

# CONTENTS

## Chapter 1 Specifications

1. Standard Specifications .....	1-2
1.1 Three-phase 230V FRENIC5000G11S Series .....	1-2
1.2 Three-phase 460V FRENIC5000G11S Series .....	1-3
1.3 Three-phase 230V FRENIC5000P11S Series (for variable torque load) .....	1-4
1.4 Three-phase 460V FRENIC5000P11S Series (for variable torque load) .....	1-5
2. Common Specifications .....	1-6
2.1 Outline of common specifications .....	1-6
2.2 Protective functions .....	1-10
2.3 Function settings .....	1-11
3. Wiring Diagram .....	1-19
3.1 Wiring diagram before shipment from factory .....	1-19
3.2 Basic wiring diagram .....	1-24
3.3 Wiring diagram using options .....	1-29
4. Terminal .....	1-33
4.1 Terminal functions .....	1-33
4.2 Main circuit and control circuit terminals .....	1-37
4.2.1 Terminal block arrangement .....	1-37
4.2.2 Main circuit terminal .....	1-38
4.2.3 Control circuit terminal .....	1-41

## Chapter 2 Operation

1. Frequency Control Operation .....	2-2
1.1 Types of frequency control signal .....	2-2
1.2 Accuracy and resolution .....	2-3
2. KEYPAD panel .....	2-4
3. Function Explanation .....	2-6
3.1 Fundamental Functions .....	2-6
3.2 Extension Terminal Functions .....	2-16
3.3 Control Functions of Frequency .....	2-26
3.4 Motor Parameters .....	2-31
3.5 High Performance Functions .....	2-33
3.6 Alternative Motor Parameters .....	2-42
4. Standard RS-485 Interface .....	2-44
4.1 Outline .....	2-45
4.1.1 Features .....	2-45
4.1.2 Function overview .....	2-45
4.2 Transmission specification .....	2-45
4.3 Connection .....	2-45
4.3.1 Connection method .....	2-45
4.3.2 RS-485 .....	2-46
4.3.3 Example of connection of FRENIC5000G11S/P11S series .....	2-46
4.3.4 Example of noise prevention .....	2-47

4.4	Transmission method .....	2-47
4.4.1	Transmission frame .....	2-47
4.4.2	Field description .....	2-53
4.4.3	Procedure on the host side .....	2-54
4.4.4	Example of communication .....	2-56
4.4.5	Communication error .....	2-57
4.5	Functions specific for communication .....	2-61
4.5.1	Command data .....	2-61
4.5.2	Operation command data .....	2-61
4.5.3	Function data .....	2-62
4.5.4	Monitoring data .....	2-63
4.6	Function data format .....	2-64
4.6.1	List of function data format .....	2-64
4.6.2	Data format specification .....	2-67
4.7	Changeover of communications .....	2-69
4.7.1	Changeover method for communication valid/invalid .....	2-70
4.7.2	Link function (operation selection) .....	2-70
4.7.3	Coexistence of link (option) and RS-485 communication .....	2-70
4.8	Response Time .....	2-70
4.8.1	Response interval time .....	2-70
4.8.2	Time of receiving preparation completion .....	2-71
4.9	Function .....	2-71
4.10	Troubleshooting .....	2-72
4.11	Appendix .....	2-73
4.11.1	Communication level converter .....	2-73
4.11.2	ASCII code list .....	2-73
4.11.3	Example of a control program .....	2-74
5.	Using Lifetime Forecast Functions .....	2-75
5.1	Contents of lifetime forecast functions .....	2-75
5.2	How to check lifetime forecast information .....	2-75
5.3	Measuring conditions of lifetime .....	2-76

### Chapter 3 Peripheral Equipment

1.	Inverter Input Current .....	3-2
2.	Circuit Breakers and Magnetic Contactors .....	3-3
3.	Wire Size .....	3-4
3.1	FRENIC5000G11S/P11S Series .....	3-4
3.2	Allowable current of insulation wire .....	3-8
4.	Braking Unit and Braking Resistor .....	3-10
5.	Braking Unit and Braking Resistor (10% ED) .....	3-12
6.	Rated Sensitive Current of GFCI .....	3-14
7.	Input Circuit Noise Filter (EMC Compliance Filter) .....	3-15
8.	Output Circuit Noise Filter (OFL- □□ -2/4) .....	3-16
9.	Output Circuit Noise Filter (OFL- □□ -4A) .....	3-18

