SETS-11 Inspection and Maintenance Manual

1. Outline

SETS-11 is the abbreviation of Smooth Emergency Terminal Slowdown Type-11 and is an electronic safety system. SETS system detects the car position continuously and accurately by the governor encoders, position detection switches on the car, and hoistway cam at terminals of the hoistway. As the SETS system detects overspeed and stops the elevator quicker than the conventional system, the speed of collision with a buffer can be decreased and the buffer can be downsized. Therefore, the overhead and pit size can be reduced.

The SETS system consists of SETS cards (CPU card, I/F card, and SF relay card) in control panel, governor encoders, position detection switches, and hoistway cam. It is necessary to carry out inspection and maintenance of SETS system on the regular basis to maintain the function properly. Even if the elevator is equipped with SETS system, safety devices depending on the maximum speed of the elevator will be installed except a buffer.

The locations of SETS cards are shown in Fig. 1-1, 1-2, 1-3, and 1-4. The setting values of EGOV and ESPD are written on the SETS setting label (see Fig. 1-5).

I/F CARD

CPU CARD

Card Basket
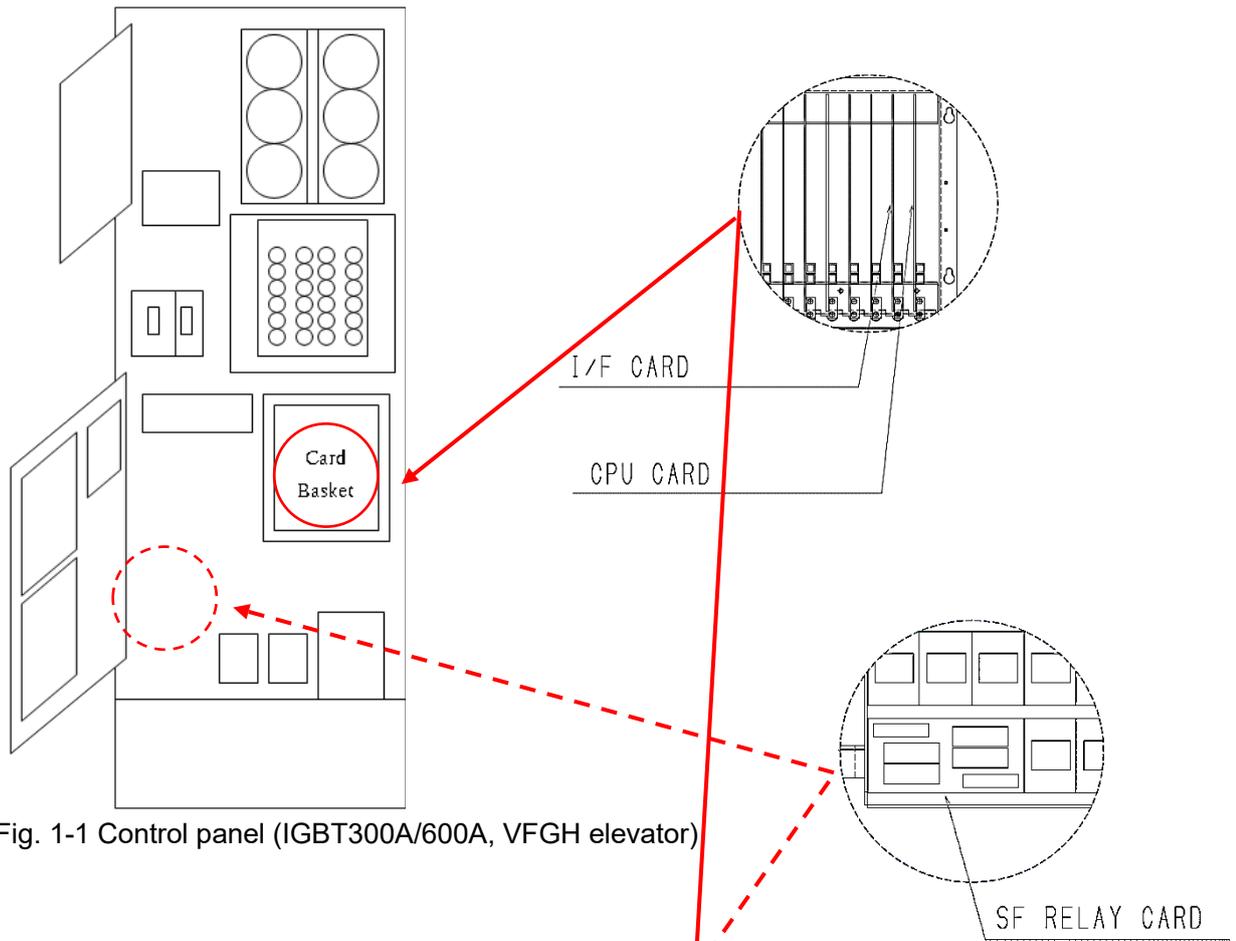
Fig. 1-1 Control panel (IGBT300A/600A, VFGH elevator)

