1. Overview

Description

The BV(B01) series is a DC power supply motor drive for both brushed DC motors and brushless DC motors. The model is dedicated in stable operation for vehicle applications. It can drive the MGW250 wheel drive and carrying load up to 1000kg. The drive is fully protected against over-voltage, under-voltage, over-current, over-heating and feedback signal fault (halls fault for BLDC motors). The operation mode and several parameters such as throttle type can be set through PC-HMI software (specific accessory required) to match different applications.

Features

- ■ Multiple Modes of Operation
- ■ Four Quadrant Regenerative Operation
- ■ Adjustable Analog Command Input and Deadband Range
- ■ Programmable IO Functions
- ■ Selectable Inhibit/Enable Logic
- ■ Programmable Protect Functions: Over-load, Over-voltage, Under-voltage, and more…
- ■ Electromagnetic Hold Brake Output
- ■ Diagnose Through PC is Possible (with accessory)
- ■ Dive Brushed or Brushless Motors (Parameter Setup Required)

MODES OF OPERATION

- Speed Control Mode
- Duty Control Mode

COMMAND SOURCE

- External Analog (0 ~ 5 or 0 ~ 10 VDC)
- External Potentiometer (Single-ended/Wig-wag)
- Digital Indexing / RS-232

I/O (Function Programmable)

- 5 Digital Inputs (X1 ~ X5)
- 1 Digital Input of 5V (X6)
- 3 Digital Outputs (Y1 ~ Y3)
- 2 Analog Inputs (VR1, VR2)
- 2 Relay Outputs (PWR-RELAY-OUT, MBRAKE-OUT)

Application

- ■ Electric Pallet Trucks
- ■ Automatic Vehicles (AGV)
- ■ Electric Scooters / Light Vehicles

Product Line

Model	Voltage	Output Power	Max. Peak Output Current	Continuous Output Current	Function	Support Motor / Drive Wheel
BVD-K120CQ	12 VDC	600 W	120 A	60 A	24VDC Standard model. It can be set to operate in 12VDC for 1 battery applications.	-
	24 VDC	1200 W				MGW250-K1K0 MGW250-K1K0S
BVD-K190CQ	24 VDC	1800 W	190 A	95 A	24 VDC large output model.	
BVD-N120CQ	48 VDC	1500 W	120 A	60 A	48 VDC standard model.	-

Product Version

Ver	Mark	Description
D.03	D.03	FREE ON can also release MBRAKE during alarm.
D.04	D.04	Improve the abnormal power consumption of analog input.
D.05	D.05	Improve the noise problem.
D.06	D.06	Drive optimization.
D.07	D.07	Optimize the current protection of the 48V model, increase its current output capacity, and can drive a 2000W motor (magnification <1.5).
D.08	D.08	Improve hot swap function.

Product Number Code

BVD - K 120 C Q

① ② ③ ④

①	Series	**BVD** : **BV** Series (B01) motor drive	
②	Power Supply Voltage	**K** : 24VDC	**N** : 48VDC
③	Ma. Output Current	**120** : 120A	**190** : 190A
④	Reserved	-	

2. Specifications

Model			BVD-K120CQ		BVD-K190CQ	BVD-N120CQ
Item			**Value**			
Rated Output Power		W	600	1200	1800	1500
Power Source	DC Supply Rated Voltage	VDC	12	24		48
	Permissible Voltage Range	-	± 20%			
	DC BUS Over Voltage Limit *1	VDC	14.5	33		60
	DC BUS Under Voltage Limit *1	VDC	8	15		30
Max. Peak Output Current *2		A	120		190	120
Rated Continuous Output Current (rms)		A	60		95	60
Low Voltage Supply Input (Control Power)		VDC	8 ~ 60			

*1. DC BUS over voltage and under voltage protect can be set between the limit range.
*2. Hardware protection limit..

NOTE The power specification is by the driver its self.

