3500/60 and 3500/61 Temperature Modules

Datasheet

Bently Nevada Machinery Condition Monitoring

141540 Rev. L



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.

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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

TCs	
Type E	-100 ºC to +1000 ºC, (-148 ºF to +1832 ºF).
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 +35C. The reduced range will be -60C to +1000C (-76F to +1832F). Rack configuration software will allow the user to configure a channel down to -100C but the system will not function properly in this scenario and therefore should not be configured to operate with these settings.	
Type J	-18 ºC to +760 ºC, (+0 ºF to +1400 ºF).
Type K	-18 ºC to +1370 ºC, (+0 ºF to +2498 ºF)
.Type T	-160 ºC to +400 ºC, (-256 ºF to +752 ºF).
RTDs	
100Ω 3-wire & 4-wire platinum RTD (alpha = 0.00385)	-200º C to +850º C (-328 ºF to +1562 ºF). With external barriers: -50 ºC to +850 ºC (-122 ºF to +1562 ºF).
100Ω 3-wire & 4-wire platinum RTD (alpha = 0.00392)	-200 ºC to +700 ºC (-328 ºF to +1292 ºF). With external barriers: -50 ºC to +260 ºC (-122 ºF to + 1292 ºF).
120Ω 3-wire & 4-wire nickel RTD	-80 ºC to +260 ºC (-112 ºF to +500 ºF). With external barriers: -50 ºC to +260 ºC (-122 ºF to + 500 ºF).
10Ω 3-wire & 4-wire copper RTD	-100 ºC to +260 ºC, (-148 ºF to +500 ºF). With external barriers: -50 ºC to +260 ºC (-122 ºF to +500 ºF).
	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: 500Vdc 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
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). ±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 Isolated	
Bulkhead Rack	±1 °C at 25 °C (±1.8 °F at 77 °F).
Standard Rack	°C at 25 °C (±1.8 °F at 77 °F)
10 Ω 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:	
Alert	From 1 to 60 seconds in 1 second intervals.
Danger	From 1 to 60 seconds in 0.5 second intervals

Measured Values

Measured values are temperature measurements used to monitor the machine. The Temperature Monitors return temperature measured values.

Environmental Limits

Operating Temprature	-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)

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 lb)
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 lb)
I/O Modules (internal barrier)	
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 lb)

Rack Space Requirements

Monitor Module	1 full-height front slot
I/O Modules	1 full-height rear slot

Compliance and Certifications (Approvals pending)

FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

EMC

European Community Directive:

EMC Directive 2014/30/EU

Standards:

EN 61000-6-2; Immunity for Industrial Environments
EN 61000-6-4; Emissions for Industrial Environments

Electrical Safety

European Community Directive:

LV Directive 2014/35/EU

Standards:

EN 61010-1

RoHS

European Community Directive:

RoHS Directive 2011/65/EU

Cyber Security

Designed to meet IEC 62443

Maritime

DNV GL rules for classification – Ships, offshore units, and high speed and light craft

ABS Rules for Condition of Classification, Part 1

- Steel Vessels Rules
- Offshore Units and Structures

Functional Safety

SIL 2

Hazardous Area Approvals

For the detailed listing of country and product specific approvals, refer to the *Approvals Quick Reference Guide* (108M1756) available from Bently.com.

CSA/NRTL/C

When used with I/O module ordering options without internal barriers	Class I, Zone 2: AEx/Ex nA nC ic IIC T4 Gc; Class I, Zone 2: AEx/Ex ec nC ic IIC T4 Gc; Class I, Division 2, Groups A, B, C, and D; T4 @ Ta= -20˚C to +65˚C (-4˚F to +149˚F) When installed per drawing 149243 or 149244.
When used with I/O module ordering options with internal barriers	Class I, Zone 2: AEx/Ex nA nC ic [ia Ga] IIC T4 Gc; Class I, Zone 2: AEx/Ex ec nC ic [ia Ga] IIC T4 Gc; Class I, Division 2, Groups A, B, C, and D (W/ IS Output for Division 1) T4 @ Ta= -20˚C to +65˚C (-4˚F to +149˚F) When installed per drawing 138547.

