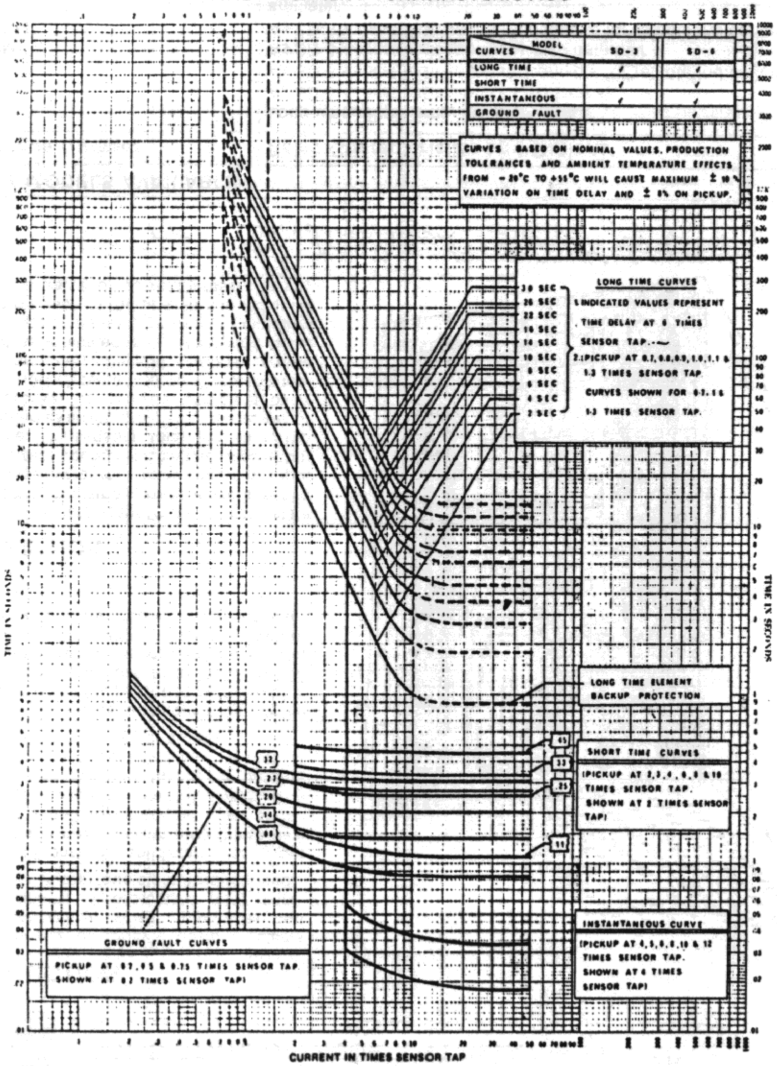
N.B. Test out 400 to [illegible] % - [illegible] — For long delay

SOLID STATE OVERCURRENT RELAY — TYPE SD

3 Ø A.C. OVERCURRENT RELAY, TYPE SD
TIME – CURRENT CHARACTERISTICS



MODEL / CURVES	SD-3	SD-6
LONG TIME	✓	✓
SHORT TIME	✓	✓
INSTANTANEOUS	✓	✓
GROUND FAULT		✓

CURVES BASED ON NOMINAL VALUES. PRODUCTION TOLERANCES AND AMBIENT TEMPERATURE EFFECTS FROM −20°C TO +55°C WILL CAUSE MAXIMUM ± 10% VARIATION ON TIME DELAY AND ± 5% ON PICKUP.
LONG TIME CURVES
30 SEC
26 SEC
22 SEC
18 SEC
14 SEC
10 SEC
8 SEC
6 SEC
4 SEC
2 SEC
1. INDICATED VALUES REPRESENT TIME DELAY AT 6 TIMES SENSOR TAP.
2. PICKUP AT 0.7, 0.8, 0.9, 1.0, 1.1 & 1.3 TIMES SENSOR TAP. CURVES SHOWN FOR 0.7, 1 & 1.3 TIMES SENSOR TAP.
LONG TIME ELEMENT BACKUP PROTECTION
SHORT TIME CURVES
(PICKUP AT 2, 3, 4, 6, 8 & 10 TIMES SENSOR TAP. SHOWN AT 2 TIMES SENSOR TAP)
INSTANTANEOUS CURVE
(PICKUP AT 4, 5, 6, 8, 10 & 12 TIMES SENSOR TAP. SHOWN AT 4 TIMES SENSOR TAP)
GROUND FAULT CURVES
PICKUP AT 0.2, 0.5 & 0.75 TIMES SENSOR TAP
SHOWN AT 0.2 TIMES SENSOR TAP)
TIME IN SECONDS
CURRENT IN TIMES SENSOR TAP

