RF MODEM

M110A

User's Manual

Ver 2.0

SEBINE Technology, Inc.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CONTENTS

1. Summary

1.1 Product Introduction

M110A is a RF MODEM which uses ISM 433MHz frequency bandwidth. M110A has a function of RF transmission and reception and provides serial communication interface. When a user transmits data through a serial port by designated protocol, M110A transmits data by wireless communication. M110A allows users to set PC MODE, DEVICE MODE, and communication channels via environment setting. Usable frequency number, channel number, and serial number are printed in shipping products.

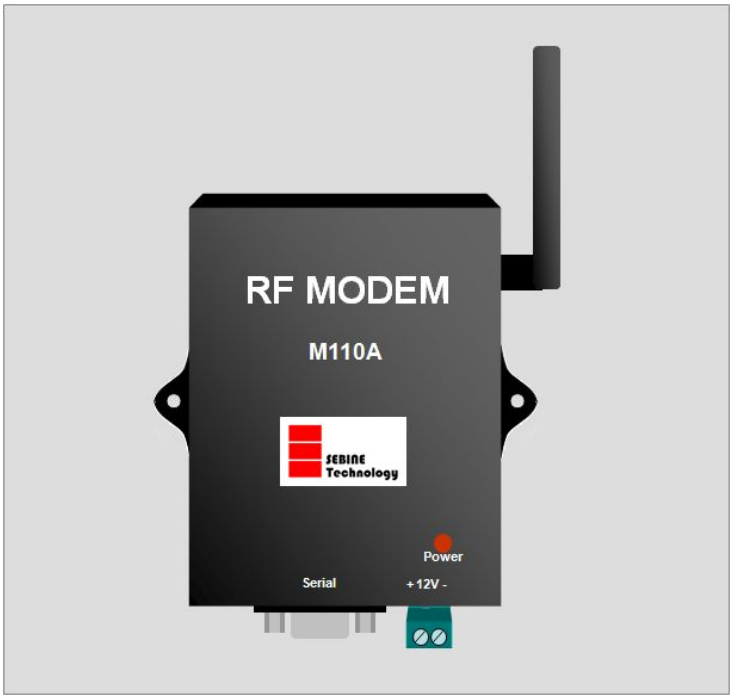


Figure 1. M110A

1.1.1 Application examples

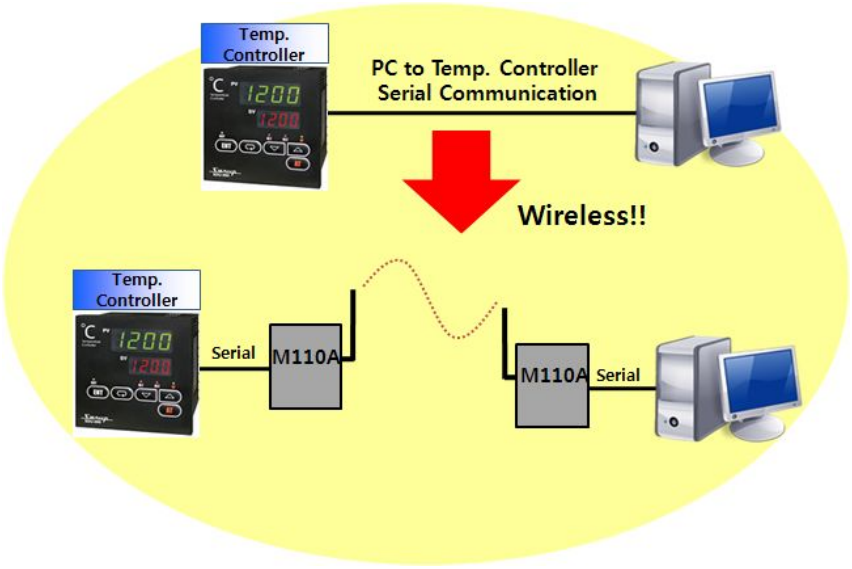


Figure 2. Wireless Serial Communication

1.1.2 Product usage

- Cable system replacement : Maintenance difficulty with cables is solved
- Hard environment for cable installation : Environment that requires long and co mplicated cable installation is solved
- Uneasy area for data acquisition by cable : Outdoor tank monitoring system

1.1.3 Product application area

- Pump, pipeline, liquid flow monitoring system
- Tank level, temperature monitoring system
- Poison gas detection and monitoring system
- Weather data (rainfall, wind direction, wind velocity, humidity, temperature) monitoring system

1.1.4 Product parts

M110A main body, one $\lambda/4$ dipole antenna, one power connector

1.2 Specification

Item	Specification
Name	M110A
Dimension	88.1mm(L)×85mm(W)×19.6mm(H) (w/o Antenna, Connector)
Housing	Aluminum
Weight	140g (w/o Antenna)
Power Supply	+12Vdc ±10%, Reverse Power/Overvoltage/Overcurrent Protection
Current Consumption	Tx 94mA, Rx 88.5mA, WDT Reset 114mA (@12Vdc)
Operating Temperature	−10℃ ~ +60℃
RF Features	• Frequency : 433.0625MHz ~ 434.7625MHz • Channel Spacing : 25KHz • Transmitter Power : 73dBuV/m • Receiver Sensitivity : −116 ~ −120dBm(−116dBm typ.) • Modulation : FSK • Bandwidth : < 14KHz
Performance	• Expected Line−Of−Sight Range : Up To 1.5km with λ/4 Dipole Antenna • RF Data Rate : 4.8K Baud, 7.2K Baud
I/O Interface	• RS232/RS485 Selectable • Serial Communication Basic Setting(User Selectable) : Data Bit 8bit, No Parity, 1 Stop Bit • User Selectable Baud Using DIP Switch: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 • 9Pin D−SUB Female Connector
Antenna Interface	• SMA(Female, Reverse)Connector • Impedance 50Ω

Table 1. M110A Specification

2. Operational mode

M110A allows PC MODE and DEVICE MODE for users' personal need. Function Code and its functionality is restricted based upon selected mode. Refer the Programmer guide for detailed protocol and Function Code.

2.1 PC MODE

2.1.1 Definition of PC MODE

Data is transmitted when data is sent through serial port by selected protocol function.

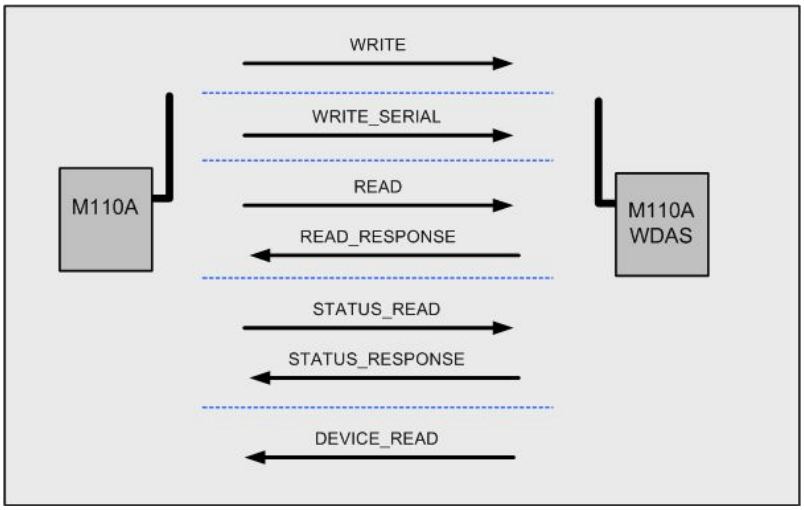


Figure 3. PC MODE of M110A

2.1.2 Function Code available at PC MODE

- WRITE : WDAS device output DO[Digital Output], AO[Analog Output]
- WRITE_SERIAL : Transmit control signal data to RF MODEM or W110A where serial port is available
- READ : WDAS device reads the status of DI[Digital Input], AI[Analog Input]
- READ_RESPONSE : Function Code of READ_RESPONSE is used when WDAS device receives READ Function Code and transmits current input status.
- STATUS_READ : WDAS device reads the status of DO[Digital Output], AO[Analog Output]
- STATUS_RESPONSE : Function Code of READ_RESPONSE is used when WDAS device receives STATUS_READ Function Code and transmits current output status.

2.1.3 Environment setting list before PC MODE use

- Select PC MODE at PC/DEVICE MODE Setting

2.2 DEVICE MODE

2.2.1 Definition of DEVICE MODE

When the device that has usable PC MODE/DEVICE MODE as Serial Port is set as DESTINATION and control signal data is input to Serial Port at once, control signal data are transmitted automatically.

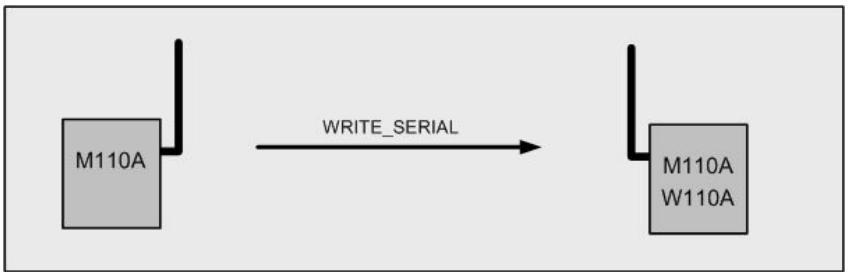


Figure 4. DEVICE MODE of M110A

2.2.2 Function Code available at DEVICE MODE

- WRITE_SERIAL : When Control Signal Data obtained through Serial Port are transmitted to established DESTINATION device, Function Code of WRITE_SERIAL is used.

2.2.3 Environment setting list before DEVICE MODE use

- DEVICE MODE selection at PC/DEVICE MODE Setting
- DESTINATION ID set up at DESTINATION ID Setting

3. Device Connection

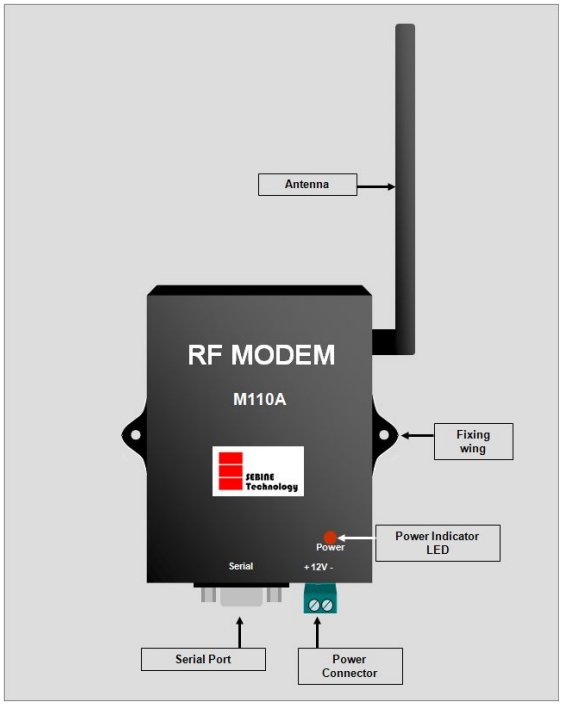


Figure 5. M110A Outer

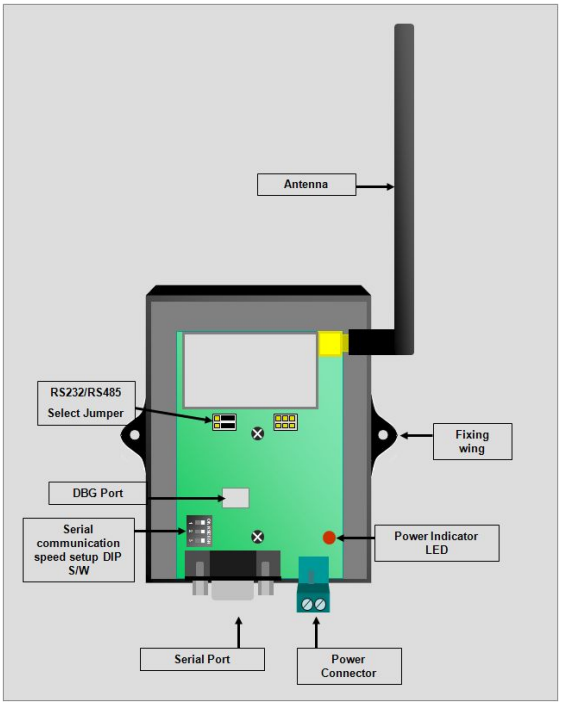


Figure 6. M110A Inner

3.1 Power Supply

M110A works at +12Vdc and equipped with Reverse Power / Overvoltage / Overcurrent Protection circuitry. Power is supplied by power connector provided at product purchase as shown in figure below. M110A has no external power switch and it becomes in working mode when the power is supplied. If normal power is supplied, power supply indicator LED is on.

