

HITACHI INVERTER

SJ300/L300P SERIES

SJ-DG (DIGITAL INPUT OPTION)

INSTRUCTION MANUAL

Thank you for purchase of "HITACHI INVERTER". This manual explains about treatment of "SJ-DG (digital input option)". By reading this manual and an instruction manual of inverter use practically for installation, maintenance, and inspection. After reading this manual, keep it handy for future reference

Make sure to reach this manual to the end user.

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After reading this manual, keep it handy for future reference

NB617X

HITACHI

Request

Thank you for purchase of "HITACHI INVERTER". This manual explains about handling of "SJ-DG (digital input option)".

This instruction manual explains about treatment and maintenance of "SJ-DG". Before using the product, carefully read this manual with the instruction manual of inverter, and keeps it handy for quick reference of operator and maintenance inspector. Before installing, operating, maintenance and inspection read this manual carefully and follow the instructions exactly.

Always keep various kinds of specification mentioned in this manual and use exactly. And make sure to prevent trouble by correct inspection and maintenance. Make sure to reach this manual to the end user.

About treatment of this manual

Please consent that mentioned items of this manual may be change without permission.

Keep this manual carefully not to lose because it cannot be reissued.

All right reserved.

Contents in this manual is written to make assurance doubly sure but, but please contact if you have some doubts about spelling mistakes, omitted word etc.

Please agree that there is no responsibility for effects resulted, in spite of contents above mentioned.

Revision History Table

No.	Revision contents	The date of issue	Manual No
1.	Initial release	1999/12	NB617X

Except this table, revised only spelling mistakes omitted words, and error writings without notice.

SAFETY PRECAUTIONS

Carefully read this manual and all of the warning labels attached to the inverter before installing, operating, maintaining, or inspecting it. Safety precautions are classified into “Warning” and “Caution” in this manual.



: Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.



: Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage to the product.

The situation described in **WARNING** may, if not avoided, lead to serious results. Important safety measures are described in **CAUTION** (as well as **WARNING**) so be sure observe them.

Notes are described in this manual in “Note”, **Precaution**. Carefully read the contents and follow them exactly.

CAUTION

In all the illustrations in this manual, covers and safety devices are occasionally removed to describe the details. When the product is operated, make sure that the covers and safety devices are placed as they were specified originally and operate it according to the instruction manual.

SAFETY PRECAUTIONS

WARNING

Wiring:

- Wiring work shall be carried out by electrical experts
Otherwise, there is a danger of electric shock, fire and/or damage of product.
- Implement wiring after checking that the power supply is off.
Otherwise, there is a danger of electric shock and/or fire.

Operating:

- Be sure not to touch the surface or the terminal of option board while energizing.
Otherwise, there is a danger of electric shock and/or fire.
- Be sure not to remove the digital input option printed board while operating.
Otherwise, there is a danger of electric shock and/or fire.

Maintenance, Inspection and Part Replacement:

- Wait at least 10 minutes after turning off the input power supply before performing maintenance and inspection.
(Confirm the charge lamp on the inverter is off, checks direct current voltage between P-N terminals and confirm it is less than 45V.)
Otherwise, there is a danger of electric shock.
- Make sure that only qualified persons will perform maintenance, inspection, and part replacement
(Before starting the work, remove metallic objects from your person (wristwatch, bracelet, etc.).
Be sure to use tools protected with insulation)
Otherwise, there is a danger of electric shock, and/or injury.

Note:

- Never modify the unit.
Otherwise, there is a danger of electric shock and/or injury.

CAUTION

Installation:

- Be sure not to let the foreign matter enter such as wire clippings, spatter from welding, metal shaving, dust, etc.
Otherwise, there is a danger of fire.
- Be sure to fix inverter to option printed board with an attached fixed screw.
Otherwise, there is a danger of connecting error.
- Be sure to fasten the screws connecting signal wire in side of option printed board. Check for any loosening of screw.
Otherwise, there is a danger of connecting error.

Wiring:

- Be sure to fasten the screws not to loose.
Otherwise, there is a danger of connecting error.

Operation:

- Check rotary direction, abnormal motor noise and vibrations during operating.
Otherwise, there is a danger of injury to personnel and/or machine breakage.

1.1 INSPECTION UPON UNPACKING

Make sure to treat the product carefully not to give shock and vibration while unpacking. Check that the product is the one you ordered, and that there is no damage during transportation.

(Contents of packing)

- (1) SJ-DG(digital input option printed board) : 1
- (2) Instruction manual : 1
- (3) Screws fixed printed board(M3 times 8mm) : 2

If you discover any problems, contact your sales agent immediately.

1.2 INQUIRY OF THE PRODUCT AND WARRANTY FOR THE PRODUCT

1.2.1 REQUIRE WHILE INQUIRING

If inquiry of breakage, question, damage etc. is needed, please tell the following information to the supplier you ordered or the nearest Hitachi Distributor.

- (1) Type
- (2) Manufacturing number (MFG,NO)
- (3) Day of purchasing
- (4) Contents of inquiry
 - Damage part and its condition
 - Question parts and their contents etc.

In order to shorten impossible working time, standing spare unit is recommended.

1.2.2 WARRANTY OF THE PRODUCT

This product is guaranteed to last for one year after purchase. But, the next case is toll repair, even if within warranty period.

