CONTROL TECHNIQUES

Mentor II
## The Intelligent Drive

Overview

DC drives are widely used in applications that require regeneration, precise speed control, dynamic performance, and constant torque over wide speed ranges. The Mentor II delivers the universal DC drive solution.

Simple stand-alone applications are easily configured to control motor speed, voltage or current using standard internal settings. Set-up is convenient using the drive keypad, CTKP remote keypad, or MentorSoft, a Windows based drive configuration tool. The Mentor II has extensive diagnostic and communication abilities that enhance system reliability. The drive's standard yet powerful microprocessor is a versatile system component that can eliminate the need for a PLC with integral functions such as thresholds, timers and logic gates that perform basic control.

The simple addition of the MD29, a 32-bit application coprocessor card, provides high performance drive systems with local intelligence for true distributed control. The MD29 enables users to incorporate custom or proprietary process control application programs to their drive. The Mentor II also provides a wide range of communication protocol options.

Mentor II systems have proven to be extremely reliable and are ideally suited to web handling, winders, slitters, extruders, wire drawing, converting lines, and plastics production. The Mentor II's integrated design and highly programmable features make it an ideal choice for OEMs and System Integrators, as well as replacement or retrofit drives for End Users.

—Extrusion
—Intelligent
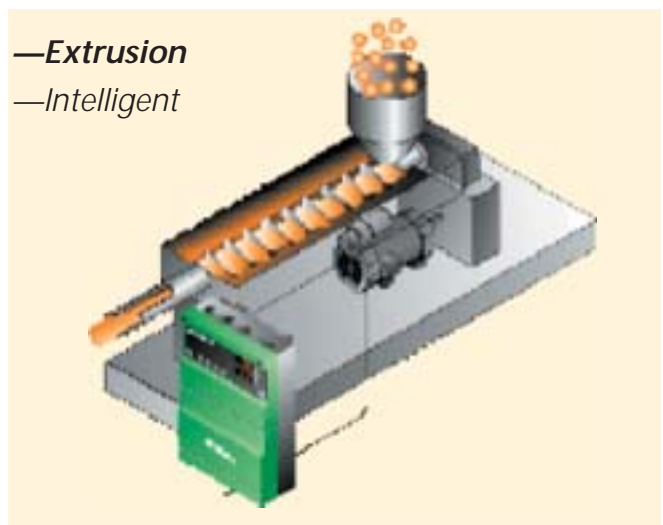
- ◉ **Microprocessor Based Digital DC Drive**
- ◉ **5 to 1000 HP, 3 phase, 208 to 660 VAC**
- ◉ **Regenerative and non-regenerative models**
- ◉ **RS485 serial communications**
- ◉ **Extensive fieldbus communication capabilities**
- ◉ **Plug-in 32-bit application coprocessor card (MD29)**
- ◉ **MentorSoft Windows-based drive configuration tool**
- ◉ **Complete Motor Solutions**

FREE Software

ONE SOURCE

ISO 9002 APPROVAL · CE · N1652 · c UL us LISTED · 2 YEAR Digital Drive Warranty · 5 YEAR Extended Warranty

CONTROL TECHNIQUES

Feature
Performance Advantage

Accepts wide range of supply voltage (208 to 660 VAC)
Can be applied to worldwide voltages

Non-regen and regen models share the same footprint
Allows for common mechanical design and mounting

MentorSoft Windows based drive configuration tool
Provides easy programming and diagnostics of the drive

32-bit application coprocessor card (MD29)
Enables customized applications for distributed control system architectures

Profibus-DP, Modbus+, Modbus RTU, Interbus-S, DeviceNet, and CTNet plug-in communication cards
Communicates on user's preferred network

Built-in RS485 serial communications
Allows for easy programming and control of drive

Extensive and configurable analog and digital I/O
Customizes drive to specific applications

Programmable boolean logic (AND, NAND, OR, NOR) gates with delay outputs
Assists with general system interface logic needs, expanding application possibilities

Programmable threshold comparators
Expands application possibilities by providing a pair of independent numerical comparators with adjustable hysteresis

Built-in digital lock function for frequency following
Allows accurate master/slave applications

Accepts DC tachometer and encoder feedback
Enables precise speed control

Extensive diagnostics and fault indicators
Used for accurate drive system diagnosis

