ZENER VARIDRIVE SOLUTIONS

ZENER 8000

Installation Manual

Document: IM00124 Rev B
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PRODUCT

This manual provides installation information for the following ZENER 8000 models;

8R : 380 to 480VAC
8L : 200 to 240VAC
8E: ECODRIVE 800VDC/380 to 480VAC (Auxiliary AC Supply)
8EL: ECODRIVE 400VDC/200 to 240VAC (Auxiliary AC Supply)

For information relating to the ECODRIVE and the connection to a solar array, refer to the *supplement manual IM00130* http://www.zener.com.au/images/im00130.pdf

This manual provides basic control configuration information to suit more common applications. Please refer to the *ZENER 8000 Reference Manual IM00140* http://www.zener.com.au/images/im00140.pdf for a detailed explanation of each control feature, including communications protocols.

All documentation for this product can be found on our product support link:

http://www.zener.com.au/support-zener.php

ZENER TECHNOLOGY AND QUALITY ASSURANCE

Since 1976 Zener Electric has supplied many thousands of drives to industry. These drives have been installed into numerous applications resulting in a wealth of in house experience. The Zener 8000 AC variable speed controller is the culmination of this experience, modern technology and industrial application requirements. The Zener Quality Assurance program ensures that every ZENER 8000 manufactured has proven to operate correctly in the production test bay before dispatch.

SAFETY

Your ZENER 8000 must be applied, installed and operated in a safe manner. It is the responsibility of the user to ensure compliance with all regulations and practices covering the installation and wiring of your ZENER 8000. The instruction manual should be completely read and understood before attempting to connect or operate the ZENER 8000. Only skilled personnel should install this equipment.

This equipment contains a number of components that are designated by their various manufacturers as “not for use in life support appliances, devices or systems where malfunction of the components can reasonably be expected to result in personal injury or death”. Customers using or selling Zener products for use in such applications do so at their own risk and agree to indemnify Zener for any damage resulting from improper use or sale.

THE CONTENTS OF THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE

Contents

Explanation of symbols

WARNING — Indicates a condition or practice that, if the warning is not strictly observed, could result in personal injury or death.

CAUTION — Indicates a condition or practice, if the caution is not strictly observed, could lead to damage or destruction of equipment or a significant impairment of proper operation.

WARNING — This symbol is used to highlight an electrical hazard. Failure to strictly observe the warning could result in electrocution.

This symbol is used to highlight additional information on the product's capabilities or a common error in installation, commissioning or operation.

Warnings

Read all operating instructions before installing, wiring, operating, servicing or inspecting the ZENER 8000.

Ensure that the instruction manual is made available to the final user of the product as well as all personnel involved in any aspect of installation, adjustment or maintenance.

Your ZENER 8000 must be applied and installed by a suitably qualified and experienced electrical tradesperson in accordance with this manual, good engineering practice and all local rules and regulations.

There are hazardous voltages inside the ZENER 8000 whenever it is connected to an electrical supply and for some time afterwards.

Before touching anything inside the ZENER 8000 enclosure or other equipment connected to the ZENER 8000 terminals, disconnect all sources of electrical power, wait at least 11 minutes for capacitors within the ZENER 8000 to discharge to less than 50VDC and then ensure, by measurement, that there is no hazardous AC or DC voltage present at any terminal.

The ZENER 8000 contains high energy circuits that may be hazardous. Do not operate the ZENER 8000 with the door open or any part of the enclosure removed.

Do not touch the terminals of the ZENER 8000 or any associated motor and wiring when it is energised, even if the ZENER 8000 and motor are stopped. Electric shock may result.

Do not modify this equipment electrically, mechanically or otherwise. Modification may create safety hazards as well as voiding the UL listing of models so listed.

The ZENER 8000 is designed to drive an appropriately rated and otherwise suitable 3 phase induction motor. It is not suitable for single phase motors or other types of motor or non-motor load. Use with inappropriate load types may create a safety hazard.

Where the ZENER 8000 is used as a component part of another product, it is the purchaser's responsibility to ensure that the final product meets all of the necessary safety, EMC, regulatory, operational and other requirements for that product. Requirements for the purchaser's final product may be substantially different to the requirements for stand-alone drive systems.

The ZENER 8000 is intended for use only in fixed wiring applications. It is not intended for use on a flexible supply cable.

The compatibility of drive systems incorporating ZENER 8000 and earth leakage protected electrical supply circuits is influenced by EMC filter components within the ZENER 8000 as well as other system components. Contact ZENER for further information before applying ZENER 8000 models to earth leakage protected installations.

Mount the ZENER 8000 on a vertical, incombustible surface such as metal or masonry. Do not place combustible or flammable material near the ZENER 8000. Failure to observe these precautions may create a fire hazard.

The ZENER 8000 is manufactured under strict quality control arrangements, however additional and independent safety equipment must be installed if the application is such that failure of the product may result in personal injury or property damage.

Ensure that electrical noise generated by the product and any associated equipment does not adversely affect the proper operation of other equipment or systems, particularly those that have a safety function.

Install emergency stop circuitry that removes power from the ZENER 8000 and does not depend on any feature of the product for proper and safe operation. Do not use the braking functions of the product for safety purposes.

The ZENER 8000 has features that may be used to cause an automatic restart in certain circumstances. The overall application (machine etc.) must be designed such that automatic restart is not hazardous.

Do not install this equipment in locations where mechanical damage to the enclosure is possible. In particular, consider vehicles, vandalism and attack by insects or animals. Severe equipment damage and safety hazards may result.

Receiving

- Inspect the ZENER 8000 for any shipping damage. If any damage is found, report it to the carrier immediately.
- Access the inside of the controller and visually check for any damage.
- Do not attempt to operate the ZENER 8000 if any obvious damage exists.
- After the initial inspection, the ZENER 8000 can be repacked and stored in a clean, dry location until it is required for use.
- DO NOT store this equipment in an area where the ambient temperature will fall below -20°C or rise above 70°C.
- DO NOT store this equipment in areas that are subject to condensation or corrosive atmosphere. Proper storage is necessary to ensure satisfactory controller start up and performance.

Software

This manual applies to ZENER 8000 software revision 5.2.9. The software revision is displayed briefly at power up and may also be viewed in the service menu.

This manual provides installation and basic control configuration information for the ZENER 8000 to suit more common applications. Please refer to the *ZENER 8000 Reference Manual IM00140* http://www.zener.com.au/images/im00140.pdf for a detailed explanation of each control feature, including communications protocols.

Installation

ZENER 8000 mounting location

See page 83 and following pages for mechanical installation dimensions and necessary clearances for ventilation.

In general, the ZENER 8000 should be mounted as close to the motor as practical, consistent with other requirements. This is not an absolute requirement, but the following advantages may support such a choice:

- Generally, electrical cabling costs per metre are lower for the unscreened power cable used on the AC supply side than for the screened output cable required between the ZENER 8000 and the motor. Cabling costs can therefore be expected to be lower when less screened cable is needed.
- EMC performance can be expected to be mildly enhanced with a shorter motor cable because of reduced leakage from the cable
- In circumstances where an isolator switch is required near the motor, it may be possible to connect this in the AC supply to the ZENER 8000. This has the advantages of saving two screened cable terminations and allowing the use of a non-metallic isolator switch enclosure where allowed by local electrical codes. There are also safety advantages for service personnel in that the local isolator switch also isolates the ZENER 8000 from the electrical supply.

The choice is predominantly an economic one. There are many perfectly satisfactory installations where, for a variety of specific site reasons, the most effective solution results in the ZENER 8000 and the motor being a long distance apart.

CAUTION Installation Information

- See page 83 and following pages for mechanical installation dimensions and necessary clearances for ventilation.
- The ZENER 8000 must be mounted on a vibration free vertical surface, away from heat radiating sources. Do not mount the ZENER 8000 in direct sunlight or on a hot surface.
- The ZENER 8000 must be mounted vertically. No other mounting orientation is acceptable.
- If the ZENER 8000 is mounted inside another enclosure, the total heat dissipation and resulting temperature rise in the enclosure must be allowed for.
- Attention is drawn to the potential for condensation in vulnerable environments. Additional precautions may be required for all enclosure types.
- The installation location and environment should provide for safe access and working conditions for service personnel. Do not mount the ZENER 8000 in “confined spaces” [1]
- Do not drill holes in the enclosure except in the gland plate.
- Remove the gland plate before drilling cable holes.
- Do not allow metal shavings or any other conductive material to enter the enclosure or damage may result.

[1]Confined spaces are generally defined in Occupational Health and Safety (OH&S) regulations to mean spaces where special precautions are necessary to ensure a safe breathing atmosphere, or there is limited access for escape/rescue in case of emergency

Supply circuit protection and switchgear

Either fuses or a circuit breaker must be connected as shown on pages 6 and 7. The protective elements used and any upstream switchgear (contactors, isolation switches etc) must be selected with due regard for the prospective short circuit currents of the electrical supply and the requirements of your local electrical code. The selection should provide for “type II” (no damage) coordination as per IEC 60947 or Australian Standard AS 3947.

Fuses or circuit breakers of the current limiting type are preferred in order to minimise the total energy let through in the unlikely, but possible, event of a major arcing fault in wiring or within ZENER 8000 enclosure.

Installations that are required to be UL compliant must use UL listed fuses of the amp rating and class detailed on page 5 of this manual.

Cable sizes

Cable sizes should be selected according to local wiring rules using the currents given in the table on page 72-73. Note that the power terminals of the ZENER 8000 are designed to accept normally stranded power cables with temperature rating of 70ºC or more. In the event that other cable types are to be used (particularly flexible cables with very fine stranding), the overall size of the conductor should be checked prior to final cable selection for proper fit in the power terminals. The combination of the cable and the supply circuit protection selected must be such that the supply cable is properly protected under all circumstances.

Earthing & Earth Cables

The ZENER 8000 chassis and the frame of the associated motor must be connected to earth at all times when the electrical supply is connected. The protective earth conductors used for this purpose should be selected according to local electrical installation regulations. Conductors in the vicinity of unscreened motor cables such as cable trays and similar supports should also be earthed to avoid hazards caused by capacitively coupled voltages.

Electrical Isolation

A suitable means of isolating the ZENER 8000 from the electrical supply must be provided in accordance with your local electrical code. In the event that a second supply is connected to the relay contacts on the control terminal strip (or otherwise brought into the ZENER 8000 enclosure), suitable marking must be applied to the outside of the ZENER 8000 enclosure by the installer to indicate the dual supply arrangement in accordance with your local electrical code and other safety requirements. A means of isolating the second electrical supply source will also be required.

Motor thermal protection

The ZENER 8000 provides an electronic type thermal overload function that relies on the measured motor current to estimate the thermal conditions of the motor. For complete motor thermal protection, microtherms or thermistors should be installed in the motor winding and wired to the appropriate trip relay. The ZENER 8000 Extended Features Option provides a thermistor relay function and other features.

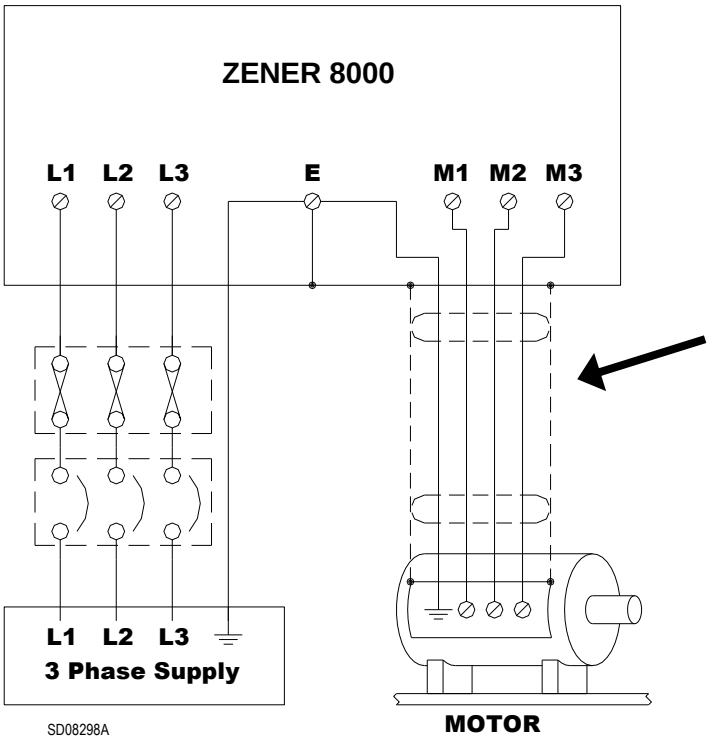
Fuse and Circuit Breaker Ratings for all ZENER 8000 Models

Model Numbers	Chassis Size	Maximum RMS Input Current	Recommended Fuse or C/B Rating (A)	UL Class Fuse for UL compliant installation (A)†
8*001..	A	2.9	10	10A, Class J
8*003..	A	5.2	10	10A, Class J
8*005..	A	7.3	10	10A, Class J
8*007..	A	10.5	16	15A, Class J
8*011..	A	15.7	20	20A, Class J
8*016..	A	17.8	20	20A, Class J
8*023..	B	34.7	40	40A, Class T
8*030..	B	42.7	63	60A, Class T
8*040..	B	53.5	63	60A, Class T
8*057..	B	66.1	75	75A, Class J
8*082..	C	89.1	125	125A, Class T
8*109..	C	123	160	175A, Class T
8*140..	C	153	200	175A, Class T
8*170..	C	183	200	200A, Class T
8R220..	D	231	250	250A, Class T
8R315..	D	336	400	400A, Class T
8R390..	D	413	630	630A, Class T
8R490..	D	516	630	630A, Class T

* R or L to specify supply voltage - see page 70 for details.

† The fuse class referred to here is the American designation fuse required for a UL compliant installation. This should not be confused with the British Type T etc designation, which refers to an entirely different kind of fuse.

ZENER 8000 Power wiring for 3 Phase supply



CAUTION

Be sure to review the information on the following pages concerning electrical installation issues.

See installation practices for Electromagnetic compatibility (EMC) compliance on page 9 and specific information for the EMC compliant installation of each chassis size on pages 10-14 BEFORE selecting or installing motor cables and glands.

The screened motor cable should only contain the phase and earth (PE) conductors of one ZENER 8000 and the associated motor. Do not include other conductors inside the screen.

DC bus chokes

ZENER 8000 may be fitted with an optional DC bus choke (standard in some models). Fitting this option offers several benefits:

- Considerable reduction in harmonic and RMS currents in the AC line, particularly on low impedance (high fault level) electrical supplies. Values become relatively independent of AC line parameters, simplifying application design
- Increased tolerance to phase imbalance in the 3 phase AC supply
- Increased immunity to AC line transients

Input / Output Filters

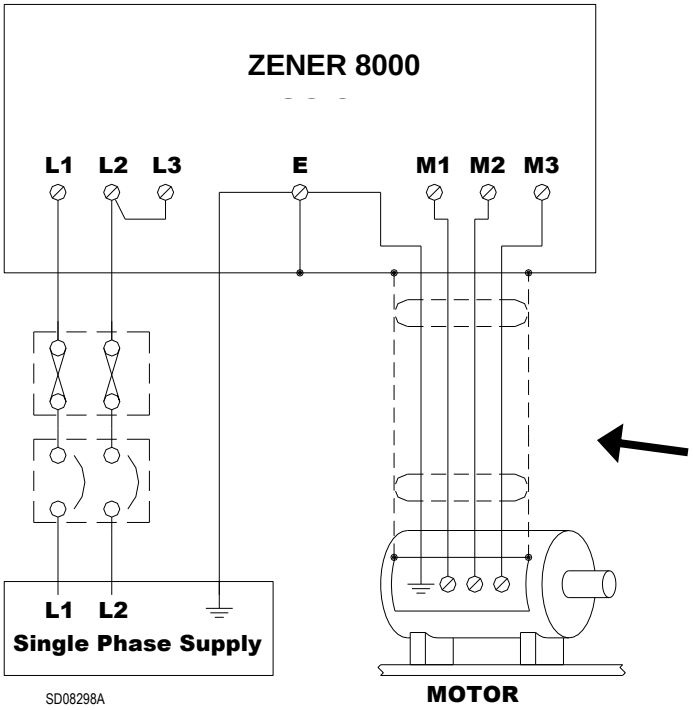
ZENER offers various input and output filters to a wide range of applications including

- Harmonic reduction filters
- Submersible pump filters
- dv/dt limitation filters
- High performance output filters

And the capability to design and supply special filters.

Contact ZENER for details.

ZENER 8000 Power wiring for Single Phase Supply



The D05 1 Phase Input Supply feature on page 77 must be enabled for single phase supply operation

CAUTION

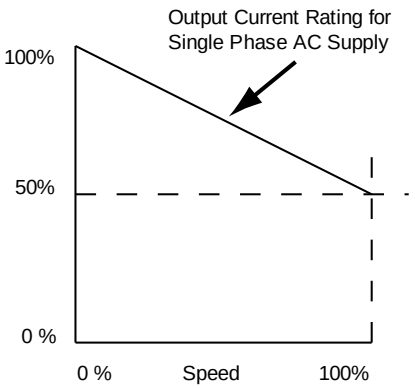
Be sure to review the information on the following pages concerning electrical installation issues.

See installation practices for Electromagnetic compatibility (EMC) compliance on page 9 and specific information for the EMC compliant installation of each chassis size on pages 10-14 BEFORE selecting or installing motor cables and glands.

The screened motor cable should only contain the phase and earth (PE) conductors of one ZENER 8000 and the associated motor. Do not include other conductors inside the screen.

Many ZENER 8000 models can be operated from a single phase AC supply. In addition to the electrical installation information on pages 4 to 6, the following additional constraints apply to operation on a single phase power supply:

- The single-phase supply voltage must be within the 3 phase supply voltage limits for the ZENER 8000 model to be used. For example, use an “8L-----“ model for a 240VAC single-phase supply or an “8R-----“ model for a 480VAC single phase supply
- A standard 3-phase motor of a voltage rating appropriate to the ZENER 8000 model should be used
- See the specifications section of this manual for output voltages
- Fuses or circuit breakers for the AC supply should be according to the table on page 5
- Single-phase motors are unsuitable for use with ZENER 8000
- The DC Bus Choke option is mandatory for operation from a single-phase supply
- The continuous output current rating is reduced from the values stated for 3-phase supply operation according to the graph on the right



- The maximum available output voltage will decrease to 95% of the RMS input voltage. This is a consequence operating from a single phase supply and means that the available motor torque at full speed will be reduced to approximately 90% of the motor rated torque. De-rating can be avoided if the single phase input voltage is at least 1.05 times the rated motor voltage
- The single phase input current (RMS) will be approximately 2.0x the output current

ZENER 8000 with a DC Supply

Some models of ZENER 8000 may be used with a DC supply. There are a number of issues to be considered in properly applying ZENER 8000 in this situation, some of which involve the characteristics of the particular DC supply to be used. Zener also offers ECODRIVE models specifically designed for use in solar photovoltaic systems.

Please consult the factory for proper application of ZENER 8000 on DC supply systems.

ZENER 8000 with a DC Supply from a Solar Array

The ECODRIVE model is a ZENER 8000 with special firmware and hardware designed to operate directly from the DC supply sourced from a solar array. The standard ZENER 8000 cannot be used for this purpose.

The ECODRIVE can also operate with an auxiliary AC supply sourced from a grid or generator supply. When the ECODRIVE is used with both an AC supply and a DC supply sourced from an array you must read both this manual and the ECODRIVE supplement manual.

Refer to the ECODRIVE support webpage http://www.zener.com.au/support-8e.php for the supplement manual (IM00130) for more details.

Generator Supplies

The ZENER 8000 may be used with a generator supply. Contact ZENER for further information concerning application and compatibility considerations.

Installation practices for Electromagnetic Compatibility (EMC) compliance

The EMC performance of the ZENER 8000 is installation dependent. For compliance with EMC standards, the use of a screened power cable between the ZENER 8000 and the motor is required. Other arrangements that provide a continuous metallic sheath enclosing only the motor phase conductors and the associated protective earth (PE) conductor may also be used.

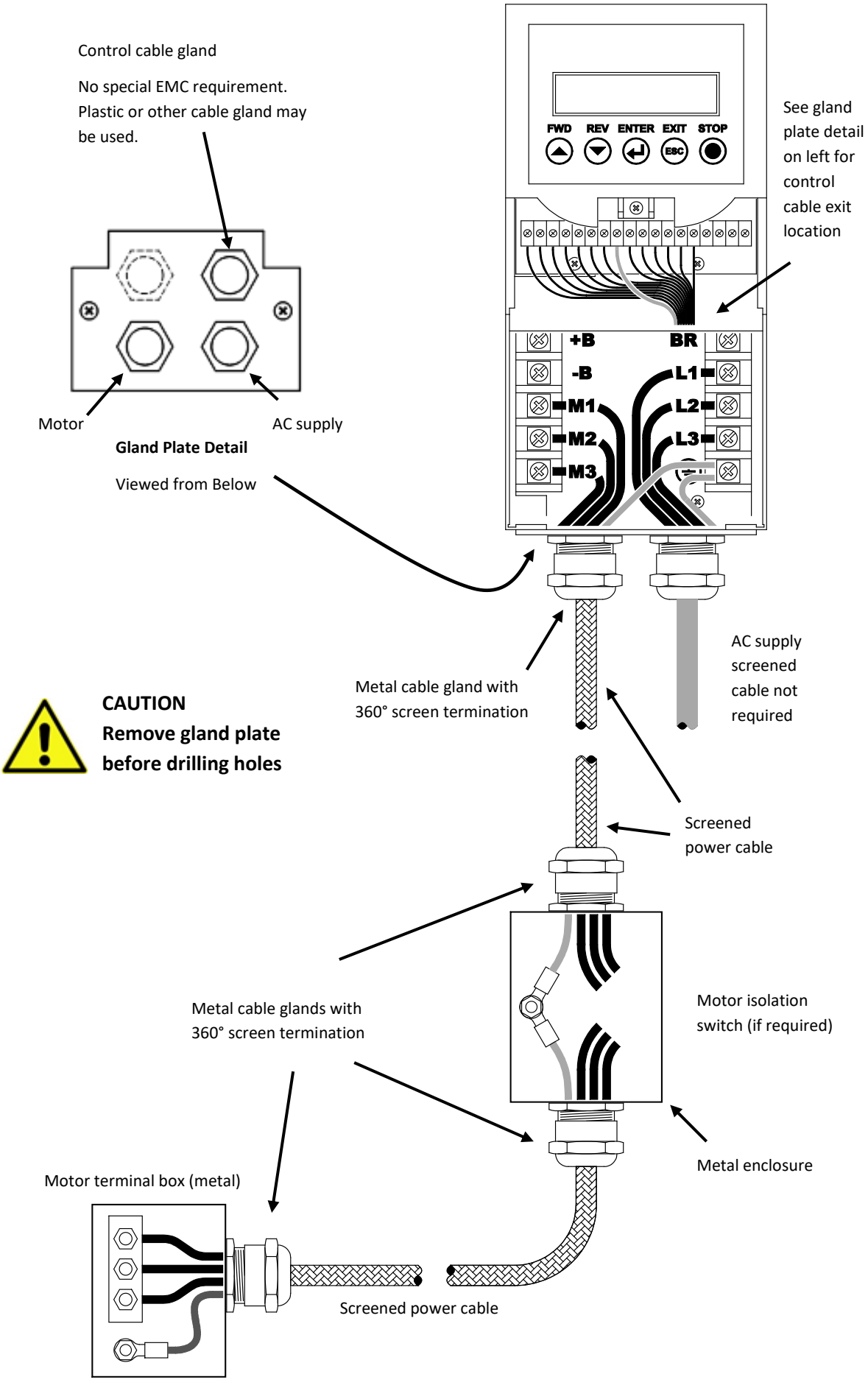
In order to achieve the required electrical performance at high frequencies, it is essential that the screen of the cable have a 360° connection to both the ZENER 8000 gland plate and the motor terminal box. The correct type of metal cable gland to suit the screened cable should be used. The protective earth (PE) conductor should be terminated in the usual way to meet the local wiring codes at the ground terminals provided in the ZENER 8000 and the motor. Isolation switches wired between the ZENER 8000 and the motor should be in a metallic enclosure with the power cable screen properly terminated on both sides. Failure to properly terminate the screened power cable (or alternative metal sheath) will result in a severe degradation of the screened cables performance at high frequencies and increase the possibility of EMC problems. The screened motor cable should only contain the phase and earth (PE) conductors of one ZENER 8000 and the associated motor. Do not include other conductors inside the screen.

Specific information for the EMC compliant installation of each chassis size is provided on pages 10 - 14.

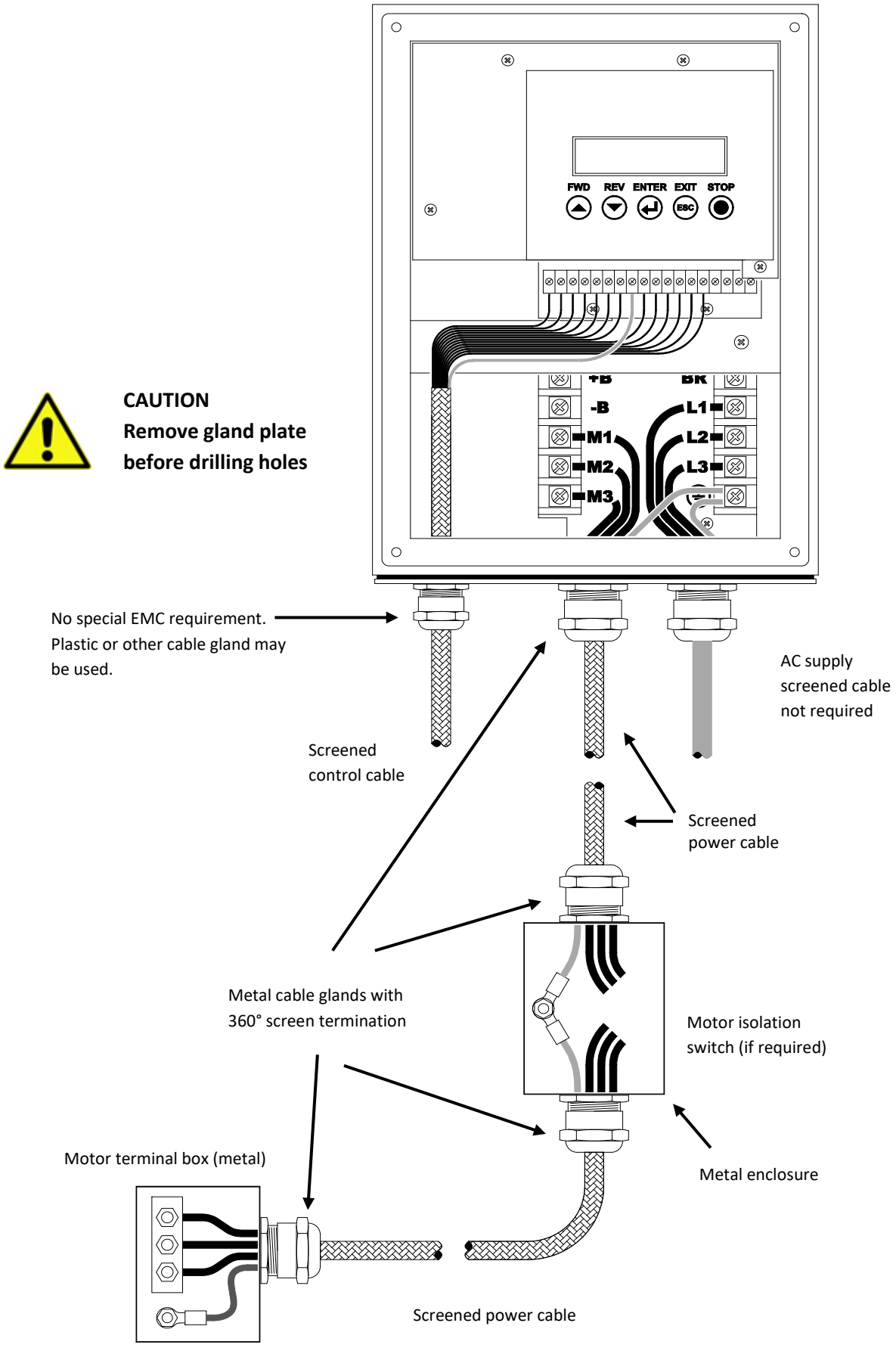
Wiring materials for EMC compliance

The EMC related properties of the shielded power cable used between the ZENER 8000 and motor will have a significant impact on the overall EMC result achieved in any given installation. The EMC performance of an installation will usually be dominated by the lowest performance section of the ZENER 8000 to motor cabling. For this reason it is imperative that appropriate material (including cable glands/terminators) is used in every part of this cabling. There is a wide range of materials available, and these may be generally categorised as follows:

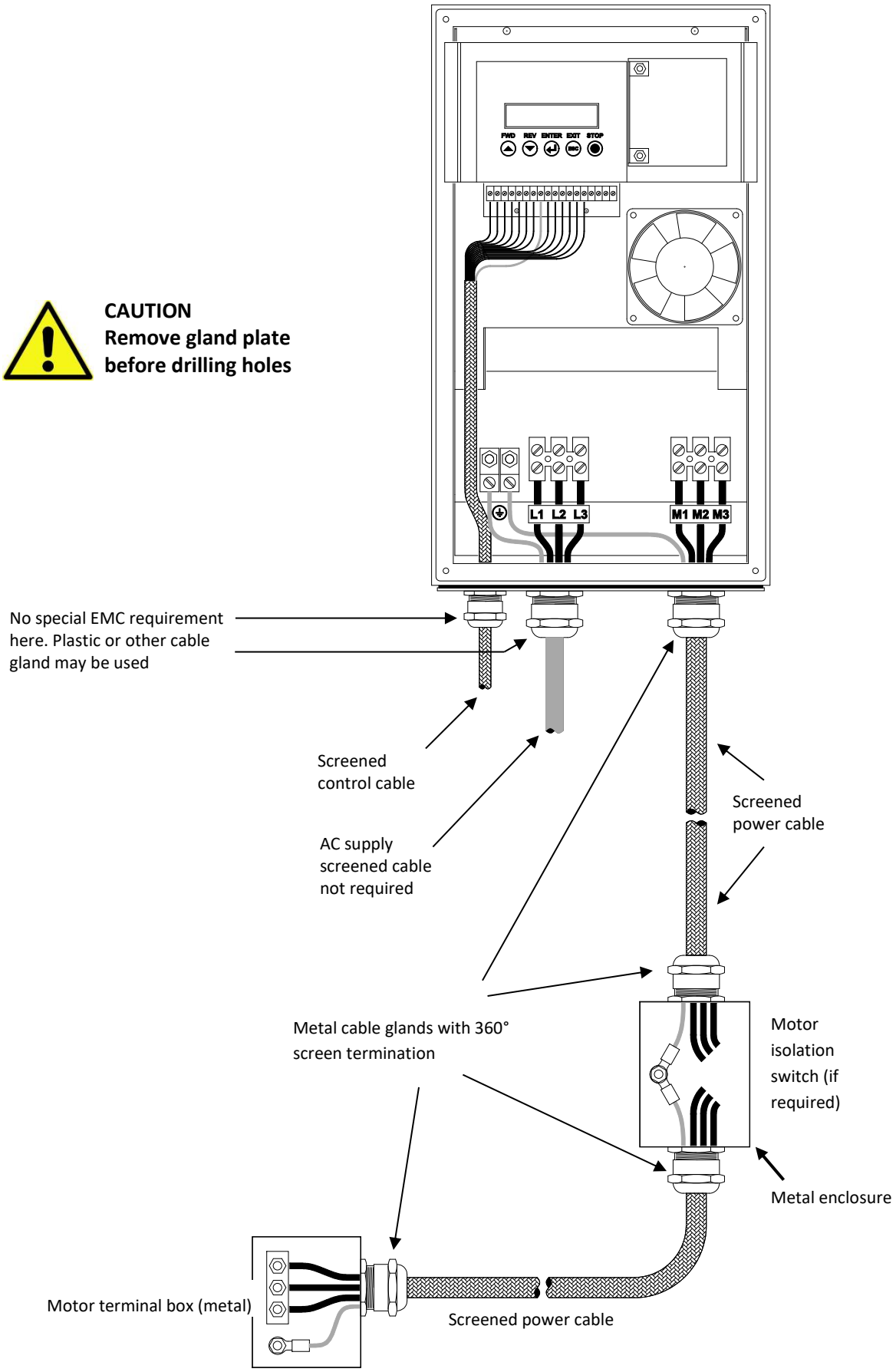
	Category	Technical Data	Comment	
1	Screened cable material from reputable manufacturers	Technical data will be available to allow assessment of the performance of the material against specific criteria	The manufacturer's claimed data can generally be relied on, provided that the proper installation and termination practices are strictly adhered to.	✓
2	Generic materials with well understood EMC properties For example, screwed steel conduit and MIMS cable	The technical performance of these materials is well understood by analysis from basic principles. Specific data has been reported in reputable engineering research journals.	These materials generally offer very high performance, provided that the proper installation and termination practices are strictly adhered to.	✓
3	Material without specific EMC performance data. Armoured cables and flexible conduit systems fall into this category when there is no EMC performance data provided. Note that there are high performance, fully EMC specified examples of these materials available which would make them part of category 1	None. Assessment of the likely performance by visual inspection is difficult and unreliable	These materials represent a high risk category because the EMC performance is simply unknown. Apparently similar materials may have widely differing EMC performance. In general, there is no control of the EMC properties during design or manufacture because this is not the intended application.	✘



