ZENER
VARIDRIVE SOLUTIONS

ECODRIVE® 8000

Solar Variable Speed Drive

Proudly 100% Australian Owned
Manufacturers & Distributors of Variable Speed Drives & Soft Starters

ECODRIVE
A ZENER VARIDRIVE SOLUTION

An Energy saving solution for Pumps

A simple solution

- Simple Selection
- Simple Installation
- Simple Setup
- Simple Operation

Call us today

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ECODRIVE

A ZENER VARIDRIVE SOLUTION

Harvesting free power from the sun is an ideal method to eliminate the high cost of pumping when using a generator or power from the grid.

Key Benefits & Features ..... Page 2

- Built-in MPPT Controller to optimise motor control to suit solar intensity
- Solar Operation with option for Auxiliary AC Supply
- Simple Setup & Operation
- Complete Control System
- Plain English Menu system
- Versatility for system integration
- Communication for remote monitoring
- Motor & Pump Protection

Simply connect direct to Solar Array ..... Page 4

Hybrid System: Solar + Aux. Power Source: ..... Page 5

The ECODRIVE can be a hybrid powered system, a system that can 'Blend' Solar Power with an Auxiliary AC supply. The ECODRIVE can automatically control the starting of a generator or the connection to an AC power source.

The AC power supply can be:

- 380-480VAC 3 Phase Grid Supply
- 380-480VAC 3 Phase from a generator supply
- 480VAC Single Phase (SWER Supply)
- 208-240VAC Single Phase (for 220-240V 3 Phase motors)

Standard Operating Configurations ..... Page 6

The ECODRIVE offers standard configurations to keep setup quick & simple. The ECODRIVE is extremely versatile and can easily adapt or integrate into more complex control systems. Standard applications include:

- **Tank Fill:** Configuration using one level switch to always keep the tank full.
- **Pressure Control:** Uses its built-in PID controller to maintain a constant pressure.

Operate standard 3 Phase motors ..... Page 7

The ECODRIVE operates a standard 3 Phase AC motor. Output Filters are available to meet pump manufacturer requirements.

Technical Specification..... Page 8

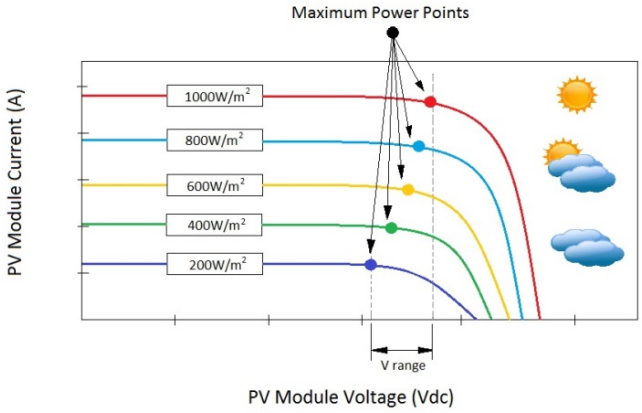
Technical Specification & options available.

ZENER ECODRIVE® 8000

SOLAR VARIABLE SPEED DRIVE

Harvesting free power from the sun is an ideal method to eliminate the high cost of pumping when using a generator or power from the grid. With a correctly optimised system you can use the power from the sun to fill a storage tank or irrigate with constant pressure for up to 8 hours a day. A water storage tank becomes an economical alternative to storing power in batteries, where gravity is the energy source used at night.

The Zener ECODRIVE® solution is a Solar Variable Speed Drive with a built-in Maximum Power Point Tracking (MPPT) controller to achieve the maximum power from the Solar Array under all conditions. The ECODRIVE® also includes Zener's sophisticated motor control algorithm designed to achieve maximum motor energy efficiency.



The ECODRIVE® is versatile, offering enormous flexibility for system integrators or OEMs with its internal logic functions, programmable I/O and ability to communicate with other equipment.

The ECODRIVE® is a complete package operating standalone from Solar Power or as a hybrid system using an auxiliary supply.

