Embedded based teaching pendant optimized for industrial robots.

DTP7H-W
Windows CE7
API User's Manual

(R1) Version

DAINCUBE Corp.
ARM Cortex-A9 Windows CE7 system

FORM 170703F – 2019.04.03

DTP7H-W Windows CE7
API User's Manual
DAINCUBE Corp.
Web: www.daincube.com
E-mail: support@daincube.com
Tel: 82-32-329-9783~4
Fax: 82-32-329-9785

#401-701, Bucheon TechnoPark 4-Danji,
655 Pyeongcheon-ro, Wonmi-gu, Bucheon-Si,
Gyeonggi-Do, Republic of Korea

Preface

Important information
This documentation is intended for qualified audience only.
The product described herein is not an end user product.
It was developed and manufactured for further processing by trained personnel.
This product is protected by the "End-User License Agreement" (EULA).

Disclaimer
Although this document has been generated with the utmost care no warranty or liability for correctness or suitability for any particular purpose is implied. The information in this document is provided “as is” and is subject to change without notice.

Trademarks
All used product names, logos or trademarks are property of their respective owners.

Product support
DAINCUBE Corp.
Web: www.daincube.com
E - MAIL: support@daincube.com

Safety precautions

Be sure to observe all of the following safety precautions.

Strict observance of these warning and caution indications are a MUST for preventing accidents, which could result in bodily injury and substantial property damage. Make sure you fully understand all definitions of these terms and related symbols given below, before you proceed to the manual.

Symbols

The following symbols may be used in this specification:

Warning

Warnings indicate conditions that, if not observed, can cause personal injury.

Caution

Cautions warn the user about how to prevent damage to hardware or loss of data.

Note

Notes call attention to important information that should be observed.

Revision history

Revision	Data	Comment
Version 1.0	2018.03.26	Initial version
Version 1.2.1	2019.04.04	Form modification, errata correction Version

Contents

1. Introduction

This document explains the DTP7H-W key, LED and Buzzer to make it easier for users to develop applications. Key, LED and Buzzer are controlled via serial communication, and DAINCUBE provides all device drivers and examples for application developers.

2. Serial communication function

2.1. COM port Open(), Close()

Open and close the serial communication port to enable the DTP7H-W's key, LED, and buzzer operation.

Serial Port : COM1
Baudrate : 115200
Parity : None
Data bit : 8 bit
Stop bit : 1 bit

```
m_comm= new CMycomm(_T("COM1"),_T("115200"),_T("None"),_T("8 Bit"),_T("1 Bit"));
if( m_comm->Create(GetSafeHwnd()) != 0 ) {
   comport_state=true;
} else {
   AfxMessageBox(_T("COM PORT OPEN ERROR!"));
}
```

(1) Parameters

Port
: Used serial port name

Baudrate
: Serial Port communication Baudrate.

Parity
: Serial Port Parity.

Databit
: Databit.

Stopbit
: Stopbit.

(2) Return value

Return error value = 0

(3) Explanation

DTP7H-W Because ETC driver is controlled through serial port, COM port must be opened

(4) Requirements

Function	Header	Reference
CMycomm() Create()	Mycomm.h	Mycomm.cpp

(5) Exemple

```
void CserialDlg::OnBnClickedBtConnect()
{
      if(comport_state) {      // Close COM port
      if(m_comm) {
         m_comm->Close();
         m_comm = NULL;
         comport_state=false;
   } else {       // Initial COM port
      m_comm= new CMycomm(_T("COM1"),_T("115200"),_T("None"),_T("8 Bit"),_T("1 Bit"));
      if( m_comm->Create(GetSafeHwnd()) != 0 ) {
```

```
            comport_state=true;
        } else {
            AfxMessageBox(_T("COM PORT OPEN ERROR!"));
        }
    }
}
```

2.2. Send()

DTP7H-W LED and Buzzer are transmitted through Serial Packet.

```
BOOL CMycomm::Send(char *outbuf, DWORD *len);
```

(1) Parameters

outbuf

Transmit data buffer.

len

Transmit data length.

(2) Return value

Return error value = 0

Return success value = 0

(3) Explanation

In order to turn on / off the LED or Buzzer, control by sending serial packet.

