

# **NSQ** *Drive*

INSTRUCTION MANUAL







## Preface

- Thank you for choosing DOOCH's high performance NSQ-Drive series. Describing specification, installation, operation, function, and maintenance of the NSQ-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 NSQ-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.

## 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.

 <b>Warning</b>	Warning : This symbol indicates the possibility of death or serious injury.
 <b>Caution</b>	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 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.



## 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.

Installation Location	Free of corrosive gas, inflammable gas, oil sludge and dust, etc
Temperature/Humidity	-10 ~ 40 °C / Below 90% RH (Dewdrop should not be formed)
Storage Temperature	-20~65 °C
Elevation/Vibration	Altitude 1,000m or lower / below 5.9m/sec <sup>2</sup> (=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



## Safety Instructions

### 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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## 1. What You Should Know 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.

- Nameplate of the Product

**dooch**

<b>Model : NSQ-0750T</b>	← Type of Drive
<b>Input : 3Phase 50Hz / 60Hz</b> 380V ~ 440V	← Input specification
<b>Output : 3Phase 0 ~ 60Hz</b> 380V ~ 440V 16A	← Output specification
<b>Serial No</b>	

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### 1.2 Type of Product

# NSQ-0750 T

S : Single Phase  
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



## Chapter 1 Basics

- 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.
- 'S' refers Single phase.  
'T' refers Three phase.

### 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.



## Chapter 2 Specifications of product

### 2.1 Rated Input and Output (Single Phase)

Model NSQ-____S		Model Specification			
		0040	0075	0150	0220
Standard Motor [kW]		0.4	0.75	1.5	2.2
Standard Motor [HP]		0.5	1	2	3
Output Capacity[ kVA]		1	2	3.2	4.8
Rated Output Current [A]		2.5	5	8	12
Output Voltage [V]		3∅ 200V ~ 230V			
Output Frequency [Hz]		0.05 ~ 50/60			
Rated Input Voltage [V]		1∅ 200V ~ 230V			
Input Frequency [Hz]		50/60			
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 Frequency			
	Overload Resistance	120% 1 Minute			
	Torque Boost	Manual Torque Boost (0~10%)			
Operation	Operation Method	FND / Terminal / Communication (CAN) Operation			
	Frequency Setting	FND / Terminal (0~10V or 4~20mA)			
	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, 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℃ ~ 40℃			
	Storage Temp.	-20℃ ~ 60℃			
	Surrounding Humidity	Below 90% RH of relative humidity (with no dew formation)			



## Chapter 2 Specifications of product

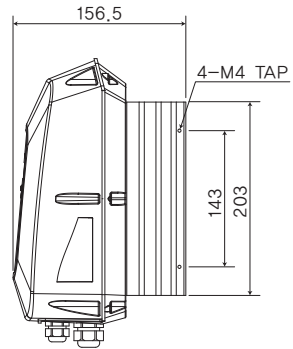
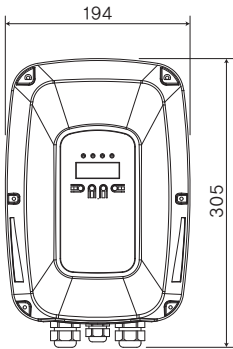
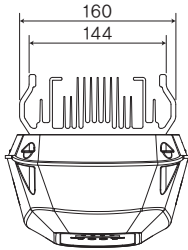
### 2.2 Rated Input and Output (Three Phase)

Model NSQ-____T		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
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	39	45
Output Voltage [V]		380 ~ 440									
Output Frequency [Hz]		0.05 ~ 50/60									
Rated Input Voltage [V]		3 ∅ 380V ~ 440V									
Input Frequency [Hz]		50/60									
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 Frequency									
	Overload Resistance	120% 1 Min,									
	Torque Boost	Manual Torque Boost (0~10%)									
Operation	Operation Method	FND / Terminal / Communication (CAN) Operation									
	Frequency Setting	FND / Terminal (0~10V or 4~20mA)									
	Acceleration /Deceleration Time	1 ~ 600 sec.									
	Abnormal Reset	Automatic Reset upon Automatic Restart Setting									
Operation Status	Abnormal Output	Output(FLT-AT,CT,BT), LED Output									
	Operation Status	Output(FLT-AT,CT,BT), LED Output									
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)									



### 3. External Dimension

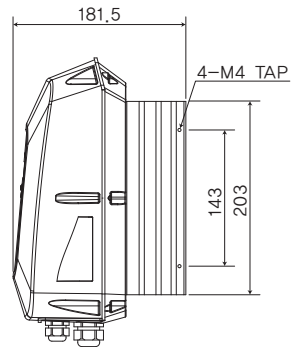
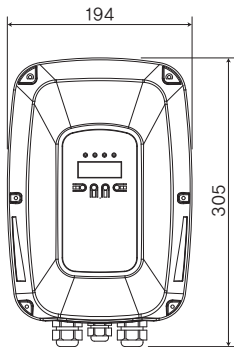
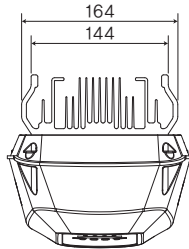
#### 3.1 NSQ-0040S, 0075S, 0075SE, 0150SE





## Chapter 3 External Dimension

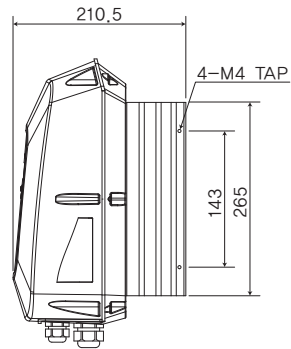
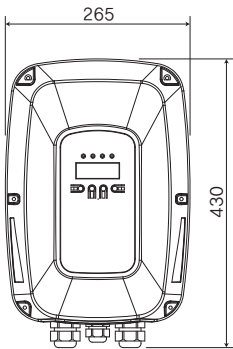
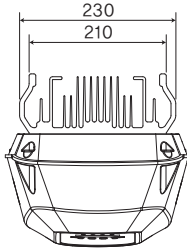
### 3.2 NSQ-0150S ~ NSQ-0220SE NSQ-0075T ~ NSQ-0400T



- NSQ-0075T, 0150T, 0220T, 0400T exterior sizes are identical
- NSQ-0075T, 0150T, 0220T (\*Note: Cooling Fan not Included\*)
- NSQ-0400T (\*Note: Cooling Fan Included)



### 3.3 NSQ-0550T ~ NSQ-0750T

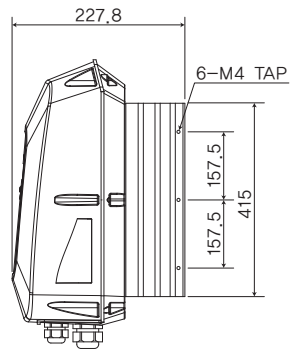
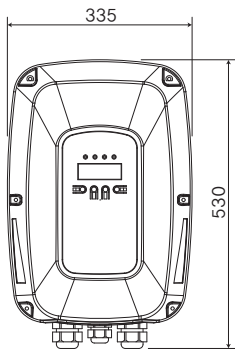
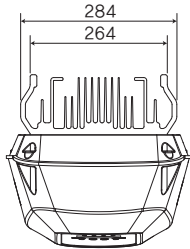


- NSQ-0550T, 0750T \*Note: All external dimensions are identical\*



## Chapter 3 External Dimension

### 3.4 NSQ-1100T ~ NSQ-2200T



- NSQ-1100T, 2200T \*Note: All external dimensions are identical\*





### 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 surrounding temperatures, make sure that the surrounding temperature does not exceed the permitted temperature (-10~0°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.

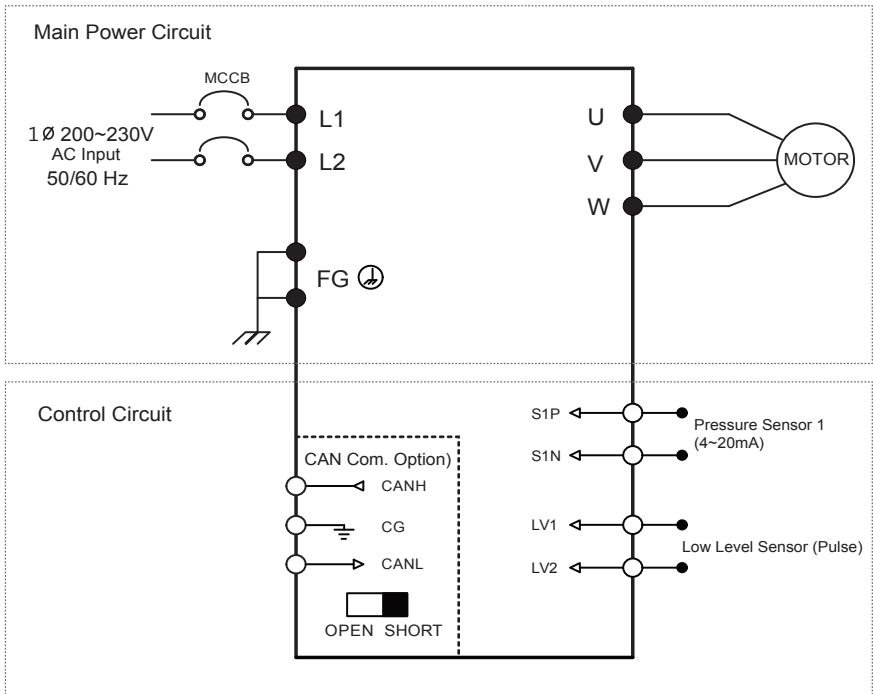
Install the inverter in a closed panel or clean place free from foreign substances such as oil mist and fiber dust.



