**V120-12-UN2**

**Graphic Operator Panel & Programmable Logic Controller**

12/24 VDC, 12 pnp/npn digital inputs, 2 universal inputs*, 2 high-speed counter/shaft encoder inputs, 12 transistor outputs, 2 high-speed outputs, I/O expansion port, 2 RS232/RS485 ports

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### Power supply

- **12VDC or 24VDC**
- **Permissible range:** 10.2VDC to 28.8VDC with less than 10% ripple
- **Maximum current consumption:**
  - 130mA@24VDC (pnp inputs)
  - 230mA@24VDC (nnp inputs)
  - 240mA@12VDC (pnp inputs)
  - 280mA@12VDC (nnp inputs)

### Digital inputs

- **12 pnp (source) or nnp (sink) inputs.** See Note 1.
- **Nominal input voltage:** 12VDC or 24VDC. See Notes 2 and 3.
- **Input voltages for pnp (source):**
  - For 12VDC: 0-3VDC for Logic ‘0’
  - 8-15.6VDC for Logic ‘1’
  - 0-5VDC for Logic ‘0’
  - 17-28.8VDC for Logic ‘1’
- **Input voltages for nnp (sink):**
  - For 12VDC: 8-15.6VDC<1.2mA for Logic ‘0’
  - 0-3VDC<3mA for Logic ‘1’
  - 17-28.8VDC<2mA for Logic ‘0’
  - 0-5VDC<6mA for Logic ‘1’
- **Input current:** 4mA@12VDC
- **Input impedance:** 3KΩ
- **Response time (except high-speed inputs):** 10ms typical
- **Galvanic isolation:** None
- **Input cable length:** Up to 100 meters, unshielded

### High-speed counter

- **Specifications** below apply when inputs are wired for use as a high-speed counter input/shaft encoder. See Notes 4 and 5.
- **Resolution:** 32-bit
- **Input frequency:** 10kHz max.
- **Minimum pulse:** 40μs

### Warning Notes:

1. All 12 inputs can be set to pnp (source) or nnp (sink) via a single jumper and appropriate wiring.
2. All 12 inputs can function in 12 VDC or 24 VDC; set via a single jumper and appropriate wiring.
3. pnp (sink) inputs use voltage supplied from the controller’s power supply.
4. Inputs #0 and #2 can each function as either high-speed counter or as part of a shaft encoder. In each case, high-speed input specifications apply. When used as a normal digital input, normal input specifications apply.
5. Inputs #1 and #3 can each function as either counter reset, or as a normal digital input; in either case, specifications are those of a normal digital input. These inputs may also be used as part of a shaft encoder. In this case, high-speed input specifications apply.

* Certain inputs can function as normal digital inputs, analog inputs, RTD inputs or thermocouple inputs, in accordance with jumper settings and wiring connections.

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[Diagram of pnp (source) inputs]

**Note:**
To avoid electromagnetic interference, mount the controller in a metal panel/cabinet and earth the power supply. Earth the power supply signal to the metal using a wire whose length does not exceed 10cm. If your conditions do not permit this, do not earth the power supply.

[Diagram of nnp (sink) inputs]

[Diagram of high-speed counter]

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**Shaft encoder**

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**Warnings:**

- Unused pins should not be connected. Ignoring this directive may damage the controller.
- Improper use of this product may severely damage the controller.
- Refer to the controller’s User Guide regarding wiring considerations.
- Before using this product, it is the responsibility of the user to read the product’s User Guide and all accompanying documentation.

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**Unitronics**

**Industrial Automation Systems**

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**V120-12-UN2 08/03**
Universal Inputs

Analog Inputs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion Inputs</td>
<td>Two 14-bit, multi-range inputs: 0-10V, 0-20mA, 4-20mA</td>
</tr>
<tr>
<td>Conversion Method</td>
<td>Voltage to Frequency</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>&gt;400KΩ for voltage, 5000Ω for current</td>
</tr>
<tr>
<td>Isolation</td>
<td>None</td>
</tr>
<tr>
<td>Resolution (except 4-20mA)</td>
<td>14-bit (16384 units)</td>
</tr>
<tr>
<td>Resolution at 4-20mA</td>
<td>2772 to 16383 (13107 units)</td>
</tr>
<tr>
<td>Conversion Time</td>
<td>100mSec minimum (according to filter type)</td>
</tr>
<tr>
<td>Absolute Max. Rating</td>
<td>±15V for voltage, ±30mA for current</td>
</tr>
<tr>
<td>Linearity Error</td>
<td>0.04% max. of full scale</td>
</tr>
<tr>
<td>Error Limit</td>
<td>0.4% of input value</td>
</tr>
<tr>
<td>Status Indication</td>
<td>Yes, see Note 2</td>
</tr>
</tbody>
</table>

