MOTORTRONICS™

Solid State AC Motor Control

Product Selection Guide

2013

Products

Low Voltage Soft Starters
Medium Voltage Soft Starters
Electronic Motor Brakes
Motor Protection / RTD Modules
Motor Winding Heater Controllers
LV & MV Transformers / MV Contactors
Current Transformers
AC Drives

Motortronics/Phasetronics
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Clearwater, Florida 33765 USA
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www.motortronics.com

MOTORTRONICS RELIABILITY

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NOTE: PRICES ARE IN US$ AND ARE SUBJECT TO CHANGE WITHOUT NOTICE

VMX SERIES COMPACT SOFT STARTER
208 - 575V, 9 - 1250 Amps, 5 - 1200 HP

VMX Series

Flexibility of Control
Multiple ramp profiles, Pump-Flex™ Decel, process control timers and advanced motor protection make the VMX Series soft starter adaptable to a wide variety of AC motor applications... no need for add-on modules or costly auxiliary devices.

Compact packaging has become critical in more and more electrical installations. The VMX Series meets this need without compromising features and ratings. By using a highly engineered packaging design and the latest generation microprocessor, all the control and protection features you need are in the VMX Series. Narrow and shallow dimensions are perfect for integrating the VMX Series into motor control centers (MCCs), pump control panels, and retrofit starter enclosures.

Integral Bypass Contactors are standard on all sizes and provide maximum efficiency of panel space while maintaining the Motortronics reputation for being able to soft start most any load. The VMX Series is the only fully integrated, compact, world-class design offering uncompromised power and control capabilities.

Multiple Ramp Types to Start any Load
Closed Loop Current Ramp or Voltage Ramp, with or without Current Limit

Built-in Decel Control, Dual Ramp, Kick Start and Jog Modes

Unit Overload Capacity (% FLA)
500% - 60 Seconds

Start & Run Protection
Two programmable overload trip curves allow for the thermal capacity required to start the load while providing motor overload protection needed during the run time.
Start: Programmable for Class 5 - 30
Run: Programmable for Class 5 - 30, enabled when starter detects motor is "At-Speed"
Reset:Manual or automatic, selectable via programming. Remote reset available.

Real-Time Thermal Modeling
Continuously calculates motor operating temperature even when the motor is not running.

Retentive Thermal Memory
Remembers the thermal condition of the motor even in the event of a power brown-out or black-out when power is restored.
Extrapolates motor temperature using a real-time clock.

Dynamic Reset Capacity
Overload will not reset until thermal capacity in the motor is sufficient for a successful restart. Starter learns and retains this information from previous starts.

Control
120V AC (customer supplied), 240V (opt)
24V DC dry contact inputs, no external DC power supply required

Motor Temperature
PTC thermistor input can also be used for E-stop or external overload relay.

Equipment Ground Fault
Residual current method with adjustable trip delay.

RS485 Modbus Communications
Full control and/or status monitoring over network or direct to a PC.

Phase Current Imbalance/Loss Protection
Trip level: 5 - 30% current imbalance between any two phases with trip delay

Phase Loss
Trips on phase current or voltage loss

Phase Rotation
Phase rotation trip can be set to A-B-C, A-C-B or disabled.

Electronic Shear Pin Protection
Trip level: 100 - 300% of motor FLA with trip delay

Load Loss (Under Current) Trip Protection
Trip level: 10 - 90% of motor FLA with trip delay

Motor Duty Cycle Protection
Back-spin/coast-down, starts-per-hour or minimum time between starts lockouts. Restart delay after a power failure.

Short Circuit
Trips at 10x unit current rating during run. Checks for shorted load prior to each start.

Shorted SCR
Locks out on any single shorted SCR (defeatable) or can provide shunt trip function if multiple SCRs short or bypass contactor is welded closed.

Metering
Monitors phase current, ground current and motor thermal capacity.

VMX Series (Module)

Model Number	Amps	208V / HP		240V / HP		480V / HP		575V / HP		List Price $
		Shunt Bypass	Start Bypass	Shunt Bypass	Start Bypass	Shunt Bypass	Start Bypass	Shunt Bypass	Start Bypass	Module Only
VMX-18-BP	9 - 18	5	3	5	5	10	10	15	10	**1,532**
VMX-28-BP	14-28	7.5	7.5	7.5	7.5	20	15	25	20	**1,532**
VMX-39-BP	19-39	10	10	10	10	25	25	30	30	**1,610**
VMX-48-BP	24-48	15	10	15	15	30	30	40	30	**1,610**
VMX-62-BP	31-62	20	15	20	20	40	40	50	50	**1,627**
VMX-78-BP	39-78	25	20	25	25	60	50	60	60	**1,694**
VMX-92-BP	46-92	30	25	30	30	60	60	75	75	**2,010**
VMX-112-BP	56-112	30	30	40	30	75	75	100	75	**2,214**
VMX-150-BP	75-150	40	40	50	50	100	100	150	-	**2,915**
VMX-160-BP	80-160	50	40	60	50	125	100	150	-	**3,116**
VMX-210-BP	105-210	60	50	75	60	150	150	200	150	**4,498**
VMX-275-BP	138-275	75	60	100	75	200	150	200	150	**5,342**
VMX-361-BP	181-361	125	75	125	125	300	250	350	300	**5,763**
VMX-450-BP	225-450	150	125	150	150	350	300	450	300	**6,466**
VMX-550-BP	275-550	200	150	200	200	450	400	500	500	**8,164**
VMX-600-BP	300-600	200	200	250	200	500	500	600	600	**8,312**
VMX-862-BP	431-862	250	250	300	300	600	500	700	600	**11,818**
VMX-900-BP	450-900	300	250	350	300	700	600	900	600	**13,054**
VMX-1006-BP	503-1006	350	300	400	400	800	800	1000	900	**19,790**
VMX-1250-BP	625-1250	450	350	500	450	1000	900	1200	1000	**22,244**

NOTES:
1 – Size the Soft Starter based on the actual motor nameplate FLA.
2 – The above data is based on the NEC Table 430-150, full load current for 3 phase motors.
3 – All VMX units rated 500% current 60 sec; Start bypass ratings allow for use of 1.15 service factor motors.
4 – Control power is required for all units.
5 – Lug Kits see page 16.

VMX - __ - BP - _

Max Amps.

Enclosure

N: N1 / N1A

E: N12 (Includes Control Power Transformer)

VMX Series (Enclosed)

Max. Amps	208V / HP		240V / HP		480V / HP		575V / HP		List Price $	
	Shunt Bypass	Start Bypass	Shunt Bypass	Start Bypass	Shunt Bypass	Start Bypass	Shunt Bypass	Start Bypass	N1/ N1A (Gasketed)	NEMA 4/12
18	5	3	5	5	10	10	15	10	**1,745**	**2,411**
28	7.5	7.5	7.5	7.5	20	15	25	20	**1,745**	**2,411**
39	10	10	10	10	25	25	30	30	**1,822**	**2,487**
48	15	10	15	15	30	30	40	30	**1,822**	**2,487**
62	20	15	20	20	40	40	50	50	**1,981**	**2,503**
78	25	20	25	25	60	50	60	60	**2,048**	**2,569**
92	30	25	30	30	60	60	75	75	**2,357**	**2,879**
112	30	30	40	30	75	75	100	75	**2,559**	**3,080**
150	40	40	50	50	100	100	150	-	**3,342**	**3,820**
160	50	40	60	50	125	100	150	-	**3,540**	**4,018**
210	60	50	75	60	150	150	200	150	**5,239**	**5,622**
275	75	60	100	75	200	150	200	150	**6,108**	**6,450**
361	125	75	125	125	300	250	350	300	**6,543**	**6,866**
450	150	125	150	150	350	300	450	300	**7,362**	**7,744**
550	200	150	200	200	450	400	500	500	**9,114**	**9,411**
600	200	200	250	200	500	500	600	600	**9,265**	**9,556**
862	250	250	300	300	600	500	700	600	**16,473**	**CF**
900	300	250	350	300	700	600	900	600	**16,966**	**CF**
1100	350	300	400	400	800	800	1000	900	**23,580**	**CF**
1250	450	350	500	450	1000	900	1200	1000	**25,989**	**CF**

NOTES:

1 – Size the Soft Starter based on the actual motor nameplate FLA.
2 – The above data is based on the NEC Table 430-150, full load current for 3 phase motors.
3 – All VMX units rated 500% current 60 sec; Start bypass ratings allow for use of 1.15 service factor motors.
4 – Enclosed units include line + load lugs.
5 – 500HP rating with 1.0 SF.
6 – VMX18 - 160 are N1, VMX210 - 1250 are N1A Gasketed

VMX Series Module Dimensions and Weights

PANEL - Dimensions and Shipping Weights				
Model Number	**H inches (mm)**	**W Inches (mm)**	**D inches (mm)**	**Shipping Weight Approx. lbs. (kg)**
VMX-18-BP thru VMX-48-BP	8.85 (225)	8 (203)	6.65 (169)	13 (6)
VMX-62-BP thru VMX-112-BP	14 (355.6)			23 (10)
VMX-150-BP thru VMX-160-BP	19 (482.6)			33 (15)
VMX-210-BP	28.1 (713.7)	12.5 (317.5)	9.1 (231)	130 (59)
VMX-275-BP				140 (64)
VMX-361-BP thru VMX-450-BP	29.3 (744.2)			145 (66)
VMX-550-BP thru VMX-600-BP	29.5 (749.3)			165 (75)
VMX-862-BP thru VMX-900-BP	44.25 (1124)	25.5 (647.7)	11.86 (301.3)	Contact Factory
VMX-1006-BP thru VMX-1250-BP	50.77 (1289.6)		13.28 (337.3)	

NOTE: Dimensions and Weights are subject to change.

VMX Series Enclosed Dimensions and Weights

N1 / N1A Gasketed - Dimensions and Shipping Weights				
Model Number	**H inches (mm)**	**W Inches (mm)**	**D inches (mm)**	**Shipping Weight Approx. lbs. (kg)**
VMX-18-BP-N thru VMX-48-BP-N	15 (381)	10 (254)	8 (203.2)	22 (10)
VMX-62-BP-N thru VMX-112-BP-N	20 (508)	10 (254)	8 (203.2)	35 (15.9)
VMX-150-BP-N thru VMX-160-BP-N	28 (711)	10 (254)	8 (203.2)	49 (22.25)
VMX-210-BP-N	48 (1219.2)	33 (838.2)	16 (406.4)	308 (140)
VMX-275-BP-N				318 (144)
VMX-361-BP-N thru VMX-450-BP-N				323 (147)
VMX-550-BP-N thru VMX-600-BP-N				343 (156)
VMX-862-BP-N thru VMX-900-BP-N	92 (2336.8)	36 (914.4)	30 (76.2)	Contact Factory
VMX-1006-BP-N thru VMX-1250-BP-N				Contact Factory

NEMA 4/12 - Dimensions and Shipping Weights				
Model Number	**H inches (mm)**	**W Inches (mm)**	**D inches (mm)**	**Shipping Weight Approx. lbs. (kg)**
VMX-18-BP-E thru VMX-48-BP-E	37 (939.8)	15 (381)	12 (304.8)	81 (37)
VMX-62-BP-E thru VMX-112-BP-E				91 (41)
VMX-150-BP-E thru VMX-160-BP-E				101 (46)
VMX-210-BP-E	48 (1219.2)	33 (838.2)	16 (406.4)	318 (144)
VMX-275-BP-E				328 (149)
VMX-361-BP-E thru VMX-450-BP-E				338 (153)
VMX-550-BP-E thru VMX-600-BP-E				358 (162)
VMX-862-BP-E thru VMX-900-BP-E	92 (2336.8)	36 (914.4)	30 (76.2)	Contact Factory
VMX-1006-BP-E thru VMX-1250-BP-E				Contact Factory

NOTE: Dimensions and Weights are subject to change.

VMX Configured

The VMX Configured Soft Starter is designed for Heavy Duty Loads and includes the advanced features of the VMX Chassis Soft Starter in a N4/12 Combination Package. The Smart Door Customer Interface Panel allows for Superior Functionality and Diagnostics.

VMX-S & VMX-H Include:
N12/4 Enclosure
VMX Softstarter with built-in Bypass
Circuit Breaker Disconnect (55A- & up)
Fusible Switch Disconnect (18A-48A)
Advanced Motor Protection
Control Power Transformer
Interface Board for easy control connections
Smart Door Customer Interface including:
Door Mounted Digital Keypad
Emergency Stop Pushbutton
Local-Off-Remote Selector Switch
Start /Stop Pushbuttons
Motor Run Pilot Light
Power On Pilot Light
Starter Fault Pilot Light
E-Stop Fault Pilot Light
External Interlock Pilot Light

VMX-H also includes:
Start Rated Bypass Contactor
External Motor Overload for Across the Line mode
Soft Start – X-Line mode Selector Switch
X-Line Enabled Pilot Light

VMX - S - __ - __ - _

VMX-S Series

Max Amps.

Disconnect
FS: 18A-48A (Fused Switch)
CB: 62A-862A (Circuit Breaker)

Line Voltage
1 = 208V, **2** = 240V
4 = 480V, **5** = 575V

Max Amps	Fused Switch/ Circuit Breaker	208V / HP	240V / HP	480V / HP	List Price $	575V / HP	List Price $
18	30A **FS**	5	5	10	**4,285**	15	**4,714**
28	60A **FS**	7.5	7.5	15-20	**4,285**	20-25	**4,714**
39	60A **FS**	10	10	25	**4,362**	30	**4,798**
48	60A **FS**	15	15	30	**4,391**	40	**4,830**
62	100A **CB**	20	20	40	**4,406**	50-60	**4,847**
78	100A **CB**	25	25	50	**5,160**	75	**5,676**
92	150A **CB**	30	30	60	**5,760**	75	**6,336**
112	150A **CB**	30	40	75	**6,360**	100	**6,996**
150	225A **CB**	40	50	100	**7,080**	125	**7,789**
160	225A **CB**	50	60	125	**7,680**	150	**8,448**
210	400A **CB**	60	75	150	**8,640**	200	**9,504**
275	400A **CB**	75	100	200	**10,140**	250	**11,154**
305	400A **CB**	100	125	250	**10,920**	300	**12,012**
361	600A **CB**	125	125	300	**11,640**	350	**12,804**
450	600A **CB**	150	150	350	**11,976**	400	**13,174**
480	600A **CB**	150	200	400	**15,000**	500	**16,500**
550	800A **CB**	200	200	450	**19,080**	500	**20,988**
600	800A **CB**	200	250	500	**22,020**	600	**24,222**
862	1200A **CB**	250	300	600	**24,300**	700	**26,730**

Consult factory for larger models.

NOTES:
1 – Size the Soft Starter based on the actual motor nameplate FLA.
2 – The above data is based on the NEC Table 430-150, full load current for 3 phase motors.
3 – The units listed are rated for 500% overload capacity for 60 sec., 1.0 SF.
4 – Enclosed units include line + load lugs.

VMX - H - __ - __ - _

VMX-H Series

Max Amps.

Disconnect
FS: 21A-45A (Fused Switch)
CB: 55A-960A (Circuit Breaker)

Line Voltage
1 = 208V, **2** = 240V
4 = 480V, **5** = 575V

Max Amps	Fused Switch/ Circuit Breaker	208V / HP	240V / HP	480V / HP	List Price $	575V / HP	List Price $
21	30A FS	7.5	7.5	15	**4,320**	10-15	**4,752**
27	60A FS	10	10	25	**4,440**	20	**4,884**
40	60A FS	10	15	30	**4,500**	25	**4,950**
45	60A FS	15	20	40	**4,800**	30	**5,279**
55	100A CB	20	25	50	**5,100**	40	**5,610**
68	100A CB	25	30	60	**5,279**	50	**5,807**
80	150A CB	30	30	75	**5,721**	50	**6,293**
96	150A CB	30	30	75	**6,361**	60	**6,997**
125	225A CB	40	60	100	**6,756**	75	**7,432**
156	225A CB	60	75	150	**7,920**	100	**8,712**
220	400A CB	60	125	150	**9,795**	150	**10,774**
248	400A CB	100	150	250	**10,464**	200	**11,511**
312	400A CB	125	150	300	**11,976**	250	**13,174**
400	600A CB	125	200	300	**13,036**	300	**14,339**
480	600A CB	150	200	400	**17,940**	500	**19,734**
600	800A CB	200	200	500	**22,200**	600	**24,421**
690	1200A CB	250	300	500	**23,700**	600	**26,069**
800	1200A CB	-	300	600	**24,900**	600	**27,391**
960	1200A / 1600A CB	300	400	800	**34,680**	900	**38,148**

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NOTES:
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3 – The units listed are rated for 500% overload capacity for 60 sec., 1.15 SF.
4 – Enclosed units include line + load lugs.
5 – 500HP rating with 1.0 SF.

VMX SERIES COMPACT SOFT STARTER
208V – 575V, 9 – 1250 Amps, 5 – 1200 HP

VMX Series Configured with Deadfront

VMX Configured with Deadfront

The VMX Configured Soft Starter is designed for Heavy Duty Loads and includes the advanced features of the VMX Chassis Soft Starter in a N4/12 Combination Package. The Smart Door Customer Interface Panel allows for Superior Functionality and Diagnostics.

VMX-S & VMX-H Include:
N12/4 Enclosure
VMX Softstarter with built-in Bypass
Circuit Breaker Disconnect (55A- & up)
Fusible Switch Disconnect (18A-48A)
Advanced Motor Protection
Control Power Transformer
Interface Board for easy control connections
Smart Door Customer Interface including:
Door Mounted Digital Keypad
Emergency Stop Pushbutton
Local-Off-Remote Selector Switch
Start /Stop Pushbuttons
Motor Run Pilot Light
Power On Pilot Light
Starter Fault Pilot Light
E-Stop Fault Pilot Light
External Interlock Pilot Light

VMX-H also includes:
Start Rated Bypass Contactor
External Motor Overload for Across the Line mode
Soft Start – X-Line mode Selector Switch
X-Line Enabled Pilot Light

VMX - S - __ - __ - _D

VMX-S Series

Deadfront

Max Amps. — Disconnect — Line Voltage

Disconnect:
FS: 18A-48A (Fused Switch)
CB: 62A-600A (Circuit Breaker)

Line Voltage:
1 = 208V, **2** = 240V
4 = 480V, **5** = 575V

Max Amps	Fused Switch/ Circuit Breaker	208V / HP	240V / HP	480V / HP	List Price $	575V / HP	List Price $
18	30A **FS**	5	5	10	**4,885**	15	**5,373**
28	60A **FS**	7.5	7.5	15-20	**4,885**	20-25	**5,373**
39	60A **FS**	10	10	25	**4,962**	30	**5,458**
48	60A **FS**	15	15	30	**4,991**	40	**5,490**
62	100A **CB**	20	20	40	**5,007**	50-60	**5,508**
78	100A **CB**	25	25	50	**5,760**	75	**6,336**
92	150A **CB**	30	30	60	**6,360**	75	**6,996**
112	150A **CB**	30	40	75	**6,960**	100	**7,655**
150	225A **CB**	40	50	100	**7,680**	125	**8,448**
160	225A **CB**	50	60	125	**8,280**	150	**9,108**
210	400A **CB**	60	75	150	**9,360**	200	**10,296**
275	400A **CB**	75	100	200	**10,860**	250	**11,947**
305	400A **CB**	100	125	250	**11,640**	300	**12,804**
361	600A **CB**	125	125	300	**12,360**	350	**13,595**
450	600A **CB**	150	150	350	**12,696**	400	**13,966**
480	600A **CB**	150	200	400	**15,720**	500	**17,293**
550	800A **CB**	200	200	450	**19,800**	500	**21,780**
600	800A **CB**	200	250	500	**22,740**	600	**25,015**

Consult factory for larger models.

NOTES:
1 – Size the Soft Starter based on the actual motor nameplate FLA.
2 – The above data is based on the NEC Table 430-150, full load current for 3 phase motors.
3 – The units listed are rated for 500% overload capacity for 60 sec., 1.0 SF.
4 – Enclosed units include line + load lugs.

VMX - H - __ - __ - _D

VMX-H Series

Deadfront

Max Amps.

Disconnect
FS: 21A-45A (Fused Switch)
CB: 55A-600A (Circuit Breaker)

Line Voltage
1 = 208V, **2** = 240V
4 = 480V, **5** = 575V

Max Amps	Fused Switch/ Circuit Breaker	208V / HP	240V / HP	480V / HP	List Price $	575V / HP	List Price $
21	30A **FS**	7.5	7.5	15	**4,920**	10-15	**5,413**
27	60A **FS**	10	10	25	**5,040**	20	**5,544**
40	60A **FS**	10	15	30	**5,100**	25	**5,610**
45	60A **FS**	15	20	40	**5,400**	30	**5,940**
55	100A **CB**	20	25	50	**5,700**	40	**6,270**
68	100A **CB**	25	30	60	**5,878**	50	**6,466**
80	150A **CB**	30	30	75	**6,320**	50	**6,952**
96	150A **CB**	30	30	75	**6,962**	60	**7,658**
125	225A **CB**	40	60	100	**7,356**	75	**8,091**
156	225A **CB**	60	75	150	**8,520**	100	**9,372**
220	400A **CB**	60	125	150	**10,515**	150	**11,566**
248	400A **CB**	100	150	250	**11,184**	200	**12,303**
312	400A **CB**	125	150	300	**12,696**	250	**13,966**
400	600A **CB**	125	200	300	**13,756**	300	**15,132**
480	600A **CB**	150	200	400	**18,660**	500	**20,526**
600	800A **CB**	150	200	500	**22,920**	600	**25,212**

Consult factory for larger models.

NOTES:
1 – Size the Soft Starter based on the actual motor nameplate FLA.
2 – The above data is based on the NEC Table 430-150, full load current for 3 phase motors.
3 – The units listed are rated for 500% overload capacity for 60 sec., 1.15 SF.
4 – Enclosed units include line + load lugs.
5 – 500HP rating with 1.0 SF.

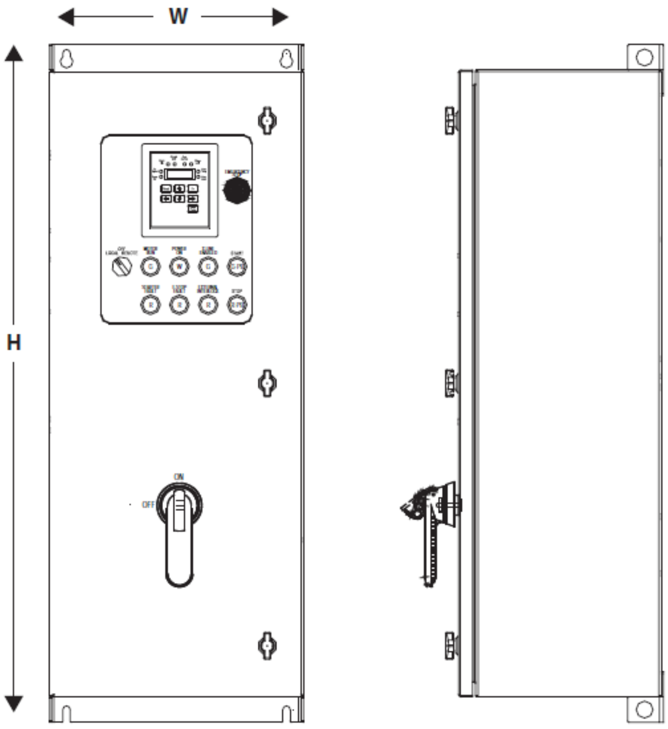
VMX Configured Dimensions and Weights

VMX-S Model	VMX-H Model	Size	Shipping Weight lbs (kg)
VMX-S-18-FS	-	1	116 (53)
VMX-S-28-FS	VMX-H-21-FS	1	
VMX-S-39-FS	VMX-H-27-FS	1	
VMX-S-48-FS	VMX-H-40-FS	1	
VMX-S-62-CB	VMX-H-45-FS	1	120 (55)
VMX-S-78-CB	VMX-H-55-CB	1	
VMX-S-92-CB	VMX-H-68-CB	1	
VMX-S-112-CB	VMX-H-80-CB	1	
VMX-S-150-CB	VMX-H-96-CB	1	125 (57)
VMX-S-160-CB	VMX-H-125-CB	1	
VMX-S-210-CB	VMX-H-156-CB	2	350 (159)
VMX-S-275-CB	VMX-H-220-CB	2	
VMX-S-305-CB	VMX-H-248-CB	2	
VMX-S-361-CB	VMX-H-312-CB	2	
VMX-S-450-CB	VMX-H-400-CB	2	
VMX-S-480-CB	-	2	
VMX-S-550-CB	VMX-H-480-CB	2	
VMX-S-600-CB	VMX-H-600-CB	2	
VMX-S-862-CB	VMX-H-690-CB	3	Consult Factory
VMX-S-900-CB	VMX-H-800-CB	3	
VMX-S-1006-CB	VMX-H-960-CB	3	
VMX-S-1250-CB	VMX-H-1080-CB	3	

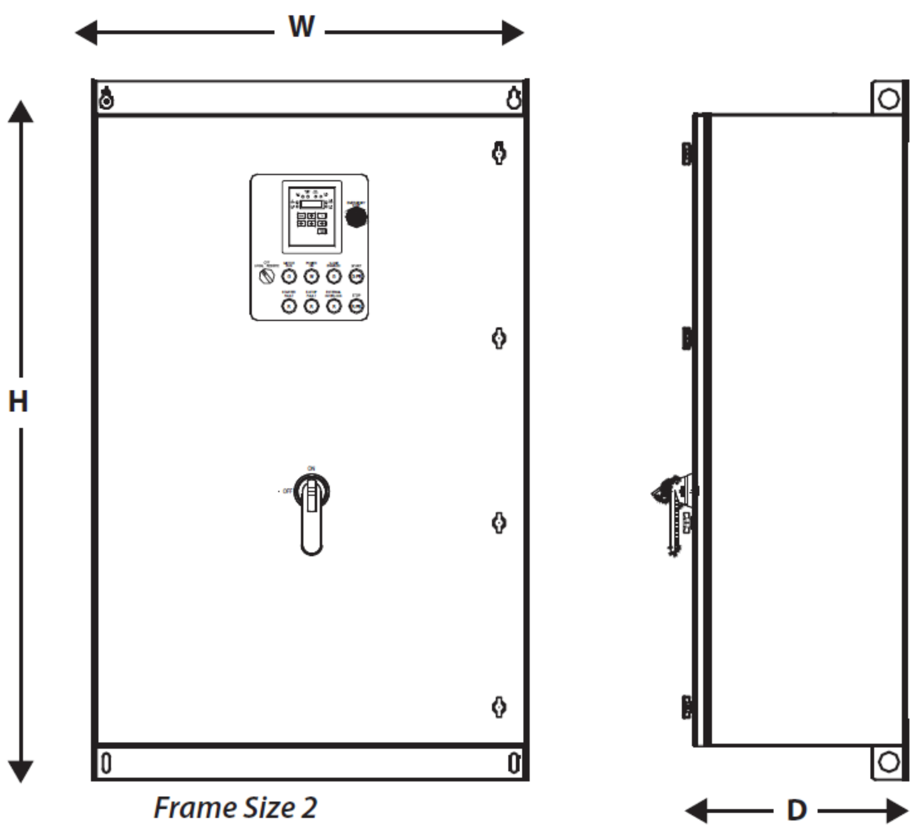
Frame Size	NEMA 4/12 Enclosure	Dimensions in inches (mm) H x W x D
1	Wall Mount	37 x 15 x 12 (934 x 381 x 305)
2	Wall Mount	48 x 33 x 16 (1219 x 838 x 406)
3	Floor Standing	92 x 36 x 30 (2337 x 914 x 762)

NOTE: Dimensions and weights subject to change.

VMX Configured Outline Dimensions



Frame Size 1



Frame Size 2

VMX Series Accessories & Spare Parts

Optional Lug Kits **			
Model Number	**Wire Size**	**Model**	**List Price $**
71-0228	# 14 to # 4 (1 per phase)	VMX-18 to VMX-48	**33**
71-0229	# 14 to 1/0 (1 per phase)	VMX-62 to VMX-112	**55**
71-0230	# 14 to 3/0 (1 per phase)	VMX-150 to VMX-160	**110**
71-0231	# 6 to 250 MCM (2 per phase)	VMX-210 to VMX-361	**165**
71-0232	# 6 to 500 MCM (2 per phase)	VMX-450 to VMX-600	**220**
71-0251	# 6 to 600 MCM (3 per phase)	VMX-862 to VMX-900	**605**
71-0252	# 6 to 600 MCM (4 per phase)	VMX-1006 to VMX-1250	**660**

**** Includes lugs for all 6 termination points (Line + Load)**

Printed Circuit Boards & Accessories				
Item	**Model Number**	**Description**	**Model**	**List Price $**
Keypad / CPU Assembly	VMX-KP-CPU-XXXX*	VMX Keypad/CPU/I/O board assembly (specify amperage when ordering)	VMX-18 to VMX-48	**618**
	VMX-KP-CPU-XXXX*		VMX-62 to VMX-112	**642**
	VMX-KP-CPU-XXXX*		VMX-150 to VMX-160	**650**
	VMX-KP-CPU-XXXX*		VMX-210 & above	**650**
Main Power Board	VMX1000-PWR	Main Power PC Board	VMX-18 to VMX-48	**336**
	VMX1001-PWR		VMX-62 to VMX-112	**350**
	VMX1002-PWR		VMX-150 to VMX-160	**370**
	VMX1003-PWR		VMX-210 to VMX-1250	**410**
Cable assembly with connectors on each end for remote mounting				
Remote Display Kit	VMX-KP12-KIT2-1	NEMA 12 Kit with 1m Cable	VMX-18 to VMX-48	**140**
	VMX-KP12-KIT2-2	NEMA 12 Kit with 2m Cable		**160**
	VMX-KP12-KIT2-3	NEMA 12 Kit with 3m Cable		**170**
	VMX-KP12-KIT-1	NEMA 12 Kit with 1m Cable	VMX-62 and Above	**150**
	VMX-KP12-KIT-2	NEMA 12 Kit with 2m Cable		**175**
	VMX-KP12-KIT-3	NEMA 12 Kit with 3m Cable		**180**

Replacement Contactors*		
Model Number	**Model**	**List Price $**
34-GMC-220	VMX-210-BP to VMX-275-BP	**983**
34-GMC-400	VMX-361-BP to VMX-440-BP	**1,426**
34-600-600-VC	VMX-550-BP to VMX-600-BP	**3,575**
34-GMC-800	VMX-718-BP to VMX-900-BP	**3,960**
34-AF1350	VMX-1006-BP to VMX-1250-BP	**Contact Factory**

*** Specify unit amperage rating.**
*** Models rated 160A and below are not designed for field replacement of the integral contactor.**

VMX Configured Series Options

Model Number	Description	List Price $
Option AA	Dual ramp option, includes 2-position switch	**132**
Option B	Jog option, includes run/jog Switch	**165**
Option H	Enclosure heater with thermostat	**550**
Option SA	Surge Suppressor	**550**
Option OL	Additional overload relay for backup in X-line mode	**330**
Option RX	RX Series motor protection/metering relay	**715**
Option X-LINE	Soft – Off – X-Line Switch	**165**
Option SHIELD	Bolt on Sun Shield	**385**

NOTE: VMX-62 thru VMX-160 are provided with terminating bus tabs as standard.

DXT SERIES ADVANCED DIGITAL SOFT STARTER
208 - 575V, 39 - 1250 Amps, 10 - 1125 HP

DXT Series

"Medium Voltage features in a low voltage starter"

- **Advanced Soft Starter Features**
- **Thermal Model Motor Protection**
- **True Motor Power Monitoring**
- **Voltage, Current and Power Metering**
- **Flexible Control Features**

The ***DXT Series*** is a high-end digitally programmable solid state reduced voltage soft starter. This heavy duty starter provides reduced voltage, stepless soft starting of 3-phase AC induction motors, protecting mechanical components from excessive torque stress and electrical systems from the effects of high motor inrush currents. The ***DXT Series*** includes advanced motor and load protection features just like those found in expensive motor protection relays. These include retentive thermal memory, dynamic reset capacity, true thermal modeling, separate trip curves for start and run protection, overload alarm, etc. But in the case of the ***DXT Series***, these features are built in as standard features, providing a cost effective and reliable motor starting and protection scheme for your critical motor applications.

The ***DXT Series*** features an easy to use interface operator for programming and status indication. It includes a large tactile feedback keypad, LED status indicators and a 2 line x 20 character backlit display using plain English text readout. In addition to programming the standard parameters such as starting torque, ramp time, current limit, dual ramp and decel control, other features like programmable overload trip curves (NEMA/UL Classes 5 - 30), starts-per-hour, time between starts and coast down/back spin lockout protection can also be programmed for your specific application needs.

The power of the ***DXT Series*** is in the CPU, a microprocessor based protection and control system for the motor and starter assembly. The CPU uses Phase Angle Firing of the SCRs to apply a reduced voltage to the motor, and then slowly and gently increases torque through control of the voltage and current until the motor accelerates to full speed. This starting method lowers the starting current of the motor, reducing electrical stresses on the power system and motor. It also reduces peak starting torque stresses on both the motor and load mechanical components, promoting longer service life and less downtime.

DXT Series (Module)

Model	Max Amps	208V / HP	230V / HP	460V / HP	575V / HP	List Price $
DXT-39	39	10	-	25	30	**3,313**
DXT-48	48	10	15	30	40	**3,423**
DXT-62	62	15	20	40	50	**3,632**
DXT-78	78	20	25	50	60	**3,864**
DXT-92	92	25	30	60	75	**4,349**
DXT-120	120	30	40	75	100	**4,712**
DXT-150	150	40	50	100	125	**4,767**
DXT-180	180	50	60	125	150	**5,450**
DXT-220	220	60	75	150	200	**5,803**
DXT-288	288	75	100	200	250	**6,244**
DXT-360	360	100	125	250	300	**7,032**
DXT-414	414	125	150	300	350	**7,049**
DXT-476	476	-	-	350	400	**7,623**
DXT-550	550	150	200	400	500	**7,986**
DXT-718	718	200	250	500	600	**9,397**
DXT-862	862	250	300	600	700	**12,143**
DXT-1006	1006	300	350	700	800	**14,081**
DXT-1150	1150	350	400	800	900	**19,320**
DXT-1200	1200	400	450	900	1000	**21,955**
DXT-1250	1250	450	500	1000	1125	**24,954**

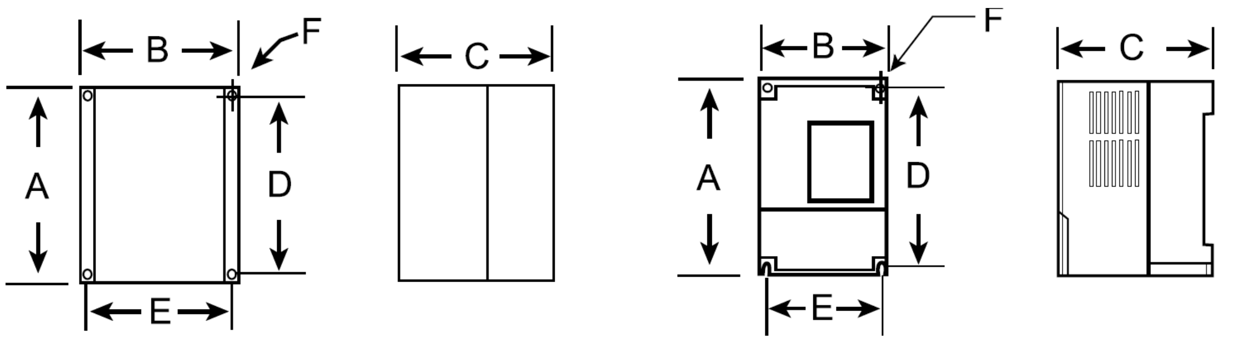
DXT-39 thru DXT-120 includes a Shunt Rated Bypass.