## Chapter 4 Installation

### 4.2 Wiring Diagram of Terminals

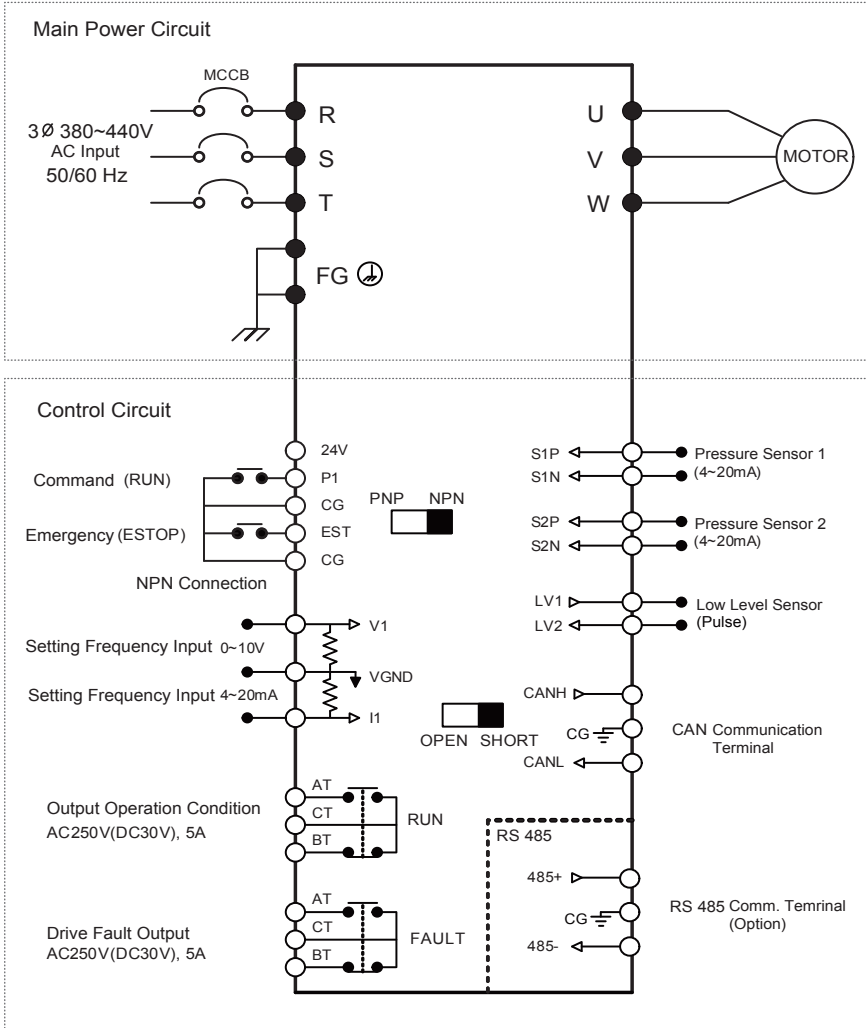
#### 4.2.1 Wiring Diagram of Terminals (Single Phase)





## Chapter 4 Installation

### 4.2.2 Wiring Diagram of Terminals (3 Phase)





## 4.3 Wiring of Main Power Supply Circuit

### 4.3.1 Description on Main Power Supply Terminals

- Single Phase

<b>U</b>	<b>V</b>	<b>W</b>	<b>FG</b>	<b>FG</b>	<b>L2</b>	<b>L1</b>
----------	----------	----------	-----------	-----------	-----------	-----------

Terminal Sign	Terminal Name	Description: 1 Phase
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.

- 3 Phase

<b>R</b>	<b>S</b>	<b>T</b>	<b>FG</b>	<b>FG</b>	<b>U</b>	<b>V</b>	<b>W</b>
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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.



## Chapter 4 Installation

- 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

- Single Phase

Drive Capacity	Terminal screw size	Screw Torque (N.m)	Thickness of Wires		
			mm <sup>2</sup> (AWG)		
			L1, L2	U, V, W	FG
0.4kW	M3.5	1.2 ~ 1.5	2(14)	2(14)	2(14)
0.75kW	M3.5	1.2 ~ 1.5	2(14)	2(14)	2(14)
1.5kW	M3.5	1.2 ~ 1.5	3.5(12)	3.5(12)	2(14)
2.2kW	M3.5	1.2 ~ 1.5	3.5(12)	3.5(12)	3.5(12)

- 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.



## Chapter 4 Installation

- 3 Phase

Drive Capacity	Terminal screw size	Screw Torque (N.m)	Thickness of Wires		
			mm <sup>2</sup> (AWG)		
			R, S, T	U, V, W	FG
0.75kW	M4	1.2 ~ 1.5	2(14)	2(14)	2(14)
1.5kW	M4	1.2 ~ 1.5	2(14)	2(14)	2(14)
2.2kW	M4	1.2 ~ 1.5	3.5(12)	3.5(12)	2(14)
4kW	M4	1.2 ~ 1.5	3.5(12)	3.5(12)	3.5(12)
5.5kW	M5	2.5	5.5(10)	5.5(10)	5.5(10)
7.5kW	M5	2.5	5.5(10)	5.5(10)	5.5(10)
11kW	M6	4 ~ 5	8(8)	8(8)	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)

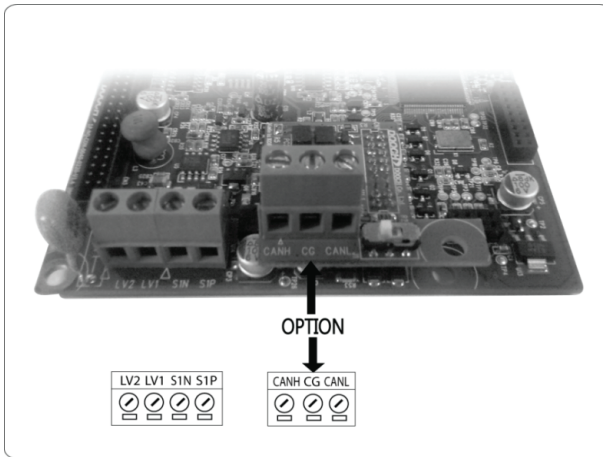
- Apply specified torque for fastening the terminal screw.
- Weak fastening may cause malfunction and too strong fastening may destroy terminal block.
- Use 600V class wires.



## 4.4 Control Circuit Wiring

### 4.4.1 Arrangement of Control Terminal Block

- 0.4kW ~ 2.2kW (Single Phase)



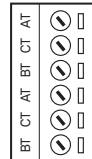
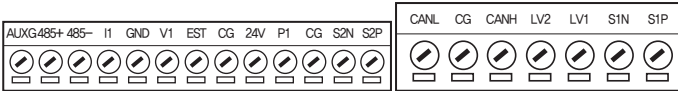
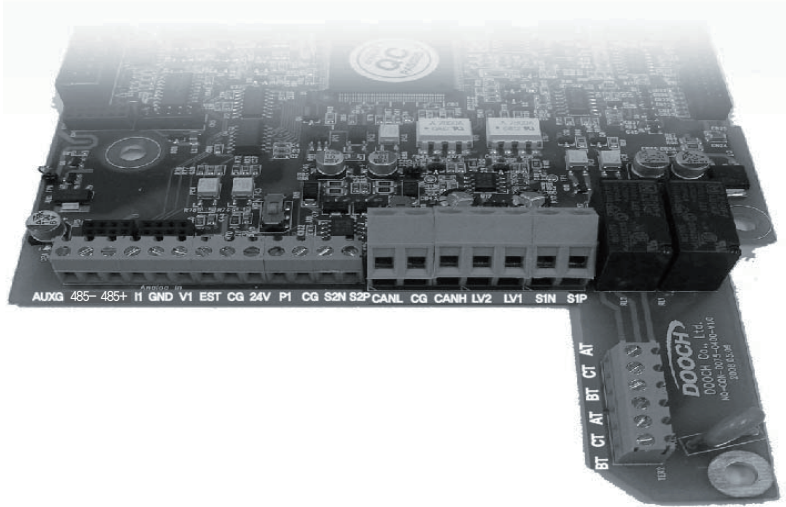
### 4.4.2 Functions of Control Terminal Block(Single Phase)

Classification		Terminal sign	Terminal Name	Description
Input Signal	Pump Control	S1P, S1N	Pressure Sensor 1	Connection terminal for Pressure Sensor 1
		S2P, S2N(Optional)	Pressure Sensor 2	Connection terminal for Pressure Sensor 2
		LV1, LV2	Low Level Sensor	Connection terminal for low level sensor
Operation	RUN(Optional)	Operation Instruction	Terminal operation shutdown	
	CG	CAN Common Terminal	Input terminals of common terminal	
Output Signal	Relay	RUNA, RUNC (Option)	Output signal operation	Signal power when starting the drive(AC220V 0.1A below)
		FLTA, FLTC (Option)	Signal Output	Signal power when the system and drive goes into protection mode.
Comm. Signal	CAN	CANH, CANL(Optional)	CAN Signal	CAN Signal Line Terminal
		CG	CAN Comm. Terminal	Common terminal of power ground for CAN comm.



## Chapter 4 Installation

- 0.4kW ~ 2.2kW (3 Phase)

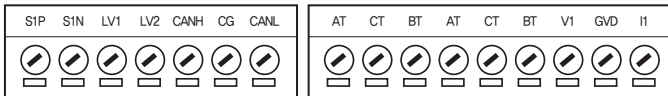
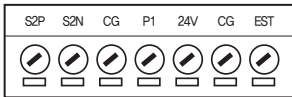
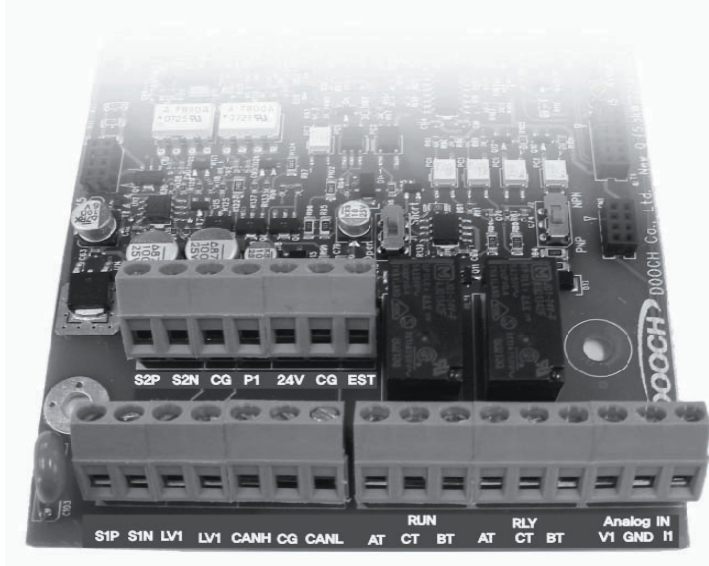






## Chapter 4 Installation

- 0.4kW ~ 2.2kW (3 Phase)