Common Specifications

Model	BVD-K120CQ / BVD-K190CQ	BVD-N120CQ
Item	**Value**	
Feedback Supported	Halls	
Mode of Operation	Speed, Duty. Default: Speed	
Digital Inputs	TTL External power supply: 8 ~ 33VDC 20mA min. SOURCE Logic	TTL External power supply: 30 ~ 60VDC 20mA min. SOURCE Logic
	Programmable digital input functions for X1 ~ X5 [ ]: Default [START/STOP(FWD)] 、[CCW/CW(REV)] 、FREE 、STOP-MODE 、EBRAKE/ALM-RST 、[ALM-RST] 、[M0] 、EBRAKE 、KEY-SWITCH 、E-FWD 、[E-REV]	
5V Digital Inputs	TTL Internal power supply: 5VDC SINK Logic	
	Programmable digital input functions for X6 [ ]: Default START/STOP(FWD) 、CCW/CW(REV) 、FREE 、STOP-MODE 、EBRAKE/ALM-RST 、ALM-RST 、M0 、EBRAKE 、[KEY-SWITCH] 、E-FWD 、E-REV	
Digital Outputs	Open-Collector output External power supply: 5 ~ 60VDC 20mA max. ON voltage: 0.8VDC max. SINK logic	
	Programmable digital output functions for Y1, Y2, Y3 [ ]: Default [SPD-OUT] 、[ALM-OUT] 、[BUSY-OUT] 、VA-OUT 、DEC-IND 、REV-IND 、PWR-IND 、BATT-GAUGE1 、BATT-GAUGE2	
Analog Inputs	The input voltage range of VR1, VR2 can be set by parameter (0 ~ 10VDC). The deadband and neutral point are programmable.	
Relay Outputs	External power supply: 24VDC 2A max.	External power supply: 48VDC 2A max.
	Functions:	

	Motor electromagnetic brake control (MBRAKE-OUT) Main power relay control (PWR-RELAY-OUT)
Brake Function	Regenerative brake ◦ (battery supply power only)
Protect Function	Over-voltage, Under-voltage, Over-current, Overload, Main circuit overheat, Feedback sensor error, Over-speed, EERPOM error

Speed Control Specifications

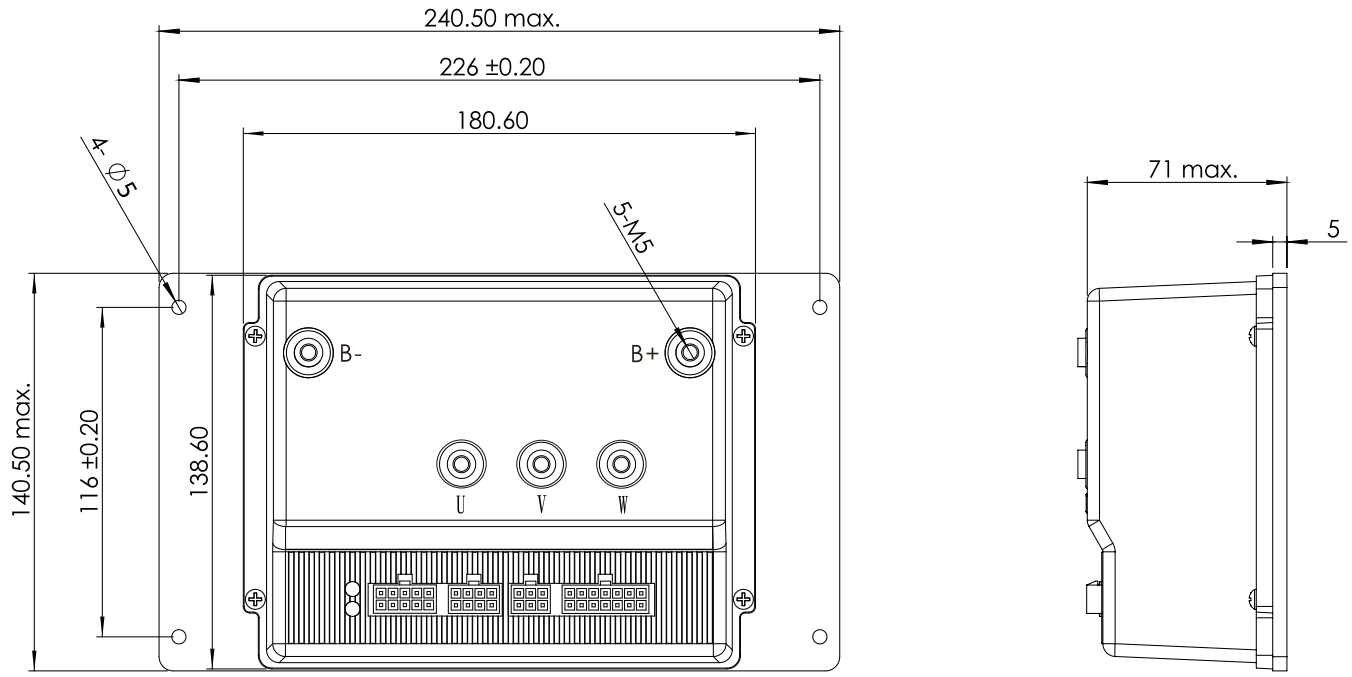
Item	Value
Speed Control Range *1	Speed control: 100 ~ 3000 r/min Brushed motor duty control: 0 ~ 94% (Parameter setting is required for different motor)
Speed Regulation *2	± 1 %
Speed Setting Method	Select one of the following methods: [ ]: Default • [External analog VR1 single-ended] • External analog VR1 wig-wag • 2 digital indexing: Operation data No. 0 ~ 1 select by input M0.
Acceleration/Deceleration Time Setting Method	Digital indexing (2 steps for each of the CW and CCW operation select by input M0)
Acceleration/Deceleration Time	0.1 ~ 10.0 sec (3000 r/min，no load) (300 r/min per 0.01 sec to 3 r/min per 0.01 sec)

