Reyrolle
Protection
Devices

# 7PG2113/4/5/6 – Solkor

**Pilot Wire Current Differential Protection with integrated Overcurrent Guard**

## Answers for energy

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# 7PG2113/4/5/6 – Solkor

Pilot Wire Current Differential Protection with Integrated Overcurrent Guard.



## Description

Solkor R & Solkor Rf are well established pilot wire feeder differential protections operating on the current balance principle. This device provides both the Solkor R/Rf current differential function and an integrated numeric module which provides Overcurrent and Earth Fault Guard as well as backup overcurrent and earth fault and other advanced protection functions including Autoreclose. Digital data communications, fault recording, instrumentation and metering is also provided. Both directional and non-directional overcurrent and earth fault versions are available.

Overcurrent and earth fault guard is used to prevent maloperation of the Solkor protection for out of zone faults during open circuit pilot conditions.

Pilot wire differential relay trip contacts are commonly connected in series with those of an external Overcurrent and Earth Fault Guard relay driven from the same current transformers. The instantaneous Guard relay must therefore be in the operated condition before the Differential relay operation can cause a circuit breaker trip.  The Guard relay is set to current levels above those experienced under normally healthy loading conditions but below the minimum fault level.  This arrangement ensures stability of the differential protection if the pilot connection is damaged pilots during normal load levels.

The R/Rf relay is primarily intended for use in the Rf mode which has the advantage of increased operating speed but can be simply changed to R mode for compatibility with pre-installed remote end relays that are older 5kv Solkor R type relays.

The relay is suitable for application on a single pair of privately owned pilots with loop resistance up to 2000ohms to protect 2 ended feeder circuits up to 20km in length. Two compatible relays are used as a pair with one relay connected to current transformers at each end of the feeder respectively.

The Solkor-R/Rf protection provides:

- High transient stability.
- High speed operation.
- Low phase and earth fault settings.
- Little or no setting variation with pilot length
- Test points at relay fascia
- Up to 20% of rated current can be tapped off from inside of the protected zone (bleed off)
- Easily reconnected as R or Rf mode
- Option of 15kV pilot isolation
- Option of pilot supervision

## Function Overview

### Protection

| | |
|---|---|
| 87L | Current Differential Line protection by the Solkor-R/Rf principle. |
| 37 | Undercurrent |
| 46BC | Broken Conductor / Load Unbalance |
| 46NPS | Negative Phase Sequence Overcurrent |
| 49 | Thermal Overload |
| 50 | Instantaneous Overcurrent |
| 50G/N | Instantaneous Earth Fault |
| 50BF | Circuit Breaker Fail |
| 51 | Time Delayed Overcurrent |
| 51G/N | Time Delayed Measured/Derived EF |
| 64H | High Impedance REF |
| 27/59 | Under/Over Voltage |
| 47 | Negative Phase Sequence Voltage |
| 51V | Voltage Controlled Overcurrent |
| 59N | Neutral Voltage Displacement |
| 67/50 | Directional Instantaneous Overcurrent |
| 67/50G/N | Directional Instantaneous Earth Fault |
| 67/51 | Directional Time Delayed Overcurrent |
| 67/51G/N | Directional Time Delayed Earth Fault |
| 81HBL2 | Inrush Detector |

### Supervision

| | |
|---|---|
| 60CTS | CT Supervision |
| 74T/CCS | Trip & Close Circuit Supervision |
| 60VTS | VT Supervision |

### Control

| | |
|---|---|
| 79 | Auto Reclose |
| 86 | Lockout |
| | CB Control |

### Features

Cold Load Settings
Four Settings Groups
Password Protection – 2 levels
User Programmable Logic
Self Monitoring
Circuit Breaker Trip and Maintenance Counter
Trip Timers

## User Interface

20 Character x 4 Line Backlit LCD
Menu Navigation Keys
9 User Programmable Tri-colour LEDs
User Language Configuration
Pilot padding resistance shorting plugs
4mm test sockets for operating current measurement with shorting link

## Monitoring Functions

Primary/Secondary Current Phases and Earth Direction
Primary/Secondary Line and Phase Voltages
Apparent Power and Power Factor
Real and Reactive Power
W Hr & VAr Hr Forward and Reverse
Historical Demand Record
Positive Phase Sequence (PPS) Voltage & Current
Negative Phase Sequence (NPS) Voltage & Current
Zero Phase Sequence (ZPS) Voltage

## Hardware

3 Normally Open contacts from Solkor contactor plus:
    4 CT  3 Binary Inputs  5 Binary Outputs or
    4 CT  6 Binary Inputs  8 Binary Outputs or
    4 CT  3 VT 3 Binary Inputs  5 Binary Outputs or
    4 CT  3 VT 6 Binary Inputs  8 Binary Outputs

## Data Storage and Communication

Front USB port +  Rear RS485 port
Protocols - IEC60870-5-103, DNP3.0 or Modbus RTU
Event Records – User Configurable
Fault Records
Waveform Records
Measurands
Commands
Time Synchronism
Viewing and Changing Settings

## Additional Equipment Options

### 15kV Isolation

The Solkor R/Rf relay has an insulation level of 5kV between pilot connections and the local ground to withstand voltages induced on the pilot cable due to coupling with the fault current and to withstand differential ground voltages caused by the flow of fault current. Experience has shown that 5kV insulation is usually adequate for most distribution feeders.

For higher voltage systems where feeders may be longer and fault levels higher, an additional external isolation transformer is available for use with the relay in Rf mode to increase the voltage withstand to 15kV. 5kV systems may be suitable for higher voltage systems where fault levels are low or feeder lengths are short.

One isolation transformer is fitted at each end of the pilot circuit. Tappings at the transformers can be utilised to allow pilots with inter-core capacitance up to 4µF can be used compared to the 0.8µF limit imposed by the 5kV standard arrangement.

### Pilot supervision

Communication via the pilots between the relay pair is essential for correct operation of the Current Differential protection system.

Additional external Pilot Supervision equipment can be supplied to detect pilot cable open or short circuit. Open circuit conditions can lead to protection operation during out of zone faults and short circuit can cause greatly reduced sensitivity of the relays under subsequent in-zone fault conditions.

Pilot supervision will not block relay operation but will provide an alarm. Pilot Supervision is available to suit the 5kV or 15kV insulation level of the scheme.

# Typical Equipment Options and Schemes

The R or Rf mode of the relays at each end must be the same. This applies to any of the arrangements shown.
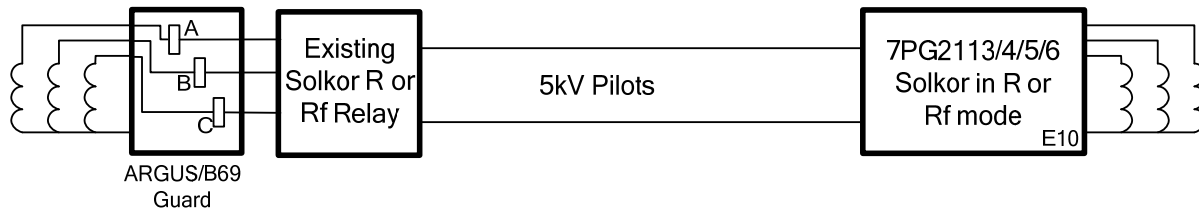
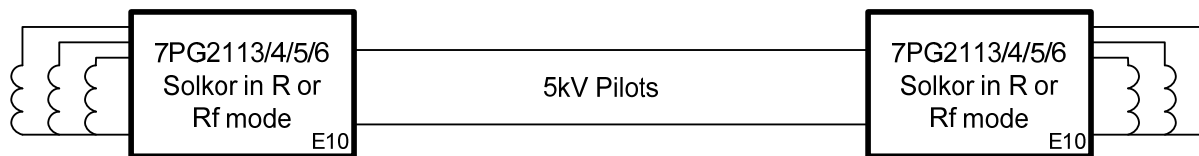Fig 1. Installation with existing Solkor R, Rf or R/Rf Relay

