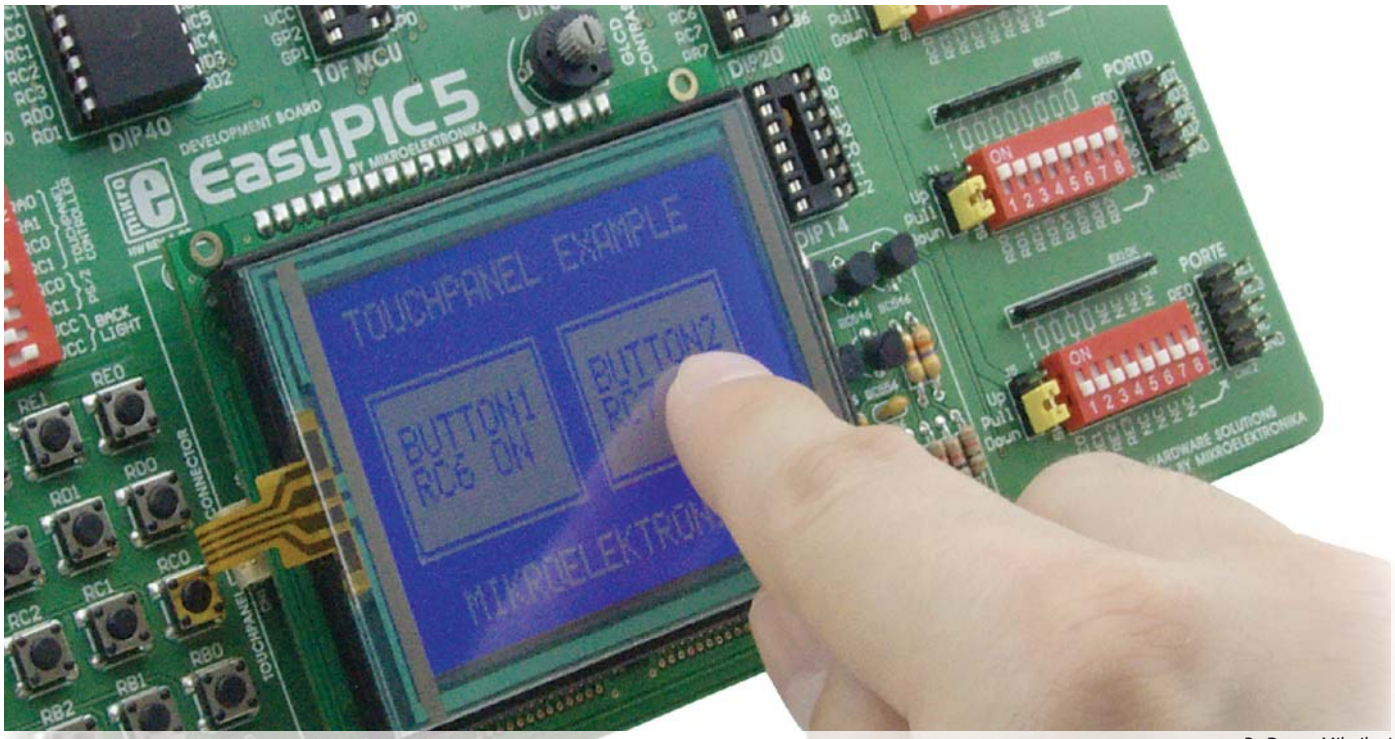
MikroElektronika
DEVELOPMENT TOOLS | COMPILERS | BOOKS

OK. Now you need a... TOUCHSCREEN



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Do you want your new device to have a simple and intuitive interface? If the answer is YES, then a graphic LCD display with touch panel is the best choice because together they create a Touchscreen (Glcd + Touch Panel = Touchscreen). In that way, with a small number of electronic components you will be able to create an attractive and easy to use device.

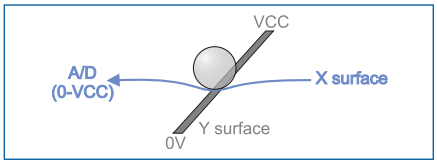
What is a touch panel? A touch panel is a thin, self-adhesive transparent panel placed over the screen of a graphic LCD. It is very sensitive to pressure so that even a soft touch causes some changes on output signal. There are a few types of touch panel. The simplest one is the resistive touch panel which will be discussed here.

