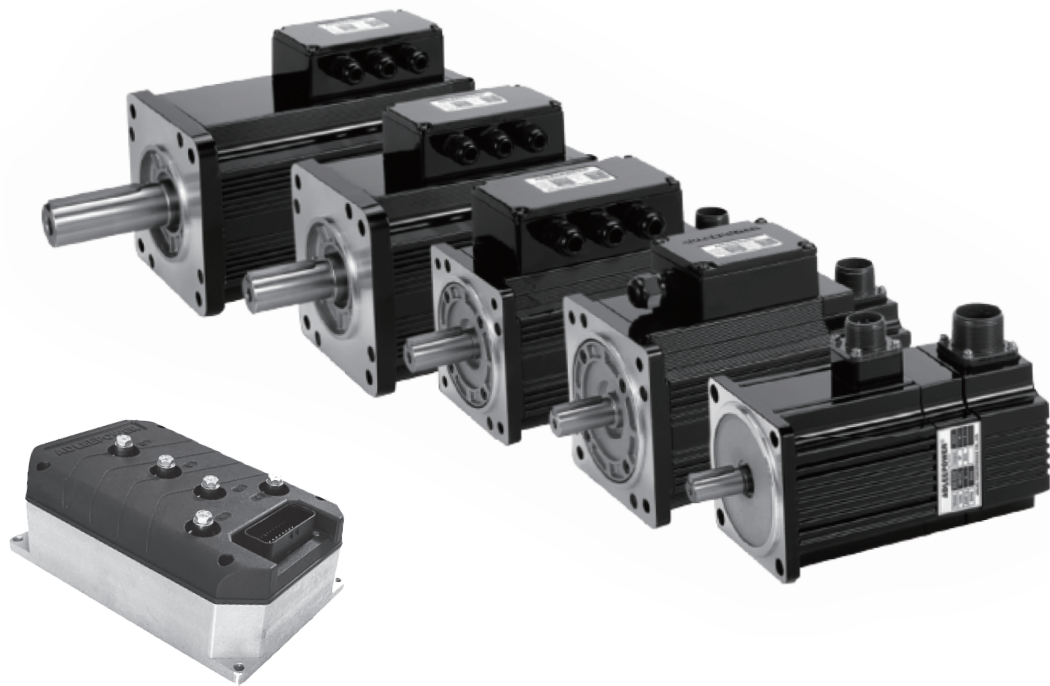


INSTRUCTION MANUAL

BM SERIES BLDC MOTOR AND SWAN9 DRIVES



THANK YOU VERY MUCH FOR YOUR PURCHASE
OF ADLEE SERVO MOTORS AND DRIVES.
PLEASE READ THIS INSTRUCTION MANUAL
BEFORE INSTALLATION OF THE DRIVER.

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1. RECEIVING

- (1) No damage is found on each product when receiving.
- (2) The package should contains a set of drive unit and instruction manual.

For any irregularity, contact the sales shop where you purchased immediately.

- (3) The product is as ordered (check the nameplate and voltage).
- (4) The drive has been designed for use in combination with the specified BLDC motors only. Check if the specifications of drive and BLDC motor are in a set.
- (5) Check if the BLDC motor's shaft can be rotated smoothly by hand.

(The BLDC motor shaft cannot be rotated if it is with mechanical brake.)

- (6) Description of nameplate

Drive

Model No.	ADLEEPOWER [®]	Model	SWAN-9
Input voltage	Model : SWAN9B	Volts	48V
	Volts : 48V	MAX. Current	220A
Maximum current	MAX. Current : 220A	Part Number	Q-0U80-248001
Part number	Part Number : A-0U90-148026	ADLEE POWERTRONIC CO., LTD.	
	ADLEE POWERTRONIC CO., LTD.		

DMC-4000 motor

ADLEEPOWER [®]			
MODEL	DMC-4000	RATING	4.0 KW
VOLTS	48VDC	S N	

BLDC motor

Model No.	ADLEEPOWER [®]	Rated power
Input voltage	Brushless DC Motor	IP code
	Model: BM-5000E Output: 5 kW	Insulation grade
Rated speed	Volts: 48 VDC IP: 55	
Rated current	Rated rpm: 1900rpm INS.: H	
	Rated current: 14.0 A	
	Driver: A-0U90-148026	
	Part NO.: Q-D0A1-0F5020	
	ADLEE POWERTRONIC CO., LTD.	

2. SPECIFICATIONS

Drive Model No.	SWAN9	
CVT Module Model No.	DMC-4000	
Rated Voltage (VDC)	48	
Rated Power (kW)	4	
Max. Current (A)	175	
Max. Power (kW)	6	
Max. Efficiency (%)	≥ 92	
Max. Torque (N-m)	13	
High Efficiency Torque Range (N-m)	$\geq 90\%$ ($\geq 3\text{N-m}$)	
Drive Method	Sine Wave	
Encoder Type and Resolution	HU,HV,HW open collector	
ACC. / DEC. time	0~5000ms/10A	
Type of Control	PWM	
Mode of Control	Torque mode	
Input Signal	Analog	VR 0~5V analog input
	Digital	DI terminal and 48V common
Operating	1.Terminal : Photocoupler interface 2.Communication : RS485, PC	
Output Signal		
Protection	Over current, over heat, low voltage, hall sensor abnormal, accelerator loss signal, power on accelerator non zero, temperature sensor open circuit, motor stall, phase to phase short circuit, standby over time	
Driver Dimension Fig.	A	
Motor Dimension Fig.	1	

Drive Model No.		SWAN9A		SWAN9B			SWAN9C
Motor Model No.		BM-2200E	BM-3700E	BM-3700E	BM-5000ES	BM-5000ER	BM-5500E
Rated Voltage (VDC)		48					72
Max. Voltage (VDC)		60					85
Rated Output Power (W)		2200	3700	3700	5000	5000	5500
Motor Rated Torque (Kg-cm)		48.7	90	90	72	250	134
Motor Max. Torque (Kg-cm)		180	150	215	130	350	300
Motor Rated Current (A)		48	87	87	114	140	89
Motor Max. Current (A)		200	140	200	200	220	200
Motor Rated Speed (RPM)		4400	4000	4000	6500	1900	4000
Maximum Speed (RPM)		4800	4700	4700	7000	6000	4600
Maximum Output Power (W)		5200	5200	5800	8000	5700	10500
Encoder Type and Resolution		A,B,Z,HU,HV,HW open collector, (A, B phase is 128PPR)					
ACC. / DEC. time		0~5000ms/10A					
Type of Control		Sin PWM					
Mode of Control		Torque mode					
Input Signal	Analog	VR 0~5V analog input					
	Digital	DI terminal and 48V(72V) common					
Operating		1.Terminal : Photocoupler interface 2.Communication : RS232, PC					
Output Signal		Open collector, External voltage (48VDC/72VDC, 10mA below)					
Protection		Overload, over current, over heat, low voltage, hall sensor abnormal, accelerator loss signal, power on accelerator non zero, temperature sensor open circuit, motor stall, phase to phase short circuit, standby over time, contactor poor contact, contactor welded detection					
Driver Dimension Fig.		A					
Motor Dimension Fig.		2	3	3	4	5	6