Benefits:

- Save on Energy Costs
- Reduce Maintenance Costs
- Help the Environment
- A Complete Package to minimise external or additional controls
- Flexible & scalable system with dual supply option
- Confidence in dealing with a reputable Australian company with local engineering support & service

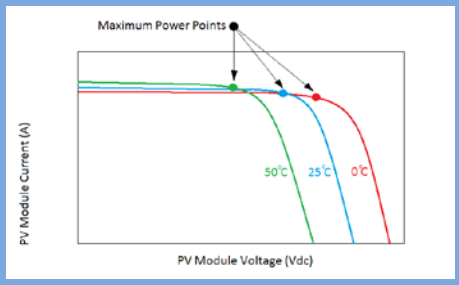
Maximum Power Point Tracker (MPPT)

The purpose of an MPPT is to extract the maximum amount of power the solar array is capable of producing with the available irradiance level. The MPPT will ensure the motor operates at the maximum power possible.

The ECODRIVE® includes a unique MPPT tracker engineered by Zener to operate at true maximum 'Power Point' by direct integral control of motor power and PV array voltage resulting in maximum efficiency from the solar array.

With the ability to measure extremely small power changes the ECODRIVE ensures the system can achieve continuous operation within 0.2% of the true 'Maximum Power Point' irrespective of system loading or temperature. This ensures that maximum power is available and maximum operating times are achieved with the varying irradiance levels throughout the day.

The Power & Voltage from a solar array is dynamic and its performance changes significantly with temperature.



The ECODRIVE® is also dynamic and automatically detects and responds to these changes. The ECODRIVE quickly responds to any irradiance changes without interruption to motor control. Typically, the dynamic response times to irradiance changes are less than 200mS.

ZENER ECODRIVE® 8000

OUTSTANDING FEATURES

- **A robust IP66 enclosure (also available in Stainless Steel)**
- **A Complete System**
- **Allows for 'Blending' of Solar Power with an Auxiliary AC Supply**
- **50°C temperature rating available**
- **Built-in MPPT, Maximum power point tracking to ensure you get the most output power and pumping capacity possible**
- **Automatic Operation without additional controls or PLC**
- **Constant flow or variable flow/pressure control**
- **Substantially reduce inrush currents & energy requirements**
- **Soft start & soft stop to eliminate water hammer**
- **Comprehensive & customised pump system protection**
- **Application Menus for simple setup**
- **Remote monitoring capability**

A Complete System

The ECODRIVE® is a complete package, a Variable Speed Drive with a built-in 'Maximum Power Point' Tracking controller that provides complete control of the motor to achieve maximum benefit from the Solar Power available.

The ECODRIVE® has been engineered to function as a standalone Solar pump controller (Solar Only). No irradiance sensor is required when operating on solar only. With some simple PV data entered, the ECODRIVE® knows when there is sufficient solar power available to operate.

Alternatively, the ECODRIVE® can operate with the assurance of an Auxiliary AC power supply to continue pumping when there is insufficient solar power available. This can be configured to be a 'seem-less' transition from Solar to AC. When an auxiliary AC power supply is connected the Solar Array remains connected providing a 'Blended' or 'Hybrid' system. This means that solar power continues to provide benefit to your solar investment.

The ECODRIVE® can achieve this functionality with minimal additional controls. An irradiance sensor is only required with an auxiliary AC Supply to monitor the Solar Power available and to control when an auxiliary supply is connected.

Robust IP66 enclosure

A robust powder coated steel enclosure to provide protection against mechanical damage. The electronics are totally enclosed in an IP66 chamber for protection against the ingress of dust & water. The heatsink is located in a separate chamber to provide maximum heat dissipation. There are no filters so there is no regular maintenance required. Also available in Stainless Steel.

Simple Menu & Setup

The ECODRIVE® has been designed to simplify installation and setup. A set of application menus are available for common configurations to minimise the setup time and the need for specialist support. Zener understands that these will be generally installed in remote locations with limited access to support and ease of setup is critical. The versatility of the ECODRIVE allows many variations to how it can operate.

Reduced starting current

The problem with starting motors on Solar Power is the current required to start a motor. Motor starting current can be 600 to 800% of the Motor Full Load Current. The ECODRIVE® solves this problem by reducing the motor starting current to levels below 100%-110%. The ECODRIVE® can provide full torque up to full speed.

Power Source Options:

The ECODRIVE® can be configured to operate from multiple power sources.

