

User' s Manual

DC MOTOR SPEED CONTROLLER

3 PHASE 2 QUADRANT

type : HN 3200 SERIES
(Ver:3.0)



HANA CONTROL ENGINEERING CO.,LTD.
HANA POWER ELECTRONICS CO.,LTD.

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1. General Specification

This DC motor speed controller HN3200 has power input voltage of AC 220 / 380 / 440 [V] and uses and frequencies of 50 and 60 [HZ]. This controller is widely used for controlling variable constant speed, constant torque, and constant output of DC motors within the range of motor capacity 7.5 ~ 250 [KW].

The characteristics of HN 3200 DRIVE UNIT are as follows.

1) It is a thyristor speed controller for three phase full wave separately excited DC motor, and it operates on the second quadrant of the speed, torque characteristic diagram.

The unit is made of one body type with the field control built in.

2) Soft start and stop and highly sensitive response characteristics are ensured by adopting soft start (accel) / soft stop (decal) and direct operation method.

3) Sufficient control current is secured to loads by adopting PID feedback of speed current loop and EMF voltage feedback for the speed control of DC motor.

4) This device displays operation condition setting value and actual operation status value in digital.

1. +VCC / +15[V]
2. -VCC / -15 [V]
3. Speed command setting value[V]
4. Motor speed[RPM]
5. Motor load current[A]
6. Motor armature voltage[V]
7. Motor field current [A]
8. DRIVE I_{max} setting value[A]
9. DRIVE I Limit setting value[A]

5) Sufficient consideration is given to the detection of abnormality and protection of this device and DC motor.

1. Detection of abnormality of motor and drive
2. Detection of motor rotation
3. Detection of load current limit
4. Detection of field circuit breaking of wire and over current
5. Detection of drive 250% instant over current
6. Detection of abnormality in drive control voltage
7. Detection of drive heat sink over heating
8. Detection of motor overheating
9. Detection of deficit voltage and phase loss
10. Detection of damage and cut of wire in motor tacho generator (T.G)

6) This device has applied input/output terminal that allows compatible configuration with winding control unit (winder), interlocking control unit, current control unit, tension control unit, proportional control unit, and other peripheral control unit that are produced by our company.

7) This device has reliability because it has high resistance to noise from external power shock. Also the digital signal control input terminals (ENB, RUN, RESET, JOG) are made of isolation structure to facilitate the configuration of system.

8) The structure of the device is easy for installation, check-out and repair.

2. Standard Specification of Device

2.1 Standard Specification of Device

[Table2-1]

No.	Recommended Capacity Pn [KW] and Current In [A] of the Device and Motor							
	DC 220 [V]				DC 380 [V]			
	Motor Capacity Pn[kw]	Motor Current In[A]	DRIVE rated current Idn[A]	Device Figure [Figure 4-1]	Motor Capacity Pn[kw]	Motor Current In[A]	DRIVE rated current Idn[A]	Device Figure [Figure 4-1]
1	7.5	40	48	ST32S	11	35	42	ST32S
2	11	60	76	ST32S	15	47	59	ST32S
3	15	81	110	ST32S	18.5	56	70	ST32S
4	18.5	97	116	ST32S	22	69	83	ST32S
5	22	120	153	ST32S/F	30	92	110	ST32S
6	30	160	192	ST32S/F	37	113	142	ST32S/F
7	37	195	236	ST32M/F	45	130	156	ST32S/F
8	45	230	276	ST32M/F	55	160	195	ST32S/F
9	55	285	350	ST32M/F	75	221	265	ST32M/F
10	75	383	460	ST32M/F	90	260	350	ST32M/F
11	90	450	540	ST32L/F	110	320	416	ST32M/F
12	110	550	710	ST32L/F	132	376	452	ST32M/F
13	132	650	833	ST32L/F	150	440	528	ST32L/F
14	150	760	912	ST32L/F	160	458	595	ST32L/F
15					185	530	665	ST32L/F
16					200	573	710	ST32L/F
17					220	636	795	ST32L/F
18					250	708	850	ST32L/F

☞ Motors with capacity over these are produced on order

[NOTE]

Where starting torque and overload ratings are high or abrupt acceleration and deceleration are frequent, the drive must have higher specification than in Table 2-1.

