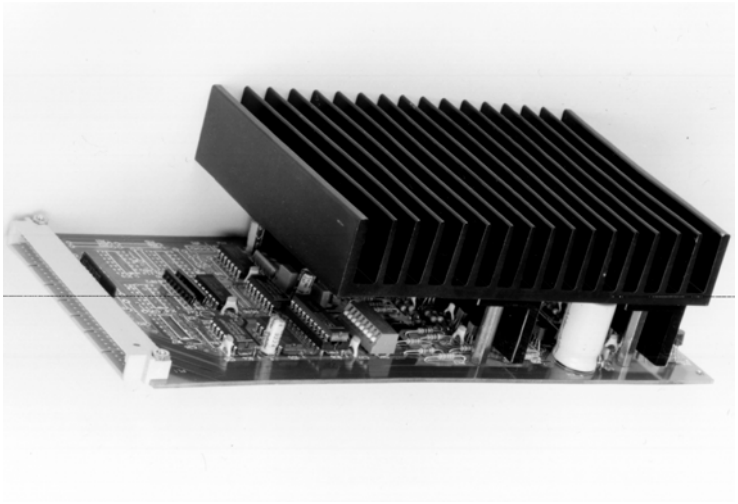
digitran **stepper motor drives** **TM164C**
TM165C



Handbook

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WARNING

FAILURE TO OBSERVE THE PRECAUTIONS AND CORRECT OPERATING PROCEDURES OR THE IMPROPER USE OF THE PRODUCT AND/OR SYSTEMS TO WHICH THESE PRODUCTS ARE FITTED CAN CAUSE PERSONAL INJURY AND DAMAGE TO PROPERTY.

LIMITATIONS OF USE

THE PRODUCTS DESCRIBED IN THIS PUBLICATION ARE INTENDED FOR INCORPORATION IN DRIVE AND CONTROL SYSTEMS. THE USER MUST ENSURE THAT THE SYSTEM IN WHICH THESE PRODUCTS ARE FITTED MEET ALL EXISTING SAFETY STANDARDS AND MACHINERY DIRECTIVES.

contents:

Introduction

The TM164C and it's 12E panel mounted version type PM164C are chopped constant current Bi-polar drives which conform to the international 3U extended eurocard format Operating from externally derived clock and direction signals the unit controls either two phase or 4 phase stepper motors connected in a bi-polar configuration causing a motor step for each clock pulse received, in the direction of rotation determined by the level of the direction signal. The ***digitran*** drive provides selectable full or half step control and is suitable for use with motor rail voltages up to 50 Vdc, with a choice of current settings up to 4.5 amps per phase resulting in optimum performance with NEMA size 23 & 34 frame motors.

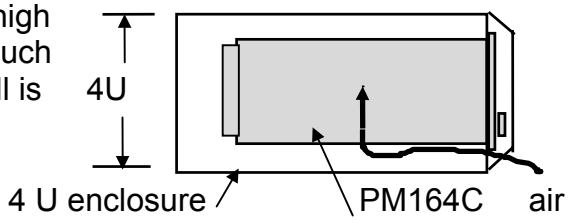
The TM165C and it's panel mounted version type PM165C utilises an internal thermal sensor to provide an over-temperature signal for increased drive protection. Additionally an internal oscillator with independently adjustable base speed and high speed settings, together with an adjustable linear acceleration/deceleration ramp may be used in addition to the external clock for operation off-line from the host controller.

Installation

Suitable enclosures

The ***digitran*** drive units are intended for mounting in 19in x 3U high rack units such as the PM170 series racked power supplies. In this arrangement the unit's heatsink is such that the cooling fins are vertical. If the drive is to be mounted in an alternative way it must be fitted such that the heatsink fins remain vertical unless forced cooling is employed.
Ensure that the rack to which the ***digitran*** drive is fitted has adequate ventilation to provide free circulation of clean air. A gap of at least 1/2U (22 mm) should be allowed above and below the drive for this purpose.

An ideal solution is the use a of 4U high enclosure designed specifically for such purposes in which a ventilation grill is provided above and below the drive.



Operating temperature

The maximum recommended working temperature of the ***digitran*** drive is 75 deg.C at the heatsink. Care should be taken to ensure that this is not exceeded since damage may otherwise occur. When the TM165C or PM165C units are employed the thermal sensor's output may be connected to the 20% STANDBY CURRENT input terminal to provide automatic power reduction if this operating temperature occurs. Alternatively the output may be used to signal the host controller to provide a power down signal to the drive at a strategic moment in the operating cycle.
As an installation guide the ***digitran*** drive unit's temperature rise with an output current setting of 4.5 amps is typically 35 deg.C when mounted correctly in a well ventilated enclosure. Consequently, a maximum ambient temperature of 40 deg.C is acceptable. When two or more drives are mounted in a single enclosure forced cooling is recommended if the drive current of either drive is set above 3.5 amps.