(4) Requirements

Function	Header	Reference
Send()	Mycomm.h	Mycomm.cpp

(5) Exemple

```
void CserialDlg::OnBnClickedBtLed1()
{
    // TODO: Add your control notification handler code here
    char buf_printf[10] = {0, };
    unsigned int crc_buf;
    DWORD dwBytes = 0;

    buf_printf[0] = STX;                // STX
    buf_printf[1] = MOD_SET;            // MOD (get : 0x10, set : 0x11)
    buf_printf[2] = SEL_LED;            // SEL (LED : 0x3A)
    buf_printf[3] = LEFT_LED1;              // Data1
    buf_printf[4] = LED_BLUE; // Data2 (off : 0x30, blue : 0x31, red : 0x32, all : 0x33)
    buf_printf[5] = DATA_RESERVED;          // Data3 (Reserved : 0x20)
    crc_buf = crc16_append(buf_printf,6);
    buf_printf[6] = (char)(crc_buf>>8)&0xff;
    buf_printf[7] = (char)crc_buf&0xff;
    buf_printf[8] = ETX;                // ETX
    buf_printf[9] = '\0';

    dwBytes = strlen(buf_printf);
    m_comm->Send(buf_printf, &dwBytes);
}
```

2.3. Receive()

Receive Serial Packet to use DTP7H-W key.

```
int CMycomm::Receive(LPSTR inbuf, int len);
```

(1) Parameters

inbuf

Recive data buffer.

len

Recive data length.

(2) Return value

Return error value = 0 or -1

Return success value = length

(3) Explanation

Key receives and controls Serial Packet.

(4) Requirements

Function	Header	Reference
Receive()	Mycomm.h	Mycomm.cpp

(5) Exemple

```
LRESULT CserialDlg::OnReceive(WPARAM length, LPARAM lpara)
{
   if(m_comm && comport_state) {

      while(length--)
      {
         m_comm->Receive(&g_Receive_Buffer[g_Head_Pointer],1);

         if(g_Head_Pointer >= BUFF_MAX-1)
            g_Head_Pointer = 0;
         else
            g_Head_Pointer++;
      }
   }

   return 0;
}
```

2.4. Protocol CRC

The serial packet of the ETC control also contains the CRC information, so the CRC value must be calculated.
CRC calculation is performed with information from the first packet to the sixth packet among the 9-bit serial packets.

```
unsigned int crc16_append(const void* data, int len);
```

(1) Parameters

data

The buffer of the Serial Packet for which to calculate the CRC value.

len

The length of the buffer in the Serial Packet for which to calculate the CRC value.

(2) Return value

16-bit CRC value.

(3) Explanation

Calculates the Send / Receive CRC value of the serial packet.

