7SG26 Tau 500

Auto Reclose and Check Synchronisation

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

Contents

Figures

Reference Material

[1] - REYDISP EVOLUTION : is a PC based relay support package which allows local or remote access to relays for uploading settings, downloading event and disturbance records, reading real-time data and allowing control of plant. The package is available from Reyrolle Protection and is compatible with all Argus and Modular II relays.

[2] - INFORMATIVE COMMUNICATIONS INTERFACE : a report detailing all aspects of the communications protocol used in the Argus and Modular II range of relays is available from Reyrolle Protection. The report reference is 434TM05B

1 INTRODUCTION

1.1 General

This Manual details the description of the Delayed Autoreclose Tau relay range.

The Tau Auto-reclose relay range consists of Multi-shot Delayed Autoreclose with or without integral Check Synchronisation.

There are separate Tau relays for Single Pole reclosing schemes, which are described in a separate manual. The Tau 100 and Tau 200 relays consist of Two-shot Single Pole / Three Pole Autoreclose relays.

Multi-shot Delayed Autoreclose relays, both with (Tau 500) or without (Tau 400) integral Check Synchronisation. The Multi-shot Delayed Autoreclose relays are described in this manual.

Tau 100 Two Shot Single Pole or Three Pole Recloser using external Check Synchronisation relay (Argus 7). Standard version in an E8 case with 27 input, 13 output and 16 programmable LEDs.

Tau 200 Two Shot Single Pole or Three Pole Recloser using internal Check Synchronisation. Standard version in an E12 case with 27 input, 13 output and 32 programmable LEDs.

Tau 400 Multi shot Three Pole Recloser applied to rural feeders where no Synchronisation is required. Standard version in an E8 case with 11 input, 13 output and 16 programmable LEDs.

Tau 401 Multi shot Three Pole Recloser using external Check Synchronisation relay (Argus 7). Standard version in an E8 case with 11 input, 13 output and 16 programmable LEDs.

Tau 500 Multi shot Three Pole Recloser using internal Check Synchronisation. Standard version in an E8 case with 11 input, 13 output and 16 programmable LEDs.

Tau 501 Multi shot Three Pole Recloser using internal Check Synchronisation. Includes one isolator control and is suitable for application to T'd feeders, Tapped off ring circuits. Standard version in an E12 case with 19 input, 21 output and 32 programmable LEDs. Associated settings marked with a (+).

Tau 502 Multi shot Three Pole Recloser using internal Check Synchronisation. Includes two isolator control and is suitable for Single Switch mesh, Four Switch mesh, or Switch and a Half type schemes. Standard version in an E12 case with 27 input, 29 output and 32 programmable LEDs. Associated settings marked with a (*)

The relay contains scheme logic, which allows input functions and output functions to be configured to meet the requirements of a particular customer's scheme. This is achieved by a number of pre-programmed customer options and features which enable various sequences to be selected together with appropriate timer mechanisms, which allow effective control of the autoreclose process. Auxiliary functions are provided which cover all aspects of the autoreclose scheme i.e. Auto-reclosing, Manual Closing, and Check Synchronisation.

Autoreclose inputs are fully programmable: Block Reclose, Lockout, Manual Close, A/R In, A/R Out, External A/R Start, Trip And Reclose, Reset Lockout.

Outputs are fully programmable to either LEDs or output contacts.

The relay has been designed for ease of setting, clear setting ranges indicate deadtimes, close pulse and reclaim time delay settings. Front panel instruments are provided that indicate the point, which the Relay has reached during an Autoreclose sequence, this greatly improves commissioning.

Suitable for single / double busbar substations where outgoing circuits are controlled by a single circuit breaker. Compatible to 'J' unit schemes. Can be applied to Teed feeders or Mesh corners which require Auto-Isolation facilities.

The relay will automatically determine circuit breaker reclosure conditions. These conditions are dead line charge, dead bar charge, dead line and dead bar close, unconditional close, or check sync close. If one of these conditions exists and reclosure under this condition has been pre-selected by the user then reclosure will be initiated.

When the dead line or dead bar deadtime has expired and dead line or dead bar conditions are met then the circuit breaker will be reclosed.

If the relay detects the presence of line and busbar volts and check sync reclosure has been pre-selected then the relay will generate a check sync request prior to any reclosure. If the required check sync conditions are met then the circuit breaker will be reclosed.

The relay can automatically select Check or System synchronise from measurements of the relative phase angles between line and bus voltages. The relay will prevent closure of the circuit breaker if either the phase angle, slip frequency or the voltage magnitude of the incoming or running voltages fall outside prescribed limits.

If the parameters are within the limits the relay will issue an output, which can be used to close the circuit breaker. Both the check and system synchronise functions have independent settings. The relay includes split system detection, which can be used for blocking purposes. Following a system split, closure of the circuit breaker can be performed by either system sync parameters (typically 10°), or by the Close On Zero function, which takes account of the circuit breaker close time.

A serial communications interface provides control of the relay, access to information stored, and integration of the relay into a sub-station control or data acquisition system

1.2 Auto-reclose

Autoreclose is commonly applied to Transmission and Distribution systems. This feature is suitable for both, providing all three phases are opened on the occurrence of a fault, and all three phases are automatically reclosed.

Statistically, the majority of system faults are of a transient nature so that once the fault has been cleared by the protection, the faulted circuit can be re-energised with a likelihood of minimal disturbance to the rest of the system. An important feature of overhead line faults is that since air is the main insulant a significant majority of flash-overs cause no permanent damage to the circuits and about 88% of fault clearances can be quickly followed by the circuits return to service by operation of automatic switching and reclosing facilities.

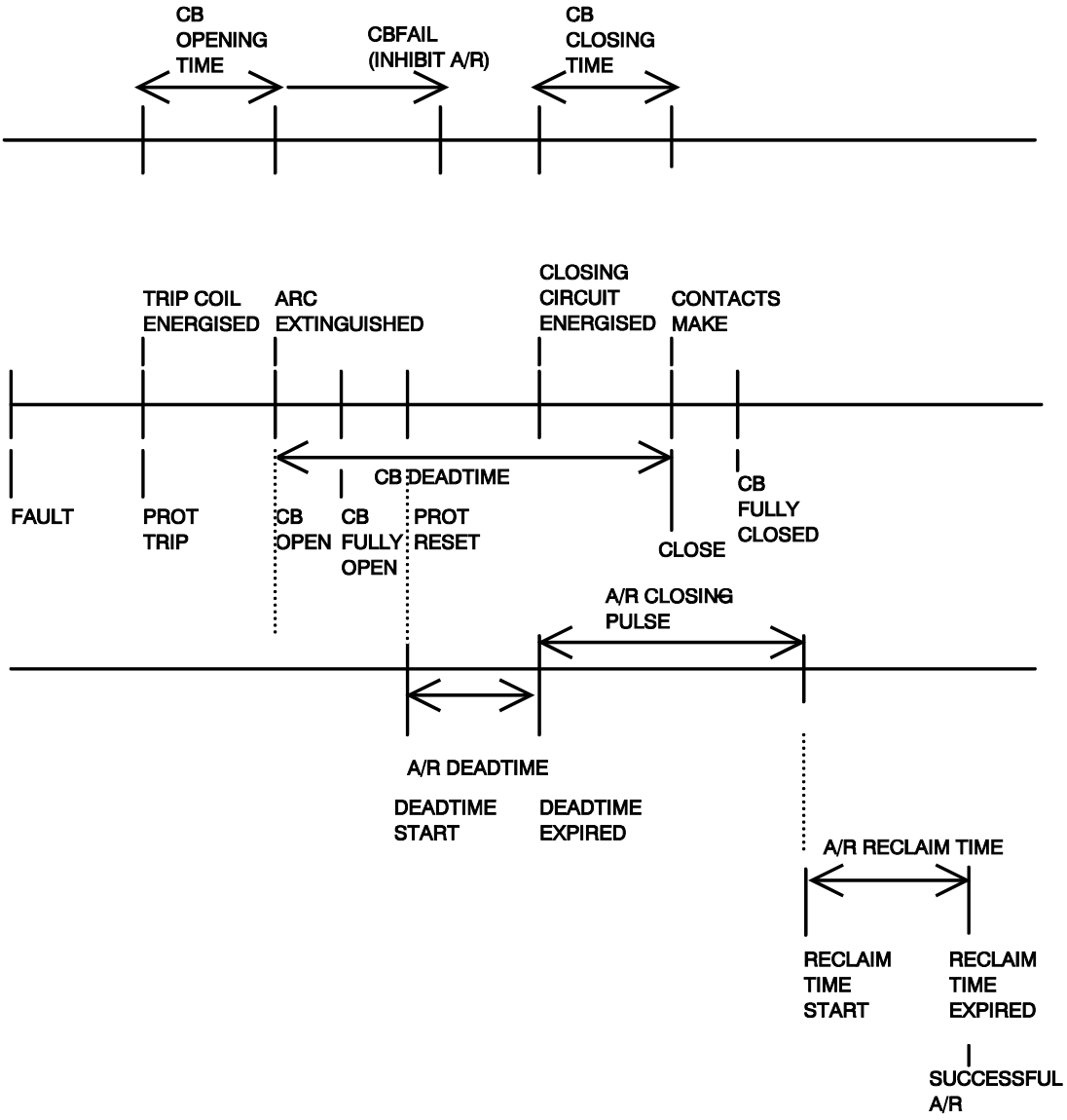

Figure 1 – Autoreclose Sequence

The relay conforms to NGTS 3.15.1, NGTS 3.24.16, TPS 12/10 and the relevant IEC255 standards.

