# Preface

Thank you for purchasing ARA388/KD386 series constant pressure water supply frequency inverter.

This manual describes how to use inverter properly. Please read it carefully before installation, operation, maintenance and inspection. Besides, please use the product after understanding the safety precautions.

| Precautions |
|---|
| ● In order to describe the product's details, the drawings presented in this instruction are sometimes shown without covers or protective guards. When using the product, please make sure to install the cover or protective guard as specified firstly, and operate the products in accordance with the instructions. |
| ● Since the drawings in this manual are represented examples, some are subject to differ from delivered products. |
| ● This manual may be modified when necessary because of improvement of the product, modification or changes in specifications. Such modifications are denoted by a revised manual No. |
| ● If you want to order the manual due to loss or damage, please contact our company agents in each region or our company customer service center directly. |
| ● If there is still any problem during using the products, please contact our company customer service center directly. |

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# Contents

# Chapter 1 Safety and preclusions

| | |
|---|---|
| ⚡<br><br>Danger | • Forbid to operate with wet hands.<br>• Forbid to carry out wiring distribution operation when the power source is not completely cut off.<br>• Please do not open the cover or carry out wiring distribution operation when ARA/ARA386 is electrified and operating. Or otherwise, there will be danger of electric shock.<br>• Carry out wiring distribution and inspection operation after cutting off power source for 10 minutes. Or otherwise, there will be danger of electric shock.<br>• ARA388/ARA386 will automatically start if its power source is cut off in operation and then connected. Please make sure operation safety before electrifying the converter. Or otherwise, there may be chances of personal injury accident. |

| | |
|---|---|
| ⚠<br><br>Warning | • Please do not install ARA388/ARA386 whose components are damaged or missing to avoid personal injury and property loss.<br>• The connection between the terminal of main circuit and the cable must be tight. Or otherwise, there may be damage to KD388/KD386 due to poor contact.<br>• Make sure that ARA388/ARA386 is installed on the fireproof materials (such as metal) to avoid fire disaster.<br>▫ Make sure there is no foreign matter entering ARA388/ARA386, such as electricity wire fragment, soldering tin, zinc-iron sheet to avoid short circuit, which may lead to ARA388/ARA386 being burned. |

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| | |
|---|---|
| ![Obligatory icon]<br><br>Obligatory | • Please configure non-fuse breaker or breaker with earth leakage protection used for protection the circuit at the input power source side of ARA388/ARA386 in order to avoid the expansion of accident caused by fault in the intelligent constant-pressure water-supply frequency converter.<br>• Carry out wiring distribution and inspection operation after cutting off power source for 10 minutes. Or otherwise, there will be danger of electric shock. |

| | |
|---|---|
| ![Caution icon]<br><br>Caution | • Please cut off the power source of ARA388/ARA386 which is not used for a long time to prevent it from being damaged by foreign matter or other factors, or even fire disaster.<br>• Do not install capacitance or surge current absorber (such as piezoresistor) at the output side, because the output voltage of KD388/KD386 is PWM pulse wave. Or otherwise, KD388/KD386 will be tripped and the power elements will be damaged. If the capacitance or surge current absorber is installed at the output side, please must disassemble it. |

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# Chapter 2 Product Information

## 2.1 Model Description

<div align="center">

## ARA388 – 00075 T 4

</div>

**Master series code of product**

**ARA388/ARA386:**
   Dedicated frequency inverter for
   constant pressure water supply

**Input voltage**

2: 220~240V
4: 380~460V

**Rated power**

00075: 0.75kW
01850: 18.5kW
16000: 160kW

**Input phase**

S: Single phase
T: Three phase
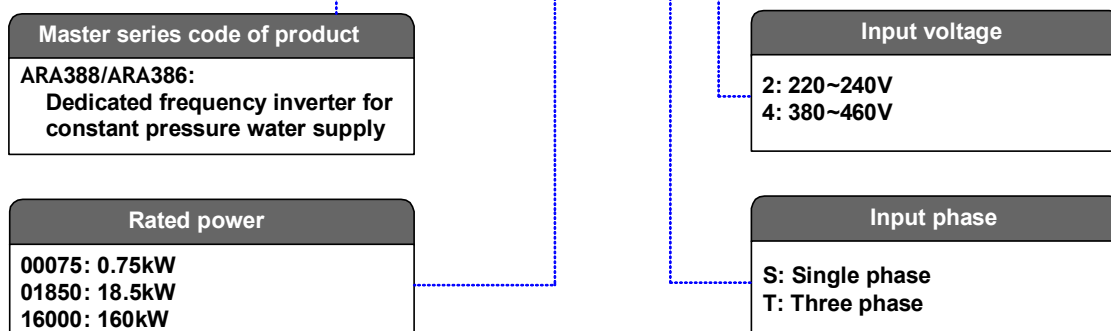
## 2.2 Selection Guide

### 2.2.1 ARA388

| Inverter Model | Motor | | Rated Input Current (A) | Rated Output Current (A) |
|---|---|---|---|---|
| | kW | HP | | |
| **1AC 220V±15%** | | | | |
| ARA388-00040S2 | 0.4 | 0.5 | 5.4 | 2.3 |
| ARA388-00075S2 | 0.75 | 1 | 8.2 | 4 |
| ARA388-00150S2 | 1.5 | 2 | 14 | 7 |
| ARA388-00220S2 | 2.2 | 3 | 24 | 9.6 |
| **3AC 220V±15%** | | | | |
| ARA388-00004T2 | 0.4 | 0.5 | 3.4 | 2.3 |
| ARA388-00075T2 | 0.75 | 1 | 5 | 4 |
| ARA388-00150T2 | 1.5 | 2 | 9.5 | 7 |
| ARA388-00220T2 | 2.2 | 3 | 11 | 9.6 |
| ARA388-00400T2 | 4.0 | 5 | 20.5 | 17 |
| **3AC 460V±15%** | | | | |
| ARA388-00075T4 | 0.75 | 1 | 3.4 | 2.8 |
| ARA388-00150T4 | 1.5 | 2 | 5 | 4.4 |
| ARA388-00220T4 | 2.2 | 3 | 6.5 | 5.8 |
| ARA388-00400T4 | 4.0 | 5 | 11 | 10 |
| ARA388-00550T4 | 5.5 | 7.5 | 14.6 | 13 |
| ARA388-00750T4 | 7.5 | 10 | 20.5 | 17 |

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### 2.2.2 ARA386

| Inverter Model | Motor | | Rated Input Current (A) | Rated Output Current (A) |
|---|---|---|---|---|
| | kW | HP | | |
| 1AC 220V±15% | | | | |
| ARA386-00040S2 | 0.4 | 0.5 | 5.4 | 2.3 |
| ARA386-00075S2 | 0.75 | 1 | 8.2 | 4 |
| ARA386-00150S2 | 1.5 | 2 | 14 | 7 |
| ARA386-00220S2 | 2.2 | 3 | 24 | 9.6 |
| ARA386-00400S2 | 4.0 | 5 | 30 | 17 |
| ARA386-00550S2 | 5.5 | 7.5 | 45 | 25 |
| 3AC 220V±15% | | | | |
| ARA386-00040T2 | 0.4 | 0.5 | 3.4 | 2.3 |
| ARA386-00075T2 | 0.75 | 1 | 5 | 4 |
| ARA386-00150T2 | 1.5 | 2 | 9.5 | 7 |
| ARA386-00220T2 | 2.2 | 3 | 11 | 9.6 |
| ARA386-00400T2 | 4.0 | 5 | 20.5 | 17 |
| ARA386-00550T2 | 5.5 | 7.5 | 27 | 25 |
| ARA386-00750T2 | 7.5 | 10 | 35 | 32 |
| ARA386-01100T2 | 11 | 15 | 46.5 | 45 |
| ARA386-01500T2 | 15 | 20 | 62.5 | 60 |
| ARA386-01850T2 | 18.5 | 25 | 76 | 75 |
| ARA386-02200T2 | 22 | 30 | 92 | 90 |
| ARA386-03000T2 | 30 | 40 | 113 | 110 |
| ARA386-03700T2 | 37 | 50 | 157 | 152 |
| ARA386-04500T2 | 45 | 60 | 180 | 176 |
| ARA386-05500T2 | 55 | 75 | 214 | 210 |
| ARA386-07500T2 | 75 | 100 | 307 | 304 |
| 3AC 380V±15% | | | | |
| ARA386-00075T4 | 0.75 | 1 | 3.4 | 2.8 |
| ARA386-00150T4 | 1.5 | 2 | 5 | 4.4 |
| ARA386-00220T4 | 2.2 | 3 | 6.5 | 5.8 |
| ARA386-00400T4 | 4.0 | 5 | 11 | 10 |
| ARA386-00550T4 | 5.5 | 7.5 | 14.6 | 13 |
| ARA386-00750T4 | 7.5 | 10 | 20.5 | 17 |
| ARA386-01100T4 | 11 | 15 | 26 | 25 |

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| | | | | |
|---|---|---|---|---|
| ARA386-01500T4 | 15 | 20 | 35 | 32 |
| ARA386-01850T4 | 18.5 | 25 | 38.5 | 37 |
| ARA386-02200T4 | 22 | 30 | 46.5 | 45 |
| ARA386-03000T4 | 30 | 40 | 62 | 60 |
| ARA386-03700T4 | 37 | 50 | 76 | 75 |
| ARA386-04500T4 | 45 | 60 | 92 | 90 |
| ARA386-05500T4 | 55 | 75 | 113 | 110 |
| ARA386-07500T4 | 75 | 100 | 157 | 152 |
| ARA386-09000T4 | 90 | 125 | 180 | 176 |
| ARA386-11000T4 | 110 | 150 | 214 | 210 |
| ARA386-13200T4 | 132 | 175 | 260 | 253 |
| ARA386-16000T4 | 160 | 210 | 310 | 304 |
| ARA386-18500T4 | 185 | 250 | 365 | 350 |
| ARA386-20000T4 | 200 | 260 | 385 | 380 |
| | | | | |
| ARA386-22000T4 | 220 | 300 | 430 | 426 |
| ARA386-25000T4 | 250 | 330 | 485 | 465 |
| ARA386-28000T4 | 280 | 370 | 531 | 520 |
| ARA386-31500T4 | 315 | 420 | 620 | 585 |
| ARA386-35500T4 | 350 | 470 | 665 | 650 |
| ARA386-40000T4 | 400 | 530 | 785 | 725 |
| ARA386-45000T4 | 450 | 600 | 880 | 820 |

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## 2.3 Technical Specifications

| Item | Technical Index | Specification |
|---|---|---|
| Input | Input voltage | 1AC/3AC 220V±15%, 3AC 460V±15% |
| | Input frequency | 50/60Hz±5% |
| Control functions | Output voltage | 0～rated input voltage |
| | Output frequency | 0~600Hz |
| | Operation command mode | Keypad control<br>Terminal control<br>Serial communication control (Modbus) |
| | Overload capacity | 150% / 60s, 180% / 10s, 200% / 1s. |
| | Built-in PID | Built-in PID control function, special for constant pressure water supply. |
| Input/output terminals | Input terminals | Programmable digital input: 5 multifunctional inputs<br>2 programmable analog input:<br>　VI: 0～10V<br>　CI: 4～20mA |
| | Output terminals | Refer to typical wiring for details |
| | Communication terminals | RS485 communication interface, support MODBUS-RTU communication protocol |
| Display | LED display | Display frequency setting, output frequency, output voltage, output current, etc.<br>Two lines display. |
| Environment | Ambient temperature | -10℃～40℃, without direct sunshine. |
| | Humidity | 90%RH or less (non-condensing) |
| | Altitude | ≤1000M: output rated power, ＞1000M: output derated. |
| | Storage temperature | -20℃～60℃ |

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## 2.4 External and keypad dimensions

### 2.4.1 ARA388
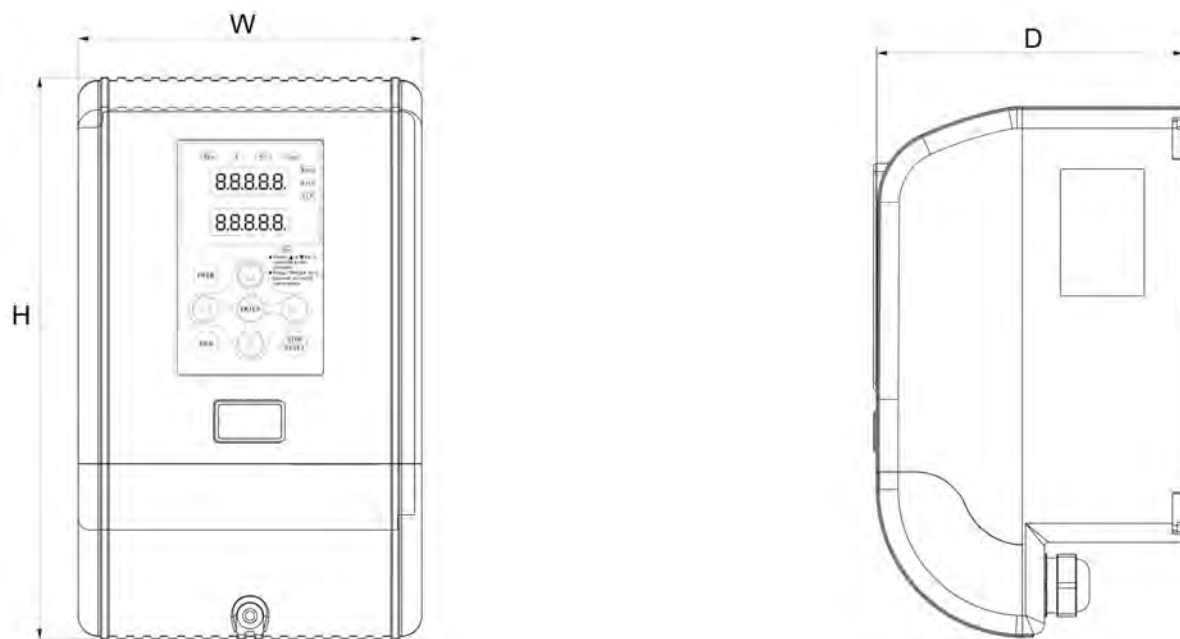


Unit (mm)

| Model | W | H | D |
|---|---|---|---|
| ARA388-00040S2 | 120 | 196.2 | 112.1 |
| ARA388-00075S2 | | | |
| ARA388-00150S2 | | | |
| ARA388-00220S2 | | | |
| ARA388-00075T4 | | | |
| ARA388-00150T4 | | | |
| ARA388-00220T4 | | | |
| ARA388-00400T4 | 150 | 241 | 142.5 |
| ARA388-00550T4 | | | |
| ARA388-00750T4 | | | |

