L510 MODBUS
Communication protocol

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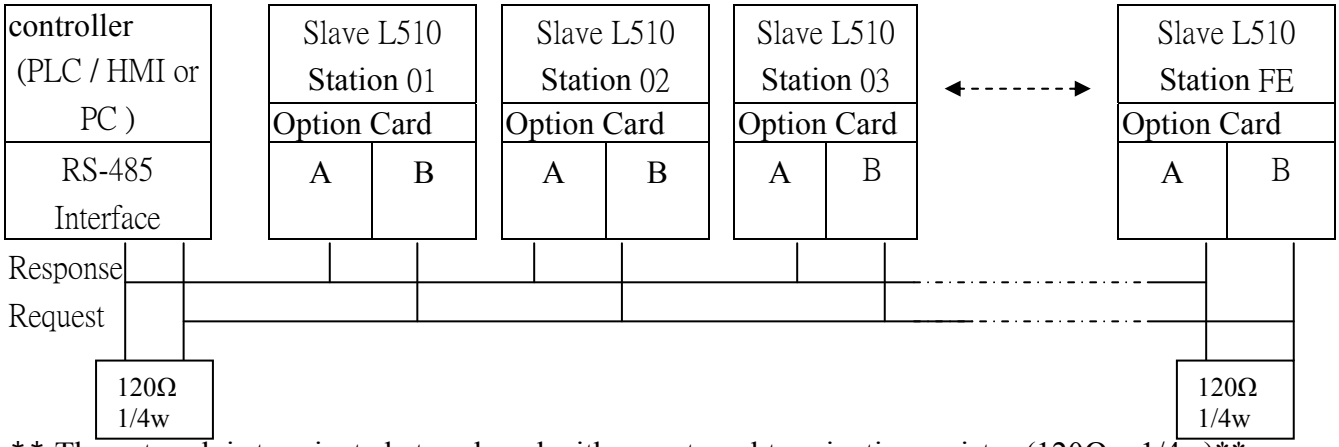
1. Communication Data Frame

L510series inverter can be Communication controlled by the PC or other controller with the Communication protocol, Modbus ASCII Mode & Mode RTU, RS485 or RS232. Frame length maximum 80 bytes.

1.1 Hardware installation



** The network is terminated at each end with an external terminating resistor (120Ω， 1/4w)**

1.2 Data format ASCII MODE

STX(3AH)	Start bit = 3AH
Address Hi Address Lo	Communication Address(Station): 2-digit ASCII Code
Function Hi Function Lo	Function Code (command): 2-digit ASCII Code
Command Start Address Command Start Address Command Start Address Command Start Address	command Start byte: 4-digit ASCII Code
Data length Data length Data length Data length	The length of the command: 4-digit ASCII Code
LRC Check Hi LRC Check Lo	LRC Check Code: 2-digit ASCII Code
END Hi END Lo	End Byte : END Hi = CR(0DH) , END Lo= LF(0AH)

MASTER(PLC etc.) send request to SLAVE, whereas response to MASTER.
The signal receiving is illustrated here.
The data length is varied with the command(Function).

SLAVE Address
Function Code
DATA
CRC CHECK
Signal Interval

** The interval should be maintained at 10ms between command signal and request.

1.3 SLAVE(Address)

```
00H : Broadcast to all the drivers
01H : to the No.01 Drivers
0FH : to the No.15 Drivers
10H : to the No.16 Drivers
and so on...., Max to 32(20H)
```

1.4 Function Code

03H : Read the register contents
06H : write a WORD to register
08H : Loop test
10H : write several data to register(complex number register write)

2.CMS (Checksum and time-out definition)

2.1 LRC CHECK

ex: ADDRESS 01H
FUNCTION 03H
COMMAND 01H
00H
DATA LENGTH 0AH

0FH----------true complement

Checksum = F1H
CS(H) = 46H (ASCII)
CS(L) = 31H (ASCII)

2.2 CRC CHECK: CRC Check Code is calculated from SLAVE Address to end of the data. The calculation method is illustrated as follow:

(1). Load a 16-bit register with FFFF hex (all's1).Call this the CRC register.

(2). Exclusive OR the first 8-bit byte of the message with the low-order byte of the 16-bit CRC register, putting the result in the CRC register.

(3). Shift the CRC register one bit to the right (toward the LSB), Zero-filling the MSB, Extract and examines the LSB.

(4). (If the LSB was 0): Repeat Steps(3)(another shift). (If the LSB was 1): Exclusive OR the CRC register with the polynomial value A001 hex (1010 0000 0000 0001), putting the result in the CRC register.

