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AS160 Low-Voltage Drive for Pump and Fan V1.1

With Creative Science and Technology
You Will Find Such is The World
COMPANY CULTURE

STEP Spirit: Face the world; pursue the best, stay always ahead of the line.
STEP Value: Faith, innovation, excellence.
STEP Tenet: Customer satisfaction, employee pride, community benefit.
STEP Mission: Provide the best control, drive and energy-saving products for our customers.
STEP vision: To be an international high-tech enterprise in electric industry.

COMPANY INTRODUCTION

Shanghai Signer STEP Electric Co., Ltd is a subsidiary of Shanghai STEP Electric Corporation. Shanghai STEP Electric Corporation is an enterprise group and was founded in 1995, and the registered trademark is “STEP”. STEP Group mainly specializes in R&D, manufacture and sales of industrial control systems and drive products, owning 4 domestic companies and 2 overseas companies.
STEP came into the A-share market publicly on December 24, 2010 while the opening bell of Shenzhen Stock Exchange was sounded.
Stock: STEP; stock code: 002527.
In 2009, Shanghai STEP Electric Corporation invested in and established the Shanghai Signer STEP Electric Co., Ltd, having a modern R&D and manufacture facility of drive product, with area of 30000 square meters, equipped with the first class test instruments and production equipments in the world. And advanced management systems and strict quality controls are implemented to make sure of providing clients with drive products and services of high quality. The company owns various series of products, including high/low voltage fans/pump drive, high/low voltage vector drive, four-quadrant drive, elevator drive, common DC bus drive, integrated driving controller, energy regenerator, door drive, AC servo system, etc.
As utilization of the STEP global strategy, the products have been exported to over 30 countries and regions in Europe, North America, and Asia. In China, STEP has set up 16 agencies and liaison offices in Beijing, Shanghai, Guangzhou, etc., with sales of service covering the entire country.
STEP insists in the enterprise spirit: Face the world; pursue the best, stay always ahead of the line. It strives to provide the best control, drive and energy-saving products for our customers and desires to be an international high-tech enterprise in electric industry step by step.
PRODUCT INTRODUCTION

AS160 low-voltage drive for pump and fan is the latest product of Shanghai Signer STEP Electric Co., Ltd., designed for the pump, water supply and ventilation markets in China, applicable to the variable speed drive of pumps and fans. (According to the load characteristics of pumps, owning functions of constant pressure water supply, sleep control, multi-pump switch, rotating speed track, flexible application, easy operation.)

AS160 drive adopts outstanding control performance as international high-end drives, but also integrates with application characteristics in China, to further strengthen the reliability of the product and environmental adaptability as well as customized and industrialized design, which better meet a wide range of drive applications, such as fan, mixer and drive belt.

PRODUCT TRAIT

Features on drive technology
- User password setting, effectively improving the safety of system operation
- Torque boost, increasing the load capacity of motor start
- New PWM dead time compensation and dynamic carrier modulation technique, effectively reducing the noise of motor
- Low inductance bus technique, excessively improving the safety of module
- Multiple frequencies setting means, satisfying the multivariate field demands
- Automatic slip compensation, abating the affects on rotating speed of motor by change in load
- Special PID control, convenient to realize process control
- Hopping frequency control, effectively avoiding the resonance point of mechanical load
- Rotating speed track restart, smooth starting of motor in rotation
- Automatic voltage adjustment, keeping the output voltage constant when the grid voltage changes

Design reliability
- Independent air duct design
- Compact structure design
- Three-proofing design of whole machine
- Wide voltage range design
- Power on self test function
- Perfect terminal protection
- Overheat pre-alarm protection
- All-around protection of whole machine
- High-precision current detection and protection
- All-around switching power supply protection

