FR-2053iT

16-channel Sink/Source Type Isolated Digital Input Module

With Isolated Communication line

User Manual

Warranty

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Table of Contents

1. Introduction 3

1.1. Features 6

1.2. Specifications 7

2. Hardware description.....8

2.1. LED indicator:..... 9

2.2. Pin Assignment and I/O wire connection 10

2.3. Address Setting:.....11

2.4. FRnet Application Structure 12

2.5. Dimensions: 15

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1. Introduction

The FR-2053iT module provides a 16-channel isolated sink/source digital output in the FRnet. The “-T” denotes the screw terminal connector, allowing users to connect to the DO signals on module directly. The I/O data transmission is controlled by the FRnet control chip which was developed by ICPDAS. It was designed to provide for a deterministic high speed network communication. The communication mechanism is dominated by the token-stream, which is generated by the network manager located at a specific node (**SA0**). This manager provides for fixed scan-time and I/O synchronization capability without the need of any special communication protocol. Furthermore, special anti-noise circuitry has also been considered and built into the FRnet control chip to ensure communication reliability. This distributive digital output module must be connected to other module or a host controller with a network manger built in.

However, the effectiveness of the FRnet connection depends on and is then ensured when the correct hardware configurations for the sender address (SA) and receiver address (RA) on the host controller and the remote module in the network have been installed properly. In general, the operating principle is structured by the strategy of delivering the 16-bit data from the specified sender address (SAn) to the corresponding receiver address (RAn) via the broadcasting method controlled by the token-stream of the

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network manager, SA0. Based on this algorithm, there are some general rules that need to be followed:

(1) The sender address needs to be unique in order to avoid any communication collisions.
(2) Each of the FRnet needs at least one network manager defined as SA0. It plays the important role of producing the token-stream in the network.
(3) The baud rates of the controller and the remote modules need to be the same as on the FRnet.
(4) The communication method is controlled by delivering the data of the specified sender address (SA) to the corresponding receiver address (RA) in the sequence of token 0 to N cyclically, as depicted below.
(5) Due to the broadcasting algorithm adopted, the receiver address is not required to be unique. Therefore, it is easy to build a data delivery from one node (16-bit data) to a multi-node.

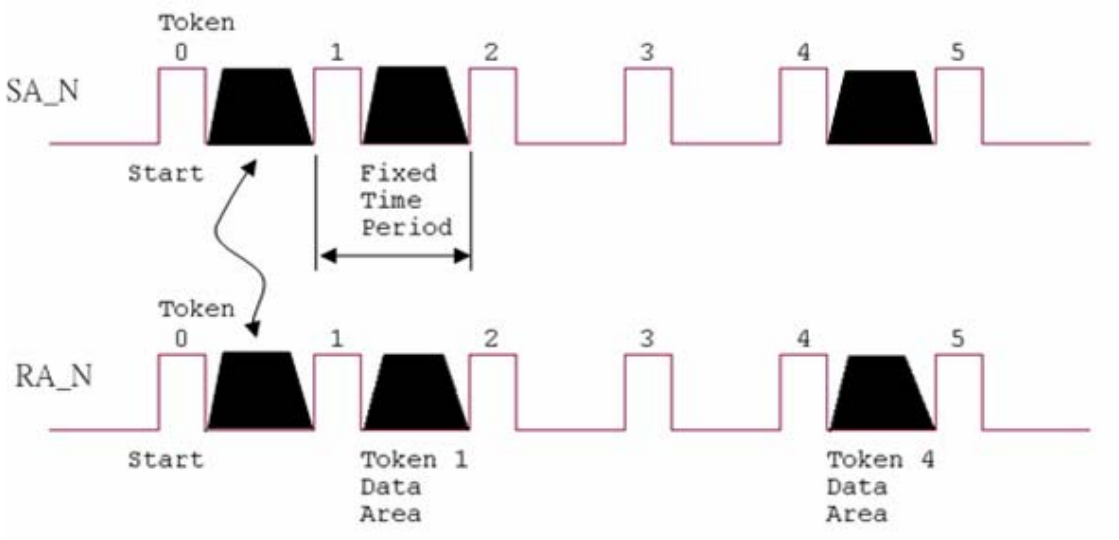


Figure 1.1 Token stream controlled by network manager, SA0

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An example of the FRnet application structure for delivering data from the specified sender address (SAn) to the corresponding receiver address (RAn) by a 4-wire inter module cable, including a 2-wire power supply cable, is shown in the figure below.

