

Freedom 2100



Freedom FlashGard



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18.1

Motor Control Centers

Freedom 2100, Freedom FlashGard & IT. 2100 and IT. FlashGard

Freedom 2100 and Freedom FlashGard



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Freedom 2100, Freedom FlashGard & IT. 2100 and IT. FlashGard

Product Overview

MCC Operation

Eaton's motor control center (MCC) product line is headquartered in Fayetteville, NC. At Fayetteville, the most progressive engineering in the industry can custom design motor control for the most demanding applications. Most MCCs can be shipped six to eight weeks after receipt of a released order.

Service Centers

One of the most unique aspects of the Eaton MCC operation is the ability to provide customized product to meet delivery requirements through an MCC service center. There are seven regional service centers located throughout the U.S. serving key geographic markets. Each service center has the ability to provide standard NEMA® 1 B wired product in as little as one to three days. Please contact the service center in your area to discuss customer opportunities and MCC support for your specific marketplace.

Regional Service Centers

Service Center	Telephone
Atlanta	678-309-4270
Chicago	630-260-6304
Denver	303-366-9949
Hartford	860-683-4221
Houston	713-939-9696
Los Angeles	562-944-6413
Portland	503-582-2700

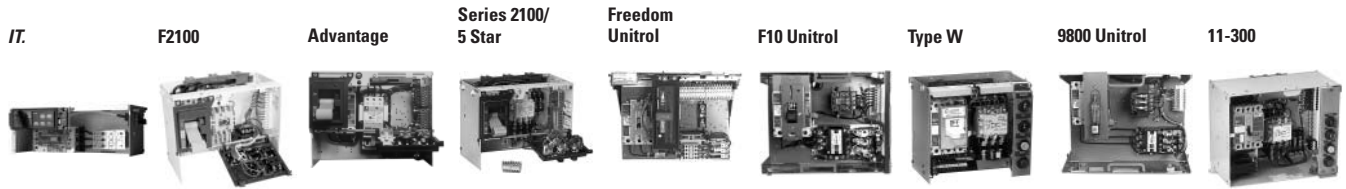
Seismic Qualification

The *IT.*, Freedom 2100 MCCs have been qualified to meet the seismic requirements of both the Uniform Building Code® (UBC) and the California Building Code (CBC) for equipment operation after seismic activity. This equipment, along with Eaton's low and medium voltage switchgear assemblies, medium voltage starter assemblies and low voltage switchboards, which meet seismic requirements, provide the user with a complete seismic qualified assemblies package that meet CBC and IBC requirements. Please contact your Eaton sales engineer for more details.

Bid Manager™

One of the most exciting new tools developed for the MCC product line is the Bid Manager program. Bid Manager is a PC-based pricing program that is capable of providing complete bills of material, front views and prices for *IT.* and Freedom 2100 MCCs. This program can configure an MCC to meet a multitude of specific applications and provide accurate bills of material and front view drawings in a matter of moments. The program operates on a user-friendly, Windows®-based format that offers the most extensive product selection found in the industry. A complete line of adjustable frequency drives and reduced voltage solid-state control, along with insulated case breakers, high ampacity molded case breakers and automatic transfer switches are featured in the program. Control and distribution product can be packaged in a multitude of variations. Please contact your Eaton sales engineer for more details.

Aftermarket Products



Motor Control Center Production Years

2002–present	1995–present	1992–present	1987–1995/ 1975–1987	1988–1994	1972–1989	1965–1975	1956–1974	1935–1965
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Background

Over 50 years ago, Cutler-Hammer® and Westinghouse® low voltage motor control centers were introduced, enabling the group mounting of low voltage (600V class) electrical controls. This allowed for supervision and safe operation of motor starter units, feeder tap units and auxiliary equipment in a flexible structure arrangement at a centralized location.

The foundation for today's MCCs is a modular plug-in combination motor controller assembly with components of proven electrical and mechanical integrity. These assemblies are enclosed in metal structures that prevent accidental contact with live electrical parts.

The MCC structure consists of structural steel, horizontal and vertical wireways for conduit and load cable entry and exit, and vertical and horizontal bus systems for distributing power throughout the MCC. The starter unit consists of a rugged steel shell (wrapper) for mounting the unit components, a combination motor starter with factory wired control, a handle mechanism for ON/OFF operation, and a rigid unit door.

Aftermarket Service

Eaton's Cutler-Hammer series of MCCs are manufactured with high quality structural parts designed to provide many years of service.

Eaton is dedicated to providing replacement units or add-on units to handle additional loads for motor control centers manufactured since 1935 for both the Westinghouse and Cutler-Hammer product lines.

The following descriptions and needed order entry information will be useful in identifying and processing a vintage MCC aftermarket unit.

1. Motor control center type: (11-300, Type W, 5-Star, Advantage, 9800, F-10, FlashGard, Freedom, **IT.**)
2. Class of unit (Non-reversing, Reversing, Two Speed)
3. Service voltage
4. Control voltage
5. Starter size or horsepower rating
6. Disconnect type (HMCP, Fusible)
7. Clip size and type (if Fusible)
8. Unit modifications (Lights, Pushbuttons, etc.)
9. Catalog Number (if available)

Product Availability

Replacement units for the 5-Star, Series 2100, Advantage, 11-300, 9800, Type W, F-10, F2100, Freedom FlashGard, **IT.**, **IT.** FlashGard motor control center lines may be obtained from the Fayetteville manufacturing plant or any of the regionally located Service Centers.

Competitive MCC units can be obtained from the Fayetteville manufacturing plant.

The seven Service Centers are located in:

Regional Service Centers

Service Center	Telephone
Atlanta	678-309-4270
Chicago	630-260-6304
Denver	303-366-9949
Hartford	860-683-4221
Houston	713-939-9696
Los Angeles	562-944-6413
Portland	503-582-2700

MCC Renewal Parts

MCC Type	Dates	Eaton's Cutler-Hammer Renewal Parts Publication
IT.	2002–present	—
IT. FlashGard	2007–present	—
F2100	1995–present	RP04304001E
Freedom FlashGard	2008–present	—
Advantage	1992–present	RP04304002E
Series 2100	1987–1995	RP04304003E
5 Star	1975–1987	RP04304003E
Freedom Unitrol	1988–1994	RP04304004E
F10 Unitrol	1972–1989	RP04304005E
Type W	1965–1975	RP04304006E
9800 Unitrol	1956–1974	RP04304007E
11-300	1935–1965	RP04304008E

Freedom 2100 and Freedom FlashGard



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Product Description

Eaton's offering of motor control centers (MCCs) features the Freedom 2100, Freedom FlashGard, **IT**, and **IT**. FlashGard lines. The Freedom 2100 incorporates the newest NEMA electromechanical starter in the industry along with the most complete, NEMA rated package of distribution and control equipment. The FlashGard MCCs are the industry's first and only MCC designed for comprehensive arc flash prevention.

Application Description

Eaton's MCCs are custom-made assemblies of conveniently grouped control equipment primarily used for control of motors and for distribution of power. MCCs are designed for three-phase, 230V applications up to 300 hp, or three-phase, 480V applications up to 600 hp. The Freedom FlashGard MCC is equipped with a patented state-of-the-art stab racking mechanism (RotoTract™) that provides bus isolation, stab indication and lockout features that proactively prevent the initiation of arc flash.

Features, Benefits and Functions

Structure Design

Eaton's MCCs are 20.00 inches (508.0 mm) wide and 90.00 inches (2286.0 mm) high with vertical compartments having 72.00 inches (1828.8 mm) of unit mounting space in 6.00-inch (152.4 mm) increments.

Structure depth is 16.00 inches (406.4 mm) or 21.00 inches (533.4 mm) deep front-mounted only and 21.00 inches (533.4 mm) deep for back-to-back mounted units.

The unique framed design permits the highest flexibility in component and structure configuration.

Accessibility

All parts and wiring are front accessible. Terminal blocks are side mounted in each unit 4.00-inch (101.6 mm) or 8.00-inch (203.2 mm) vertical wireways separate from control units provide safe and convenient access to wiring and conduits without de-energizing any equipment.

Flexibility

Modular, framed design permits structure arrangement to be tailored to exactly meet any control requirements with a minimum of unusable space. Vertical compartments are incremented for maximum space utilization and unit interchangeability. A 6.00-inch (152.4 mm) Size 1 starter unit provides users the ability to solve demanding space requirements and still meet all NEMA and UL® standards.

Safety

Design tested at Eaton's power laboratory to ensure maximum protection for control equipment. The FlashGard option ensures maximum safety for personnel working on or around the equipment.

Hardwired Control

With choices for 1A to 2C wiring schemes, the Eaton MCC offers many options for traditional or supervisory control schemes.

Industrial Communications

Eaton MCCs come with the most advanced and flexible industrial factory installed and tested communication connectivity in the marketplace with protocols that include DeviceNet, Modbus and Modbus TCP, EtherNet/IP and PROFIBUS. Eaton smart MCCs facilitate faster startup, safer working conditions and enhanced diagnostics and monitoring.

