



# SQ User Guide

Model : AC Drive (V.F.D)  
(1-Phase input)



DOOCH CO., LTD.  
[www.doochpump.com](http://www.doochpump.com)



## Preface



Thank you for purchasing SQ drive,

SQ drive provides optimal operation control performance and functions for pump. Please be sure to read this manual carefully for convenient and safe use of the product before use.

※ In order to improve performance of the drive, functions and specifications are subject to change without prior notice to the users.

## Safety Precautions

- Since the safety precautions are actions to allow using this product safely and rightly in order to prevent possible accident or dangers from occurring, be sure to follow them.
- This user' s manual contains two kinds of marks such as 'WARNING' and 'CAUTION' .

 WARNING	<b>Warning:</b> It indicates a potential dangerous situation that may cause some fault, serious injury or death if the instruction is not be observed.
 CAUTION	<b>Caution :</b> It shows a potential dangerous situation that may cause some damage on the product and loss of property if the instruction is not be observed.

- Before use SQ drive, please pressure this manual
- Please keep this manual closely so the user can refer at any time



## Warning

- Do not open cover during powered state or operation.  
(Exposed high voltage terminals or charging part of DC voltage may cause electric shock.)
- Do not open cover even when power is not supplied except for wiring or inspection work.  
(When the power is turned off, charged DC voltage in charging part of drive may cause electric shock.)
- During wiring work or regular inspection, cut off the power and check with tester if DC voltage is discharged after elapsed more than 10 minutes.  
(It may cause electric shock, Execute work when charging voltage of DC part is DC 30V or less,)
- Do not operate the switch or drive with wet hands.  
(It may cause electric shock,)
- When any part of drive input or cable jacket is damaged, do not apply electricity or operate the equipment.  
(It may cause electric shock,)
- Do not put over stress on the input/output power cable or signal wires of the drive with heavy object.  
(It may damage on the cable jacket to cause electric shock,)
- To prevent electric shock, please use ground-only rated outlet(220V with  $\pm 10\%$ )

**Caution**

- Do not install the equipment near the inflammable materials.  
(Installation on or near the inflammable materials may cause fire.)
- When drive has any fault, cut off the input power.  
(If not, it may cause fire due to consequent accident.)
- Do not touch the drive during powered state or several minutes after power is turned off.  
(Since drive has high temperature after operation, body contact may cause burn.)
- not input power for the drive with damaged product and part even if installation is completed.  
(It may cause electric shock.)
- Do not leave any damageable objects from inside of drive, such as screw, metal, water, oil, etc.  
(It may cause fire.)

## Cautions for Use

### 1. Transportation and Installation

- Transport the product with correct method according its weight.
- Do not stack the products with more than specified layers.
- Install the product upon rules described on the User' s Manual.
- Do not open during transportation of the product.
- Do not put any heavy object on the product.
- Installation direction shall follow criteria specified on the User' s Manual.
- Do not fall or give strong impact on the drive as it is a precise instrument.
- Draw water completely out of the pump during winter without using for a long time.
- Use the drive under the environmental conditions as mentioned below.

Place of Use	Indoors (No corrosive/ inflammable gas, oil sludge, dust, etc.)
Temperature/Humidity	-10 ~ 40°C / Not more than 90% RH (No dewdrop)
Storage Temperature	-20 ~ 65°C
Elevation/Vibration	Lower than altitude of 1,000m/Not more than 5,9m/sec <sup>2</sup> (=0,6g)
Atospheric Pressure	70 ~ 106 kpa

### 2. Wiring

- Wiring or inspection shall be performed by the professional technicians.
- Do not install static condenser, radio noise filter, and so on at the output terminals of the drive.
- Check if the power input line and motor output line are interchanged.
- Faulty terminal connection may cause damage on the drive.
- Use the circuit breaker.
  - ※ Do not install leakage breaker at the power input.
  - ※ If you have any question or the product has any abnormal state, please contact your supplier.

### 3. Checkup on Initial Operation

- Be sure to check setup parameters of the drive before operating it first. It may require changing parameters according to states such as type of pump or installed system environments.
- For terminal blocks for main power circuit and control circuit, be sure to follow connection method and electrical specifications specified on this manual. Improper use may damage on the drive.
- Be sure to use pressure sensor specified or recommended by us or your supplier.

### 4. Operation

- Since it has automatic restart and recovery functions after power failure in default and it is automatically restarted in case it is stopped due to fault or system alarm or power is turned off during operation, be careful when power is applied initially.
- Do not modify or change inside of the product without approval.
- Do not start or stop the drive with electronic contactor(MCB) installed at the power input.
- Parameter initialization changes the parameter values to factory settings.

### 5. Reaction on Failure and Malfunction

- In case drive is destroyed to make operation impossible, reliability of pump system may become deteriorated. It is recommended to install additional auxiliary system in preparation of such situations.
- For countermeasure against drive failure, refer to Chapter 7.

