

i³ RTC Tutorial



Introduction

The purpose of this tutorial is to demonstrate the RTC functions of the i3 by programming a simple time-based operation process, ie. Green House watering system.

The tutorial will also demonstrate one way to set the RTC clock, using the S_Clk function and user entry into registers through the screen. A method of synchronising the clock with the PC will be shown also.

The program will then go on to operate outputs at specific times through a working day in a working week.

The i3 has a Real Time Clock (RTC) that allows operations to be activated at specific times and on specific days. The i3 RTC is intelligent in that i3 knows how many days are in a particular month and so invalid dates will not be accepted.

Operations can be set to go ON at a particular time on a particular day of the month for a set amount of time and then turn off. For example, we can set a pump running for the time between 8am and 9 am every Tuesday of the Month of May, in the year 2006.

Programming the Real Time Clock Functions

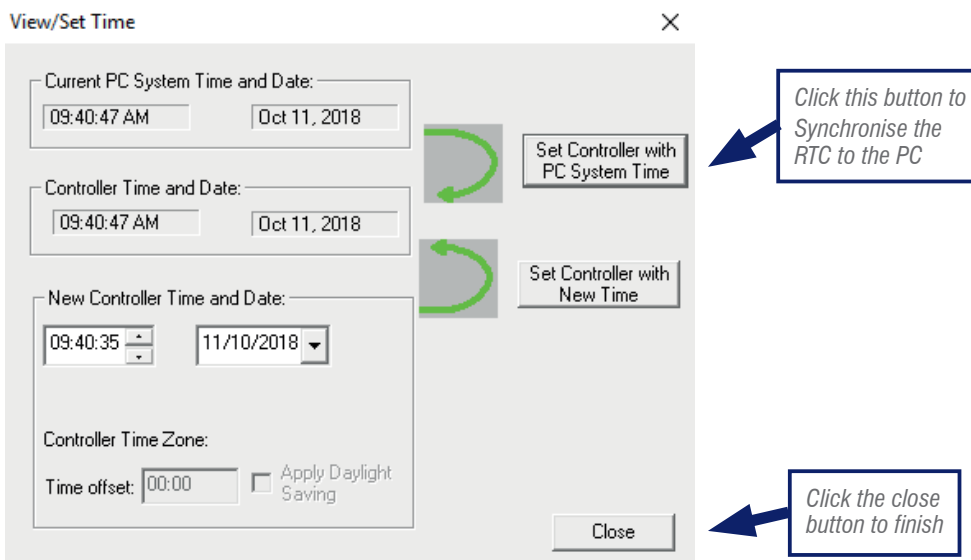
There is only one specific time function and that is to set the RTC clock. This is not the only way to set the clock as it can be synchronised with the PC.

To use the RTC we need to use the comparison functions and the specific System Registers where the time is stored.

SR Number	Description	Name	Limits
%SR0044	RTC Seconds	RTC_SEC	0-59
%SR0045	RTC Minutes	RTC_MIN	0-59
%SR0046	RTC Hours	RTC_HOUR	0-23
%SR0047	RTC Day of the Month	RTC_DATE	1-31
%SR0048	RTC Month	RTC_MON	1-12 (1=January)
%SR0049	RTC Year	RTC_YEAR	1996 - 2095
%SR0050	RTC Day of the Week	RTC_DAY	1-7 (1=Sunday)

Synchronising the RTC with the PC

Connect the i3 to the PC using the programming cable and configure the I/O. Select from the controller menu "View/Set Clock"



The screenshot shows the 'View/Set Time' dialog box. It contains three main sections for time and date configuration, each with a corresponding button to set the controller time. Green arrows point from the buttons to the annotations on the right.

- Current PC System Time and Date:** 09:40:47 AM, Oct 11, 2018. Button: **Set Controller with PC System Time**. Annotation: *Click this button to Synchronise the RTC to the PC*
- Controller Time and Date:** 09:40:47 AM, Oct 11, 2018. Button: **Set Controller with New Time**
- New Controller Time and Date:** 09:40:35, 11/10/2018. Button: **Close**. Annotation: *Click the close button to finish*

Additional options include **Controller Time Zone:** Time offset: 00:00, and a checkbox for **Apply Daylight Saving**.