Intelligent Products

Eaton MCCs include intelligent starters, soft starts, VFDs, meters and feeder breakers that can all be connected to an embedded PLC and operator interface.

Standards and Certifications

UL Listing

Standard structures and units are provided with UL label.

Contact Eaton for details and part numbers for CSA approved units.



Accessories and Options

Control and Distribution Equipment Packaging

The Freedom 2100 and Freedom FlashGuard provide the best packaged solutions for the control needs of today's users. The Freedom structural characteristics allow the user to select a complete package of control and distribution equipment in a minimum amount of space. The ability to package a wide range of solid-state products, including SVX9000 drives, the **IT**. Solid-State Reduced Voltage Starters and PLCs meets the most demanding user process needs. The option to provide high ampacity molded case breakers gives the user the flexibility to minimize switchboard or switchgear structures and thereby saves valuable space and reduces design costs. Additional safety accessories are available such as Motorguard (automatic insulation tester), Voltage Vision (voltage presence indicator) FlashGuard remote racking accessory and FlashGuard locking accessory. Other packaged products, including automatic transfer switches and panelboards, again reduce space requirements and save time and money on equipment and installation costs. Motor load terminal block that enables quick connect/disconnect of 480V power is available as standard on FlashGuard and is an option on Freedom 2100 MCCs (through 180A).

FlashGuard Remote Racking Accessory



Remote Racking Accessory

- Performs RotoTract racking safely behind NFPA arc flash boundaries
- 120 Vac motor driven
- Mounts to RotoTract mechanism
- Wired pendant station for "rack-in"/"rack-out" operation
- Momentary jog
- Mounting offset bracket to clear device panel

Voltage Presence Indicator (VoltageVision™)



Voltage Presence Indicator (VoltageVision)

- Hardwired voltage detector connected to load side of disconnect
- Enables operator to "pre-verify" voltage presence with unit door closed
- Installable in a 30 mm pilot device knockout
- Dual redundant circuitry for reliability
- Phase insensitive

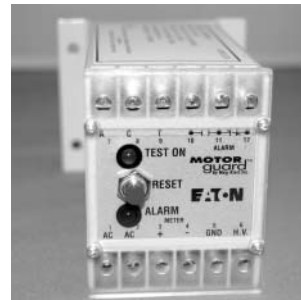
FlashGuard Locking Accessory



FlashGuard Locking Accessory

- Locks out RotoTract operation during maintenance
- Allows operation of FlashGuard units by authorized personnel only
- Provided as standard on NEMA 12 FlashGuard MCCs (prevents dust entry into RotoTract access port)
- Heavy-gauge steel construction

Automatic Insulation Tester (Motorguard)



Automatic Insulation Tester (Motorguard)

- "Meggers" equipment motor insulation to continuously monitor integrity of insulation for the period that the equipment is de-energized
- Applies 500 Vdc potential at current-limited, operator-safe maximum amperage of 200 microamperes
- Alarms upon detection of a threshold leakage to ground current
- Visual alarm indication and lockout; Form C contact available for remote alarm status

Technical Data and Specifications

Incoming Line

Incoming Line—Main Lugs Only ^①

Bus Rating	X-Space
600	2
	3
	4
800	3
	4
	6
1000	4
	6
	8
1200	5
	6
1600	12
2000	12
2500	12
3200 ^②	12

Incoming Line—Main Circuit Breaker ^①

Frame Size (Amperes)	Circuit Breaker Type	Dimensions in Inches (mm)		Freedom FlashGuard Unit Size
		F2100 Unit Size	Enclosure Width	
150	HFD	18.00 (457.2)	20.00 (508.0)	18
	FDC	18.00 (457.2)	20.00 (508.0)	18
225	HFD	18.00 (457.2)	20.00 (508.0)	18
	FDC	18.00 (457.2)	20.00 (508.0)	18
250	HJD	30.00 (762.0)	20.00 (508.0)	30
	JDC	30.00 (762.0)	20.00 (508.0)	30
400	HKD	30.00 (762.0)	20.00 (508.0)	30
	KDC	30.00 (762.0)	20.00 (508.0)	30
	CHKD ^③	30.00 (762.0)	20.00 (508.0)	30
	CKDC ^③	30.00 (762.0)	20.00 (508.0)	30
600	HLD	24.00 (609.6) ^{⑤⑥}	20.00 (508.0)	⑧
	LDC	24.00 (609.6) ^{⑤⑥}	20.00 (508.0)	⑧
	CHLD ^{②③}	24.00 (609.6) ^{⑤⑥}	20.00 (508.0)	⑧
	CLDC ^{②③}	24.00 (609.6) ^{⑤⑥}	20.00 (508.0)	⑧
800	HMDL	30.00 (762.0) ^⑥	20.00 (508.0)	⑧
	CHMDL ^{②③}	48.00 (1219.2) ^⑥	20.00 (508.0)	⑧
	NDC	42.00 (1066.8) ^⑥	20.00 (508.0)	⑧
	CHND ^③	72.00 (1828.8)	20.00 (508.0)	⑧
	CNDC ^③	72.00 (1828.8)	20.00 (508.0)	⑧
1200	HND ^④	42.00 (1066.8) ^⑥	20.00 (508.0)	⑧
	NDC ^④	42.00 (1066.8) ^⑥	20.00 (508.0)	⑧
	CHND ^{②③}	72.00 (1828.8)	20.00 (508.0)	⑧
	CNDC ^{②③}	72.00 (1828.8)	20.00 (508.0)	⑧
2000	RD ^④	72.00 (1828.8) ^⑦	20.00 (508.0)	⑧
	RDC ^④	72.00 (1828.8) ^⑦	20.00 (508.0)	⑧
	CRD ^③	72.00 (1828.8) ^⑦	20.00 (508.0)	⑧
	CRDC ^③	72.00 (1828.8) ^⑦	20.00 (508.0)	⑧
2500	RD	72.00 (1828.8) ^⑥	24.00 (609.6)	⑧
	RDC	72.00 (1828.8) ^⑥	24.00 (609.6)	⑧

Notes

- ① Table common to F2100 and Freedom FlashGuard.
- ② NEMA 1 gasketed only.
- ③ 100% rated when 90° cable applied at 75° ampacity for 100% rating. Digitrip™ 310 LS is required and included in the price.
- ④ Digitrip 310 LS is standard and included in the pricing.
- ⑤ Add 6.00 inches (152.4 mm) for top entry of incoming cables.
- ⑥ Install at top for cable top entry or at bottom for bottom cable entry.
- ⑦ The main breaker requires the complete vertical section. The rear is unusable.
- ⑧ Fixed assembly. Not available with RotoTract.

Structure Modifications

Structure Modifications

Description
Enclosure
NEMA 1 gasketed
NEMA 12—dust-tight
NEMA 3R front-mounted only
NEMA 3R front and rear
NEMA 3R walk-in
NEMA 3R tunnel
Space heater
Thermostat
Bottom plate
Channel sills
12.00-inch (304.8 mm) pull box
100K bracing
Vertical Bus
300A
600A
800A
1200A
Ground Bus 300A
Horizontal—copper
Horizontal and vertical plug-in
Standard Structures
16.00-inch (406.4 mm) front-mounted only
21.00-inch (533.4 mm) front-mounted only
21.00-inch (533.4 mm) front and rear
Main Horizontal Bus—65°C Rise
600A copper
800A copper
1200A copper
1600A copper
2000A copper
2500A copper
3200A copper
Vertical Bus Barrier
Labyrinth barrier with shutters

Neutral Bus (Bottom)

Ampere Rating
300
600 or 800
1000
1200
1600
2000
2500
3200 ①

Incoming Line Metering

IQ Meter	X-Space	
	F2100	Freedom FlashGard
IQ 100	2	2
IQ 250	2	2
IQ 260	2	2
IQ Analyzer	2	2
Power Xpert®	3	3

Surge Protection Device—18.00-Inch (457.2 mm) Units with Circuit Breaker Disconnect ②

Includes power quality meter for volts, sag, swell, outage, transient counter, Form C contact, alarm.

Surge Current Per Phase	X-Space	
	F2100	Freedom FlashGard
100 kA Model SPD ③	18.00 (457.2)	18.00 (457.2)
120 kA Model SPD ③④	18.00 (457.2)	18.00 (457.2)
160 kA Model SPD ③	18.00 (457.2)	18.00 (457.2)
200 kA Model SPD ③	18.00 (457.2)	18.00 (457.2)
250 kA Model SPD ⑤	18.00 (457.2)	18.00 (457.2)
300 kA Model SPD	18.00 (457.2)	18.00 (457.2)
400 kA Model SPD	18.00 (457.2)	18.00 (457.2)

Notes

- ① Available NEMA 1 gasketed enclosures only.
- ② Available in 12.00-inch (304.8 mm) unit (2X) without circuit breaker disconnect.
- ③ Optional integral IQ 200 meter in 18.00-inch (457.2 mm) unit for 100 kA–200 kA.
- ④ Recommended branch entrance.
- ⑤ Recommended service entrance.