Ratings: Mentor II

THREE PHASE INPUT
3 to 500 HP (208-230 VAC)
5 to 1000 HP (380-460 VAC)
Special Order (525 / 660 VAC), Models M350(R)–M1850(R) only

| 208 / 240 VAC					
Motor HP	Output Current (A) (@40°C)	Output Current (A) (@55°C)	Field Output Current	Non-Regen Catalog Number	Regen Catalog Number
3 - 7	25	20	8A Current Regulated	M25-14M	M25R-14M
7.5 - 10	45	38		M45-14M	M45R-14M
15	75	55		M75-14M	M75R-14M
20 - 35	105	89		M105-14M	M105R-14M
30	155	125		M155-14M	M155R-14M
40 - 50	210	172		M210-14M	M210R-14M
75	350	255	10A Fixed Voltage ①	M350-14M	M350R-14M
100	420	338		M420-14M	M350R-14M
125	550	428		M550-14M	M550R-14M
150	700	508		M700-14M	M700R-14M
200	825	675		M825-14M	M825R-14M
250	900	820	20A Fixed Voltage ①	M900-14M	M900R-14M
300 - 350	1200	1150		M1200-14M	M1200R-14M
400 - 500	1850	1620		M1850-14M	M1850R-14M

380 / 480 VAC					
Motor HP	Output Current (A) (@40°C)	Output Current (A) (@55°C)	Field Output Current	Non-Regen Catalog Number	Regen Catalog Number
5 - 10	25	20	8A Current Regulated	M25-14M	M25R-14M
15 - 20	45	38		M45-14M	M45R-14M
25 - 30	75	55		M75-14M	M75R-14M
40 - 50	105	89		M105-14M	M105R-14M
60 - 75	155	125		M155-14M	M155R-14M
100	210	172		M210-14M	M210R-14M
150	350	255	10A Fixed Voltage ①	M350-14M	M350R-14M
200	420	338		M420-14M	M350R-14M
250	550	428		M550-14M	M550R-14M
300	700	508		M700-14M	M700R-14M
400	825	675		M825-14M	M825R-14M
500	900	820	20A Fixed Voltage ①	M900-14M	M900R-14M
600 - 700	1200	1150		M1200-14M	M1200R-14M
800 - 1000	1850	1620		M1850-14M	M1850R-14M

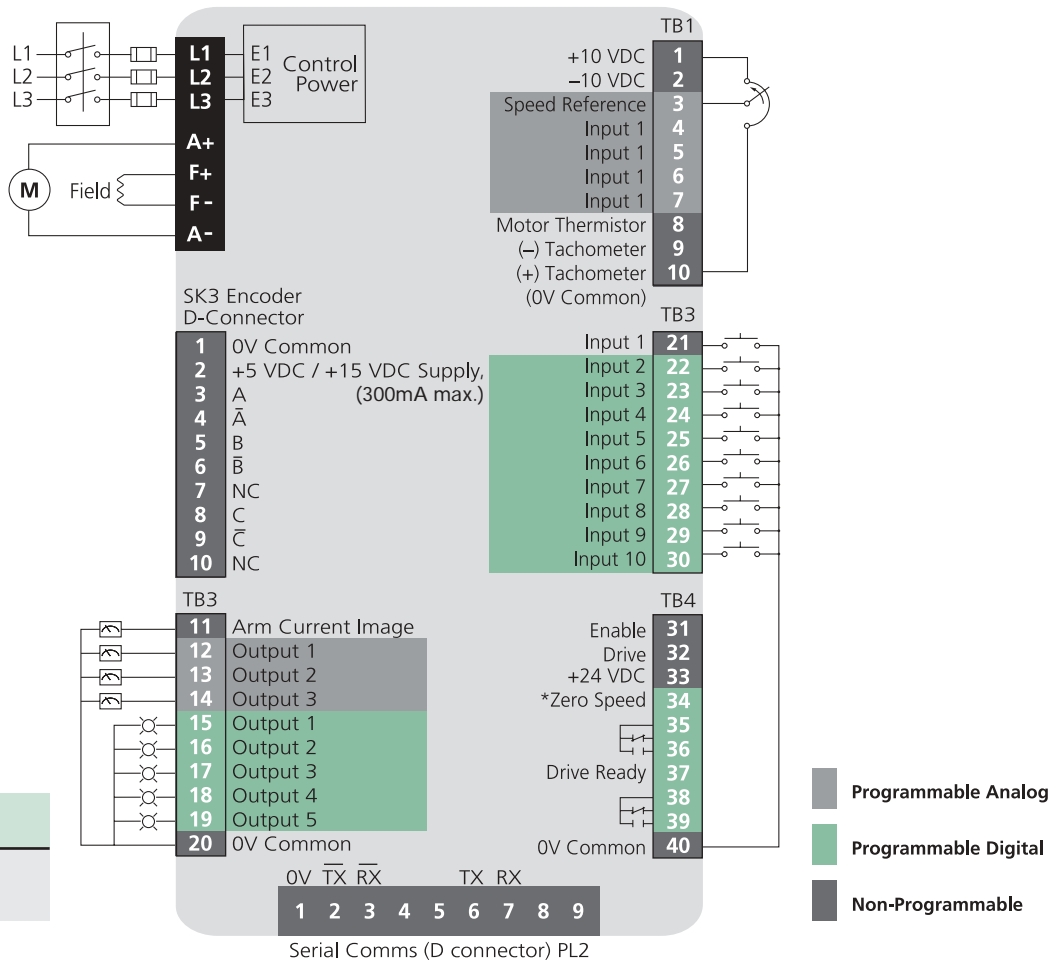① For field control, add external field regulator P/N 9500-9035.

