



CLASS 7001 TYPE SSI TIME CURRENT DC ACCELERATION MODULE

DESCRIPTION

The Class 7001 Type SSI time current dc acceleration module is a control unit consisting of solid state circuits. The components are mounted on a printed circuit board which is enclosed in a metal frame with screw-type terminals. The current set-point switch and indicating light mounted on the module are used to adjust and monitor the acceleration current set-point. A removable cover on the front of the module safeguards against unauthorized adjustment of the current set-point switch.

FUNCTION

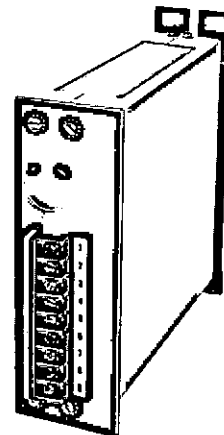
The Type SSI module is used to control closure of the accelerating contactors on dc crane and mill controllers. Proper dc motor acceleration is achieved by the module monitoring the motor current and automatically adjusting the time period between acceleration contactor closures.

PRECAUTIONS

The following list of recommended "PRECAUTIONS" must be studied and followed during installation, operation and servicing of the module.

Power must be disconnected prior to performing any installation. When performing maintenance and/or testing on the module, EXTREME CAUTION must be exercised in view of the presence of hazardous voltage. All power should be disconnected when connecting meters, making inspections or performing other procedures which may expose personnel to accidental contact with live electrical parts.

1. Read this service bulletin prior to installing or operating the module.
2. Only authorized personnel should be permitted to install or service the module.
3. The printed circuit board foil runs of the module must be protected by installing maximum NON 15 ampere or equivalent fuses in the controller control circuit. Time delay fuses may result in damage to the printed circuit board foil runs in the event a contactor coil fails shorted.



4. Erratic operation of the module may result if arc inhibitors are located directly across contactor coils in the control circuit. If arc inhibitors are installed, refer to APPLICATION INFORMATION - Arc Inhibitors section of this service bulletin.
5. Module can be damaged if meggered. Meggering can be accomplished only by jumpering module terminals 5, 6, 7, and 8 to terminal 4.

APPLICATION INFORMATION

TYPE	PART NUMBER	ACCELERATION	
		STEPS	OUTPUT TERMINALS
SSI-03	51253-007-50-03	3	8, 7, & 6
SSI-04	51253-007-50-04	4	8, 7, 6 & 5

Current Sensor Input [Terminals 1(-) & 2(+)] Maximum Voltage is ± 240 vdc

Power Supply Input [Terminals 3(+) & 4(-)] Voltage range of 200 to 300 vdc

Acceleration Control Outputs [Terminals 5, 6, 7 & 8] Each output controlled by a thyristor (S.C.R.) power module rated .36 ampere at 85°C and 1.0 ampere at 55°C. Thyristor firing is dependent upon presence of terminal voltage (200-300vdc) and completion of timing period. Timing period is 0.1 second minimum and 1 second maximum.

Hoist Lower Input [Terminal 9(+)] Voltage range of 200-300 vdc. When input voltage is applied at terminal 9 the minimum time period of terminal 8 output is increased from 0.1 to 0.5 second.

Operating Temperature - 20°C to + 85°C

Load Impedance (Maximum) 3000 ohms

Recommended Fuse Size Install maximum NON 15 ampere or equivalent fuse in control circuit for proper protection of the printed circuit board foil runs.

Arc Inhibitors If arc inhibitors are installed on the contactor coils, it is necessary that they be connected from the positive side of the contactor coil to the power supply negative as shown in Figure 2. Erratic operation may result if the arc inhibitors are located directly across the contactor coils.

ADJUSTMENT

The sixteen position current set-point switch is used to adjust the current set point equal to 100% motor full load current for hoist drives and 50% full load current for travel drives. The switch is set depending on the ratio of the last step acceleration resistance to the motor full speed resistance. This ratio times 100 percent is now expressed as a percent of the motor full speed resistance. Since the motor full speed resistance (expressed in ohms) is equal to the rated line voltage (E) divided by the motor full load current (I), this ratio is further expressed as a % E/I and ratios corresponding to switch settings are found in Table I. If the required % E/I is not in the table, use the next highest setting. When the acceleration current falls below the set-point or the maximum time has elapsed, the next acceleration circuit is energized.