Combination Starters

Circuit Breaker Starters (HMCP) Non-Reversing (F206)

Size	X-Space	
	F2100	Freedom FlashGard
1	2	2
2	2	2
3	3	3
4	3	4
5	6	7
6	9	9

Circuit Breaker Starters

Size	X-Space	
	F2100	Freedom FlashGard
Full Voltage Non-Reversing (F206)—Compact		
1	1	2
Full Voltage Reversing (F216)		
1	3	3
2	3	3
3	4	4
4	5	5
2S1W (F946)		
1	4	4
2	4	5
3	6	7
4	6	8
2S2W (F956)		
1	4	4
2	4	4
3	5	5
4	5	7
Reduce Voltage Auto Transformer (F606) ①		
3	8	9
4	8	9
5 ②	12	12
6 ③	12	12
Vacuum Starters (V206) Non-Reversing		
4	3	4
5	6	7
6	8	9

Fusible Disconnect Starters

Size	X-Space	
	F2100	Freedom FlashGard
Full Voltage Non-Reversing (F204)		
1	2	3
2	2	3
3	4	4
4	6	6
5	10	11
Full Voltage Reversing (F214)		
1	4	4
2	4	4
3	5	5
4	8	10
Fusible Non-Reversing 2S 1W (F944)		
1	4	4
2	4	5
3	6	6
4	10	10
Fusible Non-Reversing 2S 2W (F954)		
1	4	4
2	4	5
3	5	6
4	8	10

Contactor Only Units

Size	X-Space	
	F2100	Freedom FlashGard
Circuit Breaker (F208)		
1	2	2
2	2	2
3	3	3
4	3	4
5	6	7
6	9	9
Fusible (F209)		
1	2	3
2	2	3
3	4	4
4	6	6
5	10	11

Notes

- ① Must be located at bottom.
- ② 24.00 inches (609.6 mm) wide.
- ③ 28.00 inches (711.2 mm) wide.

Starter Modifications

Control Options

Description

Selector switch 2/3—Pos.
Push-to-test light 6V transformer
Tx indicating light—standard
Auxiliary switch—in breaker
Mini meters
AMM
VMM
ETM
Relay surge suppressor
Timer—pneumatic
Timer—solid-state
Relay—AR—600V two-pole
Relay—general purpose 300V
Standard solid-state overload relay ①②
NEMA size 1–3
NEMA size 4–6

Industrial Communications ③

Networked-enabled components in MCCs eliminate up to 90% of the control wiring versus traditional hardwired designs.

The industrial network is prewired throughout the MCC and factory tested for conformance.

Motor Control Communication Options

Device	DeviceNet	Modbus	PROFIBUS	EtherNet/IP	Modbus TCP
C306 Over Load	C441K	C441N	C441S	C441R	C441R
C440 Over Load	C441K	C441N	C441S	C441R	C441R
C441 Over Load	C441K	C441N	C441S	C441R	C441R
SVX Drives	OPTC7	OPTC2	OPTC3	OPTCI	OPTCI
Feeders	C441K	C441N	C441S	C441R	C441R
S811 Soft Starts	D77D-DNA	D77D-EMA	D77D-PNA	D77D-EIP	D77D-EMA

Intelligent Technologies (IT) S811 SSRV Starters with Integral Bypass

Maximum hp	X-Space		Maximum hp	X-Space	
	F2100	Freedom FlashGard		F2100	Freedom FlashGard
IT06 Solid-State Reduced Voltage Starters—HMCP			IT06 Solid-State Reduced Voltage Starters—		
65 kAIC—1.15 Service Factor—Standard Duty			65 kAIC—1.15 Service Factor—Severe Duty		
20	2	3	10	2	3
40	2	3	25	2	3
60	3	4	40	3	4
75	3	4	50	3	4
125	6	7	75	6	7
150	6	7	100	6	7
200	6	7	125	6	9
300	9	9	150	9	10
350	9	9	200	9	10
450	12	12	250	9	10
500	12	12	300	9	10
600	12	12	350	9	10
700	12 ⑤	12	450	12 ⑤	12

IT. SSRV Control Options ⑥

Description

Pump control
MOV protection
DeviceNet—standard
DeviceNet—enhanced

IT. SSRV Power Options ⑥

NEMA Bypass Contactor

Size 1
Size 2
Size 3
Size 4
Size 5
Size 6
Size 7

Notes

- ① Feature Overload provides same features as standard model plus ground fault, stall/jam protection, selectable trip class—10, 15 and 20.
- ② Size 4 units require additional 6-inch (152.4 mm) (1X) space.
- ③ This table is common for both Freedom 2100 and Freedom FlashGard MCCs.
- ④ **IT.** starters up to 66 amperes require additional 6 inches (152.4 mm) when selecting industrial network interfaces.
- ⑤ Requires 24.00-inch (609.6 mm) wide, rear is unusable, bottom exit only.
- ⑥ Options apply to both HMCP and breaker models.

Motor Isolation Contactors

Sizes
1
2
3
4
5
6
7

MVX Adjustable Frequency Drives—NEMA 1 480V— with 3% Line Reactor, CPT

hp	X-Space
2	3
3	3
5	3
7.5	3
10	3

MVX Drive Options

Description
3% load reactor
5% load reactor
Three contactor bypass

SVX9000 Adjustable Frequency Drives— Plug-in Units NEMA 1 480V Constant/Variable Torque Rated ①

hp	X-Space	
	F2100	Freedom FlashGard
3	3	6
5	4	7
7.5	4	7
10	4	7
15	4	7
20	6	10
25	6	10
30	6	10

SVX9000 Options

Description
DeviceNet communications
PROFIBUS communications
Modbus RTU
Modbus TCP
Ethernet IP
2000-foot (609.6m) dV/dT filter (3 hp)
2000-foot (609.6m) dV/dT filter (5–15 hp)
2000-foot (609.6m) dV/dT filter (20–30 hp)
Input line fuses (3–30 hp)
RFI filter (3–30 hp)

SVX9000 Adjustable Frequency Drives— Non-Plug-in Units NEMA 1 480V Constant/Variable Torque Rated

hp	X-Space	
	F2100	Freedom FlashGard
40	9	9
50	9	9
60	9	9
75 ②	9	9
100	12	12
125	12	12
150	12	12
200	12	12
250	12	12
300	12	12
400	12	12
500	12	12
600	12	12

Note: Consult *Eaton's Consulting Application Guide* for complete details on Drive/ Option Assembly Dimensions.

Note: SVX9000 Non-Plug-in Units with HMCP disconnect, 3% input line reactor, 3% output line reactor, door mounted Keypad, CPT.

Note: VT—Variable Torque drives are capable of producing 200% starting torque for 10 seconds and are rated for 10 seconds, and are rated 110% overload for 1 minute.

Note: CT—Variable Torque drives are capable of producing 200% starting torque for 10 seconds and are rated for 10 seconds, and are rated 150% overload for 1 minute.

SVX9000 Options

Description
DeviceNet communications
PROFIBUS communications
Modbus RTU
Modbus TCP
Ethernet IP
2000-foot (609.6m) dV/dT filter (40–75 VT hp)
2000-foot (609.6m) dV/dT filter (100–150 VT hp)
2000-foot (609.6m) dV/dT filter (200–250 VT hp)
2000-foot (609.6m) dV/dT filter (300–400 VT hp)
2000-foot (609.6m) dV/dT filter (500–600 VT hp)
Input line fuses (40–150 VT hp)
Input line fuses (200–250 hp)
Input line fuses (300–400 hp)

Active Harmonic Correction for AC Drives

Description	X-Space	
	F2100	Freedom FlashGard
50A harmonic correction	12 ③	12 ③
100A harmonic correction	12 ③	12 ③

18-Pulse Clean Power Drives—NEMA 1, 480V Variable Torque Duty ④

hp	X-Space Inches (mm) Wide ⑤
100	12, 40.00 (1016.0)
150	12, 40.00 (1016.0)
200	12, 60.00 (1524.0)
250	12, 60.00 (1524.0)
300	12, 60.00 (1524.0) ⑥
400	12, 60.00 (1524.0) ⑥
500	12, 106.00 (2692.4) ⑥

Feeders

Circuit Breaker

Amperes	X-Space	
	F2100	Freedom FlashGard
Standard Circuit Breakers		
HFD 50 ⑦	2	2
HFD 100 ⑦	2	2
HFD 150 ⑦	2	2
HJD 250	3	3
HKD 400	4	5
HLD 600	4	4 ⑧
HND 800	7	7 ⑧
HND 1200	7	7 ⑧

6-Inch (152.4 mm) HFD Circuit Breakers

50	1	N/A
100	1	N/A

Dual HFD Circuit Breakers

50/50	2	⑨
50/100	2	⑨
100/100	2	⑨
100/150	2	⑨
150/150	2	⑨

Fusible Disconnect— Fusible Switch

Amperes	X-Space	
	F2100	Freedom FlashGard
30 or 60	2	3
100	3	3
200	6	5
400	6	7
600	8	8

Fusible Disconnect— Dual Fusible Switch ⑩

Amperes	F2100 X-Space
30	2
60	3
30	2

Notes

- ① SVX9000 plug-in units with HMCP disconnect, 3% input line reactor, 3% output line reactor, door-mounted keypad, CPT.
- ② X-space for 75 hp CT rated drive is 12X.
- ③ Requires 24-inch (609.6 mm) wide structure.
- ④ Includes 5% input line reactor, 18-pulse rectifier, delta differential transformer.
- ⑤ X-space shown is common for both F2100 and Freedom FlashGard MCCs.
- ⑥ Extra space required for bypass contactor, consult factory.
- ⑦ HFDE breakers with RMS 310+ electronic trip unit available in 80 AF and 225 AF in 2X space.
- ⑧ Fixed assembly, no RotoTract.
- ⑨ Not available in Freedom FlashGard.

