7SG26 Tau

Auto Re-close

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 Single Pole / Three Pole Autoreclose Tau relay range.

The Tau Auto-reclose relay range consists of Two-shot Single Pole / Three Pole Autoreclose relays and Multi-shot Delayed Autoreclose relays, both with or without integral Check Synchronisation. The Multi-shot Delayed Autoreclose relays are described in a separate manual.

Tau 100 Two Shot Single/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/Three Pole Recloser using internal Check Synchronisation. Standard version in an E12 case with 27 input, 13 output and 32 programmable LEDs.

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, Check Synchronisation.

The autoreclose function has been designed to only allow reclosing if system conditions dictate. A number of features are included to prevent reclosing: CB In Service, Inhibit Close, Block Reclose; the deadtimes are only started if certain criteria are met i.e. the trip has reset and the CB has opened and the line has gone dead; The close pulse will only be issued if the system synchronisation conditions are met and the CB is open and there are no trips present. The relay errs on not closing. All of this logic is internal to the relay. Because of the complexity of autoreclose schemes and the possibility of setting the relay incorrectly the user should be familiar with all aspects of the relay before energising any equipment.

Autoreclose inputs are fully programmable via matrixes: Block Reclose, Reclose Lockout, Manual Close, A/R In, A/R Out, Reset Lockout etc. 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.

The Autoreclose control relay is connected to the Circuit Breaker, Protection relays and associated plant. The interconnection of this equipment allows for the autoreclose relay to issue a number of alarms indicating system conditions and possible problems:

- the state of the CB is monitored for CB Open, CB Closed and CB Indeterminate; per phase signals are provided.
- CB Single Pole Open and CB Three Pole Open outputs which can be used as inhibits i.e. Power Swing Blocking, Zone 1 Extension Inhibit.
- CB Pole Discrepancy protection.
- VT Alarms for Line and Bus side VTs.
- CB Counter Alarms.
- CB Failed To Close.
- CB Failed To Open.
- Close Onto Fault.
- Slow CB.

- Start Autoreclose flexibility, either Trip, Trip and CB Open, or Trip Reset.

- 3PTS logic connection provided to instruct protection to issue trips as 3P.

- CB In Service and CB Memory prevent unwanted autorecloses if the CB is open or normally de-energised. Autoreclose is only allowed to proceed if the CB was in a closed position.

- Flexible latched or self reset Lockout.

- Flexible connection of the CB Auxiliary switches, can be of type a, b or a&b.

- Switching A/R In/Out can be from switches, communications, keypad or telecontrol pulses.

- Close Mode Selection determining the autoreclose sequence employed may be changed by a selector switch.

The relay will automatically determine circuit breaker reclosure conditions. These conditions are dead line close, dead bar 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 relay has been designed for application to Transmission systems where single pole and three pole tripping is applied.

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.

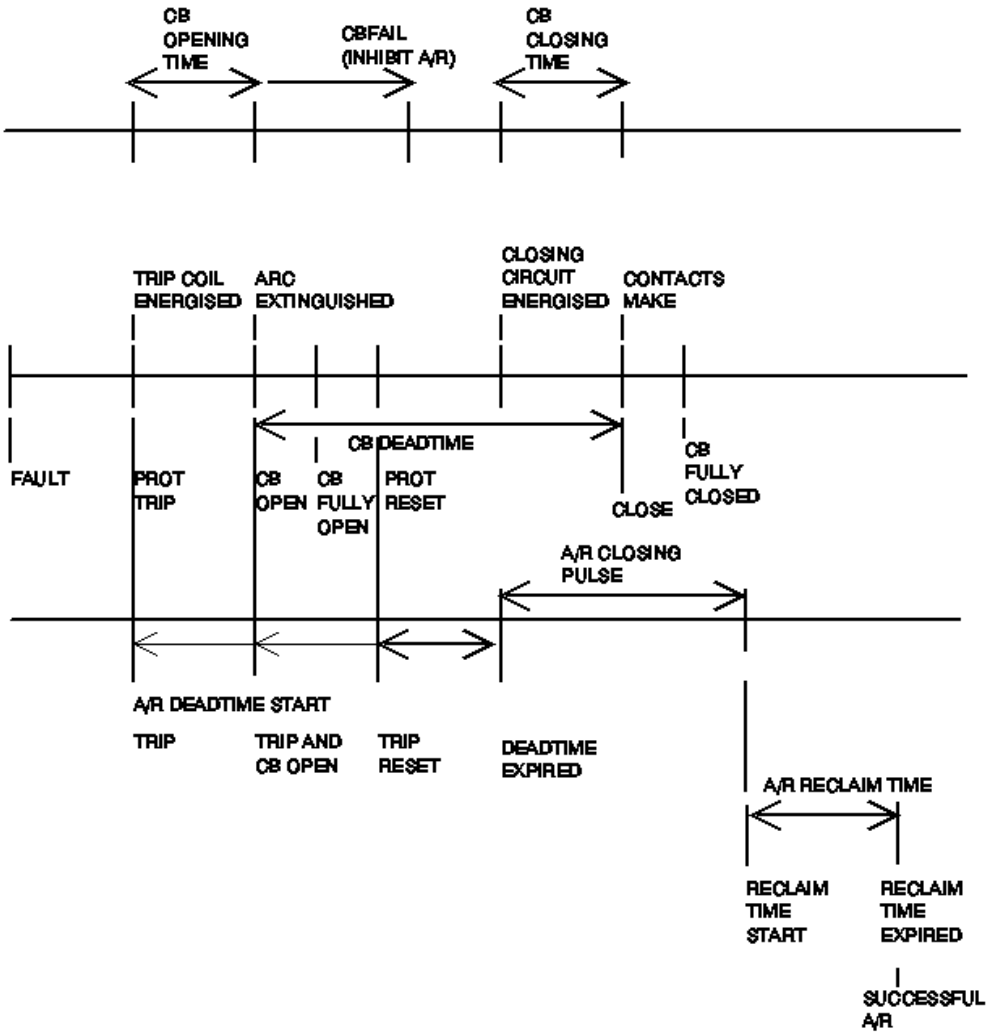


Figure 1 – Autoreclose Sequence

The relay conforms to NGTS 3.15.1 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.