2.2 Standard Technical Specification

[Table2-2]

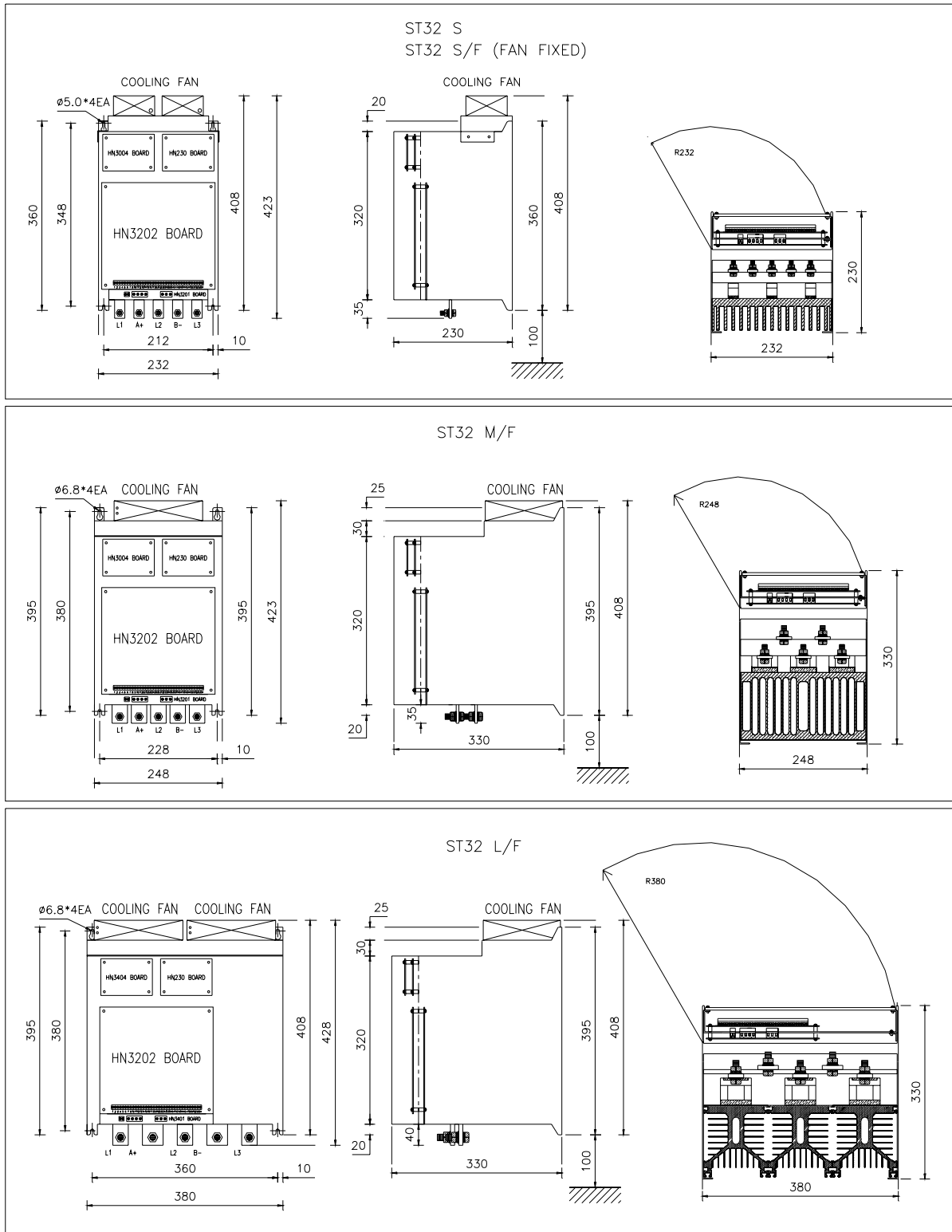
SPECIFIC DATA	Electrical Specification	
3 Phase power input voltage and frequency range	AC 220 [V] 10% AC 380 [V] 10% AC 440 [V] 5%,	50 / 60 HZ 2%
Armature voltage to be adjusted depending on power voltage	Armature voltage \leq power voltage X 0.9	
Maximum field current	16 [A]	
Limit of armature current	20 ~ 120 % of motor rated current, 0 – 60 [SEC]	
Range of speed change – Main voltage $\pm 10\%$ – Normal temperature (ambient temperature) 25°C $\pm 20^\circ\text{C}$	DC Analog T.G : $\pm 0.1\%$ rated speed,	
Speed feedback – DC tachogenerator (T.G)	DC Analog T.G (0 – 200 [V])	
Gradient of acceleration /deceleration	0.6 – 60 [SEC]	
External ENB	Input terminal for preparing drive operation (DC 24[V])	
External RUN	Input terminal for motor operation signal (DC 24[V])	
External JOG	JOG operation terminal (DC 24[V])	
External RESET	External input terminal for clearing fault (DC 24[V])	
Speed setting voltage and current	Voltage of 0–10[V],0–5[V] and 0–16[mA],0–20[mA],4–20[mA] current	
Controlling torque	Able to control within rated current using 0 ~ –10[V] I–AUX input	
Standard of 2 nd speed	Use 0~ ± 10 [V] N–AUX	
Output RELAY	– Ready Relay – Motor Turn Relay – I Limit Relay – Fault Relay	Contact point capacity AC 220 [V], 3[A]
Allowed temperature – Normal temperature – Preservation temperature	Change of current in response to ambient temperature 0°C ~ 40°C (Over 60°C, it allows temperature decrease by 1.2% in response to 1°C increase) – 25 °c ~ +75 °c	

3. Installation

- Install the device vertically so the air can circulate from the lower part to the upper part through heat sink hole.
- Separate the device from heat sources. If the device is installed in a cabinet, the cabinet must be made in a way allowing induction of exterior air and the protection cover must be open on top.
- 10 [cm] or more open space is needed on the top, bottom, right, and left of the drive.

