LC-101H/LC-102H

User Manual

Version: 1.0.0

Date: Sep. 2024

Warranty

All products manufactured by ICP DAS are warranted against defective materials for a period of one year from the date of delivery to the original purchaser.

Warning

ICP DAS assumes no liability for damages consequent to the use of this product.
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Service@icpdas.com

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1. Introduction

LC-101H and LC-102H are lighting control modules designed specifically for smart home applications, with the former being a single-loop and the latter a dual-loop model, both equipped with AC load current measurement capabilities. These modules not only effectively control lighting circuits but also provide real-time monitoring of load current, giving users an intuitive understanding of the lighting system's operational status.

Since the lighting circuits typically use inductive loads, switching can generate strong inrush currents (approximately 10 to 20 times the working current), which may damage the relays within the modules. The LC-101H and LC-102H are equipped with high-power relays that are resistant to inrush currents, allowing them to withstand these surges, prolonging their lifespan and reducing maintenance needs.

When users turn the lights on or off, the modules can detect the relay's switching state by measuring the load current, ensuring the normal operation of the lighting control system and promptly identifying any issues. Additionally, the relays in these modules utilize a Form C design, supporting dual-loop configurations with physical switches, providing users with greater flexibility and convenience. The current measurement feature also helps users monitor load current and check the relay's switching status, ensuring that the load operates correctly in the lighting circuit and preventing relay sticking.

The LC series lighting control modules are user-friendly, allowing for installation and operation without professional skills, and can control lighting channels without the need for software. When software control is required, programming can be done via the Modbus RTU communication protocol, and the Modbus RTU communication address can be set by hardware.

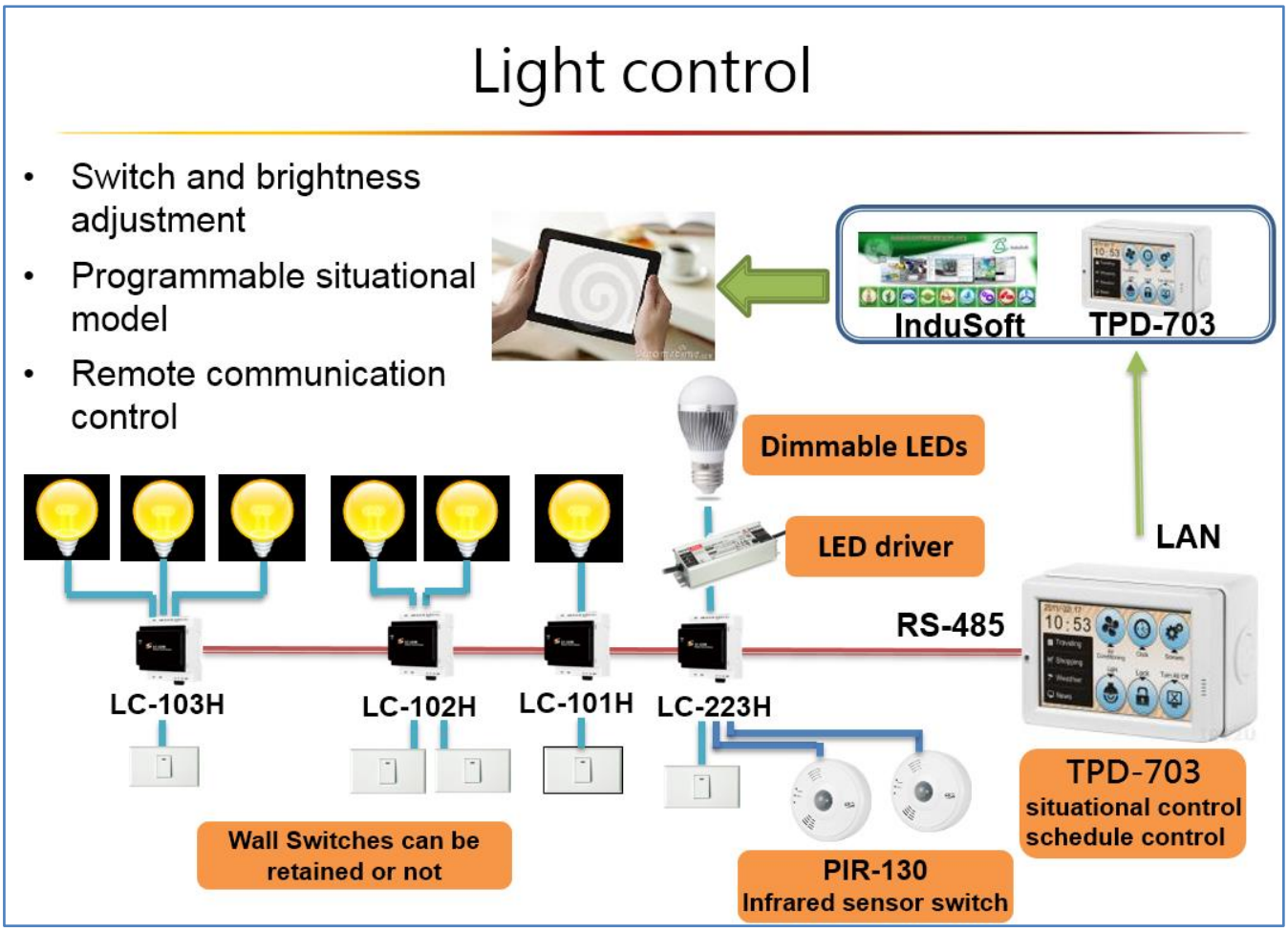
Features

- **Each lighting circuit can be controlled for on/off through RS-485 communication**
- **Each lighting circuit can also be controlled for on/off via physical switches**
- **Remote control via communication and physical switches can be used separately or combined**
- **The lighting circuit output relay is Form C, allowing for dual-loop designs with physical switches**
- **The current value on the lighting circuit can be read back via RS-485 communication to determine if any lights are faulty, and whether the lights on the dual-loop are on or off**
- **The current value on the lighting circuit ranges from 0 to 5 A**
- **Recommended number of lights that can be connected:**

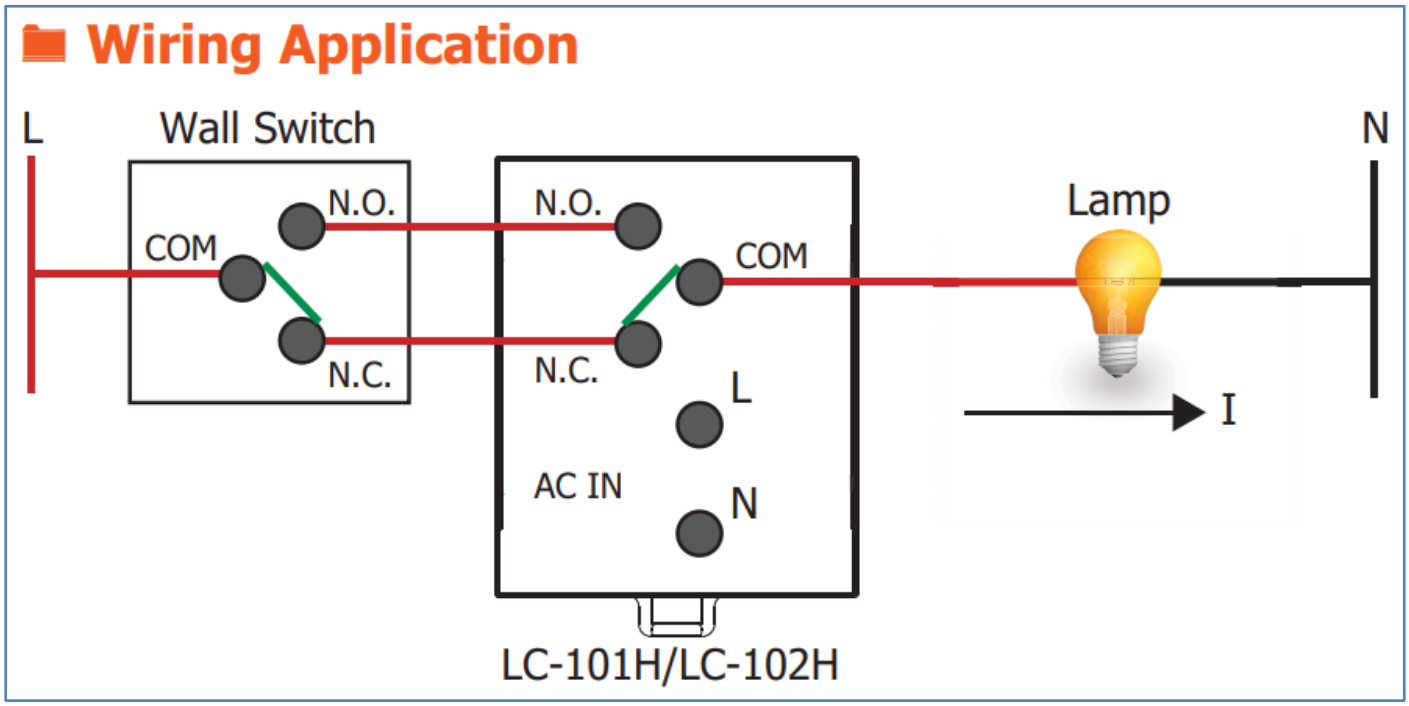
  Incandescent Lamp: 40 W/ 220 VAC * 5 units

  LED(Electronic ballast): 40 W/ 220 VAC *8 units

Applications



(For example: when 10 lamps are normally connected, the current is 2.2A. When the reading is less than 2.2A, it can be judged that there is a lamp failure and it needs to be repaired)



