**OPERATING INSTRUCTIONS FOR THE SST/ECS TEST SET**

**Cat. No TAKTS1**

**CONNECTING THE TEST SET**

*SAFETY PRECAUTIONS BEFORE CONNECTING THE TEST SET TO THE BREAKER TRIP DEVICE SYSTEM. ENSURE THAT THE CIRCUIT BREAKER IS COMPLETELY DICONNECTED FROM ITS POWER SOURCE ON DRAWOUT EQUIPMENT. RACK THE BREAKTER TO ITS DISCONNECTED POSITION. VERIFY THAT THE BREAKER IS TRIPPED.*

*NEVER DISENGAGE THE HARNESS CONNECTOR FROM THE PROGRAMMER UNIT ON A BREAKER THAT IS ENERGIZED AND CARRYING LOAD CURRENT. THIS WILL OPEN-CIRCUIT THE CURRENT SENSORS, ALLOWING DANGEROUS AND DAMAGING VOLTAGES TO DEVELOP.*

Before proceeding with the following connection work, ensure that the test set power supply cord is not connected.

A. "Programmer Only" Test
    1. Disconnect the breaker harness from the programmer unit.
    2. Plug the test set female connector lead into the receptacle on the rear of the programmer.
    3. The test set male connector lead need not be connected to the breaker harness for "Programmer Only" testing.
B. "Complete System" Test
    1. Disconnect the breaker harness from the programmer unit and reconnect the harness (female connector) to the male connector lead from the test set.
    2. Plug the test set female connector lead into the receptacle on the rear of the programmer.

PRELIMINARY TEST PROCEDURE

The following steps should be conducted before starting functional tests.

1. Position the test set controls as follows:

    CURRENT ADJUST: rotate to zero

    TEST SELECTOR: ø A

    TRIP BREAKER – PROGRAMMER ONLY: As desired.

    PROGRAMMER LONG-TIME PICKUP SETTING: Position this knob identical to the programmer's LT pickup setting.

2. Record the "In Service" settings of the programmer so that its set points can be restored upon completion of testing.

3. Connect the test set power cord to the 105-125 vac power source.
4. Turn the power ON.
5. Push the START button. The elapsed time meter will stop and the TEST indicator light will go out.
6. Push the RESET button. The elapsed time meter will stop and the TEST indicator light will go out.
7. Mechanically reset the elapsed time meter. You are now ready to begin functional testing.

**EXTERNAL MONITOR**

Should greater accuracy be desired, provision is made for connecting external instruments via the EXTERNAL MONITOR jacks on the front panel. These jacks are connected across an isolated, precision 0.2 ohm resistor in series with the test current circuit. Output at these jacks is shown in Table 1.

TABLE 1 - EXTERNAL MONITOR OUTPUT

| TEST SET CONTROL POSITIONS | | AC MILLIVOLTS PER L UNIT (±1%) |
|---|---|---|
| TEST SELECTOR | PROG.LONG TIME PICKUP SETTING | |
| øa øB or øC | 0.6X | 60 |
| | 0.7X | 70 |
| | 0.8X | 80 |
| | 0.9X | 90 |
| | 1.0X | 100 |
| | 1.1X | 110 |
| GROUND FAULT | 100 AC Millivolts per X Unit (±1%) | |

**LONG TIME PICKUP TEST**

PURPOSE – Verify that pick up occurs within tolerance. For any given pickup setting, this is achieved in two steps:

1. Test for NO PICKUP at 88 percent current, a value slightly below the published lower tolerance limit (91 percent).
2. Test for PICUP at 118 percent current, a value slightly above the published upper tolerance limit (109 percent).

NO PICKUP

1. Programmer settings:
   LONG TIME DELAY – Set on MIN band. The INT or MAX bands may be used if desired.
2. Position Test Set controls:
   PROGRAMMER LONG TIME PICKUPT SETTING – Must match the programmer's LT pickup setting.
   TEST SELECTOR – ø A, B or C
   TEST CURRENT – Preset at 0.88L
3. Reset timer and RESET button.
4. Push START – Allow test to run until time delay of Table 2 has expired. Unit should NOT trip. For 50 Hz operation, multiply timer readings by 1.2.

PICKUP

1. Position Test Set controls – Same as NO PICKUP, Step 2, except.
   a. Preset CURRENT LEVEL to 1.18L.
2. Reset timer and RESET button.
3. Push START. Allow test to run until unit trips. The time meter reading should conform to Table 2 limits. For 50 Hz operation, multiply timer readings by 1.2. If unit does not trip within the specified time, repeat the test, carefully monitoring and readjusting the test current as necessary. Transient dips in the supply voltage could lower the test signal current below its pickup value, causing the programmer's timing circuit to reset.

