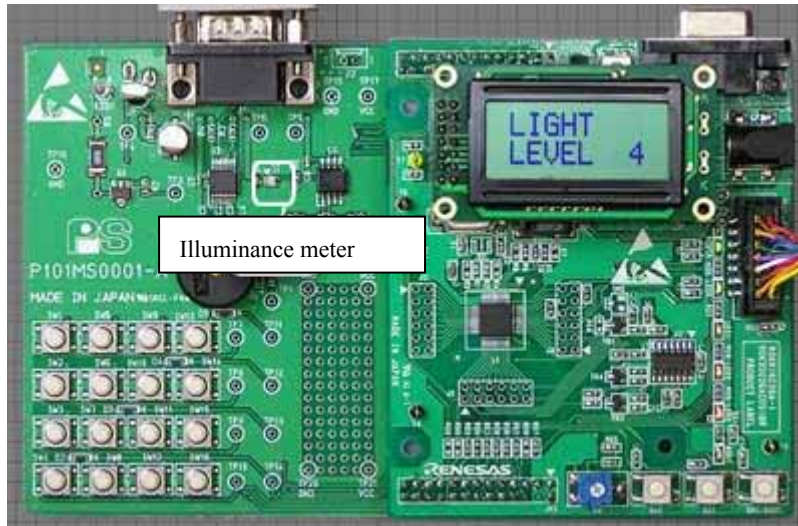


M16C/26A Group

Sample Program (Lux Meter)

1. Summary

This sample program provides the functionality of a lux, or illuminance meter by using the Renesas Starter Kit for M16C/26A (R0K33026AS000BE) and an extension board.



The extension board used here is a product from PI System Co., Ltd.

2. Introduction

The example described in this document applies to the microcomputers listed below:

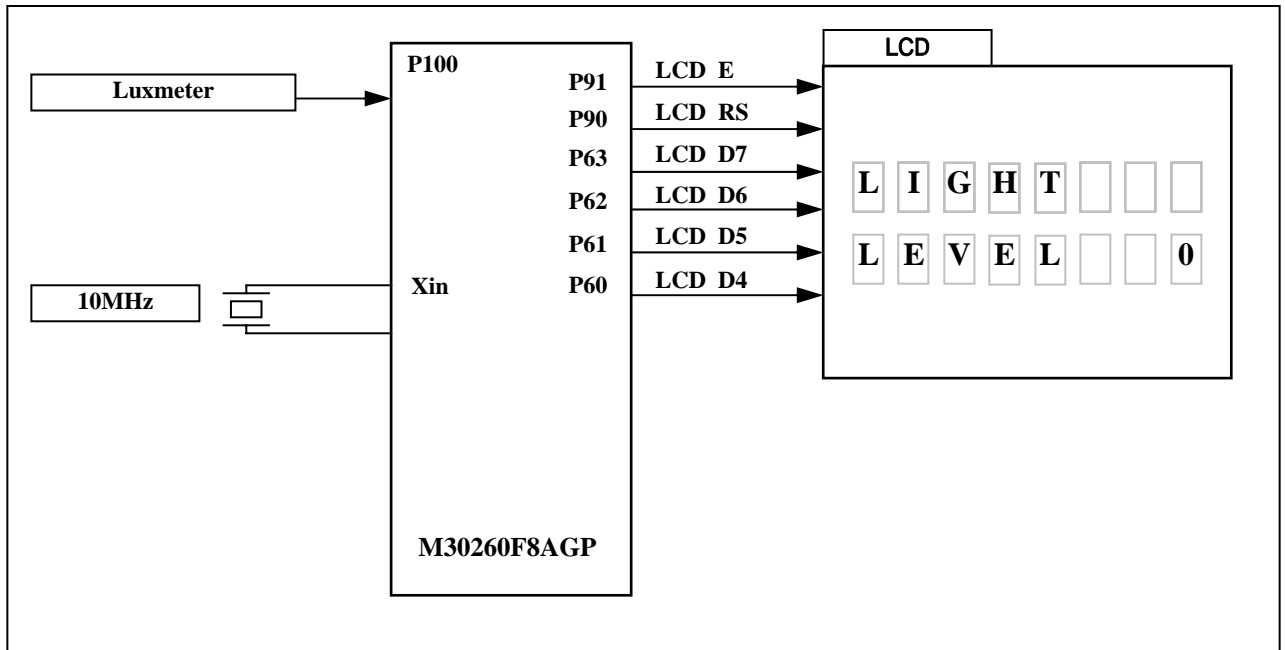
Microcomputers: M16C26A

This sample program runs on the Renesas Starter Kit for M16C/26A (R0K33026AS000BE).

