3500/60 & /61 Temperature Monitors

Product Datasheet
Bently Nevada* Asset Condition Monitoring

Description
The 3500/60 & 61 modules provide six channels of temperature monitoring and accept both Resistance Temperature Detector (RTD) and Thermocouple (TC) temperature inputs. The modules condition these inputs and compare them against user-programmable alarm setpoints. The 3500/60 and 3500/61 provide identical functionality except that the 3500/61 provides recorder outputs for each of its six channels while the 3500/60 does not.

The user programs the modules to perform either RTD or TC temperature measurements using the 3500 Rack Configuration Software. Different I/O modules are available in RTD/TC non-isolated or TC isolated versions. The user can configure the RTD/TC non-isolated version to accept either TC or RTD, or a mixture of TC and RTD inputs. The TC isolated version provides 250 Vdc of channel-to-channel isolation to protect against external interference.

When used in a Triple Modular Redundant (TMR) configuration, temperature monitors must be installed adjacent to each other in groups of three. When used in this configuration, the system employs two types of voting to ensure accurate operation and to avoid single-point failures.
## Specifications

**Inputs**

**Signal**

Accepts from 1 to 6 RTD or TC transducer signals.

**Input Impedance**

10 MΩ for each lead input.

**Power Consumption**

- **3500/60**: Nominal consumption of 7 watts.
- **3500/61**: Nominal consumption of 9 watts.

**Tranducers**

**RTDs**

**100Ω 3-wire & 4-wire platinum RTD** (alpha = 0.00385):

- -200 °C to +850 °C
- -328 °F to +1562 °F.
  
  With external barriers:
  - -50 °C to +850 °C
  - -122 °F to +1562 °F.

**100Ω 3-wire & 4-wire nickel RTD**:

- -80 °C to +260 °C
- -112 °F to +500 °F.
  
  With external barriers:
  - -50 °C to +260 °C
  - -122 °F to +500 °F.

**10Ω 3-wire & 4-wire copper RTD**:

- -100 °C to +260 °C,
- -148 °F to +500 °F.
  
  With external barriers:
  - -50 °C to +260 °C
  - -122 °F to +500 °F.

**TCs**

**Type E**: -100 °C to +1000 °C,

(-148 °F to +1832 °F).

**Note**: When using any of the isolated thermocouple I/O modules (-03 or -04 I/O ordering option) with Type E thermocouples, the available full-scale range will be reduced if the 3500 system is operated in an ambient temperature above +35°C. The reduced range will be -60°C to +1000°C (-76°F to +1832°F). Rack configuration software will allow the user to configure a channel down to -100°C but the system will not function properly in this scenario and therefore should not be configured to operate with these settings.

**Type J**: -18 °C to +760 °C,

(+0 °F to +1400 °F).

**Type K**: -18 °C to +1370 °C,

(+0 °F to +2498 °F).

**Note**: Platinum RTD’s with 0.00385 alphas are the worldwide industrial standard and are recommended for all applications.
I/O Modules

Isolated I/O Module
System Isolation: 500 Vdc
Channel to Channel Isolation: 250 Vdc
Isolation is only required for fault scenarios and these voltages will not be present on the I/O module inputs when a wiring or field fault occurs.

Outputs

Front Panel LEDs

OK LED
Indicates when the Temperature Monitor is operating properly.

TX/RX LED
Indicates then the Temperature Monitor is communicating with other modules in the 3500 rack.

Bypass LED
Indicates when the Temperature Monitor is in Bypass Mode.

RTD Current Source Value
925 ±15 µA @ 25°C per transducer (single supply for the 4-wire RTD and two supplies for the 3-wire).

Recorder
+4 to +20 mA. Values are proportional to monitor full-scale. Individual recorder values are provided for each channel. Monitor operation is unaffected by short circuits on recorder outputs.

Voltage Compliance (current output)
0 to +12 Vdc range across load. Load resistance is 0 to 600 Ω.

