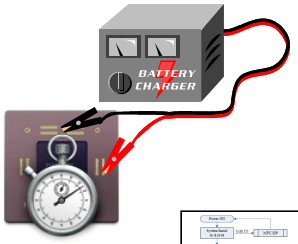
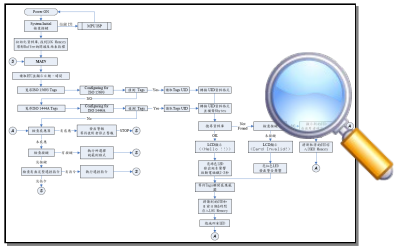
# RFID Application

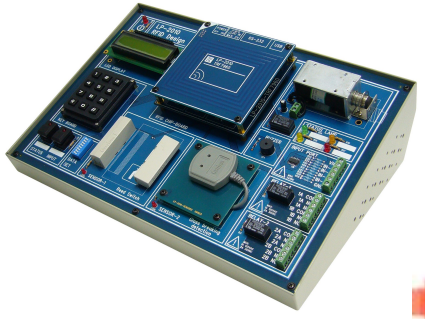
## Experimental and Applied Case

# Courses Introduction

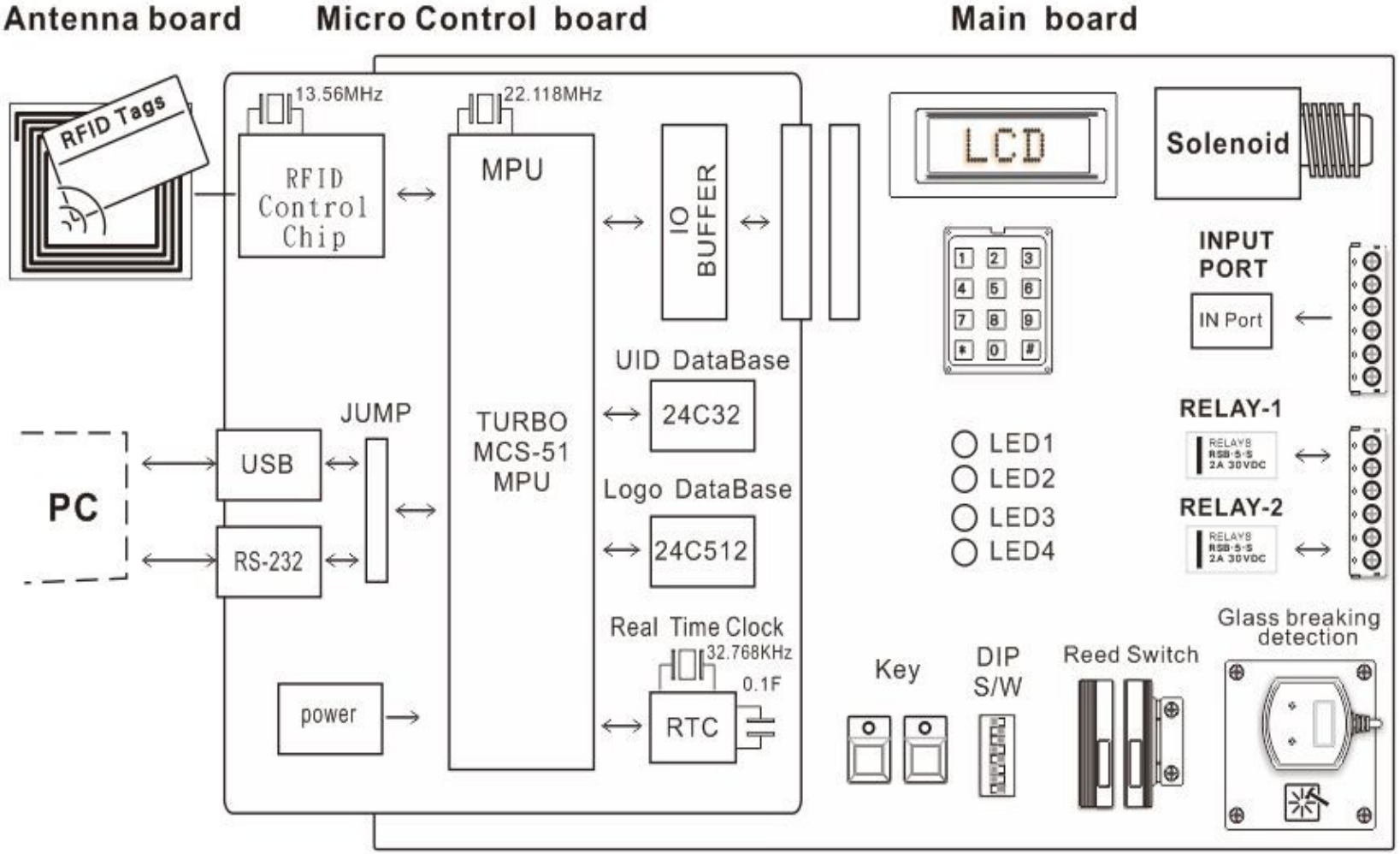
- System Block Diagram
- Key components intro.
- Example program flow chart
- Program development process: Edit, assembler, downloads, experiment
- Computer connecting
- Example program experiments
- Connection Control



