

I-87004W User Manual

Version 1.0.1/ August 2017



Warranty

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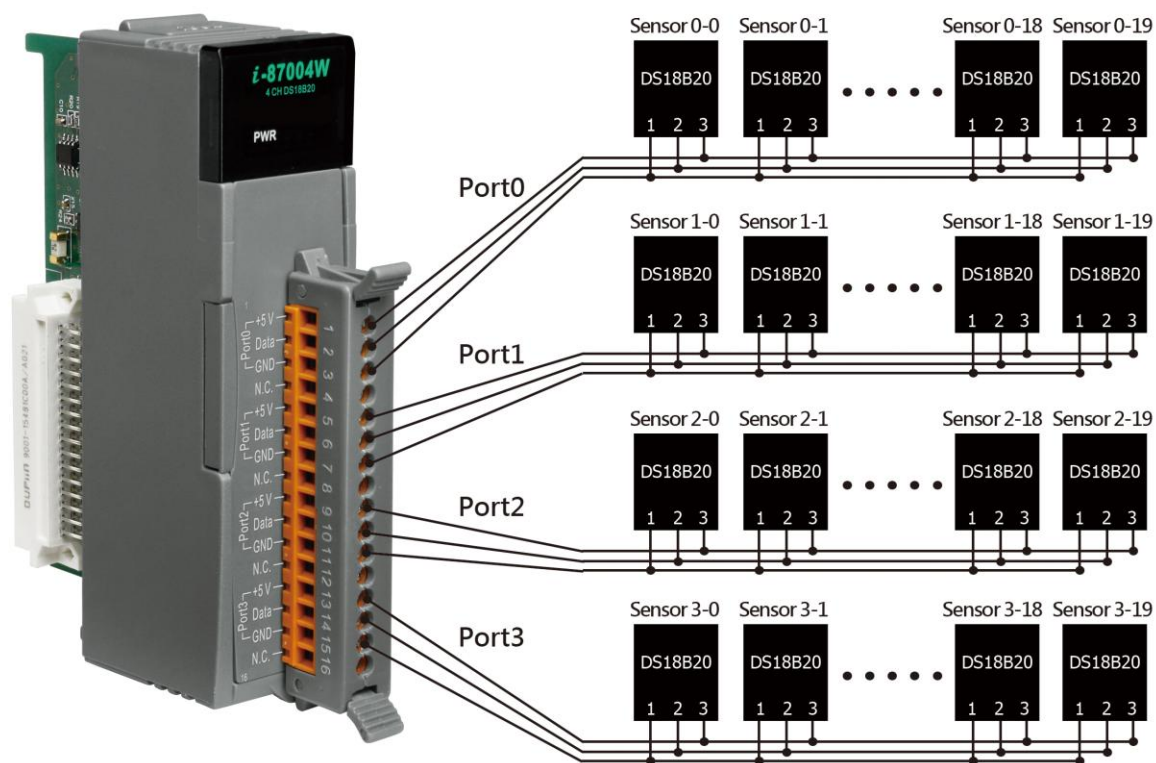
Chapter 1. Hardware

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 $\pm 0.5^{\circ}\text{C}$ when measuring temperatures between -10 and $+85^{\circ}\text{C}$, with a total measurement range of between -55 and $+125^{\circ}\text{C}$. 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



1.2. Features

- 4-Port DS18B20 Sensor Input Module
- 2/3-wire DS18B20 Wire Connection
- Max 20 Sensors 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

1.3. Specifications

I/O Specifications

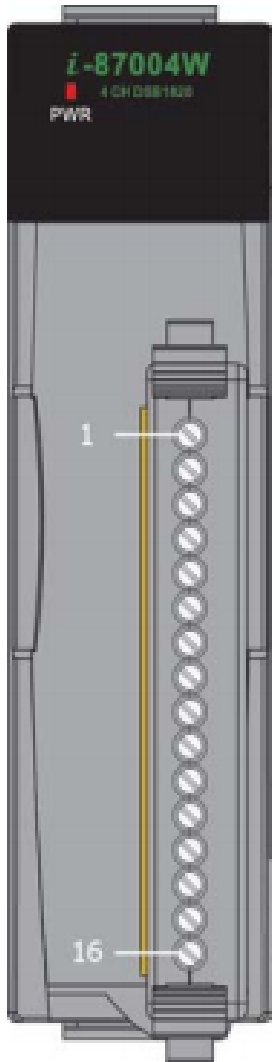
Temperature Measurement	
Port	4
Wiring	2-wire or 3-wire
Sensor Type	DS18B20
Temperature Measurement Range	-55°C to +125°C
Resolution	12-bit
Accuracy	±0.5°C (See Note 1)
Sampling Rate	1 Hz
Number of Sensors per Port	20
Sensor Wiring Length	Max. 100 m per Port