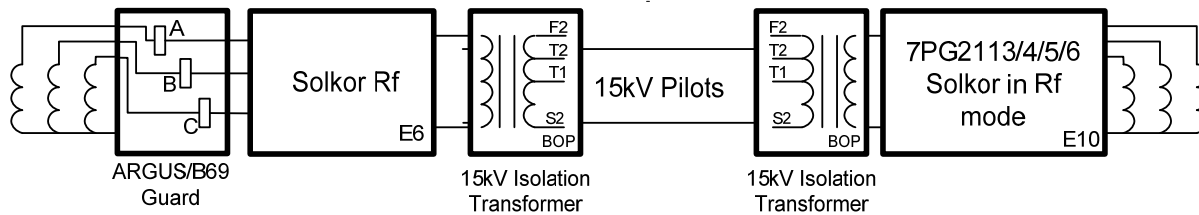Fig 2. Standard 5kV Solkor Rf with Guard

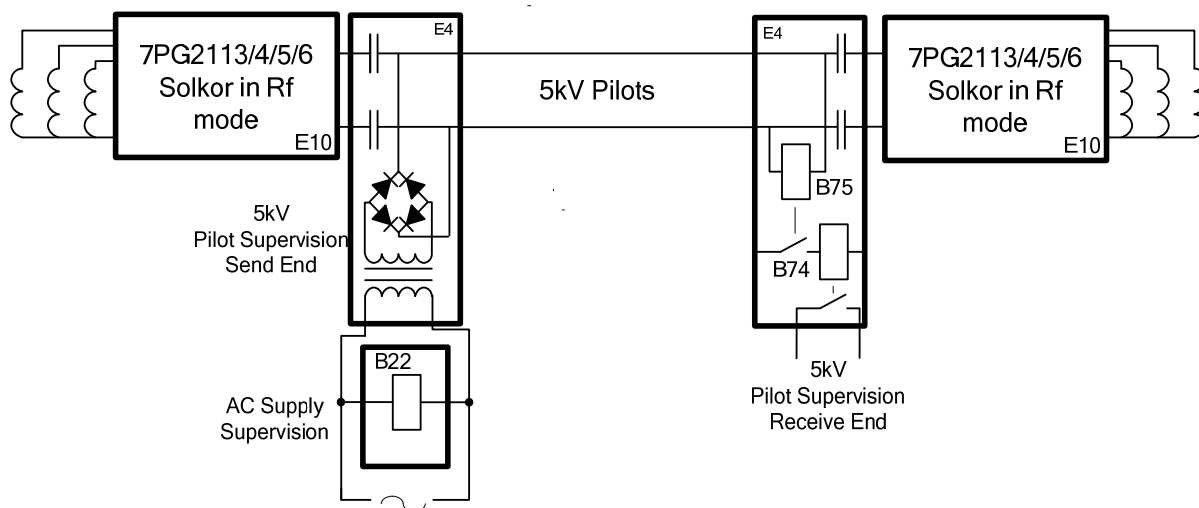Fig 3. Installation with existing 15kV Solkor Rf with Guard
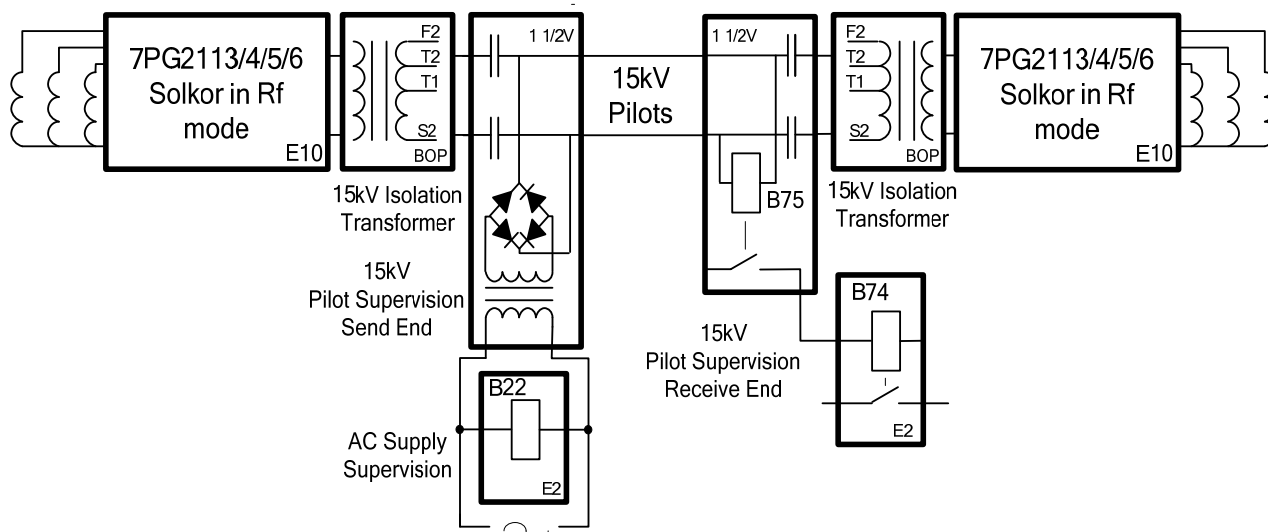
Fig 4. 5kV Solkor Rf with pilot Supervision



Fig 5. 15kV Plain Solkor Rf with Pilot Supervision

| FUNCTION | FUNCTIONAL REQUIREMENT | 7PG2113-**A12-1-***0 / 7PG2115-**A12-1-***0 | 7PG2114-**A12-1-***0 / 7PG2116-**A12-1-***0 |
|---|---|---|---|
| 27 | Undervoltage | | ■ |
| 37 | Undercurrent | ■ | ■ |
| 46BC | Broken Conductor / Load Unbalance | ■ | ■ |
| 46NPS | Negative Phase Sequence Overcurrent | ■ | ■ |
| 47 | Negative Phase Sequence Voltage | | ■ |
| 49 | Thermal Overload | ■ | ■ |
| 50 | Instantaneous Overcurrent | ■ | ■ |
| 50G | Measured Instantaneous Earth Fault | ■ | ■ |
| 50N | Derived Instantaneous Earth Fault | ■ | ■ |
| 50BF | CB Failure | ■ | ■ |
| 51 | Time Delayed Overcurrent | ■ | ■ |
| 51G | Measured Time Delayed Earth Fault | ■ | ■ |
| 51N | Derived Time Delayed Earth Fault | ■ | ■ |
| 59 | Overvoltage | | ■ |
| 59N | Neutral Voltage Displacement | | ■ |
| 64H | High Impedance Restricted Earth Fault | ■ | ■ |
| 67 | Directional Overcurrent | | ■ |
| 67G | Directional Measured Earth Fault | | ■ |
| 67N | Directional Derived Earth Fault | | ■ |
| | **CONTROL / MONITOR** | | |
| 51c | Cold Load - Phase Only | ■ | ■ |
| 60CTS | CT Supervision | ■ | ■ |
| 60VTS | VT Supervision | | ■ |
| 74T/CCS | Trip & Close Circuit Supervision | ■ | ■ |
| 79 | Autoreclose | □ | □ |
| 86 | Lockout | ■ | ■ |
| 87L | Line Differential | ■ | ■ |

Key -  ■ - Included as standard
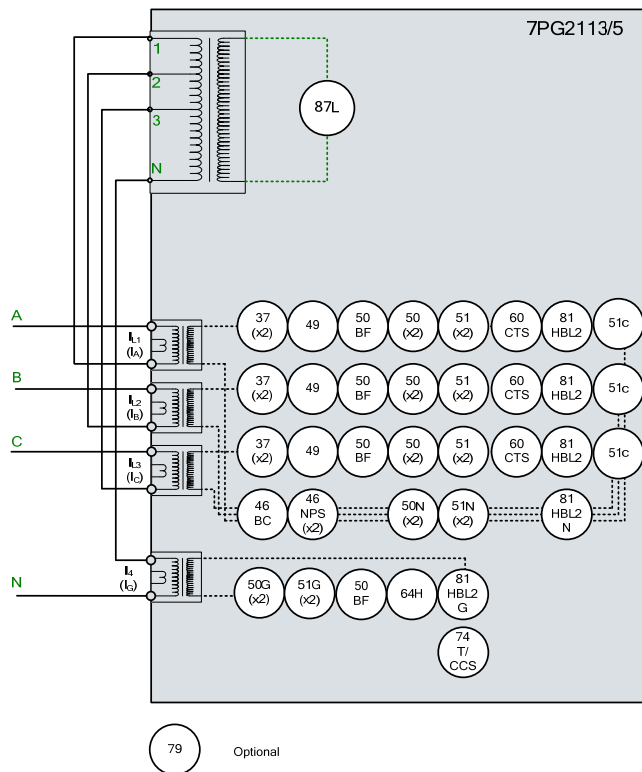□ - Ordering option

Fig 6. Non-directional Overcurrent Relay
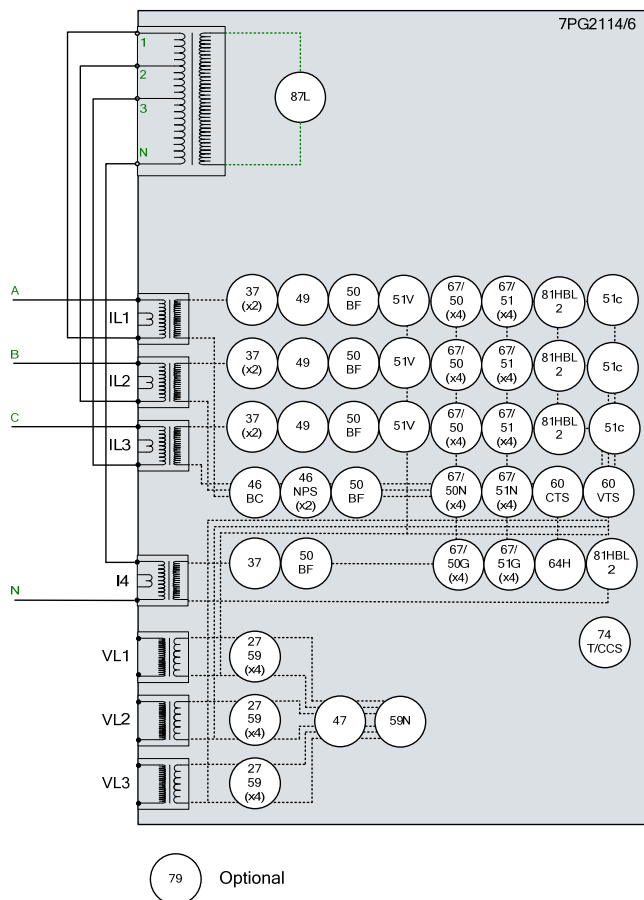
# 7PG2114/6 Functional Diagram



**Fig 7. Directional Overcurrent Relay**

Notes
1. Items shown dotted are only available in some models; please refer to the Ordering Information Section.
2. The use of some functions are mutually exclusive

# Description of Functionality

### 27/59 Under/Over Voltage

Each element has settings for pickup level, drop-off level and Definite Time Lag (DTL) delays. Operates if voltage exceeds setting for duration of delay.

### 37 Undercurrent

Each element has settings for pickup level and Definite Time Lag (DTL) delays. Operates if current falls below setting for duration of delay.

### 46BC Phase Unbalance/Broken Conductor

Element has settings for pickup level and DTL delay. With the circuit breaker closed, if the NPS:PPS current ratio is above setting this could be due to a broken conductor.

### 46NPS Negative Phase Sequence Overcurrent

Each element has user settings for pickup level and IDMTL or DTL delay, operates if NPS current exceeds setting and delay. NPS current elements can be used to detect unbalances on the system or remote earth faults when a delta-star transformer is in circuit.

### 47 Negative Phase Sequence Voltage

Each element has settings for pickup level and Definite Time Lag (DTL) delays. Operates if NPS voltage exceeds setting for duration of delay.

### 49 Thermal Overload

The thermal algorithm calculates the thermal states from the measured currents and can be applied to lines, cables and transformers. Alarm outputs are given for thermal overload and thermal capacity.

### 50BF Circuit Breaker Fail

The circuit breaker fail function may be triggered from an internal trip signal or from a binary input. Line currents and earth currents are monitored following a trip signal and an output is issued if any current is still detected, above setting, after a specified time interval. Alternatively, if the trip is from a mechanical protection the circuit breaker position can be used to determine a failure. A second time delay is available to enable another stage to be utilized if required. An input is also available to bypass the time delays when the circuit breaker is known to be faulty.

### 50/51 Phase Fault

50 INST/DTL and 51 IDMTL/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. User can select IEC or ANSI time current characteristics. The IDMT stage has a user programmable reset characteristic, either DTL or shaped current ~ time reset characteristic, to improve grading with electromechanical protection.