*1. Other speed control range can be customized.
*2. Operation condition：0 ~ rated torque, rated voltage, 25℃.

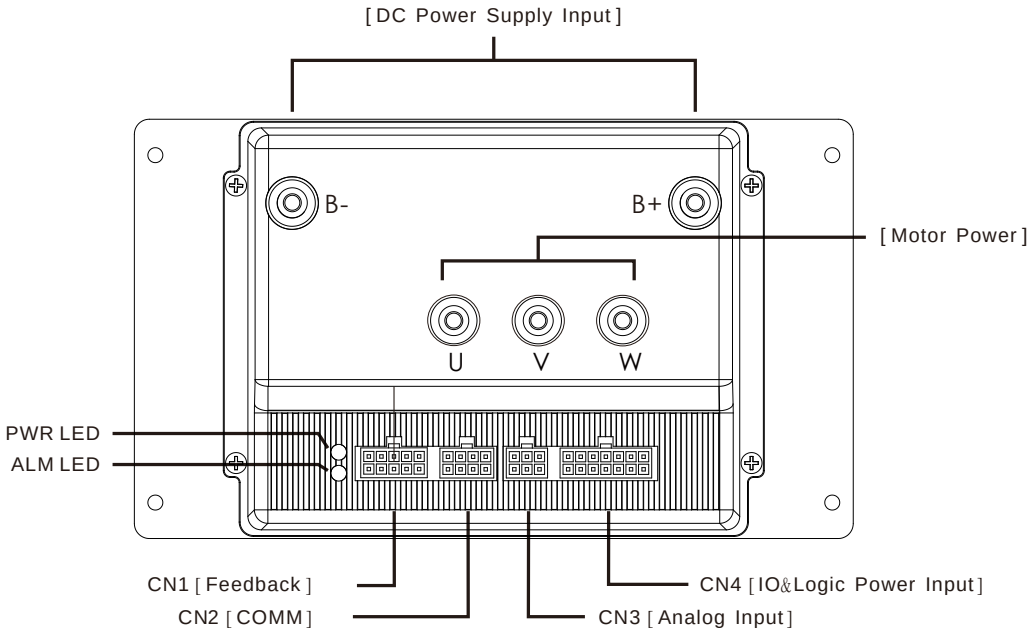
General Specifications

Item		Value
Operating Environment	Ambient Temperature	0℃ ~ +60℃ (*External cooling is required when the environment temperature is higher than 40℃)
	Ambient Humidity	< 85 % RH (non-condensing)

3. Mounting Dimension (Unit: mm)



4. Interface



LED Function

Name	Function	Description
ALM	Alarm LED	ON: Normal (motor drive enabled) Blink: Alarm occurs. The type of alarm can be confirmed by the blink count. OFF: Driver in WAIT status (KEY-SWITCH is OFF, motor drive disabled).
PWR	Power LED	ON: DC main power supply is on. OFF: DC main power supply is off.

