MSB624RA-DC User's Manual

Thank you for your purchase from Comfile Technology

Before making use of this product please be sure to read and observe all safety precautions.

⚠ **Warning**

1. **For instruments with risk to life or property (e.g. nuclear power control, medical equipment, vehicles, railways, aviation, combustion equipment, recreation equipment, safety devices, etc.), always employ adequate fail-safe mechanisms.**
   - Risk of fire, personal injury, and/or property damage.
2. **Always mount to a panel.**
3. **Do not attempt to repair, inspect, or wire while power is applied.**
4. **Do not attempt to alter or repair.   Refer to a qualified technician.**
5. **Confirm all electrical connections**

⚠ **Caution**

1. **Do not use outdoors.**
2. **Always use the product within its specifications and ratings.**
   - Risk of fire and shortening of product's life.
3. **Do not exceed ratings of relay switching contacts.**
4. **Does not use in environments with flammable or explosive materials, moisture, direct sunlight, radiation, vibration and/or shock.**
5. **Keep product free of dust and debris.**
6. **Make connections correctly and confirm polarity by measuring at the appropriate terminals.**

► CE/KCC

This product is intended for small-scale automation, standalone applications suitable for a Cubloc controller.

◆ About the MSB Series

 The Cubloc core module, in semiconductor form, can be mounted to a PCB.   This is advantageous, as users can integrate the Cubloc into a custom PCB design in a manner that suits their taste.

However, to a user without PCB fabrication skills, a custom PCB design can be quite difficult.   This user must also have the know-how to implement the necessary Input and output circuitry.

The MSB series was designed to make it easy for users to employ the Cubloc without having to have professional PCB fabrication technology and skills.

The MSB series can be installed in the field, have its input and output terminal blocks wired, and can be used just like existing PLCs.

◆ MSB User's Manual Composition

For BASIC or Ladder Logic programming, please refer the Cubloc BASIC User's Manual.

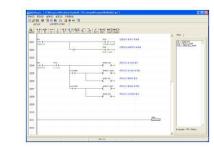This manual only covers those elements unique to the MSB612RA.

◆ CUBLOC STUDIO

To program the MSB series, CUBLOC STUDIO must be used.   It can be downloaded from www.ComfileTech.com in the "Cubloc" Support section for free.

◆ MSB LOGIC

Originally, the MSB series could only be programmed with CUBLOC Studio, which supports both BASIC and Ladder Logic. However, some users are not familiar with BASIC and prefer to use Ladder Logic exclusively.

Therefore, we have created MSB LOGIC, a Ladder Logic development environment designed specifically for the MSB series. If you prefer to do your development in Ladder Logic, you can now use MSB LOGIC to program the MSB series industrial controllers.

It can be downloaded from www.ComfileTech.com in the "Cubloc" Support section for free.

◆ MSB624RA-DC Specifications

The MSB6XX series has a core module equivalent to the Cubloc CB400.

- Program Memory : 200KB
- BASIC Data Memory : 6KB
- Ladder Logic Data Memory : 1KB
- EEPROM Memory : 4KB (Only Accessible in BASIC)
- DC24V Input s: 16 (Port Numbers 8 ~ 23)
- High Capacity Relays (10A): 8 (Port Numbers 32 ~ 39)
- RS232C Communication Port : 2
- RS485 Communication Port : 1
- Analog-To-Digital 10-bit Inputs (0~10V): 4
- Analog-To-Digital 10-bit Inputs (0~20mA): 4
- Power: 24VDC
- Ambient temperature : -30 to 75 ℃
- Humidity : 10% to 90%

◆ MSB Usage Declaration

Insert the following at the very beginning of your source code.

```
#include "MSB6XX"
```

The RS-485 port (channel 3) is already opened with a default baud rate of 57600 by including MSB6XX (i.e. #include "MSB6XX"), so it is not necessary to use OpenCom.   Please refer to the MSB6XX file in Cubloc Studio's installation folder.   To change the baud rate, please use the set rs232 command.