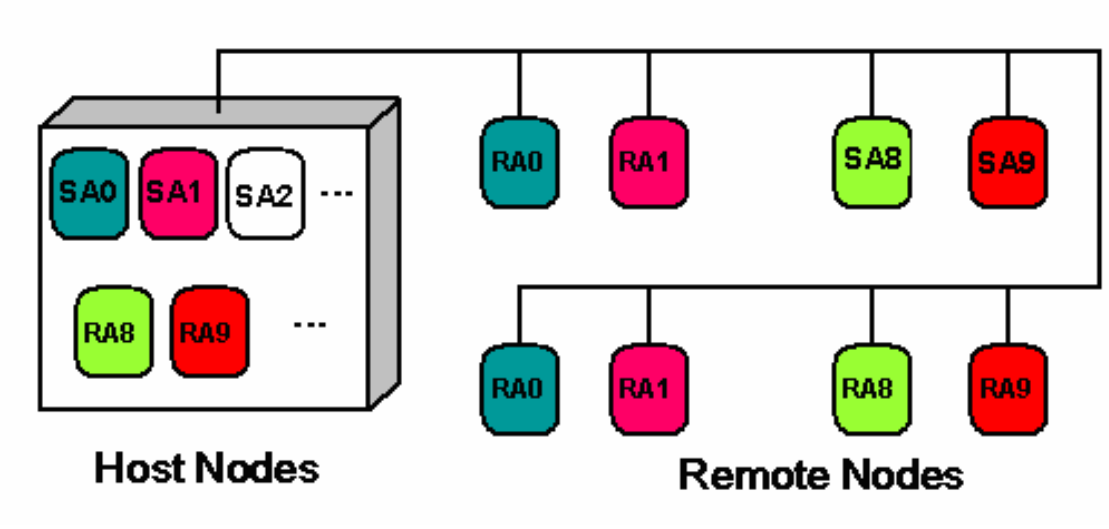


Figure 1.2 The example of an FRnet application structure

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1.1. Features

- The Token stream is used to activate data transmission from the specified SA node to the corresponding RA nodes.
- The Network Manager is defined as SA0. Each of the FRnet must have SA0 because it issues the Token stream into the network.
- The Token stream is produced cyclically by the hardware system (SA0) at the fixed time interval, see Figure 1.1. Therefore, the FRnet system can provide for both Isochronous and Deterministic functionalities.
- It can provide data transmission from one node (16-bit) to one node or from one node to multiple nodes at the same time because FRnet uses the principle of delivering the data from the sender address to the receiver address. Therefore, the sender address must be unique, but the receiver address can be different or the same in the network.
- The FRnet system can easily be extended by adding new modules to the network according to the FRnet principle.
- Device Inter-communication: A single device can talk to other devices by setting appropriate SA and RA node configurations.
- No software overhead: All data transmissions are performed automatically via the FRnet control chip. Therefore, there is no need for the CPU or firmware to process transmission protocols.
- It only needs simple RS-485 wiring.
- The DIN-Rail mounting is provided.