- (1) In case caused by operating mistake, and incorrect repair and modification
- (2) Trouble caused by reasons except the shipped product.
- (3) In case of using in range over the value of specification.
- (4) In case caused by natural calamity, disaster, and secondary disaster,

Warranty mentioned here means warranty for shipped product itself. Damage caused by trouble of shipped product is not guaranteed. Guarantee is valid only in Japan.

(Effective only Japan)

Toll repair

Any explanation and repair after the warranty period (one-year) shall be charged to the purchaser. And also any explanation and repair out of warranty mentioned above, even within warranty period, shall be charged to the purchaser. If you require the toll repair, please contact your Hitachi Distributor.

1.3 OUTLINE OF THE PRODUCT

If this option printed board is installed to SJ300/L300P series, it is possible to input setting frequency, acceleration time setting, deceleration time setting, torque limit setting, and position setting in digital.

2.1 INSTALLATION METHOD OF PRINTED BOARD

As the following Figure 2-1, exactly connect option board 1 or 2 to the holes of the four corners and the connector part of the back. Be sure to fit them to the guide post for positioning of option printed board and screw holes for fixing. After connecting, fastened the two points of printed board with the fixed screws attached.

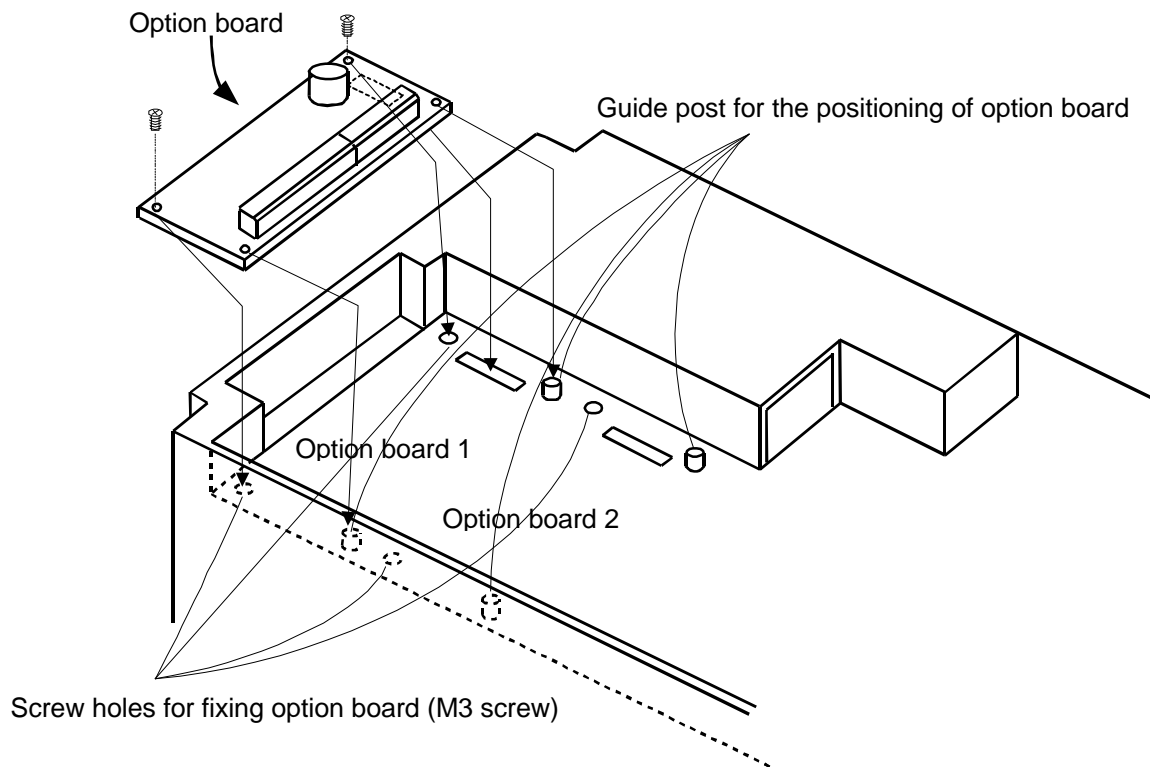


Figure 2-1 Installation of option printed board

3.1 TERMINAL ASSIGNMENT OF DIGITAL INPUT OPTION BOARD

Figure 3-1a shows terminal assignment, Figure 3-1b shows terminal standard connection.