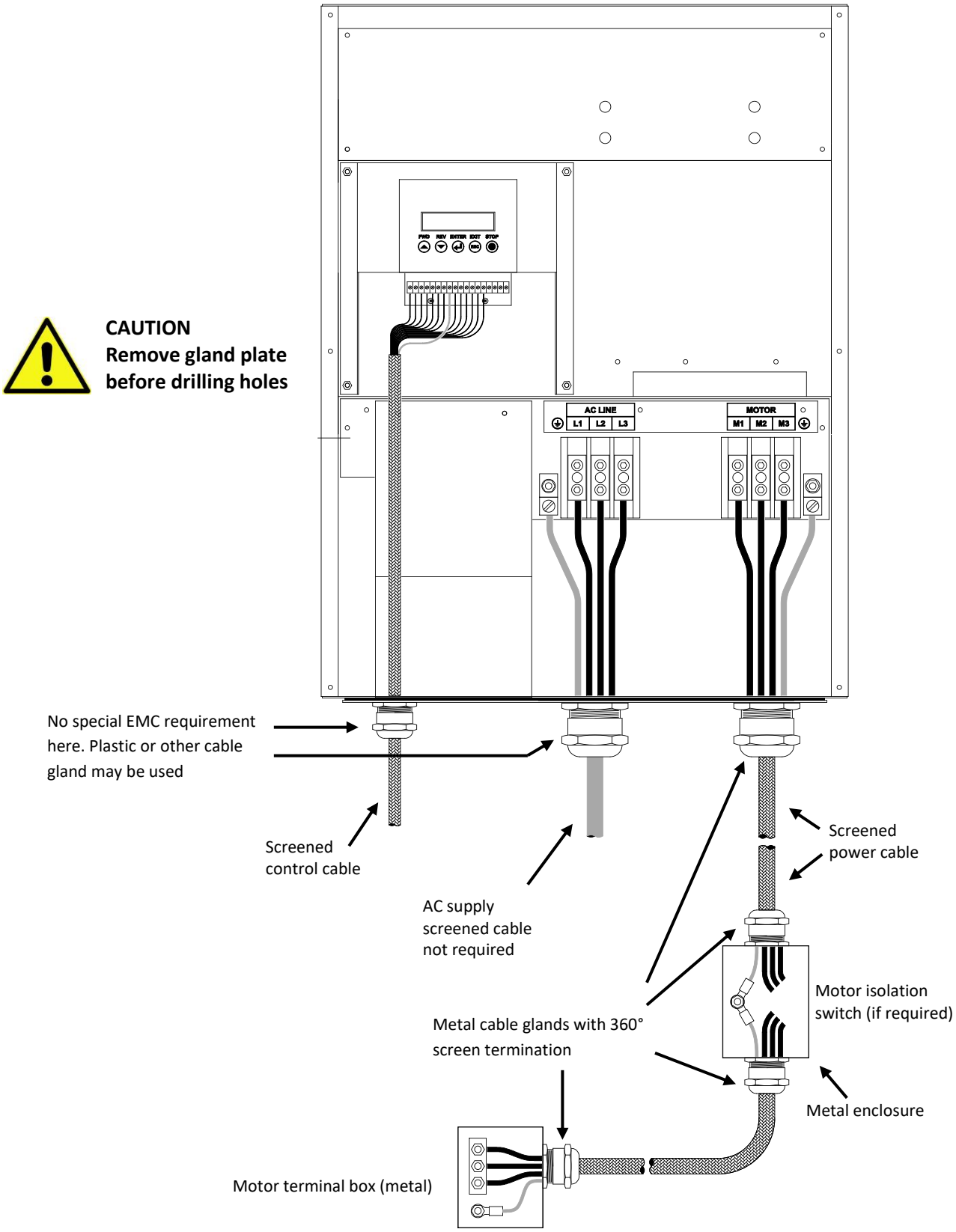
Chassis A (1-11Amp) IP30 EMC Installation



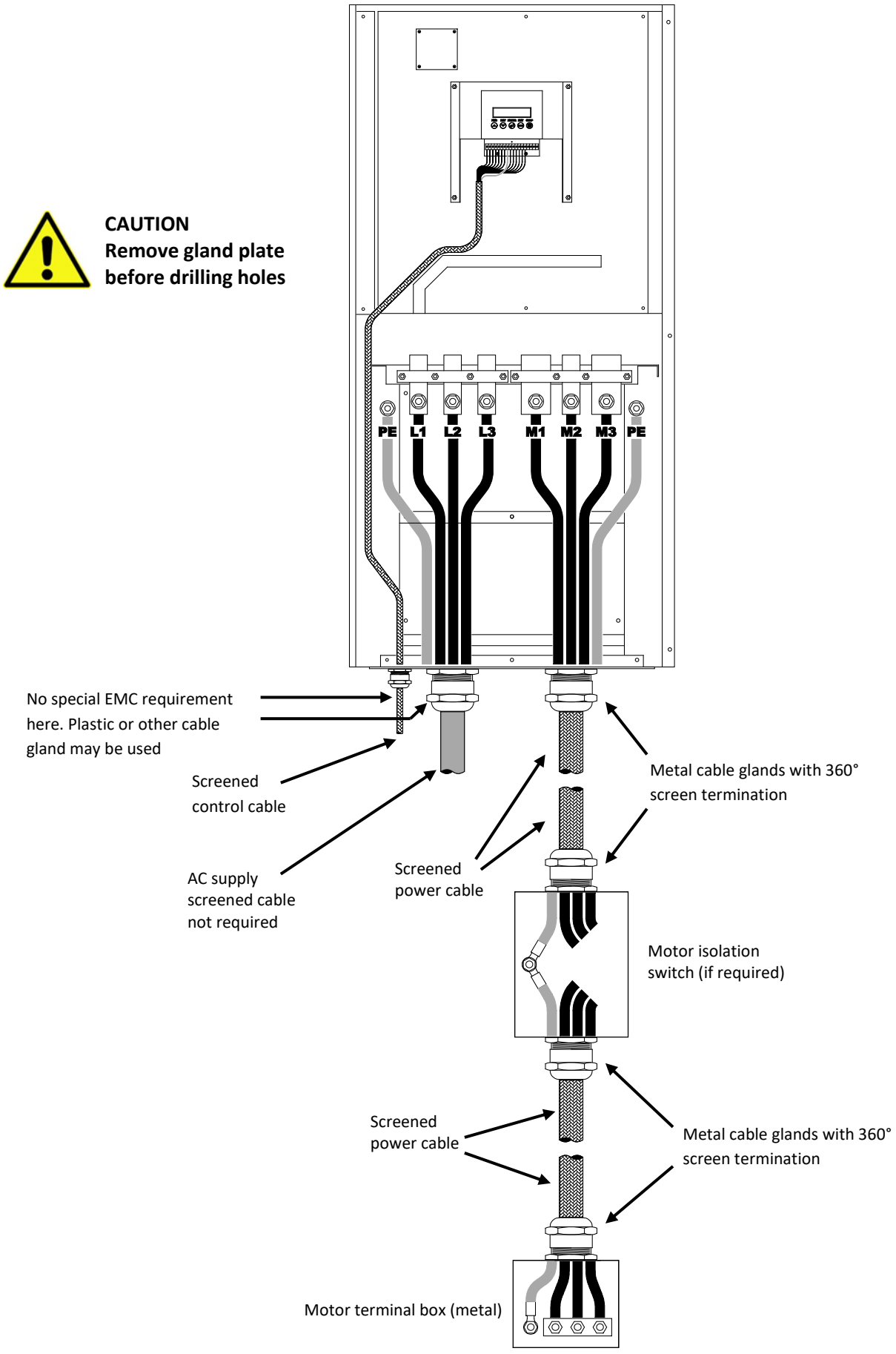
Chassis A (1-16Amp) IP66 EMC Installation



Chassis B (23 – 57Amp) EMC Installation



Chassis C (82 – 170Amp) EMC Installation



Chassis D (175 – 490Amp) EMC Installation

EIA/RS-485 Communications Wiring

The ZENER 8000 communications port is EIA/RS-485 compliant and is isolated from ground and other circuits. This communications port is used by BACnet MS/TP and Modbus RTU protocols.

The communications system (communications cable, ZENER 8000 and other devices) needs to operate reliably in a potentially electrically noisy environment. For best performance and to reduce the risk of network failure, we recommend the following:

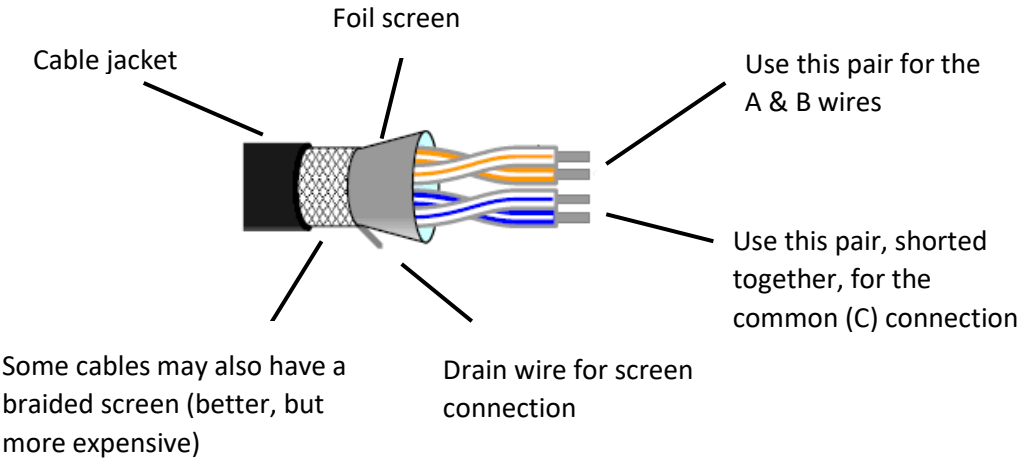
Best practice

Best practice for EIA/RS-485 communications requires 3 conductors and a shield. It is frequently discussed in terms of being a two wire network, but this is not the case.

- Two conductors are used to carry the EIA/RS-485 data as a differential voltage signal. These wires should ideally be twisted together so that any magnetically induced interference voltage will occur equally in both conductors and be rejected by the differential nature of the EIA/RS-485 interface circuit
- The third conductor is used to keep the common connection (marked as terminal "C" in ZENER 8000) in all the communications interfaces at the same potential, that is, keep the common mode voltage at each interface within the limits specified by the standard
- The Shield is connected to earth/ground at one end[2] only and provides protection against capacitive coupling to nearby cables and other electrical noise sources

One arrangement that meets these requirements using generic materials is as follows:

- Use a standard two pair shielded instrumentation cable. Internally, this will have a total of 4 conductors, physically arranged as two twisted pairs surrounded by an aluminium wrapper as a screen. A bare "drain wire", in contact with the aluminium wrapper, makes an electrical connection to the screen
- One pair is used for the data signals. The other pair is used in parallel as the common wire. The screen (drain wire) is connected to ground at one end only



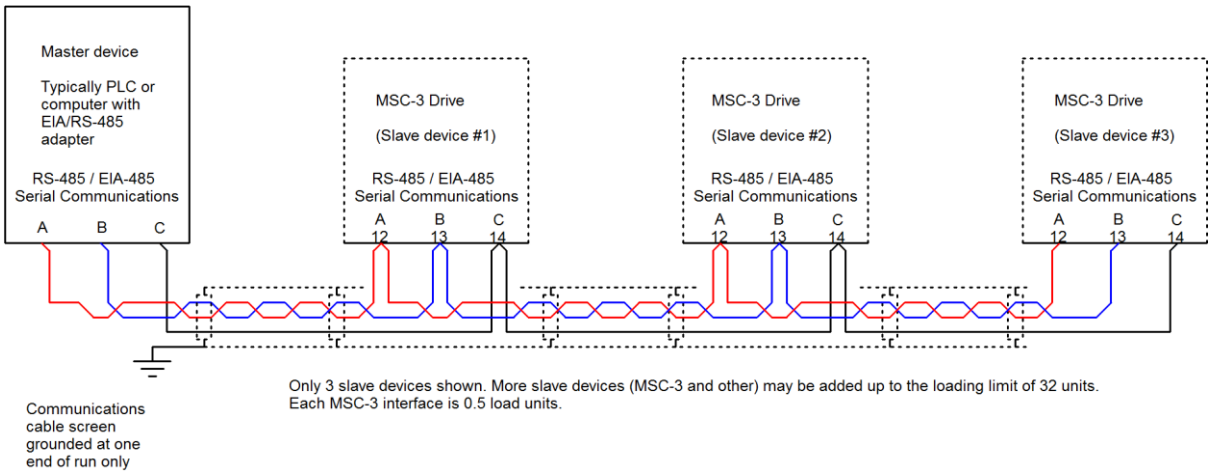
[2] Why one end only? Because there will be voltage differences between various ground points in an electrical installation that contain significant amounts of electrical noise and occasionally significant power frequency voltages during electrical fault events. We don't want these voltages to cause a current in the communications cable screen (because it would then induce a voltage in the cable conductors inside), so we ground the screen at one point only.

Terminating resistors

For best performance with long cable runs and high data rates a terminating resistor should be fitted at each end of the cable run. Values of 100 or 120 Ohms are commonly used, connected between the A and B terminals of the first and last devices on the cable run. For convenience, the ZENER 8000

EIA/RS-485 interface incorporates a 120 Ohm terminating resistor that is controlled by menu item G167 TERMINATOR. A terminator should not be fitted to, or selected at, intermediate devices on the communications cable. The built in 120 Ohm terminating resistor will be automatically disconnected whenever the ZENER 8000 is not powered.

The purpose of the terminator is to supress electrical reflections (echo) that may occur on a long communications cable where the time for the signal to travel the length of the cable becomes significant compared to the rise time of the signalling pulses. In more compact installations, this will not be an issue and the system may benefit from the slightly higher signal levels that result from terminating resistors not being fitted.



Typical EIA/RS-485 wiring arrangement

General

- Use twisted pair shielded communications cable
- Connect EIA/RS-485 common terminals in addition to data conductors
- A linear wiring scheme (daisy chain) is preferred over a star arrangement or one with stubs
- The cable should have its shield connected to ground at one end only (earthing recommended at the computer / controller end)
- Avoid laying communication cables adjacent to power cabling and wiring. If not possible utilise the best separation of communication cabling and power cabling. Communication cables should cross power cables at right angles
- The EIA/RS-485 standard allows a total of 32 standard load units on a network segment. Each ZENER 8000 interface is 0.5 standard load units, allowing a master device and at least 62 ZENER 8000 drives. Network loading for other equipment may vary – check with the equipment manufacturer

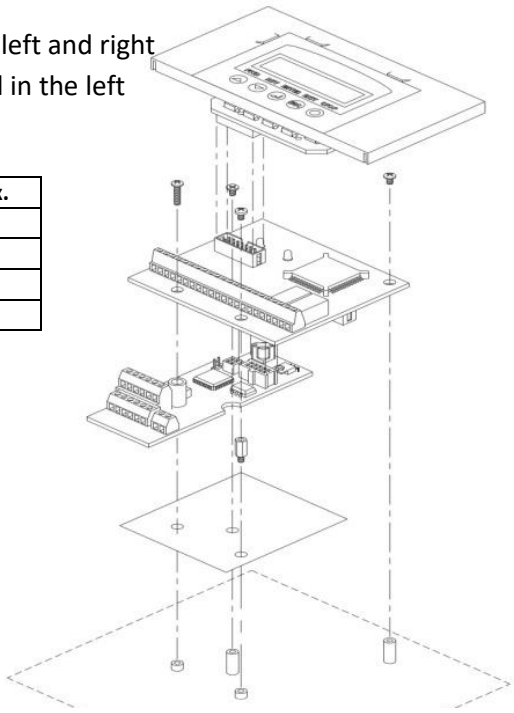
Shortcuts

From time to time we are asked if all this is really necessary and perhaps pointing out some functional installation installed in some lesser way. Will it work? Can it be made to work? The short answer is basically yes, The downside is that compromise arrangements tend to be a source of frustration with issues like setups that work during a bench test but troublesome in the field. There is also some equipment that doesn't have an accessible common connection. For these compromise situations – ask us – we can almost always find a creative solution!

Plug-in Option Board Wiring

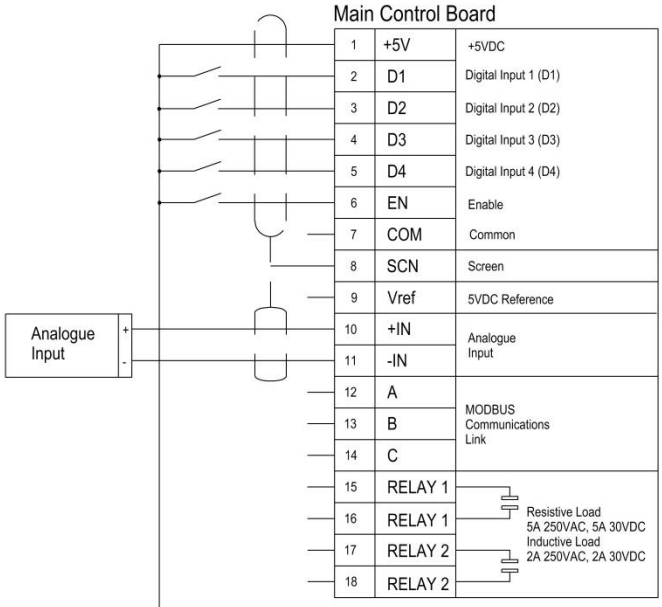
A maximum of 2 option boards may be installed, one in each of the left and right slots. Some applications require the extended features option fitted in the left slot.

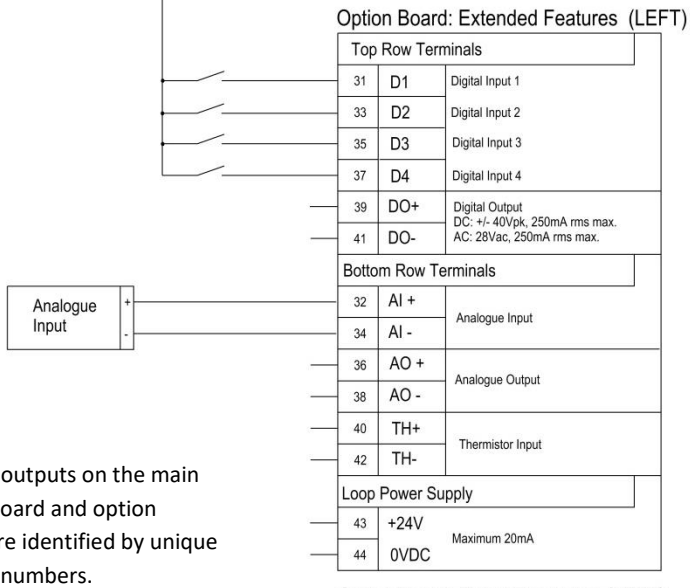
Option Board	Installation / Location	Max.
Extended Features	Left &/or right. left preferred/recommended	2x
Relay Expansion	Left &/or right. Right preferred/recommended	2x
Thermistor Only	Left &/or right. Right preferred/recommended	2x
Ethernet Modbus TCP	Left &/or right. Right preferred/recommended	1x

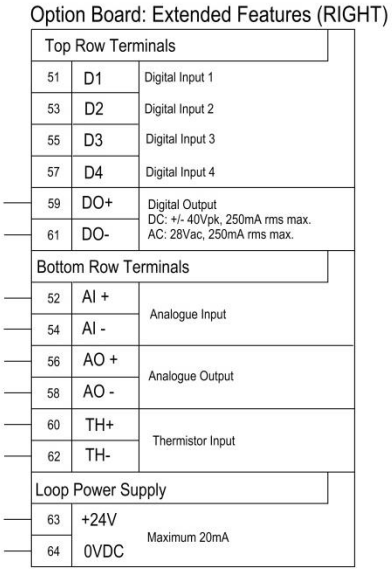


Refer to the option instruction sheet for detailed installation instructions.

Option fitted in left slot shown above.







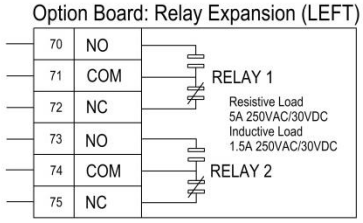
Note:

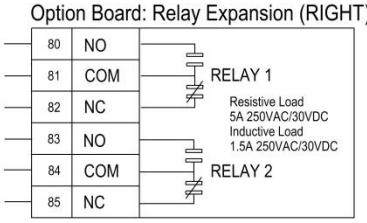
Inputs & outputs on the main control board and option boards are identified by unique terminal numbers.

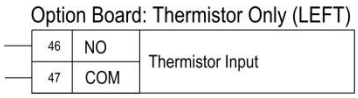
Eg. AI (32,34)

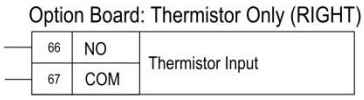
Is the analogue input terminal 32 & 34.

Option boards installed in the right slot require the terminal label provided to be fitted.









Ethernet network interface

An optional Ethernet network interface supporting Modbus TCP is available.

For further information, please see http://www.zener.com.au/support-8r.php

Remote mounted display

An optional remote mounted display console is available.

For further information, please see http://www.zener.com.au/support-8r.php

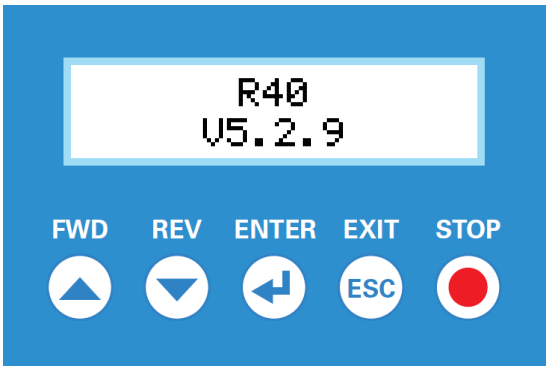
ZENER 8000 Start Up

This manual provides basic control configuration information for the ZENER 8000 to suit more common applications. Please refer to the *ZENER 8000 Reference Manual IM00140* http://www.zener.com.au/images/im00140.pdf for a detailed explanation of each control feature, including communications protocols

Connect the input and motor power wiring in accordance with the installation information beginning on page 3. Select the terminal configuration you require. Connect the control wiring according to the appropriate Control Wiring Diagram or follow a quick setup. The ZENER 8000 is now ready to run. Before applying power ensure that rotation of the motor shaft will not cause injury or damage.

Finding your way around

When the ZENER 8000 is first powered up, the drive model and version is displayed for approximately 2 seconds. This information may also be accessed from the service menu. An example of this display is:



After a few seconds, the display will switch to show the operation display.
The operation display shows the current operating status of the ZENER 8000. A detailed description is on page 20

To continue with the setup process, just press ESC. This takes you to a menu that gives access to the various settings needed to customise your ZENER 8000.

Control Modes

The ZENER 8000 takes start/stop and speed reference signals from two groups of sources. These are designated as LOCAL and REMOTE modes. The mode in use at any time is determined by the state (on or off) of the input terminal assigned to the REMOTE function. A “remote override” function can also be configured that allows switching between local and remote modes whenever the Speed / Reference Live Display is in view by pressing the ENTER button for 5 seconds. See parameter J04 for and the ZENER 8000 Reference Manual IM00140 for further details.

ZENER 8000 in the factory default (“out of the box”) state is ready to operate in the LOCAL mode from the console buttons.

Local

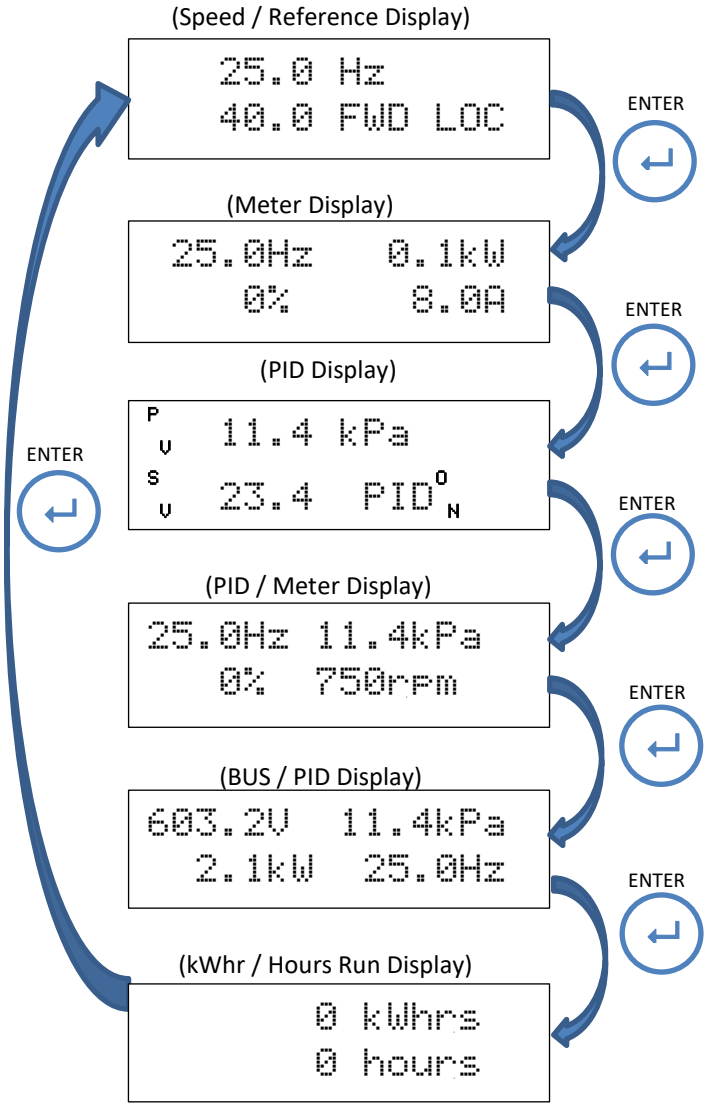
In local mode, ZENER 8000 is controlled from the console (front panel) buttons. Use FWD to start and increase speed, REV to reduce speed or select reverse direction. Reverse rotation is blocked unless parameter D03 REVERSE is enabled.

Remote

In remote mode, ZENER 8000 is controlled from the control terminals. The function of each of input terminals can be assigned by a preset “application” or individually configured as required.

Operation Displays & Pushbuttons

The operational displays show the operating state of the ZENER 8000. The six operational displays are: Speed / Reference Display, Meter Display, PID Display, PID / Meter Display and kWhr / Hours Run Display. Press ↵ (ENTER) to reveal each display.



Speed / Reference Display

The top line displays the operating output frequency and the second line displays the speed reference and the drive status

Meter Display

The top line displays the operating output frequency and power and the second line displays motor load and output current.

PID Display

The top line displays the process variable (PV) with its units and the second line displays set-point variable (SV) expressed with the same units.

PID / Meter Display

The top line displays the operating output frequency and process variable (PV) and the second line displays motor load and motor speed.

BUS / PID Display

The top line displays the DC Bus voltage and process variable (PV) and the second line displays output power and output frequency (ECODRIVE8000 only).

kWhr / Hours Run Display

The top line displays the kWhrs consumed by the motor and the second line displays accumulated running time of the motor

Local Mode Operation Example

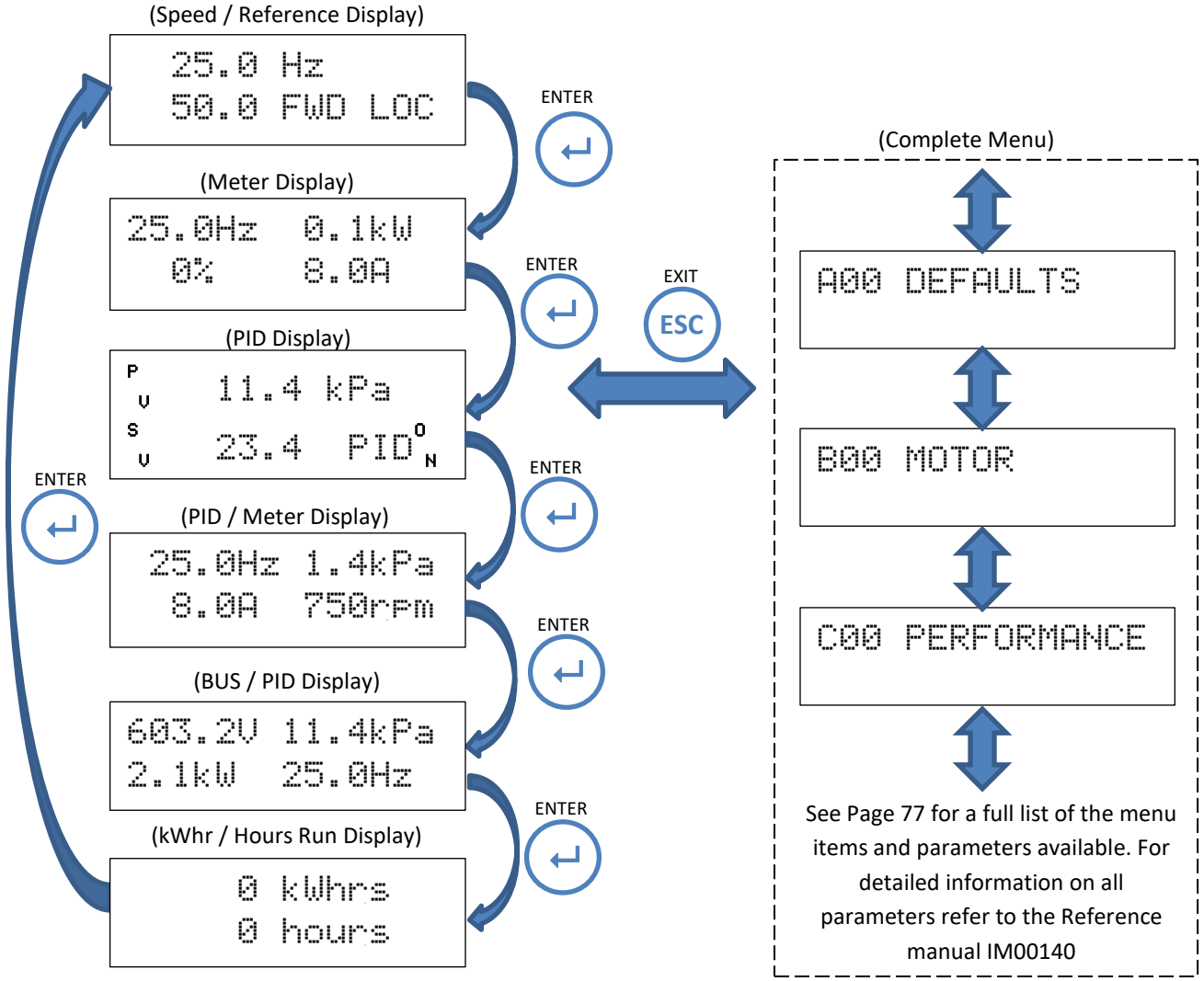
The Speed / Reference display above shows the desired output speed is 40 Hz and the motor is rotating at 25 Hz in the forward direction in local mode as indicated by the status "**FWD LOC**". Some notes:

- The ZENER 8000 is started by pressing the ▲FWD button.
- The speed reference is increased by pressing the ▲ FWD button. The motor will accelerate to this speed.
- The speed reference is decreased by pressing the ▼ REV button. The motor will decelerate to this speed.
- The ZENER 8000 may be started in reverse (if enabled) by pressing ▼ REV button.
- Pressing STOP will stop the motor or reset any trip condition.
- Press ESC to access the configuration menus

IMPORTANT! If the motor shaft rotates in the wrong direction remove the input power, wait for the ZENER 8000 to discharge and swap any two motor phase wires. Re-apply input power and select a direction by pressing ▲ FWD or ▼ REV.

