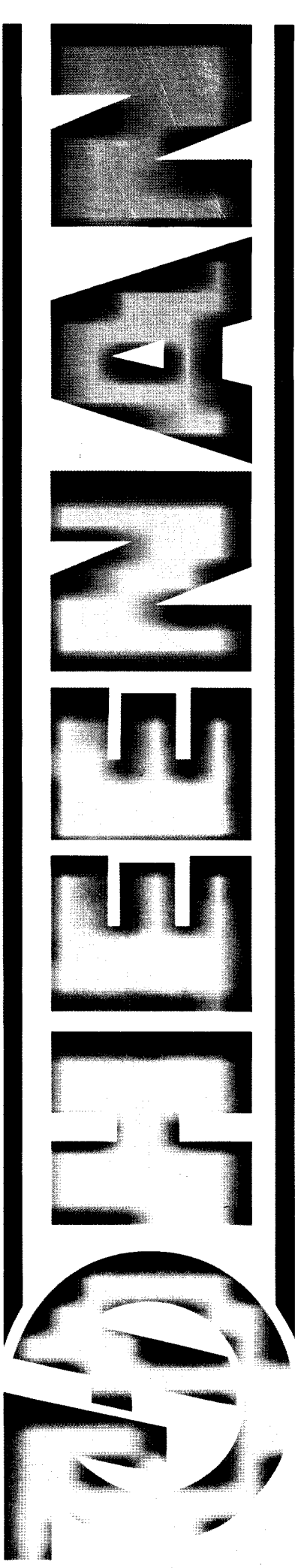
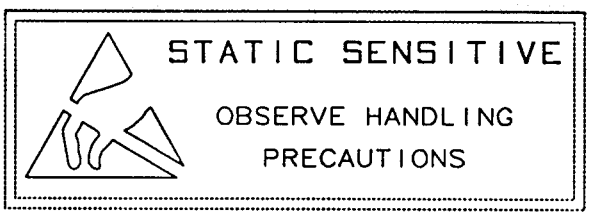
ID9001-II SERIES
Instruction Manual



INSTRUCTION MANUAL

TECHNICAL MANUAL FOR ID9001-II INVERTERS

Publication Number : 62-000 900-01



Ref. No. E2676

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SECTION 1

SPECIFICATION

1.1 Inverter General

Design	Voltage source IGBT pulse width modulated.
Input Voltage	380/415/440V 3 phase 50/60 Hz
Output Voltage	0 to 380/415/440V 3 phase
Output Frequency	0.5 to 120 Hz
Frequency Accuracy	± 0.05%
Volts/Frequency	Linear/Economy curve
Efficiency	Better than 95% at full load
Input Power Factor	Better than 0.95 lagging at all speeds
Ambient Temperature	-10° to 40°C
Storage Temperature	-40° to +70°C
Altitude	over 1000m derate by 1% per 100m
Humidity	20 to 90% RH non condensing
Maximum Vibration	0.2G

1.2 Inverter Ratings for 150% overload models

MODEL NO.	RATED CURRENT (AMPS)	NOMINAL MOTOR POWER (kW)
0052	12	5.5
0072	16	7.5
0112	25	11
0152	30	15
0222	47	22
0302	60	30
0372	72	37
0452	90	45
0552	110	55
0752	148	75
0902	170	90

APPLICATIONS NOTES:

1 For fan type loads select a model capable of 1.2 % overload based on selected motor full load current, after motor derating.

2 For constant torque loads select a model capable of 1.5 % overload based on selected motor full load current, after motor derating.

3 For vibrating conveyors, shakers or vibro-motor type loads, use a model capable of 2 x the motor full load current.

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SECTION 2

UNPACKING: GUARANTEE

2.1 Unpacking

The equipment is fully inspected and tested before being packed for shipment. It is prepared for transit by covering with plastic and/or a wood crate (Export).

Upon receipt, the Equipment should be inspected for any possible signs of damage during transit. The Packing Notes should be carefully checked to ensure all parts, boxes, etc. are accounted for. If any parts are damaged or missing, the Purchaser should immediately notify the Factory.

When moving the Equipment, it is recommended that a fork lift truck or lifting lugs (if provided) be used so that distortion will not occur. Also protect metal surfaces to keep the paint from being damaged, and ensure Meter and Relay Covers, Indicating Lamps, Switches etc. are not damaged.

After the initial inspection, the Equipment should be promptly moved to the final position or to a dry storage area. Indoor Equipment is not weatherproof and must be protected if it is necessary to temporarily store it in an outdoor area. In such cases, heaters should be placed in the Equipment and operated to prevent moisture accumulation. This is especially important if the storage is for more than a few days.

2.2 Guarantee

Heenan Drive's "standard" Guarantee Policy is listed as follows. Please keep in mind that this is a "standard policy" and your particular job agreement may vary from this. When in doubt, consult the Factory.

DEFECTS AND FAILURE TO COMPLY WITH SPECIFICATIONS OR AGREED STANDARD OF PERFORMANCE.

a] Your rights shall be your sole remedy for any failure to meet specification or standard of performance in respect of this contract.

b] We warrant that the goods/services supplied hereunder will meet any expressly agreed specifications and/or standard of performance at the date of delivery/completion. Any other condition or warranty as to the quality of the goods/services supplied hereunder or as to the fitness of the goods for any particular purpose or otherwise, whether arising under statute or otherwise, is hereby excluded.

c] Subject to the condition e] below, if on delivery/completion our goods/services are shown not to comply with such specifications or to be incapable of attaining such standard of performance as may be set out in the quotation or otherwise expressly agreed in writing, due solely to reasons for which we are entirely responsible, we shall restore the goods/services so that they comply with such specifications and/or attain such standards of performance. In the event that in spite of our reasonable endeavours the goods/services cannot be so restored, you shall be entitled to a refund of the appropriate proportion of the contract price.

d] Subject to condition e] below, we shall make good by replacement or (at our option) repair any failure (fair wear and tear excepted) in our products supplied which under conditions of proper use and maintenance, results directly from defects in our design, materials or workmanship and of which you give us notice within twelve months after the date of delivery or date of notification of readiness for delivery, whichever is the earlier.

e] Any repair work which we are required under these conditions to carry out or which we agree to carry out shall, at our option, be carried out at our own works. In the event that we agree in writing to any request by you to carry out such work at locations other than at our works, whether such work is deemed by us to be under warranty or not, then you will pay for all travelling and subsistence incurred by us and you will reimburse us our expenses for the same. You will provide at no cost to us such plant and labour deemed necessary by us to carry out such repair work.

f] Where the goods/services fail to comply with any expressly agreed specifications and/or standards of performance in such respect and manner as would entitle you in law to elect to reject the goods, your remedy in these circumstances shall be restricted to either a reduction in the contract price of rejection of the goods and refund of any contract price previously paid by you, but without prejudice to the generality of the foregoing, you shall in no circumstances have any claim whatsoever against us in damages in respect of the goods or services supplied by us.

Under no circumstances should any electrical connection be made to the inverter, other than those shown in the external connection diagram supplied by Heenan. Failure to comply with the above may void the warranty!

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SECTION 3

SAFETY

ONLY A COMPETENT ELECTRICIAN SHOULD BE ALLOWED TO CARRY OUT INSTALLATION, COMMISSIONING OR MAINTENANCE OF HEENAN ID9001-II SERIES INVERTERS

ALWAYS CHECK BY MEASUREMENT THAT THE INVERTER IS ISOLATED AND ELECTRICALLY DEAD BEFORE BEGINNING ANY MAINTENANCE WORK

WAIT AT LEAST 5 MINUTES FOR THE CAPACITOR TO DISCHARGE BEFORE TOUCHING ANY COMPONENTS INSIDE THE INVERTER. IF IN DOUBT, CHECK BY MEASUREMENT THAT THE CAPACITOR VOLTAGE HAS DECREASED TO A SAFE WORKING LEVEL

Voltages, up to 440V a.c. and 800V d.c. are present within an ID9001-II inverter.

Switching off the inverter isolator does not guarantee that the unit is electrically dead, as other remotely supplied equipment/signals present inside the inverter cubicle may still be active. Always check by measurement and ensure remote power sources are isolated and may not be re-energised before commencing maintenance work.

The unit should always be connected firmly to earth.

DO NOT connect or disconnect oscilloscopes, meters etc. to or from the inverter while it is energised.

DO NOT connect any grounded measuring equipment to the inverter.

DO NOT store any flammable material, in, around or on inverter enclosures. (This includes equipment drawings).

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SAFETY INSTRUCTIONS

1 Compliance with Instructions in this Manual

The purchaser should comply with the instructions and information in this manual and all personnel to be associated with the apparatus under this contract should be made familiar with the information contained herein. This should include adherence to BS CECC 00015 which outlines protection of Electrostatic Sensitive Devices, as this equipment is considered to be an Electrostatic Sensitive Device. The user should note that the requirements of this Foreword apply only to the apparatus supplied for installation and use in the United Kingdom (UK) and which are therefore subjected to the UK Health and Safety at Work Act, 1974, but provide prudent safety guidelines for users outside the UK.

The user should note any local or national safety precautions that are to be taken.

2 Guidance Notes for the Safety of Personnel Using Electrical Apparatus

The above Act stipulates that electrical apparatus shall be designed, tested and installed to be safe and without risk to health when properly used and that information is provided on the conditions necessary for safety and on any hazards which could arise during normal use and how these are to be avoided.

The above Act stipulates that the User, on his/her part, shall ensure that his/her employees are informed, trained and supervised and use proper working procedures to ensure their safety. He/she is advised to comply with the information provided in order to maintain the plant in a safe condition.

Compliance with these two basic requirements ensures that under normal healthy plant operating conditions, the apparatus will be safe for use by electrically unskilled operators.

With certain categories of apparatus as identified later in this Section, safety hazards may arise when it is necessary to gain access by opening enclosures, removing covers, etc., in order to carry out maintenance work, testing, setting-up, etc. This is especially the case when the apparatus cannot be completely isolated before working on it, as, for example, where circuits must be energised for the purpose of carrying out electrical tests.

As it is often impracticable or impossible to achieve hazard free conditions when working with energised circuits, the main burden of responsibility for the safe conduct of those carrying out the work rests on those under whose authority they act.

3 Operation and Maintenance

The Purchaser is advised to ensure that the apparatus supplied by the Company to the purchaser's order is correctly installed, in a suitable location, by technically qualified and competent persons experienced in the class of work involved.

The rules for ensuring the safety of personnel can be summarised under the following headings.

3.1 During Normal Use

Ensure that the plant operators :

Are fully conversant with all controls, particularly those for emergency shut down.

Comply with safety warning notices and keep all enclosures shut.

Are trained to recognise signs of maloperation and shown what action to take in the event of trouble or difficulty.

3.2 During Maintenance and Testing or Other Work involving Electrical Competence

Ensure that only suitably skilled persons are permitted to carry out work and that they :

Isolate the apparatus completely, wherever possible, before opening enclosures and starting work.

Comply with safe working procedures.

Are conversant with the information provided, particularly on measures relating to their safety.

Recognise the hazards which can arise when working on energised apparatus and take all the necessary precautions.

4 Voltages Greater than 650V

The purchaser's attention is drawn to the Electricity Regulations (Factories Act 1961) Ref.18d, in relation to work done on any apparatus of nominal voltage greater than 650V.

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5 Special Areas of Danger

Care should be taken when working on apparatus, as capacitors are included within the unit which will remain charged for sometime after supply is disconnected.

Therefore, a sufficient time should be allowed for discharge of these capacitors before entering apparatus - if in doubt, check by measurement that the capacitors voltages have decreased to a safe working level.

6 Important System Design Considerations

In normal operation, the motor can be stopped by operating the inhibit circuit to the inverter or by deactivating the set point signal. However, where accidental starting of the motor must be avoided for reasons related to the safety of operating personnel, then the electronic interlock is insufficient and the supply voltage to the inverter should be disconnected through a suitable input device.

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SECTION 4

INSTALLATION

4.1 General

Install units in an accessible, well illuminated position which is relatively free from dust, heat, damp and vibration. It is advisable to have standard 240V a.c. outlets within approximately 20 feet of the installation.

The unit should not be exposed to corrosive or flammable gases, conductive dust, strong magnetic fields, nuclear radiation or high levels of radiated radio frequency interference.

Exposure to abrasive dust, steam, condensation, oil vapour or salt air may result in reduced equipment lifetime.

Details of unit dimensions, general arrangements etc. are given in the back of this manual, in Section 11 "Dimensions".

4.2 Electrical Installation

All cable entry to a standard ID9001-II is via the bottom of the unit. The data table below, gives the size of the customers connections and recommended cable sizes. (Note: This does not apply to 12 pulse models).

Earth terminal is provided for mains and motor earth connections.

Motor cables should be armoured or enclosed in earthed trunking to prevent excessive RFI emission due to the rapid switching of the inverter PWM output.

Screened signal cables should be kept at least 10cm away from any paralleled power cable runs and preferably run in separate earthed trunking. If signal cables have to cross power cables, then the crossing should be such that the cables are at right angles to each other.

The maximum length of any single cable run should not exceed 50m.

Table 4.1 - Cable and Terminal Details

MODEL NO	MAX CONTINUOUS CURRENT (amps)	POWER TERMINALS	CONTROL/SIGNAL TERMINALS (mm^2)	POWER CABLE* (mm^2)	CONTROL CABLE (mm^2)	SIGNAL CABLE
0052	12	$10mm^2$	0.5	4	0.5 to 4	Screened cable of 0.75 mm^2 or greater
0072	16	$10mm^2$	0.5	4		
0112	25	$10mm^2$	0.5	6		
0152	30	$10mm^2$	0.5	10		
0222	47	$10mm^2$	0.5	10	0.5 to 4	Screened cable of 0.75 mm^2 or greater
0302	60	$35mm^2$	0.5	16		
0372	72	$35mm^2$	0.5	25		
0452	90	$35mm^2$	0.5	35		
0552	110	$35mm^2$	0.5	35		
0752	148	Stud	0.5	50	0.5 to 4	Screened cable of 0.75 mm^2 or greater
0902	170	Stud	0.5	70		

* Single core p.v.c. insulated cable.

Note: All cables should always be selected by user to suit site conditions and cable type, with the above table used for guidance only.

4.3 EMC and 9001-II

The standard 9001-II VSD fulfils the present requirements of the immunity standard EN50082-2. To comply with the emission limits in the EMC standard EN50081-2 all 9001-II variable speed drives require an additional input filter. These are currently supplied by Heenan Drives Limited as additional loose items.

To ensure compliance with the emission standard the 9001-II, motor cables and mains filter must be correctly installed.

Installation of the Mains Filter

The filter must be placed as close to the 9001-II as is practically possible, so that the cables between the filter and the 9001-II are less than 300mm. The earth cable from the supply must be connected onto the LINE side of the filter and an additional earth placed between the LOAD side of the filter and the earth point of the 9001-II as indicated in the figure below.

