

Nidec

All for dreams



User Guide

Mentor MP Retrofit Kit

Part Number: 0476-0026-03

Issue: 3

Original Instructions

For the purposes of compliance with the EU Machinery Directive 2006/42/EC, the English version of this manual is the Original Instructions. Manuals in other languages are Translations of the Original Instructions.

Documentation

Manuals are available to download from the following locations: <http://www.drive-setup.com/ctdownloads>

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EU Declaration of Conformity

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This declaration is issued under the sole responsibility of the manufacturer. The object of the declaration is in conformity with the relevant Union harmonization legislation. The declaration applies to the variable speed drive products shown below:

Single Quadrant		Four Quadrant	
480 V	690 V	480 V	690 V
MP1850A4_Retrofit	MP1850A6_Retrofit	MP1850A4R_Retrofit	MP1850A6R_Retrofit

The model number may be followed by additional characters that do not affect the ratings.

The variable speed drive products listed above have been designed and manufactured in accordance with the following European harmonized standards:

EN 61800-5-1:2007	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
EN 61800-3: 2004+A1:2012	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods
EN 61000-6-2:2005	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-4: 2007+ A1:2011	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
EN 61000-3-2:2014	Electromagnetic compatibility (EMC) - Part 3-2: Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
EN 61000-3-3:2013	Electromagnetic compatibility (EMC) - Part 3-3: Limitation of voltage changes, voltage fluctuations and flicker in public, low voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection

EN 61000-3-2:2014 Applicable where input current < 16 A. No limits apply for professional equipment where input power ≥ 1 kW.

These products comply with the Restriction of Hazardous Substances Directive (2011/65/EU), the Low Voltage Directive (2014/35/EU) and the Electromagnetic Compatibility Directive (2014/30/EU).



G Williams
Vice President, Technology
Date: 22nd July 2016

These electronic drive products are intended to be used with appropriate motors, controllers, electrical protection components and other equipment to form complete end products or systems. Compliance with safety and EMC regulations depends upon installing and configuring drives correctly, including using the specified input filters.

The drives must be installed only by professional installers who are familiar with requirements for safety and EMC. Refer to the Product Documentation. An EMC data sheet is available giving detailed information. The assembler is responsible for ensuring that the end product or system complies with all the relevant laws in the country where it is to be used.

1 Safety information

1.1 Warnings, Cautions and Notes



A Warning contains information which is essential for avoiding a safety hazard.



A Caution contains information which is necessary for avoiding a risk of damage to the product or other equipment.

NOTE

A Note contains information which helps to ensure correct operation of the product.

1.2 Important safety information. Hazards. Competence of designers and installers

This guide applies to products which control electric motors either directly (drives) or indirectly (controllers, option modules and other auxiliary equipment and accessories). In all cases the hazards associated with powerful electrical drives are present, and all safety information relating to drives and associated equipment must be observed.

Specific warnings are given at the relevant places in this guide.

Drives and controllers are intended as components for professional incorporation into complete systems. If installed incorrectly they may present a safety hazard. The drive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control equipment which can cause injury. Close attention is required to the electrical installation and the system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, commissioning/start-up and maintenance must be carried out by personnel who have the necessary training and competence. They must read this safety information and this guide carefully.

1.3 Responsibility

It is the responsibility of the installer to ensure that the equipment is installed correctly with regard to all instructions given in this guide. They must give due consideration to the safety of the complete system, so as to avoid the risk of injury both in normal operation and in the event of a fault or of reasonably foreseeable misuse.

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation of the equipment.

1.4 Compliance with regulations

The installer is responsible for complying with all relevant regulations, such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Particular attention must be given to the cross-sectional areas of conductors, the selection of fuses or other protection, and protective ground (earth) connections.

This guide contains instructions for achieving compliance with specific EMC standards.

All machinery to be supplied within the European Union in which this product is used must comply with the following directives:

2006/42/EC Safety of machinery.

2014/30/EU: Electromagnetic Compatibility.