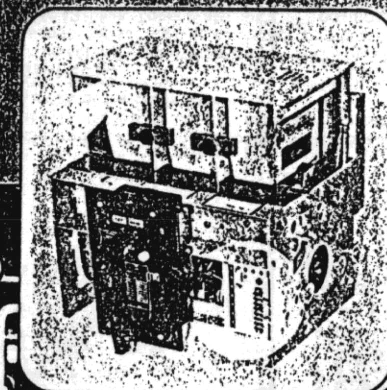
FPE FEDERAL PIONEER — FEDERAL PIONEER LIMITED

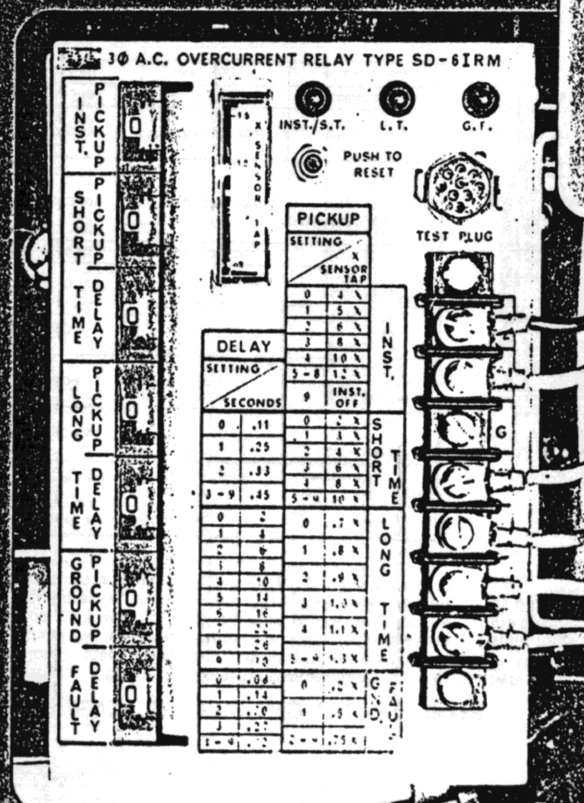
132-022B REV.1

FPE FEDERAL PIONEER

SWITCHGEAR CATALOGUE
C-3-216
DECEMBER 1978
Supersedes
Temporary Issue
January 1978

SOLID STATE OVERCURRENT RELAY





TYPE SD

FPE FEDERAL PIONEER — FEDERAL PIONEER LIMITED

ODUCTION

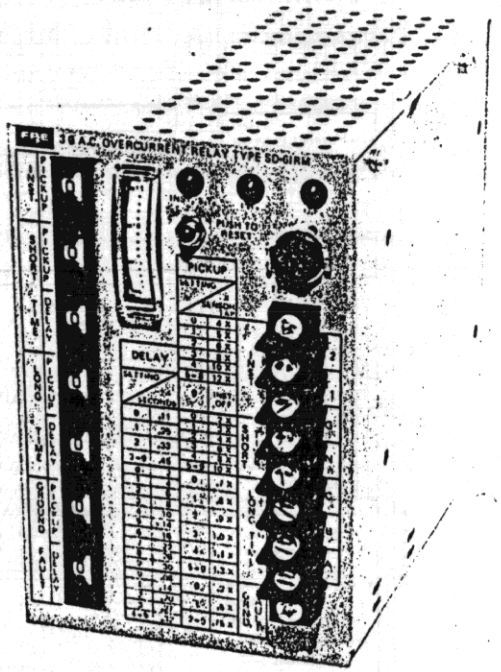
mplexity of today's power systems ls reliability, closer tolerances and stability of protective relay char- ics than previous standards required.