Prepare an extension board available for the Renesas Starter Kit or create a circuit similar to the one shown in the example circuit on page 13 and then connect it to the Starter Kit.

This program uses RSK_LIB. For details about RSK_LIB, see the RSK_LIB reference manual. (RSK_LIB is the library software provided for use with the Renesas Starter Kit for M16C/26A.)

3. Port Arrangement



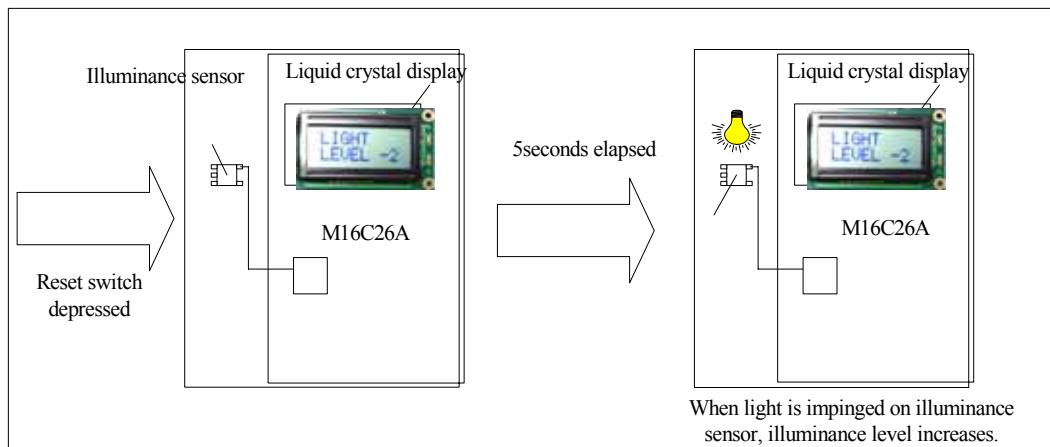
4. Operational Outline

Illuminance levels (−4 to 4) are shown on liquid crystal display by using an illuminance sensor.

Determine the criterion for brightness in 5 seconds after the pressing the reset switch.

Then, when light is impinging on the illuminance sensor to increase brightness, the illuminance level displayed on LCD changes from 0 to 1, 2, 3 and 4.

Conversely, when brightness is reduced, the illuminance level displayed on LCD changes from 0 to $\bar{1}$, $\bar{2}$, $\bar{3}$ and $\bar{4}$.



- Timer A0 (timer mode, main 2 ms cycle)
 - This timer counts 2 milliseconds using the main clock of the microcomputer as the count source.
 - It is used as the basic timer of RSK_LIB.
 - Time management, LCD display management and AD input are performed using this timer.
- AD0 (single-shot mode, illuminance input measurement)
 - Analog voltages are converted to digital data using the main clock of the microcomputer as a conversion clock.
 - More specifically, the analog voltages output from the illuminance sensor are A/D converted.

5. Operational Specification

- (1) The AD value is read-in for 5 seconds after the reset switch is depressed, and the values read during that time are averaged to yield an initial illuminance.
- (2) The initial illuminance “0” is displayed.
The initial illuminance and the current illuminance levels are compared in Table 1.

* The AD values are set by calling the common function “AD average” (RL_AdVeraging). Within the function, a value is sampled 6 times, and the sampled values except the maximum and minimum values are averaged, the result of which is returned. This average value is acquired 8 times, the average of which is made a fixed value.

