

```
/*-----|
| Name : Eeprom.c |
| Purpose: |
| I2C (inter integrated circuit bus) is a 2-wire serial interface standard defined |
| by Philips Semiconductor. This program will demonstrate the basic function, read |
| byte, write byte, sequential read and write page of the i2c eeprom. UMPS simulator |
| will be implemented for this demonstration program. select the device 'I2C Eeprom' |
| in resources, config the setting appropriate and run the program. |
|-----*/
#include "config.h"

/*
 * demonstrate the basic function of the i2c eeprom.
 */
void main(void)
{
    unsigned int i;
    unsigned char rcvdata;
    unsigned char databuf[PAGE_SIZE];

    read_Page(0x10,databuf);          // read a page from address 0x10 to 0x16
    for(i=0;i<3000;i++);              // and store it in array databuf[].
    write_Page(0x20,databuf);         // write a page form address 0x20 to 0x26
    for(i=0;i<3000;i++);              // the data is store in array databuf[].
    rcvdata=read_Byte(0x20);           // read a byte in address 0x20
    for(i=0;i<3000;i++);
    write_Byte(0x30,rcvdata);         // write a byte in address 0x30

    while(1);
}
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/*-----
| Name: advanced.c
| Purpose:
| provide the advanced function of the i2c eeprom. write byte, read byte, write page
| and sequential read.(PS: function read_Byte is call by value, read_Page is call by
| address)
|-----*/
#include "config.h"

/*
 * write a byte to i2c devices.
 */
void write_Byte(unsigned char eepromAddr, wrData)
{
    sendStart(); // start
    sendSlaveAddress(SLAVE_ADDRESS); // 7 bit slave address
    sendBitIndicateWrite(); // a bit for write mode
    waitAck();
    sendByte(eepromAddr); // eeprom address
    waitAck();
    sendByte(wrData); // a data
    waitAck();
    sendStop(); // byte written completed
}

/*
 * write a page to i2c devices, eepromAddr indicate the starting address for write
 * and eepromAddr + PAGE_SIZE is the ending address. the data for write is store in
 * array wrbuf[]. the array is pass by address that the caller determined.
 */
void write_Page(unsigned char eepromAddr, unsigned char wrbuf[PAGE_SIZE])
{
    unsigned int i;
    sendStart(); // start notation
    sendSlaveAddress(SLAVE_ADDRESS); // 7 bit slave address
    sendBitIndicateWrite(); // a bit for write mode
    waitAck();
    sendByte(eepromAddr); // eeprom address
    waitAck();
    for(i=0;i<PAGE_SIZE;i++) // send the data for write
    {
        sendByte(wrbuf[i]); // some data
        waitAck();
    }
    sendStop(); // page written completed
}

/*
 * read a byte in a particular address of eeprom memory, and return a readed value
 * to the caller.
 */
unsigned char read_Byte(unsigned char eepromAddr)
{
    unsigned char rcvdata;
    unsigned char mask; // variable for getting the reading data

    /* set the ptr of eeprom address */
    sendStart(); // set the eeprom location address
    sendSlaveAddress(SLAVE_ADDRESS); // 7 bit address for slave location
    sendBitIndicateWrite(); // bit indicated for write mode to
    waitAck(); // set the memory address of eeprom
    sendByte(eepromAddr);
    waitAck();

    /* current address read */
    sendStart();
    sendSlaveAddress(SLAVE_ADDRESS);
    sendBitIndicateRead();
    waitAck();

    mask = 0x80;
    do{ // store 8 bit data
        setSCL; // negative edge clock data out
        if (SDA==1)
            rcvdata |= mask;
        clrSCL;
        mask = mask/2;
    }while (mask>0);
    masterNoAck();
}

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    sendStop();                // read completed
    return rcvdata;
}

/*
random sequential read, the function will read the data from the address 'eepromAddr'
to the eepromAddr + PAGE_SIZE. the readed data will stored in variable rcvbuf[], which
address is passed by the caller. pass by reference, that means the caller variable array
will be changed by the called function.