Special for pump
- Diverse VF curve, particularly applicable to load with variable torque, such as pump
- PID given feedback, unit display, simple and visualized, mutual switching between two operation commands
- No need of PLC or water supply controller to realize general water supply
- Support two kinds of water supply modes, namely fixed variable frequency pump and circulating variable frequency pump
- Conventional pump, sleep pump, drainage pump and firefighting pump configured flexibly, 7 pumps control at utmost
- 8-section time-pressure setting to apply the changing demand for water supply pressure
- 16-section pressure given by combination of input terminals
- Support the flexible sleep mode, automatically start small sleep pump under the sleep condition, satisfy the pressure demand for sleep system, exit sleep mode automatically after meeting sleep wake-up conditions, and stop small pump sleeping
- Timing control in turn, equalize the working time of all pumps, prevent pump rusting effectively and avoid one pump operating always
- Water level control of sump by monitoring and controlling the water level
- Detect the water level of incoming pool, and control and regulate the given pressure of governor pump automatically
- Have overpressure and underpressure alarm function, and support fault automatic reset and restart
- Random panel may be mounted on the cabinet door externally
OPERATION METHOD

- **Mutual switching between two sets of operation commands**
  - Operation command 1 or 2:
  - Digital signals given by operation panel
  - Analog/digital given
    - Analog A0/A1 terminals: -10 V ~ +10 V or 0 ~ 20 mA
    - Digital X1 terminals: multi-step frequency, voltage given
    - Pulse D1/D0/D1 terminals: 0 ~ 50 kHz
  - Modbus communication mode given (Profibus DP optional)
  - Performance function given

- **Multiple input/output modes integrated**
  - 2-way analog inputs / 2-way analog outputs
    - Analog input filtering time may be set, strengthening anti-interference ability
    - Analog input curve has an independent multi-step correction function
    - 8-way digital inputs / 2-way digital outputs, 4 relay outputs
  - Standard 16-speed setting, 23-speed operation may be set at the utmost
  - Provide independent high-speed pulse input and output ports for high-speed pulse cascade connection

- **Two sets of frequency commands**
  - Speed command 1 or 2:
    - Panel given speed
    - A0 given speed
    - A1 given speed
    - A0+A1 given speed
    - A0-A1 given speed
    - UPON given speed
    - Communication given speed
    - PID given speed

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STANDARD WIRING DIAGRAM

- **Terminal wiring diagram**
  - For digital input terminals, 2 wiring methods apply according to source logic PNP and sink logic NPN. Sink wiring is defaulted, short circuit for 24 and XV. Source wiring is used, short circuit for XC and XV.

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AS160 Low-Voltage Drive for Pump and Fan

*Note: 3-phase 380 ~ 450V input for the 400V class, 3-phase 200 ~ 240V input for the 200V class. For 220kW built-in DC reactor (optional), for 375kW, built-in braking unit optional.*
### Control circuit terminal functions

