

# PROCESS CONTROL SYSTEMS, INC.

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# MAXIG4RD

# : Altra•gap. CT4006 & CT4012 TEMPERATURE MONITOR

# Introduction

The Maxigard CT4006 and CT4012 are temperature measuring instruments designed to monitor up to 6 or 12 thermocouple channels respectively, type J, K, T or E. Both models provide digital displays with alarms. The CT4006 or CT4012 is configured by means of a front panel key pad. The use of the keypad allows the operator to easily select thermocouple type, the number of channels to be monitored, scale and resolution, dwell time for each channel, individual adjustment for high/low set points, and alarm reset mode. The temperature alarm systems are precision built of quality material and completely factory tested to insure long life and trouble free operation.

# Principle of Operation

The CT4006 or CT4012 continuously scans up to (6 or 12) thermocouple channels. Each channel selected during configuration is scanned & measured every (3) seconds. The monitor displays the channel number, and the temperature for each input selected. This instrument can be configured for up to 12 channels with 2 set points on each. The set point action which applies to all of the channels can be selected as one of the 3 types.

<b>TYPE</b>	<u>PT</u>	<u>ALARM ACTIVATES:</u>	<b>ACTIVE RELAY</b>
HI/HH	HI	ABOVE SET POINT	LO RLY
	HH	ABOVE SET POINT	HI RLY
HI/LO	HI	ABOVE SET POINT	HI RLY
	LO	BELOW SET POINT	LO RLY
LO/LL	LO	BELOW SET POINT	HI RLY
	LL	BELOW SET POINT	LO RLY



Monitors that have alarms configured during the SETUP procedures will display the channel number followed by "HH ALARM", "HI ALARM", "LO ALARM", or "LL ALARM" when the temperature exceeds one of the stored set points. To get back to the scanning mode the **[ALARM]** key must be pressed and if the alarm still exits a flashing "A" will appear after the channel number of the point in alarm.

Monitors <u>with optional relays</u> will energize either the HI or the LO relay. If the MANUAL RESET mode was selected, the alarm relays will be de-energized only when the **[ALARM]** key is pressed. If the AUTO RESET mode was selected, the relay will not de-energize until all measured temperatures have returned to a normal range.

Monitors <u>with optional buzzer</u> will have the buzzer sound if it was enabled during SETUP. Pressing the **[ALARM]** key will cancel the display waring, and silence the buzzer.

Monitors will display "OPEN TC" instead of temperature several seconds after any thermocouple wire breaks or is disconnected. If the buzzer was enabled during SETUP it will also sound. To Cancel the display message and buzzer press [ALARM].

# **Components**

The CT4006 and CT4012 packages include the instrument mounted and internally wired in a Nema 4X fiberglass enclosure with window. An optional alarm horn is available and can be used to call attention to the alarm condition. Optional SPDT global relays to provide relay contacts for HI or LO alarms. Contacts can be used to control events or activate annunciator or other control systems. Other options include: a single channel 4/20 mA analog output, universal RS232 output interface and additional alarm relays.

# **INSTALLATION AND MOUNTING INSTRUCTIONS**

For best results read entire manual before proceeding with installation and configuration

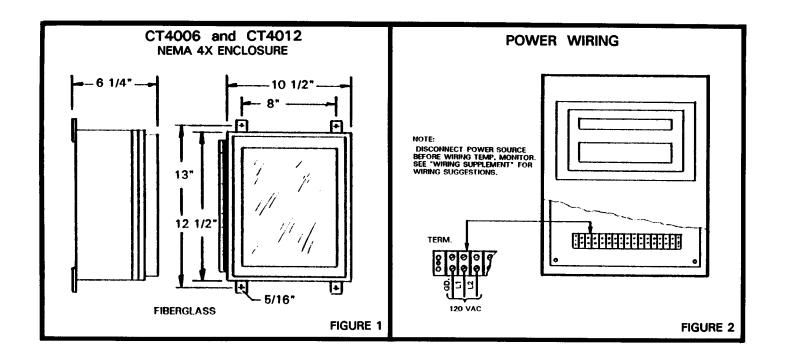
# **ALARM SYSTEM ENCLOSURE**

**1.0** CT4006 and CT4012 enclosures are fiberglass construction, rated Nema 4X, dust tight, oil tight, and water tight, suitable for indoor or outdoor use. See Fig. 1, page 3.