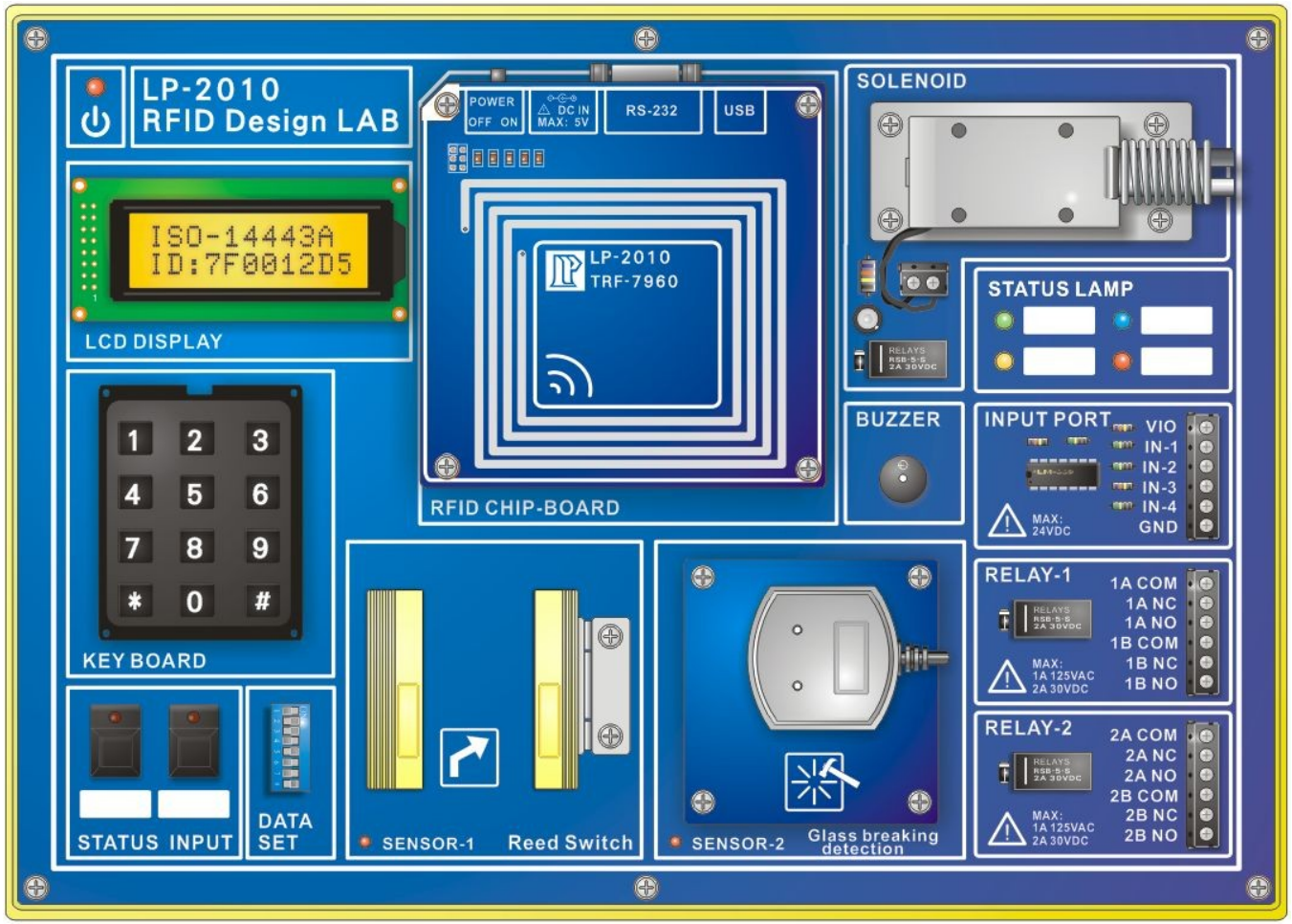





# System Block Diagram



# Product Appearance Introduction



# Key Components Introduction

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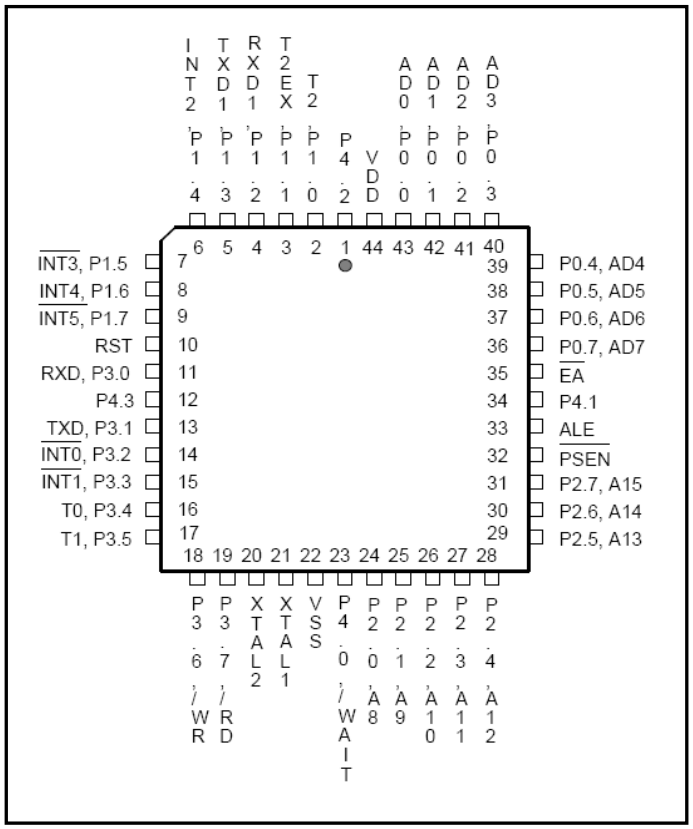
**W77E516**




## FEATURES

- 8-bit CMOS microcontroller,
- Instruction-set compatible with MCS-51
- 4 clocks/machine cycle runs up to 40 MHz
- 64KB on-chip Flash-EPROM,
- 4KB Auxiliary Flash EPROM for loader program
- 256 bytes scratch-pad RAM
- 1KB on-chip SRAM for MOVX instruction
- Four 8-bit I/O Ports

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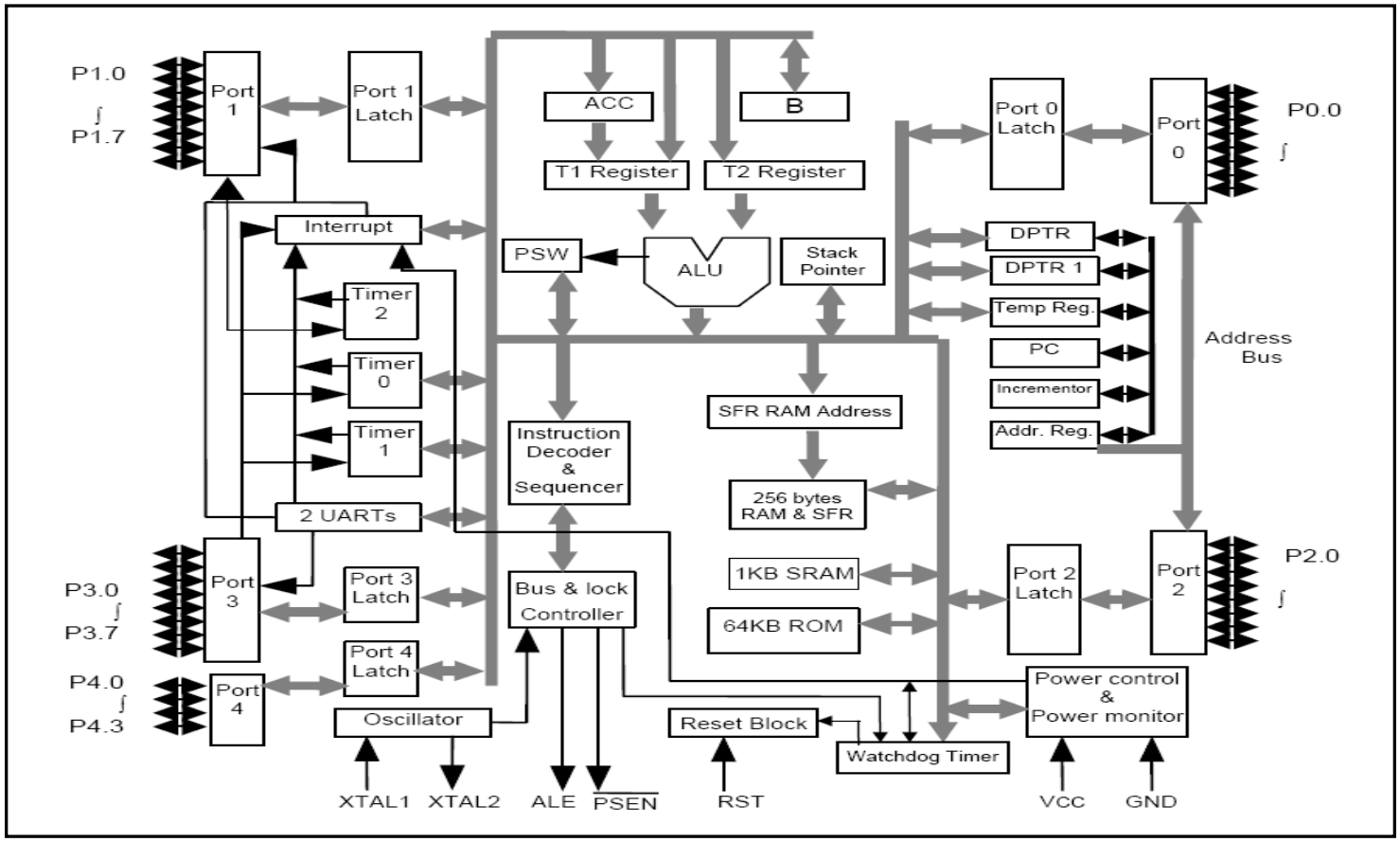
# Key Components Introduction

