

1/8 through 10 HP Adjustable Frequency AC Motor Controllers

- 1/8-10 HP
- 208/230/460 Volts Three-Phase
- Microprocessor Based
- PID Outer Loop Control
- New Generation IGBT Power Devices
- Enclosure Types
 - NEMA 1 Standard
- Output Fault Protected
- Isolated Regulator
- Cool, Quiet Motor Operation
- UL/cUL/ CE Mark
- V/F, Open Loop (Sensorless) Vector
- RS 485 Modbus RTU Standard



FIGURE 1. SERIES 5750 AC CONTROLLERS

GENERAL

Fincor Series 5750 controllers are general purpose, microprocessor based, software-controlled units representing significant advances in AC drive technology. Design features include a comprehensive operator control and programming panel for digital setup, troubleshooting, and self-diagnostics. Additional capabilities include remote interrogation, digital speed input and serial communication for direct control by programmable logic controllers and computers.

The Fincor Series 5750 Controllers offer two methods of motor control:

1. Traditional Space Vector Volts per Hertz (V/F) control
2. Sensorless Torque Control (Encoderless) for improved torque control over the rated speed range.

Fincor Series 5750 controllers provide wide range adjustable speed control of conventional AC induction motors in applications exhibiting a variety of load characteristics.. The unit converts the fixed frequency and voltage of the AC line power source to a sine coded pulse width modulated (PWM) adjustable voltage and frequency output that will control induction motors over a wide speed range.

This is efficiently accomplished by a constant potential link coupled inverter system that maintains a uniformly high displacement power factor throughout the speed range without inducing undesirable voltage notch distortion back to the power source.

The power section uses insulated-gate bipolar transistors (IGBT's) operating at carrier frequencies up to 15 KHz incorporating "soft switching" technology which provides low motor noise, high starting torque, and cool motor operation. The design features of the basic units shown in Figure 1, and available options allow application of the 5750 controllers to numerous industrial applications requiring constant horsepower, constant torque, or variable torque.

Electrical Codes:

Fincor 5750 controllers are designed and manufactured to comply with applicable standards established by the National Electric Code, and NEMA for industrial motor and control equipment. They are UL and Canadian UL listed and CE compliant.

TABLE 1 MODEL TYPES

230VAC, 3phase, 50/60Hz Input, NEMA1 Enclosed				
HP	AMPS	MODEL NUMBER	DIMENSIONS HxWxD (inches)	WEIGHT (lbs)
1/8	0.7	5751P0011A	5.12x2.76x3.78	1.3
1/4	1.4	5751P0021A	5.12x2.76x3.98	1.3
1/2	2.5	5751P0051A	5.12x2.76x4.65	1.5
1	4	5751P0101A	5.12x2.76x5.67	1.8
2	7	5752P0201A	5.12x4.18x5.91	2.9
3	10	5752P0301A	5.12x4.18x5.91	2.9
5	16.5	5753P0501A	5.12x6.69x6.22	4.4
7.5	23.5	5754P0751A	8.66x7.09x6.22	9.9
10	31	5754P1001A	8.66x7.09x6.22	9.9

460VAC, 3phase, 50/60Hz Input, NEMA1 Enclosed				
HP	AMPS	MODEL NUMBER	DIMENSIONS HxWxD (inches)	WEIGHT (lbs)
1/2	1.4	5752P0053A	5.12x4.18x4.96	2.4
1	2.1	5752P0103A	5.12x4.18x5.91	2.6
2	3.7	5752P0203A	5.12x4.18x6.7	2.9
3	5.3	5752P0303A	5.12x4.18x6.7	3.1
5	8.7	5753P0503A	5.12x6.69x6.22	4.2
7.5	12	5754P0753A	8.66x7.09x6.22	9.9
10	16	5754P1003A	8.66x7.09x6.22	9.9

MODEL TYPES

Series 5750 controllers are offered in 4 basic power frame configurations comprising 16 models covering the range of 1/8 to 10 HP as shown in TABLE 1.