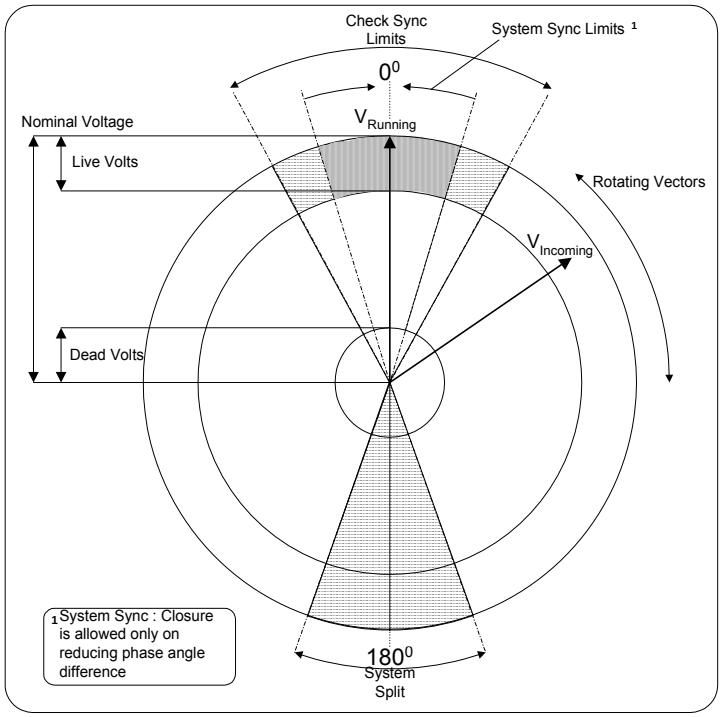


Figure 2 - Check and System Synchronising

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:

Tau 100 (1P/3P):

E8 27 input, 13 output; E12 27 input, 29 output; these have been chosen to provide the correct number of terminals for common schemes.

Tau 200 (1P/3P+CS):

E8 11 input, 13 output; E12 27 input, 13 output; 19” 27 input, 29 output; these have been chosen to provide the correct number of terminals for common schemes

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 quality waveform storage records.

2.3 Output Relays

The standard relay has 13 output relays in total, which are capable of handling 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.

2.4 Status Inputs

There are a total of 27 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.
- 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 AUTORECLOSE CONTROL FUNCTIONS

3.1 Auto-reclose

Auto-Reclose (A/R) 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 'A/R started' to 'initiate deadtime' is programmable. It can take place when the trip signal is received; or when the trip signal is active and the CB has opened (the A/R deadtime will then mimic the CB deadtime); or when the trip has occurred and the CB has opened and then the trip has reset. If any of these do not occur within the Sequence Fail time the relay will Lockout. This is provided to prevent the A/R being primed indefinitely, or the Sequence Fail timer can be switched OFF.

Once an A/R sequence has been initiated, up to 2 unsuccessful recloses (where a closure is followed by a re-trip) may be performed before the A/R feature is locked-out. Each reclosure is proceeded 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 A/R 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 per phase have been performed.

Once lockout has occurred, an alarm is issued and all further External 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 recloses.

The relay will automatically determine circuit breaker reclosure conditions. These conditions are dead line close, dead bar 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.

A number of settings allow a very flexible application of the relay. The relay can be applied to any combination of CB auxiliary contacts depending upon how many contacts are available, these can be type 'a', 'b' or both 'a' and 'b'.

The Close Mode Selection setting can be selected by status inputs thereby allowing remote change to the type of allowable autoreclose sequences. Either telecontrol, or panel mounted switches, or communications, or relay front panel keypad can be used to change this setting.

3.1.1 Protection Trips

The Protection device which trips the CB should be connected to the trip inputs to prime and start the autoreclose sequence. Separate phase trip inputs are provided together with a three phase trip input. The relay internally determines what type of fault has occurred: Phase to earth, Phase to Phase, Three Phase.

3.1.2 Developing Faults

The relay automatically determines developing faults and whether these can initiate an autoreclose sequence.

A setting is provided to inhibit the three pole deadtime by faults involving all three poles, if required. The relay can be programmed to allow different types of fault to initiate different types of autoreclose sequence. This can enhance the reliability of the reclose sequence. In systems where single pole tripping is employed the occurrence of a three phase fault can indicate severe problems and reclose can be disabled if required. For example:

Single Pole Trips initiate 1P Autoreclose.

Phase to Phase Faults initiate 3P Autoreclose.

Three Pole Faults initiate either 3P Autoreclose or Lockout.

A single pole trip which initiates a single pole deadtime and then develops into a trip involving more phases or more than one CB opens will either initiate a three pole deadtime if allowed or lockout.

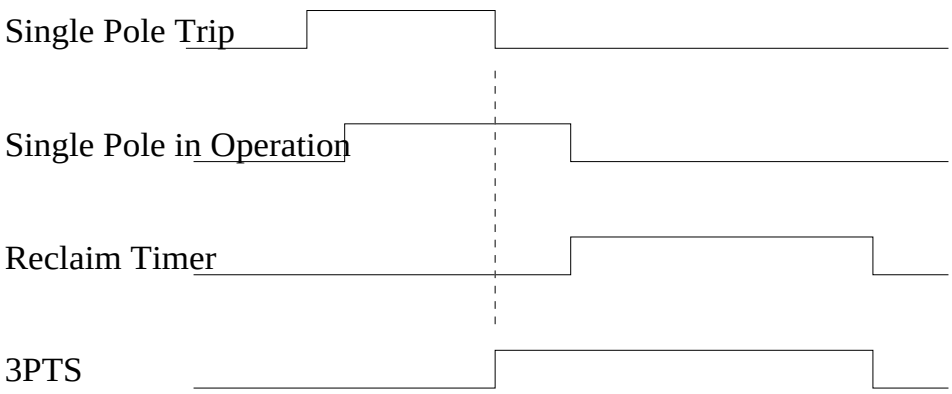
3.1.3 Three Pole Trip Select

The relay co-ordinates the action of the Protection with the state of the system. For conditions which dictate that a single pole reclose may be unsuccessful the autoreclose relay instructs the protection to issue a three pole trip signal.

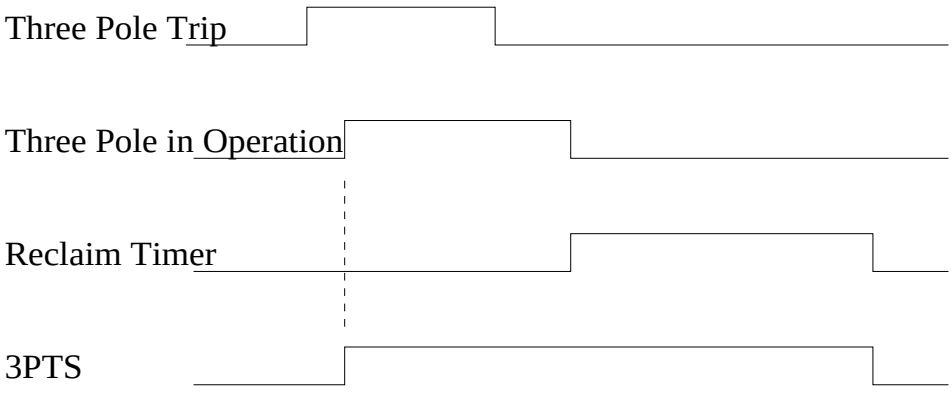
With Single pole reclosing sequences, following the first shot single pole trip and reclose subsequent tripping of the CB shall be 3 pole. An Alarm shall be issued to indicate three pole tripping is being commenced. A setting shall be provided to program an output relay to operate when the autoreclose sequence goes to three pole either on selection or during a two shot scheme.