*/
void read_Page(unsigned char eepromAddr,unsigned char rcvbuf[PAGE_SIZE])
{
    unsigned int i;
    unsigned char mask;        // variable for getting the reading data

    /* set the ptr of eeprom address */
    sendStart();               // set the eeprom location address
    sendSlaveAddress(SLAVE_ADDRESS); // 7 bit address for slave location
    sendBitIndicateWrite();    // bit indicated for write mode to
    waitAck();                 // set the memory address of eeprom
    sendByte(eepromAddr);
    waitAck();

    /* current address read */
    sendStart();
    sendSlaveAddress(SLAVE_ADDRESS);
    sendBitIndicateRead();
    waitAck();

    // get the data from eeprom and store it to array rcvbuf[], which address is
    // determined by the caller. As this function is call by address
    for(i=0;i<PAGE_SIZE;i++)    // repeat PAGE_SIZE time
    {
        mask = 0x80;
        do{                     // store 8 bit data
            setSCL;              // negative edge clock data out
            if (SDA==1)
                rcvbuf[i] |= mask;
            clrSCL;
            mask = mask/2;
        }while (mask>0);
        if(i==PAGE_SIZE-1)      // if last read, send No ack
            masterNoAck();
        else                    // if not last read, send ack
            masterAck();
    }

    sendStop();                // read completed

    return;
}
```

```
/*-----|
| Name: basic.c                               |
| Purpose:                                     |
| provide the basic level control for the combined advanced function. Eg, send a start |