1.3 Check Synchronisation

When two power systems are to be connected together it is essential that the systems either side of the breaker be reasonably in synchronism. Quantities such as the voltage magnitudes, the system frequencies and the relative phase angles of the two systems should be reasonably close before an attempt is made to connect. Closing the circuit breaker without due care and attention to some or all of these quantities can cause undue stresses to the system. The Check and System synchronising function measures single phase voltage quantities at each side of the CB and will only permit a CB close when the two systems fall within the relay setting parameters. Figure 2 shows the basic closing conditions for both the check and system synchronising functions.

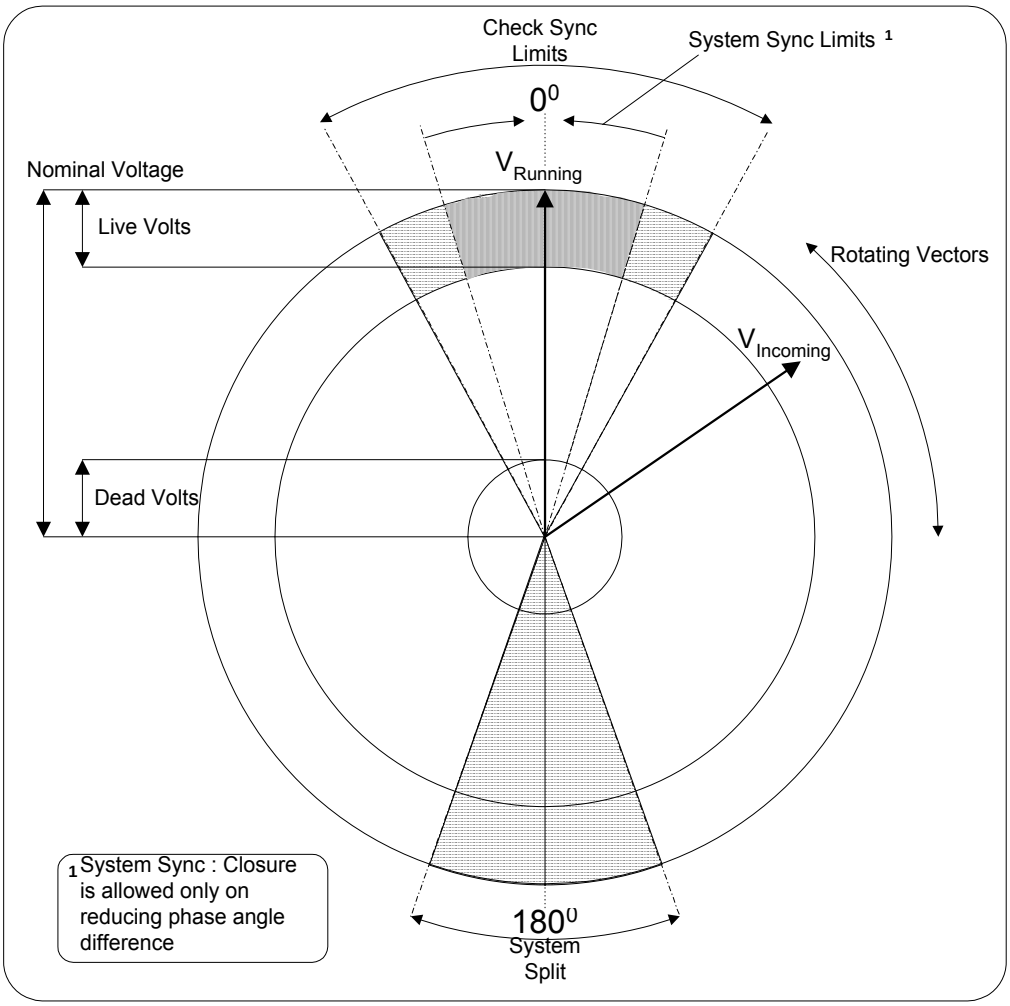

Figure 2 - Check and System Synchronising

The Check and System synchronising function is part of the comprehensive range of Modular II platform based numeric relays. These relays have extensive control functions, which are supplemented by advanced metering, data storage and fibre optic communications. Supervisory and self-monitoring features give added confidence to the user as well as reduced maintenance and down time. A menu-based interface gives user-friendly access to relay settings, meters and operational data.

The relay conforms to NGTS 3.7.7 and the relevant IEC255 standards.

2 HARDWARE DESCRIPTION

2.1 General

The Modular II series of relays are housed in E8, E12 or 19" rack size cases. They consist of standard versions with dedicated I/O: E8 11 input, 13 outputs; E12 27 input, 13 output; these have been chosen to provide the correct number of terminals for common schemes. However additional I/O can be specified, up to 19" case and 27 inputs, 29 outputs.

All Modular II relays share common hardware components and modules. The design for the mechanical arrangement of the relays has been carefully chosen to provide a high level of EMI screening using multi-layer PCB's with ground planes, RFI suppression components and earthed metal screens. The internal arrangement has been divided into noisy and quiet areas in order to improve noise immunity and reduce RFI emissions. The only direct connection from the quiet components to the external environment is via the optical serial communications interface, which is immune to radiated or conducted interference.

2.2 Analogue Inputs

The input stage of the relay measures two basic quantities, V_{Line} and V_{Bus}. The voltage transformer inputs are suitable for phase to neutral connections and the input stage overall measures in the range of 1 Vrms to 200 Vrms. It maintains accuracy within ±1% over the range 5 Vrms to 132 Vrms.

In order to ensure high accuracy true RMS measurements and accurate phase and slip frequency calculations, the voltage signals are sampled at a minimum of 8 samples per cycle for both 50Hz and 60Hz system frequencies. This sampling rate also provides high accuracy and waveform storage records.

2.3 Output Relays

The standard relay has 13 output relays in total, which are capable of handling circuit breaker tripping duty. All 13 relays are fully user configurable and can be programmed to operate from any or all of the control functions. They consist of 3 C/O contacts, and 10 N/O contacts.

In their normal mode of operation output relays remain energised for at least 200msec. If required, however, outputs can be programmed to operate as latching relays. These latched outputs can be reset by either pressing the TEST/RESET button, or by sending an appropriate communications command.

A trip test feature is provided to exercise the output contacts.

2.4 Status Inputs

There are a total of 11 status inputs available in the standard relay. All status inputs are fully user programmable. Each of the status inputs can be programmed to perform one or more of the following functions, (see settings sheet for complete list) :

- Start Autoreclose.
- CB Auxiliary contacts.
- Close the CB.
- Autoreclose control functions.
- Bypass the sync function.
- Inhibit Check or System synchronising.
- Switch to an alternative settings group
- Trigger storage of a waveform record.
- Reset the Lockout condition.

2.5 Self Monitoring

The relay incorporates a number of self-monitoring features. Each of these features can initiate a controlled reset sequence, which can be used to generate an alarm output. In addition, the Protection Healthy LED will give visual indication.

A watchdog timer continuously monitors the microprocessor. The voltage rails are also continuously supervised and the microprocessor is reset if any of the rails falls outside of their working ranges. Any failure is detected in sufficient time so that the micro can be shut down in a safe and controlled manner.

3 CONTROL FUNCTIONS

3.1 Auto-reclose control

Delayed Auto-Reclose (DAR) is initiated by a valid trip relay operation while the associated circuit breaker is in service.

A circuit breaker's service status is determined by its position and (where Check Synchronisation is applied) its voltage references. The circuit breaker is defined as being in service when it is closed and its voltage references are live. The in service status has a drop-off delay of 2 sec, this delay is known as the circuit memory time. This functionality prevents autoreclosing when the line is normally de-energised, or normally open.

The transition from DAR started to initiate deadtime takes place when the circuit breaker's line voltage reference goes dead; and the CB has opened; and the trip relay has reset. If any of these do not occur within the Sequence Fail time the relay will Lockout. This is provided to prevent the DAR being primed indefinitely, or the timer can be switched OFF.

Once a DAR sequence had been initiated, up to 4 unsuccessful recloses (where a closure is followed by a re-trip) may be performed before the DAR feature is locked-out. Each reclosure is preceded by a time delay (dead time) to give transient faults time to clear.

Once a CB has reclosed and remained closed for a specified time period (the Reclaim time), the DAR feature is re-initialised and a Successful Close output issued. A single, common Reclaim time is used.

A count is kept of how many recloses have been performed.

Once lockout has occurred, an alarm is issued and all further Close commands are inhibited for a specified time period (the Minimum Lockout time). A single, common lockout time is used. Lockout can be latched until reset.

There are separate dead-time settings for each of the 4 recloses.

The relay will automatically determine circuit breaker reclosure conditions. These conditions are dead line charge, dead bar charge, dead line and dead bar, unconditional close, or check sync close. If one of these conditions exists and reclosure under this condition has been pre-selected by the user then reclosure will be initiated.

When the dead line or dead bar deadtime has expired and dead line or dead bar conditions are met then the circuit breaker will be reclosed.

If the relay detects the presence of line and busbar volts and check sync reclosure has been pre-selected then the relay shall generate a check sync request prior to any reclosure. If the required check sync conditions are met then the circuit breaker will be reclosed.

Although the Tau500 relay is intended as a DAR plus Check Sync relay it can be applied where no line VT's are fitted. The setting Live Line Check can disable the need for VT's. This allows utilities to standardise on the Tau500 relay for all applications if required.

