TECO Westinghouse

INVERTER

L510

Communication - Addendum

- Modbus RTU / ASCII
- BACnet

DOCUMENT - TECO-L510-AC001
Ver 01: 2015.06

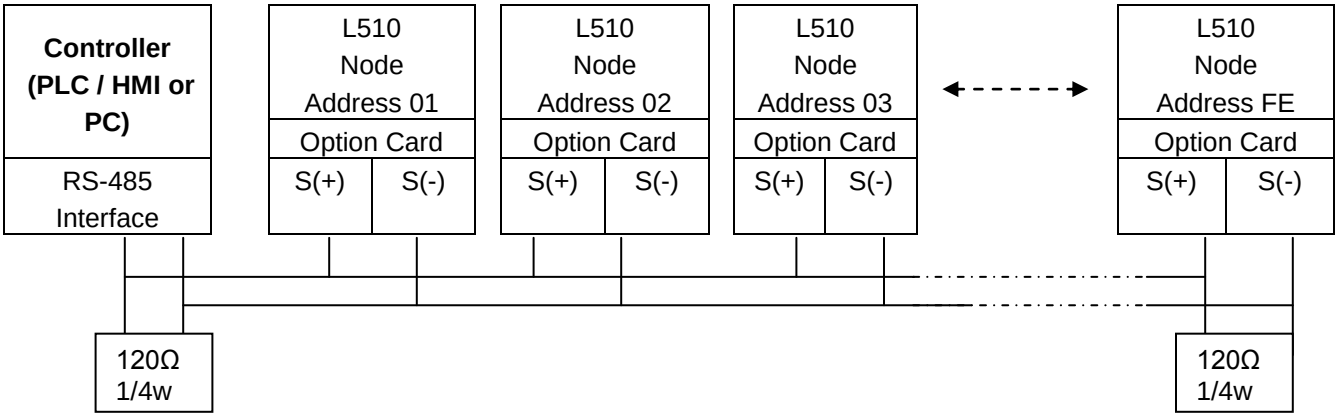
Table of Contents

1.0 Modbus Protocol Descriptions

1.0.1 Communication Connection and Data Frame

The inverter can communicate with a PC or PLC via RS485 using the Modbus RTU or Modbus ASCII protocol. The maximum frame length is 80 bytes.

Network Connection



**** Terminate the communications line with a (120 ohm, 1/4 watt) resistor at both ends.**

Data Format Frame

Data Frame for ASCII Mode

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

Data Frame for RTU Mode

Master (PLC etc.) sends request to follower (inverter), and the follower sends a response to the master (PC, PLC). The data received is illustrated here.

The data length varies depending on the command (Function).

Node Address
Function Code
DATA
CRC CHECK
Signal Interval

** The inverter response time is 10ms.

Node Address

00H: Broadcast to all the drivers
01H: to the No. 01 inverter
0FH: to the No.15 inverter
10H: to the No.16 inverter and so on...., max to No. 254 (FEH)

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)

Checksum Calculation

LRC

ex. NODE ADDRESS 01H
FUNCTION 03H
COMMAND 01H
00H
\+ DATA LENGTH 0AH

0FH ---------- 2's complement
Checksum F1H
CS (H) 46H (ASCII)
CS (L) = 31H (ASCII)

CRC

CRC Check: CRC code covers the content from node address to DATA. Please calculate it according to the following methods.

(1) Load a 16-bit register with FFFF hex (all1's). Call this CRC register.
(2) Exclusive OR the first 8-bit byte of the message, 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 CRC register.
(5) Repeat Steps (3) and (4) until 8 shifts been performed. When this is done, a complete 8-bit byte will 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 in the CRC register is the CRC value. When sending the CRC value, the Low-order byte should be sent firstly, then the High-order byte. For example, CRC value: 1241 Hex, the high-order byte should be set to 41hex and low-order byte 12hex.

