

SQ2 Drive

INSTRUCTION MANUAL

dooch
두크펌프

Safety Instructions

Preface

- Thank you for choosing DOOCH's high performance SQ2-Drive series.
- Describing specification, installation, operation, function, and maintenance of the SQ2-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 SQ-Drive series that you have purchased.

Safety Precautions

- To prevent injury and property damage, follow these instructions. Incorrect operation due to ignoring instructions will cause harm or damage.
- The seriousness on this manual are classified as "Warning" and "Caution".
- For your safety, please read this manual carefully prior to use.
- Place this manual where user can find easily.

 **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.

Safety Instructions

Warning

- **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.
- **In order to avoid electric shock accident, make sure to apply input voltage within the range of rated one (220V) ± 10 % and socket**

Caution

- **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 VFD will 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.
- Do not pile up VFD's above allowable limit.
- Be sure to install the VFD as directed in this instruction manual.
- 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.
- Keep in mind that the VFD is very vulnerable to drop from the mid air and strong shock.
- Please use the product under following conditions.

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/sec^2(=0.6g)
Ambient Atmospheric Pressure	70~106 kpa

B. Wiring

- Do wiring after installing the VFD body.
- A professional installer should have done the wiring and checking.
- Do not connect phase-leading capacitors, surge filter, radio noise filter to the output of the VFD.
- Make sure that input cable and output cable are applied correctly.
- Wrong terminal wiring can cause the drive damage.
- Apply circuit breaker for wiring.

※ Do not install an earth leakage circuit breaker to power supply part.

※ For any question or problem, please contact the distributor or our A/S centre.

C. Check before operation

- Check the drive parameters before its operation. You need to set up the parameter according to the pump model or equipment system.
- Please wire the main power board and control circuit terminals according to this manual. Any of misuse can cause the damage of drive.
- Please use the pressure sensor or low water level sensor as DOOCH designated.

D. Operation

- Please be informed that this product has automatic recovery function. So, for any case the product is stopped by any trip, system alarm or power-off, it might resume its operation when the power is supplied.
- Do not modify the product without authorization.
- Do not operate/stop the product by main circuit breaker (MCB) at power supply.
- When you initialize the parameters, please set up the required parameter before operation, again.
- Parameter initialization will bring back the product parameters to the factory setting values.

E. Reaction on Failure and Malfunction

- In case drive is not operatable dye to any damage, the pump system performance can be down. In order to avoid this situation, we recommend you to install any additional system for back-up.
- Please refer to Chapter No. 7, for any troubleshooting.

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7. Cause of fault and counteraction

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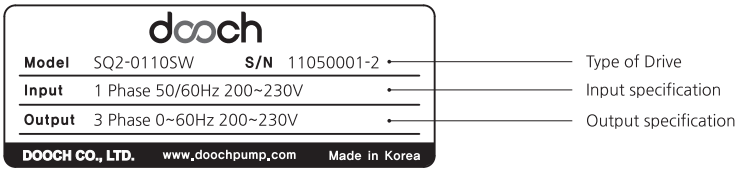
Chapter 1 Basics

1. Before use

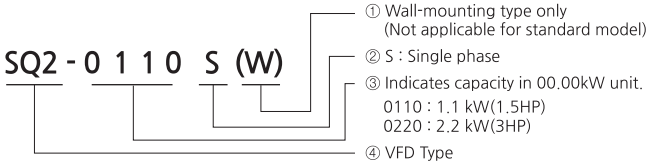
1.1 Nameplate Information

- 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.
- For any question or problem, please contact the distributor or our A/S centre.

- Nameplate of the Product



1.2 Type of Product



- Product model name is indicated as above. Initial four digits indicate driving capacity of the drive in 00.00kW unit. Second decimal point is omitted.

- 'S' refers Single phase.

- "W" refers Wall-mounting type model.

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 Appearance

1.5.1 Assembled

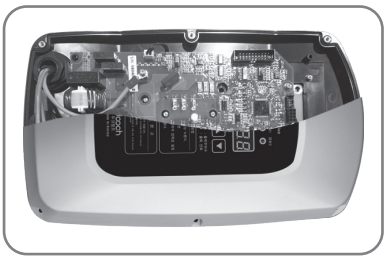


[Front]



[Side]

1.5.2 Un-covered



Chapter 2 Specification

2.1 Specifications of product

Model		SQ2-0110SW	SQ2-0220SW
Standard Motor [kW]		1.1	2.2
Standard Motor [HP]		1.5	3
Rated output	Output Capacity [kVA]	2.4	4
	Rated Output Current [A]	6	10
	Output Voltage [V]	3 phase 200V ~ 230V	
	Output Frequency [Hz]	0.05 ~ 50 / 60	
Rated input	Rated Input Voltage [V]	Single phase 200V ~ 230V (-15% ~ +10%)	
	Input Frequency [Hz]	50 / 60 (±5%)	
Protection Class		IP55	
Switching Frequency [kHz]		1 ~ 15	
Cooling		Natural cooling	Fan cooling
Control	Controlling Method	V/F Control, Slip Compensation Control	
	Frequency Stability	1% of Rated Output Frequency	
	Overload Resistance	120% 1 Minute	
	Torque Boost	Manual Torque Boost (0~10%)	
Operation	Operation Method	FND	
	Frequency Setting	FND	
	Acceleration/Deceleration Time	1 ~ 600 sec	
	Abnormal Reset	Automatic Reset upon Automatic Restart Setting	
Operation status	Abnormal Output	LED Output	
	Operation Status	LED Output	
Other Functions		Freezing Protection for Pump, Auto Recovery after Power Fail, High/Low Pressure Alarm, Low Water Level Detection, Failure History Storage, Forced Alternative Operation, PID Control, Fixed Frequency Operation, Dry running Protection	
Protection functions		High Voltage, Low Voltage, Over Current, Overload, Inverter Overheating	
Display	Drive Info.	Current pressure, Setting pressure, Output frequency, Output Current	
	Abnormality	Pressure Sensor Error, High/Low Pressure Alarm, Low water level Alarm, Drive Error	

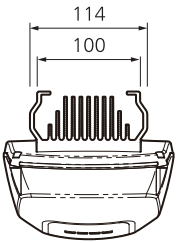
Chapter 2 Specification

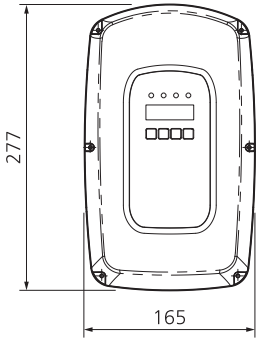
Operation condition	Environment	Altitude 1,000M or lower. Keep out of corrosive and flammable gas, oil mist and dust
	Ambient Temp.	-10℃ ~ 40℃
	Storage Temp.	-20℃ ~ 65℃
	Surrounding Humidity	Below 90% RH of relative humidity (with no dew formation)

