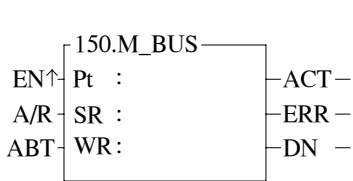| FUN150 M-BUS	Convenient instruction for Modbus RTU Master （Which makes PLC as the Modbus RTU master through Port 1～4）	FUN150 M-BUS

```
        ┌─── 150.M_BUS ───┐
 EN↑─┤ Pt  :            ├─ ACT ─
 A/R ─┤ SR  :            ├─ ERR ─
 ABT ─┤ WR  :            ├─ DN  ─
        └─────────────────┘
```

Pt : 1～4，specify the communication port being acted as the Modbus RTU master

SR : Starting register of communication program

WR : Starting register for instruction operation. It controls 8 registers，the other programs can not repeat in using.

Range Ope-	HR R0 | R3839	ROR R5000 | R8071	DR D0 | D3999	K
Pt				1～4
SR	○	○	○	
WR	○	○*	○	

Descriptions

1. FUN150 (M-BUS) instruction makes PLC act as Modbus RTU master through Port 1～4, thus it is very easy to communicate with the intelligent peripheral with Modbus RTU protocol.

2. The master PLC may connect with 247 slave stations through the RS-485 interface.

3. Only the master PLC needs to use M-BUS instruction.

4. It employs the program coding method or table filling method to plan for the data flow controls; i.e. from which one of the slave station to get which type of data and save them to the master PLC, or from the master PLC to write which type of data to the assigned slave station.　It needs only seven registries to make definition; every seven registers define one packet of data transaction.

5. When execution control 〝EN↑〞changes from 0→1 and both inputs Pause "PAU" and Abort "ABT" are 0, and if Port 1/2/3/4 hasn't been controlled by other communication instructions [i.e. M1960 (Port1) / M1962 (Port2) / M1936 (Port3) / M1938 (Port4) = 1], this instruction will control the Port 1/2/3/4 immediately and set the M1960/M1962/M1936/M1938 to be 0 (which means it is being occupied), then going on a packet of data transaction immediately. If Port 1/2/3/4 has been controlled (M1960/M1962/M1936/M1938 = 0), then this instruction will enter into the standby status until the controlling communication instruction completes its transaction or pause/abort its operation to release the control right (M1960/M1962/M1936/M1938 =1), and then this instruction will become enactive, set M1960/M1962/M1936/M1938 to be 0, and going on the data transaction immediately.

6. While in transaction processing, if operation control "ABT" becomes 1, this instruction will abort this transaction immediately and release the control right (M1960/M1962/M1936/M1938 = 1). Next time, when this instruction takes over the transmission right again, it will restart from the first packet of data transaction.

7. While 〝A/R〞=0，Modbus RTU protocol； 〝A/R〞=1，Modbus ASCII protocol （Reserved）。

8. While it is in the data transaction, the output indication "ACT" will be ON.

9. If there is error occurred when it finishes a packet of data transaction, the output indication "DN" & "ERR" will be ON.

10. If there is no error occurred when it finishes a packet of data transaction, the output indication "DN" will be ON.

FUN150 M-BUS	Convenient instruction for Modbus RTU Master （Which makes PLC as the Modbus RTU master through Port 1～4）	FUN150 M-BUS

【 Interface Signals】

・Dedicated Relays and Registers for corresponding port :

	Port 1	**Port 2**	**Port 3**	**Port 4**
Port Busy Indicator	M1960	M1962	M1936	M1938
Port Finished Indicator	M1961	M1963	M1937	M1939
Port Communication Parameters	R4146	R4158	R4043	R4044
TX Delay & RX Time-out Span	R4147	R4159	R4045	R4048

Port Busy Indicator   : This signal is generated from CPU.

ON, it represents that port is free and ready.

OFF, it represents that port is busy, data transaction is going.

Port Finished Indicator : This signal is generated from CPU.