4. Dimension of Device

[Figure 4-1]

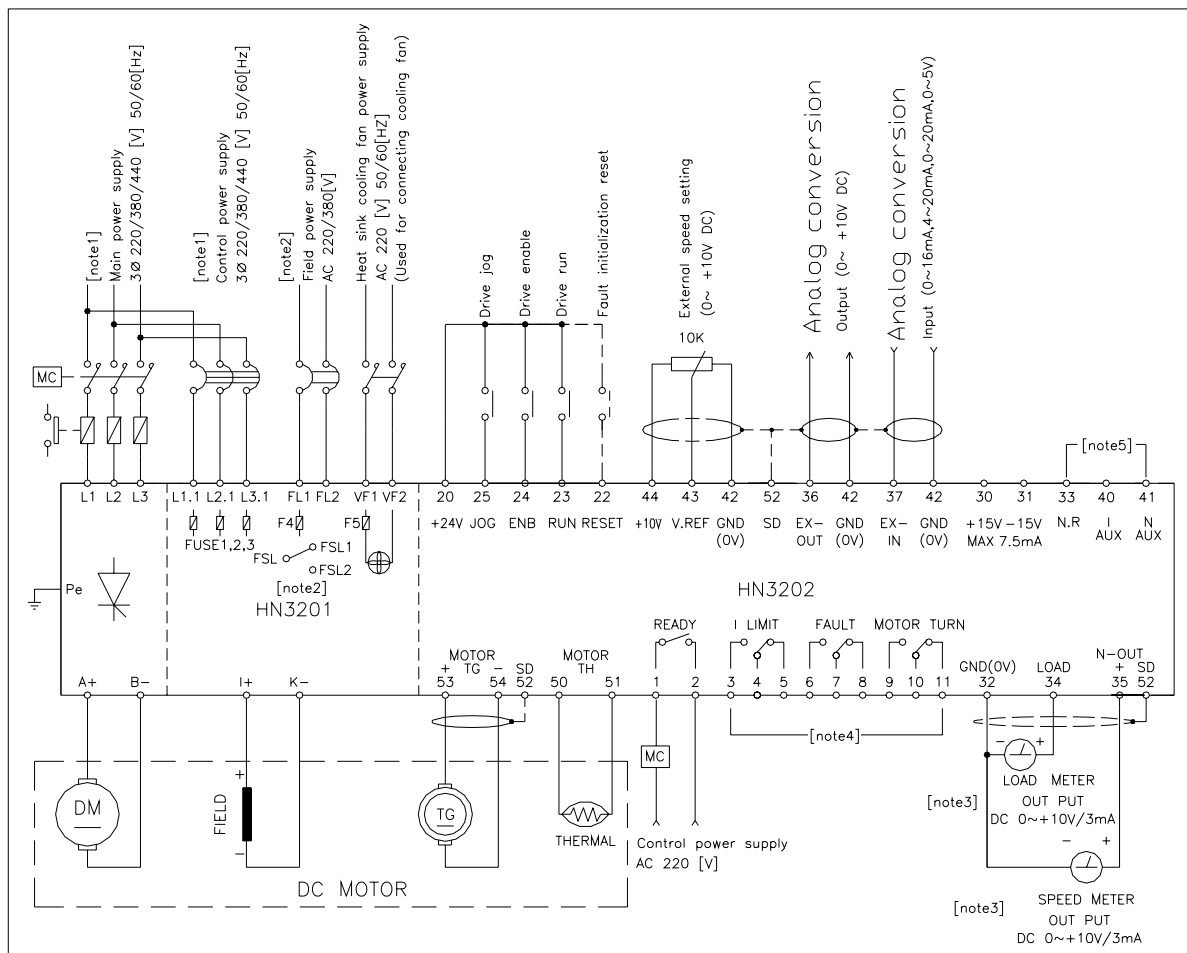


☞ Dimension can be changed to improve the product. .

5. Wiring Diagram of Device

5.1 Standard Wiring Diagram

[Figure 5-1]



[note1] Power that coincides with the rated voltage specified on drive panel must be supplied and the main power supply and control power supply must be composed of the same voltage, same phase.

[note 2] Field supply voltage must be the same as HN3201 board field voltage selection tab, even though it is used for both AC 220 and 380 [V]
(FSL1 : AC 220[V], FSL2 : AC 380 [V])

[note 3] Load current and speedometer output are for digital meters.

