Chapter 5

RUNNING THROUGH RS-485 COMMUNICATION

This chapter describes an overview of inverter operation through the RS-485 communications facility. Refer to the RS-485 Communication User's Manual (MEH448b) for details.

Contents

5.1 Overview on RS-485 Communication

Detaching the standard keypad from the FRENIC-Multi inverter and using the standard RJ-45 connector (modular jack) as an RS-485 communications port brings about the following enhancements in functionality and operation:

■ Remote operation from a keypad at the remote location

Using an extension cable to connect the standard keypad or an optional multi-function keypad to the RJ-45 port allows you to mount the keypad on a panel located far from the inverter, enabling remote operation. The maximum length of the extension cable is 20 m.

■ Operation by FRENIC Loader

The Windows-based PC can be connected to the standard RS-485 communications port via a suitable converter. Through the RS-485 communications facility, you may run FRENIC Loader on the PC to edit the function code data and monitor the running status information of the inverter.

■ Control via host equipment

You can use a personal computer (PC) or a PLC as host (higher-level) equipment and through it control the inverter as its subordinate device.

Protocols for managing a network including inverters include the Modbus RTU protocol (compliant to the protocol established by Modicon Inc.) that is widely used in FA markets and the Fuji general-purpose inverter protocol that supports the FRENIC-Multi and conventional series of inverters.

Note Connecting the keypad automatically switches to the keypad protocol; there is no need to modify the function code setting.

When using FRENIC Loader, which requires a special protocol for handling Loader commands, you need to set up some communication function codes accordingly.

For details, refer to the FRENIC Loader Instruction Manual (INR-SI47-0903-E).

Further, another RS-485 communications port can be added by mounting an optional RS-485 Communications Card onto the FRENIC-Multi inverter. This additional communications link can be used only as a port for host equipment, not used for a keypad or FRENIC Loader.

For details of RS-485 communication, refer to the RS-485 Communication User's Manual (MEH448b).

5.1.1 RS-485 common specifications (standard and optional)

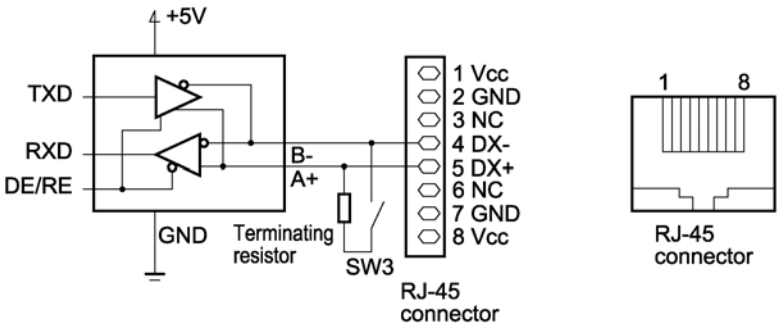
Items	Specifications		
Protocol	FGI-BUS	Modbus RTU	Loader commands (supported only on the standard version)
Compliance	Fuji general-purpose inverter protocol	Modicon Modbus RTU-compliant (only in RTU mode)	Dedicated protocol (Not disclosed)
No. of supporting stations	Host device: 1 Inverters: Up to 31		
Electrical specifications	EIA RS-485		
Connection to RS-485	RJ-45 connector (standard) or terminal block (optional)		
Synchronization	Asynchronous start-stop system		
Transmission mode	Half-duplex		
Transmission speed	2400, 4800, 9600 19200 or 38400 bps		
Max. transmission cable length	500 m		
No. of logical station addresses available	1 to 31	1 to 247	1 to 255
Message frame format	FGI-BUS	Modbus RTU	FRENIC loader
Frame synchronization	SOH (Start Of Header) character detection	Detection of no-data transmission time for 3-byte period	Start code 96H detection
Frame length	Normal transmission: 16 bytes (fixed) High-speed transmission: 8 or 12 bytes	Variable length	Variable length
Max. transfer data	Write: 1 word Read: 1 word	Write: 50 words Read: 50 words	Write: 41 words Read: 41 words
Messaging system	Polling/Selecting/Broadcast		Command message
Transmission character format	ASCII	Binary	Binary
Character length	8 or 7 bits (selectable by the function code)	8 bits (fixed)	8 bits (fixed)
Parity	Even, Odd, or None (selectable by the function code)		Even (fixed)
Stop bit length	1 or 2 bits (selectable by the function code)	No parity: 2 bits/1 bit Even or Odd parity: 1 bit Select by parity setting.	1 bit (fixed)
Error checking	Sum-check	CRC-16	Sum-check

