

Data Bulletin

E-Flex™ Enclosed Drive Controller

Specification Data

Class 8839

Retain for future use.



Applications

Well suited for commercial buildings, hospitals, airports, schools, and water/wastewater facilities HVAC pump and fan applications, the Square D brand E-Flex™ enclosed drive controller provides an efficient and economical AC drive solution.

Designed to withstand harsh environments in demanding commercial buildings, the E-Flex™ Enclosed Drive Controller meets building code seismic specifications for ground level and roof mounted applications.

AC drives help increase the energy efficiency of HVAC equipment by reducing motor speeds, thereby reducing electricity usage in:

- Air handling units
- Supply and return fans
- Ventilation fans
- Cooling tower pumps and fans
- Hot water pumps
- Chilled water pumps

Features

The E-Flex™ Enclosed Drive Controller is available in:

- 1 to 50 hp at 208 Vac and 230 Vac
- 1 to 100 hp at 460 Vac

Built to provide an efficient and economical application solution, the E-Flex™ Enclosed Drive Controller offers:

□ Performance under pressure

- UL 508C Listed to exceed minimum UL short-circuit requirements
- 100,000 AIC short circuit protection without current limiting fuses
- Advanced technology platform increases reliability and uptime; reducing the number of components needed on hand.
- Industrial-rated control operators and pilot devices

□ Easy to Control

- Large backlit LCD graphic screen with customizable display
- Clear text in six languages
- Navigation wheel for easy scrolling through menus
- Pre-programmed for HVAC variable torque operation
- Light indicators for Power, Fault, Run, and Bypass
- Test-Normal selector switch permits testing of the drive controller

□ Fully Protected

- Circuit breaker disconnect provides short circuit protection
- 3% line reactor provides transient protection from surge and overvoltage conditions, and minimizes line harmonics
- Enclosure designed to reduce radio frequency interference
- Meets International Building Code and ASCE¹ standards for seismic specifications
- Thermal management system for operation in extreme temperatures 14 °F to 122 °F (-10 °C to 50 °C) for Type 3R enclosures

□ Expandable Capabilities

- LonWorks®, BACnet, Modbus® Unitelway, Ethernet TCP/IP, Apogee® P1, Profibus, and Metasys® N2 communications capability
- HVAC controls provide end damper, smoke purge relays, and fire/freeze stat for full speed fire safety override

¹American Society of Civil Engineers

Specifications

Electrical

Input voltage	208 Vac $\pm 10\%$, 230 Vac $\pm 10\%$, 460 Vac $\pm 10\%$
Displacement power factor	98% through speed range
Input frequency	60 Hz $\pm 5\%$
Output voltage	Three -phase output, maximum voltage equal to input voltage
Galvanic isolation	Galvanic isolation between power and control (inputs, outputs, and power supplies)
Frequency range of power converter	0.1 to 500 Hz (factory setting of 60 Hz)
Torque/over torque	Variable Torque: 110% of nominal motor torque for 60 s
Current (transient)	Variable Torque: 110% of controller rated current for 60 s
Switching frequency	Selectable from 0.5 to 16 kHz on 1–100 hp VT controllers Above 8 kHz, select the next largest drive controller Factory setting: 8 kHz for 208 Vac, 230 Vac and 1–100 hp @ 460 Vac
Speed reference	AI1: 0 to +10 Vac, Impedance = 30 kW, can be used for speed potentiometer, 1–10 k Ω AI2: Factory setting: 4 to 20 mA, Impedance = 242 Ω Factory modification J09 allows 0–10 Vdc reference signal to AI2
Factory resolution in analog reference	0.1 for 100 Hz (11 bits)
Speed regulation	V/f control: equal to the motor's rated slip SLFV (sensorless flux vector): 10% of motor's rate slip from 20% to 100% of nominal motor torque
Efficiency	97% of full load typical
Reference sample time	2 ms ± 0.5 ms
Acceleration and deceleration ramps	0.1 to 999.9 seconds (definition in 0.1 s increments)
Drive controller protection	Thermal protection of power converter Phase loss of AC mains Circuit breaker rated at 100 kAIC
Motor protection	Class 10 electronic overload protection Class 20 electromechanical overload protection with bypass (Class10 electromechanical for 1 hp at 460 Vac)
Graphic display terminal	Self diagnostics with fault messages in three languages; also refer to the programming manual supplied on the CD ROM W817574030111 which ships with the power converter, and the instruction bulletin, Graphic Display Terminal VW3A1101, bulletin number 1760643 (VT)