Resolution
0.3662 µA per bit ±0.15% error at room temperature ±0.4% error over temperature range.

Signal Conditioning
Note: Specified at +25 °C (+77 °F) unless otherwise noted.

Full-scale range for each channel is set in the field via 3500 Configuration Software. No calibration is required.

RTDs and TCs (except for 10Ω Copper RTDs)

Resolution
1 °C or 1 °F

Accuracy

| Internal Termination Non-Isolated | Bulkhead Rack | ±3 °C at 25 °C | (±5.4 °F at 77 °F). |
| | Standard Rack: | ±3 °C at 25 °C | (±5.4 °F at 77 °F). |
| External Termination Non-Isolated: | Bulkhead Rack: | ±3 °C at 25 °C | (±5.4 °F at 77 °F). |
| | Standard Rack: | ±1 °C at 25 °C | (±1.8 °F at 77 °F). |
| Internal Termination Isolated: | Bulkhead Rack: | ±2 °C at 25 °C | (±3.6 °F at 77 °F). |
| | Standard Rack: | ±3 °C at 25 °C | (±5.4 °F at 77 °F). |
Bulkhead Rack: ±1 °C at 25 °C  
(±1.8 °F at 77 °F).

Standard Rack: ±1 °C at 25 °C  
(±1.8 °F at 77 °F).

10Ω Copper RTDs

Resolution
1°C or 1 °F

Accuracy
±3 °C at 25 °C  
(±5.4 °F at 77 °F).

Cold Junction Compensation Sensor (used for TC measurements)

Accuracy
±1 °C at 25 °C  
(±1.8 °F at 77 °F).

Alarms

Alarm Setpoints
The user can set Alert and Danger setpoints for the value measured by the monitor using software configuration. Alarms are adjustable from 0 to 100% of full-scale for each measured value. The exception is when the full-scale range exceeds the range of the sensor. In this case, the range of the sensor will limit the setpoint. Accuracy of alarms are to within 0.13% of the desired value. The Temperature Monitors have both under and over alarm setpoints.

Alarm Time Delays
The user can program alarm delays using software as follows:

Danger
From 1 to 60 seconds in 1 second intervals or can be set to the minimum alarm delay.

<table>
<thead>
<tr>
<th>Number of actual channel(s)</th>
<th>Minimum time delay (mS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>225</td>
</tr>
<tr>
<td>2</td>
<td>300</td>
</tr>
<tr>
<td>3</td>
<td>375</td>
</tr>
<tr>
<td>4</td>
<td>450</td>
</tr>
<tr>
<td>5</td>
<td>525</td>
</tr>
<tr>
<td>6</td>
<td>600</td>
</tr>
</tbody>
</table>

Note: 225 ms alarm time delays will not be available for all channels. As more channels are used the alarm time delay increases. The configuration software will indicate the minimum alarm time delay based on the channel loading.

Proportional Values

Proportional values are temperature measurements used to monitor the machine. The Temperature Monitors return temperature proportional values.

Environmental Limits

Operating Temperature
-30 °C to +65 °C (-22 °F to +150 °F) when used with Internal/External Termination I/O Modules
0 °C to +65 °C (32 °F to +150 °F) when used with Internal Barrier I/O Modules (Internal Termination).

Storage Temperature
-40 °C to +85 °C (-40 °F to +185 °F).
Compliance and Certifications

EMC
European Community Directives:
EMC Directive 2014/35/EU
Standards:
EN 61000-6-2 Immunity for Industrial Environments
EN 61000-6-4 Emissions for Industrial Environments

Electrical Safety
European Community Directives:
LV Directive 2014/35/EU
Standards:
EN 61010-1

