

5 ELC-CARS485

ELC-CARS485 is a serial Modbus distributed I/O adapter module which uses the standard low cost ELC I/O. As a standard Modbus slave, ELC-CARS485 is compatible with any valid master.

5.1 Features


- Supports up to 256 digital I/O points
- Supports up to 8 analog / specialty modules
- Configurable interface parameters

5.2 Specification

■ Functions Specification

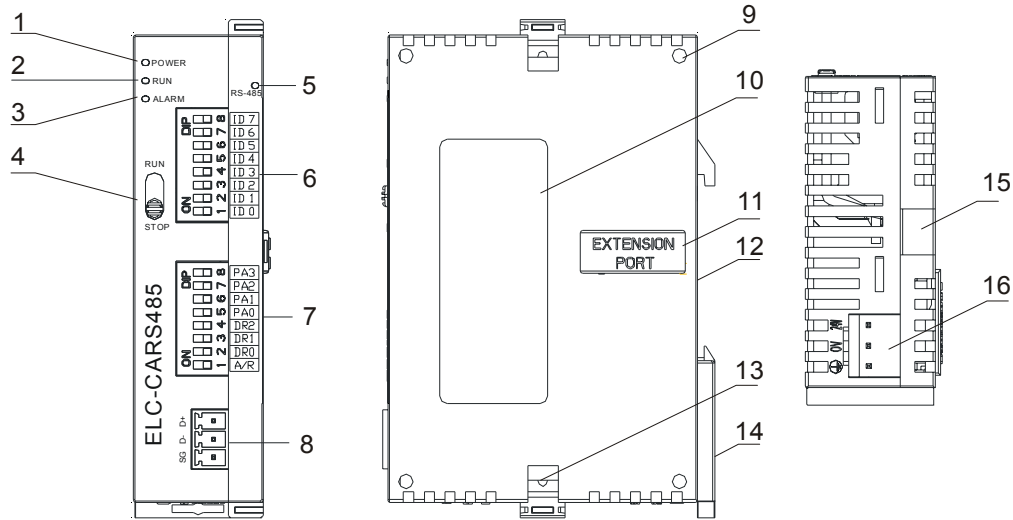
Communication	
Transmission method	RS-485
Electrical isolation	500VDC
Type	Removable 3-pin connector
Transmission cable	2 twisted isolation cables
Valid communication address	1 ~ F0 (decimal: 1 ~ 240)
Series transmission speed	1,200/2,400/4,800/9,600/19,200/38,400/57,600/115,200 bps (bits per second)
Communication mode	7,E,1-ASCII / 7,O,1-ASCII / 7,E,2-ASCII / 7,O,2-ASCII / 7,N,2-ASCII / 8,E,1-ASCII / 8,O,1-ASCII / 8,N,1-ASCII / 8,N,2-ASCII / 8,E,1-RTU / 8,O,1-RTU / 8,N,1-RTU / 8,N,2-RTU

■ Electrical Specification

Power supply voltage	24VDC (-15% ~ 20%) (with DC input polarity reverse protection)
Noise Immunity	ESD (IEC 61131-2, IEC 61000-4-2): 8KV Air Discharge, 4KV Contact Discharge EFT (IEC 61131-2, IEC 61000-4-4): Power Line: 2KV, Digital I/O: 1KV Analog & Communication I/O: 1KV Damped-Oscillatory Wave: Power Line: 1KV, Digital I/O: 1KV RS (IEC 61131-2, IEC 61000-4-3): 80MHz ~ 1000MHz , 1.4GHz ~ 2.0GHz , 10V/m
Operation/storage temperature	Operation: 0°C ~ 55°C (temperature), 50 ~ 95% (humidity), pollution degree 2; Storage: -25°C ~ 70°C (temperature), 5 ~ 95% (humidity)
Vibration/Shock Immunity	Standard: IEC61131-2, IEC 68-2-6 (TEST Fc)/IEC61131-2 & IEC 68-2-27 (TEST Ea)
Certificates	CE  , Operating temperature code: T5

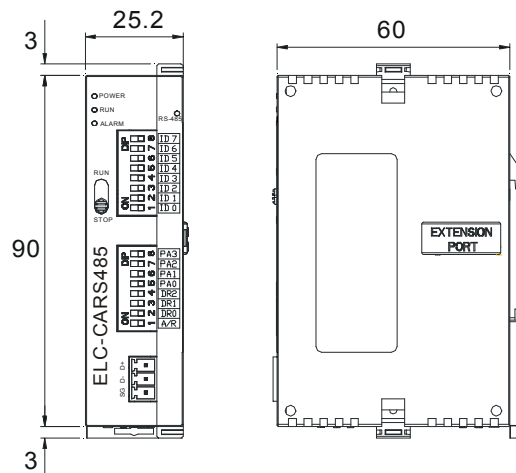
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5.3 Product Profile and Outline



