7SG1631 Ohmega 305

Protection Relay

Document Release History

This document is issue 2010/02. The list of revisions up to and including this issue is:

Pre release

2010/02	Document reformat due to rebrand

Software Revision History

2006/12	2615H80022R8	50Hz
	2615H80023R8	60Hz

Contents

1 Menu Settings

System Configuration Menu

Setting	Range	Default
Active Group	1, 2, …, 8	1
Alternate Setting Group		
CT Ratio	0, 100, …, 5000:1,2,5	2000:1
VT Ratio	1000, 1100, …, 10000, 11000, …, 600000:90, 95, …, 130	132000:110
View/Edit Group	1, 2, …, 8	1
Date	Day/Month/Year	1/1/1998
Time	Hrs:Min:Sec	00:00:00
Change Password	AAAA…ZZZZ	NOT ACTIVE
Relay Identifier	Up to 16 characters	OHMEGA 305-50

Distance Protection Menu

Setting	Range	Default
Active Scheme	PUR, POR1, POR2, Acceleration, Time Stepped	PUR
CT Secondary	1, 2, 5 A	1 A
Line Angle	0, 5, …, 90º	75º
EF Comp Z0/Z1 ratio	0, 0.01, …, 10.00	2.5
EF Comp Z0 angle	0, 5, …, 355º	75º
Z1 Phase Fault	Enabled, Disabled	Enabled
Z1 PF Impedance	See Note 1	8.00Ω
Z1 PF Time Delay	0, 10, …, 10000 ms	0ms
Z1 Earth Fault	Enabled, Disabled	Enabled
Z1 EF Impedance	See Note 1	8.00Ω
Z1 EF Time Delay	0, 10, …, 10000 ms	0ms
Z2 Phase Fault	Enabled, Disabled	Enabled
Z2 PF Impedance	See Note 1	16.00Ω
Z2 PF Time Delay	0, 10, …, 10000 ms	1000ms
Z2 Earth Fault	Enabled, Disabled	Enabled
Z2 EF Impedance	See Note 1	16.00Ω
Z2 EF Time Delay	0, 10, …, 10000 ms	1000ms
Z3 Phase Fault	Enabled, Disabled	Enabled
Z3 Type	Fwd Mho, Rev Mho, Offset Mho	Offset Mho
Z3 PF Impedance (Fwd)	See Note 1	24.00Ω
Z3 PF Impedance (Rev)	See Note 1	8.00Ω
Z3 PF Time Delay	0, 10, …, 10000 ms	2000ms
Z3 Earth Fault	Enabled, Disabled	Enabled
Z3 Type	Fwd Mho, Rev Mho, Offset Mho	Offset Mho
Z3 EF Impedance (Fwd)	See Note 1	24.00Ω
Z3 EF Impedance (Rev)	See Note 1	8.00Ω
Z3 EF Time Delay	0, 10, …, 10000 ms	2000ms
Power Swing Detector	Enabled, Disabled	ENABLE
PSD Zone Blocking	Zone 1 ¦ Zone 2 ¦ Zone 3	Zone 2-3
PSD Shape	Circular, Rectangular	CIRCULAR
PSD Blinders	Enabled, Disabled	DISABLE
PSD Inner Fwd Impedancee24.0 Ohm	0.1, 0.2, … 250Ω	
PSD Inner Rev Impedance	0.1, 0.2, … 250Ω	8.0 Ohm
PSD Inner Fwd Blinder	0.1, 0.2, … 250Ω	16.0 Ohm
PSD Inner Rev Blinder	0.1, 0.2, … 250Ω	16.0 Ohm
PSD Outer Multiplier	1.05, 1.06, … 2.00x	1.50x
PSD Transit Time	0, 5, … 1000ms	50ms

Auxiliary Protection

Setting	Range	Default
High Set	Enabled, Disabled	Enabled
HS Level	4, 4.25, …, 35 xIn	4.00xIn
HS Time Delay	0, 1, …, 1000 ms	0ms
SOFT	Enabled, Disabled	Enabled
SOFT Mode	AC SOFT, DC SOFT	AC SOFT
SOFT O/C Operate Level	0.30, 0.35, …., 4.00xIn	0.30xIn
VT Supervision	Enabled, Disabled	Enabled
VTS Mode	Alarm Only, Alarm & Inhibit	Alarm & Inhibit
VTS Phase Fault Inhibit	Enabled, Disabled	Enabled
VTS Ires Level	0.05, 0.1, …, 2 xIn	0.30xIn
VTS Vres Level	1, 2, .., 100 V	20V

Reylogic Configuration

Setting	Range	Default
SR Dropoff	0, 1, …, 60000 ms	1ms
SS Dropoff	0, 1, …, 60000 ms	1ms
AC SOFT Pickup Delay	0, 1, …, 60000 ms	10000ms
VTS Alarm Op. Delay	0, 1, …, 60000 ms	0ms
VTS Alarm Res. Delay	0, 1, …, 60000 ms	0ms

