Chapter 9 LIST OF PERIPHERAL EQUIPMENT AND OPTIONS

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

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

	Name of peripheral equipment	Function and application
Main peripheral equipment	Molded case circuit breaker (MCCB) Residual-current-operated protective device (RCD) /Ground fault circuit interrupter (GFCI)*1 *1 with overcurrent protection	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 input power supply, L1/L and L2/N for single-phase input power supply) 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.

Input power supply	Nominal applied motor (HP)	Inverter type	Rated current of MCCB and GFCI (A)	
			w/ DCR	w/o DCR
Three-phase 230 V	1/8	FRNF12E1■-2U	5	5
	1/4	FRNF25E1■-2U		
	1/2	FRNF50E1■-2U		
	1	FRN001E1■-2U		10
	2	FRN002E1■-2U	10	15
	3	FRN003E1■-2U		20
	5	FRN005E1■-2U	20	30
	7.5	FRN007E1■-2U	30	50
	10	FRN010E1■-2U	40	75
	15	FRN015E1■-2U	50	100
	20	FRN020E1■-2U	75	125
Three-phase 460 V	1/2	FRNF50E1■-4U	5	5
	1	FRN001E1■-4U		
	2	FRN002E1■-4U		10
	3	FRN003E1■-4U		15
	5	FRN005E1■-4U	10	20
	7.5	FRN007E1■-4U	15	30
	10	FRN010E1■-4U	20	40
	15	FRN015E1■-4U	30	50
	20	FRN020E1■-4U	40	60
Single-phase 230 V	1/8	FRNF12E1■-7U	5	5
	1/4	FRNF25E1■-7U		
	1/2	FRNF50E1■-7U		10
	1	FRN001E1■-7U	10	15
	2	FRN002E1■-7U	15	20
	3	FRN003E1■-7U	20	30

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.

⚠WARNING

When connecting the inverter to the power supply, add a recommended molded case circuit breaker (MCCB) or residual-current-operated protective device (RCD)/a ground fault circuit interrupter (GFCI) (with overcurrent protection) in the path of power supply. Do not use the devices with the rated current out of the recommenced range.

Fire could occur.

	Name of peripheral equipment	Function and application
Main peripheral equipment	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 supply between the inverter output and commercial power lines. ■ At the power supply (primary) side Insert an MC in the power supply side of the inverter in order to: 1) Forcibly cut off the inverter from the power supply (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 supply when the MCCB inserted in the power supply 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*** 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 output side may break the IGBTs, MCs should be used in the power control system circuits to switch the motor drive power supply 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 supply of the motor driven by the inverter to a commercial power supply.

	Name of option	Function and application
Main option	DC reactors (DCRs)	A DCR is mainly used for power supply matching and for input power factor correction (for reduction of harmonics). 1) For power supply matching - Use a DCR when the capacity of a power supply transformer exceeds 500 kVA. In this case, the percentage-reactance of the power supply 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. 2) For input power factor correction (reduction of harmonics) Generally a capacitor is used to correct 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 supply so as to decrease harmonic components on the power supply lines and correct 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 (secondary) circuit to: 1) Suppress the surge voltage at motor terminal This protects the motor from insulation damage caused by the application of high surge voltage. 2) Suppress leakage current from the power output 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 (400 m). 3) Minimize emission and/or induction noise issued from the power output lines OFLs are effective in reducing noise from long power feed lines, such as those used in plants, etc. **Note:** Use an output circuit (secondary) filter of OFL-□□□-□A.
	Zero-phase 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 noise 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). Use 4 ACLs and let the power supply lines pass through them when the sizes of the power supply lines are large. If wiring length between the inverter and motor is less than 66ft (20 m), insert an ACL to the power supply (primary) lines; if it is more than 66ft (20 m), insert it to the power output (secondary) lines of the inverter.
	AC Reactor (ACR)	• 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%. $$\text{Voltage unbalance (\%)} = \frac{\text{Max. voltage (V)} \quad \text{Min. voltage (V)}}{\text{Three - phase average voltage (V)}} \times 67$$ 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. Consult your Fuji Electric representative. • In a DC link bus system (using terminals [P (+)] and [N (-)]), the AC reactor protects the inverter against damage caused by unbalance in current.
	Braking resistors (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.

	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-Multi 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 (5 m), 9.8ft (3 m) and 3.3ft (1 m)
	RS-485 Communications card	This makes communication to a PLC or personal computer system easy. (Option) This has a pair of RJ-45 connectors that acts as a transfer port for a multidrop network configuration without using a branch adapter.
	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 magnetic contactors, mini-relays and timers, and protects the inverter from malfunctioning.
	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.
Other options	Panel-mount adapter	FRENIC-Multi series of inverters can be installed to your system panel or equipment using mounting adapters which utilize the mounting holes used for conventional inverters of FVR-E11S series. (Three-phase 230 V: 1/8 to 1 and 5 HP, Three-phase 460 V: 5 HP, Single-phase 230 V: 1/8 to 1/2 and 3 HP)
	Mounting adapter for external cooling	This adapter allows you to mount your FRENIC-Multi 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 panel. Applicable only to inverters with a capacity of 7.5 to 20 HP.