Repeat PICKUP and NO PICKUP tests on the other phases.

| TABLE 2 - LONG TIME PICKUP | | | | |
|---|---|---|---|---|
| MODE | TEST CURRENT L UNITS | TEST LIMITS TIME IN SECONDS | | |
| | | MIN BAND | INT BAND | MAX BAND |
| NO TRIP | 0.88 | 300 | 725 | 1650 |
| TRIP | 1.18 | <200 | <500 | <1200 |

**LONG TIME DELAY TEST**

PURPOSE – Verify that the LT characteristic conforms to its upper and lower band limits. This test requires measurement of delay times at three different L values.

1. Position Test Set controls:

   PROGRAMMER LONG TIME PICKUP SETTING – Must match the programmer's LT pickup setting.

   TEST SELECTOR – ø A, B, or C

TEST CURRENT – From Table 3, select three L values to be tested. Preset the first value.

NOTE: *These values must be below the short time and instantaneous pickup settings on the programmer, otherwise a premature trip signal will be received from those functions.*

2. Reset timer and RESET button.
3. Push START. Allow test to run until trip occurs. TIME meter reading should conform to Table 3 limits. For 50 Hz operation, multiply timer readings by 1.2.
4. Repeat the above test at the other two L values. This step verifies the linearity of the T-C characteristic.
5. Repeat the test on the other phases at one L value.
   Repeat the above test series on the other delay bands.

| TABLE 3 - LONG TIME DELAY | | | |
|---|---|---|---|
| TEST CURRENT | TEST LIMITS TIME IN SECONDS | | |
| L UNITS | MIN BAND | INT BAND | MAX BAND |
| 1.50 | 60.2-101.8 | 150.7-254.6 | 337.5-570.3 |
| 2.00 | 33.8-57.3 | 84.6-143.2 | 189.6-320.8 |
| 3.00 | 15.0-25.5 | 37.6-63.7 | 84.3-142.6 |
| 4.00 | 8.4-14.3 | 21.1-35.8 | 47.4-80.2 |
| 5.00 | 5.4-9.2 | 13.5-22.9 | 30.3-51.4 |
| 6.00 | 3.7-6.4 | 9.4-15.9 | 21.0-35.7 |
| 7.00 | 2.7-4.7 | 6.9-11.7 | 15.4-26.2 |
| 8.00 | 2.1-3.6 | 5.3-9.0 | 11.8-20.0 |
| 9.00 | 1.6-2.8 | 4.1-7.1 | 9.3-15.8 |
| 10.00 | 1.3-2.3 | 3.3-5.7 | 7.5-12.8 |

**SHORT TIME PICKUP TEST**

PURPOSE – Verify that pickup occurs within tolerance. This requires two tests at any desired pickup setting – one for pickup at the upper tolerance limit, the second for no pick up at the lower tolerance limit.

PICKUP

1. Programmer settings:
   ST DELAY BAND – As desired.
   INST PICKUP – Must be set higher than the ST pickup setting, otherwise the unit will trip first on INST mode.
2. Position Test Set controls:

PROGRAMMER LONG TIME PICKUP SETTING – Must match the programmer's LT pickup setting.
TEST SELECTOR – ø A, B or C
TEST CURRENT – Preset an Upper Limit L value from Table 4.

3. Reset timer and RESET button.
4. Push START. The unit must trip in less than one second, as indicated by the timer. For 50 Hz operation, multiply timer readings by 1.2.

ACTUAL PICKUP VALUE (if desired)

Starting at the Lower tolerance limit (Table 4), test incremental increases in L until a trip occurs in less than one second, as indicated by the timer. Push the PRE-SET CURRENT button, read the actual pickup value.

NO PICKUP

1. Programmer settings – Same as PICKUP, Step 1.
2. Position Test Set controls – Same as PICKUP, Step 2 except:

   TEST CURRENT – Preset the lower limit L value from Table 4.

3. Push START. The unit must not trip in less than one second. However, a trip may occur after one second due to a signal from the LT element. For 50 Hz operation, multiply timer readings by 1.2. Repeat PICKUP and NO PICKUP tests for at least one setting on each of the other phases.