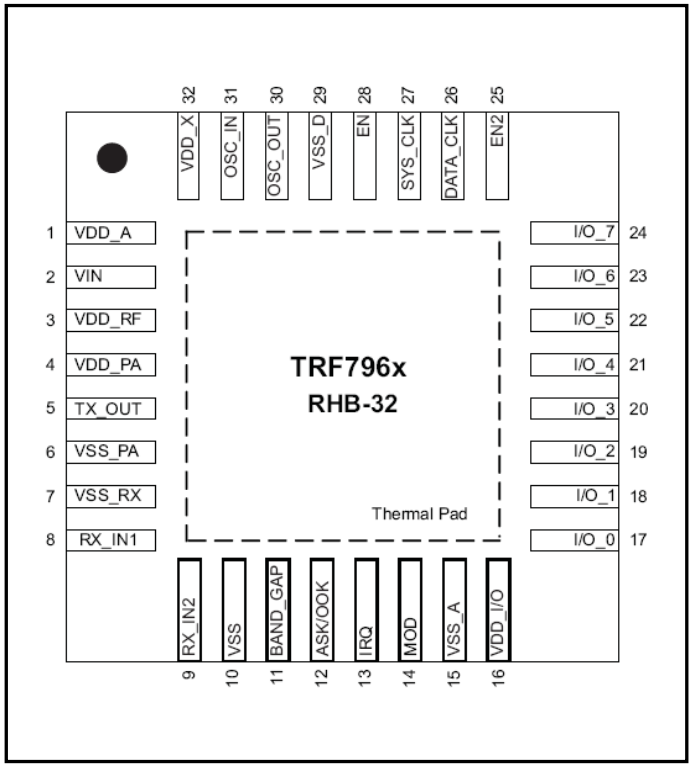
## W77E516 BLOCK DIAGRAM



# Key Components Introduction

TEXAS INSTRUMENTS

## WTRF-7960




## FEATURES

- The TRF7960/61 is an integrated analog front end and data-framing system for a 13.56-MHz RFID reader system.
- Supply Multi Standard
  ISO14443A/B, ISO15693 / ISO18000-3
- Wide Operating Voltage Range of 2.7 V to 5.5 V
- Ultralow-Power Modes
  – Power Down < 1 mA
  – Standby 120 mA
  – Active (Rx only) 10 mA

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# Example Program Introduction

- Auto-sensing ISO 14443A and ISO 15693 Tags and read the UID. Note: UID (Unique ID) unique code.

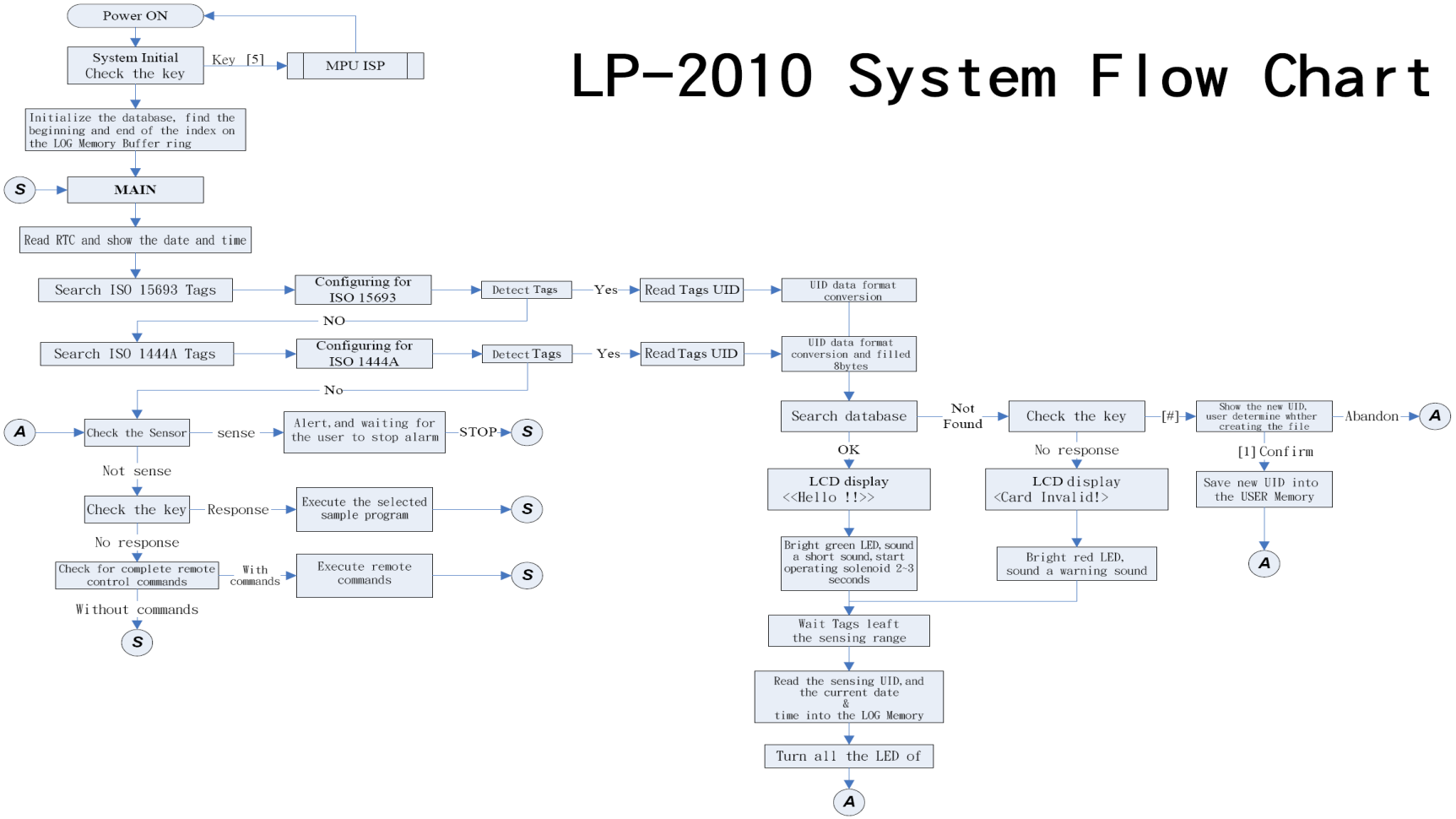
- Read the UID to the USER Memory database for data searching and matching
- If it is login tags, the system will light green and beep short tone. Besides, the door-simulated electromagnet lock will be open a few seconds. If the Tags are not login, the system will light red and beep long tone.
- Read and the date and time data from UID and store in Log Memory database, as personnel access records.