1.5 Electrical hazards

The voltages used in the drive can cause severe electrical shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the drive. Hazardous voltage may be present in any of the following locations:

- AC and DC supply cables and connections
- Output cables and connections
- Many internal parts of the drive, and external option units

Unless otherwise indicated, control terminals are single insulated and must not be touched.

The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.

The STOP and Safe Torque Off functions of the drive do not isolate dangerous voltages from the output of the drive or from any external option unit.

The drive must be installed in accordance with the instructions given in this guide. Failure to observe the instructions could result in a fire hazard.

1.6 Stored electrical charge

The drive contains capacitors that remain charged to a potentially lethal voltage after the AC supply has been disconnected. If the drive has been energized, the AC supply must be isolated at least ten minutes before work may continue.

1.7 Mechanical hazards

Careful consideration must be given to the functions of the drive or controller which might result in a hazard, either through their intended behaviour or through incorrect operation due to a fault. In any application where a malfunction of the drive or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk - for example, an over-speed protection device in case of failure of the speed control, or a fail-safe mechanical brake in case of loss of motor braking.

With the sole exception of the Safe Torque Off function, none of the drive functions must be used to ensure safety of personnel, i.e. they must not be used for safety-related functions.

The Safe Torque Off function may be used in a safety-related application. The system designer is responsible for ensuring that the complete system is safe and designed correctly according to the relevant safety standards.

The design of safety-related control systems must only be done by personnel with the required training and experience. The Safe Torque Off function will only ensure the safety of a machine if it is correctly incorporated into a complete safety system. The system must be subject to a risk assessment to confirm that the residual risk of an unsafe event is at an acceptable level for the application.

1.8 Access to equipment

Access must be restricted to authorized personnel only. Safety regulations which apply at the place of use must be complied with.

1.9 Environmental limits

Instructions in this guide regarding transport, storage, installation and use of the equipment must be complied with, including the specified environmental limits. This includes temperature, humidity, contamination, shock and vibration. Drives must not be subjected to excessive physical force.

1.10 Hazardous environments

The equipment must not be installed in a hazardous environment (i.e. a potentially explosive environment).

1.11 Motor

The safety of the motor under variable speed conditions must be ensured.

To avoid the risk of physical injury, do not exceed the maximum specified speed of the motor.

Low speeds may cause the motor to overheat because the cooling fan becomes less effective, causing a fire hazard. The motor should be installed with a protection thermistor. If necessary, an electric forced vent fan should be used.

The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive must not be relied upon. It is essential that the correct value is entered in the Motor Rated Current parameter.

1.12 Mechanical brake control

Any brake control functions are provided to allow well co-ordinated operation of an external brake with the drive. While both hardware and software are designed to high standards of quality and robustness, they are not intended for use as safety functions, i.e. where a fault or failure would result in a risk of injury. In any application where the incorrect operation of the brake release mechanism could result in injury, independent protection devices of proven integrity must also be incorporated.

1.13 Adjusting parameters

Some parameters have a profound effect on the operation of the drive. They must not be altered without careful consideration of the impact on the controlled system. Measures must be taken to prevent unwanted changes due to error or tampering.

