FR-2053

A 16 DI channels Module for the FRnet system

User Manual

Warranty

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1. Introduction

The FR-2053/2053T module provides a 16-channel isolated photo-coupler digital input in the FRnet. The “-T” denotes the screw terminal connector, allowing users to connect to the DI 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 input 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.

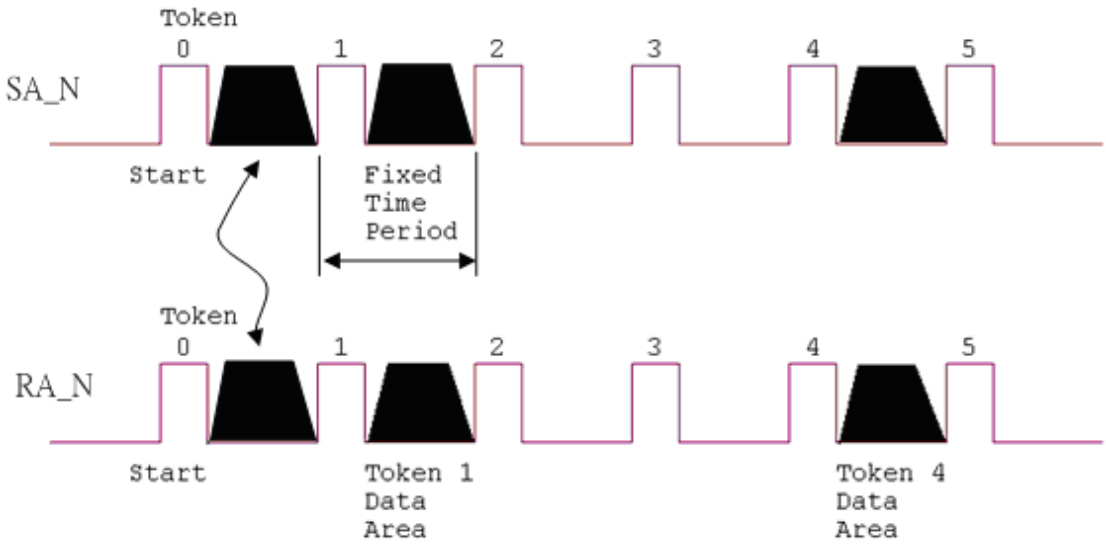


Figure 1.1 Token stream controlled by network manager, SA0

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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.

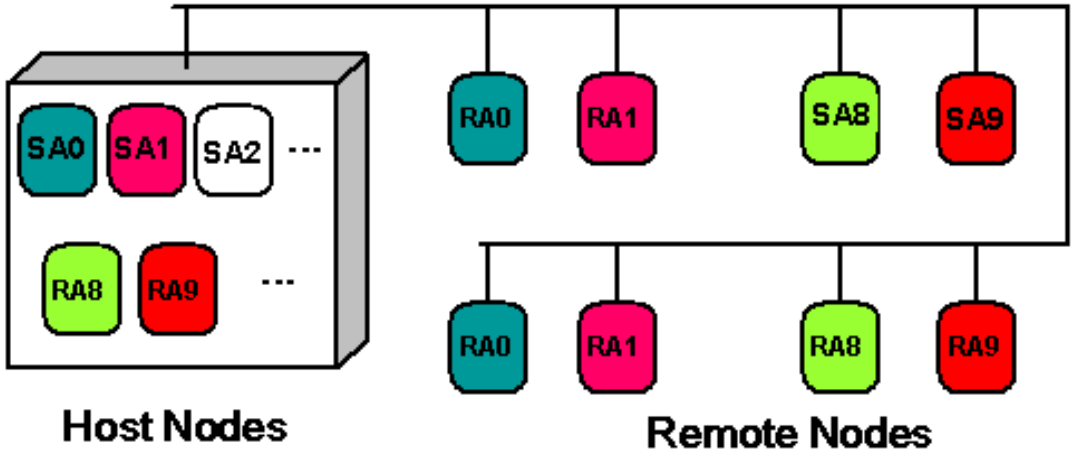


Figure 1.2 The example of an FRnet application structure.

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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

Table 1.1 Specifications for FR-2053(T)/2053H(T) modules.

