

# MAX31341 RTC Shield Software User Guide

Abstract

This document provides the information to program and evaluate the MAX31341 real-time clock (RTC) on the MAX31341 shield board (MAX31341SHLD) using the provided GUI software.

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## **General Description**

The MAX31341 shield is a fully assembled and tested PCB to evaluate the MAX31341B/C, lowcurrent, real-time clock (RTC) with power management and I<sup>2</sup>C interface. The shield operates from a single supply, either from USB or external power, and the onboard crystal provides a 32.768 kHz clock signal. This device is accessed through an I<sup>2</sup>C serial interface provided by a MAX32625PICO board.

This document provides all the information to understand and use the various functions of the GUI software provided with the shield.

### Requirements

#### MAX31341 Shield

Figure 1 shows the MAX31341 shield. It contains a MAX31341B (WLP) and a MAX31341C (TDFN) soldered onto the board with test points for  $V_{CC}$ ,  $V_{BAT}$ , GND, INTA/CLKIN, and INTB/CLKOUT. A programmed MAX32625PICO board must be connected to connectors J1 and J2 (Figure 1).



Figure 1. MAX31341 shield with MAX32625PICO.

#### MAX31341 RTC Shield Software

Maxim Integrated provides a graphical user interface (GUI) application to communicate with and program the device registers. The GUI runs on Windows 7 or later, and provides a user-friendly approach to understand, program, and test the various functions of the device. The following sections explain this in detail.

## **Functional Description and Programming**

### Menu and Status Information

The GUI offers **File**, **Device**, and **Help** menus on the menu bar at the top of the window (Figure 2).

The **File Menu** has options to **Save and Load Configuration** information. This stores all the device register values to an .ini file that is loaded anytime later to restore the device state. The **Device Menu** can **Reconnect** to the shield if the need arises. The **Help menu** offers an option to open the **MAX31342SHLD webpage**.

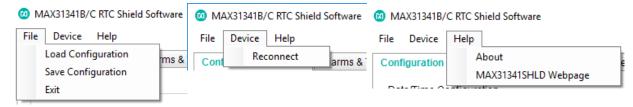


Figure 2. GUI menus.

The **status bar** at the bottom of the GUI shows the information on the software's mode of operation and shield board connection status. The **Status Log** tracks all the actions and outcomes of these actions (success/failure). These messages are also logged to an external file using the **Log to File** checkbox.

### **Configuration & Time Tab**

The GUI has four tabs with two more static group boxes to the right of the tabs.

figuration & Time	Alarms & Timer	Registers F	AM		Real Time Monitoring		
ate/Time Configurat	ion	Pov	ver Management Comparator Mode		Auto Update	:00:00	
Day (Sun-Sat) Sunday (1)			Power Mangement & 1	Frickle Charger 🔹	Day, Month dd, yyyy		
Hour (0-23) M		(0-59)	Trickle Charger	ect v	Interrupts & Flags		
		(0-199)	Supply Select	Power Fail Threshold	INTA	INTB	
01 💌	01 🔹 0	0 👻	Auto v	1.8V v	Interrupts	Flags	
	Set F	lead		Read	Alarm1 Interrupt	Alarm 1	
C Configuration					Alarm2 Interrupt	Alarm 2	
Oscillator Ena		A OD CLKIN	INTB CLKOU		AIN Interrupt	Timer Analog (AIN)	
Rd_RTC		1 Hz	1 Hz		D1 Interrupt	Digital (D1)	
Data Retentio		50 Hz	4.098 kHz 8.192 kHz		Disable OSF	OSF Loss Of Signal	
C Soft Reset		32.768 kHz	• 32.768 kHz	Read	Read	Read	
Log							
iresses found: 0xD2 (31341 I2C slave de						Log To File	

Figure 3. Configuration & Time tab.

The **Configuration & Time** tab (Figure 3) has options to configure the device and clocks, and program the date and time. This is the default tab that opens when the software launches. All the GUI fields are populated with the values read from the device if it is powered and connected to the PC at the software launch.

