This product is a USB 2.0-compliant analog output unit that extends the analog output function of USB port of PCs. This product features high-precision analog outputs, digital inputs, digital outputs, and a counter function.

As there is compatible with PCI bus-compatible board DA16-4(LPCI)L and PCI Express bus-compatible board AO-1604L-LPE in terms of connector shape and pin assignments, it is easy to migrate from the existing system.

Using the bundled API function library package [API-USBP(WDM)], you can create Windows application software for this board in your favorite programming language supporting Win32 API functions, such as Visual Basic or Visual C/C++.

With plug-ins for the dedicated libraries, this product also supports MATLAB and LabVIEW.

Multi-function
The unit contains analog outputs (16bit, 4channels), control signal (3 points) of analog output, digital inputs (LVTTL level 4channels), digital outputs (LVTTL level 4channels), and counters (32bit binary, LVTTL level 1channels). Combining all these features on one unit allows complex systems to be implemented even on PCs with USB port only.

Buffer memory
The analog outputs have their own buffer memory. You can also perform analog output in the background, independent of software and the current status of the PC.

Filter function for easy connection of external signals
The digital input signals, counter input signals, and the external control signals for analog output incorporate a digital filter to prevent wrong recognition of input signals from carrying noise or a chattering.

Compatible with PCI / PCI Express bus board in its design. Common connector shape and pin assignment with PCI / PCI Express bus board
This product has the common connector shape and pin assignment with PCI bus board DA16-4(LPCI)L, PCI Express bus board AO-1604L-LPE so you can use the common cables and accessories, it is easy to migrate from the existing system *1.

Compatible to USB1.1/USB2.0
Compatible to USB1.1/USB2.0 and capable to achieve high speed transfer at HighSpeed (480 Mbps).

Software-based calibration function
Calibration of analog output can be all performed by software. Apart from the adjustment information prepared before shipment, additional adjustment information can be stored according to the use environment.

USB HUB function, the CONTEC's USB supported products (Max. 4) can be used.
This product has the USB HUB function. *2 Max. 4 AO-1604LX-USB can be used in 1 USB port of PC. When you use 4 or more AO-1604LX-USB, you can do by connecting AO-1604LX-USB to the another USB port of PC side.
Also, you can connect the CONTEC’s USB supported products other than AO-1604LX-USB to the USB port of AO-1604LX-USB. *3*4

Windows compatible driver libraries are attached.
Also, driver library API-USBP(WDM) that makes it possible to create applications of Windows is attached.

Plug-ins for the dedicated libraries, this product also supports MATLAB and LabVIEW.

We offer a dedicated library [ML-DAQ], which allows you to use this product on MATLAB by The MathWorks as well as another dedicated library [VI-DAQ], which allows you to use the product on LabVIEW by National Instruments. These dedicated libraries are available, free of charge (downloadable), on our web site.

*1 There are some differences of the specifications between this product and AO-1604LL/LPE, DA16-4L(LPCI)L. For more details on this, refer to “Chapter7, Difference from AO-1604LL/LPE, DA16-4L(LPCI)L”.
*2 This product cannot be stacked up for installation.
*3 Do not connect the device other than that of CONTEC’s USB to the USB port included on the AO-1604LX-USB. Otherwise, this may cause a failure or malfunction.
*4 When connecting multiple units with USB HUB function and set up them, do one at a time and complete setup for the previous unit before starting to do the next unit.
**Specification**