	FR-2053(T) DI module	FR-2053H(T) DI module
Transfer speed	250Kbps	1Mbps
Scan time	2.88ms	0.72ms
Transfer distance	400m max.	100m max.
Number of input channels	16	16
Isolation voltage	1500Vrms	1500Vrms
Input current	Less than 6 mA/channel	Less than 6 mA/channel
Input impedance	Approximately 4.7KΩ	Approximately 4.7KΩ
Digital Level 0	3V max.	3V max.
Digital Level 1	20 to 24V	20 to 24V
Power requirements	24V DC	24V DC
Power consumption	2.0W Max	2.0W Max
Operating	-25°C～+70°C	-25°C～+70°C
Storage temperature	-30°C～+70°C	-30°C～+70°C
Relative humidity	35～85%	35～85%
Weight	Approximately 120g	Approximately 120g

Note: The H version (high speed version) is optional.

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1.3. Ordering information

Model No.	Description
FR-2053(T)	250Kbps SA 8,9,10,11,12,13,14,15
FR-2053H(T)	1Mbps SA 8,9,10,11,12,13,14,15
DN-20	DIN-Rail Mounting I/O Connector Block with two 20-pin header connectors

Note: a) The T version module has terminal on the panel. Therefore, users can connect their I/O to the terminal directly without a DN-20 extension board.

b) The H version (high speed version) is optional. It is recommended to choose the normal speed version first. Modules of different speed version are not allowed to work together. If you need high-speed version, please make contact with manufacturer.