### 4.4.3 Functions of Control Terminal Block (3 Phase)

Classification		Terminal Sign	Terminal Name	Description
Input Signal	Pump Control	S1P, S1N	Pressure Sensor 1	Connection terminal for Pressure Sensor 1
		S2P, S2N	Pressure Sensor 2	Connection terminal for Pressure Sensor 2 (used for differential pressure control)
		LV1, LV2	Low Level Sensor	Connection terminal for low level sensor
	Contact Operation	P1	Operation Command	Operation/Stop Terminal
		EST	Emergency Stop	When EST signal is ON, it turns off drive output.
		24V	Contact Operation Common Terminal	Common terminal of input terminal for PNP contact.
		CG	Contact Operation Common Terminal	Common terminal of input terminal for NPN contact.
	Analog Frequency Setup	V1	Frequency Setup (Voltage)	If entering DC 0~10V, it makes setup frequency.
		I1	Frequency Setup (Current)	If entering DC 4~20mA it makes setup frequency.
		GND	Frequency Setup Common Terminal	Common terminal for Analog frequency setup terminal.
Output Signal	Relay Contact	RUN (AT, CT, BT)	Abnormal Signal Output	It outputs signal when drive is output. ( $\leq$ AC250V 5A, $\leq$ DC30V 5A)
		FAULT (AT, CT, BT)	Multi-function Output	It is output when protection function of system and drive is activated to cut off output. ( $\leq$ AC250V 5A, $\leq$ DC30V 5A)
Com. Signal	CAN	CANH, CANL	CAN Signal	CAN signal line terminal
		CG	CAN Common Terminal	Common terminal of power ground for CAN communication
	RS485 (Option)	485-, 485+	RS485 Signal	RS485 Signal Terminal
		CG	RS485 Common Terminal	Common terminal of power ground for RS485 communication



## Chapter 4 Installation

### 4.4.4 Cautions on Control Circuit Wiring

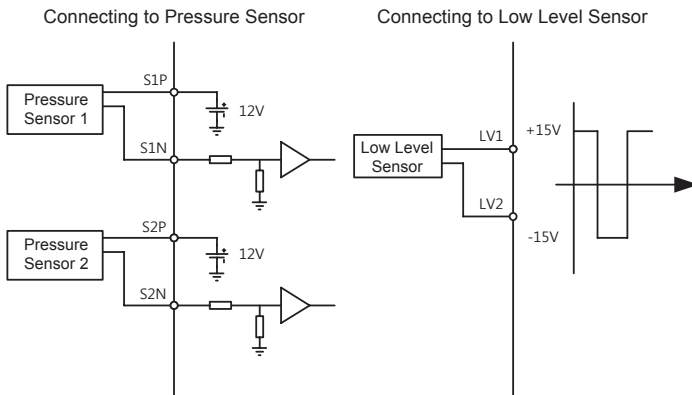
- Maintain wiring distance between pressure sensor and drive within 10m.
- In case of remote control using analog signals, maintain distance between remote control panel and drive within 50m.
- Set off sensor and analog signal lines enough from power lines.
- Use shield twisted wires for signal lines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

### 4.4.5 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 12V	DC $\pm 15V$ Pulse
Sensor Output	4~20mA	Connection

- 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.



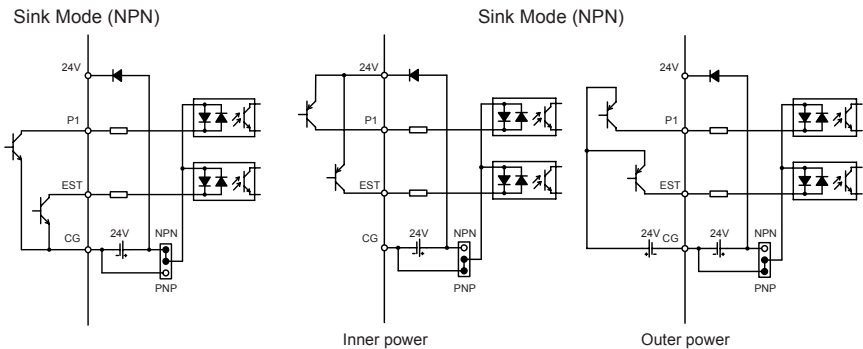


## Chapter 4 Installation

### 4.4.6 Sink Mode and Source Mode (3 Phase)

- This product is configured to allow applying both sink mode (NPN: Using CG common terminal) and source mode (PNP: Using 24V common terminal) to the input terminal logic of control circuit. It is possible to toggle between sink mode and source mode using selection switch within the control board.

Wiring methods for sink mode and source mode are shown on figures below.



### 4.4.7 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.**



### 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.





## Chapter 5 Operation

### 5.1.2 Functional Description of each Part

#### 1) LED Lamps

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

- Functions of each Button

<b>Run</b>	Turned on for waiting and flickered on operation
<b>Stop</b>	Turned on during stop
<b>Alarm1</b>	Turned on for High Pressure/Low Pressure/Sensor Error/Low Level Alarms
<b>Alarm2</b>	Turned on for drive 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 Part

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), Pr group (Pump Control Group) and dr group (Drive Group).

#### 3) Button Part

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

- Description on Button's Functions

	It is used for setting up pressure settings, various parameters or Alarm Reset
	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  key for saving the final value. If pressing  and  for 3 seconds, parameter group is moved.
	



## Chapter 5 Operation

### 5.1.3 How to Change Parameter Settings

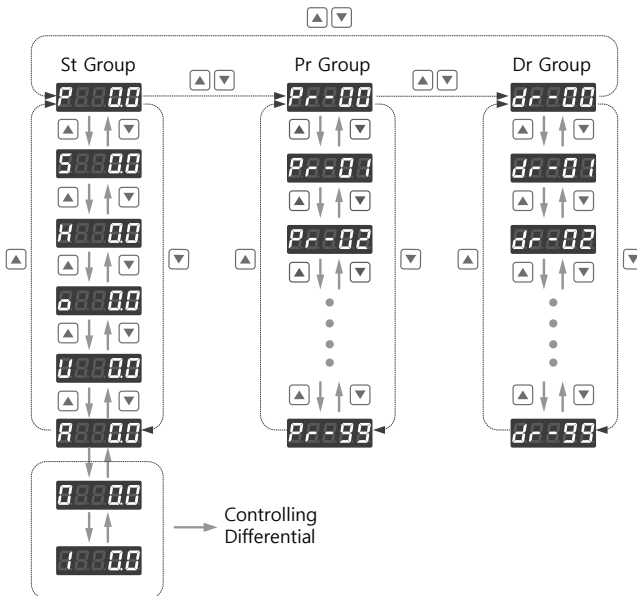
- Since any change of parameter settings has direct influence on operation, please be careful about it.
- Before changing any parameter setting, be sure to write it on paper.
- Do not change the parameter setting except for responsible operator or professional engineer.
- Since there are items with data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

#### 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.

#### 2) Parameter Item Movement

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



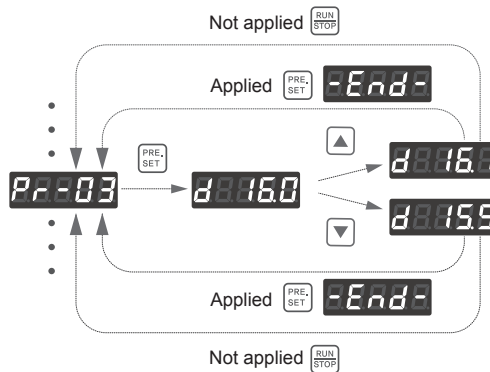


## Chapter 5 Operation

### 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
Input Location of Run Command	dr-01	To select a method to issue Run command (FND, Terminal Block)
Input Method of Target Frequency	dr-02	To select a method to control target operation frequency (Own PID, FND, V1, I1)
Capacity of Motor	dr-10	To set up Capacity of Motor
No. of Poles of Motor	dr-11	To set up No. of Poles of Motor
Rated Current of Motor	dr-12	To set up Rated Current of Motor
Rated Rotations of Motor	dr-13	To set up Rated Rotations of Motor
Rated Voltage of Motor	dr-14	To set up Rated Voltage of Motor
No-load Current of Motor	dr-15	To set up No-load Current of Motor
Rated Slip Frequency of Motor	dr-16	To set up Rated Slip Frequency of Motor
Rated Frequency of Motor	dr-17	To set up Rated Frequency of Motor
Efficiency of Motor	dr-18	To set up Efficiency of Motor
Rotation Direction Selection of Motor	dr-20	To set up Rotation Direction Selection of Motor Property
Stopping Method of Motor dr	dr-21	To set up Stopping Method of Motor to stop the motor
Increase/Decrease Time	dr-22/dr-23	To set up Increase/Decrease Time of Drive

### 2) Pump Control Function Setup

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

Setup Item	Parameter Code	Description on Function
Pump Capacity	Pr-01	To set up Pump Capacity
Pump Control Mode	Pr-02	To set up Pump Control Mode
Sensor Capacity and Correction	Pr-03~06	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 Use Low Water Level Sensor	Pr-76	To decide whether to use low water level sensor



## Chapter 5 Operation

### 3) Drive Control Function upon External Command

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

Setup Item	Parameter Code	Description on Function
Frequency Setup upon V1 Voltage	dr-60~63	To set up output frequency range against voltage when controlling drive using V1 voltage
Frequency Setup upon I1 Voltage	dr-64~67	To set up output frequency range against current when controlling drive using I1 current

### 4) 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. Mode	Pr-50	To set up CAN Comm. Mode
CAN Comm. ID	Pr-51	To set up CAN Comm. ID (If ID is '0', CAN Comm. is disabled.)
CAN Comm. Speed	Pr-52	To set up CAN Comm. Speed

### 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.

#### 1) Pump Control Parameters

Setup Item	Parameter Code	Description on Function
PID Controller Gain Setup	Pr-07 ~ 09	To set up gain to adjust response characteristics of PID controller
Control Cycle of PID Controller	Pr-10	To set up Control Cycle of PID Controller
Start Pressure Variation	Pr-12	Minimum pressure variance to allow drive to start
Initial Output Ratio on Starting	Pr-15	To set up initial starting output frequency of PID controller in order to speed up response against initial starting
Lead Pump Alternation	Pr-53 ~ 54	To operate pump alternatively in force during multi-drive operation



### 2) Setup Parameters for Pump System Protection

Setup Item	Parameter Code	Description on Function
High Pressure Alarm	Pr-70 Pr-72	To set up high pressure alarm level and time in order to protect discharge pipe from high pressure.
Low Pressure Alarm	Pr-71 Pr-73	To set up low pressure alarm level and time in order to protect the pump from damaged pump.
Low Water Level Alarm	Pr-74 ~ 77	There are two detection methods using low level sensor or software in order to protect the pump by detecting existence of water within suction pipe.