1. POWER indicator	9. Mounting hole for extension unit
2. RUN indicator	10. Nameplate
3. ALARM indicator	11. Extension port for extension unit
4. RUN/STOP switch	12. DIN rail mounting slot (35mm)
5. RS485 indicator	13. Fastening hole for extension unit
6. Address setup DIP switch	14. DIN rail clip
7. Communication mode setup DIP switch	15. Mounting rail for extension unit
8. RS-485 communication port	16. Power input

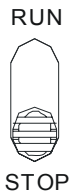
■ Dimension



Unit: mm

5.4 Installation and Wiring

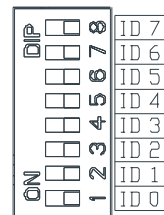
■ Switch Definition : RUN/STOP



Status	Explanation
RUN	1. RUN indicator on ELC-CARS485 is On. 2. AI/AO extension unit in RUN status.
RUN → STOP	1. AI/AO extension unit switches from RUN to STOP status. 2. Y points on DI/DO extension unit are all Off.
STOP	1. RUN indicator on ELC-CARS485 is Off. 2. AI/AO extension unit in STOP status. 3. Communication control is not allowed in AI/AO extension unit. 4. Communication control is not allowed in DI/DO extension unit.
STOP → RUN	1. ELC-CARS485 re-detects the number of points in DI/DO unit and the number of AI/AO units. 2. AI/AO extension unit switches from STOP to RUN status.

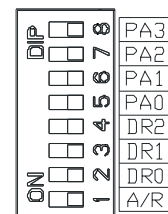
■ Modbus Address Setup DIP Switch:

DIP Switch Setting	Explanation
H'01 ~ H'F0	Valid ELC-CARS485 addresses, the dip switches are weighted as follows: ID0 ~ ID7 are: $2^0, 2^1, 2^2, \dots, 2^6, 2^7$.
H'00, H'F1 ~ H'FF	In the Modbus protocol, H'00 is defined as broadcast mode. H'F1 ~ H'FF are incorrect ELC-CARS485 addresses.



■ Communication Mode Setup DIP Switch:

PA3	PA2	PA1	PA0	A/R	Communication mode
OFF	OFF	OFF	OFF	ON	7,E,1-ASCII
OFF	OFF	OFF	ON	ON	7,O,1-ASCII
OFF	OFF	ON	OFF	ON	7,E,2-ASCII
OFF	OFF	ON	ON	ON	7,O,2-ASCII
OFF	ON	OFF	OFF	ON	7,N,2-ASCII
OFF	ON	OFF	ON	ON	8,E,1-ASCII
OFF	ON	ON	OFF	ON	8,O,1-ASCII
OFF	ON	ON	ON	ON	8,N,1-ASCII
ON	OFF	OFF	OFF	ON	8,N,2-ASCII
OFF	ON	OFF	ON	OFF	8,E,1-RTU
OFF	ON	ON	OFF	OFF	8,O,1-RTU
OFF	ON	ON	ON	OFF	8,N,1-RTU
ON	OFF	OFF	OFF	OFF	8,N,2-RTU
Other settings of PA3, PA2, PA1, PA0 and A/R are invalid					



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DR2	DR1	DR0	Series Transmission speed
OFF	OFF	OFF	1,200 bit/s
OFF	OFF	ON	2,400 bit/s
OFF	ON	OFF	4,800 bit/s
OFF	ON	ON	9,600 bit/s
ON	OFF	OFF	19,200 bit/s
ON	OFF	ON	38,400 bit/s
ON	ON	OFF	57,600 bit/s
ON	ON	ON	115,200 bit/s

5.5 Modbus Register assignments

■ Discrete Input and Output register mapping

Communication address	Devices	Attribute	Data type	Length
H'0400 ~ H'047F	X: X000 ~ X177 (Octal)	R	bit	128 points
H'0500 ~ H'057F	Y: Y000 ~ Y177 (Octal)	R/W	bit	128 points

■ Specialty Module register mapping

Communication address	Devices	Attribute	Data type	Length
H'1600 ~ H'1630	1 st specialty module: CR0 ~ CR48	Please refer to the CR attribute of each specialty module.	word	49
H'1640 ~ H'1670	2 nd specialty module: CR0 ~ CR48		word	49
H'1680 ~ H'16B0	3 rd specialty module: CR0 ~ CR48		word	49
H'16C0 ~ H'16F0	4 th specialty module: CR0 ~ CR48		word	49
H'1700 ~ H'1730	5 th specialty module: CR0 ~ CR48		word	49
H'1740 ~ H'1770	6 th specialty module: CR0 ~ CR48		word	49
H'1780 ~ H'17B0	7 th specialty module: CR0 ~ CR48		word	49
H'17C0 ~ H'17F0	8 th specialty module: CR0 ~ CR48		word	49

Note:

A maximum of 8 specialty modules are allowed. The first specialty module is first unit installed on the right hand side of the ELC-CARS485 adapter.