### 50G/51G/50N/51N Earth Fault/Sensitive Earth Fault

Two earth fault measurement modes are available. One mode directly measures the earth current from an independent CT, or the residual connection of the 3 line CTs. This input can be ordered as either earth fault or sensitive earth fault (50G/51G).
The second mode derives the earth current internally from the 3 phase CT inputs to give earth fault (50N/51N). 50 INST/DTL and 51 IDMTL/DTL elements provide overcurrent protection, each with independent settings for pickup current, time-multiplier (51) and time-delays. User can select IEC or ANSI time current characteristics. The IDMT stage has a user programmable reset characteristic either DTL or shaped current ~ time reset characteristic to improve grading with electromechanical protection.
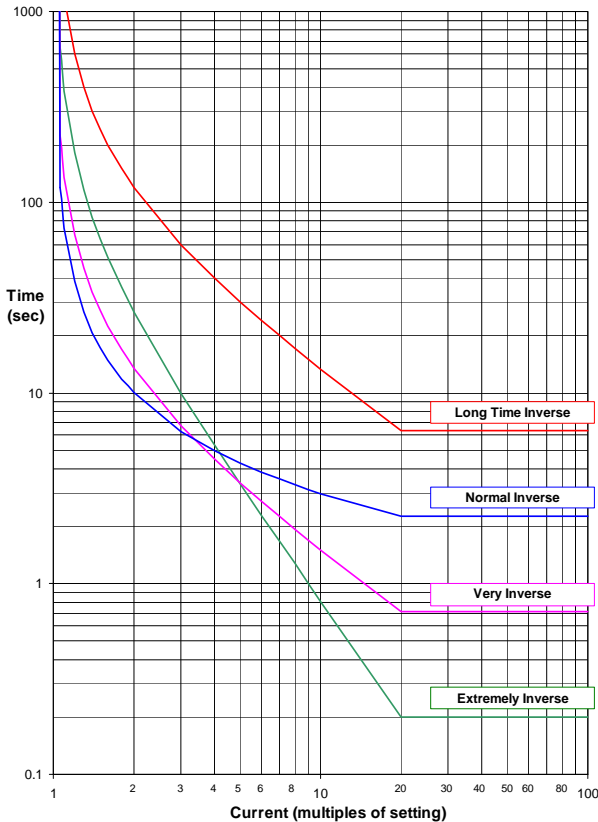
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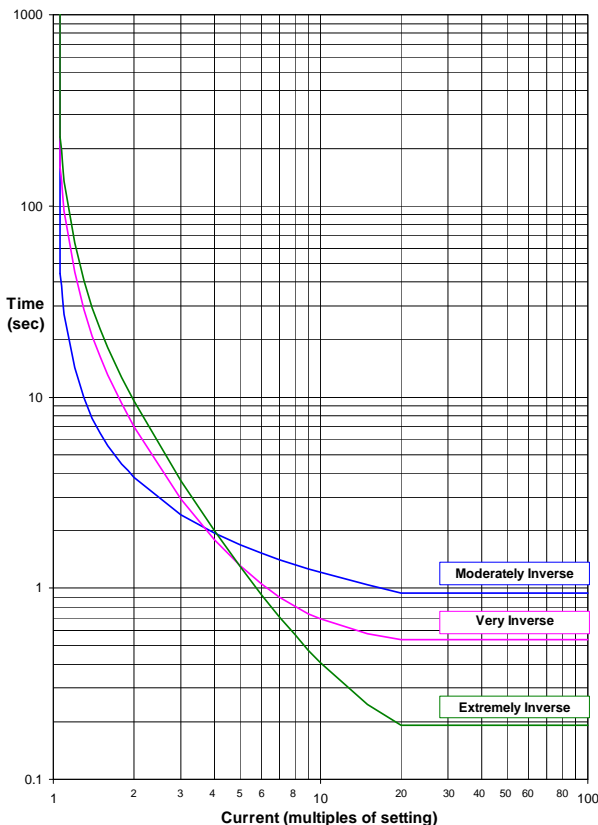
**Fig 8. IEC Overcurrent Curves**



**Fig 9. ANSI Overcurrent Curves**

### 51V Voltage Controlled Overcurrent

Each phase shaped overcurrent element can be independently controlled by the level of measured input voltage. For applied voltages above setting the 51-n element operates in accordance with its current setting but for voltages below the setting a multiplier is applied to reduce the 51-n pick up current setting.

### 59N Neutral Overvoltage

Neutral overvoltage can be used to detect earth faults in high impedance earthed or isolated systems.
Operates if the neutral voltage exceeds setting for duration of delay.

### 60CTS CT Supervision

The relay has two methods of CT supervision depending upon the relay model. The 7PG2113/5 monitors each phase current input and operates if any one or two inputs fall below the setting. The 7PG2114/6 considers the presence of negative phase sequence current, without an equivalent level of negative phase sequence voltage, for a user set time as a CT failure.
Both element types have user operate and delay settings.

### 60VTS VT Supervision

The VT supervision uses a combination of negative phase sequence voltage and negative phase sequence current to detect a VT fuse failure. This condition may be alarmed or used to inhibit voltage dependent functions. Element has user operate and delay settings.

### 64H Restricted Earth Fault

The measured earth fault input may be used in a 64H high impedance restricted earth fault scheme to provide sensitive high speed unit protection. A calculation is required to determine the values of the external series stabilising resistor and non-linear shunt resistor which can be ordered separately.

### 67/67N Directional Control

Phase, earth and sensitive earth fault elements can be directionalised. Each element can be user set to Forward, Reverse, or Non-directional.
Directional Phase Fault elements are polarised from quadrature voltage.
Derived earth fault elements can be user set to be polarised from residual voltage or negative phase sequence voltage.
Measured earth fault elements are polarized from Vo.

### 74T/CCS Trip & Close Circuit Supervision

The trip or close circuit(s) can be monitored via binary inputs. Trip circuit failure raises an HMI alarm and output(s).

### 81HBL2 Inrush Restraint

Where second harmonic current is detected (i.e. during transformer energisation) user selectable elements can be blocked and an alarm given.

### 51c Cold Load Pickup

If a circuit breaker is closed onto a 'cold' load, i.e. one that has not been powered for a prolonged period, this can impose a higher than normal load-current demand on the system which could exceed normal settings. These conditions can exist for an extended period and must not be interpreted as a fault. To allow optimum setting levels to be applied for normal operation, the cold load pickup feature will apply alternative current settings for a limited period. The feature resets when either the circuit breaker has been closed for a settable period, or if the current has reduced beneath a set level for a user set period.

### Standard Version – Plus 79 Auto-Reclose

A high proportion of faults on an overhead line network are transient and can be cleared quickly by high speed tripping followed by an automated circuit breaker reclose sequence.

The function provides independent phase fault and earth fault / sensitive earth fault sequences of up to 5 trip i.e. 4 reclose attempts before lockout. An auto-reclose sequence can be user set to be initiated from internal protection operation or via binary input from an external protection.

### Programmable Logic

The user can map binary inputs, protection elements, LEDs and binary outputs together in a logical scheme. Up to 4 logic equations can be defined using standard logic functions e.g. Timers, AND/OR gates, Inverters and Counters to provide the user required functionality. Each logic equation output can be used for alarm & indication and/or tripping.

### Virtual Inputs/Outputs

There are 8 virtual inputs/outputs to provide internal logical states to assist in the application of the functions. Each virtual I/O can be assigned in the same way as a physical I/O.

### Circuit Breaker Maintenance

Two circuit breaker operations counters are provided to assist with maintenance scheduling. The maintenance counter records the overall number of operations and the delta counter records the number of operations since the last reset.
An $I^2t$ summation counter provides a measure of the contact wear indicating the total energy interrupted by the circuit breaker contacts.
Each counter has a user set target operations count which, when reached, can be mapped to raise alarms/binary outputs. A CB Trip Time meter is also available, which measures the time between the trip being issued and the auxiliary contacts changing state.

### Control Mode

The relay has a control menu with access to commonly used command operations. Access to the control commands is restricted by a 4 character control function password. Each command requires a select then execute operation, if the execute operation is not performed

within a time window the command is aborted. The following control functions are available:
CB Operation
Auto Reclose In/Out
Auto Reclose Trip & Reclose
Auto Reclose Trip & Lockout
EF/SEF In/Out
Inst Prot In/Out
Hot Line Working In/Out



**Fig 10. Example of Control Function View**

## Data Acquisition - Via Communication Interface

### Sequence of event records

Up to 1000 events are stored and time tagged to 1ms resolution.

### Fault Records

The last 10 fault records are displayed on the relay fascia and are also available through the communication interface, with time and date of trip, measured quantities and type of fault.

### Waveform recorder

The waveform recorder stores analogue data for all poles and the states of protection functions, binary inputs, LEDs and binary outputs with user settable pre & post trigger data. A record can be triggered from protection function, binary input or via data communications. 10 records of 1 second duration are stored.

### Demand Metering

A rolling record of demand over the last 24h is stored. The demand is averaged over a user selectable period of time. A rolling record of such demand averages is stored and provides the demand history. A typical application is to record 15min averages for the last 7 days.

### Real Time Clock

The time and date can be set and are maintained while the relay is de-energised by a back up storage capacitor. The time can be synchronized from a binary input pulse or the data communication channel.

## Serial Communications

The relay offers a USB serial port as standard on the front of all units. All of the relays functions can be set on a PC using Reydisp Evolution via the USB port. The connection is made with a USB cable and operates with a 'plug and play' connection, so no pre-setting of the relay is required.

The front port can be switched off or set to use either the DNP3.0, MODBUS-RTU, IEC60870-5-103 and ASCII protocols for testing purposes.

A rear RS485 electrical connection is available on all units for system interface connections. An internal terminating resistor is provided, which can be connected into the circuit by adding a wire loop between the relevant terminals.
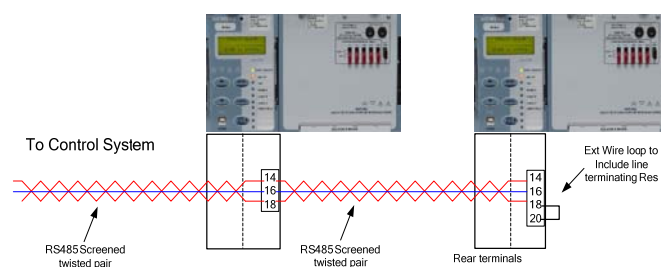


**Fig 11. Typical RS485 connection**

The rear RS485 can be user selected to be OFF, IEC60870-5-103, MODBUS RTU or DNP3.0 protocol.