[note4] Use it for configuring an external electric circuit.

(contacts capacity AC 250[V] 3 [A])

[note 5] This is an input/output terminal applying analog signals. (see Table 5-2)

[NOTE]

Control signal wire must be shielded wire for covering and only one terminal must be treated with covering shield.

5.2 Explanation on the function of Terminal Panel

[Table5-2]

B U S - B A R			
Terminal Number	Terminal Name	Functions and Electrical Specifications	
L1 L2 L3	3 phase main power supply	AC voltage input terminal for 3 phase main power supply	
A+ B-	armature voltage	Motor armature DC voltage output terminal	
POWER BOARD [HN3201]			
terminal number	terminal name	Functions and Electrical Specification	
L1.1 L2.1 L3.1(TB1)	Power for control	Voltage input terminal for 3 phase control	
FL1 FL2 (TB2)	field power supply	Field supply AC input terminal	
I+ K- (TB2)	field voltage	Motor field DC voltage output terminal	
VF1 VF2 (TB3)	Heat sink	Heat sink cooling fan input terminal AC 220[V]	
CONTROL BOARD [HN3202]			
terminal number	terminal name	Functions and Electrical Specifications	
1 2	READY	DRIVE normal operation relay contact terminal (NO)	
3 4 5	I- LIMIT	Motor limit current detection relay contact terminal (NO,NC)	
6 7 8	FAULT	Abnormality detection relay contact terminal for motor and drive (NO,NC)	
9 10 11	M- TURN	Relay contact terminal for motor rotation detection (NO,NC)	
20	+24V	Power supply for control signal for +24[V]	
21	GND (0 V)	GND terminal	
22	RESET	External reset terminal for relieving FAULT	
23	RUN	Motor operation signal input terminal	
24	ENB	Drive operation preparation input terminal	
25	JOG	JOG operation terminal	
30	+15V	+15 [V] terminal (+VCC) 7.5 [mA]	
31	-15V	-15 [V] terminal (-VCC) 7.5 [mA]	
32	GND (0 V)	GND terminal	
33	N.R	Speed controller output terminal (0 ~ - 10[V])	
34	LOAD	Load current output terminal (0 ~ + 10[V], 3[mA])	
35	N-OUT	Rotational speed output terminal (0 ~ + 10[V], 3[mA])	
36	EX-IN	Analog conversion input terminal (0-16,0-20,4-20mA,0-5V)	
37	EX-OUT	Analog conversion output terminal (0~ +10[V])	
40	I-AUX	External auxiliary current control terminal (0 ~ - 10[V])	
41	N-AUX	External auxiliary speed control terminal (0 ~ ± 10[V])	
42	GND (0 V)	GND terminal	
43	V-REF	Main speed command voltage input terminal (0 ~ + 10[V])	
44	+10V	Main speed command + Standard voltage	
50 51	MOTOR TH	Motor overheating sensor input terminal	
52	SD	External signal wire shield terminal	
53(+) 54(0V)	MOTOR T.G	Speed feedback (T.G) input terminal	