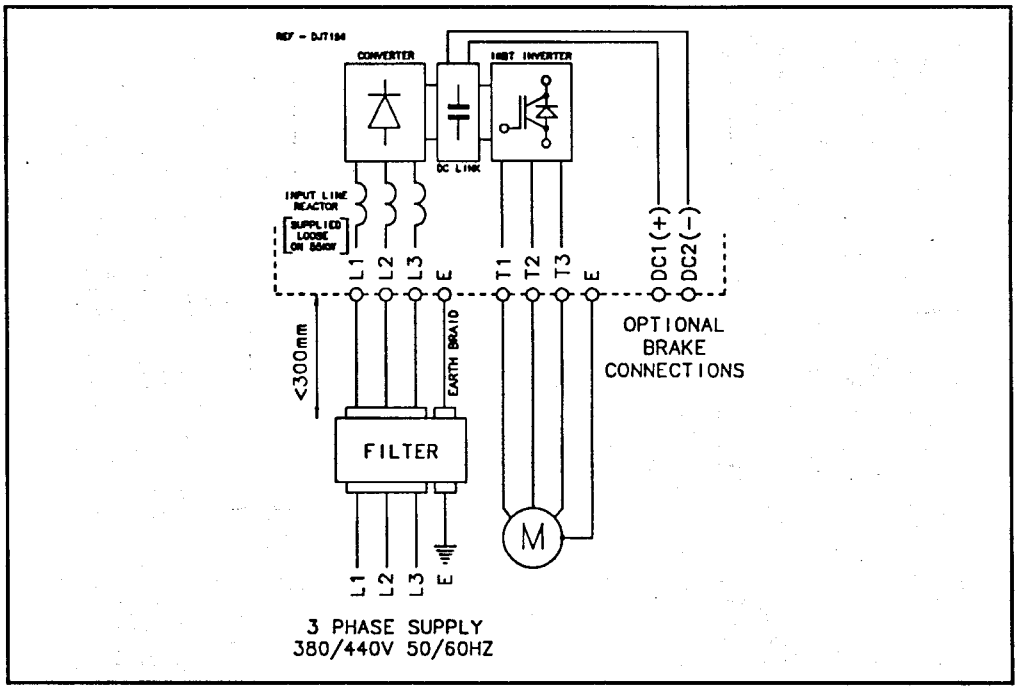


Figure 4.1 - EMC Requirements

It is important that the earth bond between the mains filter and the 9001-II is of low impedance at high frequencies, therefore it is recommended to use a copper braid connector rather than green/yellow cable.

Installation of the Motor Cables

Four cored armoured cable should be used as motor cables. The armour must be insulated and terminated at the 9001-II and the motor via a 360° termination. It is important that the armour is continuous between the motor and 9001-II, as the armour carries the high frequency noise from the motor and cables back to source i.e., the 9001-II.

General Installation

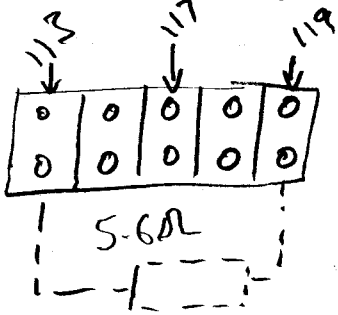
The standard control scheme applies for all control cables. Screened cables must be used where applicable, terminating the screen at the 9001-II end only.

No additional earth conductors should be made to the 9001-II and motor, other than those mentioned in the document.

The three phase and earth conductors to the LINE side of the mains filter should be separated from the motor cables by at least 300mm.

No control cables should be run in parallel with the mains or motor cables. A minimum separation of 300mm should be observed.

FOR THAMES WATER LIVE KEYPAD MODIFICAT.



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4.4 Fusing

Not all Inverter models are fitted with their own internal fuses. External fusing is required; take the maximum drive rating in amps, multiply by 1.1 and choose the next size up standard HRC fuse. If fusing for a multiple drive installation is required, total up the total ampere rating of the drives and treat as for a single drive. Any decision on fusing should take account of protection of conductors. (See figure 4.1). It is preferred that each drive should be fused separately.

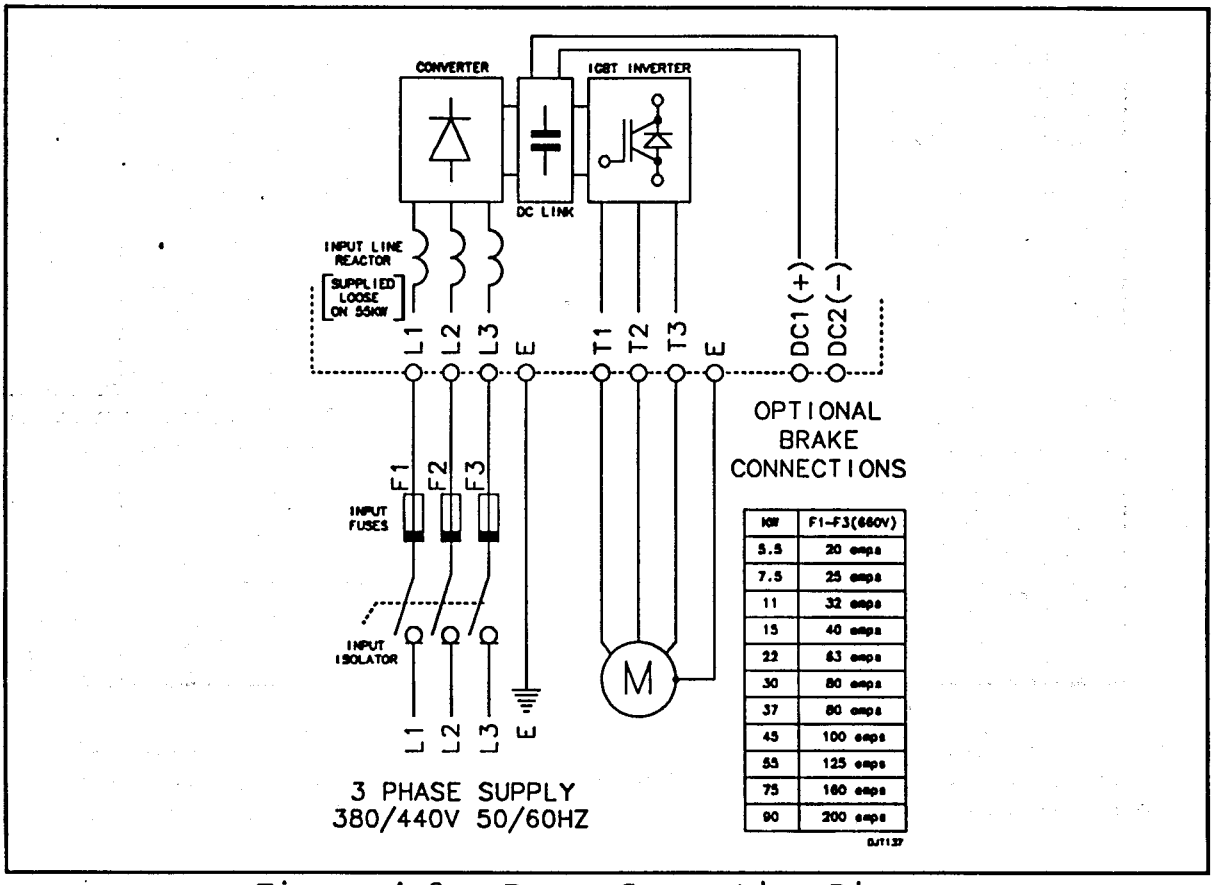

Figure 4.2 - Power Connection Diagram

4.5 Electromagnetic Circuit Breaker Rating

Cubicle versions of the ID9001-II inverter have an electromagnetic circuit breaker built in on request. It may be mechanically operated via a handle on the cubicle door, or will trip on a short circuit within the inverter.

IP20 versions are generally supplied without a circuit breaker fitted.

External circuit breakers should be rated to protect both the inverter and motor. (see previous section on Fusing).

4.6 Supply Rating

4.6.1 Transformer

If an ID9001-II is to be operated from a transformer outstation then the transformer should have a kVA rating of at least twice the total inverter kW rating. Heenan Drives can evaluate if necessary.

4.6.2 Generator

When operating on a generator the sub-transient reactance is in the order of 3 times the equivalent transformer reactance. This factor should be taken into account, hence the generator kVA rating should be six times the total inverter KW rating, thus maintaining a similar level of voltage distortion to that of the transformer. Heenan Drives can evaluate if necessary.

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4.7 Use of Measuring Instruments

The ID9001-II series inverters provide indication of motor current, voltage, power consumption and frequency of operation. However if extra instrumentation is required, specific types of instrument must be used to accurately measure the inverter input and output. Table 4.2 indicates the type of instrument required, against specific measurements.

Table 4.2 - Measuring Instruments

MEASURED QUANTITY	INSTRUMENT TYPE	REMARKS
Input voltage	Moving Iron or Rectifier	Measure between incoming phases. Meter rated for 50/60Hz operation (as applicable)
Input current	Moving Iron	Measure incoming line Current
Input power	Electrodynamic	Use three or two wattmeter method
Output voltage	Rectifier (not moving iron)	Measure between outgoing motor phases
Output current	Moving iron	Measure motor line current. Note: CT's should be overrated by a factor of at least 3 to give accurate readings over a wide speed range
Output power	Electrodynamic	Use three or two watt meter method. Note: CT's should be overrated by a factor of at least 3 to give accurate readings over a wide speed range.

4.8 Ventilation Requirements

The ID9001-II series drives are highly efficient, however, the following ventilation requirements are required to ensure that the drive internal losses may be adequately dissipated.

Cubicle versions of the ID9001-II have their own internal fans to extract and vent heat generated by the drive to the outside of the enclosure. Air is drawn in at the bottom of the cubicle door and vented out of the top of the cubicle door. Care should be taken to ensure that the inlet air temperature does not exceed 35°C. Therefore keeping average cubicle temperature below 40°C

IP20 versions only have a fan fitted to each heat sink and so customers must provide their own ventilated enclosure. Air should be drawn through the chassis unit, as indicated in Figure 4.3, with an inlet air temperature not exceeding 40°C.

In Multiple drive installations or large motor control panels care should be taken so that heat radiated from adjacent components or sections do not cause the temperature rise inside the drive enclosure to exceed 10°C.

Table 4.3 indicates the heat losses and necessary ventilation for models of six pulse inverters. This table should not be applied to twelve pulse inverter installations.

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Table 4.3 - Ventilation Requirements

SIX PULSE ID9001-II		
MODEL NO	INVERTER LOSS (APPROX) (KW)	NECESSARY VENTILATION (M^3/min)
0052	0.26	1.3
0072	0.38	1.9
0112	0.6	2.4
0152	0.8	4.0
0222	1.1	5.4
0302	1.4	6.9
0372	1.75	8.7
0452	1.9	9.4
0552	2.8	14.0
0752	3.8	19.0
0902	4.5	22.5

Where filters are fitted to enclosure fans ensure that the effect of dirty air filters is taken into account when designing a ventilation system. Adequate ventilation is a critical part of an inverter installation. Engineers at Heenan Drives should be consulted if there is any doubt.

Always ensure that fan filters are cleaned regularly as part of routine maintenance.

