for a greener tomorrow

MITSUBISHI
ELECTRIC
Changes for the Better

FACTORY AUTOMATION

INVERTER
FR-A800

Unparalleled Performance. Uncompromising Quality.
[Addition of CC-Link IE TSN models]

- Approach to the leading drive performance
- Security & safety
- Easy setup & easy to use
- Eco-friendly factories
- System support

GLOBAL IMPACT OF MITSUBISHI ELECTRIC

Through Mitsubishi Electric’s vision, “Changes for the Better“ are possible for a brighter future.

Changes for the Better

We bring together the best minds to create the best technologies. At Mitsubishi Electric, we understand that technology is the driving force of change in our lives. By bringing greater comfort to daily life, maximizing the efficiency of businesses and keeping things running across society, we integrate technology and innovation to bring changes for the better.

Mitsubishi Electric is involved in many areas including the following

Energy and Electric Systems

A wide range of power and electrical products from generators to large-scale displays.

Electronic Devices

A wide portfolio of cutting-edge semiconductor devices for systems and products.

Home Appliance

Dependable consumer products like air conditioners and home entertainment systems.

Information and Communication Systems

Commercial and consumer-centric equipment, products and systems.

Industrial Automation Systems

Maximizing productivity and efficiency with cutting-edge automation technology.

Contents

Unparalleled Performance. Uncom

What is required of inverters in this constantly changing world?

At Mitsubishi Electric, we have pursued the answer to this question through constant innovation and evolution.

Introducing our extensive range of high-value,

next-generation inverters delivering outstanding drive performance in any environment,

and a wealth of functionality covering startup to maintenance.

We utilized the traditional Mitsubishi Electric philosophy to further perfect our inverters.

01

APPROACH TO THE LEADING DRIVE PERFORMANCE

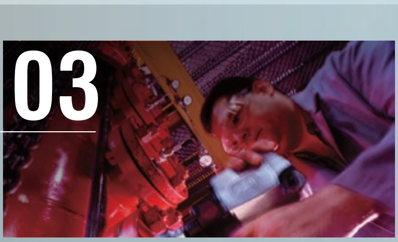
The enhanced Real sensorless vector control and vector control serve the needs of all machinery types.

02

SECURITY & SAFETY

Rapid response is obtained when an unexpected trouble occurs.

03



EASY SETUP & EASY TO USE

Fully equipped with a variety of simple functions and equipment to improve work efficiency.

04

ECO-FRIENDLY FACTORIES

Save energy while increasing factory production.

05

SYSTEM SUPPORT

Numerous functions and the extensive lineup of models are ready to support various systems.

A800

promising Quality.

APPROACH TO THE LEADING DRIVE PERFORMANCE

The new series is equipped with the new state-of-the-art high-speed processor developed by Mitsubishi Electric. With better control performance and response level, safe and accurate operation is assured in a diverse range of applications.

Swift, Smooth, yet Robust

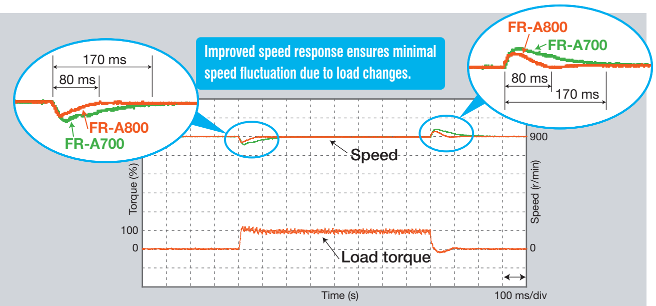
The enhanced Real sensorless vector control and vector control serve the needs of all machinery types.

The vector control is available when a vector control compatible option is installed.

(1) For high-quality products

High response

Response speed Real sensorless vector control **50 Hz**[*1] A700: 20 Hz
Vector control **130 Hz**[*2] A700: 50 Hz



[Example of changes in actual rotation speed with impact load]
(With Real sensorless vector control, SF-PR 4P motor (3.7 kW))

Fast response terminal

The response delay time is reduced.

- **Terminal response**
A700: 5 to 20 ms ➡ A800: 2 to 3 ms

Line control

Line control is necessary for the machining of elongated products such as paper, thread, wires, all kinds of sheet, and tape. This will respond rapidly to changes in line speed and suppress the occurrences of winding unevenness. This contributes to a steady supply of high-quality products.

[*1] : At 3.7 kW with no load. Differs depending on the load conditions and motor capacity.

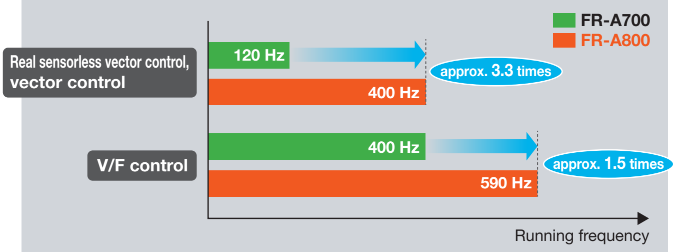
[*2] : The option (FR-A8AP, FR-A8AL, or FR-A8TP) is required.

Speed response: The speed response indicates how fast the inverter follows the change in the speed command. (The larger value indicates the better speed trackability.)

(2) Perform ultra-fine processing

High-speed rotation

Operating frequency Real sensorless vector control and vector control **400 Hz** A700: 120 Hz
V/F control **590 Hz**[*3] A700: 400 Hz



Machine tool

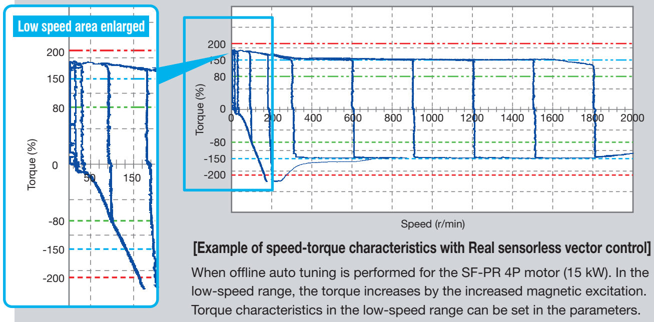
Cutting-edge machine tools are harder and thinner than ever before to be applicable to diverse new materials.
High-speed rotation is required more than ever before in order to be applicable for fine and precise cutting on hard and difficult-to-grind materials.

[*3] : According to the review result of the export control order about frequency changers, the upper limit of output frequency was determined to be 590 Hz for standard models.

(3) Swiftly move heavy weights

High torque at low speed

Starting torque (When at 0.3 Hz)
Real sensorless vector control **200%** (ND rating)[*4],
Vector control **200%** (ND rating)[*4]
(150% of initial setting for 5.5K and higher)



[Example of speed-torque characteristics with Real sensorless vector control]
When offline auto tuning is performed for the SF-PR 4P motor (15 kW). In the low-speed range, the torque increases by the increased magnetic excitation. Torque characteristics in the low-speed range can be set in the parameters.

Zero-speed torque
Vector control **200%**. (Select HD rating.)[*4]

Speed control range
V/F control **1:10** (6 to 60 Hz: Driving)
Advanced magnetic flux vector control **1:120** (0.5 to 60 Hz: Driving)
Real sensorless vector control **1:200** (0.3 to 60 Hz: Driving)
Vector control **1:1500** (1 to 1500 r/min: Both driving/regeneration)

Cranes

Cranes are in operation daily at ports carrying fully-laden containers in response to strong demand from all over the world. Our new inverter realizes smooth cargo handling work at low speed and high torque for the slow and stable movements required for heavy objects.

[*4] : Refer to page 17 for the multiple rating setting.

(4) For accurate and stable transport between machines

PM sensorless vector control

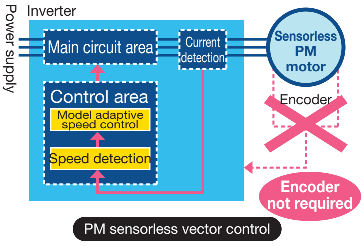
• What is a permanent magnet (PM) motor?

A PM motor is a synchronous motor with strong permanent magnets embedded in its rotor. The two major PM motor types are: the interior permanent magnet (IPM) motor with its magnets embedded inside the rotor, and the surface permanent magnet (SPM) motor with its permanent magnets attached on the rotor surface.

• What is PM sensorless vector control?

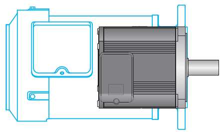
The speed and magnetic pole positions, the two essential bits of information to control a PM motor, are detected without a sensor (encoder). The speed detection internally-performed in an inverter enables highly accurate control of a PM motor, almost as accurate as an AC servo system, without the need of a sensor (encoder)*5.

Combining with Mitsubishi Electric MM-CF series IPM motors facilitates aspects of high-level control with no encoder such as **"simple positioning"*6** and **"zero speed torque"**.



• Easy maintenance for sensor (encoder)-less motor

- No additional cables means less wiring space required.
- Improved reliability is obtained in unfavorable operating environments. (e.g. high vibration)
- PM motors are usually smaller and lighter than induction motors.



