86P series

SINGLE AXIS POSITION CONTROLLER

- Large, dustproof Keyboard
- 99 Address Memory • Position/Quantity • Externally selectable
- Absolute/Incremental Operation • Automatic Backlash Compensation
- Completely plug-in construction
- Will operate with 2-speed AC or DC drives, Hydraulic cylinders, closed loop Servodrives or Stepper Motors
The automatic Position Controller 86P is a compact plug-in unit with self contained mains power supply and supply for the Encoder. Its essential main features are:

- Large, dustproof keyboard, suitable for operation with gloved hands.
- 99 Address Memory, which can be operated in a combination of Absolute and Incremental dimensions.
- Unlimited time memory of Programme and Actual position, on mains switch off.
- Facility for external Address selection.

Functions/Concepts

Absolute Mode
In absolute mode, the unit calculates the direction, speed and to be run from the instantaneous actual position, to the preset desired position. Preset correction values (eg saw width) are not used as standard in absolute mode, but can be provided if needed.

Incremental Mode
The incremental address can be preset in 3 basic forms:
1. Incremental moves will basically take place from a high value, in the direction of zero.
2. Incremental moves will basically take place in the + direction, away from zero.
3. (a) Without Incremental Error Compensation:
   A positioning error in one move, will not be compensated for in the next move, ie all steps are made with the same accuracy tolerance.
(b) With Incremental Error Compensation:
   Should one move have an error of say 0.2 mm then the following move will automatically compensate, ie the Absolute actual value will remain within accuracy tolerance.

Memory Address Allocations
Each Address comprises a 5 digit, demanded position with fixed decimal point to 1 or 2 decimal places and a three digit repeat or quantity factor.

The 99 Addresses are allocated as standard as:
(a) Address 1 - 78 Absolute
(b) Address 1 - 79 Incremental
(c) Address 80 - 89 Absolute
   Version a. or b. can be selected at the rear of the unit. Other combinations are available to special order.

The Open Loop Control Switched Positioning
Most commercially available drives are suitable for control by the 86P.
Due to limited natural retardation of the mechanics, it is advisable to fit a Brake.

Slew Running Distance, Stop Correction
The Slew running distance can be preset between 1 and 99 at the rear of the unit by means of Coding Switches VS.
Should the delay in braking result in over-run, this can be corrected by means of Coding Switch KS, which gives a range of 0.1 - 9.9.

Automatic Backlash Compensation
Should backlash be present in Screw or Pinion, then the approach to position can be selected to be always from one direction. The required conditions are set on the T Potentiometer at the back of the unit.

Automatic Retract
Should it be necessary for the Backstop to retract during a cut operation, and then return to the same previous position, this can be effected by closing contact 20 and 12. Opening the contact returns Backstop to previous position.
The required retraction distance is set on the T Potentiometer at the back of the unit.

Datum Setting
The Machine is moved to a known mechanical datum point. The value of this position is noted and programmed into address R1. When the appropriate external contact is closed, this value is transferred to the Actual Value display.
It is possible to prefix a Switch on the machine that will operate at the datum point, so as to automatically datum the machine. The datum must be approached at slow speed. The alternative method is to provide a key operated switch on the deck.

In principle, the machine need be datum only during commissioning, since the actual value is always memorised on mains switch off.

Options
Closed Loop Control, Analogue Output
This option is to be used with 4 quadrant servo drives. Instead of bi-directional fast, slow, stop operation, the drive speed is controlled by an analogue signal in closed loop mode and ramped to zero as position is approached.
This system is to be used only in machines without backlash.
When in position, the system jitters 1 bit. If the load attempts to move it out of position it will produce torque to resist the movement and if actually moved, will return into position.

Number of Strokes and Remaining Distance Calculation
Application: Sawing Machine with limited feed stroke mechanism

Example:
Maximum Cylinder Stroke 600.0 mm
Demanded move 700.0 mm
Saw width 4.0 mm
Result: The feed mechanism is first of all moved 600 mm. On reaching the preset stop, the stroking cylinder moves back and the Feed mechanism moves again automatically, a distance of 104.0 mm.
By this means the required distance of 700.0 mm is preset beyond the saw line.