SF RELAY CARD

Card basket
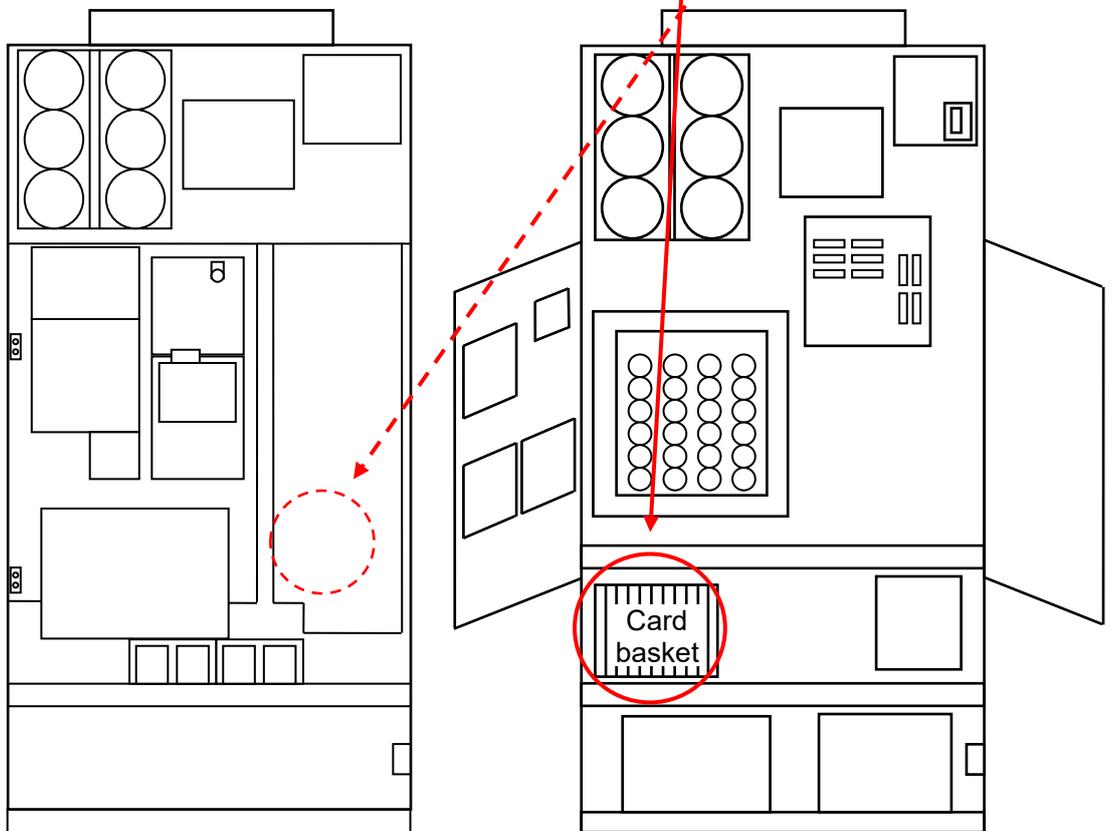
Fig. 1-2 Control panel (IGBT300A/600A, VFGHA elevator)

