F4T Flex Module
Quick Start Guide

Mixed Input / Output Modules
Control, Limit, Auxiliary and CT
FM [M or L] A- _ _ _ A-A _ _ _

Safety Information
We use caution symbols where needed within this document to draw your attention to important operational and safety information.

A “CAUTION” safety alert appears with information that is important for protecting your equipment and performance. Be especially careful to read and follow all cautions that apply to your application.

A “WARNING” safety alert appears with information that is important for protecting you, others and equipment from damage. Pay very close attention to all warnings that apply to your application.

The electrical hazard symbol, (a lightning bolt in a triangle) precedes an electric shock hazard CAUTION or WARNING safety statement. Further explanations follow:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>![CAUTION]</td>
<td>Warning or Hazard that needs further explanation than label on unit can provide. Consult QSG for further information.</td>
</tr>
<tr>
<td>![WARNING]</td>
<td>Electrical Shock Hazard</td>
</tr>
</tbody>
</table>

Document Overview
The purpose of this Quick Start Guide (QSG) is to acquaint the user with the F4T Flex Modules and associated wiring.

Product Overview
Flex modules add functionality, inputs and outputs to an F4T system. The flex modules described in this document offer various input and output options as well as a safety over/under temperature limit. Each module can include one analog input and up to two outputs. All of these modules can be placed in any available slot.

Installation and Wiring
To install the flex module:
1. Note the part number to determine the types of inputs and outputs available to be connected in step 7.
2. Turn off power to the controller.
3. Select a slot for the module. If replacing a module, remove the old module.
4. Affix corresponding slot number labels (provided) to the module and to the removable screw terminal block.
5. With the component side of the module facing right (viewing the controller from the rear) insert the module in to the slot until it latches.
6. Remove the screw terminal block from the module.
7. Wire field devices to the appropriate terminals. Wiring details for each input and output are provided in the following sections.
8. Reconnect the wired screw terminal block to the module. Be sure to reconnect the terminal block to the correct module.
9. Restore power to the controller.

Note:
If the flex module is a replacement with the same part number and slot position, the controller uses it immediately when powered up. Otherwise, use Composer software to configure the F4T to expect and use the module.

Module Characteristics
Description and Identification
Many of the modules appear to look alike at first glance, therefore, it is always recommended that the module part number be verified prior to plugging it into any of the available slots in a base. Each module is identified with a part number located on the back side of the assembly next to the screw terminal block, as displayed in the graphic above.

Wiring
Prior to wiring any of the I/O modules described in this document it is recommended that the warnings and notes listed below be reviewed.

CAUTION: ⚠️
To prevent damage to the controller, do not connect wires to unused terminals.

AVERTISSEMENT: Pour prévenir tout endommagement du régulateur, ne pas faire de raccordements à des bornes inutilisées.

Note:
Maintain electrical isolation between the analog input, digital input-outputs, switched dc/open collector outputs and process outputs to prevent ground loops.
Note:
Modules IP10 when properly installed in base enclosure with slot caps in empty slots.

CAUTION: Quencharc Note:
Switching pilot duty inductive loads (relay coils, solenoids, etc.) with the mechanical relay, solid-state relay or open collector output options requires use of an R.C. suppressor for AC load or a diode for a DC load.

AVERTISSEMENT: les charges inductives de commutation de lampes témoins (bobines de relais, solénoides, etc.) avec des options de sortie à relais mécanique, de relais statique ou collecteur ouvert requièrent un dispositif antiparasite R.C.

Note:
Wire size and torque for screw terminations:
- 0.0507 to 3.30 mm² (30 to 12 AWG) single-wire termination or two 1.31 mm² (16 AWG)
- 0.57 Nm (5.0 lb.-in.) torque

Input Connections (cont.)
Thermocouple
- Grounded or ungrounded sensors, greater than 20MΩ input impedance, 2kΩ source resistance max.
- 3 µA open-sensor detection
- Thermocouples are polarity sensitive. The negative lead (usually red) must be connected to S terminal
- To reduce errors, the extension wire for thermocouples must be of the same alloy as the thermocouple.

