

7SG1642 Ohmega 406

Distance Protection Relays

Document Release History

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2010/02	Document reformat due to rebrand

Software Revision History

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1 Relay Type

Model No. OHMEGA406-50
Software Version 2615H80018R33

1.1 System Configuration Menu

Setting	Range	Definition
CVT in use	No..Yes	Specifies whether CVTs or EVTS are being used. If set to YES, this gives extra security to the protection during the case of severe CVT transients.
Autoreclose Option	None , External, Internal	Specifies whether autoreclosing is to be carried out Internally, by an external device, or not at all.
CT Ratio	0:1..5000:5 (2000:1)	These values are used in the Instruments menu where Primary Current and Voltage are displayed. Note the setting of the CT secondary should also be made in the Distance Protection menu.
VT Ratio	1000:90..600000:130 (132000:110)	
Alternate Setting Group	1..8	This is the group that the relay will switch to if the SI assigned as <i>Use Alt Setting Grp</i> is energised. The relay will revert to the previous setting group when the status input is de-energised.
Defaults Screens Timer	Off.. 60 Minutes	Time delay after which display will return to the top of the menu.
Backlight timer	Off.. 60 (5 Min)	If no keys are pressed for this time delay, the relay will turn off the backlight.
Change Password	Password (NONE)	The relay is provided with a password feature. If set it will prevent any un-authorized changes to any of the relay settings. The password is a four character word once set it can be disabled by entering the new password NONE. If the password has been lost then an authorised person must contact a Siemens representative.
Relay Identifier	16 Character String OHMEGA 406-50	This is usually set to the circuit name. This is displayed at the top level of the menu system.

1.2 Distance Protection Menu

Setting	Range	Definition
Distance Scheme	Time Stepped , Loss of Load, Reach Extension, PUR ,POR WI 1, POR WI 2, BOR	This defines the current active scheme in the relay. A full description of all schemes is given in Section 3 of the manual.
CT Secondary	1, 2, 5A	Specifies the rating of the secondary winding of the current transformer.
Line Angle	0..90 (75°)	Angle of the positive sequence impedance.
EF Comp Z0/Z1 ratio	0..10 (2.5°)	Simple ratio between magnitudes of the zero and positive sequence impedances.
EF Comp Z0 angle	0..355 (75°)	Angle of the zero sequence impedance.
POR Weak Infeed	Disabled, Enabled	This allows the Weak Infeed detection to echo a received Scheme Signal to allow the remote end to trip and enables the POR Weak Infeed Alarm.
POR Weak Infeed Trip	Disabled, Enabled	Allows the main trip contacts to operate for a weak infeed fault detection.
WI Voltage Level	5..85 (54v)	Level below which a voltage depression will be considered to be a fault by the Weak Infeed detector.

Quad Auto Load Comp	Disabled , Enabled	Compensation applied to the reactance line of the quad characteristic to allow for load current during a fault.
Reactive Drop Angle	-20..20 (-3°)	Defines the angle of the reactance comparator to the vertical, for the quad characteristic
Z1 Extension	Disabled, Enabled	Allows the Z1 Extension scheme to be enabled or disabled. If it is set to disable the scheme and settings are not used.
Z1 Phase Fault	Disabled, Enabled	Allows the phase fault comparators to be turned on or off.
Z1 PF Impedance	0.1..250 (8Ω)	Positive sequence impedance reach of the Zone1 phase fault comparator along the line angle
Z1X PF Impedance	0.1..250 (12Ω)	When the <i>Reach Extension</i> scheme is active, this defines the extended Zone 1 phase fault reach used for the first trip. See Section 3 of this manual for more detail on relay schemes. If the active scheme is not set to <i>Reach Extension</i> , this setting has no effect on the relay.
Z1 PF Time Delay	0..10000 (0ms)	Set time delay for the Zone 1 phase fault comparators. Normally set to zero unless the <i>POR1</i> scheme is selected.
Z1 Earth Fault	Disabled, Enabled	Allows the Zone 1 earth fault comparators to be turned on or off.
Z1 EF Type	Fwd Mho , Fwd Quad	Sets the earth fault comparators as Mho or Quad characteristic.
Z1 EF Impedance	0.1..250 (8Ω)	This defines the positive sequence impedance reach of the Zone 1 earth fault comparator along the line angle.
Z1 EF Resistance	0.1..250 (4Ω)	When Quad characteristics are selected, this defines the reach along the resistive axis. Note that residual compensation is <i>not applied</i> to this part of the characteristic.
Z1X EF Impedance	0.1..250 (12Ω)	When the <i>Reach Extension</i> scheme is selected, this defines the extended Zone1 earth fault reach used for the first trip. See manual for more detail on relay schemes. If the active scheme is not <i>Reach Extension</i> , this setting has no effect on the relay.
Z1X EF Resistance	0.1..250 (6Ω)	
Z1 EF Time Delay	0..10000 (0ms)	Set time delay for the Zone 1 phase fault comparators. Normally set to zero unless the <i>POR1</i> scheme is selected
Z2 Phase Fault	Disabled, Enabled	Settings as per Zone 1
Z2 PF Impedance	0.1..250 (16Ω)	
Z2 PF Time Delay	0..10000 (1000ms)	
Z2 Earth Fault	Disabled, Enabled	
Z2 EF Type	Fwd Mho , Fwd Quad	
Z2 EF Impedance	0.1..250 (16Ω)	
Z2 EF Resistance	0.1..250 (8Ω)	
Z2 EF Time Delay	0..10000 (1000ms)	
Z3 Phase Fault	Disabled, Enabled	Allows the Zone 3 phase fault comparators to be turned on or off.
Z3 PF Type	Fwd Mho, Rev Mho, Offset Mho , Offset Shaped	Allows the direction of the Zone 3 phase fault element to be set either as forward, reverse or offset, or offset shaped.
Z3 PF Impedance Fwd	0.1..250 (24Ω)	Positive sequence impedance reach of the Zone 3 phase fault comparator, in the forward direction
Z3 PF Impedance Rev	0.1..250 (8Ω)	Positive sequence impedance of the Zone 3 phase fault comparator, in the reverse direction
Z3 PF Shape Factor 1	0..1 (1Ω)	Setting of these allows the shape of the Zone 3

