

Low Voltage Power Circuit Breakers

TYPE FPS2

Replacement Breakers with Type SS Trip Device

Interrupting Ratings

System voltage	Breaker type	Interrupting rating current measured at instant 1/2 cycle after fault, amperes*		30 Cycle short-time rating without series trip device, amperes	
		asymmetrical (average 3-phase rms)	symmetrical rms	asymmetrical	symmetrical
481-600	FPS2-25	25,000	22,000	25,000	22,000
	FPS2-50	50,000	42,000	50,000	42,000
	FPS2-75	75,000	65,000	75,000	65,000
241-480	FPS2-25	35,000	30,000	25,000	22,000
	FPS2-50	60,000	50,000	50,000	42,000
	FPS2-75	75,000	65,000	75,000	65,000
240	FPS2-25	50,000	42,000	25,000	22,000
	FPS2-50	75,000	65,000	50,000	42,000
	FPS2-75	100,000	85,000	75,000	65,000

* Rating with instantaneous direct-acting trips only.

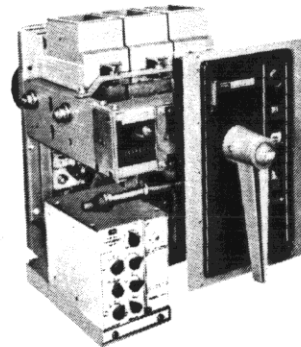
BREAKER STANDARD DEVICES

Description	Manual	Electrical	Electrical
	FPS2-25 FPS2-50	FPS2-25 FPS2-50	FPS2-75
Static Overcurrent Trip Device — 3-phase	X	X	X
Manual Trip Button	X	X	X
Manual Close Button	X	—	—
Electrical Close Button	—	X	X
Position Indicator "Connected," Test, "Disconnected"	X	X	X
Condition Indicator — "Open"-"Closed"	X	X	X
Mechanism Indicator "Springs Charged" "Springs Discharged"	X	X	X
Charging handle: attached Manual Handle or Electrically Charged Mechanism	X	X	—
48V to 250V AC/DC control	—	X	X
Closing relay with cut off, seal-in and anti-pump features for maintained contact control	—	X	X
Magnetic latch release	X	X	X
Draw-out interlock	X	X	X
Padlocking Provision	X	X	X
Shunt Close device	—	X	X
Shunt trip device —	—	X	X
Auxiliary Switch — 6 circuit	—	X	X

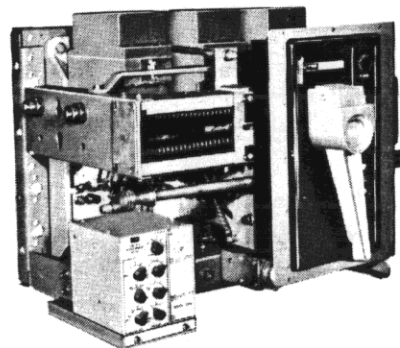
Optional Accessories

** Auxiliary Switch — 6 Circuits	X	X	X
Undervoltage device —			
Instantaneous	X	X	X
Time delay	X	X	X
Overcurrent bell alarm — hand reset	X	X	X
Key Interlock	X	X	X
Manual Close Button	—	X	X
Manual/Electric Close Button	X	X	X
Shunt Close Device	X	—	—
Shunt Trip Device	X	—	—

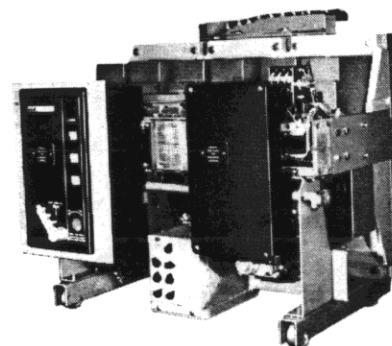
**Maximum — 12 circuit



FPS2-25-600



FPS2-50-1600



FPS2-75-3000

CLASS 6020

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TYPE FPS2

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Type SS Trip Device

DESCRIPTION

Type FPS2 low voltage power circuit breakers employ a spring charged stored energy operating mechanism that ensures fast, safe closing independent of operator speed.