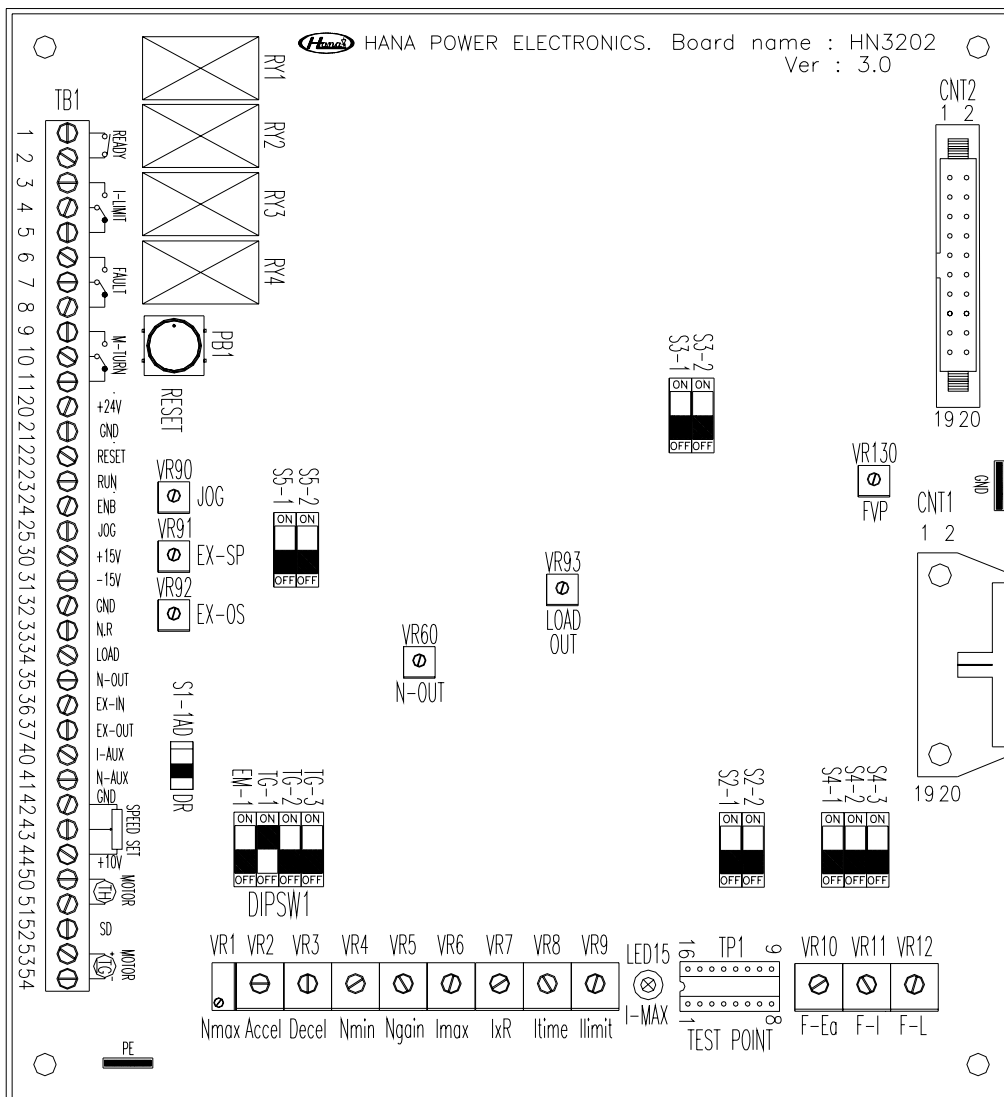
6. Explanation of Drive Configuration

6.1 Preliminary Inspection

- 1) This drive is a product that satisfies most general operation conditions.
Verify the compatibility among supplied power, drive, and motor by inspecting the specifications on the panel of device.
- 2) Confirm whether wiring is done as shown in the wiring diagram. Also, verify that the conditions of terminal connection and the linkage of connecting parts are good.
- 3) Confirm that the phases of main power supply and control power supply are the same (L1=L1.1, L2=L2.1, L3=L3.1).
- 4) Confirm that the field power supply voltage (FL1, FL2) coincide with the field selection voltage tab (FSL1, FSL2).

6.2 Reference Location Map of Selection Switch and trimmer

[Figure 5-1]



6.3 Functions of Selection Switch

[Caution] Select a selection switch when the main power and the control power are not on.

[Table6-3]

Switch	Switch Function	Explanation on Functions of Selector Switch				
		AD		DR		
S1 - 1	Selecting speed acceleration gradient	Select in operation with acceleration and deceleration gradient from speed command value		High-sensitivity operation without acceleration and deceleration gradient from external speed command value		
S2 - 1	Test switch	Normally ON				
S2 - 2	Test switch	Normally ON				
S2 - 3	Select protection and cooperation on abnormality of motor tacho generator (CUT T.G)	ON		OFF		
		Use		No use		
S3 - 1	Select protection and cooperation on abnormality of motor tacho generator (FIELD LOSS)	ON		OFF		
		When motor has separately excited field, select this (shunt and compound motor)		Select when motor has not separately excited field (series motor)		
S3 - 2	Select when motor is controlled under constant output	ON		OFF		
		Constant output control		Constant torque control		
S4	Set motor field current range	Maximum field rated current		S4-1	S4-2	S4-3
		2[A]		OFF	OFF	OFF
		4[A]		ON	OFF	OFF
		8[A]		ON	ON	OFF
		16[A]		ON	ON	ON
S5 - 1	Select analog conversion input (EX-IN/TB1 No. 36,37)	ON		OFF		
		Current input 0~16/ 0~20 / 4~20 [mA]		Voltage input 0~5[V]		
S5 - 2	Conversion input OFF SET switch (EX-IN/TB1 No. 36,37)	ON		OFF		
		40~20[mA]		0~16[mA]/ 0~20[mA] / 0~5		
DIP SW1	Set the maximum voltage scope for tacho generator(T.G) feedback	EM-1	TG-1	TG-2	TG-3	
		Armature voltage[V]	DC 10~40 [V]	DC 30~80[V]	DC 70~200[V]	