◆ Download Cable

If your PC has a built-in RS-232C (serial port), it can be used to download programs to the MSB624RA-DC.   If not, a USB-to-serial (RS-232C) adapter can be used.

RS-232 3-pin Download Cable	USB-To-Serial + 3-pin Download Cable

Note: The download cable is not included, and must be purchased separately.

If using a USB-to-Serial adapter, you must install the necessary drivers to your PC.   After the driver is installed, the PC will assign it a COM port number (e.g. COM6).   In Cubloc Studio's PC Interface Setup, select this COM port.

◆ BASIC I/O Map

Direction	Range	Input Voltage	Description
Input Port	8 ~ 23	0V or 24VDC (20V to 28V is recognized as a logic high)	1 if input is 24V 0 if input is 0V
Output Port	32 ~ 39	10A Relay Outputs	If 1, Relay is ON If 0, Relay is OFF
Analog Inputs	Ch 0~7	0~3 (0~20mA) 4~7 (0~10V)	Use "ADIn(0~7)" to read input

Example)
```
Low 32       'Turn OFF output port number 32
A = In(10)   'Read state of input at port number 10
VA = ADIn(0) 'Read analog input from channel 0
```

◆ Ladder Logic Memory Map

Designation	Range	Unit	Function
Input Relay P	P0~P31	1 bit	External Input
Output Relay P	P32~P63	1 bit	Relay, etc.. on/off control
Internal Relay M	M0~M511	1 bit	Internal State
Special Purpose Relay F	F0~F127	1 bit	System Status
Timer T	T0~T99	16 bit (1 word)	For Timer
Counter C	C0~C49	16 bit (1 word)	For Counter
Data Region D	D0~99	16 bit (1 word)	Data Storage