When the communication program completed the last packet of data transaction, this signal will be ON for one scan time (for successive data transaction).

When the communication program completed the last packet of data transaction, this signal will be still ON (for single packet of data transmission).

Port Communication Parameters :

The register is for communication parameters setting of corresponding port. (please refer to the chapter of communication parameters setting)

TX Delay & RX Time-out Span :

The content of Low Byte defines the receive time-out span of M-BUS instruction; its unit is 0.01 second (the default is 50, which means 0.5 second)

The M-BUS instruction employs receive time-out span to judge whether the slave station on line or not. When the master PLC sent out the read/write command to the slave station, the slave station didn't reply within this period means that there is abnormal event in communication called Time-out. When there are multi-drop linking, properly adjust this value (greater than 1 scan time of the slave station with the longest scann time) to shorten the communication response time among the active linking stations if there are many slave stations power off (The time-out cases will happen).

The content of High Byte defines the transmission delay time between two packets of data transaction for M-BUS instruction; its unit is 0.01 second (the default is 0).

For point to point link, this value can be set as 0 to shorten the communication transaction time and promote the communication efficiency. In the case of linking multi-drop and if the scan time of master PLC is far longer than any slave station, this value can also be set to 0 to shorten the communication

transaction time and promote the communication efficiency. When there are multi-drops linking and the scan time of master PLC is close to that of slave station's, it must properly adjust this value (greater than 1 scan time of the slave station with the longest scan time) to reach the best, error-free communication quality.
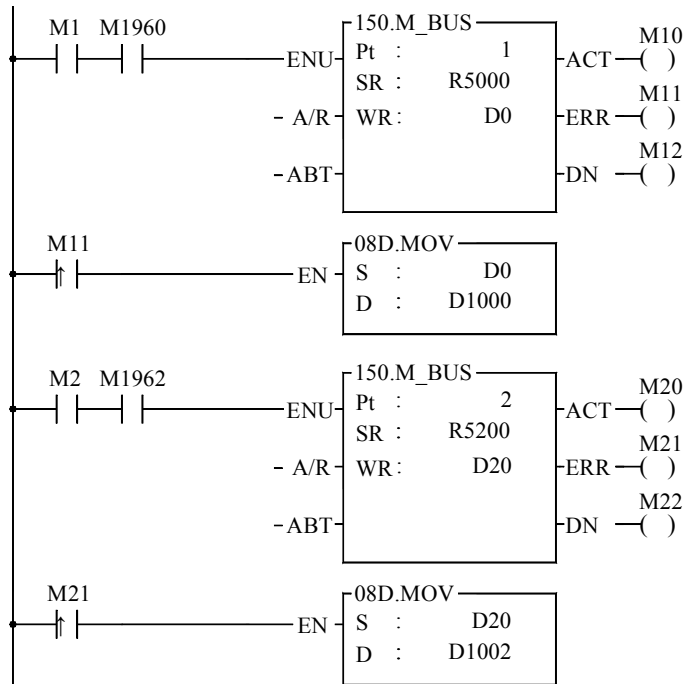
New Message Detection Time Interval :

While the communication port being used as the master or slave of Modbus RTU protocol, the system will give the default time interval to identify each packet of receiving message, if the default works not well, the user can set this time interval through the high byte setting of R4148 and let M1956 be 1, to avoid the overlap of different packet of message frame.