Status Configuration

Setting	Range	Default
Signal Receive 1	NONE, 1…27	1
DC SOFT Manual Close	NONE, 1…27	8
VT Circuits Isolated	NONE, 1…27	NONE
Trigger Storage	NONE, 1…27	NONE
Input 1	NONE, 1…27	1
Input 2	NONE, 1…27	2
Input 3	NONE, 1…27	3
Input 4	NONE, 1…27	4
Input 5	NONE, 1…27	5
Input 6	NONE, 1…27	6
Input 7	NONE, 1…27	7
Use Alt Setting Grp	NONE, 1…27	NONE

Output Configuration

Setting	Range	Default
Protection Healthy	NONE, 1…29	1
Signal Send 1	NONE, 1…29	6
SOFT Operated	NONE, 1…29	12
VTS Alarm	NONE, 1…29	11
Trip Output	NONE, 1…29	4
Phase A Fault	NONE, 1…29	NONE
Phase B Fault	NONE, 1…29	NONE
Phase C Fault	NONE, 1…29	NONE
Earth Fault	NONE, 1…29	NONE
Zone 1	NONE, 1…29	8
Zone 2	NONE, 1…29	9
Zone 3	NONE, 1…29	10
Aided Trip	NONE, 1…29	NONE
Signal Recvd 1 Flag	NONE, 1…29	NONE
Carrier Guard	NONE, 1…29	NONE
Power Swing Alarm	NONE, 1…29	NONE
Input 1 Operated	NONE, 1…29	NONE
Input 2 Operated	NONE, 1…29	NONE
Input 3 Operated	NONE, 1…29	NONE
Input 4 Operated	NONE, 1…29	NONE
Input 5 Operated	NONE, 1…29	NONE
Input 6 Operated	NONE, 1…29	NONE
Input 7 Operated	NONE, 1…29	NONE
High Set	NONE, 1…29	13
Hand Reset Outputs	NONE, 1…29	NONE

Led Configuration

Setting	Range	Default
Signal Send 1		NONE
SOFT Operated	NONE, 1…32	17
VTS Alarm	NONE, 1…32	18
Trip Output	NONE, 1…32	NONE
Phase A Fault	NONE, 1…32	6
Phase B Fault	NONE, 1…32	7
Phase C Fault	NONE, 1…32	8
Earth Fault	NONE, 1…32	9
Zone 1	NONE, 1…32	1
Zone 2	NONE, 1…32	2
Zone 3	NONE, 1…32	3
Aided Trip	NONE, 1…32	11
Signal Recvd 1 Flag	NONE, 1…32	10
Carrier Guard	NONE, 1…32	NONE
Power Swing Alarm	NONE, 1…32	24
Input 1 Operated	NONE, 1…32	NONE
Input 2 Operated	NONE, 1…32	NONE
Input 3 Operated	NONE, 1…32	NONE
Input 4 Operated	NONE, 1…32	NONE
Input 5 Operated	NONE, 1…32	NONE
Input 6 Operated	NONE, 1…32	NONE
Input 7 Operated	NONE, 1…32	NONE
High Set	NONE, 1…32	19
Self Reset LEDs	NONE, 1…32	10, 14,18,20,22,24,26-28,30-32

Data Storage Menu

Setting	Range	Default
Pre-Trigger Storage	10…90 %	10 %

Communications Menu

Setting	Range	Default
Station Address	0…254	0 – see note 2
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 Off, Light On	Light Off
Com1 Data Echo	Off, On	Off
Com2 Baud Rate	75, 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	19200
Com2 Parity	Even, Odd, None	Even
Com2 Line Idle	Light Off, Light On	Light Off
Com2 Data Echo	Off, On	Off
Com2 Direction	Auto-Detect, Rear Port, Front Port	Auto-Detect

Note 2: 0 = Disabled

Fault Locator Menu

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	Percentage, Kilometres, Miles	Percent

2 Settings Walkthrough

The relay displays are organised into three lists:-

A list of settings
A list of meters (instruments)
A list of fault records

This walkthrough describes the settings and is intended to be read in front of a powered-up relay.
The starting point is the relay identifier screen. This is the screen the relay displays when it is first powered-up and can be reached from any display by pressing CANCEL a few times.

From this position press the down arrow key ⇩
once, the relay will display "SETTINGS MODE". From this display the down arrow key ⇩ can be pressed again to enter the setting list, or the right arrow key ⇨ can be pressed to choose a different list ("INSTRUMENTS MODE" or "FAULT DATA MODE"). Press the down arrow key ⇩. The relay enters the settings list and displays "SYSTEM CONFIG MENU".

2.1 System Config Menu

This menu contains general settings which allows the relay to be configured. Press ⇨ to open the menu and display the settings.

Active Group (**1**..8)
There are 8 setting groups in the relay. Some settings can have different values in each group while others have the same value in all groups. This setting controls which group of values is applied to the relay. When it is changed all the settings which can have different values in each group are changed.

Alternate Setting Group (**1**..8)
It is possible to cause the relay to switch from one setting group to another on application of a signal to the Status Input *Use Alt Setting Grp*. When this status input is energised, the relay will switch from whichever group is currently active to the alternate group defined in this setting. The relay will revert to the previous active setting group when the *Use Alt Setting Grp* Status Input is de-energised.