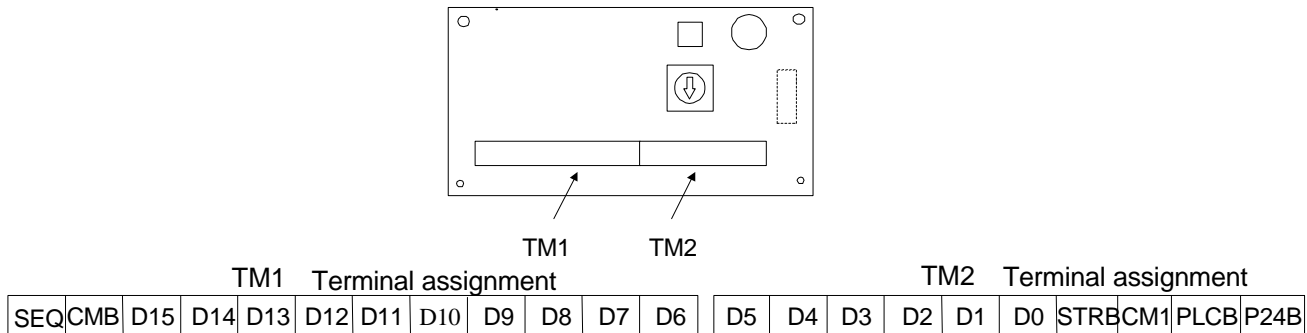


Figure 3-1a Terminal assignment

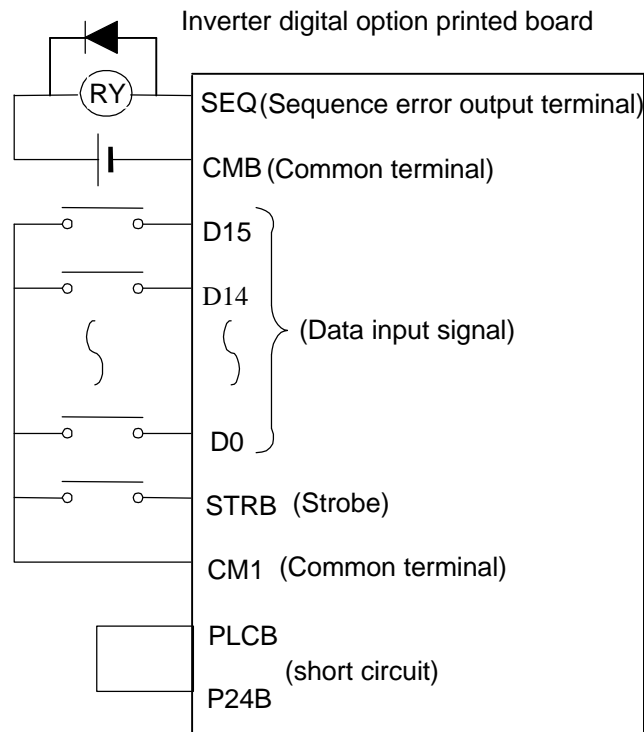


Figure 3-1b Terminal standard connection

In case of sink type interface, power is supplied to input terminal (D0 to D15, STRB) by short circuit between P24B terminal and PLCB terminal.

CHAPTER 3 WIRING, CONNECTION

3.2 CONNECTION TO PROGRAMABLE CONTROLLER

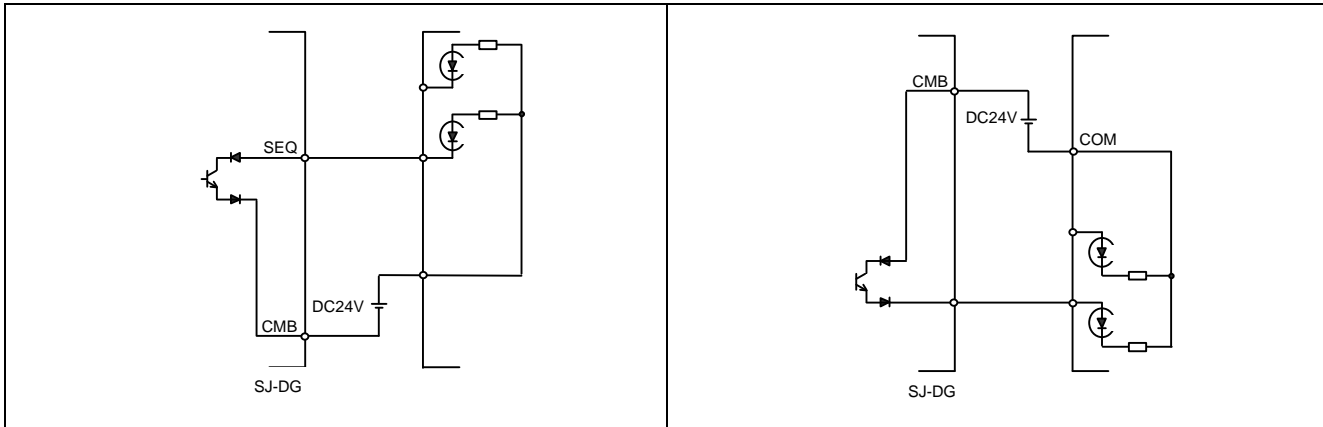
In case of operating this unit connecting to programmable controller, there are 4 patterns of input terminals (Table 3-2a), 2 patterns of output terminals (Table 3-2b). Please connect fitted to the type of programmable controller used.

Table 3-2a Connection of Input terminal (Dn, STRB, CM1) to Programmable controller

Sink logic	Source logic
In case of using internal interface power source	In case of using internal interface power source
In case of using external power source	In case of using external power source

Table 3-2b Connection of output terminal (SEQ CMB) to programmable controller

Sink logic	Source logic
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3.3 SPECIFICATION OF TERMINAL

Table 3-3 shows specification of terminal.

