

Time Event Monitoring

The TimeKeeper™ Count Up/Down timer with time-of day clock, presets, and alarms



This reference guide covers the DS-231.

Programmable Remote Inputs

Traditionally the remote inputs on our products are limited to starting or stopping the timers, and to increment or decrement a counter. In addition to these standard functions the DS-231 TimeKeeper™ also allows the user to program any or all of the four remote inputs to perform a wide range of commands or button presses. For example: A remote button could be programmed to recall a stored setting and start the timer.

Stored Presets

The DS-231 TimeKeeper™ stores three unique timer setups. In addition to storing timer presets, or the beeper mode, the DS-231 TimeKeeper™ will also store the status of the timers. By saving a timer setup while the timer is running, the timer will automatically start the next time the appropriate preset button is pressed. This allows a one-touch timer preset and start.

Set Up To 255 Alarms

The DS-231 TimeKeeper™ monitors up to 255 alarm settings. Each alarm is programmable to occur on any combination of days during the week. In addition, each alarm can be programmed to perform a wide range of

command or button presses. For example: An alarm could be programmed to stop the timer when it occurs.

Buttons and Controls

The DS-231 TimeKeeper™ has a number of buttons that perform different functions depending on whether the user momentarily presses the button, or presses and holds the button. Following is a summary of the DS-231 TimeKeeper™ button functionality:

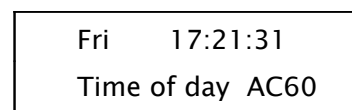
Button Name	Momentary Press and Release	Sustained Press and Hold
Reset	Sets down-timer to preset. Sets up-timer to zero.	Selects the special timer modes.
Start/Stop	Starts and stops the timer.	Reserved for future use.
Mode	Toggles between the up and down timer modes.	Selects the beeper modes.
Select	Cycles knob function between hours, minutes, and seconds.	Sets the yellow blink time.
Clock	Displays the time-of-day clock.	Sets the time-of-day clock.
Presets	Recalls the stored settings.	Saves the current timer settings.
Alarm Display	Displays alarms. Turn the knob to cycle between the alarms.	Saves the alarm setup.
Alarm Enable	Enables alarms.	Disables alarms
Test	Triggers the next alarm in the list.	Enables the manual trigger mode.
B	Reserved for future use	Selects remote input setup mode.

Table 1. Button reference

Use the rotary knob to set times, or to select commands in the DS-231 TimeKeeper™.

Clock Mode

The DS-231 TimeKeeper™ has a time-of-day clock that will look similar to the following display:



To set the clock do the following:

1. **Press and hold** the **Clock** button. The display shows the day, hours, minutes and seconds.
2. **Turn** the **knob** to set the desired day/time. **Momentarily press** the **Select** button to select between setting days, hours, minutes, and seconds.
3. **Momentarily press** the **Clock** or **Select** button again to return to normal display.

Clock Accuracy

The DS-231 TimeKeeper™ clock accuracy is influenced by its power source. Under normal conditions alternating current is used to synchronize the clock. The display indicates the AC Power line sync status.

AC50—The time of day clock is Synchronized by a 50Hz AC power source. In many countries, the AC power is accurate to within a few seconds per year.

AC60—The time of day clock is Synchronized by a 60Hz AC power source. In many countries, the AC power is accurate to within a few seconds per year.

Blank display—The time of day clock is synchronized to the internal crystal. In this mode, the clock is not nearly as accurate. If you want to use this mode, use a DC power source to power the unit instead of an AC power source.

Connecting multiple Timekeepers™ together.

- When multiple units are connected together, the DSP-231A will become the controlling unit. The rest of the units become remote displays.
- The DSP-231A will accept remote key press commands from a PLC, AMX, Crestron, PC, or any device that is capable of transmitting RS232 serial commands. See the description of the serial commands at the end of this document, and see the technical manual for programming details.

Alarms

Up to 255 alarms can be defined to start and stop the timers, automatically press buttons, send serial commands, and activate relays, LEDs and other devices. See the description of the alarm codes at the end of this document.