Z3 PF Shape Factor 2	0..1 (1Ω)	characteristic to be altered. This only applies if Shaped Characteristics are selected. See Section 2 for more details on this function.
Z3 PF Time Delay	0..10000 (2000ms)	Set time delay for the Zone 3 phase fault comparators.
Z3 Earth Fault	Disabled, Enabled	Allows the Zone 3 earth fault comparators to be turned on or off.
Z3 EF Type	Fwd Mho, Rev Mho, Offset Mho , Fwd Quad, Rev Quad, Offset Quad	Allows the direction of the Zone 3 earth fault element to be set either as forward, reverse or offset, and the shape to be set as a mho or quad.
Z3 EF Impedance Fwd	0.1..250 (24Ω)	This defines the positive sequence impedance of the Zone 3 earth fault comparator, in the forward direction.
Z3 EF Resistance Fwd	0.1..250 (12Ω)	With Quad characteristics selected, this defines the reach along the resistive axis. Note that residual compensation is not applied to this part of the characteristic.
Z3 EF Impedance Rev	0.1..250 (8Ω)	This defines the positive sequence impedance reach of the Zone 3 earth fault comparator, in the reverse direction.
Z3 EF Resistance Rev	0.1..250 (4Ω)	When Quad characteristics are selected, this defines the reverse reach along the resistive axis. Note that residual compensation is not applied to this part of the characteristic.
Z3 EF Time Delay	0..10000 (2000ms)	Set time delay for the Zone 3 earth fault comparators.
Direct Zone 4 Trip	Disable, Enable	Allows direct tripping on operation of the Zone 4 elements.
Z4 Phase Fault	Disable, Enable	Settings as per Zone1.
Z4 PF Impedance	0.1..250 (8Ω)	
Z4 PF Time Delay	0..10000 (0ms)	
Z4 Earth Fault	Disabled, Enabled	
Z4 EF Type	Rev Mho , Rev Quad	
Z4 EF Impedance	0.1..250 (8Ω)	
Z4 EF Resistance	0.1..250 (4Ω)	
Z4 EF Time Delay	0..10000 (0ms)	

1.3 Power Swing Menu

Setting	Range	Description.
Power Swing Detector	Disable, Enable	Allows the Power Swing Detector to be turned on or off.
PSD Zone blocking	Z1, Z2, Z3, Z4 (Z2, 3, 4 only)	Selects the zones of operation for which tripping is blocked during a Power Swing Condition
PSD Shape	Circular , Rectangular	Defines the shape of the Power Swing detection element.
PSD Blinders	Disable , Enable	Enables the blinders which can be used to prevent the Power Swing Characteristic encroaching upon the load impedance.
PSD Inner Fwd Impedance	0.1..250 (24Ω)	These settings define the reach of the power swing element along the line angle in the forward and reverse directions.
PSD Inner Rev Impedance	0.1..250 (8Ω)	Usually set the same as the Zone 3 impedance forward and reverse reach, or just outside of them.
PSD Inner Fwd Blinder	0.1..250 (16Ω)	Defines the perpendicular distance between the line angle and the <i>PSD Blinders</i> . If the blinders are not enabled, then these settings have no effect.
PSD Inner Rev Blinder	0.1..250 (16Ω)	
PSD Outer Multiplier	1.05..2 (1.5x)	The outer reach of the PSD zones are set as a multiple of the <i>Inner fwd and rev impedance</i> reaches.

PSD Transit Time	0..1000 (50ms)	This is the length of time for which the impedance characteristic must remain between the inner and outer zones before the power swing detector operates.
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1.4 Auxiliary Protection Menu.

