

XQ Drive

Premium V.F.D. INSTALLATION/INSTRUCTION MANUAL

dooch
두크펌프

Safety Instructions

Preface

- Thank you for choosing DOOCH's high performance XQ-Drive series.
  Describing specification, installation, operation, function, and maintenance of the XQ-Drive series provided for the users who are familiar with and having basic experience in using a variable frequency drive.
  Be sure to understand function, performance, installation, and operation of the product by reading through this User's Manual completely prior to your use of XQ-Drive series that you have purchased.
  In addition, you are required to have this User's Manual properly delivered to the end-user and maintenance manager.

Variable frequency drive Preventive Maintenance

- Dust on an electronic device can cause malfunction or even failure by absorbing moisture.
  Discharging compressed air into the VFD is a viable option in some environments.
  All lossen/rusted bolts and nuts should be safety fasten or replaced accordenly.
- This equipment should be installed and serviced by qualified personnel familiar with the type of
- equipment and experienced in working with dangerous voltages.

Safety Precautions

- To prevent injury and property damage, follow these instructions. Incorrect operation due to ignoring instructions will cause harm or damage.
- The seriousness of which is indicated by the following symbols.

 Warning	**Warning :** This symbol indicates the possibility of death or serious injury.
 Caution	**Caution :** This symbol indicates the possibility of injury or damage to property.

Remark
Even if the instructions are indicated as 'Caution', it can cause a serious result according to the kind of operation and the environment.

The meaning of each symbol in this manual and on your equipment is as follows.

Safety Instructions

 Caution	**Do not remove the cover while power is applied or the unit is in operation.** Otherwise, electric shock could occur. **Do not run the inverter with the front cover removed.** Otherwise, you may get an electric shock due to high voltage terminals or charged capacitor exposure. **Do not remove the cover except for periodic inspections or wiring, even if the input power is not applied.** Otherwise, you may access the charged circuits and get an electric shock. **Wiring and periodic inspections should be performed at least 10 minutes after disconnecting and after checking the DC link voltage is discharged with a meter (below DC 30V).** Otherwise, you may get an electric shock. **Operate the switches with dry hands.** Otherwise, you may get an electric shock. **Do not use the cable when its insulating tube is damaged.** Otherwise, you may get an electric shock. **Do not subject the cables to scratches, excessive stress, heavy loads or pinching.** Otherwise, you may get an electric shock.
 Warning	**Install the VFD on a non-flammable surface. Do not place flammable material nearby.** Otherwise, fire could occur. **Disconnect immediately the input power if the inverter gets damaged.** Otherwise, it could result in a secondary accident and fire. **After the input power is applied or removed, the VFDwill remain hot for a couple of minutes.** Otherwise, you may get bodily injuries such as skin-burn or damage. **Do not apply power to a damaged inverter or to the VFD with parts missing even if the installation** Otherwise, electric shock could occur. **Do not allow lint, paper, wood chips, dust, metallic chips or other foreign matter into the drive.** Otherwise, fire or accident could occur.

Safety Instructions

Cautions for Use

A. Transportation and Installation

- Be sure to carry VFD in a proper way suitable for its weight, or it may result in damage to the VFD.
- Be sure to use heat-treated wooden crate when you adopt wooden packaging for the product.
- Do not pile up VFD's above allowable limit.
- Be sure to install the VFD as directed in this instruction manual.
- Do not turn off the power supply to the damaged VFD.
- Do not open the front cover while carrying the VFD.
- Do not place the heavy material on the VFD.
- The direction of installation should be observed properly as criterions specified in this manual show.
- Make sure that you should not put screw, metal material, water, oil and the inflammable something else.
- Keep in mind that the VFD is very vulnerable to drop from the mid air and strong shock.
- Don't let the inverter exposed to rain, snow, fog, dust, etc.
- Do not cover, nor block, the ventilating system having cooling fan. It may cause the VFD overheated.
- Be sure to check the power is off when installing the VFD.
- To prevent the risk of fire or electric shock, keep the connected wire in a sound condition. Use the wire that meets the standard in a recommended length.
- Grounding class3 (for 200V class) / Grounding class special 3 (for 400V class) are required for drives.

Installation Location	Free of corrosive gas, inflammable gas, oil sludge and dust, etc
Temperature/Humidity	-10 ~ 40℃ / Below 90% RH (Dewdrop should not be formed)
Storage Temperature	-20~65℃
Elevation/Vibration	Altitude 1,000m or lower / below 5.9m/sec²(=0.6g)
Ambient Atmospheric Pressure	70~106 kpa

B. Wiring

- A professional installer should have done the wiring and checking.
- Do wiring after installing the VFD body.
- Do not connect phase-leading capacitors, surge filter, radio noise filter to the output of the VFD.
- Output terminals (terminals named U, V, W respectively) should be connected in a proper phase sequence.
- Make sure that there is not any short circuit terminal, wrong wiring. It may cause spurious operation or failure.
- Refrain from using a cable other than the cable shielded when you connect control circuit wiring.
- Adopt the shielded wire only when wiring the control circuit. It may cause the failure of the VFD in its operation.
- Use the twisted pair shield wire for the ground terminal of the VFD.
- Do not install the earth leakage breaker to the input of the VFD.
- In case you have any problem or question, please contact us or our agents.

C. Adjustment before starting trial operation

- Do not supply the excessive range of voltage displayed in the user manual to the each terminal.
  It may cause damage to the inverter.
- Current hunting can be occurred in the low speed territory during testing. It occurs where the capacity is above 110kW with no-load and the axis is not connected.
- The current hunting has a gap according to the motor characteristic. It will be disappeared when the load is connected and it is not the indication of abnormal condition.
  If the hunting is occurred seriously, please stop the testing and operates with the load.
- Be sure to check relevant parameters for the application before starting trial operation.

D. How to Use

- Be sure not to approach the machine when retry function is selected. The machine may start working suddenly.
- Stop key on the keypad should be set to be in use. For safety, additional emergency stop circuit should be required.
- Never modify the VFD for inappropriate use
- When a magnetic contactor is installed on the power source, do not frequently start or stop using this magnetic contactor. It may cause the failure of VFD.
- Noise filter should be used for the minimization of troubles by electro-magnetic noise.
  Electronic equipments close to the inverter should be protected against the damage caused by troubles.
- Be sure to install the AC reactor at the input of inverter in case of input voltage unbalance.
  Otherwise, generator or phase-leading capacitors may be destroyed by the harmonic current from inverter.
- Be sure to set the parameters once more, in case of initialization of parameters, all values of parameters is set to values of factory setting.
- DC braking function cannot produce a zero-servo torque.
  If required, additional equipment should be installed.
- Do not change wiring, nor disconnect connector or option card during the operation of the VFD.
- Do not disconnect the motor wiring while the voltage of inverter is output.
  Mishandling may cause damage to the VFD.

E. Reaction on Failure and Malfunction

- If the VFD is damaged and then gets into uncontrollable situation, the machine may lead to the dangerous situation, therefore to avoid this situation, be sure to install the additional equipments such as brake.

F. Maintenance, inspection and parts replacement

- Do not perform the megger (insulation resistance check) test on the control board.

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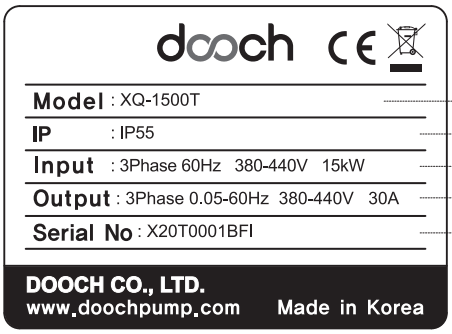
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1. Basics

1.1 Nameplate Information

- Take the VFD out of the box, check the rating shown on a side of the product body and whether the VFD type and rated output are exactly what you ordered. Check also whether the product has been damaged during delivery.

- Nameplate of the Product



: X20T-2 0001BFI

- Product Production Month/Year
- Product Production Number
- Input voltage
- 3 Phrase
- Inverter Capacity
- XQ-Drive

1.2 Type of Product

XQ-0750 T -4

- Input voltage
  - 2 : 200~240V
  - 4 : 380~440V
- T : Three Phase
- Indicates capacity in 00.00kW unit.
  - 0075 : 0.75kW (1HP)
  - 0150 : 1.5kW (2HP)
  - 0220 : 2.2kW (3HP)
  - 0400 : 4kW (5.5HP)
  - 0550 : 5.5kW (7.5HP)
  - 0750 : 7.5kW (10HP)
  - 1100 : 11kW (15HP)
  - 1500 : 15kW (20HP)
  - 1850 : 18.5kW (25HP)
  - 2200 : 22kW (30HP)
- VFD Type

- Product model name is indicated as above. Initial four digits indicate driving capacity of the drive in 00.00kW unit. Decimal point is not indicated.
- 'T' refers Three phase.
- '2' or '4' refers input voltage. (2: 200~240V, 4: 380~440V)

1.3 Installation

- Make sure you install the product correctly considering the place, direction or surroundings in order to prevent decrease in the life and performance of the VFD.

1.4 Wiring

- Connect the power supply, electric motor and operating signals (control signals) to the terminal block. If you fail to connect them correctly, the VFD and peripheral devices might be damaged.

1.5 Certification Mark description

CE	This product has been certified with a CE
	The electronics waste and recycling is subject to the provisions of national and local. In many countries, they prohibit throwing out electronic equipments, and have ban throwing away etronic equipments in the garbage.

2. Specifications of product

2.1 Input voltage class: 200V (0.75~11kW)

Model XQ-_____T-2		Model specification						
		0075	0150	0220	0400	0550	0750	1100
Rated motor [kW]		0.75	1.5	2.2	4	5.5	7.5	11
Rate motor [HP]		1	2	3	5.5	7.5	10	15
Rated output	Output capacity [kVA]	1.9	3	4.6	6	9.1	12.2	17.1
	Rated output current [A]	5	8	12	16	24	32	45
	Output voltage [V]	3Φ 200~240V						
	Output frequency [Hz]	0.05 ~ 50/60						
Rated input	Rated input voltage [V]	3Φ 200V~240V						
	Input frequency [Hz]	50/60 (±5%)						
Protection class		IP55						
Switching frequency [kHz]		1 ~ 15 (Automatic limitation according to temperature)						
Cooling		Fan cooling						

Chapter 2. Specifications of product

2.2 Input voltage class: 400V (0.75~22kW)

Model XQ-_____T-4		Model Specification									
		0075	0150	0220	0400	0550	0750	1100	1500	1850	2200
Standard Motor [kW]		0.75	1.5	2.2	4	5.5	7.5	11	15	18.5	22
Standard Motor [HP]		1	2	3	5.5	7.5	10	15	20	25	30
Rated output	Output Capacity[[kVA]	2	2.6	4	5.9	7.9	10.5	15.8	19.7	25.7	29.6
	Rated Output Current [A]	3	4	6	9	12	16	24	30	30	45
	Output Voltage [V]	3Φ 380~440V									
	Output Frequency [Hz]	0.05 ~ 50/60									
Rated input	Rated Input Voltage [V]	3Φ 380V~440V									
	Input Frequency [Hz]	50/60 (±5%)									
Protection Class		IP55									
Switching Frequency [kHz]		1 ~ 15 (Automatic limitation according to temperature)									
Cooling		Fan Cooling									

2.3 Common specifications

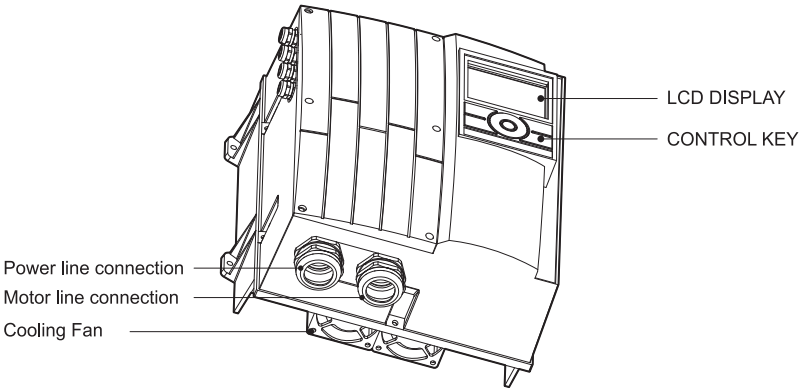
Control	Controlling Method	V/F Control, Slip Compensation Control
	Frequency Stability	1% of Rated Frequency
	Overload Resistance	120% 1 Minute
	Torque Boost	Manual Torque Boost (0~10%)
Operation	Operation Method	Color LCD keypad/Terminal block/Communication (CAN) Operation
	Frequency Setting	Color LCD Keypad/Terminal block(0~10V or 4~20mA)/Choose between the two CAN
	Acceleration/Deceleration Time	1 ~ 600 sec.
	Abnormal Reset	Automatic Reset upon Automatic Restart Setting, Reset via the reset key on the external terminal
Operation status	Abnormal Output	Output Contact (FLT-AT, CT)
	Operation Status	Output Contact (RUN-AT, CT)
	Operation info.	Analog Output(0~20mA) 2EA (Choose between; Setting Pressure, Current Pressure, Output Frequency, Output Current, Discharge Pressure, Suction Pressure,Output Voltage, Voltage Link DCOutput Power)
Other Functions		Freezing Protection for Pump, Auto Recovery after Power Fail, High/Low Pressure Alarm, Low Water Level Detection, Multi-Drive Control, Failure History Storage, Forced Alternative Operation, PID Control, Fixed Frequency Operation, Dry running Protection
Protection Structure		High Voltage, Low Voltage, Over Current, Surge, Overload, Inverter Overheating, Output Wire Disconnection, Communication Error
Display	Drive Info.	Current pressure, Setting pressure, Output frequency, DC link voltage, Output ampere
	Abnormality	Pressure Sensor Error, High/Low Pressure Alarm, Low Level Alarm, Drive Error
Operation Conditions	Environment	Altitude 1,000M or lower. Keep out of Corrosive Gases and Liquid, Dust
	Ambient Temp.	-10°C ~ 40°C
	Storage Temp.	-20°C ~ 60°C
	Surrounding Humidity	Below 90% RH of relative humidity (with no dew formation)
	Pollution degree	2

Chapter 3. External Dimension

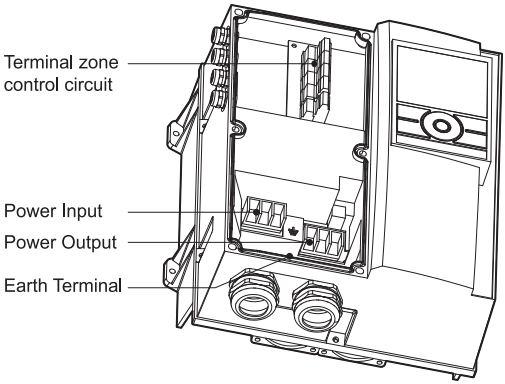
3. External Dimension

3.1 Names of each specified Parts

3.1.1 Product appearance



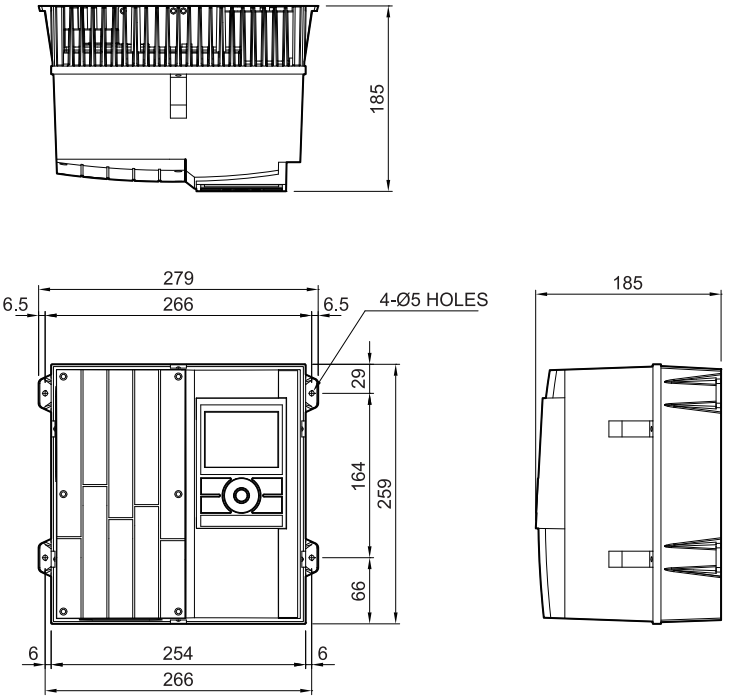
3.1.1 Product appearance without the front lid-cover