Notes:
1. Inputs #8 and #10 can each function as an analog input, related to signal 0V, in accordance with jumper settings and wiring connections.
2. The analog value can also indicate faults, as shown below:

<table>
<thead>
<tr>
<th>Value</th>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>Input value deviates slightly below the input range.</td>
</tr>
<tr>
<td>16384</td>
<td>Input value deviates slightly above the input range.</td>
</tr>
<tr>
<td>32767</td>
<td>Input value deviates greatly above or below the input range.</td>
</tr>
</tbody>
</table>

Voltage / Current connection

![Voltage / Current connection diagram](image)

Notes:
a. Shields should be connected at the signals' source.
b. The 0V signal of the analog input must be connected to the controller's 0V.

current connection

![Current connection diagram](image)

Notes:
- Shields should be connected at the signals' source.
- The 0V signal of the analog input must be connected to the controller's 0V.

Thermocouple inputs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input type</td>
<td>Thermocouple</td>
</tr>
<tr>
<td>Input ranges</td>
<td>As shown in the table below</td>
</tr>
<tr>
<td>Isolation</td>
<td>None</td>
</tr>
<tr>
<td>Conversion Method</td>
<td>Voltage to Frequency</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1°C / 0.1°F</td>
</tr>
<tr>
<td>Absolute Max. Rating</td>
<td>±1.5°C / ±2.7°F maximum</td>
</tr>
<tr>
<td>Linear Error</td>
<td>0.04% max. of full scale</td>
</tr>
<tr>
<td>Error Limit</td>
<td>0.4% of input value</td>
</tr>
<tr>
<td>Status Indication</td>
<td>Yes, see Note 2</td>
</tr>
<tr>
<td>Warm-up Time</td>
<td>½ hour typically, ±1°C / ±1.8°F repeatability</td>
</tr>
</tbody>
</table>

Notes:
1. Thermocouple #0: use Input #10 as positive input & Input #9 as negative input.
2. The analog value may also indicate when the sensor is not connected to an input or when the value exceeds the permissible range. In these cases, its value will be 32767.

Table 1: Input Ranges

<table>
<thead>
<tr>
<th>Type</th>
<th>Temperature range</th>
<th>ANSI (USA)</th>
<th>Wire Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>200 to 1820°C (-320 to 3276°F)</td>
<td>+ Grey</td>
<td>+ None</td>
</tr>
<tr>
<td>E</td>
<td>-200 to 750°C (-320 to 1382°F)</td>
<td>+ Violet</td>
<td>+ Brown</td>
</tr>
<tr>
<td>J</td>
<td>-200 to 760°C (-320 to 1300°F)</td>
<td>+ White</td>
<td>+ Yellow</td>
</tr>
<tr>
<td>K</td>
<td>-200 to 1250°C (-320 to 2282°F)</td>
<td>+ Yellow</td>
<td>+ Brown</td>
</tr>
<tr>
<td>N</td>
<td>-200 to 1300°C (-320 to 2372°F)</td>
<td>+ Orange</td>
<td>+ Orange</td>
</tr>
<tr>
<td>R</td>
<td>0 to 1768°C (32 to 3214°F)</td>
<td>+ Black</td>
<td>+ White</td>
</tr>
<tr>
<td>S</td>
<td>0 to 1768°C (32 to 3214°F)</td>
<td>+ Black</td>
<td>+ White</td>
</tr>
<tr>
<td>T</td>
<td>-200 to 400°C (-320 to 752°F)</td>
<td>+ Blue</td>
<td>+ White</td>
</tr>
</tbody>
</table>

Thermocouple connection

![Thermocouple connection diagram](image)