Input Connections (cont.)
RTD
- 2- or 3-wire platinum, 100 and 1kΩ @ 32°F (0°C) calibration to DIN curve (0.00385 Ω/°C)
- RTD excitation current of 0.09 mA typical. Each ohm of lead resistance may affect the reading by 2.55°F for a 100Ω platinum sensor or 0.25°C for a 1kΩ sensor.
- For 3-wire RTDs, the S1 lead (usually white) must be connected to R1.
- This option does not support 3-wire RTDs

Current Transformer
- Input range is 0 to 50mA (ac).
- Current transformer part number: 16-0246
- 100Ω input impedance
- Response time: 1 second maximum
- Accuracy +/-1mA typical

Lead Wire Resistance Each Wire for 2-Wire RTDs
<table>
<thead>
<tr>
<th>AWG</th>
<th>Ohms/1000ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>2.575</td>
</tr>
<tr>
<td>16</td>
<td>4.094</td>
</tr>
<tr>
<td>18</td>
<td>6.510</td>
</tr>
<tr>
<td>20</td>
<td>10.35</td>
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<tr>
<td>22</td>
<td>16.46</td>
</tr>
<tr>
<td>24</td>
<td>26.17</td>
</tr>
<tr>
<td>26</td>
<td>41.62</td>
</tr>
<tr>
<td>28</td>
<td>66.17</td>
</tr>
</tbody>
</table>

Input Connections (cont.)
Process
- 0 to 20mA @ 100Ω input impedance
- 0 to 10V= (dc) @ 20kΩ input impedance
- 0 to 50mV= (dc) @ 20MΩ input impedance
- Scalable

Potentiometer
- Potentiometer: 0 to 1.2kΩ

Thermistor
- > 20MΩ input impedance
- 0 to 40kΩ, 0 to 20kΩ, 0 to 10kΩ, 0 to 5kΩ
- 2.252kΩ and 10kΩ base at 77°F (25°C)
- User-selectable curves for Alpha Technics, Beta THERM and YSI
- User-scaling support for Steinhart-Hart coefficients

Thermistor Curve Setting

<table>
<thead>
<tr>
<th>Thermistor Curve Setting</th>
<th>Base R @ 25 ºC</th>
<th>Alpha Technics</th>
<th>Beta Therm</th>
<th>YSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve A</td>
<td>2.252k</td>
<td>Curve A</td>
<td>2.2k3A</td>
<td>004</td>
</tr>
<tr>
<td>Curve B</td>
<td>10k</td>
<td>Curve A</td>
<td>10k3A</td>
<td>016</td>
</tr>
<tr>
<td>Curve C</td>
<td>10k</td>
<td>Curve C</td>
<td>10k4A</td>
<td>006</td>
</tr>
<tr>
<td>Custom</td>
<td>Use Steinhart-Hart equation coefficients (A, B and C) from thermistor manufacturer corresponding to the terms of the Steinhart-Hart equation: 1 / T = A + Bln(R) + C (ln(R))^2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Digital Input
- Update rate: 10Hz
- Dry Contact:
  - Input inactive when ≥ 5000Ω
  - Input active when ≤ 1000Ω
  - Max. short circuit: 13mA
- Voltage:
  - Max. input 36V at 3mA
  - Input inactive when ≤ 2V
  - Input active when ≥ 3V at 0.25mA

Note:
Use of 2-wire RTDs adds error to the measurement based on wire lead length (see table). 3-wire auto compensates for wire resistance.
Output Connections (cont.)

Mechanical Relay, Form C

- 5A at 240V~ (ac) or 30V= (dc) maximum resistive load
- Requires a minimum load of 20mA at 24V
- 125 VA pilot duty at 120/240V~ (ac), 25 VA at 24V~ (ac)
- 100,000 cycles at rated load
- Output does not supply power.
- For use with ac or dc
- See Quench note (page 4).

Note:

For part number FMLA- _ EBA- _ _ _ output 1 is fixed as the limit output.

Output Connections (cont.)

