

Pneumatic Transmitters

Model 33 Nullmatic™ Temperature Transmitter

Introduction

Features & Benefits

- ▶ Rugged design ensures operation in the harshest environments
- ▶ Powder coating provides corrosion resistance
- ▶ Wide ranges of temperature spans and temperature ratings provides application versatility

Description

Model 33 Nullmatic Temperature Transmitters measure temperature to 1400°F (760°C), with measured spans as small as 50° or as large as 1000°F. Moreover, the Model 33 employs a pilot-operated null-balance principle of operation, which maintains the output pressure regardless of wide changes in flow or supply pressure. As such, they provide temperature measurements and transmit a pneumatic output proportional to the measured temperature range for vessels, reactors, fractionating columns, heat exchangers, pipelines, air ducts, and flues.

Each Model 33 includes a helium-filled thermal system and a Nullmatic force-balance transmitter. The force-balance transmitter converts pressure changes in the thermal system caused by changes in temperature to 3-15 psig output signals proportional to the measured temperature range. The thermal system includes a bulb with a bendable extension, a flexible armored capillary, and a bellows. Three kinds of bulbs are available for use with a thermal system and all are made of 316 stainless steel or copper.

A circuit maintains a constant differential-pressure-drop across the nozzle with the differential determined by the force of the spring under the diaphragm. This maintains the transmitter's total internal bellows movement within 0.001", which ensures that it is accurate under virtually any condition and it minimizes hysteresis and non-linearity errors.

Specifications

Temperature Span¹

- 3/4" O.D. and averaging bulbs
 - Minimum: 50°F (30°C)
 - Maximum: 1000°F (540°C)
- 3/8" O.D. Bulbs
 - Minimum: 70°F (40°C)
 - Maximum: 1000°F (540°C)

Operating Temp. Limits

- 3/4" O.D. and averaging bulbs
 - Minimum: -450°F (-270°C)
 - Maximum: 1400°F (760°C)
- 3/8" O.D. bulbs
 - Minimum: -450°F (-270°C)
 - Maximum: 1000°F (540°C)



Maximum Bulb Operating Temperature²

- Bulb Size: 3/4 x 4"
 - Copper: 800°F (427°C)
 - SS: 1400°F (760°C)
- Bulb Size: 3/8 x 4"
 - Copper: 800°F (427°C)
 - SS: 1000°F (540°C)

Minimum Bulb Operating Temperature

-450°F (-270°C)

Supply Pressure

- Normal: 20 psig (3-15 psi output)
- Maximum: 35 psig
- Minimum: 4 psi above maximum output

Output Pressure

3-15 psig (within 1%³)

Output Range

- 3-15 psig
- 3-27 psig and 0-30 psig output ranges are available

Connections

1/4" NPT for supply and output

Ambient Temp. Limits

-40 to 180°F (-40 to 82°C)

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Technical data

Response level

within 0.01% of full scale

Air consumption (with 20 psi supply)

less than 0.08 scfm in balanced condition on dead-end service

Speed of Response^{4,5} (with transmitter coupled through 100 ft. of 1/4" OD tubing to receiver – element immersed in agitated water)

Bare SS bulb: 0.03 minutes

3/8" SS bulb in SS well: 0.3 minutes

3/4" OD SS bulb in SS well: 0.7 minutes

Ambient Temperature Effect (max. change in output for -50°F change in ambient temperature) less than 1% of full-scale shift on most ranges

Model Number

Basic Transmitter Model Number

Order No.

Designator for Mating Transmitters and Thermal Systems

- Spans of 250 to 1000°F
- Spans of 150 to 800°F
- Spans of 100 to 475°F
- Spans of 70 to 250°F
- Spans of 50 to 70°F

Thermal System Number

Thermal System Material	Bulb Diameter	Bulb Type	Bulb Overall Length	Bulb Active Length	Bendable Extension Length	Armored Capillary Length
Copper	3/4"	Plain	4"	4"	20"	36"
Copper	3/4"	Rigid	6"	4"	None	36"
316 SS	3/4"	Plain	4"	4"	20"	36"
316 SS	3/4"	Rigid	6"	4"	None	36"
316 SS	3/4"	Plain	4"	4"	20"	36" PVC
316 SS	3/4"	Non-Rigid	4"	4"	20"	36"
316 SS	3/4"	Plain	4"	4"	20"	120"
316 SS	3/4"	Rigid	6"	4"	None	120"
Copper	3/4"	Non-Rigid	4"	4"	20"	36"
316 SS	3/16"	Extendable	14"	14"	20"	36"
316 SS	3/8"	Plain	4"	4"	24"	36"
Copper	3/8"	Plain	4"	4"	24"	36"
316 SS	3/8"	Rigid	11-1/4"	4"	None	36"
Copper	3/8"	Rigid	11-1/4"	4"	None	36"
316 SS	3/8"	Plain	4"	4"	24"	36" PVC
316 SS	3/8"	Plain	4"	4"	24"	120"

Factory Code

33-

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 C
 A
 C
 D
 E
 SE

5012

5048

5072

5079

5081

5098

5142

5257

5287

5341

5475

5476

5477

5478

5479

5580

(C7C)

- 1) Certain spans can be used to 1400°F with factory approval.
- 2) Materials contacting process fluid – stainless steel standard bulbs and wells; special materials available at extra cost. Metallic materials can be ordered to conform with NACE standard MR-01-75 (1980 Revision).
- 3) Instruments which have been calibrated to within ½% are available, at extra cost.
- 4) With 500 ft. transmission line, lag times will increase approximately 0.07 minutes.
- 5) These time constants are the lag times required for 63.2% response.

