4.1. Overview

FRnet is an innovative industrial field bus. It uses twisted pair cable to be the transmission medium. Each FRnet port can link up to 128 DI and 128 DO channels. The whole I/O statuses are updated at a fixed cycle time (0.72 ms or 2.88 ms) no mater how many FRnet I/O modules are connected to the FRnet network. Further more, the update is done by the FRnet chip, there is no need for a communication protocol. Using FRnet, the user can easily and quickly implement high-speed distributed I/O control systems.

● Applicatoins

Building Automation, Machine Automation, Testing Equipment, etc

● Features

1. Token-Stream Communication

The FRnet chip uses a simple token-stream communication mechanism to provide a fast and fixed cycle time I/O-scanning capability. It doesn't need any special transmission protocol; the chip takes care of the data transfer for every device. The most significiant benefits of FRnet are:

- **Fixed cycle time:**
  The cycle time is fixed at 2.88/0.72 ms no matter how many devices connected in the network.

	Baudrate	Max. Distance	Fixed cycle time
High Speed	1 Mbps	100 m	0.72 ms
Normal Speed	250 kbps	400 m	2.88 ms
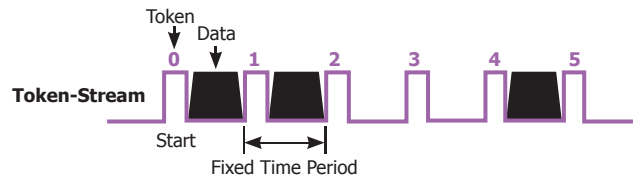
- **Memory-Mapped I/O:**
  The data transfer is automatically done by the FRnet chip. The CPU of the host (PC or PAC) doesn't need to take care of the communication protocol. All I/O statuses are mapped to the memory of the FRnet chip.
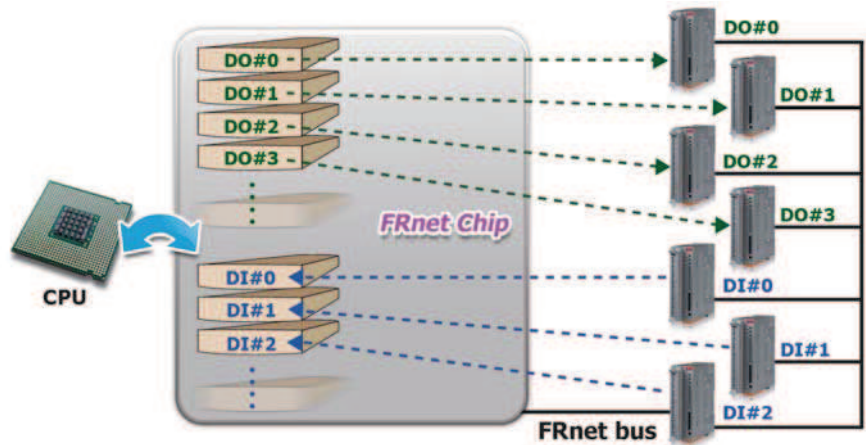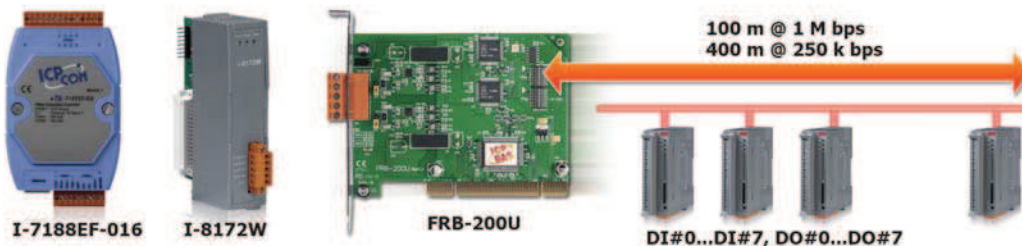
2. Multi-Drop networking

The physical connection is same as the standard RS-485 cabling to implement multi-drop networking. The maximum communication distance is up to 100/400 m at high/normal speed communication.