CRC calculate program (C language):

```
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 );
}
```

ASCII Mode	
STX	':'
Address	'0'
	'1'
Function	'8'
	'6'
Exception code	'5'
	'1'
LRC Check	'2'
	'8'
END	'CR'
	'LF'

RTU Mode		
Node Address		02H
Function		83H
Exception code		52H
CRC-16	High	C0H
	Low	CDH

During a communication error the drive will response with an Exception Code and send a message back to the main system consisting of a Function Code that is "ANDED (and 80h)" with 80 Hex.

Exception code	Content
01	Function code error
02	Register number error
03	Number error
04	DATA setting error

1.0.2 Register and Data Format

Command Data (Read / Write)

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 : EFO
	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 a zero into the register for not used bit; do not write data to a reserved register.

Monitor Data (Read-only)

Register No.		Bit	Content		
2520H	State Signal	0	Operation	1 : Run	0 : Stop
		1	Direction	1 : Reverse	0 : Forward
		2	Inverter ready	1 : ready	0 : not ready
		3	Fault	1 : Fault	
		4	Data setting error	1 :“ON”	
		5-F	Reserved		
2521H	Error Description	00	Inverter ok	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(OL510)	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	DI State		Multi-function Comm S1	1 :“ON”	0:“OFF”
		1	Multi-function Comm S2	1 :“ON”	0:“OFF”
		2	Multi-function Comm S3	1 :“ON”	0:“OFF”
		3	Multi-function Comm S4	1 :“ON”	0:“OFF”
		4	Multi-function Comm S5	1 :“ON”	0:“OFF”

			5	Reserved
			6	Relay R1Y 1 :“ON” 0:“OFF”
			7	Reserved
			8	Reserved
			9	Reserved
			A	Reserved
			B	Reserved
			C	Reserved
			D	Reserved
			E	Reserved
			F	Reserved
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			reserved	
252FH			L510 identification: 0x0110	

Note: Write a zero into the register for not used bit; do not write data to a reserved register.

Read Holding Register [03H]

Read consecutive holding registers. The address of the first holding register is specified in the protocol
Example: Read frequency command from the inverter with node address 1.

ASCII Mode

Command Message

3AH	STX
30H	Node Address
31H	
30H	Function
33H	
30H	Starting Register
31H	
32H	
33H	
30H	Number of Registers
30H	
30H	
31H	
?	LRC CHECK
?	
0DH	END
0AH	

Response Message (Normal)

3AH	STX
30H	Node Address
31H	
30H	Function
33H	
30H	Data Length
32H	
31H	Data
37H	
37H	
30H	
?	LRC CHECK
?	
0DH	END
0AH	

Response Message (Error)

3AH	STX
30H	Node Address
32H	
38H	Function
33H	
35H	Exception code
32H	
?	LRC CHECK
?	
0DH	END
0AH	

RTU Mode

Command Message

Node Address		01 H
Function		03H
Starting Register	High	01H
	Low	23H
Number of Registers	High	00H
	Low	01H
CRC-16	High	74H
	Low	3CH

Response Message (Normal)

Node Address		01H
Function		03H
Data Length		02H
Data	High	17H
	Low	70H
CRC-16	High	AFH
	Low	82H

Response Message (Error)

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

Loop back test [08H]

Check the communication between the master and the follower (inverter). The data used can be arbitrary.

ASCII Mode

Command Message

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

Response Message (Normal)

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

Response Message (Error)

3AH	STX
30H	Node Address
31H	
38H	Function
38H	
32H	Exception code
30H	
?	LRC CHECK
?	
0DH	END
0AH	

RTU Mode

Command Message

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

Response Message (Normal)

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

Response Message (Error)

Node Address		01H
Function		88H
Exception code		20H
CRC-16	High	47H
	Low	D8H

Write Single Holding Register [06H]

Write single holding register. The register address of the holding register is specified in the message.

Example: Write a 60.00Hz frequency command to node address 1.

