FR-2017

Analog Input Module

250 kS/s, 16-bit, 8/16 Channel Isolated

User Manual

Version 1.0.1/July 2011

Warranty

All products manufactured by ICP DAS are under warranty regarding defective materials for a period of one year, beginning from the date of delivery to the original purchaser.

Warning

ICP DAS assumes no liability for any damage resulting from the use of this product. ICP DAS reserves the right to change this manual at any time without notice. The information furnished by ICP DAS is believed to be accurate and reliable. However, no responsibility is assumed by ICP DAS for its use, not for any infringements of patents or other rights of third parties resulting from its use.

Copyright

Trademark

The names used for identification only may be registered trademarks of their respective companies.

Contact us

If you have any problem, please feel free to contact us.
You can count on us for quick response.

Email: service@icpdas.com

Table of Contents

1. Introduction

The FR-2017iT is a 12-bit, 8-channel differential or 16-channel single-ended analog inputs module that provides two ways to select input range (+/-150mV, +/-500mV, +/-1V, +/-5V, +/-10V, +/-20mA, 0~20mA and 4~20mA). One way provides switch selectable the same range at all channels and another each analog channel is allowed to configure an individual range by software selectable. It also has 240Vrms high over voltage protection for all analog inputs.

What is FRnet?

FRnet is a two-wire serial communication bus, wired in a similar manner to an RS-485. FRnet device connection is achieved using a multi-drop method. Unlike most communication methods based on RS-485, this new method does not use the traditional question/answer approach. Instead, it uses a fixed scan time to actively transmit data. Since there is no need for a CPU to process a communication protocol, FRnet can achieve high-speed data transmission in an isochronous manner. When FRnet is adopted as the I/O interface in an embedded controller, control of I/O data can be easily achieved by reading/writing to the memory (memory-mapped I/O), making the development of application programs very simple, which not only saves a great deal of time in communication protocol processing, but also guarantees the isochronous properties. Therefore, FRnet is highly suitable for applications that require remotely controlled, high-speed data transmission, and allows for major savings when wiring.

1.1. Features

Features

- High-speed transmission reliability
- Non-protocol communication
- Supporting broadcasting (1:n data transmission)
- High speed distributed I/O control capabilities
- Fixed cyclic scan time for deterministic control

Application

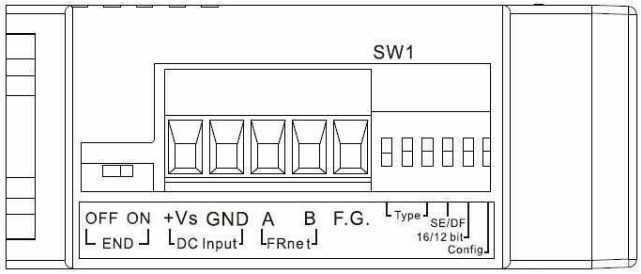
- Automatic equipment and related systems
- Airport landing lamp control systems
- Automatic warehouse control systems
- Disaster warning and security systems
- Parking lot management systems
- Fruit classification and packing systems
- Remote control
- Post Office letter classification machine systems
- Communication between PLCs
- New LED control technology
- Light control
- 4D theaters
- Monitoring of debris flow and landslides
- Building Automation
- Elevator control
- Air-conditioning systems
- Power monitoring

1.2. Specifications

Analog Input	
Input channels	8 differential or 16 single-ended, switch selectable
Input type	+/-150 mV、+/-500 mV、+/- 1 V、+/- 5 V、+/- 10 V、+/ 20 mA、0 ~ 20 mA，or 4 ~ 20 mA (requires optional external 125 Ohm resistor for current input)
Resolution	16-bit for only 1 channel, 12-bit for 8/16 channels
Sampling rate	10 S/s for only 1 channel, 50 S/s for 8/16 channels
Accuracy	+/- 0.1 % for only 1 channel, +/- 0.5% or better for 8/16 channels
Bandwidth	15.7 Hz for only 1 channel, 78.7 Hz for 8/16 channels
Zero drift	+/- 20 μV/℃
Span drift	+/- 25 ppm/℃
Input impedance	1 M Ohm for single-end, 2 M Ohm for differential
Common mode rejection	86 dB min
Over voltage protection	150 Vrms for single-ended, 240 Vrms for differential
connection	20-Pin removable terminal block
Interface	
Isolation voltage	3000 V_{DC}
2-wire cabling	Belden 8941 (2P twisted-pair cable), when different cables are used, the transmission distance may be changed
Transfer distance	Max. 400 m for speed 250 K, Max. 100 m for speed 1 M (default)
LED indicators	Power, communication run, communication error, terminal resistor
Transfer speed	250 KB or 1 MB (Default), DIP switch selectable
Cyclic scan time	2.88 ms for speed 250 K, 0.72 ms for speed 1 M (default)

Power	
Input voltage range	+10 ~ +30 VDC (non-isolation)
Power consumption	1.7 W Max.
Connection	5-Pin removable terminal block
EMS Protection	
ESD (IEC 61000-4-2)	4 kV contact for power line, communication line and each channel, 8 kV air for random point
EFT (IEC 61000-4-4)	4 kV for power liner
Surge (IEC 61000-4-5)	3 kV for FRnet and power liner
Environmental	
Operating temperature	-25 ~ +75 ℃
Storage temperature	+30 ~ +85 ℃
Humidity	10 ~ 90 % RH, non-condensing

1.3. Overview



OFF (END): 120 R terminating resistor Disable

ON (END): 120 R terminating resistor Enable

In additional to these connectors, there is also one switch on the side of the module which can decide to use the internal terminal resistor on the network or not. If you switch it on, it means that the module will provide the terminal resistor on the network. Note that each network needs two modules to be on, which are usually the first and last module on the network.

+Vs (DC Input): Power input (+10 to +30 V) and should be connected to the power supply (+)

GND (DC Input): Ground and should be connected to the power supply (-)

A (FR-net): Communication line “A (Data+)”

B (FR-net): Communication line “B (Data-)”

F.G.: F.G. stands for Frame Ground (protective ground). It is optional. If you use this pin, it can reduce EMI radiation; improve EMI performance and ESD protection.

SW1: The SW1 can be used to configure the module address, 8-ch differential/16-ch single-ended, 12/16-bit resolution and Individual/all Channel Configuration.

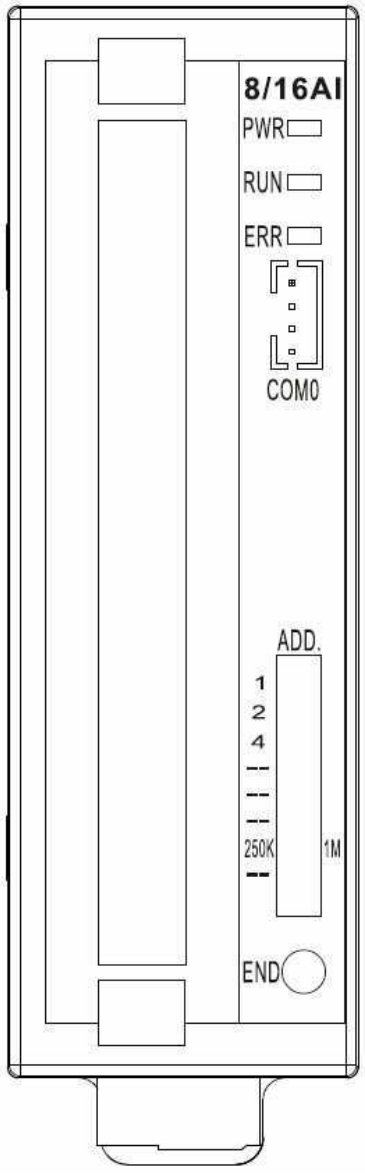
The table below shows the function list of SW1 DIP switch.

DIP Switch	Function
1st ~ 3rd	The 1st ~ 3rd DIP switch allows users to configure the input range: Please see the following table.
4th	The 4th DIP switch allows users to configure the input type: ON: 16 Single-ended OFF: 8 Differential
5th	The 5th DIP switch allows users to configure the Resolution: ON: 16 bit OFF: 12 bit
6th	The 6th DIP switch allows users to configure the operation settings: ON: Software Selectable OFF: Switch Selectable

The Max. and Min. mapping table of analog inputs.