The FPS2-25 and FPS2-50 breakers are available both manually and electrically operated. The FPS2-75 is provided as electrically operated only. All drawout models offer the three position closed door drawout feature.

The FPS2 circuit breakers should be applied within their assigned voltage, continuous current, interrupting and short time ratings. All breakers are equipped with solid state trip devices providing independent pickup and time delay settings for instantaneous, long time, short time, and ground fault functions.

Auxiliary switches:

The auxiliary switch is mounted on top of the stored energy mechanism on the right hand side of the breaker and is operated by the main movable contact. They are rotary cam operated devices ensuring positive opening and closing of the silver-to-silver contacts.

Bell alarm switch: A bell alarm switch attachment is mounted on the right side of the breaker and will function only when breaker is tripped by the overcurrent trip units. The bell alarm can be manually and/or electrically reset. Reclosing breaker also resets the alarm switch. Bell alarm switch is available with either normally open or normally closed contacts.

Shunt trip: The shunt trip attachment is mounted directly above the trip shaft. It is a non-adjustable electro-magnet intended for intermittent duty only, and its circuit is interrupted only by an auxiliary contact.

Shunt close: The shunt close attachment is mounted on top of the stored energy mechanism and is used to electrically discharge the stored energy mechanism and thus to close the breaker. It is a non-adjustable intermittent duty device and its circuit is interrupted by an auxiliary contact.

STATIC OVERCURRENT TRIPPING SYSTEM

A — General Description —

Static overcurrent trip devices operate to open the circuit breaker when the circuit current exceeds a pre-set value for a predetermined time. Depending on the selected settings, tripping may be instantaneous or delayed. Energy to operate the tripping system is obtained solely from current sensors in the circuit being protected. Batteries or other power sources are not needed. The complete static overcurrent trip system consists of three parts:

- (1) primary circuit current sensors,
- (2) the static overcurrent trip device,
- (3) a magnetically held circuit breaker latch release device.

B — Current Sensors — Toroidal current sensors, similar to standard bushing current transformers, are mounted, one per phase, on the primary studs of the circuit breaker. They provide a signal proportional to primary current and supply power to operate the static trip device including the magnetic latch release. The sensors are selected for a specific circuit breaker requirement and establish the current rating of that breaker. Each sensor provides a choice of ratings, which are listed on the sensor table shown in Table 1. The current sensors have color-coded wire leads connected to a terminal block located on the circuit breaker frame. The required sensor tap is selected by connecting the static-trip device to the proper terminals on this terminal block. The sensors have a nominal 2 amp. secondary rating.

C — Static Trip Device — The static-trip device receives the signal from the current sensors. It monitors the signal, senses overloads and faults and determines the required action in accordance with preselected settings. The static-trip device is the "brains" of the tripping system. The long delay is inversely proportional to the magnitude of the circuit overcurrent. The long time delay I²t characteristic affords accurate thermal protection of cables, motors, transformers, and other loads. The phase overcurrent short delay and ground fault current trip delay characteristics are independent of the overcurrent magnitude. The trip device will reset instantly during the delay program if the primary current drops below the selected pick-up value. The pick-up tolerance is $\pm 10\%$.

A metal enclosure, attached to the breaker, houses the trip device and its electronic circuits. On the front of the metal enclosure is a calibration plate with the necessary adjusting knobs. All pick-ups and delay bands are adjustable. Each function is controlled by a rotary selector switch with discrete steps and positive positioning. Although several types of static trip devices are available, all are similar in size and appearance (Fig. 1). The trip device terminal cover contains a current sensor tap setting window. The current rating showing in this window should correspond to the current rating of the sensor tap in use. The current rating showing in this window may be changed by removing the cover, loosening the center screw and rotating the preprinted indicator disc to the desired rating. All pick-up values are expressed as multiples of the sensor tap current rating.

