EMERSON
Industrial Automation

User Guide

Mini Maestro

Variable Speed Drive for
Permanent-magnet DC
Servo-motors

Part Number: 0470-0009-05
Issue: 5

CONTROL
TECHNIQUES
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Safety Information

Persons supervising and performing the electrical installation or maintenance of a Drive and/or its external Option Unit must be suitably qualified and competent in these duties. They should be given the opportunity to study and if necessary to discuss this User Guide before work is started.

The Drive is intended for operation from a nominal 60V DC supply. It is the installer's responsibility to ensure that this supply is safely isolated from dangerous mains supply voltages, and correctly protected by fuses.

The Stop function of the Drive does not remove voltages from the terminals of the Drive and external Option Unit. Mains supplies should be removed before any servicing work is performed.

The installation instructions should be adhered to. Any questions or doubt should be referred to the supplier of the equipment. It is the responsibility of the owner or user to ensure that the installation of the Drive and external Option Unit, and the way in which they are operated and maintained complies with the requirements of the Health and Safety at Work Act in the United Kingdom and applicable legislation and regulations and codes of practice in the UK or elsewhere.

The Drive may start automatically when power is applied. All necessary precautions must be taken to avoid injury to personnel or damage to equipment as the result of unexpected application of power.

The enable input of the Drive should not be relied upon to ensure safety of personnel. If a safety hazard could exist from unexpected starting of the Drive, an interlock should be installed to prevent the motor being inadvertently started.

General Information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional operating parameters of the equipment or from mismatching the Drive with the motor.

The contents of this User Guide are believed to be correct at the time of printing. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the contents of the User Guide, without notice.

Contents

1   Data

Analog speed reference input	±10V (33kΩ input impedance)	
Analog current reference input	±10V 22kΩ (TPRC)	
Enable signal	Minimum 10V	
	Maximum 30V	
	20kΩ input impedance	
Error amplifier temperature drift	±25 μV / °C	
Error amplifier offset	Offset at 25°C ±100μV	
Tachogenerator feedback control range	1 to 5000 RPM	
Minimum tachogenerator signal at maximum speed	5V	
Armature feedback control range	150 ~ 3000 RPM	
Ambient temperature	Operating temperature range –10°C (50°F) to +45°C (113°F)	
DC supply:	**Battery**	Minimum 24V
		Maximum 72V
	Nominal	60V
	Rectified AC supply	Minimum 20V
		Maximum 80V
		Maximum ripple 2V peak to peak

⚠ WARNING	The supply terminals are not isolated from the control terminals. The supply must either be isolated, or have its negative pole grounded.

Reference voltages	±10V 3mA maximum
Monitor motor current	±8V
Monitor motor requested current (TPRC)	±10V
Power cables	2.5 mm^2 (AWG 14) for DCD60x10/20 and DCD60x14/28 models
	1.5 mm^2 (AWG 16) for DCD60x3/6 and DCD60x7/14 models
Signal wiring	0.5mm^2(AWG 20)
Current tolerance	±10%
Protection	Overtemperature on heatsink 100°C
	Undervoltage 20V
	Overvoltage 80V

Output ratings

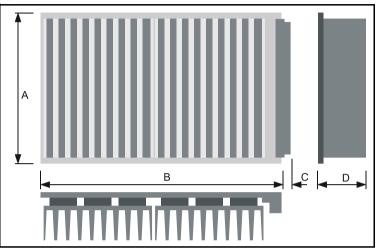| Model	Nominal current	Peak current
DCD60x3/6	1 to 3 A	6A for 2 sec.
DCD60x7/14	2 to 7 A	14A for 2 sec.
DCD60x10/20	3 to 10 A	20A for 2 sec.
DCD60x14/28	5 to 14 A	28A for 2 sec.

NOTE The peak current can be adjusted from 50% to 100% using the RIP resistor mounted on SK1.

NOTE The nominal current can be adjusted in the range shown using the RIN resistor mounted on SK1.

2 Mechanical Installation

2.1 Dimensions of the drive

Figure 2-1 Overall dimensions of the drive

Dimensions of the drive		
A	100mm	3.937in
B	160mm	6.300in
C	8mm	0.315in
D	41mm	1.614in

2.2 Mounting location

> ⚠️ **WARNING**
>
> Electric shock risk
> The heatsink on the drive is LIVE. Switch off the supply and wait at least 10 seconds before touching any part of the drive.

