# I-87004W User Manual

### Version 1.0.1/ August 2017



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# Chapter 1. Hardware

## **1.1. Introduction**

The I-87004W is a digital temperature sensor module that provides four ports for 2- or 3 wire DS18B20 digital temperature sensor input. The DS18B20 temperature sensor has a high accuracy of ±0.5°C when measuring temperatures between -10 and + 85°C, with a total measurement range of between -55 and +125°C. Up to 20 DS18B20 sensors can be connected to each port on the I-87004W module in a daisy-chain arrangement with a maximum wiring distance of 100 meters. The I-87004W module is fully RoHS compliant, and features 4 kV ESD protection as well as 3000 VDC intra-module isolation.

### Applications

- Temperature Measurement
- Environment Monitoring
- Tunnel Monitoring
- Building Monitoring



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### **1.2. Features**

- 4-Port DS18B20 Sensor Input Module
- 2/3-wire DS18B20 Wire Connection
- Max 20 Ssensors per Port
- Max. Distance of 100 m per Port when using Daisy-Chain Wiring
- Measures Temperatures from -55 to +125°C
- ±0.5°C Accuracy from -10 to +85°C
- 4 kV ESD Protection
- 3000 VDC Intra-module Isolation, Field to Logic
- RoHS Compliant
- Wide Operating Temperature Range: -25 to +75°C

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### **1.3. Specifications**

#### I/O Specifications

emperature Measurement							
Port	4						
Wiring	2-wire or 3-wire						
Sensor Type	DS18B20						
Temperature Measurement Range	-55°C to +125°C						
Resolution	12-bit						
Accuracy	±0.5°C (See Note 1)						
Sampling Rate	1 Hz						
Number of Sensors per Port	20						
Sensor Wiring Length	Max. 100 m per Port						
the second of the first							

Note 1:  $\pm 0.5^{\circ}\text{C}$  accuracy only applies for measurements between -10°C and +85°C

#### System Specifications

Communication	
Interface	RS-485
Format	N81, N82, E81, O81
Baud Rate	1200 to 115200 bps
Protocol	DCON
Dual Watchdog	Yes, Module (1.6 Seconds), Communication (Programmable)
LED Indicators/Display	
System LED Indicator	Yes, 1 as Power/Communication Indicator
I/O LED Indicator	•
Isolation	
Intra-module Isolation, Field-to-Logic	3000 VDC
EMS Protection	
ESD (IEC 61000 4 2)	±4 kV Contact for each Terminal
	±8 kV Air for Random Point
Power	
Power Consumption	0.5 W Max.
Mechanical	
Dimensions (L $\times$ W $\times$ H)	115 mm x 30 mm x 102 mm
Environment	
Operating Temperature	-25 to +75°C
Storage Temperature	-30 to +80°C
Humidity	10 to 90% RH, Non-condensing

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## **1.4. Pin Assignment**



Ter	minal No.	Pin A	ssignment
[ • ]	01	5	+5 V
[ • ]	02	ort	Data
[n]	03	<u> </u>	GND
C a l	04		N.C.
(III)	05	_	+5 V
(° 🗖	06	ort	Data
[III]	07	<u> </u>	GND
[ <b>`</b> = ]	08		N.C.
[ •	09		+5 V
[ <b>`</b> •]	10	out	Data
C	11	<u>e</u>	GND
L.	12		N.C.
Cu	13		+5 V
Ŀ	14	ort	Data
<u>C</u> el	15	<u>e</u>	GND
	16		N.C.

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## 1.5. Wiring



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### 1.6. Block Diagram



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## **1.7. Dimensions**

Dimensions (Units: mm)



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# Chapter 2. Quick start

I-87004W is a digital temperature sensor module that supports the DCON protocol. The host needs to use some DCON commands to configure and communicate with the I-87004W. ICP DAS provides the DCON Utility Pro program that can configure and test I-87004W without understanding any DCON command. Users can follow below steps to configure I-87004W and read temperature readings from I-87004W.