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D — Magnetic Latch Release — When the static-trip device senses a circuit condition that requires the circuit breaker to open, it produces an electrical output that is fed to the magnetic latch release device. The resultant reduction of magnetic holding flux operates the device and causes the circuit breaker to open and isolate the circuit. The magnetic latch release is mechanically reset by the circuit breaker mechanism when the breaker stored energy closing spring is recharged.

E — Types of Trip Devices — Six types of static-trip devices are available. Similar in many respects, they differ only in functions provided. All use identical current sensor inputs and provide the output signal to the magnetic latch release. The following table shows the functions performed by the various trip device models.

FUNCTION	MODEL					
	SS1	SS2	SS3	SS4	SS5	SS6
Long Delay	X	X	X	X	X	X
Short Delay		X	X		X	X
Instantaneous	X		X	X		X
Ground Fault				X	X	X

Functions of Static Trip Models

F — Functions and Their Characteristics —

1. Phase Overcurrent Protection

(Long Delay; Inverse Time Characteristic)

- The Long Delay Pick-Up is adjustable with settings of 0.7, 0.9, 1.0, 1.1, and 1.3 times the current sensor tap rating.
- The Long Delay Band is adjustable with three settings:
Minimum—6.5 seconds delay at 600% overcurrent.
Intermediate—19 seconds delay at 600% overcurrent.
Maximum—35 seconds delay at 600% overcurrent.

The dependent I^2t characteristics of the long delay function and the individual band widths are shown on Fig. 1 "Time Current Characteristics."

2. Phase Selective Fault Protection

(Short Delay, Definite Time Characteristic)

- The Short Delay Pick-Up is adjustable with settings of 2, 3, 4, 6, 8, and 10 times the current sensor tap rating.
- The Short Delay Band is adjustable with delays of 0.11 sec, 0.25 sec, and 0.45 sec. The delay is independent of the current magnitude.

3. Phase Fault Protection

(Instantaneous; No Intentional Delay)

The instantaneous Pick-Up is adjustable with settings of 4, 5, 6, 8, 10, and 12 times the current sensor tap rating.

4. Ground Fault Protection

(Short Delay; Definite Time Characteristic)

- Ground fault pick-up is adjustable with setting of 0.2, 0.5, and 0.75 times the phase current sensor tap rating.
- Ground fault time delays (which are independent of fault current) are adjustable with settings of 0.08, 0.14, 0.20, 0.27, and 0.32 seconds. The ground current may be sensed by either a residual current connection of the three-phase sensors and the neutral sensor (4 wire system) or by direct connection to a current sensor on the power system ground strap.

TEMPERATURE RANGE OF OPERATION

Operation of the static tripping system is extremely stable over a wide range of temperature. From -40°C to 55°C (-40°F to 131°F) the variation from performance at room temperature is less than 5 percent in pickup value and timing, and up to 10 percent on transfer from long time to short time delay on the selective model. If they must be operated in environments beyond these limits, heating or ventilation should be installed.