# **CAUTION**

Take special care to protect circuit board and display from damage or contamination when drilling or punching conduit holes.





# WIRING AND ENERGIZING

# **WARNING**

Be sure that line voltage is off before connecting power wiring.

- **2.0 POWER WIRING** (see figure 2, page 3)
  - **2.1** Open cabinet door, locate power terminal strip.
  - **2.2** Use 14 gauge wire for power connections, 12 gauge for ground connections.
    - **2.2.1** Route power wiring in separate conduit form thermocouple wiring.
    - **2.2.2** Circuit power requirements are 1/8 amp at 120 VAC.
    - **2.2.3** Connect green wire to terminal labeled (GND), black wire to terminal labeled (HOT), and white wire to terminal labeled (NEU).



# **2.3 THERMOCOUPLE WIRING** (see figure 3, page 4)

**2.3.1** Select thermocouple wire to match the type thermocouples being used with the system, either thermocouple or thermocouple extension wire may be used.

# **CAUTION**

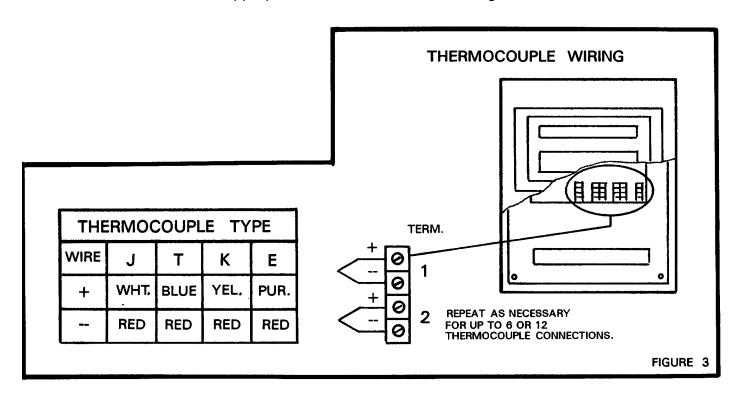
Do not splice other wire types into the thermocouple circuits.

**2.3.2** If terminal blocks or connectors must be used, be sure to use isothermal type devices of similar materials as the thermocouple.

# NOTE

Refer to Supplement I on recommended wiring practices and noise interference.

- **2.3.3** Connect thermocouple wire as shown. Note polarity markings and correct thermocouple colors. (see figure 3, page 4).
- **2.3.4** Strip 1/4 inch of insulation from the end of each thermocouple wire.
- **2.3.5** Loosen appropriate screws, insert wire and tighten screw to service wire.



# **CHECK POLARITY**

2.4 Optional Global Alarm Relays

If alarm relays are a part of your system, refer to "Alarm Relay Supplement" II.

2.5 Optional 4/20 mA Output

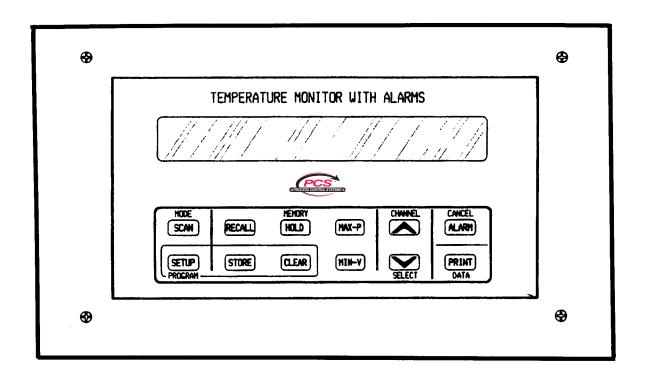
If 4/20 mA output is part of your system, refer to "4/20 mA Output Supplement" III.

2.6 Optional RS232 Output

If the RS232 output is part of your system, refer to "RS232 Output Supplement" IV.

3.0 DISPLAY AND KEY PAD DESCRIPTIONS

(see pages 8, 9 & 10 for parameter definitions).



# 3.1 SYSTEM DISPLAY

# Operating Mode

Each channel will be displayed for the length of time selected during the configuration process.

# **Configuration Mode**

Displays the prompts appropriate for the configuration step, and will display the data entered.

# 3.2 SCAN KEY

Used to return the monitor to the scan mode after using a memory function. Used to exit the configuration mode.