- **I/O expansion up to 128 DI and 128 DO channels**
  Each FRnet chip addresses 8 DI and 8 DO groups which each group contains 16 DI or DO channels
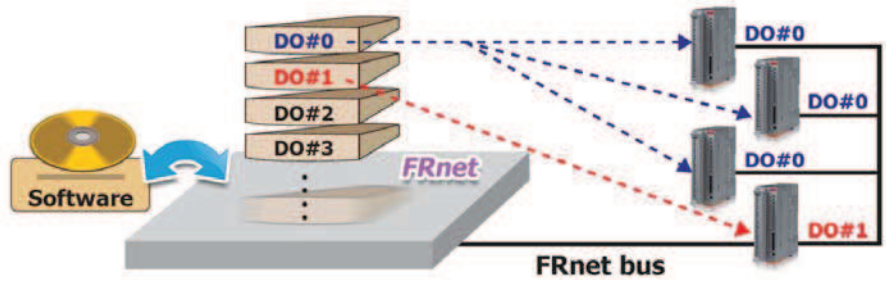
• DO broadcasting

Due to the broadcasting algorithm adopted, the DO group address is not required to be unique. Therefore, it is easy to build a data delivery from one group (16-bit data) to a multi-group.
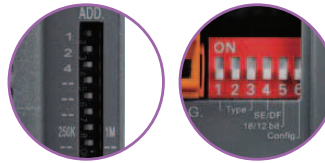
3. Easy to Diagnose

There are several LED indicators to diagnose whether FRnet I/O modules work properly. And the built-in FRnet terminator switch can be used to improve communication signal quality.

4. Easy to Configure

All basic configurations (address, speed and input/output range of AI/AO modules) are set by DIP switches. The operator can use only one screwdriver to complete the configuration.

● Hardware

1. Installation

DIN-Rail Mounting

2. Mechanical

| Left View | Front View | Right View | Rear View | Bottom View | Top View |

3. Appearance

Power Indicator
RUN Indicator
ERR Indicator
I/O Statos Indicator
DIP Switch of Address and Speed
Terminator Indicator

+Vs GND A B F.G.
DC Input   FRnet

DIP Switch of AI/AO

Switch of Terminator   Common of DI/DO   Switch of Terminator
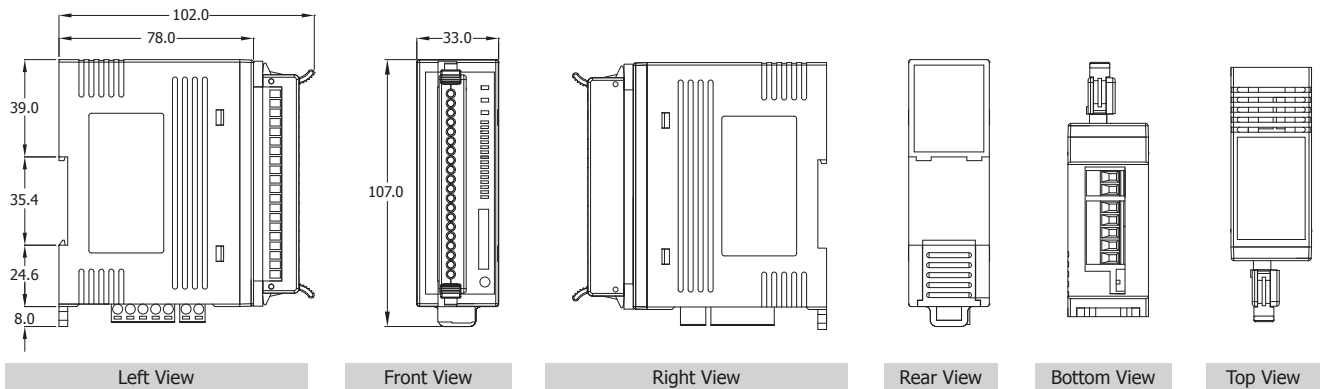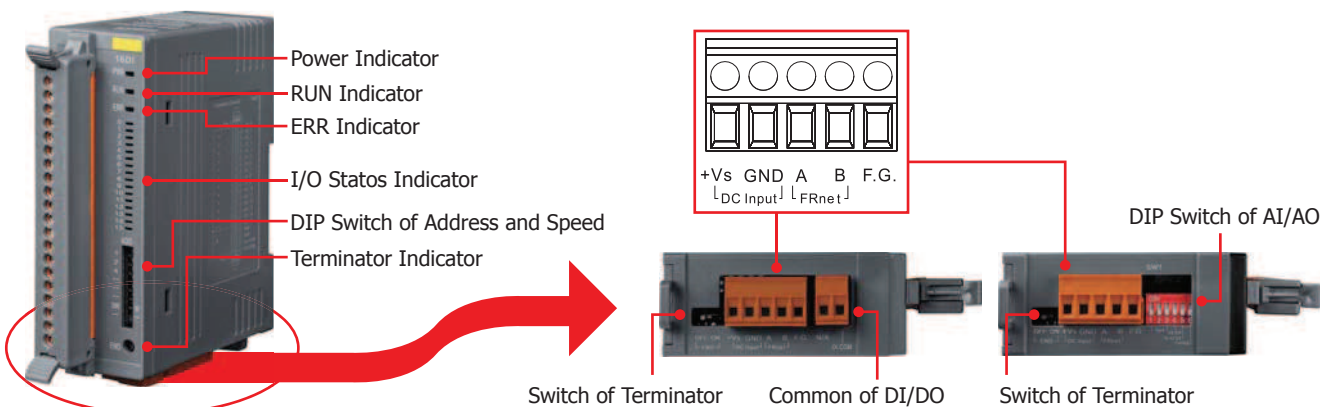
4.2. Selection Guide