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## 1. BASIC

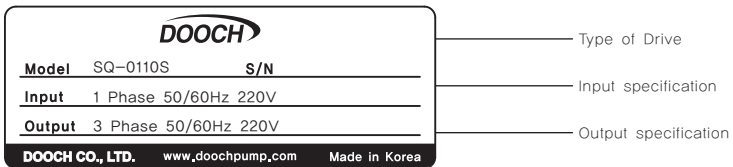
### 1.1 Precautions before Using

#### 1.1.1 Nameplate Information

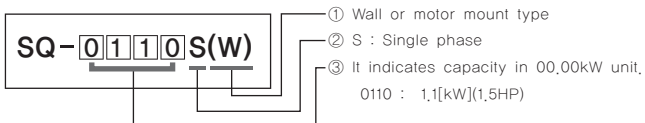
After taking drive out of the package box, check up the nameplate at the side of the body and verify if the type, rated output and so on of the drive are matched with the ordered product. In addition, check if there is any damage during transportation.

※ If you have any question or the product has any abnormal state, please contact the agent or A/S center of Dooch.

– Nameplate of the Product



#### 1.1.2 Type of Product



- Product model name is indicated as above. Initial four digits indicate driving capacity of the drive in 00,00kW unit. Decimal point is not indicated.
- 'S' means Single phase.
- 'W' means wall-mounted type.

### 1.1.3 Installation

Install the drive with proper method under specified conditions considering its lifespan and performance.

### 1.1.4 Wiring

Connect power supply and motor to the power supply terminal block and operation and control signal to the control terminal block. Since improper connection will make the drive malfunction or damaged, be sure to wire with specified method.

## 1.2 Appearance

### 1.2.1 Complete product



### 1.2.2 After remove case cover



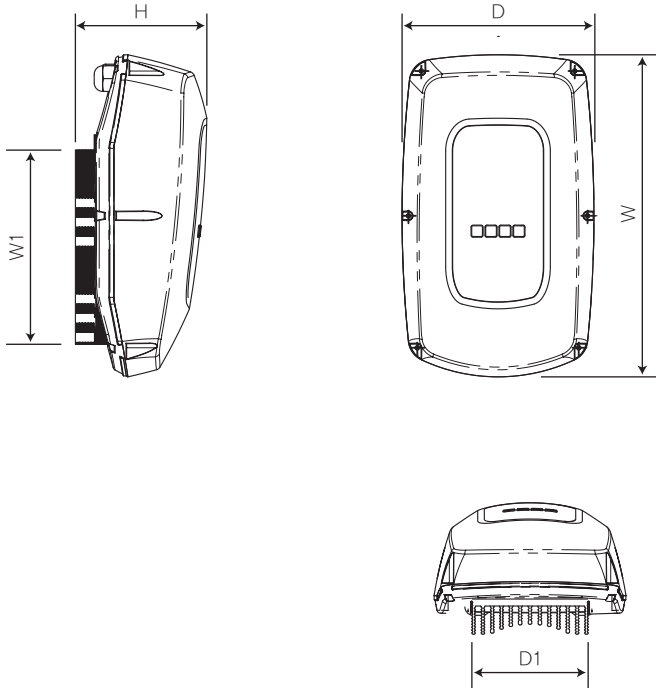
## 2.1 Specifications of Product

Model		SQ-0110S(W)
Standard Motor [kW]		1,1
Standard Motor [HP]		1,5
Rated Output	Output Capacity[kVA]	2,4
	Rated Output Current[A]	6
Output	Output Voltage[V]	3 $\phi$ 200 ~ 230V
	Output Frequency[Hz]	0,05 ~ 50 / 60
Rated Input	Rated Input Voltage[V]	1 $\phi$ 200~230V(-15% ~ +10%)
	Input Frequency[Hz]	50 / 60 ( $\pm$ 5%)
Protection Class		IP55
Switching Frequency [kHz]		1 ~ 15
Cooling		Natural 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
	Frequency Setting	FND
	Acceleration/ Deceleration Time	1 ~ 600 sec
	Abnormal Reset	Automatic Reset upon Automatic Restart Setting
Output Signal	Abnormal Output	LED Output
	Operation Status	LED Output
Other Functions		Freezing protection for pump, Automatic recovery after Power Failure, High/Low Pressure Alarm, Low Water level Alarm, Failure History Storage, Lead Pump Alternation, PID control, Fixed Frequency Operation, Dry running Protection
Protection Functions		High Voltage, Low Voltage, Over Current, Surge, Overload, Inverter Overheating, Output Wire Disconnection
Display	Drive Information	Pump's Current Pressure, Pump's Setting Pressure, Output Frequency, Output Current
	Abnormality Information	Pressure Sensor Error, High/Low Pressure Alarm, Low Level Alarm, Drive Error

Environmental Condition	Installation Location	Altitude 1,000 m or lower; must keep out of corrosive gasses, liquid and dust
	Ambient Temperature	-10°C ~ 40°C
	Storage Temperature	-20°C ~ 60°C
	Ambient Humidity	Below 90% RH (Non-condensing)