Chapter 3. External Dimension

3.2 FRAME 1 (0.75~2.2kW)

XQ-0075T-2, XQ-0150T-2, XQ-0220T-2, XQ-0075T-4, XQ-0150T-4, XQ-0220T-4



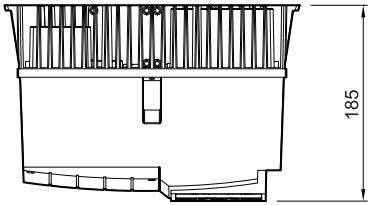
(Unit: mm)

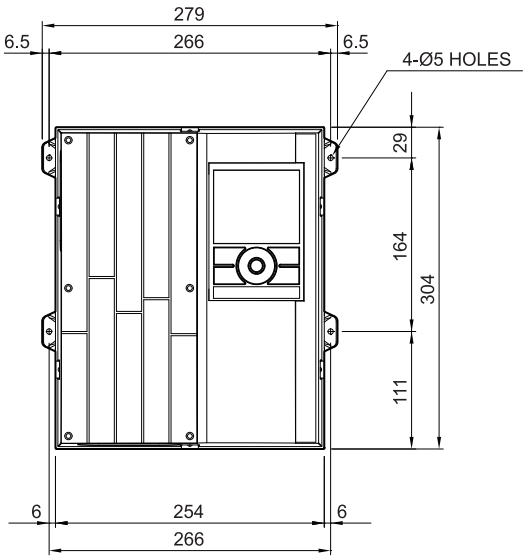
Weight : 6.7kg

Chapter 3. External Dimension

3.3 FRAME 2 (4~5.5kW)

XQ-0400T-2, XQ-0550T-2, XQ-0400T-4, XQ-0550T-4



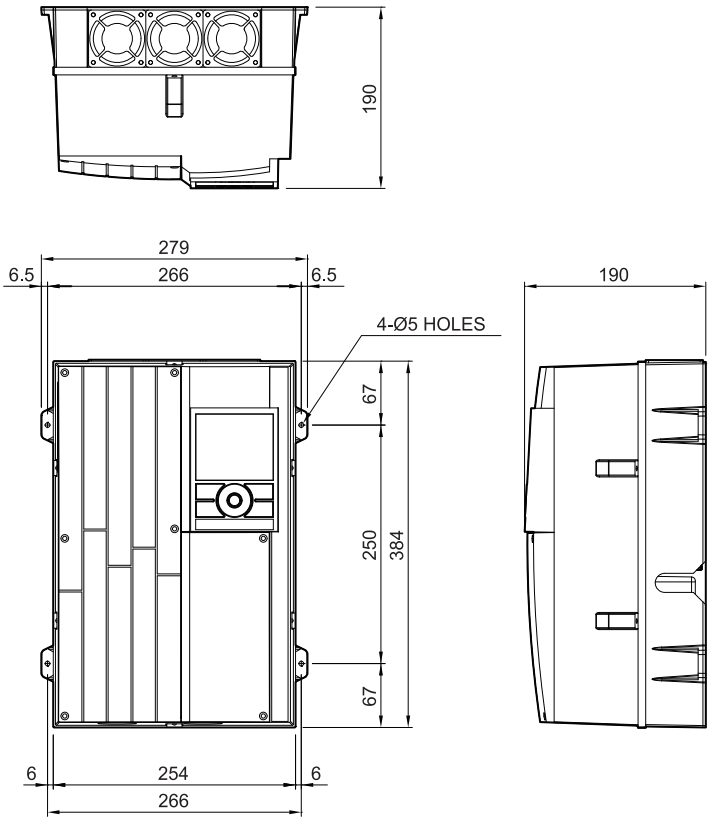


(Unit: mm)

Weight : 8.2kg

3.4 FRAME 3 (7.5~11kW)

XQ-0750T-2, XQ-1100T-2, XQ-0750T-4, XQ-1100T-4

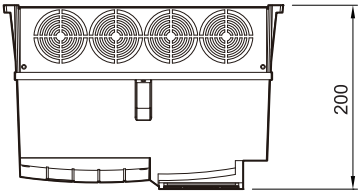


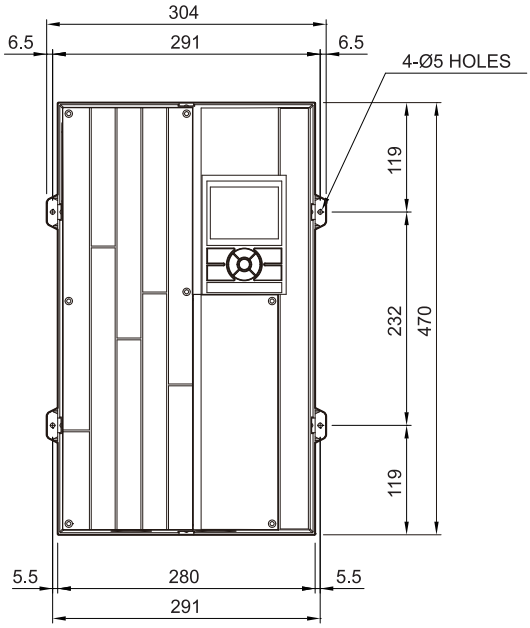
(Unit: mm)

Weight : 11.3kg

3.5 FRAME 4 (15~22kW)

XQ-1500T-2, XQ-1850T-2, XQ-2200T-2, XQ-1500T-4, XQ-1850T-4, XQ-2200T-4





(Unit: mm)

Weight : 15.8kg

Chapter 4. Installation

4. Installation

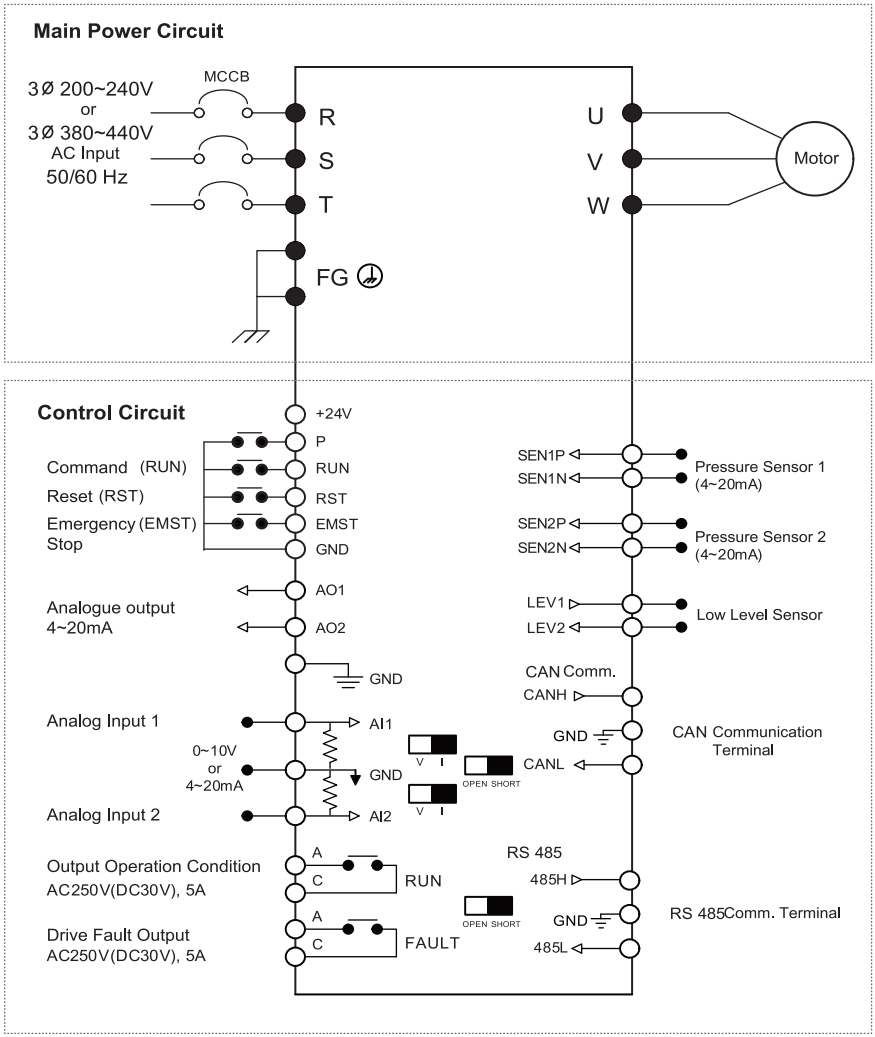
4.1 Cautions on Installation

- Be careful so that the plastic parts of the inverter may not be damaged.
- Do not move the product holding the cover only.
- Do not install the product where there is vibration, a press or truck.
- Life of the inverter greatly influenced by the surround ing temperatures, make sure that the surrounding temperature does not exceed th e permitted temperature (-10~40°C).
- The life of the inverter is affected by ambient temperature. Place that inverter installed in of ambient temperatures should not exceed the following allowable temperature.
- When the inverter is installed inside the panel, panel temperature must not exceed the following allowable temperature. In other word, the ambient temperature inside or outside of the panel, regardless of the installation, needs to be measured a round 5cm of the inverter.
- Install the inverter on an inflammable surface because its temperature rises high during operation.
- Sufficient space is required to prevent heat saturation because the inverter emits heat.

⚠ Caution

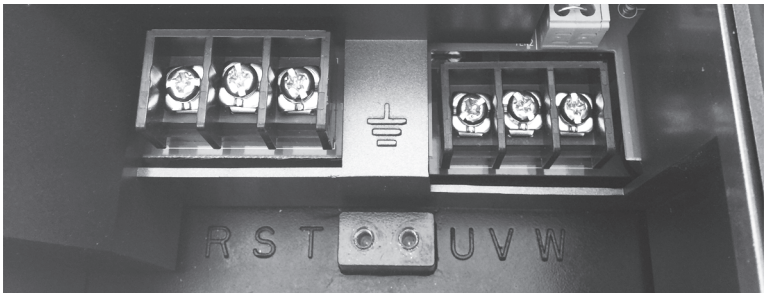
Avoid direct rays of light or a warm and humid place.
Install the inverter in a closed panel or clean place free from foreign substances such as oil mist and fiber dust.

4.2 Wiring Diagram of Terminals



4.3 Wiring of Main Power Supply Circuit

4.3.1 Description on Main Power Supply Terminals



R	S	T	FG	FG	U	V	W

Terminal Sign	Terminal Name	Description: 3 Phase
R, S, T	AC Input	To connect commercial AC Input.
FG	Ground	It is a ground terminal on drive enclosure. Please ground it.
U, V, W	Drive output	To connect Motor.

4.3.2 Cautions when wiring the Main Power Supply

- Execute wiring work after checking if DC power of drive is discharged (under 30V).
- Be sure to install wiring breaker (MCCB) between AC input power and drive input power terminals (R,S,T).
- Use the wiring breaker (MCCB) with 1.5~2 times larger capacity than rated current of the drive.
- Sometimes EMI occurs due to high speed switching of the drive and it makes radio interference on electronic devices used around the drive. For that case, install EMC filters between AC power input and the drive to reduce interference.
- If AC input power is connected to output terminals (U,V,W) of drive, drive will be damaged. Be sure to connect it to input terminals.
- Even though power input terminals (R,S,T) may be connected regardless to phase sequence of AC input power, it is required to consider rotation direction of the motor when connecting input terminals of the motor to output terminals of the drive (U,V,W). If rotation direction of the motor is reversed, 2 lines from drive output terminals (U,V,W) should be exchanged each other.
  Do not make short circuit nor ground with drive output terminals (U,V,W). Short circuit or ground of output terminals may damage on the drive.

- Do not make short circuit nor ground with drive output terminals (U,V,W). Short circuit or ground of output terminals may damage on the drive.
- Do not connect static condenser or noise filter at the output of the drive. It may cause frequent trip on the drive, or static condenser or noise filter may be destroyed due to overheating.
- Use specified thickness of wires for input/output wiring for the drive. If wires are thinner than specified thickness, it may cause torque reduced due to voltage decrease or induce fire accident from overheating. Maintain wiring distance between drive and motor within 50m. If it is longer than 50m, be sure to use the motor with reinforced insulation or micro-surge filter.

4.3.3 Cautions on Ground Wiring

- Since a leak current is generated from high speed switching of the drive, it is required to ground the drive to prevent electric shock.
- Grounding class 3 to be applied to 200V class drive, ground resistance to be under 100Ω.

  Grounding class special 3 to be applied to 400V class drive, ground resistance to be under 10Ω.
- Use thicker wires than specified one for ground wire.
- Ground system supply is TN.

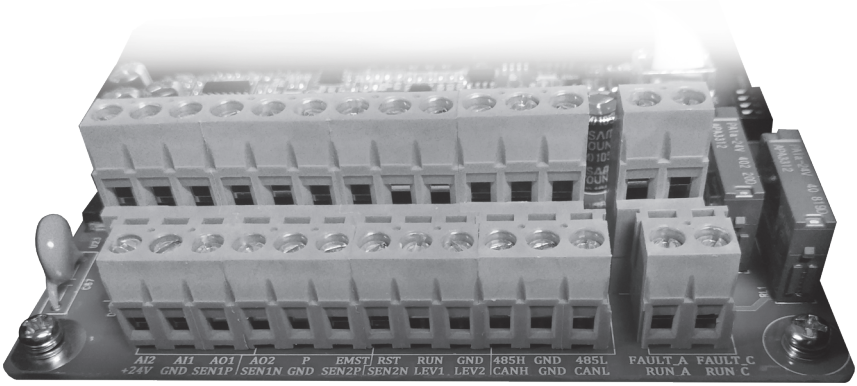
4.3.4 Specifications of Recommended Wires and Terminal Screw

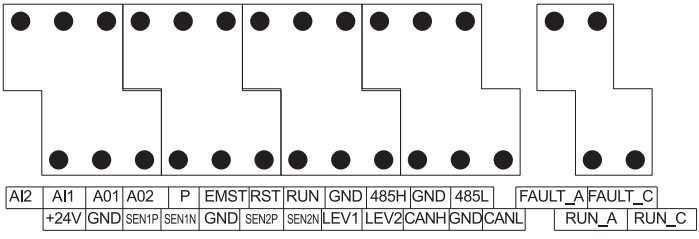
Drive Capacity	Terminal screw size	Screw Torque (N.m)	Thickness of Wires mm^2(AWG)					
			R, S, T		U, V, W		FG	
			200V	400V	200V	400V	200V	400V
0.75kW	M4	1.2 ~ 1.5	2.5(14)	2.5(14)	2.5(14)	2.5(14)	3.5(12)	2(14)
1.5kW	M4	1.2 ~ 1.5	2.5(14)	2.5(14)	2.5(14)	2.5(14)	3.5(12)	2(14)
2.2kW	M4	1.2 ~ 1.5	2.5(12)	3.5(12)	2.5(14)	3.5(12)	3.5(12)	2(14)
4kW	M4	1.2 ~ 1.5	4(12)	3.5(12)	4(12)	3.5(12)	5.5(10)	3.5(12)
5.5kW	M5	2.5	6(10)	5.5(10)	6(10)	5.5(10)	5.5(10)	5.5(10)
7.5kW	M5	2.5	10(8)	5.5(10)	10(8)	5.5(10)	14(6)	5.5(10)
11kW	M6	4 ~ 5	16(6)	8(8)	16(6)	8(8)	14(6)	8(8)
15kW	M6	4 ~ 5	-	8(8)	-	8(8)	-	8(8)
18.5kW	M6	4 ~ 5	-	14(6)	-	14(6)	-	14(6)
22kW	M6	4 ~ 5	-	22(4)	-	22(4)	-	14(6)

- Apply specified torque for fastening the terminal screw.
- Weak fastening may cause malfunction and too strong fastening may destroy terminal block.
- Use 600V class wires.