| TABLE 4 - SHORT TIME PICKUP | | | | |
|---|---|---|---|---|
| PROGRAMMER PICKUP SETTING | TEST CURRENT IN L UNITS | | | |
| | 60 Hz | | 50Hz | |
| | LOWER LIMIT @ 0.873L (NO TRIP) | UPPER LIMIT @ 1.133L (TRIP) | LOWER LIMIT @ 0.847L (NO TRIP) | UPPER LIMIT @ 1.099L (TRIP) |
| 3L | 2.61 | 3.40 | 2.54 | 3.30 |
| 4L | 3.49 | 4.54 | 3.39 | 4.40 |
| 5L | 4.36 | 5.67 | 4.24 | 5.50 |
| 6L | 5.23 | 6.80 | 5.08 | 6.59 |
| 8L | 6.98 | 9.07 | 6.78 | 8.79 |
| 10L | 8.73 | 11.33 | 8.47 | 10.99 |

**SHORT TIME DELAY TEST**

PURPOSE – Provide an approximate indication that time delay occurs within the time band selected. Due to the small time magnitudes involved (0.5 seconds or less), the timer's right digit provides only a rough approximation of the actual trip time.

1. Programmer settings:
   INST PICKUP – Set at maximum (12L)
2. Position Test Set controls:
   PROGRAMMER LONG TIME PICKUP SETTING – Must match the programmer's LT pickup setting.
   TEST SELECTOR – ø A, B, or C
   TEST CURRENT – Preset and L value two steps higher than the programmer's ST pickup setting (e.g., preset 10L for an 8L pickup setting). This avoids measurement at the knee of the time – current curve, where the time delay may be longer than the band limits given in Table 5.

   For units equipped with an INST element, these higher test current levels can extend into the INST trip band: in such cases a lower test L value must be used.

3. Reset timer and RESET button.
4. Push START. Observe trip time.
   Repeat the above test on the other time bands, then check at least one band on each of the other phases.

| TABLE 5 - SHORT TIME DELAY | | |
|---|---|---|
| BAND | PUBLISHED BAND LIMITS - TIME IN SECONDS | |
| | LOWER | UPPER |
| MIN | 0.095 | 0.19 |
| INT | 0.21 | 0.32 |
| MAX | 0.35 | 0.50 |

**INSTANTANEOUS PICKUP TEST**

PURPOSE – Verify that pickup occurs within tolerance. This requires two test at a given pickup setting – one for pickup at the upper tolerance limit, the second for no pickup at the lower tolerance limit.

PICKUP

1. Position Test Set controls:
   PROGRAMMER LONG TIME PICKUP SETTING – Must match the programmer's LT pickup setting.
   TEST SELECTOR – ø A, B, or C
   TEST CURRENT – Preset and Upper Limit L value from Table 6.
2. Reset timer and RESET button.
3. Push START. The unit must trip immediately as indicated by little or no discernible timer movement.

ACTUAL PICKUP VALUE (if desired) –

Starting at the lower tolerance limit (Table 6), test incremental increases in L until an INST trip occurs (no discernible timer movement). Push the PRESENT CURRENT button, read the actual pick up value.

NO PICKUP

1. Position Test Set controls – Same as PICKUP, Step 1:
   TEST CURRENT – Preset the Lower Limit L value from Table 6.
2. Push START. The unit must not trip instantaneously (as in PICKUP, Step 3) – the INST element is not activated at these lower limit L values. However, the unit is subject to and will respond to a time delayed trip signal from the LT element. Also, if so equipped, it responds to any ST element whose pickup is set below the INST setting. In either event, the delayed trip produces a definite movement of the timer, a positive indication that the unit did not trip via the INST mode.
   Repeat PICKUP and NO PICKUP test for at least one setting on each of the other phases.

| TABLE 6 - INSTANTANEOUS PICKUP | | | | |
|---|---|---|---|---|
| PROGRAMMER PICKUP SETTING | TEST CURRENT IN L UNITS | | | |
| | 60Hz | | 50Hz | |
| | LOWER LIMIT @ 0.873L (NO TRIP) | UPPER LIMIT @ 1.133L (TRIP) | LOWER LIMIT @ 0.847 (NO TRIP) | UPPER LIMIT @ 1.099L (TRIP) |
| 4L | 3.49 | 4.54 | 3.39 | 4.40 |
| 5L | 4.36 | 5.67 | 4.24 | 5.50 |
| 6L | 5.23 | 6.80 | 5.08 | 6.59 |
| 8L | 6.98 | 9.07 | 6.78 | 8.79 |
| 10L | 8.73 | 11.33 | 8.47 | 10.99 |
| 12L | 10.47 | 13.60 | 10.16 | 13.19 |

**SST GROUND FAULT PICKUP TEST**

PURPOSE – Verify that pickup occurs within tolerance. Two tests are required at a given pickup setting – one for pickup at the upper tolerance limit.

PICKUP

1. Position Test Set controls:
   TEST SELECTOR – GROUND FAULT TEST CURRENT – Preset and Upper Limit X value from Table 7.
   NOTE: *For ground fault testing, the digital meter displays X units.*
2. Reset timer and RESET button.
3. Push START. The unit must trip, timer will indicate less than one second. For 50 Hz operation, multiply timer readings by 1.2.