Definitions:

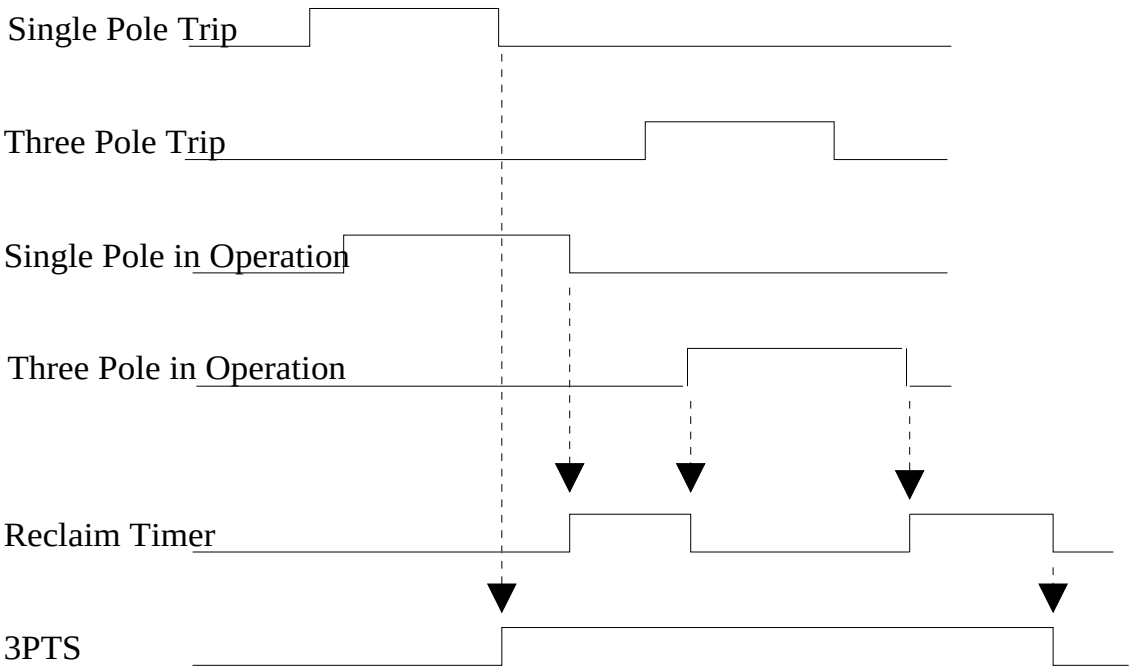
- Following a Single Pole autoreclose sequence: All tripping after a single pole sequence will be 3 Pole. i.e. Prepare the main protection to go into 3 Pole mode.



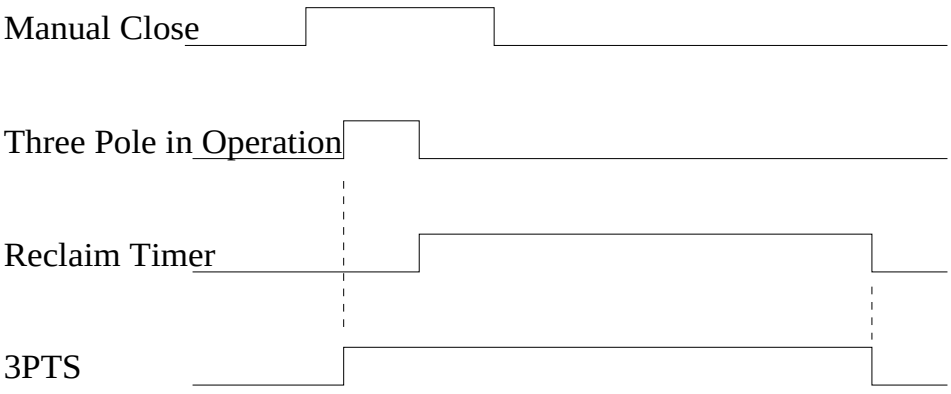
- Three pole autoreclose.



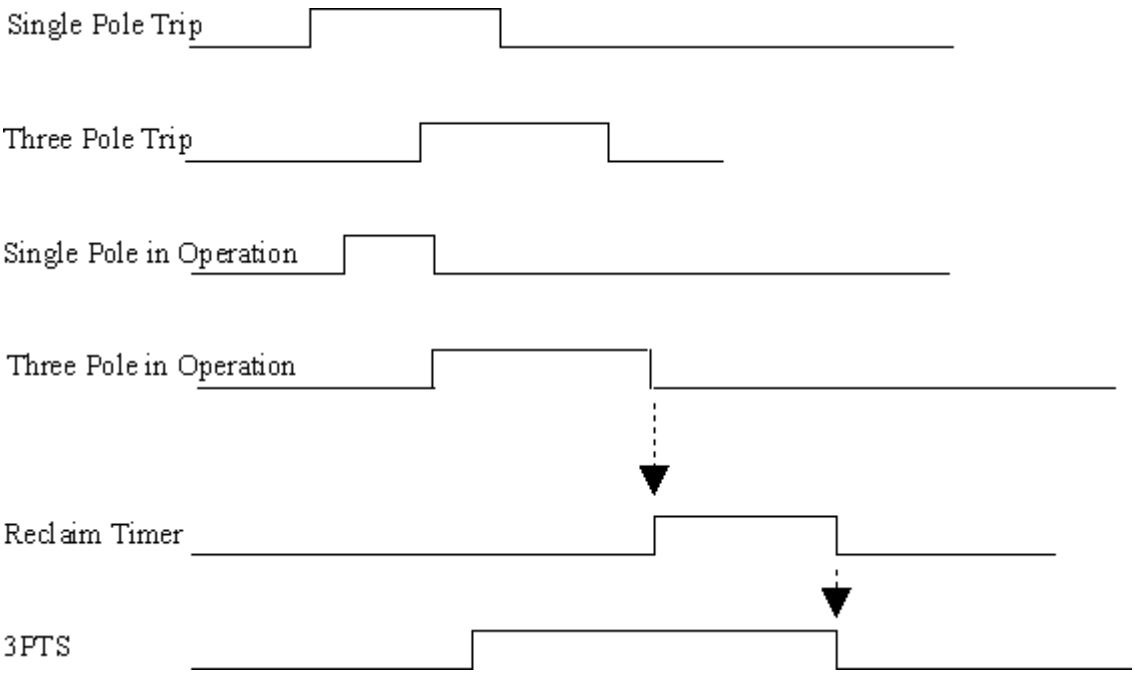
- For a sustained fault sequence (CMS set to 1P3P/3P): Subsequent tripping of the CB shall be 3 pole. An alarm will be issued to indicate 3 pole closing. We remain with 3PTS if fault in reclaim time. The Protection relay has tripped single phase and then reset, the recloser will complete the single phase reclosing sequence, a second trip within the reclaim time must be three pole, to force this second trip to be three pole the 3PTS output is given after the single pole trip has cleared.



