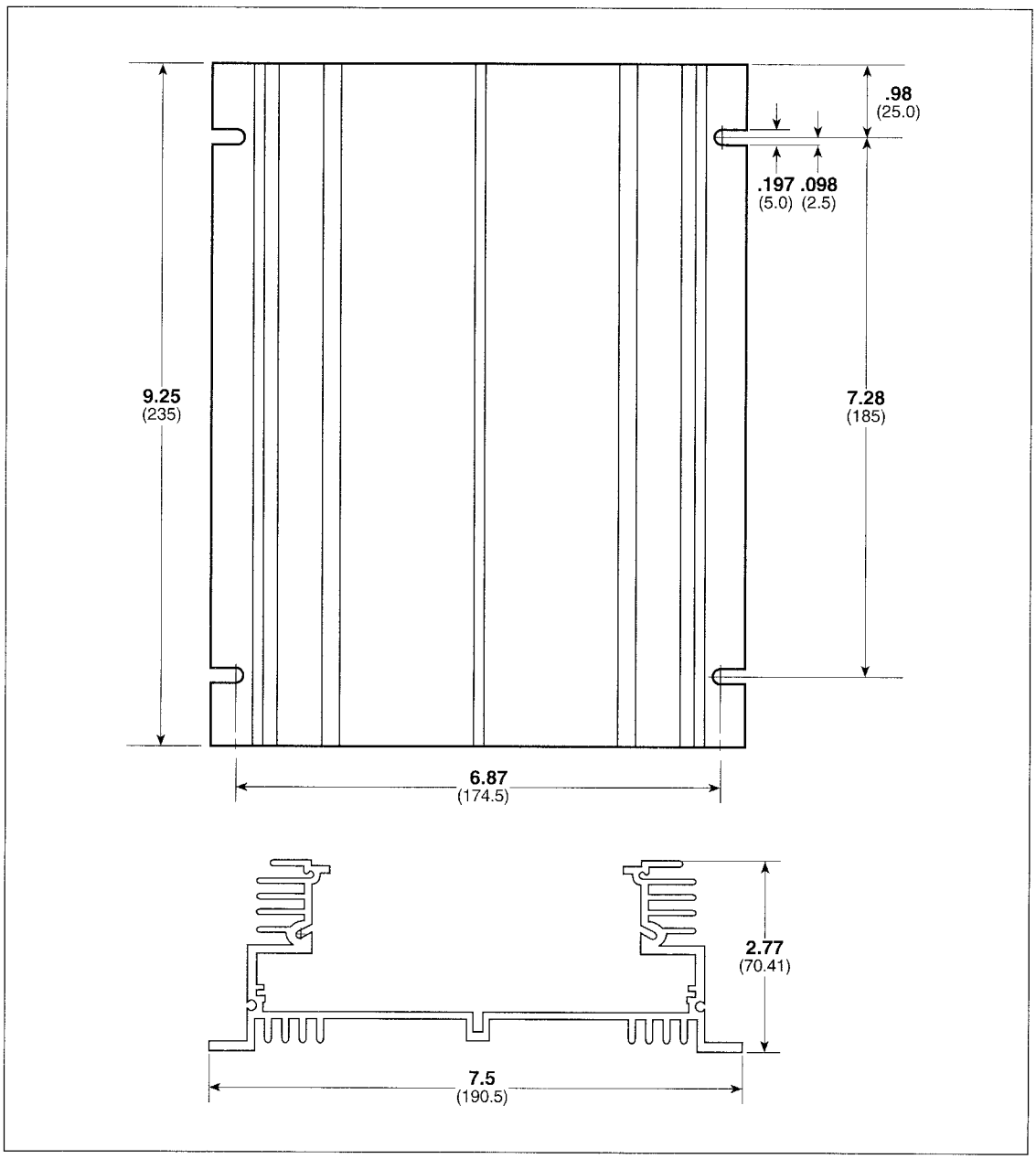
Description	Part Number
Chassis Version	
120 or 240 VAC selectable	176B4000
120 or 240 VAC selectable, with field supply	176B4001
120 or 240 VAC selectable, 1/100 - 1/20 hp	176B8013

Specifications

Control Parameters	Specification	Factory Setting
Input		
Power		
Line Voltage (1Ø) VAC ±10%	120 or 240	240
Line Frequency (Hz)	50 or 60	60
PLC or Process Input		
Follow Voltage (VDC)	±10	
Speed and Torque Potentiometer (Kohm, 1/4 W)	2.5	
Remote Two or Three Wire Start-Stop	On/Off	—
Tachometer @ 1,000 RPM (VDC)	7 or 20.8	—
Output		
Armature Current Max (Amps, DC)	10.8 (2.0)	10
Motor Rating at 120 VAC (HP)	1/4 - 1 (1/30-1/8)	—
Motor Rating at 240 VAC (HP)	1/4 - 2 (1/20-1/4)	2
Armature Voltage at 120 VAC (VDC)	0 ±100	—
Armature Voltage at 240 VAC (VDC)	0 ±200	180
Field Voltage at 120 VAC (VDC)**	100	
Field Voltage at 240 VAC (VDC)**	200	
Field Current at 120 VAC (Amps)**	1 (nominal)	
Field Current at 240 VAC (Amps)**	1 (nominal)	
Service Factor	1.0	
Overload for One Minute (%)	150	100
Start/Stops per Minute (max) @ Full Load[1]	30	—
@ Speed Change 100%	±12	
Adjustments		
Forward Acceleration Rate (sec)	0.15 - 8	4
Reverse Acceleration Rate (sec)	0.15 - 8	4
Minimum Speed/Torque (%)	0 - 50	0
Maximum Speed/Torque (%)	50 - 110	100
Forward Current Limit (%)	0 - 150	100
Reverse Current Limit (%)	0 - 150	100
IR Compensation (%)	0 - 25	12
Dynamic of Loop Regulation	—	50%

[1] **Reflected inertia 10.7 lb.in^2 at 1HP motor (55°C ambient temperature).**
* **( ) For 176B8013**
** **176B4001 only**

Vari Speed R400 Dimensions



Regenerative Control Power Section