4.4 Control Circuit Wiring

4.4.1 Arrangement of Control Terminal Block





AI2	AI1	A01	A02	P	EMST	RST	RUN	GND	485H	GND	485L	FAULT_A	FAULT_C
	+24V	GND	SEN1P	SEN1N	GND	SEN2P	SEN2N	LEV1	LEV2	CANH	GND	CANL	RUN_A	RUN_C

4.4.2 Functions of Control Terminal Block

Classification		Terminal Sign	Terminal name	Description
Input signal	Pump Control	SEN1P, SEN1N	Pressure Sensor 1	Connection terminal for Pressure Sensor 1
		SEN2P, SEN2N	Pressure Sensor 2	Connection terminal for Pressure Sensor 2 (used for differential pressure control)
		LEV1, LEV2	Low Level Sensor	Connection terminal for low level sensor
	Contact Operation	RUN	Operatoin Command	Operation(RUN/STOP) terminal
		RST	RESET	Resetting the Drive
		EMST	Emergeancy Stop	When EMST signal is ON, it turns off drive output.
		P	Input terminal	Multi input terminal
		+24V	24V Output Terminal	Terminal for 24V Output
		GND	Common Terminal	Common terminal for contact input terminal
	Analog Setting	AI1, AI2	Multi-function setup	DC 0~10V or 4~20mA Setting the output frequency, target pressure, and display the output current/ frequency/power/voltage based on input data.
		AO1, AO2	Drive information (Frequency, Voltagw, Etc.)	It outputs DC 4~20mA
		GND	Common Terminal	Common terminal for Analog frequency setup terminal.
Ouput signal	Relay Contact	RUN (RUN_A, RUN_C)	Operation Signal Output	It outputs signal when drive is output. (Below AC 250V 5A, below DC 30V 5A)
		FAULT (FAULT_A, FAULT_C)	Fault Signal Output	It is output when protection of system and drive is activated to cut off output. (Below AC 250V 5A, below DC 30V 5A)
Com. signal	CAN	CANH, CANL	CAN Signal	CAN signal line terminal
		GND	CAN Common Terminal	CAN Common terminal of power ground for CAN communication
	RS485	485L, 485H	RS485 Signal	RS485 Signal line terminal
		GND	RS485 Common Terminal	RS485 Common terminal of power ground for RS485 communication

4.4.3 Cautions on Control Circuit Wiring

- Maintain wiring distance between pressure sensor and drive within 10m.
- In case of remote control using analog signals, maintain distance between remote control panel and drive within 50m.
- Set off sensor and analog signal lines enough from power lines.
- Use shield twisted wires for signal lines of control circuit.
- Since GND are insulated, do not interconnect or ground them.

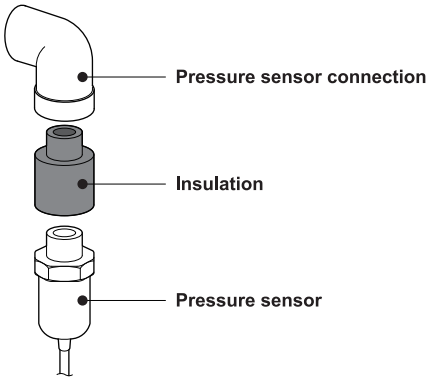
4.4.4 Connection of Pressure Sensor and Low Water Level Sensor

- Use the pressure sensor and low water level sensor specified by Dooch.
- General specifications of the pressure sensor and low water level sensor specified by Dooch are as follows:

Category	Pressure Sensor	Low Water Level Sensor
Excited Voltage	DC 15V	DC ±15V Pulse
Sensor Output	4~20mA	Connection

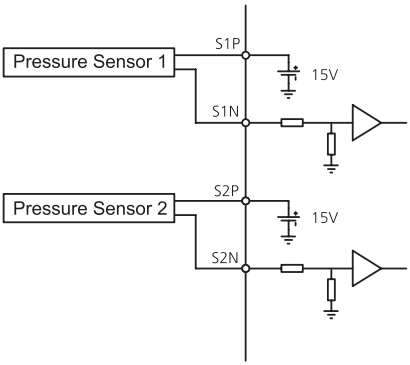
- Since terminals on pressure sensor have polarity, be careful about polarity during installation.

※ When you install the pressure sensor to pipings, please install the insulation between the pressure sensor and pipings, in order to reduce the noise from pipings.

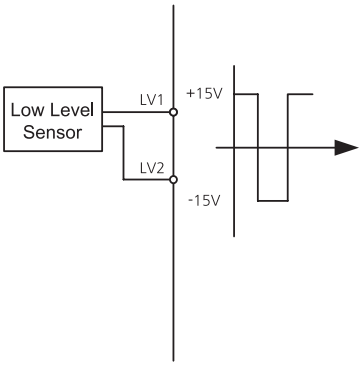


※ When using any unspecified pressure sensor and low level sensor, please contact us before using them.

Connecting to Pressure Sensor



Connecting to Low Level Sensor



4.4.5 Communication Line Wiring

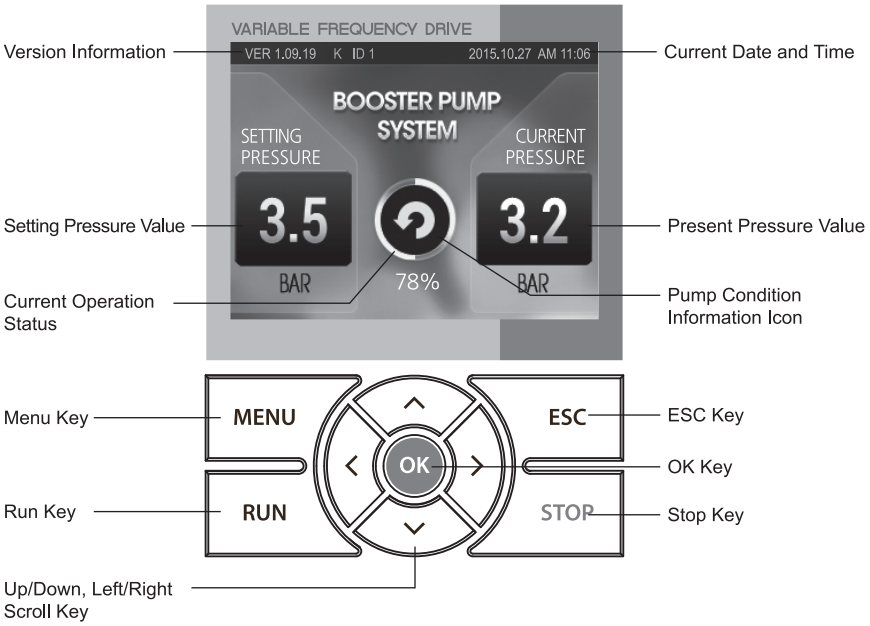
- This product basically supports CAN communication that is use for multiple pump control.
  When using CAN communication, connect CANH (High of CAN) and CANL (Low of CAN) on the terminal block and shield wire to CG. Use shield and twisted wire for wiring.
  In addition, when using termination resistor for connecting multiple CANs, change the switch from OPEN to SHORT.

※ **When using RS 485 communication, please contact us.**

Chapter 5. Operation

5.1 Keypad

5.1.1 Appearance and Description of the keypad



5.1.2 Pump Status Icon

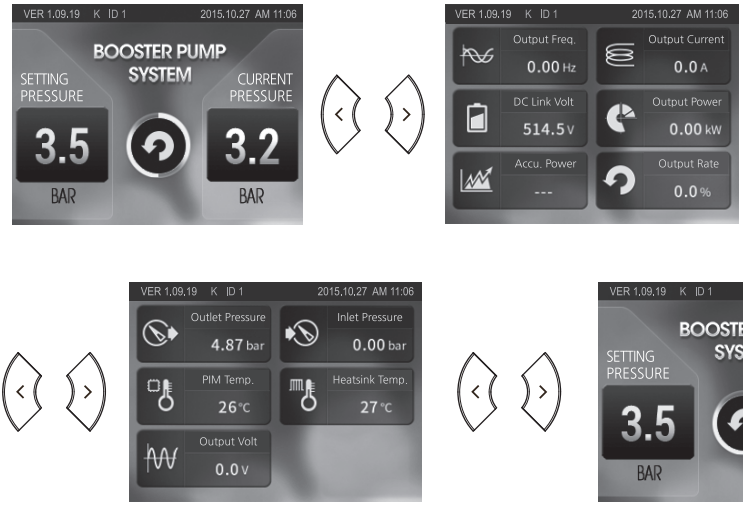
From the main screen, press the up and down key to view the current status of the pump sequentially.

ICON	Description	ICON	Description
	Operation Ratio Unit: %		**Power Consumption** Unit: kWh
	Accumulated Power Unit: kW		**DC Link Power** Unit: V
	Current Unit: A		**Output Frequency** Unit: Hz

ICON	Description	ICON	Description
	**Output Power** Unit: V		**Heat Sink Temp.** Unit: ℃
	**Power Module Temp.** Unit: ℃		**Input Pressure** Unit: bar
	**Discharge Pressure** Unit: bar		

5.1.3 Integrated pump Status Information Screen

From the main screen, press the left key to view the status of each pump sequentially on the screen.



5.2 Function Setup

5.2.1 Basic Function Setup

- Basic parameter setup to operate the drive. Any parameter that is not set by the user, it is set in the default value of the factory setting.

1) Common Setup

It is a parameter setup to set and confirm commonly when controlling pump using drive regardless to type of control.

Item Setup	Parameter Code	Description on Function
Input Location of Run Command	Drive 1	To select a method to issue Run command (Keypad, Terminal Block, Comm.)
Input Method of Target Frequency	Drive 2	To select a method to control target operation frequency (Keypad, AI1, Comm.)
Capacity of Motor	Drive 9	To set up Capacity of Motor
Rated Current of Motor	Drive 12	To set up Rated Current of Motor
Rated Voltage of Motor	Drive 13	To set up Rated Voltage of Motor
Rated Slip Frequency of Motor	Drive 15	To set up Rated Slip Frequency of Motor
Rated Frequency of Motor	Drive 16	To set up Rated Frequency of Motor
Rotation Direction of Motor	Drive 17	To set up Rotation Direction Selection of Motor Properly
Stopping Method of Motor	Drive 18	To set up Stopping Method of Motor to stop the motor
Acceleration Time	Drive 19	To set up Acceleration Time of Drive
Deceleration Time	Drive 20	To set up Deceleration Time of Drive

2) Pump Control Function Setup by PID setup

These parameters are to be set for the pump system when controlling the pump using the drive.

Item Setup	Parameter Code	Description on Function
Pump Control Mode	Pump 1	To set up Pump Control Mode (Manual Mode/Constant Pressure/Differential Pressure)
Pump Operation Mode	Pump 2	To set up Pump Operation Mode (Sequence/Partly Work)
Sensor Capacity and Correction Value	Pump 11~16	To set up capacity of pressure sensor and correct variation between actual pressure and pressure sensor (On constant pressure control, Sensor2 is not used.)
To setup Low Water Level checking mode	Pump 54	To decide whether to use low water level mode (Low water level sensor/ Discharge Pressure/ Inlet Pressure)

3) Drive Control Function upon External Command

These parameters are to be set when controlling the drive using an external controller.

Setup Item	Parameter Code	Function Description
Frequency Setup	Drive 2	To set up frequency input mode during manual operation.
Properties	Signal 8 (for AI1 input setup) Signal 18 (AI2 input setup)	To set up frequency input mode during manual operation.
External Analog input	Signal 1	To select external Analog input (I, V)
Frequency Setup upon V1 Voltage	Signal 2,4,5,7	To set up the frequency range against voltage when controlling drive using V1 voltage.
Frequency Setup upon V2 Voltage	Signal 12,14,15,17	To set up the frequency range against voltage when controlling drive using V2 voltage.
Frequency Setup upon I1 Current	Signal 3,4,6,7	To set up theoutput frequency range against current when controlling drive using I1 current.
Frequency Setup upon I2 Current	Signal 13,14,16,17	To set up the frequency range against current when controlling drive using I2 current.

4) CAN Communication Function Setup

These parameters are to be set basically for CAN communication used on interoperation or connecting LCD Monitor.

Setup Item	Parameter Code	Function Description
CAN Comm. ID	Signal 2	To set up CAN Comm. ID (If ID is '0', CAN Comm. is disabled.)
CAN Comm. Speed	Signal 3	To set up CAN Comm. Speed

5.2.2 Expansion Function Setup

- Setting up the parameters to operate pump system optimally except for those to be set for operating the drive. Any parameter that is not set by the user, is set with the factory value by default.

1) Pump Control Parameters

Setup Item	Parameter Code	Function Description
PID Controller Gain Setup	Pump 21~23	To set up gain to adjust response characteristics of PID controller
Control Cycle of PID Controller	Pump 24	To set up Control Cycle of PID Controller
Start/Stop Pressure Variation	Pump 32	Minimum pressure variance to allow drive to Start/Stop
Initial Output Ratio on Starting	Pump 31	To set up initial starting output frequency of PID controller in order to speed up response against initial starting
Lead Pump Alternation	Pump 35~36	To operate pump alternatively in force during multi-drive operation

2) Setting up the Parameters for Pump System Protection

Setting up the parameters to operate pump system optimally except for those to be set for operating the drive.
Any parameter that is not set by the user, is set with the factory value by default.

Setup Item	Parameter Code	Function Description
High Pressure Alarm	PUMP 50 PUMP 51	To set up high pressure alarm level and time in order to protect discharge pipe from high pressure
Low Pressure Alarm	PUMP 52 PUMP 53	To set up low pressure alarm level and time in order to protect the pump from damaged pump
Low Water Level Alarm	PUMP 54~59	There are two detection methods using the low level sensor or software in order to protect the pump by detecting existence of water within the suction pipe.

3) Setting up the Parameter for Fault History Storage

Setup Item	Parameter Code	Function Description
Fault History Storage/ Deletion	Trip 1~50	To store or delete fault or alarm generated from the pump system or drive

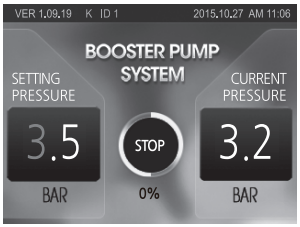
Chapter 5. Operation

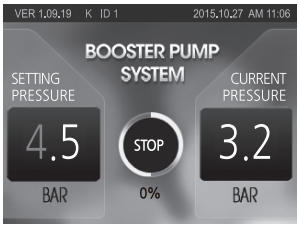
5.3 Basic Operation

5.3.1 Changing the set Pressure

EX) To change from pressure setting from 3.5bar → 4.5bar

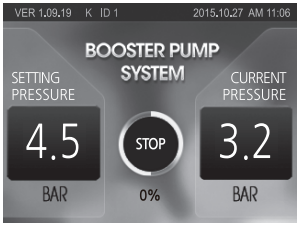
Press the OK and hold for 2 seconds to enter the set pressure change mode





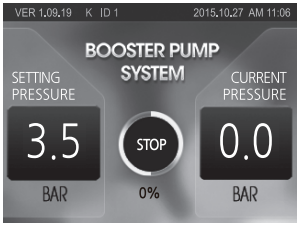
Press the left, right key to select the number of digits that you want to change, and then press the key to highlight, type the desired value



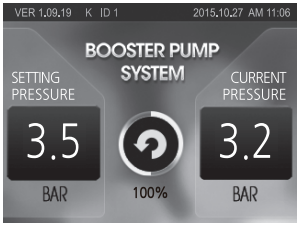


Press the OK key and a message shall appear on the screen. Press the “YES” key to change the set value and save.

