ACP Reference Design Audiocast

Slide 1: ACP Reference Design

Welcome to the ACP Reference Design tutorial. My name is Jaime Kane, 8/16-bit Product Marketer in Motorola's Distribution Marketing Organization. I will walk you through the process of setting up and operating the ACP Reference Design Kit.

Slide 2: Motorola MCU Reference Designs

Motorola has teamed up with industry experts to offer customers a set of reference designs including software, hardware and detailed, documented instructions created to enable fast construction of popular, fully operational, real-life applications. They are based on our latest, cost-effective embedded Flash 8- and 16-bit microcontrollers.

The reference designs may provide either a ready-to-use solution for software and hardware designers, or a modular library of useful application notes, hints and tips. These designs introduce innovative uses for embedded Flash MCUs, helping to reduce development time and cost and helping speed time-to-market. All of this helps our customers achieve and maintain a competitive edge.

Comprehensive, modular documentation is available to download free-of-charge to registered customers. This documentation includes instructions and a bill-of-materials to allow construction of the evaluation board. Also available are fully modular C software routines and necessary software drivers.

Third parties are expected to make available hardware on selected designs. For more details on this, visit our Web site at www.motorola.com/mcu.

Slide 3: Alarm Control Panel Reference Design

To help engineers build HCS12 applications, Motorola has developed this alarm control panel reference design. The reference design uses the high-performance 16-bit microcontroller, MC9S12DP256.

The comprehensive reference design contains a reference design board including a bill-of-materials and PCB layout files. The reference design also includes fully documented firmware for the HCS12 in C language, including drivers, function libraries and a sample application.

Slide 4: Alarm Control Panel Hardware Overview

Using the example of a networked alarm control panel, this reference design was developed to demonstrate the capabilities of the HCS12 MCU in a wide range of applications.

Based on a MC9S12DP256 microcontroller, this reference design uses several peripherals and features of the HCS12, so customers have reusable examples about how to set up and use features such as: general HCS12 setup including PLL and interrupts; SCI for connection to sensor node, PC and modem; SPI for connection with input and output devices; ADC for sensing the alarm lines and supply voltages; output compare channel to generate sound and flash an LED; input capture channel to sense the jog dial-rotary encoder; EEPROM to store configuration data; and port pins to drive the liquid crystal display, or LCD.

Slide 5: S12compact Controller Module

The alarm control panel reference design (ACPRD) hardware consists of two main units, the ACPRD carrier board and the S12compact controller module.

The ACPRD carrier board provides a number of peripheral devices, which are used to realize the specific functions of the alarm control panel application. The carrier board is equipped with connections for alarm sensors, flashlight, siren and power supply. It also has sockets for a graphical LCD, a modem and the S12compact controller module.

The S12compact controller module is a small printed circuit board that holds the microcontroller unit (MCU) as well as standard circuitry for clock and reset generation, power supply and decoupling, plus a number of additional input/output devices. The S12compact controller module can be equipped optionally with a memory expansion, which is mainly targeted as a debugging aid.

Slide 6: Alarm Control Panel Interfaces

The ACP reference design provides a variety of several interfaces.

It is possible to connect industrial standard alarm sensors to input lines 1 through 3. These alarm sensors can be connected in a bus structure, so one input line can serve more than one sensor. Input line 4 is used to connect a networked sensor via a LIN (Local Interconnect Network) or a CAN (Controller Area Network) interface. Those networked sensors will be described in detail in a later application note.

In order to switch the reference design on, connect the power supply to the power supply input.

The alarm control panel comes with an alarm sensor dummy connected to the sensor input line 1. This sensor dummy can be used to demonstrate the features of the reference design.

Slide 7: Alarm Control Panel Software Structure

The reference design software is made in a modular structure so that the customer can easily reuse the modules.

The software of the reference design is divided into three major groups. One group of software is responsible for direct hardware access; therefore it is highly specific to the HCS12 microcontroller. The modules in this group are used to initialize and control the following HCS12 peripherals: CRG, ADC, SCI, SPI and timers, as well as the graphic display.

The next software group consists of several libraries and drivers that are specific to the alarm control panel and the LCD. The actual alarm control panel application is located on top of that software. The main function consists of an infinite software loop in which the input devices are scanned and the objects are displayed on the LCD. A timer generates a periodic interrupt in which the status of all alarm lines is checked and an alarm is triggered when necessary.

All software is provided in source code in standard C language. It is well documented and highly modular.

Slide 8: LCD After Reset

After the reference design has been switched on, the graphical LCD displays the user interface. At the top of the LCD there is a status line that displays the current time, date, supply voltage, battery voltage and temperature.