Note 1: ±0.5°C accuracy only applies for measurements between -10°C and +85°C

System Specifications

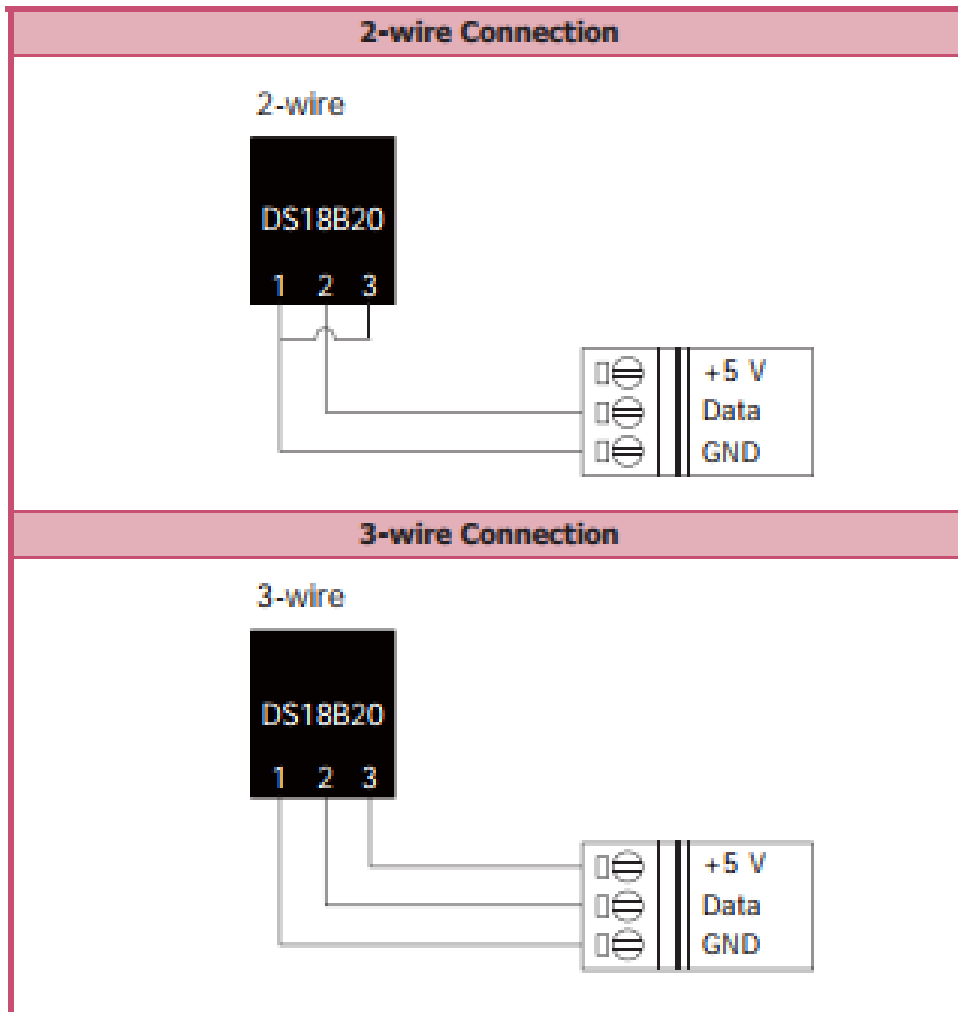
Communication	
Interface	RS-485
Format	N81, N82, E81, O81
Baud Rate	1200 to 115200 bps
Protocol	DCON
Dual Watchdog	Yes, Module (1.6 Seconds), Communication (Programmable)
LED Indicators/Display	
System LED Indicator	Yes, 1 as Power/Communication Indicator
I/O LED Indicator	-
Isolation	
Intra-module Isolation, 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 × W × 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

1.4. Pin Assignment

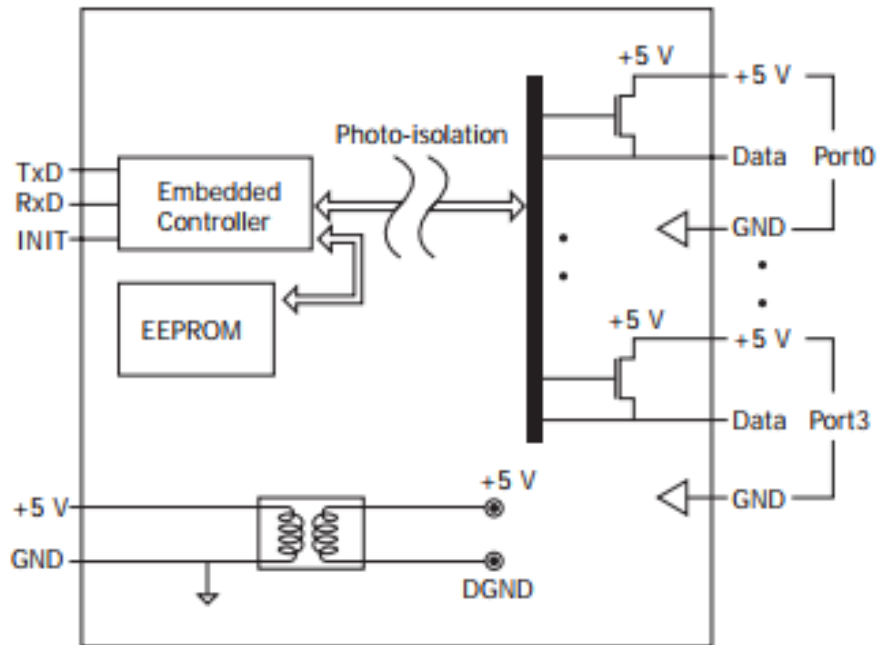


Terminal No.	Pin Assignment	
01	Port0 +5 V	
02		Data
03		GND
04	N.C.	
05	Port1 +5 V	
06		Data
07		GND
08	N.C.	
09	Port2 +5 V	
10		Data
11		GND
12	N.C.	
13	Port3 +5 V	
14		Data
15		GND
16	N.C.	