RATINGS AND CHARACTERISTICS

OPERATING CONDITIONS

- Line Voltage Variation+10-15% of rated
- Line Frequency Variation.....50 or 60 Hz, ±5%
- Ambient Temperature
 Enclosed Models.....0-40°C (32-104°F)
 Chassis Models.....-10-50°C (14-122°F)
- Altitude (Standard).....3300 Feet (1000 meters) Maximum
- Relative Humidity.....5-95% Noncondensing

RATINGS

- Horsepower Range 1/8-10 HP
- Power Source208/230/460V, 3-Phase, 50 or 60 Hz
- Output Power (Three-Phase)
 (a) Voltage 0-Rated
 (b) Frequency.....0.5 to 60 Hz Constant Torque
 (Constant V/Hz)
 Selectable Options50-400 Hz Constant HP
 (Constant V, Variable Hz)
- Service Factor1.0
- DutyIndustrial, Continuous
- Overload Capacity150% for 1 minute
 200% for .5 second
- Linearity (Output to input).....±0.1% Maximum
- Reference Power Supply10 VDC
- External Reference Source (1).....0-10 VDC, 4-20ma
- Magnetic (Pushbutton) Control Voltage.....24 VDC
- Storage Temperature.....-25-65°C
- Relative Humidity.....95% Noncondensing
 (1) Isolated reference, external control signal may be grounded or ungrounded.

ADJUSTMENTS

All adjustments are programmed digitally via the standard, integral operator panel or the standard or optional serial ports. Basic adjustments include:

- Acceleration (Linear)01-3600 Seconds up to four (4) independent accel rates selectable by digital input.
- Deceleration (Linear)01-3600 Seconds up to four (4) independent decel rates selectable by digital input.
- Minimum Speed (2).....0-50%
- Maximum Speed (2).....50-100%
- Torque Limit.....20-200% of Rated
- Voltage Boost.....See Figure 2
- Slip Compensation0-100%
- Volts/Hz Trim±20% of Nominal Setting
- Preset Speeds, 15 Provided (2)0-100%

NOTE: (2) % of Maximum Frequency Selected.

RATINGS AND CHARACTERISTICS (Continued)

PERFORMANCE CHARACTERISTICS

1. Controlled Speed Range – Zero to motor base speed. This provides constant torque operation with either standard induction motors or synchronous types.

Constant horsepower operation at speeds above motor base speed (with induction motors only) is a standard, selectable capability. See Figure 2. Speed range with respect to the specified speed regulation is as listed in Table 2.

2. Speed Regulation (See Table 2) – Regulation percentages listed are of motor rated (base) speed under steady-state operating conditions.

TABLE 2. SPEED REGULATION CHARACTERISTICS

Regulation Method	Motor Type		Load Change 95%	Line Voltage +/- 10% (1)	Motor Heating Cold to Normal	Temperature +/- 10 C (Controller and Motor)	Speed Range
	Induction	Synchronous					
Normal Volts per Hertz (2)	X	----	3.00%	0.50%	1.00%	0.25%	30:1
	----	X	0.00%	0.00%	0.00%	0.25%	60:1
Slip Comp Volts per Hertz (2)	X	----	1.00%	0.50%	0.50%	0.25%	30:1
	----	X	0.00%	0.00%	0.00%	0.00%	60:1
Normal Sensorless Torque Control (2)	X	----	0.50%	0.50%	0.50%	0.25%	100:1
	----	N/A	----	----	----	----	----

NOTES: (1) Shown at full load, full speed.

(2) Listed are average, expected values when using a wide range of standard motors. Results may vary with some makes.

3. Frequency Resolution (at 60 Hz)

- (a) Analog Input.....0.2%
- (b) Digital Input.....0.01%

4. Frequency Stability0.01%

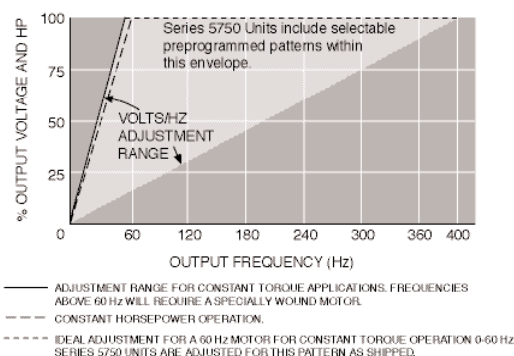
5. Modulation Frequency (Selectable)..... .75-15 KHz

6. Efficiency (at rated speed, rated load @ the specified carrier frequency)

Nominal Efficiency	2KHz	15KHz
Controller	95.7%	94.1%

7. Displacement Power Factor95%

FIGURE 2. Volts/Hertz Adjustment Range



DESIGN FEATURES AND FUNCTIONS

1. Construction – Compact, high density, dead back configuration, providing superior access for troubleshooting or replacement. Standard Series 5750 units are furnished in a NEMA 1 enclosure. Units above 1HP include fans to force cooling air over shrouded fins to aid dissipation of internal heat. NEMA 1 units are intended for application indoors in nonhazardous areas.

