Matching Unit Communication Specifications

1. Physical and Electrical Conditions

1.1 Connector Configuration: D-sub 9pin Female

1.2 Pin Assignment

Signal Pin	Name	Pin Type	Description	
1				
2	TXD		RS-232 transmit data	
3	RXD		RS-232 receive data	
4	INTERLOCK		Interlock	
5	COM		Data common	
6	RS485-		RS-485 Data-	
7	RS485+		RS-485 Data+	
8	INTERLOCK-RET		Interlock return	
9				
10				

2. Logical Conditions

Baud rate: 19200bps

Coding System: 8-bit binary

Bits per Byte: 1 start bit

8 data bits, least significant bit sent first

1 bit for parity completion: Even Parity

1 stop bit

3. Protocol Frame Description

Protocol Type: **Modbus RTU**

Frame description:

Slave Address	Function Code	Data	CRC16	
1byte	1byte	0 up to 252byte(s)	2bytes	
			Low	Hi

Salve Address: 1 ~ 247 (1:default)

Function Code: 3 (0x03) – Read Holding Registers

4 (0x04) – Read Input Registers

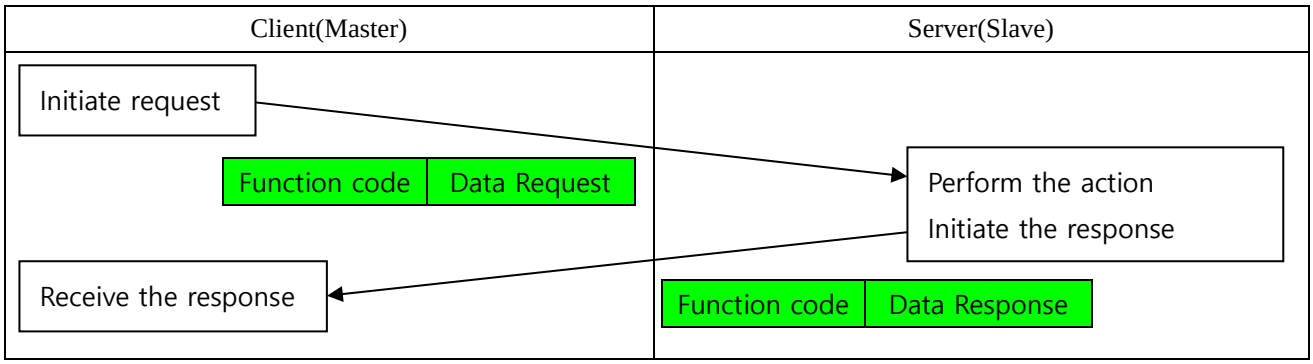
6 (0x06) – Write Single Register

16 (0x10) – Write Multiple Registers

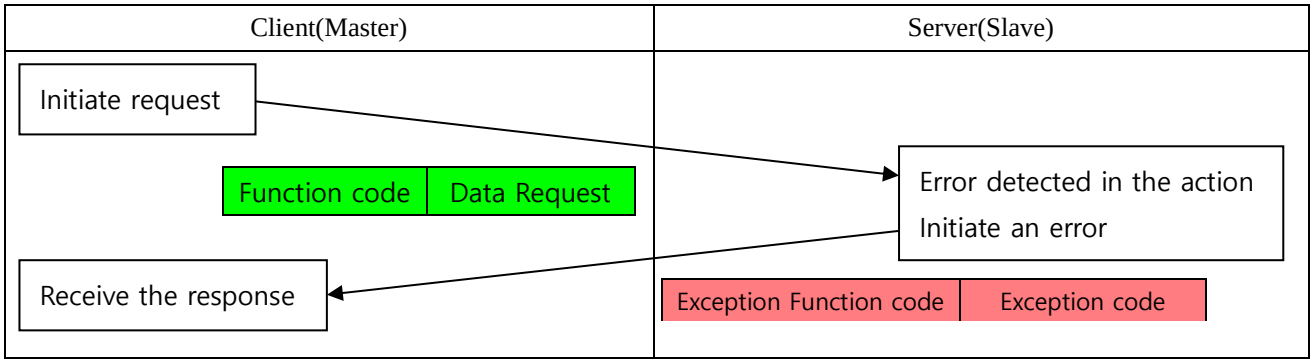
23 (0x17) – Read/Write Multiple Registers