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## 2.4.2 ARA386 (0.75~2.2kW)
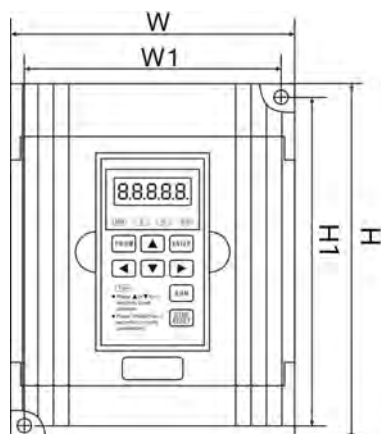


Front view
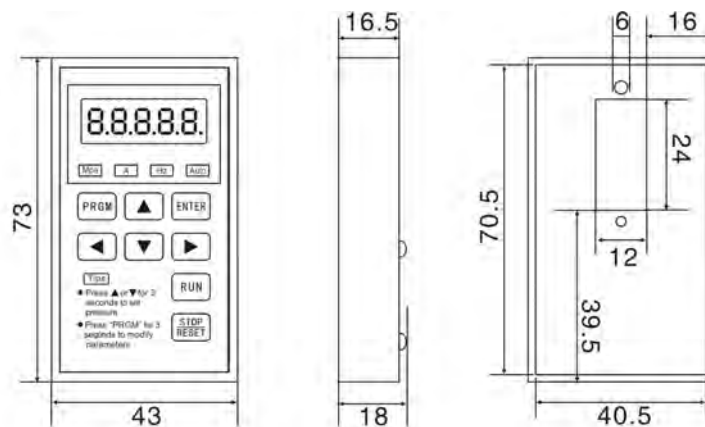
Dimensions of keypad

Side view
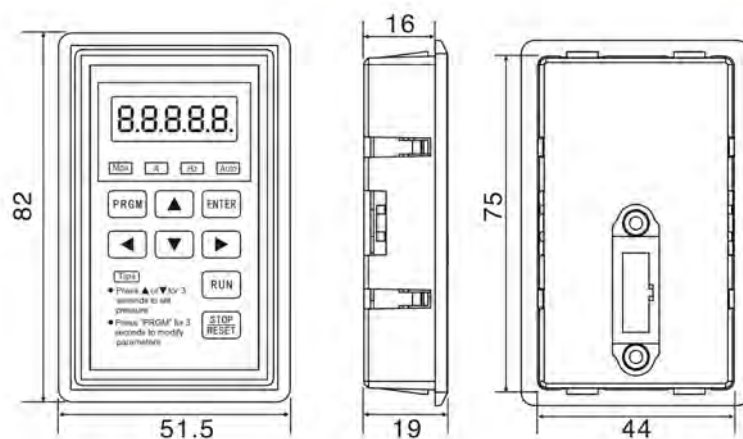
Dimensions of keypad bracket

Unit (mm)

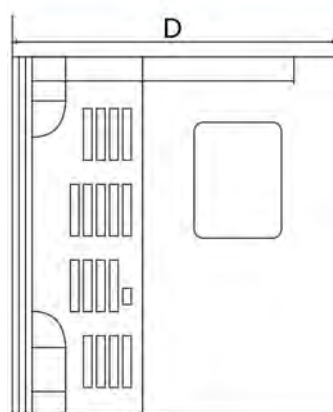| Model | W | W1 | H | H1 | D |
|---|---|---|---|---|---|
| ARA386-00040S2 | 85.5 | 74 | 142 | 132 | 113 |
| ARA386-00075S2 | | | | | |
| ARA386-00150S2 | | | | | |
| ARA386-00220S2 | 101 | 92 | 152 | 143 | 117 |
| ARA386-00075T2 | | | | | |
| ARA386-00150T2 | | | | | |
| ARA386-00220T2 | | | | | |
| ARA386-00075T4 | | | | | |
| ARA386-00150T4 | | | | | |
| ARA386-00220T4 | | | | | |
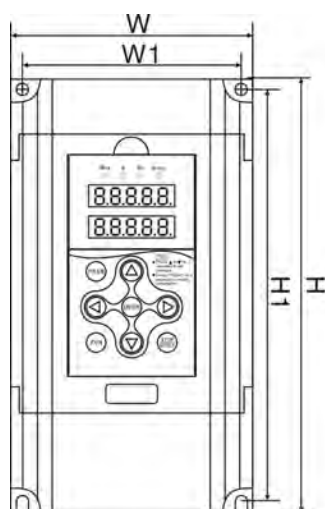
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### 2.4.3 ARA386 (4.0~7.5kW)

Front view
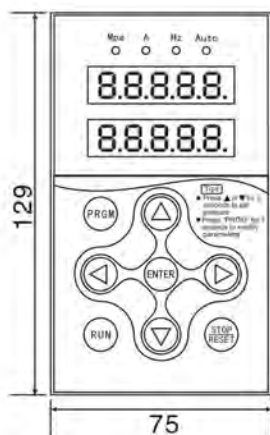
Dimensions of keypad
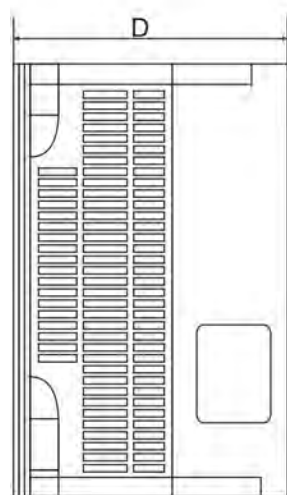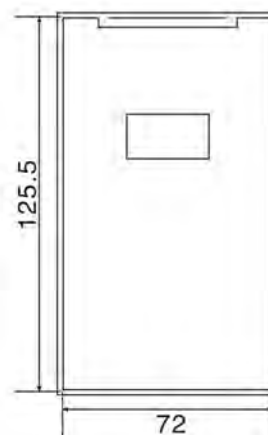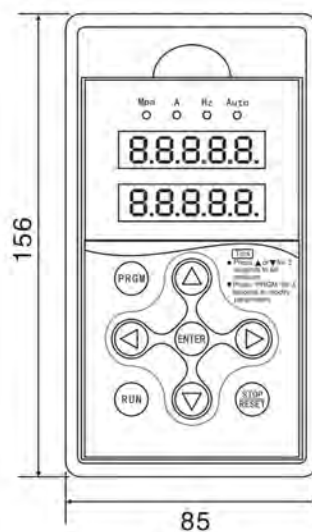
Side view

Dimensions of keypad bracket
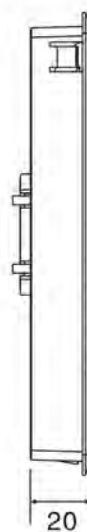
Unit (mm)

| Model | W | W1 | H | H1 | D |
|-------|---|----|---|----|---|
| ARA386-00400S2 | 130 | 115 | 264 | 244 | 153.5 |
| ARA386-00400T2 | | | | | |
| ARA386-00400T4 | | | | | |
| ARA386-00550T4 | | | | | |
| ARA386-00750T4 | | | | | |

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## 2.4.4 ARA386 (≥11kW)
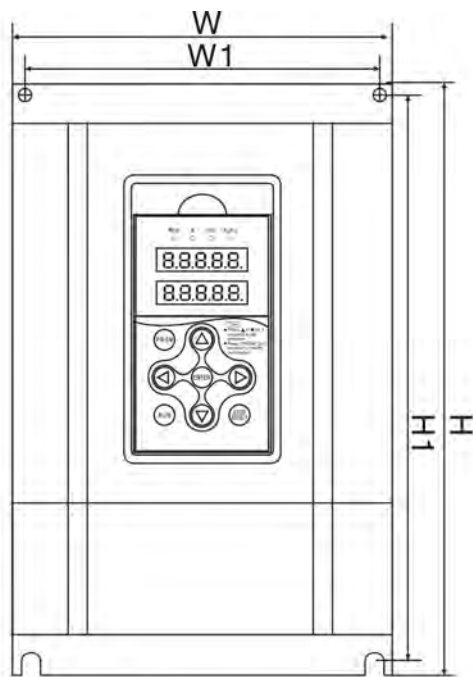


Front view
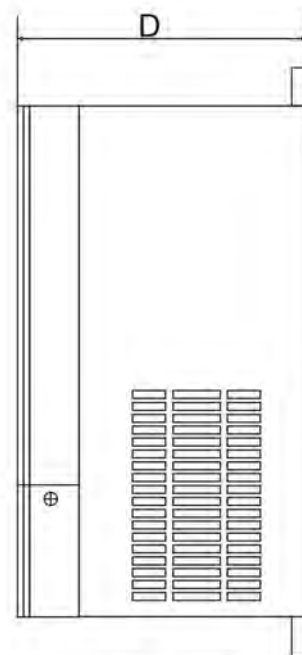
Side view
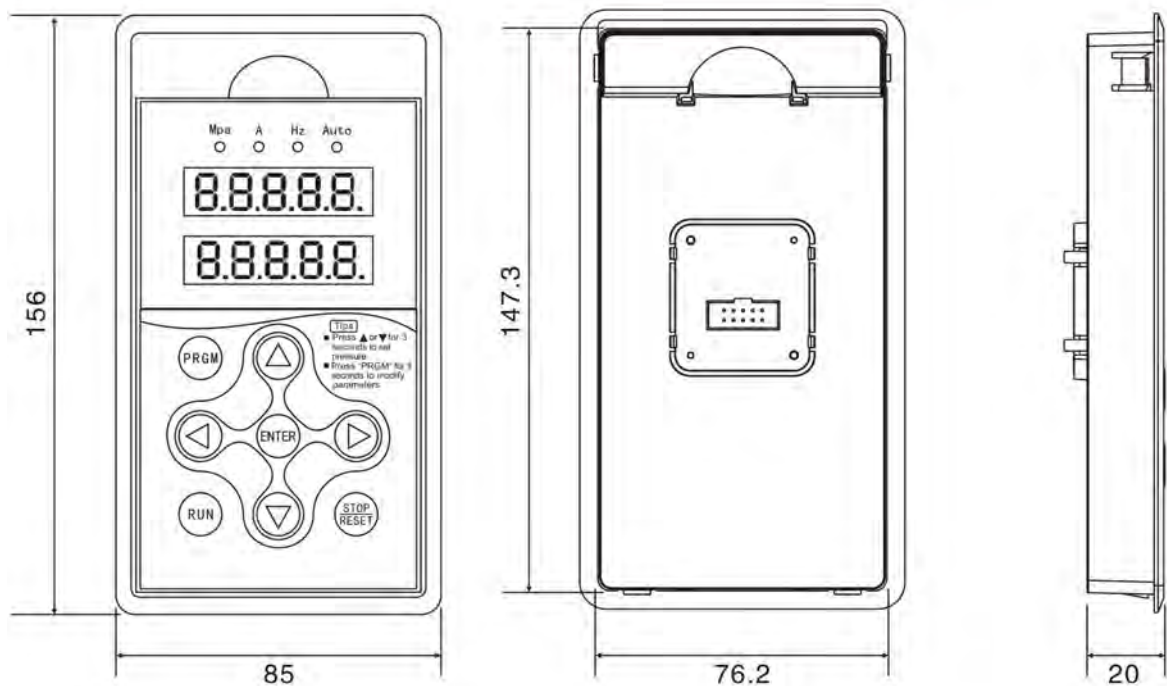


Dimensions of keypad bracket

Unit (mm)

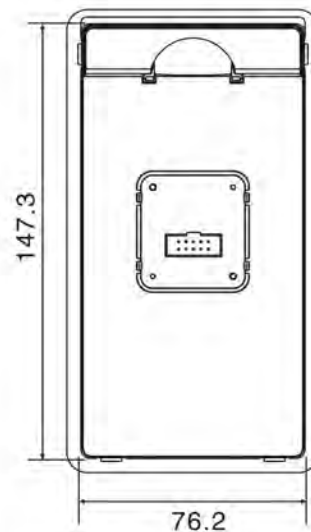| Model | W | W1 | H | H1 | D | Aperture |
|---|---|---|---|---|---|---|
| ARA386-00550S2 | 210 | 160 | 375 | 362.5 | 196 | 7 |
| ARA386-00550T2 | | | | | | |
| ARA386-00750T2 | | | | | | |
| ARA386-01100T4 | | | | | | |
| ARA386-01500T4 | | | | | | |
| ARA386-01850T4 | | | | | | |
| ARA386-01100T2 | 285 | 238 | 440 | 424 | 206 | 9 |
| ARA386-01500T2 | | | | | | |
| ARA386-01850T2 | | | | | | |
| ARA386-02200T4 | | | | | | |
| ARA386-03000T4 | | | | | | |
| ARA386-03700T4 | | | | | | |
| ARA386-02200T2 | 385 | 260 | 600 | 580 | 267.7 | 10 |
| ARA386-03000T2 | | | | | | |
| ARA386-04500T4 | | | | | | |
| ARA386-05500T4 | | | | | | |
| ARA386-03700T2 | 413 | 293 | 659 | 635 | 327 | 12 |
| ARA386-04500T2 | | | | | | |
| ARA386-07500T4 | | | | | | |
| ARA386-09000T4 | | | | | | |
| ARA386-05500T2 | 480 | 369 | 849 | 822.5 | 389 | 12 |
| ARA386-07500T2 | | | | | | |
| ARA386-11000T4 | | | | | | |
| ARA386-13200T4 | | | | | | |
| ARA386-16000T4 | | | | | | |
| ARA386-18500T4 | 650 | 420 | 1060 | 1030 | 380.5 | 12 |
| ARA386-20000T4 | | | | | | |
| ARA386-22000T4 | | | | | | |
| ARA386-25000T4 | | | | | | |
| ARA386-28000T4 | | | | | | |
| ARA386-31500T4 | 800 | 520 | 1361.5 | 1300 | 393 | 16 |
| ARA386-35500T4 | | | | | | |
| ARA386-40000T4 | | | | | | |
| ARA386-45000T4 | | | | | | |