3. DIMENSION DRAWINGS

Model No. : SWAN9/SWAN9A/SWAN9B/SWAN9C

Unit:mm

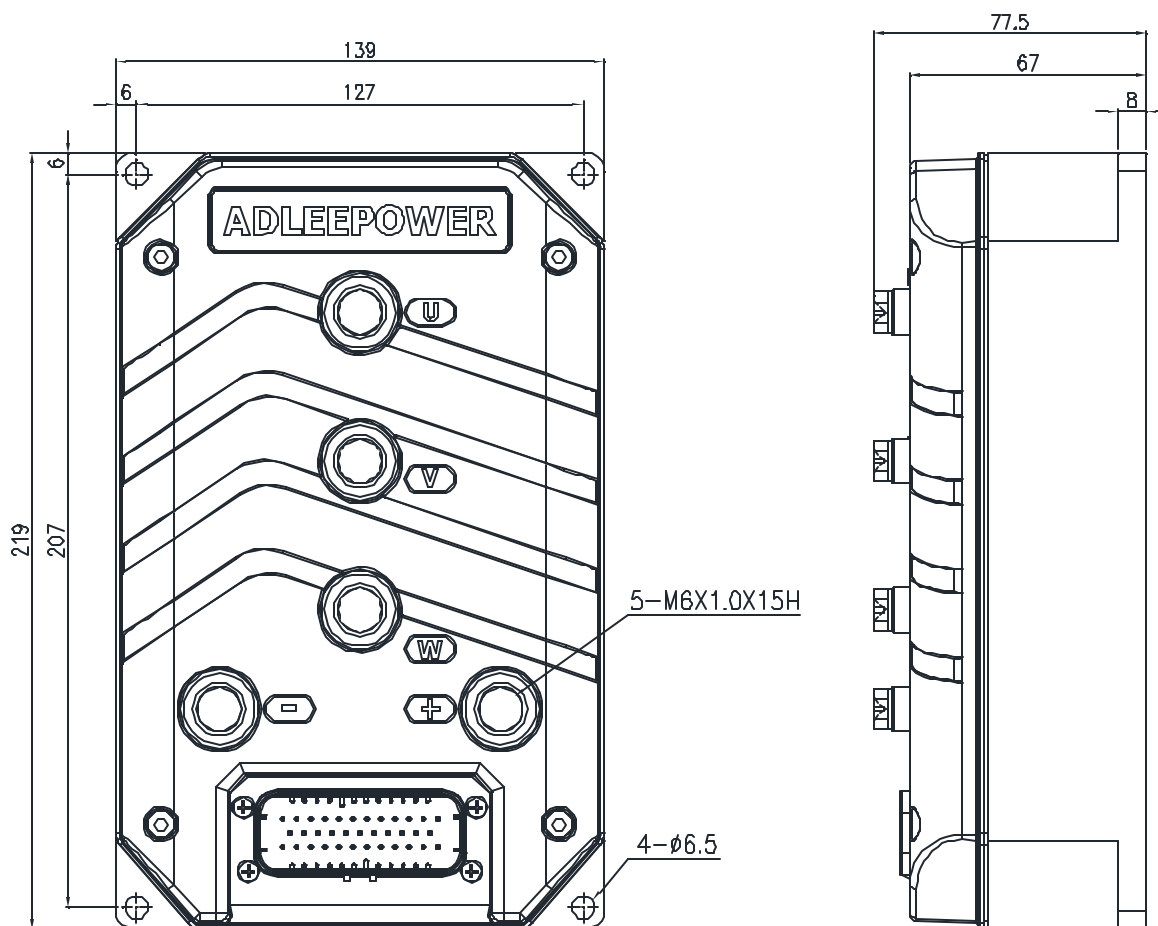


Fig A

Model No. : DMC-4000

Unit:mm

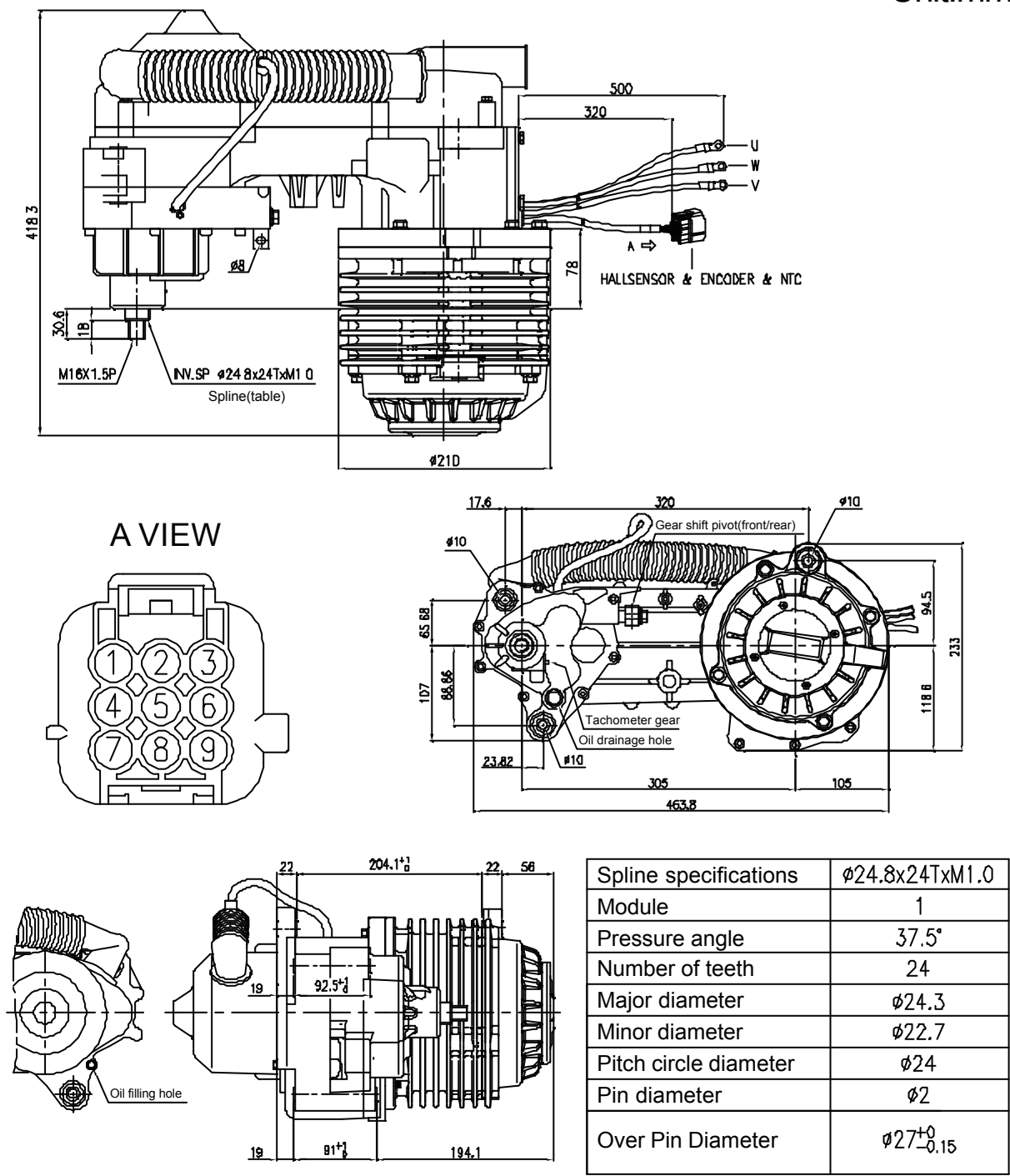


Fig 1

Model No. : BM-2200E

Unit:mm

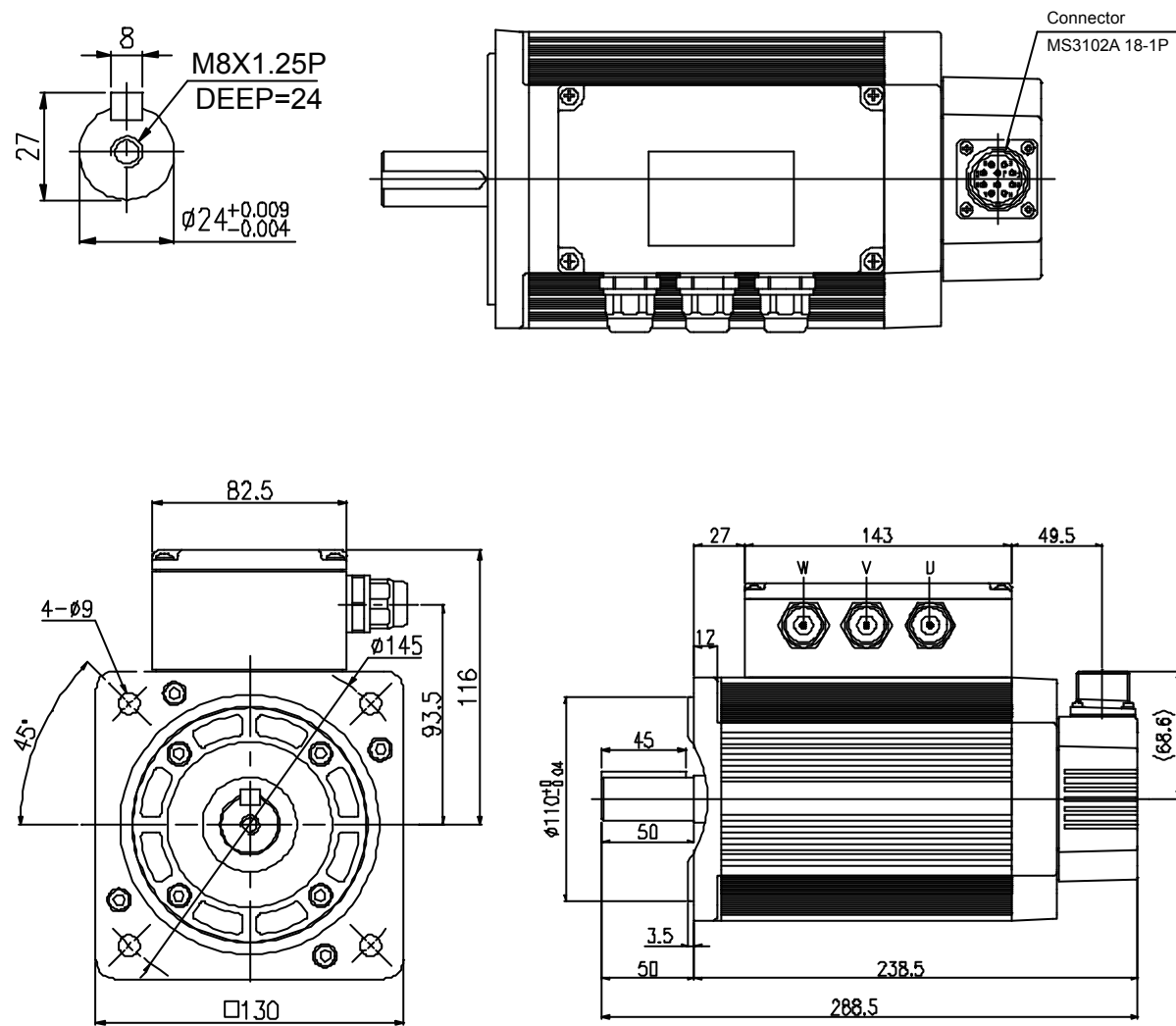


Fig 2

Model No. : BM-3700E

Unit:mm

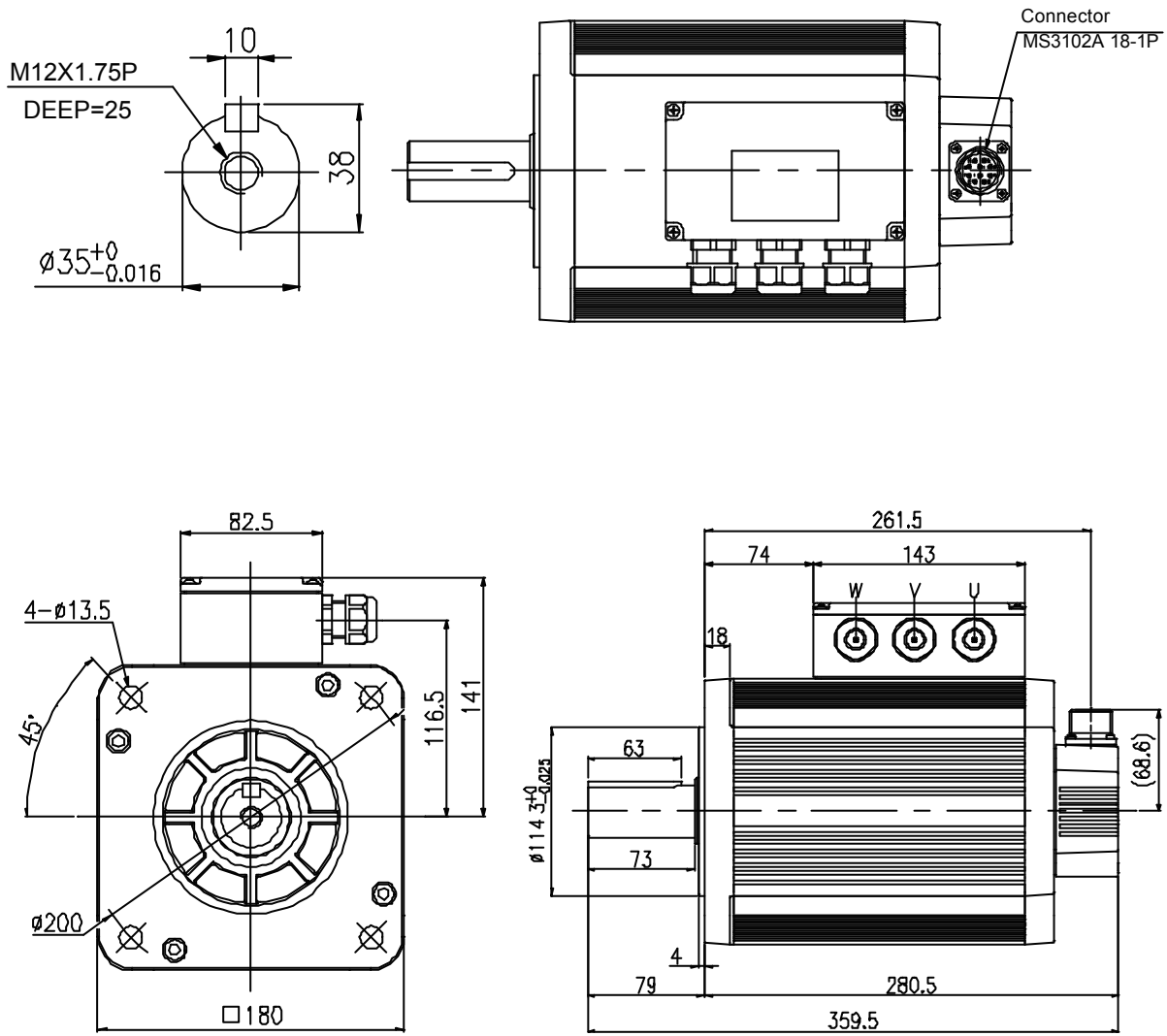


Fig 3

Model No. : BM-5000ES

Unit:mm

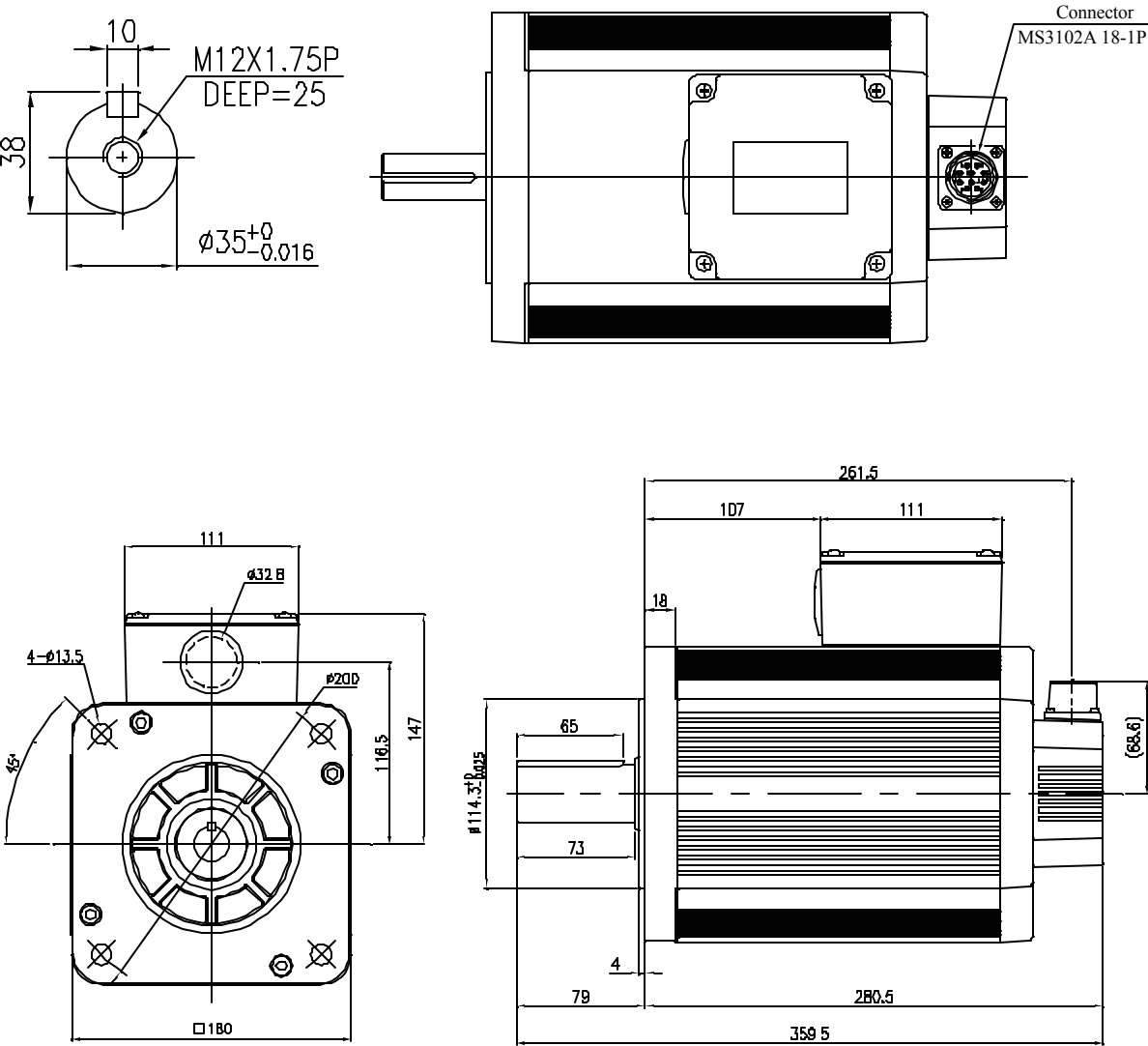


Fig 4

Model No. : BM-5000ER

Unit:mm