Input Type	SW1			Minx	Max.
	1	2	3		
0 ~ 20mA	ON	ON	ON	000 (0mA)	FFF (20mA)
4 ~ 20mA	OFF	ON	ON	000 (4mA)	FFF (20mA)
+/-10V	ON	OFF	ON	800 (-10V)	7FF (+10V)
+/-5V	OFF	OFF	ON	800 (-5V)	7FF (+5V)
+/-1V	ON	ON	OFF	800 (-1V)	7FF (+1V)
+/-500mV	OFF	ON	OFF	800 (-500mV)	7FF (+500mV)
+/-150mV	ON	OFF	OFF	800 (-150mV)	7FF (+150mV)
+/-20mV	OFF	OFF	OFF	800 (-20mV)	7FF (+20mV)

There are several LED indicators located on the top side of the module. They are Power LED, Communication Run LED, Communication error LED, I/O LED and termination resistor LED. Users can understand the meaning directly from the label on the LED indicator. Note that the Communication Run LED and the Communication error LED illustrate whether the quality of communication is OK or not.



LED Indicator	
PWR	Power LED
RUN	Communication run LED
ERR	Communication error LED
END	Terminal resistor On

DIP Switch	
1st	Module Address:0~7
2nd	
3rd	
4th	Reserved
5th	Reserved
6th	Reserved
7th	Speed: ON → 250k bps OFF → 1M bps
8th	Reserved

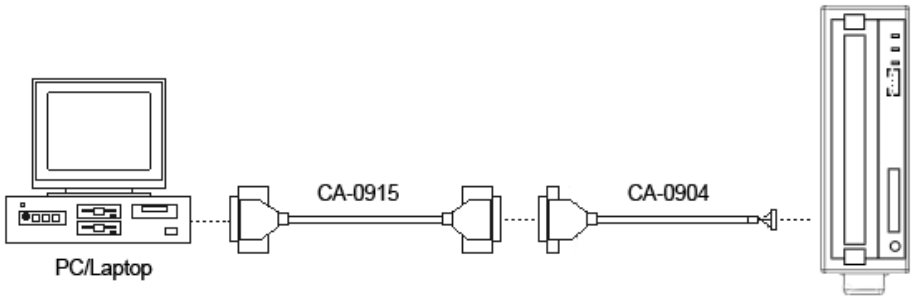
COM0
Each analog channel is allowed to configure an individual range by CA-0904 cable.

2. Getting Started

FR-2017 supports DCON protocol that is a request/reply communication protocol. Here we will demonstrate how to use DCON Utility to configure the FR-2017, it uses DCON protocol to test whether FRnet is working or not to help you get started with FR-2017.

2.1. Hardware Installation

FR-2017 contains a RS-232 interface (TxD, RxD, GND), 4-pin connector. The demo will simply use a CA-0915 (9-pin female to 9-pin male) and a CA-0904 (4-pin female to 9-pin female) connector to connect FR-2017 to PC/Laptop as shown below:



For more information about CA-0915 and CA-0904 connectors, please refer to:
http://www.i cpdas.com/products/Accessories/cable/cable_selection.htm

If your PC/Laptop don't have a standard RS-232 port, you can use a I-7560 converter (USB to RS-232) and a CA-0904 converter (RS-232 to RS-485) to connect the FR-2017. Before using the I-7560, please make sure that the USB driver has installed.

The USB driver can be obtained from:
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7000/756x/

2.2. Software Installation

FR-2017 contains a built-in DCON protocol (firmware) to support the DCON Utility. The FR-2017 can be configured via a standard RS-232 serial port by using DCON Utility.

DCON Utility is s toolkits kits that help users search the network, easily to configure the I/O modules and test the I/O status via the serial port (RS-232/485) or Ethernet port (using virtual com port).

The DCON Utility can be found at:
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/driver/dcon_utility/

2.3. Configuration

The FR-2017 can be configured not only by 6-bit DIP switch but also via DCON Utility.

The figure below shows the system configuration of the 6-bit DIP switch:

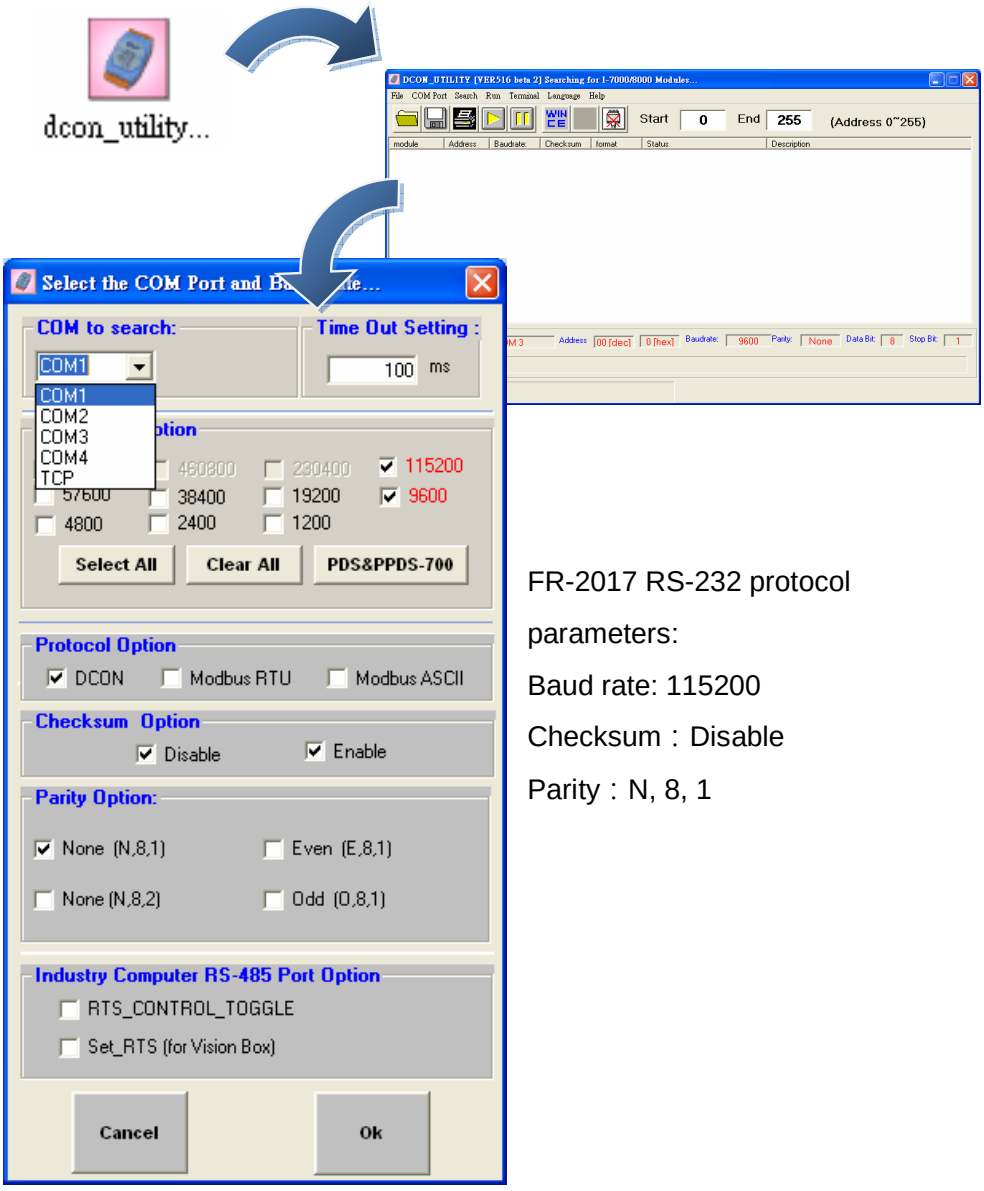
Form1

Type	Dip Switch 1	2	3	Min Value	Max Value
0 ~ 20mA	ON	ON	ON	000 (0mA)	FFF (20mA)
4 ~ 20mA	OFF	ON	ON	000 (4mA)	FFF (20mA)
+/-10V	ON	OFF	ON	800 (-10V)	7FF (+10V)
+/-5V	OFF	OFF	ON	800 (-5V)	7FF (+5V)
+/-1V	ON	ON	OFF	800 (-1V)	7FF (+1V)
+/-500mV	OFF	ON	OFF	800 (-500mV)	7FF (+500mV)
+/-150mV	ON	OFF	OFF	800 (-150mV)	7FF (+150mV)
+/-20mA	OFF	OFF	OFF	800 (-20mA)	7FF (+20mA)

	SW3 4	5	6	
Single-ended/differential	ON			Single-ended
	OFF			Differential
12/16 bit		ON		16-bit (channel 0 only)
		OFF		12-bit
Filter rejection and configuration		ON	ON	50 Hz filter rejection for 16-bit mode
		OFF	ON	software configuration for 12-bit mode
		ON	OFF	60 Hz filter rejection for 16-bit mode
		OFF	OFF	DIP switch configuration for 12-bit mode

Here is a demo that shows how to use DCON Utility to configure FR-2017. Before starting this process, make sure that the software and hardware are successfully installed as described in the previous section.