<table>
<thead>
<tr>
<th>Type</th>
<th>Terminal symbols</th>
<th>Function description</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal 485</td>
<td>1A 1B 1C 3A 3B</td>
<td>Positive end of 485 differential signal</td>
<td>1A: Serial port (9600bps), 12000bps, parallel, 3A: Serial port (57600bps), 3B: Serial port (115200bps)</td>
</tr>
<tr>
<td></td>
<td>2A 2B 2C 4A 4B</td>
<td>Negative end of 485 differential signal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y1 YC 24 XV X1 X3 X5 X7 XC 0V 0V A0 A1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y0 XC X0 X2 X4 X6 A+ B- M0 M1 V+ V-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital input</td>
<td></td>
<td>+24V</td>
<td>Maximum input current: 0mA, with over-load protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X0 - X7 Multi-functional input terminals</td>
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<td></td>
<td></td>
<td>XV +24V ground</td>
<td>Interior isolated from GND</td>
</tr>
<tr>
<td></td>
<td></td>
<td>XC Multi-function input common terminal</td>
<td>Interior isolated from GND</td>
</tr>
<tr>
<td>Digital output</td>
<td>Y0 - Y1 Open collector output terminals</td>
<td>Voltage range: 24V±20%, maximum input current: 50mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>YC Open collector output common terminal</td>
<td>Interior isolated from GND</td>
<td></td>
</tr>
<tr>
<td>Analog input</td>
<td>V+ Analog input reference voltage +15V</td>
<td>Maximum input current: 20mA, with short-circuit protection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V- Analog input reference voltage -15V</td>
<td>Maximum input current: 20mA, with short-circuit protection</td>
<td></td>
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<tr>
<td></td>
<td>A0 Analog voltage input</td>
<td></td>
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<tr>
<td></td>
<td>A1 Analog voltage input</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A1 Analog current input</td>
<td>0~20mA, input impedance 5000Ω, maximum input current: 50mA, resolution: 12 bits (0.05%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0V Analog input ground</td>
<td>Interior isolated from COM</td>
<td></td>
</tr>
<tr>
<td>Analog output</td>
<td>M0 Analog output 1</td>
<td>0<del>20mA, permissible input impedance 200</del>500Ω, 0<del>10V, permissible output impedance 0</del>10V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M1 Analog output 2</td>
<td>Output accuracy: 2%, resolution: 10 bits (0.1%), with short-circuit protection.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0V Analog output ground</td>
<td>0<del>20mA or 0</del>10V, analog input is selected through jumpers</td>
<td></td>
</tr>
<tr>
<td>Relay output</td>
<td>1A/1B/1C Relay output</td>
<td>1A/1B: 2A/2B/2C, 3A/3B, 4A/4B, normally open</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2A/2B/2C Relay output</td>
<td>Contact capacity: 250VAC/5A, 300VDC/5A</td>
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<tr>
<td></td>
<td>3A/3B Relay output</td>
<td>Minimum action current: 10mA</td>
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</tr>
<tr>
<td></td>
<td>4A/4B Relay output</td>
<td>Actuation time: 10ms below</td>
<td></td>
</tr>
</tbody>
</table>

### Main circuit terminal functions

<table>
<thead>
<tr>
<th>Terminal symbols</th>
<th>Name and function</th>
</tr>
</thead>
<tbody>
<tr>
<td>RL1, SL1, TL1</td>
<td>3-phase AC input terminal</td>
</tr>
<tr>
<td>SL1, RL1</td>
<td>DC reactor terminal, copper bar short connection when delivery</td>
</tr>
<tr>
<td>R21, B1, B2</td>
<td>Braking resistor connection terminal</td>
</tr>
<tr>
<td>B21, B2, B2</td>
<td>DC power input terminal, external braking unit and DC input terminal</td>
</tr>
<tr>
<td>U11, T12, W13</td>
<td>3-phase AC output terminal</td>
</tr>
<tr>
<td>☇</td>
<td>Grounding terminal PE</td>
</tr>
</tbody>
</table>

*STEP* Website: [www.stepelectric.com](http://www.stepelectric.com)  
With Creative Science and Technology You Will Find Such Is The World
# TECHNICAL SPECIFICATION

## Input
- **Rated voltage**: 380V ~ 480V (1±5% ~ 1±10%), 3-phase power supply
- **Rated frequency**: 50/60Hz
- **Allowable voltage range**: Voltage unbalancedness ±3%; allowable frequency fluctuation: ±5%
- **Voltage dips**: For 5-phase AC 300V ~ 450V power supply, when the input voltage: AC 330V, under-voltage protection after 15 ms

## Output
- **Voltage (V)**: Three-phase 0 to rated input voltage
- **Frequency range**: V/F control: 0.00 ~ 300.00 Hz
- **Overvoltage capacity**: 120%, 1 min., 150% 3s
- **Efficiency (full load)**: 7.5 kW and below ≥ 93%; 45 kW and below ≥ 95%; 55 kW and above ≥ 97%
- **Precision of output frequency**: ±0.01% (digital instruction) ±0.02% (analogue instruction)

## Motor protection
- **Unique functions**: Parameter copy function
- **Process PID**: For closed-loop control of process
- **Common DC bus**: Common DC bus power supply for all series multiple drives. The full series can realize common DC bus supply for several drives.
- **Power on self test**: Realizing the power-up auto-detection of internal and peripheral circuits, including motor grounding, abnormal +10V power supply output, abnormal analog input, and disconnection.

