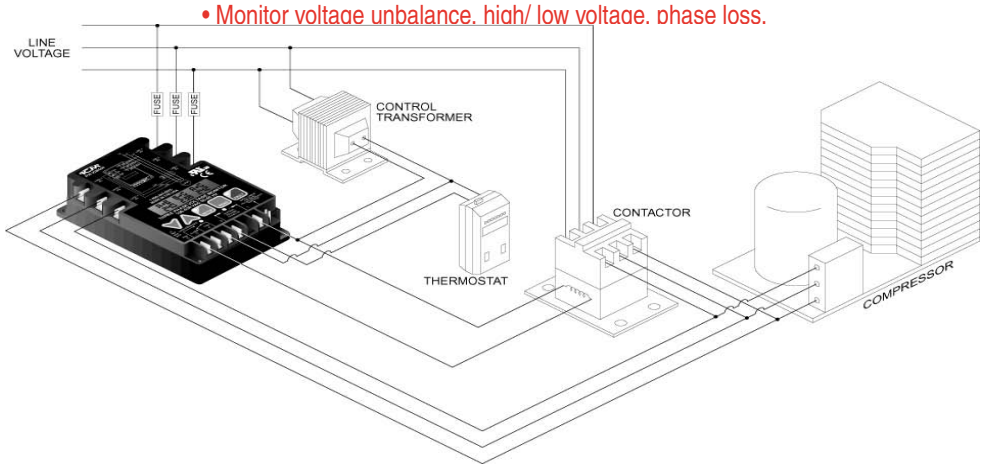
Motor Protection Controls

Part #	Features & Applications	Specifications	Cross Reference
 **24-ICM450**	• *Fully Programmable - with LCD diagnostic display.* • *Easy to configure - simple 7-step push-button setup.* • *Easy to customize - set points, variables and features are fully adjustable and may be defined by the user while in control SETUP mode.* • *25 - fault memory storage, non-volatile.* • *Independent high and low voltage settings - ideal for dual voltage compressor applications.* • *Monitors/ identifies front & back side faults.* • *Reset mode: choice of auto or manual.* • *Protects against: voltage unbalance, high/ low voltage, phase loss, reversal, faulty power, incorrect sequencing and rapid short cycling.* • *Reliable, high temperature LCD to 167°F.* • *Simultaneous voltage display - no scrolling.* • *Line voltage programmable.* • *Universal Voltage Operation: 190-630 VAC.*	• Voltage: 190-630 VAC. • Frequency: 50/60 Hz. • Voltage Unbalance: adjustable: 2-25%. • Control: 18-240 VAC. • Delay on break timer: (0.1-10 min.). • Output: relay, SPDT N.O.: 10 amps. N.C.: 6 amps.	Diversified • AC-2020 • AC-301 • AC-302 Motorsaver • 455 SSAC • QLM/ QLV Time Mark • 265 Wagner • WPC-800 Watsco • EAC-800 • EAC-8000
 **24-ICM400**	• *Lower cost, full performance version featuring bright LED indicators to display system faults.* • *Monitors "front" and "back" sides of system.* • *Universal Voltage Operation: 190-630 VAC.* • *Knob-adjustable features and system set points.* • *Reset mode: choice of auto or manual lockout.* • *Built-in anti short-cycle protection.* • *Protects against: voltage unbalance, high/ low voltage, phase loss, reversal, faulty power, incorrect sequencing and rapid short cycling.* • *6.5" x 4.25" x 1.5".*	• Voltage: 190-630 VAC. • Frequency: 50/60 Hz. • Voltage Unbalance: adjustable: 2-25%. • Control: 18-240 VAC. • Delay on break timer: (0.1-10 min.). • Output: relay, SPDT N.O.: 10 amps. N.C.: 6 amps.	Diversified • AC-2020 • AC-301 • AC-302 Motorsaver • 455 SSAC • QLM/ QLV Time Mark • 265 Wagner • WPC-800 Watsco • EAC-800 • EAC-8000

24-ICM450 Typical System Diagram

STOP MOTOR BURNOUTS!