(4) Requirements

Function	Header	Reference
crc16_append()		

```
// CRC Table
static const unsigned int crc16tab[] = {
    0x0000, 0xC0C1, 0xC181, 0x0140, 0xC301, 0x03C0, 0x0280, 0xC241,
    0xC601, 0x06C0, 0x0780, 0xC741, 0x0500, 0xC5C1, 0xC481, 0x0440,
    0xCC01, 0x0CC0, 0x0D80, 0xCD41, 0x0F00, 0xCFC1, 0xCE81, 0x0E40,
    0x0A00, 0xCAC1, 0xCB81, 0x0B40, 0xC901, 0x09C0, 0x0880, 0xC841,
    0xD801, 0x18C0, 0x1980, 0xD941, 0x1B00, 0xDBC1, 0xDA81, 0x1A40,
    0x1E00, 0xDEC1, 0xDF81, 0x1F40, 0xDD01, 0x1DC0, 0x1C80, 0xDC41,
    0x1400, 0xD4C1, 0xD581, 0x1540, 0xD701, 0x17C0, 0x1680, 0xD641,
    0xD201, 0x12C0, 0x1380, 0xD341, 0x1100, 0xD1C1, 0xD081, 0x1040,
    0xF001, 0x30C0, 0x3180, 0xF141, 0x3300, 0xF3C1, 0xF281, 0x3240,
    0x3600, 0xF6C1, 0xF781, 0x3740, 0xF501, 0x35C0, 0x3480, 0xF441,
    0x3C00, 0xFCC1, 0xFD81, 0x3D40, 0xFF01, 0x3FC0, 0x3E80, 0xFE41,
    0xFA01, 0x3AC0, 0x3B80, 0xFB41, 0x3900, 0xF9C1, 0xF881, 0x3840,
    0x2800, 0xE8C1, 0xE981, 0x2940, 0xEB01, 0x2BC0, 0x2A80, 0xEA41,
    0xEE01, 0x2EC0, 0x2F80, 0xEF41, 0x2D00, 0xEDC1, 0xEC81, 0x2C40,
    0xE401, 0x24C0, 0x2580, 0xE541, 0x2700, 0xE7C1, 0xE681, 0x2640,
    0x2200, 0xE2C1, 0xE381, 0x2340, 0xE101, 0x21C0, 0x2080, 0xE041,
    0xA001, 0x60C0, 0x6180, 0xA141, 0x6300, 0xA3C1, 0xA281, 0x6240,
    0x6600, 0xA6C1, 0xA781, 0x6740, 0xA501, 0x65C0, 0x6480, 0xA441,
    0x6C00, 0xACC1, 0xAD81, 0x6D40, 0xAF01, 0x6FC0, 0x6E80, 0xAE41,
    0xAA01, 0x6AC0, 0x6B80, 0xAB41, 0x6900, 0xA9C1, 0xA881, 0x6840,
    0x7800, 0xB8C1, 0xB981, 0x7940, 0xBB01, 0x7BC0, 0x7A80, 0xBA41,
    0xBE01, 0x7EC0, 0x7F80, 0xBF41, 0x7D00, 0xBDC1, 0xBC81, 0x7C40,
    0xB401, 0x74C0, 0x7580, 0xB541, 0x7700, 0xB7C1, 0xB681, 0x7640,
    0x7200, 0xB2C1, 0xB381, 0x7340, 0xB101, 0x71C0, 0x7080, 0xB041,
    0x5000, 0x90C1, 0x9181, 0x5140, 0x9301, 0x53C0, 0x5280, 0x9241,
    0x9601, 0x56C0, 0x5780, 0x9741, 0x5500, 0x95C1, 0x9481, 0x5440,
    0x9C01, 0x5CC0, 0x5D80, 0x9D41, 0x5F00, 0x9FC1, 0x9E81, 0x5E40,
    0x5A00, 0x9AC1, 0x9B81, 0x5B40, 0x9901, 0x59C0, 0x5880, 0x9841,
    0x8801, 0x48C0, 0x4980, 0x8941, 0x4B00, 0x8BC1, 0x8A81, 0x4A40,
    0x4E00, 0x8EC1, 0x8F81, 0x4F40, 0x8D01, 0x4DC0, 0x4C80, 0x8C41,
    0x4400, 0x84C1, 0x8581, 0x4540, 0x8701, 0x47C0, 0x4680, 0x8641,
    0x8201, 0x42C0, 0x4380, 0x8341, 0x4100, 0x81C1, 0x8081, 0x4040
};

// calculation CRC16
unsigned int ::crc16_append(const void* data, int len)
{
    int i         = 0;
    unsigned int c16      = 0;
    unsigned char* buf = NULL;

    buf  = (unsigned char*) data;
    for(i = 0; i < len; i++)
        c16 = (c16 >> 8) ^ crc16tab[(c16 ^ buf[i]) & 0xff];

    return c16;
}
```

3. ETC Driver control protocol

The protocols for controlling the DTP7H-W key, LED, and buzzer are 9-bit and 1-packet, and the bit information is as follows.

STX	Start Byte
MOD	Get/Set Select
SEL	Control Device Select (Key, LED, Buzzer)
DATA1	Control Device value
DATA2	Control Device value
DATA3	Control Device value
CRC_H	CRC High (STX ~ DATA3)
CRC_L	CRC Low (STX ~ DATA3)
ETX	End Byte

Values of define information for Key, LED and Buzzer control are as follows.

```
//KEYPAD
#define KEY_A    30
#define KEY_B    48
#define KEY_C    46
#define KEY_D    32
#define KEY_E    18
#define KEY_F    33
#define KEY_G    34
#define KEY_H    35
#define KEY_I    23
#define KEY_J    36
#define KEY_K    37
#define KEY_L    38
#define KEY_DOWN  108
#define KEY_UP    103
#define KEY_RIGHT  106
#define KEY_LEFT 105
#define KEY_F1    59
#define KEY_F2    60
#define KEY_F3    61
#define KEY_F6    64
#define KEY_F7    65
#define KEY_F8    66

// ETC
#define LEFT_LED1      0x41     // ASCII Value
#define LEFT_LED2      0x42
#define LEFT_LED3      0x43
#define RIGHT_LED1     0x61
#define RIGHT_LED2     0x62
#define RIGHT_LED3     0x63
#define LED_ALL        0x7F

//SERIAL
#define STX          0x02
#define MOD_GET        0x10
#define MOD_SET        0x11
#define SEL_LED      0x3A
#define SEL_BUZZ     0x3B
#define SEL_KEYPAD      0x3D
#define DATA_RESERVED  0x20
#define ETX          0x03
```

```
#define KEYPAD_UP     0x30
#define KEYPAD_DOWN     0x31
#define LED_OFF         0x30
#define LED_BLUE     0x31
#define LED_RED         0x32
#define LED_ALL_ON    0x33
#define BUZZ_OFF     0x30
#define BUZZ_ON         0x31
```