Order String
M XXX R - 14M

Factory Assigned
Regen (omit for Non-regen)
Output Current
Mentor II Product Family
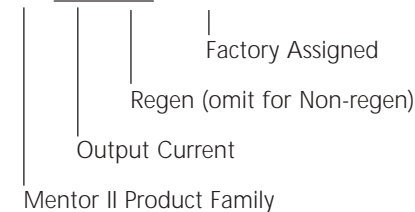
Mentor II

Terminal Diagram: Mentor II

NOTE

* Zero Speed Relay Programmable.

■ Programmable Analog

■ Programmable Digital

■ Non-Programmable

Terminal Description

Pin#	Function	Type/Description	Notes
1	+10 VDC	Reference Supply	10 mA max
2	-10 VDC		
3	Speed Reference	Analog Input, 12 bit	±10 VDC, 100k Ohms or 4-20 mA, 100 Ohms
4	Analog Input # 1	Analog Input Bi-polar, 10 bit + sign	±10 VDC, 100k Ohms
5	# 2		
6	# 3		
7	# 4		
8	Motor Thermistor	Analog Input	3k Ohms trip point, 1.8k Ohm reset level
9	DC Tachometer (-)	Analog Input	
10	DC Tachometer (+)	Circuit Common	
11	Armature Current Image	Analog Output	6.6 VDC @ 150% current
12	Analog Output # 1	Analog Output Bi-polar, 10 bit + sign	±10 VDC, 5 mA
13	# 2		
14	# 3		
15	Digital Output # 1	Digital Output Open Collector	+24 VDC, 100 mA
16	# 2		
17	# 3		
18	# 4		
19	# 5		

Pin#	Function	Type/Description	Notes
20	0V Common	Circuit Common	
21	F1 (Run Permit)	Digital Input	+24 VDC, 10k Ohms
22	F2 (Inch / Jog Reverse)	Digital Input	+24 VDC, 10k Ohms
23	F3 (Inch / Jog Forward)		
24	F4 (Run Reverse (latched))		
25	F5 (Run Forward (latched))		
26	Digital Input F6		
27	F7		
28	F8		
29	F9		
30	F10		
31	Drive Enable	Digital Input	30 mSec inhibit delay
32	Reset	Digital Input	Fault Reset
33	+24 VDC Supply	User Supply	200 mA max
34	Form C Status Relay (Zero Speed)	Relay Common	110 VAC, 5A resistive
35		N. C. Contact	
36		N. O. Contact	
37	Form C Status Relay (Drive Ready)	Relay Common	110 VAC, 5A resistive
38		N. C. Contact	
39		N. O. Contact	
40	0V Common	Circuit Common	

■ Programmable Analog   ■ Programmable Digital   All Analog I/O is scaleable

CONTROL TECHNIQUES

Specifications: Mentor II

Environment

Ambient Operating Temperature	0 to 40°C (32 to 104°F) Derate current 1.5% per °C to 55°C (32 to131°F)
Cooling Method	Convection and forced convection, model dependent
Humidity	95% non-condensing at 40°C (104°F)
Storage Temperature	-40 to 55°C (-40 to 131°F)
Altitude	0 to 4000m (13,120 ft). Derate 1% per 100m (328 ft) between 1000m (3,280 ft) and 4000m (13,120 ft).
Enclosure	Chassis (IP00)

AC Supply Requirements

Voltage	208 to 480 VAC -5%, +10% 525/575/660 VAC ±10% (Optional M350 and above)
Phase	3Ø
Frequency	45 to 62 Hz
Efficiency	98%