Displaying existing alarms

To display an existing alarm, follow the procedure below. An empty memory location is any alarm with the days of the week field blank.

1. **Momentarily press** the **Alarm Display** button.

0 Alarm	F=00
MTWTFSS HH:MM:SS	

2. **Turn** the **knob** until the desired alarm appears in the display.

Adding a new alarm

To add a new alarm, follow the procedure below.

1. **Momentarily press** the **Alarm Display** button. **Turn** the **knob** to select the desired alarm.

0 Alarm	F=00
MTWTFSS HH:MM:SS	

2. **Momentarily press** the **Select** button. The message “New” will appear in the display. **Turn** the **knob** until the desired days of the week are selected.

0 New	F=00
MTWTFSS HH:MM:SS	

3. **Momentarily press** the **Select** button. **Turn** the **knob** until the desired hour is selected. **Momentarily press** the **Select** button and **turn** the **knob** to change the minutes and seconds.

0 New	F=00
MTWTFSS HH:MM:SS	

4. **Momentarily press** the **Select** button. **Turn** the **knob** until the desired function is selected. See the alarm codes table for a list of the alarm function codes.

0 New	F=00
MTWTFSS HH:MM:SS	

5. **Press and hold** the **Alarm Display** button until the message “SAVED” appears.

Note: The alarm will be saved into EEPROM memory in the order of the time of day. Some or all the alarms will be re-numbered, if necessary. For instance, inserting a new alarm at 11:00 AM will cause all alarms after 11:00 AM to be re-numbered.

Editing existing alarms

To edit an existing alarm, follow the procedure below:

- Add a new alarm.
- Delete the existing alarm.

NOTE: You may perform these steps in any order.

Deleting an existing alarm

1. **Momentarily press** the **Alarm Display** button. **Turn the knob** until the desired alarm appears in the display.

<u>0</u> Alarm	F=00
MTWTFSS	HH:MM:SS

2. **Momentarily press** the **Select** button. **Turn the knob** until the days of the week field is blank.

<u>0</u> Alarm	F=00
	HH:MM:SS

3. **Press and hold** the **Alarm Display** button until the message “Delete” flashes momentarily.

0 Delete	F=00
	HH:MM:SS

Note: The alarm will be deleted from memory. Some or all the alarms will be re-numbered, if necessary. For instance, deleting an alarm at 11:00 AM will cause all alarms after 11:00 AM to be re-numbered.

Deleting all alarms

1. **Momentarily press** the **Alarm Display** button. **Turn the knob** until 255 appears in the alarm number.

25 <u>5</u> Alarm	F=00
MTWTFSS	HH:MM:SS

2. **Momentarily press** the **Select** button. **Turn the knob** until the days of the week field is blank.

25 <u>5</u> DelAll	F=00
	HH:MM:SS

3. **Press and hold** the **Alarm Display** button until the message “DelAll” appears in the display.

Note: All alarms stored in EEPROM are now erased.

Activating the alarms

1. To activate the alarms, **Momentarily press** the **Alarm Enable** button. The next alarm to be triggered will be displayed.

Mon	14:20:35
Run	0 17:00:00

When an alarm triggers, the next alarm in the list waiting to be triggered appears.

Mon	14:20:35
Run	1 16:00:00

If the last alarm for the current day has executed, 0 will appear in the display indicating the first alarm for the next day.

Disabling the alarms

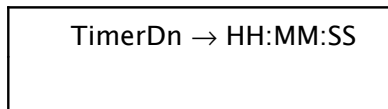
To disable the alarms **press and hold** the **Alarm Enable** button for at least 2 seconds. The display will return to time of day display.

Fri	17:21:31
Time of day AC60	

Timer Mode (HH:MM:SS)

The DS-231 TimeKeeper™ provides one count-down, and one count-up timer. To set and start the count-down timer follow the steps below:

1. **Momentarily press** the **Reset** button to select the timer mode. If the timer is running, **momentarily press** the **Start/Stop** button to stop the timer.
2. **Turn** the **knob** to set the desired time. **Momentarily press** the **Select** button to select between setting hours, minutes and seconds.