Setting	Range	Definition
High Set	Disable, Enable	The <i>Highset Overcurrent</i> is a non-directional DTL element, which will cause a main distance trip on operation.
HS Level	0.1..35 (4x In)	
HS Time Delay	0..1000 (0ms)	
Stub Protection	Disable, Enable	The Stub Protection is a simple DTL overcurrent element which is enabled whenever the <i>Stub Protection SI</i> is energised from the disconnector auxiliary switch.
SP Level	0.1..2 (1x In)	
SP Delay	0..1000 (0ms)	
LOL Level	0.1..0.9 (0.5x In)	Where the <i>Loss of Load</i> scheme is used, a LOL condition occurs if the current level in one or two phases drops below this level, and the current in the remaining phase(s) is above the level, and there is a residual voltage on the system. The relay will detect a loss of load condition (i.e the remote end breaker has opened) and allow instantaneous tripping of the zone 2 element, for a fixed time window.
LOL Pole Scatter Delay	0..50 (20ms)	This delay allows for pole scatter between phases when the breaker opens.
Directional Earth Fault	Disable, Enable	This setting enables or disables the <i>Directional Earth Fault Protection</i> .
DEF Scheme	Def Direct Trip Def POR	<i>DEF POR</i> is designed for use with a signalling channel. The relay will carry out a <i>DEF aided trip</i> if the local DEF element operates AND a permissive signal is received from the remote end. In the direct trip mode operation of the DEF element will trip the relay directly.
DEF Char Angle	-95..95 (45°)	This is the maximum torque angle for the DEF element between the residual current and the residual voltage. The residual current is taken as the reference, so for an inductive circuit the angle will be positive.
DEF Weak Infeed Trip	Disable , Enable	When enabled this allows the DEF scheme to work if the source at one end is weak or non-existent. If the forward and reverse elements are both not operated, and signal is sent from the remote end DEF, the relay will trip and send a permissive signal back to the remote end (Signal Send 2).
DEF Pole Open Block	Disable, Enable	When the relay carries out a single pole trip, the resulting unbalance in the phases may operate the DEF element. With this setting enabled the DEF element will be blocked during a single pole autoreclose.
DEF1 Direction	Forward , Reverse	The DEF can be set to operate in either the forward or reverse direction. Usually set to forward.
DEF1 Direct Trip	Disable , Enable	When enabled, a DEF1 fault detection will result in operation of the main trip output contact
DEF1 Current Setting	0.05..4 (1x In)	Pickup level of the DEF 1 element
DEF1 Time Delay	0..20000 (1000ms)	Time delay for DEF tripping. This will applied for the aided tripping if DEF POR is selected or direct tripping if the DEF Direct Trip is selected.
DEF2 Direction	Forward, Reverse	Settings as for DEF 1. The DEF 2 element is usually set to operate in the reverse direction.
DEF2 Direct Trip	Disable , Enable	
DEF2 Current Setting	0.05..4 (1xIn)	
DEF2 Time Delay	0..20000 (1000ms)	

DEF WI Res OV Level	0..20 (5V)	This is the residual overvoltage detector applied as a guard feature in the <i>DEF Weak Infeed Tripping</i> . The residual voltage must be greater than this value for the <i>DEF Weak Infeed Trip</i> to operate.
Overvoltage Prot.	Disable, Enable	Enables or disables the Overvoltage Protection.
OV Stage 1 Level	5..85 (68V)	Defines the pickup level, time delay, and hysteresis of the OV stage 1 element. The element will pick up at 100% of setting and will drop off at 100%-Hysteresis level.
OV Stage 1 Time Delay	0..600 (5s)	
OV Stage 1 Hysteresis	1..90 (2%)	
OV Stage 1 O/P Phases	Any Phase , All Phases	Defines whether the Overvoltage should be a single phase or a three-phase condition.
OV Stage 1 Trip	Disable , Enable	Determines whether operation of the stage 1 Overvoltage will trip the relay or not.
OV Stage 2 Level	5..85 (73V)	Settings as per Stage 2. The element will pick up at 100% of setting and will drop off at 100% - Hysteresis level
OV Stage 2 Time Delay	0..600 (5s)	
OV Stage 2 Hysteresis	1..90 (2%)	
OV Stage 2 O/P Phases	Any Phase , All Phases	
OV Stage 2 Trip	Disable , Enable	
Undervoltage Prot.	Disable , Enable	Enables or disables the Undervoltage Protection
UV Low V Blocking	Disable , Enable	When enabled this will prevent operation of the undervoltage detectors when the voltage drops below the block level. Prevents nuisance alarms when the line is dead.
UV Block Level	3..60 (10V)	
UV Stage 1 Level	5..85 (55V)	Settings as per Overvoltage (See Above) The element will pick up at 100% of setting and will drop off at 100% + Hysteresis level.
UV Stage 1 Time Delay	0..600 (5s)	
UV Stage 1 Hysteresis	1..90 (2%)	
UV Stage 1 O/P Phases	Any Phase All Phases	
UV Stage 1 Trip	Disable , Enable	
UV Stage 2 Level	5..85 (55V)	Settings as per Overvoltage (See Above) The element will pick up at 100% of setting and will drop off at 100% + Hysteresis level.
UV Stage 2 Time Delay	0..600 (5s)	
UV Stage 2 Hysteresis	1..90 (2%)	
UV Stage 2 O/P Phases	Any Phase , All Phases	
UV Stage 2 Trip	Disable , Enable	
Switch On To Fault	Disable, Enable	The SOTF logic caters for a situation in which a close-up three-phase fault occurs, and there is not enough voltage in the fault path to operate the forward looking distance protection elements of the relay.
SOTF Mode	AC SOTF DC SOTF	<i>AC SOTF</i> is the preferred algorithm to use, but can only be used where VTs are positioned on the Line side of the circuit breakers. Where busbar VTs are applied the <i>DC SOTF</i> logic must be selected.
SOTF O/C Operate Level	0.3..4 (0.3xIn)	When the breaker has been open for a set time delay (see <i>AC SOTF pickup delay</i> in the Reylogic Menu) and the relay detects current above this level, when the voltage is below 20% of nominal the AC SOTF logic will be enabled for 200ms.
VT Supervision	Disable, Enable	Failure of the VT can cause a maltrip, as the relay will see the voltage (and hence the impedance) drop to zero. <i>Voltage Transformer Supervision</i> will check the output from the VTs.
VTS Latched Operation	Disable, Enable	If residual/NPS current is detected above the VTS Ires level, the VTS protection blocking will reset unless this setting is enabled. If Enabled the current will only reset the VTS if it is detected before the VTS Latch Op. Delay expires.