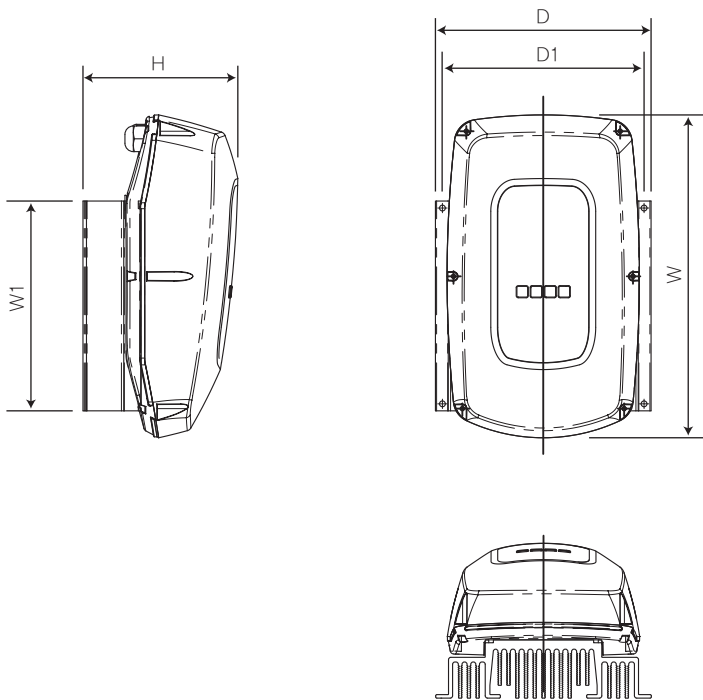
## 3. Measurement

## 3.1 SQ-0110S



Model	H[mm]	W[mm]	D[mm]	W1[mm]	D1[mm]
SQ-0110S	113	277	165	167	100

## 3.2 SQ-0110SW



Model	H[mm]	W[mm]	D[mm]	W1[mm]	D1[mm]
SQ-0110SW	133	277	185	180	173

## 4. Installation

### 4.1 Cautions on Installation

#### A. careful for handling and use.

Since drive consists of sensitive electric/electronic devices, be careful not to damage it during installation or transportation.

#### B. Be careful to install the drive on the place with vibration.

In case of installing it on the motor or piping directly, prepare a countermeasure to reduce vibration.

#### C. Cautions on Ambient Temperature

Since lifespan and performance of the drive depends on the ambient temperature largely, maintain the ambient temperature of the place not to exceed allowable temperature ( $-10 \sim 40$  °C).

If the ambient temperature is higher than allowable temperature, reduce output ratings of the drive before use.

#### D. Install on nonflammable/incombustible materials.

Since the drive becomes high temperature during operation, install it on nonflammable/incombustible materials.

#### E. Secure enough space around installation point.

Since the drive is a heating element, be sure to install it toward the direction that cooling fan flows air from bottom to top and secure enough ambient space not to interfere the cooling air in order for effective cooling.

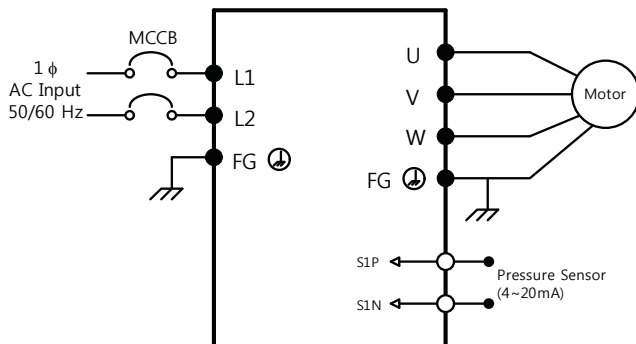
#### F. Install the drive securely in upright position.

Install the drive securely without sway in upright position using fasteners or bolts.

- Secure at least 30cm distance in order to make it easy for repair or maintenance.
- Considering the place, sand filter is needed to prevent from the impellers of pump being damaged.
- Install valve on inlet and outlet piping.
- When install the driver, earthing is needed.
- In case not use this product in winter, drain water from the pump.

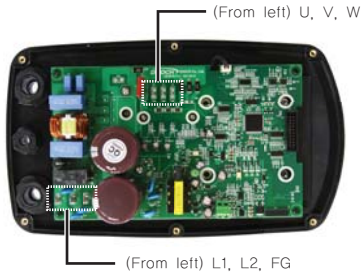


## 4.2 Wiring Diagram of Terminals



### 4.3 Wiring of Main Power Supply Circuit

#### 4.3.1 Description on Main Circuit Terminals



Terminal Sign	Terminal Name	Description
L1, L2	AC Input	To connect commercial AC Input,
FG	Ground	It is a ground terminal on drive enclosure, Please ground it,
U, V, W	Drive Output	To connect Motor,

#### 4.3.2 Cautions on Main Power Supply Wiring


- 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 (L1, L2). Use the wiring breaker (MCCB) with 1.5~2 times larger capacity than rated current of the drive.
- If AC input power(L1, L2) is connected to output terminals (U,V,W) of drive, drive will be damaged. Be sure to connect it to input/output terminals.
- Even though power input terminals (L1, L2) may be connected regardless to phase sequence of AC input power, it is required to consider rotation direction of the motor when connecting input terminals of the motor to output terminals of the drive (U,V,W). If rotation direction of the motor is reversed, 2 lines from drive output terminals (U,V,W) should be exchanged each other.