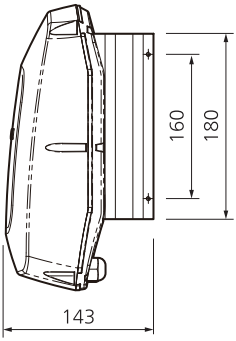


3. External dimension

3.1 SQ2-0110SW



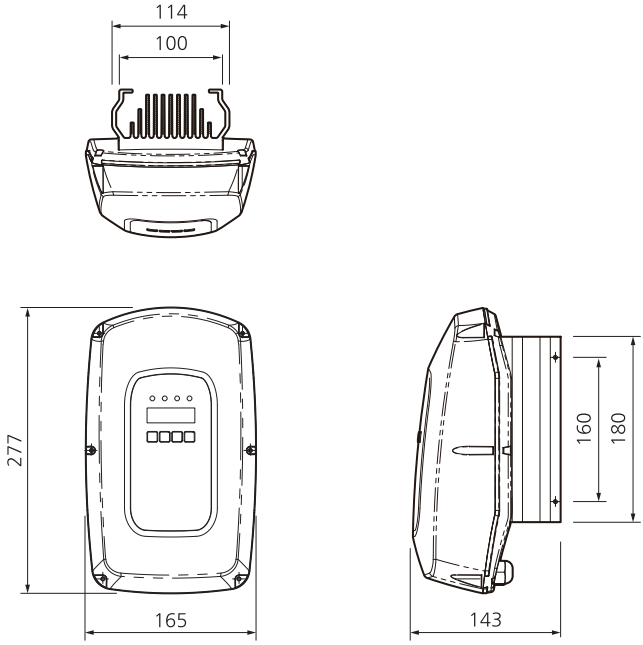




- Weight : 2.2kg

Chapter 3 External dimension

3.2 SQ2-0220SW



- Fan is installed in heatsink
- Weight : 2.2kg

Chapter 4 Installation

4. Installation

4.1 Cautions on Installation

A. Please be careful for handling

Please be careful during its transportation or installation, since the product is made of sensitive electrical parts.

B. Beware the vibration during installation.

In case you install the product on the motor or piping lines directly, please take consideration for dampening the vibration.

C. Ambient temperature

The performance and life cycle of drives are influenced by ambient temperature. So please make sure that the ambient temperature does not exceed the limitation (-10℃ ~ 40℃). In case the ambient temperature is higher than the limitation, please adjust the output amperage of drive for its operation.

D. Please install on the inflammable side.

Please install on the inflammable side since the drive temperature goes up higher during its operation.

E. Sufficient space for installation

Please make sure the side that cooling fan blows up from bottom to upside, since the drive would got to be hot. Also, you should have enough space for its installation, since the cooling should be sufficiently done by fan.

F. Please install the product tightly.

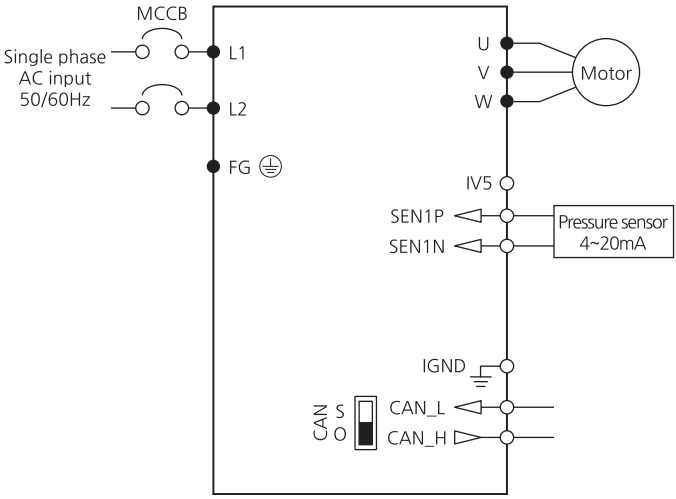
Install the product tightly with bolts for drive fixation.

- 30cm margin space around product is recommended for maintenance situation.
- Please install the filter for case that any substance is foreseen from suction piping side. You can avoid any down-performance or damage of pump impeller.
- Please install the valves to the suction/discharge side of pumps, in order to make the maintenance easily.

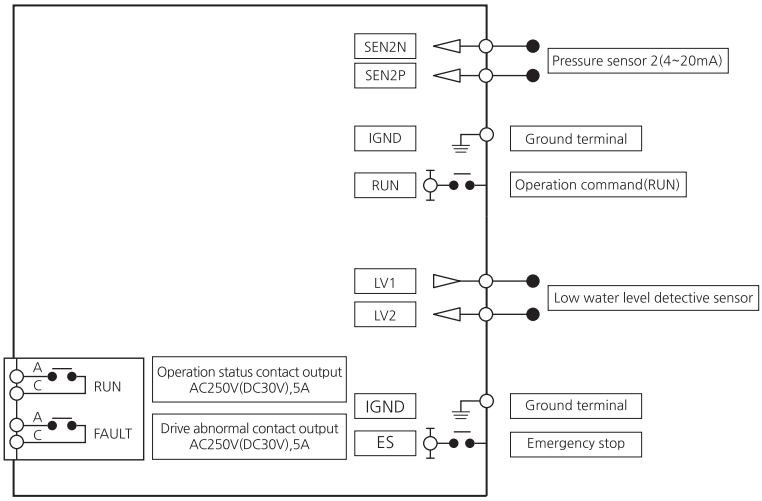
- The base for product installation should be long-lasting one.
- Please apply the earth grounding for its installation, in order to avoid any electric shock for any problem on insulation.
- Please drain out the water inside pumps, during non-operation for winter season.

4.2 Wiring Diagram of Terminals

4.2.1 Wiring diagram of main power circuit terminals

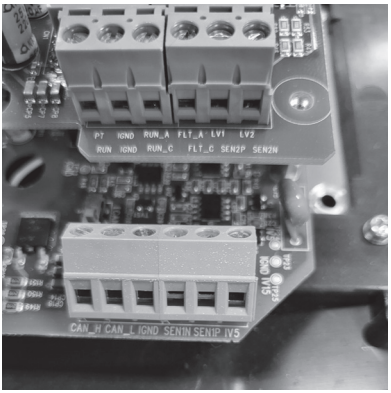


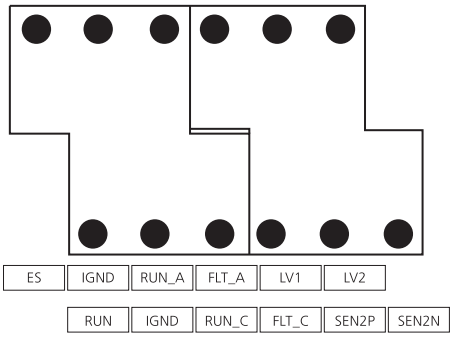
4.2.2 Wiring diagram of option circuit terminals



(Option Board)

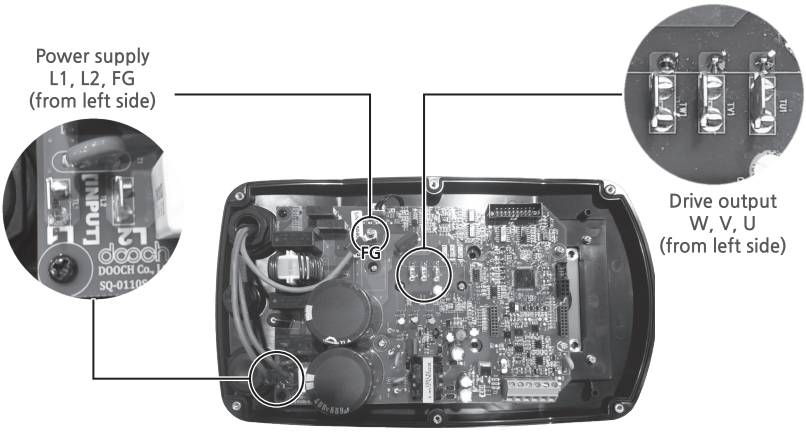
4.2.3 Wiring diagram of control circuit terminals





4.3 Wiring of Main Power Supply Circuit

4.3.1 Description on Main Power Supply Terminals



Terminal Sign	Terminal Name	Description
L1, L2	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. Use the wiring breaker (MCCB) with 1.5~2 times larger capacity than rated current of the drive.
- If AC input power (L1,L2) 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 (L1, L2) 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 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.
- Maintain ground resistance within 10Ω during grounding work.
- Use thicker wires than specified one for ground wire.

