

# **OPC-1000/OPC-1001**

User Manual for **Smart Pump Controller**





## Preface

- Thank you for choosing our OPC-1000/OPC-1001 Smart Pump Controller. This product is specially developed for pump and will provide optimized control performances and functions for operation. This product was manufactured so that users can easily operate booster pump systems. Be sure to read this Manual carefully for convenient and safe use of this product.



※ Functions and specifications can be changed without notice for improvements.

## Maintenance Precautions

- Use air to remove any foreign matters on the product such as dust.
- All loosened and rusted bolts and nuts must be fastened or replaced accordingly.
- Only designated personnel shall be allowed to perform maintenance and inspection of this product as lack of experience involves risk of electric shock.

## Safety Precautions

- Safety precautions are intended to ensure safe and proper use of this product through the prevention of accidents and dangers. Make sure to follow them.
- This Manual uses two types of safety labels, 'Warning' and 'Caution'.
- Use the drive after reading this Manual completely to ensure safe use.
- Always keep this User Manual available to users.

 <p>Warning</p>	<p>Warning :</p> <p>This symbol indicates a potential danger with the possibility of breakdown, serious injury or death.</p>
 <p>Caution</p>	<p>Caution :</p> <p>This symbol indicates a potential danger with the possibility of damage to product or property.</p>



## Safety Instructions



Warning

Do not open the cover of the controller while power is applied or the product is in operation.

(The exposed high voltage terminal can cause electric shock.)

Even if power is not applied, do not open the cover of the controller except for inspection and wiring.

(Voltage charged in the DC charging part may lead to electric shock.)

Wiring and inspection should be performed at least 10 minutes after disconnecting input power and checking with a voltage meter that DC voltage of the controller has been discharged.

(There is risk of electric shock.)

Do not operate switches using wet hands.

(There is risk of electric shock.)

Do not apply power or operate the product if input or output power cable of the controller is damaged.

(There is risk of electric shock.)

Do not put a heavy object on top of input and output power cables or signal cable.

(Damaging of cables may lead to electric shock.)



Caution

Do not install the controller nearby flammable substances.

(Installing the controller on a flammable material or next to a flammable substance can cause fire.)

In case of breakdown, disconnect input power.

(Failure to disconnect input power can lead to a secondary accident, such as fire.)

After applying or disconnecting power, do not touch the controller for a few minutes.

(There is risk of electric shock.)

After completion of installation, do not apply power to the controller if its parts are damaged.

(There is risk of electric shock.)

Do not allow substances like screw, metal, water and oil enter into the controller.

(They can cause fire.)



## Cautions for Use

### A. Transportation and Installation

- Be sure to carry the product in a proper way suitable for its weight.
- Do not pile up the product above its regulated limit.
- Install the product as described in this Manual.
- Do not open the cover during transportation.
- Do not put a heavy object on the product.
- Make sure to install the product in the direction indicated on this Manual.
- Since the controller is a sensitive device, do not drop it or apply strong shock.
- Completely remove water from the pump if not being used for long time during winter.
- Use under the following environmental conditions.

Location	Free of corrosive gas, inflammable gas, oil sludge, dust, etc.
Temperature / Humidity	-10~40°C / 90% RH or below (no dew formation)
Storage Temperature	-20~65°C
Elevation / Vibration	Altitude of 1,000m or below / 5.9m/sec <sup>2</sup> (=0.6g) or below
Ambient Pressure	70~106 kpa

### B. Wiring

- Perform wiring after installing the controller body.
- Make sure that wiring and inspection are performed by a professional engineer.
- Improper connection of terminals can cause damaging of the controller.
- Use a breaker for wiring.

### C. Confirmation Before Starting Trial Operation

- Check setting parameters of the controller before first operation. It may be necessary to adjust parameters depending on the pump type and system environment.
- Make sure to follow the designated connection method and regulated power specifications in this Manual for the main power circuit and control circuit terminal block. Improper use may cause damaging of the controller.
- Only use the pressure sensor and low water level sensor designated by our company.



### D. Operation

- The controller has automatic restart and restoration after power failure as default settings. When the controller is stopped because of breakdown/system alarm or power is disconnected during operation, be careful during power input as the controller will be restarted automatically.
- Do not remodel or modify interior of the product.
- Do not start or stop the controller using the magnetic contactor installed on the input power side.
- In case of parameter initialization, reset necessary parameters prior to operation. Initialization of parameters returns parameters to the factory setting.

### E. Reaction on Failure and Malfunction

- If the controller is damaged and falls under uncontrollable situation, performance of the pump system may not be reliable. To avoid this situation, be sure to install additional systems.
- Refer to Chapter 7 for troubleshooting of the controller.

### F. Maintenance

- Do not perform megger test (insulation resistance) on the control circuit of the controller.

### G. Disposal

- Dispose of this product as a general industrial waste.

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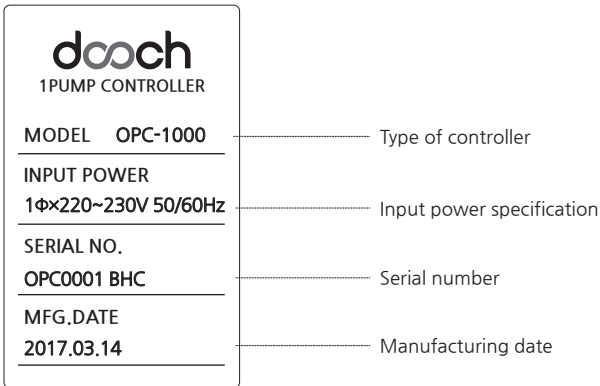




### 1. Prior to Use

#### 1.1 Confirmation of Product Specifications

- Take the controller out of the product packaging box and check the nameplate on the side to make sure that the type and rated output of the controller are identical to the ordered product. Also check whether the controller has been damaged during delivery.
- If you have any questions or problems related to the controller, please contact the seller or our A/S center.
- Nameplate of the Product



#### 1.2 Installation

- Make sure to install the controller properly in the specified environment, considering the expected life span and performance of the controller.

#### 1.3 Wiring

- Connect power to the power terminal block and connect operation and control signals to the control terminal block. They must be connected according to the described method because incorrect connection can cause malfunctioning or damaging of the controller.



### 2. Product Specifications

#### 2.1 Product Specifications

MODEL	OPC-1000	OPC-1001
Input Power	1 $\Phi$ AC 200~240V / 50~60Hz	
Display Spec	3xLED	3.5-inch TFT True Color (320 x 240)
Communication Port	RS485 Communication MODBUS-RTU CAN Communication (Internal)	
Multi-function Input and Output	Run/stop, reset, emergency stop, pressure sensor input (2EA), water sensor, multi-function digital input (3EA), multi-function analog input (2EA), run/stop fault relay output, multi-function analog output (2EA)	
Control Signal	Run/stop, reset, emergency stop, frequency command analog output, analog signal input, run/stop, fault relay signal	

#### 2.2 Product Features

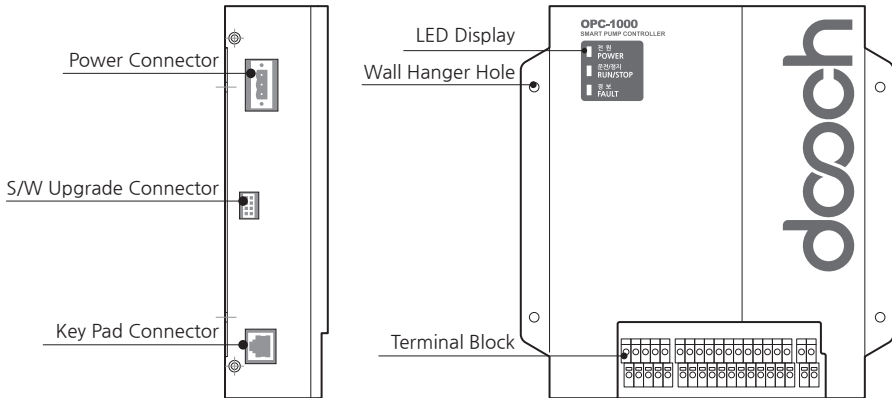
- Can control constant pressure and differential pressure
  - Can connect 2 pressure sensors
- Can control the pump using a general-purpose inverter
  - No capacity limitations
- Can connect and control up to 6 units
  - Maximized system stability
- Internalized with pump protective functions
  - Breakdown of high voltage, low voltage, water and pressure sensors
- Operation display of pump / drive (OPC-1001)
- Setting of control parameters using an exclusive key pad (optional for OPC-1000)