① As shown in Figure 7, remove the skin of wire about 7mm and put it into the terminal and tighten it by turning the left screw using screwdriver.

② As shown in Figure 8, connect it to power.

③ As shown in Figure 9, connect the terminal to power port of M110A, Make sure the direction is exact as shown in Figure 9.

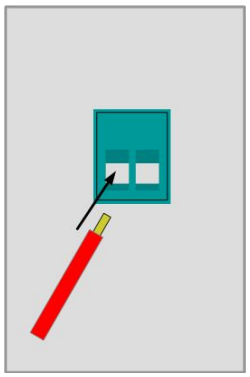


Figure7. Power Supply-1

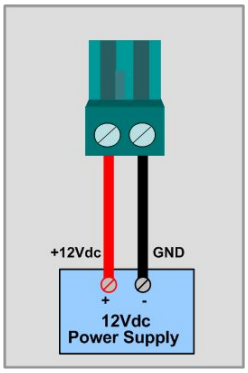


Figure8. Power Supply-2

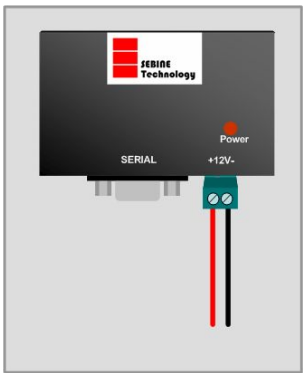


Figure9. Power Supply-3

※ Notice

Readily accessible disconnect device shall be incorporated external to the equipment.

3.2 RS232 Communication Connection

3.2.1 PC Communication

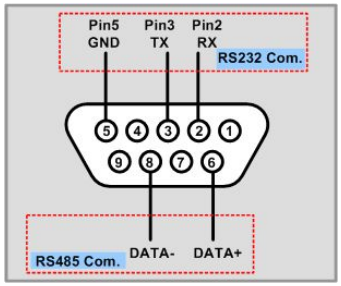


Figure 10. M110A Connector : DB-9 Female

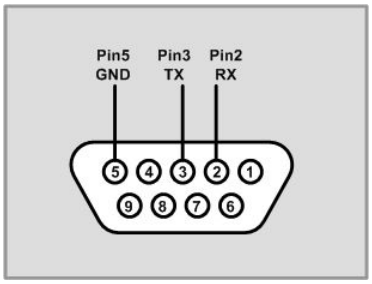


Figure 11. PC Connector

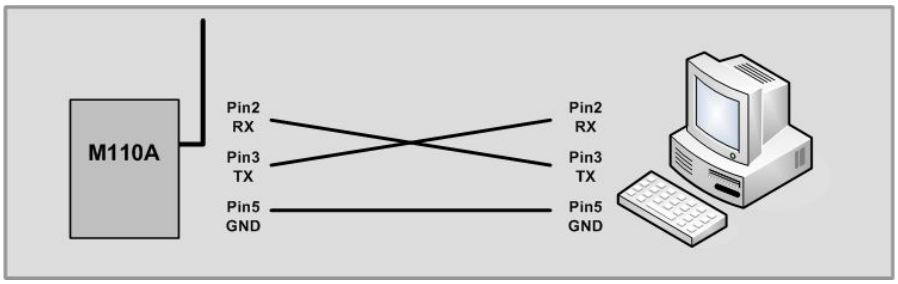


Figure 12. Connection of M110A and PC

3.2.2 DEVICE Connection

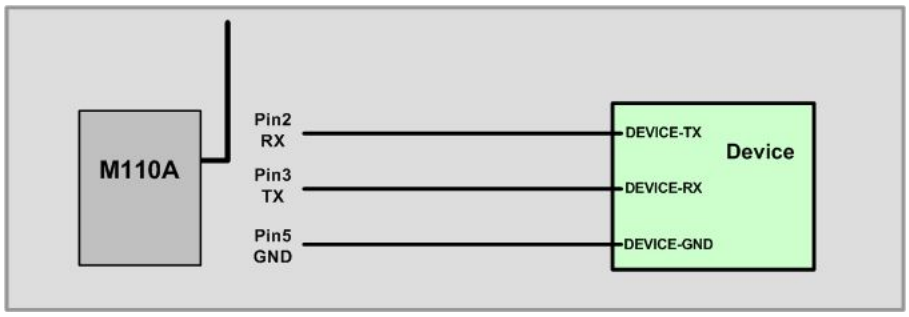


Figure 13. Connection of M110A and DEVICE

3.3 RS485 Communication Connection

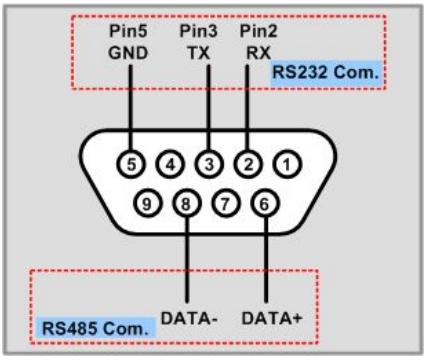


Figure 14. M110A Connector : DB-9 Female

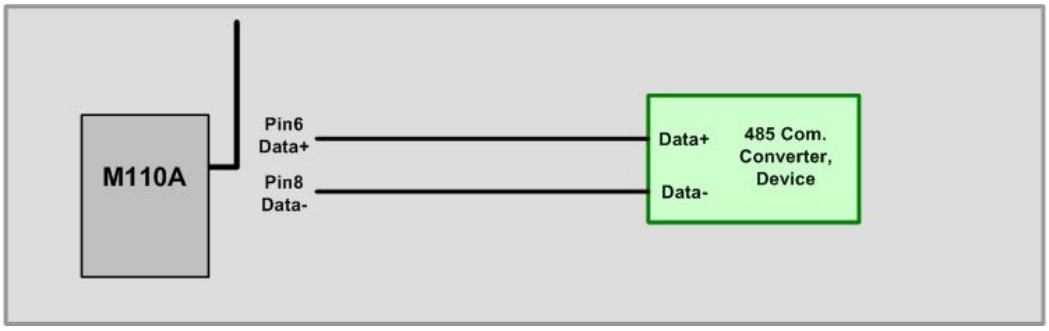


Figure 15. Connection of M110A and RS485 Communication

3.4 Serial communication speed setup

M110A is able to adjust serial communication speed with DIP switch as shown in Figure 16. Serial communication adjustment must be set before power is supplied. During the operation, if the communication speed is to be reset, DIP switch is set and then power should be OFF/ON afterward.

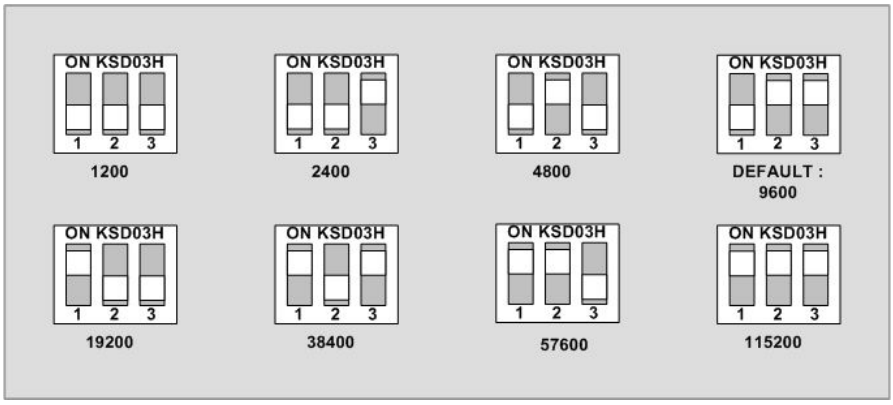


Figure 16. Communication speed adjustment with DIP switch

3.5 RS232/RS485 communication setup

M110A is able to set the serial communication method by RS232/RS485 jumper shown in Figure 6. If serial communication method is selected, appropriate pin of serial port must be used corresponding to communication method.

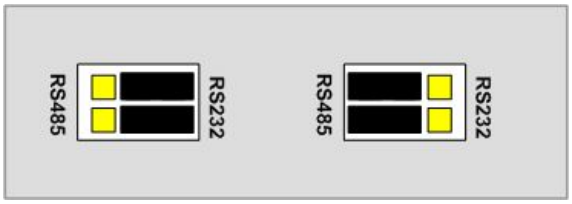


Figure 17. RS232/RS485 communication method setup by RS232/RS485 jumper

4. Environment setup

Environment setup can be made through SetModemEnv.exe program. For details, consult the corresponding manual.

4.1 Hardware connection

Use DBG port for PC connection shown in Figure 6.

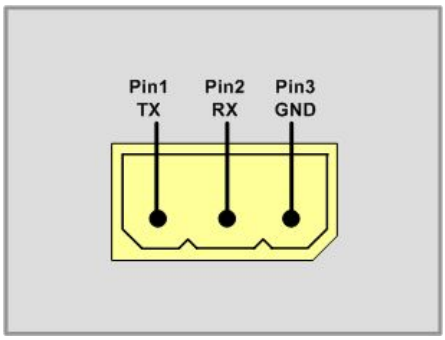


Figure 19. Hardware connection-1(M110A)

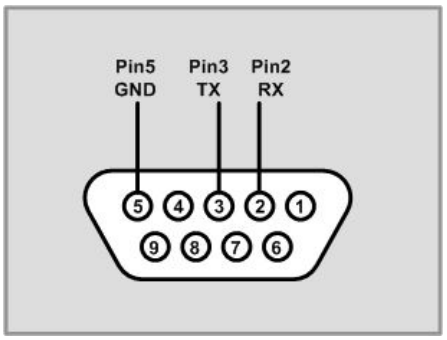


Figure 20. Hardware connection-2(PC)

For communication frequency adjustment, port and PC must be connected via serial communication program as shown in Figure 19.

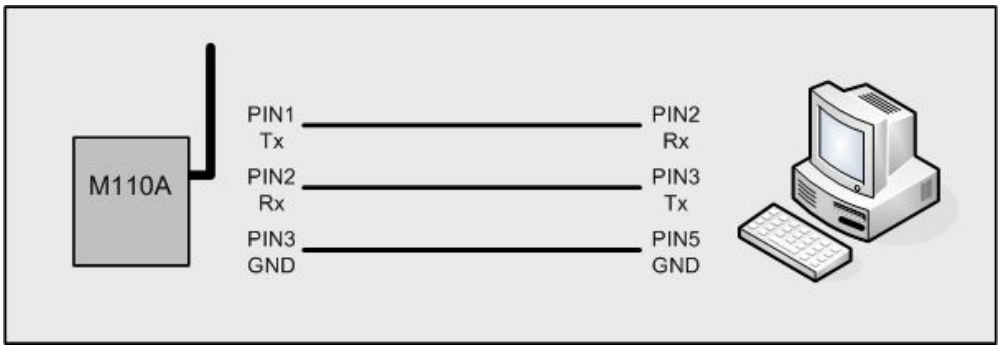


Figure 21. Hardware connection-3

The hardware connection between M110A and PC can be done as shown in Figure 21.