5.1.2 RJ-45 connector pin assignment for standard RS-485 communications port

The port designed for a standard keypad uses an RJ-45 connector having the following pin assignment:

Pin	Signal name	Function	Remarks
1 and 8	Vcc	Power source for the keypad	5V power lines
2 and 7	GND	Reference voltage level	Grounding pins
3 and 6	NC	Not used.	No connection
4	DX-	RS-485 data (-)	Built-in terminating resistor: 112Ω Open/close by SW3*
5	DX+	RS-485 data (+)	

* For details about SW3, refer to "Setting up the slide switches" in Section 8.3.1 "Terminal functions."



Note Pins 1, 2, 7, and 8 on the RJ-45 connector are exclusively assigned to power supply and grounding for keypads. When connecting other devices to the RJ-45 connector, take care not to use those pins. Failure to do so may cause a short-circuit hazard.

Do not connect the FVR-E11S series of inverters since the pin assignment of the keypad is different from that of the FRENIC-Multi series. Doing so could result in an inverter damage.

5.1.3 Pin assignment for optional RS-485 Communications Card

The RS-485 Communications Card has two RJ-45 connectors for multi-drop connection. Each RJ-45 connector has the pin assignment as listed below.

Pin	Signal name	Function	Remarks
1, 3, 6, 7 and 8	NC	No connection (Reserved for keypad power source.)	—
2	SD	Shield terminal	Internally connecting SDs
4	DX-	RS-485 data (-)	Built-in terminating resistor: 112Ω Open/close by SW9*
5	DX+	RS-485 data (+)	

* For details about SW9, refer to RS-485 User's Manual (MEH448b).

5.1.4 Cable for RS-485 communications port

For connection with the RS-485 communications port, be sure to use an appropriate cable and a converter that meet the applicable specifications.


For details, refer to the RS-485 Communication User's Manual (MEH448b).

5.1.5 Communications support devices

This section provides information necessary for connection of the inverter to host equipment having no RS-485 communications port such as a PC or for configuring a multi-drop connection.

[1] Communications level converter

Most personal computers (PC) are not equipped with an RS-485 communications port but RS-232C and USB ports. To connect a FRENIC-Multi inverter to a PC, therefore, you need to use an RS-232C—RS-485 communications level converter or a USB—RS-485 interface converter. For correct running of the communications facility to support FRENIC-Multi series of inverters, be sure to use one of the recommended converters listed below.

Recommended converters

KS-485PTI (RS-232C—RS-485 communications level converter)
USB-485I RJ45-T4P (USB—RS-485 interface converter)
Supplied by SYSTEM SACOM Corporation.

[2] Requirements for the cable

Use an off-the-shelf 10BASE-T LAN cable (ANSI/TIA/EIA-568A category 5 compliant, straight type).

Note The RJ-45 connector has power source pins (pins 1, 2, 7 and 8) exclusively assigned for keypads. When connecting other devices to the RJ-45 connector, take care not to use those pins. Failure to do so may cause a short-circuit hazard.

[3] Multi-drop adapter

To connect a FRENIC-Multi inverter to a network in a multi-drop configuration with a LAN cable that has RJ-45 as the communications connector, use a multi-drop adapter for the RJ-45 connector.

Recommended multi-drop adapter

Model MS8-BA-JJJ made by SK KOHKI Co., Ltd.

[4] RS-485 Communications Card

To equip your inverter with another RS-485 communications port in addition to the standard RS-485 communications port, you need to install this optional card. Note that you cannot use FRENIC Loader through the optional RS-485 communications port.