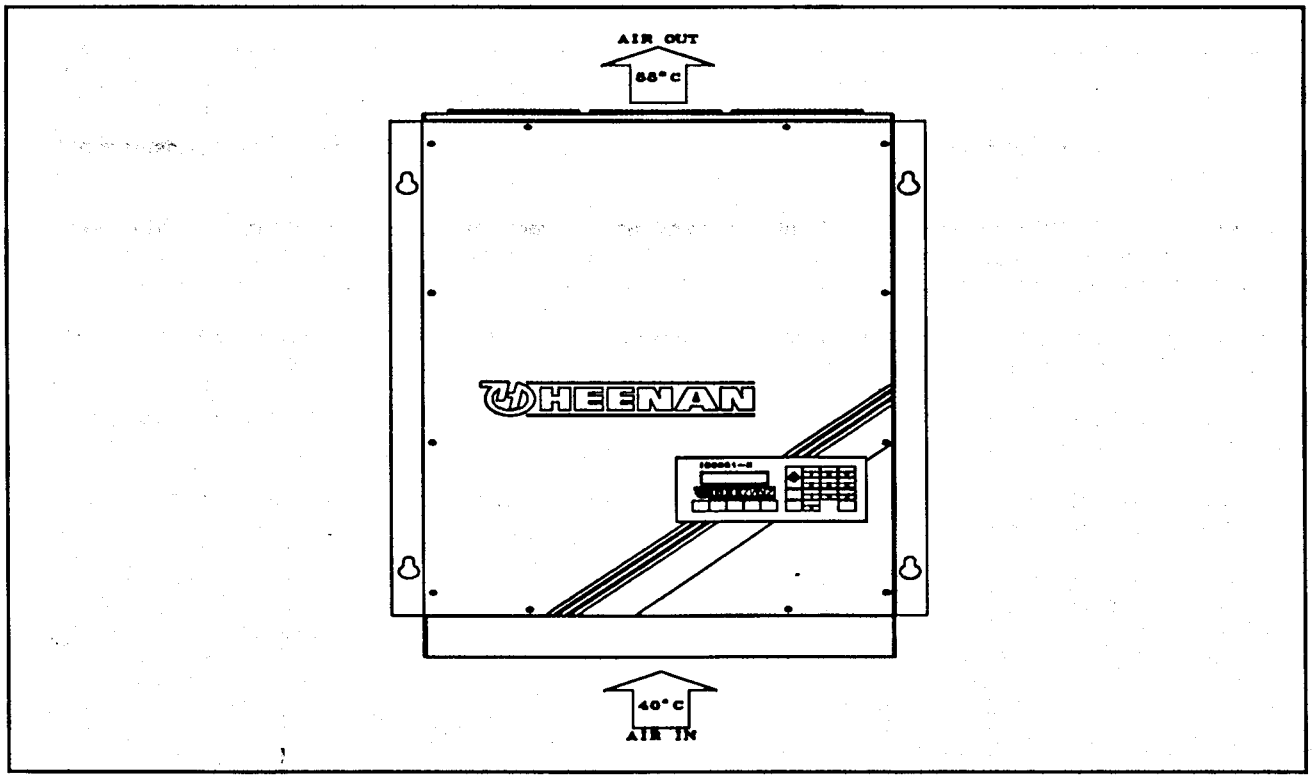

Figure 4.3 - Ventilation Requirements

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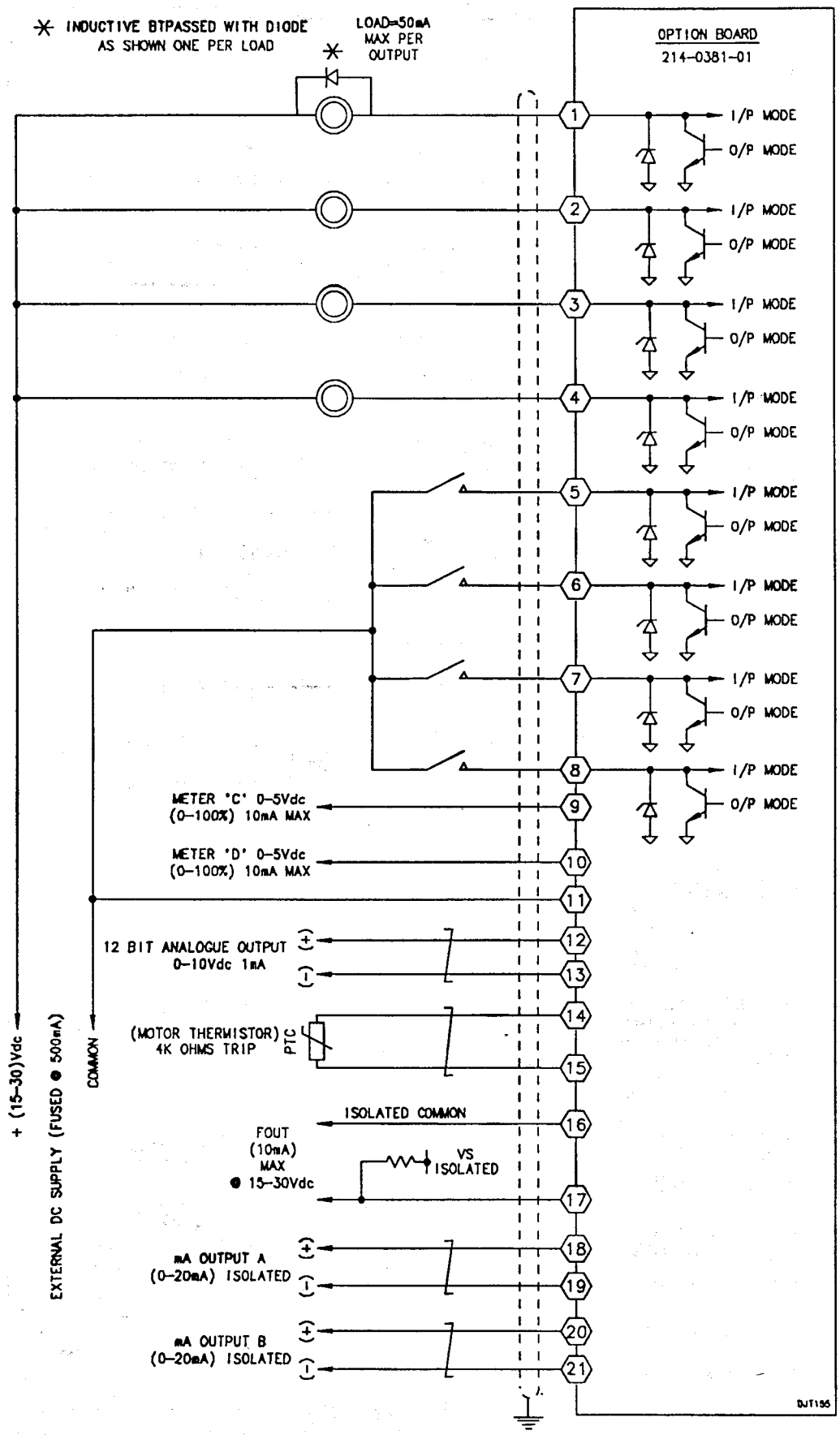

Figure 4.4 - Option Card Wiring Scheme

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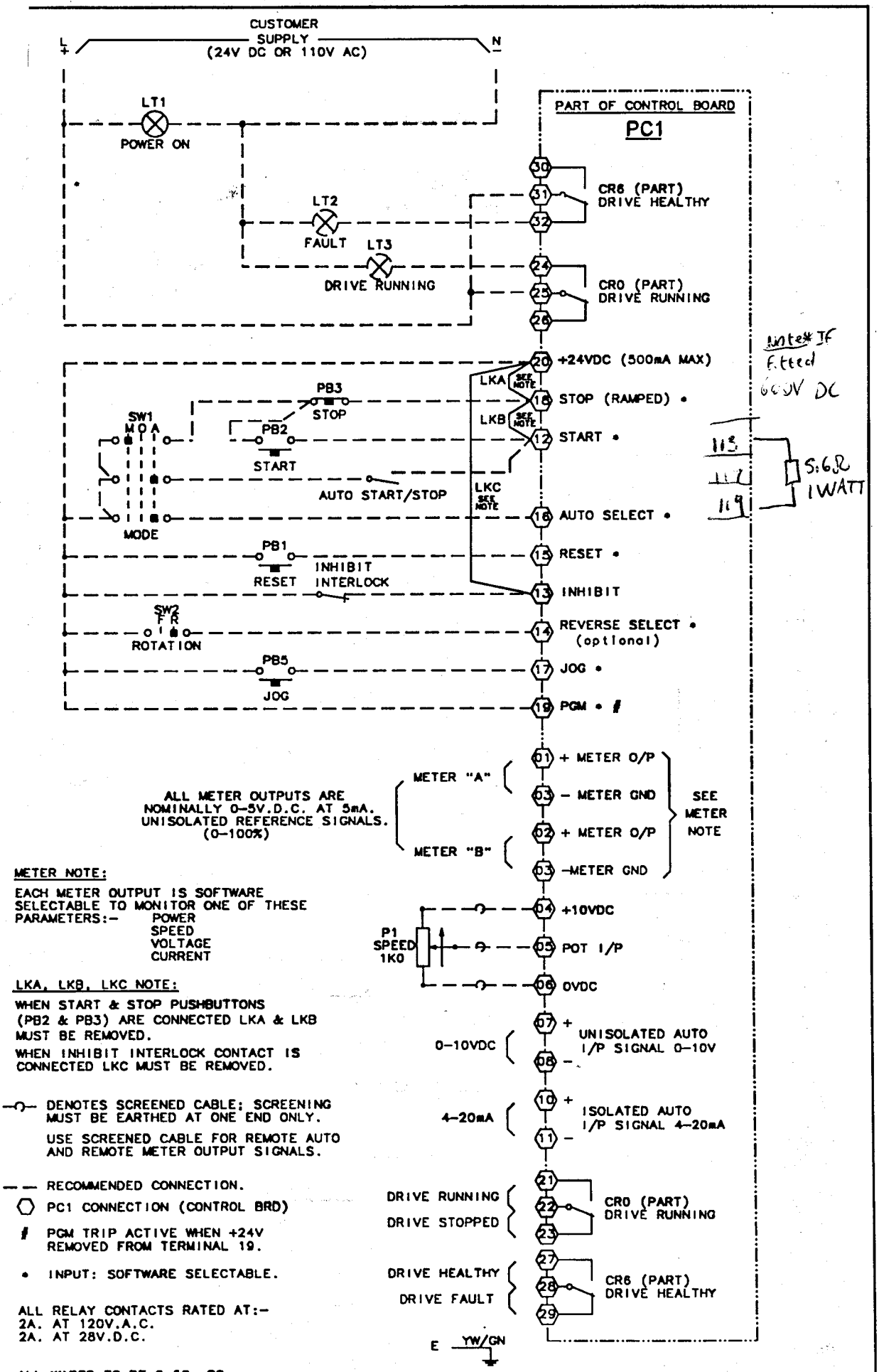

ALL METER OUTPUTS ARE NOMINALLY 0-5V.D.C. AT 5mA. UNISOLATED REFERENCE SIGNALS. (0-100%)

METER NOTE:

EACH METER OUTPUT IS SOFTWARE SELECTABLE TO MONITOR ONE OF THESE PARAMETERS:-
- POWER
- SPEED
- VOLTAGE
- CURRENT

LKA, LKB, LKC NOTE:

WHEN START & STOP PUSHBUTTONS (PB2 & PB3) ARE CONNECTED LKA & LKB MUST BE REMOVED.
WHEN INHIBIT INTERLOCK CONTACT IS CONNECTED LKC MUST BE REMOVED.

—○— DENOTES SCREENED CABLE; SCREENING MUST BE EARTHED AT ONE END ONLY.
USE SCREENED CABLE FOR REMOTE AUTO AND REMOTE METER OUTPUT SIGNALS.

— — RECOMMENDED CONNECTION.

⬡ PC1 CONNECTION (CONTROL BRD)

PGM TRIP ACTIVE WHEN +24V REMOVED FROM TERMINAL 19.

• INPUT: SOFTWARE SELECTABLE.

ALL RELAY CONTACTS RATED AT:-
2A. AT 120V.A.C.
2A. AT 28V.D.C.

ALL WIRES TO BE 0.50mmSQ. UNLESS OTHERWISE MARKED
D.C. VOLTAGE CONTROL CABLE LENGTHS TO BE 5 METRES (MAX).

Figure 4.5 - Typical Control Connection

4.9 Use of Power Factor Correction Capacitors

Power factor correction capacitors should never be connected to the output (motor terminals) of the inverter. The switched nature of the inverter output voltage will cause possible damage to the inverter or capacitors and also prevent the inverter from operating.

Power factor correction capacitors should only be connected to the mains supply, (i.e., input side of the inverter).

4.10 Use of a Fixed Speed Bypass

If a fixed speed bypass is to be used in a drive system incorporating an ID9001-II inverter, then great care should be taken to be sure that at no time the mains supply is applied to the output (motor terminals) of the inverter. Switches, contactors etc., used in the system should be interlocked to ensure that a mains to inverter output connection can not occur; or else damage to the inverter will result.

4.11 Operation of Brake Motors

There are two basic types of brake motors. Those with mechanically operated brakes, where the transient breakaway torque of the motor is required to free the brake or the electromagnetic type where the brake is held off by an electrically energised solenoid.

The ID9001-II series inverter, in common with all electronic drives, can not be used on the mechanical type, as the soft start provided to the motor produces insufficient torque to break the action of the brake.

The electromagnetic type of brake motor may easily be used with an ID9001-II inverter. However, a separate power supply is required for the brake solenoid, as the inverters reduced voltage motor start would be insufficient to release the solenoid if common connection was maintained.

By initiating the solenoid via the drive "running" and drive "fault" relays it is possible to cause the solenoid to release as the inverter is initiated and to operate the brake again when the inverter is either stopped or a fault condition occurs.

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SECTION 5.

PARAMETER DESCRIPTIONS

5.1 General Keypad Description

The ID9001-II in common with all the ID range of drives, has a very powerful and flexible library of parameter settings, allowing the drive to be optimised for many different applications. Parameters are selected and changed via a keypad, which is normally mounted on the front of the drive enclosure. The keypad is fitted with a liquid crystal display (LCD), which indicates the drive status, fifteen keys to allow parameter adjustment and five keys which allow optional operator control of the drive.

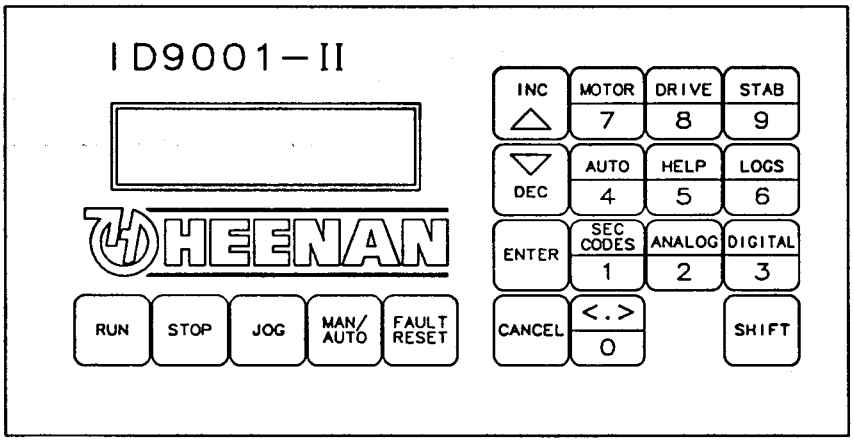

Figure 5.1 - ID9001-II Keypad General Arrangement

5.2 Display Description

The LCD display will, once the drive is energised, normally be as shown.

```
 SXXX%  SXXXHz
MMMM XXXXA XXXkW
```

where:-

S	is a sign character
X	is a decimal digit
%	is the demanded percentage drive speed, from the manual speed potentiometer, or the auto control process.
RPM/HZ	is the inverter output frequency in Hertz or speed in RPM. NOTE : RPM/Hz is selectable via the keypad.
A	is the actual motor current in Amps.
kW	is the actual power being absorbed or returned by the motor in kW's.
MMMM	is the drive Mode, which can be :-

1 AUTO - Indicates that the inverter is in the Auto mode, from the Man/Auto switch or keypad.
2 INH - Indicates that the inverter emergency stop is engaged (or some other external inhibit).
3 MAN - Indicates that the inverter is in the Manual (or hand) mode, from the Man/Auto switch or keypad.
4 R/BK - Indicates that the inverter is in the frequency rollback mode and is working in an overload condition.
5 JOG - Indicates that the inverter is in Jog mode, from the jog switch or keypad.
6 R/UP - Indicates that the inverter is in frequency roll up mode and is working in a regenerative condition.
7 PS_F - Indicates that the input supply has failed and the inverter cannot be started.

5.3 Key Function Description

Five of the keys on the keypad are primarily used for parameter changing only. These are:-

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Shift

This is a single function key and is used to enable the upper function mode on the multi function keys. When the SHIFT key is pressed "S" is displayed in the upper right hand corner of the display, informing the operator that they have selected the upper function mode. If the display was already showing "S", then pressing the SHIFT key cancels the upper function mode.

Cancel

This is a single function key and is used for going back one level of nesting in the multi function keys. Continual pressing of the CANCEL key will eventually return to the normal display.

Enter

This is a single function key and is used for going down one level of nesting in the multi function keys. Once data has been changed pressing the ENTER key will store the data into the non volatile random access memory (NVRAM).

Up-Arrow (INC)

This is a single function key and is primarily used for scrolling the menus on multi function keys. When data is being displayed, pressing the UP ARROW key will increment the data by one and on particular parameters, automatically enter the data into NVRAM. By holding the "UP ARROW" key pressed in, the displayed data will be auto incremented. This key can also be used to increase speed demand from the keypad, when enabled in the software.

Down-Arrow (DEC)

This is a single function key and is primarily used for scrolling the menus on multi function keys. When data is being displayed, pressing the DOWN ARROW key will decrement the data by one and on particular parameters, automatically enter the data into NVRAM. By holding the "DOWN ARROW" key pressed in, the displayed data will be auto decremented. This key can also be used to decrease speed demand from the keypad, when enabled in the software.

NUMBERED KEYS

The remaining keys, "1" to "9", have upper functions allowing access to parameter menus or functions; "0" to "9" may also be used for entering new parameter settings.

Security codes may be assigned to each of the "FUNCTION" keys to restrict access to particular parameter families. If software security codes are required to be set, refer to Section 5.6.

OPERATOR KEYS

Run	This key can be used, when enabled in software, to start the drive under ramp control in manual mode.
Stop	This key can be used, when enabled in software, to stop the drive under ramp control in manual mode.
Jog	This key can be used, when enabled in software, to jog the drive, where the drive ramps up to set the Jog Speed while the jog key is pressed in manual mode.
Man/Auto	This key can be used, when enabled in software, to select Manual or Automatic operation.
Fault Reset	This key can be used to reset the drive after a fault has occurred. This key is always operational.

5.4 Parameter Changing

To change a parameter press "SHIFT" and then the particular function key required, e.g. "MOTOR".

The display will now display the first of the parameters under the particular function family selected. Use "UP ARROW" and "DOWN ARROW" to scroll through the menu until the parameter which is to be changed is seen on the display. (If it is decided not to change any parameters press "CANCEL" to revert to the normal display). Automatic scrolling is performed if the "UP ARROW" and "DOWN ARROW" keys are held pressed.

To change the displayed parameter value, press "ENTER". A cursor will appear next to or under the parameter setting, press "UP ARROW" or "DOWN ARROW" to increment or decrement the parameter; alternatively use the numerical keys "0" to "9" to enter the new value required. (Numerical entry scrolls around, so if an incorrect entry is made, continue entering digits until the cursor returns to the beginning of the entry; then re-enter the correct new setting).

Once the new parameter setting is displayed press "ENTER" to store the new setting and return to the parameter family menu. (Alternatively "CANCEL" may be pressed to abort the parameter change, leaving the old value stored and returning to the parameter family menu).

