**FX3 series and Analog Control**

The **FX3 series** makes analog control simpler than ever. Custom tailor your **FX3 series** to match your application requirements. Choose from the basic expansion boards, the direct addressing adapters, or the powerful CPU-integrated special function blocks. This level of flexibility ensures that you get the perfect solution for your system needs and your budget.

**What is Analog Control anyways?**

Analog control is used in a broad range of industries. In simple terms, it enables a discrete signal to provide control within a PLC system. Basic examples of analog control include collection of sensory data from fluid levels and the control of a motor’s speed. Systems can be developed and configured to each user’s needs and requirements. There are 3 basic categories of analog control; analog to digital (A/D), digital to analog (D/A), and temperature control and measurement.

**Analog Control in action**

Here we have a typical system example. A thermocouple (TC) monitors the temperature of the heating element, and maintains a certain temperature in the orange liquid based on the input temperature from the sensor (PT). Then a flow meter (A/D) measures the amount of fluid that is pumped into the blue liquid. An inverter is controlled (D/A) to power an electric motor to agitate the blue liquid and a second flow meter (A/D) measures the amount of liquid going into each container.

**Standards and International Acceptance**

Compliance with CE and UL/cUL standards enables users worldwide to put faith in the FX brand. The FX range is also certified to a variety of shipping approvals that include Lloyd’s, German Lloyds, American Bureau of Shipping, Registro Italiano Navale, DET Norske Veritas, Bureau Veritas, and Nippon Kaiji Kyokai.
Platform – A new benchmark in analog control

Standard Functions

Standard analog control functions allow for simple control of analog related processes. Voltage and current levels can be input and output by A/D and D/A channels respectively. A standard range of 0V to 10V DC and 4mA to 20mA DC is provided, with many units having extended ranges.

Temperature levels from a thermocouple or platinum temperature sensors can be input to the temperature units. Depending on the acquisition device the temperature input can be -100 to 1300°C (-100 to 2400 °F).

Averaging of input data can be performed in all FX3 series PLCs receiving an analog input. This allows for source inconsistencies to be smoothed out as the user can specify the amount of time to perform averaging of analog values over to provide stable data.

Advanced Functions

Analog special function blocks incorporate an embedded CPU within the module. This added processing power allows the module to work independent from the PLC’s CPU and perform advanced analog control functions.

Digital Filtering – Digital filtering can be implemented to reduce the amount of noise. This function is available in the FX3U-4AD and FX3UC-4AD. See the figure below.

PID Control – Allows for automated error corrections based on PID (proportional integral derivative) control algorithms that can be set up by the user or set automatically with the Autotuning function. Other features include set upper/lower limit values to control the output and alarm output for specified input and output variations. See the figure below.

Specialized Temperature Control – The FX3U-4LC* is the new specialized module providing 4 channels of fast and precise temperature input or output.

*Available from spring 2010.
The **FX3 series** can be expanded with 3 different analog options:

**Expansion Board - Basic expandability**

with 1 or 2 channels for basic analog control*  
- Basic CPU function expansion  
- No additional installation space required  
- Direct CPU access  
  * Available for FX3U and FX3S

**Special Adapter - Standard expandability**

with 3 or 4 channels for standard analog or temperature control*  
- Standard high-speed functions  
- Direct programming  
- Space saving installation  
- Galvanic insulation of the signals  
  * Available for FX3U/FX3UC and FX3G

**Special Function Blocks - Advanced solution**

with 2 to 8 channels for advanced analog or temperature control with up to 16 bit resolution and digital filtering*  
- Advanced function expansion  
- Embedded CPU for PLC scan time independent operation  
- Integrated memory  
- Access via From/To instruction  
- Special FX3UC units available  
  * Available for FX3U/FX3UC and FX3G

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*1: For connection to an FX3U main unit, the FX3UC-CN2-IF interface adapter or the FX3UC-CN2-1PS-3V power supply unit is required.  
*2: To connect to the FX3U main unit a FX3U BD board is required. For connection to a FX3G is the FX3G-CN2-ADP required.
### Configuration rules/expandability

#### FX3u Main Units 16-128 I/O

- **Function**: Analog ADP, Communication ADP, High-Speed Output ADP, High-Speed Input ADP
- **Board**: FX3u Main Unit

#### FX3uc Main Units 16-96 I/O

- **Function**: Analog ADP, Communication ADP, Special Function Blocks, Power Supply Unit
- **Board**: FX3uc Main Unit

#### FX3uc IO Expansions

- **Function**: FX3uc IO Expansions, Special Function Blocks, Power Supply Unit
- **Board**: FX3uc Main Unit

#### FX1s Main Units 10-30 I/O

- **Function**: Analog ADP, Communication ADP, Interface Board
- **Board**: FX1s Main Unit