Electrical interference

The ***digitran*** drive units are designed for incorporation in control systems which utilise 19 in racks and control cabinets. The nature of a chopped constant current drive is such that high transient electrical signals are generated and these must be contained below acceptable limits as defined by European EMC directives. Before setting the unit to work sufficient steps should be taken to meet these requirements. The use of a separate power supply minimises the mains conducted interference and the use of a suitable mains filtered plug designed for this purpose will be sufficient. The rack mounted drive equipment should be installed in an 'EMC' approved enclosure with all external connections suitably shielded to contain radiated electrical emissions. For example, where multi-pin connectors are used these should have metal shells with an adequate screen path

Precautions

The importance of ensuring that the connections to the drive have been properly implemented **before** switching power to the unit cannot be over-stressed. The most common cause of failure is incorrect connections. The use of the MSB108 motherboard which enables all connections to the drive to be made using screw terminals not only simplifies commisioning but reduces the possibility of faulty connection as well. It is also important to observe the following:

IMPORTANT PRECAUTIONS

- Ensure that the motor coils are correctly connected before switching power to the drive
- Do not disconnect the motor with the drive energised
- Do not plug the drive into an energised connector
- Do not un-plug the drive from an energised connector
- Ensure that the output current settings are correct for the motor to be used
- Do not alter the output current settings with the drive energised
- Ensure that the Power supply requirements are correctly implemented.

Failure to observe the above precautions may cause damage to the drive and in some cases the motor and associated control devices.

Power supply requirements

The ***digitran*** drive requires a dc supply for energisation of the motor and it's internal logic circuit. In applications where limited step rate is acceptable a single rail 15-30 Vdc unregulated power supply may be used to feed both the motor and logic inputs. In such installations the PM/EM171, EM172 or EM173 units are ideal depending on the size and number of motors to be used. However, where high step rates are required a 50 Vdc motor rail is recommended.
In this case a separate logic supply of 15-30 Vdc (typically 18 Vdc) is required in which case:
IT IS IMPORTANT TO ENSURE THAT THE LOGIC SUPPLY IS SWITCHED TO THE UNIT BEFORE THE MOTOR SUPPLY AND THAT THE MOTOR SUPPLY IS SWITCHED OFF BEFORE THE LOGIC SUPPLY

When using the EM174 or the racked version type PM174 an internal circuit is provided to ensure the correct sequencing of the 50 Vdc motor supply rail (VMM) and the Logic supply rail (VLL) occurs automatically. The EM174 Power supply module will power up to 3 motor axes driven by ***digitran*** drives.

EM 170 series power supply modules are suitable for mounting in 19 in x 3U rack installations while PM170 series are provided together with the rack with sufficient space to fit up to 3 ***digitran*** drives or a two axis system comprising ***digitran*** drives and ***digistep*** controllers.

On-board current settings using TM164C & TM165C

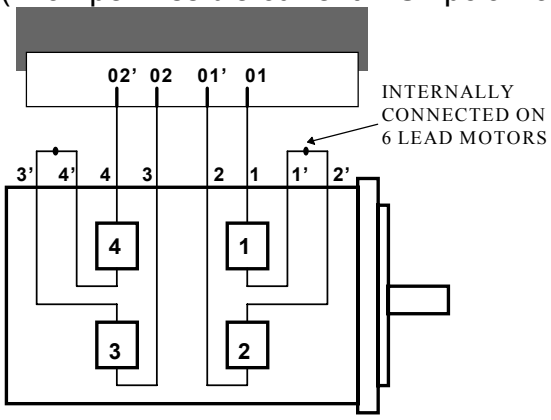
Both ***digitran*** drives utilise an 8 position DIL switch to enable the most popular motor phase currents to be set during commisioning.

internal current setting switch positions:

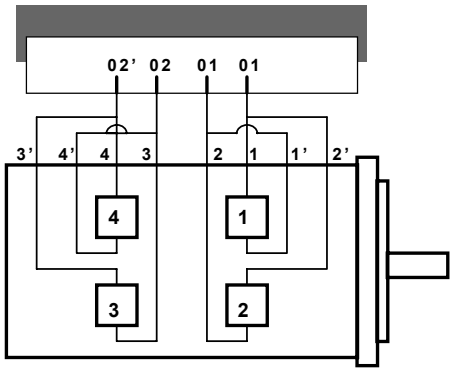
SWITCH POSITIONS								MOTOR PHASE CURRENT	POWER SUPPLY CONSUMPTION	
SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8		@ 24Vdc	@ 48Vdc
ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	2.0 Amps	2.0 Amps	1.5 Amps
ON	ON	OFF	OFF	ON	ON	OFF	OFF	3.5 Amps	3.0 Amps	2.0 Amps
ON	OFF	ON	OFF	ON	OFF	ON	OFF	4.0 Amps	3.5 Amps	2.5 Amps
ON	ON	ON	ON	ON	ON	ON	ON	4.5 Amps	4.0 Amps	3.0 Amps

