Contents

1 General Information

2 Introduction
   2.1 Analog I/O option features ............................................. 2-1
       2.1.1 Installation ......................................................... 2-1

3 Input / Output
   3.1 Introduction ............................................................. 3-1
       3.1.1 Slot selection and input / output numbering ................. 3-1
       3.1.2 Analog inputs ..................................................... 3-3
       3.1.3 Analog outputs .................................................... 3-5
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Product Notice

Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury.

Safety Notice

Intended use: Drives incorporating the Analog I/O option are intended for use in stationary ground based applications in industrial power installations according to the standards EN60204 and VDE0160. They are designed for machine applications that require variable speed controlled three-phase brushless AC motors. These drives are not intended for use in applications such as:

- Home appliances
- Medical instrumentation
- Mobile vehicles
- Ships
- Airplanes.

Unless otherwise specified, the drive is intended for installation in a suitable enclosure. The enclosure must protect the drive from exposure to excessive or corrosive moisture, dust and dirt or abnormal ambient temperatures. The installation, connection and control of drives is a skilled operation, disassembly or repair must not be attempted. In the event that a drive fails to operate correctly, contact the place of purchase for return instructions.

Precautions

Do not touch any circuit board, power device or electrical connection before you first ensure that no high voltage is present at this equipment or other equipment to which it is connected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt to start-up, program or troubleshoot this equipment.

MEDICAL DEVICE / PACEMAKER DANGER: Magnetic and electromagnetic fields in the vicinity of current carrying conductors and industrial motors can result in a serious health hazard to persons with cardiac pacemakers, internal cardiac defibrillators, neurostimulators, metal implants, cochlear implants, hearing aids, and other medical devices. To avoid risk, stay away from the area surrounding a motor and its current carrying conductors.

Electrical components can be damaged by static electricity. Use ESD (electrostatic discharge) procedures when handling this device.

To prevent equipment damage, be certain that input and output signals are powered and referenced correctly.

To ensure reliable performance of this equipment, be certain that all signals are shielded correctly.
2.1 Analog I/O option features

The Analog I/O option is available as a customer-fitted option for the MotiFlex e100 range of drives. The option adds a number of features to the drive:

- Four ±10 V differential analog inputs with 16-bit resolution.
- Four ±10 V single-ended analog outputs with 16-bit resolution.

The option card may be inserted in either of the expansion slots, located on the top and bottom panel of the drive.

2.1.1 Installation

Before touching the option card, be sure to discharge static electricity from your body and clothing by touching a grounded metal surface. Alternatively, wear an earth strap while handling the card.

1. Choose carefully which of the option slots (top or bottom) to use. The choice will often depend on the best route for the wiring that will lead to the option card.

2. Pull off the drive’s top or bottom front panel cover (as appropriate). Remove the option slot cover’s retaining screw.

3. Insert a screwdriver under the edge of the option slot cover and gently lever out the cover.
4. Confirm that the correct option card is being installed. The description is printed on the leading edge of the card, furthest from the mounting bracket.

   Insert the option card with the main component side facing towards the center of the drive. The edges of the option card should locate behind retaining brackets inside the drive.

   ![Figure 2-3: Insert the option card](image)

5. Push down the option card until it clicks into place. The option card’s external connector plate should finish approximately level with the 8 posts along the edge of the option slot.

   ![Figure 2-4: Click into place](image)

6. Insert the retaining screw and tighten. If the screw will not locate in the threaded socket on the option card, then check the position of the option card.

   The screw must be fitted since it provides mechanical support and an electrical chassis connection for the option card.

   ![Figure 2-5: Tighten retaining screw](image)

7. Push on the drive’s top or bottom front panel cover until it clicks into place.
3.1 Introduction

All external connections to the Analog I/O option card are made using the 24-pin connector. The required Weidmüller Minimate B2L 3.5/24 mating connector is supplied.

The analog inputs and outputs are described in the following sections.

