B. Communication Functions Introduction

B-1 User Guide for Communication Functions

B-1-1 Communication Interface

The communication interfaces used by M, VB and VH series PLC are RS-232, S-422 and RS-485.

- RS-232 Interface Normally used for point to point short distance (within 15 meters) communication. The main units of M, VB and VH series PLC all have built-in RS-232 interface (CP1), which is used to connect to computer system for editing program.
- RS-422 Interface Normally used for point to point long distance communication.
- RS-485 Interface Normally used for multi-points long distance communication. Since it provides multi-points data exchange function and long distance communication function, so now is widely used in industrial control area.

B-1-2 Communication Parameters

When transfer data through communication interface, the data bit length, parity, stop bit and transfer speed need to be configured first, they are called communication parameters, and can also be treated as hardware level communication protocol. The communication parameter configurations must be consistent for all communication devices in the system.

B-1-3 Communication Protocols

All devices which can communicate have communication protocols. Communication protocol is software level protocol, and different devices exchange data through the same protocol. A communication protocol usually consists of starting character, station number, communication command, data content, end character and check code, etc. Of course, each of the devices defines its own communication protocol according to the need. Some follow the common protocols in the market, and the most commonly known one is MODBUS.

B-1-4 Communication Principles

When two or more than two devices try to exchange data, we need to connect them to form a communication circuit. And this communication circuit needs to follow the basic principles below to start working:

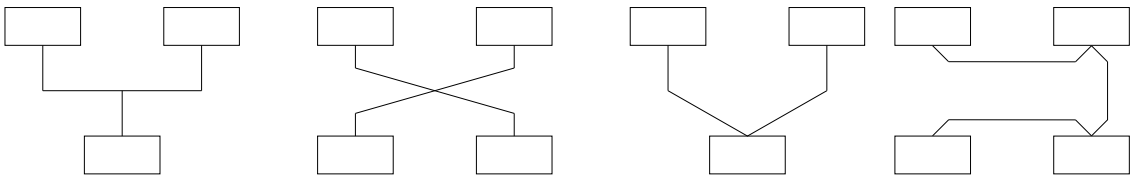
- Have consistent communication interface.
- Have consistent communication parameters.
- Have consistent communication protocols.
- The communication circuit must have a main leader role.

B-1-5 Safety Notes for Constructing Communication Systems

- Keep away from high noise source when wiring. Do not use the same groove as the power wire uses in the distribution box. Externally, keep as far away as possible from devices which have electric magnetic radiation.
- Pay attention to the communication distance and choose a suitable communication interface. Since the configurations of RS-485 interface is much better than RS-232, try to use RS-485 interface if possible for industrial control system. But there are also many guidelines need to take note when use RS-485 interface, please make sure they are strictly followed.
- Guidelines of using RS-485 interface

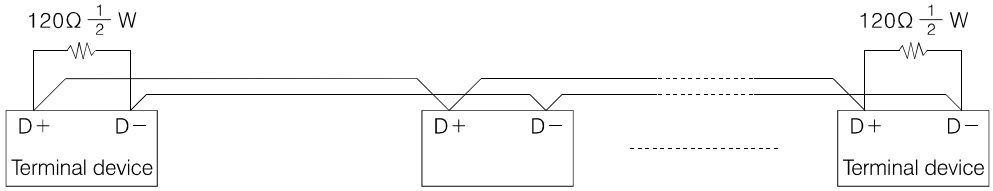
  ① The transfer wire need to use shielded twisted pair wire. Normal twisted pair wire can be used when conducting short distance communication in low noise environment to cut down cost. But in high noise environment, long distance communication or in occasions where high communication quality is required, the dedicated transfer wire for RS-485 (like Belden 9841) is recommended. It may make higher budget, but the communication quality will be improved magnificently.

  ② Make sure the principle of connect in sequence is followed when do hardware wiring, and do not use T type wiring method, star type wiring method or any other wiring method for convenience.



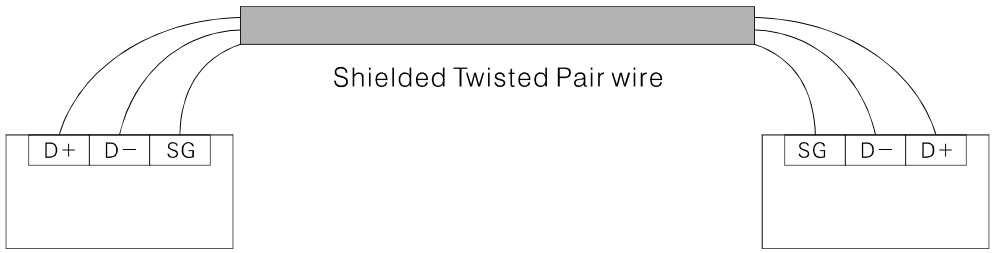
T Type Wiring Star Type Wiring Connect in Sequence Wiring

③ Terminal resistances must be parallel connected to the two terminal points of the whole communication circuit. For the twisted pair wire used by RS-485 interface, the terminal resistances should choose 120 Ω 1/2 W ones.



The communication wiring devices provided by VB and VH series PLC all have built-in terminal resistances, some of them can be enabled using sliding switch option, and some of them can be enabled using barrier terminal block style short connect option. For those communication devices which have no built-in terminal resistances, take special note during wiring to ensure that the external terminal resistances are well connected.

④ Although the RS-485 is a two-wires-style interface, when the distance between 2 communication devices is too long, communication often fails for the earth electric potential difference of the 2 devices is too big. Thus we normally recommend using the shield layer of the transfer wire to connect the SG terminals of the 2 devices, so that the earth electric potential difference can be reduced, and the communication can work well.



⑤ When the number of serial connections the RS-485 circuit has exceeds certain amount (depends on the specification of the devices connected, usually 32), an RS-485 amplifier has to be added to the circuit.

⑥ According to the standard specifications of RS-485 interface, the longest communication distance is 1200 meters. When the RS-485 communication circuit exceeds this distance, the RS-485 amplifier must be added to increase the communication distance.

- It is possible that one communication circuit connects with different devices at the same time, so when the communication fails, carefully check whether all wirings are correct and stable and whether the configuration values of each device are correct. Sometimes can even separate the devices to do individual checking to make sure it work well, before connecting it with many other devices and making it more difficult to find out the problem.
- Misconception about communication speed. The communication systems are built for various purposes and usages. People usually think that for speed, faster is the better, but this conception is actually not always true, because faster communication speed need to be supported by higher communication quality, and also means more expensive system construction budget. So the correct way is to choose a suitable communication speed according to the need, think a reasonable construction budget and target for stable communication quality.
- When the built communication system is able to function, but often has interruptions or errors, results in unsmooth and delayed transfer of the data, the following suggestions are given:

① Check whether the communication software is working properly, including whether the communication parameters (like the time-out time setting) are correct.

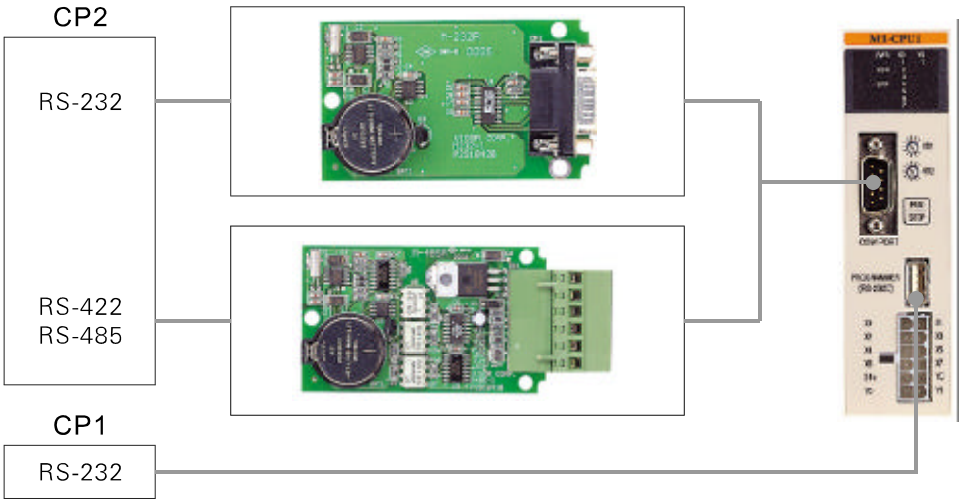
② Reduce environmental interferences. Detailed method includes lower the load frequency of frequency converters; make sure the earth connection system of the frequency converters and power suppliers are set up properly; or even add noise suppress devices to the power wire.

③ If normal transfer wire is used, the user is suggested to change it to RS-485 dedicated transfer wire.

④ Re-wire the transfer wire, and follow the keep away from noise source principle.

B-2 Communication System Structure

B-2-1 Communication System Structure of M Series PLC



◆ COM Port 1 (CP1)

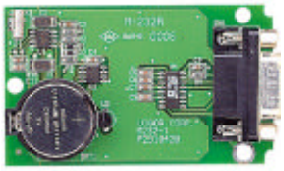
The CP1 is a built-in RS-232 communication standard interface.
The applicable communication type of CP1 is the Computer Link, which is to execute the M, VB and VH Series communication protocol. Its main purposes are to:

1. Connect to the programming tools (Computer + Ladder Master or PDA + NeoTouch).
2. Connect to the HMI (Human-Machine Interface) or SCADA (Supervisor Control And Data Acquisition)
3. Connect with a MODEM, which is for remote program modification and data monitoring.

◆ COM Port 2 (CP2)

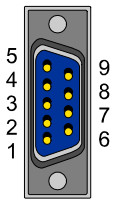
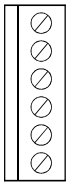
CP2 is a multi-functional expansion communication port and it can be used for various communication applications.

1. Computer Link – Uses the M, VB and VH Series communication protocol and it has the same purpose for use as CP1 in the RS-232 interface. By the RS-485 interface, a computer and several PLCs can constitute a monitoring local access network.
2. Easy Link – Uses the M, VB and VH Series communication protocol. Basically this application type is similar to the Computer Link, except this Easy Link uses a Main Unit of M or VB Series (which is called "Master PLC") to replace the computer, HMI or SCADA in the local network. For the data transfer in the network, programmer need to put the LINK instruction (FNC 89) in the Master PLC's program to access the data in Slave PLCs.
3. CPU Link – Uses the dedicated communication protocol and it is only available by the RS-485 interface. The CPU Link allows to transfer data between (2 ~ 8) PLCs, usually it is used for the distributed control system.
4. Parallel Link – Uses the dedicated communication protocol and it has the same purpose for use as the CPU Link, except its procedure is simpler and allows to transfer data between only 2 PLCs.
5. MODBUS – Uses the MODBUS (Slave) communication protocol (the MODBUS is a standard open source communication protocol). Usually all the SCADA (Supervisor Control And Data Acquisition) and HMI (Human-Machine Interfaces) have the MODBUS communication protocol.
6. MODEM Communication – Actively contacts with a MODEM when the PLC boots up (MODEM's "AA" sign should light on), then exercises M, VB and VH Series communication protocol. By the linked MODEMs, the PLC allows to perform remote program modification or data monitoring.
7. MODEM Dialing – Uses the function of MODEM Communication above (if the dialing function of VB Series PLC and MODEM are activated) then triggers the PLC's Dial-up Connection to link with the other PLC. The function is very useful, especially for remote abnormality report, security system and data collector.
8. Non-Protocol – It does not administer any specific communication protocol. All communication processes are customized and completed by PLC program. It uses RS instruction (FNC80) to receive and transfer communication operation. This communication type is usually used for links with other peripherals in the market, such as temperature controller, frequency converter, displayer, printer, card reader or bar code reader.

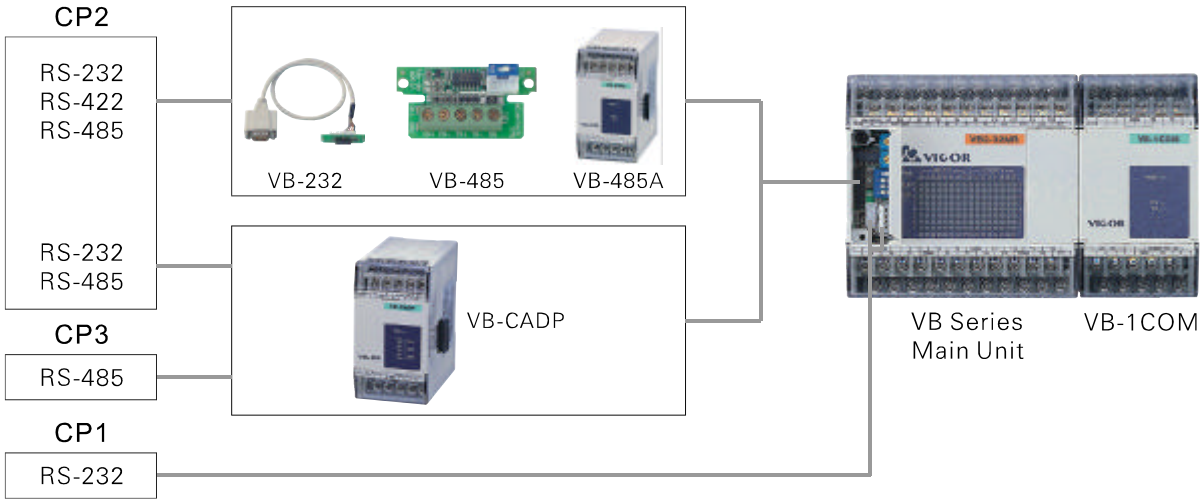


Communication Expansion Board

- M-232R and M-485R are expansion cards for M series PLC's second communication port (CP2).
- The CP2 of M series PLC is a multi-usage port which can execute many communication functions like Computer Link, CPU Link, Parallel Link, Easy Link, MODBUS, MODEM Communication, MODEM Dialing and Non Protocol Communication.

Item	M-232R	M-485R
Communication Interface	RS-232C	RS-422/RS-485
Isolation Method	Photo-coupler Isolation	
Distance	15 Meters	1000 Meters
Communication Method	Half-duplex	
Communication Speed	300/600/1200/2400/4800/9600/19200/38400 bps	
Communication Protocol	Computer Link, Easy Link, MODEM } Protocol of M, VB &VH Series PLC Parallel Link : Dedicated Protocol MODBUS : Protocol by other producer Non Protocol : User customized and complete using PLC program, then communicate with other equipment through RS instruction.	Computer Link, Easy Link } Protocol of M, VB &VH Series PLC CPU Link, Parallel Link } Dedicated Protocol MODBUS : Protocol by other producer Non Protocol : User customized and complete using PLC program, then communicate with other equipment through RS instruction.
Power Supply	DC5V 20mA (from PLC power supply)	DC5V 15mA (from PLC Power Supply) DC24V 60mA (from external Power Supply)
Wiring Method	 5 4 3 2 1 — 9 8 7 6 D-Sub Connector 9Pin Male Connector 1 : CD 2 : RXD 3 : TXD 5 : SG 7 : RTS 8 : CTS 4,6,9 : Not Use	PCB Style Terminal Block  24+ SG RDA RDB SDA SDB
Parameter Configuration	For CP2 relevant parameter configuration settings please use the “System CPU Expansion Card's Communication Port Setting” function of the programming software Ladder Master.	

B-2-2 Communication System Structure of VB Series PLC



◆ COM Port 1 (CP1)

The CP1 is a built-in RS-232 communication standard interface. It is available to connect with other equipment via either the USB type or the white JST 4P connector.
The applicable communication type of CP1 is the Computer Link, which is to execute the M, VB and VH Series communication protocol. Its main purposes are to:

1. Connect to the programming tools (Computer + Ladder Master or PDA + NeoTouch).
2. Connect to the HMI (Human-Machine Interface) or SCADA (Supervisor Control And Data Acquisition)
3. Connect with a MODEM, which is for remote program modification and data monitoring.

◆ COM Port 2 (CP2)

CP2 is a multi-functional expansion comm. port and can be used for many comm. Applications.

1. **Computer Link** – Uses M, VB and VH Series comm. protocol and has same usage as CP1 for RS-232 interface. For RS-485 interface, a pc and several PLCs can form a monitoring local access network.
2. **Easy Link** – Uses M, VB and VH Series comm. protocol. Basically it is similar to Computer Link, except that a M or VB Series Main Unit ("Master PLC") is used to replace the pc in the local network. For data exchange, LINK (FNC 89) need to be used in Master PLC program to access data in Slave PLCs.
3. **CPU Link** – Uses dedicated communication protocol and is only available for RS-485 interface.It allows to transfer data between (2 ~ 8) PLCs, usually it is used for distributed control system.
4. **Parallel Link** – Uses dedicated comm. protocol and has same usage as CPU Link, except its procedure is simpler and allows to transfer data between only 2 PLCs.
5. **MODBUS** – Uses MODBUS (Master/Slave) comm. protocol (standard open source comm. Protocol) Common SCADA and HMI have this MODBUS communication protocol. The market sold devices without VB comm. Protocol can connect to VB series PLC through this application type.
6. **MODEM Communication** – Actively contacts with MODEM when PLC boots up (MODEM AA sign is on), then runs M, VB and VH protocol through MODEMs to modify remote program or monitor data.
7. **MODEM Dialing** – Use MODEM functions above, if VB PLC connects MODEM then trigger PLC Dial-up to link with other PLCs, especially useful for remote abnormality report, security sys. And data collect.
8. **Non-Protocol** – Does not use specific comm. Protocol. Comm. processe is customized and done by PLC program. It uses RS instruction (FNC80) to receive/transfer data. It is usually used to link with temperature controller, frequency converter or bar code reader etc in market.

◆ COM Port 3 (CP3)

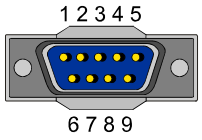
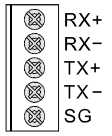
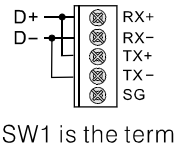
The CP3 is a RS-485 communication port which is expanded by the VB-CADP expansion module and the communication type is assigned as Computer Link (using the M,VB and VH Series communication protocol). It is usually linked with the HMI (Human-Machine Interface) or the SCADA (Supervisor Control And Data Acquisition) to make the monitoring of local networking.

◆ VB-1COM

The VB Series PLC Serial Link Communication Module provides a RS-232/RS-485 communication port. It does not administer any specific communication protocol. All the communication processes are customized and completed by the PLC program. This module is usually used for to communicate with other peripherals, such as commercially available temperature controller, frequency converter or bar code reader. A Main Unit can expand up to 16 VB-1COM modules.

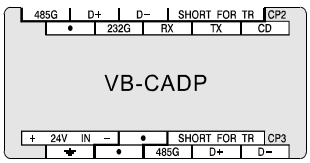
Communication Expansion Cards

- The VB-232 and VB-485 are the Second COM Port (CP2) expansion cards of the VB Series PLC.
- The CP2 of the VB & VH Series PLC is a multi-functional communication port that can be used for multifarious communication types, e.g. Computer Link, CPU Link, Parallel Link, Easy Link, MODBUS Communication, MODEM Communication and Non-Protocol Communication.

Item	VB-232	VB-485
Communication Interface	RS-232C	RS-422/RS-485
Isolation Method	No Isolation	
LED Indicator	RXD、TXD	
Distance	15 M (48.21') Max.	50 M (164.04') Max.
Communication Method	Half-duplex	
Communication Speed	300/600/1200/2400/4800/9600/19200/38400 bps	
Communication Protocol	Computer Link / Easy Link / MODEM } M , VB and VH Series PLC communication protocol Parallel Link : Dedicated Protocol MODBUS : Protocol by other producer Non Protocol : User customized and complete using PLC program, then communicate with other equipment through RS instruction. ※The VB Series PLC supports all the communication protocols mentioned above. The VH series PLC only supports Computer Link, MODBUS and Non Protocol Communication.	Computer Link / Easy Link } M , VB and VH Series PLC communication protocol CPU Link / Parallel Link } Dedicated Protocol MODBUS : Protocol by other producer Non Protocol : User customized and complete using PLC program, then communicate with other equipment through RS instruction. ※The VB Series PLC supports all the communication protocols mentioned above. The VH series PLC only supports Computer Link, MODBUS and Non Protocol Communication.
Power Supply	DC 5V, 10mA (from PLC Main Unit)	DC 5V, 60mA (from PLC Main Unit)
Wiring Method	 D-Sub Connector 9Pin Male Connector 1 : CD 2 : RXD 3 : TXD 5 : SG 7 : RTS 8 : CTS 4,6,9 : Not Use	PCB Style Terminal Block  Note: 1.RS-485 Wiring  2. SW1 is the terminal resistance switch (terminal resistance 120 Ω.)
Parameter Configuration	For CP2 relevant parameter configuration settings please use the “System CPU Expansion Card's Communication Port Setting” function of the programming software Ladder Master.	

VB-CADP Dual-Port Communication Expansion Module

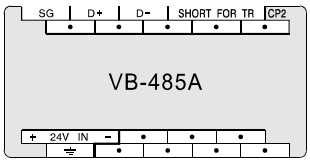
- It is a CP2 and CP3 expansion module for VB and VH series.
- The CP2 provides an isolated RS-232 or RS-485 communication interface. The communication distance of its RS-485 interface is up to 1000 M (3280').
- The CP3 provides isolated RS-485 communication interface with the communication distance of this RS-485 interface is up to 1000 M (3280').
- The CP2 of the VB Series PLC is a multi-functional communication port which can be assigned for various communication applications, e.g. Computer Link, CPU Link, Parallel Link, Easy Link, MODBUS Communication, MODEM Communication and Non-Protocol Communication.

Item	CP2		CP3
Communication Interface	RS-232	RS-485	RS-485
Isolation Method	Photocoupler Isolation		
LED Indicator	RX、TX (CP2)		RX、TX (CP3)
Distance	15 Meters	1000 Meters	1000 Meters
Communication Method	Half-duplex		
Communication Speed	300/600/1200/2400/4800/9600/19200/38400 bps		19200 bps
Communication Protocol	Computer Link Easy Link MODEM(RS-232) } M , VB and VH Series PLC communication protocol CPU Link (RS-485) Parallel Link } Dedicated Protocol MODBUS : Protocol by other producer Non Protocol : User customized and complete using PLC program, then communicate with other equipment through RS instruction. ※The VB Series PLC supports all the communication protocols mentioned above. The VH series PLC only supports Computer Link, MODBUS and Non Protocol Communication.		Computer Link : M , VB and VH Series PLC communication protocol Baud Rate : 19200 bps Data Length : 7 bits (ASCII) Parity : EVEN Stop bit : 1 bit
Power Supply	DC 24V ±10%, 70mA (External power required)		
Wiring Method	Barrier style terminal block connection		
Parameter Configuration	For selection of CP2 application types and relevant parameter configuration settings, please use the developmental software Ladder Master, then open the option: "System 2nd COM Port Setting…. " .		Communication station number setting is by the rotary switch on the left side of the module. (00 ~ 99)

- When a Main Unit connects with a VB-CADP Module, the CP1 in the Main Unit will be disabled and its function will be replaced by the CP1 in the VB-CADP.
- The VB-CADP Module also provides the Power LED and RX, TX transmission indicators for the CP1.

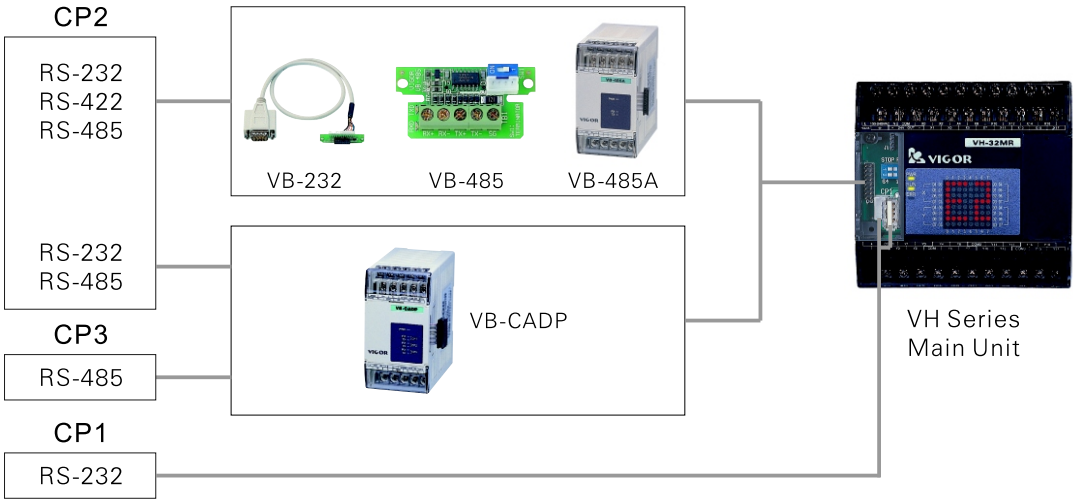
VB-485A RS-485 Communication Expansion Module

- The Second COM Port (CP2) expansion module for a Main Unit.
- It is an isolated RS-485 communication interface, the distance is up to 1000 M (3280').
- The CP2 of the VB and VH Series PLC is a multi-functional communication port that can be assigned for various communication applications, e.g. Computer Link, CPU Link, Parallel Link, Easy Link, MODBUS Communication, MODEM Communication and Non-Protocol Communication.

Item	Specification
Communication Interface	RS-485
Isolation Method	Photocoupler Isolation
LED Indicator	PWR、RX、TX
Distance	1000 Meters
Communication Method	Half-duplex
Communication Speed	300/600/1200/2400/4800/9600/19200/38400 bps
Communication Protocol	Computer Link, Easy Link } M , VB and VH Series PLC communication protocol CPU Link, Parallel Link } Dedicated communication protocol MODBUS : Protocol by other producer Non Protocol : User customized and complete using PLC program, then communicate with other equipment through RS instruction. ※The VB Series PLC supports all the communication protocols mentioned above. The VH series PLC only supports Computer Link, MODBUS and Non Protocol Communication.
Power Supply	DC 24V ±10% , 55mA (External power required)
Wiring Method	Barrier style terminal block connection 
Parameter Configuration	For CP2 relevant parameter configuration settings please use the "System CPU Expansion Card's Communication Port Setting" function of the programming software Ladder Master.

◆ About the specifications and introduction of VB-1 COM communication module, please refer to "B-4 VB-1 COM Serial Link Communication Module"

B-2-3 Communication System Structure of VH Series PLC



◆ COM Port 1 (CP1)

The CP1 is a built-in RS-232 communication standard interface. It is available to connect with other equipment via either the USB type or the white JST 4P connector.
The applicable communication type of CP1 is the Computer Link, which is to execute the M, VB and VH Series communication protocol. Its main purposes are to:

1. Connect to the programming tools (Computer + Ladder Master or PDA + NeoTouch).
2. Connect to the HMI (Human-Machine Interface) or SCADA (Supervisor Control And Data Acquisition)
3. Connect with a MODEM, which is for remote program modification and data monitoring.

◆ COM Port 2 (CP2)

CP2 is a multi-functional expansion comm. port and can be used for many comm. Applications.

1. Computer Link – Uses M, VB and VH Series comm. protocol and has same usage as CP1 for RS-232 interface. For RS-485 interface, a pc and several PLCs can form a monitoring local access network.
2. MODBUS – Uses MODBUS (Master/Slave) comm. protocol (standard open source comm. Protocol) Common SCADA and HMI have this MODBUS communication protocol. The market sold devices without VH comm. Protocol can connect to VB series PLC through this application type.
3. Non-Protocol – Does not use specific comm. Protocol. Comm. processe is customized and done by PLC program. It uses RS instruction (FNC80) to receive/transfer data. It is usually used to link with temperature controller, frequency converter or bar code reader etc in market.

◆ COM Port 3 (CP3)

The CP3 is a RS-485 communication port which is expanded by the VB-CADP expansion module and the communication type is assigned as Computer Link (using the M,VB and VH Series communication protocol). It is usually linked with the HMI (Human-Machine Interface) or the SCADA (Supervisor Control And Data Acquisition) to make the monitoring of local networking.