4.3.4 Specifications of Recommended Wires and Terminal Screw

Terminal specification (http://www.ket.com/kor/)	Thickness of Wires(mm^2)		
	L1,L2	U,V,W	FG
 (ST730135-2)	1.5	1.5	1.5

※ Weak fastening may cause malfunction.
※ Please wear tubes on terminals for wiring.
※ Use 600V class wires.

4.3.5 Cautions on control circuit wiring

- Keep the distance between drive, pressure sensor and low water level detective sensor less than 10m.
- Keep the distance between remote control panel and drive less than 50m, if you use remote control with analog signal.
- Space away sensor and analog signal cable from power cable.
- Use shielded and twisted cable for signal cable of control circuit.
- Do not ground GND as it is insulated.

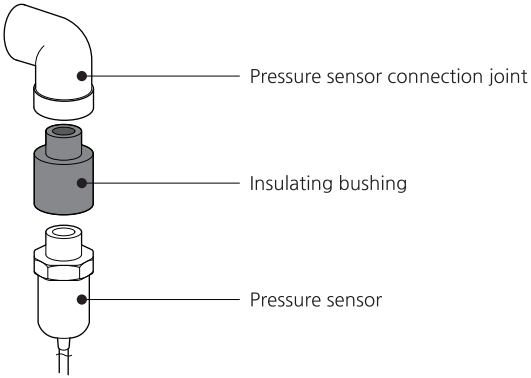
4.3.6 Wiring pressure sensor & Low water level detective sensor

- Use DOOCH's designated pressure sensor and low water level detective sensor.
- Please refer to below for the specification of DOOCH's designated pressure sensor and low water level detective sensor.

Type	Pressure sensor	Low water level detective sensor
Excitation Voltage	DC 15V	DC ±15V Pulse
Sensor output	4~20mA	Based on continuity

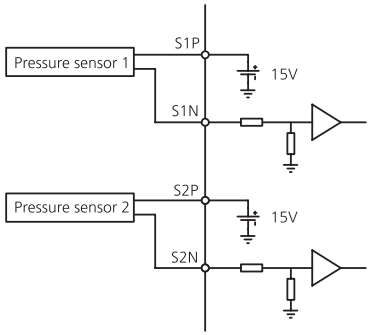
- Be cautious when you install pressure sensor, as it has polarity.
- Do install insulating bushing that reduces noises from the space between pipe and pressure sensor when you install pressure sensor to pipe.

※ Check if there is option board when you use low water level detective sensor.

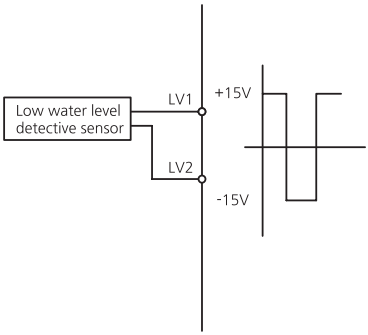


※ Please contact DOOCH's customer support center if you want to use non-designated pressure sensor or low water level detective sensor.

Pressure sensor connection



Low water level detective sensor connection

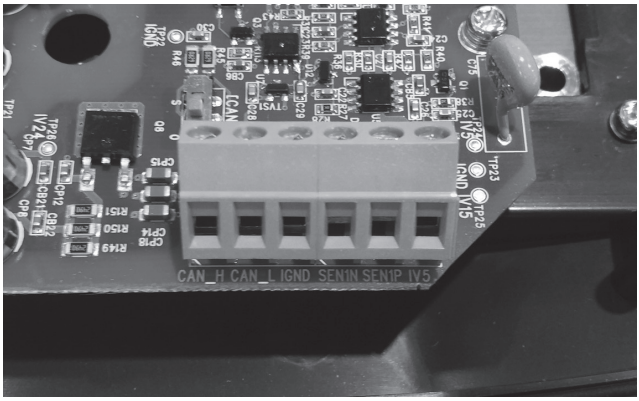


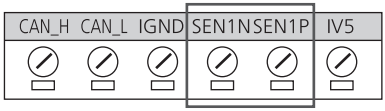
4.3.7 Wiring communication cables

- This drive supports CAN communication to connect with pump.
- Connect CANH(CAN-High) and CANL(CAN-Low) of terminal block and shielded cable to GND for CAN communication. Use shielded and twisted cable for wiring.
- Change the switch from O(OPEN) to S(SHORT) if you use terminating resistance for multiple CAN communication.

4.4 Pressure sensor wiring

4.4.1 Pressure sensor terminal block





4.4.2 Function of pressure sensor terminals

Terminal sign	Terminal Name	Description
SEN1N	Pressure sensor power	Terminal for pressure sensor power supply (VDC15V)
SEN1P	Pressure sensor output	Terminal for pressure sensor output current (4-20mA)

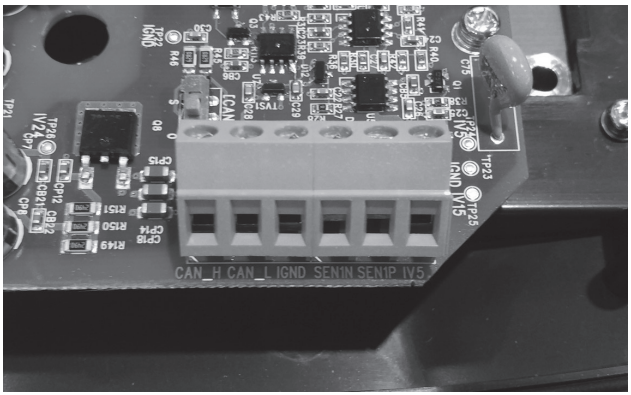
4.4.3 Wiring of Pressure sensor

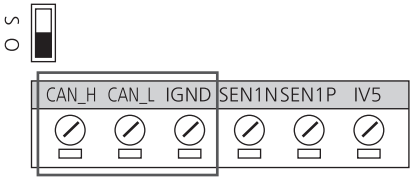
- Use the pressure sensor specified by Dooch.
- Maintain wiring distance between pressure sensor and drive within 10m.
- Set off sensor and analog signal lines enough from power lines.
- Since terminals on pressure sensor have polarity, be careful about polarity during installation.

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

4.5 CAN control circuit wring

4.5.1 CAN circuit board terminals





4.5.2 Function of CAN circuit board terminals

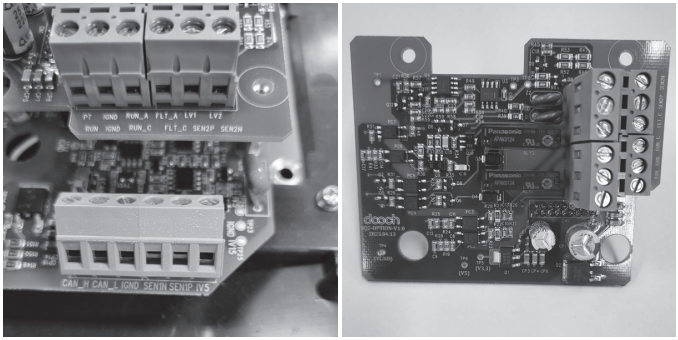
Terminal sign	Terminal Name	Description
CAN_H	CAN signal H	Terminal for signal CAN(+)
CAN_L	CAN signal L	Terminal for signal CAN(-)
IGND	CAN common	Common terminal of power ground for CAN comm.