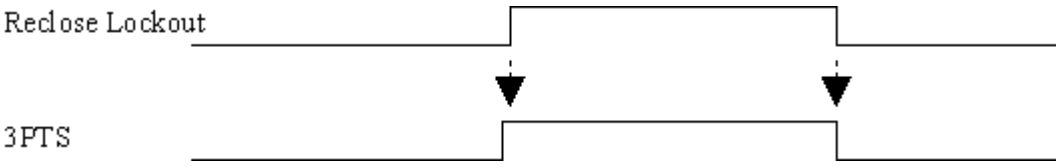
- Following the Manual Close Command: 3 pole trip select (3PTS) is initiated following a manual close command. Any subsequent faults shall initiate a 3PT.



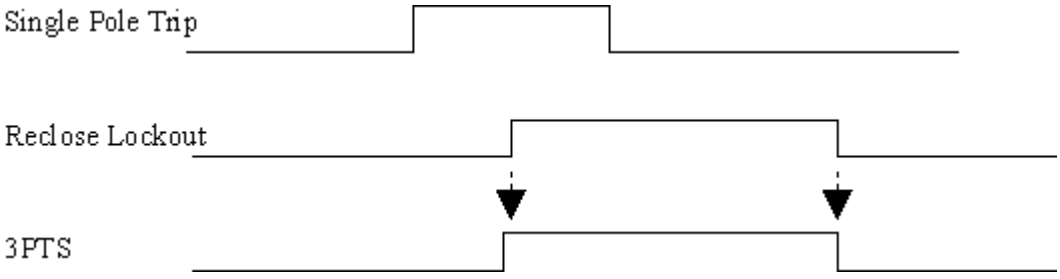
- Evolving Fault: Should the relay change to a 3 pole trip sequence during a single pole reclosure sequence, the 1PARC sequence will reset and a three pole closing alarm will be issued.



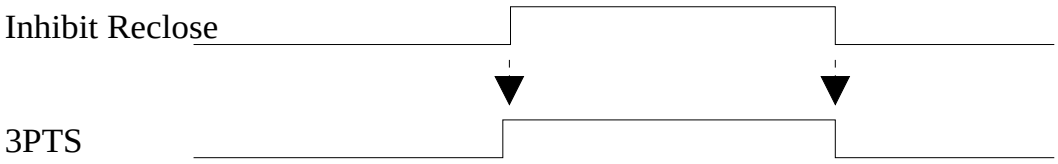
- During a Reclose Lockout signal: If a Reclose Lockout signal becomes active during a 1P autoreclose sequence the relay will select 3PT. Reclose Lockout will initiate 3PTS.



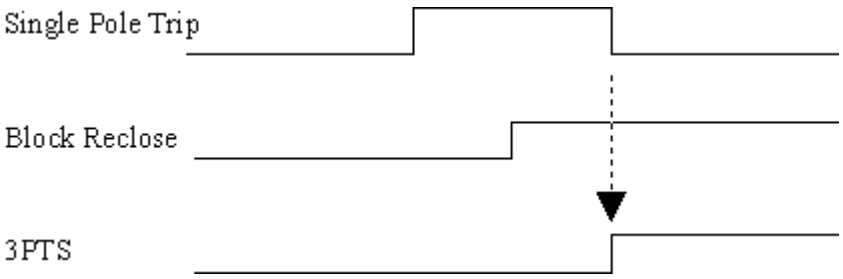
- If Reclose Lockout during Single Pole Trip: Go to Lockout, Trip 3P straight away.



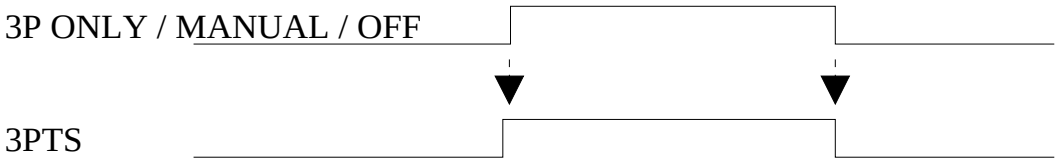
- During Block Reclose or Inhibit Close:



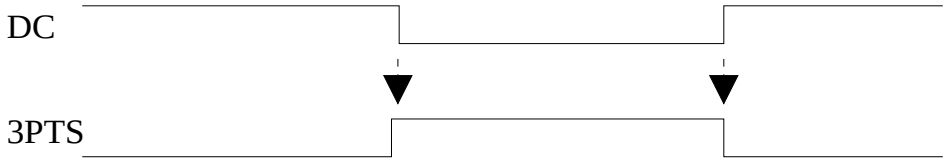
- If Block Reclose during a 1P autoreclose sequence: Should a Block Reclose signal become present during a 1PARC sequence, 3PTS shall initiate upon resetting of the current 1PARC initiate signal. i.e. give the 1P shot a chance, the Block may be transient.



- As a result of selected CMS:



- For loss of DC: Should the DC supply be lost 3PT shall be selected.



This requires that a normally energised N/C contact is used as the output for 3PTS. A separate flag 3PTS Flag is provided for use as the LED indication.

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 A/R sequence then in operation. Manual Close resets Lockout.

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 of the Manual Close input. Even if the Manual Close input is constantly energised the relay will only attempt one close.

There is a separate input Inhibit Close which prevents the close pulse being issued from a Manual Close. If the Inhibit Close signal has not been removed before the end of a defined time, the Permissive Close Delay, the A/R feature is locked-out. The input Block Reclose does not prevent Manual Closing. Block Reclose only prevents autoreclosing. Both Inhibit Close and Block Reclose utilise the Permissive Close Delay timer.