3
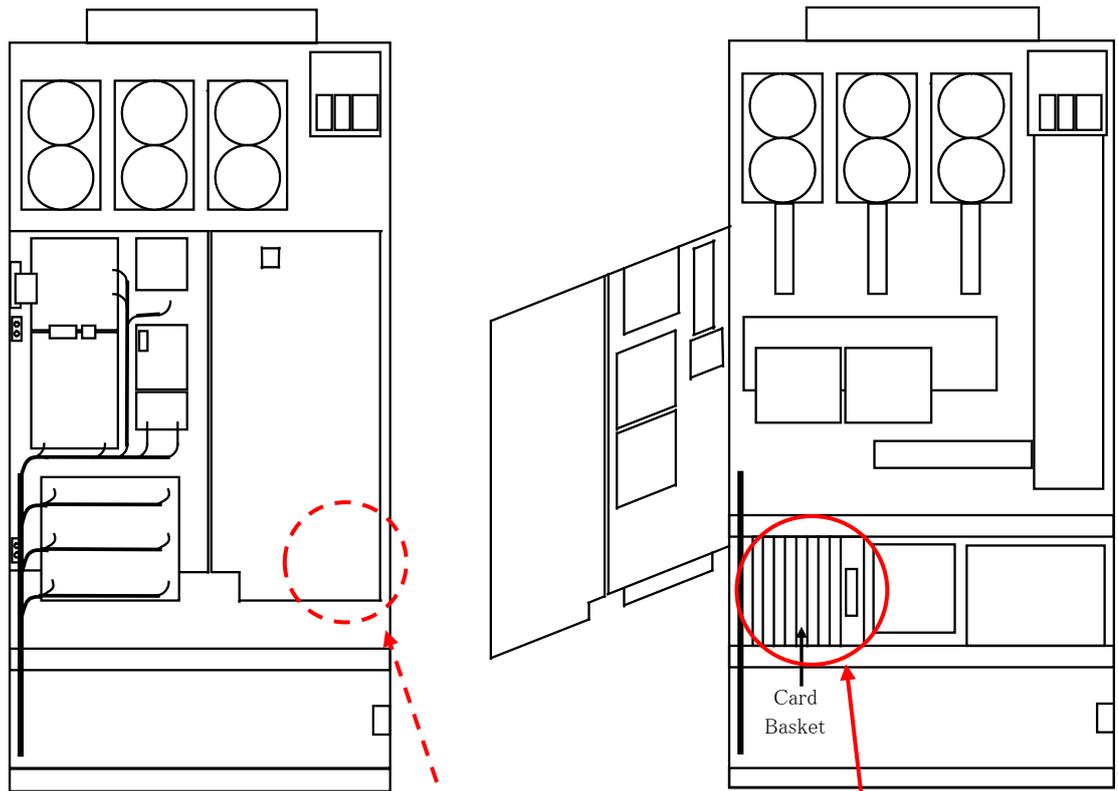
Fig. 1-3 Control panel (IGBT600A*2, VFGH or VFGHA elevator)

Card
Basket

I/F CARD

CPU CARD

SF RELAY CARD

Card
Basket
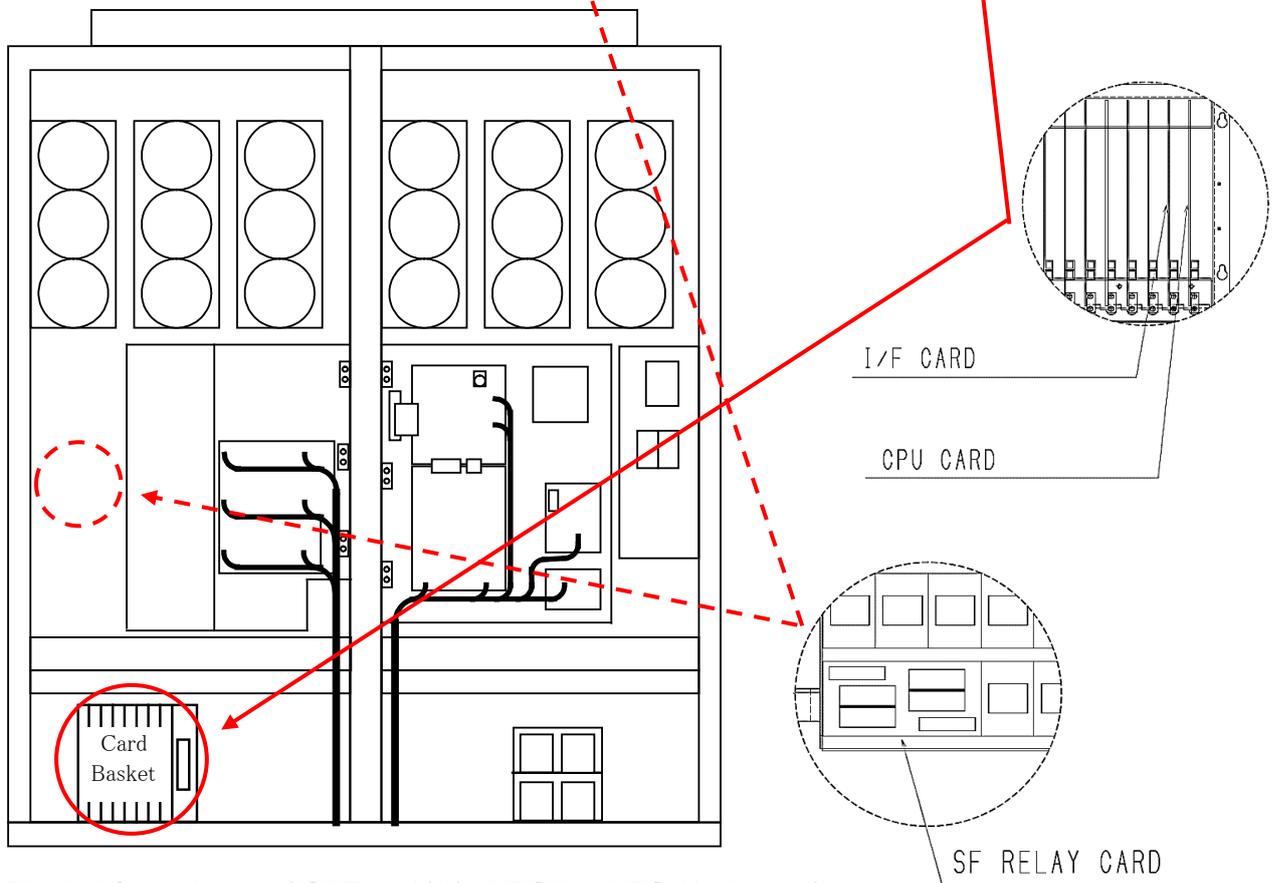
Fig. 1-4 Control panel (IGBT600A*4/6, VFGH or VFGHA elevator)