■ Adapter configuration and status registers

Communication address	Attribute	Content	Explanation
H'0000	R	Model name	Model code of the ELC-CARS485 = H'0200.
H'0001	R	Firmware version	The current firmware version is displayed in hex, e.g. V0.1 is indicated as H'0010.

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Communication address	Attribute	Content	Explanation
H'0002	R	Issue date	The issue data of the firmware is displayed in hex, e.g. H'1FD0 = K8150 indicates that the firmware is issued on the morning of August 15.
H'0003	R/W	RUN/STOP ELC-CARS485	H'0003 = 1, the ELC-CARS485 RUN; H'0003 = 0, the ELC-CARS485 STOP.
H'0004	R	Communication format	The communication parameters for the ELC-CARS485.
H'0005	R	Baud rate	The baud rate of the ELC-CARS485.
H'0006	R	Communication address	The communication address of ELC-CARS485.
H'0007	R	Number of DI/DO points	High byte stores the number of input points. Low byte stores the number of output points.
H'0008	R	Error code	The current error. See 4.4 for the meaning of error codes.
H'0009	R	Historical error code	The number of errors that have occurred. Range: 0 ~ 32
H'0017	R	Number of specialty modules	The number of specialty modules detected.
H'0018	R	Model code of the 1 st specialty module	The model code of the 1 st specialty module connected to the ELC-CARS485.
H'0019	R	Model code of the 2 nd specialty module	The model code of the 2 nd specialty module connected to the ELC-CARS485.
H'001A	R	Model code of the 3 rd specialty module	The model code of the 3 rd specialty module connected to the ELC-CARS485.
H'001B	R	Model code of the 4 th specialty module	The model code of the 4 th specialty module connected to the ELC-CARS485.
H'001C	R	Model code of the 5 th specialty module	The model code of the 5 th specialty module connected to the ELC-CARS485.
H'001D	R	Model code of the 6 th specialty module	The model code of the 6 th specialty module connected to the ELC-CARS485.
H'001E	R	Model code of the 7 th specialty module	The model code of the 7 th specialty module connected to the ELC-CARS485.
H'001F	R	Model code of the 8 th specialty module	The model code of the 8 th specialty module connected to the ELC-CARS485.

5.6 Supported Function Codes

ELC-CARS485 complies with the standard Modbus protocol, supporting the 7 function codes, H'01, H'02, H'03, H'05, H'06, H'0F, and H'10. Please refer to the standard Modbus protocol for the specific data format of each function code.

Function code	Function	Data type	Applicable address
H'01	Read output bit status	bit	DO area: H'0500 ~ H'057F
H'02	Read input bit status.	bit	DI area: H'0400 ~ H'047F
H'03	Read register(s)	word	Special function area: H'0000 ~ H'001F
			CR of the 1st AI/AO unit: H'1600 ~ H'1630
			CR of the 2nd AI/AO unit: H'1640 ~ H'1670
			CR of the 3rd AI/AO unit: H'1680 ~ H'16B0
			CR of the 4th AI/AO unit: H'16C0 ~ H'16F0
			CR of the 5th AI/AO unit: H'1700 ~ H'1730
			CR of the 6th AI/AO unit: H'1740 ~ H'1770
H'03	Read register(s)	word	CR of the 7th AI/AO unit: H'1780 ~ H'17B0
H'03	Read register(s)	word	CR of the 8th AI/AO unit: H'17C0 ~ H'17F0
H'05	Write single bit	bit	DO area: H'0500 ~ H'057F
H'06	Write single register	word	RUN/STOP ELC-CARS485 module: H'0003
			Applicable to CR with write attribute in the 1st ~ 8th AI/AO extension unit.
H'0F	Write multiple bits	bit	DO area: H'0500 ~ H'057F
H'10	Write multiple registers	word	RUN/STOP ELC-CARS485 module: H'0003
			Applicable to CR with write attribute in the 1st ~ 8th AI/AO extension unit.

■ **Example:**

- Use function code 03 to read CR0 and CR1 in the 1st AI/AO extension unit: (ASCII mode)
- The request message sent from master ELC to ELC-CARS485 is “: 01 03 16 00 00 02 E4 CR LF”
- The responding message sent from ELC-CARS485 to the master ELC is “: 01 03 04 00 88 00 00 70 CR LF”

Note:

