

40P Series Temperature Recorders, Indicators, and Recording or Indicating Controllers



**RECORDING
CONTROLLER**



**CIRCULAR CHART
RECORDER**



**SECTOR SCALE
INDICATOR**

These instruments are used wherever precise chart records, indication, or control of temperature measurement is required for efficient process management. They use filled thermal systems as the temperature measuring element.

All of these instruments either record on a circular chart or indicate on a sector scale or a concentric scale. The recorders and sector scale indicators are available with up to four pens and two pointers, respectively. One pointer only is available for concentric scale indicators. Single, dual, and duplex action controllers are available. Single action controllers may have one or two additional recording pens; duplex controllers may have one additional pen.

The controllers control one or two measurements and either record or indicate the variable. They are available for either direct connection to the measurement point or for receiving pneumatic signals from a remote temperature transmitter. The control elements transmit a standard pneumatic signal to a final operator that may be as far as 100 meters (300 feet) distant.

WEATHERPROOF CONSTRUCTION

A glass-fiber reinforced case and gasketed door with a shatterproof glass window meet IEC IP53 and provide the environmental protection of NEMA Type 3.

WIDE VARIETY OF STANDARD RANGES

Filled thermal systems are available for operation between -195 and +760° (+1400°F) with spans as small as 25°C (40°F). Each system comprises a temperature sensitive bulb connected by a capillary tube to a helical measuring element located in the instrument case. These hermetically sealed systems are filled with a liquid, a liquid and its vapor, or a gas.

VERSATILE MOUNTING

These instruments may be mounted in a panel, on a surface, or on a vertical pipe.

WIDE SELECTION OF CONTROL MODES

The controllers are available with On-Off, Proportional, Proportional plus Derivative, Proportional plus Integral (Reset) (STABILOG), and Proportional plus Integral plus Derivative (HYPER-RESET) control functions.

PERFORMANCE SPECIFICATIONS

(Under Reference Operating Conditions)

Accuracy

When using the elements as listed in Measuring Element Specifications section.

Class IA

Spans up to 215°C (400°F) $\pm 0.5\%$ of span
Spans between 215 and 330°C (400 and 600°F) $\pm 0.75\%$ of span

Class IIA and IIB

Over upper 2/3 of scale length $\pm 0.5\%$ of span

Class IIIB

Spans up to 330°C (600°F) $\pm 0.5\%$ of span
For upper range value above 315°C (600°F)
 $\pm 0.75\%$ of upper range value
For lower range value below -45°C (-50°F)
 $\pm 0.75\%$ of lower range value

Repeatability

0.25% of span

Dead Band

Recorders and Indicators

0.20% of span

Controllers

0.1% of span

FUNCTIONAL SPECIFICATIONS

Elements

Refer to Measuring Element Specifications section for thermal system classes, bulb material, and measurement ranges.

Connections

All connections are located in the bottom of the case.

Electrical

A nominal 22 mm (0.9 in) diameter hole is provided for a nominal 20 mm (CEE 23), PG16 or 1/2 in conduit fitting.

Pneumatic

The supply and output connections for the controllers are tapped for 1/4 NPT.

Mounting

Standard mounting is flush in a panel up to 16 mm (0.6 in) thick or on a surface. Kit of parts for vertical mounting on a DN 50 or 2 in pipe is available as an option.

Recorder Pens

For Recorders and Single Action Recording Controllers, specify using Model Code. For Dual, Duplex, and Auto-Selector Controllers, see applicable Model Code and Optional Features section.

Box-Type

For 1, 2, 3, or 4 pen instruments.

Fiber Tip-Type

For 1, 2, 3, or 4 pen instruments. Disposable ink cartridge with integral fiber-tip pen. Minimum of 365 m (1200 ft) ink line at a nominal 25 mm/s (1 in/s) pen speed.

Recorder Chart Drives**Electrical**

The standard speed is one revolution per 24 hours for nominal 120 or 24 V, 50 or 60 Hz, as specified.

Mechanical

The standard speed is one revolution per 24 hours with a 24-hour movement.

Recorder Expendable Accessories

100 HUMITEX nominal 300 mm (12 in) circular charts with a nominal 100 mm (4 in) calibrated width, and the specified inking systems are provided with each instrument.

Indicator Pointer

Concentric scale indicators have a black pointer and single sector scale indicators have an orange pointer. Dual sector scale indicators have one orange and one black pointer.

