

**740R Series**  
**Digital, Circular Chart Recorders**



The 740R Series of Microprocessor-Based Recorders provide continuous trending for up to four inputs on a 12-inch round chart. The recorder features an integral 40-character digital display that sequentially indicates the instantaneous value of each input. At the operator's discretion, the unit may be configured to display selected functions and inputs, or continuously display one function or input. A variety of isolated analog and discrete input types are accepted. A multi-function, internally mounted keypad is provided for configuration and operational control of the recorder. Options are also offered to enhance recorder capability.

**FEATURES**

- ▶ Display accuracy of 0.1% of input span, and recording accuracy of 0.25% of input span
- ▶ Accepts a wide range of input signals including Thermocouple (TC), Resistance Temperature Detector (RTD), mA dc, mV dc or V dc.
- ▶ Digital calibration of input signal conditioning and pen positioning.
- ▶ Up to four pens for trending; any trend pen may also be used for event oriented applications.
- ▶ Assignable absolute, rate of change, or deadpanned alarms; four alarms/channel - up to six channels.
- ▶ Brilliant, 2-Line (20 characters per line), 5 x 7, dot matrix electronic display with a neutral density filter.
- ▶ Internally mounted keypad; menu-driven prompts; configuration parameters are password protected; external programming device not required.
- ▶ Security time-coded chart provides evidence that chart position has (or has not) been changed from the installed position.
- ▶ Configuration and calibration information stored in nonvolatile, nonbattery-backed memory.
- ▶ Selectable power mains operation for worldwide voltages and frequency.
- ▶ Logic equation actuated events to control various recorder functions.
- ▶ Other options, including calculated variables; ramp generator; isolated field power for up to

four remote-mounted 2-wire transmitters; polycarbonate user interface and chart windows; up to four totalizers with remote totalizer outputs; 2, 4, 6, or 8 relay outputs; 1, 2, 3, or 4 to 20 mA retransmission outputs; 8 or 16 contact inputs.

## GENERAL DESCRIPTION

This 4-pen circular chart digital recorder (Figure 1) consists of a swing-out platen that supports the writing mechanism, display, and keypad. The platen is hinged to the enclosure, and provides easy access to the recorder electronics by simply swinging out the platen. A molded polyester door with glass, or optional plastic window.

The recorder uses a nominal 12-inch diameter chart paper, fiber-tip pens, a digital display consisting of two lines of dot-matrix characters, and a keypad for data entry and operation. All keypad access can be switch enabled or disabled. Essential configuration parameters are passcode protected.

## OPERATOR CONTROLS

The recorder can be configured from the front panel using six keys located below the digital display. The keypad is a tactile membrane type with a plastic switch panel. See Figure 1 and Table 1.

Table 1. Keypad Description

Nomenclature on Key	Usage of Multi-Functional Keys
	<ul style="list-style-type: none"> <li>▶ Clears Operator Entry, Moves Up and Out of Alternate Modes.</li> <li>▶ Restarts Display cycle in Run Mode.</li> </ul>
	<ul style="list-style-type: none"> <li>▶ Stops display Cycle in Run Mode.</li> <li>▶ Enters Value or Selection.</li> </ul>
	<ul style="list-style-type: none"> <li>▶ Enters Operator Mode.</li> <li>▶ Moves Cursor to the Next Digit Position.</li> </ul>
	<ul style="list-style-type: none"> <li>▶ Enters Configuration Mode.</li> <li>▶ Advances to Next Menu Display.</li> </ul>

Table 1. Keypad Description (Continued)

Nomenclature on Key	Usage of Multi-Functional Keys
	<ul style="list-style-type: none"> <li>▶ Increments Digit and Changes the Choices in Menu.</li> </ul>
	<ul style="list-style-type: none"> <li>▶ Decrements Digit and Changes the Choices in Menu.</li> </ul>

## DIGITAL DISPLAY SYSTEM

An alphanumeric display provides a sequential or channel-selected digital indication of the channel readings, and provides the operator interface for configuration of the recorder. See Figure 1.