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# Reydisp Evolution

Reydisp Evolution is a Windows based software tool, providing the means for the user to apply settings, interrogate settings and retrieve events and disturbance waveforms from the device and is common to the entire range of Reyrolle protection relays.
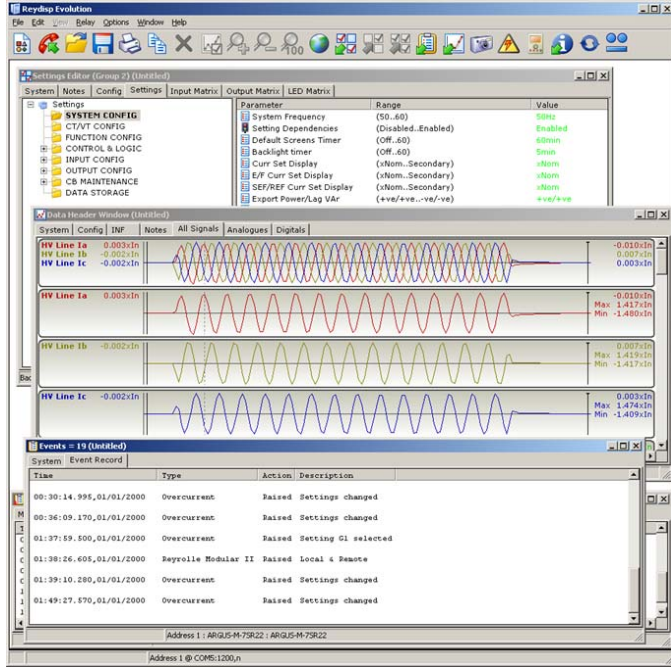


Fig 12. Typical Reydisp Evolution Screenshot

## Language Editor

The Language editor software gives the user the ability to customize the text displayed in the relays, Menu structure and instrumentation views. The tool allows a language file to be created and transferred to the relay containing Western European characters
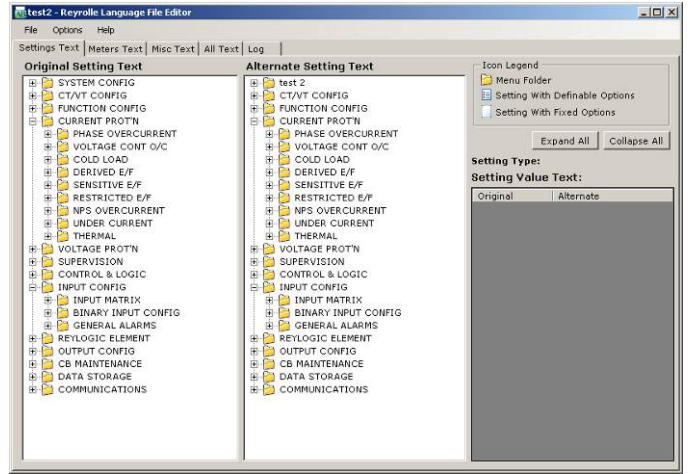


Fig 13. Typical Language Editor Screenshot

## Communications Editor

To facilitate easier interfacing to a substation the relays default protocol configuration may be modified using the communication editor software tool.
The communication editor is a PC based software package provided within the Reydisp software suite which allows modification of the IEC60870-5-103, DNP 3.0 and MODBUS Protocols.
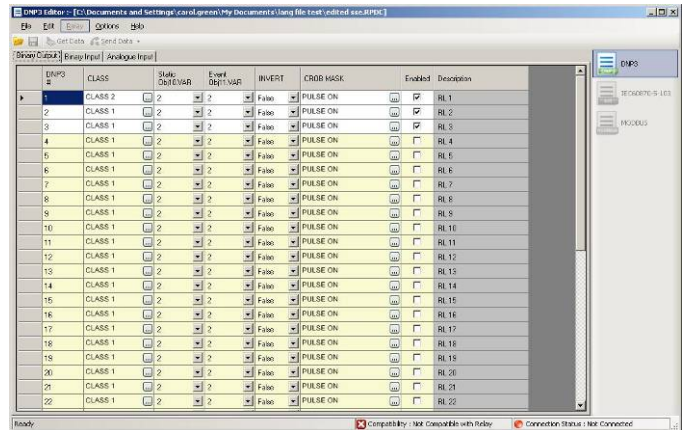


Fig 14. Typical Communications Editor Screenshot

# Service Conditions and performance data

Number of Pilot cores required     2

Pilot Requirements

|  | R Mode | Rf Mode | Rf mode with 15kv Transf. | | |
|---|---|---|---|---|---|
|  |  |  | Tap 1 | Tap 0.5 | Tap 0.25 |
| Max. Loop Resistance | 1000 Ω | 2000 Ω | 1780 Ω | 880 Ω | 440 Ω |
| Max. Inter core Capacitance | 2.5μF | 0.8 μF | 1 μF | 2 μF | 4 μF |

Pilot Current and Voltage

|  | R Mode | Rf Mode | Rf mode with 15kv Transf. | | |
|---|---|---|---|---|---|
|  |  |  | Tap 1 | Tap 0.5 | Tap 0.25 |
| Peak Voltage applied to pilots under fault conditions | 300v | 450v | 450v | 330v | 225v |
| Maximum current carried by pilots under fault conditions | 200mA | 250mA | 250mA | 380mA | 500mA |

Maximum Primary Line Capacitive Charging Current.
Solidly Earthed System, 1/3 times the most sensitive earth fault setting
Resistance Earthed System, 1/9 times the most sensitive earth fault setting

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# Technical Data

For full technical data refer to the Performance Specification Section of the Technical Manual.

## Inputs and Outputs

### Current Inputs

| Quantity | 3phase summation transformer plus 3 x Phase & 1 x Earth |
|---|---|
| Rated Current In | 1/5A |
| Measuring Range | 80 x In |
| Instrumentation ≥ 0.1xIn | ±1% In |
| Frequency | 50/60Hz |
| Thermal Withstand: Continuous | 2 x In |
| 10 Minutes | 3.5 x In |
| 2 Minutes | 6 x In |
| 1 Second | 100A (1A)  350A (5A) |
| 1 Cycle | 700A (1A)  2500A (5A) |

### Voltage Inputs

| Quantity | 3 ph-ph |
|---|---|
| Nominal Voltage | 40...160V a.c. Range |
| Instrumentation ≥ 0.8xVn | ±1% Vn |
| Thermal Withstand: Continuous 1 Second | 270V |
| Burden @ 110V | ≤ 0.06 VA |

### Auxiliary Supply

| Rated DC Voltage | 110/125/220/250V Range 64 to 300 24/48/60V Range 18 to 72 |
|---|---|
| Power Consumption: Min | 3.9W |
| Max | 8W |
| Allowable superimposed ac component | 12% of DC voltage |
| Allowable breaks/dips in supply (collapse to zero) | 50ms |

### Solkor Contactor Outputs

| Number | 3 Normally Open |
|---|---|
| Operating Voltage | Voltage Free |
| Operating Mode | Self Reset |
| Contact Rating | Make and carry for 0.2s a burden of 6600VA with a maximum of 30A |

## Binary Inputs

| Number | 3 or 6 |
|---|---|
| Operating Voltage | 19V dc Range 17 to 320V dc 88V Range 74 to 320V dc |
| Minimum dc current for operation | ≤ 1.5mA |
| Pick Up Delay | User Selectable 0 to 14,400,00ms |

## Binary Outputs

| Number | 5 or 8 (3 change over contacts) |
|---|---|
| Operating Voltage | Voltage Free |
| Operating Mode | User selectable - Self or Hand/Electrical Reset or pulsed. |
| Operating Time from Energizing Binary Input | <20ms |
| Making Capacity: Carry continuously Make and carry (L/R ≤ 40 ms and V ≤ 300 V) | 5A ac or dc 20A ac or dc for 0.5s 30A ac or dc for 0.2s |
| Breaking Capacity ( ≤ 5 A  and  ≤ 300 V): AC Resistive AC Inductive DC Resistive DC Inductive | 1250 VA 250 VA     at p.f. ≤ 0.4 75 W 30 W       at L/R ≤ 40ms 50 W       at L/R ≤ 10ms |

## Unit Design

| Housing | E10 (see dimension drawing) |
|---|---|
| Indication | 20 Character 4 line Display Relay Healthy LED 9 Tri Coloured User Programmable Self or Hand Reset LED's |
| With-drawable Elements | Yes – 2 modules |
| User Interface | 5 Navigation Keys |
| Weight | Typical 8.6 Kg |
| IP Rating Installed with cover | IP 50 |

## Serial Interface

| Communication Port | Front USB Type B Rear RS485 2 wire electrical |
|---|---|
| Protocols | IEC60870-5-103 MODBUS RTU DNP3.0 |

## Data Storage

| | |
|---|---|
| Fault Record | 10 |
| Waveform Record | 10 x 1sec<br>2 x 5sec<br>5 x 2sec<br>1 x 10sec<br>Pre trigger 10...90% |
| Events | 1000 1ms Resolution |

## Mechanical Tests

### Vibration (Sinusoidal)
*IEC 60255-21-1 Class I*

| Type | Level | Variation |
|---|---|---|
| Vibration response | 0.5 gn | ≤ 5 % |
| Vibration response | 1.0 gn | ≤ 5 % |

### Shock and Bump
*IEC 60255-21-2 Class I*

| Type | Level | Variation |
|---|---|---|
| Shock response | 5 gn, 11 ms | ≤ 5 % |
| Shock withstand | 15 gn, 11 ms | ≤ 5 % |
| Bump test | 10 gn, 16 ms | ≤ 5 % |

### Seismic
*IEC 60255-21-3 Class I*

| Type | Level | Variation |
|---|---|---|
| Seismic response | X-plane - 3.5mm displacement below crossover freq (8-9Hz) 1gn and above<br>Y-plane – 1.5mm displacement below crossover freq (8-9Hz) 0.5gn above | ≤ 5 % |

### Mechanical Classification

| | |
|---|---|
| Durability | >$10^6$ operations |

## Electrical Tests

### Insulation
*IEC 60255-5*

| Type | Level |
|---|---|
| Between any terminal and earth | 2.0 kV AC RMS for 1 min |
| Between independent circuits | 2.0 kV AC RMS for 1 min |
| Across normally open contacts | 1.0 kV AC RMS for 1 min |
| Between Pilot circuit and other terminals | 5.0 kV AC RMS for 1 min |
| Across external Pilot Isolating transformer | 15.0 kV AC RMS for 1 min |

