



# Operation **Manual**

## **RBU100H**

### **Regenerative Energy Unit**



**SHENZHEN INVT ELECTRIC CO., LTD.**

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# 1 Safety precautions

## 1.1 Safety definition



|                         |  |
|-------------------------|--|
| Danger:                 | Serious physical injury or even death may occur if not follow relevant requirements  |
| Warning:                | Physical injury or damage to the devices may occur if not follow relevant requirements   |
| Note:                   | Physical hurt may occur if not follow relevant requirements  |
| Qualified electricians: | People working on the device should take part in professional electrical and safety training, receive the certification and be familiar with all steps and requirements of installing, commissioning, operating and maintaining the device to avoid any emergency. |

## 1.2 Warning symbols


Warnings caution you about conditions which can result in serious injury or death, damage to the equipment and advice on how to avoid the danger. Following warning symbols are used in this manual:

| Symbol   | Name    | Description  | Abbreviation   |
|--|---------|--|--|
|  Danger   | Danger  | Serious physical injury or even death may occur if not follow the relative requirements    |   |
|  Warning | Warning | Physical injury or damage to the devices may occur if not follow the relative requirements |  |
| <b>Note</b>  | Note    | Physical hurt may occur if not follow the relative requirements                            | <b>Note</b>  |

## 1.3 Safety guidelines

|   |  |
|---|--|
|  | <ul style="list-style-type: none"> <li>✧ Only qualified electricians are allowed to operate.</li> <li>✧ Do not carry out any wiring and inspection or changing components when the power supply is applied.</li> </ul> |
|  | <ul style="list-style-type: none"> <li>✧ Do not refit unless authorized; otherwise fire, electric shock or other injury may occur.</li> </ul>  |


### 1.3.1 Delivery and installation

|   |  |
|---|--|
|  | <ul style="list-style-type: none"> <li>✧ Please install the RBU on fire-retardant material.</li> <li>✧ Do not operate on the RBU if there is any damage or components loss.</li> <li>✧ Do not touch the RBU, internal components and PCB board after wiring; otherwise electric shock may occur due to the present high DC voltage.</li> </ul> |
|---|--|

**Note:**

- ✧ Select appropriate moving and installing tools to ensure a safe and normal running of the RBU and avoid physical injury or death. For physical safety, the erector should take some mechanical protective measurements, such as wearing exposure shoes and working uniforms.
- ✧ Ensure to avoid physical shock or vibration during delivery and installation.
- ✧ Do not carry the RBU by its cover. The cover may fall off.
- ✧ Install away from children and other public places.
- ✧ The RBU cannot meet the requirements of low voltage protection in IEC61800-5-1 if the sea level of installation site is above 2000m.
- ✧ Please use the RBU in proper environment.
- ✧ Avoid any conductive objects on the front cover, otherwise electrical shock may occur.
- ✧ Tighten up the screws when wiring, otherwise fire, leakage current may occur.

### 1.3.2 Commissioning and running


|   |   |
|---|---|
|  | <ul style="list-style-type: none"> <li>✧ Disconnect all power supplies applied to the RBU before the terminal wiring and wait for at least the designated time after disconnecting the power supply.</li> <li>✧ Only <b>qualified electricians</b> are allowed to operate on the RBU.</li> <li>✧ Inspect the wiring before running.</li> <li>✧ Do not touch the terminals of control board when power on.</li> <li>✧ Before running, ensure the master/slave selection and voltage class setting are correct.</li> <li>✧ Adjust and inspect the RBU only after the power indicator is totally off and the RBU DC bus voltage is measured to be lower than 36V by a multi-meter.</li> <li>✧ Do not touch any internal components during the running.</li> <li>✧ The RBU is an accessory device of the variable-frequency drive (VFD). Before the use, install a special fuse for semiconductor. Otherwise, in addition to the RBU failure, the VFD failure or damage may result. No matter whether the VFD fault is related to the RBU, we are not responsible for any VFD fault. Please install semiconductor fuses.</li> </ul> |
|---|---|

|  |   |
|--|---|
|  | <ul style="list-style-type: none"> <li>✧ The RBU is not equipped with a buffer circuit. It is recommended to use the RBU with the BUB series buffer product or configure a buffer unit by yourself to avoid RBU damage due to unbuffered power-on shock.</li> </ul> |
|--|---|

**Note:**

- ✧ Do not switch on or off the input power supply of the RBU frequently.
- ✧ Ensure correct setting of the RBU.
- ✧ Do not do any voltage test on the RBU; otherwise damage to the semiconductor components may occur.
- ✧ Fans or other cooling device are needed in multiple installations.
- ✧ Temperature and other protection are needed for RBU. Our company is not responsible for any heating damage to the regenerative resistor caused by the RBU fault.



**1.3.3 Maintenance and replacement of components**

|   |  |
|---|--|
|  | <ul style="list-style-type: none"> <li>✧ Only <b>qualified electricians</b> are allowed to perform the maintenance, inspection, and components replacement of the RBU.</li> <li>✧ Disconnect all power supplies to the RBU before the terminal wiring.</li> <li>✧ Take measures to avoid screws, cables and other conductive matters to fall into the RBU during maintenance and component replacement.</li> </ul> |
|---|--|

**Note:**

- ✧ Please select proper torque to tighten screws.
- ✧ Keep the RBU, parts and components away from combustible materials during maintenance and component replacement.
- ✧ Do not carry out any isolation and pressure test on the RBU and do not measure the control circuit of the RBU by megohmmeter.

**1.3.4 Scrap treatment**

|   |  |
|---|--|
|  | <ul style="list-style-type: none"> <li>✧ There are heavy metals in the RBU. Deal with it as industrial effluent.</li> </ul>  |
|  | <ul style="list-style-type: none"> <li>✧ When the life cycle ends, the product should enter the recycling system. Dispose of it separately at an appropriate collection point instead of placing it in the normal waste stream.</li> </ul> |

## 2 Inspection

### 2.1 Unpacking inspection

Check as followings after receiving products:

|   |
|---|
| 1. Check that there are no damage and humidification to the package. If not, please contact with local agents or INVT offices.  |
| 2. Check the information on the type designation label on the outside of the package to verify that the drive is of the correct type. If not, please contact with local dealers or INVT offices.      |
| 3. Check that there are no signs of water in the package and no signs of damage or breach to the RBU. If not, please contact with local dealers or INVT offices.                                      |
| 4. Check the information on the type designation label on the outside of the package to verify that the name plate is of the correct type. If not, please contact with local dealers or INVT offices. |

### 2.2 Application confirmation

Check as followings before the actual installation and usage:

|  |
|--|
| 1. Check that the ambient temperature of the RBU is below 40°C. If exceeds, derate 3% for every additional 1°C. Additionally, the RBU cannot be used if the ambient temperature is above 50°C. |
| 2. Check that the ambient temperature of the RBU in actual usage is above -10° C. If not, add heating facilities.  |
| 3. Check that the altitude of the actual usage site is below 1000m. If exceeds, derate 1% for every additional 100m.   |
| 4. Check that the humidity of the actual usage site is below 90% and condensation is not allowed. If not, add additional protection devices.   |
| 5. Check that the actual usage site is away from direct sunlight and foreign objects cannot enter the RBU. If not, add additional protective measures.   |
| 6. Check that there is no conductive dust or flammable gas in the actual usage site. If not, add additional protection to the RBU.   |