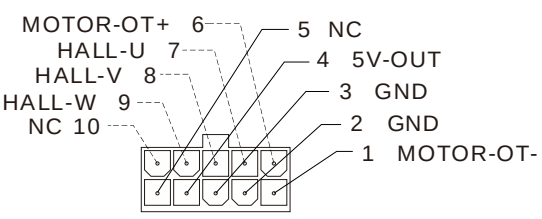
DC Power Supply Input Terminal (B+ B-)

Terminal	Description	I/O
B+	Main power supply input (Reference to B-)	I
B-	DC power ground input	PGND

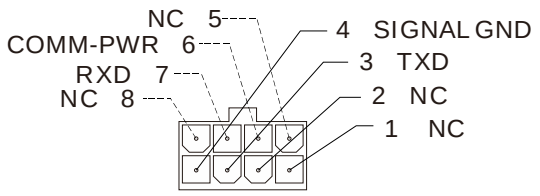
Motor Power Terminal (U, V, W)

Terminal	Description	I/O
U	Motor phase U	O
V	Motor phase V	O
W	Motor phase W	O

CN1 Feedback Connector

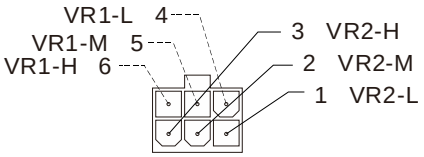
Pin	Function	Description	I/O	Connector
1	MOTOR-OT-	Motor over temperature - (signal ground)	SGND	Connector Info: 10-pin (male), 4.2mm pitch Mating Connector: 10-pin (female), 4.2mm pitch [Accessory sold separately]
2	GND	Signal ground	SGND	
3				
4	5V-OUT	+5V hall supply output	SP	
5	NC	Reserved.	-	
6	MOTOR-OT+	Motor over temperature +	I	
7	HALL-U	Motor Hall U	I	
8	HALL-V	Motor Hall V	I	
9	HALL-W	Motor Hall W	I	
10	NC	Reserved.	-	

CN2 COMM Connector

Pin	Function	Description	I/O	Connector
1	NC	Reserved.	-	Connector Info: 8-pin (male), 4.2mm pitch Mating Connector: 8-pin (female), 4.2mm pitch [Accessory sold separately]
2	NC	Reserved.	-	
3	TXD	Driver RS232 TXD	O	
4	SIGNAL GND	Signal ground.	SGND	
5	NC	Reserved.	-	
6	COMM-PWR	Communication 15 VDC Power Supply. (For Control key pad power)	SP	
7	RXD	Driver RS232 RXD	I	
8	NC	Reserved.	-	

NOTE Use twisted pair wire or cable with shielding when in heavy noise environment.

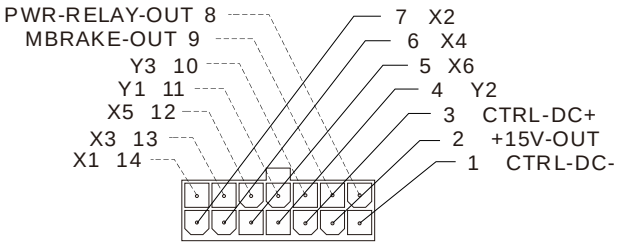
CN3 Analog Input Connector

Pin	Function	Description	I/O	Connector
1	VR2-L	Analog input signal ground.	SGND	Connector Info: 6-pin (male), 4.2mm pitch Mating Connector: 6-pin (female), 4.2mm pitch [Accessory sold separately]
2	VR2-M	Analog input VR2	I	
3	VR2-H	+15V. For External potentiometer power supply.	SP	
4	VR1-L	Analog input signal ground.	SGND	
5	VR1-M	Analog input VR1	I	
6	VR1-H	+15V. For External potentiometer power supply.	SP	