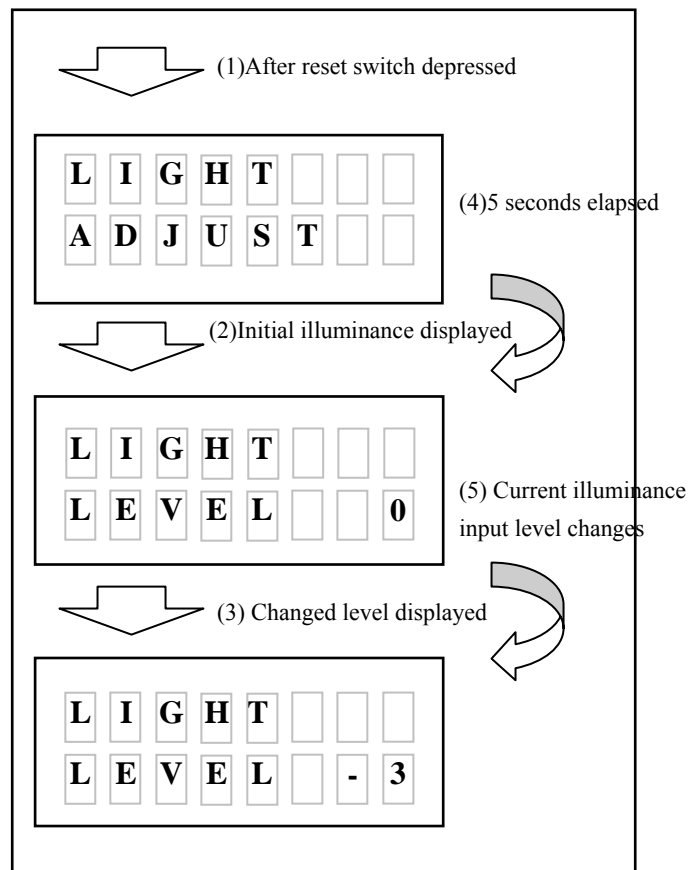


Figure 2. Example of Program Operation

Table 1. Initial Illuminance and Current Illuminance Levels

Initial illuminance level	- 0.70V	- 1.10V	- 1.60V	1.60V -
Displayed level	-4	- 0.10V	- 0.40V	- 0.90V
	-3	- 0.30V	- 0.60V	- 1.10V
	-2	- 0.50V	- 0.80V	- 1.30V
	-1	- 0.60V	- 1.00V	- 1.50V
	0	- 0.80V	- 1.20V	- 1.70V
	1	- 1.00V	- 1.40V	- 1.90V
	2	- 1.20V	- 1.60V	- 2.10V
	3	- 1.40V	- 1.80V	- 2.30V
4	1.40 V -	1.80V -	2.30V -	2.60V -

6. Definition of the RSK Functionality and the RSK_LIB APIs and Common Functions Used by the Lux Meter

6.1 Definition of the RSK Functionality

RSKdefine.h file

In this application, the following functionalities (those shown in red) are set.

```

/*****
    The boot information on CPU is defined
    Usually, this mode is used
    *****/
#define _CPU_M16C26A_NORMAL_MOD
/* Use in low power mode can be performed. */
//#define _CPU_M16C26A_32KHZ_MOD
/* Use of access of a flash can be performed. */
//#define _CPU_M16C26A_DATAFLASF_USE
/*****
    The hardware function which RSK supports is chosen
    *****/
#define _USE_KEY
#define _USE_BUZZER
#define _OPTION_USE_AD
#define _OPTION_USE_COM_RX
#define _OPTION_USE_COM_TX
#define _OPTION_USE_INFRAEDRX
#define _OPTION_USE_INFRAEDTX
#define _OPTION_USE_SW
#define _OPTION_USE_LED
#define _OPTION_USE_IO
    
```

Individual definition of each selected functionality

```

#if defined _OPTION_USE_AD
    /* Define Illumimeter Adc */
    #define _OPTION_USE_AD0
    /* Define Vr Adc */
    //#define _OPTION_USE_AD24
#endif
    
```

→ Lux meter input AD

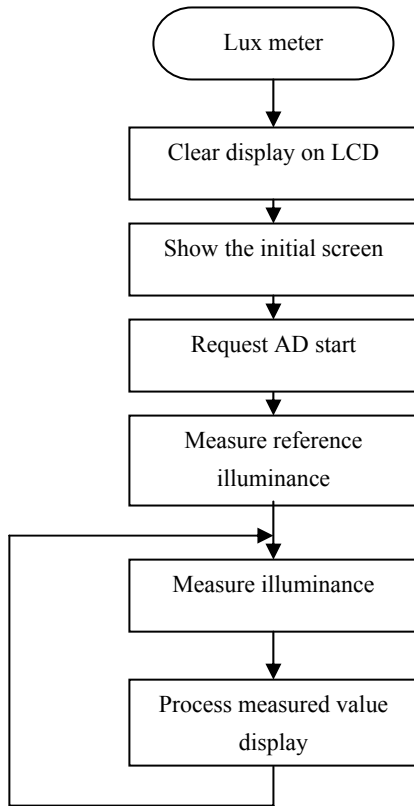
6.2 APIs and Common Functions Used

```
ApiStatusType RL_SefTimerReq( unsigned int TimerValue, char TimerMode, int *TimerNo, int *ERcode );
ApiStatusType RL_StartTimer( int TimerNo, int *ERcode );
ApiStatusType RL_CheckTimer( int TimerNo, int *ERcode );
ApiStatusType RL_CancelTimer( int TimerNo, int *ERcode );
ApiStatusType RL_Putc_Lcd( char Ylocation, char outc, int *ERcode );
                          *ERcode );
ApiStatusType RL_Putc_LcdLoc( char Xlocation, char Ylocation, char RvTime, char outc, int *ERcode );
ApiStatusType RL_Puts_LcdLoc( char Xlocation, char Ylocation, char RvTime, const char far* outc, int
                          *ERcode );

ApiStatusType RL_Start_Adc( int AdIdentfier, int *ERcode );
int RL_AdAveraging( int AdLogicalNo, int *AdAverage, int *ERcode );
void RL_ErrorHook( int FuncNo, int ErrorNo );
```

For details about the APIs and common functions used by the sample program (lux meter), see the Renesas Starter Kit Library V.1.00 Reference Manual.