◆ For introductions on the communication expansion boards (VB-232, VB-485) and communication expansion modules (VB-485A, VB-CADP) please refer to “B-2-2 Communication System Structure of VB Series PLC”

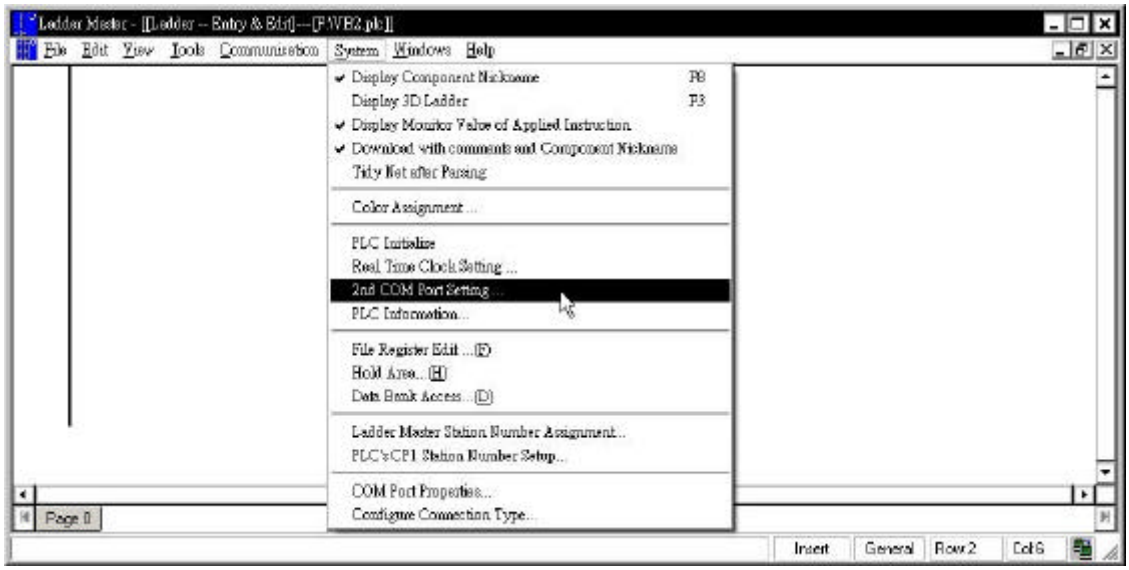
MEMO

B-3 Communication Operation Mode

The M, VB and VH series PLCs have complete communication functions and multiple communication working modes.
CP1 and CP3 support M, VB and VH communication protocols. CP2 is a multi-functional communication port which supports many other communication applications besides the M, VB and VH communication protocol, e.g. Easy Link, CPU Link, Parallel Link, MODBUS Communication, MODEM Communication, MODEM Dialing and Non-Protocol Communication. The introductions of these working modes are listed below.

B-3-1 Choosing an Operation Mode for CP2 Communication

Since CP2 supports many operation modes, the user needs to select and set an operation mode before using it.
The operation mode of CP2 is configured by the programming tool Ladder Master, the steps are as below:



Click “System” in the menu toolbar.

↓

Select “2nd COM Port Setting” from the drop-down menu.

↓

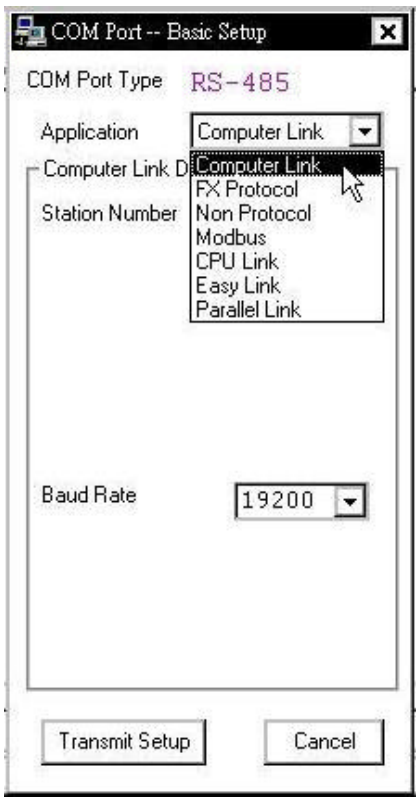
The screen will show configuration window as on the right, Select an application type as you wish.

↓

Every application type has its corresponding interface to guide the user in the parameter setting process.

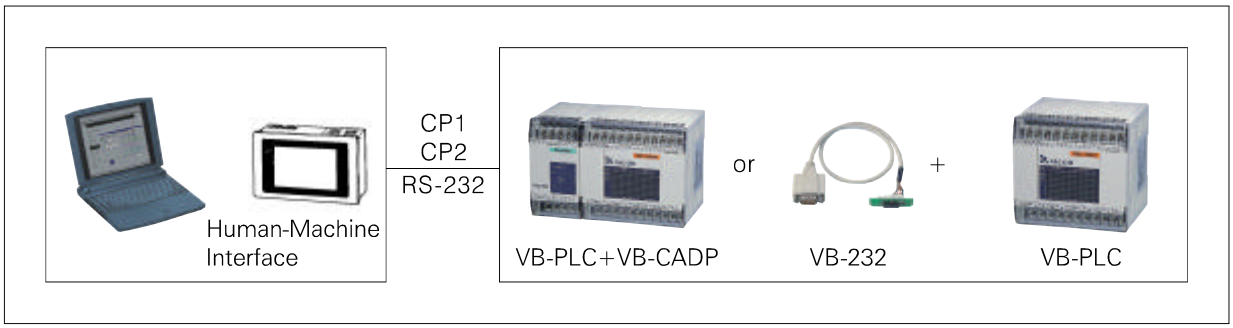
↓

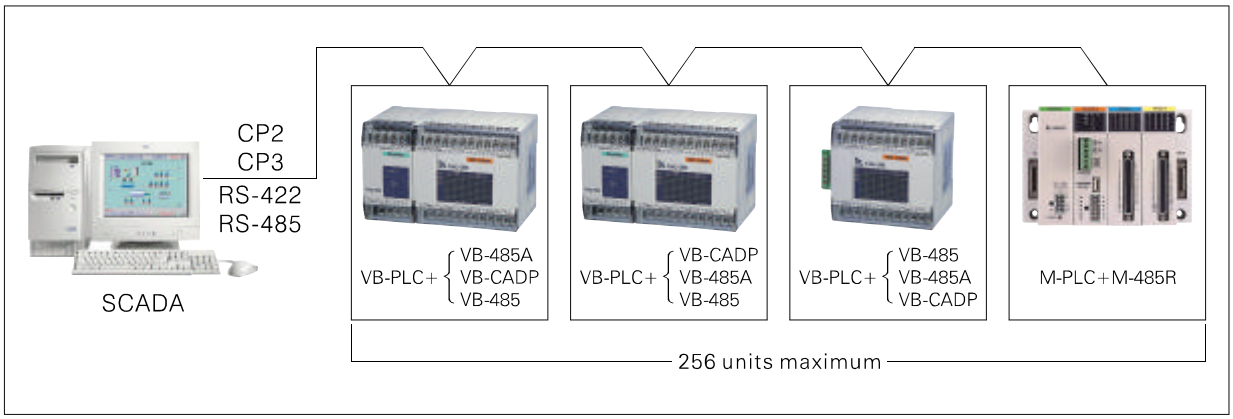
Click “Transmit Setup” after configuration done, to transfer the settings to PLC main unit.



B-3-2 Computer Link

◆ A computer, HMI (Human-Machine Interface) or SCADA (Supervisor Control and Data Acquisition) can connect to PLCs via the Computer Link. For RS-232 interface, its usage is the same as CP1. For RS-485 interface, normally a computer and many PLCs are used to form a local monitor network.



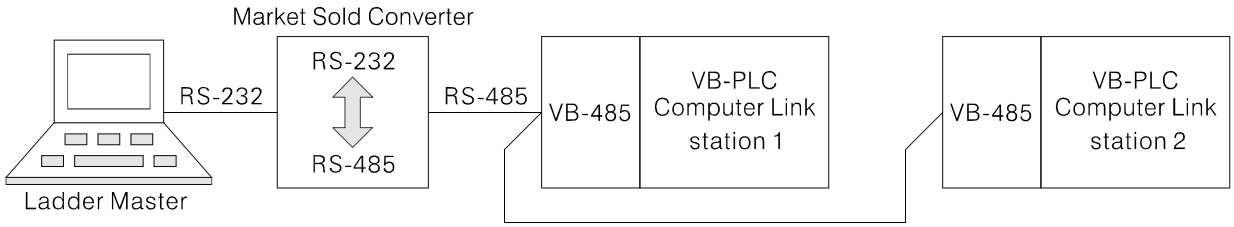


Item	Specification	
Transmission Interface	RS-232	RS-422/RS-485
Communication Protocol	M, VB and VH Series Communication Protocol	
Communication Method	Half-duplex	
Communication Parameter	Data Length: 7 bits (ASCII); Parity: EVEN; Stop Bit: 1 bit	
Baud Rate	CP1 and CP3: 19200 bps; CP2: 4800/9600/19200/38400 bps	
Distance	15 M (49')	1000 M (3280'); (50 M /164', if the network has a VB-485)
Number of Linked Stations	1 station	256 stations maximum (when more than 32 stations, a powered booster is required)
Connection Equipment	CP1: Main Unit Built-in CP2: VB-232, VB-CADP or M-232R	CP2 : VB-485 、VB-485A 、VB-CADP or M-485R CP3 : VB-CADP
Linkable PLC	VB Series, VH Series and M Series PLC	
Data Transfer Category	Including all of X, Y, M, S, T, C and D	

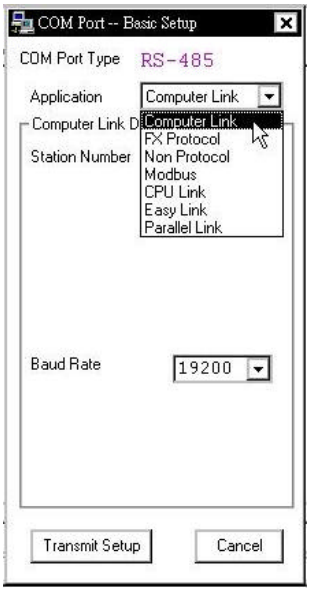
- For any device tries to communicate with M, VB and VH series PLCs, like computer, HMI, etc, as long as it follows the communication protocol of M, VB and VH series PLC to send proper command, PLC will respond to the communicating request. About the communication protocol of M, VB and VH series PLCs, please refer to “B-5 Communication Protocol of M, VB and VH Series”.
- The SCADA or HMI producers usually write corresponding driver programs according to the communication protocols provided by the PLC producers. So that the SCADA and HMI users only need to choose the proper driver program at the planning stage to connect the SCADA, HMI and PLCs together to construct a monitor network.
- Since the M, VB and VH series of PLCs use the same comm. protocol, the SCADA or HMI can choose any driver program of VIGOR M, VB or VH series. Anyway, some imported SCADA or HMI do not have M, VB or VH series driver program, thus they need to connect by “Other Producer's comm. protocol (MODBUS)”. For detailed introduction, please refer to “B-3-6 MODBUS Communication”.
- When CP2 is used for Computer Link, the comm. station number is shown in special register D9121.

◆ Application Example

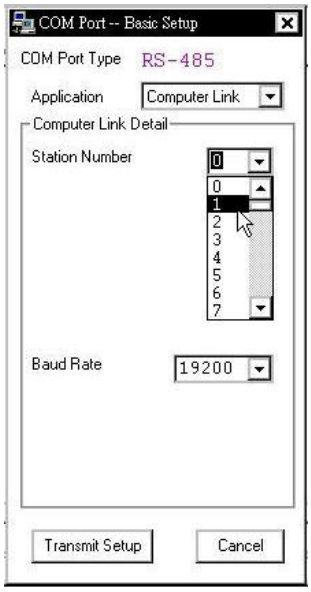
This example connects to Station 1 and Station 2 PLCs from the computer communication port (normally RS-232) through a market sold RS-232 to RS-485 converter. Then run the Ladder Master in PC to connect to station 1 and station 2 for program downloading/uploading and monitor work.



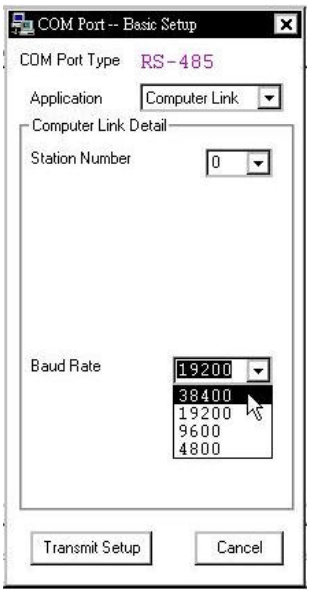
- First, set the CP2 parameter for each PLC by Ladder Master though CP1



Select the application to be Computer Link

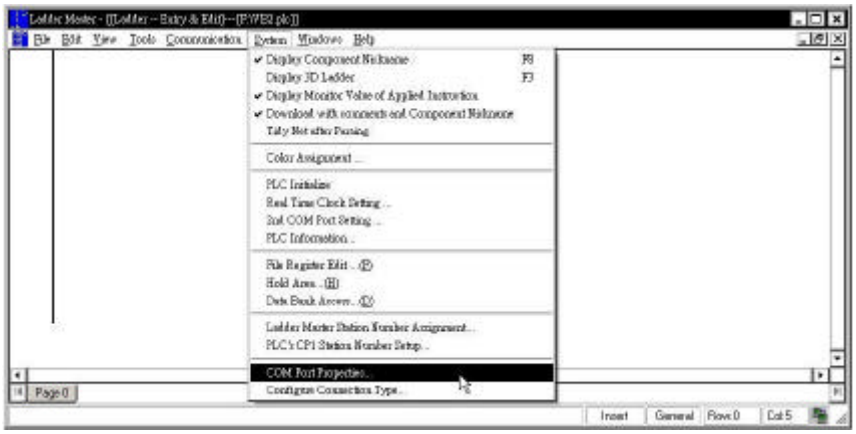


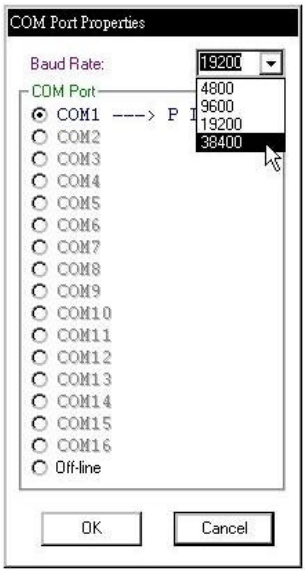
Set PLC station number to be station 1 and station 2



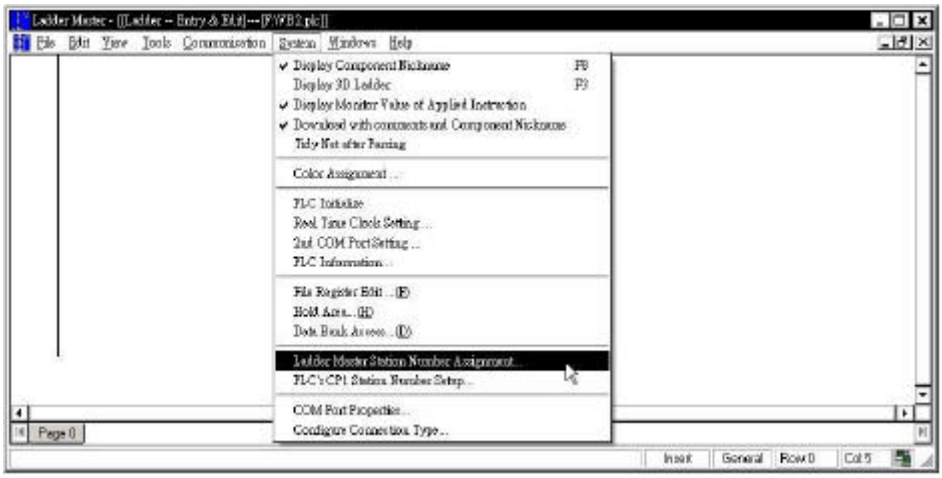
Set the baud rate, all PLCs and Ladder Master should have the same rate

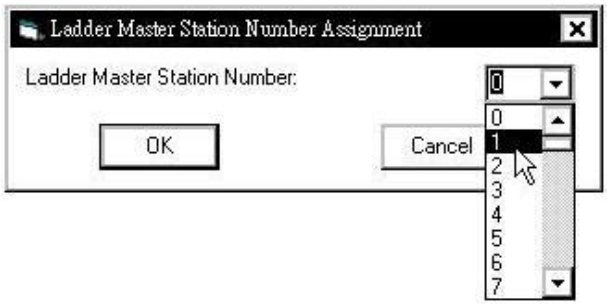
- Set the communication rate in Ladder Master.





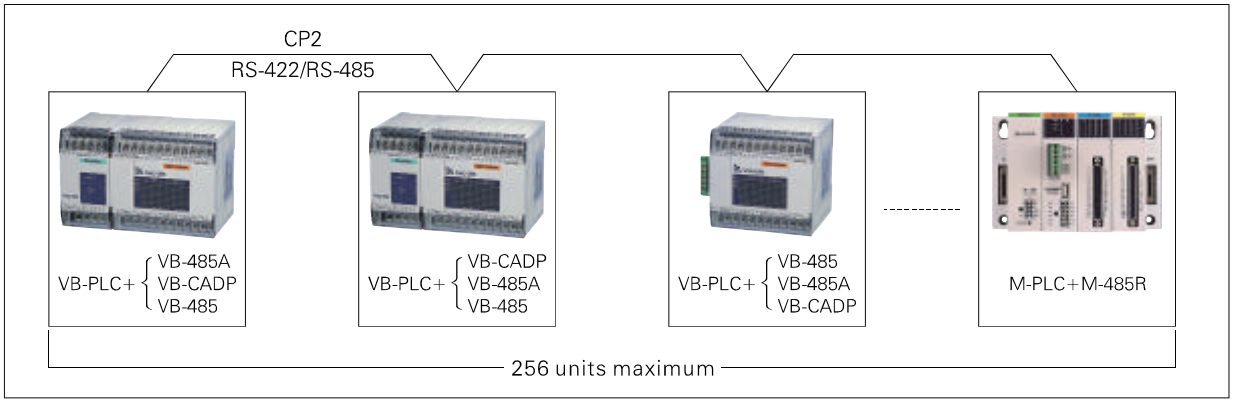
- Set the communication station number in Ladder Master to connect and communicate with this PLC station.





B-3-3 Easy Link

◆ This mode uses the M, VB and VH Series communication protocol as same as the Computer Link does, except that it uses a Main Unit of M or VB Series (which is called “Master PLC”) to replace the computer in the local network. For the data transfer in the network, the programmer needs to put the LINK instruction (FNC 89) in the Master PLC's program to access the data in Slave PLCs. This mode is mainly used for many PLCs to exchange a lot of data with each other.



Item	Specification
Transmission Interface	RS-422/RS-485
Communication Protocol	M, VB and VH Series Communication Protocol
Communication Method	Half-duplex
Communication Parameter	Data Length: 7 bits (ASCII); Parity: EVEN; Stop Bit: 1 bit
Baud Rate	4800/9600/19200/38400 bps
Distance	1000 M (3280'); (50 M /164', if the network has a VB-485)
Number of Linked Stations	256 stations maximum (when more than 32 stations, a powered booster is required)
Connection Equipment	VB or VH Series: VB-485, VB-485A or VB-CADP; M Series: M-485R
Linkable PLC	VB Series and M Series PLC (VH Series can be used as Slave)
Data Transfer Category	Including all of X, Y, M, S, T, C and D

◆ The next page introduces how to use LINK instruction.

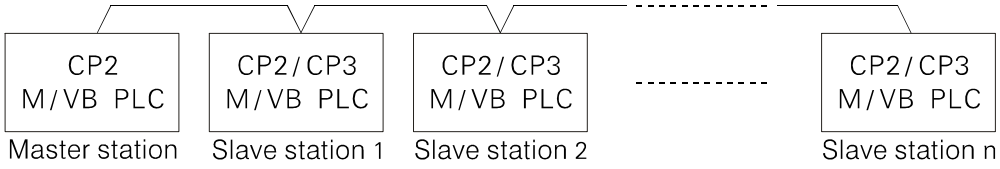
FNC 89 LINK	LINK (S1) (S2)	Easy Link Communication	M	VB	VH
			○	○	

Operand	Devices															
	X	Y	M	S	K*n*X	K*n*Y	K*n*M	K*n*S	T	C	D	SD	P	V,Z	K,H	VZ index
S1											○					○
S2											○					

S1 : Head ID number of the register, which describe the data transfer/receive actions

S2 : Instruction working area, occupies 4 consecutive registers

- If the M Series CPU module mounts a M-232R or M-485 communication card, the CPU module will have the CP2 (2nd Communication Port). Then, via this instruction to proceed data transfer between PLCs.
- If the VB Series Main Unit mounts a communication card (VB-232 or VB-485) or a communication module (VB-485A, VB-CADP etc.), the Main Unit will have the CP2 (2nd. Communication Port). Then, via this instruction to proceed data transfer between PLCs.
- The CP2 is a multi-functional expanded communication port, it can be used for multiplex communication types. When the CP2 is assigned to this instruction, the communication type should use "EASY LINK" or "COMPUTER LINK". To select and relative parameters setting about the manipulation type of CP2, please use the option in the programming tool Ladder Master "System---2nd COM Port Setting..." to get the right setting.
- At most 256 nodes of M/VB Series PLC (slave VH series). can be linked together via this instruction and the RS-485 interface. The instruction can use for transfer the data of device X, Y, M, S, T, C and D.
- As the diagram below, select one of these linked PLCs as the Master station and the rest as Slave stations. Use the program develop devices (e.g. Ladder Master) to set the "EASY LINK" or "COMPUTER LINK" as the communication mode between the Master and Slave stations, and set each Slave station properly (the range of station ID number is 1 ~ 255). And then, write the data transmission/receiving command (designated by this instruction) to the Master station, to achieve the data transmission between PLCs.



- When X20= "ON", the LINK instruction will start to be performed. Based on the designated register string (which initiating from D1000), to do the data write or read action to the appointed Slave PLC station. And also, D100 ~ D103 store the status of the instruction execution.
- Every time the transmission/receiving operation which designated by (S1) is duly completed, the M9199 will be "ON" for a scan time. And then, it will repeat the data transmission/receiving processes from the first data again.
- When X20="ON" → "OFF", the instruction will be stopped and the data transmission/receiving will be disabled immediately.
- The LINK instruction can be used once only in the program.

- The register headed with (S1) is used to describe the data transmission/receiving information:

(S1)	Content Value	Description
D1000	1 ~ 255	To designate the number of transferred and received data sets. Each data transmission/receiving set should be described with 7 registers.
D1001	1 ~ 255	Designates the Slave station ID number, to proceed data transmission/receiving for the particular Slave station
D1002	1 ~ 2	Instruction code. 1: read data from Slave stations; 2: write data in Slave stations
D1003	1 ~ 64	Length of data transferred or received. (If the data designated is a 32-bit counter, the content value = 1 ~ 32)
D1004	1 ~ 6 10 ~ 13	Designates the device type of the Master station 1:Input Contact X 2:Output Contact Y 3:Auxiliary Coil M 4:State Coil S 5:Timer Contact T 6:Counter Contact C 10:The Present-value Register of the Timer 11:16-bit Counter, Present-value Register 12:32-bit Counter, Present-value Register 13:Data Register D
D1005		Designates the initial ID number of the Master station device
D1006	1 ~ 6 10 ~ 13	Designates the device type of the Slave station
D1007		Designates the initial ID number of the Slave station device
D1008	1 ~ 255	Designates the Slave station ID number
D1009	1 ~ 2	Instruction code
D1010	1 ~ 64	Length of data transferred/received
D1011	1 ~ 6 10 ~ 13	Designates the device type of the Master station
D1012		Designates the initial ID number of the Master station device
D1013	1 ~ 6 10 ~ 13	Designates the device type of the Slave station
D1014		Designates the initial ID number of the Slave station device
⋮	⋮	

Description of the 1st data transmission/receiving operation

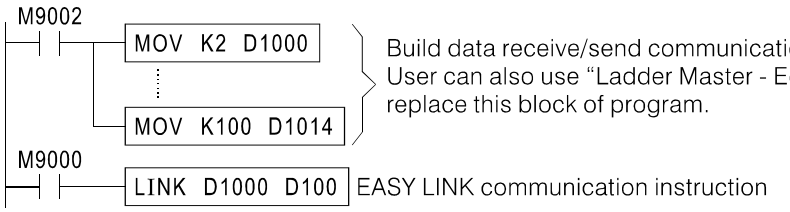
Description of the 2nd data transmission/receiving operation

- The attributes of the devices designated in a data transmission/receiving operation should be the same. For example, if the device designated by the Master station is a bit device, then the designated device of the Slave station should be also a bit device.

- The instruction working area headed with (S2):

(S2)		Description
D100	Lower 8 bits	The Slave station ID number when a communication error occurs
	Upper 8 bits	Instruction working status 0:Normal data transmission/receiving 2:Error of the length of the transferred/received data (unequal to 1 ~ 64) 4:Error of the designated device type 5:Error of the designated device ID number 6:The attributes of the designated devices by the Master and Slave stations are different A:Normal communications but no response from Slave stations B:Abnormal communications
D101 ~ D103	The working area required when the instruction is performed	

- Programming Example



There are totally 2 transmission/receiving data sets in this example.

① Read D10 ~ D19 of Slave station #5 to D0 ~ D9 of the Master station

② Write M0 ~ M29 of the Master station to M100 ~ M129 of Slave station #2.

ⓢ1	Content Value	
D1000	2	Two transmission/receiving data sets
D1001	5	Designates Slave station #5
D1002	1	Reads data from the Slave station
D1003	10	Length of the data to be read
D1004	13	Designates the device headed with the Master station as D0
D1005	0	
D1006	13	Designates the device headed with the Slave station as D10
D1007	10	
D1008	2	Designates Slave station #2
D1009	2	Write data to the Slave station
D1010	30	Length of the data to be written
D1011	3	Designates the device headed with the Master station as M0
D1012	0	
D1013	3	Designates the device headed with the Slave station as M100
D1014	100	

The 1st transmission/receiving data set:
D10 ~ D19 of Slave station #5
↓
D0 ~ D9 of the Master

The 2nd transmission/receiving data set:
M0 ~ M29 of the Master
↓
M100 ~ M129 of Slave station #2

- Edit Communication Table

Besides using program to build data receiving/sending communication table, Ladder Master provides a more user-friendly data input interface to let the users build communication table.
Select the Ladder Master "Tools ---- Edit Communication Table ...." menu to enter the communication table edition screen. Through a step-by-step guiding window, the user can easily create and edit communication table.
After the edition is done, the communication data will be stored into file register assigned by the user, and the table is created. This function also allows the user to retrieve the table data back from file register for editing.
For VB series PLCs, the file register is read-only, and its value will be treated as part of the user program. When user copy or save program file, the file register together with the program itself will be copied or saved. This feature makes the file register very suitable for communication table storing. It can be easily copied from and helps to save PLC program space. For detailed introduction on file register, please refer to "2-9 File Register (D)".

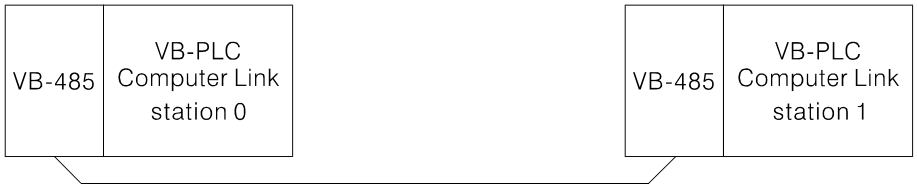
- Communication Table Example

Instruction: LINK ▼ Table Starting Position: D1000 Table Length: 15

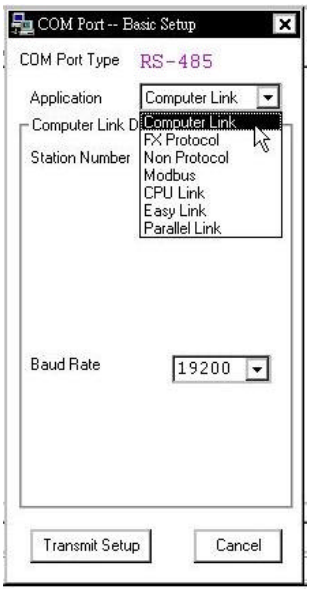
Number	Command	Master Data		Slave ID	Slave Data	Length	Word / Bit
1	Read	D0	<--	5	D10	10	W
2	Write	M0	-->	2	M100	30	B

◆ Application Example

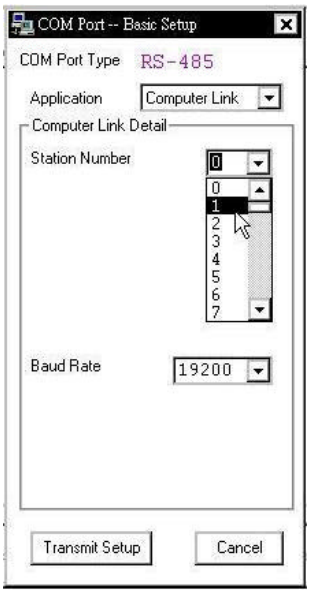
This example connects 2 VB series PLCs through RS-485 interface and executes Computer Link communication (M, VB and VH communication protocol). These 2 VB series PLCs have station number of 0 (Master) and 1 (Slave) respectively.