10. DC REACTOR (DCR) .....	3-20
11. AC Reactor (ACR) .....	3-21
12. Ferrite Ring for Reducing Radio Noise (ACL) .....	3-23
13. Power Regenerative PWM Converter (RHC) .....	3-23

## Chapter 4 Optimal Type Selection

1. Inverter and Motor Selection .....	4-2
1.1 Motor output torque characteristics .....	4-2
1.2 Selection procedure .....	4-4
1.3 Selection calculation expressions .....	4-6
1.3.1 Load torque during constant speed running .....	4-6
1.3.2 Acceleration and deceleration time calculation .....	4-7
1.3.3 Heat energy calculation of braking resistor .....	4-9
1.3.4 Appendix (calculation for other than in SI Unit) .....	4-10
2. Braking Unit and Braking Resistor Selection .....	4-11
2.1 Selection procedure .....	4-11
2.2 Notes on selection .....	4-11
2.3 Optional fan unit .....	4-11

## Chapter 5 Option

1. Options .....	5-2
1.1 Optional control cards .....	5-2
1.2 Other exclusive options .....	5-2
1.3 Detailed specifications .....	5-3
2. Optional Peripheral Equipment .....	5-14
2.1 Optional peripheral equipment .....	5-14
2.2 Specifications and dimensions .....	5-15

## Chapter 6 Application Idea

1. Setting Items and Applications .....	6-2
2. FRENIC5000G11S/P11S Series .....	6-4
2.1 Using with Aeration Tank Blowers .....	6-4
2.2 Using with Multi-storied Automated Warehouses .....	6-6
2.3 Using with Automated Parking Garages .....	6-8
2.4 Using with Vertical Circulation type Parking Facility .....	6-10
2.5 Using with Bread Dough Mixers .....	6-12
2.6 Using with Commercial-use Washing Machines .....	6-14
2.7 Using with Belt Conveyors .....	6-16
2.8 Using with Grinding Machines .....	6-18
2.9 Using with Fans for Air Conditioning Unit (1) .....	6-20
2.10 Using with Fans for Air Conditioning Unit (2) .....	6-22
2.11 Using with Cold/Warm Water Pumps .....	6-24
2.12 Using with Line/Inverter Changeover Operation .....	6-26

**Chapter 7 Glossary**

1. Standard Specifications .....	7-2
2. Common Specifications .....	7-4

**Chapter 8 Appendix**

Appendix 1. Advantageous Use of Inverters (with regard to Electrical Noise) .....	8-2
1.1 Effect of inverters on other devices .....	8-2
1.1.1 Effect on AM radios .....	8-2
1.1.2 Effect on telephones .....	8-2
1.1.3 Effect on proximity limit switches .....	8-2
1.1.4 Effect on pressure sensors .....	8-2
1.1.5 Effect on position detectors (pulse generators; PGs, or pulse encoders) .....	8-2
1.2 Noise .....	8-2
1.2.1 Inverter noise .....	8-2
1.2.2 Types of noise .....	8-3
1.3 Noise prevention measures .....	8-5
1.3.1 Noise prevention treatments prior to installation .....	8-5
1.3.2 Implementation of noise prevention measures .....	8-5
1.3.3 Specific examples .....	8-8
Appendix 2. Effect on Insulation of General-purpose Motor Driven with 460V Class Inverter .....	8-11
2.1 Operating principle of inverter .....	8-11
2.1.1 Main circuit configuration of inverter .....	8-11
2.1.2 Control method of inverter .....	8-11
2.2 Generating mechanism of surge voltages .....	8-11
2.3 Effect of surge voltages .....	8-12
2.4 Countermeasures against surge voltages .....	8-12
2.4.1 Method to use motors with enhanced insulation .....	8-12
2.4.2 Method to suppress surge voltages .....	8-12
2.5 Regarding existing equipment .....	8-13
2.5.1 In case of motor being driven with 400V class inverter .....	8-13
2.5.2 In case of existing motor driven newly with 400V class inverter .....	8-13
Appendix 3. Example Calculation of Energy Savings .....	8-14
2.1 Calculating condition .....	8-14
2.2 Calculation of shaft driving power .....	8-14
2.3 Calculation of energy savings .....	8-14
Appendix 4. Inverter Generating Loss .....	8-15