2. Hardware

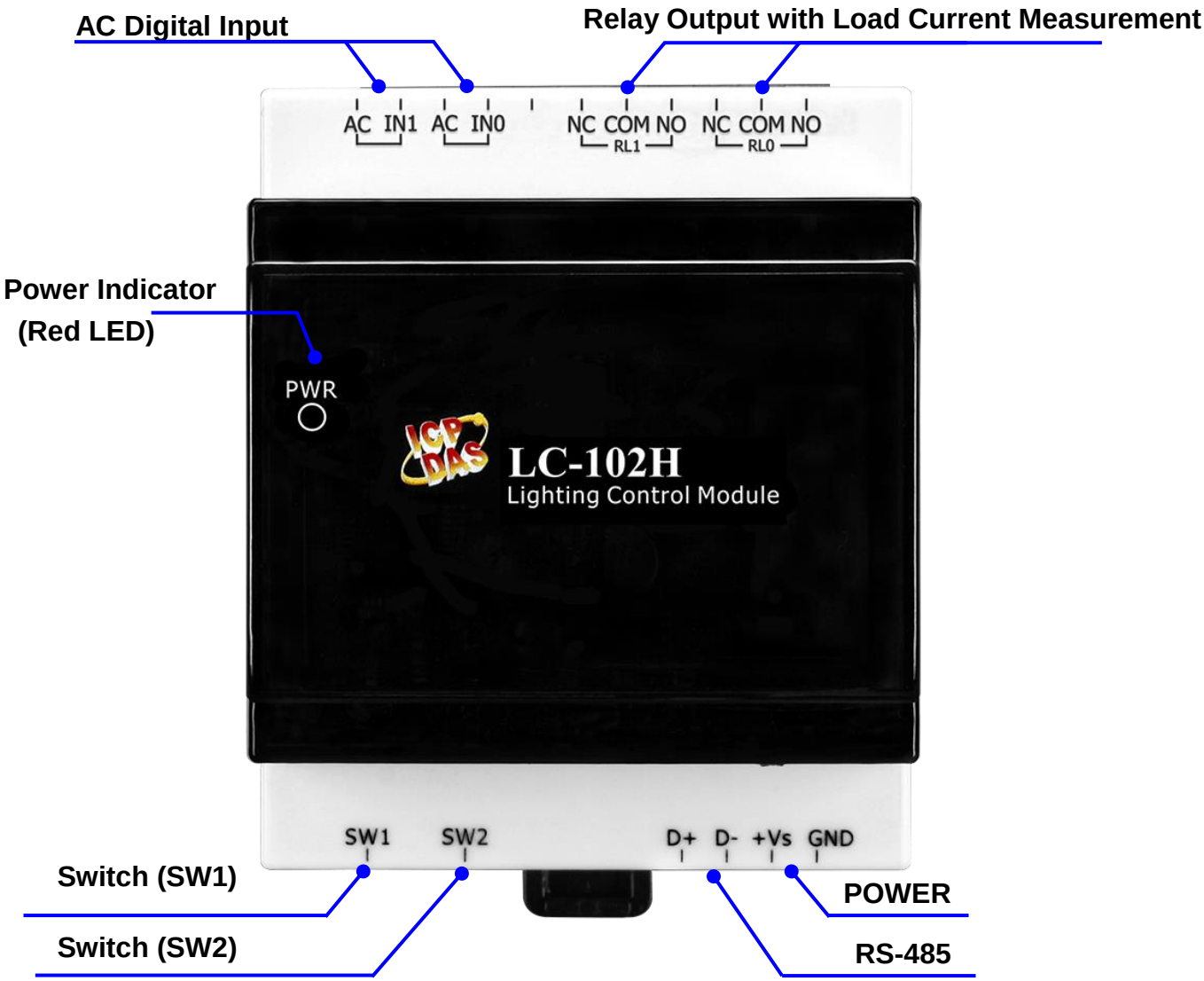
2.1 Specifications

Module	LC-101H	LC-102H
Communication		
Ports	1 x RS-485	
Data Format	N,8,1/O,8,1/E,8,1/N,8,2	
Baud Rate	Hardware Configuration: Fixed 9600 bps Software Configuration: 1200 to 115200 bps	
Protocol	Modbus RTU / DCON	
Software		
Function	Local and Remote Direct Control Relay ON/OFF and Remote Status Monitoring	
Node Addresses	32 to 63 for hardware configuration	
LED Display		
Status	1 LED as Power Indicator	
EMS Protection		
ESD (IEC 61000-4-2)	±4 kV Contact for each Terminal	
EFT (IEC61000-4-4)	±4 kV for Power	
SURGE(IEC 61000-4-5)	±2 kV for Power	
Power		
Reverse Polarity Protection	Yes	
Input Voltage Range	10 ~ 30 VDC	
Consumption	1.9 W Max.	2.8 W Max.
Mechanical		
Dimensions (W x L x H)	72 mm x 95 mm x 57 mm	
Installation	DIN-Rail	
Environment		
Operating Temperature	-25 to +75°C	
Storage Temperature	-30 to +80°C	
Humidity	10 to 95% RH, Non-condensing	

I/O Specifications

Module	LC-101H	LC-102H
Digital Input		
Channels	1	2
Type	Wet Contact, 90 ~ 240 V_{AC}	
On Voltage Level	65 VAC	
Off Voltage Level	56 VAC	
Input Impedance	68 KΩ, 2W	
Isolation	3000 VDC	
Relay Output with Load Current Measurement		
Channels	1	2
Type	Power Relay, Form C (SPDT N.O+N.C..)	
Contact Rating	30 A @ 250 VAC	
Max. Inrush Current	112A /1ms	
Number of lighting fixtures	(1).Incandescent Lamp: 40W/ 220VAC * 5 Sets (2).LED(Electronic ballast): 40W/ 220VAC *8 Sets	
Operate Time	15 ms Max	
Release Time	22 ms Max.	
Electrical Endurance	100,000 ops.	
Mechanical Endurance	10,000,000 ops	
AC Load Current Measurement	Yes, 0 ~ 5 A range with 3% of FSR Accuracy.	
Power-on Value	Yes	
Safe Value	Yes	

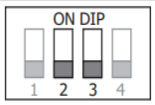
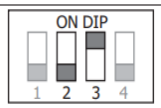
2.2 Appearance



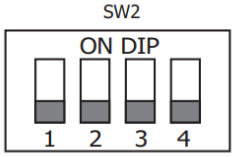
LED Indicators

- PWR: Power/Communication Indicator

Switch (SW1)

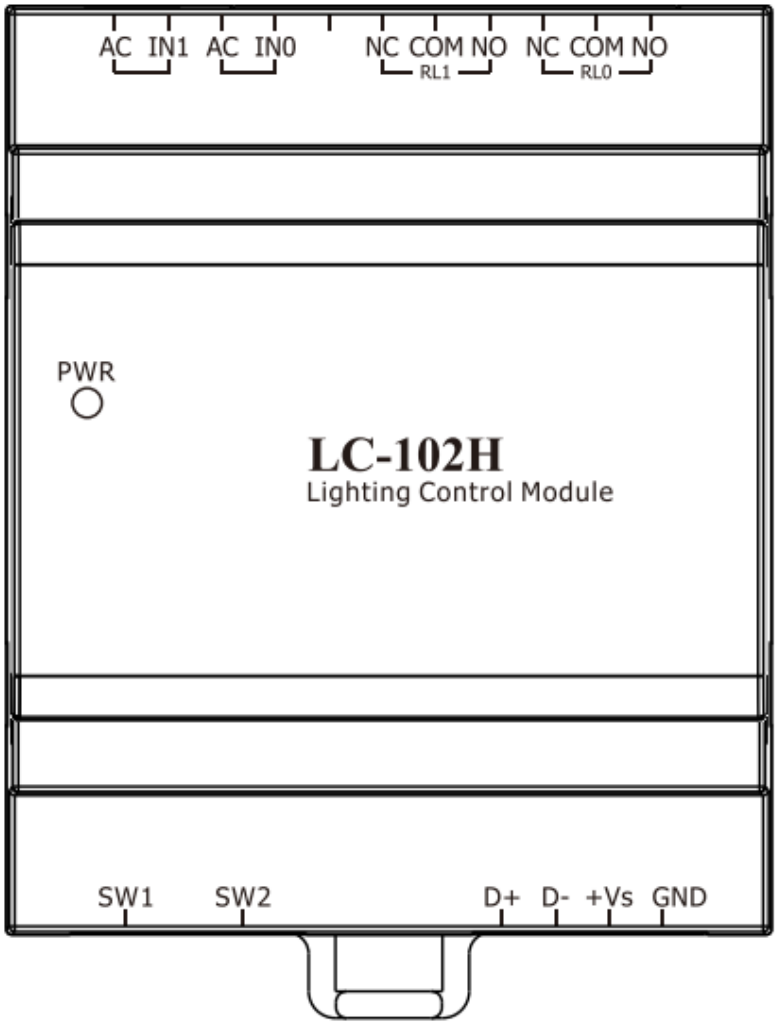
SW1 		0 to F for Address 32-47 (Node Address - Low)
		0 to F for Address 48 -63 (Node Address - High)

Switch (SW2)