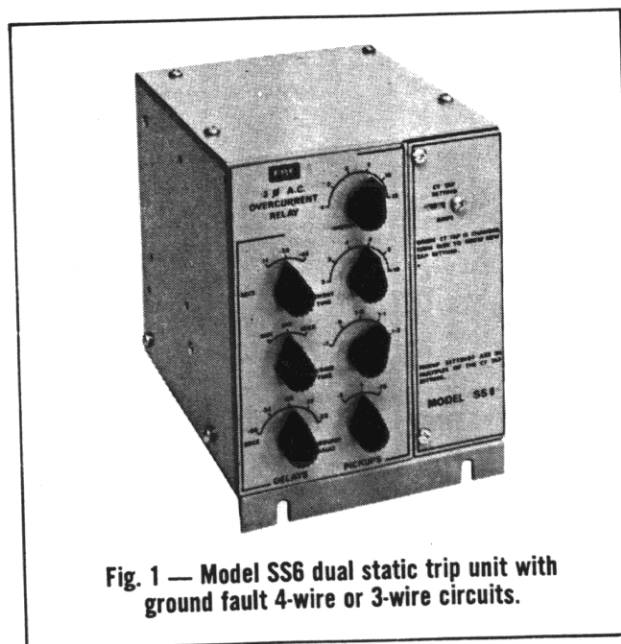


Fig. 1 — Model SS6 dual static trip unit with ground fault 4-wire or 3-wire circuits.

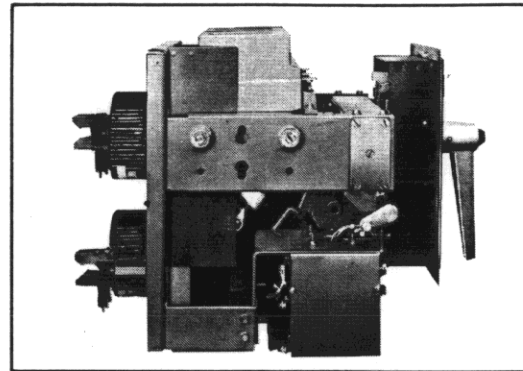
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SIMPLIFIED BREAKER RATING CHANGE

The continuous rating of the circuit breaker may be readily changed. Refer to Table 1, Page 4 and note the range of tapped current transformers available. All taps are factory wired to a readily accessible terminal block. The desired operating tap is selected at this terminal block and wired to the static overcurrent unit. Each static overcurrent unit is supplied with an adjustable CT tap setting window which permits revising the visible tap setting when any change is made.