RS-485 Communications Card (option)

For details, refer to the RS-485 Communications Card "OPC-E1-RS" Installation Manual (INR-SI47-1089).

For more details through Section 5.1.5, refer to the RS-485 Communication User's Manual (MEH448b).

5.2 Overview of FRENIC Loader

FRENIC Loader is a software tool that supports the operation of the inverter via an RS-485 communications link. It allows you to remotely run or stop the inverter, edit, set, or manage the function codes, monitor key parameters and values during operation, as well as monitor the running status (including alarm information) of the inverters on the RS-485 communications network.

For details, refer to the FRENIC Loader Instruction Manual (INR-SI47-0903-E).

5.2.1 Specifications

Item		Specifications (White on black indicates factory default)	Remarks
Name of software		FRENIC Loader Ver. 4.0.0.0 or later	
Supported inverter		FRENIC-Multi series FRENIC-Eco series FRENIC-Mini series	(Note 1)
No. of supported inverters		Up to 31	
Recommended cable		10BASE-T cable with RJ-45 connectors compliant with EIA568	
Operating environment	CPU	Intel Pentium III 600 MHz or later	(Note 2)
	OS	Microsoft Windows 2000 Microsoft Windows XP	
	Memory	32 MB or more RAM	64 MB or more is recommended
	Hard disk	5 MB or more free space	
	COM port	RS-232C or USB	Conversion to RS-485 communication required to connect inverters
	Monitor resolution	XVGA (800 x 600) or higher	1024 x 768, 16-bit color or higher is recommended
Transmission requirements	COM port	COM1, COM2, COM3, COM4, COM5, COM6, COM7, COM8	PC COM ports assigned to Loader
	Transmission rate	38400, 19200, 9600, 4800 and 2400 bps	19200 bps or more is recommended. (Note 3)
	Character length	8 bits	Prefixed
	Stop bit length	1 bit	Prefixed
	Parity	Even	Prefixed
	No. of retries	None or 1 to 10	No. of retry times before detecting communications error
	Timeout setting	(100 ms, 300 ms, 500 ms), (1.0 to 9.0 s) or (10.0 to 60.0 s)	This setting should be longer than the response interval time set by function code y09 of the inverter.

(Note 1) FRENIC Loader cannot be used with inverters that do not support SX protocol (protocol for handling Loader commands).

With special order-made inverters, FRENIC Loader may not be able to display some function codes normally.

To use FRENIC Loader on FRENIC-Mini series of inverters, an RS-485 Communications Card (Option: OPC-C1-RS) is required.

(Note 2) Use a PC with as high a performance as possible, since some slow PCs may not properly refresh the operation status monitor and Test-run windows.

(Note 3) To use FRENIC Loader on a network where a FRENIC-Mini inverter is also configured, choose 19200 bps or below.

5.2.2 Connection

By connecting a number of inverters to one PC, you can control one inverter at a time or a number of inverters simultaneously through multiple windows on the PC. You can also simultaneously monitor multiple inverters on a single screen.

For how to connect a PC to one or more inverters, refer to the RS-485 Communication User's Manual (MEH448b).