Control

Feedback Methods	Armature Voltage (resolution .83 volts) DC Tachometer (resolution 0.1%) Encoder (resolution .01%)
Field Control	Current regulated 8 Amps max (M210/M210R and smaller) Voltage regulated .675 or .9 X Line-to-line voltage (M350/M350R and larger)
Analog Input Resolution	12 bit (Qty 1), 10 bit (Qty 4)
Serial Communications	4-wire RS422 or RS485, optically-isolated Protocol is ANSI x 3.28-2.5-A4 Baud rate is 4800 or 9600

Protection

AC Line Undervoltage Trip	180 VAC
MOV Voltage Transient Protection	Input transient suppression
Instantaneous Overcurrent Trip	300% armature current
Armature Open Circuit	Armature circuit is open
Drive Overload Trip	Inverse time, 150% for 30 seconds
Phase Loss Trip	Loss of input phase
Overtemperature Trip	Heatsink exceeds 100°C (212°F)
Motor Thermal Trip	Motor over-temp switch or Thermistor
Feedback Loss	Loss of motor feedback
Feedback Reversal	Tachometer or Encoder wired backwards
Field Loss	No field current
Field On	Field current during auto-tune
Field Overcurrent	Field current greater than field demand
Current Loop Loss	Loss of 4-20 mA reference
External Power Supply	Short circuit on +24 VDC user power supply

Power Supply	Internal power supply out of tolerance
Serial Communications Loss	Mode 3 serial comms data loss
Processor 1 Watchdog Trip	Main control processor fault
Processor 2 Watchdog Trip	Second control processor fault (MD29)
Hardware Fault	Hardware malfunction on control board
Memory Fault	Stored parameter checksum fault
External Trip	User interlock fault (programmed)
Software Fault (A29)	MD29 software fault

Approvals & Listings

UL, cUL	File #E58592 Vol. 5C Section 1
CE	Designed for marking
ISO 9002	Certified Manufacturing Facility

Dimensions

Catalog Number	Size* (in.) H x W x D	Approx. Weight (lbs.)
M25-14M thru M75-14M	15 x 10 x 6	22
M25R-14M thru M75R-14M	15 x 10 x 6	24
M105-14M thru M210-14M	15 x 10 x 8	31
M105R-14M thru M210R-14M	15 x 10 x 8	33
M350-14M thru M420-14M	16 x 18 x 11	48
M350R-14M thru M420R-14M	16 x 18 x 11	51
M550-14M thru M825-14M	17 x 18 x 11	59
M550R-14M thru M825R-14M	17 x 18 x 11	66
M900-14M thru M1850-14M	41 x 18 x 20	154
M900R-14M thru M1850R-14M	61 x 18 x 20	264

* Approximate, not to be used for construction purposes.

Mentor II

Mentor II
Options / Software / Accessories

Network Communication Cards

The fieldbus interface cards provide high-speed communications using the popular networks and protocol. These networks allow large amounts of data to be transferred quickly to and from network nodes. The RS485 channel is optically isolated (CTNet is transformer isolated) for added protection.

Communication Protocol	Interface Module Catalog Number	System Configuration
Profibus-DP	MD-24	Master / Slave
Interbus-S	MDIBS	Master / Slave
CTNet*	MD-29AN*	Peer-to-peer
DeviceNet	MD-25	Master / Slave
Modbus RTU*	9729-9000*	Master / Slave
Modbus+	9500-9100	Master / Slave

* CTNet and Modbus RTU cards contain full coprocessor ability.

Refer to the Application Cards (MD29 and MD29AN) for more information.

Network Communications

MD-29

Application Cards (MD29 & MD29AN)

The MD29 (9729-9000) and MD29AN application cards contain a high-speed microprocessor which provides a low-cost facility for a system designer to write application specific programs without needing a PLC or other stand-alone controller. The add-on cards fit into a 40-pin header within the Mentor II drive. It is programmed (via the RS232 port) using our Control Techniques SyPT (System Programming Toolkit) that complies with IEC1131-3 Ladder / Function Block or DPL (Drive Programming Language). In addition to the application coprocessor, the MD29AN CTNet card supports peer-to-peer cyclic and broadcast messaging at rates up to 5Mbaud.