CRC16: Modbus_over_serial_line_V1_02.pdf 참조

4. Communication Sequence



MODBUS transaction (error free)



MODBUS transaction (exception response)

5. Exception Codes

MODBUS Exception Codes		
Code	Name	Meaning
01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the server (or slave). This may be because the function code is only applicable to newer devices, and was not implemented in the unit selected. It could also indicate that the server (or slave) is in the wrong state to process a request of this type, for example because it is unconfigured and is being asked to return register values.
02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the server (or slave). More specifically, the combination of reference number and transfer length is invalid. For a controller with 100 registers, the PDU addresses the first register as 0, and the last one as 99. If a request is submitted with a starting register address of 96 and a quantity of registers of 4, then this request will successfully operate (address-wise at least) on registers 96, 97, 98, 99. If a request is submitted with a starting register address of 96 and a quantity of registers of 5, then this request will fail with Exception Code 0x02 “Illegal Data Address” since it attempts to operate on registers 96, 97, 98, 99 and 100, and there is no register with address 100.
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value

		for server (or slave). This indicates a fault in the structure of the remainder of a complex request, such as that the implied length is incorrect. It specifically does NOT mean that a data item submitted for storage in a register has a value outside the expectation of the application program, since the MODBUS protocol is unaware of the significance of any particular value of any particular register.
04	SLAVE DEVICE FAILURE	An unrecoverable error occurred while the server (or slave) was attempting to perform the requested action.

6. Function codes descriptions

6.1 03 (0x03) Read Holding Registers

This function code is used to read the contents of a contiguous block of holding registers in a remote device. The Request PDU specifies the starting register address and the number of registers. In the PDU Registers are addressed starting at zero. Therefore registers numbered 1-16 are addressed as 0-15.

The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

Request

Function code	1 Byte	**0x03**
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	0x0001 to 0x007D

Response

Function code	1 Byte	**0x03**
Byte count	1 Byte	2 x **N***
Register value	**N*** x 2 Bytes	

***N** = Quantity of Registers

Error

Error code	1 Byte	**0x83**
Exception code	1 Byte	01 or 02 or 03 or 04

6.2 04 (0x04) Read Input Registers

This function code is used to read from 1 to 125 contiguous input registers in a remote device. The Request PDU specifies the starting register address and the number of registers. In the PDU Registers are addressed starting at zero. Therefore input registers numbered 1-16 are addressed as 0-15.

The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

Request

Function code	1 Byte	**0x04**
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	0x0001 to 0x007D

Response

Function code	1 Byte	**0x04**
Byte count	1 Byte	2 x **N***
Register value	**N*** x 2 Bytes	

***N** = Quantity of Input Registers

Error

Error code	1 Byte	**0x84**
Exception code	1 Byte	01 or 02 or 03 or 04

6.3 06 (0x06) Write Single Register

This function code is used to write a single holding register in a remote device.

The Request PDU specifies the address of the register to be written. Registers are addressed starting at zero. Therefore register numbered 1 is addressed as 0.

The normal response is an echo of the request, returned after the register contents have been written.

Request

Function code	1 Byte	**0x06**
Register Address	2 Bytes	0x0000 to 0xFFFF
Register Value	2 Bytes	0x0000 to 0xFFFF

Response

Function code	1 Byte	**0x06**
Register Address	2 Bytes	0x0000 to 0xFFFF
Register Value	2 Bytes	0x0000 to 0xFFFF

Error

Error code	1 Byte	**0x86**
Exception code	1 Byte	01 or 02 or 03 or 04

6.4 16 (0x10) Write Multiple registers

This function code is used to write a block of contiguous registers (1 to 123 registers) in a remote device.

The requested written values are specified in the request data field. Data is packed as two bytes per register.