### 2.3 Installation confirmation

Check as followings after the installation:

|   |
|---|
| 1. Check that the load range of the input and output cables meet the need of actual load.   |
| 2. Check correct setting of the RBU.  |
| 3. Check that the RBU is installed on non-flammable materials and the calorific accessories |

|   |
|---|
| (reactors and brake resistors) are away from flammable materials.   |
| 4. Check that all control cables and power cables are run separately and the routation complies with EMC requirement. |
| 5. Check that all grounding systems are properly grounded according to the requirements of the RBU.                   |
| 6. Check that the free space during installation is sufficient according to the instructions in user's manual.        |
| 7. Check that the external connection terminals are tightly fastened and the torque is appropriate.                   |
| 8. Check that there are no screws, cables and other conductive items left in the RBU. If not, get them out.           |

## 3 Product overview

### 3.1 Comprehensive features

| Technological feature         | Instruction  |
|-------------------------------|--|
| Voltage range                 | AC 3PH 380V(-15%)–440V(+10%)<br>AC 3PH 520V(-15%)–690V(+10%) |
| Brake torque                  | Continuously run with 100% of rated torque                   |
| AC power                      | 380VAC/660VAC, 50/60Hz                                       |
| AC voltage range              | +10%–15%, the imbalance between phases less than 2%          |
| AC frequency range            | Less than 3Hz  |
| Control mode                  | Current control with 120°                                    |
| AC power factor               | Higher than 0.9  |
| Overload capacity             | 60s with 150% of rated current                               |
| Operation mode                | External terminal; Keyboard                                  |
| Fault output                  | Relay output   |
| Status display                | LED keypad   |
| Analog output                 | Voltage (0–10V)  |
| Overcurrent protection        | 330% of the rated current                                    |
| Overload protection           | 60s with 150% of rated current                               |
| Overvoltage                   | DC: 830V/1250V   |
| Over-temperature              | Temperature resistance detection                             |
| AC phase failure fault        | AC phase loss  |
| AC frequency failure<br>fault | Fluctuating higher than 3Hz                                  |

### 3.2 Product name and model

**RBU100H-055-4**

Designation keys:

| Designation key | Instruction                       |
|-----------------|-----------------------------------|
| A               | RBU: regenerative braking unit    |
| B               | 1 means the technological version |
| C               | 00 are the spare codes            |
| D               | H: heavy-load                     |



| Designation key | Instruction  |
|-----------------|--|
| E               | Power code; 055 means 55kW   |
| F               | 4: AC 3PH 380V(-15%)–440V(+10%)<br>6: AC 3PH 520V(-15%)–690V(+10%) |

### 3.3 Rated specifications

The rated power of RBU100H is the motor power at 100% braking torque.

#### 3.3.1 380V

| Model         | Rated power (kW) | Rated current at DC side (A) | Rated current at AC side (A) | Input reactor | Regenerative output reactor |
|---------------|------------------|------------------------------|------------------------------|---------------|-----------------------------|
| RBU100H-022-4 | 22               | 37                           | 30                           | ACL2-022-4    | ERL-022-4-C                 |
| RBU100H-030-4 | 30               | 51                           | 40                           | ACL2-030-4    | ERL-037-4                   |
| RBU100H-045-4 | 45               | 77                           | 60                           | ACL2-045-4    | ERL-055-4                   |
| RBU100H-055-4 | 55               | 96                           | 75                           | ACL2-055-4    | ERL-055-4                   |
| RBU100H-090-4 | 90               | 150                          | 120                          | ACL2-075-4    | ERL-090-4                   |
| RBU100H-110-4 | 110              | 183                          | 145                          | ACL2-110-4    | ERL-090-4                   |
| RBU100H-132-4 | 132              | 220                          | 176                          | ACL2-160-4    | ERL-132-4                   |
| RBU100H-160-4 | 160              | 267                          | 213                          | ACL2-160-4    | ERL-160-4-C                 |
| RBU100H-200-4 | 200              | 333                          | 266                          | ACL2-200-4    | ERL-220-4                   |
| RBU100H-250-4 | 250              | 417                          | 330                          | ACL2-280-4    | ERL-250-4                   |



#### 3.3.2 660V

| Model         | Rated power (kW) | Rated current at DC side(A) | Rated current at AC side(A) | Input reactor | Regenerative output reactor |
|---------------|------------------|-----------------------------|-----------------------------|---------------|-----------------------------|
| RBU100H-055-6 | 55               | 52                          | 42                          | ACL-055-6     | ERL-055-6                   |
| RBU100H-090-6 | 90               | 86                          | 68                          | ACL-110-6-A   | ERL-090-6-A                 |
| RBU100H-160-6 | 160              | 152                         | 122                         | ACL-160-6     | ERL-160-6                   |
| RBU100H-200-6 | 200              | 190                         | 152                         | ACL-200-6     | ERL-200-6                   |
| RBU100H-315-6 | 315              | 300                         | 230                         | ACL-315-6     | ERL-315-6                   |
| RBU100H-400-6 | 400              | 400                         | 330                         | ACL-400-6     | ERL-400-6                   |

#### Note:

- ✧ RBU 380V 22kW–45 kW has internal output reactor. RBU 380V 55kW–250kW/660V 55kW–400kW has standard output reactor.
- ✧ Each RBU100H has 1 standard input reactor. Select the input reactor according to the rated parameters of the VFD.
- ✧ The input filter is optional. Select the input filter according to the rated parameters of the VFD.
- ✧ The fuse is optional. Configure the fuse at 1.5 times of the rated current of the RBU.

## 4 Installation guidelines

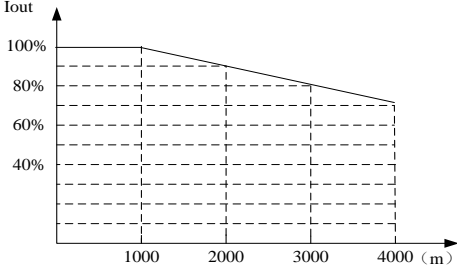
|   |  |
|---|--|
|  | <p>✧ Only qualified electricians are allowed to carry out what described in this chapter. Please operate as the instructions in chapter 1 Safety precautions. Ignoring these may cause physical injury or death or damage to the devices.</p> <p>✧ Ensure the power supply of the RBU is disconnected during the operation. Wait for at least the time designated until the POWER indicator is off after the disconnection if the power supply is applied. It is recommended to use the multimeter to monitor that the DC bus voltage of the drive is under 36V.</p> <p>✧ The installation and design of the RBU should be complied with the requirement of the local laws and regulations in the installation site. If the installation infringes the requirement, our company will exempt from any responsibility. Additionally, if users do not comply with the suggestion, some damage beyond the assured maintenance range may occur.</p> |
|  | <p>✧ Don not hold the front cover only during moving, otherwise the machine may fall.</p>  |

### 4.1 Installation environment

The installation environment is the safeguard for a full performance and long-term working of the RBU.