deral Pioneer SD solid state overcurrent as been developed to meet these new ments and to overcome other short- s of electro-mechanical relays. It is tely self powered, taking the tripping from the current through the breaker any auxiliary power supply.

very desirable to be able to identify the fault which caused the relay to react, i.e. d, short circuit or ground fault. The FPE relay can, as an option, provide this ation both locally on the relay itself or ly by contacts supplied within the relay.

CRIPTION

e SD Overcurrent Relay is a solid state tem comprising current sensors, a solid phase overcurrent relay and a high input , direct acting, SOLENOID type shunt vice. The sensors, relay and shunt trip unted as an integral part of the power air breaker to provide complete over- t, short circuit and ground fault protec- f required). Several options can be ed as indicated in the following table. a load ammeter is provided it monitors d on each of the phases and indicates ghest value of current present in any



C.T. Secondary Current = 5.0A at 100%

AY MODELS AVAILABLE	
logue Number	Relay Characteristics and Options
 IR IM IRM	Long time, Short time, Instantaneous As SD-3 + local indication (2 LED lamps) As SD-3 + local indication and contacts for remote indication As SD-3 + local indication plus load ammeter As SD-3 + local indication and contacts for remote indication plus load ammeter.
 IR IM IRM	Long time, Short time, Instantaneous, Ground fault As SD-6 + local indication (3 LED lamps) As SD-6 + local indication and contacts for remote indication As SD-6 + local indication plus load ammeter As SD-6 + local indication and contacts for remote indication plus load ammeter.

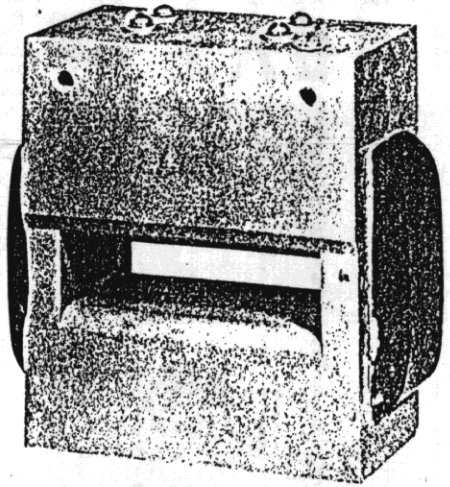
— A 120V ac 1VA supply is required when the indication option is provided.

SOLID STATE OVERCURRENT RELAY — TYPE SD

CURRENT SENSORS AND TRIP RATINGS

There are 9 types of current sensors available, each of which is sized to be mounted on one or more ratings of Federal Pioneer power circuit breakers. Sensors of the same type are mounted on each of the poles of the circuit breaker (and the external neutral, if ground fault protection is required). Each sensor has a minimum of two taps and the selection of one of these taps establishes the trip rating of the system. The same solid state relay can be used for each tap selected therefore the basic trip rating of the breaker can be changed easily by simply changing the sensor tap settings.

SENSORS AVAILABLE		
Sensor Type	Ampere Taps on Current Sensor	Breaker Frame Size and Type.
CSD-1.5	50, 70, 100, 150	600A 25H-2 1600A 50H-2 2000A 65H-2
CSD-6	250, 400, 600	600A 25H-2 1600A 50H-2 2000A 65H-2
CSD-8	400, 600, 800	800A 35H-2 1600A 50H-2 2000A 65H-2
CSD-16	1000, 1200, 1600	1600A 50H-2 2000A 65H-2
CSD-20	800, 1200, 2000	2000A 65H-2
CSD-30	1200, 2000, 3000	3000A 50H-2 3000A 75H-2 4000A 75H-2 4000A 100H-2 5000A 100H-2
CSD-40	1600, 3000, 4000	4000A 75H-2 4000A 100H-2 5000A 100H-2
CSD-50	3000, 5000	5000A 100H-2
CSD-60	4000, 6000	6000A 100H-2



FIELD ADJUSTMENTS

Switches for field selection of the various current pick-up levels and time delays are provided on the relay faceplate, grouped in a vertical column, and paired according to the characteristic controlled.