Complete Menu

The broad range of motor-drive solutions requires parametric configuration changes. To gain access to configuration parameters, press ESC to show either the “Complete Menu” or a customised user menu. With factory default parameters installed pressing ESC, will show the complete menu.



To move around the menu system, press:

- Press the ▲ FWD and ▼ REV buttons to display each menu item.
- Press the↵ ENTER push button to enter a sub menu or change a parameter.
- Press ESC to abandon a parameter change or exit a sub menu.
- Press ESC several times in a row to return back to the operation displays.

After applying power it is recommended that you at least go through the **B00 MOTOR**, **C00 PERFORMANCE** and **G00 INPUT/OUTPUT** menus to set up the ZENER 8000 before running the motor to prevent any unexpected motor operation. The ZENER 8000 is supplied with a link between the EN terminal and the +5V terminal. This link must always be made for the motor to run.

When exiting the menu & prompted ‘SAVE CHANGES’, press ENTER to save changes otherwise changes will be lost on power down. NEVER remove power while the ZENER 8000 is going through the saving process.

Setup for your application

There are two ways to set up ZENER 8000 for your specific application:

1. Select a pre-configured ZENER 'Application' and then enter a minimal list of parameters guided by a menu specific to that application. Details of the pre-configured applications begin on page 23.

OR

2. Access the ***Complete Menu*** and directly set the parameters necessary for your application (see page 27).

Note: Selecting a pre-configured application does not preclude further customisation by accessing the ***Complete Menu*** after initial setup.

What is a ZENER 'Application'

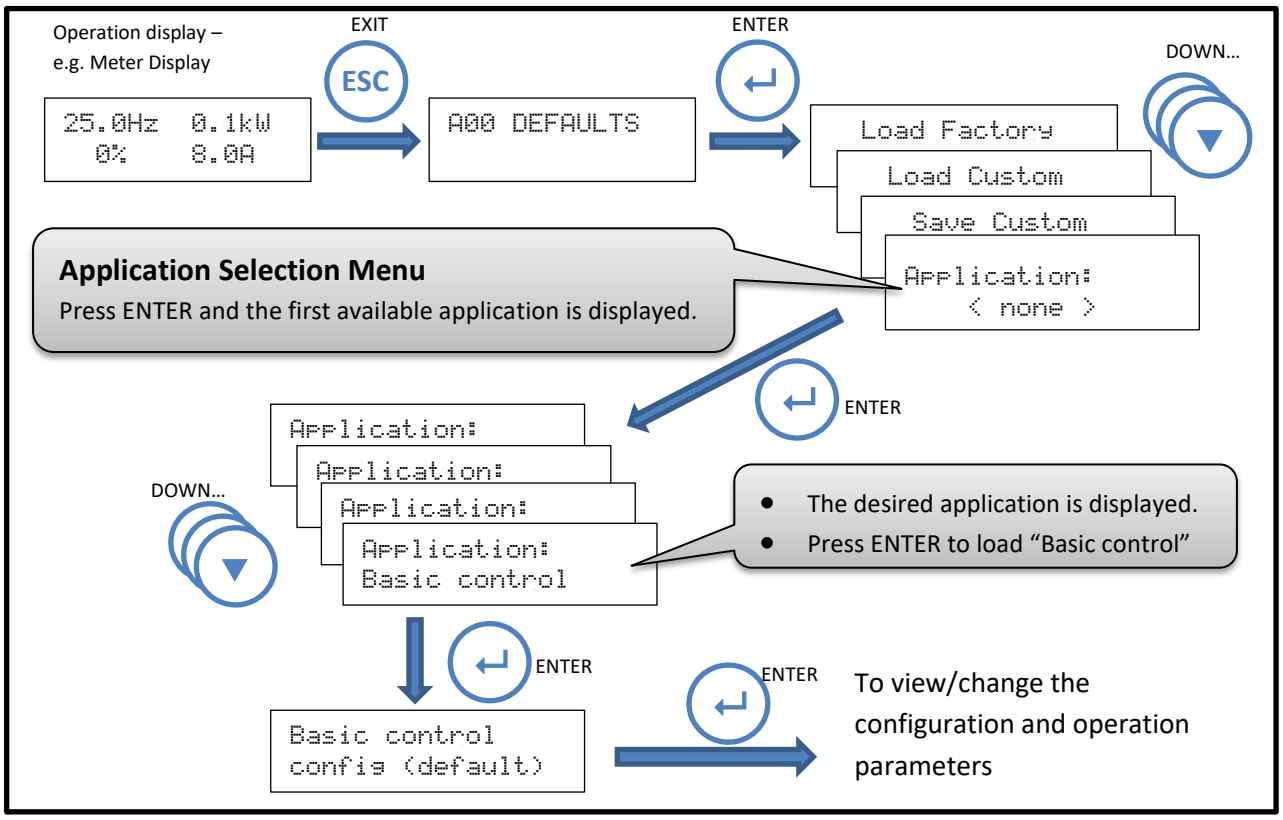
An 'Application' is firmware that aims to simplify wiring, programming and the commissioning of a ZENER 8000 drive. An 'Application' programs the drive and creates new user friendly menus with the essential settings. This eliminates time consuming setups, the reading & interpretation of complex manuals and ensures all critical protection is installed & set up correctly.

Since the 'Application' programs all the ZENER 8000 parameters required and also creates a custom 'User menu' to allow the end user of the equipment to make appropriate adjustments, there is generally no reason to program additional parameters unless there is a variation to the intended operation of this 'Application'.

Each ZENER Application is documented with a wiring diagram and step by step commissioning procedure.

Loading an Application

Follow the diagram below to load an application in this case the "Basic control" application.



Applications

An “Application” groups parameters together creating a short menu to summarise all the relevant parameters necessary for the task at hand. The ZENER 8000 has several applications on offer ready for service. Each application will have documentation detailing wiring and commissioning information.

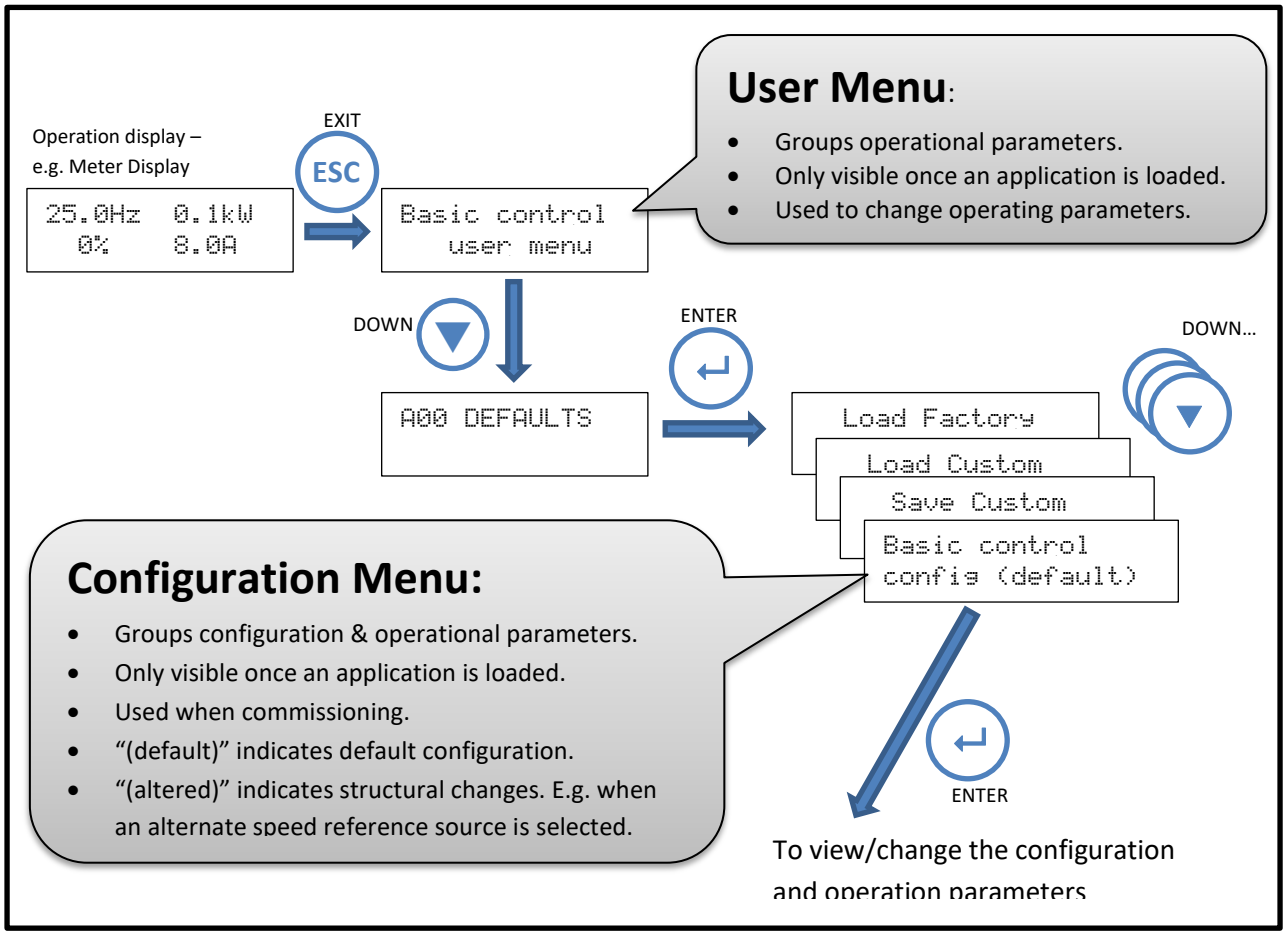
Standard ZENER8000 Applications

Application	Description	Page No.	Item number
Basic Control	Standard Industrial terminals, 0 to 10V Remote reference	33	SW08018
Machine/JOG	Machine Drive, Start/Stop, Jog Forward & Reverse	36	SW08008
4 Speed Sel	1 of 4 Speed reference selection	51	SW08017
Pressure Ctl	Water Pumping With Automatic Pressure Control	54	SW08013
Pump PID 1	PUMP PID 1 Automatic Pressure Control	57	SW08019
Pump PID 2	PUMP PID 2 Automatic Pressure Control	61	SW08020
HVAC Fan	Supply Air Fan / Smoke Spill Fan/Return Air	42	SW08012
Stairwell Fan	Stairwell Fan, HVAC terminals	45	SW08010
Air Pressure	Auto Control Stair Pressurisation Fan	48	SW08011
Cooling Tower	Auto Control Cooling Tower Fan	39	SW08007

Before loading an ‘Application’ read the overview first to confirm it is the desired configuration and operation.

Application Menus

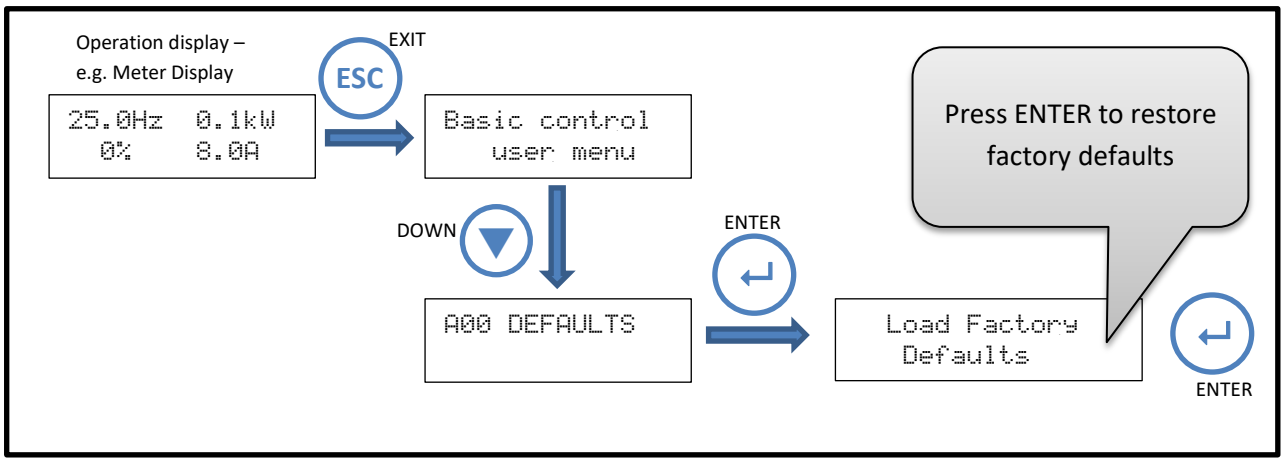
When an application is loaded, two new menus are created: The User menu and the Configuration menu.



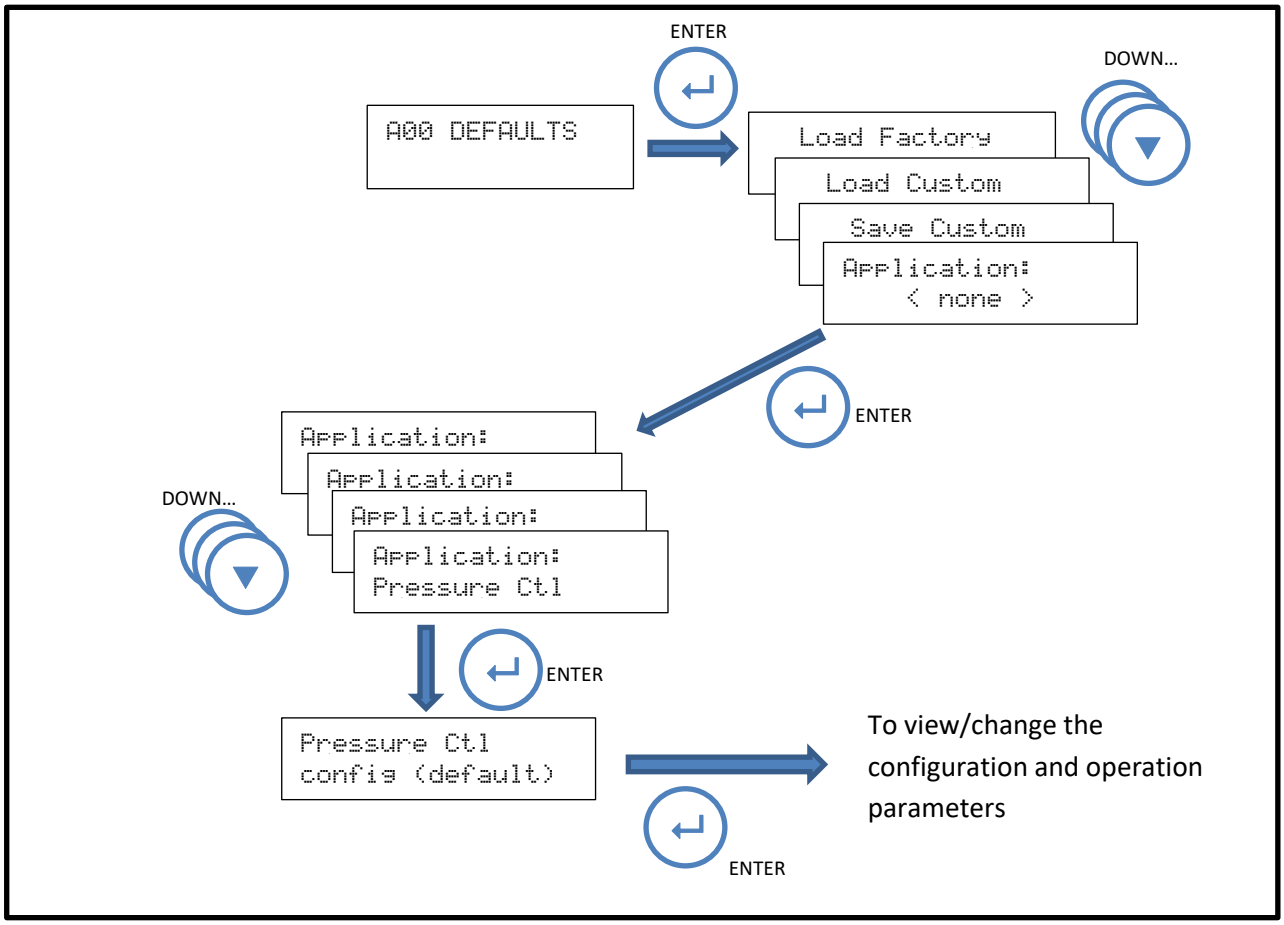
Changing an Application

There are 2 steps necessary to change an application:

1. Restore factory defaults.

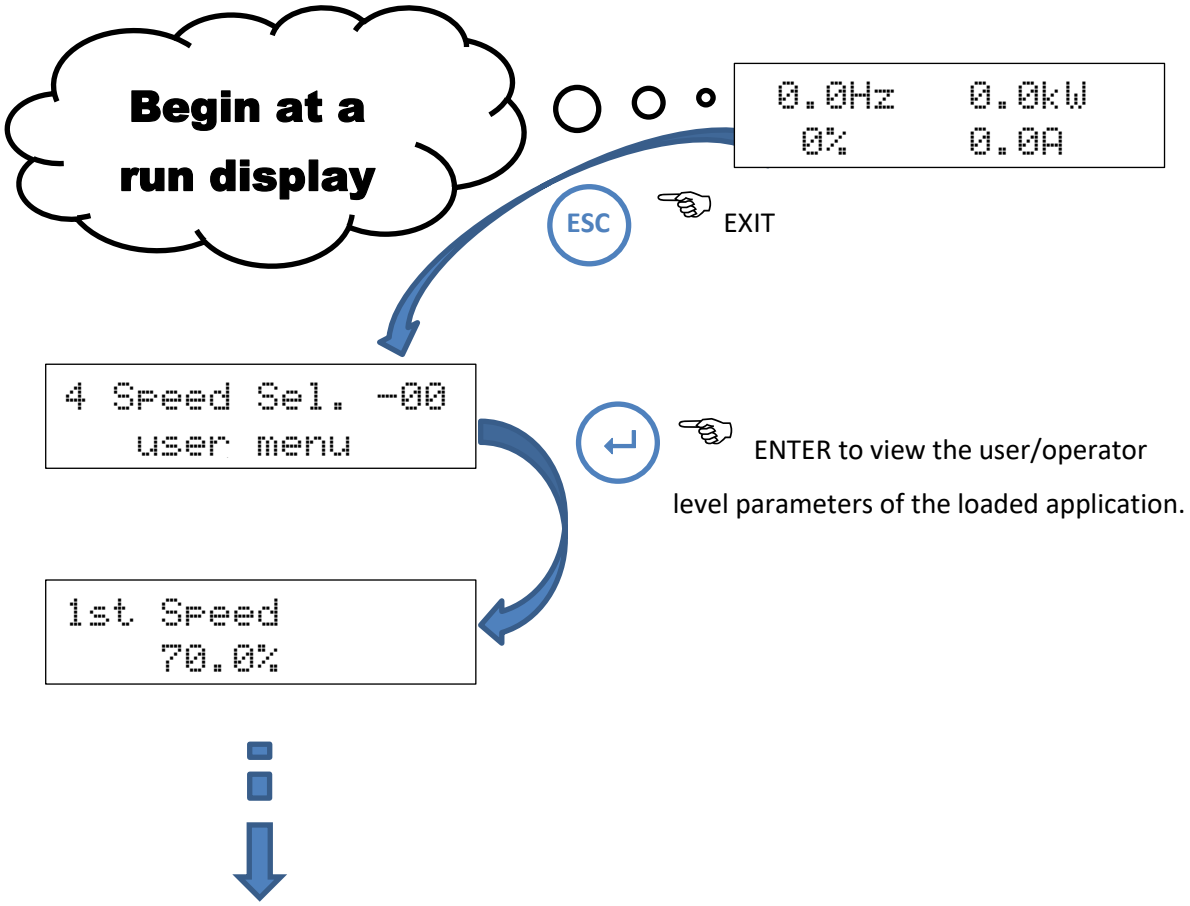


2. Select a new application.



Application user menu

Once an application is loaded, parameters that a user/operator may change are available in the Application user menu. Using the "4 Speed Sel. -00" application example, the diagram below shows how to access the Application user menu.



Control connections and configuration

The purpose of selecting particular control connections and setting various configuration parameters is to select the required logical and speed control functions for the particular application. The configurable items can be grouped into menus as follows:

Category/Menu	Description
A00 Defaults	Saving custom defaults, restoring custom or factory defaults, , selecting an application, PC connection (if fitted).
B00 Motor	Information from the motor nameplate.
C00 Performance	Maximum and minimum speeds, acceleration rates, motor flux adjustment etc.
D00 Protection	Current limit settings, I2t (thermal overload) etc.
E00 Stop / Start	Choices for stopping, automatic restart options etc.
F00 References	Choice of speed signal source to be used in local and remote modes, jog speeds.
G00 Input / Output	Assignment of particular control functions to terminals (inputs) and relays (status outputs). This menu also includes configuration for communications, Alarms/warnings , comparators, logic blocks & timers.
H00 PID Control	PID related parameters including pumping specific parameters such idle mode & pipe fill.
J00 Console	Configuration of parameters relating to console operation
S00 Service	Service related displays, logs and advanced functional settings.

The ZENER 8000 control terminals can be configured, on an individual terminal basis, to suit a wide variety of applications. This provides enormous flexibility.

Factory default settings

The factory default terminal configuration provides for single direction control from either the terminal strip or the front panel console, as selected by a local / remote input on the terminal strip. The setup procedure for this configuration begins on page 30.

There is a menu function to restore the terminal configuration and all parameters to the factory default state should you wish to do so. See Load Factory Defaults.

Settings for your application

The function of each of the analogue inputs, digital inputs and status relays may be individually assigned from an extensive list. in addition, digital inputs may be assigned to be level or edge sensitive and there are additional internal functions including timers that are fully configurable. Many applications may be easily configured using one of the quick setup applications listed below.

Quick Setup

To assist with quick configuration of the most frequently encountered applications, there are a number of pre-defined applications. Terminal strip configuration and associated setup notes are provided.

Control Inputs

The ZENER 8000 is operated by a set of digital input functions designed to work with logical signals that originate external to the drive. The extensiveness of this set of functions is testament to variety of applications the ZENER 8000 can operate with.

The list of functions includes:

- **I00 FWD&LATCH, I01 REV&LATCH, I02 ~STOP**
- **I03 FWD, I04 REV**
- **I05 UP, I06 DOWN**
- **I07 RESET**
- **I08 ESO**
- **I09 JOGFWD, I10 JOGREV**
- **I11 REMOTE**

Not all functions are necessary for a given application and unused functions may be turned "off". Functions that are necessary have assigned to them a physical input from the terminal strip. Review "Terminal Configurations" in the "Major Features" section of this document.

The "Digital Input Configurations" menu provides a way to map a finite set of physical digital inputs to the extensive internal set of input functions. The simplest way to configure digital inputs is to utilise one of the pre-existing configurations from the **G01 DI config** menu. Otherwise a custom configuration can be organised where each function has a physical input terminal assigned to it. In most cases the inputs levels and edges are available for selection. For example digital input **D1** is found at terminal **2** and is identified as **D1(2)**. The choices are:

Selection	Input Truth
D1(2)	Active high level is selected
~D1(2)	Active low level is selected
/D1(2)	Active rising edge is selected
D1(2)	Active falling edge is selected

Selecting Standard Input Configuration

Available Choices:
Standard Industrial
HVAC
Power up/start
Forward/Reverse
Machine drive 1
Machine drive 2
Machine drive 3
Custom

- Press↵ once to begin configuration selection.
- Use the ▲/ ▼ buttons to view the choices.
- Press↵ to confirm the choice. **ESC** to abandon the change.

For each configuration the digital sources are:

	G01 DI config							
Function	Standard Industrial	HVAC	Power up/start	Forward/ Reverse	Machine drive 1	Machine drive 2	Machine drive 3	Custom
I00 FWD&LATCH	D3(4)	D2(3)	EN(6)	D2(3)	D2(3)	OFF	D2(3)	Not specific. Refer to each functional assignment
I01 REV& LATCH	OFF	OFF	OFF	D3(4)	OFF	OFF	OFF	
I02 ~STOP	D2(3)	D1(2)	EN(6)	D1(2)	D1(2)	OFF	D1(2)	
I03 FWD	OFF	OFF	OFF	OFF	OFF	D1(2)	OFF	
I04 REV	OFF	OFF	OFF	OFF	OFF	D2(3)	OFF	
IO5 UP	OFF	OFF	OFF	OFF	OFF	OFF	D3(4)	
I06 DOWN	OFF	OFF	OFF	OFF	OFF	OFF	D4(5)	
I07 RESET	/D1(2)	/EN(6)	/EN(6)	OFF	OFF	OFF	OFF	
I08 ESO	OFF	D3(4)	OFF	OFF	OFF	OFF	OFF	
I09 JOGFWD	OFF	OFF	OFF	OFF	D3(4)	D3(4)	OFF	
I10 JOGREV	OFF	OFF	OFF	OFF	OFF	D4(5)	OFF	
I11 REMOTE	D4(5)	D4(5)	EN(6)	D4(5)	D4(5)	EN(6)	EN(6)	

Essential Services Override (Fire mode)

There are circumstances in some applications for which it is desirable to disable certain of the protective features of the ZENER 8000. These are situations where continued operation has a higher priority than preventing damage to the MSC-3 or associated motor. A typical example is a building air conditioning application in which a fan is required to operate as part of a smoke clearance system. Various standards, for example, AS/NZS 1668.1:1998: The use of ventilation and air conditioning in buildings - Fire and smoke control in multi-compartment buildings require that all thermal protection be disabled during operation in a smoke clearance mode and equipment allowed, if necessary, to run to destruction. The ZENER 8000 provides a special mode, Essential Services Override (ESO), to give effect to these requirements.

Operation in ESO requires a control terminal to be configured for the ESO function and that this terminal to be connected to +5V (terminal 1) whenever ESO operation is required. During ESO operation the ZENER 8000 is forced to run with protection disabled. See *Zener 8000 Reference Manual IM00140* http://www.zener.com.au/images/im00140.pdf for further details.

WARNING regarding Essential Services Override

The Essential Services Override (ESO) feature provides a “run to destruction” mode of operation for applications that justify this approach. For applications in which this approach is not mandatory, the safety and other implications of the ESO operating mode should be carefully considered in the light of alternative approaches before choosing to use the ESO functionality of the ZENER 8000. It is fundamental to the ESO mode of operation that all protection against overheating of the ZENER 8000 and the associated motor is disabled. This may represent a fire or other hazard. Damage to the ZENER 8000 due to overheating during ESO operation is not covered by warranty.

Setup using DEFAULT CONFIGURATION

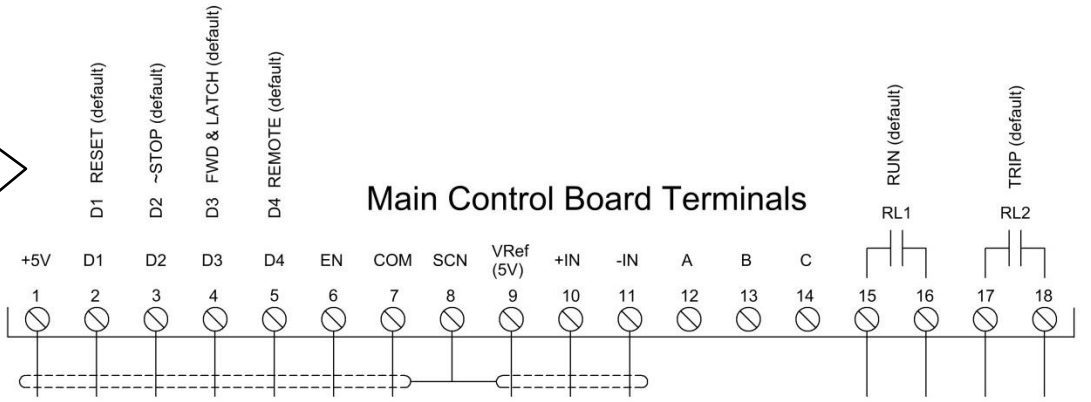
Overview: The default configuration provides single direction operation from either local (using operator console) or remote control (using external controls) and a speed signal source. Selection between the local & remote operation is by digital input 4 (terminal 5). The functionality of all I/O terminals can be easily modified. Refer to STEP 4 for settings that must be entered and common parameters that may require changing.

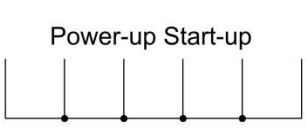
The following assumes no option board is fitted. Option boards may be fitted for additional I/O.

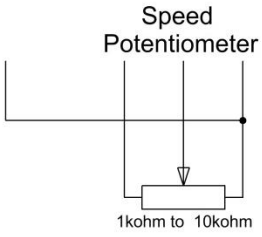
Typical Connections

This section shows the typical configurations applicable to a wide range of applications.

The functions of terminals D1…4 are programmable. These can be changed to other functions, on or off. The default settings are shown.



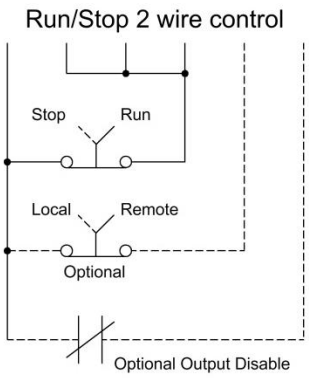


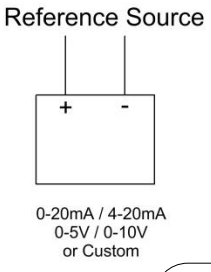


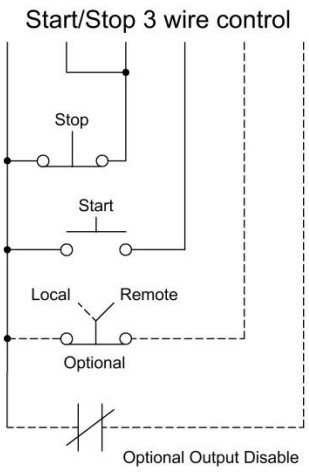
RL1 - RUN (default)	
No Power	OPEN
Power ON & Stopped	OPEN
Power ON & Running	CLOSED

RL2 - TRIP (default)	
No Power	OPEN
Power ON & No Trip	OPEN
Power ON & Tripped	CLOSED

Allows remote selection between local and remote. If selection between local/remote is not required install a link for remote mode.







Local / Remote Selection

The Local/Remote Selection can be used in conjunction with any of the above circuits using D4 (terminal 5) as shown. The Local/Remote selection can also be overridden from the control console. See Remote Override Operation on page 19. In “local” the ZENER 8000 is stopped and started from the front console. In “remote”, the ZENER 8000 stop / start is controlled from the terminal strip. The source of the speed reference in both modes may be independently configured to come from a wide variety of sources including the terminal strip, console, preset values or internal logic functions.

Setup Procedure:

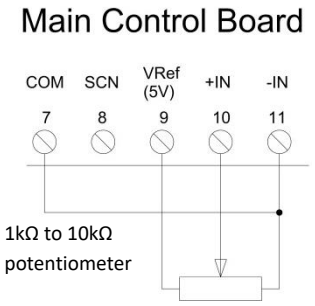
STEP 1. Complete the power wiring according to the instructions from page 6 and check the motor direction in local mode. To operate in Local mode, remove any wire in terminal 5 (D4) and use the operator console.

STEP 2. Choose your start/stop control method from the control wiring diagram and wire as shown.

You can alter between different control methods using the digital inputs. Select the appropriate control wiring from the control wiring diagram. Remove power and ensure the ZENER 8000 is completely powered down and install control wiring as required.

STEP 3. Choose your speed reference and connect it as shown.

Speed control from an external potentiometer:

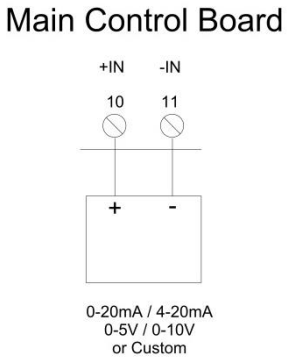


ESC to menu>
Down to G00 INPUT/OUTPUT, Enter>
Down to 'Analogue Input Configurations', Enter>
Select G02 AI(10,11), Enter>
G028 AI Config, ENTER>, Adjust G028 for input signal 0-5V
Enter to save> ESC to run display
Also save on exit when prompted, press ENTER.

i. Preset speed

ESC to menu>
Down to F00 REFERENCES, Enter>
F01 REMOTE REF, ENTER>
Enter to edit & change to F100 PRESET 1, Enter>
Enter to set your desired speed, Enter to save>, ESC to run display
Also save on exit when prompted, press ENTER.