Pneumatic Transmitters

Model 33 Nullmatic™ Temperature Transmitter

Technical data

TABLE 1 Fahrenheit Selection

Model	Maximum Operating Temperature °F ^{1,2,3}										Maximum Overrange °F			
	33A		33C		33D		33E		33SE		3/8" Bulbs (copper bulb limit - 800°F)			
	Bulb Dia.	3/8"	3/4" Aver	3/8"	3/4" Aver	3/8"	3/4" Aver	3/8"	3/4" Aver		3/4" Aver	33A	33C	33D
50	—	—	—	—	—	—	—	—	—	100	—	—	—	—
60	—	—	—	—	—	—	—	—	—	250	—	—	—	—
70	—	—	—	—	—	—	—	150	—	370	—	—	—	650
80	—	—	—	—	—	—	—	200	200	—	—	—	—	825
90	—	—	—	—	—	—	—	230	286	—	—	—	—	975
100	—	—	—	—	100	100	270	370	—	—	—	—	625	1000
110	—	—	—	—	150	165	290	465	—	—	—	—	900	1000
120	—	—	—	—	200	220	320	550	—	—	—	—	1000	1000
125	—	—	—	—	225	250	330	590	—	—	—	—	1000	1000
130	—	—	—	—	250	280	360	635	—	—	—	—	1000	1000
140	—	—	—	—	300	335	390	720	—	—	—	—	1000	1000
150	—	—	150	150	350	395	430	805	—	—	—	650	1000	1000
160	—	—	190	190	400	450	450	890	—	—	—	710	1000	1000
170	—	—	230	230	440	510	480	975	—	—	—	770	1000	1000
175	—	—	250	250	460	540	500	1000	—	—	—	800	1000	1000
180	—	—	270	270	470	565	520	1000	—	—	—	830	1000	1000
190	—	—	305	310	500	620	540	1000	—	—	—	890	1000	1000
200	—	—	340	350	520	680	570	1000	—	—	—	950	1000	1000
225	—	—	440	450	580	825	640	1000	—	—	—	1000	1000	1000
250	260	255	500	550	640	970	700	1000	—	—	650	1000	1000	1000
275	330	325	550	650	700	1000	—	—	—	—	750	1000	1000	—
300	400	400	610	750	750	1000	—	—	—	—	850	1000	1000	—
325	480	470	665	850	810	1000	—	—	—	—	1000	1000	1000	—
350	550	540	715	950	870	1000	—	—	—	—	1000	1000	1000	—
375	620	610	765	1000	920	1000	—	—	—	—	1000	1000	1000	—
400	700	680	820	1125	980	1400	—	—	—	—	1000	1000	1000	—
425	770	750	870	1215	—	1400	—	—	—	—	1000	1000	—	—
450	840	820	920	1285	—	1400	—	—	—	—	1000	1000	—	—
475	890	890	970	1380	—	1400	—	—	—	—	1000	1000	—	—
500	940	960	1000	1400	—	—	—	—	—	—	1000	1000	—	—
600	1000	1230	—	1400	—	—	—	—	—	—	1000	—	—	—
700	1000	1300	—	1400	—	—	—	—	—	—	1000	—	—	—
800	1000	1400	—	1400	—	—	—	—	—	—	1000	—	—	—
900	1000	1400	—	—	—	—	—	—	—	—	1000	—	—	—
1000	1000	—	—	—	—	—	—	—	—	—	1000	—	—	—

* All 316 SS, 3/4",
Aver - 1400°F
All Cu. 3/4" - 800°F

- 1) Maximum operating temperature for Copper Bulbs is 800°F.
- 2) Transmitter must be selected from first column (read left to right) of maximum operating temperatures which satisfy range requirements.
- 3) Thermal systems are not interchangeable between different lettered transmitters.