2. Microprocessor Design – Series 5750 units use a powerful 16-bit microprocessor for logic, communications, and regulator functions.

3. Power Devices – Series 5750 controllers use state-of-the-art new generation insulated gate bi-polar transistor (IGBT) output power switches. IGBT's require less gate drive power which reduces internal controller temperatures. Their extremely high speed switching capability produces a superior Sinusoidal PWM waveform for greater starting torque, cooler and virtually inaudible motor operation.

4. PWM Modulation Technique – Series 5750 controllers use Sinusoidal PWM Control modulation for smooth, quiet motor operation. Dynamic Torque Vector Control is available.

5. Operator Panel – Series 5750 units include a versatile, digital control panel mounted in the front cover of the unit. The panel includes a membrane keypad, and a LED display that enables its use for set-up monitoring of all controller functions and operating parameters, self diagnostic purposes, and also as a local operator control station. The operator panel is a smooth, unbroken surface which is easy to keep clean and is sealed to prevent the penetration of liquids or dust.

A. Display – LED display provides operating and function setup. Displays motor speed, motor load and power, and indicates all programmable functions and faults.

B. Visual Indicators – LED's are provided to indicate Run, Panel Control and Operating Mode.

C. Keypad – 6 buttons are provided for local operator control and programming. The buttons include a raised perimeter which defines the operating area and tactile feedback provides confidence that the command has been entered. The keypad is logically designed with two operating areas, one for local operator control, and the other for programming:

1. Local Operator Control – Buttons and their functions:

- a. RUN — Press to start operation
- b. STOP — Press to stop operation
- f. ^ – Pressing the up arrow key will increase the local run speed command, or parameter value.
- g. v – Pressing the down arrow key will decrease the local run speed command, or parameter value.

2. PRG/FUNC – Buttons and their functions:

- a. Prg – Selects adjustable drive parameters which can then be set with the arrow buttons.
- b. Func/Data – Used to switch the LED monitor or to determine the entered frequency function code, or data.



FIGURE 3. Operator Panel

DESIGN FEATURES AND FUNCTIONS (Continued)