ASCII Mode

Command Message

3AH	STX
30H	Node Address
31H	
30H	Function
36H	
30H	Starting Register
31H	
30H	
32H	
31H	DATA
37H	
37H	
30H	
?	LRC CHECK
?	
0DH	END
0AH	

Response Message (Normal)

3AH	STX
30H	Node Address
31H	
30H	Function
36H	
30H	Starting Register
31H	
30H	
32H	
31H	DATA
37H	
37H	
30H	
?	LRC CHECK
?	
0DH	END
0AH	

Response Message (Error)

3AH	STX
30H	Node Address
31H	
38H	Function
36H	
35H	Exception code
32H	
?	LRC CHECK
?	
0DH	END
0AH	

RTU Mode

Command Message

Node Address		01 H
Function		06H
Start No	High	01H
	Low	02H
DATA	High	17H
	Low	70H
CRC-16	High	27H
	Low	E2H

Response Message (Normal)

Node Address		01H
Function		06H
Start No	High	01H
	Low	02H
DATA	High	17H
	Low	70H
CRC-16	High	27H
	Low	E2H

Response Message (Error)

Node Address		01H
Function		86H
Exception code		52H
CRC-16	High	C3H
	Low	9DH

Write Multiple Holding Register [10H]

Write multiple holding registers. The address of the first holding register is specified in the message.

Example: Write a 60.00Hz frequency command to node address 1 and enable FWD run command.

ASCII Mode

Command Message

3AH	STX
30H	Node Address
31H	
31H	Function
30H	
30H	Starting Register
31H	
30H	
31H	
30H	Number of Registers
30H	
30H	
32H	
30H	Number of Bytes*
34H	
30H	DATA 1
30H	
30H	
31H	
31H	DATA 2
37H	
37H	
30H	
?	LRC CHECK
?	
0DH	END
0AH	

Response Message (Normal)

3AH	STX
30H	Node Address
31H	
31H	Function
30H	
30H	Starting Register
31H	
30H	
31H	
30H	Number of Registers
30H	
30H	
32H	
?	LRC CHECK
?	
0DH	END
0AH	

Response Message (Error)

3AH	STX
30H	Node Address
31H	
39H	Function
30H	
35H	Exception code
32H	
?	LRC CHECK
?	
0DH	END
0AH	

* Number of bytes is register amount x 2

RTU Mode

Command Message

Node Address		01H
Function		10H
Starting Register	High	01H
	Low	01H
Number of Registers	High	00H
	Low	02H
Number of Bytes*		04H
DATA 1	High	00H
	Low	01H
DATA 2	High	17H
	Low	70H
CRC-16	High	60H
	Low	27H

* Data amount is register amount x 2

Response Message (Normal)

Node Address		01H
Function		10H
Starting Register	High	01H
	Low	01H
Number of Registers	High	00H
	Low	02H
CRC-16	High	11H
	Low	F4H

Response Message (Error)

Node Address		01H
Function		90H
Exception code		52H
CRC-16	High	CDH
	Low	FDH

1.0.3 Parameter Data

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	0204H	02-04
0005H	00-05	0105H	01-05	0205H	02-05
0006H	00-06	0106H	01-06	0206H	02-06
0007H	00-07	0107H	01-07	0207H	02-07
0008H	00-08	0108H	01-08	0208H	02-08
0009H	00-09	0109H	01-09	0209H	02-09
000AH	00-10	010AH	01-10	020AH	02-10
000BH	00-11	010BH	01-11	020BH	02-11
000CH	00-12	010CH	01-12	020CH	02-12
000DH	00-13	010DH	01-13	020DH	02-13
000EH	00-14	010EH	01-14	020EH	02-14
000FH	00-15	010FH	01-15	020FH	02-15
0010H	00-16	0110H	01-16	0210H	02-16
0011H	00-17	0111H	01-17	0211H	02-17
0012H	00-18	0112H	01-18		
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
0314H	03-20			0514H	05-20
0315H	03-21			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