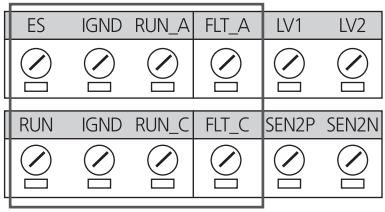
4.5.3 Wiring of CAN circuit board

- 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 IGND.
- Use shield and twisted wire for wiring.
- When using termination resistor for connecting multiple CANs, change the switch from OPEN to SHORT.

4.6 Contact signal wiring (For option board)

4.6.1 Contact signal terminal block



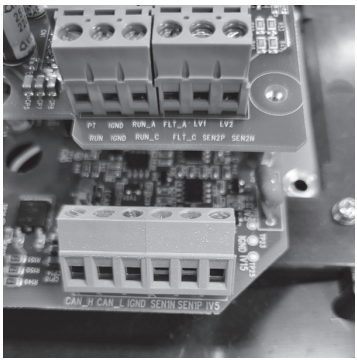


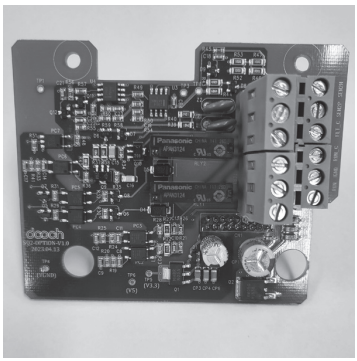
4.6.2 Contact signal terminal block functions

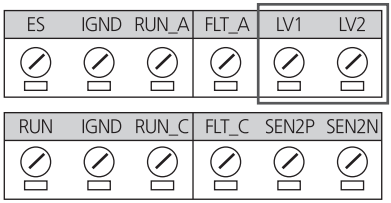
Terminal sign	Terminal name	Description
ES	Emergency stop	Blocks the drive's output if ES sign is ON.
IGND	Contact operation common terminal	Common terminal of contact input terminal
RUN	Operation command	Run/Stop terminal
IGND	Contact operation common terminal	Common terminal of contact input terminal
RUN_A	Operation signal output	Output sign when the drive operates (Less than AC 250V 5A & DC 30V 5A)
RUN_C	Operation signal output	Output sign when the drive operates (Less than AC 250V 5A & DC 30V 5A)
FLT_A	Abnormal signal output	Stop terminal
FLT_C	Abnormal signal output	Stop COM terminal

4.7 Dry running detective sensor wiring (For option board)

4.7.1 Option board terminal block





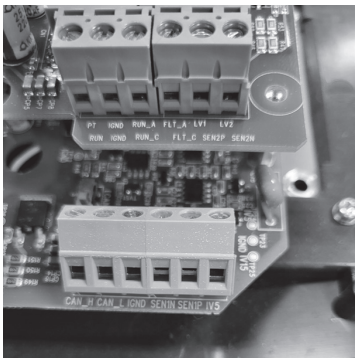


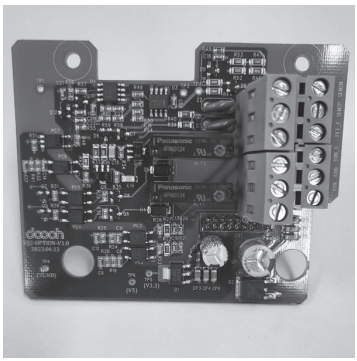
4.7.2 Low water level detective sensor terminal block functions

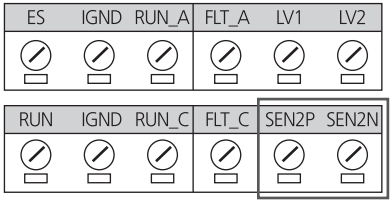
Terminal sign	Terminal name	Description
LV1	Low water level detective sensor	Terminal for connecting to low water level detective sensor
LV2	Low water level detective sensor	Terminal for connecting to low water level detective sensor

4.8 Pressure sensor 2 circuit (For option board)

4.8.1 Pressure sensor 2 terminal block







4.8.2 Pressure sensor 2 terminal block functions

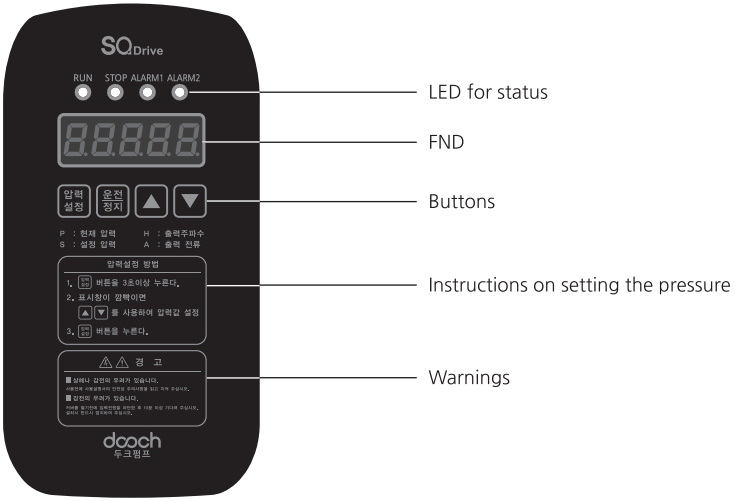
Terminal sign	Terminal name	Description
SEN2P	Pressure sensor 2	Terminal for connecting to pressure sensor 2 (For controlling differential pressure)
SEN2N	Pressure sensor 2	Terminal for connecting to pressure sensor 2 (For controlling differential pressure)

5. Operation

5.1 FND

5.1.1 Appearance and Description of FND

FND has five digits of 7-segment, four LED lamps to display various settings and states and consists of four buttons to operate drive or enter setting.



5.1.2 Functional Description of each Part

1) LED

LED lamps consist of Run, Stop, Alarm1 and Alarm2 and functions of them are as follows:

- Functions of each Button

Run	Lights on during stand-by / Blinks during operation
Stop	Lights on during stop
Alarm 1	Lights on when High pressure / Low pressure / Sensor-error / Low water level detection alarm
Alarm 2	Lights on when drive has error

- Run and Stop LEDs indicate status of the drive.
- In case of drive error, Alarm2 lamp will be turned on.
  In case of alarm for pump system, Alarm1 lamp will be turned on.

2) FND



FND consists of five digits of 7-segment and displays status value of drive and pump and parameter settings. FND displays are divided into St group (Status group) and user group.

3) Button part

Button part consists of four buttons and it is used for parameter setting or movement.

- Description on Button's Functions

PRE. SET	It is used for setting up pressure settings, various parameters or Alarm Reset.
RUN STOP	It operates or stops the drive. On operation state, RUN lamp will be turned on.
▲	It is used to change parameter items or parameter settings. ▲ Key increases the value, while ▼ key decreases the value. After changing the settings, be sure to press PRE. SET key for saving the final value. If pressing ▲ and ▼ for 3 seconds, parameter group is moved.
▼	

5.1.3 How to change Parameter Settings

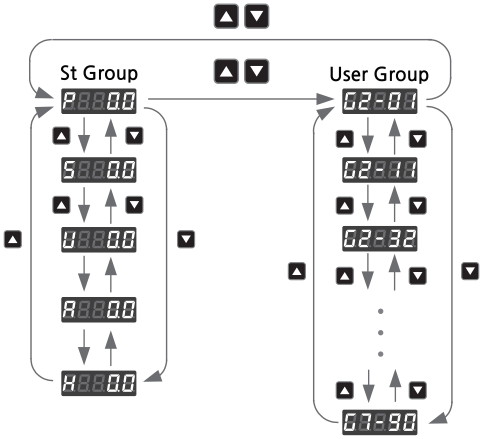
- Since any change of parameter settings has direct influence on operation, please be careful about it.
- Before changing any parameter setting, be sure to write it on paper.
- Do not change the parameter setting except for responsible operator or professional engineer.
- Since there are items with data or parameter unavailable for change during operation, be sure to confirm. (Refer to Chapter 6 Function table and description)

1) Parameter Group Movement

When applying power first, it enters into St group. In order to move to parameter group, press ▲ and ▼ buttons for 3 seconds. And you can move back to St group by pressing ▲ and ▼ buttons for 3 seconds again.