- 6. Operating Modes** – Series 5750 controllers provide two basic operating modes selectable by the operator panel:
- Operation Mode – Permits Run-Stop and speed control from the integral operator panel, a remote control station, or an external signal source such as a process controller.
 - Program Mode – Allows monitoring and adjustment of all Series 5750 parameters. Parameters are grouped in descending order from those most general to those more specific for operational simplicity and quick selection.
- 7. Fuse Protection** – An external AC line fused disconnect or circuit breaker must be provided by the user in accord with national or local electrical codes.
- 8. Control Power Supply** – A 24 VDC @ 50 mA power supply isolates all magnetic control for pushbuttons and external Run-Stop logic from the AC power source for operator protection and equipment reliability.
- 9. Overvoltage and Undervoltage Protection** – Electronic shutdown when line voltage exceeds approximately +10% of maximum or -30% of minimum specified voltage.
- 10. Power Loss Ride-Through** – The controller has sufficient energy storage to maintain control of the motor for at least 2 seconds whenever the AC power source is interrupted. Upon reapplication of AC line power, within 15 milliseconds, the motor will resume its set speed with a minimum of disturbance. The amount of speed droop during the power outage will be determined by the actual motor loading and other mechanical time constants.
- 11. Power Loss Shut-Down** – During power interruption, if control power is lost prior to DC bus power a power loss fault is registered. If bus power is lost prior to control power, this is interpreted as a normal power down, and no fault is generated. If a phase is absent that does not create the preceding conditions, a phase-loss fault will be issued if the drive is running.
- 12. Automatic Restart** – Series 5750 units may be programmed for automatic restart after any or all of the faults.
- This flexible feature allows the user to program the number of tries as well as the retry time. Units in restart mode will flash "Auto Restart" with the retry number indicated on the programming panel display.
- 13. Start Into Rotating Motor** – The unit can be programmed to restart into a spinning motor. When programmed for this mode of operation, the 5750 can start while the motor is still spinning. The drive will not trip and the motor will not necessarily be brought to zero speed.
- 14. Line Starting Capability** – The unit can be programmed to start when the main AC power is applied to its input terminals.
- 15. Visual Indicators** – LED indicators are provided to monitor circuit operation and aid in troubleshooting. Included are individual LED's showing:
- Red on control circuit board shows DC Bus Charged
 - Red on operator panel shows FWD, REV, JOG, AUTO, POWER
- 16. Multiple PWM Carrier Frequencies** – The user may program carrier frequencies of .75 - 15 KHz. The most efficient operation is produced at the lower carrier frequencies.
- 17. AC Line Voltage Compensation** – Holds output voltage constant with rated line voltage variations when output voltage is less than line voltage (10% line voltage variation causes 1% output voltage variation).
- 18. Volts/Hertz Adjustment** – Volts/Hertz may be trimmed $\pm 20\%$ of nominal (Voltage Adjustment)
- 19. Run/Stop Control** – Series 5750 controllers can be remotely started and stopped by:
- 2 wire control (maintained dry contacts)
 - 3 wire control (momentary)
 - Application of AC line power
- 20. Fault History** – Control stores 4 most recent faults to aid trouble-shooting.
- 21. Isolated Regulator** – Internal logic and control circuits are isolated from the AC power source and internal DC power circuitry for operator and equipment safety and for simplified application. Isolation eliminates the common condition of line voltage to ground potentials being present on the speed control potentiometer.
- 22. P.I.D. Control** – A built in Proportional Integral Derivative control is standard in the 5750. Provides outer loop control of speed, flow, pressure, fluid level or other process variables. The PID loop may be programmed to accept setpoint/feedback input or error input. A flexible configuration scheme allows PID inputs to be either analog or digital with PID gains being separately adjustable.
- 23. Second Motor** – Provides a second group of motor set up parameters to allow a 5750 to alternately run two dissimilar motors. Contactors for motor switching must be supplied by others.
- 24. Resonant Frequency Avoidance** – A frequency jump control is provided to eliminate undesirable speed related resonance in the driven machine or process. Over a range of 0-100% speed, up to three regions of programmable width of 0-30 Hz of maximum each can be selected to prevent motor operation in those regions.
- 25. Multiple Motor Operation** – All motors will track the common output frequency of the Series 5750 controller. Synchronous motors are ideal for this purpose since they will provide identical motor to motor shaft speeds.

26. Voltage Boost – Provides improved torque capacity at lower speeds to produce 150% or greater starting torque with most standard motors. 5750 voltage boost provides a programmable voltage boost level with two frequency break points for optimum starting performances. See Figure 4.

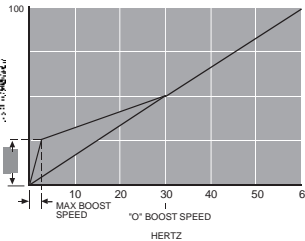


FIGURE 4. Voltage Boost

27. DC Injection Braking –

Provides effective low speed braking by injecting DC current into two motor windings. The brake time period is programmable to 30 seconds and is engaged under programmable control at stop, start, or both.

28. Electronic Braking – The 5750 is equipped with the circuitry for 100% braking. An external resistor is required - see option 1045C & 1045D.

29. Output Protection – Ground Fault, Line to Ground, Line to Line.

30. Phase-Loss Protection – The controller detects phase-loss and inhibits normal operation as necessary to prevent drive malfunction. If the phase-loss is of short duration (less than 15 milliseconds), the drive will resume normal operation with re-application of the lost phase. If the phase is lost for a longer time period, the controller interprets this as a phase loss and will shut down the drive.

31. Over Temperature Protected – Thermalguard in the power section will shut down the controller in the event of cooling fan failure or other causes for overheating.

32. Analog Output – One analog output rated 0-10 VDC at 2 mA is provided and may be programmed to follow any one of the following parameters:

- | | |
|----------------------|------------------|
| a. Load Factor | f. PID Feedback |
| b. Motor Voltage | g. Output Torque |
| c. Motor Current | h. PID Feedback |
| d. Frequency | |
| e. Power Consumption | |

The output could be used with external meters or as a speed reference for other drive units in a system.