External Address Selection
It is possible to programme all 99 addresses and select the destination from an external controller. For this option a 15 way D connector is fitted.
Details of interconnection are given on page 5.

Inch/Metric Selection
The unit can be fitted with a card for calculating inch/metric conversion. Selection is made at the rear of the unit.

Over-run Security
In case of mains failure, Encoder and Controller are supplied for about 4 sec from a battery before storage of actual position.

Flexible Multiplier
To read output in meaningful figures it is sometimes necessary to multiply Encoder pulses by any ratio 0.9999 to 0.0001.
INSTRUCTIONS FOR OPERATION

Switch-on Conditions
The Unit automatically assumes the first address number in the preset programme.

The value on Switch-off appears in Actual Value display, zero is displayed in the Required Value display. To activate the required programme, the START button must be pressed - the Required Value for the first address now appears.

Datum Setting

The Machine is moved to a known position eg 20.00mm.
- Press RESET
- Press R, then 1
- Enter 200 (fixed decimal point) by means of the numerical Keyboard. The Datum value will appear in the Reference value display as 20.00mm, Press E.
- Closing the external “datum” contact transfers this value to the Actual Value Display. The Machine is now datumed.

Saw Width Correction

Say saw width is 4.00mm.
- Press RESET
- Press R, then 2
- Enter 40 (fixed decimal point) by means of the numerical Keyboard. The value will appear in the display as 4.0.
- Press E - The Saw Width Correction is now memorised.

MODES OF OPERATION

Hand Operation
With this mode selected, the Drive can be positioned directly in pushbutton jog mode using the Actual Value display. The pushbuttons have the following functions:
- FAST forwards, SLOW forwards
- FAST backwards, SLOW backwards
These buttons are cross interlocked

Single Position Operation
With this mode selected, the numerical Keyboard is used to instantly enter dimensions into required value display (Absolute dimensions). Press C, then value required, then START.

Reset
This button is mainly used to reset all inputs. It sets the programme to the Start point and has no interlocking function.

Programme
When this button is activated the input Keys are enabled:

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>Address number</td>
</tr>
<tr>
<td>&gt;</td>
<td>Cursor forwards</td>
</tr>
<tr>
<td>F</td>
<td>Call up Datum and Saw Blade correction</td>
</tr>
<tr>
<td>T</td>
<td>Programme Scan/Correction</td>
</tr>
<tr>
<td>A</td>
<td>Programme/Cancel end</td>
</tr>
</tbody>
</table>
| C      | Independent clearing of the displayed value chosen by means of the Cursor.

Programming always begins by pressing RESET! This gives a simple format:
NR [length] > (QUANTITY)
NR [length] > (QUANTITY)
NR [length] > (QUANTITY)
... to E — Programme End.

The illuminating Cursor Point indicates the value being inserted and this can be moved forwards by Key >.

Memory Designation
Switch 8 set to on (at rear):
Address 1-79 = Absolute Address 80-99 = Incremental
Switch 8 set to off
Address 1-79 = Incremental Address 80-99 = Absolute

Example of a Complete Programme (GBP)

It is required to go to position of Absolute dimension 1000.00mm then execute an Incremental programme of 10 pieces at 20.00mm.

Press RESET
Press [NR] (Cursor point illuminates in NR display)
Press [C] then 1 (where you can enter any absolute address 1 to 79)
Press [C] (Cursor point illuminates in Reference Value display)
Press [C] and enter the desired value eg 1000.00, (1000.00mm)
Press [C] (Cursor point now illuminates in Quantity display)
Press [C] and 1 (The last address is now memorised)
Press [NR] (Cursor point illuminates in NR display)
Press [C] then 60 (Incremental address, which could also be 81-99)
Press [C] (Cursor point illuminates in Reference Value display)
Press [C] and enter say 200 (20.00mm)
Press [C] (Cursor point illuminates in Quantity display)
Press [C] and enter the quantity required eg 10, (now the second address is memorised)

When the Start is now activated, the Machine will automatically first position to 1000.00 and then make 10 incremental moves of 20.00mm in the direction of zero.