ATEX/IECEx

When used with I/O module ordering options without internal barriers	 II 3 G Ex nA nC ic IIC T4 Gc; Ex ec nC ic IIC T4 Gc; T4 @ Ta= -20˚C to +65˚C (-4˚F to +149˚F) When installed per drawing 149243 or 149244.
When used with I/O module ordering options with internal barriers	 II 3(1) G Ex nA nC ic [ia Ga] IIC T4 Gc; Ex ec nC ic [ia Ga] IIC T4 Gc; T4 @ Ta= -20˚C to +65˚C (-4˚F to +149˚F) When installed per drawing 138547.

Ordering Information

For the detailed listing of country and product specific approvals, refer to the *Approvals Quick Reference Guide* (108M1756) available from Bently.com.

Without Recorder Outputs

3500/60-AA-BB

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-AA-BB

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-AAAA-BB

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	
01	Not assembled
02	Assembled

3500/61 Recorder Output to External Termination (ET) Block Cable

134543- AAAA– BB

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	3500/60 & 3500/61 User Guide

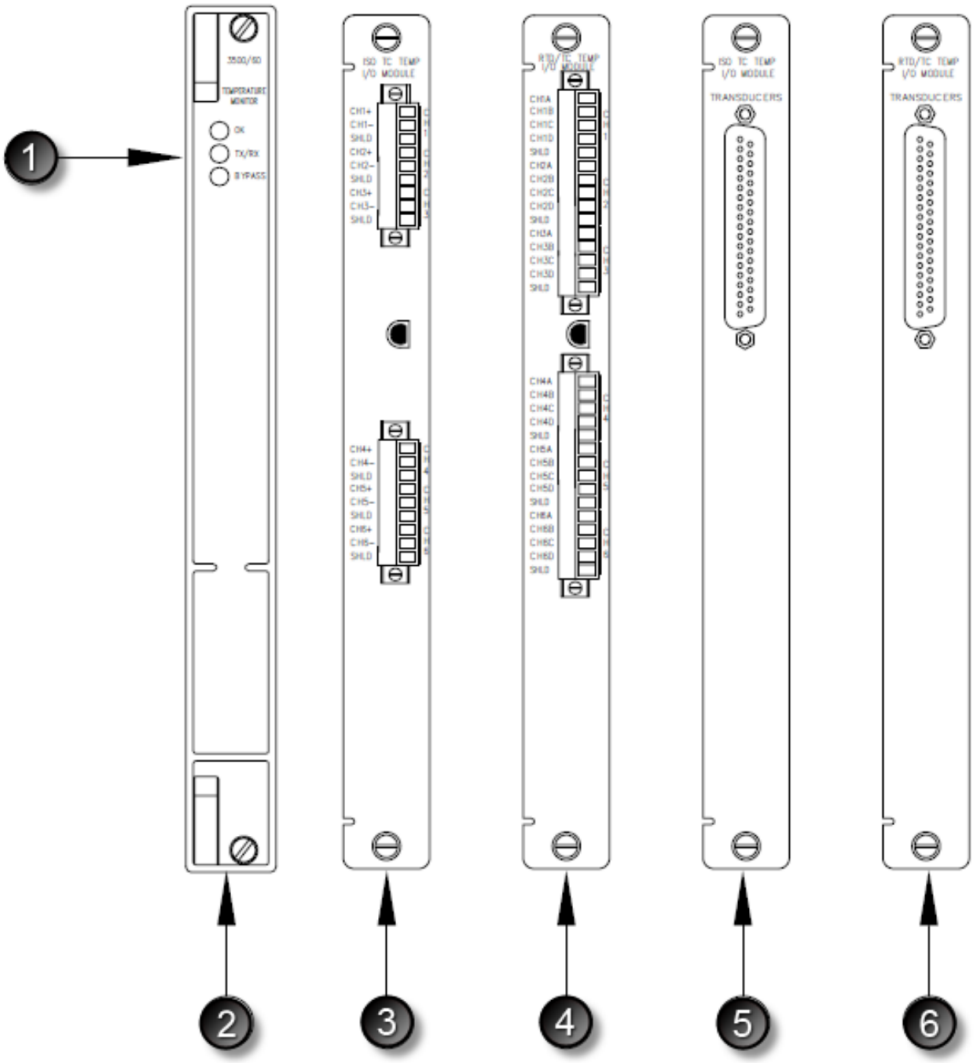
3500/60 -Specific

163179-01	3500/60 Temperature Monitor (without recorders)
133827-01	3500/60 RTD/TC Non-Isolated I/O Module, External Terminations.
133819-01	3500/60 RTD/TC non-Isolated I/O Module, Internal Terminations
133835-01	3500/60 TC Isolated I/O Module, Internal Terminations.
133843-01	3500/60 TC Isolated I/O Module, External Terminations.
136711-01	3500/60 RTD/TC I/O Module with Internal Barriers and Internal Terminations. (Not-Isolated)