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Analog output</strong></td>
<td></td>
</tr>
<tr>
<td>Isolated specification</td>
<td>Non-isolated</td>
</tr>
<tr>
<td>Number of output channels</td>
<td>8 channels</td>
</tr>
<tr>
<td>Output range</td>
<td>8bit 0~10V</td>
</tr>
<tr>
<td>Absolute max. output current</td>
<td>±3mA</td>
</tr>
<tr>
<td>Output impedance</td>
<td>1Ω or less</td>
</tr>
<tr>
<td>Resolution</td>
<td>16bit</td>
</tr>
<tr>
<td>Non-Linearity error</td>
<td>±0.1%</td>
</tr>
<tr>
<td>Conversion speed</td>
<td>15/sec</td>
</tr>
<tr>
<td>Buffer memory</td>
<td>1k Word/7k Word</td>
</tr>
<tr>
<td><strong>Counter</strong></td>
<td></td>
</tr>
<tr>
<td>Number of channels</td>
<td>1 channel</td>
</tr>
<tr>
<td>Counting system</td>
<td>Up count/Down count</td>
</tr>
<tr>
<td>Max. count</td>
<td>FFFFFFFFh (Binary data, 32bit)</td>
</tr>
<tr>
<td>Number of external inputs</td>
<td>LVTTL level</td>
</tr>
<tr>
<td>Number of external outputs</td>
<td>LVTTL level</td>
</tr>
<tr>
<td>Frequency response</td>
<td>10MHz (Max.)</td>
</tr>
<tr>
<td><strong>USB</strong></td>
<td></td>
</tr>
<tr>
<td>Bus specification</td>
<td>USB Specification 2.0/1.1 standard</td>
</tr>
<tr>
<td>USB transfer rate</td>
<td>12Mbps (Full-speed), 480Mbps (High-speed)</td>
</tr>
<tr>
<td>Power supply</td>
<td>Self power *3</td>
</tr>
<tr>
<td>Attached AC adaptor (POA200-20-2)</td>
<td>90 - 264VAC 5.0VDC±5% 2.0A (Max.)</td>
</tr>
<tr>
<td>Cable length</td>
<td>Shield Cable with 50-Pin Mini-Ribbon Connectors at both ends</td>
</tr>
<tr>
<td><strong>Common section</strong></td>
<td></td>
</tr>
<tr>
<td>Number of terminals used at the same time</td>
<td>127 terminals (Max.) *4</td>
</tr>
<tr>
<td>Power consumption (Max.)</td>
<td>5VDC 700mA</td>
</tr>
<tr>
<td>Operating condition'5</td>
<td>0 - 50°C, 10 - 90%RH (No condensation)</td>
</tr>
<tr>
<td>Physical dimensions (mm)</td>
<td>180(L) x 140(D) x 34(H), No protrusions</td>
</tr>
<tr>
<td>Weight</td>
<td>400g (Not including the USB cable, attachment)</td>
</tr>
<tr>
<td>Connector</td>
<td>10250-5ZAA2.2(3M) or equivalent to it</td>
</tr>
<tr>
<td>Attached cable length</td>
<td>USB Cable 1.8m</td>
</tr>
<tr>
<td><strong>Support Software</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Windows version of analog I/O driver API-AIO(WDM)**
(Stored on the bundled CD-ROM driver library API-USBP(WDM))

The API-AIO(WDM) is the Windows version driver library software that provides products in the form of Win32 API functions (DLL). Various sample programs such as Visual Basic and Visual C++, etc and diagnostic program useful for checking operation is provided.

**Operating environment**
- **Adaptation language**: Visual Basic, Visual C++, Visual C#, Delphi, C++ Builder

For more details on the supported OS, applicable language and how to download the updated version, please visit the CONTEC’s Web site (http://www.contec.com/apiusbp/).

**Data Acquisition library for MATLAB ML-DAQ**
(Available for downloading (free of charge) from the CONTEC web site.)

This is the library software which allows you to use our analog I/O device products on MATLAB by the MathWorks. Each function is offered in accordance with the interface which is integrated in MATLAB’s Data Acquisition Toolbox. See http://www.contec.com/mldaq/ for details and download of ML-DAQ.

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This is a VI library to use in National Instruments LabVIEW. VI-DAQ is created with a function form similar to that of LabVIEW’s Data Acquisition VI, allowing you to use various devices without complicated settings. See http://www.contec.com/vidaq/ for details and download of VI-DAQ.

**Cable & Connector**

**Cable (Option)**
- **Shield Cable with 50-Pin Mini-Ribbon Connectors at either End**
  - PCB50PS-0.5P (0.5m)
  - PCB50PS-1.5P (1.5m)
- **Shield Cable with 50-Pin Mini-Ribbon Connector at one End**
  - PCA50PS-0.5P (0.5m)
  - PCA50PS-1.5P (1.5m)

**Support Software**

**Cable & Connector**

**Cable (Option)**
- **Shield Cable with 50-Pin Mini-Ribbon Connectors at either End**
  - PCB50PS-0.5P (0.5m)
  - PCB50PS-1.5P (1.5m)
- **Shield Cable with 50-Pin Mini-Ribbon Connector at one End**
  - PCA50PS-0.5P (0.5m)
  - PCA50PS-1.5P (1.5m)

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  - PCB50PS-1.5P (1.5m)
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  - PCA50PS-0.5P (0.5m)
  - PCA50PS-1.5P (1.5m)

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- **Shield Cable with 50-Pin Mini-Ribbon Connector at one End**
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**Cable & Connector**

**Cable (Option)**
- **Shield Cable with 50-Pin Mini-Ribbon Connectors at either End**
  - PCB50PS-0.5P (0.5m)
  - PCB50PS-1.5P (1.5m)
- **Shield Cable with 50-Pin Mini-Ribbon Connector at one End**
  - PCA50PS-0.5P (0.5m)
  - PCA50PS-1.5P (1.5m)
*4 It is the same as the one appended to the product. Please buy it necessary for maintenance.
* Check the CONTEC’s Web site for more information on these options.