Table 3-3 Specification of terminal

	Terminal symbol	Terminal name	Specification	Electric characteristics
Input	D15 to D0 (Hereinafter called as Dn)	Data input terminal	Photo coupler input (1a contact signal) Sink source type	Input impedance : 4.7k Ω Allowable
	STRB	Strobe terminal (Data take in command signal terminal)		
Output	SEQ	Sequence error signal (Data input error signal output terminal)	Sink source type	Between SEQ and CMB Voltage drop at on : less than 4V Allowable max. voltage : DC27V Allowable max. current : 50mA
	CMB	Common terminal for sequence error signal output	Common terminal for sequence error signal output <small>Note)</small>	
Power source	P24B	Power source terminal for interface	DC24V power source for contact input signal In case of selecting source logic, contact input common.	Allowable max. current : 90mA
	CM1	Power source terminal for interface Common terminal	Common terminal for data input terminal, power source for interface and strobe terminal <small>Note)</small>	

Note) Never connect to earth of ground.

3.4 APPLICABLE WIRING

Make sure to use applicable wiring as the following items.
 wire that is shield less than 0.5mm².

Connect the wire which peeling length of sheathed signal wire is 5 –

In case of connecting twist wire, make sure not to loose

Use signal wire which max, outside diameter is less than 2.0mm²

CHAPTER 4 SETTING

4.1 POSITION OF SETTING SWITCH

Figure 4-1 shows position of setting switch. PAC, DIV, BIN, BCD which printed around the dip switch (TYPE) means one time input, 2 dividing input, binary input, BCD input.

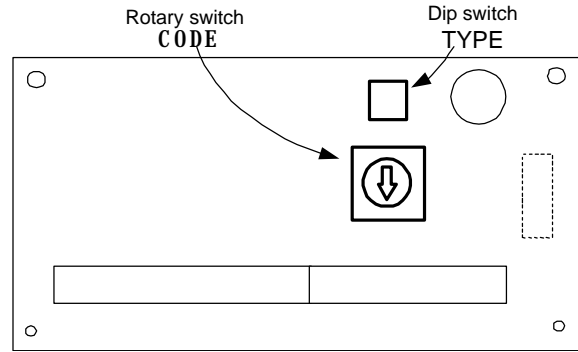


Figure 4-1 Position of switch

4.2 INITIAL SETTING CONDITION OF PRINTED BOARD

Table 4-2 shows initial setting condition (Setting condition at shipment).

Table 4-2 Initial setting condition

Setting item	Switch No.	Initial setting condition
	2	PAC (OFF)
	1	BIN (OFF)
Rotary switch CODE	0 to	0

4.3 SETTING OF INVERTER

Table 4-3 shows setting items of the inverter (SJ300, L300 series) related to operating SJ-DG.

Make sure to refer to "CHAPTER 3 OPERATION", "CHAPTER 4 EXPLANATION OF FUNCTION" of the instruction manual of the inverter, and set exactly.

Table 4-3 Table of setting items of inverter related to SJ-DG

Code	Function name	Data range	Initial data	Possible setting at operating	Possible mode of change at operating	Note
A001	Setting frequency destination	00(VR)/01(terminal)/02(operator)/03(RS485)/04(option1)/05(option2)	02 (SJ300) 00 (L300P)	X	X	-
P031	One selection of acceleration and deceleration time	00(remote)/01(option1)/02(option2)	00	X	O	-
B040	Selection of torque limit	00(4quadrant individual setting)/01(terminal switch)/02(analog input)/03(option1)/04(option 2)	00	X	O	Only SJ300
P032	Selection of position command	00(remote)/01(option1)/02(option2)	00	X	O	Only SJ300

- (1) In case of setting frequency, make sure to set frequency command destination (A001) to option.
- (2) In case of setting acceleration and deceleration time, make sure to set acceleration and deceleration time 1 selection (P031) to option.
- (3) In case of setting torque limit, make sure to set torque limit selection (B040) to option.
- (4) In case of setting position, make sure to set selection of position command (P032) to option.

4.4 INPUT MODE BY DIP SWITCH AND ROTARY SWITCH

It is possible to select input mode by combination of dip switch and rotary switch on the option printed board. Table 4-4 shows table of input mode.

Table 4-4 Table of input mode

Dip switch		Rotary switch	Setting frequency				Acceleration and deceleration time setting			Torque limit setting	Position setting	
TYPE		CODE	Setting resolution									
Switch No.		Setting code	0.01Hz	0.1Hz	1Hz	Rate	0.01sec	0.1sec	1sec	1%	1pulse	
1	2											
BIN (Binary input at OFF) / BCD (BCD input at ON)	PAC (One time input mode at OFF)	0	O									
		1		O								
		2			O							
		3				O						
		4									O	
		5										
	DIV (Dividing input mode at ON)	0						O				
		1	O						O			
		2								O		
		3					O					
		4			O				O			
		5								O		
		6						O				
		7				O			O			
8								O				
9						O						
A					O			O				
B								O				

Precaution O shows input mode set by switch setting. Make sure not to set switch setting except O because they are for adjustments of factory.

(Viewpoint of table of input mode)

Example 1) In one time input mode, switch setting which sets setting frequency by 1Hz resolution and binary input.

TYPE		CODE
1	2	2
BIN	PAC	

Example 2) In two dividing input, switch setting which sets setting frequency with 0.1Hz resolution and BCD input, and in case of setting acceleration and deceleration time by BCD input, 0.1sec.resolution.