NOTES:

1. Units require an external 120 VAC control circuit. (Specify 240 VAC if required)
2. The units listed are rated for 500% capacity for 60 sec., 1.15 SF

DXT Series Dimensions

Enclosure	Model Number	Overall Dimensions (Inches)			Mounting Dimensions (Inches)		
		A	B	C	D	E	F
PANEL	**DXT-39 to DXT-120**	16.5	10	10	15.9	9	0.28
	DXT-150 to DXT-180	20	20.1	12	18.5	17.5	0.44
	DXT-220 to DXT-288	27	20.1	11.2	25.5	17.5	0.44
	DXT-360 to DXT-550	29.5	20.1	11.5	25.5	17.5	0.44
	DXT-718 to DXT-1006	45	33	12.8	43.3	31.3	0.44
	DXT-1150 to DXT-1250	33	33	15.2	31.2	31.2	0.44



Communications Software & Modules

MLINK - Monitoring / Programming Software		
Series	**Description**	**List Price $**
VMX	Low Voltage Starters	Free
DXT	Low Voltage Starters	Free
MVC	Medium Voltage Starters	Free
RX	Motor Protection Relay	Free
TE-RTD12	Motor RTD Module	Free
VCM	Variable Frequency Drive	Free
MT	Variable Frequency Drive	Free
Download from www.motortronics.com		

Series	Description	List Price $
64-VS1	Communication Module for Soft Starters, AC Drives and Motor Protection Relays gives users web-based access to their system using a standard internet web-browser. Standard built-in features include data-logging, alarm handling, monitoring and control. The VS1-MT can be configured in just a matter of minutes and is compatible with any 3rd party device that supports MODBUS RTU over RS232/RS485 or MODBUS/TCP over Ethernet. Can also be used as a communication gateway for connection to PLC systems and simultaneously monitor/log soft starters and AC drives via your standard web-browser. This module can also be used as an Ethernet MODBUS/TCP to MODBUS RTU Communication gateway for connection to PLC systems and soft starters and AC Drives.	**1,600**
64-VS2	Ethernet Modbus TCP Communication Module for MVC Plus, DXT, VMX, RX and TE-RTD12 products.	**1,400**
64-MLINK-01K	Software Kit includes USB to RS485 Converter and MLINK software for programming, monitoring and startup of the MVC Plus.	**500**
64-AB7007	Ethernet/IP Communication Module for MVC Plus, DXT, VMX, RX and TE-RTD12 products.	**3,500**
64-GWY-500-B	Profibus DP Communication Module for MVC Plus, DXT, VMX, RX and TE-RTD12 products.	**3,500**

RX Series Motor Protection

"The prescription for a healthy motor"

- **"Thermal Model" Motor Protection**
- **True Motor Power Monitoring**
- **Voltage, Current and Power Metering**
- **Flexible Control Features**
- **Priced Right**

Protect your 3 phase motors from:
-Line power problems: Single Phasing Phase Reversal, Voltage Imbalance
-Thermal Overload (i^2t), Class 5 - 30
-Equipment Ground Fault
-Current Imbalance
-Jammed Load / Locked Rotor
-Broken shaft / belt / loss of prime
-Over / Under Voltage
-Low / High Power Factor
-Short Cycling, Too Many Starts per Hour
-Back-Spin Restart Lockout
-Excessive Run Time
-Acceleration / Incomplete Sequence
-Over / Under Frequency from a Generator

Advanced Technology for Maximum Motor and System Protection
The RX Series uses Thermal Modeling software normally found only in the most sophisticated Motor Protection Relays. This software keeps track of power related issues occurring in the motor circuit that contribute to causing a thermal overload. If there is a power loss, a unique combination of non-volatile memory and a real-time clock ensure that this protection is in effect when power is restored. Should an overload occur, the RX Series is intelligent enough to make sure that it can only be reset when the motor is sufficiently cooled down and is ready to start again successfully. Voltage input features allow true Motor Load Monitoring, not just current, along with Power Factor, kVA and monitoring.

Built-in Flexible Control Features Provide Cost and Space Savings
A 24Hr/ / 7Day Real Time Clock allows for additional features that can eliminate the need for other discrete devices. Duty cycle can be controlled by using the Starts/Hour and Minimum Time Between Starts features, plus a Coast-Down / Backspin timer can prevent restarting while a motor is spinning backwards.
Simple Batch Time processes of up to 7 events can be programmed for daily, multi-day or weekly operations without the need for an external time clock. A Restart Delay timer allows staggered restarting of multiple units as well.

Add Metering and Communications to New or Existing Starters
Metering for Three Phase Currents, Voltages, kW, kVA, kVAR, Power Factor, Frequency, kWH, Elapsed Run Time, Run Cycle Count, Lock-Out Time, Reset Time and Remaining Thermal Capacity are all included, and can be both read on the display and communicated via the built-in RS-485 Modbus RTU communication.

RX Series Motor Protection and Options

RX MOTOR PROTECTION SERIES		
Model Number	**Description**	**List Price $**
RX-5	5A, CT fed relay	**550**
RX-KP12-KIT-2	NEMA 4/12 Remote keypad kit includes 2 meter DB9 Serial Cable, Gasket and instructions	**75**
ZCT	Zero Sequence Relay	**1,300**
TE-RTD12	Relay device adds advanced RTD and Current monitoring capability.	**1,500**

Current Transformers for the RX Series

11 - 2 RL - 500

Windows Size
2 = 1.05 Inch
56 = 2.06 Inch
8 = 3.25 Inch

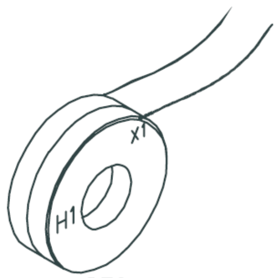
Style
RL = Round with Leads
SFT = Sq w/ Terminals and Feet
SHT = Sq with Terminals

Ratio
500 = 50:5 / ***750*** = 75:5
101 = 100:5 / ***151*** = 150:5
201 = 200:5 / ***251*** = 250:5
301 = 300:5 / ***401*** = 400:5
501 = 500:5 / ***601*** = 600:5
751 = 750:5 / ***801*** = 800:5
102 = 1000:5 / ***122*** = 1200:5
152 = 1500:5 / ***162*** = 1600:5
202 = 2000:5

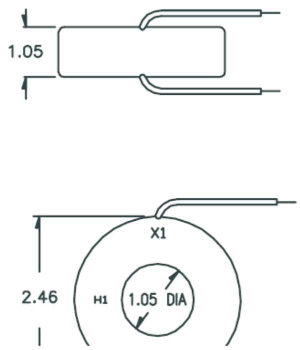
Current Transformers			
Model Number	**Current Ratio**	**Window (Inches)**	**List Price $ (Per CT)**
2RL	50:5 thru 300:5	1.05	**24**
2SFT	50:5 thru 400:5	1.05	**26**
56RL	50:5 thru 500:5	2.06	**31**
56RL	600:5 thru 1200:5	2.06	**39**
56SFT	50:5 thru 1200:5	2.06	**31**
8RL	200:5 thru 1000:5	3.25	**62**
8RL	1200:5 thru 1500:5	3.25	**70**
8RL	1600:5 thru 2000:5	3.25	**92**
8SHT	200:5 thru 1000:5	3.25	**65**
8SHT	1200:5 thru 1500:5	3.25	**89**
8SHT	1600:5 thru 2000:5	3.25	**93**

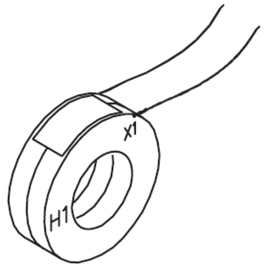
NOTE: Prices listed above are for a single CT. A quantity of 3 is required for the RX Relay.

RX Current Transformers Dimensions

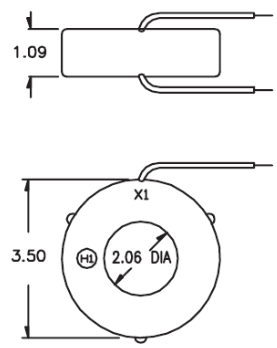


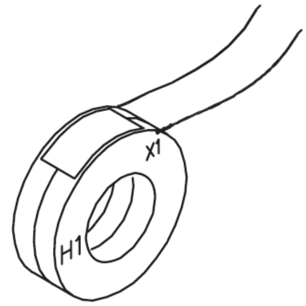
2RL



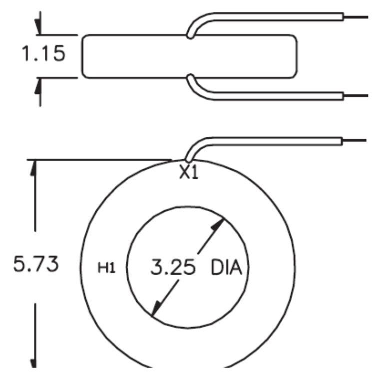


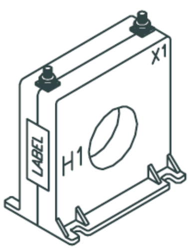
56RL



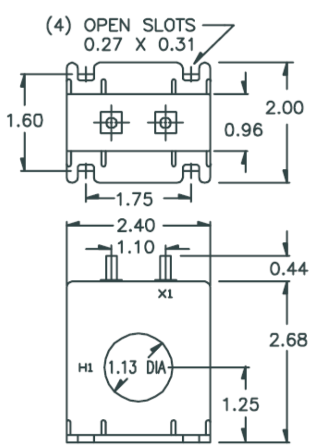


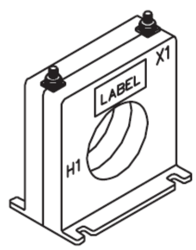
8RL



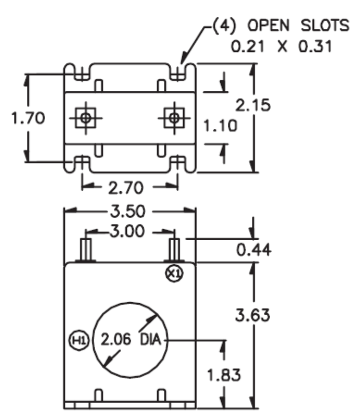


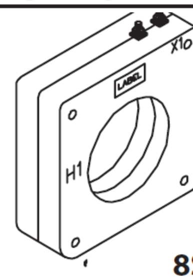
2SFT



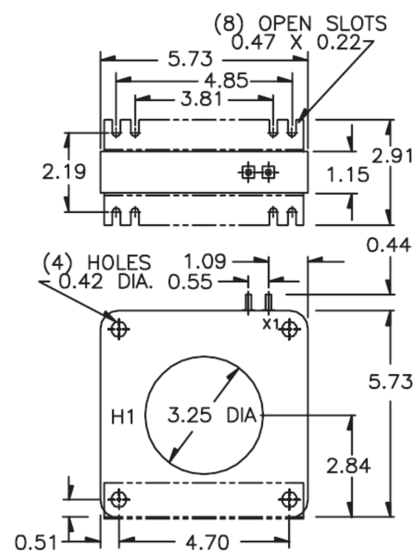


56SFT

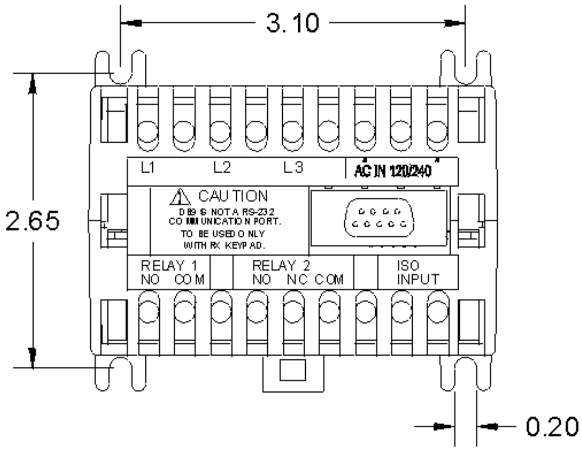




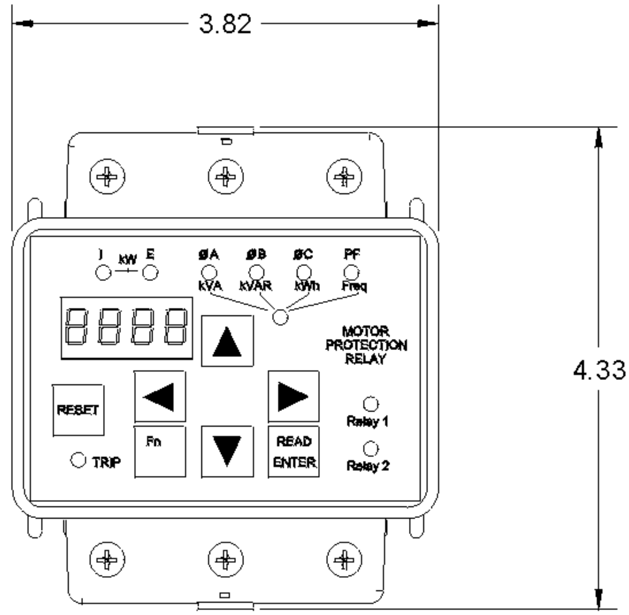
8SHT

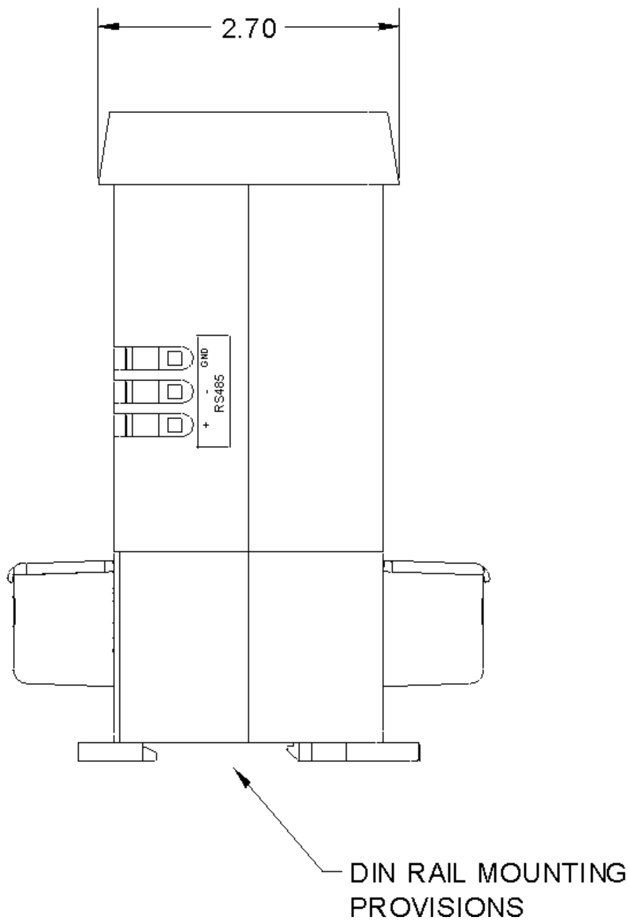


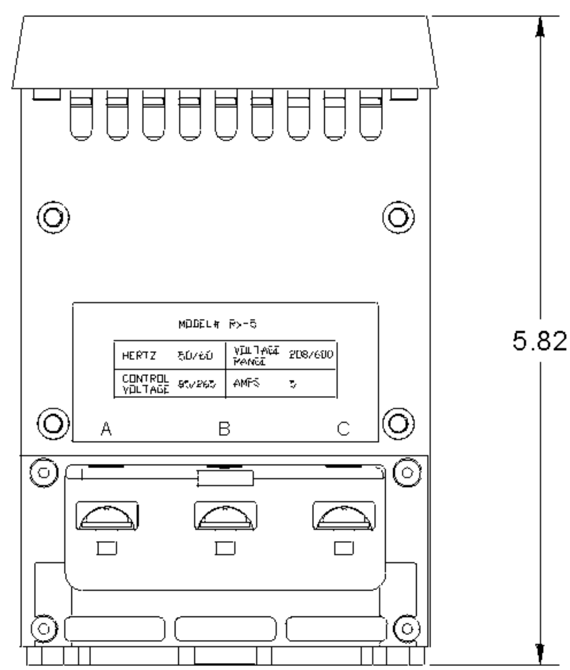
RX - 5 Dimensions



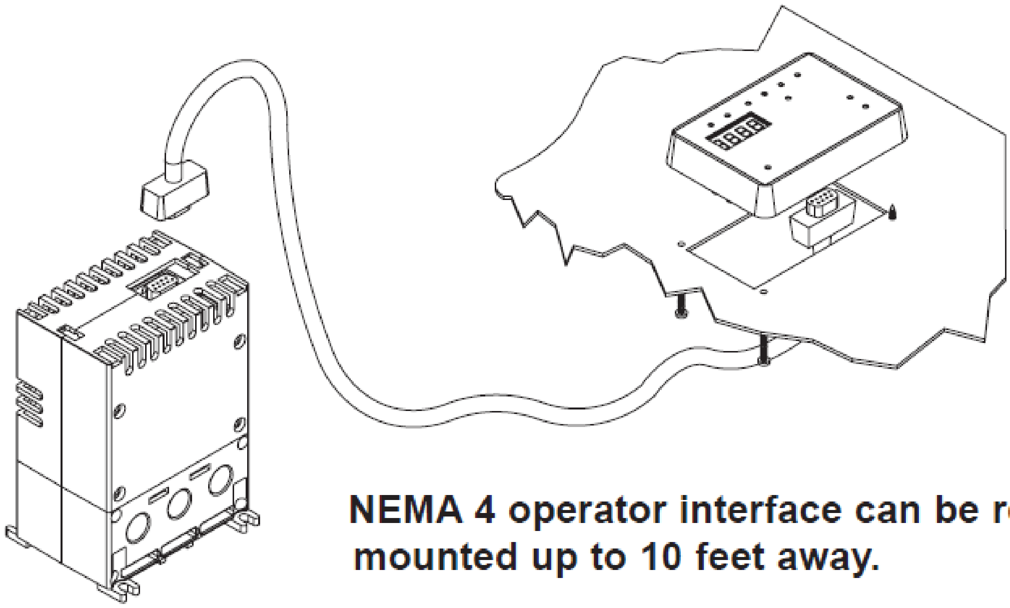
RELAY SHOWN WITHOUT KEYPAD
OR BUSBAR CONNECTIONS





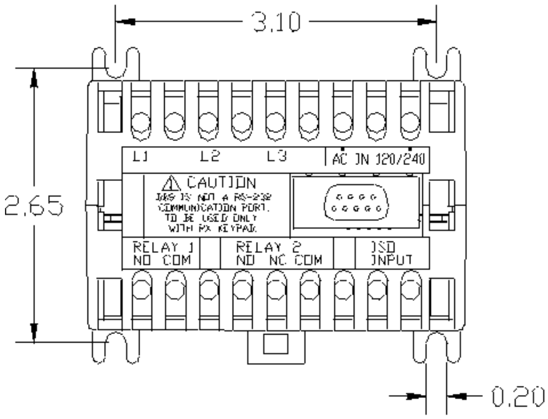


RX - KP12 – KIT – 2 Dimensions

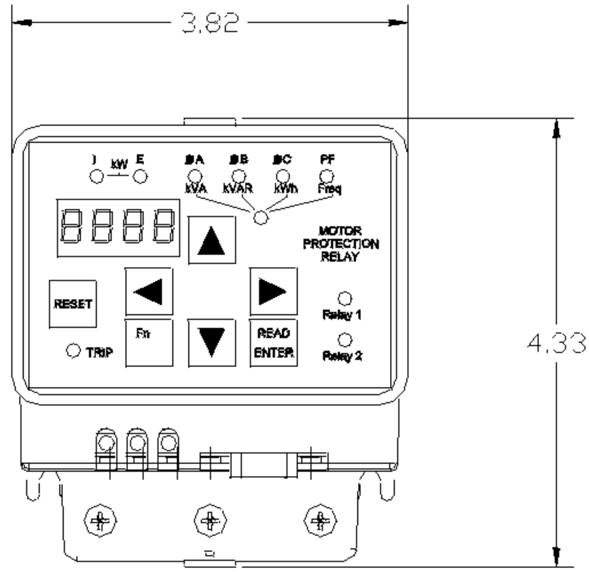


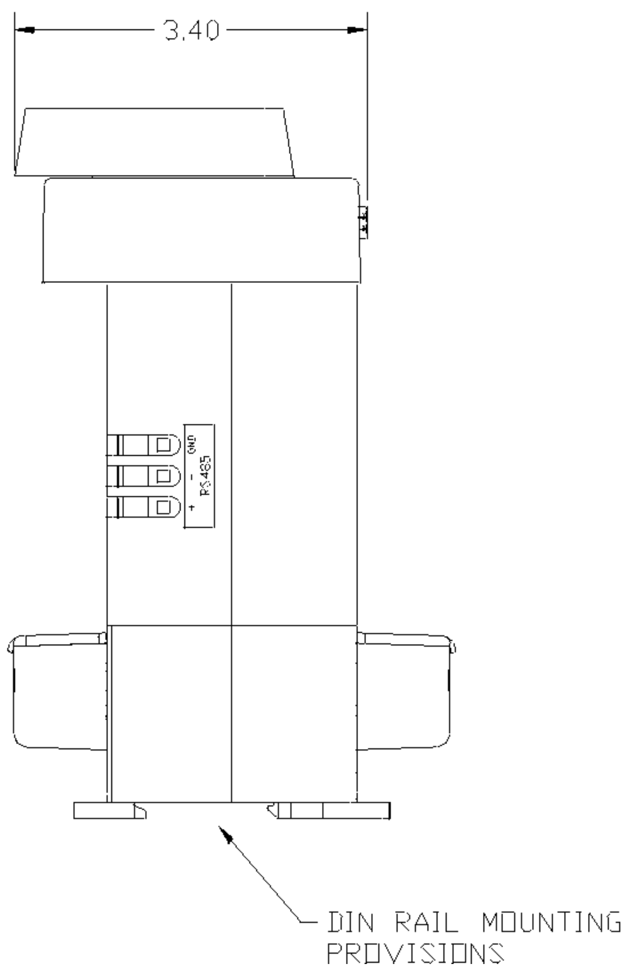
NEMA 4 operator interface can be remote mounted up to 10 feet away.

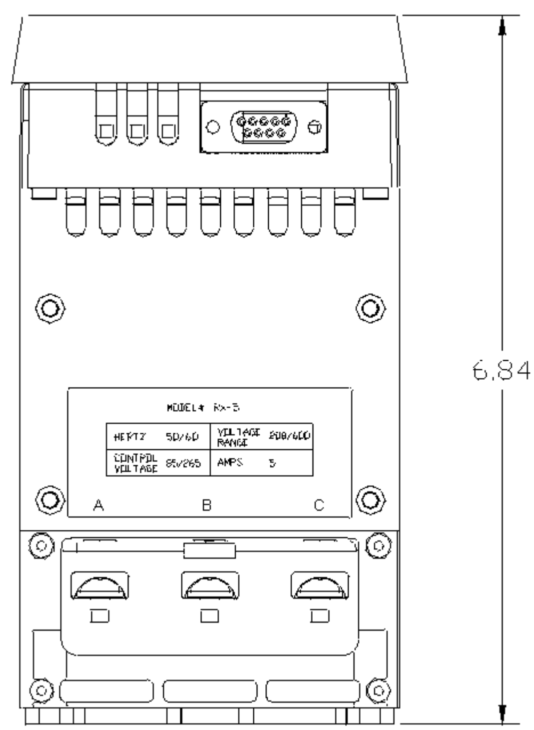
ZCT Options Dimensions



RELAY SHOWN WITHOUT KEYPAD
OR BUSBAR CONNECTIONS







TE-RTD12 Motor RTD Monitor Series

TE-RTD12 Series

The TE-RTD12 Relay device adds advanced RTD and Current monitoring capability to your new or existing motor system. The TE-RTD12 Relay device offers 12 built-in RTD inputs, 3 programmable output relays (5A), 2 isolated analog inputs (4-20mA), 3 isolated digital inputs,1 isolated analog output (4-20mA) and differential current feedback monitoring.

A built-in RS485 (2 wire) communication port allows for use with a master device (PLC / SCADA / Operator Interface) for the purpose of programming and monitoring.

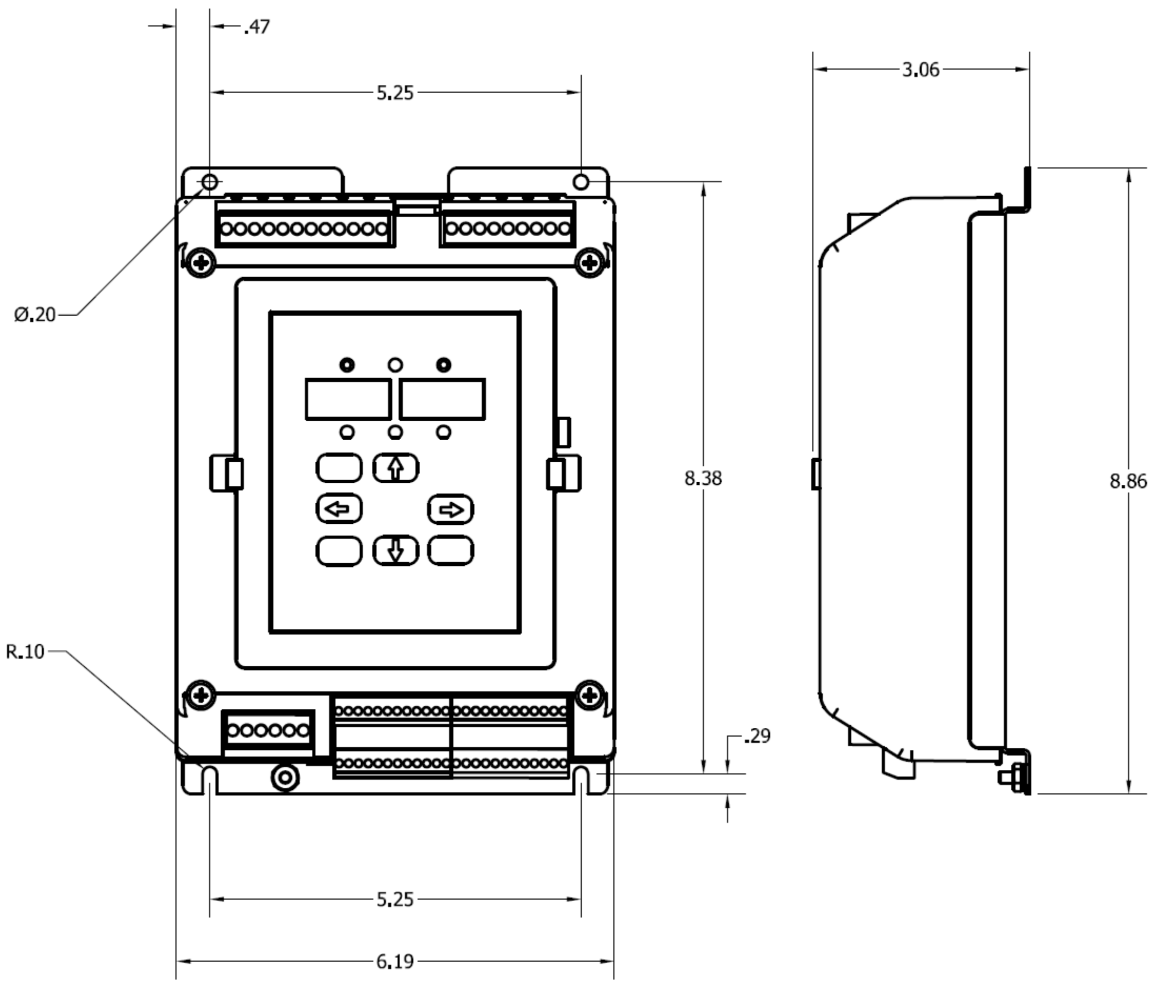
Programmable relay outputs are provided that can be set to a system function or for use as a global Alarm or Trip based on temperature readout. Temperature readout and programming can be entered in degrees Celsius or Fahrenheit.

A built-in event recorder stores fault information of current and past events with date and time-stamp. The TE-RTD12 Relay device can be mounted on a back panel using the mounting bracket or DIN-Rail mount.

Control Voltage:	110 - 240Vac Nominal 50/60Hz
Inputs:	12 RTD inputs (Pt100, Ni100, Ni120, Cu10), 3 CT inputs for differential CT's 2 isolated 4-20mA analog inputs, 3 isolated Digital Inputs
Outputs:	3 programmable form C Relays with 5A contact rating, One isolated 4-20mA analog output
Keypad:	Two 4-digit displays, one for the RTD name (St1, St2, …) and one for the temperature. 1 green 'OK' LED, 1 yellow 'ALARM' LED, 1 red 'TRIP' LED and 3 Relay LED's. 7 pushbuttons: 4 arrows, 1 'Function', 1 'Enter' and a 'Reset' button
Differential CT's:	Primary 5-2000A, Secondary 1A or 5A, Alarm and Trip Levels OFF, 5% to 90 % of CT value
Resolution/Accuracy:	Analog Inputs better than 1%, Analog Outputs better than 0.5%
Communication Port:	2 Wire RS-485, MODBUS RTU
I/O Terminals:	Removable terminal blocks
Temperature:	Operating 32ºF – 122ºF / 0ºC to 50ºC, Storage -4ºF – 176ºF / -20ºC to 80ºC
Humidity:	10% to 90% (non-condensing)

Model Number	Description	List Price $
TE-RTD12	Relay device adds advanced RTD and Current monitoring capability.	**1,500**
TE-RTD12-KP12-PTB-KIT	Remote keypad kit	**300**

Model Number	Dimensions (Inches) - H x W x D
TE-RTD12	8.86 x 6.19 x 3.06



Mounting: Use the designated mounting holes to mount the TE-RTD12 in the designated area of your system.

Current Transformers

600V ANSI and Non-ANSI Rated CTs

Frequency: 50 - 400 Hz

Insulation Level: 600 Volts, 10 kV BIL full wave

Application: With Ammeters, wattmeters, cross current compensation, energy management systems, instrumentation, relay and Metering.

Model Number Configuration

11 - 2 RL - 500

Model Number

Style

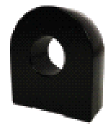
RL = Round with Leads
SFT = Sq w/ Terminals and Feet
SHT = Sq with Terminals

Ratio

500 = 50:5 / ***750*** = 75:5
101 = 100:5 / ***151*** = 150:5
201 = 200:5 / ***251*** = 250:5
301 = 300:5 / ***401*** = 400:5
501 = 500:5 / ***601*** = 600:5
751 = 750:5 / ***801*** = 800:5
102 = 1000:5 / ***122*** = 1200:5
152 = 1500:5 / ***162*** = 1600:5
202 = 2000:5

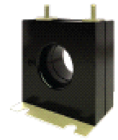
CT Images shown for illustration purposes only.