3.1. LED control protocol

LED Control Serial Packet

STX	MOD	SEL	DATA1	DATA2	DATA3	CRC_H	CRC_L	ETX
0x02	0x11	0x3A	0x41	0x33	0x20	0xXX	0xXX	0x03
1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE

- MOD : 0x11 = MOD_SET
- SEL : 0x3A = SEL_LED
- DATA1 : 0x41 = LEFT_LED1, 0x42 = LEFT_LED2, 0x43 = LEFT_LED3,
  0x61 = RIGHT_LED1, 0x62 = RIGHT_LED2, 0x63 = RIGHT_LED3
- DATA2 : 0x30 = OFF, 0x31 = BLUE, 0x32 = RED, 0x33 = ALL
- DATA3 : 0x20 = DATA_RESERVED

3.2. Buzzer control protocol

Buzzer Control Serial Packet

STX	MOD	SEL	DATA1	DATA2	DATA3	CRC_H	CRC_L	ETX
0x02	0x11	0x3B	0x31	0x20	0x20	0xXX	0xXX	0x03
1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE

- MOD : 0x11 = MOD_SET
- SEL : 0x3B = SEL_BUZZ

- DATA1 : 0x30 = OFF, 0x31 = ON
- DATA2 : 0x20 = DATA_RESERVED
- DATA3 : 0x20 = DATA_RESERVED

3.3. Keypad control protocol

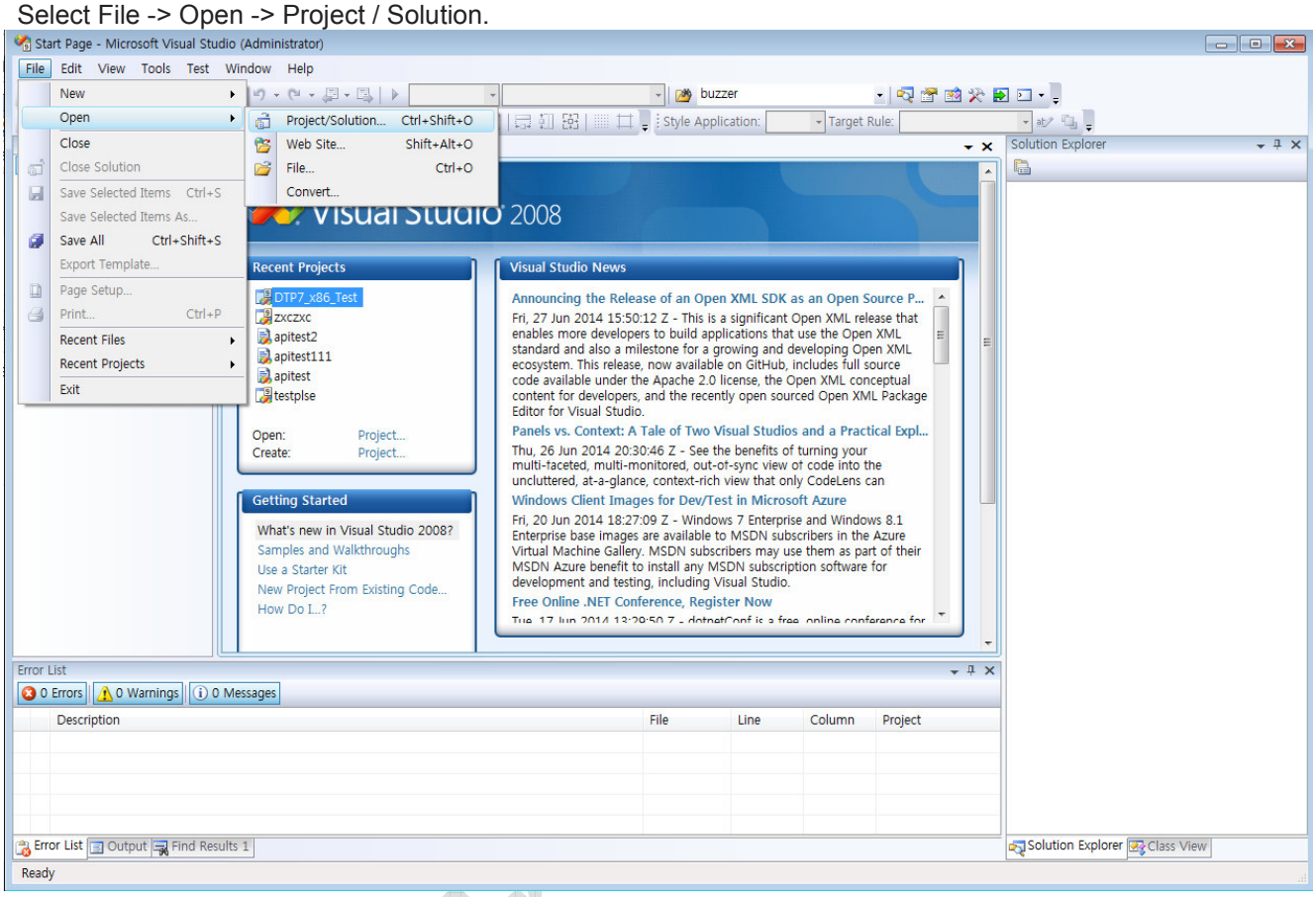
Keypad Control Serial Packet

STX	MOD	SEL	DATA1	DATA2	DATA3	CRC_H	CRC_L	ETX
0x02	0x10	0x3C	0x30	0x33	0x30	0xXX	0xXX	0x03
1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE

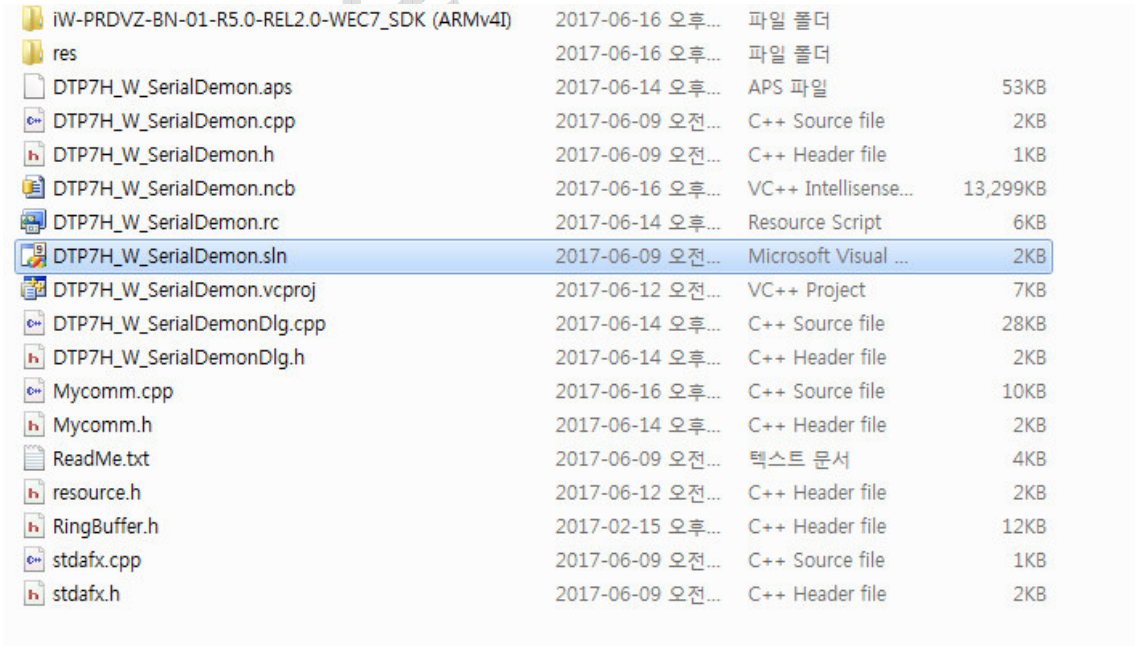
- MOD : 0x10 = MOD_GET
- SEL : 0x3D = SEL_KEYPAD
- DATA1 : 0x30 = KEYPAD_UP, 0x31 = KEYPAD_DOWN
- DATA2 : KEY_A = 30, KEY_B = 48, KEY_C = 46, KEY_D = 32, KEY_E = 18, KEY_F = 33, KEY_G = 34, KEY_H = 35, KEY_I = 23, KEY_J = 36, KEY_K = 37, KEY_L = 38, KEY_DOWN = 108, KEY_UP = 103, KEY_RIGHT = 106, KEY_LEFT = 105, KEY_F6 = 64, KEY_F7 = 65, KEY_F8 = 66, KEY_F9 = 67
- DATA3 : 0x20 = DATA_RESERVED