# 3.3 SET UP KEY

Used to enter the configuration mode.

# 3.4 STORE KEY

# **Configuration Mode**

Used to make configuration selections.

# **Memory function**

Used to store a snapshot of all active channel readings. Up to 99 snapshots can be stored. See RECALL key to read data.

# 3.5 CLEAR KEY

Used to clear Max-P, Min-V values. Used to clear stored values if in the RECALL MODE.

# 3.6 RECALL KEY

Used to recall data sets saved with the STORE key. Enables the CLEAR key to erase stored data.

# 3.7 HOLD KEY

Will hold and sequentially display the reading for each active channel. Readings for each channel can be reviewed by using the UP  $\Lambda$  DOWN V keys. Press the HOLD key again to return monitor to the operation mode.

### NOTE

If the UP key or the DOWN key were pressed, you will need to press the SCAN key to return to the normal scan mode.

# 3.8 MAX-P KEY

Pressing the MAX-P key will display the highest reading that occurred on the displayed channel since the last clear. The letter P will be displayed between the channel number and the highest temperature reading. The peak temperature can be cleared by pressing the CLEAR key. Press SCAN key to return to the scan mode.

# 3.9 MIN-V KEY

Pressing the MIN-V key will display the lowest temperature reading that occurred on the displayed channel since the last clear. The letter V will be displayed between the channel number and the temperature reading. The low temperature can be cleared by pressing the CLEAR key. Press SCAN to return to the scan mode.

# 3.10 **N V KEYS**

# NOTE

If a channel is selected for display the monitor will remain in this mode until the SCAN key is pressed.

# 3.11 PRINT KEY

If the RS232 option is part of your system, pressing this key will transmit an additional set of data.

# 3.12 ALARM KEY

Pressing this key if an alarm is present will clear the display alarm message. If the monitor is configured for MANUAL RESET pressing the ALARM key will de-energize the alarm relays.

# **CONFIGURATION PARAMETERS**

SCALE	<ul> <li>Select engineering units for display of all temperature values.</li> </ul>
	<ul> <li>Selections offered are:</li> <li>F Fahrenheit</li> <li>C Centigrade</li> <li>K Kelvin</li> <li>R Rankin</li> </ul>
DECIMAL	<ul> <li>Location of decimal point for all temperature display values.</li> </ul>
	<ul> <li>Two selections are available:</li> <li>0.1</li> <li>1</li> </ul>
ON/OFF SCAN	The monitor will accept up to 6, (CT4006) or 12, (CT4012) thermocouple inputs.
	Each channel connected should be placed in the ON scan mode.
	<ul> <li>The up date time for each channel ON is factory set for 3 seconds.</li> </ul>
DISPLAY TIME	When the display is scanning, the information for each channel is displayed for a variable period of time.
	<ul> <li>This value can be set from 2-999 seconds.</li> </ul>
	Display time is independent of scan time.
ALARM STATUS	<ul> <li>The three selections for ALARM STATUS are:</li> <li>1. ALARMS off</li> <li>Turns off all alarm functions including displays and relay outputs.</li> </ul>
	<ul> <li>2. RESET AUTO</li> <li>■ Activates all alarm displays, relay outputs, and horn if configured ON.</li> </ul>
	When an alarm occurs, the appropriate alarm relay is energized and the beeper sounds, if enabled. The alarm type characters will flash when the alarming channel is displayed. When the ALARM key is pressed, the beeper turns off and the alarm type characters stop flashing for all current alarms. When the temperature for a channel is out of the alarm condition, the alarm type characters will disappear. If all alarming channels are out of their alarm condition, the alarm relay is de-energized and the beeper turns off (regardless of whether the ALARM key was pressed). Note:This mode does not interrupt display scanning.