Check the installation environment as followings:

| Environment             | Conditions   |
|-------------------------|--|
| Installation site       | Indoor   |
| Environment temperature | <p>-10—+40°C</p> <p>It is not recommended to use the RBU if the ambient temperature is above 40°C.</p> <p>In order to improve the reliability of the device, do not use the RBU if the ambient temperature changes frequently.</p> <p>Please provide cooling fan or air conditioner to control the internal ambient temperature below the required one if the RBU is used in a closed space such as in the control cabinet.</p> <p>When the temperature is too low, if the RBU needs to restart to run after a long stop, it is necessary to provide an external heating device to increase the internal temperature, otherwise damage to the devices may occur.</p> |
| Humidity                | <p>RH≤90%</p> <p>No condensation is allowed.</p> <p>The maximum relative humidity should be equal to or less than 60% in corrosive air.</p>  |

| Environment                   | Conditions  |              |                     |   |     |      |     |      |    |      |    |      |    |
|-------------------------------|---|--------------|---------------------|---|-----|------|-----|------|----|------|----|------|----|
| Storage temperature           | -30—+60°C   |              |                     |   |     |      |     |      |    |      |    |      |    |
| Running environment condition | <p>The installation site should:</p> <p>keep away from the electromagnetic radiation source;</p> <p>keep away from contaminative air, such as corrosive gas, oil mist and flammable gas;</p> <p>ensure foreign objects, such as metal power, dust, oil, water cannot enter into the RBU(do not install the RBU on the flammable materials such as wood);</p> <p>keep away from direct sunlight, oil mist, steam and vibration environment.</p>  |              |                     |   |     |      |     |      |    |      |    |      |    |
| Altitude                      | <p>Below 1000m</p> <p>If the sea level is above 1000m, please derate 1% for every additional 100m.</p>  <table border="1"> <caption>Altitude Derating Data</caption> <thead> <tr> <th>Altitude (m)</th> <th>Derating Factor (%)</th> </tr> </thead> <tbody> <tr><td>0</td><td>100</td></tr> <tr><td>1000</td><td>100</td></tr> <tr><td>2000</td><td>90</td></tr> <tr><td>3000</td><td>80</td></tr> <tr><td>4000</td><td>70</td></tr> </tbody> </table> | Altitude (m) | Derating Factor (%) | 0 | 100 | 1000 | 100 | 2000 | 90 | 3000 | 80 | 4000 | 70 |
| Altitude (m)                  | Derating Factor (%)   |              |                     |   |     |      |     |      |    |      |    |      |    |
| 0                             | 100   |              |                     |   |     |      |     |      |    |      |    |      |    |
| 1000                          | 100   |              |                     |   |     |      |     |      |    |      |    |      |    |
| 2000                          | 90  |              |                     |   |     |      |     |      |    |      |    |      |    |
| 3000                          | 80  |              |                     |   |     |      |     |      |    |      |    |      |    |
| 4000                          | 70  |              |                     |   |     |      |     |      |    |      |    |      |    |
| Vibration                     | $\leq 5.8\text{m/s}^2(0.6g)$  |              |                     |   |     |      |     |      |    |      |    |      |    |
| Installation direction        | The RBU should be installed on an upright position to ensure sufficient cooling effect.   |              |                     |   |     |      |     |      |    |      |    |      |    |

**Note:**

- ✧ RBU100H should be installed in a clean and ventilated environment according to enclosure classification.
- ✧ Cooling air must be clean, free from corrosive materials and electrically conductive dust.

**4.2 Installation direction**

The RBU100H may be installed on the wall or in a cabinet.

The RBU100H must be installed in an upright position. Check the installation site according to the requirements below. Refer to chapter 9 Dimension and size for frame details.

**4.3 Installation steps**

(1) Mark the hole location. The location of the holes is shown in the dimension drawings in chapter 9 Dimension and size.

- (2) Fix the screws or bolts to the marked locations.
- (3) Position the drive onto the wall.
- (4) Tighten the screws in the wall securely.

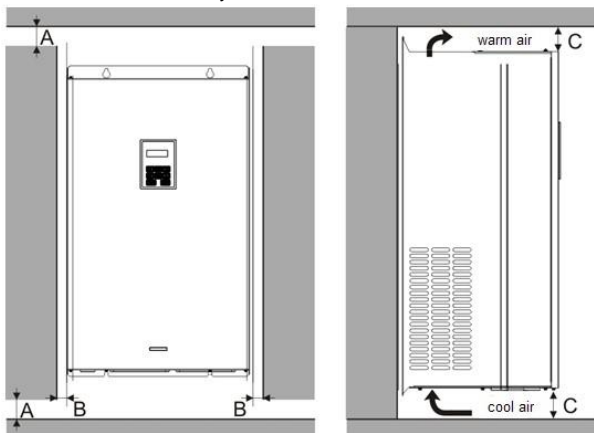


Figure 4-1 Installation space

**Note:** The minimum space of B and C is 100mm.

Multiple vertical installation

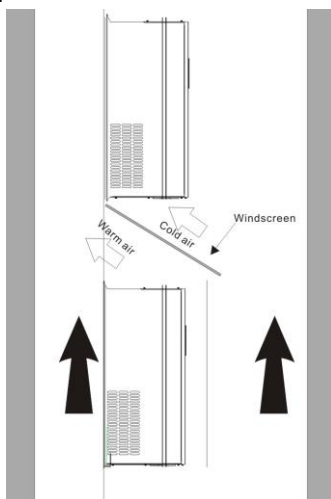


Figure 4-2 UP/DOWN installation

**Note:** Windscreen should be added in vertical installation for avoiding mutual impact and insufficient cooling.

## 4.4 Terminals and function

### 4.4.1 Terminals of the main circuit

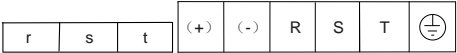


Figure 4-3 Terminals of the main circuit

| Terminal | Function  |
|----------|---|
| r, s, t  | Terminals of 3-phase AC input (see Figure 4-5 and Figure 4-6)           |
| (+), (-) | Input terminals of RBU  |
| R, S, T  | Terminals of external DC reactor or VFD (see Figure 4-5 and Figure 4-6) |
| ⊕        | Grounding terminal (PE)   |

The main circuit of RBU100H is very simple. Connect the terminals "(+)" and "(-)" of the RBU to the positive and negative poles of the VFD; connect the terminals "R", "S" and "T" of the RBU to the power supply of the VFD input end directly or by means of output reactor; connect the terminals "r", "s" and "t" of the RBU to the grid.

|  |  |
|--|--|
|  | <p>✧ It is necessary to use an external reactor on RBU100H (the RBU of 380V 22–45kW has internal reactor). The reactor terminals must match the RBU terminals; otherwise the damage to RBU and fire may occur.</p> |
|  | <p>✧ Note the polarity of the RBU; otherwise the damage to RBU and fire may occur.</p>   |
|  | <p>✧ The "r", "s" and "t" of the RBU connect to 3PH power terminals "R", "S", and "T" respectively (see Figure 4-5 and Figure 4-6). Otherwise, breaker tripping or RBU fault or even damage may occur.</p>         |
|  | <p>✧ Ground the PE terminal of the RBU to avoid physical injuries.</p>   |