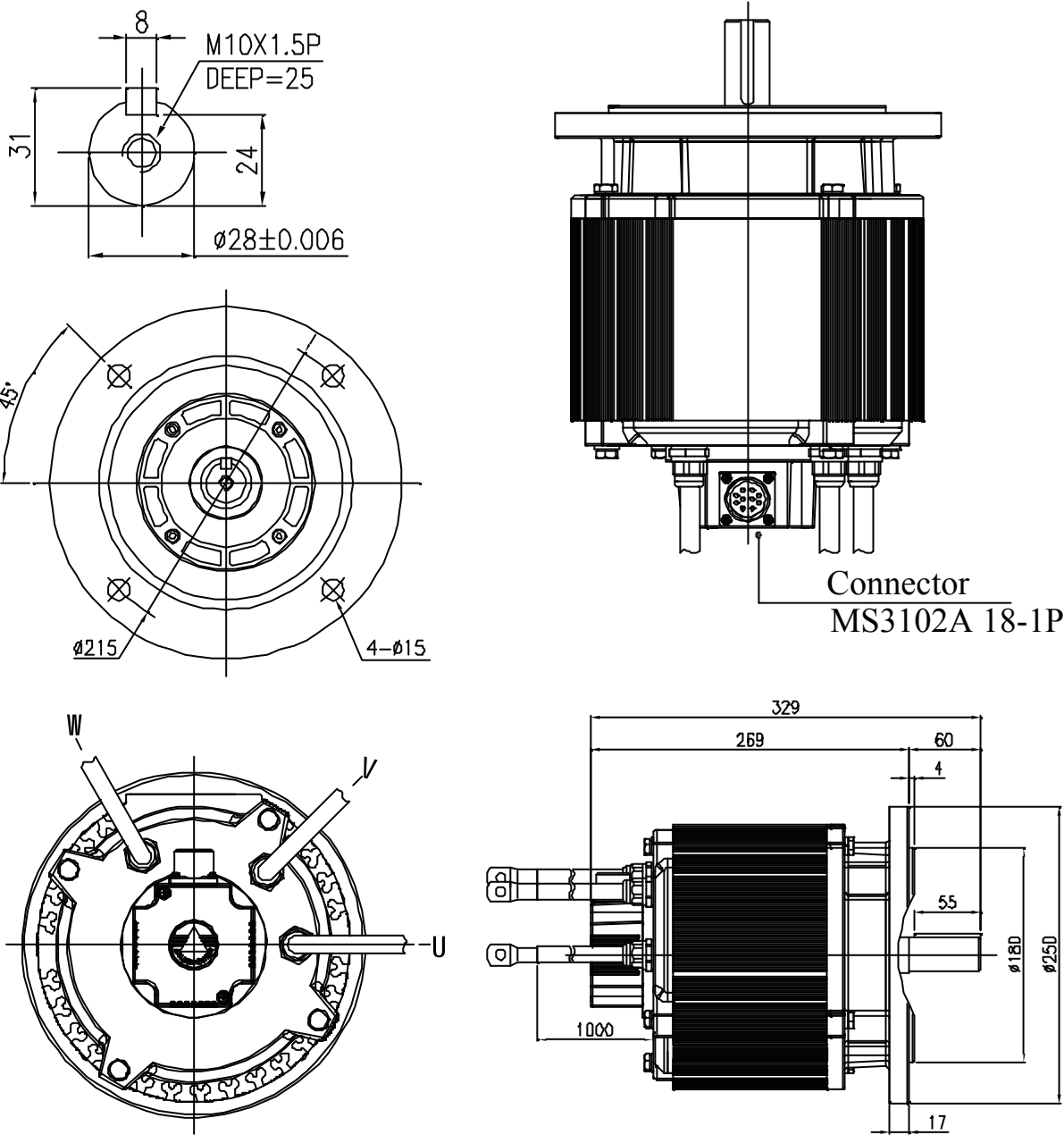


Fig 5

Model No. : BM-5500E

Unit:mm

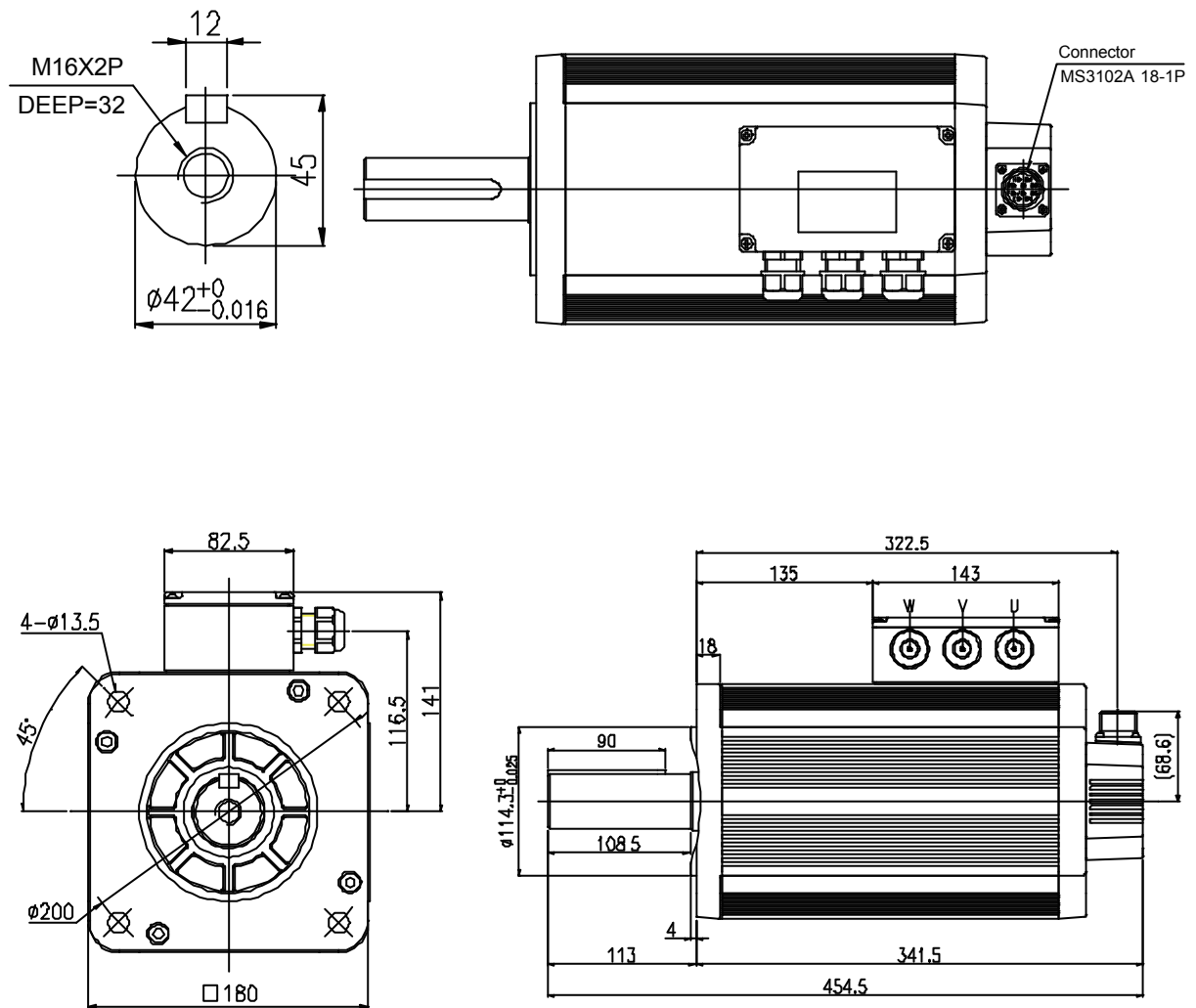


Fig 6

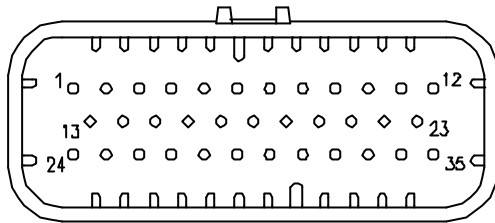
4. INSTALLATION

Installation condition for drive :

1. Well ventilation.
2. The drive should be fastened to clean, flat metal surface.
3. Posit in easy wiring and maintain place.
4. Avoid direct sunlight.
5. A thermal joint compound can be used to improve heat condition from the drive heat sink to the mounting surface.