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HORN/BUZZER (OPTIONAL DEVICE)	<ul> <li>Set ON or OFF. If set ON the audible horn/buzzer is enabled and will sound when an alarm occurs. The horn/buzzer is silenced with the Alarm key.</li> </ul>
4/20 mA OUTPUT (OPTIONAL)	<ul> <li>One channel can be selected to retransmit a 4/20 mA signal. Values for 4/20 mA are entered in units as configured in SCALE.</li> </ul>
PRINT TIME (OPTIONAL)	<ul> <li>If the optional RS232 output is present the time setting determines how often information will be transmitted.</li> <li>Time is entered in minutes and seconds. Maximum of 99 minutes 59 seconds.</li> </ul>
THERMOCOUPLE TYPE	<ul> <li>One thermocouple type is selected for the Monitor. All channels require similar types.</li> <li>Available thermocouple types are: K, T, J, E</li> </ul>

# 4.0 CONFIGURING THE CT4006/CT4012

Things you need to know before configuration

How many and which channels will be active:

CT4006, 1-6 channels

CT4012, 1-12 channels

- What type thermocouples: J, T, K, or E
- What options have been added to the basic unit:

**ALARM RELAYS** 

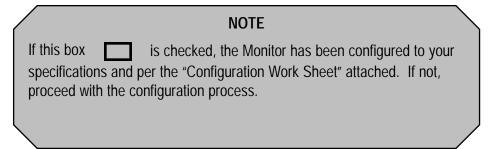
4/20 MA OUTPUT

**RS232 OUTPUT** 

**ALARM HORN** 



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Refer to "Configuration Parameters" definitions before continuing. See page 8,9 &10 of these instructions.

# 5.0 POWERING UP

- 5.1 Apply power (120 VAC) and wait for the system to self test. Display elements will show all 8's followed by \*'s.
- **5.2** The monitor will then proceed into the operating mode.

# **CONFIGURATION PROCESS**

- 6.0 Press the SETUP key to enter the configuration mode. Successively press the SETUP key to step through the various prompts until SCALE appears on the display.
  - 6.1 Press SETUP = SCALE F

    prompt flashing
  - **6.2** Press the UP ARROW or DOWN ARROW key to scroll flashing display through selections.

Available selections are: F Fahrenheit K Kelvin C Centegrade R Rankin

# NOTE

Selected prompt will apply to all channels.

**6.3** Press STORE to save your selection or press SETUP if no change is required.



- 6.4 Pressing STORE in step 6.3 will display the next prompt DECIMAL. If a change was not made at the SCALE prompt, successively press the SETUP key to step through the prompts until DECIMAL appears on the display.
  - **6.4.1** Press STORE or SETUP = DECIMAL 0.1
  - **6.4.2** Press the UP ARROW or DOWN ARROW key to scroll flashing display through selections.

Available selections are: 0.1 1.

# NOTE Selected prompt will apply to all channels.

- **6.4.3** Press STORE to save your selections or press SETUP if no change is required.
- 7.0 Pressing STORE in step 6.4.3 will display the next prompt 01 SCAN. If a change was not made at the decimal prompt, successively press the SETUP key to step through the prompts until 01 SCAN appears on the display.
  - 7.1 Press STORE or SETUP = 01 SCAN
  - **7.2** Press STORE again to change the ON/OFF scan status of channel displayed.

Press STORE = 01 SCAN ON

channel # flashing

**7.3** Press the UP ARROW or DOWN ARROW to scroll flashing display through the selections.

Available selections are: ON OFF

- **7.4** Press STORE to enter the change. The next channel will then appear. Repeat step 7.3 above to set the ON/OFF status of each channel.
- **7.5** Press SETUP when all channels have been set.



- 8.0 Pressing SETUP in step 7.5 will display the next prompt, DISPLAY TIME. If a change was not made at the 01 SCAN prompt, successively press the SETUP key to step through the prompts until DISPLAY TIME appears on the display.
  - 8.1 Press SETUP = DISPLAY TIME 3 SECONDS

### NOTE

The display will alternate between the two lines above. Displaying each line for about 3 seconds.

8.2 Press the UP ARROW or DOWN ARROW key to scroll flashing display through the selections. Holding either key depressed will cause the display to scroll through the numbers.

Available selections are 1-999 seconds

# NOTE

Selected prompt will apply to all channels.

- 8.3 Press STORE to save your selections, or press SETUP if no change was required.
- 9.0 Pressing STORE in step 8.3 above will display the next prompt. If a change was not made at the DISPLAY TIME prompt, successively press the SETUP key to step through the prompts until, RESET AUTO or LATCHED or SAFE LATCHED or ALARMS OFF appear on the display.
  - 9.1 Press SETUP = RESET AUTO or LATCHED or SAFE LATCHED or ALARMS OFF
  - 9.2 Press the UP ARROW or DOWN ARROW key to scroll the display through the selections.