4.2 Setup list of each mode

4.2.1 PC MODE

- PC/DEVICE MODE Setting : PC MODE Setting
- Channel Setting : Communication Frequency Setting
- Tx Power Level Setting : Communication RF Power Level Setting
- UART Configuration : Select RS232/RS485, Data Bit, Parity Bit, Stop Bit Setting

4.2.2 DEVICE MODE

- PC/DEVICE MODE Setting : DEVICE MODE Setting
- Channel Setting : Communication Frequency Setting
- Tx Power Level Setting : Communication RF Power Level Setting
- DESTINATION ID Setting : DESTINATION ID Setting
- UART Configuration : Select RS232/RS485, Data Bit, Parity Bit, Stop Bit Setting

4.2.3 Environment Setting Program

1) PC/DEVICE MODE Setting(MODE Setting)

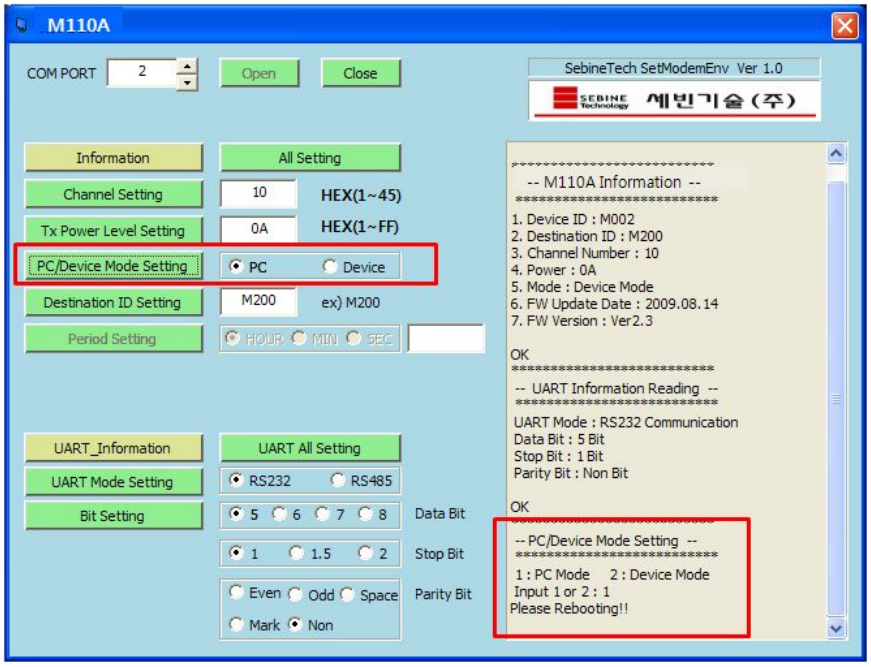


Figure 22. Environment Setting Program-MODE Setting

2) Channel Setting(Communication Frequency Setting)

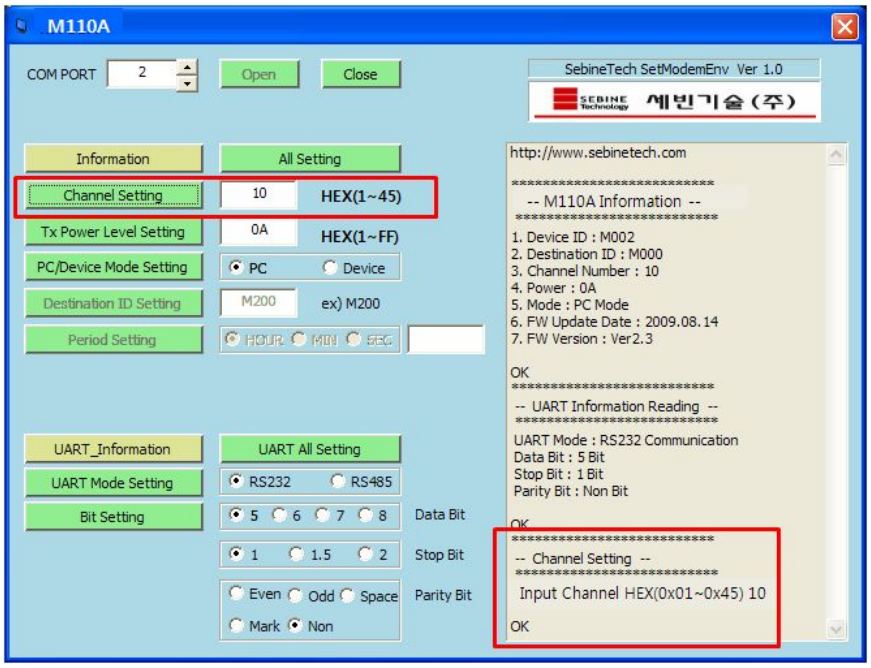


Figure 23. Environment Setting Program-Channel Setting

3) Tx Power Level Setting(Communication RF Power Level Setting)

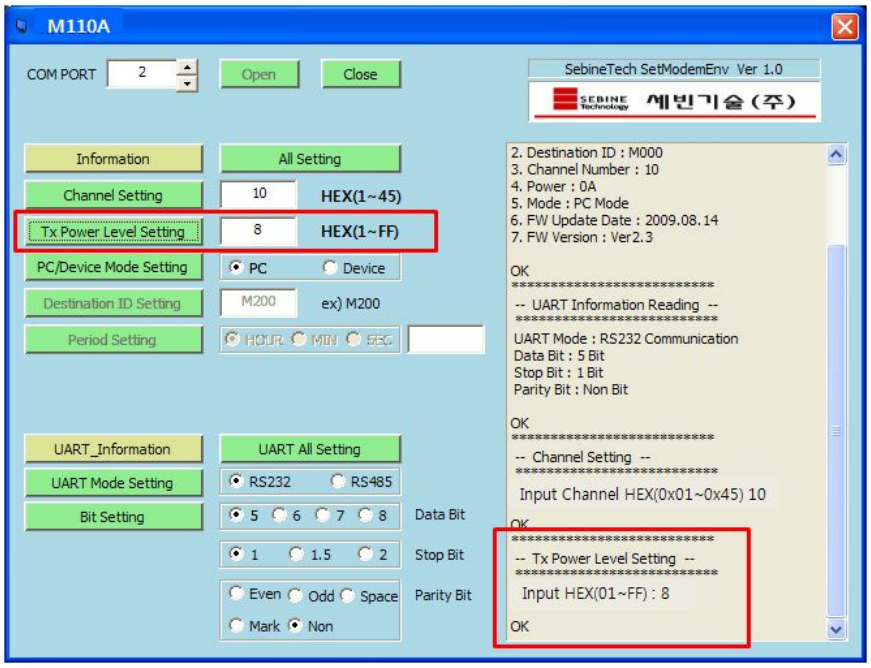


Figure 24. Environment Setting Program-Tx Power Level Setting

4) DESTINATION ID Setting(DESTINATION ID Setting)

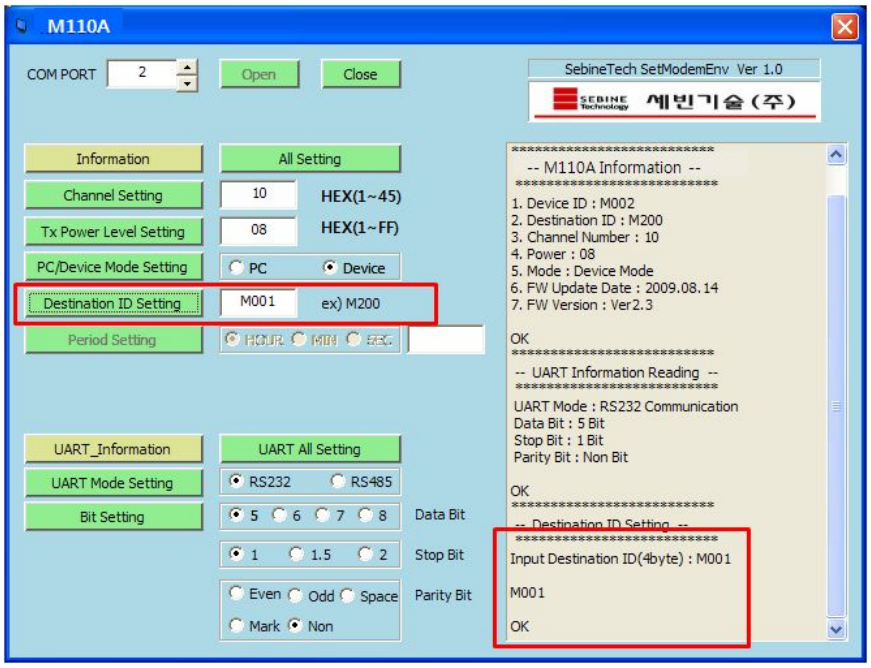


Figure 25. Environment Setting Program-DESTINATION ID Setting

5) UART MODE Setting(UART MODE Setting)

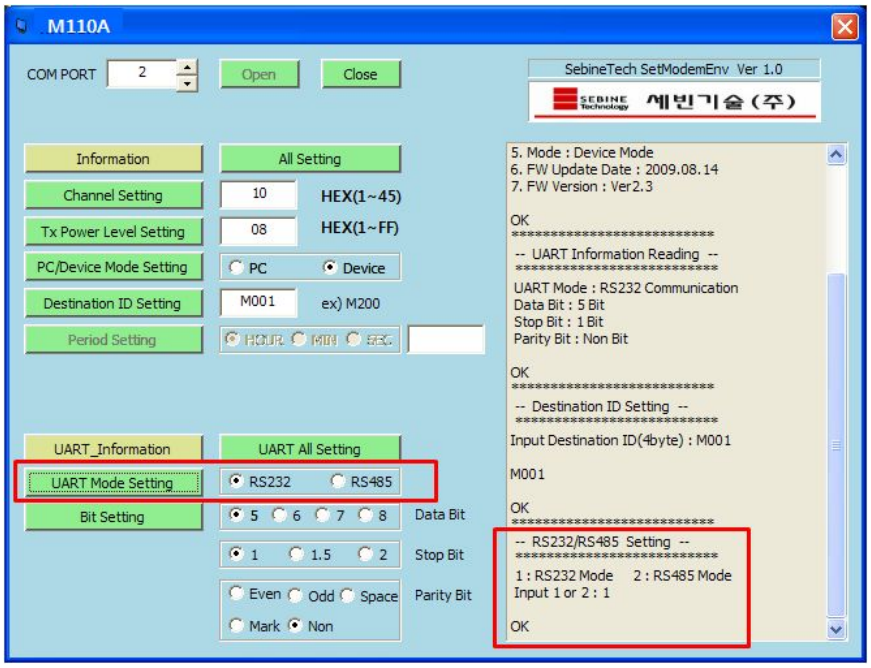


Figure 26. Environment Setting Program-UART MODE Setting

6) UART Bit Setting(UART Bit Setting)