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2. Hardware description

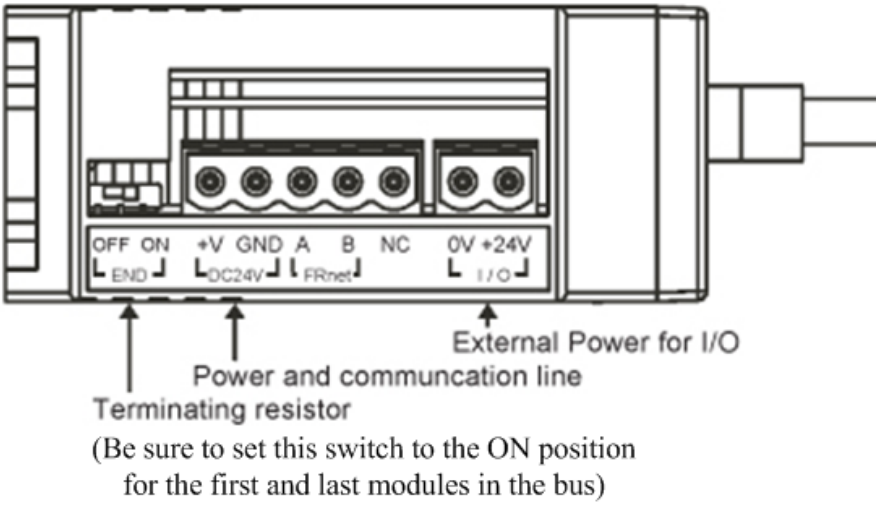


Figure 2.1 Side connector of FR-2053 and FR-2053T

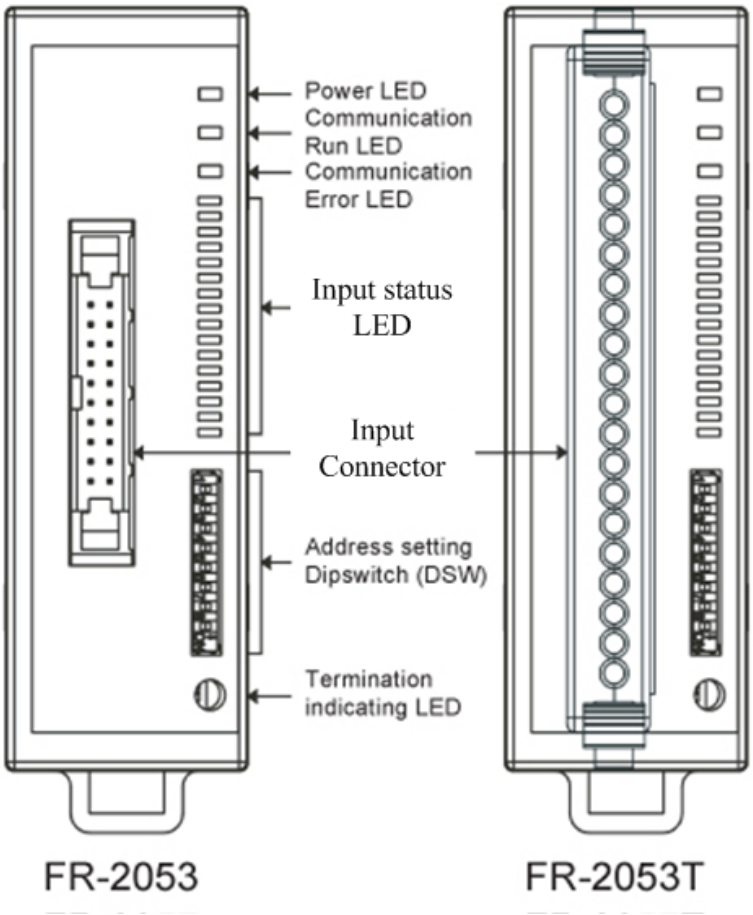


Figure 2.2 Top side view of FR-2053 and FR-2053T

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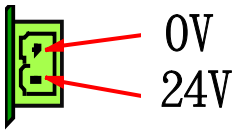
2.1. Pin Assignment

2.1.1. Side connector

Please refer to Figure 2.1. On the side of the module, there is one connector, as shown in the following figure. This connector provides the power and the communication interface. Users need to connect the DC24V power source and the FRnet cable through this interface.



The following figure is a connector on the side of the module providing the external DC Power for the module. It is designed to be used as the power source of the I/O connection interface.



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.

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2.1.2. Top connector

■ **I/O connectors :**

The FR-2053 is a digital input module with a 16-channel isolated photo-coupler interface. The Pin assignments and interface circuit of input connectors of FR-2053 and FR-2053T are shown in Fig. 2.3. The wire connection for how to cooperate with the controlled device is shown in Figure 2.4. For case 1, a function generator is used to simulate the digital input. For case 2, the push-button is used as a digital input circuit of the FR-2053 module.

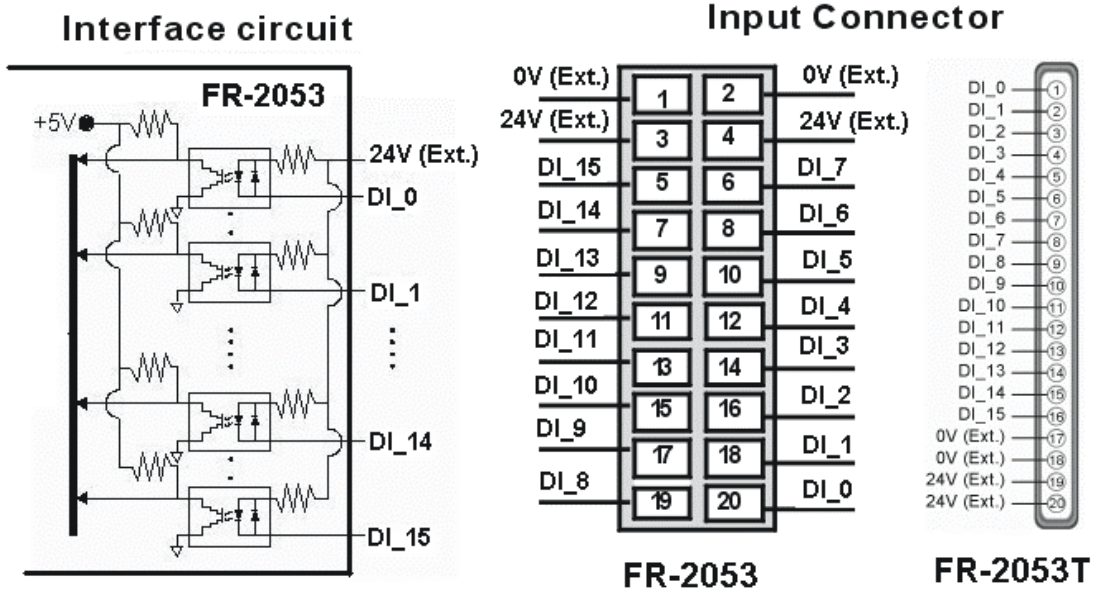


Figure 2.3 Pin assignments and interface circuit of input connectors of FR-2053 and FR-2053T.