Certain schemes require switching operations to be exactly coordinated by the deadtime of the autoreclose relay, whilst other scheme layouts can override the deadtime if In Sync conditions are met across the circuit breaker. The relay provides a setting to enable / disable this function, Check Sync During Deadtime.

3.1.1 Protection Trip

The Protection device which trips the CB should be connected to this input to prime and start the autoreclose sequence.

3.1.2 Protection Starter

Where the autoreclose relays are connected to Overcurrent protection or a protection that includes a starter then the starter can be connected to this input. This would indicate that a reclose has closed onto a fault. Multi-shot Autoreclose sequences can be co-ordinated for adjacent relays using this input, i.e. the number of shots can be kept in step.

3.1.3 External A/R Start

An External A/R Start can be received via a status input. A separate protection device would normally initiate this.

An External A/R Start will be treated the same as a Protection A/R Start by the Relay.

3.1.4 Manual Close

An External Close Command can be received via a status input or communications. This would normally be initiated manually. It causes an instantaneous closure, over-riding any DAR sequence then in operation.

An External Close will initiate Line Check. If a fault appears on the line during the Close Pulse or the Reclaim Time with Line Check set, the Protection relay will initiate a Trip and the A/R relay will Lockout. This prevents a CB being repeatedly closed onto a faulted line.

Repeated Manual Closes are avoided by checking for Positive edge triggers. Even if the Manual Close input is constantly energised the relay will only attempt one close. No Close Pulse will be issued when the Manual Close input is reset.

Manual Closing is controlled by the following settings:

Setting	**Range**	**Default**
Manual Close DBC	Enabled / Disabled	Disabled
Manual Close DLC	Enabled / Disabled	Disabled
Manual Close DLDB	Enabled / Disabled	Disabled
Manual Close CS	Enabled / Disabled	Enabled

These combinations allow full selection of the Manual Closing process.

Manual Close resets Lockout, if the conditions that set Lockout have reset i.e. there is no trip or Lockout input present.

Manual Close cannot proceed if there is a Lockout input or Block Reclose input present.

With the Autoreclose function set to Out of Service the Manual Close control is still active.

3.1.5 In/Out Switching

The DAR feature may be switched out by changing the A/R In Service setting by a number of methods. These are either a keypad change from the front panel, or via a communication, or by an A/R OUT status input. A/R OUT status input has priority over A/R IN. If both are raised the relay will be in Out Of Service. Once the relay has been switched Out Of Service the reverse action A/R IN is required before the relay will go back In Service.

3.1.6 Overall Control

The DAR feature may be disabled by a Lockout command or by an external signal applied to a status input (A/R OUT).

If the Lockout command or A/R OUT are received while a DAR operation is in progress, the feature is immediately locked-out. An External A/R IN command can be received via a status input. This will re-enable the module.

If the Lockout command is received while a Manual Close operation is in progress, the feature is immediately locked-out.

The DAR or Manual Close feature may be paused by an external Block signal applied to a status input. This causes the feature to temporarily halt before it issues the next CB close command and can be used, for example, to delay CB closure until the CB pressure has reached an acceptable level. If the Block signal has not been removed before the end of a defined time, the Reclose Block Delay, the relay is locked-out.

A Block Reclose input active within the deadtime resets the deadtime timer.

3.1.7 CB Close Command pulse

The duration of the CB Close Command pulse will be settable to allow a range of CBs to be used. The Close pulse will be terminated if any protection Starter picks-up or a trip occurs. This is to prevent Close and Trip Command pulses existing simultaneously. A Close Onto Fault Output is given if a starter or trip picks-up in the Close Pulse. This can be independently wired to Lockout.

3.1.8 CB Failed To Open and CB Failed to Close

CB Failed To Open and CB Failed to Close features are used to confirm that a CB has not responded correctly to each Trip and Close Command. If a CB fails to operate, the DAR feature can be set to lockout.

3.1.9 CB Closed by Another Device

If, during a dead time period, the Relay detects that the CB has closed (due to an external source) it increments its Reclose count and advances to the next part of the Reclose sequence (begin Reclaim time).

3.1.10 Indications

The relay has a fully programmable output to either output contacts or LEDs, see settings sheet for complete list.

The following are included:

1. A/R In Service
2. A/R Out of Service
3. A/R In Progress
4. Successful A/R
5. Lockout

3.1.11 Trip and Reclose

This is a test function, allowing the operation of the CB to be verified.

The Trip signal should be routed directly to the Circuit Breaker. Once the CB has opened and the Trip and Reclose input is removed the DAR will wait for the first Reclose Delay and then issue a CB Close command.

A Trip and Reclose command will only be accepted if the Relay is in quiescent, or line healthy mode, i.e. no autoreclose sequences are in progress.

During the Trip and Reclose reclosure, Line Check is invoked to ensure that the CB does not repeatedly close onto a faulty line.

3.1.12 CB Close Operations

Additional DAR features are provided as an aid to maintenance.

Two counters ‘Total CB Close Count’ and ‘Delta CB Close Count’ are provided. Each counter has a User settable Alarm count. These counters can be used for Maintenance Alarms. These figures are separately re-settable by either keypad, or status input **Reset Total CB Close** or **Reset Delta CB Close**. Maximum alarm number of 999.

3.1.13 Metering

All Counters and the Status of the DAR operations are displayed in Meters under the instruments Menu.

3.1.14 Dead-time and Reclaim Timing

The Deadtime will start if a Trip has occurred and the CB is Open and the Trip and Starter have then reset and the line has gone dead. Once a trip has occurred if the CB does not open or the Trip does not reset or the starter does not reset then the DAR will Lockout. This could be due to either a CB Fail condition, which would independently notify Lockout, or the Trip or Starter relay contact failing to reset. If the line does not go dead this may signify that the remote end has failed to clear the fault, and the autoreclose will go to Lockout.

A Trip during the deadtime will result in resetting the deadtime and then restarting the deadtime when the trip resets, provided the Sequence Fail Timer has not expired.

The Reclaim time will start once the Close Pulse has timed out and the CB has closed. Lockout is alarmed if the CB is open at the end of the reclaim time.

3.1.15 Lockout

The Lockout state can be reached for a number of reasons. Lockout will occur for the following:

- at the end of the Reclaim time if the CB is in the open position.

- a protection operates during the final Reclaim time.

- if a Close Pulse is given and the CB fails to close.

- The Reclose Lockout status input is active.

- At the end of the Reclose Block Delay due to a persistent Block signal not cleared.

- At the end of the Sync Close Delay due to Synchronism not being achieved.

Once the Lockout condition has been reached, it will be maintained until reset. The following will reset lockout:

- By a Manual Close command.

- By a Reset Lockout signal, provided there is no signal present that will cause Lockout.

- At the end of the Minimum Lockout time if Reset Lockout is selected to be reset by a timer, provided there is no signal present which will cause Lockout.

- if Lockout was entered by an A/R Out signal during an Autoreclose sequence then an A/R In signal must be received before Lockout can reset.

- by the CB Closed, provided there is no signal present which will cause Lockout.

The Lockout condition has a delayed drop-off of 2s.

The Lockout condition will initiate the Lockout indication and alarm contact.

Lockout does not issue a trip signal.

Lockout indicates an abnormal system occurrence, an event that needs to be investigated. When a CB is normally open the A/R relay does not go to Lockout, but using a combination of Trip and CB In Service to start the sequence prevents A/R sequences.

3.1.16 Inter-trip Initiated Autoreclose

Autoreclose can be initiated by an Inter-trip Receive signal. A Persistent Inter-trip timer is provided. If the Persistent Inter-trip timer times-out before the Inter-trip Receive signal has reset then the relay will go to Lockout. Only a one-shot autoreclose sequence is allowed by inter-tripping, any other inter-trips cause the relay to go to Lockout.

3.1.17 Auto Isolation (+)(*)

Facilities are provided to apply auto-isolation to mesh corner or T'd feeders. An auto-isolation scheme is provided. If a trip occurs within the close pulse then auto-isolation is started if selected, the isolator should send Auto-Isolation Complete when the system is isolated, the relay will then continue with its next sequence. If Auto-Isolation Complete is not received before the end of the Auto-Isolation timer then Auto-Isolation Fail is issued, and the relay will go to Lockout.

The Tau 501 provides the input/output to control one isolator. This relay is intended to be applied to T'd feeders or Ring connected feeders where permanently faulted plant can be isolated and the busbar reclosed.

The Tau 502 provides the input/output to control two isolators. This provides applications to Single Switch Mesh, Four Switch Mesh, and Switch and a Half schemes. One relay per circuit breaker is required. Features are provided to adapt the isolation dependent upon whether the feeder is cable or overhead line. This is achieved by allowing isolation prior or after reclose. Functions are provided for Transformer isolation. The Ferro-resonance Suppression F3 scheme is included.

3.1.18 Sequential Isolation

Facilities to inhibit sequential isolation are provided to enable the DAR system to stop sequential isolation if an associated DAR sequence has started. The Inhibit Sequential Isolation output is set when an A/R sequence is started and is reset at the start of the close pulse or at lockout.

3.1.19 Voltage Failure Lockout

Facilities to Lockout Autoreclose and Manual Closing if a VT Failure occurs are provided. There is a setting provided which enables and disables this feature. VT Failure is set for either:

CB Closed and Live Line and Dead Bar >> 2 sec.

Or

CB Closed and Live Bar and Dead Line >> 2 sec.

This function has been provided as a setting due to the uncertainty of isolator positions within the scheme.