Comparison of
SF-PRF 1.5 kW 4P and MM-CF152

Transfer of circuit boards

The Simple positioning control delivers a precision workpiece, such as a printed substrate, to a precise position.
Transfer of fragile glass substrates can be performed with a highly accurate driving system.

*5: Speed fluctuation ratio: ±0.05% (digital input)

$$\text{Speed fluctuation ratio} = \frac{\text{Speed under no load} - \text{Speed under rated load}}{\text{Rated speed}} \times 100(\%)$$

*6: Positional accuracy (with no load) of 1.5K and lower: ±1.8°, 2K and higher: ±3.6°

(5) Taking motor performance to the max

Induction motors and magnet motors can be combined freely

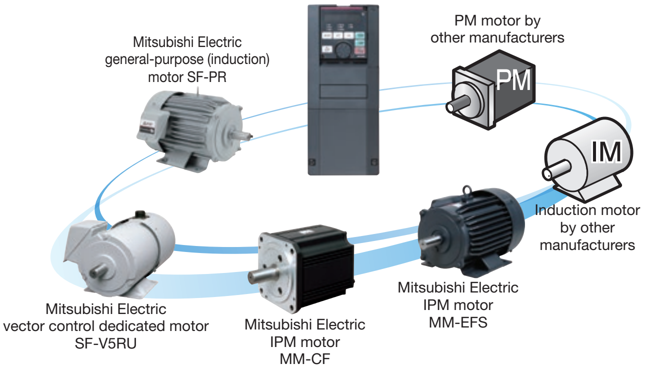
• The cutting-edge auto tuning function

The PM motor auto tuning function, which has been newly developed, enables sensorless operation of other manufacturers' permanent magnet (PM) motors.

Operation with all Mitsubishi Electric induction motors and PM motors, in addition to induction motors and PM motors from other manufacturers*7, is possible. That means you need less motors for spare and stocks.

(With IPM motors other than MM-CF and PM motors manufactured by other companies, starting torque is limited to 50%, and simple positioning control and zero speed torque cannot be used even if tuned.)

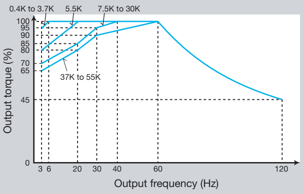
*7: Tuning may not be available depending on its motor characteristics.



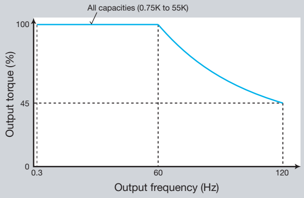
• Low speed, high torque realized with SF-PR motor

By combining with Mitsubishi Electric's high-performance, energy-saving motor SF-PR, 100% continuous operation is possible from a low speed of 0.3 Hz for inverters of any capacity.

(when using Real sensorless vector control)



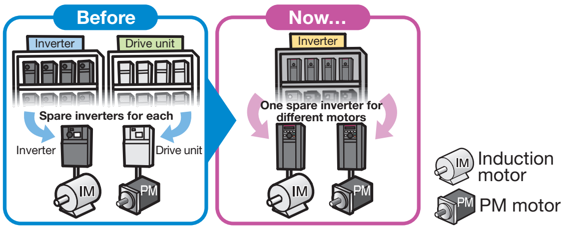
SF-JR continuous operation torque characteristics
(Motor input voltage: 200 V)



SF-PR continuous operation torque characteristics
(Motor input voltage: 200 V)

• Sharing the spare inverter

One spare inverter is enough for the two types of motors (IM and PM).



SECURITY & SAFETY

Swift recovery ensured by preventing trouble beforehand.
The FR-A800 has been developed with reliability and safety foremost in mind.

For Improved Equipment Reliability

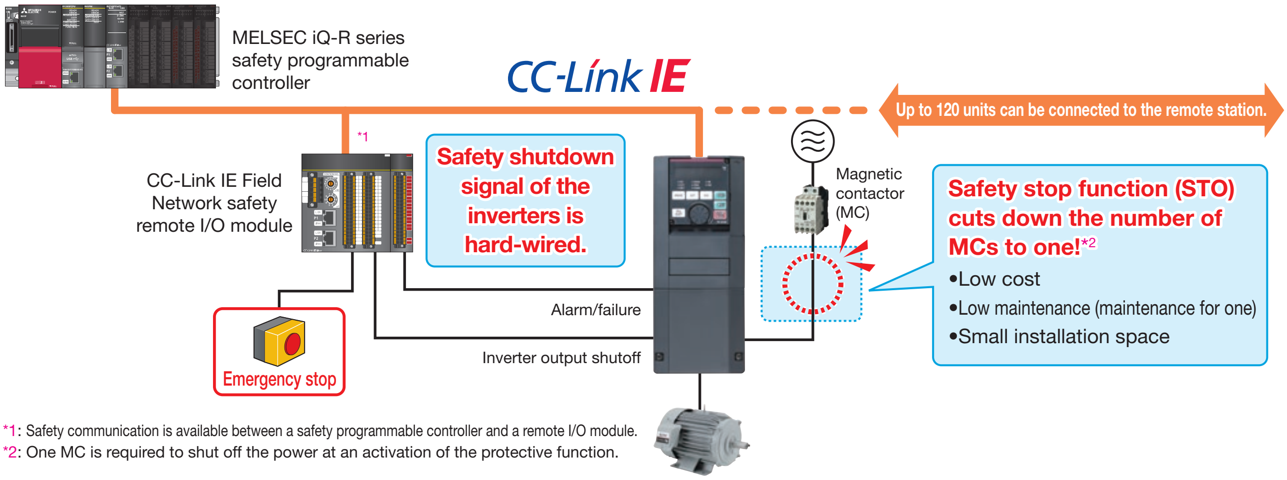
Rapid response is obtained when an unexpected trouble occurs.

(1) Improved system safety

Safety standards compliance **NEW**

Controls with safety functions can be easily performed. The Safe Torque Off (STO) safety function is supported by the inverter. The inverter with the safety function can comply with the safety standards without incurring much expenses.

- PLe and SIL3 are supported as standard.
  - ISO13849-1:2015 Category 3/PLe
  - IEC62061:2015 / IEC61800-5-2:2016 / IEC61508:2010 SIL3

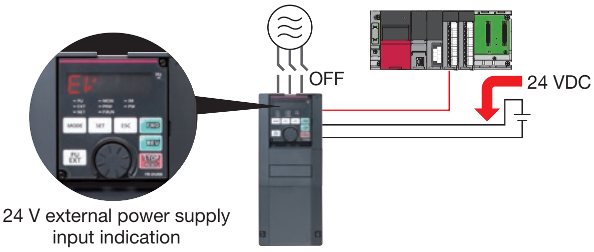


*1: Safety communication is available between a safety programmable controller and a remote I/O module.
*2: One MC is required to shut off the power at an activation of the protective function.

(2) Reliable and secure maintenance

Standard 24 VDC power supply for the control circuit **NEW**

In addition to the existing power supply input terminals (R1 and S1) of the control circuit, 24 VDC input is equipped as standard. The 24 VDC power supplied from outside can be fed to the control circuit locally, enabling the parameter settings, communication operation and safety maintenance without turning ON the main power.



Prevention of trouble with temperature monitoring **NEW**

The inverter is equipped with an internal temperature sensor, which outputs a signal when the ambient temperature is high.
This facilitates the detection of rises in temperature inside the inverter following cooling fan malfunction, or rises in ambient temperature due to inverter operating conditions.

(3) Long life components and life check function

Long life components

- The service life of the cooling fans is now 10 years[*3].
  The service life can be further extended by ON/OFF control of the cooling fan.
- Capacitors with a design life of 10 years[*3*4] are adapted.
  With these capacitors, the service of the inverter is further extended.
- Estimated service lifespan of the long-life parts

Components	Estimated lifespan of the FR-A800[*3]	Guideline of JEMA[*5]
Cooling fan	10 years	2 to 3 years
Main circuit smoothing capacitor	10 years[*4]	5 years
Printed board smoothing capacitor	10 years[*4]	5 years

*3: Surrounding air temperature: Annual average of 40˚C (free from corrosive gas, flammable gas, oil mist, dust and dirt).
The design life is a calculated value from the LD rating and is not a guaranteed product life.
*4: Output current: 80% of the inverter LD rating
*5: Excerpts from “Periodic check of the transistorized inverter” of JEMA (Japan Electrical Manufacturer’s Association).

Enhanced life diagnosis function

- An internal thermal sensor is equipped to all inverters as standard, which enables monitoring of the installation environment.
  Use this function as a guide for the life diagnosis. **NEW**
- Maintenance timers are available for up to three peripheral devices, such as motor and bearing.

