

Variable Speed Drives

& Single Wire Earth Return (SWER) Supplies



www.zener.com.au

Note: This article is intended as a guide only. It is the responsibility of the installer to define and accommodate all environmental & site factors influencing the drive selection & ensure compliance with all local rules & regulations.

Reference: IM10103 Rev A

Dated: November 2008

Section 1.0 - Introduction

This document is intended to be a guide for the installation of ZENER Variable Speed Drives on a SWER Line type supply system. The standard ZENER Variable Speed Drive is designed to operate from both a single phase & three phase supply making it ideal for SWER Line or single phase supply systems. The standard ZENER drive can operate from a 480VAC single phase supply and provide a controlled 415V 3 phase output to the motor.

A Variable Speed Drive (VSD) provides many benefits including:

- Soft starting of the motor & load reducing mechanical stresses & reduced water hammer with pumps.
- Significantly reduce the starting current, from 600-800% down to <110-150% of the motors rated FLC.
- Automation & process control using the built-in electronics to provide constant pressure / flow systems for irrigation or other pumping applications.
- Ability to control the speed of the motor.
- Energy Savings: Substantial energy savings may be achievable for Fan & Pump loads.

Operating a VSD on a SWER line supply is simple but does require some special consideration. This technical notes discusses some of these issues and explains how simple it is to install and setup a ZENER drive on a SWER line supply.

Section 2.0 – SWER Line Installations

2.1 What is a SWER Line

One method of providing power in rural areas is the Single Wire Earth Return (SWER) System. Rural areas are a special case due to the smaller loading and being widely dispersed. As the name implies, this method uses a single transmission line generally of 19kV (voltage to earth) and uses the earth as the return. Because of the high voltages, both the line currents and the earth return currents are small. Transformers are then provided at the point of distribution to reduce the supply to 240V and 480V. This generally consists of two 240V secondaries of the transformer connected in series to provide 240V & 480V (or parallel for 240V only).

The Diagram below illustrates how a SWER supply is connected.

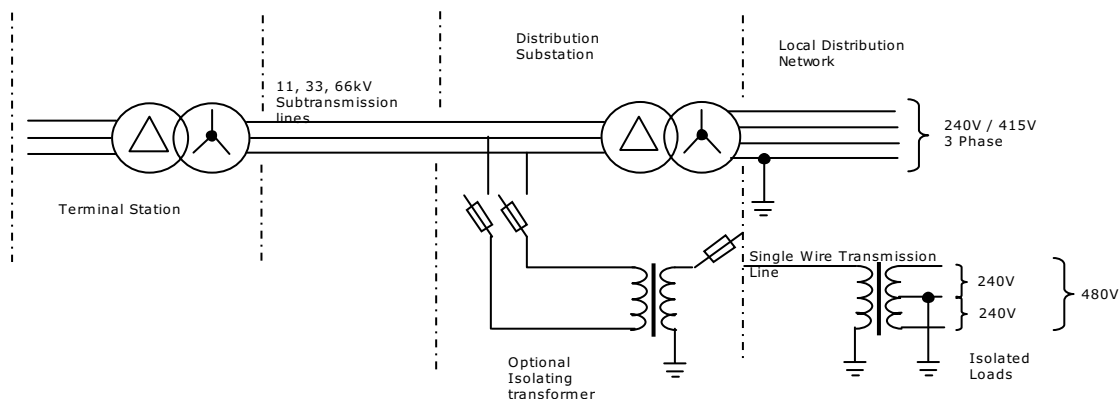


Diagram 1. Single Wire Earth Return (SWER) System

2.2 Issues when using VSD's on SWER Line Systems

The operation of a ZENER drive on a SWER Line Supply is simple, but you do need be aware of some of the issues and how they may be addressed.

1. EMC Compliance:

All Zener VSD's satisfy the requirements of the Australian standard AS61000.3 and carry the Australian C-tick label. To achieve these standards it is necessary to install the equipment as per the manufacturers instructions. This may require screened motor cables from the VSD to the motor. Additional measures may be required for installations which may be sensitive to RFI. Additional measures & alternatives to screened motor cables are available such as ZENER's High Performance Output Filter.

Section 2.0 – SWER Line Installations

2. Harmonics

All VSD's produce some form of harmonics on the supply, which is significantly increased when operating on a single phase supply and particularly so, on SWER or rural environments where the loading on smaller supplies may be relatively high. A DC bus choke is mandatory for VSD's when operating on a single phase supply. The sizing of the transformer and the VSD/motor loading on the supply needs to be taken into consideration when concerned about harmonics. The effect of excessive harmonics may cause overheating of electrical components such as transformers and cables.

3. Temperature rating

Because SWER line systems only occur in rural areas, where higher ambient temperatures may be experienced, the ambient temperature must be considered. Zener offer a Drive with a continuous rating of 50degC ambient. An IP66 enclosed Drive is also available so the equipment can be direct wall mounting without further enclosing. This promotes better cooling and lower internal operating temperatures.