NEMA 3R Drives

480V—Constant/Variable Torque Duty

Horsepower	X-Space Width ^①
1.5	5X, 24.00 (609.6)
2	5X, 24.00 (609.6)
3	5X, 24.00 (609.6)
5	5X, 24.00 (609.6)
7.5	12X, 24.00 (609.6)
10	12X, 24.00 (609.6)
15	12X, 24.00 (609.6)
20	12X, 24.00 (609.6)
25	12X, 24.00 (609.6)
30	12X, 24.00 (609.6)
40	12X, 24.00 (609.6)
50	12X, 32.00 (812.8)
60	12X, 32.00 (812.8)
75	12X, 32.00 (812.8)
100	12X, 32.00 (812.8)
125	12X, 32.00 (812.8)
150	12X, 32.00 (812.8)
200	12X, 32.00 (812.8) ^②

Transformers

Transformers Primary Breaker Only ^③

kVA	X-Space ^④
Single-Phase	
5	4
10	4
15	5
20	5
30	6
45	7
Three-Phase	
15	6
30	6
45	9

Panelboards

Panelboards (240V Maximum) ^⑤

Circuit	X-Space
18	4
30	5
42	6

ATS—Automatic Transfer Switches—Open Transition Three-Pole Only

Ampere Rating	Unit Width Inches (mm)	Unit Size Inches (mm)	
		F2100	Freedom FlashGard
100 ^⑥	20.00 (508.0)	36.00 (914.4)	36.00 (914.4)
150 ^⑥	20.00 (508.0)	36.00 (914.4)	36.00 (914.4)
100	20.00 (508.0)	48.00 (1219.2) (8X)	48.00 (1219.2) (8X)
150	20.00 (508.0)	48.00 (1219.2) (8X)	48.00 (1219.2) (8X)
225	20.00 (508.0)	48.00 (1219.2) (8X)	48.00 (1219.2) (8X)
300	20.00 (508.0)	48.00 (1219.2) (8X)	48.00 (1219.2) (8X)
400	24.00 (609.6) ^⑦	72.00 (1828.8)	72.00 (1828.8)
600	24.00 (609.6) ^⑦	72.00 (1828.8)	72.00 (1828.8)
800	24.00 (609.6) ^⑦	72.00 (1828.8)	72.00 (1828.8)
1000	24.00 (609.6) ^⑦	72.00 (1828.8)	72.00 (1828.8)
1000	44.00 (1117.6) ^⑧	72.00 (1828.8)	72.00 (1828.8)
1200	44.00 (1117.6) ^⑧	72.00 (1828.8)	72.00 (1828.8)
1600	44.00 (1117.6) ^⑧	72.00 (1828.8)	72.00 (1828.8)
2000	44.00 (1117.6) ^⑧	72.00 (1828.8)	72.00 (1828.8)

Notes

- ^① X-space shown is common for both F2100 and FlashGard MCCs.
- ^② Extra space required for bypass section. Consult factory.
- ^③ Must have primary breaker. Must be located at bottom of structure.
- ^④ X-space shown is common for both F2100 and Freedom FlashGard MCCs.
- ^⑤ Space for MLO. Branch breakers included.
- ^⑥ Manually operated switch:
NTVS = Electronically operated non-automatic.
MTVX = Single handle manual operation.
- ^⑦ Requires 21.00-inch (533.4 mm) deep structure.
- ^⑧ Requires 37.00-inch (939.8 mm) deep structure, flush at the rear. 4.00-inch (101.6 mm) filler required.
- ^⑨ Requires 42.00-inch (1066.8 mm) deep structure. 4.00-inch (101.6 mm) filler required.

Application Guide

Motor Circuit Protector Selection Guide ^①

NEMA	Maximum Horsepower						
	200V	208V	230V	380V	460V	575V	HMCP
1	—	—	—	3/4	3/4	1	3
	3/4	1	1	2	2	3	7
	2	2	2	3	5	7-1/2	15
	5	5	5	10	10	10	30
2	7-1/2	7-1/2	7-1/2	—	—	—	50
	—	—	—	—	—	15	30
	10	10	10	15	20	25	50
	—	—	15	25	25	—	70
3	—	—	—	—	—	30	50
	15	20	20	30	40	50	100
	25	25	30	50	50	—	150
4	40	40	40	60	100	100	150
	—	—	50	75	—	—	250
5	50	50	60	—	125	150	250
	75	75	75	150	200	200	400
	—	—	100	—	—	—	600
6	150	150	200	300	350	400	600
	—	—	—	—	400	—	1200

Circuit Breaker Application Chart

Frame	Frame Rating (Amperes)	Interrupting Rating (kA Symmetrical Amperes)		
		208/240V	480V	600V
Standard Rating Molded Case Circuit Breakers				
HFD	150	100	65	25
HJD	250	100	65	25
HKD	400	100	65	35
HLD	600	100	65	35
HND	800	100	65	35
HND	1200	100	65	35
RD	2000	100	65	50
High Interrupting Rating Molded Case Circuit Breakers				
FDC	150	100	100	35
JDC	250	100	100	35
KDC	400	100	100	50
LDC	600	100	100	50
NDC	800	100	100	50
NDC	1200	100	100	50
RDC	2000	100	100	65
RDC	2500	100	100	65
Current Limiting Molded Case Circuit Breakers				
HFD/CL	150	100	100	100
NBTRIPAC	300–800	100	100	100
Magnum DS Air Circuit Breakers				
MDS-608	800	65	65	65
MDS-C08	800	100	100	100
MDS-616	1600	65	65	65
MDS-C16	1600	100	100	100
MDS-620	2000	65	65	65
MDS-C20	2000	100	100	100
MDS-632	3200	65	65	65
MDS-C32	3200	100	100	100

Notes

^① Suitable for use with NEMA Design B and D (high efficiency) motors.
Circuit breakers can be supplied with optional CPT and optional shunt trip.

Individual CPT Sizes

Starter Size	Standard Transformer (VA)	Maximum Size in Standard Unit (VA)
FVNR, FVR, 2S2W		
1, 2	100	150
1, 2-6	100	100
3, 4	150	250
5, 6	500	500
4	150	250
5	150	250
6	250	350
RVAT		
3, 4	150	250
5, 6	500	500
2S1W		
1, 2, 3, 4	200	250
5, 6	500	500
Vacuum		
4	150	250
5	150	250
6	250	350

Product Specifications

Structure

- NEMA 1A, 2, 3R or 12 enclosure
- Copper horizontal bus 600–3200A
- Fully rated copper vertical bus 300–1200A
- Optional labyrinth barriers for insulated and isolated vertical bus
- Optional isolating barriers between structures
- Insulated horizontal bus and insulated vertical bus is standard for FlashGard MCCs
- Heavy-duty spring operated quarter-turn latch
- 65 kA and 100 kA bus bracing

Units

- Freedom 2100 Motor Starters:
 - NEMA size 1–7
 - Freedom overload relay
 - Single-phase protection
 - Class 10 and 20 protection
 - Widest heater range with fewest styles in the industry
- HMCP with combination starter ratings of 65 kAIC and 100 kAIC at 480V
- Plug-in units up to 400A
- Handle mechanism with positive trip indication
- Side-mounted positive latch terminal block
- Motor load terminal, Freedom block is standard on FlashGard MCC and optional on Freedom 2100
- 6.00-inch (152.4 mm) NEMA size 1 unit with either HMCP or fusible switch
- Solid-State Reduced Voltage Starters:
 - Intelligent Technologies (IT.) S811 (20–800 hp)
- Adjustable Frequency Drives:
 - MVX (1–10 hp)
 - SVX9000 (2–600 hp)
- K-Switch visible blade disconnect:
 - 30–800A
 - 100 kAIC at 600V

- 10250T 30.5 mm heavy-duty oiltight pushbuttons
- Surge protection:
 - SPD (100–400 kA)
- Energy monitoring:
 - IQ 100 (amperes, volts)
 - IQ 250 (adds, Hz, watts, PF)
 - IQ 260 (adds THD, Contact I/O)
 - IQ Analyzer (adds trending, waveform display)
 - Power Xpert (adds high-end metering, power quality analysis, open communications and Web server gateway)

***IT.* and *IT.* FlashGard MCCs**



Contents

Description

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Product Description

Eaton’s offering for motor control centers features the Intelligent Technologies (***IT.***) MCC. This product offers the highest density of motor control in the industry along with the most functionality. Its innovative design, as well as its enhanced fault performance and protective features, make it the new benchmark in the industry. The FlashGard MCCs are industry’s first and only MCC designed for comprehensive arc flash prevention.