1.14 Electromagnetic compatibility (EMC)

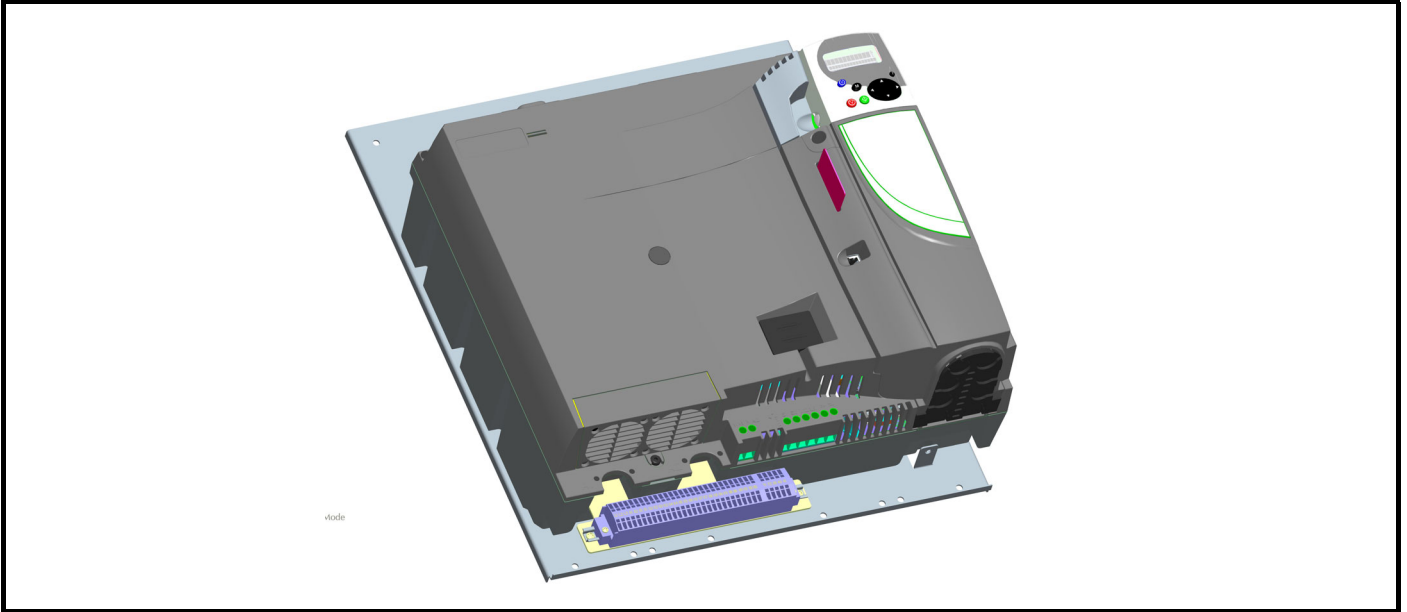
Installation instructions for a range of EMC environments are provided in the relevant Power Installation Guide. If the installation is poorly designed or other equipment does not comply with suitable standards for EMC, the product might cause or suffer from disturbance due to electromagnetic interaction with other equipment. It is the responsibility of the installer to ensure that the equipment or system into which the product is incorporated complies with the relevant EMC legislation in the place of use.

2 Introduction

The Mentor MP retrofit kit is a kit that has been designed to fit onto existing Mentor II stacks rated at 900 A, 1200 A and 1850 A. The kit consists of the control of 1850 A Mentor MP drives mounted on a panel which can be swapped out for the existing hinge down panels on Mentor II stacks. A convenient method of connecting existing Mentor II stack connections to the Mentor MP control electronics is provided. This guide explains how to swap out this kit with the existing Mentor II control electronics. If you need any assistance please contact our Automation Center in your area or your local sales contact.

NOTE

When fitting this kit, there is no warranty provided for the original stack to which it is being fitted.



2.1 Ratings and Ordering

Four product ratings are offered as indicated in Table 2-1. 480 V variants which are rated up to a maximum voltage of 525 V and must be used for existing 480 V and 525 V Mentor II stacks, while the 690 V variant must be used when fitting to an existing 660 V Mentor II stack. Only one current rating is offered (see section 2.2 below), users wishing to use the kit on 900 A or 1200 A Mentor II stacks should simply reduce the motor rated current (Pr 5.07) to the appropriate level.

Table 2-1 Kit ratings and ordering information

Supply	Quadrant	Description
480 V	Single	MP1850A4 480 V STD Retrofit
	Four	MP1850A4R 480 V STD Retrofit
690 V	Single	MP1850A6 690 V STD Retrofit
	Four	MP1850A6R 690 V STD Retrofit

2.2 Current feedback

Mentor II only samples the current in two places, at the point of firing and at the peak of the current pulse (positions 1 and 2 in Figure 2-1 & Figure 2-2). To calculate the mean current during discontinuous conduction, Mentor II also has a hardware circuit that looks for the current returning to zero and measures the zero current time period (t in Figure 2-2). This hardware circuit is problematic when the output current ripple is very low, either because the inductance of the motor is high or the supply voltage to the stack is low, or a combination of both. The detection of zero current can be falsely detected just after the firing point when the current is still rising instead of when it is returning to zero. This miss-detection of the end of the current pulse, at best causes instability in the discontinuous current region, and at worst could cause bridge to bridge faults because the hardware has miss measured the period of zero current before a bridge change. A parameter was added to the Mentor II parameter set to allow the burdens to be increased when these problems occurred.