Mechanical Relay, Form A

- 5A at 240V~ (ac) or 30V= (dc) maximum resistive load
- 20mA at 24V minimum inductive load
- 125 VA pilot duty at 120/240V~ (ac), 25 VA at 24V~ (ac)
- 100,000 cycles at rated load
- Output does not supply power.
- For use with ac or dc
- See Quench note (page 4).

Note:

For part number FMLA-_ _ _ _ _ _ J A-A- _ _ _ output 2 is fixed as the limit output.

Solid-State Relay, Form A

- 0.5A at 149°F (65°C) to 1A at 50°F (10°C), 24 to 264V~ (ac) maximum resistive load
- 20 VA 120/240V~ (ac) pilot duty
- Opto-isolated, without contact suppression
- Maximum off state leakage of 105µA
- Output does not supply power
- Do not use on dc loads
- See Quench note (page 4)

Output Connections (cont.)

Switched DC / Open Collector

Switched DC

- 30mA dc maximum supply current
- Short circuit limited to < 50mA
- 22 to 32V= (dc) open circuit voltage
- Use dc- and dc+ to drive external solid-state relay.
- DIN-A-MITE compatible

Open Collector

- 100mA maximum output current sink
- 30V= (dc) maximum supply voltage
- Any switched dc output can use the common terminal.
- Use an external class 2 or Safety Extra Low Voltage (SELV) power supply to control a dc load, with the load positive to the positive of the power supply, the load negative to the open collector and common to the power supply negative.

Switched DC

FM [M, L] A - _ [C] [C] A - _ _

Power Supply


Output Connections (cont.)

Universal Process

- 0 to 20mA ±30µA into 8000 maximum load with 5µA nominal resolution
- 0 to 10V= (dc) ±15mV into 1 kΩ minimum load with 2.5mV nominal resolution
- Scalable
- Output supplies power
- Cannot use voltage and current outputs at same time
- Output may be used as retransmit or control
- Temperature stability 100ppm/°C

Warranty

F4T Flex modules are manufactured by ISO 9001 registered processes and are backed by a three-year warranty to the first purchaser for use, providing that the modules have not been misapplied.

Technical Assistance

To get assistance from Watlow:

- Contact a local representative: see last page
- Email: wintechsupport@watlow.com
- Call: +1 (507) 494-5656 from 7 a.m. to 5 p.m. Central Standard Time (CST)

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Recognized component UL Files E185611 Process Control Equipment and E43684 Automatic Temperature Sensing Control Integrated Equipment, see conditions of acceptability.

### Specifications

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Max Error @ 25 Deg C</th>
<th>Accuracy Range</th>
<th>Operating Range</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>*J</td>
<td>±1.75</td>
<td>0</td>
<td>-210-1200</td>
<td>Deg C</td>
</tr>
<tr>
<td>*K</td>
<td>±2.45</td>
<td>-200</td>
<td>1250-1371</td>
<td>Deg C</td>
</tr>
<tr>
<td>*T (-200 to 350)</td>
<td>±1.55</td>
<td>-200</td>
<td>350-400</td>
<td>Deg C</td>
</tr>
<tr>
<td>N</td>
<td>±2.25</td>
<td>0</td>
<td>-1250-1300</td>
<td>Deg C</td>
</tr>
<tr>
<td>*E</td>
<td>±2.10</td>
<td>-200</td>
<td>900-1000</td>
<td>Deg C</td>
</tr>
<tr>
<td>R</td>
<td>±3.9</td>
<td>0</td>
<td>-1450-1767</td>
<td>Deg C</td>
</tr>
<tr>
<td>S</td>
<td>±3.9</td>
<td>0</td>
<td>-1450-1767</td>
<td>Deg C</td>
</tr>
<tr>
<td>B</td>
<td>±2.66</td>
<td>870</td>
<td>-1700-1816</td>
<td>Deg C</td>
</tr>
<tr>
<td>C</td>
<td>±3.32</td>
<td>2315</td>
<td>0</td>
<td>Deg C</td>
</tr>
<tr>
<td>D</td>
<td>±3.32</td>
<td>2315</td>
<td>0</td>
<td>Deg C</td>
</tr>
</tbody>
</table>