By default, all IO is controlled by BASIC at power on. Ladder Logic must be given permission to use it using the UsePin command.
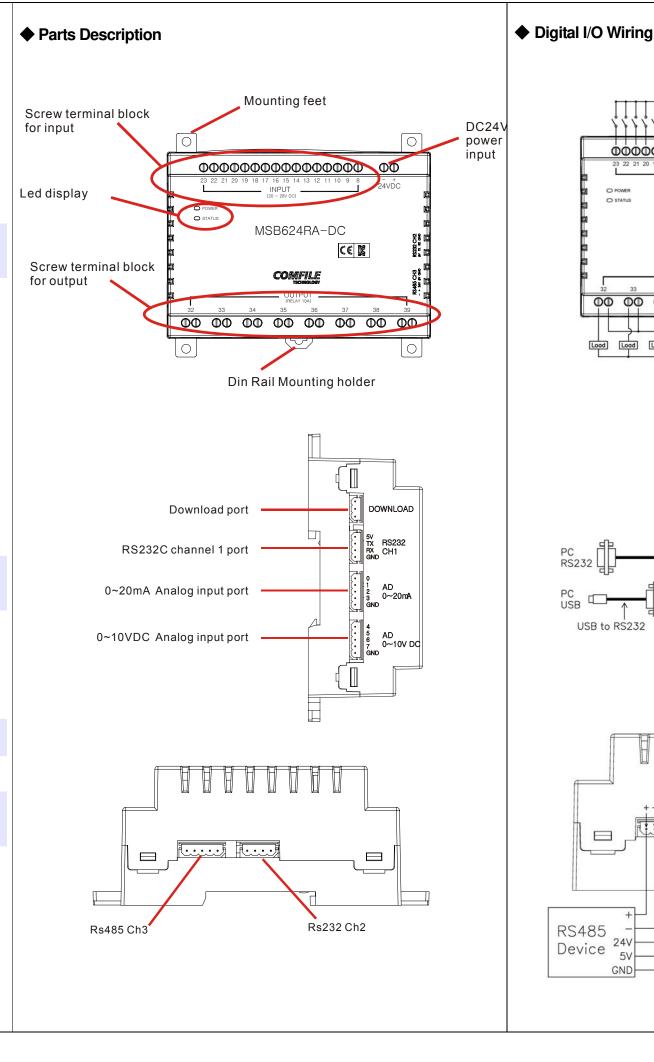
```
Usepin 0, In    ' From this point on use P0 in Ladder Logic
Usepin 32, Out  ' From this point on, use P32 in Ladder Logic
Set Ladder On   ' Place all UsePin commands before enabling Ladder
```
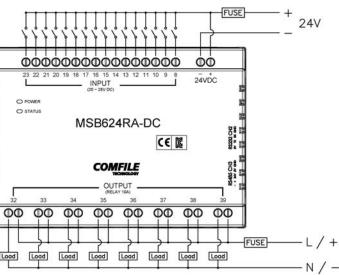
◆ Status LED
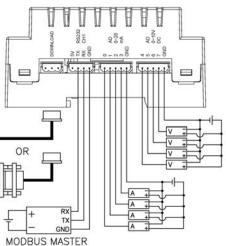
The MSB612RA-DC has a status LED that can be used to indicate the product's operating state. It can be controlled in BASIC using via pin 64.
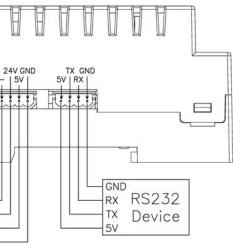
```
High 64    ' Turn status LED on
Low 64     ' Turn status LED off
```
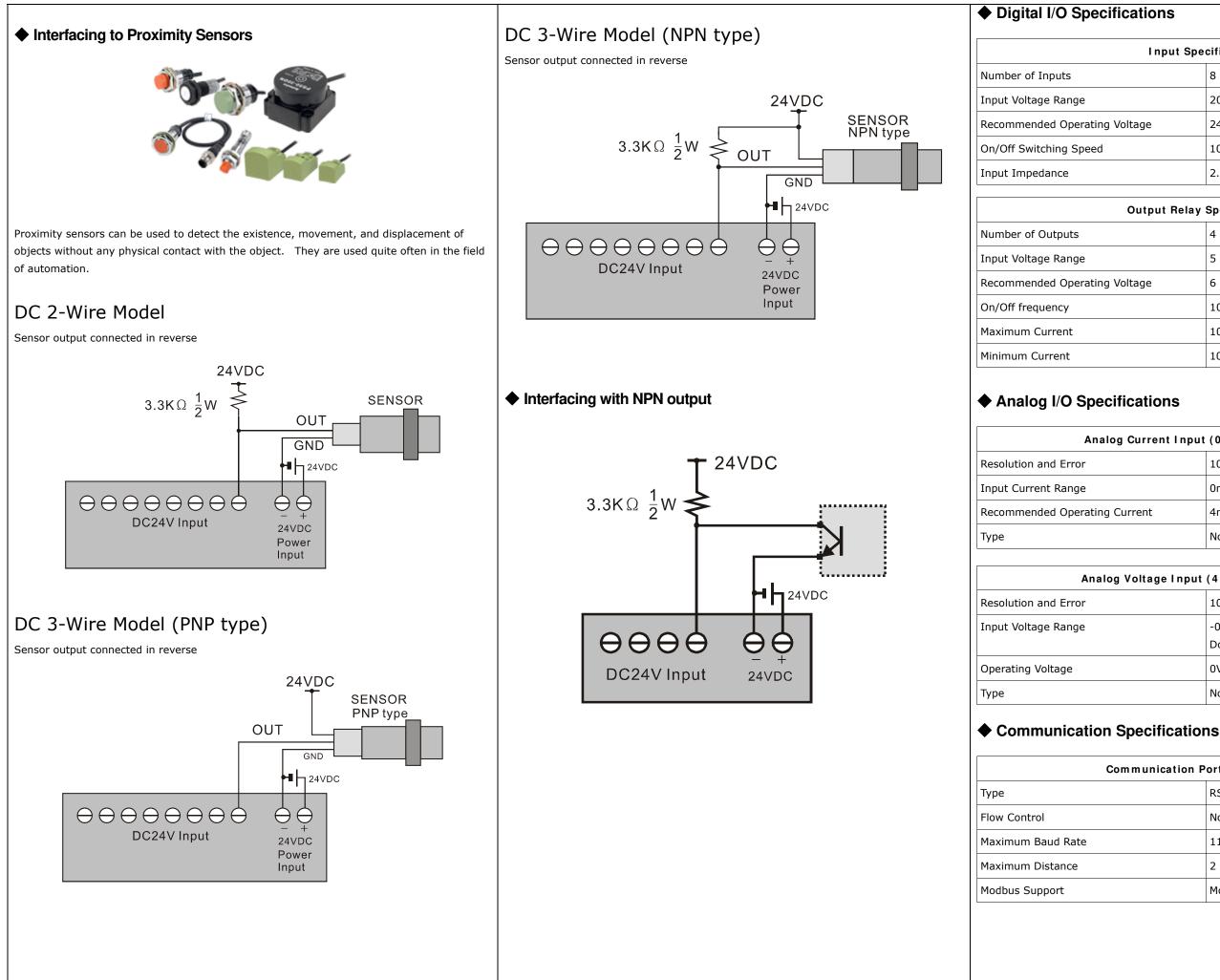
In Ladder Logic, it can be controlled using relay F64.
```
Set Ladder On ' Enable Ladder Scan
_F(64) = 1    ' Turn status LED on
_F(64) = 0    ' Turn status LED off
```