Principle of operation

A resistive touch panel consists of two transparent rigid foils, forming a "sandwich" structure, that have resistive layers on their inner sides. The resistance of these layers usually does not exceed 1Kohm. The opposite sides of the foils have contacts available for use through a flat cable. The process of determining coordinates of the point in which the touch panel is pressed can be broken up into two steps. The first one is the determination of the X coordinate and the second one is the determination of the Y coordinate of the point. In order to determine the X coordinate, it is necessary to connect the left contact on the X surface to ground and the right contact to the power supply. This enables a voltage divider to be obtained by pressing the touch panel. The value of the divider is read on the bottom contact of the Y surface. Voltage can be in the range of 0V to the power supply and depends on the X coordinate. If the point is closer to the left contact of the X surface, the voltage will be closer to 0V. In order to determine the Y coordinate, it is necessary to connect the bottom contact on the Y surface to ground, and the upper contact to power supply. In this case, the voltage is read on the left contact of the X surface.

Connecting to microcontroller

In order to connect a touch panel to the microcontroller it is necessary to create a circuit for touch panel control. By means of this circuit, the microcontroller connects appropriate contacts of the touch panel to ground and the power supply (as described above) in order to determine the X



Determination of Y coordinate

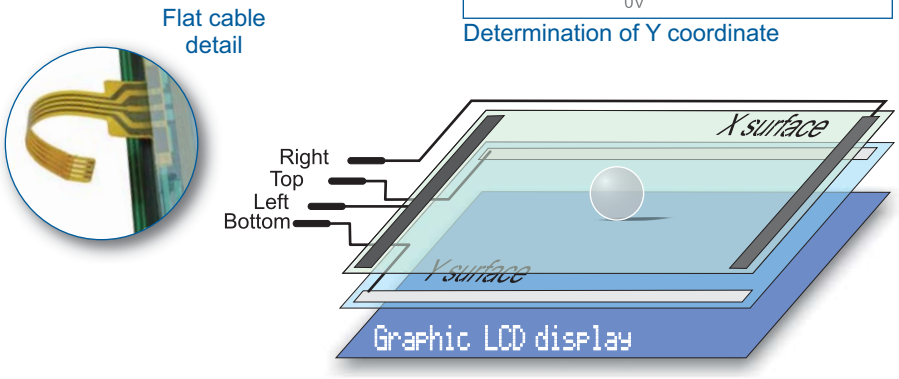
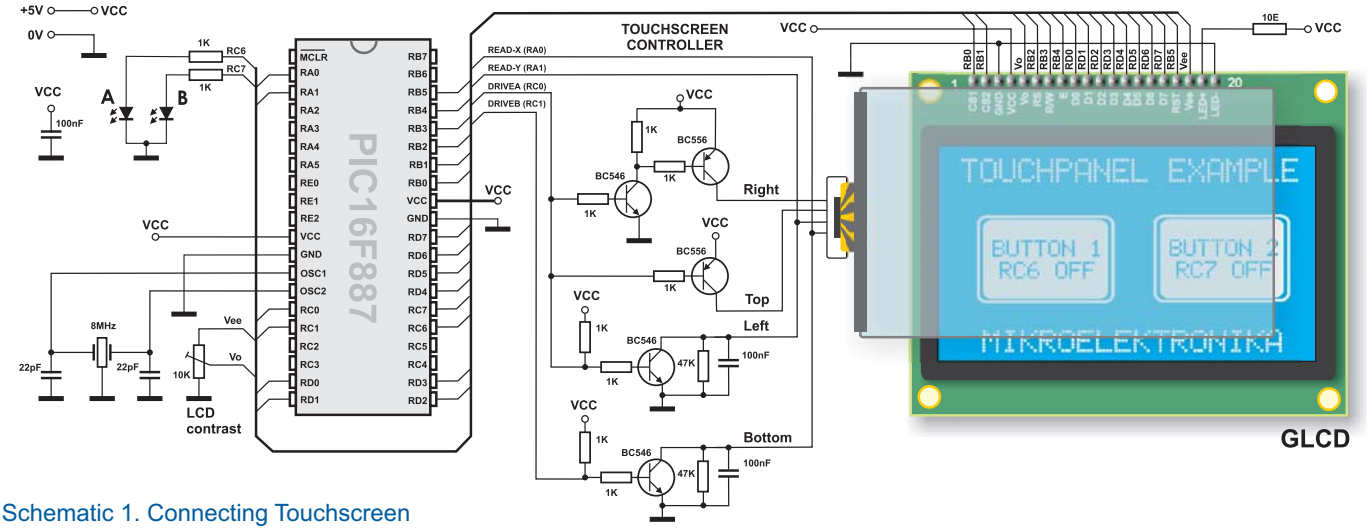