3.2 Voltage monitoring elements

3.2.1 Under-voltage detectors

The under-voltage detectors, if enabled, can block a close output command if either the line voltage or the bus voltage is below the under-voltage setting value. Both line and bus have their own independent settings.

3.2.2 Differential voltage detectors

The differential voltage detector, if enabled, can block a close output command if the difference between the line and bus voltages is greater than the differential voltage setting value.

3.2.3 Voltage detectors

Voltage detectors determine the status of the line or bus. If the voltages on either the line or bus are below a set threshold level they can be considered to be ‘dead’. If the voltages are within a setting band around the nominal voltage they are classed as ‘live’. Independent voltage detectors are provided for both line and bus.

If a voltage is in the dead band range then it will be classed as dead until it has reached the live band area. Similarly, if a voltage is live, it continues to be live until it has reached the dead band area. This effectively allows for variable amounts of hysterisis to be set. Figure 3 illustrates the voltage detector operation.

Note: the area between the dead and live zones is not indeterminate. When any voltage is applied to the relay it will ramp up the software RMS algorithm and always pass through the dead zone first.

Although a wide range is provided for live and dead voltage detector levels, these must not overlap. The relay software acts to prevent this from happening to stop unusual alarm outputs and conflicts with internal logic elements. If the user attempts to increment the dead voltage level to the live voltage level, the relay will not accept the setting. Similarly, if the live level is decremented to the dead level, the setting will not be allowed. The two voltages are displayed simultaneously on the LCD display so that this operation is clear to the user.

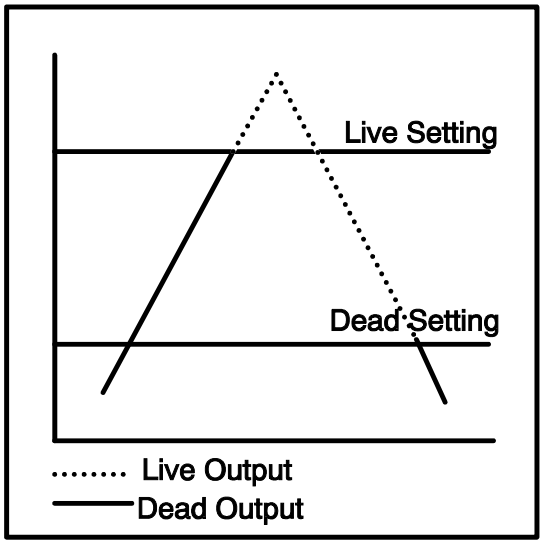

Figure 3 - Voltage Detector Operation

3.2.4 Sync Override Logic

For certain switching operations, a means of bypassing the Check Synchronisation function is provided. This is provided with a separate Sync Override and a separate Manual Sync Override.

3.3 Check Synchronising Mode

For the relay to issue a Check Sync Close the following conditions have to be met :

CS PHASE ANGLE – the phase difference between the line and bus voltages has to be less than the phase angle setting value. Whilst within the limits the phase angle can be increasing or decreasing and the element will still issue a valid close signal.

CS SLIP FREQUENCY, [If ENABLED] – the frequency difference between line and bus has to be less than the slip frequency setting value.

CS SLIP TIMER, [If ENABLED] – the phase angle and voltage blocking features have to be within their parameters for the length of the slip timer setting. If either the phase angle or the voltage elements fall outside of their limits the slip timer is reset. If they subsequently come back in then the slip timer has to time out before an output is given. (This ensures that a close output will not be given if there is a transient disturbance on the system due to e.g. some remote switching operations).

LINE U/V DETECTOR, [If ENABLED] – the line voltage has to be above the line under-voltage setting value and also above 5V for an output to be given.

BUS U/V DETECTOR, [If ENABLED] – the bus voltage has to be above the bus under-voltage setting value and also above 5V for an output to be given.

DIFFERENTIAL VOLTAGE DETECTOR, [If ENABLED] – the difference between the line and bus voltages has to be less than the □V detector setting value for an output to be given.

The relay is always started in Check Synchronising mode of operation. To proceed to System Synchronisation a system split must occur.

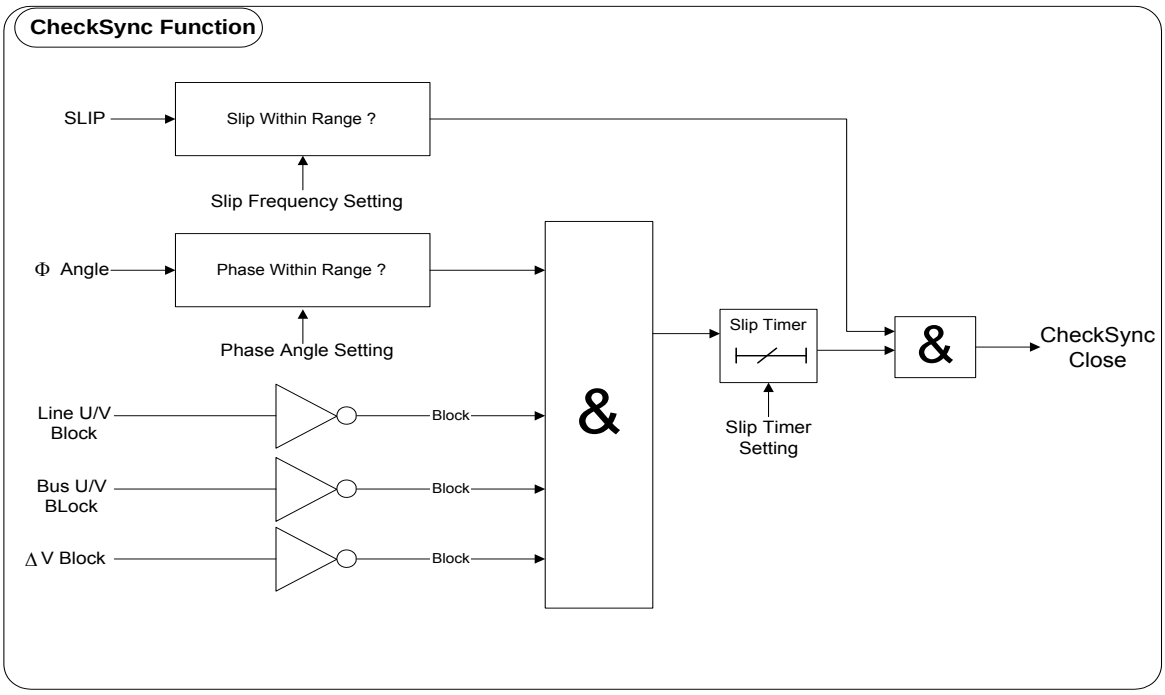

Figure 4 - Check Sync Function

3.3.1 Manual Sync Override Feature

If manual closes are required to be carried out via an operator, these will be performed with Check Synchronisation unless the Manual Sync Override input is energised.

3.4 System Split Detector

A system split occurs where there is a loosely tied or non-parallel circuits on a power system. Under these conditions the frequencies of the voltages either side of the breaker are asynchronous and therefore high phase angle differences can occur as the frequencies slip past each other. The system split detector operates when the phase angle difference exceeds a pre-set value. The setting range for a system split is from 90°-175° step 1°.

Note : the system split setting is effectively an absolute value and therefore a split will occur at the value regardless of the direction of the frequency slip e.g. if an angle of 170° is selected, then starting from 0°, a split will occur at +170° or -170° (effectively +190°).

If a system split occurs during a Check Sync operation the following events occur:

- The Check Sync function is inhibited.
- The System Sync function is started if the setting has been set to A/R Split Action SYSTEM SYNC. If the A/R Split Action has been set to LOCKOUT, then, a system split LED indication is given. The relay will stay in this lockout mode until one of the following methods of resetting it is performed:
  1) The relay is reset from Lockout.
  2) A status input command is received.
  3) An appropriate IEC870 communications command is received.
- An event is recorded.
- The split flag can be mapped to an output relay for alarm indication.
- The system split LED will stay on for a minimum time, or can be latched using non self reset LEDs.

3.5 System Synchronising Mode

For the relay to issue a System Sync Close the following conditions have to be met :

SS PHASE ANGLE – the phase difference between the line and bus voltages has to be less than the phase angle setting value and the phase angle has to be decreasing before the element will issue a valid close signal.

SS SLIP FREQUENCY, [If ENABLED] – the frequency difference between line and bus has to be less than the slip frequency setting value.

SS SLIP TIMER, [If ENABLED] – the phase angle and voltage blocking features have to be within their parameters for the length of the slip timer setting. If either the phase angle or the voltage elements fall outside of their limits the slip timer is reset. If they subsequently come back in then the slip timer has to time out before an output is given. (This ensures that a close output will not be given if there is a transient disturbance on the system due to e.g. some remote switching operations).

LINE U/V DETECTOR, [If ENABLED] – the line voltage has to be above the line under-voltage setting value and also above 5V for an output to be given.

BUS U/V DETECTOR, [If ENABLED] – the bus voltage has to be above the line under-voltage setting value and also above 5V for an output to be given.

DIFFERENTIAL VOLTAGE DETECTOR, [If ENABLED] – the difference between the line and bus voltages has to be less than the □V detector setting value for an output to be given.

The System Synchronising operation of the relay can be started in two different ways. It is set by the 'A/R Split Action' setting which has three parameters: LOCKOUT, SYSTEM SYNC, CLOSE ON ZERO; or 'MC Split Action' setting which also has three parameters: CLOSE ON ZERO, CHECK SYNC, SYSTEM SYNC.