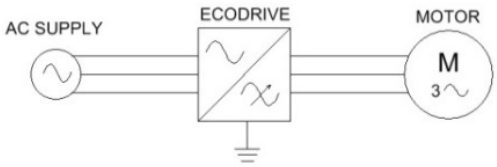
- Standalone AC Operation (as a standard Variable Speed Drive)
- Standalone Solar Operation (DC Power Source)
- Optional Auxiliary AC Power Supply
  (208-240V or 380 – 480VAC, single phase or 3 phase AC supply)
- Compatible with 480VAC SWER line supply
- Suitable for operation on generator supplies

Standard AC Operation

The ECODRIVE® can be configured to operate as a standard VSD for any type of application or load using any standard 3 phase motor.

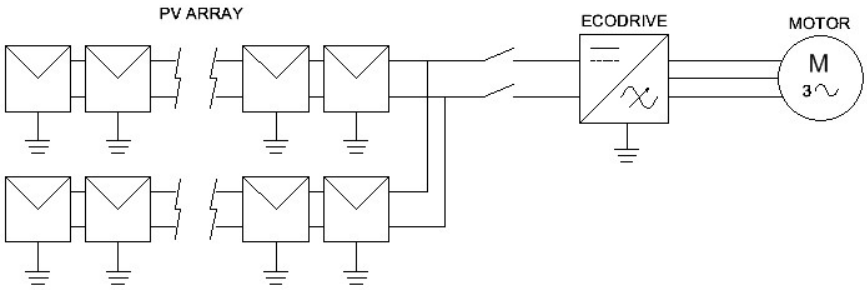
The AC supply may be:

- Grid Supply: 380-480VAC 3Phase or 480V Single Wire Earth Return (SWER).
- Grid Supply: 208-240VAC 3Phase, including 240V Single Phase supply.
- Generator Supply



Standalone Solar Operation

The ECODRIVE® is designed to operate standalone from a DC power supply sourced from a 'Solar Array'. The ECODRIVE® will automatically control the pump to achieve maximum pump running time and power available from the solar array. The ECODRIVE® can be configured to operate the pump only when sufficient solar power is available with programmable protection to prevent damage from operating at low speeds. No irradiance sensor is required for standalone solar operation, keeping the installation & setup simple.



Blocking Diode:
Blocking Diodes are also recommended for multi-string arrays when operating 'Solar only'. See page for 5 more detail.

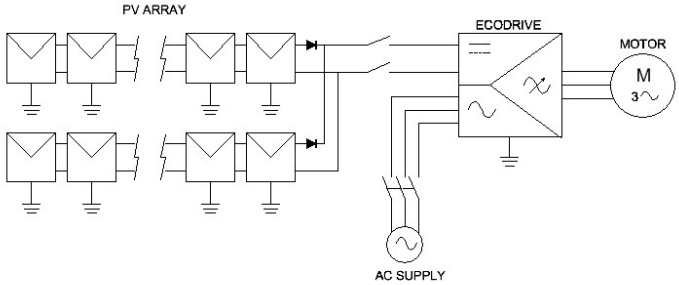
A Hybrid System:

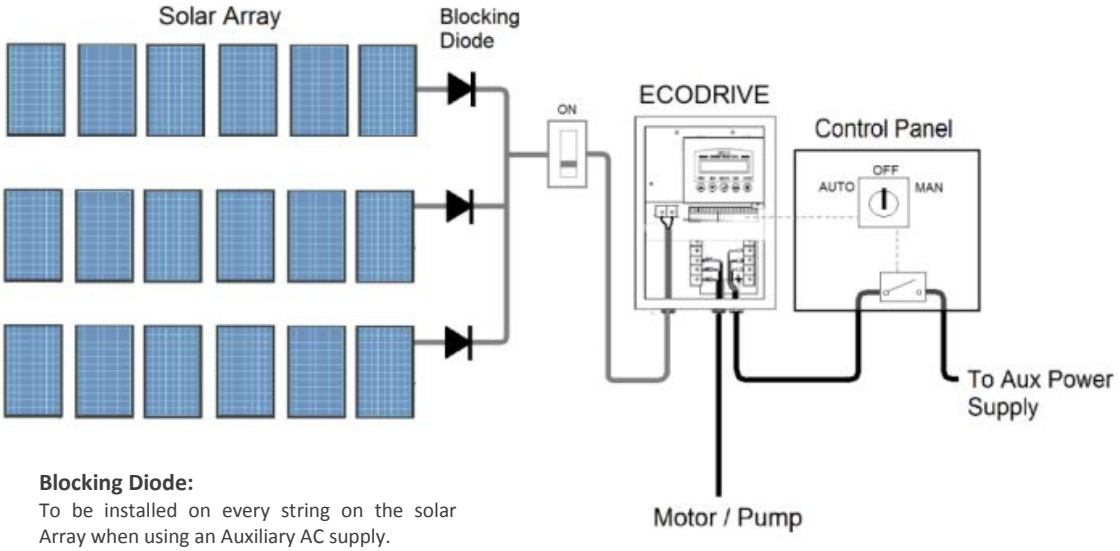
'Blending' Solar Power with an Auxiliary AC Power Supply