4

EGOV and ESPD setting values

Operating point of position detection switches

SETS setting

SETS-P1 card RSW setting	ESPD	EGOV

Max. Striking speed of Buffer	[m/s]

Switch Name	Operating point
1UAB/1DAB	[m]
2UAB/2DAB	[m]
3UAB/3DAB	[m]

Contents of error code : When RSW of SETS-P1 card is set "MON=6"

No	Error	No	Error
10		53	
20		54	
21		55	
		56	
22		57	
		58	
23		5B	
24		60	
25		61	
26		62	
27		63	
28			
30		64	
31			
38		65	
40			
41		66	
42		67	
		68	
43		69	
		6A	
44		6B	
45		6C	
46		6D	
		70	
47		71	
48		72	
49		73	
50		74	
51		75	
52		76	

Fig. 1-5 SETS setting label

5

Two governor encoders

Position detection switches

Hoistway cam

Fig. 1-6 SETS-11 system installation position

2. SETS system inspection

Make sure to carry out inspection of the SETS system on a regular basis. If not, the SETS system may decrease (limit) the traveling speed of the elevator.

2.1. Check of SETS system state in inspection and maintenance

If the SETS system is provided, carry out inspection for the following items once a year to check the state of the system.

2.1.1. SETS system

(1) Check that there is no change or abnormality in the operation and installation state of control devices such as switches.

(2) Check that terminals are fixed firmly.

(3) Check that the setting values of the rotary switches (EGOV and ESPD) on the SETS card (CPU card) are the same as those written in the SETS setting label attached on the back of the cover of its elevator control panel.

*Turn off the power to check SETS cards. Before starting the checks, confirm that the power has been turned off with a tester.

*After the check, ensure safety before turning on the power again.

2.1.2. Position detection switches

Check that there is no change or abnormality in the operating points and installation state of the position detection switches. For the correct operating points, see Table 2-1, 2-2, 2-3, and 2-4.

Table 2-1 Operating point of the position detection switches

EGOV setting value	Operating point of the position detection switches
0	See Table 2-2.
1	
2	
3	
4	See Table 2-3.
5	
6	
7	See Table 2-4.

Table 2-2 Operating point of the position detection switches (EGOV = 0, 1, 2, 3)

ESPD setting value	Operating point of the position detection switches [mm]			
	1U/1D	2U/2D	3U/3D	Tolerance within
1	9800	20500	39200	±500
2	15000	31000	53000	±500
3	600	1800	4000	±200
4	800	2300	5400	±200
5	1400	4500	7700	±500
6	2500	7400	8900	±500
7	2600	7800	15100	±500
8	4600	13800	22100	±500
9	7000	21200	30000	±500
A	9700	18900	39300	±500
B	12500	23000	49600	±500
C	15000	37000	69000	±500
D	27000	48000	71000	±500

Table 2-3 Operating point of the position detection switches (EGOV = 4, 5, 6)

ESPD setting value	Operating point of the position detection switches [mm]			
	1U/1D	2U/2D	3U/3D	Tolerance within
3	670	1900	3700	±200
4	1600	3200	5400	±200
5	900	2500	5800	±500
6	1900	5600	9100	±500
7	1900	5500	11500	±500
8	3600	10400	18100	±500
9	5600	16300	24600	±500
A	7700	12200	30800	±500
B	10100	15600	39600	±500
C	12000	32000	59000	±500
D	22000	45000	71000	±500

Table 2-4 Operating point of the position detection switches (EGOV = 7)

ESPD setting value	Operating point of the position detection switches [mm]			
	1U/1D	2U/2D	3U/3D	Tolerance within
0	70000/15000	123000/31000	184000/53000	±500
1	15000/9700	37000/18900	69000/39300	±500
2	15000/12500	37000/23000	69000/49600	±500
3	27000/15000	48000/37000	71000/69000	±500
4	31000/15000	55000/31000	83000/53000	±500
5	39000/15000	68000/31000	101000/53000	±500
6	51000/15000	87000/31000	129000/53000	±500
7	59000/15000	90000/31000	135000/53000	±500
8	73000/15000	120000/31000	176000/53000	±500
9	77000/15000	127000/31000	184000/53000	±500

2.1.3. Check the condition of the governor encoders

Check that there are no change or abnormality in the operation and installation state of governor encoders.