Figure 2-1 Continuous current

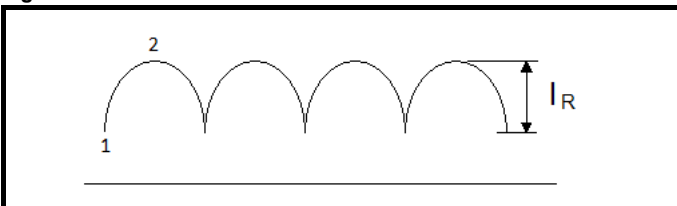
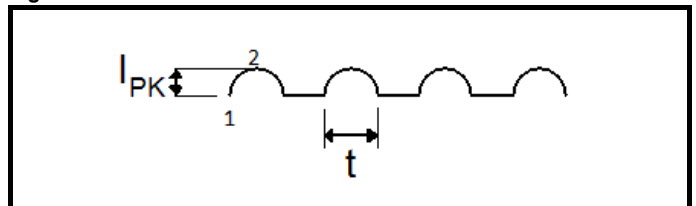


Figure 2-2 Discontinuous current



In Mentor MP the current is sampled by an A-D converter every 35 μ s. There is no hardware circuit used to detect the zero current, this is determined by robust software algorithms that do not suffer the same problems as the hardware circuits on Mentor II. The removal of the problems suffered by Mentor II, and the fact that Mentor MP samples the current much more often, gives Mentor MP a much higher current resolution than that of Mentor II. These improvements allows us to offer retrofit kits in just one current rating with no loss in performance when compared to Mentor II.