◆ Parts Description

- Mounting feet
- Screw terminal block for input
- DC24V power input
- Led display
- Screw terminal block for output
- Din Rail Mounting holder

MSB624RA-DC

- Download port
- RS232C channel 1 port
- 0~20mA Analog input port
- 0~10VDC Analog input port

- Rs485 Ch3
- Rs232 Ch2

◆ Digital I/O Wiring

MSB624RA-DC

RS485 Device

RS232 Device

◆ Interfacing to Proximity Sensors

Proximity sensors can be used to detect the existence, movement, and displacement of objects without any physical contact with the object.   They are used quite often in the field of automation.

DC 2-Wire Model

Sensor output connected in reverse

24VDC

$3.3K\Omega \; \frac{1}{2}W$ OUT   SENSOR

GND

24VDC

DC24V Input   − +   24VDC Power Input

DC 3-Wire Model (PNP type)

Sensor output connected in reverse

24VDC   SENSOR PNP type

OUT

GND

24VDC

DC24V Input   − +   24VDC Power Input

DC 3-Wire Model (NPN type)

Sensor output connected in reverse

24VDC   SENSOR NPN type

$3.3K\Omega \; \frac{1}{2}W$ OUT

GND

24VDC

DC24V Input   − +   24VDC Power Input

◆ Interfacing with NPN output

24VDC

$3.3K\Omega \; \frac{1}{2}W$

24VDC

DC24V Input   − +   24VDC

◆ Digital I/O Specifications

Input Specifications	
Number of Inputs	8
Input Voltage Range	20VDC ~ 28VDC
Recommended Operating Voltage	24VDC
On/Off Switching Speed	10ms (Ladder Scan Time is 10ms)
Input Impedance	2.2kΩ @ 24VDC (Do not connect)

Output Relay Specifications	
Number of Outputs	4
Input Voltage Range	5 ~ 30VDC / 4 ~ 264VAC
Recommended Operating Voltage	6 ~ 27VDC / 6 ~ 240VAC
On/Off frequency	10Hz (10 times per second)
Maximum Current	10A per relay
Minimum Current	100mA per relay

◆ Analog I/O Specifications

Analog Current Input (0 ~ 3) Specification	
Resolution and Error	10-bit, +/- 2%
Input Current Range	0mA ~ 22mA
Recommended Operating Current	4mA ~ 20mA
Type	Non-isolated, Built-in LPF