5.3.2 Run/Stop



In the STOP mode, press the RUN KEY to start the operation



During operation status, press the STOP key to stop the operation

Chapter 6. Function Table & Description

6.1 Pump Control Group

CODE	LCD Display	Factory Setting	Range	Unit	Changable in Operation	Desciption
1	Pump Ctrl Mode	1	0 ~2	-	×	0: Manual 1: constant pressure 2: differential pressure
2	Pump Op. mode	0	0~1	-	×	0: Sequence 1: Part operation
3	Press Set mode	0	0~2		×	0: Keypad 1: AI1 Signal 2: AI2 Signal 3: COM input
4	Setting Press.	3.00	0.00~25.00	bar	○	Display Setting Pressure and Setup
5	Current Press.	-	0.00~25.00	bar	-	Display the current pressure
6	Discharge Press.	-	0.00 ~ 25.00	bar	-	When differential Pressure mode, display discharge pressure
7	Inlet Press.	-	0.00 ~ 25.00	bar	-	When differential Pressure mode, display inlet pressure
11	Sensor1 Cap.	16.00	1.00~25.00	bar	×	Setup Max. Capacity of Sensor1(discharge)
12	Sensor1 Gain	100	50~200	%	○	Setup Gain of Sensor1(discharge)
13	Sensor1 Offset	0.00	2.00~2.00	bar	○	Setup Offset of Sensor1(discharge)
14	Sensor2 Cap.	16.00	1.00~25.00	bar	×	Setup Max. Capacity of Sensor2(inlet)
15	Sensor2 Gain	100	50~200	%	○	Setup Gain of Sensor2(inlet)
16	Sensor2 Offset	0.00	2.00~2.00	bar	○	Setup Offset of Sensor2(inlet)
21	PID P gain	10	0~100	%	○	0 ~ 100% (1%)
22	PID I gain	1.0	0.0~100.0	sec	○	0.0 ~ 100 sec. (0.1 sec.)
23	PID D gain	0	0~100	ms	○	0 ~ 100 ms (1 ms) PID Control Cycle
24	PID Con. Cycle	0.2	0.1~0.5	sec	×	0.1 ~ 0.5 sec. (0.1 sec.)
30	Stop-Rate of Drive	30	0~60	%	○	Stop-Rate of Drive
31	Start Init. %	50	5~100	%	×	~ 100% (1%) Ratio of Initial Output on Starting
32	On/OFF Band	0.30	0~2.00	bar	○	When interoperation, standby time for the next Start/Stop
33	ON/OFF Time	5	0~100	sec	○	Variation of Initial start/stop, and the next start/stop when interoperation
34	Freezing Prev.	0	0~1	-	○	0: Deactivate 1: Activate
35	Changeover Mod	0	0~2	-	×	0: Lowest ID 1: Low Integrating Watt hour 2: Half Pump
36	Changeover Sec	12	0~24	hour	○	Forced Alteration Time
37	Share Op. On %	100	70~100	%	○	Ratio of Partly Driving
41	Low-Flow Time	30	0~200	sec	○	0~200 sec. (1 sec.) Detection time of Low Level
42	Low-Flow Rate	100	0~100	%	○	0~100% (1%) Ratio of Low Level detection
50	TOP Level	16.00	0.00~25.00	bar	○	Trip Level of High Pressure
51	TOP Time	5	0~600	sec	○	Trip Time of High Pressure
52	TLP Level	0.5	0.00~25.00	bar	○	Trip Level of Low Pressure

Chapter 6. Function Table & Description

CODE	LCD Display	Factory Setting	Range	Unit	Changable in Operation	Desciption
53	TLP Time	20	0~600	sec	○	Trip Time of Low Pressure
54	TUL Mode	1	0~2	-	×	Setup Low Level Detection Mode 0: Low Level Sensor 1: Discharge Pressure 2. Inlet Pressure
55	TUL Time-LS	2	0~600	sec	○	Trip time of Low Level when the mode is Low Level Sensor
56	TUL Level-Out	0.3	0.00~25.00	bar	○	Trip Level of Discharge Pressure when the mode is Discharge Pressure
57	TUL Time-Out	20	0~600	sec	○	Trip Time of Discharge Pressure when the mode is Discharge Pressure
58	TUL Level-In	0.3	0.00~25.00	bar	○	Trip Level of Inlet Pressure when the mode is Inlet Pressure
59	TUL Time-In	20	0~600	sec	○	Trip Time of Inlet Pressure when the mode is Inlet Pressure
61	Half Pump Mode	0	0~1	-	○	0: Deactivate 1: Activate
62	Half Pump Rate	70	50~100	%	○	The Ratio for Half Pump Condition
63	Half Pump Time	10	0~200	min	○	The Time for Half Pump Condition
65	Bearing Alarm	0	0~2	-	○	Setup Bearing Alarm. 0: Deactivate 1: Activate 2: Reset
66	Bearing Lifecycle	-	0~100	%	○	Prediction Ratio of Bearing Lifecycle
67	Mech. Seal Alarm	0	0~2	-	○	Mechanical Seal Alarm 0: Deactivate 1: Activate 2: Reset
68	Mech. Seal Lifecycle	-	0~100	%	○	Prediction Ratio of Mechanical Seal Lifecycle
70	Max. Trip-level of pressure	25	0.00~25.00	bar	○	The generation of Max. pressure trip-level.
71	Limit on number of pumps	0	0~6	-	×	Setting for limit on number of pumps. 0: Disable 1: 1 Pump 2: 2 Pumps 3: 3 Pumps 4: 4 Pumps 5: 5 Pumps 6: 6 Pumps

6.1.1 Pump Control Group

Pump 1 : Pump Control Mode
Method of setting up the pump control

Description	Related Functions		
Manual Mode	Drive 2	Frequency Input Method	Target Frequency Settings
	Drive 3	Instructive Frequency Settings	Target Frequency Input by Keypad
Constant Pressure Control Method (Factory Setting)	Pump 11	Capacity of Sensor 1	
	Pump 12	Gain of Sensor 1	
	Pump 13	Offset of Sensor 1	
Differential Pressure Control Method	Pump 6	Discharge Pressure	Display when differential control Mode only
	Pump 7	Inlet Pressure	
	Pump 11	Capacity of Sensor 1	Discharge Direction
	Pump 12	Gain of Sensor 1	
	Pump 13	Offset of Sensor 1	
	Pump 14	Capacity of Sensor 2	Inlet Direction
	Pump 15	Gain of Sensor 2	
	Pump 16	Offset of Sensor 2	

Pump 2 : Pump Operation Mode
This is to improve energy efficiency on multiple pump operation and selectable for the user.
Consecutive Driving means acceleration/deceleration operation upon PID by Master for only one drive.
Partly Driving is a method when all of drivers participating into interoperation are allocated with a target value for the output frequency by one PID controller of Master. This function has an advantage to prevent overload on a drive.

Functional Description		
Consecutive operation		
Partly Driving	Partly Driving	
	Pump 37	Partly Driving ON%

Pump 3 : Pressure Setting
Select a mode for pressure settings

Description	Related Function	
Keypad		
AI1(Analog Input Signal 1)	I/O 1~8	Setup Analog Input
AI2(Analog Input Signal 2)	I/O 11~18	Setup Analog Input
Comm. (RS485 COM Input)	Comm.11~15	Setup RS485 COM

Pump 4 : Pressure Setting
Display Setting Pressure and Pressure Settings

Factory Setting	Input Range
3.00 [bar]	0.00 ~ 25.00 [bar]

Pump 5 : Current Pressure
Display the current pressure.

Pump 6 : Discharge Pressure
Display the discharge pressure only for Differential Control Mode

Pump 7 : Inlet Pressure
Display the inlet pressure only for Differential Control Mode

Pump 11 : Setup the Capacity of Sensor 1
- Enter the maximum value that the pressure sensor can measure.
- By entering capacity of pressure sensor attached to the drive being used, it is possible to display the currently measured pressure.
- Enter the rated value of the pressure sensor for normal pump operation.

Factory Setting	Input Range
16.00 [bar]	0.00 ~ 25.00 [bar]

Pump 12 : Gain of Sensor 1
- Adjust Gain Value to correct error
- Sensor Value = Average of 100 times of reading value * gain/100

Factory Setting	Input Range
100 [%]	0.00 ~ 25.00 [bar]

Pump 3 : Pressure Setting
- his allows to correct error between Analog or Digital Pressure Meter installed in the pipe and the pressure value displayed on the Drive
- Current Pressure Value = Sensor Value Offset Value

Factory Setting	Input Range
0.00 [bar]	-2.00 ~ 2.00 [bar]

Pump 14 : Setup the Capacity of Sensor 2
- Enter the maximum value that the pressure sensor can measure.
- By entering capacity of pressure sensor attached to the drive being used, it is possible to display the currently measured pressure.
  Example) In case of the capacity of using sensor is 10bar, input 10.0.
- Enter the rated value of the pressure sensor for normal pump operation.

Factory Setting	Input Range
16.00 [bar]	0.00 ~ 25.00 [bar]

Pump 15 : Gain of Sensor 2

- Adjust Gain Value to correct error
- Sensor Value = Average of 100 times of reading value * gain/100

Factory Setting	Input Range
100 [%]	0.00 ~ 25.00 [bar]

Pump 16 : Offset of Sensor 2

- It allows to correct error between Analog or Digital Pressure Meter installed in the pipe and the pressure value displayed on the Drive
- Current Pressure Value = Sensor Value + Offset Value

Factory Setting	Input Range
0.00 [bar]	-2.00 ~ 2.00 [bar]

Pump 21 : P Gain of PID Controller

- It is relevant to 'P' (Proportional Constant) out of PID control parameters.
- If Reference and Feedback is in pressure unit [bar], PID P-Gain 100% means that in case of PID I-Gain is 0 and 100bar error is maintained, controller output is 1.0[Hz].

Factory Setting	Input Range
10 [%]	0.0 ~ 100.0 [%]

Pump 22 : I Gain of PID Controller

- It is relevant to 'I' (a Constant of Integration) out of PID control parameters.
- PID I-Gain 1 second means the time required for the output power to be accumulated to 1.0[Hz] when 100 bar error is maintained.

Factory Setting	Input Range
1.0 [sec]	0.0 ~ 100.0 [sec]

Pump 23 : D Gain of PID Controller

- It is relevant to 'D' (Differential Constant) out of PID control parameters.
- PID D-Gain means that the change rate of error at the set time will be generated for the PID control cycle.

Factory Setting	Input Range
0 [ms]	0 ~ 100 [ms]

Pump 24 : PID Control Cycle

It outputs values calculated with PID in PID control cycle time unit.

Factory Setting	Input Range
0.2 [sec]	0.1 ~ 0.5 [sec]

Pump 30 : Stop-Rate of Drive
In case of a present pressure value is higher than a setting pressure value, a pump will be stopped if an operation rate is below a stop-rate of a drive.

Factory Setting	Input Range
30 [%]	0~60[%]

Pump 31 : Initial Output Rate on Starting
It refers to the minimum output ratio when the drive starts initially. That is, if it is set to 50% when the maximum operation frequency is 60 Hz, it can start from 30 Hz.

Factory Setting	Input Range
50 [%]	5~100[%]

Pump 32 : Variation of Starting the Drive
- It sets up pressure variance between Setting Pressure and Current Pressure for start of the Drive.
- The Drive starts when the variance of pressure between setting pressure and current pressure has the larger variance than the setting variance value.

Factory Setting	Input Range
0.30 [bar]	0.00 ~ 2.00 [bar]

Pump 33 : Stand-by Pump Waiting Time on Multi-Drive Control Mode
This is to give some delay to stand-by pump. If the stand-by pump starts before the main drive output reaching the maximum frequency, then the pressure may increase suddenly. On the other hand, in case the stand-by pump stops without delay time, then the pressure would decrease drastically.

Factory Setting	Input Range
5 [sec]	1~100 [sec]

Pump 34 : Freezing Prevention
- It sets up freezing prevention mode.
- It is to prevent pump from being broken due to low temperature (below zero) in winter using ambient temperature sensor information within the drive.
  The function is operated with a frequency not generating pressure between 0~10 seconds and maintained as stopped status between 11~59 seconds based on 1 minute. This function is to prevent the pump from freeze and burst by generating frictional heat upon rotation within pump casing.
  This function is not for preventing freeze and burst of pipe.

Setup Data
Release [Factory setting]
Setting

Pump 35 : Alternation method
- It determines the order of Drive's run, stop, alternation on Multi-Drive operation mode.
- As setting condition of ID order and watt-hour, pumps are rotated from low value.

Input Range
ID order [Factory setting]
In order of low watt-hour
Half pump

Pump 36 : Master Pump Alternation Time
Alternation refers to an operation that when it reaches time specified by the user, the drive with a lot of power consumed is to be stopped and the one with less power consumption is to be started alternatively at the same time in order to prevent a specific drive(pump) being operated constantly. If the time is set, drives are forcedly shifted.

Input Range
0: Input Range
1~24: Alternation time setup. [Factory Setting 12(hour)]

Pump 37 : Partly Driving On (%): Setup Output Ratio to start the next Drive when interoperaton(Preparing)
It is an output ratio to start the next drive by applying it centralized control method for interoperation.
If the output ratio of drive in operation is higher than the setting value, the next drive to be linked starts.

Factory Setting	Input Range
100[%]	70~100[%]

Pump 41 : Low level detection interval after Reaching Setup Pressure
When the pump pressure reaches to setting and maintained for longer than setup time, it starts to reduce the speed. If there is pressure difference as much as the variance of starting the Drive, the pump starts to operate again and if not, it stops.

Input Range
0: Low level detection interval off
1~200[sec]: Low Level Detection Time Setting [Factory setting 30(sec)]

Pump 42 : Low level detection Ratio to Stop after Reaching Setup Pressure
In order to stop after reaching the setting pressure, the drive is able to stop only if the current output ratio is less or equal to setup ratio.

Factory Setting	Input Range
100[%]	0~100[%]

Pump 50 : TOP- High Pressure Alarm Level
It sets standard pressure value to alert the high pressure.
※ When setup the setting pressure, it is automatically set to setup pressure + 2bar.

Factory Setting	Input Range	Related Function	
16.0[bar]	0.00~25.00[bar]	Pump 51	High Pressure Alarm Time

Pump 51 : TOP- High Pressure Alarm Time
It sets maintaining time of high pressure alarm level to issue the high pressure alarm. That is, if the current pressure increases above the high pressure alarm level (Pump 50) and maintains its state for a specified time, a high pressure alarm is displayed and operation stops.

Factory Setting	Input Range	Related Function	
5[sec]	0~600[sec]	Pump 50	High Pressure Alarm Time

Pump 52 : TLP- Low Pressure Alarm Level
It sets standard pressure value to issue the low pressure alarm.

Factory Setting	Input Range	Related Function	
0.5[bar]	0.0~25.0[bar]	Pump 52	Low Pressure Alarm Time

Pump 53 : TLP- Low Pressure Alarm Time

It sets maintaining time of low pressure alarm level to issue the low pressure alarm. That is, if the current pressure decreases under the low pressure alarm level (Pump 52) and maintains its state for a specified time, a low pressure alarm is displayed and operation stops.

Factory Setting	Input Range	Related Function	
20[sec]	0~200[sec]	Pump 53	Low Pressure Alarm Time

Pump 54 : TUL - Low Water Level Detection Mode

- It is a mode to set up low water level alarm detection method.
- In case of setting up low water level sensor, it is required to attach electrode outside on the pipe to detect water inside.
- In case of inter-operation, low water level sensor should be linked to the lowest ID Drive.
  ※ If there is no water on suction part, all of drives (pumps) will stop.
- When it is set to Software detection, it detects the alarm on the basis of low water level alarm and low water level alarm time. That is, if the operation is continued for more than low water level alarm time (Pump 56) with pressure under the low water level alarm pressure level (Pump 57), it is required to display alarm and stop operation as it is detected that there is no water inside of the piping.

Function Description	Related Function	
Low Level Pressure Sensor	Pump 55	TUL-Low Water Level Alarm Time - LS
Outlet Pressure (Factory Setting)	Pump 56	TUL-Low Water Level Alarm - OUT
	Pump 57	TUL-Low Water Level Alarm Time - OUT
Inlet Pressure	Pump 58	TUL-Low Water Level Alarm - IN
	Pump 59	TUL-Low Water Level Alarm Time - IN

Pump 55 : TUL - Low Water level Alarm Time-LS

· It sets maintain time of low level sensor signal to issue low level alarm.
That is, if the low level sensor signal is continued for more than trip time when low level sensor is selected from low level trip mode(Pump 54), it is required to display alarm and stop operation as it is detected that there is no water inside of the inlet pipe.

Functional Description
0: Low water pressure level sensor off
1~600[sec]: Time Setup [Factory Setting 2(sec)]

Pump 56 : TUL - Low Water Level Alarm - OUT

· It is a pressure level to detect low water level when the mode is software detection from Low Water Level Detection Mode (Pump 54).