2.2. Basic function check in inspection and maintenance

If the SETS system is provided, carry out inspection for the following items once a year to check that there is no abnormality in the basic functions.

2.2.1. Check the output of governor encoders

Check the car speed and direction detected by governor encoders.

2.2.1.1. Check running direction by governor encoders.
a) Set the rotary switches MON1 and MON0 on the P1 card (CPU card of the elevator in the control panel) to 8 and 3, respectively.
b) Set manual operation, run the car manually, and check that the directions calculated by SETS (7SEG3) agree with the car running direction detected by the motor encoder (7SEG2) and governor encoder (7SEG1).
*Check the above more than 6 seconds later after the car has started running because there is a time lag between the car movement and indication.
*If the direction detected by the governor encoders is not correct, check the installation state of the governor encoders.

Table 2-5 Check the direction of governor encoders

Item displayed on indicator	Timing of display	Display on 7-segment indicators on P1 card
Direction by governor encoders	b)	7SEG 3: The direction calculated by SETS 7SEG 2: The direction detected by motor encoder 7SEG 1: The direction detected by governor encoders *7SEG3 shows the direction with governor encoder 1 and 2 in order of calculation by SETS. *U means UP, d means DN.

2.2.1.2. Check the car speed by governor encoders.

    a) Set the rotary switches MON1 and MON0 on the P1 card to 3 and 5, respectively.

    b) Set manual operation, run the car manually, and check the car running speed.

    c) Set the rotary switches MON1 and MON0 on the P1 card to 3 and E, respectively.

    d) Set manual operation, run the car manually, and check that the car running speed detected by SETS as same as the speed in (b) above.

*Check the above after the running speed has become constant because there is a time lag between the car movement and indication.

*If the speed calculated by SETS is not correct, check SETS-11 setting and the installation state of the governor sheave and encoders.

Table 2-6 Check the car speed of governor encoders

Item displayed on indicator	Timing of display	Display on 7-segment indicators on P1 card
Car speed by governor encoder	b)	7SEG 3, 2, 1: [a value] [Unit: 1 m/min]
Car speed calculated by SETS	d)	7SEG 3, 2, 1: [a value] [Unit: 1 m/min]

2.2.2. Check of position and speed detection function (inspection A)

Check the function to detect car position and speed by writing the position detection function.

a) Move the car to the bottom floor and unload the car to 0% load.

b) Set automatic operation.

c) Flip the toggle switch DCB/FMS on P1 card down to the FMS side. The 7-segment indicators on the P1 card flash on and off.

d) The car automatically runs to the top floor, and then runs to the bottom floor. The 7-segment indicators flash on and off when the car is running to the top floor. The 7-segment indicators stop flashing when the car stops at the top floor, and the car runs to the bottom floor.

e) Set both of the rotary switches MON1 and MON0 on the P1 card to 7.

f) Check that the indicator showing the operating point of each position detection switch shows *OK*. (See Table 2-7.) (*1, *2)

g) Flip and hold the toggle switch SW1 down and toggle switch SW2 up for 2 seconds. The execution history is saved in P1card.

h) Restore the rotary switches on P1 card to the original values.

*1 If the indicator does not show *OK*, set the rotary switches MON1 and MON0 on the P1 card to 7 and 8, respectively. Compare with the operating point of position detection switches on the above tables and readjust the operating points.

*2 If the operating point of the position detection switches is close to the floor level of the nearest floor, an error value of the operating point is displayed and flashes on and off. Adjust the operating points of the position detection switches so that the points are away from the floor level of the nearest floor and the error value flashing on and off is not displayed any more.