7. Flowchart

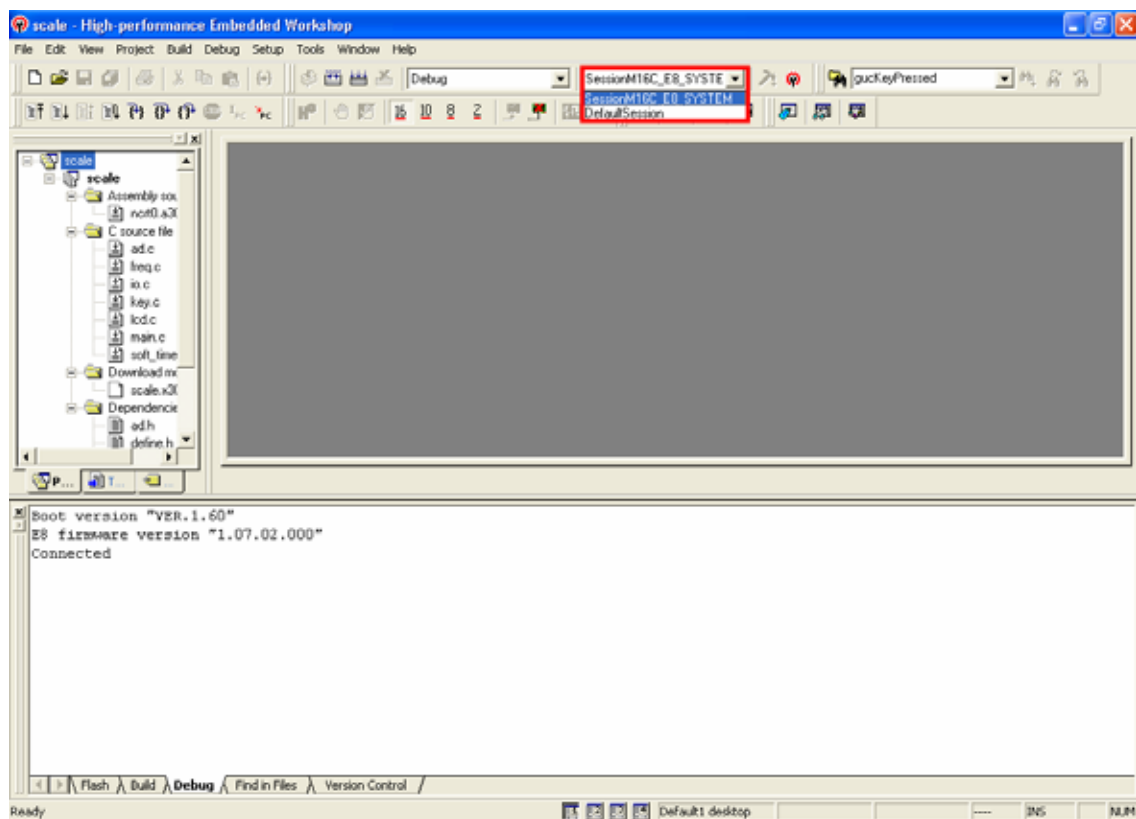


8. Tutorial

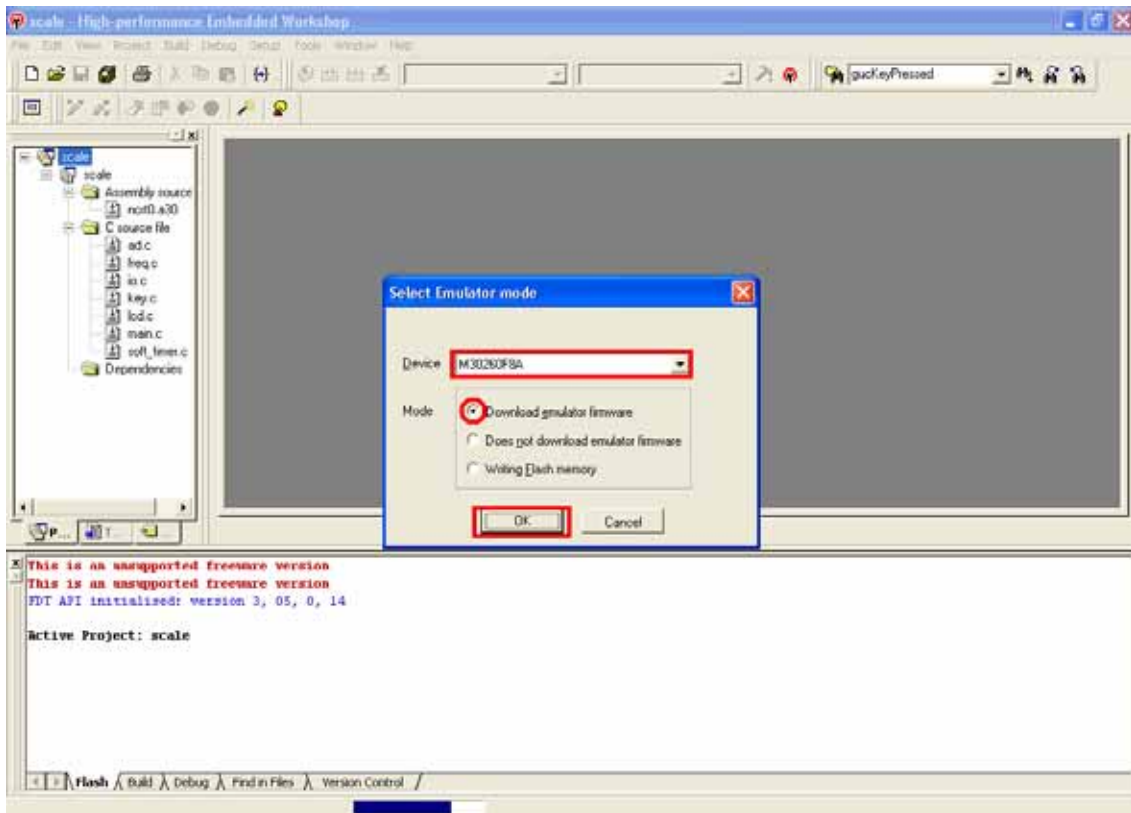
- 1 Launch the HEW by double-clicking its icon.