The ECODRIVE® is designed to also operate with an auxiliary AC power supply during periods of low solar power. The ECODRIVE® will automatically control the pump to achieve maximum pump running time and power available from the solar array. However, if there is insufficient solar power available the ECODRIVE® will automatically connect an AC supply. When sufficient solar power becomes available the ECODRIVE® will automatically switch back to solar operation.

With the use of ZENER's blocking diodes, the DC supply from the Solar Array is always connected. When the Auxiliary AC supply is switched this allows Solar Array to 'Blend' with the AC Power to provide maximum benefit from your solar investment.

Integral timers, relays, comparators and a range of inputs/outputs allows the ECODRIVE® to provide many and varied choices for controlling external devices.





Blocking Diode:
To be installed on every string on the solar Array when using an Auxiliary AC supply.

Blocking Diodes are also recommended for multi-string arrays when operating 'Solar only'.

Automatic connection to Auxiliary AC Supply

The ECODRIVE® monitors the solar power available and with its 'Maximum Power Point Tracking' provides an output when the solar power reaches a level of 'LO SOLAR' or a predetermined level using in-built comparators. Time delays and other logic may be applied to provide the desired AC control.

The AC contactor control circuit must be supplied by the Auxiliary AC supply to ensure isolation when AC power is not available or switched off.

Generator Operation & Control

When operating from a Generator there are additional controls to consider.

A '24VDC control supply option' is available to maintain power to the ECODRIVE from a separate 24VDC supply. This could be from a battery supply and have its own solar charging circuit. This may also be required to start the generator.

The ECODRIVE® has internal functions, timers and relays which can be used to prestart the generator and connect the AC supply.

The DC Bus Choke option is mandatory when operating on a Generator Supply.

Control Options:

The ECODRIVE® is a fully integrated system which can operate directly from a solar array. The integral Solar DC tracking ensures optimum pump control is achieved with the available solar power. There are standard 'application menus' to make setup quick & simple or programmed to suit individual requirements.

- Standard VSD Operation
- Standard Application: Tank Fill
- Standard Application: Pressure Control
- Flexible & customised solution(s)

A custom 'application menu' can be developed for your unique application. Contact Zener to discuss the possibilities.

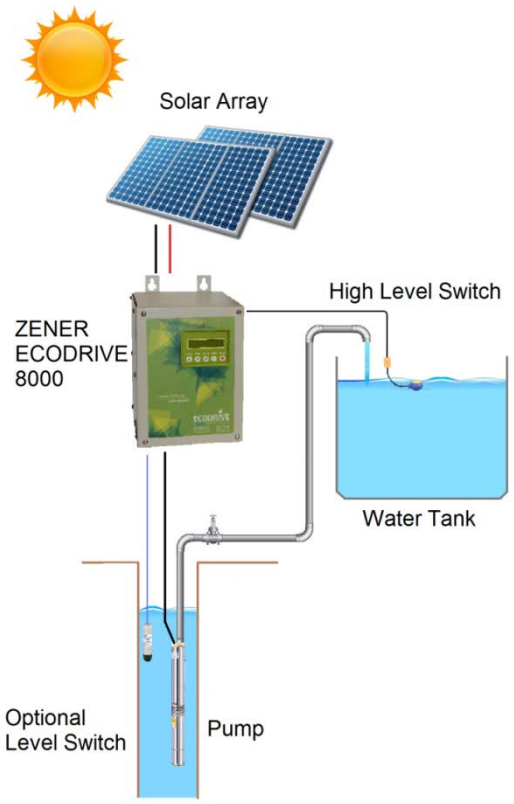
The ECODRIVE® is also extremely versatile with the flexibility to modify how it operates.

Standard Application 1: Tank Fill

The ECODRIVE® can be configured to pump and fill a tank or vessel when there is sufficient solar energy available. An AC supply can also be used to pump when insufficient solar power is available.