Factory Setting	Input Range	Related Function	
0.30[bar]	0.00~25.00[bar]	Pump 57	Low Water Pressure Level Alarm Time of Pressure Sensor - OUT
		Pump 54	Low Water Level Detection Mode

Pump 57 : TUL - Low Water Level Alarm Time - OUT

· It sets maintaining time of Low Water Level to issue the low water level alarm.
If the current pressure decreases under the low pressure alarm level (Pump 56) and maintains its state for a specified time, then display the alarm and stops the operation.

Factory Setting	Input Range	Related Function	
20[sec]	0~600[sec]	Pump 56	Low Water Pressure Alarm Level - OUT
		Pump 54	Low Water Level Detection Mode

Pump 58 : TUL - Low Water Level Alarm - IN

·It is a pressure level to detect low water level when the mode is software detection from Low Water Level Detection Mode (Pump 54)

Factory Setting	Input Range	Related Function	
0.30[bar]	0.00~25.00[bar]	Pump 59	Low Water Pressure Alarm Time - IN
		Pump 54	Low Water Level Detection Mode

Pump 59 : TUL - Low Water Level Alarm Time - IN

·It sets maintaining time of Low Water Level to issue the low water level alarm.
If the current pressure decreases under the low pressure alarm level (Pump 56) and maintains its state for a specified time, then display the alarm and stops the operation.

Factory Setting	Input Range	Related Function	
20[sec]	0~600[sec]	Pump 58	Low Water Pressure Alarm Level - IN
		Pump 54	Low Water Level Detection Mode

Pump 61 : Half Pump

· When inter-operation, Half Pump setting will be transmitted to the master pump through CAN Comm. the pump will be operated by Half pump mode for energy saving.

Functional Description	Related Function	
Disable : Deactivate Setting	Pump 35	Alteration Method
Enable : Harf Pump Setting	Pump 62	Half Pump Setup
	Pump 63	Half Pump Switching Time

Pump 62 : Half Pump Switching Condition by the rate of operation (Further Support)

· When Half Pump operation Mode, if 1(one) pump is operating more than Half Pump Switching Time (Pump 63) under Half Pump switching condition(Pump 62), the pump will be operated by Half pump.

Factory Setting	Input Range	Related Function	
70[%]	50~100[%]	Pump 35	Alteration Method
		Pump 61	Half Pump Setup
		Pump 63	Half Pump Switching Time

Pump 63 : Half Pump Switching Time

·When Half Pump operation mode, it set up the time to switch to the half pump.

Factory Setting	Input Range	Related Function	
10[Min]	0~200[Min]	Pump 35	Alteration Method
		Pump 61	Half Pump Setup
		Pump 62	Half Pump Switching condition by Working Ration

Pump 65 : Bearing Replacement Alarm

- It presumes the bearing's lifecycle from the setup time (calculate integration time) and display the alarm.
- It just alarms and doesn't stop the operation
- When the alarm arise, push Reset button to off (the alarm repeats 3 times)

Function Description
Disabled : Alarm Off
Enabled : Alarm ON
RESET - Factory setting

Pump 66 : Prediction the Ratio for Bearing Lifecycle

It presumes the ratio of the bearing's lifecycle, it displays as %.

Pump 67 : Mechanical Seal Replacement Alarm

- It presumes the lifecycle of Mechanical Seal from the setup time (calculate integration time) and display the alarm.
- It just alarms and doesn't stop the operation.
- When the alarm arise, push Reset button to off (the alarm repeats 3 times)

Function Description
Disabled : Alarm Off
Enabled : Alarm ON
Reset-Factory setting

Pump 68 : Prediction Ratio for Mechanical Seal Lifecycle

It presumes the ratio of the lifecycle of Mechanical Seal, it displays as %.

Pump 70 : Max. Trip-level of pressure

A drive will be stop if a value of present pressure is over a value of max. pressure trip-level.

Factory Setting	Input Range
25.00 [bar]	0~25 [bar]

Pump 71 : Limit on number of pumps

It limits the number of pumps.
There is no limitation on number of pumps if the value of input is disable.

Factory Setting	Input Range
0: Disable	0: Disable (No limitation on number of pumps.)
	1: 1 pump 2: 2 pumps 3: 3 pumps 4: 4 pumps 5: 5 pumps 6: 6 pumps

6.2 Drive Control Group

CODE	LCD Display	Factory Setting	Range	Unit	Changeable in operation	Description
1	RUN/Stop Mode	0	0~2	-	X	0: Keypad 1: Terminal Input 2: Comm. Input
2	Freq. Set Mode	0	0~2	-	X	When manual Mode, setup Frequency Input Mode 0: Keypad 0: Keypad 1: AI1 Signal 2: Comm.
3	Command Freq.	30	Start Freq. (CODE-36)~ Max. Freq. (CODE-37)	Hz	○	When manual mode, setup the target Frequency
9	Motor Select	-	0~16	-	X	0 : 0.75kW-2 1 : 1.5kW-2 2 : 2.2kW-2 3 : 4kW-2 4 : 5.5kW-2 5 : 7.5kW-2 6 : 11kW-2 7 : 0.75kW-4 8 : 1.5kW-4 9 : 2.2kW-4 10 : 4kW-4 11 : 5.5kW-4 12 : 7.5kW-4 13 : 11kW-4 14 : 15kW-4 15 : 18.5kW-4 16 : 22kW-4
10	Motor Pole	-	0~1	-	○	0: 2 Pole 1: 4 pole
11	Rated Motor Speed	3550	1~9999	RPM	○	The rated speed of the motor
12	Rated Current	☆	1.0~100.0	Arms	X	The rated current of the motor
13	Rated Voltage	☆	180.0~500.0	Vrms	X	The rated current of the motor
14	No load current of the motor	☆	0.00~100.00	Arms	○	No load current of the motor
15	Rated Slip	☆	0.1~10	Hz	○	The rated slip frequency
16	Rated Freq.	1	0~1	-	X	0: 50 Hz 1: 60 Hz
17	Rotation Dir.	1	0~1	-	X	0: Forward 1: Reverse
18	Stop Mode	0	0~1	-	X	0: Deceleration stop 1: Free Run (cut the Drive output)
19	Accel. Time	3	1.0~600.0	sec	○	1.0~600.0 sec (0.1 sec)
20	Decel. Time	6	1.0~600.0	sec	○	1.0~600.0 sec (0.1 sec)
21	TOL Mode	0	0~1	-	X	Setup overload trip of the motor 0: Disable(deactivation) 1: Enable(activation)
22	TOL Level	150	100~200	%	○	Setup overload trip level of the motor
23	TOL Time	60	5~200	sec	○	Setup overload trip time of the motor
24	Stall Mode	0	0~1	-	X	0: Disable (deactivation) 1: Enable (activation)
25	Stall Level	120	100~200	%	○	100~200% (1%)
26	TMOH Mode	0	0~1	-	X	Setup overheating of the motor 0: Disable(deactivation) 1: Enable(activation)
27	TGF Mode	0	0~1	-	X	Ground Protection 0: Disable(deactivation) 1: Enable(activation)
28	TOO Mode	0	0~1	-	X	Output Open Phase Protection 0: Disable(deactivation) 1: Enable(activation)
31	Retry Number	5	1~100	Time	○	The Number of Rebooting after trip
32	Retry Time	10	1~250	sec	○	Standby time for rebooting after trip
33	DRV. Ctrl Mode	0	0~1	-	X	Drive Control Mode 0: V/F Control(V/F) 1: Slip compensation control
34	V/F Pattern	0	0~1	-	X	0: Linear 1: Square
35	Torque Boost	2.0	0~10.0	%	X	Setup Volume of torque boost
36	Start Freq.	0.5	0.10~40.00	Hz	X	0.10~40.00Hz(0.01Hz)

Chapter 6. Function Table & Description

CODE	LCD Display	Factory Setting	Range	Unit	Changable in operation	Description
37	MOD Freq	20	4 .0L rated HC of the motor	Hz	○	Max. operating Frequency
38	Switching Freq.	5.0	1.0~15.0	kHz	○	1.0~15.0kHz (0.1kHz Unit)
39	Fan Ctrl Mode	1	0~1	-	○	Fan Operating Type 0: Power On Driving output 1: Driving on Frequency
40	TFF Mode	0	0~1	-	○	Setup Fan Trip 0: Disable(deactivation) 1: Enable(activation)
41	Output Freq.	-	0.00~60.00	Hz	-	Display the operating Frequency
42	Output Current	-	0.0~100.0	A	-	Display the operating Current
43	Output Rate	-	0.0~100.0	%	-	Display the operating output Rate
44	Output Voltage	-	0.0~500.0	V	-	Display the operating output Voltage
45	DC Link Volt.	-	0.0~1000.0	V	-	Display DC link Voltage of the Drive
46	Output Power	-	0.0~100.0	kW	-	Display Output Power
47	Kilo Watt hour	-	0~9999999,9	kWh	-	Display the Watt/hour
48	PIM Temp	-	-10~200	℃	-	Display Power Module Temperature
49	Heatsink Temp.	-	-10~200	℃	-	Heat sink Temperature
50	Condenser Alarm	0	0~1	-	○	Setup Condenser Alarm Notification
51	Condenser Temp	-	-10~200	%	-	Display Condenser Temperature
52	Condenser Lifecycle	-	0~60000	Hour	-	The remaining life of Condenser
53	Rotation Freq.	0	0~60.00	Hz	-	Actual Motor rotation freq.

6.2.1 Command Method Setup

Drive 1 : Run/Stop Method
It sets operation command Method.
When operating with the Keypad of the Drive, it is possible to set operation command.

Functional Description
Keypad Input (Factory Setting)
Command using Terminal Block
Comm. Input

Drive 2 : Frequency Input Method Settings
When pump control mode (Pump 1) is manual mode, it sets target frequency input method of drive.

Functional Description	Related Functions	
Keypad		
AI1 (Analog Input Signal 1)	I/O 1~8	Analog Input Setting
AI2 (Analog Input Signal 2)	I/O 11~18	Analog Input Setting
Comm. (485Comm. Input)	Comm. 11~15	485 Comm. Settings

Drive 3 : Target Frequency Settings
When pump control mode (Pump 1) is manual mode and Target Frequency Setup Method (Drive 2) is Keypad, it is possible to set up target frequency.
Range: Start Frequency (Drive 36) ~ Max. Frequency (Drive 37)

Factory Setting	Functional Settings	Related Functions	
30[Hz]	Start Freq. ~ Max Frequency [Hz]	Drive 36	Start Frequency
		Drive 37	Max. Frequency
		Pump 1	Pump Control Mode
		Drive 2	Frequency Setup Mode

Drive 9 : Motor Capacity Settings
·It sets the motor capacity.
·It is set on the drive from the factory. Setting value is for displaying
·It is used for checking the motor capacity.
·Even if you change the setting does not affect other parameters.

Drive 10: Number of motor poles
·Setting the motor pole.
·Pump and drive is set at the factory

Functional Description
2 Pole Motor
4 Pole Motor

Drive 11: Rated Motor Speed
Rated Motor Speed.

Factory Setting	Input Range
Initial value is set upon motor capacity	1 ~ 9999 [rpm]

Drive 12: Rated current of the motor
·It sets up the rated current (RMS) of the motor. It is based on the rated current indicated on the nameplate of the motor.
·It is applied to Stall Prevention Level, Slip Compensation Control and Overload Trip Level

Factory Setting	Input Range
Initial value is set upon drive capacity	1 ~ 9999 [rpm]

Drive 13: The Rated Voltage of the Motor
It sets the rated voltage of the motor. It is based on data indicated on the nameplate of the motor.

Factory Setting	Input Range
Initial value is set upon drive capacity	180.0 ~ 500.0 [Vrms]

Drive 14 : Sets the motor no load current.

Factory Setting	Input Range
Initial value is set upon drive capacity	0.0 ~ 100.0 [Arms]

Drive 15 : Sets the motor no load current.
·It displays the Rated Slip Freq. of the Motor.
·Settings are automatically set upon No. of motor poles, rated No. of rotations, and rated frequency.

Factory Setting	Input Range	Related Functions	
Automatic Setup	0.1 ~ 10.00[Hz]	Drive 10	Motor Pole
		Drive 11	Rated Motor Rev Count
		Drive 16	Rated motor frequency

Drive 16 : The Rated Frequency of the Motor
·It sets the rated frequency of the motor.

Functional Description	Related Functions	
50[Hz]	Drive 37	Max. Operation Freq.
60[Hz]		

Drive 17 : Direction of Motor Rotation Settings
·It sets rotation direction of the pump.
·Be sure to check the rotation direction of the pump for proper operation.
·As the rotation direction may change according to wiring, please check it before starting.

Functional Description
Forward Direction– CW(Clockwise)
Reverse - CCW(Counterclockwise)

Drive 18 : Motor Stop Method
It sets motor stop method

Functional Description		
Deceleration Stop	Related Function	
	Drive 20	Deceleration Time
Cutting off the drive output voltage		

Drive 19 : Acceleration Time
It is time to reach the max. frequency from 0[Hz].
If acceleration time is too short, it can cause over- current fault during motor operation.

Factory Setting	Input Range
3.0 [sec]	1.0 ~ 600.0 [sec]

Drive 20 : Deceleration Time
·It is time to decelerate to 0[Hz] from max frequency.
·If the Deceleration time is too short, over- voltage fault may be occurred during motor operation

Factory Setting	Input Range
6.0 [sec]	1.0 ~ 600.0 [sec]

Drive 21 : TOL (Motor Overload Trip) Settings

· It sets whether overload trip is on or off.
· It is used for protection of the motor.
· If output current is higher than the rated current, it checks the time and then makes trip TOL Time cause trip when output current is higher than the rated current with the accumulative time, while it is subtracted from the accumulated time when the current is less than a set value

Functional Description		
TOL OFF		
Setting	Related Function	
	Drive 12	Rated Current of Motor
	Drive 22	Overload Trip Level
	Drive 23	Overload Trip Time

Drive 22 : TOL (Motor Overload Trip) Level

· It refers to trip current level against the rated current of the motor.
· If the rated current of the motor is 10[A] and the overload trip level is 120%, the overload trip will be occurred above 12[A].
· It is used for protecting the motor upon over current.

Factory Setting	Input Range	Related Function	
120[%]	100~200[%]	Drive 12	Motor Rated Current
		Drive 23	Overload Trip Time

Drive 23 : TOL (Motor Overload Trip) Time

· It sets maintaining time of overload trip level to make overload trip.
That is, if it reaches to overload trip level (dr-22) and the specified time elapsed, it indicates overload trip alarm and stops the operation.

Factory Setting	Input Range
60[sec]	5~200[sec]

Drive 24 : Stall Prevention Settings

·It selects whether it uses Stall Protection.
·In the event of a stall, it decelerates the speed.

Functional Description		
Release		
Setting	Related Functions	
	Drive 12	Rated Current of Motor
	Drive 25	Stall Prevention Level

Drive 25 : Stall Prevention Level
It refers Stall protection current level against the rated current of motor.
That is, if the rated current of the motor is 10[A] and Stall protection level is 150%, Stall protection will be applied above 15[A].

Factory Setting	Input Range	Related Function	
150[%]	100~200[%]	Drive 12	Rated Current of Motor

Drive 26 : TMOH(Motor Overheating) Mode
It sets motor overheating protection function. By comparing the real time Drive's Current against the motor rated current, it generates a trip as follows; 120%-60

Functional Description
OFF
ON

Drive 27 : TGF(Ground) Mode
It sets ground fault protection function. It also generates Trip and blocks the output when ground fault is generated on the output and ground fault current is more than the setting value.

Functional Description
OFF
ON

Drive 28 : TOO(Output Open Phase Protection Mode) Mode
It generates Trip and blocks the output when one of the outputs (U/V/W) of the Drive is open.

Functional Description
OFF
ON

Drive 31 : No. of Auto Restart after Trip
·It refers to No. of automatic restarting for the drive after trip.
If the trip occurs more than specified number, it cannot restart.
·If there is no trip during a certain time, No. of trip might be deleted.
·It may not restart according to error code. Refer to Fault History Table.

Factory Setting	Input Range
5 [Times]	0~ 100 [Times]

Drive 32 : Automatic Reset Waiting Time after Trip
When a specified time elapsed after trip, it restarts automatically.