• Monitor voltage unbalance, high/ low voltage, phase loss,



Mode Of Operation

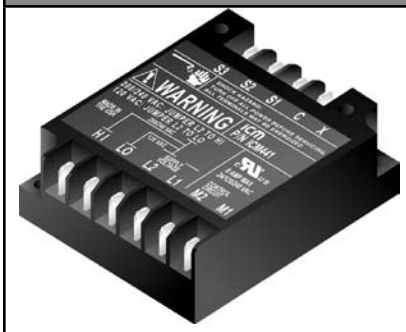
• Voltage Monitors Are Specifically Designed To Protect Compressor Motors And Other 3-Phase Loads From Premature Failure Or Damage Due To Common Voltage Faults. They Offer Complete System Protection By Monitoring Both The Source (Front) And Load (Back) Side Of The System Including The Power, Motor And Contactor Lines. In Addition, An Integral "Delay On Break Timer" Guards Against Rapid Short-Cycling At Both The Control Circuit And The 3-Phase Lines. Compact And Easy To Install, The 24-Icm400 & 24-Icm450 PRovide Highly Reliable Protection For Your Valuable Equipment.

Phase Loss & Reversal Protection - Ultra Low Cost

Part #	Features & Applications	Specifications	Cross Reference
 **24-ICM401**	• *Low cost 3-phase protection for single side.* • *Monitors for phase reversal, phase loss, unbalance % as a function of input voltage.* • *Bright LED indicators for ON and FAULT.* • *Universal 3-phase input: 190-600 VAC.* • *Highly reliable passive electronics.* • *IEEE587 transient-tested.* • *Epoxy coated for added protection.* • *Patented: U.S. Patent No. 5,337,206.* • *24-ICM401 enclosed model (Open 24-ICM403).* • *3.25" x 3" x 1.25".*	• Voltage: 190-600 VAC. • Frequency: 50/ 60 Hz. • Control: 18-30 VAC. • Output: relay, SPDT N.O.: 10 amps.	N/A
 **24-ICM402**	• *Low cost 3-phase protection for single side.* • *Monitors for phase reversal, phase loss, unbalance % as a function of input voltage.* • *Bright LED indicators for ON and FAULT.* • *Universal 3-phase input: 190-600 VAC.* • *Control voltage input: 190-240 VAC.* • *Highly reliable passive electronics.* • *IEEE587 transient-tested.* • *Epoxy coated for added protection.* • *Patented: U.S. Patent No. 5,337,206.* • *24-ICM402 enclosed model (Open 24-ICM404).* • *3.25" x 3" x 1.25".*	• Voltage: 190-600 VAC. • Frequency: 50/ 60 Hz. • Control: 115 or 208/240 VAC. • Output: relay, SPDT N.O.: 30 amps.	N/A
 **24-ICM408**	• *Reliable 3-phase protection for single side.* • *Monitors for phase reversal, phase loss, unbalance % and high/ low voltage.* • *Bright LED indicators for ON and FAULT.* • *High/ low voltage cut-out: high voltage cut-out set point +12%, low voltage cut-out set point -12%.* • *Highly reliable passive electronics.* • *Power/ phase loss detection: within 100ms.* • *User selectable unbalance voltage: 2 to 8%.* • *Phase reversal detection: detects on power up.* • *8 pin plug-in mount.* • *4" x 2.5" x 1.75".*	• Voltage: 190-480 VAC. • Frequency: 50/ 60 Hz. • Adjustable DOB: 0.1 to 5 min. • Adjustable DOM: 0.1 to 5 min. • Heavy duty SPDT relay output: NO/ NC - contacts: 10 amps. - resistive @ 250 VAC.	N/A
 **24-ICM409**	• *Reliable 3-phase protection for single side.* • *Monitors for phase reversal, phase loss, unbalance % and high/ low voltage.* • *Bright LED indicators for ON and FAULT.* • *High/ low voltage cut-out: high voltage cut-out set point +12%, low voltage cut-out set point -12%.* • *Highly reliable passive electronics.* • *Power/ phase loss detection: within 100ms.* • *User selectable unbalance voltage: 2 to 8%.* • *Phase reversal detection: detects on power up.* • *User selectable delay on make: 0.5 to 5 min.* • *DIN rail mount.* • *4.25" x 3.5" x 2.375".*	• Voltage: 190-480 VAC. • Frequency: 50/ 60 Hz. • Adjustable DOB: 0.1 to 5 min. • Adjustable DOM: 0.1 to 5 min. • Heavy duty SPDT relay output: NO/ NC - contacts: 10 amps. - resistive @ 250 VAC.	NA