CN4 IO & Logic Power Input Connector

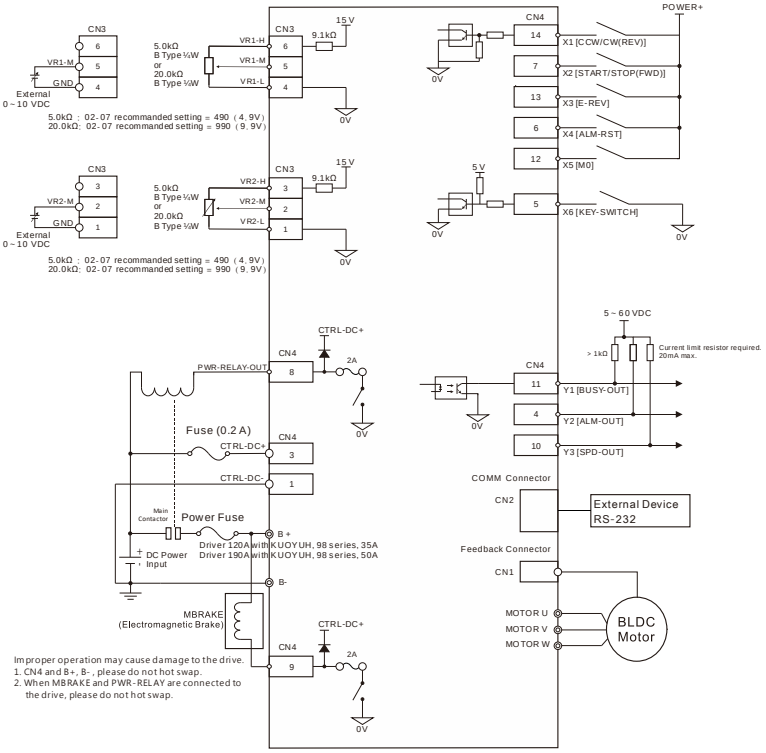
Pin	Function	Description	I/O	Default Setting
1	CTRL-DC-	Logic (control) DC power ground.	SGND	-
2	+15V-OPUT	+ 15 VDC @ 20mA. For customer use. Reference to SGND.	SP	-
3	CTRL-DC+	Logic (control) DC power supply input.	I	-
4	Y2	Programmable Digital Output	O	ALM-OUT
5	X6	5V Programmable Digital Input	I	KEY-SWITCH
6	X4	Programmable Digital Input	I	ALM-RST
7	X2		I	START/STOP(FWD)
8	Relay Output (PWR-RELAY-OUT)	BUS Voltage relay output (main contactor). This output turns ON when the KETSWITCH input is ON. This output turns OFF when the KEYSWITCH input is OFF. Reference to SGND.	O	PWR-RELAY-OUT
9	Relay Output (MBRAKE-OUT)	Electromagnetic Brake Output. This output turns ON when the motor is running. This output turns OFF when the motor is stopped. Reference to SGND.	O	MBRAKE-OUT
10	Y3	Programmable Digital Output	O	SPD-OUT
11	Y1		O	BUSY-OUT
12	X5	Programmable Digital Input	I	M0
13	X3		I	FREE
14	X1		I	CCW/CW(REV)

NOTE Use twisted pair wire or cable with shielding when in heavy noise environment.
NOTE Improper operation may cause damage to the drive.
1. CN4 and B+, B- , please do not hot swap.
2. When MBRAKE and PWR-RELAY are connected to the drive, please do not hot swap.

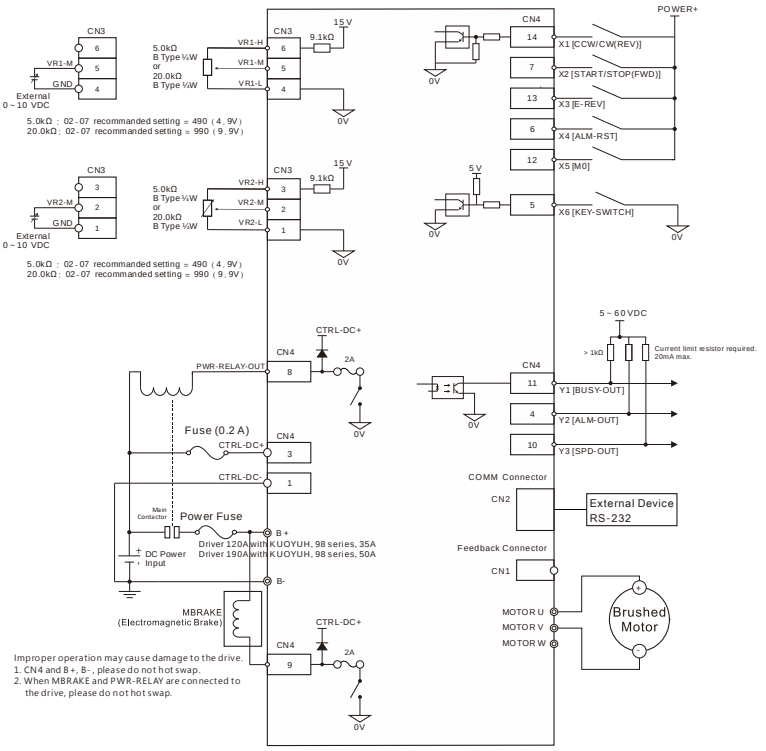
Connector	
Connector Info: 14-pin (male), 4.2mm pitch Mating Connector: 14-pin (female), 4.2mm pitch [Accessory sold separately]	