### 3) Setup Parameter for Fault History Storage

Setup Item	Parameter Code	Description on Function
Fault History Storage and Deletion	Pr-80 ~ 86	To store or delete fault or alarm generated from pump system or drive.



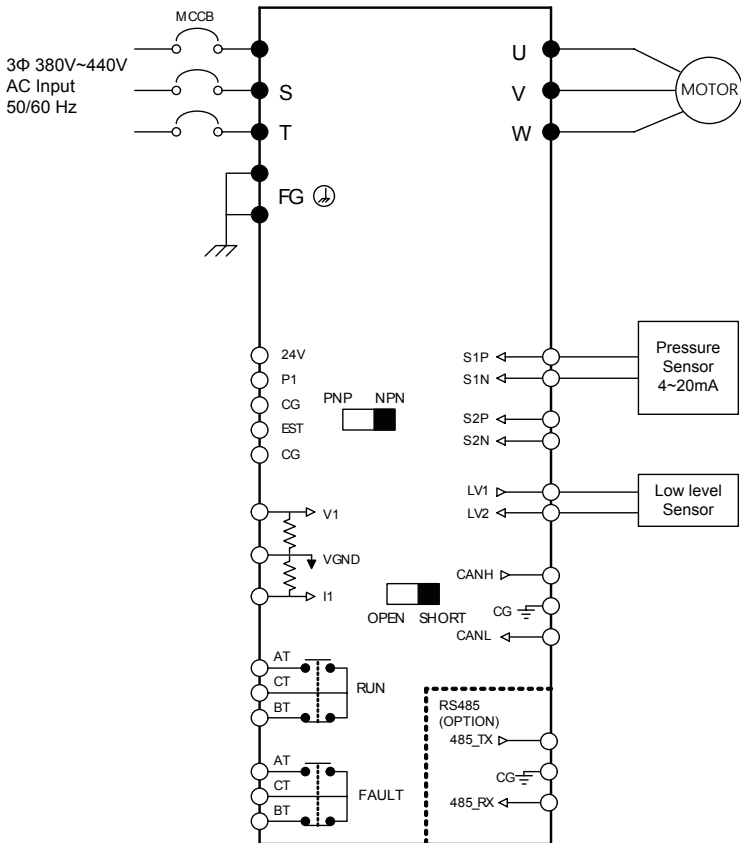
## 5.3 Basic Operation

### 5.3.1 Constant Pressure Control Mode

#### 1) 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.

#### A. Wiring Diagram





## Chapter 5 Operation

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.  
(In case of KELLER 21G series, connect brown line of pressure sensor to SEN1P terminal and white line to SEN1N terminal respectively.)
- Connect low level sensor (electrode) if necessary.

※ **In case of not using low water level sensor (electrode), change setup to use low water level detection method of software. (To select Para 'Pr-76' Low Level Trip Detection Method '0')**

### B. Setup and Operation Method

- After applying power supply, check if Stop LED on FND is turned on and FND part displays current press of **Pr 00** piping.
- ※ If **Er-01** 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.)



## C. Operation Parameters - Basic Setup

Parameters

Setup Sequence	Setup Item	Parameter Code	Functional Description
1	Run Command Input Location Setup	dr-01	To set up Run command with FND.
2	Target Frequency Input Method Setup	dr-02	To set up Target Frequency Input Method of drive with own PID.
3	Pump Control Mode Setup	Pr-02	To set up Pump Control Mode to Constant Pressure Mode.
4	Sensor1 Capacity Setup	Pr-03	To set up rated capacity of pressure sensor used.
5	Sensor1 Pressure Variation Correction	Pr-04	To correct variation between value of used pressure sensor and real pressure value.
6	Target Pressure Setup	St Group	To set up CAN Comm. ID to '0' in order to make CAN Comm. Disabled.
7	Motor Rotation Direction Selection	dr-20	To make rotation direction of motor same as pump operation direction
8	Operation		key, them pump operates with target pressure.

## D. Target Pressure Setup

If you don't know about correct pressure setting, contact the specialist.

If you press **STOP** 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 **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 ('Pr-70') setting will be automatically set to the value 2 bar higher than the pressure setting.

## E. 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.)

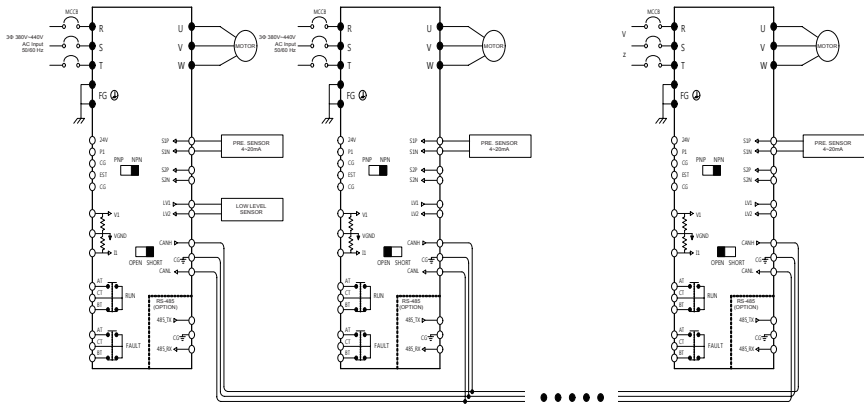
- Change two from three wires of the motor input.
- Change the value of Parameter 'dr-20' to other one. 'dr-20'.



## 2) 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:

### A. Wiring Diagram



- Connect drive wiring so that the power input lines and motor output lines does not interchanged.
- Be sure to install wiring breaker at the power input of drive.
- Check the polarity of pressure sensor and connect it properly. Connect auxiliary pressure sensor to each drive depending on the system.
- In order to detect low level of suction pipe, connect low level sensor (electrode) if necessary.
  - ※ In case a low level sensor (electrode) is not used, change the setup to use low level detection method of software  
(To select Parameter 'Pr-76' Low Level Trip Detection Method '0')

### B. Setup and Operation Method

- After applying power supply, check if the Stop LED on the FND is turned on and FND part displays current press **P 0.00** of piping  
\*If **Er-01** is displayed, be sure to check the wiring of the pressure sensor.  
(Connection status or defective pressure sensor, etc.)



## C. Operation Parameters

- Basic Setup Parameters

Setup Sequence	Setup Item	Parameter Code	Functional Description
1	Run Command Input Location Setup	dr-01	To set up Run command with FND.
2	Target Frequency Input Method Setup	dr-02	To set up Target Frequency Input Method of drive with own PID.
3	Pump Control Mode Setup	Pr-02	To set up Pump Control Mode to Constant Pressure Mode.
4	Sensor1 Capacity Setup	Pr-03	To set up rated capacity of pressure sensor used.
5	Sensor1 Pressure Variation Correction	Pr-04	To correct variation between value of used pressure sensor and real pressure value.
6	Comm. ID Setup	Pr-51	To set up CAN Comm. ID to 1~6 so that it should not be duplicated with other drive.
7	Target Pressure Setup	St Group	To set up CAN Comm. ID to '0' in order to make CAN Comm. Disabled.
8	Motor Rotation Direction Selection	dr-20	To make rotation direction of motor same as pump operation direction
9	Operation		key, then pump operates with target pressure.

## D. Target Pressure Setup

- If you don't know about correct pressure setting, contact the specialist.  
In case of linked drive operation, when setting up pressure on one drive, setup pressures are automatically changed for all drives through CAN communication.  
If you press **PREL 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 screen.  
(If you press key without pressing **SUM STOP** 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 **-End-** setting will be automatically set to the value 2 bar higher than the pressure setting.

## E. 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.)
  - Change two from three wires of the motor input.
  - Change the value of Parameter 'dr-20' to other one.





### 6. Functions/Descriptions

#### 6.1 Status Group

DISPLAY	NAME	Explanation	Remark
P	Present pressure	It shows measured present pressure	In case of difference pressure, It shows difference pressure.
S	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.
H	Output Hz	It shows present drive output to HZ	
o	Output ratio	It shows present drive output to%	
U	Voltage	It shows voltage of DC Link	Input voltage ※ $\sqrt{2}$ = DC Link voltage[V]
A	Current	It shows present output current	Unit [A]
O	Discharge pressure	In case of difference pressure control, It shows discharge pressure	Differential pressure
I	Suction pressure	In case of difference pressure control, It shows suction pressure	Differential pressure



## 6.2 Pump Controls

△ Indicates that it is an option

Display	Name	Range	Factory Setting	Para. Link	Diff. Pressure Use	Change of Operation	1 Phase	3 Phase
Pr-00	Jump Code	1 ~ 92	51	×	○	○	○	○
Pr-01	Pump Capacity Setup	0.75~25.00[kW]	—	×	○	×	○	○
Pr-02	Pump Control Mode	0 ~ 1	1	○	○	×	○	○
Pr-03	Capacity Setup of Sensor 1	1.0~25.0[bar]	16,0	×	○	×	○	○
Pr-04	Correction Value of Sensor 1	-1.0~1.0[bar]	0,0	×	○	○	○	○
Pr-05	Capacity Setup of Sensor 2	1.0~25.0[bar]	16,0	×	○	×	△	○
Pr-06	Correction Value of Sensor 2	-1.0~1.0[bar]	0,0	×	○	○	△	○
Pr-07	P Gain of PID Controller	0~100[%]	10	○	○	○	○	○
Pr-08	I Gain of PID Controller	0~100[sec]	1	○	○	○	○	○
Pr-09	D Gain of PID Controller	0~100[ms]	0	○	○	○	○	○
Pr-10	Control Cycle of PID Controller	10~200[ms]	200	○	○	×	○	○
Pr-11	Selection of Freezing Prevention	0 ~ 1	0	○	○	○	○	○
Pr-12	Starting Pressure Variation	0~2.0[bar]	0,3	○	×	○	○	○
Pr-13	Stopping Time after reaching Setup Pressure	0~200[sec]	30	○	×	○	○	○
Pr-14	Ratio of Min Output Freq. of Stop Mode after reaching Setup Pressure	0~100[%]	100	○	×	○	○	○
Pr-15	Ratio of Initial Output on starting	5~100[%]	50	○	○	×	○	○
Pr-40	485 Comm. Mode	0 ~ 1	0	×	○	×	×	○
Pr-41	485 Comm. ID	1~250	1	○	○	×	×	○
Pr-42	485 Comm. Speed	1 ~ 5	4	○	○	×	×	○
Pr-43	485 Comm. Delay time	1~9999[ms]	5	○	○	×	×	○
Pr-50	CAN Comm. Mode	0 ~ 2	1	×	○	×	○	○
Pr-51	CAN Comm. ID	0 ~ 6	0	×	○	×	○	○
Pr-52	CAN Comm. Speed	1 ~ 5	1	×	○	×	○	○
Pr-53	Alteration type	0 ~ 1	0	○	×	×	×	○
Pr-54	Lead pump alteration type	0~24[hour]	12	○	○	○	○	○



