Software Guide

ICP DAS Modbus Server

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Warranty

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Contents

Chapter 1 Introduction

This manual is written for modbus users of *ICPDAS LinPAC and LinCon series*.

This document will guide you:

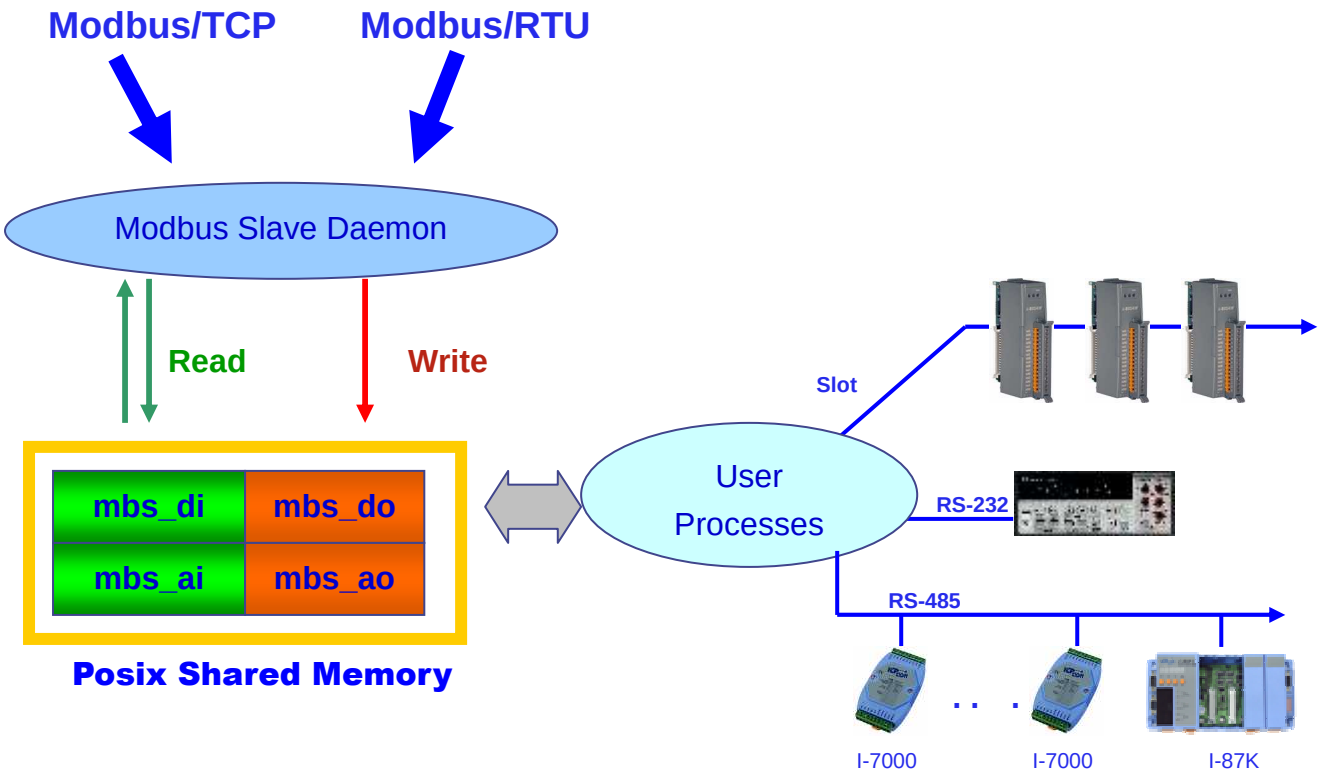
- How to setup Modbus Server on your devices.
- How to write program with shared memory

ICPDAS ® Modbus Server is a modbus slave server that provides shared memory to share data with other process.

Shared Memory is an efficient means of passing data between programs. One program will create a memory portion which other processes (if permitted) can access. The use of shared memory in an application requires implementation of just a few interfaces bundled into the standard C language library.

ICPDAS ® Modbus Server provides POSIX shared memory mechanism. POSIX shared memory is a variation of mapped memory.

The following figure shows that Modbus Server communicating to other process via POSIX shared memory.