#### 1. Date/Time Configuration

This group box has combo boxes for **Hour**, **Min**, **Sec**, **Month**, **Date**, **Year**, and **Day** selections.

**Read:** The date and time values are read from the device using the **Read** button in this group box. The status log indicates when the read operation is complete and all the GUI elements in the group box are updated.

**Set:** Enter the desired date and time values by selecting valid values in all the combo boxes of this group box. Click the **Set** button to program these values to the device. The status log indicates when the operation is complete. This action starts the device's internal oscillator if it is not already running.

#### 2. RTC Configuration

Oscillator Enable: This toggle switch is used to enable or disable the internal oscillator.

**Rd\_RTC:** This toggle switch is used to toggle the Rd\_RTC bit in Config\_reg2 (01h). Reading the time registers returns the latest date/time values when enabled. Reading the time register returns the previously programmed date/time values when disabled. **Data Retention:** This toggle switch is used to enter or exit the data retention mode. The oscillator enable must be toggled after exiting the data retention mode for the date/time to resume ticking.

**Soft Reset:** This toggle switch is used to toggle the device between the reset and normal modes. The device goes through a digital reset when enabled. Disable the soft reset to bring the device back to the normal mode prior to any other task.

**INTA/CLKIN:** This toggle switch is used to toggle the INTA/CLKIN pin between the interrupt and CLKIN modes. The CLKIN Frequency radio buttons are used to select the reference CLKIN frequency. The CLKIN frequency, when in the CLKIN mode, also updates the Sync\_Delay bitfield in the Clock\_sync\_reg (58h) accordingly.

**INTB/CLKOUT:** This toggle switch is used to toggle the INTB/CLKOUT pin between the interrupt and CLKOUT modes. The CLKOUT Frequency radio buttons are used to select the desired CLKOUT frequency. Refer to the MAX31341B/C data sheet to determine which interrupt pin is used for an interrupt based on the CLKIN/CLKOUT selections.

**Read:** Press the Read button to read all the settings in this groupbox. The status log indicates when Read is complete.

#### 3. Power Management

**Comparator Mode:** This combo box is used to choose between the Power management and Trickle Charger mode or standalone AIN Interrupt mode (where the AIN pin is connected to an analog signal and the RTC is configured to raise an interrupt when the signal goes above/below a threshold value).

**Trickle Charger:** This combo box is only available in the Power Management and Trickle Charger mode. It selects the trickle charger resistor and diode configuration.

**Supply Select:** This combo box is only available in the Power Management and Trickle Charger mode. It manually selects the active supply rail ( $V_{CC}$  or AIN), or sets it to auto for automatic selection.

**Power Fail Threshold:** This combo box is only available in the Power Management and Trickle Charger mode. It selects the power fail threshold for automatic supply selection.

**Read:** Press the Read button to read all the settings in this groupbox. The status log indicates when the Read is complete.

#### **Real-Time Monitoring**

**Auto Update:** The software reads the date and time from the device at one second intervals when this checkbox is checked, and updates the date/time labels in this group box. No further reads happen when unchecked and the date/time labels remain static.

#### Interrupts & Flags

**Interrupt Indicators:** The label and color of the interrupt indicators indicate the state of the INTA and INTB pins on the shield board. These must be grey by default. The corresponding indicator turns green when an interrupt occurs and the pin is asserted. This is an indicator to read the flags.

These jumper settings must be made on the shield board for the feature to work correctly: JU6:1-3.

**Interrupt Checkboxes:** The **Alarm1, Alarm2, Timer, AlN, and D1 Interrupt** checkboxes is used to enable or disable the corresponding interrupts. The **Disable OSF** checkbox is used to enable or disable the OSF (oscillator stop flag) functionality.

**Read:** The **Read** button in the **Flags** group box is used to read the flags register and display the status of all flags. Asserted flags are displayed with a green highlight. Unasserted flags are greyed out.