Changing the RTC values through Ladder Logic

Select the S_Clk function icon from the Special Functions menu.



Select the function and insert it into the ladder diagram.

Enter the starting register that will contain data to be moved into the SR register. The next 6 adjacent registers will also be used.

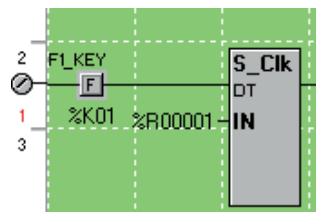
Set Real Time Clock [X]

Source
Address: Name:

Destination
Real Time Clock

Count (Sec, Min, Hour, Day, Month, Year)

Insert a NO contact and assign it to the 1st function key.

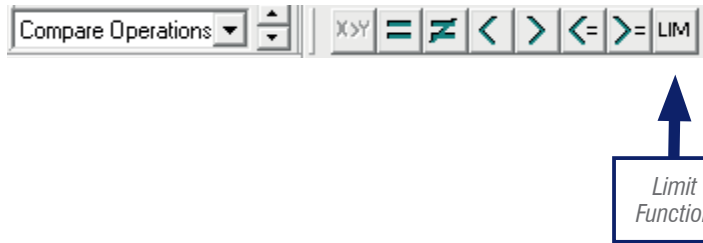


The RTC will be updated with the values in registers %R01 to %R06 when the F1 key is pressed.

There will be two screens associated with this piece of code; One to enter the values into the registers %R01 to %R06 and a second to view the current time and date of the RTC.

Programming the Compare Functions with the RTC

We are first going to ensure that the day is a working day and that the hours are office hours. We are going to use Limit functions from the Compare Operations menu.



Insert a N/O contact and assign it to %S07, Always On. Next select the Limit function and insert it on the same Rung.

Limit Function

Low: 1 Name:

Input: %SR050 Name: RTC_DAY

High: 5 Name:

Type: INT

OK Cancel

Insert the following data to check whether or not the day lies in the working week and click OK. Enter another Limit function to check if it falls between office hours.

Limit Function

Low: 9 Name:

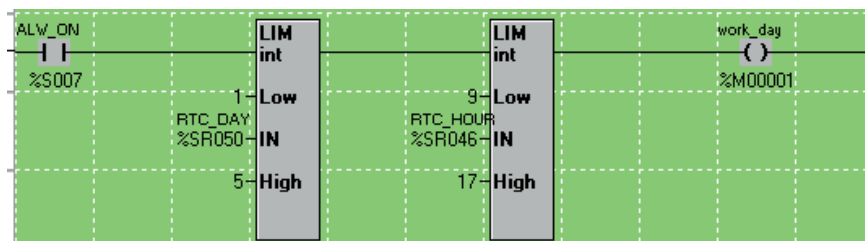
Input: %SR046 Name: RTC_HOUR

High: 17 Name:

Type: INT

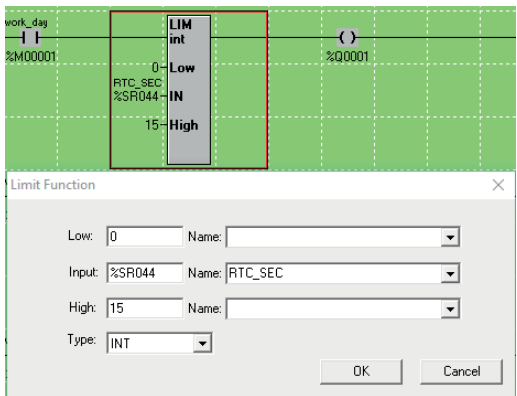
OK Cancel

Insert the data shown to ensure that the hours are between 9am and 5pm. Finally enter a NO coil after the two Limit functions, assign it to %M01. This coil will be operated when both functions are true.