1.1.Install Modbus server on your LinPAC／LinCon

▶ Software Installation

If your LinPAC／LinCon is former released, you have to install the Modebus Server by manual.

Step 1.

ICPDAS® Modbus Server supports LinPAC 8x8x and 8x4x , you can download from the following links.

- LinPAC 8x8x
  ftp://ftp.icpdas.com/pub/cd/linpac/napdos/lp-8x8x/addons/modbus/server
- LinPAC 8x4x
  ftp://ftp.icpdas.com/pub/cd/linpac/napdos/lp-8x4x/addons/modbus/server

Step 2.

Copy the “mbserver10” file to your LinPAC／LinCon, and change the file permission to “755” or above.

#chmod 755 ./mbserver10

Step 3.

Before executing LinPAC／LinCon Modbus Server, you have to check what’s the index number of your TTY devices.

#dmesg | grep ‘ttyS’

In general, LinCon support 2 serial ports,
ttyS0 ：COM2 RS-232 (Recommend!)
ttyS1 ：COM3 RS-485
and 3 serial ports are availabled on LinPAC.
ttyS0 ：COM1, RS232 (Reserved for console terminal)
ttyS1 ：COM3, RS232／RS-485
ttyS34 ：COM4, RS232 (Recommend!)

Step 4.

You can use following command to start Modbus Server.
./mbserver10
Modbus server provides the following arguments

-n	Set NetID , Default is 1
-p	Set Port Number for Modbus TCP,default is 502
-d	Enable Daemon mode, default is disable
-s	Set serial port device name for modubs rtu,default is /dev/ttyS34
-b	Set Baud rate ,default is 9600bps

-f	Set data format, default is 8N1

Example:

./mbserver10 –n 1 –s /dev/ttyS34 –b 115200 –f 8N1

Running automatically at boot time :

STEP 1 : Copy “mbserver” file to /etc/init.d of your LinPAC／LinCon

STEP 2 : Edit “mbserver” script file,

specify “mbserver10” directory and modify parameters to fit your system.

STEP 3 : Creat a symbolic link in /etc/rc2.d directory

ln –s /etc/init.d/mbserver /etc/rc2.d/S99MBServer

NOTE :

Modbus server must be executed after serial port initialization.

▶ Hardware Connection

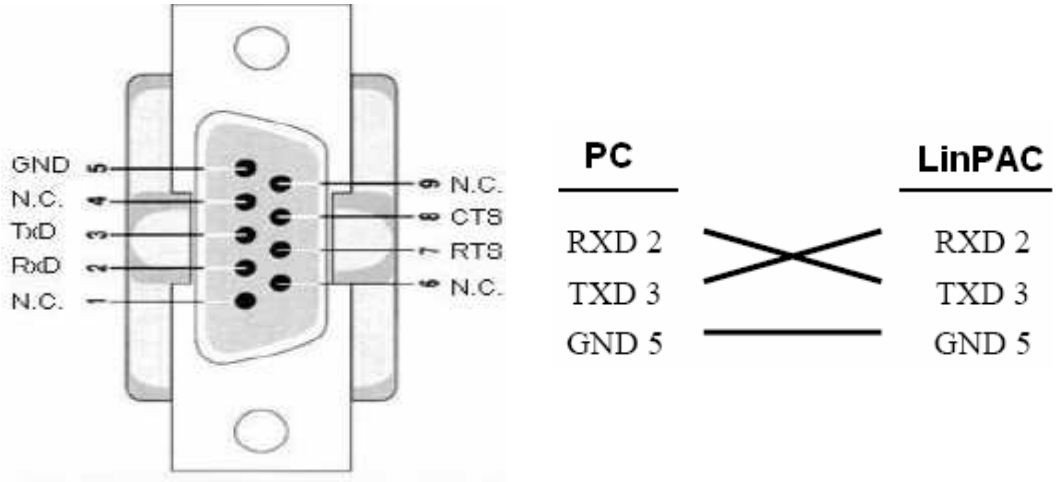
LinPAC／LinCon Modbus Server supports Modbus RTU and Modbus TCP protocol.

For TCP protocol

You can connect modbus client and server by using the ethernet cable with RJ-45 connector.