5.2.3 Function overview

5.2.3.1 Setting of function code

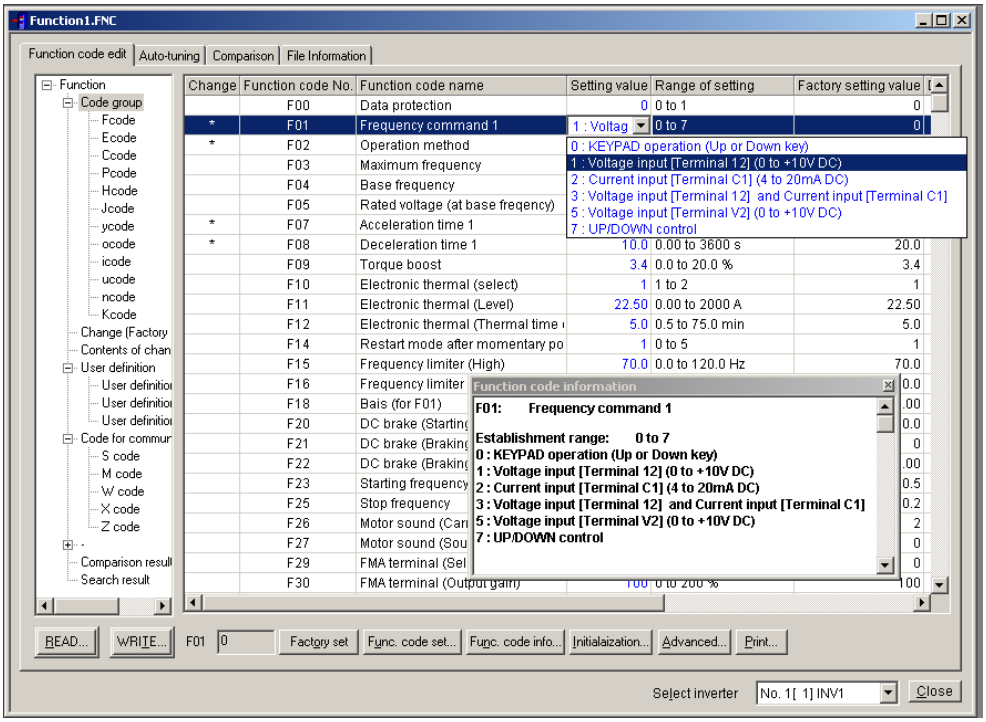
You can set, edit, and check the setting of the inverter's function code data.

List and Edit

In List and edit, you can list and edit function codes with function code No., name, set value, set range, and factory default.

You can also list function codes by any of the following groups according to your needs:

- Function code group
- Function codes that have been modified from their factory defaults
- Result of comparison with the settings of the inverter
- Result of search by function code name
- User-specified function code set



Comparison

You can compare the function code data currently being edited with that saved in a file or stored in the inverter.

To perform a comparison and review the result displayed, click the **Comparison** tab and then click the **Compared with inverter** tab or click the **Compared with file** tab, and specify the file name.

The result of the comparison will be displayed also in the Comparison Result column of the list.

File information

Clicking the **File information** tab displays the property and comments for identifying the function code editing file.

(1) Property

Shows file name, inverter model, inverter's capacity, date of readout, etc.

(2) Comments

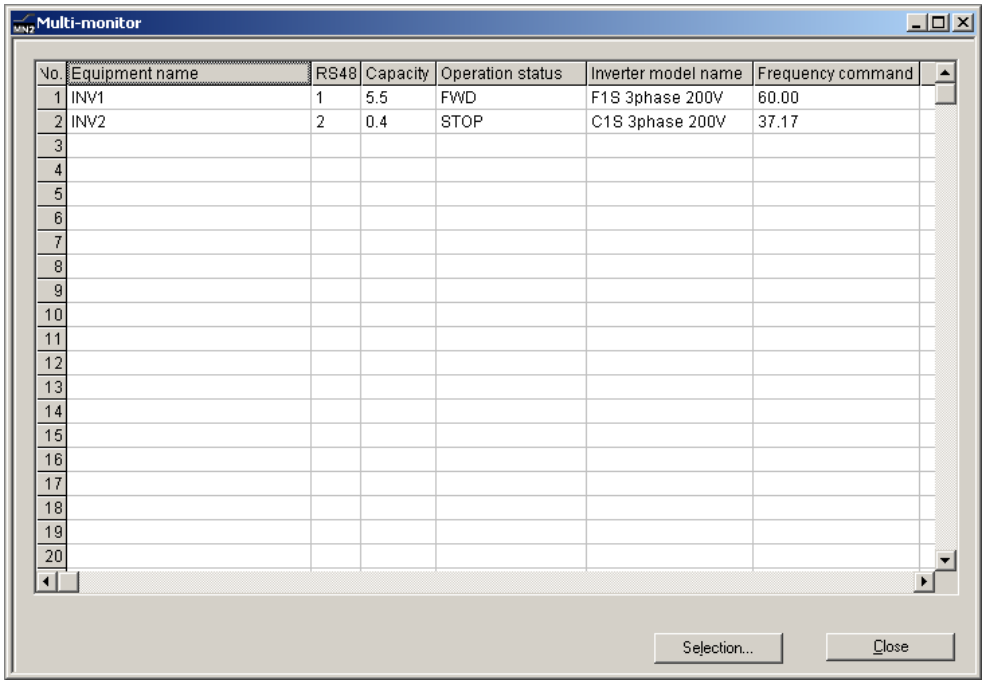
Displays the comments you have entered. You can write any comments necessary for identifying the file.