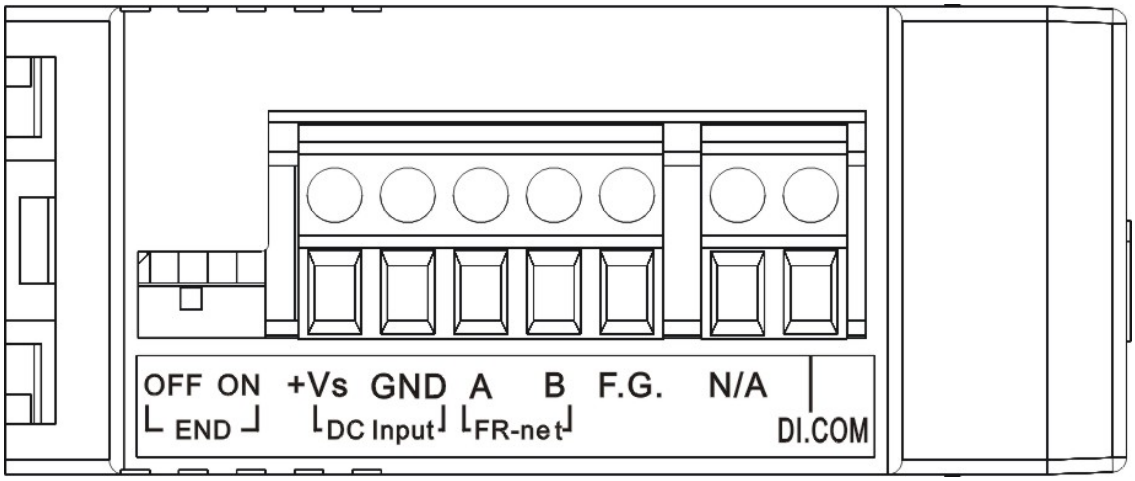
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1.2. Specifications

Input Channel	16 (Sink/Source)
Input Type	One Common Power or One Common Ground for All Inputs
On Voltage Level	+19V ~ +30V
Off Voltage Level	+11V max
Input Impedance	3.25K Ohms, 0.25W
Isolation Voltage	3750Vrms
Connection	20-Pin Removable Terminal Block
Interface	
Isolation Voltage	3000Vrms
2-wire cabling	Belden 8941 (2P twisted-pair cable), When different cables are used, the transmission distance may change
Transfer distance	Max. 400m for speed 250K Max. 100m for speed 1M(Default)
LED Indicators	Power, Communication Run, Communication Error, Terminal resistor, Digital output
Transfer speed	250Kbps and 1Mbps(Default) DIP Switch Settings
Cyclic scan time	2.88ms for speed 250K 0.72ms for speed 1M(Default)
Power	
Input Voltage Range	+10 ~ +30VDC (Non-isolation)
Power consumption	2.4W Max
Connection	5-Pin Removable Terminal Block
EMS Protection	
ESD	4KV for power liner, Communication line and each channel
EFT	1KV for power liner
Surge	0.5KV for power liner
Case	
Mechanical	Plastic
Flammability	UL 94V-0 materials
Dimensions	32.5 x 110 x 102 mm (W x H x D)
Installation	DIN-Rail
Environmental	
Operating Temperature	-25 °C~ +75°C
Storage Temperature	-30 ~ +85°C
Ambient Relative Humidity	10% to 90% non-condensing

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2. Hardware description



OFF(END) **:** 120R terminating resistor Disable

ON(END) **:** 120R 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 +30V) 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-)”

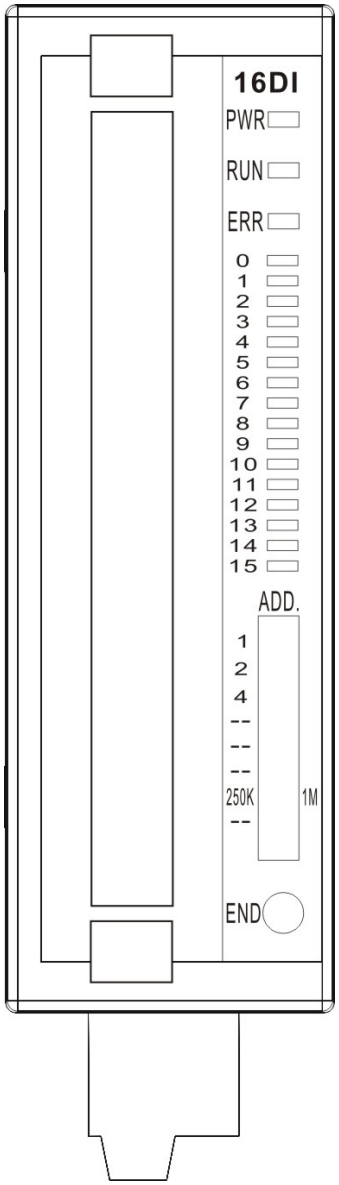
F.G. **:** F.G. stands for Frame Ground (protective ground). It is optional. If you use this pin, it can reduce EMI radiation; improve EMI performance and ESD protection.