Working with Memorised Values
It is possible for example to store all 69 addresses, or parts thereof, to which one can always return at will. It is not necessary to follow a numbered programme, but possible to create a running programme using the 69 address in any combination.

Input Checking, Test — Button T
The button T has two functions:
1. The entered programme can be checked by pressing STOP or Start after receiving the programme it is activated. It is then possible to detect errors or programming faults by pressing STOP or Start. The programme can be stopped by pressing STOP, and the required address can be selected from a programme or unit address list as specified by this means.
2. The drive is stopped (Position reached or Stop activated) the programme can be stopped by means of the T button. The required address can be selected from a programme or unit address list as specified by this means.

Pushbutton inhibit
The functioning of the Keyboard is inhibited during running. The inhibit is cancelled by pressing STOP or RESET. Start inhibit
The START is inhibited when
a. The programme is finished, or
b. The next move (eg Incremental mode) would take the Machine past zero position.

NB. Quantity pulse signal must be activated after each move, to enable the next start (button auto increment).
**CONNECTIONS/DIAGRAMS**

Plug in terminal list
NB: Shown in de-energised conditions

<table>
<thead>
<tr>
<th>Command</th>
<th>Terminals</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>10</td>
<td>Activates running process for the distance and direction.</td>
</tr>
<tr>
<td>Stop</td>
<td>11</td>
<td>De-activates output terminals. Stopping process when needed.</td>
</tr>
<tr>
<td>Datum</td>
<td>12</td>
<td>The preset reference value will be transferred to the actual value display when this contact is closed (eg by means of an external keyswitch).</td>
</tr>
<tr>
<td>Quantity</td>
<td>13</td>
<td>The Quantity counter is reduced by 1 or counting in this contact is closed. Oil quantity sensor, the pulse Start Signal resets the oil amount.</td>
</tr>
<tr>
<td>Pulse</td>
<td>14</td>
<td>With this contact closed the Back stop will return at 1500/600 RPM.</td>
</tr>
<tr>
<td>Automatic</td>
<td>15</td>
<td>Back stop is closed.</td>
</tr>
<tr>
<td>Retract</td>
<td>16</td>
<td>With this contact closed the Back stop will return to a distance that is 100% of full.</td>
</tr>
</tbody>
</table>

**Output Signals**

<table>
<thead>
<tr>
<th>Command</th>
<th>Terminals</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run Signal</td>
<td>17</td>
<td>Enable contact for the Device, closed when desired value is greater than the Actual Value. Opens when stop preset point is reached.</td>
</tr>
<tr>
<td>Slowdown</td>
<td>18</td>
<td>Closed when distance is greater than the Slow running distance. Opens when slowdown point is reached.</td>
</tr>
<tr>
<td>Reverse</td>
<td>19</td>
<td>Contact closes at distance less than the Actual Value.</td>
</tr>
<tr>
<td>&quot;Progr. End&quot;</td>
<td>20</td>
<td>The contact closes on trip (of pulse 1600V) when the required position is reached. Alternatively, contact exists during a programme of movements and reaches end of programme.</td>
</tr>
</tbody>
</table>

**Encoder Connection**

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Forwards (Channel A) - Encoder Terminal 6</td>
</tr>
<tr>
<td>18</td>
<td>Backwards (Channel B) - Encoder Terminal 4</td>
</tr>
<tr>
<td>19</td>
<td>Power Supply (+12V) - Encoder Terminal 7</td>
</tr>
<tr>
<td>20</td>
<td>Zero line - Encoder Terminal 1</td>
</tr>
</tbody>
</table>

**Mains Input**

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Earth</td>
</tr>
<tr>
<td>2</td>
<td>Line 230V/50Hz 0.15A internal fuse tested</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