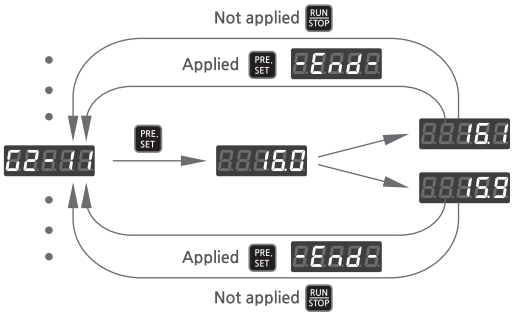
2) Parameter Item Movement

In order to move between parameter items within parameter group, use ▲ and ▼ buttons to move to desired item.



3) How To Change Parameter Settings

In order to change parameter setting, press PRE. SET key at the desired parameter item to enter into Setting Change Mode. On Setting Change Mode, use ▲ and ▼ key to change it to desired setting. Press PRE. SET key again, then -End- message is displayed to apply the setting. If pressing RUN STOP key on Parameter Edit Mode, setting is not applied and exited from Edit Mode.



5.2 Function Setup

5.2.1 Basic Function Setup

It is a basic parameter setup to operate the drive. Any parameter that is not set by the user, it is set default value of 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.

Setup Item	Parameter code	Description on Function
Rated Current of Motor	G3-12	To set up Rated Current of Motor
Rated Frequency of Motor	G3-16	To set up Rated Frequency of Motor
Rotation Direction Selection of Motor	G3-17	To set up Rotation Direction Selection of Motor Properly
Acceleration time	G3-19	To set up Acceleration Time of Drive
Deceleration time	G3-20	To set up Deceleration Time of Drive

2) CAN communication Function Setup

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

Setup Item	Parameter code	Description on Function
CAN Comm. ID	G5-02	To set up CAN Comm. ID (If ID is '0', CAN Comm. is disabled.)

5.2.2 Expansion Function Setup

It is to set up 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, it is set default value of factory setting.

Setup Parameters for Pump System Protection

Setup Item	Parameter code	Description on Function
High Pressure Alarm	G2-50, G2-51	To set up high pressure alarm level and time in order to protect discharge pipe from high pressure.
Low Pressure Alarm	G2-52, G2-53	To set up low pressure alarm level and time in order to protect the pump from damaged pump.
Low Water Level Alarm	G2-56, G2-57	To protect the pump by detecting existence of water within suction pipe.

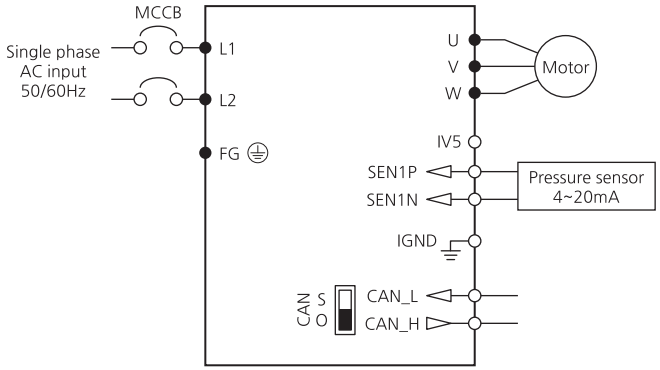
5.3 Basic Operation

5.3.1 Constant Pressure Control Mode

1) Wiring Diagram

Single Drive Operation

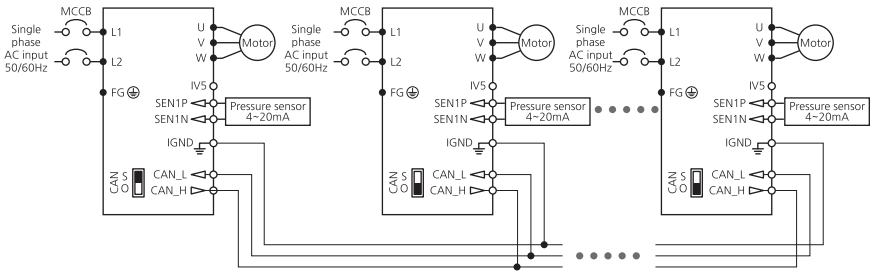
In case of using a single drive to control constant pressure, it is possible to apply it to the pump system as below.



- Connect drive wiring so that the power input lines and motor output lines should not be interchanged.
- Be sure to install wiring breaker at the power input of drive.
- Check the polarity of pressure sensor and connect it properly.

Multi-Drive Operation of Drives

In case of using several drives linked together to control constant pressure, it is possible to apply it to the pump system as follows:



- Connect drive wiring so that the power input lines and motor output lines should not be interchanged.
- Be sure to install wiring breaker at the power input of drive.
- Check the polarity of pressure sensor and connect it properly. According to the system, install and wire the additional pressure sensor to drive, for back-up.

2) Setup and Operation Method

- After applying power supply, check if Stop LED on FND is turned on and FND part displays current press of P 0.0 piping.

※ If E rr04 is displayed, be sure to check wiring of pressure sensor. (Connection status or defective pressure sensor, etc.)

※ Caution: Do not surprise even if drive is automatically operate after 10 seconds from power supply. This is a normal phenomenon that power fail recovery function operates. (Refer to power fail recovery function.)

3) Operation Parameters

- Basic parameters

Setup Sequence	Setup Item	Parameter code	Description on Function
1	Pump Control Mode Setup	G2-01	To set up Pump Control Mode to Constant Pressure Mode. (Factory setting: Constant pressure mode)
2	Sensor1 Capacity Setup	G2-11	To set up rated capacity of pressure sensor used. (Factory setting: 16bar)
3	Comm. ID Setup	G5-02	To set up CAN Comm. ID to '0' in order to make CAN Comm. Disabled.
4	Target Pressure Setup	St Group	To set up the target pressure of pump system.
5	Motor Rotation Direction Selection	G3-17	To make rotation direction of motor same as pump operation direction.
6	Operation		Press RUN STOP key, them pump operates with target pressure.

4) Target Pressure Setup

- If you don't know about correct pressure setting, contact the specialist.
- If you press PRE SET key for more than 3 seconds on a mode displaying S of St group, it changes to pressure setting screen. At the moment, if you use ▲ key or ▼ key to change the value to desired setting and press PRE SET key, the pressure setting is changed with -End- screen. If you press RUN STOP key without pressing PRE SET key after changing the setting, the setting will not be changed and the screen will exit from pressure setting change mode.

※ If the pressure setting is changed, the high pressure alarm ('G2-50') setting will be automatically set to the value 2 bar higher than the pressure setting.

5) Checkup on Rotation Direction of Pump

- It would be correct if the rotation direction is counter clockwise from a viewpoint of fan cover of the pump. (If the rotation direction is reversed, it cannot generate the normal pressure.)
- In order change the rotation direction...(Select one of the methods below.)
  1) Change two from three wires of the motor input.
  2) Change the value of Parameter 'G3-17' to other one.