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A check should be made of all changed parameters by scrolling through the parameter family menu to ensure that they have been correctly entered, before returning to the normal display by pressing "CANCEL". IF PERMISSION TO CHANGE PARAMETERS IS DENIED DUE TO SECURITY CODES BEING SET, REFER TO SECTION 5.6.

5.5 "HELP" Key

The ID9001-II contains a mini user manual accessed through the upper case of key 5 or "HELP". During parameter changing, the user, if not sure of the function of a particular parameter, has a brief description which is available by pressing "SHIFT", "5". This will enter into the "HELP" screen.

The start of a "HELP" message is indicated by a ">", the end by a "<"; use the "UP ARROW" and "DOWN ARROW" keys to scroll through the "HELP" message. Pressing "CANCEL" will return the user back to the parameter from which the "HELP" message was accessed.

Example:- The user wishes to change the Motor Voltage setting, and has already entered the "MOTOR" parameters family menu so that the display reads:-

MOTOR VOLTAGE = 415V

The user may access the "HELP" key to find a description of the parameter.

Press SHIFT HELP 5 The display responds:-

> This is the synchronous speed motor voltage

Press ⇧ The display responds:-

Entries between 300V and 750V are permitted

Press ⇧ The display responds:-

See motor nameplate for correct value <

Pressing Up Arrow again will have no effect. Pressing Down Arrow will scroll back through the "HELP" message.

Press CANCEL to return to parameter display:

MOTOR VOLTS 321 VOLTS

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5.6 Security Codes

The upper case function mode of key 1 "SECURITY CODES", can be used to set the security codes for each security level.

Each key can be assigned a security level from level 1, which is highest priority, to level 6 which is lowest priority. To change or access data on a key, any security code entered above or equal to that key's security level will allow access. For example if a key is assigned security level 3, then the security codes for levels 3, 2 or 1 will allow access.

The following levels require security codes, level 6 REQUIRES NO SECURITY CODE for access.

Level	Factory Setting
1	1111
2	2222
3	3333
4	4444
5	5555

When the Security Code function is entered, by pressing "SHIFT" "1", the level 1 security code must be entered to gain access. The user is then asked which security code level needs to be changed. When this number is entered and ENTER is pressed, the user is then allowed to enter a four digit code. Pressing ENTER will then store this code and the user will be allowed to select another level to change. If the four digits chosen are used at another level, the entry will be rejected and the user will need to enter a different code. Pressing CANCEL will revert back up to the normal display.

Each key can be assigned a security level. Level 1 being the highest.

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Table 5.1 - Parameter Description Table

PARAMETER GROUP	PARAMETER	UNITS	PRESET VALUE	LIMITS MIN.	LIMITS MAX.	DESCRIPTION
MOTOR	Motor Frequency	Hz	50	50	120	Motor synchronous frequency; see motor nameplate.
	Number of Poles		4	2	18	Number of motor poles; see motor nameplate.
	Motor FL Speed	RPM	1500 1475	299	7920	Motor shaft speed in RPM at full load; see motor nameplate. (Note : Limit = Synchronous speed ±10%).
	Motor Voltage	V	415 415	220	550	Motor rated voltage, at synchronous speed; see motor nameplate.
	Motor FL Power	kW	15.0 415	0.5	550.0	Motor full load power; see motor nameplate.
	Motor NL Current	A	9.0 50	0.0	Motor FL Current	Motor no load current, set to 20%-30% full load motor current initially. Fine tune at 20% speed on no load.
	Motor FL Current	A	30.0 207	Motor NL Current	1250.0	Motor full load current; see motor nameplate. Note: The motor FLC should not normally exceed drive rating.
	Maximum Current	A	30.0 207	Motor NL Current	1250.0	Sets the inverter current limit and load level at which the inverter will begin to slow down in order to prevent motor stalling. Set below inverter rated current (see inverter data plate).
*	Calibrate Current	A	30.0 345	0.1	1250.0	Calibrates the inverter current settings. Note: An increase in this setting increases current displayed and a decrease in setting reduces the current displayed.
	Security level		6 ✓	1	6	See Section 5.6
DRIVE	Run Speed	%	0.2	0.2	100.0	Allows the manual speed demand to be preloaded when using the keypad 'INC'/'DEC' function. (Available only if keypad 'INC/DEC' is enabled, see "Options Settings Menu").
	Man Acc Time	Sec	20.0 ✓	1.0	3600.0	Sets the inverter manual acceleration rate from 0% to 100% speed.
	Man Dec Time	Sec	20.0 ✓	1.0	3600.0	Sets the inverter manual deceleration rate from 100% to 0% speed.
	Minimum Speed	Hz	0.1 ✓	0.1	Max Speed	Sets the minimum inverter output frequency in manual mode. Min speed = 0% speed demand.
	Maximum Speed	Hz	50.0 52	Min Speed	120.0	Sets the maximum inverter output frequency in manual mode. Also used as 100% scaler for speed parameters. Max speed = 100% speed demand.
	Jog Speed	%	0.0	0.0	100.0	Sets the inverter manual and auto jog speed as a percentage of max speed. (Note: parameter only available when jog option is enabled; see "Optional Settings Menu").

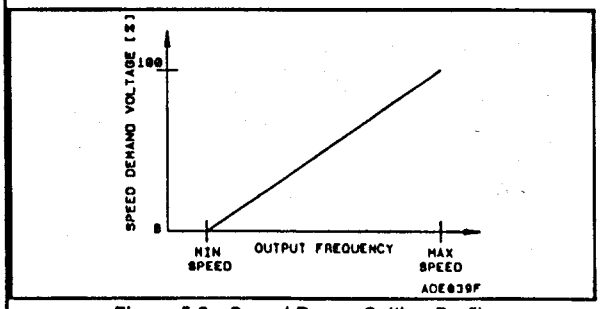

Figure 5.2 - Speed Range Setting Profile

* To access this you have go to security level. and enter secret code — for NW water its 5885. Go back to motor & 'calibrate' is permitted. After switch-off access is denied

Paul Williams Technical

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Table 5.1 - Parameter Description Table/continued

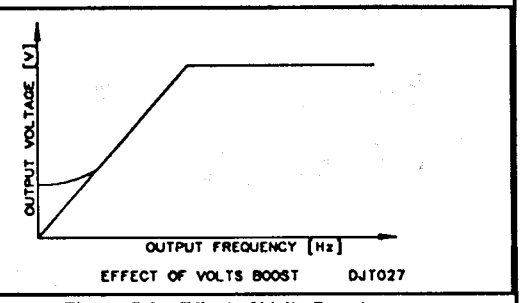
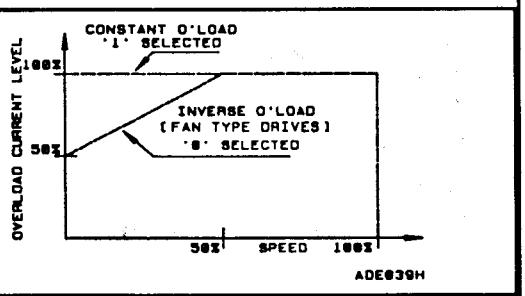
PARAMETER GROUP	PARAMETER	UNITS	PRESET VALUE	LIMITS MIN.	LIMITS MAX.	DESCRIPTION
DRIVE	Jog Time	Sec	0	0	3600	Sets the time at which a jog speed is active when the jog function is activated. A setting of 0 Sec allows continuous jog, therefore providing a preset speed setting. (Note: Parameter only available when jog option is enabled; see "Optional Settings Menu").
	Volts/Hz Ratio	%	100	10	200	Sets the relationship between inverter output volts and frequency. 100% gives the set 'Motor Voltage' at the set 'Motor Frequency'.
	Maximum Voltage	V	415	220	550	Sets the maximum inverter output voltage.
	Voltage Boost	V	0.0	0.0	20.0	Boosts the output voltage at low motor speeds, so overcoming motor losses and maintaining full load torque over the entire motor speed range.
						 Figure 5.3 - Effect of Volts Boost
	Load Boost	V	0.00	0.00	20.00	Boost the output voltage at low speed, depending upon the amount of load applied to the motor.
	Current Boost	%	0	0	50	Boost the current limit below 5Hz. Above 5Hz current limit reverts back to normal maximum current setting.
	Current Boost Time	Sec	0	0	99	Determine the maximum time at which the current limit is allowed to stay at the current boosted setting.
	Overload Current	A	30.0 253	0.0	1250.0	Sets the level at which the electronic motor thermal overload will begin to timeout. Set>Imax if no overload protection is required. Set<Imax to the required overload level, nominally 1.05 x motor FLC. NOTE: If 'Overload Mode' = 0 the overload level is automatically reduced below 50% speed.
	Droop speed	Hz	0			
	Droop Current		50A			
						 Figure 5.4 - Overload Characteristics
	Overload Period	Sec	30.0	5.0	99.9	Sets the motor electronic thermal overload period. If an overload persists beyond the set time the inverter will trip on sustained overload.
	Inc/Dec Rate	Sec	20.0	5.0	3600.0	Sets the rate at which the speed demand changes when either the 'INC' or 'DEC' keys are pressed. (Available only if keypad 'INC/DEC' or option 'INC/DEC' are enabled, see "Optional Settings Menu").

Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	UNITS	PRESET VALUE	LIMITS		DESCRIPTION
				MIN.	MAX.	
DRIVE	Min Scan Freq	Hz	5.0	0.5	25.0	Sets the minimum frequency down to which the inverter frequency is scanned when catching free spinning motors. (NOTE: parameter only available if scanning option enabled; see "Optional Settings Menu").
	Max Scan Freq	Hz	50.0	0.5	120.0	Sets the maximum frequency at which the inverter frequency is scanned when catching free spinning motors. (NOTE: parameter only available if scanning option enabled; see "Optional Settings Menu").
	Scanning Rate	Sec	20.0	1.0	300.0	Sets the rate at which the inverter frequency is scanned when catching free spinning motors. (NOTE: parameter only available if scanning option enabled; see "Optional Settings Menu").
	Scanning Voltage	%	15.0	0.5	25.0	Sets the voltage applied to the motor during frequency scanning. (NOTE: parameter only available if scanning option enabled; see "Optional Settings Menu").
	Scanning Timeout	Sec	300	1	3600	Sets the time after a trip or inhibit at which forward scanning is automatically disabled. (NOTE: parameter only available if forward scanning option enabled; see "Optional Settings Menu").
	Meter A Output		0	0	3	Sets the output function of meter output 'A'. 0 = Speed 1 = Current 2 = Voltage 3 = Power
	Meter A Scaling	%	50.0	0.0	100.0	Scales the full scale range of meter output 'A'. 50% equals to approximately +5Vdc output.
	Meter B Output		1	0	3	Sets the output function of meter output 'B'. 0 = Speed 1 = Current 2 = Voltage 3 = Power
	Meter B Scaling	%	50.0	0.0	100.0	Scales the full scale range of meter output 'B'. 50% equates to approximately +5Vdc output.
	Meter C Output		2	0	3	Sets the output function of option card meter output 'C'. 0 = Speed 1 = Current 2 = Voltage 3 = Power (NOTE: parameter only available if option card enabled; see "Optional Settings Menu").
	Meter C Scaling	%	50.0	0.0	100.0	Scales the full scale range of option card meter output 'C'. 50% equates to approximately +5Vdc output. (NOTE: parameter only available if option card enabled; see "Optional Settings Menu").
	Meter D Output		3	0	3	Sets the output function of option card meter output 'D'. 0 = Speed 1 = Current 2 = Voltage 3 = Power (NOTE: parameter only available if option card enabled; see "Optional Settings Menu").

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Table 5.1 - Parameter Description Table/continued

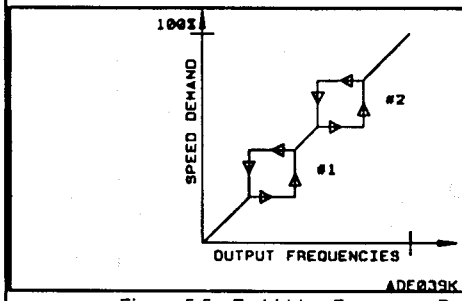
PARAMETER GROUP	PARAMETER	UNITS	PRESET VALUE	LIMITS		DESCRIPTION
				MIN.	MAX.	
DRIVE	Meter D Scaling	%	50.0	0.0	100.0	Scales the full scale range of option card meter output 'D'. 50% equates to approximately +5Vdc output. (NOTE: parameter only available if option card enabled; see "Optional Settings Menu").
	Skip #1 Frequency	Hz	0	0	120	Sets the centre point of the first forbidden frequency band, or skip frequency. (NOTE: parameter only available if skip frequency option enabled; see "Optional Settings Menu").
	Skip #1 Band Width	Hz	0	0	10	Sets the width of the first forbidden frequency band. (NOTE: parameter only available if skip frequency option enabled; see "Optional Settings Menu").
	Skip #2 Frequency	Hz	0	0	120	Sets the centre point of the second forbidden frequency band. (NOTE: parameter only available if skip frequency option enabled; see "Optional Settings Menu").
	Skip #2 Band Width	Hz	0	0	10	Sets the width of the second forbidden frequency band. (NOTE: parameter only available if skip frequency option enabled; see "Optional Settings Menu").
						 Figure 5.5 - Forbidden Frequency Bands
	O/P 1 Off Speed	%	0.0	0.0	100.0	Sets the % of max speed at which option card output 1 de-energises. (Only present if option card enabled and speed OP1 enabled; see "Optional Settings Menu").
	O/P 1 On Speed	%	0.0	0.0	100.0	Sets the % of max speed at which option card output 1 energises. (Only present if option card enabled and speed OP1 enabled; see "Optional Settings Menu").
	O/P 2 Off Speed	%	0.0	0.0	100.0	Sets the % of max speed at which option card output 2 de-energises. (Only present if option card enabled and speed OP2 enabled; see "Optional Settings Menu").
	O/P 2 On Speed	%	0.0	0.0	100.0	Sets the % of max speed at which option card output 2 energises. (Only present if option card enabled and speed OP2 enabled; see "Optional Settings Menu").
	Load Loss Level	%	0.0	0.0	150.0	Sets the percentage load level below which a loss of load is indicated. (NOTE: parameter only available if loss of load enabled; see "Optional Settings Menu").
	Load Loss Speed	%	50.0	0.0	100.0	Sets the minimum inverter speed before a loss of load can be detected. (NOTE: parameter only available if loss of load enabled; see "Optional Settings Menu").
	Load Loss Time	Sec	5	0	300.0	Sets the time period at which a loss of load condition must persist before an indication of a loss of load is given. (NOTE: parameter only available if loss of load enabled; see "Optional Settings Menu").
	Preset #1 Speed	%	0.0	0.0	100.0	Sets the preset speed demand of the inverter as a percentage of Max Speed, when Preset Speed #1 is selected.
	Preset #2 Speed	%	0.0	0.0	100.0	Sets the preset speed demand of the inverter as a percentage of Max Speed, when Preset Speed #2 is selected.