6.4 Explanation on the function of trimmer

- VR1 : N max – Setting for maximum motor rotation speed
- VR2 : Accel – Setting for acceleration gradient (when S1-2 AD is selected)
- VR3 : Decel – Setting for deceleration gradient (when S1-2 AD is selected)
- VR4 : N min – Setting for minimum motor rotation speed
- VR5 : N gain – Setting gain of trimmer amplitude ratio
- VR6 : I max – Setting for the maximum operation current of the device
- VR7 : I x R – Setting for speed compensation ratio according to load under armature voltage feedback (EM-1)
- VR8 : I time – Setting I limit value delay time scope
- VR9 : I limit – Setting limit for motor load current
- VR10 : F-Ea – Setting armature voltage scope under operation as constant output type
- VR11 : F-I – Setting field rated current
- VR12 : F-L – Setting minimum field loss
- VR60 : N-OUT – Setting output voltage (0~10[V]) for speed meter (No. 35)
- VR93 : LOAD OUT – Setting output voltage (0 ~ 10[V]) for load meter (No. 34).
- VR90 : JOG – Setting rotational speed of JOG operation
- VR91 : EX-SP – Setting analog conversion output value
- VR92 : EX-OS – Setting analog conversion input offset
- R130 : FVP – Setting gain of field current amplitude ratio

6.5 Explanation on the Adjustment of Device

Though this device is set to default at shipping, it can be readjusted according to the following when there is a need for readjustment on the site.

[Caution] Since adjustment is dangerous when the motor is connected to a load, adjustment under non-load condition is recommended.

6.5.1 Setting Field Rated Current (F-I) and Minimum Field Loss(F-L)

Applicable when the motor has separately excited field

◆ Setting field rated current (F-I)

- . Input control power supply (L1.1 / L2.1 / L3.1) and field power supply (FL1 / FL2).
- . Turn on ENB terminal for preparing drive operation (TB1 24).

- When the setting is done by using a digital display meter in the drive (HN230), select the selector switch 7 (SW1) and adjust the trimmer F-1 (VR11) to make the display meter value to reach the motor field rate current value.
- When the setting is done by using an external measurement equipment, install a DC ammeter and voltmeter that can measure the field DC current of the motor on the motor field circuit and adjust the trimmer F-1 (VR11) to make the motor field DC current to coincide with the motor field rated current by monitoring the current and voltage of the field output terminal 1+, K-.

◆ Setting the Minimum Field Loss (F-L)

This is a function for monitoring whether current is normally flowing in the field circuit.

- If the trimmer F-L (VR12) is slowly turned counterclockwise, the field loss(LD9) on the LED board (HN3204) is turned on. At this moment, turn the trimmer clockwise by 20% and complete the setting.

[Caution] The setting for Field Loss in constant output control shall be dependent on the minimum value of constant output operation condition.

6.5.2 Setting for Maximum and Minimum Rotational Speed (Nmax and Nmin) due to Tacho Generator (T.G) feedback.

- Verify that the polarity of tacho generator (T.G) is correctly wired according to the wiring diagram. (No. 53 of Terminal Board 1 is plus, and No. 54 is minus)
- Select the voltage range of the tacho generator (T.G) at the maximum rated speed of DC motor. (see Table 6-3)
- Turn on the motor operation signal RUN terminal (TB1 No 23).
- Set the external speed command to the minimum value (0 [V]), and adjust the trimmer Nmin (VR4) to set to the minimum rotational speed.
- Slowly raise the external speed command value to reach to the maximum value (+10 [V]), and adjust trimmer Nmax (VR1) to set to the maximum motor rated speed value. (clockwise: increase rotational speed, counterclockwise: decrease rotational speed)
- When using a digital display meter (HN230) embedded in the drive to adjust, choose selector switch No. 4 (SW1) and adjust trimmer Nmax (VR1) to make the display meter value to reach the maximum motor rated speed value. Provided, the trimmer speed (VR24) of HN230 must be calibrated to fit the specifications of

motor tacho generator (T.G)

- ※ Speed (VR24) is set to be compatible with tacho generator (T.G) at DC30[V]/1000[RPM].
- ※ When the rotation of the motor is unstable during the setting of the maximum rotational speed, adjust Ngain (VR5) to stabilize the speed and set Nmax (VR1).

[caution] In setting the maximum speed, the drive output voltage (A+, B-) must not exceed the armature rated voltage of DC motor.

6.5.3 Setting for the maximum and minimum rotational speed (Nmax and Nmin) due to the armature voltage feedback (EM-1), Calibration of Speed according to Load

- This applies when there is no motor tacho generator (T.G). Set selector switch DIPSW1 to EM-1.
- Turn on the motor operation signal RUN terminal (TB1 No. 23).
- Set the value for external speed command to the minimum value (0[V]), and adjust trimmer Nmin (VR4) to set to the minimum rotational speed.
- Slowly increase the external speed command value to set to the maximum value(+10 [V]), and adjust trimmer Nmax (VR1) to set it to the maximum rated speed of the motor.
- When using a digital display meter (HN230) embedded in the drive to adjust, choose selector switch No. 6 (SW1) and adjust trimmer Nmax (VR1) to make the display meter value to reach the armature rate voltage value of the motor.
- Trimmer IxR (VR7) is only used in the armature voltage feedback control (EM-1). If the rotational speed of motor changed according to the load, adjust trimmer IxR (VR7) to calibrate the speed change.