Codes and Standards

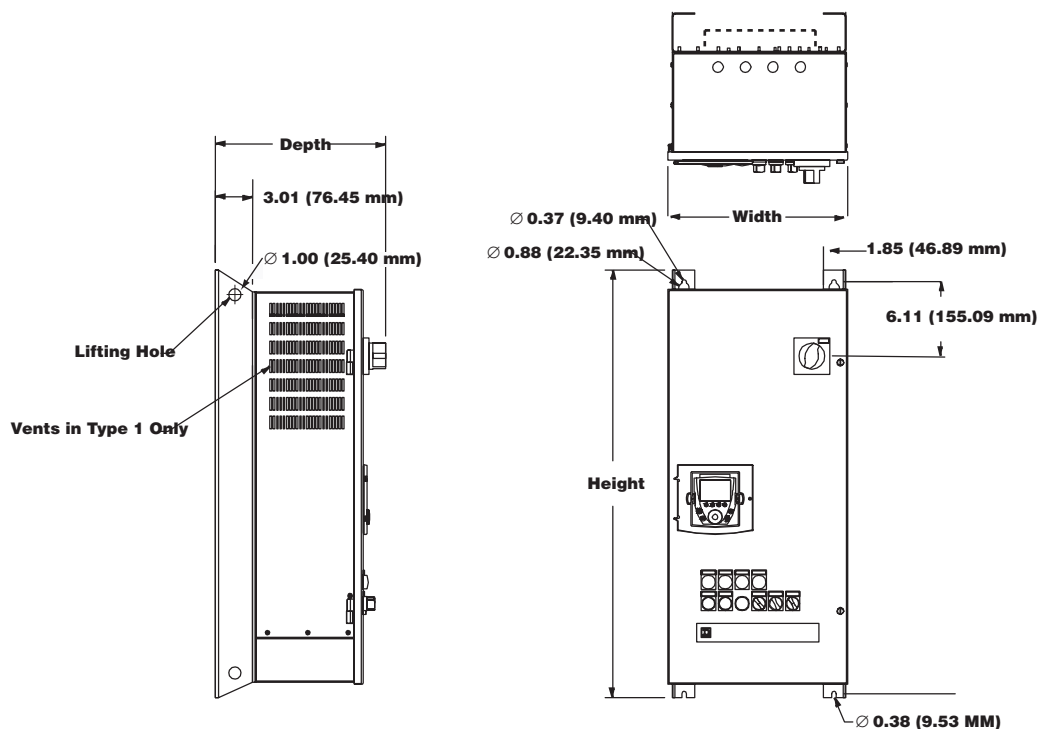
UL Listed per UL508C under category NMMS
Conforms to applicable NEMA ICS, NFPA, and IEC standards
Manufactured under ISO 9001 standards
Factory modification G10 provides Canadian cUL certification