DI.COM **:** Common Power for NPN type.
Common Ground for PNP type.

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2.1. LED indicator:

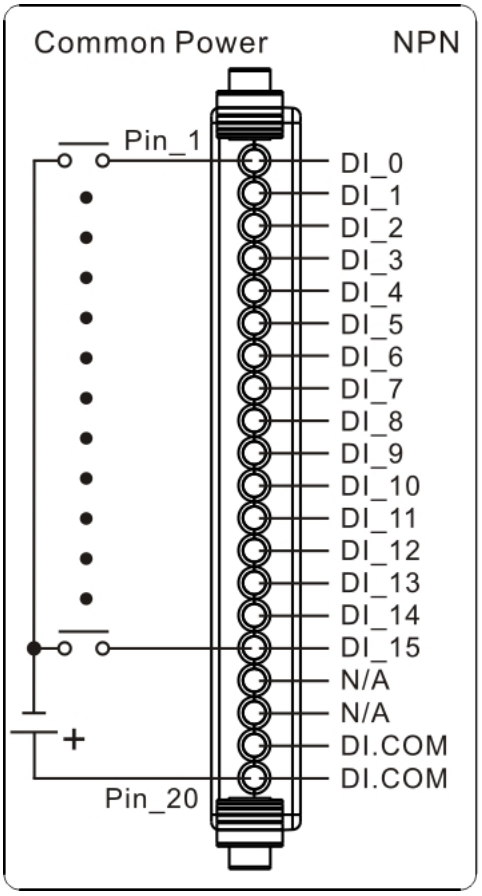
There are several LED indicators located on the top side of the module. They are Power LED, Communication Run LED, Communication error LED, I/O LED and termination resistor LED. Users can understand the meaning directly from the label on the LED indicator. Note that the Communication Run LED and the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

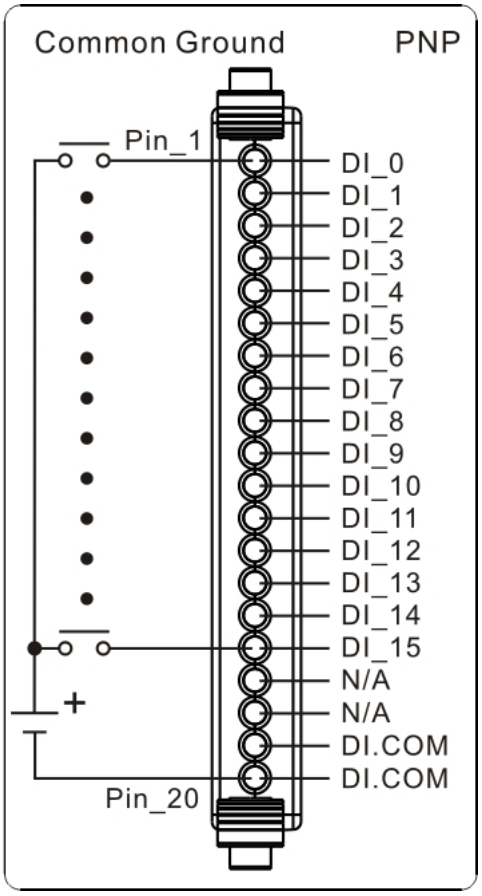


LED Mapping	
PWR	Power LED
RUN	Communication Run LED
ERR	Communication Error LED
0	CH _0 Status LED
1	CH _1 Status LED
2	CH _2 Status LED
3	CH _3 Status LED
4	CH _4 Status LED
5	CH _5 Status LED
6	CH _6 Status LED
7	CH _7 Status LED
8	CH _8 Status LED
9	CH _9 Status LED
10	CH _10 Status LED
11	CH _11 Status LED
12	CH _12 Status LED
13	CH _13 Status LED
14	CH _14 Status LED
15	CH _15 Status LED
END	Terminal resistor On