The drive is contained on a Eurocard circuit board having a 64-pin DIN connector. Two installation kits allow for installation as follows:

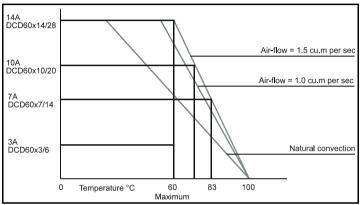| Installation kit	Part number	Installation
3MB	7500 - 0009	Standard 19 inch rack
2MH	7500 - 0008	Panel mounting

The ingress protection rating of the drive is IP00. When greater protection is required, install the drive in a cabinet.
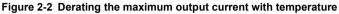
Choose a location that is free from excessive dust, corrosive vapours, gases and all liquids, including condensation of atmospheric moisture.

If condensation is likely to occur when the drive is not in use, install an anti-condensation heater. This heater must be switched off when the drive is in use; automatic switching is recommended.

Install the drive so that the heatsink fins are vertical for best flow of cooling air.

Observe the requirements for ambient temperature if the drive is to be mounted directly above any heat generating equipment (such as another drive). When the ambient temperature exceeds 50°C (120°F), the output power of the drive must be derated. The drive has over-temperature protection which trips the drive when the heatsink reaches 100°C (212°F).

Figure 2-2 Derating the maximum output current with temperature

If the drive is to be installed directly beneath other equipment (such as another Variable Speed drive), ensure the drive does not cause the ambient temperature requirements of the equipment to be exceeded.

Leave adequate clearance around the drive to allow unimpeded airflow to the heatsink.

For model DCD60x14/28, apply forced cooling using a fan and cabinet of adequate size.

The total power dissipated as heat from a drive, choke, transformer and heatsink is 10% to 15% of the motor power.

Figure 2-3 Dimensions of 3MB rack-mount installation kit

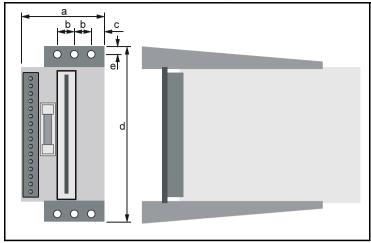| Dimension	mm	in
a	40	1.575
b	26	1.024
c	7	0.276
d	8	0.315
e	130	5.118
f	20	0.787

Figure 2-4 Dimensions of 2MH panel-mounting installation kit

Dimension	mm	in
a	66	2.598
b	15	0.591
c	8	0.315
d	132	5.197
e	5	0.197

2.3   Choke (optional)

When a motor has an inductance less than 1mH, a choke must be connected between the motor and drive, and as close as possible to the drive. Refer to Figure 2-5 for dimensions of the choke.

Model	Choke	Choke rating
DCD60x3/6 DCD60x7/14	L11	0.7mH, 8A
DCD60x10/20 DCD60x14/28	L12	1mH, 14A

Figure 2-5 Dimensions of the L11 and L12 chokes

Dimension	L11		L12	
	mm	in	mm	in
a	56	2.205	75	2.953
b	12	0.472	87	3.425
c	64	2.520	7	0.276
d	56	2.205	75	2.953
e	64	2.520	100	3.937
f	6	0.236	8	0.315
g	52	2.047	44	1.732
h	40	1.575	44	1.732
j	11	0.433		
k	46	1.811	60	2.362
Hole diameter	4	0.157	4	0.157

3 Electrical Installation

3.1 Connections

Installation kits

Figure 3-1 Signal and power connections on the 3MB installation kit

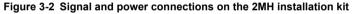|	
1	Motor current monitor output
2	Protection enable
3	TPRC
4	Signal common
5	-10V, 3mA supply output
6	+10V, 3mA supply output
7	Enable input
8	Speed reference input [non-inverting]
9	Signal common
10	Speed reference input [inverting]
11	Tachogenerator input [inverting]
12	Tachogenerator input [non-inverting]
13	+VDC supply input
14	- VDC supply input
15	Output to motor [M1]
16	Not used
17	Output to motor [M2]