Motor Protection Controls

Three Phase Line Voltage Monitors

Part #	Features & Applications	Specifications	Cross Reference	
 24-ICM441	• *Protects Against: under voltage, over temperature, power interruptions, rapid short cycling, shorted temperature sensor, open temperature sensor.* • *Control Duty, SPST relay layout.* • *6 amp, 277 VAC relay contacts.* • *Anti-Short-Cycle Time Delay, 4 minute (nominal).* • *1 second manual bypass.* • *3.25" x 3" x 1.25".*	• Voltage: 120 or 208/230 VAC. • Frequency: 50/ 60 Hz. • Output: relay, SPDT N.O.: 6 amps.	Copeland • 071-0376-01 • 071-0376-02 • 071-0397-00 • 071-0397-01 • 071-0424-00 • 071-0424-01 • 071-9800-00 • 071-9800-01 Bristol • 241680	T.I. • 15AA1600 B • 15AA1600 C • 15AA1603 C • 31AA1606 E • 31AA1600 E Mars • 37304 • 37306 • 37322 • 37300 • 37302

Single Phase Line Voltage Monitors

Part #	Features & Applications	Specifications	Cross Reference
 24-ICM491	• *Low cost single phase motor protection.* • *Built-in anti-short cycle protection.* • *Detects high/ low voltage conditions.* • *Helps prevent rapid system recycling.* • *LED indicator: "green" for normal conditions, "red" for fault.* • *Heavy duty SPDT, isolated relay output.* • *Interrogation delay prevents nuisance trips.* • *3.25" x 3" x 1.25".*	• Voltage: 95-270 VAC. • Output: relay, SPDT N.C./ N.O.: 5 amps. • Time Delay Range: adj. 6-600 sec.	Diversified • CV-100-RS • CV-200-RS15 • CV-200-RS20 Watsco • EAC-401 • EAC-402 • EAC-403 • EAC-404
 24-ICM515	• *Easy Installation.* • *Low cost, high performance.* • *Weatherproof housing.* • *Rugged, reliable.* • *Protects against:* *- Lightning power surges.* *- Voltage surges from air conditioners, generators or motors.* • *1.75" x 1.62" x 0.75".*	• Service Voltage: 120/240V single phase. • Maximum Surge Current: 24000 amps. • Maximum energy dissipation: 200 joules. • Installation point: - Electrical panel. - Electrical disconnect. • AC protection Modes: line-line, line-ground.	NA

Motor Protection Controls

3-Phase Line Voltage Monitors - Plug-in, Single Side Only

Part #	Features & Applications	Specifications	Cross Reference
24-ICM410 **24-ICM411** **24-ICM412** **24-ICM415** **24-ICM416** **24-ICM417** 	• *Basic low cost, 3-phase motor protection.* • *Super-quick 100 ms. response time.* • *Voltage ranges: 200-480 VAC.* • *410-412: fixed 8% Voltage Unbalance.* • *415-417: adj. 4-8% Voltage Unbalance.* • *Monitors single side of system for: voltage unbalance, high/ low voltage, phase loss, incorrect sequence, reversal.* • *LED indicator: green for normal conditions.* • *Interrogation delay prevents nuisance trips.* • *Patented: U.S. Patent No. 5,337,206.* • *2.5" x 1.75" x 4".*	• Line: 200-480 VAC determined by mode. • Control: 18-240 VAC/ VDC. • Frequency: switch selectable 50 or 60 Hz. • Output: relay SPDT, 8 amps resistive.	Diversified • SLA Series • SVA Series
24-ICM420 **24-ICM421** **24-ICM422** **24-ICM425** **24-ICM426** **24-ICM427** 	• *Same features as Series 24-ICM410-417 plus **built-in anti short cycle protection**.* • *Voltage ranges: 200-480 VAC.* • *420-422: fixed 8% Voltage Unbalance.* • *425-427: adj. 4-8% Voltage Unbalance.* • *Monitors single side of system for: voltage unbalance, high/ low voltage, phase loss, incorrect sequence, reversal.* • *LED indicator: green for normal conditions.* • *Interrogation delay prevents nuisance trips.* • *Patented: U.S. Patent No. 5,337,206.* • *2.5" x 1.75" x 4".*	• Voltage: 200-480 VAC determined by model. • Control: 18-240 VAC/ VDC. • Frequency: switch selectable 50 to 60 Hz. • Output: relay SPDT, 8 amps resistive. • ASC timer: range adj. 6-300 sec.	Diversified • AC-410 • AC-411
24-ACS-8 	• *Relay socket.* • *8-pin octal plug-in base.* • *Locating key ensures proper orientation.* • *Order ACS-11 for 11-pin base.* • *For use with 24-ICM410-427, 500-505.* • *Rated for 480 VAC.*	• 10 amps up to 480 VAC.	Diversified • RB-08