| notation, stop notation, send a slave address, byte and acknowledgement.           |
|-----*/
#include "config.h"

// a start notation for the i2c slave
void sendStart(void){
    setSDA;
    setSCL;
    clrSDA;
    clrSCL;
}

// a stop notation for the i2c slave
void sendStop(void){
    clrSDA;
    setSCL;
    setSDA;
    clrSCL;
}

// sends one byte of data to a i2c slave
void sendByte(unsigned char b){
    unsigned char mask;
    mask = 0x80;
    do{
        if ( b & mask ){
            setSDA;
        }
        else{
            clrSDA;
        }
        setSCL;
        clrSCL;
        mask = mask/2;
    }while (mask>0);
}

// sends lower 7 bit of data to a i2c slave
void sendSlaveAddress(unsigned char b){
    unsigned char mask;
    mask = 0x80;
    b*=2;
    do{
        if ( b & mask ){
            setSDA;
        }
        else{
            clrSDA;
        }
        setSCL;
        clrSCL;
        mask = mask/2;
    }while (mask>1);
}

// wait until acknowledgment is received from slave
void waitAck(void){
    setSDA;
    setSCL;
    while(SDA);
    clrSCL;
}

// master acknowledge by sending a clr bit to slave
void masterAck(void){
    clrSDA;
    setSCL;
    clrSCL;
}

// master disacknowledge by sending a set bit to slave
void masterNoAck(void){
    setSDA;
    setSCL;
    clrSCL;
}
```

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}

// a bit after the slave address, clr indicate i2c write
void sendBitIndicateWrite(void){
    clrSDA;
    setSCL;
    clrSCL;
}

// a bit after the slave address, set indicate i2c read
void sendBitIndicateRead(void){
    setSDA;
    setSCL;
    clrSCL;