Application Description

Eaton’s MCCs are custom-made assemblies of conveniently grouped control equipment primarily used for control of motors and power distribution. MCCs are designed for three-phase, 230V applications up to 300 hp, or three-phase, 480V applications up to 600 hp. The ***IT.*** FlashGard MCC is equipped with a patented state-of-the-art stab racking mechanism (RotoTract) that provides bus isolation, stab indication and lockout features that proactively prevent the initiation of arc flash in the mechanism.

Features, Benefits and Functions

Structure Design

Eaton’s MCCs are 20.00 inches (508.0 mm) wide and 90.00 inches (2286.0 mm) high with vertical compartments having 72.00 inches (1828.8 mm) of unit mounting space in 6.00-inch (152.4 mm) increments.

Structure depth is 16.00 inches (406.4 mm) or 21.00 inches (533.4 mm) deep front-mounted only, and 21.00 inches (533.4 mm) deep for back-to-back mounted units.

The unique framed design permits the highest flexibility in component and structure configuration.

Accessibility

All parts and wiring are front accessible. Terminal blocks are side mounted in each unit. 4.00-inch (101.6 mm) or 8.00-inch (203.2 mm) vertical wireways separate from control units provide safe and convenient access to wiring and conduits without de-energizing any equipment.

Flexibility

Modular, framed design permits structure arrangements to be tailored to exactly meet any control requirements with a minimum of unusable space. Vertical compartments are incremented for maximum space utilization and unit interchangeability. A 6.00-inch (152.4 mm) size 1–2 starter unit provides users with the ability to solve demanding space requirements and still meet all NEMA and UL standards.

Safety

Design tested at Eaton’s power laboratory to ensure maximum protection for control equipment. Engineered to minimize hazards to operating personnel.

Control Design

IT. MCCs are available in two basic control configurations:

- Hardwired for connection to traditional local/remote devices, PLC’s DCS systems
- Communicating MCCs provide the optimal integrated package for control, communication, diagnostics and simplified wiring. Eaton’s communicating MCC solution provides users with significantly reduced installation time and increased uptime through the integration of intelligent devices and advanced software tools
- Control products include: industrial network, compliant motor starters, variable speed drives, operator interface and networked I/O

Standards and Certifications

UL Listing

Standard structures and units are provided with UL label.



Accessories and Options

The *IT.* MCC features 24 Vdc control supplied to each control unit using a structure-mounted DC bus. The DC bus is fed from a power supply unit or by a separate customer-supplied DC source. Units feature fuseless self-protecting DC stabs that distribute control power to each unit. Motor lead terminal blocks can be provided through NEMA size 4 starters. The motor lead terminal block remains in the structure when a unit is withdrawn. This makes unit withdraw easy and safe.

Additional safety accessories are available, such as Motorguard (automatic insulation tester), Voltage Vision (voltage presence indicator) and FlashGuard remote racking accessory.

IT. communication can be two different network protocols.

Communication Architecture—Ethernet, PROFIBUS, DeviceNet or Modbus®

IT. communicating motor control centers use a network gateway approach. The connection point for the controlling network is in the top of the structure in the 24 Vdc power supply unit. The network gateway is connected to a communication bus that runs the length of each structure. Each of the starter units has a communicating cover control that is connected to the communication bus via a QCPort stab. This does not require any wires to be terminated when the starter unit is either inserted or withdrawn. The gateway approach allows additional flexibility that is not available with traditional communication networks.

QCPort allows for multiple starters to be attached to one gateway, up to 21 starters on a single gateway when using 6 bytes of information per starter. This vastly increases the amount of starters that can be on a single network.

For example, traditional DeviceNet networks only have 63 starters due to the one starter per node topology. QCPort could have up to 1323 starters (63 nodes x 21 starters per node) on one network. QCPort allows for configuration of each starter to be configured differently if required. QCPort units will communicate the following information:

- % FLA
- % Thermal capacity
- Average rms current
- Status
- Cause of trip
- Breaker status
- Run, stop, reset control

FlashGuard Remote Racking Accessory



Remote Racking Accessory

- Performs RotoTract racking safely behind NFPA arc flash boundaries
- 120 Vac motor driven
- Mounts to RotoTract mechanism
- Wired pendant station for “rack-in”/”rack-out” operation
- Momentary jog
- Mounting offset bracket to clear device panel

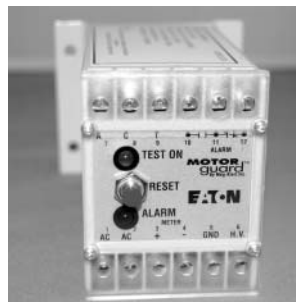
Voltage Presence Indicator (VoltageVision)



Voltage Presence Indicator (VoltageVision)

- Hardwired voltage detector connected to load side of disconnect
- Enables operator to “pre-verify” voltage presence with unit door closed
- Installable in a 30 mm pilot device knockout
- Dual redundant circuitry for reliability
- Phase insensitive

Automatic Insulation Tester (Motorguard)



Automatic Insulation Tester (Motorguard)

- “Meggers” equipment motor insulation to continuously monitor integrity of insulation for the period that the equipment is de-energized
- Applies 500 Vdc potential at current-limited, operator-safe maximum amperage of 200 microamperes
- Alarms upon detection of a threshold leakage to ground current
- Visual alarm indication and lockout; Form C contact available for remote alarm status

FlashGuard Locking Accessory



FlashGuard Locking Accessory

- Locks out RotoTract operation during maintenance
- Allows operation of FlashGuard units by authorized personnel only
- Provided as standard on NEMA 12 FlashGuard MCCs (prevents dust entry into RotoTract access port)
- Heavy-gauge steel construction

Technical Data and Specifications

Incoming Line

Incoming Line—Main Lugs Only ^①

Bus Rating	X-Space
600	2
	3
	4
800	3
	4
	6
1000	4
	6
	8
1200	5
	6
1600	12
2000	12
2500	12
3200 ^②	12

Incoming Line—Main Circuit Breaker ^①

Frame Size (Amperes)	Circuit Breaker Type	Dimensions in Inches (mm)	
		Unit Size	Enclosure Width
150	HFD	18.00 (457.2)	20.00 (508.0)
	FDC	18.00 (457.2)	20.00 (508.0)
225	HFD	18.00 (457.2)	20.00 (508.0)
	FDC	18.00 (457.2)	20.00 (508.0)
250	HJD	30.00 (762.0)	20.00 (508.0)
	JDC	30.00 (762.0)	20.00 (508.0)
400	HKD	30.00 (762.0)	20.00 (508.0)
	KDC	30.00 (762.0)	20.00 (508.0)
	CHKD ^③	30.00 (762.0)	20.00 (508.0)
	CKDC ^③	30.00 (762.0)	20.00 (508.0)
600	HLD	24.00 (609.6) ^{⑤⑥}	20.00 (508.0)
	LDC	24.00 (609.6) ^{⑤⑥}	20.00 (508.0)
	CHLD ^{②③}	24.00 (609.6) ^{⑤⑥}	20.00 (508.0)
	CLDC ^{②③}	24.00 (609.6) ^{⑤⑥}	20.00 (508.0)
	HMDL	30.00 (762.0) ^⑥	20.00 (508.0)
800	CHMDL ^{②③}	48.00 (1219.2) ^⑥	20.00 (508.0)
	NDC	42.00 (1066.8) ^⑥	20.00 (508.0)
	CHND ^③	72.00 (1828.8)	20.00 (508.0)
	CNDC ^③	72.00 (1828.8)	20.00 (508.0)
	HND ^④	42.00 (1066.8) ^⑥	20.00 (508.0)
1200	NDC ^④	42.00 (1066.8) ^⑥	20.00 (508.0)
	CHND ^{②③}	72.00 (1828.8)	20.00 (508.0)
	CNDC ^{②③}	72.00 (1828.8)	20.00 (508.0)
	RD ^④	72.00 (1828.8) ^⑦	20.00 (508.0)
	RDC ^④	72.00 (1828.8) ^⑦	20.00 (508.0)
2000	CRD ^⑤	72.00 (1828.8) ^⑦	20.00 (508.0)
	CRDC ^⑤	72.00 (1828.8) ^⑦	20.00 (508.0)
	RD	72.00 (1828.8) ^⑥	24.00 (609.6)
	RDC	72.00 (1828.8) ^⑥	24.00 (609.6)

Notes

- ① Table common to IT. and IT. FlashGuard.
- ② NEMA 1 gasketed only.
- ③ 100% rated when 90° cable applied at 75° ampacity for 100% rating. Digitrip 310 LS is required and included in the price.
- ④ Digitrip 310 LS is standard and included in the pricing.
- ⑤ Add 6-inch (152.4 mm) for top entry of incoming cables.
- ⑥ Install at top for cable top entry or at bottom for bottom cable entry.
- ⑦ The main breaker requires the complete vertical section. The rear is unusable.