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Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	UNITS	PRESET VALUE	LIMITS MIN.	LIMITS MAX.	DESCRIPTION
DRIVE	Preset #3 Speed	*%	0.0	0.0	100.0	Sets the preset speed demand of the inverter as a percentage of Max Speed, when Preset Speed #3 is selected.
	Preset #4 Speed	%	0.0	0.0	100.0	Sets the preset speed demand of the of the inverter as a percentage of Max Speed, when Preset Speed #4 is selected. (NOTE: present if option card enabled and preset speed option enabled; see "Optional Settings Menu"). Preset speed are selected via two inputs on the Option Card. Selection is as follows :- Preset SPD — I/P6 — I/P5 #1 — OPEN — OPEN #2 — OPEN — CLOSED #3 — CLOSED — OPEN #4 — CLOSED — CLOSED OPEN = External Contact Open. CLOSED = External Contact Closed. (SEE WIRING SCHEME FOR OPTION SCHEME)
	Optional Settings Menu					A Sub-Menu containing flags to select drive options.
	Build Date					Shows the date when the inverter was built (Factory set).
	Service Date					Shows the date when the inverter was commissioned.
	Software Version		Version 01.01.0			Shows the software version number and release date.
	Security Level		6	1	6	See Section 5.6
OPTIONAL SETTING MENU	Keypad Run/Stop		1	0	1	Selects whether manual start/stop is via the hardware inputs or the keypad 'RUN/STOP' keys. 0 = Hardware Control 1 = Keypad Control NOTE: When using the keypad operator controls, the hardware STOP input is used as an external ramped stop interlock.
	Keypad Man/Auto		1	0	1	Selects whether manual/auto selection is via the hardware auto input select or the keypad 'MAN/AUTO' key. 0 = Hardware Control 1 = Keypad Control
	Keypad Jog		0	0	1	Selects whether the manual jog function is activated from the hardware jog input or the keypad jog key. 0 = Hardware Control 1 = Keypad Control (NOTE: Only present if jog function enabled, see "Optional Settings Menu").
	Keypad INC/DEC		0	0	1	Selects whether the manual speed demand is set via a hardware potentiometer or digital potentiometer with the keypad 'INC/DEC' keys. 0 = Hardware Potentiometer 1 = Keypad Potentiometer

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Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	UNITS	PRESET VALUE	LIMITS MIN.	LIMITS MAX.	DESCRIPTION
OPTIONAL SETTING MENU	Overload Mode		0	0	1	This selects the type of overload characteristic used to protect against motor overload. 0 - Fan type load 1 - Constant torque loads
	Enable Scanning		0	0	2	0 - Disable the spinning load option. 1 - Enables the inverter to catch forward spinning loads after a trip or inhibit, e.g., an idling fan. 2 - Enables both forward and reverse catching of spinning loads. This should only be used for high inertia loads; for other applications consult Heenan Drives. Frequency scanning allows the inverter to catch spinning free-wheeling motors. When forward scanning is enabled the motor is scanned at startup only if a trip or inhibit has been previously received by the drive. If however, the drive has not been started after a trip or inhibit, within the 'Scanning Timeout' period then a normal start is performed. When reverse scanning is enabled the motor is always scanned at startup. Under this condition, the motor is scanned in reverse first. Reverse scanning is for motors that may be pushed backwards by external conditions.
	Enable Reverse		0	0	1	0 - Enables forward control only. 1 - Enables forward/reverse control. (NOTE; see control scheme for wiring).
	Enable Jog		0	0	1	0 - Disable jog mode. 1 - Enables jog in manual. 2 - Enable jog in auto. 3 - Enable job in manual and auto. (NOTE: see control scheme for wiring).
	Enable Supply Trip		1	0	2	This allows the input supply failure trip to be switched on or off. 0 - Disables supply failure trip. 1 - Enables supply failure trip. 2 - Enables supply failure trip with auto reset after supply restored. 3 - Enables supply failure with inverter inhibit only, i.e., no trip. Usually disabled only for ride-thru operation. Ride-thru provides the function of extending operating time of the unit when input power is removed. This is achieved by recovering energy from load inertia.
	Reset Over I		0	0	1	This allows the inverter to automatically reset after a "over current" trip. Maximum auto reset rate = 3 resets of any type per 300 seconds. 0 - Disable auto reset. 1 - Enables auto reset.
	Reset Over V		0	0	1	This allows the inverter to automatically reset after a d.c. bus over voltage trip. Maximum auto reset rate = 3 resets of any type per 300 seconds. 0 - Disable auto reset. 1 - Enables auto reset.
	Enable PGM Input		0	0	3	This parameter determines whether the inverter trips when the PGM input opens and which trip message is displayed when the trip occurs.

Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	UNITS	PRESET VALUE	LIMITS MIN.	LIMITS MAX.	DESCRIPTION
OPTIONAL SETTING MENU	Enable PGM Input (Contd)					0 - Disables trip. 1 - Enables trip message = 'Programmable Trip'. 2 - Enable trip message = Thermistor Trip'. 3 - Enable trip message = 'Brake Over-Temperature'. (NOTE: see control scheme or wiring).
	Enable Energy Saver		0 ✓	0	1	This condition sets inverter output voltage to be dependant upon the motor load. By allowing the load to dictate the output voltage, maximum motor efficiency may be obtained over a wide range of load and duty cycles. 0 - Disables energy saver operation. 1 - Enables energy saver operation.
	Display Hz or RPM		0 ✓	0	1	0 - Display output in Hz. 1 - Display output in RPM.
	Enable Slip Comp		0 ✓	0	1	Enables the inverter to compensate for motor slip, so considerably improving the motor load/speed regulation. 0 - Disables slip compensation. 1 - Enables slip compensation.
	Enable Skip Freq		0 ✓	0	1	Enables the skip frequency function. 0 - Disables skip frequencies. 1 - Enables skip frequencies.
	Enable Option Card		0 ✓	0	1	Determines whether the option card is fitted. 0 - Option card not fitted. 1 - Option card fitted.
	Option Speed OP1		0	0	3	Enables speed dependant output 1 utilising option card output 1. 0 - Disables. 1 - Enable from output frequency. 2 - Enable from speed ramp output. 3 - Enabled from speed demand input.
	Option Speed OP2		0	0	3	(NOTE: Present only if option card enabled). Enables speed dependant output 2 utilising option card output 2. 0 - Disables. 1 - Enabled from output frequency. 2 - Enabled from speed ramp output. 3 - Enabled from speed demand input. (NOTE: Present only if option card enabled).

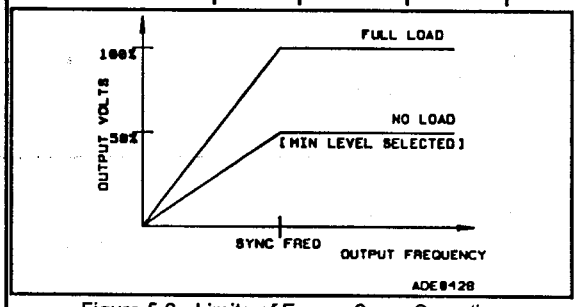

Figure 5.6 - Limits of Energy Saver Operation

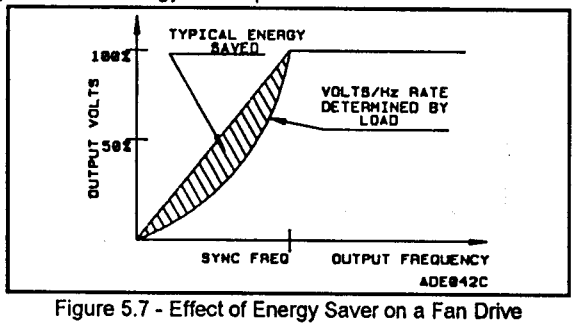

Figure 5.7 - Effect of Energy Saver on a Fan Drive

NOTE: That the energy saver feature is designed for fan and pump type loads and therefore will not function optimally where true shock loads are experienced by the motor.

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Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	UNITS	PRESET VALUE	LIMITS MIN.	LIMITS MAX.	DESCRIPTION
OPTIONAL SETTING MENU	Enable Loss of Auto		0 ✓	0	3	Enables the loss of auto control signal function and determines the action taken by the drive. 0 - Disables. 1 - Enable with warning by energising option card output 3 when loss of auto occurs. 2 - Enable with trip when loss of auto occurs. 3 - Enable with warning and trip when loss of auto occurs. (NOTE: Option 1 and 3 can only be selected if option card is enabled).
	Enable Loss of Load		0 ✓	0	3	Enables the loss of load function, and determines the action taken by the drive. 0 - Disables. 1 - Enable with warning by energising option card output 4 when loss of load occurs. 2 - Enable with trip when loss of load occurs. 3 - Enable with warning and trip when loss of load occurs. (NOTE: Option 1 and 3 can only be selected if option card is enabled).
	Option PTC Input		0	0	1	Enables the option card PTC (thermistor) input sensing. 0 - Disables. 1 - Enables. (NOTE: present only if option card enabled).
	Option Preset Speed		0	0	3	Enables preset speed selection via two inputs on the Option Card up to four preset speeds can be selected. 0 - Disables preset speeds. 1 - Enables preset speeds in manual mode only. 2 - Enables preset speeds in auto mode only. 3 - Enables preset speeds in both manual and auto modes. (NOTE: present only if option card enabled).
	Option Inc/Dec Speed ENABLE TACHO FB ENABLE DC BRAKE MODE ENABLE HIGH SWITCHING		0 ✓ 0 ✓ 0	0	3	Enables increase/decrease speed operation via two inputs on the Option Card. 0 - Disable Inc/Dec Speed. 1 - Enables Inc/Dec Speed in auto mode only. 2 - Enables Inc/Dec Speed in auto mode only. 3 - Enables Inc/Dec Speed in both manual and auto modes. (NOTE: Present only if option card enabled). Increase/Decrease Speed essentially performs a motorised potentiometer function where the rate of rise or fall of demand is set at the Inc/Dec rate selected. Two inputs on the Option Card determine whether the demand increases or decreases. Operation IP7 IP8 No change Open Open 'Inc' Closed Open 'Dec' Open Closed No Change Closed Closed OPEN = External contact open. CLOSED = External contact closed. (SEE WIRING SCHEME FOR OPTION DETAILS)
	Security Level		6	1	6	See Section 5.6

Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	UNITS	PRESET VALUE	LIMITS MIN.	LIMITS MAX.	DESCRIPTION
STAB	Speed Prop gain		10.00 ✓	0.00	50.00	Factory set, consult supplier before making changes.
	Speed Integ Gain		5.00 ✓	0.000	50.00	Factory set, consult supplier before making changes.
	Current Prop Gain		0.06 ✓	0.00	5.000	Factory set, consult supplier before making changes.
	Current Integ Gain		0.0025 ✓	0.000	2.0000	Factory set, consult supplier before making changes.
	Minimum VDC Level	V	350 ✓	120	950	Factory set, consult supplier before making changes.
	Minimum VDC Gain		8 ✓	0	50	Factory set, consult supplier before making changes.
	Minimum FL VDC	V	520 ✓	200	950	Factory set, consult supplier before making changes.
	Maximum VDC Level	V	700 ✓	300	950	Factory set, consult supplier before making changes.
	Regen Comp		0 ✓			
	Maximum VDC Gain		6 4	0	50	Factory set, consult supplier before making changes.
	Security Level		6	1	6	See Section 5.6
AUTO	Auto ref/FBK select		0 ✓	0	6	Selects the type of external or internal control signal to use. 0 = Internal setpoint and 4-20mA feedback 1 = Internal setpoint and 0 to +10V feedback 2 = 0 to +10V setpoint and 4-20 mA feedback 3 = 4-20mA setpoint and 0 to +10V feedback 4 = Remote serial link setpoint and 4-20mA feedback 5 = Remote serial link setpoint and 0 to +10V feedback 6 = Remote serial link setpoint used as auto speed demand
	4-20mA Scaler		1023 ✓	256	1280	Used to scale the internal setpoint to the maximum 4-20mA control feedback when the inverter is acting as a process controller.
	0-10V Scaler		1023 ✓	256	1280	Used to scale the internal setpoint to the maximum 0 to +10V control feedback when the inverter is acting as a process controller.
	Auto Acc Time	Sec	20.0 ✓	1.0	3600.0	Sets the auto inverter acceleration rate from 0% to 100% speed.
	Auto Dec Time	Sec	20.0 ✓	1.0	3600.0	Sets the auto inverter deceleration rate from 100% to 0% speed.
	Auto On/Off Mode		0 ✓	0	1	Select whether an external auto contact or the auto feedback level controls and start/stop of the inverter in auto mode. 0 - External Contact Start/Stop Control. 1 - Both external contact and auto feedback level Start/Stop control.
	Auto Off Setpoint	%	0.0	0.0	100.0	Sets the % level of the speed demand at which the inverter will de-energise if no delay time is set. (NOTE: accessible only if 'Auto On/Off mode' set to '1').
	Auto Off Delay	Sec	0.1	1.0	100.0	Sets the time delay between the Auto Off level and the inverter de-energising. (NOTE: accessible only if 'Auto On/Off mode' set to '1').
	Auto On Setpoint	%	0.0	0.0	100.0	Sets the % level of the speed demand at which the inverter will energise if no time delay is set. (NOTE: accessible only if 'Auto On/Off mode' set to '1').
	Auto On Delay	Sec	0.1	0.1	100.0	Sets the time delay between the Auto On level and the inverter energising. (NOTE: accessible only if 'Auto On/Off mode' set to '1').

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Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	UNITS	PRESET VALUE	LIMITS MIN.	LIMITS MAX.	DESCRIPTION
AUTO	Auto PID Enable		0 1	0	1 *	Selects whether the inverter PID loop is used to control the process. 0 = Control signal used as a speed command. 1 = Control signal used as PID loop feedback.
	Auto PID Setpoint	%	0.0 50	0.0	100.0	Sets the percentage level at which the inverter PID loop will control. (NOTE: accessible only if 'Enable Auto PID' set to '1').
	Auto PID Prop Band	%	100 ✓	20	300	Sets the linear gain between the controller i/p and o/p. 100% = gain of 1, 200% = gain of 0.5. (NOTE: accessible only if 'Enable Auto PID' set to '1').
	Auto PID Reset Time	Sec	0 1sec	0	30	Sets the integral time constant of the controller, allowing rapid variations I control to be averaged. (NOTE: accessible only if 'Enable Auto PID' set to '1').
	Auto PID Rate Time	Sec	0 ✓	0	30	Set the derivative time constant of the controller, providing a momentary boost to the controller, speeding up the response to sharp deviations of control input.
	Entry Point	%	0.0 ✓	0.0	100.0	Sets the percentage level of process controlling signal at which the inverter will begin to respond by a change of speed.
	Exit Point	%	100.0 ✓	0.0	100.0	Sets the percentage level of process controlling signal at which the inverter will stop responding, clamping the output frequency.
	Entry Speed	%	0.0 100	0.0	100.0	Sets the percentage of maximum speed at which the inverter will run when the process controlling signal is equal or below the entry point.
	Exit Speed	%	100.0 6	0.0	100.0	Sets the percentage level of maximum speed at which the inverter will run when the process controlling signal is equal or above the exit point.
	Auto Loss Level	%	0.0	0.0	100.0	Sets the percentage level of auto control signal below which a loss of auto is indicated. (NOTE: parameter only available if loss of auto enable; see "Optional Settings Menu").
	Auto Loss Time	Sec	5	0	300	Sets the time period at which a loss of auto condition must persist before an indication of a loss of auto is given. (NOTE: Parameter only available if loss of auto enabled; see "Optional Settings Menu").
	Auto Loss Speed	%	0.0	0.0	100.0	Sets the speed at which the inverter runs while a loss of auto condition exists. This is only active for loss of auto warning condition only. (NOTE: Parameter only available if loss of auto enabled; see "Optional Settings Menu").