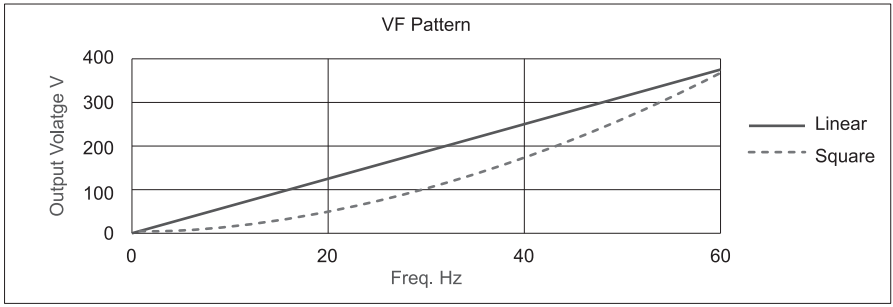
Factory Setting	Input Range
10 [sec]	0 ~ 250 [sec]

Drive 33 : Drive Control Method
It selects V/F control or slip compensation control.

Functional Description
V/F Control: Output Voltage of the Drive increase/decrease by the rate of output voltage and output frequency in accordance with the Frequency Increase/Decrease.
Slip Compensation Control ·It compensates the slip of the motor which increases with the load increases, so that it makes the motor rotate at a constant speed ·Slip Frequency = the rated Slip Frequency of the motor * (the real current – No Load current)/the rated current – No Load current) ·Slip frequency does not exceed the motor rated slip frequency.

Drive 34 : V/F Pattern Settings
It selects V/F control or slip compensation control.
V/F control refers to a control to make ratio of output voltage and output frequency constant, while slip compensation control makes motor speed regular with slip compensation function.

Setup Data	Functional Description
0 (Factory Setting)	Output Voltage and Frequency of the Drive increase/decrease by the rate of output voltage and frequency in accordance with the Frequency Increases/Decreases
1	The output voltage in proportion to the square of the frequency increasing/decreasing pattern



Drive 35 : Torque Boost Amount
·It is a boost amount to be applied on initial operation of drive.
·If starting torque is not enough under overload operation, torque can be increased by rising this value.

Factory Setting	Input Range
2.0[%]	0.0 ~ 10.0[%]

Drive 36 : Start Frequency
It refers to frequency that drive starts to generate output voltage.

Factory Setting	Input Range
0.50[Hz]	0.1 ~ 40.00[Hz]

Drive 37 : Max Operation Frequency
· It can limit max operation frequency of the drive.
· It cannot exceed range of rated frequency (Drive 15) of the motor.

Factory Setting	Input Range
60.00[Hz]	40.00 ~ rated frequency of the motor[Hz]

Drive 38 : Switching Frequency Settings
· In case of high noise or temperature, it is required to decrease the frequency.
· As the switching frequency becomes lower, the noise of motor will be increased while frequency noise or leakage current is decreased.

Factory Setting	Input Range
5.0[kHz]	1.0 ~ 15.0[kHz]

Drive 39 : Fan Operation Method
It sets cooling fan operation method.

Functional Description
To operate upon application of drive power
To operate upon output of drive frequency

Drive 40 : TFF(Fan Trip Mode)
It sets whether stop the drive or not if cooling fan operation has a problem.

Functional Description
OFF
Set – stop the drive when trip occurs

Drive 41 : Frequency of the Drive
It displays an output Frequency of the Drive

Drive 42 : Current of the Drive
It displays an output rate of the Drive.

Drive 43 : Output Rate of the Drive
It displays an output rate of the Drive.

Drive 44 : Output Voltage of the Drive
It displays an output Voltage of the Drive.

Drive 45 : DC Link Voltage of the Drive
It displays DC Link Voltage of the Drive.

Drive 46 : Power Consumption of the Drive
It displays a Power Consumption of the Drive.

Drive 47 : kilo Watt hour of the Drive
It displays an watt-hour of the Drive in kilo Watt unit.

Drive 48 : Temperature of the Power Module
· It displays a temperature of the core power module of the Drive.
· It alerts if the temperature is more than 100 °C, and stop the Drive if the Drive runs for protection.

Drive 49 : Temperature of the Heatsink of the Drive
· It displays a temperature of the Heatsink of the Drive.
· The freezing protection is based on a temperature of the Heatsink.

Drive 50 : Condenser Alarm Settings
· If you set this, it alerts you when it is time to replace the condenser.
· If you set this, it makes trip when the temperature of a condenser is more than 120°C and stops the Drive for protection

Functional Description
OFF
SET
Reset – to initialize condenser life expectancy

Drive 51 : Condenser Temperature
It displays a temperature of the condenser of the Drive.

Drive 52 : Condenser Life Expectancy
It displays the remaining life of the condenser.

Drive 53 : Rotation Frequency
Actual Motor rotation frequency will appear during during operation.

6.3 I/O Group

CODE	LCD Display	Factory Setting	Range	Unit	Changable in Operation	Description
1	AI1 Mode	0	0~1	-	○	External Analog Input 1 settings 0: I 1: V
2	V1 Min. Voltage	0.0	0.0~10.0	V	○	V1 : The Min. Input Voltage
3	I1 Min. Current	4.0	0.0~20.0	mA	○	I1: The Min. Input Voltage
4	AI1 applied Min. value of attribute	0.00	0.00~60.00		○	A Min. value of attribute corresponds to a value of current and voltage received from signal No. 2, 3.
5	V1 Max. Voltage	10.0	0.0~10.0	V	○	V1 : The Max. Input Voltage
6	I1 Max Current	20.0	0.0~20.0	mA	○	I1 The Max. Input Current
7	AI1 applied Max. value of attribute	100.0	0.0~600.0		○	A Max. value of attribute corresponds to a value of current and voltage received from signal No. 5, 6.
8	AI1 Attribute	5	0~5		○	Attribute of Analog Input 1 0: Output Current 1: Output Freq. 2: Output Power 3: Output Voltage 4: Setting Press. 5: Frequency reference value
11	AI2 Mode	0	0~1		○	External Analog Input 2 settings 0: I 1: V
12	V2 Min. Voltage	0.0	0.0~10.0	V	○	V2 : The Min. Input Voltage
13	I2 Min Current	4.0	0.0~20.0	mA	○	I2 : The Min. Input Current
14	AI2 applied Min. value of attribute	0	0.0~600.0		○	A Min. value of attribute corresponds to a value of current and voltage received from signal No. 12, 13.
15	V2 Max. Voltage	10.0	0.0~10.0	V	○	V2 : The Max. Input Voltage
16	I2 Max. Current	0.0	0.0~20.0	mA	○	I2 : The Max. Input Current
17	AI2 applied Max. value of attribute	30.0	0.0~600.0		○	A Min. value of attribute corresponds to a value of current and voltage received from signal No. 15, 16.
18	AI2 Attribute	4	0~5		○	Attribute of Analog Input 2 0: Output Current 1: Output Freq. 2: Output Power 3: Output Voltage 4: Setting Press. 5: Frequency reference value
21	AO1 Mode	0	0~10	-	X	Attribute of Analog Output 1 0: Disable 1: Setting Press. 2: Current Press. 3: Output Freq. 4: Output Current 5: Outlet Press. 6: Inlet Press. 7: Output Rate 8: Output Voltage 9: DC-Link Volt. 10: Output Power
22	AO1 Gain	80	0~200	-	○	Gain of Analog Output 1
23	AO1 Offset	20	0~100		○	Offset of Analog Output 1
24	AO2 Mode	0	0~10		X	Attribute of Analog Output 2 0:Disable 1: Setting Press. 2: Current Press. 3: Output Freq. 4: Output Current 5: Outlet Press. 6: Inlet Press. 7: Output Rate 8: Output Voltage 9: DC-Link Volt. 10: Output Power
25	AO2 Gain	80	0~200	%	○	Gain of Analog Output 2
26	AO2 Offset	20	0~100	%	○	Gain of Analog Output 2
30	Multi-function Input P1	0	0~1		○	Setting for multi-function input 0: Disable 1: Manual-Operation

6.3.1 Signal Control Group

Signal 1 : AI1 Mode (Analog Input 1)
· When Pump Control Mode (Pump 1) is manual mode and Frequency Setup Mode is AI1, you can operate by settings of external input current or frequency.
· You should set Jump J1 on the control board together.

Functional Description
By Current Input
By Voltage Input

Signal 2 : V1 Minimum Input Voltage
When AI1 Mode is set as a Voltage Input and you would enter the minimum Voltage coming from the external input.

Factory Setting	Input Range
0.0[V]	0.0 ~ 10.0[V]

Signal 3 : I1 Minimum Input Current
When AI1 Mode is set as a Current Input and you would enter the minimum Current coming from the external input.

Factory Setting	Input Range
4.0[mA]	0.0 ~ 20.0[mA]

Signal 4 : AI1 applied Min. value of attribute
A min. value of attribute corresponds to a value of current and voltage received from signal No.2, 3.

Factory Setting	Input Range
0	0.0 ~ 600.0

Signal 5 : Maximum Input Voltage
When AI1 Mode is set as a Voltage Input and you would enter the maximum Voltage coming from the external input.

Factory Setting	Input Range
10[V]	0.0 ~ 10.0[V]

Signal 6 : Maximum Input Current
When AI1 Mode is set as a Current Input and you would enter the maximum Current coming from the external input.

Factory Setting	Input Range
20.0[mA]	0.0 ~ 20.0[mA]

Signal 7 : AI1 applied Max. value of attribute
A max. value of attribute corresponds to a value of current and voltage received from signal No.5, 6.

Factory Settings	Input Range
0	0.0 ~ 600.0

Signal 8 : AI1 Attribute
It sets the attribute of AI1

Set-up Data	Functional Description	Drive Display Max. Value
0	Output Current of Inverter	Display a value received from an AI1value on the screen
1	Output Freq. of Inverter	
2	Output Power of Inverter	
3	Output Voltage of Inverter	
4	Setting Pressure of Inverter	Setting the AI1 signal regarding pressure setting method of Drive 3
5 (Factory Setting)	Operating frequency reference value under Manual-Mode	Setting the manual mode on Pump1 Setting the AI1 signal on Drive 2 regarding frequency setting method.

Signal 11 : AI2 Mode (Analog Input 2)
When Pump Control Mode is manual mode and Pressure Setting is AI2, you can setup the pressure by settings of external input current or voltage.

Signal 12 : V2 Minimum Input Voltage
When AI2 Mode is set as a Voltage Input and you would enter the minimum Voltage coming from the external input.

Factory Settings	Input Range
0.0[V]	0.0 ~ 10.0[V]

Signal 13 : I2 Minimum Input Current
When AI2 Mode is set as a Current Input and you would enter the minimum Current coming from the external input.

Factory Settings	Input Range
4.0[mA]	0.0 ~ 20.0[mA]

Signal 14 : AI2 applied Min. value of attribute
A min. value of attribute corresponds to a value of current and voltage received from signal No.12, 13.

Factory Settings	Input Range
0	0.0 ~ 600.0

Signal 15 : Maximum Input Voltage
When AI2 Mode is set as a Voltage Input and you would enter the maximum Voltage coming from the external input.

Factory Settings	Input Range
10[V]	0.0 ~ 10.0[V]

Signal 16 : Maximum Input Current
When AI1 Mode is set as a Current Input and you would enter the maximum Current coming from the external input.

Factory Settings	Input Range
20.0[mA]	0.0 ~ 20.0[mA]

Signal 17 : AI2 applied Max. value of attribute
A max. value of attribute corresponds to a value of current and voltage received from signal No.15, 16.

Factory Settings	Input Range
30.0	0.0 ~ 600.0

Signal 18 : AI2 Attribute
It sets the attribute of AI2

Set-up Data	Functional Description	Drive Display Max. Value
0	Output Current of Inverter	Display a value received from an AI2 value on the screen
1	Output Freq. of Inverter	
2	Output Power of Inverter	
3	Output Voltage of Inverter	
4	Setting Pressure of Inverter	Setting the AI2 signal regarding pressure setting method of Drive 3
5 (Factory Setting)	Operating frequency reference value under Manual-Mode	Setting the manual mode on Pump1 Setting the AI2 signal on Drive 2 regarding frequency setting method.

Signal 21 : AO1
It outputs Drive Information set as Analog output to 0 ~ 25mA.

Set-up Data	Functional Description	Drive Display Max. Value
0 (Factory Setting)	OFF	-
1	Setting Pressure	Capacity of Sensor (Pump 11)
2	Current Pressure	Capacity of Sensor (Pump 11)
3	Output Frequency	Max. Frequency (Drive 37)
4	Output Current	Rated Current output of the Drive
5	Discharge Pressure	Capacity of Sensor (Pump 11)
6	Inlet Pressure	Capacity of Sensor (Pump 11)
7	Output Rate	100.0%
8	Output Voltage	Rated Voltage of the Motor
9	DC Link Voltage	1000[V]
10	Output Power	Rated Power of the Drive

Signal 22 : AO1 Gain

To adjust the Analog output error, you can adjust the Gain.

Factory Settings	Input Range
80[%]	0~ 200[%]

If you set the Offset, as the overall value will be Offset, you should also set AO1 Gain as the same

$$\text{Analog output [mA]} = \frac{\text{the displayed value of the Drive information currently} * (\text{Max. AO1[20mA]} - \text{AO1 Offset Value})}{\text{Drive Max. value}} \times \text{A01 Gain}/100$$

Signal 22 : AO1 Gain

Analog default output is 0~20mA. If you are using 4~20mA, you need to set Offset value (20%) of 4mA. This is the Offset rate of 20mA.

If you set the Offset, as the overall value will be Offset, you should also set AO1 Gain as the same.

$$\text{Analog output[mA]=A01 Offset Value} + \frac{\text{the displayed value of the Drive information currently} \times \text{A(Max. AO1[20mA]} - \text{AO1 Offset Value})}{\text{Drive Max. value}} \times \text{A01 Gain} \div 100$$

Factory Settings	Functional Description
20[%]	0~ 100[%]

Signal 24~26 : AO2 MODE

AO2 Mode is the same as AO1

Signal 30 : Multi-function input P1

A drive will be operated as Max. Frequency when a signal is inputted to 'P' terminal of input signal. The CAN communication is disable and high & low pressure, low water level don't be generated under manual mode.

It will be recovered when an input signal is released at input terminal.

Settings Data	Functional Description
0 (Factory setting)	Disable
1	Manual Operation

6.4 Communication Group

CODE	LCD Display	Factory Setting	Range	Unit	Changable in Operation	Description
2	CAN COMM. ID	0	0~6	-	×	0: Disable 1~6 : ID
3	CAN Speed	1	1~5	-	×	1: 40kbps 2: 50kbps 3: 100kbps 4: 200kbps 5: 250kbps
11	RS-485 Comm. Setting	0	0~1	-	×	0: Disable 1: Enable
12	RS-485 Comm. ID	1	1~250	-	×	RS-485 Comm. ID
13	RS-485 Comm. Speed	4	1~5	-	×	1: 1200 bps 2: 2400 bps 3: 4800 bps 4: 9600 bps 5: 19200 bps
14	RS-485 Delay Time	5	1~9999	ms	×	1~9999 (1ms Unit)
15	RS-485 Address Offset	0	-30000 ~30000	-	×	RS-485 Offset settings for the Data request Address

6.4.1 Description of Parameter Settings on Comm. Group Code

※ In case of a version of firmware is over Ver. 5.0, please don't interlink with below Ver. 5.0.
Please update the firmware of a drive(below Ver. 5.0) as latest version if you want to interlink a drive(below Ver. 5.0) with a drive(over Ver. 5.0) it is possible to check a version of drive on [Configualtion 90] (ref. P.63)

COMM. 2 : CAN COMM. ID
It is CAN Communication ID on Multi-Drive interoperation mode.
Be sure that ID is not duplicated for setup.

Functional Description		
Disabling (Signal Mode: Factory Setting)		
Interlock Mode Comm. ID Number	Related Functions	
	Comm. 1	CAN Comm. Mode
	Comm. 3	CAN Comm. Speed

COMM. 3 : CAN Communication Speed
It sets up CAN communication speed.
It is recommended to reduce the communication speed when connected to a long distance.

Functional Description
40kbps (Factory Setting)
50kbps
100kbps
200kbps
250kbps

COMM. 11 : RS-485 Comm. Mode
It is to setup RS485 Comm. Mode.
ModBus RTU is used for communication protocol.