5. DESCRIPTION OF TERMINALS & WIRING

(1) Terminal Diagram

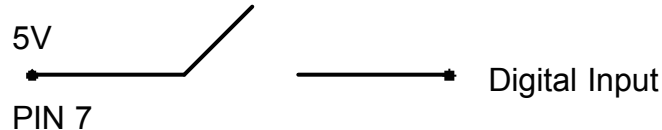


(1-1) High voltage circuit

Pin No.	NAME	DESCRIPTION
13/25	Coil Return	Main Relay, EM Brake Source Common
1	EM Brake	For EM Brake coil control
24	Main Relay	For Main Relay coil control
2	KSI	Drive control power key switch

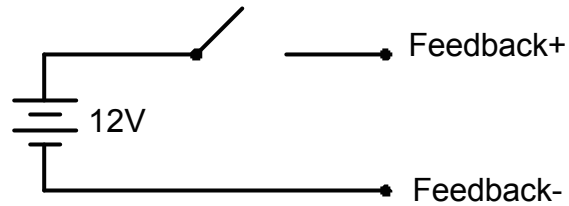
(1-2) Digital input

Wire



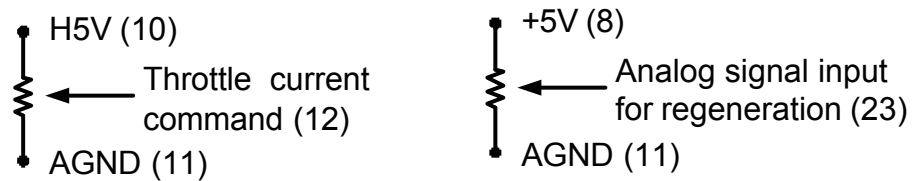
Pin No.	NAME	DESCRIPTION
26	InterLock	Operation enable
15	Clutch	For gear transmission with clutch
4	ECO	Economic mode switch
16	Reverse	Reverse run
27	Forward	Forward run
7	5V	External terminal control ground +
6	EXG	External terminal control ground -

Feedback wire



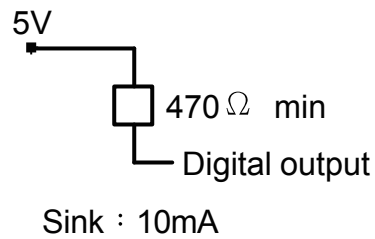
Pin No.	NAME	DESCRIPTION
3	Feedback+	Regeneration control +
14	Feedback-	Regeneration control -

(1-3) Analog input Wire



Pin No.	NAME	DESCRIPTION
8	+5V	Brake AD ground +
10	H5V	Throttle analog input ground +
11	AGND	Analog input ground -
12	TCMD	Throttle current command
23	Brake AD	Analog signal input for regeneration

(1-4) Digital output Wire



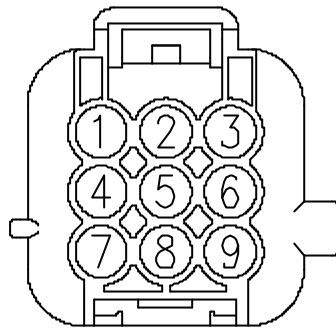
Pin No.	NAME	DESCRIPTION
5	Feedback LED	Regeneration status display
17	Buzzer Out	Connect buzzer
28	Alarm Out	Connect LED for alarm display
29	Speed Out	Speed out (open collector)128PPR

(1-5) Communication

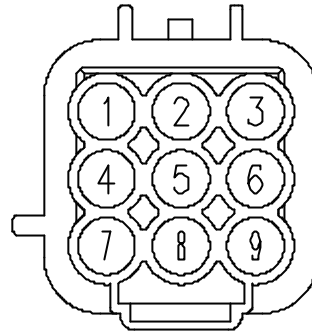
Pin No.	NAME	DESCRIPTION
31	S+	RS485 S+
19	S-	RS485 S-
18	CAN H	CAN H
30	CAN L	CAN L

(1-6) Motor waterproof connector (FW09FB-M) and counterparty (FW09MB-M) definition

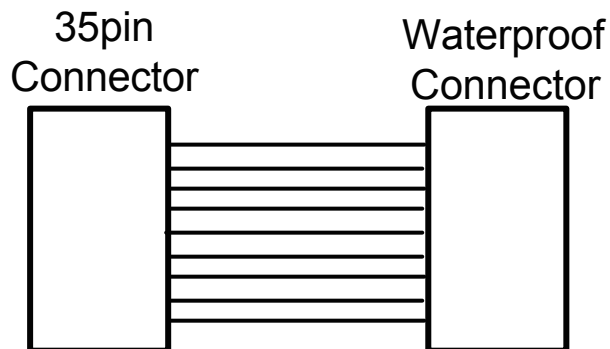
A. FW09FB-M



B. FW09MB-M



Note : Shielding ground connect with GND for EMS.



Pin No.	Sensor Name	Waterproof Connector
8	5VDC	1
9	GND	6
34	HA	3
22	HB	2
33	HC	5
21	A	7
32	B	8
20	Z	9
35	NTC+	4

(2) Wire Specification

(2-1) Input / output power cable (P_N_U_V_W)

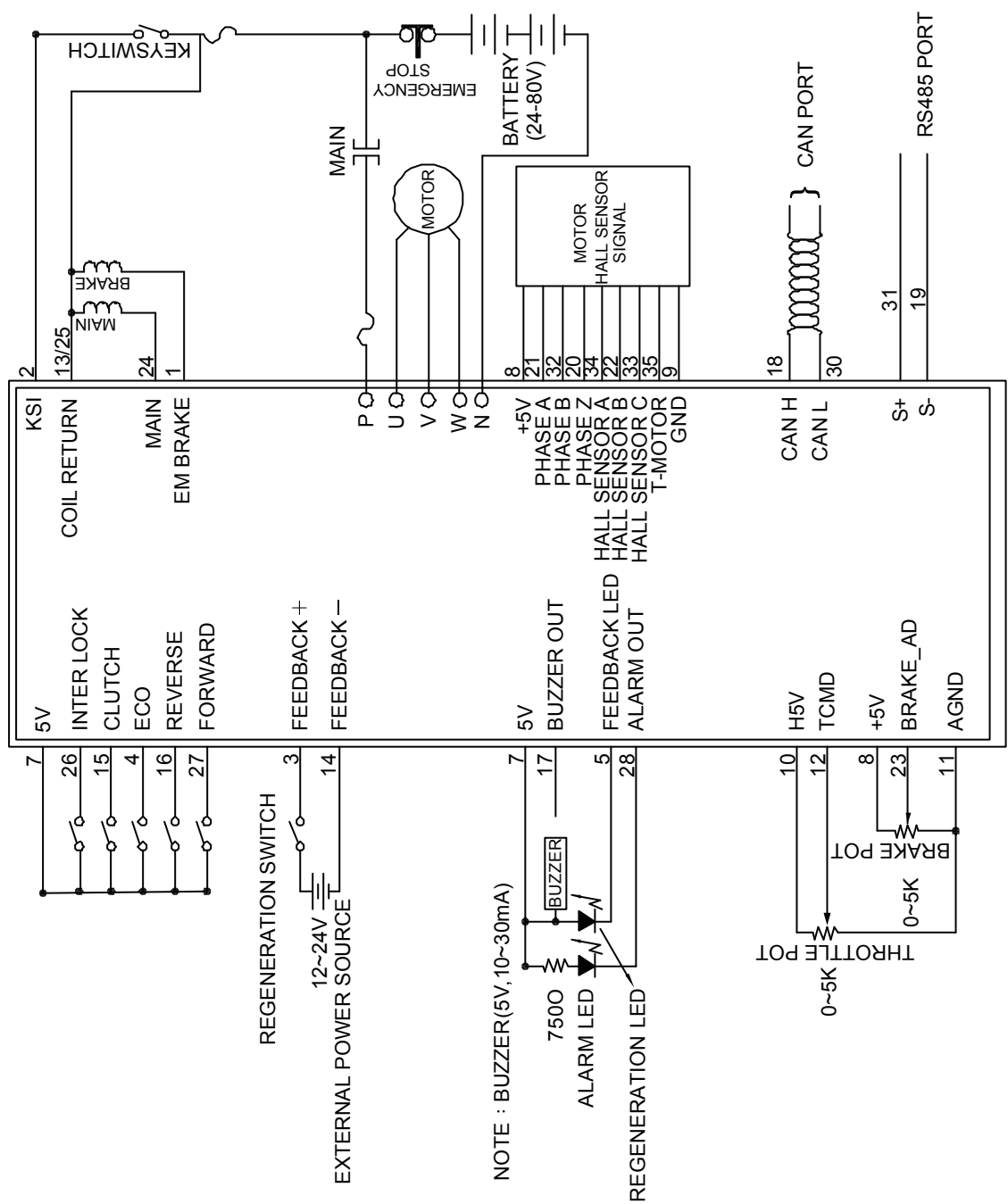
MODEL	WIRE SIZE	WIRE TYPE	TORQUE
SWAN9	2AWG (36.62mm ²)	Stranded copper only 300V/105°C	11N.m (95.65lb-in)

(2-2) External control cable (AMP770520-3)

Use AMP776164-1 housing

MODEL	WIRE SIZE	WIRE TYPE
SWAN9	16~22AWG (1.3mm ² ~0.32mm ²)	Stranded copper only 300V/105°C

(3) Wiring Diagram



6. DRIVE PARAMETER

	DISPLAY CODE	FUNCTION	ADJUST RANGE	DEFAULT VALUE	UNIT
General (7-1)					
	P1	Motor Mode Current Limit (PEAK)	10~320	320	A
	P9	Motor Mode Current Increasing Rate	0~5000	10	ms
	P11	Motor Lock Detect Speed	100~1000	100	RPM
	P12	ECO Mode 1 st Stage Current Limit	10~100	60	%
	P16	Motor Reverse Mode Current Limit	0~100	100	%
	P19	ECO Mode Current Limit Speed 1	0~100	45	%
	P20	ECO Mode 2 nd Stage Current Limit	10~100	60	%
	P21	ECO Mode Current Limit Speed 2			
	P25	Maximum Speed	1000~7200	6500	RPM
	P26	Motor Mode Current Decreasing Rate	0~5000	0	ms
	P27	Clutch Current	1~10	6	%
	P28	Clutch Time	1~30	1	SEC
	P32	Creep Torque (Current)	0~10	0	%
	P34	Creep Speed Limit	100~2000	500	RPM
	P43	Operation Command Source	0~1	0	
	P96	Machine Code			
	P97	Program Version			
★	P100	Motor Direction Definition	0~1	0	