3500/61 -Specific

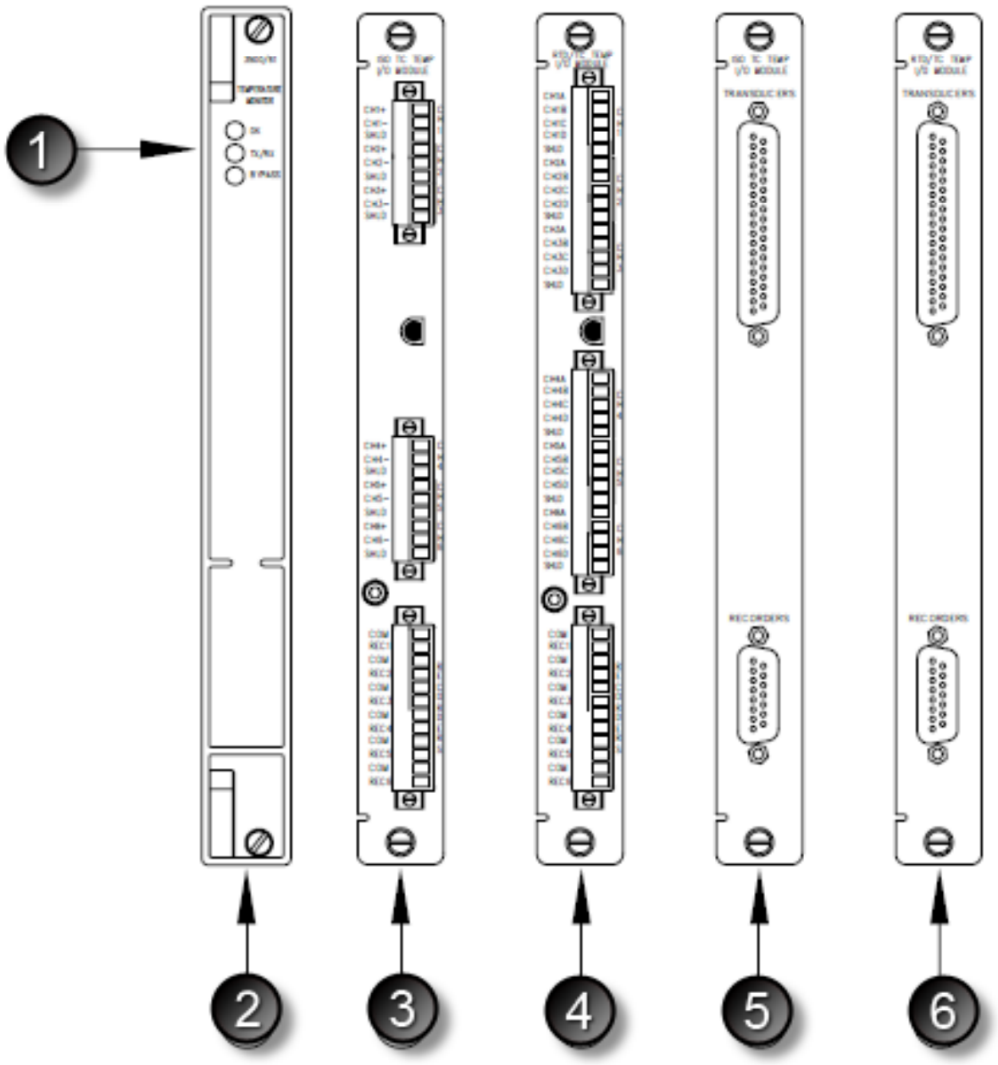
163179-02	3500/61 Temperature Monitor (with recorders)
133819-02	3500/61 RTD/TC Non-Isolated I/O Module Internal Terminations.
133827-02	3500/61 RTD/TC Non-Isolated I/O Module External Terminations.
133835-02	3500/61 TC Isolated I/O Module Internal Terminations.
133843-02	3500/61 TC Isolated I/O Module 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)

Figure 1: Front and Rear Views of the 3500/60 Temperature Monitor (Without Recorder Outputs)



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)

Figure 2: Front and Rear Views of the 3500/61 Temperature Monitor (Recorder Outputs)

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