SystempaK
Single-P/I Converter
Model : KUX122/127

User's Manual

Azbil Corporation
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1. SCOPE

This manual covers information required for operation, calibration and maintenance of the model KUX122 Individual-Type P/I converter. Be sure to read this manual before handling the instrument.

2. DESCRIPTION

2.1 Outline

The Individual-Type P/I converter is comprised of P/I converter modules (up to two), a chassis assembly, a case, a cover, customer connection terminals, and an air connection manifold. Each of the P/I converter modules converts a pneumatic signal of 20 - 100 kPa (or 3 - 15 psi, 0.2 - 1.0 bar, or 0.2 - 1 kgf/cm²) into an electrical signal of 4 - 20 mA DC, employing a diffused silicon semiconductor for the pressure to current conversion element.

![Figure 1. External Views of KUX122](Image)
2.2 Structure and Features

Up to two P/I converter modules can be installed on the chassis assembly. The chassis assembly can be removed from the case by removing two chassis mounting-screws and five current junction terminal screws.

The chassis can be removed without requiring to shut down the loop since the pneumatic signal circuit is automatically closed as you remove the chassis from the case. The module has CHECK terminals on its front panel, allowing you to check the output current signal simply by connecting a milliammeter to these terminals.

![Figure 2. Chassis Assembly Detached from Case](image-url)
3. SPECIFICATIONS

3.1 Performance specifications

Input signal: 19.6 - 98.1 kPa, 20 - 100 kPa, 3 - 15 psi, 0.2 - 1.0 bar, or 0.2 - 1.0 kgf/cm², (pressure rating 200 kPa)
Output Signal: 4 - 20 mA DC (current limit at approx. 30 mA)
Power Source: 24V DC (+15%, -10%)
Power Consumption: 0.48 W (max.) per P/I converter module
External Load: 480 ohms (or less) with 24V DC supply

Note) The maximum allowable external load resistance is calculated as follows:

\[ R = \frac{V - 14.4}{0.02} \]

where, R : Load resistance (ohm)
V : Supply voltage (volt)

Air Connections: Rc1/4, 1/4NPT internal thread
Ambient Temperature: 0 to 50 degrees C
Ambient Humidity: 10 to 90% RH
Accuracy: +0.25% FS

Temperature Characteristics

Zero Shift: 0.6% FS per 25°C (max.)
Span Shift: 0.6% FS per 25°C (max.)
Zero Drift: 0.5% FS per 6 months (max.)

Installation: Wall mount
Weight: Approx. 1.2 kg
Finish: Case . . . Zn plated (chromate processed)
Cover . . . Dark beige (Munsell 10YR4.7 / 0.5)

Place of use: Indoor
### 3.2 Model Number Table

#### 1) Individual-Type P/I Converter

<table>
<thead>
<tr>
<th>Basic Model No.</th>
<th>Power Source</th>
<th>Input</th>
<th>Output</th>
<th>Air Piping Connections</th>
<th>Modules</th>
<th>Environment</th>
<th>Options</th>
<th>Description</th>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-1</td>
<td>Individual-Type P/I converter</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.2 - 1.0 kgf/cm²</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>0.2 - 1.0 bar</td>
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<tr>
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<td>20 - 100 kPa</td>
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<tr>
<td>4</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19.6 - 98.1 kPa</td>
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<tr>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Rc 1/4</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1/4 NPT internal thread</td>
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</tr>
<tr>
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<td></td>
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<td>For tropical service (Specific order)</td>
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<td>Corrosive atmosphere resistant (Specific order)</td>
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#### 2) P/I Converter Module

<table>
<thead>
<tr>
<th>Basic Model No.</th>
<th>Power Source</th>
<th>Input</th>
<th>Output</th>
<th>Environment</th>
<th>Options</th>
<th>Description</th>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 - 15 psi</td>
</tr>
<tr>
<td>2</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>0.2 - 1.0 bar</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20 - 100 kPa</td>
</tr>
<tr>
<td>4</td>
<td></td>
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<td></td>
<td></td>
<td>4 - 20 mA DC</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20 - 4 mA DC (Specific order)</td>
</tr>
<tr>
<td>X</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Standard</td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>For tropical service (Specific order)</td>
</tr>
<tr>
<td>B</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Corrosive atmosphere resistant (Specific order)</td>
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<td></td>
<td>No options</td>
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</tbody>
</table>
4. OPERATING PRINCIPLES

The input pressure signal which represents a process variable is fed to a silicon sensor, which is a resistance bridge with a piezoresistance effect, and converts the pressure signal into a resistance signal. A constant current is fed to the resistance bridge and its resistance change is detected into a voltage signal. The voltage signal is amplified by an amplifier and then it is converted into a current signal by a voltage-to-current converter.