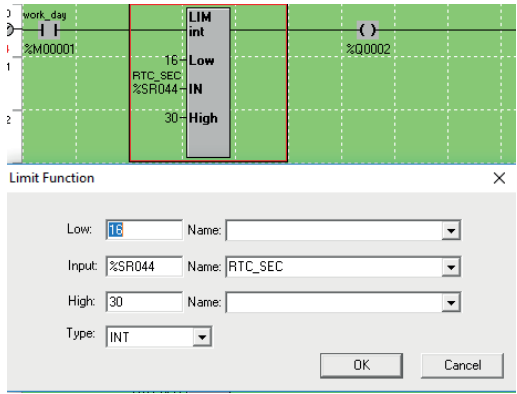
Next, we need to set up the four outputs to come on individually in the four different quadrants of a minute. Output %Q01 will be on between 0-15s, %Q02 16-30s, %Q03 31-45s and %Q04 46-59s. However, they will only come on if it is during the working period.

Start a new Rung with a N/O coil and assign it to %M01. On the same Rung insert a Limit function with the limits for %Q01. After the limit function insert a N/O coil and assign it to %Q01.

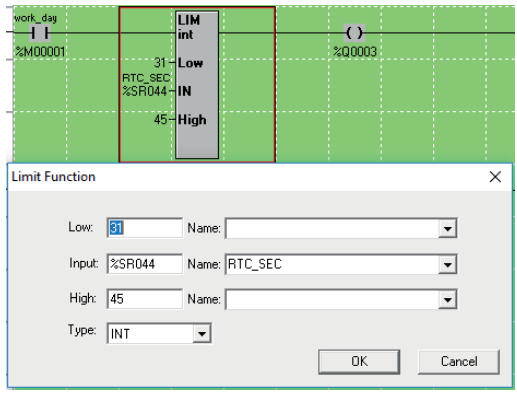


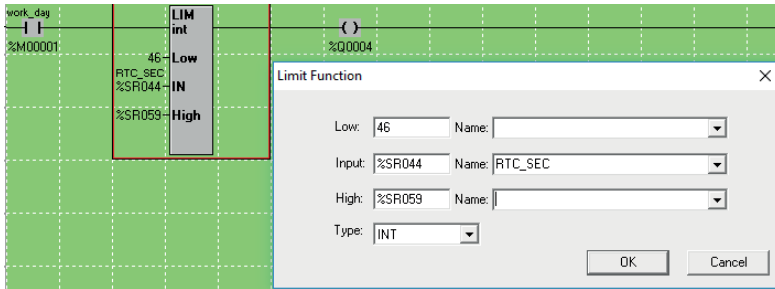
Repeat this code for the remaining outputs.

Output %Q02



Output %Q03





There will be one HMI screen to illustrate the outputs on during the cycle time.

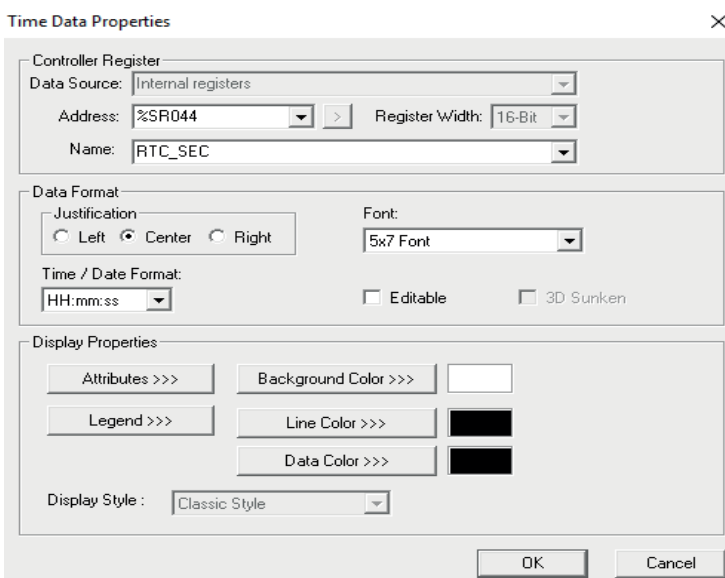
Screen Editor Programming

We need to program three screens.