1.5. Wiring

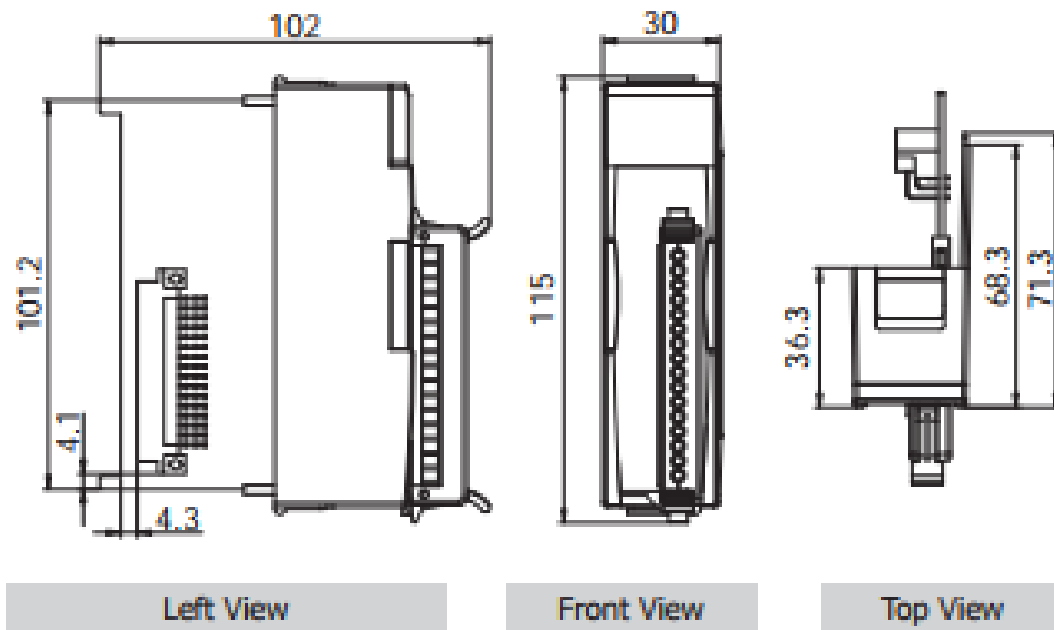


1.6. Block Diagram



1.7. Dimensions

Dimensions (Units: mm)



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.

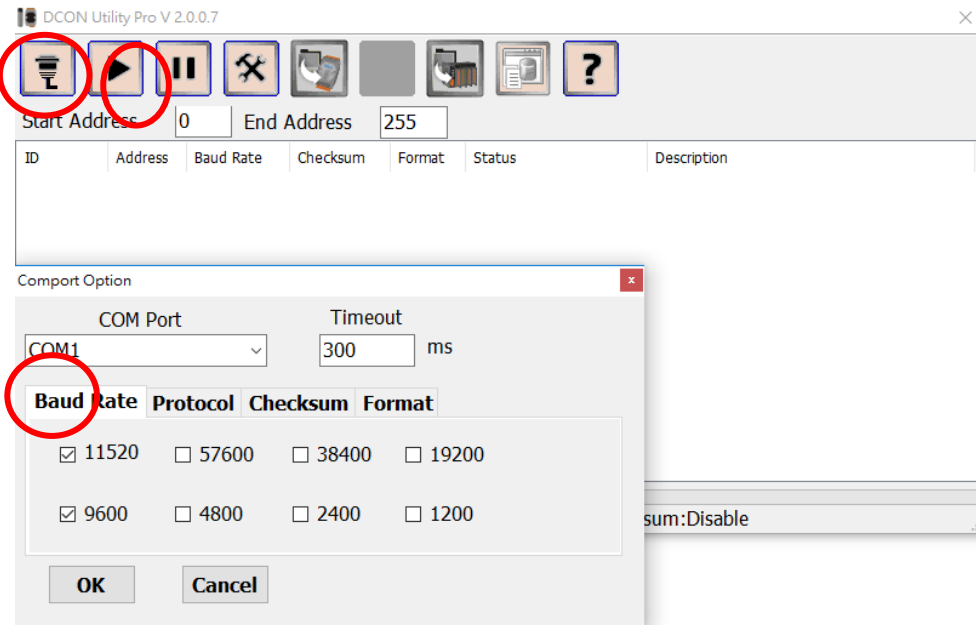
Note: DCON Utility pro supports I-87004W for version 2.0.0.7 and later.

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:

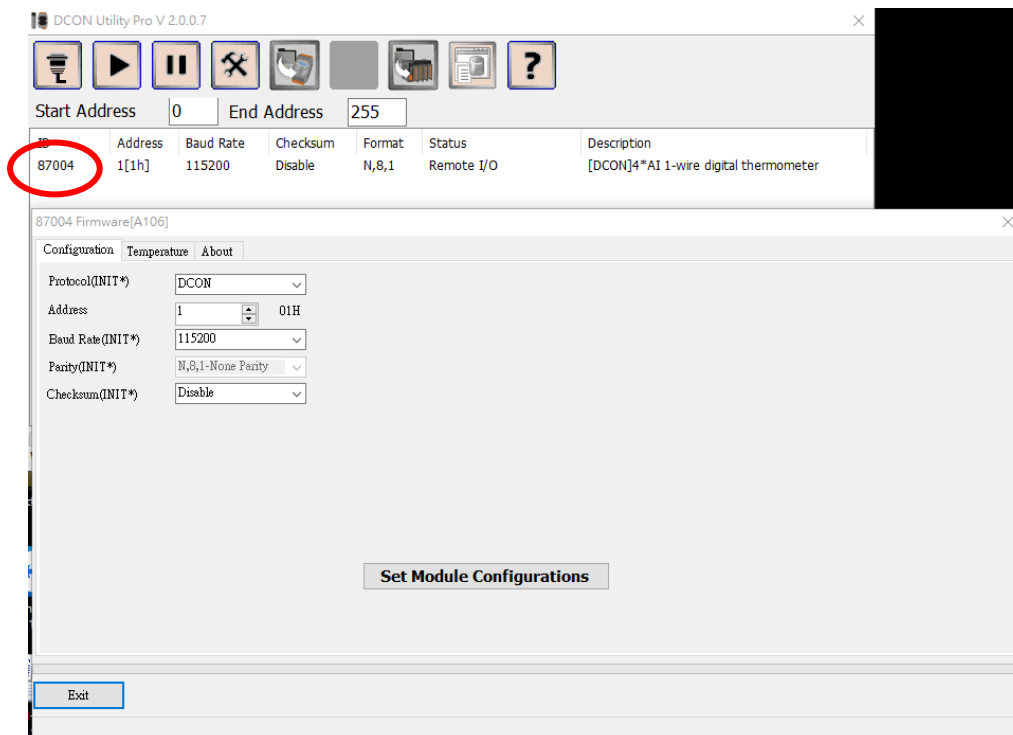
For Windows 98,NT,2000,XP,Vista,Win 7 and Win 8 on PC, laptop and etc computer	
CD	CD:\ 8000\NAPDOS\Driver\DCON_Utility
FTP	http://ftp.icpdas.com/pub/cd/8000cd/napdos/driver/dcon_utility/
For ICP DAS CE5 platform PAC	
CD	CD:\ napdos\wp-8x4x_ce50\Micro_SD\DCON_Utility_Pro
FTP	http://ftp.icpdas.com.tw/pub/cd/winpac/napdos/wp-8x4x_ce50/micro_sd/dcon_utility_pro/
For ICP 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_utility_pro/
For ICP 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/system_disk/tools/dcon_utility_pro
For ICP 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