# Example Program Introduction

- Simulate preservation movement. Tap the PCB in front of "Glass breaking detection sensor", it will make the sensor respond. The system will continue to sound the alarm until pressing "SW1" key.
- Login new Tags to User Memory database.
- Receive and process USB or RS-232 remote control commands.
- Press numeric keypad to perform simple single experiment.

# Example Program Flow Chart

## LP-2010 System Flow Chart



# Example Description

| --- File Name --- | ---------- File contents ---------- |
|---|---|
| LP-2010.ASM | LP-2010 main program |
| LP-2010.DEF | LP-2010 system definition |
| LP2010-VOLU.INC | LP-2010 system parameters and variables definition |
| LP2010-SEEP.DEF | LP-2010 system serial EEPROM data definitions |
| LP2010-EXAMPLE.INC | LP-2010 experiment example program |
| TRF-15693.INC | ISO-15693 related service function |
| TRF-14443A.INC | ISO-14443A related service function |
| LP2010-IO.INC | LP-2010 experiment, ,I/O peripherals, control service function |
| LP2010-QC.INC | LP-2010 I/O, peripherals, simple quality control program |
| LP2010-2432.INC | LP-2010 User database, 24C32 Serial EEPROM service function |
| LP2010-24512.INC | LP-2010 Log database, 24C512 Serial EEPROM service function |
| LP2010-LCD.INC | LCD service function |
| LP2010-RTC.INC | M41T0 Serial Real-Time Clock service function |
| LP2010-OPER.INC | data format conversion, math service function |
| LP2010-KEY.INC | keyboard function service program, Buzzer service function |
| LP2010-TIME.INC | time delay service function |

# Program Development Process

## 1.Edit

Use text edit program to open source code files of example program.

Error

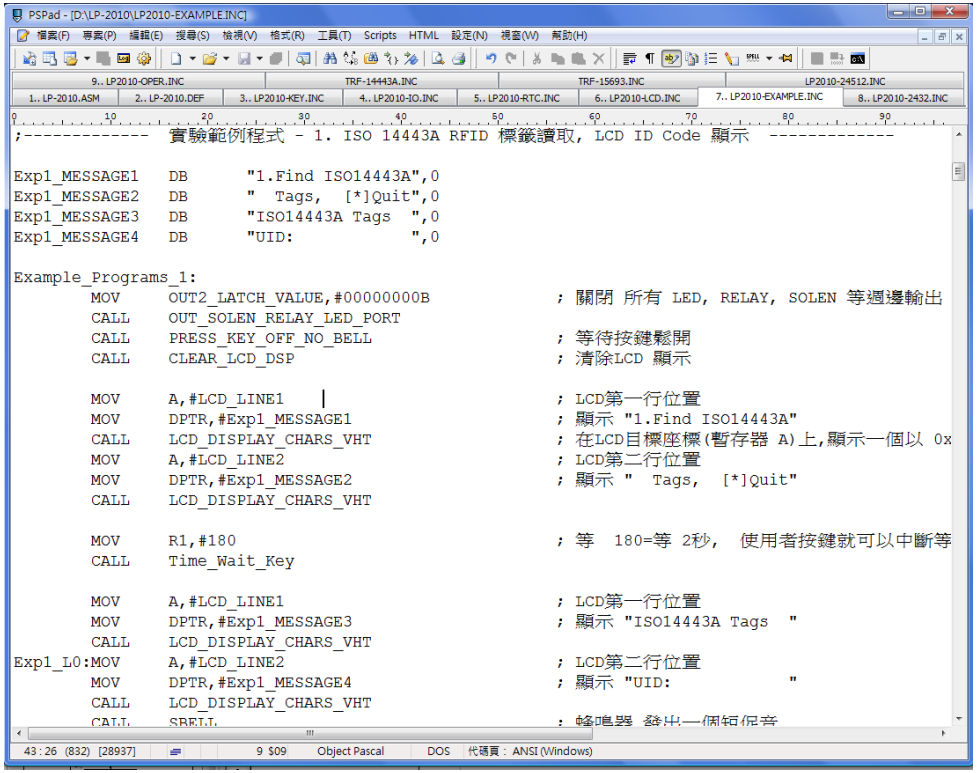
Assemble the example program and connect to ". HEX" file. Execute "X1.BAT" batch file to assemble and connect.