### 4.4.2 Terminals of the control circuit

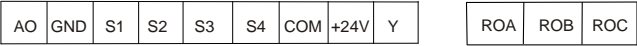


Figure 4-4 Terminals of the control circuit

| Terminal | Function  |
|----------|---|
| S1–S4    | <p>ON-OFF input terminal. Optical coupling isolation input terminal with +24V and COM.</p> <p>S1: Valid in terminal control. Automatic input.</p> <p>S2: Valid in terminal control. Automatic/Manual input.</p> <p>S3: Multi-function terminal</p> <p>S4: Multi-function terminal</p> |
| Y        | Open collector output terminal, the corresponding common ground terminal  |

| Terminal               | Function   |
|------------------------|--|
|                        | is COM.<br>External voltage range: 0–24V<br>Output current range: 0–50mA                           |
| +24V                   | +24V power supply for the local device, with a maximum output current of 150mA                     |
| COM                    | +24V common terminal   |
| AO                     | Output range: 0–10V  |
| GND                    | Reference null potential of AO   |
| RO1A,<br>RO1B,<br>RO1C | RO1 relay output, ROA common terminal, ROB NC, ROC NO<br>Contactor capability: AC250V/3A, DC30V/1A |

## 4.5 Standard wiring

#### 4.5.1 400V 22kW–45kW

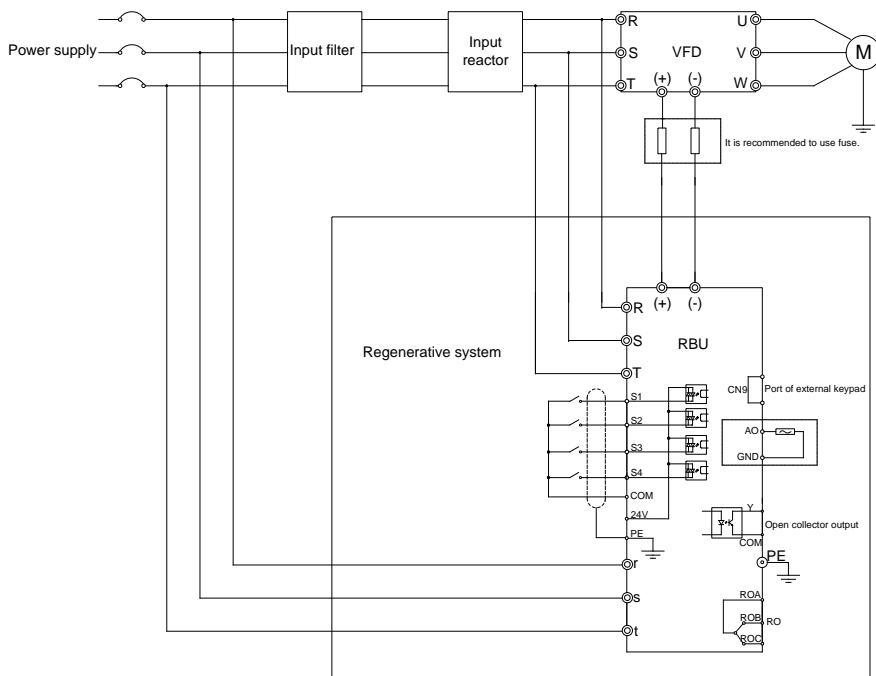


Figure 4-5 Standard wiring of RBU 380V 22kW–45kW

**Note:**

- ✧ RBU 380V 22kW–45kW has internal output reactor.
- ✧ The input reactor is standard.

- ◇ The input filter is optional.
- ◇ The fuse is optional. Configure the fuse at 1.5 times of the rated current of the RBU.

#### 4.5.2 380V 55kW–250kW/660V 55kW–400kW

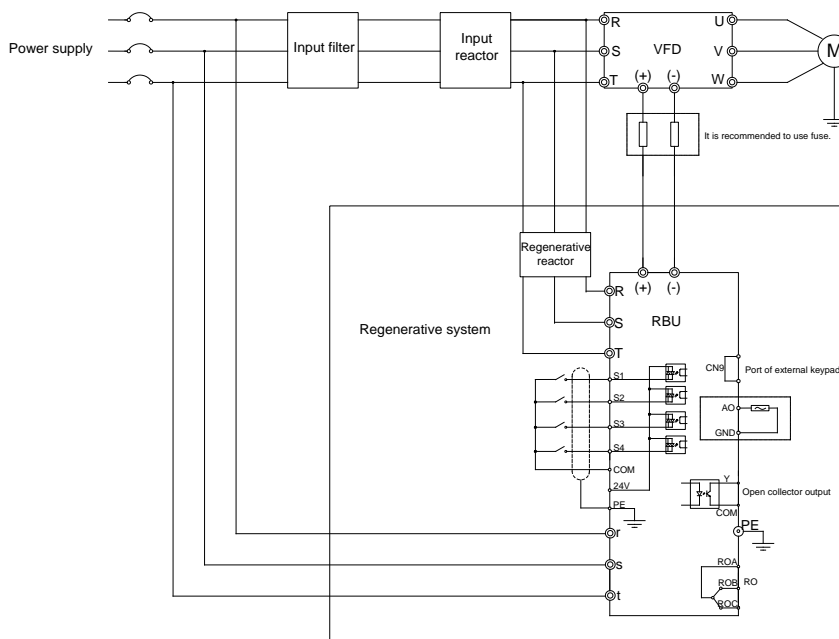


Figure 4-6 Standard wiring of RBU 380V 55kW–250kW/660V 55kW–400kW

#### Note:

- ◇ RBU 380V 55kW–250kW/660V 55kW–400kW has standard input/output reactor.
- ◇ Input filter is optional.
- ◇ The fuse is optional. Configure the fuse at 1.5 times of the rated current of the RBU.

### 4.6 Parallel connection

#### 4.6.1 Parallel connection of RBU100H (M-S configuration)

Steps:

1. Master setting:

- 1) P0.17=2;
- 2) Select P0.00=1 (terminal control);
- 3) Set as manual mode or automatic mode.

2. Slave setting:

- 1) Connect Y and COM of the master to S2 and COM of the slave;

- 2) Select P0.00=1 (terminal control);
- 3) Set as manual mode (S2 valid).

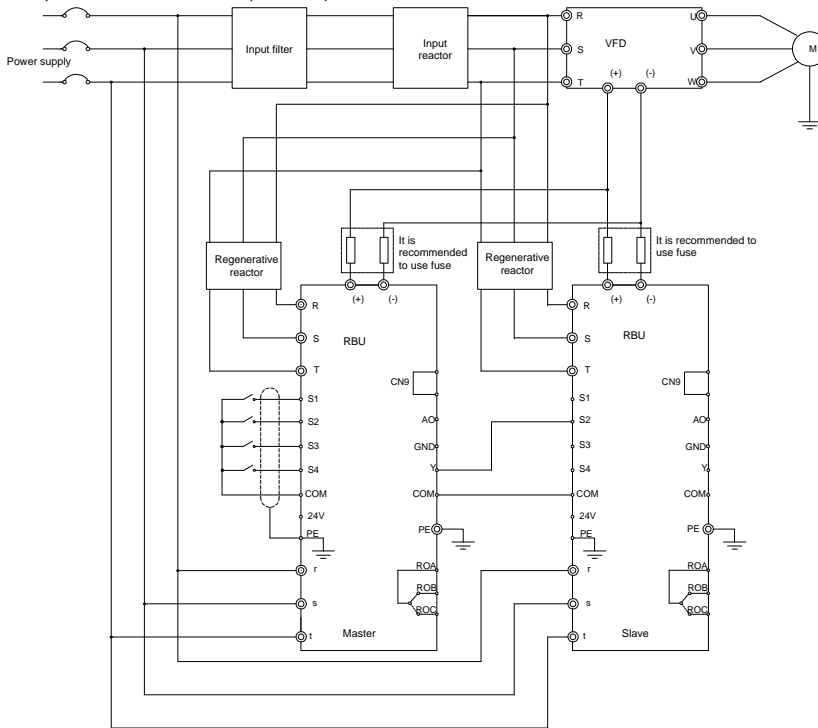


Figure 4-7 Parallel connection 1 of RBU100H

Connection instruction: make the first RBU as the master and others as the slave in parallel connection. Connect the Y and COM terminal of the first RBU to the S2 and COM terminal of the second one, third one and so on.