Table 2-7 SETS position detection switches display

Item displayed on indicator	Timing of display	Display on 7-segment indicators on P1 card
Check the operating point of the position detection switches	e)	7SEG 3,2,1: *Tr-* → *OK* or error value → *1U-* → *OK* or error value → *2U-* → *OK* or error value → *3U-* → *OK* or error value → *1D-* → *OK* or error value → *2D-* → *OK* or error value → *3D-* → *OK* or error value → (repeated) [Unit: mm]
Display the position of the operating point of detection switches	*1	7SEG 3,2,1: *1U-* → 1U-position upper 3 digits (with lighting dots) → 1U-position lower 3 digits → *2U-* → 2U-position upper 3 digits (with lighting dots) → 2U-position lower 3 digits……… → *3D-* → 3D-position upper 3 digits (with lighting dots) → 3D-position lower 3 digits → (repeated) [Unit: mm]

2.2.3. Check of self-diagnosis history and result (Inspection D)

Check the history and result of diagnosis conducted by the self-diagnosis function of the SETS system. This is to check that the SETS system powered on, check that the self-diagnosis has been conducted.

a) Set the rotary switches MON1 and MON0 on the P1 card to 7 and B, respectively.

b) Check that each self-diagnosis history on the 7-segment indicators on the P1 card is not *FF*. When the indicators 7SEG4 and 7SEG3 show *b* and *5*, respectively, check that the self-diagnosis history is *bF*. (See Table 2-8.)

   *If the self-diagnosis history is not *FF* while the indicator 7SEG4 shows *A*, conduct inspection B and C and keep the power of SETS system on for a few days for the diagnosis.

   *If the indicator 7SEG4 shows *b* and the self-diagnosis history is not *FF*, except when the indicator 7SEG3 shows *5*, conduct inspection A and move the car from the bottom to the top floors and from the top to the bottom floors (one round trip).

   *If this problem persists after the above measures, the CPU card in the SETS needs to be replaced.

c) Flip down the toggle switch SW2 on the P1 card. (The display changes *cb--* (self-diagnosis history) to *cc--* (self-diagnosis result).)

d) Check that all self-diagnosis results on the 7-segment indicators on P1 card are *FF*. (See Table 2-8.)

   *If the result includes something other than *FF*, inspect the governor sheave, governor encoders, position detection switches, and hoistway cam. If there are no problems, it is necessary to replace SETS cards.

e) If there are no errors in the history and result, flip and hold the toggle switch SW1 down and the toggle switch SW2 up at the same time for several seconds.

f) Restore the rotary switches on P1 card to the original values.

12

Table 2-8 Self-diagnosis status display

Item displayed on indicator	Timing of display	Display on 7-segment LED on P1 card	Remarks
Self-diagnosis history	b)	7SEG4, 3, 2, 1: *cb-* → *cP1_* → *A,1,*(a value), (a value) → *A,2,* (a value), (a value)… *A,8,* (a value), (a value) → *b,1,* (a value), (a value) → *b,2,* (a value), (a value)… *b,8,* (a value), (a value) 7SEG4, 3, 2, 1: *cb-* → *cP2_* → *A,1,* (a value), (a value) → *A,2,* (a value), (a value)… *A,8,* (a value),(a value) → *b,1,* (a value), (a value) → *b,2,* (a value), (a value)… *b,8,* (a value), (a value)	Check that the indicators [(a value), (a value)] show *FF*. (Except when showing the history and b5)
Self-diagnosis result	d)	7SEG4, 3, 2, 1: *cc-* → *cP1_* → *A,1,*(a value), (a value) → *A,2,* (a value), (a value)… *A,8,* (a value), (a value) → *b,1,* (a value), (a value) → *b,2, (*a value), (a value)… *b,8,* (a value), (a value) 7SEG4, 3, 2, 1: *cc-* → *cP2_* → *A,1,* (a value), (a value) → *A,2,* (a value), (a value)… *A,8,* (a value),(a value) → *b,1,* (a value), (a value) → *b,2,* (a value), (a value)… *b,8,* (a value), (a value)	Check that the indicators [(a value), (a value)] show *bF*. (When showing the history and b5)

2.2.4. Check of Sequence and braking performance inspection (Inspection B) and check of Initialization operation (Inspection C)

When the SETS system detects overspeed, it decelerates the car by using the emergency stop function. The check described in this section ensures that the emergency stop function surely decelerates the car to the allowable buffer striking speed while the car is traveling from the overspeed detection position to the top of the buffer. In this test, however, the car does not actually strike the buffer. This is a simulation in which the overspeed detection pattern is shifted to the middle of the hoistway to activate the emergency stop function there. Observe the procedure below, and check that the assumed speed of the car at the buffer position based on the shift amount of the overspeed detection point (hypothetical buffer striking speed) is within the allowable buffer striking speed range by looking at the indicators. Also, check that the initial operation starts properly and that the SETS system functions normally after the power has been restored.

a) Move the car to the bottom floor and unload the car to 0% load.

b) Move the car from the bottom floor to the top floor and from the top floor to the bottom floor (one round trip).

c) Set the rotary switches SET1 and SET0 on the P1 card to D and 1, respectively. By flipping down toggle switch SW1, "Braking performance inspection mode" is set.