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<table>
<thead>
<tr>
<th>Group</th>
<th>Function</th>
<th>Product Name</th>
<th>FX3u</th>
<th>FX3uc</th>
<th>FX3x</th>
<th>Description</th>
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<tr>
<td>2-1</td>
<td>Expansion Boards</td>
<td>FX3u-2AD-BD</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>8 analog setpoint potentiometers with 8bit</td>
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<td>FX3u-10A-BD</td>
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<td>8 analog setpoint potentiometers with 8bit</td>
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<td>FX3u-1DA-BD</td>
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<td>Analog Setpoint</td>
<td>FX3u-8AV-BD</td>
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<td>Special Adapters</td>
<td>FX3uc-4DA-ADP</td>
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<td>✓</td>
<td>2 Volt/Current – – Max. 12bit resolution</td>
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<td>✓</td>
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<td>Analog</td>
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<td>✓</td>
<td>✓</td>
<td>2 Volt/Current – – Max. 12bit resolution</td>
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<td>✓</td>
<td>✓</td>
<td>2 Volt/Current – – Max. 12bit resolution</td>
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<td>FX3uc-4DA-BD</td>
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<td>2 Volt/Current – – Max. 12bit resolution</td>
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<tr>
<td>4-1</td>
<td>Special Function Blocks</td>
<td>FX3uc-4DA-PT-ADP</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>4 Pt/100 – – -50°C to +250°C</td>
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<td>FX3uc-4DA-PT-ADP</td>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>4 Pt/100 – – -50°C to +250°C</td>
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<td>FX3uc-4DA-PT-ADP</td>
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<td>✓</td>
<td>✓</td>
<td>4 Pt/100 – – -50°C to +250°C</td>
</tr>
</tbody>
</table>

Note: Some items require additional expansion modules in order to function where other connection rules and requirements may apply. For more details, refer to the respective product manuals.

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*1: For connection to an FX3uc main unit, the FX3uc-CNVI-IF interface adapter or the FX3uc-IPS-5V supply unit is required.

*2: To connect to the FX3u main unit a FX3u BD board is required. For connection to a FX3uc is the FX3uc-CNVI-ADP required.

*3: The FX3uc-3A-ADP is supported in FX3uc PLCs version 2.61 or later and FX3uc PLCs version 1.20 or later.
### Specifications

#### Expansion Board

<table>
<thead>
<tr>
<th>Model</th>
<th>Analog Output Range (External load resistance)</th>
<th>Resolution</th>
<th>Digital Input</th>
<th>Overall Accuracy *1</th>
<th>Conversion Time</th>
<th>Isolation</th>
<th>No. of Occupied I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>FXn-1DA-BD</td>
<td>0 to 10V DC (2k to 1MΩ) / 4 to 20mA (500Ω or less)</td>
<td>2.5mV / 8μA</td>
<td>12 bits (voltage), 11 bits (current)</td>
<td>±1% (0 to 30°C), ±0.5% (20°C to 100°C)</td>
<td>60 μs, data updated every scan time</td>
<td>None</td>
<td>0 points</td>
</tr>
<tr>
<td>FXn-2DA</td>
<td>0 to 10V DC (2k to 1MΩ) / 4 to 20mA (500Ω or less)</td>
<td>2.5mV / 8μA</td>
<td>12 bits (voltage), 11 bits (current)</td>
<td>±1% (0 to 30°C), ±0.5% (20°C to 100°C)</td>
<td>60 μs, data updated every scan time</td>
<td>None</td>
<td>0 points</td>
</tr>
<tr>
<td>FXn-1DA-BD</td>
<td>0 to 10V DC (2k to 1MΩ) / 4 to 20mA (500Ω or less)</td>
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<td>12 bits (voltage), 11 bits (current)</td>
<td>±1% (0 to 30°C), ±0.5% (20°C to 100°C)</td>
<td>60 μs, data updated every scan time</td>
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<td>0 points</td>
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<td>FXn-1DA-BD</td>
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<td>12 bits (voltage), 11 bits (current)</td>
<td>±1% (0 to 30°C), ±0.5% (20°C to 100°C)</td>
<td>60 μs, data updated every scan time</td>
<td>None</td>
<td>0 points</td>
</tr>
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</table>