Step 1: Install DCON Utility Pro on the host.

Note: DCON Utility pro supports I-87004W for version 2.0.0.7 and later.

ICP DAS provides different versions of DCON Utility Pro for different platforms that can be used to configure and test I/O modules. The installation file locations for different platforms are as follows:

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For Wi compu	For Windows 98,NT,2000,XP,Vista,Win 7 and Win 8 on PC, laptop and etc computer					
CD	CD:\ 8000\NAPDOS\Driver\DCON_Utility					
FTP	http://ftp.icpdas.com/pub/cd/8000cd/napdos/driver/dcon_utility/					
For ICI	P DAS CE5 platform PAC					
CD	CD:\ napdos\wp-8x4x_ce50\Micro_SD\DCON_Utility_Pro					
FTP	http://ftp.icpdas.com.tw/pub/cd/winpac/napdos/wp-8x4x_ce50/ micro_sd/dcon_utility_pro/					
For ICI	P DAS CE6 platform PAC					
CD	CD:\ XPAC\XPAC-ATOM-CE6\PC_Tools\DCON_Utility_Pro					
FTP	http://ftp.icpdas.com.tw/pub/cd/xpac-atom-ce6/pc_tools/dcon_ut ility_pro/					
For ICF	P DAS CE7 platform and ARM CPU PAC					
CD	CD:\WinPAC_AM335x\Wp-5231\System_Disk\Tools \DCON_Utility_Pro					
FTP	http://ftp.icpdas.com.tw/pub/cd/winpac_am335x/wp-5231/syste m_disk/tools/dcon_utility_pro					
For ICI	P DAS WES platform PAC					
CD	CD:\ XPAC\XPAC-Atom\tools\DCON_Utility_pro					
FTP	http://ftp.icpdas.com.tw/pub/cd/xpac-atom/tools/dcon_utility_pro/					

### Step 2: Search and find the I-87004W module

DCON Utility Pro V 2.0.0.7	$\times$
Start Address 0 End Address 255	
ID Address Baud Rate Checksum Format Status Description	
Comport Option ×	
COM Port Timeout	
COM1 ~ 300 ms	
Baud Rate Drotocol Checksum Format	
☑ 11520 □ 57600 □ 38400 □ 19200	
☑ 9600	
OK Cancel	

Select the correct COM Port and search:

Find the I-87004W module, click the module name to enter configuration form

	DCON Utility Pro V	2.0.0.7					$\times$	
		II 🛠	<b>S</b>		?			
	Start Address	0 End A	ddress 2	55				
(	10 Address 87004 1[1h]	Baud Rate 115200	Checksum Disable	Format N,8,1	Status Remote I/O	Description [DCON]4*AI 1-wire digital thermometer		
	87004 Firmware[A106]							×
	Configuration Tempera	ture About						
	Protocol(INIT*)	DCON	~					
	Address	1	01H					
	Baud Rate(INIT*)	115200	$\sim$					
	Parity(INIT*)	N,8,1-None Parity	~					
	Checksum(INIT*)	Disable	~					
	1							
	ŧ			Set M	odule Configurations	5		
	1							
	1							
	Exit							
								.::

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### Step 3: Configure I-87004W using DCON Utility Pro

To read temperature, each sensor must be assigned a channel index. The easiest way is to select Temperature tab and select "Assign all new sensor as default". Then, you can read the temperature for all sensors.

For the sensor which is not installed or not assigned, its temperature reading is -999.99 as shown below.

87004 Firmware[A107]					×
Configuration Temperature About					
Port_0	Select	Port_0			
Port_1	Sensor:0	026.93	Sens	or:1 027.06	
Port_ 2	Sensor:0	026.93	Sens	or:1 027.06	
Port_ 3	Sensor:0	027.00	Sens	or:1 027.00	
	Sensor:0	026.93	Sens	or:1 027.12	
	Sensor:0	027.18	Sens	or:1 026.93	
	Sensor:0	027.00	Sens	or:1 027.12	
	Sensor:0	026.93	Sens	or:1 027.00	
	Sensor:0	026.93	Sens	or:1 027.06	
	Sensor:0	027.00	Sens	or:1 027.00	
	Sensor:0	027.06	Sens	or:1 -999.99	
				$\sim$	
Update Selection Update assigned sensor		Export Assigned	Sensor		
Update new sensor Vocate assigned sensor					 
Assign all new sensors as default	>				
Exit					
					11.