TABLE I

SW-1 POSITION		0	1	2	3	4	5	6	7
MAX. %E/I	BRIDGE AND TROLLEY	6	10	14	18	22	26	30	34
	HOIST	3	5	7	9	11	13	15	17

TABLE 1 (CONT'D)

SW-1 POSITION		8	9	10	11	12	13	14	15
MAX. %E/I	BRIDGE AND TROLLEY	38	42	46	50	54	58	62	66
	HOIST	19	21	23	25	27	29	31	33

SW-1 switch settings versus set-point voltages are shown in Table II. These voltage values can be used to calculate motor current set-point values.

TABLE II

SW-1 POSITION	0	1	2	3	4	5	6	7
INPUT SET-POINT VOLTAGE	6.9	11.5	16.1	20.7	25.3	29.9	34.5	39.1

SW-1 POSITION	8	9	10	11	12	13	14	15
INPUT SET-POINT VOLTAGE	43.7	48.3	52.9	57.5	62.1	66.7	71.3	75.9

EXAMPLE: Assume dc series wound mill motors (frame size 808) are used for hoist and travel drives.

30 minute rating -65 horsepower
-246 amperes at
230 vdc

60 minute rating - 50 horsepower
-184 amperes at
230 vdc

NEMA Class 162 resistors are used. Last step acceleration resistance is .231 ohms for the hoist drive and .248 ohms for the travel drive.

SW-1 switch is set according to the ratio of
Last Step of Acceleration Resistance

Motor E/I

For hoist drive the ratio equals

$$\frac{.231 \text{ ohms}}{230 \text{ volts}} = \frac{.231 \text{ ohms}}{.935 \text{ ohms}} = .247 = 24.7\%$$

246 amperes

Table I shows that the current set-point switch is set at position 11. This corresponds to a current value of 249 amperes:

$$\frac{57.5 \text{ volts (from Table II)}}{.231 \text{ ohms}} = 249 \text{ amperes}$$

For travel drive the ratio equals

$$\frac{.248 \text{ ohms}}{230 \text{ volts}} = \frac{.248 \text{ ohms}}{1.25 \text{ ohms}} = .1984 = 19.8\%$$

184 amperes

Table I shows that the current set-point switch is set at position 4. This setting corresponds to a current value of 102 amperes:

$$\frac{25.3 \text{ volts (from Table II)}}{.248 \text{ ohms}} = 102 \text{ amperes}$$

The settings in Table I and Table II correspond to a set-point current of 100% FLA for hoist drives and 50% FLA for travel drives. Experience has shown that travel drive motors are sized for acceleration and a 50% current setting should protect against wheel spinning whenever a light load is being moved. If spinning of wheels should occur, the current set-point switch should be set on the next lower number. If faster acceleration is desired for the travel drive, the current set-point switch should be set on the next higher number.

OPERATION

The Class 7001 Type SSI time current dc acceleration module can be installed in either a hoist or a travel drive controller as shown in Figure 1 or 2.

The current set-point switch adjusts the acceleration current set-point. (Proper adjustment procedure is described in ADJUSTMENT section of this service bulletin.)

The last step acceleration resistor is connected to **terminals 1 (-) and 2 (+)**.

Power supply input voltage is applied to **terminals 3 (+) and 4 (-)**.