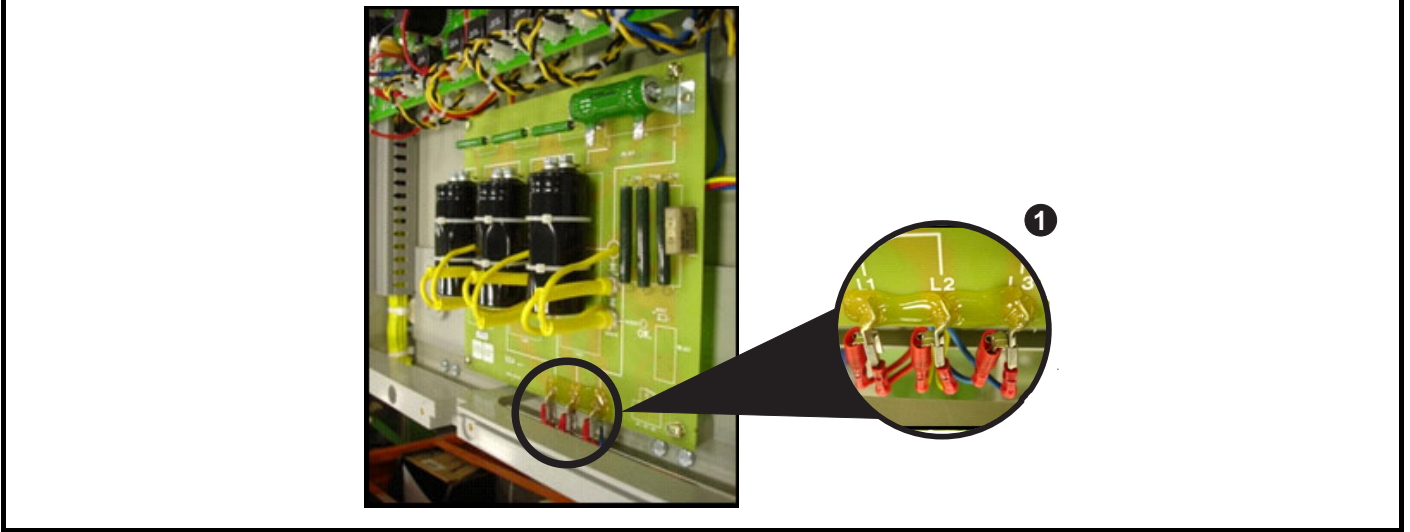
3 Installation

3.1 Disconnecting the existing Mentor II control

Remove any control wiring to the MDA2 board. Remove the left hand cover moulding and the hinge down right hand cover of the Mentor II control housing, disconnecting the ribbon cable from the MDA6 board to allow removal. Remove all the cables connected to the Mentor II auxiliary connector, ensuring to identify each one. Disassemble the parts inside the Mentor II housing in the following order:

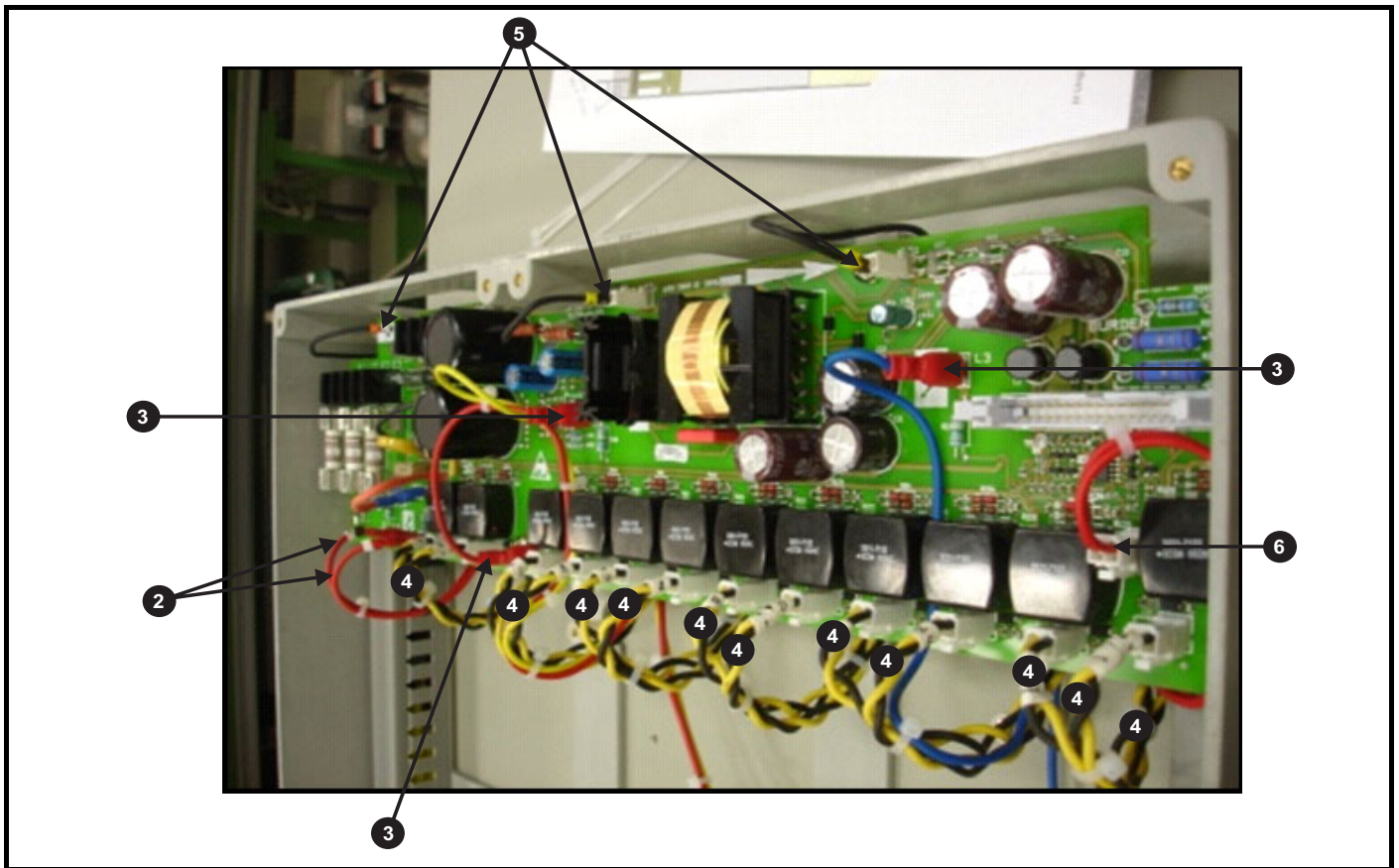
- Disconnect all the leads between the rectifiers mounted on the heatsink and the MDA6 board and discard.
- Unscrew the rectifier mounting screws and remove the rectifiers and heatsink.