	DISPLAY CODE	FUNCTION	ADJUST RANGE	DEFAULT VALUE	UNIT
★	P174	Standby Time	0~300	10	min
Battery Protection (7-2)					
★	P4	Battery Low Voltage Protection Level	36~60	44	V
★	P5	Battery Low Voltage Shut Down Level	36~60	41	V
★	P6	Battery Low Voltage Trip Monitoring Time	1~20	5	SEC
★	P13	Low Voltage Protection Current Limit	0~100	15	%
Regeneration Brake (7-3)					
★	P7	Maximum Generation Voltage	48~60	57	V
	P8	Maximum Generation Current (PEAK)	1~320	85	A
	P14	Generation Mode Current Increasing Rate	0~500	250	ms
	P17	Digital Regeneration Current	0~100	100	%
	P18	Coast Regeneration Current	0~100	10	%
	P33	EMBK Regeneration Current	0~100	100	%
★	P154	Coast Regeneration Minimum Speed	1~100	3	%RPM
Communication (7-4)					
	P40	Communication Mode Selection	0~1	1	

	DISPLAY CODE	FUNCTION	ADJUST RANGE	DEFAULT VALUE	UNIT
	P41	Communication Address	1~255	1	
	P42	Communication Speed Selection	0~2	0	
	P44	CAN ID	1~127	1	
EM Brake (7-5)					
★	P52	EM Brake Control Type	0~2	1	
	P53	EM Brake Pull in Voltage	0~100	60	%
	P54	EM Brake Holding Voltage	0~100	30	%
	P55	EM Brake Battery Voltage Compensation	0~1	1	
★	P56	EM Brake on Fault	0~1	1	
	P57	Speed Threshold	30~300	80	RPM
	P58	Release Delay	40~2000	100	msec
Main Contactor (7-6)					
	P60	Main Relay Pull in Voltage	0~100	60	%
	P61	Main Relay Holding Voltage	0~100	30	%
	P62	Main Relay Battery Voltage Compensated	0~1	1	
	P64	Main Relay OFF Delay Time	0~40	1	SEC
★	P65	Main Relay Check	0~1	1	
★	P66	Main DNC Threshold Voltage	0~84	1	V
★	P67	Main Capacitor Pre-charge	0~1	1	

	DISPLAY CODE	FUNCTION	ADJUST RANGE	DEFAULT VALUE	UNIT
Interlock (7-7)					
	P51	Sequencing Delay	0~5000	50	msec
★	P63	Source of Interlock Control	0~2	0	
★	P68	Interlock Regeneration Brake	0~1	1	
★	P69	Interlock Regeneration Time	0~8000	8000	msec
Vehicle (7-8)					
★	P80	Unit	0~1	1	
★	P81	Gear Ratio	100~20000	1200	0.01
★	P82	Tire Diameter	1~1000	520	0.1cm (inch)
	P83	Capture Speed 1	10~10000	3000	0.01km/hr (mile/hr)
	P84	Capture Speed 2	10~10000	5000	0.01km/hr (mile/hr)
	P85	Capture Distance 1	1~1000	1	m (0.001mile)
	P86	Capture Distance 2	1~1000	2	m (0.001mile)
	P87	Capture Distance 3	1~1000	3	m (0.001mile)
Motor Mode Throttle Map (7-9)					
★	P10	Throttle Polarity	0~1	0	
★	P159	Throttle Deadband Voltage	0~50	15	*0.1V
★	P160	Throttle Full Scale Voltage	0~50	40	*0.1V
★	P162	Throttle Knee Voltage	0~50	30	*0.1V

	DISPLAY CODE	FUNCTION	ADJUST RANGE	DEFAULT VALUE	UNIT
★	P163	Throttle Knee Current Command	0~100	80	%
Regeneration Mode (Brake AD) Analog Map (7-10)					
★	P210	Source of Brake Regeneration	0~1	1	
★	P211	Regeneration Maximum Current Command Reference	10~200	85	A
★	P212	Brake AD Deadband Voltage	0~50	15	*0.1V
★	P213	Brake AD Full Scale Voltage	0~50	40	*0.1V
★	P214	Brake AD Knee Voltage	0~50	30	*0.1V
★	P215	Brake AD Knee Current Command	0~100	80	%
★	P216	Brake AD Polarity	0~1	0	

★ : After modify parameter, please RE-POWER ON the drive.

7. PARAMETER DESCRIPTION

7-1. General

Motor Mode Current Limit (PEAK)
P1

Adjust Range	10~320A
Default Value	320A

In motor mode, the maximum current for driving at forward direction current.

Ex : P1=280, maximum output current is 280A (peak).

Note : This value means Sin-Wave peak value.

Motor Mode Current Increasing Rate
P9

Adjust Range	0~5000ms
Default Value	10ms

Slope of motor mode current which is increasing every 10A by P9 time.

Ex : P9=30 means 30ms for increasing 10A.

Motor Lock Detect Speed
P11

Adjust Range	100~1000RPM
Default Value	100RPM

P11=100, if TCMD $\geq$ 40% TCMDmax. and loading causes speed lower than P11 value. Drive execute lock protection function.

Note : TCMD max. is P157(Throttle Maximum Current Command Reference).

When motor lock time over 1 second, drive will change current limit to 80A. If motor at 80A still lock and last over 1 second, drive execute lock shut down function (motor current=0 A). Return accelerator to zero to reset lock shut down function.

If lock shut down function happens 3 times continuously, need to repower on to reset lock shut down function.

ECO Mode 1st Stage Current Limit
P12

Adjust Range	10~100%
Default Value	60%

Current = P12*P157.

Refer to P21.

P157 default value 320A.

Motor Reverse Mode Current Limit
P16

Adjust Range	0~100%
Default Value	100%

Current = P16*P157.

P157=280A, P16=90%, P157*P16=280*0.9=252A.

When motor is in reverse direction, drive maximum output current is 252A. Direction definition refer to P100. Factory setting CCW is forward direction. CCW is viewed at motor shaft.

ECO Mode Current Limit Speed 1
P19

Adjust Range	0~100%
Default Value	45%

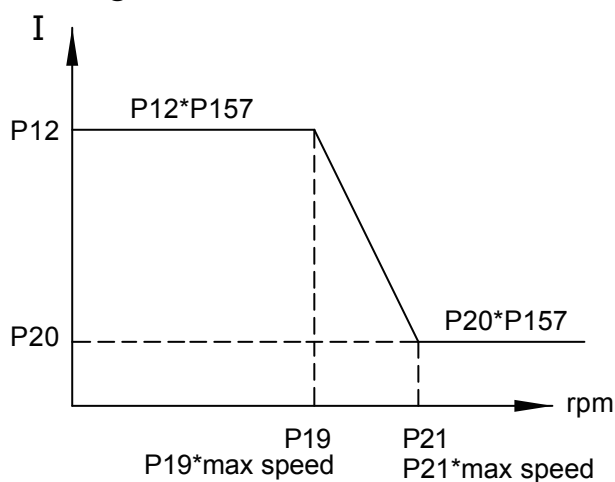
ECO Mode 2nd Stage Current Limit
P20

Adjust Range	10~100%
Default Value	60%

ECO Mode Current Limit Speed 2
P21

This parameter set by internal program only.

When terminal “ECO” is “ON”, drive will enter ECO mode. Current limit of drive is changed from P1 to P12 or P20.



Maximum Speed
P25

Adjust Range	1000~7200RPM
Default Value	6500RPM

When motor speed is over P25, drive will decrease current command automatically to maintain motor speed lower than P25.

Motor Mode Current Decreasing Rate
P26

Adjust Range	0~5000ms
Default Value	0ms

Motor current is reduced 10A by every P26 time when throttle is reduced or motor direction is changed.

- Note :
1. A higher value will cause the rider feel still accelerating.
 2. If the drive enter generation mode, then the drive does not execute deceleration time.

Clutch Current
P27

Adjust Range	1~10%
Default Value	6%

Current = P27*P157.

Clutch Time
P28

Adjust Range	1~30 SEC
Default Value	1 SEC

P27 and P28 is used for gear with clutch. Drive will run P27 command with P28 time, if throttle is returned to zero and terminal "CLUTCH" is "ON",

If "CLUTCH" is "OFF", but duration does not reach P28 time setting, drive will stop output.

If throttle is activated, drive will stop the "CLUTCH" function automatically and enter motor mode.

Creep Torque (Current)
P32

Adjust Range	0~10%
Default Value	0%

Drive in standby status, terminal "INTERLOCK" is "ON" and throttle is zero, drive will enter creep mode. Motor start to run and current command is $P32 \times P157$.

Creep Speed Limit
P34

Adjust Range	100~2000RPM
Default Value	500RPM

When motor speed is reached speed limit, drive will decrease current command automatically to maintain motor speed to be lower than P34.

Operation Command Source
P43

Adjust Range	0~1
Default Value	1

0 : Terminal control.
1 : CAN control.

Machine Code
P96

Read only.

Program Version
P97

Read only.

Motor Direction Definition
P100

Adjust Range	0~1
Default Value	0

0 : View at shaft, CCW is forward direction.
1 : View at shaft, CW is forward direction.
P100=0 : If terminal “REVERSE” is “ON”, then motor CW run and BUZZER is active (Bi-Bi-).

Standby Time
P174

Adjust Range	0~300min
Default Value	10min

When motor stop running over P174 setting time, the drive will enter sleep mode. Re-power ON to reset this protection.

7-2. Battery Protection

Battery Low Voltage Protection Level
P4

Adjust Range	36~60V
Default Value	44V

When battery voltage is lower than P4 and last 5 seconds, low battery protection function is activated. Drive change motor mode current limit from P1 to P13 and alarm LED and BUZZER are activated.

When battery voltage rise over P4+4 volt, drive reset the low battery protection function (alarm LED "OFF", current limit return to P1).

When battery voltage is lower than P4 for 5 seconds again, low battery protection function is activated again. Drive change motor mode current limit from P1 to P13 and alarm LED and BUZZER are activated.

Battery Low Voltage Shut Down Level
P5

Adjust Range	36~60V
Default Value	41V

Battery Low Voltage Trip Monitoring Time
P6

Adjust Range	1~20 SEC
Default Value	5 SEC

When battery voltage is lower than P5 and last P6 second, battery low voltage protection function is activated. Re-power ON to reset this alarm.

Low Voltage Protection Current Limit
P13

Adjust Range	0~100%
Default Value	15%

When drive's low voltage protection occur, drive change current limit from P1 to $P1 \times P13$.

7-3. Regeneration Brake

Maximum Generation Voltage
P7

Adjust Range	48~60V
Default Value	57V

Power generation affect battery voltage to be over P7 setting when drive is into generation mode (accelerator return to zero, press brake, interlock “OFF”). Drive will decrease generation current to maintain battery voltage at P7 voltage.