### ALARM INDICATION

Each Alarm has its own character position within a channel display. The universal bell symbol is provided to indicate an alarm condition on any display.

### DISPLAY TYPE

Blue-Green, Vacuum-Fluorescent Display.

### DISPLAY FORMAT

Two lines of 20 characters, each character defined using a 5 x 7 dot matrix.

## CHART DRIVE SYSTEM

### ELECTRONIC SPEED SELECTION

Configurable; incremental speeds from 1 to 4096 hours per revolution.

### CHART DRIVE

Synchronous ac stepper motor with fixed reduction gear box.

### CHART SIZE

Nominal 12-inch Round Chart

### CHART INSTALLATION

Two holes automatically punched in chart when installed. Guarantees reinstallation of same chart in identical position.

#### CHART SCALE

Per Foxboro Chart Catalog 600.

*Rate of change*

Engineering units of configured range per unit time configured.

#### WRITING SYSTEM

##### NUMBER OF PENS

1, 2, 3, or 4 Pens

##### ALARM RELAYS

2, 4, 6, or 8 dry contact outputs are optionally available; rated at 30 W dc or 60 VA ac maximum, or 260 V ac maximum.

##### TYPE OF RECORDING

Continuous Line

##### HYSTERESIS

##### PEN TYPE

Disposable Fiber-Tip Pen

Adjustable

##### TIME LINE PEN

Red pen represents time line

##### PEN DRIVE

Stepper motor via anti-backlash linkage and reduction gear box with integral, resistive type feedback.

##### MINIMUM RESPONSE TIME

5 seconds, typical; for a 10 to 90% step.

#### ALARMS

The recorder provides programmable alarms and event processing. Input channels (1 to 4) plus the calculated channels (5 and 6) each have four programmable alarm set points available. Alarms are self-clearing (nonlatchable). Alarm specifications are as follows:

##### ALARM TYPES

High, low, deadband, rate of change (rising or falling).