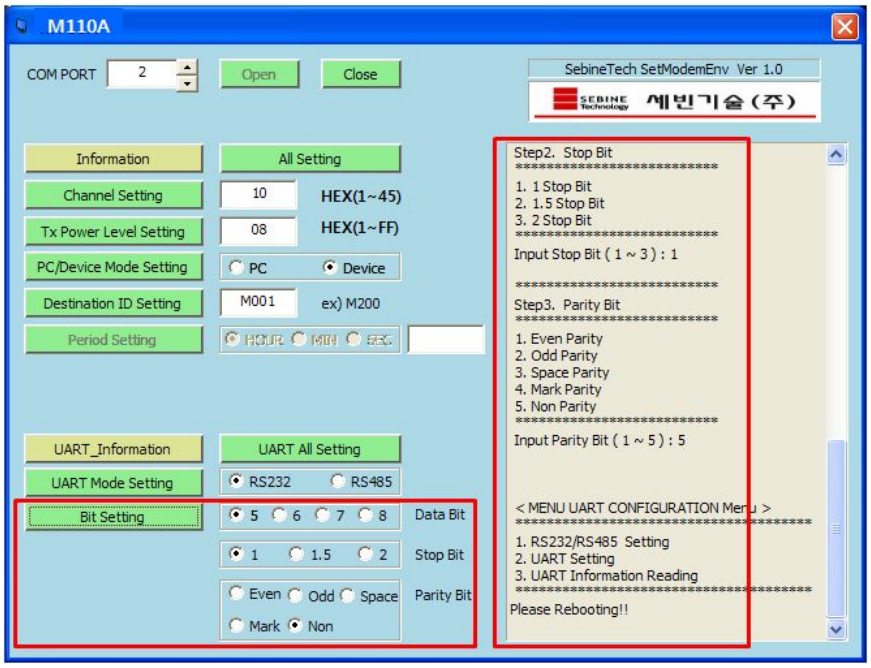


Figure 27. Environment Setting Program-UART Bit Setting

5. Example

(EX. 1) M110A(PC MODE) to W110A(PC MODE) Communication

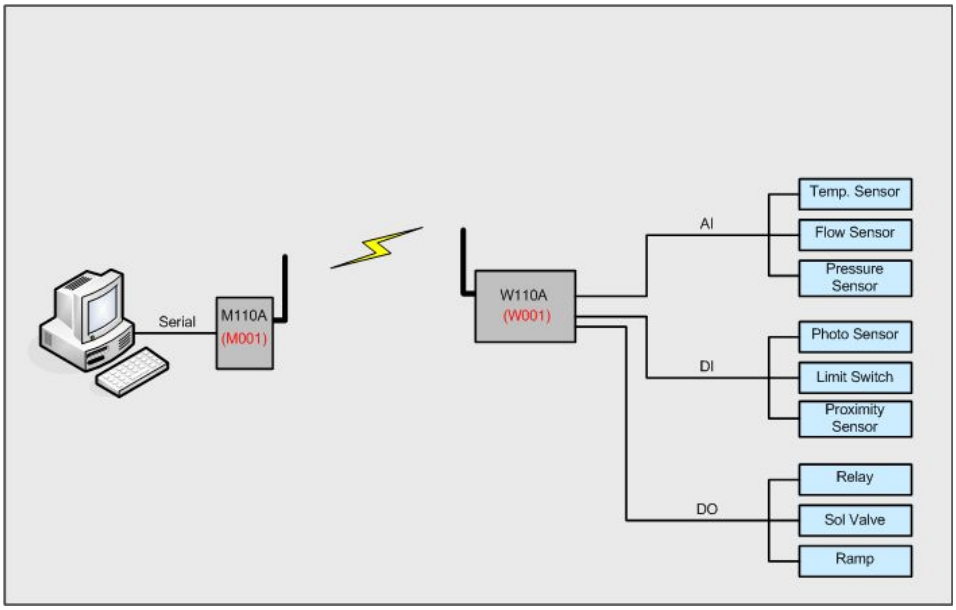


Figure 29. M110A to W110A Communication Example

(EX. 2) W210A(PC MODE) to M110A(PC MODE) Communication

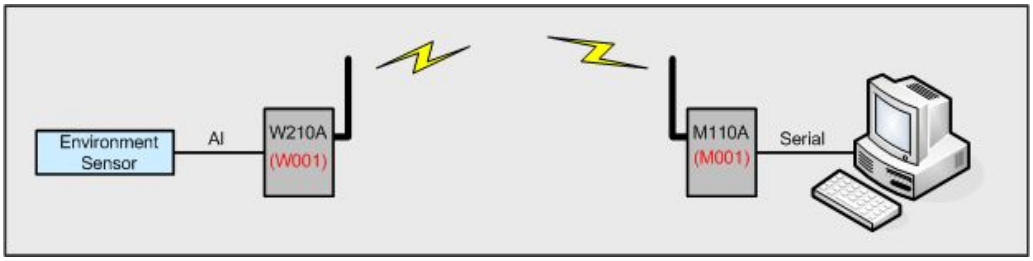


Figure 30. W210A to M110A Communication Example

(EX. 3) W310A(PC MODE) to M110A(PC MODE) Communication

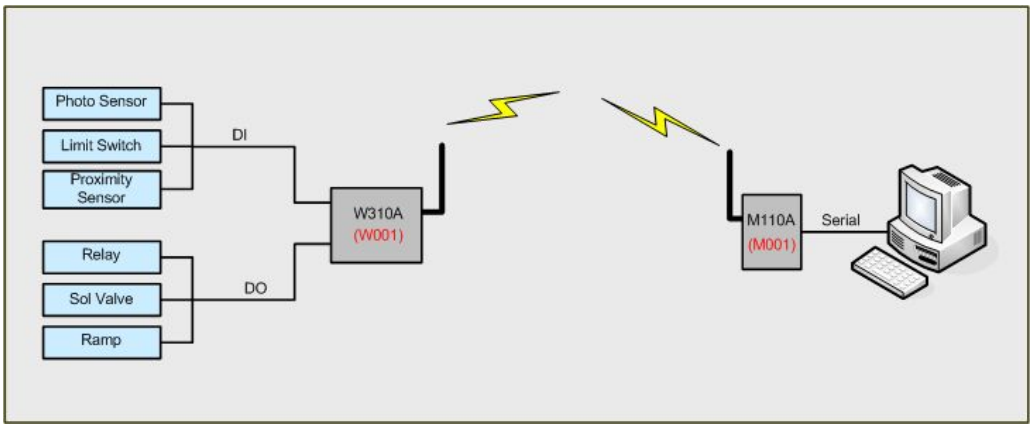


Figure 31. W310A to M110A Communication Example

(EX. 5) W410A(PC MODE) to M110A(PC MODE) Communication

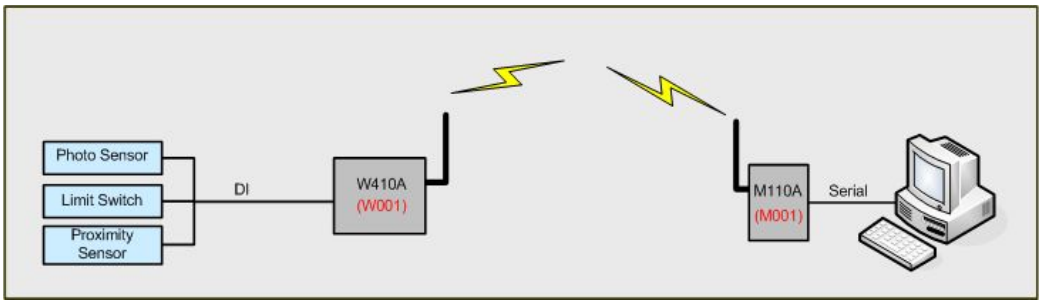


Figure 32. W410A to M110A Communication Example

(EX. 7) M110A(PC MODE) to W510A(PC MODE) Communication

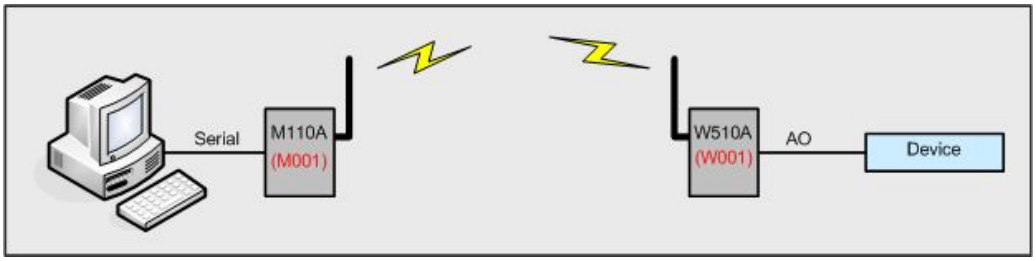
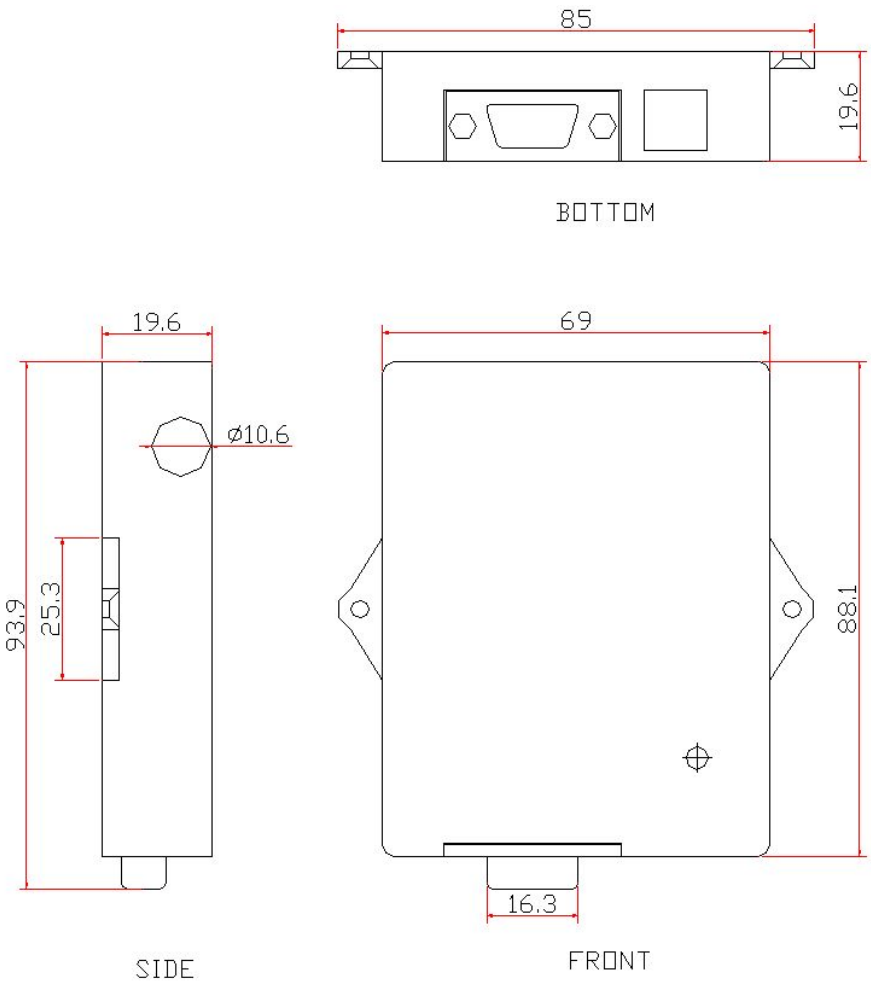


Figure 33. M110A to W510A Communication Example

Appendix 1. Dimension



Appendix 2. R&TTE

Hereby, SEBINE Technology, Inc. declares that this device(M/N: M110A) is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

Appendix 3. Document Information

Revision	H/W Version	Description
1.0	RF1-AE-RS Ver 1.1	03/30/2009 - Initial Release Version
2.0	RF1-AE-RS Ver 1.1	09/14/2009 - Modified

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RF MODEM / WDAS

Programmer's Guide

Ver 1.0

Ver 1.0

SEBINE Technology, Inc.

CONTENTS

1. Summary

RF MODEM and WDAS(Wireless Data Acquisition and Control System) is a wireless transmitter/receiver device. RF MODEM and WDAS are distinguished depending on I/O interface.

[Products List '09]

Group	Products	I/O Interface
RF MODEM	M110A	RS232/RS485 Interface
WDAS	W110A	DI 8ch, DO 8ch, AI 5ch, RS232 Interface
	W210A	AI 2ch
	W310A	DI 8ch, DO 8ch
	W410A	DI 4ch
	W510A	AO 2ch

Table 1. Products Classification with I/O

Users select applicable products on their desired system and make a easy use through simple environment setup and GUI.
For use of RF MODEM and WDAS, use SEBINE Technology's own environment setup program and protocol.
M110A can't RF transmission and reception without control signal.

2. Basic Communication Concept

For system configuration using RF MODEM and WDAS, 1:1, 1:N method is applied. All products receive command through RF communication and transmit ACK or NACK for received command through RF communication. ACK means command is done correctly and NACK means command is done incorrectly. However, if ACK or NACK is not received within some amount of time, RF communication has problem. So, users should always check ACK, NACK for system operation.