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Step 4: Manual update, assign and remove sensor

87004 Firmware[A106] × Configuration Temperature About Select Port\_ 0 Port\_ 1 Sensor:00 -999.99 Sensor:10 -999.99 Port\_ 2 Sensor:01 -999.99 Sensor:11 -999.99 Port\_ 3 Sensor:02 -999.99 Sensor:12 -999.99 Sensor:03 -999.99 Sensor:13 -999.99 Sensor:04 -999.99 Sensor:14 -999.99 Sensor:05 -999.99 Sensor:15 -999.99 Sensor:06 -999.99 Sensor:16 -999.99 Sensor:07 -999.99 Sensor:17 -999.99 Sensor:08 -999.99 Sensor:18 -999.99 Sensor:09 -999.99 Sensor:19 -999.99 Update Selection Export Un-Assigned Sensor Update new sensor Update assigned sensor Assign all new sensors as default Remove all assigned sensors Exit

Select "Update new sensor" to manually assign sensor

Select "Update assigned sensor" then you can read temperature reported by the sensor:

37004 Firmware[A106]							
Configuration Temperature About							
₽ Port_0	Select Po	rt_ 0					
	Sensor:00	026.37	Sensor:10	026.25			
Assigned_Sensor_2_6E0000078F1E8C28	Sensor:01	-999.99	Sensor:11	026.31			
- Assigned_Sensor_3_FC0000078DD39C28	Sensor:02	026.31	Sensor:12	026.37			
Assigned_Sensor_4_820000078E383C28	Sensor:03	026.43	Sensor:13	085.00			
Assigned_Sensor_6_18000078E75FC28	Sensor:04	085.00	Sensor:14	026.31			
Assigned_Sensor_7_0A0000078F278228	Sensor:05	026.43	Sensor:15	085.00			
Assigned_Sensor_8_CF0000078EE49E28	Sensor:06	-999.99	Sensor:16	026.43			
Assigned_Sensor_10_660000078D9B2128	Sensor:07	026.37	Sensor:17	026.50			
Assigned_Sensor_11_4E0000078CA41928	Sensor:08	026.43	Sensor:18	026.43			
	Sensor:09	026.25	Sensor:19	026.31			
< >>							
Update Selection Update assigned sensor		Export Assigned Sensor					

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Select "Remove all assigned sensor" to remove all assigned sensor, the temperature readings of all sensors will be changed to "-999.99"

87004 Firmware[A106]					$\times$
Configuration Temperature About					
Port_ 0	Select CH	1:0			
- Port_ 1 - Port_ 2 - Port_ 3	Septor:00	-999.99	Sensor:10	-999.99	
	Sens v:01	-999.99	Sensor:11	-999.99	
	Sensor:02	-999.99	Sensor:12	-999.99	
	Sensor:03	-999.99	Sensor:13	-999.99	
	Sensor:04	-999.99	Sensor:14	-999.99	
	Sensor:05	-999.99	Sensor:15	-999.99	
	Sensor:06	-999.99	Sensor:16	-999.99	
	Sensor:07	-999.99	Sensor:17	-999.99	
	Sensor:08	-999.99	Sensor:18	-999.99	
	Sensor:09	-999.99	Sensor:19	-999.99	
Update Selection Update assigned sensor		Export Assigned Sensor			
Update new sensor Update assigned sensor	-				
Remove all assigned sensors	)				
					.::

Step 5: Save the Assigned Sensor to a .csv file.

To ease checking, comparing and re-assigning sensors, DCON Utility Pro provides the "Export Assigned Sensor" function, as shown below, to save sensor data to a Excel .csv file. Then use can have more convenience to check, compare or re-assign sensor in many sensors conditions.