1. The initial screen will display the RTC current time and date and have two screen jump buttons: one to jump to the setting the RTC screen, with the second to jump to the output cycle screen.
2. The RTC setting screen will have 6 numeric data entries and a screen jump button to go back to the initial screen.
3. Output cycle screen will have 4 lamps to display the state of %Q01 to %Q04. There will also be a numeric data function to display the RTC seconds and a text table to display the RTC day of the week.

Initial Screen

Click the Time Data icon  and insert it into the screen. Position it to the top left of the screen. Double click and enter the data as shown.

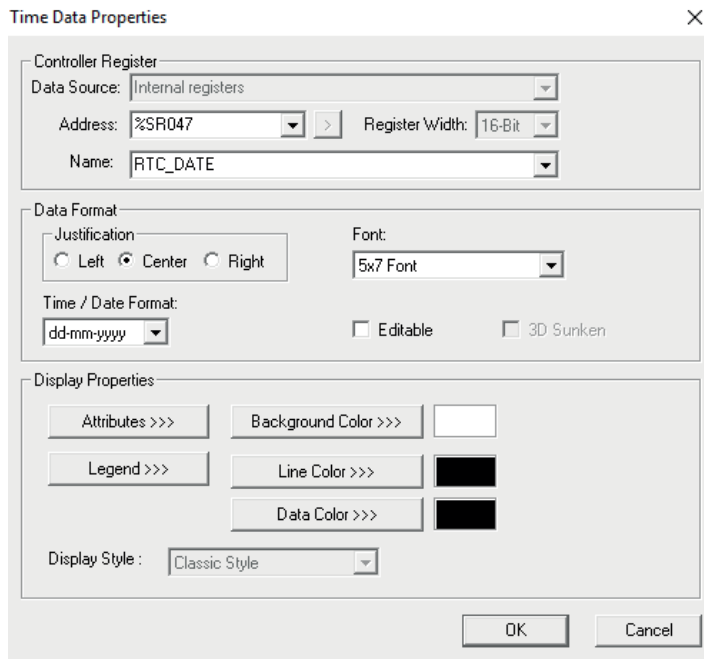


Enter the starting register as %SR044 and the next 2 registers will also be used. This will provide the hours, minutes and seconds for display.

Select the format HH:mm:ss

Click OK when complete.

Select another Time Data function to display the current date.



Time Data Properties

Controller Register
 Data Source: Internal registers
 Address: %SR047 Register Width: 16-Bit
 Name: RTC_DATE

Data Format
 Justification: ☐ Left ☒ Center ☐ Right
 Font: 5x7 Font
 Time / Date Format: dd-mm-yyyy
☐ Editable ☐ 3D Sunken

Display Properties
 Attributes >>> Background Color >>>
 Legend >>> Line Color >>>
 Data Color >>>
 Display Style: Classic Style

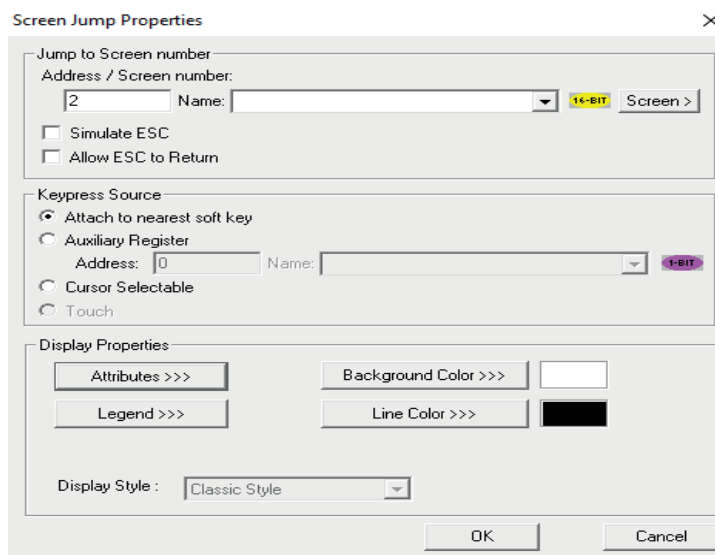
OK Cancel

Select %SR047, RTC_Date as the starting register to display the date.