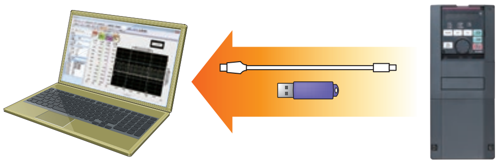

"Maintenance 1 output" warning

(4) Quick reaction to troubles

Easy fault diagnosis **NEW**

- The operating status (output frequency, etc.) immediately before the protection function activates can be stored in the inverter built-in RAM with the trace function. The stored data (trace data) can be copied to a USB memory device or directly imported to a computer, facilitating trouble analysis using the inverter setup software (FR Configurator2).

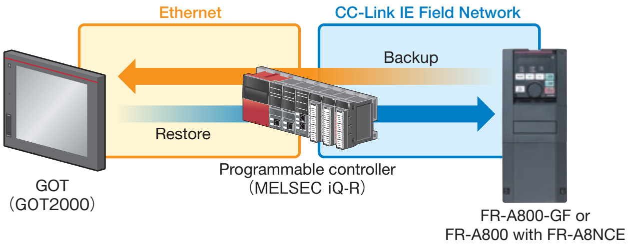
  Trace data stored in the built-in RAM is deleted when the power is turned OFF or the inverter is reset.



- Clock setting is now available in addition to the already-available cumulative energization time. The time and date at a protective function activation are easily identified. (The clock is reset at power-OFF.) The date and time are also saved with the trace data, making the fault analysis easier. By using the real-time clock function with the optional liquid crystal display (LCD) operation panel (FR-LU08) (when using battery), the time is not reset even when the power supply is turned OFF.

Backup/restore **NEW**

- The GOT can be used for backing up inverter's parameter settings and the data used in the PLC function of inverter, and the backup stored in the GOT can be used to restore the data in the inverter.



(5) Renewal assurance

Intercompatibility with existing models

- The inverter installation method is the same as that for the FR-A700 series, eliminating any concerns over replacement.

  Furthermore, FR-A700 series control circuit terminal blocks can be installed with the use of an option (FR-A8TAT).

- The terminal response adjustment function allows a user to adjust the response speed in accordance with the existing facility. **NEW**
- The conversion function of Inverter Setup Software (FR Configurator2) enables parameter copy from an FR-A700 and even from an FR-A500 (to be supported soon).

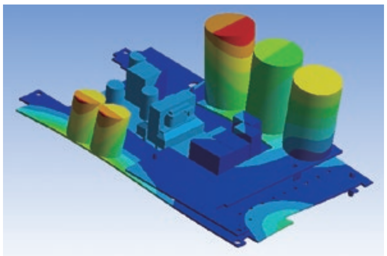
☞ For the compatibilities and differences with the FR-A700 series, refer to page 245.

(6) Reasons for high quality

Design considering the hazardous environment

3D-vibration analysis is performed to confirm the vibration resistance. The analysis is also useful to find the best layout position and to further improve the product's rigidity.

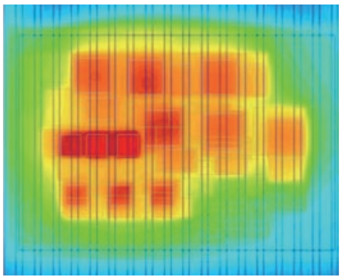
Assuming a hazardous service condition, the product reliability is thoroughly assessed in the design stage. Every effort is made to ensure the best quality of the Mitsubishi Electric inverter.[*6]



3D-vibration analysis

Heat control for high quality

Resistance against heat is what makes an inverter reliable.
A well-designed heat-resistant power module is essential in a reliable inverter. From the power module's design stage, its heat resistance is carefully considered.[*6]



Hydraulic analysis and heat simulation

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*6: The usage beyond the product's specified service condition is not guaranteed.

EASY SETUP & EASY TO USE

A range of equipment and functions are prepared allowing work to be performed anywhere to suit product life cycles.

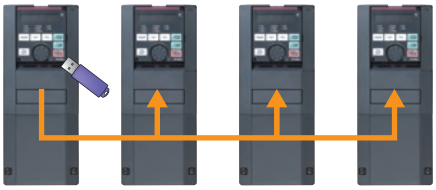
From Startup to Maintenance

Fully equipped with a variety of simple functions and equipment to improve work efficiency.

(1) Streamlining the startup process

Parameter copying with USB memory NEW

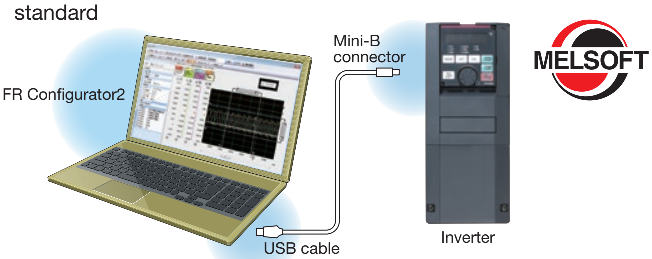
- A USB host connecter (A type), which allows external device connections, has been added.
  Parameters can be copied to commercial USB memory devices. (Refer to page 69)



USB 2.0 (full speed) supported

Easy setup with the Inverter Setup Software (FR Configurator2)

- It is a software which is easy to use and has unity as Mitsubishi Electric FA products with MELSOFT common design and good operability.
- Easy plug-and-play connection to USB terminal equipped as standard

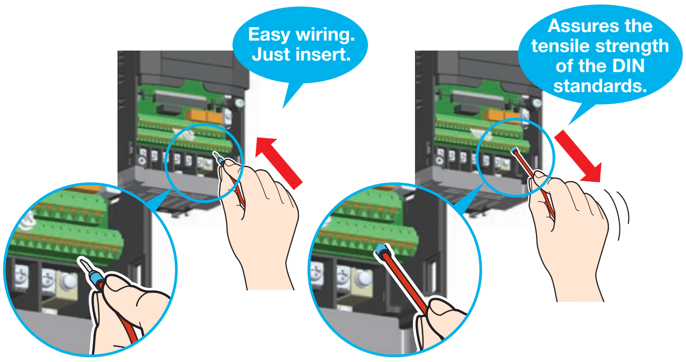


- Free trial version, which contains start-up functions, is available. It can be downloaded at Mitsubishi Electric FA Global Website.

☞ For FR Configurator2, please refer to page 30.

Easy wiring to the control circuit NEW

Spring clamp terminals have been adopted for control circuit terminals. Wires can be protected against loosening under vibrations during transportation of the inverter. Ten additional terminals are used as compared to the FR-A700 series. Round crimping terminals can also be used by employing a control terminal option (FR-A8TR).



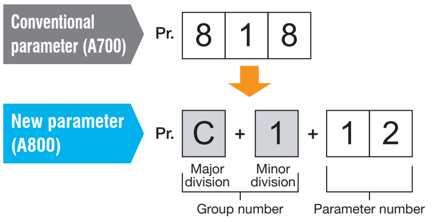
(2) Easy-to-follow display improves the operability

Easy operation with GOT NEW

- Automatic communication is possible without specifying any parameter settings simply by connecting to the GOT2000 series.
- The PLC function device monitor can be displayed at the GOT2000 series.
  Batch control of multiple inverter device monitors is possible with a single GOT unit.
- The sample screen data for the A800 can be found in the screen design software of the GOT2000 series. The newest version of the screen design software can be downloaded from the Mitsubishi Electric FA Global Website.

Easy-to-follow parameter configuration NEW

One of the selectable mode by the operation panel is the Group parameter mode, which provides intuitive and simple parameter settings. (The conventional parameter setting mode is selected by default.)



Major division	Name
E	Environment
F	Acceleration/deceleration
D	Start and frequency commands
H	Protective function
M	Monitor
T	Multi function I/O terminal
C	Motor constant
A	Applications
B	Applications (position control)
N	Communication
G	Control

Easy-to-read operation panel NEW

A 5-digit, 12-segment display has been adopted for the operation panel (FR-DU08) for a more natural character display. Furthermore, an optional LCD operation panel (FR-LU08) adopting an LCD panel capable of displaying text and menus is also available.

FR-DU08 (12-segment type)

FR-LU08 (LCD type) (option)

(3) To aid with maintenance

Reduced wiring check time

Split-type covers are adapted for all capacity models.
Maintenance is now easy because all an operator has to do is to remove the cover for the target wiring area.

Maintenance and control of multiple inverters (Option) NEW

Serial number reading is possible using the optional LCD operation panel (FR-LU08) or the Inverter Setup Software (FR Configurator2). Administration of different inverters has become much more simple.

ECO-FRIENDLY FACTORIES

The power consumption by motors is said to amount about the half of all power consumption made by the Japanese manufacturing industry. Factories can save more energy without dropping their production. Less energy and more production—the FR-A800 series will help you to get the both.

The Next Step — Go Green

Save energy while increasing factory production.

(1) Energy-saving function tailored to system, application

Variety of functions

• Check the energy saving effect at a glance

- You can check the energy saving effect on the energy saving monitor.
- The measured output power amount can be output in pulses.

• Reduce power consumption during standby

- Control circuits other than those for power-related parts can be operated with 24 VDC power supplied from an external power source. **NEW**
  Since the control circuit can use the external 24 VDC, other power control circuits can stay OFF while no driving is required, and that saves the standby energy.
- By turning the cooling fan ON/OFF based on the inverter status, wasteful power consumption during stoppages can be reduced.