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

#### 4.3.3 Cautions on Ground Wiring

- Since a leak current is generated from high speed switching of the drive, it is required to ground the drive to prevent electric shock.
- Maintain ground resistance within  $100\Omega$  during grounding work
- Use thicker wires than specified one for ground wire.

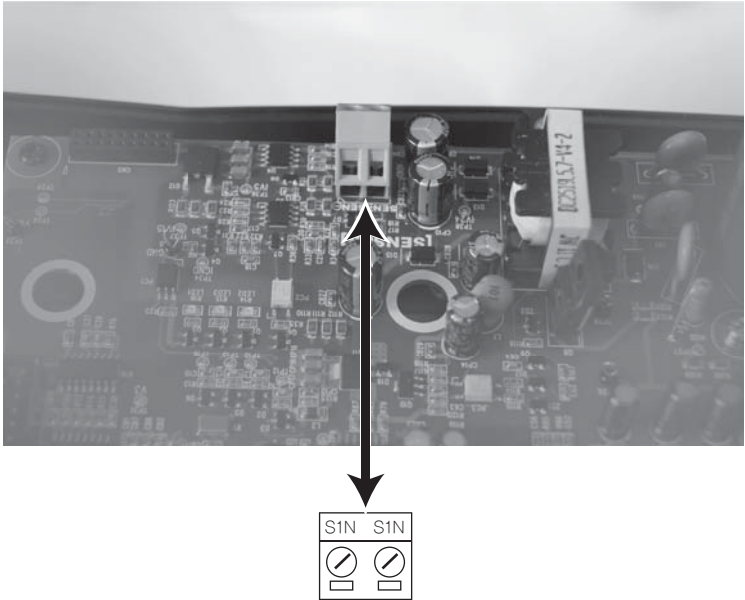
#### 4.3.4 Specifications of Recommended Wires and Terminal Screw

Socket Specification ( <a href="http://www.ket.com/kor/">http://www.ket.com/kor/</a> )	Thickness of Wires(mm <sup>2</sup> )		
	L1,L2	U,V,W	FG
 (ST730135-2)	1.5	1.5	1.5

- ※ Weak fastening may cause malfunction and strong fastening may destroy terminal block.
- ※ Apply specified torque for fastening the terminal screw.
- ※ Use wire 600V range

## 4.4 Pressure Sensor Wiring

### 4.4.1 Pressure Sensor Terminal



### 4.4.2 Pressure Sensor Terminal

Terminal Sign	Terminal Name	Description
S1P	Pressure Sensor Power	Connection terminal for Pressure Sensor 1
S1N	Pressure Sensor Output	Connection terminal for low level sensor

#### 4.4.3 Connection of Pressure Sensor

- Use the pressure sensor specified or recommended by Dooch Co.,Ltd.
- Maintain the distance between pressure sensor and drive within 10meters.
- Keep distance wire of pressure sensor and that electric power.
- When connect the pressure sensor to drive, mind the polarity.

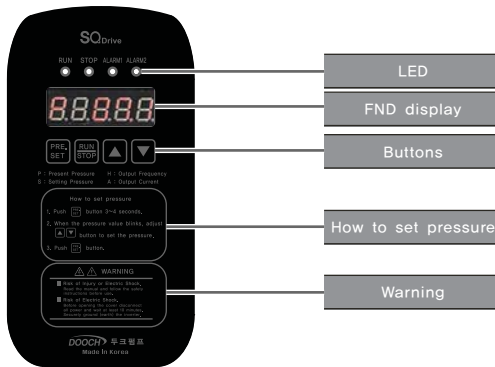
※ When not using our recommended sensor, please contact your supplier.

## 5.Operation

### 5.1 FND

#### 5.1.1 Appearance and Description of FND

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



#### 5.1.2 Functions

##### 1) LED

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

– Functions of each Button

Run	Turned on for waiting and flickered on operation
Stop	Turned on during stop
Alarm1	Turned on for High Pressure/Low Pressure/ Sensor Error/Low Level Alarms
Alarm2	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 push  and  at the same time for 3 seconds, parameter group moves.
	

## 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) How to enter into Parameter Group

When applying power first, it enters into St group. In order to move to parameter group, push



▲ and ▼ buttons at the same time for 2 seconds and you will see **n 10** on the display.