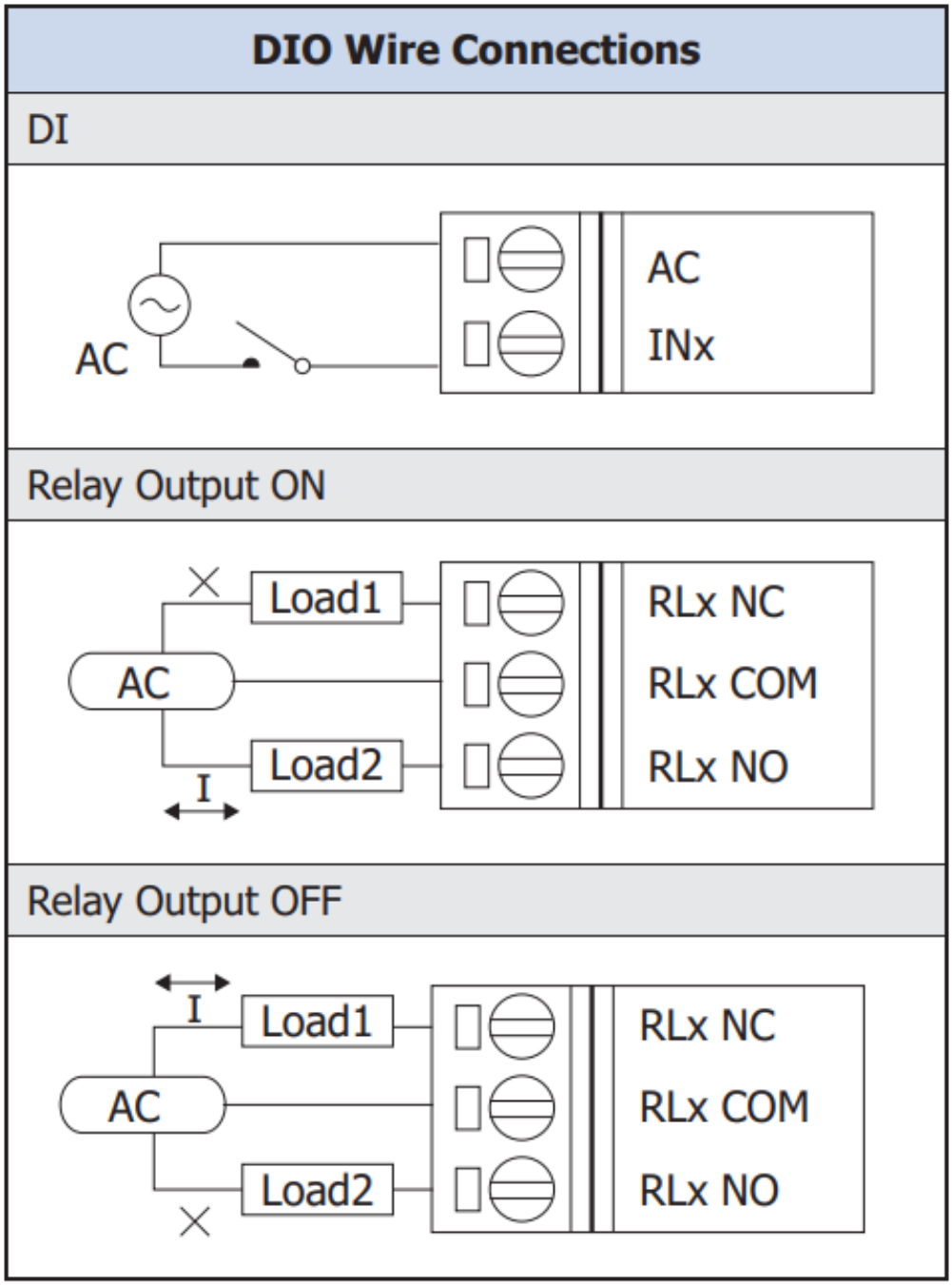


1	ON	DCON Protocol
	OFF	Modbus RTU Protocol
2	ON	Software Configuration
	OFF	Hardware Configuration
3	ON	Node Address (High)
	OFF	Node Address (Low)
4	ON	INIT Mode
	OFF	Normal Mode

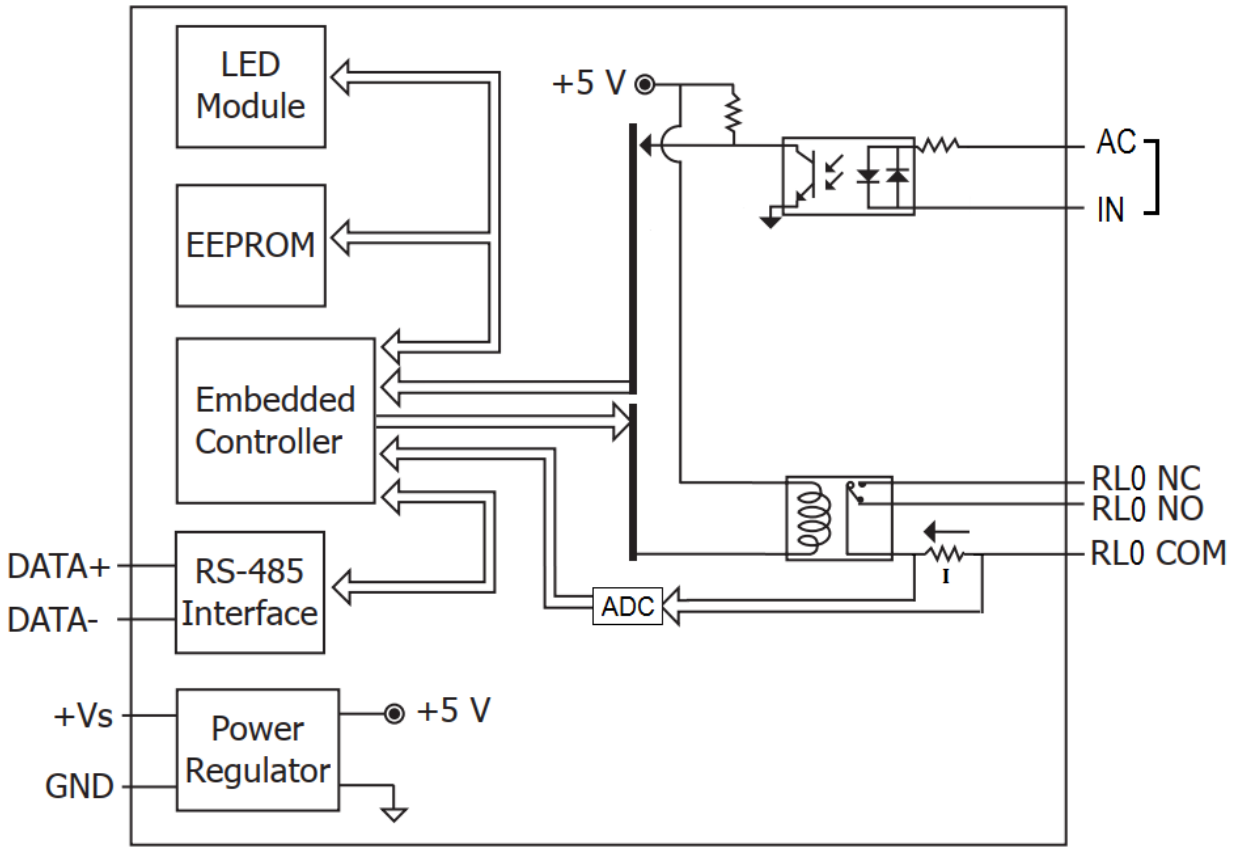
2.3 Pin Assignments

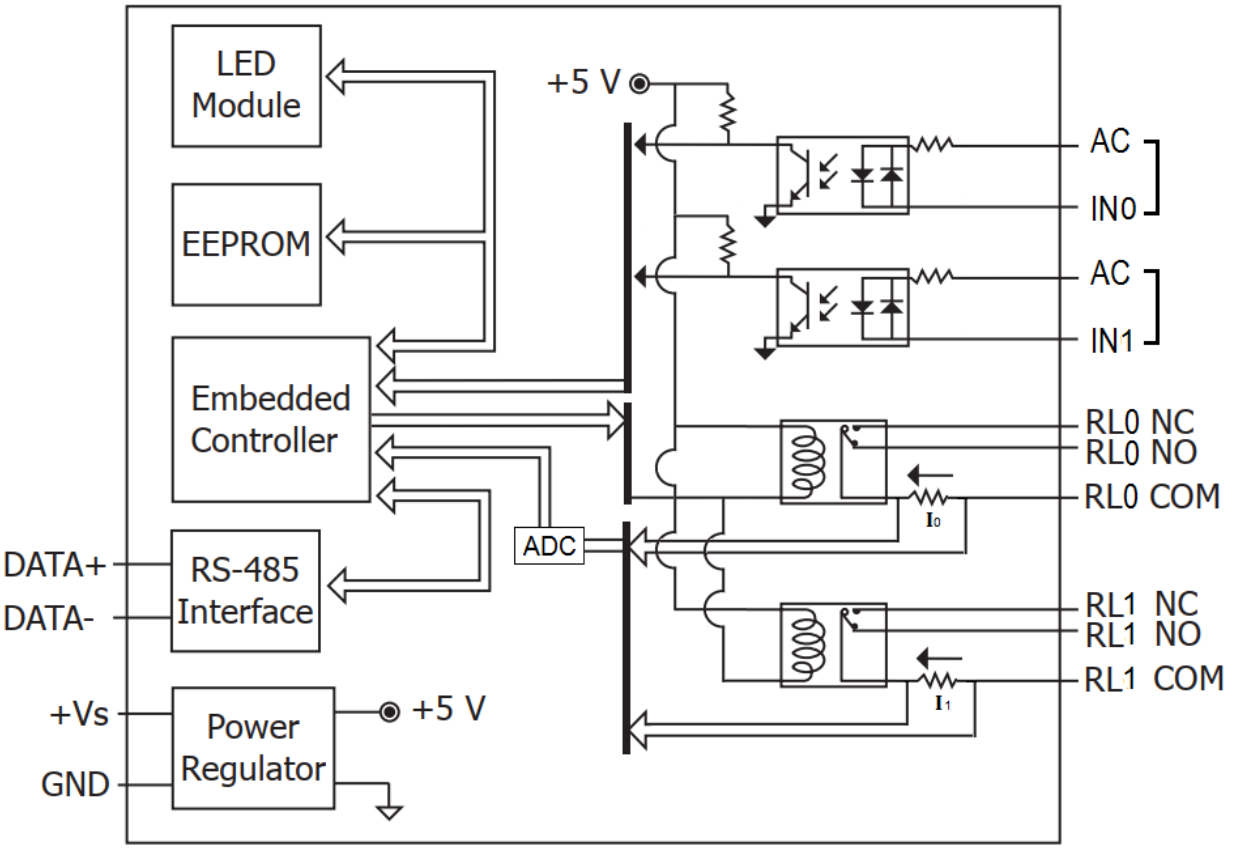


2.4 Wire Connections

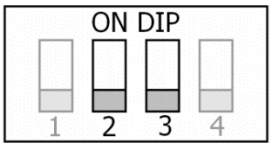
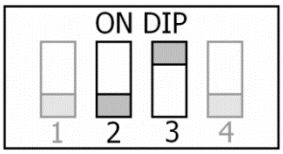