3.1.1 Slot selection and input / output numbering

The MotiFlex e100 implements a system of I/O 'banks', with each bank allowing up to 8 inputs and outputs. The I/O available as standard on the MotiFlex e100 always resides in bank 0. The I/O available on option cards resides in bank 1 if the card is inserted in slot 1, or bank 2 if the card is inserted in slot 2.

The numbering of bank 1 (slot 1) inputs and outputs always starts at 8, since 0-7 are reserved by bank 0 (even though only AIN0 is used by a standard MotiFlex e100).

The numbering of bank 2 (slot 2) inputs and outputs always starts at 16, since 0-7 are taken by bank 0, and 8-15 are taken by bank 1.

This numbering system is summarized in the following table, and in Figures 3-1 and 3-2.

<table>
<thead>
<tr>
<th>Bank/Slot</th>
<th>Analog inputs</th>
<th>Analog outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Standard drive, connector X3</td>
<td>AIN0</td>
<td>(None)</td>
</tr>
<tr>
<td>1 Option card, top slot</td>
<td>AIN8</td>
<td>AOUT8</td>
</tr>
<tr>
<td></td>
<td>AIN9</td>
<td>AOUT9</td>
</tr>
<tr>
<td></td>
<td>AIN10</td>
<td>AOUT10</td>
</tr>
<tr>
<td></td>
<td>AIN11</td>
<td>AOUT11</td>
</tr>
<tr>
<td>2 Option card, bottom slot</td>
<td>AIN16</td>
<td>AOUT16</td>
</tr>
<tr>
<td></td>
<td>AIN17</td>
<td>AOUT17</td>
</tr>
<tr>
<td></td>
<td>AIN18</td>
<td>AOUT18</td>
</tr>
<tr>
<td></td>
<td>AIN19</td>
<td>AOUT19</td>
</tr>
</tbody>
</table>

The same numbering system is used when referring to the I/O using the Mint ADC and DAC keywords; for example AOUT16 is referred to as DAC(16). See the Mint help file for details.
### Figure 3-1: 24-pin connector assignment - slot 1 (top) numbering

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(NC)</td>
</tr>
<tr>
<td>2</td>
<td>AGND</td>
</tr>
<tr>
<td>3</td>
<td>AOUT9</td>
</tr>
<tr>
<td>4</td>
<td>AOUT8</td>
</tr>
<tr>
<td>5</td>
<td>AGND</td>
</tr>
<tr>
<td>6</td>
<td>AIN11-</td>
</tr>
<tr>
<td>7</td>
<td>AIN10-</td>
</tr>
<tr>
<td>8</td>
<td>AGND</td>
</tr>
<tr>
<td>9</td>
<td>AIN9-</td>
</tr>
<tr>
<td>10</td>
<td>Shield</td>
</tr>
<tr>
<td>11</td>
<td>AGND</td>
</tr>
<tr>
<td>12</td>
<td>AIN8-</td>
</tr>
<tr>
<td>13</td>
<td>(NC)</td>
</tr>
<tr>
<td>14</td>
<td>AGND</td>
</tr>
<tr>
<td>15</td>
<td>AOUT11</td>
</tr>
<tr>
<td>16</td>
<td>AOUT10</td>
</tr>
<tr>
<td>17</td>
<td>AGND</td>
</tr>
<tr>
<td>18</td>
<td>AIN11+</td>
</tr>
<tr>
<td>19</td>
<td>AIN10+</td>
</tr>
<tr>
<td>20</td>
<td>AGND</td>
</tr>
<tr>
<td>21</td>
<td>AIN9+</td>
</tr>
<tr>
<td>22</td>
<td>Shield</td>
</tr>
<tr>
<td>23</td>
<td>AGND</td>
</tr>
<tr>
<td>24</td>
<td>AIN8+</td>
</tr>
</tbody>
</table>