LONG TIME
The pick-up setting is adjustable from 0.7 to 1.3 times the current sensor tap setting with calibration points at 0.7, 0.8, 0.9, 1.0, 1.1, and 1.3 times. Pick-up tolerance is ±8%.

The independent Long Time delay characteristics are adjustable from 2 seconds to 30 seconds with 10 calibration points at 2, 4, 6, 8, 10, 14, 16, 22, 26 and 30 seconds. The time intervals shown are at 6 times the current sensor tap setting. The band width is ±10% of the times shown.

SHORT TIME
The pick-up setting is adjustable from 2 to 10 times the current sensor tap settings with calibration points at 2, 3, 4, 6, 8 and 10 times. Pick-up tolerance is ±8%.

The independent Short Time delay characteristics are adjustable from 0.11 to 0.45 seconds with calibration points at 0.11, 0.25, 0.33 and 0.45 seconds. The bandwidth is ±10% of the times shown.

INSTANTANEOUS
The pick up setting is adjustable from 4 to 12 times the current sensor tap setting with calibration points at 4, 5, 6, 8, 10 and 12 times. There is also an "OFF" position on the selector switch. Pick-up tolerance is ±8%.

GROUND FAULT
The pick up setting is adjustable from 0.2 to 0.75 times the current sensor tap setting with calibration points at 0.2, 0.5 and 0.75 times. Pick up tolerance is ±8%.

The ground fault element has a definite time delay characteristic for fault currents in excess of 10 times the sensor tap setting. For fault currents below this value it has an inverse time characteristic.

The definite time delay characteristics at the 10 time current level are adjustable from 0.08 to 0.32 seconds with calibration points at 0.08, 0.14, 0.2, 0.27 and 0.32 seconds. The bandwidth is ±10% of the time shown.