Indicator Scales

Black markings on white background. Refer to Chart and Dial Catalog 600 for available ranges.

Sector

The effective length is 171 mm (6.75 in).

Concentric

The effective length is 594 mm (23.4 in).

Controllers Only**Controller Action**

The output signal either increases or decreases with increasing measurement, as specified. The action is reversible in the field.

Supply Pressure

140 kPa, 20 psi, or 1.4 bar or kg/cm², as specified.

Output Signal

20 to 100 kPa, 3 to 15 psi, or 0.2 to 1.0 bar or kg/cm², as specified.

Air Consumption Under Normal Operation

0.5 m³/h (0.3 cfm) at standard conditions.

Dual Indicating Gauge

Visible through a window near the top of the door. The output signal is indicated on the upper scale and the supply pressure on the lower scale. Both are expressed in kPa, psi, bar or kg/cm², as specified.

Index Pointer

The setting index in sector scale indicating controllers has a bright orange tip. The setting index in recording controllers is silver color.

Blow-Out Plug

Located in the bottom of the case.

Cardboard Nameplate

A cardboard nameplate is supplied for displaying the chart factor.

MEASURING ELEMENT SPECIFICATIONS

(To achieve stated Performance Specifications)

Range Limits and Spans

A variety of standard and alternative thermal systems is available for the range limits and spans shown in Table 1.

Table 1. Range Limits and Spans

Filled Thermal System Class	Range Limits		Spans Available Between	
	°C	°F	°C	°F
IA	−130 and +315	−200 and +600	25 and 330	40 and 600
IIA and IIB	−45 and +315	−50 and +600	40 and 215	70 and 400
IIB	−195 and +760	−320 and +1400	70 and 550	120 and 1000

Materials of Construction

Standard Systems

Sensors

AISI Type 316 stainless steel (316 ss).

Connecting Tubing

Flexible AISI Type 302 stainless steel (302 ss) over 316 ss capillary.

Alternative Systems

Sensors

Inconel or silver-coated copper alloy.

Connecting Tubing

Flexible bronze over copper capillary, nominal 3 mm (0.13 in) OD 316 ss, vinyl covered flexible bronze over copper capillary, or vinyl covered nominal 3 mm (0.13 in) OD 316 ss.

NOTE:

Refer to PSS 3-3A1 A for further details regarding filled thermal systems.

PHYSICAL SPECIFICATIONS

Enclosure

The case and door are glass-fiber reinforced polyester moldings, compounded for superior corrosion resistance. The door has a shatterproof glass window. The overall construction meets IEC IP53 and provides the environmental protection of NEMA Type 3.

Approximate Mass (Excluding Element)

Recorders and Indicators

11 kg (24 lb)

Controllers

13 kg (28 lb)

Flammability Rating

The case and door meet Type V-O of UL94: (Underwriters Laboratory Incorporated Standard for Test Flammability of Plastic Materials, UL94),

Finish

Case is gray polyester and door is blue textured (either epoxy powder coating or baked vinyl).

Data Label

Aluminum data label fastened to chart plate with pressure sensitive adhesive. Includes space for customer tag data up to a maximum of 110 characters and spaces. For additional space, see optional Customer Tag.

OPTIONAL FEATURES

Inlet Purge Restrictor

Connection tapped for 1/4 NPT fittings (AS Reference IPR).

Nameplate

Laminated plastic nameplates 38 x76 mm (1.5 x 3 in) with white characters on a black background. Maximum of 5 lines with 28 characters or spaces 3 mm (0.13 in) high or 24 characters or spaces 4 mm (0.16 in) high per line (AS Reference N/P).

Customer Tag

Stainless steel tag wired to instrument for customer tag data that does not fit on data plate. There can be a maximum of 10 lines of data with 40 characters and spaces per line. Specify AS Code MTS.

Flush Door Lock

With 2 keys (AS Reference FDL).

Internal Illumination

An incandescent lamp is available for operation from a nominal 120 or 240 V ac power source, as specified (AS Reference II-I).

Pipe Mounting

A kit of parts is available for mounting the instrument on a DN 50 or 2 in vertical pipe.

Type 70 Electric Contacts

A variety of contact systems is available to provide a wide range of switching functions to actuate external control or alarm circuits. Refer to Technical Information (TI) 33-10a.