And press  for 2 seconds than **d 10** will blink. Now press ▲ or ▼ to adjust to the password number and press **-End-**

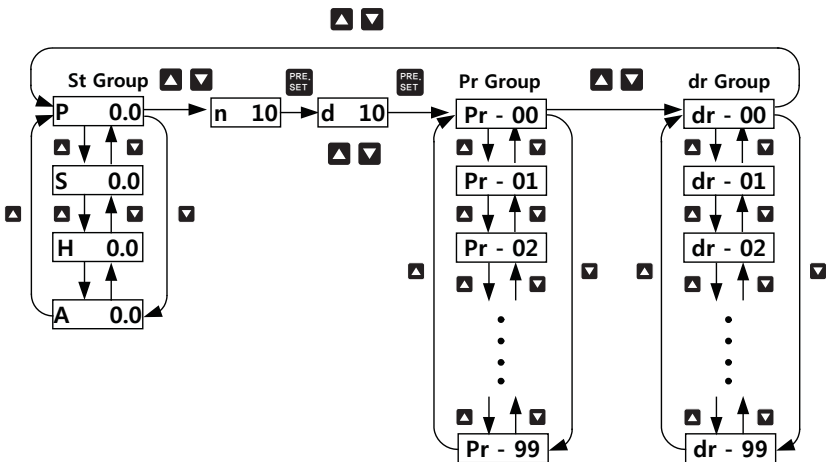
## 2) Move to other parameter group

Press ▲ and ▼ at the same time for 2–3 seconds.

## 3) Parameter Item Movement

In order to move between parameter items within parameter group,

push ▲ or ▼ buttons to move to your desired item.



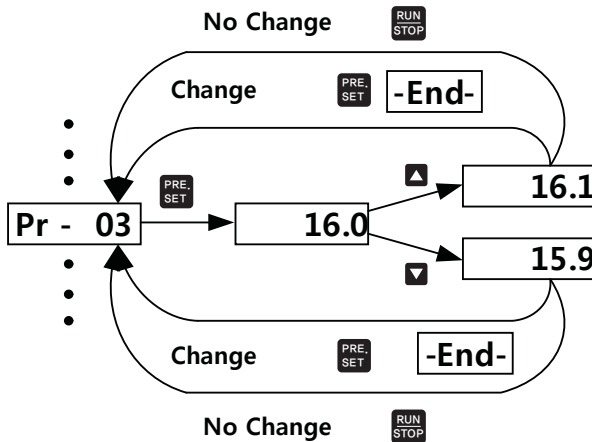


## 4) How To Change Parameter Settings

In order to change parameter setting, press **PRE. SET** key at the desired parameter item to enter into Setting Change Mode for 2 seconds. On Setting Change Mode, use **▲** and **▼** key to change it to desired setting.

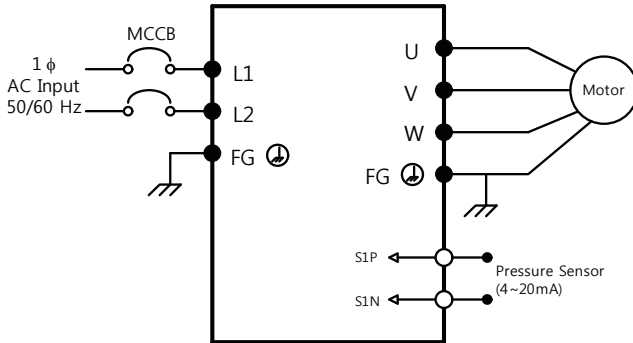
Press **PRE. SET** again, then **-End-** shows on the FND and the setting is done.

If push **RUN STOP** key on Parameter Edit Mode, setting is not applied and exit from Edit Mode.



## 5.2 Basic Operation

## 5.2.1 Wiring Diagram




- 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 the brown line of pressure sensor to SENIP terminal and the white line to SENIN terminal)

## 5.2.2 Setup and Operation

- After applying power supply, check if Stop LED on FND is turned on and FND part displays current press **P - 0.0** of piping.
  - ※ If **Er - 01** is displayed, be sure to check wiring of pressure sensor,  
(Connection status or defective pressure sensor, etc.)
  - ※ Caution: Do not be surprised even if drive operates automatically,  
10 seconds after power supplied.  
This is a normal phenomenon due to the power failure recovery function .  
(Refer to power fail recovery function.)

### 5.2.3 Operation Parameters

– Basic Setup Parameters

Setup Sequence	Setup Item	Parameter Code	Function
1	Target Frequency Input Method Setup	dr-02	To set up Target Frequency Input Method of drive with own PID.
2	Sensor Capacity Setup	Pr-03	To set up rated capacity of pressure sensor
3	Sensor Pressure Variation Correction	Pr-04	To correct variation between value of used pressure sensor and real pressure value.
4	Target Pressure Setup	st Group	To set up target pressure of pump system.
5	Motor Rotation Direction Selection	dr-20	To make rotation direction of motor same as pump operation direction
6	Operation		Press  key, then pump operates with target pressure.

### 5.2.4 Target Pressure Setup

- If you don't know about correct pressure setting, contact the specialist.
  - If you press **PRE SET** key for more than 3 seconds on a mode displaying S of St group, it changes to pressure setting screen. And push key **▲** or **▼** key to change the value to desired setting and press **PRE SET** key, then the pressure setting is changed with **-End-** screen.  
(If you press **RUN STOP** key without pressing **PRE SET** key after changing the setting, the setting will not be changed and the screen will exit from pressure setting change mode.)
- ※ If the pressure setting is changed, the high pressure alarm ( 'Pr-70' ) setting will be automatically set to the value of 2 bar higher than the pressure setting value.