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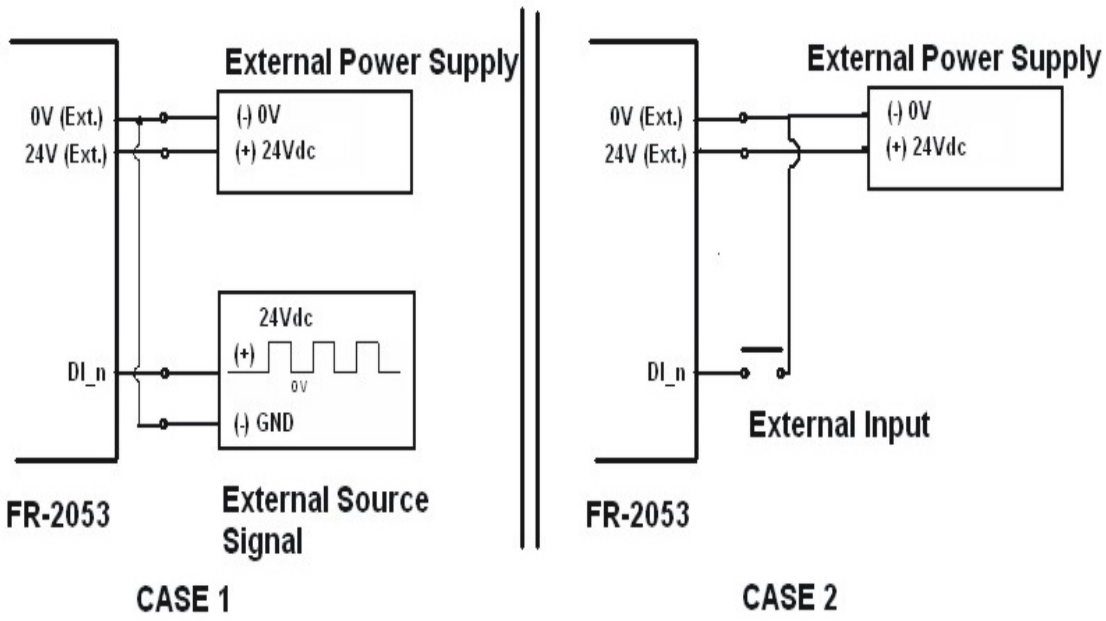


Figure 2.4 The wire connection examples of FR-2053 and input devices.

■ 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.

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■ Sender address setting :

Since the FR-2053 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-2053 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:

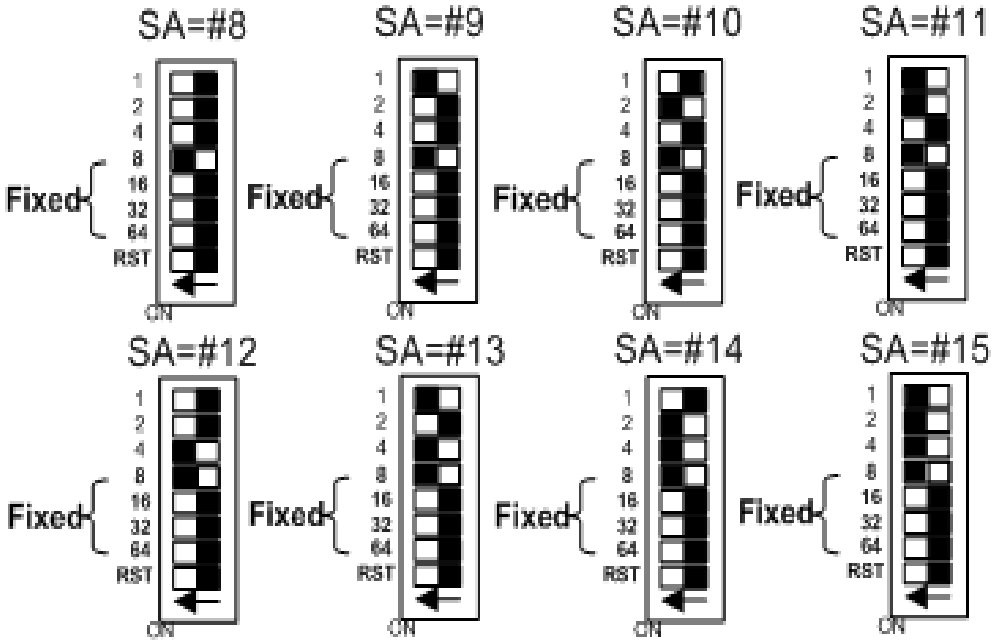


Figure 2.5 Sender address setting

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2.2. 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 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-200/100 is used as the host controller.