If the 'A/R Split Action' setting is set to:

LOCKOUT: after a split has occurred the relay will go into lockout mode

SYSTEM SYNC: the relay will only start system synchronising after a split condition has occurred. It will issue a System Sync Close automatically if the relevant parameters are met. There is also a **Start System Sync** input which when energised will switch the Check Synchronisation to System Sync.

CLOSE ON ZERO: the relay will only start system synchronising after a split condition has occurred. The relay will issue a close command determined by the CB close time and synchronisation parameters.

If the 'MC Split Action' setting is set to:

CLOSE ON ZERO: the relay will only start system synchronising after a split condition has occurred. The relay will issue a close command determined by the CB close time and synchronisation parameters.

CHECK SYNC: the relay will only start system synchronising after a split condition has occurred. It will issue a Check Sync Close automatically if the relevant parameters are met.

SYSTEM SYNC: the relay will only start system synchronising after a split condition has occurred. It will issue a System Sync Close automatically if the relevant parameters are met. There is also a **Start System Sync** input which when energised will switch the Check Synchronisation to System Sync.

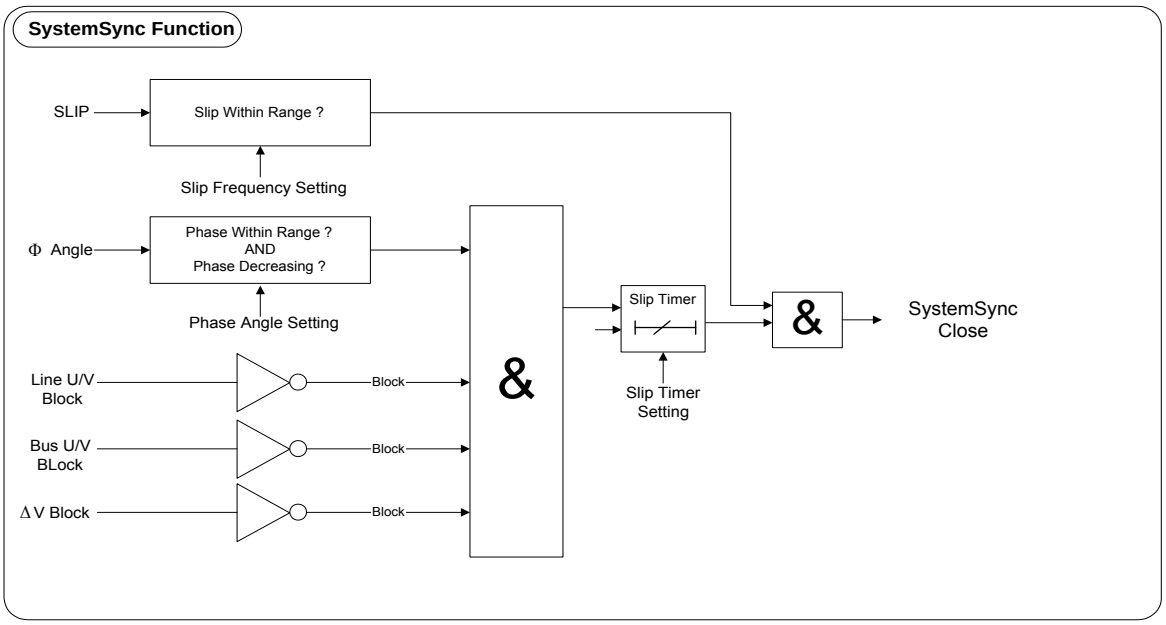

Figure 5 - System Sync Function

4 OTHER FEATURES

4.1 Metering

The metering feature provides real-time data available from the relay fascia in the 'Instruments Mode' or via the communications interface. The following displays are available:

- Phase difference between Line and Bus
- Frequency of both Line and Bus
- Frequency slip between Line and Bus
- RMS volts for both Line and Bus
- Voltage Differential between line and Bus
- Total Number of CB Closes
- Delta Number of CB Closes
- A/R Sequence Shot Number
- A/R State
- Digital input status
- Output relay status
- Date - displayed in DD/MM/YY format
- Time - displayed in HH:MM:SS format

Note: while the instrument displays are updated as often as the software routines can service them, some have their response time deliberately slowed down to enable them to be read.

Figure 6 shows the display menu structure from where the available instruments can be accessed.

4.2 Data Storage

Data records are available in two forms, namely Waveform records and Event records. All records are time and date stamped with a real time clock which maintains the time even when the relay is de-energised [see Note]. Time and date can be set either via the relay fascia using appropriate commands in the System Config menu or

via the communications interface. In the latter case, relays connected in a network can be synchronised by a global time sync command.

Alternatively, synchronising pulses can be received via a special input.

4.2.1 Waveform Records.

The waveform record feature stores analogue and digital information for the voltage inputs, status inputs and output relays. A single phase waveform record for both the line and bus voltages can be stored and this shows the voltages at either side of the breaker at the moment of closing of the switch. The waveform record is 1 second wide with a sampling resolution of 8 samples per cycle. The recorder feature has the ability to store records for the previous ten close operations of the relay. These are labelled 1-10 with 1 being the most recent record.

The waveform recorder can be triggered in the following ways;

- Via the waveform trigger status input signal.
- By the Close Pulse.

4.2.2 Event Records

The event recorder feature allows the time tagging of any change of state (Event) of the relay. As an event occurs the actual event condition is logged as a record along with a time and date stamp to a resolution of 5msec. There is capacity for a maximum of 500 event records to be stored in the relay and when the event buffer is full any new record will over-write the oldest. The following events are logged:

- Change of setting (though not the actual setting change). Also indication of which group of settings is active.
- Change of state of Output Relays.
- Change of state of Status Inputs.
- Change of state of any of the control functions of the relay.
- Change of state of any of the voltage elements.

For a full list of all the events available see Table 1.

4.3 Communications

A fibre optic communication port is provided which gives superior EMC performance. Communication is compatible with the IEC60870-5-103 FT 1.2 transmission and application standards. For communication with the relay via a PC (personal computer) a user-friendly software package, REYDISP EVOLUTION [1], is available to allow transfer of the following:

- Relay Settings
- Waveform Records
- Event Records
- Close Data Records
- Instrument and meters
- Control Functions

Communications operation is described in detail in Section 4 of this manual.

4.4 Multiple Setting Group.

The relay provides four alternative setting groups, making it possible to edit one group while the relay protection algorithms operate using another ‘active’ group. An indication of which group is being viewed is given by the ‘Gn’ character in the top left of the display. The relay can then be switched instantaneously from one group of settings to another to cater for reconfiguration of the power system. Changeover will occur within 25 msec.

A change of group can be achieved either locally at the relay fascia, remotely via a communication interface command or by energisation of a status input. In the case of the latter method, the ‘Sett Grp Select’ setting in the SYSTEM CONFIG MENU is used to configure one of the status inputs to select a settings group. The selected group is then made active if the status input is energised and remains active for as long as the input remains energised.

4.5 Password Feature

The programmable password feature enables the user to enter a 4 character alphanumeric code to secure access to the relay settings. The relay is supplied with the password set to 'NONE', which means that the password feature is not activated. Once a password has been entered then it will be required thereafter to change settings. It can, however, be de-activated by using the password to gain access and by resetting it back to 'NONE'.

As soon as the user attempts to change a setting the password is requested before any setting alterations are allowed. Once the password has been validated, the user is 'logged on' and any further changes can be made without re-entering the password. If no more changes are made within 1 hour then the user will automatically be 'logged off', re-enabling the password feature.

Note that the password validation screen also displays a numerical code. If the password is lost or forgotten, this code can be communicated to Reyrolle Protection by authorised personnel, and the password can be retrieved.

5 USER INTERFACE

The user interface is designed to provide a user-friendly method of entering settings and retrieving data from the relay. The relay fascia includes a 20 character by 2 line, backlit, liquid crystal display (LCD), 16 (E8), or 32 (E12) light emitting diodes (LED) and 5 push buttons. Figure 7 shows the fascia.

5.1 Liquid Crystal Display

The liquid crystal display is used to present settings, instrumentation and close data in a textual format.

To conserve power the display backlighting is turned off if no push buttons are pressed for 5 minutes. After an hour the whole display is de-activated except if the display is left in the 'Instruments Mode' where it remain visible permanently. This is so that instruments such as voltages can be displayed continuously.

5.2 LED Indications

The following indications are provided:

- **Protection Healthy – Green LED.**

This LED is solidly illuminated to indicate that DC volts have been applied to the relay and that the relay is operating correctly. If the internal relay watchdog detects a protection relay unhealthy condition then this LED will continuously flash.

- **Programmable – Red LED.**

An LED MENU is provided to steer any output to an LED. Useful during commissioning to check the autoreclose logic.

5.3 Keypad

Five pushbuttons are used to control the functions of the relay. They are labelled ⇧ ⇩ ⇨ ENTER and CANCEL. Note that the ⇨ button is also labelled TEST/RESET.
When the relay front cover is in place only the ⇩ and ⇨ buttons are accessible. This allows only read access to all the menu displays.

6 SETTINGS AND DISPLAYS

The display menu structure is shown in Figure 6. This diagram shows the three main modes of display, which are the Settings Mode, Instruments Mode and the Fault Data Mode.

On relay start up the user is presented with a default relay identifier,

Settings Defaulted

Which shows that the relay has been set with the standard factory default settings.

Pressing the ⇨ key on this display initiates an LED test. Pressing ⇩ at this display allows access to the three display modes, which are accessed in turn by pressing the ⇨ key.