### High Frequency Disturbance
*IEC 60255-22-1 Class III*

| Type | Level | Variation |
|---|---|---|
| Common (longitudinal) mode | 2.5 kV | ≤ 5 % |
| Series (transverse) mode | 1.0 kV | ≤ 5 % |

### Electrostatic Discharge
*IEC 60255-22-2 Class IV*

| Type | Level | Variation |
|---|---|---|
| Contact discharge | 8.0 kV | ≤ 5 % |

### Fast Transients
*IEC 60255-22-4 Class IV*

| Type | Level | Variation |
|---|---|---|
| 5/50 ns  2.5 kHz repetitive | 4kV | ≤ 5 % |

### Surge Immunity
*IEC 60255-22-5*

| Type | Level | Variation |
|---|---|---|
| Between all terminals and earth | 4.0 kV | ≤ 10 % |
| Between any two independent circuits | 2.0kV | ≤ 10 % |

## Conducted Radio Frequency Interference

*IEC 60255-22-6*

| Type | Level | Variation |
|------|-------|-----------|
| 0.15 to 80 MHz | 10 V | ≤ 5 % |

## Radiated Radio Frequency

*IEC 60255-25*

| Type | Limits at 10 m, Quasi-peak |
|------|----------------------------|
| 30 to 230 MHz | 40 dB(μV) |
| 230 to 10000 MHz | 47 dB(μV) |

| Rated Frequency ($f_N$) | Operating Range |
|-------------------------|-----------------|
| 50 Hz | 47Hz to 52Hz |
| 60Hz | 57Hz to 62Hz |

## Conducted Radio Frequency

| Type | Limits | |
|------|--------|--|
| | Quasi-peak | Average |
| 0.15 to 0.5 MHz | 79 dB(μV) | 66 dB(μV) |
| 0.5 to 30 MHz | 73 dB(μV) | 60 dB(μV) |

## Radiated Immunity

*IEC 60255-22-3 Class III*

| Type | Level |
|------|-------|
| 80 MHz to 1000 MHz Sweep | 10 V/m |
| 1.4GHz to 2.7GHz Sweep | 10V/m |
| 80,160,380,450,900,1850,2150 MHz  Spot | 10V/m |

# Climatic Tests

## Temperature

*IEC 60068-2-1/2*

| Operating Range | -10 °C to +55 °C |
|-----------------|------------------|
| Storage range | -25 °C to +70 °C |

## Humidity

*IEC 60068-2-78*

| Operational test | 56 days at 40 °C and 93 % relative humidity |
|------------------|---------------------------------------------|

# Performance

## 87I Current Differential

| Operating Time | R Mode | 5kV Rf Mode | 15kV Rf Mode |
|----------------|--------|-------------|--------------|
| 3x fault setting | 60ms | 50ms | 45ms |
| 5x fault setting | 55ms | 45ms | 40ms |
| 10x fault setting | 50ms | 45ms | 40ms |

Primary fault settings with typical current transformers and zero pilot capacitance are given below. Values are expressed as percentages of the current transformer rating.

| Fault Type | Fault Setting | | | | | |
|------------|---------------|--|--|--|--|--|
| | 5kV scheme | | | | 15kV scheme | |
| | R mode | | Rf mode | | Rf mode only | |
| | N1 | N | N1 | N | N1 | N |
| A-E | 16 | 22 | 18 | 25 | 25 | 35 |
| B-E | 18 | 27.5 | 21 | 32 | 30 | 44 |
| C-E | 22 | 37 | 25 | 42 | 35 | 59 |
| A-B | 110 | | 125 | | 177 | |
| B-C | 110 | | 125 | | 177 | |
| C-A | 55 | | 62 | | 88.5 | |
| 3P | 63 | | 72 | | 101 | |

The addition of Pilot Supervision will increase the nominal settings by up to 20%.

## 27/59 Under/Over Voltage

| Number of Elements | 4 Under or Over |
|--------------------|-----------------|
| Operate | Any phase or All phases |
| Voltage Guard | 1,1.5...200V |
| Setting Range Vs | 5,5.5...200V |
| Hysteresis Setting | 0.0.1...80% |
| Vs Operate Level | 100% Vs, ±1% or ±0.25V |
| Reset Level: Overvoltage Undervoltage | =(100%-hyst)xVop, ±1% =(100%+hyst)xVop, ±1% |
| Delay Setting td | 0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400s |
| Basic Operate Time : 0 to 1.1xVs 0 to 2.0xVs 1.1 to 0.5xVs | 73ms ±10ms 63ms ±10ms 58ms ±10ms |
| Operate time following delay. | Tbasic +td , ±1% or ±10ms |
| Inhibited by | Binary or Virtual Input VT Supervision Voltage Guard |

## 37 Undercurrent

| | |
|---|---|
| Number of Elements | 2 |
| Setting Range Is | 0.05,0.10...5.0 x In |
| Operate Level | 100% Is, ±5% or ±1%xIn |
| Delay Setting td | 0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400s |
| Basic Operate Time: 1.1 to 0.5xIn | 35ms ±10ms |
| Operate time following delay. | Tbasic +td , ±1% or ±10ms |
| Overshoot Time | < 40ms |
| Inhibited by | Binary or Virtual Input |

## 46 Negative Phase Sequence Overcurrent

| | |
|---|---|
| Number of Elements | DT & IT |
| DT Setting Range Is | 0.05,0.10...4.0 x In |
| DT Operate Level | 100% Is, ±5% or ±1%xIn |
| DT Delay Setting td | 0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400s |
| DT Basic Operate Time 0 to 2 xIs 0 to 5 xIs | 40ms ±10ms 30ms ±10ms |
| DT Operate time following delay. | Tbasic +td , ±1% or ±10ms |
| IT Char Setting | IEC NI,VI,EI,LTI, ANSI MI,VI,EI & DTL |
| IT Setting Range | 0.05..2.5 |
| Tm Time Multiplier | 0.025,0.050...1.6 |
| Char Operate Level | 105% Is, ±4% or ±1%In |
| Overshoot Time | < 40ms |
| Inhibited by | Binary or Virtual Input |

## 47 Negative Phase Sequence

| | |
|---|---|
| Number of Elements | 2 |
| Setting Range Vs | 1,1.5...90V |
| Hysteresis Setting | 0,0.1...80% |
| Operate Level | 100% Vs, ±2% or ±0.5V |
| Delay Setting td | 0.00,0.01...20,20.5...100,101...1000,1010...10000,10100...14400s |
| Basic Operate Time 0V to 1.5xVs 0V to 10xVs | 80ms ±20ms 55ms ±20ms |
| Operate time following delay. | Tbasic +td , ±2% or ±20ms |
| Overshoot Time | < 40ms |
| Inhibited by | Binary or Virtual Input |

## 49 Thermal Overload

| | |
|---|---|
| Operate levels | Operate and Alarm |
| Setting Range Is | 0.10,0.11...3.0 x In |
| Operate Level | 100% Is, ±5% or ±1%xIn |
| Time Constant Setting | 1,1.5...1000min |
| Operate time | $t = \tau \times In\left\{\dfrac{I^2 \cdot I_p^2}{I^2 \cdot (k \times I_B)^2}\right\}$ |

| | |
|---|---|
| | ±5% absolute or ±100ms where Ip = prior current |
| Alarm Level | Disabled, 50,51...100% |
| Inhibited by | Binary or Virtual Input |

## 50 (67) Instantaneous & DTL OC&EF (Directional)

| | |
|---|---|
| Operation – 7PG2114/6 only | Non directional, Forward or reverse |
| Elements | Phase, Derived Earth, Measured Earth |
| Number of Elements 2 x 7PG2113/5 4 x 7PG2114/6 | 2/4 x OC 2/4 x Derived EF 'N' 2/4 x Measured EF 'G' |
| Setting Range Is | 0.05,0.06...50 x In SEF 0.005...5 x In |
| Time Delay | 0.00...14400s |
| Operate Level | 100% Is, ±5% or ±1%xIn |
| Operate time: 50 50N | 0 to 2xIs – 35ms, ±10ms, 0 to 5xIs – 25ms, ±10ms 0 to 2xIs – 40ms, ±10ms, 0 to 5xIs – 30ms, ±10ms |
| Operate time following delay | Tbasic +td , ±1% or ±10ms |
| Inhibited by | Binary or Virtual Input Inrush detector VT Supervision |

## 51(67) Time Delayed OC&EF (Directional)

| | |
|---|---|
| Operation – 7PG2114/6 only | Non directional, Forward or reverse |
| Elements | Phase, Derived Earth, Measured Earth |
| Number of Elements 2 x 7PG2113/5 4 x 7PG2114/6 | 2/4 x OC 2/4 x Derived EF 'N' 2/4 x Measured EF 'G' |
| Characteristic | IEC NI,VI,EI,LTI ANSI MI,VI,EI & DTL |
| Setting Range Is | 0.05,0.1...2.5 x In SEF 0.005...0.5 x In |
| Time Multiplier | 0.025,0.05...1.6 |
| Time Delay | 0,0.01... 20s |
| Operate Level | 105% Is, ±4% or ±1%xIn |
| Minimum Operate time IEC ANSI | $t_{op} = \dfrac{K}{\left[\frac{I}{Is}\right]^\alpha - 1} \times Tm$ $t_{op} = \left[\dfrac{A}{\left[\frac{I}{Is}\right]^P - 1} + B\right] \times Tm$ ± 5 % absolute or ± 30 ms |
| Follower Delay | 0 - 20s |
| Reset | ANSI decaying, 0 – 60s |
| Inhibited by | Binary or Virtual Input Inrush detector VT Supervision |

## 51V Voltage Controlled Overcurrent

| | |
|---|---|
| Setting Range | 5,5.5...200V |
| Operate Level | 100% Vs, ±5% or ±1%xVn |
| Multiplier | 0.25.0.3...1 x 51Is |
| Inhibited by | VT Supervision |

## 50BF Circuit Breaker Fail

| | |
|---|---|
| Operation | Current check - Phase and Measured Earth with independent settings Mechanical Trip CB Faulty Monitor |
| Setting Range Is | 0.05,0.055...2.0 x In |
| 2 Stage Time Delays | Timer 1 20...60000ms Timer 2 20...60000ms |
| Operate Level | 100% Is, ±5% or ±1%xIn |
| Disengaging time | < 20ms |
| Operate time following delay | Tcbf ±1% or ±2ms |
| Triggered by | Any function mapped as trip contact. |
| Inhibited by | Binary/Virtual Input |
| Timer By pass | Yes, 50BF CB Faulty Input |