Figure 3-1 SS4 board



- Disconnect the L1, L2 and L3 (red, yellow and blue) leads from the piggy back faston's connected to the SS4 board in the bottom right hand corner of the housing **1** as shown in Figure 3-1. Disconnect the piggy back faston's from the SS4 board.
- On 660 V drives, disconnect the green and brown leads from the capacitors on the SS4 board. These leads will not be required to be connected to the Mentor MP kit.
- Remove the SS4 board.

Figure 3-2 MDA6 board



- Disconnect the Armature voltage leads (marked A1 and A2) from the MDA6 board **2** as shown in Figure 3-2.
- Disconnect the L1, L2 and L3 leads from the MDA6 board **3** as shown in Figure 3-2.
- Disconnect the gate drive leads (pairs of yellow and black leads marked from 1 - 12 for 4 quadrant drives and 1 - 6 for single quadrant drives) from the MDA6 board **4** as shown in Figure 3-2.
- Disconnect the CT leads (marked 39, 40 and 41) from the MDA6 board **5** as shown in Figure 3-2.
- Disconnect the thermistor lead (PL18) from the MDA6 board **6** as shown in Figure 3-2.
- Remove the MDA6 board from the housing.
- Unclip the ty-wraps that hold the red, yellow and blue leads that were used to link between the SS4 and MDA6 boards and discard the leads.
- Unclip all the remaining ty-wraps that are holding the remaining leads in place.
- Pull the two cable harnesses that enter the housing free from the housing.

The lid to which the Mentor II housing is fixed can now be removed from the stack assembly by removing the two screws at the top of the lid and the 4 screws that connect the lid to the hinges.

3.2 Lid fixings

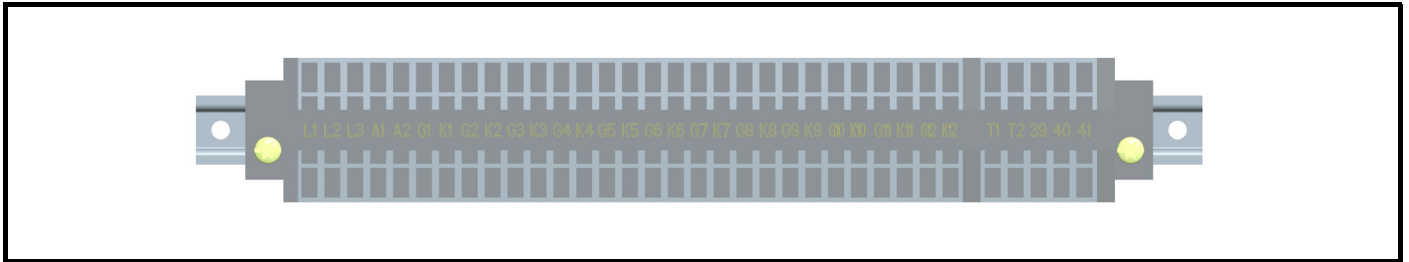
For Mentor II stacks that have been built since around 1997, the fixings are the same as on the retrofit kit. For Mentor II drives built before this time the top two fixings are different. If the kit is to be fitted to an older stack, the top fixings should be removed from the Mentor II lid and fitted to the kit lid.