**Note:**

- ✧ RBU 380V 22kW–45Kw has internal output reactor. RBU 380V 55kW–250kW/660V 55kW–400kW has standard output reactor.
- ✧ Each RBU100H has 1 standard input reactor. Select the input reactor according to the rated parameters of the VFD.
- ✧ The input filter is optional. Select the input filter according to the rated parameters of the VFD.
- ✧ The fuse is optional. Configure the fuse at 1.5 times of the rated current of the RBU.
- ✧ Derate 90% of the RBU100H in parallel connection.



#### 4.6.2 Parallel connection of RBU100H (No master and slave)

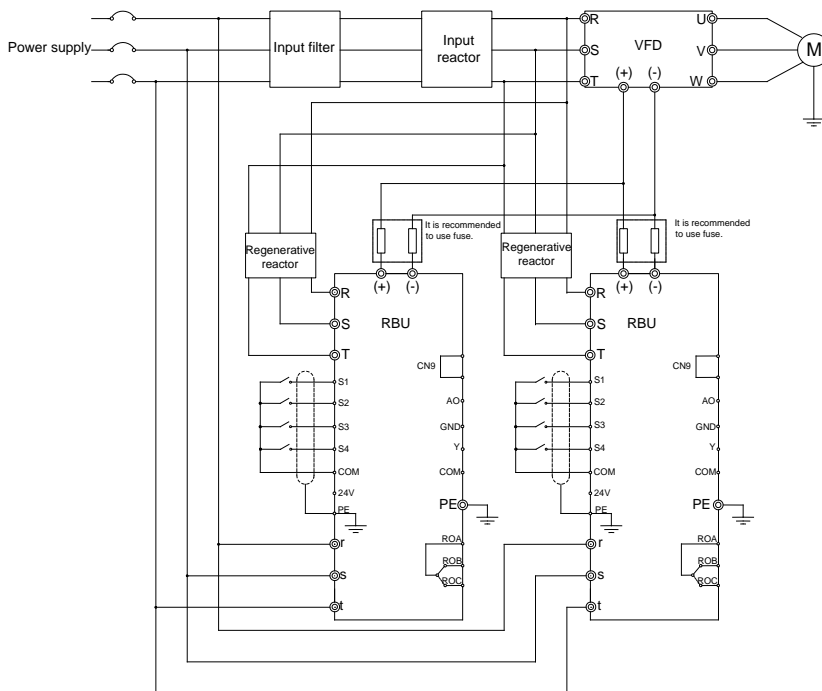


Figure 4-8 Parallel connection 2 of RBU100H

**Note:**

- ✧ RBU100H 380V 22kW–45kW has internal output reactor. RBU100H 380V 55kW–250kW/660V 55kW–400kW has standard output reactor.
- ✧ Each RBU100H has 1 standard input reactor. Select the input reactor according to the rated parameters of the VFD.
- ✧ The input filter is optional. Select the input filter according to the rated parameters of the VFD.
- ✧ The fuse is optional. Configure the fuse at 1.5 times of the rated current of the RBU.
- ✧ Derate 90% of the RBU100H in parallel connection.

## 5 Keypad operation

### 5.1 Keypad

#### 5.1.1 Keyboard diagram

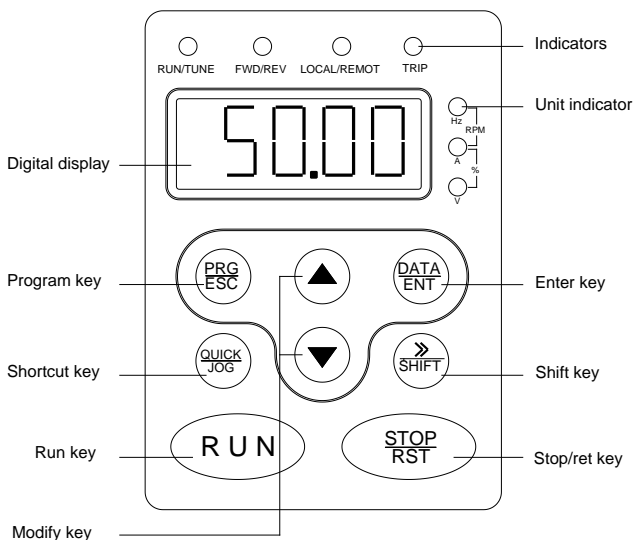



Figure 5-1 Keypad diagram

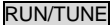


#### 5.1.2 Buttons

| Button | Name               | Function   |
|--------|--------------------|--|
|        | Program Key        | Enter or escape from the first level menu to delete the parameter quickly  |
|        | Enter Key          | Progressively enter menu and confirm parameters.   |
|        | UP Increment Key   | Progressively increase data or function codes.   |
|        | DOWN Decrement Key | Progressive decrease data or function codes.   |
|        | Shift Key          | In parameter setting mode, press this button to select the bit to be modified. In other modes, cyclically displays parameters by right shift |
|        | Run Key            | Start to run the device in keypad control mode.  |

| Button  | Name            | Function  |
|---|-----------------|---|
|  | STOP/RST<br>Key | In running status, restricted by P0.00, can be used to stop the device. When fault alarm, the button can be used to reset the device without any restriction. |

### 5.1.3 Indicators

1) Function indicator light description:

| Function indicator  | Description  |
|---|--|
|  | Extinguished: stop status<br>Flickering: parameter autotuning status<br>Light on: operating status |
|  | Extinguished: keypad control<br>Flickering: terminal control<br>Light on: communication control    |
|  | Extinguished: normal operation status<br>Flickering: overload pre-warning status                   |

2) Unit indicator light description:

| Function indicator | Description         |
|--------------------|---------------------|
| Hz                 | Frequency unit      |
| A                  | Current unit        |
| V                  | Voltage unit        |
| RPM                | Rotating speed unit |
| %                  | Percentage          |
|                    | System temperature  |

3) Digital display:

5-digit LED, which can display all kinds of monitoring data and alarm codes such as reference frequency, output frequency and so on.