## Chapter 6 Functions & Descriptions

Display	Name	Range	Factory Setting	Para. Link	Diff. Pressure Use	Change of Operation	1 Phase	3Phase
Pr-55	Standby Pump waiting time	1~100[sec]	5	○	○	○	○	○
Pr-61	PID control Type Setup	0 ~ 1	0	○	○	×	○	○
Pr-64	Output Ratio of Starting AllPID increase	70~100[%]	100	○	○	○	○	○
Pr-70	High Pressure Alarm Level	0~Sen1 Cap.[bar]	20.0	○	×	○	○	○
Pr-71	Low Pressure Alarm Level	0~10.0[bar]	0.5	○	×	○	○	○
Pr-72	High Pressure Alarm Time	0~100[sec]	5	○	×	○	○	○
Pr-73	Low Pressure Alarm Time	0~200[sec]	20	○	×	○	○	○
Pr-74	Low Level Trip Time of Pressure Sensor	0~250[sec]	20	○	×	○	○	○
Pr-75	Low Level Trip Pressure Level	0~1.0[bar]	0.3	○	×	○	○	○
Pr-76	Low Level Detection Method Selection	0 ~ 1	0	×	×	×	○	○
Pr-77	Low Level Trip Time of Low Level Sensor	0~250[sec]	2	○	×	○	○	○
Pr-80	Current Fault History	-	-	×	○	×	○	○
Pr-81	Fault History 1	-	-	×	○	×	○	○
Pr-82	Fault History 2	-	-	×	○	×	○	○
Pr-83	Fault History 3	-	-	×	○	×	○	○
Pr-84	Fault History 4	-	-	×	○	×	○	○
Pr-85	Fault History 5	-	-	×	○	×	○	○
Pr-86	Delete Fault History	0 ~ 1	0	×	○	○	○	○
Pr-87	Sensor percentage	0 ~ 200	100	×	×	○	×	○
Pr-90	Initialization Code	0 ~ 1	0	×	○	×	○	○
Pr-92	S/W Version	-	-	×	○	×	○	○



## Chapter 6 Functions & Descriptions

### 6.3 Drive Control Group

★ To setup initial value according to drive capacity

☆ To setup initial value with basis of Dooch induction motor

Display	Name	Range	Factory Setting	Change of Operation	1 Phase	3Phase
dr-00	CAN Comm. Speed	1 ~ 90	1	○	○	○
dr-01	Command Input Location Setup	0 ~ 1	0	×	○	○
dr-02	Target Freq. Input/Method Setup	0 ~ 3	0	×	○	○
dr-03	Target Freq. Value Setup	Min Freq. (dr-42) ~Max Freq.	30.0	○	○	○
dr-10	Motor Capacity	0.10~75.00[kW]	★	×	○	○
dr-11	No. of Motor Poles Rated	1 ~ 2	1	×	○	○
dr-12	Current of Motor	1.0~100.0[Arms]	☆	×	○	○
dr-13	Rated Rotations of Motor	1~9999[rpm]	☆	×	○	○
dr-14	Rated Voltage of Motor	200.0~500.0[Vrms]	☆	×	○	○
dr-15	Non-load Current of Motor	0.5~100.0[Arms]	☆	×	○	○
dr-16	Rated Slip Frequency of Motor	0.10~10.00[Hz]	☆	×	○	○
dr-17	Rated Frequency of Motor	0 ~ 1	1	×	○	○
dr-18	Motor Efficiency	50~100[%]	☆	×	○	○
dr-20	Selection of Motor rotation	0 ~ 1	0	×	○	○
dr-21	Method of motor stoppage	0 ~ 1	0	×	○	○
dr-22	Time Increase	1.0~600.0	3.0	○	○	○
dr-23	Time Decrease	1.0~600.0	6.0	○	○	○
dr-30	Motor Overload Trip Selection	0 ~ 1	1	○	○	○
dr-31	Motor Overload Trip Level	100~200[%]	120	○	○	○
dr-32	Motor Overload Trip Time Stoll	5~200[sec]	60	○	○	○
dr-33	Prevention Setup	0 ~ 1	0	×	○	○
dr-34	Stoll Prevention Level	100~200[%]	150	×	○	○
dr-35	Motor Overheat Selection	0 ~ 1	0	○	○	○



## Chapter 6 Functions & Descriptions

Display	Name	Range	Factory Setting	Change of Operation	1 Phase	3Phase
dr-37	No. of Restart after Trip	0 ~ 50	3	○	○	○
dr-38	Waiting Time of Automatic Restart after Trip	1~250[sec]	10	×	○	○
dr-40	Drive Control Mode	0 ~ 1	10	×	○	○
dr-41	Torque Boost Amount	0~10.0[%]	2.0	×	○	○
dr-42	Start Frequency	0.10~40.00[Hz]	0.50	×	○	○
dr-43	Max Operation Freq.	40.00~ Rated Freq. of Motor[Hz]	60.00	×	○	○
dr-44	Switching Frequency.	1.0~15.0[Hz]	5.0	○	○	○
dr-50	Fan Operation Type	0 ~ 2	1	○	○	○
dr-51	Power Consumption Correction	0.0~1000.0	100.0	○	○	○
dr-52	Output Power Indication	0.0~100.0[kW]	-	-	○	○
dr-53	Accumulated Mega Wh indication	0~9999[MWh]	-	-	○	○
dr-54	Accumulated Kilo Wh indication	0~9999[kWh]	-	-	○	○
dr-56	Power Semiconductor Temp.	0~200℃	-	-	○	○
dr-57	Ambient Temp. Display	0.0~500.0[V]	-	-	○	○
dr-60	V1 Min. Input Voltage	0.0~5.0[V]	0.0	○	×	○
dr-61	Corresponding Freq. to V1 Min. Input Current	0.00~30.00[Hz]	0.00	○	×	○
dr-62	V1 Max. Input Current	5.1~10.0[V]	10.0	○	×	○
dr-63	Corresponding Freq. to V1 Max. Input Current	30.01~ Rated Freq. of Motor[Hz]	Rated Freq. of Motor	○	×	○
dr-64	I1 Min. Input Current	0~10[mA]	4	○	×	○
dr-65	Corresponding Freq. to I1 Min. Input Current	0.00~30.00[Hz]	0.00	○	×	○
dr-66	I1 Max. Output Current	11~20[mA]	20	×	×	○
dr-67	Corresponding Freq. to I1 Max. Input Current	30.01~ Rated Freq. of Motor	Rated Freq. of Motor	×	×	○
dr-70	Year Display	0~9999	-	-	×	○
dr-71	Month/Date Display	01.01~12.31	-	-	×	○
dr-72	Hr/Min. Display	00.00~23.59	-	-	×	○
dr-89	Initializing Integrated Watt	0 ~ 1	0	×	×	○
dr-90	Initialization Code	0 ~ 1	0	×	○	○



## 6-4. Description on Functions of Parameter Settings

### 6-4-1 Pump Control Group

#### Pr-00 Jump Code

- It allows moving to desired code number directly.
- It is also possible to move to other code using ▲▼ key after moving.

#### Pr-01 Pump Capacity

- To set up and confirm pump capacity.
- Initial value is automatically set by drive capacity.

Related Functions	
dr-10	Capacity of Motor
dr-11	No. of Poles of Motor
dr-12	Rated Current of Motor
dr-13	Rated Rotations of Motor
dr-14	Rated Voltage of Motor
dr-15	No-load Current of Motor
dr-16	Rated Slip Frequency of Motor
dr-17	Rated Frequency of Motor
dr-18	Efficiency of Motor

#### Pr-02 Pump Control Mode

- To set up pump control method.

Setup Data	Functional Description	Related Functions		
0	Differential Pressure Control Method	Pr-03	Capacity of Sensor 1	Discharge Direction
		Pr-04	Correction of Sensor 1	
		Pr-05	Capacity of Sensor 2	Suction Direction
		Pr-06	Correction of Sensor 2	
1	Constant Pressure Control Method (Factory Setting)	Pr-03	Capacity of Sensor 1	
		Pr-04	Correction of Sensor 1	



### Pr-03 Sensor 1 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.

Example) 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]

### Pr-04 Sensor 1 Correction Setup

- It corrects pressure variation between analog or digital pressure meter and the one displayed on drive FIND.

Factory Setting	Input Range
0.0 [bar]	-1.0 ~ 1.0 [bar]

### Pr-05 Sensor 2 Capacity Setup

- It is used in case of pressure difference control mode.
- Setup method is same as described on Pr-03.

### Pr-06 Sensor 2 Correction Setup

- It is used in case of pressure difference control mode.
- Setup method is same as described on Pr-04.

### Pr-07 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 if PID I-Gain is 0 and 100bar error is maintained, controller output is 1.0[Hz].

Factory Setting	Input Range
10 [%]	0 ~ 100 [%]



### Pr-08 I Gain of PID Controller

- It is relevant to 'I' (Integral Constant) 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 [sec]	0 ~ 100 [sec]

### Pr-09 D Gain of PID Controller

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

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

### Pr-10 PID Control Cycle

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

Factory Setting	Input Range
200 [ms]	0 ~ 200 [ms]

### Pr-11 Freezing Prevention Function

- It sets up freezing prevention mode of pump.
- 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	Functional Description
0 (Factory Setting)	OFF
1	ON





## Chapter 6 Functions & Descriptions

### Pr-12 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.
- In case of alarm occurrence, operation does not start.