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# Chapter 3 Installation and wiring

## 3.1 System wiring connection
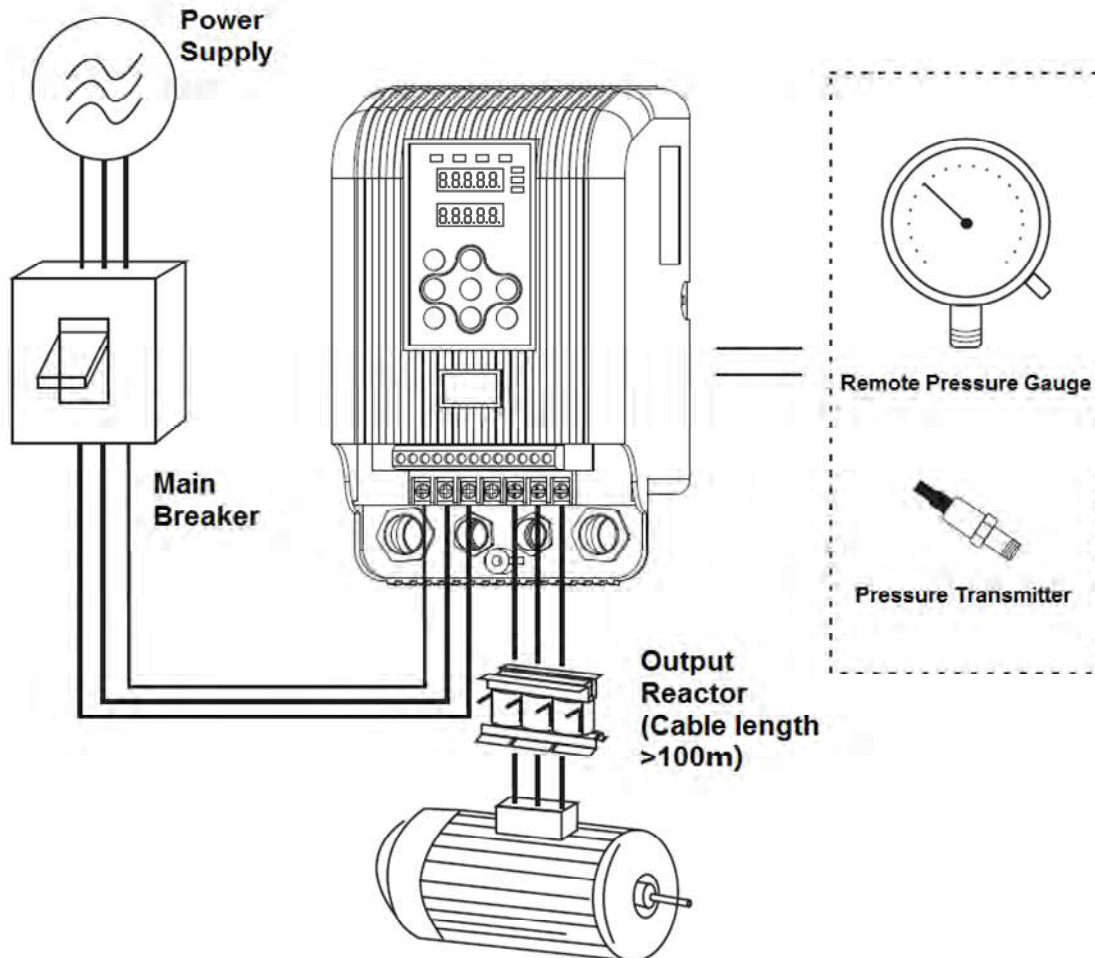


(1) ARA388/KD386 build-in a lightning protection device, it will be self-protected for induction thunder. But for some special places where the thunder happens very frequently, it is better to add an additional lighting protection device.

(2) If the installation place's altitude is higher than 1000m, the output power of ARA388/ARA386 will be derated.

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## 3.2 Installation

1, ARA388 is designed to install on the water pump directly, it has the below two installation types:
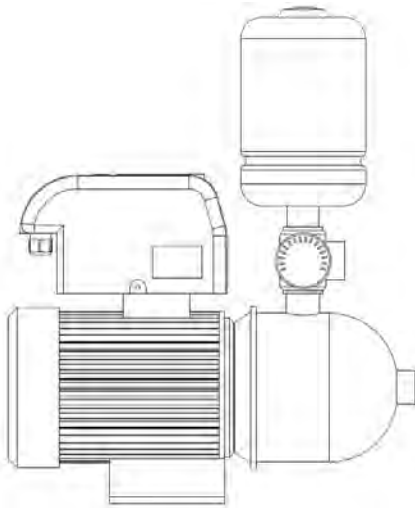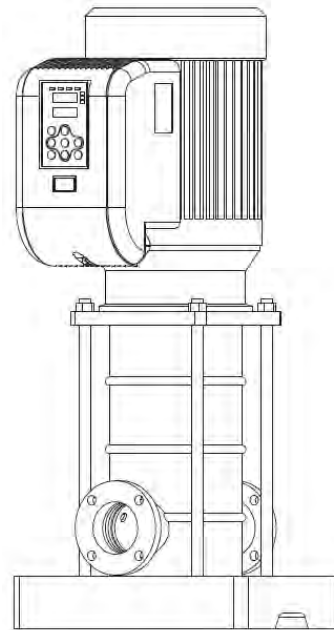


Horizontal type                                                                 Vertical type

2, ARA386 is designed to install on the wall or in the control cabinet.
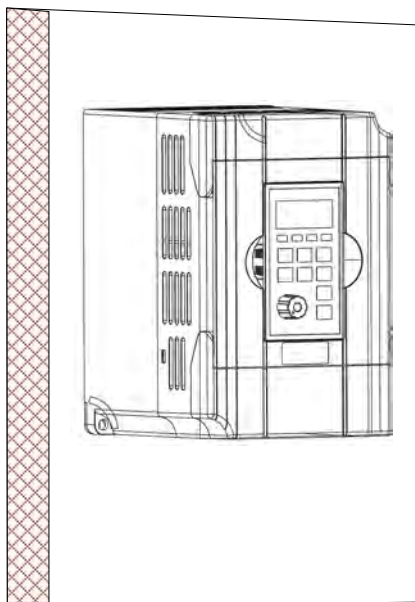


On the wall                                                    In the control cabinet

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## 3.3 ARA388 disassemble and install diagram



① Remove the fix screw

② Draw out the bottom plate

③ Fix the screws of bottom plate and pump

④ Fix KD388 with the bottom plate

Horizontal type pump

③ Fix the screws of bottom plate and pump

④ Fix KD388 with the bottom plate

Vertical type pump
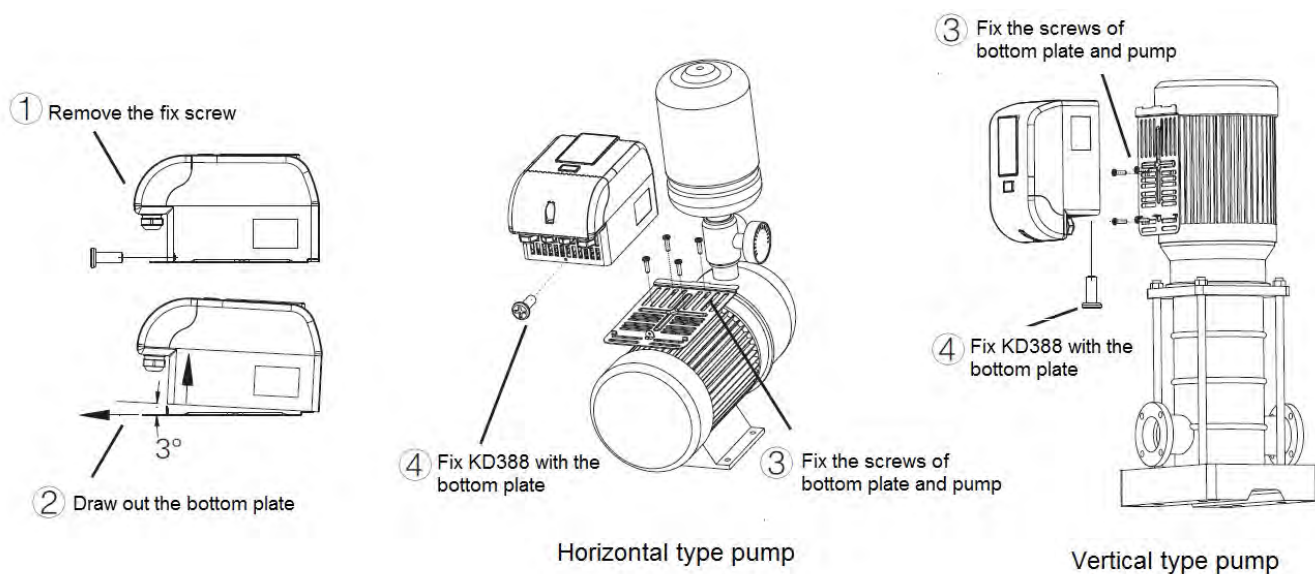
## 3.4 Typical diagram

### 3.4.1 ARA388



Power supply 1AC/3AC)

MCB

R
S
T

P    PB

U
V
W
E

M

Multi-functional Input 1

Multi-functional Input 2

MI1
MI2
GND

10V
VI (0~10V)
GND

Remote pressure gauge

24V
CI (4~20mA)
GND

ressure  transducer

TA
TB
TC

NO
NC

Relay output

24V
MO1
GND

Open collector output

S+
S-

RS485 (Modbus)

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## 3.4.2 ARA386 (0.4~7.5kW)



**MCB**

Power supply AC/3AC) — R, S, T

P  PB

U, V, W, E — M

Multi-functional Input 1 — MI1
Multi-functional Input 2 — MI2
Multi-functional Input 3 — MI3
GND

TA, TB, TC — Relay output (NO / NC)

10V
VI (0~10V)
GND

Remote pressure gauge

24V
CI (4~20mA)
GND

ressure transducer

24V
MO1 — Open collector output 1
GND
MO2 — Open collector output 2
GND
MO3 — Open collector output 3
GND
MO4 — Open collector output 4
GND

S+
S- — RS485 (Modbus)

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### 3.4.3 ARA386 (≥11kW)



## 3.5 Instructions of main circuit terminals

| Terminal | Description |
| --- | --- |
| R, T | Connect to single-phase AC power |
| R, S, T | Connect to three-phase AC power |
| (+), (-) | Reserved terminals for external brake unit (>18.5kW) |
| P, PB | Reserved terminals for braking resistor (0.4kW~7.5kW) |
| (+), PB | Reserved terminals for braking resistor (11kW~18.5kW) |
| P1, (+) | Reserved terminals for external DC reactor |
| U, V, W | Connect to three phase motor |
| ⏚ | Ground connection terminal |

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## 3.6 Description of Control Terminals Function

| Type | Terminal Symbol | Terminal Name | Function Description |
|---|---|---|---|
| Power Supply | 10V | 10V power supply | Provide +10V power supply for external units, and the maximum output current is 100mA. |
| | 24V | 24V power supply | Provide +24V power supply for external units. It is generally used as the operating power supply for the external pressure transducer.<br>The maximum output current is 150mA. |
| Analog Input | VI | Analog input terminal 1 | 1. Input range: DC 0V~10V.<br>2. Input impedance: 6.8kΩ. |
| | CI | Analog input terminal 2 | 1. Input range: 4mA~20Ma<br>2. Input impedance: 500Ω. |
| | GND | Zero potential | Zero potential reference of 10V and 24V (≤7.5kW) |
| | ACM | Zero potential | Zero potential reference of 10V (≤7.5kW) |
| | DCM | Zero potential | Zero potential reference of 24V ( > 7.5kW) |
| Digital Input | MI1 | Digital input 1 | 1. Optical coupling isolation, compatible with dual polarity input<br>2. Input impedance: 2.4kΩ<br>3. Voltage range for level input: 9V～30V |
| | MI2 | Digital input 2 | |
| | MI3 | Digital input 3 | |
| | MI4 | Standby | |
| | MI5 | Standby | |
| Digital Output | MO1 | | Correspond common terminal is GND (≤7.5kW).<br>Correspond common terminal is DCM ( > 7.5kW).<br>External connection voltage range: 0~24V<br>Output current range: 0mA~50mA |
| | MO2 | | |
| | MO3 | | |
| | MO4 | | |
| Relay Output 1 | TB-TC | Normally close terminal | Driving capacity:<br>AC 250V/3A,<br>DC 30V/1A |
| | TB-TA | Normally open terminal | |
| Relay Output 2 | TA1-TB1 | Normally open terminal | Driving capacity:<br>AC 250V/3A<br>DC 30V/A |
| RS485 | S+ | RS485+ | Communication interface of Modbus, it is suggested to use twisted-pair cable or shielded cable. |
| | S- | RS485- | |

ARA Booster Systems

## 3.7 Principle of wiring connection

### (1) Power cables

◆ Please select the cables size (diameter) properly based on the power rating, current and electrician standard.