5. Wiring Diagram

- BLDC Motor



- Brushed Motor



6. Functions

NOTE Reference to user manual for detailed information about other extension functions.

Digital Input Functions

The activate logic level (ON status) of each digital input can be set to closed circuit or open circuit by parameter.

No.	Name	Description	Setting	
			ON	OFF
0	NC	Not used.	-	-
1	START/STOP (SC Mode)	SC mode: The motor rotates in the direction set by CCW/CW input when the START/STOP input is ON. The motor stops when the START/STOP input is OFF. Select how the motor should stop by the STOP-MODE input. CC mode: The motor rotates in the CW direction when the FWD input is ON. The motor rotates in the CCW direction when the REV input is ON. If the FWD and REV inputs are turned ON simultaneously, the motor stops if the parameter 08-07 was set to 1. Select how the motor should stop by the STOP-MODE input.	Operation	Stop
	FWD (CC Mode)		CW Operation	Stop
2	CCW/CW (SC Mode)		Rotating Direction set to CCW	Rotating Direction set to CW
	REV (CC Mode)		CCW Operation	Stop
5	FREE	When FREE is activated the driver will cut off the power to the motor for the motor to coast to stop. The electromagnetic brake will release when FREE input is ON. D.03 FREE ON can also release MBRAKE during Alarm.	FREE activate (MBRAKE OFF)	FREE deactivate
6	STOP-MODE	Set how the motor stops: The motor stops instantaneously when STOP-MODE input is ON. The motor stops by the rate of deceleration time setting when STOP-MODE input is OFF.	Instantaneous Stop	Decelerate Stop
7	EBRAKE/ ALM-RST	The function of BRAKE/ALM-RST input is the same as EBRAKE input when the driver is in normal operation. When an alarm generates, the function of EBRAKE/ALM-RST input becomes the same as ALM-RST input.	-	-
8	ALM-RST	Resets the alarm: Turn the ALM-RST input OFF for more than 0.5 sec then turn it to ON for more than 0.5 sec then turn it OFF to reset the alarm. The alarm cannot be reset If the driver operation command is ON (etc. START/STOP input is ON).	-	-
10	M0	Operation data No. indexing select bit 0.	M0 ON	M0 OFF
13	EBRAKE	Emergency Brake: Set the EBRAKE input ON while the motor is running will make the motor stop instantaneously. When the EBRAKE input is ON, the motor operation is disabled. To start motor operation, please set the EBRAKE input OFF.	Instantaneous Stop /Motor Operation Disabled	Motor Operation Normal
14	KEY-SWITCH	Master switch for the drive: (KEY SWITCH is only functional when 02-014 is set to 0 or 1) When the KEYSWITCH input is OFF the motor will decelerate to stop by the setting of 08-12. Then the BUS V RELAY OUTPUT is set to OFF. The MBRAKE-OUT will be ON to lock the motor and the drive will be set to the WAIT(disable, no output from the drive to the motor) states and all the other IO functions are disabled in this state. When the KEYSWICH input is ON the motor drive is enabled and the BUS V RELAY OUTPUT will set to ON. Set the KEYSWITCH input to OFF can release the activated protection function and reset the drive system.	Motor Drive Enabled	Motor Drive Disabled / WAIT
15	E-FWD	Emergency Forward: While the motor is running in CCW direction, setting the E-FWD	E-FWD ON	E-FWD OFF