(5). Repeat Steps (3) and (4) until 8 shifts been performed. When this is done, a complete 8-bit byteWill be processed .

(6). Repeat Steps (2) through (5) for next 8-bit byte of the message, Continue doing this until all bytes have been processed. The final content of the CRC register is the CRC value. Placing the CRC into the message: When the 16-bit CRC (2 8-bit bytes) is transmitted in the message, the Low-order byte will be transmitted first, followed by the high-order byte, For example, if the CRC value is 1241 hex, the CRC-16 Upper put the 41h, the CRC-16 Lower put the 12h.

- CRC calculation application program

```
UWORD ch_sum ( UBYTE long , UBYTE *rxdbuff )
{
    BYTE i = 0;
    UWORD wkg = 0xFFFF;
    while ( long-- )
    {
      wkg ^= rxdbuff++;
      for ( i = 0 ; i < 8; i++ )
      {
         if ( wkg & 0x0001 )
         {
           wkg = ( wkg >> 1 ) ^ 0xa001;
         }
         else
         {
           wkg = wkg >> 1;
         }
      }
   }
   return( wkg );
}
```

3.Error code

ASCII Mode

STX	‘:’
Address	‘0’
	‘1’
Function	‘8’
	‘6’
Exception code	‘5’
	‘1’
LRC Check	‘2’
	‘8’
END	‘CR’
	‘LF’

RTU Mode

SLAVE Address		02H
Function		83H
Exception code		52H
CRC-16	High	C0H
	Low	CDH

Under communication linking, the driver responses the Exception Code and send Function Code AND 80H to main system if there is error happened.

Error Code	Description
51	Function Code Error
52	Address Error
53	Data Amount Error
54	DATA Over Range
55	Writing Mode Error

4 Inverter Control

4.1Command Data (Readable and Writable)

Register No.	Bit	Content
2500H	Reserved	
2501H		Operation Signal
	0	Operation Command 1 : Run 0 : Stop
	1	Reverse Command 1 :Reverse 0 :Forward
	2	Abnormal 1 : EF0
	3	Fault Reset 1 : Reset
	4	Jog Forward Command 1 : Jog Forward
	5	Jog Reverse Command 1 : Jog Reverse
	6	Multi-function CommandS1 1 :“ON” 0:“OFF”
	7	Multi-function CommandS2 1 :“ON” 0:“OFF”
	8	Multi-function CommandS3 1 :“ON” 0:“OFF”
	9	Multi-function CommandS4 1 :“ON” 0:“OFF”
	A	Multi-function CommandS5 1 :“ON” 0:“OFF”
	B	Reserved
	C	Relay R1 1 :“ON” 0:“OFF”
	D	Reserved
	E~F	Reserved
2502H	Frequency Command	
2503~251FH	Reserved	

Note: Write in zero for Not used BIT, do not write in data for the reserved register.

4.2Monitor Data(Only for reading)

Register No.			Bit	Content
2520H				
			0	Operation state 1 : Run 0 : Stop
			1	Direction state 1 : Reverse 0 : Forward
			2	Inverter operation prepare state 1:ready 0 : unready
			3	Abnormal 1 : Abnormal
			4	DATA setting error 1 : Error
			5-F	Reserved

Register No.	Content			
2521H		abnormity		
	00	The inverter is normal	20	Over current during decelerating)(OC-D)
	01	Inverter over heat)(OH)	21	(OC_S)
	02	Over current at stop)(OC)	22	Reserved
	03	Under voltage(LV)	23	Under voltage during running(LV-C)
	04	Over voltage)(OV)	24	Over voltage at constant speed(OV-C)
	05	Reserved	25	Inverter over heat during running(OH-C)
	06	External BB(bb)	26	stop at 0 Hz(STP0)
	07	(CTER)	27	Direct start disable)(STP1)
	08	(PDER)	28	Control panel emergency stop(STP2)
	09	(EPR)	29	Keypad operation error)(Err1)
	10	(ATER)	30	Parameter setting error(Err2)
	11	(OL3)	31	(Err4)
	12	Inverter over load(OL2)	32	Communication failure) (Err5)
	13	Motor over load(OL1)	33	Communication failure(Err6)
	14	(EFO)	34	(Err7)
	15	External bb E.S)	35	(Err8)
	16	(LOC)	36	Reserved
	17	Reserved	37	Reserved
	18	Over voltage at constant speed (OC-C)	38	(EPR1)
	19	Over current during accelerating)(OC-A)	39	(EPR2)
	40	Inverter over speed(OVSP)		
2522H		Sequence input status		
	0	Terminal S1 1 :“ON” 0:“OFF”		
	1	Terminal S2 1 :“ON” 0:“OFF”		
	2	Terminal S3 1 :“ON” 0:“OFF”		
	3	Terminal S4 1 :“ON” 0:“OFF”		
	4	Terminal S5 1 :“ON” 0:“OFF”		
	5	Reserved		
		Contact output		
	6	Reley R1 1 :“ON” 0:“OFF”		
	7	Reserved		
	9~F	Reserved		