No speed reference wiring is necessary.



ii. Speed control from an external signal

ESC to menu>
Down to G00 INPUT/OUTPUT, Enter>
Down to 'Analogue Input Configurations', Enter>
Select G02 AI(10,11) , Enter>
G028 AI Config, ENTER>, Adjust G028 for the type of input signal , (0-10V, 0-5V, 4-20mA or Custom)
Enter to save> ESC to run display.
Also save on exit when prompted, press ENTER.

iii. Speed control from operator Console

(although the start/stop command is given by digital inputs, this allows the speed to be adjusted manually using the console, UP/DOWN buttons.)

ESC to menu>
Down to F00 REFERENCES, Enter >
F01 REMOTE REF, Enter>
Enter to change to CONSOLE, Enter to save>
Also save on exit when prompted, press ENTER.
No speed reference wiring is necessary

Using the digital inputs you can alter between different speed references. Refer to the ZENER 8000 reference manual IM00140.

STEP 4. Follow the instructions on page 19-21 for ZENER 8000 start up and how to navigate the menus. Set the parameters according to the table below. Alternative values may be used to suit the application.

Ref.	Menu	Menu Item	Suggested Setting
1	B00 MOTOR	B01 MOTOR VOLTS	Motor nameplate voltage
		B02 MOTOR AMPS	Motor nameplate amps
		B03 MOTOR HZ	Motor nameplate frequency
		B04 MOTOR RPM	Motor nameplate RPM
2	C00 PERFORMANCE	C03 RAMP	C030 ACCEL TIME = 10 sec (default)
			C031 DECEL TIME = 10 sec (default)
3	D00 PROTECTION	D02 I2t Thermal overload	Motor nameplate current
4	E00 STOP/START	E0 Coast to stop	Enabled (Default) or Disabled
5	F00 REFERENCES	F01 REMOTE REF	AI(10,11) or PRESET or CONSOLE as selected in Step 3
6	G00 INPUT/OUTPUT	G01 Input fxn CFG	I00 FWD & LATCH = D3(4) (default)
			I02 ~STOP = D2(3) (default)
			I07 RESET = D1(2) (default)
			I11 REMOTE = D4(5) (default)
7	G00 INPUT/OUTPUT	G03 RL1	G030 RL1 Signal = RUN (default)
		G04 RI2	G040 RL2 Signal = TRIP (default)

STEP 5. Test the operation and make changes required. For parameters not mentioned refer to the ZENER 8000 reference manual IM00140.

End of procedure…

Setup using APPLICATION 'Basic Control' {SW08018}

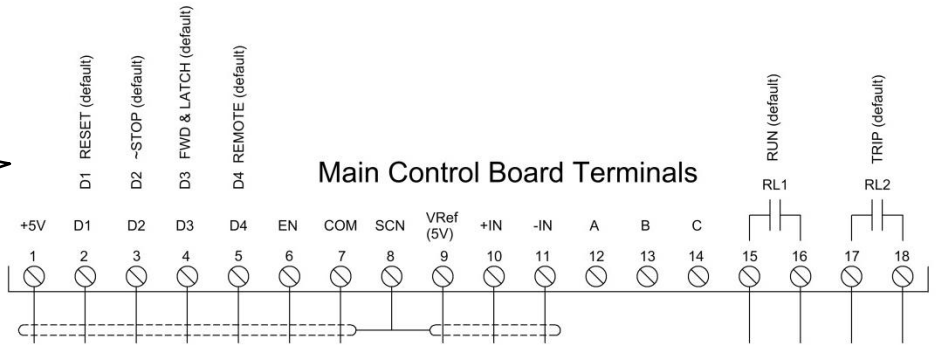
Overview: This application is for quick setup based on a simple configuration using default control terminals and commonly used parameters. This is an extension of the 'Default Configuration' but creates a unique menu with just the common parameters required.

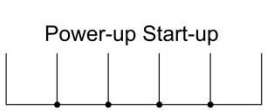
Features include but not limited to:

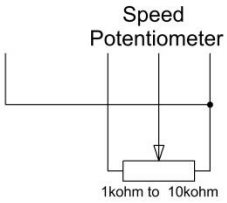
- Selection of Speed Reference source
- Accel & Decel Times
- Minimum Speed
- Coast or ramp to stop
- Relays configured for RUN and TRIP operation
- The full range of ZENER 8000 features and functions remain available

Control Wiring

The functions of terminals D1…4 are programmable. These can be changed to other functions, on or off. The default settings are shown.



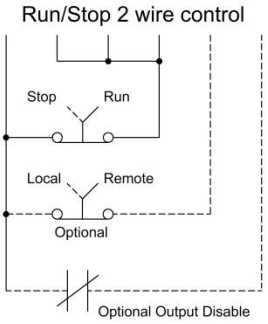


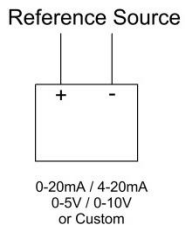


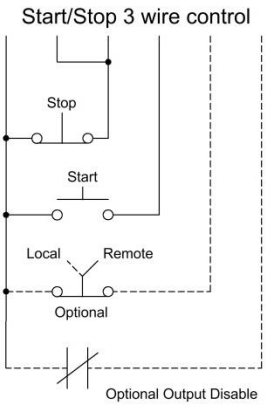
RL1 - RUN (default)	
No Power	OPEN
Power ON & Stopped	OPEN
Power ON & Running	CLOSED

RL2 - TRIP (default)	
No Power	OPEN
Power ON & No Trip	OPEN
Power ON & Tripped	CLOSED

Allows mode selection between local and remote using a digital input. If selection between local/remote is not required install a link for remote mode.







Local / Remote Selection

Changing between 'Local/Remote' mode is achieved using D4 (terminal 5) as shown. The display will indicate the mode with LOC or REM.

The Local/Remote selection can also be temporarily overridden from the control console. This feature is enabled by this Application.

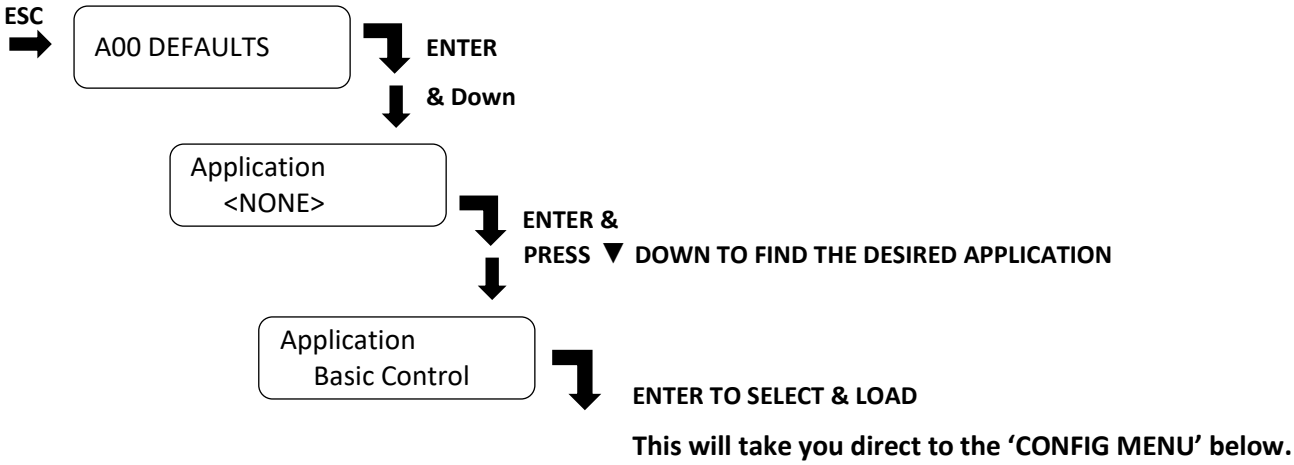
PRESS 'ENTER' for 5 seconds to toggle between LOCAL & REMOTE.
See page 19 for more details on this feature.

In "local" the start & stop control is from the front console. In "remote", the start & stop control is from the terminal strip. The source of the speed reference in both modes may be independently configured to come from a wide variety of sources including the terminal strip, console, preset values or internal logic functions.

Setup Procedure

STEP 1. Complete the power wiring according to the instructions from page 4 & check motor direction in local mode. To operate in Local mode remove any wire in terminal 5 (D4) and use the operator console. Do not install control wiring until STEP 4.

STEP 2. Load the application "Basic Control" (SW08019)

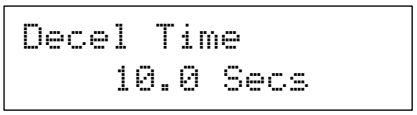


STEP 3. When this application is loaded it will program all the parameters required for the wiring configuration and create dedicated menus with only the parameters required.

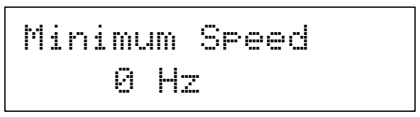
Config & User Parameters

Adjust the following parameters:
Always exit the menu and save changes before removing power.

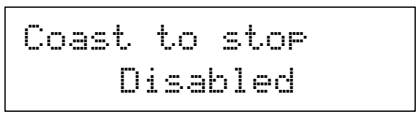
Rated motor amps 40.0 A	This screen displays the value of the motor's name plate current. Note the default value is model size dependent.
Overload current 40.0 A	This screen displays the value of the overload current setting for the motor. Note the default value is model size dependent.
Motor RPM 1465	This screen displays the value of the motor's name plate Speed in RPM. This is for display purposes only.
Remote Reference AI(10,11)	This screen displays the source of the speed reference. The default is analogue input 0-10VDC. AI(10,11) is the Analogue Input terminal 10 & 11. The default signal type is 0-10Vdc. This can be modified in menu 'G00 Input/Outputs >> Analogue Input Configurations. For a potentiometer AI(10,11) must be set for 0-5VDC.
Accel Time 10.0 Secs	This screen displays the time to accelerate from 0 to 50Hz.



This screen displays the time to decelerate from 50 to 0Hz.



This screen displays the minimum speed in Hz.



This screen displays the mode when stopping. Choose between coasting to stop (Enabled) or ramp to stop (Disabled).

When the menu cycles to the first parameter the setup is complete. Press ESC to exit until prompted 'SAVE CHANGES'. Press ENTER to save changes and wait until the process has completed.

STEP 4. Select the desired control method from the control wiring diagram. Remove power, ensure the ZENER 8000 is completely powered down and install control wiring as per control wiring diagram.

STEP 5. Test the operation and make changes required. For parameters not mentioned refer to the ZENER 8000 reference manual IM00140.

End of procedure…

Parameters configured & Menus created when the application is loaded.

The following is for reference only. Refer to STEP 3 for configuration.

Config & User menus created:

Menu	Parameter	Default
CONFIG & USER	Rated motor amps	**
CONFIG & USER	Overload current	**
CONFIG & USER	Motor RPM	1465
CONFIG & USER	Remote Ref.	AI(10,11)
CONFIG & USER	Accel Time	10.0 sec
CONFIG & USER	Decel Time	10.0 sec
CONFIG & USER	Minimum Speed	0 Hz
CONFIG & USER	Coast to stop	Disable

Parameters automatically programmed:

Menu Ref	Parameter
J04 Remote Override	Enabled

Note: Refer to page 24 for accessing CONFIG & USER menus

Setup using APPLICATION 'Machine/JOG' {SW08008}

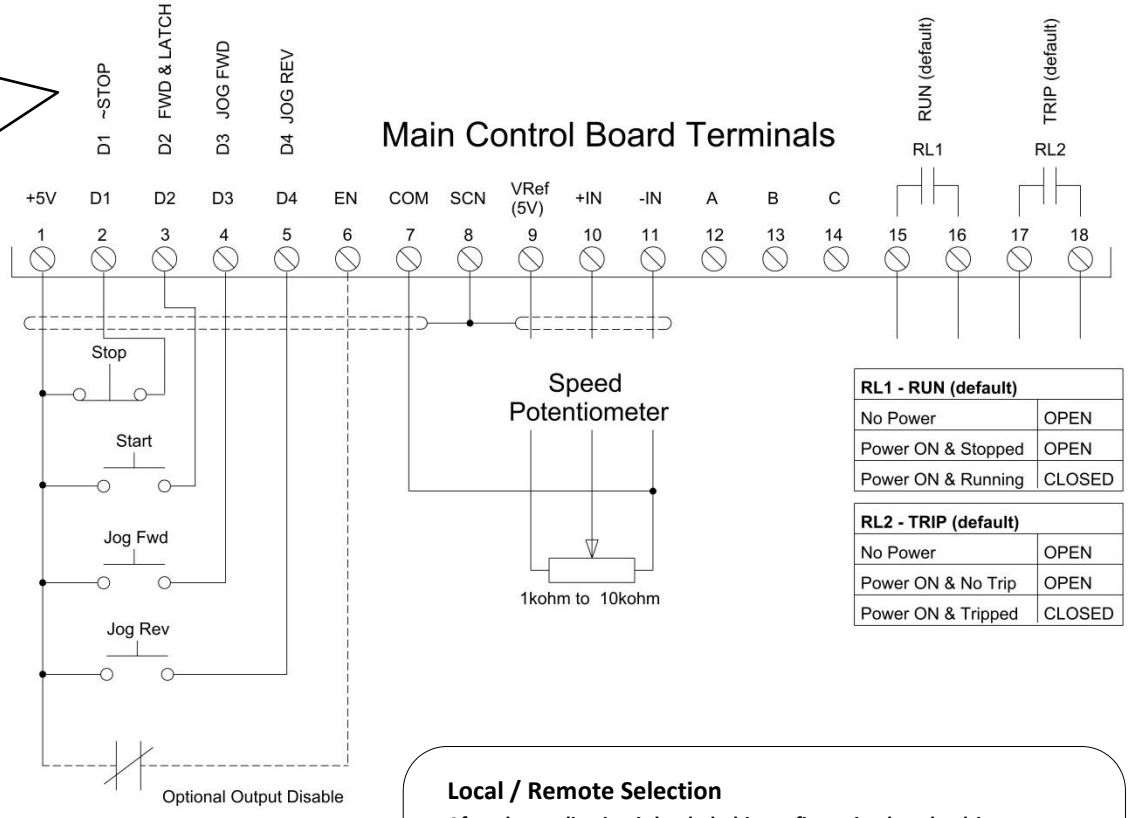
Overview: This application is for a typical industrial process that requires start/stop with the ability to jog the machinery in both directions.

Features include but not limited to:

- Individual jog forward and jog reverse speed references.
- Remote potentiometer normal operating speed reference.
- Relays configured for RUN and TRIP operation.
- The full range of ZENER 8000 features and functions remain available.

Control Wiring:

The functions of terminals D1…4 are programmable. These can be changed to other functions, on or off. The functions programmed by this Application are shown.



RL1 - RUN (default)	
No Power	OPEN
Power ON & Stopped	OPEN
Power ON & Running	CLOSED

RL2 - TRIP (default)	
No Power	OPEN
Power ON & No Trip	OPEN
Power ON & Tripped	CLOSED

Local / Remote Selection

After the application is loaded, this configuration has the drive operating always in REMOTE mode. I11 REMOTE (digital input function) has been assigned to ON opposed to a digital input.

The Local/Remote selection can also be temporarily overridden from the control console. This feature is enabled by this Application. The display will indicate the mode with LOC or REM.

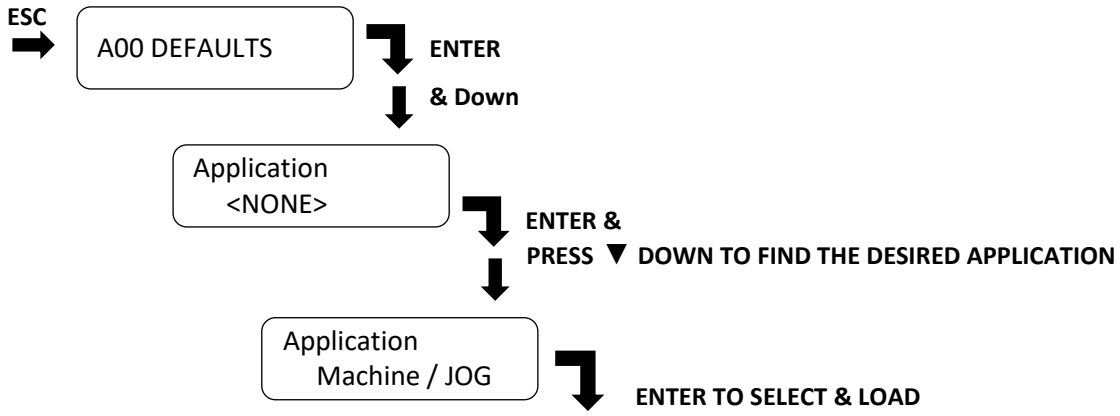
PRESS 'ENTER' for 5 seconds to toggle between LOCAL & REMOTE.
See page 19 for more details on this feature.

In "local" the start & stop control is from the front console. In "remote", the start & stop control is from the terminal strip. The source of the speed reference in both modes may be independently configured to come from a wide variety of sources including the terminal strip, console, preset values or internal logic functions.

Setup Procedure:

STEP 1. Complete the power wiring according to the instructions from page 6 & check motor direction in local mode. To operate in Local mode, remove any wire in terminal 5 (D4) and use the operator console. (This assumes factory settings and no application has been loaded). Do not install control wiring until STEP 4.

STEP 2. Load the application "Machine/ JOG" (SW08008)

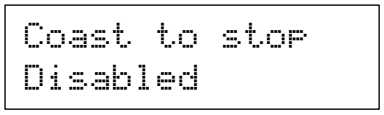


STEP 3. When this application is loaded it will program all the parameters required for the wiring configuration and create dedicated menus with only the parameters required.

Config & User Parameters

Adjust the following parameters:
Always exit the menu and save changes before removing power.

Jog FWD speed 10.0 %	This screen displays the preset jog forward speed required for the machine in % of maximum rated speed (default 50Hz).
Jog REV speed 10.0 %	This screen displays the preset jog reverse speed required for the machine in % of maximum rated speed (default 50Hz).
Rated motor amps 40.0 A	This screen displays the value of the motor's name plate current. Note the default value is model size dependent.
Overload current 40.0 A	This screen displays the value of the overload current setting for the motor. Note the default value is model size dependent.
Motor RPM 1465	This screen displays the value of the motor's name plate speed in RPM. This is for display purposes only.
Accel Time 10.0 Secs	This screen displays the time to accelerate from 0 to 50Hz.
Decel Time 10.0 Secs	This screen displays the time to decelerate from 50 to 0Hz.



This screen displays the mode when stopping. Choose between coasting to stop (Enabled) or Ramping to stop (disabled).

When the menu cycles to the first parameter the setup is complete. Press ESC to exit until prompted 'SAVE CHANGES'. Press ENTER to save changes and wait until the process has completed.

STEP 4. Remove power and ensure the ZENER 8000 is completely powered down and install control wiring as per control wiring diagram.

STEP 5. Test the operation and make changes required. For parameters not mentioned refer to the ZENER 8000 reference manual IM00140.

End of procedure…

Parameters configured & Menus created when the application is loaded.

The following is for reference only. Refer to STEP 3 for configuration.

Config & User menus created:

Menu	Parameter	Default
CONFIG & USER	Jog FWD Speed	10.0Hz
CONFIG & USER	Jog REV Speed	10.0Hz
CONFIG	Rated motor amps	**
CONFIG	Overload current	**
CONFIG	Motor RPM	**
CONFIG	Accel Time	10sec
CONFIG	Decel Time	10sec
CONFIG	Coast to stop	Disabled

Parameters automatically programmed:

Menu Ref	Parameter
D03 Reverse	Enabled
G01 Digital Input Config	Custom terminals
I00 FWD & latch	D2(3)
I02 ~Stop	D1(2)
I07 Reset	D1(2)
I09 JOGFWD	D3(4)
I10 JOGREV	D4(5)
I11 REMOTE	ON
G028 AI(10,11)	0-5V
F040 JOG FWD REF	Preset 1, 10%
F050 JOG REV REF	Preset 2, 10%
J04 Remote Override	Enabled

Note: Refer to page 24 for accessing CONFIG & USER menus.

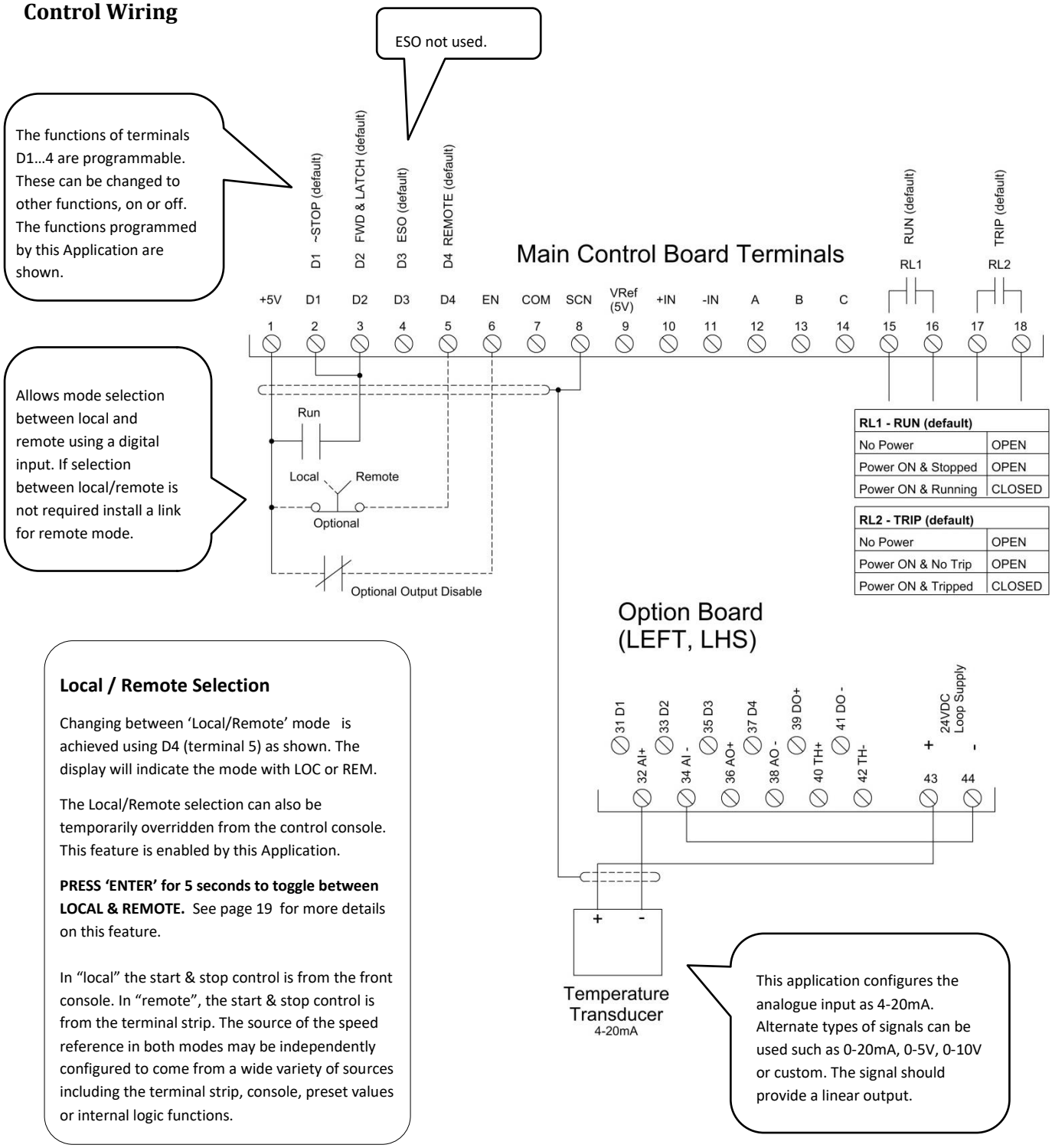
Setup using APPLICATION 'Cooling Tower' {SW08007}

Overview: This application is for a typical 'Cooling Tower Fan' with configuration for temperature control system using an external water temperature sensor and the ZENER 8000 internal PID controller. For open loop control use APPLICATION 'HVAC Fan'.

System Requirements:

- Extended Features Option Board (AQ/AF08001) is fitted in the left hand side position.
- External water temperature sensor with linear output (default for 4-20mA)

Control Wiring



Local / Remote Selection

Changing between 'Local/Remote' mode is achieved using D4 (terminal 5) as shown. The display will indicate the mode with LOC or REM.

The Local/Remote selection can also be temporarily overridden from the control console. This feature is enabled by this Application.

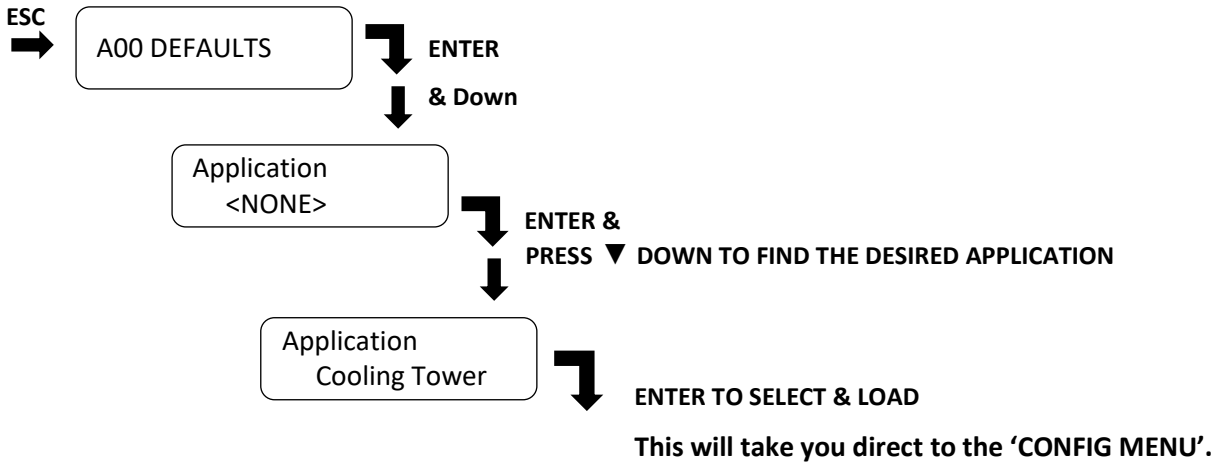
PRESS 'ENTER' for 5 seconds to toggle between LOCAL & REMOTE. See page 19 for more details on this feature.

In "local" the start & stop control is from the front console. In "remote", the start & stop control is from the terminal strip. The source of the speed reference in both modes may be independently configured to come from a wide variety of sources including the terminal strip, console, preset values or internal logic functions.

Setup Procedure:

STEP 1. Complete the power wiring according to the instructions from page 4 & check motor direction in local mode. To operate in Local mode remove any wire in terminal 5 (D4) and use the operator console. Do not install control wiring until STEP 4.

STEP 2. Load the application "Cooling Tower" (SW08007)

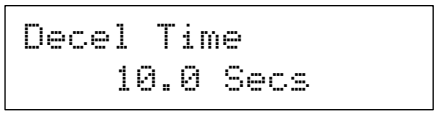


STEP 3. When this application is loaded it will program all the parameters required for the wiring configuration and create dedicated menus with only the parameters required.

Config. Parameters

Adjust the following parameters:
Always exit the menu and save changes before removing power.

Rated motor amps 40.0 A	This screen displays the value of the motor's name plate current. Note the default value is model size dependent.
Overload current 40.0 A	This screen displays the value of the overload current setting for the motor. Note the default value is model size dependent.
Current Limit 46 A	This screen displays the value for the current limit setting. This value should be at least FLC x 1.15 for a fan/pump type load.
Motor RPM 1465	This screen displays the value of the motor's name plate speed in RPM. This is for display purposes only.
Temperature Scale 100.0°C	This screen displays the temperature of the transducer at 20mA. Eg. 0-100°C = 4-20mA, Enter 100.0.
Set Temp 50.0°C	This screen displays the desired operating temperature. The set point Variable.
Accel Time 10.0 Secs	This screen displays the time to accelerate from 0 to 50Hz.



This screen displays the time to decelerate from 50 to 0Hz.

NOTE: This application activates the auto restart function (ie. 5 restarts)

When the menu cycles to the first parameter the setup is complete. Press ESC to exit until prompted 'SAVE CHANGES'. Press ENTER to save changes and wait until the process has completed.

STEP 4. Remove power and ensure the ZENER 8000 is completely powered down and install control wiring as per control wiring diagram.

STEP 5. Test the operation and make changes required. For parameters not mentioned refer to the ZENER 8000 reference manual IM00140.

End of procedure…

Parameters configured & menus created when the application is loaded

The following is for reference only. Refer to STEP 3 for configuration.

Config & User menus created

Menu	Parameter	Default
CONFIG & USER	Rated motor amps	**
CONFIG & USER	Overload current	**
CONFIG & USER	Current Limit	**
CONFIG & USER	Motor RPM	1465
CONFIG & USER	Temp. Scale (°C)	100.0
CONFIG & USER	Set Temp. (°C)	50.0
CONFIG & USER	Accel Time	10.0 secs
CONFIG & USER	Decel Time	10.0 secs

Parameters automatically programmed.

Menu Ref	Parameter
E030 Auto Restart	5
F010 Remote Ref.	PID-A Output
F1001 Preset Unit	PID-A units
G01 Digital Input Config	HVAC terminals
G108 Config AI(32,34)	4-20mA
H01 PB%	-300%
H06 SV Choice	Preset 1
H07 PV Choice	AI(32,34)
H08 Units	°C
J02 Display	PID/Meter
J04 Remote Override	Enabled

Note: Refer to page 24 for accessing CONFIG & USER menus.

Setup using APPLICATION 'HVAC Fan' {SW08012}

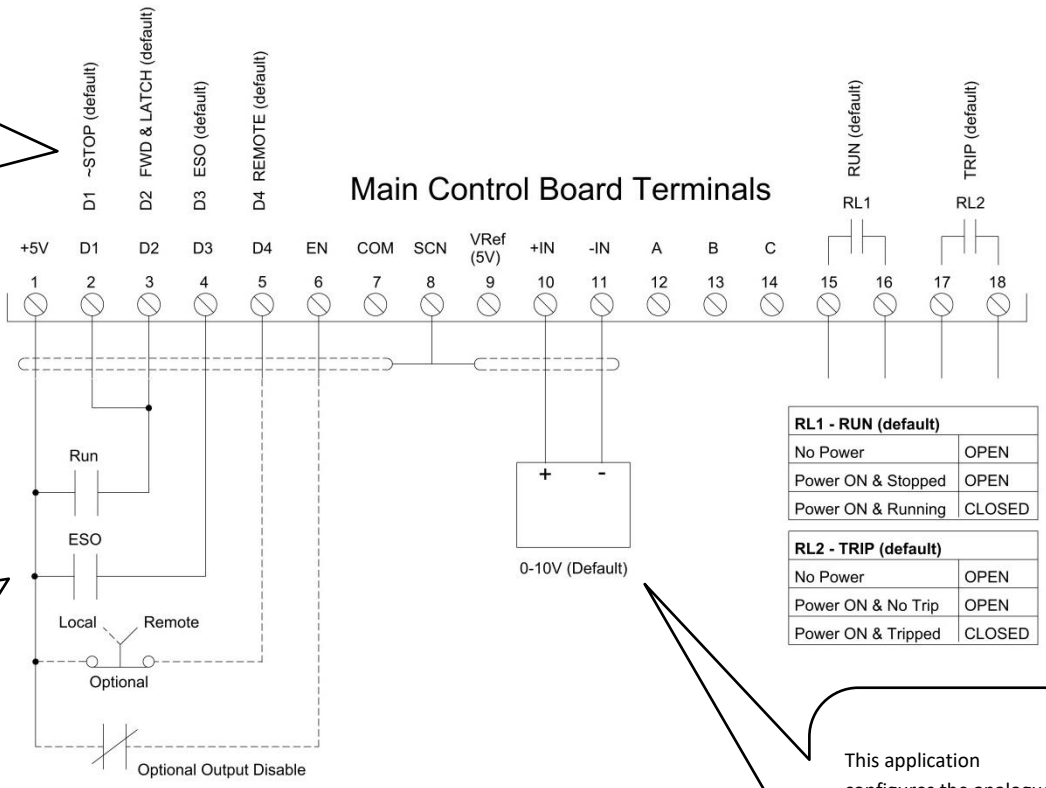
Overview: This application is for a typical 'Supply Air Fan', 'Smoke Spill fan' or 'Return Air fan'. This configuration provides speed control from an external source during normal operation, a preset speed in ESO (fire) mode and local control from the front control panel. Default speed reference is 0-10Vdc.