Motor Protection Controls - 24-ICM410 to 24-ICM427 Specifications

Part #	24-ICM410-415 Ultra Low Cost Protection	Part #	24-ICM420-427 With Built-in Anti Short-Cycle Protection
24-ICM410	USER-ADJUSTABLE INPUT VOLTAGE: 200 TO 240 VAC. FACTORY FIXED 8% VOLTAGE UNBALANCE.	**24-ICM420**	USER-ADJUSTABLE INPUT VOLTAGE: 200 TO 240 VAC. FACTORY FIXED 8% VOLTAGE UNBALANCE.
24-ICM411	USER-ADJUSTABLE INPUT VOLTAGE: 360 TO 430 VAC. FACTORY FIXED 8% VOLTAGE UNBALANCE.	**24-ICM421**	USER-ADJUSTABLE INPUT VOLTAGE: 360 TO 430 VAC. FACTORY FIXED 8% VOLTAGE UNBALANCE.
24-ICM412	USER-ADJUSTABLE INPUT VOLTAGE: 400 TO 480 VAC. FACTORY FIXED 8% VOLTAGE UNBALANCE.	**24-ICM422**	USER-ADJUSTABLE INPUT VOLTAGE: 400 TO 480 VAC. FACTORY FIXED 8% VOLTAGE UNBALANCE.
24-ICM415	USER-ADJUSTABLE INPUT VOLTAGE: 200 TO 240 VAC. USER-ADJUSTABLE VOLTAGE UNBALANCE: 4% TO 8%.	**24-ICM425**	USER-ADJUSTABLE INPUT VOLTAGE: 200 TO 240 VAC. USER-ADJUSTABLE VOLTAGE UNBALANCE: 4% TO 8%.
24-ICM416	USER-ADJUSTABLE INPUT VOLTAGE: 360 TO 430 VAC. USER-ADJUSTABLE VOLTAGE UNBALANCE: 4% TO 8%.	**24-ICM426**	USER-ADJUSTABLE INPUT VOLTAGE: 360 TO 430 VAC. USER-ADJUSTABLE VOLTAGE UNBALANCE: 4% TO 8%.
24-ICM417	USER-ADJUSTABLE INPUT VOLTAGE: 400 TO 480 VAC. USER-ADJUSTABLE VOLTAGE UNBALANCE: 4% TO 8%.	**24-ICM427**	User-adjustable input voltage: 400 to 480 VAC. User-adjustable voltage unbalance: 4% to 8%.
24-ICM420 TO 24-ICM427 FEATURE AN INTEGRAL, USER-ADJUSTABLE ANTI SHORT-CYCLE TIMER.			