CT Ratio (0:1..5000:5) **1:2000**
This setting defines the turns ratio of the protection CT. This will allow the meter display to show the correct primary current. This setting does not affect any protection functions.

VT Ratio (1000:90..600000:130) **33000:110**
This setting defines the ratio of the protection VT. This will allow the meter display to show the correct primary voltage. This setting does not affect any protection functions.

CVT in use (**NO**, YES)
If CVT's are used then this setting should be set to YES. This will give extra security to the protection during the case of severe CVT transients. Due to this extra security, operation of the relay will be approximately 5ms slower if CVTs are being used.

Clock Sync from Status (Disabled, Seconds, **Minutes**)
When the Status input defined as Clock Sync is energised, the relay's real time clock will be set to the nearest second or nearest minute according to the setting made here.

View/Edit Group (**1**..8)
Each setting group can be viewed and edited without making it active. Settings that can be different in each group indicate which group the displayed value belongs to with the letter "G" and the group number in front of the setting description. This setting controls which group is displayed.
IMPORTANT: whichever group of settings are visible may NOT be the settings the relay is using. The relay will only operate on the Active Group regardless of the displayed settings.

Default Screens Timer (Off, 1, 2, 5, 10, 15, 30, **60** mins)
Defines the length of time that the relay will remain on the selected screen before returning to the top of the menu tree. When the relay returns to the default screen, this is indicated by a small inverted D in the top right corner of the LCD screen.
Unless otherwise specified, the default screen is the relay identifier (i.e. the top level of the menu structure).

Backlight Timer (Off, 1, 2, **5**, 10, 15, 30, 60 mins)

Defines the length of time for which the backlight for the LCD screen will remain illuminated after the last keypress.

Date
The current date is set in this menu. The format is DD,MM,YYYY

Time
The current time is set. In this menu only minutes and hours are set. The format is HH,MM the 24 hour clock is used.

Change Password **(NONE)**
The relay is provided with a password feature. If set it will prevent any un-authorised 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". Once a password has been set, the relay will display a 10 digit code in the Change Password setting. If the password has been lost then an authorised person should contact a Reyrolle Protection representative, quoting this 10-digit code. This can be used to obtain the current password.
The password must be entered in order to alter any of the relay settings. Once the password has been entered, the relay will remain "logged-in" for 1 hour. After this time, the relay password must be entered again before settings can be changed.

Relay Identifier
The relay is supplied with a default identifier usually the relay type. This can be changed to any 16-digit identifier to give any meaningful identification to the relay. e.g. feeder name or circuit number.

2.2 Distance Protection Menu

The settings for the impedance elements are located in this menu.

Active Scheme (**PUR**, POR1, POR2, Acceleration, Time Stepped)
There are a number of different protection schemes available in the relay depending upon the model. These can be chosen at this setting. Only one scheme can be active at a time. The schemes are described in Section 3 of this manual..

Carrier Guard (Disable, **Enable**)
This allows the carrier guard feature to be enabled or disabled. Where an output contact is available from the protection signalling equipment, which can indicate that there is a problem with the signalling channel, this can be used to energise a status input defined as *Carrier Guard*.
When enabled, if the status input assigned as *Carrier Guard* is energised, the relay will carry out time delayed trips only – it will not carry out an aided trip under any circumstances, regardless of the condition of the *Signal Received 1* and *Signal Received 2* status inputs.

CT Secondary (**1A**, 2A, 5A)
The relay can operate from 1, 2 or 5 Amp CT secondary circuits. The value MUST be programmed for the correct CT. This will affect the impedance measurements if not programmed correctly.

Line Angle (0-90˚ in steps of 5˚) **75˚**
This is the angle of the positive sequence impedance of the composite transmission line.

EF Comp Z0/Z1 ratio (0-10) **2.5**
This is the ratio between the magnitudes of the zero sequence and positive sequence impedances of the system. The ratio of Z0/Z1 is used in an internal calculation for earth-fault compensation. This is common for all Zones.

EF Comp Z0 angle (0-355˚ in steps of 5˚) **75˚**
This is the angle of the zero sequence impedance of the system.

Z1 Phase Fault (Disable, **Enable**)
The zone 1 phase fault elements A-B, B-C, C-A, can be disabled from this setting. No other elements are affected.

Z1 PF Impedance (0.1 – 250) **8Ω**
The zone 1 phase fault impedance values are applied using this setting. The values are in terms of secondary positive sequence impedance.

Z1 PF Time Delay (**0** – 10000ms)
An independent time delay from 0 – 10s can be applied to the zone 1 phase fault protection elements.

Z1 Earth Fault (Disable, **Enable**)

The zone 1 earth fault elements A-E, B-E, C-E, can be disabled from this setting. No other elements are affected.

Z1 EF Impedance (0.1 – 250) **8Ω**
The zone 1 earth fault impedance values are applied using this setting. The values are in terms of secondary positive sequence impedance. This allows a reach setting which is independent from the phase fault setting.

Z1 EF Time Delay (**0** – 10000ms)
An independent time delay from 0 – 10s can be applied to the zone 1 earth fault protection elements.