PASS

Execute 8051IspWriter to download ". HEX" file via USB to the LP-2010

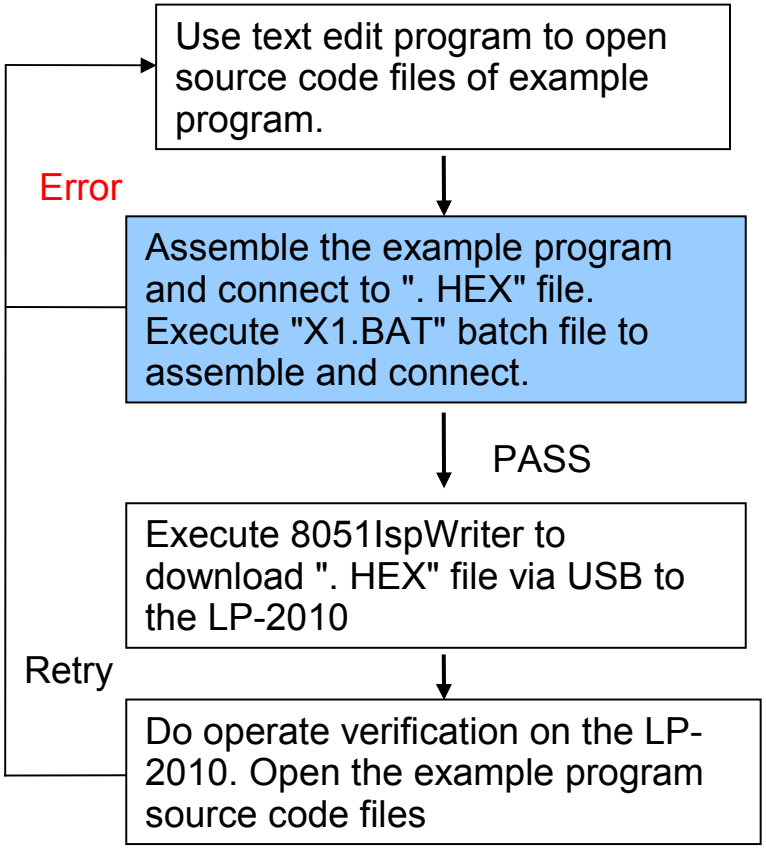
Retry

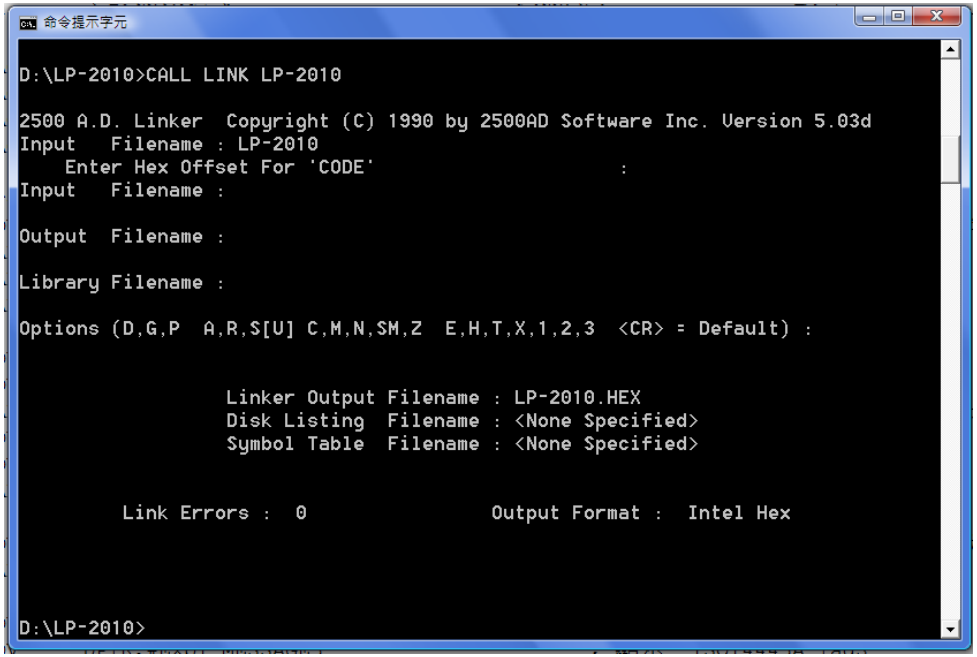
Do operate verification on the LP-2010. Open the example program source code files



# Program Development Process

## 2.Assembler



# Program Development Process

## 3.Download program

Use text edit program to open source code files of example program.

Error

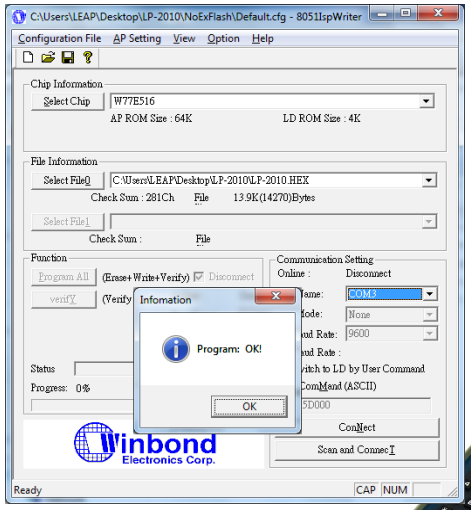
Assemble the example program and connect to ". HEX" file. Execute "X1.BAT" batch file to assemble and connect.

PASS

Execute 8051IspWriter to download ". HEX" file via USB to the LP-2010

Retry

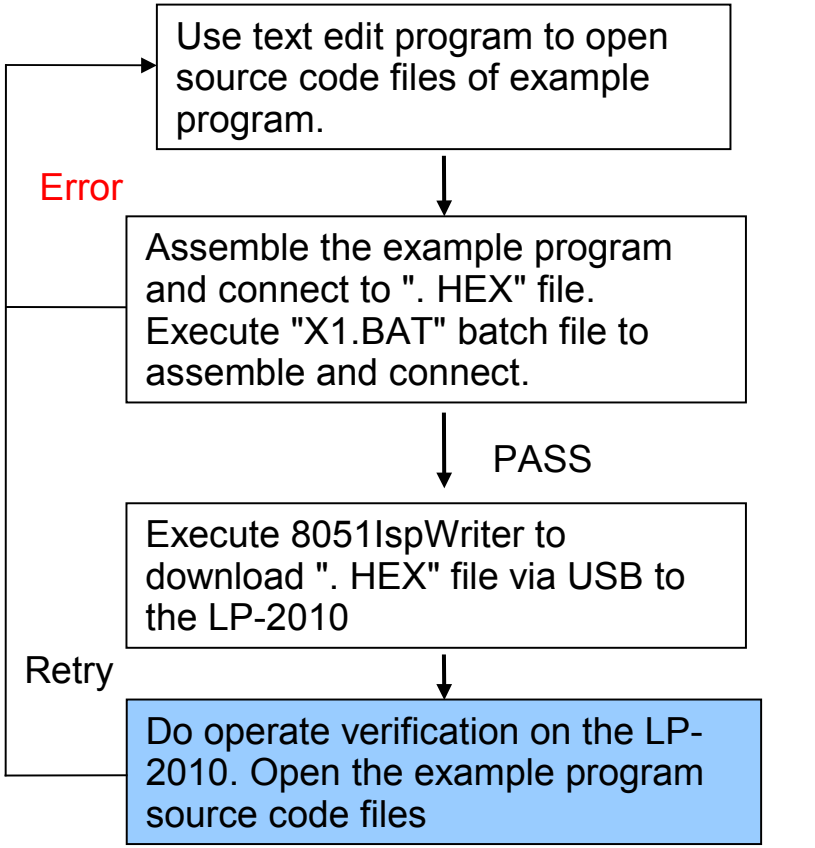
Do operate verification on the LP-2010. Open the example program source code files