Environmental

Temperature	Storage (all enclosures): -13 to +149 °F (-25 to +65 °C) Operation: +14 to +104 °F (-10 to +40 °C) Type 3R Operation: +14 to +122 °F (-10 to +50 °C). For 1–100 hp drives (208 Vac, 230 Vac, and 460 Vac) operating between +104 °F and +122 °F (+40 °C and +50 °C), derate the current 2% per °C above 104 °F (40 °C)
Humidity	95% with no condensation or dripping water, conforming to IEC 60068-2-3
Altitude	3,300 ft. (1,000 m) maximum without derating; derate the current by 1% for each additional 330 ft. (100 m)
Enclosure	Type 1, Type 12/12K, and Type 3R
Pollution degree	Type 1: Pollution degree 2 per NEMA ICS-1, Annex A and IEC 60664-1 Type 12/12K: Pollution degree 3 per NEMA ICS-1, and IEC17.560664-1
Operational test vibration	Conforming to IEC 60721-3-3-3M3 amplitude—1.5 mm peak to peak from 3 to 13 Hz—1 g from 13 to 200 Hz
Transit test to shock	Conforming to National Safe Transit Association and International Safe Transit Association test for packages
Operational shock	15 g. 11ms
Seismic qualification	2003 IBC, NFPA 5000 and ASCE 7 ICC ES AC156 acceptance criteria test protocol with importance factor of 1.5

Dimensions and Weights

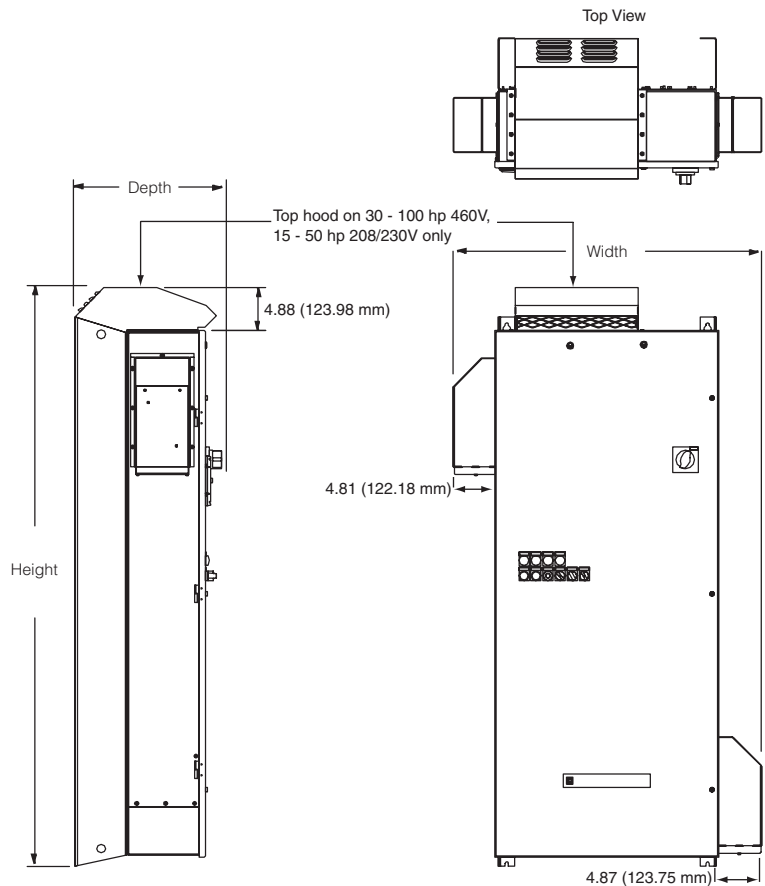
Figure 1: Type 1 or Type 12/12K Enclosure
Dimensions (mm and inches) and Weights (kg and lbs)



NOTE: Provide at least 3 inches (76.2 mm) of mounting clearance on each side of the drive controller and at least 6 inches (152.4 mm) of mounting clearance at the top and bottom of the drive controller.

hp		Height		Width		Depth		Weight	
208/230 Vac	460 Vac	mm	in.	mm	in.	mm	in.	kg	lbs
1-5	1-7.5	889	35	374.9	14.76	353.91	13.93	37.7	83
7.5-10	1-25	1041.4	41	521.21	20.52	353.91	13.93	57.2	126
15-25	30-50	1244.6	49	524.51	20.65	427.49	16.83	80.5	177
30-50	60-100	1600.2	63	651.51	25.65	427.49	16.83	95.9	211