Figure 1. Touch panel internal structure

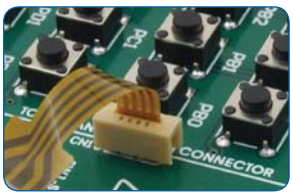


Schematic 1. Connecting Touchscreen

and Y coordinates (Refer to Schematic 1). The bottom contact of the Y surface and left contact of the X surface are connected to the microcontroller's A/D converter. The X and Y coordinates are determined by measuring voltage on these contacts, respectively. The software consists of writing a menu on graphic LCD, turning the circuit for touch panel control on/off (driving touch panel) and reading the values of A/D converter which actually represent the X and Y coordinates of the point.

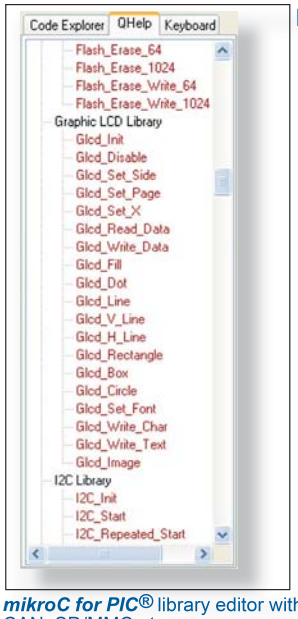
Once the coordinates are determined, it is possible to decide what we want the microcontroller to do. For the purpose of illustration, let us examine Example 1. It explains how to turn on/off two digital microcontroller pins, connected to LED diodes A and B, using a display and a touch panel.

Flat cable on-board connector before...



...and after connecting touch panel.

Considering that the touch panel surface is slightly larger than the surface of the graphic LCD, in case you want greater accuracy when determining the coordinates, it is necessary to perform the software calibration of the touch panel.



Functions used in the program

ADC_Read() Read analog value
Delay_ms() Delay

Glcd_box()	Draw filled box*
Glcd_circle()	Draw circle
Glcd_Dot()	Draw dot
Glcd_Fill()	Delete/fill display*
Glcd_H_Line()	Draw horizontal line
Glcd_Image()	Import image
Glcd_Init()	LCD display initialization*
Glcd_Line()	Draw line
Glcd_Read_Data()	Read data from LCD
Glcd_Rectangle()	Draw rectangle*
Glcd_Set_Font()	Select font*
Glcd_Set_Page()	Select page
Glcd_Set_Side()	Select side of display
Glcd_Set_X()	Determine X coordinate
Glcd_V_line()	Draw vertical line
Glcd_Write_Char()	Write character
Glcd_Write_Data()	Write data
Glcd_Write_Text()	Write text*

* Glcd library functions used in the program

mikroC for PIC® library editor with ready to use libraries such as: Ethernet, CAN, SD/MMC etc.

NOTE: Code for this example written for PIC® microcontrollers in C, Basic and Pascal as well as the programs written for AVR® and dsPIC® microcontrollers can be found on our web site **www.mikroe.com/en/article/**