Select the correct COM Port and search:



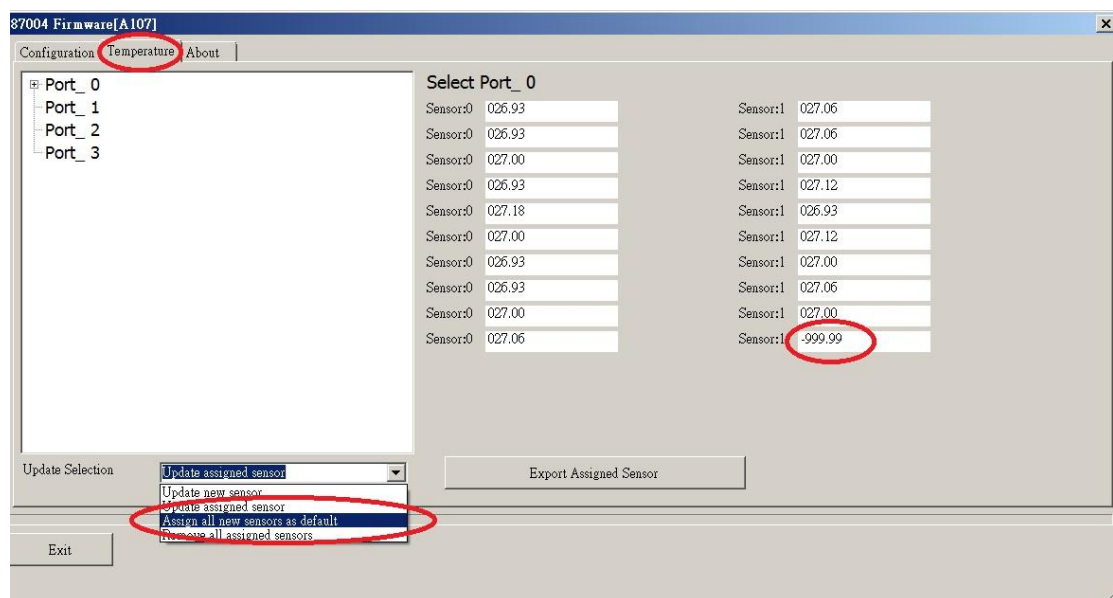
Find the I-87004W module, click the module name to enter configuration form



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

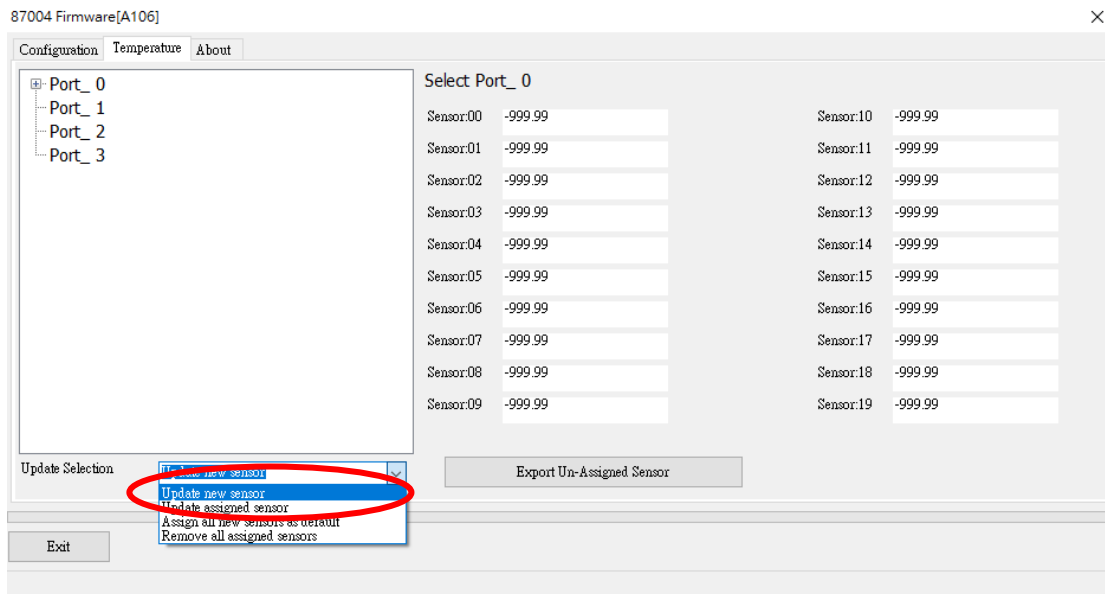
To read temperature, each sensor must be assigned a channel index. The easiest way is to select Temperature tab and select “Assign all new sensor as default”. Then, you can read the temperature for all sensors.