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2.2. Pin Assignment and I/O wire connection





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2.3. Address Setting:

■ **Sender address setting :**

Since the FR-2053iT is a digital input module, the module can only configure the sender address (SA) by the dip-switch, as shown in the following figure. This means that the FR-2053iT can only transmit 16-bit data of the digital input circuit to the node of the corresponding receiver address. The configuration method is depicted in the following figure:

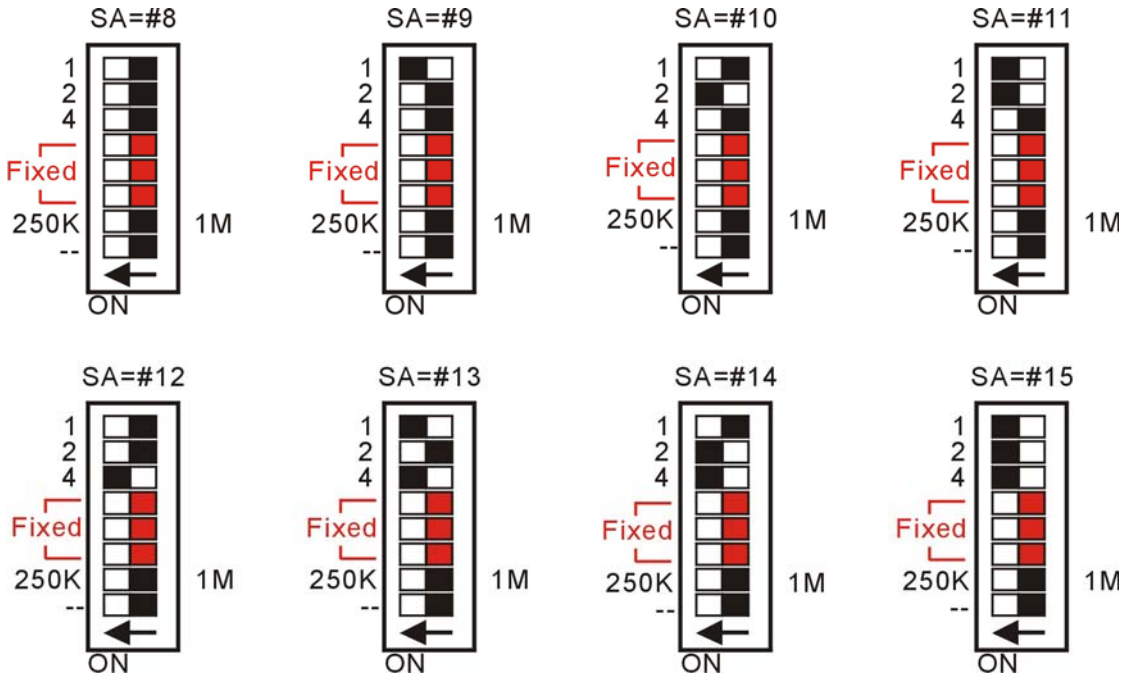


Figure 2.5 Sender address setting.