Motor coils connected in series

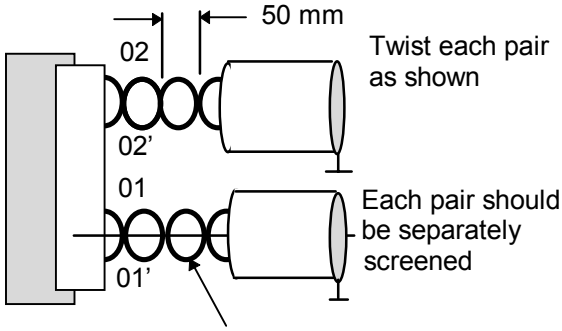
(Max permissible current = Unipolar rating / 1.4)



Motor coils connected in parallel



Motor lead preparation



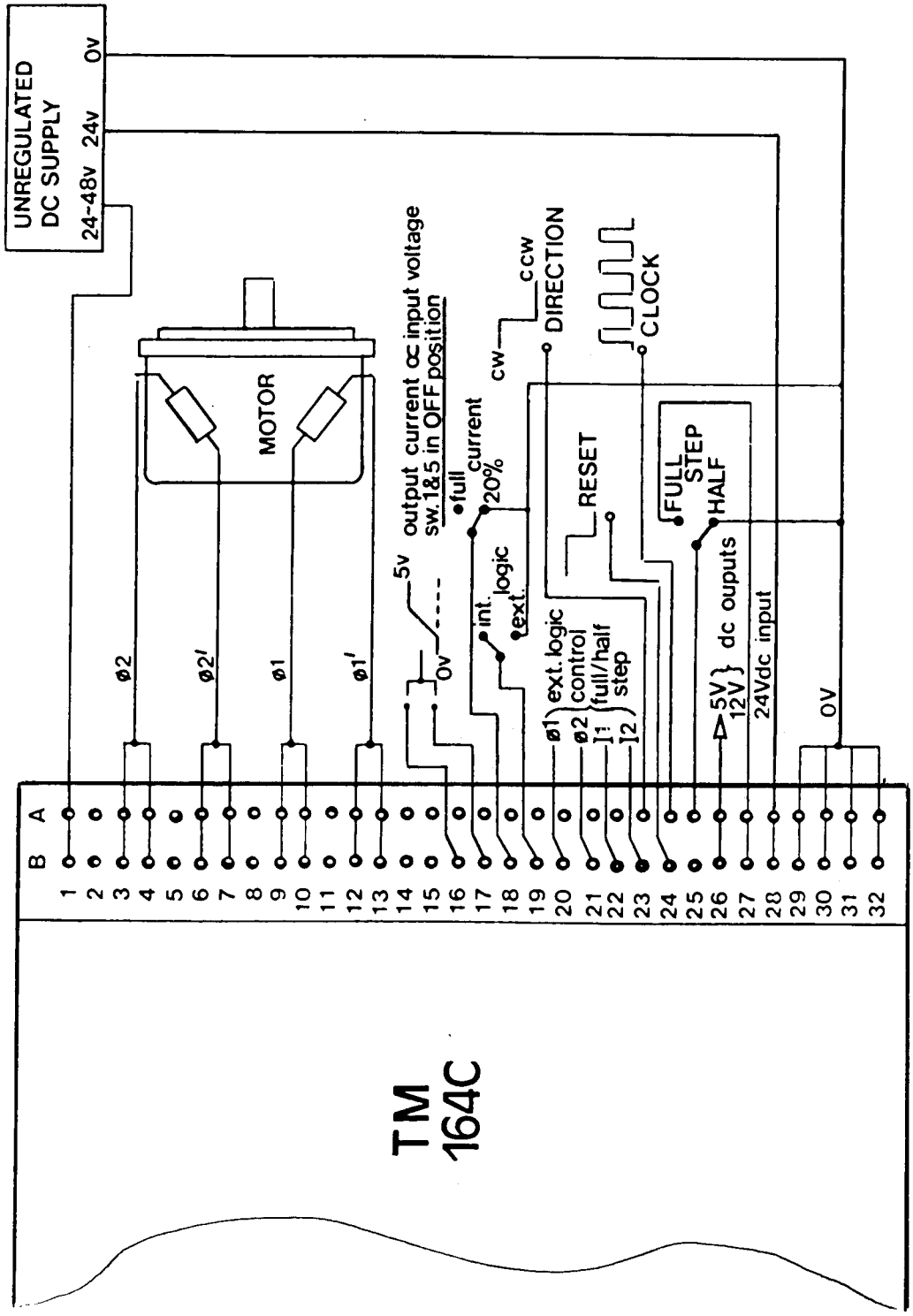
Use 1 mm^2 for distances up to 3 metres
Use 2 mm^2 for distances up to 15 metres
Use 4 mm^2 for distances up to 30 metres
Use 6 mm^2 for distances up to 50 metres

HS series motor lead colours

1	1'	2'	2	3	3'	4'	4
red	black	white	red/white	green	orange	white/black	green/white

Connections to TM164C & TM165C using an external clock

Connections may be made directly to the DIN connector of the ***digitran*** drives as shown below. Alternatively, the MSB108 motherboard may be used to provide external connections via solder-free screw terminals as shown on pages 9 & 10.