A single level switch located in the tank provides feedback to the ECODRIVE®. When the water level falls below the set level and there is sufficient solar power available, the ECODRIVE® will automatically start the pump. The ECODRIVE® will operate the pump at the desired speed or a speed dependant on the available solar power. When the water level increases above the level of the float switch, the ECODRIVE® will continue to operate the pump for a preset time before switching the pump off. The level switch is installed below the high water level with an allowance for pumping for the duration of the qualifying time. This approach means the tank is always full and not waiting for a low level switch to turn on the pump when there may be no solar power available. Two level switches may be used if preferred.

Instead of using a level switch it is possible to use pressure to provide level control. This could be using an external pressure switch or pressure transducer. This could eliminate the need to run a wire to the tank.



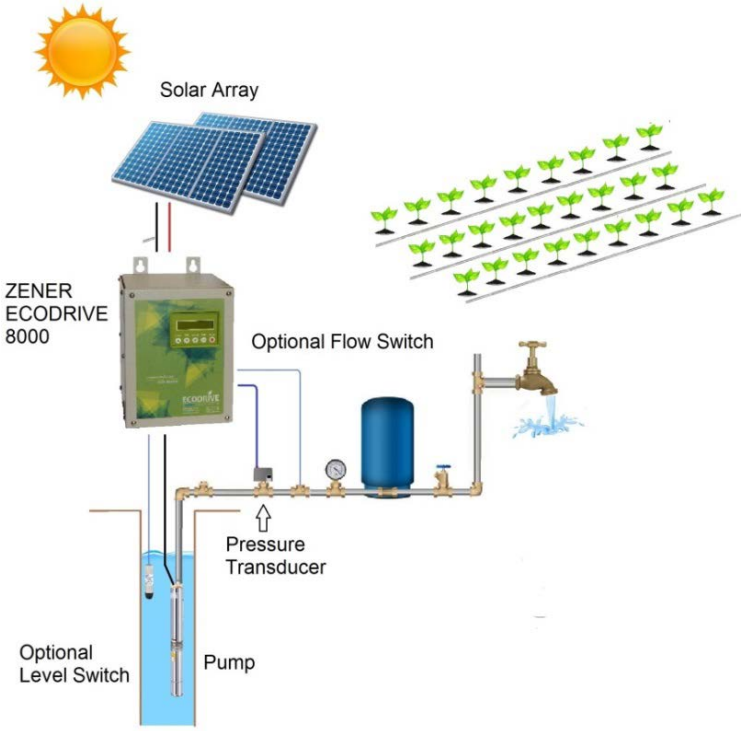
Control Options:

Standard Application 2: Pressure Control

The ECODRIVE® can be configured to provide a constant pressure using an integral PID controller. The ECODRIVE monitors the pressure and adjusts the motor/pump speed to achieve the set pressure.

The ECODRIVE® will operate the pump at the speed required to achieve constant pressure whilst there is sufficient solar power available. If the solar power is not sufficient to maintain this pressure, the system can be configured to operate at a lower pressure, switch off or switch to an auxiliary AC power supply. When there is sufficient solar energy the ECODRIVE® will re-power and automatically restart the pump.

The ECODRIVE® with an option board fitted provides a 24VDC DC loop power supply for a pressure transducer. Also available is additional protection for bore level, no flow or external over pressure.



Operate Standard Motors & Pumps

The ECODRIVE® can be used on any standard 3 Phase induction motor or motor pump combination such as a bore pump or submersible pump.

Although Pumps may be the most common type of load for solar operation, the ECODRIVE® can be used on any type of application: such as a fan, conveyor, auger or other types of loads.

Special Output Filters:

Some manufacturers of bore pumps have certain requirements for their pumps and would require a special output filter.

Zener can provide a filter that ensures compliance with their requirements and also eliminate the need for screened motor cables. Zener can also provide assistance with providing a solution to reducing harmonics or RF interference.

See page 9 for more details.

ECODRIVE® Specification:

The following applies to the 480V model only (suitable for 3 phase 380/415V motors)

Maximum input DC Voltage:	800VDC
Auxiliary AC voltage:	380 - 480Vac 3 Phase or 1 phase [1] (-15%, +10%)
Nominal MPP Voltage:	407-727VDC
Minimum MPP Voltage:	586V for 415V output @ 50Hz
Output Voltage:	0-480VAC 3 Phase [2]
Output Frequency:	0-200Hz (maximum speed subject to DC bus voltage & solar energy available)
V/Hz:	Adjustable

Other voltages are available, contact Zener for more information.