3.3 Fitting the MP control kit

Figure 3-3 Fitting the MP control kit



Fix the kit lid, to which the MP control is already fixed, to the Mentor II stack in the same way that the existing Mentor II lid was fixed **7**. Connect the cabling from the Mentor II stack that has been disconnected from the Mentor II control electronics to the terminal block at the bottom of the Mentor MP control kit in sequence. The cables should be shortened to an appropriate length and stripped back by 8 mm for insertion into the terminal block. Alternatively, ferrules may be used with a cross section no greater than 4 mm².



- Connect the L1, L2 and L3 (Red, Yellow and Blue leads) to the L1, L2 and L3 terminals.
- Slide the A1 and A2 cable markers down their respective leads to an appropriate position and connect the leads to the A1 and A2 terminals.
- The gate drive cable pairs are marked from 1 to 12 (4Q) or 1 to 6 (1Q). For each gate drive cable pair in turn, cut the leads to an appropriate length and wrap new cable markers provided in the kit around the pair to keep them appropriately identified. For each pair, the yellow wire should be connected to the equivalently numbered G terminal on the connector, and the black wire should be connected to the equivalently numbered K terminal.
- The two red leads connected to the thermistor should be connected to terminals T1 and T2. It does not matter which cable is connected to which terminal.
- Slide the CT cable markers (39, 40 & 41) down their respective leads to an appropriate position and connect the leads to the equivalently marked terminals on the connector block.
- On 660 V stacks the green and brown leads are not required and so excess lead can be cut off and discarded. These leads are connected to resistors in the air ducting that are not required when using the MP control kit and so do not have any voltage on them when not connected to anything.

Connect the earth lead that is attached to the retrofit kit to the earth stud on the existing Mentor II stack.

Reconnect the cabling that had been connected to the Mentor II auxiliary input to the MP kit auxiliary connections. As the MP connections are along the bottom of the drive rather than the top on Mentor II, they may have to be rerouted in the cabinet or extended. The connections are marked the same on Mentor MP as they are on Mentor II.

Reconnect the control wiring as appropriate for the application.

4 Kit Depth

The 1200 A and 1850 A Mentor MP's are 576 mm deep (584 mm with smart card fitted) which is 106 mm deeper than the equivalent Mentor II's. If the Mentor II has been squeezed into a small cabinet, allowance may need to be made for this. Leaving the kit on the front of the stack and allowing for the extra depth is preferred, but if this is not possible the kit may be mounted by the side of the existing stack, ensuring to keep the cable lengths to it as short as possible.

5 Temperature measurement

Mentor MP uses an NTC thermistor to measure the heatsink temperature. A comprehensive thermal model is used to model the junction temperature of the thyristors so that the stack can be used at its maximum capacity. This includes an adjustment of the heatsink temperature based on armature current output to allow for the difference in temperature between the stack's hottest point and the actual temperature measured by the thermistor. The indicated temperature will therefore be higher on the kit than on the existing Mentor II control because of the adjustment in temperature made. Also, the cooling on Mentor MP frame sizes 2C and 2D is better than that of the Mentor II large stacks and so the thermal characteristics are different. The

Mentor II stack was never characterized in the same way that the Mentor MP stack has been and so the compensation factor will not be correct for the Mentor II stack. It is therefore possible that if an existing Mentor II stack is running at maximum output current in a high ambient temperature, the retrofit kit may trip out where the Mentor II did not. If the end user is confident that the existing Mentor II stack is capable of delivering the required current in the expected ambient conditions, and finds that the Mentor MP kit is close to tripping out (the trip will occur when Pr **7.04** exceeds 110 °C), some impedance can be added in series with the thermistor to reduce the measured temperature. For the Mentor MP kit to trip at a similar measured stack temperature as Mentor II at 1850 A, a value of 560 Ω should be added in series. However, it is recommended that the added impedance is kept as low as possible to maintain adequate stack over temperature protection. If in doubt, the complete drive should be replaced with a Mentor MP drive where the stack has been characterized and the correct thermal model is in place to protect it from over temperature.

6 Parameter set-up

Pr **5.07** (Motor rated current) should be set to the rating of the stack that the kit is being fitted to, or to the motor rating if this is more appropriate. For other parameter changes please refer to the set-up wizard within CT Soft.



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