Analog Voltage Input (4 ~ 7) Specifications	
Resolution and Error	10-bit, +/- 2%
Input Voltage Range	-0.5VDC ~ 10.5VDC Don't connect series resistance
Operating Voltage	0VDC ~ 10VDC
Type	Non-isolated, Built-in LPF

◆ Communication Specifications

Communication Port Specifications	
Type	RS-232 (+/- 10VDC)
Flow Control	No RTS Flow Control
Maximum Baud Rate	115200
Maximum Distance	2 meters
Modbus Support	Modbus RTU Slave
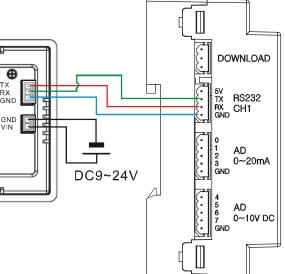
◆ A Few Simple Examples

1. Blinking the Status LED

The following program will blink the status LED.

```
#include "MSB6XX"
Do
    High 64
    Wait 500
    Low 64
    Wait 500
Loop
```

Blinking the status LED while using Ladder Logic

```
#include "MSB6XX"
Set Ladder On
Do
    _F(64) = 1
    Wait 500
    _f(64) = 0
    Wait 500
Loop
```

Blinking the status LED from ladder logic


```
F30                 F64
─┤ ├───────────────( )───
F_640ms             F_led
```

2.Toggle Relay

Toggle Status LED and relay number 32.

```
#include "MSB6XX"
Do
    High 64  'Status LED On
    High 32  'Relay 32 On
    Wait 500
    Low 64   'Status LED Off
    Low 32   'Relay 32 off
    Wait 500
Loop
```

3. Input and Output Control

If Input 8 is active, the status LED and relay 32 are turn switched on.

```
#include "MSB6XX"
Do
    If In(8) = 1 Then
        High 64 'Status LED On
        High 32 'Relay 32 On
    Else
        Low 64  'Status LED off
        Low 32  'Relay 32 Off
    EndIf
Loop
```



```
P8                  P32
─┤ ├───────────────( )───
                    F64
                   ( )───
                    F_led
```

The same behavior using Ladder Logic

You'll find Ladder Logic to be quite easy for handling simple logic.