		input to ON will make the motor to stop instantaneously (in the time set by 08-14) and then rotates in CW direction. The CW operation speed is set by digital indexing. To stop the motor during emergency forward, set all the FWD, REV and E-FWD inputs OFF. The motor will stop by the current deceleration setting. After the motor stops from the emergency forward, the drive will be inhibited until reset by the KEY-SWITCH input.		
16	E-REV	Emergency Reverse: Mechanism is the same as E-FWD but in opposite direction.	E-REV ON	E-REV OFF

Digital Indexing of operation data No. (Speed/duty, ACC/DEC, Torque limit)

Desired operation data No. can be selected by a combination of operation direction and the ON/OFF status of the M0 input.

NOTE Digital speed/duty indexing only has 2 steps No.0 and No.1 operation data (doesn't effect by the operation direction).

Operation data No. of digital speed/duty	Operation data No. of ACC/DEC, Torque limit and analog input command limit	Operation direction	M0
No.0	CW No. 0	CW	OFF
No.1	CW No. 1	CW	ON
No.0	CCW No. 0	CCW	OFF
No.1	CCW No. 1	CCW	ON

Digital Output Functions

The activate logic level (ON status) of each digital output can be set to closed circuit or open circuit by parameter.

No.	Name	Description
0	NC	Not used.
1	SPD-OUT	Motor speed pulse output. The driver sends the pulse out signal at a rate of 12 pulses per revolution for an 8 poles motor (6 pulses for a 4 poles motor and so on).
2	ALM-OUT	The ALM-OUT output is ON when an alarm has generated.
3	BUSY-OUT	The BUSY-OUT is ON while the driver is providing power to the motor even if the motor is not rotating.
4	VA-OUT	The VA-OUT is ON when the motor rotating speed is in the set value.
6	DEC-IND	The DEC-IND is ON when the motor is decelerating.
7	REV-IND	The REV-IND is ON when the motor is operating in CCW direction.
8	PWR-IND	The PWR-IND is ON when the DC power supply input is connected (Synchronized with PWR LED).
10	BATT-GAUGE1	The DC power supply input indication (battery status):
11	BATT-GAUGE2	

Battery Status	Output Status	
	BATT-GAUGE2	BATT-GAUGE1
When the voltage is higher than the setting of 08-15	OFF	ON
When the voltage is lower than the setting of 08-16	ON	OFF
When the voltage is dropped from the setting of 08-15 and is between the setting of 08-15 and 08-16 for less than 60 sec.	OFF	ON
When the voltage is dropped from the setting of 08-15 and is between the setting of 08-15 and 08-16 for more than 60 sec.	ON	ON
When the voltage is raised from the setting of 08-16and is between the setting of 08-15 and 08-16.	ON	ON

Relay Output Functions

Name	Description
MBRAKE-OUT	Motor electromagnetic brake control. When MBRAKE-OUT is ON, the brake is released and the motor is free to turn. When MBRAKE-OUT is OFF, the brake is locked. The MBRAKE-OUT will be ON during the motor operation. After the motor stops, the MBRAKE-OUT will be OFF after the time set by 08-11. The MBRAKE-OUT is OFF when there is an alarm.
PWR-RELAY-OUT	Main DC power supply input relay control. When the KEY-SWITCH is ON, the BUSV-RELAY-OUT is ON. When the drive is in WAIT/disable state, the BUSV-RELAY-OUT is OFF.

Speed Control Setting

The command range of external analog input VR1 can be set by parameter.