Features include but not limited to:

- Digital input for run and optional selection for remote operation or local operation from front console.
- Analogue input for speed reference (Default 0-10Vdc)
- Relays configured for RUN and TRIP operation.
- ESO (fire) mode operation from digital input
- The full range of ZENER 8000 features and functions remain available.
- Communication with Building Management Systems

Control Wiring

The functions of terminals D1…4 are programmable. These can be changed to other functions, on or off. The functions programmed by this Application are shown.



RL1 - RUN (default)	
No Power	OPEN
Power ON & Stopped	OPEN
Power ON & Running	CLOSED

RL2 - TRIP (default)	
No Power	OPEN
Power ON & No Trip	OPEN
Power ON & Tripped	CLOSED

ESO/Fire Mode
Refer to page 29 for important information regarding the use and operation of ESO mode.

ESO has an independent speed reference and ramp time. This application programs the speed reference as a preset speed, adjustable in the config menu.

This application configures the analogue input as the speed reference with a 0-10Vdc signal. Alternate types of signals can be used such as 0-20mA, 0-5V, 0-10V or custom. Other speed references may be selected such as a preset speed.

Local / Remote Selection

Changing between 'Local/Remote' mode is achieved using D4 (terminal 5) as shown. The display will indicate the mode with LOC or REM.

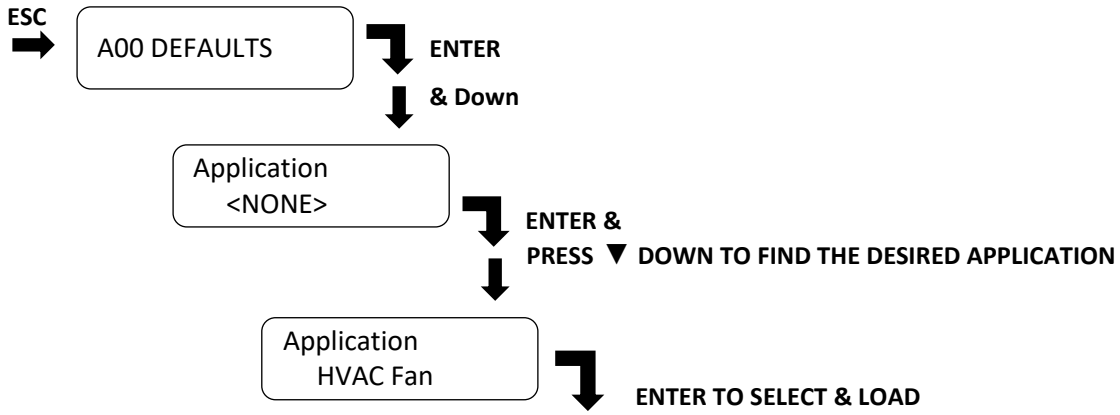
The Local/Remote selection can also be temporarily overridden from the control console. This feature is enabled by this Application.
PRESS 'ENTER' for 5 seconds to toggle between LOCAL & REMOTE. See page 19 for more details on this feature.

In "local" the start & stop control is from the front console. In "remote", the start & stop control is from the terminal strip. The source of the speed reference in both modes may be independently configured to come from a wide variety of sources including the terminal strip, console, preset values or internal logic functions.
NOTE: ESO Mode over-rides remote & local controls.

Setup Procedure

STEP 1. Complete the power wiring according to the instructions from page 4 & check motor direction in local mode. To operate in Local mode remove any wire in terminal 5 (D4) and use the operator console. Do not install control wiring until STEP 4. Any wire in the ESO input must also be removed to operate in local mode.

STEP 2. Load the application "HVAC Fan" (SW08012)



This will take you direct to the 'CONFIG MENU'.

STEP 3. When this application is loaded it will program all the parameters required for the wiring configuration and dedicated menus with only the parameters required.

Config. Parameters

Adjust the following parameters:
Always exit the menu and save changes before removing power.

ESO Speed 50.0 Hz	This screen displays the operating speed when in ESO (fire) mode. ESO mode is activated by Input D3(4).
Rated Motor Amps 40.0 A	This screen displays the value of the motor's name plate current. Note the default value is model size dependent.
Overload current 40.0 A	This screen displays the value of the overload current setting for the motor. Note the default value is model size dependent.
Current Limit 46 A	This screen displays the value for the current limit setting. This value should be at least FLC x 1.15 for a fan/pump type load.
Motor RPM 1465	This screen displays the value of the motor's name plate speed in RPM. This is for display purposes only.

NOTE: This application activates the auto restart function (ie. 5 restarts)

When the menu cycles to the first parameter the setup is complete. Press ESC to exit until prompted 'SAVE CHANGES'. Press ENTER to save changes and wait until the process has completed.

STEP 4. Remove power and ensure the ZENER 8000 is completely powered down and install control wiring as per control wiring diagram.

STEP 5. Test the operation and make changes required. For parameters not mentioned refer to the ZENER 8000 reference manual IM00140.

End of procedure…

Parameters configured & Menus created when the application is loaded

The following is for reference only. Refer to STEP 3 for configuration.

Config menus created (No User menu)

Menu	Parameter	Default
CONFIG	ESO Speed (Hz)	50.0
CONFIG	Rated motor amps	**
CONFIG	Overload current	**
CONFIG	Current Limit	**
CONFIG	Motor RPM	1465

Parameters automatically programmed.

Menu Ref	Parameter
E030 Auto Restart	5
C030 Accel Ramp	60 secs
C031 Decel Ramp	60 secs
F010 Remote Ref.	AI(10,11) - default 0-10Vdc
F1051 Preset Units	RUN UNITS
G01 Digital Input Config	HVAC terminals
J04 Remote Override	Enabled

Note: Refer to page 24 for accessing the CONFIG menu.

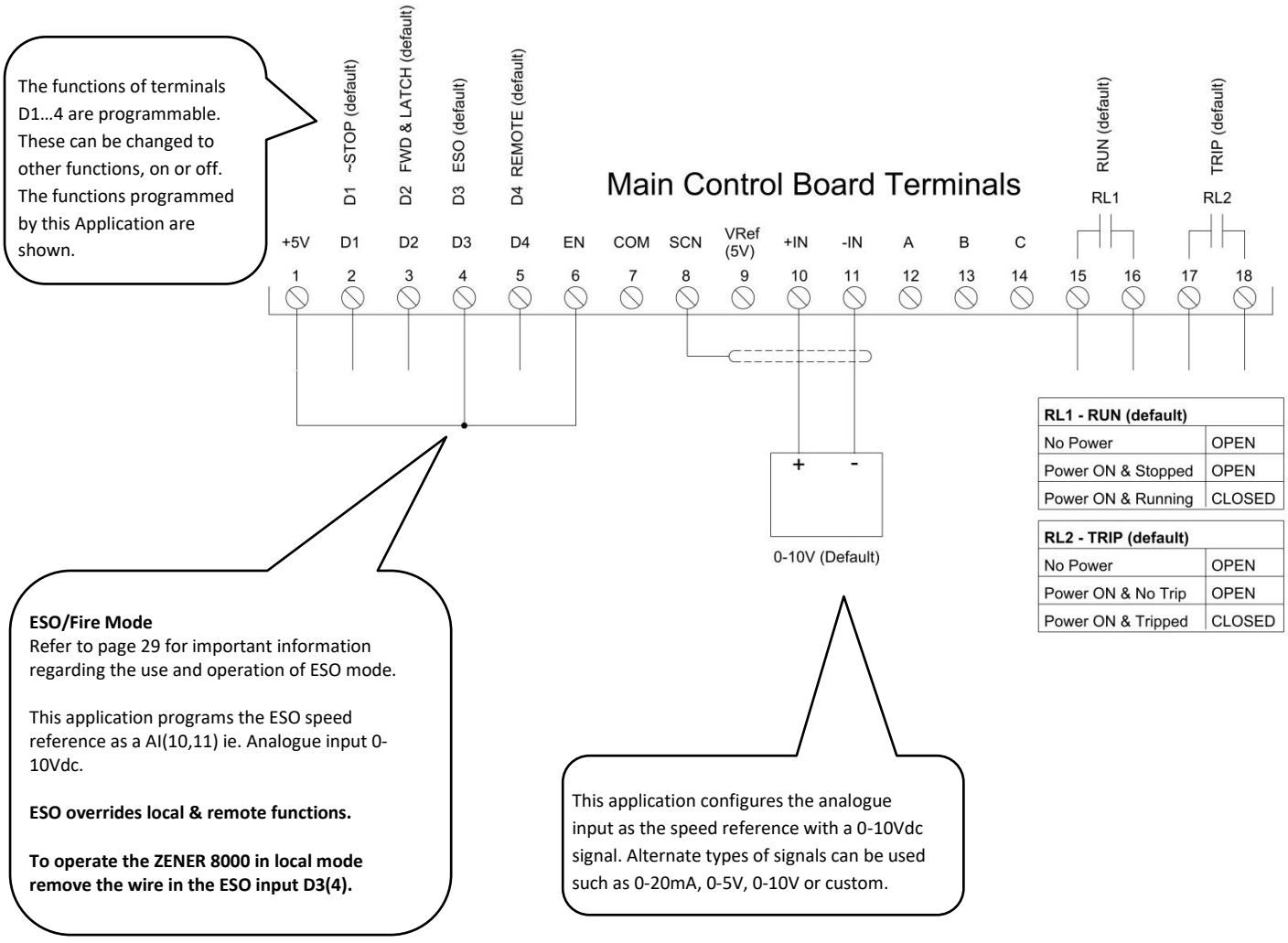
Setup using APPLICATION 'Stairwell Fan' {SW08010}

Overview: This application is for a 'Stairwell Fan' with speed control & reference from an external source. The default speed reference is 0-10Vdc. The pressure control (PID) is performed by the building management system or external PID controller. This configuration operates in ESO mode whenever operating.

Features include but not limited to:

- Analogue input for speed reference (Default 0-10Vdc)
- Relays configured for RUN and TRIP operation (default)
- ESO (fire) mode operation from digital input
- The full range of ZENER 8000 features and functions remain available
- Communication with Building Management Systems

Control Wiring



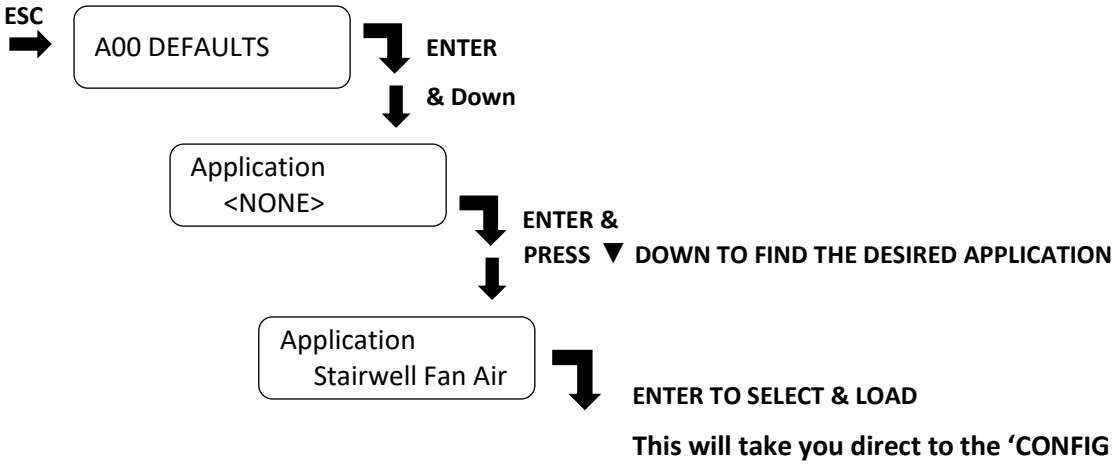
RL1 - RUN (default)	
No Power	OPEN
Power ON & Stopped	OPEN
Power ON & Running	CLOSED

RL2 - TRIP (default)	
No Power	OPEN
Power ON & No Trip	OPEN
Power ON & Tripped	CLOSED

Setup Procedure

STEP 1. Complete the power wiring according to the instructions from page 6 & check motor direction in local mode. To operate in Local mode remove any wire in terminal 5 (D4) and use the operator console. Do not install control wiring until STEP 4. Any wire in the ESO input must also be removed to operate in local mode.

STEP 2. Load the application "Stairwell Fan" (SW08010)



STEP 3. When this application is loaded it will program all the parameters required for the wiring configuration and dedicated menus with only the parameters required.

Config. Parameters

Adjust the following parameters:
Always exit the menu and save changes before removing power.

Rated motor amps	This screen displays the value of the motor's name plate current. Note the default value is model size dependent.
Overload current	This screen displays the value of the overload current setting for the motor. Note the default value is model size dependent.
Current Limit 46 A	This screen displays the value for the current limit setting. This value should be at least FLC x 1.15 for a fan/pump type load.
Motor RPM 1465	This screen displays the value of the motor's name plate speed in RPM. This is for display purposes only.

NOTE: This application activates the auto restart function (ie. 5 restarts)

When the menu cycles to the first parameter the setup is complete. Press ESC to exit until prompted 'SAVE CHANGES'. Press ENTER to save changes and wait until the process has completed.

STEP 4. Remove power and ensure the ZENER 8000 is completely powered down and install control wiring as per control wiring diagram.

STEP 5. Test the operation and make changes required. For parameters not mentioned refer to the ZENER 8000 reference manual IM00140.

End of procedure…

Parameters configured & Menus created when the application is loaded.

The following is for reference only. Refer to STEP 3 for configuration.

Config & User menus created:

Menu	Parameter	Default
CONFIG	Rated motor Amps	**
CONFIG	Overload current	**
CONFIG	Current Limit	**
CONFIG	Motor RPM	1465

Parameters automatically programmed:

Menu Ref	Parameter
E030 Auto Restart	5
G01 Digital Input Config	HVAC terminals
ESO Ref	AI(10,11) - default 0-10Vdc
J04 Remote Override	Enabled

Note: Refer to page 24 for accessing CONFIG & USER menus

Setup using APPLICATION 'Air Pressure' {SW08011}

Overview: This application is for a 'Stairwell fan' configured to use internal PID controller to maintain stairwell air pressure. The default speed reference is 4-20mA from a pressure transducer. The pressure control (PID) is performed by the ZENER 8000 internal PID controller. This configuration operates in ESO mode whenever operating.

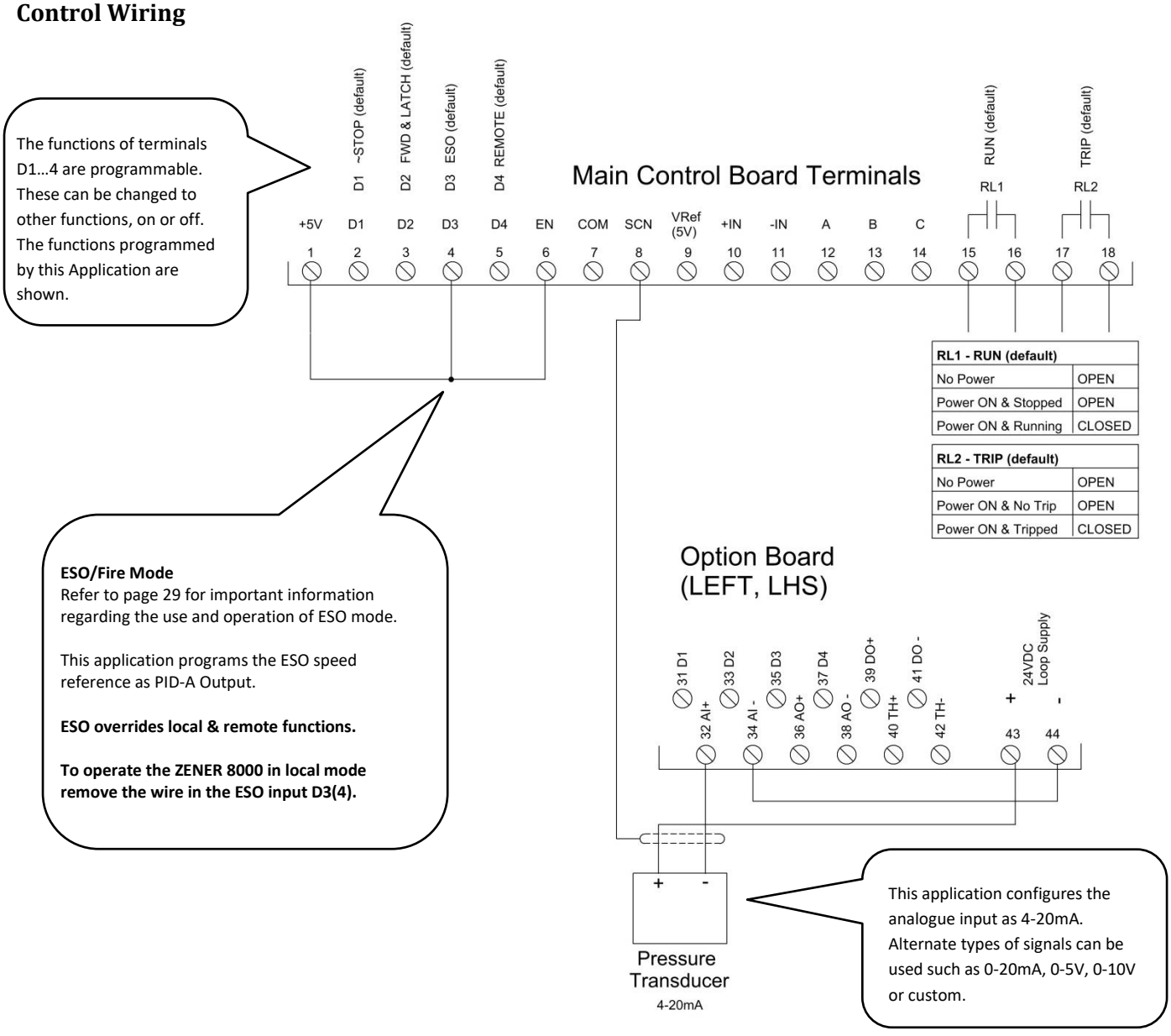
Features include but not limited to:

- Analogue input for speed reference (Default 4-20mA)
- Relays configured for RUN and TRIP operation (default).
- ESO (fire) mode operation from digital input
- The full range of ZENER 8000 features and functions remain available.
- Communication with Building Management Systems

System Requirements:

- Extended Features Option Board (AQ/AF08001) is fitted in the left hand side position.
- External air pressure transducer (default for 4-20mA)

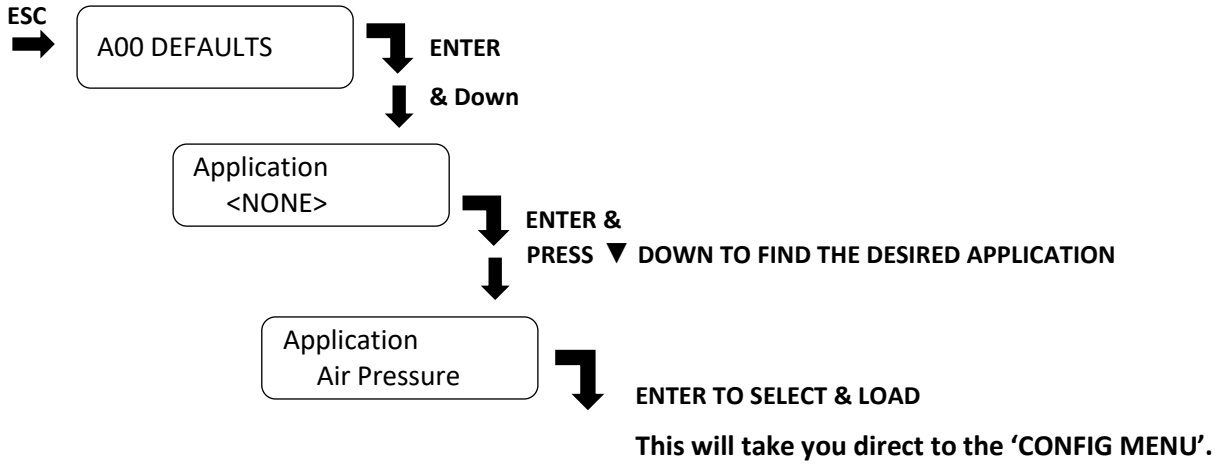
Control Wiring



Setup Procedure

STEP 1. Complete the power wiring according to the instructions from page 6 & check motor direction in local mode. To operate in Local mode remove any wire in terminal 5 (D4) and use the operator console. Do not install control wiring until STEP 4.

STEP 2. Load the application "Air Pressure" (SW08011)



STEP 3. When this application is loaded it will program all the parameters required for the wiring configuration and dedicated menus with only the parameters required.

Config. Parameters

Adjust the following parameters:
Always exit the menu and save changes before removing power.

Pressure Units Pa	This screen displays the pressure units to be used
Set pressure 30.0 Pa	This screen displays the set-point pressure of the PID controller
Transducer Scale 100.0 Pa	This screen displays the pressure of the transducer at full output eg. At 20mA.
Rated motor amps 40.0 A	This screen displays the value of the motor's name plate current. Note the default value is model size dependent.
Overload current 40.0 A	This screen displays the value of the overload current setting for the motor. Note the default value is model size dependent.
Current Limit 46 A	This screen displays the value for the current limit setting. This value should be at least FLC x 1.15 for a fan/pump type load.
Motor RPM 1465	This screen displays the value of the motor's name plate speed in RPM. This is for display purposes only.

NOTE: This application activates the auto restart function (ie. 5 restarts)

When the menu cycles to the first parameter the setup is complete. Press ESC to exit until prompted 'SAVE CHANGES'. Press ENTER to save changes and wait until the process has completed.

STEP 4. Remove power and ensure the ZENER 8000 is completely powered down and install control wiring as per control wiring diagram.

STEP 5. Test the operation and make changes required. For parameters not mentioned refer to the ZENER 8000 reference manual IM00140.

End of procedure…

Parameters configured & Menus created when the application is loaded.

The following is for reference only. Refer to STEP 3 for configuration.

Config & user menus created

Menu	Parameter	Default
CONFIG	Pressure Units	Pa
USER & CONFIG	Set Pressure	30.0
CONFIG	Transducer Scale	100.0
CONFIG	Rated Motor Amps	**
CONFIG	Overload Current	**
CONFIG	Current Limit	**
CONFIG	Motor RPM	1465

Parameters automatically programmed.

Menu Ref	Parameter
E030 Auto Restart	5
F030 ESO Reference	PID-A output
F1001 Preset 1	PID-A units
G01 Digital Input Config	HVAC terminals
G108 AI(32,34) Config	0-10Vdc
H06 SV choice	Preset 1
H07 PV Choice	AI(32,34)
J02 Default Display	PID/meter display
J04 Remote Override	Enabled

Note: Refer to page 24 for accessing CONFIG & USER menus

Setup using APPLICATION '4 Speed Sel' {SW08017}

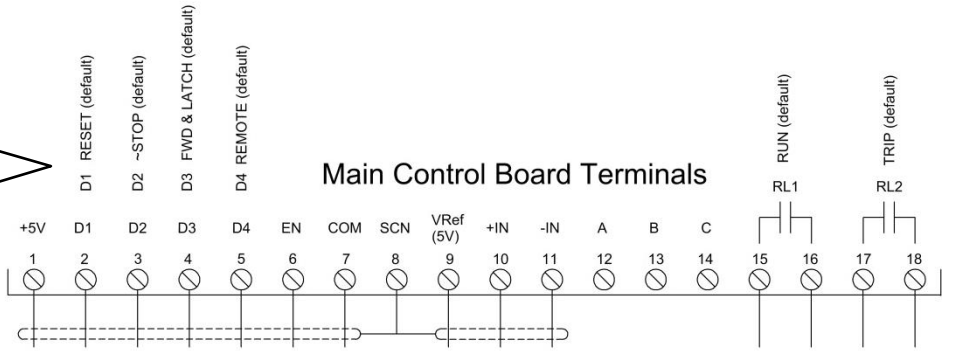
Overview: This application configures the ZENER 8000 to operate at 4 selectable preset speeds.

System Requirements:

- Extended Features Option Board (AQ/AF08001) is fitted in the left hand side position.
- External selector switch or voltage free contacts.

Control Wiring

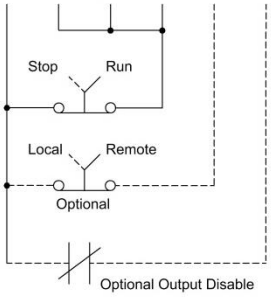
The functions of terminals D1…4 are programmable. These can be changed to other functions, on or off. The functions programmed by this Application are shown.



RL1 - RUN (default)	
No Power	OPEN
Power ON & Stopped	OPEN
Power ON & Running	CLOSED

RL2 - TRIP (default)	
No Power	OPEN
Power ON & No Trip	OPEN
Power ON & Tripped	CLOSED

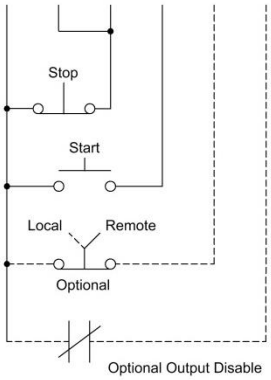
Power-up Start-up



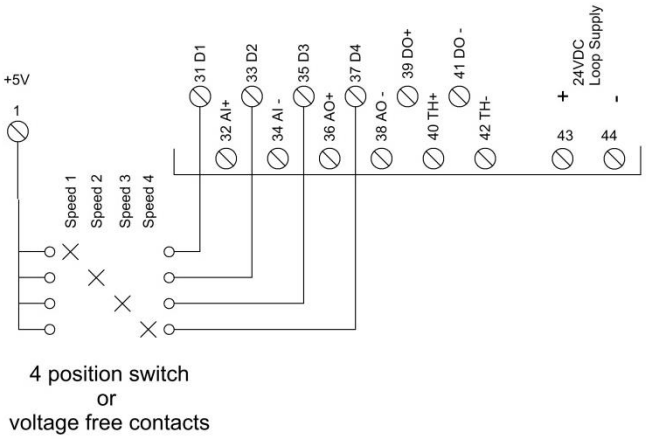
Allows remote selection between local and remote. If selection between local/remote is not required install a link for remote mode.

Run/Stop 2 wire control

Start/Stop 3 wire control



Option Board (LEFT, LHS)



4 position switch or voltage free contacts

Local / Remote Selection

Changing between 'Local/Remote' mode is achieved using D4 (terminal 5) as shown. The display will indicate the mode with LOC or REM.

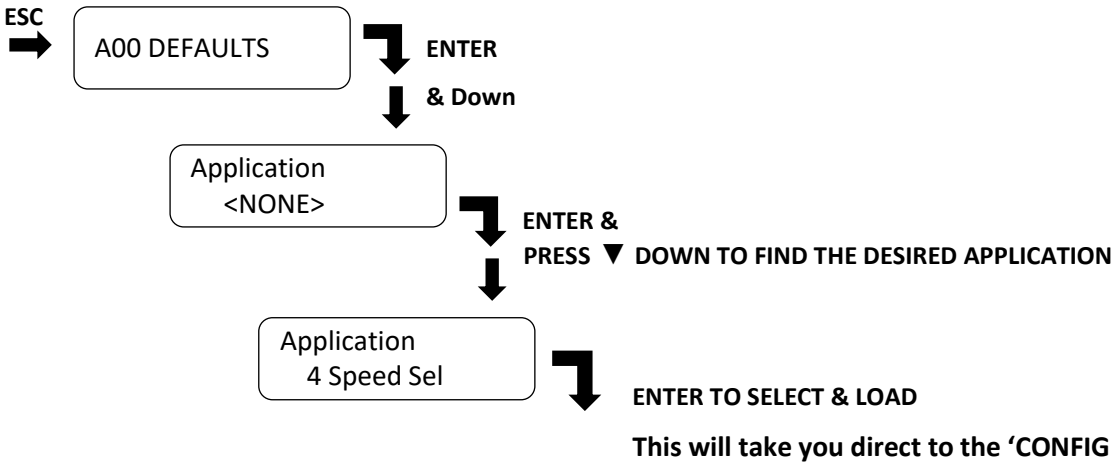
The Local/Remote selection can also be temporarily overridden from the control console. This feature is enabled by this Application.
PRESS 'ENTER' for 5 seconds to toggle between LOCAL & REMOTE. See page 19 for more details on this feature.

In "local" the start & stop control is from the front console. In "remote", the start & stop control is from the terminal strip. The source of the speed reference in both modes may be independently configured to come from a wide variety of sources including the terminal strip, console, preset values or internal logic functions.

Setup Procedure

STEP 1. Complete the power wiring according to the instructions from page 4 & check motor direction in local mode. To operate in Local mode remove any wire in terminal 5 (D4) and use the operator console. Do not install control wiring until STEP 4.

STEP 2. Load the application "4 Speed Sel." (SW08017)



STEP 3. When this application is loaded it will program all the parameters required for the wiring configuration and dedicated menus with only the parameters required.

Config. Parameters

Adjust the following parameters:
Always exit the menu and save changes before removing power.

1st Speed 70.0 %	This screen displays Speed 1. Enter as a % of motor rated speed at 50Hz.
2nd Speed 80.0 %	This screen displays Speed 2. Enter as a % of motor rated speed at 50Hz.
3rd Speed 85.0 %	This screen displays Speed 3. Enter as a % of motor rated speed at 50Hz.
4th Speed 90.0 %	This screen displays Speed 4. Enter as a % of motor rated speed at 50Hz.
Rated Motor Amps	This screen displays the value of the motor's name plate current. Note the default value is model size dependent.
Overload Amps 40.0 A	This screen displays the value of the overload current setting for the motor. Note the default value is model size dependent.
Motor RPM 1465	This screen displays the value of the motor's name plate speed in RPM. This is for display purposes only.

Accel Time 10.0 Secs	This screen displays the time to accelerate from 0 to 50Hz.
Decel Time 10.0 Secs	This screen displays the time to decelerate from 50 to 0Hz.
Min Speed 0.0 Hz	This screen displays the minimum operating speed.
Coast to stop Disabled	This screen displays the mode when stopping. Choose between coasting to stop (Enabled) or ramping to stop (Disabled).

When the menu cycles to the first parameter the setup is complete. Press ESC to exit until prompted 'SAVE CHANGES'. Press ENTER to save changes and wait until the process has completed.

STEP 4. Remove power and ensure the ZENER 8000 is completely powered down and install control wiring as per control wiring diagram.

STEP 5. Test the operation and make changes required. For parameters not mentioned refer to the ZENER 8000 reference manual IM00140.

End of procedure…

Parameters configured & Menus created when the application is loaded

The following is for reference only. Refer to STEP 3 for configuration.

Config & user menus created .

Menu	Parameter	Default
USER & CONFIG	1st Speed	70.0
USER & CONFIG	2nd Speed	80.0
USER & CONFIG	3rd Speed	85.0
USER & CONFIG	4th Speed	90.0
CONFIG	Rated motor amps	**
CONFIG	Overload current	**
CONFIG	Motor RPM	1465
CONFIG	Accel Ramp	10.0
CONFIG	Decel Ramp	10.0
CONFIG	Min speed (Hz)	0.0
CONFIG	Coast to stop	Disabled

Parameters automatically programmed.

Menu Ref	Parameter
F060 Multispeed mode	1
F061 User ref 1	F100 Preset 1
F062 User ref 2	F101 Preset 2
F0630 Selector 1	D1(31)
F0631 Selector 2	D2(33)
F0632 Selector 3	D3(35)
F0630 Selector 4	D4(37)
F010 Remote Ref	Reference Selector
J031 Run Scale	100.0
J032 Run Units	% Speed
J04 Remote Override	Enabled

Note: Refer to page 24 for accessing CONFIG & USER menus.