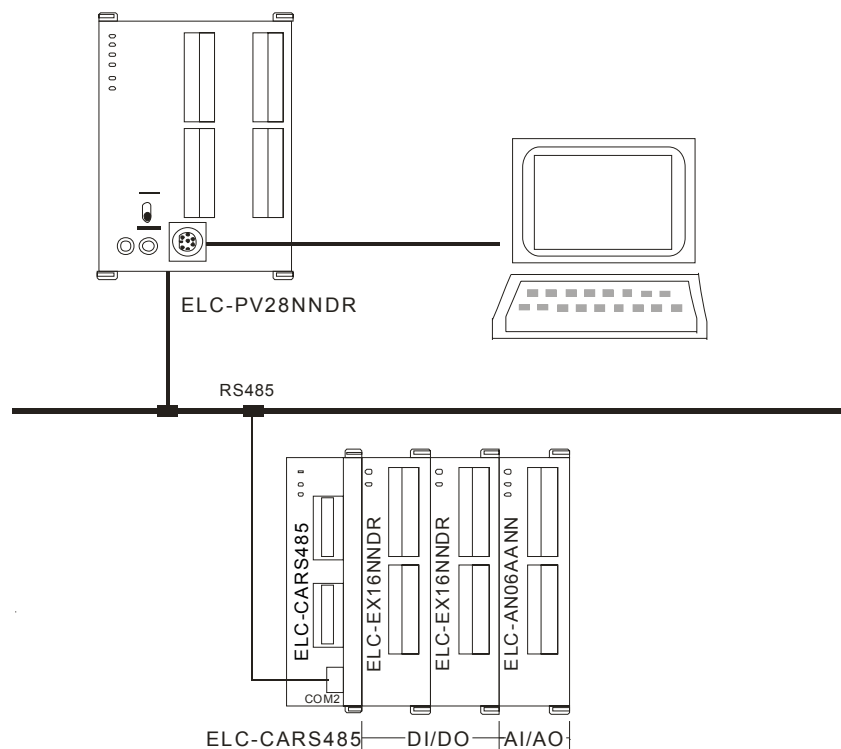
1. ELC-CARS485 can only read and write one AI/AO extension unit at a time.
 2. ELC-CARS485 is able to read/write a maximum of 16 words at a time.
- Error Codes

Code	Indication	Explanation
0001	Incorrect function code	The ELC-CARS485 does not support this function code.

Code	Indication	Explanation
0002	Incorrect operand address	The function code is not valid for the operand address
0003	Incorrect data	The data read/written exceeds the maximum length.
0004	The ELC-CARS485 in STOP	The ELC-CARS485 is in STOP mode.
000B	Incorrect communication format	The length of data received by the ELC-CARS485 is too short.
000C	Incorrect communication format	The length of data received by the ELC-CARS485 is too long.

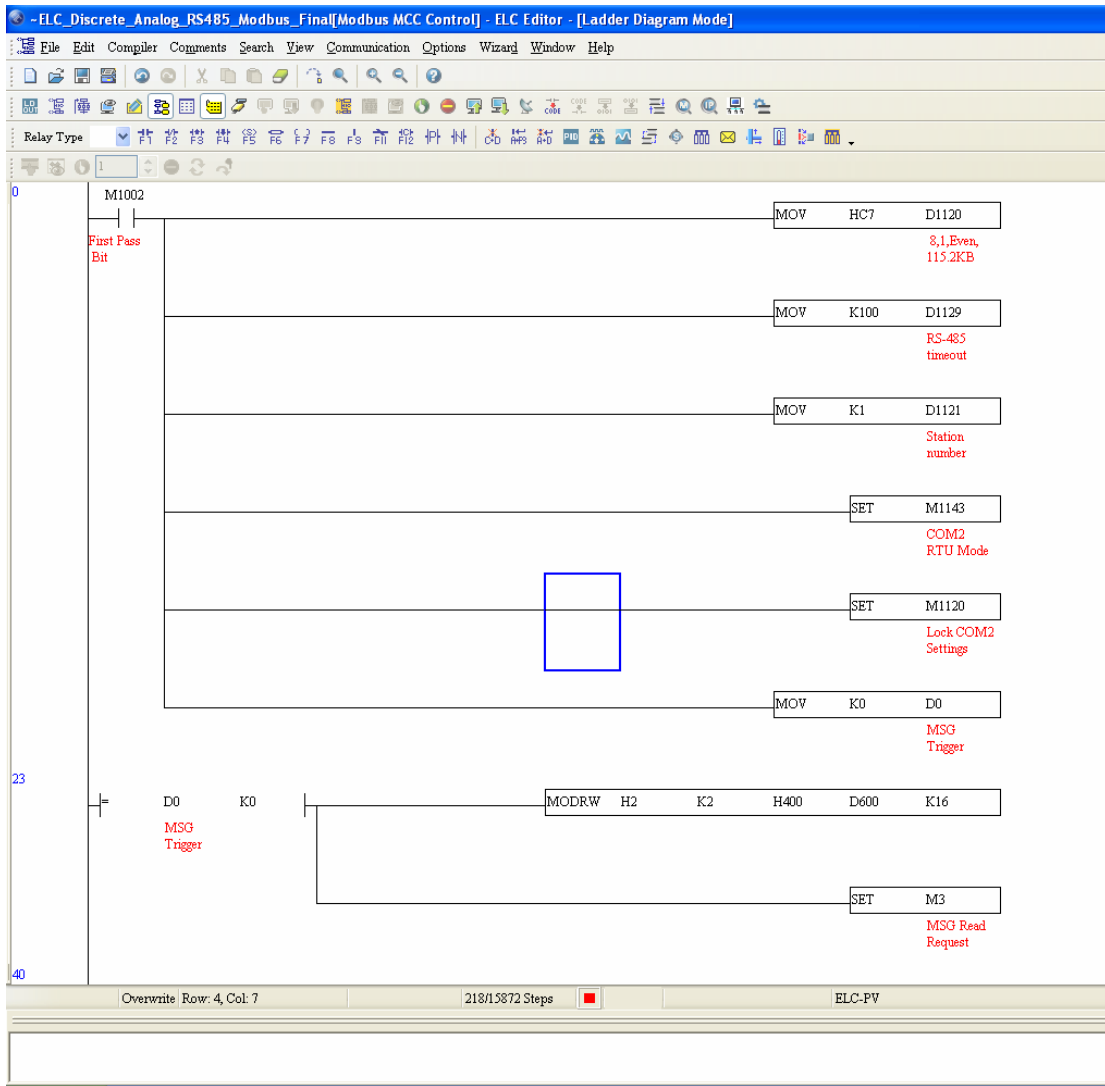
5.7 Application example: ELC processor as the Modbus master