Select the format: dd-mm-yyyy

Click OK when complete.

Finally select the screen jump icon  , to insert two screen jumps.



Screen Jump Properties

Jump to Screen number
 Address / Screen number: 2 Name: 16-BIT Screen >
☐ Simulate ESC
☐ Allow ESC to Return

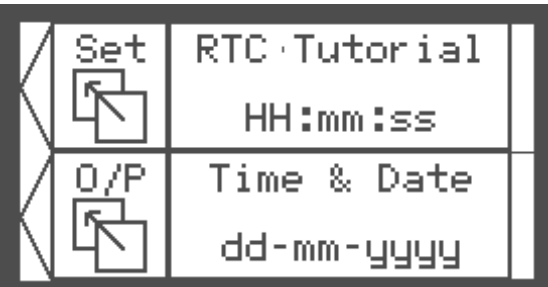
Keypress Source
☒ Attach to nearest soft key
☐ Auxiliary Register
 Address: 0 Name: 16-BIT
☐ Cursor Selectable
☐ Touch

Display Properties
 Attributes >>> Background Color >>>
 Legend >>> Line Color >>>
 Display Style: Classic Style


OK Cancel

Set the first screen jump to jump to screen 2, with the legend set and the second to jump to screen 3, with the legend O/P.

The initial screen should now look something like the screen opposite.



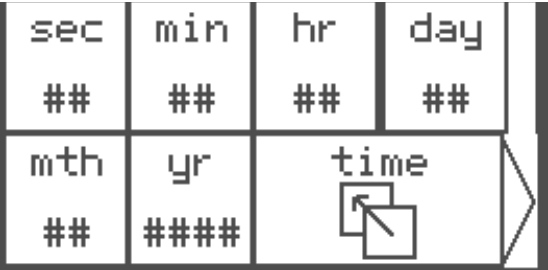
RTC Setting Screen

Select the data numeric function icon  and insert it to the screen. We need to set up six such numeric functions for seconds, minutes, hours, date, month and year.

Enter the following data into 6 numeric data functions, all of which should be “editable”.


Register	Legend	Digits to display	Min-Max entry
%R01	Sec	2	0-59
%R02	Min	2	0-59
%R03	Hr	2	0-23
%R04	Day	2	1-31
%R05	Mth	2	1-12
%R06	Yr	4	1996 - 2095

Finally insert a screen jump function to go back to the initial screen.



The second screen should now look like the screen opposite.

Output Cycle Screen

Select the numeric data function icon  and insert it into the screen. Position it in the top right and enter the following details.

Legend Properties

Text:

Justification: ☐ Left ☒ Center ☐ Right

☐ Vertical Text

Insert Special Char >>>

Display Properties

Font:

OK Cancel

Numeric Data Properties

Controller Register

Data Source:

Address: Register Width:

Name:

Display Format

Format:

Engineering Units:

☐ Zero Filled ☐ 3D Sunken

Font: Scaling >>>

Justification

☐ XXX.X ☒ _XXX.X ☐ _XXX.X

Edit/Write

☐ Enabled Minimum: Maximum:

Display Properties

Attributes >>> Background Color >>>

Legend >>> Line Color >>>

Data Color >>>

Display Style:

OK Cancel

Next select the text table icon  and insert into the screen.