VTS Mode	Alarm Only Alarm & Inhibit	On detecting a VT failure, the relay can either raise an alarm only or inhibit tripping and raise an alarm.
VTS Phase Fault Inhibit	Disable, Enable	If this is enabled, the relay will inhibit tripping of the phase fault element whenever a VT fail condition occurs. The relay will not trip however, if a phase fault occurs after a VT has failed. With this setting disabled, the relay will not restrain the distance elements if two phases of the VT fail. Under such conditions the relay will trip.
VTS Input Source	Res.I/V, NPS I/V (Res.I/V)	This selects to use either Residual voltage and current or Negative Phase Sequence voltage and current to detect VT failure.
VTS Ires Level	0.05..2 (0.3 x In)	The relay will raise a VTSalarm if it detects residual voltage greater than the <i>Vop Level</i> , AND residual current less than the <i>Ires Level</i> .
VTS Vop Level	1..100 (20)	

1.5 Autoreclose Menu

Setting	Range	Description
A/R In Service	In..Out	Switches the autorecloser in and out of service.
Close Mode Selection	Off, 1p, 3p , 1p/3p, 1p3p/3p, 3p3p, 1p1p, 1p1p/3p3p	Defines the Mode of tripping and closing as single-pole or three-pole, and multishot or single shot. The “/” is used to separate relay operation, for a single pole trip, and secondly for a three pole trip.

During the autoreclose cycle, (either during or at the end of the Deadtime), the relay goes through a number of checks to determine whether a close pulse should be issued or not. The following are the checks carried out by the relay before the close pulse is issued.

If all these conditions are all disabled, the relay will not issue a close pulse.

Setting	Range	Description
Dead Bar Charge	Enable, Disable	Checks that the bar is dead.
Dead Line Charge	Enable, Disable	Checks that the line is dead.
Dead Line & Dead Bar Close	Enable, Disable	Checks that both line & bar are dead.
Check Sync Close	Enable , Disable	Checks synchronism between line and bus before allowing a close pulse. See check sync settings.
Unconditional Close	Enable, Disable	Allows a close pulse regardless of the conditions at the end of the deadtime.

The remainder of the settings are to do with the general operation of the autorecloser.

Setting	Range	Description
First 1P Deadtime	0.05..100 (1s)	This setting determines the length of the deadtime under the various trip conditions. The conditions for starting the deadtime are defined below.
Second 1P Deadtime	0.05..100 (1s)	
First 3P Deadtime	0.1..900 (5s)	
Second 3P Deadtime	0.1..900 (5s)	
Start Deadtime	Trip Make Trip & CB Open	Defines whether the deadtime is started when the relay trips or when the relay has tripped and the CB has opened.
3P Deadtime Initiate	1P/2P/3P , 1P/2P	This determines whether the autorecloser operates for single phase and phase faults only, or 1, 2 AND 3 phase faults.
Live Line Check	Enable , Disable	With this setting enabled, in addition to the Start Deadtime condition defined above, the relay will check that the line goes dead before the deadtime is started. This is to ensure that breakers at both ends of the line have tripped before the start of the deadtime.