*Note: The timer may display **TimerUp**, or **TimerDn**, but the count-down timer is always the timer being set.*

3. **Momentarily press** the **Start/Stop** button to start the timers.

*Note: The **Mode** button selects between count-up and count-down displays. You may change between count-up and count-down displays while the timer is running. In count-down mode, the timer stops when it reaches zero. In count-up mode, the timer keeps running when the preset time is reached.*

*The **Start/Stop** button starts both timers.*

*The **Reset** button resets the count-up timer to zero, and the count-down timer to the previous preset time.*

Special Timer Modes

While in the count down mode, when the timer reaches zero, one of several actions can be selected.

1. **Press and hold** the **Reset** button until the display changes.
2. **Turn** the **knob** to select the desired mode.
 - Mode 0 - Stop when the timer reaches zero: The timer stops when the elapsed time reaches zero. The red indicator comes on steady. The red indicator remains on until the timer is reset.
 - Mode 1 - Stop when the timer reaches zero: The timer stops when the elapsed time reaches zero. The red indicator begins blinking. The red

indicator continues to blink until the timer is reset.

- Mode 2 - Auto-Restart: The timer automatically restarts counting down from the preset value each time the timer reaches zero. The red indicator flashes on momentarily. The Auto-Restart mode works in both count up and count down modes. The count up mode uses the count down timer preset time to determine when to reset the count up timer back to zero and restart.
- Mode 3 - Change to Count Up when the timer reaches zero: The timer changes to the count up mode and starts counting up when the timer reaches zero. The red indicator remains on until the timer is reset.

Red-Yellow-Green Indicators

The DS-231 TimeKeeper™ has three warning indicators, two are programmable. If the DS-231 TimeKeeper™ is connected to a physical red-yellow-green indicator unit, colored indicators are displayed at the appropriate times, and if not, the indicators are shown on the display.

- Green Warning time: The **Green** indicator comes on when the timer is started.
- Yellow blink warning time: The **Yellow** indicator begins to blink at the yellow blink warning time. When the **Yellow** blink warning time is reached, the **Green** indicator goes off and the **Yellow** indicator blinks on and off.
- Yellow steady warning (**Wrap-It-Up**) time: When the **Yellow** steady warning time is reached, the **Yellow** indicator comes on steady.

Note: The yellow blink or the yellow steady warning times may occur in either order depending on the user settings.

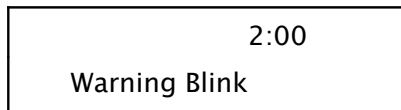
- Red warning time: When the elapsed timer reaches zero, the **Red** indicator comes on and the **Yellow** indicator goes off. In the count down mode, the timer stops when the **Red** indicator turns on. In the count up mode, the timer keeps running after the indicator turns **Red**. Press the **Reset** button to turn off the **Red** warning indicator.

Note: The factory default warning times are set to 2:00 minutes for the yellow blink warning and 1:00 minute for the yellow steady warning.

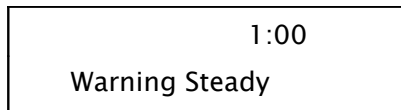
The warning indicators may be changed to any value. A yellow blink warning time of 2:00 minutes and yellow steady warning time of 1:00 minute means that the yellow warning indicator comes on 2 minutes before the timer expires. For example, If the preset time is set to 10 minutes, then the yellow blink warning indicator comes on after 8 minutes have elapsed. The yellow steady warning indicator comes on after 9 minutes have elapsed. The red warning indicator comes on after 10 minutes have elapsed.

To change the warning times, follow the procedure below:

1. **Press and hold** the **Select** button until the display changes.



2. **Turn** the **knob** to set the yellow blink warning time. **Momentarily press** the **Select** button to select between setting minutes and seconds.
3. **Press and hold** the **Select** button again until the display changes.