Window Sizes
0.56″



13

Window Sizes
0.56″
0.94″
1.25″

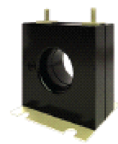


14, 15, 16 SFT

Window Sizes
0.64″

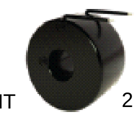
1A 1B

Window Sizes
1.00″
1.05″
1.13″



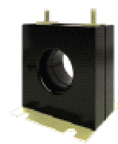
2 SFT

2 SHT

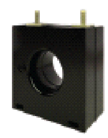


2 RL

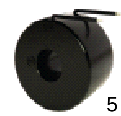
Window Sizes
1.56″



5 SFT



5 SHT

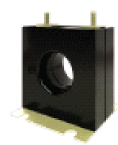


5 RL

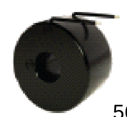
Window Sizes
1.56″

5 DRL

Window Sizes
2.06″

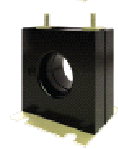


56 SFT



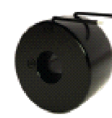
56 RL

Window Sizes
2.06″



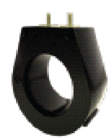
6 SFT

6 SHT



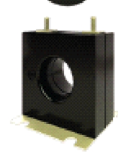
6 RL

Window Sizes
0.56″
1.25″
2.00″

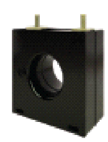


63A SFT 63B RT 63C RT

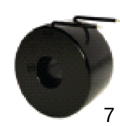
Window Sizes
2.05″



7 SFT

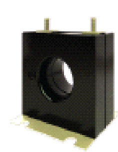


7 SHT

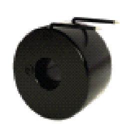


7 RL

Window Sizes
3.00″



76 SFT



Current Transformers

Model Number	Current Ratio	Window (Inches)	List Price $
13	500 TURNS	0.56	**46**
13	1000 TURNS	0.56	**56**
13	2000 TURNS	0.56	**60**
10SFT	50:5 THRU 300:5	0.94	**64**
2DARL	50:5 THRU 300:5	1	**70**
14	50:5 THRU 100:5	0.50	**44**
15SFT	50:5 THRU 200:5	0.94	**56**
1A	50:5 THRU 250:5	0.64	**44**
1B	50:5 THRU 250:5	0.64	**48**
2DRL	50:5 THRU 600:5	1	**64**
2RL	50:5 THRU 300:5	1.05	**48**
2RL	400:5 THRU 500:5	1.05	**48**
2SFT	50:5 THRU 400:5	1.13	**52**
2SHT	50:5 THRU 300:5	1.13	**72**
5RL	50:5 THRU 500:5	1.56	**60**
5RL	600:5 THRU 1200:5	1.56	**74**
5RL	1300:5 THRU 2400:5	1.56	**74**
5SFT	50:5 THRU 500:5	1.56	**64**
5SFT	600:5 THRU 1200:5	1.56	**78**
5SHT	50:5 THRU 500:5	1.56	**64**
5SHT	600:5 THRU 1200:5	1.56	**78**
5DRL	50:5 THRU 500:5	1.56	**70**
5DRL	600:5 THRU 1200:5	1.56	**86**
56	50:5 THRU 500:5	2.06	**62**
56	600:5 THRU 1200:5	2.06	**78**
56RL	50:5 THRU 500:5	2.06	**62**
56RL	600:5 THRU 1200:5	2.06	**78**
56RL	1400:5 THRU 3200:5	2.06	**78**
56SFT	50:5 THRU 500:5	2.06	**62**
56SFT	600:5 THRU 1200:5	2.06	**62**
6RL	100:5 THRU 600:5	2.06	**68**

Current Transformers

Model Number	Current Ratio	Window (Inches)	List Price $
6RL	750:5 THRU 1500:5	2.06	**86**
6SFT	100:5 THRU 600:5	2.06	**70**
6SFT	700:5 THRU 1500:5	2.06	**88**
6SHT	100:5 THRU 600:5	2.06	**70**
6SHT	750:5 THRU 1500:5	2.06	**88**
7RL	100:5 THRU 800:5	2.50	**70**
7RL	1000:5 THRU 1600:5	2.50	**94**
7SFT	100:5 THRU 800:5	2.50	**72**
7SFT	1000:5 THRU 1600:5	2.50	**104**
7SHT	100:5 THRU 800:5	2.50	**72**
7SHT	1000:5 THRU 1600:5	2.50	**104**
76RL	200:5 THRU 800:5	3	**72**
76RL	1000:5 THRU 1800:5	3	**104**
76RL	2000:5	3	**124**
76SFT	200:5 THRU 800:5	3	**72**
76SFT	1000:5 THRU 1800:5	3	**104**
76SFT	2000:5	3	**124**
76SHT	100:5 THRU 300:5	3	**144**
76SHT	400:5 THRU 800:5	3	**178**
5ARL	50:5 THRU 500:5	1.56	**68**
5ARL	600:5 THRU 1200:5	1.56	**84**
5ASFT	50:5 THRU 500:5	1.56	**110**
5ASHT	600:5 THRU 1200:5	1.56	**86**
5ASFT	50:5 THRU 500:5	1.56	**72**
5RBT	50:5 THRU 500:5	1.56	**68**
5RBT	600:5 THRU 1200:5	1.56	**84**
5DARL	50:5 THRU 600:5	1.56	**80**
5DARL	750:5 THRU 1000:5	1.56	**100**
6ARL,6ASHT, 6ASFT	100:5 THRU 600:5	2.06	**76**
6ARL,6ASHT, 6ASFT	750:5 THRU 1500:5	2.06	**106**

Current Transformers

Model Number	Current Ratio	Window (Inches)	List Price $
7ARL	50:5 THRU 600:5	2.50	**80**
7ARL	750:5 THRU 1600:5	2.50	**114**
7ASFT	50:5 THRU 600:5	2.50	**80**
7ASFT	750:5 THRU 1600:5	2.50	**114**
7ASHT	50:5 THRU 600:5	2.50	**80**
7ASHT	750:5 THRU 1600:5	2.50	**114**
8RL	200:5 THRU 1000:5	3.25	**124**
8RL	1200:5 THRU 1500:5	3.25	**140**
8RL	1600:5 THRU 2500:5	3.25	**184**
8RL	3000:5	3.25	**220**
8RL	3200:5 THRU 4000:5	3.25	**260**
8SHT	200:5 THRU 1000:5	3.25	**180**
8SHT	1200:5 THRU 1500:5	3.25	**194**
8SHT	1600:5 THRU 2500:5	3.25	**202**
8SHT	3000:5	3.25	**228**
8SHT	3200:5 THRU 4000:5	3.25	**272**
19RL	300:5 THRU 600:5	4.25	**120**
19RL	750:5 THRU 1200:5	4.25	**126**
19RL	1500:5 THRU 2000:5	4.25	**138**
19RL	2500:5 THRU 3000:5	4.25	**148**
19SHT	300:5 THRU 600:5	4.25	**120**
19SHT	750:5 THRU 1200:5	4.25	**126**
19SHT	1500:5 THRU 2000:5	4.25	**138**
19SHT	2500:5 THRU 3000:5	4.25	**148**
64	50:5 THRU 500:5	1.56	**78**
65	50:5 THRU 600:5	2	**92**
65	750:5 THRU 1500:5	2	**110**
66	50:5 thru 800:5	2.50	**104**
100	200:5 thru 600:5	4	**156**
100	800:5	4	**170**
100	1000:5 thru 1200:5	4	**212**

Current Transformers

Model Number	Current Ratio	Window (Inches)	List Price $
100	1500:5 THRU 2000:5	4	**246**
100	2500:5 THRU 3000:5	4	**296**
120	200:5 THRU 600:5	5.75	**184**
120	800:5	5.75	**198**
120	1000:5 THRU 1200:5	5.75	**234**
120	1500:5 THRU 2000:5	5.75	**252**
120	2500:5 THRU 3000:5	5.75	**268**
120	3500:5 THRU 4000:5	5.75	**314**
125	600:5 THRU 1200:5	6.31	**196**
125	1500:5 THRU 2000:5	6.31	**214**
125	2500:5 THRU 3000:5	6.31	**228**
125	3500:5 THRU 5000:5	6.31	**266**
126	400:5 THRU 1200:5	8.25	**292**
126	1500:5 THRU 2000:5	8.25	**320**
126	2500:5 THRU 3000:5	8.25	**338**
126	3200:5 THRU 4000:5	8.25	**380**
126	5000:5	8.25	**400**
135	50:5 THRU 750:5	5.75	**378**
135	800:5 THRU 1500:5	5.75	**388**
135	1600:5 THRU 2000:5	5.75	**406**
135	2500:5 THRU 3000:5	5.75	**428**
135	3200:5 THRU 4000:5	5.75	**492**
135	5000:5	5.75	**512**
140	50:5 THRU 600:5	8.13	**400**
140	800:5	8.13	**412**

Current Transformers

Model Number	Current Ratio	Window (Inches)	List Price $
140	1000:5 THRU 1200:5	8.13	**426**
140	1500:5 THRU 2000:5	8.13	**440**
140	2500:5 THRU 3000:5	8.13	**496**
140	4000:5	8.13	**530**
140	5000:5	8.13	**620**
140	6000:5	8.13	**738**
170	200:5 THRU 600:5	4.25	**120**
170	750:5 THRU 800:5	4.25	**134**
170	1000:5 THRU 1200:5	4.25	**162**
170	1500:5 THRU 2000:5	4.25	**200**
170	2500:5 THRU 3000:5	4.25	**234**
170	3500:5 THRU 4000:5	4.25	**264**
170RL	750:5 THRU 800:5	4.25	**134**
180SHT	75:5 THRU 600:5	4.25	**100**
180SHT	750:5 THRU 800:5	4.25	**114**
180SHT	1000:5 THRU 1200:5	4.25	**142**
180SHT	1500:5 THRU 2000:5	4.25	**178**
180SHT	2500:5 THRU 3000:5	4.25	**214**
180SHT	3500:5 THRU 4000:5	4.25	**242**
191	100:5 THRU 400:5	1.25	**138**
192	100:5 THRU 500:5	1.75	**128**
194	100:5 THRU 800:5	2.50	**104**
194	1000:5 THRU 1200:5	2.50	**138**
194	1500:5 THRU 1600:5	2.50	**154**
195	200:5 THRU 800:5	3.06	**116**

Current Transformers

Model Number	Current Ratio	Window (Inches)	List Price $
195	1000:5 THRU 1200:5	3.06	**160**
195	1500:5 THRU 2000:5	3.06	**178**
300	50:5 THRU 1000:5	3.75	**194**
300	1200:5 THRU 2000:5	3.75	**224**
197	400:5 THRU 800:5	3.12	**116**
197	1000:5 THRU 1200:5	3.12	**160**
197	1500:5 THRU 2000:5	3.12	**178**
780	50:5 THRU 600:5	6.50	**456**
780	750:5 THRU 1500:5	6.50	**490**
780	1600:5 THRU 3000:5	6.50	**516**
780	3200:5 THRU 4000:5	6.50	**544**
781	600:5MR	6.50	**616**
781	1200:5MR	6.50	**676**
781	2000:5MR	6.50	**684**
781	3000:5MR	6.50	**690**
781	4000:5MR	6.50	**704**
785	50:5 THRU 600:5	6.50	**846**
785	750:5 THRU 1500:5	6.50	**908**
785	1600:5 THRU 2500:5	6.50	**938**
785	3000:5 THRU 4000:5	6.50	**990**
786	600:5MR	6.50	**1006**
786	1200:5MR	6.50	**1068**
786	2000:5MR	6.50	**1098**
786	3000:5MR	6.50	**1140**

MVC Plus Series

Soft start & protect any AC motor

Motor and starter protection is taken to a new level by combining a high-end motor protection relay with a heavy duty solid state starter. Flexible control features and selectable ramping profiles to match any application... no need to compromise performance. High level circuit isolation via fiber optics (standard on all units) for safety and power quality immunity. Sealed NEMA 12 enclosures are standard equipment, not an expensive option.

The MVC Plus Series starter is designed to start AC motors in any fixed speed application. It provides maximum protection with "True Thermal Modeling," while allowing smooth, stepless control of acceleration and deceleration. The MVC Plus Series guarantees power control and protection for your most important assets.

Heavy-duty attitude highest rated power devices for maximum current carrying capacity. Rated at 500% for 60 seconds, the MVC Plus Series starter will never be the limiting factor in your application. Powerful sustained gate pulse insures reliable SCR firing without reactors (unlike "wimpy" pulse train designs that require a reactor to prevent SCR and motor damage) .

Advanced motor protection relay and ramp features programmable via the keypad or a laptop computer.
Fiber optically isolated low voltage compartment with up to 110kV BIL rating for safety and reliability.
Built-in 120V control power transformer; voltage and current metering.
Load-break / fault-make rated disconnect switch with door safety interlocking.
Visible grounding bar for safe operation.
Coordinated motor fuses with blown fuse indicators.
Line isolation vacuum contactor.
Fully rated bypass contactor for increased thermal capacity and optional across-the-line starting.
Heavy duty SCR stack assemblies with ring transformer isolation for reliable SCR gate firing.
RTD Option accepts up to 12 RTD inputs.
Zero sequence ground fault protection option.
Top entry, bottom exit with room for stress cones.
Removable entry plates for easy connections.
NEMA 12 gasketed enclosure (NEMA 3R optional).

Advanced Protection
True Thermal Modeling monitors the motor for excessive thermal conditions due to starting, running and even ambient conditions.
Retentive Thermal Memory for continuous overload protection even after a complete power loss.
MVC Plus remembers the last thermal condition of the motor, observes the off time via a real-time clock and adjusts the thermal model accordingly.
Non-Volatile Memory stores the thermal memory without the need for batteries.
True Time Thermal Tracking adjusts the thermal model for different cooling rates based on motor temperature, running state or power loss.
Dynamic Reset Response Reset is only allowed after the motor has sufficient thermal capacity for a successful restart.
Thermal Model Biasing adjusts for heating effects of phase current imbalance or optional RTD inputs.
Flexible Setup Choose the level of overload protection.
Programmable Trip Classes selectable from NEMA/UL Classes 5 - 30.
Dual Mode Protection separate trip curves for start and run modes (example: Class 20 for start, Class 10 for run).
Warning Levels can be programmed and assigned to one of six built-in output relays.
Custom Trip Curve programmable based on the motor manufacturer’s data
Remote or Automatic Overload Reset can be activated for unattended operations.

MVC Plus Series Model Ratings

MVC Plus Series Model Ratings (Motor FLA x Service Factor = Max Amps)					COMPLETE STARTER CLASS E-2 CONTROLLER	
Model Number	**Nominal Voltage**	**Max Amps**	**Nominal HP**	**Nominal kW**	**Approx. Dimensions: H x W x D (in)**	**List Price $**
MVC4-23100-E-SWG	2300	100	350	261	92.5 x 36 x 30	**35,000**
MVC4-23200-E-SWG		200	700	522		**37,000**
MVC4-23400-E-SWG		400	1,400	1044		**38,500**
MVC4-23600-E-SWG		630	2,200	1,300	92.5 x72 x 30	**65,000**
MVC4-23800-E-SWG		800	2,800	1,600		**70,000**
MVC4-33100-E-SWG	3300	100	500	373	92.5 x 36 x 30	**38,500**
MVC4-33200-E-SWG		200	1,000	746		**45,000**
MVC4-33400-E-SWG		400	2,000	1,492		**48,000**
MVC4-33600-E-SWG		630	3,150	2,350	95 x 84 x 44	**77,000**
MVC4-33800-E-SWG		800	4,000	2,984		**84,000**
MVC4-41100-E-SWG	4160	100	600	448	92.5 x 36 x 30	**43,000**
MVC4-41200-E-SWG		200	1,250	933		**47,600**
MVC4-41400-E-SWG		400	2,500	1,865		**52,600**
MVC4-41600-E-SWG		630	4,000	2,984	95 x 84 x 44	**103,000**
MVC4-41800-E-SWG		800	5,000	3,730		**120,500**
MVC4-411000-E-SWG		1,000	6,350	4,737	95 x 84 x 80	**250,000**
MVC4-66100-E-SWG	6600	100	1,000	746	92.5 x 42 x 30	**45,500**
MVC4-66200-E-SWG		200	2,000	1,492		**55,000**
MVC4-66400-E-SWG		400	4,000	2,984		**60,400**
MVC4-66600-E-SWG		630	6,350	4,737	92.5 x 117 x 30	**117,400**
MVC4-66800-E-SWG		800	8,000	5,968		**150,400**
MVC4-661000-E-SWG		1,000	10,000	7,460	95 x 84 x 80	**275,000**
MVC4-69100-E-SWG	6.9kV	100	1,000	746	92 x 72 x 30	**50,540**
MVC4-69200-E-SWG		200	2,100	1,567		**61,500**
MVC4-69400-E-SWG		400	4,200	3,133		**67,500**
MVC4-69600-E-SWG		630	6,650	4,961	92.5 x 117 x 30	**130,800**
MVC4-69800-E-SWG		800	8,000	5,968		**195,000**
MVC4-691000-E-SWG		1,000	10,500	7,833	95 x 84 x 80	**290,000**

MVC Plus Series Model Ratings (Motor FLA x Service Factor = Max Amps)					COMPLETE STARTER CLASS E-2 CONTROLLER	
Model Number	**Nominal Voltage**	**Max Amps**	**Nominal HP**	**Nominal kW**	**Approx. Dimensions: H x W x D (in)**	**List Price $**
MVC4-72100-E-SWG	7.2KV	100	1,100	821	92 x 72 x 30	**52,600**
MVC4-72200-E-SWG		200	2,200	1,641		**64,740**
MVC4-72400-E-SWG		400	4,400	3,282		**70,500**
MVC4-72600-E-SWG		630	7,000	5,222	92.5 x 117 x 30	**137,950**
MVC4-72800-E-SWG		800	8,800	6,565		**205,000**
MVC4-721000-E-SWG		1000	11,000	8,206	95 x 84 x 80	**304,600**
MVC4-110100-E-SWG	11kV	100	1,700	1,268	95 x 126 x 44	**230,000**
MVC4-110200-E-SWG		200	3,400	2,536		**245,200**
MVC4-110400-E-SWG		400	6,700	4,998		**264,900**
MVC4-110600-E-SWG		630	10,600	7,908		**345,700**
MVC4-110800-E-SWG		800	13,500	10,071	95 x 120 x 80	**450,600**
MVC4-1101000-E-SWG		1000	16,500	12,309		**480,000**
MVC4-138100-E-SWG	13.8kV	100	2,100	1,567	95 x 126 x 44	**264,900**
MVC4-138200-E-SWG		200	4,200	3,133		**287,300**
MVC4-138320-E-SWG		320	6,750	5,035		**314,400**
MVC4-138400-E-SWG		400	8,500	6,341		**324,700**
MVC4-138600-E-SWG		600	12,500	9,325	95 x 120 x 80	**500,800**
MVC4-138800-E-SWG		800	17,000	12,682		**650,900**
MVC4-1381000-E-SWG		1,000	21,000	15,666		**700,600**

MVC DOL - Full Voltage Starters

The MVC DOL series full voltage starters combine the protection and monitoring capabilities of our MVC4 series soft starters with the economics of a full voltage starter.

Each MVC DOL starter includes:

- All protection and monitoring features and functions of the MVC4 Series Soft Starter
- Isolated load break rated disconnect switch
- Interlocked door to prevent access unless main power is “OFF”
- Current limiting fuses
- 7.2kV rated main vacuum contactor
- 3-Phase PT/CPT for voltage metering and control power
- Current transformers sized for your application
- An isolated low voltage section
- The RX -5 Multifunction Motor Protection Relay

MVC Plus Series Model Ratings (Motor FLA x Service Factor = Max Amps)					**DOL STARTER**	**List Price $**
Model Number (2)	**Nominal Voltage**	**Max Amps**	**Nominal HP**	**Nominal kW**	**Dimensions: H x W x D (in)**	
MVC4-23200-E-DOL	2300	200	700	526	92 x 36 x 30	**16,500**
MVC4-23400-E-DOL		400	1,400	1052		**17,500**
MVC4-23600-E-DOL		630	2,200	1657	92.5 x 72 x 30	**34,200**
MVC4-41200-E-DOL	4160	200	1,250	952	92 x 36 x 30	**16,500**
MVC4-41400-E-DOL		400	2,500	1900		**17,500**
MVC4-41600-E-DOL		630	4,000	3000	92.5 x 72 x 30	**34,200**

MVC Series Accessory Pricing		List Price $
Options		
GF Option adder for units up to 600 Amps		1,320
GF Option adder for units 800 Amps and above		1,560
Emergency OL Relay Option (for use with across line start mode)		1,200
Add Contactors (Multi-motor, inline on soft start only, etc.)		
2300 - 4160V	200A	4,000
	400A	7,200
	600A	9,600
6600 / 6900V	400A	8,400
	600A	12,200
Reversing Contactors		
2300 / 3300 / 4160V	200A	11,000
	400A	11,400
	600A	12,600
6600 / 6900V	400A	12,400
	600A	16,400
Bus Bars & Bus Slice Kits		
800A bus bars		990
800A Bus splice kits		462
1200A bus bars		1,980
1200A bus splice kits		660
1600A bus bars		2,640
1600A Bus splice kits		990
2000A bus bars		4,290
2000A bus splice kits		1,650
Incoming Sections		
18" empty pull section		2,760
24" empty pull section		3,120
PFC switch section		C/F
Extra sections w/ LV comp	36" Wide	4,800
	60" wide	7,200
Switch only sections w/ LV comp (up to 5kV class)		
Note: fuses supplied separately (C/F for pricing)	24" wide w/ 400A switch	10,334
	30" wide w/ 400A switch	11,290
	36" wide w/ 400A switch	11,486
	36" wide w/ 600A switch	18,140
	36" wide w/ 800A switch	19,300
	36" wide w/ 1200A switch	21,050
Space heater w/ Thermostat (per enclosure)		
400W		800
600W		1,200
Synchronous Controller (C/F for brush type & other ratings)		
Brushless (125VDC, 15A or less)		24,500
Brush Type		C/F

MVC Plus Series Options *Cont.*

MVC Series Accessory Pricing *Cont.*	List Price $
Pushbuttons and Pilot Lights (C/F for custom control scheme)	
Pushbuttons (run, stop, jog, reset, etc..)	**160**
Mushroom head stop PB	**210**
Illuminated PB (specify color & function)	**320**
Pilot light	**230**
Push to test light	**300**
Selector Switches (C/F for custom control scheme)	
H-O-A or Local-Off-Remote switch (3 position)	**320**
Dual Ramp Switch (2 position)	**280**
RTD Options: Standard Unit Options	
Option RTD (board & hardware only)	**1500**
Option RTD-Wire (same as above but wired to terminal block)	**1900**
RTD OEM Kit Options	
Option RTD-KIT, includes: DSS1000-RTD remote RTD TCB and all plug connectors (no wire)	**1,825**
70-RTDWIRE (12) 6' cables for above	**325**
Communications Bridges (Modbus is standard)	
Profibus DP	**3,500**
DeviceNet	**3,500**
Ethernet / IP	**3,500**
Miscellaneous	
Conformal Coating of PC boards	**1,000**
1kVA CPT (100-400A soft start only model)	**1,600**
Lightning Arrestor (6kV station class with fusing in 36" wide enclosure)	**7,000**
Power factor correction capacitor	**C/F**
3rd Party Meters and Motor Protection Relays	**C/F**
Miscellaneous Services:	
Certifications (Cost per model rating, contact factory for quote on other certifications)	
DNV (Det Norske Veritas)	**10,000**
ABS (American Bureau of Shipping)	**3,600**

MVC Plus Series Spare Parts

Description / Rating	Range	Model Number	Qty per Unit	List Price $ ea.
SCR/Heatsink assembly with boards (One phase assembly) see Note 1				
2300V	100A	**MVC3-STK23100P**	3	**3,288**
	200A	**MVC3-STK23200P**	3	**3,616**
	400A	**MVC3-STK23400P**	3	**4,060**
	500A	**MVC3-STK23500P**	3	**5,250**
	600A	**MVC3-STK23600P**	3	**6,560**
3300V	100A	**MVC3-STK33100P**	3	**4,936**
	200A	**MVC3-STK33200P**	3	**5,922**
	400A	**MVC3-STK33400P**	3	**6,642**
	500A	**MVC3-STK33500P**	3	**10,500**
	600A	**MVC3-STK33600P**	3	**13,126**
	800A	**MVC3-STK33800P**	3	**C/F**
4160V	100A	**MVC3-STK41100P**	3	**4,936**
	200A	**MVC3-STK41200P**	3	**5,922**
	400A	**MVC3-STK41400P**	3	**6,642**
	500A	**MVC3-STK41500P**	3	**10,500**
	600A	**MVC3-STK41600P**	3	**13,126**
	800A	**MVC3-STK41800P**	3	**C/F**
6000/6600 V	100A	**MVC3-STK66200P**	3	**8,374**
	200A	**MVC3-STK66200P**	3	**8,976**
	400A	**MVC3-STK66400P**	3	**9,136**
	600A	**MVC3-STK66600P**	3	**12,324**
6900/7200 V	100A	**MVC3-STK72100P**	3	**8,814**
	200A	**MVC3-STK72200P**	3	**9,450**
	400A	**MVC3-STK72400P**	3	**9,615**
	600A	**MVC3-STK72600P**	3	**12,975**
13.8kV	125A	**MVC3-STK-130125**	3	**39,030**
	200A	**MVC3-STK-130200**	3	**42,932**
	300A	**MVC3-STK-130300**	3	**46,836**
	600A	**MVC3-STK-130600**	3	**51,276**

NOTES:

1 - These items are recommended as spare parts
2 – For aftermarket replacement parts, <u>always verify correct part numbers with factory prior to ordering</u>

MVC Plus Series Spare Parts *Cont.*

Description / Rating	Range	Model Number	Qty per Unit	List Price $ ea.
SCR(s) and Heatsink assembly				
2300V (one set of 2)	100A	**25-0100-6500-23**	3	**2,000**
2300V (one set of 2)	200A	**25-0200-6500-23**	3	**C/F**
2300V (one set of 2)	400A	**25-0400-6500-23**	3	**2,700**
2300V (one set of 2)	500A	**25-0500-6500-23**	3	**3,000**
2300V (one set of 2)	600A	**25-0600-3500-23**	3	**3,500**
3300/4160V (one set of 4)	100A	**25-0100-6500-41**	3	**3,194**
3300/4160V (one set of 4)	200A	**25-0200-6500-41**	3	**3,514**
3300/4160V (one set of 4)	400A	**25-0400-6500-41**	3	**3,500**
3300/4160V (one set of 4)	500A	**25-0500-6500-41**	3	**6,990**
3300/4160V (one set of 4)	600A	**25-0600-3500-41**	3	**7,200**
6600/7200V (two sets of 4 and one set of 2)	100A	**25-0100-6500-72**	3	**7,600**
6600/7200V (two sets of 4 and one set of 2)	200A	**25-0200-6500-72**	3	**8,050**
6600/7200V (two sets of 4 and one set of 2)	400A	**25-0400-6500-72**	3	**8,450**
6600/7200V (three sets of 4)	500A	**25-0500-3500-72**	3	**C/F**
6600/7200V (three sets of 4)	600A	**25-0600-3500-72**	3	**C/F**
13.8kV (three sets of 4)	300A	**25-0300-6500-38**	3	**C/F**
13.8kV (three sets of 4)	600A	**25-0600-6500-38**	3	**C/F**

NOTE: For aftermarket replacement parts, <u>always verify correct part numbers with factory prior to ordering</u>

MVC Plus Series Spare Parts *Cont.*

Description / Rating	Range	Model Number	Qty per Unit	List Price $ ea.
Gate Drive Transformer (Ring transformer)				
2300V	≤ 400A	**10-0090**	3	**430**
	≥ 500A	**10-0090**	6	**430**
3300 / 4160V	≤ 400A	**10-0090**	6	**430**
	≥ 500A	**10-0090**	12	**430**
6600 / 7200V	≤ 400A	**10-0090**	9	**430**
	≥ 500A	**10-0090**	12	**430**
13.8kV	≤ 600A	**10-0090A**	18	**430**
Potential Transformers				
2300V	All	**10-0068**	1	**1,272**
3300V	All	**10-0072-50**	1	**1,300**
4160V	All	**10-0067**	1	**1,272**
6600 / 7200V	All	**10-0084**	1	**1,760**
13.8kV	All	**10-0103**	2	**C/F**
Control Power Transformers				
2300V	All	**10-0080**	1	**960**
3300V	All	**10-0081**	1	**1,300**
4160V	All	**10-0083**	1	**1,376**
6600 / 7200V	All	**10-0084**	1	**1,760**
13.8kV	All	**10-0104**	1	**C/F**
CT Boards				
-	100 - 400A	**MVC3-Temp/CT-PS**	3	**360**
-	600, 800A & 13.8kV	**MVC3-3CT**	1	**660**
Gate Drive Boards				
2300V	≤ 400A	**MVC3-GDF**	3	**647**
	≥ 500A	**MVC3-GDFP**	6	**750**
3300 / 4160V	≤ 400A	**MVC3-GDF**	6	**647**
	≥ 500A	**MVC3-GDFP**	12	**750**
6600 / 7200V	≤ 400A	**MVC3-GDF**	15	**647**
	≥ 500A	**MVC3-GDFP**	18	**750**
13.8kV	≤ 300A	**MVC3-GDF**	18	**647**
	≥ 600A	**MVC3-GDFP**	18	**750**

NOTE: For aftermarket replacement parts, <u>always verify correct part numbers with factory prior to ordering</u>

MVC Plus Series Spare Parts *Cont.*

Description / Rating	Range	Model Number	Qty per Unit	List Price $ ea.
MOV Boards				
2300V	≤ 400A	**MVC3-MOV**	3	**428**
	≥ 500A	**MVC3-MOV**	6	**428**
3300 / 4160V	≤ 400A	**MVC3-MOV**	6	**428**
	≥ 500A	**MVC3-MOV**	12	**428**
6600 / 7200V	≤ 400A	**MVC3-MOV**	15	**428**
	≥ 500A	**MVC3-MOV**	18	**428**
dv/dt Boards				
2300V	≤ 400A	**MVC3-DVDT**	3	**540**
	≥ 500A	**MVC3-DVDT-5-200**	6	**540**
3300 / 4160V	≤ 400A	**MVC3-DVDT**	6	**540**
	≥ 500A	**MVC3-DVDT-5-200**	12	**540**
6600 / 7200V	≤ 400A	**MVC3-DVDT**	15	**540**
	≥ 500A	**MVC3-DVDT-5-200**	18	**540**
13.8kV	≤ 300A	**MVC3-DVDT-150**	18	**540**
	≥ 600A	**MVC3-DVDT-5-200**	36	**540**
Main board, CPU board & digital controller assembly with lexan cover & harness	All ratings	**MVC3-MB/CPU-KIT (Note 1)**	1	**4,400**
Main board & CPU board (stacked) w/ jumper connector	All ratings	**MVC3-MB/CPU-MTR**	1	**3,400**
Digital controller with lexan cover & harness	All ratings	**DSS1000-COM-KIT**	1	**1,130**
Control board	All ratings	**MVC3-TCB**	1	**570**
RTD board	All ratings	**DSS1000-RTD**	1	**1,500**

NOTES:

1 - These items are recommended as spare parts
2 – For aftermarket replacement parts, <u>always verify correct part numbers with factory prior to ordering</u>

MVC Plus Series Spare Parts *Cont.*

Description / Rating	Range	Model Number	Qty per Unit	List Price $ ea.
Medium Voltage Fuses (Note 1)				
2300V	FLA dependent (check unit for actual fuse rating used)	**52-9R-2400**	3	**642**
		52-12R-2400	3	**700**
		52-18R-2400	3	**1,140**
3300 / 4160V		**52-9R-4800**	3	**510**
		52-12R-4800	3	**594**
		52-18R-4800	3	**948**
6600 / 7200V		**52-9R-7200**	3	**852**
		52-12R-7200	3	**900**
		52-18R-7200	3	**1,476**

Contactors (Contact factory for pricing on export models)				
2300V-7200V	200A Vacuum	**34-200-3-7200**	2	**5,326**
	400A Vacuum	**34-400-3-7200**	2	**7,790**
	600A Vacuum	**34-600-3-7200**	2	**10,992**

NOTES:

1 - These items are recommended as spare parts
2 – For aftermarket replacement parts, always verify correct part numbers with factory prior to ordering

MVF Series - Medium Voltage Contactors

MVF Series Medium Voltage Contactors

Motortronics MVF Series 7.2kV Class, ‘Non-Latching’ and ‘Latching’ Series of medium voltage three-phase vacuum contactors can be used in power systems with a rated voltage up to 7.2 kV and can be used for continuous AC operating currents of up to 400 amperes. Control voltage for the contactor is AC/DC 100~125V or AC/DC 200~230V*, including an auxiliary relay with 3 NO and 2NC contacts.

Non-Latching - uses constant-on electromagnetic coils to close, and hold closed the vacuum bottle contacts. When the power to the electromagnetic coil is removed, the vacuum chamber contacts spring open (termed as; electrically held contacts or non-latching contacts).

Latching - uses separate coils and mechanisms to both close and open the vacuum bottle contacts (termed as; mechanically held or latching, contacts).

Non-Latching Model Number	Rated Voltage	Rated Current (Amps)	Configuration	List Price $
34-72-4-C-X-0-3-0-12	7.2kV	400A	Fixed Mount, Dbl Terminal w/o counter, non-fused, 120VAC control.	**3,058**
34-72-4-C-B-F1-0-12	7.2kV	400A	Draw-out, Compartment Style, non-fused, 120VAC control.	**4,850**
Latching Model Number	**Rated Voltage**	**Rated Current (Amps)**	**Configuration**	**List Price $**
34-72-4-L-X-0-3-0-12	7.2kV	400A	Fixed Mount, Dbl Terminal w/o counter, non-fused, 120v control.	**3,058**
34-72-4-L-B-F1-0-12	7.2kV	400A	Draw-out, Compartment Style, non-fused, 120v control.	**4,850**

***For 200 – 230V control, contact factory for price and availability.**

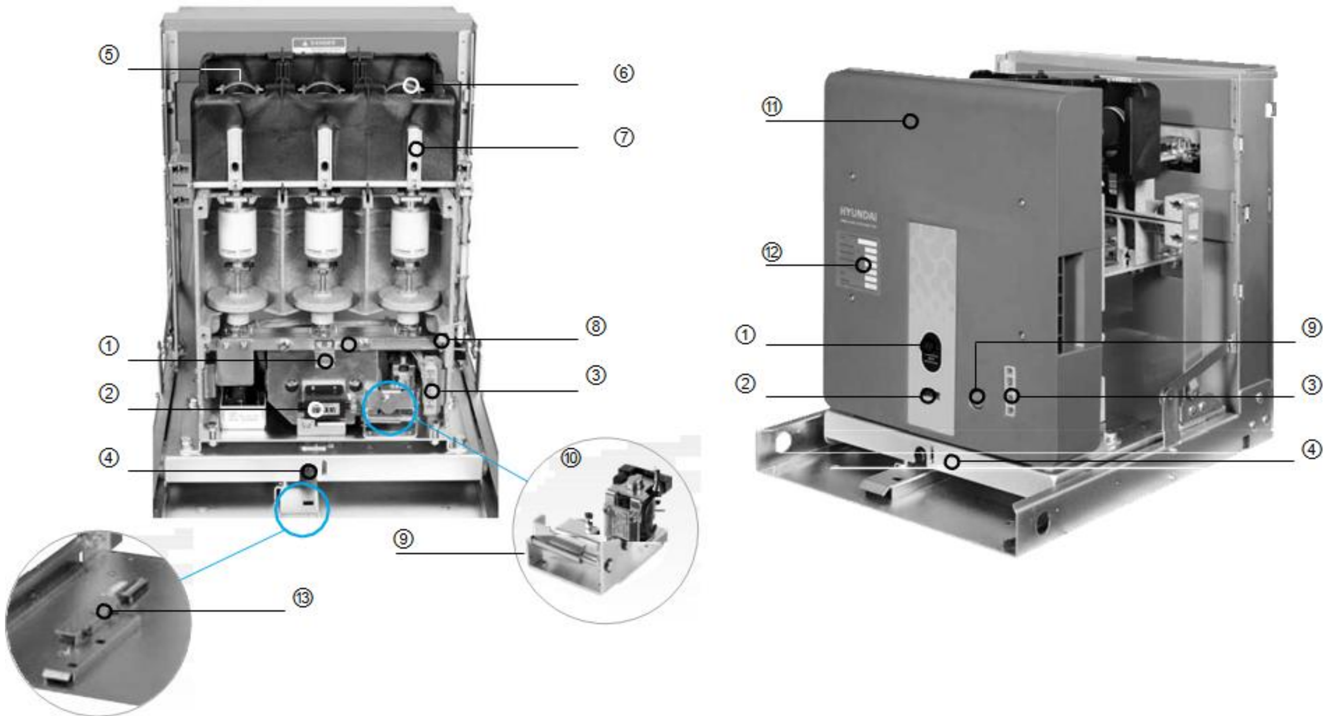
MVF Series - 7.2kV MV Contactors Specifications

Specification		**Fixed type without fuse**	**Draw-out type without fuse**
Type	**Continuously energized**	**34-72-4-C-X-0-3-0-12**	**34-72-4-C-B-F1-0-12**
	Latched	**34-72-4-L-X-0-3-0-12**	**34-72-4-L-B-F1-0-12**
Rated insulation voltage (kV)		7.2 kV	
Rated operation voltage (kV)		6.6 kV	
Rated frequency (Hz)		50/60 Hz	
Rated current (A)		400 A	
Impulse withstand voltage (kV) (BIL)		60 kV	
Power frequency withstand voltage (kV/min)		20 kV/min	
Control dielectric strength (kV/min)		2 kV/min	
Making and breaking capability (kA)		4 kA	
Breaking Capacity (kA, O-3min-CO-3min-CO)	E1	4 (50 MVA@7.2 kV)	
	E2	50 @7.2 kV	
Peak current (kA)	1 sec	6.3 kA	
	30 sec	3 kA	
Mechanical Endurance	Continuously energized	1,000,000 operations	
	Latched	300,000 operations	
Control voltage(V)		AC/DC 100~125 V	
Auxiliary contact		3 Normally Open and 2 Normally Closed Contacts	
Applicable load capacity	Motor (kW)	3000 kW	
	Transformer (kVA)	4000 kVA	
	Condenser (KVAR)	2000 KVAR	
Weight (kg / lbs.)		19 kg / 42 lbs.	35 kg / 77 lbs.

Operating Time and Current	**Closing Current (A)**	**Holding Current (A)**	**Opening Current (A)**	**Closing Time(ms)**	**Opening Time(ms)**
Continuously Energized Type	3	0.5	-	Max. 100	Max. 40
Latched Type	3	-	4	Max. 100	Max. 25

Control Voltage		
Closing	85~110 % of rated voltage	
Opening	75~110 % of rated voltage	
Rated Current of Auxiliary Contact		
Voltage	110 VAC	220 VAC
Rated Current	5 A	2 A
Operation condition		
Altitude	Less than 1,000 A.S.L	
Relative humidity	Below 85 %	
Ambient temperature	-5C ~ +40C	
Switching frequency	Not faster than 20 operations / 1 minute	
Required mounting direction	Horizontal or Vertical	
Additional Ratings		
Drop-out control voltage	AC/DC 25 V	
Chopping current	1 A	

MVF Series - 7.2kV MV Contactors Structure



① ON/OFF indicator, ON means closed condition, OFF means open condition.

② Counter The counter shows how many times the contactor has operated since it was produced.

③ Control plug. The control source is supplied through the control Jack.

④ Draw-out button

⑤ Fuse. Fuses prevent the magnification of the short-circuit current.

⑥ Fuse holder

⑦ Fuse melting detector. The fuse melting detector can show electrically whether the fuse has blown or not.

⑧ Manual checking hole. A manual checking hole is used to close the contactor manually.

⑨ Emergency trip button. Only the latched types have the trip button which is used in emergencies.

⑩ Latch device

⑪ Front cover

⑫ Name plate

⑬ Position switch. Indicates electrically whether the contactor is in the TEST or CONNECTION position.