As a Modbus slave, the ELC-CARS485 is compatible with any valid Modbus master. This example uses an ELC controller as the Modbus master. The PC downloads the ladder program to the ELC controller via the RS-232 programming port (COM1). When controller executes the ladder program, it will issue Modbus commands through the RS-485 communication port (COM2), monitoring inputs and controlling outputs through the ELC-CARS485 adapter. See the figure below for the system overview:

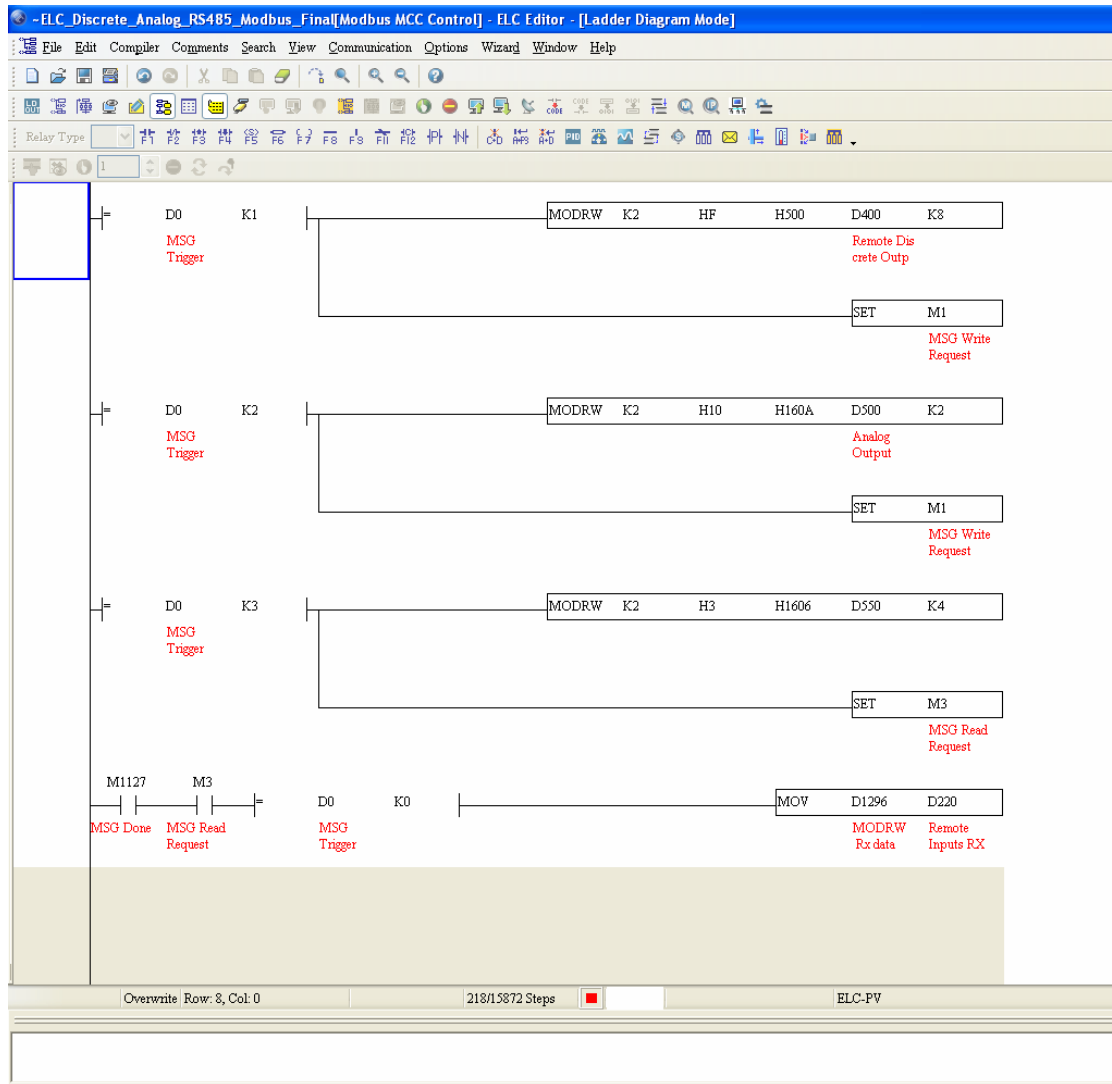


The station No. of the ELC-CARS485 is node "2". The master ELC-PV controller is node 1. Read the state of "X0 ~ X15" with the ELC-PV controller from the ELC-CARS485. Also, write to control outputs "Y0 ~ Y7" in the first ELC-EX16NDR. Then write the value from "D500 ~ D501" in the ELC-PV controller to "CR10 ~ CR11" in the ELC-AN06AANN module. Finally, read the values in "CR6 ~ CR9" in ELC-AN06AANN.