Maximum Generation Current (PEAK)
P8

Adjust Range	1~320A
Default Value	85A

Limit Maximum Generation Current.

Note : Limit motor phase current not bus current (recharge to battery). This value is peak value.

Generation Mode Current Increasing Rate
P14

Adjust Range	0~500ms
Default Value	250ms

Drive is in generation mode (accelerator return to zero, press brake, interlock “OFF”). Slope of generation mode current which is P14 ms increasing every 10A by P9 time.

Digital Regeneration Current
P17

Adjust Range	0~100%
Default Value	100%

Set P210=1 to select digital brake

Drive change motor mode to regeneration mode if throttle return to zero and terminal FEEDBACK is ON.

Final regeneration current limit :

Regeneration current = $P17 \times P211$, if $P17 \times P211 < P8$.

Regeneration current = $P8$, if $P17 \times P211 > P8$.

Coast Regeneration Current
P18

Adjust Range	0~100%
Default Value	10%

Drive change motor mode to regeneration mode if throttle return to zero and motor speed over P154.

Final regeneration current limit :

Regeneration current = $P18 \times P211$, if $P18 \times P211 < P8$.

Regeneration current = $P8$, if $P18 \times P211 > P8$.

EMBK Regeneration Current
P33

Adjust Range	0~100%
Default Value	100%

Drive will enter generation mode if terminal “INTERLOCK” is “OFF”.

Final regeneration current limit :

Regeneration current = $P33 \times P206$, if $P33 \times P206 < P8$.

Regeneration current = $P8$, if $P33 \times P206 > P8$.

Coast Regeneration Minimum Speed
P154

Adjust Range	1~100%RPM
Default Value	3%RPM

Coast Regeneration mode is activated, if motor speed is greater than $P154 \times 7200\text{RPM}$. Refer to P18 description.

7-4. Communication

Communication Mode Selection
P40

Adjust Range	0~1
Default Value	1

0 : PC.

1 : RS485 interface (protocol MODBUS).

Communication Address
P41

Adjust Range	1~255
Default Value	1

Set MODBUS ID.

Communication Speed Selection
P42

Adjust Range	0~2
Default Value	0

Set MODBUS speed.

0 : 9600bps.

1 : 19200bps.

2 : 38400bps.

Note : Character format only 8, N,1.

CAN ID
P44

Adjust Range	1~127
Default Value	1

7-5. EM Brake

EM Brake Control Type
P52

Adjust Range	0~2
Default Value	1

0 : EM Brake disable.

1 : EM Brake controlled by interlock.

The drive will command the EM Brake to release if the interlock is closed (interlock=ON).

The drive will stop the motor by regeneration brake if the interlock is opened and motor speed is greater than P57.

Once the motor speed is lower than P57, the drive will command the EM Brake to lock.

2 : EM Brake controlled by interlock or neutral.

Either the interlock opened or neutral condition happened, the drive will stop motor and command the EM Brake to lock. The stop or lock behavior is same as 1.

Neutral condition : Throttle return to zero or both “Reverse” and “Forward” terminal are ON or OFF.

EM Brake Pull in Voltage
P53

Adjust Range	0~100%
Default Value	60%

The EM Brake pull in voltage allows a high initial voltage when the EM Brake first turns on, to ensure brake release. After 1 second, this peak voltage drops to the EM Brake holding voltage. The EM Brake holding voltage must be set high enough to hold the brake released under all shock and vibration conditions of the vehicle.

Pull in Voltage = $V_{bus} \times P53\%$.

EM Brake Holding Voltage
P54

Adjust Range	0~100%
Default Value	30%

Refer to P53.

Holding Voltage = $V_{bus} \times P54\%$.

EM Brake Battery Voltage Compensation
P55

Adjust Range	0~1
Default Value	1

0 : OFF.

1 : ON. (with compensation)

Only EM Brake Holding Voltage is compensated. When battery voltage is low, P55=1, the drive will compensate EM Brake holding voltage.

EX : Nominal voltage=48V,

EM Brake holding voltage=75%(48*0.75=36V),

If battery voltage is 40V, the EM Brake holding voltage is :

P55=0 : EM Brake holding voltage=40*0.75=30V

P55=1 : EM Brake holding voltage=36V (PWM=90%)

EM Brake on Fault
P56

Adjust Range	0~1
Default Value	1

0 : OFF. (Fault took place, EM Brake is not effect.)

1 : ON. (EM Brake will lock when fault took place.)

Speed Threshold
P57

Adjust Range	30~300RPM
Default Value	80RPM

The EM Brake active speed, refer to P52.
Setting this speed too high may cause a jerky stop.

Release Delay
P58

Adjust Range	40~2000msec
Default Value	100msec

After EM Brake is released, drive will delay P58 time to active throttle command.

7-6. Main Contactor

Main Relay Pull in Voltage
P60

Adjust Range	0~100%
Default Value	60%

Pull in Voltage = $V_{bus} \times P60$.

The main relay pull in voltage allows a high initial voltage when the main relay first turns on, to ensure main relay contacting. After 1 second, this peak voltage drops to the main relay holding voltage. The main relay holding voltage must be set high enough to holding the main relay contacting tightly under all shock and vibration conditions of the vehicle.

Main Relay Holding Voltage
P61

Adjust Range	0~100%
Default Value	30%

Refer to P60.

Holding Voltage = $V_{bus} \times P61$.

Main Relay Battery Voltage Compensation
P62

Adjust Range	0~1
Default Value	1

0 : OFF.

1 : ON. (with compensation)

Only Main Relay Holding Voltage is compensated. When battery voltage is low, P62=1, then drive will compensate Main Relay Holding Voltage.

EX : Nominal voltage=48V,

Main Relay Holding Voltage=75% ($48 \times 0.75 = 36V$),

If battery voltage is 40V, the Main Relay Holding Voltage is :

P62=0 : Main Relay Holding Voltage= $40 \times 0.75 = 30V$

P62=1 : Main Relay Holding Voltage=36V (PWM=90%)

Main Relay OFF Delay Time
P64

Adjust Range	0~40 SEC
Default Value	1 SEC

Active by P63=0

When interlock opens, the drive will delay P64 second and then turn the Main Relay “OFF”.

Main Relay Check
P65

Adjust Range	0~1
Default Value	1

0 : Disable.

1 : Check to ensure that the Main Relay closes properly each time it is commanded to close, and that it has not welded closed.

The welded closed check is activated when P63=0.

Main DNC Threshold Voltage
P66

Adjust Range	0~1000
Default Value	10
Unit	0.1V

When P65 set 1, this parameter is used as the threshold voltage for detecting a Main Relay not close properly fault. The main DNC threshold voltage is the minimum voltage difference between the key switch and capacitor voltages. When the voltage difference is greater than this voltage, a poor contact fault will be occurred.

Main Capacitor Pre-charge
P67

Adjust Range	0~1
Default Value	1

0 : Disable.

1 : The drive provides a limited current to charge the drive's internal capacitor bank before the Main Relay is closed. This decreases the arcing that would otherwise occur when the relay is closed with a capacitor bank discharge.

7-7. Interlock

Sequencing Delay
P51

Adjust Range	0~5000msec
Default Value	50msec

This function is special designed in application when the interlock switch is bounce.

Source of Interlock Control
P63

Adjust Range	0~2
Default Value	0

0 : Terminal "INTERLOCK".

1 : Reserve.

2 : KSI (Key Switch).

Interlock Regeneration Brake
P68

Adjust Range	0~1
Default Value	1

0 : OFF.

When interlock signal OFF (Interlock Terminal = OFF), the drive will command motor to free run to stop after execute sequencing delay.

1 : ON.

When interlock signal OFF (Interlock Terminal = OFF), the drive will enter generation mode to stop the motor (vehicle).

Interlock Regeneration Time
P69

Adjust Range	0~8000msec
Default Value	8000msec

Drive controls the maximum allowable duration of an Interlock Regeneration event. The timer starts as soon as the interlock signal is OFF. If the time expires before the motor speed has slowed below P57, the EM Brake will engage to stop motor automatically.

7-8. Vehicle

All the outputs of vehicle parameters are read by communication (PC terminal or MODBUS RTU). Please refer to communication chapter.

Unit
P80

Adjust Range	0~1
Default Value	1

0 : English system.
1 : Metric system.

Gear Ratio
P81

Adjust Range	100~20000
Default Value	1200
Unit	0.01

Ex : Gear Ratio is 10. P81 setting is 1000 ($10/0.01=1000$).

Tire Diameter
P82

Adjust Range	1~1000
Default Value	520
Unit	0.1cm (Metric) 0.1inch (English)

Convert motor speed to vehicle speed.

The vehicle speed is stored at address 320, when power OFF, the record will disappear.

EX : Vehicle speed(metric)=(RPM/(60*G))*(3.1416*d)/100*3.6km/H .
G=P81, d=P82

Capture Speed 1
P83

Adjust Range	10~10000
Default Value	3000
Unit	0.01km/hr (Metric) 0.1mile/hr (English)

The drive captures the time which takes the vehicle to go from 0 km/hr to the Capture Speed 1(P83). The result is stored at address 324. When power OFF, the record will disappear.

Capture Speed 2
P84

Adjust Range	10~10000
Default Value	5000
Unit	0.01km/hr (Metric) 0.1mile/hr (English)

The drive captures the time which takes the vehicle to go from 0 km/hr to the Capture Speed 2(P84). The result is stored at address 325. When power OFF, the record will disappear.

Capture Distance 1
P85

Adjust Range	1~1000
Default Value	1
Unit	m (Metric) 0.001mile (English)

The drive captures the time which takes the vehicle to go from stop to the Capture Distance 1(P85). The result is stored at address 326. When power OFF, the record will disappear.

Capture Distance 2
P86

Adjust Range	1~1000
Default Value	2
Unit	m (Metric) 0.001mile (English)

The drive captures the time which takes the vehicle to go from stop to the Capture Distance 2(P86). The result is stored at address 327. When power OFF, the record will disappear.

Capture Distance 3
P87

Adjust Range	1~1000
Default Value	3
Unit	m (Metric) 0.001mile (English)

The drive captures the time which takes the vehicle to go from stop to the Capture Distance 3(P87). The result is stored at address 328. When power OFF, the record will disappear.

7-9. Motor Mode Throttle Map

Throttle Polarity
P10

Adjust Range	0~1
Default Value	0

P10=0 : Throttle=1~4V means 0~P157 (TCMDmax.)

P10=1 : Throttle=4~1V means 0~P157 (TCMDmax.)

Throttle Deadband Voltage
P159

Adjust Range	0~50
Default Value	15
Unit	0.1V

$V = P159 \times 0.1V$.

This parameter is used for throttle command which initial position voltage is not zero.

Throttle Full Scale Voltage
P160

Adjust Range	0~50
Default Value	40
Unit	0.1V

$V = P160 \times 0.1V$.

This parameter is used for full throttle command which can not reach 5V.

Throttle Knee Voltage
P162

Adjust Range	0~50
Default Value	30
Unit	0.1V

$$V = P162 \times 0.1V.$$

This parameter is used to change the current command pattern in motor mode.