Available selections are: 1. RESET AUTO

- 3. SAFE LATCHED
- 2. LATCHED
- 4. ALARMS OFF

# NOTE

Selected prompt will apply to all channels.

9.3 Press STORE to save your selections and continue the alarm configuration. Press SETUP to make no change and continue past alarm configuration. If no change is required, system will skip to Buzzer prompt step 12.0.



- **9.4** Pressing STORE in 9.3 will display the next prompt ALARM H/LO.
- 9.5 Press the UP ARROW or DOWN ARROW key to scroll the display through the selections
  - 1. ALARMS HI/LO
  - 2. ALARMS HI/HH
  - 3. ALARMS LO/LL
- **9.6** Press STORE to save your selection and continue alarm configuration.
- **10.0** Pressing STORE in 9.6 will display the next prompt HYSTERESIS, only if RESET AUTO or LATCHED or SAFE LATCHED was selected. If ALARMS OFF was selected proceed to step 12.0 BUZZER.

# NOTE BUZZER = OPTIONAL HORN

**10.1** Display shows HYSTERESIS 1.5S

# NOTE

Display will alternate between the two lines shown above, displaying each line for about 3 seconds.

**10.2** Press the UP ARROW or DOWN ARROW key to scroll the flashing display through the selections.

Available selections are: 0 to 999 units. Units are defined in SCALE prompt, step 6.0.

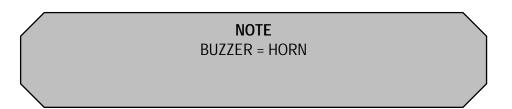
# NOTE

Selected number will apply to all channels.

**10.3** Press STORE to save your selection and continue the alarm configuration. If there is no change press SETUP and proceed to step 12.0.



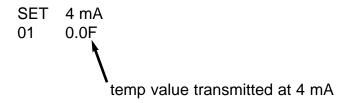
- **11.0** Pressing STORE in 10.3 will display the next prompt 01 ALARM OFF.
  - **11.1** Display shows = 01 ALARM OFF.
  - 11.2 Press the UP ARROW or DOWN ARROW key to select the channel. Press the STORE key to turn the alarm ON for the selected channel. This allows you to enter the high (H) and low (LO) temperature alarm set points.
    - 11.2.1 Pressing STORE as instructed in 11.2 will display 01HI\*\*\*\*F.
    - **11.2.2** Press the UP ARROW or DOWN ARROW key to enter a value for the high (HI) temperature alarm.
    - 11.2.3 Pressing STORE will save the value, and will display the next prompt 01LO\*\*\*\*F.
    - **11.2.4** Press the UP ARROW or DOWN ARROW key to enter a value for the low (LO) temperature alarm.
    - 11.2.5 Press STORE to save the value.
  - **11.3** If a channel alarm is ON and you want to turn it OFF, press CLEAR to change 01 ALARM ON to 01 ALARM OFF.
  - **11.4** Continue to set alarms as described in 11.2 until all channels are set. Then press SETUP to continue the configuration process.
- **12.0** Pressing SETUP in 11.4 will display the next prompt: BUZZER OFF;



- 12.1 Display will show BUZZER OFF.
- **12.2** Press the UP ARROW or DOWN ARROW key to turn the buzzer ON or OFF.
- **12.3** Press STORE to save your selection, or SETUP to continue without changing the buzzer status.

# 4/20 mA OUTPUT - OPTION

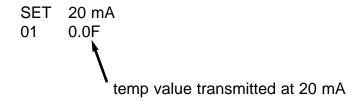
- **13.0** Pressing STORE in 12.3 will display the next prompt: 01 4-20 mA.
  - **13.1** Display will show: 01 4-20 mA.
  - **13.2** Press the UP ARROW or DOWN ARROW key to select which channel will transmit the 4-20 mA output.
  - **13.3** Press STORE to save your selection, or SETUP to continue without changing the channel number.
  - **13.4** Pressing STORE in 13.3 will display the next prompt:



# NOTE

The display will alternate between the two lines above displaying each line for about 3 seconds.

- **13.5** Press the UP ARROW or DOWN ARROW key to set the temp. value to transmit at 4 mA.
- **13.6** Press STORE to save the 4 mA value.
- **13.7** Pressing STORE in 13.6 will display the next prompt.