Connector

Figure 3-2 Signal and power connections on the 2MH installation kit

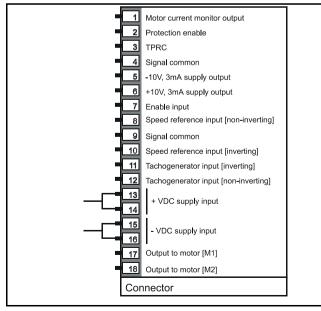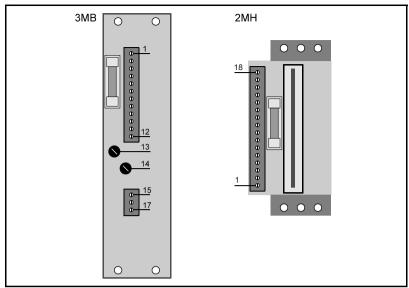|	
1	Motor current monitor output
2	Protection enable
3	TPRC
4	Signal common
5	-10V, 3mA supply output
6	+10V, 3mA supply output
7	Enable input
8	Speed reference input [non-inverting]
9	Signal common
10	Speed reference input [inverting]
11	Tachogenerator input [inverting]
12	Tachogenerator input [non-inverting]
13	+ VDC supply input
14	
15	- VDC supply input
16	
17	Output to motor [M1]
18	Output to motor [M2]

Connector

Figure 3-3 Locations of the signal and power connections on the installation kits

Edge connector of the drive

When an installation kit is used, the functions of the connections on the edge connector do not need to be known. The connections are as follows:

Pin number	Function
1	Signal common
2	Protection enable
3	TPRC
4	−10V, 3mA supply
5	+10V, 3mA supply
6	Speed reference input [non inverting]
7	Drive enable
8	Signal common
9	Tachogenerator input
10	Speed reference input [inverting]
11	I_{mot} Analog signal proportional to the effective current in the motor
14, 15, 16, 17	+DC supply input
19, 20, 21, 22	−DC supply input
24, 25, 26, 27	Motor output + [M1]
29, 30, 31, 32	Motor output − [M2]
12, 13, 18, 23	Do not use

> ⚠ **CAUTION**
>
> The signal common terminals are at the same potential as the -DC supply input terminals
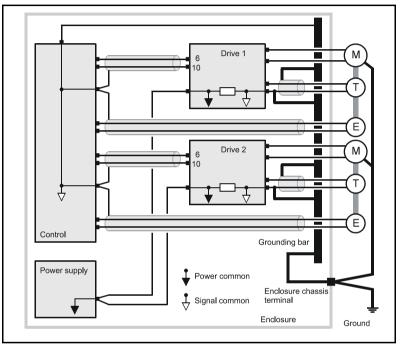
3.2 Grounding

To avoid intermittent tripping of the drive, use a single ground point for the supply and signal circuits. A grounding bar of appropriate size can be used. This must be mounted on insulated supports as close as possible to the drive and connected to the chassis ground using cable of 10mm^2 to 20mm^2. The shortest possible wiring should be used.

The connection to the chassis terminal of the enclosure must be adequately sized.

If in doubt, consult the supplier of the drive.

Figure 3-4 Ground connections

NOTE   Signal cables and supply cables must be segregated and wired through different trunking
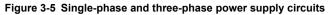
3.3 External power supply

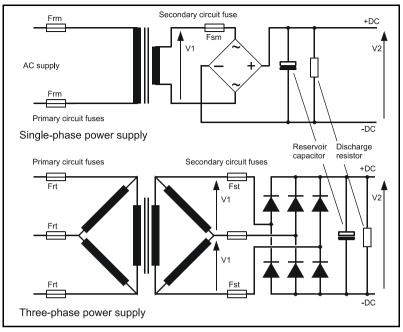A single external power supply may be used to supply a number of drives.

Peak motor current less than 15A
Use a single-phase or three-phase AC supply.

Peak motor current 15A or greater
Use a three-phase AC supply.