Using internal voltage controlled oscillator on TM165C

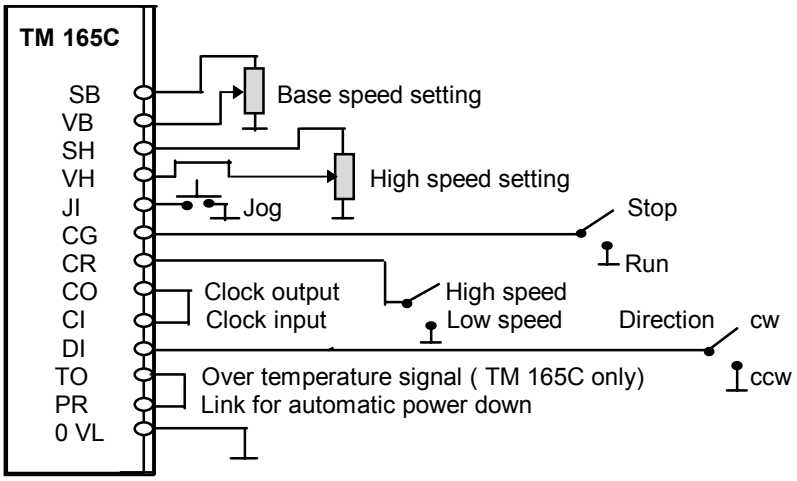
Digitran models TM165C and PM165C are provided with an internal oscillator as a standard feature.
The internal clock features Selectable BASE SPEED (run/stop without error) and HIGH SPEED drive frequencies, adjustable up to 10,000 steps per second. A linear RAMP circuit, adjustable over the range of 0.25 - 1.5 seconds enables the motor to be accelerated and decelerated at the start and end of each positioning cycle. An additional JOG circuit enables reliable single step operation from an external contact closure.

The internal clock provides a STAND-ALONE facility for operating the motor off-line from the main control system. It may also be integrated with PLC based systems to provide a run / stop function in simple positioning systems using proximity switches to detect target locations.
Separate logic gates and settings are provided for:

- Run / Stop gate
- Base (slow) speed / High speed gate
- Three Base speed ranges proportional to external 0 - 12Vdc signal
- Three High speed ranges proportional to external 0 - 12 Vdc signal
- Internal adjustment of ramp time

Alternatively, where more complex PLC based positional control is required the PM/TM165C drives may be used in conjunction with the PLC interfaced Indexer module type EM261. Using a typical arrangement, the PLC will control alternative step distances from 1 - 999,999 steps using 10 outputs and 2 inputs for hand-shaking purposes.

connections



control signals

Terminal	Pin No.	Function
SB	14a	Base speed potentiometer supply (12 Vdc)
VB	19a	Base speed command signal (0-12 Vdc): max rate: 3,500 Hz.
SH	15a	High speed potentiometer supply (12 Vdc)
VH	18a	High speed command signal (0-12 Vdc): max rate 10,000 Hz
JI	17a	Jog (single step) input signal
CG	20a	Internal oscillator RUN / STOP gate signal
CR	16a	High speed range / Low speed range gate signal
CO	21a	Internal oscillator clock pulse output signal
CI	24a	Clock pulse input signal (Link to 'CO' to use internal oscillator)
DI	23a	Direction input signal
TO	15b	Over temperature signal (TM165C only)
OVL	29a-32b	0V common
PR	18b	Power reduction signal (Link to 'TO' for automatic power reduction)

digitran connections using MSB108 motherboard

Connections to the PM 164C and PM165C ***digitran*** drives are simplified by the use of the MSB 108 motherboard. The following connections on pages 9 & 10 show the typical arrangement for implementing the drives when the internal step logic is used and connected for operation in the preferred 1/2 step mode.