6. Function Table & Description

6.1 Display of present status

DISPLAY	NAME	Explanation	Remark
	Present pressure	It shows measured present pressure	
	Setting pressure	It shows setting pressure and operator can input pressure value.	If you press setting button for longer than 2 seconds, It change to pressure input mode.
	Output Hz	It shows present drive output to Hz	
	DC link voltage	It shows voltage of DC Link	Input voltage ※ 2 = DC Link voltage[V]
	Output Current	It shows present output current	Unit [A]
	Outlet pressure	It shows current discharge pressure	Indicates during differential-pressure control Unit [bar]
	Inlet pressure	It shows current suction pressure	Indicates during differential-pressure control Unit [bar]

6.2 Group for users

DISPLAY	NAME	Range	Factory setting	Change of operation	Interactive operation
G2-01	Pump Control Mode	0: Manual 1: Constant pressure	1: Constant pressure	×	×
G2-11	Capacity Setup of Sensor	1.0 ~ 25.0 [bar]	16.0 bar	×	×
G2-32	Starting Pressure Variation	0.0 ~ 2.0 bar	0.3 bar	○	○
G2-41	Stopping Time after reaching Setup Pressure	0 ~ 200 sec	30 sec	○	○
G2-50	High Pressure Alarm Level	0~Sen1 Cap.[bar]	25.0 bar	○	○
G2-51	High Pressure Alarm Time	0 ~ 600 sec	5 sec	○	○
G2-52	Low Pressure Alarm Level	0.0 ~ 25.0 bar	0.5 bar	○	○
G2-53	Low Pressure Alarm Time	0 ~ 600 sec	20 sec	○	○
G2-56	Low Level Trip Pressure Level	0.0 ~ 25.0 bar	0.3 bar	○	○
G2-57	Low Level Trip Time of Pressure Sensor	0 ~ 600 sec	20 sec	○	○
G3-03	Target Freq. Value Setup (for Manual mode)	1.00 ~ 60.00 Hz	30.00 Hz	○	×
G3-12	Current of Motor	1.0 ~ 100.0 A	1.1kW : 4.4A 2.2kW : 8.2A	×	×
G3-16	Rated Frequency of Motor	0: 50 Hz 1: 60 Hz	1: 60Hz	×	×

DISPLAY	NAME	Range	Factory setting	Change of operation	Interactive operation
G3-17	Selection of Motor rotation	0: Clockwise 1: Counter clockwise	0: Clockwise	×	×
G3-19	Acceleration time	0.0 ~ 600.0 sec	3.0 sec	○	×
G3-20	Deceleration time	0.0 ~ 600.0 sec	6.0 sec	○	×
G3-38	Switching Frequency	1.0 ~ 15.0 kHz	5.0 kHz	○	×
G5-02	CAN Comm. ID	0 ~ 6	0	○	×
G7-07	Group initialization	0: Not apply 1: Initialization	0: Not apply	×	×
G7-90	S/W version	-	-	-	-

Additional parameters if option board is added					
DISPLAY	NAME	Range	Factory setting	Change of operation	Interactive operation
G2-14	Sensor 2(Inlet) capacity	0.00~25.00 bar	16.00 bar	×	○
G2-15	Sensor 2(Inlet) gain	0.00~25.00 bar	100%	○	○
G2-16	Sensor 2(Inlet) offset	-2.00~2.00 bar	0.00 bar	○	○
G2-54	TUL Detection mode	0:Outlet Pressure 1:Low water level detective sensor 2:Inlet Pressure	0	×	×
G2-55 G2-54 : 0일때만 보임	TUL Time-LS	0~600 sec	2 sec	○	○
G2-56 G2-54 : 1일때만 보임	TUL Level-Out	0.00~25.00 bar	0.30 bar	○	○
G2-57 G2-54 : 1일때만 보임	TUL Time-Out	0~600 sec	20 sec	○	○
G2-58 G2-54 : 2일때만 보임	TUL Level-In	0.00~25.00 bar	0.30 bar	○	○
G2-59 G2-54 : 2일때만 보임	TUL Time-In	0~600 sec	20 sec	○	○
G3-01	Run/Stop setting	0:Keypad 1:Terminal	0	×	×

6.3 Description on Function of Parameter Settings

6.3.1 Group for users

G2-01 Pump Control Mode

· To set up pump control method.

Setup Data	Functional Description	Related Functions		
0	Manual	G3-03	Command Freq. Value Setup	Target Freq. Value Setup
1	Constant Pressure Control Method (Factory Setting)	G2-11	Capacity Setup of Sensor	
2	Differential pressure control method	O	Outlet pressure	Indicates only during differential-pressure control Indicates drive's status group
		I	Inlet pressure	
		G2-11	Sensor 1 capacity	Outlet direction
		G2-14	Sensor 2 capacity	Inlet direction
		G2-15	Sensor 2 gain	
		G2-16	Sensor 2 offset	

G2-11 Sensor Capacity Setup

· 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.
Ex) In case the using sensor has 10bar, enter 10.0.
If the using sensor has 16bar, enter 16.0.
· And enter the rated value of the pressure sensor for normal pump operation.

Factory setting	Input range
16.0 bar	0.0~25.0 bar

G2-32 Start Variation

· It sets up start variation pressure value. That is, the operation starts when the current pressure has larger variance than the specified value comparing to setting.
· Pump stops when current pressure is higher than setting pressure + start variation.
· In case of alarm occurrence, operation does not start.

Factory setting	Input range
0.3 bar	0.0~2.0 bar

G2-41 Stopping Time after Reaching Setup Pressure

· When the pump pressure reaches to setting and maintained for longer than setup time, it starts to reduce speed. If there is pressure difference as much as starting variation, the pump starts to operate again during decrease of speed and if not, it stops.

Setup Data	Functional Description
0	Deactivation of Pressure Sensing
1~200 sec	Setting the time for pressure sensing(Factory setting 30(Sec)

G2-50 High Pressure Alarm Level

· It sets standard pressure value to issue the high pressure alarm.

※ When setting the setup pressure, it is automatically set to setup pressure + 2bar.

Factory setting	Input range	Related Functions	
25.0 bar	0.0~25.0 bar	G2-51	High Pressure Alarm Time

G2-51 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 (G2-50) and maintains its state for a specified time, a high pressure alarm is displayed and operation stops.

Factory setting	Input range	Related Functions	
5 bar	0~100 sec	G2-50	High Pressure Alarm Level

G2-52 Low Pressure Alarm Level

· It sets standard pressure value to issue the low pressure alarm.

Factory setting	Input range	Related Functions	
0.5 bar	0.0~25.0 sec	G2-53	Low Pressure Alarm Time

G2-53 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 (G2-52) and maintains its state for a specified time, a low pressure alarm is displayed and operation stops.

Factory setting	Input range	Related Functions	
20 sec	0~600 sec	G2-52	Low Pressure Alarm Level

G2-56 Low Water Level Alarm Pressure Level

· It sets maintaining time of alarm level to issue the low water level alarm.

Factory setting	Input range	Related Functions	
0.3 bar	0.0~25 bar	G2-57	Low Level Trip Time of Pressure Sensor

G2-57 Low Water Level Alarm Time of Pressure Sensor

· It sets maintaining time of alarm level to issue the low water level alarm.
That is, if the current pressure decreases under the low pressure alarm level (G2-56) and maintains its state for a specified time, an alarm is displayed and operation stops.

Factory setting	Input range	Related Functions	
20 sec	0~600 sec	G2-56	Low Water Level Alarm Pressure Level

G3-03 Target Freq. Value Setup (for Manual mode)

· When using as a fixed frequency, it is possible to set up target frequency value.
It is available when the pump control mode (G2-01) is set as manual.

Factory setting	Input range
30.00 Hz	1.00 ~ Max. Freq. [Hz]

G3-12 Motor Rated Current

· It sets up 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	1.00 ~ 100.0 Arms

G3-16 Rated Frequency of Motor

· It sets rated frequency of motor.