}
```

```
/*-----*
| Name: config.h                                     |
| Purpose:                                           |
| config the hardware setting, define the hardware control pin with a notation name |
| select the require lib for the MPU, and define the protocol for the program access |
|-----*/
#include <reg51.h>
#include <stdio.h>

#define setSCL      SCL=1;while (SCL!=1);
#define clrSCL      SCL=0;
#define setSDA      SDA=1;
#define clrSDA      SDA=0;

#define PAGE_SIZE    7                          // max no. of page size for read/ write
#define SLAVE_ADDRESS 0x50                      // the address of the i2c slave

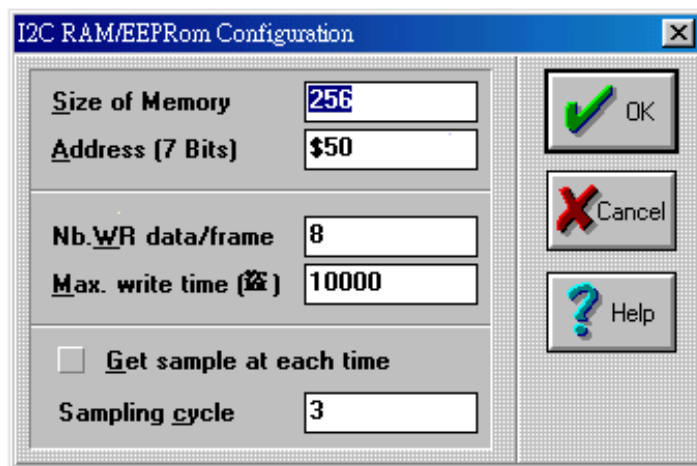
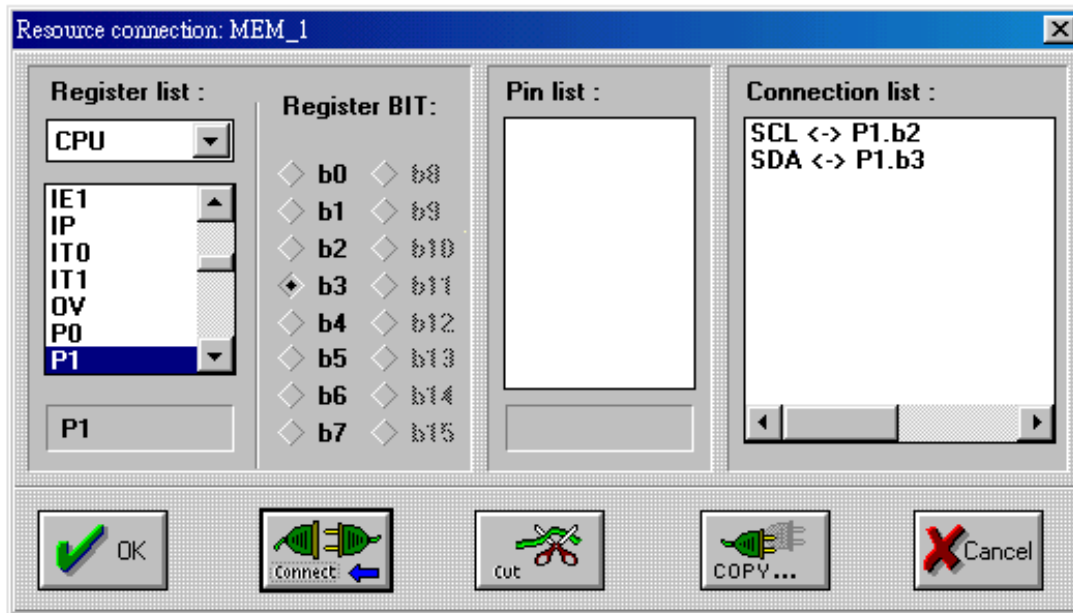
sbit    SCL = P1^2;                            // i2c clock pin
sbit    SDA = P1^3;                            // i2c data pin

// basic.c
void sendStart(void);
void sendStop(void);
void sendByte(unsigned char);
void sendSlaveAddress(unsigned char b);
void waitAck(void);
void masterAck(void);
void masterNoAck(void);
void sendBitIndicateWrite(void);
void sendBitIndicateRead(void);

// advanced.c
void write_Byte(unsigned char eepromAddr, eepromData);
void write_Page(unsigned char eepromAddr, unsigned char wrbuf[PAGE_SIZE]);
unsigned char read_Byte(unsigned char eepromAddr);
void read_Page(unsigned char eepromAddr,unsigned char rcvbuf[PAGE_SIZE]);
```

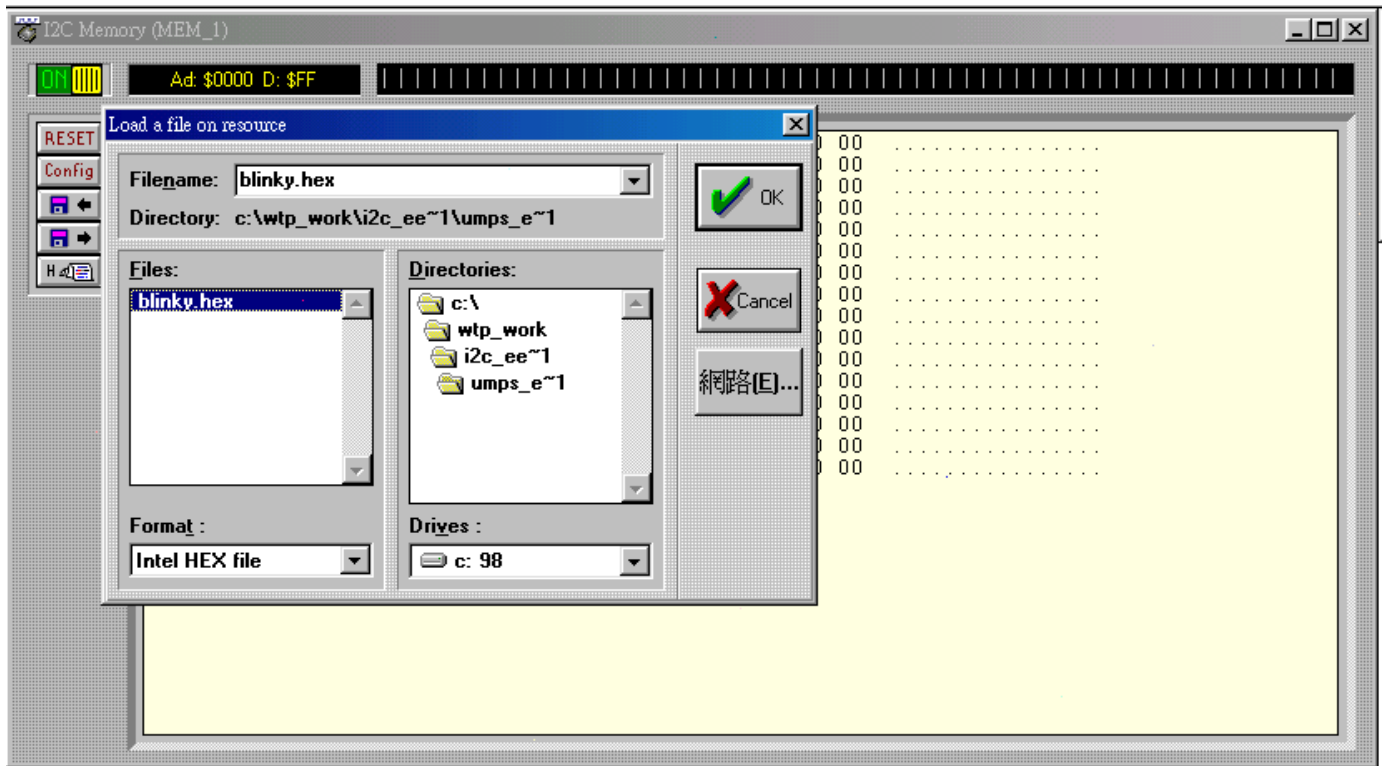
process.doc

This document is for the demonstration of the I2C Eeprom using the software um ps .
The read byte , write byte , read page and write page will be demonstrated .