Z2 Phase Fault (Disable, **Enable**)
The zone 2 phase fault elements A-B, B-C, C-A, can be disabled from this setting. No other elements are affected.

Z2 PF Impedance (0.1 – 250) **16Ω**
The zone 2 phase fault impedance values are applied using this setting. The values are in terms of secondary positive sequence impedance.

Z2 PF Time Delay (0 – 10000) **1000ms**
An independent time delay from 0 – 10s can be applied to the zone 2 phase fault protection elements.

Z2 Earth Fault (Disable, **Enable**)
The zone 2 earth fault elements A-E, B-E, C-E, can be disabled from this setting. No other elements are affected.

Z2 EF Impedance (0.1 – 250) **16Ω**
The zone 2 earth fault impedance values are applied using this setting. The values are in terms of secondary positive sequence impedance. This allows a reach setting which is independent from the phase fault setting.

Z2 EF Time Delay (0 – 10000) **1000ms**
An independent time delay from 0 – 10s can be applied to the zone 1 earth fault protection elements.

Z3 Phase Fault (Disable, **Enable**)
The zone 3 phase fault elements A-B, B-C, C-A, can be disabled from this setting. No other elements are affected.

Z3 PF Type (Fwd Mho, Rev Mho, **Offset Mho**)
There are three types of zone 3 characteristic, Offset Mho, Forward (Fwd) Mho and Reverse (Rev) Mho. If either forward or reverse is selected then these elements become a standard directional element and require a polarising voltage. If an offset Mho characteristic is selected, then operation can occur without polarising voltage.

Z3 PF Impedance (Fwd) (0.1 – 250) **24Ω**
The zone 3 phase fault forward reach impedance values are applied using this setting. The values are in terms of secondary positive sequence impedance. If the element is selected as a reverse element then this setting is ignored.

Z3 PF Impedance (Rev) (0.1 – 250) **8Ω**
The zone 3 phase fault reverse reach impedance values are applied using this setting. The values are in terms of secondary positive sequence impedance. If the element is selected as a forward element then this setting is ignored.

Z3 PF Time Delay (0 – 10000) **2000ms**
An independent time delay from 0 – 10s can be applied to the zone 3 phase fault protection elements.

Z3 Earth Fault (Disable, **Enable**)
The zone 3 earth fault elements A-E, B-E, C-E, can be disabled from this setting. No other elements are affected.

Z3 EF Type (Fwd Mho, Rev Mho, **Offset Mho**)
There are three types of zone 3 characteristic, Offset Mho, Forward (Fwd) Mho and Reverse (Rev) Mho. If either forward or reverse is selected then these elements become a standard directional element and require a polarising voltage. If an Offset Mho characteristic is selected, then operation can occur without polarising voltage.

Z3 EF Impedance (Fwd) (0.1 – 250) **24Ω**
The zone 3 earth fault forward reach impedance values are applied using this setting. The values are in terms of secondary positive sequence impedance. If the element is selected as a reverse element then this setting is ignored.

Z3 EF Impedance (Rev) (0.1 – 250) **8Ω**

The zone 3 earth fault reverse reach impedance values are applied using this setting. The values are in terms of secondary positive sequence impedance. If the element is selected as a forward element then this setting is ignored.

Z3 EF Time Delay (0 – 10000) **2000ms**
An independent time delay from 0 – 10s can be applied to the zone 3 earth fault protection elements.

POR Weak Infeed Tripping (**Disabled**, Enabled)
Allows the weak infeed tripping features to be turned on or off, where the Permissive overreach scheme is being applied. See Section 3 of this manual for a full description of the Weak Infeed tripping feature.

POR Current Rev Reset (0 – 60000) **200ms**
When there is a change indirection of the flow of current (due to circuit breakers opening), 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 Permissive Overreach schemes. See Section 3 of this manual for a full description of the Current Reversal Guard feature.

POR CB Echo Pulse (0 – 60000) **250ms**
This is the length of pulse "Echoed" back to the remote end when a signal is received from the remote end distance protection and the local breaker is open. Used only with POR scheme. See Section 3 of this manual for a full description of the CB Echo Pulse feature.

LOL Level (0.1 – 0.9) **0.5 x I_N**
Where the Loss of Load scheme is used, a LOL condition occurs if the current level in one or two phases drops below this level, but the current in the remaining phase(s) is above this level. When this occurs, the relay will remove the time delay from Zone 2 for the *LOL Time Limit* (see below). Thus, the relay will allow tripping for 100% of the line upon detection of a loss of load (i.e. a fault outside of the local zone 1 for which the remote end breaker has tripped). See Section 3 of this manual for a full description of the Loss of Load feature.

LOL CB Op Delay (0 – 60000) **20ms**
This delay allows for pole scatter between phases. A short delay is placed on the operation of the LOL detector to allow for slight differences in the opening time between poles of the circuit breaker, thus preventing nuisance alarms. The standard value of 20ms will be suitable for most cases.

LOL Time Limit (0 – 60000) **40ms**
Maximum time after the loss of load condition is detected for which the Zone 2 time delay will be removed. The standard value of 40ms will be suitable for most applications.