The **Read** button within the **Interrupts & Flags** group box (outside the Flags group box) is used to read the current status of the interrupt enable bits and DOSF bit.

#### Alarms & Timer Tab

The **Alarms & Timer** tab covers the remaining device functions: Alarm 1, Alarm 2, Timer, and AIN/D1 Inputs (Figure 4)

#### 1. Alarm 1 Configuration

**Repetition Rate:** This combo box is used to select the alarm repetition rate. Perform this step first when configuring the alarm.

**Date/Time Selections:** Some or all of the remaining combo boxes in this group box are enabled based on the selected repetition rate. The exact alarm match condition are selected using these combo boxes.

**Read:** The **Read** button is used to read the current Alarm 1 configuration from the device.

#### 2. Alarm 2 Configuration

**Repetition Rate:** This combo box is used to select the alarm repetition rate. Perform this step first when configuring the alarm. Alarm 2 offers fewer repetition rates than Alarm 1.

**Date/Time Selections:** Some or all of the remaining combo boxes in this group box are enabled based on the selected repetition rate. The exact alarm match condition are selected using these combo boxes.

**Read:** The Read button is used to read the current Alarm 2 configuration from the device.

MAX31341B/C RTC Shield Software File Device Help		- D X
Configuration & Time Alarms & Timer Registers	RAM	Real Time Monitoring
Alarm 1 Configuration Repetition Rate Date, Time Match	Alarm 2 Configuration Repetition Rate Date, Hr, Min Match	O0:00:00 Day, Month dd, yyyy
Hour (0-23) Min (0-59) Sec (0-59) 0 • 00 • 00 • Date (1-31)	Hour (0-23) Min (0-59) Date (1-31)	Interrupts & Flags
Read Timer Configuration	Read Analog & Digital Inputs	Alarm1 Interrupt Alarm 1 Alarm2 Interrupt Alarm 2 Timer Interrupt Timer
Timer Enable Repeat Pause	AIN Polarity D1 Polarity Falling Edge    AIN Threshold  1.4V	AIN Interrupt     Analog (AIN)       D1 Interrupt     Digital (D1)       Disable OSF     OSF
Timer Count           0         Read	Read	Read Read
Status Log		Log To File Clear Log
Connected Mode		USB Connected

Figure 4. Alarms & Timer tab.

#### 3. Timer Configuration

**Timer Enable:** This checkbox is used to start/stop the timer. The timer starts counting down when checked. The timer is reset when unchecked.

**Pause:** The timer pauses at its current count when checked. The timer resumes counting when unchecked. This is used only when the timer enable is checked.

**Repeat:** The timer reloads its last unit value when checked and starts counting when it reaches zero. The timer stops after counting to zero when unchecked.

**Timer Frequency:** These radio buttons is used to select the frequency of the timer clock.

**Timer Init:** This combo box is used to select the timer initial value. This is an 8-bit field (0-255) and the timer starts counting down from this value when enabled.

**Timer Count:** This read-only field displays the timer count and updates on clicking the Read button.

**Read:** This button is used to read the current values of all timer fields from the device and display them in this group box.

#### 4. Analog & Digital Inputs

**AIN Polarity:** This combo box is used to choose a falling or rising edge polarity for the analog input (AIN) interrupt.

**AIN Threshold:** This combo box is used to choose the threshold for the AIN interrupt comparator.

**D1 Polarity:** This combo box is used to choose a falling or rising edge polarity for the digital input (D1) interrupt.

**Read:** This button is used to read the current values of all the AIN/D1 configurations.

#### **Registers Tab**

The **Register** tab provides access to all device registers (Figure 5).

Select the corresponding checkboxes and click Read to read registers.

Enter the desired 8-bit value in the hexadecimal format (e.g., 0xAB) in the corresponding **Value** field, select the corresponding checkboxes, and click **Write** to write to the registers.