Low & Medium Voltage Transformers





INDOOR POTENTIAL TRANSFORMERS

Primary Voltage Range: 69V – 15.5kV

Secondary Voltage: 110/220V or 120/240V

CONTROL POWER TRANSFORMERS

Primary Voltage Range: 2.4 – 6.9kV

Secondary Voltage: 110/220V or 120/240V

VT Images shown for illustration purposes only.

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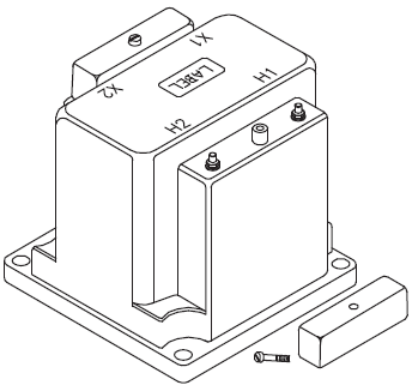

Frequency: 60 Hz
Insulation Level: 600V, 10 kV BIL full wave
Accuracy Class: 0.6 W 1.2 x 60 Hz
Weight: Approximately 7.75 lbs.
Thermal Rating:
150 VA at 30ºC amb. / 100 VA at 55ºC amb.
Standard Secondary Voltage: 120 Volts

Model Number	Rated Primary Voltage	Ratio	List Price $
460-069	69	0.58:1	**180**
460-120	120	1:1	**180**
460-208	208	1.73:1	**180**
460-240	240	2:1	**180**
460-277	277	2.31:1	**180**
460-288	288	2.4:1	**180**
460-300	300	2.5:1	**180**
460-346	346	2.88:1	**189**
460-480	480	4:1	**189**
460-600	600	5:1	**189**
460i-415	415 (50Hz)	3.46:1	**210**
460i-690	690 (50Hz)	6.27:1	**240**

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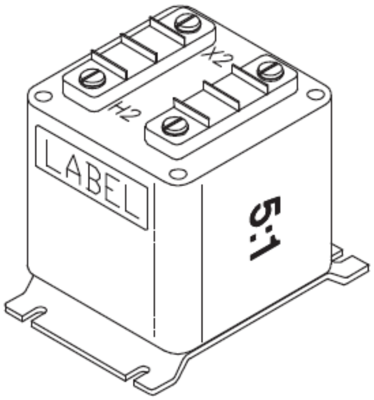

Frequency: 60 Hz
Insulation Level: 600V, 10 kV BIL full wave
Accuracy Class: + 1% at all burdens up to 5VA at 1.0 and 0.95 P.F.
Weight: Approximately 2.5 lbs.
Thermal Rating:
40 VA at 30ºC amb. / 27 VA at 55ºC amb.
Standard Secondary Voltage: 120 Volts

Model Number	Rated Primary Voltage	Ratio	List Price $
467-069	69	0.58:1	**175**
467-120	120	1:1	**175**
467-208	208	1.73:1	**175**
467-240	240	2:1	**175**
467-277	277	2.31:1	**175**
467-288	288	2.4:1	**175**
467-300	300	2.5:1	**175**
467-346	346	2.88:1	**175**
467-480	480	4:1	**175**
467-600	600	5:1	**175**

Primary Voltage 69 – 600V

Indoor Potential Transformer

Low Voltage

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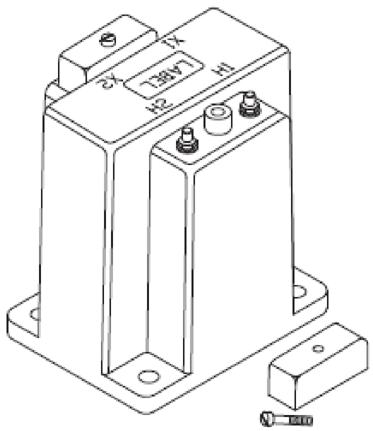

Frequency: 60 Hz
Insulation Level: 600V, 10 kV BIL full wave
Accuracy Class: + 0.6% at all burdens up to 7.5VA and + 1.5% with 20VA burden.
Weight: Approximately 4 lbs.
Thermal Rating:
75 VA at 30ºC amb. / 50 VA at 55ºC amb.
Standard Secondary Voltage: 120 Volts

Model Number	Rated Primary Voltage	Ratio	List Price $
468-069	69	0.58:1	**134**
468-120	120	1:1	**134**
468-208	208	1.73:1	**134**
468-240	240	2:1	**134**
468-277	277	2.31:1	**134**
468-288	288	2.4:1	**134**
468-300	300	2.5:1	**134**
468-346	346	2.88:1	**134**
468-480	480	4:1	**134**
468-600	600	5:1	**134**

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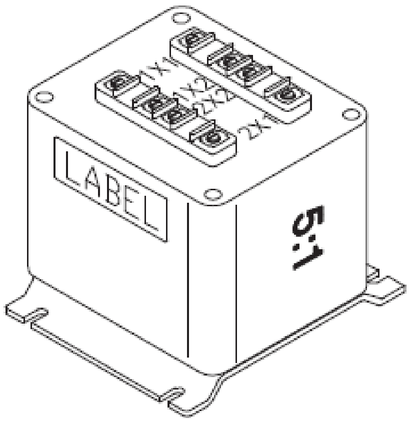

Frequency: 60 Hz
Insulation Level: 600V, 10 kV BIL full wave
Accuracy Class: + 1% at all burdens up to 5 VA at 1.0 and 0.95 P.F.
Weight: Approximately 4.5 lbs.
Thermal Rating:
40 VA at 30ºC amb. / 27 VA at 55ºC amb.
Standard Secondary Voltage: 120 Volts

Model Number	Rated Primary Voltage (Three Phase Input)	Ratio	List Price $
2VT469-069	69	0.58:1	**258**
2VT469-120	120	1:1	**258**
2VT469-208	208	1.73:1	**258**
2VT469-240	240	2:1	**258**
2VT469-277	277	2.31:1	**258**
2VT469-288	288	2.4:1	**258**
2VT469-300	300	2.5:1	**258**
2VT469-346	346	2.88:1	**275**
2VT469-480	480	4:1	**275**
2VT469-600	600	5:1	**275**

Primary Voltage 840 – 6.6kV

Indoor Potential Transformer

Medium Voltage

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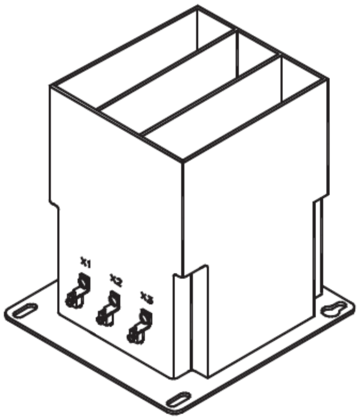


Frequency: 60 Hz
Accuracy Class: 0.3 WX, 0.6M, 1.2Y at 100% rated voltage with 120V based ANSI burden
Weight: Approximately 38 lbs.
Thermal Rating:
700 VA total, 350 VA per phase at 30ºC amb.
450 VA total, 225 VA per phase at 55ºC amb.
Standard Secondary Voltage: 120 Volts
Maximum System Voltage: 5.6 kV, 60 kV BIL full wave

Model Number Three Fuses	Rated Primary Voltage	Ratio	List Price $
3PT3-60-841FFF	840	7:1	**1,238**
3PT3-60-122FFF	1200	10:1	**1,238**
3PT3-60-242FFF	2400	20:1	**1,238**
3PT3-60-332FFF	3300	30:1	**1,210**
3PT3-60-422FFF	4200	35:1	**1,210**
3PT3-60-482FFF	4800	40:1	**1,302**
3PT3-60-552FFF	5500	50:1	**1,302**
3PT3-60-602FFF	6000	54:1	**1,302**
3PT3-60-662FFF	6600	55:1	**1,302**

Model Number Three Fuse Clips Only	Rated Primary Voltage	Ratio	List Price $
3PT3-60-841CCC	840	7:1	**1,126**
3PT3-60-122CCC	1200	10:1	**1,126**
3PT3-60-242CCC	2400	20:1	**1,126**
3PT3-60-332CCC	3300	30:1	**1,126**
3PT3-60-422CCC	4200	35:1	**1,126**
3PT3-60-482CCC	4800	40:1	**1,218**
3PT3-60-552CCC	5500	50:1	**1,218**
3PT3-60-602CCC	6000	54:1	**1,218**
3PT3-60-662CCC	6600	55:1	**1,218**

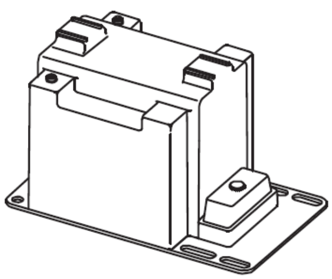
PTG3-1-60 & PTG3-2-60
PTW3-1-60 & PTW3-2-60

Indoor Potential Transformer

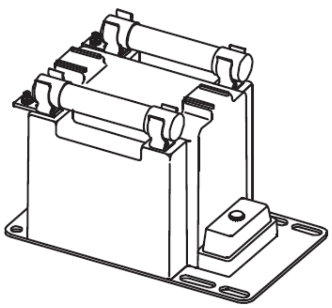
Medium Voltage

Visit www.motortronics.com for Specification Sheets

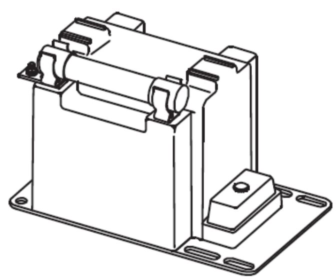
Frequency: 60 Hz
Accuracy Class: 0.3 WXMY, 0.6M, 1.2Z at 100% rated voltage with 120V based ANSI burden. 0.3 WX, 0.6M, 1.2 Y at 58% rated voltage with 69.3 V based ANSI burden
Weight: Approximately 34 lbs., unfused.
Thermal Rating: 750 VA at 30ºC amb. / 500 VA at 55ºC amb.
Standard Secondary Voltage: 120 Volts
Maximum System Voltage: 5.6 kV, 60 kV BIL full wave



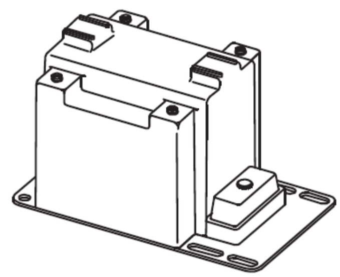
Unfused
Two Bushings
(one bushing not shown)



Two Fuses
Two Bushings



One Fuse
One Bushing



Switchgear Style
Two Bushings
(one bushing not shown)

Primary Voltage 2.4 – 6.9kV
Secondary Voltage 120V

Indoor Potential Transformer

Medium Voltage

Visit www.motortronics.com for Specification Sheets

Model Number Unfused – One Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTG3-1-60-242	2400	20:1	120	**902**
PTG3-1-60-332	3300	30:1	110 (50Hz)	**902**
PTG3-1-60-422	4200	35:1	120	**902**
PTG3-1-60-482	4800	40:1	120	**902**
PTG3-1-60-502	5000	41.66	120	**1,020**
PTG3-1-60-552	5500	45.83	120	**1,020**
PTG3-1-60-602	6000	50.00	120	**1,020**
PTG3-1-60-662	6600	55.00	120	**1,020**
PTG3-1-60-692	6900	57.50	120	**1,052**

Model Number Single Fuse – One Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTG3-1-60-242F	2400	20:1	120	**990**
PTG3-1-60-332F	3300	30:1	110 (50Hz)	**990**
PTG3-1-60-422F	4200	35:1	120	**990**
PTG3-1-60-482F	4800	40:1	120	**1,014**
PTG3-1-60-502F	5000	41.66	120	**1,065**
PTG3-1-60-552F	5500	45.83	120	**1,065**
PTG3-1-60-602F	6000	50.00	120	**1,065**
PTG3-1-60-662F	6600	55.00	120	**1,133**
PTG3-1-60-692F	6900	57.50	120	**1,167**

Model Number Single Fuse Clip Only – One Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTG3-1-60-242CS	2400	20:1	120	**947**
PTG3-1-60-332CS	3300	30:1	110 (50Hz)	**947**
PTG3-1-60-422CS	4200	35:1	120	**947**
PTG3-1-60-482CS	4800	40:1	120	**947**
PTG3-1-60-502CS	5000	41.66	120	**1,014**
PTG3-1-60-552CS	5500	45.83	120	**1,014**
PTG3-1-60-602CS	6000	50.00	120	**1,042**
PTG3-1-60-662CS	6600	55.00	120	**1,065**
PTG3-1-60-692CS	6900	57.50	120	**1,097**

Primary Voltage 2.4 – 6.9kV
Secondary Voltage 120V

Indoor Potential Transformer

Medium Voltage

Visit www.motortronics.com for Specification Sheets

Model Number Unfused – Two Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTG3-2-60-242	2400	20:1	120	**902**
PTG3-2-60-332	3300	30:1	110 (50Hz)	**902**
PTG3-2-60-422	4200	35:1	120	**902**
PTG3-2-60-482	4800	40:1	120	**902**
PTG3-2-60-502	5000	41.66	120	**1,020**
PTG3-2-60-552	5500	45.83	120	**1,020**
PTG3-2-60-602	6000	50.00	120	**1,020**
PTG3-2-60-662	6600	55.00	120	**1,020**
PTG3-2-60-692	6900	57.50	120	**1,052**

Model Number Two Fuses – Two Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTG3-2-60-242FF	2400	20:1	120	**990**
PTG3-2-60-332FF	3300	30:1	110 (50Hz)	**990**
PTG3-2-60-422FF	4200	35:1	120	**990**
PTG3-2-60-482FF	4800	40:1	120	**1,014**
PTG3-2-60-450FF	5000	41.66	120	**1,065**
PTG3-2-60-455FF	5500	45.83	120	**1,065**
PTG3-2-60-460FF	6000	50.00	120	**1,065**
PTG3-2-60-466FF	6600	55.00	120	**1,133**
PTG3-2-60-469FF	6900	57.50	120	**1,167**

Model Number Two Fuse Clips Only – Two Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTG3-2-60-242CCS	2400	20:1	120	**947**
PTG3-2-60-332CCS	3300	30:1	110 (50Hz)	**947**
PTG3-2-60-422CCS	4200	35:1	120	**947**
PTG3-2-60-482CCS	4800	40:1	120	**947**
PTG3-2-60-502CCS	5000	41.66	120	**1,014**
PTG3-2-60-552CCS	5500	45.83	120	**1,014**
PTG3-2-60-602CCS	6000	50.00	120	**1,042**
PTG3-2-60-662CCS	6600	55.00	120	**1,065**
PTG3-2-60-692CCS	6900	57.50	120	**1,097**

Primary Voltage 2.4 – 6.9kV
Secondary Voltage 120V

Indoor Potential Transformer

Medium Voltage

Visit www.motortronics.com for Specification Sheets

Model Number Unfused – One Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTW3-1-60-242	2400	20:1	120	**947**
PTW3-1-60-332	3300	30:1	110 (50Hz)	**947**
PTW3-1-60-422	4200	35:1	120	**947**
PTW3-1-60-482	4800	40:1	120	**947**
PTW3-1-60-502	5000	41.66	120	**1,065**
PTW3-1-60-552	5500	45.83	120	**1,065**
PTW3-1-60-602	6000	50.00	120	**1,065**
PTW3-1-60-662	6600	55.00	120	**1,065**
PTW3-1-60-692	6900	57.50	120	**1,097**

Model Number Single Fuse – One Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTW3-1-60-242F	2400	20:1	120	**1,035**
PTW3-1-60-332F	3300	30:1	110 (50Hz)	**1,035**
PTW3-1-60-422F	4200	35:1	120	**1,035**
PTW3-1-60-482F	4800	40:1	120	**1,059**
PTW3-1-60-502F	5000	41.66	120	**1,110**
PTW3-1-60-552F	5500	45.83	120	**1,110**
PTW3-1-60-602F	6000	50.00	120	**1,110**
PTW3-1-60-662F	6600	55.00	120	**1,178**
PTW3-1-60-692F	6900	57.50	120	**1,212**

Model Number Single Fuse Clips Only – One Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTW3-1-60-242CS	2400	20:1	120	**992**
PTW3-1-60-332CS	3300	30:1	110 (50Hz)	**992**
PTW3-1-60-422CS	4200	35:1	120	**992**
PTW3-1-60-482CS	4800	40:1	120	**992**
PTW3-1-60-502CS	5000	41.66	120	**1,059**
PTW3-1-60-552CS	5500	45.83	120	**1,059**
PTW3-1-60-602CS	6000	50.00	120	**1,059**
PTW3-1-60-662CS	6600	55.00	120	**1,110**
PTW3-1-60-692CS	6900	57.50	120	**1,142**

Primary Voltage 2.4 – 6.9kV
Secondary Voltage 120V

Indoor Potential Transformer

Medium Voltage

Visit www.motortronics.com for Specification Sheets

Model Number Unfused – Two Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTW3-2-60-242	2400	20:1	120	**947**
PTW3-2-60-332	3300	30:1	110 (50Hz)	**947**
PTW3-2-60-422	4200	35:1	120	**947**
PTW3-2-60-482	4800	40:1	120	**947**
PTW3-2-60-502	5000	41.66	120	**1,065**
PTW3-2-60-552	5500	45.83	120	**1,065**
PTW3-2-60-602	6000	50.00	120	**1,065**
PTW3-2-60-662	6600	55.00	120	**1,065**
PTW3-2-60-692	6900	57.50	120	**1,097**

Model Number Two Fuses – Two Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTW3-2-60-242FF	2400	20:1	120	**1,035**
PTW3-2-60-332FF	3300	30:1	110 (50Hz)	**1,035**
PTW3-2-60-422FF	4200	35:1	120	**1,035**
PTW3-2-60-482FF	4800	40:1	120	**1,059**
PTW3-2-60-502FF	5000	41.66	120	**1,059**
PTW3-2-60-552FF	5500	45.83	120	**1,059**
PTW3-2-60-602FF	6000	50.00	120	**1,059**
PTW3-2-60-662FF	6600	55.00	120	**1,178**
PTW3-2-60-692FF	6900	57.50	120	**1,212**

Model Number Two Fuse Clips Only – Two Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTW3-2-60-242CCS	2400	20:1	120	**992**
PTW3-2-60-332CCS	3300	30:1	110 (50Hz)	**992**
PTW3-2-60-442CCS	4200	35:1	120	**992**
PTW3-2-60-482CCS	4800	40:1	120	**992**
PTW3-2-60-450CCS	5000	41.66	120	**1,110**
PTW3-2-60-455CCS	5500	45.83	120	**1,110**
PTW3-2-60-460CCS	6000	50.00	120	**1,110**
PTW3-2-60-466CCS	6600	55.00	120	**1,110**
PTW3-2-60-469CCS	6900	57.50	120	**1,142**

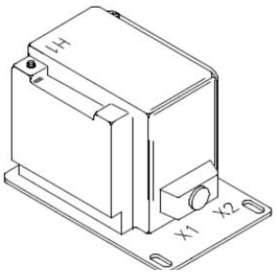
PTG5-1-60 & PTG5-2-60
PTW5-1-60 & PTW5-2-60

Indoor Potential Transformer

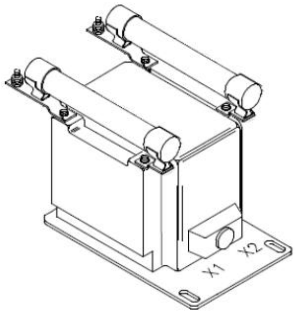
Medium Voltage

Visit www.motortronics.com for Specification Sheets

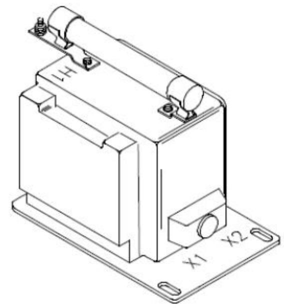
Frequency: 60 Hz
Accuracy Class: 0.3 WXMYZ, 1.2ZZ at 100% rated voltage with 120V based ANSI burden. 0.3 WXMY, 1.2 Z at 58% rated voltage with 69.3 V based ANSI burden
Weight: Approximately 85 lbs., unfused.
Thermal Rating: 1500 VA at 30ºC amb. / 1000 VA at 55ºC amb.
Standard Secondary Voltage: 120 Volts
Maximum System Voltage: 15.5 kV, 1100 kV BIL full wave



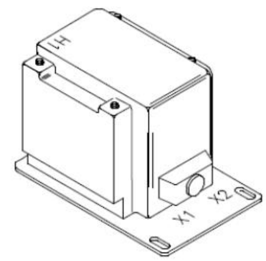
Unfused
Two Bushings
(one bushing not shown)



Two Fuses
Two Bushings



One Fuse
One Bushing



Switchgear Style
Two Bushings
(one bushing not shown)

Visit www.motortronics.com for Specification Sheets

Model Number Unfused – One Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTG5-1-110-722	7200	60:1	120	**1,521**
PTG5-1-110-842	8400	70:1	120	**1,521**
PTG5-1-110-113	11000	100:1	110 (50Hz)	**1,521**
PTG5-1-110-123	12000	100:1	120	**1,521**
PTG5-1-110-1322	13200	110:1	120	**1,521**
PTG5-1-110-1382	13800	115:1	120	**1,521**
PTG5-1-110-1442	14400	120:1	120	**1,521**

Model Number Single Fuse – One Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTG5-1-110-722F	7200	60:1	120	**1,660**
PTG5-1-110-842F	8400	70:1	120	**1,660**
PTG5-1-110-113F	11000	100:1	110 (50Hz)	**1,660**
PTG5-1-110-123F	12000	100:1	120	**1,660**
PTG5-1-110-1322F	13200	110:1	120	**1,660**
PTG5-1-110-1382F	13800	115:1	120	**1,660**
PTG5-1-110-1442F	14400	120:1	120	**1,660**

Model Number Single Fuse Clip Only – One Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTG5-1-110-242C	2400	60:1	120	**1,580**
PTG5-1-110-332C	3300	70:1	110 (50Hz)	**1,580**
PTG5-1-110-442C	4200	100:1	120	**1,580**
PTG5-1-110-482C	4800	100:1	120	**1,580**
PTG5-1-110-502C	5000	110:1	120	**1,580**
PTG5-1-110-552C	5500	115:1	120	**1,580**
PTG5-1-110-602C	6000	120:1	120	**1,580**

Primary Voltage 7.2 – 14.4kV
Secondary Voltage 120V

Indoor Potential Transformer

Medium Voltage

Visit www.motortronics.com for Specification Sheets

Model Number Unfused – Two Bushings	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTG5-2-110-722	7200	60:1	120	**1,561**
PTG5-2-110-842	8400	70:1	120	**1,561**
PTG5-2-110-113	11000	100:1	110 (50Hz)	**1,561**
PTG5-2-110-123	12000	100:1	120	**1,561**
PTG5-2-110-1322	13200	110:1	120	**1,561**
PTG5-2-110-1382	13800	115:1	120	**1,561**
PTG5-2-110-1442	14400	120:1	120	**1,561**

Model Number Two Fuses – Two Bushings	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTG5-2-110-722FF	7200	60:1	120	**1,700**
PTG5-2-110-842FF	8400	70:1	120	**1,700**
PTG5-2-110-113FF	11000	100:1	110 (50Hz)	**1,700**
PTG5-2-110-123FF	12000	100:1	120	**1,700**
PTG5-2-110-1322FF	13200	110:1	120	**1,700**
PTG5-2-110-1382FF	13800	115:1	120	**1,700**
PTG5-2-110-1442FF	14400	120:1	120	**1,700**

Model Number Two Fuse Clips Only – Two Bushings	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTG5-2-110-242CC	2400	60:1	120	**1,620**
PTG5-2-110-332CC	3300	70:1	110 (50Hz)	**1,620**
PTG5-2-110-442CC	4200	100:1	120	**1,620**
PTG5-2-110-482CC	4800	100:1	120	**1,620**
PTG5-2-110-502CC	5000	110:1	120	**1,620**
PTG5-2-110-552CC	5500	115:1	120	**1,620**
PTG5-2-110-602CC	6000	120:1	120	**1,620**

Primary Voltage 7.2 – 14.4kV
Secondary Voltage 120V

Indoor Potential Transformer

Medium Voltage

Visit www.motortronics.com for Specification Sheets

Model Number Unfused – One Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTW5-1-110-722	7200	60:1	120	**1,561**
PTW5-1-110-842	8400	70:1	120	**1,561**
PTW5-1-110-113	11000	100:1	110 (50Hz)	**1,561**
PTW5-1-110-123	12000	100:1	120	**1,561**
PTW5-1-110-1322	13200	110:1	120	**1,561**
PTW5-1-110-1382	13800	115:1	120	**1,561**
PTW5-1-110-1442	14400	120:1	120	**1,561**

Model Number Single Fuse – One Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTW5-1-110-722F	7200	60:1	120	**1,700**
PTW5-1-110-842F	8400	70:1	120	**1,700**
PTW5-1-110-113F	11000	100:1	110 (50Hz)	**1,700**
PTW5-1-110-123F	12000	100:1	120	**1,700**
PTW5-1-110-1322F	13200	110:1	120	**1,700**
PTW5-1-110-1382F	13800	115:1	120	**1,700**
PTW5-1-110-1442F	14400	120:1	120	**1,700**

Model Number Single Fuse Clip Only – One Bushing	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTW5-1-110-722C	2400	60:1	120	**1,620**
PTW5-1-110-842C	3300	70:1	110 (50Hz)	**1,620**
PTW5-1-110-113C	4200	100:1	120	**1,620**
PTW5-1-110-123C	4800	100:1	120	**1,620**
PTW5-1-110-1322C	5000	110:1	120	**1,620**
PTW5-1-110-1382C	5500	115:1	120	**1,620**
PTW5-1-110-1442C	6000	120:1	120	**1,620**

Primary Voltage 7.2 – 14.4kV
Secondary Voltage 120V

Indoor Potential Transformer

Medium Voltage

Visit www.motortronics.com for Specification Sheets

Model Number Unfused – Two Bushings	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTW5-2-110-722	7200	60:1	120	**1,561**
PTW5-2-110-842	8400	70:1	120	**1,561**
PTW5-2-110-113	11000	100:1	110 (50Hz)	**1,561**
PTW5-2-110-123	12000	100:1	120	**1,561**
PTW5-2-110-1322	13200	110:1	120	**1,561**
PTW5-2-110-1382	13800	115:1	120	**1,561**
PTW5-2-110-1442	14400	120:1	120	**1,561**

Model Number Two Fuses – Two Bushings	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTW5-2-110-722FF	7200	60:1	120	**1,700**
PTW5-2-110-842FF	8400	70:1	120	**1,700**
PTW5-2-110-113FF	11000	100:1	110 (50Hz)	**1,700**
PTW5-2-110-123FF	12000	100:1	120	**1,700**
PTW5-2-110-1322FF	13200	110:1	120	**1,700**
PTW5-2-110-1382FF	13800	115:1	120	**1,700**
PTW5-2-110-1442FF	14400	120:1	120	**1,700**

Model Number Two Fuse Clips Only – Two Bushings	Rated Primary Voltage	Ratio	Secondary Voltage	List Price $
PTW5-2-110-722CC	2400	60:1	120	**1,620**
PTW5-2-110-842CC	3300	70:1	110 (50Hz)	**1,620**
PTW5-2-110-113CC	4200	100:1	120	**1,620**
PTW5-2-110-123CC	4800	100:1	120	**1,620**
PTW5-2-110-1322CC	5000	110:1	120	**1,620**
PTW5-2-110-1382CC	5500	115:1	120	**1,620**
PTW5-2-110-1442CC	6000	120:1	120	**1,620**

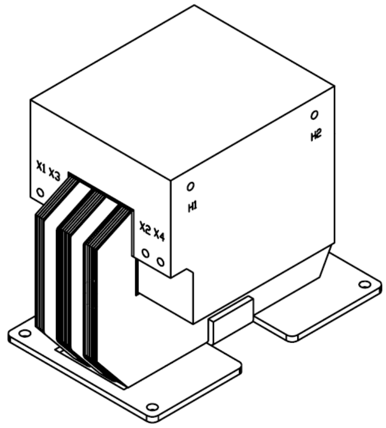
Primary Voltage 2.4 – 6.9kV
Secondary Voltage 110/220V, 120/240V

Control Power Transformer

Medium Voltage

Visit www.motortronics.com for Specification Sheets

* Secondary Voltage
"-5" Model 110/220
* Secondary Voltage
"-6" Model 120/240



Frequency: 50/60 Hz
Insulation Level: 6.9kV, 60 kV BIL full wave
Weight: Approximately 57 lbs.
Thermal Rating:
2.0 kVA at 30ºC amb.
Standard Secondary Voltage: 110/120 Volts

Model Number Three Fuses	Rated Primary Voltage	Ratio 110V "-5"	Ratio 120V "-6"	Rated VA	List Price $
CPT3-60-2-2400-*	2400	21.81	20.00	750	**834**
CPT3-60-2-3300-*	3300	30.00	27.50	750	**834**
CPT3-60-2-4160-*	4160	37.61	34.66	750	**834**
CPT3-60-2-4800-*	4800	43.63	40.00	750	**954**
CPT3-60-2-5000-*	5000	45.45	41.66	750	**954**
CPT3-60-2-5500-*	5500	50.00	45.83	750	**954**
CPT3-30-2-6000-*	6000	54.54	50.00	750	**954**
CPT3-60-2-6600-*	6600	60.00	55.00	750	**954**
CPT3-60-2-6900-*	6900	62.72	57.50	750	**954**

ABC Series Electric Brakes

ABC Series

Voltage Rating
Selected voltage ratings + 10%
Selectable for 50/60Hz + 2 Hz

Current Ratings
10 - 1000A in 10 sizes:
10, 24, 50, 100, 200, 300, 400, 550, 800, 1000A

Output Capacity
25% duty cycle at 100% unit rating (model dependant above 200 Amps)

Power Circuit
Full wave bridge, 4 SCRs, designed for use without isolation contactors

Transient Protection
RC snubber dv/dt circuit on each SCR device

Fusing
Approved for use with existing motor starter fusing when unit is sized for motor FLA. Consult NEC for any other fusing requirements.

Control Circuit
Self-powered directly from line terminals. No separate control voltage required.

Control Method
Microprocessor unit controls sequencing. I/O monitoring and status annunciation. Braking current is adjustable via true RMS regulated control using phase angle firing of SCRs.

Operator Adjustments
Brake Time and Jog Time = 7 position binary dipswitch
Brake Current = potentiometer

Adjustment Ranges
Brake Jog Times = 0 - 127 seconds in 1 second increments
Brake Current = Up to 100% unit rating

Inputs
Starter Monitor = Dry input for auxiliary contact from motor starter. Jumper selectable for N.O. or N.C. contact.
Brake Disable = Dry input for N.O. contact to disable braking before or during operation. Can be wired to the starter thermal overload N.O. auxiliary contact to prevent braking of overloaded motor.
Motor Power Sensor (T3) = voltage input used for sensing motor power presence in sequencing/status circuit and for zero speed sensing during braking.

Outputs
Starter Coil Interlock Two sets of FORM "C" relay contacts for use in interlocking the starter coil and/or other devices to prevent energizing while the braking power is applied.
Mechanical Brake Release N.O. relay contact for use in controlling electro-mechanical brake as a holding brake. When the ABC is "disabled," this circuit controls the mechanical brake normally as if it were the only brake in the system.

Aux Contact Ratings
5 amps, 250VAC max

LED Status Indicators
Large LEDs: Braking = green; Fault = red
Small LEDs: Power On, Jog/Armed, Brake Off, Disabled, Over Temp, and Wiring Error

Operating Design Temperature
0 - 50°C (32-122°F) open
0 - 40°C (32 - 104°) enclosed

Ambient Conditions
0 - 95% relative humidity
0 - 3300ft (1000M) elevation

Approvals UL, cUL Listed

ABC Series Model Ratings

ABC - 200 - [ ] - E

Max. Brake Amps
10 – 1000 A.

Voltage
240 = 208 – 240V, ***400*** = 380 – 415V
480 = 440 – 480V, ***600*** = 575 – 600V

Enclosure
P = Panel Mount
E = NEMA 4/12 Sealed

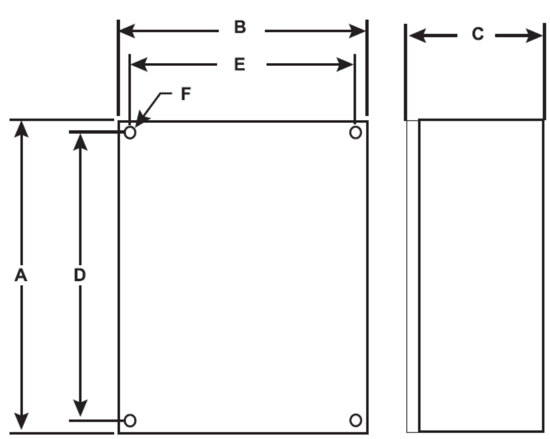
ABC SERIES													
Model Number*	Max Amps	Typical Horsepower Usage								List Price $			
		208 V		240V		480V		600V		Panel	Dim Ref. #	NEMA 4/12	Dim Ref. #
		Std. Duty	Extra Duty	Std. Duty	Extra Duty	Std. Duty	Extra Duty	Std. Duty	Extra Duty				
ABC-10	**10**	5	5	10	5	15	10	25	10	**1,331**	2	**1,697**	7
ABC-24	**24**	10	5	15	7.5	20	15	30	20	**1,398**	2	**1,782**	7
ABC-50	**50**	15	7.5	20	10	40	25	50	30	**1,464**	2	**1,867**	7
ABC -100	**100**	30	20	40	25	75	50	100	60	**1,783**	2	**2,264**	7
ABC-200	**200**	75	40	75	50	150	100	200	125	**2,529**	3	**3,021**	8
ABC-300	**300**	100	60	125	75	250	150	300	200	**3,581**	4	**4,272**	9
ABC-400	**400**	150	75	150	100	350	200	400	250	**4,312**	4	**5,031**	9
ABC-550	**550**	250	125	200	150	500	300	600	350	**5,178**	5	**5,870**	10
ABC -800	**800**	350	200	350	200	700	450	900	500	**7,853**	5	**8,533**	10
ABC-1000	**1000**	400	250	400	300	900	500	1000	600	**9,610**	5	**10,516**	10

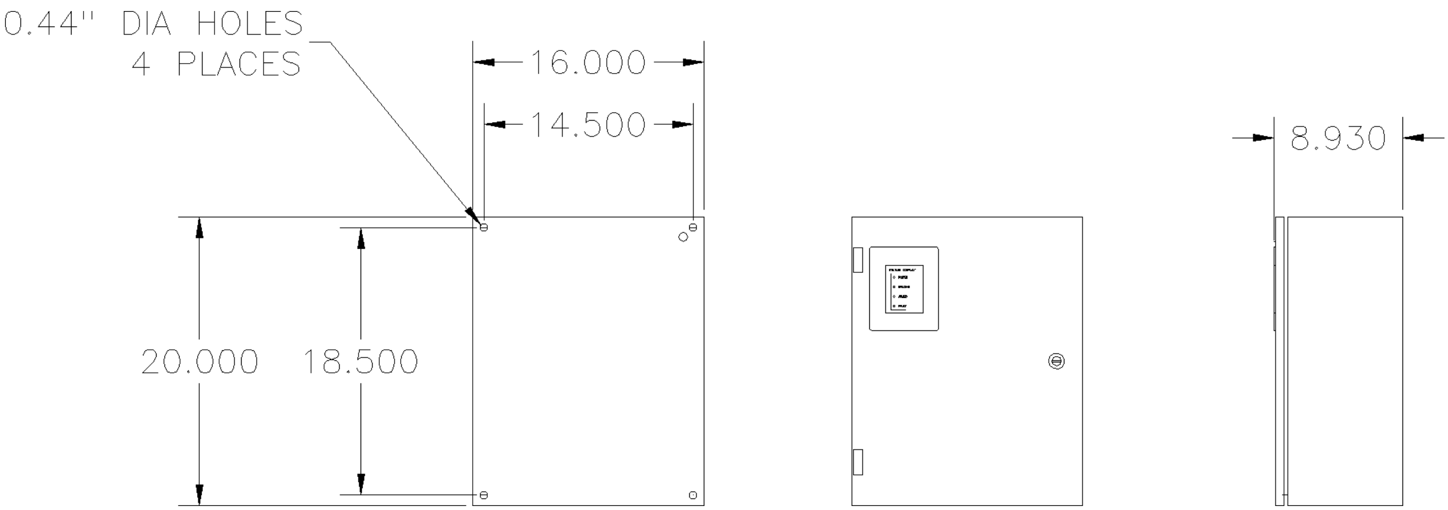
* Specify voltage and enclosure type when ordering.