The application cards use dual port RAM to provide intimate high-speed bi-directional access. They can read and modify any parameter within the drive, enabling customized real-time calculations under a multi-tasking run-time environment. The Intel i960 32-bit RISC processor and 256K of user program FLASH memory (equivalent to >2000 lines of ladder logic or basic instruction code) provide a powerful base for a designer to accomplish complex algorithms for demanding time-critical process control.

The optically isolated RS485 channel serves as a communication port for our CTIU operator interface units. It is fully configurable, supporting multiple communication modes including an ANSI 2 or 4-wire protocol at data rates up to 38.4kbaud. A Modbus protocol with RTU and ASCII slave modes is also available.

32-bit coprocessor (MD-29)....................9729-9000

32-bit coprocessor with CTNet MD29AN-RevD*

*RevD for current product, see page 148 for details.

Pre-configured Application Programs*	Catalog Number
S-ramp accel / decel profiling	9729-9001
Digital lock with adjustable ratio control	9729-9002
Spindle orientation	9729-9003
Constant tension, center wind (CTCW)	9729-9004
PID control for load cell tension or dancer position	9729-9005
Power calculations	9729-9006
Dual Mode Winder	9729-9008

* Contact Control Techniques for detailed information.

MD-29AN

CONTROL
TECHNIQUES
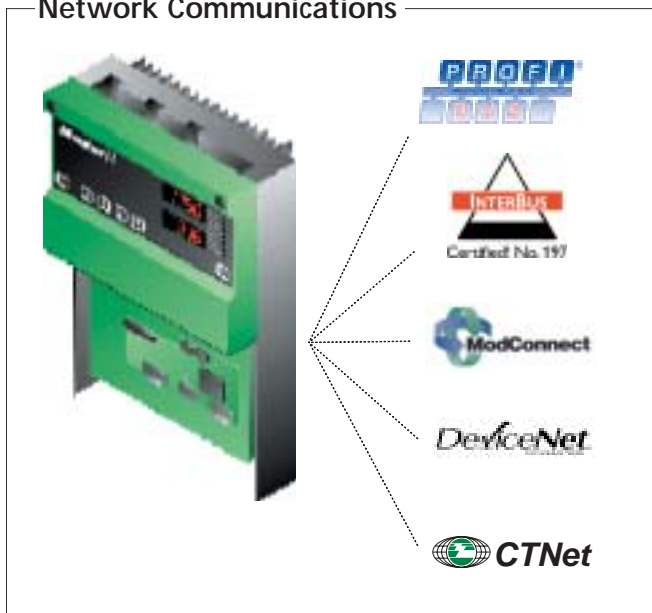
Mentor II

## PC to Drive Accessories

Drive Configuration Tool (MentorSoft)

MentorSoft is a complimentary Windows based drive configuration tool designed to enable the complete control and display of all parameters within a Mentor II. Functions within MentorSoft allow data to be uploaded, viewed and saved or retrieved from disk, modified and printed. It can be used off-line in the office or on-line on the plant floor. MentorSoft communicates with the Mentor II via the computer's serial port to the drive's RS485 port using a communications cable (CTD-PC-485-XXX). (XXX = ft.)

Some of its many capabilities include:

- Commissioning screen – displays wiring and control logic

- Compare functions – compares current drive configuration with previously stored versions

- User screen – customized by the user with up to 15 key parameters

- Built-in reference manuals and search functions – provide extensive "Help" files for both the drive and the software

For more information, refer to the Accessories Section on page 138.

FREE
Software
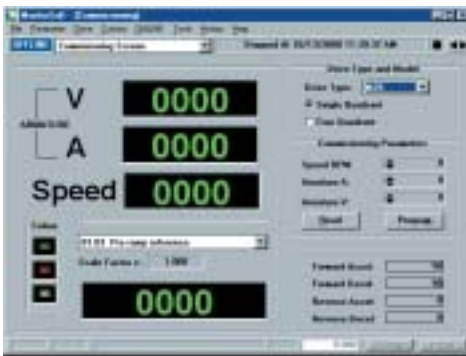
Operator Interfaces

Universal Keypad (CTKP)

The CTKP Universal Keypad is an ideal maintenance tool for use with CT's digital drives (SE, Unidrive, Mentor II, Quantum III) and option modules (UD7X, MD series). Five navigation keys and plain text parameter descriptions make the CTKP easy to use for viewing and modifying drive data. The keypad is designed for hand-held or panel mounting. The IP65 rating, screw-down terminals and stress relief for cable connections assure a rugged and robust design.

For more information, refer to the Accessories Section on page 154.