2.5 Internal I/O Structure

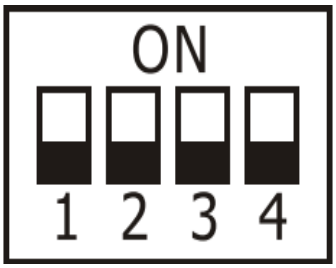




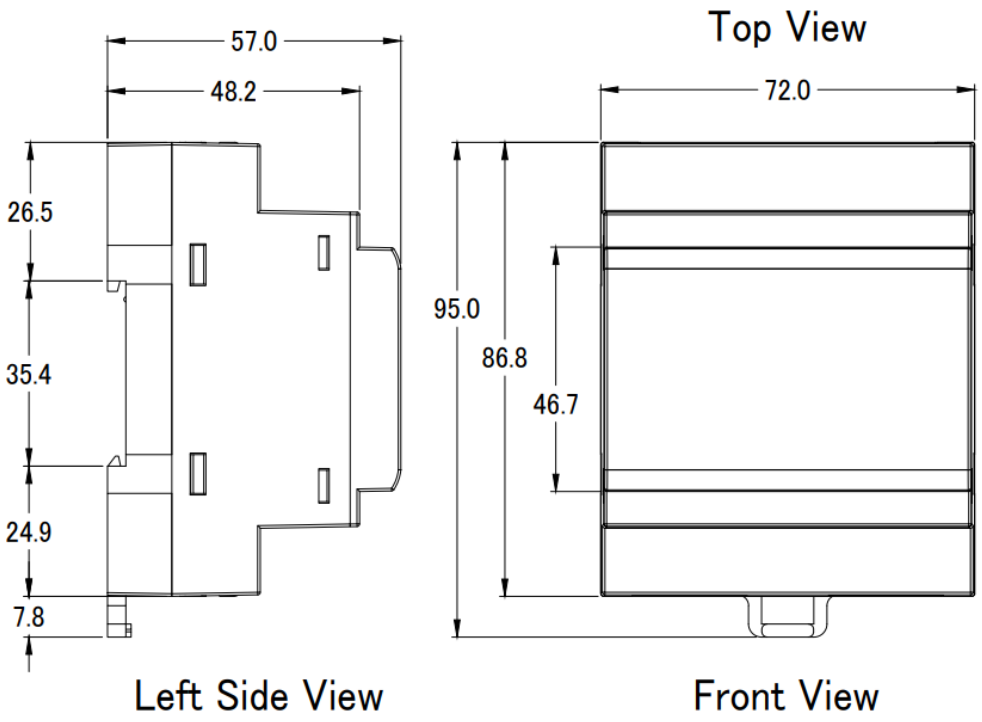
2.6 Switch (SW1)

SW1		
		0 to F for Address 32-47 (Node Address - Low)
		0 to F for Address 48 -63 (Node Address - High)

2.61Switch (SW2)

SW2			
	1	ON	DCON Protocol
		OFF	Modbus RTU Protocol
	2	ON	Software Configuration
		OFF	Hardware Configuration
	3	ON	Node Address (High)
		OFF	Node Address (Low)
	4	ON	INIT Mode
		OFF	Normal Mode

2.7 Dimensions (unit: mm)



3. Configuration via RS-485

➢ The factory default settings for RS-485 communication

- Address: 1
- Protocol: Modbus RTU / DCON
- Baud rate: Hardware Configuration: Fixed 9600 bps
  Software Configuration: 1200 to 115200 bps
- Data Format: N,8,1/O,8,1/E,8,1/N,8,2

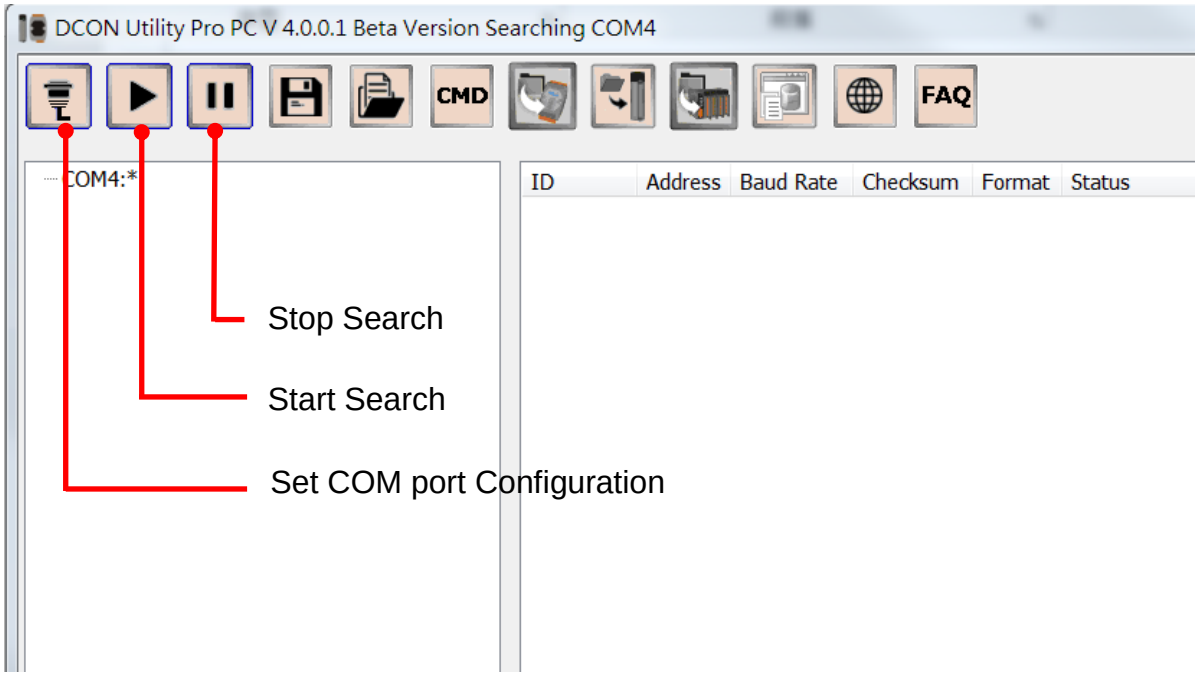
Note

If there are multiple LC-101H/LC-102H connected to the same RS-485 network, each module needs be set with a unique RS-485 address. More than one module having the same address will cause communication failure

➢ Testing RS-485 Communication

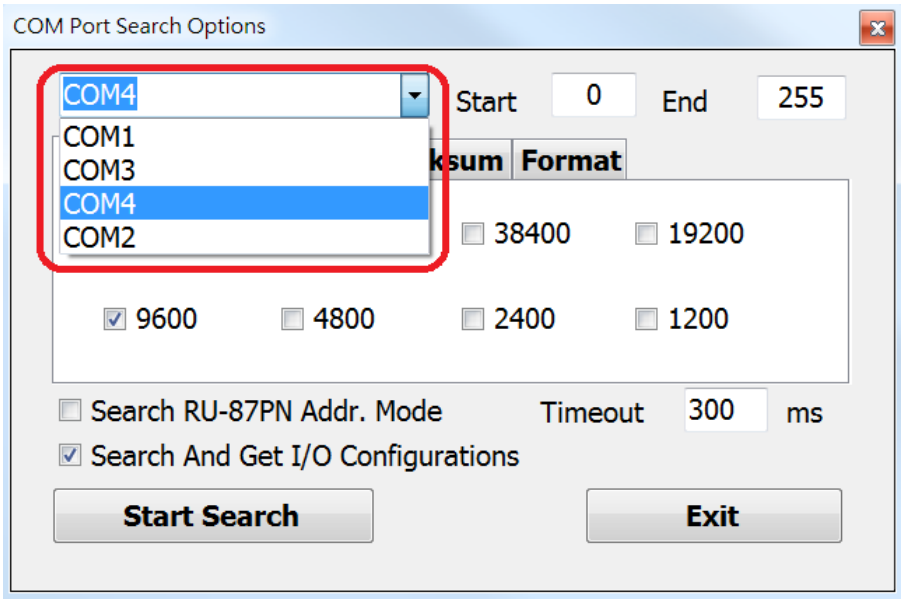
1. Download the DCON Utility Pro from
   ICPDAS web site : https://www.icpdas.com/en/download/DCON_Utility_Pro

2. Launch the DCON_Utility_Pro.exe.

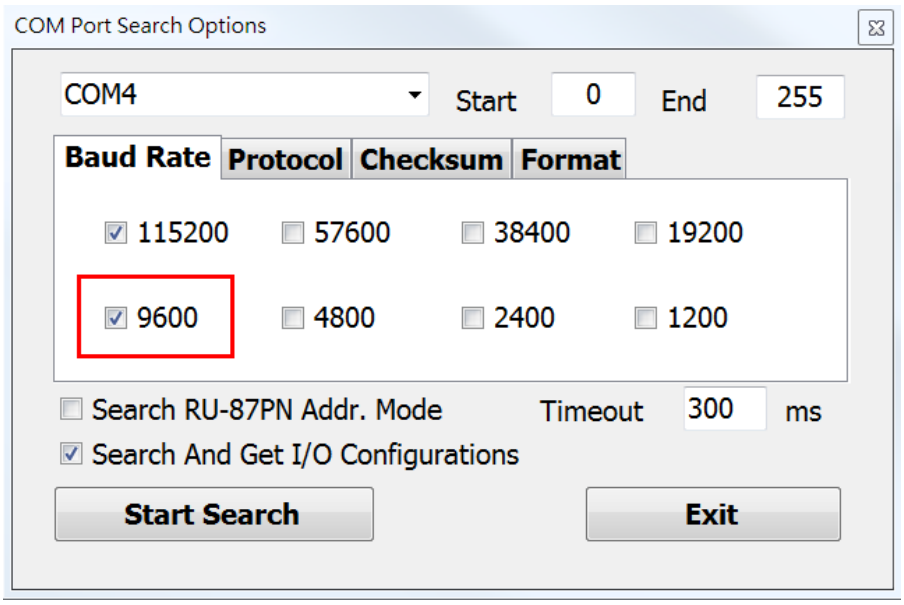


3. Click the icon  to configure the COM port.

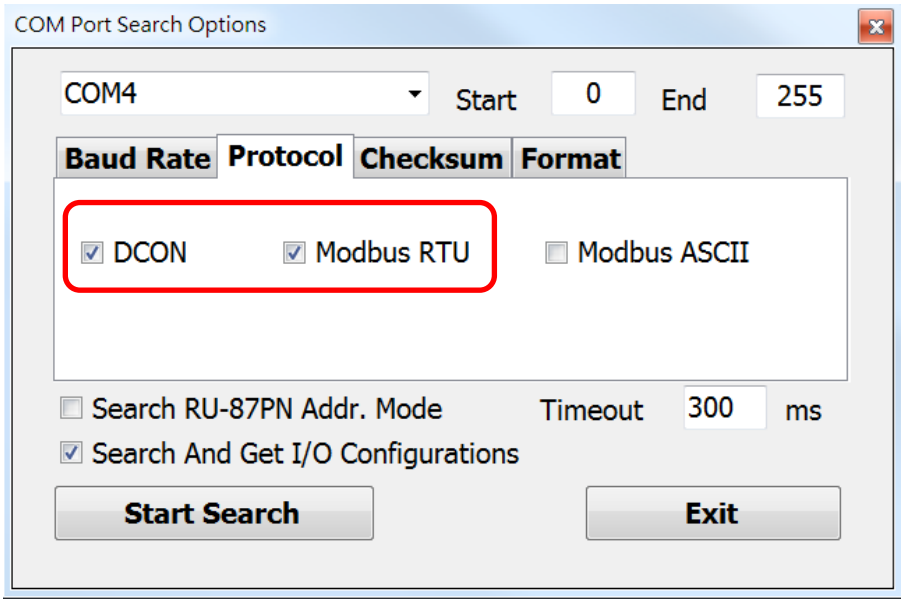
4. Select the COM Port number used to connect the LC-101H/LC-102H logger.