**Technical Data**

- **Mains Supply**: 220v/50Hz +/- 10% alternatively 110v ac
- **Load**: 10VA
- **Encoder Power Supply**: 12v dc 100mA
- **Encoder Signal**: NPN Switching (Other on request)
- **Actual Value Display**: 5 digit red LED 10mm high
- **Reference Address Nr**: 2 digit red LED 8mm high
- **Distance**: 5 digit red LED 8mm high
- **Quantity**: 5 digit red LED 8mm high
- **Memory on Mains Removal for Programme and Actual Value**: 5 years
- **System Accuracy**: +/- 1 Increment
- **Positioning Speed**: 60mm/min max with 0.1mm resolution
- **Acquisition time of Reference**: 10ms from contact closure
- **Output Signals**: Potential free n/o contacts rated at 250V/0.5A
- **Internal Heating**: 25°C
- **Ambient Temperature**: -5°C to 45°C
- **Connector**: Plug-on Terminal block with orientation
- **Mounting Attitude**: Any

**Mechanical Data**

- **Enclosure**: Switchboard mounting, metal case
- **Front dimensions**: H:129mm, W:290mm
- **Cut-Out**: H:107mm, W:275mm
- **Depth**: 150 mm including Connector - 230 mm with external address selection
- **Connector**:
- **Mass**: 1 kg.
Details of Analogue Module

Pot 4: Zero Setting
Using this potentiometer, the output voltage can be set to 0V when in position, ie when required and actual position values are equal.
The red LED on the board must illuminate when in position. To set, disable drive, press from Reset button and monitor Analogue output on Digital meter. Turn Pot 4 to give zero reading.

Pot 3: Amplitude
Setting for maximum positive and negative output voltage, ie maximum speed in the range available. Clockwise increases voltage, anti-clockwise decreases volts.
Full clockwise gives +10V.
Full anti-clockwise gives 0V.
The voltages are equal in both directions.

Pot 2: Amplitude
Amplitude max +/− 10V

Pot 1: Ramping Range
(Proportional Loop Gain)
Potentiometer for setting the ramp rate (proportional band).
The fastest ramp is set when the break point is +/−998 bits from the required position point.
The sharpest ramp is set when the break point is approx +/−100 bits away.
Turn the potentiometer clockwise to sharpen rate.
Too sharp a ramp causes instability; too long a ramp causes sloppy positioning.

Connector for External Address Selection

The programmed address 1-96 can be externally selected via this connector. Selection of address 0 inhibits the start.
The standard input is NPN. If PNP is required this must be specified at order stage.
An external 5V power supply is required. Any other voltage must be specified at order stage.

<table>
<thead>
<tr>
<th>Pin Connections</th>
<th>2 decade, BCD code</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSD</td>
<td>MSD</td>
</tr>
<tr>
<td>PIN</td>
<td>PIN</td>
</tr>
<tr>
<td>A(1)</td>
<td>5</td>
</tr>
<tr>
<td>B(2)</td>
<td>4</td>
</tr>
<tr>
<td>C(3)</td>
<td>3</td>
</tr>
<tr>
<td>D(6)</td>
<td>2</td>
</tr>
<tr>
<td>0V</td>
<td>1</td>
</tr>
<tr>
<td>15V</td>
<td>8</td>
</tr>
</tbody>
</table>

These pins to be connected to zero volts of the external power supply, to activate input.

