

SPR System Protection, Control and Measurement Relay

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 12 user definable relay outputs. The high contrast 80 character backlit LCD display allows the user to monitor any of the measured parameters, inspect set point details and relay contact status. The set points and configuration are all fully programmable via the simple menu driven user interface. Remote monitoring of status information is achievable via the integral RS485 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 12 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 8 relays, but for the most demanding applications four additional relays can be supplied as an option. Each relay can be configured to energise or de-energise 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

Follows comprehensive self diagnostic checks at power-up and once correct operation has been verified, the dedicated change-over (NO+NC) relay contacts energise to indicate product availability. The microprocessor continuously monitors the relay system for healthy operation and the contacts will de-energise 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 itemised by date and time stamp to a time resolution of 100ms, ideal for analysing 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.



Features

- Integrated protection, control, measurement and communication of up to 37 power parameters
- Digital communications
- Fully programmable VT and CT ratios
- Simple menu driven interface
- High quality backlit LCD display
- True rms measurement
- Three-phase, three-wire or four-wire unbalanced load options
- 18 protection relay functions
- 12 relay contacts outputs
- Trip event history log
- Watchdog relay

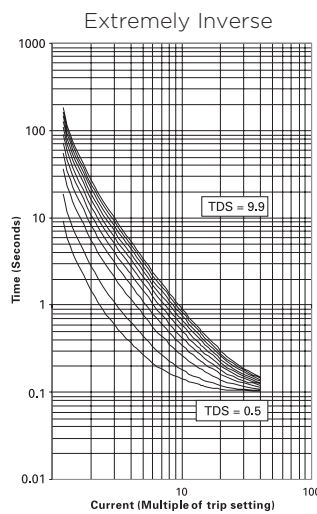
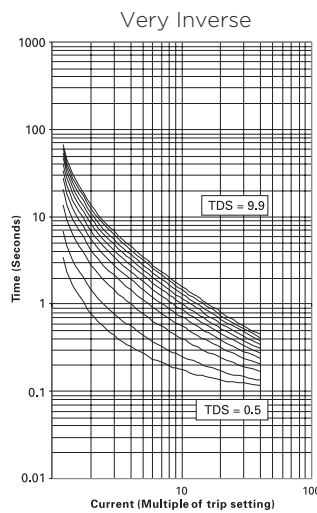
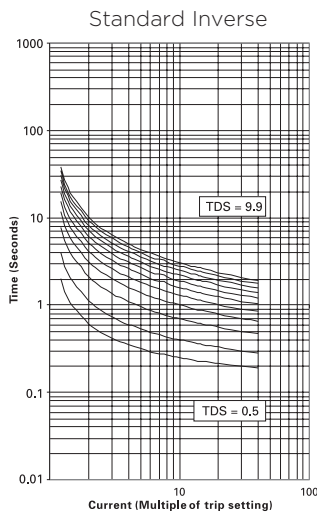
Benefits