### 5.2.5 Checkup on Rotation Direction of Pump

- It would be correct if the rotation direction is counter clockwise from a viewpoint of fan cover of the pump. (If the rotation direction is reversed, it cannot generate the normal pressure.)
- In order to 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. Function Table and Description

### 6.1 Display of present status

DISPLAY	Name	Explanation on the function	Remark (unit)
P	Present pressure	It shows measured present pressure	bar
S	Setting pressure	It shows setting pressure and operator can input pressure value.	bar
H	Output Hz	It shows present drive output frequency in HZ	Hz
A	Current	It shows present output current	A

## 6.2 Pump Control Group

DISPLAY	Name	Range	Factory Setting	Change on Operation	Ref. Page
Pr-00	Jump Code	1~92	1	O	32
Pr-01	Pump Capacity	0,40~2,20[kW]	1,10	X	
Pr-03	Capacity Setup of Sensor	1,0~25,0[bar]	16,0	X	
Pr-04	Correction Value of Sensor	-1,0~1,0[bar]	0,0	O	33
Pr-07	P Gain of PID Controller	0~100[%]	10	O	
Pr-08	I Gain of PID Controller	0~100[sec]	1	O	
Pr-09	D Gain of PID Controller	0~100[ms]	0	O	
Pr-10	Control Cycle of PID Controller	10~200[ms]	200	X	34
Pr-11	Selection of Anti-freeze	0~1	0	O	
Pr-12	Starting pressure Deviation	0~2,0[bar]	0,3	O	35
Pr-13	Low water detection time	0~200[sec]	30	O	
Pr-14	Ratio of Min Output Freq. of low water detection	0~100[%]	100	O	
Pr-15	Ratio of Initial Output on Starting	5~100[%]	50	X	36
Pr-70	High Pressure Alarm Level	0,0~Sen1용량[bar]	5,0	O	
Pr-71	Low Pressure Alarm Level	0,0~10,0[bar]	0,5	O	37
Pr-72	High Pressure Alarm Time	0~100[sec]	10	O	
Pr-73	Low Pressure Alarm Time	0~400[sec]	200	O	
Pr-74	Low Level Trip Time of Pressure Sensor	0~250[sec]	20	O	
Pr-75	Low Level Trip Pressure Level	0,0~1,0[bar]	0,5	O	37
Pr-80	Fault History				
Pr-81	Fault History 1				

DISPLAY	Name	Range	Factory Setting	Change on Operation	Ref. Page
Pr-82	Fault History 2				37
Pr-83	Fault History 3				
Pr-84	Fault History 4				
Pr-85	Fault History 5				
Pr-86	Fault History Delete	0~1	0	0	
Pr-90	Initialization Code	0~1	0	X	38
Pr-92	S/W Version	X,XX			

## 6.3 Drive Control Group

DISPLAY	Name	Range	Factory Setting	Change on Operation	Ref. Page
dr-00	Jump Code	1~99	1	O	39
dr-02	Target Freq. Input Method Setup	0~1	0	X	
dr-03	Target Freq. Value Setup	Min Freq. (dr-42)~ Max Freq.	30,0	O	
dr-10	Motor Capacity Selection	0,40~2,20[kW]	1,1	X	
dr-11	No. of Motor Poles Selection	1~2	1	X	40
dr-12	Rated Current of Motor	1,5~15,0[Arms]	4,4	X	
dr-13	Rated Rotations of Motor	1000~9999[rpm]	3248	X	
dr-14	Rated Voltage of Motor	50,0~250,0[Vrms]	220	X	
dr-15	Non-load Current of Motor	1,0~5,0[Arms]	2,0	X	41
dr-16	Rated Slip Frequency of Motor	1,00~10,00[Hz]	1,50	X	
dr-17	Rated Frequency of Motor	0~1	1	X	
dr-20	Rotation Direction Selection of Motor	0~1	1	X	
dr-21	Method of Stopping Motor	0~1	0	X	42
dr-22	Increase Time	1,0~600,0	3,0	O	
dr-23	Decrease Time	1,0~600,0	6,0	O	
dr-30	Motor Overload Trip Selection	0~1	0	O	
dr-31	Motor Overload Trip Level	100~200[%]	120	O	43
dr-32	Motor Overload Trip Time	5~200[sec]	60	O	
dr-35	Motor Overheat Selection	0~1	0	O	
dr-36	Ground Detection	0~1	0	O	44
dr-37	No. of Restart Trial after Trip	0~50	3	O	