##### NUMBER OF ALARM SET POINTS

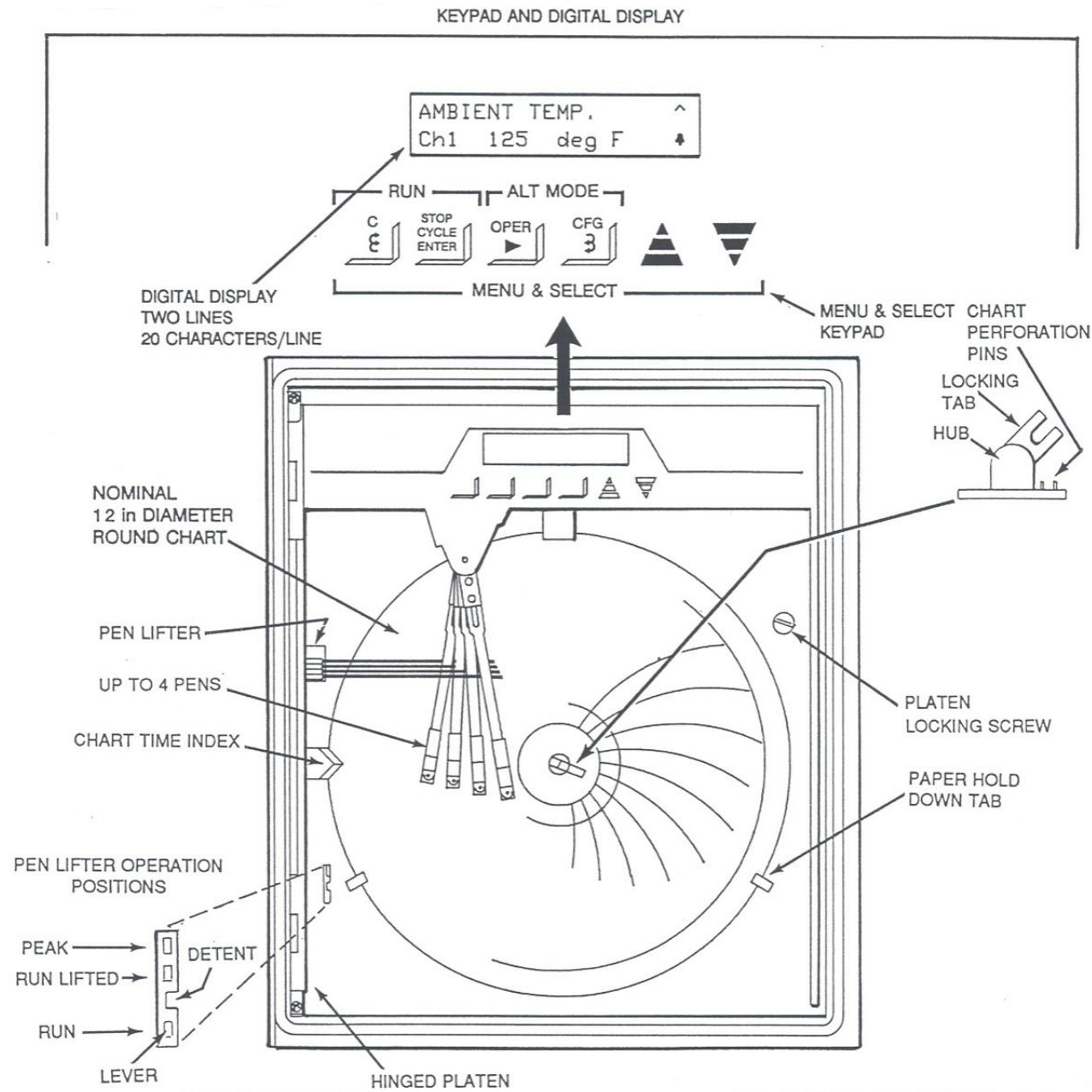
Twenty-four alarm set points (four per input channel, four per calculated variables channel).

##### ALARM SET POINT RANGE

*Absolute and Deviation*

Engineering units per configured range.

Figure 1. Recorder with Front Door Removed



### OPERATING AND STORAGE CONDITIONS

Influence	Reference Operating Conditions	Normal Operating Condition Limits	Operative Limits	Storage and Transportation Limits
Ambient Temperature	25 $\pm 1^{\circ}\text{C}$ (77 $\pm 2^{\circ}\text{F}$ )	0 and 50°C (32 and 122°F)	0 and +50°C (32 and +122°F)	-20 and +75°C (-4 and +167°F)
Relative Humidity	50 $\pm 10\%$	5 and 95% (noncondensing)	5 and 95%	0 and 95%
Supply Voltage	120 V ac 220/240 $\pm 2$ V ac	90 and 132 V ac 180 and 264 V ac	90 and 132 V ac 180 and 264 V ac	Not Applicable
Supply Frequency	50 $\pm 2.0$ Hz 60 $\pm 2.0$ Hz	48 and 62 Hz	48 and 62 Hz	Not Applicable
Vibration and Shock	Negligible	Vibration from 20 to 200 Hz at an acceleration of 5 m/s <sup>2</sup> (0.5 "g") can cause a $\pm 4\%$ pen shift; no effect on display readings		With the instrument in its packing container, the instrument will not sustain damage when subject to: Vibration of 5 Hz at 10 m/s <sup>2</sup> (1 "g") for one hour Ten 76 mm (30 in) drops

### PERFORMANCE SPECIFICATIONS

(At Reference Operating Conditions unless otherwise specified)

**Accuracy - Display**

$\pm 0.1\%$  of Input Span

170  $\mu\text{V}$  on 1.7 V Span

500  $\mu\text{V}$  on 5.0 V Span

**Accuracy - Recording**

$\pm 0.25\%$  of Input Span

**Supply Voltage Effect**

Less than 0.025% of span within  $\pm 10\%$  of Reference Operating Supply Voltage.