5.2.3.2 Multi-monitor

This feature lists the status of all the inverters that are marked "connected" in the configuration table.

Multi-monitor

Allows you to monitor the status of more than one inverter in a list format.

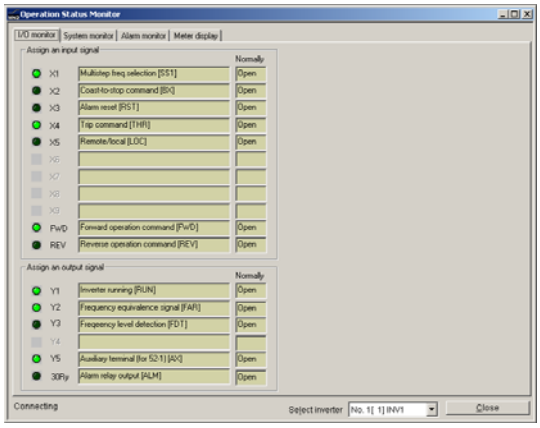


5.2.3.3 Running status monitor

The running status monitor offers four monitor functions: I/O monitor, System monitor, Alarm monitor, and Meter display. You can choose an appropriate monitoring format according to the purpose and situation.

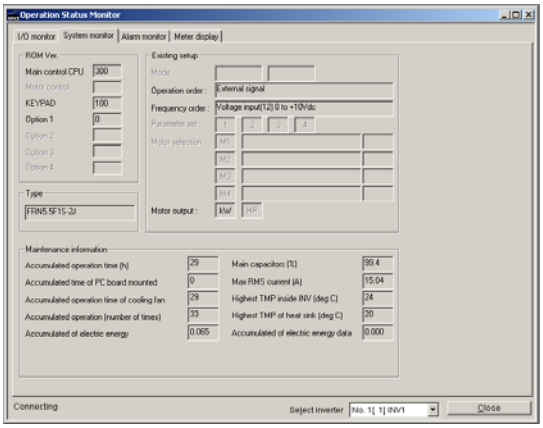
I/O monitor

Allows you to monitor the ON/OFF states of the digital input signals to the inverter and the transistor output signals.



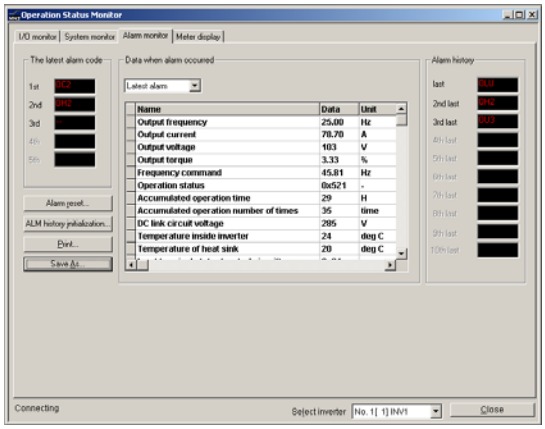
System monitor

Allows you to check the inverter's system information (version, model, maintenance information, etc.).