The normal response returns the function code, starting address, and quantity of registers written.

Request

Function code	1 Byte	**0x10**
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	0x0001 to 0x007D
Byte Count	1 Byte	2 x **N***
Register value	**N*** x 2 Bytes	Value

***N** = Quantity of Registers

Response

Function code	1 Byte	**0x10**

Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	0x0001 to 0x007D

Error

Error code	1 Byte	**0x90**
Exception code	1 Byte	01 or 02 or 03 or 04

7. Matcher Parameter Address Map

7.1 MODBUS Input Registers (Read Only)

Address	Name	Data Type	Description	Semantics of Value
0	Matcher Status	UINT	Reports the status of the matcher.	See below.
1	Load Position	INT	Reports the load capacitor Positions.	Min: 0 (0.00%) Max: 10000 (100.00%)
2	Tune Position	INT	Reports the tune capacitor Positions.	Min: 0 (0.00%) Max: 10000 (100.00%)
3	VPP	UINT	Reports the peak to peak voltage of RF output.	Min: 0 (0V) Max: 65535 (65535V)
4	~~VDC~~	~~INT~~	~~Reports the DC voltage of RF output.~~	~~Min: -32768 (3276.8V)~~ ~~Max: 32767 (3276.7V)~~
5	VRMS	UINT	Reports the RMS voltage of RF output.	Min: 0 (0V) Max: 65535 (65535V)
6	IRMS	UINT	Reports the RMS current of RF output.	Min: 0 (0.00A) Max: 65535 (655.35A)
7	Phase	INT	Reports the phase in degrees.	Min: -900 (-90.0°) Max: 900 (90.0°)

▶ **Matcher Status**

15	14	13	12	11	10	9	8
~~LEAK2~~	~~LEAK1~~	FAN2	FAN1	MOTOR	COVER	~~TEMP~~	COAXIAL

7	6	5	4	3	2	1	0
			TUNED	RFON	ALARM	PRESET	MANUAL

• Bitfield Description

Bit	Name	Description
0	MANUAL	0 – Automatic Mode 1 – Manual Mode

1	PRESET	0 – Preset Disable 1 – Preset Enable
2	ALARM	0 – No Alarm 1 – Alarm
3	RFON	0 – RF Off 1 – RF On
4	TUNED	0 – Not Matching 1 – Matched
8	COAXIAL	0 – No Alarm 1 – Alarm
~~9~~	~~TEMP~~	~~0 – No Alarm~~ ~~1 – Alarm~~
10	COVER	0 – No Alarm 1 – Alarm
11	MOTOR	0 – No Alarm 1 – Alarm
12	FAN1	0 – No Alarm 1 – Alarm
13	FAN2	0 – No Alarm 1 – Alarm
~~14~~	~~LEAK1~~	~~0 – No Alarm~~ ~~1 – Alarm~~
~~15~~	~~LEAK2~~	~~0 – No Alarm~~ ~~1 – Alarm~~

7.2 MODBUS Holding Registers (Read / Write)

Address	Name	Data Type	Description	Semantics of Value
10000	Operating Mode	UINT	Sets the operating mode of the matcher	See Below.
10001	Preset Load Position	INT	Sets the load capacitor preset position.	Min: 0 (0.00%) Max: 10000 (100.00%)
10002	Preset Tune Position	INT	Sets the tune capacitor preset position.	Min: 0 (0.00%) Max: 10000 (100.00%)

▶ **Operating Mode**

15	14	13	12	11	10	9	8

7	6	5	4	3	2	1	0
						PRESET	MANUAL

• Bitfield Description

Bit	Name	Description
0	MANUAL	0 – Automatic Mode 1 – Manual Mode
1	PRESET	0 – Preset Disable 1 – Preset Enable

▶ Date Types

Data Type Name	Data Type Description
INT	Signed 16-bit integer value.
UINT	Unsigned 16-bit integer value.
DINT	Signed 32-bit integer value.
UDINT	Unsigned 32-bit integer value.
REAL	32-bit floating-point value.