		Note: This should not be used in conjunction with single pole tripping
CB Aux Switches	Type a , Type b Type a & b	Determines whether the SI should be energised when the breaker is open (Type a) or energised when the breaker is closed (Type b) or both. Note that if type a is selected, the SI CB A, B, C Aux One SI should be used, and if type b is selected, then the SI CB A, B, C Aux Two SI should be used. Obviously, if type a & b are selected, all these SI must be used.
CB Close Pulse	0.2..20 (2s)	This is the length of the close pulse issued by the relay.
Reclaim Time	1..600 (5s)	This is the time after the end of the close pulse before the Autoreclose cycle resets itself. If a fault occurs during the reclaim time, the relay will lockout the autorecloser, or carry out a second autoreclose shot depending on the close mode selected.
Sync Close Delay	0..60 (30s)	This is the maximum length of time allowed between the end of the deadtime, and the line and bus voltages coming into synchronism. If synchronism is not achieved within this time, the relay will lockout.
Permissive Close Delay	Off..600 (60s)	If the SI assigned to Block Autoreclose remains energised for longer than this time delay the relay will lockout the autorecloser.
Overall Sequence Timer	Off..3000 (Off)	This acts as a check on the timing of the overall autoreclose system. Its starts when the autoreclose is initiated, and is reset when the autoreclose cycle has been successfully completed. If the sequence is not completed within this time the relay will lockout.
Sequence Fail Timer	Off..200 (120s)	This is the maximum time between the start of the autoreclose sequence and the start of the deadtime. If the conditions set for <i>3P Deadtime Initiate</i> (see above), the relay will lockout the autorecloser.
Persistent Intertrip	1..180 (60s)	If the <i>Intertrip Receive</i> status input is energised for longer than this time delay the relay will lock out the autorecloser.
CB Fail To Open Delay	50..2000 (100ms)	Time between the trip command and the breaker issuing a CB Fail to Open alarm.
Minimum LO Timer	0..60 (2s)	Normally, the AR lockout will be reset automatically when the Breaker is successfully re-closed. Alternatively, it is possible, to reset the Lockout after a time delay as set here.
Reset LO By Timer	Enable, Disable	
CB Indeterminate	50..200 (80ms)	
CB Memory Timer	0.5 (2s)	This setting allows a delay in dropoff of the CB in service function. The CB is said to be out of service if the breaker is open or the line voltage is dead. If either of these conditions exist for longer than this timer the CB not in service alarm will operate. The autorecloser will not start if the CB is not in service
Set Type	Master , Slave	Where two auto-reclose relays are applied for one CB the relay which is designated Master can be set to override the Slave. This requires that the Master's output A/R In Progress is wired to the Master Slave input of the Slave. When the Master Slave input of the Slave is active it will cancel any auto-reclose sequence, reset and wait in its ready state until the A/R In Progress of the Master is released.
Total Close Counts to Alarm	1..999 (100)	Total number of close pulses issued by the relay before the Total CB Count Alarm operates.
Delta Close Counts to Alarm	1..999 (20)	Total number of close pulses issued by the relay before the Delta CB Count Alarm operates.

1.6 Pole Discrepancy Time

A mismatch of CB positions across the three phases might indicate CB problems. Generally if one or two of the phases is indicating closed whilst the others are open, and vice versa, for longer than a time delay setting then an alarm will be issued.

Setting	Range	Definition
Pole Discrepancy Time	Off..20 (1.6s)	

1.7 Check Sync Menu

Setting	Range	Default	Description
Sync Connection	Phase B Earth Phase A-Phase B	Phase B-Earth	This describes the connection of the VT used to provide the sync voltage.

The next two settings are used when the relay is set to Dead Line or Dead Bar charge or both

Setting	Range	Default	Description
Bus : Dead Live	5:10..150:155	20:90%	These settings define the "live" and "dead" conditions of the relay. Once the voltage goes below the "dead" level, the line will remain dead until the voltage rises above the "live" level. Similarly when the voltage goes above the live level it will remain live until it goes below the "dead" level.
Line: Dead Live	5:10..150:155	20:90%	

The following settings determine the conditions which must be met for, a Check Sync Close

Setting	Range	Description
Bus Undervolts	Off..150 (90%)	These set the maximum allowable undervoltage on the bus and the line for a check sync close.
Line Undervolts	Off..150 (90%)	
Voltage Differential	Off..100 (10%)	This is the maximum allowable difference in magnitude between the line voltage and the busbar voltage for a check sync close
Split Angle	Off..(175°)	This is the angle at which the relay will switch from check sync mode to system sync mode.
MC Split Action	System Sync Check Sync	This is the action that will be carried out, if a manual close is attempted, when a system split condition is detected.
ARC Split Action	System Sync Lockout	This defines the relay operation when the angle between line and bus voltage reaches the Split angle during an autoreclose operation.
Check Sync Angle	5..90 (20Deg)	These are the conditions that must exist for the relay to indicate that the voltages are In Sync, during a Check Sync operation. Also the angle between the two signals must be decreasing.
Check Sync Slip	Off..2000 (50mHz)	
Check Sync Timer	Off..100 (Off)	Once the synchronising conditions are met, they must remain in sync for this time delay, before the in sync command is issued.
System Sync Angle	5..90 (10Deg)	These are the conditions that must exist for the relay to indicate that the voltages are In Sync, during a System Sync operation. Also the angle between the two signals must be decreasing. The conditions are more onerous than for a check sync condition.
Sys Sync Slip Frequency	Off..2000 (125mHz)	
System Sync Timer	Off..100 (Off)	

1.8 Reylogic Config

Each of these timers has a settable range of 0, 60000ms

Settings	Default	Definition
LOL Time Limit	40ms	Maximum time after a loss of load condition is detected for which the Zone2 time delay will be removed.

