

731C Series

Digital Process Controllers 1/4 DIN Size

The 731C Series of Microprocessor-Based, 1/4 DIN Sized, Digital Process Controllers provide the standard PID control requirements of process controllers. The instrument receives inputs from thermocouples (TC's), resistance temperature detectors (RTD's), or 0 to 20 or 4 to 20 mA signals. The mA input is field selectable for TC's or RTD's. The controller features two independent outputs that are a selection mix of 4 to 20 mA, time proportional relay, or relay contact outputs. The front panel contains two lines of numeric digital displays. The top display depicts process measurement, while the second display may be used to display set point or output. The front panel also contains a horizontal bargraph for displaying the output. The lower surface of the front panel contains six tactile push buttons which allow the user to operate in the Run, Extended Run, or Configure Mode.

The controller is light weight and mounts in a panel cutout conforming to 1/4 DIN sized instruments. The front panel is sealed to meet the environmental protection of IEC IP65 enclosures. Numerous options are also offered to enhance the controller's capability.

FEATURES

- Conforms to the European Union Directives (Symbolized by the "CE" Marking)
- Accuracy better than $\pm 0.25\%$ of Span
- Small 1/4 DIN Size, 96 x 96 x 150 mm
- Light Weight, approximately 0.45 kg (1 lb)
- Two, Bright, Easily Read Measurement and Set Point Displays, and one Bargraph Display to Continuously Indicate Output Signal
- Integral 6-Tactile Push Button Keypad
- Ten Status Message and Mode LED Displays
- Universal Power Supply, 88 to 265 V ac, 50 or 60 Hz
- Pre-Tuning and Auto-Tuning
- Three Operational Modes: Run, Extended Run, and Configure



- Up/Down Scrolling
- TC, RTD, and mA dc Inputs
- Selectable I/O to Match Application
- IEC/IP65 Front Panel Prevents Ingress of Dust and Water
- Multi-Zone Password Security
- Up to two Alternate Local Set Points Triggerable via Contact Closure. Set Point Transition Rate may be Adjusted.
- Optional Features include RS-485 or RS-422 Serial Communications, Integral 30 V dc Transmitter Power Supply, Remote Set Point, Retransmission Output, and Relay Output for Alarm 1 or Alarm 2.

DIGITAL DISPLAY SYSTEM

The controller front panel (Figure 1) contains a measurement signal display, a set point display, a bargraph display, and a status and mode message display. Unless otherwise indicated, the displays do not contain units of measure. The entire display system is updated not less than 10 times per second.

Measurement Signal Display

This is a five character numeric display. Each character has seven segments and is 12 mm (0.47 in) high. The five characters includes the position for a plus or minus sign; eg., +9999.

Set Point Display

This display can have five alpha or numeric (depending on mode) characters. Each character has seven segments and is 9 mm (0.35 in) high. A decimal point is accommodated within the display without adding to the five character limit; eg., 9999.9.

Bargraph Display

This is a horizontal bargraph that gives a continuous approximation of the output signal level. Refer to Figure 1.

Status Message and Mode Indicators

These indicators consist of 8 status message and 2 mode LED indicators. An LED will “go on” to indicate a particular status message and mode. The individual LED's are identified as shown in Table 1.

KEYPAD

The keypad consists of a horizontal row of six push buttons. The push buttons are tactile and raised 3.2 mm (0.13 in) above the panel surface. Each push button actuates a switch when a force of approximately 0.23 kg (0.5 lb) is applied.

The keypad is used for mode selection, set up, and all operational running functions required by the controller. The keys are multifunctional and serve unique functions depending on the current operational mode of the controller – Run, Extended Run, or Configure. Refer to Table 2.

Table 1. Status Message and Mode Indicators

LED Display	Status Message or Mode
Up Arrow(a)	Time Proportion Output is On.
Down Arrow(a)	Not Applicable
MAN(a)	Controller is in Manual Mode.
REM(a)	The Set Point is from Remote.
AL1(a)	Alarm 1 is Active.
AL2(a)	Alarm 2 is Active.
TUNE(a)	Flashing: Pretune is ON On: Autotune is ON.
TALK(a)	The Controller is actively Communicating via Serial Communication Link.
SP(b)	The Display is Set Point.
OP(b)	The Display is Output.

(a)These eight status message indicators appear directly above the measurement signal display.

(b)These two mode indicators appear directly to the left of the set point display.

In the Run Mode, the controller is running per the functional and variable assignments made in the configuration set up. In this mode the upper display reads measurement value, and the lower display reads either set point or output.