For RTU protocol

9 pins D-sub cable is necessary. The pin assignment is :



Ordering Information :

CA-0910F：9-pin Female-Female D-sub cable, 1M Cable

Chapter 2 Using shared memeoy in you program

2.1 Using Posix Shared memory

When you start the modbus server, it will allocate four shared memory on LinPAC / LinCon. Shared memory are located at `/dev/shm/mbs_ao`, `/dev/shm/mbs_ai` , `/dev/shm/mbs_do` and `/dev/shm/mbs_di` .

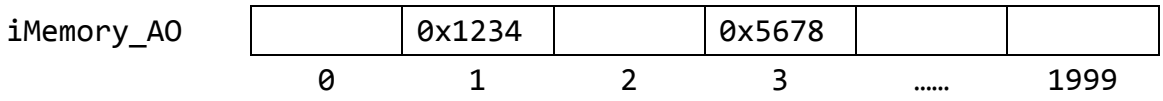
Shared memory	Size	Use
/dev/shm/mbs_ao	2000 * sizeof(int)	AO
/dev/shm/mbs_ai	2000 * sizeof(int)	AI
/dev/shm/mbs_do	2000 * sizeof(int)	DO
/dev/shm/mbs_di	2000 * sizeof(int)	DI

POSIX provides a standardized API for using shared memory. POSIX Shared Memory uses the function `shm_open` from `sys/mman.h`.
(http://www.opengroup.org/onlinepubs/009695399/basedefs/sys/mman.h.html)
If you never used POSIX shared memory, we also provide a simple MACRO `SHM_INIT` in `icpdas_mbs.h` to help you using shared memory.

Example：

```
SHM_INIT(AO,2000);
```

It will open shared memory `/dev/shm/mbs_ao` and mapping it to `*iMemory_AO` by default.Then you can access shared memory via array (Array's range is from 0~1999).



Example:

```
iMemory_AO[1]=0x01234;          //Set value 0x01234 to address 1 of iMemory_AO
printf("%04x\n",iMemory_AO[3]); //GET value from address 3 of iMemory_AO
```

2.2 Analog I/O DEMO

2.2.1. Set AO (I-8024W)

The following graph shows how to **SET AO** value between modbus server and **setao** program via shared memory .

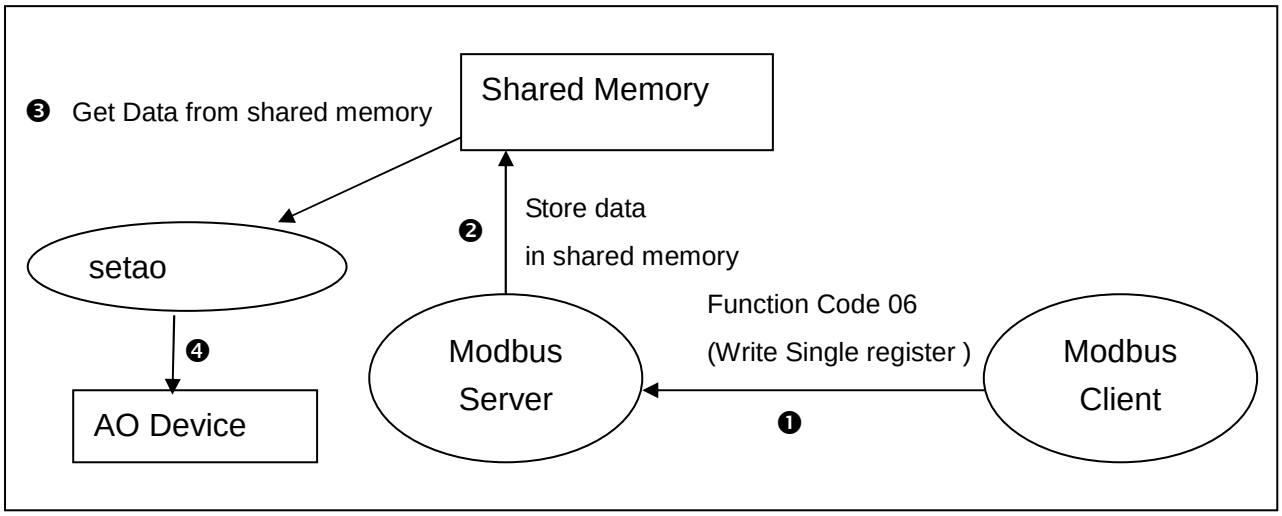


Figure 2.2.1

❶ modbus client send request to modbus server .
❷ modbus server put the AO value to shared memory.
❸ setao program fetch ao value from share memory
❹ setao program set ao value to AO device (I-8024W)