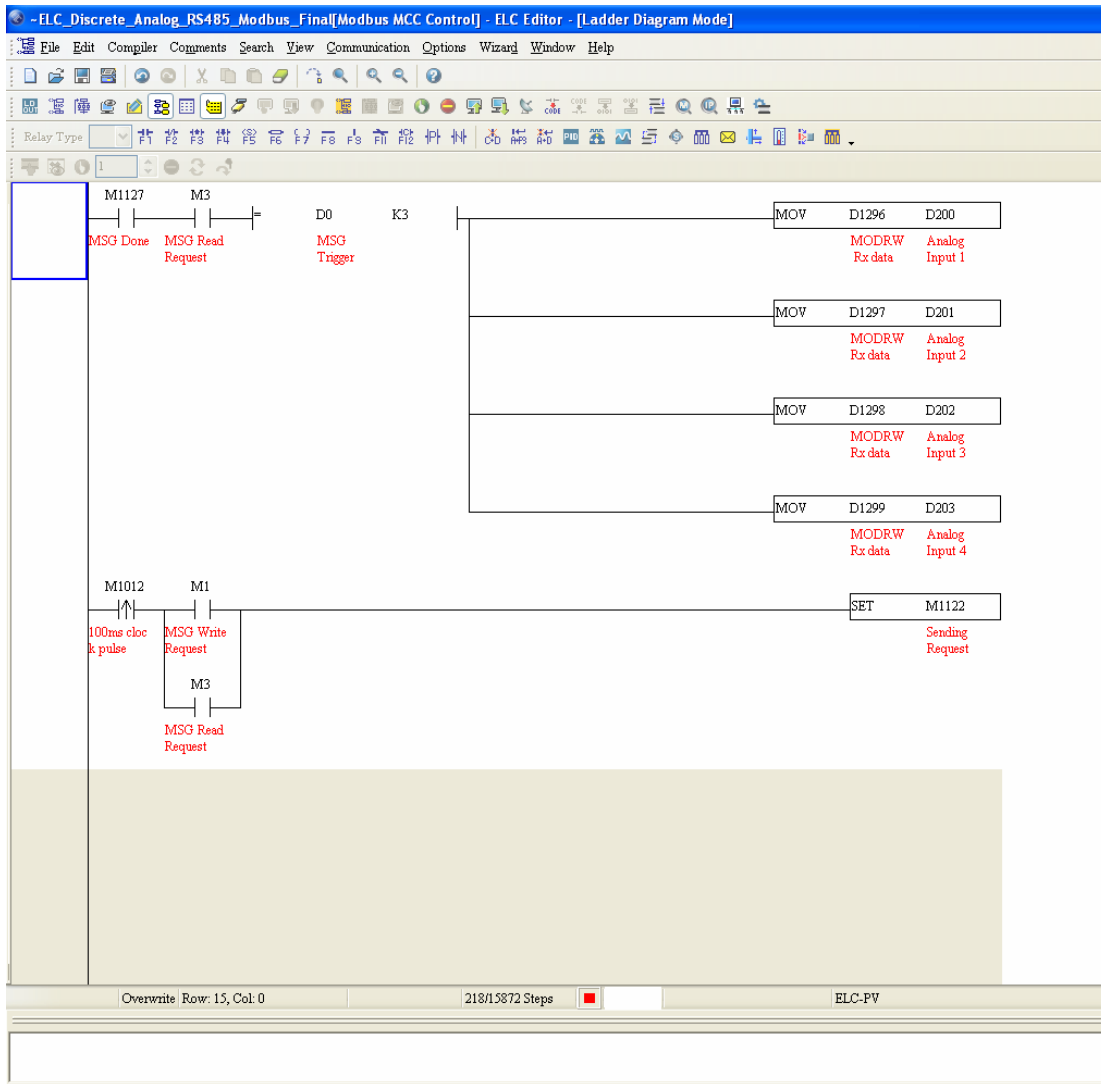
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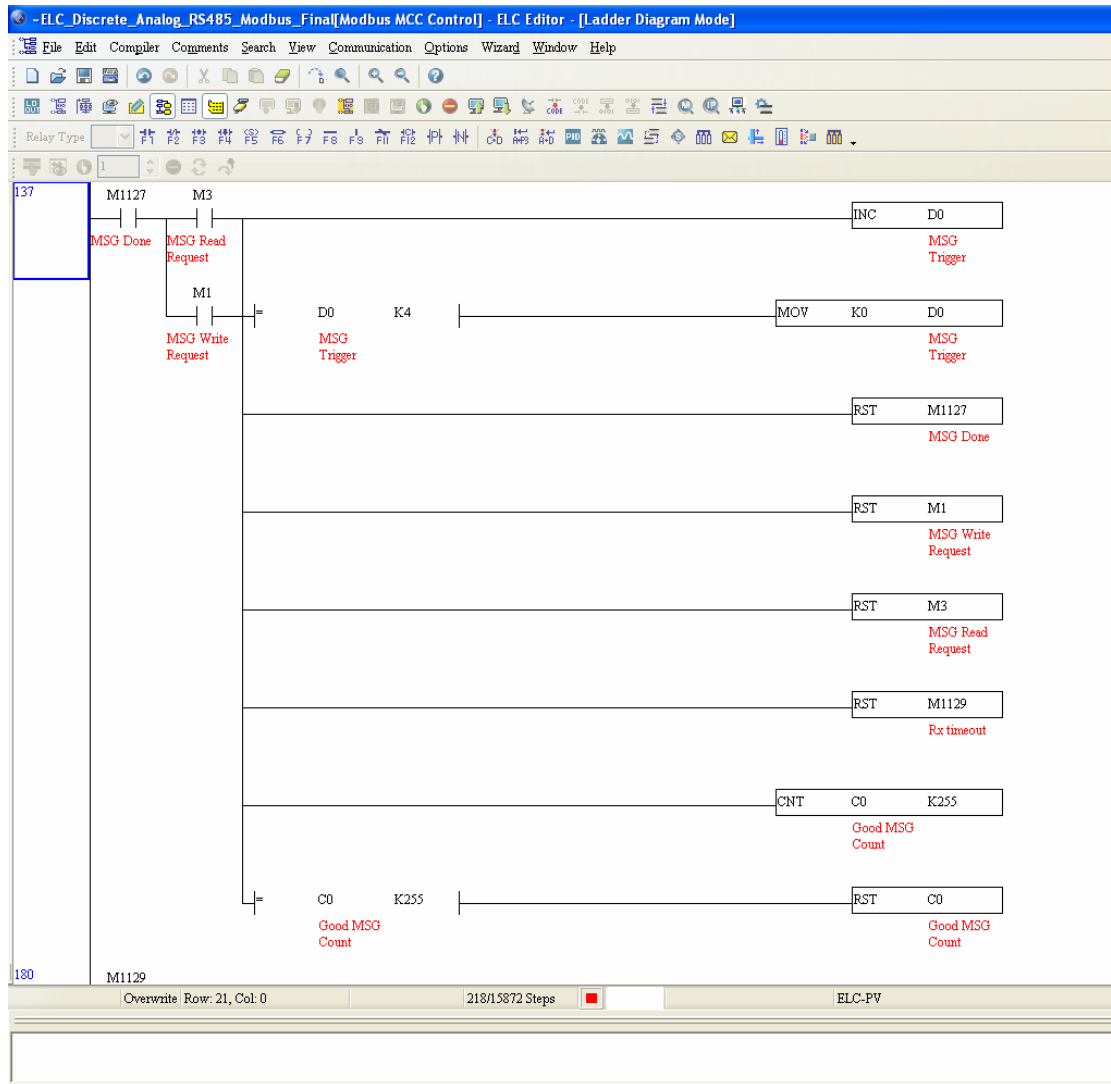