### Packing List

- Unit [AO-1604LX-USB] …1
- AC adaptor …1
- AC Cable (for 125VAC)…1
- USB cable (1.8m) …1
- USB cable attachment on the main unit’s side (For Mini B connector side) …1
- Clamps for prevention of cable on the main unit’s side …1
- Disk *1 [API-USBP(WDM)] …1
- First step guide … 1
- Power connector MC1.5/3-ST-3.5 …1
- Ferrite core …1
- Warranty Certificate …1
- Serial Number Label …1

*1 The bundled disk contains the driver software and User’s Guide

### Block Diagram

[Diagram of the device showing block diagram with labels for analog outputs, digital inputs, and control circuit.

### Physical Dimensions

[Physical dimensions diagram showing measurements for length and width.]

- **Unit [AO-1604LX-USB]**
- **AC adaptor**
- **AC Cable (for 125VAC)**
- **USB cable (1.8m)**
- **USB cable attachment on the main unit’s side (For Mini B connector side)**
- **Clamps for prevention of cable on the main unit’s side**
- **Disk**
- **First step guide**
- **Power connector MC1.5/3-ST-3.5**
- **Ferrite core**
- **Warranty Certificate**
- **Serial Number Label**

*1 The bundled disk contains the driver software and User’s Guide.
### How to Connect the Connectors

#### Connector Shape

To connect an external device to this product, plug the cable from the device into the interface connector (CN1) of unit shown below.

- **Connector used**: 50-pin mini-ribbon connector 10250-02AJL or equivalent to it
- **Compatible connectors**: 10150-000EL or equivalent to it

*Please refer to page 3 for more information on the supported cable and accessories.*

#### Connector Pin Assignment

**Pin Assignments of Interface Connector(CN1)**

<table>
<thead>
<tr>
<th>Pin Code</th>
<th>Description</th>
<th>Pin Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>AO 00</td>
<td>Analog Output 00</td>
<td>10</td>
</tr>
<tr>
<td>AO 01</td>
<td>Analog Output 01</td>
<td>11</td>
</tr>
<tr>
<td>AO 02</td>
<td>Analog Output 02</td>
<td>12</td>
</tr>
<tr>
<td>AO 03</td>
<td>Analog Output 03</td>
<td>13</td>
</tr>
<tr>
<td>AO 04</td>
<td>Analog Output 04</td>
<td>14</td>
</tr>
<tr>
<td>AO 05</td>
<td>Analog Output 05</td>
<td>15</td>
</tr>
<tr>
<td>AO 06</td>
<td>Analog Output 06</td>
<td>16</td>
</tr>
<tr>
<td>AO 07</td>
<td>Analog Output 07</td>
<td>17</td>
</tr>
<tr>
<td>AO 08</td>
<td>Analog Output 08</td>
<td>18</td>
</tr>
<tr>
<td>AO 09</td>
<td>AO External Start Trigger Input</td>
<td>19</td>
</tr>
<tr>
<td>AO 10</td>
<td>AO External Stop Trigger Input</td>
<td>20</td>
</tr>
<tr>
<td>AO 11</td>
<td>AO External Sampling Clock Input</td>
<td>21</td>
</tr>
<tr>
<td>AO 12</td>
<td>AO External Sampling Clock In</td>
<td>22</td>
</tr>
<tr>
<td>AO 13</td>
<td>AO External Sampling Clock In</td>
<td>23</td>
</tr>
<tr>
<td>AO 14</td>
<td>AO External Sampling Clock In</td>
<td>24</td>
</tr>
<tr>
<td>AO 15</td>
<td>AO External Sampling Clock In</td>
<td>25</td>
</tr>
<tr>
<td>AO 16</td>
<td>AO External Sampling Clock In</td>
<td>26</td>
</tr>
<tr>
<td>AGND</td>
<td>Analog Ground</td>
<td>27</td>
</tr>
<tr>
<td>AGND</td>
<td>Analog Ground</td>
<td>28</td>
</tr>
<tr>
<td>DGND</td>
<td>Digital Ground</td>
<td>29</td>
</tr>
<tr>
<td>DGND</td>
<td>Digital Ground</td>
<td>30</td>
</tr>
<tr>
<td>DI 00</td>
<td>Digital Input 00</td>
<td>31</td>
</tr>
<tr>
<td>DI 01</td>
<td>Digital Input 01</td>
<td>32</td>
</tr>
<tr>
<td>DI 02</td>
<td>Digital Input 02</td>
<td>33</td>
</tr>
<tr>
<td>DI 03</td>
<td>Digital Input 03</td>
<td>34</td>
</tr>
<tr>
<td>DO 00</td>
<td>Digital Output 00</td>
<td>35</td>
</tr>
<tr>
<td>DO 01</td>
<td>Digital Output 01</td>
<td>36</td>
</tr>
<tr>
<td>DO 02</td>
<td>Digital Output 02</td>
<td>37</td>
</tr>
<tr>
<td>DO 03</td>
<td>Digital Output 03</td>
<td>38</td>
</tr>
<tr>
<td>CNT UP</td>
<td>Count Up Clock Input</td>
<td>39</td>
</tr>
<tr>
<td>CNT DOWN</td>
<td>Count Down Clock Input</td>
<td>40</td>
</tr>
<tr>
<td>CNT UP</td>
<td>Counter Up Clock Input</td>
<td>41</td>
</tr>
<tr>
<td>CNT DOWN</td>
<td>Counter Down Clock Input</td>
<td>42</td>
</tr>
</tbody>
</table>