4. ETC Sample Usage

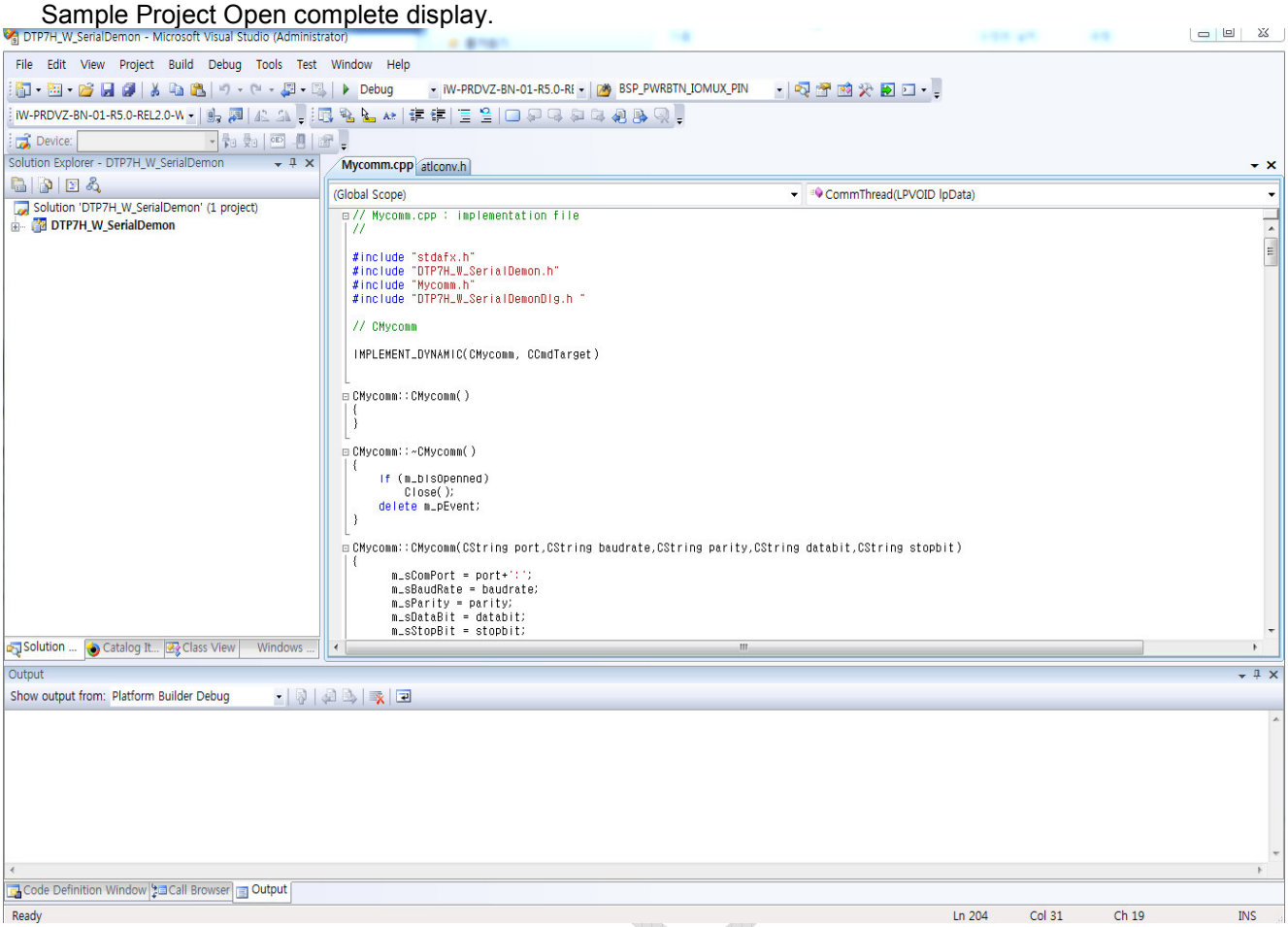
Open using Visual Basic to use the Sample Project provided by DAINCUBE.
Select File -> Open -> Project / Solution.