In the Extended Run Mode, the operator has timed access to a subset of the total configuration and is able to change parameter values, alarm settings, etc.

In the Configure Mode, the user sets up the total configuration, thereby establishing which controller operational mode is present. Also, this mode is used to calibrate the controller. This Mode can only be entered by selection of a jumper within the controller, and the controller will remain in this mode until the jumper is repositioned.

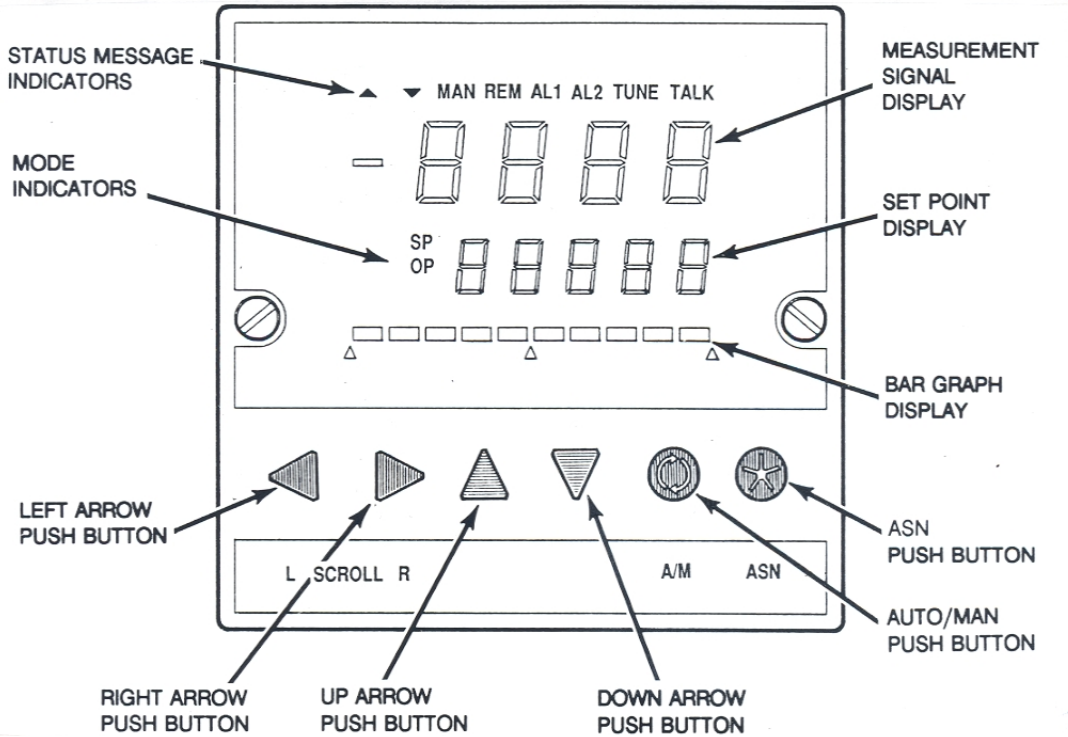






Figure 1. Controller Front Panel

Table 2. Keypad Description and Use

Key(s)	Usage of Multi-Functional Keys in the		
	Run Mode	Extended Run Mode	Configure Mode
Left/Right Arrows (L Scroll R) 	Provides selection of the “set point” or “output” display. Allows user to access Extended Run Mode by “pressing and holding” either key between 2 to 5 seconds.	Allows user to scroll through an expanded set of parameters, including password access (if set). If no key is pressed within 20 seconds, the controller will return to the Run Mode.	Each key is assigned a function, and will be used to access an expanded set of parameters used for setting up the basic controller functions, hardware configuration, and calibration of the controller.
Up/Down Arrows 	These keys are used to ramp set point or output (when the controller is in Manual) through their ranges. Initial pressing of the key will change the displayed value by one unit. Continued pressing the key will accelerate the value change through its range.	These keys (if enabled) will allow the user to change the values of the displayed parameters to within specified limits. If no key is pressed within 20 seconds, the controller will return to the Run Mode.	<p style="text-align: center;">NOTE</p> This Mode can only be entered by selection of a jumper within the controller.
 (A/M)	This key is used to switch the controller from Auto to Manual, or from Manual to Auto.	This key is inactive in the Extended Run Mode.	
 (ASN)	This assignable key is used to unlatch latched alarms, if permitted; or Remote/Local set point transfer.	This key is inactive in the Extended Run Mode.	