Setup using APPLICATION: 'Pressure Ctl' {SW08013}

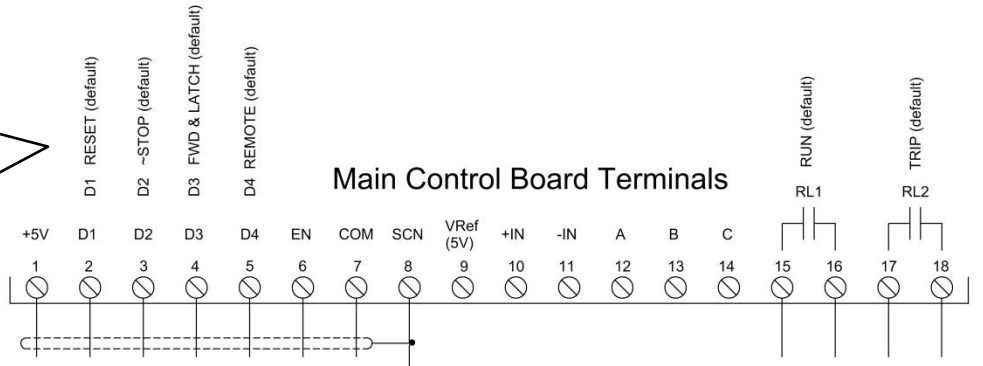
Overview: This application is for a simple water pressure control system using the internal PID controller. The default speed reference is 4-20mA from a pressure transducer. The pressure control (PID) is performed by the ZENER 8000 internal PID controller. The set point is adjustable in the user & config menus. For more advance automatic pressure control systems & protection refer to APPLICATIONS: PUMP PID 1 & PUMP PID 2.

System Requirements:

- Extended Features Option Board (AQ/AF08001) is fitted in the left hand side position
- Water pressure transducer (default for 4-20mA)

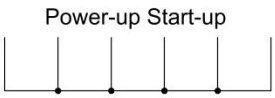
Control Wiring

The functions of terminals D1…4 are programmable. These can be changed to other functions, on or off. The default settings are shown.

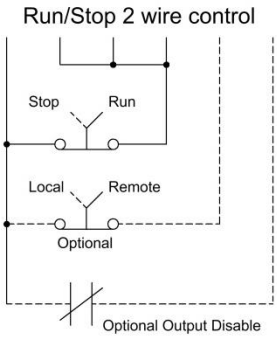


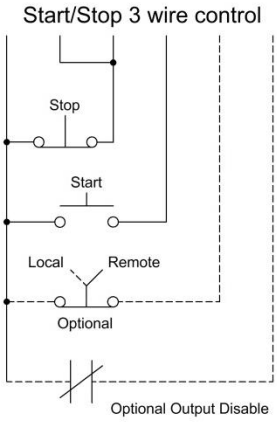
RL1 - RUN (default)	
No Power	OPEN
Power ON & Stopped	OPEN
Power ON & Running	CLOSED

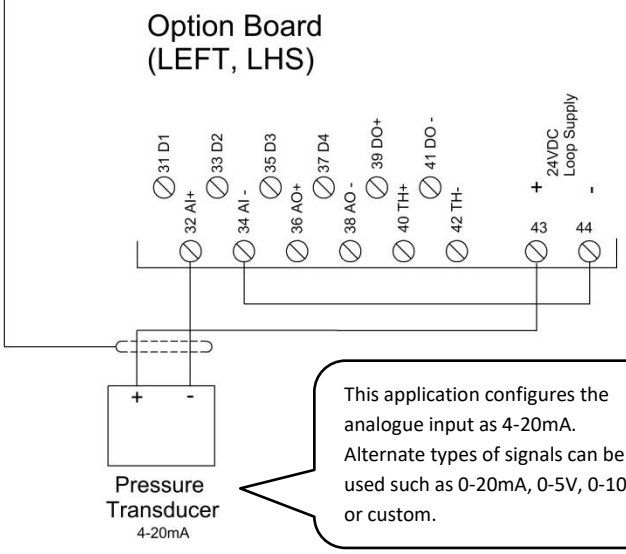
RL2 - TRIP (default)	
No Power	OPEN
Power ON & No Trip	OPEN
Power ON & Tripped	CLOSED



Allows mode selection between local and remote using a digital input. If selection between local/remote is not required install a link for







This application configures the analogue input as 4-20mA. Alternate types of signals can be used such as 0-20mA, 0-5V, 0-10V or custom.

Local / Remote Selection

Changing between 'Local/Remote' mode is achieved using D4 (terminal 5) as shown. The display will indicate the mode with LOC or REM.

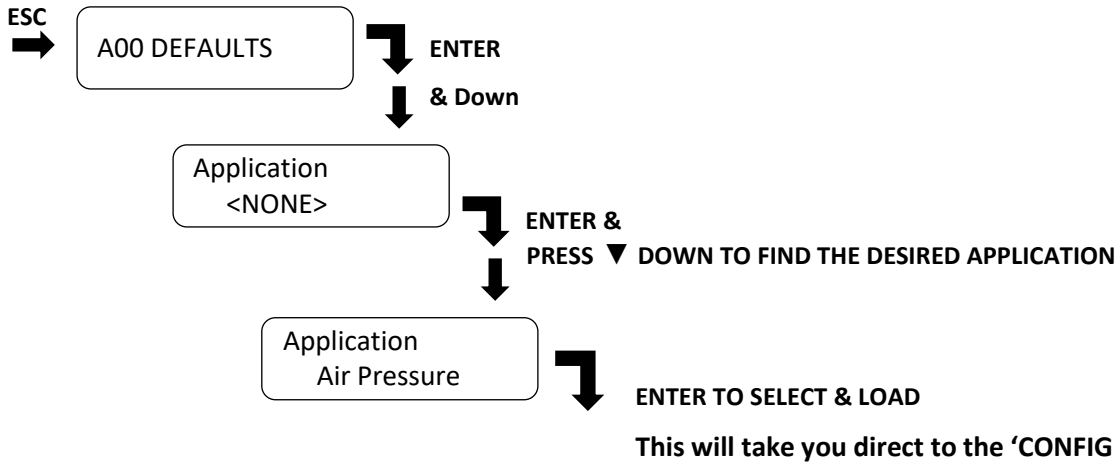
The Local/Remote selection can also be temporarily overridden from the control console. This feature is enabled by this Application.

PRESS 'ENTER' for 5 seconds to toggle between LOCAL & REMOTE. See page 19 for more details on this feature

Setup Procedure

STEP 1. Complete the power wiring according to the instructions from page 4 & check motor direction in local mode. To operate in Local mode remove any wire in terminal 5 (D4) and use the operator console. Do not install control wiring until STEP 4.

STEP 2. Load the application "Pressure Ctl" (SW08013)



STEP 3. When this application is loaded it will program all the parameters required for the wiring configuration and dedicated menus with only the parameters required.

Config. & User Parameters

Adjust the following parameters:
Always exit the menu and save changes before removing power.

Pressure Units kPa	This screen displays the pressure units to be displayed
Set pressure 500.0	This screen displays the operating pressure of the PID controller
Min Speed 0.0 Hz	This screen displays the minimum operating speed for the pump. Check manufacturer specifications for the Pump.
Transducer Scale 1000.0 kPa	This screen displays the pressure of the transducer at full output eg. At 20mA.
Rated motor amps 40.0 A	This screen displays the value of the motor's name plate current. Note the default value is model size dependent.
Overload current 40.0 A	This screen displays the value of the overload current setting for the motor. Note the default value is model size dependent.
Motor RPM 1465	This screen displays the value of the motor's name plate speed in RPM. This is for display purposes only.

When the menu cycles to the first parameter the setup is complete. Press ESC to exit until prompted 'SAVE CHANGES'. Press ENTER to save changes and wait until the process has completed.

STEP 4. Remove power and ensure the ZENER 8000 is completely powered down and install control wiring as per control wiring diagram.

STEP 5. Test the operation and make changes required. For parameters not mentioned refer to the ZENER 8000 reference manual IM00140. If the PID operation is unstable refer to page 67 for a 'Guide to tuning PID Control'

End of procedure…

Parameters configured & Menus created when the application is loaded.

The following is for reference only. Refer to STEP 3 for configuration.

Config & user menus created

Menu	Parameter	Default
CONFIG	Pressure Units	kPa
USER & CONFIG	Set Pressure	500.0
CONFIG	Min Speed	0.0
CONFIG	Transducer Scale	1000.0
CONFIG	Rated motor amps	**
CONFIG	Overload Current	**
CONFIG	Motor RPM	1465

Parameters automatically programmed.

Menu Ref	Parameter
C030 Accel Ramp	2secs
C031 Decel Ramp	2secs
E030 Auto Restart	5
F010 Remote Reference	PID-A output
F1001 Preset 1	PID-A units
G108 AI(32,34) config	4-20mA
H06 SV choice	Preset 1
H07 PV Choice	AI(32,34)
J02 Default Display	PID/meter display
J04 Remote Override	Enabled

Note: Refer to page 24 for accessing CONFIG & USER menus.

Setup using APPLICATION: 'PUMP PID 1' {SW08019}

Overview: This application is for water pressure control system using the internal PID controller without 'Idle mode' (sleep). The default speed reference is 4-20mA from a pressure transducer. The pressure control (PID) is performed by the ZENER 8000 internal PID controller. The set point is adjustable in the User & Config menus. Protection includes loss of signal, high pressure & low pressure and pipe fill timeout.

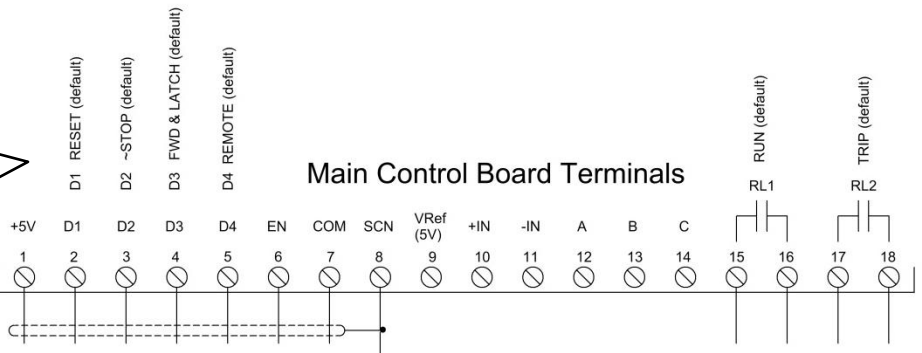
For a more advance pressure control systems with automatic idle function, bore level control, input for a flow switch & additional protection refer to APPLICATION PUMP PID 2.

System Requirements:

- Extended Features Option Board (AQ/AF08001) is fitted in the left hand side position
- Pressure transducer (default for 4-20mA)

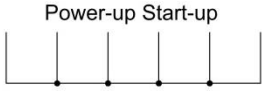
Control Wiring

The functions of terminals D1…4 are programmable. These can be changed to other functions, on or off. The default settings are shown.

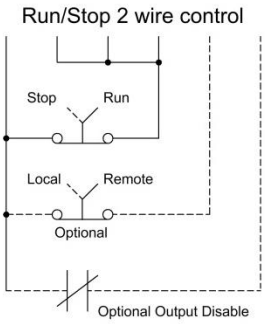


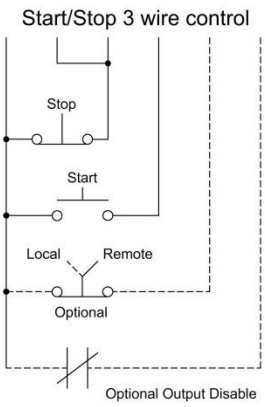
RL1 - RUN (default)	
No Power	OPEN
Power ON & Stopped	OPEN
Power ON & Running	CLOSED

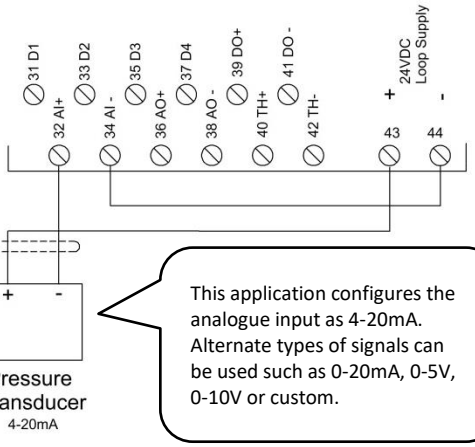
RL2 - TRIP (default)	
No Power	OPEN
Power ON & No Trip	OPEN
Power ON & Tripped	CLOSED



Allows mode selection between local and remote using a digital input. If selection between local/remote is not required install a link for remote mode.







This application configures the analogue input as 4-20mA. Alternate types of signals can be used such as 0-20mA, 0-5V, 0-10V or custom.

Local / Remote Selection

Changing between 'Local/Remote' mode is achieved using D4 (terminal 5) as shown. The display will indicate the mode with LOC or REM.

The Local/Remote selection can also be temporarily overridden from the control console. See page 19 for more details on this feature.

When enabled, PRESS 'ENTER' for 5 seconds to toggle between LOCAL & REMOTE.

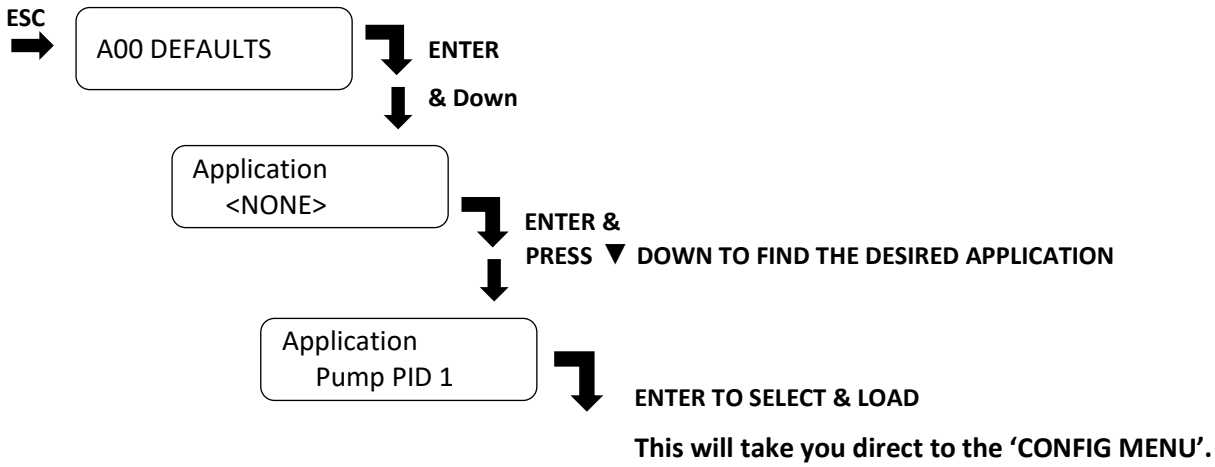
Setup Procedure

Some important points to note before proceeding:

- It is critical that the transducer feedback and the PV displayed is checked against a pressure gauge.
- Ensure that the motor, pump & pipework (and non-return valve) are in good working order.
- Separate & independent high & low pressure protection is employed to prevent economic loss.

STEP 1. Complete the power wiring according to the instructions from page 6 & check motor direction in local mode. To operate in Local mode remove any wire in terminal 5 (D4) and use the operator console. Do not install control wiring until STEP 4.

STEP 2. Load the application "PUMP PID 1" (SW08019)



STEP 3. When this application is loaded it will program all the parameters required for the wiring configuration and dedicated menus with only the parameters required.

Config. & User Parameters

Adjust the following parameters:
Always exit the menu and save changes before removing power.

Rated motor amps 40.0 A	This screen displays the value of the motor's name plate current. Note the default value is model size dependent.
Overload current 40.0 A	This screen displays the value of the overload current setting for the motor. Note the default value is model size dependent.
Motor RPM 1465	This screen displays the value of the motor's name plate speed in RPM. This is for display purposes only.
Transducer Scale 1000.0 kPa	This screen displays the pressure of the transducer at full output eg. At 20mA.
Set pressure 500.0	This screen displays the operating pressure of the PID controller.

Min Speed (Hz) 0.0 Hz	This screen displays the minimum operating speed for the pump. Check manufacturer specifications for the Pump.
Low Trip Level 250.0 kPa	This screen displays the level for a low pressure trip.
Low Trip Time 30	This screen displays the trip time for a Low pressure trip in seconds.
High Level Trip 800.0 kPa	This screen displays the trip time for a High pressure trip.
Pipe Fill Off	This screen displays whether pipe Fill is disabled or operates by pressure.
Fill Speed 40 Hz	This screen displays the speed to run at when in Pipe Fill mode.
Fill to Level 300.0 kPa	This screen displays the pressure to change from pipe fill to PID operation.
Fill Time 40.0 secs	This screen displays the time allowed for Pipe Fill to reach the 'Fill level' before a trip occurs.

When the menu cycles to the first parameter the setup is complete. Press ESC to exit until prompted 'SAVE CHANGES'. Press ENTER to save changes and wait until the process has completed.

STEP 4. Remove power and ensure the ZENER 8000 is completely powered down and install control wiring as per control wiring diagram.

STEP 5. Test the operation and make changes required.

- Ensure the pressure feedback (PV) is equal to the pressure indicated on the pressure gauge.
- Ensure the PID responds to changes and operates in a stable manner. If the PID operation is unstable refer to the 'Guide to tuning PID Control' on page 67.

For parameters not mentioned refer to the ZENER 8000 reference manual IM00140.

End of procedure…

Parameters configured & Menus created when the application is loaded.

The following is for reference only. Refer to STEP 3 for configuration.

Config & User menus created:

Menu	Parameter	Default
CONFIG	Rated Motor Amps	**
CONFIG	Overload Current	**
CONFIG	Motor RPM	1465
USER & CONFIG	Set Pressure (kPa)	500.0
CONFIG	Transducer Scale (kPa)	100.0
CONFIG	Min Frequency	0.0
CONFIG	Low Trip level	250.0
CONFIG	Low Trip Time	30 secs
CONFIG	High Level Trip	800.0kPa
CONFIG	Pipe Fill	Off
CONFIG	Fill Speed (Hz)	40.0
CONFIG	Fill to Level	300kPa
CONFIG	Fill Time	40.0 secs

Parameters automatically programmed.

Menu Ref	Parameter
C030 Accel Ramp	3secs
C031 Decel Ramp	3secs
C032 S time	0.5sec
C033 Dual Ramp	Enabled
F010 Remote Reference	PID-A output
F1001 Preset 1	PID-A units
G230 UA1	Trip always active
G231 UA1 Signal	PV-A Over
G233 UA1 Text	HI PRESSURE
G106 AI(32,34) Lo CMP	2.0mA
G240 UA2 trip active	With run cmd
G241 UA2 Signal	Lo AI(32,34)
G243 UA2 text	SIGNAL LOST
G250 UA3 Trip Active	With loop ctl
G251 UA3 Signal	PV A Under
G253 UA3 text	LO PRESSURE
G108 AI(32,34) config	4-20mA
H01 Prop band	200%
H06 SV choice	Preset 1
H07 PV Choice	AI(32,34)
H08 PID-A units	kPa
J02 Default Display	PID/meter display

Note: Refer to page 24 for accessing CONFIG & USER menus.

Setup using APPLICATION: 'PUMP PID 2' {SW08020}

Overview: This application is for water pressure control system using the internal PID controller with 'Idle mode' (sleep). The default speed reference is 4-20mA from a pressure transducer. The pressure control (PID) is performed by the ZENER 8000 internal PID controller. The set point is adjustable in the User & Config menus. Protection includes loss of signal, high pressure & low pressure and bore level. Digital inputs are provided for the connection of a bore level switch and a flow switch. The flow switch input provides an additional trigger for idle mode from a flow switch.

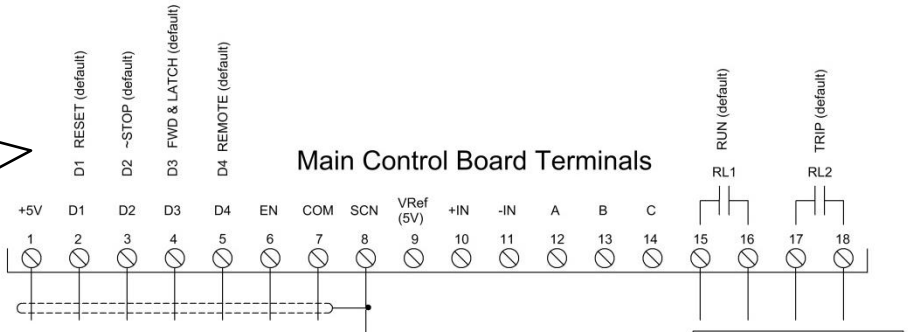
Application Guide Available: Document IM00127 (for more detailed explanation and setup guide)

System Requirements:

- Extended Features Option Board (AQ/AF08001) is fitted in the left hand side position
- Pressure transducer (default for 4-20mA)
- Optional 'Flow Switch' & Bore level switch

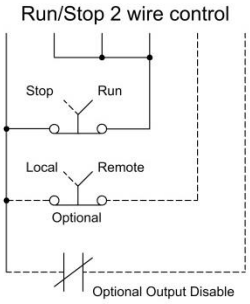
Control Wiring

The functions of terminals D1…4 are programmable. These can be changed to other functions, on or off. The default settings are shown.

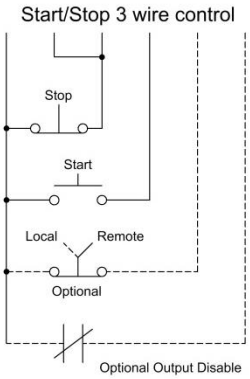


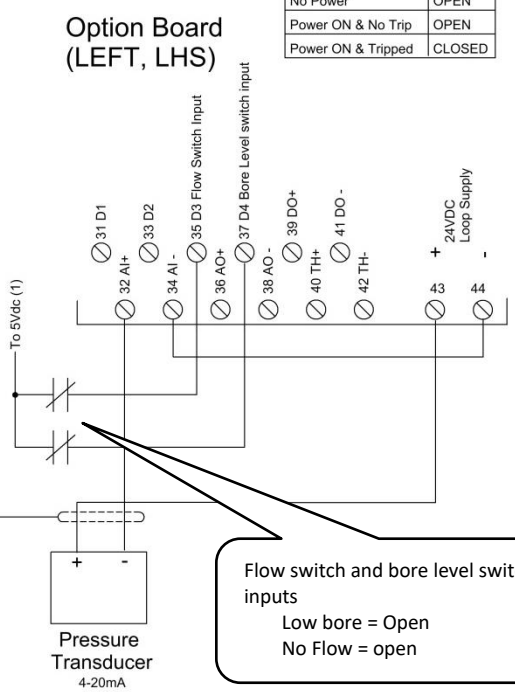
RL1 - RUN (default)	
No Power	OPEN
Power ON & Stopped	OPEN
Power ON & Running	CLOSED

RL2 - TRIP (default)	
No Power	OPEN
Power ON & No Trip	OPEN
Power ON & Tripped	CLOSED



Allows mode selection between local and remote using a digital input. If selection between local/remote is not required install a link for remote mode.





Flow switch and bore level switch inputs
Low bore = Open
No Flow = open

This application configures the analogue input as 4-20mA. Alternate types of signals can be used such as 0-20mA, 0-5V, 0-10V or custom.

Local / Remote Selection

Changing between 'Local/Remote' mode is achieved using D4 (terminal 5) as shown. The display will indicate the mode with LOC or REM.
The Local/Remote selection can also be temporarily overridden from the control console. See page 19 for more details on this feature

When enabled, PRESS 'ENTER' for 5 seconds to toggle between LOCAL & REMOTE.

Setup Procedure

Application Guide : Document IM00127

www.zener.com.au/images/im00127

An application guide is available for this Application due to its complexity. We strongly recommend you download the document or contact Zener for a copy. The guide will provide more details about this application and a step by step instruction to commissioning the ZENER 8000.

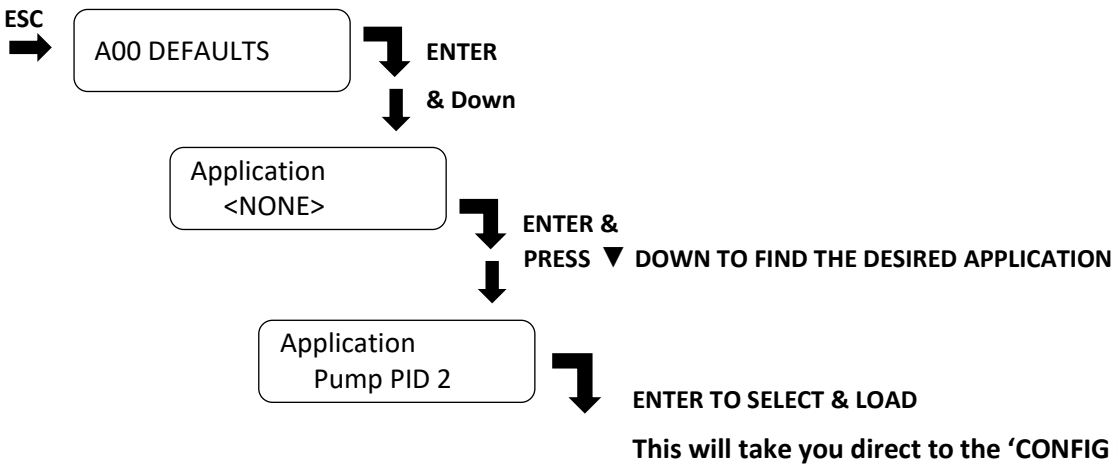
Some important points to note before proceeding:

- It is critical that the transducer feedback and the PV displayed is checked against a pressure gauge.
- Ensure that the motor, pump & pipework (and non-return valve) are in good working order and that pressure holds when all field taps are turned off.
- Separate & independent high & low pressure protection is employed to prevent economic loss.
- Bore level switch is installed to provide protection against dry run. If not used ensure the link is in place.
- A flow switch may be required for more direct 'idle' control or where the set point maybe varied and affects the performance of the 'load %' method. If a flow switch is not used ensure the link is in place.

The following is a summary of the setup.

STEP 1. Complete the power wiring according to the instructions from page 4 & check motor direction in local mode. To operate in Local mode remove any wire in terminal 5 (D4) and use the operator console. Do not install control wiring until STEP 4.

STEP 2. Load the application "PUMP PID 2" (SW08020)



STEP 3. When this application is loaded it will program all the parameters required for the wiring configuration and dedicated menus with only the parameters required.

Config. & User Parameters

Adjust the following parameters:
Always exit the menu and save changes before removing power.

Rated motor amps 40.0 A	This screen displays the value of the motor's name plate current. Note the default value is model size dependent.
Overload current 40.0 A	This screen displays the value of the overload current setting for the motor. Note the default value is model size dependent.
Motor RPM 1465	This screen displays the value of the motor's name plate speed in RPM. This is for display purposes only.
Transducer Scale 1000.0 kPa	This screen displays the pressure of the transducer at full output eg. At 20mA.
Set pressure 500.0 kPa	This screen displays the operating pressure of the PID controller

STEP 4. To check the transducer feedback: Operate the ZENER 8000 in local mode. Start & Increase the speed using the UP button to the operating pressure on the gauge. Check the PV reading on the ZENER 8000 equals the pressure on the gauge. If not the same rectify the problem do not proceed with the setup.

STEP 5. Remove power and ensure the ZENER 8000 is completely powered down and install control wiring as per control wiring diagram. Apply power and operate the ZENER 8000 to check the following.

STEP 6. Check the PID operation: Operate the ZENER 8000 in remote mode (PID). Check the PID controller operation ensuring that the pressure builds to the set pressure and stabilises around that pressure. If unstable, over shoots or slow to respond refer to the PID tuning guide on page 67.

The following should be adjusted after the transducer feedback (PV) has been checked and the PID operation has been checked and tuned (ie. stable operation).

STEP 7. Find the Idle Values: Operate the pump and close all discharge valves (No flow). The pressure should remain constant and the speed & load % reduce. Quickly note the speed and Load % values and stop the pump. There are 2 methods to detect 'No flow'; Load % method and using an external flow switch. A flow switch will also operate in conjunction with the 'Load %' method. Refer to the application guide (IM000127) or reference manual (IM000140) for more explanation on 'Idle' Mode operation.

Enter the idle parameters.

The CONFIG menu can be accessed from the A00 DEFAULTS selection of the Complete Menu (see page 21)

Min Speed (Hz) 0.0 Hz	This screen displays the minimum operating speed for the pump. Check manufacturer specifications for the Pump. Must be set to allow the idle threshold to be achieved.
Idle Threshold 20.0%	This screen displays the '% Load' threshold for the 'time before Idle' to go into 'Idle Mode'. This needs to be set above the Load at no flow under all conditions. To switch off this idle function adjust to 0%.

Time before Idle 5.0 secs	This screen displays the 'time before idle'. This time also applies to a flow switch if used.
Resume at PV 25% below SV	This screen displays the pressure to wake from 'Idle Mode' as a % below the set point.

STEP 8. Check the idle function operates under all conditions. Open and close dicharge valves and field taps at required setpoint and check idle function & PID response. Adjust as required.

STEP 9. Adjust remaining parameters.

Low Trip Level 250.0 kPa	This screen displays the level for a low pressure trip.
Low Trip Time 30	This screen displays the trip time for a Low pressure trip.
High Level Trip 800.0 kPa	This screen displays the trip time for a High pressure trip.
Pipe Fill Off	This screen displays whether pipe Fill is disabled or operates by pressure.
Fill Speed 40 Hz	This screen displays the speed to run at when in Pipe Fill mode.
Fill to Level 300.0 kPa	This screen displays the pressure to change from pipe fill to PID operation.
Fill Time 40.0 secs	This screen displays the time allowed for Pipe Fill to reach the 'Fill level' before a trip occurs.
Low Bore timeout 0.0 secs	This screen displays the restart time after a low bore situation. A bore level switch is required for this function. If not used ensure a link is fitted between terminal 1 (+5V) and terminal 37.

STEP 10. Test the protection & operation under all possible conditions and make any changes required.

- Ensure the pressure feedback (PV) is equal to the pressure indicated on the pressure gauge.
- Ensure the PID responds to changes and operates in a stable manner. If the PID operation is unstable refer to the 'Guide to tuning PID Control' on page 67.
- Ensure the ZENER 8000 goes into idle mode (sleep) when no flow.
- Ensure all protection required is installed & operating correctly.

For parameters not mentioned refer to the ZENER 8000 reference manual IM00140.

Parameters configured & Menus created when the application is loaded.

The following is for reference only. Refer to STEP 3 for configuration.

Config & User menus created:

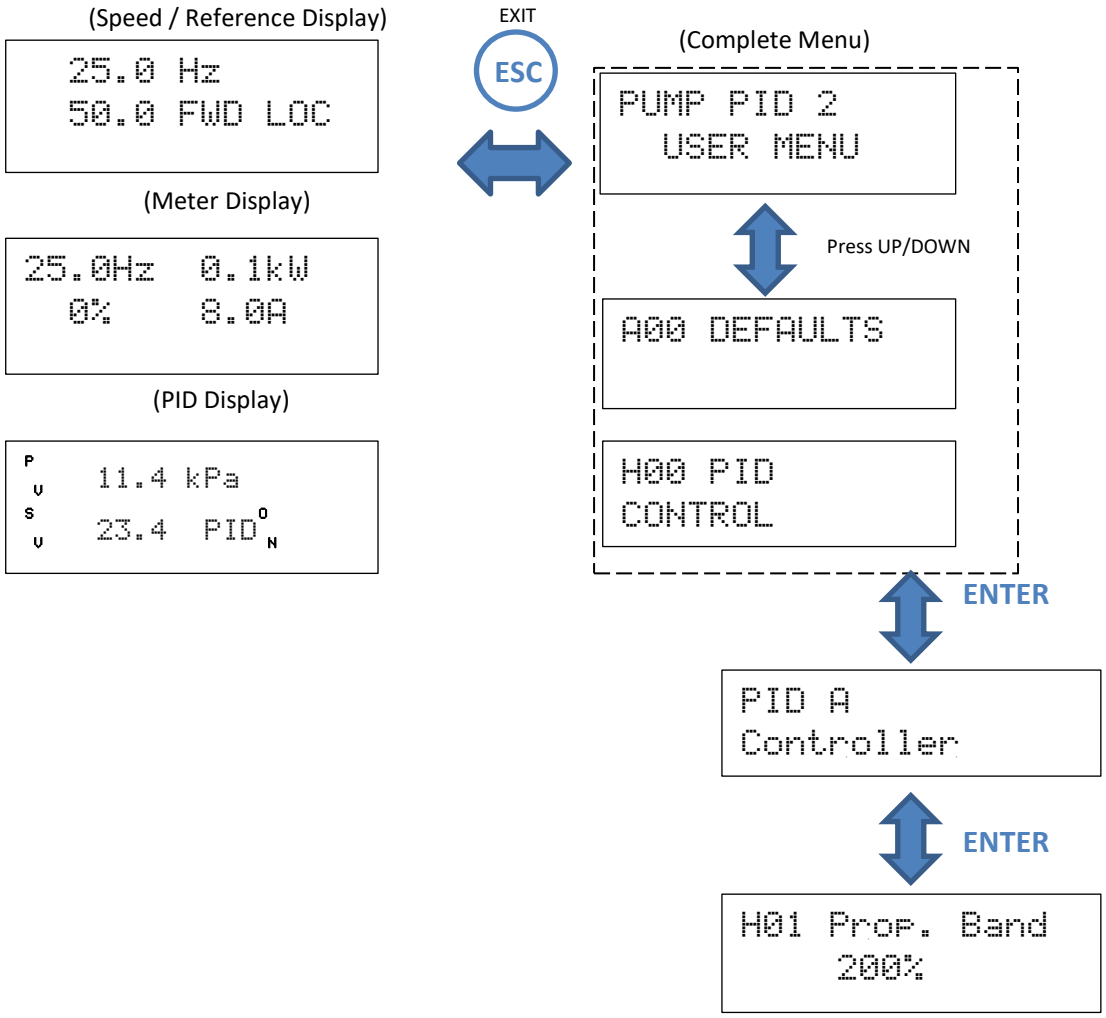
Menu	Parameter	Default
CONFIG	Rated Motor Amps	**
CONFIG	Overload Current	**
CONFIG	Motor RPM	1465
CONFIG	Transducer Scale (kPa)	1000
USER & CONFIG	Set Pressure (kPa)	500
CONFIG	Min Speed	0.0
CONFIG	Idle Threshold %	20%
CONFIG	Time before Idle	5 secs
CONFIG	Resume at PV	25% below SV
CONFIG	Low Trip level	250.0 kPa
CONFIG	Low Trip Time	30 secs
CONFIG	High Level Trip	800.0kPa
CONFIG	Pipe Fill	Off
CONFIG	Fill Speed (Hz)	40.0
CONFIG	Fill to Level	300kPa
CONFIG	Fill Time	40.0 secs
CONFIG	Low Bore Timeout	O sec

Note: Refer to page 24 for accessing CONFIG & USER menus.