## 59N Neutral Voltage Displacement

| | |
|---|---|
| Number of Elements | DT & IT |
| DT Setting Range Is | 1...100V |
| DT Operate Level | 100% Vs, ±2% or ±0.5V |
| DT Delay Setting td | 0 ...14400s |
| DT Basic Operate Time 0V to 1.5 x Vs 0V to 10 x Vs | 76ms ±20ms 63ms ±20ms |
| DT Operate time following delay. | Tbasic +td , ±1% or ±20ms |
| IT Char Setting | IDMTL & DTL |
| IT Setting Range | 1...100V |
| Tm Time Multiplier(IDMT) | 0.1...140 |
| Delay (DTL) | 0...20s |
| Reset | ANSI Decaying, 0...60s |
| Char Operate Level | 105% Vs, ±2% or ±0.5V |
| Inhibited by | Binary or Virtual Input |

## 60 Supervision

| | |
|---|---|
| CT | 7PG2113/5 Current 7PG2114/6 Vnps & Inps |
| VT | nps/zps |

## 64H Restricted Earth Fault

| | |
|---|---|
| Setting Range | 0.05...0.95xIn |
| Operate Level | 100% Is, ±5% or ±1%xIn |
| Time Delay | 0.00... 14400s |
| Basic Operate Time | 0 to 2 xIs 45ms ±10ms 0 to 5 xIs 35ms ±10ms |
| Inhibited by | Binary or Virtual Input |

## 74T/CC Trip/Close Circuit Supervision

| | |
|---|---|
| Number of supervisable circuits | 3 x Trip and 3 x Close |
| Number of BI's Required | 1 or 2 per function |

## 79 AutoReclose

| | |
|---|---|
| Operating Mode | Phase, Earth, External |
| Number of Reclosures | 4 |
| Number of Trips | 5 |
| Dead Time | 0...14400 |
| Reclaim Time | 0...600 |
| Lockout Reset | CB, Timer & BI |

## Control Functions

| | |
|---|---|
| CB | Open/Close |
| Inst Prot | IN/OUT |
| EF | IN/OUT |
| SEF | IN/OUT |
| Hot Line | IN/OUT |
| Relay Mode | Local/Remote/Local or Remote |
| Reset | LED's & O/P's |

## CB Maintenance

| | |
|---|---|
| Trip Counter | Total & Delta 0...10000 |
| Counts to AR Block | 0...10000 |
| Frequent Operations | 0...10000 |
| $I^2t$ Alarm | 10...100000 |

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# Current Transformer Requirements

| | R mode | Rf mode |
|---|---|---|
| Maximum output of CT required to operate relay | 1.2VA | 3VA |

The current transformer requirements are governed by those of the Current Differential protection rather than the less onerous auxiliary and backup functions. The main requisite is that the saturation voltage of the current transformers should not be less than that given by the formula:

$$V_k = \frac{50}{I_n} + \frac{I_F}{N}\left(R_{CT} + 2R_L\right)$$

Where
$I_n$ = Rated current of Solkor Rf relay.
$I_F$ = Primary current under maximum steady state THROUGH FAULT conditions.
$N$ = Current Transformer ratio.
$R_{CT}$ = Secondary resistance of the current transformer
$R_L$ = Lead resistance between the current transformers and the Solkor R/Rf, per phase.

For the above purpose the saturation voltage i.e. the knee point of the magnetising curve, may be taken as that point on the curve at which a 10% increase in output voltage requires 50% increase in magnetising current.

To ensure good balance of the protection the current transformers at the two ends should have identical turns ratios. Close balance of the ratio is provided by current transformers to IEC60044: pt1, class px, whose ratio error is limited to ±0.25% and these CTs are recommended to meet the above requirements.

It is recommended that no other burdens should be included in the current transformer circuit, but where this cannot be avoided the additional burden should be added to those listed when determining the current transformer output voltage required.

In addition to the above, the secondary magnetising currents of the current transformers at different ends of the feeder should normally not differ by more than In/20 amperes for output voltages up to 50/In volts where In = rated current of Solkor Rf relay. This criterion is applied to quantify matching of the transient response of the two CTs so that relay operations do not occur due to differing responses of the CTs to normal load switching or the incidence and clearance of out of zone faults. This condition is usually easily satisfied by modern CTs of similar size since the magnetising current is usually a lower value. Care should be taken when applying a new CT to be paired with existing CT and also when interposing CTs are required to match CT ratios.

# Pilot Supervision (External)

## Auxiliary Supply

| Send End | 110/220/240V ac 50/60Hz |
|---|---|
| Receive End | 30V dc |
| | 50V dc |
| | 125V dc |
| | 240V dc |

## Burdens

| AC Supervision Supply | 10VA approx. |
|---|---|
| AC supply fail relay | 3 to 5VA |
| Receive Repeat Relay | 1W |

## Contact Arrangements

| Pilot Supervision Relay(B75) | 1NO self reset |
|---|---|
| Repeat relay B74 | 2NO & 2NC |
| Supervision supply fail relay | 2NO & 2NC |

## Contact Ratings

Type B22, B74 and B75

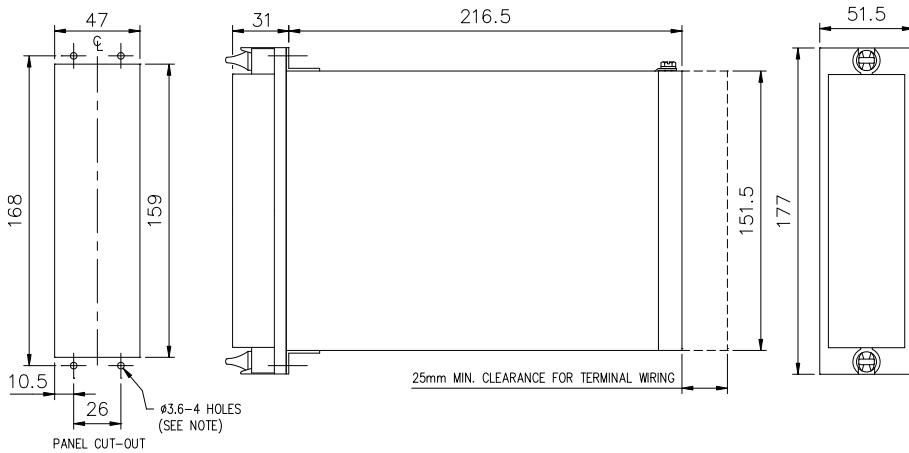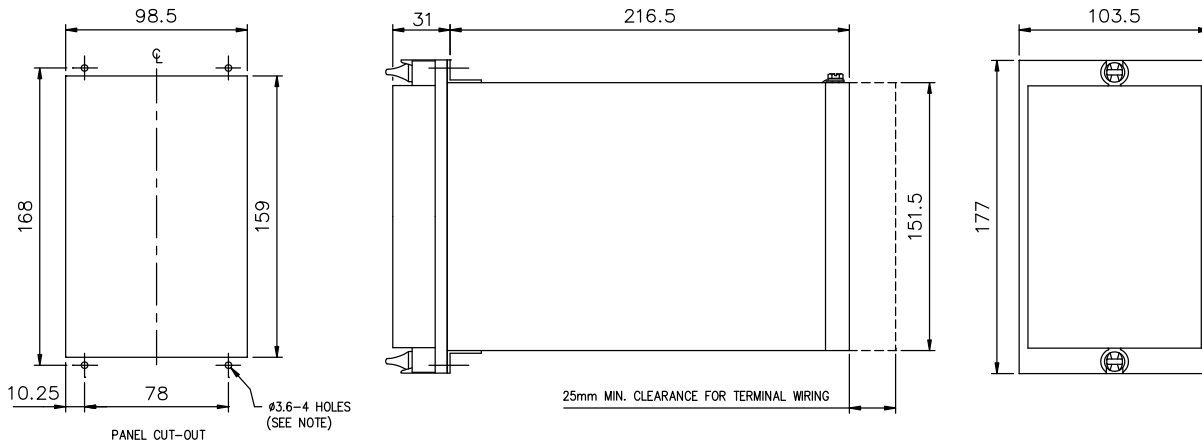| Make & Carry Continuously | 1500VA ac or 1500W dc within limits of 660V and 3A. Make and carry 8A for 3 secs or 16A for 1 second. |
|---|---|
| Break | 300VA ac or 75W dc (inductive L/R 0.04) within limits of 250V and 5A |
| Indication | Flag indicators shown on de-energisation |
| Supervision supply fail relay (B22) | Hand Reset Flag |
| Receive Repeat Relay | Self Rest Flag |

**Fig 15. E2 Case**
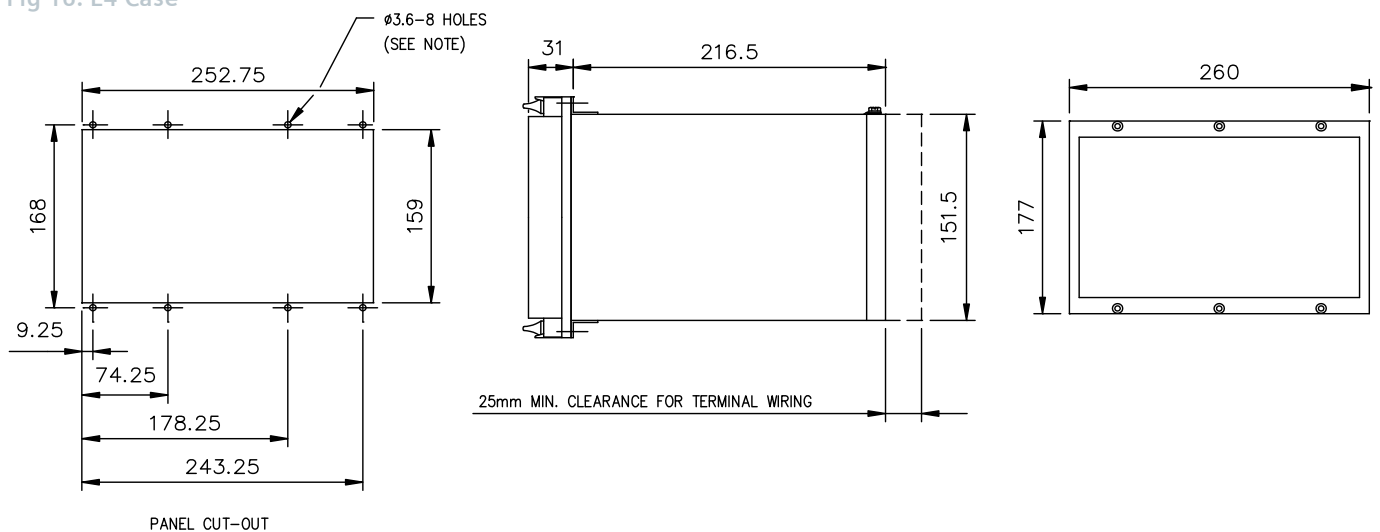


**Fig 16. E4 Case**



**Fig 17. E10 Case**

Note: The Ø3.6holes are for M4 thread forming (tri-lobular) screws. These are supplied as standard and are suitable for use in ferrous/aluminium panels 1.6mm thick and above. For other panels, holes to be M4 clearance (typically Ø4.5) and relays mounted using M4 machine screws, nuts and lockwashers (supplied in panel fixing kit).