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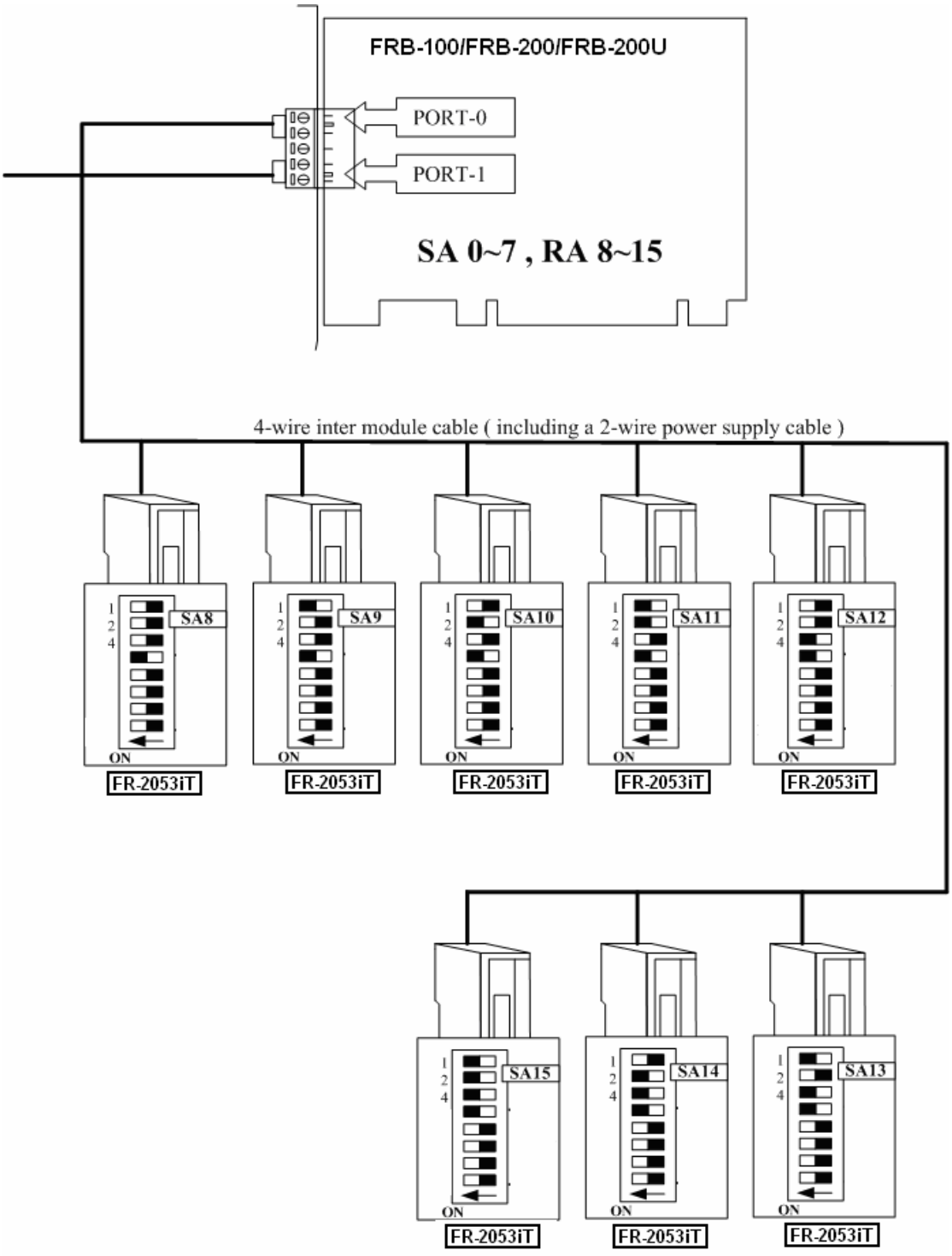
2.4. FRnet Application Structure

Within conventional communication methods in the control network system, the master (host) controller (CPU) 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 (host) controller (CPU). Therefore, the performance of communication efficiency between the host 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 two FRnet host controllers provided by ICPDAS products, the FRB-100/200/200U and the 7188EF-016. The first one is a PCI interface add-on card, and the other one is an Ethernet embedded controller. Two possible application configurations are demonstrated as follows.