## Motor protection
- **Rotor locking**: Motor overload
- **Motor overheating (PTC)**: Speed limit
- **Torque limit**:

## Drive protection
- **Output current limit**: Install vertically in a well ventilated electrical cabinet, horizontal or other installation method is not permitted. The cooling medium is air. Installed in an environment without exposure to direct sunlight, dust, corrosive gas, inflammable gas, oil mist, steam and water drop.

## Control characteristics
- **Carrier frequency**: 5.5 kHz, carrier frequency may be adjusted automatically according to the load characteristic
- **Frequency setting resolution**: 0.001 Hz (digital instruction), 0.005 Hz/0.02 Hz (analogue instruction 11bit + unsigned)
- **Operation command channel**: Operation panel given, control terminal given, communication given
- **Multiple Frequency Reference Models**: Operation panel reference, digital/analog terminals, communication mode reference, performance function reference
- **Torque boost**: Automatic torque boost, manual torque boost
- **V/F curve**: User-defined V/F curve, linear V/F curve and 5 kinds of droop torque characteristic curves
- **Automatic voltage regulation (AVR)**: Regulate the duty ratio of output PWM signal automatically according to fluctuation of bus voltage so as to release the effect on the output voltage fluctuation by fluctuation of grid voltage
- **Instantaneous power-down disposal**: At the time of instantaneous power-down, control by bus voltage to realize uninterrupted operation
- **DC braking capacity**: Braking current: 0.0 ~ 150.0% rated current

### Analog input/output
- **V/F control**: 2-way, maximum input frequency: 0 ~ 50 kHz
- **Open collector output**: 2-way, output function may be defined

### Digital input/output
- **Digital input**: 8-way, 24VDC high-level set effectively. Input function may be defined
- **Pulse frequency output**: 2-way, maximum output pulse: 0 ~ 50 kHz
- **Relay output**: 4-way, Normally open and close, contact capacity: resistive 5 A 250 VAC or 5 A 30 VDC, output function may be defined
- **Pulse frequency output**: 1-way, 0 ~ 50 kHz, open collector pulse square signal output, programmable
## MODEL-SELECTION AND ORDERING

### Product series model

**AS160**

<table>
<thead>
<tr>
<th>Code</th>
<th>Voltage class</th>
<th>Code</th>
<th>Voltage class</th>
</tr>
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<tbody>
<tr>
<td>4</td>
<td>200V class</td>
<td>0200</td>
<td>5 phase</td>
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<tr>
<td>4</td>
<td>400V class</td>
<td>0200</td>
<td>5 phase</td>
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</table>

### Product series description

<table>
<thead>
<tr>
<th>Drive model</th>
<th>Rated output current (A)</th>
<th>Applicable motor power (kW)</th>
<th>Overload 120% (A)</th>
<th>150% (A)</th>
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<tbody>
<tr>
<td>200–240V</td>
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<td>AS160 2TO0P2</td>
<td>5</td>
<td>2.2</td>
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<td>AS160 2TO0P5</td>
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<td>AS160 2TO0P6</td>
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<td>7.5</td>
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<td>AS160 2TO0P7</td>
<td>42</td>
<td>9</td>
<td>60</td>
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<tr>
<td>AS160 2TO0P8</td>
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<td>2.2</td>
<td>6</td>
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<tr>
<td>AS160 2TO0P9</td>
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<td>3</td>
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<td>AS160 2TO0P10</td>
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<td>4</td>
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<td>AS160 2TO0P14</td>
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<td>18.5</td>
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<td>AS160 2TO0P16</td>
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<td>AS160 2TO0P19</td>
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<td>134</td>
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<td>380–460V</td>
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<td>4</td>
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<td>AS160 3TO0P19</td>
<td>98</td>
<td>58</td>
<td>134</td>
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</tr>
</tbody>
</table>

Note: as to the higher power and voltage class of 4-pole standard AC motor (1500 r/min), please contact STEP Corporation. Be sure to check the motor nameplates to ensure selected drive compatible with this motor.