4.2.1. Analog Input Module

Analog Input Module	
Model Name	**FR-2017iT**
Pictures	NEW
Channels	1 or 8/16
Wiring	Differential/Single-Ended
Voltage Input Range	+/-150 mV, +/- 500 mV, +/- 1V, +/-5 V, +/-10 V
Current Input Range	+/-20 mA, 0 ~ 20 mA, 4 ~ 20 mA; Requires optional external 125 Ω resistors
Resolution	16-bit(1 channel) or 12-bit (8/16 channels)
Accuracy	± 0.1% (1 channel) or ± 0.5% (8/16 channel) of FSR
Sampling Rate	10 Hz (1 channel) / 50 Hz (8/16 channels); for total channels
Input Impedance	2 MΩ (differential), 1 MΩ (sigle-ended)
Common Voltage Protection	200 V_{DC}
Individual Channel Configuration	Yes (by software, requires optional CA-0904 cable)
Overvoltage Protection	240 V_{rms} (differential), 150 V_{rms} (single-ended)

FRnet Communication

Normal Speed	Update time	2.88 ms	Yes
	Baud rate	250 Kbps	
	Distance	400 m Max.	
High Speed	Update time	0.72 ms	Yes (default)
	Baud rate	1 Mbps	
	Distance	100 m Max.	

LED Indicators

Power	1 LED (Yellow)
Communication Run	1 LED (Green)
Communication Error	1 LED (Red)
Terminal Resistor	1 LED (Yellow)

Power

Input range	+10 ~ +30 V_{DC}
Power Consumption	2.4 W

Environment

Operating Temperature	-25 ~ +75°C
Storage Temperature	-30 ~ +85°C
Relative Humidity	10 ~ 90 % RH (non-condensing)

Mechanical

Installation	DIN-Rail Mounting
Dimensions (W x H x D)	33 mm x 107 mm x 102 mm
Optional Accessory	CA-0904

CA-0904

4 FRnet Remote I/O Modules

② Selection Guide

4.2.2. Analog Output Module

Analog Output Module	
Model Name	**FR-2024iT**
Pictures	Available soon
Channels	4
Wiring	Bipolar/Unipolar
Voltage Input Range	0 ~ 5V, +/-5 V, 0 ~ 10 V, +/-10 V
Current Input Range	0 ~ 20 mA, 4 ~ 20 mA
Resolution	12-bit
Accuracy	+/-0.1% of FSR
Output Capacity	Voltage: 10 V_{DC} @ 20 mA Current: External 24 V_{DC} @ 1050 Ω
Output Slew Rate	Immediately Output (default) or 0.0625 ~ 1024 V/second (by Software) Immediate Output (default) or 0.125 ~ 2048 mA/second (by Software)
Individual Channel Configuration	Yes (by software)
Channel to Channel Isolation	-
Common Voltage Protection	-
Overvoltage Protection	±35 V_{DC}

FRnet Communication			
Normal Speed	Update time	2.88 ms	Yes
	Baud rate	250 Kbps	
	Distance	400 m Max.	
High Speed	Update time	0.72 ms	Yes (default)
	Baud rate	1 Mbps	
	Distance	100 m Max.	