Power Swing Detector (**Disable**, Enable)
This setting allows the Power Swing detector to be enabled or disabled.

PSD Zone Blocking (Zone 1, **Zone 2, Zone 3, Zone 4**)
This defines which Zones of protection tripping would be blocked for in the event of a Power Swing.

PSD Shape (**Circular**, Rectangular)
Allows setting of the Power Swing Zone characteristics as either circular or rectangular.

PSD Blinders (**Disable**, Enable)
This allows blinders to be applied to the Power Swing Zone to prevent load encroachment. These are applied parallel to the line angle when enabled.

PSD Inner Fwd Impedance (0.1 – 250) **24Ω**
Sets the inner impedance reach in the forward direction (on the line angle) for the PSD characteristic. This is usually set equal to, or greater than, the Zone 3 reach.

PSD Inner Rev Impedance (0.1 – 250) **8Ω**
Sets the inner impedance reach in the reverse direction (on the line angle) for the PSD characteristic. This is usually set equal to, or greater than, the Zone 3 reverse reach.

PSD Inner FWD Blinder (0.1 – 250) **16Ω**
This is the impedance (perpendicular to the line angle) between the line impedance and the blinder applied to the PSD Zone, to the right of the line characteristic. The blinder is applied parallel to the line angle.

PSD Inner REV Blinder (0.1 – 250) **16Ω**
This is the impedance (perpendicular to the line angle) between the line impedance and the blinder applied to the PSD Zone, to the left of the characteristic. The blinder is applied parallel to the line angle.

PSD Outer Multiplier (1.05 – 2) **1.5 x**

The outer reach of the Power Swing detector is set as a multiple of the inner reach, normally 1.5 times the inner reach.

PSD Transit Time (0 – 1000) **50ms**
This is the length of time for which the impedance characteristic must be between the inner and outer Zones of the Power Swing Detector for a Power Swing to be detected. The default setting of 50ms should be suitable for most applications.

2.3 Aux Protection Menu

Any additional protection elements are programmed in this section.

High Set (**Disabled**, Enabled)
Overcurrent high set elements can be enabled or disabled using this setting.

HS Level (0.1 – 35) **4 x I_N**
The overcurrent setting is applied here. It is set in multiples of the nominal current, I_n which is set in the DISTANCE PROTECTION MENU under the *CT Secondary* setting.

HS Time Delay (0.00 – 60s) **1.00s**
A definite time delay from 0 – 1s can be added to the instantaneous operating time of the high set elements.

SOTF (Enabled, **Disabled**)
This setting determines whether the Switch On To Fault protection is enabled or not.

SOTF Mode (**AC SOTF**, DC SOTF)
The Switch On To Fault feature has two modes of operation. It can be energised from an AC function or a DC function. The DC SOTF function is energised by the operation of a status input from the CB manual close handle (i.e. a D.C. signal). The AC SOTF function monitors the line current and voltage (i.e. the AC signals) and thus cannot be used if the VT is on the busbar side of the relay.

SOTF O/C Operate Level (**0.3** – 4 x I_N)

This current setting is used as a minimum value to cause operation of the SOTF function after 25ms of fault current on all three phases.

VT Supervision (Enabled, **Disabled**)
This checks for the security of the VT circuit. It can be enabled or disabled.

VTS Mode (**Alarm Only**, Alarm & Inhibit)
If the VTS operates it can be selected to give an alarm only or it can inhibit the operation of the impedance elements.

VTS Phase-fault Inhibit (Enabled, **Disabled**)
During a fault condition the VTS is reset when the zero sequence current exceeds the setting. For a phase-fault there is no zero sequence current therefore the relay may be inhibited during a phase-fault.
With this setting disabled, the relay will trip for a two-phase VT failure.
With this setting enabled, the relay will remain stable for a two-phase VT failure but will not trip if a phase-fault occurs during such a failure.

VTS Ires Level (0.05 – 4 x I_N) **0.3 x I_N**
VTS Vres Level (1 – 100V) **20V**
The VTS feature operates by measuring the summated voltages of the healthy system, and comparing this with the measured residual current. The VTS will operate if the relay detects residual voltage without detecting a corresponding residual current. These settings define the levels of residual current and voltage used. The default residual voltage setting of 20 volts is suitable for most applications, but this can be changed to make the function more or less sensitive. The current setting is made in terms of the nominal current, and the default setting is 30%. The default settings used here are suitable for most applications.

VTS Alarm Op. Delay (0 – 60000ms) **1000ms**
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 Alarm Res. Delay (0 – 60000ms) **1000ms**
This is the delay on reset of the VT fail alarm.

Trip Circuit Fail (**Disabled**, Enabled)

Allows the trip circuit to be monitored by a status input. If this status input is de-energised it will indicate that the Trip Circuit is faulty and operate the *Trip Circuit Fail* relay output.

2.4 Reylogic Config Menu

Elements of functions that have had the logic configured in REYLOGIC are found in this menu.

SR Dropoff (0..60000) **1ms**
The Distance signal received can be extended using this timer to provide a variable pulse length.