Pneumatic Transmitters

Model 33 Nullmatic™ Temperature Transmitter

Technical data

TABLE 2 Celsius Selection

Model	Maximum Operating Temperature °C ^{1,2,3}										Maximum Overrange °C			
	33A		33C		33D		33E		33SE		3/8" Bulbs (copper bulb limit - 425°C)			
	Bulb Dia. Com. Spans °C	3/8" Aver	3/4" Aver	3/8" Aver	3/4" Aver	3/8" Aver	3/4" Aver	3/8" Aver	3/4" Aver	3/4" Aver	33A	33C	33D	33E
28	—	—	—	—	—	—	—	—	—	35	—	—	—	—
30	—	—	—	—	—	—	—	—	—	40	—	—	—	—
35	—	—	—	—	—	—	—	—	—	120	—	—	—	—
40	—	—	—	—	—	—	—	70	—	190	—	—	—	380
45	—	—	—	—	—	—	—	90	90	—	—	—	—	450
50	—	—	—	—	—	—	—	110	140	—	—	—	—	525
60	—	—	—	—	60	65	140	225	—	—	—	—	380	540
70	—	—	—	—	105	125	170	310	—	—	—	—	480	540
80	—	—	—	—	155	185	205	395	—	—	—	—	540	540
90	—	—	95	95	200	240	240	480	—	—	—	385	540	540
100	—	—	130	135	245	300	270	540	—	—	—	445	545	540
110	—	—	165	175	265	355	—	540	—	—	—	510	540	—
120	—	—	205	215	295	415	—	540	—	—	—	540	540	—
130	—	—	240	255	315	470	—	540	—	—	—	540	540	—
140	—	125	265	295	335	530	—	540	—	—	—	540	540	—
150	155	155	285	335	360	540	—	—	—	—	390	540	540	—
160	185	185	305	375	385	540	—	—	—	—	455	540	540	—
170	210	210	325	415	405	540	—	—	—	—	540	540	540	—
180	240	240	345	455	430	540	—	—	—	—	540	540	540	—
190	265	265	365	495	455	540	—	—	—	—	540	540	540	—
200	320	295	400	535	475	540	—	—	—	—	540	540	540	—
225	390	365	450	600	—	760	—	—	—	—	540	540	—	—
250	450	435	495	700	—	760	—	—	—	—	540	540	—	—
275	500	505	535	750	—	760	—	—	—	—	540	540	—	—
300	540	535	—	760	—	—	—	—	—	—	540	—	—	—
350	540	680	—	760	—	—	—	—	—	—	540	—	—	—
400	540	700	—	760	—	—	—	—	—	—	540	—	—	—
500	540	760	—	—	—	—	—	—	—	—	540	—	—	—
556	540	—	—	—	—	—	—	—	—	—	540	—	—	—

* All 316 SS, 3/4",
Aver - 760°C
All Cu. 3/4" - 425°C

Options & Accessories

- ▶ Compression fitting 3/4" bulb NPT Connection
- ▶ Compression fitting 3/4" bulb for Thermowell (P/N 1551-31)
- ▶ Compression fitting for 3/8" bulb – Tapped Exhaust (P/N 12140-3)
- ▶ Bracket to Mount Transmitter to Thermowell (P/N 859-89)
- ▶ Kit for 2" Pipe Mounting (P/N 3351-101)
- ▶ Plastic Cover for Transmitter (P/N 3351-94)

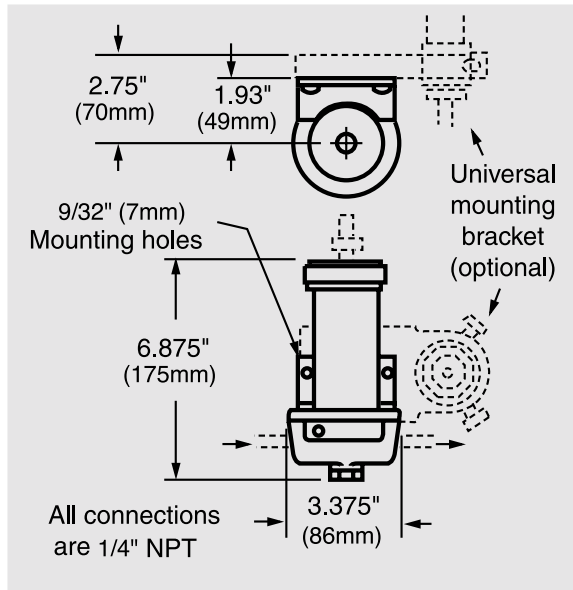
1) Maximum operating temperature for Copper Bulbs is 425°C.
 2) Transmitter must be selected from first column (read left to right) of maximum operating temperatures which satisfy range requirements.
 3) Thermal systems are not interchangeable between different lettered transmitters.

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Dimensional drawings

Mounting Dimensions



	0.75" (19mm) x 4.0" (102mm) Bulbs	0.375" (9.5mm) x 4.0" (102mm) Bulbs
Plain bulb with compression fitting	Adjustable 3.375" (86mm) to 23.375" (594mm) 4.0" (102mm) Active portion 0.75" NPT	Adjustable 4.0" (102mm) to 25.75" (654mm) 4.0" (102mm) Active portion 0.5" NPT
Rigid bulb with union screw connection	6.0" (152mm) Below seat 4.0" (102mm) Active portion 0.75" NPT	Adjustable 5.0" (127mm) to 9.0" (229mm) on initial installation 4.0" (102mm) Active portion 0.5" NPT
Plain bulb in thermal well with compression fitting	1.0" (25.4mm) 2.125" (54mm) 5.5" (140mm) or longer 1.0" NPT Plain bulb	2.25" (57mm) 5.5" (140mm) or longer 0.75" NPT Plain bulb