3.1.5 In/Out Switching

The A/R 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. A/R In Status Input is positive edge triggered.

3.1.6 Overall Control

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

If the Lockout command or A/R OUT are received while an A/R 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.

The A/R feature may be paused by an external Block Reclose or Inhibit Close 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 Reclose signal has not been removed before the end of a defined time, the Permissive Close Delay, the A/R feature is locked-out. A Block Reclose 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 trips occur. This is to prevent Close and Trip Command pulses existing simultaneously. A Close Onto Fault Output is given if a 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 A/R feature can be set to lockout.

CB Failed To Open utilises the CB Closed status input and trip signal. If the CB remains closed after a trip signal has been received for longer than the CB Fail To Open time delay setting then an alarm is issued. This alarm could be used to lockout the autoreclose sequence; or could indicate a slow CB opening.

CB Failed To Close results in lockout if the CB is still open at the end of the Close Pulse time delay setting.

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.

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
6. 3PTS and 3PTS Flag

see Output Relay Menu and LED Menu for complete list.

3.1.11 CB Close Counters

Additional A/R 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 re-settable and have a maximum alarm number of 999.

3.1.12 Metering

All Counters and the Status of the A/R sequence are displayed in Meters under the Instruments Menu.

3.1.13 Dead-time and Reclaim Timing

The Deadtime will start if a Trip has occurred and the CB is Open and the Trip has 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 then the A/R will Lockout. This could be due to either a CB Fail condition, which would independently notify Lockout, or the Trip 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.

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. If the CB remains closed for the Reclaim time, the relay will reset and be ready for further operation.

3.1.14 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 Permissive Close Delay due to a persistent Block Reclose or Inhibit Close.

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

- At the end of the Sequence Fail time.

- At the end of the Overall Sequence time.

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

- By a Manual Close command.

- By a Reset Lockout signal, provided there is no signal present which 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 A/R sequences are prevented by using a combination of Trip and CB In Service to start the sequence.

3.1.15 Intertrip Initiated Autoreclose

Autoreclose can be initiated by an Intertrip Receive signal. A Persistent Intertrip timer is provided. If the Persistent Intertrip timer times-out before the Intertrip Receive signal has reset then the relay will go to Lockout. Only a one shot autoreclose sequence is allowed by intertripping, any other intertrips cause the relay to go to Lockout. Intertrip deadtime initiate must correspond to Trip Reset.

3.1.16 Sequential Isolation

Some utilities apply an arrangement when a CB is opened to automatically open the isolator. This is called Sequential Isolation. This needs to be inhibited if the CB is to be automatically reclosed.

Facilities to inhibit sequential isolation are provided to enable the A/R system to stop sequential isolation if an associated A/R 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.

3.1.17 CB Single Pole In Op / CB Three Pole In Op

Two outputs are provided which indicate whether all CB's are open (Three Pole In Op) or a single pole CB is open (Single Pole In Op). These outputs can be used for inhibit purposes i.e. Power Swing Blocking, Zone 1 Extension Inhibit.

3.1.18 VT Alarms

The relay detects if a VT Fail has occurred. This could be a Line VT Fail or a Bus VT Fail. If the CB is closed and the Line is Live and the Bus is Dead for greater than 2 seconds a Bus VT Alarm is issued. If the CB is closed and the Line is Dead and the Bus is Live for greater than 2 seconds a Line VT Alarm is issued. The relay cannot distinguish between the system VT and the measuring VT within the relay, the VT Fail could be either.

3.1.19 Close Onto Fault

This output provides flexibility to be able to distinguish faults occurring during the close pulse. Any Trip occurring within the close pulse is designated as a Close Onto Fault. This can be used to stop the autoreclose sequence if required, wired to Lockout. There can now be a difference between trips in the close pulse and trips in the reclaim time. A trip in the reclaim time can be designated as a separate fault. This can be enhanced further by extending the close pulse time setting to longer than usual, say 5 seconds, effectively creating two reclaim times.

3.1.20 CB Pole Discrepancy

Systems using single pole tripping or CB's with separate phase operation govern the time which a single CB may be open by CB Pole Discrepancy Protection. If the single pole is open greater than the Pole Discrepancy time, typically 1.6 seconds, the autoreclose process is normally Locked out. This is also applied to three pole tripping schemes.

3.1.21 Close Mode Selection (CMS)

Close Mode Selection (CMS) refers to the autoreclose sequence selected. The setting can be changed by the front panel keypad; or status inputs wired to panel switches or telecontrol; or communications.

The table below illustrates the available autoreclose schemes i.e. 1st Action = 1P refers to first reclose attempt is allowed to be a Single Pole Reclose; 1st Action = 1P/3P refers to first reclose attempt can be either Single Pole OR Three Pole; 2nd Action = 3P refers to second reclose attempt can only be Three Pole Reclose; 2nd Action = LO refers that no reclose will be allowed and that for any further reclose initiations (protection trips), the relay will go to Lockout.

1st Action	2nd Action	3rd Action	CMS Setting from keypad/ comm's.
F-LO			Off
1PF-1PR	F-LO		1P
F-3PR	F-LO		3P
1PF-1PR 3PF-3PR	F-LO		1P/3P
1PF-1PR 3PF-3PR	3PR 2*3PF-LO	F-LO	1P3P/3P

F-3PR	F-3PR	F-LO	3P3P
1PF-1PR 3PF-LO	1PF-1PR 3PF-LO	F-LO	1P1P
1PF-1PR 3PF-3PR	1PF-1PR 3PF-3PR	F-LO	1P1P/3P3P

The Close Mode Selection defines the allowable number and type of reclose shots allowed during the sequence.

KEY:

1PF	Single Pole Fault
1PT	Single Pole Trip
1PR	Single Pole Reclose
LO	Lockout
3PF	Three Pole Fault
3PR	Three Pole Reclose
F	Any Fault

SINGLE SHOT SEQUENCE

The following tables attempt to define the autoreclose sequence for that selected Close Mode setting. For example

1st Action

1PF - 1PR

A Single Pole Fault which results in a Single Pole Protection trip will initiate a Single Pole Reclose.

1st Action

3PF - LO

If the first protection trip is multi-phase then no reclose attempt will be allowed and the reclose relay will proceed directly to Lockout.

2nd Action

F - LO

Any fault occurring in the Reclaim time will result in the reclose relay proceeding directly to Lockout.