SS Dropoff (0..60000) **1ms**
The Distance send signal can be delayed using this timer to provide a variable pulse length.

Timer 1 Pickup Delay (0..60000) **1ms**
This is a time for which the Status Input *Timer 1* must be energised before the *Timer 1 Operated* output is operated.

Timer 1 Dropoff Delay (0..60000) **0ms**
This is a time for which the *Timer 1 Operated* output remains operated, once the Status Input *Timer 1* has been de-energised.

Timer 2 Pickup Delay (0..60000) **1ms**
This is a time for which the Status Input *Timer 2* must be energised before the *Timer 2 Operated* output is operated.

Timer 2 Dropoff Delay (0..60000) **0ms**
This is a time for which the Status Input *Timer 2* must be energised before the *Timer 2 Operated* output is operated.

Counter 1 Target (1..60000) **1**
This is the number of pulses which must be applied to the Status Input *Counter 1* before the *Counter 1 Operated* output is operated.

Counter 2 Target (1..60000) **1**
This is the number of pulses which must be applied to the Status Input *Counter 2* before the *Counter 2 Operated* output is operated.

2.5 Status Config Menu

The number of status inputs can vary with the relay model type. Each of the status inputs can be mapped to any one or more of the relay functions. The following list shows the purpose of the function.

Signal Receive 1
This is the received signal from the remote end of a distance protection scheme.

Carrier Guard

Energisation of this status input will revert the distance protection to a time stepped distance scheme. Can be used if the signalling channel fails. As soon as this status input is de-energised, the relay will revert to the Active Scheme.

CB Phase A Closed
CB Phase B Closed
CB Phase C Closed
CB Phase A Open
CB Phase B Open
CB Phase C Open

These inputs may be connected to the auxiliary contacts of the circuit breaker to indicate the position of the three phases of the circuit breaker.

DC SOTF Manual Close
This status input must be used if the *Switch On To Fault mode* is set to *DC SOTF*. A contact is required from the circuit breaker closing handle. It is disabled by default. For 400ms after this element is first energised, the relay will remove the time delay from Zone 3. See Section 2 of this manual for a full description of the *Switch On To Fault* feature.

VT Circuits Isolated
This input is used to detect a three-phase VT failure, and should be connected to an auxiliary contact from a three-phase MCB. The relay will indicate a VTS condition whenever this status input is energised.

Trigger Storage
An external device can be used to trigger the waveform storage whenever this status input is energised.

Increment Trip Count.
The relay records the number of trip operations carried out. If the circuit breaker is tripped by another protection device, this status input can be used to increment the trip counter. This means that the relay will record the total number of trips carried out by the breaker, regardless of which device carried out the tripping.
One example of the use of this would be for a single switch substation where two distance relays control the same circuit breaker. By connecting the trip contact of one relay to this status input on the other relay (and vice versa) the trip counter on each relay will record the total number of trips for that breaker.

Reset Total Trip Cnt
Energising this Status Input will reset the Total trip count. The number of trips recorded by the Total Trip Counter carried out by the relay can be viewed in the INSTRUMENTS mode of the relay.

Reset Delta Trip Cnt
Energising this Status Input will reset the Delta trip count. The number of trips recorded by the Delta Trip Counter carried out by the relay can be viewed in the INSTRUMENTS mode of the relay.

Reset Total CB Close
Energising this Status Input will reset the Total CB close counter. The number of trips recorded by the Total CB Close Counter carried out by the relay can be viewed in the INSTRUMENTS mode of the relay.

Reset Delta CB Close
Energising this Status Input will reset the Total CB close count. The number of trips recorded by the Delta Trip Counter carried out by the relay can be viewed in the INSTRUMENTS mode of the relay.

Use Alt Settings Grp
This input when energised will cause the relay to switch to the alternative setting group defined in the system configuration menu. The relay will revert to the original setting group when this status input is de-energised.

Input 1 ... 4
In order to utilise the status inputs and output relay matrix a number of connections have been created. These are named as Input 1..n where n is a maximum of 4. This will depend upon the relay model type.

Input 5a, 5b, 5c, 5d
When all four of these status inputs are energised the relay will operate the *Input 5 Operated* relay output. This acts as a four input AND gate. By assigning more than one of these labels to the same relay input, a 3 or a 2 input AND gate can be created.

Input 6a, 6b, 6c, 6d
When all four of these status inputs are energised the relay will operate the *Input 5 Operated* relay output. This acts as a four input AND gate. By assigning more than one of these labels to the same relay input, a 3 or a 2 input AND gate can be created.

Timer 1
When this is energised, timer 1 will start. If the Status Input remains energised for longer than the *Timer 1 pick-up delay* (see Reylogic Config) this will operate the *Timer 1 Operated* Output. When de-energised the output will drop-off after the Timer 1 Drop Off Delay. If the timer is de-energised before the *Timer 1 pick-up delay* it will reset to zero.

Timer 2
As above.

Counter 1 Count
Energising this SI will increment Counter 1 by 1. When the counter reaches the target set as *Counter 1 Target* (Reylogic Configuration) the output assigned to *Counter 1 Operated* will operate.