# NOTE

The display will alternate between the two lines above displaying each line for about 3 seconds.

- **13.8** Press the UP ARROW or DOWN ARROW key to set the temp. value to transmit at 20 mA.
- **13.9** Press STORE to save the 20 mA value.

# **RS232 OUTPUT OPTION**

**14.0** Pressing STORE in 13.9 will display the next prompt.

PRINT TIME 0 MIN 00 SEC

# NOTE

The display will alternate between the two lines above displaying each line for about 3 seconds.

- **14.1** Press UP ARROW or DOWN ARROW key to change the number of minutes in the print interval.
- **14.2** Press STORE to save the minutes selected in 14.1.
- **14.3** Pressing STORE in 14.2 will change the prompt to 0 MIN 00 SEC.
- **14.4** Press the UP ARROW or DOWN ARROW key to change the number of seconds in the print interval.
- **14.5** Press STORE to save the number of seconds selected in 14.4.
- **15.0** Pressing STORE in 14.4 will display the next prompt: TYPE T.
  - **15.1** Display will show TYPE T.
  - **15.2** Press the UP ARROW or DOWN ARROW key to scroll flashing display through the thermocouple selections.

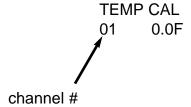
Available thermocouple type selections are: K, T, J, and E

### NOTE

Selected prompts will apply to all channels.



- **15.3** Press STORE to save your selection, or SETUP to continue without changing the thermocouple type.
- **16.0** Pressing STORE in 15.3 will display the next prompt.



# NOTE

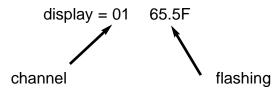
The display will alternate between the two lines above, displaying each line for about 3 seconds.

**16.1** If a thermocouple calibration is required, press UP ARROW or DOWN ARROW key to select the channel. If calibration is not required press SETUP or SCAN to leave the configuration mode.

# NOTE

Temperature calibration requires that a known temperature signal be attached to the channel requiring calibration. This signal can be from a calibrator, an ice bath, or other known temperature sources. A comparison measurement with a calibrated instrument or thermometer can also be used.

**16.2** When the channel number requiring calibration is displayed, press STORE.



- 16.3 Press the UP ARROW or DOWN ARROW key to increase or decrease the displayed temperature value to match that of the known temperature value or comparison measurement.
- **16.4** Press STORE to save the value entered.
- **16.5** Repeat steps 16.1 through 16.3 for other channels requiring calibration.
- **16.6** Press SETUP or SCAN to return to normal operation.



# MEMORY FUNCTIONS

# **STORE**

Pressing STORE transfers current reading for all active channels to memory. Each time STORE is pressed, a set of readings is saved, up to 99 sets can be saved.

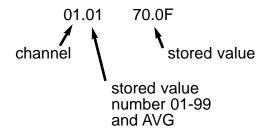
Example, when STORE is pressed the display reads STORE (05). This indicated a value have been saved in the fifth memory location of 99.

# **RECALL**

1. Pressing RECALL displays the current channel number, followed by, AVG, and the calculated average of all values stored with the STORE key.

01 AVG 69.0F

2. While AVG is displayed the UP ARROW or DOWN ARROW keys can be pressed to scroll through all values stored for the channel displayed.



3. While AVG is displayed, pressing RECALL again causes the channel number to flash. Press the UP ARROW or DOWN ARROW key to select the channel, then press RECALL again to scroll through stored values for that channel as described above.

# **CLEAR**

To clear all stored values press STORE then press CLEAR. The display will read EMPTY. This indicates all stored values have been erased from memory.

# HOLD

Pressing the HOLD key will freeze readings on all active channels. This allows review of a simultaneous set of readings. Press the UP ARROW or DOWN ARROW to review the reading held for each channel. Press HOLD again to return to normal.

# MAX-P

Pressing the MAX-P key will display the highest reading recorded since the last CLEAR. While the MAX-P is displayed, CLEAR can be pressed to clear the reading. Pressing MAX-P again will return the display to normal.

# MIN-V

Pressing the MIN-V key will display the lowest reading recorded since the last clear. While the MIN-V is displayed, CLEAR can be pressed to clear the reading. Pressing MIN-V again will return to display to normal.



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