NOTE:
1. PANEL CUTOUT FOR FLUSH MOUNTED TO BE 348mm x 150mm ±0.5.
2. FOR FLUSH MOUNTING DETAILS SEE DRAWING 409X19006.
3. RECOMMENDED MINIMUM RELAY CENTRES 178mm.
4. TERMINAL BLOCK C FITTED TO TEC RELAY BUT IS NOT FITTED TO 15kV SEND OR RECEIVE RELAYS

Fig 18. C11/2 Case

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**Fig 19. 7PG2113/5 Solkor Relays**

External connections shown dotted are required for correct operation of Current Differential and Guard functions.

87L R/Rf Mode

Pilot Connection

Link for R Mode Only

**\*** This connection is internal to the relay chassis and is removed with the chassis as it is withdrawn from the case.
Terminals 24-26-28 must be connected together in external wiring

BI 1
BI 2
BI 3

BI 4
BI 5
BI 6

RS485: A, GND, B, Term.

BO 6
BO 7
BO 8

7PG2115 only

GND.

| 1 • | • 2 | | | 1 • | • 2 | 1 • | • 2 |
| E R/Rf | | | | B PSU | | A Analogue | |
| 27 • | • 28 | | | 27 • | • 28 | 27 • | • 28 |

Rear View
Arrangement of terminals and modules

IL1
IL2
IL3
IL4

BO 1
BO 2
BO 3
BO 4
BO 5

NOTES

BI = Binary Input
BO = Binary Output

Shows contacts internal to relay case assembly.
Contacts close when the relay chassis is withdrawn from case

Fig 20 .7PG2114/6 Solkor Relays

External connections shown dotted are required for correct operation of Current Differential and Guard functions. Connections for 1A rating are shown..

**\*** This connection is internal to the relay chassis and is removed with the chassis as it is withdrawn from the case.
Terminals 24-26-28 must be shorted in external wiring

87L R/Rf Mode

Pilot Connection

Link for R Mode Only

Rear View
Arrangement of terminals and modules

| E | B | A |
|---|---|---|
| R/Rf | PSU | Analogue |

NOTES

BI = Binary Input
BO = Binary Output

Shows contacts internal to relay case assembly.
Contacts close when the relay chassis is withdrawn from case

7PG2116 only

## Fig 21. 5kV Pilot Supervision Send End



## Fig 22. 15kV Pilot Supervision Send End (Vedette Case)



## Fig 23. 5kV Pilot Supvn. Receive End



* contacts may be 2M2B as shown or 4M or 4B
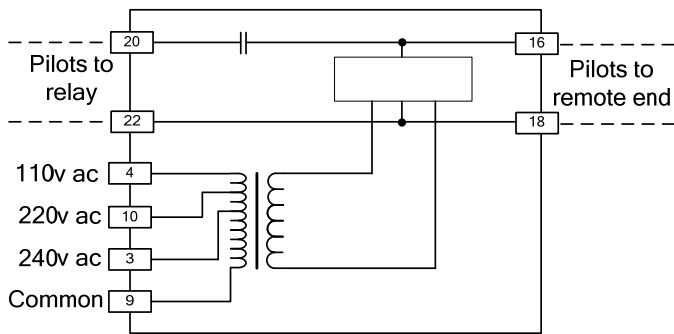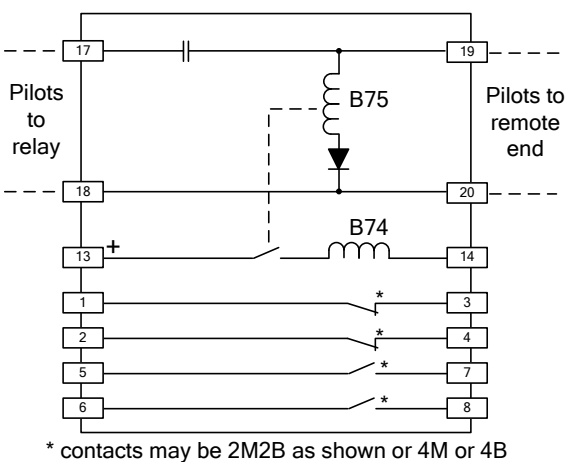
## Fig 24. 15kV B75 Pilot Supervision Receive Relay
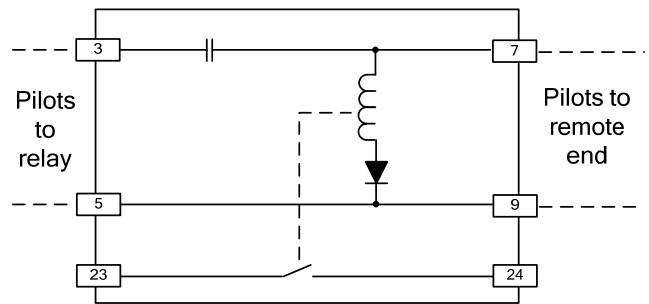


## Fig 25. B74 Repeat Relay for 15kV Pilot Supvn. Scheme



* contacts may be 2M2B as shown or 4M or 4B
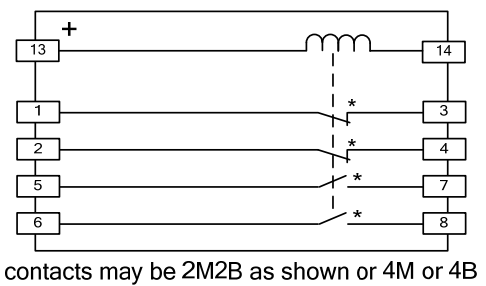
## Fig 26. B22 Power Supply Supvn Relay for Pilot Supvn Scheme
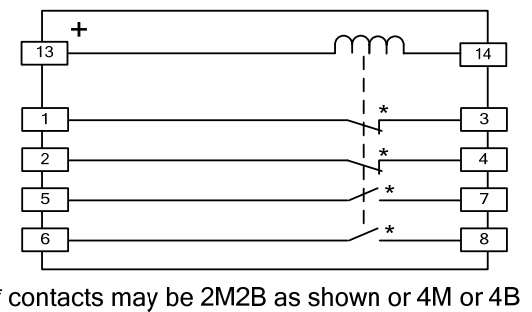


* contacts may be 2M2B as shown or 4M or 4B

| Product description | Variants | Order No. |
|---|---|---|
| | | 7 P G 2 1 1 1 □ - □ □ A 1 2 - 1 □ □ 0 |

**Solkor R/Rf**

Pilot wire current differential feeder protection with Overcurrent Guard

<u>Relay type</u>
Solkor R/Rf relay — 1

<u>Case, I/O and Fascia</u>
Non Directional OC, E10 case, 4 CT, 3NO contacts plus 3 Binary Inputs / 5 Binary Outputs, 10 LEDs — 3
Non Directional OC, E10 case, 4 CT, 3NO contacts plus 6 Binary Inputs / 8 Binary Outputs, 10 LEDs — 5

<u>Measuring input</u>
1A, 50/60Hz — 1
5A, 50/60Hz — 2

<u>Auxiliary voltage</u>
80-250V DC, binary input threshold 19V DC — G
80-250V DC, binary input threshold 88V DC — H
24-60V DC, binary input threshold 19V DC — J

<u>Spare</u> — A

<u>Communication Interface</u>
Standard version - included in all models, USB front port, RS485 rear port — 1

<u>Protocol</u>
IEC 60870-5-103, Modbus RTU and DNP3(user selectable setting) — 2

<u>Spare</u> — 1

<u>Protection Function Packages</u>
For future development — A
For future development — B
Standard version - included in all models — C
37 Undercurrent
46BC Broken conductor/load unbalance
46 Negative phase sequence overcurrent
49 Thermal overload
50BF Circuit breaker fail
50N 50G Instantaneous earth fault
50 Instantaneous phase fault overcurrent
51 Time delayed phase fault overcurrent
51N 51G Time delayed earth fault
60CTS CT Supervision
64H High impedance REF
74TC Trip circuit supervision
51c Cold load pickup
81HBL2 Inrush Restraint
Programmable logic

Standard version - plus
79 — D

<u>Solkor Mode</u> [1]
Solkor Rf — A
Solkor R — B
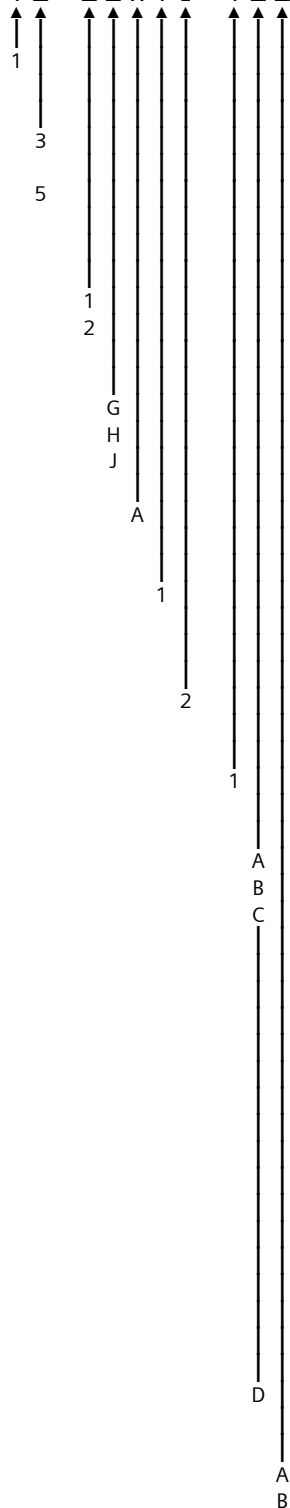
1) Default mode when supplied, relay mode is easily changed later my internal links

**Solkor R/Rf**

Pilot wire current differential feeder protection with Overcurrent Guard.