Counter 1 Reset
Energising this will reset *Counter 1* to Zero.

Counter 2 Count
Energising this SI will increment Counter 2 by 1. When the counter reaches the target set as *Counter 2 Target* (Reylogic Configuration) the output assigned to *Counter 2 Operated* will operate.

Counter 2 Reset
Energising this will reset *Counter 2* to Zero.

Trip Circuit Fail.
Where the condition of the trip circuit is monitored using a status input, this status input will be energised whenever the trip circuit is healthy.

Clock Sync
Energising this Status Input will cause the relay to reset to either the nearest minute or nearest second depending on the setting made in the System Config menu.

2.6 Output Config Menu

Depending upon the configuration of the relay there are a large number of signals which can be mapped to output contacts.

Protection Healthy
This output monitors the condition of the relay and dc power supply to the relay. This is usually mapped to one of the changeover outputs, and connected to the normally closed contact (by default relay 1). When this function is selected it will permanently operate the selected relay. By using a normally closed contact if there is any failure then this contact will close giving a fail-safe alarm condition.

Signal Send 1
Depending on the active scheme for Distance Protection, this output is used for Distance Protection Signalling. See Section 3 of this manual for a full description of this feature.

POR Weak Infeed
Indicates that the Weak Infeed logic for the distance protection POR scheme has operated

CB Open
CB Closed

Shows the position of the circuit breaker, as indicated by the status inputs CB A/B/C Open and CB A/B/C Closed.

SOTF Operated
Indicates that a Switch-onto-fault Operation has occurred.

VTS Alarm
Operates when one or more phases of the Voltage Transformer fails.

Trip Output
This is used as the initiation for the tripping of the local circuit breaker. Depending on the settings of the relay I may be operated by any of the distance elements, Highset Overcurrent, Directional Earth Fault, Sensitive Earth Fault, energisation of the *Trip and Auto-Reclose* Status Input, Under/Overvoltage tripping.

Trip Reset
This output gives a reset pulse immediately after the trip output has dropped off internally. The pulse will remain high for either 100ms or the minimum relay operating time (if set higher).

Phase A Fault / Phase B Fault / Phase C Fault
Indicates the phase(s) involved in the fault condition

Earth-fault
Operates when the fault involved an earth-fault comparator.

Zone 1 / Zone 2 / Zone 3
Indicates the Zone (s) which operated. Note these outputs are not starters – they will have the same time-delayed operation as the zones themselves.

Aided Trip
Operates when the relay operation was aided by the active distance scheme, i.e. indicates whether it was a simple time stepped distance trip or not.

Sig Recvd 1 Flag
Operates on receipt of a signal from the remote end distance protection. It will mirror the operation of the Status Input.

Carrier Guard
Operates when the *Carrier Guard* Status Input is energised because of a faulty signalling channel.

Power Swing Alarm
Operates when the System impedance characteristic has entered the Power Swing Detection Zone and remained there for longer than the *PSD Transit time*.

Delta Trip Cnt Alarm
Operate when the Delta trip counter has reached the target set in the CB Maintenance menu.

Total Trip Cnt Alarm
Operate when the Total trip counter has reached the target set in the CB Maintenance menu.

High Set
Operates when the relay has tripped due to operation of the Highset Overcurrent Element.

Input 1 Operated
Operates when the Status Input assigned to *Input 1* is energised.

Input 1 Not Operated
Operates when the Status Input assigned to *Input 1* is de-energised. This can be used as an inverter.

Input 2 Operated
Operates when the Status Input assigned to *Input 2* is energised.

Input 2 Not Operated
Operates when the Status Input assigned to *Input 2* is de-energised. This can be used as an inverter.

Input 3 Operated
Operates when the Status Input assigned to *Input 3* is energised.

Input 4 Operated
Operates when the Status Input assigned to *Input 4* is energised.

Input 5 Operated
Operates when the inputs assigned to *Input 5a, Input 5b, Input 5c* and *Input 5d* are all energised

Input 6 Operated
Operates when the inputs assigned to *Input 6a, Input 6b, Input 6c* and *Input 6d* are all energised

Timer 1 Operated
Operates when the *Timer 1* SI is energised for longer than the *Timer 1 Pickup Delay*. Remains operated until that initiating status input is de-energised.

Timer 2 Operated
This will operate when the *Timer 2* SI is energised for longer than the *Timer 2 Pickup Delay*. Remains operated until that initiating status input is de-energised.

Counter 1 Operated
This will operate when Counter 1 has received a set number of pulse inputs. The operating point for counter 1 is set as *Counter 1 Target* in the Reylogic Config menu.

Counter 2 Operated (as above)
This will operate when Counter 2 has received a set number of pulse inputs. The operating point for counter 1 is set as *Counter 2 Target* in the Reylogic Config menu.

Trip Circuit Fail
Operates when the SI assigned to Trip Circuit Fail operates.

IRIG B Synch'
This status input is used to provide a time synchronising signal.

Hand Reset Outputs Indicates which Outputs are latched.