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

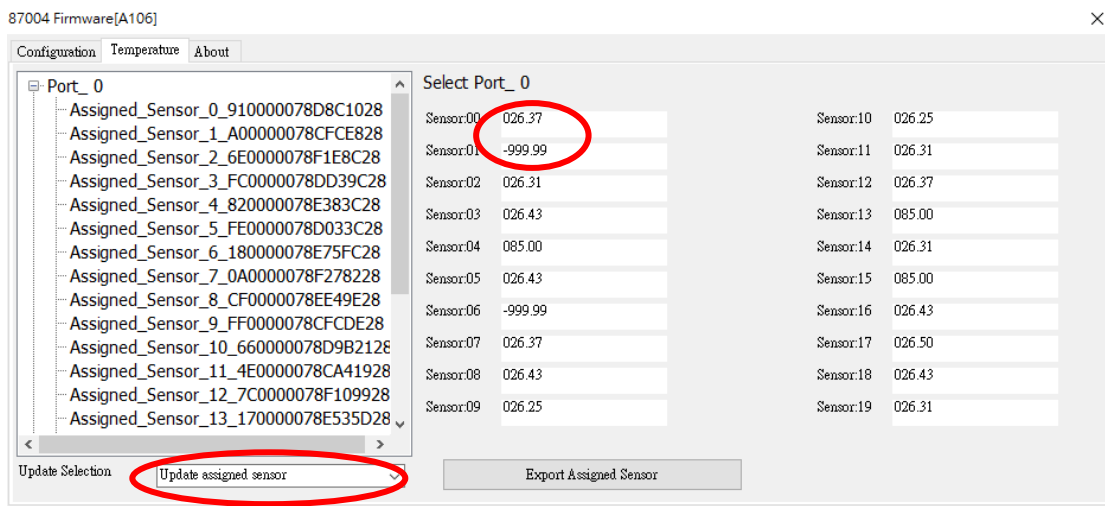


Step 4: Manual update, assign and remove sensor

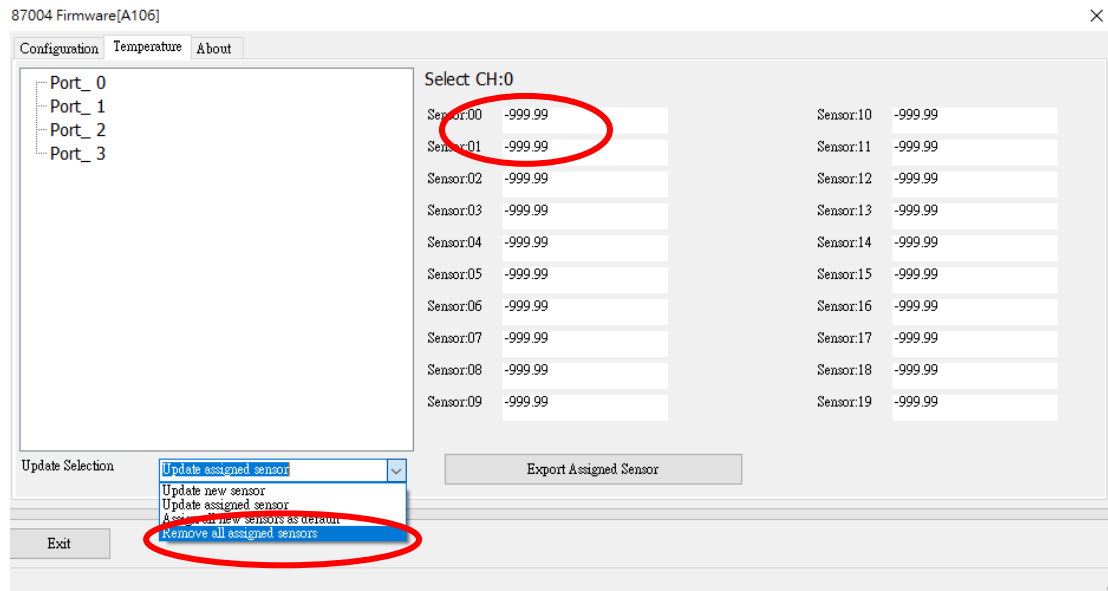
Select “Update new sensor” to manually assign sensor