Functional Description
Disable : 485 Comm. OFF
Enable : 485 Comm. ON

COMM. 12 : RS-485 Comm. ID
It setup RS 485 Comm. ID.

Setup Data	Functional Description
1 ~ 250 (Factory Setting: 1)	RS-485 Comm. ID Settings. If the ID of data request protocol is different, The data is not transmitted.

COMM. 13 : RS-485 Comm. Speed
It setup RS-485 Comm. Speed.

Functional Description
1200 bps
2400 bps
4800 bps
9600 bps (Factory Setting)
19200 bps

COMM. 14 : RS-485 Comm. Delay Time for Data Transmission
It setup RS 485 Comm. delay time for the data transmission.

Setup Data	Functional Description
1 ~ 9999 [msec]	When receive the protocol of the requested data, the data will be transmitted after delay time settings (Factory Default : 5 [msec]

COMM. 15: RS-485 Comm. Offset value for the Address of the requested Data
It setup RS-485 Comm. Data request address using Offset value.
Example: - The current address of the requested Data: 3000
- Offset Value: +2000
- The actual address for requested Data: 5000

Setting Data	Functional Description
0	-30000~30000

6.5 Alarm History Group

TRIP	CODE	LCD Display	Setting Value	Range	Unit	Description
Last Trip 1 ~ Last Trip 5	1	Recent Trip 1	0	0~9999	-	The cumulative Number of the recent same kind of Trip
	1.1	Trip types	-	1~28	-	**Trip Type** 1:TSF (Sensor Fault) 2:TOP (High Pressure) 3:TLP (Low Pressure) 4:TUL-LS (Level Sensor - Low Water Level) 5:TUL-OUT (Outlet Pressure - Low Water Level) 6:TUL-IN (Inlet Pressure - Low Water Level) 7:TASH (IGBT Short Circuit) 8:TOC (Drive Overcurrent) 9:SOC (Drive Overcurrent Control) 10:TMOH (Motor Overheating) 11:TOH (Drive Overheating) 12:TLV (Low Voltage) 13:TOV (High Voltage) 14: TDOL (Drive Overload) 15: TGF (Ground Fault) 16: TIDE (Comm. ID duplication) 18: TOO (Output Open Phase) 19: TFF (Fan Fault) 20: TES (Emergency Stop) 22: TCA (Condenser Replacement Alarm) 23: TCH (Condenser Over - temperature) 24: TBA (Bearing Replacement Alarm) 25: TMA (Mechanical Seal Replacement Alarm) 26: TSF2 (Sensor compare fault) 27: TMOP (Max. Pressure generated)
	1.2	Setting Press.	-	0.00~25.00	bar	Setting Pressure at the time of the Trip
	1.3	Current Press.	-	0.00~25.00	bar	Current Pressure at the time of the Trip
	1.4	Output Freq.	-	0.00~60.00	Hz	Output Frequency at the time of the Trip
	1.5	Output Current	-	0.0~100.0	A	Output Current at the time of the Trip
	1.6	DC-link Volt.	-	0.0~1000.0	V	DC-link Voltage at the time of the Trip
	1.7	PIM Temp	-	0~100	℃	Power Module Temperature at the time of the Trip
	1.8	Date/Time	-	-	-	Date/Time at the time of the Trip
	1.9	Trip 1 Delete	0	0~21	-	Trip 1 Delete 0: No 1: Yes

Alarm 1 : Recent Trip1
· It displays the cumulative Number of the recent same kind of Trip.
· It counts whenever the same type of Trip is generated.

Alarm 2 : Trip Type
It displays what kind of trip is generated.

Trip Code	Functional Description
TSF	Sensor Fault
TOP	High Pressure
TLP	Low Pressure
TUL-LS	Level Sensor -Low Water Level
TUL-OUT	Outlet Pressure- Low Water Level
TUL-IN	Inlet Pressure-Low Water Level
TASH	IGBT Short Circuit
TOC	Drive Overcurrent
SOC	Drive Overcurrent Control
TMOH	Motor Overheating
TOH	Drive Overheating
TLV	Low Voltage
TOV	High Voltage
TDOL	Drive Overload
TGF	Ground Fault
TIDE	Comm. ID duplication
TCE	Comm. Fault
TOO	Output Open Phase
TES	Emergency Stop
TOL	Expired Validity Date
TFF	Fan Fault
TCA	Condenser Replacement Alarm
TCH	Condenser Over-temperature
TBA	Bearing Replacement Alarm
TMA	Mechanical Seal Replacement Alarm
TSF2	Sensor compare fault
TMOP	Max. Pressure generated

Alarm 3 : Setting Pressure
· It displays Setting Pressure at the time of the Trip

Alarm 4 : Current Pressure
· It displays Current Pressure at the time of the Trip

Alarm 5 : Output Frequency
· It displays Output Frequency at the time of the Trip

Alarm 6 : Output Current
· It displays Output Current at the time of the Trip.

Alarm 7 : DC-link Voltage
· It displays DC-link Voltage at the time of the Trip.

Alarm 8 : Power Module Temperature
· It displays Power module Temperature at the time of the Trip

Alarm 9 : Date/Time
· It displays Date/Time at the time of the Trip

Alarm 10 : Delete Trip1
· It deletes Trip1 log permanently

Alarm 11 ~ 50 :
· It operates the same way of the Trip1 group

6.6 Configuration Group

CODE	LCD Display	Factory Setting	Range	Unit	Changeable in Operation	Description
1	Language	1	1~3	-	○	Language Settings : English, Korean, Chinese
2	LCD Brightness Adjustment	-	0~100	%	-	LCD Brightness Adjustment
7	Para Group Reset	0	0~6		X	Group Reset 0: Null 1: All Group 2: Pump Group 3: Drive Group 4: Signal Goup 5: Comm. Group 6: Configuration
10	Erase All Trip	0	0~1	-	○	Reset All Trip 0: No 1: Yes
11	Power-On Time	0	0~999999999	hour	X	Cumulative Power-On Time
12	Reset On Time	0	0~1	-	X	Reset Power-On Tim 0: No 1: Yes
13	Run Time	10	0~999999999	sec	○	Cumulative Drive operating time
14	Reset Run Time	0	0~1	-	X	Reset the cumulative Drive operating time 0: No 1: Yes
15	Reset kWh	0	0~1	-	X	Reset kilo Watt hours 0: No 1: Yes
16	Trip Count	0	0~65535	-	X	Display the cumulative Trip Numbers
17	Trip Trip Count	0	0~1	-	X	Reset All Trip Counts 0: No 1: YES
18	Seriel Number	0	0~9999	-	X	Serial Number for the remote control
19	Date/Time	0	-	-	X	Date/Time Setting
30	Bearing kWh	0	0~999999999	kWh	-	At the time of Bearing Alarm
31	Mech. Seal kWh	0	0~999999999	kWh	-	At the time of Mechanical Seal Alarm
90	S/W Version	-	0.0~999.9	-	-	S/W Version

6.6.1 Config Group Functional Description

Configuration 1 : Language
Korean, Chinese, English compatible

Functional Description
한국어
中文
English (Factory Setting)

Configuration 2 : LCD Brightness Adjustment
Adjust the brightness of the LCD to your preference.

Configuration 7 : Initialization of Factory Settings
It carries out initialization with factory settings for all or each group.

Functional Description
To maintain settings
To initialize All the data settings with factory settings
To initialize PUMP Group
To initialize DRIVE Group
To initialize I/O Group
To initialize COMM.Group
To initialize CONFIG Group

Configuration 10 : Delete Trip History
· It deletes all of the trip history
· In case of deleting the trip history, the data (trip history) will be removed permanently.

Functional Description
No: Maintain Data
Yes: Reset Data

Configuration 11 : Power-On Time
It displays the accumulative time of Power-On the drive.

Configuration 12 : Reset Power-On Time
· It resets the Power-On Time of the Drive.
· After resetting, data is unrecoverable.

Functional Description
No: Maintain Data
Yes: Reset Data

Configuration 13 : Run Time
It displays the accumulative time of the actual Drive operating time.

Configuration 14 : Reset Run Time
· It resets the accumulative time of the actual Drive operating time.
· After resetting, data is unrecoverable.

Functional Description
No: Maintain Data
Yes: Reset Data

Configuration 15 : Reset the kilo-Watt hour
· It resets kilo-Watt hour (Drive 47).
· After resetting, data is unrecoverable.

Functional Description
No: Maintain Data
Yes: Reset Data

Configuration 16 : Accumulative Trip Number
It displays the accumulative trip number.

Configuration 17 : Reset the accumulative Trip Number
· It resets the accumulative Trip Number.
· After resetting, data is unrecoverable

Functional Description
No: Maintain Data
Yes: Reset Data

Configuration 18 : Serial Number
Internet Option: Serial Number is indicated for the user

Configuration 19 : Date/Time Settings
It sets Date and Time.

Configuration 30 : Bearing kWh
It sets the accumulative time for Bearing replacement time.

Configuration 31 : Mechanical Seal kWh
It sets the accumulative time for Mechanical Seal replacement time.

Configuration 90 : S/W Version
It displays the S/W Version.

Chapter 7. Cause of Fault and Reaction

7.1 Protection Function Table

Function	LCD Display	Description
Pump Protection	Er-01:TSF	Pressure Sensor Fault If the Pressure Sensor has a problem or disconnection with the Drive
	Er-02:TOP	High Pressure Alarm If the current pressure is above the TOP level and TOP Time, it makes trip and shut off the Drive output.
	Er-03:TLP	Low Pressure Alarm If the current pressure is below the TLP level and more the TLP Time, it makes trip and shuts off the Drive output.
	Er-04:TUL	Low Water Level Alarm by Low Water Level Sensor If it detects Low Water Level by Low Water Level Sensor and TUL time is more than TUL-LS Settings, it makes trip and shut off the Drive output.
		Low Water Level Alarm by the Outlet pressure sensor If the current pressure is below the TUL-OUT Level and more than TUL-OUT Time, it shuts off the Drive output.
		Low Water Level Alarm by the Inlet pressure sensor If the current pressure is below the TUL-IN Level and more than TUL-IN Time, it shut off the Drive output
Drive Over-Current	Er-05:TASH	IGBT Short Circuit: If IGBT has a short circuit or output short circuit, it shut off the Drive output
	Er-06:TOC	Drive Over-Current Trip If the Drive detects the Over-Current, it shuts off the Drive output
	Er-07:SOC	Drive Over-Current Control Trip If the Drive detects Over-Current, it tries to control the Over-Current by dropping the Hz and still detects Over-Current then, it shuts off the Drive output.
	Er-09:TOH	Drive Over-Temperature If there is a problem with the cooling fan or the ambient temperature is high, it alerts and stops the operation to protect IGBT damages.
	Er-13 TDOL	Drive Over-Load Trip If the Drive output Current is more than 120% of the rated output of the Drive, it shuts off the Drive output.
Motor Protection	Er-08:TMOH	Motor Over-Heating The Drive considers Motor Temperature Increasing theoretically by checking several parameters and the Load Current, the Drive figures out the motor over-heating and shuts off the Drive output.
	Er-12:TOL	Motor Over-Load Trip If the output Current of the Drive is more than TOL level of the rated Current of the motor and more than TOL Time, it shuts off the Drive output.
Low-Voltage Protection	Er-10:TLV	DC-Link Low Voltage Trip If the Voltage of the Drive is lower, the motor will be lack of torque and over-heating. Therefore, it shuts off the Drive output if the Drive detects DC-Link Low Voltage.
High-Voltage Protection	Er-11:TOV	DC-Link High Voltage Trip If the Drive detects the higher DC Voltage of the main circuit by regenerative energy from the motor, the Drive shuts off the output. Sometimes DC-Link high Voltage is generated by Surge Power of power system.
Ground Fault Current Protection	Er-14:TGF	If Ground Fault Current of the Drive is generated more than setting value, it makes a trip and shut off the Drive output
Comm. ID Duplication Trip	Er-15:TIDE	The trip is generated by the same ID input when assigning ID on each drive for inter-operation.
Comm. Fault	Er-16:TCE	The trip is generated by communication failure between Drive to Drive when inter-operation
Output Open Phase	Er-18:TOO	It generates Trip and blocks the output when one of the outputs (U/V/W) of the Drive is open.
Fan Fault	Er-19:TFF	If there is a problem with Fan operation, it stops the Drive to protect the over-heating of the Drive.

Chapter 7. Cause of Fault and Reaction

Function	LCD Display	Description
Emergency Stop	Er-20:TES	If there is a problem with external input or device, the drive make a trip and shut off output
Condenser Alarm	Er-22:TCA	It alerts you when it is time to replace the condenser. It just displays the Condenser replacement Alarm and the other is the same as usual.
Condenser over-Temp.	Er-23:TCH	If the condenser is over-temperature then, it makes trip and shut off the Drive output.
Bearing Alarm	Er-24:TBA	It alerts you when it is time to replace the Bearing. It just displays the Bearing replacement Alarm and the other is the same as usual.
Mechanical Seal Alarm	Er-25:TMA	It alerts you when it is time to replace the Mechanical Seal. It just displays the Mechanical replacement Alarm and the other is the same as usual.
Sensor compare fault	Er-26:TSF2	A trip is generated under situation which has different value over 1 bar among each input sensors from an interlink-system has connected input sensor more than two.
Max. Pressure generated	Er-27:TMOP	A trip is generated under situation on which pressure is over Max. pressure trip level (Pump Group 70)

7.2 Reset of fault and alarm

- In case of fault or alarm, LCD display shows the description of trip code or contents.
- To reset the fault and alarm, press Reset Key.
  : In case of 1.TSF(Pressure Sensor Fault), 2. TOP (High Pressure Alarm), 4.TUL-LS (Low Water Level Alarm), If the case becomes white alert, it resets and restarts automatically. But if the case is still Alarm condition then, it alerts again.

7.3 Cause of Fault and Trouble Shooting

Er-01 : TSF (Pressure Sensor Fault)

Cause
- Sensor Error
- Drive Error
- Sensor Terminal Wiring
- In case of multi-drive operation, Comm. ID not set up

Action
- Replace sensor.
- Replace drive.
- Check sensor terminal wiring or Comm. ID settings in case of interoperation.

Related Function	Function Name	Ref. Page
Comm. 2	CAN Communication ID	56
Comm. 3	CAN Communication Speed	57

Er-02 : TOP(High Pressure Alarm)

Cause

- In case the current pressure increases more than 2 bar than the pressure setting during operation, operation will stop after elapsed High Pressure Alarm Time(Pump 51) and the alarm will be displayed on the screen. (It may occur temporary during installation site or trial run test.

Action

- Check Pressure Settings and high pressure alarm level.
- When the current pressure goes down under the high pressure alarm setting, the drive will be recovered automatically.

Related Function	Function Name	Ref. Page
Pump 50	High Pressure Alarm Level	37
Pump 51	High Pressure Alarm Time	37

Er-03 : TLP(Low Pressure Alarm)

Cause

- It alerts when the current operation pressure is maintained under the low pressure alarm level. It starts automatically after Automatic Restart Time (Drive 32) from trip. However, if it repeats more than No. of Automatic Restart after Trip (Drive 31), it does not restart anymore to protect motor and drive.

Action

- Check if the water tank (water reservoir) is filled with water
- Check if it may intake air into the pump.
- Check if any water flows by opening the air inlet valve of the pump.
- After resetting the fault by pressing the reset key, and press RUN key to start the pump.

Related Functions	Function Name	Ref. Page
Pump 52	Low Pressure Alarm Level	37
Pump 53	Low Pressure Alarm Time	38
Drive 31	No. of Automatic Restart after Trip	47
Drive 32	Stand by Time for Automatic Restart after Trip	48

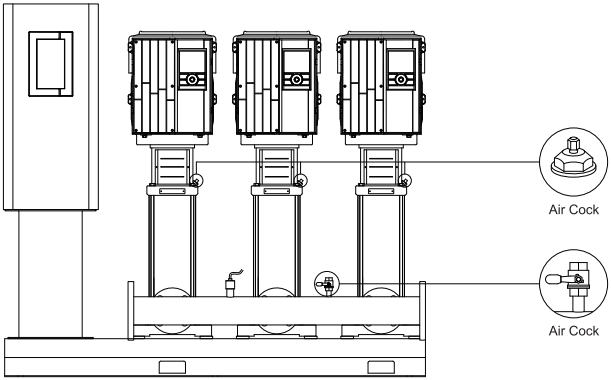
Er-04 : TUL (Low Water Level Alarm by Inlet Pressure Sensor)

Cause

- It alerts to prevent the mechanical seal from being damaged due to running of the pump when there is no water on the suction side.
  It alerts when the low level sensor (electrode) does not detect the water. In case of not using the low water level sensor, the software generates the alarm when the current pressure is maintained under the low pressure alarm level (Pump 56, Pump 58) and the operation continues for low pressure trip time (Pump 57, Pump 59). In case of using the low water level sensor (electrode), when there is water, the alarm will be automatically released and the drive will be automatically operate.