ID	Name	Function	Setting Range	Default
02-07	Analog input max voltage	Analog input command max voltage.	0 ~ 10 VDC	5.00 VDC
02-08	Analog input min voltage	Analog input command min voltage.	0 ~ 10 VDC	0.30 VDC
03-01	Analog speed upper limit CW No.0	Analog speed setting max. speed of CW No.0	200 ~ 10000 r/min	3000
03-02	Analog speed lower limit CW No.0	Analog speed setting min. speed of CW No.0	100 ~ 10000 r/min	100
03-03	Analog speed upper limit CCW No.0	Analog speed setting max. speed of CCW No.0	200 ~ 10000 r/min	3000
03-04	Analog speed lower limit CCW No.0	Analog speed setting min. speed of CCW No.0	100 ~ 10000 r/min	100
03-05	Analog speed upper limit CW No.1	Analog speed setting max. speed of CW No.1	200 ~ 10000 r/min	1500
03-06	Analog speed lower limit CW No.1	Analog speed setting min. speed of CW No.1	100 ~ 10000 r/min	100
03-07	Analog speed upper limit CCW No.1	Analog speed setting max. speed of CCW No.1	200 ~ 10000 r/min	1500
03-08	Analog speed lower limit CCW No.1	Analog speed setting min. speed of CCW No.1	100 ~ 10000 r/min	100

$$\text{Target speed} = (\text{Command voltage} - \text{Analog input min voltage}) \times \frac{(\text{Analog speed upper limit} - \text{Analog speed lower limit})}{(\text{Analog input max. voltage} - \text{Analog input min. voltage})} + \text{Analog speed lower limit}$$

Protect Function (Alarm)

When an alarm generates, the motor coast to stop, the ALM-OUT will turn ON and the ALM-LED blinks.

Before resetting an alarm, always remove the cause of the alarm and ensure safety, and perform one of the reset operations specified below.

- Turn the ALM-RST input OFF for more than 0.5 sec then turn it to ON for more than 0.5 sec then turn it OFF.
- Cycle the power. When cycling the power please turn the power off for at least 1 min or till the PWR LED off then turn the power on again.

NOTE Some alarms can only be reset by cycling the power.

NOTE The alarm cannot be reset If the driver operation command is ON (etc. START/STOP input is ON). Please turn all the operation command to OFF before reset the alarm.

■ **ALM LED**

When an alarm generates, the ALM LED blinks. The type of alarm can be confirmed by the blink count of ALM LED.

LED Blink	Alarm Code	Protect Function	Description
Blink 1 time	1	Over current	Excessive current has flown through the driver. Or the load exceeds the rated value has applied to the motor more than 5 sec. (the time allowed for the load exceeds the rated value could be different depends on the parameter setup.)
Blink 2 times	2	Over load	The load exceeds the rated value has applied to the motor more than 5 sec. (the time allowed for the load exceeds the rated value could be different depends on the parameter setup.)
Blink 3 times	3	Motor feedback fault	The motor failed to start. The motor cable is not connected correctly.
Blink 4 times	4	Over voltage	The input power supply voltage has exceeded the maximum Limit of the driver. Or the inertia of the load is too large.
Blink 5 times	5	Under voltage	The input power supply voltage is under the low limit.
Blink 4 times	6	Driver overheat	The driver's temperature is over its maximum limit.
Blink 7 times	7	Startup fault	The motor failed to start. The motor cable is not connected correctly.
Blink 8 times	8	EEP data error	Error in EEPROM data. (Can NOT be reset by ALM-RST input)
Blink 10 times	10	Motor overheat	The motor's temperature is too high. (The MOT-OT terminal has been set to ON state.)

Blink 12 times	12	Over speed	The speed has exceeded the maximum setup of the driver.
Blink 21 times	21	Communication error	RS232 or RS485 time out.
Blink 22 times	22	Parameter error	The parameter setup value was incorrect.

Revision History

REV	Date	Remark
1.0	20130828	1st Release.
1.1	20131127	Power specification modified. Model number updated.
1.2	20131231	Specification updated. CN3, CN4 details corrected.
1.3	20151019	CN3, VH, VL description corrected.
2.0	20160408	Overall content updated based on the PGNSS-011.
3.0	20201230	Assign the new file number SS-01-S0279. Overall content updated based on the PGNSS-011 (SS-01-S0278), aroughly as follows: • The ON voltage of the output circuit is corrected to 0.8VDC max. • Speed Control Specifications modified. • The function of CN1-2 modified. • Added communication cable specification recommendations. • CN4 connector drawing modified. • Wiring Diagram modified about the electromagnetic brake wiring. And the current limit resistor of CN4 recommended >1kΩ. • The description of “Blink 21 times” modified.
3.1	20210223	Added CN4 wiring precautions (table and wiring diagram).
3.2	20210519	Added description of product version D.08.