Step 1: Start DCON Utility, and then configure protocol parameters



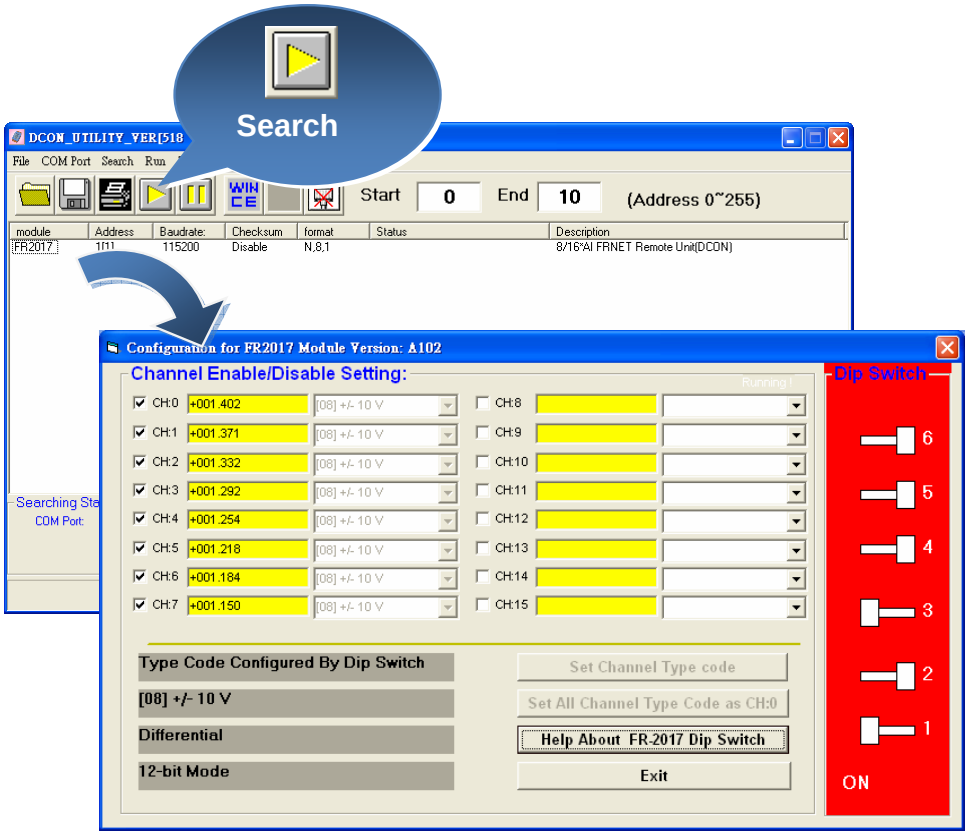
FR-2017 RS-232 protocol parameters:

Baud rate: 115200

Checksum：Disable

Parity：N, 8, 1

Step 2: Search the module, when finished, click the name of the I/O module to enter the configuration form in the list



The following sections will introduce some of the basic procedures of the FR-2017 configuration form of the DCON Utility.

i. Getting help – FR-2017 configuration

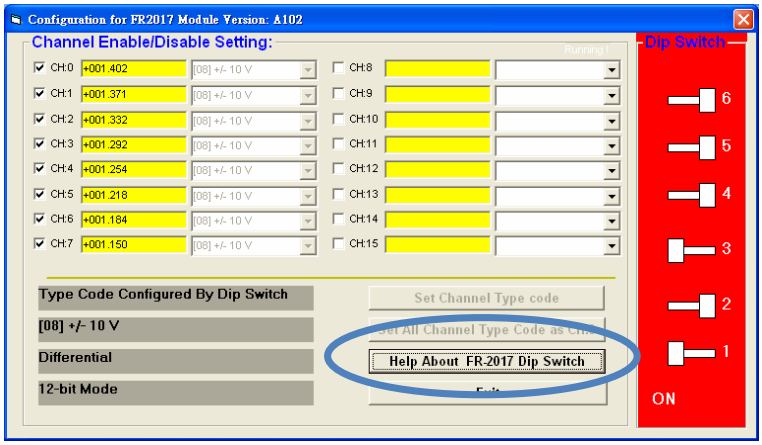
ii. Configuring the input type

iii. Configuring the resolution

iv. Configuring the operation settings

2.3.1. Getting help – FR-2017 Configuration

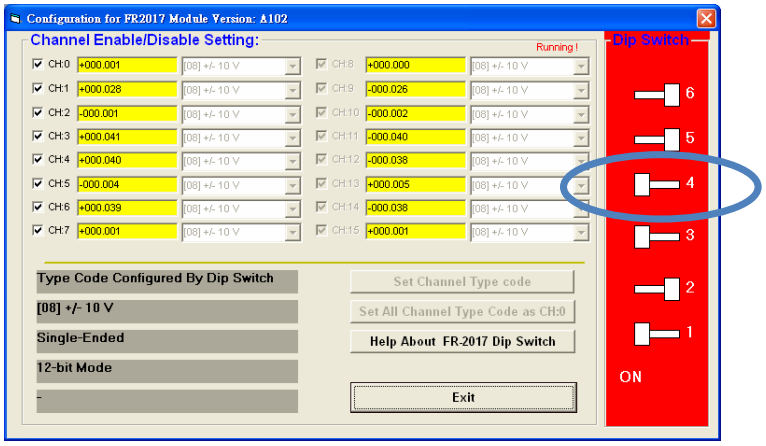
The 『Help About FR-2017 Dip Switch』 button allows users to get the configuration information of the FR-2017.



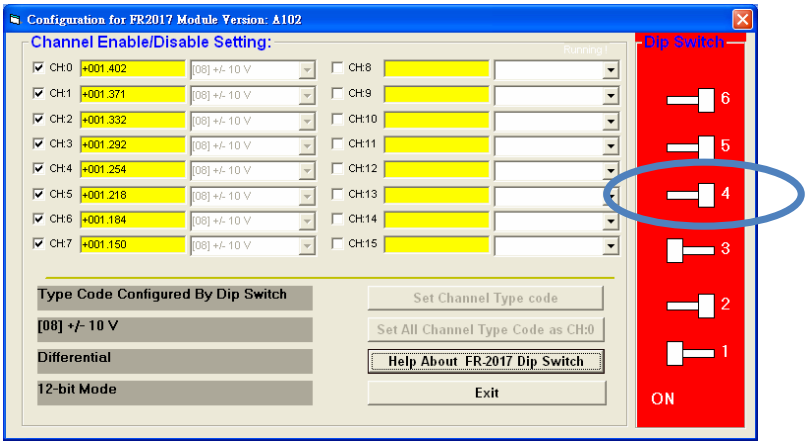
2.3.2. Configuring the Input Type

The 4th DIP switch allows users to change the input type to single-ended mode or differential mode.