The Settings Mode contains 11 setting sub-menu's. These hold all of the programmable settings of the relay in separate logical groups. The sub menus are accessed by pressing the ⇨ key. This enters the sub menu and presents a list of all the settings within that sub menu. Pressing the ⇩ key scrolls through the settings until after the last setting in the group the next sub menu is presented. Access to this group is via the same method as

before. If a particular sub menu is not required to be viewed then pressing the ⇩ key will skip past that particular menu and present the next one in the list. Note that all screens can be viewed even if the password is not known. The password only protects against unauthorised changes to settings.

While viewing an editable screen pressing the ENTER key allows the user to change the displayed data. A flashing character(s) will indicate the editable field. Pressing ⇧ or ⇩ scrolls through the available setting values or, pressing the ⇨ key moves right through the edit fields. Note that all settings can be incremented or decremented using the ⇧ or ⇩ keys and they all wraparound so that to go from e.g. a setting minimum value to the maximum value it is quicker to press the ⇩ key, rather than scroll through every setting. Also, to facilitate quicker setting changes an acceleration feature is available which if ⇧ or ⇩ are depressed and held, then the rate of scrolling through the setting values increases.

If CANCEL is pressed during a setting change operation the original setting value is restored and the display is returned to the normal view mode.

If changes are made to the setting value then pressing ENTER disables the flashing character mode and displays the new setting value. This is immediately stored in non-volatile memory.

The next sections give a description of each setting in the relay. The actual setting ranges and default values can be found in the Relay Settings section of this manual.

Note: the relay exhibits a method of locking settings that are not relevant to a particular customer's scheme, which is known as setting dependencies. Some settings are dependant on others and if a function is not enabled then associated settings can not be used e.g. example if System Sync is not required then all System Sync settings are locked.

There are many examples of setting dependencies and care must be taken to ensure a function is enabled before looking for other associated settings that may be hidden. The following list of settings shows all possible settings that can be displayed.

6.1 System Config Menu

Active Group - this setting selects the settings group that the relay will act upon.

View/Edit Group – this setting selects the settings group to be displayed on the LCD.

Calendar – Set Date – this setting sets the current date in DD/MM/YY format.

Clock – Set Time – this setting sets the time in HH:MM:SS format. Note that only the hours and minutes can be set. The seconds default to zero on pressing the ENTER key.

Switched Group – this setting sets the group number that will be selected when the Switch Group Status Input is active.

Change Password – this setting allows a 4 character alphanumeric code to be entered as the password. Note that the display shows a password dependant encrypted code on the second line of the LCD.

Set Identifier – this setting allows a 16-character alphanumeric code or unique identification reference to be entered for the relay.

6.2 DAR Menu

A/R In Service – this setting switches the Autoreclose in or out.

Gn Dead Bar Charge – this setting determines the autoreclosing action.

Gn Dead Line Charge – this setting determines the autoreclosing action.

Gn Dead Line & Dead Bar Close – this setting determines the autoreclosing action.

Gn Check Sync Close – this setting determines the autoreclosing action.

Gn Unconditional Close – this setting determines the autoreclosing action.

Gn Manual Close DBC – this setting determines the Manual Closing action. Closing will occur if there is a Dead Bar and Live Line.

Gn Manual Close DLC – this setting determines the Manual Closing action. Closing will occur if there is a Dead Line and Live Bar.

Gn Manual Close DLDB – this setting determines the Manual Closing action. Closing will occur if there is a Dead Bar and Dead Line.

Gn Manual Close CS – this setting determines the Manual Closing action. Closing will occur if the system is within the Synchronisation limits.

Gn Number of Shots – this setting sets the number of autoreclose closes in a sequence.

Gn First Deadtime – this setting sets the first shot three pole deadtime time delay.

Gn Second Deadtime – this setting sets the second shot three pole deadtime time delay

Gn Third Deadtime – this setting sets the third shot three pole deadtime time delay.

Gn Fourth Deadtime – this setting sets the fourth shot three pole deadtime time delay.

Gn Live Line Check – this setting determines whether a line VT is fitted.

Gn Check Sync During Deadtime – this setting allows the deadtime to be over-ridden if an In Synch signal is present.

Gn VT Fail Lockout – this setting determines whether Lockout is set if a VT Fail occurs.

Gn CB Close Pulse – this setting sets the close pulse duration.

Gn Reclaim Time – this setting sets the reclaim time.

Gn Dead Line Charge Delay – this setting adds an additional delay to the deadtime when the Dead Line Charge conditions are met.

Gn Dead Bar Charge Delay – this setting adds an additional delay to the deadtime when the Dead Bar Charge conditions are met.

Gn Reclose Blocked Delay – this setting sets the allowable time a Block may be active before the Autoreclose sequence is locked out.

Gn Sync Close Delay – this setting sets the allowable time the Autoreclose sequence will wait for an In Sync signal before the sequence is locked out.

Gn Sequence Fail Timer – this setting sets the time to lockout if all the DAR start signals are not received. These are Trip Reset, CB Open and Dead Line.

Gn CB Fail To Open Delay – this setting sets the CB Fail to Open time delay.

Gn Persistent Intertrip – this setting sets the time to lockout if the Intertrip Receive input does not reset.

Gn AutoIsolation Action (+)(*) – this setting sets whether AutoIsolation can occur.

Gn AutoIsolation Timer (+)(*) – this setting sets the time delay which the AutoIsolation will wait for the AutoIsolation Complete signal before going to Lockout.

Gn Minimum LO Timer – this setting sets the minimum Lockout timer.

Gn Reset LO By Timer – this setting determines whether Lockout can be reset by the time delay setting, or by some other means i.e. a Reset LO status input.

Gn Total CB Close Counter – this setting sets the count at which an alarm will be given if that number of closes occur.

Gn Delta CB Close Counter – this setting sets the count at which an alarm will be given if that number of closes occur.

Gn Reset Total CB Count – this setting resets the count and alarm.

Gn Reset Delta CB Count – this setting resets the count and alarm.

6.3 CB Pole Discrepancy Menu

Gn Pole Discrepancy Time – this setting sets the time delay before Pole Discrepancy is issued.

6.4 Sync Menu

Gn Check Sync Vnom – this setting sets the nominal voltage used at the measuring Voltage Transformer.

Gn Live Bus/Dead Bus – this setting sets the voltage levels for Live and Dead Bus.

Gn Live Line/Dead Line – this setting sets the voltage levels for Live and Dead Line.

Gn Bus Undervolts – this setting sets the Bus undervoltage detector.

Gn Line Undervolts – this setting sets the Line undervoltage detector.

Gn Voltage Differential – this setting sets the differential voltage allowed between Bus and Line.

Gn Split Angle – this setting sets the angle at which a system split will occur.

Gn MC Split Action – this setting sets the action that will occur if a Manual Close is given after a system split.

Gn A/R Split Action – this setting sets the action that will occur if a system split occurs during an autoreclose sequence.

Gn Check Sync Angle – this setting sets the phase angle limits for the Check Sync element.

Gn Check Sync Slip – this setting sets the Check Sync Slip frequency.

Gn Check Sync Timer – this setting sets the Check Sync time delay.

Gn System Sync Angle – this setting sets the phase angle limits for the System Sync element.

Gn SS and COZ Slip Frequency – this setting sets the slip frequency for the System Sync and Close On Zero functions

Gn System Sync Timer – this setting sets the System Sync time delay.

Gn CB Close Time – this setting sets the CB Close time required for the Close On Zero function.

6.5 Status Input Menu

Manual Close - this setting sets the status input(s) which, when energised, starts the Manual Close operation of the relay.

Block Reclose - this setting sets the status input(s) which, when energised, Blocks Reclose during the autoreclose sequence.

A/R Out - this setting sets the status input(s) which, when energised, switches the Autoreclose Out. This input has priority over A/R In.

A/R In - this setting sets the status input(s) which, when energised, switches the Autoreclose In, unless the A/R Out is raised.

Trip - this setting sets the status input(s) which, when energised, starts the autoreclose cycle. It is required in conjunction with the state of the Circuit Breaker and Line.

Starter - this setting sets the status input(s) which, when energised, monitors the Starter output from the Protection relay. It is used to keep Autoreclose relays connected in series on a Distribution Feeder in sequence by counting the number of trip and closes on a line. If there is no starter available then this input is not connected.

Reclose Lockout - this setting sets the status input(s) which, when energised, causes the relay to go to Lockout.

Trip And Reclose - this setting sets the status input(s) which, when energised, cause a trip and reclose to occur. It is intended as a test input and cannot be used whilst an autoreclose sequence is in progress.

External A/R Start - this setting sets the status input(s) which, when energised, starts the operation of the relay. Provided as an alternative to the Trip input.

Reset Lockout - this setting sets the status input(s) which, when energised, will reset a latched lockout condition if there is no signal still present to cause the relay to be still in Lockout.

Sync Override - this setting sets the status input(s) which, when energised, will allow a Close Pulse to be issued irrelevant of the condition of the Check Sync function.

Manual Sync Override - this setting sets the status input(s) which, when energised, will allow a Close Pulse to be issued when it has been initiated by Manual Closing, irrelevant of the condition of the Check Sync function.

Start System Sync - this setting sets the status input(s) which, when energised, puts the Check Synchronisation function into the System Sync mode.

Intertrip Receive - this setting sets the status input(s) which, when energised, starts the autoreclose cycle. The Intertrip Receive is required to reset within the Persistent Intertrip time. Only a one shot Intertrip initiated autoreclose sequence is allowed.