◆ It is suggested to install a MCB (Main Circuit Breaker) between power supply and R, S, T terminals, and the MCB should not be interfered by high frequency signals.

◆ The power cables must keep safe distance with control cables, don't put them in one wire casing.

◆ Never connect the power supply to U, V, W terminals.

◆ The output power cables cannot touch any point of frequency inverter's metal case, otherwise it will cause grounding short-circuited.

◆ The power cables must keep safe distance with other devices.

◆ If the cables' length between motor and frequency inverter is longer than 50 meters (220V inverter) or 100 meters (380V inverter), it must install an additional output reactor in the system.

◆ If the cables' length between motor and frequency inverter is long, please reduce the carrier frequency, if the carrier frequency is bigger, the leakage current of higher harmonic on the cable will be bigger, which will bring bad effect to frequency inverter and other devices.

### (2) Control cables

◆ Don't put the power cables and control cables in one wire casing, otherwise it will cause interferences.

◆ Please use shield cables for control circuit, and it is suggested to use $1mm^2$ shield cables.

◆ Don't make the analog signal cables' length longer than 20 meters.

ARA Booster Systems
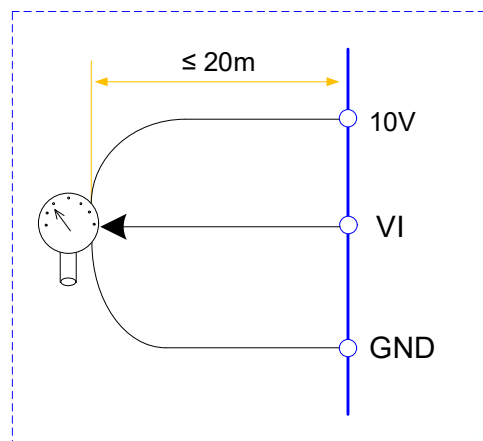
**(3) Ground connection**

◆ The grounding resistor should be less than 100 Ω.

◆ The grounding cables length is the shorter the better.

◆ Please don't make frequency inverters' grounding point separated with other big power equipment (like electric welder and other large-scale mechanical devices)

◆ Please make correct grounding as below diagram
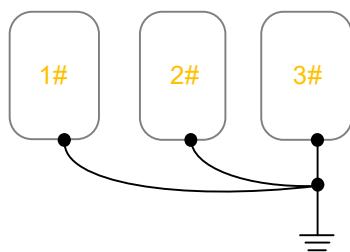


A: Correct ✓  B: Wrong ✗  C: Wrong ✗

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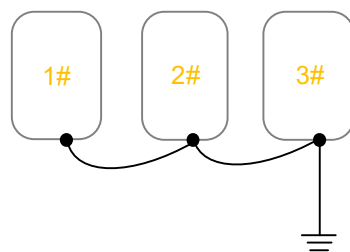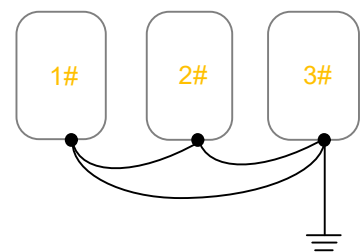
# Chapter 4 Keypad operation instruction

## 4.1 diagram of keypad

### 4.1.1. ARA388 keypad



### 4.1.2 ARA386 keypad



0.75~2.2kW                                    ≥4kW

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## 4.2 functions description of keypad

| Button | Name | Function |
|---|---|---|
| PRGM | Programming key | Entry and exit of primary menu |
| ENTER | Confirmation key | Progressively enter menu, and confirm parameters |
| RUN | Run key | Start ARA388/ARA386 under keyboard control mode （F1-00=0） |
| STOP RESET | Stop / Reset | Stop ARA388/ARA386 in running status and reset operation in fault alarm status. |
| ▲ | Increase key | Increase the setting value or function codes |
| ▼ | Decrease key | Decrease the setting value or function codes |
| ◀ | Left shift key | Left shift while parameters changing, shift the parameters display on main LED (Top LED) |
| ▶ | Right shift key | Right shift while parameters changing, shift the parameters display on main LED (Top LED) |

## 4.3 Functions description of indicators

| Indicators | Function |
|---|---|
| Mpa | When LED display the pressure of pipe line, the indicator will light-on |
| A | When LED display the output current, the indicator will light-on |
| Hz | When LED display the running frequency, the indicator will light-on |
| Auto | Light-on: Auto operation mode    light flicker: stand by |
| Com | When multiple KD388 inter connected successfully, the indicator will light-on |
| Manu | ARA388 under Manual operation mode |
| SLP | ARA388 under sleep mode |

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## 4.4 Operation

### 4.4.1 Brief introduction

ARA388/ARA386 has 8 operation buttons on the keypad; customers can achieve system monitoring, parameters modification easily.

Under auto operation mode, press [▲] or [▼] button for more than 3 seconds to set the target pressure, press [◄] or [►] button can shift different display of real time pressure, current etc.

Under manual operation mode, press [▲] or [▼] button can change the running frequency.

### 4.4.2 Operation example
To change F0-24=1 (Restore factory setting)

| Operation process | LED display | |
|---|---|---|
| | Main LED (UP) | Slave LED (DOWN) |
| Before operation | 0.00 | 0.000 |
| Press "PRGM" button for 3 seconds | F0 | |
| Press "ENTER" | F0-00 | 1 |
| Press [▲] button to F0-24 | F0-24 | 0 |
| Press "ENTER" to read | 0 | 0 |
| Press [▲] to 1 | 1 | 0 |
| Press "ENTER" to confirm | F0-00 | 1 |
| Press "PRGM" button two times to return back | 0.00 | 0.000 |

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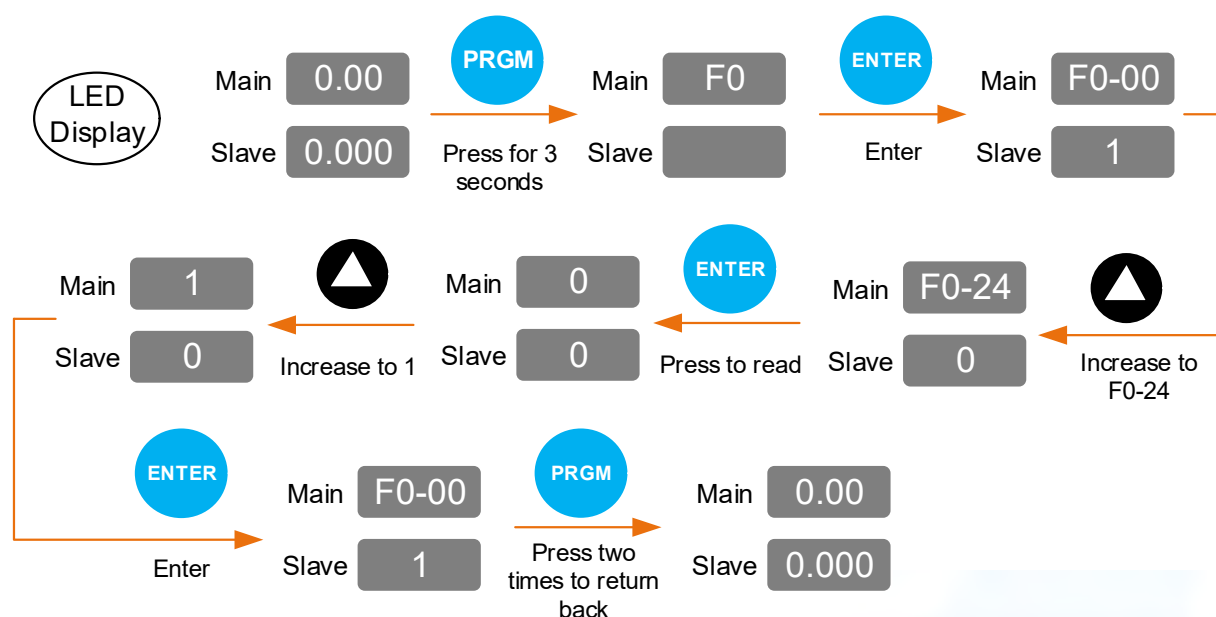
# Chapter 5 Function Parameter List

"○" Means the parameter can be modified at stop and running status.

"◎" Means the parameter cannot be modified at the running status.

"●" Means the parameter is the real detection value which cannot be modified.

| Function code | Name | Detailed instruction | Factory default | Modify |
|---|---|---|---|---|
| **F0 Group: Basic Functions** | | | | |
| F0-00 | Operation mode | 0: Manual: ARA388/ARA386 can be operated manually<br>1: Single pump system<br>2: Multiple pumps system<br>3: General: ARA388/ARA386 is used as a general frequency inverter | 1 | ◎ |
| F0-01 | Setting pressure | **Range**: F0-07~F0-05<br>Set the real requested pressure, the unit is Mpa, 1Mpa=10bar. | 0.4Mpa | ○ |
| F0-02 | Pump wake-up pressure | **Range:** 0.0%~100.0%<br>It is the percentage of setting frequency (F0-01).<br>For example, if F0-01=0.5Mpa, and set F0-02=90%, that means the wake up pressure is 0.45Mpa. | 80.0% | ○ |
| F0-03 | Pressure feedback channel | **0**: 0~10V, voltage signal, it is usually connect with remote pressure gage;<br>**1**: 4~20Ma, current signal, connect with pressure transducer. | 0 | ◎ |
| F0-04 | Maximum measure range of pressure transducer | **Range:** 0.000~6.000Mpa<br>Set it according to the real pressure transducer's measure range.<br>**Note:** it must be set correctly, otherwise, may cause the water supply pressure incorrect. | 1.600MPa | ◎ |

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| Function code | Name | Detailed instruction | Factory default | Modify |
|---|---|---|---|---|
| F0-05 | Upper limitation pressure | Range: F0-01~F0-04<br>While the pipe line pressure higher than this value, ARA388/ARA386 will stop, it is used to protect the pressure transducer. | 1.5MPa | ◎ |
| F0-06 | Time delay of upper limitation pressure | **Range:** 0~6000s<br>Response time of upper limitation pressure, set 0 to disable this protection. | 3s | ○ |
| F0-07 | Lower limitation pressure | Range: 0.000~F0-01<br>While the pipe line pressure less than this value, ARA388/ARA386 stops.<br>To check whether the pipe line is broken. | 0.05Mpa | ◎ |
| F0-08 | Time delay of lower limitation pressure | **Range:** 0~6000s<br>Response time of lower limitation pressure, set 0 to disable this protection. | 300s | ○ |
| F0-09 | Lack of water protection | 0~1000s<br>0: No protection | 60s | ◎ |
| F0-10 | Motor rated current | 0.1~1000.0kW | Model depend | ◎ |
| F0-11 | Motor rated current | 0.01~655.35A (≤55kW)<br>0.1~6553.5A　(＞55kW) | Model depend | ◎ |
| F0-12 | Pressure calibration | Range: 0.000~1.000<br>To adjust the difference between pressure gauge and ARA388/ARA386 displays pressure. If display pressure bigger than real pressure, it needs to reduce this value. Vice versa. | 0.500 | ○ |
| F0-13 | Acceleration time | 0.1~6500.0s | Model depend | ○ |
| F0-14 | Deceleration time | 0.1~6500.0s | Model depend | ○ |

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| Function code | Name | Detailed instruction | Factory default | Modify |
|---|---|---|---|---|
| F0-15 | Pressure maintaining detection time | 3~6000s | 30s | ○ |
| F0-16 | Pressure maintaining detection coefficient | 0: Disable<br>1~10: Increase this value will get faster pressure maintaining response. | 2 | ○ |
| F0-17 | Dormancy frequency | 0.00 ~ F1-23 | 30.00Hz | ○ |
| F0-18 | Auto-reset times of pressure abnormal | 0 ~ 1000<br>Auto-reset times of pressure abnormal.<br>Set 0 means no auto-reset, set 1000 means no times limitation of auto-reset. | 1000 | ○ |
| F0-19 | Interval of pressure abnormal auto-reset | 0~60000min<br>Pressure abnormal recovery time | 10min | ○ |
| F0-20 | Time delay of rust-proof (freeze-proof) | 3~60000min | 1500min | ○ |
| F0-21 | Rust-proof (freeze-proof) duration | 0: Disable rust-proof (freeze-proof) function.<br>0~6000s | 10s | ○ |
| F0-22 | Running frequency of rust-proof (freeze-proof) | 0.00 ~ F1-23 | 30.00Hz | ○ |
| F0-23 | User password | 0000~9999 | 0000 | ○ |
| F0-24 | Parameters initialization | 0: no action<br>1: Initialize parameters to default setting | 0 | ◎ |
| F0-25 | Pumps alternate time | **Range:** 0~60000min<br>In multiple pumps system, when this pump needs to be alternated as master pump, F0-25 is to set the running time as master pump, when | 300min | ○ |

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| Function code | Name | Detailed instruction | Factory default | Modify |
|---|---|---|---|---|
| | | time arrive, it switches to next pump as master. When set F0-25=0, this pump will only work as slave pump. | | |
| **F1 Group: Control Parameters** | | | | |
| F1-00 | Running command source | 0: keypad<br>1: terminal (digital input signal)<br>2: communication (Modbus) | 0 | ○ |
| F1-01 | Selection of frequency source | 0: set by keypad [▲] and [▼] buttons<br>1: VI (0~10V)<br>2: CI (4~20mA)<br>3: communication (Modbus)<br>9: PID | 9 | ◎ |
| F1-02 | Running direction | 0: same direction<br>1: reverse direction | 0 | ○ |
| F1-03 | Stop mode | 0: deceleration to stop<br>1. coast to stop | 0 | ○ |
| F1-04 | Main LED display parameters | 0000~01FF<br>Bit00: running frequency<br>Bit01: DC Bus voltage<br>Bit02: output current<br>Bit03: setting pressure<br>Bit04: real time pressure<br>Bit05: current power-on time<br>Bit06: current running time<br>Bit07: temperature of KD388/KD386<br>Bit08: accumulated running time | 001D | ○ |
| F1-05 | Slave LED display parameters | 0: running frequency<br>1: DC Bus voltage<br>2: output current<br>3: setting pressure<br>4: real time pressure<br>5: current power-on time | 4 | ○ |