2.7 Output Operate Time Menu

R1..R29 Min Operate Time

When an output operates, it will remain operated for a minimum length of100ms, or the time set in this section. If the initiating condition remains for longer than this time, the output will drop off after the initiating condition has been removed, or until the relay is reset, if the output is

2.8 Led Configuration Menu

With the exception of the “Protection Healthy” item, this menu has the same relay outputs as the output Configuration menu and these can be used to energise any of the LED flags.

2.9 Communications Menu

Station Address (0, 1, … 254) **0**
Defines the relay address number. When set to zero, the relay will not communicate.

IEC870 on port (**COM1**, COM2)
Defines the port which uses IEC 870 Communication protocol. The front port and the top rear fibre Optic ports are denoted COM2. When using a PC to communicate locally with the relay, this should be set to COM2. Note that this should not be confused with the comms port on the PC.

COM1 Baud Rate **(**75, 110, 300, 600, 1200, 2400, 4800, 9600, **19200**, 38400, 57600, 115200)
Defines the Baud rate used by the COM 1 of the relay to communicate with an external device. The relay and the external device must both be using the same baud rate in order for communications to be established.

COM1 Parity (Even, Odd, ***None***)
Defines the type of Parity used by the COM 1 of the relay when communicating with an external device. The relay and the external device must both be using the parity in order for communications to be established.

COM1 Line Idle (Light On, **Light Off**)
For the Fibre Optic port. Defines whether the fibre optic light will be ON or OFF when the line is idle.

COM1 Data Echo (**Off**, On)
This setting must be switched on, to enable the relay to pass data around a ring system. If a number of relays are connected together, the data echo feature must be switched on to allow data transfer. When communicating with a single relay it may be easier to switch this setting to OFF.

COM2 Baud Rate (75, 110, 300, 600, 1200, 2400, 4800, 9600, **19200**, 38400, 57600, 115200)
Defines the Baud rate used by the COM 1 of the relay to communicate with an external device. The relay and the external device must both be using the same baud rate in order for communications to be established.

COM2 Parity (Even, Odd, **None**)
Defines the type of Parity used by the COM 2 of the relay when communicating with an external device. The relay and the external device must both be using the parity in order for communications to be established.

COM2 Line Idle **(**Light On, **Light Off**)
For the Fibre Optic port. Defines whether the fibre optic light will be ON or OFF when the line is idle.

COM2 Data Echo **(Off**, On)
This setting must be switched on, to enable the relay to pass data around a ring system. If a number of relays are connected together, the data echo feature must be switched on to allow data transfer. When communicating with a single relay it may be easier to switch this setting to OFF.

COM2 Direction **(Auto-Detect**, Rear Port, Front Port)
The relay has two external connections to COM port 2 – via the rear fibre optic connection or via the front RS232 connection. This defines which port is used. When set as auto-detect it will switch between ports depending on the connected devices.

2.10 CB Maintenance Menu

Total CB Trip Count Alarm (*OFF*, 1 – 9999)
Sets the number of trip operations after which the *Total CB Trip Cnt* output will operate.

Delta CB Trip Count Alarm (*OFF*, 1 – 9999)
Sets the number of trip operations after which the *Delta CB Trip Cnt* output will operate.

Total CB Close Count Alarm (1, 2, … 999) 100
Sets the number of close operations after which the *Total CB Close Cnt* output will operate.

Delta CB Close Count Alarm (1, 2, … 999) 20
Sets the number of close operations after which the *Delta CB Close Cnt* output will operate.

Reset Total CB Trip Count NO
Selecting this setting to YES will reset the counter. It will automatically reset to NO.

Reset Delta CB Trip Count NO
Selecting this setting to YES will reset the counter. It will automatically reset to NO.

Reset Total CB Close Count NO
Selecting this setting to YES will reset the counter. It will automatically reset to NO.

Reset Delta CB Close Count NO
Selecting this setting to YES will reset the counter. It will automatically reset to NO.

2.11 Data Storage Menu

The relay will trigger storage of fault data whenever the relay trips, or the Trigger Storage status input is energised.

Pre-trigger Storage (10 … 90%) **20%**
Sets the proportion of pre and post fault which will be stored in the waveform record.

Record Duration (**10x1**, 5x2, 2x5, 1x10)
The relay can record 10 seconds of data. Normally the relay is arranged to store 1 a total of ten 1-second records. The size of those records can be changed, though the total length of data stored will not be changed. Thus the relay can store either ten 1-second records, five 2-second records, two 5-second records or one tens second record. Whenever a trip occurs the relay will trigger waveform storage and the oldest record in the memory will be overwritten.

2.12 Fault Locator Menu

The following settings are used for the fault locator. These settings are based on 100% of the line length.

Pos Seq Line Impedance (0.1 – 250 Ω) **10 Ω**
This is the positive sequence impedance of 100% of the line.

Sec'y Z+ per unit distance (0.1 – 250Ω) **0.500 Ω**
Defines the secondary positive sequence impedance per mile or kilometre.

Display distance as (**Percent**, Kilometres, Miles)
Defines whether the distance is displayed as a distance or as a percentage of the Pos Seq Line Impedance setting.

Fault Locator (Enabled, Disabled)
Allows the fault locator to be enabled or disabled.