Hazardous Area Approvals

North American
Approval Option (01)
When used with I/O module ordering options with internal barriers:
Ex nC [ia] IIC T4 Gc
Class I, Zone 2, AEx nC [ia] IIC T4 Gc
Class I, Division 1, Groups A, B, C, and D
T4 @ Ta = -20 °C ≤ Ta ≤ +65 °C
(-4 °F ≤ Ta ≤ +149 °F)
per control drawing 138547
When used with I/O module ordering options without internal barriers:
Ex nC [L] IIC T4 Gc

ATEX/IECEx Approval Option (02)
For Selected Ordering Options with ATEX/IECEx agency approvals:
For ATEX/IECEx agency approval ordering options with internal barriers:
II 3 (1) G
Ex nA nC ic [ia Ga] IIC T4 Gc
T4 @ Ta = -20°C ≤ Ta ≤ +65 °C
(-4°F to +149°F)
per control drawing 138547
For ATEX/IECEx agency approval ordering options without internal barriers:
II 3 G
Ex nA nC ic IIC T4 Gc
T4 @ -20°C ≤ Ta ≤ +65°C
(-4°F ≤ Ta ≤ +149°F)

Physical

Monitor Module

Dimensions (Height x Width x Depth)
241.3 mm x 24.4 mm x 241.8 mm
(9.50 in x 0.96 in x 9.52 in).

Weight
0.91 kg (2.0 lbs.).
I/O Modules

**Dimensions**
(Height x Width x Depth)
241.3 mm x 24.4 mm x 99.1 mm
(9.50 in x 0.96 in x 3.90 in).

**Weight**
0.45 kg (1.0 lbs.).

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Internal Barrier I/O Module

**Dimensions**
(Height x Width x Depth)
241.3 mm x 24.4 mm x 163.1 mm
(9.50 in x 0.96 in x 6.42 in).

**Weight**
0.46 kg (1.01 lbs.).

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**Rack Space Requirements**

**Monitor Module**
1 full-height front slot.

**I/O Modules**
1 full-height rear slot.

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**Ordering Considerations**

**General**
If the 3500/60 or 3500/61 is added to an existing 3500 System the following firmware and software versions (or later) are required:

- 3500/20 Module Firmware – Revision G
- 3500/01 Software – Version 2.00
- 3500/02 Software – Version 2.00
- 3500/03 Software – Version 1.10

**Note:** External Termination Blocks cannot be used with Internal Termination I/O modules.

When ordering I/O Modules with External Terminations the External Termination Blocks and Cables must be ordered separately.

Consult the 3500 Internal Barrier specification sheet (part number 141495-01) if the Internal Barrier Option is selected.
Ordering Information


No Recorder Outputs
3500/60-AXX-BXX

A: I/O Module Type
0 1 RTD/TC Non-isolated I/O Module Internal Terminations
0 2 RTD/TC Non-isolated I/O Module External Terminations
0 3 TC Isolated I/O Module Internal Terminations
0 4 TC Isolated I/O Module External Terminations
0 5 RTD/TC Non-isolated I/O Module with Internal Barriers

B: Agency Approval Option
0 0 None
0 1 CSA/NRTL/C (Class 1, Div 2)
0 2 ATEX/IECEx/CSA (Class 1, Zone 2)

Recorder Outputs
3500/61-AXX-BXX

A: I/O Module Type
0 1 RTD/TC Non-isolated I/O Module Internal Terminations
0 2 RTD/TC Non-isolated I/O Module External Terminations
0 3 TC Isolated I/O Module Internal Terminations
0 4 TC Isolated I/O Module External Terminations
0 5 RTD/TC Non-isolated I/O Module with Internal Barriers

B: Agency Approval Option
0 0 None
0 1 CSA/NRTL/C (Class 1, Div 2)
0 2 ATEX/IECEx/CSA (Class 1, Zone 2)

External Termination Blocks

133908-01
RTD/TC Non-Isolated External Termination Block (Terminal Strip connectors).

133916-01
RTD/TC Non-Isolated External Termination Block (Euro Style connectors).

133924-01
TC Isolated External Termination Block (Terminal Strip connectors).

133932-01
TC Isolated External Termination Block (Euro Style connectors).