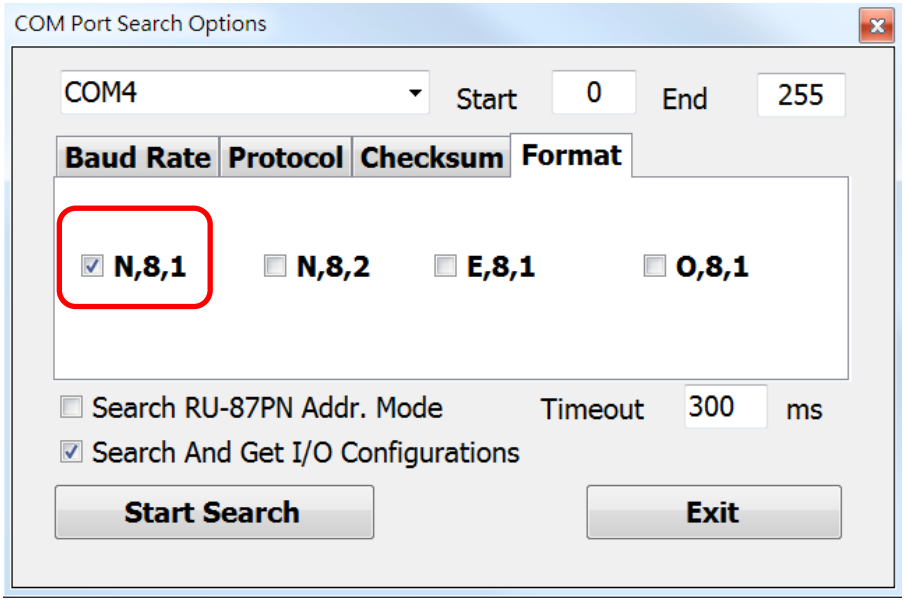
5. The Baud Rate is factory default to 9600 bps.



6. Select the Protocol tab.

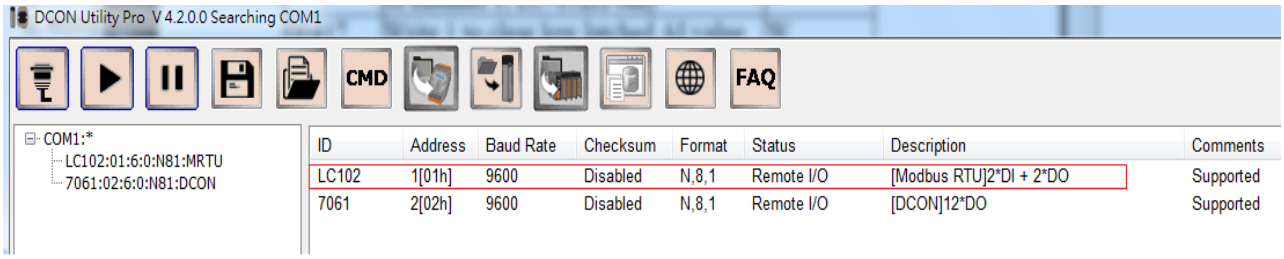


7. Select the Format tab and check the parity that set in the logger.

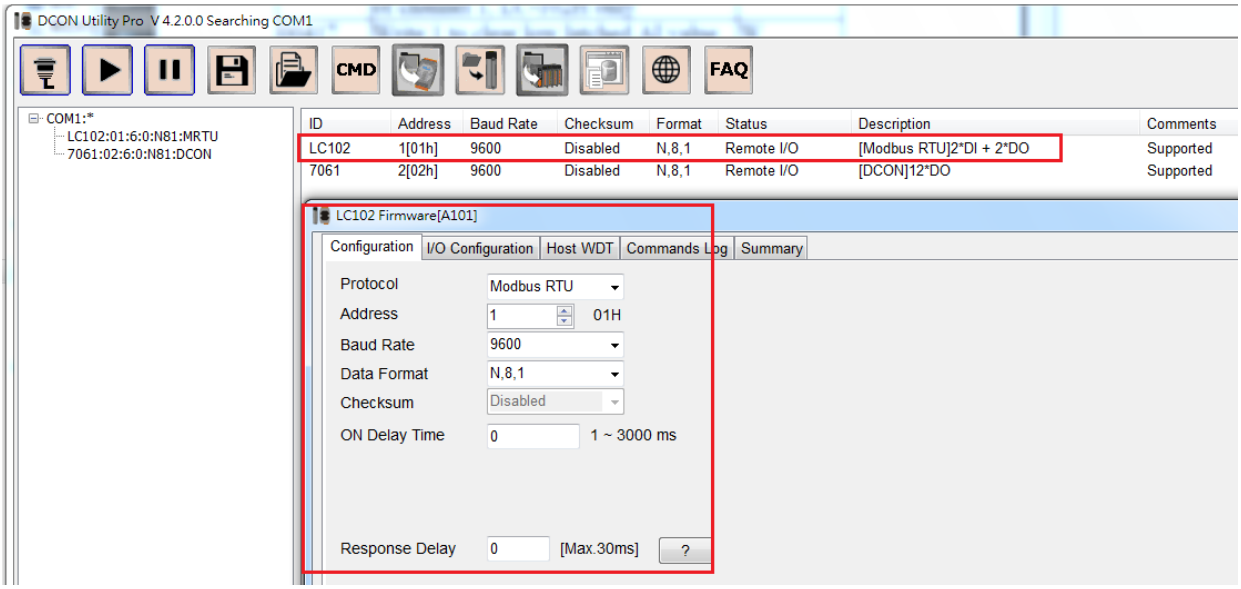


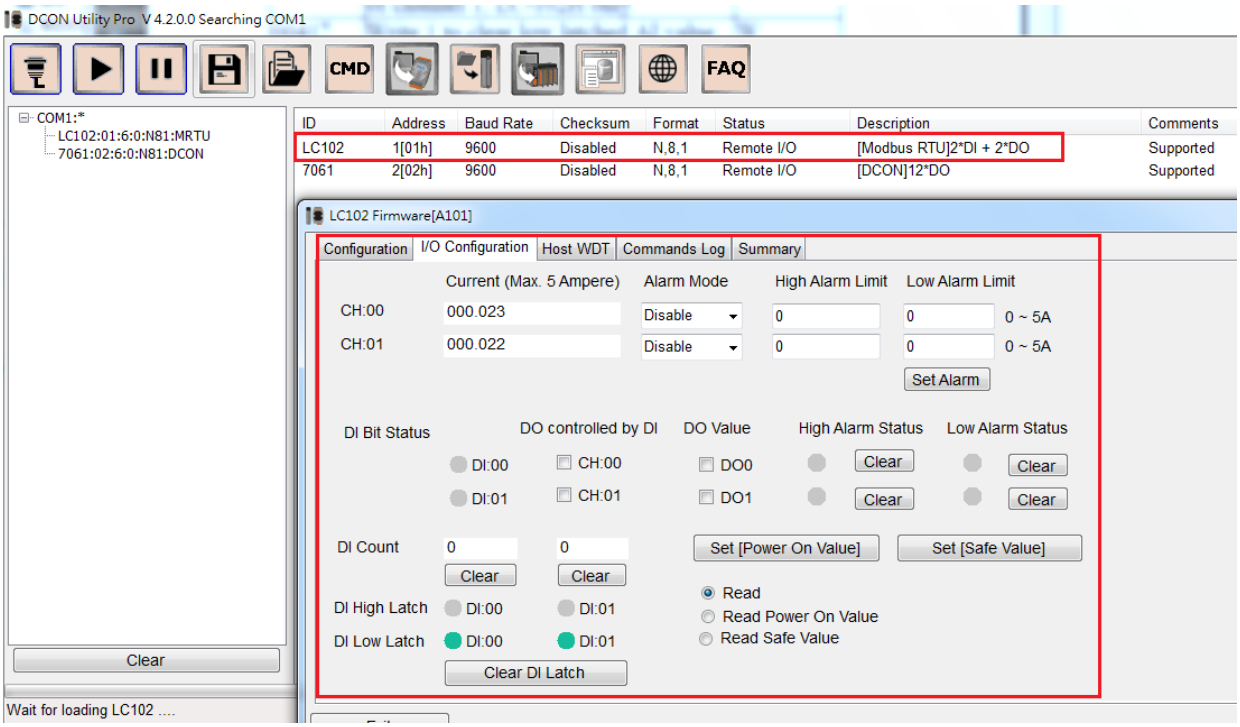
8. Click the Start Search icon. 

9. The LC-101H/LC-102H logger searched out will be listed as below.



10. Click the module name to configure the logger.





Note

The Protocol/Baud Rate/Parity/Checksum items marked with ”(INIT*)” means that when any of those items needs be modified, the pin 4.INIT needs to be set in ON position and power cycle the logger, then the item can be modified. After complete setting, set the pin 4. INIT back to OFF position and power cycle the logger again to take the setting effect.