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| Function code | Name | Detailed instruction | Factory default | Modify |
|---|---|---|---|---|
| | | 6: current running time<br>7: temperature of ARA388/ARA386 8: accumulated running time | | |
| F1-06 | Protection of power supply voltage | 70.0%~100.0% | 100% | ○ |
| F1-07 | Fault auto-reset times | 0~20 | 3 | ○ |
| F1-08 | Fault auto-reset interval | 0.1~100.0s | 20.0s | ○ |
| F1-09 | Baud rate | 0: 300BPS     1: 600BPS<br>2: 1200BPS     3: 2400BPS<br>4: 4800BPS     5: 9600BPS<br>6: 19200BPS     7: 38400BPS<br>8: 57600BPS     9: 115200BPS | 5 | ○ |
| F1-10 | Data format | 0: No parity check (8-N-2)<br>1: Even parity check (8-E-1)<br>2: Odd parity check (8-O-1)<br>3: No parity check (8-N-1) | 0 | ○ |
| F1-11 | Address of this ARA388/ARA386 | Range: 1~4<br>In multiple pumps system,<br>Set 1 or 2, this pump will be master pump;<br>Set 3 or 4, this pump will be slave pump.<br>In one system, the addresses of different inveters cannot be set the same. | 1 | ○ |
| F1-12 | Communication delay time | 0ms ~ 20ms | 2ms | ○ |
| F1-13 | Communication timeout time | 0.0 (invalid)<br>0.1s ~ 60.0s | 0.0s | ○ |
| F1-14 | MI1 terminal function | 0: No function | 1 | ◎ |
| F1-15 | MI2 terminal function | 1: Forward (FWD) | 0 | ◎ |
| F1-16 | MI3 terminal function | 2: Reverse (REV) | 0 | ◎ |

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| Function code | Name | Detailed instruction | Factory default | Modify |
|---|---|---|---|---|
| F1-17 | Reserved | 3: Running command switch<br>4: Forward Jog (FJOG)<br>5: Reverse Jog (RJOG)<br>6: Terminal UP<br>7: Terminal DOWN<br>8: Coast to stop<br>9: Fault reset (RESET)<br>10: Pause running<br>11: External fault (normal open) input | 0 | ◎ |
| F1-18 | MO1 output function (Open collector output) | 0: No output<br>1: Inverter is running | 0 | ○ |
| F1-19 | Relay 1 output function (TA, TB, TC) | 2: Fault output<br>3: Zero-speed running | 2 | ○ |
| F1-20 | MO2 output function (Open collector output) | 4: Inverter is ready to run<br>5: VI ＞ CI | 0 | ○ |
| F1-21 | MO3 / Relay 2 (TAI, TB1) output function | 6: Frequency upper limit arrival<br>7: Dormancy frequency arrival | 0 | ○ |
| F1-22 | MO4 output function (Open collector output) | 8: Under voltage<br>9: Frequency 1 arrival<br>10: Frequency 2 arrival<br>11: Reverse running<br>12: Over temperature alarm<br>13: Fault output (output only fault stop)<br>14: Reserved<br>15: Output current over limit | 0 | |
| F1-23 | Frequency upper limit | 10.00~100.00Hz | 50.00Hz | ◎ |
| F1-24 | Carrier frequency | 0.5~15.0kHz | Model depend | ○ |
| F1-25 | Frequency detection value 1 | 0.00Hz~F1-23 | 50.00Hz | ○ |
| F1-26 | Frequency detection amplitude 1 | 0.0~100.0% | 0.0% | ○ |

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| Function code | Name | Detailed instruction | Factory default | Modify |
|---|---|---|---|---|
| F1-27 | Frequency detection value 2 | 0.00Hz~F1-23 | 0.00Hz | ○ |
| F1-28 | Frequency detection amplitude 2 | 0.0~100.0% | 0.0% | ○ |
| F1-29 | MO1 output delay time | 0.0s~3600.0s | 0.0s | ○ |
| F1-30 | Relay 1 (TA, TB, TC) output delay time | 0.0s~3600.0s | 0.0s | ○ |
| F1-31 | MO2 output delay time | 0.0s~3600.0s | 0.0s | ○ |
| F1-32 | MO3 / Relay 2 (TAI, TB1) output delay time | 0.0s~3600.0s | 0.0s | ○ |
| F1-33 | MO4 output delay time | 0.0s~3600.0s | 0.0s | ○ |
| F1-34 | Output terminal valid status selection | 0: positive logic<br>1: negative logic<br>Unit bit: MO1<br>Tens bit: relay 1<br>Hundreds bit: MO2<br>Thousand bit: MO3 / relay 2<br>Ten thousand bit: MO4 | 00000 | ○ |
| F1-35 | Pre-set frequency of manual operation mode | 0.00Hz~F1-23 | 20.00Hz | ○ |
| F1-36 | Auto restart selection after power recovery | 0: No action<br>1: Auto restart | 1 | ◎ |
| **F2 Group: Fault record** | | | | |
| F2-00 | The first fault type | | ― | ● |
| F2-01 | The second fault type | | ― | ● |
| F2-02 | The third (latest) fault type | | ― | ● |
| F2-03 | Frequency at the third (latest) fault | ― | ― | ● |

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| Function code | Name | Detailed instruction | Factory default | Modify |
|---|---|---|---|---|
| F2-04 | Current at the third (latest) fault | — | — | ● |
| F2-05 | DC Bus voltage at the third (latest) fault | — | — | ● |
| F2-06 | Input terminal's status at the third (latest) fault | — | — | ● |
| F2-07 | Output terminal's status at the third (latest) fault | — | — | ● |
| F2-08 | ARA388/386 status at the third (latest) fault | — | — | ● |
| F2-09 | Power-on time at the third (latest) fault | — | — | ● |
| F2-10 | Running time at the third (latest) fault | — | — | ● |
| F2-11 | Frequency at the second fault | — | — | ● |
| F2-12 | Current at the second fault | — | — | ● |
| F2-13 | DC Bus voltage at the second fault | — | — | ● |
| F2-14 | Input terminal's status at the second fault | — | — | ● |
| F2-15 | Output terminal's status at the second fault | — | — | ● |
| F2-16 | ARA388/386 status at the second fault | — | — | ● |
| F2-17 | Power-on time at the second fault | — | — | ● |
| F2-18 | Running time at the second fault | — | — | ● |
| F2-19 | Frequency at the first fault | — | — | ● |

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| Function code | Name | Detailed instruction | Factory default | Modify |
|---|---|---|---|---|
| F2-20 | Current at the first fault | — | — | ● |
| F2-21 | DC Bus voltage at the first fault | — | — | ● |
| F2-22 | Input terminal's status at the first fault | — | — | ● |
| F2-23 | Output terminal's status at the first fault | — | — | ● |
| F2-24 | ARA388/386 status at the first fault | — | — | ● |
| F2-25 | Power-on time at the first fault | — | — | ● |
| F2-26 | Running time at the first fault | — | — | ● |
| **U0 Group: Monitoring Parameters** | | | | |
| U0-00 | Running frequency | | Hz | ● |
| U0-01 | DC bus voltage | | V | ● |
| U0-02 | Output current | | A | ● |
| U0-03 | Setting pressure | | MPa | ● |
| U0-04 | Real time feedback pressure | | MPa | ● |
| U0-05 | Power-on time | | Min | ● |
| U0-06 | Running time | | Min | ● |
| U0-07 | Temperature | | ℃ | ● |
| U0-08 | Accumulated running time | | Min | ● |

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# Chapter 6 MODBUS Communication Protocol

ARA388／ARA386 series inverter provides RS485 communication interface, and adopts MODBUS communication protocol. User can realize centralized monitoring through PC/PLC, host computer, and also can set inverter's operating commands, modify or read function parameters, read operating status and fault information, etc.

## 6.1 About Protocol

This serial communication protocol defines the transmission information and use format in the series communication. It includes the formats of master-polling, broadcast and slave response frame, and master coding method with the content including slave address (or broadcast address), command, transmitting data and error checking. The response of slave adopts the same structure, including action confirmation, returning the data and error checking etc. If slave takes place the error while it is receiving the information or cannot finish the action demanded by master, it will send one fault signal to master as a response.

## 6.2 Application Method

The inverter could be connected into a "Single-master & Multi-slaves" PC/PLC control network with RS485 bus.

## 6.3 Bus Structure

(1) Interface mode

   RS485

(2) Transmission mode

  There provide asynchronous series and half-duplex transmission mode. At the same time, just one can send the data and the other only receives the data between master and slave. In the series asynchronous communication, the data is sent out frame by frame in the form of message.

(3) Topological structure

  In Single-master Multi-slave system, the setup range of slave address is 0 to 247. 0 refers to broadcast communication address. The address of slave must be exclusive in the network. That is basic condition of MODBUS communication.

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**a.** Connect with PC

```
                    ┌─────────────────┐
                    │    Master: PC   │
                    └────────┬────────┘
                             │
                    ┌────────┴────────┐
                    │  RS232 / RS485  │
                    │    converter    │
                    └────────┬────────┘
```

| ARA388/386 (1#) | ARA388/386 (2#) | ARA388/386 (3#) | ...... | ARA388/386 (249#) |
|---|---|---|---|---|

**b.** Connect with PLC

```
        ┌─────────────────────────────┐
        │         Master: PLC         │
        │   (compatible with RS485)   │
        └──────────────┬──────────────┘
```

| ARA388/386 (1#) | ARA388/386 (2#) | ARA388/386 (3#) | ...... | ARA388/386 (249#) |
|---|---|---|---|---|
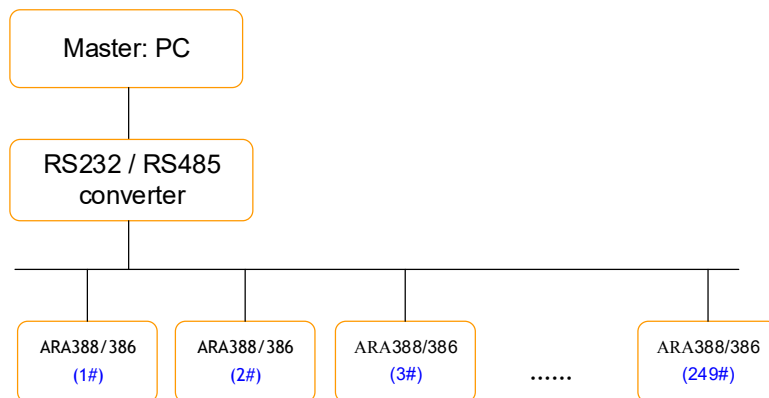
## 6.4 Interfaces and wiring connection

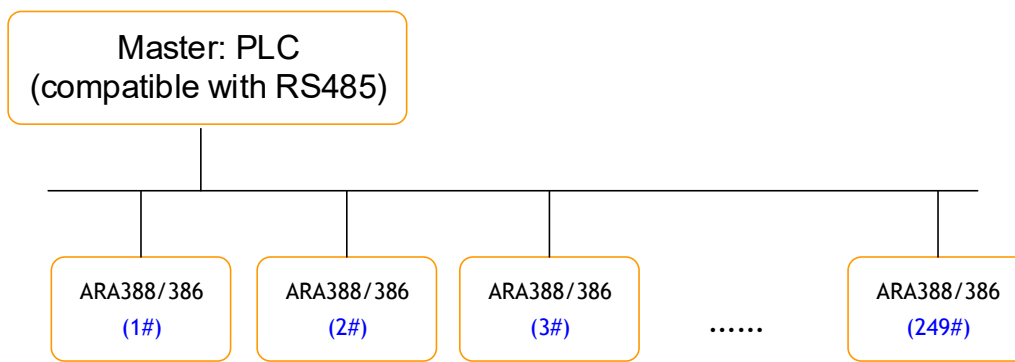ARA388/386 series inverter provides S+ and S- interfaces for Modbus communication.

There are two kinds of communication type suitable for Modbus connection;

(1) Daisy chain connection

| | S+ | S- | S+ | S- | S+ | S- | | S+ | S- |
|---|---|---|---|---|---|---|---|---|---|
| **485+    485-** | 120Ω | | | | | | | 120Ω | |
| **Master: PC / PLC** | **1#** | | **2#** | | **3#** | | ...... | **249#** | |
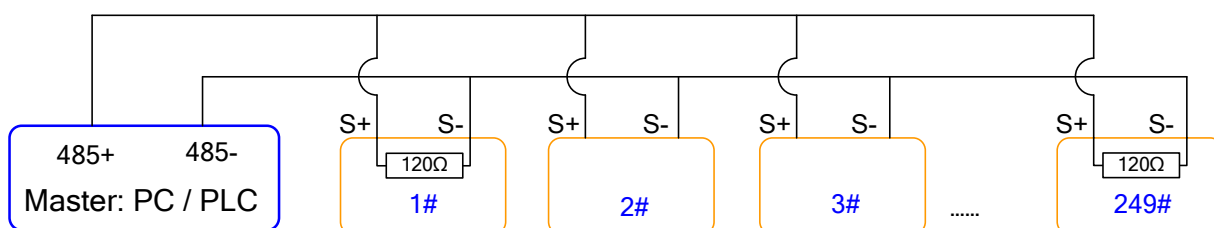
**Notice:** the **first one** and **last one inverters** should connect the terminal resistor.