`7 P G 2 1 1 □ - □ □ A 1 2 - □ □ □ □ 0`

<u>Relay type</u>
Solkor R/Rf relay      1

<u>Case, I/O and Fascia</u>
Directional OC, E10 case, 4 CT, 3 VT, 3 NO contacts    4
plus 3 Binary Inputs / 5 Binary Outputs, 10 LEDs
Directional OC, E10 case, 4 CT, 3 VT, 3NO contacts    6
plus 6 Binary Inputs / 8 Binary Outputs, 10 LEDs

<u>Measuring input</u>
1A, 50/60Hz      1
5A, 50/60Hz      2

<u>Auxiliary voltage</u>
80-250V DC, binary input threshold 19V DC      G
80-250V DC, binary input threshold 88V DC      H
24-60V DC, binary input threshold 19V DC      J

<u>Spare</u>      A

<u>Communication Interface</u>
Standard version - included in all models,      1
    USB front port, RS485 rear port

<u>Protocol</u>
IEC 60870-5-103, Modbus RTU and      2
DNP3(user selectable setting)

<u>Spare</u>      1

<u>Protection Function Packages</u>
For future development      A
For future development      B
Standard version - included in all models      C
27/59 Under/Over Voltage
37 Undercurrent
46BC Broken conductor/load unbalance
46 Negative phase sequence overcurrent
47 Negative phase sequence voltage
49 Thermal overload
50BF Circuit breaker fail
51V Voltage Controlled Overcurrent
59N Neutral voltage displacement
60CTS CT Supervision
60VTS VT Supervision
64H High impedance REF
67/50 Directional instantaneous phase fault overcurrent
67/50N 67/50G Directional instantaneous earth fault
67/51 Directional time delayed phase fault overcurrent
67/51n 67/51G Directional time delayed earth fault
74TCS Trip circuit supervision
51c Cold load pickup
81HBL2 Inrush Restraint
Programmable logic

<u>Standard version - plus</u>
79      D

<u>Solkor Mode</u> [1]
Solkor Rf      A
Solkor R      B

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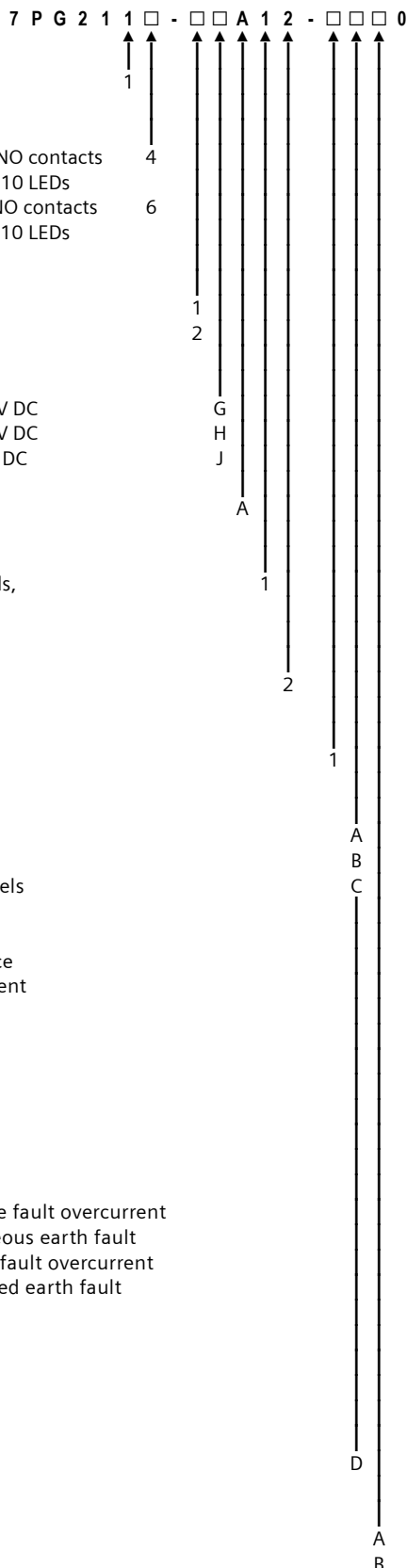
1)      Relay is set in Solkor Rf mode as default but can be changed by setting of internal links

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**Solkor R/Rf**

15kV isolation transformer for use with Solkor Rf.

7 P G 2 1 □ □ - 0 A A 0 0 - 0 □ A 0

<u>Relay type</u>
Solkor R/Rf - Circulating current feeder protection scheme      1

<u>Solkor R/Rf equipment</u>
Solkor Rf – 15kV isolation transformer      2

<u>Housing size</u>
Special      A

1)     For pilot insulation of between 5kV and 15kV, SOLKOR Rf mode only, order 7PG2112-0AA00-0AA0 isolating transformer with the relay at each feeder-end

| Product description | Variants | Order No. |
|---|---|---|

**Send End transformer rectifier unit**

For use with Solkor R/Rf relay, pilot supervision send end.

Order No.: 7 P G 2 1 ☐ 0 - 0 A A 0 0 - ☐ ☐ ☐ 0

Relay type
Supply Transformer/Rectifier unit (send end) [1]   **2**

Type of Flag
No flag   **0**

Contact Arrangement - NO
0 NO   **A**

Contact Arrangement – NC
0 NC   **A**

Number of contacts
None   **0**

Contact type
None   **0**

Insulation level
5kV   **1 C**
15kV   **2 W**
15kV, front connection   **3 W**

Housing size
Case size E4 (4U high)   **C**
Case size C1 1/2 Vedette   **W**

Rating [1]
110/220/240V AC, 50/60Hz   **A**

---
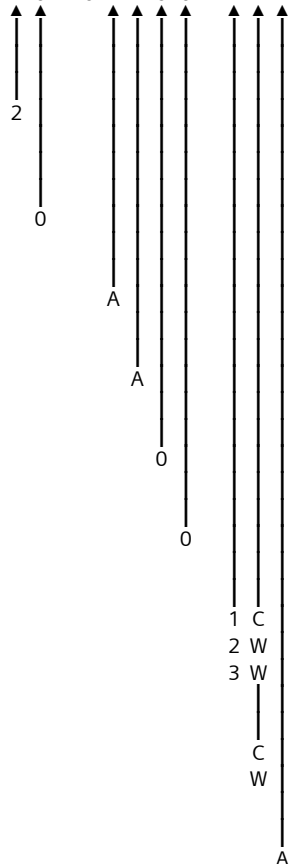
[1]) Supply Transformer/Rectifier unit (send end), ratings 110/220/240V ac, 50/60Hz.

[2]) For required supply supervision relay B22, see 7PG213*.

[3]) For optional guard relay B69, one 3 phase set (two sets required one at each feeder end), see 7PG217*.

---

Siemens Protection Devices Limited

**SIEMENS**

| Product description | Variants | Order No. |
|---|---|---|

**B22-AC**

For use with Solkor R/Rf relay, pilot supervision send end.

```
7 P G 2 1 □ □ - □ □ □ □ □ - □ □ □ 0
```

Relay type
Supply supervision (B22-AC)                3

Type of flag
Hand reset reverse acting flag                2

Contact operation
Self reset contacts                                 1

Contact arrangement – NO
2 NO                                                         C

Contact arrangement NC
2 NC                                                              C

Number of contacts
Four                                                                 4

Contact type
NO (Standard) / NC (Standard)                            0

Frequency
50Hz                                                                       1
60Hz                                                                       2

Housing size
Case size E2 (4U high)                                             A

Voltage rating
110V AC                                                                       A
220V AC                                                                       B
240V AC                                                                       C

| Product description | Variants | Order No. |
|---|---|---|

**B75/74**

For use with Solkor R/Rf relay, pilot supervision receive end (5kV).

7 P G 2 1 ☐☐ - ☐☐☐☐ - ☐☐☐ 0

Relay type [1]
Receive and repeat (B75/B74)     **4**

Type of flag
Self reset reverse acting flag     **4**

Contact operation
Self reset contacts     **1**

Contact arrangement – NO
0 NO     **A E**
2 NO     **C C**
4 NO     **E A**

Contact arrangement NC
0 NC     **A**
2 NC     **C**
4 NC     **E**

Number of contacts
Four     **4**

Contact type
NO (Standard) / NC (Standard)     **0**

Insulation level
5kV     **1**

Housing size
Case size E4 (4U high)     **C**

Voltage rating
24V DC     **A**
30V DC     **B**
50V DC     **C**
125V DC     **E**
240V DC     **F**

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[1]   Option selection for B74 element, B75 (3mA, 1NO/0NC) element included as standard

| Product description | Variants | Order No. |
|---|---|---|
| **B75**<br><br>For use with Solkor R/Rf relay, pilot supervision receive end (15kV). | | 7 P G 2 1 ☐ ☐ - ☐ ☐ ☐ ☐ ☐ - ☐ ☐ ☐ 0 |

Relay type
Receive (B75)    **5**

Type of flag
Self reset reverse acting flag    **4**

Contact operation
Self reset contacts    **1**

Contact arrangement – NO
1 NO    **B**

Contact arrangement NC
0 NC    **A**

Number of contacts
One    **1**

Contact type
NO (Standard) / NC (Standard)    **0**

Insulation level
15kV    **2**
15kV, front connection    **3**

Housing size
Case size C1 1/2 Vedette    **W**

Current setting
3mA    **A**

| Product description | Variants | Order No. |
|---|---|---|
| | | 7 P G 2 1 ☐ ☐ - ☐ ☐ ☐ ☐ ☐ - ☐ ☐ ☐ 0 |

**B74**

For use with Solkor R/Rf relay, pilot supervision receive end (15kV).

Relay type
Receive repeat (B74) — 6

Type of flag
Self reset reverse acting flag — 4

Contact operation
Self reset contacts — 1

Contact arrangement – NO
2 NO — C

Contact arrangement NC
2 NO — C

Number of contacts
Four — 4

Contact type
NO (Standard) / NC (Standard) — 0

Insulation level
15kV — 2

Housing size
Case size E2 (4U high) — A

Voltage rating
24V DC — A
30V DC — B
50V DC — C
125V DC — E
240V DC — F

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