TYPE		CODE
1	2	2
BCD	DIV	

4.5 PRECAUTIONS AT SETTING OF SWITCH

- (1) In case of setting rotary switch code to (5, 7 to F) in one time input mode, sequence error outputs just after power on of inverter.
- (2) In case of setting rotary switch code to (B to F) in 2 dividing input mode, sequence error outputs just after power on of inverter.
- (3) In case of (1) or (2), turn off power of inverter and set exactly.

5.1 FUNCTION

5.1.1 ONE TIME BINARY INPUT

It is possible to select frequency setting, torque limit setting or position setting of one time data input by rotary switch CODE.

Figure 5.1.1 shows data bit construction of one time binary input.

(Example of setting) In case of setting frequency to 60.0Hz by 0.1Hz resolution

Setting of dip switch TYPE

1	2
BIN	PAC

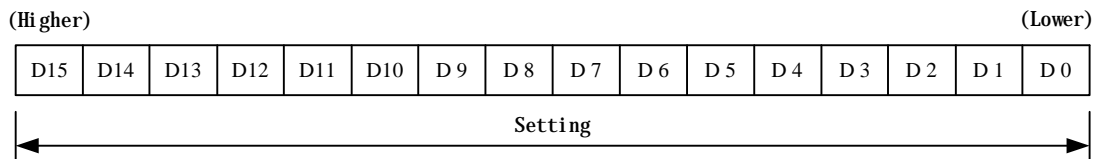
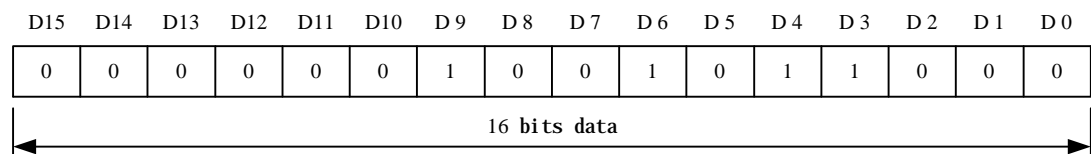


Figure 5.1.1 Data bit construction of one time binary input

(Setting of rotary switch CODE --- 1).

- (1) Input value which 60 multiplies 10 to D15 - D0 terminal by 16 bits binary value.



- (1) $60 \times 10 = 600$ ---- 0000001001011000 (Binary)
- (2) When data input is definite, turn the strobe signal on.
- (3) Turn the strobe signal off.

Precaution Refer to 5.3 "DATA INPUT TIMING" for signal input timing.

5.1.2 ONE TIME BCD INPUT

It is possible to select frequency setting, torque limit setting or position setting of one time data input by rotary switch CODE.

Figure 5.1.2 shows data bit construction of one time BCD input.

(Example of setting) In case of setting frequency to 30.0Hz resolution by 0.01Hz

Setting of dip switch TYPE

1	2
BCD	PAC

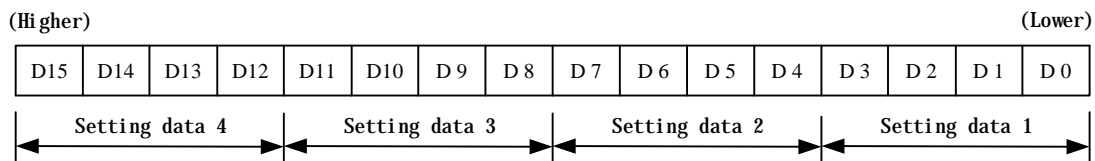
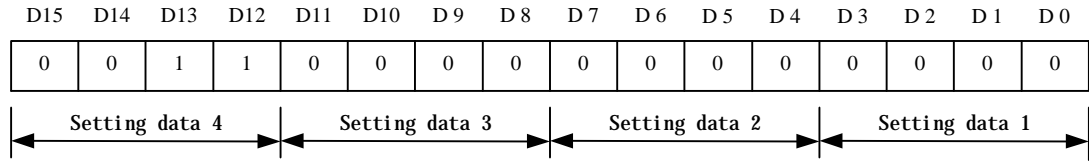


Figure 5.1.2 Data bit construction of one time BCD input

- (2) When data input is definite, turn the strobe signal on.
- (3) Turn the strobe signal off.

CHAPTER 5 FUNCTION



Precaution Refer to 5.3 "DATA INPUT TIMING" for signal input timing.

5.1.3 TWO DIVIDING BINARY INPUT

It is possible to change setting data by twice input of data, higher data and lower data. And it is possible to select frequency setting, torque limit setting, acceleration and deceleration time setting or position setting by change of classification code (Refer to Figure 5.2 Table of classification code.). Setting resolution can be selected by rotary switch CODE.

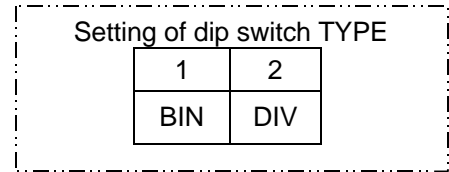


Figure 5.1.3 shows data bit construction of the input binary data divided into two.