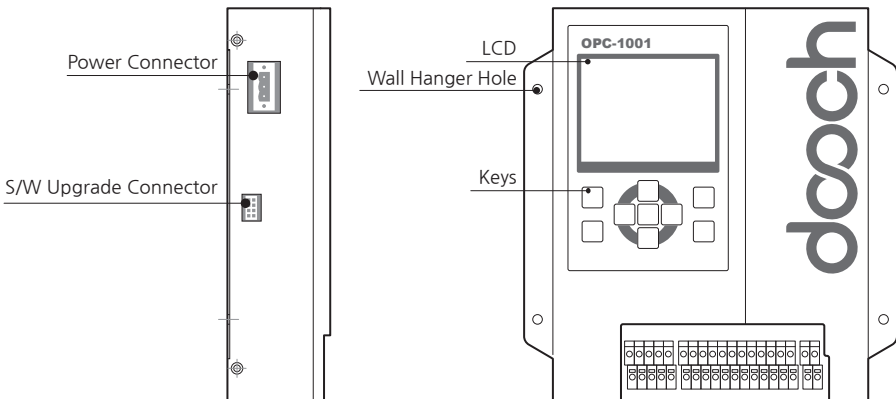
### 3. External Dimension

#### 3.1 Name of Each Part

##### 3.1.1 OPC-1000

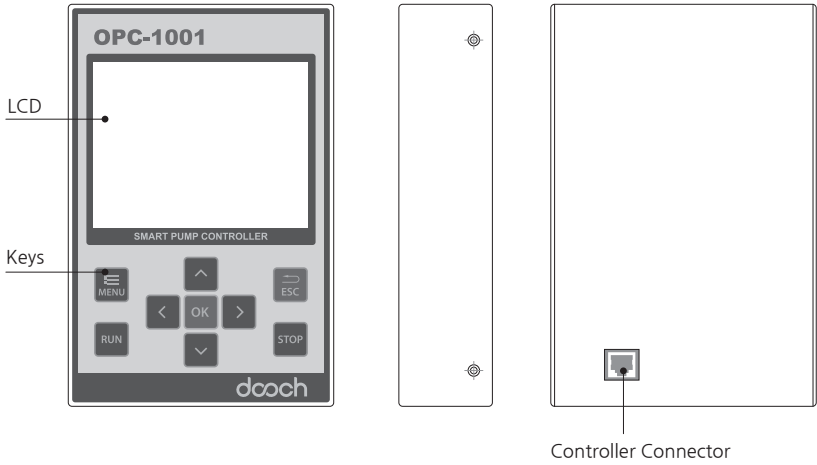


##### 3.1.2 OPC-1001





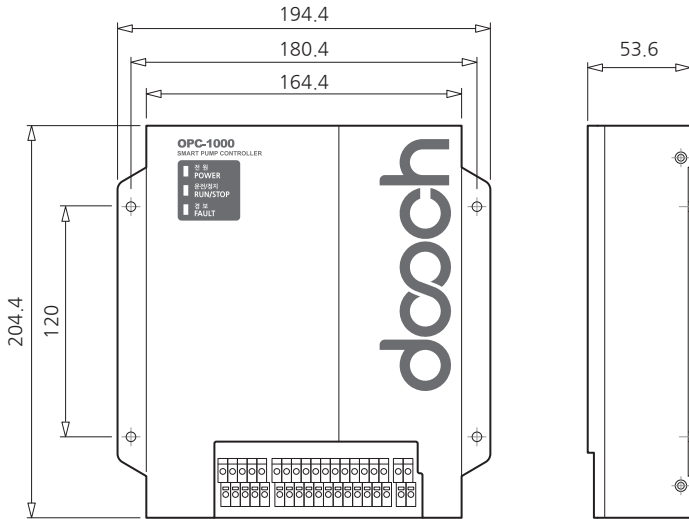
### 3.1.3 Key Pad





## 3.2 External Dimensions

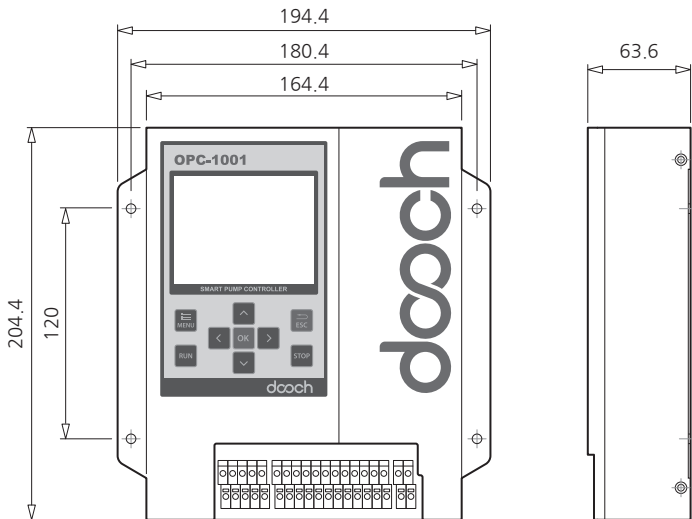
### 3.2.1 OPC-1000



(Unit : mm)



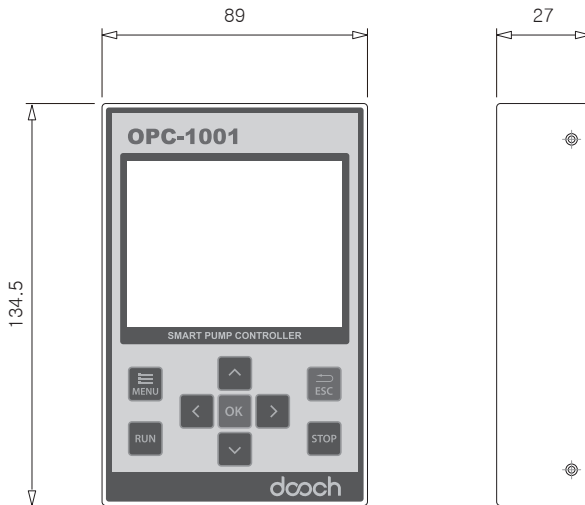
3.2.2 OPC-1001



(Unit : mm)



### 3.2.3 Key Pad for OPC-1000



(Unit : mm)

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### 4. Installation

#### 4.1 Precautions for Installation

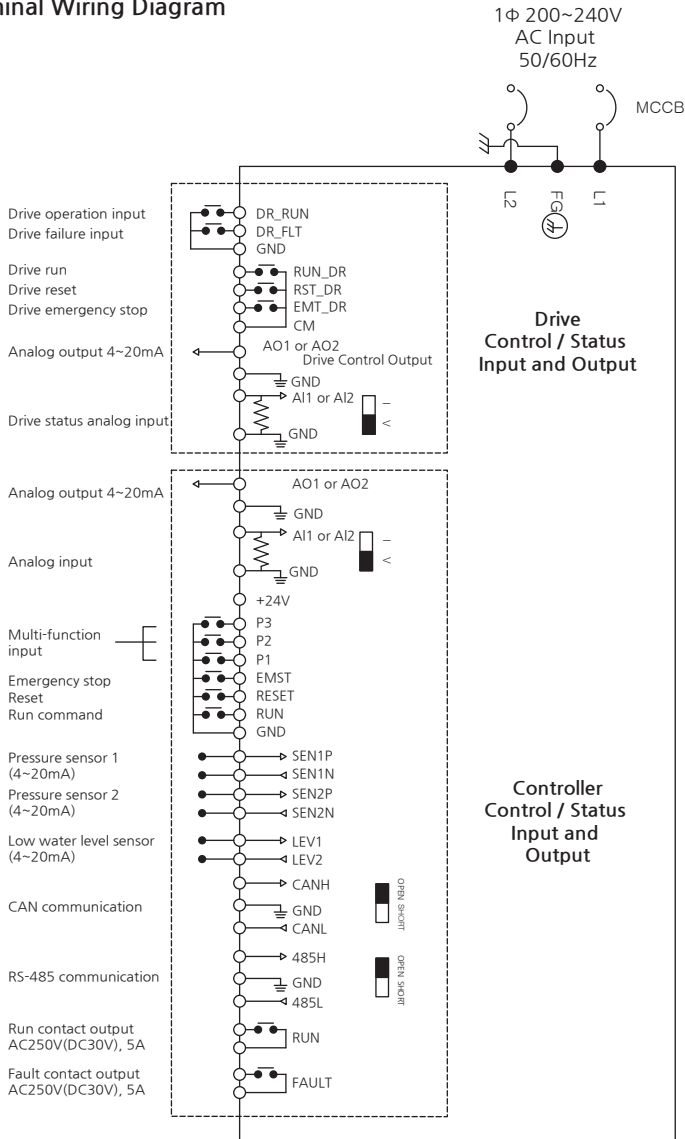
- Be careful when handling the controller.  
As the controller is comprised of sensitive electrical and electronic parts, be careful so they are not damaged during installation or transportation.
- Be cautious when installing in a place with vibration.  
When installing the controller in such a place, take measures to reduce vibration.
- Precautions for surrounding temperature  
Since the life span and performance of the controller are greatly affected by surrounding temperature, make sure that surrounding temperature of the installation environment does not exceed permitted temperature (-10°C~40°C). If it does, install a cooling fan.
- Install on a flame-resistant / non-flammable material.  
Install the controller on a flame-resistant / non-flammable surface.
- Secure enough space during installation.  
Install the controller with enough space nearby to ensure effective cooling.
- Properly erect the controller.  
Use screws or bolts to make sure that the controller erects straight and does not shake.





## Chapter 4. Installation

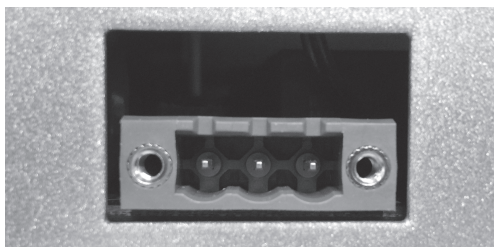
### 4.2 Terminal Wiring Diagram





### 4.3 Wiring of Main Power Circuit

#### 4.3.1 Description of Main Power Supply Terminals



L1	FG	L2
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Terminal Sign	Terminal Name	Terminal Description
L1, L2	AC Input	They are used to connect commercial AC input.
FG	Ground	It is a ground terminal on drive enclosure. Ground it.

#### 4.3.2 Precautions for Main Power Wiring

- Be sure to install a wiring breaker (MCCB) between AC input power and controller power terminals (L1, L2).

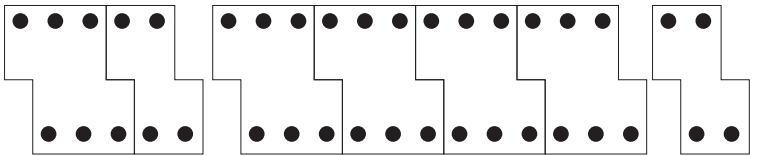
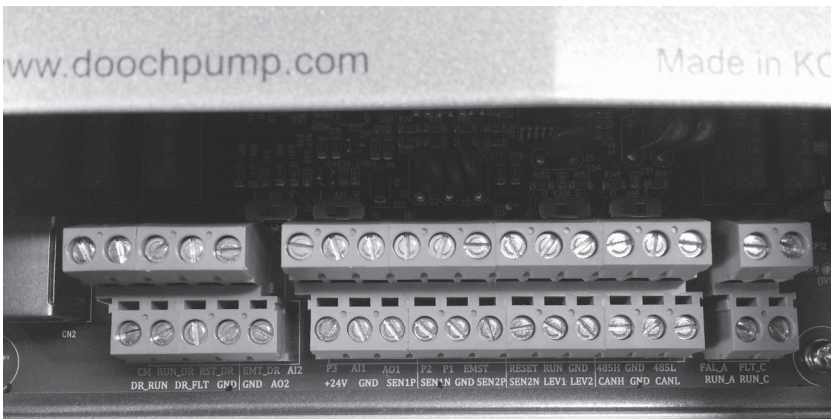
#### 4.3.3 Precautions for Ground Wiring

- Maintain ground resistance at or below 100Ω.