(2) star connection
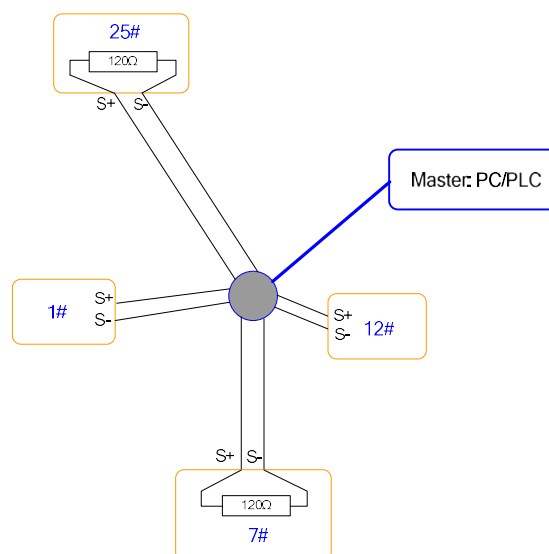


**Notice:** the **furthest one (25#)** and **second furthest one (7#)** inverters should connect the terminal resistor.

## 6.5 Protocol Description

ARA388/ARA386 series inverter communication protocol is a kind of asynchronous serial master-slave communication protocol. In the network, only one equipment (master) can build a protocol (Named as "Inquiry/Command"). Other equipment (slave) response "Inquiry/Command" of master only by providing the data, or doing the action according to the master's "Inquiry/Command". Here, master is Personnel Computer, Industrial control equipment or Programmable logical controller, and the slave is inverter or other communication equipment with the same communication protocol. Master not only can visit some slave separately for communication, but also sends the broadcast information to all the slaves. For the single "Inquiry/Command" of master, all of slaves will return a signal that is a response; for the broadcast information provided by master, slave needs not feedback a response to master.

## 6.6 Communication Data Structure

MODBUS protocol communication data format of ARA388/ARA386 series inverter is shown as below: In RTU mode, the Modbus minimum idle time between frames should be no less than 3.5 bytes. The checksum adopts CRC-16 method. All data except checksum itself sent will be counted into the calculation. Please refer to section: CRC Check for more information. Note that at least 3.5 bytes of Modbus idle time should be kept and the start and end idle time need not be summed up to it.

The entire message frame must be transmitted as a continuous data stream. If a idle time is more than 1.5 bytes before completion of the frame, the receiving device flushes the incomplete message and assumes that the next byte will be the address field of a new message. Similarly, if a new message begins earlier than 3.5 bytes interval following a previous message, the receiving device

will consider it as a continuation of the previous message. Because of the frame's confusion, at last the CRC value is incorrect and communication fault will occur.

RTU frame format:

| START | Transmission time of 3.5 bytes |
|---|---|
| Slave Address | Communication address : 0 to 249 |
| Command Code | 03H: Read slave parameters<br>06H: Write slave parameters |
| DATA (N-1) | Data: |
| DATA (N-2) | Function code parameter address, the number of function code parameter, Function code parameter, etc. |
| …… | |
| DATA 0 | |
| CRC Low byte | Detection Value: CRC value |
| CRC High byte | |
| END | Transmission time of 3.5 bytes |

## 6.7 Parameters address list

| Classification | Address | Parameters | Description |
|---|---|---|---|
| Function codes | F000H ~ F025H | F0-00 ~ F0-25 | F0 group parameters |
| | F100H ~ F136H | F1-00 ~ F1-36 | F1 group parameters |
| | F200H ~ F226H | F2-00 ~ F2-26 | F2 group parameters |
| | 7000H ~ 7008H | U0-00 ~ U0-08 | U0 group parameters |
| Control command<br>(Write only) | 2000H | 0001 | Forward run |
| | | 0002 | Reverse run |
| | | 0003 | Forward jog |
| | | 0004 | Reverse jog |
| | | 0005 | Coast to stop |
| | | 0006 | Decelerate to stop |
| | | 0007 | Fault reset |
| KD388/KD386 status<br>(Read only) | 3000H | 0001 | Forward running |
| | | 0002 | Reverse running |
| | | 0003 | Stop |
| Fault information<br>(Read only) | 8000H | 0000 | No fault |
| | | 0001 | Reserved |
| | | 0002 | Over current when acceleration |

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| | | 0003 | Over current when deceleration |
|---|---|---|---|
| | | 0004 | Over current when constant speed running |
| | | 0005 | Over voltage when acceleration |
| | | 0006 | Over voltage when deceleration |
| | | 0007 | Over voltage when constant speed running |
| | | 0008 | Reserved |
| | | 0009 | Under voltage |
| | | 000A | ARA388/386 Overload |
| | | 000B | Motor overload |
| | | 000C | Reserved |
| | | 000D | Output phase failure |
| | | 000E | IGBT overheat |
| | | 000F | External fault |
| | | 0010 | Communication fault |

Besides, due to EEPROM be frequently stored, it will reduce the lifetime of EEPROM. So in the communication mode, some function codes needn't be stored, only change the RAM value.

For F group parameters, to achieve this function, just change high bit F of the function code into 0.

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# Chapter 7 Troubles Shooting

## 7.1 Fault and Trouble Shooting

| Fault Name | Converter short circuit protection |
|---|---|
| Fault Code | **Err01** |
| Reason | 1. Short-circuit or ground fault occurred at inverter output side<br>2. The cable connecting the motor with the inverter is too long<br>3. The module is over-heat<br>4. The cable connections inside the inverter are loosen<br>5. The control board is abnormal<br>6. The power board is abnormal<br>7. The IGBT module is abnormal |
| Solution | 1. Inspect whether motor damaged, insulation worn or cable damaged<br>2. Install a reactor or output filter<br>3. Check if the air duct is blocked and if the fan is in normal status, and resolve the existing problems<br>4. Make sure the cables are connected well<br>5, 6, 7. Ask for technical support |

| Fault Name | Over current when acceleration |
|---|---|
| Fault Code | **Err02** |
| Reason | 1. Short-circuit or ground fault occurred at inverter output side<br>2. Control mode is vector control but don't perform auto-tuning<br>3. The acceleration time is too short<br>4. The manual torque boost or V/f curve is not proper<br>5. The voltage is too low<br>6. Start the running motor<br>7. Load is added suddenly during the acceleration<br>8. Power selection of inverter is too small |

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| | |
|---|---|
| Solution | 1. Inspect whether motor damaged, insulation worn or cable damaged<br><br>2. Identify the motor parameters<br><br>3. Increase the acceleration time<br><br>4. Adjust the manual torque boost or V/F curve<br><br>5. Make the voltage in the normal range<br><br>6. Select speed tracking start or start the motor till it stops<br><br>7. Cancel the sudden added load<br><br>8. Select bigger power inverter |

| | |
|---|---|
| Fault Name | Over current when deceleration |
| Fault Code | **Err03** |
| Reason | 1. Short-circuit or ground fault occurred at inverter output side<br><br>2. The deceleration time is too short<br><br>3. The voltage is too low<br><br>4. Load is added suddenly during the deceleration |
| Solution | 1. Inspect whether motor damaged, insulation worn or cable damaged<br><br>2. Increase the deceleration time<br><br>3. Make the voltage in the normal range<br><br>4. Remove the sudden added load |

| | |
|---|---|
| Fault Name | Over-current when constant speed running |
| Fault Code | **Err04** |
| Reason | 1. Short-circuit or ground fault occurred at inverter output<br><br>2. The voltage is too low<br><br>3. Load is added suddenly during running<br><br>4. Power selection of inverter is too small |
| Solution | 1. Inspect whether motor damaged, insulation worn or cable damaged<br><br>2. Make the voltage in the normal range<br><br>3. Remove the sudden added load<br><br>4. Select bigger power inverter |

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| Fault Name | Over-voltage when acceleration |
|---|---|
| Fault Code | **Err05** |
| Reason | 1. The input voltage is too high<br>2. There is and external force driving the motor to run during acceleration<br>3. The acceleration time is too short |
| Solution | 1. Make the voltage in the normal range<br>2. Remove the external force<br>3. Increase the acceleration time |

| Fault Name | Over-voltage when deceleration |
|---|---|
| Fault Code | **Err06** |
| Reason | 1. The input voltage is too high<br>2. There is an external force driving the motor to run during deceleration<br>3. The deceleration time is too short<br>4. Have not installed braking unit and braking resistor |
| Solution | 1. Make the voltage in the normal range<br>2. Remove the external force<br>3. Increase the deceleration time<br>4. Install braking unit and braking resistor |

| Fault Name | Over-voltage when constant speed running |
|---|---|
| Fault Code | **Err07** |
| Reason | 1. The input voltage is too high<br>2. There is external force driving the motor to run during the inverter running |
| Solution | 1. Make the voltage in the normal range<br>2. Remove the external force or install braking resistor |

| Fault Name | Power-supply fault |
|---|---|
| Fault Code | **Err08** |
| Reason | 1. The input voltage is out of range |
| Solution | 1. Make the voltage in the normal range |

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| Fault Name | Under-voltage |
|---|---|
| Fault Code | **Err09** |
| Reason | 1. Instantaneous power-off<br><br>2. The input voltage is out of range<br><br>3. DC Bus voltage is abnormal<br><br>4. The rectifier bridge and buffer resistor are abnormal<br><br>5. The power board is abnormal<br><br>6. The control board is abnormal |
| Solution | 1. Fault Reset<br><br>2, 3. Make the voltage in the normal range<br><br>4, 5, 6. ask for technical support |

| Fault Name | Inverter over load |
|---|---|
| Fault Code | **Err10** |
| Reason | 1. The load is too heavy or motor blockage occurs<br><br>2. Power selection of inverter is too small |
| Solution | 1. Reduce the load, check the status of motor & machinery<br><br>2. Select bigger power inverter |

| Fault Name | Motor over load |
|---|---|
| Fault Code | **Err11** |
| Reason | 1. F0-10 and F0-11 are set improperly<br><br>2. The load is too heavy or motor blockage occurs<br><br>3. Power selection of inverter is too small |
| Solution | 1. Set F0-10 and F0-11 properly<br><br>2. Reduce the load, check the status of motor & machinery<br><br>3. Select bigger power inverter |

| Fault Name | Reserved |
|---|---|
| Fault Code | **Err12** |

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| Fault Name | Output phase failure |
|---|---|
| Fault Code | **Err13** |
| Reason | 1. The connection between inverter and motor is abnormal<br>2. Output voltage unbalance during the motor running<br>3. The power board is abnormal<br>4. The IGBT module is abnormal |
| Solution | 1. Inspect whether motor damaged, insulation worn or cable damaged<br>2. Make sure the motor three phase winding is normal<br>3, 4. Ask for technical support |

| Fault Name | IGBT module over-heat |
|---|---|
| Fault Code | **Err14** |
| Reason | 1. Ambient temperature is too high<br>2. Air duct is blocked<br>3. Cooling fans are broken<br>4. Thermal resistor(temperature sensor) of the module is broken<br>5. IGBT module is broken |
| Solution | 1. Reduce the ambient temperature<br>2. Clear the air duct<br>3. Replace cooling fans<br>4, 5. Ask for technical support |

| Fault Name | External device fault |
|---|---|
| Fault Code | **Err15** |
| Reason | MI terminal receives an external fault signal generated by peripheral device |
| Solution | Find out the fault source, solve it and reset the inverter |

| Fault Name | Communication fault |
|---|---|
| Fault Code | **Err16** |
| Reason | 1. Master computer works abnormal<br>2. Communication cable is abnormal<br>3. Communication parameters (F1-09~F1-13) are set improperly |
| Solution | 1. Check the connection of master computer<br>2. Check the communication connection<br>3. Set communication parameters properly |

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| Fault Name | Reserved |
|---|---|
| Fault Code | **Err17** |

| Fault Name | Current detection fault |
|---|---|
| Fault Code | **Err18** |
| Reason | 1. Hall sensor is abnormal<br>2. The power board is abnormal |
| Solution | 1. Check hall sensor and connection<br>2. Replace the power board |
| Fault Name | Reserved |
| Fault Code | **Err19, Err20** |

| Fault Name | EEPROM read/write fault |
|---|---|
| Fault Code | **Err21** |
| Reason | 1. EEPROM chip is broken |
| Solution | 1. Replace the control board |

| Fault Name | Inverter hardware fault |
|---|---|
| Fault Code | **Err22** |
| Reason | 1. Over voltage<br>2. Over current |
| Solution | 1. Handle as over voltage fault<br>2. Handle as over current fault |

| Fault Name | Motor short-circuit to ground |
|---|---|
| Fault Code | **Err23** |
| Reason | 1. The motor is short-circuit to ground |
| Solution | 1. Replace cables or motor |

| Fault Name | Current-limiting fault |
|---|---|
| Fault Code | **Err40** |
| Reason | 1. Whether the load is heavy or the motor is blocked<br>2. Power selection of inverter is too small. |
| Solution | 1. Reduce the load and detect the motor & machinery condition<br>2. Select bigger power inverter |

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| Fault Name | Abnormal of high pressure |
|---|---|
| Fault Code | **Err60** |
| Reason | The real feedback pressure is higher than upper limitation pressure (F0-05) |
| Solution | 1. Wiring connection of pressure transducer is wrong or pressure transducer is damaged<br>2. Increase the value of F0-05<br>3. The pressure of pipe line is too high<br>4. Ask for technical support |

| Fault Name | Abnormal of low pressure |
|---|---|
| Fault Code | **Err61** |
| Reason | The real feedback pressure is lower than lower limitation pressure (F0-07) |
| Solution | 1. Wiring connection of pressure transducer is wrong or pressure transducer is damaged<br>2. Reduce the value of F0-07<br>3. Change the selection of F0-03<br>4. Connect the pressure transducer with master ARA388<br>5. Check whether the pipe line is broken somewhere<br>6, Open the valve and discharge the air inside the pipe line |

| Fault Name | Abnormal of lack water |
|---|---|
| Fault Code | **Err63** |
| Reason | ARA388/386 runs at 50Hz, no pressure from pipe line, and the running current is less than 80% of ARA388's rated current. |
| Solution | 1. Wiring connection of pressure transducer is wrong or pressure transducer is damaged.<br>2. Change the selection of F0-03<br>3. Connect the pressure transducer with master ARA388/386<br>4. Check whether the pipe line is broken somewhere<br>5, Open the valve and discharge the air inside the pipe line<br>6. Ask for technical support |