Figure 3-5 Single-phase and three-phase power supply circuits

Transformer ratings

Power rating
Use the following equation:

$$Pt = \{(Paz \times 1.7) + 80\} \times 1.73 \div \sqrt{(n + 2)}$$

Where:

Paz	=	($Vm1 \times Cm1$) + ($Vm2 \times Cm2$) + ...
Vm	=	Motor speed in radians per second (**RPM** ÷ **9.5**)
Cm	=	Nominal torque in Nm
1.73 ÷ √(n + 2)		Empirical conversion factor for drives connected in parallel

Secondary voltage
Select the required secondary voltage, as follows:

DC supply to the drive	Secondary voltage VRMS
63	45
21	15
80	56

With no load: $V2 \cong V1 \times 1.4$

With full load: $V2 \cong V1 \times 1.2$

Reservoir capacitors

Use the following equation to calculate the total required value of reservoir capacitance:

$$C = (Pt \div V2) \times 2000 \; \mu F$$

The factor 2000 allows for regeneration current during braking.

The factor can be reduced to 1000 when all of the following conditions apply:

$V2$ = 24V to 45V

Maximum motor speed = 1500 RPM

Three-phase AC supply is used

System inertia is less than the motor inertia

| NOTE | If the green drive normal LED on the drive becomes unlit (even temporarily) when the motor is being decelerated, this indicates overvoltage protection is occurring. To prevent this occurrence, increase the value of reservoir capacitance |

.Discharge resistor

The discharge resistor ensures the reservoir capacitors are discharged in 10 seconds when the AC supply is disconnected from the drive.

Use the following equation to calculate the required value: $R = 20 \div C$

Use the following equation to calculate the power rating: $P = [V2]^2 \div R$

⚠️ **WARNING** Correct fuse protection must be used to avoid fire risk.

AC supply fuses

Delayed action fuses should be connected in the primary and secondary circuits of the transformer.

Use the following equations to calculate the ratings of the fuses:

Number of phases	Primary fuses		Secondary fuses	
1	$1.3 \times Pt \div (VAC + 1)$	Frm	$1.6 \times Pt \div V1$	Fsm
3	$0.75 \times Pt \div (VAC + 1)$	Frt	$Pt \div V1$	Fst

DC supply fuses

A 12.5A fast-action fuse is fitted in the fuse holder on the panel of the installation kit. This protects the DC supply to the drive. If necessary, replace this fuse with a 16A fast-action fuse. Refer to the following table:
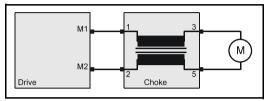
DCD60x3/6	DCD60x7/14	DCD60x10/20	DCD60x14/28
12.5A	12.5A	16A	16A

3.4　Motor connections

Normally the motor should be connected directly to the connector on the installation kit.

When any of the following conditions apply, a choke should be connected to each drive output as shown in Figure 3-6.

- The motor inductance is less than 1mH
- During emergencies, the user short-circuits the motor connections
- High frequency switching noise is troublesome
- The motor overheats (irrespective of motor inductance)

Figure 3-6　Motor and choke connections

The two cables between the drive and the choke are a source of noise. The cables should be kept as short as possible (300mm is recommended).

Terminal 3 of the choke should be connected to the + terminal of the motor.

Terminal 5 should be connected to the – terminal on the motor.

Terminal 4 should be connected to the grounding bar (only applies to L12).

3.5 Signal connections

NOTE Signal cables and power cables must be segregated and wired through different trunking.

Table 3.1 Signal connections common to both mounting kits

Terminal No.	Description	I/O	Notes
1	I_{MOT}	O	Analog signal proportional to the effective current in the motor. Output signal ± 8V at maximum current.
2	Protection active	O	NPN open-collector output 100mA, 47V. Use this to enable external protection devices when the drive trips.
3	TPRC	I/O	Analog signal proportional to the value of the requested current. Signal range ±10V. When at ±10V the drive generates peak current. When used as an input, and the same voltage range is applied, the drive becomes a current amplifier using the applied voltage as current reference.
4	0V		Signal common
5	-10V reference	O	3mA max
6	+10V reference	O	3mA max
7	Enable	I	When a 10V DC to 30V DC signal is applied to this terminal, the drive is enabled. When the signal is discontinued, the drive is disabled (0V). Input impedance = 47kW
8	Speed reference (non-inverting input)	I	When a differential signal from the external controller is not available, connect terminal 10 to terminal 9.
9	0V		Signal common.
10	Speed reference (inverting input)	I	The speed reference signal input is a differential input to minimize noise problems.
11	Tacho (non-inverting input)	I	Tachogenerator signal.
12	Tacho (inverting input)	I	Tachogenerator signal.