33. Output Contacts – One set of Form C output contacts, rated 30 VDC @ 2 mA or 250 VAC @ 300 mA, for fault annunciation.

34. Digital Control Outputs – Two buffered open collector outputs, rated 24 VDC @ 50 mA, are available for external alarms or monitoring of the following functions:

- | | |
|-----------------|---------------------|
| a. Run | e. Torque Polarity |
| b. At Speed | f. Auto Restart |
| c. Speed Point | g. Overload Warning |
| d. Undervoltage | h. At Speed #2 |

35. Slip Compensation – Programmable slip compensation is provided to correct for induction motor speed droop or slip and thereby improve speed regulation up to 15.00 Hz.

36. Electronic Inverse Time Motor Overload Protection – Inverse time motor overload protection provides a programmable threshold and time to trip to reduce the potential of costly motor damage. NOTE: To insure motor protection, a motor thermal switch is suggested.

37. Static Reversing Control – Contactorless reversing is a standard capability. Requires only the selection of an operator station with reversing controls, or direction may be selected by external control contacts.

38. Protective Features –

A. Inverter Trip – Due to overvoltage, overcurrent, undervoltage, controller overtemperature, ground fault, motor overtemperature, overload, and CPU error. The unit will annunciate the fault.

39. Analog Inputs - 0-10 Volt, 0-5 Volt or 4-20 ma can be programmed for reference or PID feedback.

40. Digital Control Inputs – A total of 2 predefined and 5 programmable digital inputs are provided, these provide the following basic functions.

Predefined Digital Inputs:

- a) Forward
- b) Reverse

Programmable Digital Inputs:

- a) Multi-step frequency selection
- b) Accel / Decel time select
- c) Self-hold selection
- d) Coast-to-stop command
- e) Alarm reset
- f) External Alarm
- g) Jogging
- h) Motor 1/Motor 2
- i) DC inject brake command
- j) Torque Limit 1 / Torque Limit 2
- k) UP command
- l) DOWN command
- m) PID control cancellation
- n) Normal / Inverse switching
- o) Link Operation

All inputs are designed for use with the 24V control voltage supplied by the 5750 controller or an external power source. The predefined Digital Inputs can be disabled if desired.

41. Serial Communications - An RS-485 compatible serial port is standard on the 5750. Modbus RTU is provided as the standard Communication Protocol. See page 5750-6 for additional communication options.

OPTION DESCRIPTIONS

OPTION NUMBER	DESCRIPTION
1045C	<p>Braking Resistor Assembly - NEMA 1 Option 1045A braking modules can either be used in conjunction with a Fincor Option 1045C Braking Resistor package or with user supplied resistors.</p> <p>This option includes a ventilated metal enclosure designed for mounting on top of standard Series 60 enclosure or for separate mounting. The braking circuit is rated for stopping a typical load a maximum number of two stops per minute from motor base speed. A typical load is defined as:</p> <ol style="list-style-type: none"> 1. Not exceeding rated-load torque. 2. External load inertia (beyond the motor shaft) not exceeding that of the motor rotor. <p><i>High inertia loads may extend braking times beyond the wattage rating of the power dissipation resistor. The braking circuit is not rated for continuous regeneration and should be used only where intermittent control of overhauling loads is required. The braking circuit is not a holding brake; it will not prevent a motor at rest from rotating.</i></p>
1045D	<p>Braking Resistor Assembly - Open Open "L" Bracket for Separate Mounting</p>
1085	<p>Controller Less Enclosure Provides an unenclosed, panel-mount version of the controller. Caution must be used in the selection of an enclosure with adequate provisions for proper ventilation and operating environment. Temperature within the enclosure should not exceed 50°C.</p>
1655	<p>Communications:</p> <ul style="list-style-type: none"> B Provides a cable and FINbusII-AC 5750 communications software for the setup and maintenance of the 5750. This option is a ideal tool for the monitoring and logging of parameter setup data, data logging, realtime chart recording, monitoring parameters through a windows based software. C Provides the FINbusII-AC 5750 communications software for the system PC for set up and monitoring through the serial
1727F	<p>Profibus -DP- Serial Communication Card.</p>
1727G	<p>Device Net-Serial Communication Card.</p>
1727H	<p>Interbus S-Serial Communication Card.</p>
1727J	<p>Modbus Plus-Serial Communication Card.</p>