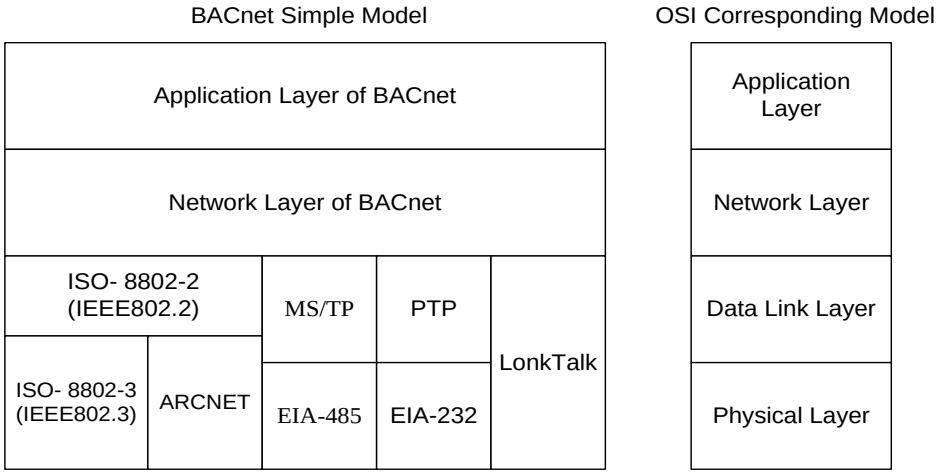
Register No.	Function	Register No.	Function	Register No.	Function
Group06		**Group07**		**Group08**	
0600H	06-00	0700H	07-00	0800H	08-00
0601H	06-01	0701H	07-01	0801H	08-01
0602H	06-02	0702H	07-02	0802H	08-02
0603H	06-03	0703H	07-03	0803H	08-03
0604H	06-04	0704H	07-04	0804H	08-04
0605H	06-05	0705H	07-05	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			080AH	08-10
060BH	06-11			080BH	08-11
060CH	06-12			080CH	08-12
060DH	06-13			080DH	08-13
060EH	06-14			080EH	08-14
060FH	06-15			080FH	08-15
0610H	06-16			0810H	08-16
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
090AH	09-10	0A0AH	10-10	0B0AH	11-10
		0A0BH	10-11	0B0BH	11-11
		0A0CH	10-12	0B0CH	11-12
		0A0DH	10-13	0B0DH	11-13
		0A0EH	10-14	0B0EH	11-14
		0A0FH	10-15	0B0FH	11-15
		0A10H	10-16	0B10H	11-16
		0A11H	10-17	0B11H	11-17
		0A12H	10-18	0B12H	11-18
		0A13H	10-19	0B13H	11-19
		0A14H	10-20	0B14H	11-20
		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		

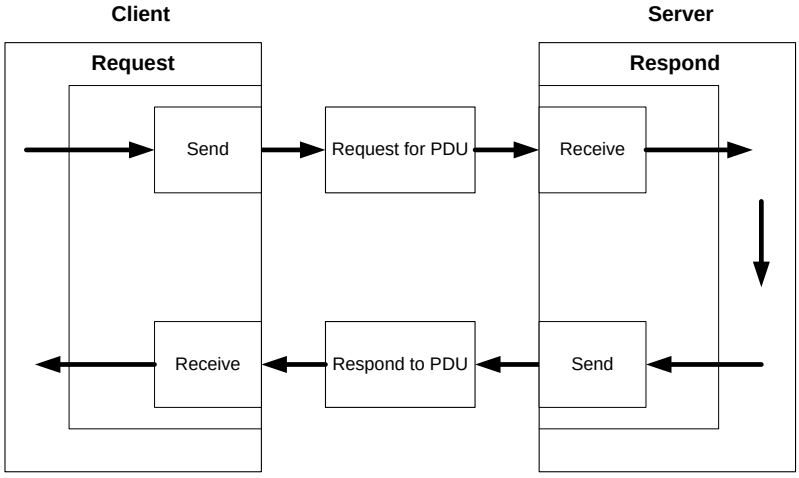
1.1 BACnet Protocol Descriptions

BACnet is in compliance with four-layers of the seven-layer structure models in OSI (Open Systems Interconnection) of International Standard Organization (ISO). The four-layers are application layer, network layer, data link layer and physical layer. BACnet uses “object” and “properties.” All BACnet devices are controlled via the property of the objects. Every controller with BACnet devices is considered an object collector so that every controller device can execute different functions supported by the objects to control and monitor a BACnet device.