133892-01
3300/61 Recorder Output External Termination Block (Terminal Strip connectors).

133900-01
3300/61 Recorder Output External Termination Block (Euro Style connectors).

Cables

3500/60 and 3500/61 Transducer (XDCR) Signal to External Termination (ET) Block Cable
134544-AXXXX-BXX

A: Cable Length
0 0 0 5 5 feet (1.5 metres)
0 0 0 7 7 feet (2.1 metres)
0 0 0 1 0 10 feet (3.0 metres)
0 0 0 2 5 25 feet (7.5 metres)
0 0 0 5 0 50 feet (15 metres)
0 0 1 0 0 100 feet (30.5 metres)

B: Assembly Instructions
0 1 Not assembled
0 2 Assembled

3500/61 Recorder Output to External Termination (ET) Block Cable
134543- AXX – BXX

A: Cable Length
0 0 0 5  5 feet (1.5 metres)
0 0 0 7  7 feet (2.1 metres)
0 0 1 0  10 feet (3.0 metres)
0 0 2 5  25 feet (7.5 metres)
0 0 5 0  50 feet (15 metres)
0 1 0 0  100 feet (30.5 metres)

B: Assembly Instructions
0 1 Not assembled
0 2 Assembled
Note: Recorder cables are not used with /60 or /62 monitors

Spares

Shared components for /60 and /61
133908-01
RTD/TC Non-Isolated External Termination Block (Terminal Strip connectors).

133916-01
RTD/TC Non-Isolated External Termination Block (Euro Style connectors).

133924-01
TC Isolated External Termination Block (Terminal Strip connectors).

133932-01
TC Isolated External Termination Block (Euro Style connectors).

00580442
Connector Header, Internal Termination, 9-position, Green.

00580443
Connector Header, Internal Termination, 12-position, Green.

00502133
Connector Header, Internal Termination, 12-position, Blue.

00580444
Connector Header, Internal Termination, 15-position, Green.

134542-01
3500/60 & 3500/61 Manual.

3500/60-Specific
163179-01
3500/60 Temperature Monitor (without recorders)

133827-01
3500/60 RTD/TC Non-Isolated I/O Module External Terminations.

133835-01
3500/60 TC Isolated I/O Module Internal Terminations.

133843-01
3500/60 TC Isolated I/O Module Internal Terminations.

3500/61-Specific
163179-02
3500/61 Temperature Monitor (with recorders)

133819-02
3500/61 RTD/TC Non-Isolated I/O Module Internal Terminations.

133827-02
3500/61 RTD/TC Non-Isolated I/O Module External Terminations.

133835-02
3500/61 TC Isolated I/O Module Internal Terminations.

133843-02
3500/61 TC Isolated I/O Module External Terminations.

133892-01
3500/61 Recorder Output External Termination Block (Terminal Strip connectors).

133900-01
3500/61 Recorder Output External Termination Block (Euro Style connectors).
136711-02

3500/61 RTD/TC I/O Module with Internal Barriers and Internal Terminations. (Not-Isolated)
Graphs and Figures

1) Status LEDs
2) 3500/60 Main Module Front View
3) ISO TC Temp I/O Module (Internal Terminations)
4) RTD/TC Temp I/O Module (Internal Terminations)
5) ISO TC Temp I/O Module (External Terminations)
6) RTD/TC Temp I/O Module (External Terminations)  
   *(No Recorder Outputs)*

**Figure 1: Front and Rear Views of the 3500/60 Temperature Monitor**
1) Status LEDs  
2) 3500/61 Main Module Front View  
3) ISO TC Temp I/O Module (Internal Terminations)  
4) RTD/TC Temp I/O Module (Internal Terminations)  
5) ISO TC Temp I/O Module (External Terminations)  
6) RTD/TC Temp I/O Module (External Terminations) (Recorder Outputs)

Figure 2: Front and Rear Views of the 3500/61 Temperature Monitor