- 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

Time Curves



Relay Trip Parameters and Functions

| ANSI | Description | Parameter | Range/Resolution/Accuracy |
|------|---|---|---|
| 25 | Synchronism-check monitoring | Phase difference Slip frequency Voltage difference Minimum volts level | 2 to 20 degrees/0.1 degrees/±1° 0.1 to 1Hz/0.01Hz/±0.03Hz of nominal 0 to 20%/0.1 V/±2% of nominal 5 to 119%/0.1 V/±1% of nominal |
| 25D | Synchronism-check monitoring with dead bus feature | Phase difference Slip frequency Voltage difference Minimum volts level Dead bus voltage | 2 to 20 degrees/0.1 degrees/±1° 0.1 to 1Hz/0.01Hz/±0.03Hz of nominal 0 to 20%/0.1 V/±2% of nominal 5 to 119%/0.1 V/±1% of nominal 5 to 50%/0.1 V/±1% of nominal |
| 27 | Under-voltage relay | Voltage set point Diff | 5 to 119% V/0.1 V/±1% of nominal 1 to 15% V/0.1 V/±1% of nominal |
| 32O | Directional active power (forward watts) | Power set point Diff | 3 to 120% W/0.1 W/±3% of nominal 1 to 15% W/0.1 W/±1% of nominal |
| 32R | Directional active power (reverse watts) | Power set point Diff | 3 to 120% W/0.1 W/±3% of nominal 1 to 15% W/0.1 W/±1% nominal |
| 37 | Under-current relay | Current set point Diff | 30 to 300% A/0.01 A/±2.5% of nominal 1 to 15% A/0.01 A/±1% of nominal |
| 40Q | Directional reactive power nominal (Loss of excitation/reverse VAR) | Power set point Diff | 3 to 120% VAr/0.1 VAr/±4% of nominal 1 to 15% VAr/0.1 VAr/±1% of nominal |
| 46 | Unbalanced current relay | Current set point Diff | 5 to 120% A/0.01 A/±2.5% of nominal 1 to 15% A/0.01 A/±1% of nominal |
| 47 | Phase sequence relay | No parameters | |
| 47 | Unbalanced voltage relay | Voltage set point Diff | 1 to 25% V/0.1 V/±2% of nominal 1 to 15% V/0.1 V/±1% of nominal |
| 50 | Instantaneous over-current relay | Current set point Diff | 30 to 300% A/0.01 A/±2.5% of nominal 1 to 15% A/0.01 A/±1% of nominal |
| 50N | Instantaneous neutral over-current relay | Current set point Diff | 30 to 300% A/0.01 A/±2.5% of nominal 1 to 15% A/0.01 A/±1% of nominal |
| 51 | AC time over-current relay with 3 time curves | Current set point Time dial Time curves | 5 to 120% A/0.01 A/±2.5% of nominal 0.1 to 9.9 sec/0.1 seconds/- Standard inverse, very inverse, extremely inverse |
| 51V | AC time over-current with voltage restraint | Current set point Restraint voltage Time dial Time curve | 5 to 120% A/0.01 A/±2.5% of nominal 80 to 120%/0.1 V/±1% of nominal 0.1 to 9.9 sec/0.1 seconds/- Standard inverse, very inverse, extremely inverse |
| 51G | Neutral ground fault relay | Current set point Time dial Time curve | 5 to 120% A/0.01 A/±3% of nominal 0.1 to 9.9 sec/0.1 seconds/- Long time standby earth fault curve |
| 59 | Over-voltage relay | Voltage set point Diff | 5 to 120% V/0.1 V/±1% of nominal 1 to 15%/0.1 volts/±1% of nominal |
| 81O | Over-frequency relay | Frequency set point Diff | 40 to 70Hz/0.01Hz/±0.03Hz of nominal 0.1 to 10Hz/0.01Hz/±0.03Hz of nominal |
| 81U | Under-frequency relay | Frequency set point Diff | 40 to 70Hz/0.01Hz/±0.03Hz of nominal 0.1 to 10Hz/0.01Hz/±0.03Hz 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 optimise the physical relay wiring in the application. Logic functions accept their input signals from the status of up to three trip relays. The following functions are available: Logical AND, OR, NAND, NOR, XOR, Vote, Discrepancy Alarm and Unacknowledged Alarm.

Specification - System Protection

| | |
|-------------------------------------|--|
| 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 VT ratio (primary) | Any value up to 400kV |
| Nominal input voltage burden | <0.2VA |
| Nominal input current | 5A (1A option) |
| System CT ratio (primary) | Any value up to 10kA |
| Max continuous input current | 2 x nominal |
| Max short duration input current | 20x nominal (1 second) |
| Nominal input current burden | <0.6VA |
| Auxiliary | |
| Nominal supply voltage | 24V dc (10.6 to 55V dc absolute) |
| Supply burden | <20VA |
| 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 | 2000VA |
| 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 | 45-66Hz |
| 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 150Hz @ 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 | <3Kg approx. |
| Railtrack certificate of acceptance | PA05/1450 protective device on signalling power supply systems |

Modbus® is a trademark of Schneider Automation Inc.



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



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.