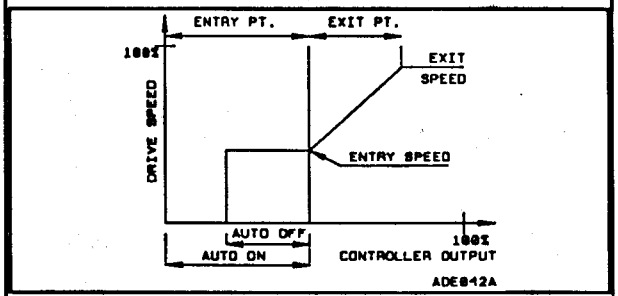

Figure 5.8 - Control Signal Profiling

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Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	DESCRIPTION
LOGS	Serial Comms Setup	The RS232 serial link is configured by entering this function. TX = By pressing the UP and DOWN ARROWS the transmit baud rate is scrolled on the display. The following baud rates can be set:- 110, 150, 300, 600, 2400, 4800 and 9600. Pressing the ENTER stores the value and displays the next parameter to be changed. RX = By pressing the UP and DOWN ARROWS the receive baud rate is scrolled on the display. The following baud rates can be set:- 110, 150, 300, 600, 1200, 2400, 4800 and 9600. Pressing ENTER stores the value and displays the next parameter to be changed,. Stop bits = By pressing the UP and DOWN ARROWS the number of Stop Bits required is scrolled on the display. Either 1 or 3 Stop Bits can be selected. Pressing ENTER stores the value and displays the next parameter to be changed. Char Bits = By pressing the UP and DOWN ARROWS the number of characters required is scrolled on the display. Either 5, 6, 7 or 8 character bits can be selected. Pressing ENTER stores the value and displays the next parameter to be changed. Parity on = By pressing the UP and DOWN ARROWS the parity check can be enabled or disabled. Selecting N then ENTER disables the parity check. Selecting Y then ENTER enables the parity check. If the parity check is enabled the next display allows even or odd parity to be selected. Pressing ENTER stores the selection and displays the next parameter to be changed, CTS/RTS control = XON/XOFF control = By pressing the UP and DOWN ARROWS the handshake control of CTS/RTS or XON/XOFF can be enabled or disabled. Pressing ENTER stores the selection and displays the next parameter to be changed. Terminal or printer? By pressing the UP and DOWN ARROWS a Terminal or Printer can be selected as the receiving device. The difference between terminal and printer selection is only in the format of data. If a terminal is selected the information is paged (ie, a header appears above every page). If a printer is selected the header only appears once. Connection to the RS232 Serial Communication port is made via connector CONN4 on the 9001 Series II control board. CONN4 is a 9 way D-type plug, connections of which are as follows: Pin 2 - RX (Receive data input) Pin 3 - TX (Transmit data output) Pin 5 - GND (Common) Pin 7 - RTS (Request to send output) Pin 8 - CTS (Clear to send input)
LOGS	Print Parameters	When ENTERED this prints a copy of the inverter parameter settings via the RS232 communications port. An example of a parameter log is shown in Figure 5.9

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Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	DESCRIPTION

HEENAN DRIVES LIMITED

PARAMETER SETTINGS

Parameter		min Limit	max Limit	Sec Level	Remote Code
Auto ref/fbk sel	0	0	6	NONE	4000
4-20mA scaler	1023	256	1280	NONE	4001
0-10V scaler	1023	256	1280	NONE	4002
Auto Acc Time	20.0 Sec	1.0	300.0	NONE	4003
Auto Dec Time	20.0 Sec	1.0	300.0	NONE	4004
SecAuto on/off	0	0	1	NONE	4005
Enable Auto PID	0	0	1	NONE	4010
Entry Point	0.0%	0.0	100.0	NONE	4015
Exit Point	100.0%	0.0	100.0	NONE	4016
Entry Speed	0.0%	0.0	100.0	NONE	4017

Figure 5.9 - Example Parameter Log

LOGS — **Print Historic Log**

When ENTERED this prints a copy of 100 sets of key inverter parameters, feedback etc., taken at 5mSec intervals previous to the last inverter fault trip. A sample log is shown in Figure 5.10

HEENAN DRIVES LIMITED

HISTORIC RECORD LOG

A=Inverter O/Temp.	F=Low DC Fail.	K=Sustained O/L.	P=Loss of Load.
B=Over Voltage.	G=Detection Error.	L=PGM Input Trip.	Q=Not Allocated.
C=Over Current.	H=Software Fault.	M=Thermistor.	R=Not Allocated.
D=Earth Leakage.	I=Waveform Gen.	N=Brake O/Temp.	S=Not Allocated.
E=Supply Fail.	J=Remote Watchdog.	O=Loss of Auto.	T=Not Allocated.

Inv.Mode	Speed Dmd	Output Freq.	Motor Amps	Motor Volts	Motor Power	Fault Status <---------->	Ent No.

Figure 5.10 - Example Historic Record Log

LOGS — **Display Fault Log**

Shows a history of faults and a time in hours from a datum at which they occurred. This is displayed on the LCD display. The oldest fault is displayed first in the following format.

(MODE) TIME RST

where

(MODE) is either MAN or AUTO
TIME is the time in Hours from the datum time
RST is the method of reset, either AUTO(A) or Manual(MAN)

(FAULT) is the fault which has occurred. Up to 50 faults are logged. Logged faults may be scrolled through by using the "DOWN ARROW" key.

LOGS

If, however, no faults have occurred since the last time the log was reset the following is displayed

NO FAULT SINCE

Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	DESCRIPTION
LOGS	Print Fault Log	Shows a history of faults and a time in hours from a datum at which they occurred. This is output to the RS232 serial communication port if its printer mode has been selected. An example is shown in Figure 11. HEENAN DRIVES LIMITED [FAULT LOG] INV. ELAPSED MODE HOURS. | FAULT-NAME <----------> | RESET-MODE <----------> | ENT No. AUTO 0000.1 | Over Current | MAN. RESET | 01 AUTO 0000.0 | Over Current | MAN. RESET | 02 Figure 5.11 - Example Fault Log If no faults have occurred since the last time the log was reset the following appears on the LCD display. NO FAULT SINCE The datum time is reset each time the fault is reset, or each time the drive is switched on. Hence if the log is to be useful, the date and time must be recorded each time the Log Reset Function is employed.
LOGS	Clear Fault Log	This option causes the Fault Log to be cleared and the datum time reset.
LOGS	Remote Configuration	Configures the inverter for remote Serial Communications **Remote Control mode.** This parameter allows selection of 3 remote communication modes. 0 - Single drive mode (Communication with one drive only with no drive address required). 1 - Multi listen only (Several drives connected but none will respond back to host). 2 - Multi drive mode (Full two way communication). **Drive Address** This parameter sets the drive address for multi drive operation. Entries between 0-99 are allowed. Each drive should have a unique drive address if correct remote communication is to be achieved. **Watchdog Time** This parameter sets the input character watchdog time. Entries between 0-60 seconds are allowed (NOTE: 0 disables the function). If no character is received by the drive within the watchdog timer period then a watchdog error condition occurs. **Watchdog Trip Enable** This parameter sets whether a watchdog error message or watchdog trip occurs when an input character watchdog occurs. 0 - Remote watchdog message. 1 - Remote watchdog trip.
LOGS		**Remote Error Enable** This parameter enables transmission of a serial link error codes to the host. (NOTE: this is only applicable to single drive mode). 0 - Disables transmission of serial link error codes. 1 - Enables transmission of serial link error codes.

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Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	DESCRIPTION

HEENAN DRIVES LIMITED

PARAMETER SETTINGS

Parameter		min Limit	max Limit	Sec Level	Remote Code
Auto ref/fbk sel	0	0	6	NONE	4000
4-20mA scaler	1023	256	1280	NONE	4001
0-10V scaler	1023	256	1280	NONE	4002
Auto Acc Time	20.0 Sec	1.0	300.0	NONE	4003
Auto Dec Time	20.0 Sec	1.0	300.0	NONE	4004
SecAuto on/off	0	0	1	NONE	4005
Enable Auto PID	0	0	1	NONE	4010
Entry Point	0.0%	0.0	100.0	NONE	4015
Exit Point	100.0%	0.0	100.0	NONE	4016
Entry Speed	0.0%	0.0	100.0	NONE	4017

Figure 5.9 - Example Parameter Log

LOGS — Print Historic Log

When ENTERED this prints a copy of 100 sets of key inverter parameters, feedback etc., taken at 5mSec intervals previous to the last inverter fault trip. A sample log is shown in Figure 5.10

HEENAN DRIVES LIMITED

HISTORIC RECORD LOG

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B=Over Voltage.	G=Detection Error.	L=PGM Input Trip.	Q=Not Allocated.
C=Over Current.	H=Software Fault.	M=Thermistor.	R=Not Allocated.
D=Earth Leakage.	I=Waveform Gen.	N=Brake O/Temp.	S=Not Allocated.
E=Supply Fail.	J=Remote Watchdog.	O=Loss of Auto.	T=Not Allocated.

Inv.Mode	Speed Dmd	Output Freq.	Motor Amps	Motor Volts	Motor Power	Fault Status <---------->	Ent No.

Figure 5.10 - Example Historic Record Log

LOGS — Display Fault Log

Shows a history of faults and a time in hours from a datum at which they occurred. This is displayed on the LCD display. The oldest fault is displayed first in the following format.

(MODE) TIME RST

where

(MODE) is either MAN or AUTO
TIME is the time in Hours from the datum time
RST is the method of reset, either AUTO(A) or Manual(MAN)

(FAULT) is the fault which has occurred. Up to 50 faults are logged. Logged faults may be scrolled through by using the "DOWN ARROW" key.

LOGS

If, however, no faults have occurred since the last time the log was reset the following is displayed

NO FAULT SINCE

Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	DESCRIPTION
		Remote Buffer Enable This parameter enables use of an external transmit tri-stake control buffer from the hardwire serial handshaking lines. 0 - Disables remote buffer. 1 - Enables remote buffer. **Checksum Test Enable** This enables input and output checksum testing i.e., tests for input checksum and creates output checksum. 0 - Disables checksum testing. 1 - Enables checksum testing.
LOGS	Security Level	See Section 5.6
ANALOG		Allows sets of important signal inputs or outputs to the inverter to be monitored in real time. Values are in scalars and are updated every 0.5 second. Once ENTERED the display can be toggled between its input and output screens by use of either the UP or DOWN ARROW keys. Selection of the required screen is then made by pressing the ENTER key and scrolling through to the required signal to be monitored. Entries are updated every 0.5 seconds. The scalars are set so that a reading of 1023 corresponds to a level of +10V d.c. in the control circuit. Inputs Range 0 to 1023 (0 to +10V). I Fbk : Actual inverter output current V Avail : Available inverter input voltage V Actual : Actual DC link Voltage 4-20mA : Auto feedback - current Potr : Speed potentiometer input, 0 to + 10V Tacho : Tacho input 0 - 10V : Auto feedback - voltage Outputs Range ± 32000 Freq Ref : Reference frequency to speed loop Load Demd : Torque demand to torque loop Load Fbk : Torque feedback to torque loop Freq O/P : Output frequency to waveform generator Max Load : Maximum torque loop demand limit Min Load : Minimum torque loop demand limit V/Hz : V/Hz ratio to waveform generator MotorV : Motor voltage in volts

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Table 5.1 - Parameter Description Table/continued

PARAMETER GROUP	PARAMETER	DESCRIPTION.
DIGITAL		Used to display digital inputs/outputs to the control circuit. Once ENTERED the display can be toggled between its input and output screens by use of either the UP or DOWN ARROW keys. Selection of the required screen is then made by pressing the ENTER key and scrolling through to the required signal to be monitored. Entries are updated every 0.5 seconds. <u>Inputs</u> Start : On = Start I/p closed Inhibit : Off = EM Stop close Fwd/Rev : Off = Fwd; On = Rev Fault Reset : Off = Normal; On = Reset closed Manual/Auto : Off = Man; On = Auto Jog : On = Jog closed Stop : Off = Stop closed PGM : Off = PGM Open; On = PGM Closed Option IP1 : Indicates On/Off status of the eight option card inputs. (See fig 4.4) Option IP2 : Indicates On/Off status of the eight option card inputs. (See fig 4.4) Option IP3 : Indicates On/Off status of the eight option card inputs. (See fig 4.4) Option IP4 : Indicates On/Off status of the eight option card inputs. (See fig 4.4) Option IP5 : Indicates On/Off status of the eight option card inputs. (See fig 4.4) Option IP6 : Indicates On/Off status of the eight option card inputs. (See fig 4.4) Option IP7 : Indicates On/Off status of the eight option card inputs. (See fig 4.4) Option IP8 : Indicates On/Off status of the eight option card inputs. (See fig 4.4) <u>Outputs</u> Run relay : Status of run relay output (On = energised). Fault relay : Status of fault relay output (On = energised). Option OP1 : Indicates On/Off status of the eight option card outputs. (See fig 4.4) Option OP2 : Indicates On/Off status of the eight option card outputs. (See fig 4.4) Option OP3 : Indicates On/Off status of the eight option card outputs. (See fig 4.4) Option OP4 : Indicates On/Off status of the eight option card outputs. (See fig 4.4) Option OP5 : Indicates On/Off status of the eight option card outputs. (See fig 4.4) Option OP6 : Indicates On/Off status of the eight option card outputs. (See fig 4.4) Option OP7 : Indicates On/Off status of the eight option card outputs. (See fig 4.4) Option OP8 : Indicates On/Off status of the eight option card outputs. (See fig 4.4)

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SECTION 6

COMMISSIONING

6.1 Commissioning by Heenan Engineers

At least two weeks notice is required for commissioning and details of contacts, site location, time etc. should be sent to:

Service Manager
Heenan Drives Limited
PO Box 52
Blackpole Road
WORCESTER WR3 8TL

Please note that many drive systems do not include commissioning as part of the system contract. If it is found that commissioning is now required, please notify the Service Manager as soon as possible. A charge will normally be made for engineers travel, time and living expenses. Contact the Service Manager for further details.

6.2 Customer Commissioning

Commissioning should only be carried out by qualified personnel. Working practice should comply to the relevant Health and Safety at Work Legislation and particular attention paid to Section 3, "Safety", of this manual.

Personnel commissioning ID9001-II inverters should be in possession of a full set of works drawings and a copy of this manual.

Installation of inverters should have been made in accordance to Section 4 "Installation". The equipment should be in an accessible position, well lit and relatively free from dust, heat, damp and vibration. Adequate ventilation should be available. A source of 240V a.c. nearby is also recommended.

If in doubt about the inverters operating environment consult the factory.

6.3 Before Starting-up

Check:-

1 That the inverter chassis/cubicle is clean, and dry, that no parts are broken or hanging loose, and that it is correctly mounted to a firm non-flammable surface. Terminal block connections should be checked for good contact and tightness.

2 Before connecting ensure that the incoming power is 380/415V three phase a.c. (440V for high voltage version).

3 Before connecting the motor/motors, megger the motor cables to ground checking for a low leakage to earth. Readings in excess of 100 Meg Ohms should be observed.

4 That the inverter chassis/cubicle is firmly bonded to earth. Check that the motor frame is also firmly bonded to earth (this may be done via the inverter earth termination).

5 If fitted, the continuity of the following START/STOP logic, auto control logic, motor over temperature switches, speed demand potentiometer, 4-20mA signal, meter outputs (number each i -> vii) and remote inverter status signals.