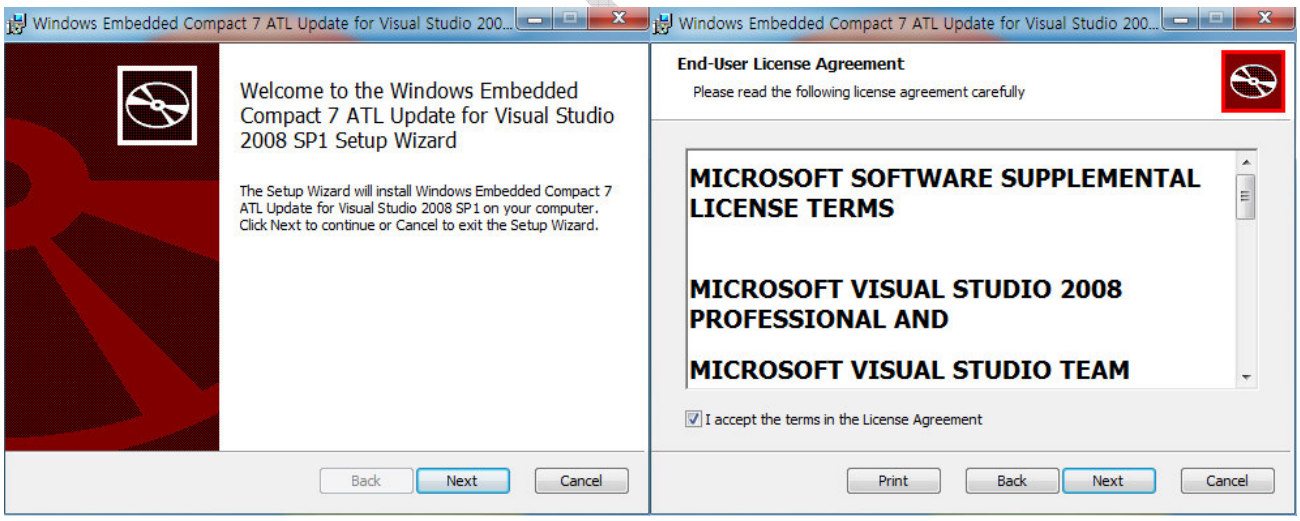
Select Project "02_Sample >> DTP7H_W_SerialDemon_ETC >> DTP7H_W_SerialDemon.sln"