Structure Modifications

Structure Modifications

Description
Enclosure
NEMA 1 gasketed
NEMA 12—dust-tight
NEMA 3R front-mounted only
NEMA 3R front and rear
Space heater
Thermostat
Bottom plate
Channel sills
12.00-inch (304.8 mm) pull box
100K bracing
DC bus and vertical ground bus
QCPort communication bus
Vertical Bus
300A
600A
800A
1200A
Ground Bus 300A
Horizontal—copper
Standard Structures
16.00-inch (406.4 mm) front-mounted only
21.00-inch (533.4 mm) front-mounted only
21.00-inch (533.4 mm) front and rear
Main Horizontal Bus
600A copper
800A copper
1200A copper
1600A copper
2000A copper
2500A copper
3200A copper
Vertical Bus Barrier
Labyrinth barrier with shutters

Neutral Bus (Bottom) ①

Ampere Rating
300
600 or 800
1000
1200
1600
2000
2500
3200 ②

Incoming Line Metering

IQ Meter	X-Space	
	IT	IT FlashGuard
IQ 100	2	2
IQ 250	2	2
IQ 260	2	2
IQ Analyzer	2	2
Power Xpert	3	3

Surge Protective Device—18.00-Inch (457.2 mm) Units with Circuit Breaker Disconnect ③

Includes power quality meter for volts, sag, swell, outage, transient counter, Form C contact, alarm.

Surge Current Per Phase	X-Space	
	IT	IT FlashGuard
100 kA model SPD ④	18.00 (457.2)	18.00 (457.2)
120 kA model SPD ④⑤	18.00 (457.2)	18.00 (457.2)
160 kA model SPD ④	18.00 (457.2)	18.00 (457.2)
200 kA model SPD ④	18.00 (457.2)	18.00 (457.2)
250 kA model SPD ⑥	18.00 (457.2)	18.00 (457.2)
300 kA model SPD	18.00 (457.2)	18.00 (457.2)
400 kA model SPD	18.00 (457.2)	18.00 (457.2)

SPD—Control Power Supplies ⑦

Ampere Rating	Description	X-Space ⑧
6.5	Single power supply	1
6.5	Dual redundant power supplies	1
12	Single power supply	2

Notes

- ① 1/2 size main bus copper.
- ② Available NEMA 1 gasketed enclosures only.
- ③ Available in 12.00-inch (304.8 mm) unit (2X) without circuit breaker disconnect.
- ④ Optional integral IQ 200 meter in 18.00-inch (457.2 mm) unit for 100 kA–200 kA add \$4,146.
- ⑤ Recommended branch entrance.
- ⑥ Recommended service entrance.
- ⑦ Required in all structures that will contain a starter, drive or soft start.
- ⑧ Common to both IT and IT FlashGuard MCCs.

18.3

Motor Control Centers

IT. and *IT.* FlashGard

Combination Starters

Full Voltage Non-Reversing —HMCP (T206)

Size	X-Space	
	<i>IT.</i>	<i>IT.</i> FlashGard
1	1	2
2	1	2
3	2	3
4	2	3
5	6	6
6	9	9

Full Voltage Reversing —HMCP (T216)

Size	X-Space	
	<i>IT.</i>	<i>IT.</i> FlashGard
1	2	3
2	2	3
3	3	4
4	4	4
5	10	10
6	12	12

2S1W HMCP (T946)

Size	X-Space	
	<i>IT.</i>	<i>IT.</i> FlashGard
1	2	4
2	3	4
3	4	5
4	4	5

2S2W, HMCP (T956)

Size	X-Space	
	<i>IT.</i>	<i>IT.</i> FlashGard
1	2	4
2	2	4
3	3	4
4	4	5

Fusible Disconnect Starters

Size	X-Space	
	<i>IT.</i>	<i>IT.</i> FlashGard
Full Voltage Non-Reversing (T204)		
1	2	3
2	2	3
3	4	4
4	5	6
5	10	10

Full Voltage Reversing (T214)

1	3	4
2	3	4
3	5	6
4	6	9

Fusible, Non-Reversing 2S, 1W (T944)

1	3	4
2	3	4
3	6	5
4	7	6

Fusible, Non-Reversing 2S, 2W (T954)

1	3	4
2	3	4
3	5	6
4	6	7

Contactors Only Units

Size	X-Space	
	<i>IT.</i>	<i>IT.</i> FlashGard
Circuit Breaker (T208)		
1	1	2
2	1	2
3	2	3
4	2	3
5	5	6
6	9	9

Fusible (T209)

1	2	3
2	2	3
3	3	5
4	4	6
5	9	11

Starter Modifications

Control Options ①

Description
Auxiliary switch—in breaker
ETM mini meters
Timer—pneumatic
Timer—solid-state
Relay—AR—600V two-pole
Relay—general purpose 300V
AC E-Stop relay

Network Options ①

Description
QCPort DeviceNet adapter ②
QCPort Modbus TCP adaptor ②
QCPort Ethernet IP adaptor ②
QCPort PROFIBUS adaptor ②
5A—24 Vdc power supply
20A—24 Vdc power supply
Trunk cable and tee ③
Drop and auxiliary cable, tee
Terminating resistors

Pilot Control Modules ①

Description
Stop
Start/Stop
HOA
Fast Slow-Stop
Fwd/Rev-Stop
Fast/Slow/Off/Auto
Fwd/Rev/Off/Auto

Pilot Lights

Run (red)
Stop (green)
OL trip (red)
CB trip (red)
Ground fault trip (red)
Fwd/Rev (red)
Fast/Slow (red)

Intelligent Technologies (IT.) S801/S811 SSRV Starters with Integral Bypass ①

Maximum hp	X-Space	
	IT.	IT. FlashGard
IT06 Solid-State Reduced Voltage Starters—HMCP 65 kAIC—1.15 Service Factor—Standard Duty		
20	2	3
40	2	3
60	3	4
75	3	4
125	6	4
150	6	7
200	6	7
300	9	9
350	9	9
450	12	12
500	12	12
600	12	12
700	12 ④	12 ④

IT06 Solid-State Reduced Voltage Starters—HMCP 65 kAIC—1.15 Service Factor—Severe Duty

10	2	3
25	2	3
40	3	4
50	3	4
75	6	7
100	6	7
125	6	10
150	9	10
200	9	10
250	9	9
300	9	9
350	9	9
450	12 ④	12 ④

Note: Consult *Eaton's Consulting Application Guide* for more complete information, including fusible type disconnects and severe duty-rated design.

IT. SSRV Control Options ①⑤

Description
Pump control
MOV protection
DeviceNet
Modbus
Modbus TCP
PROFIBUS
EtherNet/IP

IT. SSRV Power Options ①⑤

NEMA Bypass Starter
Size 1
Size 2
Size 3
Size 4
Size 5
Size 6
Size 7

Motor Isolation Contactors ①

NEMA Isolation Contactor
Size 1
Size 2
Size 3
Size 4
Size 5
Size 6
Size 7

MVX Adjustable Frequency Drives—NEMA 1 480V with 3% Line Reactor, CPT ①

hp	X-Space
2	3
3	3
5	3
7.5	3
10	3

MVX Drive Options ①

Description
3% load reactor
5% load reactor
Three contactor bypass

SVX9000 Adjustable Frequency Drives—Plug-in Units NEMA 1 480V Constant/Variable Torque Rated ①⑥

hp	X-Space	
	IT.	IT. FlashGard
3	3	6
5	4	6
7.5	4	7
10	4	7
15	4	7
20	7	10
25	7	10
30	7	10

SVX9000 Options—Plug-in Units ①

Description
DeviceNet communications
PROFIBUS communications
Modbus RTU
Modbus TCP
Ethernet IP
2000 ft (609.6m) dV/dT filter (3 hp)
2000 ft (609.6m) dV/dT filter (5–15 hp)
2000 ft (609.6m) dV/dT filter (20–30 hp)
Input line fuses (3–30 hp)
RFI filter (3–30 hp)

Notes

- ① Table common to IT. and IT. FlashGard.
- ② One adapter required for every 21 starters.
- ③ Includes drop cables.
- ④ Requires 24-inch (609.6 mm) wide, rear is unusable, bottom exit only.
- ⑤ Options apply to both HMCP and thermal-magnetic breaker models.
- ⑥ SVX9000 plug-in units with HMCP disconnect, 3% input line reactor, 3% output line reactor, door-mounted keypad, CPT.

SVX9000

SVX9000 Adjustable Frequency Drives—Non-Plug-in Units NEMA 1 480V Constant/Variable Torque Rated

hp	X-Space	
	IT.	IT. FlashGard
40	9	9
50	9	9
60	9	9
75	12	12
100	12	12
125	12	12
150	12	12
200	12	12
250	12	12
300	12	12
400	12	12
500	12	12
600	12	12

Note: Consult *Eaton's Consulting Application Guide* for complete details on Drive/Option Assembly Dimensions.