Example (setao.c)
Source code:

```
#include <stdio.h>
#include <stdlib.h>
#include "icpdas_mbs.h"
#include "msw.h"

int main( void ) {
    /* OPEN AO,AI,DO,DI Share Memory */
    SHM_INIT(AO,2000);
    int RetValue,slot,channel;
    float tmp=0.0;
    float f=0.0;
    unsigned long l;
    slot=2;
```

Include icpdas_mbs.h

Use SHM_INIT Marco to open shared memory

```
    channel=0;
    tmp=0;

    RetValue = Open_Slot(slot);
    if (RetValue >0) {
        printf("open Slot %d failed!\n",slot);
        return -1;
    }
    I8024_Initial(slot);
    while (1) {
        /* Float inverse (Big-Endian) , it depends on your SCADA */
        /*
            *((short *)&l+1)=iMemory_AI[0];
            *((short *)&l)=iMemory_AI[1];
        */
        /* Float (Little-Endian) */
        *((short *)&l)=iMemory_AO[0];
        *((short *)&l+1)=iMemory_AO[1];
        f = *((float *)&l);
        if (tmp!=f) {
            printf("set value %f\n",f);
            I8024_VoltageOut(slot,channel,f);
            tmp=f;
        }
        usleep(100);
    }
    Close_Slot(slot);
    return 0;
}
```

Analog value using floating point data type to represent. Floating point data size is 4 bytes. It uses two registers to store floating point data.

2.2.2. Get AI (I-8017HW)

The following graph shows the how to **Get AI** value between modbus server and **getai** program via shared memory .

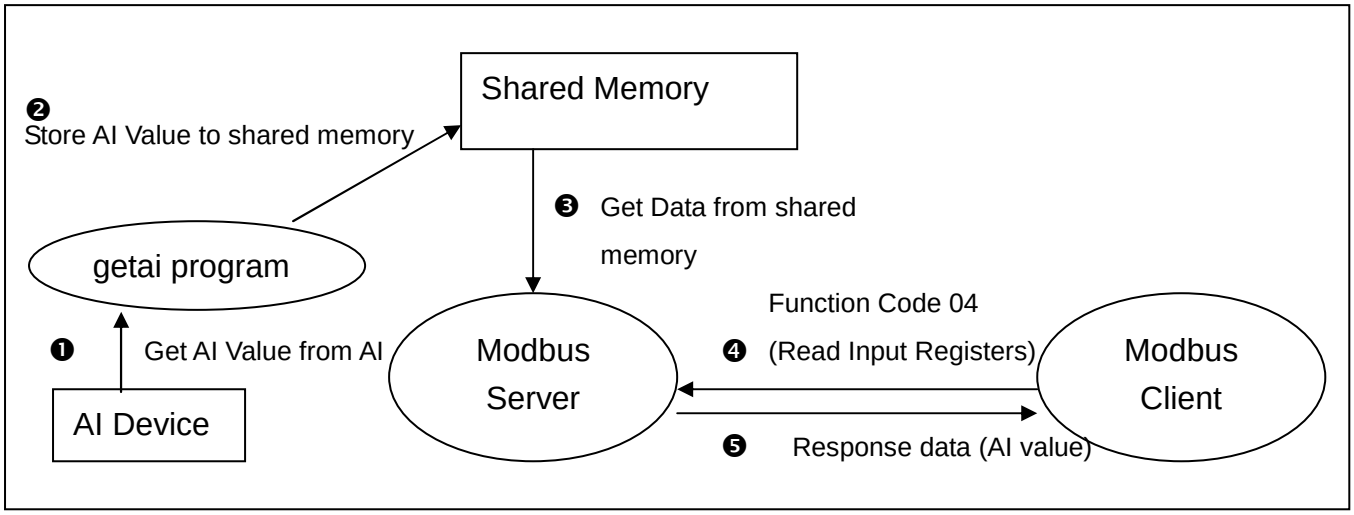


Figure 2.2.2

❶ getai program get ai value from AI Device (I-8017HW)
❷ getai program put AI value to share memory
❸ modbus server get AI value from shared memory
❹ modbus client send requeset to modbus server
❺ modbus server send response to modbus client