Factory Setting	Input Range
0.3 [bar]	0.0 ~ 2.0 [bar]

### Pr-13 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))

### Pr-14 Min Output Frequency Ratio to Stop after Reaching Setup Pressure

- In order to stop after reaching to specified pressure, the drive is able to stop only if the current minimum output frequency ratio is less or equal to setup ratio.

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

### Pr-40 485 Comm. Mode

- To set up 485.

Setup Data	Functional Description
0 (factory setting)	Not use 485 comm.
1	Use 485 comm.



## Chapter 6 Functions & Descriptions

### Pr-41 485 comm.

- It setup 485 comm. ID set up

Setup Data	Functional Description
1 ~ 250 (Factory Setting 1)	f the number of data request protocol is different, data is not transmitted.

### Pr-42 485 comm. speed

- 485 comm. speed set up

Setup Data	Functional Description
1	1200 bps
2	2400 bps
3	4800 bps
4 (Factory Setting)	9600 bps
5	19200 bps

### Pr-43 485 comm. delay time

- 485 comm. delay time set up

Setup Data	Functional Description
1 ~ 9999 [msec]	When receive data request protocol, data transmit after set up delay time (Factory set up : 5[msec])

### Pr-50 CAN Communication Mode

- It set up for multi-drive control, when each drive has different version

Setup Data	Functional Description
0	NSQ Ver. 1.2x
1 (Factory Setting)	NSQ Ver. 1.3x
2	NSQ Ver. 2.xx

※ Available for version 1.3x. Please refer version check page

※ When set up for 0(NSQ Ver 1.2x), the Pr-53 alteration automatically changed to 0(in order of ID)



## Chapter 6 Functions & Descriptions

### Pr-51 Communication ID Setup

- 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.	Related Functions	
		dr-02	Target Frequency Input Method
		Pr-52	CAN Communication Speed
		Pr-53	Lead Pump Alternation method
		Pr-54	Lead Pump Alternation Time
		Pr-55	Stand-by Pump Waiting Time
	Pr-61	PID Type on Multi-Drive control	

### Pr-52 CAN Communication Speed

- It sets up CAN communication speed. In case of long connection distance, it is better to reduce the communication speed.

Setup Data	Functional Description
1 (Factory Setting)	40 kbps
2	50 kbps
3	100 kbps
4	200 kbps
5	250 kbps

### Pr-53 Alternation method

- It determines the order of Q-Driver's run, stop, alternation on Multi-Drive operation mode.

Setup Data	Functional Description
0 (Factory Setting)	In order if ID
1	In order of low watt-hour

※ Setting is available for Ver 1.3x

※ When Pr-50 can comm. mode is 0, alternation is set 0.



## Chapter 6 Functions & Descriptions

### Pr-54 Lead Pump Alternation Time

- Alternative operation 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 times is set, drives are forcedly shifted.

Setup Data	Functional Description
0	Release of alternation
1 ~ 24 (hour)	Alternation time setup. (Factory Setting 12[hour])

### Pr-55 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 operation before the main drive outputs maximum frequency then the pressure may increase suddenly.

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

### Pr-61 PID Type Setup on Multi-Drive Control Mode

- This is to improve energy efficiency on multiple pump operation and selectable for the user. Master control means acceleration/deceleration operation upon PID by Master for only one drive. Centralized control is a method that all of drivers participating into operation are allocated with target value for the output frequency by one PID controller of Master. This function has an advantage to prevent overload on the drive.

Setup Data	Functional Description	
0 (Factory Setting)	0 (Factory Setting) Master Control	
1	Centralized Control	Related Function
		Pr-64 Output Ratio on Starting Increase of All PID



### Pr-64 Output Ratio on Starting Increase of AllPID(Preparing)

- It is an output ratio to start the next drive by applying its centralized control method for multiple pump operation. That is, if the output ratio of drive in operation is higher than a specified value, the next drive to be linked starts to be operated.

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

### Pr-70 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 Function	
20.0 [bar]	0.0 ~ 20.0 [bar]	Pr-72	High Pressure Trip Time

### Pr-71 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 ~ 10.0 [bar]	Pr-73	Low Pressure Alarm Level

### Pr-72 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 (Pr-70) 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 ~ 100 [sec]	Pr-70	High Pressure Alarm



### Pr-73 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 (Pr-71) 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]	Pr-71	Low Pressure Alarm Level

### Pr-74 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 (Pr-75) and maintains its state for a specified time, an alarm is displayed and operation stops.
- It is applied when low water level sensor setup (Pr-76) is released.

Factory Setting	Input Range	Related Function	
30 [sec]	0 ~ 250 [sec]	Pr-75	Pressure Alarm Level
		Pr-76	Low Pressure Alarm Method Selection

### Pr-75 Low Water Level Alarm Pressure Level

- It is a pressure level to determine low water level when selecting software detection method from Low Water Level Alarm Detection Method Selection (Pr-76).

Factory Setting	Input Range	Related Function	
0.3 [bar]	0.0 ~ 1.0 [bar]	Pr-74	Low Water Level Alarm Time of Pressure Sensor
		Pr-76	Low Water Level Alarm Method Selection



## Chapter 6 Function Table & Description

### Pr-76 Low Water Level Alarm Method Selection

- 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 to determine existence of water within piping.
- In case of multi-drive 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 pressure level (Pr-75) and low water level alarm time (Pr-74). That is, if the operation is continued for more than low water level alarm time (Pr-74) with pressure under the low water level alarm pressure level (Pr-75), it is required to display alarm and stop operation as it is determined that there is no water within the piping.




Setup Data	Functional Description	Related Function	
0 (Factory Setting)	Software detection using pressure sensor	Pr-74	Low Water Level Alarm Time Of Pressure Sensor
		Pr-71	Pressure Level for Low Water Level Alarm
1	Low water level sensor setup	Pr-71	Low Level Alarm Time of Low Water Level Sensor

### Pr-77 Low level Sensor Low Level Trip Time

- 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 method (Pr-76), it is required to display alarm and stop operation as it is determined that there is no water within the suction piping.

Setup Data	Functional Description
0	Release of low level detection using low level sensor
1 ~ 250 [sec]	Time Setup (Factory Setting 2[sec])

### Pr-80 ~ Pr-85 Fault History List

- Pr-80 displays Error Code value occurred currently.
- Pr-81 ~ Pr-85 are memorized in reverse order of Error occurrence.
- It is possible to enter into using  key and to confirm frequency, current, operation state and error content of the fault using   key.



## Chapter 6 Function Table & Description

FND Display	Description
tSF, tOP, tUP, tUL, tASH etc	Error Content (Refer to Chapter 8 Fault History Table)
H xx.x	Frequency with Error
A xx.x	Current with Error
t xx.x	No. of Errors occurred
Stdy, StOP, AdOFS, wdOG	Operation status with Error

### Pr-86 Deletion of Fault History

- It deletes all of the fault history

Setup Data	Functional Description
0	To maintain error contents(Factory Setting)
1	To delete all of error contents

### Pr-87 Sensor percentage

- It corrects sensor by % unit.

In order to decrease sensor value, enter smaller value than 100 based on 100% while in order to increase it, enter larger value than 100.

### Pr-90 Initialization Code

- 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

### Pr-92 S/W Version

- It displays program version.





## Chapter 6 Function Table & Description

### 6-4-2 Drive Control Group

#### dr-00 Jump Code

- It allows moving to desired code number directly.  
It is also possible to move to other code using key after moving.

#### dr-01 Command Input Location Setup

- It sets operation command location.  
When selecting FND key, it is possible to issue operation command using key on main body of drive.  
When setting up terminal block, it is possible to issue operation command using external input(P1)

Setup Data	Functional Description
0 (Factory Setting)	Operation Command with FND
1	Operation Command with Terminal Block(P1)

#### dr-02 Target Frequency Input Method Setup

- It sets up target frequency input method of drive.

Setup Data	Functional Description	
0 (Factory Setting)	Setup with own PID operation	
1	Setup when using fixed freq. on the main body of FND drive	Related Function
		dr-03 Target Freq. Value Setup
2	Setup with external voltage V1(0~10V)	
3	Setup with external current I1(4~20mA)	

#### dr-03 Target Frequency Value Setup

- When using as a fixed frequency, it is possible to set up target frequency value.  
Target Frequency Input Method (dr-02) should be set with FND.

Factory Setting	Input Range
30.0 [Hz]	Start Freq. (dr-42) ~Max Freq (dr-43)[Hz]



## Chapter 6 Function Table & Description

### dr-10 Motor Capacity

- It sets motor capacity.
- It is set when pump drive is released from the factory. Setting value is for displaying.  
It is used when the current pump drive checks the motor capacity being set.  
Changing the setting does not have influence other parameters.

Factory Setting	Input Range
Initial value is set upon drive capacity	0.10 ~ 75.00 [kW]

### dr-11 Motor Pole Selection

- It sets No. of motor poles.
- It is set when pump drive is released from the factory.

Setup Data	Functional Description
1	2 Pole Motor
2	4 Pole Motor

### dr-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]

### dr-13 No. of Rated Rotations of Motor

- It sets No. of rated rotations of motor. It is based on data indicated on the nameplate of the motor.

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

### dr-14 Rated Voltage of Motor

- It sets rated voltage of motor. It is based on data indicated on the nameplate of the motor.

Factory Setting	Input Range
Initial value is set upon drive capacity	200.0 ~ 500.0 [Vrms]



## Chapter 6 Function Table & Description

### dr-15 Non-load Current of Motor

- It sets non-load current of motor.

Factory Setting	Input Range
Initial value is set upon drive capacity	0.5 ~ 100.0 [Arms]

### dr-16 Rated Slip Freq. of Motor

- It displays slip freq. of motor.  
Settings are automatically set upon No. of motor poles, rated No. of rotations, and rated frequency.

Factory Setting	Input Range	Related Function
Automatic Setup	0.10 ~ 10.00 [Hz]	dr-11 No. of motor poles
		dr-13 Rated No. of Rotations of Motor
		dr-17 Rated Frequency of Motor

### dr-17 Rated Frequency of Motor

- It sets rated frequency of motor.

Setup Data	Functional Description	Related Function	
0	50 [Hz]	dr-43	Max Operation Freq.
1 (Factory Setting)	60 [Hz]		

### dr-18 Efficiency of Motor

- It is set when pump drive is released from the factory.