d) Check that the display on the 7-segment 3 indicator on P1 card has changed from $L \to U \to b$ (not in inspection mode) to $L \to U \to A$ (in inspection mode). (See Table 2-9.)
  *It takes several seconds to change to the inspection mode. If the SETS system limits the car speed for an error other than the inspection execution abnormality specified in SETS setting label, the inspection mode cannot be set.

e) Flip the toggle switch SW2 up to run the car upward.

f) Check that the emergency stop function is activated and the car stops around the middle of the hoistway.

g) After the emergency stop, the result is displayed on the 7-segment indicator on P1 card. (See Table 2-9.)

h) Check that the start speed of the emergency stop (S→the speed value) is within -5% to +10% of the maximum speed. (See Table 2-9.)

i) Check that the hypothetical buffer striking speed (B→the speed value) does not exceed the allowable buffer striking speed (written in the MAX. STRIKING SPEED column in the buffer nameplate). (See Table 2-9.)
  *If not, check that there are no problems with the governor sheave, governor encoders, position detection switches, hoistway cam, and traction machine brake, etc.

j) Shut off the power and then turn it on again to restore the elevator. Check that SETS system functions properly.
  *Inspections B and C are completed in this procedure.

14

Table 2-9 Braking performance inspection mode display

Item displayed on indicator	Timing of display	Display on 7-segment LED on P1 card
Braking performance inspection mode	d)	(Not in inspection mode) 7SEG3: $L \rightarrow U \rightarrow b$ (In inspection mode) 7SEG3: $L \rightarrow U \rightarrow A$
	g, h, i)	7SEG3, 2, 1: ET- $\rightarrow$ S-- $\rightarrow$ A value (the start speed of the emergency stop [m/min])* $\rightarrow$ P-- $\rightarrow$ A value with lighting dots $\rightarrow$ A value $\rightarrow$ E-- $\rightarrow$ A value $\rightarrow$ d-- $\rightarrow$ A value with lighting dots $\rightarrow$ A value $\rightarrow$ b-- $\rightarrow$ A value (hypothetical buffer striking speed [m/min])* *Be careful of the unit for [m/min].

2.2.5. Check of the number of days before next inspections

Regarding inspection A, B, C, and D, the number of days left before the next inspection can be checked.

a) Set the rotary switches MON1 and MON0 on the P1 card to 7 and 6, respectively.

b) The information on each inspection is displayed. Check the display. (See Table 2-10.)

c) Restore the rotary switches on P1 card to the original values.

*For approximately 20 seconds after SETS system has been powered on, correct data is not displayed.

Table 2-10 Display of the number of days before next inspection

Item displayed on indicator	Timing of display	Display on 7-segment LED on P1 card	Remarks

The number of days left before next inspection	b)	7SEG3, 2, 1:
		
		-X- → c - - → A value with lighting dots → A value → n - - → A value with lighting dots → A value → r - - → A value*1 → (Repeated)
		
		*1 The values show the number of days left before the next inspection.
			*X means the code of inspection (A/B/C/D).
			
			By the toggle switch SW2 on P1 card, the display data is changed to other inspection.
			
			⎡ Flipping up SW2:
			  A→B→C→D→A
			  Flipping down SW2:
			⎣ A→D→C→B→A

16

3. Troubleshooting

3.1. How to check error code of CPU card of SETS

a) Set the rotary switches SET1 and SET0 on the P1 card in the control panel to D and D(C), respectively. Flip the toggle switch SW1 down to change the mode to "SETS 7-segment LED display mode".

   *The indicators show the information on SETS CPU1 when the rotary switch SET0 is set to D or the information on SETS CPU2 when the rotary switch SET0 is set to C.

b) Flip the toggle switch SW2 down repeatedly to change the display of the indicator 7SEG2 from 0 to 6. Check the error code of SETS displayed on the indicator 7SEG1.

*Inspection of the governor sheave, governor encoders, position detection switches, and hoistway cam or replacement of the SETS card in elevator control panel is required depending on the error.

Table 3-1 SETS 7-segment LED display mode

Item displayed on indicator	Timing of display	Display on 7-segment LED on P1 card
SETS 7-segment LED display mode (CPU1)	b) and SET 0 is D	S/W error code signal (When 7SEG2 is 6, it corresponds to MON:6 of SETS PCB.) 7SEG1 means that two-digit codes of all detected errors are displayed one by one. For example, if two errors with the code XY and YZ are detected, they will be displayed as below. $E \rightarrow X \rightarrow Y \rightarrow E \rightarrow Y \rightarrow Z \rightarrow H \rightarrow X \rightarrow Y \rightarrow H \rightarrow Y \rightarrow Z \rightarrow E \rightarrow$ (repeated) *E represents an error code being detected at present, and H represents an error code detected in the past. If no error is detected, the indicator displays as below. $E \rightarrow 0 \rightarrow 0 \rightarrow H \rightarrow 0 \rightarrow 0 \rightarrow E \rightarrow$ (repeated)
SETS 7-segment LED display mode (CPU2)	b) and SET 0 is C	Same as above

17

4. SETS connection diagram

SETS system is connected to other devices as follows.