❶ to ❷ is Looping

Example (setao.c)
Source code:

```
#include <stdio.h>
#include "icpdas_mbs.h"
#include "msw.h"

int main(int argc, char **argv) {
    int RetValue,slot,channel,gain,mode;
    float f ;
    unsigned long l;
    slot=3;
    channel=0;
    gain=0;
    mode=0;
    /* OPEN Share Memory */
    SHM_INIT(AI,2000);
```

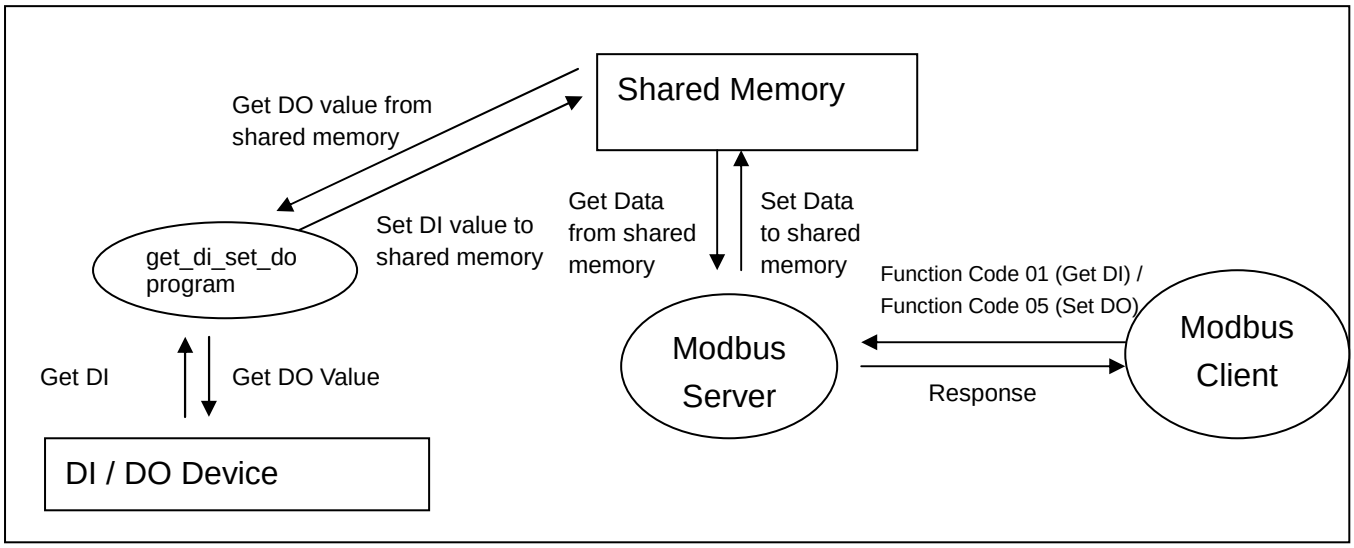
```
    /* open device file */
    RetValue = Open_Slot(slot);
    if (RetValue >0) {
       printf("open Slot %d failed!\n",slot);
       return FAILURE;
    }

    RetValue=I8017_Init(slot);
    I8017_SetChannelGainMode(slot,channel,gain,mode);
    while (1) {
       /* Get AI Value */
       f=I8017_GetCurAdChannel_Float_Cal(slot);

      l = *((unsigned long *)&f);
       /* Float inverse (Big-Endian) , depends on your SCADA */
       /* iMemory_AI[0]=*((short *)&l+1);
          iMemory_AI[1]=*((short *)&l);  */

       /* Float (Little-Endian) */
      iMemory_AI[0]=*((short *)&l);
      iMemory_AI[1]=*((short *)&l+1);
       printf("%f\n",f);
       usleep(1);
    }

    Close_Slot(slot);
    return 0;
}
```

Analog value using floating point data type to represent. Floating point data size is 4 bytes.
It use two register to store floating point data.