Factory Setting	Input Range
Initial value is set upon drive capacity	70 ~ 100 [%]

※ **Motor related constants (dr-10~dr-18) set upon drive capacity may not match with motor data of the user. Be sure to check data on the nameplate.**



## Chapter 6 Function Table & Description

### dr-20 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)

### dr-21 Motor Stopping Method

- It sets motor stopping method

Setup Data	Functional Description	
0 (Factory Setting)	Decelerated Stop	Related Function
		dr-23 Falling Time
1	To cut off drive output voltage	

### dr-22 Rising 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]

### dr-23 Falling 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]



## Chapter 6 Function Table & Description

### dr-30 Overload Trip Selection

- It sets up whether it will generate trip upon overload of the motor.
- It is used for protecting the motor.

Setup Data	Functional Description		
0	Release		
1 (Factory Setting)	Setting	Related Function	
		dr-12	Rated Current of Motor
		dr-31	Overload Trip Level
		dr-32	Overload Trip Time

### dr-31 Overload Trip Level

- It refers to trip current level against rated current of the motor.  
That is, if the rated current of the motor is 10[A] and the overload trip level is 120%, the overload trip will be generated above 12[A].
- It is used for protecting the motor upon overload.

Factory Setting	Input Range	Related Function	
120 [%]	100 ~ 200 [%]	dr-12	Motor Rated Current
		dr-32	Overload Trip Time

### dr-32 Overload Trip Time

- It sets maintaining time of overload trip level to generate overload trip.  
That is, if it reaches to overload trip level (dr-31) and the specified time elapsed, it indicates overload trip alarm and stops the operation.

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



## Chapter 6 Function Table & Description

### dr-33 Stall Prevention Selection

- It selects whether it uses Stall Protection.
- On occurrence of Stall, it decelerates the speed.

Setup Data	Functional Description		
0 (Factory Setting)	Release		
1	Setup	Related Function	
		dr-12	Rated Current of Motor
		dr-34	Stall Prevention Level

### dr-34 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 [%]	dr-12	Rated Current of Motor

### dr-35 Motor Overheat Selection

- It sets motor overheat protection function.  
The drive calculates load current of motor by itself and determines overheat by expecting increase of temperature.

Setup Data	Functional Description
0 (Factory Setting)	Release
1	Setup

### dr-36 Ground Detection

- It sets ground protection function.

Setup Data	Functional Description
0 (Factory Setting)	Release
1	Setup



## Chapter 6 Function Table & Description

### dr-37 No. of Auto Restart after Trip

- It refers to No. of automatic operations for drive after occurrence of trip.
- If the trip occurs more than specified number, it can not restart.
- If there is no trip during certain time, No of trip might be deleted.
- It may not be restarted according to error code. Refer to Chapter 7 Fault History Table.

Factory Setting	Input Range
3[times]	0~50[times]

### dr-38 Automatic Restart Waiting Time after Trip

- When a specified time elapsed after trip, it restarts.

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

### dr-40 Drive Control Mode

- 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 slipcompensation function.

Setup Data	Functional Description	Related Function	
0 (Factory Setting)	V/F control	dr-41	Torque boost amount
1	Slip Compensation Control	dr-10	Motor capacity
		dr-12	Rated current of motor
		dr-15	Non-load current of motor
		dr-16	Rated slip of motor
		dr-18	Efficiency of motor

### dr-41 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 [%]



## Chapter 6 Function Table & Description

### dr-42 Start Frequency

- It refers to frequency that drive starts to output.

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

### dr-43 Max Operation Frequency

- It can limit max operation frequency of drive.
- It cannot exceed range of rated frequency (dr-17) of motor.

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

### dr-44 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 ~ 15.0 [kHz]

### dr-50 Fan Operation Method

- It sets cooling fan operation method.

Setup Data	Functional Description
0	To operate upon application of drive power
1 (Factory Setting)	To operate upon output of drive frequency
2	To operate upon abnormal state of internal setup temperature

### dr-51 Power Consumption Correction

- It corrects a consumed power upon operation of drive.

### dr-52 Indication of Power Consumption

- It displays a consumed power upon operation of drive.

Range	0.0 ~ 100.0 [kW]
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## Chapter 6 Function Table & Description

### dr-53 ~ dr-54 Indication of Accumulated Power

- It displays accumulated power of drive in Mega, kilo Wh unit.  
Displayed accumulated power may have error comparing to actual value.

Parameter	Functional Description
dr-53	To display in Mega Wh unit
dr-54	To display in Kilo Wh unit

### dr-55 Power Semiconductor Temperature

- It displays temperatures of core module devices in the drive.  
If temperature is more than 100 °C, It display alarm and stop.

<b>Range</b>	0 ~ 200 [°C]
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### dr-56 Ambient Temperature Display

- It displays ambient temperature of the drive.

<b>Range</b>	-10 ~ 200 [°C]
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### dr-57 Output Voltage Display

- It display effective output voltage of the drive.

<b>Range</b>	0.0 ~ 500.0 [V]
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## Chapter 6 Function Table & Description

### dr-60 ~ dr-67 Command Frequency Setup upon External Analog Input

Parameter No.	Function Name	Functional Description
dr-60	V1 Min Input Voltage	To set up min voltage to be input from external.
dr-61	Corresponding Freq. to V1 Min Input Voltage	To set up frequency corresponding V1 min input voltage
dr-62	V1 Max Input Voltage	To set up max voltage to be input from external.
dr-63	Corresponding Freq. to V1 Max Input Voltage	To set up frequency corresponding V1 max input voltage.
dr-64	I1 Min Input Current	To set up min current to be input from external.
dr-65	Corresponding Freq. to I1 Min Input Current	To set up frequency corresponding I1 min input current
dr-66	I1 Max Input Current	To set up max current to be input from external.
dr-67	Corresponding Freq. to I1 Max Input Current	To set up frequency corresponding I1 max input current.

Parameter No.	Factory Setting	Input Range
dr-60	0.0	0.0 ~ 5.0 [V]
dr-61	0.0	0.00 ~ 30.00 [Hz]
dr-62	10.0	5.1 ~ 10.0 [V]
dr-63	Rated Freq. of Motor	30.10 ~ Rated Freq. of Motor
dr-64	4	0 ~ 10 [mA]
dr-65	0.0	0.00 ~ 30.00 [Hz]
dr-66	20	11 ~ 20 [mA]
dr-67	Rated Freq. of Motor	30.10 ~ Rated Freq. of Motor

### dr-70 ~ dr-72 Time Display

- It displays year, month, date and time set within the drive.
- Time cannot be modified and set upon factory settings.

Parameter No.	Functional Description
dr-70	To display current year
dr-71	To display current month and date
dr-72	To display current hour and minute



## Chapter 6 Function Table & Description

### dr-89 Initialization Code

- It initializes to the factory settings.

※ **Caution : All present data will be lost once it is re-setted to the factory setting.**

Setup Data	Functional Description
0 (Factory Setting)	To maintain content
1	To initialize dr-53, dr-54 to the factory settings

### dr-90 Initialization Code

- It initializes to the factory settings.

Setup Data	Functional Description
0 (Factory Setting)	To maintain content
1	To initialize dr-group to the factory settings





### 7.1 Fault History Table

FND Display	Content	Description	Restarting	Remarks
Er-01	tSF	Pressure Sensor Error	○	69
Er-02	tOP	High Pressure Alarm	○	
Er-03	tLP	Low Pressure Alarm	○	70
Er-04	tUL	Low Level Alarm	○	
Er-05	tASH	Drive Arm Short Trip	×	71
Er-06	tOC	Drive H/W Over Current Trip	○	72
Er-07	SOC	Drive H/W Over Current Restriction Trip	○	
Er-08	tMOH	Motor Overheat (TMOH)	○	73
Er-09	tOH	Drive Overheat Trip	○	
Er-10	tLv	DC-Link Low Voltage Trip	○	74
Er-11	tOv	DC-Link High Voltage Trip	○	
Er-12	tOL	Overload Operation Trip	○	
Er-13	tdOL	Drive Overload Operation Trip	○	75
Er-14	tGF	Ground Trip	×	
Er-15	tIdE	Communication ID Duplication Trip	×	
Er-16	tCE	Communication Error	×	76
Er-17	tIO	The Defects of Input	×	
Er-18	tOO	The Defects of Output	×	
Er-20	tES	External Fault Input	×	77
Er-21	tLt	Allowable Time Elapsed	×	



## 7.2 Reset of fault and alarm

- In case of fault or alarm, FND shows Pr-80.
  - To reset in Pr-group, Press  twice.  
To reset in St-group, Press  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 Reaction

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 incase of interoperation.

Related Function	Function Name	Ref. Page
Pr-50	CAN Communication Mode	50
Pr-51	Communication ID	51
Pr-52	CAN Communication Speed	

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 (Pr-72) and the alarm lamp will be turned on. (It may occur on temporary installation site or trial run test.)



## Chapter 7 Checking and Troubleshooting

### 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
Pr-70	High Pressure Alarm Level	53
Pr-72	High Pressure Alarm Time	

### 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 (dr-38) from trip. However, if it repeats more than No. of Automatic Restart after Trip (dr-37), 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  key, press  key to start the pump.

Related Function	Function Name	Ref. Page
Pr-71	Low Pressure Alarm Level	53
Pr-73	Low Pressure Alarm Time	54
dr-37	No. of Automatic Restart after Trip	63
dr-38	Waiting Time for Automatic Restart after Trip	

### 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. It is generated when the low levelsensor (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 (Pr-75)and operation continues for low pressure trip time(Pr-74).

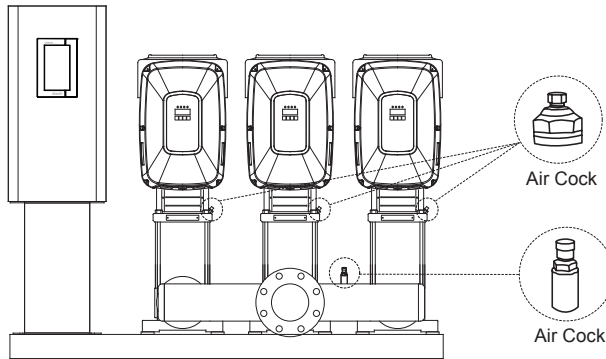
In case of using the low water level sensor (electrode), when there is water, the alarm will be automatically released and the drive will be automatically operate



## Chapter 7 Checking and Troubleshooting

### Reaction

- Check if the water tank (water reservoir) is filled with water.
- Check if there is any water by opening the air cock of the pump.
- After releasing error by pressing **PRESET** key, press **START** key to start the pump



Related Function	Function Name	Ref. Page
Pr-74	Pressure Sensor Low Level Trip Time	54
Pr-75	Pressure Sensor Low Level Trip Level	
Pr-76	Low Level Detection Method Selection	55
Pr-77	Low Level Sensor Trip Time	

### 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 (dr-22).
- 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.