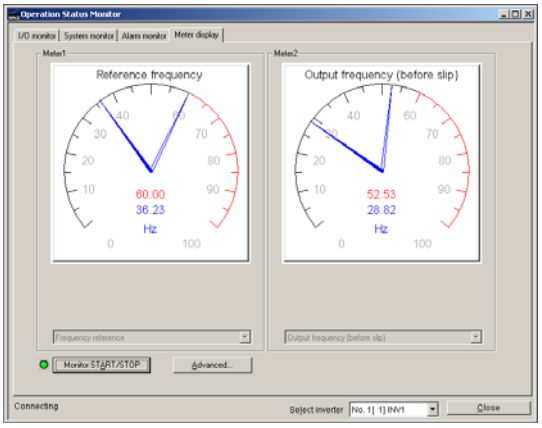
Alarm monitor

The alarm monitor shows the alarm status of the selected inverter. In this window you can check the details of the alarm currently occurs and related information.



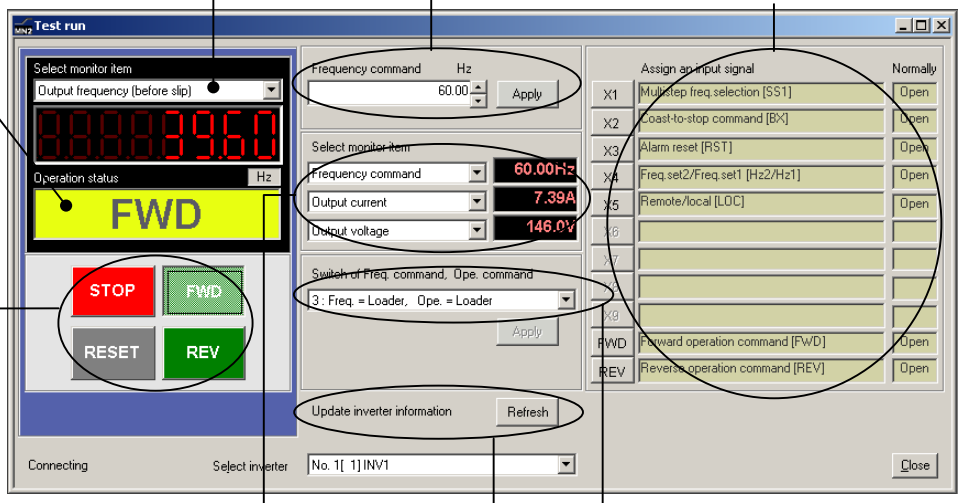
Meter display

Displays analog readouts of the selected inverter (such as output frequency) on analog meters. The example on the right displays the reference frequency and the output frequency.



5.2.3.4 Test-running

The Test-running feature allows you to test-run the motor in "Run forward" or "Run reverse" while monitoring the running status of the selected inverter.



Select monitor item

Select what is to be displayed here from output frequency, current, etc.

Setting frequency command

Enter or select the set frequency command to write it into the inverter. Click **Apply** to make it effective.

I/O terminal status

Shows status of the programmable I/O terminals of the inverter.

Indicating Operation status

Shows FWD, REV, STOP and Alarm codes.

Operation buttons*

Selecting monitor item

Select the operation status information to be monitored real-time.

Update the inverter info for the latest ones

Click the **Refresh** button to update running status of the inverter shown on the Loader screen. Loader will become to show the latest inverter status.

Switching frequency and run command sources

Select the frequency and run command sources and apply them by clicking **Apply**.

* Refer to the table shown below for details of the operation buttons. The indented appearance of the **FWD** button as shown in the figure above indicates that it is active for running the motor forward, while that of the REV button is same for running reverse.