Parameters automatically programmed.

Menu Ref	Parameter
C030 Accel Ramp	3 sec
C031 Decel Ramp	3 sec
C032 S time	0.5 sec
C033 Dual Ramp	Enabled
F010 Remote Reference	PID-A output
F1001 Preset 1	PID-A units
G106 AI(32,34) Lo CMP	2.0 mA
G108 AI(32,34) config	4-20mA
G230 UA1	Always
G231 UA1 Signal	PV-A Over
G233 UA1 Text	HI PRESSURE
G240 UA2 trip active	Run Command
G241 UA2 Signal	Lo AI(32,34)
G243 UA2 text	SIGNAL LOST
G250 UA3 Trip Active	PID Closed Loop
G251 UA3 Signal	PV A Under
G253 UA3 text	LO PRESSURE
G260 UA4 Trip Active	RUN Command
G261 UA4 Signal	Pipe Fill TMR
G262 UA4 delay	1 secs
G263 UA4 text	Fill T.O
G271 Warn input	~TMR 1
G272 Warning Text	“-DRY-
G01 DI config	Custom
I02 `STOP	Logic Block 1
I201 LB1 Input 2	D2(3)
I202 LB1 Input 3	TMR 1
I203 LB1 m0:7	LLLHLLLH
G071 T1 Mode	Delay ON init
G0720 T1 Input 1	ON
G0721 T1 input 2	D4(37)
H01 Prop band	200%
H06 SV choice	F100 Preset 1
H07 PV Choice	AI(32,34)
H08 PID-A units	kPa
H102 RESUME	By PV Threshold
H107 No Flow Sel	~D3(35)
J02 Default Display	PID display

PID Parameters explanation



The Proportional gain: amplifies the difference between the set point reference and feedback signals. The **H01 Prop. Band** value is the proportion of input required to generate 100% at the output of the PID control. For example **H01 Prop. Band** is 300.0%, the proportional gain is 100/300 = 0.333. That is 3 units of input will generate 1 unit of output. The higher the % value, the lower the 'proportional gain'.

The integral time: The integral action adds a corrective component to reduce a constant error difference between set point and feedback signals. The greater the error, the quicker the gain increases. The **H02 Integ. time** value sets the time to 'repeat' the error difference between set point and feedback signals - This assumes the Proportional gain is equal to 1.

A low **H02 Integ. time** value attempts to regulate the process variable quickly. However if excessively low, over shooting and under shooting will be more prominent.

A high **H02 Integ. time** value diminishes over shooting and under shooting. However regulation takes longer to achieve.

Guide to PID Tuning

Step	Problem	Action
1.	The plumbing is set for typical flow but the system responds too slowly	1.1 Stop the ZENER 8000 & pump 1.2 Halve the value of **H01 Proportional band** (avoid adjustments below 10%) 1.3 Stop & restart the ZENER 8000 & pump. 1.4 Observe the time it takes to reach pressure (or reacts to changes) 1.5 Repeat if the response is slow. Keep halving **H01 Proportional band** until overshoots or starts to oscillate then proceed to step 2.
2.	The system starts to overshoot or oscillate	2.1 Stop the ZENER 8000 2.2 Double the value **H01 Proportional band** 2.3 Observe the time it takes to reach pressure (or reacts to changes) 2.4 Repeat if the system still overshoots or oscillates proceed to step 3.
3.	The system still responds slowly (after adjusting **H01 Proportional band**)	3.1 Halve the **H02 Integral Time** 3.2 Observe the time it takes to reach the pressure (or reacts to changes) 3.3 Repeat if the response is still slow (half Again) otherwise proceed to step 4."
4.	The system starts to overshoot or oscillate (after adjusting **H01 Proportional band**)	4.1 Double the **H02 Integral Time** 4.2 Observe the time it takes to reach the pressure (or reacts to changes) 4.3 Repeat if the system still overshoots or oscillates (half Again)

Additional detailed information

This manual provides basic control configuration information for the ZENER 8000 to suit more common applications. Please refer to the *ZENER 8000 Reference Manual IM00140* for a detailed explanation of each control feature, including communications protocols

Communications Protocols

Please refer to the *ZENER 8000 Reference Manual IM00140* for details of the communications protocols supported.

Display Messages

The ZENER 8000 displays a variety of messages on the second line of its display to indicate the drive status.

These messages may be divided into two types, trip messages and run messages.

The ZENER 8000 will protect itself from a variety of fault conditions. When one of these conditions is experienced the ZENER 8000 will trip, shut down the motor and display one of the following messages. The message will be displayed until the fault is cleared and a rest signal is applied.

Trip Message	Description
EXTERNAL ALARM	User defined trip input activated
THERMISTOR HOT	The thermistor wired to the Extended Features card indicates the motor is over heated
THERMISTOR SHORT	The thermistor wired to the Extended Features card is short circuit
SUPPLY FAIL	There is a problem with the input power supply. One phase is either partially or totally missing and motor operation will be impaired
BRAKE SHORT	Either an Over Current or a Ground Fault has been detected on the dynamic brake resistor terminals
OVER TEMPERATURE	The ZENER 8000 is too hot
EARTH FAULT	An earth leakage fault has been detected on the motor terminals
I2t OVERLOAD	An I2t trip has occurred
CHARGE FAULT	An abnormal condition associated with the DC bus slow charge control has been detected.
DC BUS LOW	The DC Bus voltage has fallen below its minimum threshold to operate the motor
POWER FAILURE	One or more phases of the input power supply are either low or missing
OVER CURRENT	The output current has exceeded the ZENER 8000's intermittent output current rating
INV OVER TEMP	One or more power devices have reached the limit of their thermal protection rating
RELAY OPEN	The internal bus charge relay has failed to operate correctly
OVER VOLTAGE	The DC Bus voltage has exceeded its maximum value
OUTPUT SHORT	An output short circuit has been detected. This is caused by either an Over Current or a Ground Fault on the motor terminals

Run Message	Description
EXT WARN	User defined warning input activated
V LIMIT	The motor is regenerating or the input voltage is too high
C LIMIT	The motor is drawing its maximum overload current
P LIMIT	The motor's absorbed power exceeds the ZENER 8000 rating when operating from a single phase supply
ESO FWD	The ZENER 8000 is operating in Essential Services Override mode with FWD rotation
ESO REV	The ZENER 8000 is operating in Essential Services Override mode with REV rotation
OFF LINE	The ZENER 8000 has not been given a terminal strip run command in line contactor mode
NO AC!	The ZENER 8000 has been given a terminal strip run command but has detected no AC input voltage supply
CHARGING	The ZENER 8000 is waiting for the DC Bus capacitors to be fully charged before running the motor. This may be due to a low AC input voltage in one or all phases as well as input power conditions that do not represent a normal AC supply. This condition may occur if the ZENER 8000 is operated from a single phase supply without first enabling ***D05 1 Phase Inpt***. A faulty charging circuit is also possible.
NOT EN	The ZENER 8000 is ON but has no enable signal so it is not able to turn a motor
IDLE REM	The ZENER 8000 is idle in remote mode
FWD REM	The ZENER 8000 is running in the FWD direction in remote mode
REV REM	The ZENER 8000 is running in the REV direction in remote mode
EN REM	The ZENER 8000 has an enable signal but no direction selected in remote mode
IDLE LOC	The ZENER 8000 is idle in local mode
FWD LOC	The ZENER 8000 is running in the FWD direction in local mode
REV LOC	The ZENER 8000 is running in the REV direction in local mode
EN LOC	The ZENER 8000 has an enable signal but no direction selected in local mode

Specifications

General

Input Supply Voltage
- 8R models 380 to 480Vac, 3ϕ
- 8L models 208 to 240Vac, 3ϕ

Input voltages have tolerance of -15% to +10%

Input Frequency 48 to 62 Hz

Output Voltage
- 8R models 0 to 480Vac, 3ϕ
- 8L models 0 to 240Vac, 3ϕ

The output voltage cannot be higher than the input voltage.

Output Frequency
- Range 0 to 200Hz
- Resolution: 0.1%
- Linearity 0.2% of max frequency

Enclosure rating
According to model: IP30, IP54, IP66

Environmental Rating
- Storage temperature -20 to +70ºC
- Operating temperature 0 to 40ºC
  0 to 50ºC (dependant on load current)
- Relative humidity 5 to 95%, Non Condensing
- Altitude 0 to 1000m

Standards Compliance

Models marked with this symbol comply with the Australian EMC Framework requirements

Models marked with this symbol are listed by Underwriters Laboratories Inc and comply with UL 508C

The I^2t function complies with IEC 60947-4-1 Ed. 2.0B (2000) and AS/NZS 3947.4.1:2001: Low voltage switchgear and control gear - Contactors and motor starters - Electromechanical contactors and motor starters thermal overload specification class 10A.

Local Controls

Console display
- 16 x 2 line backlit LCD

Console buttons
- Fwd, Rev, Up, Down, Enter, Escape, Stop/Reset

Terminal Strip

Digital Inputs
- +5V & COM:
  - 5Vdc supply;
  - 40mA max current

D1(2)..D4(5),EN(6),
D1(31)..D4(37) (left fit EF card option)
D1(51)..D4(57) (right fit EF card option)
- Logic High: 3 to 5 Vdc
- Logic Low: 0 to 2 Vdc

Relays / Digital Outputs

RL1(16,17),RL2(17,18)
- Form A (single pole, normally open)
- 5A@250Vac (resistive load)
- 5A@30Vdc (resistive load)
- 2A@250Vac (inductive load)
- 2A@30Vdc (inductive load)

RL(70,71,72), RL(73,74,75) (left fit relay card option)
RL(80,81,82), RL(83,84,85) (right fit relay card option)
- Form C (single pole, changeover)
- 5A@250Vac (resistive load)
- 5A@30Vdc (resistive load)
- 1.5A@250Vac (inductive load)
- 1.5A@30Vdc (inductive load)

DO(39,41) (left fit relay card option)
DO(59,61) (right fit relay card option)
- 2Ω R_{ON}
- DC: +/- 40Vpk, 250mA RMS max
- AC: 28Vac, 250mA RMS max

Analogue Inputs
- Vref & COM
  - 5Vdc Supply
  - 5mA max current
- IN+, IN- (AI(10,11)),
- AI(32,34) (left fit EF card option)
- AI(52,54) (right fit EF card option)
  - Differential input
  - 0…5V, 0…10V, 4…20mA ranges
  - 10V or 20mA max custom range
  - ± 32V to COM common mode range

Analogue Outputs
- AO(36,38) (left fit EF card option)
- AO(56,58) (right fit EF card option)
  - Differential output
  - 0…5V, 0…10V, 4…20mA ranges
  - 10V or 20mA max custom range
  - ± 42V to COM common mode range

Loop Transducer Supply
- Terminals (43,44) (left fit EF card option)
- Terminals (63,64) (right fit EF card option)
  - 24Vdc ± 10%
  - 20mA maximum
  - Short circuit protected

TIA/EIA/RS-485 Interface
- Terminals A(12), B(13) & C(14)
  - Isolated interface (2kV ESD)
  - 120Ω optional line termination
  - Internal line bias (> 100kΩ)
  - User selectable bit rate & line termination

Thermistor Inputs
- TH(40,42) (left fit EF card option)
- TH(60,62) (right fit EF card option)
- TH(46,47) (left fit Thermistor card option)
- TH(66,67) (right fit Thermistor card option)
  - 3300Ω nom. @ T_{rated}
  - 20Ω short circuit detection

User Parameters

Motor Voltage	200 to 900V The output voltage cannot exceed the input voltage
Motor Current	25 to 180% of continuous general purpose rating
Motor Frequency	30 to 200Hz
Motor Speed	500 to (60 x Motor frequency) RPM
Minimum Frequency	0 to 195Hz
Maximum Frequency	5 to 200Hz
Acceleration time	0.5 to 600 sec
Deceleration time	0.5 to 600 sec
S time	0.01 to 40 sec
Flux Plus	0 to 200%
Slip Comp	0 to 150% of slip speed
Audible Frequency[3]:	2 to 16kHz
Current Limit	18 to 100% of overload current rating
I^2t overload	18 to 100% of max cont rating
I2t Zero Hz	18 to 100% of max cont rating
I2t cnr Hz	2 to 200Hz
Drive Stopping	Ramp to stop Coast to stop Dynamic braking (optional)

Auto Restart

Number of restarts	0 to 20
Reset time	0.1 to 10 minutes

References
- Analog input
- Console reference
- Presets
- Motorised Potentiometer
- Communications sources

Communications (included as standard)
- Modbus RTU (EIA/RS-485)
- BACnet MS/TP (EIA/RS-485)

Communications (optional)
- Modbus TCP (Ethernet)

[3] This is the frequency apparent in motor acoustic noise. The audible frequency is automatically reduced according to heat sink temperature and load current.

Output Current Specifications

Model	Continuous Current for General Purpose Rating (A) Typically variable torque applications	Continuous Current for Extended Duty Rating (A) Typically constant torque applications	Over Load Current (A)
8*001..	2.0	2.0	4.7
8*003..	3.6	3.1	4.7
8*005..	5.0	4.2	6.3
8*007..	7.2	6.0	9.0
8*011..	10.8	8.9	13.4
8*016..	16.0	13.5	20.3
8*023..	22.5	19.1	28.6
8*030..	30.1	25.6	38.4
8*040..	40.3	34.1	51.1
8*057..	57.0	48.3	72.5
8R082..	82.0	69.5	104.3
8R109..	109	92.4	138.6
8R140..	140	119	178.0
8R170..	170	133	199.0
8R220..	220	161	242.0
8R315..	315	231	346.5
8R390..	390	286	429.0
8R490..	490	359	539.0

* L or R designates input voltage range.

These currents apply to all ranges ZENER 8000 at an ambient temperature of 40ºC independent of the input voltage. ZENER 8000 may be applied at higher ambient temperatures at reduced ratings. Please consult the factory for ratings for ambient temperatures above 40ºC.

Input supply and terminal torques

Model	Max. Supply Short Circuit Rating (Amps RMS Symmetrical)	Max. Fuse Size	Fuse Class	Max. Wire Size	Max. Tightening Torque
240V					
8L001..	18,000A, 240V	20	J	6mm^2	1.76Nm
8L003..	18,000A, 240V	20	J	6mm^2	1.76Nm
8L005..	18,000A, 240V	20	J	6mm^2	1.76Nm
8L007..	18,000A, 240V	20	J	6mm^2	1.76Nm
8L011..	18,000A, 240V	20	J	6mm^2	1.76Nm
8L016..	18,000A, 240V	20	J	16mm^2	1.76Nm
8L023..	18,000A, 240V	60	T	16mm^2	1.8Nm
8L030..	18,000A, 240V	60	T	16mm^2	1.8Nm
8L040..	18,000A, 240V	60	T	16mm^2	1.8Nm
8L057..	18,000A, 240V	100	T	21mm^2	2.0Nm
480V					
8R001..	18,000A, 480V	20	J	6mm^2	1.76Nm
8R003..	18,000A, 480V	20	J	6mm^2	1.76Nm
8R005..	18,000A, 480V	20	J	6mm^2	1.76Nm
8R007..	18,000A, 480V	20	J	6mm^2	1.76Nm
8R011..	18,000A, 480V	20	J	6mm^2	1.76Nm
8R016..	18,000A, 480V	20	J	16mm^2	1.8Nm
8R023..	18,000A, 480V	60	T	16mm^2	1.8Nm
8R030..	18,000A, 480V	60	T	16mm^2	1.8Nm
8R040..	18,000A, 480V	60	T	16mm^2	1.8Nm
8R057..	18,000A, 480V	75	T	21mm^2	2.0Nm
8R082..	18,000A, 480V	200	T	70mm^2	13.6Nm
8R109..	18,000A, 480V	200	T	70mm^2	13.6Nm
8R140..	18,000A, 480V	200	T	70mm^2	13.6Nm
8R170..	18,000A, 480V	200	T	70mm^2	13.6Nm
8R220..	18,000A, 480V	250	T	As per customer's crimp lug	55Nm
8R315..	18,000A, 480V	400	T		55Nm
8R390..	18,000A, 480V	630	T		55Nm
8R490..	18,000A, 480V	630	T		55Nm

• Inverse-time circuit breakers can be used provided that the let-through energy (I2t) and peak let through current (Ip) is less than that of the maximum fuse rating specified.

• Use Copper Conductors Only.

Troubleshooting Guide

Symptom	Cause	Remedy
Front Display does not illuminate.	Input power wiring not connected properly. Input voltage not within specification.	Check input power wiring; refer to the ZENER 8000 Electrical Installation Diagram. Measure the input voltage at the ZENER 8000 input terminals. Check with specifications.
Motor does not rotate when UP button on the Console is pressed.	Enable signal is not active.	Check that the EN terminal is connected to +5V. Check that the ENABLED message is displayed.
	ZENER 8000 is in REMOTE	Check that if you have a remote terminal it is not at +5V with respect to COM.
	Speed is set to minimum	Increase speed by holding down the UP button.
Motor does not rotate when remote START signal is activated.	Incorrect control signal wiring.	Check control wiring to terminals and the terminal functions assigned. Refer to Control Wiring Diagrams and Terminal Configurations.
	Enable signal is not active.	Check that the EN terminal is connected to +5V. Check that the ENABLED message is displayed.
	ZENER 8000 is in LOCAL	Check that your remote terminal is at +5V with respect to DIG COM
	A direction has not been selected.	Check that either a FWD or a REV terminal has been assigned and that it is at +5V with respect to DIG COM. If the reverse direction is selected ensure that reverse is enabled from the Protection menu.
	Speed signal is not correctly connected.	Check the REMOTE speed source in the References menu. Ensure that this source is not at zero.
Motor does not accelerate in the time set by the ACCEL ramp and C LIMIT message appears .	Current limit circuit is operating.	This is a normal operating mode for the ZENER 8000. When the load is being accelerated too fast, the ZENER 8000 limits current drawn by the motor by extending the acceleration ramp time. A faster Accel time is not possible with this Current Limit setting. Increase the ACCEL time

Symptom	Cause	Remedy
		until the C LIMIT message disappears
	CURRENT LIM set too low.	Increase CURRENT LIM value so that the ZENER 8000 is not prematurely limiting current. Check that the motor does not overheat with the new setting.
C LIMIT message appears continuously	Motor mechanically overloaded.	Check the actual load is within the motor's capacity at the required speed.
	Motor shaft jammed.	Check the mechanical drive system.
	Fault in motor or motor wiring.	Check that motor is wired correctly
	Incorrect motor voltage selected.	Enter correct MOTOR VOLTAGE from the MOTOR menu
	Incorrect motor frequency selected.	Enter correct MOTOR FREQUENCY from the MOTOR menu.
	FLUX PLUS is set too high.	Reduce the FLUX PLUS setting.
Motor does not decelerate in the time set by the DECEL ramp and V LIMIT message appears.	Voltage limit circuit is operating.	This is a normal operating mode for the ZENER 8000. When the load is being decelerated too fast, the ZENER 8000 limits the voltage regenerated by the motor by extending the deceleration ramp time. Increase the DECEL time to make this message disappear.
V LIMIT message appears continuously.	Input voltage has exceeded maximum rating.	See ZENER 8000V General Specifications for input voltage ratings.
OUTPUT SHORT message appears	Short circuit on motor terminals.	Check motor & wiring to motor terminals.
	Earth Fault on motor terminals	Check motor & wiring to motor terminals.
OVER CURRENT message appears	Motor current was greater than the ZENER 8000's maximum current.	Check drive and motor current ratings.
OVER VOLTAGE message appears.	Input voltage has exceeded maximum ratings.	See general specification and check the input is within ratings. Check input supply for voltage transients. Fix the external source.
	Motor is overhauling.	Ensure load cannot overdrive the motor.
Any of these messages appear:	Ventilation problem.	Ensure operating ambient temperature is within

Symptom	Cause	Remedy
Tj OVERTEMP HOT INTERNAL AIR Ths OVERTEMP T* OVERTEMP (* is any digit 1..8)		specification. Check fans are rotating freely and there is no build-up of dust or debris in blades. Visually examine the heatsink fins for build-up of dust and debris.
	Drive is constantly overloaded.	Check the ZENER 8000 continuous current and ambient temperature rating.
Motor is unstable.	SLIP COMP is set too high.	Check that MOTOR NAMEPLATE RPM setting is equal to the motor rated speed. Check that NAMEPLATE CURRENT setting is equal to the motor nameplate current. Reduce SLIP COMP setting.
	FLUX PLUS set too high.	Reduce FLUX PLUS setting.
	Incorrect motor voltage selected.	Enter correct MOTOR VOLTAGE from the MOTOR menu.
	Incorrect motor frequency selected.	Enter correct MOTOR FREQUENCY from the MOTOR menu.
	CURRENT LIMIT is set too low.	Increase CURRENT LIMIT setting.
Excessive Motor Heating.	Motor is running at low speeds for long times.	Do not run the motor heavily loaded at low speeds for long periods unless the motor has been suitably de-rated or is force cooled.
	Motor damaged or incorrectly wired.	Check the motor and motor wiring for faults.
	Incorrect motor voltage selected.	Enter correct MOTOR VOLTAGE from the MOTOR menu.
	Incorrect motor frequency selected.	Enter correct MOTOR FREQUENCY from the MOTOR menu.

Your ZENER 8000 Setup Notes

Photocopy or complete in pencil Date: ……

Site designator: …….. Serial No: ……

Parameter	User	Default
A00 DEFAULTS ➔		
A06 Application:		<none>
B00 MOTOR ➔		
B01 MOTOR VOLTS		*
B02 MOTOR AMPS		*
B03 MOTOR Hz		*
B04 MOTOR RPM		*
C00 PERFORMANCE ➔		
C01 MIN Hz		0
C02 MAX Hz		*
C00 PERFORMANCE ➔ C03 RAMP		
C030 ACCEL TIME		10.0 secs
C031 DECEL TIME		10.0 secs
C032 S TIME		0.01secs
C033 DUAL RAMP		DISABLED
C00 PERFORMANCE ➔ C04 FLUX PLUS		
C040 FLUX PLUS		0.00%
C041 HiSpd Flux+		DISABLED
C00 PERFORMANCE ➔		
C05 SLIP COMP %		0.00%
C06 AUDIBLE FREQ		AUTO
D00 PROTECTION ➔		
D01 CURRENT LIM		*
D00 PROTECTION ➔ D02 I2t		
D020 I2t		*
D021 I2t zero Hz		*
D022 I2t CNR Hz		10.0 Hz
D00 PROTECTION ➔		
D03 REVERSE		DISABLED
D04 DC INPUT		DISABLED
D05 1 Phase Inpt		DISABLED
D00 PROTECTION ➔ D06 SKIP SPEED		
D060 SKIP SPEED		30 Hz
D061 SKIP RANGE		0 Hz
D07 Rotation		Normal
E00 STOP/START ➔		
E01 COAST STOP		DISABLED
E02 DYNAMIC BRK		DISABLED
E00 STOP/START ➔ E03 AUTO RESTART		

Parameter	User	Default
E030 ARs ALLOWED		0
E031 AR CLR TIME		1200 secs
E00 STOP/START ➔		
E04 Reset by PF		DISABLED
E05 Motor Resync		DISABLED
E06 LC CONTROL		DISABLED
E00 STOP/START ➔ E07 Solar Supply		
E0701 SOLAR FXN		DISABLED
E070 RUN MODE		OFF
E071 Restart DC		550V
E072 Restart DLY		60 secs
E073 Lo Radiance		OFF
E074 Hi Radiance		OFF
E075 Vmp Volts		*
E0751 MPPT step		2V/sec
E0752 MPP P step		*
E076 Display var		PV-A
E077 Lo Solar t		3 secs
E078 SFC time		1 minute
E079 SFC Ext sel		OFF
E00 STOP/START ➔ E08Mains-Sync		
E080 Mains Sync		DISABLED
E081 Phase comp		0.75msec
F00 REFERENCES ➔ F01 REMOTE CFG		
F010 REMOTE REF		AI(10,11)
F011 REMOTE Inpt[4]	(see I11)	D4(5)
F00 REFERENCES ➔ F01 REMOTE CFG ➔ F012 USER MODE 1		
F0120 MODE1 REF		AI(10,11)
F0121 MODE1 Inpt		OFF
F0122 MODE1 text		"U MODE 1"
F0123 MODE1 cfg		Reference only
F00 REFERENCES ➔ F01 REMOTE CFG ➔ F013 USER MODE 2		
F0130 MODE2 REF		AI(10,11)
F0131 MODE2 Inpt		OFF
F0132 MODE2 text		"U MODE 2"
F0133 MODE2 cfg		Reference only
F00 REFERENCES ➔		

[4] Alias name for the parameter

Parameter	User	Default
F02 LOCAL		CONSOLE
F00 REFERNCES **➔F03 ESO Config**		
F030 ESO REF		F105 Preset 6
F031 ESO Input[4]	(see I08)	OFF
F032 ESO RAMP		10.0 secs
F00 REFERENCES **➔ F04 JOGFWD CFG**		
F040 JOGFWD REF		F105 Preset 6
F041 JOGFWD Inpt[4]	(see I09)	OFF
F00 REFERNECES **➔ F05 JOGREV CFG**		
F050 JOGREV REF		F105 Preset 6
F051 JOGREV Inpt[4]	(see I10)	OFF
F00 REFERENCES **➔ F06 Reference Selector CFG**		
F060 Sel Method		Multiplexed
F061 USER REF 1		AI(10,11)
F062 USER REF 2		CONSOLE
F00 REFERENCES **➔ F06 Reference Selector CFG** **➔F063 Selector Input Configs**		
F0630 Selector 1		OFF
F0631 Selector 2		OFF
F0632 Selector 3		OFF
F0633 Selector 4		OFF
F0634 Selector 5		OFF
F0635 Selector 6		OFF
F0636 Selector 7		OFF
F0637 Selector 8		OFF
F00 REFERENCES **➔ F07 AI fxn Cfg**		
F070 AI Function		Average fxn
F071 AI in 0 sel		ZERO_REF
F072 AI in 1 sel		ZERO_REF
F073 AI in 2 sel		ZERO_REF
F00 REFERENCES **➔ F08 CONSOLE CFG**		
F080 PERSISTENT		DISABLED
F081 STOP RESET		DISABLED
F00 REFERENCES ➔		
F09 COMMS PRESET		60.00%
F00 REFERENCES **➔ F10 PRESETS**		
F1001 PRESET1 units		%
F100 PRESET1		10.00%
F1001 PRESET2 units		%
F101 PRESET2		20.00%
F1011 PRESET3 units		%
F102 PRESET3		30.00%
F00 REFERENCES **➔ F10 PRESETS** (continued)		
F1021 PRESET4 units		%
F103 PRESET4		40.00%
F1031 PRESET5 units		%
F104 PRESET5		50.00%

Parameter	User	Default
F1041 PRESET6 units		%
F105 PRESET6		60.00%
F1051 PRESET7 units		%
F106 PRESET7		70.00%
F1061 PRESET8 units		%
F107 PRESET8		80.00%
G00 INPUT/OUTPUT **➔ Digital Input Configuration**		
G01 DI config		Standard Indust
G00 INPUT/OUTPUT **➔ Analogue Input Configurations** **➔ G02 AI(10,11) Config.** **➔ G028 AI config = "custom"**		
G020 Input Type		Volts
G021 MIN Input		0.0 V
G022 MAX Input		10.0 V
G023 Ref @MIN in		0.00%
G024 Ref @MAX in		100.00%
G00 INPUT/OUTPUT **➔ Analogue Input Configurations** **➔ G02 AI(10,11) Config.**		
G025 Hi Compare Level		8 V
G026 Lo Compare Level		2 V
G027 Hysteresis		2.00%
G028 AI config		0 to 10V
G00 INPUT/OUTPUT **➔ Relay Output Configurations** **➔ G03 RL1(15,16)**		
G030 RL1 Signal		RUN
G031 RL1 Sense		DIRECT
G032 RL1 TON		0 secs
G033 RL1 TOFF		0 secs
G00 INPUT/OUTPUT **➔ Relay Output Configurations** **➔ G04 RL2(17,18)**		
G040 RL2 Signal		TRIP
G041 RL2 Sense		DIRECT
G042 RL2 TON		0 secs
G043 RL2 TOFF		0 secs
G00 INPUT/OUTPUT **➔ Relay Output Configurations** **➔ G030 RL1 Signal** = "**UNDER SPEED**" OR **➔ G040 RL2 Signal** = "**UNDER SPEED**"		
G050 UNDER SPEED		20.00%
G00 INPUT/OUTPUT **➔ Relay Output Configurations** **➔ G030 RL1 Signal** = "**OVER SPEED**" OR **➔ G040 RL2 Signal** = "**OVER SPEED**"		
G051 OVER SPEED		80.00%
G00 INPUT/OUTPUT **➔ Relay Output Configurations** **➔ G030 RL1 Signal** = "**%LOAD WARNING**" OR **➔ G040 RL2 Signal** = "**%LOAD WARNING**"		
G053 %LOAD UNDER		10%
G054 %LOAD OVER		100%
G00 INPUT/OUTPUT **➔ Timers & Compare Configurations** **➔ Timer 1 (G070…G0723)**		

Parameter	User	Default
G070 T1 Interval		1 secs
G071 T1 mode		Delay ON
G0720 T1 Input 1		OFF
G0721 T1 Input 2		OFF
G0722 T1 Reset		OFF
G0723 T1 Logic		Standard
G00 INPUT/OUTPUT ➔ **Timers & Compare Configurations** ➔ **Timer 1 (G070…G0723)** ➔ **G0723 T1 Logic** = "**custom**"		
T1 IN1,2,3 m0:7 IN:		LLLLLLHL
T1 IN1,2,3 m0:7 Reset:		LHLHLHLH
G00 INPUT/OUTPUT ➔ **Timers & Compare Configurations** ➔ **Timer 2 (G073…G0753)**		
G073 T2 Interval		1 secs
G074 T2 mode		Delay ON
G0750 T2 Input 1		OFF
G0751 T2 Input 2		OFF
G0752 T2 Reset		OFF
G0753 T2 Logic		Standard
G00 INPUT/OUTPUT ➔ **Timers & Compare Configurations** ➔ **Timer 2(G073…G0753)** ➔ **G0753 T2 Logic** = "**custom**"		
T2 IN1,2,3 m0:7 IN:		LLLLLLHL
T2 IN1,2,3 m0:7 Reset:		LHLHLHLH
G00 INPUT/OUTPUT ➔ **Relay Output Configurations** ➔ **G08 DO(39,41)** (Extended Features Card, left side fit)		
G080 DO Function		RUN
G081 DO Sense		DIRECT
G082 DO TON		0 secs
G083 DO TOFF		0 secs
G00 INPUT/OUTPUT ➔ **Thermistor Configurations** (Extended Features Card, left side fit)		
G09 TH(40,42)		DISABLED
G00 INPUT/OUTPUT ➔ **Analogue Input Configurations** ➔ **G10 AI(32,34) Config.** (Extended Features Card, left side fit) ➔ **G108 AI config = "custom"**		
G100 Input Type		Volts
G101 MIN Input		0.0V
G102 MAX Input		10.0V
G103 Ref @MIN in		0.00%
G104 Ref @MAX in		100.00%
G00 INPUT/OUTPUT ➔ **Analogue Input Configurations** ➔ **G10 AI(32,34) Config.** (Extended Features Card, left side fit)		
G105 Hi Compare Level		8V
G106 Lo Compare Level		2V
G107 Hysteresis		2.00%
G108 AI config		0 to 10V
G00 INPUT/OUTPUT ➔ **Analogue Output Configurations** ➔ **G11 AO(36,38) Config.** (Extended Features Card, left side fit)		