4. DC Bus Choke

A DC Bus choke is mandatory for operation on a single phase supply. There are numerous benefits provided by a DC bus choke which include:

- Reduction of Power Line Harmonics
- Improved Power Factor
- Transient Filter
- Reduce peak inrush currents

5. Supply Current Capacity

Since the ZENER VSD acts as an inverter and produces a 3 Phase supply from a 2 Phase supply, the current is expected to be higher on the input than the output. It is therefore important to determine what level of supply current is required for the intended motor. As a guide the RMS AC line current to be allowed for, is 1.84 times the motor phase current.

6. Drive Rating

When a drive is operating from a single phase SWER supply, the standard drive must be rated accordingly. Other considerations when selecting the most suitable drive is the ambient temperature and the type of load. Your nearest ZENER Distributor can assist with selecting the correct Drive for your applicaton.

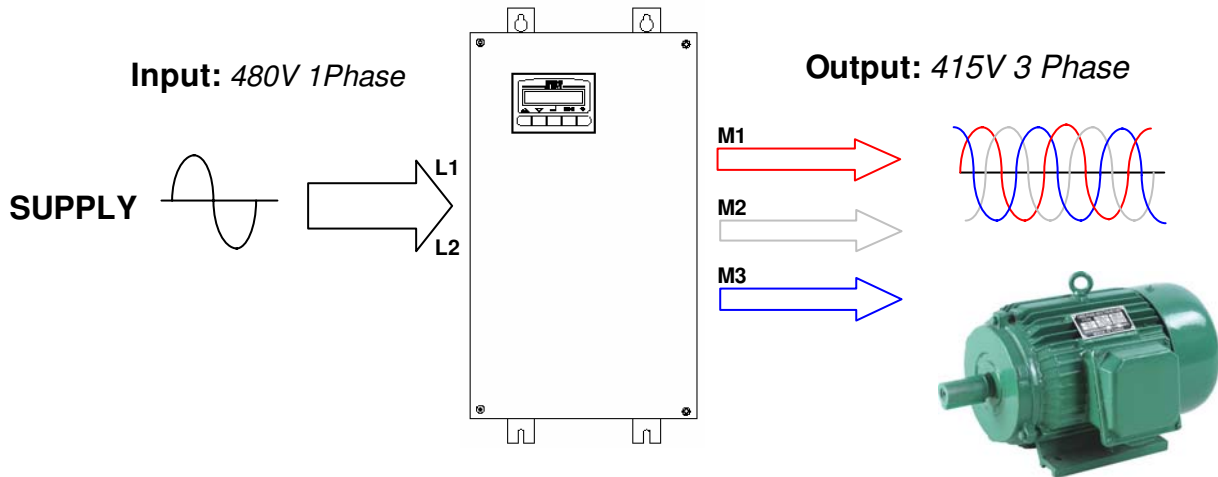
7. Motor Suitability

The motor should be suitable for operation on a Variable Speed Drive and comply with the Australian standard AS60034 Part 17.