Note: SVX9000 Non-Plug-in Units with HMCP disconnect, 3% input line reactor, 3% output line reactor, door-mounted Keypad, CPT.

Note: VT—Variable Torque drives are capable of producing 200% starting torque for 10 seconds and are rated for 10 seconds, and are rated 110% overload for 1 minute.

Note: CT—Variable Torque drives are capable of producing 200% starting torque for 10 seconds and are rated for 10 seconds, and are rated 150% overload for 1 minute.

SVX9000 Options—Non-Plug-in Units

Description
DeviceNet communications
PROFIBUS communications
Modbus RTU
Modbus TCP
Ethernet IP
2000 ft (609.6m) dV/dT filter (3 hp)
2000 ft (609.6m) dV/dT filter (5–15 hp)
2000 ft (609.6m) dV/dT filter (20–30 hp)
Input line fuses (3–30 hp)
RFI filter (3–30 hp)

Active Harmonic Correction for AC Drives

Description	X-Space	
	IT.	IT. FlashGard
50A harmonic correction	12 ^①	12 ^①
100A harmonic correction	12 ^①	12 ^①

18-Pulse Clean Power Drives—NEMA 1, 480V Variable Torque Duty^②

hp	X-Space, Inches (mm) Wide ^③
100	12, 40.00 (1016.0)
150	12, 40.00 (1016.0)
200	12, 60.00 (1524.0)
250	12, 60.00 (1524.0)
300	12, 60.00 (1524.0) ^⑤
400	12, 60.00 (1524.0) ^⑤
500	12, 106.00 (2692.4) ^⑤

Feeders

Standard Circuit Breaker

Amperes	X-Space	
	IT.	IT. FlashGard
E125 50	1	2
E125 125	1	2
J250 225	1	3
J250 250	1	3
HKD 400	4	6
HLD 600	4	4 ^⑥
HND 800	7	7 ^⑥
HND 1200	7	7 ^⑥

Fusible Switch

Amperes	X-Space	
	IT.	IT. FlashGard
30 or 60	2	3
100	3	4
200	6	6
400	6	8
600	8	8

Dual Fusible Switches^⑦

Amperes	IT. X-Space
30	2
60	3

Transformers

Transformers Primary Breaker Only^④

kVA	X-Space ^③
Single-Phase	
5	4
10	4
15	5
20	5
30	6
45	7
Three-Phase	
15	6
30	6
45	9

Notes

- ① Requires 24.00-inch (609.6 mm) wide structure.
- ② Includes, 5% input line reactor, 18-pulse rectifier, delta differential transformer.
- ③ X-space shown is common for both **IT.** and **IT. FlashGard** MCCs.
- ④ Must have primary breaker. Must be located at bottom of structure.
- ⑤ Extra space required for bypass section. Consult factory.
- ⑥ Fixed assembly, no RotoTract.
- ⑦ Not available in **IT. FlashGard**.

NEMA 3R Drives

480V—Constant/Variable Torque Duty

Horsepower	X-Space Width ^①
1.5	5X, 24.00 (609.6)
2	5X, 24.00 (609.6)
3	5X, 24.00 (609.6)
5	5X, 24.00 (609.6)
7.5	12X, 24.00 (609.6)
10	12X, 24.00 (609.6)
15	12X, 24.00 (609.6)
20	12X, 24.00 (609.6)
25	12X, 24.00 (609.6)
30	12X, 24.00 (609.6)
40	12X, 24.00 (609.6)
50	12X, 32.00 (812.8)
60	12X, 32.00 (812.8)
75	12X, 32.00 (812.8)
100	12X, 32.00 (812.8)
125	12X, 32.00 (812.8)
150	12X, 32.00 (812.8)
200	12X, 32.00 (812.8) ^②

Panelboards

Panelboards (240V Maximum) ^③

Circuit	X-Space	
	<i>IT</i> .	<i>IT</i> . FlashGard
18	4	4
30	5	5
42	6	6

ATS—Automatic Transfer Switches—Open Transition Three-Pole Only

Ampere Rating	Dimensions in Inches (mm)		<i>IT</i> . Unit Size	<i>IT</i> . FlashGard Unit Size
	Unit Width			
100 ^④	20.00 (508.0)		36.00 (914.4)	36.00 (914.4)
150 ^④	20.00 (508.0)		36.00 (914.4)	36.00 (914.4)
100	20.00 (508.0)		48.00 (1219.2) (8X)	48.00 (1219.2)
150	20.00 (508.0)		48.00 (1219.2) (8X)	48.00 (1219.2)
225	20.00 (508.0)		48.00 (1219.2) (8X)	48.00 (1219.2)
300	20.00 (508.0)		48.00 (1219.2) (8X)	48.00 (1219.2)
400	24.00 (609.6) ^⑤		72.00 (1828.8)	72.00 (1828.8)
600	24.00 (609.6) ^⑤		72.00 (1828.8)	72.00 (1828.8)
800	24.00 (609.6) ^⑤		72.00 (1828.8)	72.00 (1828.8)
1000	24.00 (609.6) ^⑤		72.00 (1828.8)	72.00 (1828.8)
1000	44.00 (1117.6) ^⑥		72.00 (1828.8)	72.00 (1828.8)
1200	44.00 (1117.6) ^⑥		72.00 (1828.8)	72.00 (1828.8)
1600	44.00 (1117.6) ^⑦		72.00 (1828.8)	72.00 (1828.8)
2000	44.00 (1117.6) ^⑦		72.00 (1828.8)	72.00 (1828.8)

Notes

- ^① X-space shown is common for both F2100 and FlashGard MCCs.
- ^② Extra space required for bypass section. Consult factory.
- ^③ For space and price for MLO, contact Eaton. Branch breakers included.
- ^④ Manually operated switch:
NTVS = Electronically operated non-automatic.
MTVX = Single handle manual operation.
- ^⑤ Requires 21.00-inch (533.4 mm) deep structure.
- ^⑥ Requires 37.00-inch (939.8 mm) deep structure, flush at the rear. 4.00-inch (101.6 mm) filler required.
- ^⑦ Requires 42.00-inch (1066.8 mm) deep structure. 4.00-inch (101.6 mm) filler required.

Application Guide

Motor Circuit Protector Selection Guide ^①

NEMA	Maximum Horsepower						
	200V	208V	230V	380V	460V	575V	HMCP
1	—	—	—	3/4	3/4	1	3
	3/4	1	1	2	2	3	7
	2	2	2	3	5	7-1/2	15
	5	5	5	10	10	10	30
2	7-1/2	7-1/2	7-1/2	—	—	—	50
	—	—	—	—	—	15	30
	10	10	10	15	20	25	50
3	—	—	15	25	25	—	70
	—	—	—	—	—	30	50
	15	20	20	30	40	50	100
4	25	25	30	50	50	—	150
	40	40	40	60	100	100	150
5	—	—	50	75	—	—	250
	50	50	60	—	125	150	250
	75	75	75	150	200	200	400
6	—	—	100	—	—	—	600
	150	150	200	300	350	400	600
	—	—	—	—	400	—	1200

Circuit Breaker Application Chart

Frame	Frame Rating (Amperes)	Interrupting Rating (kA Symmetrical Amperes)		
		208/240V	480V	600V
Standard Rating Molded Case Circuit Breakers				
E125H	125	65	65	25
HFD	150	100	65	25
HJD	250	100	65	25
J250	250	65	65	25
HKD	400	100	65	35
HLD	600	100	65	35
HND	800	100	65	35
HND	1200	100	65	35
RD	2000	100	65	50
High Interrupting Rating Molded Case Circuit Breakers				
FDC	150	100	100	35
JDC	250	100	100	35
KDC	400	100	100	50
LDC	600	100	100	50
NDC	800	100	100	50
NDC	800	100	100	50
NDC	1200	100	100	50
RDC	2500	100	100	65
Current Limiting Molded Case Circuit Breakers				
HFD/CL	150	100	100	100
NBTRIPAC	300–800	100	100	100
Magnum™ DS Air Circuit Breakers				
MDS-608	800	65	65	65
MDS-C08	800	100	100	100
MDS-616	1600	65	65	65
MDS-C16	1600	100	100	100
MDS-620	2000	65	65	65
MDS-C20	2000	100	100	100
MDS-632	3200	65	65	65
MDS-C32	3200	100	100	100

Note

^① Suitable for use with NEMA Design B and D (High Efficiency) Motors.