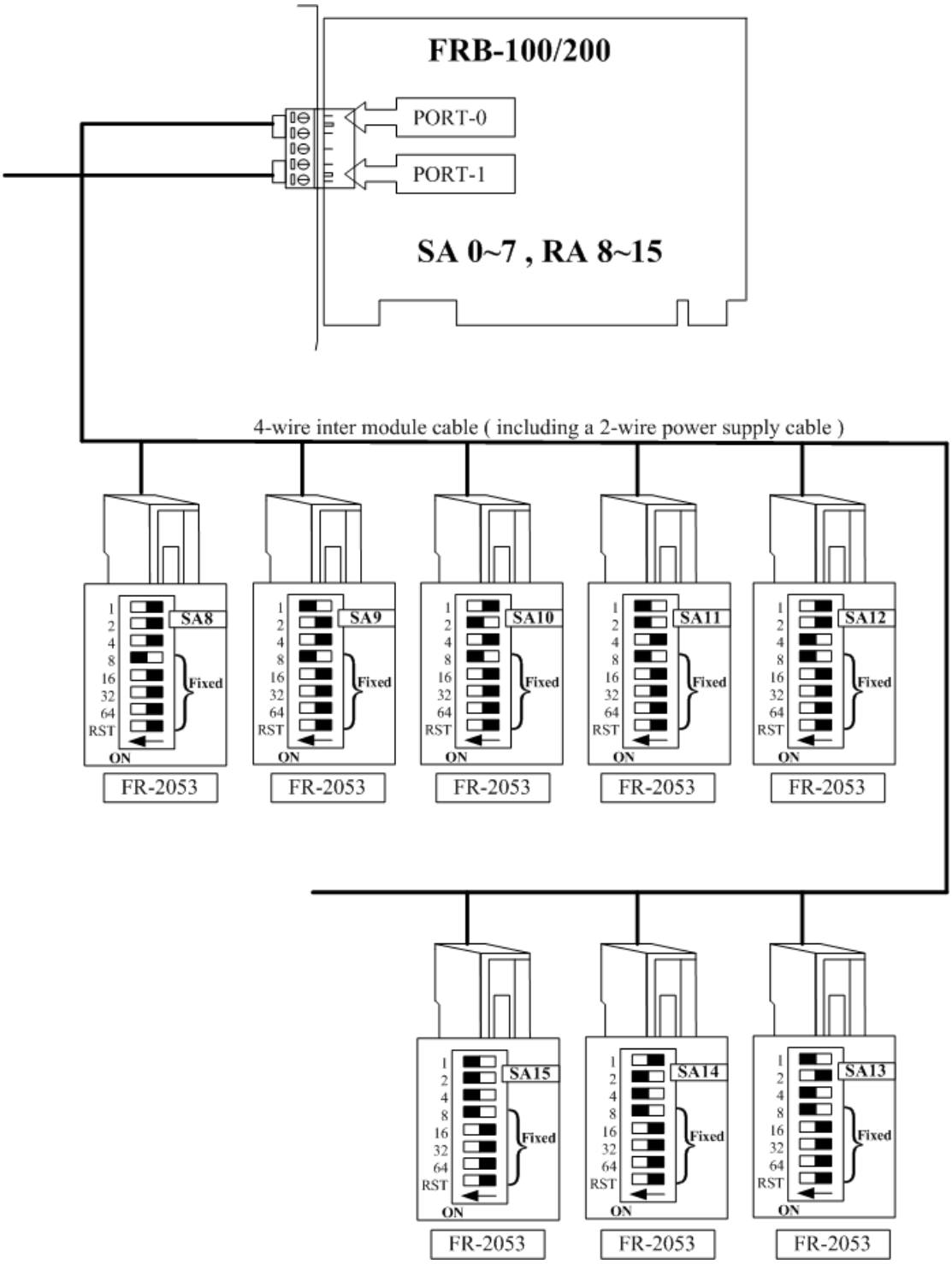


Figure 2.6 PCI interface FRnet card and distributed IO modules

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