NOTES:

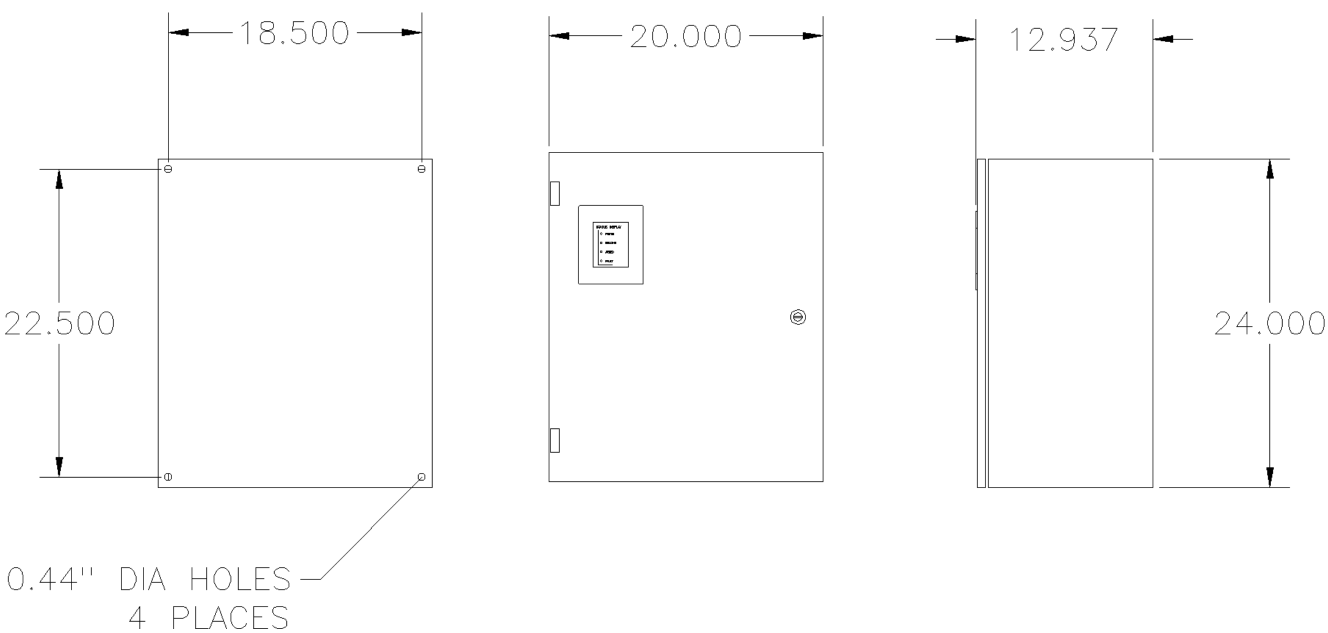
1. Never exceed the Full Load Amp rating of the motor without checking the motor manufacturer's data with regards to appropriateness of the application and duty cycle.
2. If duty cycle is not known, Motortronics recommends using the Extra Duty Brake since braking current can be adjusted down to meet the actual load requirements.

Dim Ref. #	Dimensions (Inches)					
	A	B	C	D	E	F
2	10.5	7.9	7.2	10	6.8	0.21
3	16.5	10	10	15.9	9	0.28
4	16	16	10	15	15	0.5
5	21	26	10.4	20	25	0.5
6	16	12	9	14.5	10.5	0.5
7	20	16	9	18.5	14.5	0.5
8	24	20	16	22.5	18.5	0.5
9	36	24	16	34.5	22.5	0.5
10	36	30	16	34.5	28.5	0.5

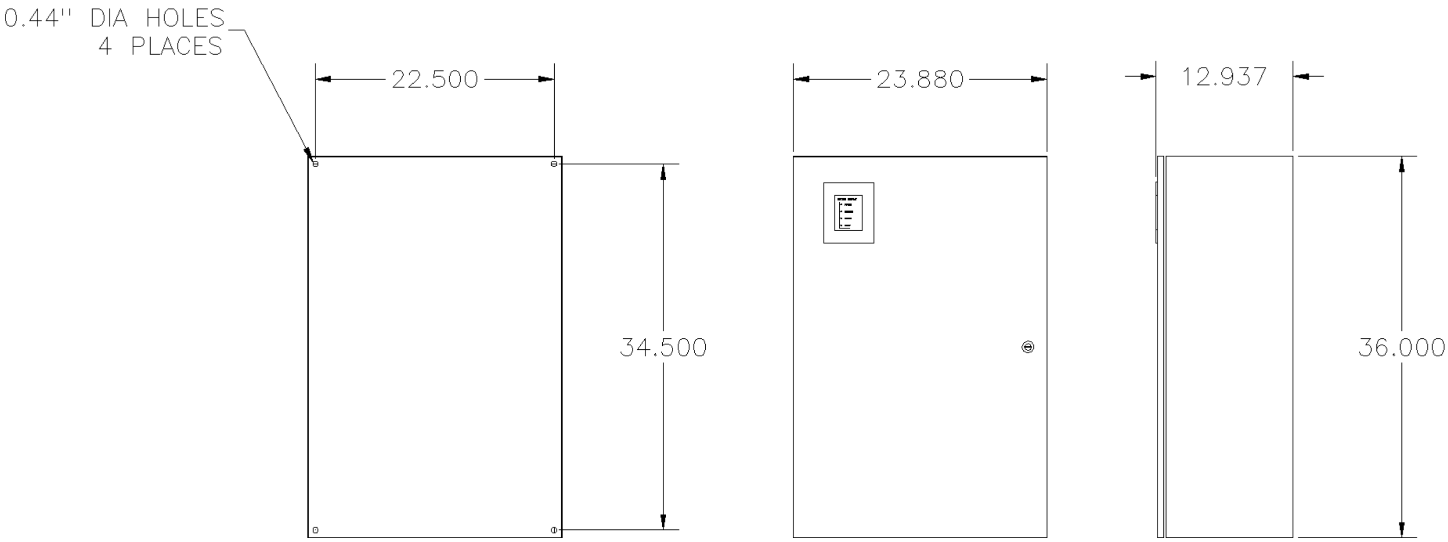




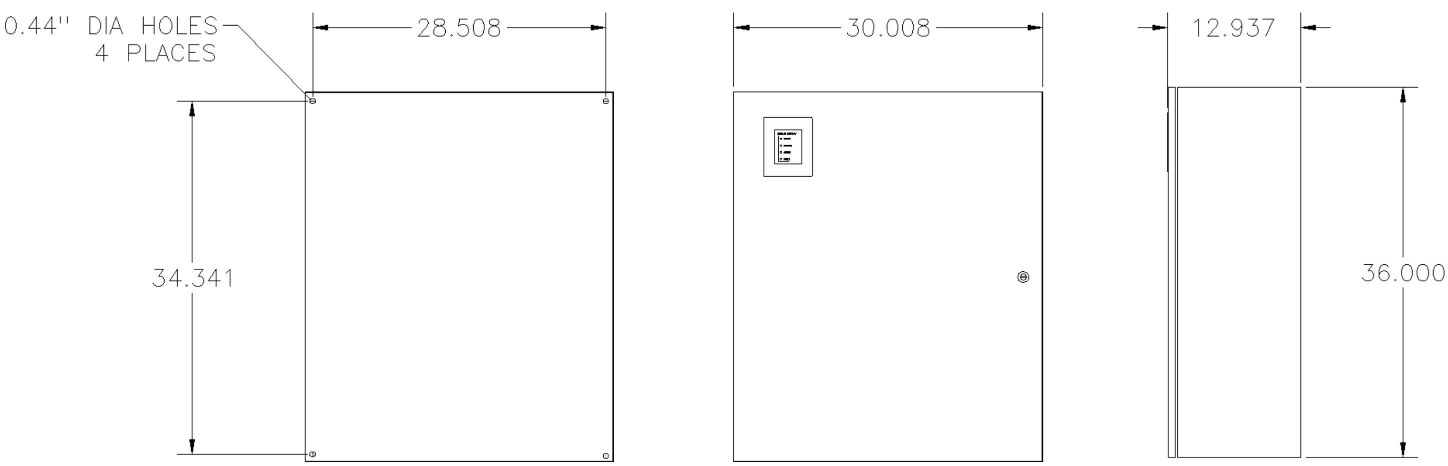
N4/12 Outline: ABC-10/24/50/100-E



N4/12 Outline: ABC-200-E

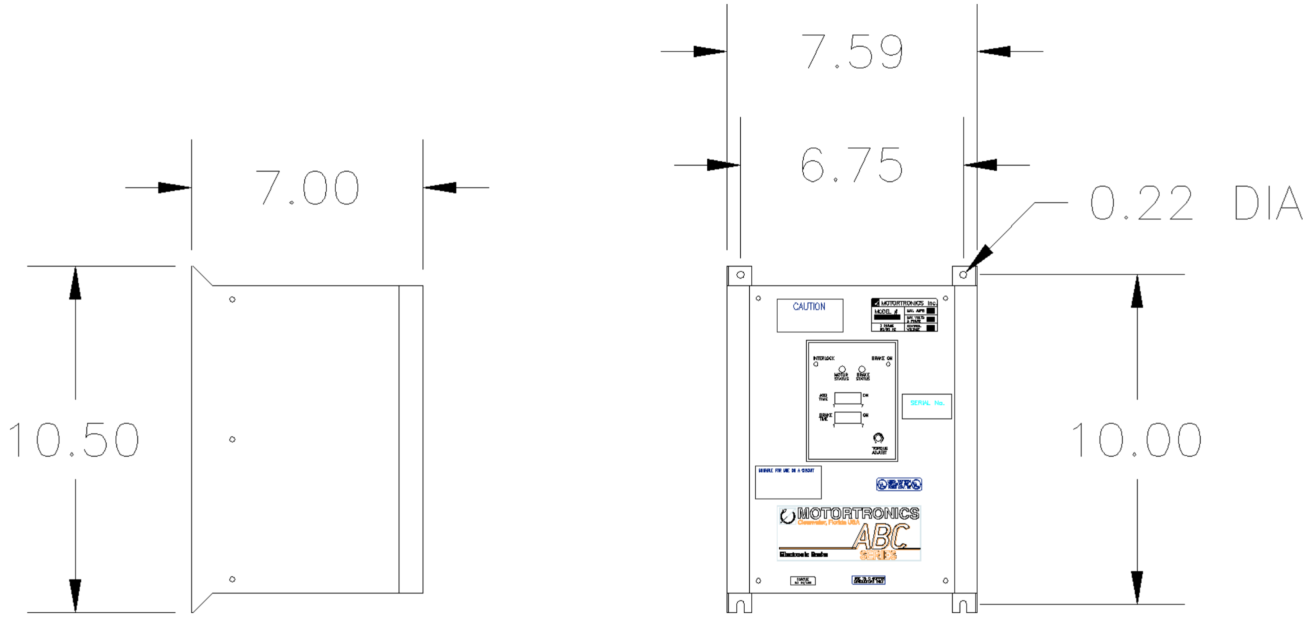


N4/12 Outline: ABC-300/400-E

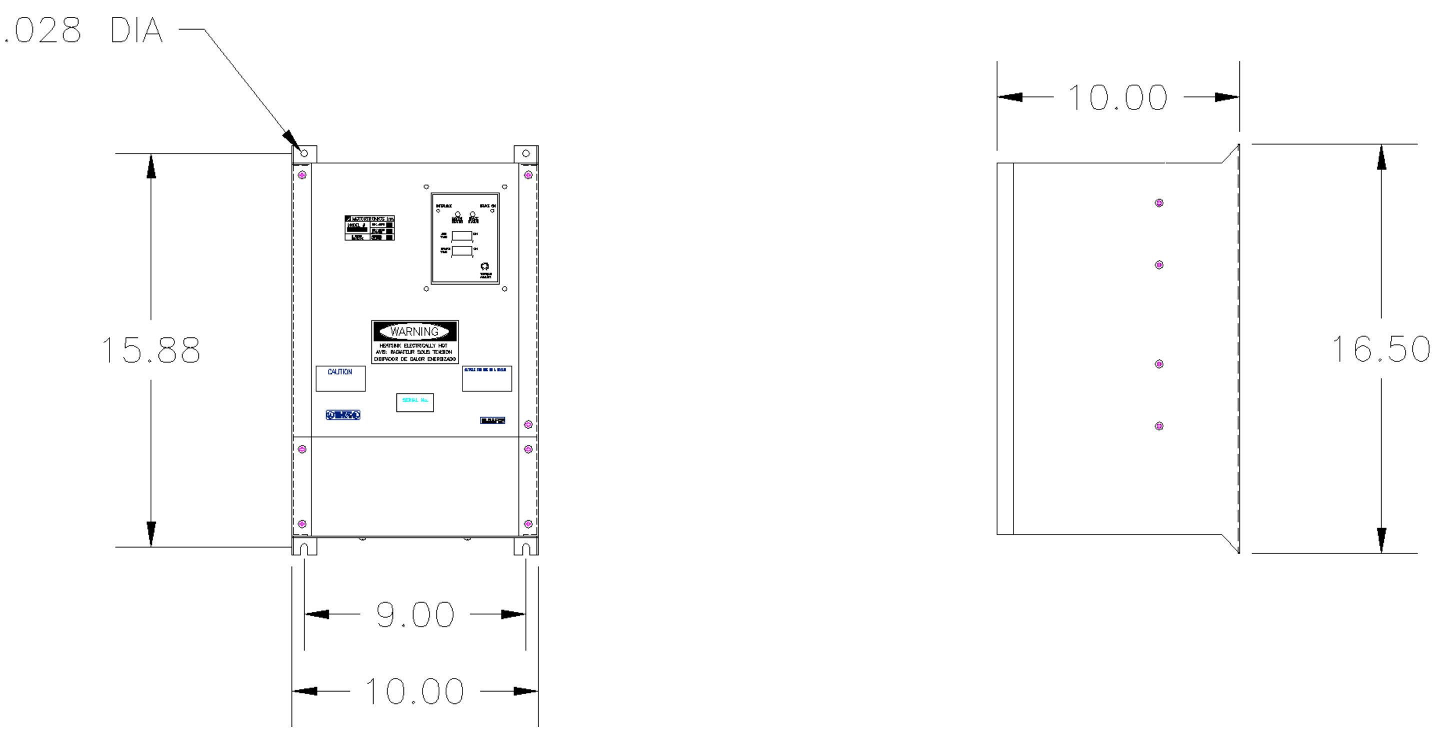


N4/12 Outline: ABC-550/800-E

ABC Series Outline Dimensions
Panel Outline

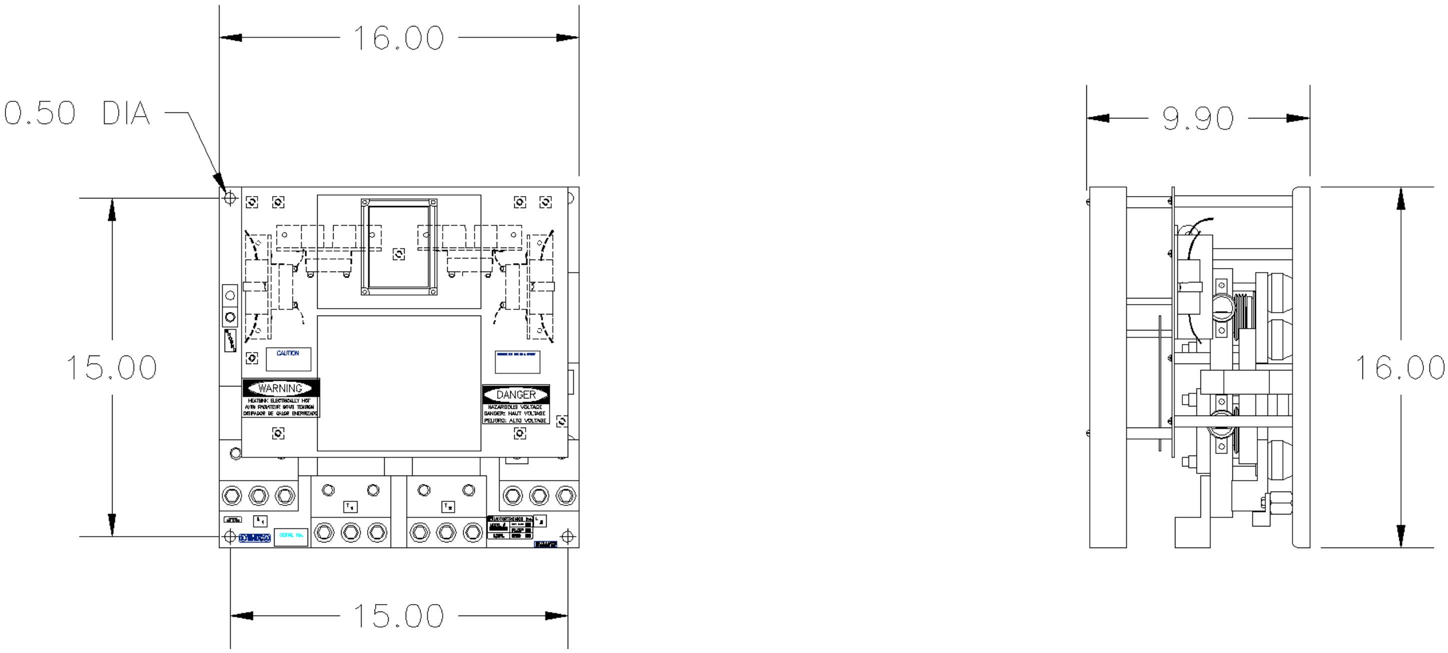


Panels Outline: ABC-10/24/50/100

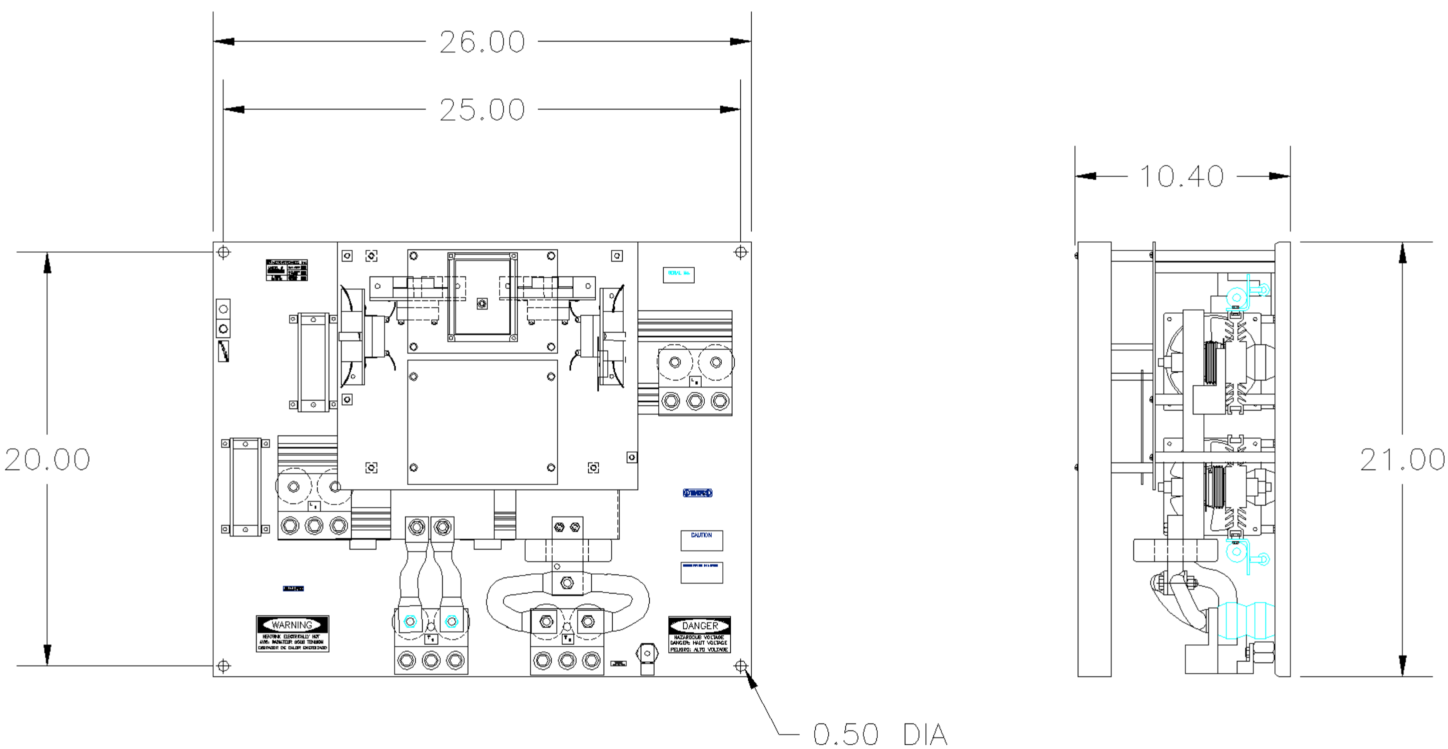


Panels Outline: ABC-200

ABC Series Outline Dimensions
Panel Outline *Cont.*

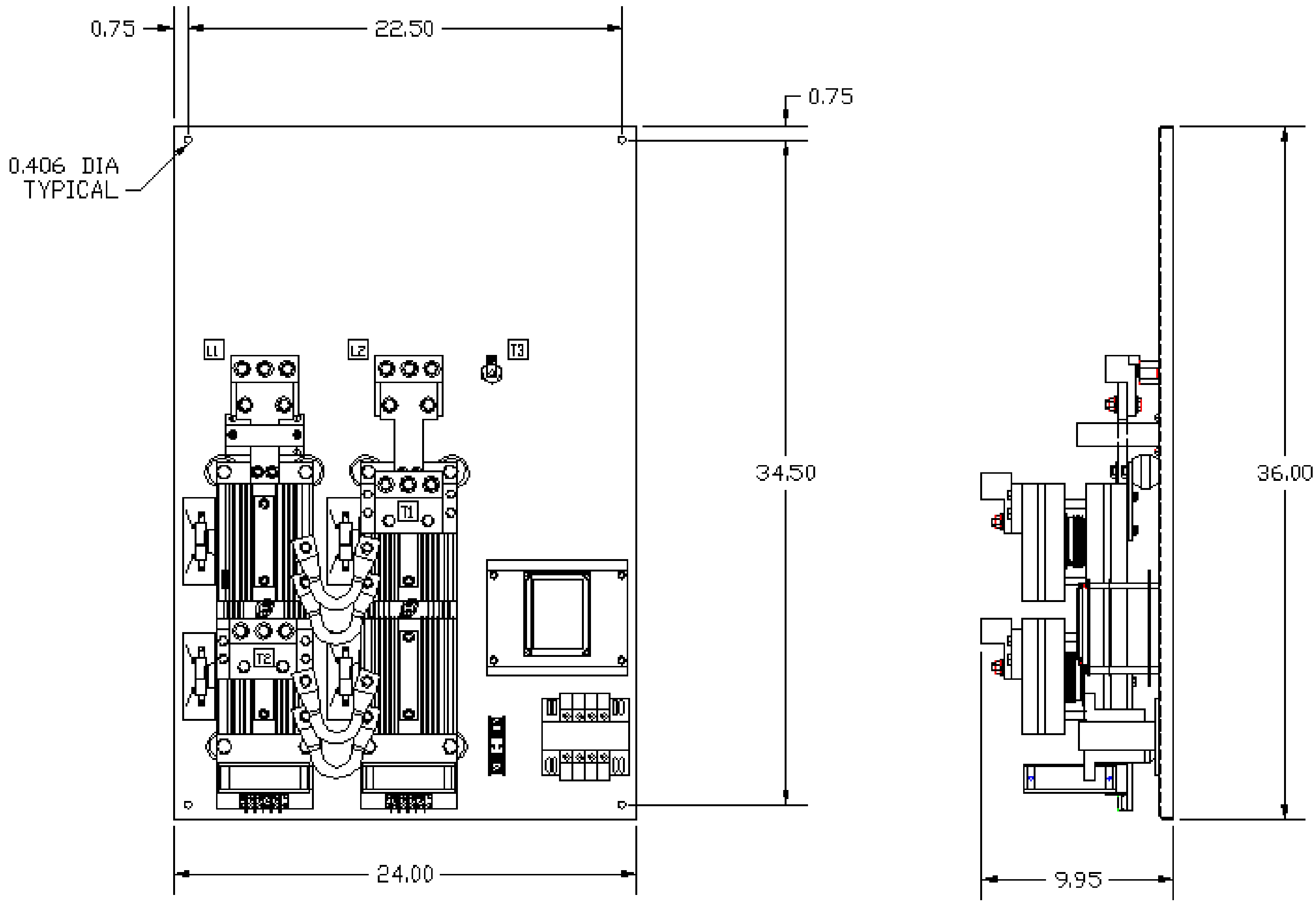


Panels Outline: ABC-300/400



Panels Outline: ABC-550/800

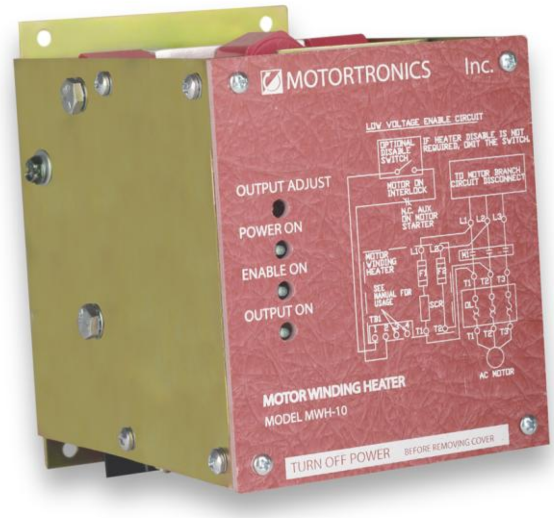
ABC Series Outline Dimensions
Panel Outline *Cont.*



Panels Outline: ABC-1000

MWH Series Motor Winding Heaters

MWH Series



The MWH Series keeps motors warm & moisture-Free during extended shut down times

- **Use On Any AC Motor**
- **Simple to Wire/Easy Retrofit**
- **Cost-Effective Alternative to Strip Heaters**
- **Protects Motors from Problems Due to Condensation Build-up**
- **Reliable, Maintenance-Free Operation**

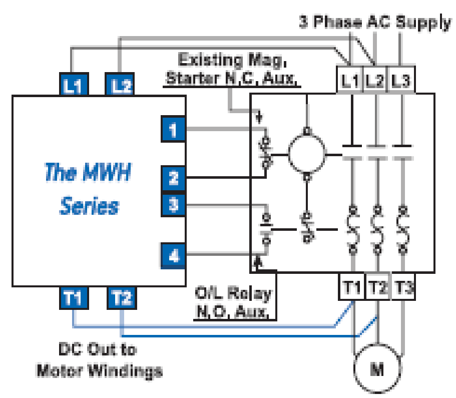
Protect Your Motors

Even the best motor winding insulation materials become water permeable with repeated exposure to temperature extremes and moisture. If the ambient temperature is below the “dew point” when a motor is turned off, condensation will form inside the motor as it cools down. When the motor is re-energized, the moisture heats up and permeates the windings, eventually shorting and damaging the motor. Airborne corrosive elements like salt and chemicals can also combine with condensation and erode the rotor and bearings, leading to premature motor failure.

The MWH Series provides a cost effective solution to these problems by preventing condensation build-up in motors. By applying a low level current to the motor windings during extended shut down periods, the MWH Series keeps AC motors warm and moisture-free.

Fully Automatic Operation

Designed for fully automatic operation, the MWH Series turns on when the motor starter has turned off. A built-in one minute timer ensures that the motor magnetic field has collapsed before it injects DC power into the windings. When the motor is restarted, the MWH Series instantly turns off. No operator interface is required... The MWH Series is in control.



Built-in Overload Sensing

The MWH Series had an optional shutdown input that can be connected to the N.O. auxiliary contact on the motor starter’s thermal overload relay. This will disable the motor winding heater control, preventing any additional heating in the motor and allowing for a faster motor cool down period. The MWH Series then goes back on-line after the overload relay is reset.

Ideal Alternative to Strip Heaters

Eliminate the cost and hassle of installing strip heaters into your motors. Simply wire up the MWH Series to generate heat throughout the motor stator windings. The heat is dissipated evenly without the “hot spots” caused by strip heaters. Conduction of heat to the rotor, bearings and shaft is also more effective which means maximized protection for the whole motor.

MWH Series Model Ratings

MWH - 10 - P - ____

Amps

Enclosure
P = Panel (Open Chassis)
N = NEMA 1

Voltage
Blank = 208/240/480V, ***380*** = 380V
415 = 415V, ***575*** = 575/600V

Model Number	Max. Amp. Rating	Motor Horsepower / Voltage			List Price $
		208V	240V	480V	
MWH-10-P-*	**10**	3-40	5-50	10-100	**750**
MWH-25-P-*	**25**	50-100	60-125	125-250	**906**
MWH-50-P-*	**50**	125-200	150-250	300-500	**1,392**
MWH-80-P-*	**80**	250-300	300-400	600-800	**1,804**

NOTES:

1 - Specify voltage at end of model number.
2 - Contact factory for pricing of unit in NEMA 1 enclosure.

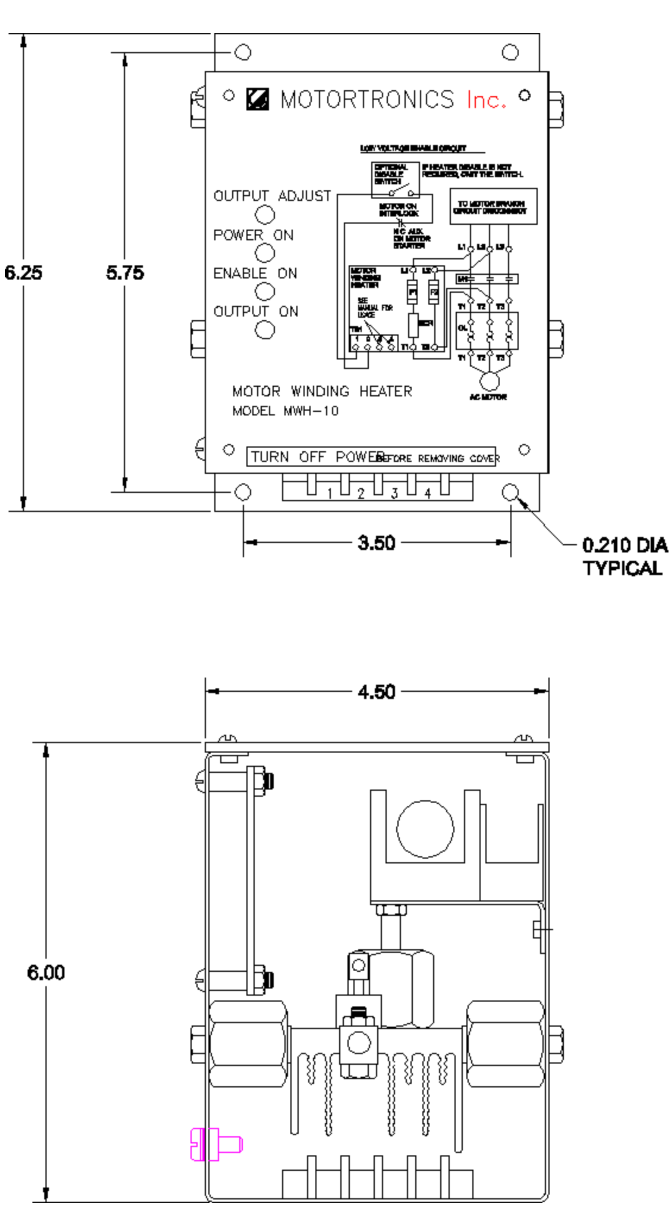
Model Number	Max. Amp. Rating	Motor Horsepower / Voltage	List Price $
		575V	
MWH-10-P-*	**10**	15-125	**750**
MWH-25-P-*	**25**	150-300	**906**
MWH-50-P-*	**50**	350-600	**1,392**
MWH-80-P-*	**80**	700-900	**1,804**

NOTE: Contact factory for pricing of unit in NEMA 1 enclosure.

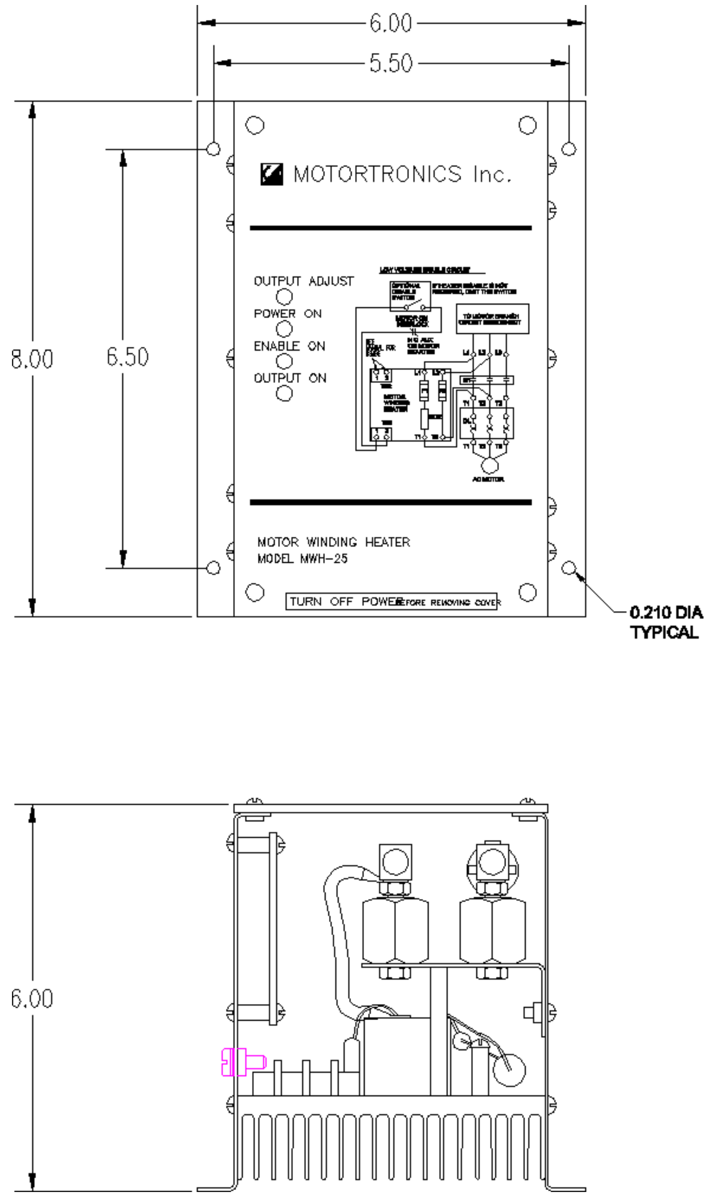
MWH Series Dimensions (Inches)						
Model Number	OPEN PANEL			NEMA 1		
	H	W	D	H	W	D
MWH-10	**6.2**	4.5	6	11	7	7
MWH-25	**8**	6	6	11	7	7
MWH-50	**10**	8	7.9	15	10	8
MWH-80	**10**	8	9.3	20	10	10

NOTE: Dimensions are subject to change without notice. (Contact factory for exact dimensions.)