Legend :
1) Connector name-pin no.
   ≪
   Signal
2) Terminal block no.
   ○
   Signal
3) ⌐·⌐ : Card
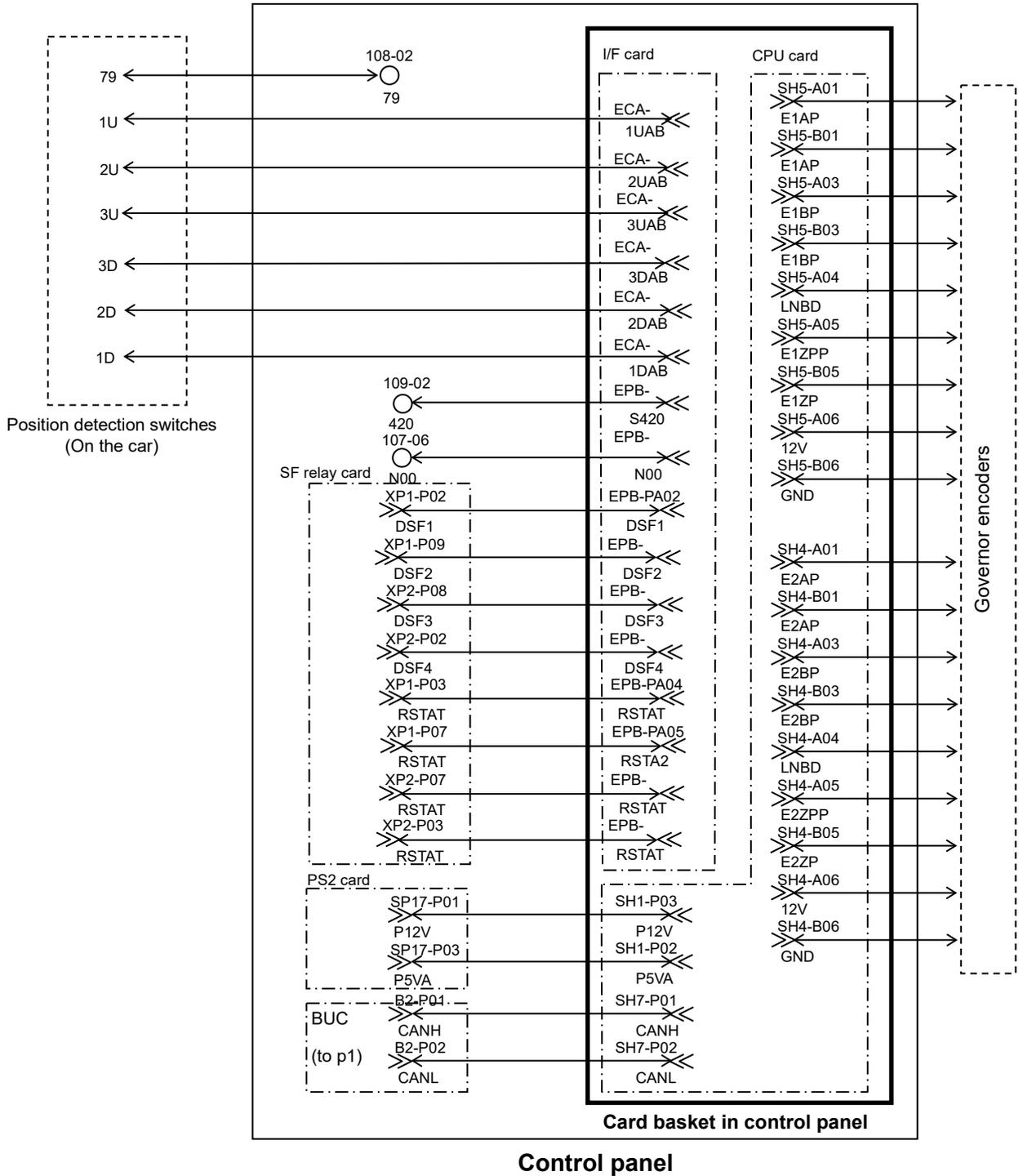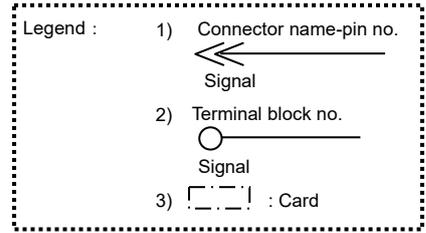
Fig. 4 SETS component connection diagram