



Features

Integrated protection, control, measurement and communication of up to 37 power parameters

Digital communications

Fully programmable PT and CT ratios

Simple menu driven interface

High quality backlit LCD display

True RMS measurement

3 phase, 3 wire or 4 wire unbalanced load options

18 protection relay functions

12 relay contacts outputs

Trip event history log

Watchdog relay

Benefits

Replaces numerous traditional protection relays

Significant cost savings

High accuracy

Remote monitoring

Investment protection

Delinquency avoidance

Compact and easy to configure

Time and space saving

Applications

G.59/1 Protection

General purpose system protection

Switchgear

Distribution systems

Generator sets

Control panels

Utility power monitoring

Motor protection

Cable protection

Feeder protection

Automatic transfer switches

Railway applications

Approvals

UL File No. E214283

CSA Compliant

Railtrack Certificate of Acceptance

PA05/1450. Scope: Protective Device on Signalling Power Supply Systems

The SPR system protection relay is a microprocessor based panel mounted device offering protection, control, measurement and communication of up to 37 power parameters in a single package. The SPR monitors three phases of voltage and current and provides up to twelve user definable relay outputs. The high contrast 80 character backlit LCD display allows the user to monitor any of the measured parameters, inspect setpoint details and relay contact status. The setpoints and configuration are all fully programmable via the simple menu driven user interface. Remote monitoring of status information is achievable via the integral RS 485 communication port which supports Modbus RTU protocol. SPR is suitable for many diverse applications, providing cost effective protection of expensive power assets.

Operation

Using an alphanumeric display, the SPR is simple to operate via four buttons which configure and control the product, all parameters can be inspected or modified through front of panel menu selections. For security, alterations of any parameters can be disabled with up to four levels of password protection. The default display is the status screen, where the status of each of the relay contacts can be clearly identified, but a user-defined screen can be easily configured to display four lines of metering information. SPR can also be remotely monitored and fully controlled over the RS485 Modbus connection.

Output Relays

The SPR has up to twelve sets of form C change-over (NO+NC) relay contacts, each rated at 8 Amps 250V AC. These do not have fixed functions, allowing each relay to be configured to suit a specific application. Flexibility is the key to this product and any function, or combination of functions, can be assigned to any relay. With a choice of up to 18 protective trip functions, and 9 logical functions, SPR provides a cost-effective method of protection combined with significant space savings. If additional contact sets are required for any function, programmable logic allows the paralleling of as many additional contacts as are available. The standard product has eight relays, but for the most demanding applications, four additional relays can be supplied as an option. Each relay can be configured to energize or de-energize on trip (failsafe or non-failsafe operation), latch or self-reset, have its activity recorded in the event log, or trigger a common alarm, as required.

Watchdog Relay

Following comprehensive self diagnostic checks at power-up, and once correct operation has been verified, the dedicated change-over (NO+NC) relay contacts energize to indicate product availability. The microprocessor continuously monitors the relay system for healthy operation, and the contacts will de-energize if an internal fault is detected or the auxiliary supply is lost.

Event History Log

Every trip event can be selectively recorded in the history log. Up to 50 events are itemized by date and time stamp to a time resolution of 100ms, ideal for analyzing the sequence of events leading up to a system fault. The internal real time clock has battery backup to maintain the correct time and date for many years, even if the product is not powered up.