Fiber Tip Pen

For Dual, Duplex, and Auto-Selector Controllers only. (Note that this pen is a standard selection using Model Code for a Recorder or Single Action Recording Controller.) Standard box-type pen can be replaced with fiber-tip pen with disposable ink cartridge. Minimum of 365 m (1200 ft) ink line at a nominal 25 mm/s (1 in/s) chart speed. Specify Auxiliary Specification Code (AS Code) PN-FT.

Recorder Chart Drives

Pneumatic, Single Speed

One revolution in 24 hours.

Pneumatic, Two Speed

One revolution in 24 hours or 7 days.

Electrical, Single Speed

One revolution in 1, 2, 4, 6, 7.5, 12, 15, 24, or 30 minutes; 1, 2, 3, 4, 6, 8, or 12 hours; or 2, 3, 4, 7, or 31 days.

Electrical, Two Speed

Any combination of two of the following speeds:
One revolution in 30 seconds; 1, 5, 6, 12, 24 or 30 minutes; 1, 4, 8, 12, or 24 hours; 2, 3, or 7 days.

Mechanical, Single Speed

One revolution in 8 or 12 hours with 24-hour movement; 24 or 48 hours with 7-day movement; 8 days with 8-day movement; 7 days with a 7-day movement; or 31 days with a 31-day movement.

Mechanical, Two Speed

One revolution in 7 days/24hours with 7-day movement; or 8 days/24hours with 8-day movement.

Controllers Only

Transfer Switch and Supply Regulator Arrangements

Four basic arrangements are available; Internal supply regulator only; two-position nozzle seal switch only; internal supply regulator with two-position nozzle seal switch; and internal subpanel with an output regulator and a balance indicator and two-position A/M switch (right or left).

External Manual Set Knob

A knob which engages with the set point adjustment mechanism is fitted on the door (AS Reference OCS).

External Connection To Integral (Reset) Bellows

Used when an external feedback signal must be applied to prevent integral circuit saturation (AS Reference FSM).

"Batch" Function Attachment

For processes involving discontinuous control, the integral function is modified to prevent overshoot and to initiate immediate corrective action when control is resumed.

Pneumaticset Attachment

Enables the set point to be positioned pneumatically. Available over the full span or part of the span.

Ratio Attachment

Provides manual means for setting the ratio between an uncontrolled variable (primary) and a controlled variable (secondary). The ratio is adjustable between 0.5:1 and 1.7:1 for square-root scales, or between 0.3:1 and 3:1 for uniform scales.

Relation Attachment

Maintains a fixed manually adjustment difference between an uncontrolled variable (primary) and a controlled variable (secondary). The relation is adjustable between 0 and $\pm 50\%$ of span (AS Reference RELATION).

MODEL CODE (RECORDERS AND INDICATORS)

<u>Description</u>	<u>Model</u>
Recorders and Indicators - Rectangular Polyester Case	40P
<u>Function</u>	
Circular Chart Recorder	R
Sector Scale Indicator	N
Concentric Scale Indicator	K
<u>Internal Mechanism</u>	
Standard Recorder (40PR)	-R
Standard Sector Scale Indicator (40PN)	-N
Standard Concentric Scale Indicator (40PK)	-K
Recorder or Indicator with Type 70 Contacts	-E
<u>Mounting</u>	
Flush	F
Pipe	P
Surface	S
<u>Scale or Chart Drive</u>	
Mechanical Chart Drive, 24-hour rotation and wind (40PR) (a)	M
Electrical Chart Drive, 24-hour rotation, 120 V ac, 60 Hz (40PR) (b)	E
Sector Scale (40PN)	N
Concentric Scale (40PK)	K
No chart drive	X
<u>Pens or Pointers</u>	
One pen (40PR) or one pointer (40PN or 40PK)	1
Two pens (40PR) or two pointers (40PN only)	2
Three pens (40PR)	3
Four pens (40PR)	4
<u>Pen Type or Scale Type</u>	
Box-Type Pen (40PR)	B
Fiber Tip Disposable Pen (40PR)	F
Single Range Scale (40PN or 40PK)	S
Double Range Scale (40PN)	D
<u>Measuring Element</u>	
Temperature, Filled Thermal System	/TA-1A, 2A, 2B, 3B

a. For optional rotations and winds, specify M and refer to "OPTIONAL FEATURES" section.

b. For optional rotations, voltages, and frequencies, specify E and refer to "OPTIONAL FEATURES" section.