Head Pressure Controls

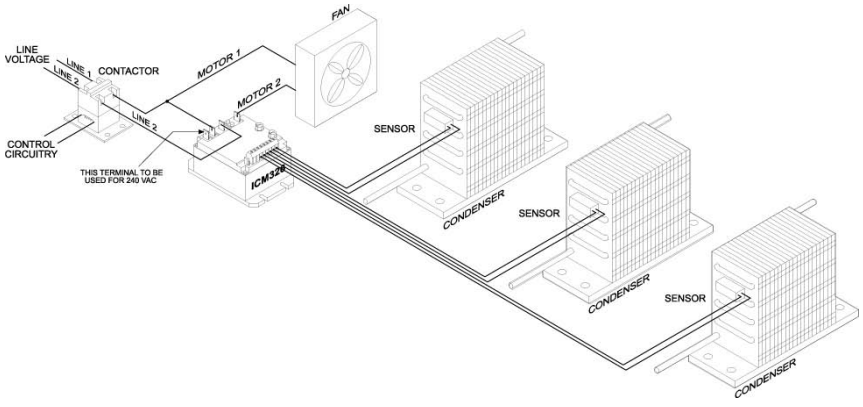
Dual ON/ OFF Delays Control Fan

Part #	Features & Applications	Specifications	Cross Reference
 **24-ICM325H** 120-480 VAC	• *Integral heat pump bypass circuitry allows electronic bypass of speed control.* • *Eliminates overshoots common to on/ off and pressure switch controls.* • *Helps prevent evaporator freeze-ups, low pressure cut-outs and liquid-slugged compressors in low ambient conditions.* • *One model covers 120 to 480 VAC.* • *Features hard start (adj. 1 to 5 sec.), low speed cut-off (adj.), high temperature bypass, isolated 24 VAC supply.* • *Controls up to 3 refrigerant circuits.* • *Typical application: heat pumps.* • *4.5" x 3" x 1.75".*	Input • Control: 18-30 VAC. • Frequency: 50/ 60 Hz. 1.8 VA max. • Line input: 120-480 VAC. Output • Max: 10 amps. • Min: 100 mA.	One ICM model replaces: Hoffman • 800 • 800A • 800AA • 814-50 • 816-10 Ranco • E31 Series Johnson Controls • P66 ACT • FM2000
 **24-ICM325** 120-600 VAC	• *Eliminates overshoots common to on/ off and pressure switch controls.* • *One model covers 120 to 600 VAC.* • *Features hard start, low temperature bypass, isolated 24 VAC supply.* • *Controls one refrigerant circuit.* • *Typical application: refrigeration and A/C.* • *4.5" x 3" x 1.75".* *Accessories:* • *24-ICM375 probe, 50° to 80°F (10° to 27°C).* • *24-ICM376 probe, 70° to 100°F (21° to 38°C).* • *24-ICM377 probe, 95 to 120°F (35° to 49°C).*	Input • Control: 18-30 VAC. • Frequency: 50/ 60 Hz. • Line input: 120-600 VAC. Output • Max: 10 amps. • Min: 100 mA.	N/A
 **24-ICM326H** 120 OR 208/ 240 VAC **24-ICM327H** 480 VAC	• *Built-in transformer eliminates cost, reduces installation time and simplifies wiring.* • *Helps prevent evaporator freeze-ups, low pressure cut-outs and liquid-slugged compressors in low ambient conditions.* • *Features hard start, low temperature cut-off, high temperature bypass.* • *4.5" x 3" x 2".* • *Typical application: ideal for heat pumps, line voltage air conditioning and refrigeration.*	24-ICM326H • Control: 120 or 208/ 240 VAC. 24-ICM327H • Control: 480 VAC. • Frequency: 50/ 60 Hz. Output current: • Max: 10 amps. • Min: 100 mA.	Hoffman • 800 • 800A • 800AA • 814-50 • 816-10 Ranco • E31 Series Johnson Controls • P66

24-ICM326H Typical System Diagram

Applications

- Ideal For Low Ambient Conditions.
- Found In Supermarkets, Frozen Food Storage, Computer Rooms, Cooling Tower Fans, Temperature/ Humidity-sensitive Environments.



Mode Of Operation

• Head pressure controls operate as temperature-sensitive motor fan speed controls. Head pressure is regulated during low ambient conditions by varying the amount of airflow through the condenser. This helps ensure sufficient pressure across the expansion valve, preventing costly down time and or loss of valuable perishable goods.

Components

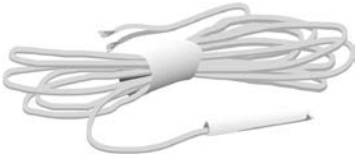
3-Phase Head Pressure Controls

With LCD Diagnostics - Designed for 3-Phase Systems

Part #	Features & Applications	Specifications	Cross Reference
 **24-ICM336** 208/ 240 VAC **24-ICM337** 460 VAC	• *Specifically designed for 3-phase systems.* • *Easy LCD programming and diagnostics.* • *Helps prevent evaporator freeze-ups, low pressure cutouts & liquid slugged compressors in low ambient conditions.* • *Controls head pressure by varying the amount of airflow through the condenser.* • *Low temp cut-off & high temp set points.* • *Temperature, pressure, milliamps, or DC voltage input.* • *True sine wave output.* • *Modulates voltage and frequency.*	**24-ICM336** • Control: 208-240 VAC 1 to 3 HP. **24-ICM337** • Control: 480 VAC 1 to 5 HP.	• Motormaster III • Hoffmann