**Accuracy - Retransmission Output**

$\pm 0.1\%$  of Span

**Supply Frequency Effect**

Less than 0.025% of span between 48 and 62 Hz.

**Repeatability - Display**

0.02% of Span

**Ambient Temperature Effect - Resistance Converter**

**Resolution - Display**

0.01% of Full Scale

**SPAN ERROR**

Less than 0.5% of span per 50°C (90°F) change in temperature.

**Input Resolution**

0.01% of Operating Span

**ZERO ERROR**

2  $\mu\text{V}$  on 20 mV Span

Less than 0.1% of span per 50°C (90°F) change in temperature.

6  $\mu\text{V}$  on 60 mV Span

8  $\mu\text{V}$  on 80 mV Span

20  $\mu\text{V}$  on 200 mV Span

40  $\mu\text{V}$  on 400 mV Span

**Ambient Temperature Effect - Thermocouple/mV Converter****SPAN ERROR**

Less than 0.5% of span per 50°C (90°F) change in temperature.

**ZERO ERROR**

Less than 0.1% of span per 50°C (90°F) change in temperature.

**REFERENCE JUNCTION ERROR**

$\pm 1^\circ\text{C}$  ( $\pm 1.8^\circ\text{F}$ ).

**REFERENCE JUNCTION TRACKING ERROR**

$\pm 1^\circ\text{C}$  between 0 and 50°C

( $\pm 1.8^\circ\text{F}$  between 32 and 122°F)

**FUNCTIONAL SPECIFICATIONS****Number of Inputs**

1, 2, 3, or 4

**Input Signal Types**

TC, RTD, mA dc, mV dc, or V dc

**Thermocouple (TC) Types**

ISA or ANSI Base Metal Types T, J, E, C, L, K, and N; and Platinum Metal Types R, S, and B.

**Resistance Temperature Detector (RTD) Types**

ANSI or IEC Calibration, 100 Ω Platinum RTD, 10 Ω Copper RTD, 120 Ω Nickel RTD

**Input Signal Ranges (See Table below)**

Input Signal Range	Comments
-4 to +20 mV -12 to +60 mV -16 to +80 mV -40 to +200 mV -80 to +400 mV -0.34 to +1.7 V -0.50 to +2.5 V -1.0 to +5.0 V	Field Configurable; includes TC and RTD Input Signals
Greater than 0 to 5.0 V dc through 0 to 100 V dc	Field Configurable; requires external resistor divides 100:1, 1 MΩ
4 to 20 mA dc, or other mA dc	Field Configurable; uses 250 Ω precision shunt resistor

**Standard Linearizations Provided**

Square root, Power 3/2 and 5/2, and Log 10.

**Resistance Converter Lead Wire**

10Ω maximum per lead

## FUNCTIONAL SPECIFICATIONS

**Power Supply****LINE VOLTAGES**

Operator selectable switch 120V or 240V (both - 25% +10%).

**LINE FREQUENCY**

48 to 62 Hz

**POWER RATING**

30 W, maximum

**MEMORY BACKUP**

0.1 Farad storage capacity provides three day backup of active values, such as Totalizer readings.

**Thermocouple Burnout Detection****TC BURNOUT DETECTION RESPONSE TIME**

10 s

**LEAD WIRE ZERO ERROR DUE TO TC BURNOUT DETECTION CIRCUIT**

±550 mA burnout current

**RTD Excitation Current**

0.5 mA ±20%

**Channel Isolation**

All channels electrically isolated to 250 V from each other, line, and earth (ground).