CMS set to 1P, Single Phase Operating Sequence - 1 POLE

1st Action	2nd Action
1PF - 1PR 3PF – LO	F - LO

Single Pole Operation

The CMS setting provides for a one shot Single Pole autoreclose sequence.

The Autoreclose sequence will be started by a single pole reclose initiation provided only a single pole of the CB pole has opened, there is no Reclose Lockout signal present and the selection of the Close Mode Selection (CMS) function permits single pole reclosing.

If the single pole trip evolves into a multiple phase trip the single pole reclosing sequence is disabled.

The single pole initialisation signal will be maintained until it is reset by the closing of the open pole of the CB.

If no Lockout condition exists after the single phase reclosing sequence has elapsed the open pole is closed directly by issuing a Close Pulse to the breaker close coils.

The Reclaim time timer will be started by the Close command to the CB.

All subsequent tripping within the Reclaim time following an autoreclose can be set to be three pole.

CMS set to 3P, Three Phase Operating Sequence - 3 POLE

1st Action	2nd Action
1PF - 3PT - 3PR	F - LO
3PF - 3PR	F - LO

The CMS setting provides for a one shot Three Pole autoreclose sequence.

The 3 phase Dead time timer will be started by a three pole reclose initiation provided all poles of the CB have opened, there is no Reclose Lockout signal present, the selection of the CMS function permits 3 pole reclosing.

If 3 pole closing only is selected, the recloser will issue a three pole trip select.

The initiation command will be maintained until it is reset by the closing of the open breaker.

For a 3 pole reclose, if the line and/or busbar are 'dead', and if no lockout condition exists, it will be possible to issue a close pulse directly to the CB. However should both the line and busbar be 'live', a 3 pole reclose of the open breaker is only possible following a successful Check Synchronism, whereupon a closing pulse will be issued to the CB.

Following a decision to close, a timer will ensure that the Close Pulse is maintained long enough to allow for the spring rewind time if a single pole trip and reclose preceded the 3 pole trip.

The Reclaim time timer will be started by the close command to the CB.

All subsequent tripping within the Reclaim time following an autoreclose can be set to be three pole.

CMS set to 1P/3P, Single or Three Pole Operation - 1P/3P

1st Action	2nd Action
1PF - 1PR	F - LO
3PF - 3PR	F - LO

Single or Three Pole Operation

The CMS setting provides for a single shot Single or Three Pole autoreclose sequence.

If the single pole trip evolves into a multiple phase trip the single pole reclosing sequence will be disabled and the sequence will proceed with a three phase reclose after the appropriate three phase dead time provided all three poles of the CB have opened.

If a single pole trip causes all poles of the CB to open then a three pole reclose will be allowed after the appropriate three pole deadtime.

TWO SHOT SEQUENCES

CMS set to 1P3P/3P, Two Shot Reclosing Sequence - IP3P/3P

1st Action	2nd Action	3rd Action
1PF - 1PR	1PF - 3PT - 3PR 3PF - 3PR	F – LO
3PF - 3PR	F – LO	

Single Pole then Three Pole Operation OR Three Pole

The CMS setting provides for a two shot autoreclose sequence if the first shot has been a Single Pole reclose. This option is commonly applied to Transmission systems and succeeds because the opening of all three poles of the CB after a failed single pole reclose can remove the mechanism of induced voltage across the phases which caused the reclose to fail.

If the CB re-trips for a recurring fault within the Reclaim time following a single pole autoreclose, a 3 pole autoreclose can be initiated if a second reclose attempt is permitted.

A second reclose is permitted if the CMS function is selected to 1P3P and the Block Second Shot input has not been initiated.

When the Block Second Shot input is initiated, a second reclose attempt is not permitted.

When a second reclose is permitted, the Reclaim time is reset by the renewed reclose initiation signal and commences again with the close command to the CB.

For a 3 pole reclose, if the line and/or busbar are 'dead', and if no lockout condition exists, it will be possible to issue a close pulse directly to the CB. However should both the line and busbar be 'live', a 3 pole reclose of the open breaker will only be possible following a successful synchronism check, whereupon a close pulse is issued to the CB.

Following a decision to reclose, a timer ensures that the close pulse is maintained long enough to allow for the spring rewind time if a single pole trip and reclose preceded the 3 pole trip.

The 3 phase Dead time timer is started by a 3 pole reclose initiation for a recurring fault within the Reclaim time following a single pole trip and autoreclose.

If the breaker re-trips within the Reclaim time following a 3 pole second reclose, the Lockout condition will be established immediately to ensure no further 3 pole recloses are attempted.

All subsequent tripping within the Reclaim time following an autoreclose can be set to be three pole.

CMS set to 3P3P, Two Shot Reclosing Sequence - 3P3P

1st Action	2nd Action	3rd Action
1PF - 3PT - 3PR 3PF - 3PR	1PF - 3PT - 3PR 3PF - 3PR	F - LO F - LO

3P3P

The CMS setting provides for a two shot Three Pole autoreclose sequence.

CMS set to 1P1P/3P3P, Two Shot Reclosing Sequence - 1P1P/3P3P

1st Action	2nd Action	3rd Action
1PF - 3PT - 3PR 3PF - 3PR	1PF - 3PT - 3PR 3PF - 3PR	F - LO F - LO

1P1P/3P3P

The CMS setting provides for a two shot, Single or Three Pole autoreclose sequence.

CMS set to 1P1P, Two Shot Reclosing Sequence - 1P1P

1st Action	2nd Action	3rd Action
1PF - 1PR	1PF - 3PT - 3PR	F - LO
3PF - LO	F – LO	

1P1P

The CMS setting provides for a two shot Single Pole autoreclose sequence.

CMS Change Selection

The method of changing the Close Mode Selection by a connection of status inputs wired to a switch or telecontrol is outlined below:

CMS Change One	CMS Change Two	CMS Change Three	CMS Scheme Selected
0	0	0	No Change
0	0	1	1P
0	1	0	3P
0	1	1	1P/3P
1	0	0	1P3P/3P
1	0	1	3P3P
1	1	0	1P1P
1	1	1	1P1P/3P3P

A change to the CMS scheme is implemented if the switch position remains at the new setting for greater than 2 seconds. To allow for connection to tele-control pulses, no change is implemented when all inputs are not energised. The switch should either stay at it's selection or return to it's 'no change' position after the change has completed.

Note: It is not possible to select Close Mode Selection to OFF by the CMS Change Status Inputs. A/R Out Status Input can be used for this purpose.

3.2 Voltage monitoring elements

3.2.1 Undervoltage detectors

The undervoltage detectors, if enabled, can block a close output command if either the line voltage or the bus voltage is below the undervoltage 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 hysteresis 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 and this is 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 so that this operation is clear to the user.