DC supply connections for 3MB

13	+DC	I	
14	-DC	I	

DC supply connections for 2MH

13 + 14	+DC	I	
15 + 16	-DC	I	

Motor connections for 3MB

15	Motor M1	O	Motor positive
16	Not used		
17	Motor M2	O	Motor negative

Motor connections for 2MH

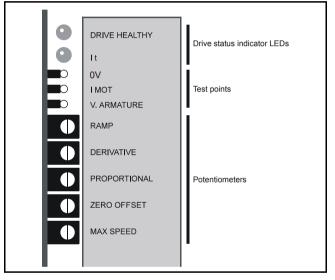| 17	Motor M1	O	Motor positive
18	Motor M2	O	Motor negative

4 Setting up the drive

Set up the drive by adjusting potentiometers and replacing specific capacitors and fixed resistors. These components are fitted to socket SK1. If a drive is replaced, the socket can be transferred to the replacement drive in order to keep the settings.

4.1 Adjusting the potentiometers

Five potentiometers are labelled as follows:

RAMP

DERIVATIVE

PROPORTIONAL

ZERO OFFSET

MAX SPEED

Figure 4-1 Locations of the potentiometers on the drive

RAMP potentiometer

Adjust the potentiometer to increase or decrease the time from 0 second to 2 seconds for the motor to reach maximum speed (with a 10V speed reference signal). To disable ramps set the potentiometer at the fully anti-clockwise position.

DERIVATIVE potentiometer

Turn the potentiometer clockwise to reduce the amount of overshoot in the system response by increasing the derivative gain of the PID amplifier.

PROPORTIONAL potentiometer

Turn the potentiometer clockwise to increase the proportional gain of the PID amplifier.

ZERO REF potentiometer

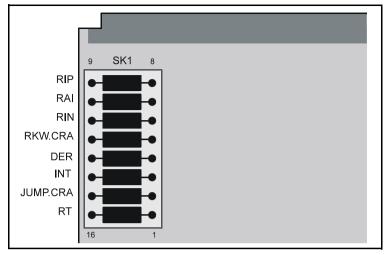Adjust this potentiometer to cancel any offset in the external speed reference signal.

MAX SPEED potentiometer

Turn the potentiometer anti-clockwise to reduce the maximum motor speed to 50%.
Turn the potentiometer clockwise to increase the maximum motor speed to 120%.

4.2   Mounted components

Figure 4-2 Locations of the mounted components on the drive

The following resistors and capacitors are mounted on socket SK1:

RIP resistor
Reduces the peak current to the required value.

RAI resistor
Compensates for the voltage drop due to internal resistance of the motor.

RIN resistor
Reduces the nominal current to the required value.

RKW.CRA resistor
Adjusts the drive for armature voltage speed feedback.

DER capacitor
Adjusts derivative gain.

INT capacitor
Adjusts integral gain.

JUMP.CRA jumper
Adjusts the response of the system when the drive is in armature feedback mode.

RT resistor
Normalizes the tachogenerator input signal and adapts the drive to the voltage constant of the tachogenerator.

NOTE   Most applications do not require DER or INT capacitors to be used. When an application does require these capacitors, the recommended value is between 0.1mF and 5mF.

4.3   Making adjustments to the drive

Zero speed offset

ZERO REF potentiometer

1. Connect the non-inverting input of the speed reference signal to terminal 9 and the inverting input to terminal 10.
2. Set the speed reference signal for zero speed.
3. Apply +10V to +30V to terminal 7 **Drive Enabl**e.
4. Connect a digital multimeter to pins 11 and 12.
5. Enable the drive and adjust the ZERO REF potentiometer to reduce the multimeter reading to not more than 1mV.
6. Restore the original wiring.

Maximum speed

RT resistor

NOTE A 10kΩ RT resistor is fitted as standard. This value is suitable for tachogenerator voltage constant, Ke_{tacho} = 10 and maximum motor speed = 3000 rpm.

Use the following equation to calculate the value of the RT resistor:

$$RT = 400 \; [(Vm \times Ke_{tacho}) - 5\Omega]$$

Where:

Vm = Maximum speed of motor in RPM ÷ 1000

Ke_{tacho} = Tachogenerator voltage constant (voltage output at 1000 RPM) and in general $Ke_{tacho} = V^{*}$ 1000 / RPM

Resistor ratings:

Power: 0.25W

Tolerance: +20%.