6.5.4 Setting the Maximum Operational Current Value (Imax)

- The setting for the maximum operational current of drive is determined by the actual load current, and is set by trimmer Imax (VR6).
(Clockwise: Increase the set current, Counterclockwise: Decrease the set current)
- When readjusting the maximum operational current, turn off selector switch S2-2 while ENB terminal (TB1 No.24) and RUN terminal (TB1 23) are open, and set the external speed setting to +5[V].
Choose selector switch No. 8 (SW1) of the digital display meter (HN230) embedded in the drive, and adjust trimmer Imax (VR6) to make the maximum operational

current value to be displayed on the display meter.

When the setting of I_{max} is completed, turn on selector switch S2-2.

The rated current of the device must be bigger than the actual motor load current.

※ I_{max} (VR6) is set to the rated current of device (I_{dn}) at production.

[Caution] When turning selector switch S2-2 on or off, turn off the device beforehand.

6.5.5 Limit of Load Rate Current (I limit) and Setting Delay Time (I time)

The trimmer I limit (VR9) for setting limit current of motor is determined in reliance on the rated current of the motor. When trimmer is fully turned in clockwise, it is set to the value of 120% of the rated current of the device.

Trimmer I time (VR8) for setting the delay time for motor limit current can be set within the range of 0 ~ 60 seconds. (When it is fully turned in clockwise, the delay time is set to 60 seconds.)

When more current than I limit (VR9) setting value flows for more than the time set on I time (VR8), the relay (RY3) starts to operate.

– When readjusting the limit value of load rated current (I limit – VR9), choose selector switch No. 9 (SW1) while ENB terminal (TB1 No. 24) and RUN terminal (TB1 No. 23) are open and adjust trimmer I limit (VR9) to make the limit of load rated current to be displayed on the display meter.

※ I limit is set to the rated current of the device (I_{dn}) and I time is set to 10 seconds.

6.5.6 Setting Acceleration and Deceleration Gradient

When not choosing acceleration and deceleration gradient, set selector switch S1-2 to DR, and When using acceleration and deceleration gradient, set selector switch S1-2 to AD to adjust the acceleration and deceleration gradient from 0.6 [SEC] to 60 [SEC].

(Accel (VR2): Acceleration Gradient, Decel (VR3): Deceleration Gradient)

To increase the acceleration and deceleration time, turn each switch clockwise.

6.5.7 Setting Speed Loop Gain (N_{gain})

When the motor rotational speed is unstable, adjust the settings as follows.

First, set selector switch S1-2 to DR. Fix the external speed command value to 5 [V] under device operation mode and observe the speed feedback value of test point TP7 while turning the command value on and off.

Set trimmer N_{gain} (VR5) to a value that enables the motor to reach the preset value at the shortest time without delay. When the adjustment is completed, restore selector switch S1-2 to AD position.

When there is no oscilloscope, the values can be set with reference to LED15 (Imax) on the control panel HN3202. When the setting is done under tacho generator (TG) feedback method, first set the external speed command value to 5[V] under device operation mode and slowly turn trimmer Ngain (VR5) clockwise until LED 15 (Imax) starts to flicker, to turn trimmer Ngain (VR5) by 5% counterclockwise.

(Provided, when the device is operated in armature voltage feedback control method (EM-1) without tacho generator (T.G), set the value by turning Ngain (VR5) by 20% counterclockwise from the initial point.)

※ Since there are various kinds of time constant control scope of Ngain depending on the type of motor and reactance value, when the adjustment is not feasible, C64 condenser value (default value 1.0uF) must be changed.

6.5.8 Setting EMF Scope When Used as constant output type (F-Ea)

If DC motor is constant output type, turn on selector switch S3-2 to choose constant output operation and set trimmer F-Ea (VR10) to the middle position. Set the values as follows with reference to the rotational speed of motor No.4 of selector switch (SW1) of the digital display meter (HN23) and the armature voltage of motor No. 6. Set to n1 speed command value by slowly increasing the external speed command value.

* n1 : maximum rated speed in constant torque interval, n2 : maximum rated speed in constant output interval

* $n1 \text{ speed command value} = (n1 \text{ speed} / n2 \text{ speed}) * n2 \text{ speed maximum command value (10[V])}$

Set trimmer Nmax (VR1) to the motor armature rated voltage, and set trimmer F-Ea (VR10) to reach the maximum speed n1 in the constant torque interval.

Slowly increase the external speed command value to the maximum value (+10[V]).