MWH Series Dimensions
MWH-10 & MWH-25

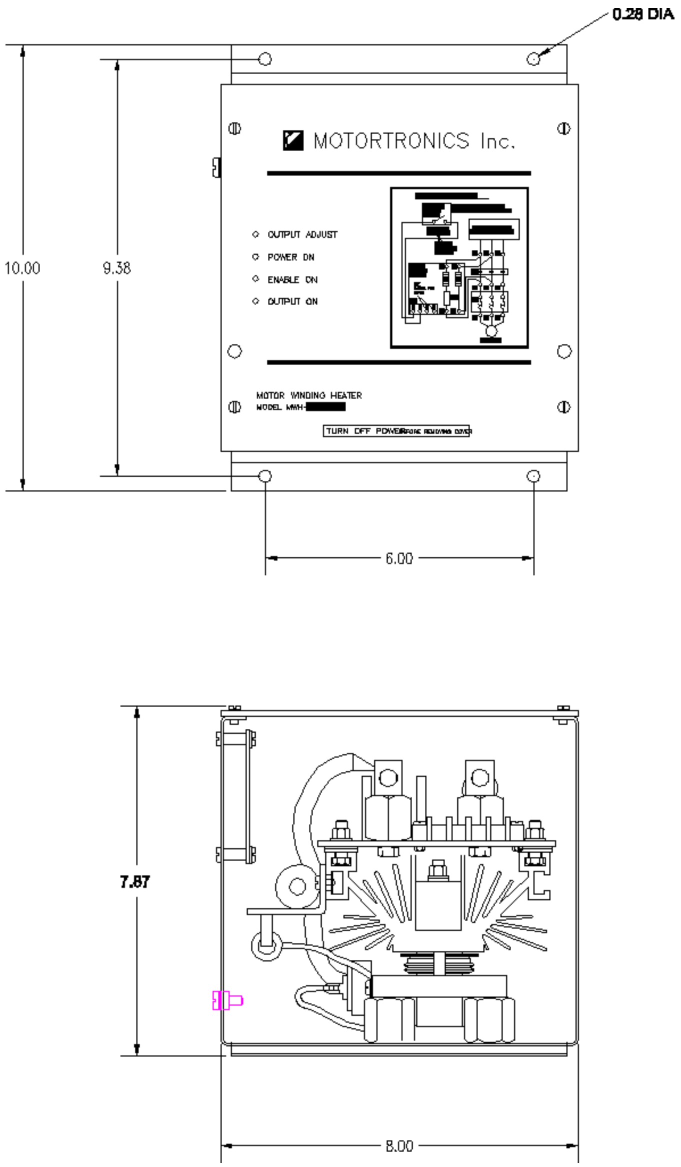


MWH-10

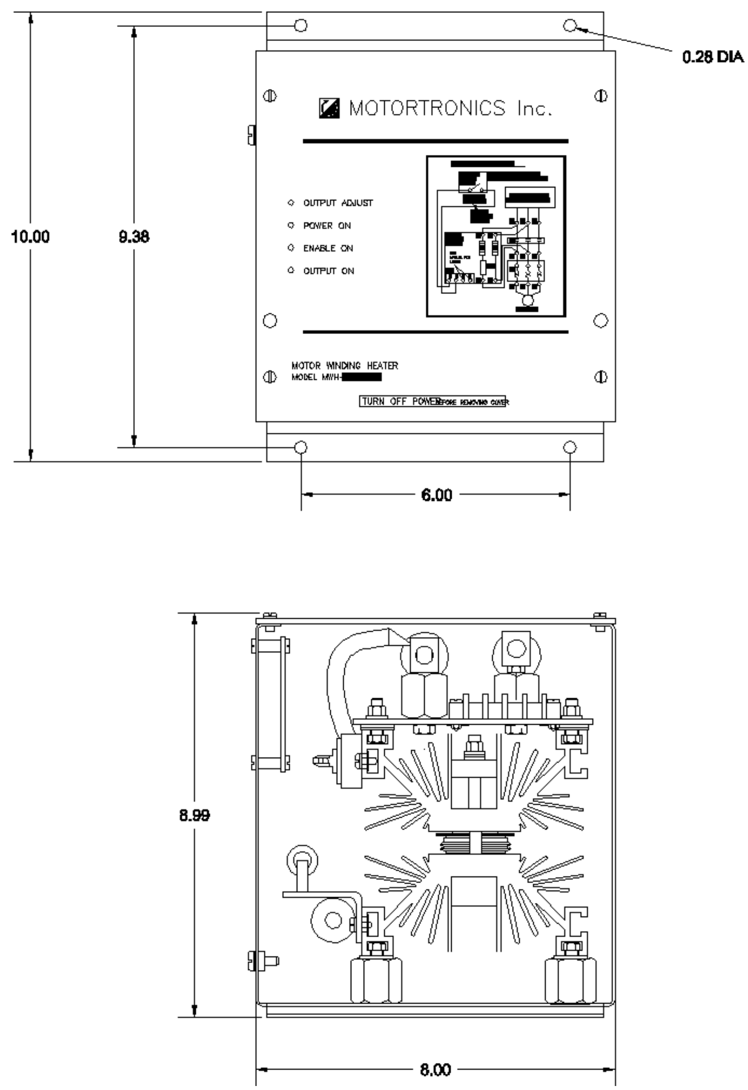


MWH-25

MWH Series Dimensions
MWH-50 & MWH-80



MWH-50



MWH-80

XLD Series Digital Soft Starters

XLD Series

Acceleration Adjustments
Ramp types Voltage ramp or current ramp
Starting torque 0 - 100% of line voltage or 0 - 600% of FLA
Ramp time 1 to 120 seconds
Current limit 200 - 600%

Dual Ramp Settings*
Four (4) programmable ramp options

Deceleration Adjustments
Begin decel level 0 - 100% of line voltage
Stop level 0 to 1% less than begin decel
Decel time 0 - 60 seconds
Operation during overload Ramp down or coast-to-stop

Jog Settings*
Jog at set current 100 - 500% of FLA
Jog at set voltage 0 - 100% of line voltage
Voltage jog max time 0 - 20 seconds

Kick Start Settings
Kick start 0 - 100% of line voltage
Kick start time 0.1 - 2 seconds

Programmable Output Relays
Three (3) relays can be individually programmed for change of state indication for any one of 18 conditions.
Type / Rating FORM C (SPDT),
rated 5 amps, 240VAC max (1200VA)

* separate external control inputs

Two programmable overload trip curves allow for the thermal capacity required to start the load while providing motor overload protection needed during the run time.

Start: Programmable for Class 5 – 30
Run: Programmable for Class 5 - 30, enabled when starter detects motor is "At-Speed"
Reset: Manual or automatic, selectable via programming

The ***XLD Series*** recognizes motor cool-down rates are a function of the run time and that sometimes a motor will cool faster if allowed to run.

Real-Time Thermal Modeling — Continuously calculates motor operating temperature even when your motor isn't running. Knows when your motor is cool enough for a successful restart.

Retentive Thermal Memory — Remembers the thermal condition of the motor even in the event of a power brown-out or black-out. Extrapolates motor temperature using a real-time clock.

Dynamic Reset Capacity — Overload will not reset until thermal capacity in the motor is sufficient for a successful restart. Starter learns and retains this information from previous starts.

Phase Current Imbalance/Loss Protection

Imbalance trip level -	5 - 30% current between any two phases
Imbalance trip delay-	0 - 20 seconds
Phase loss -	Trips on any phase current loss

Electronic Shear Pin Protection

Shear pin trip level -	50 - 300% of motor FLA
Shear pin trip delay -	0 - 20 seconds

Load Loss Trip Protection

Under current trip level -	10 - 90% of motor FLA
Under current trip delay -	0 - 20 seconds

Coast Down (Back Spin) Lockout Timer

Coast down time -	0 - 60 minutes

Starts-per-Hour Lockout Timer

Starts-per-hour -	1 - 10 successful starts per hour
Time between starts -	0 - 60 min. between start attempts

Phase Rotation — Phase sequence insensitive

Shorted Load — During start, injects voltage for 0.25 second and will trip if it sees a 9x unit current surge

Short Circuit — Trips in 12.5 ms at 10x unit current rating during run

XLD Series Model Ratings

XLD - 288 - [ ] - N - [ ]

Max. Amps
39 – 1250 A.

Voltage
Blank = 208 – 480V
600 = 208 – 600V

Enclosure
P = Panel Mount, N = NEMA 1
E = NEMA 12, N4 = NEMA 4/4X

Control Power
Blank = 120 VAC
240 = 240 VAC

MODEL NUMBER	MAX AMPS	HP				kW		List Price $			
		208V	240V	480V	600V	230V	400V	PANEL	NEMA 1	NEMA 4/4X	NEMA 12***
XLD-39	**39**	10		25	30	11	19	**2,015**	**2,417**	**3,068**	**2,861**
XLD-48	**48**	10	15	30	40		22	**2,278**	**2,734**	**3,298**	**2,879**
XLD-62	**62**	15	20	40	50	15	30	**2,354**	**2,824**	**3,905**	**2,955**
XLD-78	**78**	20	25	50	60	22	37	**2,942**	**3,531**	**4,336**	**3,311**
XLD-92	**92**	25	30	60	75	-	45	**3,843**	**3,843**	**C/F**	**4,393**
XLD-120	**120**	30	40	75	100	30	55	**4,071**	**4,410**		**4,620**
XLD-150	**150**	40	50	100	125	45	75	**5,078**	**5,857**		**6,465**
XLD-180	**180**	50	60	125	150	55	90	**5,120**	**6,144**		**6,879**
XLD-220	**220**	60	75	150	200	-	110	**6,031**	**6,518**		**7,418**
XLD-288	**288**	75	100	200	250	75	132	**6,133**	**7,225**		**7,913**
XLD-360	**360**	100	125	250	300	110	160	**7,300**	**8,335**		**9,296**
XLD-414	**414**	125	150	300	350	-	200	**7,314**	**8,690**		**11,243**
XLD-476	**476**	-	-	350	400	132	250	**9,108**	**10,199**		**13,376**
XLD-550	**550**	150	200	-	500	160	-	**9,246**	**13,410**		**14,490**
XLD-718	**718**	200	250	500	600	200	315	**13,469**	**16,415**		**20,540**
XLD-862	**862**	250	300	600	700	-	400	**14,738**	**18,822**		**21,757**
XLD-1006	**1006**	300	350	700	800	-	550	**20,134**	**23,307**		**29,485**
XLD-1150	**1150**	350	400	800	900	-	637	**23,902**	**27,196**		**43,514**
XLD-1200	**1200**	400	450	900	1000	-	665	**27,593**	**30,987**		**55,686**
XLD-1250	**1250**	450	500	1000	1125	-	700	**31,740**	**36,426**		**67,856**

NOTES:

1. Units require an external 120 VAC control circuit. Specify 240 VAC if required.
2. Motor FLA plus service factor must not exceed unit max amp rating.
3. NEMA1 units rated 150A and above, and all NEMA 12 units, have the keypad operator mounted internally. See Accessories Page for Remote Keypad Display Kit if required.

Prices subject to change without notice - Consult factory for pricing on modifications.

XLD SERIES DIGITAL SOFT STARTER WITH CIRCUIT BREAKER

BXLD Series

Acceleration Adjustments
Ramp types Voltage ramp or current ramp
Starting torque 0 - 100% of line voltage or 0 - 600% of FLA
Ramp time 1 to 120 seconds
Current limit 200 - 600%

Dual Ramp Settings*
Four (4) programmable ramp options

Deceleration Adjustments
Begin decel level 0 - 100% of line voltage
Stop level 0 to 1% less than begin decel
Decel time 0 - 60 seconds
Operation during overload Ramp down or coast-to-stop

Jog Settings*
Jog at set current 100 - 500% of FLA
Jog at set voltage 0 - 100% of line voltage
Voltage jog max time 0 - 20 seconds

Kick Start Settings
Kick start 0 - 100% of line voltage
Kick start time 0.1 - 2 seconds

Programmable Output Relays
Three (3) relays can be individually programmed for change of state indication for any one of 18 conditions.
Type / Rating FORM C (SPDT), rated 5 amps, 240VAC max (1200VA)

* separate external control inputs

Two programmable overload trip curves allow for the thermal capacity required to start the load while providing motor overload protection needed during the run time.

Start: Programmable for Class 5 – 30
Run: Programmable for Class 5 - 30, enabled when starter detects motor is "At-Speed"
Reset: Manual or automatic, selectable via programming

The ***XLD Series*** recognizes motor cool-down rates are a function of the run time and that sometimes a motor will cool faster if allowed to run.

Real-Time Thermal Modeling Continuously calculates motor operating temperature even when your motor isn't running. Knows when your motor is cool enough for a successful restart.

Retentive Thermal Memory Remembers the thermal condition of the motor even in the event of a power brown-out or black-out. Extrapolates motor temperature using a real-time clock.

Dynamic Reset Capacity Overload will not reset until thermal capacity in the motor is sufficient for a successful restart. Starter learns and retains this information from previous starts.

Phase Current Imbalance/Loss Protection
Imbalance trip level - 5 - 30% current between any two phases
Imbalance trip delay- 0 - 20 seconds
Phase loss - Trips on any phase current loss

Electronic Shear Pin Protection
Shear pin trip level - 50 - 300% of motor FLA
Shear pin trip delay - 0 - 20 seconds

Load Loss Trip Protection
Under current trip level - 10 - 90% of motor FLA
Under current trip delay - 0 - 20 seconds

Coast Down (Back Spin) Lockout Timer
Coast down time - 0 - 60 minutes

Starts-per-Hour Lockout Timer
Starts-per-hour - 1 - 10 successful starts per hour
Time between starts - 0 - 60 min. between start attempts

Phase Rotation Phase sequence insensitive

Shorted Load During start, injects voltage for 0.25 second and will trip if it sees a 9x unit current surge

Short Circuit Trips in 12.5 ms at 10x unit current rating during run

BXLD Series Model Ratings

BXLD - 288 - [ ] - N - [ ]

Max. Amps
39 – 1250 A.

Voltage
Blank = 208 – 480V
600 = 208 – 600V

Enclosure
N = NEMA 1
E = NEMA 12

Control Power
Blank = 120 VAC
240 = 240 VAC

Model Number	Max. Amps.	HP				kW		Circuit Breaker		List Price $	
		208V	240V	480V	600V	230V	400V	Frame Size	Trip Rating	NEMA1	NEMA 12 Inc. Bypass
BXLD-39	**39**	10		25	30	11	19	80	50	**5,116**	**5,363**
BXLD-48	**48**	10	15	30	40		22	100	60	**5,174**	**5,578**
BXLD-62	**62**	15	20	40	50	15	30	150	100	**5,955**	**6,129**
BXLD-78	**78**	20	25	50	60	22	37	150	100	**6,302**	**6,592**
BXLD-92	**92**	25	30	60	75		45	150	100	**6,534**	**7,593**
BXLD-120	**120**	30	40	75	100	30	55	150	150	**7,607**	**8,114**
BXLD-150	**150**	40	50	100	125	45	75	250	250	**8,791**	**9,246**
BXLD-180	**180**	50	60	125	150	55	90	250	250	**8,832**	**9,798**
BXLD-220	**220**	60	75	150	200		110	250	250	**10,946**	**12,649**
BXLD-288	**288**	75	100	200	250	75	132	400	400	**11,178**	**13,455**
BXLD-360	**360**	100	125	250	300	110	160	400	400	**12,507**	**15,125**
BXLD-414	**414**	125	150	300	350		200	800	600	**13,799**	**17,751**
BXLD-476	**476**			350	400	132	250	800	600	**15,001**	**21,804**
BXLD-550	**550**	150	200		500	160		800	600	**15,808**	**21,887**
BXLD-718	**718**	200	250	500	600	200	315	800	800	**18,898**	**28,635**
BXLD-862	**862**	250	300	600	700		400	1200	1000	**27,255**	**30,581**
BXLD-1006	**1006**	300	350	700	800			1200	1200	**28,635**	**39,882**
BXLD-1150	**1150**	350	400	800	900			1200	1200	**39,882**	**Contact Factory**
BXLD-1200	**1200**	400	450	900	1000			1600	1600	**45,540**	
BXLD-1250	**1250**	450	500	1000	1125			1600	1600	**46,459**	

NOTES:

1. Units require an external 120 VAC control circuit. Specify 240 VAC if required.
2. Motor FLA plus service factor must not exceed unit max amp rating.
3. NEMA1 units rated 150A and above, and all NEMA 12 units, have the keypad operator mounted internally. See Accessories Page for Remote Keypad Display Kit if required.

Prices subject to change without notice - Consult factory for pricing on modifications.

XLD/BXLD Series Circuit Boards & Accessories

Printed Circuit Board and Accessories				
Part	**Model Number**	**Description**	**Series**	**List Price $**
CONTROL BOARDS	**XLD1000-120**	CPU and Power Board Assembly (120VAC Control)	XLD	**1,725**
	XLD1000-240	CPU and Power Board Assembly (240VAC Control)	XLD	**1,725**
	XLD-Keypad	Replacement Digital Keypad Operator	XLD	**150**
	XLB1000-120	PC Board for units rated ≥ 39A (120 VAC control)	XLC/XLS	**1,121**
	XLB1000-240	PC Board for units rated ≥ 39A (240 VAC control)	XLC/XLS	**1,121**

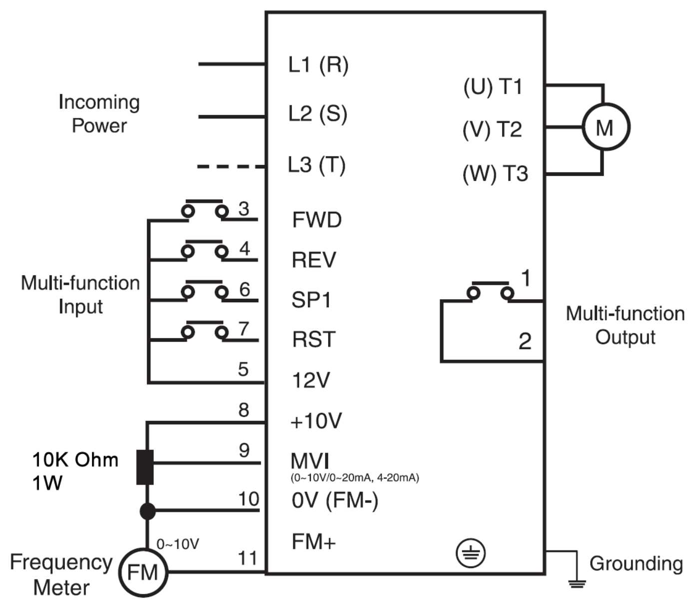
Cable Assembly with connectors on both ends for remote mounting XLD Series Digital Operator (Operator not included).

REMOTE DISPLAY KITS	**XLD-KPN1-KIT-1**	NEMA 1 Kit with 1 Meter Cable	XLD	**147**
	XLD-KPN1-KIT-2	NEMA 1 Kit with 2 Meter Cable	XLD	**164**
	XLD-KPN1-KIT-3	NEMA 1 Kit with 3 Meter Cable	XLD	**181**
	XLD-KP12-KIT-1	NEMA 12 Kit with 1 Meter Cable	XLD	**242**
	XLD-KP12-KIT-2	NEMA 12 Kit with 2 Meter Cable	XLD	**276**
	XLD-KPD12-KIT-3	NEMA 12 Kit with 3 Meter Cable	XLD	**293**
COMM KITS	**XLD-RS485-KIT-1**	RS485 Communications Kit with 1 Meter Cable	XLD	**397**
	XLD-RS235-KIT-1	RS232 Communications Kit with 1 Meter Cable	XLD	**397**

NOTE: Contact Factory for DXT Spare Parts.

ME2 SERIES MICRO OEM AC DRIVE
110 – 460V, 0.25 – 3HP (CT)

ME2 AC Drive



Compact Size but with the Features you need
- 150% overload capacity for one minute
- Fully rated and fully protected
- 1-200 Hz frequency range

Easy to Install
- Takes up less panel space than other drives in its class
- Single or three phase input (3 phase output) standard
- Optional DIN rail adapter (1HP and below)

Easy to Program / Easy to Operate
- Built-in ‘finger’sized” keypad operator
- Operate directly via the keypad or remotely via a PLC, analog inputs or a 10k potentiometer.

World-wide Credentials
- CE, UL and cUL approvals
- Built-in EMI filter (up to 1HP), no external inductor needed to meet CE requirements.

Application Flexibility
- Use as replacement for DC drives. Allows you to use a standard AC motor instead of ‘maintenance prone” brush-type DC motors.
- Ideal for high duty cycle, reversing applications as a cost effective alternative to mechanical reversing starters

ME2 SERIES MICRO OEM AC DRIVE
Specifications Continued

ME2 AC Drive

Model Ratings

Model	Input Voltage	Output Voltage	Motor Rating		Rated Current (Amps)	Rated Capacity (kVA)
			HP	kW		
ME2-1P2-M	Single phase 110 - 120V	Three phase 200 - 230V	¼	0.2	1.4	0.53
ME2-1P5-M			½	0.4	2.3	0.88
ME2-101-M			1	0.75	4.2	1.6
ME2-2P2-M	Single phase 200 - 240V		¼	0.2	1.4	0.53
ME2-2P5-M			½	0.4	2.3	0.88
ME2-201-M			1	0.75	4.2	1.6
ME2-202-M	Single or Three phase 200 - 240V		2	1.5	7.5	2.9
ME2-203-M			3	2.2	10.5	4
ME2-401-M	Three phase 380 - 460V	Three phase 380 - 460V	1	0.75	2.3	1.7
ME2-402-M			2	1.5	3.8	2.9
ME2-403-M			3	2.2	5.2	4

Frequency Control

Frequency Control Range	1 - 200Hz
Frequency Resolution	Digital: 0.1 Hz (0-99.9 Hz), 1 Hz (100 - 200 Hz) Analog: 1 Hz (60 Hz)
Frequency Setting Signal	Digital Keypad; 0 - 10VDC, 0-20mA, 10k Potentiometer
Frequency Limit	Frequency upper/lower limit
Carrier Frequency	4 ~ 16 kHz

Control Characteristics

Accel/Decel Time	0.1 - 999 seconds
V/f Pattern	6 Patterns
Torque Control	Manual torque boost (adjustable)
Braking Torque	Approximately 20%
Multifunction Inputs	2 inputs; emergency stop, pre-set speed, reset, run enable
Multifunction Outputs	1 (N.O.) relay for fault, run, up to speed indicator
Other Built-in Functions	Upper/lower frequency limit, ramp down or coast to stop, auto reset, DC injection brake, electronic motor protection

Protective Functions

Instantaneous Overcurrent	200% of rated current
Overload	150% for 1 minute
Over-voltage	ME2-1XX and ME2-2XX: DC-bus voltage >410VDC ME2-4XX: DC-bus voltage >800VDC
Under-voltage	ME2-1XX and ME2-2XX: DC-bus voltage <200VDC ME2-4XX: DC-bus voltage <400VDC
Momentary Power Loss	0-2 seconds (can be restarted via speed search)
Stall prevention	During accel/decel/constant speed
Output short circuit	Provided by electronic circuit
Ground fault	Provided by electronic circuit during start-up and run
Other protection	Heatsink fin overtemp, current limit

Other

Control Method	Sinusoidal wave PWM control (PNP type 12 - 24 VDC)
Digital Display	Indicates frequency, parameter selection, fault record
Ambient temperature	- 10 to + 50° C (14° to 122° F)
Humidity	≤ 95% relative, non-condensing
Vibration	Under 1G
EMC	Class A filter standard in all 200 volt units rated 1/4 - 1 HP; Optional Class B for all other units
Enclosure	Panel Mount / IP20
Approvals	UL, cUL, CE
Mounting	Direct or optional DIN rail mount (for drives rated 1 HP and below)

ME2 - 2 P2 - M - DIN

Input Voltage
1 = 110V
2 = 220V
4 = 460V

Horsepower
P2 = 0.25 HP
P5 = 0.50 HP
01 = 1HP
02 = 2HP
03 = 3HP

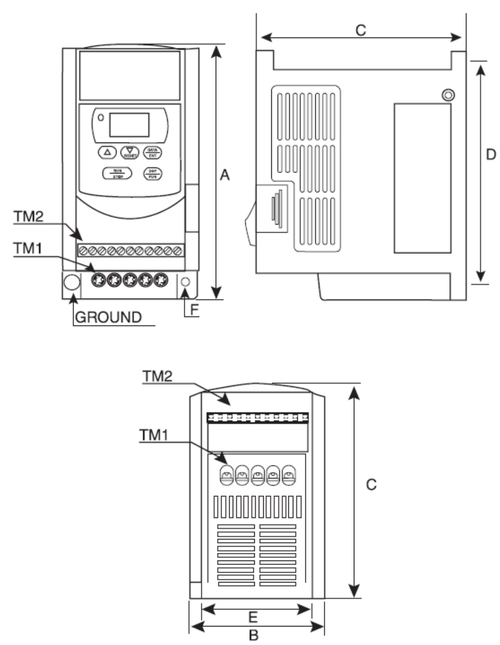
Enclosure
IP20/Chassis

Optional
DIN = Din Rail Adapter
(1HP and below)

Model Number	Input Voltage	Output Voltage	HP (CT)	kW (CT)	List Price $
ME2-1P2-M	Single phase 110 - 120V	Three phase 200 - 230V	¼	0.2	**227**
ME2-1P5-M			½	0.4	**243**
ME2-101-M			1	0.75	**260**
ME2-2P2-M	Single phase 200 - 240V		¼	0.2	**217**
ME2-2P5-M			½	0.4	**233**
ME2-201-M			1	0.75	**243**
ME2-202-M	Single or Three phase 200 - 240V		2	1.5	**393**
ME2-203-M			3	2.2	**483**
ME2-401-M	Three phase 380 - 460V	Three phase 380 - 460V	1	0.75	**417**
ME2-402-M			2	1.5	**467**
ME2-403-M			3	2.2	**567**

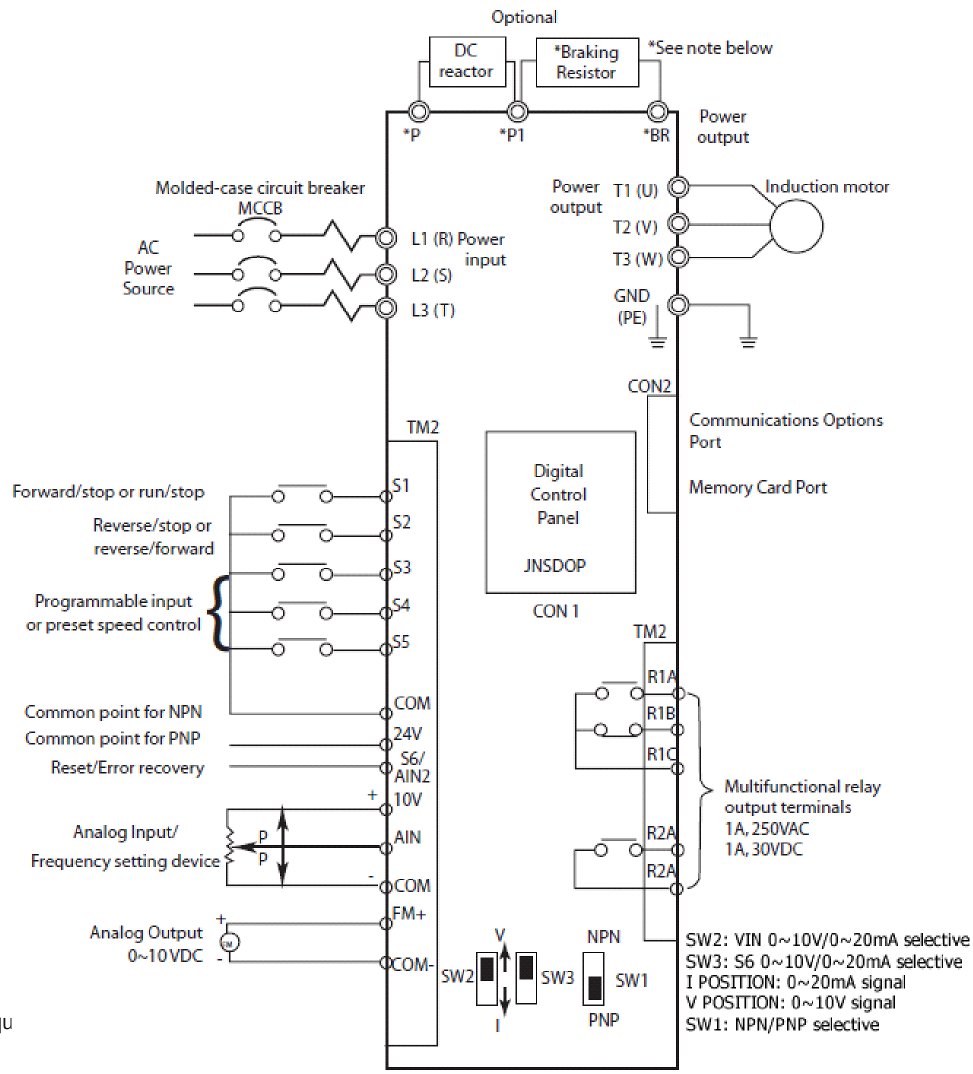
ME2 Series Dimensions

Model Number	Overall Dimensions (Inches)			Mounting Dimensions (Inches)			Shipping Weights (lbs)
	A	B	C	D	E	F	
ME2-1P2-M	5.2	2.8	4.65	4.6	2.4	0.18	1.5
ME2-1P5-M							
ME2-101-M							
ME2-2P2-M							1.6
ME2-2P5-M							1.7
ME2-201-M							1.8
ME2-202-M	5.63	4.65	6.78	5.02	4.26	0.18	3.6
ME2-203-M							3.8
ME2-401-M							3.5
ME2-402-M							3.5
ME2-403-M							3.6



VCM SERIES V/Hz or OL Vector AC DRIVE
200 – 460V, 0.25 – 75HP (CT)

VCM AC Drive



* Note: Diagram applies to models rated up to 10HP at 240V and 15HP at 480V. Contact factory for power schematic for larger sizes.

Easy to Use
- Built-in speed potentiometer
- Quick start guide for installation & setup
- Windows based programming software option

Sensorless Vector or V/Hz Control
- Maintain frequency accuracy to 0.01 Hz
- 150% starting torque, up to 200% running torqu
- Autotuning for sensorless vector control

Built-in Electronic Overload Relay
- Program to match the exact motor FLA

Wide Frequency Output Range
- 0.1 - 400Hz with 18 selectable V/f patterns, one programmable custom curve

Adjustable Carrier Frequency
- Up to 16kHz for low noise applications

Heavy Duty Power Design
- 150% overload for 1 minute
- Maximizes power delivery, yet compact in size

PID Function
- 8 PID modes
- Feedback loss detection
- Sleep function
- Engineering unit display

Flexible Speed Command Choices
- Local via keypad or built-in potentiometer
- Remote via 4-20mA, 0-10Vdc, 0-5Vdc 10k ohm potentiometer or floating point (up-down) signal

7 Preset Speeds for Complete Process Control
- Selectable via digital inputs

Programmable I/O Maximizes System Design
- 6 digital inputs, 2 relay outputs
- 2 analog inputs, 1 analog output
- Analog inputs can be reconfigured for additional digital inputs

VCM SERIES V/Hz or OL Vector AC DRIVE Specifications

VCM AC Drive

Control Mode	Sensorless Vector Control with Auto-tuning, or V/Hz control of three phase AC motors
Carrier Frequency	2 - 16 KHz
Frequency Control Range	0.1 - 400 Hz
Speed Control Range	1:50 (Vector mode)
Speed Control Precision	+ 0.5%
Frequency Resolution	Digital: 0.01 Hz (Note 1); Analog: 0.06Hz/60 Hz (10bits)
Frequency Setting Signal	Local: Built-in potentiometer or Up/Down keys on Operator Interface Remote: Analog Input or multifunction contacts on terminal block (TM2)
ACCEL/DECEL Time	2 separately programmable ACCEL/DECEL times 0.1 - 3600 seconds with two S-curves Programmable DECEL or free run to stop
Starting Torque	150%/ 1Hz (Vector mode)
Braking Torque	Standard braking torque = 20%, 10% duty cycle (>20HP requires braking module option) 100% braking torque available with addition of optional braking resistors
V/f Pattern	18 patterns, one curve programmable
Frequency limit function	Upper/lower frequency limits, programmable skip frequencies and vibration control
Instantaneous Overcurrent	Approximately 200% of unit rated current
Overload Capacity of Drive	150% for 1 minute
Motor Overload Protection	Programmable electronic thermal overload relay
Overvoltage	200V Class: DC bus exceeds 410V 400V Class: DC bus exceeds 820V
Undervoltage	200V Class: DC bus voltage drop < 190V 400V Class: DC bus voltage drop < 380V
Momentary Power Loss	Programmable 0~2 seconds: unit can be restarted via speed search
DC Bus Protection	Motor coast to stop at blown fuse
Heat Sink Fin Overheat	Protected by thermistor/thermostat
Ground Fault Protection	Standard on all units
Stall Prevention	Stall prevention for Acceleration/Deceleration while running

Digital Inputs	Dry contacts through internal power supply: NPN/PNP toggle	
	Multifunction Input Selection: 30 functions	
Digital Relay Outputs	(1) FORM C, (1) FORM A, 16 functions, 250 VAC 1A, 30 VDC 1A maximum	
Built-in Functions	Momentary power loss restart, speed search, overload detection, 8 preset speeds, accel/decel (2 stages), S-curves, 3-wire control, PID control, auto/manual torque boost, slip compensation, frequency upper/lower limit, auto energy savings, and auto reset	

Analog Inputs	AIN1	0-20ma, 0-10 VDC, or external 10K ohm potentiometer Programmable offset and gain, positive or negative bias and slope
	AIN2	S6 multifunction input can be reconfigured to be 0 - 20mA or 0 -10 VDC analog input with offset/gain
Analog Output (0-10 VDC)	Motor speed, voltage and current, DC bus voltage, PID feedback (all with gain calibration)	
Display function	Four digit LED (or 2x16 LCD optional) and status indicator; display frequency/ speed/line speed/DC voltage/output voltage/current/rotation direction/ Inverter parameter/trouble log/program version	
Communications	Control via RS232 or RS485 Modbus RTU One-to-one or One-to-many (RS485 Only) control Baud rate/Stop bit/Parity/ bit setting	
Standard Enclosure	NEMA 1 (IP20), Chassis (HP dependent)	
Location and Altitude	Indoor (protected from gas and dust) 3,300 feet (without derating). Use in an enclosure with filtered forced ventilation, or if standalone, in a clean pollution- free environment	
Ambient Temperature	Enclosed: -10ºC to 40ºC (14ºF to 104ºF) Chassis: -10ºC to 50ºC (14ºF to 122ºF)	
Storage Temperature	-10ºC to 50ºC (14ºF to 122ºF)	
Humidity	0-95% non-condensing	
Vibration	1.0 G	
EMC	EN_61800-3	
LVD	EN_50178	
Approvals	UL listed and Canadian UL (cUL) listed, CE Approved	

Single Phase Operation/Sizing	Three phase drives up to frame size 3 may be operated from single phase power at 56% of original capacity (Example: 15HP drive will operate 7.5HP motor).