Single-ended



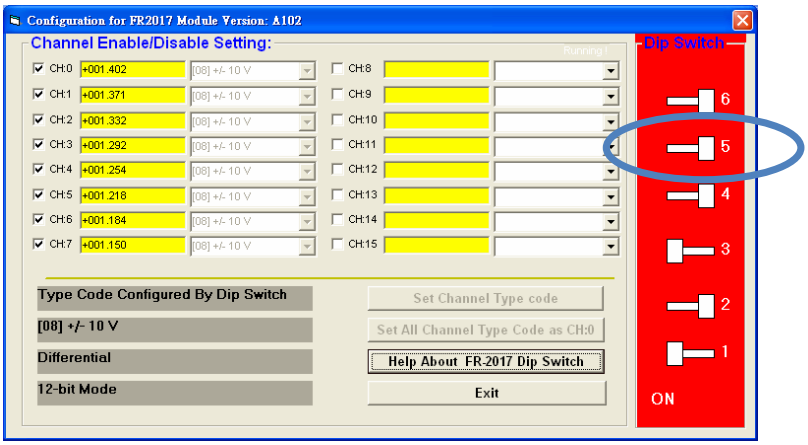
Differential (Default)



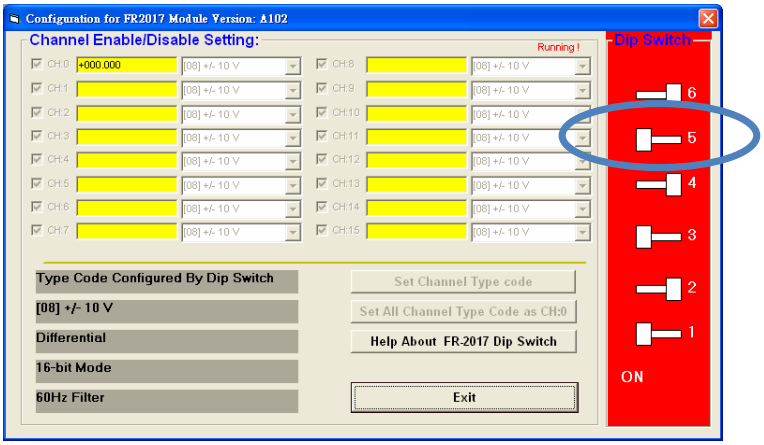
2.3.3. Configuring the Resolution

The 5th DIP switch allows users to change the resolution to 12-bit or 16-bit.

12-bit resolution



16-bit resolution (for only 1 channel ch0)

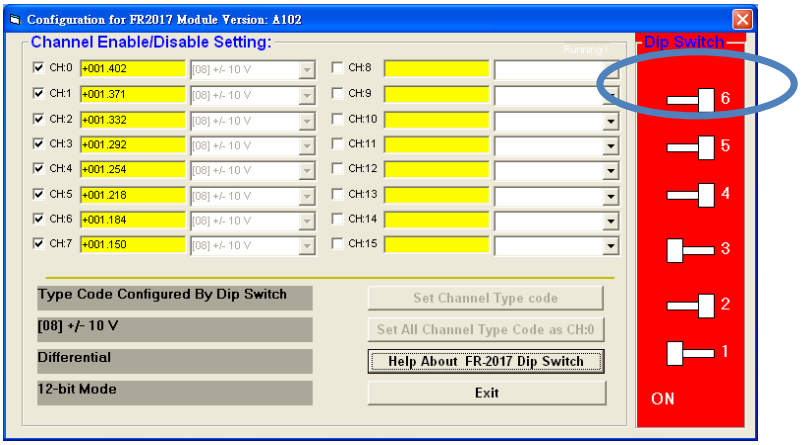


2.3.4. Configuring the Operation Settings

The 6th DIP switch allows users to change the input operation from hardware setting to software setting, and vice versa.

The input operation from hardware setting (Default)

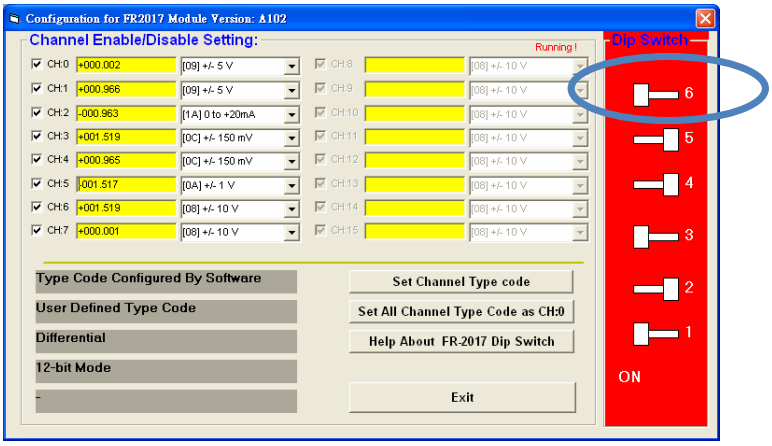
To choose the input operation from hardware setting, all of the input with the same input value that can be configured from the 1st to 3rd DIP switches.



The input operation from software setting (Default)

To choose the input operation from software setting, each channel can have different input value, and can close some of them to improve the sample rate.

Besides, users can monitor the configuration and the measured value by using DCON Utility configuration to contrast and debug the program.

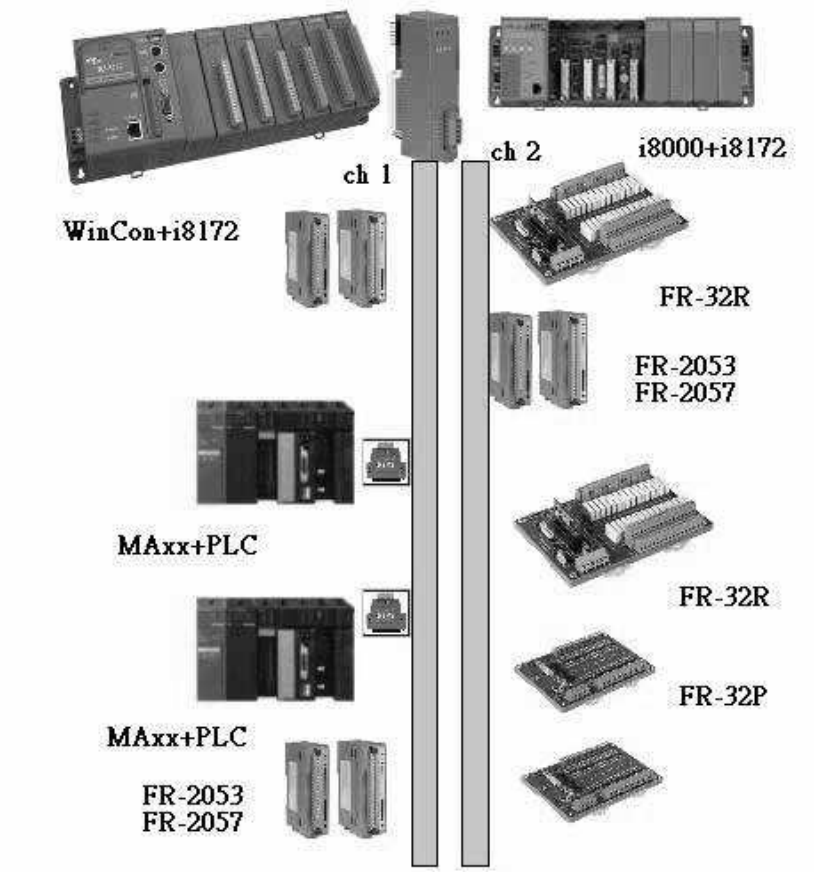


3. FRnet Application

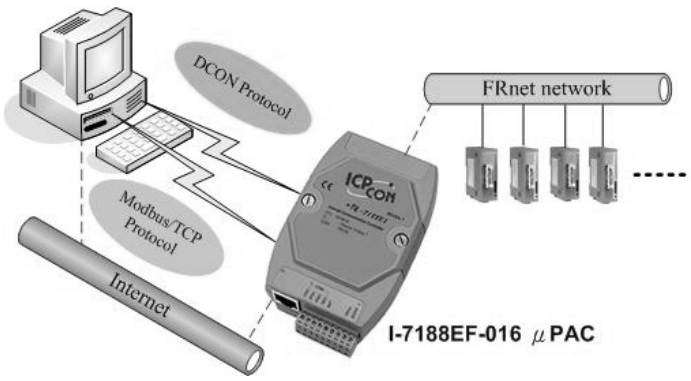
Within conventional communication methods in the control network system, the master controller must send a command with data to the slave module. Then it must wait for confirmation from the slave's response, which is based on a complicated and fixed transmission protocol. If there are many devices on the network, all the data transmission within the network must be controlled by the master controller. Therefore, the performance of communication efficiency between the master controller and each of the devices will usually be deteriorated when more and more devices are added in. In contrast to this solution, our FRnet provides innovative data transmission method which adopts the hardware FRnet control chip to do communication broadcasting and gets rid of the software transmission protocol. It is easy to set up a reliable network merely by hardware setting both the "Sender Address" and "Receiver Address" of all the modules.