Head Pressure Control Accessories

Sensor Probes

Part #	Features & Applications
 **24-ICM375** **24-ICM376** **24-ICM377**	• *Probes for use with 24-ICM325, 24-ICM326, and 24-ICM327 head pressure controls.* • *Sensor probes, choose from (3) temperature ranges.* • *24-ICM375: 50° to 80°F (10° to 27°C).* • *24-ICM376: 70° to 100°F (21° to 38°C).* • *24-ICM377: 95 to 120°F (35° to 49°C).*
 **24-ICM379**	• *Probe for use with 24-ICM325H, 24-ICM326H, and 24-ICM327H head pressure controls with optional heat pump bypass features.*
 **24-ICM380**	• *Optional pressure transducer for 24-ICM336 & 24-ICM337 three-phase head pressure controls.*

Outdoor Enclosure

Part #	Features & Applications
 **24-ACCOEO1**	• *It's worth protecting the controls that protect your equipment!* • *Rugged Steel Construction.* • *Easy to mount.* • *Protects controls from harsh environmental conditions such as temperature, shock, humidity and vibration.*

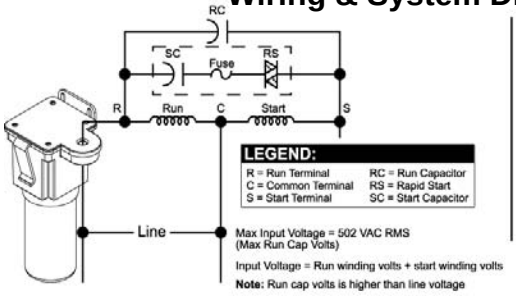
RapidStart® Motor Starters

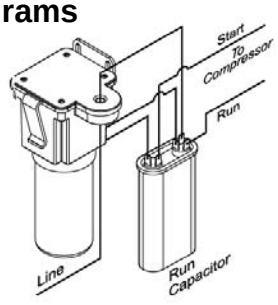
Current Sensing

By monitoring the compressor "current" upon start-up, RapidStart® is able to engage the hard start capacitor for precisely the correct amount of time, ensuring maximum starting torque without the risk of supplying too much current into the start winding. A timed safety circuit is provided in the event the motor fails to start within 2 seconds. Current sensing hard start precisely increases starting torque.

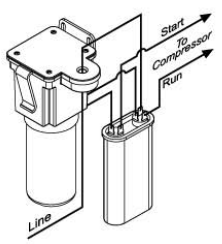
Part #	Features & Applications	Specifications	Cross Reference
24-ICM803 	• *Operates from 95 to 288 VAC.* • *Max input voltage: 502 VAC.* • *Patented current sensing circuitry.* • *Self-adjusting to voltage fluctuation.* • *Easy to install, 2 wires.* • *OEM approved.* • *Solid-state circuitry.* • *Boosts starting torque.* • *Disengages upon start.*	• Ideally suited for 1/2 thru 3 Hp. • 88 to 106 Mfd. capacitor.	Supco • SPP-8 Kickstart • TO5 • TO-5
24-ICM805 	• *Operates from 95 to 288 VAC.* • *Max input voltage: 502 VAC.* • *Patented current sensing circuitry.* • *Self-adjusting to voltage fluctuation.* • *Easy to install, 2 wires.* • *OEM approved.* • *Solid-state circuitry.* • *Boosts starting torque.* • *Disengages upon start.*	• Ideally suited for 3 thru 5 Hp. • 145 to 175 Mfd. capacitor.	Kickstart • KS1
24-ICM810 	• *Operates from 95 to 288 VAC.* • *Max input voltage: 502 VAC.* • *Patented current sensing circuitry.* • *Self-adjusting to voltage fluctuation.* • *Easy to install, 2 wires.* • *OEM approved.* • *Solid-state circuitry.* • *Boosts starting torque.* • *Disengages upon start.*	• Ideally suited for 5 thru 10 Hp. • 243 to 292 Mfd. capacitor.	N/A

