7SG164 Ohmega 400 Series

Distance Protection Relays

Document Release History

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Pre release

2010/02	Document reformat due to rebrand
2012/01	Format only, header was missing

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1 Voltage Protection

Under / over-voltage elements :

Four independent elements are supplied, two of which can be set to operate for under-voltage and the other two are set as over-voltage elements each having separate DTL time delay elements. These can be used to protect generators against over-voltages, motors against loss of supply or applied as backup protection in the event of defective system regulating equipment.

Blocking operation :

The voltage elements can be blocked by the Voltage Blocking Threshold, which has a variable setting range.

2 Analogue Inputs

The input stage measures all three voltage quantities over the range of 5 Vrms to 90 Vrms it maintains accuracy within ±1% (or 0.25V) over the declared frequency performance range. The measuring range of the input stage allows for phase-neutral connections e.g. 63.5Vrms nominal voltages.

Measuring Principles

The input phase voltages to the relay are passed through voltage transformers, which step down the phase voltages to levels which are suitable for the electronic input stage of the relay. The transformers also provide essential isolation between the power system and the relay.

The main signal processing algorithm in the relay is a discrete Fourier transform (DFT) which is performed on each phase input. The DFT extracts the power system fundamental frequency component from the input voltages, effectively filtering out noise, D.C. and harmonics. The DFT is tuned for either 50Hz. Output from the DFT calculations are real and imaginary components for each voltage input.

The real and imaginary components are used to derive the magnitude quantity, which is then scaled to give a RMS value. Part of the DFT calculation includes extra filtering which smoothes the real and imaginary components, giving reduced ripple on the RMS calculation for off-system frequency conditions. In addition, a lookup table is used to compensate for magnitude variations from the output of the RMS calculation for 47-52Hz frequencies.

The real and imaginary components output from the DFT module are also used to derive the phase of the input signal.

3 Protection Functions

Voltage Blocking Element

The voltage blocking element acts as a block to the Voltage, elements in the relay. If all phase voltages fall below the threshold level then the blocking operation will operate.

The setting range for the voltage blocking threshold is ENABLED/DISABLED, 3V - 60V with a 0.5V step. This element is required mainly for under-voltage operation conditions. Under normal circumstances, if all phase voltages fall below the under-voltage setting, a trip output would be the expected response. However, in some applications e.g. auto-reclose schemes, having an under-voltage relay trip when the line is de-energised during the auto-reclose sequence is not usually desirable. Blocking the under-voltage operation in this situation can be achieved by using the Voltage Blocking Threshold, which should generally be set above the level of expected induced voltages on the line.

Voltage Elements

The relay has 4 voltage elements as standard. These are configured as two under-voltage (U/V) and two over-voltage (O/V) elements. If the input voltages exceed the pickup level, whether U/V or O/V, then each element operates through a gate, which selects operation from any one phase or all phases. At this point the element can still be inhibited from starting if the input voltages are below the voltage blocking threshold level. Figure 1 shows the basic operation of each voltage element. The ‘event’ and ‘instrument’ labels in the diagram indicate where this type of information is generated.

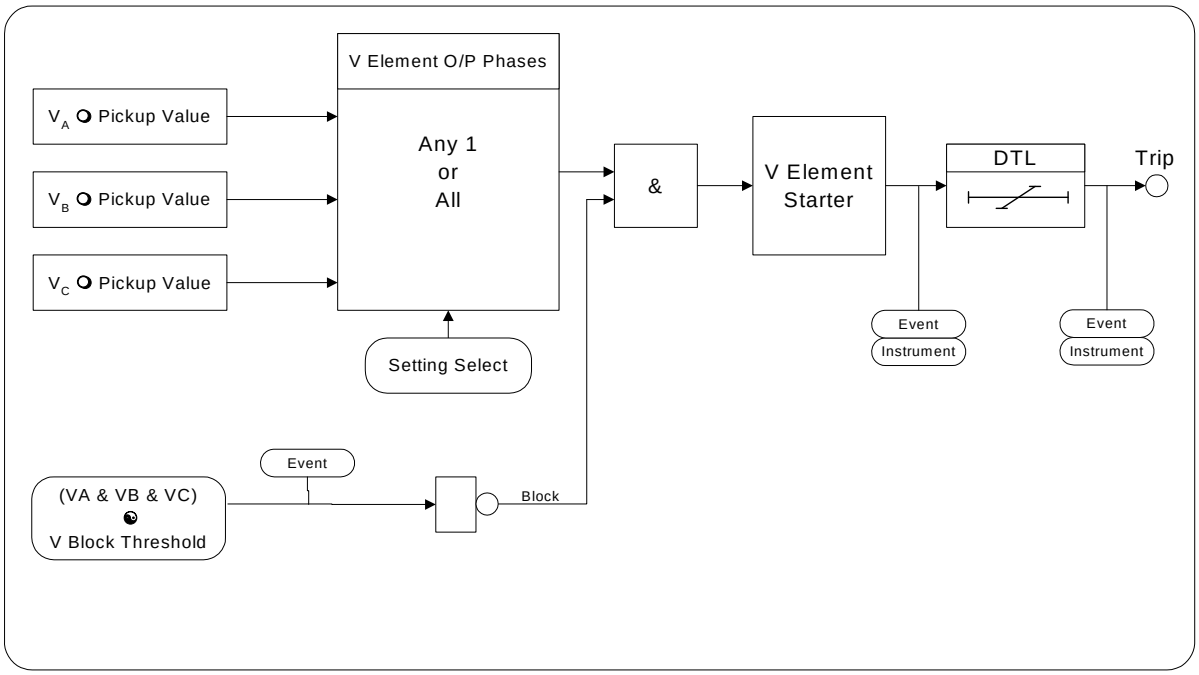

Figure 1 - Voltage Element

The voltage elements each have a variable Hysteresis setting which allows the user to vary the pick-up - drop-off ratio for a particular element.

The over-voltage function in the relay has two independent setting ranges they can be configured for an alarm function or a trip function.

The relay measures the voltage between each phase and neutral and will react to whichever phase exceeds the setting. If the setting is exceeded an LED is illuminated displaying over-voltage trip or alarm.

Data storage can only be initiated from a trip condition.

The voltage elements are instantaneous transient free elements, which have independent DTL timers. The output can be set to 0s for instantaneous operation or time delayed up to 1000 ms.

To switch on the over-voltage functions they first have to be enabled in the AUXILLIARY PROTECTION MENU. If the function is not enabled any applied settings for that function is ignored.

4 Settings

The setting is applied as a voltage. The nominal relay system voltage is 63.5 volts. The voltage settings on this relay operate two ways; any voltage that exceeds the over-voltage setting will cause an output. The reset level will be determined by the Hysteresis setting that allows a variable PU/DO ratio. For the under-voltage setting any voltage below the set value will cause an output. Again the reset is determined by the hysterisis setting. The under-voltage element will be blocked if all three phases are below this setting.

The alarm function can be mapped to any of the output contacts. The trip function will operate whichever contact(s), has been set to cause a general trip.