## 4.4 Control Circuit Wiring

### 4.4.1 Arrangement of Control Terminal Block



CM	RUN_DR	RST_DR	EMT_DR	AI2	P3	AI1	AO1	P2	P1	EMST	RESET	RUN	GND	485H	GND	485L	FLT_A	FLT_C
DR_RUN	DR_FLT	GND	GND	AO2	+24V	GND	SEN1P	SEN1N	GND	SEN2P	SEN2N	LEV1	LEV2	CANH	GND	CANL	RUN_A	RUN_C



## 4.4.2 Functions of Control Terminal Block

Classification		Terminal Sign	Terminal Name	Terminal Description	
Controller Control / Status Input and Output	Pump Control	SEN1P, SEN1N	Pressure Sensor 1	Connection terminal for Pressure Sensor 1	
		SEN2P, SEN2N	Pressure Sensor 2	Connection terminal for Pressure Sensor 2 (used to control differential pressure)	
		LEV1, LEV2	Low Water Level Sensor	Connection terminal for low water level sensor	
	Contact Operation	RUN	Run Command	Run / stop terminal	
		RESET	Reset	Resets trip and drive when trip occurs	
		EMST	Emergency Stop	Sends emergency stop signal to drive when EST is ON	
		P1, P2, P3	Input Terminal	Multi-function input terminal	
		+24V	24V External Output	24V output terminal	
		GND	Common Terminal	Common terminal for contact input terminal	
	Analog Input	AI1 or AI2	Analog Input	Set to DC 0~10V or 4~20mA	
		GND	Common Terminal	Common terminal for contact input terminal	
	Output Signal	Analog Output	AO1 or AO2	Analog Output	DC 4~20mA output
		Relay Output Contact	RUN (RUN_A, RUN_C)	Run Signal Output	Sends signal when the controller is run (AC 250V 5A or below, DC 30V 5A or below)
			FAULT (FLT_A, FLT_C)	Fault Signal Output	Shuts off output when system or drive breakdown occurs (AC 250V 5A or below, DC 30V 5A or below)
	Communication Signal	CAN	CANH, CANL	CAN Signal	CAN signal line terminal
			GND	CAN Common Terminal	Common terminal for CAN power ground
RS485		485L, 485H	RS485 Signal	RS485 signal line terminal	
		GND	RS485 Common Terminal	Common terminal for RS485 power ground	
Drive Control / Status Input and Output	Drive Status Input	DR_RUN	Drive Run Status Input	Input terminal for drive run/stop status	
		DR_FLT	Drive Fault Status Input	Input terminal for drive fault status	
		GND	Common Terminal	Common terminal for status input	
	Analog Input	AI1 or AI2	Analog Input	Set to DC 0~10V or 4~20mA	
		GND	Common Terminal	Common terminal for input terminal	
	Output Command Contact	Analog Output	AO1 or AO2	Analog Output	DC 4~20mA output ※ AO2 output frequency (drive frequency command)
		RUN_DR	Drive Run Command Output	Sends out drive run command signal	
		RST_DR	Drive Reset Signal Output	Sends out drive reset command signal	
EMT_DR		Drive Emergency Stop Signal Output	Sends out drive emergency stop signal		
CM	Common Terminal	Common terminal for drive command signal			



### 4.4.3 Precautions for Control Circuit Wiring

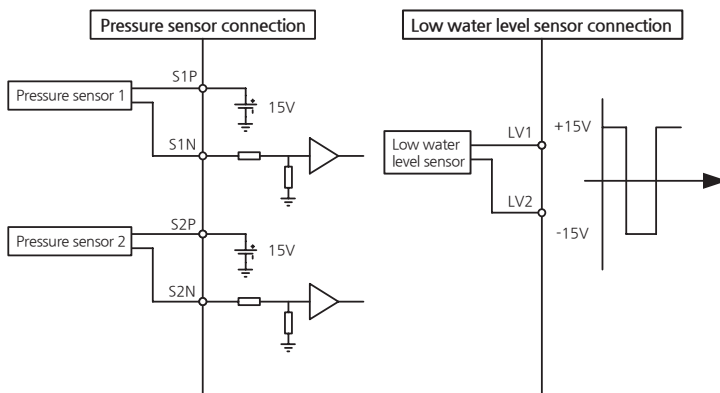
- Maintain wiring distance between the pressure sensor, low water level sensor and controller within 10m.
- In case of remote control using analog signals, maintain distance between the remote-control panel and controller within 50m.
- Keep sensors and analog signal lines away from power lines.
- Use shielded twisted wires for signal lines of the control circuit.

### 4.4.4 Connection of Pressure Sensor and Low Water Level Sensor

- Please only use pressure sensor and low water level sensor specified by DOOCH.
- General specifications of pressure sensor and low water level sensor specified by DOOCH are as below.

Category	Pressure Sensor	Low Water Level Sensor
Excited voltage	DC 15V	DC $\pm 15V$ pulse
Sensor output	4~20mA	Connection

- Since terminals on the pressure sensor have polarity, be careful about polarity during installation.
- ※ To use an unspecified pressure sensor or low water level sensor, please contact us beforehand.





### 4.4.5 Communication Line Wiring

- This product supports CAN communication used for linked pump drive control and RS484 for external communication.

When using CAN communication, connect CANH (CAN High), CANL (CAN Low) and shield wire to GND. Use shielded and twisted wires for wiring.

When using a termination resistor for connection of multiple CAN, change the switch from OPEN to SHORT.

When using RS485 communication, connect 485H and 485L of the terminal block and shield wire to GND.

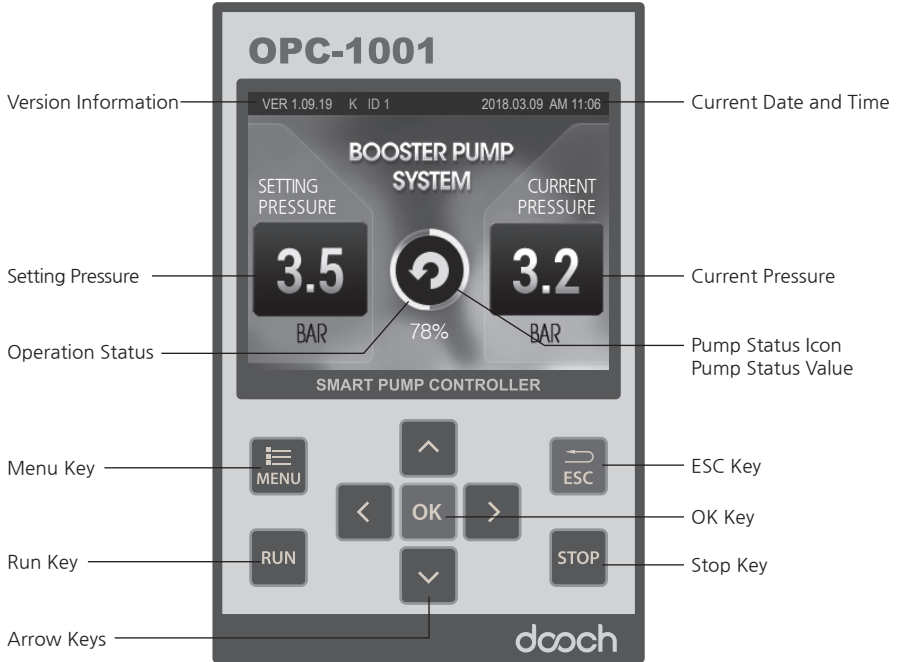
Use shielded and twisted wires for wiring.

When using a termination resistor for connection of multiple RS485s, change the switch from OPEN to SHORT.



## 5.1 Keypad

### 5.1.1 Appearance and Description of Keypad



### 5.1.2 Pump Status Icon

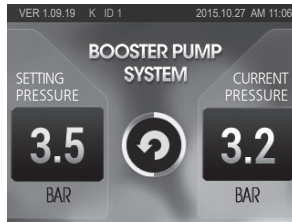
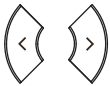
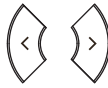
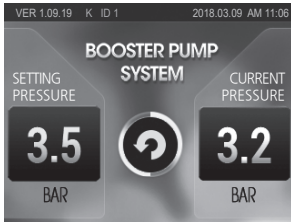
Press up and down arrow keys on the main screen to view current status of the pump sequentially.

ICON	Description	ICON	Description
	Operation ratio display unit : %		Output current display unit : A
	Input pressure display unit : bar		Discharge pressure display unit : bar



### 5.1.3 Integrated Pump Status Information Screen

Press left and right arrow keys on the main screen to view the integrated pump status screen sequentially.







### 5.2 Function Setup

#### 5.2.1 Basic Function Setup

- This is a basic parameter set-up in order to operate the controller. For the parameters those are not set by user, they will be applied with factory setting value.

#### 1) Common Setup

The parameters to be checked and set-up regardless its control type.

Setup Item	Parameter Code	Description on Function
Input Location of Run Command	Drive 1	To select the method of issuing run command (keypad, terminal block, Comm.)
Frequency Setting Method	Drive 2	Frequency input method for manual operation (keypad, AI1 input, comm.)
Rated Frequency of Motor	Drive 16	To set up rated frequency of motor
Acceleration Time	Drive 19	To set up acceleration time of drive
Deceleration Time	Drive 20	To set up deceleration time of drive

#### 2) Pump Control Function Setup of PID

These parameters are set for the pump system when controlling the pump using the controller.

Setup Item	Parameter Code	Description on Function
Pump Control Method	Pump 1	To set up pump control method (manual, constant pressure, differential pressure)
Pump Operation Method	Pump 2	To set up pump operation method (sequential, partial)
Sensor Capacity and Correction Value	Pump 11~16	To set up capacity of the pressure sensor and correct variation between actual pressure and the pressure sensor (sensor 2 not used during constant pressure control)
Low Water Level Detection	Pump 54	To set up low water level detection method (low water level sensor, discharge pressure, input pressure)

#### 3) CAN Communication Function Setup

These parameters are set for CAN communication used for interoperation or LCD monitor connection.

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

### 5.2.2 Extended Function Setup

- Here are additional parameters for optimal operation of the pump system. Any parameters not set by the user are set to default factory values.