The status log indicates success/failure of the register read/write action.

guration & Reg	Time /	Alarms & Timer	Registers	RAM						Real Time Monitoring	
	Addr	Reg Name	R/W	Value	Desel All	^				0	0:00:00
	0x00	Config_reg1	R/W	0x01		1				Day, Mo	onth dd, yyyy
	0x01	Config_reg2	R/W	0x1C							
	0x02	Int_polarity_config	R/W	0x00						Interrupts & Flags	
	0x03	Timer_config	R/W	0x07						INTA	INTB
	0x04	Int_en_reg	R/W	0x00						INIA	
	0x05	Int_status_reg	RC	0x40							
	0x06	Seconds	R/W	0x00						Interrupts	Flags
	0x07	Minutes	R/W	0x00	$\checkmark$					Alarm1 Interrupt	Alarm 1
	0x08	Hours	R/W	0x00						Alarm2 Interrupt	
	0x09	Day	R/W	0x01	$\checkmark$						
	0x0A	Date	R/W	0x01						Timer Interrupt	Timer
	0x0B	Month	R/W	0x01						AIN Interrupt	Analog (AIN)
	0x0C	Year	R/W	0x00						D1 Interrupt	Digital (D1)
	0x0D	Alm1_sec	R/W	0x00							
	0x0E	Alm1_min	R/W	0x00				Dent		Disable OSF	OSF
	0x0F	Alm1_hrs	R/W	0x00				Read			Loss Of Signal
	0x10	Alm1day_date	R/W	0x00							
	0x11	Alm2_min	R/W	0x00	$\checkmark$	$\mathbf{v}$		Write		Read	Read
.og									, 		
.09											*
											Log To Fil

Figure 5. Registers tab.

#### RAM Tab

The **RAM** tab provides access to all the 64 bytes of the RAM registers (Figure 6).

Select the corresponding checkboxes and click **Read** to read the RAM registers.

Enter the desired 8-bit value in the hexadecimal format (e.g. 0xAB) in the corresponding **Value** field, select the corresponding checkboxes, and click **Write** to write to the RAM registers.

onfiguration &	Time Ala	arms & Timer	Registers	RAM			Real Time Monitor	ing	
RA	М						Auto Update		00.00
	Addr	Reg Name	R/W	Value	Desel All	^			00:00
	0x16	RAM_Reg_0	R/W	0x00			Day	, Mon	th dd, yyyy
	0x17	RAM_Reg_1	R/W	0x00	$\checkmark$				
	0x18	RAM_Reg_2	R/W	0x00			Interrupts & Flags		
	0x19	RAM_Reg_3	R/W	0x00			INT	A	INTB
	0x1A	RAM_Reg_4	R/W	0x00					
	0x1B	RAM_Reg_5	R/W	0x00			Internet		Flags
	0x1C	RAM_Reg_6	R/W	0x00			Interrupts		Гауз
	0x1D	RAM_Reg_7	R/W	0x00			Alarm1 Inte	errupt	Alarm 1
	0x1E	RAM_Reg_8	R/W	0x00			Alarm2 Inte	errupt	Alarm 2
	0x1F 0x20	RAM_Reg_9	R/W R/W	0x00 0x00			Timer Inter	runt	Timer
	0x20	RAM_Reg_10 RAM_Reg_11		0x00					
	0x22	RAM_Reg_12		0x00			AIN Interru	pt	Analog (AIN)
	0x23	RAM_Reg_13		0x00			D1 Interrup	t	Digital (D1)
	0x24	RAM_Reg_14		0x00			Disable OS	F	OSF
	0x25	RAM_Reg_15		0x00					Loss Of Signal
	0x26	RAM_Reg_16	R/W	0x00					LUSS OF Signal
	0x27	RAM_Reg_17	R/W	0x00		~	Rea	ad	Read
us Log									
Jo Log									
									Log To File
									Clear Log

The status log indicates success/failure of the register read/write action.

Figure 6. RAM Registers tab.