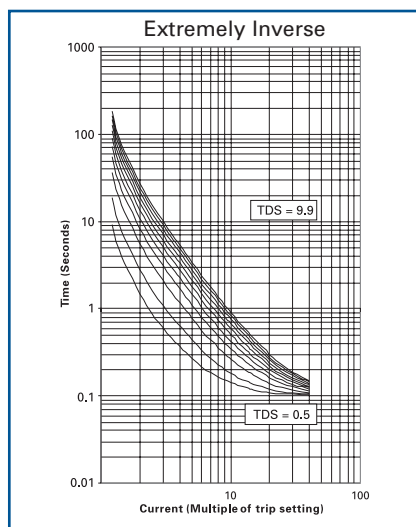
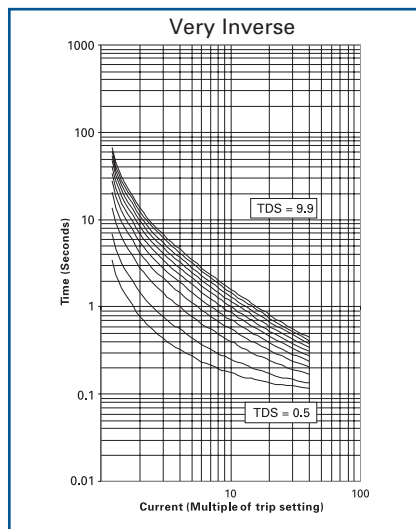
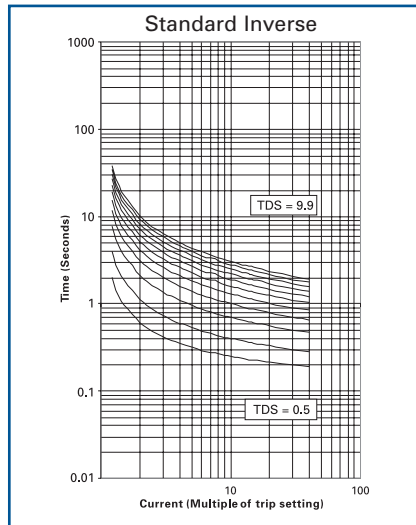
Power Metering

True RMS measurements of up to 37 power measurements are continuously updated. The voltage, current and frequency signals are measured directly, while other parameters, such as Watts, VAr and VA, are computed from this data. Current inputs are given a very wide dynamic range in order to process overloads for time over current functions. Since the readings are true RMS, distorted waveforms are accurately measured, leading to excellent harmonic performance.

Digital Communications

The built-in RS485 communication port supports Modbus RTU protocol and offers metering of Phase Voltages, Phase Currents, Watts, VAr, VA, Phase Angle, Power Factor, Gen and Bus frequency, plus accessibility to all other features and functions available through the front panel. Relay status and system measurements can be interrogated, and relay parameters can be modified remotely. Remote metering is available using Crompton software.

Time Curves



Relay Trip Parameters and Functions

ANSI	Description	Parameter	Range/Resolution/Accuracy
25	Synchronism-Check Monitoring	Phase Difference	2 to 20 degrees / 0.1 degrees / $\pm 1^\circ$
		Slip Frequency	0.1 to 1 Hz / 0.01 Hz / ± 0.03 Hz of nominal
		Voltage Difference	0 to 20% / 0.1 V / $\pm 2\%$ of nominal
		Minimum Volts Level	5 to 119% / 0.1 V / $\pm 1\%$ of nominal
25D	Synchronism-Check monitoring with Dead Bus feature	Phase Difference	2 to 20 degrees / 0.1 degrees / $\pm 1^\circ$
		Slip Frequency	0.1 to 1 Hz / 0.01 Hz / ± 0.03 Hz of nominal
		Voltage Difference	0 to 20% / 0.1 V / $\pm 2\%$ of nominal
		Minimum Volts Level	5 to 119% / 0.1 V / $\pm 1\%$ of nominal
27	Under Voltage Relay	Dead Bus Voltage	5 to 50% / 0.1 V / $\pm 1\%$ of nominal
		Voltage Setpoint	5% to 119% V / 0.1 V / $\pm 1\%$ of nominal
320	Directional Active Power (Forward Watts)	Diff	1 to 15% V / 0.1 V / $\pm 1\%$ of nominal
		Power Setpoint	3 to 120% W / 0.1 W / $\pm 3\%$ of nominal
32R	Directional Active Power (Reverse Watts)	Diff	1 to 15% W / 0.1 W / $\pm 1\%$ nominal
		Power Setpoint	3 to 120% W / 0.1 W / $\pm 3\%$ of nominal
37	Under Current Relay	Diff	1 to 15% A / 0.01 A / $\pm 1\%$ of nominal
		Current Setpoint	30 to 300% A / 0.01 A / $\pm 2.5\%$ of nominal
40Q	Directional Reactive Power (Loss of Excitation / Reverse VAR)	Diff	1 to 15% VARs / 0.1 VARs / $\pm 1\%$ of nominal
		Power Setpoint	3 to 120% VARs / 0.1 VARs / $\pm 4\%$ of nominal
46	Unbalanced Current Relay	Diff	1 to 15% A / 0.01 A / $\pm 1\%$ of nominal
		Current Setpoint	5 to 120% A / 0.01 A / $\pm 2.5\%$ of nominal
47	Phase Sequence Relay	No Parameters	
47	Unbalanced Voltage Relay	Diff	1 to 15% V / 0.1 V / $\pm 1\%$ of nominal
		Voltage Setpoint	1 to 25% V / 0.1 V / $\pm 2\%$ of nominal
50	Instantaneous Over Current Relay	Diff	1 to 15% A / 0.01 A / $\pm 1\%$ of nominal
		Current Setpoint	30 to 300% A / 0.01 A / $\pm 2.5\%$ of nominal
50N	Instantaneous Neutral Over Current Relay	Diff	1 to 15% A / 0.01 A / $\pm 1\%$ of nominal
		Current Setpoint	30 to 300% A / 0.01 A / $\pm 2.5\%$ of nominal
51	AC Time Over Current Relay with 3 Time Curves	Time Curves	Standard Inverse, Very Inverse, Extremely Inverse
		Time Dial	0.1 to 9.9 sec / 0.1 seconds / -
		Current Setpoint	5 to 120% A / 0.01 A / $\pm 2.5\%$ of nominal
51V	AC Time Over Current with Voltage Restraint	Time Curve	Standard Inverse, Very Inverse, Extremely Inverse
		Time Dial	0.1 to 9.9 sec / 0.1 seconds / -
		Restraint Voltage	80 to 120% / 0.1 V / $\pm 1\%$ of nominal
		Current Setpoint	5 to 120% A / 0.01 A / $\pm 2.5\%$ of nominal
51G	Neutral Ground Fault Relay	Time Curve	Long time standby Earth Fault curve
		Time Dial	0.1 to 9.9 sec / 0.1 seconds / -
		Current Setpoint	5 to 120% A / 0.01 A / $\pm 3\%$ of nominal
59	Over Voltage Relay	Diff	1 to 15% / 0.1 Volts / $\pm 1\%$ of nominal
		Voltage Setpoint	5 to 120% V / 0.1 V / $\pm 1\%$ of nominal
810	Over Frequency Relay	Diff	0.1 to 10 Hz / 0.01 Hz / ± 0.03 Hz of nominal
		Frequency Setpoint	40 to 70 Hz / 0.01 Hz / ± 0.03 Hz of nominal
81U	Under Frequency Relay	Diff	0.1 to 10 Hz / 0.01 Hz / ± 0.03 Hz of nominal
		Frequency Setpoint	40 to 70 Hz / 0.01 Hz / ± 0.03 Hz of nominal