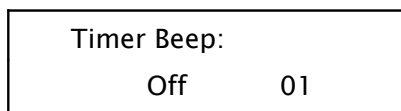


4. **Turn** the **knob** to set the yellow steady warning time (Wrap-It-Up time). **Momentarily press** the **Select** button to select between setting minutes and seconds.

Beeper modes.

The DS-231 Timekeeper™ has four beeper modes: Single beep when the timer reaches zero; Beep at each of the warning times; Beep until the timer is reset; and beeper disabled.

1. **Press and hold** the **MODE** button to enter the beeper set mode.
2. **Turn** the **knob** to select the desired beeper mode.



- **Single beep:** The timer will generate a beep when the preset time is reached.

- **Beep on warning:** The timer will generate a beep at the start of the yellow blink time, yellow warning time and when the preset time is reached.
- **Beep until reset:** The beeper will sound every two seconds until the reset button is pressed.
- **Beeper disabled:** No beeps are generated. Also, the software version number is displayed in this mode.

Remote inputs

The DS-231 TimeKeeper™ has four ground closure GPI (General Purpose) remote inputs.

- Remote inputs (IN1, IN2, IN3, and IN4) perform standard functions.
- Alternatively, each remote input is programmable and can generate any of the alarm codes. See the alarm codes table for a list of the alarm function codes.

Standard functions for the remote inputs.

Activating a single input:

- **IN1:** If the unit is not in timer mode, activating IN1 puts the unit into the timer mode. If the unit is in the timer mode and the timer is not running, start the count up timer and Increment the counter. If the unit is in the timer mode and the timer is running, freeze the display for several seconds to display the lap time. The count up timer keeps running.
- **IN1 Maintained closure:** If IN1 is held closed for more than 2 seconds, it is treated as a maintained closure. The timer is started when IN1 is closed (grounded) and stopped when IN1 is opened.
- **IN2:** If the unit is in the timer mode, and the timer is running activating IN2 stops the timers. If the unit is in the counter mode activating IN2 decrements the counter by the scale factor (default 1).
- **IN3:** If the unit is in the timer mode, activating IN3 resets the count up timer to zero, and resets the count down timer to the preset value. Activating IN3 does not stop the timers. If the unit is in the counter mode, Activating IN3 resets the counter to zero.

Activating multiple inputs at the same time:

- IN1,IN2 - Run-Pause mode: If the unit is not in the timer mode activating IN1 and IN2 puts the unit into the timer mode. If the unit is in the timer mode and the timer is not running activating IN1 and IN2 starts or continues the count up timer, and increments the counter. If the unit is in the timer mode and the timer is running activating IN1 and IN2 pauses the timer.
- IN1,IN3 - Reset, Start, and Stop mode: If the unit is not in timer mode activating IN1 and IN3 puts the unit into the timer mode. If the unit is in the timer mode and the timer is not running activating IN1 and IN3 resets, and then starts the count up timer, and Increments the counter. If the unit is in the timer mode and the timer is running activating IN1 and IN3 stops the timer.
- IN1,IN2,IN3 - Two lap mode; Reset and Start, Lap Display, Stop mode: If the unit is not in the timer mode activating IN1, IN2, and IN3 puts the unit into the timer mode. If the unit is in the timer mode and the timer is not running activating IN1, and IN2, and IN3 resets, and then starts the count up timer, and Increments the counter. If the unit is in the timer mode and the timer is running activation IN1, IN2, and IN3 freezes the Display for several seconds to display the lap time. The count up timer keeps running. If the unit is in the timer mode and the timer is running and the lap time was displayed once activating IN1, IN2, and IN3 stops the timer.
- IN1,IN4 - Beep the Horn.

Alternative functions for remote inputs.

Each of the remote inputs can be programmed to activate any of the alarm codes. See the alarm codes table for a list of the alarm function codes.

1. **Press and hold** the **B** button until the display shows “Rem IN1”.

REM IN1 F=00

2. **Turn** the **knob** until the desired input is selected IN1 – IN4.
3. **Momentarily press** the **Select** button and **turn** the **knob** to change the function of the selected remote input. If the function value is zero, the standard function is selected.