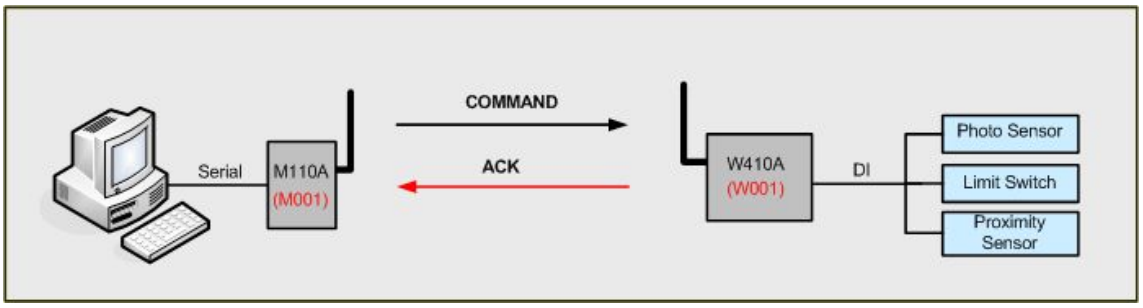

Figure 1. Transmission ACK after correct command receive (W410A)

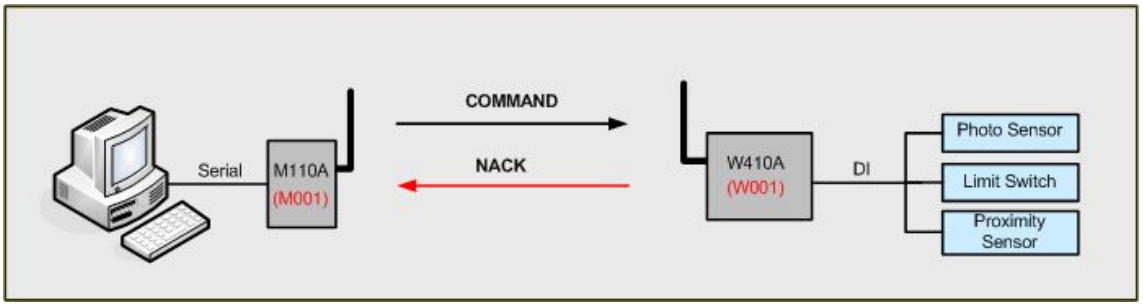

Figure 2. Transmission NACK after incorrect command receive(W410A)

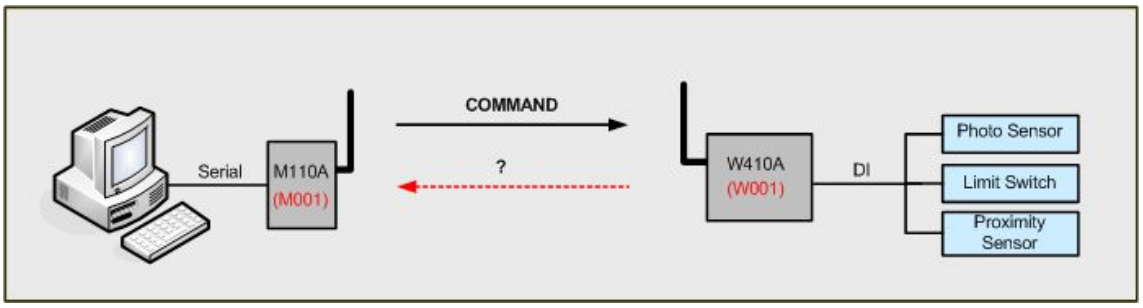

Figure 3. Command receive fail(W410A)

3. Protocol

3.1 Protocol

For system configuration with RF MODEM and WDAS, use SEBINE Technology's own protocol for control of installed RF MODEM and WDAS. Protocol is as follows.

SOURCE	FUNCTION CODE	@	Control Signal DATA	/	DESTINATION	S/O/F	REPEATER	CR

3.1.1 SOURCE

- Description : Unique ID of Transmitter(M110A, W110A, W210A, W310A, W410A, W510A). It is pre-fixed at factory delivery.
- Length : 4byte
- Example : RF MODEM : Mxxx -> M001
  WDAS : Wxxx -> W001

3.1.2 FUNCTION CODE

- Description : Command. Use appropriate FUNCTION CODE for each component

Function Code	Command	Description	SOURCE	DESTINATION
10	WRITE	Signal output command to DESTINATION with AO, DO function	M110A, W110A	W110A, W310A, W510A
11	WRITE_SERIAL	Data communication command to DESTINATION with serial interface function	M110A, W110A	M110A, W110A
20	READ	Measure input signal command to DESTINATION with AI, DI function	M110A, W110A	W110A, W210A, W310A, W410A
21	READ_RESPONSE	Read and transmit signal command to SOURCE with AI, DI function	W110A, W210A, W310A, W410A	M110A, W110A
22	STATUS_READ	Measure output signal command to DESTINATION with AO, DO function	M110A, W110A	W310A, W510A
23	STATUS_RESPONSE	Reply output signal value command to DESTINATION with AO, DO function	W310A, W510A	M110A, W110A

Table 2. Function Code

- Description : 2byte
- Example : None

3.1.2 @

- Description : Classifier for beginning of DATA

※'@'is a reserved classifier. User cannot use it for other use

- Length : 1 Byte
- Example : None

3.1.3 Control Signal DATA

- Description : Control Signal Data sent to DESTINATION by SOURCE. Depending on products, contents of Control Signal DATA changes or skipped. In ACK, NACK, it is skipped.
- Length : 0 ~ 50byte
- Example : None

3.1.4 /

- Description : Classifier for end of DATA

※'/'is a reserved classifier. User cannot use it for other use

- Length : 1 Byte
- Example : None

3.1.5 DESTINATION

- Description : Object communicates with SOURCE (M110A, W110A, W210A, W310A, W410A, W510A)
- Length : 4 Byte
- Example : RF MODEM : Mxxx -> M001
  WDAS : Wxxx -> W001

3.1.6 S/O/F

- Description :Transmitting/Receiving data Status (S - Send, O - OK, F - Fail). Automatically generated from device.
- Length : 1 Byte
- Example : None

3.1.7 REPEATER

- Description : ID of Repeater passes data sent by SOURCE. It is automatically generated by device. If not passed through repeater, R00 is displayed.
- Length : 3 Byte
- Example : R110A : Rxx -> R01

3.1.8 CR

- Description : Carriage Return [= 0x0D]
- Length : 1 Byte
- Example : None

3.2 Protocol and Device Operation Mode

3.2.1 PC MODE of device with Serial Interface

: RF MODEM(M110A), WDAS(W110A)

If M110A, W110A(In Serial Port use, only PC MODE is available) set as PC MODE for 1:1, 1:N system configuration, device operates as follows.

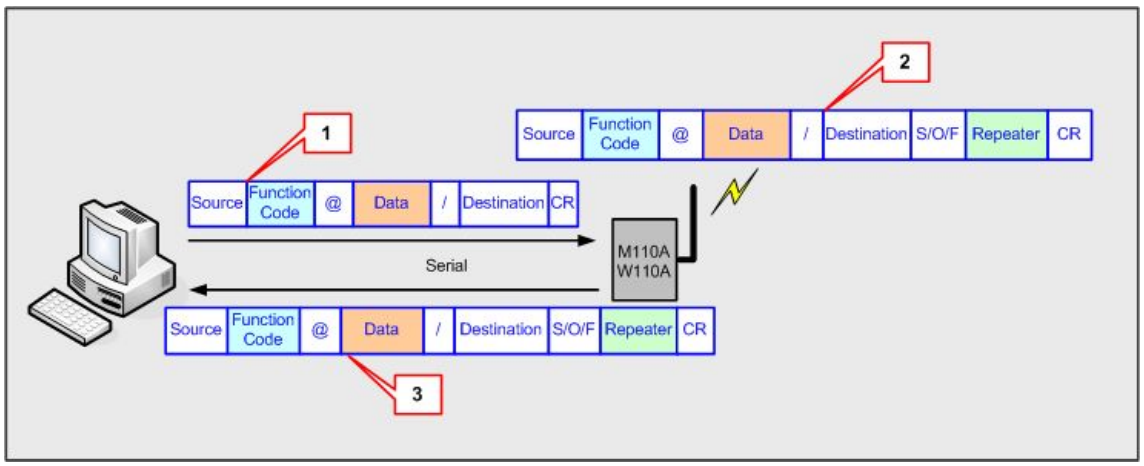

Figure 4. PC MODE of Serial Interface

1) PC->M110A(W110A)

Users transmit Device ID, FUNCTION CODE, @, Control Signal DATA, /, DESTINATION ID of Device to be communicated, CR to M100A(W110A) through serial communication program.

SOURCE	FUNCTION CODE	@	Control Signal DATA	/	DESTINATION	CR

2) M110A(W110A) <-> RF

M110A(W110A) automatically generate proper Status, REPEATER ID for received data and transmit them by RF.

SOURCE	FUNCTION CODE	@	Control Signal DATA	/	DESTINATION	S/O/F	REPEATER	CR

3.2.2 DEVICE MODE of device with Serial Interface : RF MODEM(M110A)

If system is configurated by setting DEVICE MODE for M110A, 1:1, that is only RF MODEM to RF MODEM communication configuration is possible. It operates as follows.

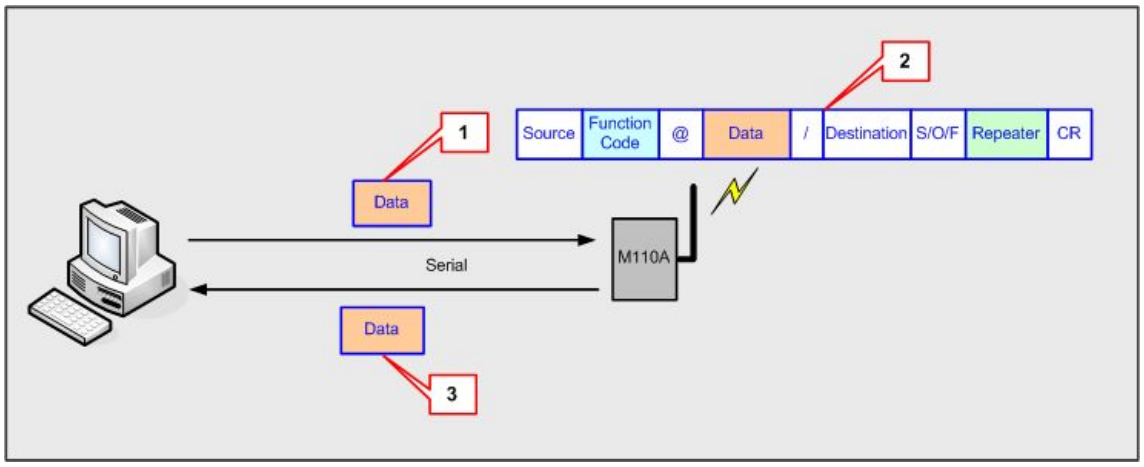

Figure 5. DEVICE MODE of Serial Interface device

1) PC->M110A

Users transmit control signal data to M110A through serial communication program. (Max 50Byte)

Control Signal DATA

2) M110A <-> RF

M110A automatically generates proper SOURCE, FUNCTION CODE, @, /, Status, REPEATER ID, CR for received data via serial interface and transmit them via RF.

SOURCE	FUNCTION CODE	@	Control Signal DATA	/	DESTINATION	S/O/F	REPEATER	CR

3) M110A -> Serial Interface Controller

If DESTINATION device that request communication is RF MODEM and DEVICE MODE is set, only Control Signal DATA part is transmitted to Serial Interface Controller via serial port by protocol.

Control Signal DATA

3.2.3 PC MODE of device with DI, DO, AI, AO function : WDAS

If system is configured by setting PC MODE for WDAS, 1:1, 1:N communication setup is available through RF MODEM(M110A), WDAS(W110A Serial Port)with Serial Port.