There are three FRnet master controllers provided by ICPDAS products, the PAC family, 7188EF-016 and the FRB-100/200. The first one is a PCI interface add-on card, and the other one is an Ethernet embedded controller. Three possible application configurations are demonstrated as follows. The following FRnet I/O modules are two basic architectures that are available

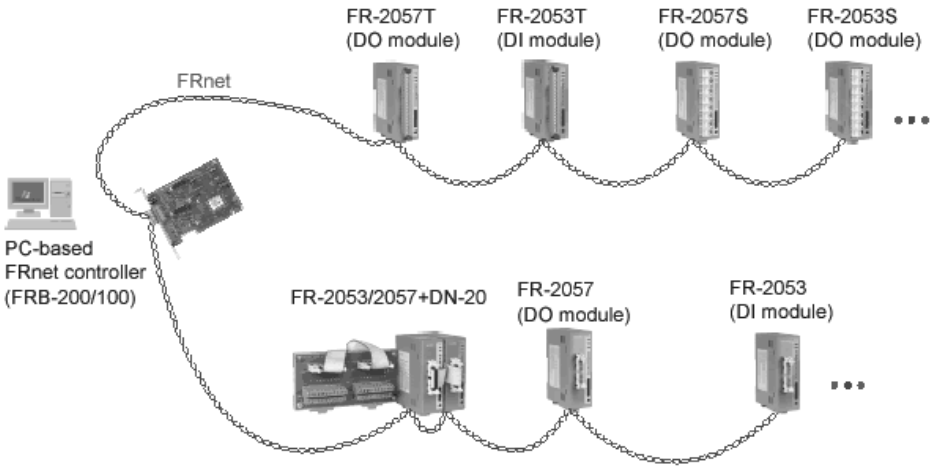
1. PAC-Based System



2. uPAC-Based System



3. PC-Based System



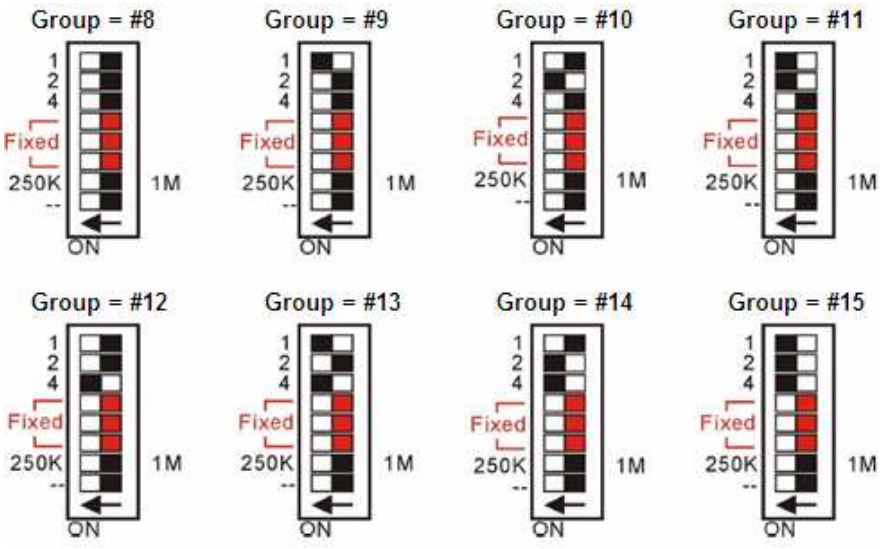
For more information about the FRB-100/FRB-200(U) module, please refer to:

http://www.icpdas.com/products/Remote_IO/frnet/frb-200.htm

Before using the FR-2017 development kits or other function to access data, please make sure the following settings:

1. Group Number

The FR-2017 module can configure the group number by the dip-switch. The configuration method is depicted in the following figure:



2. Resolution and input type

The resolution and input type of the FR-2017 can be configured with the following two options:

i. 12-bit resolution: 8-channel differential or 16-channel single-ended

bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
12-bit AD												AD channel			

i. 16-bit resolution: only 1-channel, ch0

bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
16-bit AD															

3.1. PAC-Based System

ICP DAS provides various series of PACs that can support the FRnet expanded I/O module via an I-8172 I/O module.

For more information about the I-8172 I/O module, please refer to:
http://www.icpdas.com/products/Remote_IO/i-8ke/i-8172w.htm

The table below lists all the PAC library and demo program for supporting I-8172 I/O module:

Platform	Controller	API Comparison
MiniOS7	I-8000 Series iPAC-8000Series VP-2000Series	i8172_API name
Website	ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/fr_net/8172/demo/bc/	
Windows CE5 /Windows CE6 / Windows Embedded Standard (WES)	WP-8000 series WP-2000 series XPAC-CE6 series XPAC-XPE series	pac_i8172W_API name
Windows CE5	ftp://ftp.icpdas.com/pub/cd/winpac/napdos/wp-8x4x_ce50/sdk/io_modules/ ftp://ftp.icpdas.com/pub/cd/winpac/napdos/wp-8x4x_ce50/demo/winpac/	
Windows CE6	ftp://ftp.icpdas.com/pub/cd/xp-8000-ce6/sdk/special_io/ ftp://ftp.icpdas.com/pub/cd/xp-8000-ce6/demo/xpac/ ftp://ftp.icpdas.com/pub/cd/xpac-atom-ce6/sdk/special_io/ ftp://ftp.icpdas.com/pub/cd/xpac-atom-ce6/demo/xpac/	
Windows Embedded Standard	ftp://ftp.icpdas.com/pub/cd/xp-8000/sdk/io/ ftp://ftp.icpdas.com/pub/cd/xpac-atom/sdk/io/ ftp://ftp.icpdas.com/pub/cd/xp-8000/demo/specialized_io/ ftp://ftp.icpdas.com/pub/cd/xpac-atom/demo/specialized_io/	

3.1.1. i8172_ReadAIHex

Retrieve a 16-bit unsigned integer value from the specified channel.

Syntax

short i8172_ReadAIHex(int slot,int port,int group,short bitMode,short *chIndex, short* aiHex);

Parameters

slot: 0 ~ 7

port: 0 or 1

group: 8 ~ 15

bitMode:

12: 12-bit resolution

16: 16-bit resolution

*chIndex: Reads the number of the specified channel as a 16-bit signed integer.

*aiHex: Reads the analog data of the specified channel as a 16-bit signed integer.

Return Values

If the function fails, the return value is less than 0.

3.1.2. i8172_AIHexToFloat

Retrieve a hexadecimal raw data converted to a float value according to the type code and the resolution.

Syntax

float i8172_AIHexToFloat(short hexData, short typeCode, short bitMode);

Parameters

hexData: The hexadecimal data.

typeCode: The input range

bitMode:

12: 12-bit resolution

16: 16-bit resolution

Return Values

If the function succeeds, the return value is the float number.

3.1.3. i8172_ReadAI_Ch

Retrieve the analog data converted to a float value from the specified channel.

Syntax

short i8172_ReadAI_Ch(int slot,int port, int group, short bitMode,short typeCode, short chIndex, float* aiFloat);

Parameters

slot: 0 ~ 7

port: 0 or 1

group: 8 ~ 15

bitMode:

12: 12-bit resolution

16: 16-bit resolution

typeCode: The measurement range

chIndex: The channel number

*aiFloat: The receiving analog data

Return Values

If the function succeeds, the return value is the unit of time ms of the specified channel.

Remarks

This function needs the time of 0 to 45 ms to get the value from the specified channel.