OPERATING AND STORAGE CONDITIONS

Influence	Reference Operating Conditions	Normal Operating Condition Limits	Operative Limits	Storage Limits
Ambient Temperature	23 ±2°C (73 ± 3.6°F)	0 and 50°C (32 and 122°F)	0 and 50°C (32 and 122°F)	-10 and +60°C (14 and 140°F)
Relative Humidity	50 ±15%	0 and 95%	0 and 95%	0 and 100% (noncondensing)
Supply Voltage	120, 220, and 240 V ac, ±1 V ac	88 to 265 V ac	88 to 265 V ac	Not Applicable
Supply Frequency	50 or 60 Hz, ±0.5%	Rated Frequency ±3 Hz	Rated Frequency ±3 Hz	Not Applicable
Output Load	0 to 600Ω ±0.5%	0 and 600Ω	0 and 600Ω	Not Applicable

PERFORMANCE SPECIFICATIONS

Under Reference Operating Conditions unless Otherwise Specified

Accuracy

Better than ±0.25% of Span

Linearity

0.05% of Span

Resolution

TC INPUT

1 in 50 000 (equivalent to 2.5 μV)

RTD INPUT

0.0045 O

mA INPUT

1 in 50 000 (equivalent to 2.5 μV)

FUNCTIONAL SPECIFICATIONS

Input Signal Types (Software Selectable)

Thermocouple, Resistance Temperature Detector
Milliamp, Millivolt, or Volt. Refer to Table 3.

Input Signal Ranges Limits

Refer to Table 3.

Electrical Certification

The controller is designed for use in general purpose
(ordinary) locations

Sample Rate

Four times per second

Output Signals

OUTPUT 1

Time proportioned or Alarm 1 Relay

OUTPUT 2

0 to 20 or 4 to 20 mA, or Alarm 1 Relay

NONE

Output 1 and/or Output 2 function as an indicator.

Relay Output (Form C)

Single pole, double throw (SPDT) for Alarm 1, as
specified. Optionally available for Alarm 2. Rated 2 A
at 250 V ac RMS, or 50 W dc.

Table 3. Input Type and Range Limits

Input Type(a)	Description	Range
Type T TC	Copper-Constantan Thermocouple	-270 to +400°C (-450 to +750°F)
Type T10 TC	Type T TC in 1/10°C or 1/10°F	-50.0 to +400.0°C (-58.0 to +400.0°F)
Type K10 TC	Type K TC in 1/10°C or 1/10°F	-50.0 to +500.0°C (-58.0 to +400.0°F)
Type L TC	Fe-CuNi Thermocouple	-200 to +900°C (-300 to +1650°F)
Type E TC	Chromel-Constantan Thermocouple	-270 to +1000°C (-450 to +1800°F)
Type J TC	Iron-Constantan Thermocouple	-210 to +1200°C (-340 to +2150°F)
Type N TC	Nicrosil-Nisil Thermocouple	-270 to +1300°C (-450 to +2350°F)
Type NM TC	Ni-Ni18Mo Thermocouple	0 to 1300°C (32 to 2350°F)
Type K TC	Chromel-Alumel Thermocouple	-270 to +1373°C (-450 to +2500°F)
Type R TC	Pt13Rh-Pt(b) Thermocouple	-50 to +1767°C (-58 to +3200°F)
Type S TC	Pt10Rh-Pt Thermocouple	-50 to +1767°C (-58 to +3200°F)
Type B TC	Pt30Rh-Pt6Rh Thermocouple	0 to 1820°C (32 to 3300°F)
Type W TC	W-W26Re Thermocouple	0 to 2300°C (32 to 4150°F)
Type W3 TC	W3Re-W26Re Thermocouple	0 to 2300°C (32 to 4150°F)
Type W5 TC	W5Re-W26Re Thermocouple	0 to 2300°C (32 to 4150°F)
Type RT RTD	PT100 Res. Temp. Det.	-150 to +200°C (-230 to +400°F)
Type RT10 RTD	Type RT RTD in 1/10°C or 1/10°F	-150.0 to +200.0°C (-230.0 to +400.0°F)
0 to 90mV	Linear	-9999 to +9999
0 to 90mV	Square Root	
0 to 20mA	Linear	
4 to 20mA		
0 to 10 V	Linear	

(a) Thermocouple types are ISA designation. These designations are also used by NBS, ANSI, ASTM, and IEC.

(b) Pt13Rh-Pt is read as Platinum 13% Rhodium vs. Platinum.

Power Consumption

Less than 15 VA

Calibration

Software calibration

Automatic Zero

Correction every second for thermal drift and RTD lead resistance

Cold Junction (TC)

Rejection better than 20 to 1 for a 1°C (1.8°F) change from "reference" ambient temperature.