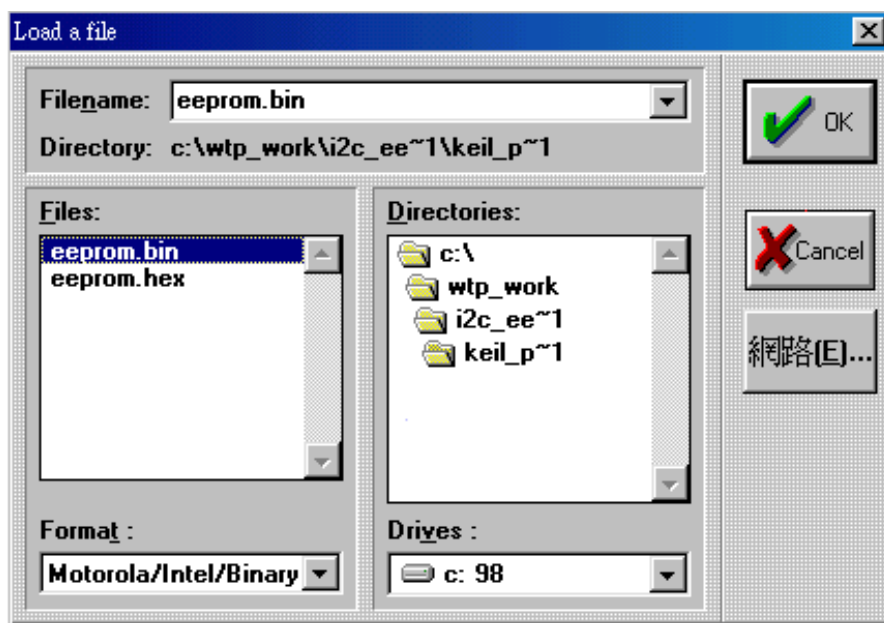


Open the UMPS software, click configure and then click resources, select the device I2C Eeprom .
Set the wire connection and other configure for the eeprom .

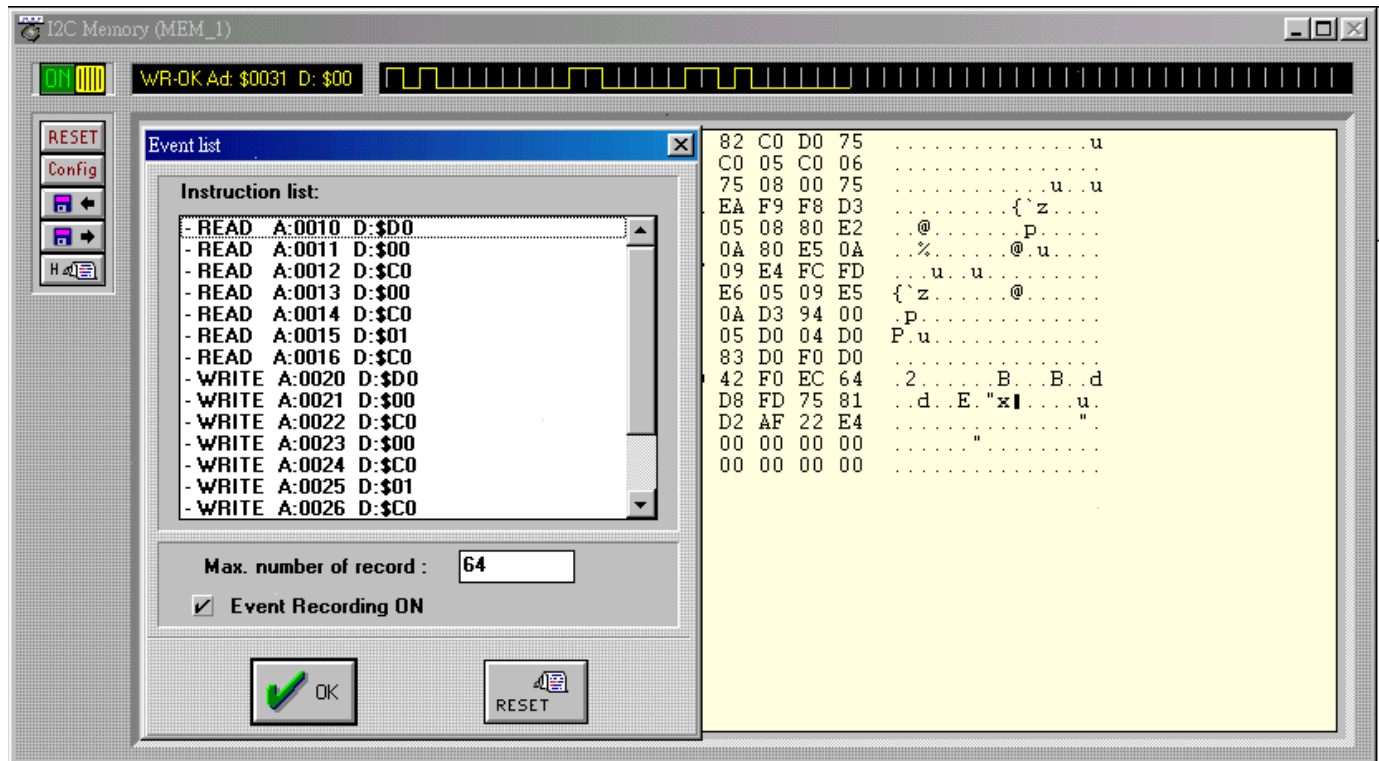
process.doc



Exit the resource, and double click the i2c device, the memory map will be pop up. Load the hex file locate in directress umps_eeprom .



load the bin file from directress keil_program



Press reset icon and then press run to implement i2c eeprom simulation.



I2C EEPROM/RAM

See also: [Resources](#)
[Resource mechanism detail](#)

Refresh style:

- on refresh breakpoint,
- at each N CPU cycles CPU (option *Get Sample at each time* checked) .

As this resource is able to simulate a RAM or an EEPROM, there are two additional parameters:

- Write buffer size: which determine the maximum number of bytes an EEPROM can handle in a single frame: 2 for a PCF8570, 8 for XICOR, etc ...
- Write Time in microseconds: which determines the time needed to perform a write operation.

WARNING:

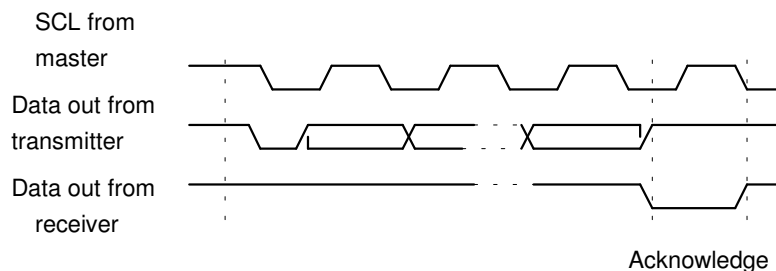
Some EEPROM are greater than 256 bytes, even greater than 2 K-Byte. The resource will make the difference according to the memory size, so the address to access a byte will be specified as:

- a byte (size < 256 bytes),
- a part of the address is contained in Slave address (3 bits), and the other part is transmitted in the following byte (256 byte < size < 2K-Byte),
- 2 bytes, high and low part of the 16-bit address (size > 2K-Byte).

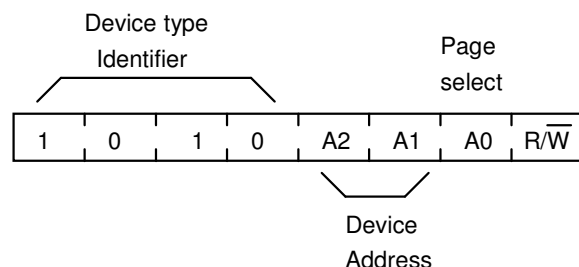
Start and Stop Conditions

Each commands is preceded by a START condition, which is a transition from ONE to ZERO of the SDA line while the SCL line is set to one.