Operator Interface Unit (CTIU)

The CTIU operator interface units incorporate a back-lit LCD display and five easy-to-use navigation keys. Using the intuitive "WYSIWIG" page editor, they can be programmed to display a variety of menus, submenus, alarms, fault conditions and other critical information. The CTIUs support a range of capabilities including multiple font sizes, real time trends and graphs, scheduling and background programs. They communicate via 2 or 4-wire RS485 and to simplify installation, CTIUs are rated NEMA 4/12 and require no screw mounting holes.

For more information, refer to the Accessories Section on pages 152-53.

Mentor II

Mentor II

Remote I/O (I/O Box)

The I/O Box expands the I/O capabilities of the Mentor II and Quantum III drives. The I/O Box is connected to the drive through the MD29 / AN application card using an optically isolated RS485 serial link.

Specifications

Voltage	110 to 240 VAC ±10%
Frequency	48 to 62 Hz
Phase	1Ø
RS485 Interface	Supports binary protocol at data rates up to 38.4kbaud for connection to a single drive.

Qty	Type / Description	Notes
1	Analog Input (12 bit)	±10 VDC, 100k Ohms or 4-20 mA, 100 Ohms
4	Analog Input (10 bit)	±10 VDC, 100k Ohms
3	Analog Output (10 bit)	±10 VDC, 5 mA
8	Digital Input	+24 VDC, 10k Ohms
8	Digital Output	+24 VDC, 100 mA (200 mA total for all outputs)

Field Regulators (FXM Family)

The FXM family of field regulators is designed to control the field current of DC motors up to 90 amps. When used in conjunction with either the Mentor II or Quantum III variable speed DC drives, the field regulator is controlled directly via the drive parameters. This allows full customization of the field control for any application. The FXMs can also be used as stand-alone units when retrofitting existing applications.

The field regulators are single phase, controlled thyristor rectifier bridges with a control logic PC board. The bridge can be configured by jumpers to operate in half (single quadrant) or full (two quadrant) control mode.

The FXMs may be independently controlled by an external reference, or set for automatic field weakening (constant horsepower) or constant field current. Field economy control via contact or logic input and a field loss relay for protection are provided for stand-alone operation. The unit also has a bar graph display (10% increments of the selected range) for field current magnitude.

Catalog Number	Current (A)	Frequency (Hz)	Input Voltage (VAC)	Output Voltage* (VDC)
9500-9035	20	50	220 / 380 / 440	198 / 342 / 396
		60	240 / 480	216 / 432
9500-9032	50	50	220 / 380 / 440	198 / 342 / 396
		60	240 / 480	216 / 432
9500-9033	90	50	220 / 380 / 440	198 / 342 / 396
		60	240 / 480	216 / 432

* Maximum output voltage equals 90% of input RMS line voltage.

Field current is the controlled variable.

Mentor II

CONTROL TECHNIQUES

Mentor II

Critical Components

Minimize Your Machine Downtime Delays

All too often, spare parts are over looked which results in a panic search, no less the possibility of costly Next Day shipping expenses. Having these items on hand can reduce the associated stress of machine downtime. To facilitate this effort, Control Techniques has assembled several levels of Critical Component kits to fit within your maintenance budget constraints. These pre-assembled kits represent a significant savings over purchasing the same items separately.

Warranty

Extended Warranty

An industry-leading two-year warranty is standard for Mentor II drives. An extended warranty is available that increases the warranty period to five years.

Mentor II Model	Catalog Number
M25	M25WE
M45	M45WE
M75	M75WE
M105	M105WE
M155	M155WE
M210	M210WE
M350	M350WE
M420	M420WE
M550	M550WE
M700	M700WE
M825	M825WE
M900	M900WE
M1200	M1200WE
M1850	M1850WE

Drive Frame Size	Kit Cat. No.	Description
M25 – M210 (non-regen and regen)	M25-210-SP	1 – MDA1 Control board 1 – MDA2B Interface board 6 – Power board fuses
M350 – M825 (non-regen and regen)	M350-825-SP	1 – MDA1 Control board 1 – MDA2B Interface board 6 – Fuses for MDA5 Filter board 6 – Fuses for MDA6 Power board
M900 – M1850 (non-regen)	M900-1850-SP	1 – MDA1 Control board 1 – MDA2B Interface board
M900R – M1850R (regen)	M900R-1850R-SP	1 – SCR heatsink assembly 6 – 6A fuses for MDA6 board 2 – 2A fuses for SD1 board 2 – 30A fuses for SD1 board

Mentor II