Example 1: Program to demonstrate touchscreen operation

```
const char msg1[] = "TOUCHPANEL EXAMPLE";
const char msg2[] = "MIKROELEKTRONIKA";
const char msg3[] = "BUTTON1";
const char msg4[] = "BUTTON2";
const char msg5[] = "RC6 OFF";
const char msg6[] = "RC7 OFF";
const char msg7[] = "RC6 ON";
const char msg8[] = "RC7 ON";

long x_coord, y_coord, x_coord128, y_coord64;          // scaled x-y position
char msg[16];

char * CopyConst2Ram(char * dest, const char * src){

 for(;*dest++ = *src++;)
  ;
 return dest;
}

unsigned int GetX() {
                                   //reading X
 PORTC.F0 = 1;                     // DRIVEA = 1 (LEFT drive on, RIGHT drive on, TOP drive off)
 PORTC.F1 = 0;                     // DRIVEB = 0 (BOTTOM drive off)
 Delay_ms(5);
 return ADC_read(0);               // reading X value from RA0 (BOTTOM)
}

unsigned int GetY() {
                                   //reading Y
 PORTC.F0 = 0;                     // DRIVEA = 0 (LEFT drive off, RIGHT drive off, TOP drive on)
 PORTC.F1 = 1;                     // DRIVEB = 1 (BOTTOM drive on)
 Delay_ms(5);
 return ADC_read(1);               // reading Y value from RA1 (from LEFT)
}

void main() {
 PORTA  = 0x00;
 TRISA  = 0x03;                    // RA0 i RA1 are analog inputs
 ANSEL  = 0x03;
 ANSELH = 0;                       // Configure other AN pins as digital I/O

 PORTC  = 0 ;
 TRISC  = 0 ;                      // PORTC is output

 Glcd_Init(&PORTB, 0, 1, 2, 3, 5, 4, &PORTD);   // Glcd_Init_EP5
 Glcd_Set_Font(FontSystem5x8, 5, 8, 32);        // Choose font
 Glcd_Fill(0);                     // Clear GLCD

 CopyConst2Ram(msg,msg1);                       // Copy "TOUCHPANEL EXAMPLE" string to RAM
 Glcd_Write_Text(msg,10,0,1);
 CopyConst2Ram(msg,msg2);                       // Copy "MIKROELEKTRONIKA" string to RAM
 Glcd_Write_Text(msg,17,7,1);

 Glcd_Rectangle(8,16,60,48,1);                  //Display Buttons on GLCD:
 Glcd_Rectangle(68,16,120,48,1);
 Glcd_Box(10,18,58,46,1);
 Glcd_Box(70,18,118,46,1);
 CopyConst2Ram(msg,msg3);                       // Copy "BUTTON1" string to RAM
 Glcd_Write_Text(msg,14,3,0);
 CopyConst2Ram(msg,msg5);                       // Copy "RC6 OFF" string to RAM
 Glcd_Write_Text(msg,14,4,0);
 CopyConst2Ram(msg,msg4);                       // Copy "BUTTON2" string to RAM
 Glcd_Write_Text(msg,74,3,0);
 CopyConst2Ram(msg,msg6);                       // Copy "RC7 OFF" string to RAM
 Glcd_Write_Text(msg,74,4,0);

 while (1) {
                                                // read X-Y and convert it to 128x64 space
  x_coord = GetX();
  y_coord = GetY();
  x_coord128 = (x_coord * 128) / 1024;
  y_coord64 = 64 -((y_coord *64) / 1024);
                                                //if BUTTON1 is selected
  if ((x_coord128 >= 10) && (x_coord128 <= 58) && (y_coord64 >= 18) && (y_coord64 <= 46)) {
   if(PORTC.F6 == 0) {
    PORTC.F6 = 1;
    CopyConst2Ram(msg,msg7);                    // Copy "RC6 ON" string to RAM
    Glcd_Write_Text(msg,14,4,0);
   }
   else {
    PORTC.F6 = 0;
    CopyConst2Ram(msg,msg5);                    // Copy "RC6 OFF" string to RAM
    Glcd_Write_Text(msg,14,4,0);
   }
  }
                                                //if BUTTON2 is selected
  if ((x_coord128 >= 70) && (x_coord128 <= 118) && (y_coord64 >= 18) && (y_coord64 <= 46)) {
   if(PORTC.F7 == 0) {
    PORTC.F7 = 1;
    CopyConst2Ram(msg,msg8);                    // Copy "RC7 ON" string to RAM
    Glcd_Write_Text(msg,74,4,0);
   }
   else {
    PORTC.F7 = 0;
    CopyConst2Ram(msg,msg6);                    // Copy "RC7 OFF" string to RAM
    Glcd_Write_Text(msg,74,4,0);
   }
  }
  Delay_ms(100);
 }
}
```

Written in compiler mikroC for PIC