All trip functions feature latching, alarm and invert controls, plus adjustable time delay 0 to 30 seconds, resolution 0.1 seconds.

In addition to the 18 electrical trip functions, SPR also offers 9 logical functions which can be used to create additional trip combinations, selective lockout, or to optimize the physical relay wiring in the application. Logic functions accept their input signals from the status of up to 3 trip relays. The following functions are available: Logical AND, OR, NAND, NOR, XOR, Vote, Discrepancy, Alarm and Unacknowledged Alarm.



Measurement, Display and Communication

SPR offers configuration, display and communication of up to 37 true RMS power measurements

- Voltage L1-L2
- Voltage L2-L3
- Voltage L3-L1
- Voltage L1-N
- Voltage L2-N
- Voltage L3-N
- System Voltage (average)
- Current L1
- Current L2
- Current L3
- System Current (average)
- System Current (sum)
- Neutral Current
- Ground Current
- System Watts
- Watts L1
- Watts L2
- Watts L3
- System VAR
- VAR L1
- VAR L2
- VAR L3
- System VA
- VA L1
- VA L2
- VA L3
- Power Factor
- PF L1
- PF L2
- PF L3
- Phase Angle
- PA L1
- PA L2
- PA L3
- Gen Frequency
- Bus Frequency
- Gen-Bus Angle