2.3 Digital I/O Demo

2.3.1 Set DO and Read DI (i-87054W)

The following graph shows the how to **Get AI** and **Set AO** value between modbus server and **get_di_set_do** program via shared memory .



Figrue 2.3.1

> i-87054w provides both DO and DI function

Example (get_di_set_do.c)

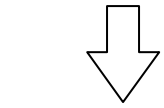
Source code:

```
#include<stdio.h>
#include<stdlib.h>
#include "icpdas_mbs.h"
#include "msw.h"

char szSend[80], szReceive[80];
DWORD dwBuf[12];
float fBuf[12];

void change_bit(int *val, int num, char bitval) {
    *val=((*val & ~(1<<num)) | (bitval << num));
}
```

```
void set_di(char b) {
    unsigned char mask = 0x01;
    int i;
    for (i=0; i<8; ++i) {
        if ((b & mask) != 0) {
            iMemory_DI[i]=1;
        } else {
            iMemory_DI[i]=0;
        }
        mask <<= 1;
    }
}

int main() {
    int i, wRetVal;
    int tval=0;
    int tval2=0;

    SHM_INIT(DO,2000);
    SHM_INIT(DI,2000);
    //Check Open_Slot
    wRetVal = Open_Slot(0);
    if (wRetVal > 0) {
        printf("open Slot failed!\n");
        return (-1);
    }

    //Check Open_Com1
    wRetVal = Open_Com(COM1, 115200, Data8Bit, NonParity, OneStopBit);
    if (wRetVal > 0) {
        printf("open port failed!\n");
        return (-1);
    }
```

EX:

DI value is **21(10101000)**



1	0	1	0	1	0	0	0
0	1	2	3	4	5	6	7

iMemory_DI

```
//Choose Slot3
ChangeToSlot(4);
while (1) {
    for (i=0;i<8;i++) {
        if (iMemory_DO[i]) {
            change_bit(&tval,i,1);
        } else {
            change_bit(&tval,i,0);
        }
    }

    if (tval != tval2 ) {
        //--- digital output ----  **(DigitalOut_87K()**)
        dwBuf[0] = 1;                // COM Port
        dwBuf[1] = 00;              // Address
        dwBuf[2] = 0x87054;         // ID
        dwBuf[3] = 0;               // CheckSum disable
        dwBuf[4] = 100;             // TimeOut , 100 msecond
        dwBuf[5] = tval;            // digital output
        dwBuf[6] = 0;               // string debug
        wRetVal = DigitalOut_87K(dwBuf, fBuf, szSend, szReceive);
// DO Output
        //  printf("DO Value= %u\n", dwBuf[5]);
        tval2=tval;
    }
    usleep(100);
    //--- digital Input ----   **(DigitalIn_87K()**)
    dwBuf[0] = 1;                 // COM Port
    dwBuf[1] = 00;               // Address
    dwBuf[2] = 0x87054;      // ID
    dwBuf[3] = 0;                 // CheckSum disable
    dwBuf[4] = 100;           // TimeOut , 100 msecond
    dwBuf[6] = 0;                 // string debug
    DigitalIn_87K(dwBuf, fBuf, szSend, szReceive);   // DI Input
    //get di value and put value to share memory
    set_di(dwBuf[5]);
    // printf("DI Value= %d\n",dwBuf[5]);
    usleep(100);
}
Close_Com(COM1);
```

Get DO value from shared memory(iMemory_DO[0]~iMemory[7]) and save to variable tval

Get DI value and Set its value to Shared Memory

```
    Close_SlotAll();

    return 0;
}
```

2.4 Download Demo Files

You can download example file from

- ftp://ftp.icpdas.com/pub/cd/linpac/napdos/lp-8x8x/addons/modbus/demo
- ftp://ftp.icpdas.com/pub/cd/linpac/napdos/lp-8x4x/addons/modbus/demo