M1956=1, High Byte of R4148 is used to set the new message detection time interval for Port 1～Port 4 (Unit in mS)

FUN150 M-BUS	Convenient instruction for Modbus RTU Master （Which makes PLC as the Modbus RTU master through Port 1～4）	FUN150 M-BUS

Program example   Automatic cycling transmission

```
  M1  M1960          ┌─150.M_BUS─┐          M10
──┤ ├──┤ ├──────ENU─┤Pt  :     1├─ACT──( )
                     │SR  :  R5000│          M11
           ─ A/R─┤WR :     D0├─ERR──( )
                     │            │          M12
             ─ABT─┤            ├─DN ──( )
                     └────────────┘

  M11                ┌─08D.MOV───┐
──┤↑├──────────EN ─┤S  :     D0├
                     │D  :   D1000│
                     └────────────┘

  M2  M1962          ┌─150.M_BUS─┐          M20
──┤ ├──┤ ├──────ENU─┤Pt  :     2├─ACT──( )
                     │SR  :  R5200│          M21
           ─ A/R─┤WR :    D20├─ERR──( )
                     │            │          M22
             ─ABT─┤            ├─DN ──( )
                     └────────────┘

  M21                ┌─08D.MOV───┐
──┤↑├──────────EN ─┤S  :    D20├
                     │D  :   D1002│
                     └────────────┘
```

- Configure R5000～R5399 as the read only register (ROR) before programming, after then, when storing program, the ladder program will automatically contains the communication program .
- When there is communication error, gets and stores the error message to D1000 & D1001 would be helpful for error analysis or logging.

1. When execution control 〝EN↑〞 changes from 0→1, and Port 1 is not occupied by other communication instruction (M1960 ON), M-BUS instruction will start the data transaction. The M1960 is OFF during data transaction, and when the transaction is finished, the M1960 becomes ON. Employ the OFF⟷ ON change of M1960 (M-BUS execution control "EN↑" = 0→1 means starting) may automatically starts for every packet of data transaction successively (when the last packet of transaction is completed, it will automatically return to the first packet of transaction to obtain the automatic cycling transmission).

2. When execution control 〝EN↑〞 changes from 0→1, and Port 2 is not occupied by other communication instruction (M1962 ON), M-BUS instruction will start the data transaction. The M1962 is OFF during data transaction, and when the transaction is finished, the M1962 becomes ON. Employ the OFF⟷ ON change of M1962 (M-BUS execution control "EN↑" = 0→1 means starting) may automatically starts for every packet of data transaction successively (when the last packet of transaction is completed, it will automatically return to the first packet of transaction to obtain the automatic cycling transmission).

FUN150 M-BUS	Convenient instruction for Modbus RTU Master （Which makes PLC as the Modbus RTU master through Port 1～4）	FUN150 M-BUS

SR：Starting register for communication program of M-BUS instruction

SR+0	A5h	50h	• A550h，it means valid M-BUS program
SR+1	07h	Total transactions	• Low Byte：Total number of transactions，one transaction needs 7 registers to describe
SR+2	Slave station No. Which is about to transact with		• Low Byte is valid, 0～247 (0 means that master PLC broadcasts the data to all slaves, the slaves do not reply).
SR+3	Command code		• Low Byte is valid; =1, means "Read data from slave station" =2, means"Write multiple data to slave station" =3, means "Write singal data to slave station"
SR+4	Data length of this transaction		• Low Byte is valid; the range is 1～125 (Reg.) or 1～255 (Dis).
SR+5	Data type of Master PLC		• Low Byte is valid, and its range is 1～3 or 12～13; it defines the data type of master PLC (see next page).
SR+6	Starting reference of Master PLC		• Word is valid; it defines the starting address of data (master).
SR+7	Data type of slave station		• Low Byte is valid, and its range is 0 or 4; it defines the data type of slave station (see next page).
SR+8	Starting reference of Slave station		• Word is valid; it defines the starting address of data (slave).
SR+9	Slave station No. which is about to transact with		
SR+10	Command code		
SR+11	Data length of this transaction		
SR+12	Data type of Master PLC		Description of the 2_nd packet of transaction
SR+13	Starting reference of Master PLC		
SR+14	Data type of slave station		
SR+15	Starting reference of Slave station		
SR+2+N ×7	Reserved		• N is the total number of transaction

Communication instruction

FUN150 M-BUS	Convenient instruction for Modbus RTU Master（Which makes PLC as the Modbus RTU master through Port 1～4）	FUN150 M-BUS