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## 7.2 Common Faults and Solutions

| Fault | Reason | Solution |
|---|---|---|
| ARA388 stops after running for 10s. The indicator of "Auto" flakers | 1. Wiring connection of pressure transducer is wrong or pressure sensor is damaged. <br> 2. Setting of F0-03 is wrong. <br> 3. Without connecting pressure sensor for multiple pumps system. <br> 4. No output 10V or 24V voltage from ARA388. <br> 5. The valve for pressure transducer is not opened. <br> 6. Air inside the pump or pipe line. | 1. Check the wiring connection of pressure transducer or change a new transducer. <br> 2. Change the setting of F0-03. <br> 3. Connect pressure sensor with master ARA388/ARA386. <br> 4. Replace a new control board. <br> 5. Open the valve make pressure senor is working. <br> 6. Discharge the air in the pump or pipe line. |
| Communication is abnormal under multiple pumps system. <br> 1, water pressure is low, cannot start next pump. <br> 2, The feedback pressure displayed on different ARA388 is unbalance, system cannot work normally. <br> 3, pumps cannot be alternated while set F0-25 properly. | 1. Communication terminals S+, S- are not connected or wrongly connected. <br> 2. F1-11 doesn't set as master (should be set as 1 or 2) <br> 3. F1-11 is set the same value in different ARA388/386. <br> 4. Communication terminals S+, S- are fault. | 1. Connect S+, S- terminals correctly, and confirm the communication is normal. <br> 2. Reset F1-11, make sure different ARA388 set different value <br> 3. Initialize parameters to factory default (F0-24) <br> 4. Ask for technical support. |
| Pump doesn't stop while nobody use the water | 1. The pipe line is broken, water leakage happen. <br> 2. The one-way valve is broken. <br> 3. The pressure transducer is broken. | 1. Check the pipe line, valve and pressure transducer. <br> 2. Increase the value of F0-16. <br> 3. Change a new pressure transducer. <br> 4, Ask for technical support. |

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| | | |
|---|---|---|
| The displayed pressure values on ARA388/386 and pressure gauge (transducer) have big difference. | 1. The measure range of F0-04 is set incorrect.<br>2. The pressure gauge (transducer) itself has big deviation, or it's broken. | 1. Set a correct value in F0-04.<br>2. Set a suitable value to adjust the pressure.<br>3. Change a new pressure gauge (transducer).<br>4, Ask for technical support. |
| ARA388/386 running at highest frequency level but the feedback pressure still very low. | 1. Motor running direction is reversed.<br>2, Air inside the pump or pipe line.<br>3. The pressure gauge (transducer) is broken. | 1. Change any two motor cables of output side, or change the value of F0-02.<br>2, Discharge the air in the pump or pipe line.<br>4. Change a new pressure gauge (transducer)<br>4, Ask for technical support. |
| The frequency with big fluctuation, cannot keep stable while ARA388/ARA386 is running. | 1, The dormancy frequency of F0-17 is set too big.<br>2, F0-05 is set too small.<br>3. The feedback pressure is abnormal. | 1. Set suitable value of F0-17.<br>2. Set suitable value of F0-05.<br>3. Change a new pressure transducer. |
| After pressing "RUN" button, the pump cannot run. | 1. ARA388/ARA386 is under dormancy status.<br>2. F1-11 is not set suitable.<br>3. F1-00 is not set suitable.<br>4. Wiring connection of pressure transducer is incorrect, or the pressure transducer is broken. | 1. Open the value to discharge the pipe line pressure.<br>2. Set suitable value in F1-00 and F1-11.<br>3. Reconnect the wiring connection of pressure transducer, or change a new pressure transducer.<br>4. Ask for technical support. |

ARA Booster Systems

# Chapter 8 Commissioning

## 8.1 One pump system

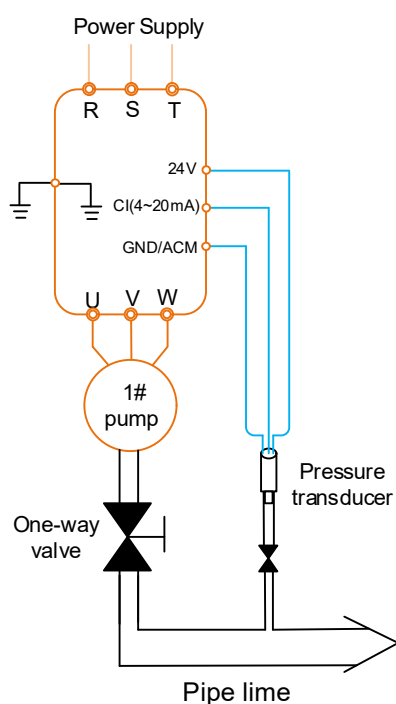### 8.1.1 Wiring connection



Fig 8.1 Connect with pressure transducer    Fig 8.2 Connect with remote pressure gauge
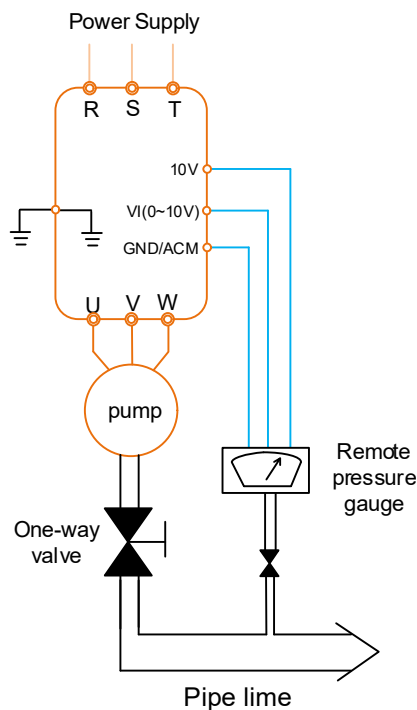
### 8.1.2 Parameters setting

| Function code | Default value | Set value | Description |
|---|---|---|---|
| F0-00 | 1 | 1 | Single pump system |
| F0-01 | 0.4MPa | Customer set | **1**. Please set it correctly based on requested pressure, the unit is MPa, 1MPa=10bar.<br>**2**. Most of the family used systems, the pressure is 0.3~0.4MPa (3~4bar) |
| F0-02 | 80% | Customer set | Wake up pressure; it is the percentage of F0-01. |
| F0-03 | 0 | 0 | It must be set as "0" while use 0~10V remote pressure gauge. |
| | | 1 | It must be set as "1" while use 4~20mA pressure transducer. |
| F0-04 | 1.6MPa | 1.6MPa | **1**. To set the maximum measure range of pressure transducer.<br>**2**. It must be set correctly, otherwise it may cause pressure is inaccurate. |

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**For more parameters setting, please refer to chapter 5 in details.**

### 8.1.3 process of fast operation and commissioning

**1)** Please check all the packing in KD388/KD386 is in good condition;

**2)** Wiring connection

① Main circuit, please connect the power supply to R, S, T (Single phase please connect R, T), and output side please connect U, V, W with pump.

② Connect the pressure transducer or remote pressure gauge to KD388 correctly, please refer to Fig 8.1 and Fig 8.2 for details.

**3)** After confirm the wiring connection, switch on the power supply.

① Set F0-00=0 (Manual operation mode) firstly, start ARA388 and check whether the running direction of pump is correct. If the running direction is incorrect, change the value of F0-02 or change any two motor cables connection.

② Under manual operation mode, discharge the air inside the pump and pipe line.

**4)** Check whether the pressure transducer is connected correctly.

① Set correct value in F0-04.

② Under manual operation mode, start ARA388/ARA386 and check whether the feedback pressure and real time display pressure on ARA388/ARA386 are the same. Long time press [▲][▼] to increase or decrease pump speed to check whether the feedback pressure is changed accordingly, if the feedback changes, it means the pressures transducer's wiring connection is correct,

**5)** Parameters setting

① While start ARA388 at the first time or forget some parameters, please set F0-24=1 to initialize the factory default value.

② Set parameters one by one based on the parameters list.

**6)** Routine inspection

① Check the constant water supply function, the water pressure can be keep at a stable level..

② Check the dormancy function, while close all the values in the water system, ARA388/ARA386 can enter into dormancy status automatically.

③ Check the wake up function, under dormancy status, open some of valves in the water system, ARA388/ARA386 can wake up automatically.

NOTE: If any failures happen, please refer to chapter 7 to find the solutions.
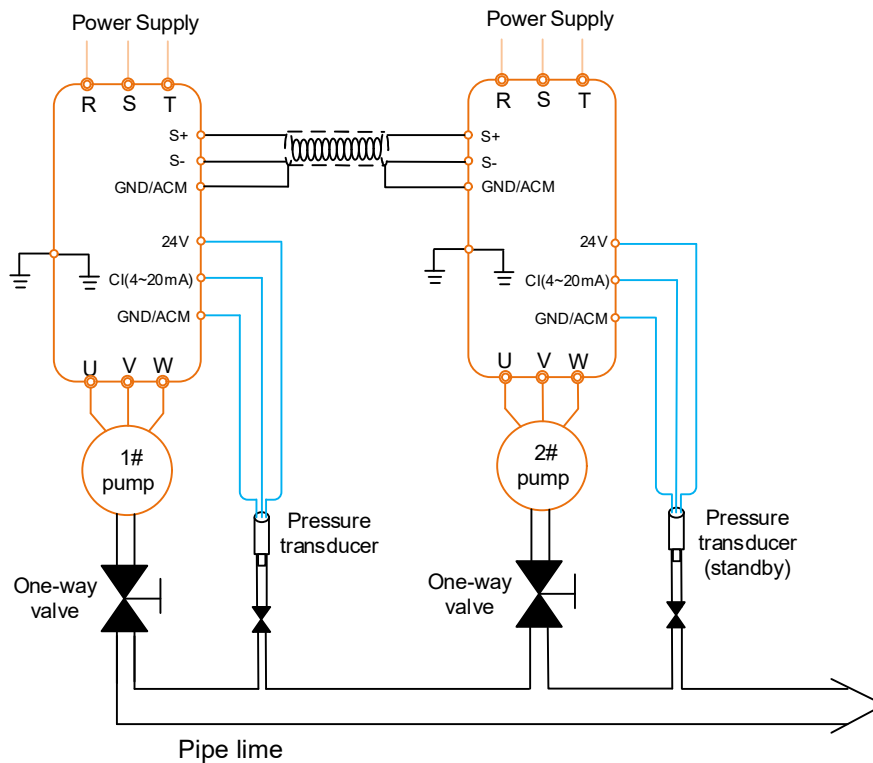
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## 8.2 Two pumps system

### 8.2.1 Wiring connection



Fig 8.3 Connect with pressure transducer
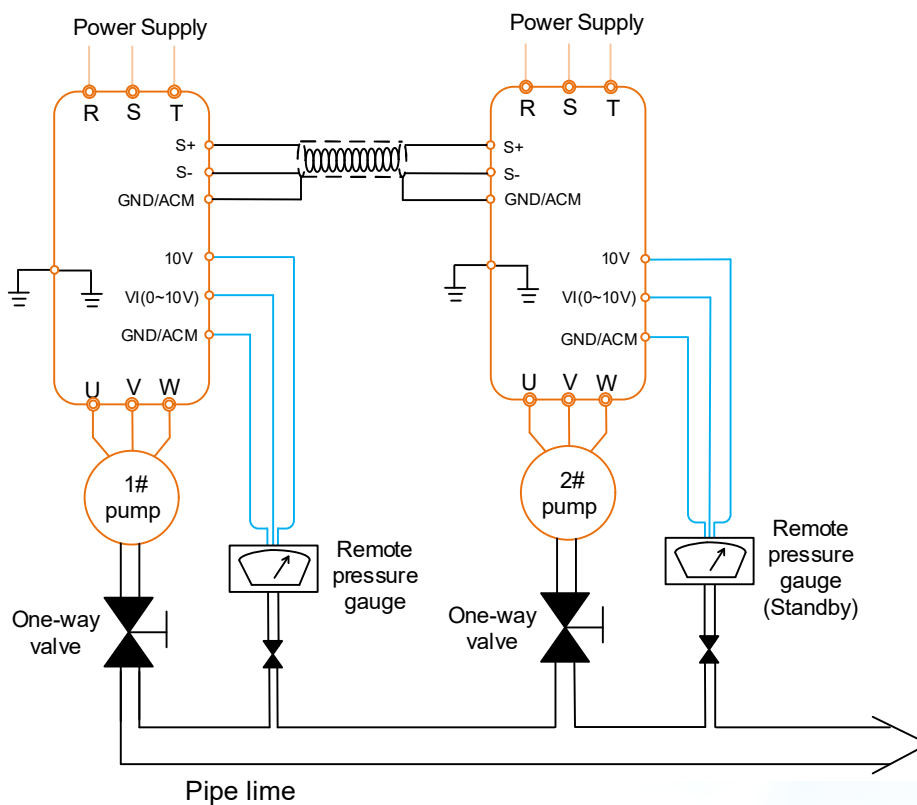


Fig 8.4 Connect with remote pressure gauge

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## 8.2.2 Parameters setting

| Function code | Default value | Set value | | Description |
|---|---|---|---|---|
| F1-11 | 1 | 1# inverter | 1 | 1# inverter (master), it must connect the pressure sensor. |
| | | 2# inverter | 2 | 2# inverter (slave / standby master), connect the pressure senor. **Warning:** the address of each inverter cannot be the same, otherwise, the system will work abnormally. |
| F0-00 | 1 | 2 | | Multiple pumps system |
| F0-01 | 0.4MPa | Customer set | | **1**. Please set it correctly based on requested pressure, the unit is MPa, 1MPa=10bar. **2**. Most of the family used systems, the pressure is 0.3~0.4MPa (3~4bar) |
| F0-02 | 80% | Customer set | | Wake up pressure; it is the percentage of F0-01. |
| F0-03 | 0 | 0 | | It must be set as "0" while use 0~10V remote pressure gauge. |
| | | 1 | | It must be set as "1" while use 4~20mA pressure transducer. |
| F0-04 | 1.6MPa | 1.6MPa | | **1**. To set the maximum measure range of pressure transducer. **2**. It must be set correctly, otherwise it may cause pressure is inaccurate. |
| F0-25 | 300Min | Customer set | | To set the running time as master pump, when time arrive, it switches to next pump as master. When set F0-25=0, this pump will only work as slave pump. |

**For more parameters setting, please refer to chapter 5 in details.**

## 8.2.3 Process of fast operation and commissioning

**1)** Please check all the packing in ARA388/ARA386 is in good

condition; **2)** Wiring connection

① Main circuit, please connect the power supply to R, S, T (Single phase please connect R, T), and output side please connect U, V, W with pump.