#### 1) Pump Control Parameters for PID

Setup Item	Parameter Code	Description on Function
PID Controller Gain Setup	Pump 21~23	To set up gain to adjust response characteristics of PID controller
Control Cycle of PID Controller	Pump 24	To set up control cycle of PID controller
Run/Stop Pressure Difference	Pump 32	Minimum pressure difference to run the drive
Initial Output Ratio on Running	Pump 31	To set up initial output frequency of PID controller for faster response during initial running
Alternate Operation	Pump 35~36	To operate pump alternately during multi operation

#### 2) Parameters for Pump System Protection

Setup Item	Parameter Code	Description on Function
High Pressure Alarm	Pump 50 Pump 51	To set up high pressure alarm level and time for protection of discharge pipe from high pressure
Low Pressure Alarm	Pump 52 Pump 53	To set up low pressure alarm level and time for protection of pump from damaging
Low Water Level Alarm	Pump 54~59	This is a function that protects pump by detecting water in suction pipe. There are two detection methods, one using low water level sensor and the other using software program

#### 3) Parameters for Fault History Storage

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

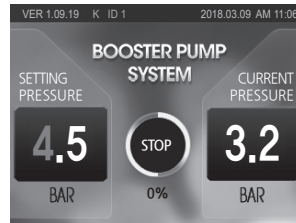
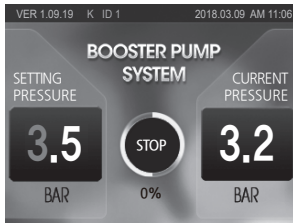


### 5.3 Basic Operation

#### 5.3.1 Changing Pressure Setting

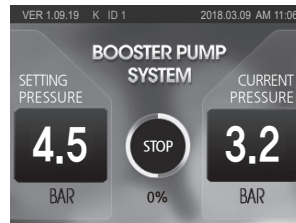
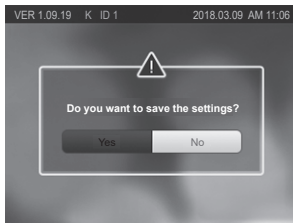
EX) To change pressure from 3.5bar→4.5bar


Press and hold  for 2 seconds on the main screen to enter the pressure setting mode.



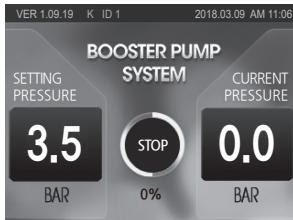
Press left and right arrow keys to select the number of digits to be changed.

Then press up and down arrow keys to choose the desired value.

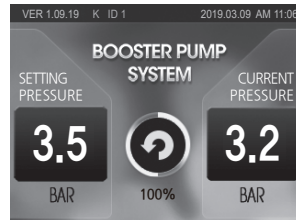


 key is pressed to pop a message asking to change the setting. Press the “Yes” key to save the setting.

#### 5.3.2 Run / Stop



Press the RUN key when the system is at a stop to start running.



Press the STOP key when the system is in operation to stop running.



## 6.1 Pump Control Group

CODE	LCD Display	Factory Setting	Range	Unit	Changeable During Operation	Description
1	Pump Ctrl. Mode	1	0~2	-	×	0: Manual, 1: Constant pressure, 2: Differential pressure
2	Pump Op. Mode	0	0~1	-	×	0: Sequential, 1: Partial
3	Pressure Set Mode	0	0~2	-	×	0: Keypad, 1: AI2 signal, 2: Communication input
4	Pressure Setting	3.00	0.00~25.00	bar	○	Setting pressure display and setup
5	Current Pressure	-	0.00~25.00	bar	-	Display of current pressure
6	Discharge Pressure	-	0.00~25.00	bar	-	Display of discharge pressure in differential pressure mode
7	Input Pressure	-	0.00~25.00	bar	-	Display of input pressure in differential pressure mode
11	Sensor 1 (Discharge) Cap.	16.00	1.00~25.00	bar	×	Maximum capacity setting of sensor 1 (discharge)
12	Sensor 1 (Discharge) Gain	100	50~200	%	○	Gain setting of sensor 1 (discharge)
13	Sensor 1 (Discharge) Offset	0.00	-2.00~2.00	bar	○	Offset setting of sensor 1 (discharge)
14	Sensor 2 (Input) Cap.	16.00	1.00~25.00	bar	×	Maximum capacity setting of sensor 2 (input)
15	Sensor 2 (Input) Gain	100	50~200	%	○	Gain setting of sensor 2 (input)
16	Sensor 2 (Input) Offset	0.00	-2.00~2.00	bar	○	Offset setting of sensor 2 (input)
21	PID P Gain	10	0~100	%	○	0~100% (1%)
22	PID I Gain	1.0	0.0~100.0	sec	○	0.0~100sec (0.1sec)
23	PID D Gain	0	0~100	ms	○	0~100ms (1ms)
24	PID Control Cycle	0.2	0.1~0.5	sec	×	0.1~0.5sec (0.1sec)
30	Drive Stop Ratio	30	0~60	%	○	Drive stop ratio
31	Start Initial %	50	5~100	%	×	5~100% (1%)
32	ON/OFF Band	0.30	0~2.00	bar	○	Band during initial run and next run/stop band during interoperation
33	ON/OFF Time	5	0~100	sec	○	Run/stop waiting time during interoperation
34	Freezing Prevention	0	0~1	-	○	0: Disable, 1: Enable
35	Changeover Mode	0	0~2	-	×	0: Low ID, 1: Low integrating watt-hour, 2: Half pump
36	Changeover Time	12	0~24	hour	○	Forced alternation time
37	Share Op. ON %	100	70~100	%	○	Ratio of partial operation when pump is operating in partial mode
41	Low Flow Time	30	0~200	sec	○	0~200sec (1sec)
42	Low Flow Rate	100	0~100	%	○	Low flow detection ratio: 0~100% (1%)
50	TOP Level	16.00	0.00~25.00	bar	○	High pressure trip level
51	TOP Time	5	0~100	sec	○	High pressure trip time
52	TLP Level	0.5	0.00~10.00	bar	○	Low pressure trip level



## Chapter 6. List of Functions and Description

CODE	LCD Display	Factory Setting	Range	Unit	Changable in Operation	Description
53	TLP Time	20	0~200	sec	○	Low pressure trip time
54	TUL Mode	1	0~2	-	×	Low water level detection mode 0: Low water level sensor, 1: Discharge pressure, 2. Input pressure
55	TUL Time-LS	2	0~600	sec	○	Low water level trip time when detection mode is low water level sensor
56	TUL Level-Out	0.3	0.00~25.00	bar	○	Low water level trip pressure when detection mode is discharge pressure
57	TUL Time-Out	20	0~600	sec	○	Low water level trip time when detection mode is discharge pressure
58	TUL Level-In	0.3	0.00~25.00	bar	○	Low water level trip pressure when detection mode is input pressure
59	TUL Time-In	20	0~600	sec	○	Low water level trip time when detection mode is input pressure
61	Half Pump	0	0~1	-	○	0: Disable, 1: Enable
62	Half Pump Rate	70	50~100	%	○	Ratio for half pump condition
63	Half Pump Time	10	0~200	min	○	Time for half pump condition
70	Maximum Pressure Trip level	25.00	0~25.00	bar	○	Maximum pressure level setting



## Chapter 6. List of Functions and Description

### 6.1.1 Pump Control Group

#### Pump 1 : Pump Control Mode

Here is the method of setting pump control.

Setting	Description	Related Functions		
0	Manual Mode	Drive 2	Frequency setting	Target frequency setting
		Drive 3	Command frequency setting	Target frequency setting for keypad mode
1	Constant Pressure Control (Factory Setting)	Pump 11	Sensor 1 capacity	
		Pump 12	Sensor 1 gain	
		Pump 13	Sensor 1 offset	
2	Differential Pressure Control	Pump 6	Discharge pressure	Only displayed in differential pressure control
		Pump 7	Input pressure	
		Pump 11	Sensor 1 capacity	Discharge direction
		Pump 12	Sensor 1 gain	
		Pump 13	Sensor 1 offset	
		Pump 14	Sensor 2 capacity	Input direction
		Pump 15	Sensor 2 gain	
Pump 16	Sensor 2 offset			

#### Pump 2 : Pump Operation Mode

This function can be selected by the user to increase energy efficiency on multiple pump operation. Sequential operation performs acceleration/deceleration of a single unit by PID using the master. Partial operation is a method of allocating target output frequency to all drives in multiple operation according to a single PID controller of the master. This method can be useful when all pipes of the system have same diameter. There is an advantage of preventing overloading of a drive.

Setting	Description		
0 (Factory setting)	Sequential operation		
1	Partial operation	Related Functions	
		Pump 37	Partial operation ON %

#### Pump 3 : Pressure Setting Method

Select a pressure setting method.

Setting	Description	Related Function	
0 (Factory setting)	Keypad		
1	AI1 (analog input signal 1)	I/O 1~8	Analog input 1 setting
2	AI2 (analog input signal 2)	I/O 11~18	Analog input 2 setting
3	Comm. (RS485 Comm. input)	Comm 11~15	RS485 Comm. setting



## Chapter 6. List of Functions and Description

### Pump 4 : Pressure Setting

Pressure setting is displayed and set.

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

### Pump 5 : Current Pressure

Current pressure is displayed.

### Pump 6 : Discharge Pressure

Discharge pressure is displayed only in differential pressure control mode.

### Pump 7 : Input Pressure

Input pressure is displayed only in differential pressure mode.

### Pump 11 : Sensor 1 Capacity

- Enter the maximum value that can be measured by the pressure sensor.
- Current pressure can be displayed by entering capacity of the pressure sensor attached to the drive.  
**Example)** If capacity of the pressure sensor is 10bar, enter 10.00.  
If capacity of the pressure sensor is 16bar, enter 16.00.
- Enter the rated value of the pressure sensor for normal pump operation.

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

### Pump 12 : Sensor 1 Gain

- Adjust gain to correct error.
- Sensor value = Average of 100 sensor readings \* gain / 100

Factory Setting	Input Range
100[%]	50~200[%]

### Pump 13 : Sensor 1 Offset

- This allows to correct pressure error between the analog or digital pressure meter installed on the pipe and pressure displayed on the drive.
- Current pressure value = sensor value  $\pm$  offset value

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

### Pump 14 : Sensor 2 Capacity

- Enter the maximum value that can be measured by the pressure sensor.
- Current pressure can be displayed by entering capacity of the pressure sensor attached to the drive.  
**Example)** If capacity of the pressure sensor is 10bar, enter 10.00.  
If capacity of the pressure sensor is 16bar, enter 16.00.
- Enter the rated value of the pressure sensor for normal pump operation.