VCM AC Drive

VCM - 2 30 - [ ] - N

Voltage Class
2 = 200 – 240V
4 = 380 – 460V

Horsepower
See Selection Chart

Input Phase
1 = Single Phase
Blank = Three Phase

Enclosure
P = Protected Chassis
N = NEMA 1 (IP20)

Input Voltage	Model Number	Rated Output Current	HP (CT)	kW (CT)	Frame Size	Dimensions (Inches)			List Price $
						H	W	D	
Single Phase 200-240V	**VCM-2P5-1-P**	3.1	0.5	0.4	1	6.42	3.55	5.79	**380**
	VCM-201-1-P	4.5	1	0.75					**440**
	VCM-202-1-P	7.5	2	1.5	2	7.37	5.04	5.83	**560**
	VCM-203-1-P	10.5	3	2.2					**740**
Three Phase 200-240V	**VCM-2P5-P**	3.1	0.5	0.4	1	6.42	3.55	5.79	**375**
	VCM-201-P	4.5	1	0.75					**400**
	VCM-202-P	7.5	2	1.5					**470**
	VCM-203-P	10.5	3	2.2	2	7.37	5.04	5.83	**640**
	VCM-205-P	17.5	5	3.7					**720**
	VCM-207-P	26	7.5	5.5	3	10.24	7.33	7.68	**1,040**
	VCM-210-P	35	10	7.5					**1,170**
	VCM-215-N	48	15	11	4	14.18	10.44	9.77	**2,060**
	VCM-220-N	64	20	15					**2,080**
	VCM-225-N	80	25	18.5					**2,820**
	VCM-230-N	96	30	22	6	25.73	12.14	12.17	**4,320**
	VCM-240-N	130	40	30					**4,840**
Three Phase 380-480V	**VCM-401-P**	2.3	1	0.75	1	6.42	3.55	5.79	**460**
	VCM-402-P	3.8	2	1.5					**500**
	VCM-403-P	5.2	3	2.2	2	7.37	5.04	5.83	**670**
	VCM-405-P	8.8	5	3.7					**740**
	VCM-407-P	13	7.5	5.5	3	10.24	7.33	7.68	**1,040**
	VCM-410-P	17.5	10	7.5					**1,140**
	VCM-415-P	25	15	11					**1,300**
	VCM-420-N	32	20	15	4	14.18	10.44	9.77	**1,930**
	VCM-425-N	40	25	18					**2,570**
	VCM-430-N	48	30	22					**2,820**
	VCM-440-N	64	40	30	5	21.79	10.6	11.98	**4,310**
	VCM-450-N	80	50	37					**4,700**
	VCM-460-N	96	60	45	6	25.73	12.14	12.17	**5,340**
	VCM-475-N	128	75	55					**5,960**

VCM SERIES V/Hz or OL Vector AC DRIVE Options

VCM AC Drive

Model Number	Option Description	Option Information	List Price $
VCM-N1-KIT1	NEMA 1 Kit	Frame 1	**18**
VCM-N1-KIT2	NEMA 1 Kit	Frame 2	**22**
VCM-N1-KIT3	NEMA 1 Kit	Frame 3	**24**
VCM-KEYPD-LCD	Optional LCD Keypad	Replaces LED Keypad	**54**
VCMW30P5	Keypad Extension Cable	0.5 meters	**60**
VCMW3001	Keypad Extension Cable	1 meters	**65**
VCMW3002	Keypad Extension Cable	2 meters	**70**
VCMW3003	Keypad Extension Cable	3 meters	**75**
VCMW3005	Keypad Extension Cable	5 meters	**80**
VCM-232-KIT	Communications Option	RS232	**30**
VCM-485-KIT	Communications Option	RS485	**34**
VCM-MP	Communications Option	Memory Pack	**15**

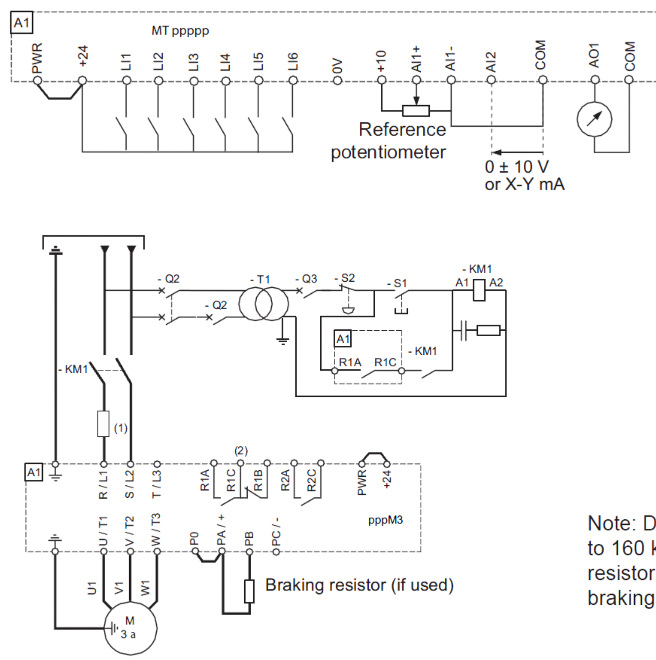
Braking Resistors

Input Voltage	Model Number	Braking Resistor Model Number	List Price $
Three Phase 200-240V	VCM-2P5-P	**JNBRN2-201**	**32**
	VCM-201-P	**JNBRN2-201**	**32**
	VCM-202-P	**JNBRN2-202**	**38**
	VCM-203-P	**JNBRN2-203**	**55**
	VCM-205-P	**JNBRN2-205**	**78**
	VCM-207-P	**JNBRN2-207**	**140**
	VCM-210-P	**JNBRN2-210**	**165**
Three Phase 380-480V	VCM-401-P	**JNBRN2-401**	**34**
	VCM-402-P	**JNBRN2-402**	**40**
	VCM-403-P	**JNBRN2-403**	**60**
	VCM-405-P	**JNBRN2-405**	**85**
	VCM-407-P	**JNBRN2-407**	**140**
	VCM-410-P	**JNBRN2-410**	**165**

MT SERIES V/Hz, OLV, CLV AC DRIVE
200 – 480V, 0.5 – 700HP (CT)

MT AC Drive

Typical control card connection diagram



Note: Diagram applies to models rated up to 160 kW (250 HP). Above this, braking resistors are connected to an external braking module.

High Performance Vector Drive
• Sensorless vector with autotuning, closed loop vector or simple V/Hz control
• Intuitive programming & monitoring
• Easy to read multi-line LCD display
• Best in-class torque performance & speed regulation
• Built-in application macros

Remarkable Torque Capability
• Up to 220% over torque capability for 2 seconds (170% for up to 60 seconds)

Maximum Response Time and Stability
• Dual-processor design with a dedicated microprocessor for motor control algorithm means response times in 2 microseconds(not milliseconds).
• Closed loop performance even in the open loop vector mode (160% full load torque down to 0.5Hz)
• On the fly switching from speed control mode to torque control mode via logic input

Superior Braking Capability
• Built-in braking transistor in all MT units rated up to 250HP.
• 30% braking torque (on average) without the need for an external dynamic braking resistor.

Longer Motor-to-Drive Lead Lengths
Unique 'Sinus Filter' output function in software limits motor overvoltage to two times the DC bus voltage. Eliminates the need for external filtering and extends the maximum allowable motor-to-drive lead length (up to 500 feet).

Cool Drive Operation
Performs in 50 degrees C (and even higher) ambient operating temperatures at 115% load WITHOUT derating.

Intuitive Multi-line Keypad

Easy to ready multi-line graphic keypad (8 lines of 24 characters) with English display or programmable for one of five other languages.
Simple navigation wheel for 'surfing' through the menus, to set your parameters or adjust the motor speed.
For remote mount or door mount requirements use the quick disconnect tabs for tool-less removal of the NEMA12 rated LCD keypad. Then mount the keypad wherever you want using a standard CAT5 communications cables and off-the-shelf connectors to either of the two built in RJ45 connection points (as far as 300 feet away from the drive).

Adaptable Chassis Design

MT Series drives are designed as a 'protected' chassis with a NEMA1 kit available as an option for all sizes. The power section on all sizes is a NEMA12 separate compartment that allows the power section to be mounted outside of an enclosure using a simple flange kit.
Standard Features…
• Custom ramps • Accepts up to 50% line voltage drop
• 150 programmable functions • Fast stop / freewheel to stop
• 16 preset speeds • Frequency, current, thermal state, high
• Summing reference speed attained reference
• +/- speed • Catch on-the-fly
• Jog • Defeatable faults stored in EEPROM
• Reference switching • Reverse operation inhibit
• Ramp switching • DC braking
• 2 or 3 wire control • PID control
• Integrated Modbus? & CANopen Port

Control Characteristics	Control Mode	Sensorless vector, closed loop vector or V/Hz control of AC induction motors
	Carrier Frequency	Adjustable during operation from 1…8, 2.5…8 or from 1…16 based on rating 200V Drives: 1…16 kHz up to 60HP / 45kW (CT) 1…8 kHz up to 75HP / 60kW to 100HP / 75kW (CT) 400V Drives: 1…16 kHz up to 100HP / 75kW (CT) 2.5…8 kHz up to 125HP / 90kW to 700HP / 500kW (CT) **Note:** Above 2.5 or 4 kHz, depending on the rating, the drive decreases the switching frequency itself in the event of excessive temperature rise. For continuous operation above the nominal switching frequency, derate the nominal drive current.
	Output Frequency Range	< 50HP / 37 kW (CT) = 0 - 1000 Hz > 50HP / 37 kW (CT) = 0 - 500 Hz
	Speed Control Range	1: 1000 in closed loop mode with incremental encoder feedback 1: 100 in open-loop mode without encoder feedback
	Speed Control Accuracy	+ 0.01% of nominal speed, in closed-loop mode with encoder feedback +10% of nominal slip, without encoder feedback
	Frequency Resolution	Digital: 0.1 Hz; Analog: 50 Hz/2048 (11 bit converter)
	Frequency Setting Signal	Graphical display, analog inputs or multi-function logic inputs
	Accel/Decel Time	Ramp profiles: • Linear, can be adjusted separately from 0.01 to 9999 seconds • S, U, or customized Automatic adjustment of decel ramp time if braking capacity exceeded
	Torque Overload	170% of the nominal motor torque (typical value at + 10%) for 60 seconds 220% of the nominal motor torque (typical value at + 10%) for 2 seconds
	Braking Torque	30% of the rated motor torque without braking resistor (typical value). Up to 150% with braking resistor (installed as an option)
	V/f Pattern for V/Hz control	2 or 5 points
	Frequency limit function	Upper/lower freq. limits, programmable skip freq. & vibration control

Protection Functions	Current Overload		150% of the nominal drive current for 60 seconds (typical value) 165% of the nominal drive current for 2 seconds (typical value)
	Motor Overload Protection		Thermal protection integrated in drive via continuous I²T calculation The motor thermal state is saved when the drive is powered down Function can be modified via operator dialog terminals, depending on the type of motor (force air-cooled or non-ventilated) Protection against motor phase loss, PTC inputs
	Input voltage range		200V range: 200V -15%; 240V +10% 400V range: 380V -15%; 480V +10%
	DC Bus Protection		DC Bus overvoltage
	Heat Sink Fin Overheat		Protected by thermistor/thermostat
	Power Stage Protection		Calculated IGBT Temperature
	Ground Fault Protection		Standard on all units
	Stall Prevention		Stall prevention for Acceleration/Deceleration while running
Operation Conditions	Digital Inputs	LI1 - LI5	5 programmable logic inputs, 24VDC, compatible with Level 1 PLC Impedance: 3.5 Ω Maximum voltage: 30VDC Max. sampling time: 2ms + 0.5ms Multiple assignment allows configuration several functions via one input
		LI6	1 logic input, switch-configurable as logic input or as input for PTC probes Logic input, characteristics identical to inputs LI1 - LI5 Input for a maximum of 6 PTC probes mounted in series:
		Positive logic (Source)	State 0 if < 5VDC or logic input not wired, state 1 if > 11VDC
		Negative logic (Sink)	State 0 if >16VDC or logic input not wired, state 1 if < 10 VDC
		Other inputs	See option cards
	Digital Relay Outputs	R1A, R1B, R1C	1 relay logic output, one NC contact and one NO contact with common point Minimum switching capacity 3 mA for 24VDC Maximum switching capacity • Resistive load (cos Ω = 1): 5A for 250VAC or 30VDC • Inductive load (cos Ω = 0.4 and L/R = 7ms): 2A for 250VAC or 30VDC Max response time: 7ms + 0.5ms Electrical service life: 100,000 operations
		R2A, R2B	1 relay logic output, one "N/O" contact Minimum switching capacity 3 mA for 24VDC Maximum switching capacity • Resistive load (cos Ω = 1): 5 A for 250VAC or 30VDC • Inductive load (cos (SYM) = 0.4 and L/R = 7ms): 2A for 250VAC or 30VDC Max response time: 7ms + 0.5ms Electrical service life: 100,000 operations
		Other outputs	See option cards

Operation Conditions	Built-in Functions		Torque regulation, torque/speed regulation switching, torque limitation, current limitation, reference switching, operations on the reference, S and customized ramps, ramp switching, Jog, preset speeds, PID regulation, auto/manual, preset PID references, brake sequence, high speed hoisting, brake contact feedback processing, weight measurement processing, limit switch management, load balancing, multi-motors, multi-configurations, motor fluxing, + speed / - speed with single or 2-stage pushbuttons, reference saving, automatic DC injection, configuration of type of stop (freewheel, fast stop, DC injection, etc), configurable undervoltage management, line contactor control, downstream contactor control, downstream contactors integrity check, fault reset, fault inhibition, automatic restart, multi-parameters, auto-tuning and more.
	Analog Inputs	AI1-/AI1+	1 bipolar differential analog input + 10VDC (max safe voltage 24VDC) Max. sampling time: 2 ms + 0.5 ms Resolution 11 bits + 1 sign bit Accuracy + 0.6% for a temperature variation of 60° C Linearity + 0.15% of the maximum value
		AI2	1 software-configurable voltage or current analog input: • Voltage analog input 0 - 10 V impedance 30kΩ (max. safe voltage 24VDC) • Current analog input X - Y mA by programming X and Y from 0 to 20 mA, with impedance 242Ω Max. sampling time: 2 ms + 0.5 ms Resolution 11 bits Accuracy + 0.6% for a temperature variation of 60° C Linearity + 0.15% of the maximum value
	Analog Output	AO1	1 software-configurable voltage or current analog input: • Voltage analog input 0 - 10 V impedance 30kΩ (max. safe voltage 24VDC) • Current analog input X - Y mA by programming X and Y from 0 to 20 mA, with impedance 242Ω Max. sampling time: 2 ms + 0.5 ms Resolution 11 bits Accuracy + 0.6% for a temperature variation of 60° C Linearity + 0.15% of the maximum value
	Display function		24 character, 8 line display; 6 languages available including English, Chinese, French, Spanish, German, Italian; storage of 4 configurations for upload from keypad to MT drives and remote mount option.
	Communications		Modbus and CANopen communication protocols as standard via 2 RJ45 connector ports; optional deviceNet, Ethernet TCP/IP, Profibus DP, Interbus-S, Modbus Plus

<table>
<tr><td rowspan="12">Environmental Conditions and Approvals</td><td colspan="2">Standard Enclosure</td><td>IP20 Protected Chassis, IP00 on large drives (optional NEMA1 Kit available for all frame sizes)</td></tr>
<tr><td colspan="2">Altitude</td><td>Up to 3,300 feet (derating required at higher altitudes)</td></tr>
<tr><td colspan="2">Ambient Temperature</td><td>-10° C to 50°C (14°F to 122°F)
Operation up to 60°C with derating or use of ventilation control kit</td></tr>
<tr><td colspan="2">Storage Temperature</td><td>-25°C to 70°C (-13°F to 115°F)</td></tr>
<tr><td colspan="2">Humidity</td><td>5 - 95% non-condensing, conforming to IEC 60068-2-3</td></tr>
<tr><td rowspan="2">Vibration</td><td>< 75 kW</td><td>1.5mm peak to peak, 3-13Hz, 1gn from 13-200 Hz (IEC/EN 60068 2-6)</td></tr>
<tr><td>>90kW</td><td>1.5mm peak to peak, 3-10Hz, 0.06gn from 10-200Hz (IEC/EN 60068 2-6)</td></tr>
<tr><td rowspan="2">Shock resistance</td><td>< 75 kW</td><td>15gn for 11ms (IEC/EN 60068-2-27)</td></tr>
<tr><td>>90kW</td><td>7gn for 11 ms (IEC/EN 60068-2-27)</td></tr>
<tr><td colspan="2">EMC</td><td>Emissions: IEC/EN 61800-3, environments 1 & 2, categories C1, C2, C3
Immunity: IEC/EN 61000-4-2, -3, -4, -5, -6, and-11</td></tr>
<tr><td colspan="2">LVD</td><td>EN 50178 and IEC 529</td></tr>
<tr><td colspan="2">Approvals</td><td>UL, CE, CSA, NOM 117, C-Tick</td></tr>
</table>

MT AC Drive

MT - 2 30 - P

Voltage Class
2 = 200 – 240V
4 = 380 – 460V

Horsepower
See Selection Chart

Enclosure
P = Protected Chassis
(Optional NEMA1 kit and NEMA 4/12 flange kit available)
N = NEMA 1 Drive Package
18P = 18 Pulse Drive Package

Input Voltage	Model Number	Rated Output Current	HP (CT)	kW (CT)	List Price $
200-240V	**MT-2P5-P**	3	0.5	0.37	**1,198**
	MT-201-P	4.8	1	0.75	**1,260**
	MT-202-P	8	2	1.5	**1,360**
	MT-203-P	11	3	2.2	**1,560**
	MT-205-P	17.5	5	4	**2,160**
	MT-207-P	27.5	7.5	5.5	**2,684**
	MT-210-P	33	10	7.5	**3,300**
	MT-215-P	54	15	11	**4,120**
	MT-220-P	66	20	15	**4,852**
	MT-225-P	75	25	18.5	**5,600**
	MT-230-P	88	30	22	**7,208**
	MT-240-P	120	40	30	**7,744**
380-480V	**MT-401-P**	2.3	1	0.75	**1,395**
	MT-402-P	4.1	2	1.5	**1,395**
	MT-403-P	5.8	3	2.2	**1,395**
	MT-405-P	10.5	5	4	**1,707**
	MT-407-P	14.3	7.5	5.5	**2,019**
	MT-410-P	17.6	10	7.5	**2,337**
	MT-415-P	27.7	15	11	**2,766**
	MT-420-P	33	20	15	**3,447**
	MT-425-P	41	25	18.5	**4,140**
	MT-430-P	48	30	22	**4,740**
	MT-440-P	66	40	30	**5,550**
	MT-450-P	79	50	37	**6,510**
	MT-460-P	94	60	45	**8,190**
	MT-475-P	116	75	55	**9,075**

Cont.

MT AC Drive

MT - 2 30 - P

Voltage Class
2 = 200 – 240V
4 = 380 – 460V

Horsepower
See Selection Chart

Enclosure
P = Protected Chassis
(Optional NEMA1 kit and NEMA 4/12 flange kit available)
N = NEMA 1 Drive Package
18P = 18 Pulse Drive Package

	MT-4100-P	160	100	75	**9,600**
	MT-4125-P	179	125	90	**12,675**
	MT-4150-P	215	150	110	**17,580**
	MT-4200-P	259	200	132	**18,507**
	MT-4250-P	314	250	160	**21,828**
380-480V	**MT-4300-P**	387	300	200	**24,465**
	MT-4400-P	481	400	250	**26,661**
	MT-4450-P	550	450	280	**31,530**
	MT-4500-P	616	500	310	**41,124**
	MT-4600-P	759	600	400	**59,445**
	MT-4700-P	941	700	500	**82,245**

MT SERIES V/Hz, OLV, CLV AC DRIVE
Weights and Dimensions

MT AC Drive

Input Voltage	Model Number	Frame Size	Dimensions (Inches)			Shipping Weight (Lbs)
			H	W	D	
200-240V	**MT-2P5-P**	2	9.06	5.12	6.89	6.61
	MT-201-P					
	MT-202-P					
	MT-203-P	3	10.24	6.1	7.36	8.82
	MT-205-P					
	MT-207-P	4	11.61	6.89	7.36	12.13
	MT-210-P	5A	11.61	8.27	8.39	15.43
	MT-215-P	5B	15.75	9.06	8.39	19.84
	MT-220-P					
	MT-225-P	6	16.54	9.45	9.29	66.14
	MT-230-P					
	MT-240-P	7B	21.65	12.6	10.47	81.57
	MT-401-P	2	9.06	5.12	6.89	6.61
	MT-402-P					
	MT-403-P					
	MT-405-P	3	10.24	6.1	7.36	8.82
380-480V	**MT-407-P**	4	11.61	6.89	6.34	12.31
	MT-410-P					
	MT-415-P	5A	11.61	8.27	8.39	15.43
	MT-420-P	5B	15.75	9.06	8.39	19.84
	MT-425-P					
	MT-430-P	6	16.54	9.45	9.29	66.14
	MT-440-P	7A	21.65	9.45	10.47	81.57
	MT-450-P					
	MT-460-P	8	24.80	12.6	11.42	100
	MT-475-P					
	MT-4100-P					
	MT-4125-P	9B	26.77	12.2	15.43	176
	MT-4150-P	10A	30.79	13.78	15.43	207
	MT-4200-P	11A	46.85	13.39	15.43	300
	MT-4250-P	12A	46.85	17.32	15.43	402
	MT-4300-P	13	37.4	23.43	15.43	455
	MT-4400-P					
	MT-4450-P					
	MT-4500-P	14A	54.72	35.04	15.43	704
	MT-4600-P					726
	MT-4700-P	15A	54.72	44.09	15.43	957

NOTE: Dimensions are subject to change. See manual for mounting dimensions

Model Number	Option Description	Option Information	List Price $
MT-VW3A1101	LCD graphic spare keypad. Supplied as standard		**411**
Remote Mount Extension Cables			
MT-VW3A1104R10	Cable for remote mounting LCD graphic keypad with RJ45 connector included on each end.	1 meter / 3.28 ft	**40**
MT-VW3A1104R30		3 meter / 9.84ft	**47**
MT-VW3A1104R50		5 meter / 16.4ft	**53**
MT-VW3A1104R100		10 meter / 32.8ft	**69**
Door Mounting Kits and Accessories			
MT-VW3A1102	IP54 / NEMA12 mounting kit incl. bezel & hardware		**104**
MT-VW3A1103	IP65 / NEMA 4 mounting kit door used above		**63**
MT-VW3A1105	RJ45 female-female adaptor to connect keypad		**42**
Contact factory	USB to RS485 converter or RS232 to RS485 converter for PC connection		**C/F**
I/O Option Cards			
MT-VW3A3202	Extended I/O option board		**400**
MT-VW3A3101	115V input adaptor (adapts 7 logic inputs, user supplied 115VAC signals)		**205**
Communication Option Cards			
MT-VW3A3307	Profibus Option Board		**500**
MT-VW3A3309	DeviceNet Option Board		**351**
MT-VW3A3302	Modbus Plus Option Board		**325**
MT-VW3A3310	Ethernet MB TCP/IP Option Board		**417**
Encoder for Closed Loop Vector Control			
MT-VW3A3401	300kHz max frequency, 5,000 pulses/ rev. maximum A, A -, B, B -	RS422 output, 5VDC	**173**
MT-VW3A3403		Open collector output, 12VDC	**164**
MT-VW3A3403		Open collector output, 15VDC	**162**
MT-VW3A3405		Push-pull outputs, 12VDC	**185**
MT-VW3A3406		Push-pull outputs, 15VDC	**185**
MT-VW3A3407		Push-pull outputs, 25VDC	**185**

MT SERIES V/Hz, OLV, CLV AC DRIVE
NEMA 1 Conduit Kit, NEMA 4/12 Mounting Kits

MT AC Drive

Description	Model Number	List Price $
NEMA 1 conduit kit Frames 2-13 (Includes metal box with conduit knockouts)		
Frame 2 (MT-2P5, -201, -202, -401, -402, -403)	**MT-VW3A9201**	**150**
Frame 3 (MT-203, -205, -405)	**MT-VW3A9202**	**150**
Frame 4 (MT-207, -407, -410)	**MT-VW3A9203**	**160**
Frame 5A (MT-210, -415)	**MT-VW3A9204**	**165**
Frame 5B (MT-215, -220, -420, -425)	**MT-VW3A9205**	**170**
Frame 6 (MT-225, -230, - 430)	**MT-VW3A9206**	**170**
Frame 7A (MT-440, -450)	**MT-VW3A9207**	**175**
Frame 7B (MT-240)	**MT-VW3A92017**	**195**
Frame 8 (MT-460, -475, -4100)	**MT-VW3A9208**	**200**
Frame 9B (MT-4125)	**MT-VW3A9209**	**1,056**
Frame 10A (MT-4150)	**MT-VW3A9210**	**1,268**
Frame 11A (MT-4200)	**MT-VW3A9211**	**1,136**
Frame 12A (MT-4250)	**MT-VW3A9212**	**1,280**
Frame 13 (MT-4300, -4400)	**MT-VW3A9213**	**1,384**
NEMA 4/12 flange mount kit for mounting the heatsink outside a customer supplied enclosure.		
Frame 2 (MT-2P5, -201, -202, -401, -402, -403)	**MT-VW3A9501**	**388**
Frame 3 (MT-203, -205, -405)	**MT-VW3A9502**	**420**
Frame 4 (MT-207, -407, -410)	**MT-VW3A9503**	**466**
Frame 5A (MT-210, -415)	**MT-VW3A9504**	**500**
Frame 5B (MT-215, -220, -420, -425)	**MT-VW3A9505**	**573**
Frame 6 (MT-225, -230, - 430)	**MT-VW3A9506**	**590**
Frame 7A (MT-440, -450)	**MT-VW3A9507**	**630**
Frame 7B (MT-240)	**MT-VW3A9508**	**630**
Frame 8 (MT-460, -475, -4100)	**MT-VW3A9509**	**650**
Frame 9B (MT-4125)	**MT-VW3A9510**	**750**
Frame 10A (MT-4150)	**MT-VW3A9511**	**775**
Frame 11A (MT-4200)	**MT-VW3A9512**	**915**
Frame 12A (MT-4250)	**MT-VW3A9513**	**915**
Frame 13 (MT-4300, -4400)	**MT-VW3A9514**	**915**

On Site Assistance and Service Rates

Technical Assistance and Service Rates			
Activity	**Field Engineer**	**Daily**	**Definition**
Hourly Rate	$200 / Hour	$1500 / Day	8 Hours / Day, Monday – Friday 7:00am – 6:00pm
Overtime - Standard	$250 / Hour		Weekdays hours prior to 7:00 am or beyond 6:00pm; All Saturday time. Total time not to exceed 8 hours/day
Overtime - Premium	$400 / Hour		All Sunday and holiday work; all time in excess of 8 hours/Saturday
Travel and Living Expense	At Cost		
Standby	Invoiced at appropriate activity rate		
Travel Time	Invoiced at 50% of appropriate activity rate		
Auto Travel	$0.55 / Mile	$0.55 / Mile	Rate covers round trip use of company or personal car

NOTE:

- **Rates are subject to change consult factory for current rates and scheduling.**
- **Prices are for service within the continental USA.**

Frequently Asked Questions

Topic: Why use a RVSS Soft Starter?

Question: I have new equipment to install. Why should I consider using a Reduced Voltage Solid State Soft Starter?

Answer:

All equipment that utilizes electric motors requires a “starter” to control and protect the motor. The starter can be anything from a cheap Across-the-Line (X-Line) clapper style relay to the much more sophisticated RVSS soft starter. A RVSS soft starter is the product to choose for system reliability, maximum motor protection and the lowest long term cost of operation.

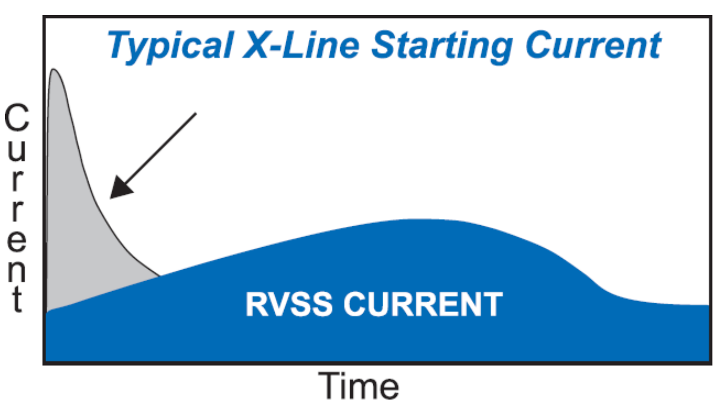
As the horsepower goes up, Power Utility or generator sizing requirements may limit your starter options to “Reduced Voltage” (RV) starting in order to keep the Starting Inrush Current under control. Most utilities require Reduced Voltage starting on motors over a certain horsepower rating, some as low as 15HP!

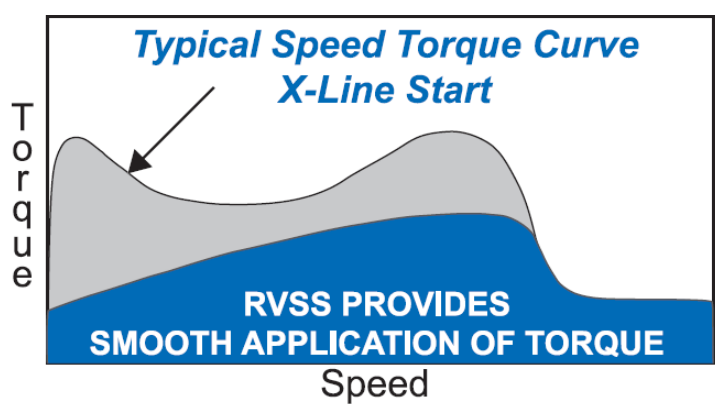
Various types of Reduced Voltage starters for AC motors will reduce the negative effects of Inrush Current on the power source (including voltage dips or generator stalling). Older technologies like electro-mechanical Reduced Voltage (RV) starters are just one approach to solving this problem. Although they have been around for years, they are now being replaced by the newer solid state technology available in RVSS starters. In most cases, RVSS starters cost LESS than the older electro-mechanical RV starters and provide more benefits. This FAQ section offers comparisons on RVSS starting to the different types of electro-mechanical RV starting methods.

In addition to being less expensive, RVSS offers additional benefits. Most importantly, RVSS starters prevent mechanical shock and damage to all of your power train components by providing smooth stepless acceleration of the motor. Reduced repair costs for the motor and machinery is an immediate benefit. The increased reliability of the work they are doing increases the net value.

Being solid state, RVSS starters give you longer performance with virtually no maintenance. There are no contacts to burn out, and no armatures to break from repeated slamming on and off. In many cases, replacement contact points for an electro-mechanical RV starter can be more expensive than replacing the existing starter with an RVSS.

Motortronics RVSS starters offer built in premium motor protection features. Reduced Voltage Solid State Starters are the optimum value in motor starting technology today.





Topic: RVSS vs X-Line

Question: My Across-the-Line starter has worked fine for years. Why should I change to a RVSS starter?

Answer:

The primary benefit of using RVSS starters is to reduce mechanical stress from excess starting torque. A good analogy to starting an AC motor across the-line is to imagine having an expensive sports car. If you rev the engine up to the “red line” RPMs and then pop the clutch, what will happen? After smoking the tires the car will start moving but at what cost to your drive train? The engine, clutch, transmission...even the body and frame will be affected!

X-Line starting of an AC motor is virtually the same. All of the excess torque from that jerking start is absorbed by the mechanical components in your equipment. Although they will continue to work, damage is being done every time you start the motor and you will eventually pay the price.

If your motor runs continuously and shuts down only for routine maintenance, there may still be a valid reason to use an RVSS. As power distribution grids become more stressed, energy saving becomes more important. Shutting your motor off more regularly will provide important energy savings (The BEST energy saver is the OFF button). However, this means you will have to restart your loads more often than the original mechanical design may have allowed for. More frequent restarts (after load shedding or power losses) will accelerate equipment damage, jeopardizing your machinery and/or operation. The benefits of restarting softly may take longer to recognize in these applications, but that is only because the cost of eventual downtime is difficult to predict.

Keep in mind that with torque reduction being a prime benefit, applications which require all the available torque all of the time may not be good applications for an RVSS. Some examples of these types of applications might include hoists, lifts, positive displacement pumps and even some types of compressors that must start under full load. If however, the high torque is only required on occasional starts (such as a loaded restart after a power failure) there is still a place for Soft Starting. By using the Dual Ramp feature, normal starts can be as soft as possible and high torque starts can be selected using the second ramp when necessary.

Topic: RVSS vs RVAT

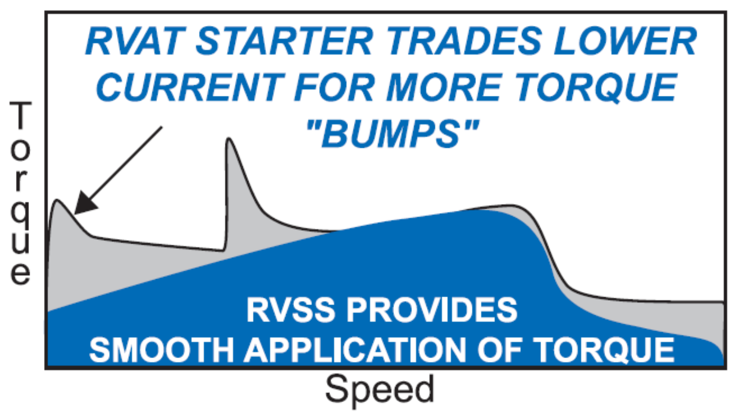
Question: How do RVSS starters compare to Reduced Voltage Auto-Transformer (RVAT) starters?

Answer:

RVSS starters are smaller, more reliable and much more flexible than Reduced Voltage Autotransformer (RVAT) starters, and are LESS EXPENSIVE! RVAT starters require a 2-step starting process, trading the benefit of the initial starting current reduction for two consecutive bumps of high torque. This creates mechanical stress in the system which can lead to equipment damage, product breakage and costly downtime. An RVSS minimizes the mechanical stress by providing a smooth, gentle ramp for the motor and the load over a selected ramp time. This cannot be done using RVAT starting. An RVSS starter has no moving parts to wear out or contacts to burn. Even if a Bypass Contactor is added (as with NEMA12 enclosed models), special controls in the Motortronics' RVSS will prevent any contact deterioration. In contrast, RVAT starters have 9 sets of contacts that need frequent replacement, along with 3 coils and a timer which means an increased likelihood of failure.

RVAT starters also have a severely limited duty cycle making them unsuitable for many applications. If a motor/load needs to be in the Reduced Voltage mode for longer than 15 seconds or if the motor is started too often, thermal devices in the RVAT starter transformer will trip. A Motortronics RVSS starter will match or exceed the duty cycle rating of the motor it controls, so duty cycle limits are dictated by the motor being used, not the starter. An RVSS can also be used in applications where extended ramping times are required (to as much as a 120 second ramp time!).

Another important difference between the two types of starters is flexibility. A Motortronics RVSS can be used to Soft Stop a motor but an RVAT starter cannot. "Soft Stopping" is the opposite of braking. This feature makes the motor and load take LONGER to stop than if it was turned off (See Pump Applications FAQ on page 147).

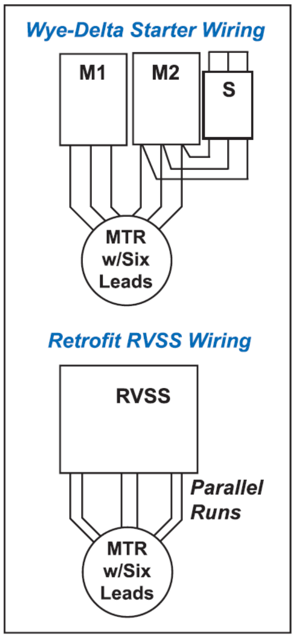


Topic: RVSS vs Wye-Delta

Question: Can I use a Motortronics RVSS to replace a Wye-Delta starter?