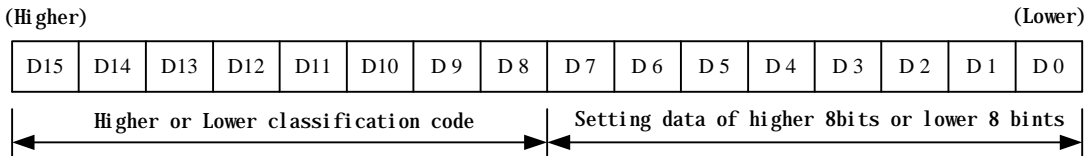


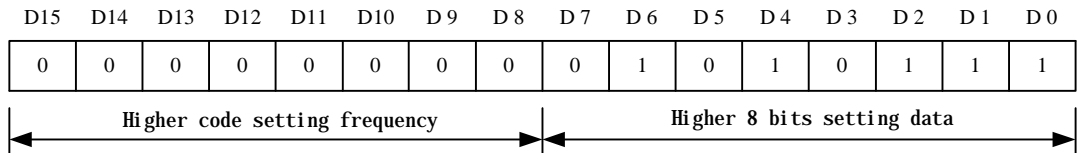
Figure 5.1.3 Data bit construction of the input binary data divided into two

(Example of setting) In case of setting frequency to resolution 0.01Hz

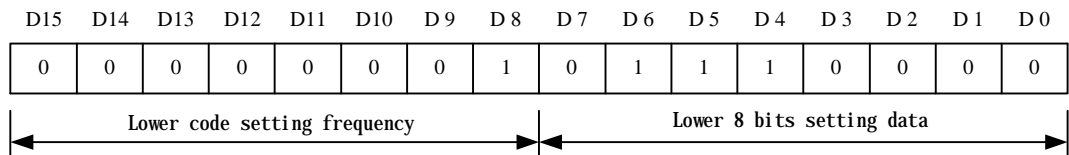
(Setting of rotary switch CODE --- 0, 1, 2

- (1) Converse value which 60 multiply 100 to 16 bits binary value. And then input higher 8 bits to D7 to D0 terminal, higher code of setting frequency to D15 to D8 terminal.

$$60 \times 100 = 6000 \quad 0001011101110000 \text{ (Binary)}$$



- (2) When data input is definite, turn strobe signal on.
- (3) Turn strobe signal off.
- (4) Input remaining data, lower 8 bits to D7 to D0 terminal, and D15 to D8 terminal to lower code of setting



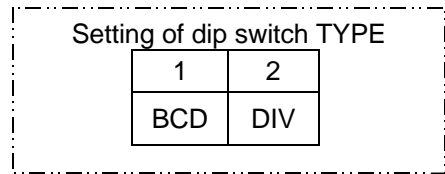
frequency.

- (5) When data input is definite, turn strobe signal on.
- (6) Turn strobe signal off.

Precaution Refer to 5.3 "DATA INPUT TIMING" for signal input timing.

5.1.4 TWO DIVIDING BCD INPUT

It is possible to change setting data by twice input of data, higher data and lower data. And it is possible to select frequency setting, torque limit setting, acceleration and deceleration time setting, or position setting by change of classification code (Refer to Figure 5.2 Table of classification code.). Setting resolution can be selected by rotary switch CODE.



(Example of setting) In case of setting acceleration time to 60.0sec by 0.1sec resolution

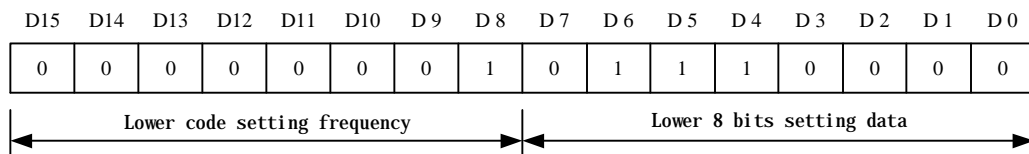
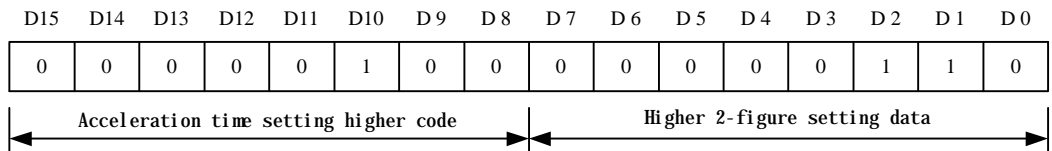


Figure 5.1.4 Data bit construction of the input BCD data divided into two

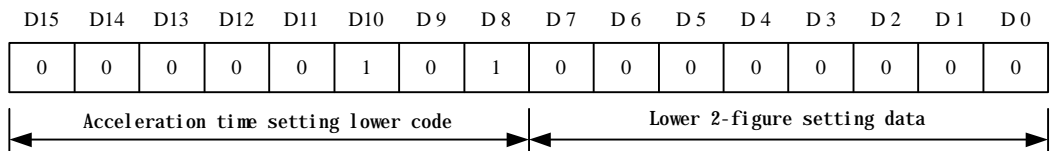
(Setting of rotary switch CODE ---- 1, 4, 7, A)

- (1) Converse value which 60 multiply 10 to binary value of BCD. And then input higher 2-figure data to D7 to D0 terminal, acceleration time setting higher code to D15 to D8 terminal.