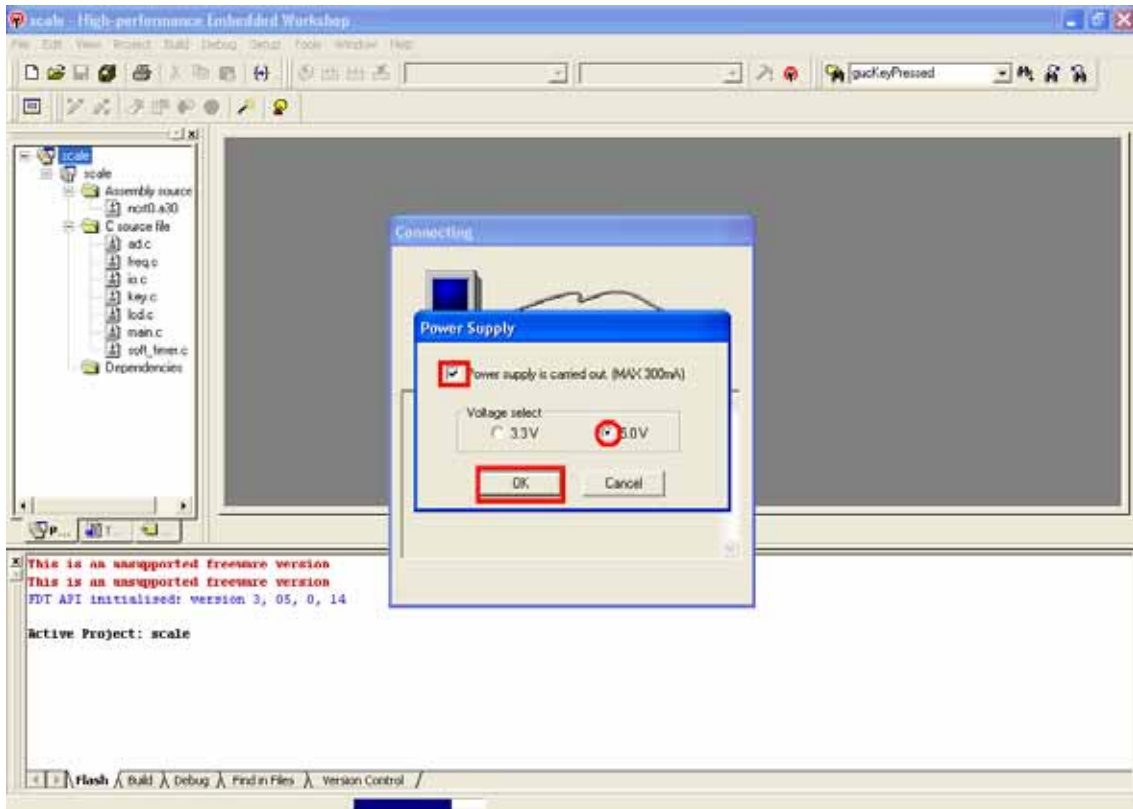
- 2 Change the session name from “default Session” to “SessionM16C_E8_System.”