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



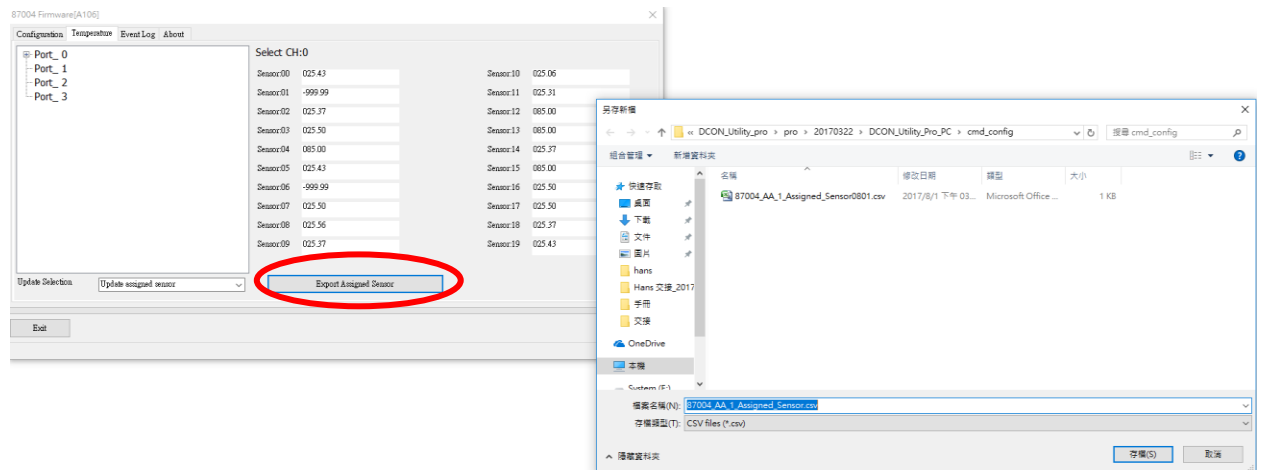
Select “Remove all assigned sensor” to remove all assigned sensor, the temperature readings of all sensors will be changed to “-999.99”



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.

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



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	B	C	D	E
1	Port	Sensor Index	Serial Number		
2	Port_0	Sensor[0]	910000078D8C1028		
3	Port_0	Sensor[1]	A00000078CFCE828		
4	Port_0	Sensor[2]	6E0000078F1E8C28		
5	Port_0	Sensor[3]	FC0000078DD39C28		
6	Port_0	Sensor[4]	820000078E383C28		
7	Port_0	Sensor[5]	FE0000078D033C28		
8	Port_0	Sensor[6]	180000078E75FC28		
9	Port_0	Sensor[7]	0A0000078F278228		
10	Port_0	Sensor[8]	CF0000078EE49E28		
11	Port_0	Sensor[9]	FF0000078CFCDE28		
12	Port_0	Sensor[10]	660000078D9B2128		
13	Port_0	Sensor[11]	4E0000078CA41928		
14	Port_0	Sensor[12]	7C0000078F109928		
15	Port_0	Sensor[13]	170000078E535D28		
16	Port_0	Sensor[14]	5C0000078E558328		
17	Port_0	Sensor[15]	9E0000078EA0A328		
18	Port_0	Sensor[16]	FC0000078C73E328		
19	Port_0	Sensor[17]	050000078C753B28		
20	Port_0	Sensor[18]	950000078C47B728		
21	Port_0	Sensor[19]	2C0000078D607728		
22					
23					

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.

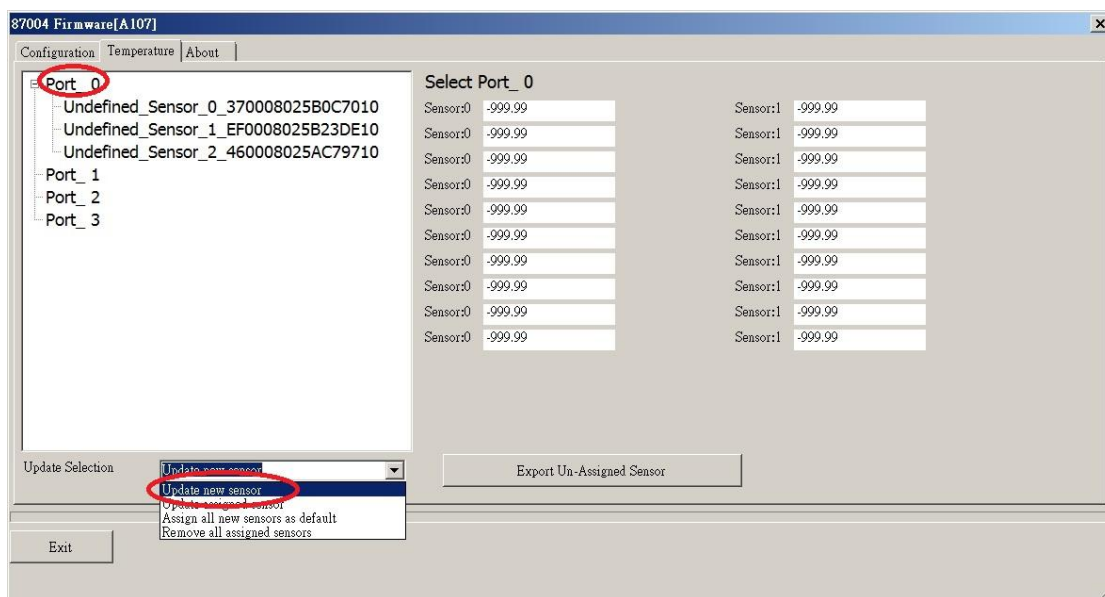
When the I-87004W is powered on, it scans all the DS18B20 sensors connected for each port. Each scanned DS18B20 is checked to see whether a channel index is assigned. If it is not assigned, then the DS18B20 is added to the not assigned list. The user has to check the not assigned list and assign channel 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.

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.

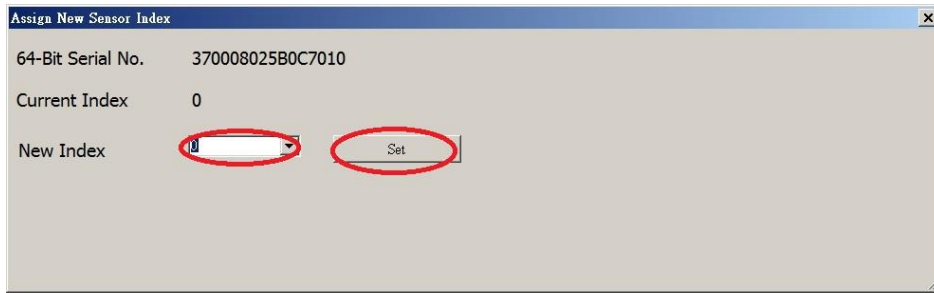
Followings are the procedure to configure the I-87004W.