MODEL CODE (SINGLE ACTION CONTROLLER)

<u>Description</u>	<u>Model</u>
Single Action Controller - Rectangular Polyester Case	40P
<u>Function</u>	
Recording	R
Indicating with Sector Scale	N
<u>Action</u>	
Single (Control unit actuated by the first listed element)	–A
<u>Control</u>	
On-Off	1
Full Proportional	2
Full Proportional plus Derivative	3
Full Proportional plus Integral (Reset)	4
Full proportional plus Integral plus Derivative	5
Narrow Band Proportional	6
<u>Internal Relays</u>	
W/o internal regulator, w/o transfer switch (A1 only)	J
Two-position nozzle seal switch (A2, A3, A4, A5, and A6)	L
Balanceable automatic/manual unit – right (A2, A3, A4, A5, and A6)	N
Balanceable automatic/manual unit – left (A2, A3, A4, A5, and A6)	P
<u>Output Signal and Gauge</u>	
3 to 15 psi signal, 22 psi gauge	2
0.2 to 1.0 kg/cm ² signal, 1.5 kg/cm ² gauge	4
20 to 100 kPa signal, 150 kPa gauge	5
0.2 to 1.0 bar signal, 1.5 bar gauge	6
<u>Mounting</u>	
Flush	–F
Pipe	–P
Surface	–S
<u>Chart Drive or Scale</u>	
Mechanical Chart Drive, 24-hour rotation and wind (40PR) (a)	M
Electrical Chart Drive, 24-hour rotation, 120 V ac, 60 Hz (40PR) (b)	E
Sector Scale (40PN)	N
No chart drive	X
<u>Pens or Pointers</u>	
One pen (40PR) or one pointer (40PN)	1
Two pens (40PR) or two pointers (40PN)	2
Three pens (40PR only)	3
<u>Pen Type or Scale Type</u>	
Box-Type Pen (40PR)	B
Fiber-Tip Disposable Pen (40PR)	F
Single Range Scale (40PN)	S
Double Range Scale (40PN)	D
<u>Measuring Element</u>	
Temperature, Filled Thermal System	/TA-1A, 2A, 2B, 3B

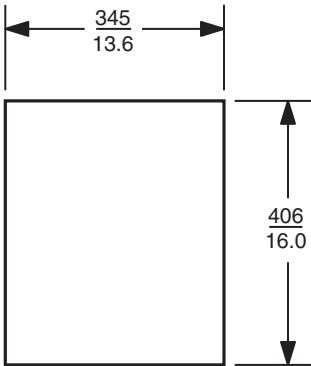
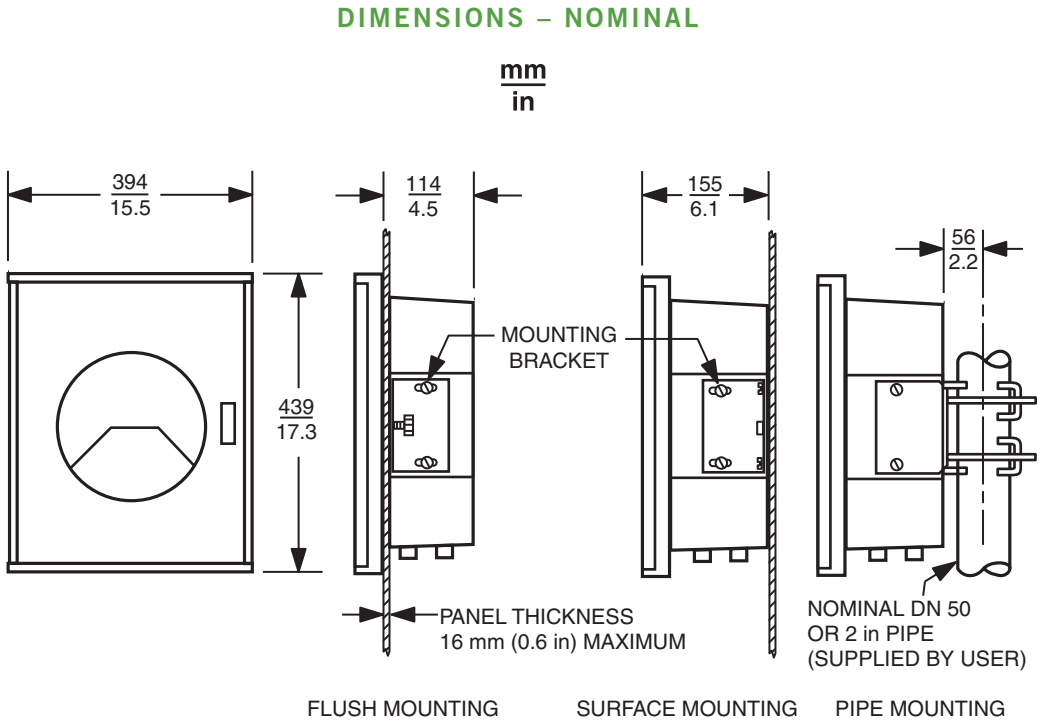
a. For optional rotations and winds, specify M and refer to “OPTIONAL FEATURES” section.