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

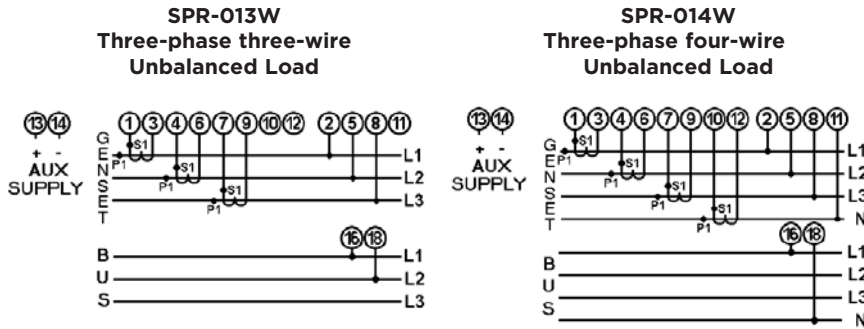
Product Codes

| 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 |
| 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 and 100-375V dc |
| SPR - SOFT 9D-485 | Communication and programming software RS232 to RS485 serial converter |

Modbus® is a trademark of Schneider Automation Inc.

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 dc 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.

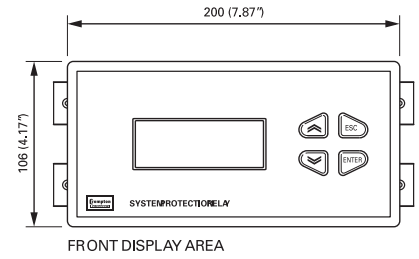
SPR-POWER Switched Mode Power Supply

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 utilising 85 to 264V ac, 45-66Hz or 100 to 375V dc. This switched mode power supply is simply attached to the System Protection Relay (SPR) chassis via two threaded screws.

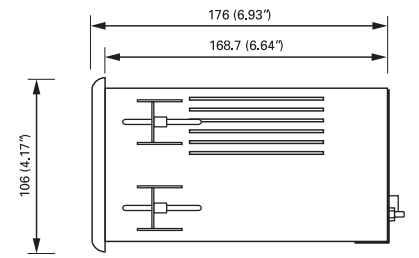
| Input | |
|-----------------------|--|
| Input voltage | 85 to 264V ac, 45-66Hz 100 to 375V dc |
| Burden | <36VA |
| Output | |
| Output voltage | 24 volts dc @ 600mA |
| Environmental | |
| Operating temperature | -20°C to +50°C |
| Storage temperature | -30°C to +80°C |
| Relative humidity | 0<95% 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 |

SPR Dimensions

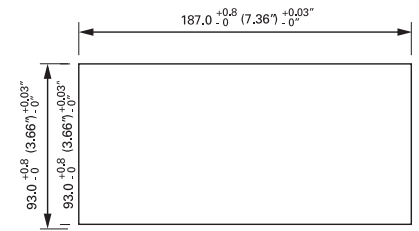
Front Display Area



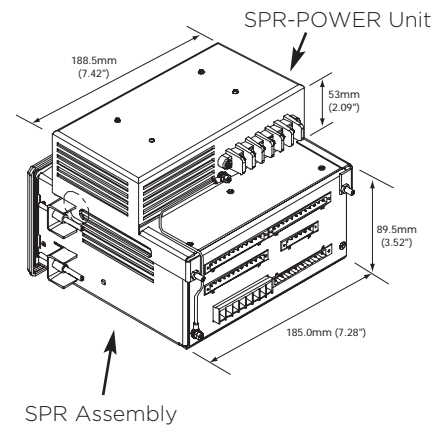
Side View



Panel cut-out



Dimensions with Optional SPR-POWER Unit



Energy Division

With 4000 employees and more than 10,000 customers world-wide, the Energy Division represents a very significant part of Tyco Electronics. Based in headquarters in Ottobrunn, near Munich, Germany, the Energy Division is a global supplier to power utilities and power industry customers, to equipment manufacturers and transport systems. These customers are served by dedicated R&D teams, sales representatives in more than 80 countries, a professional marketing organisation and 25 manufacturing sites in five continents.

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