• Save energy with Optimum excitation control **NEW**

The excitation current is constantly adjusted to drive the motor in the most efficient method which leads to energy saving.
For example, with optimum excitation control with motor load torque of 10% when using the SF-JR, motor efficiency has increased by approximately 15% over the previous V/F control method.

• Effective use of regenerative energy (option)

Multiple inverters can be connected to the power regeneration common converter (FR-CV)/high power factor converter (FR-HC2) via a common PN bus.

Regenerative power is used at other inverters, and surplus energy is returned to the power supply, resulting in energy saving.
The 315K or higher models are inverter-converter separated types, which are suitable for power regeneration. **NEW**

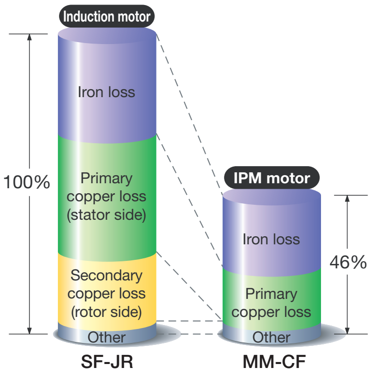
(2) PM motor contributes to the energy saving in factories

PM motor

If the inverter is being used for an application requiring constant-torque, such as a conveyor, factory energy savings can be achieved by replacing your current induction motors with permanent magnet motors (PM motors).
(Tuning is required for an IPM motor other than MM-CF, and for the PM motors of other manufacturers.)

• Why is a PM motor so efficient?

- The current does not flow to the rotor (secondary side), so there is no secondary copper loss.
- Magnetic flux is generated by permanent magnets, so less current is required to drive a motor.



[Comparison of motor losses]
(Example of 1.5 kW motors)

Conveyor

A conveyor transports different goods and products according to its application. A PM motor can keep the carrying speed constant while saving energy.

SYSTEM SUPPORT (NETWORK)

Further Visualization of Information

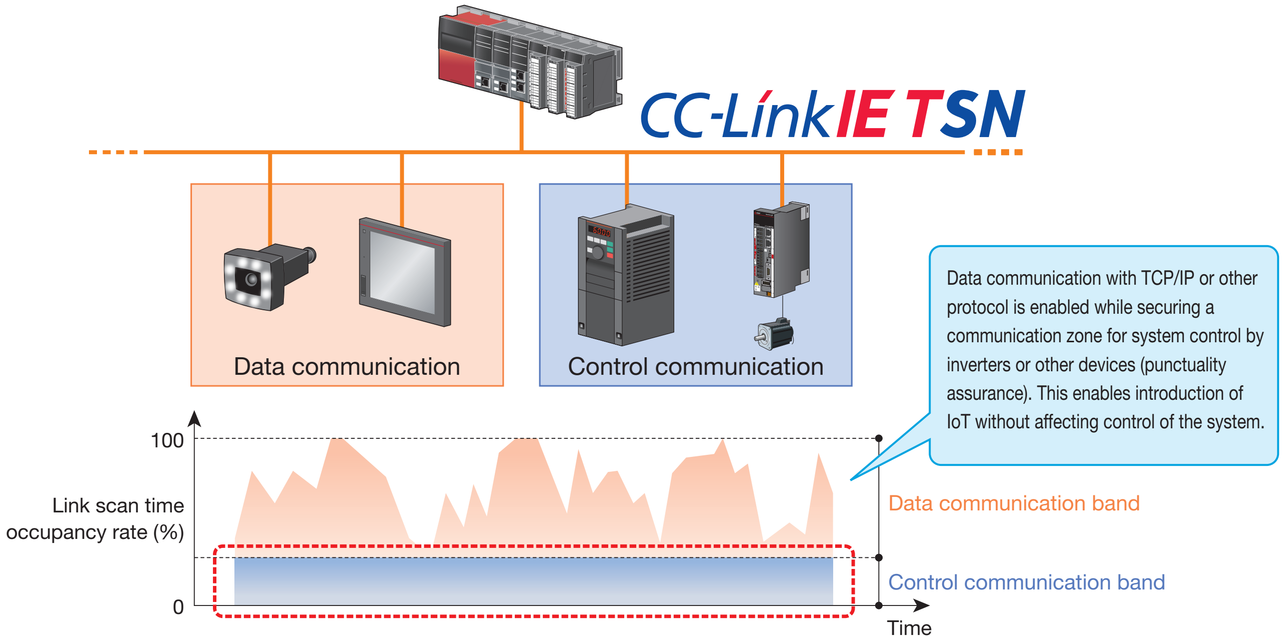
A seamless data interface is offered.

(1) Ethernet communication function integrated

Inverter with communication function ***NEW***

FR-A800-GN CC-Link IE TSN

With the CC-Link IE TSN (Time Sensitive Networking) communication function, data can be transmitted to IT systems while performing real-time cyclic communication control. This will contribute to startup time reduction and maintainability improvement.



Data communication with TCP/IP or other protocol is enabled while securing a communication zone for system control by inverters or other devices (punctuality assurance). This enables introduction of IoT without affecting control of the system.

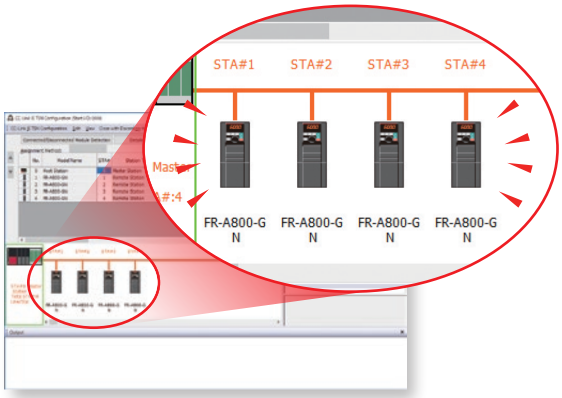
Network load diagram

Startup time reduction

Station numbers are easily set with rotary switches.

Automatic detection of the network configuration by the engineering software (GX Works3) reduces the startup time.

Problems at startup such as line faults can be discovered at a glance with the diagnostic function.



Example of GX Works3 screen

Improved maintainability

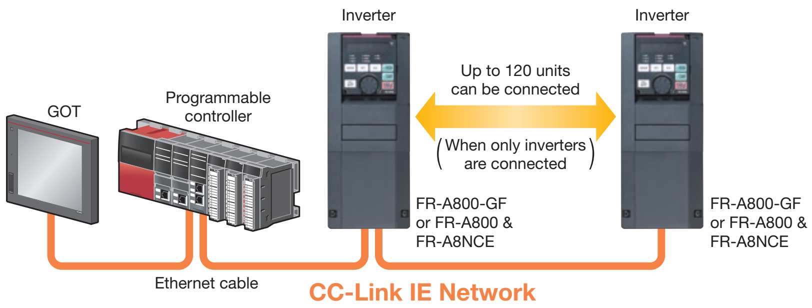
Time synchronization allows for real-time monitoring.

This enables trouble analysis to be performed right after an error has occurred.

FR Configurator2 can be connected via Ethernet, which makes maintenance work easier.

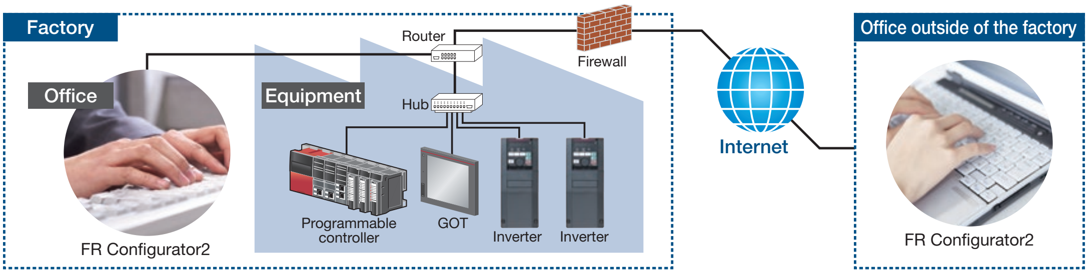
FR-A800-GF **CC-Link IE Field**

The inverter has the CC-Link IE Field Network communication function, which enables immediate operation via the CC-Link IE Field Network.



FR-A800-E **CC-Link IE Field Basic**

The CC-Link IE Field Network Basic is supported, so the network can be created easily. The inverter's status can be monitored and the parameters can be set via Internet. (MODBUS/TCP is also supported.)