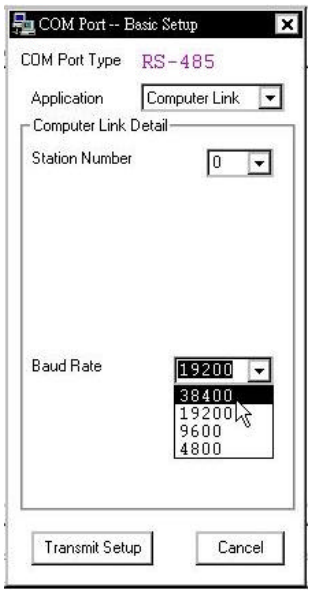
- Set the CP2 parameter for each PLC by Ladder Master though CP1



Select the application to be Computer Link



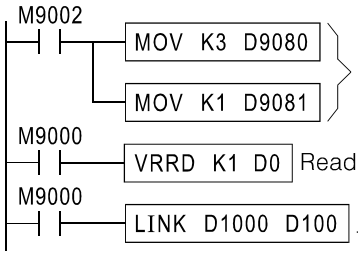
Set PLC station number to be station 0 and station 1



Set the baud rate, each PLC and Ladder Master should have the same rate

- When this example executes, the 2 PLCs exchange data with each other, the VR1 value of master PLC will be shown on the screen of slave PLC, and the VR1 value of slave PLC will be shown on the screen of the master PLC.
  At first, the master PLC reads the value of VR1, and then stores this value in D0 register. Then it writes the value of register D0 through communication interface into the D1 register of slave PLC. The slave PLC reads the VR1 value at the same time, and put the value into register D0. Then the master PLC reads the D0 register of the slave PLC through the communication interface, and then put this value into the D1 register of master PLC, at last, the master PLC shows the value of D1 register onto the screen.

- Program of the Master PLC

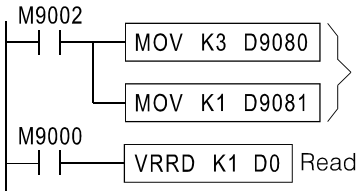


Set the display screen to display mode 3 (displays a 4-digits numeric value), and show the value of D1 onto the screen.

Read the value of VR1, and store it to D0.

Execute data receiving/transmitting job of the communication table starting from D1000.

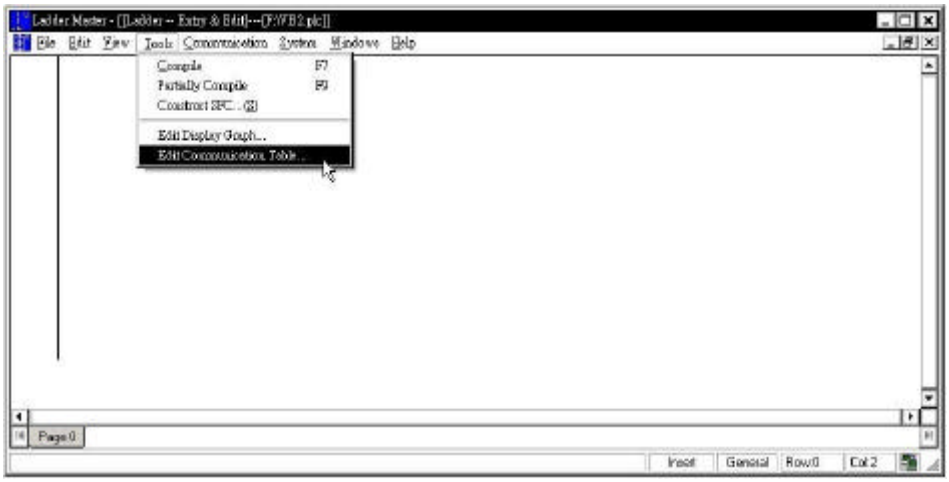
- Program of the Slave PLC

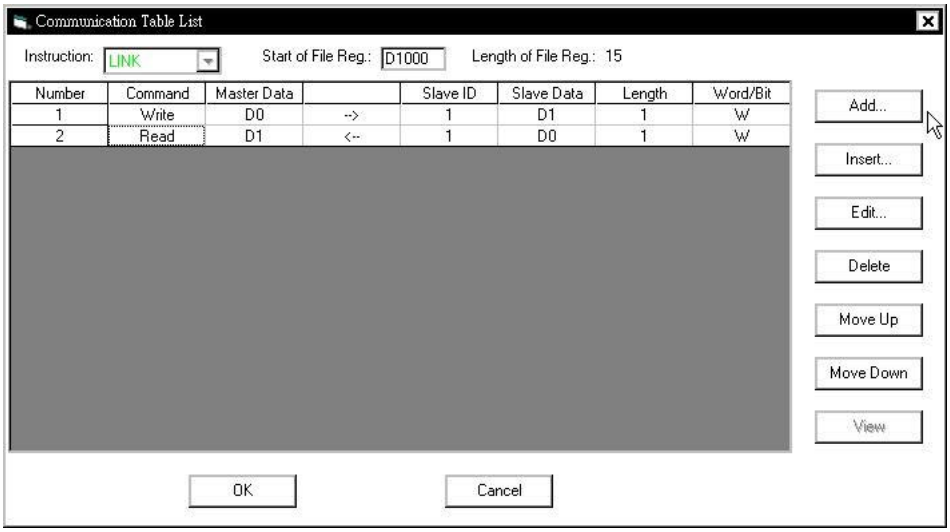


Set the display screen to display mode 3 (displays a 4-digits numeric value), and show the value of D1 onto the screen.

Read the value of VR1, and store it to D0.

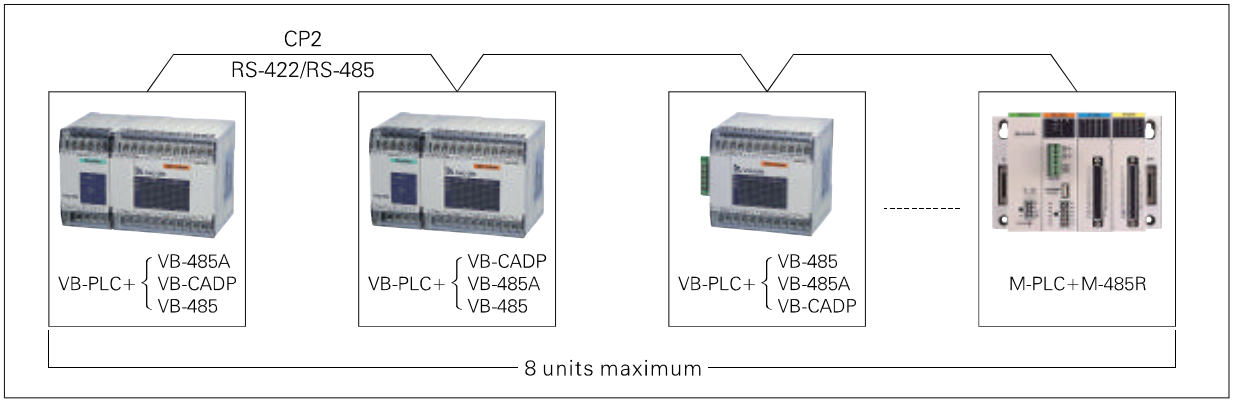
- Edit Communication Table





B-3-4 CPU Link

◆ CPU Link let 2 ~ 8 PLCs exchange data with each other, and is often used in distributed control system. In CPU Link network, PLC use dedicated communication protocol, and the PLCs in the network transfer data automatically based on configuration settings.



Item		Specification							
Transmission Interface		RS-422/RS-485							
Communication Protocol		Dedicated Communication Protocol							
Communication Method		Half-duplex							
Baud Rate		38400 bps							
Distance		1000 M (3280'); (50 M /164', if the network has a VB-485)							
Number of Linked Stations		2 ~ 8 stations							
Connection Equipment		VB Series: VB-485, VB-485A or VB-CADP; M Series: M-485R							
Linkable PLC		VB Series and M Series PLC							
Transferable Data Range	Station No.	0 (Master)	1 (Slave)	2 (Slave)	3 (Slave)	4 (Slave)	5 (Slave)	6 (Slave)	7 (Slave)
	Mode 1	D0~3	D10~13	D20~23	D30~33	D40~43	D50~53	D60~63	D70~73
	Mode 2	D0~3 M1000~1031	D10~13 M1064~1095	D20~23 M1128~1159	D30~33 M1192~1223	D40~43 M1256~1287	D50~53 M1320~1351	D60~63 M1384~1415	D70~73 M1448~1479
	Mode 3	D0~7 M1000~1063	D10~17 M1064~1127	D20~27 M1128~1191	D30~37 M1192~1255	D40~47 M1256~1391	D50~57 M1320~1383	D60~67 M1384~1447	D70~77 M1448~1511
Communication Time	Linked Stations No	2	3	4	5	6	7	8	
	Mode 1	7mS	11mS	15mS	19mS	23mS	27mS	31mS	
	Mode 2	10mS	15mS	20mS	25mS	30mS	35mS	40mS	
	Mode 3	16mS	24mS	33mS	42mS	50mS	59mS	68mS	

- Nearly all the communication work modes of M, VB and VH series PLCs execute communication work after PLC completes the user program execution. Thus, the communication speed of the communication circuit is affected by not only the communication rate, but also the scan time of all the PLCs in the circuit. As a result, it is not easy to calculate the communication time of the circuit.
- CPU Link deals with communication work in instant interrupt way. So its communication speed is the fastest one, and can calculate the communication time of the circuit easily (see above table). As a result, it is suitable for distributed control system which requires instant reaction.

◆ CPU Link Related Components

For components with symbol "■" or are missing from the list below, their relay coils cannot be driven by instructions and no data can be written to them.

Coil ID. No.	Instruction of Function	M	VB	VH
■ M9183	CPU Link Comm. Failed (Master)	○	○	
■ M9184	CPU Link Comm. Failed (Slave 1)	○	○	
■ M9185	CPU Link Comm. Failed (Slave 2)	○	○	
■ M9186	CPU Link Comm. Failed (Slave 3)	○	○	
■ M9187	CPU Link Comm. Failed (Slave 4)	○	○	
■ M9188	CPU Link Comm. Failed (Slave 5)	○	○	
■ M9189	CPU Link Comm. Failed (Slave 6)	○	○	
■ M9190	CPU Link Comm. Failed (Slave 7)	○	○	

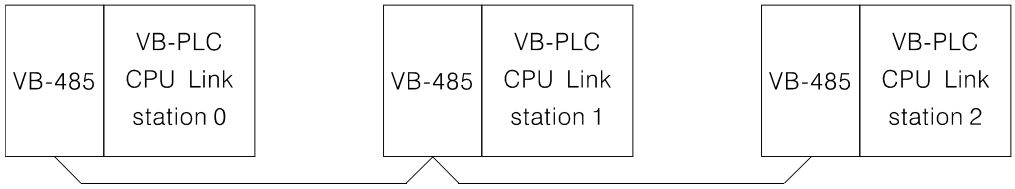
Register ID.	Instruction of Function	M	VB	VH
■ D9172	Comm. Time Out time		○	
■ D9177	Number of network slave stations	○	○	
■ D9178	Range of send component	○	○	
■ D9179	Time of comm. Retry	○	○	
■ D9201	Current network scan time	○	○	
■ D9202	Max. network scan time	○	○	
■ D9203	Time of comm. errors happen to master	○	○	
■ D9204	Time of comm. errors happen to slave 1	○	○	
■ D9205	Time of comm. errors happen to slave 2	○	○	
■ D9206	Time of comm. errors happen to slave 3	○	○	
■ D9207	Time of comm. errors happen to slave 4	○	○	
■ D9208	Time of comm. errors happen to slave 5	○	○	
■ D9209	Time of comm. errors happen to slave 6	○	○	
■ D9210	Time of comm. errors happen to slave 7	○	○	
■ D9212	Comm. error code of slave 1	○	○	
■ D9213	Comm. error code of slave 2	○	○	
■ D9214	Comm. error code of slave 3	○	○	
■ D9215	Comm. error code of slave 4	○	○	
■ D9216	Comm. error code of slave 5	○	○	
■ D9217	Comm. error code of slave 6	○	○	
■ D9218	Comm. error code of slave 7	○	○	

Communication Error Code of CPU Link (Value of D9212 ~ D9218)

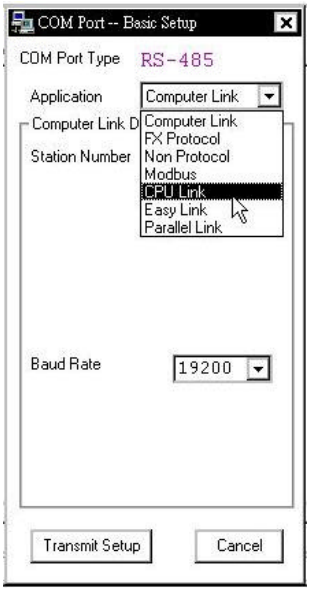
Error Code	Detail
00H	No Error
01H	Communication Time Out error
05H	Communication Check Sum error

◆ Application Example

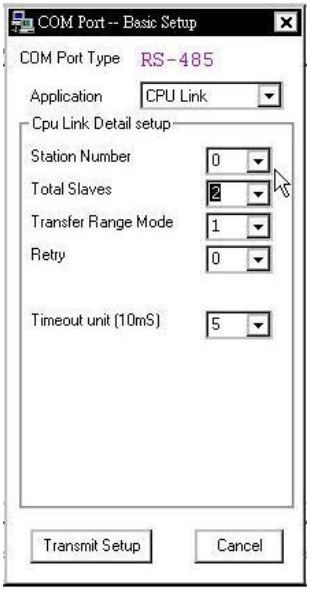
This example connects 3 VB series PLCs through RS-485 interface and executes CPU Link communication, data transfer range choose mode 1. These 3 VB series PLCs have station number of 0 (Master), 1 (Slave) and 2 (Slave) respectively.



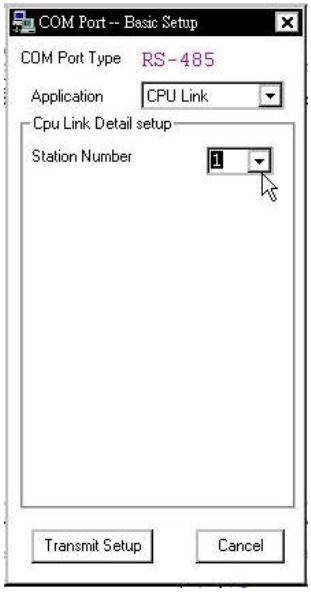
- Set the CP2 parameter for each PLC by Ladder Master though CP1.



Select the application to be CPU Link



Set station number, 0 is master, set master parameters.



Set station number, 1 ~ 7 are slaves.

- When this example executes, the PLC stations will execute the following job as programmed:

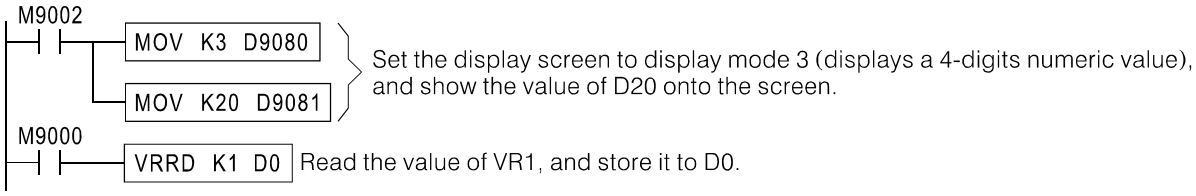
  Master PLC (Station 0): Read value of VR1 and store in register D10, show the content of register D20 on the screen.

  Slave PLC 1 (Station 1): Read value of VR1 and store in register D10, show the content of register D0 on the screen.

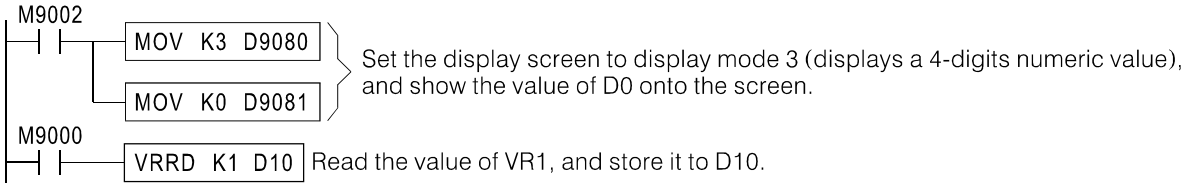
  Slave PLC 2 (Station 2): Read value of VR1 and store in register D20, show the content of register D10 on the screen.

- The following result will be produced after the CPU Link communication.
  The value of master VR1 will be shown on the screen of slave 1 (change the master VR1, can see the changes on slave 1 screen also.)
  The value of slave 1 VR1 will be shown on the screen of slave 2 (change the slave 1 VR1, can see the changes on slave 2 screen also.)
  The value of slave 2 VR1 will be shown on the screen of master station (change the slave 2 VR1, can see the changes on master station screen also.)

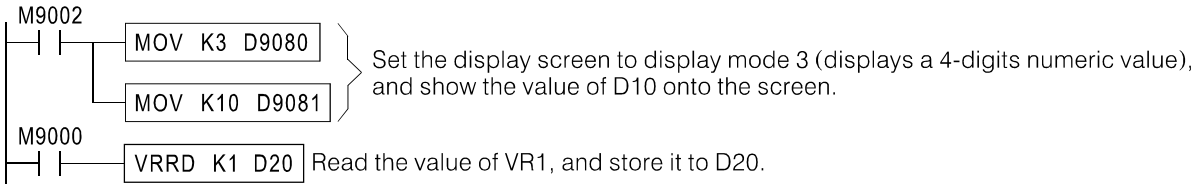
- Program of the Master PLC



- Program of the Slave 1 PLC

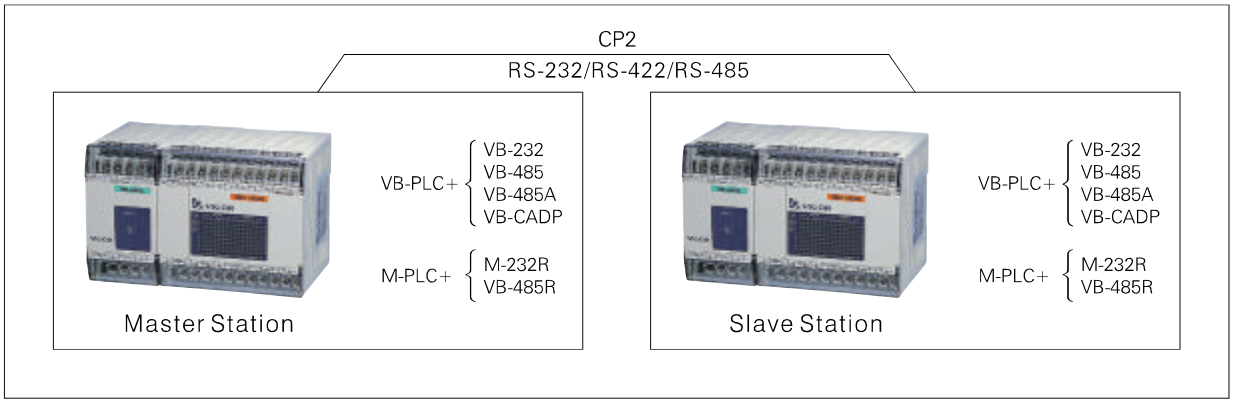


- Program of the Slave 2 PLC



B-3-5 Parallel Link

◆ PLC use dedicated communication protocol, and the 2 PLCs in the network transfer data automatically based on configuration settings.



Item		Specification	
Transmission Interface		RS-232	RS-422/RS-485
Communication Protocol		Dedicated Communication Protocol	
Communication Method		Half-duplex	
Baud Rate		4800/9600/19200/38400 bps	
Distance		15 M (49')	1000 M (3280'); (50 M /164', if the network has a VB-485)
Number of Linked Stations		2 stations	
Connection Equipment		VB Series: VB-232 or VB-CADP M Series: M-232R	VB Series: VB-485, VB-485A or VB-CADP M Series: M-485R
Linkable PLC		VB Series, M Series PLC	
Data Transfer Range	Low Speed	Master → Slave: M800 ~ 899, D490 ~ 499	Slave → Master: M900 ~ 999, D500 ~ 509
	High Speed	Master → Slave: D490, D491	Slave → Master: D500, D501
Communi-cation Time	Low Speed	73mS + Master Scan Time + Slave Scan Time (Baud Rate = value at 19200 bps)	
	High Speed	14mS + Master Scan Time + Slave Scan Time (Baud Rate = value at 19200 bps)	

- Parallel Link executes communication work after PLC completes the user program execution. Thus, the communication speed is affected by the scan time. As a result, if 2 PLCs need to exchange data fast and instantly, please use CPU Link.

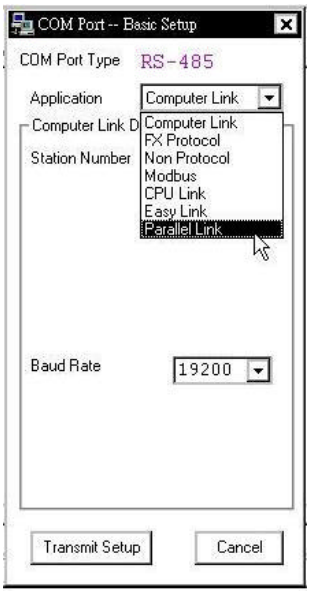
◆ Parallel Link Related Components

Coil ID. No.	Instruction of Function	M	VB	VH
■ M9063	Parallel operation or RS comm. Error. PLC keeps running.	○	○	○
■ M9070	M9070=ON indicates this Unit is master	○	○	
■ M9071	M9071=ON indicates this Unit is slave	○	○	
■ M9072	M9072=ON indicates parallel operation in normal	○	○	
■ M9162	M9162=ON indicates parallel operation high speed transfer. This msg is based on the status of master M9162.	○	○	

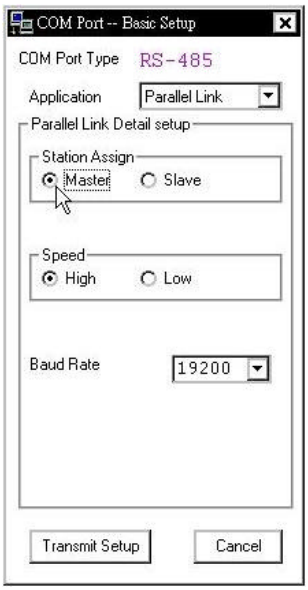
◆ Application Example

This example connects 2 VB series PLCs through RS-485 interface and executes Parallel Link communication, data transfer range choose high speed.

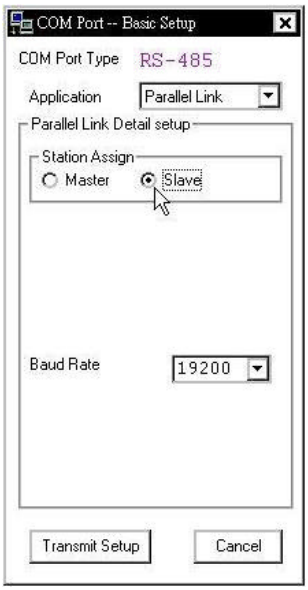
- Set the CP2 parameter for each PLC by Ladder Master though CP1.



Select the application to be Parallel Link



Set station type as master, set data transfer range and baud rate.



Set station type as slave, set baud rate. It must be the same as master baud rate.

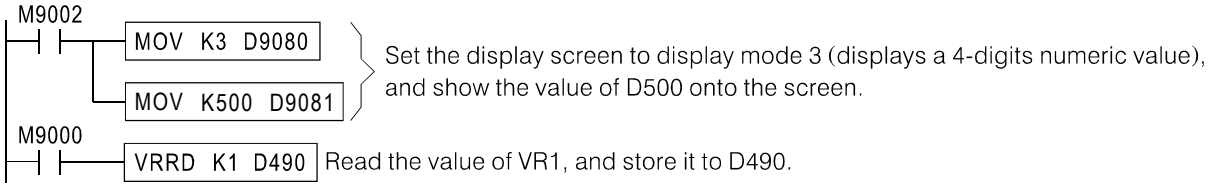
- When this example executes, the 2 PLC stations will execute the following job as programmed:

  Master PLC: Read value of VR1 and store in register D490, show the content of register D500 on the screen.

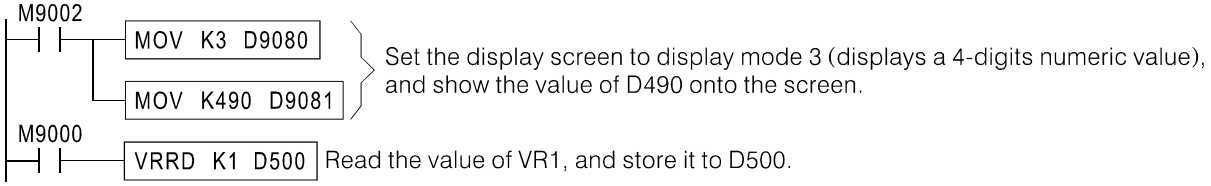
  Slave PLC: Read value of VR1 and store in register D500, show the content of register D490 on the screen.

- The following result will be produced after the Parallel Link communication.
  The value of master VR1 will be shown on the screen of slave (change the master VR1, can see the changes on slave screen also.)
  The value of slave VR1 will be shown on the screen of master station (change the slave VR1, can see the changes on master station screen also.)

- Program of the Master PLC



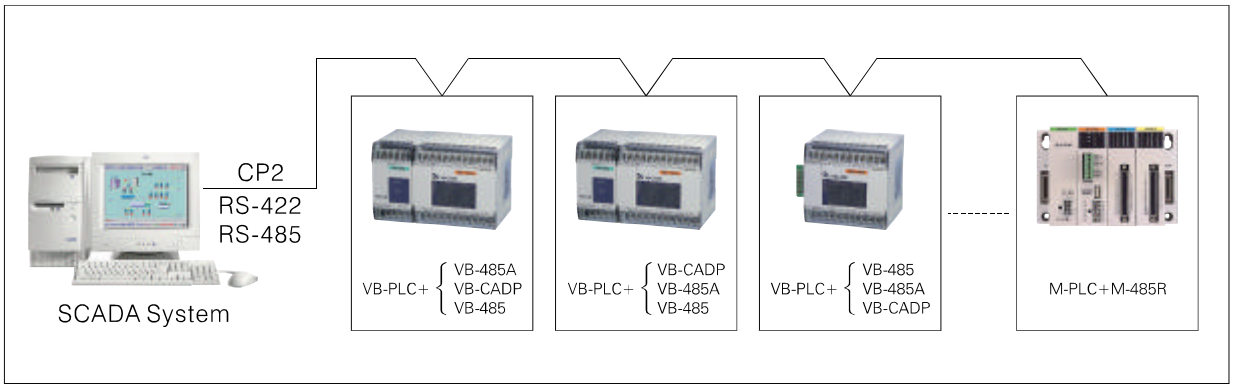
- Program of the Slave PLC



B-3-6 MODBUS Communication

◆ MODBUS Passive (Slave) Communication

MODBUS is a popular communication protocol in the market, and is supported by the market sold SCADA and HMI. So when the SCADA or HMI used does not support VIGOR M, VB and VH series communication protocol, MODBUS can be used to communicate with M, VB and VH series PLCs.



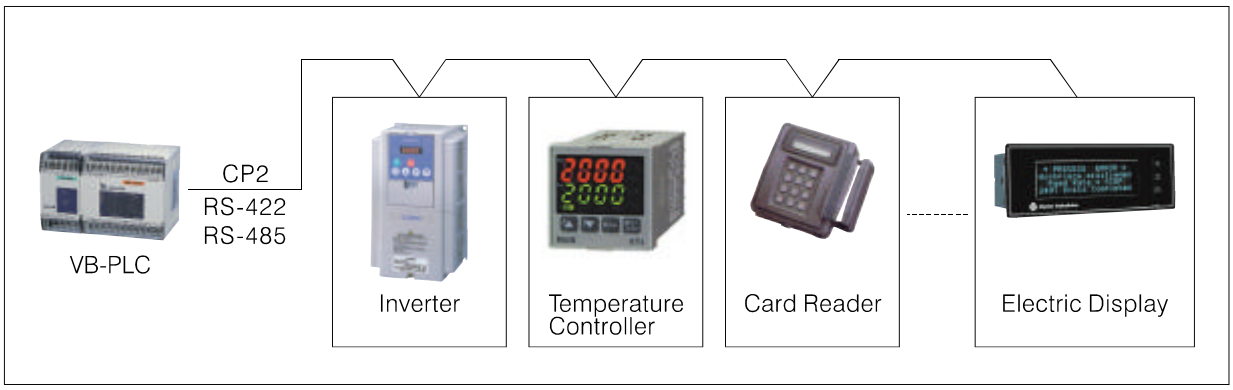
Item	Specification	
Transmission Interface	RS-232	RS-422/RS-485
Communication Method	Half-duplex	
Communication Parameters	Communication Mode: ASCII or RTU Parity: None/Odd/Even	Data Length: 7 bits / 8 bits Stop Bit: 1 bit / 2 bits
Baud Rate	300/600/1200/2400/4800/9600/19200/38400 bps	
Distance	15 M (49')	1000 M (3280'); (50 M /164', VB-485)
Number of Linked Stations	1 station	247 stations at most
Connection Equipment	VB and VH Series: VB-232 or VB-CADP M Series: M-232	VB or VH Series: VB-485, VB-485A or VB-CADP M Series: M-485R
Linkable PLC	VB Series, M and VH Series PLC	

M, VB and VH Series PLC Components and MODBUS Components Compare Table

Item	PLC Component No.	MODBUS Component No.
Bit Components	X000 ~ X777	10000 ~ 10511
	Y000 ~ Y777	00000 ~ 00511
	M0 ~ M5119	00512 ~ 05631
	S0 ~ S999	05632 ~ 06631
	T0 ~ T255	06656 ~ 06911
	C0 ~ C255	06912 ~ 07167
	M9000 ~ M9255	07424 ~ 07679
Character Components	D0 ~ D8191	40000 ~ 48191
	T0 ~ T255	48192 ~ 48447
	C0 ~ C199	48448 ~ 48647
	C200 ~ C255	48648 ~ 48759
	D9000 ~ D9255	48760 ~ 49015

- Configuration Method:
  Configure the CP2 communication type of the PLC to be MODBUS by Ladder Master through CP1, set the communication parameters and station number. Every PLC (or equipment) in the communication network must have the same communication parameters.