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② Connect the pressure transducer or remote pressure gauge to ARA388/ARA386 correctly, please refer to Fig 8.3 and Fig 8.4 for details.

③ Connect the communication cables, please select shielded twisted-pair cable to connect the S+ and S- of the two inverters together.

**3)** After confirm the wiring connection, switch on the power supply.

① Set F0-00=0 (Manual operation mode) firstly, start ARA388/ARA386 and check whether the running direction of pump is correct. If the running direction is incorrect, change the value of F0-02 or change any two motor cables connection.

② Under manual operation mode, discharge the air inside the pump and pipe line.

**4)** Check whether the pressure transducer is connected correctly.

① Set correct value in F0-04.

② Under manual operation mode, start ARA388/ARA386 and check whether the feedback pressure and real time display pressure on ARA388/ARA386 are the same. Long time press [▲] or [▼] to increase or decrease pump speed to check whether the feedback pressure is changed accordingly, if the feedback changes, it means the pressures transducer's wiring connection is correct (watch 1# pump).

**5)** Parameters setting

① While start ARA388/ARA386 at the first time or forget some parameters, please set F0-24=1 to initialize the factory default value.

② Set parameters one by one based on the above mentioned parameters list, F1-01 ~ F1-04 parameters are only needed to set in master inverter, but for two master system, it needs to set the parameters both in 1# inverter and 2 # inverter..

**6)** Routine inspection

Before inspecting, please start these two inverters, make them both work at running condition.

① Check the constant pressure water supply function, the water pressure can be keep at a stable level, 1# and 2# inverters display the same feedback pressure.

② Check the pump adding function, increase the water flow, while the master pump cannot get the target pressure, the slave pump will be started.

③ Check the pump remove function, decrease the water flow, while the master pump can get the target pressure, the salve pump will be stopped.

④ Check the dormancy function, while close all the valves in the water system, these two inverters can enter into dormancy status automatically.

⑤ Check the wake up function, under dormancy status, open some of valves in the water system, the master pump will be woken up by the setting wake up value of F0-02 automatically, then system enter into normal working conditions.

NOTE: If any failures happen, please refer to chapter 7 to find the solutions.

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## 8.3 Three pumps system

### 8.3.1 Wiring connection



Fig 8.5 Connect with remote pressure transducer



Fig 8.6 Connect with remote pressure gauge

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### 8.3.2 Parameters setting

| Function code | Default value | Set value | | Description |
|---|---|---|---|---|
| F1-11 | 1 | I# inverter | 1 | 1# inverter (master), it must connect the pressure sensor.<br>2# inverter (slave / standby master), connect the pressure senor.<br>3# inverter (slave)<br>**Warning:** the address of each inverter cannot be the same, otherwise, the system will work abnormally. |
| | | 2# inverter | 2 | |
| | | 3# inverter | 3 | |
| F0-00 | 1 | 2 | | Multiple pumps system |
| F0-01 | 0.4MPa | Customer set | | **1**. Please set it correctly based on requested pressure, the unit is MPa, 1MPa=10bar.<br>**2**. Most of the family used systems, the pressure is 0.3~0.4MPa (3~4bar) |
| F0-02 | 80% | Customer set | | Wake up pressure; it is the percentage of F0-01. |
| F0-03 | 0 | 0 | | It must be set as "0" while use 0~10V remote pressure gauge. |
| | | 1 | | It must be set as "1" while use 4~20mA pressure transducer. |
| F0-04 | 1.6MPa | 1.6MPa | | **1**. To set the maximum measure range of pressure transducer.<br>**2**. It must be set correctly, otherwise it may cause pressure is inaccurate. |
| F0-25 | 300Min | Customer set | | To set the running time as master pump, when time arrive, it switches to next pump as master.<br>When set F0-25=0, this pump will only work as slave pump. |

**For more parameters setting, please refer to chapter 5 in details.**

### 8.3.3 Process of fast operation and commissioning

**1)** Please check all the packing in ARA388/386 is in good condition;

**2)** Wiring connection

① Main circuit, please connect the power supply to R, S, T (Single phase please connect R, T), and output side please connect U, V, W with pump.

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② Connect the pressure transducer or remote pressure gauge to ARA388/ARA386 correctly, please refer to Fig 8.5 and Fig 8.6 for details.

③ Connect the communication cables, please select shielded twisted-pair cable to connect the S+ and S- of the three inverters together.

**3)** After confirm the wiring connection, switch on the power supply.

① Set F0-00=0 (Manual operation mode) firstly, start ARA388/ARA386 and check whether the running direction of pump is correct. If the running direction is incorrect, change the value of F0-02 or change any two motor cables connection.

② Under manual operation mode, discharge the air inside the pump and pipe line.

**4)** Check whether the pressure transducer is connected correctly.

① Set correct value in F0-04.

② Under manual operation mode, start ARA388/ARA386 and check whether the feedback pressure and real time display pressure on ARA388/ARA386 are the same. Long time press [▲] or [▼] to increase or decrease pump speed to check whether the feedback pressure is changed accordingly, if the feedback changes, it means the pressures transducer's wiring connection is correct (watch 1# pump).

**5)** Parameters setting

① While start ARA388/ARA386 at the first time or forget some parameters, please set F0-24=1 to initialize the factory default value.

② Set parameters one by one based on the above mentioned parameters list, F1-01 ~ F1-04 parameters are only needed to set in master inverter, but for two master system, it needs to set the parameters both in 1# inverter and 2 # inverter..

**6)** Routine inspection

Before inspecting, please start these three inverters, make them work at running condition.

① Check the constant pressure water supply function, the water pressure can be keep at a stable level, 1#, 2# and 3# inverters display the same feedback pressure.

② Check the pump adding function, increase the water flow, while the master one pump cannot get the target pressure, the slave pumps will be started one by one.

③ Check the pump remove function, decrease the water flow, while the master pump can get the target pressure, the salve pumps will be stopped one by one.

④ Check the dormancy function, while close all the valves in the water system, all of the three inverters can enter into dormancy status automatically.

⑤ Check the wake up function, under dormancy status, open some of valves in the water system, the master pump will be woken up by the setting wake up value of F0-02 automatically, then system enter into normal working conditions.

NOTE: If any failures happen, please refer to chapter 7 to find the solutions.

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## 8.4 Four pumps system
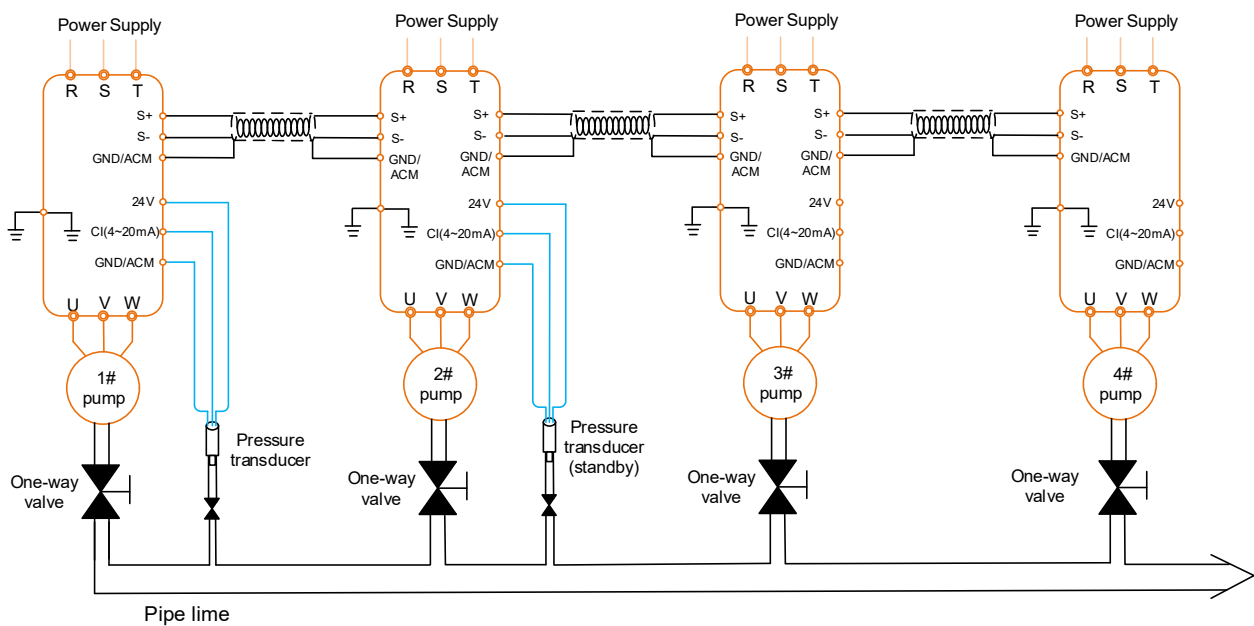
### 8.4.1 Wiring connection

Fig 8.7 Connect with remote pressure transducer

Fig 8.8 Connect with remote pressure gauge

ARA Booster Systems

### 8.4.2 Parameters setting

| Function code | Default value | Set value | | Description |
|---|---|---|---|---|
| F1-11 | 1 | I# inverter | 1 | 1# inverter (master), it must connect the pressure sensor. |
| | | 2# inverter | 2 | 2# inverter (slave / standby master), connect the pressure senor. |
| | | 3# inverter | 3 | 3# and 4# inverters (slave). **Warning:** the address of each inverter |
| | | 4# inverter | 4 | cannot be the same, otherwise, the system will work abnormally. |
| F0-00 | 1 | 2 | | Multiple pumps system |
| F0-01 | 0.4MPa | Customer set | | **1**. Please set it correctly based on requested pressure, the unit is MPa, 1MPa=10bar. **2**. Most of the family used systems, the pressure is 0.3~0.4MPa (3~4bar) |
| F0-02 | 80% | Customer set | | Wake up pressure; it is the percentage of F0-01. |
| F0-03 | 0 | 0 | | It must be set as "0" while use 0~10V remote pressure gauge. |
| | | 1 | | It must be set as "1" while use 4~20mA pressure transducer. |
| F0-04 | 1.6MPa | 1.6MPa | | **1**. To set the maximum measure range of pressure transducer. **2**. It must be set correctly, otherwise it may cause pressure is inaccurate. |
| F0-25 | 300Min | Customer set | | To set the running time as master pump, when time arrive, it switches to next pump as master. When set F0-25=0, this pump will only work as slave pump. |

**For more parameters setting, please refer to chapter 5 in details.**

### 8.3.3 Process of fast operation and commissioning

**1)** Please check all the packing in ARA388/386 is in good condition;

**2)** Wiring connection

① Main circuit, please connect the power supply to R, S, T (Single phase please connect R, T), and output side please connect U, V, W with pump.

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② Connect the pressure transducer or remote pressure gauge to ARA388/ARA386 correctly, please refer to Fig 8.7 and Fig 8.8 for details.

③ Connect the communication cables, please select shielded twisted-pair cable to connect the S+ and S- of the four inverters together.

**3)** After confirm the wiring connection, switch on the power supply.

① Set F0-00=0 (Manual operation mode) firstly, start ARA388/386 and check whether the running direction of pump is correct. If the running direction is incorrect, change the value of F0-02 or change any two motor cables connection.

② Under manual operation mode, discharge the air inside the pump and pipe line.

**4)** Check whether the pressure transducer is connected correctly.

① Set correct value in F0-04.

② Under manual operation mode, start ARA388/386 and check whether the feedback pressure and real time display pressure on ARA388/ARA386 are the same. Long time press [▲] or [▼] to increase or decrease pump speed to check whether the feedback pressure is changed accordingly, if the feedback changes, it means the pressures transducer's wiring connection is correct (watch 1# pump).

**5)** Parameters setting

① While start ARA388/386 at the first time or forget some parameters, please set F0-24=1 to initialize the factory default value.

② Set parameters one by one based on the above mentioned parameters list, F1-01 ~ F1-04 parameters are only needed to set in master inverter, but for two master system, it needs to set the parameters both in 1# inverter and 2 # inverter..

**6)** Routine inspection

Before inspecting, please start these four inverters, make them work at running condition.

① Check the constant pressure water supply function, the water pressure can be keep at a stable level, 1#, 2#, 3# and 4# inverters display the same feedback pressure.

② Check the pump adding function, increase the water flow, while the master one pump cannot get the target pressure, the slave pumps will be started one by one.

③ Check the pump remove function, decrease the water flow, while the master pump can get the target pressure, the salve pumps will be stopped one by one.

④ Check the dormancy function, while close all the valves in the water system, all of the four inverters can enter into dormancy status automatically.

⑤ Check the wake up function, under dormancy status, open some of valves in the water system, the master pump will be woken up by the setting wake up value of F0-02 automatically, then system enter into normal working conditions.

NOTE: If any failures happen, please refer to chapter 7 to find the solutions.

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