CC-Link family compatible with the FR-A800 series inverters

Item		CC-Link IE TSN	CC-Link IE Field	CC-Link IE Field Basic	CC-Link
Compatible inverter		FR-A800-GN, FR-A800 & FR-A8NCG	FR-A800-GF, FR-A800 & FR-A8NCE	FR-A800-E	FR-A800 & FR-A8NC
Communication speed		1 Gbps	1 Gbps	100 Mbps	10 Mbps
Cable		Ethernet category 5e or higher	Ethernet category 5e or higher	Ethernet category 5 or higher	Dedicated cable
Number of connectable inverters		121 (sum of master and slave stations)	64	64 (open specification)[*1]	42 (maximum)
Cyclic communication		Compatible	Compatible	Compatible	Compatible
Number of links[*2]	RX	64	64	64	64
	RY	64	64	64	64
	RWr	128 (256 bytes)	128 (256 bytes)	32 (64 bytes)	32 (64 bytes)
	RWw	128 (256 bytes)	128 (256 bytes)	32 (64 bytes)	32 (64 bytes)
Combination with TCP/IP		Supported	Not supported	Supported	Not supported
Topology		Line, star, ring[*3], line-star	Line, star, ring, line-star	Star	Bus

[*1]: The actual number of connectable inverters differs according to the setting of the master.

[*2]: The numbers of inverter's remote I/O devices and the addresses of inverter's remote registers are common between CC-Link and CC-Link IE Field Network Basic.

[*3]: Ring topology will be supported later.

(2) Other network communication

Communication option

- •CC-Link, SSCNET III (/H), DeviceNet™, PROFIBUS-DPV0 are supported using a compatible communication option. Other Ethernet-based communication such as the CC-Link IE Field Network communication and the FL remote communication can be also supported.
- •A function block (FB) programming for CC-Link communication is available for the MELSEC-Q/L series to create the inverter control sequence programs easily. (The FB library (collection of FB elements) can be downloaded from the Mitsubishi Electric FA Global Website.)
- •The standard model with an RS-485 interface (Mitsubishi inverter protocol, MODBUS® RTU protocol) enables communication with other devices without using a communication option.

SYSTEM SUPPORT (ENVIRONMENT ADAPTABILITY)

Installation Anywhere

Compliant with a variety of standards, our extensive range of the FR-A800 series inverter covers various applications.

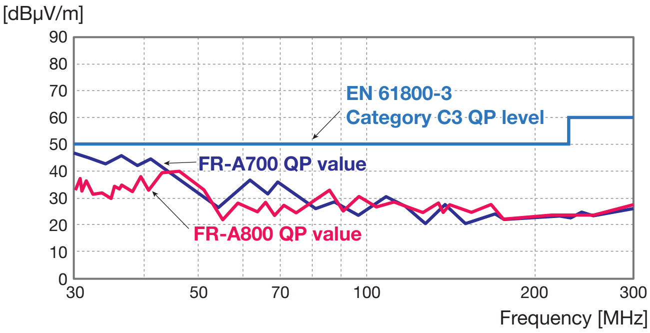
(1) Comprehensive noise countermeasures

Compliance with EU EMC Directive with inverter alone

Troublesome acquisition of standards is unnecessary.

- The FR-A800 series is equipped with an EMC filter as standard for compliance with EMC Directive with the inverter alone. (EN 61800-3 2nd Environment Category C3)
- The newly developed drive technology and the power supply technology minimize the EMI emitted from inverters.

	Capacitive filter (radio noise filter)	Input-side common mode choke (line noise filter)	DC reactor
55K or lower	Standard (built-in)	Standard (built-in)	Option (sold separately)
75K or higher	Standard (built-in)	Option (sold separately)	Option (sold separately)



(2) Global compatibility

Compliance with a variety of standards

- Complies with UL, cUL, and EC Directives (CE marking), and the Radio Waves Act (South Korea) (KC marking). It is also certified as compliant with the Eurasian Conformity (EAC).
- The inverters are compliant with the EU RoHS Directive (Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), friendly to people and to the environment.
- For the 400 V class[*1], compliance with various countries ship classifications allows use on ship equipment. (A noise filter is required for the FR-A840 inverter and the FR-CC2 converter unit, and a ferrite core is required for the FR-A846 inverter. (Refer to page 210.))

Certification body	
NK	(Nippon Kaiji Kyokai)
ABS	(American Bureau of Shipping)
BV	(Bureau Veritas)
LR	(Lloyd's Register of Shipping)
DNV GL	(DNV GL AS)
CCS	(China Classification Society)
KR	(Korean Register of Shipping)

[*1]: The IP55 compatible model with a built-in C3 filter is not compliant with the ship classification standards.

For details of the models compliant with global standards, contact your local sales office.

c UL us LISTED CE KC EAC

(3) Protected in hazardous environment

Circuit board coating

The inverters with PCB coating (IEC60721-3-3 3C2/3S2) and conductive plating are available for improved environmental resistance. ("-60" or "-06" is affixed to the end of the inverter model name.)

(4) Wire saving, space saving

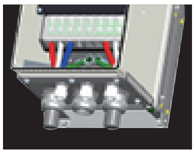
Built-in brake transistor *NEW*

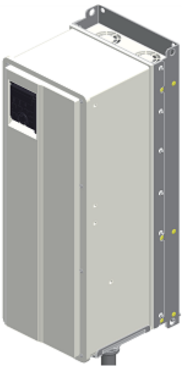
In addition to the 22K and lower, 400 V class 30 to 55K models have also been equipped with a built-in brake transistor. In an application where the motor is hardly decelerated, connecting a brake resistor can shorten the deceleration time; no brake unit or power regeneration converter is required. Wiring, space, and ultimately the cost will be all saved.

(5) Direct installation by the machine

IP55 compatible NEW

- Inverters can be installed nearby the machine, minimizing cable length between the inverter and motor.
- Support is available for use even in high-humidity or dusty environments, facilitating a more flexible choice of installation locations.
- By enclosing a DC reactor, it requires less wiring and less space.
- Compatible with cable glands to meet the IP55 specification at the wiring section.





IP 5 5

- **First digit** (protection rating against solid objects)

IP rating	Description
Class 5	Protection against dust. No ingress of dust that may inhibit normal operation.

- **Second digit** (protection rating against water)

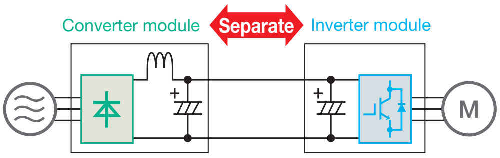
IP rating	Description
Class 5	Protection against water jets from all directions.

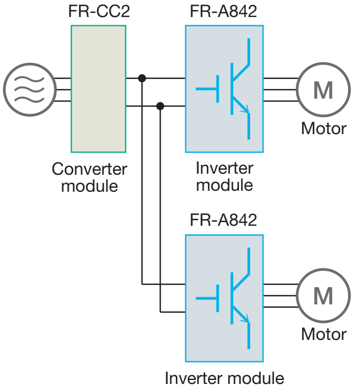
(6) Flexible configuration to meet the needs

Separate inverter and converter modules NEW

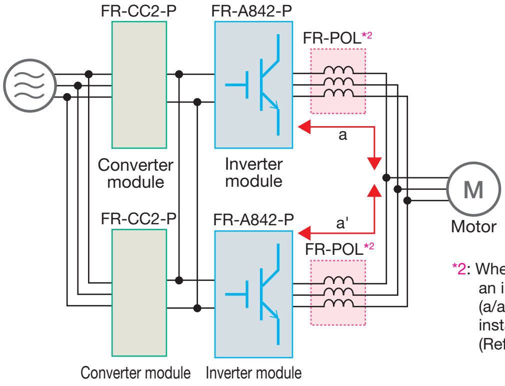
The inverter module and the converter module are physically separated for the 315K or higher capacity models.
Inverter module : FR-A842
Converter module : FR-CC2

This facilitates flexible support for a variety of systems such as common bus line (to be supported soon) and parallel operation. The fuse in the FR-A842 inverter eliminates the need of a fuse between terminals P/+ and N/-. These features allow the installation space to be minimized and costs to be reduced. The converter unit can be run with 12-phase rectifier power supply. Motors up to 1350 kW (LD rating) can be driven by the inverters with parallel operation function (FR-A842-P) and the converter units (FR-CC2-P).





Common bus



Parallel operation

*2: When the cable length from an inverter to the node point (a/a') is less than 10 m, install the FR-POL. (Refer to page 193.)

Some functions from the standard inverter are limited or not available. (Refer to page 248.)

SYSTEM SUPPORT (FUNCTION)

High Equipment Functionality

Numerous functions and the extensive lineup of models are ready to support various systems.

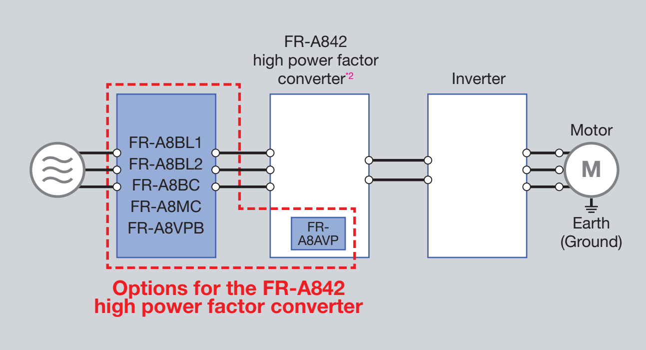
(1) Turn spare inverters into converters

Changeover between inverter and high power factor converter **NEW**

Install the FR-A8AVP (option) in a separated converter type inverter to use it as a high power factor converter. To use the converter, the following options are needed: phase detection transformer box, dedicated filter reactor, dedicated reactor for PWM control, dedicated filter capacitor, inrush current limit resistor, etc.