Figure 2: Type 3R Enclosure
Dimensions (mm and inches) and Weights (kg and lbs)

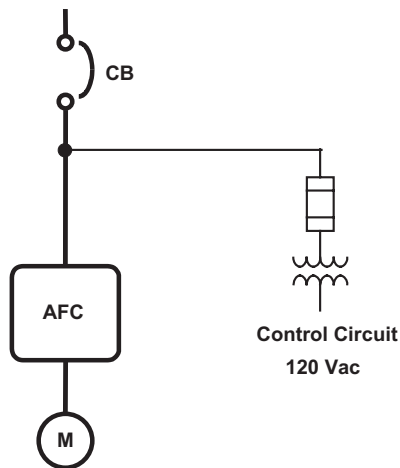


NOTE: Provide at least 2 inches (50.8 mm) of mounting clearance from each side hood, at least 6 inches (152.4 mm) of mounting clearance at the top and at least 12 inches (304.8mm) of mounting clearance at the bottom of the drive controller.

hp		Height		Width		Depth		Weight	
208/230 Vac	460 Vac	mm	in.	mm	in.	mm	in.	kg	lbs
1-5	1-7.5	889	35	620.52	24.43	347.73	13.69	52.3	115
7.5-10	10-25	1041.4	41	766.83	30.19	347.73	13.69	74.1	163
15-25	30-50	1326.39	52.22	770.13	30.32	415.04	16.34	96.8	213
30-50	60-100	1681.99	66.22	897.13	35.32	415.04	16.34	112.3	247

Power Circuit Configuration

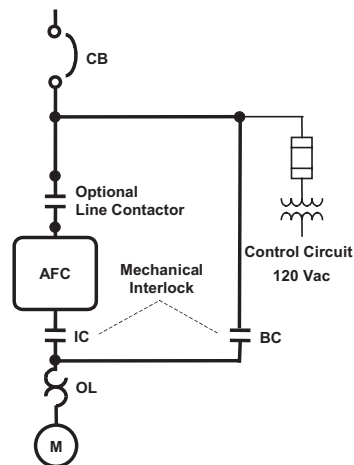
NON-BYPASS: *Power Circuit W*



The *Power Circuit W* assembly includes:

- 120 Vac fused control transformer
- Circuit breaker disconnect with means for locking in the open position
- Hand-Off-Auto switch provided as the standard control interface unless other options are selected

BYPASS: *Power Circuit Y*



The *Power Circuit Y* assembly includes:

- IEC-rated isolation and bypass contactors with mechanical and electrical interlocking and a Class 20 overload relay
- 120 Vac fused control transformer and circuit breaker disconnect with lockout/tag out capability
- AFC-Off-Bypass switch and Hand-Off-Auto switch provided as standard control interface unless other options are selected
- Test-Normal selector switch provides drive controller testing capability without running the motor, and allows drive controller testing if bypass mode is selected. The isolation contactor is sequenced open to provide drive isolation during the test mode.

Catalog Identification Numbers

The controller catalog number, located on the nameplate on the inside of the door, is coded to describe the configuration and options present. Use the following grid to translate the catalog number into a description of the drive controller.

Class Type

8839	EFD	•	•	•	V	•
①	②	③	④	⑤	⑥	

Modification

Control	Light	Misc.
•	•	•
⑦	⑧	⑨

① Product

Code	Drive
EFD	E-Flex Controller

② Horsepower Code

Code	hp Rating	Code	hp Rating
C	1	L	25
D	2	M	30
E	3	N	40
F	5	P	50
G	7.5	Q	60 (460 Vac only)
H	10	R	75 (460 Vac only)
J	15	S	100 (460 Vac only)
K	20		

③ Enclosure Type

Code	Environmental Rating
A ⁷	Type 12K
G	Type 1
H	Type 3R (outdoor)