- Data code, type and reference number of Master station (FATEK PLC)

Data code	Data type	Reference number
1	Y（Output Relay）	0～255
2	M（Internal M Relay）	0～1911
3	S（Step Relay）	0～999
12	R（Data Register Rxxxx）	0～3839
13	D（Data register Dxxxx）	0～3999

- Data code, type and reference number of Slave station (Modbus slave)

Data code	Data type	Reference number
0	Discrete Output	1～65535
4	Holding register	1～65535

Note: The data type for master and slave must be consistent.   i.e. if the master station is any value between 1 to 3, the slave station must be the value 0; if the master station is any value between 12 to 13, the slave station must be the value 4.

- WR：Starting register for instruction operation of M-BUS (FUN150)

	High Byte	Low Byte
WR+0	Result code	Transaction No.
WR+1	Station number	Command code
WR+2	For internal working use	
WR+3	For internal working use	
WR+4	For internal working use	
WR+5	For internal working use	
WR+6	For internal working use	
WR+7	For internal working use	

- Result code indicates the transaction result; 0 means "Normal", other value means "Abnormal"
- Transaction No. indicates which one is in processing (beginning from 0).
- Station number: the slave station No. which is in transaction.
  - Command code=01H，reading coil status from slave station
  - =03H，reading holding registers from slave station
  - =05H，force single coil to slave station
  - =06H，preset single register to slave station
  - =0FH，force multiple coils to slave station
  - =10H，preset multiple registers to slave station
- WR+4   B0=1, Port has been occupied and this instruction is waiting to acquire the transmission right for data transaction
  - B4=1, this instruction is not first time performing.
  - B12, output indication for "ACT"
  - B13, output indication for "ERR"
  - B14, output indication for "DN"

Result code: 0, Ttransaction is successful.
2, Data length error (for length is 0 or over limit).
3, Command code error (Command code is 0 or greater than 3)
4, Data type error
5, Reference number error
6, Inconsistence in data type (e.g. master station is 1～3 while slave is 12～13).
7, Port error (Not Port 1～4)
8, Invalid communication program
A, No response from slave station (Time-out error).
B, Communication error (received error data or exception reply).

FUN150 M-BUS	Convenient instruction for Modbus RTU Master （Which makes PLC as the Modbus RTU master through Port 1～4）	FUN150 M-BUS

‧ For easy programming and trouble shooting, the Winproladder provides the table editing environment to edit the communication table of FUN150 instruction; Key in the complete FUN150 instruction first and then move the cursor to the position of it, depressing the "Z" key, now comes the table editing environment. The user can create the new communication table or display the existed table under this friendly user interface operation.

M-BUS Communication Table

Sequence No.	Command	Slave	Data of Master	Data of Slave	Length
0～nnn	Read (=1) Write (=2) Write single (=3)	The station number of slave which is about to transact with Station No.=0, It means broadcasting, there will not any response from the slave Station No.=N, It means the station number of slave which is about to transact with; N=1～247	The data type of Master for this transaction Y0～Y255 M0～M1911 S0～S999 R0～R3839 D0～D3999	The data type of Slave for this transaction 000001～ 065535 400001～ 465535	Quantity of this transaction While Register, 1～125 While Discrete, 1～255

※ Win-Proladder provides the user friendly table edit for M-BUS Master：

Sequence No.	Command	Slave	Data of Master		Data of Slave	Data length
000	Read	1～247	Y0～Y255	←	000001～065535	1～255
			M0～M1911	←	000001～065535	1～255
			S0～S999	←	000001～065535	1～255
			R0～R3839	←	400001～465535	1～125
			D0～D3999	←	400001～465535	1～125
001	Write	0～247	Y0～Y255	→	000001～065535	1～255
			M0～M1911	→	000001～065535	1～255
			S0～S999	→	000001～065535	1～255
			R0～R3839	→	400001～465535	1～125
			D0～D3999	→	400001～465535	1～125
002						
.						
.						
.						

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