Setup Data	Functional Description
0	50 Hz
1 (Factory setting)	60 Hz

G3-17 Motor Rotation Direction Selection

· It sets up rotation direction of the pump.
· Be sure to check the rotation direction of the pump for normal operation.
As the rotation direction may change according to wiring, be sure to check it.

Setup Data	Functional Description
0 (Factory setting)	Forward Direction- CW(Clockwise)
1	Reverse - CCW(Counterclockwise)

G3-19 Acceleration time

· It is time to reach max frequency from 0[Hz].

· If rising time is too short, over- current fault may be occurred during motor operation.

Factory setting	Input range
3.0 sec	1.0 ~ 600.0 sec

G3-20 Deceleration time

· It is time to decelerate to 0[Hz] from max frequency.

· If falling 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

G3-38 Switching Frequency Setup

· In case of high noise or temperature, it is required to decrease the frequency for use. As the switching frequency becomes lower, noise of motor is increased while noise or leak current is decreased.

Factory setting	Input range
5.0 kHz	1.0 ~ 15.0kHz

G5-02 CAN Comm. ID

· It is CAN Communication ID on Multi-Drive control mode.

· Be sure to not duplicate ID for setup.

Setup Data	Functional Description
0 (Factory setting)	Single Mode
1~6	Multi-Drive control Comm. ID No.

G7-07 Group initialization

· It carries out initialization with factory settings.

Setup Data	Functional Description
0 (Factory setting)	To maintain settings (Factory Setting)
1	To initialize with factory settings

G7-90 S/W Version

· It displays program version.

G2-14 Sensor 2(Inlet) capacity

· Put in the maximum capacity that pressure sensor can detect
· Current pressure will be indicated by putting in pressure sensor's capacity
Ex) Put in 10.00 if pressure sensor capacity is 10 bar.
Put in 16.00 if pressure sensor capacity is 16 bar.
· Put in pressure sensor's rated capacity for normal operation.

Factory setting	Range
16.00 bar	0.00 ~ 25.00 bar

G2-15 Sensor 2(Inlet) gain

· Correct error by adjusting gain
· Sensor value = Average value of the values that sensor read 100 times x gain÷100

Factory setting	Range
100 %	0.00 ~ 25.00 bar

G2-16 Sensor 2(Inlet) Offset

· This adjusts the deviation between pressure gauge(Analog or digital) mounted on pipe and indicated pressure on drive.
· Current pressure value = Sensor value ± Offset value

Factory setting	Range
0.00 bar	-2.00 ~ 2.00 bar

G2-54 TUL(Low water level) Detection mode

· This mode is to set low water level detecting method.
· When you set low water level sensor, check water level in pipe by installing electrode externally.
· When you set low water level sensor during interactive operation, sensor connects to the lowest ID drive.
※ All drives(pumps) stop if there is no water in inlet.
· Drive detects alarm based on TUL Level and TUL Time on software detection setting.
Drive stops(if it was operating) and indicates alarm if pump was operating under TUL Level(G2-56) pressure and over TUL Time(G2-57), because it detects as no-water.

Function description	Related functions	
Low water level detective sensor	G2-55	TUL(low water level) Time-LS
Outlet pressure (Factory setting)	G2-56	TUL(low water level) Level-OUT
	G2-57	TUL(low water level) Time-OUT
Inlet pressure	G2-58	TUL(low water level) Level-IN
	G2-59	TUL(low water level) Time-IN

G2-55 TUL(low water level) Time-LS

· This sets the time to keep low water level signal for low water level alarm.
Drive stops(if it was operating) and indicates alarm if TUL Detection mode(G2-54) is on and low water level signal is on over TUL Time, because it detects as no-water.

Function description
0: Cancel low water level detection using low water level detection sensor
1~600 sec : Set time(Factory setting 2 sec)

G2-56 TUL(low water level) Level-OUT

· This is pressure level to detect low water level by outlet pressure, if you select outlet pressure in TUL Detection mode(G2-54).
· Sensor should be installed on outlet.

Factory setting	Range	Related functions	
0.30 bar	0.00~25.00 bar	G2-57	TUL Time-OUT
		G2-54	TUL Detection mode

G2-57 TUL(low water level) Time-OUT

· This sets the time to keep low water level alarm on.
Drive stops(If it was operating) and indicates alarm if the current pressure is under TUL Level(G2-56) for the set time.

Factory setting	Range	Related functions	
20 sec	0~600 sec	G2-56	TUL Level-OUT
		G2-54	TUL Detection mode

G2-58 TUL(low water level) Level-IN

· This detects low water level by inlet sensor, if you select inlet pressure in TUL Detection mode(G2-54). Sensor should be installed on inlet.

Factory setting	Range	Related functions	
0.30 bar	0.00~25.00 bar	G2-59	TUL Time-IN
		G2-54	TUL Detection mode

G2-59 TUL(low water level) Time-IN

· This sets the time to keep low water level alarm on.
Drive stops(if it was operation) and indicates alarm if the current pressure keeps under TUL level(G2-58) for the time the current pressure is set.

Factory setting	Range	Related functions	
20 sec	0~600 sec	G2-58	TUL Level-IN
		G2-54	TUL Detection mode

G3-01 Run/Stop setting

· This sets where to operate command.
You can command operation with keypad on drive if you select keypad, or with external input(RUN) if you select terminal block.

Description
Keypad(Factory setting)
Terminal block input
Communication input

7. Cause of fault and counteraction

7.1 Fault History Table

FFND Display	Content	Description	Restarting	Limitation of restart	Remarks
Er-01	tSF	Pressure Sensor Error	○	×	45
Er-02	tOP	High Pressure Alarm	○	×	45
Er-03	tLP	Low Pressure Alarm	○	○	45
Er-04	tUL	Low Level Alarm	○	○	46
Er-05	tASH	Drive Arm Short Trip	×	-	47
Er-06	tOC	Drive H/W Over Current Trip	○	○	47
Er-07	SOC	Drive H/W Over Current Restriction Trip	×	-	47
Er-08	tMOH	Motor Overheat (TMOH)	○	○	48
Er-09	tOH	Drive Overheat Trip	○	○	48
Er-10	tLv	DC-Link Low Voltage Trip	○	×	48
Er-11	tOv	DC-Link High Voltage Trip	○	○	49
Er-12	tOL	Overload Operation Trip	○	○	49
Er-13	tdOL	Drive Overload Operation Trip	○	○	49
Er-15	tIdE	Communication ID Duplication Trip	×	-	50
Er-16	tCE	Communication Error	×	-	50
Er-21	tLt	Allowable Time Elapsed	×	-	50

7.2 Measures to be taken in case of fault or alarm

· In case of fault or alarm, you can enter the trip group via 

· To reset in Pr-group, Press PRE. SET twice.

· To reset in St-group, Press PRE. SET once.

※ In case of Er-01, Er-02, Er-04(Low Level Sensor Alarm), If cause is resolved, it reset and restart automatically. In case of reset without resolving cause, it alarm again.

7.3 Cause of fault and counteraction

Er-01 (Pressure Sensor Error-tSF)

Cause

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

Reaction

· Replace sensor.
· Replace drive.
· Check sensor terminal wiring or comm.. ID setup in case of interaction.

Related Function	Function Name	Ref. Page
G5-02	CAN Comm. ID	40

Er-02 (High Pressure Alarm-tOP)

Cause

· In case the current pressure increases more than 2bar than the pressure setting during operation, operation will stop after elapsed High Pressure Alarm Time (G2-51) and the alarm lamp will be turned on.(It may occur on temporary installation site or trial run test.)

