



Chapter 9 LIST OF PERIPHERAL EQUIPMENT AND OPTIONS

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

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

	Name of peripheral equipment	Function and application																																																																																																																																																																							
Main peripheral equipment	Molded case circuit breaker (MCCB)	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) from overload or short-circuit which in turn prevents secondary disasters caused by the inverter malfunctioning.																																																																																																																																																																							
	Residual-current-operated protective device (RCD) /Ground fault circuit interrupter (GFCI) * with overcurrent protection	RCDs/GFCIs function in the same way as MCCBs. Use the MCCBs and RCDs/GFCIs that satisfy the recommended rated current listed below.																																																																																																																																																																							
			<table border="1"> <thead> <tr> <th data-bbox="333 379 445 464" rowspan="2">Input power source (3-phase)</th> <th data-bbox="456 379 568 464" rowspan="2">Applicable motor rating (HP)</th> <th data-bbox="580 379 736 464" rowspan="2">Inverter type</th> <th colspan="2" data-bbox="748 379 1028 432">Rated current of MCCB and GFCI (A)</th> </tr> <tr> <th data-bbox="748 432 871 464">w/ DCR</th> <th data-bbox="882 432 1028 464">w/o DCR</th> </tr> </thead> <tbody> <tr> <td data-bbox="344 635 400 655" rowspan="14">208 V</td> <td data-bbox="468 464 490 485">1</td> <td data-bbox="591 464 725 485">FRN001F1S-2U</td> <td data-bbox="759 464 792 485">10</td> <td data-bbox="893 464 927 485">10</td> </tr> <tr> <td data-bbox="468 485 490 505">2</td> <td data-bbox="591 485 725 505">FRN002F1S-2U</td> <td data-bbox="759 485 792 505" rowspan="2">15</td> <td data-bbox="893 485 927 505">15</td> </tr> <tr> <td data-bbox="468 505 490 526">3</td> <td data-bbox="591 505 725 526">FRN003F1S-2U</td> <td 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	Name of peripheral equipment	Function and application
Main peripheral equipment	Molded case circuit breaker Ground fault circuit interrupter * with overcurrent protection	<div style="border: 1px solid black; padding: 10px; text-align: center;">  <h2 style="margin: 0;">WARNING</h2> </div> <p>When connecting the inverter to the power supply, add a recommended molded case circuit breaker and ground fault circuit interrupter in the path of power supply. Do not use the devices with the rated current out of the recommended range.</p> <p>*With overcurrent protection</p> <p>Fire could occur.</p>
	Magnetic contactor (MC)	<p>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.</p> <p>■ At the power source (primary) side</p> <p>Insert an MC in the power source side of the inverter in order to:</p> <ol style="list-style-type: none"> 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. <p>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.</p> <p>■ At the output (secondary) side</p> <p>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.</p> <p>Note: As application of high voltage external current to the inverter's output side 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.</p> <p>■ Driving the motor using commercial power lines</p> <p>MCs can also be used to switch the power source of the motor driven by the inverter to a commercial power source.</p>

	Name of option	Function and application
Main option	DC reactors (DCRs)	<p>A DCR is mainly used for power supply normalization and for supplied power-factor reformation (for reducing harmonic components).</p> <p>1) For power supply normalization</p> <ul style="list-style-type: none"> - Use a DCR when the capacity of a power supply transformer exceeds 500 kVA and is 10 times or more than the rated inverter capacity. In this case, 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 phase-advancing capacitors are being turned ON/OFF. <p>2) For supplied power-factor reformation (harmonic component reduction)</p> <p>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 86 to 90%.</p> <p>Note: At the time of shipping, a short bar is connected across the terminals P1 and P (+) on the terminal block. Remove the short bar when connecting a DCR.</p>
	Output circuit filters (OFLs)	<p>Include an OFL in the inverter power output (secondary) circuit to:</p> <p>1) Suppress the voltage fluctuation at the motor input terminals</p> <p>This protects the motor from insulation damage caused by the application of high voltage surge currents by the 400 V class of inverters.</p> <p>2) Suppress leakage current from the power output lines (due to harmonic components)</p> <p>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 400 m.</p> <p>3) Minimize emission and/or induction noise issued from the power output lines</p> <p>OFLs are effective in reducing noise from long power feed lines, such as those used in plants, etc.</p> <p>Note: Use an OFL within the allowable carrier frequency range specified by function code F26 (Motor sound (Carrier frequency)). Otherwise, the filter will overheat.</p>
	Ferrite ring reactors for reducing radio frequency noise (ACL)	<p>An ACL is used to reduce radio noise emitted by the inverter.</p> <p>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).</p> <p>If wiring length between the inverter and motor is less than 65.6ft(20 m), insert an ACL to the power supply (primary) lines; if it is more than 65.6ft(20 m), insert it to the power output (secondary) lines of the inverter.</p>
	EMC-compliant filter	<p>A special filter for making the inverter in conformity with Europe's EMC directives.</p>
	AC Reactor (ACR)	<ul style="list-style-type: none"> • This optional feature must be connected to the primary side (commercial power supply side) of the inverter, when the inter-phase unbalance factor of the commercial power supply is 2% to 3%. $\text{Voltage unbalance (\%)} = \frac{\text{Max. voltage (V)} - \text{Min. voltage (V)}}{3\text{-phase average voltage (V)}} \times 67$ <p>In case the inter-phase unbalance factor of the commercial power supply exceeds 3%, you would need to take other measures such as increasing the capacity of the inverter. Contact your Fuji Electric representative.</p> • In a DC link bus system (using terminals [P (+)] and [N (-)]), the AC reactor protects the inverter against damage caused by unbalance in current.

	Name of option	Function and application
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.
	Multi-function keypad	Allows you to monitor the status of the inverter including voltage, current, and input power, as well as to set various parameters in a conversational mode. Equipped with a liquid crystal display (LCD). Also allows you to copy function code data from one FRENIC-Eco inverter to another.
	Extension cable for remote keypad operation	The extension cable connects the RS-485 communications port (standard) with a keypad or an RS-485-USB converter. Three lengths are available: 16.4ft, 9.8ft and 3.3ft (5 m, 3 m and 1 m)
	RS-485 Communications Card	This makes communication to a PLC or personal computer system easy. (Option)
	RS-485-USB converter	A converter that allows connection of an RS-485 communications port to a USB port on a PC.
	Inverter support loader software	Inverter support loader software, Windows GUI (Graphics User Interface) based, that makes setting of function codes easy.
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 suppressors	A surge suppressor eliminates surge currents induced by lightning and noise from the power supply lines. Use of a surge suppressor 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.
Other options	Mounting adapters	FRENIC-Eco series of inverters can be installed to your system enclosure or equipment using mounting adapters which utilize the mounting holes used for conventional inverters of FRENIC5000P11S (7.5HP, 20HP or 40HP) series. FRENIC5000P11S 10HP, 15HP, 25HP and 30HP models do not need this adapter.
	Attachment for external cooling	This adapter allows you to mount your FRENIC-Eco series of inverters on the panel in such a way that the heat sink assembly may be exposed to the outside. Using this adapter greatly reduces heat radiated or spread inside your enclosure. Applicable only to inverters with a capacity of 30HP for 208V, 40HP for 460V or below. (On inverters with a capacity of 40HP for 208V, 50HP for 460V or above, you only need to re-position the mounting bases.)