NOTE If the calculated value of RT is zero, fit a jumper instead of a resistor

If the calculated value is negative, the tachogenerator must be changed for one with a greater value of Ke_{tacho} in order for the motor to reach the required speed.

Example

Max required speed = 3000 RPM $\therefore$ **Vm** = 3

Tachogenerator output = 7V at 1000 RPM $\therefore$ Ke_{tacho} = 7

Calculate:

$$RT = 400 \; [\; (3 \times 7) - 5\Omega \;] = 6.4k\Omega$$

The nearest suitable value is 6.8kΩ.

Adjusting the nominal current

When the nominal current rating of the motor is less than the nominal current of the drive, it is possible to reduce the maximum value of current produced by the drive by fitting a RIN resistor. Refer to the following table:

Model	Nominal current										
3 / 6	3.0	2.8	2.6	2.4	2.2	1.9	1.7	1.5	1.2	1.1	0.9
7 / 14	7.0	6.5	6.0	5.5	5.0	4.4	4.0	3.4	2.8	2.5	2.2
10 / 20	10	9.3	8.6	7.8	7.0	6.3	5.7	4.9	4.0	3.5	3.1
14 / 28	14	13	12	11	9.9	8.8	8.1	6.8	5.6	4.9	4.3
Value KΩ		65	30	18	12	8.6	6.8	4.7	3.3	2.7	2.2

The following equation is used to calculate the value of the RIN resistor:

$$\text{RIN} = \frac{(\mathbf{10000} \times \mathbf{I_{NOM}})\Omega}{[\mathbf{I_{PEAK}} - (\mathbf{2} \times \mathbf{I_{NOM}})]}$$

> ⚠️ **WARNING**
>
> The correct setting of RIN resistor is necessary to prevent damage to motor and risk of fire in the event of overload.

Where:

I_{NOM} = nominal desired current value

I_{PEAK} = Drive peak current value

Adjusting speed for operation in armature feedback mode

JUMP.CRA jumper
RKW.CRA resistor
RAI resistor

Armature feedback mode can be used when a tachogenerator is not fitted to the motor. Speed control is then less precise.

Speed is controlled using the motor voltage as feedback.

Voltage drop due to motor resistance can be compensated by adjusting the value of the RAI resistor.

1. Connect jumper **JUMP.CRA** to enable operation with armature feedback.
2. Use the following equation to calculate the correct value of RKW resistor:

    RKW = 0.260 x **Vm** x **Ke$_{motor}$**

Where:

Vm = Maximum speed in RPM

Ke$_{motor}$ = Motor voltage constant (voltage at 1000 RPM)

Calculating the value of the RAI resistor can be difficult since it is a function of the following:

- Motor characteristics. (eg. armature resistance and temperature).
- Brush resistance (changing with wear).

The following equation can be used to calculate a value for the RAI resistor:

$$RAI = 80 \times Vm \times \frac{Ke_{motor}}{Ip} \times Ratot$$

Where:

    Ip = Peak output current

    Ratot = Ra + **Rsp1** + **Rsp2**

    Ra = Armature resistance (Ω)

    Rsp = Brush resistance (Ω)

An approximate value may be found experimentally using a RAI resistor value of 400kΩ to 600kΩ.

NOTE Too low a value for the RAI resistor may modify the velocity loop response.
For guidance, contact Control Techniques.

Adjusting the peak current
RIP resistor

When a RIN resistor is fitted, I_{PEAK} may become excessively high in relation to I_{NOM}. To reduce the value of the peak current, use a RIP resistor.

NOTE The new value for I_{PEAK} must be ignored when the value of RIN is calculated.

Use the following equation to calculate the value of the RIP resistor:

$$RIP = \frac{(10 \times I_{LIM})}{(I_{PEAK} - I_{LIM})} k\Omega$$

Where:

    I_{LIM} = the new value required for I_{PEAK}

NOTE When the peak current is reduced, the ratio between I_{PEAK} and I_{NOM} is altered. This alteration increases the time before I^2t protection takes place.