Wiring & System Diagrams

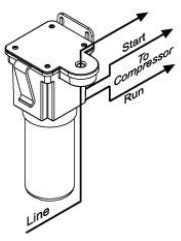




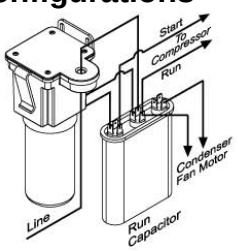
Alternate Wiring Configurations



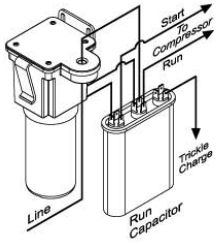
PSC Units



Capacitor Start Induction Run



Double Capacitor



Off Cycle Heat

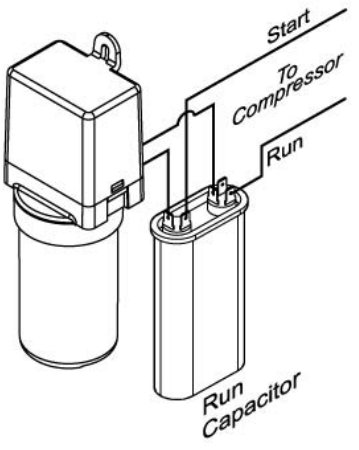
RapidStart® Motor Starters

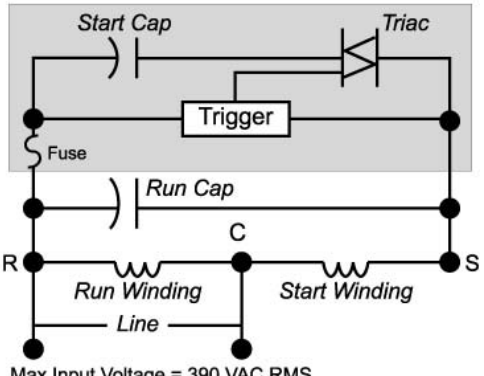
Voltage Sensing

ICM's differential voltage sensing products employ patented circuitry which monitors differential compressor auxiliary voltage, determines the state of the motor and precisely engages and disengages the start capacitor. A timed safety circuit is provided in the event the motor fails to start within 2 seconds.

Part #	Features & Applications	Specifications	Cross Reference
24-ICM850 	• *Increases starting torque up to 500%.* • *Ensures precise starts.* • *Reduces inventory.* • *Not affected by ambient temperature.* • *Recycles instantly (less than one second).* • *Multi-voltage operation... either 115 or 240 VAC motors.*	• Voltage: 90 to 277 VAC. • Max input voltage: 390 VAC. • Range: 1/12 to 10 Hp. • Recommended range: 1/12 to 1 Hp. • Oper. Temp. Range: 40°C to +65°C 43 to 52 Mfd 330 V Capacitor.	N/A
24-ICM860 	• *Increases starting torque up to 500%.* • *Ensures precise starts.* • *Reduces inventory.* • *Not affected by ambient temperature.* • *Recycles instantly (less than one second).* • *Multi-voltage operation... either 115 or 240 VAC motors.*	• Voltage: 90 to 277 VAC. • Max input voltage: 390 VAC. • Range: 2 to 5 Hp. • Oper. Temp. Range: -40°C to +65°C 88 to 106 Mfd 330 V Capacitor.	N/A

Wiring & System Diagrams





Max Input Voltage = 390 VAC RMS
(Max Run Cap Volts)
Input voltage = Run winding volts + start winding volts

Note: Run cap volts is higher than line voltage

RapidStart® Features

- SELF ADJUSTING
- USES CURRENT DIFFERENTIAL TECHNOLOGY
- DOES NOT USE POTENTIAL MOTOR START RELAY
- TWO WIRES, NON-POLARIZED
- RECYCLES INSTANTLY
- SENSES WHETHER MOTOR STARTED OR NOT
- REPLACES 3-WIRE RELAY & CAPACITOR KIT
- UL & CSA RECOGNIZED
- APPROVED BY COMPRESSOR & EQUIPMENT MANUFACTURERS
- USED BY OEM MANUFACTURERS
- SAFETY CUT-OFF
- TRUE POWER FACTOR STARTING NOT REQUIRED
- NOT FACTORY CALIBRATED
- NOT VOLTAGE SENSITIVE
- DOES NOT REQUIRE PTCR DEVICE
- NO TIMING CIRCUIT DEVICE
- NOT AFFECTED BY AMBIENT TEMPERATURE

RapidStart® Applications

- Water Coolers
- Vending Machines
- Household Refrigerators (115 or 230 VAC)
- Commercial Refrigerators (115 or 230 VAC)
- Air Conditioners
- Heat Pumps