◆ Interfacing with the UIF-5K

The UIF-5K is a 5-key character LCD panel that can be used in conjunction with the MSB612RA-DC to add a simple user interface.
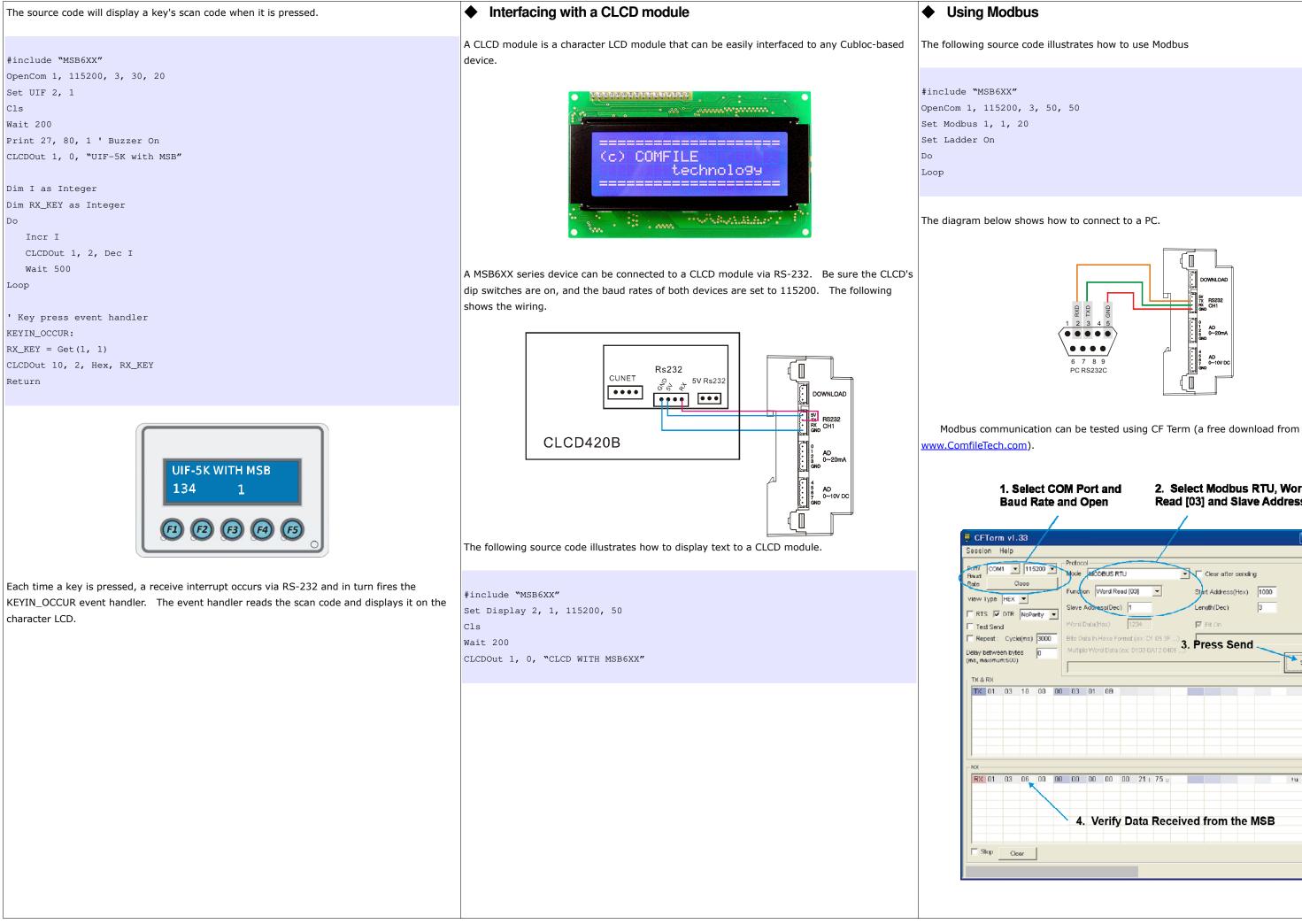
The following shows how to connect the two together.   The UIF-5k must be powered separately with a 9V~24V supply.

The following source code will output text to the UIF-5K's display.

```
#include "MSB6XX"
OpenCom 1, 115200, 3, 30, 20
Set UIF 2, 1
Cls
Wait 200
Print 27, 80, 1 ' Buzzer On
CLCDOut 1, 0, "UIF-5K with MSB"
```

The source code will display a key's scan code when it is pressed.

```
#include "MSB6XX"
OpenCom 1, 115200, 3, 30, 20
Set UIF 2, 1
Cls
Wait 200
Print 27, 80, 1 ' Buzzer On
CLCDOut 1, 0, "UIF-5K with MSB"

Dim I as Integer
Dim RX_KEY as Integer
Do
    Incr I
    CLCDOut 1, 2, Dec I
    Wait 500
Loop

' Key press event handler
KEYIN_OCCUR:
RX_KEY = Get(1, 1)
CLCDOut 10, 2, Hex, RX_KEY
Return
```

Each time a key is pressed, a receive interrupt occurs via RS-232 and in turn fires the KEYIN_OCCUR event handler. The event handler reads the scan code and displays it on the character LCD.

◆ Interfacing with a CLCD module

A CLCD module is a character LCD module that can be easily interfaced to any Cubloc-based device.

A MSB6XX series device can be connected to a CLCD module via RS-232. Be sure the CLCD's dip switches are on, and the baud rates of both devices are set to 115200. The following shows the wiring.