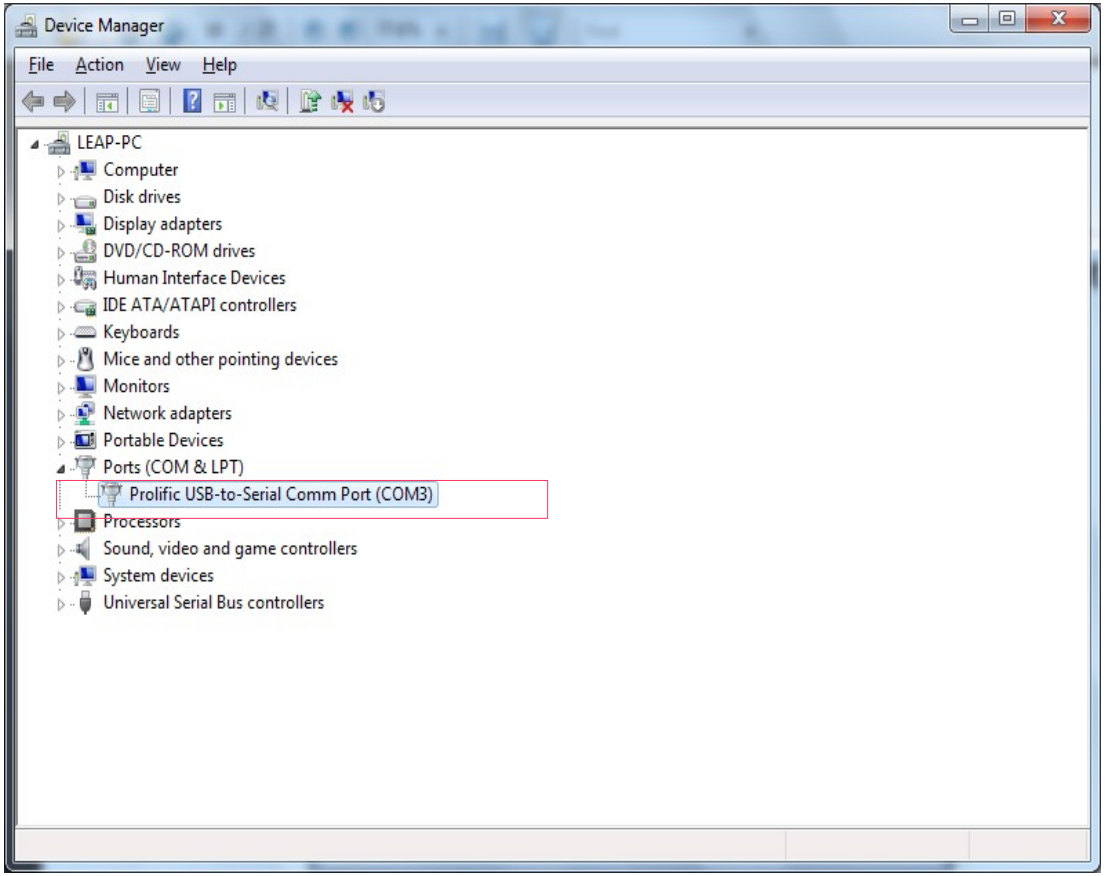
# Program Development Process

## 4.Verification



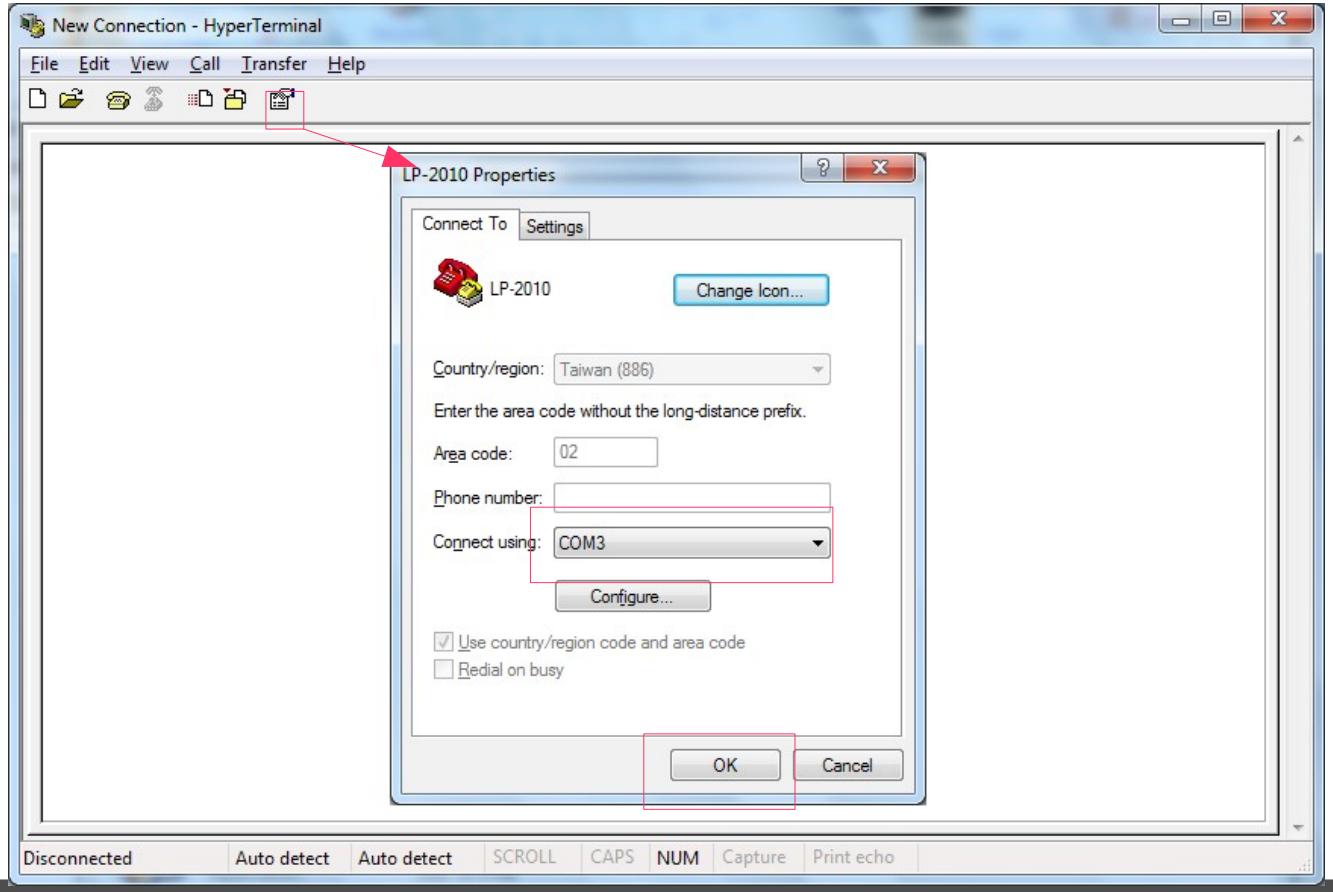

# Terminal Program Set

- **Set virtual COM port number from path: Start\ Control Panel\ System\ Device Manager**