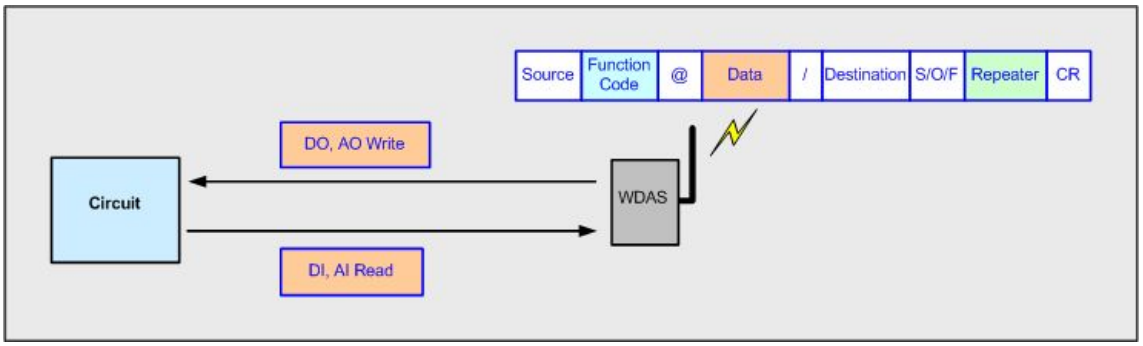

Figure 6. PC MODE of DI, DO, AI, AO device

When command is received from RF MODEM(M110A), WDAS(W110A Serial Port), perform corresponding operation for each model of WDAS, For details, refer the application example.

3.3 Use of FUNCTION CODE

3.3.1 10 : WRITE

1) Description : Command that device with Serial Interface (M110A, W110A) in PC MODE becomes SOURCE, then DESTINATION device in PC MODE with DO[Digital Output], AO[Analog Output] function generates desired signal value.

2) Send Data :

=> DATA : *DO(2Byte)*, *AO0(4Byte)*AO1(4Byte)*

※'*'is a classifier. It must be inserted.

=> S/O/F

- S : Data Send

3) Value Range of DATA

- DO : ※ Current applied products are W110A, W310A

Classification	Digital Port								Note
Name	DO#7	DO#6	DO#5	DO#4	DO#3	DO#2	DO#1	DO#0	
Signal Range	0~1	0~1	0~1	0~1	0~1	0~1	0~1	0~1	1="High", 0="Low"
Data Range (Char)	0 ~ F				0 ~ F				
Description	8 DO ports in bit is expressed as Express 0x00 ~ 0xFF(Hex) in CHAR(2Byte) Ex) Express 0xF0(Hex) -> F0(Char)								

- Example :

Data	DO 1st Byte				DO 2nd Byte				Note
Port No.	DO#7	DO#6	DO#5	DO#4	DO#3	DO#2	DO#1	DO#0	
Output Signal	1	1	1	1	1	1	1	1	1="High", 0="Low"
DO Data Value	F				F				
Description	All DO#0 ~ DO#7 Signal Output "High"								

=> DATA = *FF*

▸ AO : ※ Current applied product is W510A

Classification	Analog Port		Note
Name	AI#0	AI#1	
Signal Range	0~5V, 0~10V, 0~20mA	0~5V, 0~10V, 0~20mA	
Data Range (Char)	0000~FFFF(16Bit)	0000~FFFF(16Bit)	
Description	0~5V : 0V->0000, 5V->FFFF 0~10V : 0V->0000, 10V->FFFF 0~20mA : 0mA->0000, 20mA->FFFF AO0, AO1 is generated proportionally in 16 bit resolution (0000~FFFF(HEX)) depending on the setup output value range. AO Data Value is an approximate value.		

- Example :

Classification	Analog Port		Note
Port Num	AI#0	AI#1	
Output Signal	FFFF	0000	
AO Data Value	5V when 0~5V	0V when 0~10V	
Description	AO Data Value is approximate value.		

=> DATA = *FFFF*0000*

4) ACK Data :

=> DATA : Blank

=> S/O/F

- O : Data Receive OK
- F : Data Receive Fail

5) Applicable products :

- SOURCE : M110A, W110A
- DESTINATION : W110A , W310A, W510A

6) Example :

- M110A(PC MODE) : Serial Interface
- W310A(PC MODE) : DO [Digital Output]
- Configuration :

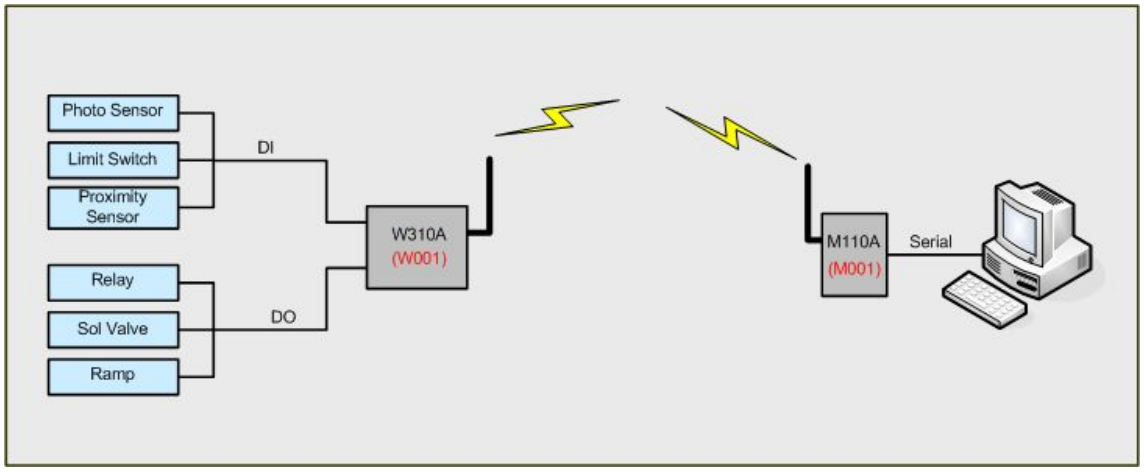

Figure 8. WRITE communication configuration example

- DO = 99 output is desired

Flow	Data Flow			Data Format	Status
1	PC	→	M001	M00110@*99*/W001↵	Wire
2	M001	→	W001	M00110@*99*/W001SR00↵	Wireless
3	M001	←	W001	▸ W00110@/M001FR00↵ -> Fail ACK ▸ W00110@/M001OR00↵ -> OK ACK	Wireless
4	PC	←	M001	▸ W00110@/M001FR00↵ -> Fail ACK ▸ W00110@/M001OR00↵ -> OK ACK	Wire

3.3.2 11 : SERIAL_WRITE

1) Description : Command that device with serial interface (M110A, W110A) in DEVICE MODE becomes SOURCE, then transmit control signal data to DESTINATION device with serial interface function in DEVICE MODE.

2) Send Data :

=> Control Signal DATA : MAX 20Byte

=> S/O/F

- S : Data Send

3) Control Signal DATA Value Range : MAX 20Byte

4) ACK Data :

=> DATA : Blank

=> S/O/F

- O : Data Receive OK
- F : Data Receive Fail

5) Applicable products :

- SOURCE : M110A(DEVICE MODE)
- DESTINATION : M110A(DEVICE MODE)

6) Example-1 : Serial Interface of PC MODE to PC MODE

- M110A(DEVICE MODE) : Serial Interface
- M110A(DEVICE MODE) : Serial Interface
- Configuration :

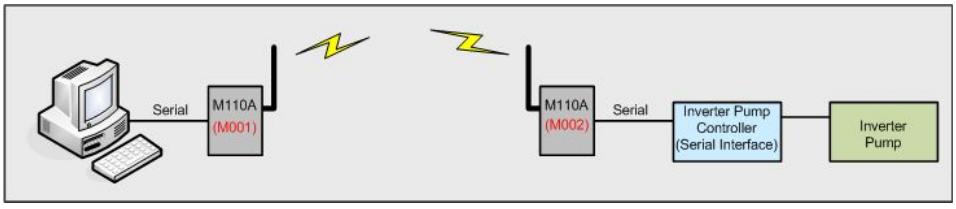

Figure 9. WRITE_SERIAL communication configuration example_1

- Control Signal Data = Inverter Pump open

Flow	Data Flow			Data Format	Status
1	PC	→	M001	Pump Open Control Signal Data send	Wire
2	M001	→	M002	M00111@/M002SR00(CRC)↵	Wireless
3	M001	←	M002	▸ M00211@/M001FR00(CRC)↵ -> Fail ACK ▸ M00211@/M001OR00(CRC)↵ -> OK ACK	Wireless
4	Inverter Pump Controller	←	M002	▸ Pump Open Action -> OK ACK ▸ -> Fail ACK	Wire

※ Cautions in using DEVICE MODE :

1. When data is sent through serial port, data must be sent at once without delay.
2. Only WRITE_SERIAL function can be used.

3.3.3 20 : READ

1) Description : Command that device with serial interface in PC MODE (M110A, W110A) becomes SOURCE, then ask current received value from DESTINATION device in PC MODE with DI[Digital Input], AI[Analog Input] function.

2) Send Data :

=> DATA : Blank

=> S/O/F

- S : Data Send

3) DATA Value Range : None

4) ACK Data :

=> READ_RESPONSE(21) is used as ACK for READ(20).

5) Applicable products : W110A , W210A, W310A, W410A

6) Example :

- M110A(PC MODE) : Serial Interface
- W310A(PC MODE) : DI[Digital Input] Interface
- Configuration :

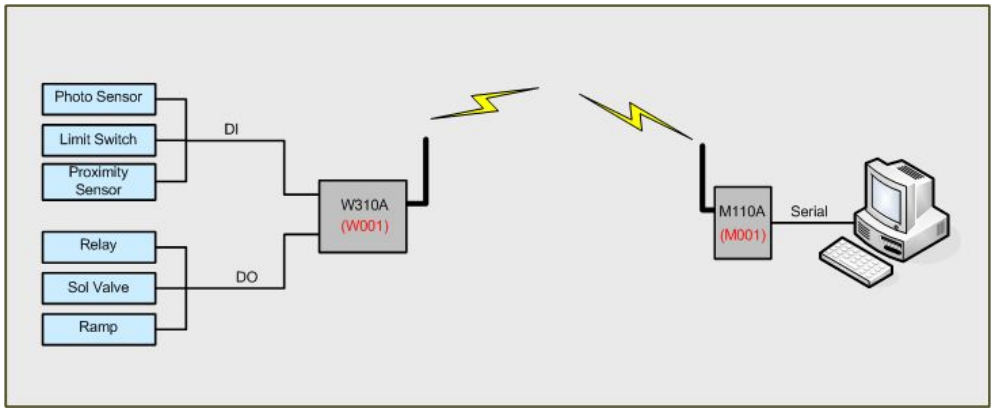

Figure 11. READ communication configuration example

- Case that Destination with AI, DI function is requested to measure the current input signal.

Flow	Data Flow			Data Format	Status
1	PC	→	M001	M00120@/W001↵	Wire
2	M001	→	W001	M00120@/W001SR00↵	Wireless

3.3.4 21 : READ_RESPONSE

1) Description : Command that SOURCE device with DI[Digital Input], AI[Analog Input] function in PC MODE measures current input value and transmits DESTINATION device requesting measured value. If 20(READ) is received, measures and transmits current input value.

2) Send Data :

=> DATA : DI[Digital Input], AI[Analog Input] acquisition data

- W210A : *AI0(4Byte)*AI1(4Byte)*
- W310A, W410A : *DI(2Byte)*

=> S/O/F

- S : Data Send

3) Value Range of DATA

- DI : ※Current applied products are W110A, W310A, W410A

Classification	Digital Port								Note
Name	DI#7	DI#6	DI#5	DI#4	DI#3	DI#2	DI#1	DI#0	
Signal Range	0~1	0~1	0~1	0~1	0~1	0~1	0~1	0~1	1="High", 0="Low"
Data Range (Char)	0 ~ F				0 ~ F				
Description	8 DI Ports are expressed in Bit as Express 0x00 ~ 0xFF(Hex) in CHAR(2Byte) Ex) Express 0xF0(Hex) -> F0(Char)								

- Example :

Data order	DI 1st Byte				DI 2nd Byte				Note
Port Num	DI#7	DI#6	DI#5	DI#4	DI#3	DI#2	DI#1	DI#0	
Output Signal	1	1	1	1	1	1	1	1	1="High", 0="Low"
DI Data Value	F				F				
Description	DI#0 ~ DI#7 Set all “High"								

=> DATA = *FF*

※ W410A has 4 DI[Digital Input] Ports. So, DI 1st Byte is '0'.