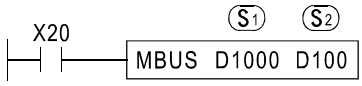
◆ MODBUS Active (Master) Communication
Many market sold automation components and equipments (like frequency converter, temperature controller…) support MODBUS communication protocol. The VB and VH series PLCs provide MBUS instruction, through which, the VB and VH series PLCs can send command to equipments having MODBUS communication function, and thus exchange data with each other.



◆ Since there are some differences between the MBUS instructions used by VB and VH series PLC, the following chapters will introduce the ways of using MBUS instructions for VB and VH PLCs respectively.

FNC 149 MBUS	MBUS (S1) (S2)	MODBUS Communication	M	VB	VH
				○	

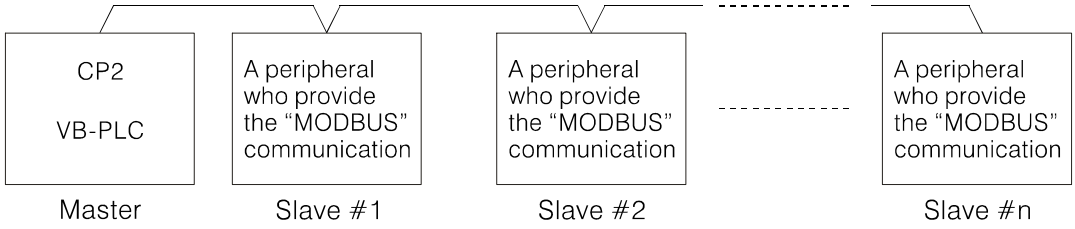
Operand	Devices															
	X	Y	M	S	K*n*X	K*n*Y	K*n*M	K*n*S	T	C	D	SD	P	V,Z	K,H	VZ index
S1											○					○
S2											○					
• S2 occupies 4 consecutive registers																



S1 : To indicate the head ID number of receiving/sending data registers

S2 : Instruction working area, occupies 4 consecutive registers

- This section is for VB series PLC only; for the MBUS instruction in a VH series PLC, please revere to page 299.
- When a VB Series Main Unit has been installed a communication card (VB-232R or VB-485) or a communication module (VB-485A, VB-CADP etc.), the Main Unit will have the CP2 (2nd Communication Port). Then, via this instruction to proceed data transfer between the PLC and a device who has MODBUS communication protocol.
- The CP2 is a multi-functional expanded communication port, it can be used for multiplex communication types. When the CP2 would like to use for this instruction, the communication type of CP2 should chose the "MODBUS". To select and relative parameters setting about the manipulation type of CP2, please use the option in the programming tool Ladder Master "System---2nd COM Port Setting..."to get the right setting.
- As the diagram below, use the CP2 to connect the PLC and other peripherals, use the program develop devices (e.g. Ladder Master) to set the "MODBUS" communication mode and the communication parameters. Then, to properly finish all the setting of station IDs (the range of station ID number is 1 ~ 255, but when this system link is used the RS-232, there is only one slave available) and parameters for slaves (or peripherals). Write the data transmission/receiving command to the PLC (Master station), to drive the data transmission between PLCs or peripherals.



- When X20="ON", the MBUS instruction will start to be performed. Based on the designated register string (which initiating from D1000), to process writes/reads data into/from an appointed Slave PLC or peripheral. At the same time, D100 ~ D103 store the status of the instruction execution.
- Every time the transmission/receiving operation which designated by (S1) is duly completed, the M9199 will be "ON" for a scan time. And then, it will repeat the data transmission/receiving processes from the first data again.
- When X20="ON" → "OFF", the instruction will be stopped and the data transmission/receiving will be discontinued immediately.
- The MBUS instruction can be used once only in the program.
- For avoid the corresponding breakup, when the MBUS instruction sends a communication request to a particular Slave, if the respondent time of the Slave exceeds the Time-out duration (designated by D9129), the MBUS instruction will stops communication from the specific Slave and operates next communication command.
- The setting value of the Time-out duration is restored in D9129. The Time-out duration = (the content value of D9129) ×10ms. When D9129=0 (the default value), the Time-out duration is 100 ms.
- Most of the applied situation is not necessary to change the Time-out duration.
  But, if an equipment in the communication link, its response is very slow, then the longer Time-out duration is necessary.

- The register headed with (S1) is used to describe the data transmission/receiving information:

(S1)	Content Value	Description
D1000	1 ~ 255	To designate the number of transferred and received data sets. Each data transmission/receiving set should be described with 7 registers.
D1001	1 ~ 247	Designates the Slave station ID number, to proceed data transmission/receiving for the particular Slave station
D1002	1 ~ 3	Instruction commend. 1: read data from the Slave station; 2: write a series of data into the Slave station; 3: write one device's data into the Slave station.
D1003	1 ~ 64	Length of data transferred or received. If the instruction code ((S1)+2)= 3, this data will be ignored.
D1004	1 ~ 6 10,11,13	Designates the device type of the Master station 1: Input Contact X 2: Output Contact Y 3: Auxiliary Coil M 4: State Coil S 5: Timer Contact T 6: Counter Contact C 10: The Present-value Register of the Timer 11: 16-bit Counter, Present-value Register 13: Data Register D
D1005		Designates the initial component ID number of the Master station device
D1006	0,1,3,4	Designates the device type of the Slave station 0: A readable/writable bit device 1: A readable only bit device 3: A readable only 16 bits data Register 4: A readable/writable 16 bits data Register
D1007	0 ~ 32767	Designates the initial component data ID number of the Slave station device
D1008	1 ~ 247	Designates the Slave station ID number
D1009	1 ~ 3	Instruction commend
D1010	1 ~ 64	Length of data transferred/received
D1011	1 ~ 6 10,11,13	Designates the device type of the Master station
D1012		Designates the initial component ID number of the Master station device
D1013	0,1,3,4	Designates the device type of the Slave station
D1014	0 ~ 32767	Designates the initial component data ID number of the Slave station device
⋮	⋮	

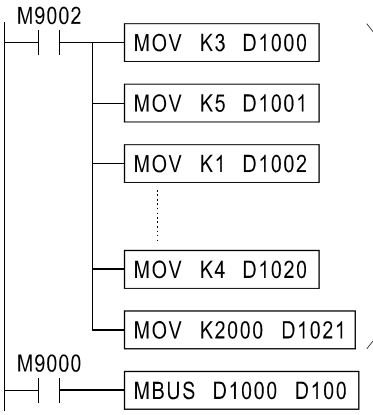
Description of the 1st data transmission/receiving operation

Description of the 2nd data transmission/receiving operation

- The attributes of the devices designated in a data transmission/receiving operation should be the same. For example, if the device designated by the Master station is a bit device, then the designated device of the Slave station should be also a bit device.
- The instruction working area headed with (S2) :

(S2)		Description
D100	Lower 8 bits	The Slave station ID number when a communication error occurs
	Upper 8 bits	Instruction working status 0: Normal data transmission/receiving 2: Error of the length of the transferred/received data (unequal to 1 ~ 64) 4: Error of the designated device type 5: Error of the designated device ID number 6: The characteristic of devices between the Master and Slave stations are different A: Normal communications but no response from Slave stations B: Abnormal communications
D101 ~ D103	The working area required when the instruction is performed	

Description by an Example (For the VB series only)



To create a communication table.
This block can be replaced by the function of File Registers

MODBUS communication instruction

There are totally 3 transmission/receiving data sets in this example.

① To read the data in 40000 ~ 40009 of Slave station #5 and put they to D2000 ~ D2009 of the Master station.

② To write the data in D2010~D2014 of the Master station into 41000 ~ 41004 of Slave station #2.

③ To write the data in D2015 of the Master station into 42000 of Slave station #3.

(S1)	Content Value	
D1000	3	Three transmission/receiving data sets
D1001	5	Designates Slave station #5
D1002	1	Reads data from the Slave station
D1003	10	Length of the data to be read
D1004	13	Designates the device in the Master station which headed with D2000
D1005	2000	
D1006	4	Designates the device in the Slave station which headed with 40000
D1007	0	
D1008	2	Designates Slave station #2
D1009	2	Write a series of data into the Slave station
D1010	5	Length of the data to be written
D1011	13	Designates the device in the Master station which headed with D2010
D1012	2010	
D1013	4	Designates the device in the Slave station which headed with 41000
D1014	1000	
D1015	3	Designates Slave station #3
D1016	3	Write the device's data to the Slave station
D1017	1	This information will be ignored
D1018	13	Designates the data in the Master station D2015
D1019	2015	
D1020	4	Designates the data in the Slave station 42000
D1021	2000	

The first transmission/receiving data sets:
40000 ~ 40009 of Slave station #5
↓
D2000 ~ D2009 of the Master

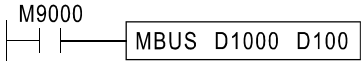
The second transmission/receiving data sets:
D2010 ~ D2014 of the Master
↓
41000 ~ 41004 of Slave station #2

The third transmission/receiving one data set:
D2015 of the Master
↓
42000 of Slave station #3

- Use the File Registers to set up the communication table
  In the VB series PLC, the File Registers are read only registers and the their contents are assumed as a part of program.
  When a user copy or access the program file, the program itself and the File Registers will be handled together. Since the File Registers have this characteristic, use they to store the communication table were suitable. They are not only to copy the data of File Registers easily but also can minimize the program size. Please refer to CH 2-9 "File Register (D)" for more information about the File Register.
  To plan the contents of File Registers, which can use the programming tool software "Ladder Master", it provide the edit tool "System ---- File Register Edit....", easily to set the data in the registers.

- Edit Communication Table
  In addition to the File Registers' layout function; and further, the Ladder Master provides more user friendly and easily of data input interface, it provide the user to create and edit the Communication Table List.
  Please select the Ladder Master's "Tools ---- Edit Communication Table ...." function to start the Communication Table List document edit window. By the interlocutory pop-up window, user can easily create and edit the communication table step-by-step. After the Communication Table has been finished, the user can put the communication data into the designated File Registers then this communication table is completed. And also, this function provides user to retrieve, access and edit the Communication Table back from the File Registers.
  For the VB series PLCs, the File Register is read-only, and its value will be treated as a part of the user program. When user copy or save program file, the File Register together with the program itself will be copied or saved. This feature makes the File Register very suitable for communication table storing; it can be easily copied from and helps to save PLC program space. For detailed introduction on the File Register, please refer to the section "2-9 File Register (D)".

- Communication Table example :



Instruction: MBUS ▼ Start of File Reg: D1000 Length of Reg: 22

Number	Command	Master Data		Slave ID	Slave Data Type	Slave Data #	Length	Word / Bit
1	Read	D2000	<--	5	4	0	10	W
2	Write	D2010	-->	2	4	1000	5	W
3	Single Write	D2015	-->	3	4	2000	1	W

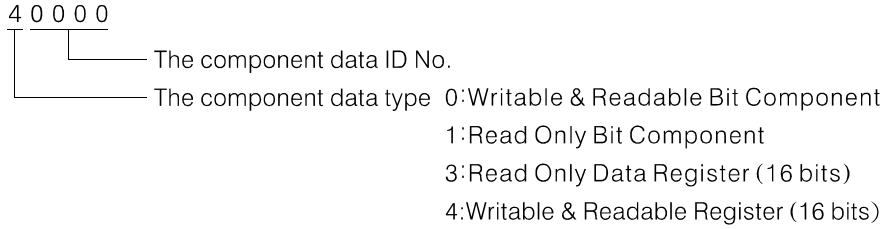
There are totally 3 transmission/receiving data sets in this Communication Table example.

(1) To read the data in 40000 ~ 40009 of Slave station #5 and put they to D2000 ~ D2009 of the Master station.

(2) To write the data in D2010 ~ D2014 of the Master station into 41000 ~ 41004 of Slave station #2

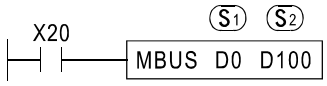
(3) To write the data in D2015 of the Master station into 42000 of Slave station #3.

The "Slave Data Type" and "Slave Data No." in the communication table refers to the component ID number of the slave station equipment.
For example, there is a MODBUS component:



FNC 149 MBUS	MBUS (S1) (S2)	MODBUS Communication	M	VB	VH
					○

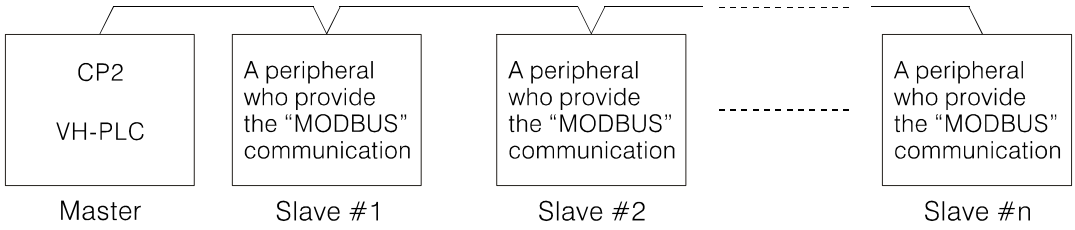
Operand	Devices															
	X	Y	M	S	K*n*X	K*n*Y	K*n*M	K*n*S	T	C	D	SD	P	V,Z	K,H	VZ index
S1											○					○
S2											○					
• S2 occupies 4 consecutive registers																



S1 : To indicate a virtual register for the communication table

S2 : Instruction working area, occupies 4 consecutive registers

- This instruction is for the VH series PLC only. The MBUS instruction for VB series, please referee to page 295
- When a VH Series Main Unit has been installed a communication card (VB-232R or VB-485) or a communication module (VB-485A, VB-CADP etc.), the Main Unit will have the CP2 (2nd Communication Port). Then, via this instruction to proceed data transfer between the PLC and a device who has MODBUS communication protocol.
- The CP2 is a multi-functional expanded communication port, it can be used for multiplex communication types. When the CP2 would like to use for this instruction, the communication type of CP2 should chose the "MODBUS". To select and relative parameters setting about the manipulation type of CP2, please use the option in the programming tool Ladder Master "System---2nd COM Port Setting..."to get the right setting.
- As the diagram below, use the CP2 to connect the PLC and other peripherals, use the program develop devices (e.g. Ladder Master) to set the "MODBUS" communication mode and the communication parameters. Then, to properly finish all the setting of station IDs (the range of station ID number is 1 ~ 255, but when this system link is used the RS-232, there is only one slave available) and parameters for slaves (or peripherals). Write the data transmission/receiving command to the PLC (Master station), to drive the data transmission between PLCs or peripherals.



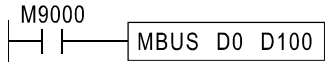
- When X20="ON", the MBUS instruction will start to be performed. Based on the designated Comm Table string (which initiating from D1000), to process writes/reads data into/from an appointed Slave PLC or peripheral. At the same time, D100 ~ D103 store the status of the instruction execution.
- Every time the transmission/receiving operation which designated by (S1) is duly completed, the M9199 will be "ON" for a scan time. And then, it will repeat the data transmission/receiving processes from the first data again.
- When X20="ON" → "OFF", the instruction will be stopped and the data transmission/receiving will be discontinued immediately.
- The MBUS instruction can be used once only in the program.
- For avoid the corresponding breakup, when the MBUS instruction sends a communication request to a particular Slave, if the respondent time of the Slave exceeds the Time-out duration (designated by D9129), the MBUS instruction will stops communication from the specific Slave and operates next communication command.
- The setting value of the Time-out duration is restored in D9129. The Time-out duration = (the content value of D9129) ×10ms. When D9129=0 (the default value), the Time-out duration is 100 ms.
- Most of the applied situation is not necessary to change the Time-out duration.
  But, if an equipment in the communication link, its response is very slow, then the longer Time-out duration is necessary.
- The attributes of the devices designated in a data transmission/receiving operation should be the same. For example, if the device designated by the Master station is a bit device, then the designated device of the Slave station should be also a bit device.

- The instruction working area headed with (S2) :

(S2)	Description	
D100	Lower 8 bits	The Slave station ID number when a communication error occurs
	Upper 8 bits	Instruction working status 0: Normal data transmission/receiving 2: Error of the length of the transferred/received data (unequal to 1 ~ 64) 4: Error of the designated device type 5: Error of the designated device ID number 6: The characteristic of devices between the Master and Slave stations are different A: Normal communications but no response from Slave stations B: Abnormal communications
D101 ~ D103	The working area required when the instruction is performed	

- Edit Communication Table
  In addition to the File Registers' layout function; and further, the Ladder Master provides more user friendly and easily of data input interface, it provide the user to create and edit the Communication Table List.
  Please select the Ladder Master's “Tools ---- Edit Communication Table ....” function to start the Communication Table List document edit window. By the interlocutory pop-up window, user can easily create and edit the communication table step-by-step. After the Communication Table has been finished, the contents will become a part of the user program. The communication commands in the table will go with the user program and keep in VH PLC's system process area. And also, this function provides user to retrieve, access and edit the Communication Table.

- Communication Table Example:



Instruction: MBUS ▼ Length of Reg: 22

Number	Command	Master Data		Slave ID	Slave Data Type	Slave Data #	Length	Word / Bit
1	Read	D200	<--	5	4	0	10	W
2	Write	D210	-->	2	4	1000	5	W
3	Single Write	D215	-->	3	4	2000	1	W

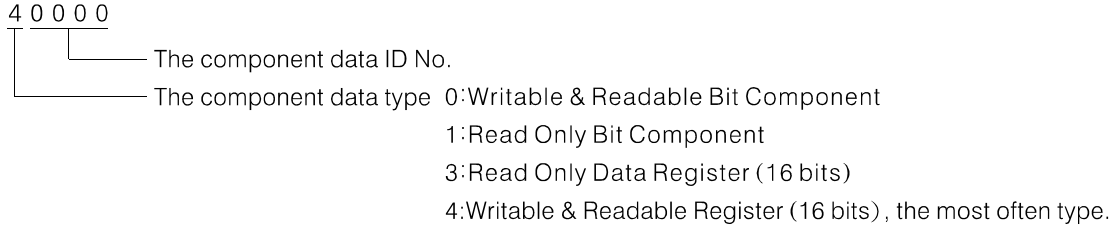
This example is for communication table to execute 3 data receiving/transmitting operations.

(1) To read the data in 40000 ~ 40009 of Slave station #5 and put they to D200 ~ D209 of the Master station.

(2) To write the data in D210 ~ D214 of the Master station into 41000 ~ 41004 of Slave station #2

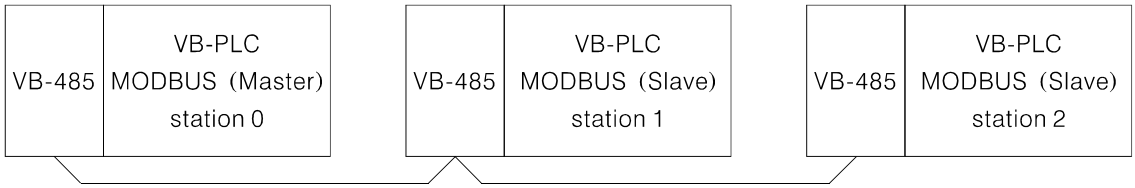
(3) To write the data in D215 of the Master station into 42000 of Slave station #3.

The “Slave Data Type” and “Slave Data No.” in the communication table refers to the component ID number of the slave station equipment.
For example, there is a MODBUS component:

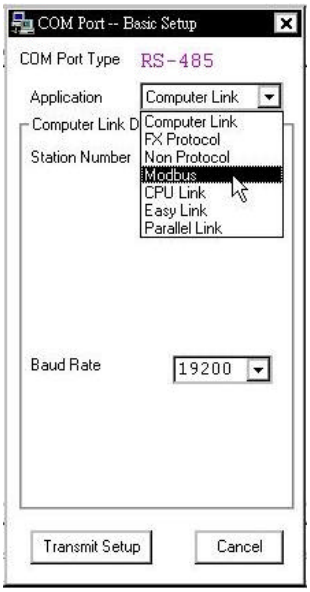


◆ Application Example

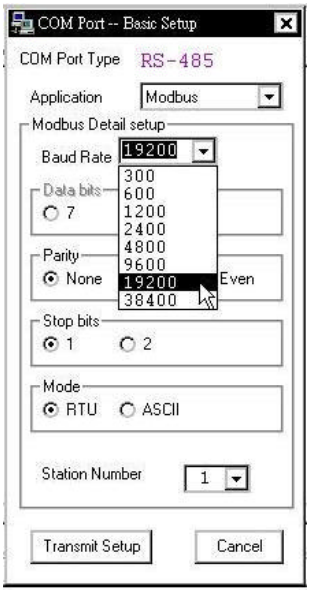
This example connects 3 VB series PLCs through RS-485 interface and executes MODBUS communication. Assign the left most PLC as master station, write MBUS instruction in its program, and use the MBUS instruction to do data receiving/transmitting job with the slave stations, then assign the other 2 PLCs as slave station 1 and slave station 2. In actual application, the slave stations usually are automation components like frequency converter or temperature controller, just for convenience this example use VB-PLC instead.



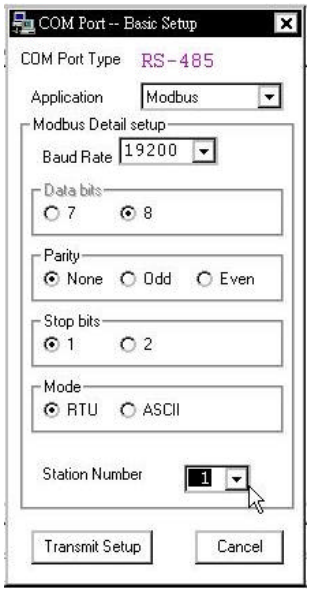
- Set the CP2 parameter for each PLC by Ladder Master though CP1.



Choose the application to be MODBUS



Set station number and the communication parameters



Each PLC (or equipment) in the network should have the same parameters.

- When this example executes, the PLC stations will execute the following job as programmed:

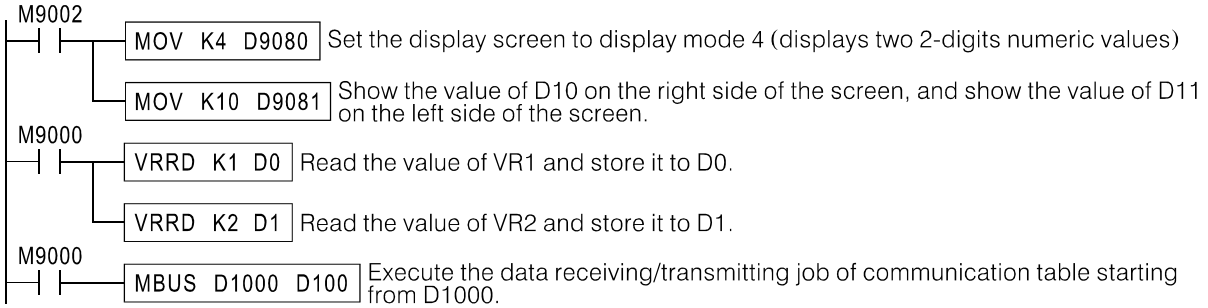
  Master PLC: Read value of VR1 and VR2, store in registers D0 and D1, set the display screen to display mode 4 (show 2 two-digit numeric values), displays the content of register D10 on the right, and the content of register D11 on the left.

  Slave Station 1: Read value of VR1, change the value range from 0 ~ 255 to 0 ~ 99 and store in register D0. Show the content of register D100 on the screen.

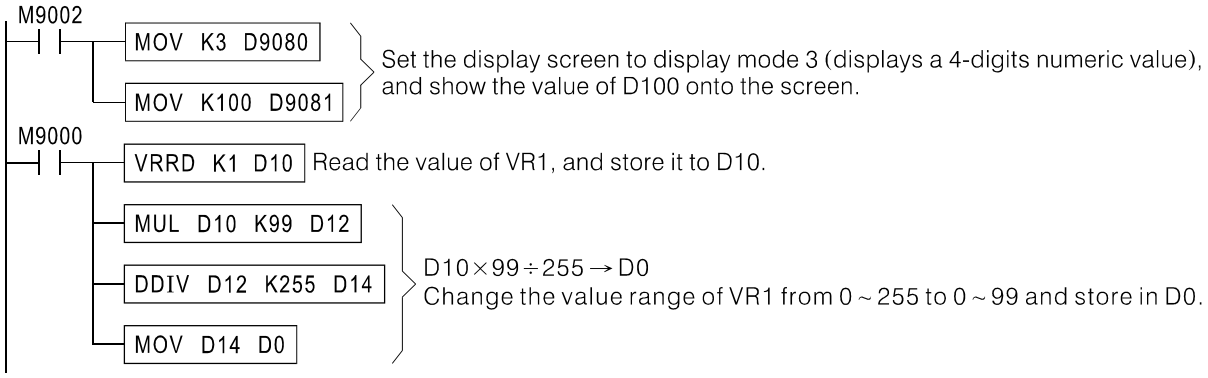
  Slave Station 2: Read value of VR1, change the value range from 0 ~ 255 to 0 ~ 99 and store in register D0. Show the content of register D100 on the screen.

- The following result will be produced by the MODBUS communication and master station MBUS instruction.
  The value of master VR1 will be shown on the screen of slave 1, the value of master VR2 will be shown on the screen of slave 2, change the master VR1 and VR2, can see the changes on slave1 and slave 2 screens as well.
  The read value of slave station 1 VR1 (0 ~ 99) will be shown on the right side of the master station PLC screen, and the read value of slave station 2 VR1 (0 ~ 99) will be shown on the left side of the master station PLC screen

- Program of the Master PLC



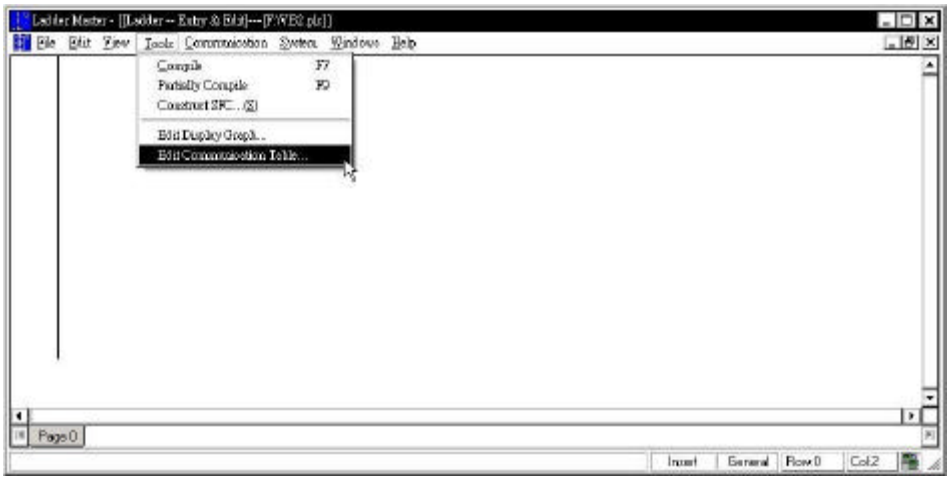
- Program of the Slave 1 and Slave 2 PLC

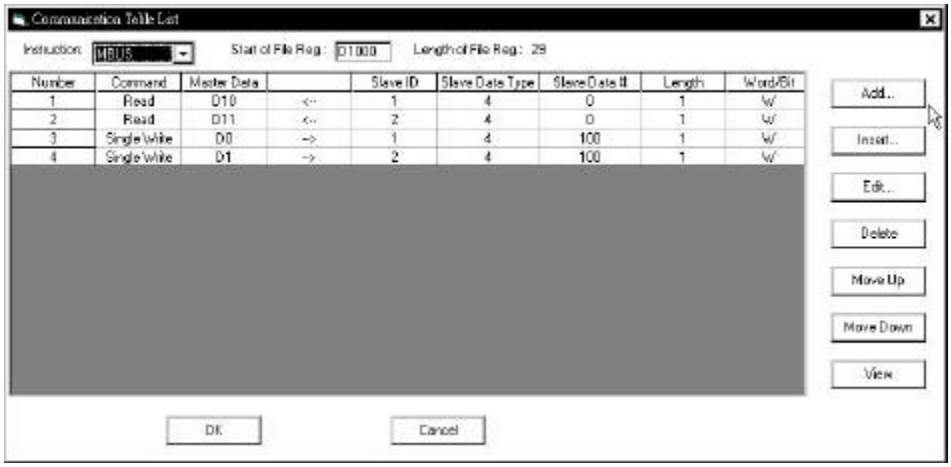


- Data exchange list between the master station and the slave station.