**Input Impedance (For Voltage Inputs Only)****FOR 5 V dc OR LESS**

20 MΩ, minimum

**FOR GREATER THAN 5 V dc**

1 MΩ divider

**Cold Junction Compensation**

±1°C from 0 to 50°C

±1.8°F from 32 to 122°F

**Common Mode Rejection**

140 dB minimum at 50 or 60 Hz

**Normal Mode Rejection**

50 dB minimum at 50 or 60 Hz

**Sample Rate**

Two samples per second on each channel

**ac Power Interruptions**

33.3 ms, minimum

**Radio Frequency Interference (RFI) Susceptibility**

10 V/m, from 20 to 1000 MHz. Maximum shift of -3% provided signal and power leads are brought in by separate metal conduit.

**Electrostatic Discharge Withstand (per IEC 801-2)**

8 kV minimum at operator accessible surfaces

**High Frequency Transients (per IEC 801-4)**

4 kV to mains for survival;

1 kV to mains for no effect (Level II)

500 V to signal for no effect (Level I)

**Lightning Transients (per ANSI/IEEE C.62.41-1980)**

2 kV to mains

**Surge Withstand Capability (per ANSI/IEEE 37.90A-1978)**

2.5 kV to mains

**mV or TC Converter Input Resistance****WITHOUT BURNOUT**

Greater than 20 MΩ

**WITH BURNOUT ACTIVE**

20 MΩ

## PHYSICAL SPECIFICATIONS

### Enclosure (Case and Door)

Polyester sheet molding compound, ultraviolet stabilized.

### PLATEN

Polyphenylene oxide resin (Noryl FN-215)

### DOOR WINDOW

Standard window is shatterproof glass. See "Optional Features" section for ultraviolet, stabilized, polycarbonate window.

### Flammability Rating

The enclosure meets Type V-0 of UL 94.  
(Underwriter Laboratory Incorporated Standard for Test Flammability of Plastic Materials, UL 94.)

### Dimensions

See "Dimensions–Nominal" section.

### Approximate Mass

8.2 kg (18 lb)

### Mounting

A kit of parts is provided for mounting the recorder on a surface, or flush in a panel up to 16 mm (0.6 in) thick.

### Electrical Connections

Two nominal 22 mm (0.875 in) diameter holes are provided in the bottom surface of the enclosure for a nominal 20 mm (CEE 23), P616, or 1/2 in conduit fitting, one each for power and measurement. Six additional 22 mm (0.875 in) diameter holes are available as "knockouts".

### Physical Orientation

Recorder designed for operation while in the vertical position, but it may also be operated in the horizontal, face up position (or any intermediate angle between the vertical and face-up position).

## OPTIONS AND ACCESSORIES

### 28 V dc Transmitter Power Supply

This nominal 28 V dc, 22 mA power supply option provides isolated field power outputs for up to four remote-mounted, 2-wire transmitters. Select Model Code Optional Suffix -A.

### Relay Output

Two, four, six, or eight dry contact relay outputs can be provided, rated at 30 W dc or 60 VA ac maximum, 260 V ac maximum. Must be selected when Remote Totalizer Output option is selected. Select Model Code Optional Suffix -R or -T for four or eight relay outputs, respectively.

### Contact Inputs

This option provides a selection of either 8 or 16 contact inputs. These contact inputs are used to remotely switch auto/manual and remote/local set point, to reset and hold programmed set points, and

to reset totalizers. Select Model Code Optional Suffix -U or -V for 8 or 16 contact inputs, respectively.

### Calculated Variables and Custom Curve

This software option provides two additional channels (5 and 6), and allows the user to select a computational function from a fixed set of equations. The user can configure up to nine calculated variable functions. The functions are split into two basic categories: simple mathematics functions and specialized processing functions, as shown in the table below. Select Model Code Optional Selection -B.