Specification

Input	
Nominal Input Voltage	57.7 to 277V L-N (100 to 480V L-L)
Max Continuous Input Voltage	1.2 x Nominal
Max Short Duration Input Voltage	2 x Nominal (1 second)
System PT ratio (primary)	Any value up to 400 kV
Nominal Input Voltage Burden	< 0.2 VA
Nominal Input Current	5A (1A option)
System CT Ratio (primary)	Any value up to 10 kA
Max Continuous Input Current	2 x Nominal
Max Short Duration Input Current	20x Nominal (1 second)
Nominal Input Current Burden	< 0.6 VA
Auxiliary	
Nominal Supply Voltage	24V DC (10.6 to 55V DC absolute)
Supply Burden	< 20 VA
RS485 Communication	
Protocol	Modbus RTU, two wire half duplex
Baud Rates	2400, 4800, 9600, 19200
Parity / Stop Bits	Odd, Even, None / 1 or 2
Response Time	Typical 80ms. Maximum 150ms
Relay Outputs	
Watchdog Relay Outputs	1
User Programmable Relays	8 or 12
Relay Contact Type	Volts-free change-over (form C)
Relay Contact Rating	8 Amp (resistive) 250V AC
Relay Make Current	30 Amp (4 sec @ <10% duty cycle)
Rated Breaking Capacity	2000 VA
Relay Mechanical Life	30 Million Operations
Relay Contact Life	B300/120V AC/70°C to UL508 B300/240V AC/70°C to UL508
Measuring Ranges	
Voltage	20 .. 120% of nominal
Current	20 .. 120% of nominal (functional 5 .. 500%)
Frequency	45 .. 66 Hz
Power Factor	0.5 .. 1 .. 0.5 Importing or Exporting
Watts	5 .. 120%
Enclosure	
IP Rating	IP54 with panel gasket (supplied)
Material	Zinc passivated steel with polycarbonate front panel
Terminals	Removable shrouded screw clamp terminals
Operating Temperature	0°C to +50°C (Optional -20°C to +60°C)
Storage Temperature	-20°C to +70°C
Relative Humidity	95% non-condensing
Shock	30g in 3 planes
Vibration	10 to 150 Hz, @ 1g amplitude
Dimensions	200mm (7.87") wide, 106mm (4.17") high, 176mm (6.93") deep.
Panel Cut Out	187mm wide (7.36") x 93mm (3.66") high
Weight	< 3 kg
Compliant With	G.59/1, BS EN 50081-1, BS EN 50082-2, BS EN 61010-1, BS EN 60255-4, BS EN 60255-6, ANSI/IEEE C37.90 UL508, UL and CSA File No: E214283
Railtrack Certificate of Acceptance	PA05/1450 Protective Device on Signalling Power Supply Systems



Order Code Example:

SPR-013W-PQLS-C5-BD-12-MB

SPR 3 phase 3 wire, 120V L-L, 5A, 50Hz,
24V DC auxiliary power with RS485
Modbus, 12 relays

SPR-SOFT Communication and Programming Software

The software configuration package allows the user to configure and monitor the operation of the SPR system protection relay through a Windows style user interface. It allows the user to load and save the configuration to and from a hard disk on a PC, and to send and retrieve configuration settings to and from up to 31 SPR units. Communication is achieved with a Modbus connection to a COM port on the PC via an RS485/RS232 converter.

The software configurator is designed to display and set up the parameters of the SPR relays, to monitor the status of the selected SPR, and to provide status of the power supplies the SPR is monitoring. A separate configuration page is provided for setting the parameters of each relay.

The configurator incorporates separate pages to display measurements, relays and event data. When one of these pages is selected in on-line mode, the configurator interrogates the selected SPR every few seconds to obtain the data required for that page. In addition, there is an option to bring up the measurements page from any other page if the SPR raises an alarm.

Product Codes

Product Code	Product Configuration
SPR-013W-*LS-**-BD-***-MB	SPR 3 phase 3 wire, 5A, 24V DC auxiliary power with RS485 Modbus
Input Voltage*	
PK	100 Volts L-L
PM	110 Volts L-L
PO	115 Volts L-L
PQ	120 Volts L-L
RM	208 Volts L-L
RU	380 Volts L-L
RW	400 Volts L-L
SB	415 Volts L-L
SH	440 Volts L-L
SE	480 Volts L-L

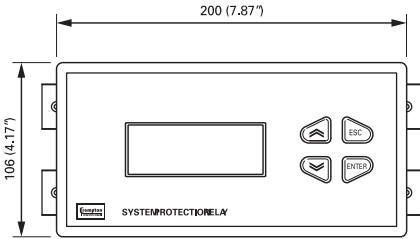
Product Code	Product Configuration
SPR-014W-*LS-**-BD-***-MB	SPR 3 phase 4 wire, 5A, 24V DC auxiliary power with RS485 Modbus
Input Voltage*	
NV	57.7 Volts L-N
NX	63.5 Volts L-N
PA	69.0 Volts L-N
PK	100 Volts L-N
PM	110 Volts L-N
PQ	120 Volts L-N
P7	127 Volts L-N
R4	220 Volts L-N
RQ	230 Volts L-N
RR	240 Volts L-N
RS	250 Volts L-N
R6	277 Volts L-N