At the right of the LCD is the main menu for the configuration of the alarm control panel using the jog dial, which has turn and click functionalities.

The alarm status display is in the middle of the LCD. This display shows the global status of the alarm control panel—whether it is armed or disabled; the configuration of each alarm line; and the alarm status of each alarm line.

The functions of the four pushbuttons for user inputs are displayed at the bottom of the LCD. Note that there can be different functions depending on the chosen menu.

Slide 9: Alarm Control Panel Main Menu

To make a selection in the main menu, turn the jog dial and press it. The following menu functions are available:

The "Arm/Disable" function switches the alarm on and off globally. The "Reset Lines" function is used to reset the input lines after an alarm event. "Setup Lines" configures the four alarm lines. "Set Tim/Dat" changes the time and date. "Remote Control" is the function used to set up the system via PC or to connect to a modem. In the current reference design the modem function is not implemented. It will be described in a later application note. The "EntertainMe" function is used to switch the entertainment mode on and off for trade shows. In entertainment mode the reference design blinks and plays a melody.

Slide 10: Arming the Alarm Control Panel

In order to arm the alarm control panel, go to "Arm/Disable" and click the jog dial. The status symbol in the display changes from a minus sign to a checkmark.

When an alarm occurs, the following happens: the Checkmark symbol changes to a bell; the blue LED on the alarm control panel flashes; if enabled, a siren tone is sounded by the loudspeaker; and the output relays switch on the siren and flashlight outputs for external sirens and flashlights.

To disable the panel or switch the alarm off, click the jog dial again. The pushbuttons can be used as an alternative. The actual functions of the pushbuttons are displayed on the LCD.

In a real alarm control panel application, the function of disabling the alarm would be secured with a PIN code to prevent a burglar from disabling the alarm. This function is not implemented in the reference design.

Slide 11: Configuration of the Alarm Lines

In order to configure the alarm lines, select "Setup Lines" by turning the jog dial and pressing it. Then select the line to be configured by clicking the jog dial. The line that is currently configured will be indicated by an arrow pointing to the line. Choose the configuration of the selected line by turning the jog dial. Each alarm line can have five configurations. When you have configured one line, select the next line by pressing the jog dial.

Each alarm line can have five following configurations: "Line Enabled, Loud Alarm" is the default configuration of alarm line 1 after a reset. Choose the "Line Enabled, Silent Alarm" configuration to prevent a burglar from knowing that an alarm has been released. The "Line Enabled, Delayed Loud Alarm" option delays the arming of the alarm. Choose the "Control Panel by 30 Seconds" if you wish to leave your house. "Line Enabled,

Delayed Silent Alarm" is a combination of the "Line Enabled, Delayed Loud Alarm" and "Control Panel by 30 Seconds" configurations. The "Line Disabled" option switches the line off. This is the default configuration of the alarm lines 2 through 4 after a reset.

Slide 12: Alarm Status of the Lines

The alarm status of all lines is shown in the LCD.

If the line is enabled and an event on that line occurs, it is designed to trigger an alarm. A delayed line would release the alarm only after 30 seconds.

When an alarm event is sensed, the status display is designed to show two bells ringing. The alarm event is also latched, which means that even if the alarm event disappears, you still know that there was an alarm. To switch it off, the line has do be reset manually.

If an alarm line has been tampered with, that means it has been sensed that the alarm line does not work properly. A possible reason can be an attempt to manipulate the alarm line—for example, to shorten or to cut the wires.

Because the standard demo version of the alarm control panel does not have any sensors on alarm lines 2 through 4, the display is designed to show that these alarm lines have been tampered with. However, these lines are disabled so they do not trigger an alarm.

Slide 13: Configuration of the Panel via PC

It is possible to configure the alarm control panel via a standard terminal on a PC. For this purpose, the terminal should be connected to the RS232 interface of the alarm control panel.

The switch for the SCI configuration should be on the position for RS232 communication. The other position of the switch should be used for modem communication. Communication via modem is not described in this reference design but will be the subject of a later application note.

Slide 14: Alarm Control Panel Summary

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Elektronikladen is a member of Motorola's Design Alliance Program.

More information can be found at the author's project page. For your convenience, we've included the URL on this slide.
http://hc12web.de/acprd

The alarm control panel can be purchased at Elektronikladen:
http://www.elektronikladen.de
http://www.starterGATE.com

For more information about Motorola's semiconductor products, visit us at www.motorola.com/semiconductors.

For more details on available hardware from third parties on selected designs, visit our Web site at www.motorola.com/mcu.

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