### Figure 3-2: 24-pin connector assignment - slot 2 (bottom) numbering

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(NC)</td>
</tr>
<tr>
<td>2</td>
<td>AGND</td>
</tr>
<tr>
<td>3</td>
<td>AOUT17</td>
</tr>
<tr>
<td>4</td>
<td>AOUT16</td>
</tr>
<tr>
<td>5</td>
<td>AGND</td>
</tr>
<tr>
<td>6</td>
<td>AIN19-</td>
</tr>
<tr>
<td>7</td>
<td>AIN18-</td>
</tr>
<tr>
<td>8</td>
<td>AGND</td>
</tr>
<tr>
<td>9</td>
<td>AIN17-</td>
</tr>
<tr>
<td>10</td>
<td>Shield</td>
</tr>
<tr>
<td>11</td>
<td>AGND</td>
</tr>
<tr>
<td>12</td>
<td>AIN16-</td>
</tr>
<tr>
<td>13</td>
<td>(NC)</td>
</tr>
<tr>
<td>14</td>
<td>AGND</td>
</tr>
<tr>
<td>15</td>
<td>AOUT19</td>
</tr>
<tr>
<td>16</td>
<td>AOUT18</td>
</tr>
<tr>
<td>17</td>
<td>AGND</td>
</tr>
<tr>
<td>18</td>
<td>AIN19+</td>
</tr>
<tr>
<td>19</td>
<td>AIN18+</td>
</tr>
<tr>
<td>20</td>
<td>AGND</td>
</tr>
<tr>
<td>21</td>
<td>AIN17+</td>
</tr>
<tr>
<td>22</td>
<td>Shield</td>
</tr>
<tr>
<td>23</td>
<td>AGND</td>
</tr>
<tr>
<td>24</td>
<td>AIN16+</td>
</tr>
</tbody>
</table>
3.1.2 Analog inputs

- Four independent differential inputs.
- Voltage range: ±10 V.
- Resolution: 16-bit (i.e. theoretical resolution ±305 µV).
- Input impedance: >120 kΩ.
- Sampling frequency: 125 µs.

Each analog input can be connected as either a differential or a single ended input as shown in Figure 3-4. The analog inputs are not optically isolated from internal power rails, so care must be taken to avoid earth/ground loops and similar associated problems. The analog inputs pass through a differential buffer and second order low-pass filter with a cut-off frequency of approximately 1kHz. To minimize the effects of noise, the analog input signal should be connected to the system using an individually shielded twisted pair cable with an overall shield. The overall shield should be connected to the chassis at one end only. No other connection should be made to the shield.

When the MotiFlex e100 is connected to Mint WorkBench, the analog input value (expressed as a percentage) can be viewed using the Spy window’s Monitor tab. Alternatively, assuming the card is mounted in slot 1, the command \texttt{Print ADC(8)} can be used in the command window to return the value of analog input 8 (and similarly \texttt{Print ADC(9)}, \texttt{Print ADC(10)}, \texttt{Print ADC(11)} for the other inputs). See the Mint help file for details.
Figure 3-4: AIN8/16 analog input wiring

Figure 3-5: Typical input circuit to provide 0-10V (approx.) input from a 24V source

Figure 3-6: Analog input - typical connection from a Baldor NextMove e100
3.1.3 Analog outputs

- Four independent bipolar analog outputs.
- Output range: ±10 VDC (±0.1%).
- Resolution: 16-bit.
- Output current: 10 mA maximum.
- Update frequency: 8 kHz.

All of the outputs may be used as general purpose analog outputs - see the DAC keyword in the Mint help file. The analog outputs may be used to drive loads of 1 kΩ or greater. Shielded twisted pair cable should be used. The shield connection should be made at one end only.

![Figure 3-7: AOUT8/16 analog output circuit](image)

When the MotiFlex e100 is connected to Mint WorkBench, the analog output value (expressed as a percentage) can be viewed using the Spy window's Monitor tab. The DAC command can be used in the command window to set the value of an analog output as a percentage of full scale. For example, assuming the card is mounted in slot 1, the command 

\[
\text{DAC}(8) = 50
\]

will set analog output 8 to +50% (approximately +5 V). See the Mint help file for details.
If you have any suggestions for improvements to this manual, please let us know. Write your comments in the space provided below, remove this page from the manual and mail it to:

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