They can be switched to a converter and back to an inverter again to match process requirements.

The converter is classified as the self-excitation three-phase bridge circuit, and achieves K5 (the conversion factor) = 0. The total harmonic distortion of the input current (THDi) is 5% or less[*1], which facilitates compliance with the overseas standards related to harmonic suppression.



[*1] When the input voltage is distorted, harmonic contents increase because power harmonics flow into the converter.

[*2] FR-A842 inverter serving as a high power factor converter

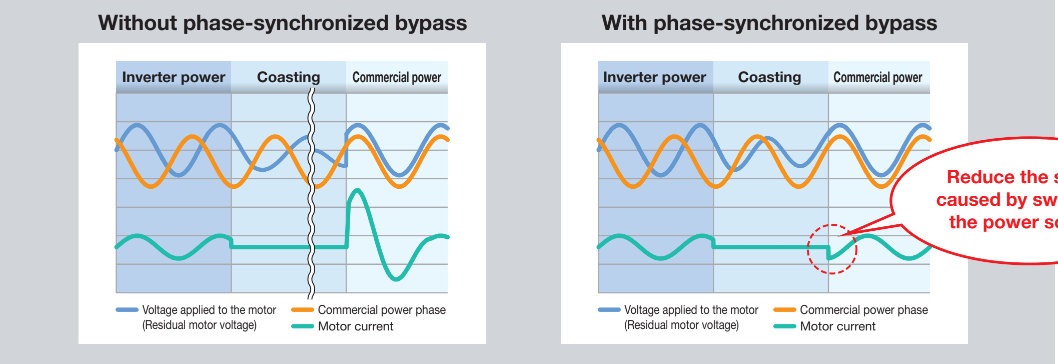
(2) Reduce the shock caused by switching the power source

Phase-synchronized bypass switching (400 V class only) **NEW**

The FR-A8AVP (option) and the FR-A8VPB (option) make it possible to detect the phase of the commercial power supply. (For wiring details, refer to page 186.)

By synchronizing the inverter output with the phase of the commercial power supply, the spike in the motor current can be suppressed and shock reduced.

Furthermore, the time required for the switching is reduced, which is more beneficial for larger inverters.


Without phase-synchronized bypass

With phase-synchronized bypass

(3) Reduced tact time with functionality suited to the application

Anti-sway control **NEW**

When an object is moved by a crane, swinging at the time of stopping is suppressed on the crane's transverse axis or traveling axis. This control cuts down the tact time and facilitates efficient operation.

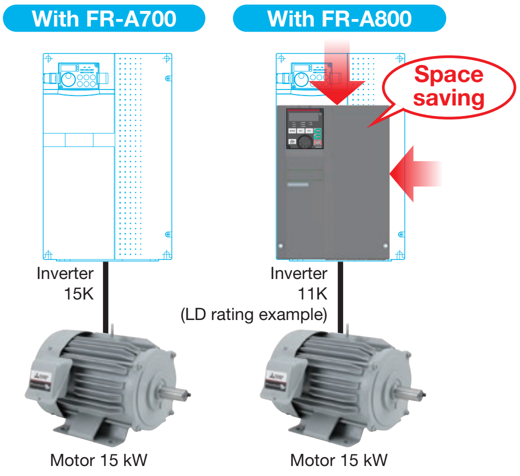
Increased magnetic excitation deceleration **NEW**

Deceleration time can be reduced without a brake resistor.
Tact time can be eliminated at conveyor lines, etc.

(4) Selection of optimum capacity to suit the application

Multiple rating NEW

Rated current and four different overload capacity ratings (SLD rating (super light duty), LD rating (light duty), ND rating (normal duty), HD rating (heavy duty)) can be selected with parameters. The optimum inverter can be selected to suit the application, and by selecting an inverter with SLD or LD rating, equipment size can be reduced when compared with the FR-A700 series. The HD rating is best suited for applications requiring low speed and high torque.
If using an inverter with capacity of 75K or higher, or motor with capacity of 75 kW or higher, always select and install the inverter based on the capacity of the motor with DC reactor.



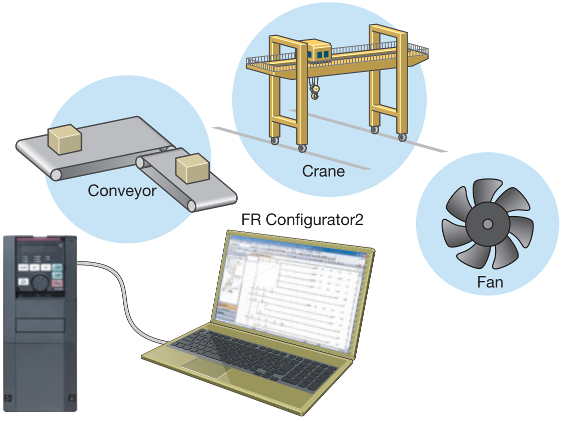
<table>
<tr><th rowspan="2">Rating</th><th>SLD</th><th>LD</th><th>ND</th><th>HD</th></tr>
<tr><th>Super light duty</th><th>Light duty</th><th>Normal duty</th><th>Heavy duty</th></tr>
<tr><td rowspan="4">Application</td><td colspan="3">Fan and Pump</td><td></td></tr>
<tr><td></td><td colspan="2">Tunnel Boring Machines,
Winding and Unwinding, Printing Machines</td><td></td></tr>
<tr><td></td><td></td><td colspan="2">Cranes, Press</td></tr>
<tr><td></td><td colspan="3">Conveyor</td></tr>
<tr><td>Pr.570 (E301) setting</td><td>0</td><td>1</td><td>2 (Initial value)</td><td>3</td></tr>
<tr><td>Overload current rating (inverse-time characteristics)</td><td>110% 60 s,
120% 3 s</td><td>120% 60 s,
150% 3 s</td><td>150% 60 s,
200% 3 s</td><td>200% 60 s,
250% 3 s</td></tr>
<tr><td>Surrounding air temperature</td><td>40°C</td><td>50°C</td><td>50°C</td><td>50°C</td></tr>
</table>

☞ Refer to page 16 for the inverter rating selection.

(5) PLC control with an inverter

Built-in PLC function in an inverter NEW

- Parameters and setting frequency can be changed at the program.
- Inverter control such as inverter operations triggered by input signals, signal output based on inverter operation status, and monitor output can be freely customized based on the machine specifications.
- All machines can be controlled by the inverter alone, and control can also be dispersed.
- Time-based operation is possible by using in combination with the real-time clock function (optional LCD operation panel (FR-LU08)).
- The FR-A800-E enables communication between multiple inverters using the I/O devices and special registers of the PLC function, which can create a small-scale system by Ethernet using the inverter-to-inverter link function.



☞ Refer to page 28 for the details.

Extensive lineup

For the details of the lineup, please contact your sales representative.

•Standard model

F R - A 8 2 0 - 0.4K - 1 - □ □

Symbol	Voltage class
2	200 V class
4	400 V class

Symbol	Structure, functionality
0	Standard model

Symbol*1	Description
0.4K to 280K	Inverter ND rated capacity (kW)

Symbol	Type*2	Communication type
1	FM	RS-485
2	CA	

Symbol	Circuit board coating (IEC60721-3-3 3C2/3S2 compatible)	Plated conductor
None	Without	Without
60	With	Without
06*3	With	With

Symbol	Function
None	Standard type
GF	With built-in CC-Link IE Field Network function
GN	CC-Link IE TSN communication function

F R - A 8 2 0 - 0.4K - E1 - □

Symbol	Voltage class
2	200 V class
4	400 V class

Symbol	Structure, functionality
0	Standard model

Symbol*1	Description
0.4K to 280K	Inverter ND rated capacity (kW)

Symbol	Type*2	Communication type
E1	FM	Ethernet
E2	CA	

Symbol	Circuit board coating (IEC60721-3-3 3C2/3S2 compatible)	Plated conductor
None	Without	Without
60	With	Without
06*3	With	With

Three-phase 200V class FR-A820-□*4	0.4K	0.75K	1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K	75K	90K
	00046	00077	00105	00167	00250	00340	00490	00630	00770	00930	01250	01540	01870	02330	03160	03800	04750
	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Three-phase 400V class FR-A840-□*4	0.4K	0.75K	1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K	75K	90K
	00023	00038	00052	00083	00126	00170	00250	00310	00380	00470	00620	00770	00930	01160	01800	02160	02600
	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	110K	132K	160K	185K	220K	250K	280K										
	03250	03610	04320	04810	05470	06100	06830										
	●	●	●	●	●	●	●										