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



## Chapter 6. List of Functions and Description

### Pump 15 : Sensor 2 Gain

- Adjust gain to correct error.
- Sensor value = Average of 100 sensor readings  $\times$  gain  $\div$  100

Factory Setting	Input Range
100[%]	50~200[%]

### Pump 16 : Sensor 2 Offset

- This allows to correct pressure error between the analog or digital pressure meter installed on the pipe and pressure displayed on the drive.
- Current pressure value = sensor value  $\pm$  offset value

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

### Pump 21 : PID P Gain

- This is relevant to 'P' (proportional constant) among PID control parameters.
- Assuming that reference and feedback are in pressure unit [bar], PID P-Gain 100% means that output of the controller is 1.0[Hz] when PID I-Gain is 0 and 100bar error is maintained.

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

### Pump 22 : PID I Gain

- This is relevant to 'I' (integration constant) among PID control parameters.
- PID I-Gain 1 second refers to time taken to accumulate output to 1.0[Hz] when 100bar error is maintained.

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

### Pump 23 : PID D Gain

- This is relevant to 'D' (differential constant) among PID control parameters.
- PID D-Gain means that change rate of error is output for PID control cycle during set time.

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

### Pump 24 : PID Control Cycle

It outputs the value calculated by PID in unit of control cycle time.

Factory Setting	Input Range
0.2[sec]	0.1~10.0[sec]





## Chapter 6. List of Functions and Description

### Pump 30 : Drive Stop Ratio

If current pressure is higher than setting pressure, the drive stops when current drive operation rate drops below the drive stop rate.

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

### Pump 31 : Initial Output Rate on Starting

This refers to initial output rate on starting of the drive.

In other words, it starts at 30hz if maximum frequency is 60Hz and rate setting is 50%.

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

### Pump 32 : Start/Stop Variation

- Set start/stop variation of pressure value. In other words, current pressure must be smaller than setting pressure by start/stop variation or more to run the drive.
- Current pressure must be larger than setting pressure by start/stop variation or more to stop the auxiliary pump.
- In case of an alarm, the drive does not start.

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

### Pump 33 : Start/Stop Time

This is waiting time for the auxiliary pump to start or stop during multiple operation.

Pressure can increase suddenly if the auxiliary pump starts before the master drive reaches maximum frequency. It can drop suddenly if the auxiliary pump stops without waiting time.

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

### Pump 34 : Freezing Prevention

- This sets up freezing prevention.
- This is a function to prevent freezing of the pump at low temperature (sub-zero) using information of the temperature sensor installed inside the drive.

It is operated at a frequency that does not generate pressure during 0~10 seconds and is stopped between 11~59 seconds. This function is intended to prevent freezing of the pump by generating frictional heat by rotation of the pump and is irrelevant to prevention of freezing of pipes.

Setup Data
Release[Factory Setting]
----- Setting



## Chapter 6. List of Functions and Description

### Pump 35 : Alternation method

- It determines the order of drive running and alteration during multiple operation.

Setup Data	Input Range
0[Factory setting]	ID order[factory setting]
1	Low integrated watt-hour
2	Half pump

※ The integrated watt-hour method can be used if the drive can receive information.

### Pump 36 : Alternation Time

The initial pump is alternated after operating for alternation time. If the alternation method is ID order, it is alternated to the next ID. In case of the low integrated watt-hour method, it is alternated to a pump with low integrated watt-hour. In case of the half pump method, the pump is alternated to low ID among standby pumps, only if the main pump is in operation.

Setup Data	Input Range
0	Alternation OFF
1~24[hour]	Alternation time setup (factory setting: 12[hour])

### Pump 37 : Partial Operation ON %

It is an output ratio to start the next drive, applied to the partial operation method for interoperation. In other words, the next drive starts operating if output ratio of the current drive is above the setting.

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

### Pump 41 : Low Level Detection Time

If the pump maintains pressure for set time after reaching pressure setting, it starts decelerating. The pump restarts operation if pressure difference becomes as large as starting variation. The pump stops if there is no pressure difference.

Setup Data	Input Range
0	Low level detection OFF
1~200[sec]	Low level detection time (factory setting: 30 [sec])

### Pump 42 : Low Level Detection Ratio

It is the ratio to detect low level. Level is considered as low level if current output rate is lower than low level detection ratio. For example, if output rate of current pressure compared to pressure setting is lower than detection ratio, it is detected as low level.

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



## Chapter 6. List of Functions and Description

### Pump 50 : TOP (High Pressure) Level

It sets the reference pressure value to generate the high pressure alarm.

※ It is automatically set to setting pressure + 2bar during constant pressure setting.

Factory Setting	Input Range	Related Function	
16.0[bar]	0.00~25.00[bar]	Pump 51	TOP (high pressure) time

### Pump 51 : TOP (High Pressure) Time

It sets high pressure alarm level time to generate the high pressure alarm.

That is, if pressure is maintained at or above TOP level (Pump 50), the high pressure alarm is displayed. Operation will be stopped.

Factory Setting	Input Range	Related Function	
5[sec]	0~600[sec]	Pump 50	TOP (high pressure) level

### Pump 52 : TLP (Low Pressure) Level

It sets the reference pressure value to generate the low pressure alarm.

Factory Setting	Input Range	Related Function	
0.5[bar]	0.0~25.0[bar]	Pump 52	TLP (low pressure) level

### Pump 53 : TLP (Low Pressure) Time

It sets high pressure alarm level time to generate the low pressure alarm.

That is, if pressure is maintained at or below TLP level (Pump 52), the high pressure alarm is displayed. Operation will be stopped.

Factory Setting	Input Range	Related Function	
20[sec]	0~600[sec]	Pump 53	TLP (low pressure) time

### Pump 54 : TUL (Low Water Level) Detection Mode

- This is a mode to set up low water level detection method.
- When setting up the low water level sensor, an electrode is attached to the outside to detect water inside the pipe.
- When setting up the low water level sensor during interoperation, the low water level sensor is connected to the lowest ID drive.
  - ※ All drives (pumps) stop if there is no water on the suction side.
- When it is set to software detection, the alarm is detected based on TUL level and TUL time. In other words, if operation continues at pressure below TUL (Pump 56) for TUL time (Pump 57) or longer, an alarm is displayed and operation is stopped.

Setup Data	Description	Related Function	
0	Low water level sensor	Pump 55	TUL (low water level) time - LS
1 (Factory Setting)	Discharge pressure (software detection)	Pump 56	TUL (low water level) level - OUT
		Pump 57	TUL (low water level) time - OUT
2	Input pressure (software detection)	Pump 58	TUL (low water level) level - IN
		Pump 59	TUL (low water level) time - IN



## Chapter 6. List of Functions and Description

### Pump 55 : TUL (Low Water Level) Time - LS

- It sets low water level sensor signal time to generate the low water level alarm.  
That is, if the low water level sensor is set to TUL detection mode (Pump 54) and continues for TUL time or longer, it means that there is no water in the suction pipe. The alarm is displayed and operation is stopped.

Setup Data	Description
0	Low water level detection OFF
1~600[sec]	Time setting (factory setting: 2[sec])

### Pump 56 : TUL (Low Water Level) Level - OUT

- It is pressure level to detect low water level by discharge pressure when TUL detection mode (Pump 54) is set to discharge pressure.
- The sensor must be installed on the discharge part.

Factory Setting	Input Range	Related Function	
0.30[bar]	0.00~25.00[bar]	Pump 57	TUL time - OUT
		Pump 54	TUL detection mode

### Pump 57 : TUL (Low Water Level) Time - OUT

- It sets low water level time to generate the low water level alarm.  
That is, if current pressure is maintained at or below TUL level (Pump 56) for set time, the alarm is displayed and operation is stopped.

Factory Setting	Input Range	Related Function	
20[sec]	0~600[sec]	Pump 56	TUL level - OUT
		Pump 54	TUL detection mode

### Pump 58 : TUL (Low Water Level) Level - IN

- It is pressure level to detect low water level by input pressure when TUL detection mode (Pump 54) is set to input pressure. The sensor must be installed on the input part.

Factory Setting	Input Range	Related Function	
0.30[bar]	0.00~25.00[bar]	Pump 59	TUL time - IN
		Pump 54	TUL detection mode

### Pump 59 : TUL (Low Water Level) Time - IN

- It is low water level alarm time to generate the low water level alarm.  
That is, if current pressure is maintained at or below TUL level (Pump 58) for set time, the alarm is displayed and operation is stopped.

Factory Setting	Input Range	Related Function	
20[sec]	0~600[sec]	Pump 58	TUL level - IN
		Pump 54	TUL detection mode



## Chapter 6. List of Functions and Description

### Pump 61 : Half Pump

- During interoperation, half pump setting is transmitted to the master via CAN communication.
- The drive set to half pump is recognized as a half pump and is operated in half pump mode.

Setup Data	Description	Related Function	
0	Disable	Pump 35	Alternation method
1	Half pump setting	Pump 62	Half pump rate
		Pump 63	Half pump time

### Pump 62 : Half Pump Condition Rate

- When one main pump is operating in half pump mode, it can be replaced by a half pump to save energy. The main pump is replaced by a half pump after operating for half pump condition time at or below half pump condition rate.

Factory Setting	Input Range	Related Function	
70[%]	50~100[%]	Pump 35	Alternation method
		Pump 61	Half pump setting
		Pump 63	Half pump condition time

### Pump 63 : Half Pump Condition Time

- It is time condition to switch from the main pump to the half pump in half pump mode.

Factory Setting	Input Range	Related Function	
10[Min]	0~200[Min]	Pump 35	Alternation method
		Pump 61	Half pump setting
		Pump 62	Half pump condition rate

### Half Operation

The pump system is comprised of a small (half) pump and large pump. As for the order of operation, the small pump is started first. The small pump is stopped by starting the large pump.

On the subsequent run, the small pump is started first. The small pump is stopped as the large pump is started.

※ The order of starting may differ in alternation mode.