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6.4 Power Connections

The motor and mains supply power cables may be connected once the initial checks have been made. Mains connections are made to L1, L2 and L3. These inputs are not phase rotation sensitive.

Motor connections are made to T1, T2 and T3. Ensure that these are connected correctly to ensure the required directions of rotation.

6.5 Starting Up

The starting procedure outlined is general, specific applications may differ in procedure from that given. If in doubt, consult the factory.

1 Turn the manual speed demand potentiometer fully anti-clockwise, to zero demand, if fitted.

2 Select manual control (MAN) on the EXTERNAL/MAN/AUTO switch, if fitted.

3 Apply mains power to the inverter.

4 The keypad should light up and after a short initialisation period the display should read:-

	0%	0Hz
MAN	0.0A	0.0kWs

If the display reads INH instead of MAN, release the emergency stop button or inhibit.

A full description of the keypad display is given in Sections 5.1 to 5.6.

5 The preliminary inverter parameters now need to be set using the keypad. Set the following parameters:-

Under the MOTOR key, using data from the motor nameplate:-

1 Motor Freq - e.g., 50Hz or 60Hz.
2 Number of Poles - e.g., 2, 4, 6, etc.
3 Motor F.L. Speed - e.g., 1470 rpm.
4 Motor Voltage - nominally 380V or 415V.
5 Motor F.L. Current - Motor full load current in amps.
6 Motor FL Power - Motor power in kilowatts.
7 Motor NL Current - Set to 20% motor FL current initially.
8 Maximum Current - Set to 1.1 x motor FLC or the inverter rating, which ever is smaller.

Under the DRIVE key set

1 Man ACC time - to a suitable rate e.g., 30 seconds.
2 Man DEC time - to a suitable rate e.g., 30 seconds.
3 Maximum Speed - to the inverter maximum running speed. (Normally the motor frequency, 50Hz or 60Hz).
4 Minimum Speed - to the inverter minimum running speed, initially set to zero, (0).
5 Overload Mode - set to appropriate load setting.
6 Overload Current- set to motor full load current.
7 Overload Period - set to required protection period.

The inverter has now been programmed to run on a specific motor.
Motor entries should not ever need to be altered, unless the inverter is moved to drive another type of motor.

DRIVE parameters may be altered to suit the duty required once commissioning is complete.

6 Press the START pushbutton. The "Drive Running" light should illuminate if fitted.

7 Turn the speed demand potentiometer slowly clockwise until the display reads a demand (DEMD) of 1 or 2% and the output frequency of the inverter (FREQ) reads +1Hz. Check that the motor is rotating in the correct direction. (Note: If potentiometer is not fitted you may use up/down arrow to increase/decrease speed).

Note: if the motor fails to rotate, it may be due to the slip required by a high inertia load being greater than the output frequency. Increase the output frequency slowly; by 5Hz the motor should have started to rotate.

If the direction of rotation is incorrect, stop the inverter, isolate the inverter and wait 5 minutes for the storage capacitors to discharge; then change over any two of the motor cables to reverse the motor direction. Re-START the inverter.

8 Slowly increase the speed potentiometer so that the inverter/motor run up to the maximum required speed. Check that the motor current and power are as expected and that the system is stable over the entire speed range. If the display mode message changes to R/BK then the motor is overloaded.

Run the drive at 20% speed on little or no load, set the 'parameter motor NL current' under Motor Key to the value seen on the LCD display.

9 Press STOP to initiate a ramped deceleration down to zero speed.

The inverter has now been tested over the operating range and proved to be functional. All that remains to be done is to set any other parameters which need adjusting and check that meter outputs, the AUTO control mode, and any auxiliary control logic are functioning correctly.

If any problems occur during the commissioning, in terms of fault trips or unsatisfactory performance, consult Section 10, "FAULT FINDING" for possible causes and solutions.

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SECTION 7

NORMAL START/STOP OPERATION

Once an ID9001-II has been commissioned and is functioning correctly it will operate in the following manner once mains power has been applied.

7.1 Manual Operation

Select the MAN position on the AUTO/MAN switch for manual control. See Figure 4.2.

Set the speed potentiometer to the required level. Clockwise rotation will increase the speed setting or use up/down arrows on the keypad to increase/decrease speed.

Ensure that the lockable emergency stop button EM-STOP is free (if fitted).

Press the START pushbutton.

The inverter should ramp the motor up in speed to the set level. Changing the speed setting will cause the inverter to ramp the motor to the new setting.

Pressing the STOP pushbutton will cause the inverter to ramp the motor down to zero speed.

Pressing the EM-STOP pushbutton will cause the inverter to instantaneously stop providing current to the motor, so initiating a free running, coasting stop.

7.2 Automatic Operation

Under automatic (AUTO) control set the AUTO/MAN switch to AUTO.

The inverter will now run under command of the Auto Input signal (normally 4-20mA) or the inverters internal process controller. Manual speed setting will have no effect on this mode. Note; that in AUTO mode the inverter may be enabled to run, but will be still, at zero output frequency, as the auto control signal has not reached the level required to cause the drive to operate above zero speed.

In AUTO mode, if fitted, the emergency stop (EM-STOP) will override the auto control signals causing an instantaneous free running stop.

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SECTION 8

SETTING AUTO PARAMETERS

8.1 General

Most applications require the inverter to work in two modes, namely Manual and Auto. In Manual operation the inverter speed is controlled by the speed potentiometer only. When Auto is selected the inverter normally becomes part of a process and the speed will be determined by the internal process controller or by the auto input signal from an external process controller. The speed potentiometer will have no effect.

8.2 Internal Process Controller Tuning

8.2.1 Introduction

As described in the AUTO section of Table 5.1 if the Auto PID Enable parameter is set to one (1) then the process is controlled by the internal process controller within the ID9001-II. The parameter tuning of this PID controller is dependant on the type of system and is described below.

8.2.2 Feedback Scaling

The internal controller cannot control the process effectively until the measured value, or feedback is scaled correctly to the setpoint. The ID9001-II achieves this with the parameter 4-20mA Scaler or 0-10V Scaler.

The Auto Scaler should initially be set at 1023. The system should then be run and stabilised (see below) at a setpoint of 20%. At this point read the value of the appropriate auto Feedback on the Display Analogue Key.

Take a reading from the feedback transducer and calculate what percentage of full output this is.

The Scaler is now:- Scaler % Full Output

Normally 100% Full Output will give an Auto Feedback reading of 1023. Hence the normal Scaler is:-

Normal Scaler 100

8.2.3 Controller Tuning

For a given level of capacity, optimum control can be obtained at one set point only. Where operation at several levels of capacity (set points) is required, control should be optimised (controller retuned) at each level. Then the separate combinations of control settings should be recorded and kept for reference for operation at each level.

Because the drive is part of the process loop, that is the motor response will dictate the process response, the drive acceleration and deceleration rates play an important part. Their settings depend on the process response for a nominal change in motor speed. The ramp rates need to be set higher, the greater the change in process measured value is for a small change in motor speed (approx 5%).

Once the ramp rates are set the controller can now be tuned, if the ramp rates are changed, the controller must be retuned.

1 Proportional Action - set by the Prop Band parameter provides a fixed and linear relationship between the measured value (feedback) and the position of the control element. The controller moves the controller output to a definite position for each value of the measured amount.
In practical terms decreasing the Prop Band (increasing gain) will increase the sensitivity of a control system and vice versa. With the exception of simple position control systems, proportional only control is rarely used. The proportional mode is best suited to short lag systems. It is unsuited to applications having 'noisy' input signals unless smoothing networks are used prior to the controller input. The greatest limitation is however the inability to counteract process load changes which result in an offset.

To set the Prop Band, set Reset Time and Rate Time to zero (0), then set the desired Set Point, then adjust the Prop Band to obtain the smallest offset (error) between Set Point and Feedback.

Table 8.1 gives a guide to the effects of Prop Band adjustment.

2 Integral Action - set by the Reset Time parameter provides the elimination of comparatively long term errors experienced in proportional only systems. Thus the Reset Time provides an extra slow acting control mode

to average out deviations and apply corrections according to the sign (plus or minus) and time integral of the steady state proportional error. The control action is greater for larger and longer errors.

This averaging capacity is very useful in controlling systems where the input signal is subject to rapid variations about a mean value and Integral only controllers can provide a practical solution.

In practice the effect of Reset Time is to drift the proportional range of the controller in such a direction as to centre it upon the desired value.

To set the Reset Time, increase slowly from zero until the steady state proportional error is overcome and the Set Point met smoothly with minimum overshoot. Table 8.1 gives a guide to the effects of Reset Time adjustment.

3 Derivative Action - set by the Rate Time parameter depends on the rates of change of the increase or decrease of the deviation and not the magnitude of the deviation as in the case of proportional and integral control. It is of great value where the process load changes are both large and sudden. Under these conditions the controller gain is modified to cope with the change at a different sensitivity to that required during the steady state. An example of this is the occasional requirement for quick start up. If a proportional and integral option (P+I) was set up for minimum delay to reach set point at start up, severe overshoot and possible oscillation would result. False rate of change information due to noise is however a severe limiting factor and derivation action control systems are difficult to tune up.

To set the Rate Time parameter increase slowly until minimum overshoot occurs. NOTE, Derivative action increases the controller gain when the deviation increases. This is a worsening situation.

Table 8.1 gives a guide to the effects of Rate Time adjustment.

MODE	ACTION	MAIN PURPOSE	SETTING	STABILITY	CONTROL LOOP REACTION TIME
P (Gain-PB%)	Output proportional to Input Signal	Bulk of corrective effort	Increase Gain (Decrease Prop Band)	Decreased	Quicker
			Decreased Gain (Increase Prop Band)	Increased	Slower
I (Time)	Output proportional to time integral of error	Eliminate proportional offset	Decreased I Time	Decreased	Quicker
			Increase I Time	Increased	Slower
D (Time)	Output proportional to rate of change of deviation	"Extra push" for quick return to desired value	Decreased D Time	Decreased	Quicker
			Increased D Time	Increased	Slower

Table 8.1 - Controller Tuning Examples

8.2.4 Application Examples

The process controller, whether internal or external can only provide an output which is a measure of the error between setpoint and feedback. How the inverter operates on this output can vary with application and this is where use is made of the signal profiling functions found under the AUTO key. Three different application examples for settings of the signal profile function are described below.

NOTE: the Auto On and Auto Off parameters are ALWAYS controlled by the input signal, regardless of the PID select parameter.

Remote Speed Control Only - in this application, shown below, the user might only want to control the speed of the drive manually from a long distance using an isolated 4-20mA signal. Typical settings of the signal profile for a linear response are shown below.

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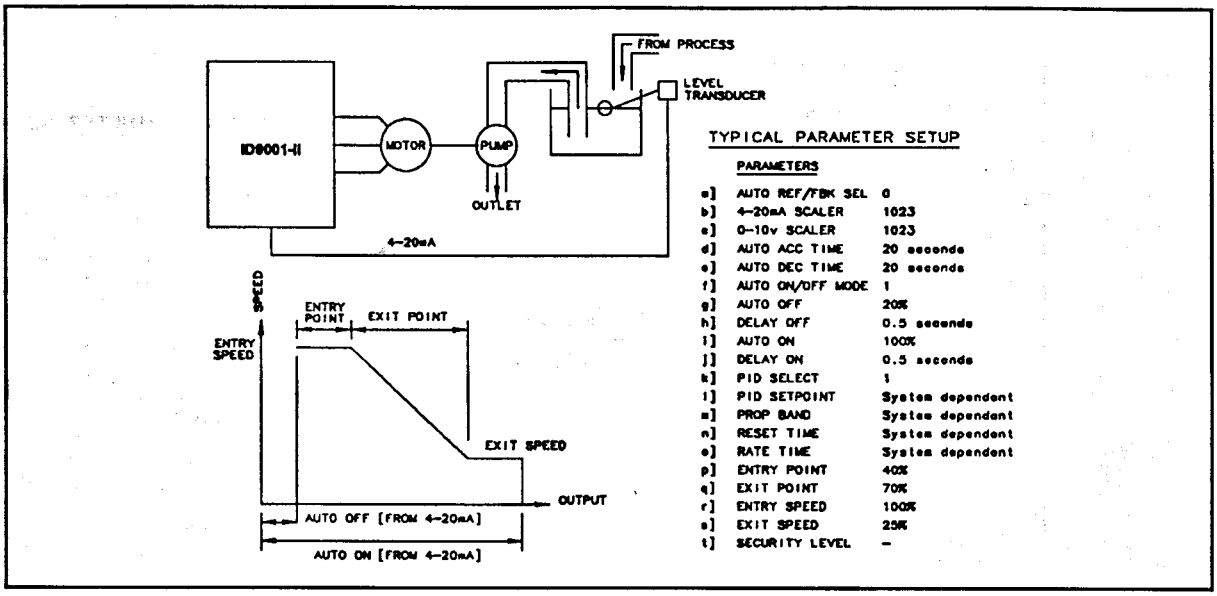

Figure 8.4 - Level Control Application

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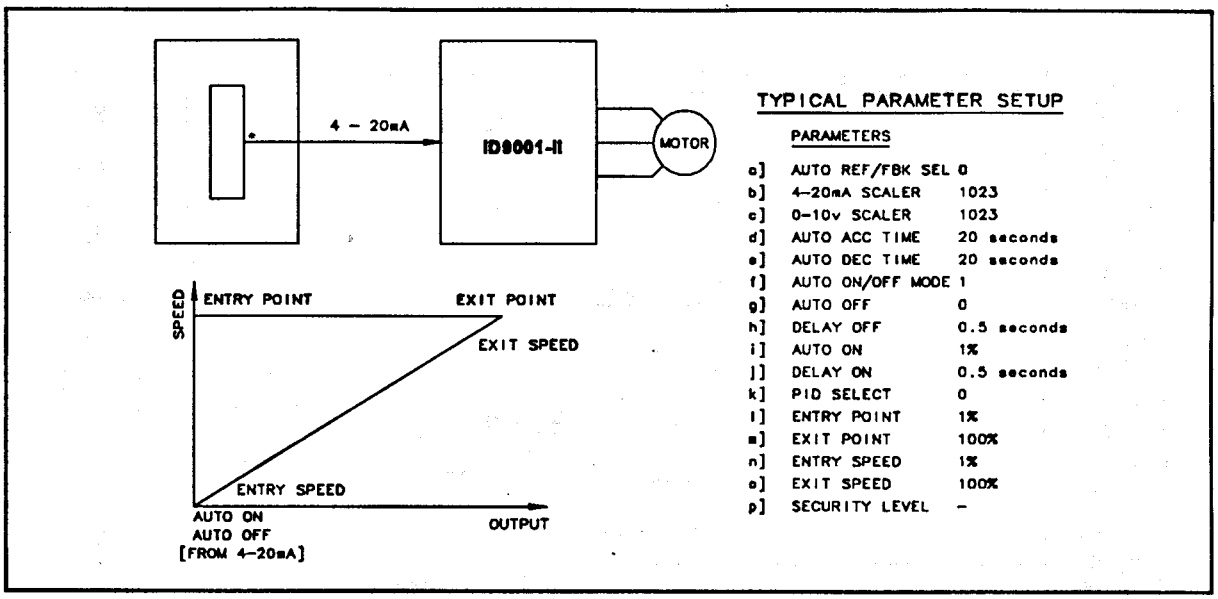

Figure 8.2 - Remote Speed Control Application

Flow - in this application, (See figure 8.2), the inverter is driving a fan which can vary the flow in the system by varying the fan speed. If a drop in pressure occurs an increase in fan speed is required. If the pressure has dropped below the setpoint then the controller output will also INCREASE, hence the signal profile could be set as shown in the Air Flow Control Application table. The inverse applies if there is an increase in pressure. The Auto On point is used as minimum pressure detection to start the system and the Auto Off point is set as an overpressure detection. Clearly the Auto Off point is above the Auto On point so the On/Off Mode parameter is selected to 1. The Entry Speed is normally set around 30% to 40% as for below this speed little work is done. The Exit Speed is set to minimise overpressures occurring in the system.