④ Voltage Rating

Code	Voltage
2 ⁸	208
3 ⁸	230
4	460

⑤ Application Type

Code	Applied Rating
V	Variable Torque

⑥ Device Type

Code	Power Circuit
W ¹⁸	Without Bypass
Y ²¹	Bypass

⑦ Control Option

Code	AFC Controls
A07 ¹	Hand/Off/Auto, Speed Potentiometer
B07 ¹	Hand/Off/Auto, Start/Stop, Speed Potentiometer
C07 ²	Start/Stop, Speed Potentiometer
D07	Hand-Off-Comm, Speed Potentiometer
E07	Hand-Off-Comm, Start/Stop, Speed Potentiometer
N07	None

⑧ Light Option

Code	Light Cluster
A08 ^{3, 4}	Red Power On
	Green AFC Run
	Yellow AFC Fault
	Yellow Auto
B08 ^{3, 5}	Red Power On
	Green AFC Run
	Yellow AFC Fault
	Yellow Bypass
C08 ^{3, 6}	Red Power On
	Green AFC Run
	Yellow AFC Fault

⑨ Miscellaneous Options

Code	Feature
A09	Line Reactor 5%
B09 ^{9, 10}	Line Contactor
C09 ¹¹	3–15 PSI Transducer
D09 ¹²	Omit Keypad
E09 ¹³	Smoke Purge (Fireman's Override)
F09 ^{14, 19}	Profibus
H09 ¹⁵	I/O Extension Analog Card, 0–20 mA output, 4 logic inputs, 2 logic outputs, 2 analog inputs, 1 differential analog output
J09 ¹⁶	0–10 Vdc Auto Speed Reference
K09 ¹⁷	cUL Listing Certification
L09 ^{14, 19, 20}	LonWorks Card
M09 ^{14, 19}	ModBus/Unitelway Card
O09 ^{14, 19}	Apogee P1 Card
P09 ^{14, 19}	Metasys N2 Card
Q09 ^{14, 19}	Ethernet TCP/IP Card
R09 ^{14, 19}	BACnet Card
S09 ²²	End Damper Control
U09	Seismic Qualification

- ¹ Hand-Off-Auto switch must be placed in the Off position for AFC fault reset.
- ² Control option C07 (Start/Stop, Speed Potentiometer) is not compatible with Power Circuit Y (Bypass) or light options A08 or B08.
- ³ Light Options A08, B08 and C08 cannot be selected together. Select only one option.
- ⁴ Light Option A08 is compatible with Control Options A07, B07, D07 and E07.
- ⁵ Light option B08 is not compatible with Power Circuit W (Without Bypass).
- ⁶ Light option C08 is not compatible with A07 (Hand/Off/Auto, Speed Potentiometer), B07 (Hand/Off/Auto, Start/Stop, Speed Potentiometer), D07 (Hand-Off-Comm, Speed Potentiometer), or E07 (Hand-Off-Comm, Start-Stop, Speed Potentiometer).
- ⁷ Type 12 Enclosure with knock-outs.
- ⁸ 208 Vac and 230 Vac ratings are not available in 60 hp, 75 hp, and 100 hp horsepower ratings.
- ⁹ Line contactor B09 is not compatible with Power Circuit W (Without Bypass).
- ¹⁰ Miscellaneous Option B09 (Line Contactor) is not compatible with H03 (Type 3R Enclosure).
- ¹¹ Miscellaneous Option C09, 3–15 PSI Transducer, is not compatible with Control option C07, D07 or E07, J09 0–10 Vdc Auto Speed Reference Option, H09 I/O Extension Card, F09, L09, M09, O09, P09, Q09 and R09 Serial Communication Cards.
- ¹² Omit the keypad option D09 from enclosure door, the user must buy a separate device to program the controller inside.
- ¹³ Smoke purge (Fireman's Override) Miscellaneous Option E09 permits the motor to run at full speed.
- ¹⁴ Control Option D07 or E07 must be selected.
- ¹⁵ I/O Extension Analog Card H09 is not compatible with C09 3–15 PSI Transducer or serial communication F09, L09, M09, O09, P09, Q09 or R09.
- ¹⁶ Miscellaneous Option J09, 0–10 Vac Auto Speed Reference, is not compatible with Control Options C07, D07 or E07 or Miscellaneous Option C09, 3–15 PSI Transducer.
- ¹⁷ K09 requires Hypot of Controller.
- ¹⁸ W06 (Without Bypass Option) includes Form C AFC Run Contact, Form C AFC Fault Contact and Fire/Freeze Stat interlock.
- ¹⁹ Serial communication F09, L09, M09, O09, P09, Q09 and R09 cannot be selected together. Select only one. Serial communication and Miscellaneous Option H09 are not compatible.
- ²⁰ Communication Option L09 with Control Option D07 or E07 is for monitoring and control.
- ²¹ When Y06 Bypass is selected, AFC/Off/Bypass switch and Test/Normal switch are supplied.
- ²² Miscellaneous Option S09 (End Damper Control) is not compatible with Control Options D07 (Hand-Off-Comm, Speed Potentiometer) or E07 (Hand-Off-Comm, Start-Stop, Speed Potentiometer).