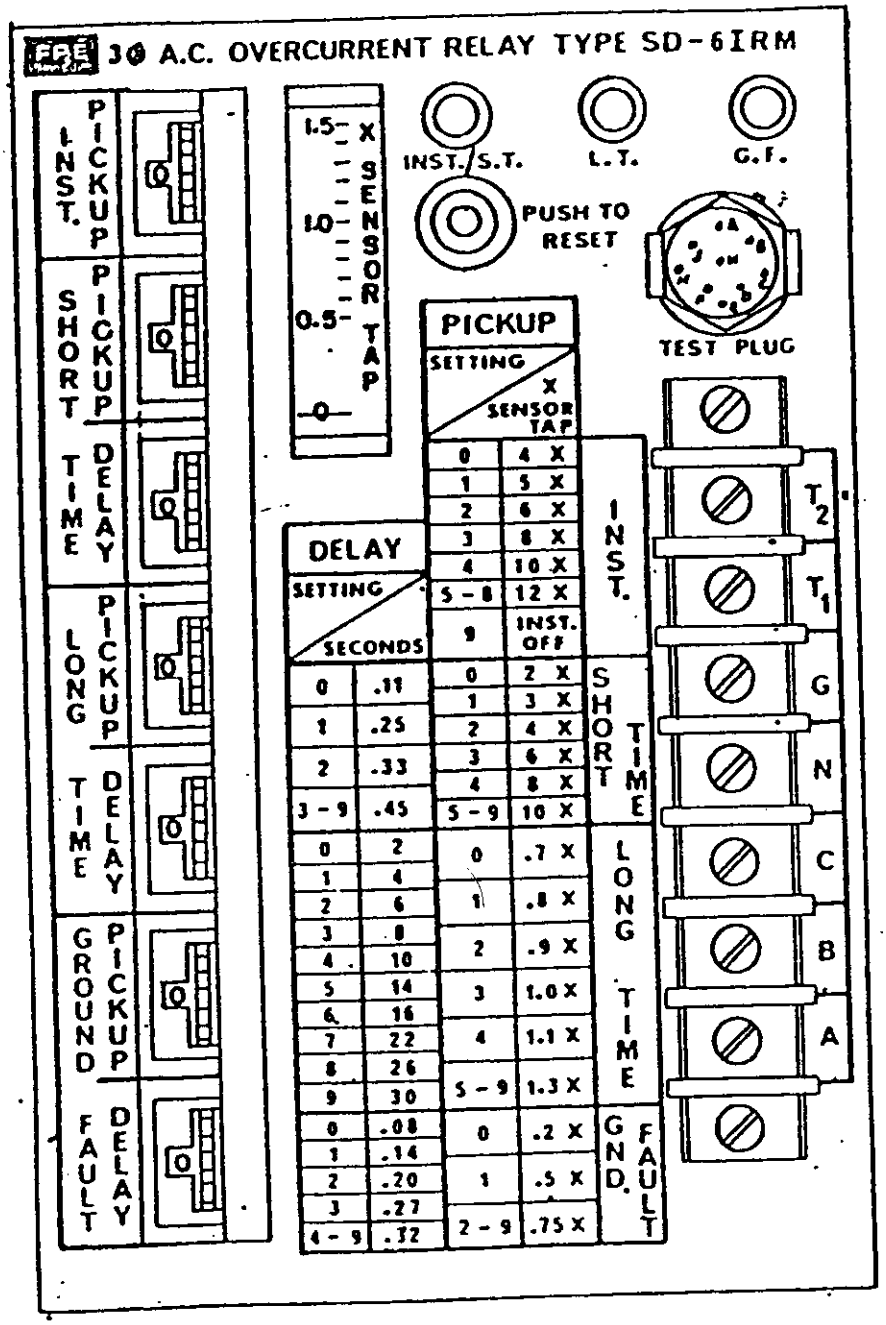


FIG. 1

SD RELAY FRONT-PANEL LAYOUT

IONS

L INDICATION

three lamps can be provided on the faceplate of ay to indicate the type of fault that caused the o operate i.e. LONG TIME; INSTANTANEOUS/ T TIME and GROUND FAULT if the G.F. element ided in the relay.

the breaker has tripped the relay will automa- reset allowing the breaker to be reclosed. The are manually reset by a pushbutton mounted on nt of the relay thus indication is retained even e relay has reset.

nps are solid state light emitting diodes (L.E.D.) ideally suited to withstand the shock vibrations ccur when the breaker is opened and closed. A e 120 volt ac 1.0VA auxiliary supply, derived from side of the circuit breaker, is required to power ps and the remote indication relay.

E INDICATION

s for remote indication can be provided by three dry, normally open contacts rated 2.0A resistive olts ac located within the relay. These contacts can be field connected through a terminal strip mounted on the rear of the relay. The pushbutton which resets the local indicators also resets the internal auxiliary relays used for remote indication.

LOAD INDICATION

A vertical edgewise mounted analog meter can be provided on the faceplate of the relay. This meter continuously monitors the load current on the 3 phases and indicates the highest single phase value during normal operation. The meter is scaled in multiples of the tap setting selected with the full scale deflection being at 1.5 times the tap setting. The meter is protected against high fault conditions.

SOLENOID TRIP UNIT

The shunt trip is a solenoid device which operates from a high energy input signal from the solid state relay, therefore, no separate trip supply is necessary. However, if the breaker has to be tripped by some other external means such as remote pushbuttons, other types of protective relays etc., then an additional conventional shunt trip must be added to the breaker plus the necessary shunt trip supply to operate it.

ATIONAL CHARACTERISTICS

lerances indicated are at a nominal ambient ture of 25° C and are stable over a temperature -20° C to +55° C.