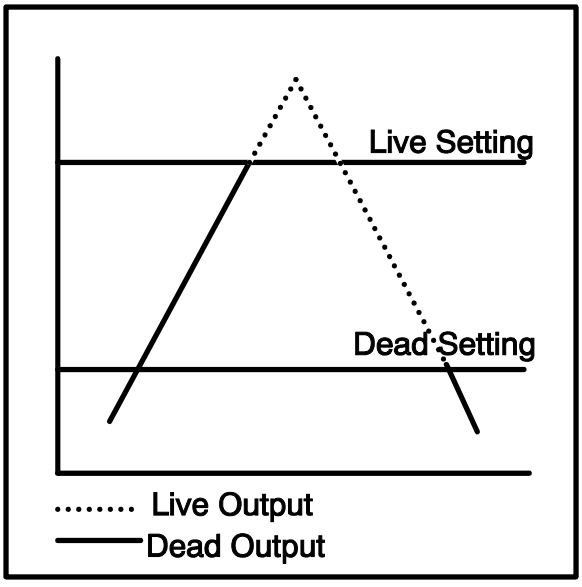


Figure 3 - Voltage Detector Operation

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 CheckSync 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 undervoltage setting value for an output to be given.

BUS U/V DETECTOR, [If ENABLED] – the bus voltage has to be above the bus undervoltage setting value 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.

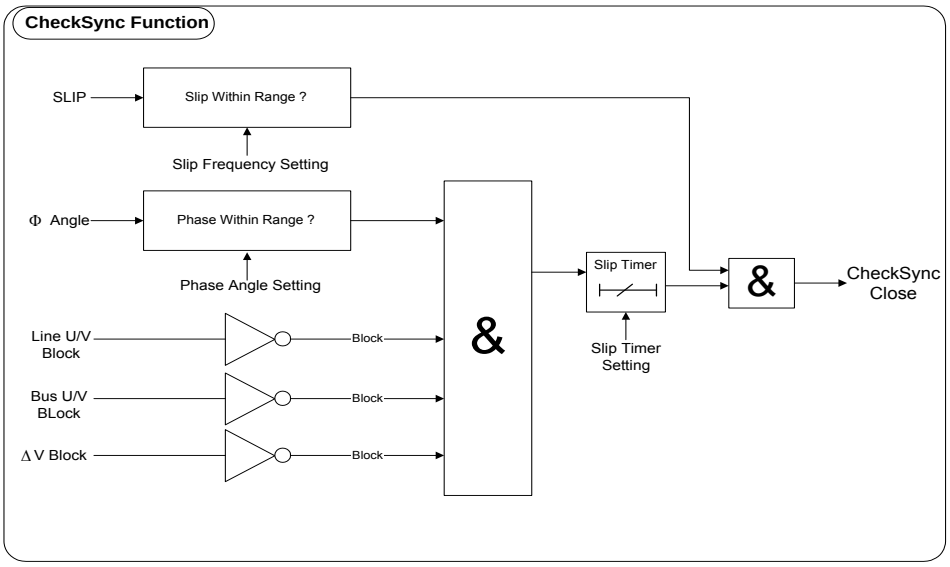


Figure 4 - Check Sync Function

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 CheckSync operation the following events occur :

- The CheckSync function is inhibited.
- The SystemSync 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 comms. 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 SystemSync 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 undervoltage setting value for an output to be given.

BUS U/V DETECTOR, [If ENABLED] – the bus voltage has to be above the line undervoltage setting value 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.

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.

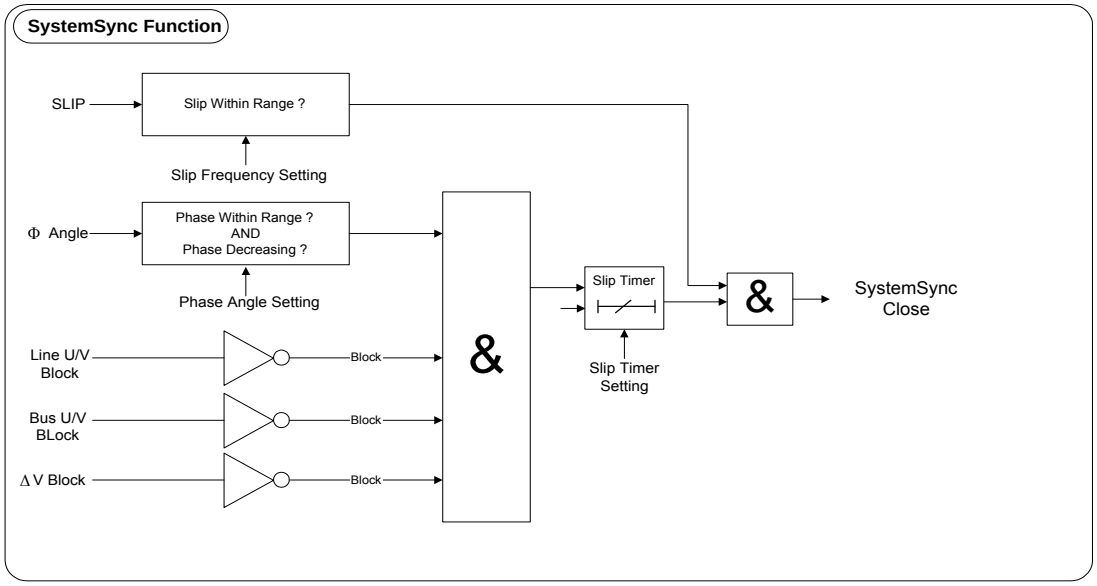


Figure 5 - System Sync Function

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 per phase
- Delta Number of CB Closes per phase
- 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. 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 is 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 IEC870-5-103 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 alpha-numeric 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 remains 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 permanent fault 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.

5.4 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. The editable field will be indicated by a flashing character(s). 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 which are not relevant to a particular customer 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 which may be hidden. The following list of settings shows all possible settings that can be displayed.

5.5 System Config Menu

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

View/Edit Griup – 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 which 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.

5.6 A/R Menu

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

Close Mode Selection – this setting selects the appropriate autoreclose sequence.

Gn Dead Bar Close – this setting determines the closing action.

Gn Dead Line Close – this setting determines the closing action.

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

Gn First 1P Deadtime – this setting sets the first shot Single pole deadtime time delay.

Gn Second 1P Deadtime – this setting sets the second shot Single pole deadtime time delay

Gn First 3P Deadtime – this setting sets the first shot Three pole deadtime time delay.

Gn Second 3P Deadtime – this setting sets the second shot Three pole deadtime time delay.