b. For optional rotations, voltages, and frequencies, specify E and refer to “OPTIONAL FEATURES” section.

MODEL CODE (DUPLEX, DUAL AND AUTO-SELECTOR CONTROLLER

Description	Model
Duplex, Dual, and Auto-Selector Controller - Rectangular Polyester Case	40P
Function	
Recording (a)	R
Indicating with Sector Scale	N
Action	
Duplex (one element actuates one measurement pen or pointer and two control units)	-B
Dual (two elements each actuate one pen or pointer and one control unit)	-C
Auto-Selector	-H
First Control (Right Hand)	
On-Off	1
Full Proportional	2
Full Proportional plus Derivative (-C, -H only)	3
Full Proportional plus Integral (Reset) (-C, -H only)	4
Full Proportional plus Integral plus Derivative (-C, -H only)	5
Narrow Band Proportional	6
Second Control (Left Hand)	
On-Off	1
Full Proportional	2
Full Proportional plus Derivative (-C, -H only)	3
Full Proportional plus Integral (-C, -H only)	4
Full Proportional plus Integral plus Derivative (-C, -H only)	5
Narrow Band Proportional	6
Internal Relays (First Control - Right Hand)	
W/o internal regulator, w/o transfer switch (1 only)	J
Two-position nozzle seal switch (-B2, -B6, -C2 to -C6, -H2 to -H6, only)	L
Balanceable automatic/manual unit (-B2, -B6, -C2 to -C6, -H2 to -H6, only)	N
Internal Relays (Second Control - Left Hand)	
W/o internal regulator, w/o transfer switch (-B, -C) (1 only)	J
Two-position nozzle seal switch (-B2, -B6, -C2 to -C6, only)	L
Balanceable automatic/manual unit (-B2, -B6, -C2 to -C6, only)	N
Auto-Selector (-H only)	T
Mounting	
Flush	-F
Pipe	-P
Surface	-S
Chart Drive or Scale	
Mechanical Chart Drive, 24-hour rotation and wind (40PR) (b)	M
Electrical Chart Drive, 24-hour rotation, 120 V ac, 60 Hz (40PR) (c)	E
Single Scale (40PN)	S
Double Scale (40PN)	D
No chart drive	X
Measuring Element	
Temperature, Filled Thermal System	/TA-1A, 2A, 2B, 3B

- Box-type pen is standard. For optionally available fiber tip pen, specify AS Reference PN-FT. See "OPTIONAL FEATURES" section.
- For optional rotations and winds, specify M and refer to "OPTIONAL FEATURES" section.
- For optional rotations, voltages, and frequencies, specify E and refer to "OPTIONAL FEATURES" section.



NOTE:
FOR HORIZONTAL MULTIPLE PANEL MOUNTING,
A MINIMUM DISTANCE OF 445 mm (17.5 in) FROM
CENTER LINE TO CENTER LINE IS REQUIRED.

NOTES

ORDERING INSTRUCTIONS

1. Model Number
2. Thermal System: Class, Bulb Type, Material, Dimensions, Tubing Length, and Bushing
3. Measurement Range
4. Chart or Scale Range
5. For Controller: Controller Action
6. For Controller: Supply Pressure and Output Signal
7. Ambient Temperature at Instrument Case and Along Tubing
8. Sensor Distance Above or Below Instrument Case (For Class II Systems only)
9. Optional Features
10. Tag and Application

OTHER FOXBORO PRODUCTS

The Foxboro product lines offer a broad range of measurement and instrument products, including solutions for pressure, flow, analytical, temperature, positioning, controlling, and recording.

For a list of these offerings, visit our web site at:

www.fielddevices.foxboro.com