An incorrect setting will upset the setting of the zero point of the regulator.
If it is absolutely essential that resetting must be done, proceed as follows:
(c) Disconnect encoder.
(b) Press reset pushbutton (Red LED on the analogue card must illuminate).
(c) Monitor analogue output voltage on digital meter.
(d) Plug back in the direction bridge and note the voltage on the meter.
(e) Proceed carefully. Turning the potentiometer causes a considerable voltage change (in millivolts).
The accuracy is dependent on the correct setting:
(f) The offset is correctly set, when changing the direction bridge produces no change in output voltage.
(g) Having reset the offset correctly, the zero setting (Pot 4) can be adjusted.
h) On completion of this operation, reset Pot 1 and check the direction bridge is firmly plugged in.
**SETTINGS - TECHNICAL DATA**

**Layout - Settings and Connections**

![Diagram of the settings and connections](image)

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**Function List**

- **T - Potentiometer**
  - The following values can be preset by means of this potentiometer.
  - 1. The over-run distance under Backlash compensation.
  - 2. Proportional time for the over-run, e.g., the dwell time on reversal at the end of over-run (about 10:1).
  - 3. Automatic retract distance.

- **VS Decade Switches**
  - The slow running distance can be preset by means of these switches, between 01 and 99. Minimum value must be 01.

- **KS Decade Switches**
  - The over-run distance to rest can be compensated for by means of these switches, between 0.1 and 99.

**Function Switches S1 - S14**

Switch down = closed (on).
Switch up = open (off).

<table>
<thead>
<tr>
<th>Switch Nr</th>
<th>Switch down (on)</th>
<th>Switch up (off)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Decimal point before 1 digit</td>
<td>No decimal point</td>
</tr>
<tr>
<td>2</td>
<td>Decimal point before 2 digits</td>
<td>No decimal point</td>
</tr>
<tr>
<td>3</td>
<td>mm</td>
<td>inch</td>
</tr>
<tr>
<td>4</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>5</td>
<td>Output Relay on terminals 10/11 operates as “programme end”</td>
<td>With incremental mode error compensation,</td>
</tr>
<tr>
<td>6</td>
<td>Output Relay on terminals 10/11 operates as “stop” pulse</td>
<td>Address 1 - 79 Absolute</td>
</tr>
<tr>
<td>7</td>
<td>Without incremental mode error compensation.</td>
<td>Address 80 - 99 Incremental</td>
</tr>
<tr>
<td>8</td>
<td>Address 1 - 79 Absolute</td>
<td>Incremental mode in direction away from zero</td>
</tr>
<tr>
<td>9</td>
<td>Address 80 - 99 Incremental</td>
<td>With backlash compensation</td>
</tr>
<tr>
<td>10</td>
<td>Without backlash compensation</td>
<td>Without analogue control</td>
</tr>
<tr>
<td>11</td>
<td>Encoder pulse x 1</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Encoder pulse x 2</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Encoder pulse x 4</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Encoder direction</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>With analogue control</td>
<td></td>
</tr>
</tbody>
</table>

---

**Options**

- **Inch/Metric Switching**
  - An external switch can be connected to the unit to select inch or mm operation.

- **N.B.** On switching over, the unit must be given the appropriate reference datum point in correct dimensions. Also VS and KS must be reset.

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**External Address Selection**

See connections on page 4.

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**Analogue Output**

Settings, characteristics and connections are shown on page 4.

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**Hints for Use:**

The controller is designed for use as an industrial panel mounting unit. The components used are the most up to date available and protected against the external environment.

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**Mounting Situation**

- This electronic unit should be mounted away from inductive or capacitive radiation.
- Avoid the warmest spots.

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**Mains Input**

- Keep within tolerances, protect by over voltage relays.

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**Power Cabling**

- Keep low voltage signal cabling away from power cabling.
- Screen input and encoder cables.

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**Output Contacts**

- Output relay contacts are protected internally by Variators. Nevertheless protect all cables and contacts with Suppressors.

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**Ordering Code**

The basic unit gives the flexibility to the customer to select the functions by means of switches 1 - 14. It is only necessary to select the required switches to the ‘on’ position.

**Example:**

- Type 86.1.5.7.13/Option mm/inch
- Set switches to "On" 1.5.7 and 13.
- Set all other switches to "Off".
Commissioning

Without Analogue Closed Loop Control

A simple guide to putting the unit into operation is as follows:

1. Switch out of operation
   (a) incremental error compensation (sw7 on)
   (b) Backlash compensation (sw10 on)
   (c) Saw blade compensation (set to 0.9)

2. Rotate Encoder in manual mode (function D) to check that Encoder gives correct direction of count. Change switch 14 if incorrect.