Terminals **5, 6, 7 and 8** control the acceleration steps and are always connected to the negative side of the acceleration contactor coils as shown in Figures 1 and 2. Operation of the acceleration

module is demonstrated by Figure 3. When input voltage is applied to terminal 5, 6, 7 or 8, two timing circuits are initiated. After a 0.1 second initial delay the primary timing circuit will provide a trigger pulse to the thyristors (SCR) only if the motor current is less than the current set-point. If the motor current exceeds the current set-point, the primary timing circuit is disabled and indicator LED will light. When the motor current decays to a value less than the current set-point, indicator LED will go out, and the primary timing circuit will be reactivated and instantaneously provide a trigger pulse to the thyristors. If the motor current remains above the current set-point for one second, the trigger pulse to the thyristors (SCR) is provided by the back-up timer circuit. In all cases ONLY the thyristors that have voltage present at their input terminals will latch on. Therefore, contactor coils connected to these terminals must be consecutively interlocked so that a stepping sequence is obtained.

Terminal 9 is the hoist-lower input. It is only used on hoist drives and is connected to the positive side of 1L contactor coil (Figure 1). When input voltage is applied at **terminal 9**, the minimum timing circuit of **terminal 8** is changed from a 0.1 to 0.5 second timing circuit. A minimum timing circuit of 0.5 second is usually sufficient to insure brake release but extremely sluggish brakes may require additional time. When required, a 1.0 second minimum timing circuit is obtained by removing resistor R20 from the module printed circuit board.

TROUBLESHOOTING

WARNING

WHEN PERFORMING MAINTENANCE AND/OR TESTING ON THE MODULE, EXTREME CAUTION MUST BE EXERCISED IN VIEW OF THE PRESENCE OF HAZARDOUS VOLTAGE. ALL POWER SHOULD BE DISCONNECTED WHEN CONNECTING METERS, MAKING INSPECTIONS OR PERFORMING OTHER PROCEDURES WHICH MAY EXPOSE PERSONNEL TO ACCIDENTAL CONTACT WITH LIVE ELECTRICAL PARTS.

MODULE MOUNTED IN CONTROLLER

1. Open control circuit disconnect and then open the main line disconnect.

WARNING

IF CONTROLLER DOES NOT HAVE A MAIN LINE DISCONNECT, LINE VOLTAGE WILL BE PRESENT IN THE CONTROLLER POWER CIRCUIT AND POWER TO THE MOTOR MUST BE DISCONNECTED BEFORE PROCEEDING.

2. Disconnect wires from terminals 1 and 2.
3. Connect a jumper between terminals 1 - 4.

TROUBLESHOOTING (CONT'D)

MODULE MOUNTED IN CONTROLLER

4. Connect a jumper between terminals 2 - 3.
5. With no power connected to the motor, close the control circuit disconnect.
Indicator LED should light immediately and remain lit until the control circuit disconnect is opened.
6. Measure the input voltage at terminals 3 (+) - 4 (-). Voltage should be 200-300 vdc with terminal 3 positive.
7. Sequence the controller and check that the closed contactor power tips in each speed point match that of the contactor sequence table on the controller wiring diagram. The acceleration module should provide a one second time delay between acceleration contactor closures.
 - a. If the controller sequences properly and there is no time delay between acceleration contactor closures, the acceleration module should be tested removed from the controller.
 - b. If a contactor will not operate in a specific speed point controlled by the acceleration module, check the module terminal voltage for the specific speed point.
 - 1) If terminal voltage (200-300 vdc) is present, the acceleration module should be tested removed from the controller.
 - 2) If no terminal voltage is present, the problem is in the controller control circuit. Refer to the controller service bulletin.
9. Open the control circuit disconnect.
10. Remove jumpers between terminals 1-4 and 2-3.
11. With no power connected to the motor, close the control circuit disconnect.
Indicator LED should not light.
12. Sequence the controller and check that the closed contactor power tips in each speed point match that of the contactor sequence table on the controller wiring diagram. The acceleration module should provide a 1/10 second time delay between acceleration contactor closures.
 - a) If a contactor will not operate in a specific speed point controlled by the acceleration module, check the module terminal voltage for the specific speed point.
 - 1) If terminal voltage (200-300 vdc) is present, the acceleration module should be tested removed from the controller.
 - 2) If no terminal voltage is present, the problem is in the controller control circuit. Refer to the controller service bulletin.
13. Open the control circuit disconnect.
14. Reconnect wires to terminals 1 and 2.