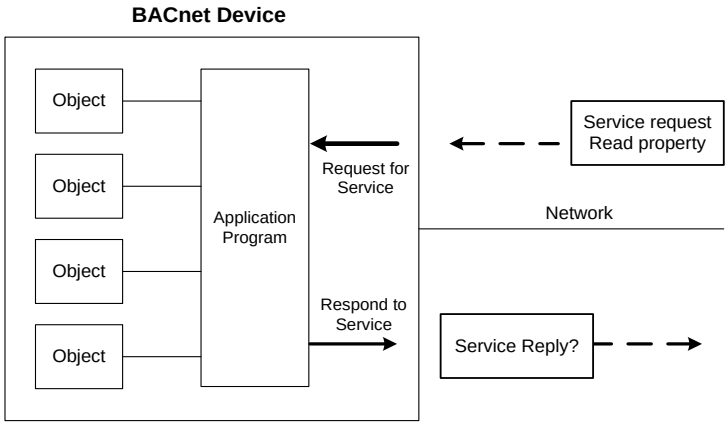


1.1.1 BACnet Services

Services provide commands to save or control information and functions for the purpose of monitoring and control. Example, a BACnet device receives information or a command to handle a request from another BACnet device therefor the two devices have to support the same service. To complete the exchange of these service messages, requires implementation of the communication protocol application layer. Therefore, services are parts of the communication protocol data unit (PDU) in the application layer and build the communication modes between the Server – Client. Client will send a service request to the Server and the Server needs to respond to Client to execute this service. Refer to the following figure.

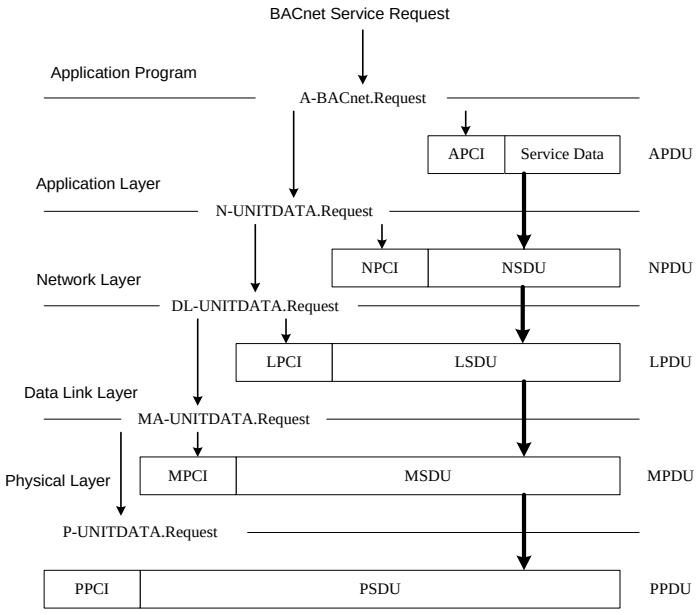


All BACnet devices use application programs to manage and handle services. Example: Application program has to display the status of every input so it requires sending the service request to the object of another device to update its display with the input status. The application program of the device needs to respond to the service request. Refer to the following figure.



1.1.2 BACnet Protocol Structure

The BACnet communication protocol is implemented by way of a protocol stack composed of stacked layer types. Refer to the following figure.



When an application program sends a BACnet service request, it is handled by the BACnet node in the application layer via the application program interface. The request is sent to the application layer and application protocol data unit (APDU) consists of Application Protocol Control Information (APCI) and Service Data of application program. It then passes the APDU downward to the BACnet request program in the network layer. APDU becomes Network Layer Protocol Data Unit (NPDU) composed of Network Service Data Unit (NSDU) and Network Protocol Control Information (NPCI) and the data link layer and physical layer complete the service request for the packet.

1.1.3 BACnet Specifications

The L510 inverter has a built-in BACnet MS/TP communication protocol. Control or monitor the inverter via BACnet allowing for reading and writing of specific parameters. The BACnet implementation supports the following standard objects:

- **Inverter Objects**
- **Analog Input**
- **Analog Output**
- **Analog Value**
- **Digital Input**
- **Digital Output**
- **Digital Value**

Refer to Table 4.7.3.1 for property information of each object. User can retrieve object properties using the dedicated BACnet software to control or monitor the inverter.