Text Table Data Properties

Controller Register

Data Source:

Address: Register Width:

Name:

Data Format

Justification: ☐ Left ☒ Center ☐ Right

Font:

Digits: Text Table Number:

☐ Editable ☐ 3D Sunken

Display Properties

Attributes >>> Background Color >>>

Legend >>> Line Color >>>

Data Color >>>

Display Style:

OK Cancel

Edit/View Text Tables

Value	Text
1	Sunday
2	Monday
3	Tuesday
4	Wednesday
5	Thursday
6	Friday
7	Saturday

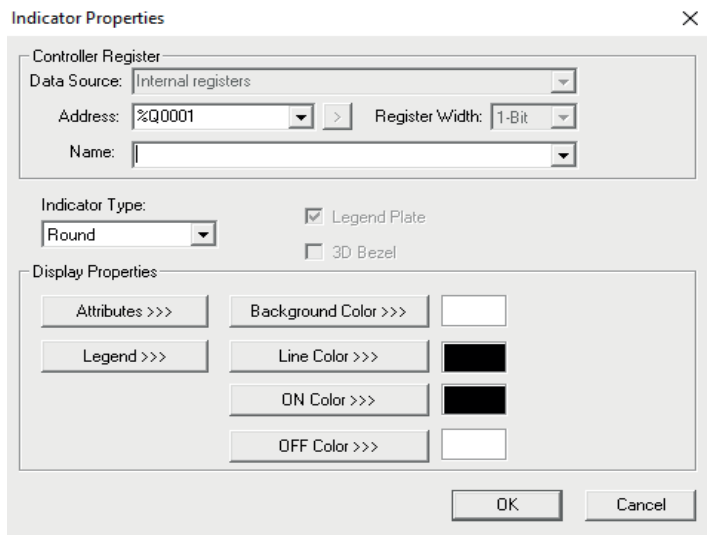
Table Number:

Add Edit Remove Import Export


OK

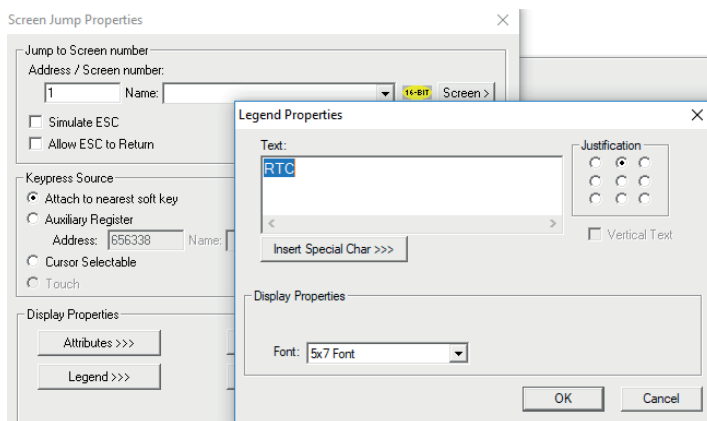
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Now select the lamp icon  and insert lamps for the outputs %Q01 to %Q04.



The 'Indicator Properties' dialog box is shown. It has a 'Controller Register' section with 'Data Source' set to 'Internal registers', 'Address' set to '%Q0001', and 'Register Width' set to '1-Bit'. The 'Name' field is empty. Below this is the 'Indicator Type' section with 'Round' selected and 'Legend Plate' checked. The 'Display Properties' section contains buttons for 'Attributes >>>', 'Legend >>>', 'Background Color >>>', 'Line Color >>>', 'ON Color >>>', and 'OFF Color >>>'. The 'OK' and 'Cancel' buttons are at the bottom right.

Lastly select the screen jump icon  to insert a screen jump back to the initial



Two dialog boxes are shown. The 'Screen Jump Properties' dialog box has 'Jump to Screen number' selected, 'Address / Screen number' set to '1', and 'Name' set to 'Screen'. The 'Legend Properties' dialog box is overlaid on it, showing 'Text' set to 'RTC' and 'Font' set to '5x7 Font'. The 'OK' and 'Cancel' buttons are at the bottom right of the 'Legend Properties' dialog box.

The final screen should now look like the screen below.



Please see the i3-Configurator tutorial program "rtc-tut.csp"