Action

- Check if the water tank (water reservoir) is filled with water.
- Check if any water flows by opening air cock of the pump.
- After resetting the fault by pressing the reset key, and press RUN key to start the pump.



Related Function	Function Name	Ref. Page
PUMP 54	Low water level alarm detection method	38
PUMP 55	Low water level alarm time-LS	38
PUMP 56	Low Water Pressure Alarm Level - OUT	38
PUMP 57	Low Water Pressure Level Alarm Time of Pressure Sensor - OUT	38
PUMP 58	Low Water Pressure Alarm Level - IN	39
PUMP 59	Low Water Pressure Alarm Time - IN	39

ER-05 : TASH (IGBT Short Circuit Trip)

Cause

- In case acceleration/deceleration time is excessively short comparing to load inertia
- Up/Down short circuit of IGBT
- Output short circuit

Action

- Extend Acceleration time (Drive 18).
- Check motor damage from fire and insulation fault.
- Conduct test run after separation motor and drive. If the same alarm occurs, it would be an up/down short circuit of IGBT, please contact A/S center.

Related Function	Function Name	Ref. Page
Drive 19	Acceleration Time	45

ER-06 : TOC (Drive Over-Current Trip)

Cause

- In case acceleration/deceleration time is excessively short comparing to load inertia.
- If drive restarts during free run of motor, Drive could be damaged by fire.

Action

- Adjust the acceleration/deceleration time.
- Check if the drive capacity is suitable for motor capacity.
- Start the pump when the motor is stopped.
- Check load, motor, and output wiring.
- If the same alarm occurs, please contact A/S center.

Related Function	Function Name	Ref. Page
Drive 18	Motor Stop Method	45
Drive 19	Acceleration Time	45
Drive 20	Deceleration Time	45

ER-07 : SOC (Drive Over-Current Control Trip)

Cause

- In case acceleration/deceleration time is excessively short comparing to load inertia
- It cuts off the motor output to control the current when the drive restarts on motor Free-run state or over current is generated due to sudden overload.

Action

- Adjust the acceleration/deceleration time.
- Check if the drive capacity is suitable for motor capacity.
- Start the pump when the motor is stopped.
- If load is large on starting, adjust torque boost amount (Drive 35).
- If the same alarm occurs, please contact A/S center.

Related Function	Function Name	Ref. Page
Drive 9	Motor Capacity	43
Drive 18	Motor Capacity	45
Drive 19	Motor Capacity	45
Drive 20	Deceleration Time	45
Drive 35	Torque Boost Amount	48

ER-09 : TOH (Drive Over-Heating Trip)

Cause

- It alerts and stops operation to prevent IGBT from being damaged by cooling fan fault or foreign materials and high ambient temperature.

Action

- Check if there is any cooling fan fault or if there are any foreign materials in the intake.
- Check the ambient temperature and maintain it under 40℃ if it is too high

ER-10 : TLV (DC-Link Low Voltage Trip)

Cause

- Occurs when the power supply voltage is low.
- Occurs when the connected load is larger than the power capacity.

Action

- Check the drive input voltage.
- Check the power capacity.

※Check the DC Link voltage (Drive 45) on the main LCD Screen.

ER-11 : TOV (DC-Link High Voltage Trip)

Cause

- Occurs when the deceleration time (Drive 19) is short compared to the load inertia
- Occurs when the drive input voltage is too high.

Action

- increase the deceleration time (Drive 20).
- Check the driver power supply voltage

※Check the DC Link voltage (Drive 45) on Parameter Settings.

Related Function	Function Name	Ref. Page
Drive 20	Deceleration Time	45

ER-12 : TOL(Motor Over-Load Trip))

Cause

- It alerts and stops operation to protect the motor when the load is above the overload trip level (Drive 22) of the rated current of the motor and the motor operates for more than overload trip time (Drive 23).
  EX) If the rated current of the motor is 10[A], the overload trip level is 120%, and the overload trip time is 5 seconds, It makes a trip when the pump operates above 12[A] of output current for more than 5 seconds.

Action

- Check the rated current of the motor (on the nameplate) and the rated current setting (Drive 12).

※It is possible to check the output current on the main LCD screen.

Related Function	Function Name	Ref. Page
Drive 9	Motor Capacity	43
Drive 12	The Rated Current of Motor	44
Drive 21	TOL (Motor Overload Trip) Settings	46
Drive 22	TOL (Motor Overload Trip) Level	46
Drive 23	TOL (Motor Overload Trip) Time	46

ER-13 : TDOL (Drive Over-load Trip)

Cause

- Occurs when the load is larger than the rated capacity of the Drive.

Action

- Use a larger capacity Drive for the load.

ER-14 : TGF (Ground Fault Trip)
Cause
- Occurs when the Output line of the drive makes a short circuit with ground line.
- Occurs when insulation of the motor is damaged.

Action
- Check the drive output wiring.
- Replace the motor.

ER-15 : TIDE (Comm. ID Duplication Trip)
Cause
- Occurs upon the same ID duplication when assigning ID on each drive for inter-operation.

Action
- Check the drive ID and be sure not to make ID duplication.

Related Function	Function Name	Ref. Page
Comm. 2	Communication ID	56

ER-16 : TCE(Comm. Fault Trip)
Cause
- Occurs when CAN communication lines have bad connection.
- Occurs when drive CAN communication IC is defective.

Action
- Check the connection of CAN communication lines.
- Replace the drive

ER-18 : TOO(Output Open Phase Trip)
Cause
- Occurs when output wiring is defective.
- Occurs when output wiring has short circuit

Action
- Check the connection of output wiring.
- Check the condition of output terminal.

ER-19 : TFF (Fan Fault Trip)
Cause
- Intake of foreign materials or cooling fan fault.

Action
- Check the air intake and outlet part.
- Replace the Cooling Fan.

ER-20 : TES(Emergency Stop Trip)
Cause
- There is a problem with external input or device, the drive make a trip and shut off output.

Action
- Check input side of the external signals.

ER-22 : TCA(Condenser Replacement Alarm)
Cause
・It alerts when it is time to replace the condenser

Action
・Replace the DC condenser inside the drive.

ER-23 : TCH (Condenser Over-Temperature Trip)
Cause
・It makes a trip when the temperature of the condenser is over-temperature.

Action
・Replace the DC condenser inside the drive.

ER-24 : TBA (Bearing Replacement Alarm)
Cause
・It alerts when it is time to replace the bearing

Action
・Check and replace the bearing.

ER-25 : TMA (Mechanical Seal Replacement Alarm)
Cause
・It alerts when it is time to replace the mechanical seal.

Action
・Check and replace the mechanical seal.

ER-26 : TSF2 (Sensor compare fault)
Cause
・Sensor fault
・Drive fault

Action
・Replace the sensor
・Replace the Drive

ER-27 : TMOP (Max. Pressure generated)
Cause
・Sensor fault
・In case of that value of setting pressure is over the value of Max. pressure trip level.

Action
・Replace the sensor
・Re-setting the value of setting pressure.

Chapter 8. RS-485

8.1 RS-485

Article	Specification
Communication Speed	Choose from; 1200/2400/4800/9600/19200bps
Control Procedure	Asynchronous communication
Communication System	Half duplex system
Text	8 bits
Stop bit	1 bit
Error Check (CRC16)	16 bits
Parity Check	None

Communication Protocol (ModBus - using RTU protocol)

Code	Name
0 X 03	Read Hold Register
0 X 06	Preset Single Register

READ

Query(Example of reading setting pressure)

Start	Slave ID		Function		Start Add Hi		Start Add Lo		No Hi		No Lo		CRC				END
3.5 byte Time	X	X	0	3	1	0	0	2	0	0	0	1	X	X	X	X	3.5 byte Time Hex

Response

Start	Slave ID		Function		Byte Count		Data Hi		Data Lo		CRC				END
3.5 byte Time	X	X	0	3	0	2	0	0	3	7	X	X	X	X	3.5 byte Time Hex

Single Write

Query(Example of writing the set pressure 5.5bar)

Start	Slave ID		Function		Add Hi		Add Lo		Data Hi		Data Lo		CRC				END
3.5 byte Time	X	X	0	6	1	0	0	2	0	0	3	7	X	X	X	X	3.5 byte Time Hex

Response

Start	Slave ID		Function		Add Hi		Add Lo		Data Hi		Data Lo		CRC				END
3.5 byte Time	X	X	0	6	1	0	0	2	0	0	3	7	X	X	X	X	3.5 byte Time Hex

Fault Diagnosis: In-case communication is not connected

Points to check	Note
Connection between master of computer or FA equipment and XQ drive	Connect to Master Drive
RS485 Comm. Settings	Comm. 11 485 comm. Mode
RS485 Comm. Speed	Comm. 12 485 comm. Speed
RS485 Comm. ID	Comm. 485 comm. ID
Starting communication of master of computer or FA equipment	
Check Data format of user's program	

8.2 XQ drive operation (Parameter table)

Address (decimal)	Address (Hexadecimal)	Parameter	Scale	Unit	R/W	Contents
4096	0X1000	Program version	0.01		R	0 ~ 65535
4097	0X1001	System operation			R	0:STOP 1:READY (inverter EN and output zero) 2:RUN (inverter EN and output non-zero) 3:Fault(system fault)
4098	0X1002	Setting Pressure	0.01	bar	R/W	0 ~ 10000
4099	0X1003	Discharge Pressure	0.01	bar	R	0 ~ 10000
4100	0X1004	STOP			R	Bit 0 : 1 Inverter Bit 1 : 2 Inverter Bit 2 : 3 Inverter Bit 3 : 4 Inverter Bit 4 : 5 Inverter Bit 5 : 6 Inverter
4101	0X1005	READY			R	Bit 0 : 1 Inverter Bit 1 : 2 Inverter Bit 2 : 3 Inverter Bit 3 : 4 Inverter Bit 4 : 5 Inverter Bit 5 : 6 Inverter
4102	0X1006	RUN			R	Bit 0 : 1 Inverter Bit 1 : 2 Inverter Bit 2 : 3 Inverter Bit 3 : 4 Inverter Bit 4 : 5 Inverter Bit 5 : 6 Inverter
4103	0X1007	System Fault Contents				Trip Contents Bit 0 : Sensor Bit 1 : High Pressure Bit 2 : Low Pressure Bit 3 : Low level of water
4104	0X1008	Inverter Fault			R	Bit 0 : 1 Inverter Bit 1 : 2 Inverter Bit 2 : 3 Inverter Bit 3 : 4 Inverter Bit 4 : 5 Inverter Bit 5 : 6 Inverter

Address (decimal)	Address (Hexadecimal)	Parameter	Scale	Unit	R/W	Contents
4111	0X100F	Inverter 1 Output Power	0.1	%	R	0~1000
4112	0X1010	Inverter 2 Output Power	0.1	%	R	0~1000
4113	0X1011	Inverter 3 Output Power	0.1	%	R	0~1000
4114	0X1012	Inverter 4 Output Power	0.1	%	R	0~1000
4115	0X1013	Inverter 5 Output Power	0.1	%	R	0~1000
4116	0X1014	Inverter 6 Output Power	0.1	%	R	0~1000
4117	0x1015	Inverter 1 Output Freq.	0.1	Hz	R	0~600
4118	0x1016	Inverter 2 Output Freq.	0.1	Hz	R	0~600
4119	0x1017	Inverter 3 Output Freq.	0.1	Hz	R	0~600
4120	0x1018	Inverter 4 Output Freq.	0.1	Hz	R	0~600
4121	0x1019	Inverter 5 Output Freq.	0.1	Hz	R	0~600
4122	0x101A	Inverter 6 Output Freq.	0.1	Hz	R	0~600
4123	0x101B	Inverter 1 Output Amp.	0.1	A	R	0~1000
4124	0x101C	Inverter 2 Output Amp.	0.1	A	R	0~1000
4125	0x101D	Inverter 3 Output Amp.	0.1	A	R	0~1000
4126	0x101E	Inverter 4 Output Amp.	0.1	A	R	0~1000
4127	0x101F	Inverter 5 Output Amp.	0.1	A	R	0~1000
4128	0x1020	Inverter 6 Output Amp.	0.1	A	R	0~1000
4129	0x1021	Inverter 1 DC Link Voltage	1	V	R	0~9999
4130	0x1022	Inverter 2 DC Link Voltage	1	V	R	0~9999
4131	0x1023	Inverter 3 DC Link Voltage	1	V	R	0~9999

Address (decimal)	Address (Hexadecimal)	Parameter	Scale	Unit	R/W	Contents
4132	0x1024	Inverter 4 DC Link Voltage	1	V	R	0~9999
4133	0x1025	Inverter 5 DC Link Voltage	1	V	R	0~9999
4134	0x1026	Inverter 6 DC Link Voltage	1	V	R	0~9999
4135	0x1027	Inverter 1 Output Power	0.1	kW	R	0~10000
4136	0x1028	Inverter 2 Output Power	0.1	kW	R	0~10000
4137	0x1029	Inverter 3 Output Power	0.1	kW	R	0~10000
4138	0x102A	Inverter 4 Output Power	0.1	kW	R	0~10000
4139	0x102B	Inverter 5 Output Power	0.1	kW	R	0~10000
4140	0x102C	Inverter 6 Output Power	0.1	kW	R	0~10000
4141	0x102D	Inverter 1 Accumulated Power	1	MWh	R	0~9999
4142	0x102E	Inverter 2 Accumulated Power	1	MWh	R	0~9999
4143	0x102F	Inverter 3 Accumulated Power	1	MWh	R	0~9999
4144	0x1030	Inverter 4 Accumulated Power	1	MWh	R	0~9999
4145	0x1031	Inverter 5 Accumulated Power	1	MWh	R	0~9999
4146	0x1032	Inverter 6 Accumulated Power	1	MWh	R	0~9999
4147	0x1033	Inverter 1 Accumulated Power	0.1	kWh	R	0~9999
4148	0x1034	Inverter 2 Accumulated Power	0.1	kWh	R	0~9999
4149	0x1035	Inverter 3 Accumulated Power	0.1	kWh	R	0~9999
4150	0x1036	Inverter 4 Accumulated Power	0.1	kWh	R	0~9999
4151	0x1037	Inverter 5 Accumulated Power	0.1	kWh	R	0~9999
4152	0x1038	Inverter 6 Accumulated Power	0.1	kWh	R	0~9999

Warranty

Dooch guarantee the quality of the product authorized and passed all the required QC procedure. Warranty periods and warranty services are varied in accordance with the region where the customers purchase our product.
The warranty period applies from the date of purchase by the first customer and is transferable only between end-users. The warranty covers manufacturing defects only.

Product	V.F.D.	Warranty	1 year
Model	XQ–Drive	Date from	
Place		Agent	

The liability of Dooch Co., Ltd. (or its appointed maintenance agent) is limited to The cost of repair and/or replacement of the product under warranty.
The warranty is invalidated if the defect is caused (howsoever) by misuse, neglect, and tampering or incorrect adjustment.
It is invalidated if unauthorized persons carry out any alterations and/or repairs.
Also, the warranty is invalidated in the following cases:

- For repair due to incorrect installation by customer's discretion
- For repair to any product where the serial number has been removed

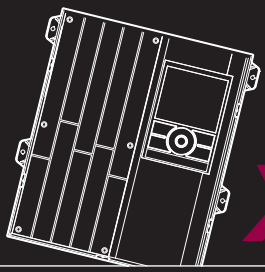
To obtain technical assistance or to book a service/repair to your product under warranty, please contact our customer care centre.
To assist our customer service team, please have your model number, serial number and date of purchase ready when calling.

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MEMO

XQ-1907-E-M



XQ Drive

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