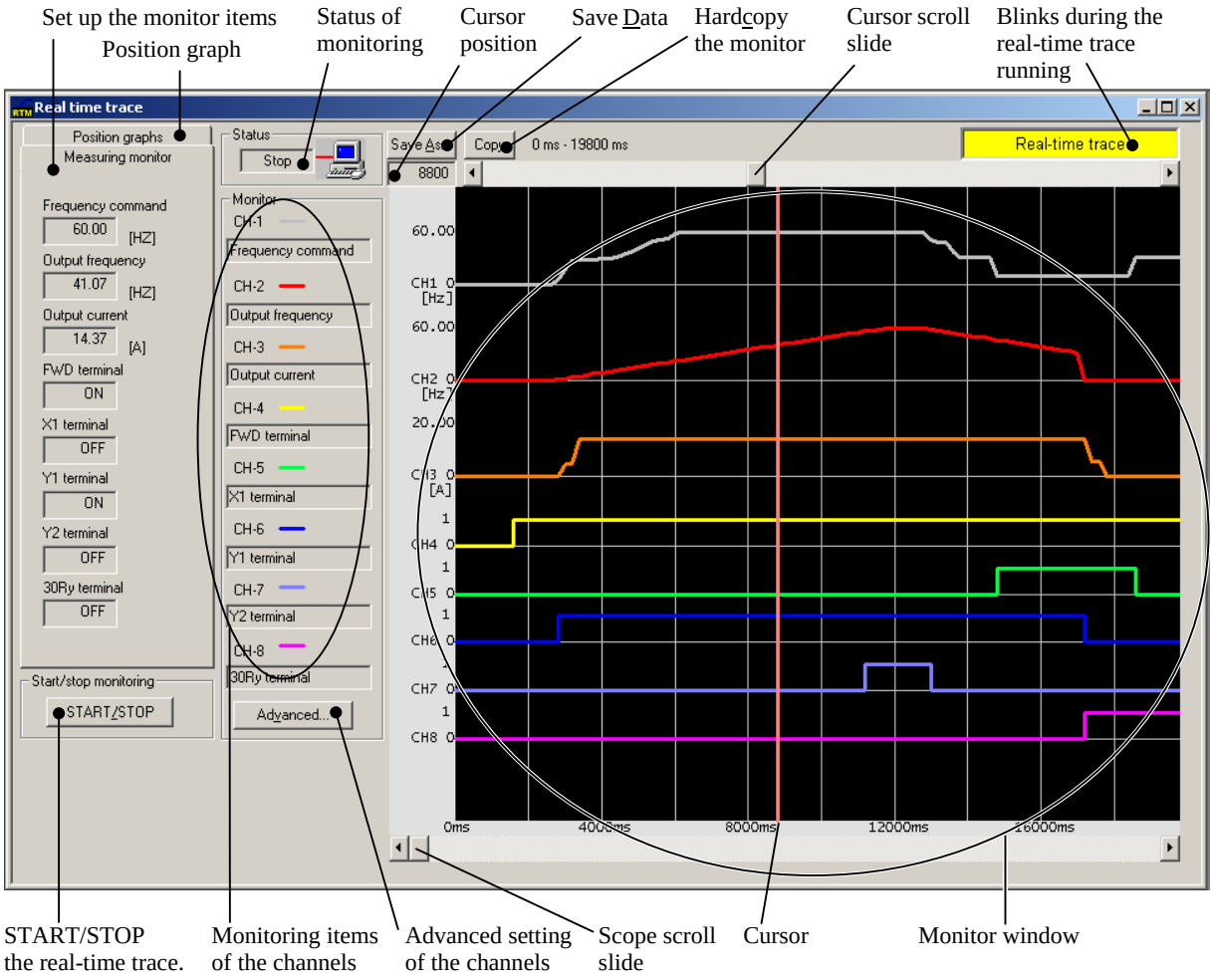
Button	Description
STOP	Stops the motor.
FWD	Run the motor forward.
REV	Run the motor reverse.
RESET	Resets all alarm information saved in the selected inverter.

5.2.3.5 Real-time trace—Displaying running status of an inverter in waveforms

This function allows you to monitor up to 4 analog readouts and up to 8 digital ON/OFF signals (a combined total of 8 channels), measured at fixed sampling intervals of 200 ms, which represent the running status of a selected inverter. These quantities are displayed in real-time waveforms on a time trace.

Waveform capturing capability: Max. 15,360 samples/channel

Sub-panes



Note During the trace in progress you cannot:

- Change the RS-485 station address,
- Change the advanced waveform settings, or
- Scroll the real-time trace screen or move the cursor.

Resizing the real-time trace window automatically changes the monitor window size.