Frequency**	
C5	50Hz
C6	60Hz
Relays***	
08	8 x relays
12	12 x relays

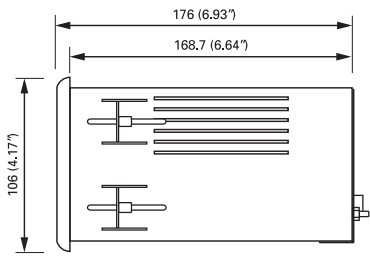
Optional Accessories	
SPR-POWER-A1	Auxiliary Power Supply Unit 85-264V AC & 100-375V DC
SPR - SOFT	Communication and Programming Software
9D-485	RS232 to RS485 Serial Converter

SPR Dimensions

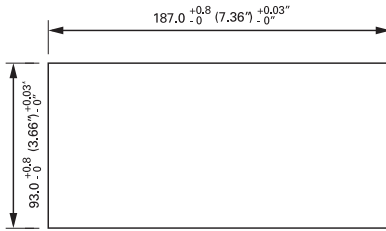
Front Display Area



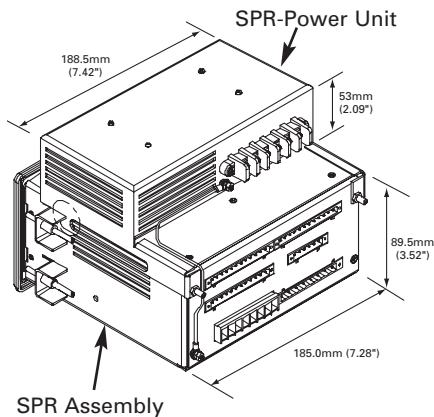
Side View



Panel Cutout

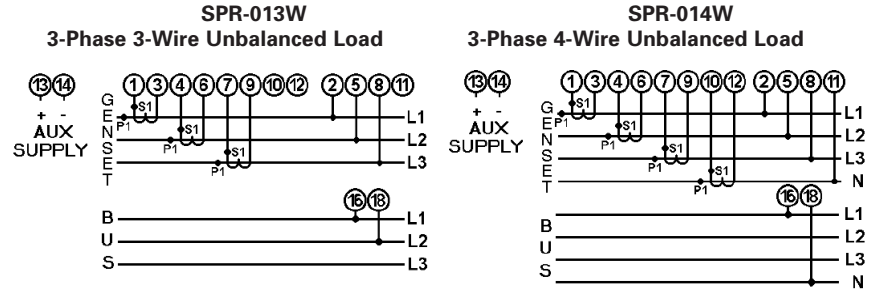


Dimensions with Optional SPR-POWER Unit



Connections

The four current transformer inputs are fully isolated from ground and from each other, allowing the SPR to be used as an intermediate device or connected to a common ground as required. All electrical connections are made using two-part removable connecting blocks.



Auxiliary Supply

Designed to operate from 24V D.C. nominal engine batteries, operating normally at reduced voltage when the engine is cranking, and increased voltage when the batteries are on charge. The switched mode auxiliary power supply has a very wide operating range of 10.6 to 55 volts. A separate auxiliary module is available for other auxiliary voltages.

Safety / Ground Connections

The ground stud on the rear panel should be connected to a clean ground. For safety reasons, CT secondary connections should be grounded according to appropriate codes of practice.

SPR-POWER Switched Mode Power Supply

The SPR is designed to operate with a nominal 24 volt DC auxiliary supply, however, the SPR-POWER unit will derive a suitable supply for applications utilizing 85 to 264V AC, 45-66 Hz or 100 to 375V DC. This switched mode power supply is simply attached to the System Protection Relay (SPR) chassis via two threaded screws.

Input	
Input Voltage	85 to 264V AC, 45-66 Hz 100 to 375V DC
Burden	< 36 VA
Output	
Output Voltage	24 volts DC @ 600mA
Environmental	
Operating Temperature	-20 to +50°C
Storage Temperature	-30 to +80°C
Relative Humidity	0 .. 95% non condensing
Enclosure	
Style	Custom design to mount directly on SPR
Material	Zinc passivated steel
Terminals	Barrier terminal strip 6-32 binding head screw
Grounding	Dedicated grounding stud provided