![Figure 3. Operating Principle](image-url)
5. INSTALLATION

5.1 Installation Method
The Single-P/I Converter can be directly installed on a wall. Remove the cover and fix the converter with the three M4 mounting-screw (supplied).

5.2 Place of Installation
The instrument should be installed in a place where ambient temperature is within 0 to 50°C and with less temperature change and where atmosphere is not highly humid. The place must be reasonably free from mechanical vibration.

![Figure 4. Removing the Cover](image)

5.3 Customer Connections

(1) Input Air Connections
The ports [Rc1/4 (or 1/4NPT internal thread)] located underneath the air connection manifold are the connectors for the input air signals. As viewed from the instrument front, the left hand one is for #1 and the right hand one is for #2.

(2) Electrical Output Signal Connections
Connect the cables to the customer connection terminals as indicated on the terminal cover. The terminal screws are M3.5, 5 mm long.
No fuse is provided inside of the instrument. As required, provide a fuse externally. Electrical connections can be conveniently made by using Digitronik Line Wiring Block (Model KMW110-X-X).
5.5 Removing or Installing the Chassis Assembly

(1) Removing the Chassis Assembly
Remove the chassis assembly by undoing the two chassis mounting-screws and five current junction terminal screws.

(2) Installing the Chassis Assembly
Insert the air connection pins (at underside of the chassis) and current junction terminals into the guide of the case side and, pressing down the chassis, fix the chassis mounting-screws and current junction terminal screws.

6. OPERATING PROCEDURE
When air piping and electrical wiring are complete and pneumatic input signal and power supply are turned on, the instrument is ready to operated.

7. CALIBRATION AND ADJUSTMENTS

7.1 Setup
Connect a variable air pressure source and a precision pressure gauge (or a mercury column) to the air connection port of the P/I converter module to be calibrated, and connect a 250-ohm precision resistor and a digital voltmeter in parallel to the corresponding terminals.

NOTE: The 4 - 20 mA DC current output can be measured more accurately by connecting a 250-ohm precision resistor in series to develop a voltage drop of 1 - 5V DC across the resistor and measuring this voltage with a digital voltmeter than by measuring the current signal directly with a milliammeter although it may be used simply to monitor the output current.
7.2 Calibration

Adjustment of inputs and outputs are completed at the factory before shipment. Check the accuracies referring to the below table and make adjustments if the accuracies are not met within the required tolerances (±0.25% FS).

<table>
<thead>
<tr>
<th>%</th>
<th>Input</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>bar</td>
<td>kPa</td>
</tr>
<tr>
<td>0</td>
<td>0.2</td>
<td>20</td>
</tr>
<tr>
<td>25</td>
<td>0.4</td>
<td>40</td>
</tr>
<tr>
<td>50</td>
<td>0.6</td>
<td>60</td>
</tr>
<tr>
<td>75</td>
<td>0.8</td>
<td>80</td>
</tr>
<tr>
<td>100</td>
<td>1.0</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>%</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mA DC</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>50</td>
<td>12</td>
</tr>
<tr>
<td>75</td>
<td>16</td>
</tr>
<tr>
<td>100</td>
<td>20</td>
</tr>
</tbody>
</table>

As measuring made at reference temperature 20°C.
7.3 Adjustment

To adjust the zero and span, turn respective potentiometers using a fine screwdriver from the front of the P/I Converter module in the procedure mentioned below. The potentiometers are clockwise.

