Chapter 9 LIST OF PERIPHERAL EQUIPMENT AND OPTIONS

The table below lists the main peripheral equipment and options that are connected to the FRENIC-Mini. Use them in accordance with your system requirements.

For details, refer to the FRENIC-Mini User's Manual, Chapter 6 "SELECTING PERIPHERAL EQUIPMENT."

<table>
<tr><th></th><th>Name of peripheral equipment</th><th>Function and application</th></tr>
<tr><td>Main peripheral equipment</td><td>Molded case circuit breaker (MCCB)

Residual-current-operated protective device (RCD) /Ground fault circuit interrupter (GFCI)*

* with overcurrent protection</td><td>MCCBs are designed to protect the power circuits between the power control board and inverter's main terminals (L1/R, L2/S and L3/T for three-phase power, L1/L and L2/N for single-phase power) from overload or short-circuit which in turn prevents secondary disasters caused by the inverter malfunctioning.

RCDs/GFCIs function in the same way as MCCBs. Use the MCCBs and RCDs/GFCIs that satisfy the recommended rated current listed below.
<table>
<tr><th rowspan="2">Power supply voltage</th><th rowspan="2">Applicable motor rating (HP)</th><th rowspan="2">Inverter type</th><th colspan="2">Recommended rated current (A) of MCCB and RCD/GFCI</th></tr>
<tr><th>w/ DC reactor</th><th>w/o DC reactor</th></tr>
<tr><td rowspan="8">Three-phase 230 V</td><td>1/8</td><td>FRNF12C1■-2U</td><td rowspan="4">5</td><td rowspan="3">5</td></tr>
<tr><td>1/4</td><td>FRNF25C1■-2U</td></tr>
<tr><td>1/2</td><td>FRNF50C1■-2U</td></tr>
<tr><td>1</td><td>FRN001C1■-2U</td><td>10</td></tr>
<tr><td>2</td><td>FRN002C1■-2U</td><td rowspan="2">10</td><td>15</td></tr>
<tr><td>3</td><td>FRN003C1■-2U</td><td>20</td></tr>
<tr><td>5</td><td>FRN005C1■-2U</td><td>20</td><td>30</td></tr>
<tr><td rowspan="6">Three-phase 460 V</td><td>1/2</td><td>FRNF50C1■-4U</td><td rowspan="4">5</td><td rowspan="2">5</td></tr>
<tr><td>1</td><td>FRN001C1■-4U</td></tr>
<tr><td>2</td><td>FRN002C1■-4U</td><td>10</td></tr>
<tr><td>3</td><td>FRN003C1■-4U</td><td>15</td></tr>
<tr><td>5</td><td>FRN005C1■-4U</td><td>10</td><td>20</td></tr>
<tr><td rowspan="7">Single-phase 230 V</td><td>1/8</td><td>FRNF12C1■-7U</td><td rowspan="4">5</td><td rowspan="2">5</td></tr>
<tr><td>1/4</td><td>FRNF25C1■-7U</td></tr>
<tr><td>1/2</td><td>FRNF50C1■-7U</td><td>10</td></tr>
<tr><td>1</td><td>FRN001C1■-7U</td><td>10</td><td>15</td></tr>
<tr><td>2</td><td>FRN002C1■-7U</td><td>15</td><td>20</td></tr>
<tr><td>3</td><td>FRN003C1■-7U</td><td>20</td><td>30</td></tr>
<tr><td rowspan="4">Single-phase 115 V</td><td>1/8</td><td>FRNF12C1■-6U</td><td rowspan="2">5</td><td>5</td></tr>
<tr><td>1/4</td><td>FRNF25C1■-6U</td><td>10</td></tr>
<tr><td>1/2</td><td>FRNF50C1■-6U</td><td>10</td><td>15</td></tr>
<tr><td>1</td><td>FRN001C1■-6U</td><td>15</td><td>20</td></tr>
</table>
Note 1) A box (■) in the above table replaces S or E depending on the enclosure.