MODULE REMOVED FROM CONTROLLER

All inputs of the Class 7001 Type SSI time current acceleration module are protected against damage except for the thyristor power modules. If failure occurs in the circuitry, the entire assembly should be replaced. If a thyristor power module is damaged due to excessive current, replace only the damaged thyristor power module.

Any Class 7001 Type SSI time current acceleration module can be tested with the use of the following equipment:

1. 200-300 volt dc power supply
2. 10K ohm, 1 watt carbon resistor
3. 47K ohm, 2 watt carbon resistor
4. Two 60 watt, 120 volt (ac or dc) light bulbs or one dc relay with 200-300 volt dc coil having coil resistance between 300-3000 ohms.

TEST PREPARATIONS

1. Remove module from controller.
2. Connect a 10K ohm resistor between terminals 1-2.
3. Connect a 47K ohm resistor between terminals 2-3.
4. Connect a jumper between terminals 1-4.
5. Connect two 60 watt light bulbs in series or one dc relay coil between:
 - a. terminals 3-5 for module part number 51253-007-50-04.
 - b. terminals 3-6 for module part number 51253-007-50-03.
6. Remove current set-point selector switch cover on front of module.
7. Note position of current set-point selector switch.

TEST PROCEDURE**A. Class 7001 Type SSI-04 Module, Part Number 51253-007-50-04.**

1. Set current set-point selector switch to position 11.
2. Connect dc power supply to terminals 3 (+) and 4 (-).

Light bulbs should light 1/10 second after power is applied and module LED indicator should not light.

3. Remove power.
4. Set current set-point selector switch to position 6.
5. Reconnect power per Step 2.
Module LED indicator should light immediately and light bulbs should light one second after power is applied.
6. Remove power.
7. Disconnect light bulbs from terminal 5 and reconnect to terminal 6.
8. Repeat Steps 1 through 6.
9. Disconnect light bulbs from terminal 6 and reconnect to terminal 7.
10. Repeat Steps 1 through 6.
11. Disconnect light bulbs from terminal 7 and reconnect to terminal 8.
12. Repeat Steps 1 through 6.
13. Connect jumper between terminals 3-9.
14. Repeat Steps 1 and 2.

Light bulbs should light 1/2 second after power is applied and module LED indicator should not light.

15. Remove power.
16. Disconnect and remove all wires connected to module terminal board.

17. Reset current set-point selector switch to position noted in step 7 under TEST PREPARATIONS.

18. Install current set-point selector switch cover.

B. Class 7001 Type SSI-03 Module, Part Number 51253-007-50-03.

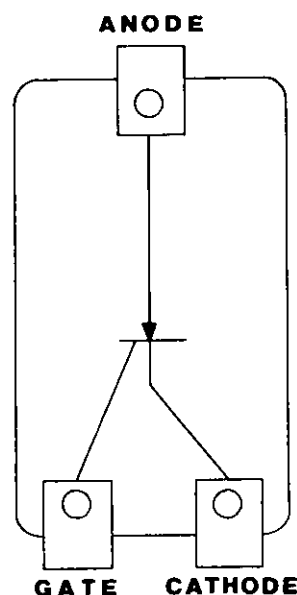
Use Test Procedure A less Steps 7 and 8.

If the module LED indicator does not light when specified in the above test procedures, the module is defective and should be replaced.

If the light bulbs do not light for specific steps, check the thyristor power modules (SCR) associated with the particular steps. A damaged thyristor power module is usually evidenced by a crack in the potting epoxy and can be replaced with another unit, part number 51229-028-51.