4. **Momentarily press** the **Select** button. This will store the new function value in memory. Repeat the above steps until all remote inputs are setup as desired.

Note: When a remote input is triggered, the following display appears.

0 RemTrig F=01
MTWTFSS HH:MM:SS

If the function automatically presses a button, the display will change to reflect the action of the button press.

User Programmable Presets

1. The DS-231 TimeKeeper™ can save and recall three user programmable setups. There is a button for each preset labeled 1, 2, and 3. Each preset will store the following parameters:
 - Count down timer preset value in Hours, Minutes and Seconds.
 - Yellow blink warning time in Minutes and Seconds.
 - Yellow steady warning time in Minutes and Seconds.
 - Beeper mode.
 - Special mode.
 - Timer running or stopped.
 - Count up or count down.
 - Remote input function for inputs IN1, IN2, IN3 and IN4.

To **store** a setup:

1. **Setup** the DS-231 TimeKeeper™ to contain the desired settings.
2. **Press and hold** one of the **Preset** buttons. The display will indicate that the settings are saved by briefly showing the word “saved” on the display similar to what is shown below:

TimerUp 00:30:49
Run=SAVED RED

Note: If the settings are saved while the timer is running the next time the settings are recalled, the timer will be started automatically.

To **recall** a setup:

1. **Momentarily press** the appropriate **Preset** button. The unit will load all of the above information that was previously saved, and start the timer if the units settings were saved with the timer running.

Testing Alarms

The DS-231 TimeKeeper™ allows the user to test alarm programming by following the procedure below:

1. **Press and hold** the **Alarm Enable** button to disable the alarms.
2. **Momentarily press** the **Test** button. The Timekeeper™ will change to a display similar to what is shown below.

Q Manual	F=D6
M	17:00:00

3. **Turn the knob** to select the desired alarm. **Momentarily press** the **Test** button to activate the alarm.

Triggering Alarm Codes

The DS-231 TimeKeeper™ allows the user to manually trigger alarm codes by following the procedure below:

1. **Press and hold** the **Alarm Enable** button to disable the alarms.
2. **Press and hold** the **Test** button. The Timekeeper™ will change to a display similar to what is shown below.

0 Manual	F=D6
M	17:00:00

3. **Momentarily press** the **Test** button. The DS-231 Timekeeper™ display will look similar to what is shown below.

Manual	F=D6
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4. **Momentarily press** the **Test** button to activate the selected alarm code. **Turn the knob** to change the alarm code, continue **momentarily pressing** the **Test** button as desired to activate alarm codes.

Alarm Code Definitions

The following group of alarm codes affect the command RLY@xI where x is defined as:

- 01 - Sends momentary activation on relay 1
- 02 - Sends momentary activation on relay 2
- 03 - Sends momentary activation on relay 3
- 04 - Sends momentary activation on relay 4
- 05 - Sends momentary activation on relay 5
- 06 - Sends momentary activation on relay 6

The following group of alarm codes affect the command RLY01P1:

- 07 - Sends momentary activation on beeper.

The following group of alarm codes enable commands to be sent on the serial port:

- 0E - Disables sending "KPn commands along with the C0 to FF commands.
- 0F - Enables sending "KPn commands along with the C0 to FF commands.

The following group of alarm codes affect the command RLY@xI where x is defined as one of the following:

Odd numbers enable functions/relays/LEDs.
Even numbers disable functions/relays/LEDs.

- 10 - Disables relay 1 (bit 0 of x)
- 11 - Enables relay 1 (bit 0 of x)
- 12 - Disables relay 2 (bit 1 of x)
- 13 - Enables relay 2 (bit 1 of x)
- 14 - Disables relay 3 (bit 2 of x)
- 15 - Enables relay 3 (bit 2 of x)
- 16 - Disables relay 4 (bit 3 of x)
- 17 - Enables relay 4 (bit 3 of x)
- 18 - Disables relay 5 (bit 4 of x)
- 19 - Enables relay 5 (bit 4 of x)
- 1A - Disables relay 6 (bit 5 of x)
- 1B - Enables relay 6 (bit 5 of x)
- 1C - Enables messages sent every second.
- 1D - Enables messages only when alarm is triggered.
- 1E - Disables above relays to send serial commands.
- 1F - Enables above relays to send serial commands.