Power Supply requirements:

The following diagrams show the connections for the drives when the PM174 power supply is used. This 50Vdc unit provides sufficient power for up to 3 ***digitran*** drives when optimum performance is required and is, itself, provided with a motherboard, type MSB107, which is recommended to simplify connections. Alternatively the PM/EM171, EM172 & EM173 Power supplies with a 24 Vdc output can be used where high step rates are not required. When these are used the 24 Vdc output is connected to both the VMM and VLL terminals on the MSB108 motherboard

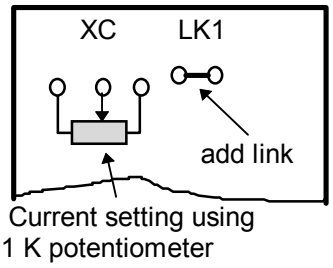
Motor current settings

The desired motor drive current can be pre-set between 2 and 4.5 amps using the on-board DIL switches as shown on page 5 in the handbook. Alternatively two other possibilities are available and commonly used with ***digitran*** drives:

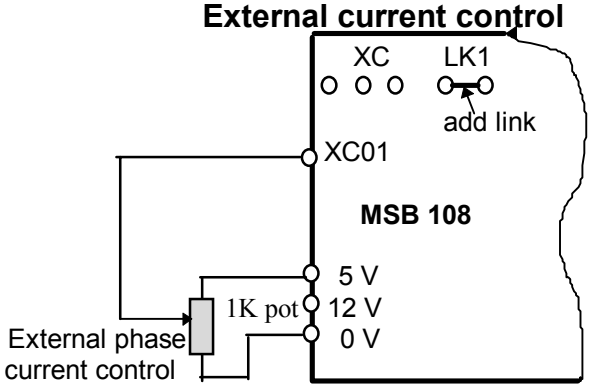
1) Alternative current settings:

If the current setting options are not ideal for the motor to be used,
set switches 2,3,4,6,7& 8 **ON** and set switches 1 & 5 **OFF**
Connect a 1 K potentiometer to the XC terminals and add a link as shown. The motor phase current can then be adjusted to any set value between 2 and 4.5 amps.

Alternative current setting using on-board trimmer



External current control

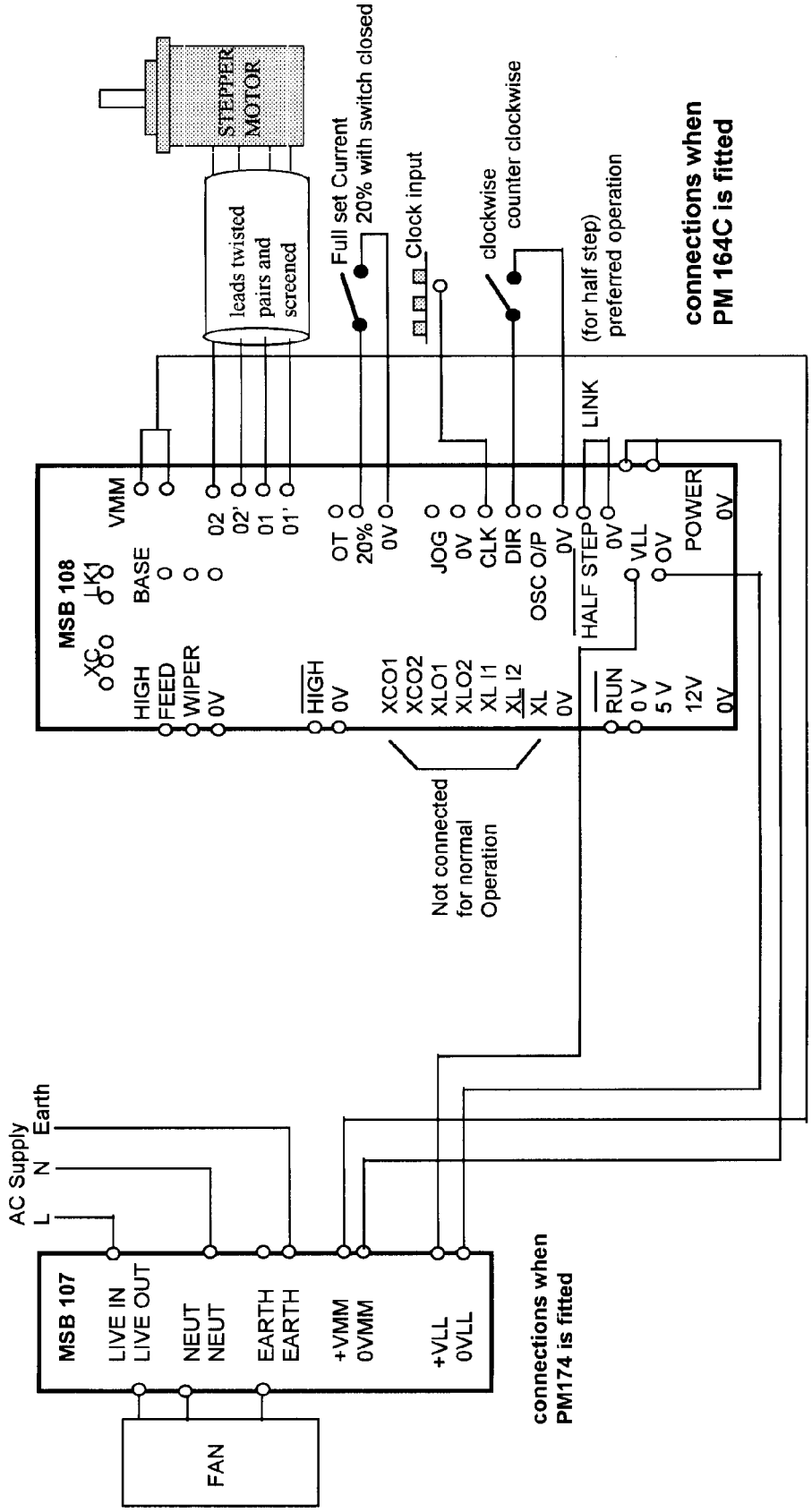


2) External Current settings:

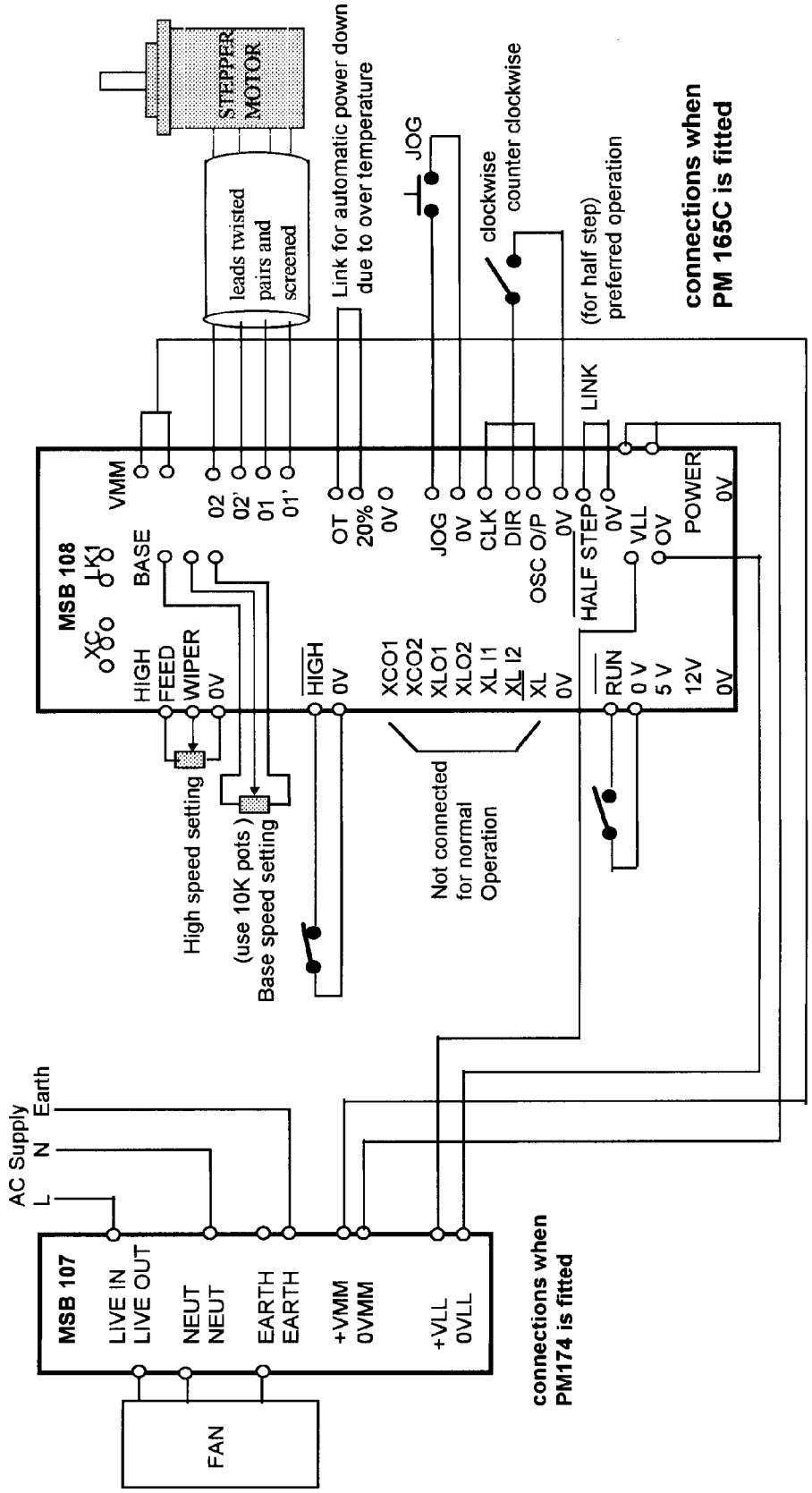
If the current is required to be adjusted externally with, for example, a panel mounted trimmer, set switches 2,3,4,6,7& 8 **ON** and set switches 1 & 5 **OFF**
Connect a 1 K potentiometer across the 5V and 0V terminals with the wiper connected to the XC01 terminal and **add a link across LK1**. The motor phase current can then be adjusted to any set value between 2 and 4.5 amps.