SENSOR RATINGS — TABLE 1

Current Sensor			Long Time Pick-Up Amperes					Short Time Pick-Up Amperes						Instantaneous Pick-Up Amperes						Ground Fault Pick-Up Amperes				
Assembly No.	Tap Selection •	Lead Color Code (Red Common)																						
			.7X	.9X	1.0X	1.1X	1.3X	2X	3X	4X	6X	8X	10X		4X	5X	6X	8X	10X	12X		.2X	.5X	.75X
3000 AMPERE FRAME																								
1151A6646	3000 2500 2000	White Black Green	2100 1750 1400	2700 2250 1800	3000 2500 2000	3300 2750 2200	3900 3250 2600	6000 5000 4000	9000 7500 6000	12000 10000 8000	18000 15000 12000	24000 20000 16000	30000 25000 20000	12000 10000 8000	15000 12500 10000	18000 15000 12000	24000 20000 16000	30000 25000 20000	36000 30000 24000	600 500 400	1500 1250 1000	2250 1875 1500		
1600 AMPERE FRAME																								
1151C6645	1600 1200 1000	White Black Green	1120 840 700	1440 1080 900	1600 1200 1000	1760 1320 1100	2080 1560 1300	3200 2400 2000	4800 3600 3000	6400 4800 4000	9600 7200 6000	12800 9600 8000	16000 12000 10000	6400 4800 4000	8000 6000 5000	9600 7200 6000	12800 9600 8000	16000 12000 10000	19200 14400 12000	320 240 200	800 600 500	1200 900 750		
1152C6645	800 600 500	White Black Green	560 420 350	720 540 450	800 600 500	880 660 550	1040 780 650	1600 1200 1000	2400 1800 1500	3200 2400 2000	4800 3600 3000	6400 4800 4000	8000 6000 5000	3200 2400 2000	4000 3000 2500	4800 3600 3000	6400 4800 4000	8000 6000 5000	9600 7200 6000	160 120 100	400 300 250	600 450 375		
1153C6645	400 350 300	White Black Green	280 245 210	360 315 270	400 350 300	440 385 330	520 455 390	800 700 600	1200 1050 900	1600 1400 1200	2400 2100 1800	3200 2800 2400	4000 3500 3000	1600 1400 1200	2000 1750 1500	2400 2100 1800	3200 2800 2400	4000 3500 3000	4800 4200 3600	80 70 60	200 175 150	300 262.5 225		
1154C6645	250 225 200	White Black Green	175 157.5 140	225 202.5 180	250 225 200	275 247.5 220	325 292.5 260	500 450 400	750 675 600	1000 900 800	1500 1350 1200	2000 1800 1600	2500 2250 2000	1000 900 800	1250 1125 1000	1500 1350 1200	2000 1800 1600	2500 2250 2000	3000 2700 2400	50 45 40	125 112.5 100	187.5 168.75 150		
1155C6645	175 150 125	White Black Green	122.5 105 87.5	157.5 135 112.5	175 150 125	192.5 165 137.5	227.5 195 162.5	350 300 250	525 450 375	700 600 500	1050 900 750	1400 1200 1000	1750 1500 1250	700 600 500	875 750 625	1050 900 750	1400 1200 1000	1750 1500 1250	2100 1800 1500	35 30 25	87.5 75 62.5	131.25 112.5 93.75		
1156C6645	100	White	70	90	100	110	130	200	300	400	600	800	1000	400	500	600	800	1000	1200	20	50	75		
600 AMPERE FRAME																								
1151C6644	600 500 400	White Black Green	420 350 280	540 450 360	600 500 400	660 550 440	780 650 520	1200 1000 800	1800 1500 1200	2400 2000 1600	3600 3000 2400	4800 4000 3200	6000 5000 4000	2400 2000 1600	3000 2500 2000	3600 3000 2400	4800 4000 3200	6000 5000 4000	7200 6000 4800	120 100 80	300 250 200	450 375 300		
1152C6644	350 300 250	White Black Green	245 210 175	315 270 225	350 300 250	385 330 275	455 390 325	700 600 500	1050 900 750	1400 1200 1000	2100 1800 1500	2800 2400 2000	3500 3000 2500	1400 1200 1000	1750 1500 1250	2100 1800 1500	2800 2400 2000	3500 3000 2500	4200 3600 3000	70 60 50	175 150 125	262.5 225 187.5		
1153C6644	225 200 175	White Black Green	157.5 140 122.5	202.5 180 157.5	225 200 175	247.5 220 192.5	292.5 260 227.5	450 400 350	675 600 525	900 800 700	1350 1200 1050	1800 1600 1400	2250 2000 1750	900 800 700	1125 1000 875	1350 1200 1050	1800 1600 1400	2250 2000 1750	2700 2400 2100	45 40 35	112.5 100 87.5	168.75 150 131.25		
1154C6644	150 125 100	White Black Green	105 87.5 70	135 112.5 90	150 125 100	165 137.5 110	195 162.5 130	300 250 200	450 375 300	600 500 400	900 750 600	1200 1000 800	1500 1250 1000	600 500 400	750 625 500	900 750 600	1200 1000 800	1500 1250 1000	1800 1500 1200	30 25 20	75 62.5 50	112.5 93.75 75		
1155C6644	90 70 50	White Black Green	63 49 35	81 63 45	90 70 50	99 77 55	117 91 65	180 140 100	270 210 150	360 280 200	540 420 300	720 560 400	900 700 500	360 280 200	450 350 250	540 420 300	720 560 400	900 700 500	1080 840 600	18 14 10	45 35 25	67.5 52.5 37.5		
1156C6644	40	White	28	36	40	44	52	80	120	160	240	320	400	160	200	240	320	400	480	8	20	30		

* Set current sensor tap rating on trip device indicator

NOTES

- 1) The power system neutral must be grounded on the power source side of the neutral sensor in residual ground current sensing protection schemes.
- 2) The current sensor in the neutral bus must be identical to the sensors in each of the phase lines.
- 3) The current sensors must be carefully connected for proper polarity. Polarity marks on all current sensors face toward the power source.