Master PLC	Data Transmitted Direction	Slave PLC			
		MODBUS Component		VIGOR Component Identify Number	Slave ID #
		Data Type	Data #		
D10	<---	4	0000	D0	1
D11	<---	4	0000	D0	2
D0	--->	4	0100	D100	1
D1	--->	4	0100	D100	2

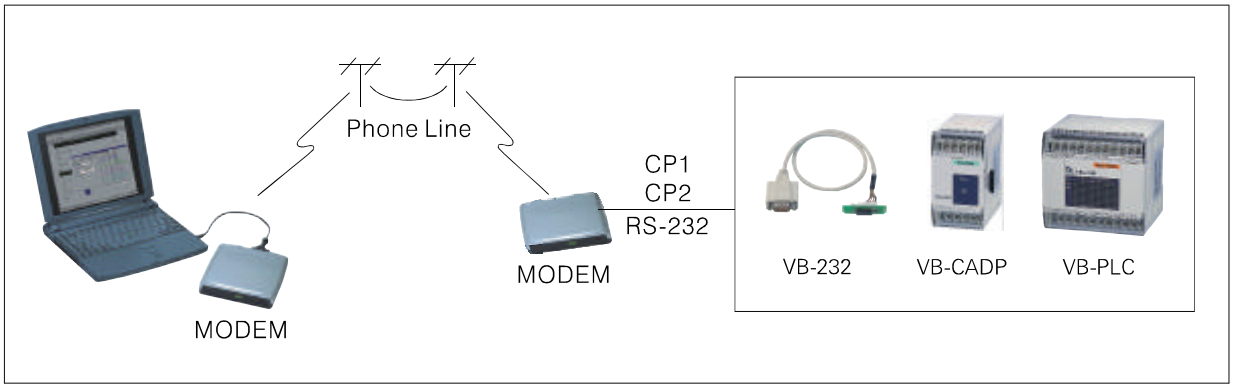
- Edit Communication Table





B-3-7 MODEM Communication

◆ Besides directly communicate with PLC through RS-232 interface, Ladder Master can also use telephone line to communicate with remote PLC though MODEM.



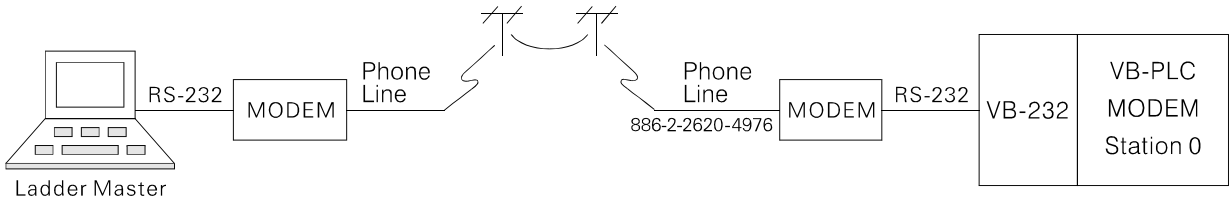
- M, VB and VH series PLCs all have this function, it works using the PLC main unit built in communication port (CP1) or the expansion communication port (CP2).

- When Ladder Master tries to connect to the remote PLC at the other end of the telephone line through MODEM, before Ladder Master starts dialing, the MODEM connecting to PLC should be in "auto-answer" mode (the "AA" LED on the MODEM should be ON), so that it responds the call coming in and builds a connection.

- About the "AA" LED on the MODEM
  There usually is an "AA" (Auto Answer) LED on the MODEM. When this LED is ON, means the MODEM will respond to the dialing in phone call. After the call-and-answer process, these 2 MODEMs have built a connection with each other through phone line. And then the Ladder Master and PLC at the two ends of the phone line can communicate with each other.
  When the users attach the connection lines to the communication ports of MODEM and PLC, switch on the power supply, the "AA" LED on the MODEM should be ON. If the LED is still OFF at this stage, please switch off the MODEM and PLC power. Then switch on the MODEM power first, wait for 5 seconds, switch on the PLC power, and check the MODEM "AA" LED again.
  When use MODEM connection, the user must make sure the MODEM which supposes to answer the coming call is in auto-answer mode ("AA" LED is ON), and the connection may be successful.

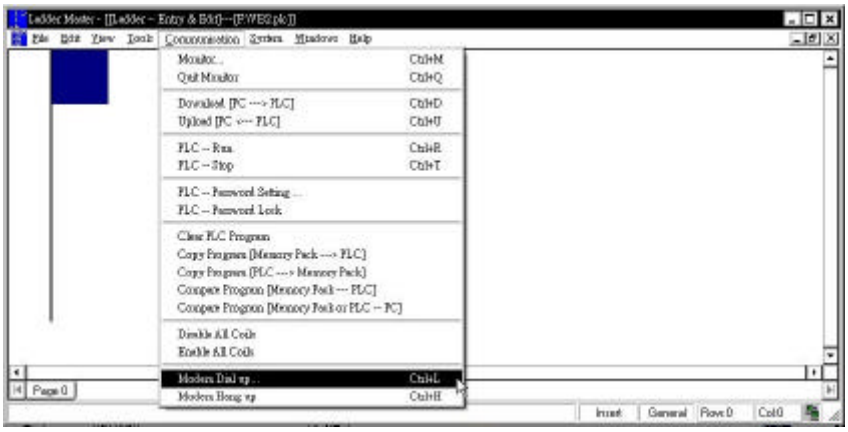
◆ Application Example

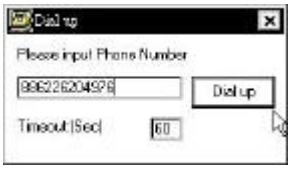
In this application example, the computer connects to a MODEM through RS-232 interface (can also use the pc built-in MODEM if any), then connects with the phone line, to be the caller. And the PLC connects to a MODEM through the RS-232 interface of VB-232 (CP2) (can also use the PLC built-in CP1 RS-232 interface), then connects with the phone line, to be the responder.



- When the PLC uses the RS-232 interface of VB-232 (CP2) to connect to the MODEM, please use Ladder Master to set the communication port type of CP2 to be “MODEM”.

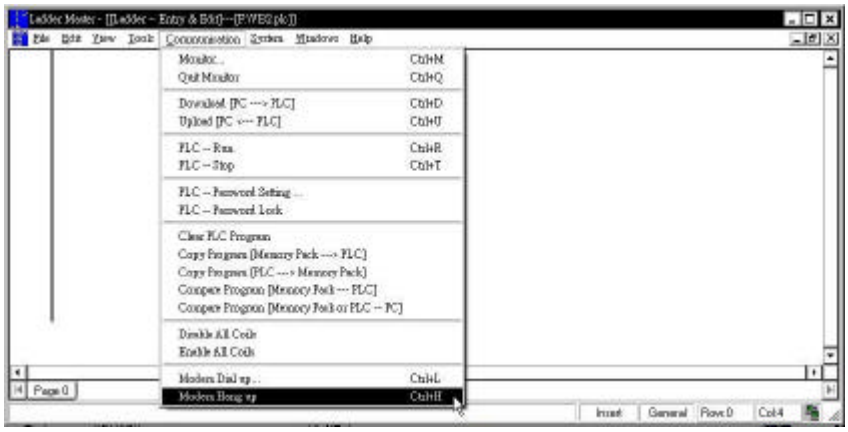
- Use the “Modem Dial Up” function of Ladder Master to connect with the PLC at the other end of the phone line.





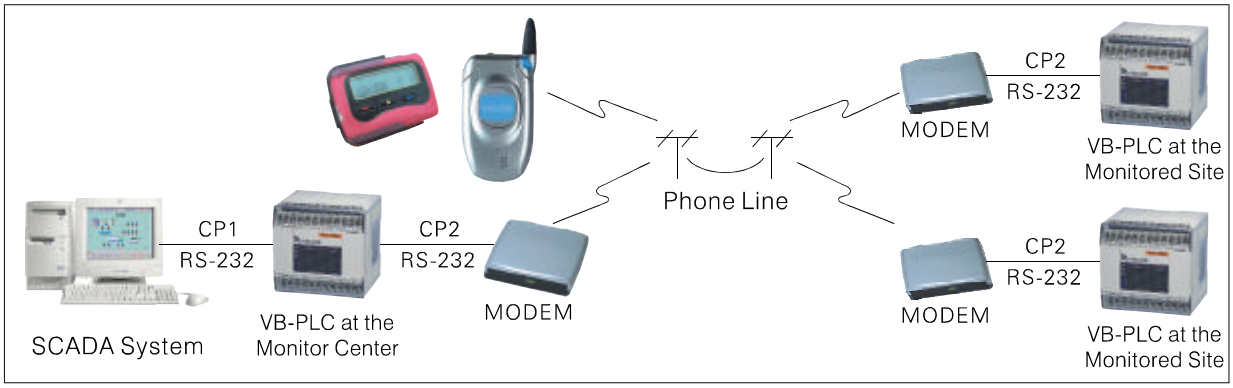
When key in telephone number, like the usual phone dialing, if the computer and PLC are in different regions, add the region code prefix; if they are in different countries, add the country code prefix.

- When the connection ends, use the “Modem Hang Up” function to cut the phone call.



B-3-8 MODEM Dialing

◆ There is a phone number register in the M/VB series PLC, for the user to execute MODEM dialing function through the CP2 communication port. The M/VB-PLC at the monitored site can send data through MODEM dialing to the M/VB-PLC in the monitor center for data collection, or dial to beeper and Mobile Phone for incoming call display. This function is usually used in security system and remote data gathering system.



◆ There is a phone number register in the M/VB series PLC, for the user to execute MODEM dialing function through the CP2 communication port. The M/VB-PLC at the monitored site can send data through MODEM dialing to the M/VB-PLC in the monitor center for data collection, or dial to beeper and Mobile Phone for incoming call display. This function is usually used in security system and remote data gathering system.

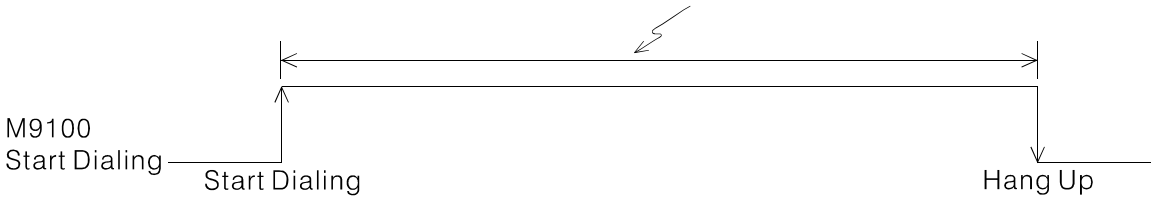
● Introduction on the M/VB-PLC MODEM Dialing Function

Coil ID. No.	Instruction of Function	M	VB	VH
M9100	CP2 dialing start signal	○	○	
■ M9101	CP2 dialing failed	○	○	
■ M9124	When CP2 of PLC connects with MODEM, M9124 shows the CD signal	○	○	

Register ID.	Instruction of Function	M	VB	VH
D9110 ~ D9115	Telephone number register. Store the telephone number dialing out when execute MODEM dialing function.	○	○	

● M9100: Start dialing. When M9100=OFF→ON, start dialing.
When M9100=ON→OFF, hang up call.

If the receiver is not MODEM (like beeper or Mobile Phone),
make this ON period less than 1 minute, or else the PLC will do retry.



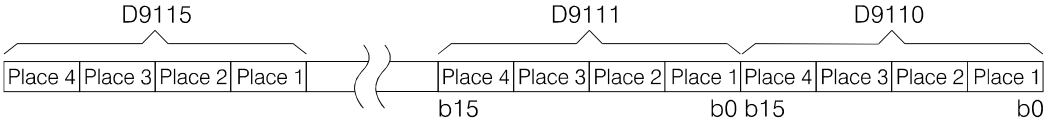
M9101: Dialing Failed. If the load signal (M9124) hasn't been received within 1 minute since the dialing starts, the retry function will be triggered to dial again. Three times of continuously dialing failure means the connection is unsuccessful, and M9101=ON indicates the dialing failed, and will stop trying.

M9124: Load signal. M9124=ON means the MODEM connection is successful, can start sending data.

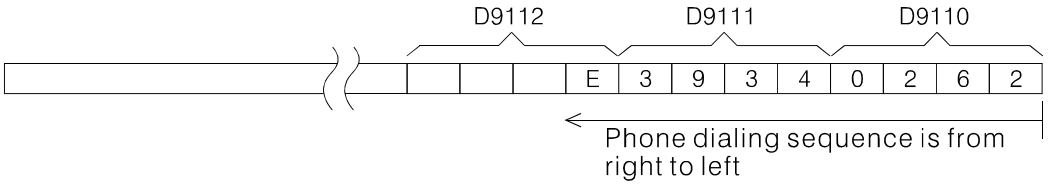
- D9110 ~ D9115 Telephone number registers. Each register can store 4 numbers, in hex code number format.
  The table below lists the meaning of hex code numbers of the telephone number registers.

No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Code	No. 0	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	″ , ″ Delay	″#″	″∗″	—	End Code	—

- The sequence of telephone numbers stored in the registers.



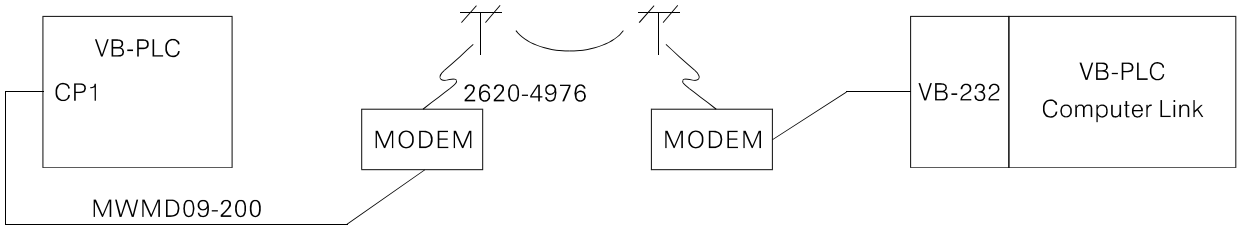
E.g. the dialing number is 2620-4393, then the content of D9110 ~ D9115 is as below:



∗ Take note that the register content is in hex code.

◆ Application Example

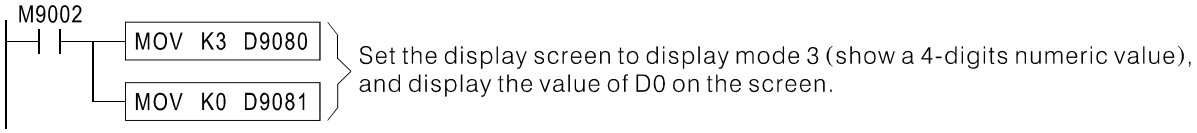
In this example, 2 VB-PLC are connected by MODEM and telephone line as shown in the diagram below. When the dialing condition of the PLC on the right is satisfied, it will dial to connect to the PLC on the left. When the connection is successful, PLC on the right will use LINK instruction (FNC89) to send the relevant data to PLC on the left. When the data sending is completed, cut off the connection. The PLC on the right transmit data to the PLC on the left in this way, obviously, it can also read data from the PLC on the left in the same way. Moreover, more than one PLC on the right side can send data to the PLC on the left side using this method.



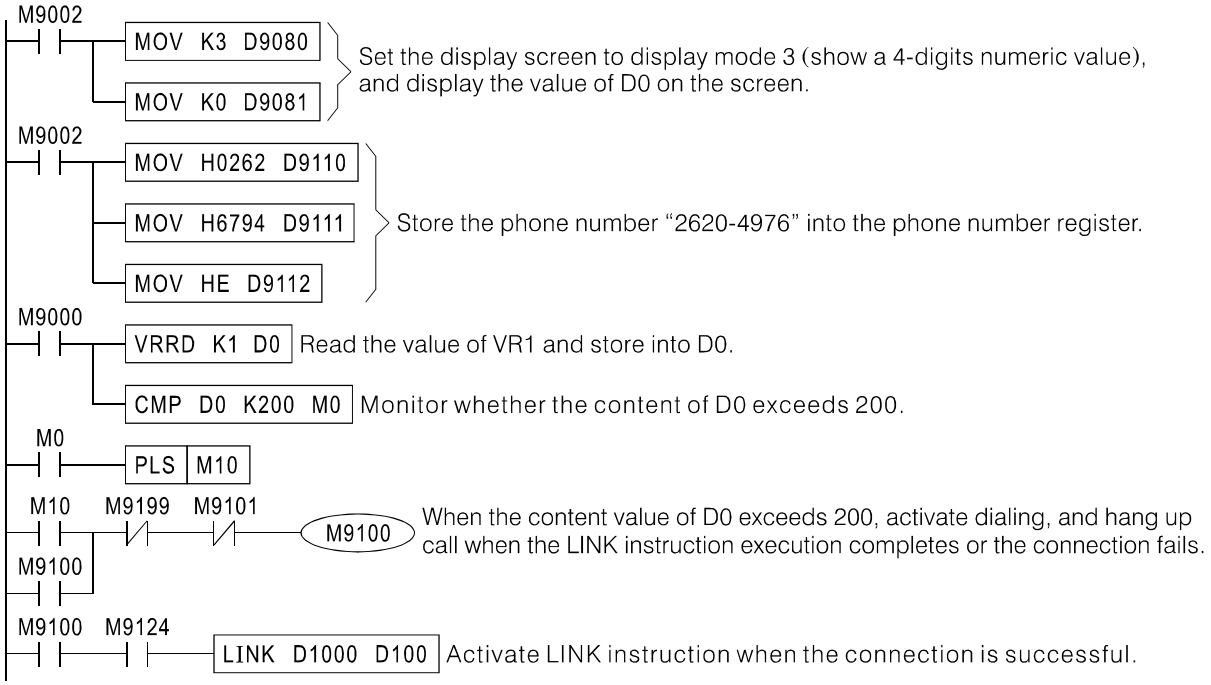
- When this example executes, the PLC on the left and the MODEM will be in auto-answer mode (the "AA" LED on the MODEM will be ON). And as programmed, the PLC on the left will display the content of D0 on the screen.

- The PLC on the right will read the value of VR1 as programmed and store in register D0, and show on the display screen. And when the value of VR1 exceeds 200, it will activate MODEM dialing, and use LINK instruction to send the value of VR1 to the register D0 of the PLC on the left, when the transmitting completes, it will automatically cut off the phone connection. At that time, the display screens of the PLC on the left and the PLC on the right will show same value.

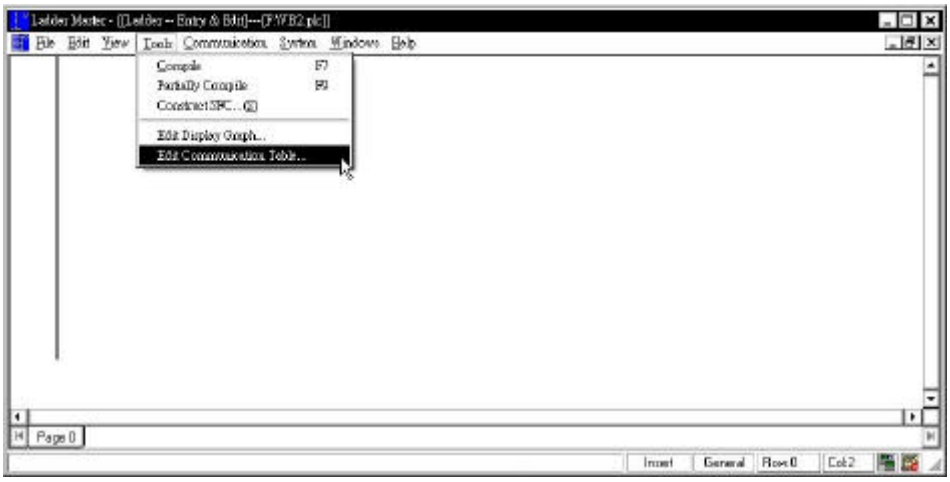
- Program of the PLC on the Left

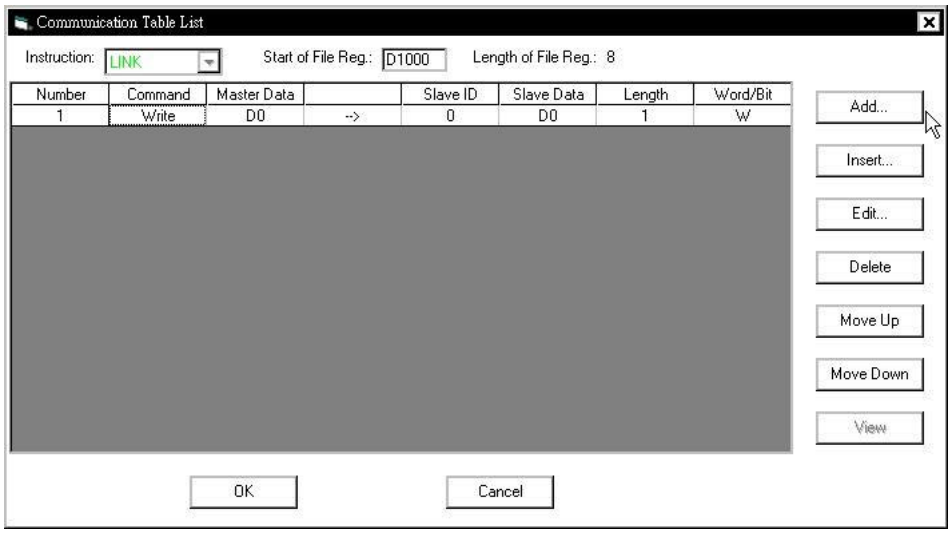


- Program of the PLC on the right



- Edit Communication Table

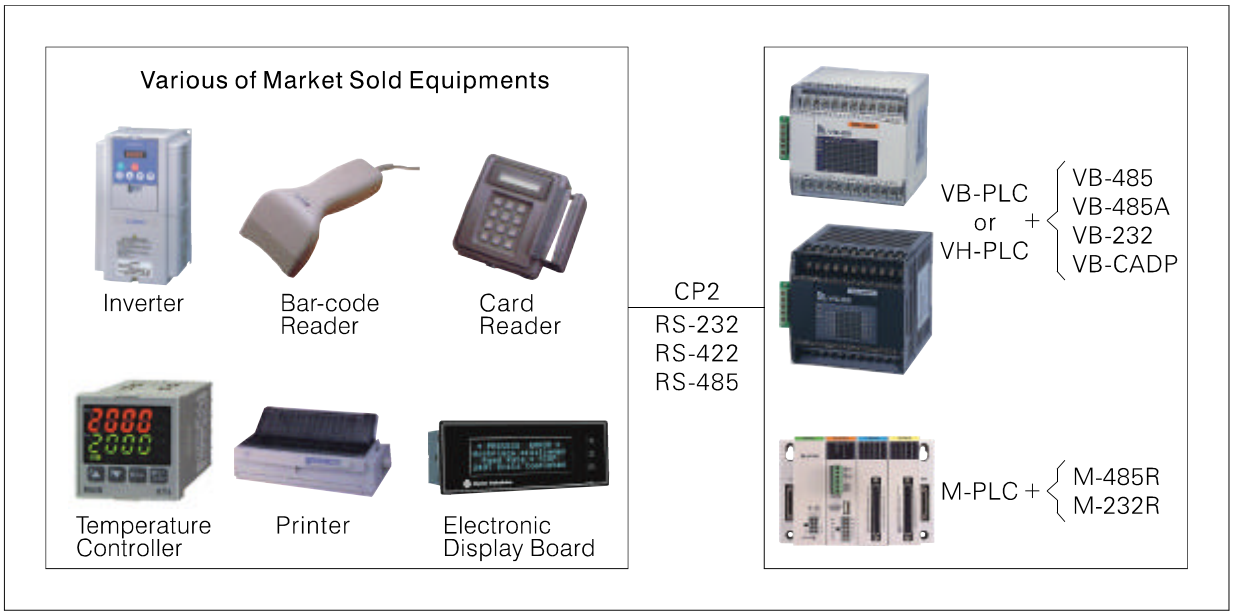




MEMO

B-3-9 Non Protocol Communication

◆ PLCs do not execute any specified communication protocol. All communication programs are defined by the user and completed by the PLC program. Then use the RS instruction (RNC 80) to receive/send communication data and accomplish the communication. This application type is usually used to communicate with market sold temperature controllers, Inverter and bar code readers,etc.



Item	Specification	
Transmission Interface	RS-232	RS-422/RS-485
Communication Protocol	No protocol	
Communication Method	Half-duplex	
Communication Parameters	Baud Rate	300/600/1200/2400/4800/9600/19200 bps
	Data Length	7 bits/8 bits
	Parity	NONE/ODD/EVEN
	Stop Bit	1 bit/2 bits
	Starting Code	None or any
	End Code	None or any
Distance (Refer to the specifications of connection equipments)	15 M (49')	1000 M (3280'); (50 M /164', if the network has a VB-485)
Connection Equipment	VB-232 、VB-CADP or M-232R	VB-485 、VB-485A 、VB-CADP或M-485R
Linkable PLC	VB, M and VH Series PLC	

◆ RS Instruction Related Components

For components with symbol "■" or are missing from the list below, their relay coils cannot be driven by instructions and no data can be written to them.

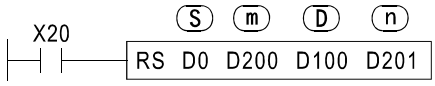
Coil ID. No.	Instruction of Function	M	VB	VH
■ M9063	Parallel Operation or RS communication Error, PLC keeps running.	○	○	○
M9122	RS Instruction Send Flag	○	○	○
M9123	RS Instruction Receive Done	○	○	○
■ M9124	CD Signal shown by M9124 when CP2 connects with MODEM	○	○	
M9129	Time out during RS	○	○	○

Register ID.	Instruction of Function	M	VB	VH
■ D9063	Error code identifying RS communication error	○	○	○
■ D9122	Num of data left when RS Send	○	○	○
■ D9123	Num of data received by RS	○	○	○
D9124	RS starting point setting		○	○
D9125	RS ending point setting		○	○
D9129	RS time out setting	○	○	○

◆ The next page introduces the way of using RS instruction.

FNC 80 RS	RS (S) (m) (D) (n)	Serial communications Instruction	M	VB	VH
			○	○	○

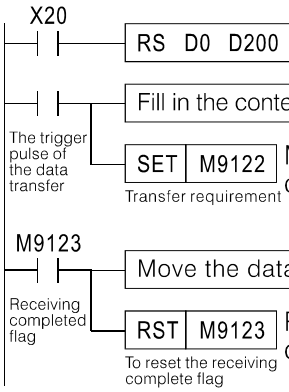
Operand	Devices															
	X	Y	M	S	K*n*X	K*n*Y	K*n*M	K*n*S	T	C	D	SD	P	V,Z	K,H	VZ index
S											○					○
m											○				○	
D											○					○
n											○				○	
• m,n=0～256																



S : Head ID number of the register transferring data
m : Number of groups transferring data
D : Head ID number of the register receiving data
n : Number of groups receiving data

- When M Series PLC's M1-CPU1 module is equipped with the communication expansion card M-232R or M-485R, therefore this CPU module is provided with the CP2 (the second Communication Port). Then the instruction can be used to transfer or receive the data via the serial communications interface of external peripheral facilities.
- When VB and VH Series PLC's Main Unit is equipped with the communication expansion card (VB-232 or VB-485) or expansion module (VB-485A , VB-CADP etc.), therefore this CPU module is provided with the CP2 (the second Communication Port). Then the instruction can be used to transfer or receive the data via the serial communications interface of external peripheral facilities.
- The CP2 is a multi-functional expansion communication port, it can operation various communication types. When the CP2 is assigned to this instruction, the manage type should select to "Non protocol". About the CP2, to select the manage type and related parameter setting, please specify it from the programming software (Ladder Master - System - 2nd COM Port Setting).
- Designate "(m)" as K0 where data transmission (send) is not needed, and designate "(n)" as K0 where data received is not needed.
- As many commercialized peripheral facilities (e.g. Inverters, barcode readers, card readers, electronic displays, etc.) equipped with serial communications interface have their individual protocols, PLC users have to use the RS instruction writing communication programs (in accordance with the communication protocol format of peripheral facilities), when M series PLC is to be connected with peripheral facilities, to transfer data between PLC and those peripherals.
- If the communication of the RS instruction is performed, data transmissions can be divided into 16-bit mode (M9161= "OFF") and 8-bit mode (M9161= "ON").
- M9063 will turn "ON" when any error occurs during data transmissions and receiving and the error code will store in D9063.
- More than one RS instruction can be programmed but only one may be active at any one time.