## 6 Function parameters

### 6.1 Function code

| Code  | Name  | Detailed instruction   | Default            | Modify |
|-------|---|--|--------------------|--------|
| P0.00 | Control mode                                    | 0–1<br>0: Keypad<br>1: Terminal<br>S1 valid: automatic operation<br>S2 valid: manual operation | 1                  | ☉      |
| P0.01 | Keypad control                                  | 0–1<br>0: Automatic operation<br>1: Manual operation   | 0                  | ☉      |
| P0.02 | Filter time                                     | 1–10   | 1                  | ☉      |
| P0.03 | DC bus voltage establishment time               | 0–10000ms  | 10000ms            | ○      |
| P0.04 | Regenerative voltage difference during starting | 0.0–240.0V<br>380V voltage degree<br>660V voltage degree                                       | 40.0V<br>60.0V     | ○      |
| P0.05 | Regenerative voltage difference during stopping | 0.0–120.0V<br>380V voltage degree<br>660V voltage degree                                       | 10.0V<br>15.0V     | ○      |
| P0.06 | Regenerative stop time                          | 0.1–10.0s  | 1.0s               | ○      |
| P0.07 | Input frequency                                 | 0~1<br>0:50Hz<br>1:60Hz  | 0                  | ☉      |
| P0.08 | S3 function                                     | 1–15<br>3:Valid when connect S3 to COM<br>Other reserved                                       | 3 (external fault) | ☉      |
| P0.09 | S4 function                                     | 1–15<br>2: Valid when connect S4 to COM<br>Other reserved                                      | 2 (fault reset)    | ☉      |
| P0.10 | Reserved  |  | 1                  | ○      |
| P0.11 | AO output                                       | 0–8<br>0: DC voltage(0–1000V/1500V/3000V)<br>1: Output current (0–200.0%)<br>2–8: Reserved     | 1                  | ○      |
| P0.12 | Lower limit of AO output                        | 0.0%–100.0%  | 0.0%               | ○      |

| Code  | Name  | Detailed instruction  | Default          | Modify |
|-------|---|---|------------------|--------|
| P0.13 | Corresponding output of lower limit of AO     | 0.00V–10.00V  | 0.00V            | ○      |
| P0.14 | Upper limit of AO output                      | 0.0%–100.0%   | 100.0%           | ○      |
| P0.15 | Corresponding output of upper limit of AO     | 0.00V–10.00V  | 10.00V           | ○      |
| P0.16 | Running mode of the cooling fan               | 0–1<br>0:Operate after starting<br>1:Start when the temperature of the heat sink exceeds 45°C         | 1                | ○      |
| P0.17 | Y switch output selection                     | 0–15<br>0:No output   | 0                | ○      |
| P0.18 | RO selection                                  | 1:Operation command valid<br>2:Regenerative output<br>3: Reserved<br>4:Fault output<br>5–15: Reserved | 4 (fault output) | ○      |
| P0.19 | UV protection                                 | 300.0–1500.0V<br>380V voltage degree<br>660V voltage degree   | 380.0V<br>470.0V | ○      |
| P0.20 | Fault reset times                             | 0–3   | 0                | ◎      |
| P0.21 | Fault reset time                              | 0.1–10.0s   | 3.0s             | ◎      |
| P0.22 | Reserved                                      |   |                  |        |
| P0.23 | Regenerative current limit                    | 100–500   | 330              | ◎      |
| P0.24 | Operation time                                | 0–XXXXXH  |                  | ●      |
| P0.25 | Function parameters reset/fault history clear | 0–2<br>0: No change<br>1: Reset<br>2: Fault history clear   | 0                | ◎      |
| P0.26 | Software version                              |   |                  | ●      |

| Code  | Name                        | Detailed instruction  | Default | Modify |
|-------|-----------------------------|---|---------|--------|
| P0.27 | Previous three fault type   | 0–26<br>0: No fault<br>1: Reserved<br>2: Reserved<br>3: Out3<br>4: Reserved<br>5: Reserved<br>6: OC3  |         | ●      |
| P0.28 | Previous two fault type     | 7: Reserved<br>8: Reserved<br>9: OV3<br>10: UV<br>11: Reserved<br>12: OL2<br>13: Reserved<br>14: SPO<br>15: Reserved<br>16: OH2<br>17: EF<br>18: Reserved |         | ●      |
| P0.29 | Previous fault type         | 19: ItE   |         | ●      |
| P0.30 | Current fault               | 20: Reserved<br>21: EEP<br>22: Reserved<br>23: Reserved<br>24: Reserved<br>25: CP<br>26: PEr  |         | ●      |
| P0.31 | OC at current fault         |   |         | ●      |
| P0.32 | DC voltage at current fault |   |         | ●      |
| P0.33 | Parameter lock              | 0–1<br>0: Null<br>1: Lock   | 0       | ○      |
| P1.00 | User password               | 0–65535   | *****   | ◎      |

## 6.2 Detailed function

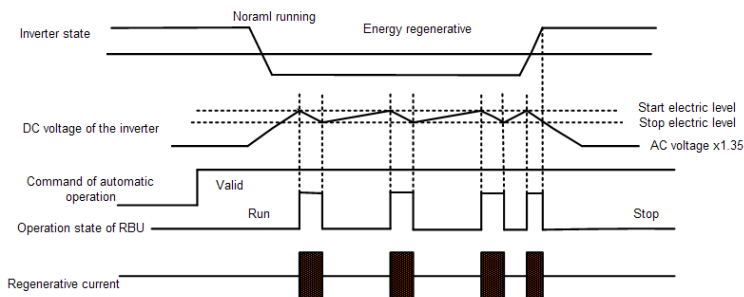
| Function code | Name           | Detailed instruction   | Default |
|---------------|----------------|--|---------|
| P0.00         | Control mode   | 0 - 1<br>0: Keypad<br>1: Terminal<br>S1 valid: automatic operation<br>S2 valid: manual operation | 1       |
| P0.01         | Keypad control | 0 - 1<br>0: Automatic operation<br>1: Manual operation   | 0       |

Automatic operation:

In automatic operation, the RBU detects the DC voltage and the operation stops.

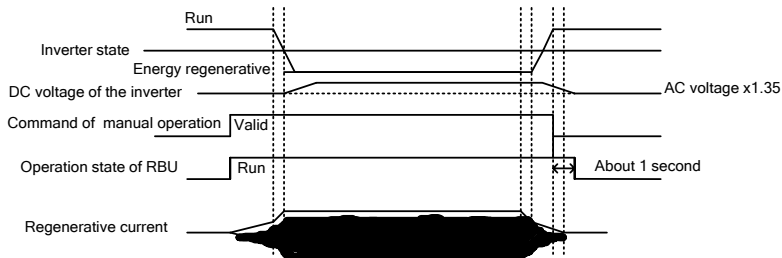
The RBU works when DC voltage of the VFD-standard DC voltage  $> P0.04$

The RBU stops when DC voltage of the VFD-standard DC voltage  $< P0.05$



Manual operation:

RBU works when receiving the command.