Answer

Wye Delta starting (referred to as Star-Delta in Europe) utilizes six leads going to the motor. This starts in two steps. But unlike RVAT starting, the voltage to the motor is never actually reduced. Instead, the winding pattern of the motor is switched around externally by means of contactors and shorting bars. This requires a special motor that has the ends of each winding brought out to the terminal box (meaning that dual voltage motors will have 12 leads that must be connected). In the Start stage, the motor windings are connected in a Wye (Star) pattern to a common center point for each of the three phases. This reduces the output capacity of the motor's rated torque to 33%. This means the current is reduced to 33% as well. After the load starts moving (assuming that 33% is enough torque), the motor windings are switched to the Delta pattern to provide full torque and full current.



Again, this is a two-step starting process. When the starter transitions from Start to Run, a significant torque "bump" is created, often at Locked Rotor levels. A special version of starter, known as a "Closed Transition" starter will overcome this problem by utilizing a 4th contactor in the circuit that switches in a resistor bank during transition (which increases the complexity and makes it more expensive). In this case, a RVSS starter is a much more attractive alternative to Wye Delta starting.

Since the 33% torque value is fixed, many users select RVSS as an alternative for greater flexibility in available torque. If you are retrofitting an existing starter and have all 6 wires brought out from the motor, simply connect them in the Delta pattern to the RVSS starter. If you are choosing RVSS over Wye-Delta in a new installation, you only need to run three conductors from the motor to the starter. This also means you can use a motor from readily available stock.

There are other significant problems that can occur with Wye Delta starting including severe voltage spikes and field misconnection. These problems are virtually eliminated if you use RVSS starters.

Topic: RVSS vs PW

Question: I have a Part Winding starter on my pump right now, can I replace it with a Solid State Starter?

Answer:

Part Winding (PW) starting requires a special motor that has it's windings split into two sections, each brought out to the terminal box. The electromechanical starter has separate contactors and a timer to bring the motor on-line in two steps. This is the least expensive STARTER, but requires a special motor, which means higher cost and less flexibility in finding a replacement if the motor fails. Pumping is the most common application for PW starting. Like the RVAT it cannot provide Decel, an essential feature in pumping applications. The Decel feature is ONLY available with RVSS starters (see the FAQ entitled "Pumping Applications"). In some cases, the higher initial torque of a PW starter may cause surges and equipment damage on start-up. Using an RVSS provides flexibility of adjustment for just the right amount of torque. For retrofit applications where a PW motor is being used, simply connect all leads for each phase to the RVSS terminals.

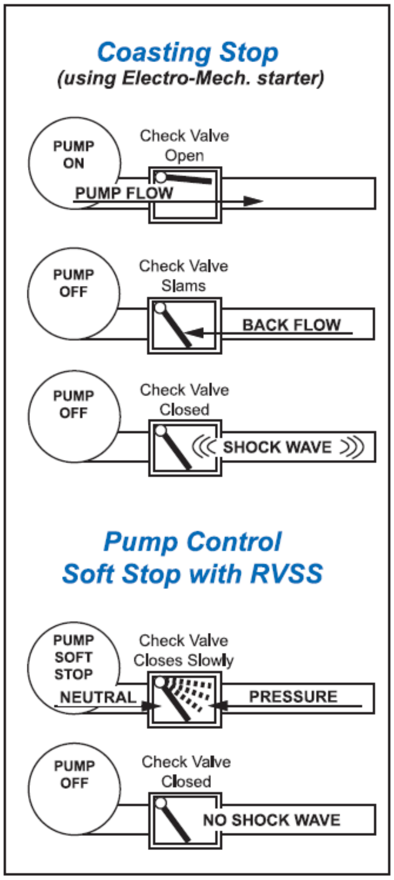
Frequently Asked Questions (Cont.)

Topic: Pumping Applications

Question: What makes RVSS starters so ideal for use in Pumping Applications?

Answer:

A unique feature available only on RVSS starters is the ability to provide controlled deceleration (Decel) of the motor over a period that is LONGER than the coast-to-stop time. This Decel feature prevents the load from coming to an abrupt stop and causing equipment damage or other load problems. The prime use of this feature is in preventing surges and shock waves (water hammer) in centrifugal pump systems.



Water Hammer is the result of the kinetic energy of the moving water being trapped abruptly by a check valve. Since water does not compress, the energy has nowhere to go and becomes a “shock wave” traveling up and down the piping system searching for an outlet. The outlet for that energy will be the pipes, seals, hangers, flanges, concrete walls, mounting bases and a host of other mechanical equipment in the entire pump and piping system. By extending the ramp-down time, the energy of the moving liquid is dissipated gradually with the reduced pressure from the pump. Then, when the check valve closes, there is little or no energy left in the liquid to be trapped, preventing the shock wave.

Another benefit of using Motortronics RVSS starters on pumps is their ability to provide controlled acceleration using current limit on turbine pump systems. Rapid acceleration can cause upthrust of the pump shaft and surging of the water when it reaches the top of the pipe. Using Current Limit, the RVSS can reduce the pump motor torque to provide just enough lift to get the water to the top, without excess surging or upthrust. Since the pump may require very little initial torque to start, the Motortronics RVSS can ramp gently into that current limit setting, providing the maximum benefit. Electromechanical RV starters and other RVSS starters are less able to control these situations.

Reduced Voltage starting is required on many pump applications just as a means of reducing Inrush Current. By choosing Motortronics RVSS starters, all of the other benefits of solid state starting are provided as well. Reduced mechanical shock, no maintenance and advanced motor protection make RVSS technology the starter of choice for Pump motors.

Topic: Peak Demand

Question: Can soft starters save me money on the peak demand charges from my utility?

Answer

Demand charge savings are possible in many applications, but may come in a different form than what you might expect. To determine possible savings, it is first necessary to determine how your utility registers demand charges for your billing cycle. If they use any of the “ratcheting instantaneous demand” meters to measure usage, savings may come as a direct result of using the Soft Starter Current Limit feature to reduce starting current peaks.

For example, if your utility charges you extra whenever you turn on a large motor, you may be paying for instantaneous peaks. In a majority of installations however, the demand charges are calculated using a thermal device that takes a certain amount of time to “warm up” and register the demand. The time it takes the thermal action to register an increase is called the “demand window”, and is typically 15 to 30 minutes long.

This means that any single event shorter than the demand window will have little effect on the overall demand registration. The best way to avoid demand charges in this case is to use the #1 rated energy saving device in the world; the “OFF” button! By using soft starters, you can restart your machines when necessary without causing the associated mechanical damage or voltage drop problems experienced with across-the-line starting. This allows you to shed loads whenever possible, saving on both total energy consumption and demand charges.

Topic: Generator Power

Question: I have had several problems trying to power Soft Starter from an emergency diesel generator. Are Motortronics soft starters suitable for that application?

Answer

Motortronics soft starter products are especially well suited for operating behind portable or stationary emergency generators. Motortronics soft starters were designed from the outset to provide high precision gate firing in all power environments. By using an exclusive “Auto-Synchronizing” firing circuit, Motortronics starters maintain firing circuit integrity regardless of drifting or unstable power. A common problem encountered by users of other soft starters is that the fluctuations in power frequency and output waveform can cause the firing circuit of the soft starter to “lock-up” and shut down.

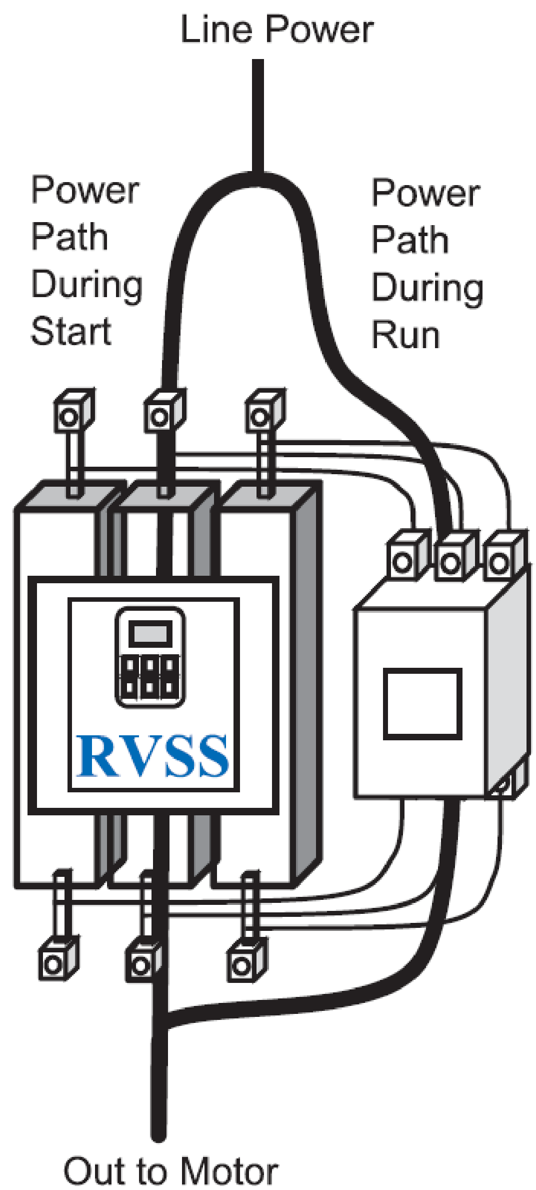
The reasons are complicated and involve the roots of their power sensing circuitry, but it is very real and happens all too frequently. Another problem comes from the generator voltage regulating circuit. The small amount of electrical “noise” created by firing the SCRs causes some older voltage regulators to allow the voltage to drift up and down as the soft starter is trying to start the motor. If the soft starter is having trouble tracking that voltage swing, it may stall the motor. Because of Motortronics’ unique “Auto-Synchronizing” firing circuit, the soft starter does not have these problems. As such, Motortronics soft starter products are preferred among many customers who regularly use portable power systems and demand reliability.

Topic: Bypass Contactors

Question: What is the benefit of having a soft starter with an integral bypass contactor?

Answer

Bypass Contactors are mainly used to shunt the motor power around the SCRs after the soft starter is finished ramping the motor to full speed. SCRs give off a small amount of heat as they conduct current. A conservative rule of thumb is that each SCR rejects 1.5 watts of heat for each ampere passing through it per phase, or 4.5 watts per running load amp. On a 10HP, 460V motor at 14 FLA, this amounts to only 63 watts (4.5W x 14 FLA). On a 200 HP 460V motor, the total comes to 1080 watts (4.5W x 240 FLA), a large amount of heat to dissipate.



If your application is in a dry and clean environment that allows you to use a NEMA type 1 (ventilated) enclosure, a Bypass Contactor is not necessary in the soft starter. Ventilation and /or fans will take the heat out of the box and into the surrounding air. However, if your application requires a sealed (i.e. NEMA 12, 3R or 4) enclosure, the heat will build up inside the enclosure leading to the point of failure of the soft starter. To prevent this, Bypass Contactors are used to “shunt” the power around the SCRs when they are no longer needed in the circuit. With Motortronics XLD/DXT Series, all units 92A (100HP @ 460V) and larger in sealed enclosures automatically include a shunt rated bypass contactor in the price. In addition, all combination starters (prefix "B" or "D") provided with a built-in circuit breaker or disconnect also includes a shunt bypass contactor in the price. VMX Series soft starters include an internal shunt bypass contactor on all ratings.

Another valid reason to use Bypass contactors even in NEMA 1 applications is when there are several soft starters in a small room. The heat rejected into the room from each starter must be dealt with using building ventilation or air conditioning, adding expense. Example: A control trailer at a rock quarry with four NEMA 1 starters rated at 200HP will be receiving over 4300W of heat into the inside air. Ventilation would introduce a lot of dust, so air conditioning would be required. Adding Bypass Contactors may be less expensive than the additional BTU’s of air conditioning required in cooling the ambient air in the trailer.

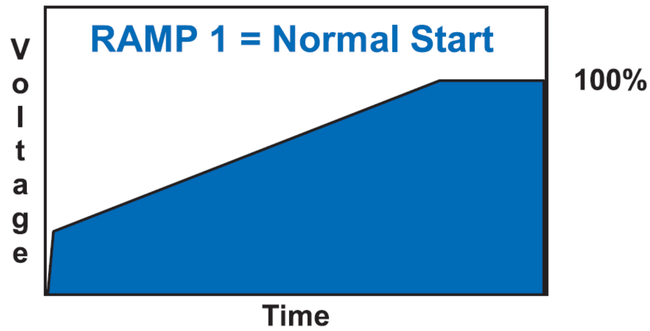
Frequently Asked Questions (Cont.)

Topic: Line Start Rated Bypass Contactor

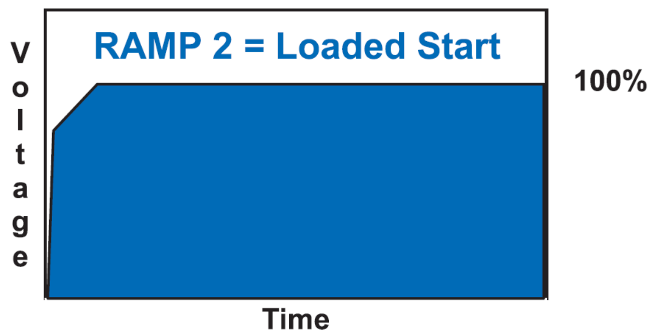
Question: Can I start the motor using the Bypass Contactor if the solid state starter should trip or fail?

Answer

Standard duty Motortronics soft starters with built-in bypass contactors use a Shunt Rated contactor. Motortronics' design includes a "Silver Saver" circuit that always uses the SCR devices to both start and stop the motor. The contactor only needs to handle the running current. Shunt ratings are based on this lower running current level and are sized specifically for the intended motor. This usually means that the Shunt Bypass Contactor cannot be used for repeated Across-the-Line (X-Line) starting of that motor. Before continuing on your quest for a contactor rated for X-Line starting duty, ask yourself these important questions; *Am I requesting this just to be able to apply Locked Rotor Torque on occasional starts?*



All Motortronics starters are capable of delivering at least of 350% current for up to 30 seconds. The VMX, XLD and DXT Series are capable of delivering 500% current for up to 60 seconds (which is usually more than the motor can take). By using the Dual Ramp feature, this high level of starting torque can be made available with the flick of a switch. Since you are still using the solid state devices, there will be no flash or contact burn. If you need even slightly less than locked rotor torque, the Motortronics unit can be adjusted to give you the exact starting torque you need but with the least amount of mechanical stress.



Will my electrical system even allow me to start X-Line?
In many cases, soft starter starting is being used because the transformer or generator cannot deliver sufficient power to start the motor X-Line. A soft starter with a contactor rated to do so might be a waste of money since it will not be able to start the load anyway.

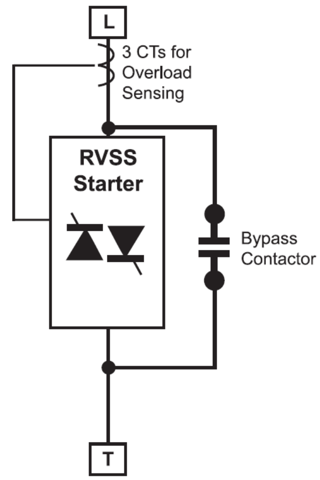
Do I want to be able to start the motor with the Bypass Contactor if the soft starter fails?
This is the most common reason for requesting a Line Rated Bypass. Keep in mind that the soft starter will be MORE reliable than an X-Line starter. There is a valid need for an X-Line rated bypass contactor only when the application itself poses significant risk of physical or electrical damage to the soft starter, i.e. in areas where lightning strikes or flooding are common. If you have addressed these issues and you still feel you need X-Line starting capability, we recommend the VMX Series "Heavy Duty" model.

Topic: Overload Protection

Question: How is the motor protected from Overload when running in bypass?

Answer

In order to provide running overload protection for the motor while in the Bypass mode, Motortronics soft starters maintain a current path that always has the Solid State Overload Protection in the circuit.



Power to feed the Bypass contactor is taken from downstream of the current sensors, so no matter how it gets to the motor, it is always monitored. Care must be taken if building your own Bypass system to ensure that this current path is maintained. Motortronics can provide recommended wiring diagrams to help you in that case.

Topic: Electronic Overload

Question: I have had problems with electronic overloads loosing track of my motor after a power failure. Will this be a problem with the Motortronics soft starters?

Answer

Electronic overload protection has been around for some time now, and has proved to be superior to bi-metallic and eutectic overload relays in repeatability and accuracy. One design problem unfortunately goes unnoticed with some manufacturers. The electro-mechanical overload relays inherently retained the thermal condition of the motor, even if power was removed. When power was restored and the motor restarted, the protective elements were still at the same temperature state as the motor. If the motor was close to overloading before power failed, as is often the case when a blackout is preceded by a “brown out”, the bi-metallic overload relay “remembers” and trips quicker if the overload persists.

Microprocessor based electronics must have electricity to operate, and when the power fails, memory can be lost as well. Several “electronic overloads” have been found to have no provisions to maintain thermal information. This holds true for some manufacturers of digital soft starters as well. Motortronics has gone to great lengths to develop and implement a Retentive Thermal Memory system that virtually duplicates the action of an electro-mechanical thermal overload. A Real Time Clock keeps track of the elapsed time when power fails. When power is restored, the microprocessor reads the off-time of the motor from the RTC and adjusts the Thermal Register to provide real Overload Protection that matches the motor. This protection scheme also involves having non-volatile memory, another feature that sets Motortronics apart. The bottom line is that you can count on Motortronics’ Solid State Overload to provide reliable, accurate motor overload protection even in the event of the loss of power.

Frequently Asked Questions (Cont.)

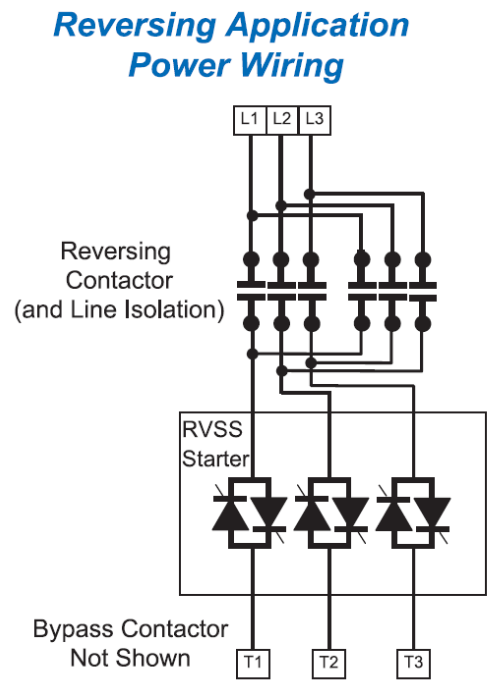
Topic: Reversing Starters

Question: My application requires a Reversing Starter. How can I do that with a Motortronics Soft Starter?

Answer

Reversing can easily be accomplished with any Motortronics soft starter by adding a reversing contactor to the circuit. Some Motortronics products are not phase-rotation sensitive so the reversing contactor can be either upstream or downstream from the soft starter.

Placing it upstream provides the additional benefits of having isolation as described below. This also allows for simple retrofits where a FVR (Full Voltage Reversing) starter is already in place. Just add the Motortronics soft starter downstream, and control it with auxiliary contacts of the FVR starter. The VMX Series must be programmed to disable phase sensitivity if a reversing contactor is used upstream.



Topic: Isolation Contactors

Question: Do I need a contactor upstream from a Solid State Starter?

Answer

If severe transient voltage spikes and frequent lightning strikes are not problems in your area, the added cost of Isolation Contactors may not be warranted. All Motortronics low voltage soft starter products are designed for use without the need for Line Isolation Contactors. Isolation Contactors however, are a good protective measure to consider using when spikes and / or lightning are a common occurrence. While the motor is running, these spikes and surges are passed through with little harm. When the motor is off (but the SCRs are still connected), the SCRs are exposed to these spikes and surges, causing gradual damage that can lead to eventual failure. If the spikes or surges are severe, immediate failure of multiple SCR devices is possible.

The “air-gap” provided by an Isolation Contactor is excellent low-cost insurance. Another application is when there are Power Factor Correction Capacitors (PFCs) in the circuit. The Isolation Contactor can then serve two purposes and is therefore more cost effective. See the following FAQ entitled “PFC Capacitors” for more details. Some brands of Soft Start controller designs require in-line contactors for basic operation. Others have no transient protection at all. Those other manufacturers may state that Isolation Contactors are always REQUIRED, but that may be applicable only to their brand.

Frequently Asked Questions (Cont.)

Topic: 2-Speed Motors

Question: Can a soft starter used in a 2-speed motor application?

Answer

Two speed motor applications are not a problem for Motortronics soft starters, but they do require some thought and investigation. There are several ways to do this depending on the answer to these three questions:

1. What Type of 2-speed motor is it, i.e. two speed, two winding or two speed single winding etc.?

2. How does the machine or process operate, i.e. always start in Low and switch to High, or is it possible to start the motor in either speed?

3. Is it a new application or retrofit to an existing starter? It is often easier to add an soft starter to an existing 2-speed starter and leave the rest of the control system intact. Contact Motortronics with this information for further assistance.

Topic: Over Sizing

Question: When should I consider over-sizing or derating a Motortronics Soft Starter?

Answer

Motortronics soft starters are all built as Heavy Duty products. As such, we can tell you that “If your motor can start the load, Motortronics’ soft starter can start the motor”. Motortronics soft starters are capable of providing 500% of their rated current for at least 60 seconds. That is the heaviest duty rating available on the market! This rating means that you should never have to oversize (or derate) these series on any standard or even mill-duty motor application.

In addition, these starters are designed to meet or exceed the duty cycle capabilities of the motor it is intended to serve. For example, in an application where a 10HP motor is capable of being started 10 times per hour, the Motortronics soft starters are capable of at least 10 starts per hour as well. The benefit to users is that with Motortronics, your motor will be the only device limiting your duty cycle. If your motor is oversized to handle a higher duty cycle, just size the Motortronics unit to match the motor nameplate.

Frequently Asked Questions (Cont.)

Topic: Altitude Derating

Question: Do I need to derate my soft starter in high altitude applications?

Answer

Because of the limited cooling capacity of thinner air, careful consideration should be given to applying a soft starter in high altitudes. If the unit will be used in a NEMA 1 ventilated enclosure, some degree of de-rating may be necessary if the altitude is significantly above 3300 ft. (1000 meters). A very conservative de-rate formula is 1% for each 330 ft. elevation above 3300 ft.

Example, at a 6000 ft. elevation, this de-rate would be 6000 – 3300 = 2700, divided by 330 = 8.18% de-rate. Keep in mind, however, that Motortronics starters are sized for maximum current, and in most cases provide significantly more capacity than what the typical motor at a selected HP requires.

Example, a 200HP 460V motor with a FLA of 240A and a 1.15 service factor may draw 276 FLA at worst case. The standard Motortronics with the 8.18% de-rate it can still provide 282 amps which is more than that motor requires. Units with bypass contactors utilize the SCRs for such a short period of time (during ramp-up) that they rarely need derating. But you must be sure the current never exceeds the maximum rating of the contactor. When in doubt, give all pertinent altitude information and motor rating data to Motortronics Tech Support for proper unit sizing and selection.

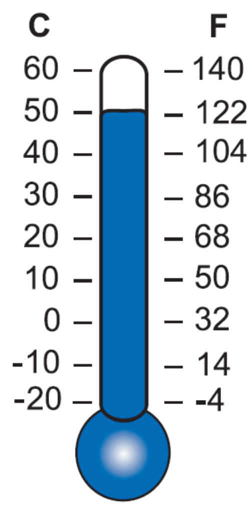
At 10,000 ft., the current de-rate factor becomes 20% and may require derating of the starter. Again, keep in mind that the motor FLA may be derated as well, so make sure you are working with all of the correct information. Another consideration at elevations over 10,000 feet is the voltage rating of all electrical devices. The dielectric insulating properties of the air are decreased, requiring a possible voltage derate at extreme altitudes. Contact Motortronics for additional help in this situation.

Topic: Temperature

Question: Can I use a Motortronics soft starter in high ambient temperature applications?

Answer

Motortronics starters also provide some of the highest ambient temperature ratings available. Every soft starter chassis model is designed for a 50° C (122° F) ambient and is factory tested at 60° C (140° F). Units with factory supplied enclosures are designed based on a 40° C (104° F) maximum ambient operating temperature. Derating is possible within these limits using the formula of 1% per degree above 50° C (40° C for enclosed), to an absolute maximum of 60° C.



If your application is outdoors, de-rating is rarely necessary providing the enclosure is protected from direct sun exposure. Radiant heat loading from any source including the sun can quickly exceed even a derated unit's maximum temperature rating. Protect soft starters from all sources of radiant heat and direct contact with any extremely hot objects such as ovens or steam pipes.

Topic: Variable Frequency Drive Bypass

Question: Can I use a soft starter as the emergency bypass for my Variable Frequency Drive?

Answer

While Variable Frequency Drives (VFDs) can vary the output speed or torque of the motor, they also provide almost all of the features offered by soft starters. Users often get their first exposure to the benefits of Soft Stopping a pump to reduce water hammer because it was a feature of their VFD.

When the VFD fails and the user must run the pump on bypass, they quickly notice that their Soft Stop (Decel Control) feature is lost with an electro-mechanical bypass starter. Many users are discovering the benefits of using a soft starter as the emergency bypass of a VFD. In addition to the Soft Stop, they also help in applications where available power is limited, especially when the application is powered from a back-up generator.

Motortronics Soft starters are ideal for this situation as well. The only consideration to keep in mind is that the soft starter and VFD must be isolated from each other when operating the motor. Two contactors, one being fed from the VFD output and one fed from the soft starter output, tie together to feed either output to the motor, but never both. If not, damage to both the VFD and the soft starter would result.

Contact us for additional help.

Terms and Conditions

1. General: All orders for products or services of Phasetronics (hereinafter “Company”) are subject to these conditions of sale. No modifications of, or additions to, these terms will be recognized by the Company unless specifically agreed to in writing by an authorized Company officer. Failure of Company to object to any provision in conflict with any part of this instrument contained in any prior or subsequent order to communication from a buyer hereinafter referred to as “the Purchaser” shall be construed as a waiver of these conditions nor an acceptance of any such provision.

2. Prices: Prices are subject to change without notice. Published prices shown in Company’s catalogs and price bulletins provide a price and catalog number guide for the selection and application of a specific product. All prices are subject to confirmation by authorized Company personnel. In the event of a net price change, the price of products on order but unshipped will be adjusted to the price in effect at the time of shipment. Downward adjustment of prices shall only apply to unshipped portions of outstanding orders. Written quotations must be for specific quantities, catalog number, price and delivery date(s). In lieu of catalog number, complete specifications must be included in the quotation. Unless noted otherwise on the written quotation, all quotes are conditioned upon acceptance by Purchaser within thirty (30) days from date issued and shall be considered as offers by Company to sell during such thirty (30) day period unless sooner terminated by notice. Products to be furnished or services rendered hereunder will be produced or performed in compliance with all applicable requirements of Sections 6, 7 and 12 of the Fair Labor Standards Act of 1938, as amended on the date hereof, and of all valid and applicable regulations and orders of the Administrator of the Wage and Hour Division issued under Section 14 thereof, as written on the date of acceptance of the Purchaser’s order.

3. Patents: Company will hold Purchaser harmless against any liability for infringement of any apparatus claim of any United States patent, issued at the date of the contract, and arising out of the sale or use in the form supplied by Company of equipment designed and/or manufactured by Company. Company will assume no liability with respect to equipment specified by either Company or Purchaser, but not designed and/or manufactured by Company. Purchaser will hold Company harmless against any liability for infringement of any apparatus claim of any United States patent, issued at the date of the contract or order, and involving equipment furnished by Company, in accordance with drawings and/or specifications furnished by Purchaser. The party assuming liability, as stated above, shall be notified immediately of any assertion of infringement, and shall have the absolute control of the defense thereto, including the right to settle, defend against legal action, or make changes in the equipment to avoid infringement.

4. Weights and Dimensions: Catalog weights and dimensions are carefully calculated estimates but are not guaranteed.

5. Taxes: Published or quoted prices do not include sales, excise, use or similar taxes. Applicable taxes must be paid by the Purchaser.

6. Minimum Billing: Orders amounting to less than $100.00 net will be billed at $100.00.

7. Orders: All orders must be bona fide commitments showing definite prices, mutually agreed upon delivery dates, stipulated quantities and complete item descriptions.

8. Acceptance: No order or commitment is binding upon the Company until accepted at a point of shipment by an authorized Company official.

9. Penalties and Delays: No penalty clause of any kind will be effective unless approved in writing by an authorized Company officer. The Company will not be liable for any damages caused by delays beyond Company’s reasonable control including, without limitation, fire, strike, act of the Purchaser, restrictions by civil or military authority, act of God, transportation failures or inability to obtain labor, materials or manufacturing facilities. In the event of any such delay, the date of delivery shall be extended for a period equal to the time lost by reason of the delay.

10. Cancellation: Cancellation of any item on an order to the Company will be accepted only on the following basis: Any items which upon receipt of a written notice of cancellation are within thirty (30) calendar days of completion, as determined by the Company’s best estimate at the time of receipt of cancellation notice, will be completed and paid for by Purchaser in full under the regular terms and conditions of billing. All items which are not within thirty (30) days of completion when cancellation is requested may be canceled or altered by the Purchaser only upon payment of reasonable charges based upon expenses already incurred and commitments made by Company. Company reserves the right to manufacture ahead of the shipping schedule whenever it is deemed necessary and such advance manufacture shall not void Purchaser’s responsibility for payment of cancellation or alteration charges.

11. Delivery: Prices are f.o.b. Company plant or point of shipment, with freight collect or, when instructed by the customer, freight may be prepaid and added to the invoice.

12. Damage and Loss: Company’s products are packed in specifically designated cartons to protect the products from damage during shipment. Upon delivery to the carrier and his receipt for the products, all responsibility for delivery intact and undamaged to the destination rests with the carrier and not with the Company.

    All shipments should be inspected upon receipt at the destination for visible or concealed damage. Claims for loss or damage should be filed with the carrier immediately. A concealed damage claim against the carrier is required when damage is not externally visible. Company will assist insofar as is practical in securing satisfactory adjustment of claims, however, all claims for loss and damage must be made by the Purchaser to the carrier.

13. Terms of Payment and Reservations of Title: Standard Terms to Purchasers determined by the Company to have satisfactory credit are as follows: One percent 10 days, net 30 days. All quoted prices and payments shall be in U.S. dollars. Phasetronics accepts Visa or MasterCard. Company reserves the right to require full or partial payment in advance of shipment where in the Company's opinion, exercised in its sole discretion; the financial condition of the Purchaser does not justify continuance of production or shipment on the terms of payment specified. Title to all products purchased from Company shall remain in the Company until Company receives payment in full for the products from the Purchaser at which time title shall pass to the Purchaser. Purchaser agrees, upon request of Company, to promptly execute and return to Company any documentation necessary to perfect Company's security interest in the products. Company agrees that upon receipt of payment in full for the products, it shall cause any existing perfected security interest in the products to be discharged.

    Payment Schedules

    Orders less than $100,000: On orders having price of less than $100,000 the standard terms of payment are cash in full within 30 days from the date of each invoice.

    Orders for $100,000 or more: On orders having a price of $100,000 or more, the standard method of payment will be PROGRESSIVE DEPOSITS.

    Progressive Deposits are deposits of fixed amounts or percentages at stated monthly intervals during the production period.

    If, in the judgment of the Company, the financial conditions of the Purchaser at any time does not justify continuance of production or shipment on the terms of payment originally specified, the Company may require full or partial payment in advance, and, in the event of bankruptcy or insolvency of the Purchaser or if Purchaser fails to pay Company any sum when due, then upon seven (7) calendar days written notice, the Company may cancel any order then outstanding and Purchaser shall be responsible for compensating the Company for expenses incurred in the performance of the order which have theretofore not been paid.

    Each shipment shall be considered a separate and independent transaction and payment, therefore, shall be made accordingly. If work covered by the purchase order is delayed by the Purchaser, upon demand by Company, payments shall be made on the purchase price based upon percentage of completion. Products held for the Purchaser shall be at the risk and expense of the Purchaser unless otherwise agreed upon in writing. The Company reserves the right to ship to its order and make collections by sight draft, C.O.D., or any other terms approved in writing by the Company's Credit Department.

14. Late Payment and Past Due Accounts: A finance charge of 1.5% per month (Annual Percentage of 18%) will be charged on any portion of the unpaid balance over 30 days old. All accounts which have unpaid balances for over 90 days may be turned over for collection or legal action and Purchaser shall be required to pay collection fees or the costs, including reasonable attorneys fees, incurred by the Company in the trial court and on appeal for any such collection action.

15. Responsibility: Company is not responsible for the misuse or misapplication of its products, intentional or otherwise. Improper application, installation, failure to provide safety devices or protective measures, or operation above a product's rated capacity, and failure to properly maintain or service products are all beyond the control and responsibility of the Company. Under no circumstances shall Company be liable or loss of profits, indirect, incidental, special, consequential, or other similar damages arising out of the misuse, misapplication, or failure to maintain Company's products.

16. Return of Products: Under No Circumstances are Products to be returned to Company Without First Obtaining Company's Permission and a Returned Material Authorization Number (RMA). Unless authority has been granted for return and an RMA issued, shipment will be refused. Products built to a Purchaser's specifications cannot be returned for credit under any condition. Products which are authorized for return must be properly packed to protect against physical damage during shipment and must be shipped prepaid. Transportation charges are Purchaser's responsibility for all returned products. Credit will be allowed on authorized returned products on the following basis: Only unused products which Company is currently selling and which have been sold to the Purchaser within one year of the return date will be considered. Products ordinarily carried in stock will be accepted for return subject to a minimum service charge of $100.00 or 30% if the billing invoice is more than $330.00 net. All products must be returned in perfect condition. Any cost incurred by Company to place returned products in perfect condition will be charge to the Purchaser. Products built-to-order are not subject to return regardless of condition. No credit memo will be issued where any amount less than $100.00 is involved except to correct errors made by Company. If return is authorized by Company due to a recognized fault of Company, full credit will be allowed for the returned products including all transportation charges.

17. Warranty: Company warrants its products to be free from defects in material and/or workmanship for a period of one year from the date of installation, to a maximum of eighteen months from the date of shipment as indicated by the unit's date code. The Company reserves the right to repair or replace any malfunctioning units under warranty at Company's sole option. All warranty repairs must be performed at the Company's factory or on site by factory authorized service firms or personnel approved by the Company. Company shall not be responsible for misuse or failure to maintain its products. See Section 15 - Responsibility, above. Except as Specifically Provided Herein, There Are No other Warranties, Express or Implied, Including, But Not Limited To, Any Implied Warranties of Merchantability or Fitness for a Particular Purpose. Solid state controls have different operating characteristics from those of electromechanical equipment. Because of these differences and the wide variety of applications for solid state controls, each application designer must verify that the solid state equipment is acceptable for his particular application. In no event will company be responsible or liable for indirect or consequential damages resulting from the use or application of its products. The diagrams and illustrations, if any, found in documents and/or manuals accompanying Company's products are included solely for illustrative purposes. Because of the number of different applications of Company's products, Company cannot be responsible or liable for actual use based on the examples or diagrams.

18. Governing Law: Interpretation and enforcement of any rights and obligations between Company and Purchaser arising out of the sale of the Company products shall be governed by the laws of the State of Florida and any action brought to enforce those rights and/or obligations shall be brought in the court of competent jurisdiction located in Pinellas County, Florida.

MOTORTRONICS™

Solid State AC Motor Controls

For the latest product information
visit www.motortronics.com

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