Table 4.6.3.1 Object and property supporting list

Property	Inverter (DEV)	Analog Input (AI)	Analog Output (AO)	Analog Value (AV)	Digital Input (BI)	Digital Output (BO)	Digital Value (BV)
Object_Identifier	V	V	V	V	V	V	V
Object_Name	V	V	V	V	V	V	V
Object_Type	V	V	V	V	V	V	V
System_Status	V						
Vendor_Name	V						
Vendor_ Identifier	V						
Model_Name	V						
Firmware_Revision	V						
Applocation_Software_Supported	V						
Protocol_Version	V						
Protocol_Revision	V						
Protocol_Services_Supported	V						
Protocol_Object_Type_Supported	V						
Object_List	V						
Max_APDU_Length_Accepted							
Segmentation_Supported							
APDU_Timeout							
Number_Of_APDU_Retries							
Max_Masters	V						
Max_Info_Frames	V						
Device_Address_Binding							
Location	V						
Presnent_Value		V	V	V	V	V	V
Status_Flags							
Event_State							
Reliability							
Out_Of_Service							
Units		V	V	V			
Priority_Array							
Relinquish_Default							
Polarity							
Inactive_Text							
Active_Text							

1.1.4 BACnet Object Properties

This section gives an overview of the BACnet objects supported by the inverter.

Refer to Table 1.1.4.1 for the inverter property information.

Refer to Table 1.1.4.2 ~ Table 1.1.4.7 for object information that the inverter supports.

Table 1.1.4.1 – Inverter property list

Property	Inverter
Object_Identifier	DEV
Object_Name	TECO L510
Object_Type	8
System_Status	0
Vendor_Name	TECO L510
Vendor_ Identifier	461
Model_Name	TECO.Inc
Firmware_Revision	0.14
Application_Software_Supported	0.14
Protocol_Version	1
Protocol_Revision	5
Protocol_Services_Supported	{ readProperty , writeProperty , who is }
Protocol_Object_Type_Supported	{ Analog_Input , Analog_Output, Analog_Value Binary_ Input, Binary_Output, Binary_Value, Device}
Max_Masters	127
Max_Info_Frames	1
Location	R.O.C

Table 1.1.4.2 Analog input property list (READ)

No.	Object Name	Description	Unit	Classification	Range
AI0	**TM2 AIN**	AVI input	Percent	R	0 - 100
AI1	**TM2 AIN2**	ACI input	Percent	R	0 - 100
AI2	**Error code**	Recent fault message	No Units	R	0 - 43
AI3	**Freq cmd**	Frequency command	Hz	R	0 - 599
AI4	**Frequency**	Output frequency	Hz	R	0 - 599
AI5	**Current**	Output current	Amps	R	
AI6	**Control Mode**	Control mode	No Units	R	0 - 1
AI7	**Motor R-Volt**	Motor rated voltage	Volt	R	
AI8	**Motor R-HP**	Motor rated power	horsepower	R	
AI9	**Motor R-RPM**	Motor rated rotation speed	rpm	R	
AI10	**Motor R-Hz**	Motor rated frequency	Hz	R	
AI11	**CarrierFreq**	Carrier frequency	kHz	R	1 - 16
AI12	**Comm Station**	INV communication station	No Units	R	1 - 254
AI13	**BaudRate**	Baudrate setting	No Units	R	0 - 3
AI14	**BacnetSel**	Communication mode selection	No Units	R	0 - 1
AI15	**DevInstance**	Inverter number	No Units	R	1 - 254

Table 1.1.4.3 – Analog output property list (READ/ WRITE)