Ex) Order of operation in a pump system with 2 small pumps and 2 large pumps

Small pump 1 starts. → Large pump 1 starts and small pump 1 stops. → Small pump 2 starts and large pump 1 is in operation. → Large pump 2 starts, large pump 1 is in operation and small pump 2 stops. → Small pump 1 starts, large pump 1 is in operation and large pump 2 is in operation. → Small pump 2 starts, small pump 1 is in operation, large pump 1 is in operation and large pump 2 is in operation.

### Order of Stopping

The small pumps stop first when stopping operation.

If all pumps (small 1, small 2, large 1 and large 2) are in operation, the order of stopping is small pump 1 → small pump 2 → large pump 1 → large pump 2.

※ The order of stopping may differ according to the starting pump.

### Pump 70 : Maximum Pressure Trip Level

- Trip occurs and the drive is stopped if current pressure reaches the maximum pressure trip level.

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



### 6.2 Drive Control Group

CODE	LCD Display	Factory Setting	Range	Unit	Changeable During Operation	Description
1	Run/Stop Mode	0	0~2	-	X	0: Keypad, 1: Terminal block input, 2: Communication input
2	Frequency Setting	0	0~2	-	X	Setting of frequency input method during manual operation 0: Keypad, 1: AI1 signal, 2: Communication input
3	Command Frequency	30	Start frequency (CODE-36)~ Max. frequency (CODE-37)	Hz	○	Setting of command frequency during manual operation
16	Motor Rating Hz	1	0~1	-	X	0: 50 Hz 1: 60 Hz
19	Acceleration Time	3	1.0~600.0	sec	○	1.0~600.0sec (0.1sec)
20	Deceleration Time	6	1.0~600.0	sec	○	1.0~600.0sec (0.1sec)
31	Retry Number	5	1~100	Times	○	Number of reboots after trip
32	Retry Time	10	1~250	sec	○	Standby time for reboots after trip
41	Output Frequency	-	0.00~60.00	Hz	-	Display of output frequency during operation
42	Output Current	-	0.0~100.0	A	-	Display of output current during operation
43	Output Rate	-	0.0~100.0	%	-	Display of output rate during operation
44	Output Voltage	-	0.0~500.0	V	-	Display of output voltage during operation
45	DC Link Voltage	-	0.0~1000.0	V	-	Display of drive DC link voltage
46	Output Power	-	0.0~100.0	kW	-	Display of power consumption during operation
47	Kilo watt-hour	-	0~9999999.9	kWh	-	Display of cumulative power consumption
49	Internal temperature	-	-10~200	℃	-	Display of internal temperature



## Chapter 6. List of Functions and Description

### 6.2.1 Description of Control Group Functions

#### Drive 1 : Run/Stop Method

It sets location of operation command.

If the keypad is selected, operation can be commanded using keys on the body. If the terminal block input is selected, operation can be commanded by external input (RUN).

Setup Data	Description
0 (Factory Setting)	Operation command using keypad (RUN/STOP button)
1	Operation command using terminal block (RUN on terminal block)
2	Communication input (RS-485 communication)

#### Drive 2 : Frequency Setting Method

It selects how to set frequency if pump control mode (Pump 1) is manual mode.

Setup Data	Description	Related Function	
0 (Factory Setting)	Keypad		
1	AI1 (analog input signal 1)	Signal 1~8	Analog input 1 setting
2	AI2 (analog input signal 2)	Signal 11~18	Analog input 2 setting
3	Comm. (RS485 Comm. input)	Comm. 11~15	RS485 communication setting

#### Drive 3 : Command Frequency

Command frequency can be set if pump control mode (Pump 1) is manual mode and frequency setting method (Drive 2) is keypad.

Factory Setting	Input Range	Related Function	
30[Hz]	0~60.00	Pump 1	Pump control mode
		Drive 2	Frequency setting method

#### Drive 16 : Motor Rating Hz

It sets rated frequency of the motor

Description	Related Function	
50[Hz]	Drive 37	Maximum operating frequency
60[Hz]		

#### Drive 19 : Acceleration Time

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

If acceleration time is too short, over-current can occur when starting the motor.

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



## Chapter 6. List of Functions and Description

### Drive 20 : Deceleration Time

- It is time to decelerate from maximum frequency to 0[Hz].
- If deceleration time is too short, over-voltage can occur in the motor.

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

### Drive 31 : Retry Number

- This is the number of automatic retries that can be attempted after trip occurs. It does not restart if trip recurs for this number of times.
- Previous trip count is reset when trip does not occur for certain time.
- It may not restart depending on the trip code. Please refer to the trip history table.

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

### Drive 32 : Retry Time

It is restarted after waiting for retry time.

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

### Drive 41 : Output Frequency

It displays output frequency of the drive.

### Drive 42 : Output Current

It displays output current of the drive.

### Drive 43 : Output Rate

It displays output rate of the drive.

### Drive 44 : Output Voltage

It displays effective output voltage of the drive.

### Drive 45 : DC Link Voltage

It displays DC link voltage of the drive.

### Drive 46 : Output Power

It displays power consumption of the drive.





## Chapter 6. List of Functions and Description

### **Drive 47 : Kilo Watt-Hour**

Cumulative power consumption of the drive is displayed in unit of kWh.

### **Drive 49 : Internal Temperature**

- It displays internal temperature of the controller.
- The freezing prevention function is determined using internal temperature of the controller.

※ Information on Drives 41~47 is only displayed if information is received from the respective drive.



## Chapter 6. Function Table & Description

### 6.3 I/O Group

CODE	LCD Display	Factory Setting	Range	Unit	Changable in Operation	Description
1	AI1 Mode	0	0-1	-	○	External Analog Input 1 settings 0: Current Input 1: Voltage Input
2	V1 Min. Voltage	0.0	0.0-10.0	V	○	V1 : The Min. Input Voltage
3	I1 Min. Current	0.0	0.0-20.0	mA	○	I1 : The Min. Input Current
4	AI1 Min. Freq.	0.00	0.00-600.00	Hz	○	The Min. Frequency corresponding to the External Analog Input 1
5	V1 Max. Voltage	10.0	0.0-10.0	V	○	V1 : The Max. Input Voltage
6	I1 Max Current	20.0	0.0-20.0	mA	○	I1 : The Max. Input Current
7	AI1 Max Freq.	60.00	0.00-600.00	Hz	○	The Max. Frequency corresponding to the External Analog Input 1
8	AI1 Attribute	5	0-5		○	0 : Drive Output Current 1 : Drive Output Frequency 2 : Drive Output Power 3 : Drive Output Voltage 4 : Setting Press 5 : Instruction frequency
11	AI2 Mode	0	0-1		○	External Analog Input 2 settings 0: I 1: V
12	V2 Min. Voltage	0.0	0.0-10.0	V	○	V2 : The Min. Input Voltage
13	I2 Min Current	0.0	0.0-20.0	mA	○	I2 : The Min. Input Current
14	AI2 Min. Press.	0.00	0.00-600.00		○	The Min. Pressure corresponding to the External Analog Input 2
15	V2 Max. Voltage	10.0	0.0-10.0	V	○	V2 : The Max. Input Voltage
16	I2 Max. Current	20	0.0-20.0	mA	○	I2 : The Max. Input Current
17	AI2 Max. Press.	30.00	0.00-600.00		○	The Max. Pressure corresponding to the External Analog Input 2
18	AI2 Attribute	4	0-5		○	0 : Drive Output Current 1 : Drive Output Frequency 2 : Drive Output Power 3 : Drive Output Voltage 4 : Setting Press 5 : Instruction frequency
21	AO1 Mode	0	0-10	-	X	Attribute of Analog Output 1 0 : Disable 1 : Setting Press. 2 : Current Press. 3 : Output Freq. 4 : Output Current 5 : Outlet Press. 6 : Inlet Press. 7 : Output Rate 8 : Output Voltage 9 : DC-Link Volt. 10 : Output Power
22	AO1 Gain	80	0-200	-	○	Gain of Analog Output 1
23	AO1 Offset	20	0-100		○	Offset of Analog Output 1
24	AO2 Mode	3	0-10		X	Attribute of Analog Output 2 0 : Disable 1 : Setting Press. 2 : Current Press. 3 : Output Freq. 4 : Output Current 5 : Outlet Press. 6 : Inlet Press. 7 : Output Rate 8 : Output Voltage 9 : DC-Link Volt. 10 : Output Power
25	AO2 Gain	80	0-200	%	○	Gain of Analog Output 2
26	AO2 Offset	20	0-100	%	○	Offset of Analog Output 2



### 6.3.1 Signal Control Group

#### Signal 1 : AI1 Mode (Analog Input 1)

- When Pump Control Mode (Pump 1) is manual mode and Frequency Setup Mode (Drive 2) is AI1, you can operate by settings the frequency to external input current or voltage.
- You should set Jump J2 on the control board together.

Setup Data	Functional Description
0 (Factory Setting)	Current Input
1	Voltage Input

#### Signal 2 : V1 Minimum Input Voltage

When AI1 Mode is set as a voltage Input and you would enter the minimum voltage of V coming from the external input.

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

#### Signal 3 : I1 Minimum Input Current

When AI1 Mode is set as a Current Input and you would enter the minimum Current of I coming from the external input.

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

#### Signal 4 : Minimum Frequency

The minimum frequency corresponding to the input value of the current or voltage from I/O 2,3.

Factory Setting	Input Range
0.00[Hz]	0.0 ~ 600.00

#### Signal 5 : Maximum Input Voltage

When AI1 Mode is set as a voltage Input and you would enter the maximum voltage of V coming from the external input.

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

#### Signal 6 : Maximum Input Current

When AI1 Mode is set as a current Input and you would enter the maximum current of I coming from the external input.

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



## Chapter 6. Function Table & Description

### Signal 7 : AI1 Maximum Frequency

The Maximum Frequency corresponding to the input value of the Current or Voltage from I/O 5,6.

Factory Setting	Input Range
100.00	0.0 ~ 600.00

### Signal 8 : AI1 Attribute

Set the Attribute of analog input 1.

Setup Data	Functional Description	Remarks
0	Drive Output Current	The analog value of the drive connected to the AI1 input is displayed on the screen
1	Drive Output Frequency	
2	Drive Output Power	
3	Drive Output Voltage	
4	Current Pressure	Drive 3 pressure setting method is AI signal setting
5 (Factory Setting)	Instruction frequency during manual operation	Manual mode setting in Pump 1 Set frequency setting method in drive 2 to AI1 signal

### Signal 11 : AI2 Mode (Analog Input 2)

When Pump Control Mode is manual mode and Pressure Setting is J3, you can setup the pressure by settings of external input current or voltage.