SR Dropoff	1ms	Delay on dropoff of the Signal Received 1 (Distance) output of the relay.
POR Current Rev Reset	200ms	When there is a change indirection of the flow of current (due to remote circuit breaker operation), the relay will restrain for this time delay to prevent race conditions between the dropoff of the remote end signal send and the drop off of the local measuring element. (Used only with DEF POR scheme).
POR CB Echo Pulse	250ms	Length of pulse returned to sending end if local CB is open in POR scheme.
WI Sig Recv PU Delay	0ms	This is used to delay the acknowledgement of a Signal Receive by the Weak Infeed logic. This may be required to co-ordinate the W.I. blocking due to slow local fault detection with a particularly fast remote fault detection combined with a fast signalling system.
SS Dropoff	1ms	Delay on dropoff of the Signal Send 1 (Distance) output of the relay.
Permissive Trip Time	1ms	Time delay used by the BOR scheme to allow for a blocking signal to be received before carrying out an aided trip.
SR2 Dropoff	1ms	Delay on drop off of the Signal receive 2 (DEF) input to the relay.
DEF Current Rev Reset	200ms	When there is a change indirection of the flow of current (due to remote circuit breaker operation), the relay will restrain for this time delay to prevent race conditions between the drop-off of the remote end signal send and the drop off of the local measuring element. (Used only with DEF POR scheme).
CB Echo Pulse Width	250ms	When a DEF signal is received from the remote end and the local breaker is open, the relay will issue a signal send to allow a DEF aided trip at the remote end. The length of pulse "Echoed" back to the remote end in this way is defined here. Used only with DEF POR scheme.
DEF Backup Trip Delay	1ms	If the relay detects a DEF condition, but does not receive a permissive signal from the remote end it will perform a backup trip after this time delay.
SS2 Dropoff	1ms	Delay on drop off of the Signal Send 2 (DEF) output of the relay.
AC SOTF Pickup Delay	10000ms	The logic requires that the circuit breakers must have been closed for a minimum time before the SOTF logic is initiated. This minimum time is set here.
VTS Alarm PU Delay	100ms	This is the minimum time for which the VT fail conditions must remain on the system before the VT alarm is operated. It is usually set to 1000ms to avoid nuisance alarms.
VTS Latch PU Delay	5000ms	This is the minimum time that the VT fail conditions must remain on the system before the VT condition will latch. When latched, the VTS condition will only reset if the voltage is restored, i.e. it will not reset if residual current is measured above the setting. It is usually set to 5000ms.
TCS 1 Alarm Pick Up	400ms	Delay on Pick-up of the Trip Circuit Supervision Status Inputs, to avoid nuisance alarms.
TCS 2 Alarm Pick Up	400ms	
TCS 3 Alarm Pick Up	400ms	

1.9 Status Config

Setting	Definition
Reset LED Flags	Energising this SI will reset all LED flags, in the same way as pressing the TEST/RESET button on the relay.
Enable Stub Prot'n	Energising this SI will start the <i>Stub Protection</i> (if it has been enabled in Aux protection menu). It will be energised from a disconnecter auxiliary switch.
Inputs 1-8	Connection points for unallocated logic inputs 1-8.
3 Pole Trip Select	Energising this SI will cause the relay to carry out a three-phase trip for all fault types.
Block Reach Ext	Energising this SI will block operation of the <i>Reach Extension</i> scheme, i.e. it will cause the relay to operate as a time stepped distance scheme. It allows the Reach extension to be easily disabled from a panel switch.
Carrier Recv Guard	Where it is available, a signal may be taken from the signalling equipment, which will energise this status input when the signalling channel is faulty. This will cause the selected scheme to act as a time stepped distance scheme, until the SI is de-energised.
Signal Receive 1	Signalling channel used for Distance Protection.
Unstabilise Relay	When used this will cause the relay to issue a permissive signal or remove a blocking signal, depending on the selected scheme.
Block Mode Inhibit	Will inhibit operation of the <i>Blocked Overreach</i> scheme (where selected)
Block DEF	Energising this status input will prevent operation of the DEF function.
Signal Receive 2	Signalling channel used for <i>DEF Protection</i> depending on the selected scheme.
Manual Close	This SI is required where <i>DC SOTF</i> has been specified. It should be connected to the manual close handle of the breaker. For 400ms after this SI is energised, it will allow instantaneous tripping of the Zone3 element and indicate an <i>SOTF</i> condition.
VT Circuits Isolated	Used where MCBs are used to isolate VTs. IF all VT phases are lost, this SI should be energised to indicate a 3-phase VT failure.
Trip Cct 1 Fail	Connected to the three single-phase trip circuits. Where 3-pole tripping is used these can be assigned to the same input, if required. Operation of these will directly operate the output assigned to <i>Trip Circuit Fail</i> .
Trip Cct 2 Fail	
Trip Cct 3 Fail	
Trigger Storage	Energising this SI will trigger waveform storage.
Block Reclose	This will halt the auto-recloser at whatever point it is at. All timers will stop until this Status Input is de-energised. If this status input is energised for longer than the <i>Reclose Blocked Delay</i> , the relay will lockout.
Inhibit Close	Energising this SI will prevents the close pulse being issued from a Manual Close command.
Intertrip Receive	Dedicated Intertripping channel.
Master/Slave	Where two auto-reclose relays are applied for one CB the relay which is designated Master can be set to override the Slave. This requires that the Master's output A/R In Progress is wired to the Master/Slave input of the Slave. When the Master/Slave input of the Slave is active it will cancel any auto-reclose sequence, reset and wait in its ready state until the A/R In Progress of the Master is released.
A/R Out	These control the autorecloser. A pulse to the "AR in" SI will switch it into service, one to the "AR out" will switch it out of service. If both are high simultaneously, the autorecloser will be switched out of service
A/R In	
Go Direct To Lockout	This will cause the relay to go into lockout regardless of the status of the Autorecloser.
External A/R Start	Energising this SI will cause the relay to start an autoreclose sequence. All conditions for autoreclosing must still be met.
Reset Lockout	Energising this SI will reset the relay from a lockout condition. This is not normally required because the lockout condition will be reset when the breaker is successfully reclosed.
Sync Override	Used where an external Synchronising device is applied.