The following group of alarm codes affect the command RLY@x1 where 1 is defined as:

- 20 - Disables LED 1 (bit 0 of 1)
- 21 - Enables LED 1 (bit 0 of 1)
- 22 - Disables LED 2 (bit 1 of 1)
- 23 - Enables LED 2 (bit 1 of 1)
- 24 - Disables LED 3 (bit 2 of 1)
- 25 - Enables LED 3 (bit 2 of 1)
- 26 - Disables LED 4 (bit 3 of 1)
- 27 - Enables LED 4 (bit 3 of 1)
- 28 - Disables LED 5 (bit 4 of 1)
- 29 - Enables LED 5 (bit 4 of 1)
- 2A - Disables LED 6 (bit 5 of 1)
- 2B - Enables LED 6 (bit 5 of 1)
- 2C - Disables alternating clock/timer display every 10 seconds.
- 2D - Enables alternating clock/timer display every 10 seconds.
- 2E - Disables above LEDs to send serial commands.
- 2F - Enables above LEDs to send serial commands.
- 40 - Sends "KP@", "KPa,... to "KP
- 7F commands on serial port.
- C0 - Executes internal button press commands.
- FF

Momentary button presses:

- C1 - Mode button
- C2 - Select button
- C3 - Alarm recall button
- C4 - Alarm activate button
- C5 - Recall preset 3 button
- C6 - Recall preset 2 button
- C7 - Recall preset 1 button
- C8 - Time of day clock button
- C9 - Alarm manual activate button
- CB - Timer Reset button
- CC - Timer Start/Stop button
- CD - Recall preset 4 button
- CE - Recall preset 5 button
- CF - Recall preset 6 button
- D1 - Cycle time display/activate button
- D5 - Remote Timer Start button
- D6 - Remote Timer Stop button
- D7 - Remote Timer Reset button
- D8 - Remote Tally UP button

Press and hold button presses:

- E1 - Beep button
- E2 - Yellow Blink and Yellow warning button

- E3 - Alarm save button
- E4 - Alarm de-activate button
- E5 - Store preset 3 button
- E6 - Store preset 2 button
- E7 - Store preset 1 button
- E8 - Time of day clock button
- E9 - Alarm manual activate button
- EB - Timer Reset button
- EC - Timer Start/Stop button
- ED - Store preset 4 button
- EE - Store preset 5 button
- EF - Store preset 6 button
- F1 - Remote alarm trigger edit button

Serial port command definitions

The DS-231 TimeKeeper™ can receive commands from other sources through a serial connection. The commands are sent in the form, "KPn, where n is the character command. The list below shows the available commands.

Commands received as momentary button presses:

- A - Mode button
- B - Select button
- C - Alarm recall button
- D - Alarm activate button
- E - Recall preset 3 button
- F - Recall preset 2 button
- G - Recall preset 1 button
- H - Time of day clock button
- I - Alarm manual activate button
- K - Timer Reset button
- L - Timer Start/Stop button
- M - Recall preset 4 button
- N - Recall preset 5 button
- O - Recall preset 6 button
- Q - Cycle time display/activate button
- U - Remote Timer Start button
- V - Remote Timer Stop button
- W - Remote Timer Reset button
- X - Remote Tally UP button

Commands received as press and hold button presses:

- a - Beep button
- b - Yellow Blink and Yellow warning button
- c - Alarm save button
- d - Alarm de-activate button
- e - Store preset 3 button
- f - Store preset 2 button
- g - Store preset 1 button
- h - Time of day clock button
- i - Alarm manual activate button
- k - Timer Reset button

- l - Timer Start/Stop button
- m - Store preset 4 button
- n - Store preset 5 button
- o - Store preset 6 button
- q - Remote alarm trigger edit button