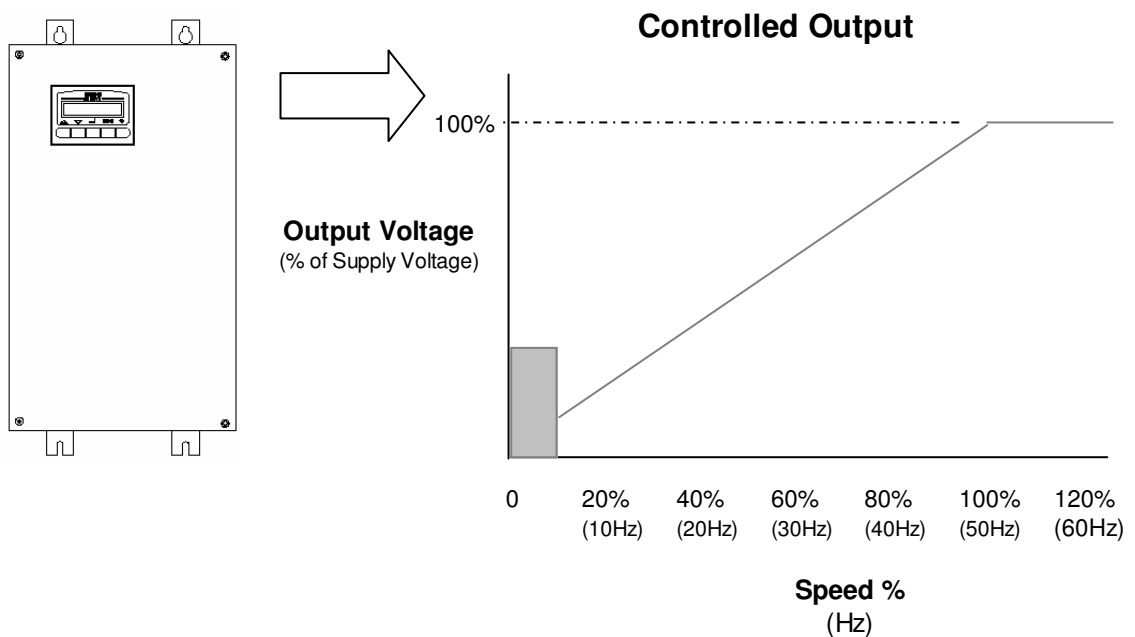
Section 4 – Other Considerations

3.1 The ZENER Variable Speed Drive

The Variable Speed Drive operates from the 480V single phase supply connected to L1 and L2. The ZENER VSD takes the single phase AC Supply and converts it to a 3 Phase output suitable for a standard 3 phase 415V motor.



The ZENER Drive actually does more than just convert from a single to 3 phase supply. The VSD controls the output waveform to allow the speed to be controlled by changing the frequency to the motor from 0-200Hz. The normal supply frequency is 50Hz, so the drive actually allows you to over speed the motor if desired. With full control of the motor speed, you have direct control of the load, enabling manual or automatic control of a process, such as water pressure or flow. The ZENER drive also has total control over the rate which a motor accelerates and decelerates, providing a smooth controlled soft start and soft stop.



Section 4 – Other Considerations

3.2 The MSC-3 Series

The ZENER MSC-3 is designed in Australia for the Australian climate, offering a robust IP66 enclosure and a 50°C rating.

- Allows direct mounting close to the motor (protection from sunlight required)
- Protection against the ingress of dust & moisture
- More efficient cooling and reduces internal operating temperatures
- Increased life expectancy of electronic components
- No air filters to clean, eliminating nuisance over temperature trips from poor ventilation.
- Robust metal enclosure

Other enclosure types are also available including; IP30 & Stainless Steel IP66.

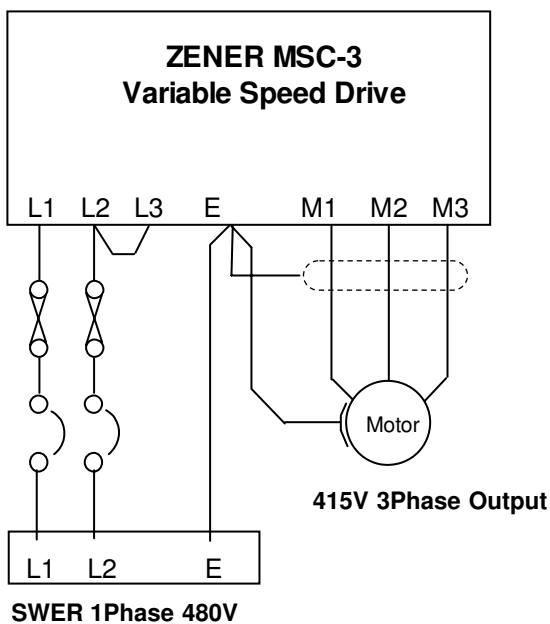
The ZENER MSC-3 has the technology built-in to provide automated control systems and to interface with external control systems.

Including:

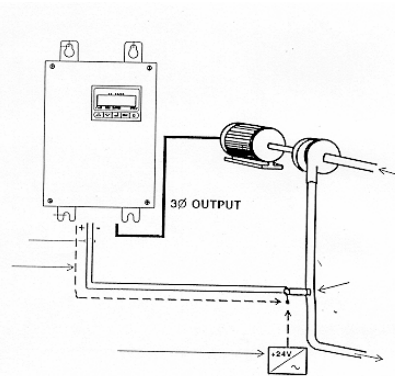
- Digital & Analogue I/O for remote controls and interfacing with control systems.
- PID control for automated process controls such as constant pressure system.
- 'Hibernation' mode to automatically switch the output on and off with demand.

3.3 Installation

The installation of a ZENER VSD is simple as shown.



Speed control can be manually using the controls provided or remote speed potentiometer. A Pressure control system can be easily achieved using the drives internal PID control and an external pressure transducer.



Refer to the instruction manual for comprehensive details on installation, in particular using screened motor cables.

Section 4 – Other Considerations

4.0 Drive Selection & Supply Requirements

For assistance in the selection of a suitable Variable Speed Drive please contact your nearest authorized ZENER Distributor.

Factors that need to be considered are:

1. Motor Nameplate Full Load Current (FLC) and voltage.
2. Type of load.
3. The environment:
 - 3.1 Enclosure IP rating.
 - 3.2 Ambient Temperature.
 - 3.3 Protection from Sunlight & other heat sources.
4. Actual Supply Voltage.
5. Appropriate de-rating for Single Phase operation.
6. Adequate Supply Capacity Available.
7. VSD Options required.
8. Special requirements from motor or pump manufacturer.

For more information on this topic or Zener products please contact your nearest authorized Zener Distributor. To locate your nearest Zener distributor or for more information on Zener products refer to our website: www.zener.com.au