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**STEP**

Website: www.stepelectric.com

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### Installation Dimension

<table>
<thead>
<tr>
<th>Drive model</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>H (mm)</th>
<th>W (mm)</th>
<th>D (mm)</th>
<th>Installation aperture d (mm)</th>
<th>Installation Bolt</th>
<th>Installation Nut</th>
<th>Installation washer</th>
<th>Fastening length (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS160 2T02P2</td>
<td>100</td>
<td>288</td>
<td>330</td>
<td>160</td>
<td>168</td>
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### Take AS160 4T07P9 and below power class for example
WATER SUPPLY

Circulating soft starting

Operating principle:
in auto mode, the drive starts, 1A1B closes, KM2 actuates, 1# pump runs by variable frequency. The drive output reaches to startup frequency, 1A1B opens after startup delay. The drive stops output immediately. 1A1B closes again after 2A2B closes, the drive reruns, then 2# pump runs by power frequency and 2# pump runs by variable frequency, and pressure is added by analogy. When the output frequency drops down to stop frequency, switch off the pump run firstly by power frequency after stop delay. Thermal relay overload signal accesses to input terminal, and switch off this pump from the circulating soft starting logic while overloading.

One main several auxiliary

One main pump, with a great capacity, runs by variable frequency. Several auxiliary pumps, with relatively small capacity, powered directly by power frequency supply, but other startup and stop are controlled by the drive.

Operating principle:
Main pump is controlled by the drive. When the output frequency reaches to the startup frequency, switch on the relay after delay, start one small pump; if the pressure is not sufficient, the output frequency reaches to the startup frequency again, start another small pump, and the rest may be deduced by analogy. When the pressure exceeds, the frequency reduces to stop frequency, switch off the relay after delay, and stop the small pumps.
Duration of load balance. When the operating time of pump expires and there is idle pump, switch to the idle pump automatically.
SERVICES COMMITMENT

When you contact products of Sigriner STEP for the first time, you will find their differences. Our experts own rich experiences and may help you select drives applicable to your process. From the initial technical specifications to production, delivery and installation, we will comply with all your requirements.

Sigriner STEP’s services and supports are not only limited to telephone assistance. At different stages of installation, startup, maintenance and troubleshooting, our representatives will provide technical services and supports for you for 24 hours per day, 7 days per week.

- **Range of our services**
  - Round-the-clock service 24 / 7 / 365
  - Preventive maintenance
  - Training
  - Spares sales
  - Product renewal
  - Upgrading
  - Maintenance and replacement
  - Professional services (harmonic analysis, power supply quality research, electrical system application, remote diagnosis, etc.)

- **Our commitment**
  Sigriner STEP is honorable to its reputation in long-term product services (including high-voltage drive). We commit to provide supports in the whole service life. However long the service life of product is, we shall never give up our responsibilities in product services and will ensure your full satisfaction. To prolong the service life of drivers and strengthen their functions, Sigriner STEP upgrades their programs ceaselessly to make you have opportunity for enjoying the newly upgraded technologies.

- **Convenient local services**
  Because of our long-term field service for all customers, we own numerous professional service personnel. Each one of our service representatives receives all-around special training.

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**Domestic service network**

**Domestic market**
5 agencies
14 liaison offices

**Agencies**
Beijing, Shanghai, Guangzhou, Wuhan, Jinan

**Liaison offices**
Dalian, Shenyang, Tianjin, Shijiazhuang, Zhengzhou, Chongqing, Xian, Hangzhou, Wuxi, Nanxun, Wujian, Changsha, Shenzhen, Fuzhou, etc.

**Oversea network**

**Oversea companies**
Germany, Hong Kong

**Overseas sales**
Germany, England, Denmark, Scotland, Canada, Japan, Brazil, Chile, Singapore, Australia, India, Pakistan, Turkey, Saudi Arabia, Korea, Hong Kong, Macao, Taiwan, etc.