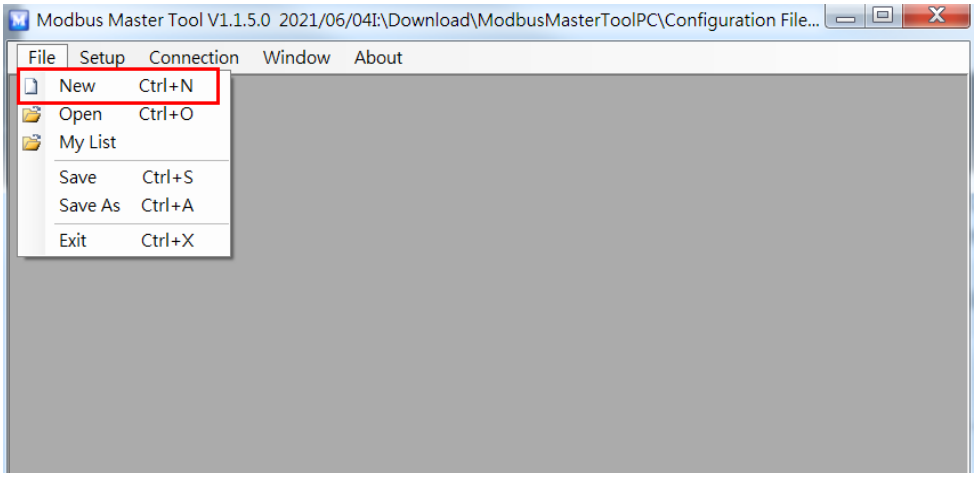
Appendix A: Modbus Master Tool PC

Modbus Master Tool PC is a free, easy-to-use tool for Modbus communication and diagnosing the wiring.

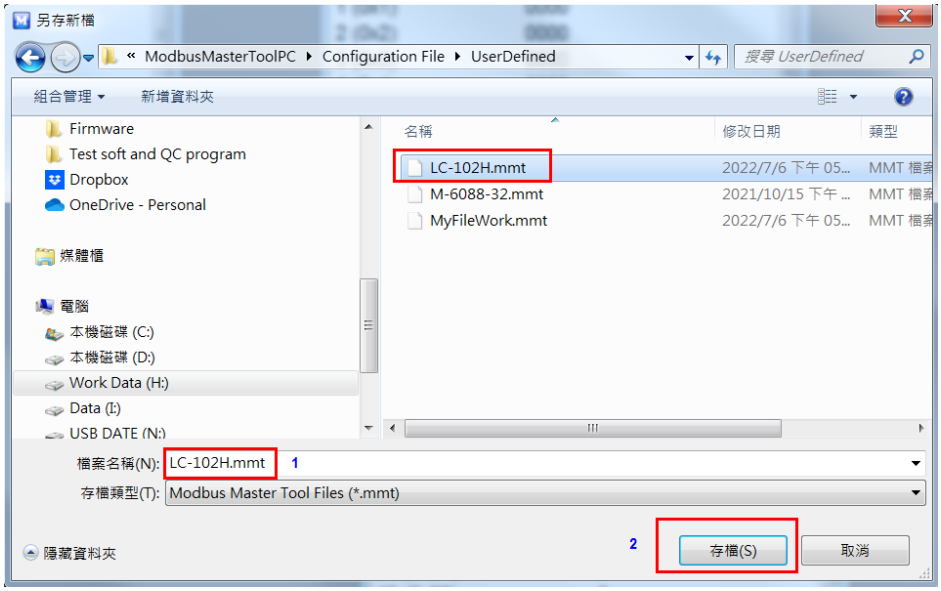
ICPDAS web site :https://www.icpdas.com/en/download/ModbusMasterToolPC

This section intends to guide the steps for creating the Modbus communication with LC-101H/LC-102H logger.

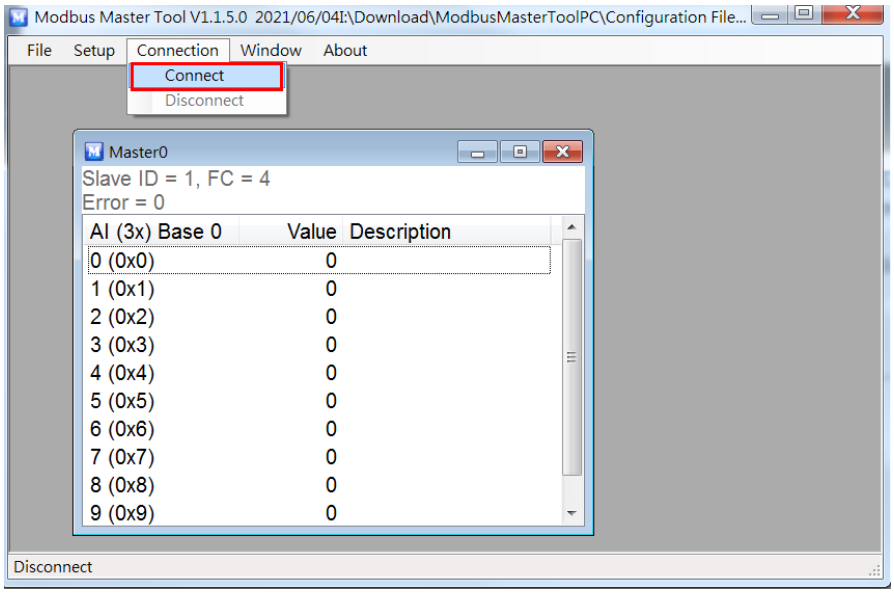
1. Launch the ModbusMasterToolPC.exe.
2. Select ***New*** in the File menu.



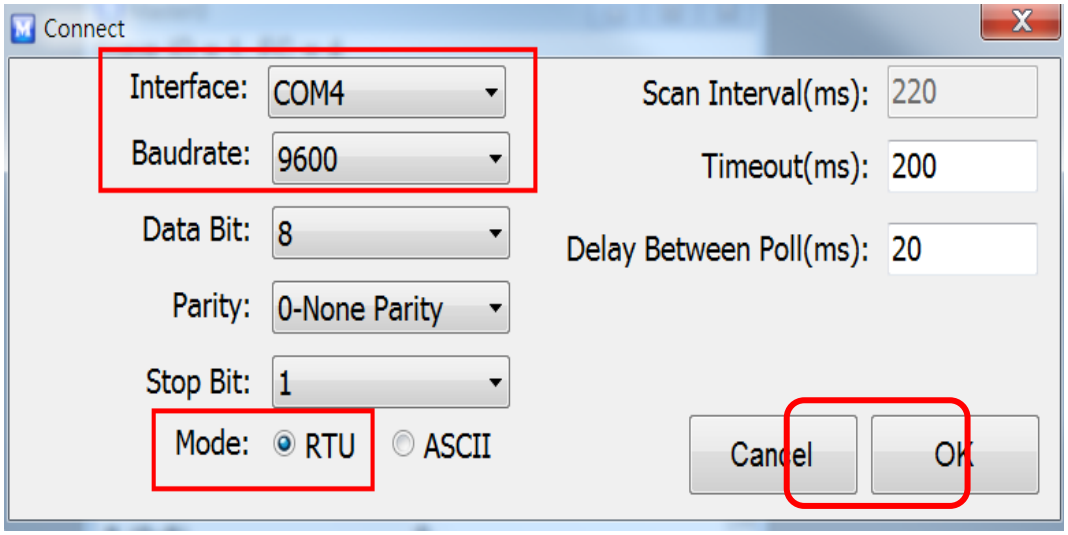
3. Input the file name and click on the ***Save*** button.



4. Select ***Connect*** in the *Connection* menu.

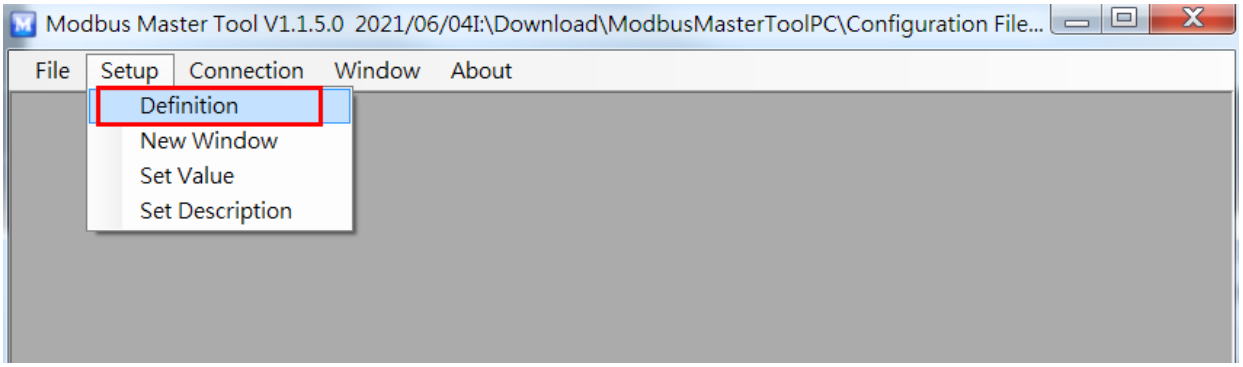


5. Select the communication interface.

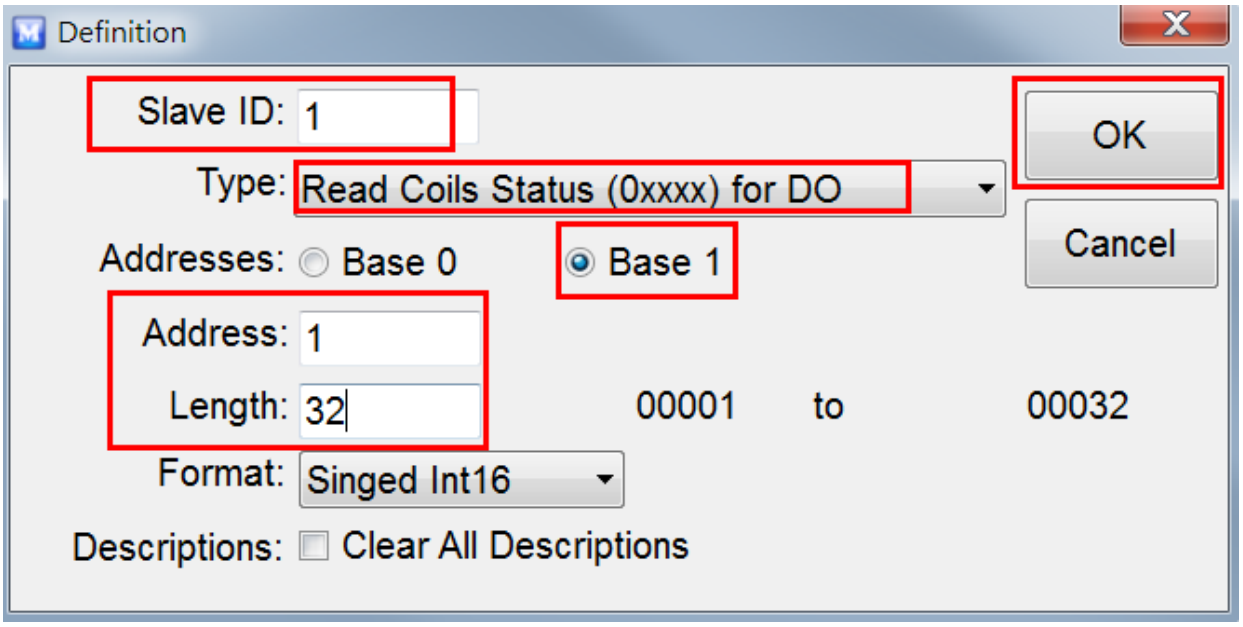


When using RS-485 as the interface, select the COM port, check the RTU mode and click on the ***OK*** button.