Gn Start Deadtime – this setting selects how to initiate the deadtime.

Gn 3P Deadtime Initiate – this setting sets whether the deadtime can be initiated from three phase faults.

Gn CB Aux Switches – this setting sets the type of connection to the CB Auxiliary contacts.

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

Gn Reclaim Time – this setting sets the reclaim time.

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 Permissive Close Delay – this setting sets the allowable time a Block Reclose or Inhibit Close may be active before the Autoreclose sequence is locked out.

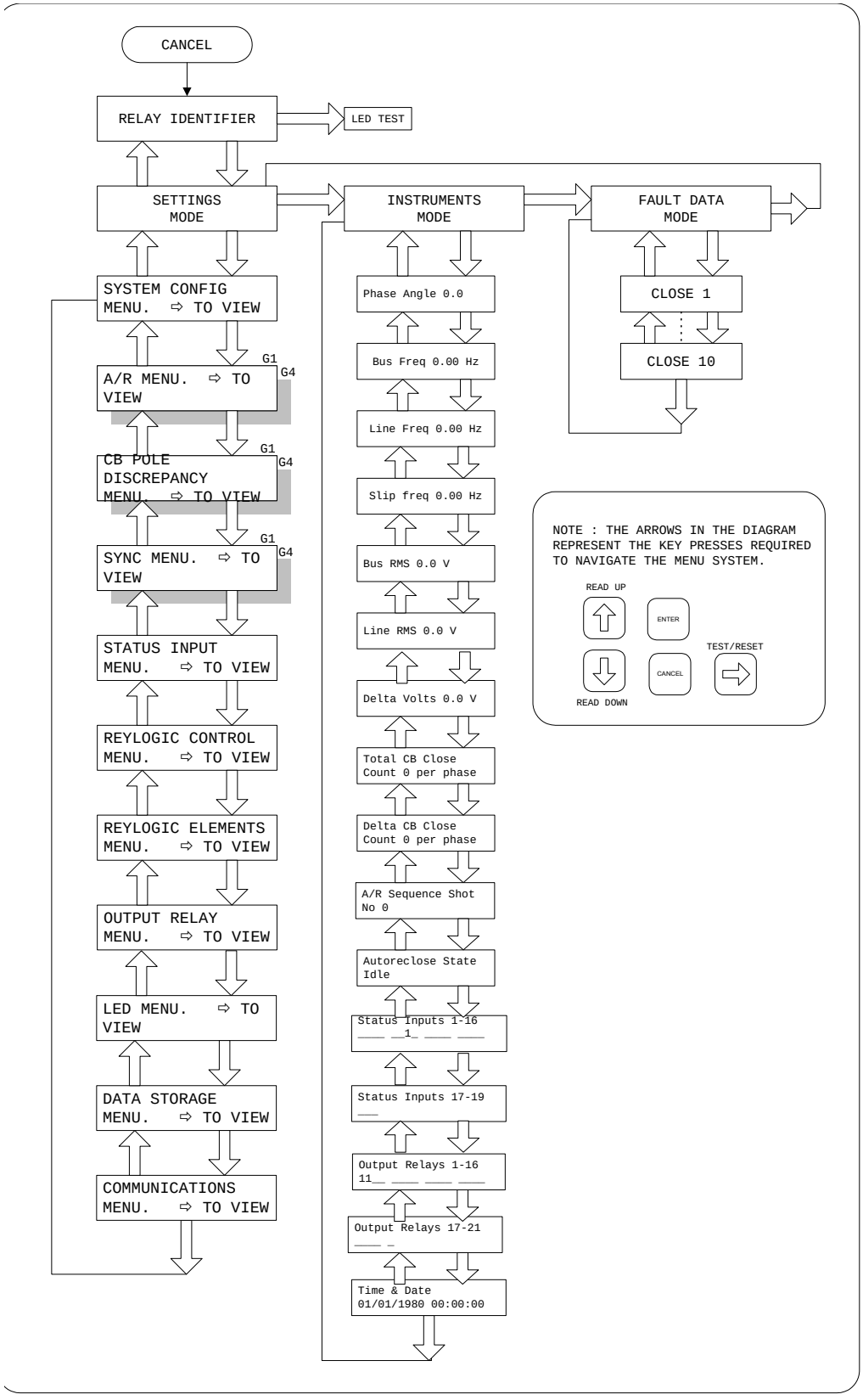


Figure 6 - Display Menu Structure

Figure 7 - Tau E8 Relay Fascia

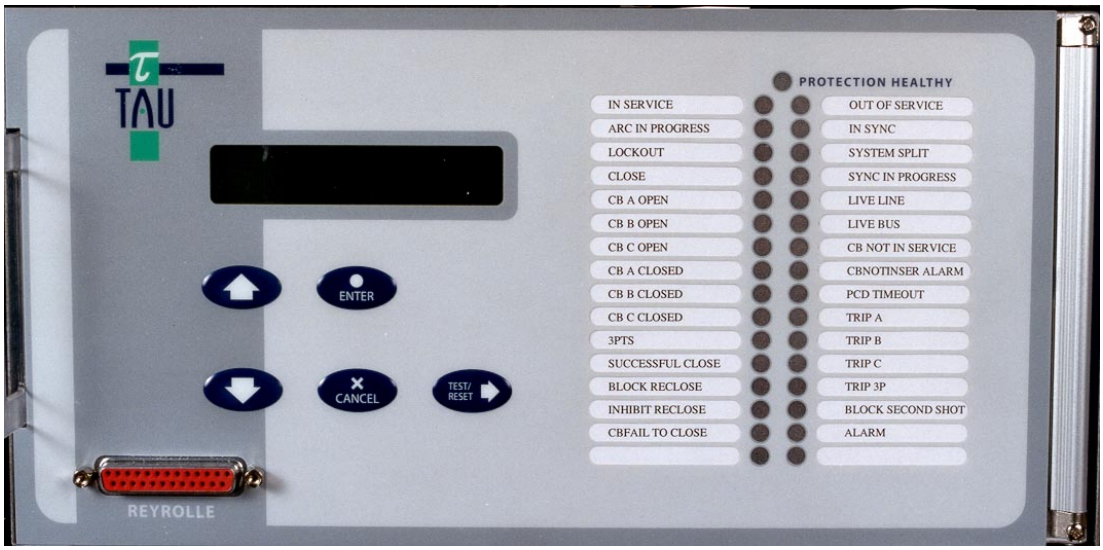


Figure 8 – Tau E12 Relay Fascia

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
AR in progress	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

Table 1 - Tau Event Codes

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.