Register No.	Content
2523H	frequency command(100/1Hz)
2524H	Output frequency (100/1Hz)
2525H	Output voltage command (10/1V)
2526H	DC voltage command (1/1V)
2527H	Output current (10/1A)
2528H	reserved
2529H	reserved
252AH	PID feedback (100% / fmax , 10/1%)
252BH	PID input (100% / fmax, 10/1%)
252CH	TM2 AVI input value (1000 / 10V) *1
252DH	TM2 ACI input value (1000 / 10V) *1
252EH-~ 252FH	reserved

4.3Read the data in the holding register [03H]

Master unit reads the contents of the holding register with the continuous number for the specified quantity.

Note:1、Limit number of read data，RTU: 37，ASCII:17.

2、Can only Continuous read the address of the same Group

3、Read data Quantity≥1.

(Example) Read the SLAVE station No:01 ,L510 drive's frequency command.

ASCII Mode

Instruction Message

3AH	STX
30H	SLAVE Address
31H	
30H	Function Code
33H	
41H	Start Address
30H	
32H	
33H	
30H	Quantity
30H	
30H	
31H	
?	LRC CHECK
?	
0DH	END
0AH	

Response Message (Normal)

3AH	STX
30H	SLAVE Address
31H	
30H	Function Code
33H	
30H	DATA Number
32H	
31H	First holding register
37H	
37H	
30H	
?	LRC CHECK
?	
0DH	END
0AH	

Response(Fault)

3AH	STX
30H	SLAVE Address
31H	
38H	Function Code
33H	
35H	Error Code
32H	
?	LRC CHECK
?	
0DH	END
0AH	

RTU Mode

Instruction Message

SLAVE Address		01H
Function Code		03H
Start Address	High	A0H
	Low	23H
Quantity	High	00H
	Low	01H
CRC-16	High	57H
	Low	C0H

Response Message (Normal)

SLAVE Address		01H
Function Code		03H
DATA Number		02H
First holding register	High	07H
	Low	D0H
CRC-16	High	BBH
	Low	E8H

Response(Fault)

SLAVE Address		01H
Function Code		83H
Error Code		52H
CRC-16	High	C0H
	Low	CDH

4.4 LOOP BACK testing [08H]

The function code checks communication between MASTER and SLAVE, the Instruction message is returned as a response message without being changed, Any values can be used for test codes or data.

ASCII Mode

Instruction Message

3AH	STX
30H	SLAVE Address
31H	
30H	Function Code
38H	
30H	Test Code
30H	
30H	
30H	
41H	DATA
35H	
33H	
37H	
31H	LRC CHECK
42H	
0DH	END
0AH	

Response Message (Normal)

3AH	STX
30H	SLAVE Address
31H	
30H	Function Code
38H	
30H	Test Code
30H	
30H	
30H	
41H	DATA
35H	
33H	
37H	
31H	LRC CHECK
42H	
0DH	END
0AH	

Response(Fault)

3AH	STX
30H	SLAVE Address
31H	
38H	Function Code
38H	
32H	Error Code
30H	
37H	LRC CHEC
35H	
0DH	END
0AH	

RTU Mode

Instruction Message

SLAVE Address		01H
Function Code		08H
Test Code	High	00H
	Low	00H
DATA	High	A5H
	Low	37H
CRC-16	High	DAH
	Low	8DH

Response Message (Normal)

SLAVE Address		01H
Function Code		08H
Test Code	High	00H
	Low	00H
DATA	High	A5H
	Low	37H
CRC-16	High	DAH
	Low	8DH

Response(Fault)

SLAVE Address		01H
Function Code		88H
Error Code		20H
CRC-16	High	47H
	Low	D8H

4.5 Write holding register [06H]

Specified data are written into the several specified holding registers from the Specified respectively.