Modifications

Enclosure Modifications

Type 12K Enclosure (if used)

Replaces the Type 1 enclosure with a Type 12 enclosure with bottom-only conduit knockouts, to provide an additional degree of protection in dusty and dripping-liquid environments.

Type 3R Enclosure (if used)

Replaces the Type 1 enclosure with a Type 3R enclosure with bottom-only conduit knockouts, to provide an additional degree of protection in outdoor environments. The controller's ambient operating temperature is -10 to 50 °C (14 to 122 °F).

Modification Options

MOD A07 Hand-Off-Auto and Speed Potentiometer (factory supplied)

Provides a two-wire control strategy and allows auto restart capability. Moving the Hand-Off-Auto switch to the Off position resets a drive fault condition.

MOD B07 Hand-Off-Auto, Start/Stop, and Speed Potentiometer (if used)

Provides a three-wire hand mode control strategy, momentary Start and Stop pushbuttons, and a manual speed potentiometer to the factory-supplied Hand-Off-Auto selector switch. In the Hand mode only, this option will not allow auto restart capability. Moving the Hand-Off-Auto switch to the Off position resets a drive fault condition.

MOD C07 Start/Stop and Speed Potentiometer Only (if used)

Replaces the factory-supplied Hand-Off-Auto selector switch with momentary Start and Stop pushbuttons. Speed control is accomplished via the door-mounted LCD display and navigation wheel. Automatic (remote) mode selection is not provided.

MOD N07 Delete Hand-Off-Auto Switch and Manual Speed Potentiometer (if used)

Removes the factory-supplied Hand-Off-Auto switch. Under certain conditions, the user may prefer to control the power converter by means of a remote or external source only. The user provides the control sequence logic. Refer to instruction bulletin 30072-451-51A for details on the recommended sequence of operation.

MOD A08 Pilot Light Cluster (if used)

Provides visual indication of protective functions and circuit status. The pilot devices are rated 120 Vac. Included within this configuration are:

- **Power On (Red):** Illuminates whenever mains power is applied to the controller.
- **AFC Run (Green):** Illuminates whenever drive output relay R2 (programmed for running state) is high, to annunciate a drive run condition.
- **Auto Mode (Yellow):** Illuminates whenever the Hand-Off-Auto switch is in the Auto position, controlled by a contact block on the switch.
- **AFC Fault (Yellow):** Illuminates (via relay ADFR) whenever drive output relay R1 (programmed for fault state) is low, to annunciate a fault condition. This light is normally off until a drive protective circuit has caused a shutdown.