AutoIsol Complete (+)(*) - this setting sets the status input(s) which, when energised, indicate that AutoIsolation has completed and the sequence may continue.

CB Phase A Closed - this setting sets the status input(s) which, when energised, indicates the condition of the CB Auxiliary contacts.

CB Phase B Closed - this setting sets the status input(s) which, when energised, indicates the condition of the CB Auxiliary contacts.

CB Phase C Closed - this setting sets the status input(s) which, when energised, indicates the condition of the CB Auxiliary contacts.

CB Phase A Open - this setting sets the status input(s) which, when energised, indicates the condition of the CB Auxiliary contacts.

CB Phase B Open - this setting sets the status input(s) which, when energised, indicates the condition of the CB Auxiliary contacts.

CB Phase C Open - this setting sets the status input(s) which, when energised, indicates the condition of the CB Auxiliary contacts.

Input 1..16 - this setting sets the status input(s) which, when energised, provide a time delayed output.

Switch Groups - this setting sets the status input(s) which, when energised, switches the active Group to the number programmed in Switched Group in the SYSTEM CONFIG MENU.

Trigger Storage - this setting sets the status input(s) which, when energised, triggers the data storage.

Reset Total CB Close - this setting sets the status input(s) which, when energised, will cause the counter Total CB Close to reset.

Reset Delta CB Close - this setting sets the status input(s) which, when energised, will cause the counter Delta CB Close to reset.

Inverted Inputs - this setting sets the status input(s) which, when energised, will cause the selected inputs to invert. This is of special importance where series connected N/C contacts are used to drive status input logic.

6.6 Reylogic Control Menu

General Logic – this setting allows any Reylogic to be enabled/disabled.

6.7 Reylogic Elements Menu

Gn Input 1..8 Timer PU – this setting sets the pick up time delay associated with that input.

Gn Input 1..8 Timer DO – this setting sets the drop off time delay associated with that input.

6.8 Output Relay Menu

Close Pulse – this setting sets the output relay(s) which is operated when a Close Pulse is given.

Lockout – this setting sets the output relay(s) which is operated when Lockout is given.

A/R Out Of Service – this setting sets the output relay(s) which is operated when A/R Out of Service is given.

A/R In Service – this setting sets the output relay(s) which is operated when A/R In Service is given.

A/R In Progress – this setting sets the output relay(s) which is operated when A/R In Progress is given.

Manual Close – this setting sets the output relay(s) which is operated when a Manual Close is given.

Line Check – this setting sets the output relay(s) which is operated when a Line Check is commenced.

Live Line – this setting sets the output relay(s) which is operated when a Live Line is detected.

Live Bus – this setting sets the output relay(s) which is operated when a Live Bus is detected.

In Sync – this setting sets the output relay(s) which is operated when an In Sync is given.

CB Open – this setting sets the output relay(s) which is operated when a CB Open is detected.

CB Closed – this setting sets the output relay(s) which is operated when a CB Closed is detected.

CB Failed To Close – this setting sets the output relay(s) which is operated when the CB Fails To Close within the close pulse time.

System Split – this setting sets the output relay(s) which is operated when a System Split occurs.

Manual Close Fail – this setting sets the output relay(s) which is operated when the CB Fails To Close during a Manual Close sequence.

Successful Close – this setting sets the output relay(s) which is operated when the autoreclose sequence has successfully completed.

CB Failed To Open – this setting sets the output relay(s) which is operated when the CB has failed to open within the allocated time.

Block Reclose Alarm – this setting sets the output relay(s) which is operated when a Block Reclose input is active.

Check Sync Start – this setting sets the output relay(s) which is operated when the required Check Sync relay is requested to start.

Sync In Progress Flag – this setting sets the output relay(s) which is operated when the relay is waiting for In Sync.

Dead Line Close Flag – this setting sets the output relay(s) which is operated when the relay has closed due to Dead Line closing.

Dead Bus Close Flag – this setting sets the output relay(s) which is operated when the relay has closed due to Dead Bus closing.

Close Onto Fault – this setting sets the output relay(s) which is operated when a trip has occurred during the close pulse.

Delta CB Count Alarm – this setting sets the output relay(s) which is operated when the count exceeds it's setting.

Total CB Count Alarm – this setting sets the output relay(s) which is operated when the count exceeds it's setting.

VT Failure – this setting sets the output relay(s) which is operated when either the line or bus VT has failed.

Bus VT Failure – this setting sets the output relay(s) which is operated when the Bus VT has failed.

Line VT Failure – this setting sets the output relay(s) which is operated when the Line VT has failed.

CB Pole Discrepancy – this setting sets the output relay(s) which is operated when a CB Pole Discrepancy condition exists.

CB Not In Service Alarm – this setting sets the output relay(s) which is operated when the CB is not in service.

CB Memory – this setting sets the output relay(s) which is operated when the CB is closed and the Line is live with a 2 sec delayed drop-off.

A/R Not Allowed – this setting sets the output relay(s) which is operated to indicate an alarm condition that a trip has tried to initiate an autoreclose sequence but the CB was not in service.

Inhibit Seq Isolation – this setting sets the output relay(s) which is operated to stop sequential isolation. (N/O contact).

Persistent Intertrip – this setting sets the output relay(s) which is operated when a Persistent Intertrip is given.

AutoIsolation Fail (+)(*) – this setting sets the output relay(s) which is operated when an AutoIsolation Fail is given.

AutoIsolation Completed (+)(*) – this setting sets the output relay(s) which is operated when an AutoIsolation Completed is given.

AutoIsolation Initiate (+)(*) – this setting sets the output relay(s) which is operated when an AutoIsolation is required to be initiated.

Input1..16Operated – this setting sets the output relay(s) which are operated when the associated input(s) are operated.

ExtGroupSwitched – this setting sets the output relay(s) which is operated when the Group has changed.

New Data Stored – this setting sets the output relay(s) which is operated when new data has been stored.

Inhibit Seq Isol OP - this setting sets the output relay(s) which is operated to stop sequential isolation. (N/C contact).

Hand Reset Outputs – this setting sets the output relay(s) which are required to be latched until reset.

Protection Healthy – this setting sets the output relay(s) which is operated when Protection Healthy is given. This acts as a normally energised C/O contact.

6.9 LED Menu

The LED menu is a duplication of the output relay menu, allowing all outputs to be steered to an LED.

6.10 Data Storage Menu

Waveform Pre-Trigger – this setting sets the percentage of pre-trigger that is required.

6.11 Communications Menu

Station Address – this setting sets the required address of a particular relay within a network.

IEC870 on port – this setting can direct to communications to either of the relay comms ports.

COM1 Comms Baud Rate – this setting sets the required communications Baud rate.

COM1 Parity – this setting sets the required communications parity bit.

COM1 Line Idle – this setting sets the required communications line idle sense.

COM1 Data Echo – this setting enables data echo, which is necessary for use with relays connected in a ring.

COM2 Comms Baud Rate – this setting sets the required communications Baud rate.

COM2 Parity – this setting sets the required communications parity bit.

COM2 Line Idle – this setting sets the required communications line idle sense.

COM2 Data Echo – this setting enables data echo, which is necessary for use with relays connected in a ring.

COM2 Direction – this setting switches COM 2 to either front or rear ports.