## 7 Fault tracking

Fault is indicated by LEDs. When "TRIP" indicator is on, the RBU is in an abnormal state. Use the information given in this chapter to find out the fault cause. If not, contact with the INVT office.

| Fault code | Fault type              | Possible cause   | What to do   |
|------------|-------------------------|--|--|
| OUt3       | IGBT fault              | <ol style="list-style-type: none"> <li>1. IGBT module fault.</li> <li>2. The connection of the driving wires is not good.</li> <li>3. Grounding is not properly.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Inspect external equipment and eliminate interference and press <b>STOP/RS1</b>.</li> <li>2. Ask for help</li> </ol>   |
| OC3        | Over-current in running | <ol style="list-style-type: none"> <li>1. The RBU is abnormal.</li> <li>2. The power of RBU is too low.</li> </ol>   | <ol style="list-style-type: none"> <li>1. Check the input power</li> <li>2. Select the RBU with a larger power</li> <li>3. Ask for help</li> </ol>   |
| OV3        | Over-voltage in running | <ol style="list-style-type: none"> <li>1. The input voltage is abnormal.</li> <li>2. There is large energy feedback.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Check the input power</li> <li>2. Check if the DEC time of the load is too short or the VFD starts during the rotation of the motor or it needs to increase the energy consumption components.</li> <li>3. Ask for help</li> </ol> |
| OL2        | RBU overload            | <ol style="list-style-type: none"> <li>1. Reset the rotating motor</li> <li>2. The voltage of the power supply is too low.</li> <li>3. The load is too heavy.</li> <li>4. Close loop vector control, reverse direction of the code panel and long low-speed operation</li> </ol> | <ol style="list-style-type: none"> <li>1. Avoid the restarting after stopping.</li> <li>2. Check the power of the supply line</li> <li>3. Select a VFD with bigger power.</li> <li>4. Select a proper motor</li> <li>5. Ask for help</li> </ol>                              |
| SPO        | Output phase loss       | U,V,W phase loss input   | <ol style="list-style-type: none"> <li>1. Check the output distribution</li> <li>2. Ask for help</li> </ol>  |



| Fault code | Fault type              | Possible cause   | What to do   |
|------------|-------------------------|--|--|
| OH2        | IGBT overheat           | <ol style="list-style-type: none"> <li>1. Air duct jam or fan damage</li> <li>2. Ambient temperature is too high.</li> </ol>             | <ol style="list-style-type: none"> <li>1. Refer to the overcurrent solution</li> <li>2. Redistribute dredge the wind channel or change the fan</li> <li>3. Low the ambient temperature</li> <li>4. Check and reconnect</li> <li>5. Ask for help</li> </ol> |
| EF         | External fault          | S3 external fault input terminals action   | <ol style="list-style-type: none"> <li>1. Check the external device input</li> <li>2. Ask for help</li> </ol>  |
| ItE        | Current detection fault | The connection of the control board is not good  | <ol style="list-style-type: none"> <li>1. Check the connector and reconnect</li> <li>2. Ask for help</li> </ol>  |
| EEP        | EEPROM fault            | <ol style="list-style-type: none"> <li>1. Error of controlling the write and read of the parameters</li> <li>2. EEPROM damage</li> </ol> | <ol style="list-style-type: none"> <li>1. Press <b>STOP/RST</b></li> <li>2. Ask for help</li> </ol>  |
| CP         | Control power fault     | Auxiliary power supply damage  | <ol style="list-style-type: none"> <li>1. Ask for help</li> </ol>  |
| PEr        | Parameters error        |  |  |



✧ Apply non-isolation circuit for the RBU. Disconnect (+) and (-) and ensure there is no voltage present before operation.

## 8 Maintenance and hardware diagnostics

### 8.1 Maintenance interval

If installed in an appropriate environment, the RBU requires very little maintenance. The table lists the routine maintenance intervals recommended by INVT.

| Checking            |                            | Item  | Method                                 | Criterion  |
|---------------------|----------------------------|---|--|--|
| Ambient environment |                            | Check the ambient temperature, humidity and vibration and ensure there is no dust, gas, oil fog and water drop.                 | Visual examination and instrument test | Conforming to the manual   |
|                     |                            | Ensure there are no tools or other foreign or dangerous objects   | Visual examination                     | There are no tools or dangerous objects.   |
| Voltage             |                            | Ensure the main circuit and control circuit are normal.   | Measurement by millimeter              | Conforming to the manual   |
| Main circuit        | For public use             | Ensure the screws are tightened up  | Tighten up                             | NA   |
|                     |                            | Ensure there is no distortion, crackles, damage or color-changing caused by overheating and aging to the machine and insulator. | Visual examination                     | NA   |
|                     |                            | Ensure there is no dust and dirtiness   | Visual examination                     | NA<br><b>Note:</b> if the color of the copper blocks change, it does not mean that there is something wrong with the features. |
|                     | The lead of the conductors | Ensure that there is no distortion or color-changing of the conductors caused by overheating.                                   | Visual examination                     | NA   |
|                     |                            | Ensure that there are no crackles or color-changing of the protective layers.   | Visual examination                     | NA   |
|                     | Terminals seat             | Ensure that there is no damage  | Visual examination                     | NA   |
|                     | Resistors                  | Ensure whether there is   | Smelling and                           | NA   |

| Checking        |               | Item   | Method   | Criterion  |
|-----------------|---------------|--|--|--|
|                 |               | replacement and splitting caused by overheating.             | visual examination   |  |
|                 |               | Ensure that there is no offline.                             | Visual examination or remove one ending to coagulate or measure with multimeters       | The resistors are in $\pm 10\%$ of the standard value. |
| Control circuit | PCB and plugs | Ensure there is no loose screws and contactors.              | Fasten up  | NA   |
|                 |               | Ensure there is no smelling and color-changing.              | Smelling and visual examination  | NA   |
|                 |               | Ensure there are no crackles, damage distortion and rust.    | Visual examination   | NA   |
|                 |               | Ensure there is no weeping and distortion to the capacitors. | Visual examination or estimate the usage time according to the maintenance information | NA   |
| Cooling system  | Cooling fan   | Estimate whether there is abnormal noise and vibration.      | Hearing and Visual examination or rotate with hand                                     | Stable rotation  |
|                 |               | Estimate there is no losses screw.                           | Tighten up   | NA   |
|                 |               | Ensure there is no color-changing caused by overheating.     | Visual examination or estimate the usage time  | NA   |

| Checking |                  | Item   | Method                                   | Criterion |
|----------|------------------|--|--|-----------|
|          |                  |  | according to the maintenance information |           |
|          | Ventilating duct | Ensure whether there is stuff or foreign objection in the cooling fan, air vent. | Visual examination                       | NA        |


Consult the local INVT Service representative for more details on the maintenance. Visit the official website of INVT: [www.invt.com](http://www.invt.com) and choose **Support > Services**.

## 8.2 Cooling fan

The RBU's cooling fan has a minimum life span of 25,000 operating hours. The actual life span depends on the VFD usage and ambient temperature.

Fan failure can be predicted by the increasing noise from the fan bearings. If the RBU is operated in a critical part of a process, fan replacement is recommended once these symptoms appear. Replacement fans are available from INVT.

### 8.2.1 Replacing the cooling fan

|   |  |
|---|--|
|  | <p>✧ Read and follow the instructions in chapter 1 Safety precautions. Ignoring the instructions would cause physical injury or death, or damage to the equipment.</p> |
|---|--|

1. Stop and disconnect the power supply and wait for at least the time designated on the RBU.
2. Lever the fan holder off the drive frame with a screwdriver and lift the hinged fan holder slightly upward from its front edge.
3. Free the fan cable from the clip.
4. Disconnect the fan cable.
5. Remove the fan holder from the hinges.
6. Install the new fan holder including the fan in reverse order.
7. Restore power.