LED Indicators	
Power	1 LED (Yellow)
Communication Run	1 LED (Green)
Communication Error	1 LED (Red)
Terminal Resistor	1 LED (Yellow)

Power	
Input range	+10 ~ +30 V_{DC}
Power Consumption	2.88 W

Environment	
Operating Temperature	-25 ~ +75°C
Storage Temperature	-30 ~ +85°C
Relative Humidity	10 ~ 90 % RH (non-condensing)

Mechanical	
Installation	DIN-Rail Mounting
Dimensions (W x H x D)	33 mm x 107 mm x 102 mm
Optional Accessory	CA-0904

CA-0904

4

FRnet Remote I/O Modules

②

Selection Guide

4.2.3. Digital Input/Output Module

Digital Input Module

Model Name	FR-2053iT	FR-2053TA	FR-2053HTA	FR-2054T	FR-2057iT	FR-2057TW	FR-32R
Pictures							
Digital Input							
Channels	16			8	-		-
Type	Wet			Wet	-		-
Sink/Source (NPN/PNP)	Sink/Source			Sink, Source	-		-
Isolation	3750 V$_{rms}$			3750 V$_{rms}$	-		-
On Voltage Level	19 ~ 30 V$_{DC}$	3.5 ~ 30 V$_{DC}$		19 ~ 30 V$_{DC}$	-		-
Off Voltage Level	11 V$_{DC}$ Max.	1 V$_{DC}$ Max.		11 V$_{DC}$ Max.	-		-
Input Impedance	3.25 KΩ	3 KΩ		3.3 KΩ	-		-
Digital Output							
Channels	-			8	16		32
Type	-			Open Collector	Open Collector		Power Relay (Form A, SPST)
Sink/Source (PNP/NPN)	-			Sink (NPN)	Sink (NPN)		-
Isolation	-			3750 V$_{rms}$	3750 V$_{rms}$	1500 V$_{rms}$	3000 V$_{rms}$
Load Voltage	-			5 ~ 30 V$_{DC}$	5 ~ 30 V$_{DC}$	5 ~ 30 V$_{DC}$	3A/125 V$_{DC}$, 3A/270 V$_{AC}$
Max. Load Current	-			250 mA	100 mA	250 mA	
FRnet Communication							
Normal Speed — Update time	2.88 ms	Yes	Yes (default)	-	Yes	Yes	Yes	Yes (default)
Normal Speed — Baud rate	250 Kbps							
Normal Speed — Distance	400 m Max.							
High Speed — Update time	0.72 ms	Yes (default)	-	Yes (default)	Yes (default)	Yes (default)	Yes (default)	-
High Speed — Baud rate	1 Mbps							
High Speed — Distance	100 m Max.							
LED Indicators							
Power	1 LED (Yellow)						
Communication Run	1 LED (Green)						
Communication Error	1 LED (Red)						
Terminal Resistor	1 LED (Yellow)						
I/O Status	16 DI LEDs (Green)			8 DO LEDs (Red) and 8 DI LEDs (Green)	16 DO LEDs (Red)	16 DO LEDs (Red)	32 DO LEDs (Red)
Power							
Input range	+10 ~ +30 V$_{DC}$						
Power Consumption	2.4 W	2.4 W		2 W	2.4 W	2.4 W	3.36 W
Environment							
Operating Temperature	-25 ~ +75°C						
Storage Temperature	-30 ~ +85°C						
Relative Humidity	10 ~ 90 % RH (non-condensing)						
Mechanical							
Installation	DIN-Rail Mounting						
Dimensions (W x H x D)	33 mm x 107 mm x 102 mm						173 mm x 177 mm