Parameter	User	Default
G116 AO config		0 to 5V
G111 AO Source		FREQUENCY
G112 Signal min		0.0Hz
G113 Signal max		50.0Hz
G00 INPUT/OUTPUT ➔ **Analogue Output Configurations** ➔ **G11 AO(36,38) Config.** (Extended Features Card, left side fit) ➔ **G116 AO config = "custom"**		
G110 Output Type		Volts
G114 MIN Output		0.0V
G115 MAX Output		5.0V
G00 INPUT/OUTPUT ➔ **Relay Output Configurations** ➔ **G12 DO(59,61)** (Extended Features Card, right side fit)		
G120 DO Function		RUN
G121 DO Sense		DIRECT
G122 DO TON		0sec
G123 DO TOFF		0sec
G00 INPUT/OUTPUT ➔ **Thermistor Configurations** (Extended Features Card, right side fit)		
G13 TH(60,62)		DISABLED
G00 INPUT/OUTPUT ➔ **Analogue Input Configurations** ➔ **G14 AI(52,54) Config.** (Extended Features Card, right side fit) ➔ **G148 AI config = "custom"**		
G140 Input Type		Volts
G141 MIN Input		0.0V
G142 MAX Input		10.0V
G143 Ref @ MIN in		0.00%
G144 Ref @ MAX in		100.00%
G00 INPUT/OUTPUT ➔ **Analogue Input Configurations** ➔ **G14 AI(52,54) Config.** (Extended Features Card, right side fit)		
G145 Hi Compare Level		8V
G146 Lo Compare Level		2V
G147 Hysteresis		2.00%
G148 AI config		0 to 10V
G00 INPUT/OUTPUT ➔ **Analogue Output Configurations** ➔ **G15 AO(56,58) Config.** (Extended Features Card, right side fit)		
G156 AO config		0 to 5V
G151 AO Source		FREQUENCY
G152 Signal min		0.0Hz
G153 Signal max		50.0Hz
G00 INPUT/OUTPUT ➔ **Analogue Output Configurations** ➔ **G15 A0(56,58) Config.** (Extended Features Card, right side fit) ➔ **G156 AO config = "custom"**		
G150 Output Type		Volts
G154 MIN Output		0.0V
G155 MAX Output		5.0V
G00 INPUT/OUTPUT ➔ **Communication Configuration**		
G160 Protocol		none

Parameter	User	Default
G00 INPUT/OUTPUT ➔ **Communication Configuration** ➔ **G160 Protocol ≠ "none"**		
G166 RUN SIGNALS		FROM TERMINALS
G168 Comms Lost Time		10sec
G169 Serial No.		G1000000
G00 INPUT/OUTPUT ➔ **Communication Configuration** ➔ **G160 Protocol** = **"MODBUS RTU"** OR ➔ **G160 Protocol** = **"BACnet MS/TP"**		
G161 bits/sec		19200
G162 Parity		Even parity
G163 MAC/Dev ID		1
G167 Terminator		DISABLED
G00 INPUT/OUTPUT ➔ **Communication Configuration** ➔ **G160 Protocol** = **"BACnet MS/TP"**		
G164 Dev Inst.		1
G165 Max Masters		127 masters
G00 INPUT/OUTPUT ➔ **Communication Configuration** ➔ **G160 Protocol** = **"MODBUS/TCP"** (Ethernet card fitted)		
G1630 IP address		192.168.0.180
G1631 IP mask		255.255.255.0
G00 INPUT/OUTPUT ➔ **Relay Output Configurations** ➔ **G17 RL(70,71,72)** (Relay Expansion Card, left side fit)		
G170 RLY Signal		RUN
G171 RLY Sense		DIRECT
G172 RLY TON		0sec
G173 RLY TOFF		0sec
G00 INPUT/OUTPUT ➔ **Relay Output Configurations** ➔ **G18 RL(73,74,75)** (Relay Expansion Card, left side fit)		
G180 RLY Signal		RUN
G181 RLY Sense		DIRECT
G182 RLY TON		0sec
G183 RLY TOFF		0sec
G00 INPUT/OUTPUT ➔ **Relay Output Configurations** ➔ **G19 RL(80,81,82)** (Relay Expansion Card, right side fit)		
G190 RLY Signal		RUN
G191 RLY Sense		DIRECT
G192 RLY TON		0sec
G193 RLY TOFF		0sec
G00 INPUT/OUTPUT ➔ **Relay Output Configurations** ➔ **G20 RL(83,84,85)** (Relay Expansion Card, right side fit)		
G200 RLY Signal		RUN
G201 RLY Sense		DIRECT
G202 RLY TON		0sec
G203 RLY TOFF		0sec
G00 INPUT/OUTPUT ➔ **Thermistor Configurations** (Thermistor option card, left side fit)		
G21 TH(46,47)		DISABLED

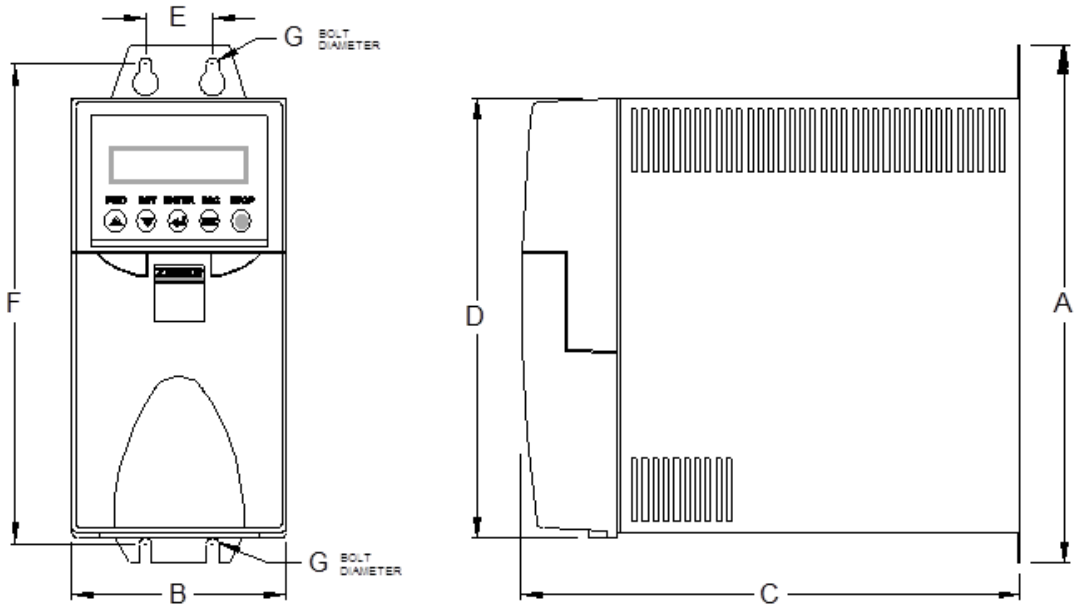
Parameter	User	Default
G00 INPUT/OUTPUT ➔ **Thermistor Configurations** (Thermistor option card, right side fit)		
G22 TH(66,67)		DISABLED
G00 INPUT/OUTPUT ➔ **Warning & Alarm Configurations** ➔ **G23 USER ALARM 1**		
G230 Alarm mode		ALWAYS
G231 Alarm input		OFF
G232 Alarm delay		1 sec
G233 Alarm text		UA1: ALARM
G00 INPUT/OUTPUT ➔ **Warning & Alarm Configurations** ➔ **G24 USER ALARM 2**		
G240 Alarm mode		ALWAYS
G241 Alarm input		OFF
G242 Alarm delay		1 sec
G243 Alarm text		UA2: ALARM
G250 Alarm mode		ALWAYS
G00 INPUT/OUTPUT ➔ **Warning & Alarm Configurations** ➔ **G25 USER ALARM 3**		
G251 Alarm input		OFF
G252 Alarm delay		1 sec
G253 Alarm text		UA3: ALARM
G00 INPUT/OUTPUT ➔ **Warning & Alarm Configurations** ➔ **G26 USER ALARM 4**		
G260 Alarm mode		ALWAYS
G261 Alarm input		OFF
G262 Alarm delay		1 sec
G263 Alarm text		UA4: ALARM
G00 INPUT/OUTPUT ➔ **Warning & Alarm Configurations** ➔ **G27 WARNING 1**		
G270 Warn mode		ALWAYS
G271 Warn input		OFF
G272 Warn text		-<UW1>-
G00 INPUT/OUTPUT ➔ **Warning & Alarm Configurations** ➔ **G28 WARNING 2**		
G280 Warn mode		ALWAYS
G281 Warn input		OFF
G282 Warn text		-<UW2>-
G00 INPUT/OUTPUT ➔ **Warning & Alarm Configurations** ➔ **G29 WARNING 3**		
G290 Warn mode		ALWAYS
G291 Warn input		OFF
G292 Warn text		-<UW3>-
G00 INPUT/OUTPUT ➔ **Warning & Alarm Configurations** ➔ **G30 WARNING 4**		
G300 Warn mode		ALWAYS
G301 Warn input		OFF
G302 Warn text		-<UW4>-

Parameter	User	Default
G00 INPUT/OUTPUT ➔ **Timers & Compare Configurations** ➔ **Signal Compare (G400…G407)**		
G400 CMP Signal		FREQUENCY
G401 CMP Scale		50 Hz
G402 CMP Ref		F100 Preset 1
G403 Threshold 1		20%
G404 Threshold 2		40%
G405 Threshold 3		60%
G406 Threshold 4		820%
G407 CMP mode		WINDOW
H00 PID Control ➔ **PID-A Controller**		
H01 Prop. Band		300.00%
H02 Integ. time		2.00 sec
H03 Diff time		0.00 sec
H04 +Opt clamp		100
H05 –Opt clamp		0
H06 SV choice		CONSOLE
H07 PV choice		AI(10,11)
H08 PID Units (selection)		%
H081 PID Units		%
H09 PID Scale		100.00%
H00 PID Control ➔ **PID-A Controller** ➔ **H10 IDLE Func.**		
H100 IDLE %LOAD		0%
H101 IDLE DELAY		0 secs
H102 RESUME		by speed ref
H105 IDLE boost		100% of SV
H106 Boost time		0 secs
H107 No Flow Sel		OFF
H00 PID Control ➔ **PID-A Controller** ➔ **H10 IDLE Func.** ➔ **H102 RESUME = "by speed ref"**		
H103 RESUME Hz		0 Hz
H00 PID Control ➔ **PID-A Controller** ➔ **H10 IDLE Func.** ➔ **H102 RESUME = "by PV threshold"**		
H104 RESUME @PV		10% below SV
H00 PID Control ➔ **PID-A Controller** ➔ **H11 PV Compare**		
H110 PV LO value		20%
H111 PV HI value		80%
H00 PID Control ➔ **PID-A Controller** ➔ **H12 Pipe Fill**		
H120 Fill Mode		OFF
H121 Fill Time		0 secs
H122 Fill Threshold		0%
H123 Fill Ref		0 Hz
H00 PID Control ➔ **PID-A Controller** ➔ **H13 OutOfReg CFG**		

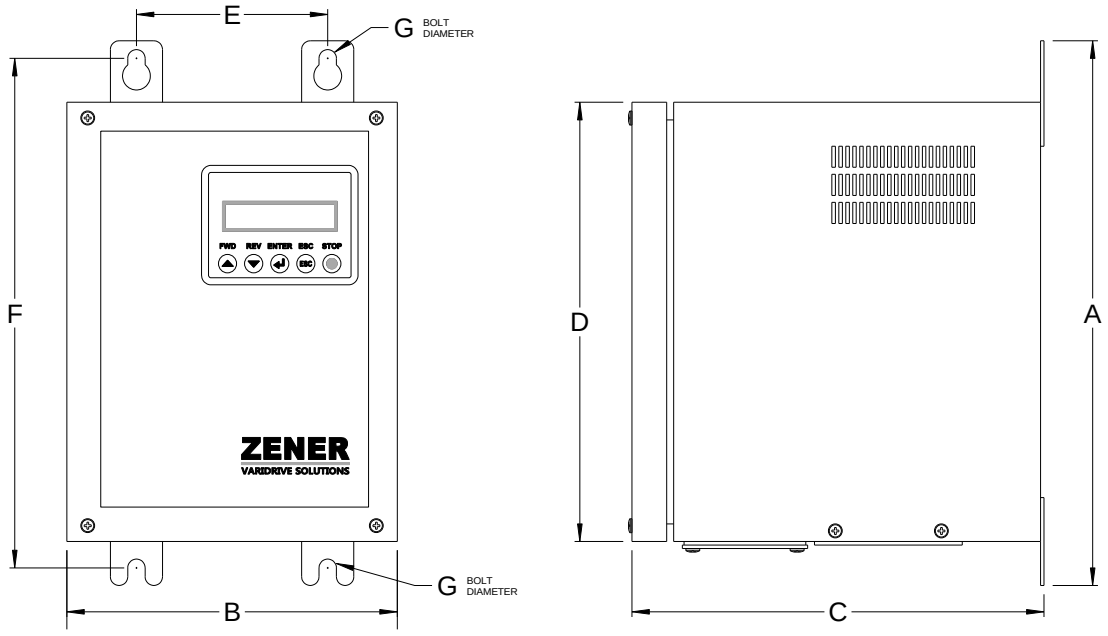
Parameter	User	Default
H131 OOR Thresh		10.0%
H132 OOR Time		5 secs
H00 PID Control ➔ **PID-B Controller**		
H21 Prop. Band		300.00%
H22 Integ. time		2.00 sec
H23 Diff time		0.00 sec
H00 PID Control ➔ **PID-B Controller** (continued)		
H24 +Opt clamp		100
H25 –Opt clamp		0
H26 SV choice		CONSOLE
H27 PV choice		AI(10,11)
H28 PID Units (selection)		%
H281 PID Units		%
H29 PID Scale		100.00%
H30 PV LO value		20%
H31 PV HI value		80%
H00 PID Control ➔ **PID-B Controller** ➔ **H32 OutOfReg CFG**		
H321 OOR Thresh		10.0%
H322 OOR Time		5 secs
G00 INPUT/OUTPUT ➔ **Digital Input Configuration** ➔ **G01 DI config = "custom"**		
I00 FWD & LATCH		D3(4)
I01 REV & LATCH		OFF
I02 ~STOP		D2(3)
I03 FWD		OFF
I04 REV		OFF
I05 UP		OFF
I06 DOWN		OFF
I07 RESET		D1(2)
I08 ESO		OFF
I09 JOGFWD		OFF
I10 JOGREV		OFF
I11 REMOTE		D4(5)
G00 INPUT/OUTPUT ➔ **Digital Input Configuration** ➔ **I20 Logic Block1**		
I200 LB1 Input 1		OFF
I201 LB1 Input 2		OFF
I202 LB1 Input 3		OFF
I203 LB1 m0:7		LLLLLLLL
G00 INPUT/OUTPUT ➔ **Digital Input Configuration** ➔ **I21 Logic Block2**		
I210 LB2 Input 1		OFF
I211 LB2 Input 2		OFF

Parameter	User	Default
I212 LB2 Input 3		OFF
I213 LB2 m0:7		LLLLLLLL
G00 INPUT/OUTPUT **➔ Digital Input Configuration** **➔ I22 Logic Block3**		
I220 LB3 Input 1		OFF
I221 LB3 Input 2		OFF
I222 LB3 Input 3		OFF
I223 LB3 m0:7		LLLLLLLL
G00 INPUT/OUTPUT **➔ Digital Input Configuration** **➔ I23 Logic Block4**		
I230 LB4 Input 1		OFF
I231 LB4 Input 2		OFF
I232 LB4 Input 3		OFF
I233 LB4 m0:7		LLLLLLLL
J00 CONSOLE ➔		
J01 Menu Lock		UNLOCKED
J02 Def. Display		SPEED-REF DISP
J00 CONSOLE **➔ J03 Run Display**		
J030 Run Display Format		999.9
J031 Run Display Scale		50
J032 Run Display Units		Hz
J00 CONSOLE ➔		
J04 REMOTE OVRD		DISABLED
J00 CONSOLE **➔ G01 DI config ≠ "custom"**		
J05 LOCAL RUN EN		ON
S00 SERVICE ➔		
S04 FAN OVERRIDE		DISABLED
S00 SERVICE **➔ Fault Log**		
S05 PF & UV MASK		DISABLED
S06 PWR UP ENTRY		ENABLED
S00 SERVICE **➔ Advanced**		
S100 Load comp BW		default
S101 OvrMod lvl		Default
S104 CL gain		100.0%
S105 REGN CL fxn		ENABLED

Mechanical Installation Information

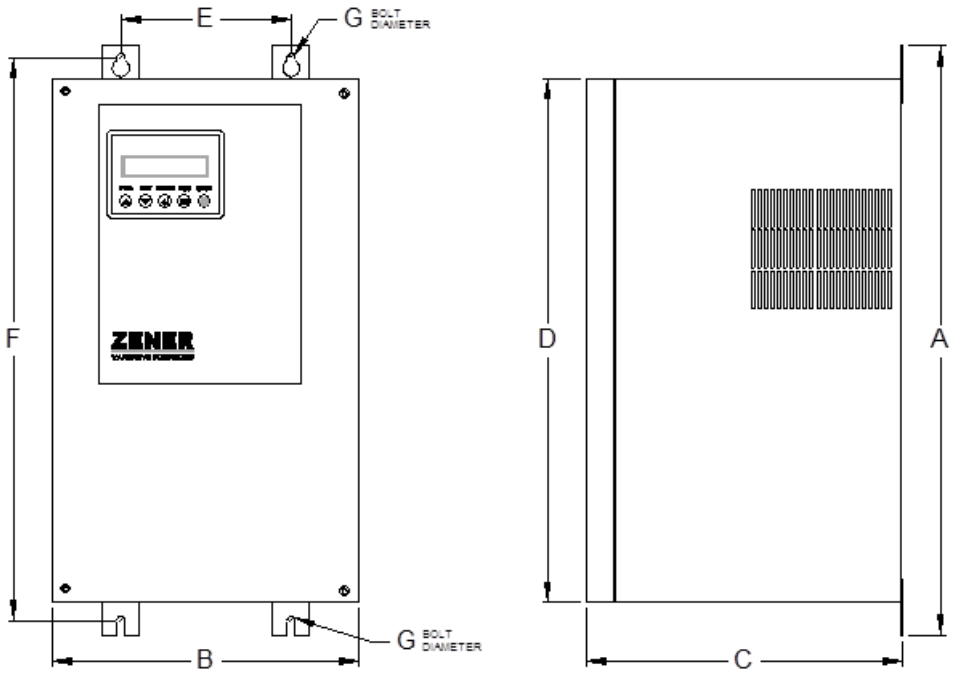


Chassis A IP30 (1 - 11 Amps)



Chassis A IP66 (1-16Amps)

CAUTION - Allow 50mm above, below and either side of the enclosure for ventilation

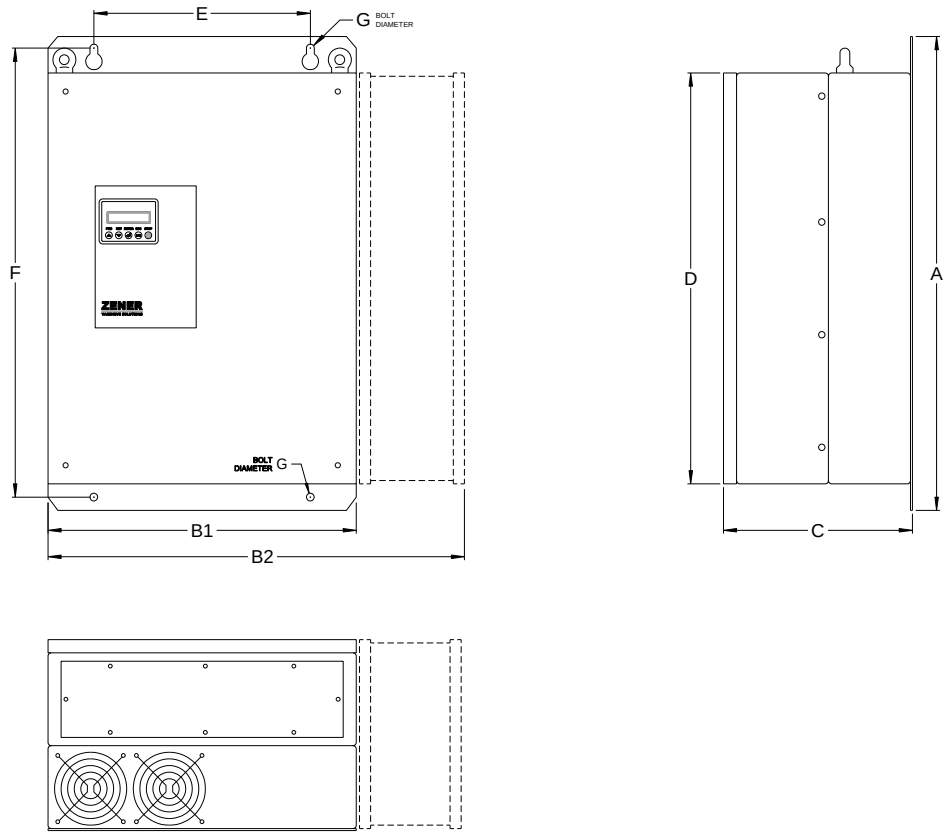


Chassis B (23 - 57 Amps)

CAUTION - Allow 75mm above, below and either side of the enclosure for ventilation

Models	Enclosure type	Dimensions in mm - tolerance +/- 1.0mm							Weight without choke kg	Weight with choke kg
		A	B	C	D	E	F	G		
8*00113 8*00313 8*00513 8*00713 8*01113	Chassis A IP30	248	102	237	208	32	230	6	3.5	
8*001..	Chassis A IP66	310	190	236	250	108	287	6	7.5	8.6
8*003..									7.5	8.6
8*005..									7.5	8.6
8*007..									7.5	8.6
8*011..									7.5	11.3
8*016..										11.5
8*023.. 8*030.. 8*040.. 8*057..	Chassis B All types	459	234	243	400	130	436	6	18	23
									18	23
									18	23
										24

* L or R to specify supply voltage

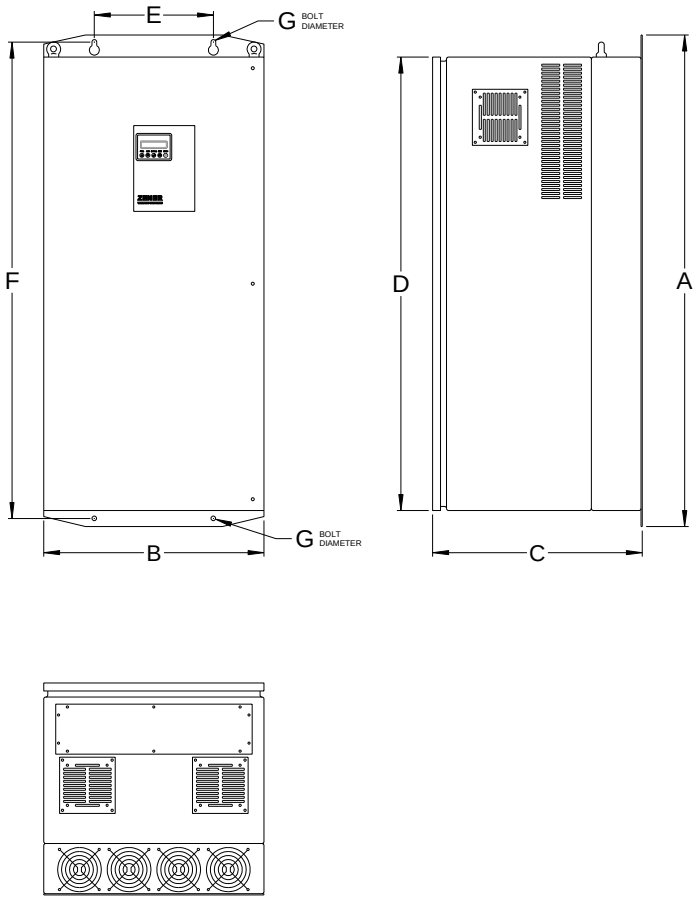


Chassis C (82 - 170Amps)

CAUTION - Allow 100mm above, below and either side of the enclosure for ventilation

Model	Enclosure type		Dimensions in mm - tolerance +/- 1.0mm							Weight
		A	B1	B2	C	D	E	F	G	kg
8*082..	Chassis C									64
8*109..	All types	715	470		290	625	330	677	12	66
8*140..										70
8*170D4	Chassis C IP54	715	470		290	625	330	677	12	72
8*170D6	Chassis C IP66	715		635	290	625	330	677	12	75

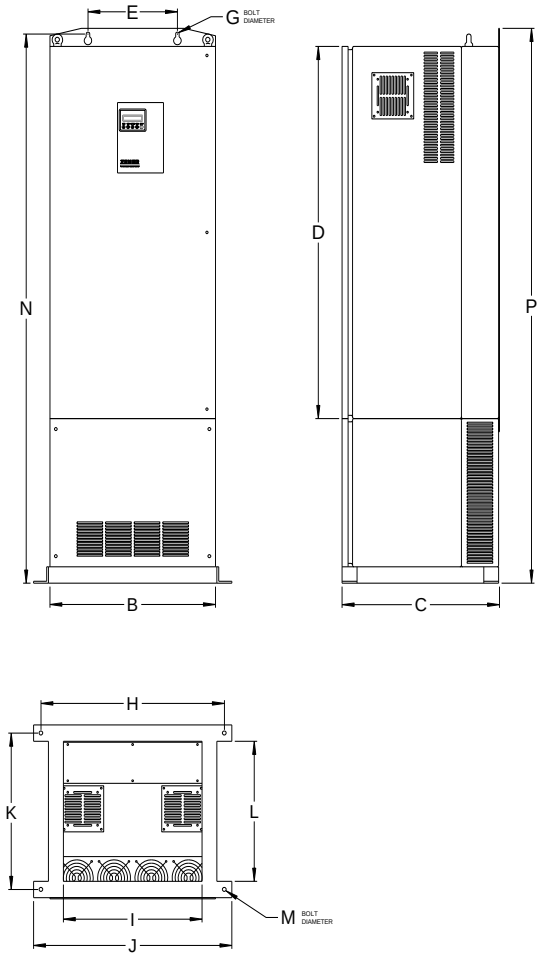
* L or R to specify voltage



Chassis D Wall mount (220 – 490 Amps)

CAUTION - Allow 150mm above, below and either side of the enclosure for ventilation

Model	Enclosure type	Dimensions in mm - tolerance +/- 1.0mm							Weight
		A	B	C	D	E	F	G	kg
8R220D4	Chassis D Wall mount (standard)	1225	555	525	1132	300	1185	12	220
8R315D4									240
8R390D4									280
8R490D4									300



Chassis D with optional Floor mount (220 – 490 Amps)

CAUTION - Allow 150mm above, below and either side of the enclosure for ventilation

Model	Enclosure type	Dimensions in mm - tolerance +/- 1.0mm									Weight
		E,G	H	I	J	K	L	M	N	P	kg
8R220D4	Chassis D	As per previous page	618	459	659	475	425	13	1663	1684	255
8R315D4	With optional floor stand										275
8R390D4											315
8R490D4											335

Transportation sizes and weights

The table below lists the approximate dimensions and weights for ZENER 8000 models in the standard packing material.

Model	Enclosure Type	Shipping Dimensions L x W x H (cm)	Weight without Choke	Weight with Choke	Packaging
8*00313 8*00513 8*00713 8*01113	Chassis A IP30 (No DC Choke)	31 x 28 x 18cm	4Kg		Carton
8*003.. 8*005.. 8*007.. 8*011..	Chassis A IP66	39 x 33 x 38cm	8Kg	10Kg	
8*016..				12kg	
8*023.. 8*030..	Chassis B All types	54 x 36 x 40cm	20Kg	25.6Kg	
8*040..				27.5Kg	
8*057..				28Kg	
8*082..	All types	76 x 54 x 44cm	48Kg	74Kg	Pallet
8*109..			50Kg	76Kg	
8*140..			62Kg	80Kg	
8*170..	IP54	76 x 54 x 44cm		82Kg	
8*170..	IP66	81 x 77 x 49cm		102Kg	Pallet box
8R220.. 8R315.. 8R390.. 8R490..	All Chassis D All types without floor stand	127 x 63 x 70cm		250Kg 270Kg 310Kg 330Kg	Pallet box

Glossary

~STOP	The logical inverse of STOP. This circuit must be closed for the ZENER 8000 to run.
2-wire control	Control of the stop / start function by a simple contact closure (eg a start / run switch contact).
3-wire control	Control of the stop / start function by momentary contacts, typically separate start and stop pushbuttons. This arrangement has the advantage of preventing an inadvertent re-start following a power outage.
COM	The common terminal to which all inputs on the ZENER 8000 are referenced.
AWG	American Wire Gauge
Console	The pushbuttons and LCD display on the front of the ZENER 8000
Constant Torque	A load characteristic in which the driving torque requirement is largely independent of speed. e.g. a horizontal conveyor
DC Bus Choke	An inductor connected in series with the DC bus inside the ZENER 8000. This provides several benefits including reducing the harmonic content of the AC line current.
EMC	Electromagnetic Compatibility. The arrangement of emission and immunity levels to achieve functional coexistence between various items of equipment in a given environment.
EN	The enable input on the ZENER 8000.
ESO	Essential Services Override. A mode of operation that disables certain protection features in order to allow the ZENER 8000 and/or the motor to run to destruction in certain circumstances, for example clearing smoke from a building.
HVAC	Heating, Ventilation and Air Conditioning [industry]
IEC	International Electrotechnical Commission, publisher of many standards related to electrical / electronics technology.
IN+, IN-	These are the designations of differential analog inputs on the ZENER 8000. The ZENER 8000 will respond to the difference between the two inputs, rather than the voltage between either input and AN COM.
JOG	A control input that causes motion only while it is active (ie non-latched) that is usually used to manually operate equipment for the purposes of setting up or alignment prior to continuous operation.
LATCH	A feature of a control input that requires only a momentary signal (e.g. contact closure) to provide sustained (latched) operation.
Local	Operation of the ZENER 8000 from the console pushbuttons on the enclosure.
PF	Power factor. The ratio of real (active or in-phase) current to the total current in an AC circuit.
PID	A type of automatic controller that seeks to drive a measured value (e.g. temperature, pressure etc) to a preset value by means of a control effort (e.g. motor speed) determined by proportional, integral, and derivative functions. PID, reverse acting A PID control system in which an increase in control effort (e.g. motor speed) results in a decrease in the measures variable (e.g. temperature). A common example is a cooling tower where an increase in fan speed causes a reduction in water temperature.
Ramp	A control function within the ZENER 8000 that controls the rate at which the motor speed can increase or decrease.

Remote	Operation of the ZENER 8000 via connections made to the control board terminal strip.
RMS	Technically, Root-Mean-Square. A method of measuring an AC voltage or current that gives the same numerical result as a DC voltage or current would on the basis of heating effect.
RMS line current	AC input current measured in a way that reflects the true heating value of the current.
SCN	The terminal on the ZENER 8000 for the connection of the screen of all cabled associated with analogue and digital control functions.
UL	Underwriters Laboratories Inc. An American organization involved in product safety standards and certification.
Variable Torque	A load characteristic in which the driving torque requirement is significantly influenced by speed. This term is most often used to describe the load characteristic of centrifugal fans and pumps.
VRef	A reference voltage (5.0V) available on the ZENER 8000 control terminal strip to assist in generating a speed reference voltage etc.

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