Sequence of Data Transmissions and Receiving



Write the data to be transferred, which headed with D0 and the number of groups is specified by D200.

M9122 will turn "OFF" automatically when data transmissions are completed. Do not use the RST instruction to reset the M9122.

Move the received data, which headed with D100 to the data storage area.

Reset the Receive Completed flag M9123 and prepare to receive the coming data. Do not reset M9123 consecutively in the program.

Related Flags and Data Register

① Transmission Trigger Flag M9122

- When the conditional contact X20= "ON", the RS instruction is performed. At this time, if the pulse signal forces the status of M9122 to be "ON", the content value of the register initiating from D0 will be transferred via the serial interface. When the data transmission is completed, M9122 will be reset to "OFF" automatically.

② Receive Completed Flag M9123

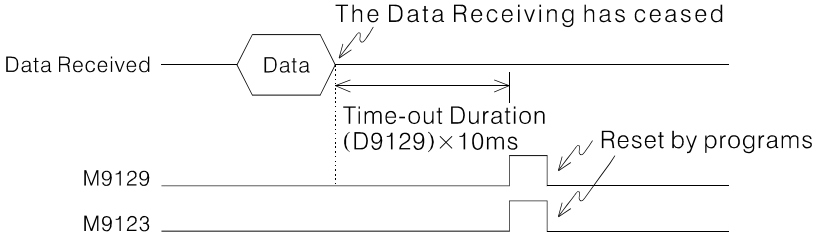
- When the conditional contact X20= "ON", the RS instruction is performed. PLC is ready for the status of receiving.
- When the data receiving is completed, M91213= "ON". At this moment, the received data in the buffer will be moved to the data storage area, and then M9123 will be reset to "OFF". Afterwards, PLC will be ready for the status of receiving immediately.

③ Carrier Detection Flag M9124 (VH Series do not support this signal)

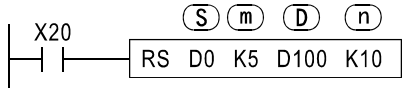
- When PLC receives the CD (Carry Detect) signal from the serial interface, M9124= "ON".
- When PLC is connected with a MODEM, the CD signal is used to represent the status of MODEM. If M9124= "OFF", the transmission of the dialing signal can be performed. If M9124= "ON", data transmissions and receiving can be performed.

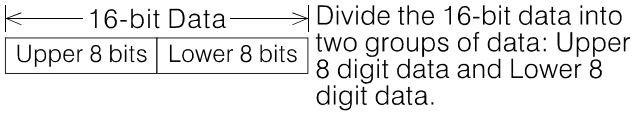
④ Time-out Flag M9129

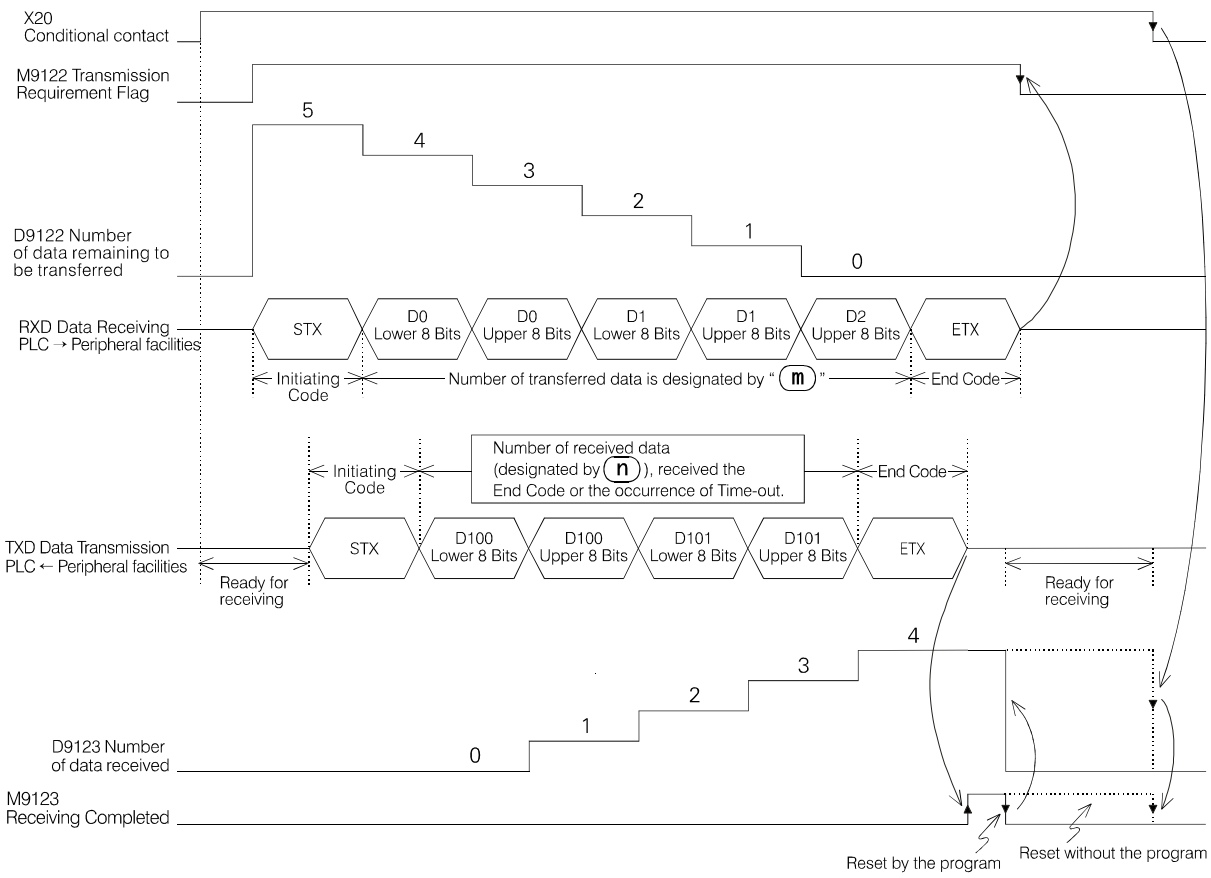
- During the data receiving, if the receiving time exceeds the time-out duration (designated by D9129), M9129 will turns "ON" to represent as the occurrence of Time-out, and also the Receive Completed flag M9123 will be forced "ON" to close the data receiving action.
- The M9129 will not be reset automatically, must using an instruction in the program to reset the status of M9129.
- By applying the Time-out function, PLC will receive the data of transferred from peripheral facilities which is no "End Code" or no length can be predicted.
- The setting value of the Time-out duration is restored in D9129. The Time-out duration = (the content value of D9129) × 10ms. When D9129=0 (the default value), the Time-out duration is 100ms.



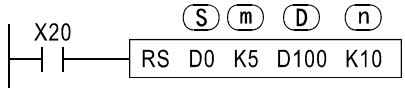
Description of Data Transmissions and Receiving Actions: 16-bit Mode (M9161="OFF")

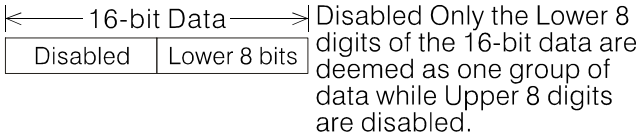


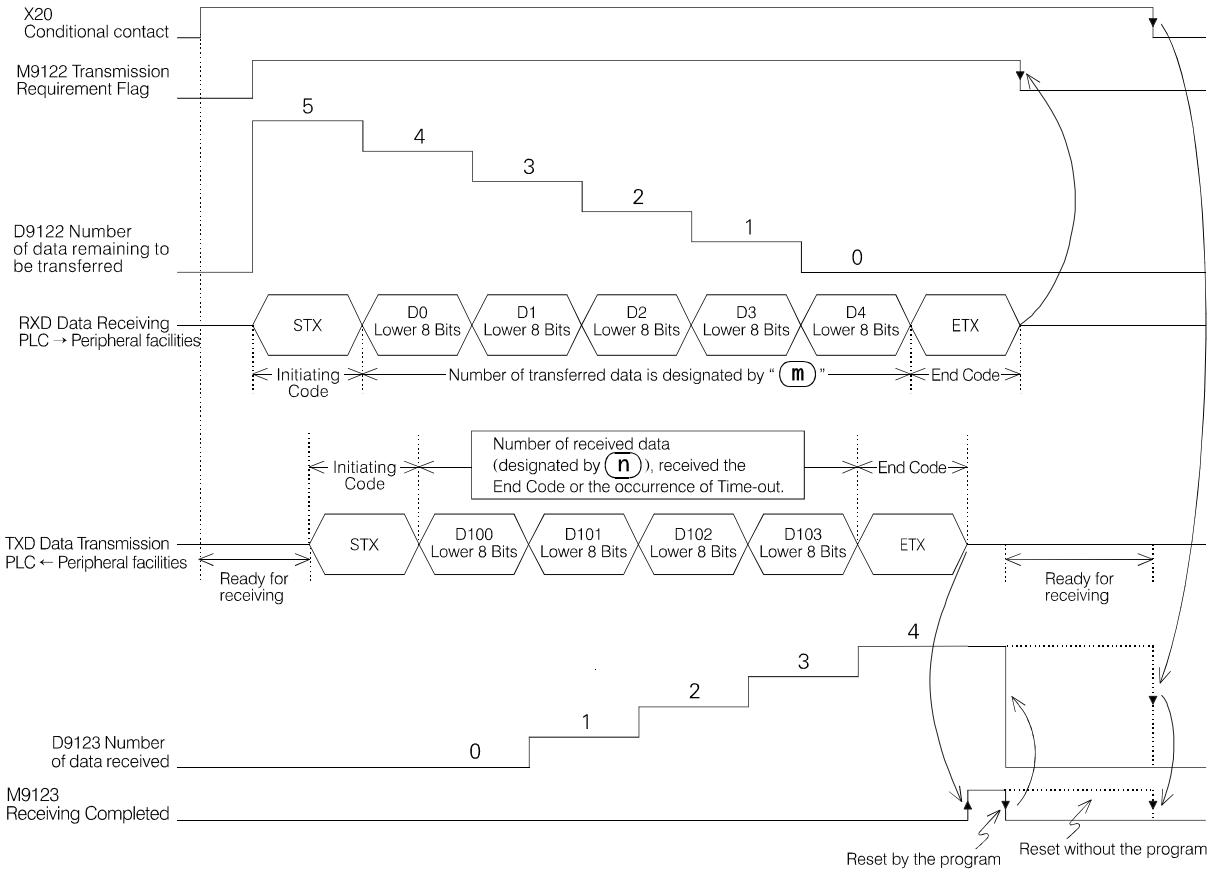




Description of Data Transmissions and Receiving Actions: 8-bit Mode (M9161="ON")



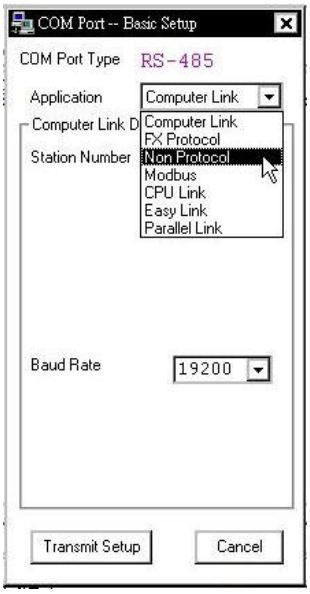




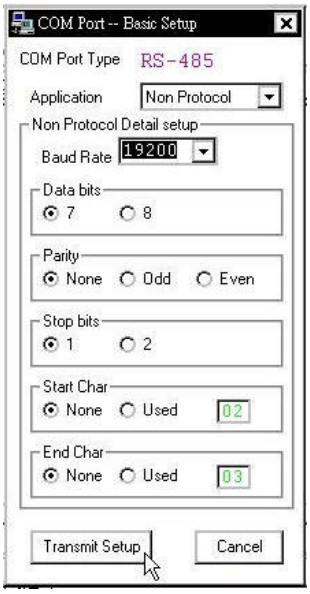
◆ Application Example

In this example, 2 VB series PLCs are connected through RS-485 interface as shown in the diagram below. Set the CP2 application type of the left side PLC to be Non protocol, then write the related instructions for M, VB and VH communication protocol in program to read/send data from/to the station 1 PLC.
Of course, in actual application, the VB series PLC can use CPU Link or Easy Link to exchange data easily without taking such trouble. The purpose of this example is to demonstrate how to use Non protocol and RS instructions. For communication protocols please refer to “Communication Protocol of M, VB and VH Series”.

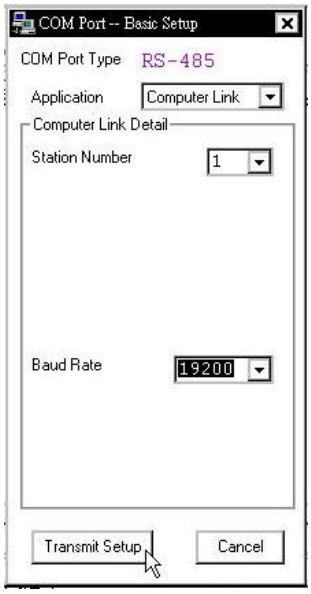
- Set the CP2 parameter for each PLC by Ladder Master though CP1.



Select application type as Non protocol for the left PLC



Set Non protocol parameters based on the M, VB and VH communication protocols.



Select application type as Computer Link for the right PLC, the baud rate must be the same as the left PLC's.

- When this example executes, the 2 PLC stations will execute the following job as programmed:

  Left (Master) PLC: Read value of VR1 and store in register D111, show the content of register D110 on the display screen.
  Execute RS instruction based on the “M, VB and VH communication protocols”. Read the register D0 on the right (slave station 1) PLC and store the value into register D110. Store the content of register D111 to the register D1 on the right (slave station 1) PLC.

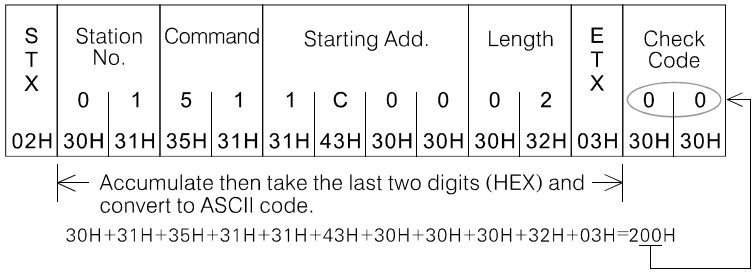
  Right (Slave) PLC: Read the value of VR1 and store in register D0, show the content of register D1 on the display screen.

- Since the left (master station) PLC execute RS instruction based on the “M, VB and VH communication protocol” to transmit data, the following result will be produced:
  The VR1 value of left (master station) PLC will be shown on the display screen of the right (slave station) PLC (Change the VR1 of left PLC, can see the changes on the display screen of right PLC).
  The VR1 value of right (slave station) PLC will be shown on the display screen of the left (master station) PLC (Change the VR1 of right PLC, can see the changes on the display screen of left PLC).

- Below is a general introduction on the M, VB and VH communication protocol related instructions used in this example. For the detailed content of the communication protocol, please refer to “B-5 Communication Protocol of M, VB and VH Series”.

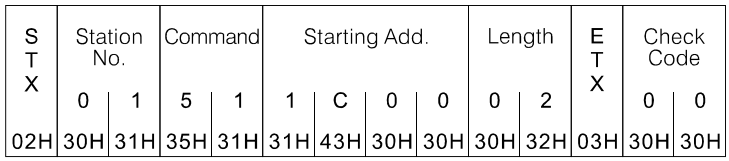
  - Communication parameters of the M, VB and VH communication protocols.
    Data length: 7 bits (ASCII) / Parity: EVEN / Stop bit: 1 bit

  - Calculation method of the check code

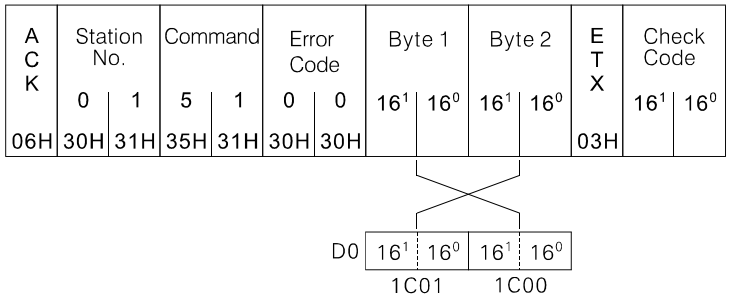


  - Calculation method of the check code

Data to send to slave station 1

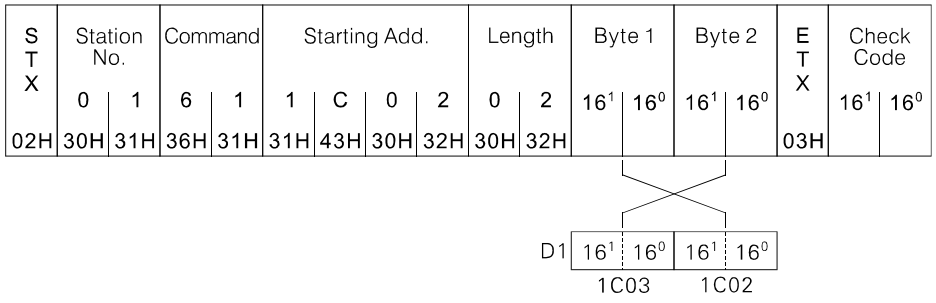


Data responded by slave station 1

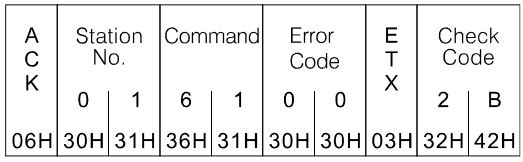


  - Communication instruction to write data into the register D1 of slave station 1 (data address 1C02H)

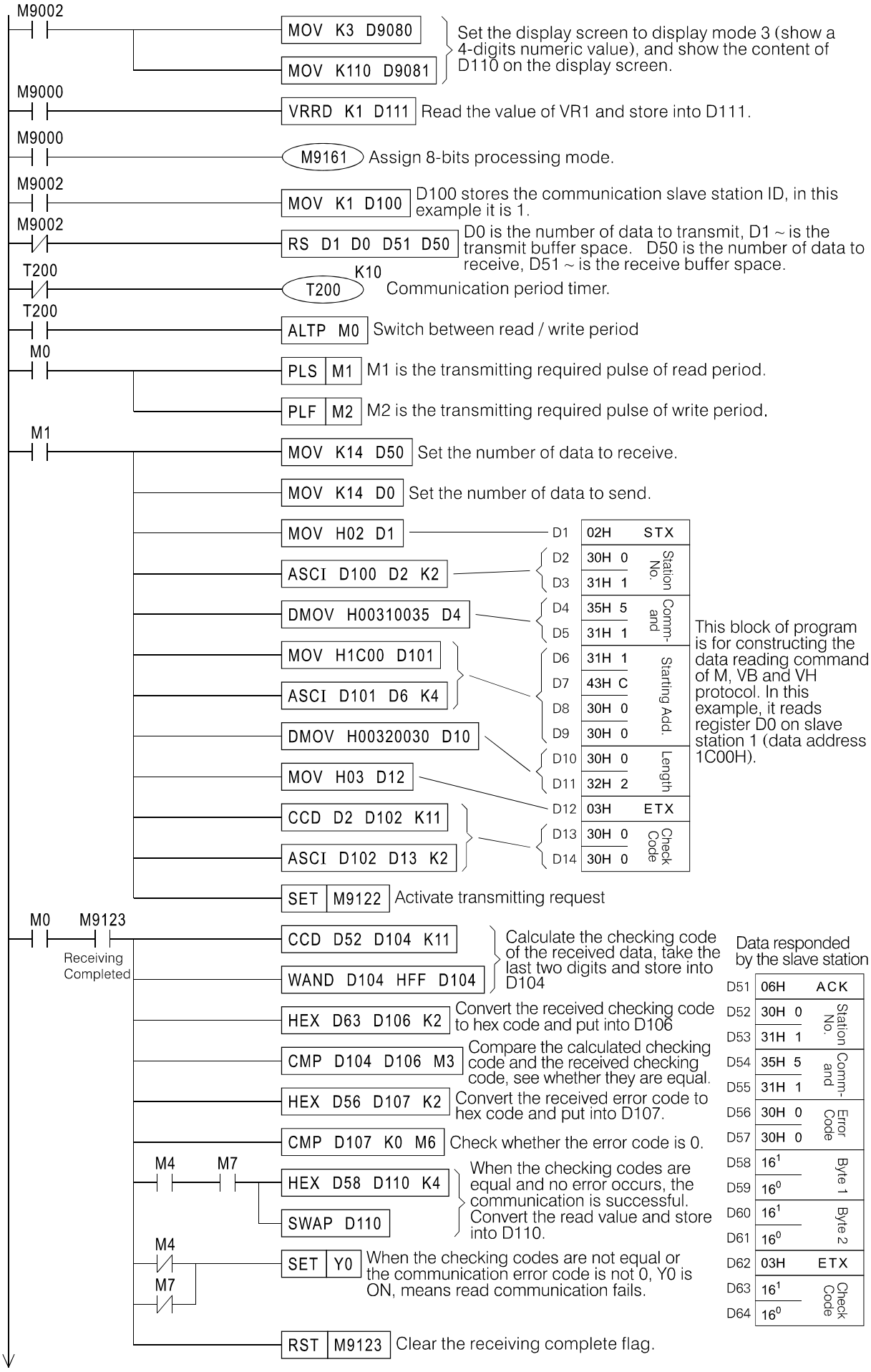
Data to send to slave station 1

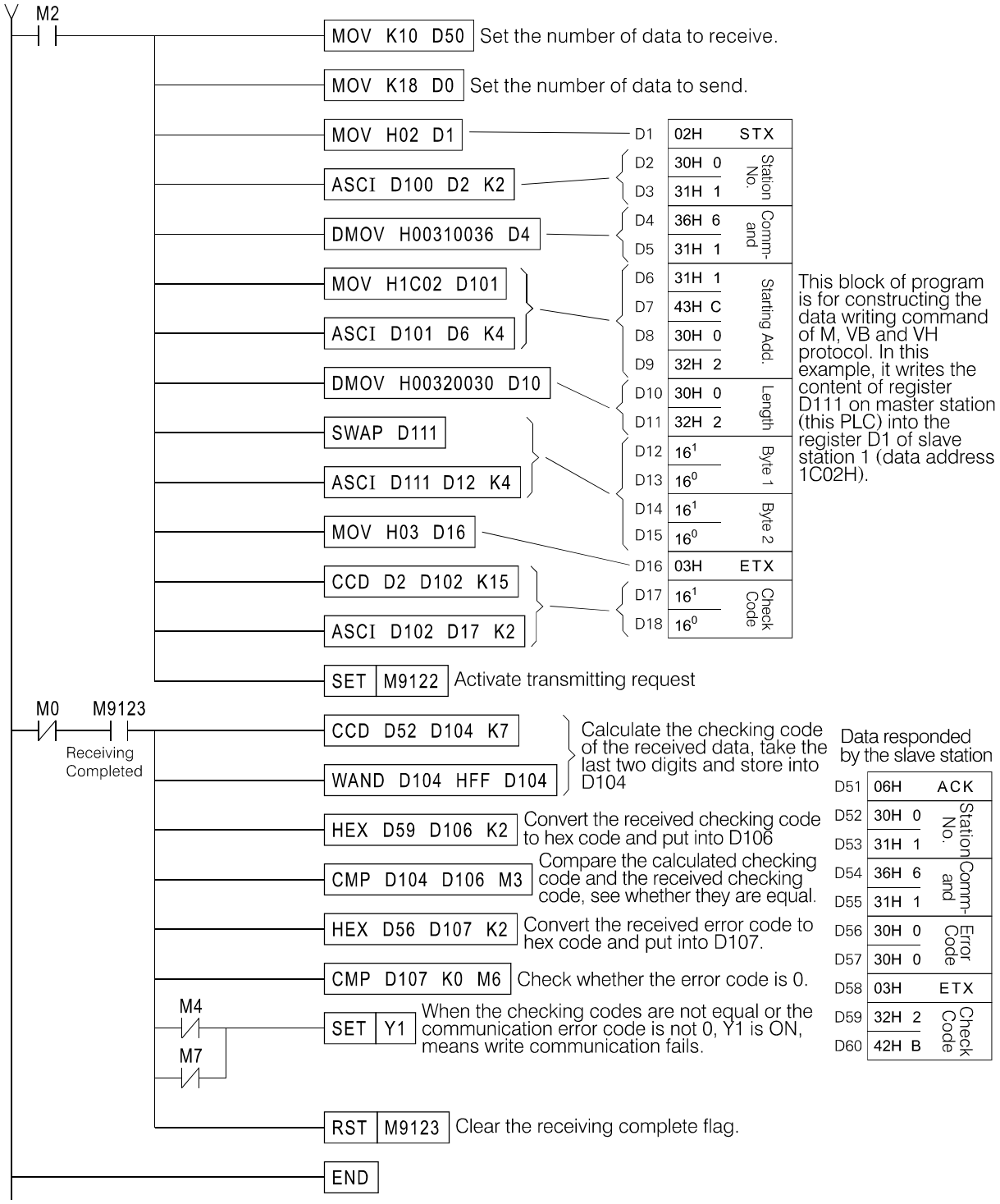


Data responded by slave station 1

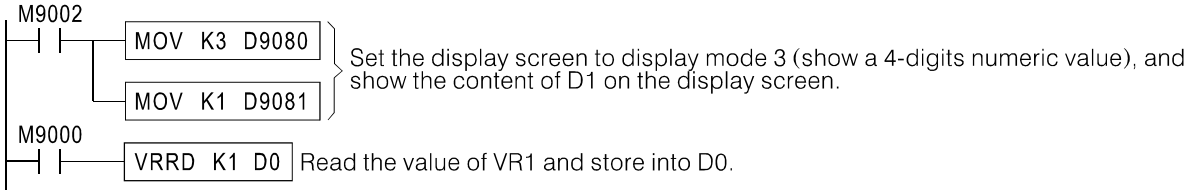


- Program of the left (master station) PLC





- Program of the Right side (Slave Station) PLC

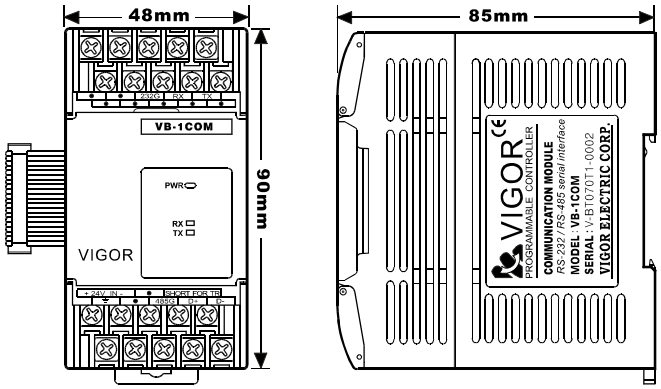


B-4 VB-1COM Serial Link Communication Module

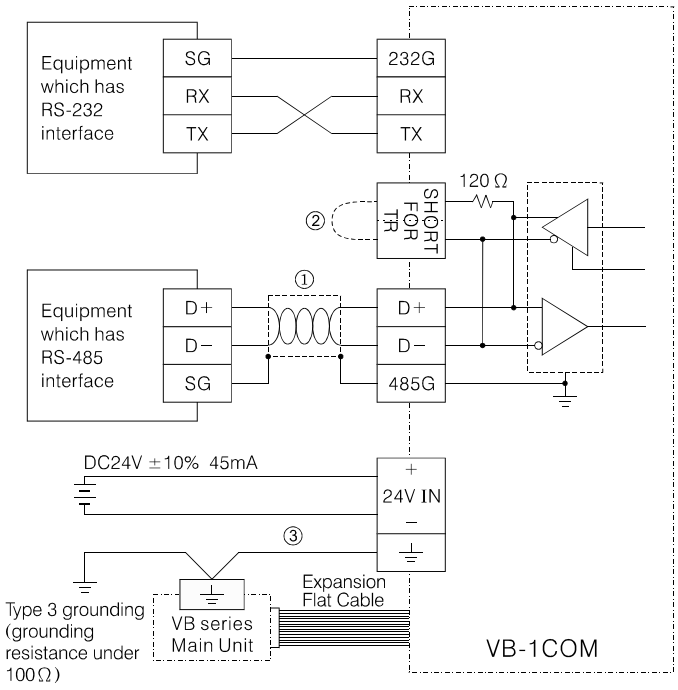
This introduction includes diagrams and texts to guide the user install and use the VB-1COM module correctly. Please read carefully before install and use the VB-1COM module.