## OPTIONS AND ACCESSORIES

- |   |   |
|---|---|
| <p><b>Simple Mathematic Functions Provided</b></p> <ul style="list-style-type: none"> <li>▶ Addition, Subtraction, Multiplication, Division</li> <li>▶ Linear Scaling, Polynomial Scaling, Log 10, and Power of 10</li> <li>▶ High Select, Low Select</li> <li>▶ High Peak, Low Peak</li> <li>▶ Single Point Average</li> </ul> | <p><b>Specialized Processing Functions Provided</b></p> <ul style="list-style-type: none"> <li>▶ Pressure and Temperature Compensated Flow Equations</li> <li>▶ Relative Humidity, from Wet and Dry Temperature Readings</li> <li>▶ Sterilization Constant (<math>F_0</math>)</li> <li>▶ Zirconia Oxide Oxygen Probe</li> </ul> |
|---|---|

**Integral Totalizer**

This option provides up to four totalizers (one per channel). Each can be configured to totalize a measurement channel or a calculated variable channel. The Totalizer is not alarmable. The Totalizer may be the inventory type (nonresettable), or the resettable type.

Each totalized value may be read on the alphanumeric display, one at a time. The totalized value is displayed as a 9-digit integer value. A scaled internal trigger is available to activate a counter (relay) output.

The Totalizer can be configured to operate in one of the following modes: Continuous, Preset Up, or Preset Down.

Each Totalizer requires entry of the following parameters:

- ▶ Source Channel and Type (or Mode)
- ▶ High Cutoff in Engineering Units
- ▶ Low Cutoff in Engineering Units
- ▶ Totalization Factor
- ▶ Preset Value
- ▶ Reset Logic Equation
- ▶ Hold Logic Equation
- ▶ Counter Output Enable

This option must be selected if Remote Totalizer Output option is selected. Select Model Code Optional Suffix -C, -D, -E, or -F, for one, two, three, or four totalizers, respectively.

**Remote Totalizer Output**

A totalizer and at least one relay output must be selected for each Remote Totalizer Output selected. Select Model Code Optional Suffix -1, -2, -3, or -4 for one, two, three, or four outputs, respectively.

**Polycarbonate Chart and User Interface Windows**

The standard glass chart and user interface windows on the front door are replaced with ultraviolet stabilized, polycarbonate (Lexan) windows. Select Model Code Optional Suffix M.

**Ramp Generator**

The option generates a pre-programmed profile. The pre-programmed profile is called a Recipe. The user selects all the variables using time versus values to create the recipe. The 740 may have up to 4 recipes per instrument. Each recipe may have up to 20 segments. Up to 8 event outputs may be programmed per recipe. Contact inputs may be used to initiate a ramp profile. Select Model Code Optional Suffix -G.

**Retransmission Outputs**

The retransmission output option allows the user to scale and retransmit any one of the following values as an analog 4 to 20 mA output:

- ▶ Channel Engineering Unit Values
- ▶ Calculated Variable Engineering Unit Values

The retransmitted outputs are fully isolated from inputs and from the serial communications link. Specify Model Code Optional Suffix -6 or -8 for two or four 4 to 20 mA outputs, respectively.

**Replacement Fiber Tip Pens**

These replacement pens are provided in a package of two in a sealed, foil pack. Specify the part number listed in the table below.

Description	Part No.
Red, Number One Pen, Inner Position	L0122AR
Violet, Number Two Pen, Second Position	L0122BP
Green, Number Three Pen, Third Position	L0122CG
Blue, Number Four Pen, Outer Position	L0122DB