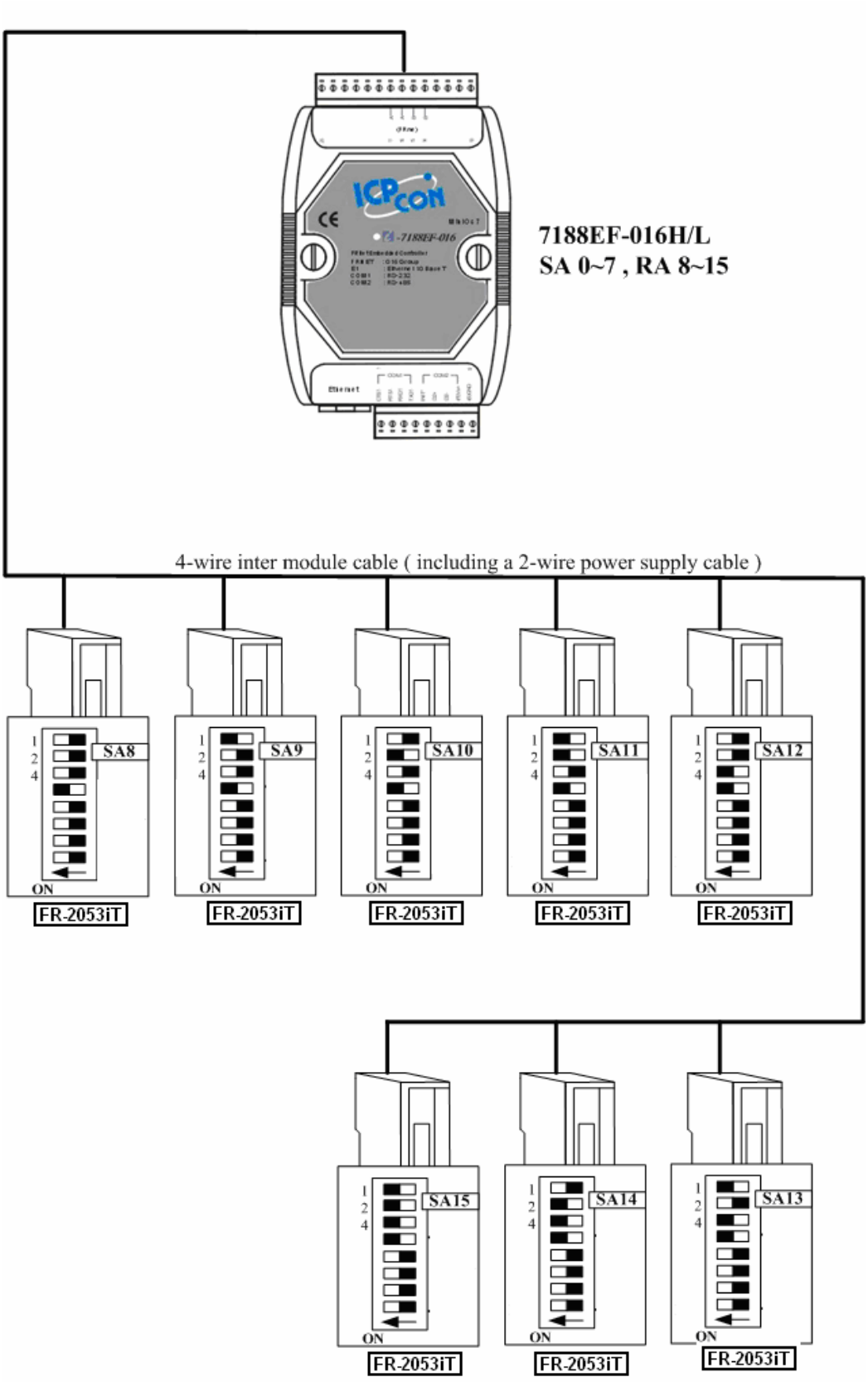
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Case 1: If the PC-based FRB-200(U)/100 is used as the host controller.