▸ AI : ※ Current applied product is W210A(16Bit resolution)

Classification	Analog Port		Note
Name	AI#0	AI#1	
Signal Range	0~5V, 0~10V, 0~20mA	0~5V, 0~10V, 0~20mA	
Data Range (Char)	0000~FFFF(16Bit)	0000~FFFF(16Bit)	
Description	0~5V : 0V->0000, 5V->FFFF 0~10V : 0V->0000, 10V->FFFF 0~20mA : 0mA->0000, 20mA->FFFF AI0, AI1 is generated proportionally in 16 bit resolution (0000~FFFF(HEX)) depending on the setup input value range.		

- Example :

Classification	Analog Port		Note
Port Num	AI#0	AI#1	
Input Signal	5V when 0~5V	0V when 0~10V	
AI Data Value	FFFF	0000	
Description	AI Data Value is an approximate value		

=> DATA = *FFFF*0000*

4)ACK Data :

=> DATA : Blank

=> S/O/F

- O : Data Receive OK
- F : Data Receive Fail

5) Applicable products : W110A , W210A, W310A, W410A

6) Example :

- M110A(PC MODE) : Serial Interface
- W310A(PC MODE) : DI[Digital Input] Interface
- Configuration :

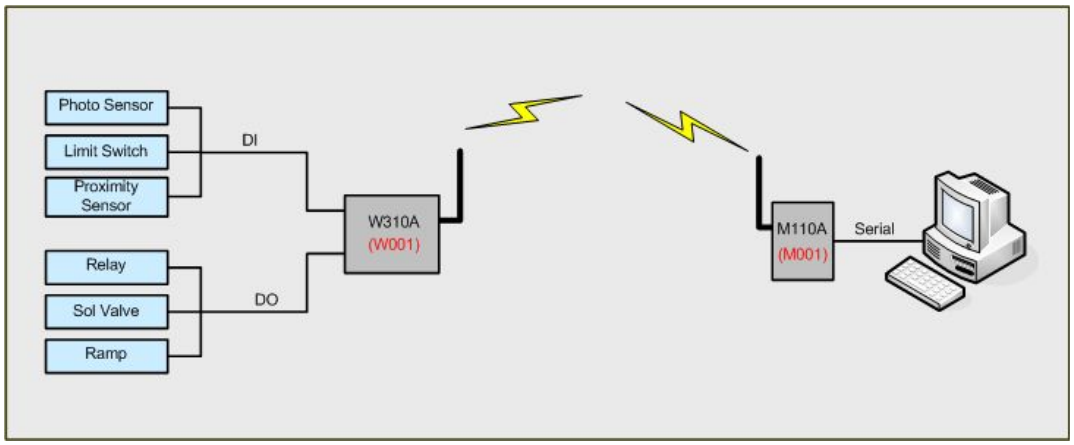

Figure 12. READ_RESPONSE communication configuration example

- DI Range : 00~FF(HEX)
- Acquisition case : DI = FF

Flow	Data Flow			Data Format	Status
1	M001	←	W001	W00121@*FF*/M001SR00↵	Wireless
2	M001	→	W001	▸ M00121@/W001FR00↵ -> Fail ACK ▸ M00121@/W001OR00↵ -> OK ACK	Wireless
3	PC	←	M001	▸ W00121@*FF*/M001SR00↵ -> case OK ▸ -> case Fail	Wire

3.3.5 22 : STATUS_READ

1) Description : Command that device with Serial interface in PC MODE (M110A, W110A) becomes SOURCE, then requests DESTINATION device with AO[Analog Output], DO[Digital Output] function in PC MODE about current output value.

2) Send Data :

=> DATA : Blank

=> S/O/F

- S : Data Send

3) Value Range of DATA : None

4) ACK Data :

=> STATUS_RESPONSE(23) is used as ACK for STATUS_READ(22).

5) Applicable products : W110A , W310A, W510A

6) Example :

- M110A(PC MODE) : Serial Interface
- W310A(PC MODE) : DO[Digital Output] Interface
- Configuration :

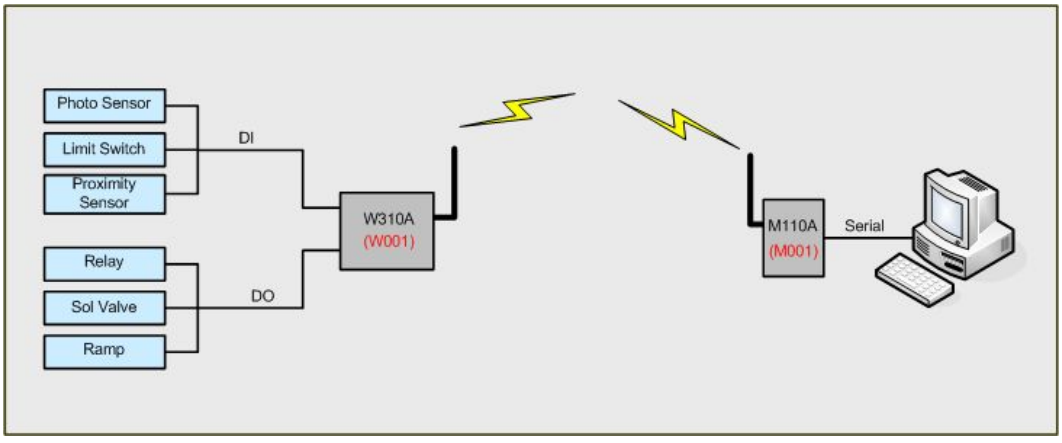

Figure 13. READ communication configuration example

- Case that Destination with DO, AO function is requested to measure the current output signal value.

Flow	Data Flow			Data Format	Status
1	PC	→	M001	M00122@/W001↵	Wire
2	M001	→	W001	M00122@/W001SR00↵	Wireless

3.3.6 23 : STATUS_RESPONSE

1) Description : Command that SOURCE device with AO[Analog Output], DO[Digital Output] function in PC MODE transmits current output value to DESTINATION device requesting output value.

2) Send Data :

=> DATA : DO[Digital Output], AO[Analog Output] Output Data

- W110A, W310A : *DO(2Byte)*
- W510A : *AO0(4Byte)*AO1(4Byte)*

=> S/O/F

- S : Data Send

3) Value Range of DATA : Same as 10(WRITE) command

4) ACK Data :

=> DATA : Blank

=> S/O/F

- O : Data Receive OK
- F : Data Receive Fail

5) Applicable products : W110A, W310A, W510A

6) Example :

- M110A(PC MODE) : Serial Interface
- W310A(PC MODE) : DO[Digital Output] Interface
- Configuration :

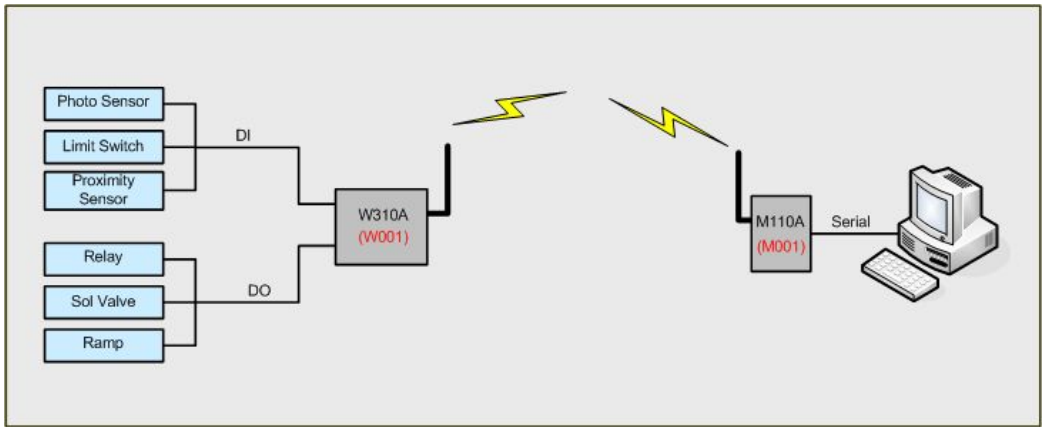

Figure 14. STATUS_RESPONSE communication configuration example

- DO Range : 00~FF(HEX)
- Output case : DO = FF

Flow	Data Flow			Data Format	Status
1	M001	←	W001	W00123@*FF*/M001SR00↵	Wireless
2	M001	→	W001	▸ M00123@/W001FR00↵ –> Fail ACK ▸ M00123@/W001OR00↵ –> OK ACK	Wireless
3	PC	←	M001	▸ W00123@*FF*/M001SR00↵ –> case OK ▸ –> case Fail	Wire

4. Communication Consumption Time

Intial booting time needed for normal operation after power on is about 200ms. In serial data transmission (maximum 50Byte), it takes 450ms. Total time up to normal ACK/NACK receiving takes 650ms. Also, total time for receiving READ command and READ_RESPONSE, then transmitting ACK/NACK and for receiving STATUS_READ command and STATUS_RESPONSE, then transmitting ACK/NACK takes about 850ms. It takes about 400ms for transmitting WRITE command and receiving ACK/NACK. However, in W500A case, it takes up to 1100ms. Users should use products considering the communication consumption time. (Communication consumption time is a time with some spare time. Consumption time becomes longer when transmitting data length by RF becomes longer.) when users send repeated data through RF MODEM, WDAS, ACK/NACK must be checked.
All device has silent period between transmission 10 seconds.

Operation	Min.	Typ.	Max.	Unit	Note
Init			**200**	**ms**	
RF MODEM → WRITE_SERIAL → RF MODEM WDAS			**450**	**ms**	**Max 50Byte**
RF MODEM ← ACK/NACK ← RF MODEM WDAS			**200**	**ms**	
RF MODEM → READ → WDAS			**200**	**ms**	
RF MODEM ← READ_RESPONSE ← WDAS			**450**	**ms**	**Max. W100A**
RF MODEM → ACK/NACK → WDAS			**200**	**ms**	
RF MODEM → WRITE → WDAS			**1100**	**ms**	**Max. W500A**
RF MODEM ← ACK/NACK ← WDAS			**200**	**ms**	

Table 3. Communication consumption time

5. Example

(EX 1) M110A(DEVICE MODE) to M110A(DEVICE MODES) communication

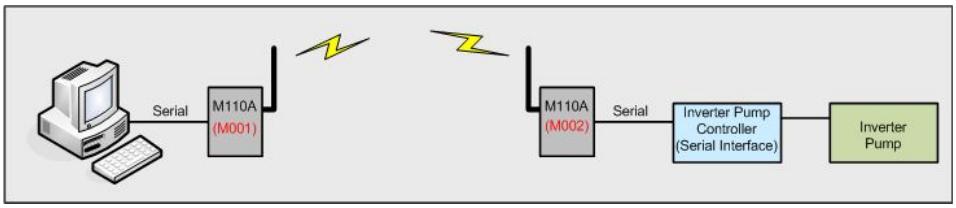

Figure 17. WRITE_SERIAL communication configuration example_1

- Control Signal Data = Inverter Pump open

Flow	Data Flow			Data Format	Status
1	PC	→	M001	Pump Open Control Signal Data send	Wire
2	M001	→	M002	M00111@/M002SR00(CRC)↵	Wireless
3	M001	←	M002	▸ M00211@/M001FR00(CRC)↵ -> Fail ACK ▸ M00211@/M001OR00(CRC)↵ -> OK ACK	Wireless
4	Inverter Pump Controller	←	M002	▸ Pump Open Action -> OK ACK ▸ -> Fail ACK	Wire

※ Caution in using DEVICE MODE : When data is sent through serial port, data must be sent at once without delay.