DISPLAY	Name	Range	Factory Setting	Change on Operation	Ref. Page
dr-38	Waiting Time of Automatic Restart after Trip	1~250[sec]	10	O	44
dr-41	Torque Boost Amount	0~10,0[%]	2,0	X	
dr-42	Start Frequency.	0,10~40,00[Hz]	0,50	X	45
dr-43	Max Operation Freq.	40,0~Rated Freq. of Motor [Hz]	60,00	X	
dr-44	Switching Frequency.	2,0~15,0[kHz]	5,0	O	
dr-51	Power Consumption Correction	0~1000[%]	100	O	
dr-52	Output Power Indication	0,0~999,9[W]			
dr-53	Indicating Accumulated Mega Wh	0~9999[MWh]			46
dr-54	Indicating Accumulated Killo Wh	0,0~999,9[kWh]			
dr-55	DC link voltage	0~9999[V]			
dr-56	Cooling Fan Temp. Display	0~200[°C]			
dr-57	Output Power Display	0,0~500,0[V]			
dr-87	Password change	0~9999			
dr-89	Initializing accumulated power	0~1	9	O	
dr-90	Initialization Code	0~1	0	X	47

## 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.

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

#### Pr-03 Sensor Capacity

- 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 actual 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 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-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 Protection Function

- It sets up freezing protection function.
- 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 being destroyed with freezing by generating frictional heat upon rotation within pump rather than preventing freezing of piping.

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

## Pr-12 Start Pressure 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 Low water detecting time

- 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.

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

## Pr-14 Minimum Output Frequency Ratio for Detecting Low Water Level

- 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
100[%]	0 ~ 100[%]

## Pr-15 Initial Output Ration on Starting

- It refers to the minimum output ratio on starting of the drive. That is if it is set to 50% when the maximum operation frequency is 60 Hz, it can start from 30 Hz.

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

## 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
5.0[bar]	0.0~sensor range (pr-03 [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 Trip Time

## 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	
0	Release High Pressure Alarm function	
1 ~ 100[sec]	High Pressure Alarm time set up(factory setting: 10[sec])	
	Related function	Pr-70 High Pressure Alarm Level

## 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	
0	Release Low Pressure Alarm time	
1 ~ 400[sec]	Low Pressure Alarm time set up(factory setting: 200[sec])	
	Related function	Pr-71 Low pressure alarm level

## Pr-74 Low Level 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-75) and maintains its state for a specified time, an alarm is displayed and operation stops.




Factory Setting	Description	
0	Release Low Level Alarm Function	
1 ~ 250[sec]	Low Level Alarm Time Setup (factory setting: 20[sec])	
	Related function	Pr-75 Low water level alarm pressure level

## Pr-75 Low Level Alarm Pressure Level

- It is a pressure level to determine low water level

Factory Setting	Input Range	Related Function
0,5[bar]	0,0 ~ 1,0[bar]	Pr-74 Low Pressure Trip Time

## 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.

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	No. of Errors occurred
Stdy,StOP,AdOFS,wDOG	Operation status with Error

## Pr-86 Deletion of Fault History

- It deletes all of contents for fault history.

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

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.



## 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-02 Target Freq. 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

## dr-03 Target Freq. Value Setup

- When using as a fixed frequency, it is possible to set up target frequency value. Target Freq. 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]

## 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.

Factory Setting	Input Range
1,1	0,40 ~ 2,20[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(Factory set)
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
4,4	1,5 ~ 15,0[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
3248	1000 ~ 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
220	50,0 ~ 250,0[Vrms]

dr-15 Non-load Current of Motor

- It sets non-load current of motor.

Factory Setting	Input Range
2.0	1.0 ~ 5.0[Arms]

dr-16 Rated Slip Freq. of Motor

- It displays slip freq. of motor.

Factory Setting	Input Range	Related Function
1.50	0.10 ~ 10.00[Hz]	dr-11 No. of motor poles dr-11 Rated No. of Rotations of Motor dr-11 Rated Frequency of Motor

dr-17 Rated Freq. of Motor

- It sets rated frequency of motor.

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

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	Forward Direction - CW(Clockwise)
1(Factory Setting)	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]

## 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(Factory Setting)	Release	
1	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]

## 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

## 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 Auto Restart Waiting Time after Trip

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

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

## 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[%]

## 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]	2,0 ~ 15,0[kHz]

## dr-51 Power Consumption Correction

- It corrects a consumed power upon operation of drive.

Factory Setting	Input Range
100[%]	0 ~ 1000[%]

## dr-52 Indication of Power Consumption

- It displays a consumed power upon operation of drive.

Range	0 ~ 9999[W]
-------	-------------

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[MWh] unit
dr-54	To display in Kilo Wh[KWh] unit

dr-55 DC Link voltage display

- Input voltage  $\times \sqrt{2}$ =DC Link [V]

Range	0 ~ 9999[V]
-------	-------------

dr-56 Hear Sink Temperature Display

- It displays ambient temperature of the drive.

Range	0 ~ 200[°C]
-------	-------------

dr-57 Output Voltage Display

- It display effective output voltage of the drive.

Range	0,0 ~ 500,0[V]
-------	----------------

dr-87 Password Change

- It changes installer password.

Factory Setting	Input Range
9	0 ~ 9999

dr-89 Accumulated Power [W(watt)]Initialization Code

- It initializes accumulated [W].