Throttle Knee Current Command
P163

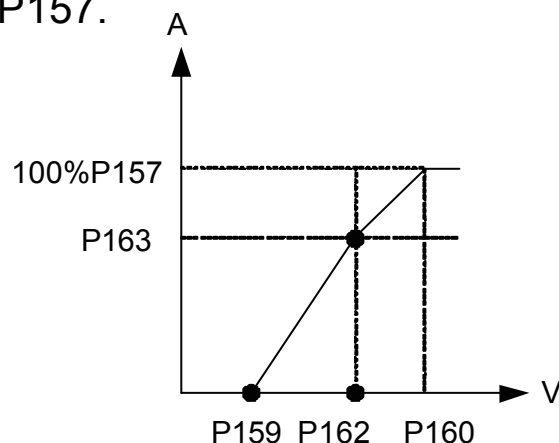
Adjust Range	0~100%
Default Value	80%

$$\text{Current} = P163 \times P157.$$

Throttle Current Command has 2 stages.

1st stage : P159(Throttle Deadband Voltage)~P162(Throttle Knee Voltage) correspond to 0~P163(Throttle Knee Current Command).

2nd stage : P162~P160(Throttle Full Scale Voltage) correspond to P163~P157.



7-10. Regeneration Mode (Brake AD) Analog Map

Source of Brake Regeneration
P210

Adjust Range	0~1
Default Value	1

0 : Analog : Controlled by terminal "BRAKE AD".

1 : Digital : Controlled by terminal "FEEDBACK".

Regeneration Maximum Current Command Reference
P211

Adjust Range	10~320A
Default Value	85A

Define the peak current reference of full Brake AD(100%)
Regeneration Current command.

Brake AD Deadband Voltage
P212

Adjust Range	0~50
Default Value	15
Unit	0.1V

$V = P212 \times 0.1V$.

This parameter is used for Brake AD command which initial
position voltage is not zero.

Brake AD Full Scale Voltage
P213

Adjust Range	0~50
Default Value	40
Unit	0.1V

$V = P213 \times 0.1V$.

This parameter is used for full Brake AD command which can not reach 5 voltage.

Brake AD Knee Voltage
P214

Adjust Range	0~50
Default Value	30
Unit	0.1V

$V = P214 \times 0.1V$.

This parameter is used to change the current command pattern in regeneration mode.

Brake AD Knee Current Command
P215

Adjust Range	0~100%
Default Value	80%

$\text{Current} = P215 \times P211$.

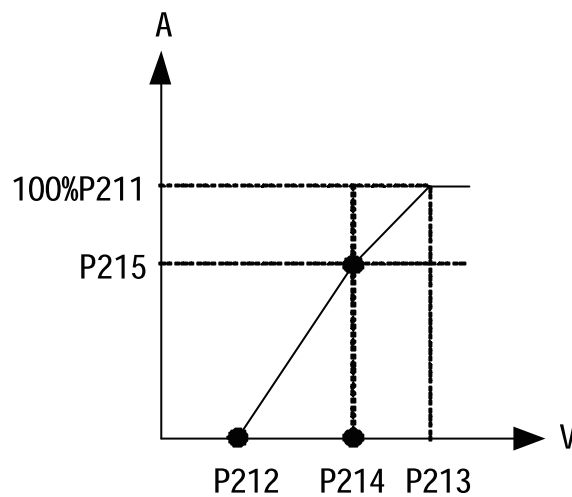
Brake AD Regeneration Current command has 2 stages.

1st stage :

P212(Brake AD Deadband Voltage)~P214(Brake AD Knee Voltage) correspond to 0~P215(Brake AD Knee Current Command).

2nd stage :

P214~P213(Brake AD Full Scale Voltage) correspond to P215~P211.



Brake AD Polarity
P216

Adjust Range	0~1
Default Value	0

0 : Brake AD=1~4V means 0~P211.

1 : Brake AD=4~1V means 0~P211.

8. COMMUNICATION

1. PC Terminal (P40=0)

A. Read Alarm Code and Definition

- Read 8 alarm code : key in AT ? then press ENTER.
- Read any alarm code : key in AT X then press ENTER (X=0~7).

X=0 : show last 1st alarm code

X=1 : show last 2nd alarm code

Note : Once communication connection success, the promote chart ">" will show up. Key in communication command after ">".

B. Clear Alarm Trace

Key in AT CC then press ENTER.

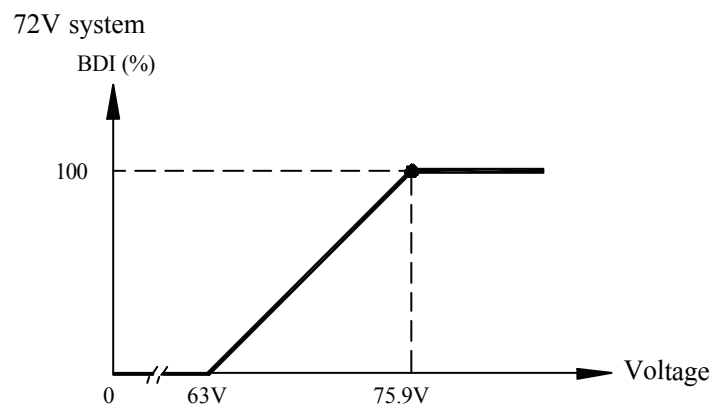
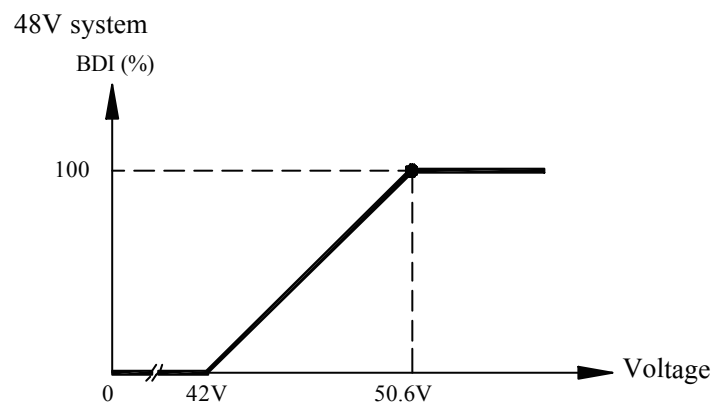
C. Monitor Parameter

Key in AT X , then press ENTER.

X	NAME	DESCRIPTION
S	Speed	1. Motor speed (RPM) 2. Vehicle speed (km/H or mile/H)
V	Voltage	1. Battery voltage (V) 2. BDI (refer to note)
M	Mode	Mode display : Normal, ECO, Generation
W	How	Run or halt
C	Current	
CC	Current Command	
CL	Current Limit	
DEFAULT		Parameter default to factory set
PASSWORD xxxx	Password	Key in password
T	Odometer	Vehicle odometer (km or mile)
TR 0	Start Capture	Start to capture TS&TD(324~328) record
TR 1	Finish Capture	Finish to capture TS&TD(324~328) record
TS	Capture Speed	Display TS1(324) and TS2(325) (second)
TD	Capture Distance	Display TD1(326), TD2(327) and TD3(328) (second)
AT	Alarm Trace	Show all alarm trace

X	NAME	DESCRIPTION
AT x	Alarm Trace	x=0~7 AT 0 show alarm trace 0 AT 7 show alarm trace 7
AT CC	Clear All Alarm Trace	Clear all alarm trace
?	Help	Show all command
?P	Parameter List	Show all parameter and adjust range

Note : BDI (Battery Discharge Indicator) for lead acid battery.



D. Modify Parameter

Key in P nn XX , then press ENTER.

nn : Parameter no.

XX : Setting value.

EX : Change P1 value to 130

>P 1 130 , then press ENTER

E. Read Parameter

Key in P nn , then press ENTER.

nn : Parameter no.

EX : Read P 11 value,

> P 11, then press ENTER, then P11 content value
show up.

2. MODBUS RTU (P40=1)

A. Character Format

8,N,1 RTU (1 start bit+8 data bits+1 stop bit)

8,N,1 RTU (10-bit)(character frame in hexadecimal)

Start bit	0	1	2	3	4	5	6	7	Stop bit
--------------	---	---	---	---	---	---	---	---	-------------

B. Communication Protocol (data contents are in hexadecimal with postive and negative format.)

Start	A silent interval of more than 10ms
Address	8-bit Address
Function	8-bit Command
Data (n-1)	Contents of Data : n*8-bit data, $n \leq 16$
...	
Data 0	
CRC CHK Low	Check Sum (CRCL)
CRC CHK High	Check Sum (CRCH)
End	A silent interval of more than 10ms

C. CRC(Cyclical Redundancy Check) is calculated by the flowing steps :

Step 1. Load a 16-bit register (called CRC register) with FFFFH .

Step 2. Exclusive OR the first 8-bit byte of the command message with the low order byte of the 16-bit CRC register, putting the result in the CRC register.

Step 3. Shift the CRC registers one bit to the right with MSB zero filling.
Extract and examine the LSB.

Step 4. If the LSB of CRC register is 0, repeat step 3, else Exclusive OR the CRC register with the polynomial value A001H .

Step 5. Repeat step 3 and 4 until eight shifts have been performed. When this is done, a complete 8-bit byte will have been processed.

Step 6. Repeat step 2 to 5 for the next 8-bit byte of the command message. Continue doing this until all bytes have been processed. The final contents of the CRC register are the CRC value.

D. Read Drive's Setting	
Inquire	
D1. Communication Address	(00~FFH)
D2. Function Code	(03H)
D3. Parameter Number (H)	(00~FFH)
D4. Parameter Number (L)	(00~FFH)
D5. Quantity of Parameter (H)	(00H)
D6. Quantity of Parameter (L)	(00~10H)
D7. CRCL	CRCL
D8. CRCH	CRCH
Respond	
D1. Communication Address	(00~FFH)
D2. Function Code	(03H)
D3. Quantity of Parameter	(00~20H)
D4. Content of Data (H) of Inquire Parameter Number	(00~FFH)
D5. Content of Data (L) of Inquire Parameter Number	(00~FFH)
.....	
Dn-1	CRCL
Dn	CRCH

E. Write Drive's Setting	
Inquire	
D1. Communication Address	(00~FFH)
D2. Function Code	(06H)
D3. Parameter Number (H)	(00~FFH)
D4. Parameter Number (L)	(00~FFH)
D5. Quantity of Parameter (H)	(00~FFH)
D6. Quantity of Parameter (L)	(00~FFH)
D7. CRCL	CRCL
D8. CRCH	CRCH
Respond	
D1. Communication Address	(00~FFH)
D2. Function Code	(06H)
D3. Quantity of Parameter (H)	(00~FFH)
D4. Quantity of Parameter (L)	(00~FFH)
D5. Content of Data (H) of Inquire Parameter Number	(00~FFH)
D6. Content of Data (L) of Inquire Parameter Number	(00~FFH)
D7. CRCL	CRCL
D8. CRCH	CRCH