## MODEL CODE

Description	Model
Digital, Circular Chart Recorder	740RA
<b>Nominal Supply Voltage and Frequency</b>	
120 V ac, 50/60 Hz	-A
240 V ac, 50/60 Hz	-C
<b>Input Channel 1 (a)</b>	
0 to 20 mV dc through 0 to 5 V dc, with Pens, RTD and TC (b)	1
4 to 20 mA dc, with Pens (a)	3
<b>Input Channel 2 Selection (a)</b>	
None	0
0 to 20 mV dc through 0 to 5 V dc, with Pens, RTD and TC (b)	1
4 to 20 mA dc, with Pens(a)	3
<b>Input Channel 3 Selection (a)</b>	
None	0
0 to 20 mV dc through 0 to 5 V dc, with Pens, RTD and TC (b)	1
4 to 20 mA dc, with Pens(a)	3
<b>Input Channel 4 Selection (a)</b>	
None	0
0 to 20 mV dc through 0 to 5 V dc, with Pens, RTD and TC (b)	1
4 to 20 mA dc, with Pens (a)	3
<b>Optional Selections</b>	
28 V dc Transmitter Power Supply	-A
Calculated Variables and Custom Curve	-B
<b>Select one option below only:</b>	
One Integral Totalizer (One input Channel)	-C
Two Integral Totalizer (Two Input Channels)	-D
Three Integral Totalizers (Three Input Channels)	-E
Four Integral Totalizers (Four Input Channels)	-F
Dual Ramp Generators	-G
<b>Select one option below only:</b>	
Polycarbonate Door Windows	-M
<b>Select one option below only:</b> (c)	
Four Relay Output	-R
<b>Select one option below only:</b> (c)	
Eight Contact Inputs	-U
Sixteen Contact Inputs	-V
<b>Select one option below only:</b>	
One Remote Totalizer Output (d) (e)	-1
Two Remote Totalizer Outputs (d) (e)	-2
Three Remote Totalizer Outputs (d) (f)	-3
Four Remote Totalizer Outputs (d) (f)	-4
<b>Select one option below only:</b> (c)	
Two 4 to 20 mA Retransmission Outputs	-6
Four 4 to 20 mA Retransmission Outputs	-8

**Examples:** 740RA-A1110; 740RA-C1113-BK; 740RA-A1100-LDR2

- Input channels must be specified sequentially. Specify Input Code 0 if previous channel selection is Code 0.
- Operating ranges are field configurable.

- c. The availability of Relay Output, Contact Input, and Retransmission Output Options is space dependent and therefore contingent upon previously selected functions. The instrument accommodates a maximum of three function PWAs with each PWA loaded as shown in Table 2.
- d. A totalizer must be selected for each totalizer output selected.
- e. Includes two relay outputs; maximum eight relay outputs.
- f. Includes four relay outputs; maximum eight relay outputs.

Table 2. PWA Functions and Capacity

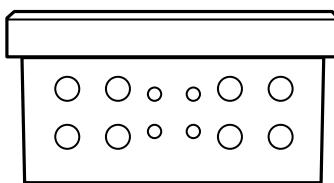
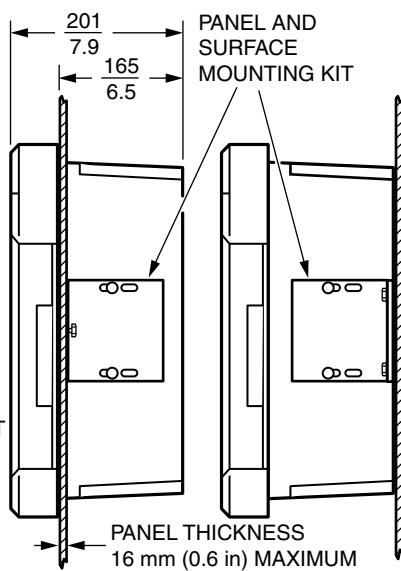
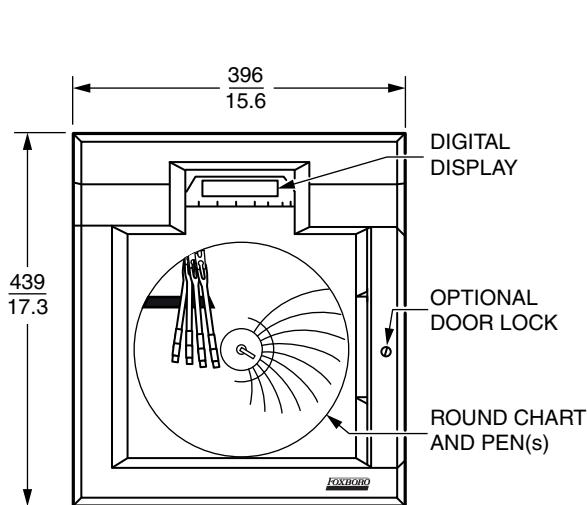
Number of PWAs Required	Selected Function
1	One or two 4 to 20 mA Retransmission Outputs
1	Two or Four Relay Outputs
1	Eight Contact Inputs plus One or Two 4 to 20 mA Retransmission Outputs
1	Eight Contact Inputs