Caliberate at trimmer F-Ea (VR10) so that it does not exceed the motor armature rated voltage, and reset trimmer Nmax (VR1) so that it can reach the maximum rotational speed n2 in the constant output interval.

[Caution]

1. The value for trimmer F-L (VR12) for setting the minimum field magnetizing current under constant output control must be reset depending on the minimum value of constant output operation condition.
2. When there is no motor tacho generator (T.G), constant output operation is impossible

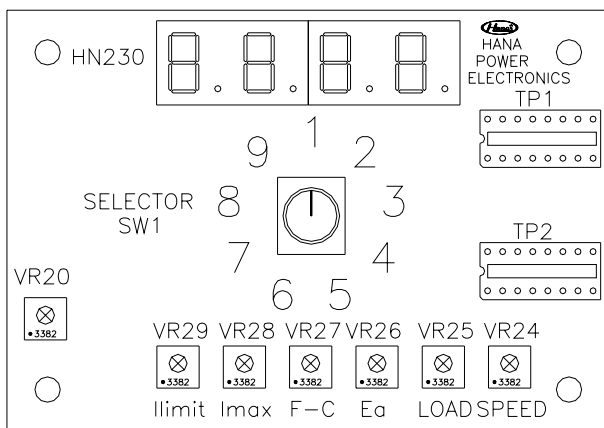
7. Explanation on the Digital Display Function [HN230]

[Table7-1]

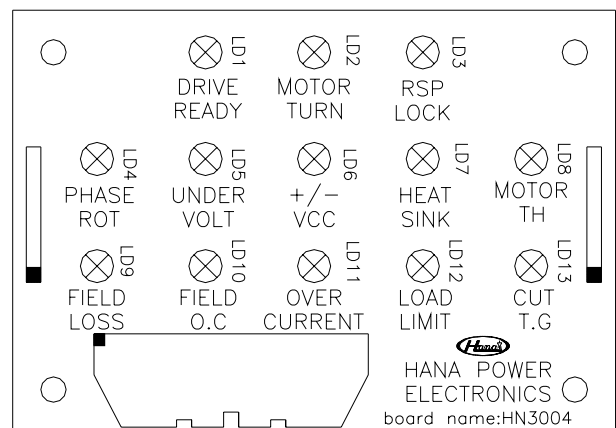
SW 1	Display	Internal Display
1	+ 15.0 [V] (+VCC) 5 %	Constant voltage power supply circuit + voltage
2	- 15.0 [V] (-VCC) 5 %	Constant voltage power supply circuit - voltage
3	0 ~ + 10.0 [V]	DRIVE external speed command setting value
4	0 ~ 1999 [RPM]	Motor rotational speed (T.G)
5	0 ~ 1999 [A]	Motor actual load current
6	0 ~ 600 [V]	Motor armature voltage
7	0 ~ 99.9 [A]	Motor actual field current
8	0 ~ 1999 [A]	Maximum operational current setting value (I _{max} : VR6)
9	0 ~ 1999 [A]	Limit motor current setting (I _{limit} : VR9)

* See [Figure7-1]

[Figure7-1]



[Figure8-1]



8. Trouble Inspection, and Remedial Measures

[Caution] When inspecting or carrying out remedial measures in the device, turn off the power.

8.1 Explanation on LED DISPLAY function (HN3204)

[Table8-1]

LED NO.	Name	Explanation on Function	Inspection and Remedial Measures
LD1	DRIVE READY	Normal Status of MOTOR and DRIVE. Preparation for Operation	Light on when normal
LD2	MOTOR TURN	MOTOR Rotation	Light on when motor rotates
LD3	RSP LOCK	DRIVE stop and hold	Light off when drive operates
LD4	PHASE LOSS	Phase loss of 3 phase power supply	Inspection of power supply circuit and fuses 1, 2, and 3.
LD5	UNDER VOLT	Reduction of rated voltage by less than 15%.	Verify power supply voltage
LD6	+/- VCC	Abnormality in drive power circuit.	Voltage check +15, -15 [V] $\pm 13 \leq \pm VCC \leq \pm 17[V]$ SCOPE
LD7	HEAT SINK	Overheating of drive's heatsink	Check heatsink cooling fan
LD8	MOTOR TH	MOTOR overheating	Check motor cooling fan and filter
LD9	FIELD LOSS	When rated field current is not introduced	Check field circuit and fuse 4.
LD10	FIELD O.C	Motor field overcurrent	Check field circuit
LD11	OVER CURRENT	Temporary exceeding of DRIVE rated current by 2.5 times.	Check load status and external speed setting
LD12	LOAD LIMIT	Exceeding I limit set load current	Check load status and I limit setting
LD13	CUT T.G	Damage to MOTOR's T.G.	Check motor T.G and wiring.

* See Figure [8-1]

☞ When conducting inspection or remedial measure, refer to a person in charge of drive at Hana Control Engineering.

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