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Use DCON Utility Pro to save assigned sensors to a file.

87004 Firmware[A1	06]					×									
Configuration Temp	persiture Event Log About														
Port_ 0		Select CH	1:0												
Port_1		Sensor:00	025.43	Sensor:10	025.06										
Port_2		Sensor:01	-999.99	Sensor 11	025.31										
-		Sensor:02	025.37	Sensor 12	085.00	另存新措									×
		Sensor:03	025.50	Sensor:13	085.00	← → ^ ↑	« DC	ON_Utility_pro → pro	> 20170322 > DCOM	N_Utility_Pro_PC > cn	nd_config	~ Ö	授尋 cmd_config		٩
		Sensor:04	085.00	Sensor:14	025.37	組合管理 ▼ 第	増資料す	ŧ						Re: •	0
		Sensor:05	025.43	Sensor:15	085.00		^	名稱	^	修改日期	湖리	大小			-
		Sensor:06	-999.99	Sensor:16	025.50	★ 快速存取		Si 87004 ΔΔ 1 Δssi	aned Seasor(1801 csv	2017/8/1 下午 03	Microsoft Office	1.6	R		
		Sensor:07	025.50	Sensor:17	025.50		*	3	5 <sup>-</sup>						
		Sensor:08	025.56	Sensor:18	025.37	◆ ト町 ○ 十件	1								
		Sensor:09	025.37	Sensor:19	025.43		<u> </u>								
						hans									
Update Selection	Update assigned sensor 🤍		Export Assigned Sensor			Hans 交接_2	017								
						_ 手冊									
Excit						交接									
						ConeDrive									
						- 本機									
						- Sustem (F-)	~								
						福案名稱(N)	87004	AA_1_Assigned_Senso	r.csv						~
						存檔類型(T)	CSV fil	es (*.csv)							~
						▲ 陽磁資料夾							存欄(S)	取満	

User can use the information saved in the file to check, compare and re-assign sensors between software and the sensors located in the field.

	A	В	С	D	E	
1	Port	Sensor Index	Serial Num	ber		
2	Port_0	Sensor[0]	91000078	8D8C1028		
3	Port_0	Sensor[1]	A0000007	8CFCE828		
4	Port_0	Sensor[2]	6E000007	8F1E8C28		
5	Port_0	Sensor[3]	FC000007	8DD39C28		
6	Port_0	Sensor[4]	820000078	8E383C28		
-7	Port_0	Sensor[5]	FE000007	8D033C28		
8	Port_0	Sensor[6]	180000078	8E75FC28		
9	Port_0	Sensor[7]	0A000007	8F278228		
10	Port_0	Sensor[8]	CF000007	8EE49E28		
11	Port_0	Sensor[9]	FF0000078	8CFCDE28		
12	Port_0	Sensor[10]	660000078	8D9B2128		
13	Port_0	Sensor[11]	4E000007	8CA41928		
14	Port_0	Sensor[12]	7C0000078F109928			
15	Port_0	Sensor[13]	17000007	8E535D28		
16	Port_0	Sensor[14]	5C000007	8E558328		
17	Port_0	Sensor[15]	9E000007	8EA0A328		
18	Port_0	Sensor[16]	FC000007	8C73E328		
19	Port_0	Sensor[17]	050000078	8C753B28		
20	Port_0	Sensor[18]	95000007	8C47B728		
21	Port_0	Sensor[19]	2C000007	8D607728		
22						
22	▶ ₩ 87004	AA 1 Assigned	Sensorfi 4		▶ 1	Y
	0.00		and an address of the second s			

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## Chapter 3. Using DS18B20 Temperature Sensor

The I-87004W provides four ports and up to 20 DS18B20 sensors can be connected to each port. Each DS18B20 has a unique 64-bit serial code, which can be represented by 16 characters in hexadecimal format. The user must know the serial code of each DS18B20 sensor and assign unique channel index to each DS18B20 when using the I-87004W to read temperature data from DS18B20 sensors.