ACTUAL PICKUP VALUE (if desired) –

Starting at the Lower Limit (Table 7), test incremental increases in X unit a trip occurs in less than one second, as indicated by the timer. Push the PRESET CURRENT button, read the actual pickup value.

NO PICKUP

1. Position Test Set controls – Same as PICKUP, Step 1 except:
   TEST CURRENT – Preset the Lower Limit X value from Table 7.
2. Reset timer and RESET button.
3. Push START. The unit should not trip, timer will read greater than one second delay.
   Discontinue the test after one second. If the test is allowed to run longer than 30 seconds, a trip signal can be received from the LT element for some programmer setting combinations. For 50 Hz operation, multiply timer readings by 1.2.
   Repeat PICKUP and NO PICKUP tests for at least one setting on each of the other phases.

TABLE 7 - GROUND FAULT PICKUP

| PROGRAMMER PICKUP SETTING | TEST CURRENT IN X UNITS | | | |
|---|---|---|---|---|
| | 60Hz | | 50Hz | |
| | LOWER LIMIT @ 0.873X (NO TRIP) | UPPER LIMIT @ 1.133X (TRIP) | LOWER LIMIT @ 0.847X (NO TRIP) | UPPER LIMIT @ 1.099X (TRIP) |
| 0.18X | 0.157 | 0.204 | 0.152 | 0.198 |
| 0.2X | 0.174 | 0.227 | 0.169 | 0.220 |
| 0.22X | 0.102 | 0.219 | 0.186 | 0.242 |
| 0.25X | 0.218 | 0.283 | 0.212 | 0.275 |
| 0.27X | 0.235 | 0.306 | 0.229 | 0.297 |
| 0.3X | 0.260 | 0.340 | 0.254 | 0.330 |
| 0.35X | 0.305 | 0.397 | 0.296 | 0.385 |
| 0.4X | 0.348 | 0.453 | 0.339 | 0.440 |
| 0.5X | 0.436 | 0.567 | 0.424 | 0.550 |
| 0.6X | 0.523 | 0.680 | 0.508 | 0.659 |
| 0.7X | 0.611 | 0.793 | 0.593 | 0.769 |
| 0.8X | 0.698 | 0.906 | 0.678 | 0.879 |
| 1.0X | 0.873 | 1.133 | 0.847 | 1.099 |
| 1.2X | 1.047 | 1.360 | 1.016 | 1.318 |

**SST GROUND FAULT TIME DELAY TEST**

PURPOSE – Provide an approximate indication that time delay occurs within the time band selected. Due to the small time magnitudes involved (0.5 seconds or less), the timer's right digit provides only a rough approximation of the actual trip time. If a more accurate reading is desired, the EXTERNAL MONITOR jacks may be employed.

1. Position test Set controls:
   TEST SELECTOR – Ground Fault.
   TEST CURRENT – Preset a value of 2X. This ensures that the test current is well above the knee of the curve for all GROUND FAULT pickup settings.
   NOTE: *For ground fault testing, the digital meter displays X values.*
2. Reset timer and RESET button.
3. Push START. Observe trip time.

Repeat test on the other time bands, then check at least one band on each of the other phases.

TABLE 8 - GROUND FAULT TIME DELAY

| BAND | PUBLISHED BAND LIMITS TIME IN SECONDS | |
|---|---|---|
| | LOWER | UPPER |
| MIN | 0.065 | 0.150 |
| INT | 0.165 | 0.270 |
| MAX | 0.300 | 0.430 |

**PHASE SENSOR CONTINUITY TEST**

PURPOSE – Check continuity of the breaker-mounted phase sensors.

NOTE 1. *The test set does not measure accuracy of the phase sensors. This can be established only by testing the complete trip device as a system, in conjunction with the breaker, using a commercially available high current – low-voltage test set.*

NOTE 2. *The test set is not for use in testing the equipment-mounted neutral sensor employed with SST trip devices equipped with a ground fault trip element for three-phase, four-wire applications. This neutral sensor is excluded from the scope of the circuit breaker/trip device test procedures, and instead should be treated as an integral part of the maintenance and testing activity associated with the switchgear equipment.*

1. Ensure that all power is removed from the circuit breaker and that the male connector from the test set is connected to the female connector of the circuit breaker harness.

2. Select the phase to be tested.
3. Push the PUSH-TO-TEST button. The OK light must light while the PUSH-TO-TEST button is depressed. Absence of the OK light indicates a high resistance or open circuit in the CT or wiring harness.