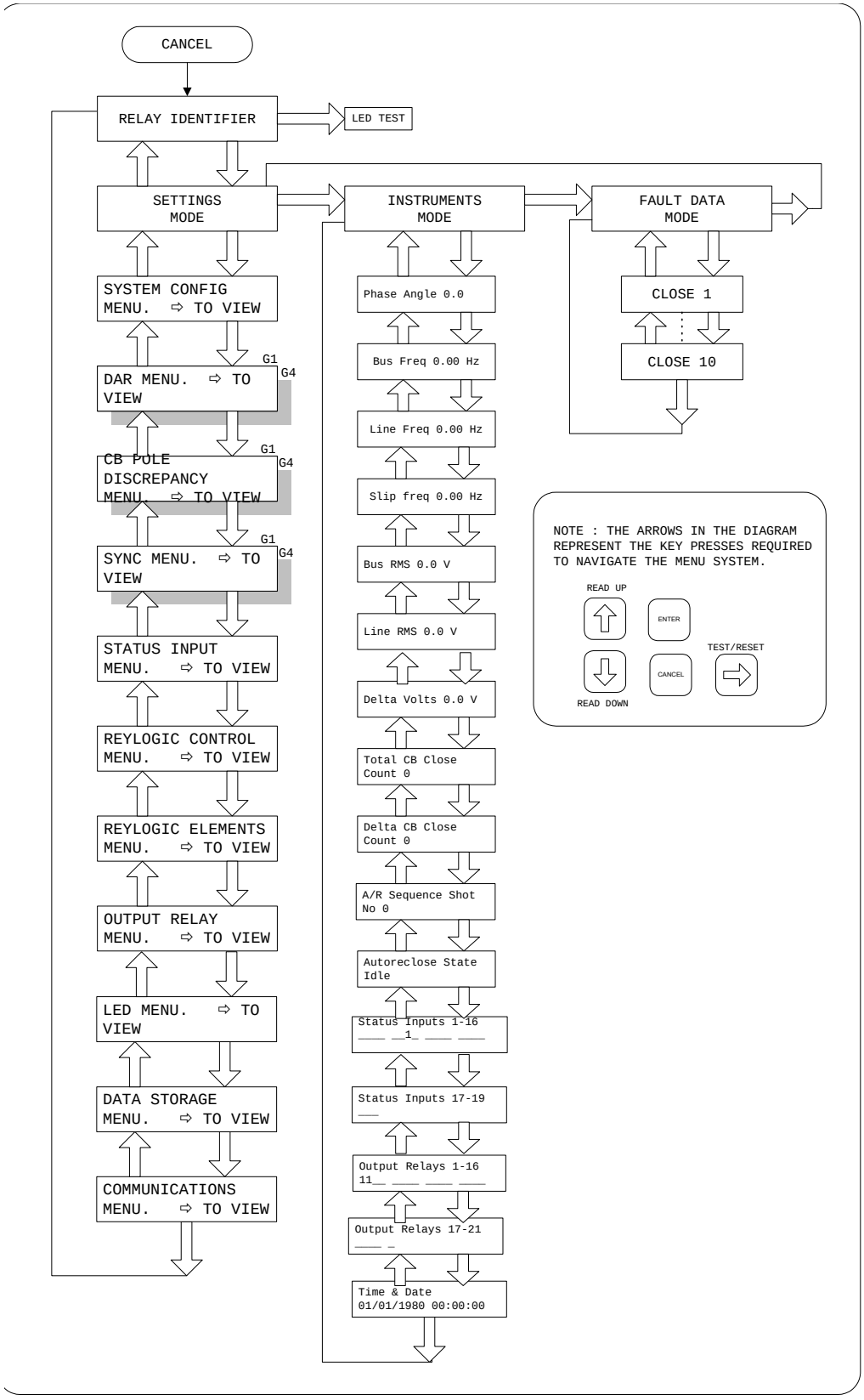

Figure 6 - Display Menu Structure

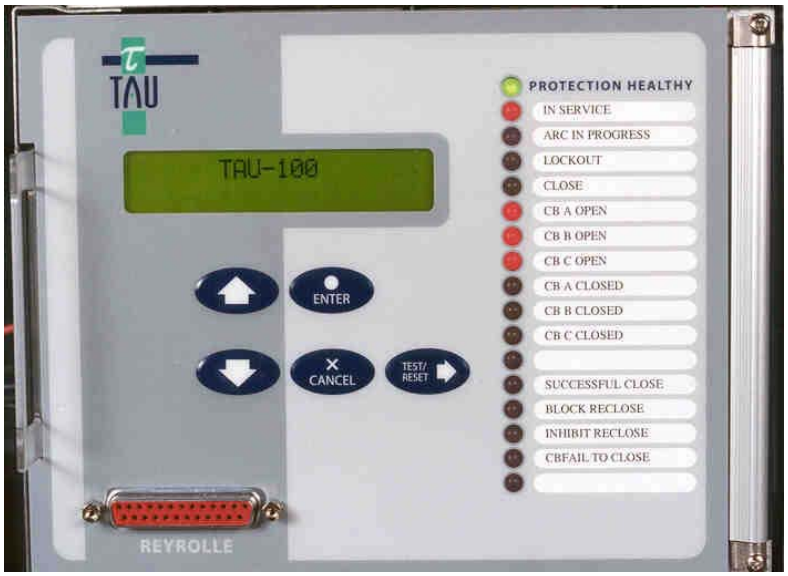

Figure 7 - Tau E8 Relay Fascia

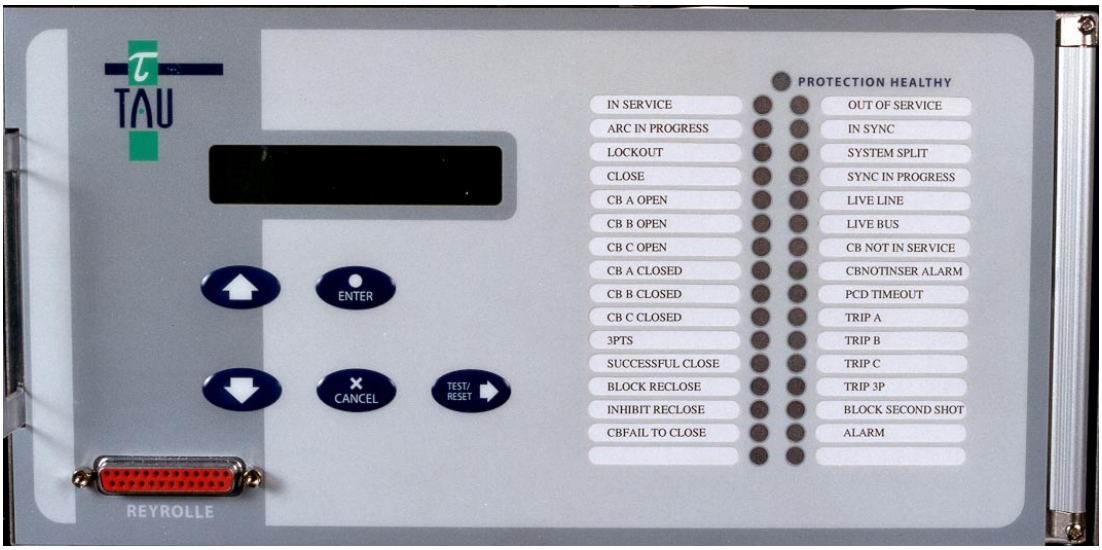

Figure 8 – Tau E12 Relay Fascia

Event Table

Event Description	Event Code	GI	Frame Type
Data lost	0	6	1
Reset FCB	2	6	5
Reset CU	3	6	5
Start/Restart	4	6	5
Power On	5	6	5
Auto-reclose active	16	6	1
Teleprotection Active	17	6	1
Protection Active	18		
LEDs reset	19	6	1
Monitor Direction Reset	20		
Trip Test	21		
Settings Changed	22	4	1
Setting G1 selected	23	4	1
Setting G2 selected	24	4	1
Setting G3 selected	25	4	1
Setting G4 selected	26	4	1
Input 1	27	4	1
Input 2	28	4	1
Input 3	29	4	1
Input 4	30	4	1
CB on by AR	128	6	1
CB “on” by long time AR	129	6	1
Reclose blocked	130	6	1
Lockout	131	6	1
CBFailToClose	132	6	1
CBFailToOpen	133	6	1
CloseOntoFault	134	6	1
VTFailAlarm	135	6	1
CBCloseCounterAlarm	136	6	1
SyncInProgress	137	6	1
SyncOverride	138	6	1
DeadLineClose	139	6	1
DeadBusClose	140	6	1
SystemSplit	141	6	1
CheckSyncStart	142	6	1
Input 5	165	4	1
Input 6	166	4	1
Input 7	167	4	1
Input 8	168	4	1
Input 9	169	4	1
Input 10	170	4	1
Input 11	171	4	1
Input 12	172	4	1
Input 13	173	4	1
Input 14	174	4	1
Input 15	175	4	1
Input 16	176	4	1
Input 17	177	4	1
Input 18	178	4	1
Input 19	179	4	1
Input 20	180	4	1
Input 21	181	4	1
Input 22	182	4	1
Input 23	183	4	1
Input 24	184	4	1
Input 25	185	4	1
Input 26	186	4	1
Input 27	187	4	1
Input 28	188	4	1
Input 29	189	4	1
Input 30	190	4	1
Input 31	191	4	1
Input 32	192	4	1
Output 1	193	4	1
Output 2	194	4	1
Output 3	195	4	1
Output 4	196	4	1
Output 5	197	4	1
Output 6	198	4	1
Output 7	199	4	1
Output 8	200	4	1
Output 9	201	4	1
Output 10	202	4	1
Output 11	203	4	1
Output 12	204	4	1
Output 13	205	4	1
Output 14	206	4	1
Output 15	207	4	1
Output 16	208	4	1
Output 17	209	4	1
Output 18	210	4	1
Output 19	211	4	1
Output 20	212	4	1
Output 21	213	4	1
Output 22	214	4	1
Output 23	215	4	1
Output 24	216	4	1
Output 25	217	4	1
Output 26	218	4	1
Output 27	219	4	1
Output 28	220	4	1

Output 29	221	4	1
Output 30	222	4	1
Output 31	223	4	1
Output 32	224	4	1
Successful Close	225	6	1
External AR Start	226	6	1
Manual Close	227	6	1
Reset lockout	228	6	1
AR Out	229	6	1
AR In	230	6	1
In Sync	231	4	1
Live Bus	232	4	1
Live Line	233	4	1
Trip	234	6	1
Starter	235	6	1
Reclose Lockout	236	6	1
Trip And Reclose Input	237	6	1
CB PoleDiscrepancy	238	6	1
Reclaim	239	6	1
Ext Group Change	240	6	1
Ext Group Back	241	6	1
Manual Sync Override	242	6	1
Intertrip Receive	243	6	1
AutoIsolation Complete I/P	244	6	1
Inhibit Seq Isolation	245	6	1
Persistent Intertrip	246	6	1
AutoIsolation Fail	247	6	1
AutoIsolation Completed	248	6	1
AutoIsolation Initiate	249	6	1
CB ‘on’ by MC	250	6	1
A/R In Progress	251	6	1
Total CB Count Reset	252	6	1
Delta CB Count Reset	253	6	1

KEY :

Event Code – is the allocated number given to a particular event.

GI – If the relay is interrogated for its events using the general interrogation (GI) command then only those indicated with the 4 will respond.

Frame Type – a ‘1’ indicates that the event is time tagged. A ‘5’ indicates an event which is generated only on power-on or reset of the relay.

Table 1 - Tau Event Codes