When the I-87004W is powered on, it scans all the DS18B20 sensors connected for each port. Each scanned DS18B20 is checked to see whether a channel index is assigned. If it is not assigned, then the DS18B20 is added to the not assigned list. The user has to check the not assigned list and assign channel index for all members in the not assigned list. This needs to be done only once, since all of the data will be saved to the non-volatile memory.

When a DS18B20 sensor is broken and is replaced by a new one, its channel index should be removed first. Then, send command to I-87004W to rescan DS18B20 on the port. The new DS18B20 will be found and put to the not assigned list. The user can reassign the previous channel index to the new DS18B20.

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Suppose that there are three DS18B20 sensors installed at location A, B, and C and they are connected to port 0 of an I-87004W. Followings are the procedure to configure the I-87004W.

- 1. Refer to Chapter 2 and go through steps 1 and 2.
- 2. Select Temperature tab.
- 3. Select Port\_0.
- 4. Select "Update new sensor" and you will see the undefined sensor list.

87004 Firmware[A107]					×
Configuration Temperature About					
Port 0	Select	Port_0			
-Undefined_Sensor_0_370008025B0C7010	Sensor:0	-999.99	Sensor:1	-999.99	
Undefined_Sensor_1_EF0008025B23DE10	Sensor:0	-999.99	Sensor:1	-999.99	
Undefined_Sensor_2_460008025AC79710	Sensor:0	-999.99	Sensor:1	-999.99	
Port_1	Sensor:0	-999.99	Sensor:1	-999.99	
Port 3	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
Update Selection		Export Un-Assigned Sensor			
Assign all new sensors as default Remove all assigned sensors					

Index in undefined list	Serial Code	Location
0	370008025B0C7010	А
1	EF0008025B23DE10	С
2	460008025AC79710	В

- 5. Select Undefined\_Sensor\_X\_YYYYYYYYYYYYYYYYY to assign channel index.
- 6. Set the new index and click on the Set button.

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Assign New Sensor Inde	x	×
64-Bit Serial No.	370008025B0C7010	
Current Index	0	
New Index	Set	
		11.

- Repeat steps 5 and 6 until all undefined sensors are assigned with new index.
- Select "Update assign sensor" and it will show the list of assigned sensors. We can use channel index 0 to read temperature at location A, channel index 1 to read temperature at location B, and channel index 2 to read temperature at location C.

0	Select	Port_0		
igned_Sensor_0_370008025B0C7010	Sensor:0	027.37	Sensor:1	-999.99
igned_Sensor_1_460008025AC79710	Sensor:0	027.50	Sensor:1	-999.99
igned_Sensor_2_EF0008025B23DE10	Sensor:0	027.50	Sensor:1	-999.99
2	Sensor:0	-999.99	Sensor:1	-999.99
3	Sensor:0	-999.99	Sensor:1	-999.99
-	Sensor:0	-999.99	Sensor:1	-999.99
	Sensor:0	-999.99	Sensor:1	-999.99
	Sensor:0	-999.99	Sensor:1	-999.99
	Sensor:0	-999.99	Sensor:1	-999.99
	Sensor:0	-999.99	Sensor:1	-999.99
tion Update assigned sensor		Export Assigned Sensor		

Assigned channel index	Serial Code	Location
0	370008025B0C7010	А
2	EF0008025B23DE10	С
1	460008025AC79710	В

If the sensor at location B is broken and to be replaced by a new sensor, then do the followings.

1. Select Assigned\_Sensor\_1\_460008025AC79710.

87004 Firmware[A107]					
Configuration Temperature About					
Port_ 0	Select	Port_ 0			
Assigned Sensor 0 370008025B0C7010	Sensor:0	025.25	Sensor:1	-999.99	
Assigned Sensor_1_460008025AC79710	Sensor:0	025.37	Sensor:1	-999.99	
Assigned_Sensor_2_EF0008025B23DE10	Sensor:0	025.31	Sensor:1	-999.99	
Port_1	Sensor:0	-999.99	Sensor:1	-999.99	
Port_2	Sensor:0	-999.99	Sensor:1	-999.99	
roit_5	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
Update Selection Update assigned sensor		Export Assigned Sensor			
Exit					

2. Select Remove.

Assign New Sensor Index		×
64-Bit Serial No.	460008025AC79710	
Current Index	1 Cancel	
2		11.