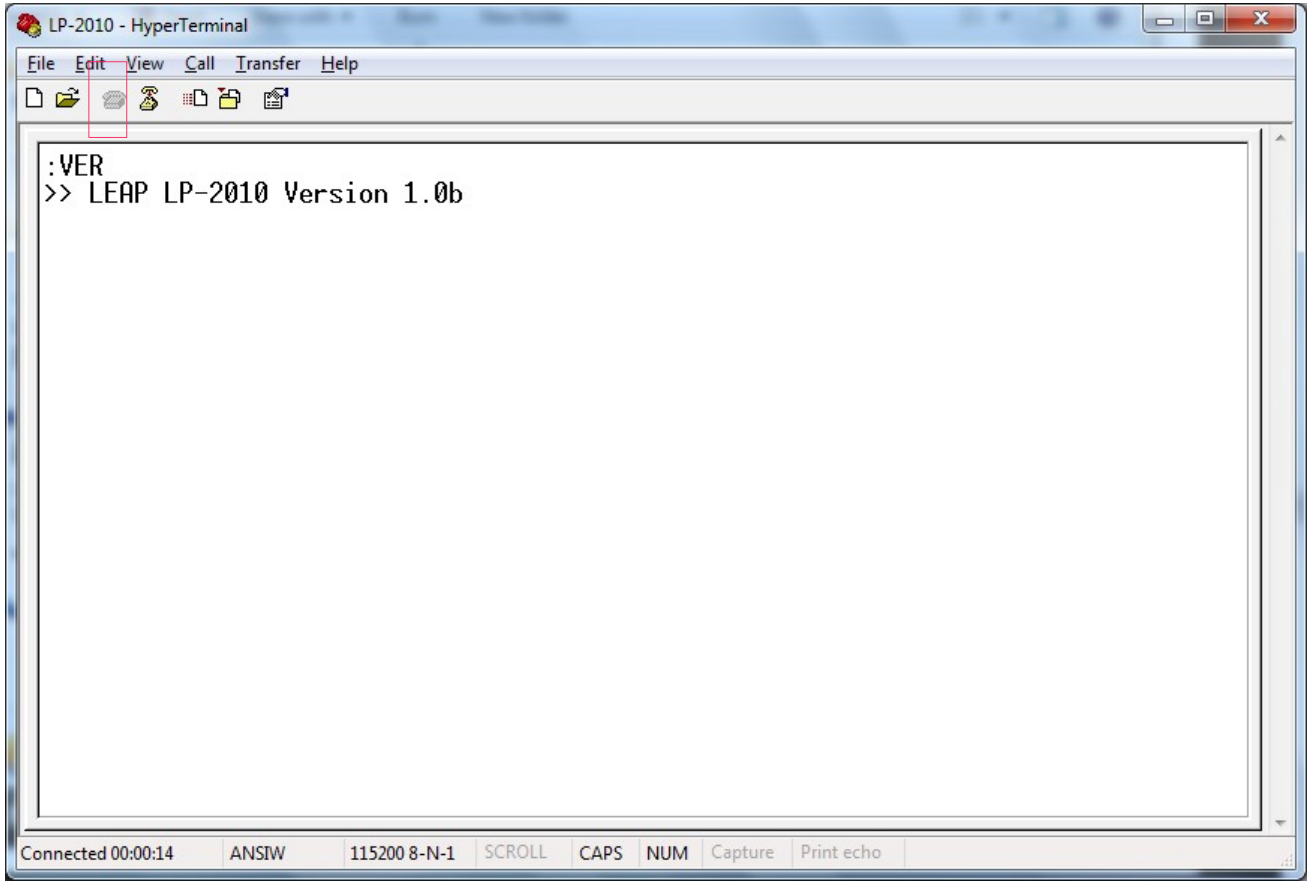
# Terminal Program Set

- **Implement HyperTerminal and load "LP-2010.ht" hypothesis files, then set the communication parameters.**



# Terminal Program Connect

- **Click icon "Dial", and type LP-2010 control commands in the window.**



# Example Program Experiments

- e.g.1. Number Key "0"-
  Through example program to control and verify every peripheral device, such as LCD, Relay, Solenoid, Magnetic reeds switch sensor, Glass shattered sensor, External input signal and so on.

- e.g.2. Number Key “1"-
  Implement reading function of ISO 14443A RFID tag, and display UID on the LCD.

- e.g.3. Number Key “2"-
  Implement reading function of ISO 15693 RFID tag, and display UID on the LCD.
  Transmit the text format of the ID to the PC through USB or RS-232.

# Example Program Experiments

- e.g.4. Number Key “3"-
  Implement reading function of ISO 14443A RFID tag. Do UID data searching and matching from USER Memory. Then showing conformed or not by LED signal.

- e.g.5. Number Key “4"-
  Read system RTC (real-time clock), then display date and timen on the LCD.

- e.g.6. Number Key “5"-
  The reading experiment of each USER DATA block in ISO 15693 tags. (There're 64 blocks and 32bits/each in the tag)
  Key“1”-Read the Block#3 data of tags and display on the LCD.
  Key”2”-Write the RTC data (day / week / hour / minute / second) in BLOCK # 3.
  Key”9”-Clear ISO 15693's Block#3 data to 00000000.

# Example Program Experiments

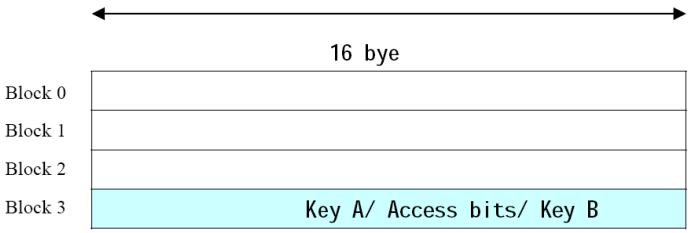
- e.g.7. Number Key “6"-
  Check multiple ISO 15693 Tags within sensing range, and transmit all UID to the PC through USB.
  Key”#”-Repeat implementing ISO 15693 Tags inventory checking once, and show Tags finding number on the LCD.