Note:
- Shields should be connected at the signals' source.
**RTD inputs**

- **Input ranges**: -200 to 600°C (-328 to 1100°F) to 1 to 320 ohms
- **Isolation**: None
- **Measurement resolution**: 0.1°C / 0.1°F
- **Conversion method**: Voltage to Frequency
- **Conversion time**: 200mSec minimum (according to filter type)
- **Input impedance**: >10MΩ
- **Auxiliary current for PT100**: 150µA typical
- **Linearity error**: 0.04% max. of full scale
- **Error limit**: 0.4% of input value
- **Status indication**: Yes, see Note 2

**Notes:**
1. PT 100 #0: use Input #9 & Input #10, related to CM signal (Input #11).
   PT100 #1: use Input #7 & Input #9, related to CM signal (Input #11).
   To use inputs as PT100, set the relevant jumpers and use appropriate wiring.
2. The analog value can also indicate faults, as shown below:

<table>
<thead>
<tr>
<th>Value</th>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>32767</td>
<td>Sensor is not connected to input, or value exceeds the permissible range</td>
</tr>
<tr>
<td>-32767</td>
<td>Sensor is short-circuited</td>
</tr>
</tbody>
</table>

**PT100 connection**

**Digital outputs**

- **Output type**: P-MOSFET (open drain)
- **Output current**: 0.5A max.
- **Max. frequency for normal outputs**: 50Hz (resistive load) / 0.5Hz (inductive load)
- **High speed output maximum frequency**: 2kHz (resistive load)
- **Short circuit protection**: Yes
- **Short indication**: by software
- **On voltage drop**: 0.5VDC maximum

**Power supply for outputs**

- **Operating voltage**: 10.2 to 28.8VDC
- **Nominal operating voltage**: 12VDC or 24VDC

**Notes:**
1. Output #0 and Output #1 may be used as high-speed outputs.

**I/O expansion port**

- **Up to 128 additional I/Os**, including digital & analog I/Os, RTD and more.

**Miscellaneous**

- **Clock (RTC)**
  - **Date and time-year 2000**: compliant.
- **Battery back-up**: 7 years typical battery back-up for RTC and system data.
- **Battery**: Coin type, 3V lithium battery, CR2450
- **Weight**: 280g (9.87 oz.)
- **Operational temperature**: 0 to 50°C (32 to 122°F)
- **Storage temperature**: -20 to 60°C (-4 to 140°F)
- **Relative Humidity (RH)**: 5% to 95% (non-condensing)
- **Mounting method**: DIN-rail mounted (IP20/NEMA1) Panel mounted (IP65/NEMA4X)

**Transistor Outputs**

**Graphic Display**

- **STN, LCD display**
- **Illumination backlight**: LED, yellow-green, software-controlled
- **Display resolution**: 128x64 pixels

**Keypad**

- **Sealed membrane**
- **Number of keys**: 16

**Program**

- **Ladder Code Memory**: 192K
- **Memory Bits (coils)**: 2048
- **Memory Integers (registers)**: 1600
- **Long Integers (32 bit)**: 256
- **Double Word (32 bit unsigned)**: 64
- **Floats**: 24
- **Timers**: 192
- **Counters**: 24
- **Data Tables**: 120K (RAM) / 64K (FLASH)
- **HMI displays**: Up to 255

**RS232/RS485 serial ports**

- **Used for:**
  - Application Download/Upload
  - Application Testing (Debug) mode
  - Connect to GSM or standard telephone modem:
   - Send/receive SMS messages
   - Remote access programming
  - RS485 Networking

- **RS232 (see note)**: 2 ports
  - Galvanic isolation: None
  - Voltage limits: ±20V
- **RS485 (see note)**: 2 ports
  - Input voltage: -7 to +12V differential max.
  - Cable type: Shielded twisted pair, in compliance with EIA RS485
  - Galvanic isolation: None
  - Baud rate: 110 – 57600 bps
  - Nodes: Up to 32

**Note:**
RS232/RS485 is determined by jumper settings and wiring. Refer to the controller’s User Guide regarding communications.
The tables below show how to set a specific jumper to change the functionality of a specific input. To open the controller and access the jumpers, refer to the directions at the end of these specifications.