**Digital Ground**

- Common digital ground for digital I/O signals, external trigger inputs, sampling clock inputs, and counter I/O signals.

**Reserved**

- Reserved pin.
- N.C.: No connection to this pin.

#### Digital I/O signals, Counter signals and Control signals Connection

The following sections show examples of how to connect digital I/O signals, counter I/O signals, and other control I/O signals (external trigger input signals, sampling clock input signals, etc.).

All the digital I/O signals and control signals are LV/TTL level signals.

### Analog Output Signal Connection

#### Analog Output Connection (Flat Cable)

This section shows how to connect the analog output signal by using a flat cable or a shield cable. The following figure shows an example of flat cable connection. Connect the signal source and ground to the CN1 analog output.

![Analog Output Connection (Flat Cable)](image)

**CAUTION**

- If this product or the connected wire receives noise, or the distance between this product and the target is long, data may not be outputted properly.
- For analog output signal, the current capacity is ±3mA (Max.). Check the specification of the connected device before connecting this product.
- Do not short the analog output signal to analog ground, digital ground, and/or power line. Doing so may damage this product.
- Do not connect an analog output signal to any other analog output, either on this product or on an external device, as this may cause a fault on this product.
- Analog output signal outputs hundreds of μA voltages when USB cable is inserted.

#### Analog Output Connection (Shielded Cable)

The following figure shows an example of shield cable connection. Use shield cable if the distance between the signal source and this product is long or if you want to provide better protection from noise. For the CN1 analog output, connect the core wire to the signal line and connect the shielding to ground.

![Analog Output Connection (Shielded Cable)](image)

### Digital Input Connection

The following sections show examples of how to connect digital I/O signals, counter I/O signals, and other control I/O signals (external trigger input signals, sampling clock input signals, etc.).

All the digital I/O signals and control signals are LV/TTL level signals.

#### Digital Input Connection

![Digital Input Connection](image)

### Digital Output Connection

![Digital Output Connection](image)
About the counter input control signal

Counter Gate Control Input (refer to the chapter 3 Connector Pin Assignment) acts as an input that validate or invalidate the input of an external clock for the counter. This function enables the control of an external clock input for the counter. The external clock for the counter is effective when input is "High", and invalid when input is "Low". If unconnected, it is a pull-up in this product and remains "High". Therefore the external clock for the counter is effective when the counter gate control input is not connected.

⚠️ CAUTION
- Do not short the output signals to analog ground, digital ground, and/or power line. Doing so may damage the product.
- If connected to each output, a pull-up resistor must be about 10kΩ to pull up with a 3.3V power source.
- Each input accepts 5V TTL signals.

Connection with 5VDC Power Supply for Self-power

+5 VDC Input Terminal Pinouts

This product must be connected with 5VDC power supply (in a self-powered state).

Connect with 5VDC power supply by using +5VDC input pin.