(Example)Set SLAVE station No:01, writeL510 drive frequency reference 60.0HZ.

ASCII Mode

Instruction Message

3AH	STX
30H	SLAVE Address
31H	
30H	Function Code
36H	
41H	Start Address
30H	
30H	
32H	
31H	DATA
37H	
37H	
30H	
?	LRC CHECK
?	
0DH	END
0AH	

Response Message (Normal)

3AH	STX
30H	SLAVE Address
31H	
30H	Function Code
36H	
41H	Start Address
30H	
30H	
32H	
31H	DATA
37H	
37H	
30H	
?	LRC CHECK
?	
0DH 0AH	END

Response(Fault)

3AH	STX
30H	SLAVE Address
31H	
38H	Function Code
36H	
35H	Error Code
32H	
?	LRC CHECK
?	
0DH	END
0AH	

RTU Mode

Instruction Message

SLAVE Address		01H
Function Code		06H
Start Address	High	A0H
	Low	02H
DATA	High	17H
	Low	70H
CRC-16	High	04H
	Low	1EH

Response Message (Normal)

SLAVE Address		01H
Function Code		06H
Start Address	High	A0H
	Low	02H
DATA	High	17H
	Low	70H
CRC-16	High	04H
	Low	1EH

Response(Fault)

SLAVE Address		01H
Function Code		86H
Error Code		52H
CRC-16	High	C3H
	Low	9DH

4.6 Write in several holding registers [10H]

Specified data are written into the several specified holding registers from the Specified number, respectively.

Note:1、Limit number of read data，RTU: 35，ASCII:15.

2、Can only Continuous read the address of the same Group.

3、Read data Quantity≥1.

(Example)Set SLAVE station No:01, L510 drive as forward run at frequency reference 60.0HZ.

ASCII Mode

Instruction Message

3AH	STX
30H	SLAVE Address
31H	
31H	Function Code
30H	
41H	Start Address
30H	
30H	
31H	
30H	Quantity
30H	
30H	
32H	
30H	DATA Number *
34H	
30H	First DATA
30H	
30H	
31H	
31H	Next DATA
37H	
37H	
30H	
?	LRC CHECK
?	
0DH	END
0AH	

Response Message (Normal)

3AH	STX
30H	SLAVE Address
31H	
31H	Function Code
30H	
41H	Start Address
30H	
30H	
31H	
30H	Quantity
30H	
30H	
32H	
?	LRC CHECK
?	
0DH	END
0AH	

Response(Fault)

3AH	STX
30H	SLAVE Address
31H	
39H	Function Code
30H	
35H	Error Code
32H	
?	LRC CHECK
?	
0DH	END
0AH	

RTU Mode

Instruction Message

SLAVE Address		01H
Function Code		10H
Start Address	High	A0H
	Low	01H
Quantity	High	00H
	Low	02H
DATA Number *		04H
First DATA	High	00H
	Low	01H
Next DATA	High	17H
	Low	70H
CRC-16	High	95H
	Low	B0H

Response Message (Normal)

SLAVE Address		01H
Function Code		10H
Start Address	High	A0H
	Low	01H
Quantity	High	00H
	Low	02H
CRC-16	High	32H
	Low	08H

Response(Fault)

SLAVE Address		01H
Function Code		90H
Error Code		52H
CRC-16	High	CDH
	Low	FDH

* DATA Numbers are the actual number timers 2

5.Comparison list between parameter and register

Note：

Parameter register No.: GGnnH，“GG”means Group number ，“nn” means Parameter number

for example: the address of Pr 08-03 is 0803H. the address of Pr 10-11 is 0A0BH

Register No.	Function	Register No.	Function	Register No.	Function
Group00		Group01		Group02	
0000H	00-00	0100H	01-00	0200H	02-00
0001H	00-01	0101H	01-01	0201H	02-01
0002H	00-02	0102H	01-02	0202H	02-02
0003H	00-03	0103H	01-03	0203H	02-03
0004H	00-04	0104H	01-04		
0005H	00-05	0105H	01-05		
0006H	00-06	0106H	01-06		
0007H	00-07	0107H	01-07		
0008H	00-08	0108H	01-08		
0009H	00-09	0109H	01-09		
000AH	00-10	010AH	01-10		
000BH	00-11	010BH	01-11		
000CH	00-12				
000DH	00-13				
000EH	00-14				
000FH	00-15				
0010H	00-16				
0011H	00-17				
0012H	00-18				
0013H	00-19				
0014H	00-20				