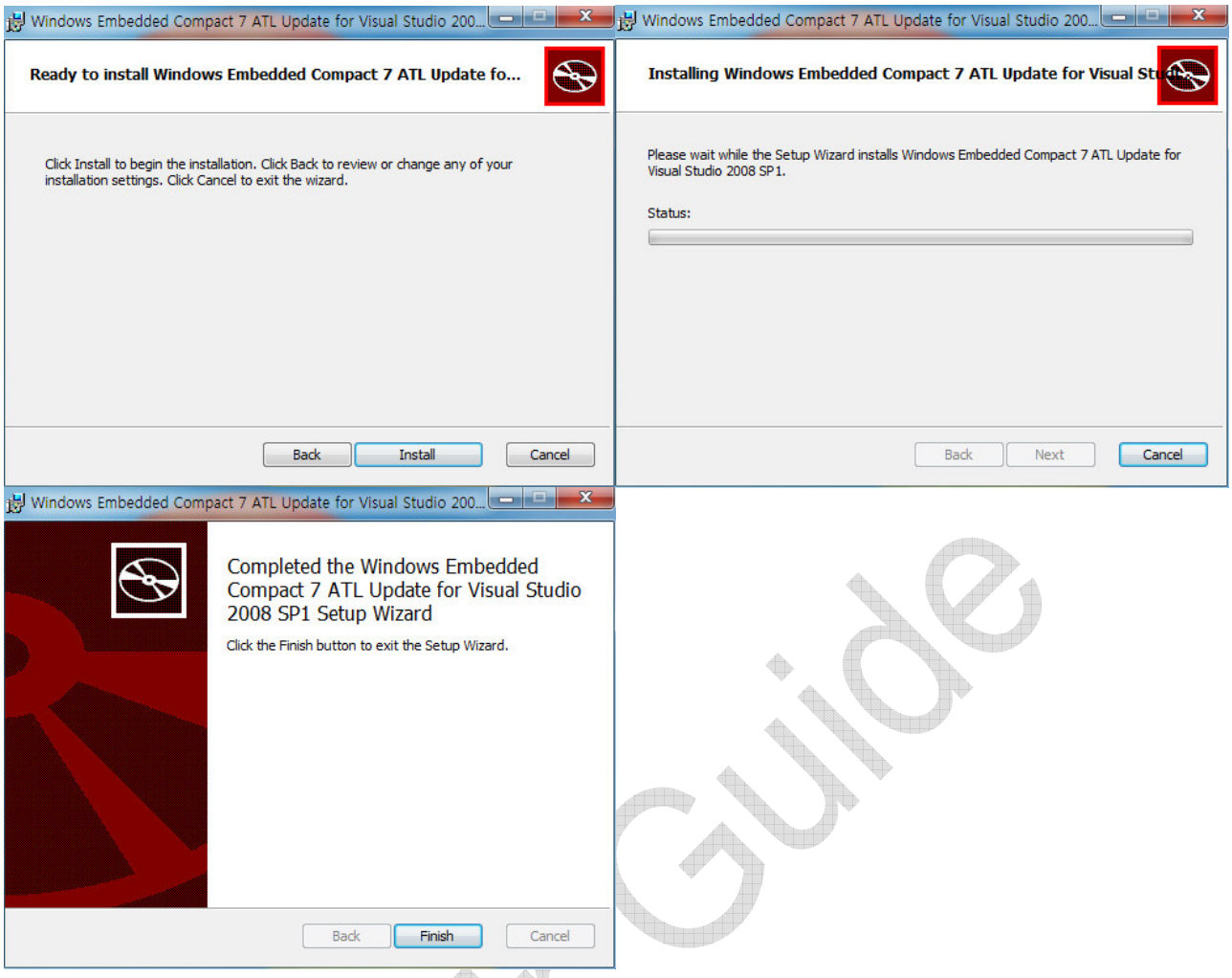


Sample Project Open complete display.

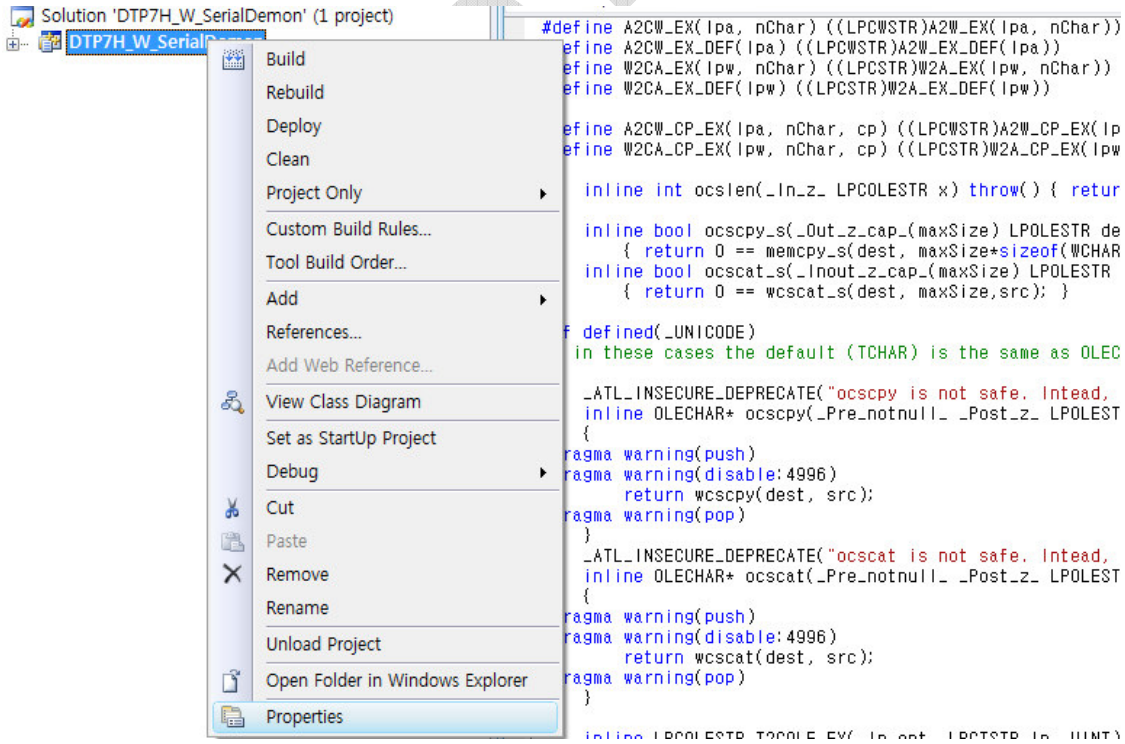


If the build does not work normally, install the attachment VisualStudioDeviceWindowsEmbeddedCompact7.msi.





When the installation is complete, the project properties are entered.



Add that path to "Additional Include Directions" in " Configuration Properties -> C / C ++ -> General ".

Path:
C:\Program Files (x86)\Microsoft Visual Studio 9.0\VC\ce7\atlmfc\include
C:\Program Files (x86)\Microsoft Visual Studio 9.0\VC\ce7\include