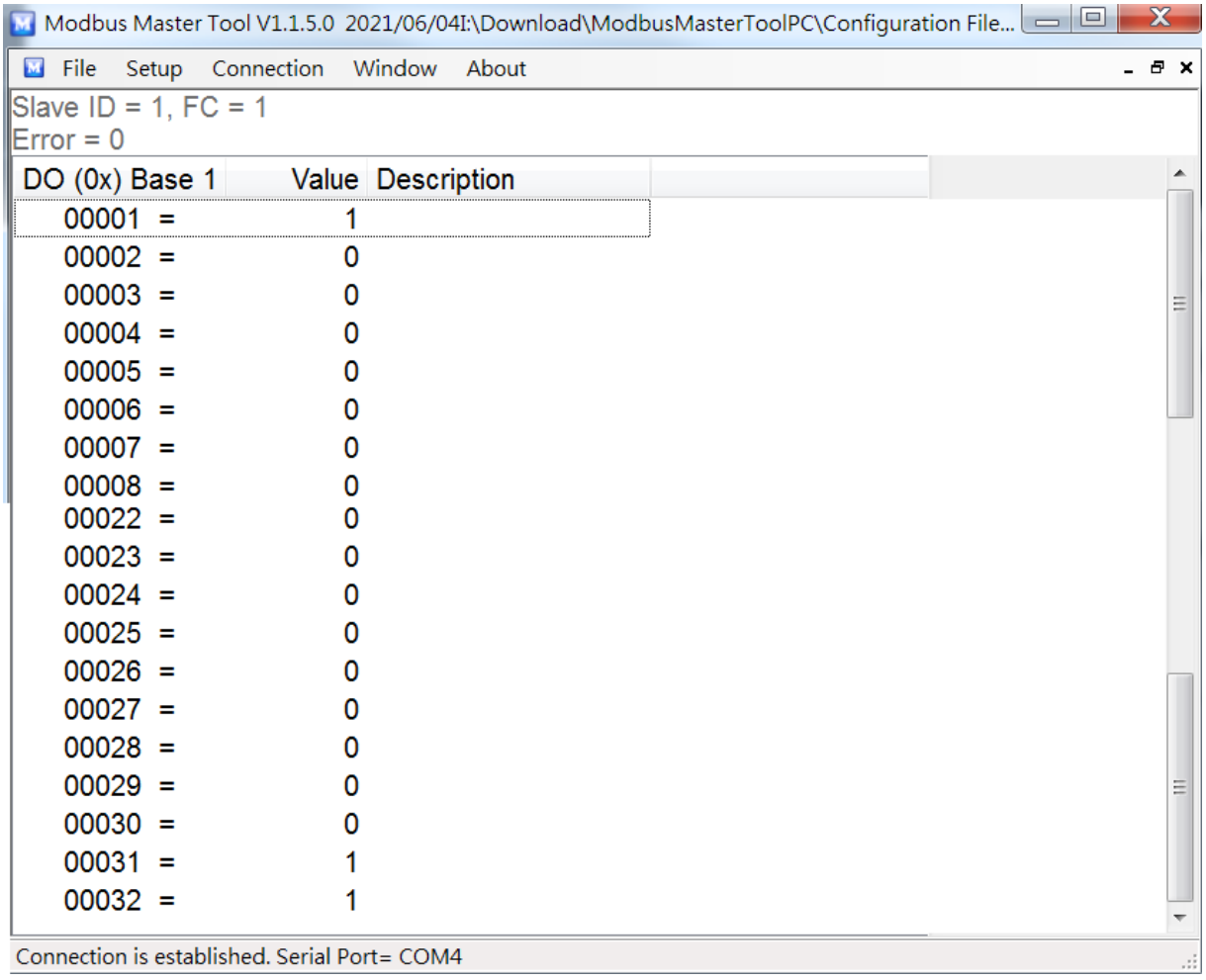
6. Select ***Definition*** in the *Setup* menu.



7. Select the Modbus function code, input the start address and length, and click on the ***OK*** button.

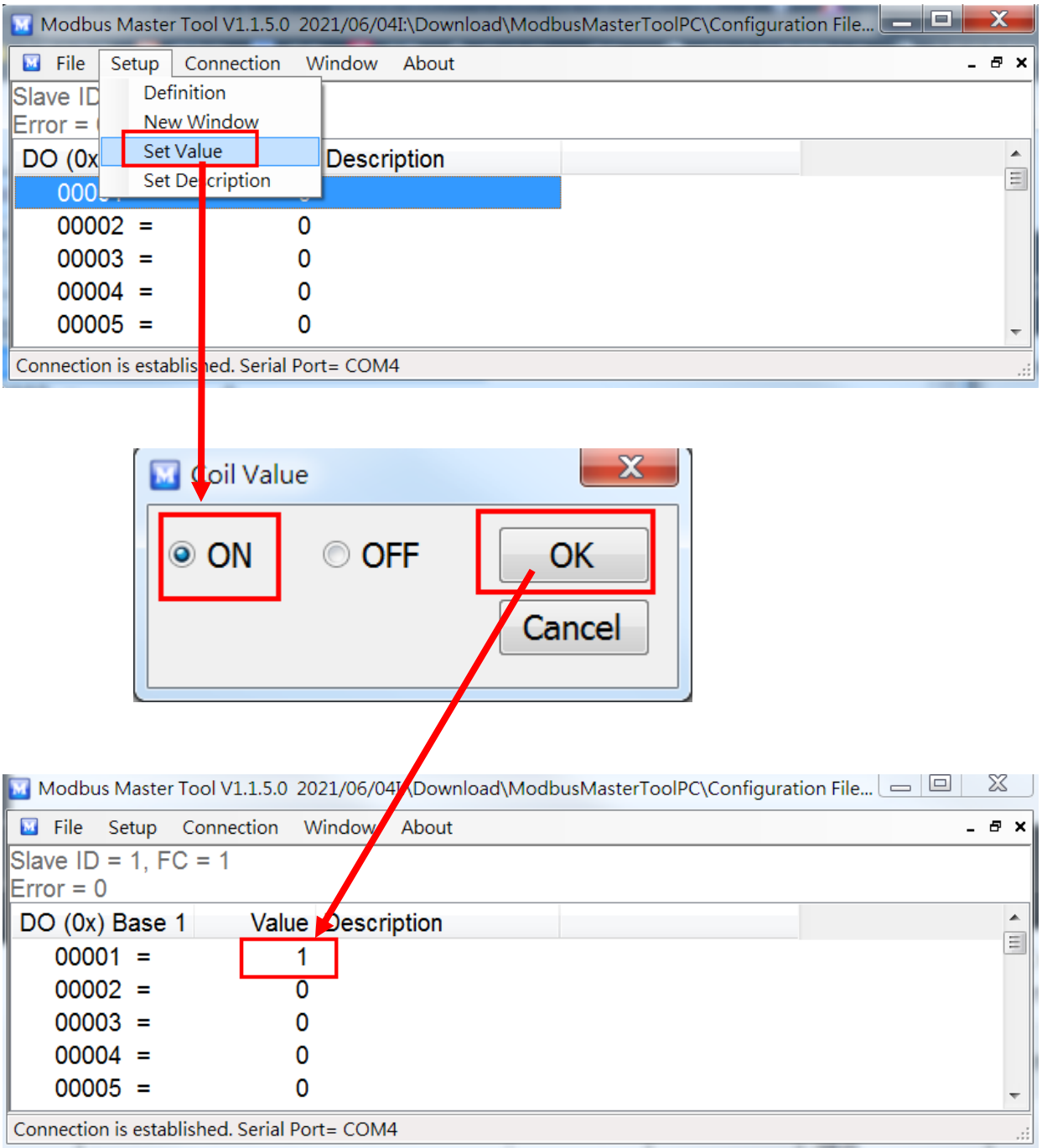


8. Read data.



9. Write data to Holding Register or Coil Status

1. Highlight the Modbus address in the Holding Register or Coil Status list
2. Select ***Set Value*** in the *Setup* menu.
3. Input the data in the Value box and click on the ***OK*** button



Appendix B: Modbus Address Table

LC-101H/LC-102H Modbus Address Mappings (Base 1)

Address	Description	Attribute
30001 40001	Counter value of digital input channel 0	R
30002 40002	Counter value of digital input channel 1, LC-102H only	R
30033 40033	Current input value of channel 0 in mA	R
30034 40034	Current input value of channel 1 in mA, LC-102H only	R
30225 40225	High alarm limit of current input value of channel 0 in mA	R/W
30226 40226	High alarm limit of current input value of channel 1 in mA, LC-102H only	R/W
30233 40233	Low alarm limit of current input value of channel 0 in mA	R/W
30234	Low alarm limit of current input	R/W

40234	value of channel 1 in mA, LC-102H only	
40481	Firmware version (low word)	R
40482	Firmware version (high word)	R
40483	Module name (low word)	R
40484	Module name (high word)	R
40485	RS-485 module address, 1 to 247	R/W
40486	RS-485 baud rate and parity settings Bits 5:0 Baud rate, valid range: 3 ~ 10 Bits 7:6 00: no parity, 1 stop bit 01: no parity, 2 stop bit 10: even parity, 1 stop bit 11: odd parity , 1 stop bit	R/W
40488	RS-485 response delay time in ms, valid range, 0 ~ 30	R/W
40489	Host watchdog timeout value, 0 to	R/W