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.

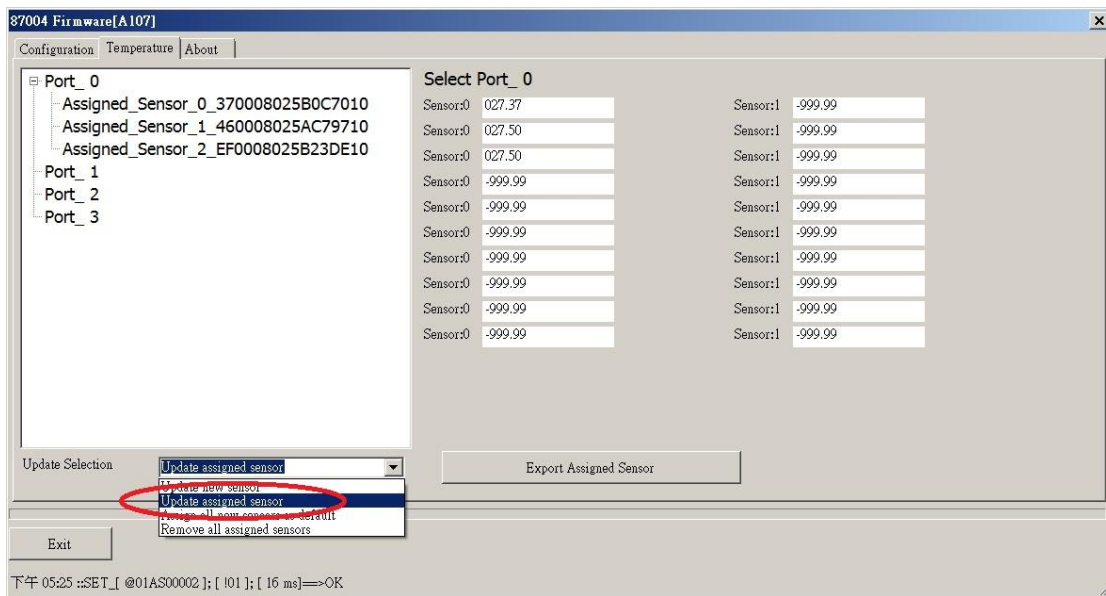


Index in undefined list	Serial Code	Location
0	370008025B0C7010	A
1	EF0008025B23DE10	C
2	460008025AC79710	B

5. Select Undefined_Sensor_X_YYYYYYYYYYYYYYYYYYY to assign channel index.
6. Set the new index and click on the Set button.



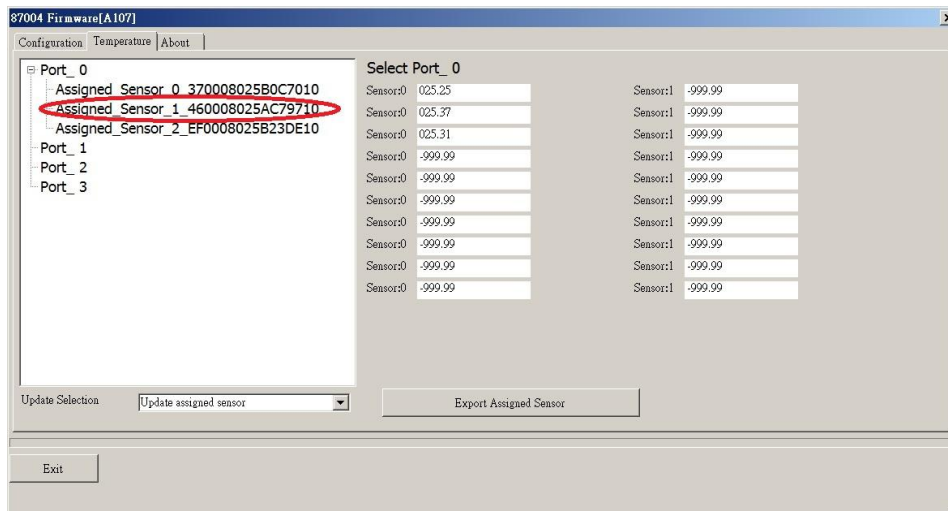
7. Repeat steps 5 and 6 until all undefined sensors are assigned with new index.
8. Select “Update assign sensor” and it will show the list of assigned sensors. We can use channel index 0 to read temperature at location A, channel index 1 to read temperature at location B, and channel index 2 to read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



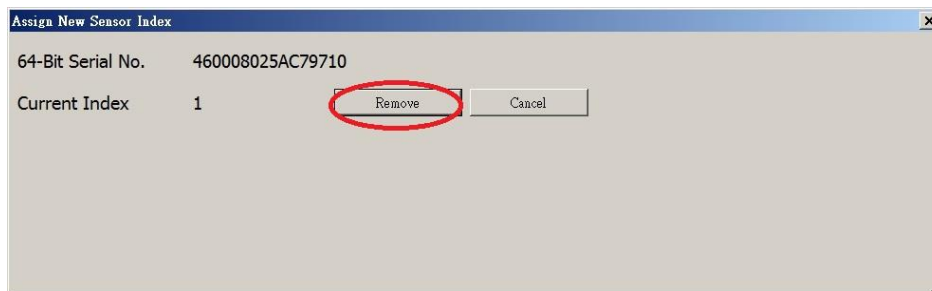
Assigned channel index	Serial Code	Location
0	370008025B0C7010	A
2	EF0008025B23DE10	C
1	460008025AC79710	B

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.