Select the MCCB or RCD/GFCI with appropriate breaking capacity according to the power supply capacity.</td></tr>
</table>

	Name of peripheral equipment	Function and application
Main peripheral equipment	Molded case circuit breaker Ground fault circuit interrupter* * with overcurrent protection	**⚠WARNING** When connecting the inverter to the power supply, add a recommended molded case circuit breaker and a ground fault circuit interrupter* in the path of power supply. Do not use the devices with the rated current out of the recommenced range. *With overcurrent protection **Fire could occur.**
	Magnetic contactor (MC)	An MC can be used at both the power input (primary) and output (secondary) sides of the inverter. At each side, the MC works as described below. When inserted in the output circuit of the inverter, an MC can also switch the motor drive power source between the inverter output and commercial power lines. ■ At the power source (primary) side Insert an MC in the power source side of the inverter in order to: 1) Forcibly cut off the inverter from the power source (generally, commercial/factory power lines) with the protection function built into the inverter, or with the terminal signal line. 2) Stop the inverter operation in an emergency when the inverter cannot interpret the stop command due to internal/external circuit failures. 3) Cut off the inverter from the power source when the MCCB inserted in the power source side cannot cut it off for maintenance or inspection purpose. If you are to use the MC for this purpose only, it is recommended that you use an MC capable of turning the MC on/off manually. **Note:** When your system requires the motor(s) driven by the inverter to be started/stopped with the MC, the frequency of the starting/stopping operation should be once or less per hour. The more frequent the operation, the shorter operation life of the MC and capacitor/s used in the DC link bus due to thermal fatigue caused by the frequent charging of the current flow. If this is not necessary, start/stop the motor with the terminal commands ***FWD***, ***REV*** and/or ***HLD***, or with the keypad. ■ At the output (secondary) side Prevent externally turned-around current from being applied to the inverter power output terminals (U, V, and W) unexpectedly. An MC should be used, for example, if a circuit that switches the motor driving source between the inverter output and commercial/factory power lines is connected to the inverter. **Note:** As application of high voltage external current to the inverter's secondary (output) circuits may break the IGBTs, MCs should be used in the power control system circuits to switch the motor drive power source to the commercial/factory power lines after the motor has come to a complete stop. Also ensure that voltage is never mistakenly applied to the inverter output terminals due to unexpected timer operation, or similar. ■ Driving the motor using commercial power lines MCs can also be used to switch the power source of the motor driven by the inverter to a commercial power source.

	Name of option	Function and application
Main option	Braking resistors (Standard model) (DBRs)	A braking resistor converts regenerative energy generated from deceleration of the motor and converts it to heat for consumption. Use of a braking resistor results in improved deceleration performance of the inverter.
	DC reactors (DCRs)	A DCR is mainly used for power supply normalization and for supplied power-factor reformation (for reducing harmonic components). 1) For power supply normalization - When connecting the inverter to the power supply of 500 kVA or more (50 kVA or more for single-phase 115 V class series), use an optional DC reactor (DCR). Otherwise, the percentage-reactance of the power source decreases, and harmonic components and their peak levels increase. These factors may break rectifiers or capacitors in the converter section of inverter, or decrease the capacitance of the capacitor (which can shorten the inverter's service life). - Also use a DCR when there are thyristor-driven loads or when condensive capacitors are being turned on/off. 2) For supplied power-factor reformation (harmonic component reduction) Generally a capacitor is used to reform the power factor of the load, however, it cannot be used in a system that includes an inverter. Using a DCR increases the reactance of inverter's power source so as to decrease harmonic components on the power source lines and reform the power factor of inverter. Using a DCR reforms the input power factor to approximately 90 to 95%. **Note:** At the time of shipping, a jumper bar is connected across the terminals P1 and P (+) on the terminal block. Remove the jumper bar when connecting a DCR.
	Output circuit filters (OFLs)	Include an OFL in the inverter power output circuit to: 1) Suppress the voltage fluctuation at the motor input terminals This protects the motor from insulation damage caused by the application of high voltage surge currents by the 400 V class of inverters. 2) Suppress leakage current from the power output (secondary) lines (due to harmonic components) This reduces the leakage current when the motor is hooked by long power feed lines. It is recommended that the length of the power feed line be kept to less than 1300ft(400m). 3) Minimize emission and/or induction noise issued from the power output (secondary) lines OFLs are effective in reducing noise from long power feed lines, such as those used in plants, etc. **Note:** Use an OFL within the allowable carrier frequency range specified by function code F26 (Motor sound (carrier frequency)). Otherwise, the filter will overheat.
	EMC-compliant filter	A special filter for making the inverter compliant with Europe's EMC directives.