Factory Setting	Functional Description
0 (Factory Setting)	Input Current
1	Input Voltage

### Signal 12 : V2 Minimum Input Voltage

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

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

### Signal 13 : I2 Minimum Input Current

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

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



## Chapter 6. Function Table & Description

### Signal 14 : Minimum Pressure

The Minimum Pressure corresponding to the input value of the Current or Voltage from I/O I2, I3.

Factory Settings	Input Range
0.00[bar]	0.0 ~ 25.00[bar]

### Signal 15 : Maximum Input Voltage

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

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

### Signal 16 : Maximum Input Current

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

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

### Signal 17 : AI2 Maximum Pressure

The Maximum Pressure corresponding to the input value of the Current or Voltage from I/O I5, I6.

Factory Settings	Input Range
30	0.00 ~ 600.00

### Signal 18 : AI2 Attribute

Set the Attribute of analog input 2.

Setup Data	Functional Description	Remarks
0	Drive Output Current	It displays the analog value of the drive connected to the AI2 input
1	Drive Output Frequency	
2	Drive Output Power	
3	Drive Output Voltage	
4 (Factory Setting)	Current Pressure	Drive 3 pressure setting method is AI signal setting
5	Command frequency during manual operation	Manual mode setting in Pump 1 Frequency setting method in drive 2 to AI1 signal



## Chapter 6. Function Table & Description

### Signal 21 : AO1

It outputs Drive Information set as Analog output to 0 ~ 20mA.

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

### Signal 22 : AO1 Gain

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

Factory Setting	Input Range
20[%]	0 ~ 100[%]

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

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

### Signal 22 : AO1 Gain

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

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

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

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

### Signal 24~26 : AO2 Mode

AO2 Mode is the same as AO1



## 6.4 Communication Group

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

### 6.4.1 Description of Parameter Settings on Comm. Group Code

#### Comm. 2 : CAN Comm. ID

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

Functional Description			
0 (Factory Setting)	Disabling (Signal Mode: Factory Setting)		
1~6	Interlock Mode, Comm. ID Number	Related Functions	
		Comm. 3	CAN Comm. Speed

#### Comm. 3 : CAN Communication Speed

It sets up CAN communication speed.  
It is recommended to reduce the communication speed when connected to a long distance.

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



## Chapter 6. Function Table & Description

### Comm. 11 : RS 485 Comm. Mode

It is to setup RS485 Comm. Mode.  
ModBus RTU is used for communication protocol.

Setup Data	Functional Description
0 (Factory Setting)	Disable : 485 Comm. OFF
1	Enable: 485 Comm. ON

### Comm. 12 : RS 485 Comm. ID

It setup RS 485 Comm. ID.

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

### Comm. 13 : RS 485 Comm. Speed

It setup RS-485 Comm. Speed.

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

### Comm. 14 : RS 485 Comm. Delay Time for Data Transmission

It setup RS 485 Comm. delay time for the data transmission.

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

### Comm. 15 : RS 485 Comm. Offset value for the Address of the requested Data It setup RS-485 Comm. Data request address using Offset value.

Example; - The current address of the requested Data: 3000

- Offset Value: +2000
- The actual address for requested Data : 5000.

Setup Data	Functional Description
0	-30000~30000





## 6.5 Alarm History Group

TRIP	CODE	LCD Display	Setting Value	Scale	Unit	Description
Last Trip 1 ~ Last Trip 5	0	Jump Code	1	1~99	-	
	1	Recent Trip 1	0	0~9999	-	The cumulative Number of the recent same kind of Trip
	2	Trip types	-	0	-	Trip Type 1 : TSF (Sensor Fault) 2 : TOP (High Pressure) 3 : TLP (Low Pressure) 4 : TUL-LS (Level Sensor -Low Water Level) 5 : TUL-OUT (Outlet Pressure- Low Water Level) 6 : TUL-IN (Inlet Pressure-Low Water Level) 16 : TIDE (Comm. ID duplication) 17 : TCE (Comm. Fault) 20 : TES (Emergency Stop) 21 : TOL (Expired Validity Date) 22:TFF (Fan Fault) 26 : TBA (Bearing Replacement Alarm) 27 : TMOP(Maximum pressure trip) 28 : INV1 (Drive Fault) 29 : INV2(Drive RUN signal fault)
	3	Setting Pressure	-	0.00~25.00	bar	Setting Pressure at the time of the Trip
	4	Current Pressure	-	0.00~25.00	bar	Current Pressure at the time of the Trip
	5	Output Frequency	-	0.00~60.00	Hz	Output Frequency at the time of the Trip
	6	Output Current	-	0.0~100.0	A	Output Current at the time of the Trip
	7	DC-link Voltage	-	0.0~1000.0	V	DC-link Voltage at the time of the Trip
	1.7	PIM Temp	-	0~100	℃	Power Module Temperature at the time of the Trip
	10	Trip 1 Delete	0	0~21	-	Trip 1 Delete Trip 0: No 1: Yes



## Chapter 6. Function Table & Description

### Alarm 1 : Recent Trip 1

- It displays the cumulative Number of the recent same kind of Trip.
- It counts whenever the same type of Trip is generated.

### Alarm 2 : Trip Type

It displays what kind of trip is generated.

Trip Code	Functional Description
TSF	Sensor Fault
TOP	High Pressure
TLP	Low Pressure
TUL-LS	Level Sensor -Low Water Level
TUL-OUT	Outlet Pressure- Low Water Level
TUL-IN	Inlet Pressure-Low Water Level
TIDE	Comm. ID duplication
TCE	Comm. Fault
TES	Emergency Stop
TSF2	Sensor Comparison Fault
TMOP	Maximum pressure trip
INV1	Drive Fault
INV2	Drive RUN signal fault

### Alarm 3 : Setting Pressure

It displays Setting Pressure at the time of the Trip.

### Alarm 4 : Current Pressure

It displays Current Pressure at the time of the Trip.

### Alarm 5 : Output Frequency

It displays Output Frequency at the time of the Trip.

### Alarm 6 : Output Current

It displays Output Current at the time of the Trip.

### Alarm 7 : DC-link Voltage

It displays DC-link Voltage at the time of the Trip.

### Alarm 9 : Date/Time

It displays Date/Time at the time of the Trip.

### Alarm 10 : Delete Trip1

- It deletes Trip1 log permanently.
- After resetting, data is unrecoverable.

### Alarm 11 ~ 50 :

It operates the same way of the Trip1 group.



### 6.6 Configuration Group

CODE	LCD Display	Factory Setting	Range	Unit	Changeable in	Description
1	Language	1	1~3	-	X	Language Settings : English, Korean, Chinese
2	LCD Brightness Adjustment	-	0~100	%	-	LCD Brightness Adjustment
7	Para Group Reset	0	0~6		X	Group Reset 0: Null 1: All Group 2: Pump Group 3: Drive Group 4: Signal Group 5: Comm. Group 6: Configuration
10	Erase All Trip	0	0~1	-	○	Reset All Trip 0: No 1: Yes
11	Power-On Time	0	0~65535	hour	X	Cumulative Power-On Time
12	Reset On Time	0	0~1	-	X	Reset Power-On Time 0: No 1: Yes
13	Run Time	10	1~250	sec	○	Cumulative Drive operating time
14	Reset Run Time	0	0~1	-	X	Reset the cumulative Drive operating time 0: No 1: Yes
15	Reset kWh	0	0~1	-	X	Reset kilo Watt hours 0: No 1: Yes
16	Trip Count	0	0~65535	-	X	Display the cumulative Trip Numbers
17	Reset Trip Count	0	0~1	-	X	Reset All Trip Counts 0: No 1: Yes
18	Serial Number	0	0~9999	-	X	Serial Number for the remote control
19	Date/Time	0	-	-	X	Date/Time Setting
90	S/W Version	-	1.0	-	-	S/W Version

#### 6.6.1 Config Group Functional Description

**Configuration 1 :** Language Korean, Chinese, English compatible.

Setup Data	Functional Description
0 (Factory Setting)	0 : English
1	1 : Korean
2	Chinese (中文)

#### **Configuration 2 :** LCD Brightness Adjustment

Adjust the brightness of the LCD to your preference.



### Configuration 7 : Initialization of Factory Settings

It carries out initialization with factory settings for all or each group.

Setup Data	Functional Description
0 (Factory Setting)	To maintain settings
1	To initialize All the data settings with factory settings
2	To initialize PUMP Group
3	To initialize DRIVE Group
4	To initialize DRIVE Group
5	To initialize DRIVE Group
6	To initialize DRIVE Group

### Configuration 10 : Delete Trip History

- It deletes all of the trip history.
- In case of deleting the trip history, the data (trip history) will be removed permanently.

Setup Data	Functional Description
0 (Factory Setting)	No : Maintain data
1	Yes : Reset Data

### Configuration 11 : Power-On Time

It displays the accumulative time of Power-On the drive.

### Configuration 12 : Reset Power-On Time

- It resets the Power-On Time of the Drive.
- After resetting, data is unrecoverable.

Functional Description	Functional Description
0 (Factory Setting)	No : Maintain data
1	Yes : Reset Data

### Configuration 13 : Run Time

It displays the accumulative time of the actual Drive operating time.

### Configuration 14 : Reset Run Time

- It resets the accumulative time of the actual Drive operating time.
- After resetting, data is unrecoverable.

Functional Description	Functional Description
0 (Factory Setting)	No : Maintain data
1	Yes : Reset Data



## Chapter 6. Function Table & Description

### Configuration 16 : Accumulative Trip Number

It displays the accumulative trip number.

### Configuration 17 : Reset the accumulative Trip Number

- It resets the accumulative Trip Number.
- After resetting, data is unrecoverable.

Setup Data	Functional Description
0 (Factory Setting)	No : Maintain Data (Factory Setting)
1	Yes : Reset Data

### Configuration 18 : Serial Number

Internet Option : Serial Number is indicated for the user.

### Configuration 19 : Date/Time Settings

It sets Date and Time.

### Configuration 90 : S/W Version

It displays the S/W Version.