No.	Object Name	Description	Unit	Classification	Range
AO0	**Set frequency**	Frequency command	Hz	R/W	0 - 599
AO1	**TB2 AO1**	Output voltage1	Volt	R	0 - 10
AO3	**Motor R-Amp**	Motor rated current	Amps	R/W	0-65535
AO4	**PwrL Sel**	Momentary stop and restart selection	No Units	R	0 - 1
AO5	**RestartSel**	Number of Fault Auto-Restart Attempts	No Units	R	0 – 10
AO6	**RestartDelay**	Fault Auto-Restart Time	seconds	R	0 - 800
AO7	**FreqCommand1**	Speed frequency setting-stage 0	Hz	R/W	0 - 599
AO8	**FreqCommand2**	Speed frequency setting-stage 1	Hz	R/W	0 - 599
AO9	**FreqCommand3**	Speed frequency setting-stage 2	Hz	R/W	0 - 599
AO10	**FreqCommand4**	Speed frequency setting-stage 3	Hz	R/W	0 - 599
AO11	**FreqCommand5**	Speed frequency setting-stage 4	Hz	R/W	0 - 599
AO12	**FreqCommand6**	Speed frequency setting-stage 5	Hz	R/W	0 - 599
AO13	**FreqCommand7**	Speed frequency setting-stage 6	Hz	R/W	0 - 599
AO14	**FreqCommand8**	Speed frequency setting-stage 7	Hz	R/W	0 - 599
AO23	**RunMode**	Main run command source selection	No Units	R/W	0 - 2
AO24	**ReverseOper**	Direction locked command	No Units	R/W	0 - 1
AO25	**StoppingSel**	Stop modes selection	No Units	R/W	0 - 1
AO26	**FrequenceComm**	Main frequency command source selection	No Units	R/W	0 - 6
AO27	**FreqUpperLim**	Upper limit frequency	Hz	R/W	0.01 - 599
AO28	**FreqLowerLim**	Lower limit frequency Hz R	Hz	R/W	0 – 598.99
AO29	**Acc Time1**	Acceleration time 1	seconds	R/W	0.1 - 3600
AO30	**Dec Time1**	Deceleration time 1	seconds	R/W	0.1 - 3600

Table 4.7.4.4 Analog value property list (READ/ WRITE)

No.	Object Name	Description	Unit	Classification	Range
AV0	**PID – P Gain**	Proportional gain (P)	No Units	R/W	0 - 10
AV1	**PID – I Time**	Integral time (I)	No Units	R/W	0 - 100
AV2	**PID – D Time**	Differential time (D)	No Units	R/W	0 – 10

Table 1.1.4.5 Digital input property list (READ)

No.	Object Name	Description	Unit	Classification	Range
BI0	**Run/Stop**	Operation status	Stop / Run	R	0 - 1
BI1	**Direction**	Operation direction	FWD/REV	R	0 - 1
BI2	**status**	Inverter status	OK/Fault	R	0 - 1
BI3	**Abnormal**	Error occurs	Close/Open	R	0 - 1
BI4	**DI_1 status**	S1 status	Close/Open	R	0 - 1
BI5	**DI_2 status**	S2 status	Close/Open	R	0 - 1
BI6	**DI_3 status**	S3 status	Close/Open	R	0 - 1
BI7	**DI_4 status**	S4 status	Close/Open	R	0 - 1
BI8	**DI_5 status**	S5 status	Close/Open	R	0 - 1

Table 1.1.4.6 Digital output property list (READ/ WRITE)