**Important:**
Incompatible jumper settings and wiring connections may severely damage the controller.

Input #9 and Input #10 (universal input no. 0)

<table>
<thead>
<tr>
<th>To use as</th>
<th>JP3 for Input #10</th>
<th>JP4 for Input #10</th>
<th>JP5 for Input #9</th>
<th>JP11 for Input #9</th>
<th>JP12 for Input #10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal digital inputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermocouple input*</td>
<td>B</td>
<td>A</td>
<td>A</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>(See Note 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PT100 input</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(See Note 2)</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Analog input - voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(see Note 4)</td>
<td>B</td>
<td>B</td>
<td>A</td>
<td>See Note 3</td>
<td>B</td>
</tr>
<tr>
<td>Analog input - current</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(see Note 4)</td>
<td>B</td>
<td>B</td>
<td>A</td>
<td>See Note 3</td>
<td>B</td>
</tr>
</tbody>
</table>

**Notes:**
1. Thermocouple input is between Input #10 (T+) and Input #9 (T-).
2. PT100 input is connected to Input #9 and Input #10, related to CM signal (Input #11).
3. When using Input #10 as analog input, Input #9 can be used as a normal digital input.
4. Analog inputs are related to signal 0V.

Input #7 and Input #8 (universal input no. 1)

<table>
<thead>
<tr>
<th>To use as</th>
<th>JP2 for Input #7</th>
<th>JP6 for Input #8</th>
<th>JP7 for Input #8</th>
<th>JP10 for Input #7</th>
<th>JP13 for Input #8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal digital inputs</td>
<td>A</td>
<td>A</td>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>Thermocouple input*</td>
<td>B</td>
<td>B</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>(See Note 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PT100 input</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(See Note 2)</td>
<td>B</td>
<td>B</td>
<td>A</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Analog input - voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(see Note 4)</td>
<td>A</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>Analog input - current</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(see Note 4)</td>
<td>A</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>A</td>
</tr>
</tbody>
</table>

**Notes:**
1. Thermocouple input is between Input #8 (T+) and Input #7 (T-).
2. PT100 input is connected to Input #9 and Input #10, related to CM signal (Input #11).
3. When using Input #8 as analog input, Input #7 can be used as a normal digital input.
4. Analog inputs are related to signal 0V.

**JP1**
Input #11

<table>
<thead>
<tr>
<th>To use as</th>
<th>JP1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal digital input*</td>
<td>A</td>
</tr>
<tr>
<td>CM signal for PT100 inputs</td>
<td>B</td>
</tr>
</tbody>
</table>

*Default factory setting
**V120-12-UN2**

**I/O Jumper Settings**

**JP8**

*Input type (for all digital inputs)* - see Note 1

<table>
<thead>
<tr>
<th>To use as</th>
<th>JP8</th>
</tr>
</thead>
<tbody>
<tr>
<td>nnp (sink)</td>
<td>A</td>
</tr>
<tr>
<td>pnp (source)*</td>
<td>B</td>
</tr>
</tbody>
</table>

**JP9**

*Input voltage (for all digital inputs)* - see Note 1

<table>
<thead>
<tr>
<th>To use as</th>
<th>JP9</th>
</tr>
</thead>
<tbody>
<tr>
<td>12VDC</td>
<td>A</td>
</tr>
<tr>
<td>24VDC*</td>
<td>B</td>
</tr>
</tbody>
</table>

Note:

1. Inputs #0-6, and #7-11 when these are set as normal digital inputs.

*Default factory setting

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**In this figure, the jumper settings will cause the inputs to function as follows:**

- **Universal Input #0 (Input #10):** Voltage input, related to 0V
- **Universal Input #1 (Input #7 and Input #8):** PT100 input, related to the CM signal (Input#11)
- **Input#9:** Normal nnp, 24VDC digital input
- **Input#0 to Input #6:** nnp, 24VDC digital inputs. (Note that these inputs can only function as normal digital inputs.)

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**Opening the controller's enclosure**

1. Turn power off before opening the controller.
2. Locate the 4 slots on the sides of the enclosure.
3. Using the blade of a flat-bladed screwdriver, gently pry off the back of the controller as shown in the figure below, exposing the controller's board.