## 8.3 Capacitors

### 8.3.1 Reforming the capacitors

The DC bus capacitors must be reformed according to the operation instruction if the RBU has been stored for a long time. The storing time is counted from the producing date other than the delivery data which has been marked in the serial number of the RBU.

| Time                           | Operational principle   |
|--------------------------------|---|
| Storing time less than 1 year  | Operation without charging  |
| Storing time 1-2 years         | Connect with the power for 1 hour before first ON command   |
| Storing time 2-3 years         | Use power surge to charge for the RBU <ul style="list-style-type: none"> <li>• Add 25% rated voltage for 30 minutes</li> <li>• Add 50% rated voltage for 30 minutes</li> <li>• Add 75% rated voltage for 30 minutes</li> <li>• Add 100% rated voltage for 30 minutes</li> </ul> |
| Storing time more than 3 years | Use power surge to charge for the RBU <ul style="list-style-type: none"> <li>• Add 25% rated voltage for 2 hours</li> <li>• Add 50% rated voltage for 2 hours</li> <li>• Add 75% rated voltage for 2 hours</li> <li>• Add 100% rated voltage for 2 hours</li> </ul>             |

The method of using power surge to charge for the RBU:

The right selection of Power surge depends on the supply power of the RBU. Single phase 220V AC/2A power surge applied to the RBU with single/three-phase 220V AC as its input voltage. The RBU with single/three-phase 220V AC as its input voltage can apply Single phase 220V AC/2A power surge. All DC bus capacitors charge at the same time because there is one rectifier.

High-voltage RBU needs enough voltage (for example, 380V) during charging. The small capacitor power (2A is enough) can be used because the capacitor nearly does not need current when charging.

The operation method of RBU charging through resistors (LEDs):

The charging time is at least 60 minutes if charge the DC bus capacitor directly through supply power. This operation is available on normal temperature and no-load condition and the resistor should be serially connected in the 3-phase circuits of the power supply:

380V driven device: 1k/100W resistor. LED of 100W can be used when the power voltage is no more than 380V. But if used, the light may be off or weak during charging.

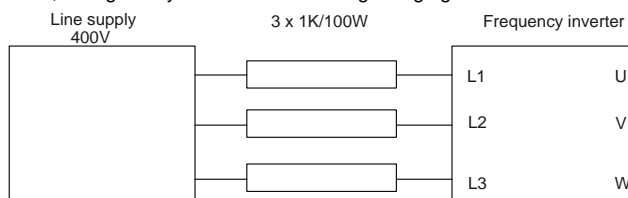


Figure 8-1 Illustration of the driven device 380V

### 8.3.2 Change electrolytic capacitors



✧ Read and follow the instructions in chapter 1 Safety precautions. Ignoring the instructions may cause physical injury or death, or damage to the equipment.

Change electrolytic capacitors if the working hours of electrolytic capacitors in the RBU are above 35000. Please contact with the local INVT offices or dial our national service hotline (400-700-9997) for detailed operation.

### 8.4 Power cables



✧ Read and follow the instructions in chapter 1 Safety precautions. Ignoring the instructions may cause physical injury or death, or damage to the equipment.

1. Stop the drive and disconnect it from the power line. Wait for at least the time designated on the RBU.
2. Check the tightness of the power cable connections.
3. Restore power.

## 9 Dimension and size

### 9.1 Dimension of the keypad

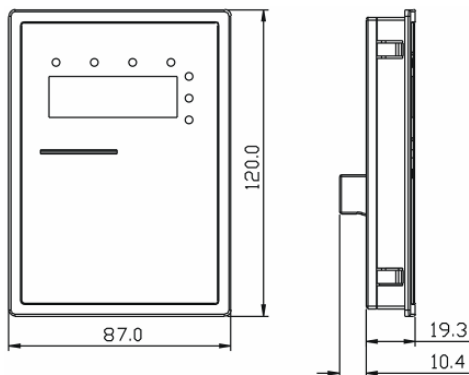


Figure 9-1 Dimension of the external keypad (big)

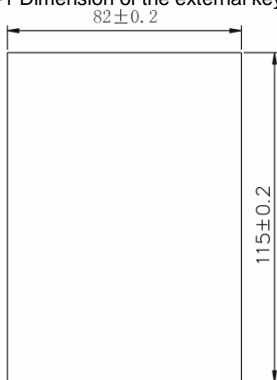


Figure 9-2 Hole dimension of the external keypad (big)

## 9.2 External dimension and weight of RBU

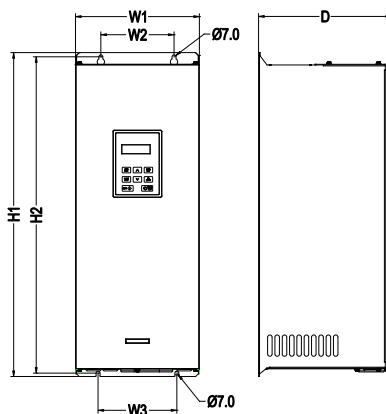


Figure 9-3 External dimension and installation dimension of RBU

| Voltage class | Model     | W2                     | W3   | H2    | W1                 | H1   | D     | Installation hole (mm) | Recommended screw | Gross weight (kg) |
|---------------|-----------|------------------------|------|-------|--------------------|------|-------|------------------------|-------------------|-------------------|
|               |           | (mm)                   | (mm) | (mm)  | (mm)               | (mm) | (mm)  |                        |                   |                   |
|               |           | Installation dimension |      |       | External dimension |      |       |                        |                   |                   |
| 380V          | 22–45kW   | 130                    | 140  | 563.5 | 220                | 577  | 236   | 7                      | M6*16             | 41                |
|               | 55–132kW  | 130                    | 140  | 563.5 | 320                | 577  | 261   | 7                      | M6*16             | 32                |
|               | 160–250kW | 250                    | 250  | 732   | 440                | 750  | 326.2 | 9                      | M8*16             | 70                |
| 660V          | 55–160kW  | 130                    | 140  | 563.5 | 320                | 577  | 261   | 7                      | M6*16             | 32                |
|               | 200–400kW | 250                    | 250  | 732   | 440                | 750  | 326.2 | 9                      | M8*16             | 70                |

**Note:** The gross weight of 22–45kW contains the regenerative reactor weight.





Service line: 86-755-23535967 E-mail: [overseas@invt.com.cn](mailto:overseas@invt.com.cn) Website: [www.invt.com](http://www.invt.com)

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**INVT Power Electronics (Suzhou) Co., Ltd.** (origin code: 06)

Address: 1# Kunlun Mountain Road, Science & Technology Town,  
Gaixin District, Suzhou, Jiangsu, China

|                        |  |                                      |                  |                |
|------------------------|--|--------------------------------------|------------------|----------------|
| Industrial Automation: | ■ HMI                                  | ■ PLC                                | ■ VFD            | ■ Servo System |
|                        | ■ Elevator Intelligent Control System  | ■ Rail Transit Traction System       |                  |                |
| Energy & Power:        | ■ UPS                                  | ■ DCIM                               | ■ Solar Inverter | ■ SVG          |
|                        | ■ New Energy Vehicle Powertrain System | ■ New Energy Vehicle Charging System |                  |                |
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