## Chapter 7 Checking and Troubleshooting

Related Function	Function Name	Ref. Page
dr-22	Rising Time	60

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

#### Cause

- In case acceleration/deceleration time is excessively short comparing to load inertia
- When the drive restarts during free run of motor
- Drive damage from fire

#### 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
dr-21	Motor Stopping Method	60
dr-22	Rising Time	
dr-23	Falling Time	

### 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 load is large on starting, adjust torque boost amount (dr-41).
- If the same alarm occurs, please contact your local sales agent.





## Chapter 7 Checking and Troubleshooting

Related Function	Function Name	Ref. Page
dr-10	Motor Capacity	58
dr-21	Motor Stopping Method	60
dr-22	Rising Time	
dr-23	Falling Time	
dr-41	Torque Boost Amount	63

### 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.

Related Function	Function Name	Ref. Page
dr-10	Motor Capacity	58
dr-35	Motor Overheat Selection	62

### 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 °C if it is too high



## Chapter 7 Checking and Troubleshooting

### 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 (dr-23) is short comparing to the load inertia.
- Occurred when the drive input voltage is too high.

#### Reaction

- Increase the deceleration time (dr-23).
- 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
dr-23	Falling Time	60

### 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 (dr-31) and the motor operates for more than overload trip time (dr-32). 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 when the pump operates above 12[A] of output current for more than 5 seconds.

#### Reaction

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



## Chapter 7 Checking and Troubleshooting

Related Function	Function Name	Ref. Page
dr-10	Motor Capacity	58
dr-12	Rated Current of Motor	
dr-30	Motor Overload Trip Selection	61
dr-31	Motor Overload Trip Level	
dr-32	Motor Overload Trip Time	

### 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-14(Ground Trip-tGF)

#### Cause

- Occurred when Output line of drive make short circuit with ground line.
- Occurred when insulation of motor is defective.

#### Reaction

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

### 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
Pr-51	Communication ID	51

### 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-17(The Defects of Input-tIO)

#### Cause

- Occurred when input wiring is defective.
- Occurred when input terminal contacts are defective.

#### Reaction

- Check input wiring.
- Check status of input terminals.

### Er-18 (The Defect s of Output-tOO)

#### Cause

- Occurred when output wiring is defective.
- Occurred when output terminal contacts are defective.

#### Reaction

- Check output wiring.
- Check status of output terminals.



## Chapter 7 Checking and Troubleshooting

Er-20(External Fault Input-tES)

Cause

- An error upon external signals.

Reaction

- Check input side of external signals.

Er-21(Allowable Time Elapsed-tLt)

Reaction

- Contact your local sales agent.



## 8.1 RS-485

- Communication Specification

Article	Specification
Communication Speed	1200/2400/4800/9600/19200 bps
Control Procedure	Asynchronous Communication
Communication System	Half duplex system
Letter	8 bit
Stop bit	1 bit
Error Check (CRC16)	1 byte
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 set 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	0	0	0	0	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



## Chapter 8 Appendix

### 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	0	1	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 the communication is not connected

Check List	Remark
Connections between the NSQ Drive and the Master computer/FA equipment	Check terminal block
RS485	Pr-40 485 comm. Mode
RS485 comm. speed	Pr-42 485 comm. Speed
RS485 comm. ID	Pr-41 485 comm. ID
CAN comm. ID	Pr-51 CAN comm. ID(must be set, as 485 is communication with master of pump system)
Verify the starting communication of the Master computer/FA equipment	
Data formatting of the user's program	



## Chapter 8 Appendix

### NSQ System Operation Conditions

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





Address (Decimal)	Address (Hexidecimal)	Parameter	Scale	Unit	R/W	Remark
4104	0X1008	Inverter Fault			R	Bit Description Bit 0 : 1      Bit 1 : 2 Bit 2 : 3      Bit 3 : 4 Bit 4 : 5      Bit 5 : 6
4111	0X100F	Output Current (Inverter 1)	0.1	%	R	0~1000
4112	0X1010	Output Current (Inverter 2)	0.1	%	R	0~1000
4113	0X1011	Output Current (Inverter 3)	0.1	%	R	0~1000
4114	0X1012	Output Current (Inverter 4)	0.1	%	R	0~1000
4115	0X1013	Output Current (Inverter 5)	0.1	%	R	0~1000
4116	0X1014	Output Current (Inverter 6)	0.1	%	R	0~1000



## Chapter 8 Appendix

### NSQ System Operation Conditions

Address (Decimal)	Address (Hexadecimal)	Parameter	Scale	Unit	R/W	Remark
4117	0x1015	Output Current (Inverter 1)	0.1	Hz	R	0~600
4118	0x1016	Output Current (Inverter 2)	0.1	Hz	R	0~600
4119	0x1017	Output Current (Inverter 3)	0.1	Hz	R	0~600
4120	0x1018	Output Current (Inverter 4)	0.1	Hz	R	0~600
4121	0x1019	Output Current (Inverter 5)	0.1	Hz	R	0~600
4122	0x101A	Output Current (Inverter 6)	0.1	Hz	R	0~600
4123	0x101B	Output Current (Inverter 1)	0.1	A	R	0~1000
4124	0x101C	Output Current (Inverter 2)	0.1	A	R	0~1000
4125	0x101D	Output Current (Inverter 3)	0.1	A	R	0~1000
4126	0x101E	Output Current (Inverter 4)	0.1	A	R	0~1000
4127	0x101F	Output Current (Inverter 5)	0.1	A	R	0~1000
4128	0x1020	Output Current (Inverter 6)	0.1	A	R	0~1000
4129	0x1021	DC Link Voltage (Inverter 1)	1	V	R	0~9999
4130	0x1022	DC Link Voltage (Inverter 2)	1	V	R	0~9999
4131	0x1023	DC Link Voltage (Inverter 3)	1	V	R	0~9999
4132	0x1024	DC Link Voltage (Inverter 4)	1	V	R	0~9999
4133	0x1025	DC Link Voltage (Inverter 5)	1	V	R	0~9999
4134	0x1026	DC Link Voltage (Inverter 6)	1	V	R	0~9999



Address (Decimal)	Address (Hexadecimal)	Parameter	Scale	Unit	R/W	Remark
4135	0x1027	Output Current (Inverter 1)	0.1	kW	R	0~10000
4136	0x1028	Output Current (Inverter 2)	0.1	kW	R	0~10000
4137	0x1029	Output Current (Inverter 3)	0.1	kW	R	0~10000
4138	0x102A	Output Current (Inverter 4)	0.1	kW	R	0~10000
4139	0x102B	Output Current (Inverter5)	0.1	kW	R	0~10000
4140	0x102C	Output Current (Inverter 6)	0.1	kW	R	0~10000
4141	0x102D	Output Current (Inverter 1)	1	MWh	R	0~9999
4142	0x102E	Output Current (Inverter 2)	1	MWh	R	0~9999
4143	0x102F	Output Current (Inverter 3)	1	MWh	R	0~9999
4144	0x1030	Output Current (Inverter 4)	1	MWh	R	0~9999
4145	0x1031	Output Current (Inverter 5)	1	MWh	R	0~9999
4146	0x1032	Output Current (Inverter 6)	1	MWh	R	0~9999
4147	0x1033	Output Current (Inverter 1)	0.1	kWh	R	0~9999
4148	0x1034	Output Current (Inverter 2)	0.1	kWh	R	0~9999
4149	0x1035	Output Current (Inverter 3)	0.1	kWh	R	0~9999
4150	0x1036	Output Current (Inverter 4)	0.1	kWh	R	0~9999
4151	0x1037	Output Current (Inverter 5)	0.1	kWh	R	0~9999
4152	0x1038	Output Current (Inverter 6)	0.1	kWh	R	0~9999



### 8.2 Accessories

#### 8.2.1 EMC FILTER

EMC(electromagnetic compatibility to EN 61800-3)

VFD Model	EMC Filter(Manufacturer : Schaffner)			
	Model	Rated Current[A]	Weight[kg]	Dimensions[mm]
NSQ-0075T	FN 3258-7-45	7	0.5	190X40X70
NSQ-0150T				
NSQ-0220T	FN 3258-16-45	16	0.8	250X45X70
NSQ-0400T				
NSQ-0550T	FN 3258-30-45	30	1.2	270X50X85
NSQ-0750T				
NSQ-1100T	FN 3258-55-45	55	2.0	250X85X90
NSQ-1500T				
NSQ-1850T	FN 3258-75-45	75	2.7	270X80X135
NSQ-2200T				



# Warranty

This product has been manufactured through a strict quality management and inspection process by Dooch Technical Team. The warranty period is 12 months from the date manufactured, provided that, the warranty period is subject change depending on the terms and condition of the agreement under separate cover.

Maker	DOOCH CO., LTD.	Installation Date	
Model No.		Warranty Period	
Customer Information	Name		
	Address		
	Tel.		
Sales Office (Distributor)	Name		
	Address		
	Tel.		

● **FOC Service**

If there is any failure in the product during the afore-mentioned warranty period you can have it repaired FOC by requesting our distributor or designated service center subject that you are found to have used it under our recommended environment. For further details, please refer to our company's regulation.

● **Charged Service**

※ In the event of any of the following cases, the service will be charged.

- The failure occurred from the consumer's improper storage, handling, and careless handling
- The failure occurred from the consumer's error in the design of software or hardware
- The failure occurred from the error of power source and the defect of the connector
- The failure occurred from the force majeure (fire, flood, gas disaster, earthquake, etc.)
- The product was modified or repaired at the discretion of the consumer in the place other than our distributor or the Service Center.
- The name plate provided by DOOCH is not attached on the product
- The product was used in an improper way or beyond the operating range.

※ Waiver of the warranty for the mechanical loss, etc.

Dooch Co., Ltd. doesn't bear any responsibility to indemnify indirect, special, incidental, or consequential loss (including the indemnification of sales loss, loss profit, etc.



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