MOD B08 Pilot Light Cluster (if used)

Provides visual indication of protective functions and circuit status. Only available on power circuit Y. The pilot light devices are rated 120 Vac. Included within this configuration are:

- **Power On (Red):** Illuminates whenever mains power is applied to the controller.
- **AFC Run (Green):** Illuminates whenever drive output relay R2 (programmed for running state) is high, to annunciate a drive run condition.
- **Bypass Run (Yellow):** Illuminates whenever the bypass contactor coil is energized.
- **AFC Fault (Yellow):** Illuminates (via relay ADFR) whenever drive output relay R1 (programmed for fault state) is low, to annunciate a fault condition. This light is normally off until a drive protective circuit causes a shutdown.

MOD C08 Pilot Light Cluster (if used)

Provides visual indication of protective functions and circuit status. The pilot devices are rated 120 Vac. Included within this configuration are:

- **Power On (Red):** Illuminates whenever mains power is applied to the controller.
- **AFC Run (Green):** Illuminates whenever drive output relay R2 (programmed for running state) is high, to annunciate a drive run condition.
- **AFC Fault (Yellow):** Illuminates (via relay ADFR) whenever drive output relay R1 (programmed for fault state) is low, to annunciate a fault condition. This light is normally off until a drive protective circuit causes a shutdown.

MOD A09 Line Reactor (if used)

Provides a 5% AC line reactor factory-wired between the circuit breaker and the power converter terminals L1, L2, and L3. 3% line reactors are included in the drive controller as standard on all horsepower ratings.

MOD B09 Line Isolation Contactor (if used)

Provides a line isolation contactor factory-wired between the circuit breaker and the power converter terminals L1, L2, and L3. This Mod is only available with bypass configurations (power circuit Y), as well as Type 1 and Type 12K enclosures.

MOD C09 3–15 PSI Module (if used)

Provides a pneumatic transducer to allow the controller to follow a user-supplied 3–15 PSI speed reference signal.

MOD D09 Omit Keypad (if used)

Omits the keypad interface from the enclosure door. The end user must buy a separate device to program the controller.

MOD E09 Smoke Purge Option (Fireman's Override) (if used)

A smoke purge relay (SPR) permits the motor to operate at full speed. When a bypass is supplied, the controller will operate in the bypass mode. This circuit requires a user-supplied 120 Vac signal to energize the SPR relay to run the motor at full speed.

MOD F09 Profibus Serial Communication (if used)

Provides a factory installed plug-in Profibus card, VW3A3307.

MOD H09 I/O Extension 0-20 mA Analog Output (if used)

Provides an analog I/O extension card, VW3A3202, factory-installed on the drive controller to provide a 4–20 mA selectable analog output for customer use. The analog output is factory programmed for motor frequency. Reassignable X-Y range with keypad display. Also includes logic inputs, logic outputs, analog inputs, analog outputs, configurable relay outputs, PTC probe input, and frequency control input.

MOD J09 Automatic Speed Reference 0–10 Vdc Input (if used)

Provides a factory programming change to allow AI2 to be a 0–10 Vac analog input rather than 4–20 mA input for the automatic mode of operation.

MOD K09 cUL Listing (if used)

Provides Canadian cUL certification when required by local code requirements.

MOD L09 LonWorks® Serial Communication (if used)

Provides factory-installed LonWorks communications card, VW3A3312.

MOD M09 ModBus® Serial Communication (if used)

Provides factory-installed plug-in ModBus card, VW3A3303.

MOD O09 Apogee® P1 Serial Communication (if used)

Provides factory-installed Apogee P1 communications card, VW3A3314.

MOD P09 Metasys® N2 Serial Communication (if used)

Provides factory-installed Metasys N2 communications card, VW3A3313.

MOD Q09 Ethernet TCP/IP Serial Communications (if used)

Provides factory installed Ethernet TCP/IP communications card, VW3A3310.

MOD R09 BACnet Serial Communication (if used)

Provides factory installed BACnet communications card, VW3A3315.

MOD S09 End Damper Control (if used)

Provides a circuit to delay drive operation until the damper is fully open.

MOD U09 Seismic Qualified

Provides a certification label and hardware qualified to seismic rating ICC ES AC156 acceptance criteria test protocol with an importance factor of 1.5.

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