$60 \times 10 = 600$ 0000011000000000 (Binary)



- (2) When data input is definite, turn the strobe signal on.
- (3) Turn the strobe signal off.
- (4) Input remaining data, lower 8 bits to D7 to D0 terminal, and D15 to D8 terminal to lower code of setting frequency.



- (5) When data input is definite, turn the strobe signal on.
- (6) Turn strobe signal off.

Precaution Refer to 5.3 "DATA INPUT TIMING" for signal input timing.

5.2 CLASSIFICATION CODE

Table 5.2 shows table of classification code. Make sure to input classification code in order, higher code and then lower code.

Table 5.2 Table of classification code

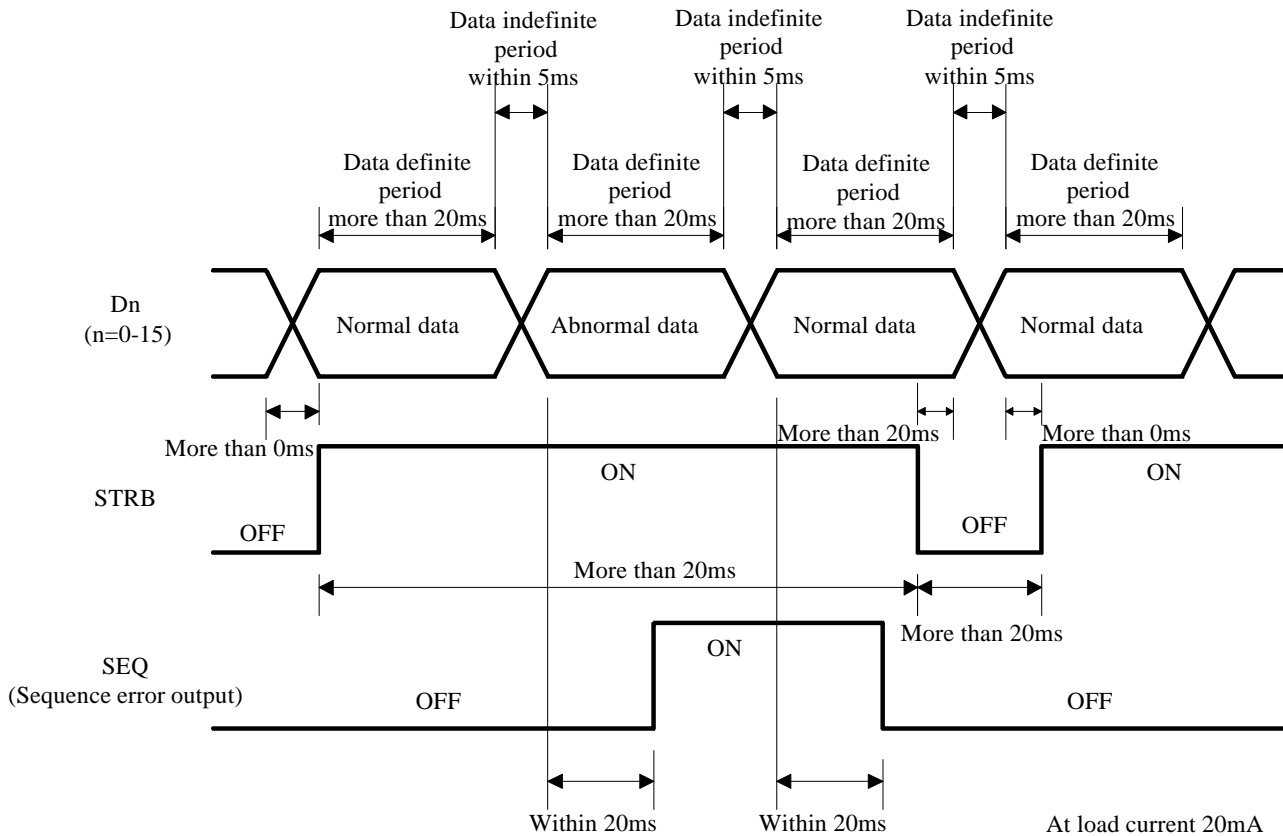
Setting item	Classification code (D15 - D8)	
	Binary	Hexadecimal
Setting frequency (Higher)	00000000	0
Setting frequency (Lower)	00000001	1
Torque limit setting (Higher)	00000010	2
Torque limit setting (Lower)	00000011	3
Acceleration time setting (Higher)	00000100	4
Acceleration time setting (Lower)	00000101	5
Deceleration time setting(Higher)	00000110	6
Deceleration time setting(Lower)	00000111	7
Position setting (Higher)	00001000	8
Position setting (Lower)	00001001	9

5.3 DATA INPUT TIMING

5.3.1 TIMING AT ONE TIME INPUT

MO
DE

Take in data in on level that strobe signal. Let on/off time of strobe signal be more than 20ms. Be in state of on. And if data indefinite area is more than 5ms, turn strobe signal off in order to satisfy Figure 5.3.1 timing chart of one time data input.



Precaution If Figure 5.3.1 timing chart is not satisfied, be careful because of possibility of taking in error data.