Manual Sync Override	Used directly to override synchronisation under manual close conditions.
CB A Aux One	Used where <i>Type a</i> CB Auxiliary Switches are specified.
CB B Aux One	
CB C Aux One	
CB A Aux Two	Used where <i>Type b</i> CB Auxiliary Switches are specified.
CB B Aux Two	
CB C Aux Two	
Reset Total CB Close	Resets the <i>Total CB Close Count</i> .
Reset Delta CB Close	Resets the <i>Delta CB Close Count</i> .
Block Output Relays	When this SI is energised, operation of the relays selected as 'inhibit outputs' in the output menu, will be blocked.
Switch Settings Grp	When this SI is energised, the relay will switch groups, from the currently active group to the <i>Alternate Setting Group</i> defined in the System Config Menu. The relay will remain in the alternate setting group until the SI is de-energised, when the relay will revert to the previous setting group.
Inhibit Group Switch	Energising this status input will prevent the relay from changing groups when the Switch Settings group Input is energised.
Inverted Inputs	All input selected here will have their logic sense reversed, i.e. no connection or connection to 0v will constitute a switched on input.

1.10 Output Config

Setting	Definition
Protection Healthy	Operates when the Protection is healthy. Will drop off when the relay watchdog identifies any problem with the relay, or the DC supply is removed.
Output 1-8	Outputs driven by energisation of the unallocated inputs 1-8.
Loss Of Load	Operates when the <i>Loss of Load</i> trip has occurred.
Aided Trip	Operates when the relay operation was aided by the active scheme, i.e. indicates whether it was a simple time stepped distance trip or not.
Z1 Extension	Operates when a fault is detected by Zone 1 whilst zone 1 extension is in service.
Signal Received 1	Operates on receipt of a signal from the remote end distance relay.
POR Weak Infeed	
Signal Send 1	Operates according to the selected scheme to send either a permissive signal or a blocking signal to the remote end.
DEF1 Alarm	Operates when the DEF1 element has picked up.
DEF2 Alarm	Operates when the DEF2 element has picked up.
Signal Received 2	Operates on receipt of a permissive DEF signal from the remote end.
DEF Aided Trip	Operates when the DEF carries out an aided trip.
DEF POR Weak Infeed	Operates in DEF POR mode when a signal is received from the remote end, the breaker is closed, and the forward and reverse DEF elements have not operated.
Signal Send 2	Operates in DEF POR mode when the forward-looking DEF element operates.
Zone 1	Indicates the Zones involved in the fault.
Zone 2	
Zone 3	
Zone 4	
High Set	Indicates operation of the Highset Overcurrent element.
Stub Protection	Indicates operation of the Stub Protection.
OV Alarm	Operates when the Overvoltage Stage 1 Element picks up.
OV Trip	Operates when the Overvoltage Stage 2 Element picks up.
UV Alarm	Operates when the Undervoltage Stage 1 Element picks up.
UV Trip	Operates when an Undervoltage Stage 2 Element picks up.
SOTF Operated	Indicates that a Switch-onto-fault Operation has occurred.