RTD Lead Rejection

88 to 1

Noise Rejection

SERIES MODE

60 dB at 50/60 Hz

COMMON MODE

120 dB

Common Mode Voltage

265 V ac, RMS, maximum

Control Functions

PROPORTIONAL BAND

0.1 to 500% and On/Off

INTEGRAL TIME

Settable from 0 to 2000 seconds; setting integral time to zero disables the function.

DERIVATIVE TIME

Settable from 0 to 1000 seconds; setting the derivative time to zero disables the function.

TIME PROPORTIONING OUTPUT CYCLE TIME

2 to 500 seconds

OUTPUT ACTION

INC/DEC and INC/INC, action selectable.

AUTO/MANUAL

Bumpless transfer, if within proportional band and integral is not set to zero.

ALARM TYPES

Absolute hi or lo; Deviation hi, lo, or band; Latched or nonlatched alarm action; energize or de-energize by software.

SET POINTS

Two internal set points; local, remote, remote + local; Remote – high changed to local; Remote – low changed to local. Ramping feature may be enabled between set point values.

DIGITAL INPUTS

Two provided for selective use such as: Auto/Manual, Remote/Local, Unlatch Alarms, Inhibit Alarms, Keylock, Freeze Controller Output, and Switch to Alternate Set Point.

PHYSICAL SPECIFICATIONS

Enclosure

Extruded aluminum case and molded, flame retardant Noryl front panel, rear panel, and rear terminal cover.

Environmental Protection

The gasketed front panel protects the instrument from ingress of dust and water in conformance with the requirements of IEC IP65.

Approximate Mass

0.45 kg (1 lb)

Electrical Connections

All connections to the instrument are made at the rear terminal block. The terminal block is easily accessed by loosening one captive screw and removing the rear cover.

Mounting

The controller is a 1/4 DIN size instrument that mounts in a panel. See Dimensions–Nominal section for instrument size and panel cutout information.

MODEL CODE

Description	Model
Digital Process Controller, 1/4 DIN Size	731CA
Input Signal Type (See Table 3)	
Thermocouple, Type J; Field Selectable to other TC Types Listed in Table 3	-1
Platinum RTD, DIN 100 O; Field Selectable to other RTD Types Listed in Table 3	-2
4 to 20 mA dc; Field Selectable to other mA, mV, V Types Listed in Table 3	-3
Output Signal Type	
None (Functions as Indicator Only)	0
4 to 20 mA dc	1
4 to 20 mA dc <u>plus</u> One SPDT Relay for Alarm 1	2
Time Proportioned Relay Output	3
Time Proportioned Relay Output <u>plus</u> One SPDT Relay for Alarm 1	4
One SPDT Relay Output for Alarm 1	5
Two SPDT Relay Outputs for Alarm 1	6
Optional Selections	
30 V dc Transmitter Power Supply	-A
Remote Set Point(a)	-B
4 to 20 mA Retransmission Output(a)	-C
One SPDT Relay Output for Alarm 1 or 2(a)	-D
RS-485, 2-Wire Serial Communications(a)(b)	-E
RS-422, 4-Wire Serial Communications(a)(c)	-F
Examples: 731CA-12, 731CA-24-E, 731C-31-BC	

(a) This option automatically includes Option "-A" Power Supply.

(b) If the RS-485 Option is selected, do not select the RS-422 option.

(c) If the RS-422 Option is selected, do not select the RS-485 option.

OPTIONAL FEATURES

30 Volt Transmitter Power Supply

An integral power supply is offered to power a remote transmitter. This supply provides up to 25 mA of current, is packaged on an "options" PWA, is isolated from all other supplies within the instrument, and is isolated from earth (ground). Select Model Optional Suffix "-A".

Remote Set Point

The controller will accept a 4 to 20 mA signal from a remote (external) set point. This option automatically includes the 30 V Transmitter Power Supply (Option "-D"). Select Model Code Optional Suffix "-B".

4 to 20 mA Retransmission Output

A 4 to 20 mA output signal proportional to the measured process temperature, or input signal, is transmitted to an external source. This option automatically includes the 30 V Transmitter Power Supply (Option "-A"). Select Model Code Optional Suffix "-C".

One SPDT Relay Output for Alarm 1 or 2

This Form C relay provides an alarm output for either Alarm 1 or Alarm 2. The relay specifications are identical to the standard offering. This option automatically includes the 30 V Transmitter Power Supply (Option "-A"). Select Model Code Optional Suffix "-D".