F. MODBUS Parameters

DECIMAL ADDRESS	HEX ADDRESS	R/W	
300	12CH	R	Speed(RPM) ; Unit 0.1RPM
301	12DH	R	Voltage(Volt) ; Unit : 1V
302	12EH	R	Mode 0 : Normal 1 : ECO 2 : Generation
303	12FH	R	Operate condition 0 : Error 1 : FWD 2 : REV 3 : STOP
304	130H	R	Current(Amp) ; Unit : 1A
305	131H	R	Current command(Amp) ; Unit : 1A
306	132H	R	Current limit(Amp) ; Unit : 1A
307	133H	W	Password
308	134H	W	0 : No function 1 : Default
320	140H	R	Vehicle speed display ; Unit : 0.1km/H or mile/H
321	141H	R	Vehicle odometer : Vehicle distance traveled, address 321 in units of 10miles or 10km ; address 322 in units of 0.001 miles or 1m ; maximum value of address 321 & 322 is 9999. After 9999 will return to 0. Note : Only command=0 and motor stop. MCU saved odometer data to EEPROM. It will lost data, if power shut down suddenly when in run status.
322	142H	R	
323	143H	R	BDI battery discharge indicator 0~100% ; Unit : 1%
324	144H	R	TS1, time between 0 to P83 speed. (0.1SEC)
325	145H	R	TS2, time between 0 to P84 speed. (0.1SEC)

DECIMAL ADDRESS	HEX ADDRESS	R/W	
326	146H	R	TD1, time between 0 to P85 distance. (0.1SEC)
327	147H	R	TD2, time between 0 to P86 distance. (0.1SEC)
328	148H	R	TD3, time between 0 to P87 distance. (0.1SEC)
329	149H	R/W	Address 329=1 : start to capture 324~328 records When throttle voltage is over P159 (Throttle Deadband Voltage), the drive start to count the time which vehicle spent from 0 to TS1, TS2, TD1, TD2, TD3. The record is saved at address 324, 325, 326, 327, 328. Address 329=0 : finish capture function Note 1 : Set address 329 to 0. Then set address to 1 to re-capture the record. Note 2 : Modify P80(System Unit), P81(Gear Ratio), P82(Tire Diameter). Need to repower "ON".
330	14AH	R	Alarm trace 0 (Newest alarm record)
331	14BH	R	Alarm trace 1
332	14CH	R	Alarm trace 2
333	14DH	R	Alarm trace 3
334	14EH	R	Alarm trace 4
335	14FH	R	Alarm trace 5
336	150H	R	Alarm trace 6
337	151H	R	Alarm trace 7
338	152H	W	Clear all alarm trace 0 : No function 1 : Clear

3. CAN Control

Bitrate : 500Kbit/sec.

Endian : Little Endian.

A. CCU (Car Control Unit)

COB-ID : 0x010 Cycle Time 50ms

Position	Name	Formula	Adjust Range	Resolution	Unit	Description
Byte 0	Bit 0	Servo ON 0 : Lock 1 : UnLock	--	–	–	0 : Servo OFF 1 : Servo ON
	Bit 1	Forward 0 : Off 1 : On	--	–	–	Bit 1 Bit 2 Status
						0 0 Neutral
						1 0 FWD
	Bit 2	Backward 0 : Off 1 : On	--	–	–	Bit 1 Bit 2 Status
						0 1 REV
						1 1 Stop
	Bit 3	Brake 0 : Off 1 : On	--	–	–	0 : No brake action 1 : Brake action
Byte 1	Current command-L byte		0~320	1	A	If current command=320A(0140H) Byte 1 : 40H Byte 2 : 01H
Byte 2	Current command-H byte					

B. MCU (Motor Control Unit)
COB-ID : 0x011 Cycle Time 50ms

Position	Name	Formula	Adjust Range	Resolution	Unit	Description
Byte 0	Bit 0 Servo ON	0 : Lock 1 : UnLock	--	--	--	0 : Servo OFF 1 : Servo ON
	Bit 1 Operation status	0 : STOP 1 : RUN	--	--	--	0 : Stop 1 : Run
	Bit 2 Motor mode	0 : Motor Mode 1 : Generation Mode	--	--	--	0 : Motor Mode 1 : Generation Mode
	Bit 3 Feedback signal	0 : Off 1 : On	--	--	--	0 : Feedback switch OFF 1 : Feedback switch ON
	Bit 4 Motor direction Lb	00 : Neutral 01 : FWD 10 : REV	--	--	--	00 : Neutral 01 : FWD 10 : REV
	Bit 5 Motor direction Hb					
	Bit 6	0				
	Bit 7	0				
Byte 1	Motor speed	Data*50	0~255	50	rpm	Speed range : 0~12750rpm
Byte 2	Motor temperture	Data-40	0~255	1	℃	Data=0 : -40℃
Byte 3	Drive temperture	Data-40	0~255	1	℃	Data=140 : 100℃
Byte 4	Current command - L byte		0~320	1	A	
Byte 5	Current command -H byte					

Position	Name	Formula	Adjust Range	Resolution	Unit	Description
Byte 6	Every bit represent one protection function in Byte 6 & Byte 7					0 : Normal 1 : Protection active
	Bit 0	Motor Lock	0 : False 1 : True			
	Bit 1	Over Current	0 : False 1 : True			
	Bit 2	Low Voltage Protection	0 : False 1 : True			
	Bit 3	Vehicle Long Time Idle	0 : False 1 : True			Idle over 10min
	Bit 4	Driver Overheat	0 : False 1 : True			
	Bit 5	Motor Overheat	0 : False 1 : True			
	Bit 6	Encoder Signal Error	0 : False 1 : True			Hu=Hv=Hw=H or L
	Bit 7	Power On if Throttle Is Not at Zero Position	0 : False 1 : True			
Byte 7	Bit 0	EEPROM Error	0 : False 1 : True			
	Bit 1	Current Sensor Error	0 : False 1 : True			
	Bit 2	CANBUS Open Circuit	0 : False 1 : True			
	Bit 3	Main Contactor Poor Contact	0 : False 1 : True			
	Bit 4	Main Contactor Welded	0 : False 1 : True			
	Bit 5					
	Bit 6					
	Bit 7					

9. REPAIRING AND MAINTENANCE

1. Turn off the power and wait for 5 minutes before inspection and maintenance.
2. Only the qualified professional engineers can do repairing and maintenance work.
3. Take off the watches, rings or any other metal accessories before repairing and maintenance, and use insulating measure tools.
4. Please make a static electricity protection to prevent damage the drive inner precision parts.
5. DO NOT use water, solvent or volatilizable liquor to clean drive. Please use dry clothes to clean stain or use compressed air to clean dirt.
6. Please contact agent or ADLEEPOWER® when you cannot obviate problems.
7. Recommend check list for maintenance.
 - a. Ambient condition around the drive. Checking the ambient temperature, vibration, humidity and any oil, gas, dust or water drops.
 - b. Check if there is any missing or loose screw.
 - c. Check if the magnetic contactor relay work correctly.
 - d. Check cooling system if there is any obstruction in the heat sink, air intake or air outlet.

10. TROUBLE SHOOTING

(1) Alarm LED Display & Buzzer

	CONDITION	ALARM LED	BUZZER	NOTE
1	Key On	X	BI-BIBI	
2	Motor Reverse	X	BI-BI	
3	Low Voltage Alarm	Flash	BI--(6 times)	
4	Motor / Drive Overheat Alarm	Flash	BI--(6 times)	
5	Motor Lock	Light	BI-BI(2 times)	
6	Motor Lock 3 Times Within 1 Minute	Light	BIBIBI	
7	Low Voltage Shutdown	Light	BIBIBI	
8	Encoder Signal Error	Light	BIBIBI	
9	Motor / Driver Overheat Shutdown	Light	BIBIBI	
10	Power On if Accelerator Is Not at Zero Position	Light	X	
11	Current Signal Offset Fail	Light	BIBIBI	
12	Over Current Shutdown	Light	BIBIBI	
13	Throttle Signal Break	Light	BIBIBI	
14	Vehicle Long Time Idle	Flash	BI-BI--(2 minutes)	After 2 minutes alarm LED light on
15	Motor or Drive Temperature Sensor Open Circuit	Flash	BI-BI--continuous	
16	Over Load	Flash	X	
17	Main Contactor Poor Contact	Light	BIBIBI	
18	Main Contactor Welded	Light	BIBIBI	

(2) Alarm Code

ALARM CODE	DEFINITION
01	EEPROM Error
02	Current Sensor Error
03	Over Current
04	Encoder Signal Error
05	Driver Overheat
06	Motor Overheat
07	Low Voltage Protection
08	Motor Lock
09	Power On if Throttle Is Not at Zero Position
11	Throttle Signal Break
12	Vehicle Long Time Idle
13	Drive or Motor Temperature Sensor Open Circuit
16	Over Load
18	Main Contactor Poor Contact
19	Main Contactor Welded

(3) Alarm Trouble Shooting

	ALARM CODE	MESSAGE	SUGGESTED REMEDY
1		Low Voltage Alarm	Battery low SOC : Charge battery
2		Motor / Driver Overheat Alarm	Reduced load or take a rest
3	01	EEPROM Error	Return to factory
4	02	Current Sensor Error	Return to factory
5	03	Over Current Shutdown	Repower on. If fault do not reset contact factory.
6	04	Encoder Break	Return to factory
7	05/06	Motor / Driver Overheat Shutdown	Take a rest and repower on to reset alarm
8	07	Low Voltage Shutdown	Charge battery and repower on to reset alarm
9	08	Motor Lock	Released by throttle to reset
10	08	Motor Lock 3 Times Within 1 Minute	Repower on to reset alarm
11	09	Power On if Throttle Is Not At Zero Position	Released by throttle to reset
12	11	Throttle Fail	Check throttle wiring broken or not
13	12	Vehicle Long Time Idle	Repower on to reset alarm
14	13	Motor or Drives Temperature Sensor Open Circuit	Return to factory
15	18	Main Conactor Poor Contact	1. Check main contactor. 2. Replace main contactor.
16	19	Main Contactor Welded	

11. SYMBOL DESCRIPTION

NAME	DESCRIPTION	NAME	DESCRIPTION
AT	Alarm Trace	S	Speed
AT CC	Clear All Alarm Trace		
Brake AD	Analog Signal Input for Regeneration	TCMD	Current command
BDI	Battery Discharge Indicator	TCMDmax.	Throttle maximum current command
COIL RETURN	Main Relay, EM BRAKE, FAN Source Common	T Motor	Motor temperature sensor signal
C	Current	T	Odometer
CC	Current Command	TR 0	Start capture
CL	Current Limit	TR 1	Finish capture
ECO	Economic	TS	Capture speed
CRC	Cyclical Redundancy Check	TD	Capture distance
EM BRAKE	Electromagnetic BRAKE	V	Voltage
EMBK	Electromagnetic BRAKE	W	How
FAN	Fan Control	?	Help
Feedback+ Feedback-	Regeneration Control Terminal	?P	Parameter list
KSI	Key Switch Input		
ECO	Economic Mode Switch	Z	Encoder Z
MAIN RELAY	Main Contactor Coil Control	A	Encoder A
Main DNC	Main Did Not Close(Main Contactor Poor Contact)	B	Encoder B
M	Mode	HA	Encoder HA
		HB	Encoder HB
		HC	Encoder HC

MEMO

INSTRUCTION MANUAL

PART NO : E-PHAA-ES9A01

Model : SWAN9 series

MAY 2021 1ST Edition



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