5.3.2 TIMING AT TWO DIVIDING DATA INPUT

Take in data in on-edge of strobe signal. Let on/off time of strobe signal be more than 20ms. And let off time of strobe signal be more than 20ms,

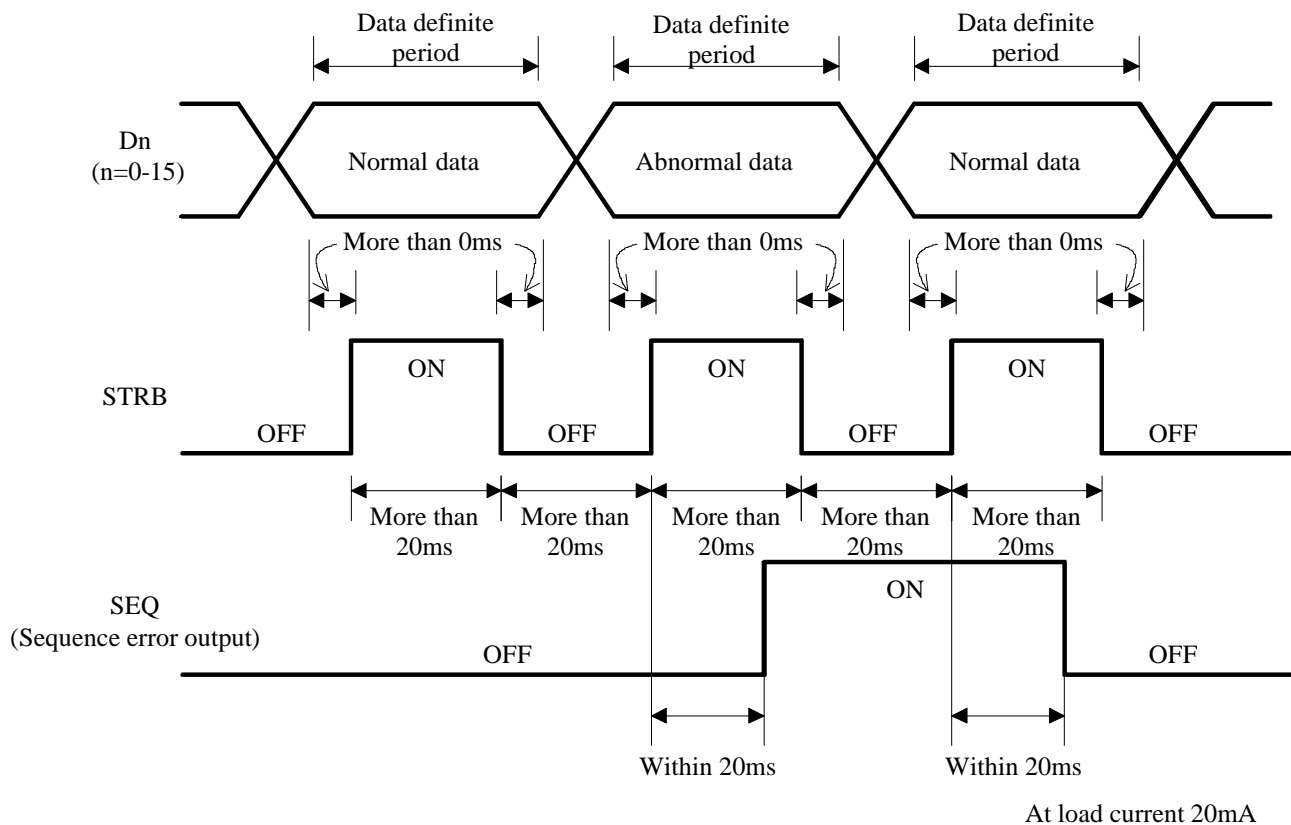


Figure 5.3.2 Timing chart of two dividing data input

Precaution If Figure 5.3.2 timing chart is not satisfied, be careful because of possibility of taking in error data.

5.4 NOTICE AT DATA INPUT

While inputting the data by terminal of SJ-DG, notice the following items.

- (1) Each input is possible to set within data range of the inverter in every setting item. If inputting without data range, sequence error is outputted and data input is invalid (previous data is kept).
- (2) If classification code is inputted in dividing input mode, make sure to input classification code in order, higher code, and then lower code. If lower code is inputted at first, sequence error is outputted and data input is invalid (previous data is kept)
- (3) Re-input of correct data, or reset of inverter, or power off carries out cancellation of sequence error. And, if two times input are correct in dividing input mode, they are cancelled just after second input.
- (4) If a code without codes in table of classification is inputted, sequence error is outputted.
- (5) In case of trip of inverter, data input is invalid. Make sure to reset inverter and re-input.
- (6) When each command destination of inverter is not set to option board put on, do not input data.
- (7) If setting frequency is input in "rate", do the following process below.

(Example) If 75% of max frequency is set, input I_{in} is

$$I_{in} = 0.75 \times M \quad 0.75 \quad \text{rate}$$

M input data full scale

Switch type 1	Input data full scale value(M)
BIN	65535

BCD	9999
-----	------

However, f Hz set actually is calculated in

$$f = \frac{I_{in}}{M} F_{\max} \quad F_{\max} \text{ max frequency Hz}$$

and, value which is ignored less than is setting frequency.