Reaction

· Check the setup pressure and high pressure alarm level.
· When the current pressure goes down under the high pressure alarm setting, the drive will recover automatically.

Related Function	Function Name	Ref. Page
G2-50	High Pressure Alarm Level	38
G2-51	High Pressure Alarm Time	38

Er-03 (Low Pressure Alarm-tLP)

Cause

· The alarm will be generated when the current operation pressure is maintained under the low pressure alarm level. It starts automatically after Automatic Restart Time (10 seconds) from trip. However, if it repeats more than 5 times, it does not restart anymore to protect motor and drive.

Reaction

· Check if the water tank (water reservoir) is filled with water.
· Check if the air enters into the pump.
· Check if there is any water by opening air cock of pump.
· After releasing error by pressing PRE. SET key, press RUN STOP key to start the pump.

Related Function	Function Name	Ref. Page
G2-52	Low Pressure Alarm Level	38
G2-53	Low Pressure Alarm Time	38

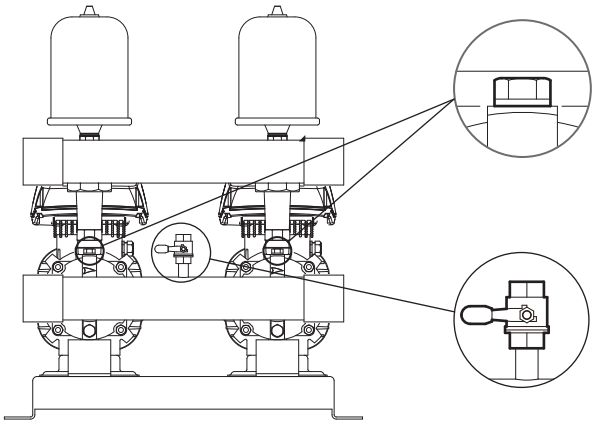
Er-04 (Low water Level Alarm-tUL)

Cause

· It is an alarm generated to prevent the mechanical seal from being damaged due to running of the pump when there is no water on the suction side. The software generates the alarm when the current pressure is maintained under the low pressure alarm level (G2-56) and operation continues for low pressure trip time (G2-57).

Reaction

· Check if the water tank (water reservoir) is filled with water.
· Check if there is any water by opening air cock of pump.
· After releasing error by pressing PRE SET key, press RUN STOP key to start the pump.



Related Function	Function Name	Ref. Page
G2-56	Low Level Trip Pressure Level	38
G2-57	Low Level Trip Time of Pressure Sensor	39

Er-05 (Arm Short Trip-tASH)

Cause

- In case acceleration/deceleration time is excessively short compared to the load inertia
- Up/Down short circuit of IGBT
- Output short circuit
- Motor damage from fire and insulation defect

Reaction

- Expand rising time (G3-19).
- Check motor damage from fire and insulation fault.
- Conduct test run by separating motor line from the drive. If the same alarm occurs, it would be an up/down short circuit of IGBT. For that case, please contact A/S center.

Related Function	Function Name	Ref. Page
G3-19	Acceleration time	40

Er-06 (H/W Over Current Trip-tOC)

Cause

- In case acceleration/deceleration time is excessively short comparing to load inertia
- Drive restart under motor free run status
- Damage of drive

Reaction

- Adjust the acceleration/deceleration time.
- Check if the drive capacity is suitable for the motor capacity.
- Start the pump after the motor has stopped.
- Check load, motor, and output wiring.
- If the same alarm occurs, please contact your local sales agent.

Related Function	Function Name	Ref. Page
G3-19	Acceleration time	40
G3-20	Deceleration time	40

Er-07(H/W Over Current Restriction Trip-SOC)

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.

Reaction

· Adjust the acceleration/deceleration time.
· Check if the drive capacity is suitable for motor capacity.
· Start the pump after the motor stopped.
※ If the same alarm occurs, please contact your local sales agent.

Related Function	Function Name	Ref. Page
G3-19	Acceleration time	40
G3-20	Deceleration time	40

Er-08 (Motor Overheat-tMOH)

Cause

· Occurred by motor overheat.
· Occurred when load is larger than rated drive capacity.
· In case drive capacity is not properly selected
· Operation under low speed for long time

Reaction

· Check if load capacity is suitable for rated drive capacity.
· Reduce load or No. of operations.

Er-09 (Overheat Trip-tOH)

Cause

· It generates an alarm and stops operation to prevent IGBT from being damaged in case of cooling fan interruption due to cooling fan fault or foreign materials and high ambient temperature.

Reaction

· Check if there is any cooling fan fault and insertion of foreign materials.
· Check the ambient temperature and maintain it under 40℃ if it is too high.

Er-10 (Low Voltage Trip-tLv)

Cause

· Occurred when the power supply voltage is low.
· Occurred when the connected load is larger than the power capacity.

Reaction

· Check the drive input voltage.
· Check the power capacity.
※ It is possible to check the DC Link voltage on FND display part.

Er-11 (High Voltage Trip-tOv)

Cause

· Occurred when the deceleration time (G3-20) is short comparing to the load inertia.
· Occurred when the drive input voltage is too high.

Reaction

· Increase the deceleration time (G3-20).
· Check the driver power supply voltage.
※ It is possible to check the DC Link voltage on FND display part.

Related Function	Function Name	Ref. Page
G3-20	Deceleration time	40

Er-12 (Motor Overload Operation Trip-tOL)

Cause

· It generates an alarm and stops operation to protect the motor when the load is above the overload trip level of the motor rated current and the motor operates for more than overload trip time. That is, if the rated current of the motor is 10[A], the overload trip level is 120%, and the overload trip time is 5 seconds, the overload operation trip will be generated.

Reaction

· Check the rated current of the motor (on the nameplate) and the rated current setting (G3-12).
※ It is possible to check the DC Link voltage on FND display part.

Related Function	Function Name	Ref. Page
G3-12	Rated Current of Motor	39

Er-13 (Drive Overload Operation Trip-tdOL)

Cause

· Occurred when the load is larger than the rated drive capacity.

Reaction

· Use drive with larger capacity suitable for the load.

Er-15 (Comm. ID Duplication-tIdE)

Cause

· Occurred upon entering same ID duplicated when assigning ID on each drive for Multi-drive operation.

Reaction

· Check drive ID and be sure to not to make duplication.

Related Function	Function Name	Ref. Page
G5-02	Communication ID	40

Er-16 (Communication Error-tCE)

Cause

· Occurred when CAN communication lines have defective connection.
· Occurred when drive CAN communication IC is defective.

Reaction

· To check connection status of CAN communication lines.
· Replace the drive.

Er-21 (Allowable Time Elapsed-tLt)

Reaction

· Contact your local sales agent.

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	SQ2-Driver	Warranty	1 year
Model	SQ2-	Purchased	
Agent		Valid until	
Address		TEL.	

Warranty policy

1. This product is under warranty for 1 year from purchased date.
   Please contact to our A/S centre or agent for any trouble.
2. This product will not be under responsibility of warranty for following cases.
   - Trouble due to user's misuse (Not operating by manual instruction.)
   - Trouble due to unauthorized repair, modification or dis-assemble.
   - Force majeure
   - Trouble due to improper storage. (High temperature / humidity, place with chemicals)
   - In case this warranty certificate is lost.
   - In case any warranty information is corrected.
   - Parts or consumables are not under warranty.
   - The product is not under responsibility for any consequential damage from product trouble.

Notice

1. This certificate is for the warranty according to above policy, not for the restriction for user's legal right.
2. For any question on this certificate, please contact our A/S centre or agent.
3. Please get this certificate filled with warranty information.
4. Please keep this certificate carefully, since this can not be re-issued.

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SQ2 Drive

INSTRUCTION MANUAL

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