B-4-1 Module Introduction

- VB-1COM module has the RS-232 and RS-485 interfaces at the same time, and these 2 interfaces can communication with majority of the equipment sold in market.
- RS-232 and RS-485 are both isolated style, and the distance of RS-485 can be 1000 meters.
- Automatic converting function from HEX to ASCII code of the transmitting/received data is provided.
- The VB series PLCs use the FROM/TO instructions to do data exchange and parameter setting with the VB-1COM.
- Dimensions diagram of this module.



B-4-2 External Wiring



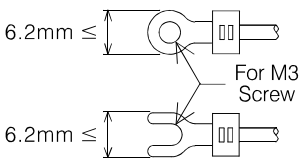
① Please use shielded twisted pair wiring as the connection wire for RS-485 communication interface. In occasions where long distance or high-speed is required, to improve the communication quality, the RS-485 dedicated communication cable (like Belden 9841) is preferred.

② Please parallel attach terminal resistance to the terminals of the communication circuit when construct RS-485 circuit.
The VB-1COM module has a built-in 120 Ω terminal resistance. When short-connect the "SHORT FOR TR" terminals with short connecting wire, the 120 Ω terminal resistance will be parallel connected to the "D+" and "D-" terminals.

③ Please parallel attach terminal resistance to Please connect the terminals of PLC main unit to VB-1COM module, and then use this terminal as type 3 grounding or connect it to the covering case of the distribution box.

④ This module provides RS-232 and RS-485 interfaces, and only one of them can be used at a time.

- Wiring Terminals



- Use O or Y type terminal when wiring as specified in the left hand side diagram.
- Tighten the screw properly to avoid mis-operation. The proper strength used to turn the terminal screw is 5 ~ 8kg-cm.

B-4-3 Module Specifications

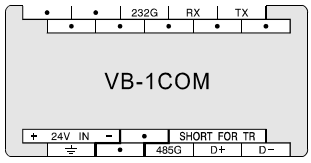
- Common Specifications

Item	Specification
Common Specifications	Same as the VB series Main Unit
Dielectric Strength	500VAC 1 min between all terminals and rack panel

- Power Specifications

Item	Specification
External Driving Circuit	24V DC +10% ~ −10% ， 45mA
Internal Circuit	5V DC, 75mA (Power supplied by the internal expansion bus)

- Functional Specifications

Item	Specification	
Transmission Interface	RS-232	RS-485
Isolation Method	Photocoupler isolation	
LED Indicator	PWR 、RX 、TX	
Communication Distance	15 Meters	1000 Meters
Communication Method	Half-duplex	
Baud Rate	300/600/1200/2400/4800/9600/19200/38400/76800/14400/28800/57600 bps	
Communication Protocol	Non Protocol, user defined communication process done by PLC program.	
Communication Format	Assigned by BFM (9 formats in total)	
PLC Communication	Use FROM/TO instructions through BFM	
Wiring Method	Barrier style terminal block connection 	

B-4-4 Buffered Memory (BFM)

◆ BFM Table List for VB-1COM

VB-1COM modules exchange data with the VB series Main Units through the following BFM.

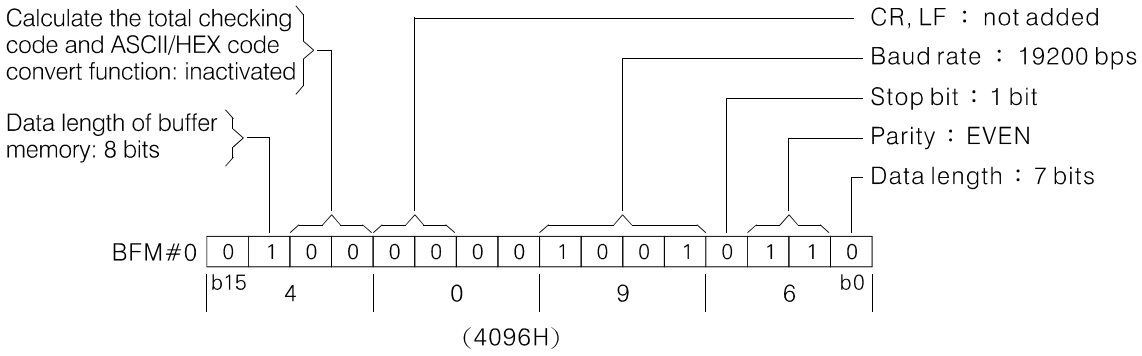
BFM Num	Name	Setting Range	Initial Value	Data Access
#0	Communication Format	—	0087H	W
#1	Command	—	0	W
#2	Upper Limit of byte num received	1 to 512 (when set buffer data length to 16 bits) 1 to 256 (when set buffer data length to 8 bits) "0" indicates "512" or "256"	0	W
#3	Receiving time-out time	0 ~ 4 byte	0	W
#4	Send start code, lower 2 bytes	0 ~ 4 byte	0 (no start code)	W
#5	Send start code, upper 2 bytes			
#6	Send end code, lower 2 bytes	0 ~ 4 byte	0 (no end code)	W
#7	Send end code, upper 2 bytes			
#8	Get start code, lower 2 bytes	0 ~ 4 byte	0 (no start code)	W
#9	Get start code, upper 2 bytes			
#10	Get end code, lower 2 bytes	0 ~ 4 byte	0 (no end code)	W
#11	Get end code, upper 2 bytes			
#13	Num of data left for sending	0 to 512 (when set buffer data length to 16 bits) 0 to 256 (when set buffer data length to 8 bits)	0	R
#14	Byte num of receive buffer memory	0 to 256	0	R
#15	Total checking code of sending data	—	0	R
#16	Total checking code of receiving data	—	0	R
#28	Status	—	0	R
#29	Error Code	—	0	R
#30	Module model ID	—	K7030	R
#1000	Byte num sent	0 to 512 (when set buffer data length to 16 bits) 0 to 256 (when set buffer data length to 8 bits)	0	W
#1001 to #1256	Send buffer	—	0	W
#2000	Byte num received	0 to 512 (when set buffer data length to 16 bits) 0 to 256 (when set buffer data length to 8 bits)	0	R
#2001 to #2256	Receive buffer	—	0	R

◆ Detailed Introduction of BFM

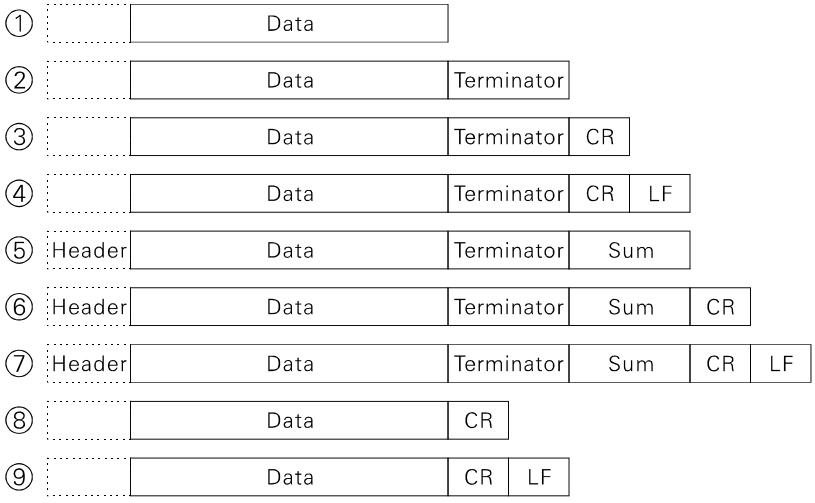
- BFN # 0: communication format

Bit	Introduction	0	1	Initial Value
b0	Data length	7 bits	8 bits	1 : 8 bits
b1 b2	Parity	(00) : None (01) : Odd (11) : Even		(11) : Even
b3	Stop bit	1 bit	2 bits	0 : 1 bit
b4 b5 b6 b7	Baud rate	(0011) : 300 (0100) : 600 (0101) : 1200 (0110) : 2400 (0111) : 4800 (1000) : 9600	(1001) : 19200 (1010) : 38400 (1011) : 76800 (1100) : 14400 (1101) : 28800 (1110) : 57600	(1000) : 9600 bps
b8 b9	Undefined	—		0 : undefined
b10 b11	Add CR and LF code	(0 0) : not used (0 1) : Add CR code only (1 1) : Add CR and LF code		(0 0) : Not add
b12 b13	Calculate total checking code and ASCII/HEX code convert	(0 0) : not used (0 1) : activate ASCII/HEX code convert function (1 0) : activate calculate total checking code function (1 1) : Activate calculate total checking code and ASCII/HEX code convert function		(0 0) : not used
b14	Data length of the send/ receive buffer memory	16 bits	8 bits	0 : 16 bits
b15	Undefined	—		0 : undefined

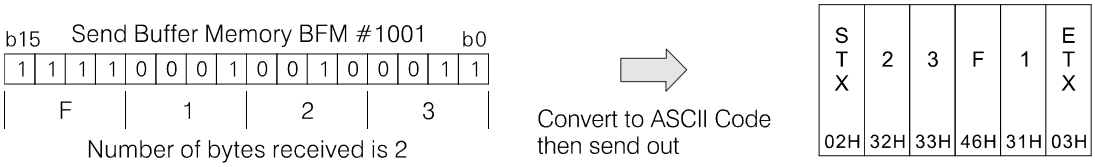
- Configuration Example of communication format (the format need to be configured based on the communication specifications of the corresponding equipment)

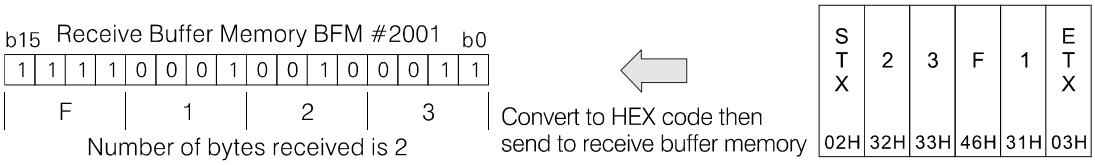


- The VB-1COM module can do the following 9 formats of serial communications



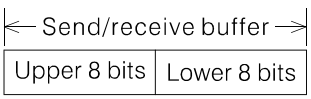
- ASCII/HEX codes convert function
  Activate the ASCII/HEX codes convert function, will first convert the HEX codes (0 ~ F) in the send buffer memory to ASCII code then send out. And the received ASCII code data will also be converted to HEX code first then store in receive buffer memory. At this time, the sent/received byte number refers to the byte number of the HEX data.
  The following example demonstrates the converting process when the send/receive data is F123H, with start code STX and end code ETX.





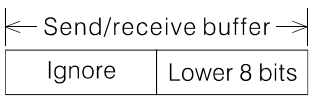
- Data Length of the send/receive buffer

When b 14 = 0, set to 16 bits.



Separate 16-bits data into lower 8-bits and upper 8 bits

When b14=1, set to 8 bits.



Take lower 8-bits of the 16-bits data as 1 group, and ignore the upper 8-bits.

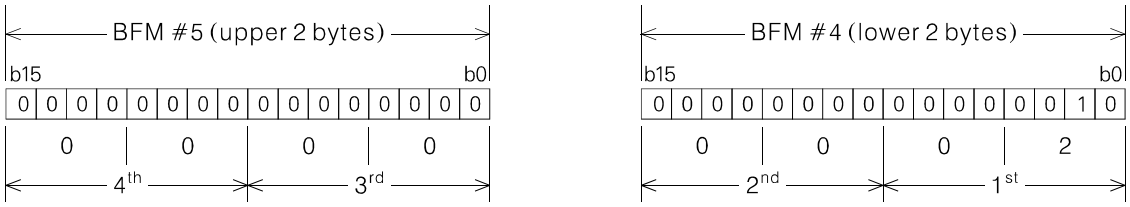
- BFM #1: Command

Bit	Name	Introduction
b0	Activate send/receive	When b0=ON, VB-1COM can send and receive data. When b0=OFF → ON, decide BFM#0 (communication format) and BFM #8 ~ #11 (receive start and end codes), and will clear BFM#28 b3 (error occurred) and BFM#29(error code). So the related data should be prepared before b0=OFFON.
b1	Start send	When b1=OFFON, will decide BFM#4 ~ 7 (send start and end codes), and start sending out the data in send buffer. And when the send completed the BFM#28 b0 (send complete) will be ON. Before giving the send start command next time, the BFM#28 b0 will be automatically cleared to OFF.
b2	Clear command when receive completed	When b2=ON, it decides BFM#8 ~ 11 (receive start code and end code), and clears BFM#28 b1 (receive completed) and the receive buffer. When data receive is completed (BFM#28 b1 turns ON), b2 must=ON, so that BFM#28 b1 will be cleared, otherwise VB-1 COM will not be able to receive the next data.
b3	Clear error	When b3=ON, BFM#28b3 (error occurs) and BFM#29 (error code) will both be cleared.

- BFM #2: the upper limit of the number of bytes received
  When the number of data bytes received in receive buffer become equal to the value of BFM #2, BFM #28 b1 (receive complete) will ON, indicates that receive completed.

- BFM #3: receive time-out time
  BFM #3 is used to set the maximum waiting time between 2 bytes in the data receive process. When the configured time past after a byte data is received, and the next byte of data has not arrived, BFM #28 b2 (receive time-out) will be ON, and the BFM #28 b1 (receive complete) will be ON too, indicate receive completed.

- BFM #5, #4: send start code
  VB-1COM can configure a 0 ~ 4 bytes send start code, when the setting value is 0, means no send start code, and this byte will not be sent. For the actual sending, the send sequence of start code is the 4^{th}, 3^{rd}, 2^{nd}, 1^{st}.
  The start code of this example is 02H (STX)



- BFM #7, #6: send end code
  VB-1COM can configure a 0 ~ 4 bytes send end code, when the setting value is 0, means no send end code. The storage format of the send end code and sending sequence is the same as the send start code.
  User has to assign a 01H ~ 1FH ASCII code to the 1^{st} byte of the send end code, and this rule does not apply to the 2^{nd}~4^{th} bytes.

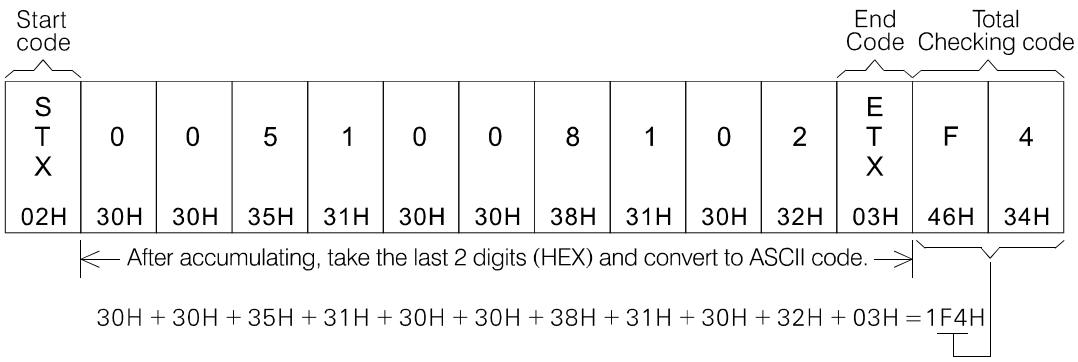
- BFM #9, #8: receive start code
  VB-1COM can configure a 0 ~ 4 bytes receive start code, when the setting value is 0, means no receive start code.
  The storage format of the receive start code is the same as the send start code.
  For the actual receiving, the receive sequence of start code is the 4^{th}, 3^{rd}, 2^{nd}, 1^{st}.

- BFM #11, #10: receive end code
  VB-1COM can configure a 0 ~ 4 bytes receive end code, when the setting value is 0, means no receive end code.
  The storage format of the receive end code and receiving sequence is the same as the receive start code.
  In the data receiving process, if the end code set by BFM #11, #10 is received, BFM #28 b1 (receive complete) will be ON to indicate receive completed.

- BFM #13: number of data left for sending
  In the data sending process, the number of data byte waiting to be sent out in the send buffer.

- BFM #14: number of data byte received in the buffer
  In the data receiving process, the number of actual data byte received in the receive buffer.

- BFM #15: total checking code of the send data
  BFM #16: total checking code of the receive data
  The calculation method of the total checking code provided by this module is as below:



- BFM #28: status

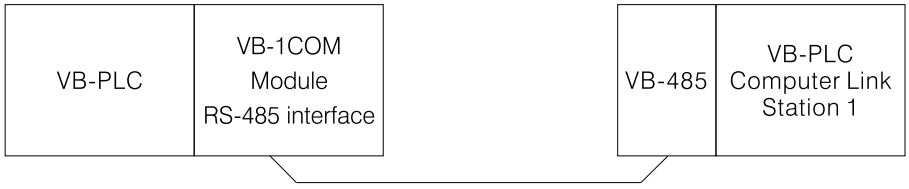
Bit	Name	Introduction
b0	Send complete	When the number of data sent out is equal to the set value of BFM#1000 (number of bytes sent), indicates send complete, and b0 turns ON. Before the next send start command (BFM#1 b1), b0 will be automatically cleared to OFF.
b1	Receive complete	Receive buffer has received the number of bytes as configured By BFM #2 (upper limit of number of bytes to receive), or the configured end code has been received, or time-out happens, VB-1COM takes as receive completes, b1 turns ON. After b1＝ON, BFM #1 b2 (receive complete clear) has to be used to clear b1 to OFF. Otherwise, VB-1COM will not be able to receive the next data.
b2	Receive time-out	BFM #3 sets the receive time-out time. When receive time-out happens, b2 turns ON. And then BFM #28 b1 will turn ON to indicate receive completed. When BFM#1 b2 (receive complete clear) command is executed, b2 will be cleared to OFF as well.
b3	Error occur	If any error happens in the data sending/receiving process, b3 will be ON, and the error code will be store into BFM #29.
b6	Data sending	From the sending start command (BFM#1 b1) is given, until sending completed (BFM #28 b0 status turns ON), b6 will be ON.
b7	Data receiving	From the first character is received, until receiving completed (BFM #28 b1 turns ON), b7 will be ON.

- BFM #28: status

Num	Introduction	Possible Causes
0	No error	—
1	Receive parity error, overrun error,framing error	Invalid communication format causes control sequence error.
2	Undefined	—
3	Defective receive character	The data received is not ASCII code.
4	Receive sum check error	The total checking code received is not equal to the calculated total checking code (BFM#16).
5	Undefined	—
6	Baud rate setting error	Configured a non-existing baud rate.
7	Receive CR error	CR is not in the correct position.
8	Receive LF error	LF is not in the correct position
9	Send/receive initial terminator setting error	The 1st byte of the end code is not within 01H～1FH range.
10	Receive terminator error	The receive end code is not in correct position or is inconsistent with the configured value.

B-4-5 Programming Example

The VB-1COM communication module is normally used to connect with devices which do not have VIGOR “M, VB and VH communication protocol” like the market sold temperature controller, frequency converter, etc.
To make it easier to understand, here use “M, VB and VH communication protocol” as example, to introduce how to use VB-1COM module to connect to VB series PLC through proper program planning. Firstly, 2 VB-PLCs are connected as shown in the diagram, the left PLC uses the RS-485 interface of its VB-1COM to connect to the VB-485 interface of the VB-1COM of the right PLC. Set the CP2 application type of the right PLC to Computer Link. Then write communication program in the left PLC using “M, VB and VH communication protocol” format, send communication command to the right PLC through the RS-485 interface of VB-1COM module, and then read/write data from/to the right PLC.



- The right side PLC has to configure CP2 parameter through CP1 by Ladder Master.
  The application type of CP2 is set to Computer Link, the baud rate is set to 19200, and the communication station number is set to 1.

- This program example will give 2 application examples for user reference, and the execution results of these 2 programs are exactly the same.

  Program example 1: make no use of the start code, end code setting and calculate total checking Code, ASCII/HEX convert functions, treat the start code, end code and check codes of the communication format as parts of the data array, then use program to analyze the data array and read/write the transmission data. Since it is a common way of connecting to other devices using VB1COM, users need to understand this example thoroughly.

  Program example 2: activate the start code, end code settings and calculate total checking codes, ASCII/HEX code convert functions provided by VB-1COM. If the communication protocol format of the devices connected to VB-1COM corresponds with the auxiliary function definition, activate the auxiliary functions can help to improve the efficiency of the written communication program.

- The 2 PLC will execute the following actions as programmed when this application example executes.

  Left (master station) PLC: read value of VR1 and store into register D111, then show the content value of register D110 on the display screen.
  Write communication program according to the “M, VB and VH communication protocol”. Read the register D0 of the right (slave station 1) PLC, and store this value into register D110. Then write the content value of register D111 to the register D1 on the right (slave station 1) PLC.

  Right (slave station 1) PLC: read value of VR1 and store into register D0, then show the content value of register D1 on the display screen.

- Since the left (master station) PLC writes communication program based on the “M, VB and VH communication protocol” and transmit data, the following result will be generated.
  The read value of VR1 on the left (master station) PLC will be shown on the display screen of the right (slave station) PLC. Change the VR1 of left PLC, can see the changes on the display screen of the right PLC.
  The read value of VR1 on the right (slave station) PLC will be shown on the display screen of the left (master station) PLC. Change the VR1 of right PLC, can see the changes on the display screen of the left PLC.

- Below is a simplified introduction of the related instructions used in this application example of "M, VB and VH communication protocol". For the detailed content of the communication protocol, please refer to the specifications in "B-5 Communication Protocol of M, VB and VH Series".

  - Parameters of the M, VB and VH communication protocol
    Data length: 7 bits (ASCII) /Parity: EVEN/Stop bit: 1 bit

  - Calculation method of the checking code

STX	Station No.		Command		Starting Add.				Length		ETX	Check Code	
	0	1	5	1	1	C	0	0	0	2		0	0
02H	30H	31H	35H	31H	31H	43H	30H	30H	30H	32H	03H	30H	30H

After accumulating, take the last 2 digits (HEX) and convert to ASCII code.

30H+31H+35H+31H+31H+43H+30H+30H+30H+32H+03H=200H

  - Communication instruction to read the value of register D0 of slave station 1 (data address: 1C00H)

Data to send to slave station 1

STX	Station No.		Command		Starting Add.				Length		ETX	Check Code	
	0	1	5	1	1	C	0	0	0	2		0	0
02H	30H	31H	35H	31H	31H	43H	30H	30H	30H	32H	03H	30H	30H

Data responded by slave station 1

ACK	Station No.		Command		Error Code		Byte 1		Byte 2		ETX	Check Code	
	0	1	5	1	0	0	16^1	16^0	16^1	16^0		16^1	16^0
06H	30H	31H	35H	31H	30H	30H					03H		

D0	16^1	16^0	16^1	16^0
	1C01		1C00	

  - Communication instruction to write data into register D1 (data address: 1C02H) on slave station 1

Data to send to slave station 1

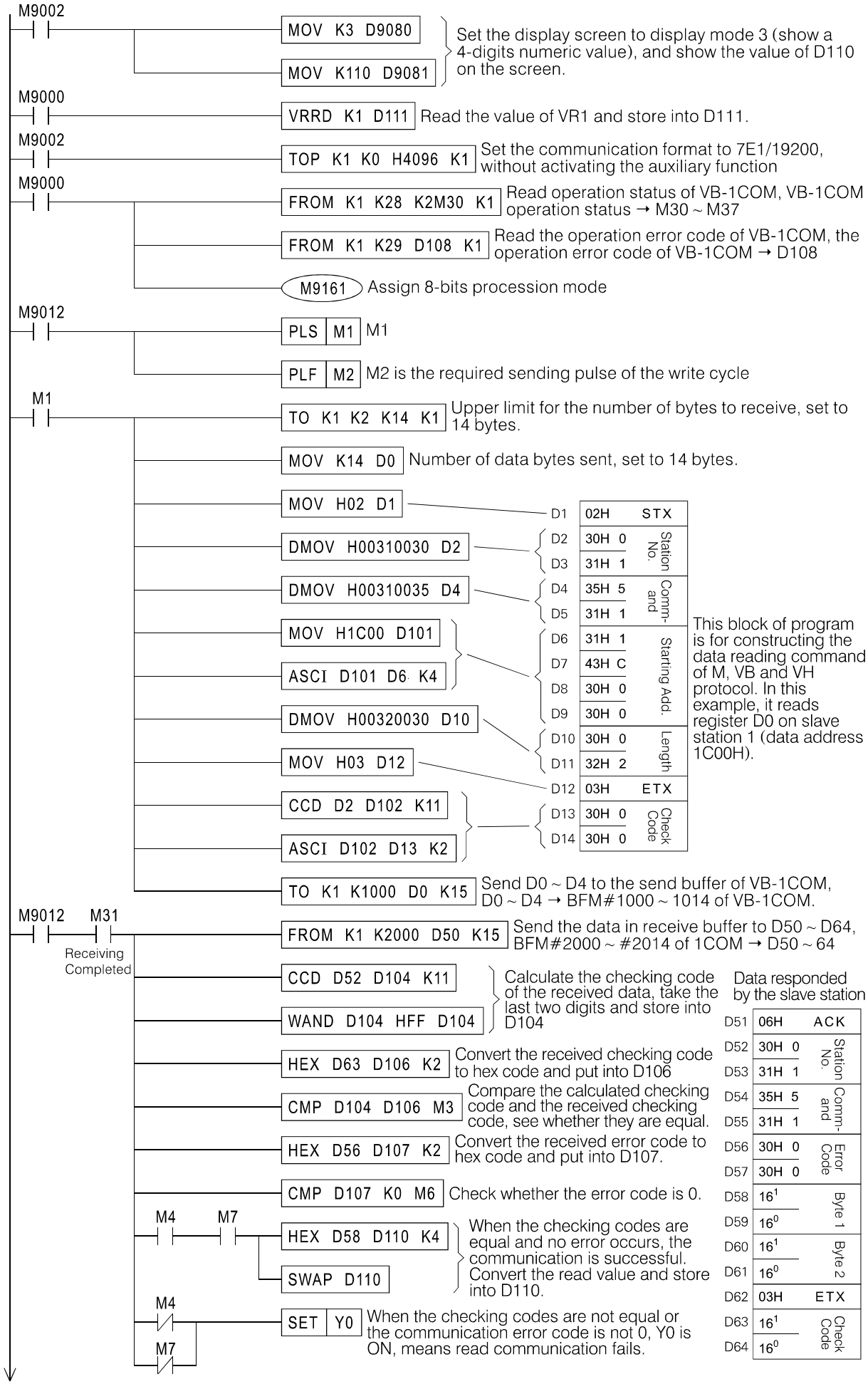
STX	Station No.		Command		Starting Add.				Length		Byte 1		Byte 2		ETX	Check Code	
	0	1	6	1	1	C	0	2	0	2	16^1	16^0	16^1	16^0		16^1	16^0
02H	30H	31H	36H	31H	31H	43H	30H	32H	30H	32H					03H		