3.1.4. i8172_ReadAI_All

Retrieve the value of all channels.

Syntax

short i8172_ReadAI_All(int slot,int port, int group, short bitMode,short totalCh,short typeCode[], float aiFloat[]);

Parameters

slot: 0 ~ 7

port: 0 or 1

group: 8 ~ 15

bitMode:

12: 12-bit resolution

16: 16-bit resolution

totalCh: 16-bit resolution, totalCh = 1,

16-bit resolution, totalCh=1

12-bit resolution, differential signal, totalCh=8

12-bit resolution, single-ended signal, totalCh=16

typeCode[]: The input range

aiFloat[]: The receiving analog data of all channels

Return Values

If the function succeeds, the return value is the unit of time ms of the specified channel.

Remarks

This function needs the time of 0 to 45 ms to get the value from the specified channel.

格式化: 段落前分頁

3.2. uPAC-Based System

The I-7188EF-016 is a µPAC with isolated FRnet, Ethernet, RS-485 and RS-232 ports. I-7188EF-016 is designed to make that the host PC easily access the FRnet I/O module via Ethernet. I-7188EF-016 controls the distributed FR-2000 and FR I/O module via FRnet, and provides the Modbus and DCON protocol for host PC to access these FR I/O channels via Ethernet.

For more information about the I-7186EF-016/I-7188EF-016 module, please refer to:

http://www.icpdas.com/products/Remote_IO/frnet/i-7188ef-016_c.htm

I-7186EF-016/I-7188EF-016 accesses the FRnet I/O module via not only Ethernet but also the Modus/TCP and the DCON command.

The following section introduces some of the function used to access the FR-2017 via Ethernet, and some of the Modbus and the DCON command via the Modbus/TCP and the DCON protocol.

i. Access the FR-2017 via Ethernet (Please refer to.2.1 ~ 3.2.3)

ii. Access the FR-2017 via the Modbus and the DCON command (Please refer to 3.2.4)

格式化: 內文, 間距 套用後: 0 pt

3.2.1. FRnet_AIHexToFloat

Retrieve a hexadecimal raw data converted to a float value according to the type code and the resolution.

Syntax

float FRnet_AIHexToFloat(short hexData, short typeCode, short bitMode);

Parameters

hexData: The hexadecimal raw data

typeCode: The measurement range

bitMode:

12: 12-bit resolution

16: 16-bit resolution

Return Values

If the function succeeds, the return value is the float number.

3.2.2. FRnet_ReadAI_Ch

Retrieve the float number from the specified analog channel.

Syntax

short FRnet_ReadAI_Ch(int group, short bitMode,short typeCode, short chIndex, float* aiFloat);

Parameters

group: 8 ~ 15

bitMode:

12: 12-bit resolution

16: 16-bit resolution

typeCode: The measurement range

chIndex: The channel number

*aiFloat: The receiving analog data

Return Values

If the function succeeds, the return value is the unit of time ms of the specified channel.

Remarks

This function needs the time of 0 to 45 ms to get the value from the specified channel.

3.2.3. FRnet_ReadAI_All

Retrieve the value of all channels.

Syntax

short FRnet_ReadAI_All(int group, short bitMode,short totalCh,short typeCode[], float aiFloat[]);

Parameters

slot: 0 ~ 7

port: 0 or 1

group: 8 ~ 15

bitMode:

12: 12-bit resolution

16: 16-bit resolution

totalCh:

16-bit resolution, totalCh=1

12-bit resolution, differential signal, totalCh=8

12-bit resolution, single-ended signal, totalCh=16

typeCode[]: The input range

aiFloat[]: The receiving analog data of all channels

Return Values

If the function succeeds, the return value is the unit of time ms of the specified channel.

Remarks

This function needs the time of 0 to 45 ms to get the value from the specified channel.

3.2.4. Modbus and DCON Commands

Here we will demonstrate how to use the I-7186EF-016/I-7188EF-016 to access the data through the DCON protocol or Modbus/TCP protocol to

The I-7186EF-016/I-7188EF-016 is available in firmware version 0x1010 or above.

The latest version of the firmware can be obtained from:
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/fr_net/7188ef/firmware/

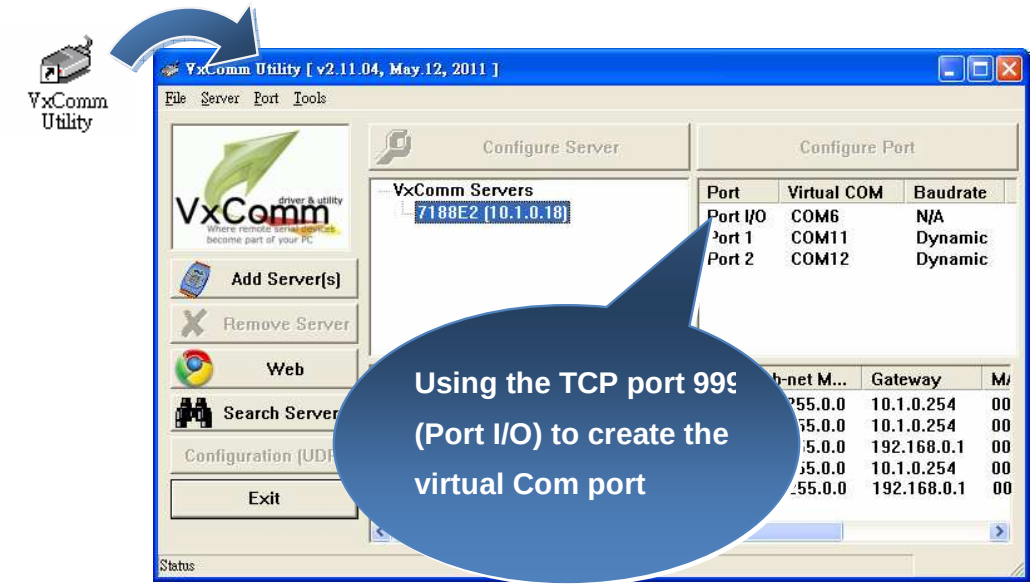
DCON Protocol

Before using the DCON command to access the FR-2017, you need establish a connection between the host PC and I-7186EF-016/I-7188EF-016.

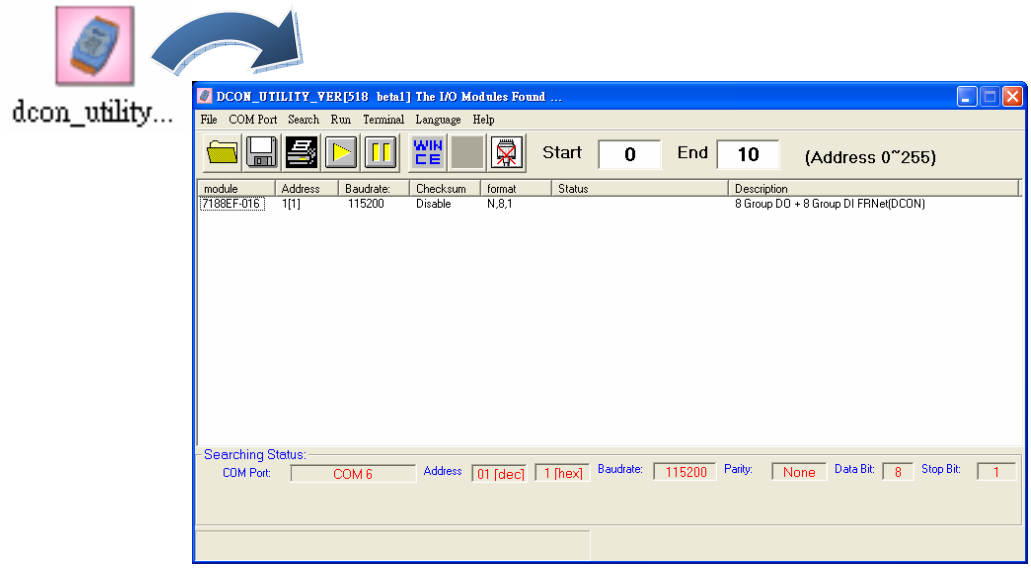
VxComm Utility can create a virtual COM port for using DCON protocol via Ethernet.