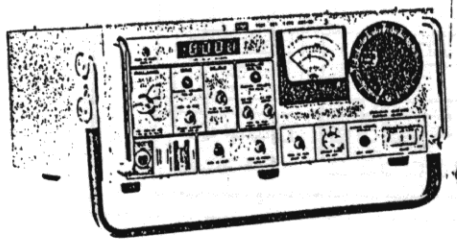
IS

ition withstand test voltage, 2200 volts with the disconnected

- Insulation, Class B (130° C)
- Thermal 1 second rating, 80 times maximum sensor tap setting
- Continuous thermal rating at 30° C ambient, 1.75 times the maximum sensor tap setting
- Mechanical short time current rating, 125 times the maximum sensor tap setting
- Impulse withstand level, up to 10kV.

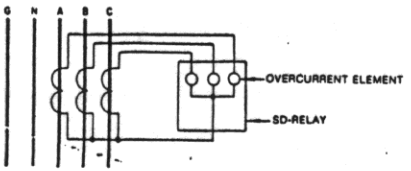
TEST UNIT TYPE DDT-SD

le test device is available to provide accurate f the calibration and operation of all functions lay. The test set will also check the output energy provided by the relay to the shunt trip The test unit is plugged into a convenient le provided on the faceplate of the relay. A 120 50VA supply is required to power the test unit be derived from any source.

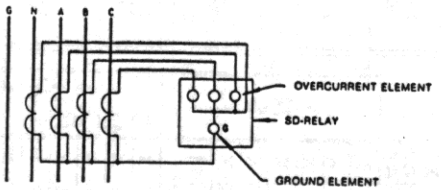


CURRENT SENSOR CONNECTION DIAGRAMS

(A) 3Ø 3W ungrounded system
3Ø 4W system without ground fault protection

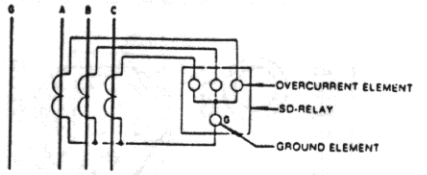


(B) 3Ø 4W system with ground fault protection



Note: System must be solidly or resistor grounded on the line side of neutral sensor. Resistor must let through more current than the ground fault pick-up setting on relay.
System must not be grounded on the load side of the neutral sensor.

(C) 3Ø 3W system with ground fault protection
(Neutral solidly grounded)
3Ø 3W ungrounded system (see note below)



Note: Since there will not be any significant ground current in the ungrounded system, the ground fault element will not pick-up on the first phase to ground fault. It will operate on the second phase to ground fault providing this fault is on another feeder and phase from the first fault.
This G element will only pick-up on a phase to ground to phase fault.

TYPICAL SPECIFICATION

A solid state three phase overcurrent relay shall be supplied with the air circuit breaker. The solid state elements shall be mounted on plug-in printed circuit boards. The relay shall be designed to function within the published characteristic curves for single phase and three phase balanced loads and all arrangements of unbalanced loads. The trip system shall function within the rated characteristics of the breaker under normal operating conditions, short circuit interruption and electrical and mechanical endurance.

The relay shall contain long time pick-up, short time delay, instantaneous and ground fault elements. These elements shall operate independently. The long time, short time and ground fault elements shall each have field selectable bands. All calibrated points shall be set by a definite position selector switch on the relay faceplate.

The relay shall be supplied complete with a local trip indication which will describe the type of fault as an overload, short circuit or ground fault (optional). In addition contacts shall be provided to initiate a remote indication system.

The relay shall derive its power from current sensors which shall have a minimum of two tap connections brought out on the sensor face. The relay shall operate in conjunction with a high energy solenoid shunt trip. No external power supply shall be required to trip the breaker. The relay shall be a type SD solid state device as manufactured by Federal Pioneer Limited.

A portable test device shall be provided which shall be capable of checking the calibration of all functions of the relay. It shall be also capable of checking the energy output level of the relay and be operable from a 120 volt 750VA supply. The test device shall be type DDT-SD as manufactured by Federal Pioneer Limited.