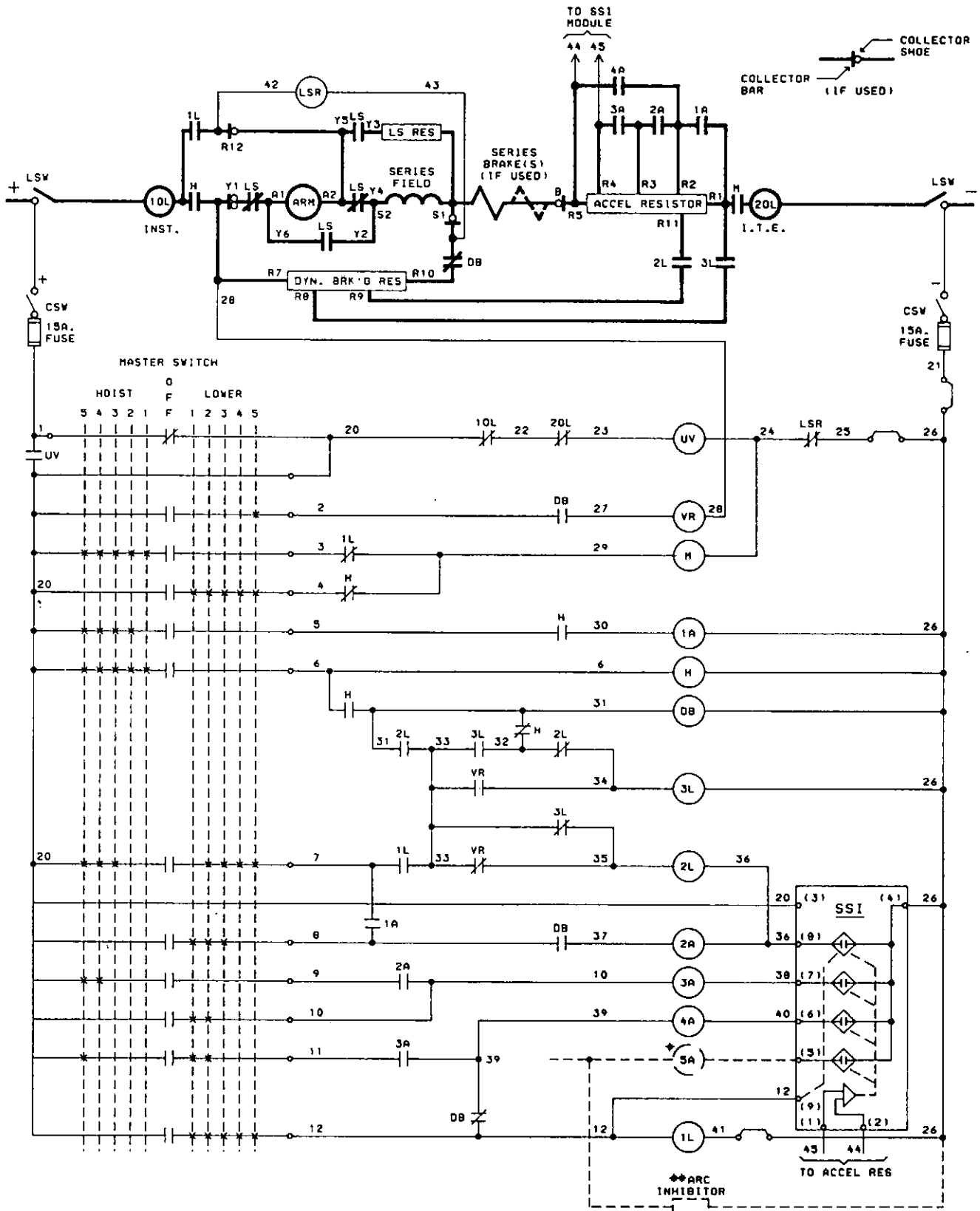
Any of the thyristor power modules can be tested with the use of a VOM (Triplett Model 630 or equivalent) as follows:

1. Remove the thyristor power module from the printed circuit board by removing the three mounting screws.
2. Set the VOM to the X10 resistance scale.
3. Connect meter positive input to thyristor anode and meter negative input to thyristor cathode. Meter should indicate infinite resistance.
4. Momentarily short the anode to the gate. The thyristor should conduct and hold. The meter should now indicate 10-500 ohms.
5. Remove anode connection to reset thyristor power module.