Digital Inputs:	8x Programmable Digital Inputs
Digital Outputs:	2x Programmable Relay Outputs
	1x Programmable Digital Output
Analogue Inputs:	2x Programmable Analogue Inputs
Analogue Outputs:	2x Programmable Analogue Outputs
Thermistor Input:	1x selectable input with short circuit detection
Internal Logic:	Programmable Alarms & Warnings
	Timers with logic input
	Programmable relays with logic and timer function
	Programmable logic function block(s)
	Analogue input comparators
	Programmable comparators

1) The above are standard inclusions which may be expanded with additional option boards available.
2) For more detailed product specification refer to the ZENER8000 manual or ECODRIVE manual supplement.

ECODRIVE® Input / Output Current

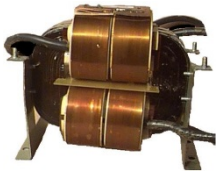
Model	Max. Continuous Output Current (Amps/3Phase)		Motor Nameplate Power (estimated kW)[3]	Input DC RMS current at rated ECODRIVE Output		Optional Aux Power Supply (415V / 3P) Max. RMS input current
	40°C	50°C	40°C / 50°C	Continuous	Intermittent	
8E001XX	2.0	2.0	0.75 / 0.75	2.5	5.8	2.5
8E003XX	3.6	3.0	1.5 / 1.1	4.4	5.8	4.1
8E005XX	5.0	4.1	2.2 / 1.5	6.1	7.7	6.9
8E007XX	7.2	6.0	3.0 / 1.1	8.8	11.1	9.6
8E011XX	10.8	9.0	5.5 / 4.0	13.2	16.7	15.1
8E015XX	14.9	12.4	7.5 / 5.5	18.1	23.1	22.5
8E023XX	22.5	18.8	11.0 / 7.5	27.4	34.8	33.0
8E030XX	30.1	25.0	15.0 / 11.0	36.6	46.7	43.1
8E040XX	40.3	33.8	22.0 / 15.0	49.0	62.1	55.0
8E055XX	55.0	46.0	30.0 / 22.0	66.9	84.9	78.0
8E082XX	82.0	69.1	45.0 / 37.0	99.7	126	108.0
8E109XX	109.0	91.3	55.0 / 45.0	133	168	148.0
8E140XX	140.0	118.9	75.0 / 55.0	171	213	179.0
8E170XX	170.0	141.3	90.0 / 75.0	207	242	187.0

For sizes **220A to 490A** contact Zener for more information and to provide a customised solution

[1] For single phase operation a DC bus choke must be fitted and a derating applied. Contact Zener for assistance.
[2] The output voltage cannot be higher than the AC input voltage or 70% of the DC input.
[3] Always select the ECODRIVE on motor full load current not power.

DC Bus Choke

A DC bus choke is optional but recommended for all applications using an Auxiliary AC power Supply. A DC Bus Choke is mandatory for all single phase and generator supplies. The DC bus choke is fitted within the ECODRIVE's IP30 or IP66 enclosure.



ECODRIVE® Option Boards

- **Extended Features (standard Inclusion)**

Every ECODRIVE comes standard with one 'Extended Features' option card fitted.

This option provides:
2nd Analogue Input
Additional Digital Programmable Output
Thermistor Input
Additional (4) Digital Programmable Inputs
24VDC loop supply (for transducer – Max 20mA)

- **Ethernet MODBUS TCP/IP Communications**

The ECODRIVE comes standard with MODBUS RS485. An option board is available to provide an Ethernet MODBUS TCP/IP connectivity.

- **24VDC Control Supply Option**

Provides the ability to connect 24VDC to the ECODRIVE. This allows the ECODRIVE to maintain functionality and access to the menu, without high voltage from the Solar Array or an AC supply.

- **Additional Relay Output**

Provides an additional two (2) programmable relays. Each relay has a change-over contact.

- **Thermistor Only**

extended features option board provided with ECODRIVE as a standard inclusion offers a thermistor input.

ECODRIVE® Output Filters

Filters are selected to match the ECODRIVE model and its rated ambient operating temperature. These filters may be required to satisfy the requirements of some submersible or bore pump manufacturers. They can also eliminate the need for screened motor cables.