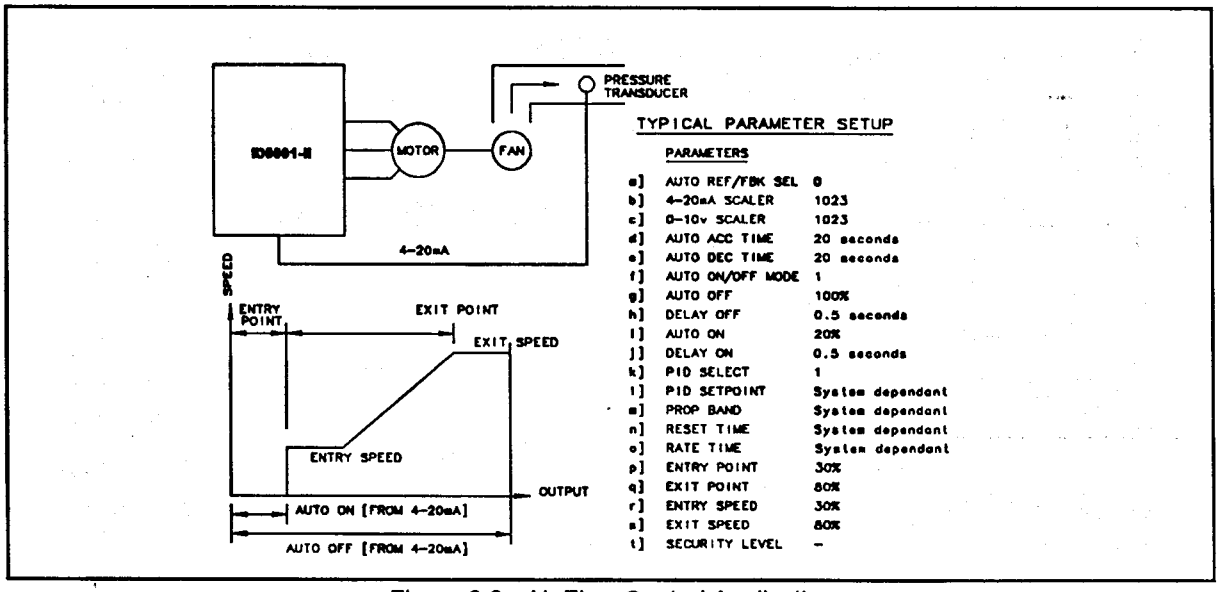

Figure 8.3 - Air Flow Control Application

Level Controller - in this application, shown below, the inverter is driving a pump which is emptying a tank which is being filled with liquid. The rate at which the tank is filled clearly determines the rate at which the pump must empty to maintain constant level. If the level drops a reduction in pump speed is required. However because the setpoint is above the feedback the controller output will be increasing, hence a speed signal profile could be set as below. The Auto On point is used as a maximum level detection to start the pump and the Auto Off point is used as a minimum level detection to stop the pump to allow the tank to refill. Clearly the Auto On point is above the Auto Off point so the On/Off Mode parameter is set to 0. The Entry Speed is normally set around 30% to 40% on a pump to prevent cavitation.

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SECTION 9

MAINTENANCE

Heenan Inverters are designed, built and tested for long, trouble-free service. Periodic maintenance is required to keep the Drive working reliably.

> **IMPORTANT NOTE: ALWAYS SWITCH OFF THE INPUT MAINS POWER TO THE EQUIPMENT BEFORE ATTEMPTING INSPECTION OR MAINTENANCE PROCEDURE.**

9.1 Inspection - every 6 months

1 Thoroughly clean the inside and outside of the Enclosure, using a vacuum cleaner fitted with a plastic nozzle. Keeping the Equipment free from dirt and dust allows proper heat dissipation.

2 Use touch-up paint as required on any rusty or exposed parts.

3 Inspect all electrical connections for tightness (especially during the first 6 months from start-up) and re-tighten if necessary.

Where the connectors are screw pressure types, it is strongly recommended that the power connections be retightened after the first few days of operation and checked monthly for tightness during the first few months of operation, then every 6 months thereafter. This includes the pressure connections on the Input Circuit Breaker and the power connections to the main terminal block TB3, in addition to any others that may be present.

4 Clean, and if necessary, replace ventilation fan filters if they are fitted.

9.2 Replacement of Parts

1 Replacement of component parts may be the most expedient method of troubleshooting when spare parts are available. When any sub-assembly is to be replaced, always check that the part number of the New Unit matches that of the Old Unit - including the dash number.

2 If any power electronic devices are removed during inspection or troubleshooting, prepare the matting surfaces as follows:-

It is recommended that complete modules be kept on hand as spare parts for an Inverter which contains IGBT's and Diodes, in order to reduce the amount of "down time". Although the power electronics devices used in Heenan inverters are conventional devices, the installation and mounting of devices to a heatsink requires some skill and care. If there is any doubt about the competency of maintenance personnel to re-mount devices, satisfactorily, it is suggested that modules with unserviceable devices be returned to the Factory for repair. However, if it is elected to keep spare devices on hand, the manufacturers of power semiconductors supply data on mounting practices, clamping forces and torques must be followed to preserve the reliability of the devices.

3 In environments where inverters are exposed to the maximum allowable climatic and loading conditions, the long term reliability of units may be enhanced by replacing the fans, fan starting capacitors and possibly, the d.c. link capacitors every 5 years. Under European type climatic conditions this service period may be extended.

When replacing d.c. link capacitors with new capacitors which may have been in storage for more than a few months, perform the following procedure to reform capacitors up to their original specification, before use.

1 Apply 80% the capacitor rated voltage for one hour.
2 Apply 90% the capacitor rated voltage for one hour.
3 Apply the capacitor rated voltage for five hours.

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SECTION 10

FAULT FINDING

10.1 Inverter Trip Message Description

An inverter fault trip will generally cause one of several standard trip messages to appear. Table 10.1 describes the conditions under which such trips will occur and gives guidance on how to solve any trip related problems.

When trips occur the ID9001-II will stop in a manner similar to an emergency stop and the LCD display change to indicate the type and number of trips. If multiple trips have occurred they may be read by scrolling the display using the "UP ARROW" and "DOWN ARROW" keys

Table 10.1 - Fault Finding Table

LCD DISPLAY MESSAGE	CAUSE OF TRIP	POINTS TO CHECK	SOLUTIONS
Drive Over Temperature	Overheating of the inverter stack heatsink	Heatsink and cubicle fans operating when the drive is running?	Replace fans and stack fan relay
		Ambient temperature too high?	Reduce ambient temperature
		Drive running in overload?	Reduce load
		Broken temperature sensor or sensing wires?	Replace sensor and/or sensing wires
Over Voltage	Over voltage on the d.c. link capacitors	Too short deceleration time set for the inertia of the load?	Lengthen the deceleration time
		Motor being overhauled by the load?	Dynamic braking required to increase inverter braking torque.
		Mains supply too high?	Change supply to suit inverter rating
Earth Leakage Trip	Short circuit to earth	Motor or motor cables shorted to earth?	Repair fault
		Excess humidity or ingress of water into the inverter or motor causing break down of insulation clearances?	Dry out machine and/or inverter. Megger machine before restarting in accordance with Section 6.3
		Low resistive path to earth via the inverter?	Check the inverter for shorts to earth Check cable length, consult Heenan Drives Limited
Supply Fail	Power to drive has dropped below 150V a.c.	Has the supply dipped or failed or lost a phase?	Restore the mains supply. If trips reoccur, check whether the starting of large motors etc., is causing transient dips in the supply
		Have any of the input fuses failed?	Replace input fuses
		Has the inverter been isolated and re-energised while running? Check inverter before fitting new fuses	
		Ensure operation cannot be illegally carried out	

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LCD DISPLAY MESSAGE	CAUSE OF TRIP	POINTS TO CHECK	SOLUTIONS
Over Current	Excess current flowing from the inverter	Too short acceleration time set for the inertia of the load?	Set a longer acceleration time
		Too much voltage boost applied for overcoming the motor losses?	Reduce the Volts Boost parameter
		Violent application of a heavy motor load?	Remove or slow down transient motor loads.
		I overload parameter set too high?	Reduce I overload down to the motor FLC, or lower on over rated inverters.
Thermistor Trip	Motor Thermistor has gone open circuit	Is the motor overheating?	Check loading and derating are correct for motor type.
	Thermal resistance > 4KΩ	Has the thermistor or its associated wiring failed?	Replace and repair as necessary
Sustained Overload	Overload on the inverter unit	Is the motor overloaded?	Remove overload
		Incorrect overload parameter settings?	Change overload parameters to suit motor loading cycle.
Detection Error!	Trip caused by spurious noise or control card/base driver card fault	Spurious strong electrical, RFI magnetic or radioactive noise present?	Protect unit and change all control cards and possibly semi-conductor devices.
		Control or power card failure?	Replace control and/or power card
Remote Watchdog Trip	No character received via the serial link	Check serial link connections. Check data being transmitted	
Programable Trip	Programmable Input went open circuit	PGM input open circuit	Investigate circuitry driving PGM input
Brake Over Temperature	Dynamic brake unit went over temperature	Dynamic brake cooling failed. Broken temperature sensor.	Check brake unit Check wiring to PGM input
Low DC Fail	DC link voltage has dropped below 150Vdc	Has the supply dropped or failed or lost a phase?	Restore the mains supply. If trips reoccur, check whether the starting of large motors etc., is causing transient dips in the supply.
		Has any of the input fuses failed?	Check inverter before fitting new fuses.
		Has the inverter been isolated and re-energised while running?	Ensure operation cannot be illegally carried out.
Loss of Auto	Auto control signal has dropped below the 'Auto Loss Level'	Has the auto control signal failed? Has the auto control signal wiring failed?	Replace auto control signal supply Repair auto control signal wiring
Loss of load	Motor load has dropped below the 'Load Loss Level'	Motor to load failed? Speed set point too low? Pump cavitating?	Check mechanical connection. Increase speed set point. Re-prime pump.

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SECTION 11

DIMENSIONS

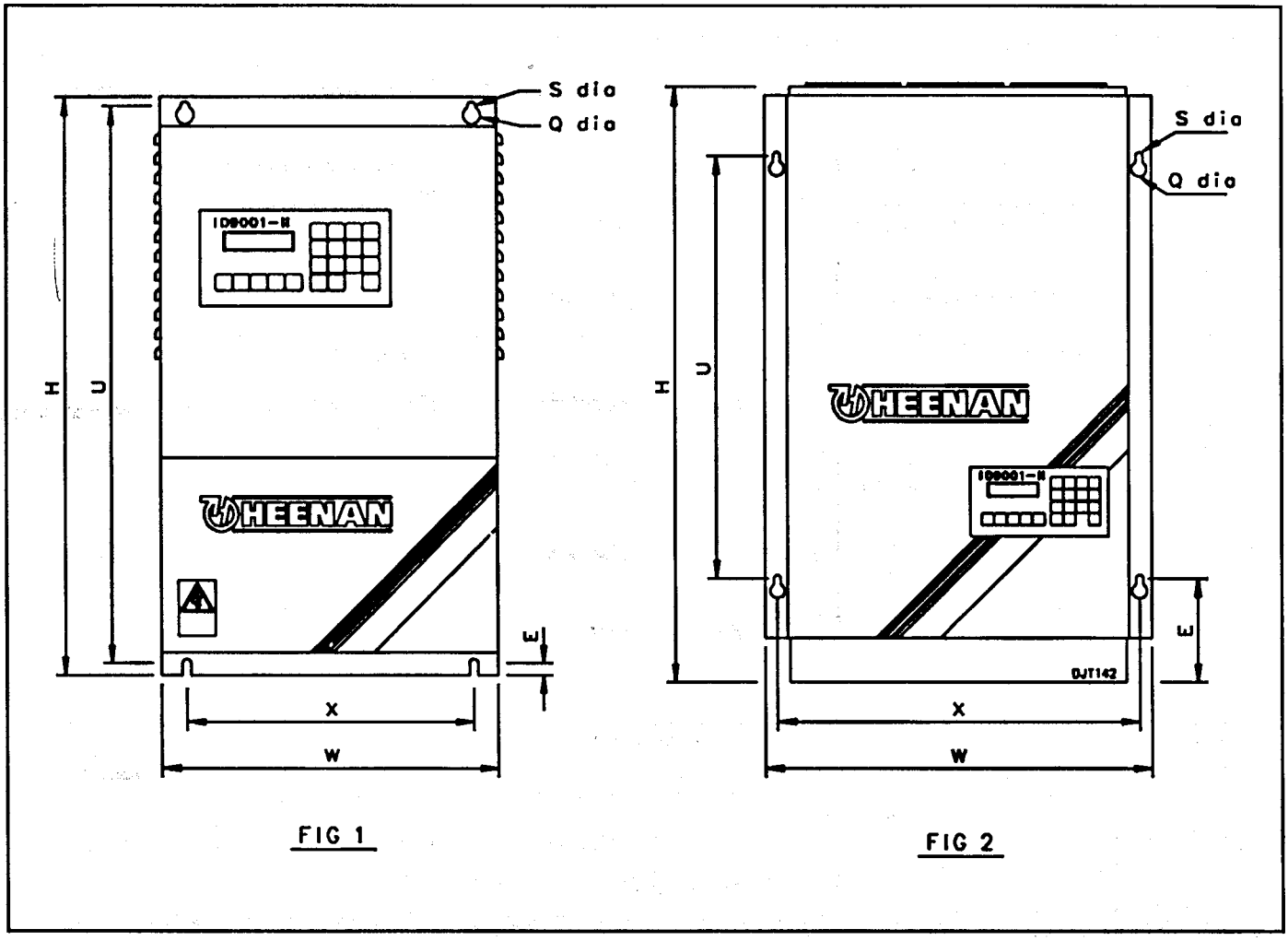

FIG 1

FIG 2

Figure 11.1 - ID9001-II Dimension and Ventilation

Model No.	Power kW	U	H	W	X	Depth	E	S dia	Q dia	Fig.
052	5.5kW	480	505	302	250	270+	12.5	9	18	1
072	7.5kW	480	505	302	250	270+	12.5	9	18	1
112	11kW	480	505	302	250	270+	12.5	9	18	1
152	15kW	480	505	302	250	270+	12.5	9	18	1
222	22kW	578	600	352	300	270+	12.5	9	18	1
302	30kW	514	730	475	445	290+	128	9	18	2
372	37kW	514	730	475	445	290+	128	9	18	2
452	45kW	514	730	475	445	290+	128	9	18	2
552*	55kW	514	730	475	445	290+	128	9	18	2
752	75kW	1040	1070	333	250	440+	12.5	11	22	1
902	90kW	1040	1070	333	250	440+	12.5	11	22	1

Note: * Loose 3-Phase Line Reactor
+ Add 25mm for optional RS232 and remote keypad plugs and cables

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