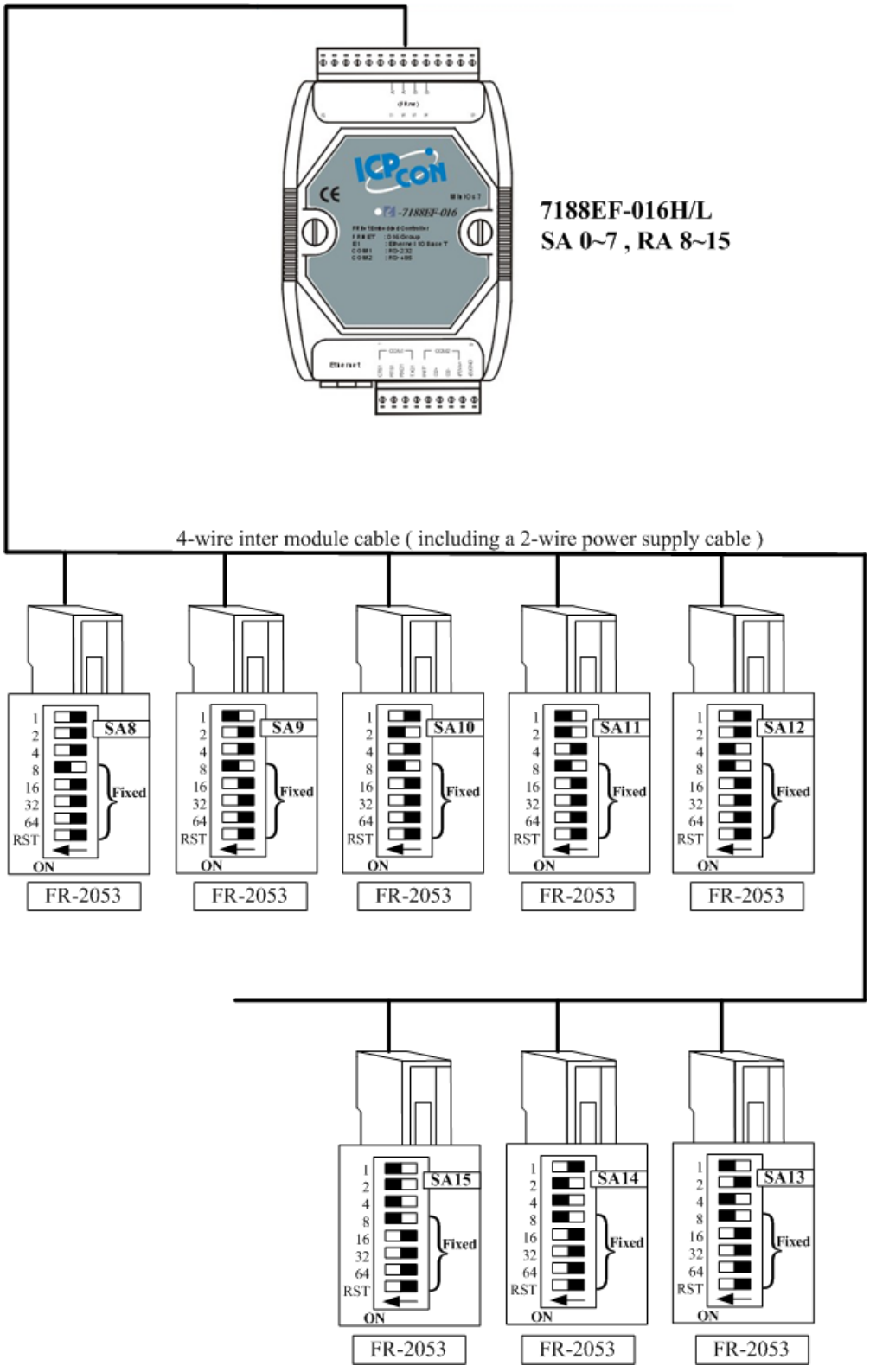


Figure 2.7 Embedded controller and distributed IO modules

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