ECODRIVE Model	High Performance Output Filter IP00 Note 1. Part No.	High Performance Output Filter IP66 Enclosed Note 2. Part No.
8E001XX	AHP0010	AHP0016
8E003XX	AHP0030	AHP0036
8E005XX	AHP0050	AHP0056
8E007XX	AHP0070	AHP0076
8E011XX	AHP0110	AHP0116
8E015XX	AHP0150	AHP0156
8E023XX	AHP0230	AHP0236
8E030XX	AHP0300	AHP0306
8E040XX	AHP0400	AHP0406
8E055XX	AHP0550	AHP0556
8E082XX	AHP0820	AHP0826
8E109XX	AHP1090	AHP1096
8E140XX	AHP1400	AHP1406
8E170XX	AHP1700	AHP1706

IP00 Output Filter

IP66 Output Filter

Note 1. IP66 Filter: A DC bus terminal kit must be fitted to the ECODRIVE. This allows the Filter to connect to the DC bus (positive & negative).

Note 2. IP00 Filter: An optional 'fused' DC bus terminal kit is available for chassis C only (55A an above). Only one connection to the DC bus is required.

Note 3.: Contact Zener to ensure correct selection of output filter.

Blocking Diode Module

A blocking diode module is required to be fitted on each 'PV string' whenever an Auxiliary AC Power Supply is used. With standalone solar installations, blocking diodes are optional but recommended with multi-string installations to ensure maximum efficiency where partial shading of the PV modules may occur.

Maximum Intermittent Current:	25Amps
Maximum Panel/String Isc:	10Amps
Voltage Rating:	1600VDC

Irradiance Sensor

Irradiance sensor is required to provide feedback on the available solar power when an Auxiliary AC Power Supply is used. An Irradiance sensor is optional for Solar only installations but may provide more accurate control. The irradiance sensor must be installed in the same plane as solar panels. The irradiance sensor provides a 0-5VDC signal to the ECODRIVE®.

Auxiliary AC Supply Control Panel

A control panel that interfaces the ECODRIVE® with an Auxiliary AC Power Supply. The Panel provides an Auto / off / Test control switch, indication of AC status and an isolation contactor that connects the AC power when the solar power available is 'low'. AC & PV Circuit Protection not included.

In the 'AUTO' position the ECODRIVE® operates from the solar array when there is sufficient solar power available. In the 'TEST' position the ECODRIVE operates on solar only.

Standard panels are available up to 40Amps. Contact Zener for larger sizes or for customised control panels.

Transducers

Zener can offer a range of transducers that connect directly to the ECODRIVE® to provide pressure control or pressure switching capability.

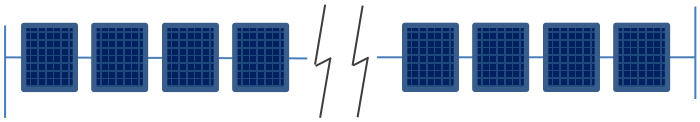
Other transducers, switches or process devices are available on request.

Lightning / Surge protection

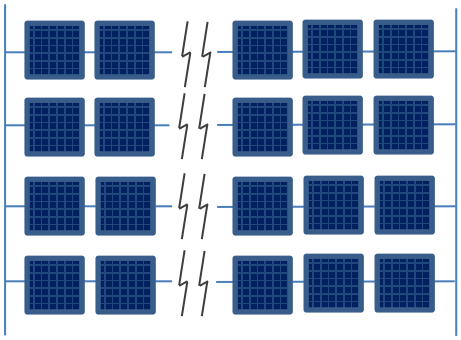
Lightning or surge protection may be required at the Solar Array and the ECODRIVE depending on the installation.

PV Array Selection:

The key factors to consider when selecting your PV array are:

- The correct number of PV Modules are connected in series (referred to as a 'String') to achieve the required DC voltage and within the rating of the ECODRIVE®.
- 

- Correct number of 'Strings' in parallel to achieve the required Current &/or Power for a minimum irradiance level. This will impact how many hours a day you can pump or the irradiance level required to actually pump. The actual location and the pumping requirements for summer and winter periods must be considered to allow for different irradiance levels achievable.



- The motor & pump size may also need to be considered when selecting the best PV array configuration.

Contact Zener for assistance and/or seek the assistance from a qualified Solar System Designer or Engineer with experience in solar pumping.

OR

Complete our on-line form for guidance on the number of panels required:

<ECODRIVE ENQUIRY FORM>

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