### How to Reach Us

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Fax: +52 442 217-6431

**Thermistor Input**

<table>
<thead>
<tr>
<th>Resistance Range</th>
<th>Max Error @ 25 Deg C</th>
<th>Accuracy</th>
<th>Operating Range</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>5k range</td>
<td>±5</td>
<td>0</td>
<td>5000</td>
<td>Ohms</td>
</tr>
<tr>
<td>10k range</td>
<td>±10</td>
<td>0</td>
<td>10000</td>
<td>Ohms</td>
</tr>
<tr>
<td>20k range</td>
<td>±20</td>
<td>0</td>
<td>20000</td>
<td>Ohms</td>
</tr>
<tr>
<td>40k range</td>
<td>±40</td>
<td>0</td>
<td>40000</td>
<td>Ohms</td>
</tr>
</tbody>
</table>

**Specifications (cont.)**

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Max Error @ 25 Deg C</th>
<th>Accuracy Range</th>
<th>Operating Range</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>*RTD, 100Ω</td>
<td>±2.00</td>
<td>-200</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td>RTD, 1kΩ</td>
<td>±2.00</td>
<td>-800</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td>mV</td>
<td>±0.05</td>
<td>50</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>Volts</td>
<td>±0.01</td>
<td>10</td>
<td></td>
<td>Volts</td>
</tr>
<tr>
<td>mAdc</td>
<td>±0.02</td>
<td>20</td>
<td></td>
<td>mA DC</td>
</tr>
<tr>
<td>mAac</td>
<td>±5</td>
<td>-50</td>
<td>50</td>
<td>mA AC</td>
</tr>
<tr>
<td>Potentiometer 1k range</td>
<td>±1</td>
<td>0</td>
<td>1000</td>
<td>Ohms</td>
</tr>
</tbody>
</table>

* NSF approved inputs

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**Declaration of Conformity**

Series EZ-ZONE® Flex Modules

**WATLOW Electric Manufacturing Company**
1241 Bundy Blvd.
Winona, MN 55987 USA

Declarates that the following products:
- Series EZ-ZONE® Flex Modules
- FMCA-(R1,P1,C1,F1,B1,J,K,L1)AAA-A(A1,F1,B1,G1)
- FMHA-(R1,P1,C1,F1,B1,J,K,L1)AAA-A(A1,F1,B1,G1)
- FMLA-(LAJ, LCJ, LEJ, MAJ, MCJ, MEJ, YEB1)A-A(A1,F1,B1,G1)

To comply with the following directives:
- EN 60730-1:2011 – EMC requirements (Industrial Immunity, Class B Emissions).
- EN 55011 – EMC requirements (Industrial Immunity, Class B Emissions).
- EN 50178 – EMC requirements (Industrial Immunity, Class B Emissions).
- EN 50174 – Industrial Immunity, Class B Emissions.
- EN 50082-1 – Industrial Immunity, Class B Emissions.
- EN 61010-1:2010 ED3 – All IEC is in all bases are compliant with this standard.
- EN 60335-2-10 – All IEC is in all bases are compliant with this standard.
- EN 60730-2-9 – All IEC is in all bases are compliant with this standard.

All FM’s in all bases are Process Control modules, FMCA are Communication modules; Modules are Integrated Controls in either EZ-ZONE® CC or F4T Bases

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**Watlow’s Commitment to Compliance**

Watlow’s commitment to compliance with relevant standards and regulations is supported by the following:

- ISO 9001:2015 Quality Management System
- ISO 14001:2015 Environmental Management System
- OHSAS 18001:2007 Occupational Health and Safety Management System
- RoHS Directive 2011/65/EU
- WEEE Directive 2012/19/EU
- ELV Directive 2009/124/EC
- BPR Directive 2009/125/EC
- IMDG Code 1999
- ATEX Equipment Directive 2014/34/EU
- WEEE Directive 2012/19/EU
- ErP Directive 2009/125/EC
- RoHS Directive 2011/65/EU

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Fax: +61 3 9335 9566
Website: www.watlow.com

**Thermistor Input**

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</tr>
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<td>Ohms</td>
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