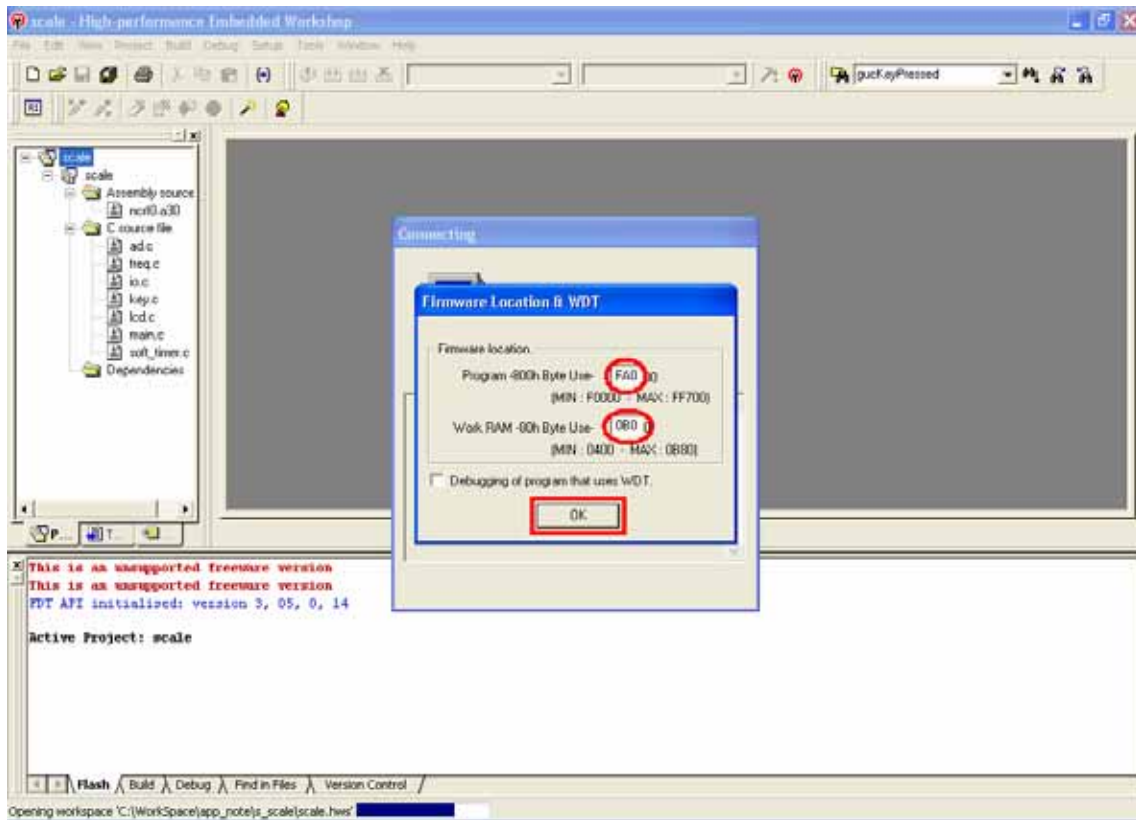
- 3 Select "M30260F8A" for Device.
Select "Download emulator firmware" for Mode.