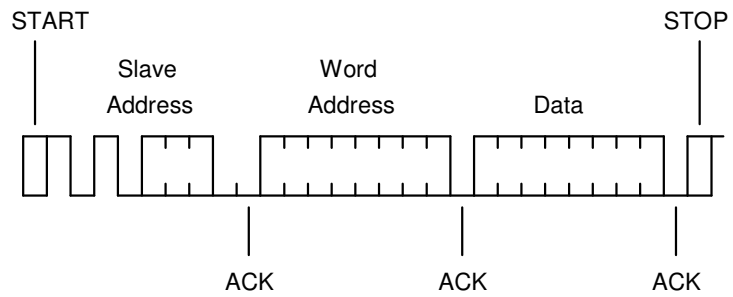
The handshake is given when the 9th bit is transmitted.



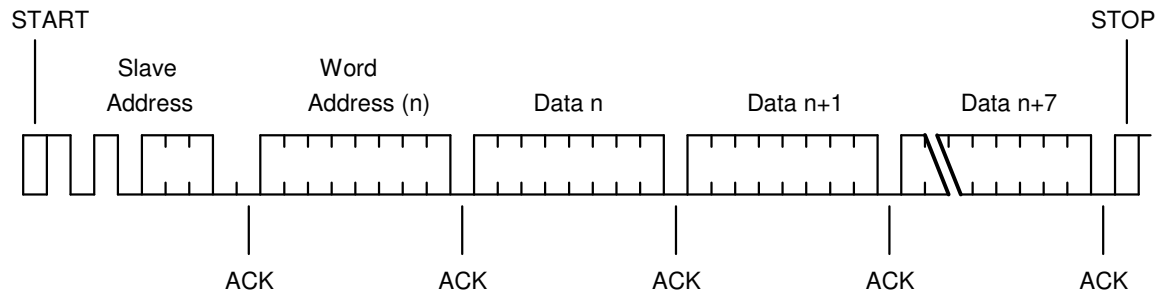
Slave Address



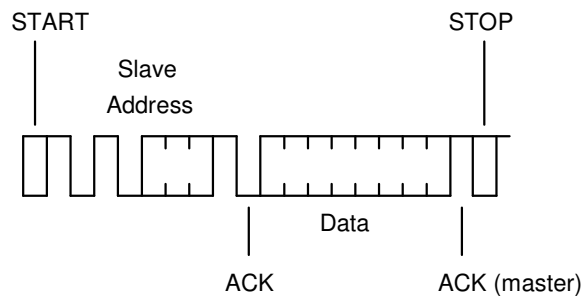
Byte Write



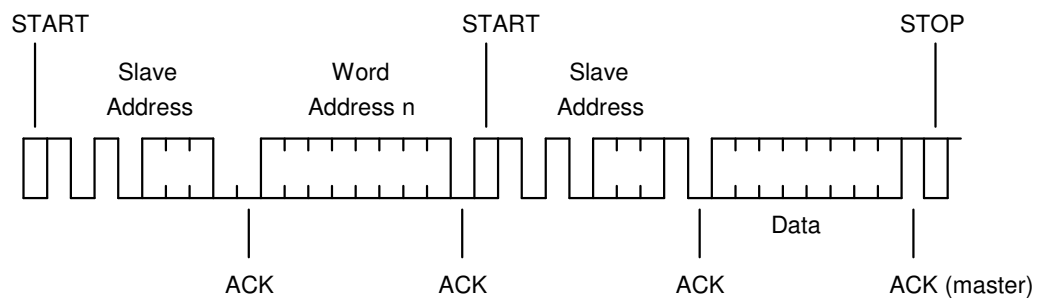
Page Write



Current Address Read



Random Read



Sequential Read