Whichever method is used for current setting, the value set may be reduced by connecting the 20% terminal to 0V for operation of the motor in a standstill condition.

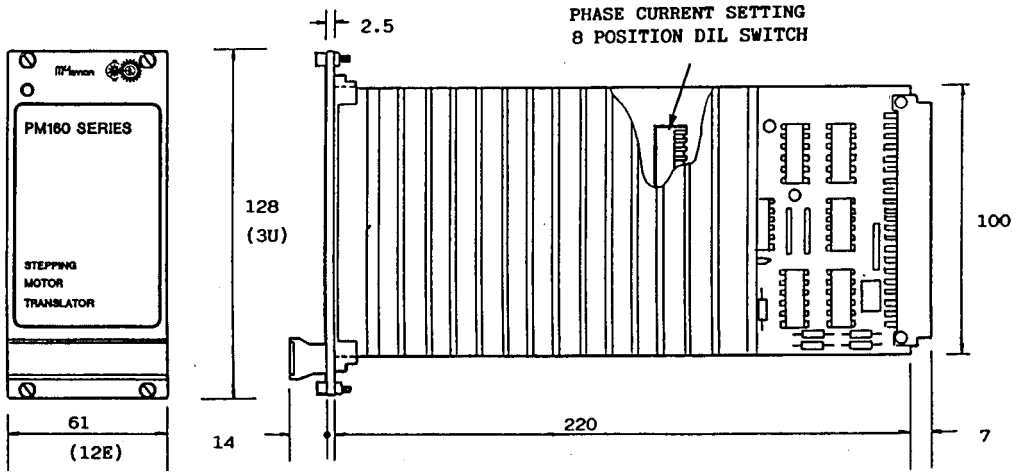
Connections when PM164C is used with MSB108 motherboard



Connections when PM165C is used with MSB108 motherboard



dimensions : mm



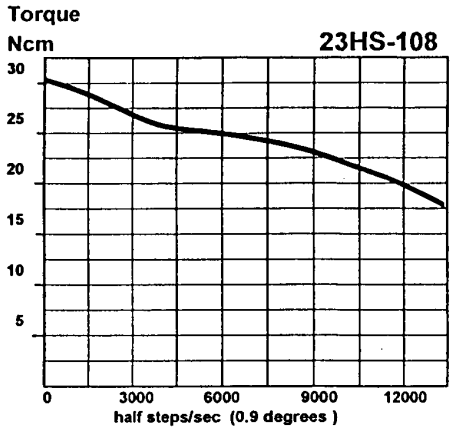
specification

Types without front panel Types with front panel		**TM 164C TM.165C** **PM 164C PM 165C**	**notes**
Motor supply	Vdc	15 - 50	Max ripple 3 V peak/peak
Max. input current	amps	4	depending on output setting
Logic supply max supply current	Vdc amps	15 - 30 0.5	motor supply may be used when below 30 Vdc

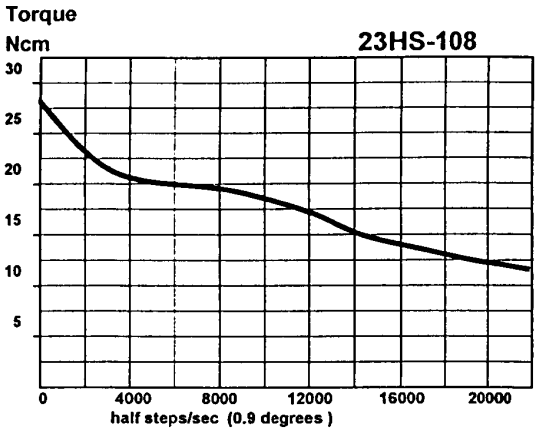
Important note: When using separate motor and logic supplies ensure that the logic supply has stabilised before switching on the motor supply. Also, ensure that the motor supply is switched off before the logic supply. This function is automatically provided when EM & PM series power supplies are specified.

Output stage		chopped constant current	low audible noise
phase control		2 phase BI-POLAR	
output current per phase	amps	2 - 4.5	adjustable using DIL switch
Full set current selection	PR	open circuit or '1'state signal	@ pin 18B
Power reduction	20 %	'0' state signal	@ pin 18B
Internal step logic control		optimised waveform	for increased response
Full step selection		open circuit or '1'state signal	@ pin 25A
half step selection		'0' state signal	@ pin 25A
external clock	trigger	'1' to '0' state signal	@ pin 24A
Minimum pulse duration	µ secs.	5	
clockwise motor rotation	DI	'1' state signal	@ pin 23A
counter clockwise rotation	DI	'0' state signal	@ pin 23A
External phase control			alternative to internal logic
phase polarity		'1' or '0' state signal	@ pins 20B & 21B
phase current proportional to	volts	0 - 5 signal	@ pins 22B & 23B
		TM 165C	**only**
Over temperature signal	TO	'0' state signal	@ pin 15B
Internal oscillator			
type		voltage controlled	with internal linear ramp
run / stop gate	CG	'0' / '1' state signal	@ pin 20A
base speed control signal	VB	proportional to 0-12 V signal	@ pin 19A
high speed control signal	VH	proportional to 0-12 V signal	@ pin 18A
single step jog signal	JI	'0' state signal	@ pin 17A
high speed / low speed gate	CR	'0' /'1' state signal	@ pin 16A
high speed reference supply	SH	12Vdc for 10 K pot.	@ pin 15A
base speed reference supply	SB	12Vdc for 10 K pot.	@ pin 14A
max. base speed setting	steps/s.	3,500 .	3 speed ranges available
max. high speed setting	steps/s.	10,000	3 speed ranges available
acceleration / deceleration ramp adjustment	seconds	0.25 to 1.5	adjusted by on-board trimmer