	Name of option	Function and application
Main option	Ferrite ring reactors for reducing radio frequency noise (ACL)	An ACL is used to reduce radio noise emitted by the inverter. An ACL suppresses the outflow of high frequency harmonics caused by switching operation for the power supply (primary) lines inside the inverter. Pass the power supply lines together through the ACL for 4 turns (coiled 3 times). If wiring length between the inverter and motor is less than 65ft(20m), insert an ACL to the power supply (primary) lines; if it is more than 65ft(20m), insert it to the power output (secondary) lines of the inverter.
	Options for 115V single-phase power supply	An optional single-phase 115 V power supply may be used to operate an inverter designed for a three-phase 230 V power supply with single-phase 115 V power.
Options for Operation and Communications	External potentiometer for frequency commands	An external potentiometer may be used to set the drive frequency. Connect the potentiometer to control signal terminals [11] to [13] of the inverter.
	Remote keypad	This allows you to perform remote operation of the inverter. (You need an extension cable and RS-485 communications card to connect the remote keypad to the inverter.) With the remote keypad, you may copy function code data set in the inverter to any other inverter.
	Extension cable for remote operation	The extension cable connects the RS-485 communications card with a remote keypad or a USB–RS-485 converter. Three lengths are available: 16ft(5m), 10ft(3m) and 3.3ft(1m)
	RS-485 communications card	This makes communication to a PLC or personal computer system easy.
	Copy adapter	Used to copy data into multiple inverters.
	Connector adapter	A spare connector for the copy adapter.
	USB–RS-485 converter	A converter that allows connection of an RS-485 communications card to a USB port on a PC.
	Inverter loader software	Windows-based inverter loader software that makes function code setting easy. The RS-485 communications card must be connected.
Other peripheral equipment	Surge absorbers	A surge absorber suppresses surge currents and noise from the power lines to ensure effective protection of your power system from the malfunctioning of the magnetic contactors, mini-relays and timers.
	Surge killers	A surge killer eliminates surge currents induced by lightening and noise from the power supply lines. Use of a surge killer is effective in preventing the electronic equipment, including inverters, from damage or malfunctioning caused by such surges and/or noise.
	Arresters	An arrester suppresses surge currents and noise invaded from the power supply lines. Use of an arrester is effective in preventing electronic equipment, including inverters, from damage or malfunctioning caused by such surges and/or noise.
	Frequency meter	Displays the frequency in accordance with signal output from the inverter.

	Name of option	Function and application
Other options	Mounting adapters	FRENIC-Mini series of inverters can be installed to the control board of your system using mounting adapters which utilize the mounting holes used for conventional inverters (FVR-E11S series of 1HP or below or 5HP). The FVR-E11S-2/4 (2HP/3HP) and FVR-E11S-7 (1HP/2HP) series may be replaced with any of the FRENIC-Mini series of inverters without the use of adapters.
	Rail mounting bases	A rail mounting base allows any of the FRENIC-Mini series of inverters to be mounted on a DIN rail (1.38 in wide).
	NEMA1 kit	Installing the NEMA1 kit to the inverter lets the inverter have the NEMA1-compliant (UL TYPE1 certified) protective enclosure.