CLCD420B

The following source code illustrates how to display text to a CLCD module.

```
#include "MSB6XX"
Set Display 2, 1, 115200, 50
Cls
Wait 200
CLCDOut 1, 0, "CLCD WITH MSB6XX"
```

◆ Using Modbus

The following source code illustrates how to use Modbus

```
#include "MSB6XX"
OpenCom 1, 115200, 3, 50, 50
Set Modbus 1, 1, 20
Set Ladder On
Do
Loop
```

The diagram below shows how to connect to a PC.

Modbus communication can be tested using CF Term (a free download from www.ComfileTech.com).

1. Select COM Port and Baud Rate and Open

2. Select Modbus RTU, Word Read [03] and Slave Address 1

3. Press Send

4. Verify Data Received from the MSB

◆ Analog Input Example

The following source code illustrates how to use analog inputs. Results are displayed in the PC's debug terminal.

For channels 0 ~ 3 (0 ~ 20mA).

```
#include "MSB6XX"
Dim AD as Integer
Do
    AD = ADIn(0)  'Read from channel 0
    Debug Dec AD, Cr
    Delay 1000
Loop
```

For channels 4 ~ 7 (0 ~ 10VDC).

```
#include "MSB6XX"
Dim AD as Integer
Do
    AD = ADIn(4)  'Read from channel 4
    Debug Dec AD, Cr
    Delay 1000
Loop
```
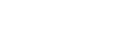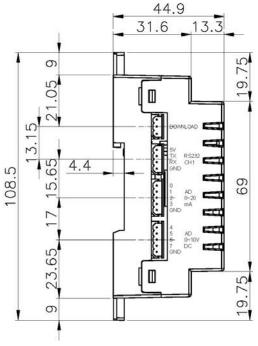
◆ Modbus Address

Word Address

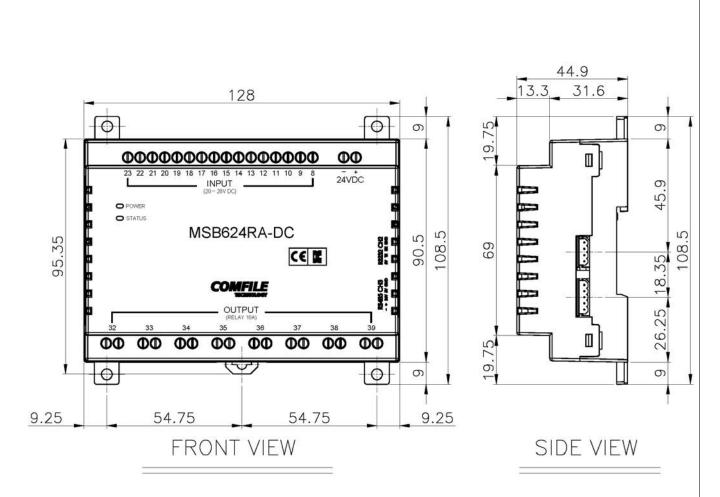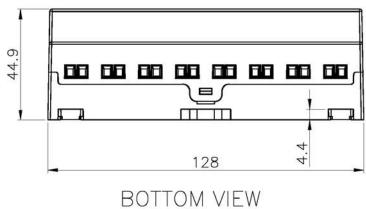| Holding/Input Registers	
Function : 3,4,6,16	
Address	Area
0 ~ 255	D (D0 ~ D255)
256 ~ 355	Y (Y0 ~ Y99) A/D result : Y20~Y27: 276 ~283
1000 ~ 1255	T (T0 ~ T255)
2000 ~ 2255	C (C 0~ C255)
3000 ~ 3255	WM (WM0 ~ WM255)

Bit Address

Coil, Input Status	
Function : 1,2,4,15	
Address	Area
0 ~ 127	P (P0 ~ P127)
4096 ~ 6143	M (M0 ~ M2047)

◆ Dimensions

SIDE VIEW

FRONT VIEW

SIDE VIEW

BOTTOM VIEW

Unit: mm