	255, in 0.1s	
Address	**Description**	**Attribute**
40492	RS-485 host watchdog timeout count, write 0 to clear	R/W
40498	DO silent time on power-on in ms, 0 to 5000	R/W
30513 40513	High latched current input value of channel 0 in mA	R
30514 40514	High latched current input value of channel 1 in mA, LC-102H only	R
30545 40545	Low latched current input value of channel 0 in mA	R
30546 40546	Low latched current input value of channel 1 in mA, LC-102H only	R
00001	Digital output channel 0	R/W
00002	Digital output channel 1, LC-102H only	R/W
00033 10033	Digital input status of channel 0	R

00034 10034	Digital input status of channel 1, LC-102H only	R
00065 10065	Latched high of digital input status of channel 0	R
00066 10066	Latched high of digital input status of channel 1, LC-102H only	R
00069 10069	Latched high of digital output status of channel 0	R
00070 10070	Latched high of digital output status of channel 1, LC-102H only	R
00097 10097	Latched low of digital input status of channel 0	R
00098 10098	Latched low of digital input status of channel 1, LC-102H only	R
00101 10101	Latched low of digital output status of channel 0	R
00102 10102	Latched low of digital output status of channel 1, LC-102H only	R

Address	Description	Attribute
00129	Safe value of digital output channel 0	R/W
00130	Safe value of digital output channel 1, LC-102H only	R/W
00161	Power on value of digital output channel 0	R/W
00162	Power on value of digital output channel 1, LC-102H only	R/W
00193	Counter trigger edge of digital input channel 0 0: updated on falling edge 1: updated on rising edge	R/W
00194	Counter trigger edge of digital input channel 1 0: updated on falling edge 1: updated on rising edge LC-102H only	R/W
00257	Protocol, 0: DCON, 1: Modbus	R/W

	RTU	
00260	Modbus Host Watchdog mode 0: The same as I-7000 series modules 1: The DO command will clear Host Watchdog timeout status	R/W
00261	Host Watchdog 0: Disabled 1: Enabled	R/W
00264	Write 1 to clear the latched digital input and output status	W
00266	Inverse the digital output level 0: No inverse 1: Inverse	R/W
00270	Host Watchdog timeout status, write 1 to clear the Host Watchdog timeout status	R/W
00272	Write 1 to reload calibration parameters	W

Address	Description	Attribute
00273 10273	Reset status, 1: first read after powered on, 0: not the first read after powered on	R
00274	DO0 is controlled by DI0 0: disable 1: enable	R/W
00275	DO1 is controlled by DI1 0: disable 1: enable LC-102H only	R/W
00280	Write 1 to clear all high latched AI values	W
00281	Write 1 to clear all low latched AI values	W
00289	Low alarm status of channel 0, write 1 to clear latched alarm status	R/W
00290	Low alarm status of channel 1, write 1 to clear latched alarm	R/W

	status, LC-102H only	
00305	High alarm status of channel 0, write 1 to clear latched alarm status	R/W
00306	High alarm status of channel 1, write 1 to clear latched alarm status, LC-102H only	R/W
00321	Alarm mode of channel 0 0: disabled 1: enabled	R/W
00322	Alarm mode of channel 1 0: disabled 1: enabled LC-102H only	R/W
00337	Alarm type of channel 0 0: momentary 1: latched	R/W
Address	Description	Attribute
00338	Alarm type of channel 0 0: momentary	R/W

	1: latched LC-102H only	
00385	Write 1 to clear high latched AI value of channel 0	W
00386	Write 1 to clear high latched AI value of channel 1, LC-102H only	W
00417	Write 1 to clear low latched AI value of channel 0	W
00418	Write 1 to clear low latched AI value of channel 1, LC-102H only	W
00513	Write 1 to clear counter value of digital input channel 0	W
00514	Write 1 to clear counter value of digital input channel 1, LC-102H only	W

Appendix C: DCON Command Sets

Command	Description
$AA0CN	Span calibration of an analog input channel, N is 0 for LC-101H and 0 or 1 for LC-102H. Span calibration current is 5A.
$AA1CN	Zero calibration of an analog input channel, N is 0 for LC-101H and 0 or 1 for LC-102H. Zero calibration current is 0.1A.
$AA2	read configuration
$AA4	Read the synchronized data that was retrieved by the last #** command. response > SOI0000, S is 1 for the first read and 0 for not the first read
$AA5	read reset status !AA1 first after power on, !AA0 others
$AA6	Read the digital output and input status response > 0O0I00, where O is digital output and I is digital input
$AAC	Clear the status of the latched digital input and output channels.
$AACN	Clear the counter value of a digital input channel, N is 0 for LC-101H and 0 or 1 for LC-102H.
$AAF	read firmware version
$AAI	read INIT status response: !AA0 -> INIT short to GND !AA1 -> else
$AALS	Read the status of the latched digital output and input channels, S is 0 to read the low latched status and 1 to read the high latched status. response: !0O0I00
$AALC0h	Specify the dependency of the digital output channel on the digital input channel, h is a hexadecimal value, where bit 0

	corresponds to channel 0 and bit 1 corresponds to channel 1. Channel 1 is only for LC-102H. For each bit, 0 denotes no dependency and 1 for dependency.
$AALC1	Read the dependency of the digital output channel on the digital input channel. response: !AAh
$AALC2hhhh	Set the no operation time on power-on of the digital output channels, where hhhh is four digit hexadecimal value in ms.
$AALC3	Read the no operation time on power-on of the digital output channels. response: !AAhhhh
$AAM	read module name

Command	**Description**
$AAP	Read Modbus RTU/DCON protocol response: !AA0 -> DCON !AA1 -> Modbus RTU
$AAPN	Set Modbus RTU/DCON protocol N-> 0: DCON, 1: Modbus RTU
$AAS1	Reload factory calibration parameters.
#**	Instruct the module to read digital input/output data and store the data to be retrieved by the $AA4 command.
#AA	Read all analog inputs response > (channel 0 current) for LC-101H > (channel 0 current)(channel 1 current) for LC-102H Data format SDD.DDD, where S is sign '+' or '-' and D is decimal digit
#AAN	Read digital input counter value of a channel N = 0 for LC-101H, 0 and 1 for LC-102H response !AAddddd

#AA000h	Set the digital output values, h is a hexadecimal value, where bit 0 corresponds to DO0 and bit 1 corresponds to DO1. DO1 is only for LC-102H.
#AA0A0h	Set the digital output values, h is a hexadecimal value, where bit 0 corresponds to DO0 and bit 1 corresponds to DO1. DO1 is only for LC-102H.
#AA1c0b	Set a single digital output channel, c specifies the channel 0 or 1, b is 0 for off and 1 for on. Channel 1 is only for LC-102H.
#AAAc0b	Set a single digital output channel, c specifies the channel 0 or 1, b is 0 for off and 1 for on. Channel 1 is only for LC-102H.
%AANNTTCCFF	set configuration, NN: new address, TT = 00, CC: new baud rate FF: new data format
@AA	read the status of digital output and input channels response >0O0I, O is digital output status and I is digital input status
@AAh	set digital output values, h is a hexadecimal value, where bit 0 corresponds to DO0 and bit 1 corresponds to DO1. DO1 is only for LC-102H.
@AACH	Clear all high latched analog inputs to the current values
@AACHN	Clear channel high latched analog input to the current value, N = 0 for LC-101H, and 0 or 1 forLC-102H.
@AACHCN	Clear high latched alarm of a channel, N = 0 for LC-101H, and 0 or 1 forLC-102H.
@AACL	Clear all low latched analog inputs to the current values
@AACLN	Clear channel low latched analog input to the current value, N = 0 for LC-101H, and 0 or 1 forLC-102H.

Command	**Description**
@AACLCN	Clear low latched alarm of a channel, N = 0 for LC-101H, and 0 or 1 forLC-102H.
@AADACN	Disable analog input alarm of a channel, N = 0 for LC-101H, and 0 or 1 forLC-102H.
@AAEATCN	Enable analog input alarm of a channel, N = 0 for LC-101H, and 0 or 1 forLC-102H.

	T->M: momentary alarm, L: latched alarm
@AAHI(data)CN	Set high alarm limit of an analog input channel, N = 0 for LC-101H, and 0 or 1 forLC-102H.
@AALO(data)CN	Set low alarm limit of an analog input channel, N = 0 for LC-101H, and 0 or 1 forLC-102H.
@AARACN	Read analog input alarm enabled/disabled status of a channel response !AAN, N->0: disabled, 1: momentary, 2: latched
@AARAO	Read analog input alarm status response !AAHHLL
@AARH	Read all high latched values of analog input channels
@AARHN	Read channel high latched value of analog input
@AARHCN	Read high alarm limit of an AI channel
@AARL	Read all low latched values of analog input channels
@AARLN	Read channel low latched value of analog input
@AARLCN	Read low alarm limit of an AI channel
~**	clear host watchdog timeout counter
~AA0	read host watchdog status
~AA1	clear host watchdog timeout status
~AA2	read host watchdog enable/disable status and timeout value
~AA3ETT	enable/disable host watchdog and set timeout value E-> 0: disable host watchdog, 1: enable host watchdog TT: host watchdog timeout in 0.1s in hex format
~AA4V	read digital output power on or safe value, V is P for power on and S for safe.
~AA5V	set the current digital output value as power on or safe value, V is P for power on and S for safe
~AAD	Read the miscellaneous settings of a module response !AAhh, hh: bit 0 for invert digital input channels and bit 1 for invert digital output channels.
~AADVV	Set the miscellaneous settings of a module, where VV is a two digital hexadecimal value, bit 0 for invert digital input channels and bit 1 for invert digital output channels.
~AAEV	Enable/disable module calibration, V is 0 to disable and 1

	to enable.
~AARD	read response delay time in ms in hex format
~AARDVV	set response delay time in ms, VV in hex format, 00 - 1E

Baud Rate Settings (CC)

Code	03	04	05	06	07	08	09	0A
Baud Rate	1200	2400	4800	9600	19200	38400	57600	115200

Data Format Settings (FF)

7	6	5	4	3	2	1	0
CU	CS	Reserved					

Key	Description
CS	Checksum Settings 0: Disabled 1: Enabled
CU	Counter Update: 0: The counter is updated when there is a falling edge in the input signal. 1: The counter is updated when there is a rising edge in the input signal.

Note: All Reserved bits should be zero.

DIP Switch setting

1	Protocol	ON: DCON, OFF: Modbus RTU
2	Configuration	ON: by software, OFF: by hardware
3	Address	ON: added by 16, OFF: added by 0
4	INIT mode	ON: INIT, OFF: Normal

Base address: 32 (0x20)