In this case, the peak current is supplied for more than 2 seconds

The following table may be used for finding an approximate value for I_{PEAK}

Model	Current									
3 / 6	5.8	5.6	5.4	5.1	4.9	4.1		3.9	3.6	3.0
7 / 14	13.5	13.0	12.5	12.0	11.5	10.0	9.6	9.0	8.4	7.0
10 / 20	19.3	18.6	17.9	17.0	16.5	15.4	13.7	18.9	12.0	10.0
14 / 28	27	26	25	24	23	21	19	18	17	14
Value KΩ	**270**	**130**	**83**	**56**	**47**	**33**	**22**	**18**	**15**	**10**

4.4 Motor phasing

⚠️ **WARNING**

If the motor connections are not correct, the motor could rotate at a high speed in an unspecified direction.
Before testing the motor, disconnect the motor from the machine and ensure the AC supply can be quickly disconnected from the drive.

1. Ensure the speed reference signal is zero.
2. Ensure a drive enable signal is *not* applied.
3. Apply AC power.
4. Check that the green LED is lit.
5. Check the motor remains stationary or rotates slowly.
6. Increase the speed reference signal and check the motor rotates in the intended direction and the speed increases.
7. If required, refer to *Diagnostic*s.

4.5 Dynamic calibration

For modifying the settings, the following equipment is required:

Low frequency function generator

Frequency range: 0Hz to 10Hz

Output voltage: –3.5V to +3.5V

Twin-trace storage oscilloscope

1. Remove the speed reference signal from pins 9 and 10.
2. Connect the function generator output to pins 9 and 10.
3. Set the function generator at the following:
Squarewave output
Amplitude: ±2V
Frequency: 0.2Hz
4. Connect oscilloscope channel A to pin 11.
5. Connect oscilloscope channel B to pin 8.
6. Connect oscilloscope ground to pin 9.
7. Connect the oscilloscope external trigger input to the function generator output.
8. Set the oscilloscope as follows:
Sensitivity: 1mV per division
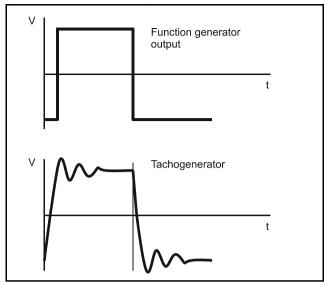Timebase: 20ms per division

⚠️ **CAUTION**

When the motor load is a slide with limited travel, avoid the slide activating the limit switches by increasing the reference signal frequency or decreasing the reference signal amplitude in order to reduce the speed.

NOTE The minimum acceptable amplitude for the reference signal is 1V peak-to-peak.

9. Apply power to the drive.
10. Enable the drive.

Figure 4-3 Waveform resulting from insufficient proportional gain

11. The waveform could be as shown in Figure 4-3. In this case, the system has insufficient dynamic gain. Turn the PROPORTIONAL potentiometer clockwise to obtain a waveform without oscillation.

12. When a waveform without oscillation has been obtained, in most cases the response will have an overshoot as shown in Figure 4-4. In this case, the system has insufficient derivative action. Turn the DERIVATIVE potentiometer clockwise to eliminate the overshoot, as shown in Figure 4-5.

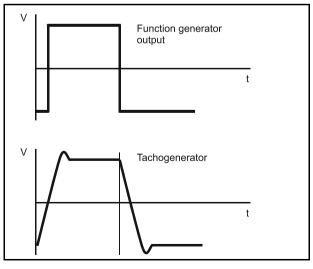**Figure 4-4 Waveform resulting from insufficient derivative gain**
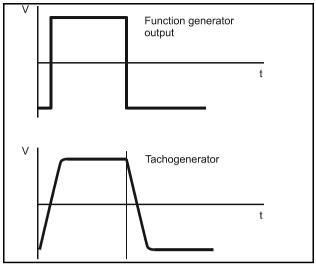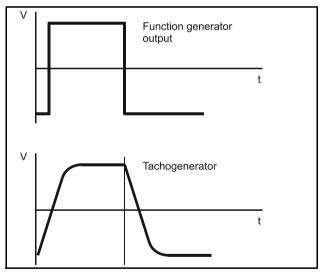
Figure 4-5 Ideal waveform

Figure 4-6 Waveform resulting from excessive derivative gain

NOTE   It may be necessary to adjust repetitively the PROPORTIONAL and DERIVATIVE potentiometers.