### 7.1 Protection Function Table

Function	LCD Display	Description
Pump Protection	Er-01 : TSF	Pressure Sensor Fault If the Pressure Sensor has a problem or disconnection with the Drive.
	Er-02 : TOP	High Pressure Alarm If the current pressure is above the TOP level and TOP Time, it makes trip and shut off the Drive output.
	Er-03 : TLP	Low Pressure Alarm If the current pressure is below the TLP level and more the TLP Time, it makes trip and shuts off the Drive.
	Er-04 : TUL	Low Water Level Alarm by Low Water Level Sensor If it detects Low Water Level by Low Water Level Sensor and TUL time is more than TUL-LS Settings, it makes trip and shut off the Drive output.
Low Water Level Alarm by the Outlet pressure sensor If the current pressure is below the TUL-OUT Level and more than TUL-OUT Time, it shuts off the Drive .		
Low Water Level Alarm by the Inlet pressure sensor If the current pressure is below the TUL-IN Level and more than TUL-IN Time, it shut off the Drive output.		
Comm. ID Duplication Trip	Er-15 : TIDE	The trip is generated by the same ID input when assigning ID on each drive for inter-operation.
Comm. Fault	Er-16 : TCE	The trip is generated by communication failure between Drive to Drive when inter-operation.
Emergency Stop Trip	Er-20 : TES	If there is a problem with external input or device, the drive make a trip and shut off output.
Sensor Comparison Fault	Er-26 : TSF2	The trip is generated when the value of each pressure sensor differs by more than 1 bar in a system with two or more pressure sensors connected.
Maximum pressure trip	Er-27 : TMOP	if the current pressure is above the maximum pressure trip level (pump group 70), it makes trip.
Drive Fault	Er-28 : INV	Drive trip
	Er-29 : INV2	Drive trip

### 7.2 Reset of fault and alarm

- In case of fault or alarm, LCD display shows the description of trip code or contents
- To reset the fault and alarm, press Reset Key.

In case of 1. TSF (Pressure Sensor Fault), 2. TOP (High Pressure Alarm), 4. TUL-LS (Low Water Level Alarm), If the case becomes white alert, it resets and restarts automatically. But if the case is still Alarm condition then, it alerts again.



### 7.3 Cause of Fault and Trouble Shooting

#### Er-01 : TSF (Pressure Sensor Fault)

##### Cause

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

##### Action

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

Related Function	Function Name	Ref. Page
Comm. 2	CAN Communication ID	47
Comm. 3	CAN Communication Speed	47

#### Er-02 : TOP (High Pressure Alarm)

##### Cause

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

##### Action

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

Related Function	Function Name	Ref. Page
Pump 50	High Pressure Alarm Level	35
Pump 51	High Pressure Alarm Time	35

#### Er-03 : TLP (Low Pressure Alarm)

##### Cause

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

##### Action

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

Related Function	Function Name	Ref. Page
Pump 52	Low Pressure Alarm Level	35
Pump 53	Low Pressure Alarm Time	35
Drive 31	No. of Automatic Restart after Trip	40
Drive 32	Stand by Time for Automatic Restart after Trip	40



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

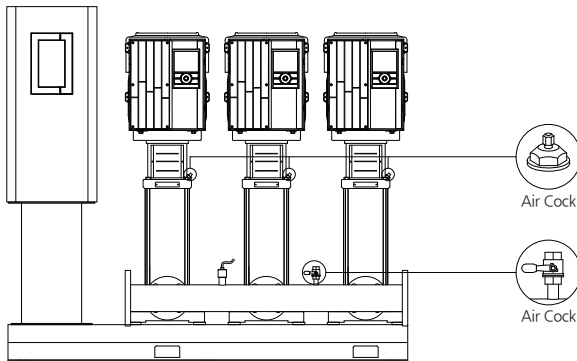
#### Cause

- It alerts to prevent the mechanical seal from being damaged due to running of the pump when there is no water on the suction side.

It alerts when the low level sensor (electrode) does not detect the water. In case of not using the low water level sensor, the software generates the alarm when the current pressure is maintained under the low pressure alarm level (Pump 56, Pump 58) and the operation continues for low pressure trip time (Pump 57, Pump 59). In case of using the low water level sensor (electrode), when there is water, the alarm will be automatically released and the drive will be automatically operate.

#### Action

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



Related Funtion	Funtion Name	Ref. Page
PUMP54	Low Water level alarm detection method	35
PUMP55	Low Water level alarm time - LS	36
PUMP56	Low Water Pressure Alarm Level - OUT	36
PUMP57	Low Water Pressure Level Alarm Time of Pressure Sensor - OUT	36
PUMP58	Low Water Pressure Alarm Level - IN	36
PUMP59	Low Water Pressure Alarm Time - IN	36

### ER-15 : TIDE (Comm. ID Duplication Trip)

#### Cause

- Occurs upon the same ID duplication when assigning ID on each drive for inter-operation.

#### Action

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

Related Function	Function Name	Ref. Page
Comm. 2	Communication ID	47





## Chapter 7. Cause of Fault and Reaction

### **Er-16 : TCE (Comm. Fault Trip)**

#### **Cause**

- Occurs when CAN communication lines have bad connection
- Occurs when drive CAN communication IC is defective

#### **Action**

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

### **Er-20 : TES (Emergency Stop Trip)**

#### **Cause**

- There is a problem with external input or device, the drive make a trip and shut off output.

#### **Action**

- Check input side of the external signals.

### **Er-21 : TLT (Over Time Trip)**

#### **Action**

- Contact your local sales agent.

### **Er-26 : TSF2 (Sensor Comparison Fault)**

#### **Cause**

- Defective Sensor
- Defective Drive

#### **Action**

- Replace Sensor
- Replace Drive

### **Er-27 : TMOP (Maximum pressure trip)**

#### **Cause**

- Defective Sensor
- If the set pressure is bigger than the maximum pressure trip level

#### **Action**

- Replace Sensor
- Reset the set pressure

### **Er-28 : INV1 (Drive fault)**

#### **Cause**

- Drive Trip

#### **Action**

- Identify and resolve drive trip causes

### **Er-29 : INV2 (Drive RUN signal fault)**

#### **Cause**

- No drive RUN signal

#### **Action**

- Check whether drive RUN signal is set



### 8.1 RS-485

Article	Specification
Communication Speed	Choose from: 1200/2400/4800/9600/19200 bps
Control Procedure	Asynchronous communication
Communication System	Half duplex system
Text	8 bits
Stop bit	1 bit
Error Check (CRC16)	2 bytes
Parity Check	None

Communication Protocol (ModBus - using RTU protocol)

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

#### READ

Query (Example of reading setting pressure)

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

#### Response

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

#### Single Write

Query (Example of writing the set pressure 5.5bar)

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

#### Response

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



## Chapter 8. RS-485

Fault Diagnosis : In-case communication is not connected

Points to check	Note
Connection between master of computer of FA equipment and drive	Connect to Master Drive
RS485 Comm. Settings	Comm. 11 485 Comm. Mode
RS485 Comm. Speed	Comm. 12 485 Comm. Speed
RS485 Comm. ID	Comm. 13 485 Comm. ID
Starting communication of master of computer or FA equipment	



### 8.2 OPC operation status

Address (decimal)	Address (Hexadecimal)	Parameter	Scale	Unit	R/W	Contents
4096	0X1000	Program version	0.01		R	0~65535
4097	0X1001	System operation			R	0 : STOP 1 : READY(Inverter EN and output zero) 2 : RUN (Inverter EN and output non-zero) 3 : Fault (system fault)
4098	0X1002	Setting Pressure	0.01	bar	R/W	0~10000
4099	0X1003	Discharge Pressure	0.01	bar	R	0~10000
4100	0X1004	Operation stop (STOP) Inverter			R	Bit 0 : 1 Inverter Bit 1 : 2 Inverter Bit 2 : 3 Inverter Bit 3 : 4 Inverter Bit 4 : 5 Inverter Bit 5 : 6 Inverter
4101	0X1005	Operation ready (READY) Inverter			R	Bit 0 : 1 Inverter Bit 1 : 2 Inverter Bit 2 : 3 Inverter Bit 3 : 4 Inverter Bit 4 : 5 Inverter Bit 5 : 6 Inverter
4102	0X1006	Operation run (RUN) Inverter			R	Bit 0 : 1 Inverter Bit 1 : 2 Inverter Bit 2 : 3 Inverter Bit 3 : 4 Inverter Bit 4 : 5 Inverter Bit 5 : 6 Inverter
4103	0X1007	System fault description				Trip description Bit 0 : Sensor Bit 1 : High Pressure Bit 2 : Low Pressure Bit 3 : Low level of water
4104	0X1008	Inverter Fault			R	Bit 0 : 1 Inverter Bit 1 : 2 Inverter Bit 2 : 3 Inverter Bit 3 : 4 Inverter Bit 4 : 5 Inverter Bit 5 : 6 Inverter
4105	0X1009	Controlling mode	1		R	0 : differential pressure 1 : static pressure



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



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

# Warranty

DOOCH guarantee the quality of the product authorized and passed all the required QC procedure. Warranty periods and warranty services are varied in accordance with the region where the customers purchase our product.

The warranty period applies from the date of purchase by the first customer and is transferable only between end-users. The warranty covers manufacturing defects only.

Product	Smart pump controller / Key Pad	Warranty	1 year
Model	OPC-1000 / OPC-1001 / Key pad	Date from	
Place		Agent	

The liability of DOOCH. (or its appointed maintenance agent) is limited to the cost of repair and/or replacement of the product under warranty.

The warranty is invalidated if the defect is caused (howsoever) by misuse, neglect, and tampering or incorrect adjustment.

It is invalidated if unauthorized persons carry out any alterations and/or repairs.

Also, the warranty is invalidated in the following cases:

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

To obtain technical assistance or to book a service/repair to your product under warranty, please contact our customer care centre.

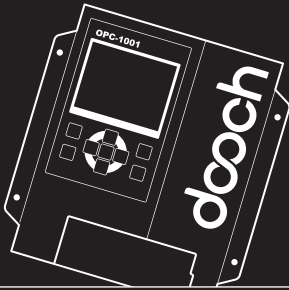
To assist our customer service team, please have your model number, serial number and date of purchase ready when calling.

**dooch**  
DOOCH CO., LTD.

DOOCH CO., LTD. : 2F~4F, 162 LS-ro, Gunpo-si, Gyeonggi-do, Korea

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# OPC-1000/OPC-1001

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