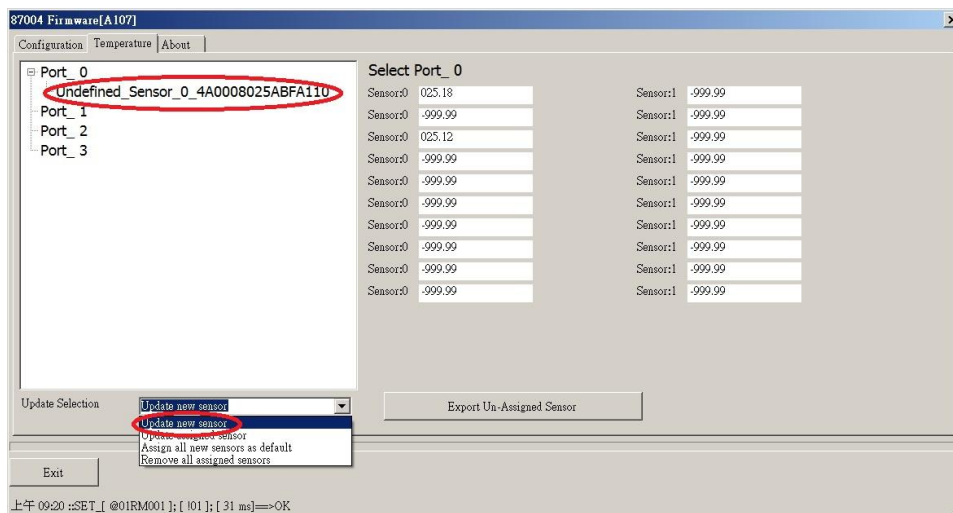
2. Select Remove.



3. Disconnect the broken sensor from the port.

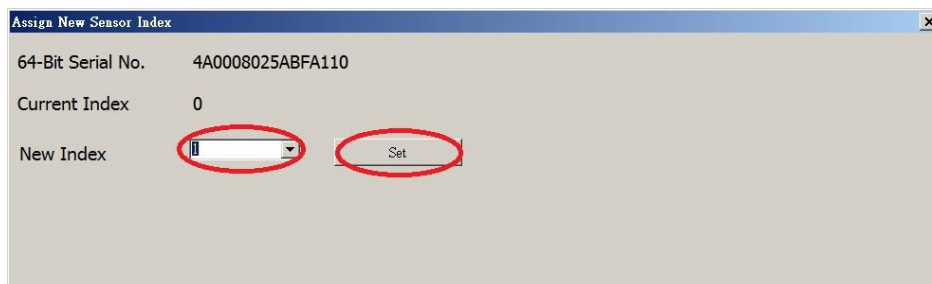
4. Connect the new sensor to the port.

5. Select "Update new sensor" and you will see the new sensor as undefined sensor.

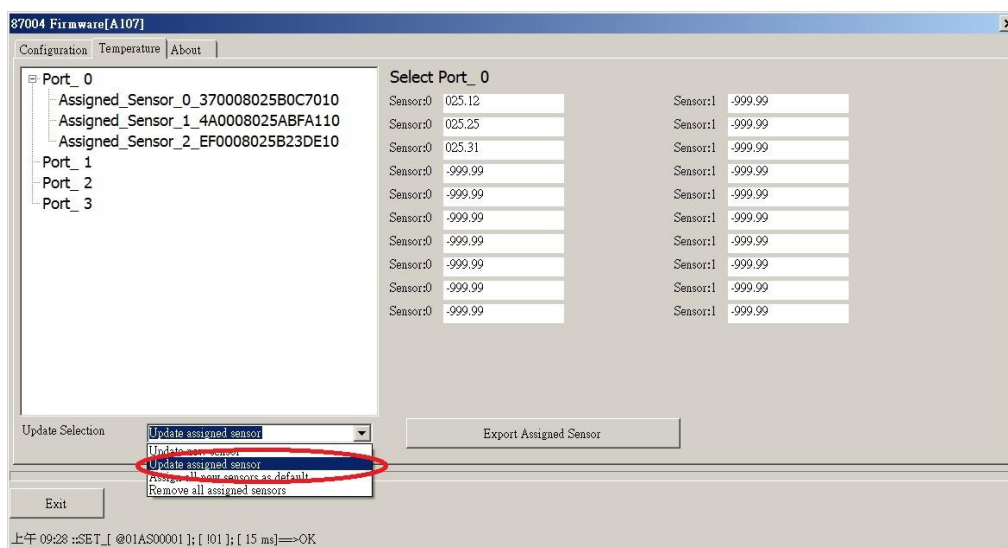


6. Select Undefined_Sensor_0_4A0008025ABFA110 to assign channel index.

7. Set the new index and click on the Set button.



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



Assigned channel index	Serial Code	Location
0	370008025B0C7010	A
2	EF0008025B23DE10	C
1	4A0008025ABFA110	B

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)

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 ~ 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
@AACL P	Clear all low latched temperature readings of a port to the current values P: port number, 0 ~ 3

Command	Description
@AACLP II	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 ~ 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 ~ 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), FFFFFFFFFFFFFFFF for no sensor
@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 ~ 13 response !AA (16-character serial code), FFFFFFFFFFFFFFFF for no sensor

Command	Description
@AASNRPN	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 ~ 13 response !AA (16-character serial code), FFFFFFFFFFFFFFFF for no sensor
~**	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