3. Set datum. Either put machine to mechanical zero or to a measurable position and set datum as per instructions.

4. Set overrun distance (KS) to 0.0

5. Set slowdown distance (VS) to some fairly large number, eg 50.


7. Key in a position eg 100.0. Press start and note machine runs at fast speed, slow speed and stops on a reading other than 100.0 in actual value display. Note this reading eg 101.3 and the error is 1.3 mm. Repeat at 200.0, 300.0 etc in the upward direction and then the same positions in downward direction. Note the error at each position. It should be consistent to +/- 0.1.

Take an average of this error and set KS to this value. Repeat the positions and note that machine stops accurately to +/- 0.1. You may need to trim KS another + or - 0.1 to get best results.

If stopping error is not consistent to +/- 0.1 in all positions, then accuracy of +/- 0.1 cannot be achieved. The problem is that friction is not constant throughout and improvement can only be made by reducing the slow (creep) speed, till consistent errors are seen.

8. When accuracy has been achieved, the slow speed point can be reduced so that cycle times are improved. Progressively reduce value of VS until the machine creeps only for the shortest time, before KS (stop) is activated.

NB: VS must never be set to 00.

If VS is reduced too far, errors in positioning will now start appearing.

9. You may now select the mode of operation (if required) in:
   (a) Incremental error compensation
   (b) Backlash compensation
   (c) Saw blade compensation

10. You may now operate a program and operate in incremental mode.

NB: To operate in programme mode you need to activate quantuty pulse signal.

With Analogue Closed Loop Control

First of all it is necessary to set up the 4 quadrant drive on its own such that it is stable and gives correct full speed for +/-10v reference signal. The drive and 86P can now be coupled.

Proceed commissioning as follows:

1. Set machine slide in mid position. Set P3 on analogue card to 90% anticlockwise.

2. Switch power on.

   The drive should stand still. If it runs away, switch off immediately. Reverse direction of Encoder channels A and B.

3. Switch on again and note drive stands still.

4. Turn P3 to full clockwise.

   Set KS to 1.0

   Ensure slide is still in middle.

5. Switch on.

   Set datum to 0.0 (see instructions).

   This is an arbitrary datum, for initial commissioning only.

   Select "single position".

   Key in a reasonable position eg 100.0

   Press start. Note that drive moves towards 100.0. Check that this is in correct sense for your machine for increasing values. If not, switch off and reverse Encoder, Armature and Tacho.

6. Switch on.

   Select “single position”.

   Key in position 0.0

   Press Start.

   Note correct sense of direction.

   When correctly set, the drive will run firmly into position without overshoot and the actual value display will jitter 0.1-0.1 etc.

7. If drive fails to reach zero position:

   (a) Press reset.

   (b) Press single position.

   (c) Increase gain pot P2, 2 turns clockwise.

   (d) Key in 100.0

   (e) Press start.

   If it does not reach position repeat (a) to (e) keying in 0.0 and 100.0 alternately, until position is reached.

8. The rate of deceleration is set on Pot 2. Too low gain gives exponential and long time to position. Too high gain produces position overshoot. The ideal setting is when position is achieved with a hint of exponential. The correct conditions are reached when jitter is 0.0-0.1 and not 0.999-0.999.

9. It is now permissible to set the proper datum. A programme of positions can be tried and accuracy of positioning noted.

   Final trimming can be effected using top speed pot P3, gain pot P2 and also offset, pot P4.

   NB: To operate in programme mode you need to activate quantity pulse signal.
Liability exclusion / Guarantee

We have checked the contents of this instruction manual carefully, to the best of our knowledge and belief for conformity with the described hardware and software. Nevertheless errors, mistakes or deviations can not be excluded, therefore we do not guarantee complete conformity. Necessary corrections will be included in the subsequent editions. We appreciate your ideas and improvement suggestions very much.

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