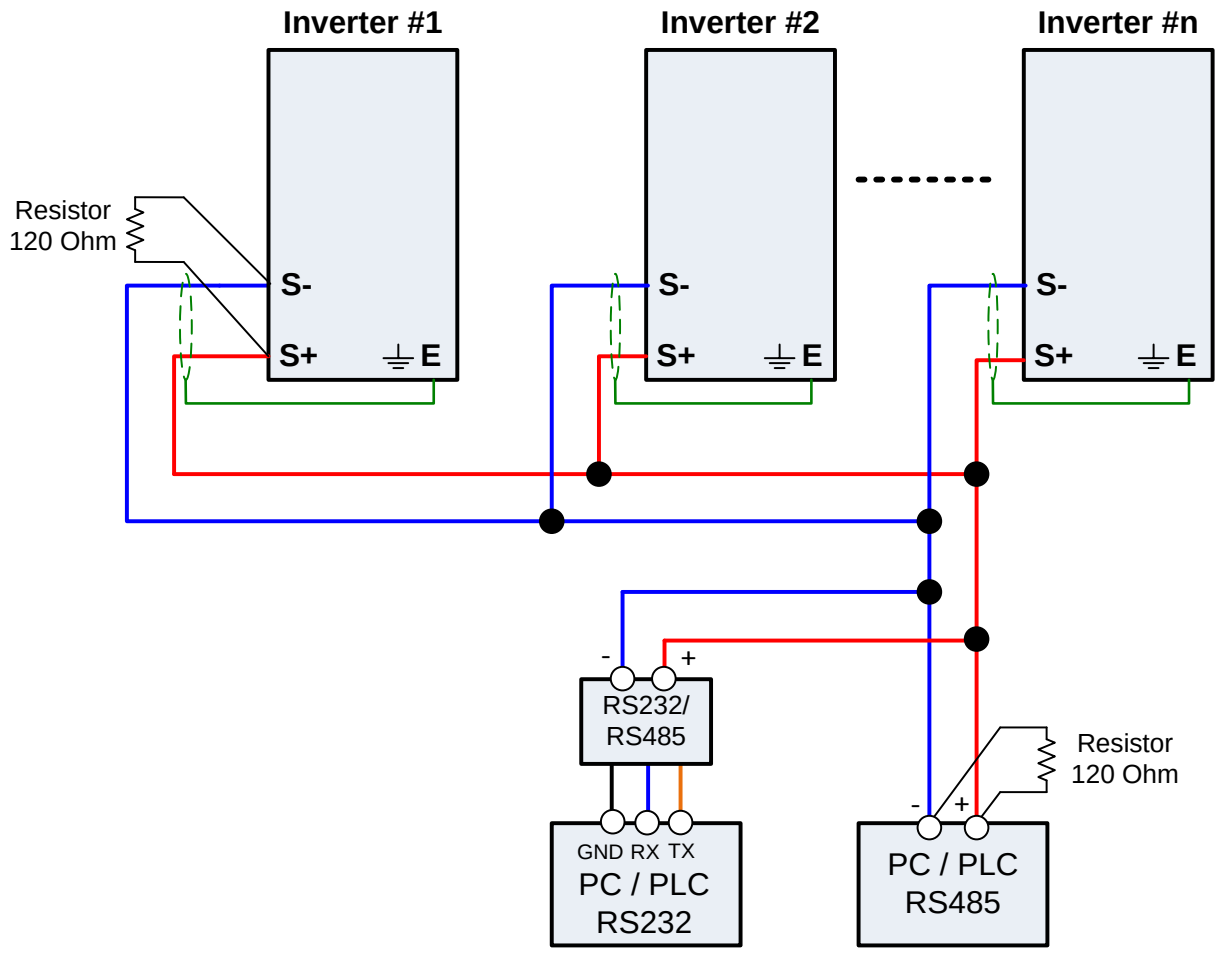
No.	Object Name	Description	Unit	Classification	Range
BO0	**RY1 status**	Relay output 1 status	Close/Open	R	0 - 1

Table 1.1.4.7 Digital value property list (READ/ WRITE)

No.	Object Name	Description	Unit	Classification	Range
BV0	**RUN/STOP**	RUN/STOP	Stop / Run	R/W	0 - 1
BV1	**FWD/REV**	FWD/REV	FWD/REV	R/W	0 - 1

A1.1 RS485 –Network (Modbus)

This section shows a RS485 network consisting of several inverters communicating using the built-in Modbus RTU protocol.



Wiring diagram RS485 Modbus RTU Network

Notes:

- A PC / PLC controller with a built-in RS-485 interface can be connected directly to the RS-485 network. Use a RS232 to RS485 converter to connect a PC / PLC with a built-in RS-232 interface.
- A maximum of 31 inverters can be connected to the network. Terminating resistors of 120 ohm must be installed at both end of the network.

TECO Westinghouse

INVERTER

L510

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