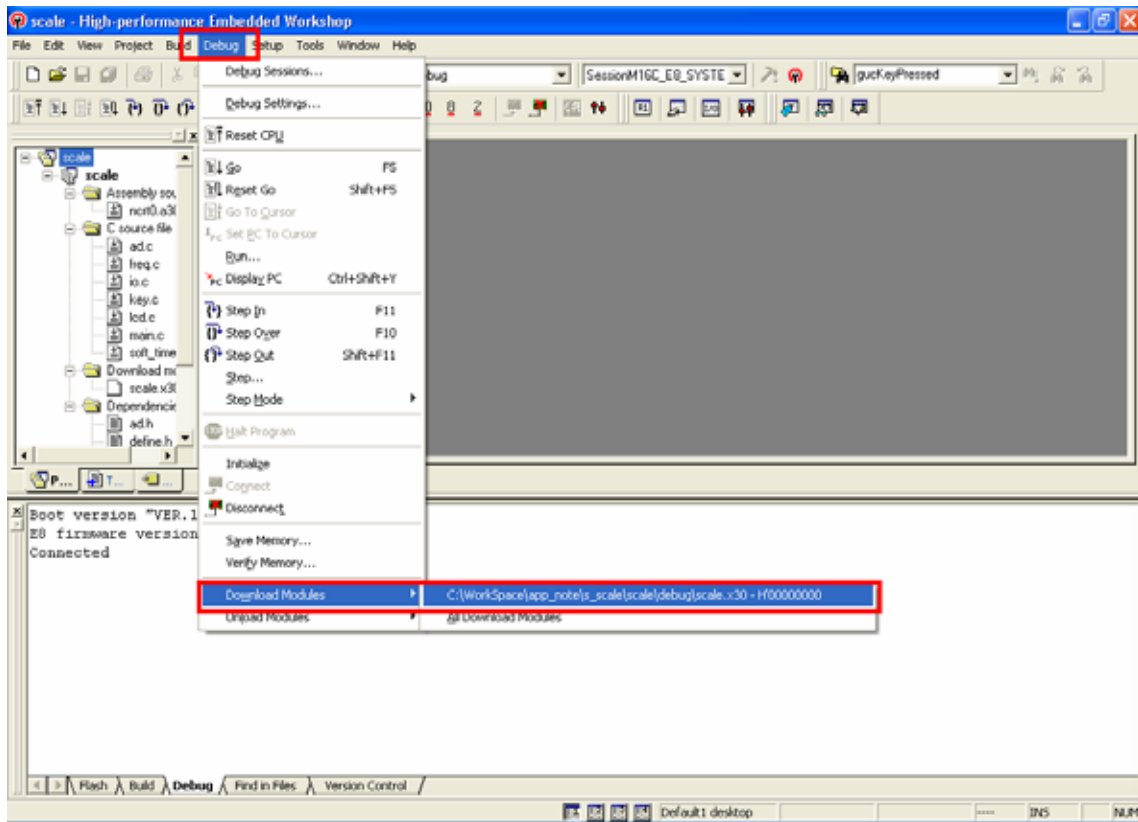
Check the box labeled “Power supply is carried out. (MAX 300mA)” and then select “5.0V.”



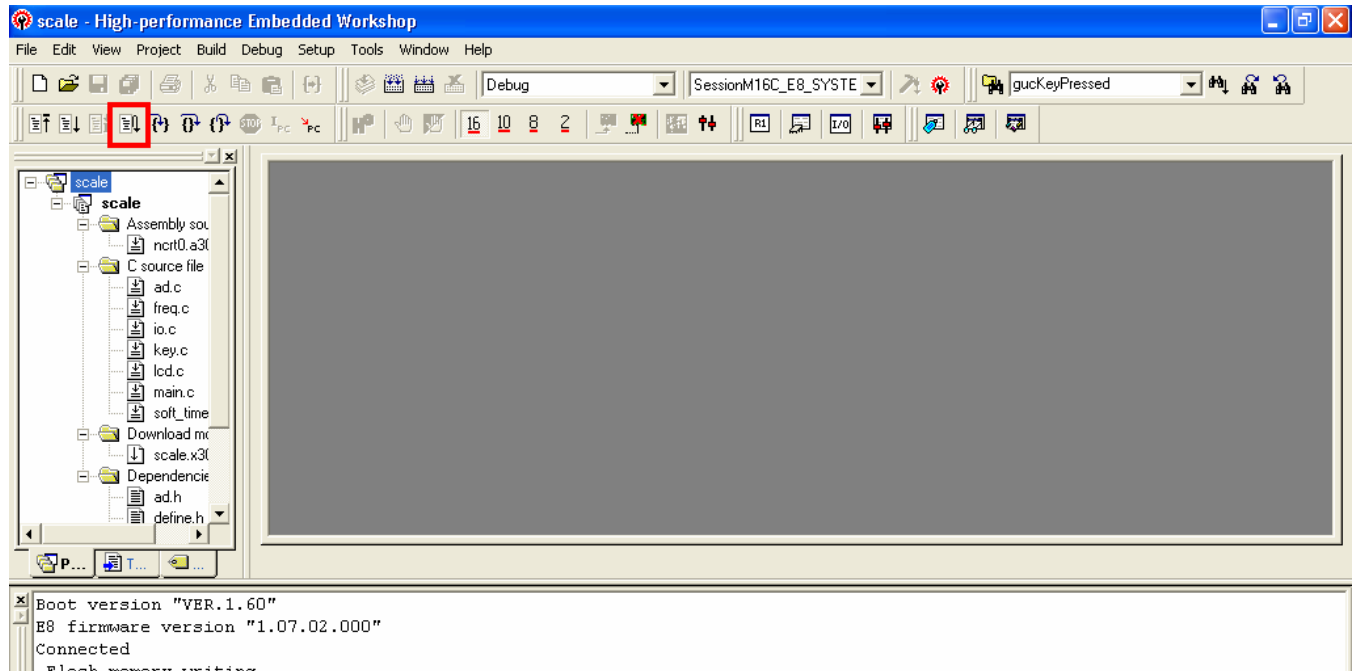
- 4 In the program and the work RAM text boxes of Firmware Location Address, enter “FA0” and “0B8” respectively. Leave the box labeled “Debug a program using the WDT” unchecked.