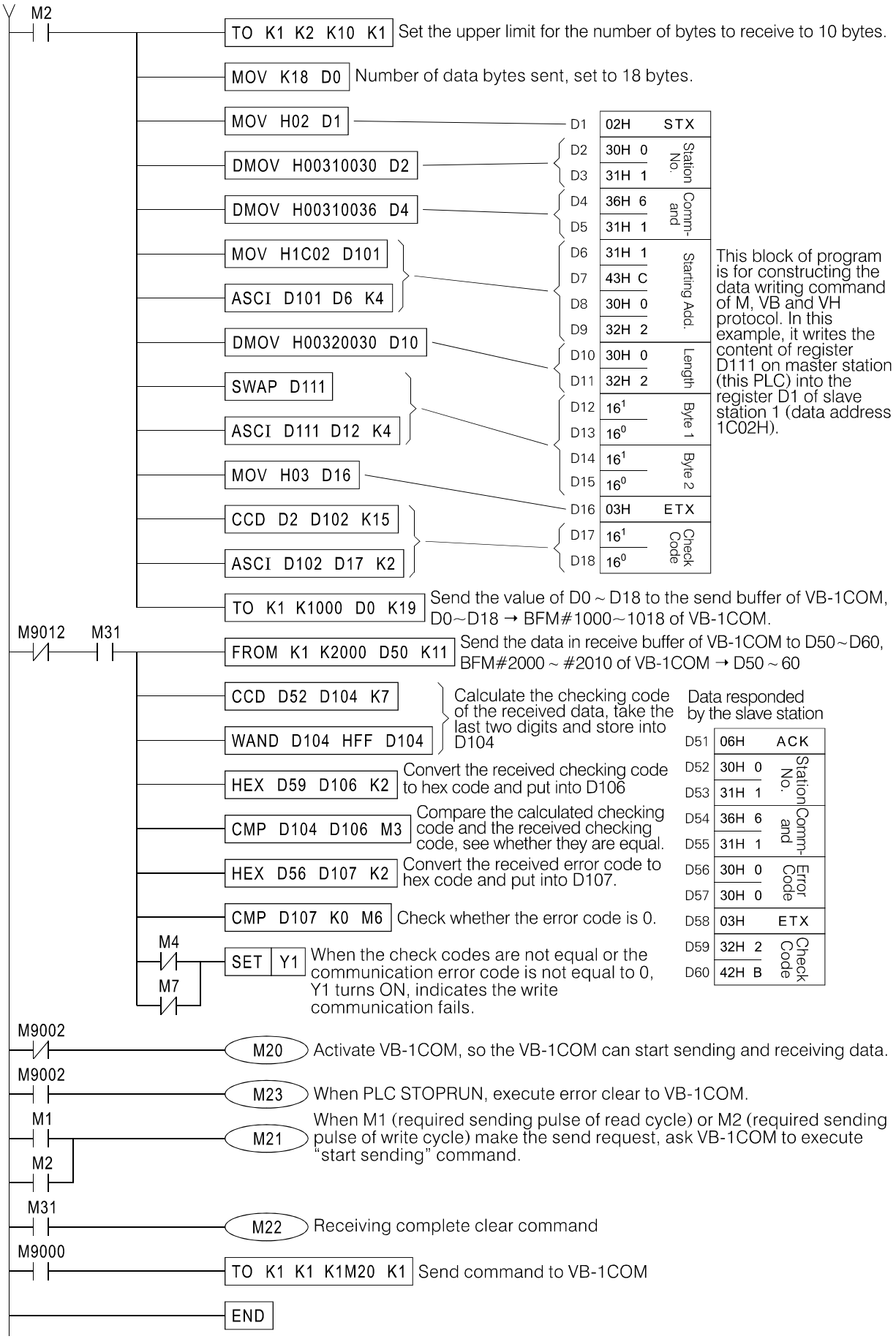
D1	16^1	16^0	16^1	16^0
	1C03		1C02	

Data responded by slave station 1

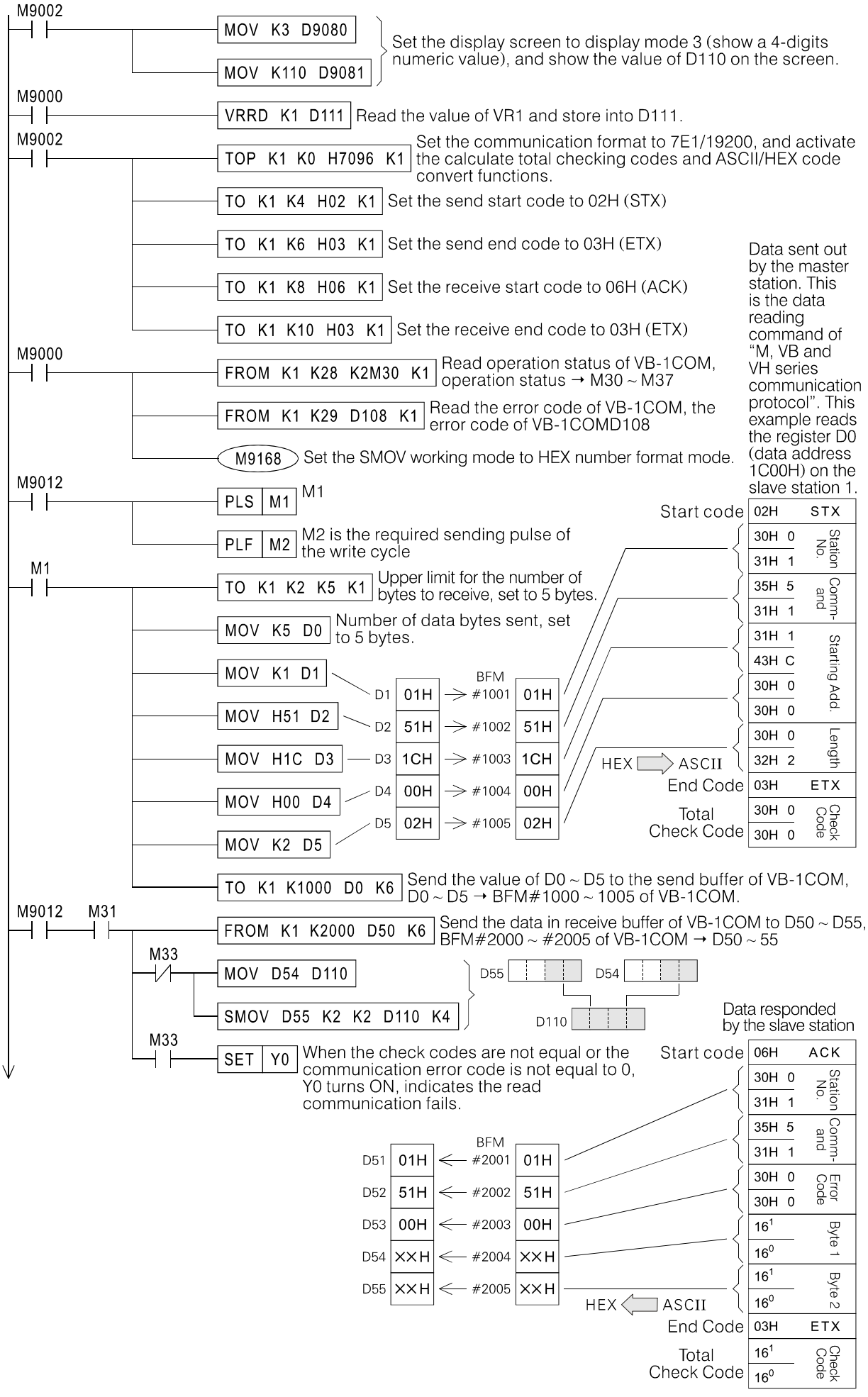
ACK	Station No.		Command		Error Code		ETX	Check Code	
	0	1	6	1	0	0		2	B
06H	30H	31H	36H	31H	30H	30H	03H	32H	42H

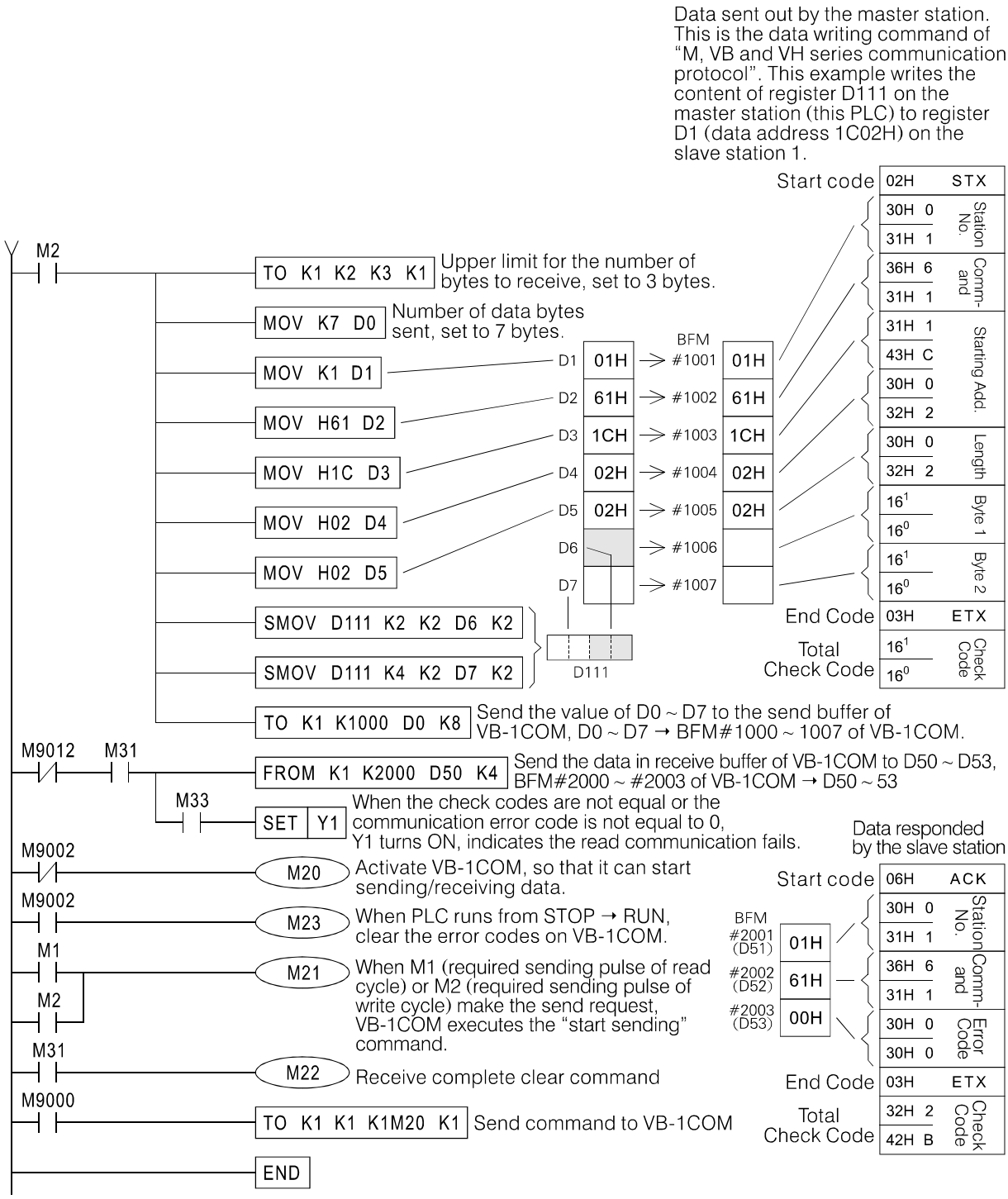
- Program example 1 of left PLC: without activating the auxiliary function



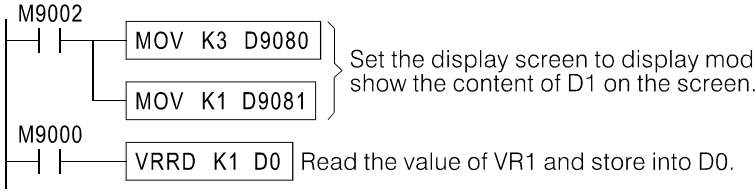

M2
TO K1 K2 K10 K1
Set the upper limit for the number of bytes to receive to 10 bytes.
MOV K18 D0
Number of data bytes sent, set to 18 bytes.
MOV H02 D1
DMOV H00310030 D2
DMOV H00310036 D4
MOV H1C02 D101
ASCI D101 D6 K4
DMOV H00320030 D10
SWAP D111
ASCI D111 D12 K4
MOV H03 D16
CCD D2 D102 K15
ASCI D102 D17 K2
D1 02H STX
D2 30H 0
D3 31H 1
Station No.
D4 36H 6
D5 31H 1
Comm-and
D6 31H 1
D7 43H C
D8 30H 0
D9 32H 2
Starting Add.
D10 30H 0
D11 32H 2
Length
D12 16^1
D13 16^0
Byte 1
D14 16^1
D15 16^0
Byte 2
D16 03H ETX
D17 16^1
D18 16^0
Check Code
This block of program is for constructing the data writing command of M, VB and VH protocol. In this example, it writes the content of register D111 on master station (this PLC) into the register D1 of slave station 1 (data address 1C02H).
TO K1 K1000 D0 K19
Send the value of D0 ~ D18 to the send buffer of VB-1COM, D0~D18 → BFM#1000~1018 of VB-1COM.
M9012 M31
FROM K1 K2000 D50 K11
Send the data in receive buffer of VB-1COM to D50~D60, BFM#2000 ~ #2010 of VB-1COM → D50 ~ 60
CCD D52 D104 K7
WAND D104 HFF D104
Calculate the checking code of the received data, take the last two digits and store into D104
HEX D59 D106 K2
Convert the received checking code to hex code and put into D106
CMP D104 D106 M3
Compare the calculated checking code and the received checking code, see whether they are equal.
HEX D56 D107 K2
Convert the received error code to hex code and put into D107.
CMP D107 K0 M6
Check whether the error code is 0.
M4
M7
SET Y1
When the check codes are not equal or the communication error code is not equal to 0, Y1 turns ON, indicates the write communication fails.
Data responded by the slave station
D51 06H ACK
D52 30H 0
D53 31H 1
Station No.
D54 36H 6
D55 31H 1
Comm-and
D56 30H 0
D57 30H 0
Error Code
D58 03H ETX
D59 32H 2
D60 42H B
Check Code
M9002
M20
Activate VB-1COM, so the VB-1COM can start sending and receiving data.
M9002
M23
When PLC STOPRUN, execute error clear to VB-1COM.
M1
M2
M21
When M1 (required sending pulse of read cycle) or M2 (required sending pulse of write cycle) make the send request, ask VB-1COM to execute "start sending" command.
M31
M22
Receiving complete clear command
M9000
TO K1 K1 K1M20 K1
Send command to VB-1COM
END

- Left PLC Program Example 2: activate auxiliary function





- Program of right side (slave station) PLC



MEMO

B-5 Communication Protocol of M, VB and VH Series

B-5-1 Communication Parameters

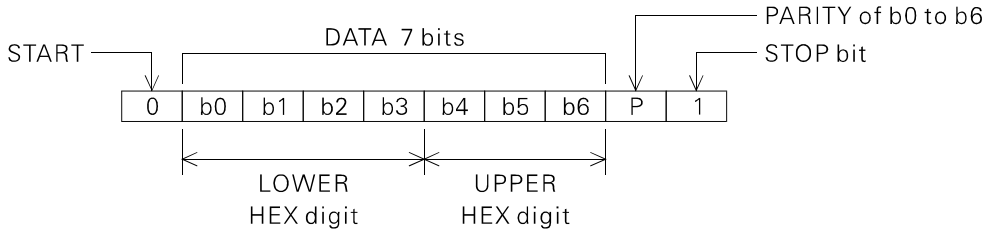
- Data length: 7 bits (ASCII)

  Parity: EVEN

  Stop bit: 1 bit

  Baud rate: the PLC built-in CP1 is fixed to 19200 bps
  User can select any of 4800/9600/19200/38400 bps for CP2 by Ladder Master.
  CP3 is fixed to 19200 bps.

- Format of communication syntax



- This communication protocol use ASCII Code to transmit data, the table below lists the possible characters and the corresponding ASCII Codes.

Character	ASCII Code
STX	02H
ETX	03H
ACK	06H

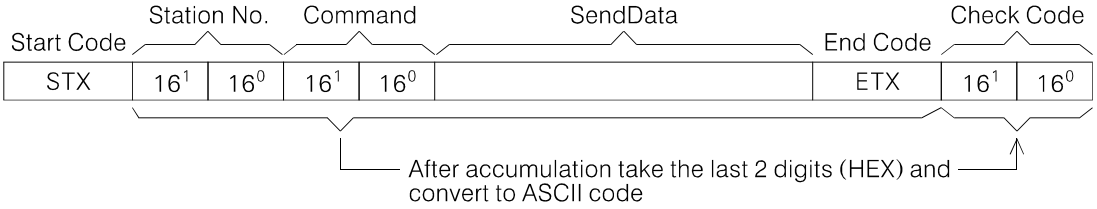
Character	ASCII Code
0	30H
1	31H
2	32H
3	33H
4	34H
5	35H
6	36H
7	37H

Character	ASCII Code
8	38H
9	39H
A	41H
B	42H
C	43H
D	44H
E	45H
F	46H

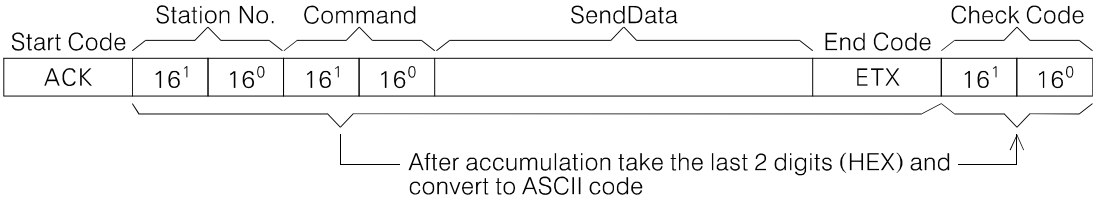
- Communication station number: PLC built-in CP1 is fixed to be number 0.
  User can select any of the range 0 ~ 255 by Ladder Master for CP2.
  CP3 is set using the rotary switch on the left side of VB-CADP module, the range is 0~99.

B-5-2 Communication Protocol Data Format

- The communication format to PLC



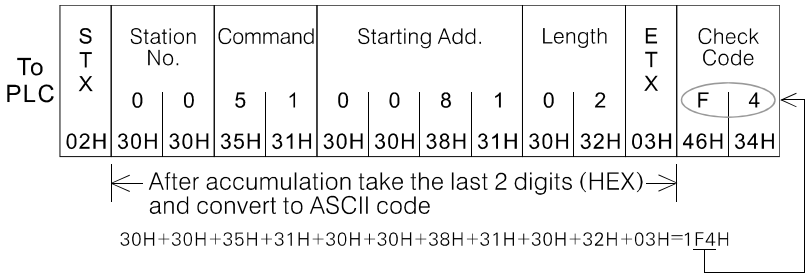
- The communication format to PLC



- Start code: starting character of data to transfer. The start code when send command to PLC is ASCII code STX (02H) and the start code when PLC send back data is ASCII code ACK (06H).
- Station Number: the identification number of the data transfer target. Every PLC in the communication circuit needs to have a station number. And when computer give communication command to PLC, it uses station number to identify which PLC is the target.
- Command: the computer command PLC to do the assigned tasks.

Command	Command code	Target Component	Introduction
Serial Data Read	51H	X、Y、M、S、T、C、D	Continuously read the bit component status or register value
Serial Data Write	61H	X、Y、M、S、T、C、D	Continuously write the bit component status or register value
Bit Component ON	70H	X、Y、M、S	Set the appointed component to ON
Bit Component OFF	71H	X、Y、M、S	Set the appointed component to OFF

- Data to Send: the content of the data to send. It may includes error code, data address, length of data to send, content of data to send, etc.
- End Code: the end bit of the data to send. The end code is ASCII code ETX (03H).
- Check Code: accumulate the data value from the station number until the end code, then take the last 2 digits (HEX) and convert to ASCII code as the checking code. Execute the same checking code processing operation at both the data sending side and the data receiving side, in order to ensure the transmit data is correct.



- Error Code: there will be an error code information in the data sent back by PLC to computer, and the table below lists the meaning of each error code.

Error Code	Details
00H	Communication no error
10H	ASCII converting error
11H	Communication SUM Check Error
12H	No such command
14H	Communication Error like STOP, Parity Error
28H	Data address exceeds range

B-5-3 Communication Instructions

- The table of component ID and the corresponding communication data addresses.

Component Name	Component ID	Data Address	Data Content							
			b7	b6	b5	b4	b3	b2	b1	b0
Input Relay X	X0～X7	0000	X7	X6	X5	X4	X3	X2	X1	X0
	≀	≀	≀							
	X770～X777	003F	X777	X776	X775	X774	X773	X772	X771	X770
Output Relay Y	Y0～Y7	0040	Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0
	≀	≀	≀							
	Y770～Y777	007F	Y777	Y776	Y775	Y774	Y773	Y772	Y771	Y770
Auxiliary Relay M	M0～M7	0080	M7	M6	M5	M4	M3	M2	M1	M0
	≀	≀	≀							
	M5112～M5119	02FF	M5119	M5118	M5117	M5116	M5115	M5114	M5113	M5112
Step Relay S	S0～S7	0300	S7	S6	S5	S4	S3	S2	S1	S0
	≀	≀	≀							
	S992～S999	037C	S999	S998	S997	S996	S995	S994	S993	S992
Timer Contact	T0～T7	0380	T7	T6	T5	T4	T3	T2	T1	T0
	≀	≀	≀							
	T248～T255	039F	T255	T254	T253	T252	T251	T250	T249	T248
Counter Contact	C0～C7	03A0	C7	C6	C5	C4	C3	C2	C1	C0
	≀	≀	≀							
	C248～C255	03BF	C255	C254	C253	C252	C251	C250	C249	C248
Special Relay M9000 ≀ M9255	M9000～M9007	03E0	M9007	M9006	M9005	M9004	M9003	M9002	M9001	M9000
	≀	≀	≀							
	M9248～M9255	03FF	M9255	M9254	M9253	M9252	M9251	M9250	M9249	M9248
Timer Coil	T0～T7	0780	T7	T6	T5	T4	T3	T2	T1	T0
	≀	≀	≀							
	T248～T255	079F	T255	T254	T253	T252	T251	T250	T249	T248
Counter Coil	C0～C7	07A0	C7	C6	C5	C4	C3	C2	C1	C0
	≀	≀	≀							
	C248～C255	07BF	C255	C254	C253	C252	C251	C250	C249	C248
Timer Current Value	T0	1400	T0 MSB 16^1 16^0 16^1 16^0 LSB 1401 1400							
		1401								
	≀	≀								
	T255	15FE								
		15FF								
Special register D9000 ≀ D9255	D9000	1600	D9000 MSB 16^1 16^0 16^1 16^0 LSB 1601 1600							
		1601								
	≀	≀								
	D9255	17FE								
		17FF								
C0 ≀ C199 Current Value	C0	1800	C0 MSB 16^1 16^0 16^1 16^0 LSB 1801 1800							
		1801								
	≀	≀								
	C199	198E								
		198F								
C200 ≀ C255 Current Value	C200	1A00	C200 MSB 16^1 16^0 16^1 16^0 16^1 16^0 16^1 16^0 LSB 1A03 1A02 1A01 1A00							
		1A03								
	≀	≀								
	C255	1ADC								
		1ADF								
D0 ≀ D8191 Content Value	D0	1C00	D0 MSB 16^1 16^0 16^1 16^0 LSB 1C01 1C00							
		1C01								
	≀	≀								
	D8191	5BFE								
		5BFF								

- Command Number 51H: continuous data read command (can read 128 bytes at most)

To PLC

STX	Station No.		Command		Starting Add.				Length (Bytes)		ETX	Check Code	
	16^1	16^0	16^1	16^0	16^3	16^2	16^1	16^0	16^1	16^0		16^1	16^0

From PLC

ACK	Station No.		Command		Error Code		Byte 1 data		Byte 2 data		∫∫	Last data Byte		ETX	Check Code	
	16^1	16^0	16^1	16^0	16^1	16^0	16^1	16^0	16^1	16^0	∫∫	16^1	16^0		16^1	16^0

Example 1: read the status value of M8 ~ M23

Suppose that the status of M8 ~ M23 of the PLC are as below:

M23								M16	M15						M8
1	0	0	1	0	0	1	1	1	0	1	0	0	1	1	1
9				3				A				7			

To PLC

STX	Station No.		Command		Starting Add.				Length		ETX	Check Code	
	0	0	5	1	0	0	8	1	0	2		F	4
02H	30H	30H	35H	31H	30H	30H	38H	31H	30H	32H	03H	46H	34H

From PLC

ACK	Station No.		Command		Error Code		Byte 1		Byte 2		ETX	Check Code	
	0	0	5	1	0	0	A	7	9	3		0	D
06H	30H	30H	35H	31H	30H	30H	41H	37H	39H	33H	03H	30H	44H

Example 2: read the content value of D1, D2

Suppose the content value of D1 of the PLC is 1234H, and the content value of D2 is ABCDH.

To PLC

STX	Station No.		Command		Starting Add.				Length		ETX	Check Code	
	0	0	5	1	1	C	0	2	0	4		0	3
02H	30H	30H	35H	31H	31H	43H	30H	32H	30H	34H	03H	30H	33H

From PLC

ACK	Station No.		Command		Error Code		Byte 1		Byte 2		Byte 3		Byte 4		ETX	Check Code	
	0	0	5	1	0	0	3	4	1	2	C	D	A	B		F	D
06H	30H	30H	35H	31H	30H	30H	33H	34H	31H	32H	43H	44H	41H	42H	03H	46H	44H

● Command Number 61H: continuous data write command (can write 128 bytes at most)

To PLC

STX	Station No.		Command		Starting Add.				Length (Bytes)		Byte 1 data		Byte 2 data		⟅⟆	Last data Byte		ETX	Check Code	
	16^1	16^0	16^1	16^0	16^3	16^2	16^1	16^0	16^1	16^0	16^1	16^0	16^1	16^0		16^1	16^0		16^1	16^0

From PLC

ACK	Station No.		Command		Error Code		ETX	Check Code	
	16^1	16^0	16^1	16^0	16^1	16^0		16^1	16^0

Example 1: write into Y30 ~ Y47

Suppose that the status of Y30 ~ Y47 of the PLC to be written are as below:

Y47							Y40	Y37							Y30
0	0	1	1	1	1	1	0	1	1	0	0	0	1	1	0
3				E				C				6			

To PLC

STX	Station No.		Command		Starting Add.				Length		Byte 1		Byte 2		ETX	Check Code	
	0	0	6	1	0	0	4	3	0	2	C	6	3	E		E	4
02H	30H	30H	36H	31H	30H	30H	34H	33H	30H	32H	43H	36H	33H	45H	03H	45H	34H

From PLC

ACK	Station No.		Command		Error Code		ETX	Check Code	
	0	0	6	1	0	0		2	A
06H	30H	30H	36H	31H	30H	30H	03H	32H	41H

Example 2: write A325H into the register D1 of the PLC

To PLC

STX	Station No.		Command		Starting Add.				Length		Byte 1		Byte 2		ETX	Check Code	
	0	0	6	1	1	C	0	2	0	2	2	5	A	3		D	D
02H	30H	30H	36H	31H	31H	43H	30H	32H	30H	32H	32H	35H	41H	33H	03H	44H	44H

From PLC

ACK	Station No.		Command		Error Code		ETX	Check Code	
	0	0	6	1	0	0		2	A
06H	30H	30H	36H	31H	30H	30H	03H	32H	41H

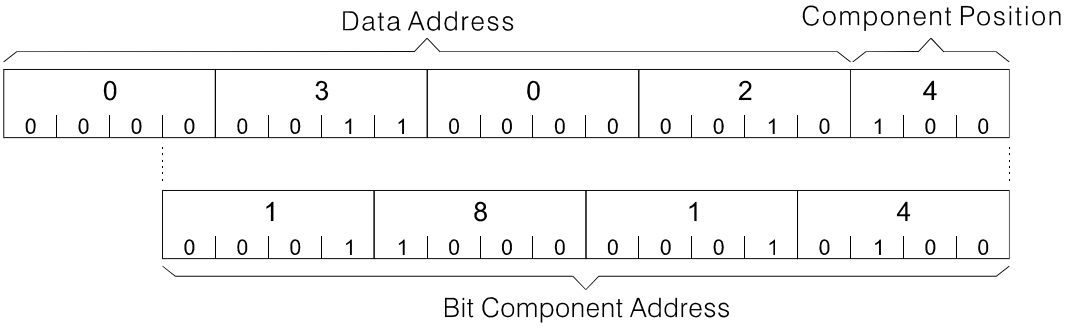
- Command Number 70H: bit component ON command
  Command Number 71H: bit component OFF command

To PLC

STX	Station No.		Command		Bit Component Address				ETX	Check Code	
	16^1	16^0	16^1	16^0	16^3	16^2	16^1	16^0		16^1	16^0

The bit component address consists of the data address and the big component position. Here use S20 as example to explain below:
Bit component is S20 (S)20÷8=2…4。

The component position of S20 is 4
The data address of S0 is 0300H
The data address of S20 is 0300H + 2H = 0302H



From PLC

ACK	Station No.		Command		Error Code		ETX	Check Code	
	16^1	16^0	16^1	16^0	16^1	16^0		16^1	16^0

Example 1: set M10 to ON

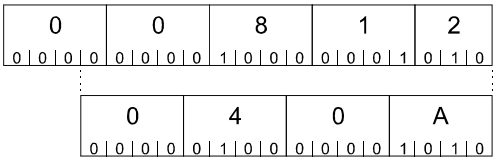
To PLC

STX	Station No.		Command		Bit Component Address				ETX	Check Code	
	0	0	7	0	0	4	0	A		9	F
02H	30H	30H	37H	30H	30H	34H	30H	41H	03H	39H	46H

From PLC

ACK	Station No.		Command		Error Code		ETX	Check Code	
	0	0	7	0	0	0		2	A
06H	30H	30H	37H	30H	30H	30H	03H	32H	41H

Calculate the bit component address of M10:
(M) 10 / 8 = 1…2
The data address of M0 is 0080H, and the data address of M10 is 0080H + 1H = 0081H
0080H+1H=0081H



Example 2: set M1000 to OFF

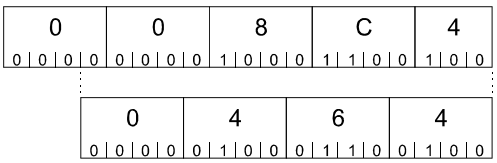
To PLC

STX	Station No.		Command		Bit Component Address				ETX	Check Code	
	0	0	7	1	0	4	6	4		9	9
02H	30H	30H	37H	31H	30H	34H	36H	34H	03H	39H	39H

From PLC

ACK	Station No.		Command		Error Code		ETX	Check Code	
	0	0	7	1	0	0		2	B
06H	30H	30H	37H	31H	30H	30H	03H	32H	42H

Calculate the bit component address of M100:
(M) 10 / 8 = 12…4
The data address of M0 is 0080H, and the data address of M10 is 0080H + CH = 008CH



MEMO

MEMO