The VxComm Utility can be found at:
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/driver/dcon_utility/

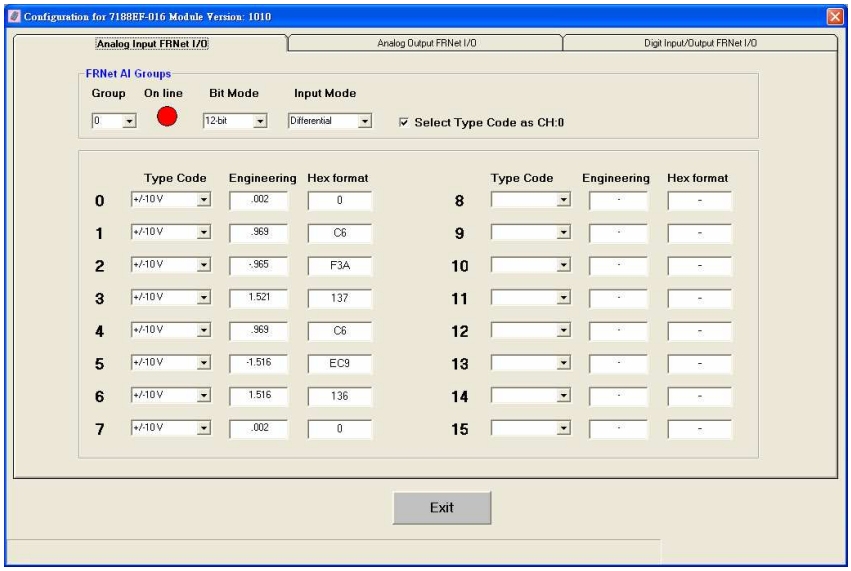
Step 1: Start VxComm Utility to create a virtual COM port



Step 2: Start DCON Utility to search the I-7186EF-016/I-7188EF-016 module through the establishment of the virtual COM port



Step 3: Click the module name to enter the configuration form, and then click the AI Input FRnet I/O tab

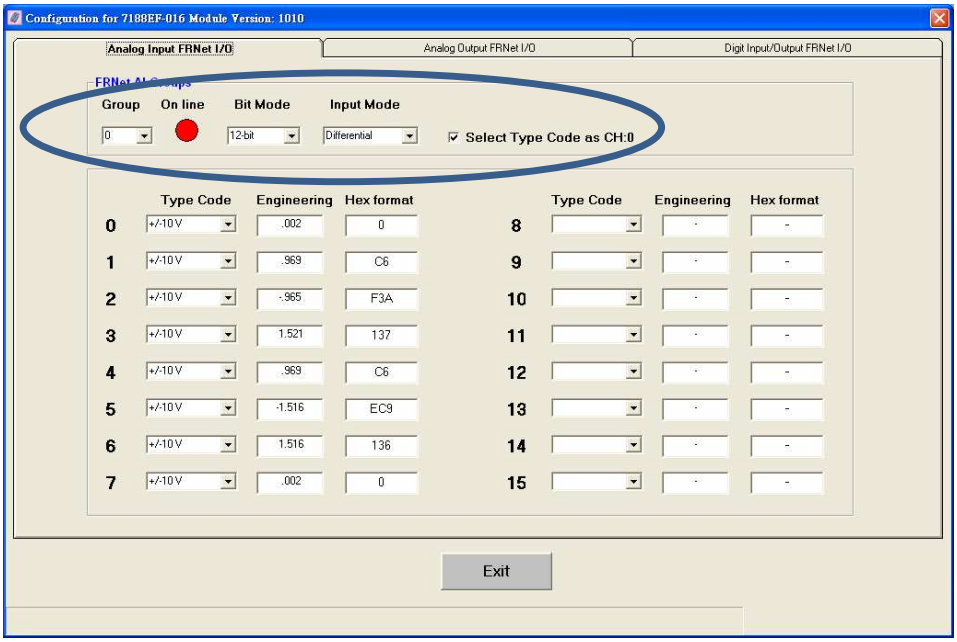


Step 4: Connect to FR-2017 to configure the settings. The step required to configure the following settings.

i. Group: Group number

ii. Bit Mode and Input Mode: Resolution and input mode

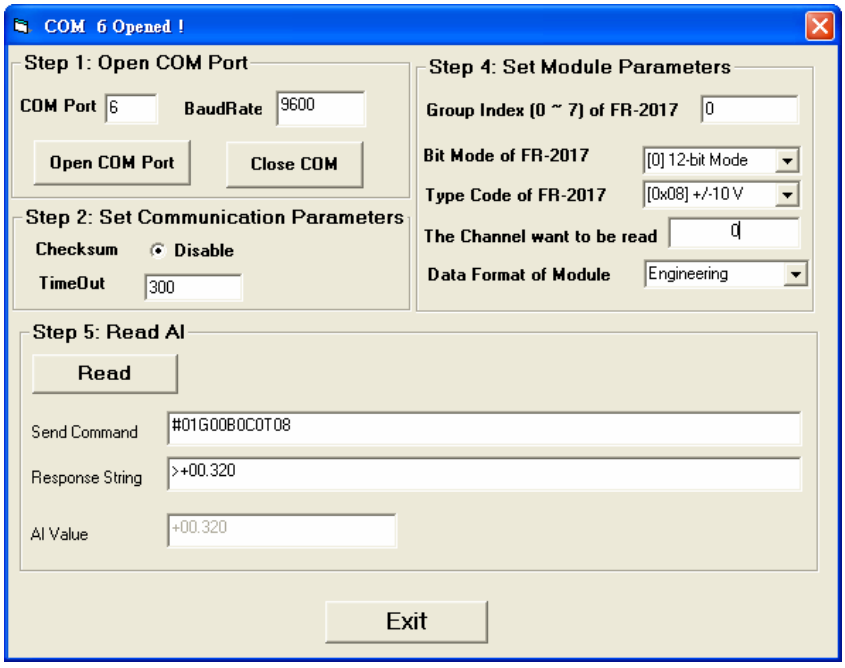
iii. Input range



The following DCON commands are available for the I-7186EF-016/I-7188EF-016 to access the FR-2017.

DCON Command	Description	Demo
#AAGggBn	Read one group Hex data with bit mode	Bn: N = 0 12 bit, 16 channel data N = 4 16 bit, 1 channel data
#AAGggBnCjTnn	Read float format channel data with bit mode and type code	

The figure below shows how to use VB 6.0 to develop the application by using the DCON protocol.



Modbus/TCP Protocol

The Modbus command use Modbus function code 04 to read the analog input data of the FR-2017 via TCP port 502.

FR-2017 Modbus Protocol Parameters

Address	Description
30000	Group 8, 16-bit only 1 channel
iMemory_AI range 30001 to range 30014 is reserved.	
30015	Group 8, 12-bit channel 0
30016	Group 8, 12-bit channel 1
30017	Group 8, 12-bit channel 2
30018	Group 8, 12-bit channel 3
30019	Group 8, 12-bit channel 4
30020	Group 8, 12-bit channel 5
30021	Group 8, 12-bit channel 6
30022	Group 8, 12-bit channel 7
30023	Group 8, 12-bit channel 8
30024	Group 8, 12-bit channel 9
30025	Group 8, 12-bit channel 10
30026	Group 8, 12-bit channel 11
30027	Group 8, 12-bit channel 12
30028	Group 8, 12-bit channel 13
30029	Group 8, 12-bit channel 14
30030	Group 8, 12-bit channel 15

30031	Group 9, 16-bit only 1 channel
iMemory_AI range 30032 to range 30045 is reserved.	
30046	Group 9, 12-bit channel 0
30047	Group 9, 12-bit channel 1
30048	Group 9, 12-bit channel 2
30049	Group 9, 12-bit channel 3
30050	Group 9, 12-bit channel 4
30051	Group 9, 12-bit channel 5
30052	Group 9, 12-bit channel 6
30053	Group 9, 12-bit channel 7
30054	Group 9, 12-bit channel 8
30055	Group 9, 12-bit channel 9
30056	Group 9, 12-bit channel 10
30057	Group 9, 12-bit channel 11
30058	Group 9, 12-bit channel 12
30059	Group 9, 12-bit channel 13
30060	Group 9, 12-bit channel 14
30061	Group 9, 12-bit channel 15
30062	Group 10, 16-bit only 1 channel
iMemory_AI range 30063 to range 30076 is reserved.	
30077	Group 10, 12-bit channel 0
30078	Group 10, 12-bit channel 1
30079	Group 10, 12-bit channel 2
30080	Group 10, 12-bit channel 3