•IP55 compatible model

F R - A 8 4 6 - 7.5K - 1 - 60 C3

Symbol	Voltage class
4	400 V class

Symbol	Structure, functionality
6	IP55 compatible model

Symbol*1	Description
0.4K to 132K	Inverter ND rated capacity (kW)

Symbol	Type*2	Communication type
1	FM	RS-485
2	CA	
E1	FM	Ethernet
E2	CA	

Symbol	Circuit board coating (IEC60721-3-3 3C2/3S2 compatible)	Plated conductor
60	With	Without
06	With	With

Symbol	EMC filter
C2	Built-in C2 filter
C3	Built-in C3 filter

Three-phase 400V class FR-A846-□ (with a built-in DC reactor)	0.4K	0.75K	1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K	75K	90K
	00023	00038	00052	00083	00126	00170	00250	00310	00380	00470	00620	00770	00930	01160	01800	02160	02600
	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	110K	132K															
	03250	03610															
	●	●															

•Separated converter type

[Inverter]

FR-A842-315K-1-□□

Symbol	Voltage class
4	400 V class

Symbol	Structure, functionality
2	Separated converter type

Symbol*1	Description
315K to 500K	Inverter ND rated capacity (kW)

Symbol	Type*2	Communication type
1	FM	RS-485
2	CA	

Symbol	Circuit board coating (IEC60721-3-3 3C2/3S2 compatible)	Plated conductor
None	Without	Without
60	With	Without
06	With	With

Symbol	Function
None	Standard type
GF	With built-in CC-Link IE Field Network function
P	Parallel operation
GN	CC-Link IE TSN communication function

FR-A842-315K-E1-□

Symbol	Voltage class
4	400 V class

Symbol	Structure, functionality
2	Separated converter type

Symbol*1	Description
315K to 500K	Inverter ND rated capacity (kW)

Symbol	Type*2	Communication type
E1	FM	Ethernet
E2	CA	

Symbol	Circuit board coating (IEC60721-3-3 3C2/3S2 compatible)	Plated conductor
None	Without	Without
60	With	Without
06	With	With

Three-phase 400V class FR-A842-□ *5	315K	355K	400K	450K	500K
	07700	08660	09620	10940	12120
	●	●	●	●	●

[Converter unit]

FR-CC2-H315K-60□

Symbol	Voltage class
H	400 V class

Symbol	Description
315K to 630K	Applicable motor capacity (kW)

Symbol	Circuit board coating (IEC60721-3-3 3C2/3S2 compatible)	Plated conductor
60	With	Without
06	With	With

Symbol	Function
None	Standard type
P	Parallel operation

Three-phase 400V class (with a built-in DC reactor)	315K	355K	400K	450K	500K	560K	630K
FR-CC2-H□	●	●	●	●	●	●	●
FR-CC2-H□-P	—	—	●	●	●	●	—

*1: Models can be alternatively indicated with the inverter rated current (SLD rating).
(For the FR-A842-P and the FR-A846, the current rating is LD or ND. However, the rated current used to represent the model is the SLD rated current of the standard model.)

*2: Specification differs by the type as follows.

Type	Monitor output	Initial setting			
		Built-in EMC filter	Control logic	Rated frequency	Pr.19 Base frequency voltage
FM (terminal FM equipped model)	Terminal FM (pulse train output) Terminal AM (analog voltage output (0 to ±10 VDC))	OFF	Sink logic	60 Hz	9999 (same as the power supply voltage)
CA (terminal CA equipped model)	Terminal CA (analog current output (0 to 20 mADC)) Terminal AM (analog voltage output (0 to ±10 VDC))	ON	Source logic	50 Hz	8888 (95% of the power supply voltage)

*3: Available for the 5.5K or higher.

*4: For using the 75K or higher inverter and a 75 kW or higher motor, always install a DC reactor (FR-HEL), which is available as an option.

*5: Always install the converter unit (FR-CC2(-P)). (Not required when a high power factor converter (FR-HC2) is used.)

●: Released model

Inverter by rating

•200 V class

Inverter model FR-A820-□		SLD (Super light duty)		LD (Light duty)		ND (Normal duty initial value)		HD (Heavy duty)	
		Motor capacity (kW)[*1]	Rated current (A)	Motor capacity (kW)[*1]	Rated current (A)	Motor capacity (kW)[*1]	Rated current (A)	Motor capacity (kW)[*1]	Rated current (A)
0.4K	00046	0.75	4.6	0.75	4.2	0.4	3	0.2	1.5
0.75K	00077	1.5	7.7	1.5	7	0.75	5	0.4	3
1.5K	00105	2.2	10.5	2.2	9.6	1.5	8	0.75	5
2.2K	00167	3.7	16.7	3.7	15.2	2.2	11	1.5	8
3.7K	00250	5.5	25	5.5	23	3.7	17.5	2.2	11
5.5K	00340	7.5	34	7.5	31	5.5	24	3.7	17.5
7.5K	00490	11	49	11	45	7.5	33	5.5	24
11K	00630	15	63	15	58	11	46	7.5	33
15K	00770	18.5	77	18.5	70.5	15	61	11	46
18.5K	00930	22	93	22	85	18.5	76	15	61
22K	01250	30	125	30	114	22	90	18.5	76
30K	01540	37	154	37	140	30	115	22	90
37K	01870	45	187	45	170	37	145	30	115
45K	02330	55	233	55	212	45	175	37	145
55K	03160	75	316	75	288	55	215	45	175
75K	03800	90/110	380	90	346	75	288	55	215
90K	04750	132	475	110	432	90	346	75	288

•400 V class

Inverter model FR-A84□-□		SLD (Super light duty)		LD (Light duty)		ND (Normal duty initial value)		HD (Heavy duty)	
		Motor capacity (kW)[*1]	Rated current (A)	Motor capacity (kW)[*1]	Rated current (A)	Motor capacity (kW)[*1]	Rated current (A)	Motor capacity (kW)[*1]	Rated current (A)
0.4K	00023	0.75	2.3	0.75	2.1	0.4	1.5	0.2	0.8
0.75K	00038	1.5	3.8	1.5	3.5	0.75	2.5	0.4	1.5
1.5K	00052	2.2	5.2	2.2	4.8	1.5	4	0.75	2.5
2.2K	00083	3.7	8.3	3.7	7.6	2.2	6	1.5	4
3.7K	00126	5.5	12.6	5.5	11.5	3.7	9	2.2	6
5.5K	00170	7.5	17	7.5	16	5.5	12	3.7	9
7.5K	00250	11	25	11	23	7.5	17	5.5	12
11K	00310	15	31	15	29	11	23	7.5	17
15K	00380	18.5	38	18.5	35	15	31	11	23
18.5K	00470	22	47	22	43	18.5	38	15	31
22K	00620	30	62	30	57	22	44	18.5	38
30K	00770	37	77	37	70	30	57	22	44
37K	00930	45	93	45	85	37	71	30	57
45K	01160	55	116	55	106	45	86	37	71
55K	01800	75/90	180	75	144	55	110	45	86
75K	02160	110	216	90	180	75	144	55	110
90K	02600	132	260	110	216	90	180	75	144
110K	03250	160	325	132	260	110	216	90	180
132K	03610	185	361	160	325	132	260	110	216
160K	04320	220	432	185	361	160	325	132	260
185K	04810	250	481	220	432	185	361	160	325
220K	05470	280	547	250	481	220	432	185	361
250K	06100	315	610	280	547	250	481	220	432
280K	06830	355	683	315	610	280	547	250	481
315K	07700	400	770	355	683	315	610	280	547
355K	08660	450	866	400	770	355	683	315	610
400K	09620	500	962	450	866	400	770	355	683
450K	10940	560	1094	500	962	450	866	400	770
500K	12120	630	1212	560	1094	500	962	450	866

•Overload current rating

SLD	110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature of 40°C
LD	120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C
ND	150% 60 s, 200% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C
HD	200% 60 s, 250% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C

[*1] The applicable motor capacity is the maximum applicable capacity of a Mitsubishi Electric 4-pole standard motor.

☞ For selection of the DC reactor and the converter unit, refer to page 223.

Dedicated inverter for specialized field

FR-A800 Plus

Series

FR-A800-CRN

- **Reduction in tact time**
  Specialized functions such as anti-sway control facilitate efficient operation.
- **Load slippage prevention**
  Optimum brake operation is obtained. It is possible to detect the slippage at a start of operation.
- **Dedicated monitoring functions**
  Overload detection and start time counting are possible.
- **Easier maintenance**
  Protection against vibration, dust and dirt, or corrosion is also available.