(1) Set the ZERO and SPAN potentiometers in the mid-position (horizontal position).
(2) Set the input at 0% and note the output “a” volts.
(3) Set the input at 100% and note the output “b” volts.
(4) Calculate b1 (V) = 5 + (5a - b)/4.
(5) With the input remaining at 100%, adjust the output to “b1” volts with the SPAN potentiometer.
(6) Set the input at 0% and adjust the output to 1 volt with the ZERO potentiometer.
(7) Set the input at 100% and check that the output is 5 volts.
8. ELECTRICAL CONNECTIONS

Figure 7. Electrical Connections

4 - 20 mA DC output
9. TROUBLESHOOTING

(1) No output signal is delivered.

- Is power supply voltage normal?
  - NO: Provide power supply line voltage within tolerance (DC: +15%, -10%)
  - YES:

- Is output current greater than 0 mA?
  - NO:
  - The load resistance is too large. (The load resistance must not be greater than 480 ohms.)
  - YES:

- Is Voltage between customer connection terminals "+" and "-" of P/I converter module 14.4V or higher?
  - NO:
  - Make the input pressure greater than 0% (0.2 kgf/cm²).
  - YES:

- Is input pressure greater than 0% (0.2 kgf/cm²)?
  - NO:
  - Make the input pressure greater than 0% (0.2 kgf/cm²).
  - YES:

- Is output current greater than 4 mA?
  - YES: Normal
  - NO:

- Is output current adjustable to greater than 0% (4 mA) with ZERO and SPAN potentiometers?
  - YES:
  - Replace for trial the P/I converter chassis assembly with a one known to be operating normally.
  - NO:
(2) The output signal deflects overscale.

Overscale output signal

Is power supply voltage normal?  

- NO: Provide power supply voltage within tolerance. (DC: +15%, -10%)
- YES

Is input pressure greater than 0% (0.2 kgf/cm²) and less than 100% (1.0 kgf/cm²)?  

- NO: Make the input pressure greater than 0% (0.2 kgf/cm²) and less than 100% (1.0 kgf/cm²)
- YES

Is output current greater than 0% (4 mA) and less than 100% (20 mA)?  

- YES: Normal
- NO

Is output current adjustable to greater than 0% (4 mA) and less than 100% (20 mA) with ZERO and SPAN potentiometers?  

- YES
- NO: Replace for trial the P/I converter chassis assembly with a one known to be operating normally.
(3) The Output Signal is Unstable.

- **Unstable output signal**
  - Is signal changing periodically? (NO)
  - Does output signal vary when input pressure is made zero? (NO)
  - A probable cause is pulsation of input pressure signal.
  - A probable cause is external noise.

- **Is signal change with directivity?**
  - NO
  - YES
  - Correct the supply voltage and load resistance. (DC: +15%, -10%  Load resistance: Not greater than 480 ohms)

- **Is there any leak from piping?**
  - YES
  - Correct the piping
  - NO

- **Is not ambient temperature changing in one direction?**
  - YES
  - A probable cause is ambient temperature change.
  - NO

- **Are supply voltage and load resistance within the specified tolerances?**
  - NO
  - Correctly adjust zero and span.
  - YES
  - Replace for trial the P/I converter chassis assembly with a one known to be operating normally.
10. NOTES FOR REPLACEMENT OF NOX120S

The instruments are interchangeable on the chassis assembly basis. That is, model KUX127 P/I converter module of KUX122 Individual-Type P/I Converter can be installed in the NOX120-S converter provided that the NOX120-S is of the 24V DC supply voltage type and of the 1-point type.

Pay attention to the external load. If the load resistance is less than 360 ohms for each P/I converter module, supply voltage change of +15% and -10% from 24V DC is allowable. For details, refer to Section 3 “SPECIFICATIONS.”

When the local resistance is greater than 360 ohms, model NAX520/522 CurrentpaK Impedance Converter should be used.
11. DRAWINGS

Figure 8. Schematic Diagram of KUX P/I Converter
1) Individual Type P/I Converter (KUX 122)

![Diagram of Individual Type P/I Converter (KUX 122)]

- Mounting holes, φ 4mm dia.
- Customer connection terminals

2) P/I Converter Module (KUX 127)

![Diagram of P/I Converter Module (KUX 127)]

- 4 to 20 mA DC output
- No.1 input connection port
- No.2 input connection port
- Screws. M3 x 8mm long. two

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Figure 9. Dimensions and Connections
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