- 5 Choose **Download** from the **Debug** tab and download a module.
The upper-side choices for **Download** show the location from which a project was downloaded.

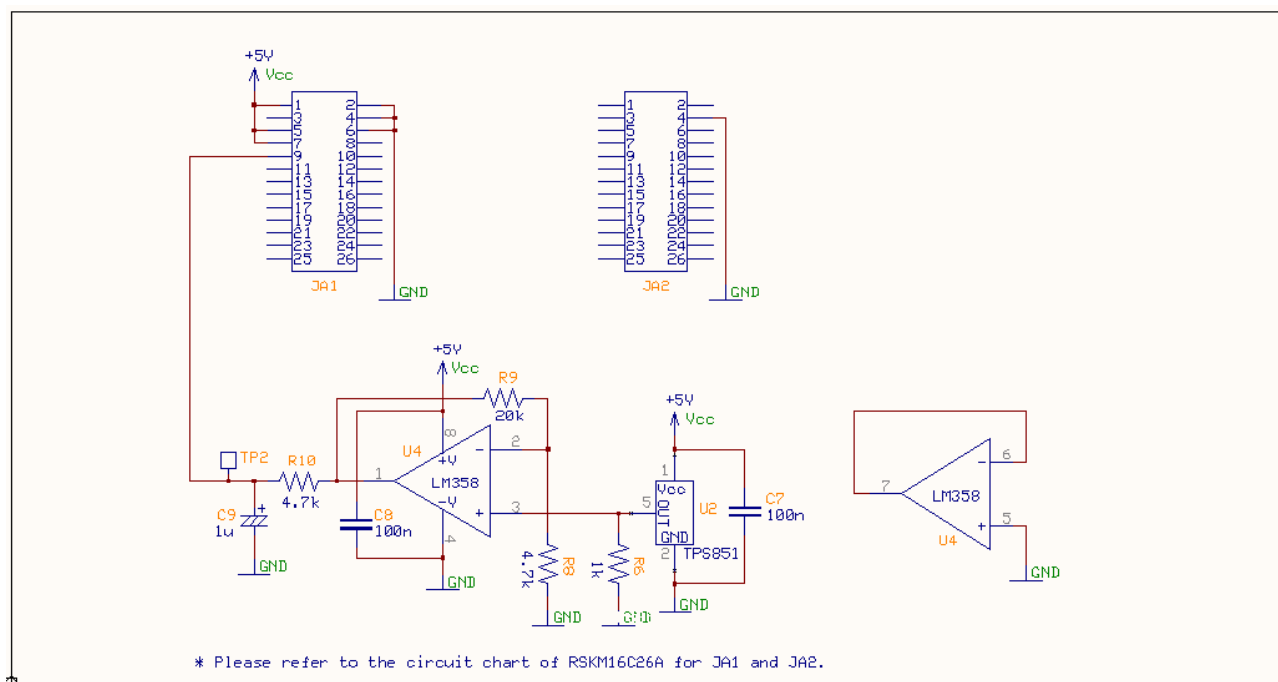


- Click "Start after Reset" to start program execution.



- Please do "Cancellation" when "The file is opened" window opens.

9. Example Circuit



10. Part List

Part name	Part No.	Q'ty	Manufacturer	Type number	Value	Remark
Illuminance sensor	U2	1	TOSHIBA	TPS851		
Op-amp	U4	1	TI	LM358PSR		
Laminated ceramic capacitor	C7 - C8	2	Panasonic	ECJ-1VF1H104	100nF/50V	
Electrolytic capacitor	C9	1	Panasonic	ECE-V1HS010SR	1uF/50V	
Chip resistor	R6	1	ROHM	MCR10EZHF102	1k	1/8W,1%(5% also acceptable)
Chip resistor	R8,R10	2	ROHM	MCR10EZHF472	4.7k	1/8W,1%
Chip resistor	R9	1	ROHM	MCR10EZHF103	10k	1/8W,1%(5% also acceptable)
PCB header	JA1,JA2	2	Molex	10-88-1261	26-pin	Male, 2-row, vertical type

11. Web Sitet

Renesas Technology Web site

<http://www.renesas.com/>

Revision History

Rev.	Date of issue	Content of revision	
		Page	Points
1.00	2006.06.30	-	First revision issued
1.10	2007.11.29	-	RSK_LIB APIs supported

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