(EX 2) M110A(PC MODE) to W110A(Only PC MODE) communication

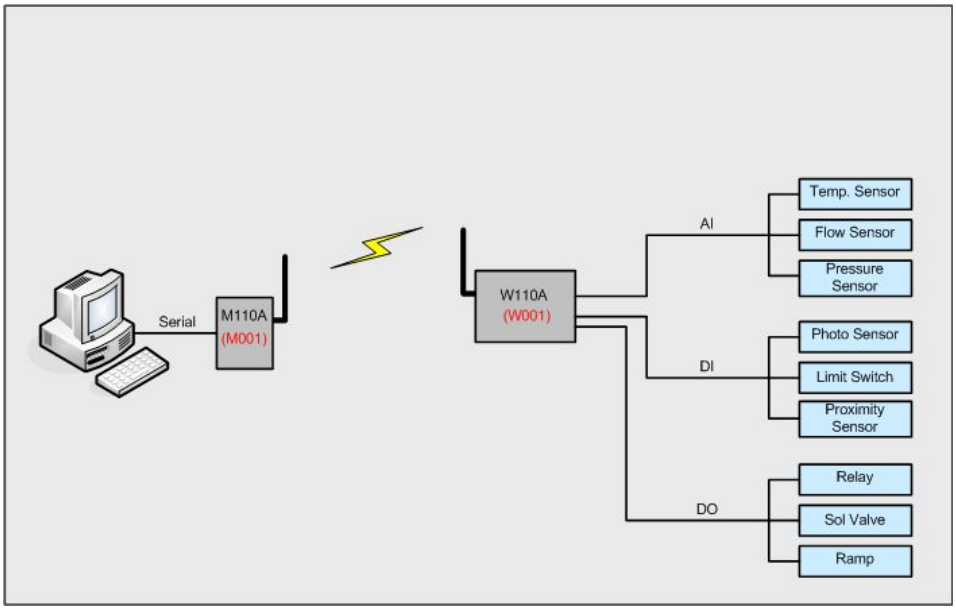

Figure 18. M110A to W110A communication example

1. DO Control

W110A : DO#0, DO#1, DO#4, DO#5 output is desired

Flow	Data Flow			Data Format	Status
1	PC	→	M001	M00110@*33*/W001↵	Wire
2	M001	→	W001	M00110@*33*/W001SR00↵	Wireless
3	W001	→	Device	DO#0, DO#1, DO#4, DO#5 => "High[=1]" Output	Wire
4	M001	←	W001	▸ W00110@/M001FR00↵ -> Fail ACK ▸ W00110@/M001OR00↵ -> OK ACK	Wireless
5	PC	←	M001	▸ W00110@/M001FR00↵ -> Fail ACK ▸ W00110@/M001OR00↵ -> OK ACK	Wire

2. Read AI, DI Status

Flow	Data Flow			Data Format	Status
1	PC	→	M001	M00120@/W001↵	Wire
2	M001	→	W001	M00120@/W001SR00↵	Wireless
3	W001	←	Sensors	Analog Input, Digital Input Signal Read	Wire

3. AI, DI Data Transmission

(AI0 = 0x03FF, AI1 = 0x03FF, AI2 = 0x03FF, AI3 = 0x03FF, AI4 = 0x03FF, Digital Input Data = 0xFF)

Flow	Data Flow			Data Format	Status
1	M001	←	W001	W00121@*03FF*03FF*03FF*03FF*03FF*FF*/M001SR00↵	Wireless
2	M001	→	W001	▸ M00121@/W001FR00↵ -> Fail ACK ▸ M00121@/W001OR00↵ -> OK ACK	Wireless
3	PC	←	M001	▸ W00121@*03FF*03FF*03FF*03FF*03FF*FF*/M001SR00↵ -> case OK ▸ -> case Fail	Wire

(EX 3) W210A(PC MODE) to M110A(PC MODE) communication

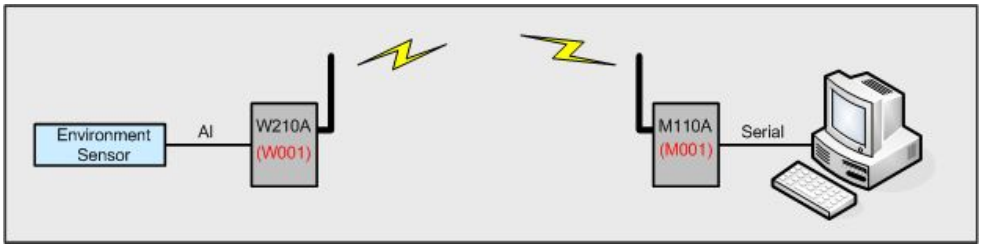

Figure 19. W210A to M110A communication example

1. Read AI Status

Flow	Data Flow			Data Format	Status
1	PC	→	M001	M00120@/W001↵	Wire
2	M001	→	W001	M00120@/W001SR00↵	Wireless
3	W001	←	Sensors	Analog Input Signal Read	Wire

2. AI Data Transmission(Analog Input Data AI0 = FFFF, AI1 = 0000)

Flow	Data Flow			Data Format	Status
1	M001	←	W001	W00121@*FFFF*0000*/M001SR00↵	Wireless
2	M001	→	W001	▸ M00121@/W001FR00↵ -> Fail ACK ▸ M00121@/W001OR00↵ -> OK ACK	Wireless
3	PC	←	M001	▸ W00121@*FFFF*0000*/M001SR00↵ -> case OK ▸ -> case Fail	Wire

(EX 4) W310A(PC MODE) to M110A(PC MODE) communication

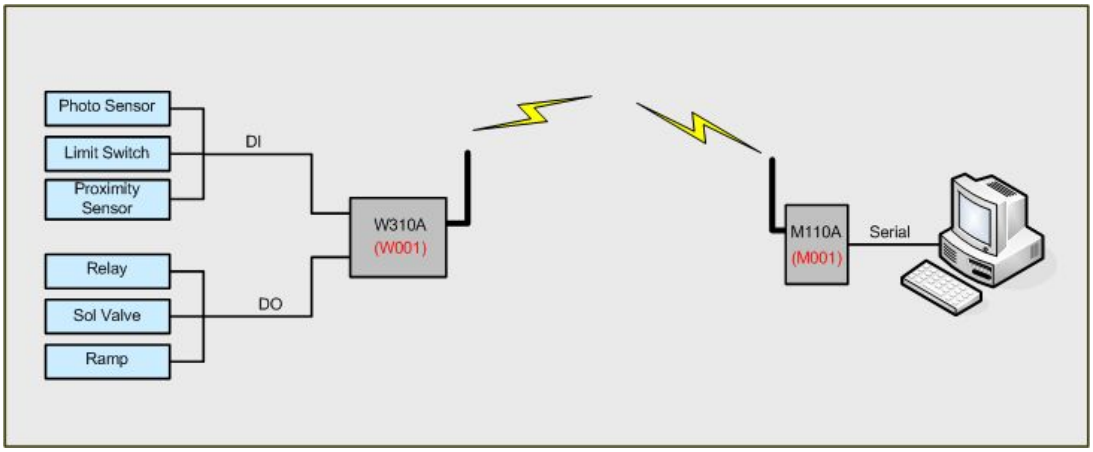

Figure 22. W310A to M110A communication example

1. DO Control

W310A : DO#0, DO#1, DO#4, DO#5 output is desired

Flow	Data Flow			Data Format	Status
1	PC	→	M001	M00110@*33*/W001↵	Wire
2	M001	→	W001	M00110@*33*/W001SR00↵	Wireless
3	W001	→	Device	DO#0, DO#1, DO#4, DO#5 => "High[=1]" Set	Wire
4	M001	←	W001	▸ W00110@/M001FR00↵ -> Fail ACK ▸ W00110@/M001OR00↵ -> OK ACK	Wireless
5	PC	←	M001	▸ W00110@/M001FR00↵ -> Fail ACK ▸ W00110@/M001OR00↵ -> OK ACK	Wire

2. Read DI Status

Flow	Data Flow			Data Format	Status
1	PC	→	M001	M00120@/W001↵	Wire
2	M001	→	W001	M00120@/W001SR00↵	Wireless
3	W001	←	Sensors	Digital Input Signal Read	Wire

3. DI Data Transmission(Digital Input Data = 0xFF)

Flow	Data Flow			Data Format	Status
1	M001	←	W001	W00121@*FF*/M001SR00↵	Wireless
2	M001	→	W001	▸ M00121@/W001FR00↵ –> Fail ACK ▸ M00121@/W001OR00↵ –> OK ACK	Wireless
3	PC	←	M001	▸ W00121@*FF*/M001SR00↵ –> case OK ▸ –> case Fail	Wire

(EX 5) W410A(PC MODE) to M110A(PC MODE) communication

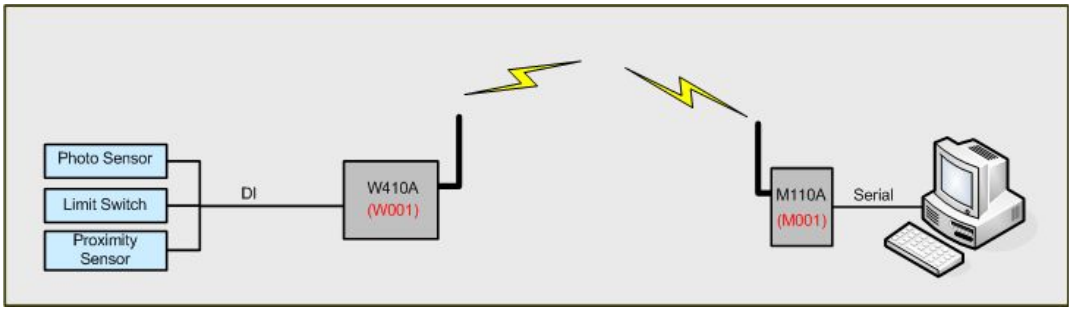

Figure 25. W410A to M110A communication example

1. Read DI Status

Flow	Data Flow			Data Format	Status
1	PC	→	M001	M00120@/W001↵	Wire
2	M001	→	W001	M00120@/W001SR00(CRC)↵	Wireless
3	W001	←	Sensors	Digital Input Signal Read	Wire

2. DI Data Transmission (Digital Input Data = 0x0F)

Flow	Data Flow			Data Format	Status
1	M001	←	W001	W00121@*0F*/M001SR00↵	Wireless
2	M001	→	W001	▸ M00121@/W001FR00↵ –> Fail ACK ▸ M00121@/W001OR00↵ –> OK ACK	Wireless
3	PC	←	M001	▸ W00121@*0F*/M001SR00↵ –> case OK ▸ –> case Fail	Wire

(EX 6) W510A(PC MODE) to M110A(PC MODE) communication

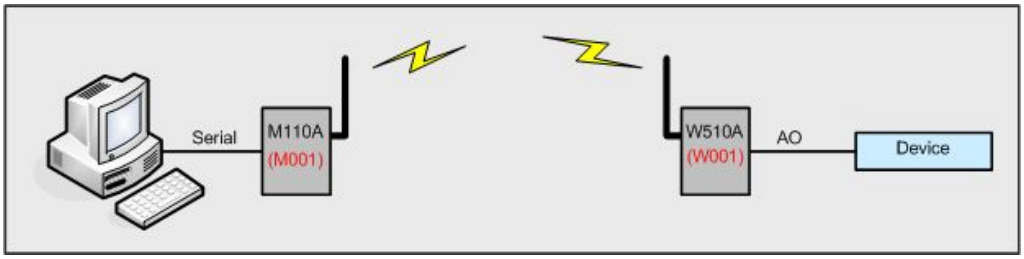

Figure 27. W510A to M110A communication example

1. AO Control

Flow	Data Flow			Data Format	Status
1	PC	→	M001	M00110@*FFFF*FFFF*/W001↵	Wire
2	M001	→	W001	M00110@*FFFF*FFFF*/W001SR00↵	Wireless
3	W001	→	Device	Analog Output Signal Write	Wire

2. Read AO Status

Flow	Data Flow			Data Format	Status
1	PC	→	M001	M00122@/W001↵	Wire
2	M001	→	W001	M00122@/W001SR00↵	Wireless
3	W001	←	Sensors	Analog Output Signal Read	Wire

3. AO Status Transmission (Analog Output Data : AO0=0xFFFF, AO1=0xFFFF)

Flow	Data Flow			Data Format	Status
1	M001	←	W001	W00123@*03FF*03FF*/M001SR00↵	Wireless
2	M001	→	W001	▸ M00123@/W001FR00↵ –> Fail ACK ▸ M00123@/W001OR00↵ –> OK ACK	Wireless
3	PC	←	M001	▸ W00123@*FFFF*FFFF*/M001SR00↵ –> case OK ▸ –> case Fail	Wire

Appendix 1. Document Information

Revision	Description
1.0	07/13/2011 - Initial Release Version

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