## ELECTRICAL SAFETY SPECIFICATIONS

Testing Laboratory, Type of Protection, and Area Classification	Electrical Certification Specification
cUL certified for use in General Purpose, Ordinary Locations	CS-E/cUL1

## DIMENSIONS – NOMINAL

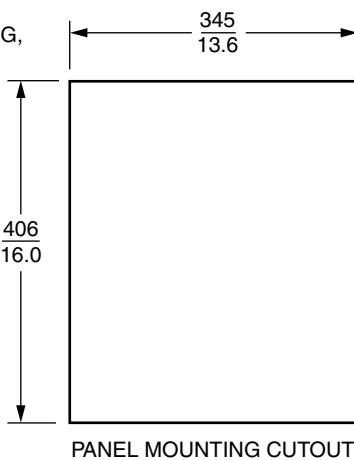
**mm**  
in



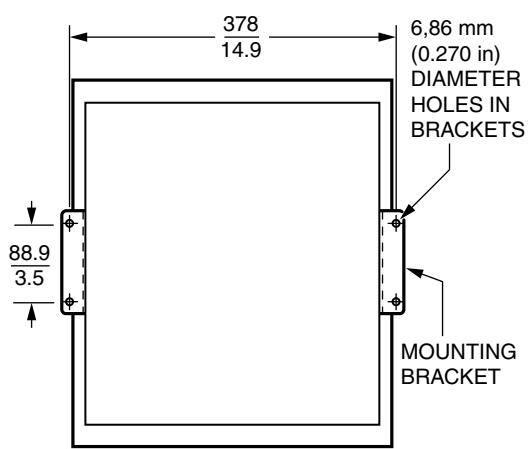
2 HOLES, 22 mm (0.875 in)  
DIAMETER, SPACED 58 mm (2.3 in)  
APART, FOR 20 mm (CEE 23),  
PG 16, OR 1/2 in CONDUIT FITTING,  
6 ADDITIONAL HOLES  
(KNOCKOUTS), 22 mm (0.875 in).  
AS REQUIRED.

PANEL  
MOUNTING  
(SEE BELOW  
FOR PANEL  
MOUNTING  
CUTOUT)

SURFACE  
MOUNTING  
(SEE BELOW  
FOR SURFACE  
MOUNTING  
DIMENSIONS)



PANEL MOUNTING CUTOUT



SURFACE MOUNTING DIMENSIONS

**NOTES**

**NOTES**



**NOTES**

## ORDERING INSTRUCTIONS

1. Model Number
2. Charts and Chart Range (see NOTE below)
3. Electrical Certification Specification
4. AS Code and Part Numbers from Options/Accessories section.
5. Customer Tag Data

### NOTE

Approximately 10 complimentary 24-hour charts with 0-100% graduations are supplied with the recorder. For additional charts, specify the charts and range required from Foxboro Chart and Dial Catalog 600.

## 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](http://www.fielddevices.foxboro.com)

**Foxboro®**

by Schneider Electric

Invensys Systems, Inc.  
38 Neponset Avenue  
Foxboro, MA 02035  
United States of America  
<http://www.invensys.com>

Global Customer Support  
Inside U.S.: 1-866-746-6477  
Outside U.S.: 1-508-549-2424  
Website: <http://support.ips.invensys.com>

Copyright 1993-2015 Invensys Systems, Inc.  
All rights reserved.

Invensys and Foxboro are trademarks of Invensys Limited, its subsidiaries, and affiliates. All other trademarks are the property of their respective owners.

Invensys is now part of Schneider Electric.