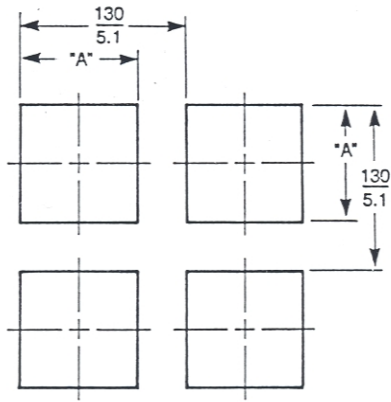
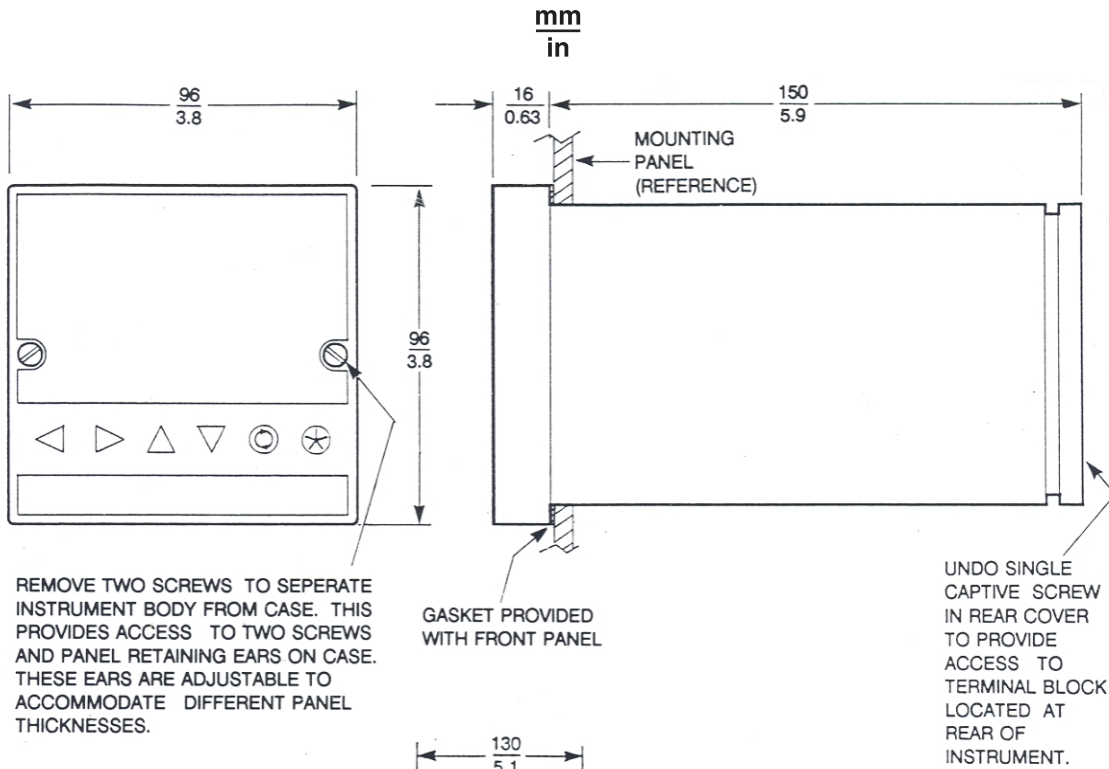
RS-485 2-Wire Serial Communication

This option provides a 2-wire communication via an RS-485 half duplex, multidrop (30 drops) link system. This is an isolated system with a software selectable baud rate of 1200, 2400, 4800, or 9600 baud. Communication commands include Poll, Extended Poll, Set, and Read and Write to a Parameter or a sequence of parameters. This protocol is compatible with all supervisory software written for the Foxboro 700 Series Controllers, such as the Model 761C. This option automatically includes the 30 V Transmitter Power Supply (Option "-A"). This option is not available if RS-422 Serial Communication is selected. Select Model Code Optional Suffix "-E".

RS-422 4-Wire Serial Communications

The RS-422 Serial Communications provides the same capabilities as the RS-485 option, except that it is a 4-wire system and provides 10 drops rather than 30 drops. This option automatically includes the 30 V Transmitter Power Supply (Option "-A"). This option is not available if RS-485 Serial Communication is selected. Select Model Code Optional Suffix "-F".

DIMENSIONS – NOMINAL



A = 92.0 TO 92.8 mm (3.62 TO 3.65 in)

PANEL CUTOUT AND SPACING

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