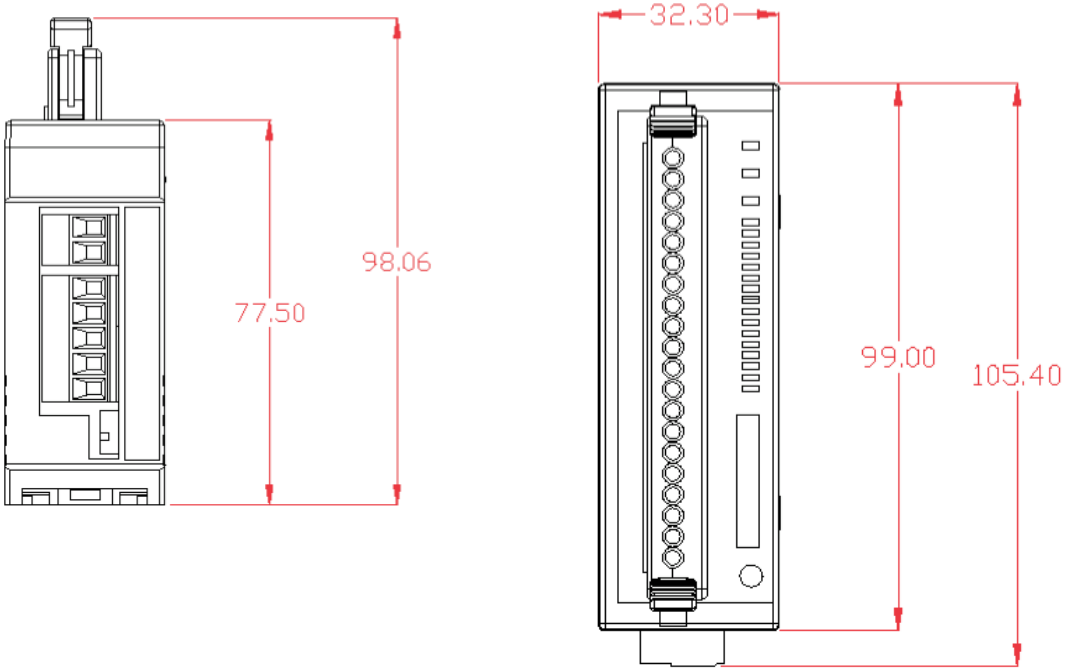
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Case 2: If the embedded controller i-7188EF-016 is used as the host controller.

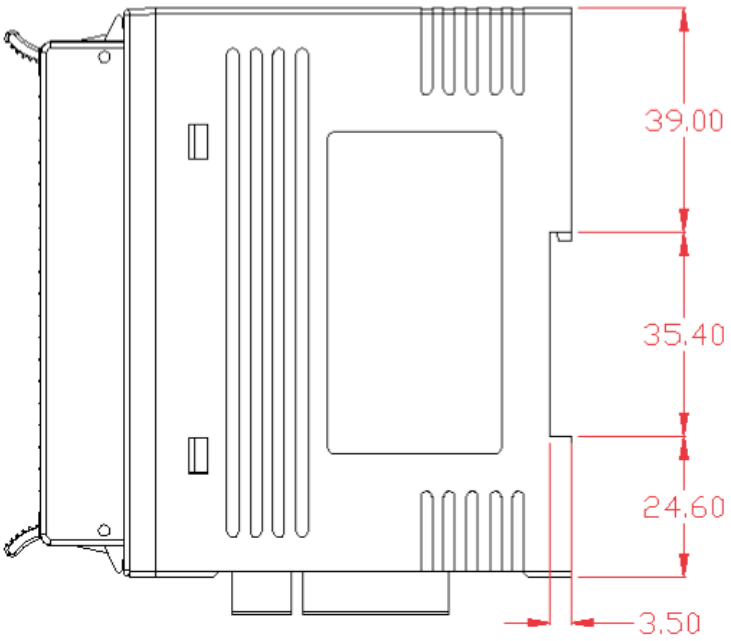


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2.5. Dimensions:



Unit: mm



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