- 3. Disconnect the broken sensor from the port.
- 4. Connect the new sensor to the port.
- 5. Select "Update new sensor" and you will see the new sensor as undefined sensor.

87004 Firmware[A107]					
Configuration Temperature About					
Port_ 0	Select	Port_ 0			
Undefined_Sensor_0_4A0008025ABFA110	Sensor:0	025.18	Sensor:	-999.99	
Port_1	Sensor:0	-999.99	Sensor:	-999.99	
Port_2	Sensor:0	025.12	Sensor:	-999.99	
Port_ 3	Sensor:0	-999.99	Sensor:	-999.99	
	Sensor:0	-999.99	Sensor:	-999.99	
	Sensor:0	-999.99	Sensor:	-999.99	
	Sensor:0	-999.99	Sensor:	-999.99	
	Sensor:0	-999.99	Sensor:	-999.99	
	Sensor:0	-999.99	Sensor:	-999.99	
	Sensor:0	-999.99	Sensor:	-999.99	
Update Selection Update new sensor		Export Un-Assign	ed Sensor		
Update new sensor					
Assign all new sensors as default Remove all assigned sensors					
Exit					
上午 09:20 ::SET [@01RM001 ]: [ 101 ]: [ 31 ms]=>OK					

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- 6. Select Undefined\_Sensor\_0\_4A0008025ABFA110 to assign channel index.
- 7. Set the new index and click on the Set button.

Assign New Sensor Inde	x	×
64-Bit Serial No.	4A0008025ABFA110	
Current Index	0	
New Index	Set	

8. Select "Update assign sensor" and it will show the updated list of assigned sensors.

signed Sensor 0 370008025B0C7010					
	Sensor:0	025.12	Sensor:1	-999.99	
igned_Sensor_1_4A0008025ABFA110	Sensor:0	025.25	Sensor:1	-999.99	
signed_Sensor_2_EF0008025B23DE10	Sensor:0	025.31	Sensor:1	-999.99	
1	Sensor:0	-999.99	Sensor:1	-999.99	
2	Sensor:0	-999.99	Sensor:1	-999.99	
5	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
	Sensor:0	-999.99	Sensor:1	-999.99	
ection Update assigned consor	<u> </u>	Export Assigned Sensor			

Assigned channel index	Serial Code	Location
0	370008025B0C7010	А
2	EF0008025B23DE10	С
1	4A0008025ABFA110	В

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## Chapter 4. DCON Command Sets

Command	Description						
\$AAF	read firmware version						
\$AAI	read INIT status						
	response:						
	!AA0 -> INIT short to GND						
	!AA1 -> else						
\$AAM	read module name						
\$AAP	Read Modbus RTU/DCON protocol						
	response:						
	!AA0 -> DCON						
	!AA1 -> Modbus RTU						
\$AAPN	Set Modbus RTU/DCON protocol						
	N-> 0: DCON, 1: Modbus RTU						
\$AA2	read configuration						
\$AA5	read reset status						
	AA1 first after power on, AA0 others						
#AAP	Read temperature readings of all connected sensors of a						
	port						
	P: port number, 0 ~ 3						
	response						
	> (sensor 0 reading in 0.01°C)(sensor 1 reading in						
	0.01°C) (sensor last reading in 0.01°C)						