5VDC

<table>
<thead>
<tr>
<th>FG</th>
<th>VI-</th>
<th>VI+</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Power supply (5V)</td>
</tr>
<tr>
<td></td>
<td>VI-</td>
<td>Power supply (GND)</td>
</tr>
<tr>
<td>FG</td>
<td>Frame ground</td>
<td></td>
</tr>
</tbody>
</table>

Connecting the AC Adapter POA200-20-2

When using the attached AC adaptor [POA200-20-2], please connect directly to the input terminals. When the accompanying power connector (MC1,5/3-ST-3,5, suitable cable: AWG28 - 16) is used to supply power to this unit, strip the end of the suitable cable and insert it to the power connector before firmly securing it using a screw.

⚠️ CAUTION
- Connect 5VDC power supply to the main unit. Next, connect the USB cable to the PC. Do not turn it on or off when using. If you remove, USB cable is first and then 5VDC power supply.
- When the USB module is not used, leave the AC adaptor unplugged.
- Continuously using the AC adaptor heated affects its life.
- Use the AC adaptor not in a closed place but in a well-ventilated place not to be heated.
- Do not remove the power connector [MC1,5/3-ST-3,5] attached to the AC adapter.

### Difference from AO-1604L-LPE and DA16-4(LPCI)L

<table>
<thead>
<tr>
<th>Item</th>
<th>AO-1604LX-USB</th>
<th>AO-1604L-LPE</th>
<th>DA16-4(LPCI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog output</td>
<td>LVTTL level</td>
<td>TTL level</td>
<td>LVTTL level</td>
</tr>
<tr>
<td>External start signal</td>
<td>Non-isolated input 4 channels (LVTTL level positive logic)</td>
<td>Non-isolated input 4 channels (TTL level positive logic)</td>
<td>Non-isolated input 4 channels (LVTTL level positive logic)</td>
</tr>
<tr>
<td>External stop signal</td>
<td>Non-isolated input 4 channels (LVTTL level positive logic)</td>
<td>Non-isolated input 4 channels (TTL level positive logic)</td>
<td>Non-isolated input 4 channels (LVTTL level positive logic)</td>
</tr>
<tr>
<td>External clock signal</td>
<td>LVTTL level</td>
<td>TTL level</td>
<td>LVTTL level</td>
</tr>
<tr>
<td>External status output signal</td>
<td>LVTTL level</td>
<td>TTL level</td>
<td>LVTTL level</td>
</tr>
<tr>
<td>Digital I/O</td>
<td>LVTTL level</td>
<td>TTL level</td>
<td>LVTTL level</td>
</tr>
<tr>
<td>Number of input channels</td>
<td>Non-isolated input 4 channels (LVTTL level positive logic)</td>
<td>Non-isolated input 4 channels (TTL level positive logic)</td>
<td>Non-isolated input 4 channels (LVTTL level positive logic)</td>
</tr>
<tr>
<td>Number of output channels</td>
<td>Non-isolated output 4 channels (LVTTL level positive logic)</td>
<td>Non-isolated output 4 channels (TTL level positive logic)</td>
<td>Non-isolated output 4 channels (LVTTL level positive logic)</td>
</tr>
<tr>
<td>Counter</td>
<td>LVTTL level</td>
<td>TTL level</td>
<td>LVTTL level</td>
</tr>
<tr>
<td>Number of external inputs</td>
<td>LVTTL level</td>
<td>TTL level</td>
<td>LVTTL level</td>
</tr>
<tr>
<td>Number of external outputs</td>
<td>LVTTL level</td>
<td>TTL level</td>
<td>LVTTL level</td>
</tr>
<tr>
<td>Power consumption (Max.)</td>
<td>5VDC 700mA</td>
<td>3.3VDC 400mA</td>
<td>5VDC 440mA (Max.)</td>
</tr>
<tr>
<td>Bus specification</td>
<td>USB Specification 2.0/1.1 standard</td>
<td>PCI Express Base Specification Rev. 1.0a</td>
<td>PCI(32bit, 33MHz, Universal key shapes supported)</td>
</tr>
<tr>
<td>Physical dimensions (mm)</td>
<td>180(L) x 140(D) x 34(H) (No protrusions)</td>
<td>121.69(L) x 67.90(H)</td>
<td>121.69(L) x 63.41(H)</td>
</tr>
<tr>
<td>Weight</td>
<td>450g (Not including the USB cable, attachment)</td>
<td>80g</td>
<td>130g</td>
</tr>
</tbody>
</table>