Factory Setting	Input Range
0(Factory Setting)	Maintain the record
1	dr-53, dr-54 Accumulated Power Initialization



dr-90 Initialization Code

- It initializes the factory settings.

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

※ Not applied to these parameters.

dr-53 (accumulated power - MWh), dr-54(accumulated power - KWh),

dr-88(Pump capacity setup)

## 7.1 Fault History Table

FND Display	Content	Description	Restarting	Reference Page
Er-01	tSF	Pressure Sensor Error	O	49
Er-02	tOP	High Pressure Alarm	O	
Er-03	tLP	Low Pressure Alarm	O	
Er-04	tUL	Low Level Alarm	O	50
Er-05	tASH	Drive Arm Short Trip	X	51
Er-06	tOC	Drive H/W Over Current Trip	O	
Er-07	SOC	Drive H/W Over Current Restriction Trip	O	52
Er-08	tMOH	Motor Overheat (TMOH)	O	
Er-09	tOH	Drive Overheat Trip	O	53
Er-10	tLv	DC-Link Low Voltage Trip	O	
Er-11	tOv	DC-Link High Voltage Trip	O	
Er-12	tOL	Overload Operation Trip	O	54
Er-13	tdOL	Drive Overload Operation Trip	O	
Er-14	tGF	Ground Trip	X	

## 7.2 Reset of fault and alarm

- In case of fault or alarm, FND shows Error number and content alternately.
- To cancel alarm, push **RUN STOP** button or gently push **PRE. SET** button twice and this will reset the driver.

In case the alarm is Er-01 or Er-02, when the failure is resolved the driver will cancel alarm and restart automatically.

In case of reset without resolving the failure, the driver alarms again.

### 7.3 Cause of Fault and Reaction

Er-01(Pressure Sensor Error-tSF)

Cause

- Sensor Error
- Drive Error
- Sensor Terminal Wiring disconnection

Reaction

- Replace sensor.
- Replace drive.

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.)

Reaction

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

Related Function	Function Name	Ref. Page
Pr-70	High Pressure Alarm Level	35
Pr-72	High Pressure Alarm Time	36

Er-03(Low Pressure Alarm-tLP)

Cause

- It is an alarm 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 storage) is filled with water.
- Check if the air enters into the pump.
- Check if there is any water by opening air discharge cock.
- After releasing error by pressing **PRE SET** key, press **RUN STOP** key to start the pump.

Related Function	Function Name	Ref. Page
Pr-71	Low Pressure Alarm Level	36
Pr-73	Low Pressure Alarm Time	36
dr-37	No. of Automatic Restart after Trip	44
dr-38	Waiting Time for Automatic Restart after Trip	44

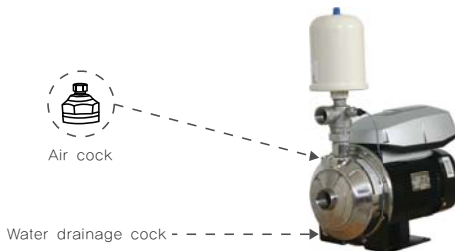
## Er-04(Low Level Alarm-tUL )

## 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 level sensor (electrode) does not detect the water. In case of not using the low 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 level sensor (electrode), when there is water, the alarm will be automatically released and the drive will be automatically operate

## Reaction

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



Related Function	Function Name	Ref. Page
Pr-74	Low Level Trip Time	36
Pr-75	Low Level Trip Level	37

Er-05(Arm Short Trip-IASH)

Cause

- In case acceleration/deceleration time is excessively short comparing to 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.

Related Function	Function Name	Ref. Page
dr-22	Rising Time	42

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

Cause

- In case acceleration/deceleration time is excessively short comparing to load inertia
- When 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 motor capacity.
- Start the pump after the motor stopped.
- Check load, motor, and output wiring.
- If the same alarm occurs, please contact A/S center.

Related Function	Function Name	Ref. Page
dr-21	Motor Stopping Method	42
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 A/S center.

Related Function	Function Name	Ref. Page
dr-10	Motor Capacity	39
dr-21	Motor Stopping Method	42
dr-22	Rising Time	
dr-23	Falling Time	
dr-41	Torque Boost Amount	44

## 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	39
dr-35	Motor Overheat Selection	43

## Er-09(Overheat Trip-tOH)

## Cause

- It generates an alarm and stops operation to prevent IGBT from being damaged due to foreign materials and high ambient temperature.

## Reaction

- Check if there is foreign materials.
- Check the ambient temperature and maintain it under 40°C if it is too high.

## Er-10(Low Voltage Trip-tLv)

## Cause

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

## Reaction

- Check the drive input voltage.
- Check the power capacity.
- \* 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	42

## 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

- 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.

Related Function	Function Name	Ref. Page
dr-10	Motor Capacity	39
dr-12	Rated Current of Motor	40
dr-30	Motor Overload Trip Selection	42
dr-31	Motor Overload Trip Level	43
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.









SQ-I-1106

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