Register No.	Function	Register No.	Function	Register No.	Function
Group03		Group04		Group05	
0300H	03-00	0400H	04-00	0500H	05-00
0301H	03-01	0401H	04-01	0501H	05-01
0302H	03-02	0402H	04-02	0502H	05-02
0303H	03-03	0403H	04-03	0503H	05-03
0304H	03-04	0404H	04-04	0504H	05-04
0305H	03-05	0405H	04-05	0505H	05-05
0306H	03-06	0406H	04-06	0506H	05-06
0307H	03-07	0407H	04-07	0507H	05-07
0308H	03-08	0408H	04-08	0508H	05-08
0309H	03-09	0409H	04-09	0509H	05-09
030AH	03-10	040AH	04-10	050AH	05-10
030BH	03-11	040BH	04-11	050BH	05-11
030CH	03-12	040CH	04-12	050CH	05-12
030DH	03-13	040DH	04-13	050DH	05-13
030EH	03-14	040EH	04-14	050EH	05-14
030FH	03-15	040FH	04-15	050FH	05-15
0310H	03-16			0510H	05-16
0311H	03-17			0511H	05-17
0312H	03-18			0512H	05-18
0313H	03-19			0513H	05-19
				0514H	05-20
				0515H	05-21
				0516H	05-22
				0517H	05-23
				0518H	05-24
				0519H	05-25
				051AH	05-26
				051BH	05-27
				051CH	05-28
				051DH	05-29
				051EH	05-30
				051FH	05-31
				0520H	05-32

Register No.	Function	Register No.	Function	Register No.	Function
Group06		Group07		Group08	
0600H	06-00	0700H	07-00	0800H	08-00
0601H	06-01	0701H	07-01	0801H	08-01
0602H	06-02	0702H	07-02	0802H	08-02
0603H	06-03	0703H	07-03	0803H	08-03
0604H	06-04	0704H	07-04	0804H	08-04
0605H	06-05	0705H	07-05	0805H	08-05
0606H	06-06	0706H	07-06	0806H	08-06
0607H	06-07	0707H	07-07	0807H	08-07
0608H	06-08	0708H	07-08	0808H	08-08
0609H	06-09	0709H	07-09	0809H	08-09
060AH	06-10				
060BH	06-11				
060CH	06-12				
060DH	06-13				
060EH	06-14				
060FH	06-15				
0610H	06-16				
0611H	06-17				
0612H	06-18				
0613H	06-19				
0614H	06-20				
0615H	06-21				
0616H	06-22				
0617H	06-23				
0618H	06-24				
0619H	06-25				
061AH	06-26				
061BH	06-27				
061CH	06-28				
061DH	06-29				
061EH	06-30				
061FH	06-31				
0620H	06-32				
0621H	06-33				
0622H	06-34				
0623H	06-35				
0624H	06-36				

0625H	06-37				
0626H	06-38				
0627H	06-39				

Register No.	Function	Register No.	Function	Register No.	Function
Group09		Group10		Group11	
0900H	09-00	0A00H	10-00	0B00H	11-00
0901H	09-01	0A01H	10-01	0B01H	11-01
0902H	09-02	0A02H	10-02	0B02H	11-02
0903H	09-03	0A03H	10-03	0B03H	11-03
0904H	09-04	0A04H	10-04	0B04H	11-04
0905H	09-05	0A05H	10-05	0B05H	11-05
0906H	09-06	0A06H	10-06	0B06H	11-06
0907H	09-07	0A07H	10-07	0B07H	11-07
0908H	09-08	0A08H	10-08	0B08H	11-08
0909H	09-09	0A09H	10-09	0B09H	11-09
		0A0AH	10-10	0B0AH	11-10
		0A0BH	10-11	0B0BH	11-11
		0A0CH	10-12		
		0A0DH	10-13		
		0A0EH	10-14		
		0A0FH	10-15		
		0A10H	10-16		
		0A11H	10-17		
		0A12H	10-18		
		0A13H	10-19		
		0A14H	10-20		
		0A15H	10-21		
		0A16H	10-22		

Register No.	Function	Register No.	Function	Register No.	Function
Group12		Group13			
0C00H	12-00	0D00H	13-00		
0C01H	12-01	0D01H	13-01		
0C02H	12-02	0D02H	13-02		
0C03H	12-03	0D03H	13-03		
0C04H	12-04	0D04H	13-04		
0C05H	12-05	0D05H	13-05		
		0D06H	13-06		
		0D07H	13-07		
		0D08H	13-08		