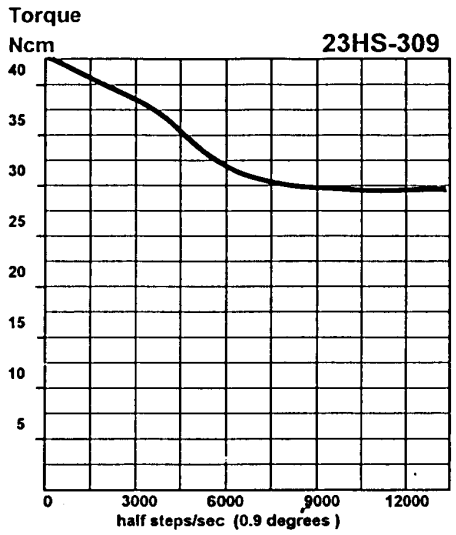
performance using TM164C with 50Vdc supply



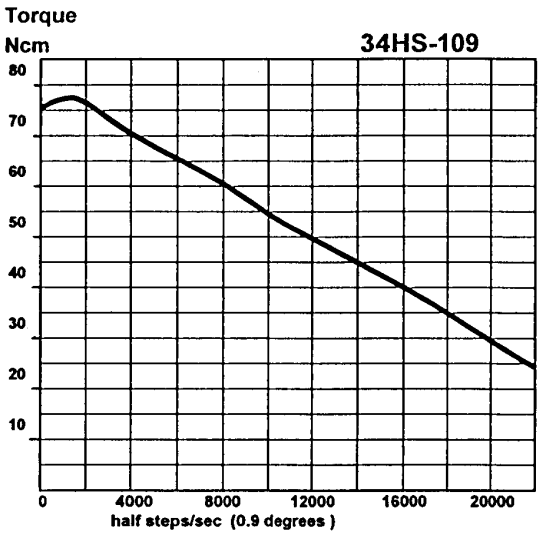
coils in series, 2.0 amps per phase



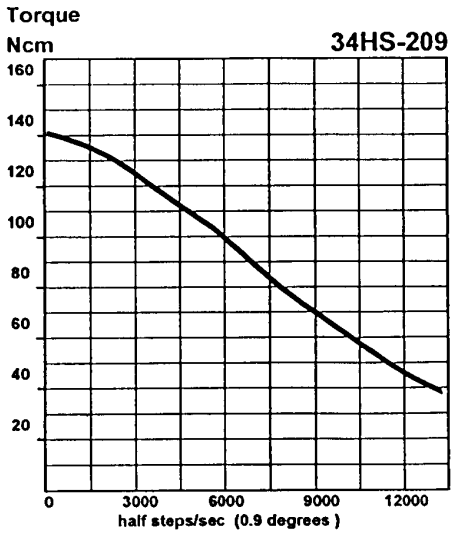
coils in parallel, 3.5 amps per phase



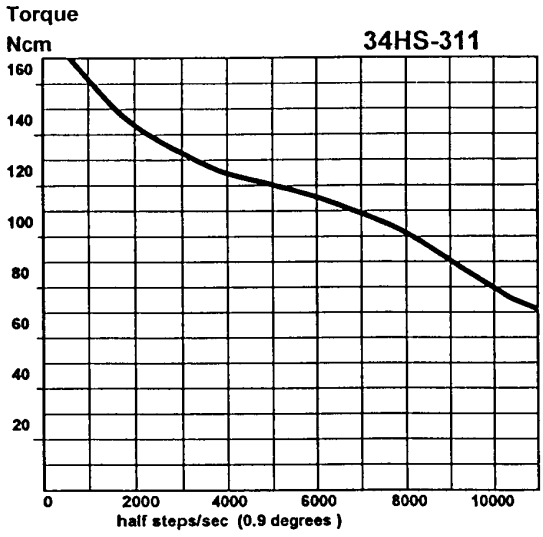
coils in parallel, 3.5 amps per phase



coils in parallel, 4.0 amps per phase



coils in parallel, 4.0 amps per phase



coils in parallel, 4.5 amps per phase