Control Power Requirements (IT. Only)

NEMA Size	Continuous Current	Inrush
FVNR, 252W, FVR		
Size 1	0.39	3.8
Size 2	0.45	5.4
Size 3	0.47	5.8
Size 4	0.47	5.8
Size 5	0.62	7.8
Size 6	0.41	3.3
Size 7	0.41	3.3
2S1W		
Size 1	0.54	7.6
Size 2	0.66	10.8
Size 3	0.70	11.6
Size 4	0.70	11.6
Size 5	1.00	15.6
SSRV		
24A	0.45	3.8
33–304A	1.24	10.0
360–850A	1.64	10.0

Product Specifications**Structure**

- NEMA 1A, 2, 3R or 12 enclosure
- Copper horizontal bus 600–3200A
- Fully rated copper vertical bus 300–1200A
- Labyrinth barriers for insulated and isolated vertical bus
- Optional isolating barriers between structures
- Insulated horizontal and insulated vertical bus is standard for FlashGard units
- 65 kA and 1000 kA bus bracing
- Plug-in DC, ground and communication bus

Units

- **IT.** Motor Starters:
 - NEMA size 1–7.
 - Heaterless overload relay with Class 10, 20 and 30 overload protection
 - Built-in phase loss, single-phase
 - Compact size
 - Longer contact life
 - Communications
 - Extended ride-through
- HMCP with combination starter ratings of 65 kAIC and 100 kAIC at 480V
- Plug-in units up to 400A
- Handle mechanism with positive trip indication
- Side-mounted positive latch terminal block
- Motor load terminal block for quick connect/disconnect of 480V power
- 6.00-inch (152.4 mm) NEMA size 1 and 2 units with HMCP
- Solid-State Reduced Voltage Starters:
 - Intelligent Technologies (**IT.**) S801/S811 (20–800 hp)
- Adjustable Frequency Drives:
 - MVX (1–10 hp)
 - SVX9000 (2–600 hp)
- K-Switch visible blade disconnect:
 - 30–800A
 - 100 kAIC at 600V
- Surge protection:
 - SPD (100–500 kA)
- Energy monitoring:
 - IQ 100 (amperes, volts)
 - IQ 250 (adds, Hz, watts, PF)
 - IQ 260 (adds THD, Contact I/O)
 - IQ Analyzer (adds trending, waveform display)
 - Power Xpert (adds high-end metering, power quality analysis, open communication and Web server gateway)

18.4

Motor Control Centers

Appendix

Freedom 2100 and Freedom FlashGard



Contents

Description

Appendix

Motor Control Center Takeoff Check Sheet

Customer/Job Name	Neg No.
MCC Model	
Freedom 2100/IT.	FlashGard
Service 60 Hz	208V/230V/ 480V /575V
Voltage 50 Hz	380V/415V
DC	125V/250V
Three-wire /four-wire	
Structure Configuration	
16-inch front mount	21-inch front mount
21-inch front and rear mount	
42-inch front mount back-to-back	
32-inch front mount back-to-back	
NEMA 1A /2DP/12/3RNWI/3R aisle/3R tunnel	
Enclosure Modifications	
Space heaters (150W) 120V/240V	
Channel sills	CBC/IBC seismic qualified
Thermostat	Split proof
Bottom plates	Split rear cover
Corner structure	Vertical section barrier
8-inch vertical wireway	Special paint color (adder)
Seismic Zone 3/4	ABS Certification
Handle extensions ("two meter rule")	
Top hat (certain sections)	12-inch/18-inch/24-inch
Top hat (all sections)	12-inch/18-inch/24-inch

Bus Rating and Options	
Horizontal bus	600 /800/1200/1600
21-inch deep structure only	2000/2500/3200
Bus plating	Silver (AG)/ tin (SN)
Bus temp rise	50°C/ 65°C
Insulated horizontal bus	
Vertical bus	300 /600/800/1200
Ground bus	300/600/800
Location	Top /bottom
Vertical ground bus	Lugs: incoming /each end
Neutral bus (4W only)	Half/full/ lug pad
Bus bracing	42K/ 65K /100K
Vertical bus barrier	STD Glastic sheet
	Labyrinth with/without shutter
Incoming Metering and Bus Protection	
Protection	Metering
Power Xpert	IQ 250/IQ 260
TVSS	PX2000
SAC	IQ 100
Three-phase voltage monitor	IQ DP4130
Incoming Line MLO/Breaker/Switch	
Cable—top/bottom/bus duct	
Main trip: LS/LSI/LSG/LSIG/other	
Crimp lugs	Screw type lugs
Main tie main (MTM)	Auto throw over
Kirk key	Service entrance (SUSE)

MCC Spec Review Checklist, continued

Breaker Options	
Aux. contacts (1NO 1NC) (2NO 2NC)	
LS/LSI/LSIG/LSG trip units	
Under voltage release	Shunt trip
Panelboards	
12/24/30/36/42 count	1-pole/2-pole/3-pole
Starter Disconnect Type	
HMCP/TM. bkr./fusible	
NEMA wiring class	
1A/1B/2B/1C/2C/1S/2S	
HMCP/TM. Bkr./fusible	
If any type "C" choose MTB location: Master terminal blocks (MTBs) top/bottom/relay structure	
Terminal Blocks	
Side latch pull apart (Std) (2x7-point)	
Spare points = _____% (call DSE)	Front utility (call DSE)
Nameplates: White w/ Black Letters/Black w/ White Letters	
Starter OL Types	
Bi-metallic/solid-state	Ground fault
Advanced solid-state	
Plug-In Starter Bucket Unit Features	
# 16 MTW wire	Coil surge suppression
# 14 SIS wire	Blown fuse indicators
# 14 MTW	Ground fault relays
Wiremarkers each end	
Ring wire lugs control	Riley current sensor
Spade wire lugs	Heater packs
Ring power wire lugs	SSOL Std
Wiring diagram on door	SSOL advanced
SIS power wire	Vacuum contactors

Control Power	
Size 1 100 VA (Std)/150 VA max.	
Size 2 100 VA (Std)/150 VA max.	
Size 3 150 VA (Std)/250 VA max.	
Size 4 150 VA (Std)/250 VA max.	
Size 5 250 VA (Std)/300 VA max.	
Size 6 250 VA (Std)/300 VA max.	
Separate source power	
Aux. Starter Contacts	
NO 1/2/3/4	NC 1/2/3/4
Control Devices	
Pushbutton 1 unit/2 unit/reset	VoltageVision
Selector switch 2pos/3pos/4pos	Motorguard
Light—Std Xfmr/PTT/LED bulb	Motor load block
On/off run/stop	
Mini ETM	Panel ETM
AMM (mini/panel)	VM (mini/panel)
Riley transducer (Loop/Self Pwr)	
CTs for remote metering	
Ground fault	
IP relay—size 1/2/3/4/5/6	Voltage=
Relays 300V or 600V	Timers
Communications	
DeviceNet direct	Modbus RTU
Ethernet	Power Xpert Gateway
Modbus TCP	PROFIBUS DP
IT SSRVs	
Isolation contactor	MOVs
Pump control software	Bypass starter
VFDs	
EMI/RFI	Line fuses
dV/dT filter 600 ft or 1000 ft	3-contactor bypass
Harmonic Correction (IEEE 519)	
50A/100A	

18.4

Motor Control Centers

Appendix

Component Count Sheet

FVNR Starters		FVR Starters	
Size	Quantity	Size	Quantity
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7			

Feeder Breakers			
Single	Quantity	Dual	Quantity
50A		50/50	
100A		100/50	
150A		100/100	
225A		150/100	
250A		150/150	
400A			
600A			
800A			
1200A			
1600A			
2000A			
2500A			
3200A			

VFDs		
HP	Quantity	Type
1.5		CT/VT
2		CT/VT
3		CT/VT
5		CT/VT
7.5		CT/VT
10		CT/VT
20		CT/VT
25		CT/VT
30		CT/VT
40		CT/VT
50		CT/VT
60		CT/VT
75		CT/VT
100		CT/VT
125		CT/VT
150		CT/VT
200		CT/VT
250		CT/VT
300		CT/VT
400		CT/VT

Two Speed, One Winding		Two Speed, Two Winding	
Size	Quantity	Size	Quantity
1		1	
2		s	

Fusible Feeders			
Single	Quantity	Dual	Quantity
30A		30/30	
60A		60/60	
100A			
200A			
400A			
600A			
800A			
1200A			

Starter Circuit Protection		Future Space	
		Size	Quantity
HMCP	Thermal Magnetic	2X	
HMCPE		3X	
Fusible		4X	

Relay Panels	
Size	Quantity
2X	
3X	
4X	
5X	
6X	
7X	
8X	
9X	
10X	
11X	
12X	

Component Count Sheet, continued

Soft Starts

HP	Quantity	Duty	Cable Exit
20		Std/severe	
40		Std/severe	
60		Std/severe	
75		Std/severe	
125		Std/severe	
200		Std/severe	
300		Std/severe	Top/bottom
350		Std/severe	Top/bottom
450		Std/severe	Top/bottom
500		Std/severe	Top/bottom
600		Std/severe	Top/bottom
100		Std/severe	Top/bottom

Transformers

Single-Phase	Quantity	Three-Phase	Quantity
10 kVA		15 kVA	
15 kVA		30 kVA	
20 kVA		45 kVA	
30 kVA		45 kVA	
45 kVA			

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Motor Control Centers

Appendix