- e.g.8. Number Key “7"-
  Reading and writing experiment of ISO 14443A Mifare Card inner data blocks.
  Key”1”-Read and show Block#0 information about card vendor.
  Key”2”-Read and show Block#1 information.
  Key”3”-Write year / month / day / week / hour / minute / sec and 01-08 numeric data to the Block#1 of Tags.
  Key”9”-Clear Block#1's data of Tags to 0000000 ... 000.

# Example Program Experiments

## Mifare Card

| | | | | |
|---|---|---|---|---|
| Sector 0 | Block 0 | Block 1 | Block 2 | Block 3 |
| Sector 1 | Block 4 | Block 5 | Block 6 | Block 7 |
| . | Block 8 | Block 9 | Block 10 | Block 11 |
| . | Block 12 | Block 13 | Block 14 | Block 15 |
| . | Block 16 | Block 17 | Block 18 | Block 19 |
| . | Block 20 | Block 21 | Block 22 | Block 23 |
| . | Block 24 | Block 25 | Block 26 | Block 27 |
| | Block 28 | Block 29 | Block 30 | Block 31 |
| | Block 32 | Block 33 | Block 34 | Block 35 |
| | Block 36 | Block 37 | Block 38 | Block 39 |
| | Block 40 | Block 41 | Block 42 | Block 43 |
| | Block 44 | Block 45 | Block 46 | Block 47 |
| | Block 48 | Block 49 | Block 50 | Block 51 |
| | Block 52 | Block 53 | Block 54 | Block 55 |
| | Block 56 | Block 57 | Block 58 卡 | Block 59 |
| Sector 15 | Block 60 | Block 61 | Block 62 | Block 63 |




- MIFARE card is the electronic tags with ISO 14443A specification. The sensing distance is about 0~10cm. Now in Taiwan, Metro Taipei's EasyCard is MIFARE card.
- In MIFARE-1-S50, can be divided into 1Kbyte EEPROM contains 16 sectors(Sector0~15). 1 sector is divided into 4 Blocks(Block0~63). Each block is 16byte. There's a Sector Trailer in each Sector/Block, btw 2 Keys (Key-A & Key-B) included in each Sector Trailer.
- Block0 records card's vendor ID, Manufacturer Code. Also recording chip type, card serial number, manufacturing date and so on related card information.

# Connection Control

- **Connection interface:** USB and RS-232 interface
  **Communication parameters:** 115,200 baud rate, No parity, 8 bits, 1 stop bit
  **Command quick reference:**

- **System control instructions:**

| Instruction | Instruction format and example | Description |
|---|---|---|
| **:Ver** | :Ver | Inquiry system version? |
| **:Help** | :Help | Ask remote command list? |
| **:WR:MID** | :WR:MID {Decimal ID information}<br>:WR:MID 12 | Set card reader to identify the ID. |
| **:RD:MID?** | :RD:MID? | Read identified ID from card reader. |
| **:SET:DATE** | :SET:DATE {A.D.Year Month Date Week}<br>:SET:DATE 09 10 21 3 | Set the date of card reader. |
| **:SET:TIME** | :SET:TIME {Hour Minute Second}<br>:SET:TIME 15 32 45 | Set the time of card reader. |
| **:RD:LOG?** | :RD:LOG?<br>>> Number of Login: 1 <*0DH*><br>26 92 9A 48 6F 8D 00 1E 00 00 07 E0 <*0DH*><br>>> File END <*0DH*> | Read the access records of staff. |

# Connection Control

## RFID tag commands

| Instruction | Instruction format and example | Description |
|---|---|---|
| **:RD:TAGS?** | :RD:TAGS? | Read the current sensing UID data of the RFID tag. |
| **:SET:ECHO** | :SET:ECHO *{ off/on/? }*<br>:SET:ECHO ON | Whether immediately transmitting card's UID to the PC when card reader inducts the RFID card. |
| **:RD:BLK** | :RD:BLK {Decimal block number}<br>:RD:BLK 2 | Read specified block data of ISO 15693 tags. |
| **:WD:BLK** | :WD:BLK {Decimal block number} {4 hexadecimal data}<br>:WD:BLK 2 12 34 AB CD | Write 4Bytes data to the specified block of ISO 15693 Tag. |
| **:INVENTORY** | : INVENTORY | Check multiple ISO 15693 Tags within inducting range, and transmit all UID to the PC. |

## Database commands

| Instruction | Instruction format and example | Description |
|---|---|---|
| **:LIST:UID?** | :LIST:UID? | Ask card reader's RFID UID list from database. |
| **:ADD:UID** | :ADD:UID {8 hexadecimal UID label data}<br>:ADD:UID A1 B2 C3 D4 E5 F6 78 90 | Add new RFID tags' UID data to the database of card reader. |
| **:CHG:UID** | :CHG:UID {Number} {8 hexadecimal UID label data}<br>:CHG:UID 1 A1 B2 C3 D4 E5 F6 78 90 | Revise the original RFID tags' UID in the database |
| **:DEL:UID** | :DEL:UID {Decimal block number}<br>:DEL:UID 2 | Delete the RFID tags' UID data in card reader's database. |

# Connection Control

## I/O peripheral output control instruction

| Instruction | Instruction format and example | Description |
|---|---|---|
| **:WR:OUT** | :WR:OUT {Hexadecimal data}<br>:WR:OUT 01 | Set card reader's I/O output port data. |
| **:RD:OUT?** | :RD:OUT? | Read card reader I/O output port setting data. |

## I/O Output Port

| Data Bit | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|
| **Function** | Electromagnet | | Relay#2 | Relay#1 | Orange LED | Red LED | Yellow LED | Green LED |
| Initial Status | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Control | 0=OFF<br>1=ON | | 0=OFF<br>1=ON | 0=OFF<br>1=ON | 0=OFF<br>1=ON | 0=OFF<br>1=ON | 0=OFF<br>1=ON | 0=OFF<br>1=ON |

# Connection Control

## I/O peripheral input control instruction

| Instruction | Instruction format and example | Description |
|---|---|---|
| **:RD:IN?** | :RD:IN? | Read card reader I/O input port data. |

## I/O Input Port Definition

| Data Bit | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|
| Function | Sersor-2 Glass breaking induction | Sersor-1 Magnetic reed switch | Key SW2 | Key SW1 | IO_IN4 | IO_IN3 | IO_IN2 | IO_IN1 |
| Initial Status | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| I/O Status | 0=Not induct 1=Induct the frequency of the breaking glass. | 0=Not induct 1=Induct the magnet leaving, which means the door and window are opened. | 0=Press 1=Not press | 0=Press 1=Not press | 0=The I/O Input signal voltage is 25% lower than the voltage level of the external VIO voltage or more. (For example, 5V power supply, the Input voltage is below 1.25V) 1=The IO Input signal voltage is 25% higher than the external VIO voltage or more | | | |