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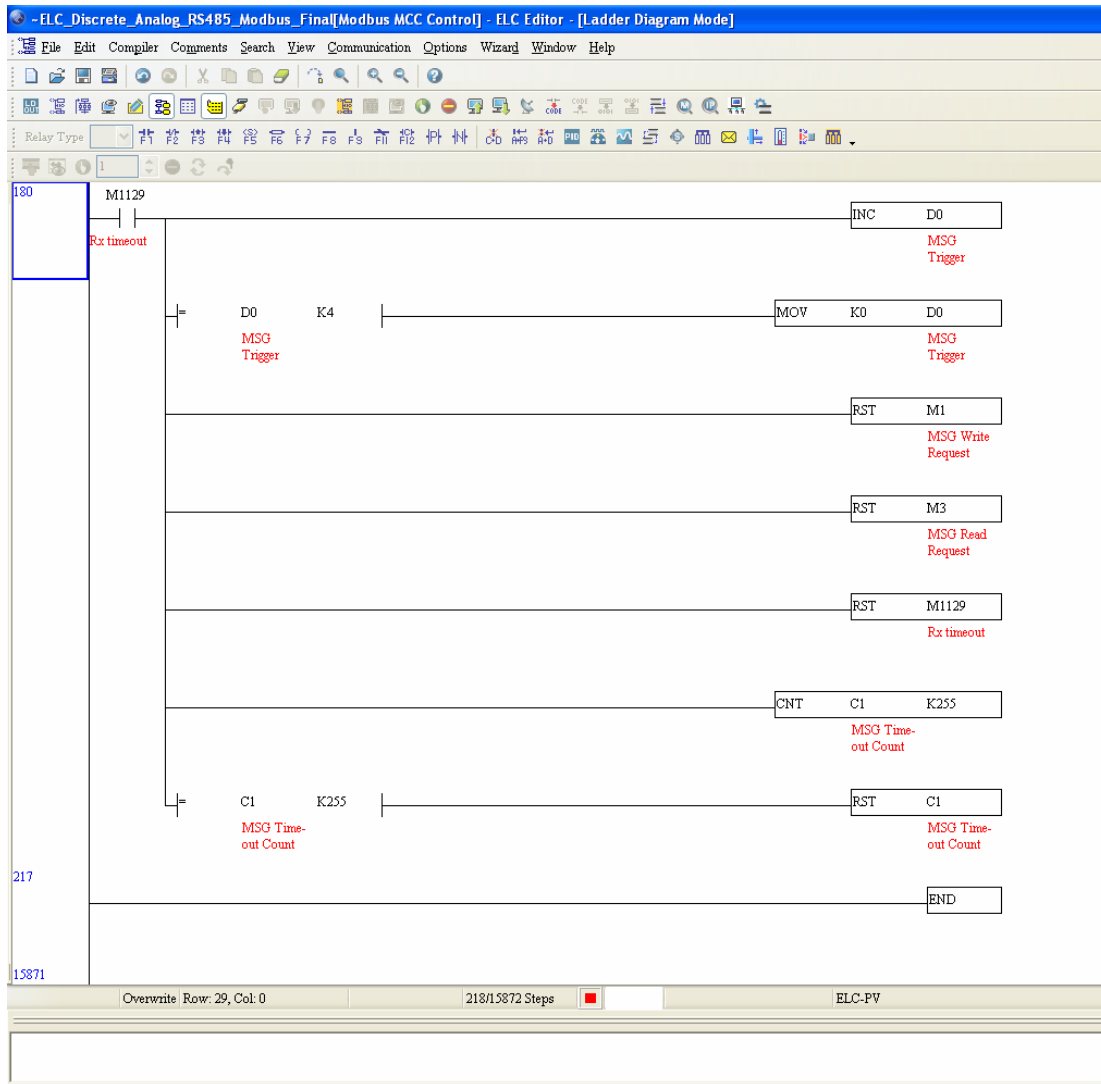
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Explanations:

- (1) Set up the communication parameters at the beginning of the program, conditioned with the power-up bit. The communication parameters for the master and slave must be the same, e.g. both devices must be configured for the same baud rate, bits/byte, parity, stop bits and RTU/ASCII mode. Each device must also have a unique node address. For this example, each device is configured for: 115200 baud, 8 bits/byte, Even parity, 1 stop bit and RTU mode.
- (2) When the ELC controller transitions to run mode, the value of “D0” will be initialized to “0”.
- (3) When the value of “D0” is “0”, the ELC controller will read the state of “X0 ~ X15” (H400 – H40F) in the ELC extension modules and save it in “D220”.
- (4) When the value of “D0” is “1”, the ELC controller will write to “Y0 ~ Y7” with the data in the low byte of “D400”.
- (5) When the value of “D0” is “2”, the ELC controller will write the values in “D500~D501” to “CR10~CR11” in the 1st special module (ELC-AN06 for this example).
- (6) When the value of “D0” is “3”, the ELC controller will read the values from “CR6 ~ CR9” in

the special module (ELC-AN06) and buffer it in "D200 ~ D203". The Modbus reply header information will be written to D550-D553.

- (7) When the value of "D0" is "4", and the fourth message has been executed, the ELC controller will re-initialize the value of "D0" to K0, to begin the message cycle again.

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