30081	Group 10, 12-bit channel 4
30082	Group 10, 12-bit channel 5
30083	Group 10, 12-bit channel 6
30084	Group 10, 12-bit channel 7
30085	Group 10, 12-bit channel 8
30086	Group 10, 12-bit channel 9
30087	Group 10, 12-bit channel 10
30088	Group 10, 12-bit channel 11
30089	Group 10, 12-bit channel 12
30090	Group 10, 12-bit channel 13
30091	Group 10, 12-bit channel 14
30092	Group 10, 12-bit channel 15
30093	Group 11, 16-bit only 1 channel
iMemory_AI range 30094 to range 300107 is reserved.	
30108	Group 11, 12-bit channel 0
30109	Group 11, 12-bit channel 1
30110	Group 11, 12-bit channel 2
30111	Group 11, 12-bit channel 3
30112	Group 11, 12-bit channel 4
30113	Group 11, 12-bit channel 5
30114	Group 11, 12-bit channel 6
30115	Group 11, 12-bit channel 7
30116	Group 11, 12-bit channel 8
30117	Group 11, 12-bit channel 9

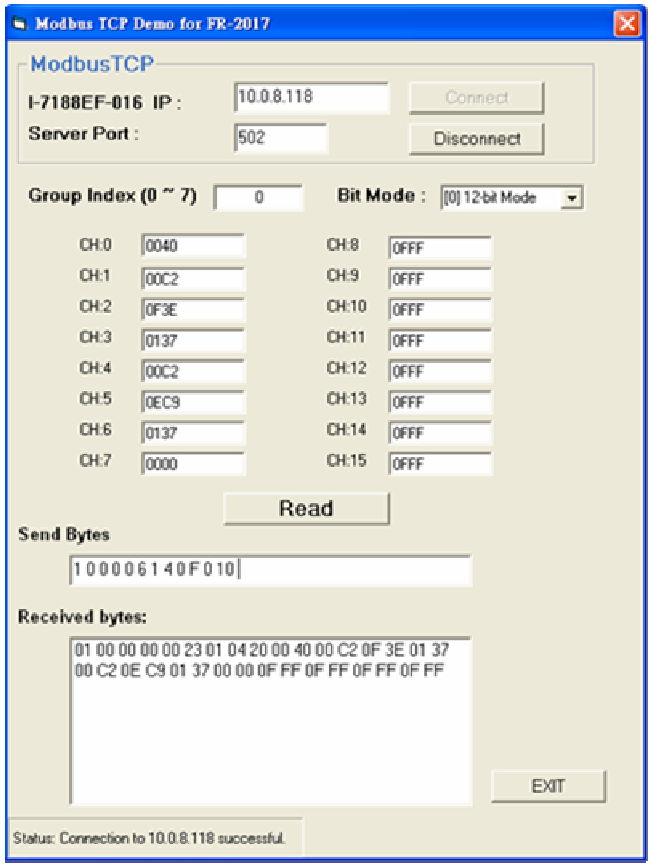
30118	Group 11, 12-bit channel 10
30119	Group 11, 12-bit channel 11
30120	Group 11, 12-bit channel 12
30121	Group 11, 12-bit channel 13
30122	Group 11, 12-bit channel 14
30123	Group 11, 12-bit channel 15
30124	Group 12, 16-bit only 1 channel
iMemory_AI range 30125 to range 300138 is reserved.	
30139	Group 12, 12-bit channel 0
30140	Group 12, 12-bit channel 1
30141	Group 12, 12-bit channel 2
30142	Group 12, 12-bit channel 3
30143	Group 12, 12-bit channel 4
30144	Group 12, 12-bit channel 5
30145	Group 12, 12-bit channel 6
30146	Group 12, 12-bit channel 7
30147	Group 12, 12-bit channel 8
30148	Group 12, 12-bit channel 9
30149	Group 12, 12-bit channel 10
30150	Group 12, 12-bit channel 11
30151	Group 12, 12-bit channel 12
30152	Group 12, 12-bit channel 13
30153	Group 12, 12-bit channel 14
30154	Group 12, 12-bit channel 15

30155	Group 13, 16-bit only 1 channel
iMemory_AI range 30156 to range 300169 is reserved.	
30170	Group 13, 12-bit channel 0
30171	Group 13, 12-bit channel 1
30172	Group 13, 12-bit channel 2
30173	Group 13, 12-bit channel 3
30174	Group 13, 12-bit channel 4
30175	Group 13, 12-bit channel 5
30176	Group 13, 12-bit channel 6
30177	Group 13, 12-bit channel 7
30178	Group 13, 12-bit channel 8
30179	Group 13, 12-bit channel 9
30180	Group 13, 12-bit channel 10
30181	Group 13, 12-bit channel 11
30182	Group 13, 12-bit channel 12
30183	Group 13, 12-bit channel 13
30184	Group 13, 12-bit channel 14
30185	Group 13, 12-bit channel 15
30186	Group 14, 16-bit only 1 channel
iMemory_AI range 30187 to range 300200 is reserved.	
30201	Group 14, 12-bit channel 0
30202	Group 14, 12-bit channel 1
30203	Group 14, 12-bit channel 2
30204	Group 14, 12-bit channel 3

30205	Group 14, 12-bit channel 4
30206	Group 14, 12-bit channel 5
30207	Group 14, 12-bit channel 6
30208	Group 14, 12-bit channel 7
30209	Group 14, 12-bit channel 8
30210	Group 14, 12-bit channel 9
30211	Group 14, 12-bit channel 10
30212	Group 14, 12-bit channel 11
30213	Group 14, 12-bit channel 12
30214	Group 14, 12-bit channel 13
30215	Group 14, 12-bit channel 14
30216	Group 14, 12-bit channel 15
30217	Group 15, 16-bit only 1 channel
iMemory_AI range 300218 to range 300231 is reserved.	
30232	Group 15, 12-bit channel 0
30233	Group 15, 12-bit channel 1
30234	Group 15, 12-bit channel 2
30235	Group 15, 12-bit channel 3
30236	Group 15, 12-bit channel 4
30237	Group 15, 12-bit channel 5
30238	Group 15, 12-bit channel 6
30239	Group 15, 12-bit channel 7
30240	Group 15, 12-bit channel 8
30241	Group 15, 12-bit channel 9

30242	Group 15, 12-bit channel 10
30243	Group 15, 12-bit channel 11
30244	Group 15, 12-bit channel 12
30245	Group 15, 12-bit channel 13
30246	Group 15, 12-bit channel 14
30247	Group 15, 12-bit channel 15

The figure below shows how to use VB 6.0 to develop the application by using the DCON protocol.



Resolution and Input type

FR-2017 Input Type

Input Type	Address
0 ~ 20 mA	0x1a
4 ~ 20 mA	0x7
+/-10 V	0x8
+/-5 V	0x9
+/-1 V	0xa
+/-500 mV	0xb
+/-150 mV	0xc
+/-20 mA	0xd

FR-2017 input type can be defined as uni-polar or bi-polar:

Uni-Polar

Bit mode	Min	Max
12-bit	0	FFF
16-bit	0	FFFF

Bi-Polar

Bit mode	Min	Zero	Max
12-bit	800	0	7FF
16-bit	8000	0	7FFF

格式化: 段落前分頁

3.3. PC-Based System

FRB-100/FRB-200(U) is a PC-based card that allows user to access the data of the distributed FR-net I/O modules.

For more information about the specification and related development applications of the FRB-100/FRB-200(U), please refer to the corresponding manual.

http://www.icpdas.com/download/frnet/frb-200/frb-200.pdf

4. Error Codes

The table below shows all of the error codes that are returned as integer values:

Value	Description
0	OK
-1	ID_ERROR
-2	SLOT_OUT_RANGE
-3	CHANNEL_OUT_RANGE
-4	MODE_ERROR