#### Special Function Block

<table>
<thead>
<tr>
<th>Model</th>
<th>Analog Input Range (Input resistance)</th>
<th>Resolution</th>
<th>Digital Output</th>
<th>Overall Accuracy *1</th>
<th>Conversion Time</th>
<th>Isolation</th>
<th>No. of Occupied I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>FXn-2AD-BD</td>
<td>0 to 10VDC (300kΩ) / 4 to 20mA (250Ω)</td>
<td>2.5mV / 8μA</td>
<td>12 bits (voltage), 11 bits (current)</td>
<td>±1% (0 to 30°C), ±0.5% (20°C to 100°C)</td>
<td>2.5 ms / 1 channel</td>
<td>None</td>
<td>0 points</td>
</tr>
<tr>
<td>FXn-2AD-BD</td>
<td>0 to 10VDC (300kΩ) / 4 to 20mA (250Ω)</td>
<td>2.5mV / 8μA</td>
<td>12 bits (voltage), 11 bits (current)</td>
<td>±1% (0 to 30°C), ±0.5% (20°C to 100°C)</td>
<td>2.5 ms / 1 channel</td>
<td>None</td>
<td>0 points</td>
</tr>
<tr>
<td>FXn-2AD-BD</td>
<td>0 to 10VDC (300kΩ) / 4 to 20mA (250Ω)</td>
<td>2.5mV / 8μA</td>
<td>12 bits (voltage), 11 bits (current)</td>
<td>±1% (0 to 30°C), ±0.5% (20°C to 100°C)</td>
<td>2.5 ms / 1 channel</td>
<td>None</td>
<td>0 points</td>
</tr>
</tbody>
</table>

#### Temperature

<table>
<thead>
<tr>
<th>Model</th>
<th>Input Types</th>
<th>Compensated range</th>
<th>Resolution</th>
<th>Digital Output</th>
<th>Accuracy</th>
<th>Conversion Time</th>
<th>No. of Occupied Points</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>FXn-2AD-BD</td>
<td>Thermocouple type K, J, R, S, E, T, B, N, PL II, WR65-26, U, and L, 3-wire platinum resistance Thermometer sensor(s) Pt100, and JPt100</td>
<td>Examples: Type K: -100 to +1300°C / -100 to +2400°F Type J: -100.0 to +800.0°C / -100 to +2100°F Voltage input: 0 to 10mVDC, 0 to 10mVDC</td>
<td>±0.7% of range span ±1 digit</td>
<td>Examples: Type K: -100 to +1300°C / -100 to +2400°F Type J: -100.0 to +800.0°C / -100 to +2100°F Voltage input: 0 to 10mVDC, 0 to 10mVDC</td>
<td>±0.7% of range span ±1 digit</td>
<td>500ms Sampling time</td>
<td>8 I/O points</td>
<td>Control method: Two-position, PID (with auto-tuning), PI control</td>
</tr>
</tbody>
</table>

### Notes

- *1: Percentage of full scale
- *2: For Shipping approvals consult with respective manual
- *3: A photocoupler is used to insulate the analog input or output area from the PLC.
- *4: Channels are not insulated from each other.
### Analog Input Range
- **0 to 10V DC**
- **-100 to +1500°C / -1800 to +2700°F**
- **-100 to +350°C / -148 to +662°F**
- **-500 to +3500°C / -900 to +6322°F**

### Conversion Time
- **500μs (250Ω)**
- **1ms (2k to 1MΩ)**
- **2.5mV**
- **5mV**
- **2NC**

### Overall Accuracy
- **±0.7% of range span ± 1 digit**
- **±0.5% (20 to 30°C)**
- **±0.5% (0 to 55°C)**

### Notes
- See below: *3, *4 and *6

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* If 1 or more channels use the thermocouple input(s), the input voltage/current data conversion speed will be 1 ms x number of selected channels.
* 10: C1-12-516-8 or C1-6-P-I (manufactured by U.R.D. Co., Ltd.)
* 11: Cold contact temperature compensation error Within ±0.8°C when using a thermocouple.
* 12: Temperature input 2CH, Transistor output 2CH and CT input 2CH.

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*13: Temperature input 4CH, Transistor output 2CH and input 4CH
*14: Also can be used as TC for AD inputs or V/mA for temperature input.
Visualization

Industrial control panels are increasingly turning into multifunctional human-machine interfaces. The GOT1000 family features 3 different series to provide the best fit of functionality for all kind of user requirements.

**GT16**
The all-in-one model

- **Multimedia Video-Video-Sound-QVGA**
- **GT1695M 65,536 colors**
- **GT1665M 65,536 colors**
- **GT1675M 65,536 colors**

**GT11**
Standard functions for demanding users

- **GT10**

- **TFT**
  - **GT1050** QVGA
  - **GT1040** QVGA
  - **GT1045** QVGA

- **STN**
  - **GT1055** STN
  - **GT1155** STN
  - **GT1150** STN

- **Touch Panel**
  - **GT1165M** STN

**GT10**
Affordability with basic functionality

- **STN**
  - **GT1075** STN
  - **GT1040** STN
  - **GT1065M** STN

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- **U.S.A.**
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