VTS Alarm	Operates when one or more phases of the Voltage Transformer fails.
DAR Lockout	Operates when a trip occurs which should not initiate Autoreclose, i.e. a Zone 2 or Zone 3 fault. May be used to prevent operation of an external Autorecloser.
Pole A Trip	Main trip segregated tripping output contacts.
Pole B Trip	
Pole C Trip	
3 Pole Trip	Alarm contact which operates when the relay has carried out a three pole trip.
Trip Cct 1 Failed	When a Trip circuit fails, this indicates which phases are involved.
Trip Cct 2 Failed	
Trip Cct 3 Failed	
Phase A Fault	Indicates the phase(s) involved in the fault condition
Phase B Fault	
Phase C Fault	
Earth Fault	Operates when the fault involves an earth path.
Power Swing Alarm	Operates when the System impedance characteristic has entered the Power Swing Detection Zone and remained there for longer than the <i>PSD Transit time</i> .
Carrier Recv Guard	Operates when the carrier guard SI has operated because of a faulty signalling channel.
Start A	Indicates the phase(s) which have starters initiated.
Start B	
Start C	
Close Pulse	Operates when the relay carries out a close command during an autoreclose cycle.
Lockout	Operates when the Autorecloser has locked out.
A/R In Service	Operates whenever the Autorecloser is in service.
A/R In Progress	Starts when the relay carries out a trip which will start an autoreclose, and drops off at the end of the reclaim time. If the Autorecloser locks out this will remain operated until the Lockout condition is reset.
Live Line	Operates when the line is live according to the settings made for <i>Line Live : Dead</i> in the Check Sync Menu
Live Bus	Operates when the bus is live according to the settings made for <i>Bus Live : Dead</i> in the Check Sync Menu
In Sync	Operates whenever the bus and line voltages are in sync. This will run constantly, not just during a <i>Check Sync</i> operation.
VT Failure	This alarm is generated when the relay detects either Live line and CB Closed and dead bus OR Live bar and CB Closed and dead line for greater than 2 seconds.
CB A Open	Indicates the position of the three phases of the circuit breaker.
CB B Open	
CB C Open	
CB Failed To Open	Operates if the relay trip and the breaker fails to open within the <i>CB Fail To Open Delay</i>
CB Failed To Close	Operates if the CB fails to close by the end of the close pulse.
CB Pole Discrepancy	Operates if detection of CB Open from separate phases differs by more than the pole discrepancy time.
Successful Close	Operates when a close pulse is issued and the CB closes successfully.
System Split	Operates when the angle between Bus and Line voltages becomes greater than the <i>Split Angle</i> (See Check Sync Menu).
Check Sync Start	Operates when the synchronising conditions are being checked during an autoreclose cycle.
Sync In Prog Flag	Operates when the relay is checking the synchronising conditions.
Close Onto Fault	Operates when the relay recloses on a permanent fault and thus locks out.
Delta CB Count Alarm	Operates when the <i>Delta Close Counter</i> reaches its target.

Total CB Count Alarm	Operates when the <i>Total Close Counter</i> reaches its target.
CB Not In Ser Alarm	This will operate when the CB is open or the line is dead for longer than the <i>CB Memory Time</i> . Either of these conditions must exist for the CB to be not in service. A circuit breaker's service status is determined by its position and its voltage references. The circuit breaker is defined as being in service when it is closed and its voltage references are live. If either of these conditions are not in place the relay will raise this alarm after the <i>CB Memory Time</i> .
CB Memory	This indicates that the CB is in service (opposite to the above setting).
A/R Not Allowed	Operates when a system condition prevents the operation of the autorecloser.
Zone 1 Start Zone 2 Start Zone 3 Start Zone 4 Start	Operates for any fault detection by individual zone instantaneous pick-up without expiry of the zone timer. Simulates 'Starter' pick-up of previous generation relays.
Hand Reset Outputs	Indicates which Outputs are latched.
Fast Reset Outputs	Logic outputs driving these output contacts are checked for drop off more frequently than standard outputs to provide contacts with accurately timed drop off where necessitated by certain functions.
Inhibit Outputs	Operation of outputs specified here will be blocked when the inhibit outputs status input is energised.

1.11 Output Relay Dwell Time Menu

All relays are individually set for minimum operating time.

Setting	Range	Default
Min. Op. Time 1	0 ... 2000ms	100ms
:	:	:
Min. Op. Time *	0 ... 2000ms	100ms

1.12 LED Config

Settings as per the Output Configuration.

Setting	
Self Reset leds	List which leds will self extinguish when the applicable function resets. Any leds not listed here will latch on, once operated, until they are manually reset.

1.13 Data Storage Menu

The relay is capable of storing up to 10 fault records. The records are stored as a 1 second rolling window, with a set pre-fault time – thus with the setting below, the relay will record 100 ms of data prior to the fault and 900ms after the fault.

Setting	Range	Default
Pre-trigger Storage	10 ... 90%	10%
Record Duration	10x1s, 5x2s, 2x5s, 1x10s	10 x 1 second

1.14 Communications Menu

More details on the communications can be found in Section 6 of this manual.

Setting	Range	Default
Station Address	0, 1, ... 254	0
IEC870 on port	COM1, COM2	COM1
COM1 Baud Rate	75, 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	19200
COM1 Parity	Even, Odd, None	EVEN
COM1 Line Idle	Light On, Light Off	LIGHT OFF
COM1 Data Echo	Off, On	OFF
COM2 Baud Rate	75, 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400,	19200

	57600, 115200	
COM2 Parity	Even, Odd, None	NONE
COM2 Line Idle	Light On, Light Off	LIGHT OFF
COM2 Data Echo	Off, On	OFF
COM2 Direction	Auto-Detect, Rear Port, Front Port	AUTO-DETECT

1.15 Fault Locator Menu

The setting here are used for the Fault locator calculation.

Setting	Range	Default
Fault Locator	Enabled, Disabled	Enabled
Pos Seq Line Impedance	0.1, 0.11, ..., 10, 10.1, ..., 100, 101, ..., 250 Ω	10.00 Ohm
Sec'y Z+ per unit distance	0.001, 0.002, ..., 5 Ω	0.500 Ohm
Display distance as	Percent, Kilometres, Miles	Percent

2 Menu Structure