**BOTTOM VIEW
THYRISTOR
POWER MODULE**

ELEMENTARY DIAGRAM FOR HOIST CONTROL



◆ USED ON 6 STEP CONTROL
 ◆◆ TYPICAL CONNECTION WHEN USED

Figure 1

CLASS 7001 TYPE SSI STATIC DC ACCELERATION MODULE

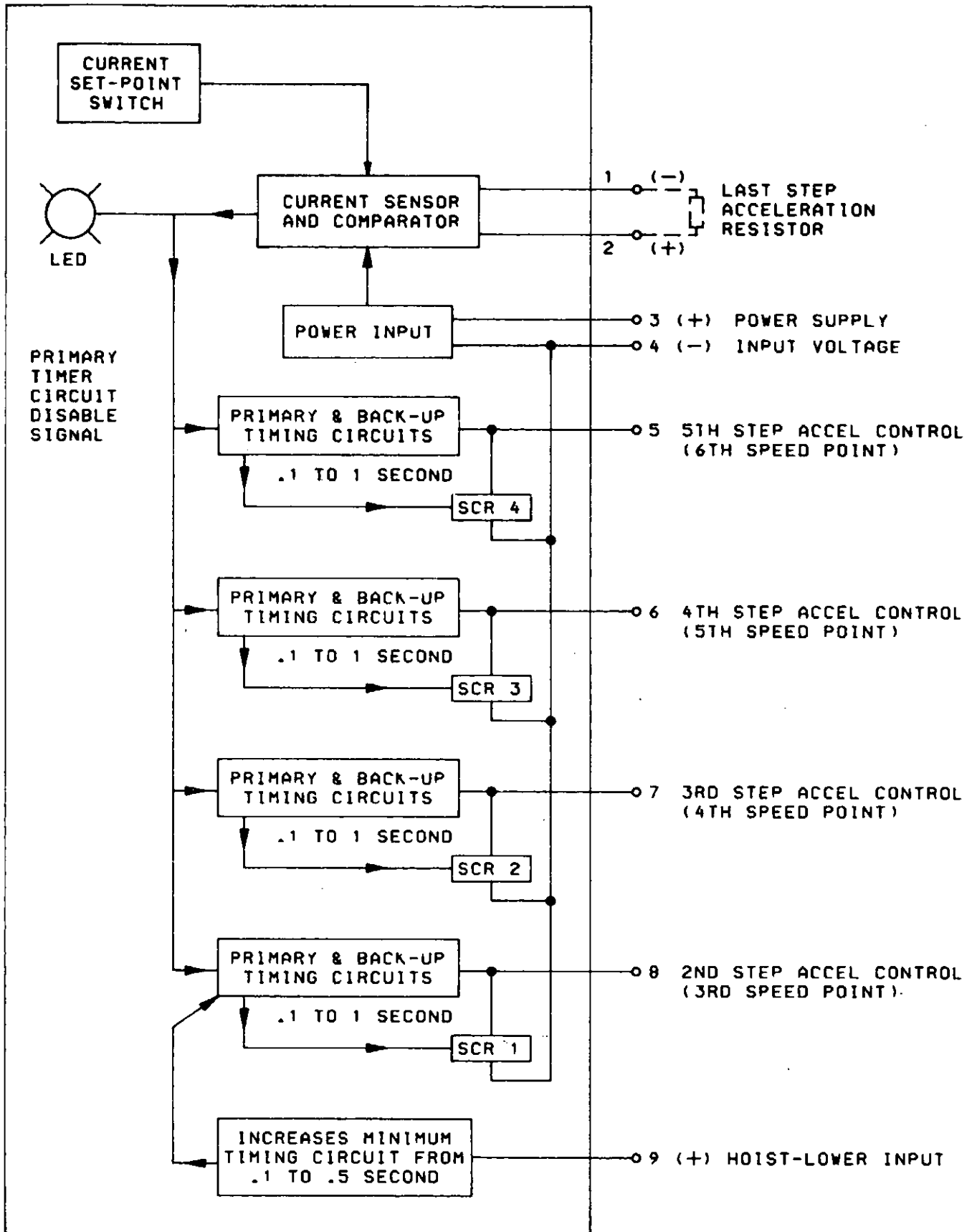


Figure 3