If the drive has instability problems after adjustment and when it is connected to a position controller, re-adjust the proportional and derivative gains.

If the derivative gain is set at an excessive value, current noise can occur. This causes unnecessary heating of the drive and motor, and can induce I^2t current limit trips.

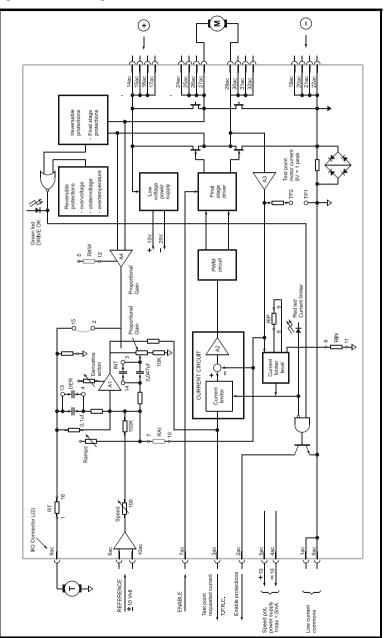The maximum acceptable amplitude for the current noise is 15% of the amplitude of the waveform.

Figure 4-7 Block diagram of the drive

5 Diagnostics

Two LEDs and one digital output are available on the drive to give the following:

Monitoring the status of the drive

Diagnostics

I^2t protection

5.1 LED indicators

I^2t protection indicator

The I^2t LED is lit when I^2t exceeds the programmed value set by the RIN resistor. When the I^2t LED is lit, the drive is limited to the value of nominal current set by the RIN resistor.

I^2t protection can be caused by:

A heavy working cycle with quick and frequent accelerations

Reversal of the drive

Drive rating inadequate.

When I^2t limiting is not activated, the green LED will light and a **Drive NORMAL** output signal will be produced.

DRIVE HEALTHY indicator

The **DRIVE HEALTHY** LED indicates that the drive is operating normally. When the LED is unlit it indicates at least one of the drive protection functions is active.

5.2 Fault finding

Use the following procedures when the system is not working correctly after calibration.

Green LED off

Power supply voltage out of range

Check the DC supply voltage is within the acceptable range.

Drive protection is activated

Check for a short circuit between the power connector terminals.

Check the motor inductance is not too low.

Motor not in full control

Tachogenerator cables reversed

Reverse the tachogenerator cables.

Motor cables reversed

Reverse the motor cables.

No tachogenerator signal on pin 11

Check the tachogenerator and the tachogenerator cables.

RT resistor not installed

Calculate the correct value for the RT resistor see Setting up the drive to adjust the components.

Speed reference signal

Reduce the speed reference signal to less than 1mV.

Motor turns in reverse direction

Speed reference signal connections reversed

Correct the speed reference signal connections.

Motor connections connections reversed

Correct the motor connections.

Tachogenerator connection pins reversed

Correct the tachogenerator connections.

6 Accessories

DCD60x3/6
DCD60x7/14
Single-phase AC power supply

Code	Description	Part number
2MH	Panel mount installation kit including fuses and connecting cable	7500-0008
3MB	Installation kit for 19 inch rack mounting including screws and fuses	7500-0009
L11	0.7mH, 8A inductor	4371-1108
Bridge rectifier	25A 400V single - phase bridge rectifier	
	10,000μF 75V electrolytic capacitor	1664-1000

DCD60x3/6
DCD60x7/14
Three-phase AC power supply

Code	Description	Part number
2MH	Panel mount installation kit including fuses and connecting cable	7500-0008
3MB	Installation kit for 19 inch rack mounting including screws and fuses	7500-0009
L11	0.7mH, 8A inductor	4371-1108
Bridge rectifier	25A 400V three - phase rectifier	
	10,000μF 75V electrolytic capacitor	1664-1000

DCD60x10/20
DCD60x14/28
Three-phase AC power supply

Code	Description	Part number
2MH	Panel mount installation kit including fuses and connecting cable	7500-0008
3MB	Installation kit for 19 inch rack mounting including screws and fuses	7500-0009
L12	1mH, 14A inductor	4371-1214
Bridge rectifier	25A 400V three - phase rectifier	
	10,000μF 75V electrolytic capacitor	1664-1000

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