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Command	Description			
#AAPNN	Read temperature reading of a sensor			
	P: port number, 0 ~ 3			
	NN: sensor channel index in hex, 00 ~ 13			
	response			
	> (sensor reading in 0.01°C)			
%AANNTTCCFF	set configuration, NN: new address, TT = 00, CC: new			
	baud rate			
	FF: data format			
@AAASPSSII	Assign channel index to a new sensor of a port			
	P: port number, 0 ~ 3			
	SS: index of the sensor in the new list in hex, $00 \sim 13$			
	II: channel index of the sensor in a port to be assigned in			
	hex, 00 ~ 13			
@AACH	Clear all high latched temperature readings to the current			
	values			
@AACHP	Clear all high latched temperature readings of a port to the			
	current values			
	P: port number, 0 ~ 3			
@AACHPII	Clear high latched temperature reading of a sensor to the			
	current value			
	P: port number, 0 ~ 3			
	II: channel index of the sensor in a port in hex, 00 ~ 13			
@AACL	Clear all low latched temperature readings to the current			
	values			
@AACLP	Clear all low latched temperature readings of a port to the			
	current values			
	P: port number, 0 ~ 3			

Command	Description		
@AACLPII	Clear low latched temperature reading of a sensor to the		
	current value		
	P: port number, 0 ~ 3		
	II: channel index of the sensor in a port in hex, $00 \sim 13$		
@AANSP	Read number of assigned sensors of a port		
	P: port number, 0 ~ 3		
	response		
	!AANN, NN in hex, 00 ~ 13		
@AANSNP	Read number of not assigned sensors of a port		
	P: port number, 0 ~ 3		
	response		
	!AANN, NN in hex, 00 ~ 13		
@AANSRP	Read number of removed sensors of a port		
	P: port number, 0 ~ 3		
	response		
	!AANN, NN in hex, 00 ~ 13		
@AARHP	Read all high latched values of a port		
	P: port number, 0 ~ 3		
	response		
	> (sensor 0 reading in 0.01°C)(sensor 1 reading in		
	0.01°C) (sensor last reading in 0.01°C)		
@AARHPNN	Read high latched value of a sensor of a port		
	P: port number, 0 ~ 3		
	NN: sensor channel index in hex, 00 ~ 13		
	response		
	> (sensor reading in 0.01°C)		

Command	Description				
@AARLP	Read all low latched values of a port				
	P: port number, 0 ~ 3				
	response				
	> (sensor 0 reading in 0.01°C)(sensor 1 reading in				
	0.01°C) (sensor last reading in 0.01°C)				
@AARLPNN	Read low latched value of a sensor of a port				
	P: port number, 0 ~ 3				
	NN: sensor channel index in hex, 00 ~ 13				
	response				
	> (sensor reading in 0.01°C)				
@AARMPII	Remove a sensor from a port				
	P: port number, 0 ~ 3				
	II: index of the sensor in a port to be removed in hex, 00 $\sim$				
	13				
@AARSP	Rescan sensors connected to a port				
	P: port number, 0 ~ 3				
@AASNPNN	Read serial code of an assigned sensor of a port				
	P: port number, 0 ~ 3				
	NN: sensor channel index in hex, 00 ~ 13				
	response				
	!AA (16-character serial code),				
	FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF				
@AASNNPNN	Read serial code of a not assigned sensor of a port				
	P: port number, 0 ~ 3				
	NN: sensor index in the not assigned list in hex, $00 \sim 13$				
	response				
	!AA (16-character serial code),				
	FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF				

Command	Description			
@AASNRPNN	Read serial code of a removed sensor of a port			
	P: port number, 0 ~ 3			
	NN: sensor index in the removed list in hex, $00 \sim 13$			
	response			
	!AA (16-character serial code),			
	FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF			
~**	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			
~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 Setting (CC)**

Bits 5:0

Baud rate, 0x03 ~ 0x0A

Code	0x03	0x04	0x05	0x06
Baud	1200	2400	4800	9600
Code	0x07	0x08	0x09	0x0A
Baud	19200	38400	57600	115200

Bits 7:6

00: no parity, 1 stop bit

01: no parity, 2 stop bits

10: even parity, 1 stop bit

11: odd parity, 1 stop bit

### Data Format Setting (FF)

Bit 6

- 0: checksum disabled
- 1: checksum enabled

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