A800 Plus

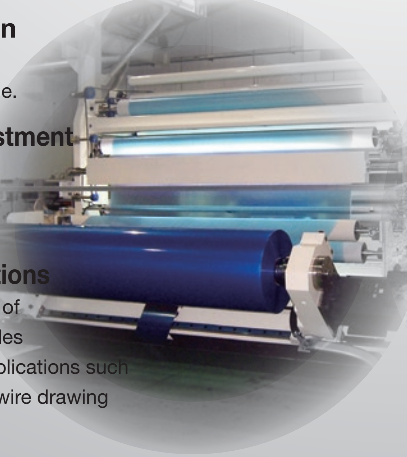
A800 Plus

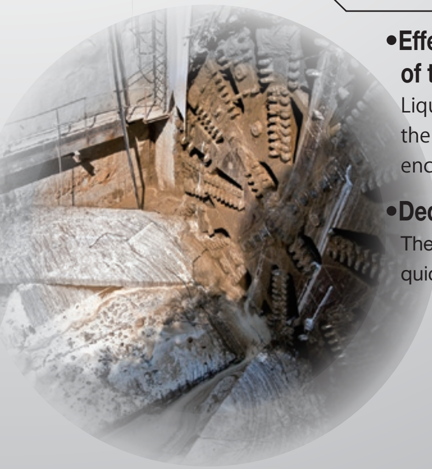
A new lineup of dedicated inverters for specialized fields are born!

Plus! The optimum functions for each dedicated field are added to the already high performance and high functionality FR-A800 series inverter.

FR-A800-R2R

- **System simplification**
  Winding/unwinding can be stabilized by the inverter alone.
- **Easy startup and adjustment**
  Parameters can be used for mechanical adjustment according to applications.
- **Wide range of applications**
  The inverter offers four types of control functions which enables the use in various system applications such as winding/unwinding in the wire drawing machines and printers.





FR-A800-LC

- **Effective solution for downsizing of the enclosure**
  Liquid cooling enables installation of the cooling system outside of the enclosure.
- **Dedicated monitoring functions**
  The coolant flow is monitored for quick detection of system faults.

Dedicated inverter for specialized field

FR-A800 Plus

Series

Crane
FR-A800-CRN

Roll to Roll
FR-A800-R2R

Liquid cooled
FR-A800-LC

Pursuing optimum functions to meet our customers' needs

A lineup of dedicated inverters for specialized fields are offered.

Plus! The optimum functions for each dedicated field are added to the already high performance and high functionality FR-A800 series inverter.

Optimum functions for cranes

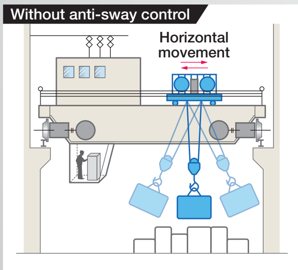
FR-A800-CRN

The inverter has various functions ideal for a crane application such as reduction in tact time, load slippage prevention, etc.

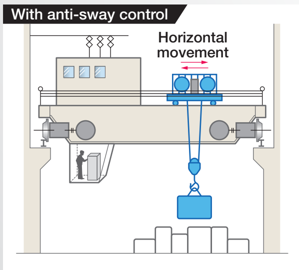
Reduction in tact time

By using the Mitsubishi Electric's original anti-sway control technology, the swinging of an object moved by a crane is suppressed at the time of stopping, even without operator's input adjustment. This control cuts down the tact time and facilitates efficient operation.

Without anti-sway control



With anti-sway control



Load slippage prevention

- The highly scalable brake sequence function enables the output of a brake opening signal for the optimum brake operation calculated from the load torque or the speed.
- Slippage during the start of a lift can be checked. (A speed detector such as an encoder is required.)

Dedicated monitoring functions

- A signal can be output when too much load is applied.
- The inverter starting times can be counted to determine the timing of the maintenance.

Easier maintenance

- A strong vibration may occur in some operating conditions, for example, during the crane traveling. Inverters with enhanced vibration resistance are available. They have components fixed to the circuit board with adhesive and wires that are tied in place with cable ties.
- Using the inverter in a dusty environment may cause faults such as a short circuit. Inverters with circuit board coating (conforming to IEC 60721-3-3 3C2/3S2) and plated conductors are available for improved environmental resistance.

Model

F R - A 8 2 0 - 0.4K - 1 - 60 CRN

Symbol	Voltage class
2	200 V class
4	400 V class

Symbol	Structure, functionality
0	Standard model*4
2	Separated converter type

Capacity*1	Description
0.4K to 500K	Inverter ND rated capacity (kW)

Symbol	Type	Communication type
1	FM	RS-485
2	CA*2	
E1	FM	Ethernet
E2	CA*2	

Symbol	Circuit board coating (IEC60721-3-3 3C2/3S2 compatible)	Plated conductor
60	With	Without
06*3		With
61		Without
16*3		With

Symbol	Dedicated function
CRN	Crane dedicated model

Inverter model	Inverter capacity
FR-A820	0.4kW to 90kW
FR-A840	0.4kW to 280kW
FR-A842	315kW to 500kW

*1: Models can be alternatively indicated with the inverter rated current (SLD rating).

*2: For the CA type, the monitor output terminal F/C operates as terminal CA (analog current output: 0 to 20 mADC), not as terminal FM (pulse train output).

*3: Available for the 5.5K or higher.

*4: For the 75K or higher inverter, or whenever a 75 kW or higher motor is used, always connect a DC reactor (FR-HEL), which is available as an option.

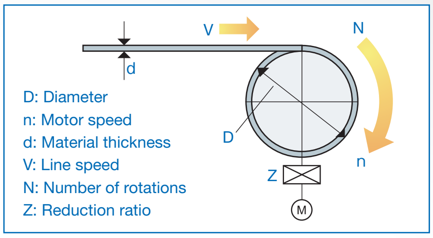
Optimum functions for roll to roll applications

FR-A800-R2R

The inverter can be used in a wide variety of systems with various dedicated functions. High productivity can be achieved by stable tension control.

System simplification

The FR-A800-R2R inverter has various dedicated functions such as winding diameter calculation, providing stable winding/unwinding control independently.



Easy startup and adjustment

- Mechanical adjustment according to applications can be achieved just by setting parameters, which enables the startup and adjustment work of the system by the inverter alone.
- Tension PI gain tuning: By automatically adjusting the tension PI gain for PID control, the time required for adjustment is significantly cut down.

Wide range of applications

The inverter offers four types of control functions which enables the use in various system applications such as winding/unwinding in the wire drawing machines and printers.

- Dancer feedback speed control
- Tension sensor feedback speed control
- Tension sensorless torque control
- Tension sensor feedback torque control

Model

FR-A820-0.4K-1-☐R2R

Symbol	Voltage class
2	200 V class
4	400 V class

Symbol	Structure, functionality
0	Standard model*4
2	Separated converter type

Capacity*1	Description
0.4K to 500K	Inverter ND rated capacity (kW)

Symbol	Type	Communication type
1	FM	RS-485
2	CA*2	
E1	FM	Ethernet
E2	CA*2	

Symbol	Circuit board coating (IEC60721-3-3 3C2/3S2 compatible)	Plated conductor
None	Without	Without
60	With	
06*3		With

Symbol	Dedicated function
R2R	Roll to roll dedicated model

Inverter model	Inverter capacity
FR-A820	0.4kW to 90kW
FR-A840	0.4kW to 280kW
FR-A842	315kW to 500kW

*1: Models can be alternatively indicated with the inverter rated current (SLD rating).

*2: For the CA type, the monitor output terminal F/C operates as terminal CA (analog current output: 0 to 20 mADC), not as terminal FM (pulse train output).

*3: Available for the 5.5K or higher.

*4: For the 75K or higher inverter, or whenever a 75 kW or higher motor is used, always connect a DC reactor (FR-HEL), which is available as an option.

Liquid Cooled Type Inverter

FR-A800-LC

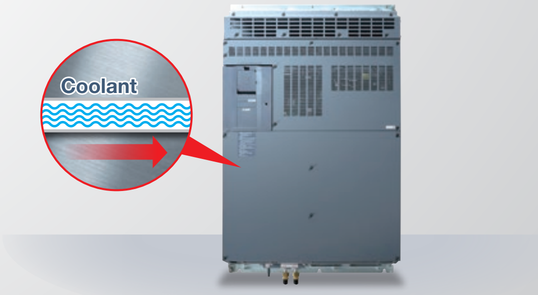
Coolant is used for cooling the inside of the inverter. Liquid cooling enables the use of inverters for tunnel boring machines or chillers in the environments where heat is difficult to be dissipated.

Effective solution for downsizing of the enclosure

A smaller enclosure can be used since the quantity of the heat dissipated in the enclosure is reduced.

Dedicated monitoring functions

A sensor (flow switch) is attached at the inlet of coolant to send a signal to the inverter. When the coolant flow rate decreases, a warning is output, enabling quick, direct detection of system faults.



Model

FR-A840-280K-1-☐LC

Symbol	Voltage class
4	400 V class

Symbol	Description
110K to 280K	Inverter ND rated capacity (kW)
03250 to 06830	Inverter rated current (SLD rated current of the standard FR-A800 inverter) (A)

Symbol	Type	Communication type
1	FM	RS-485
2	CA*1	
E1	FM	Ethernet
E2	CA*1	

Symbol	Circuit board coating (IEC60721-3-3 3C2/3S2 compatible)	Plated conductor
None	Without	Without
60	With	
06		With

Symbol	Function
LC	Liquid cooled type

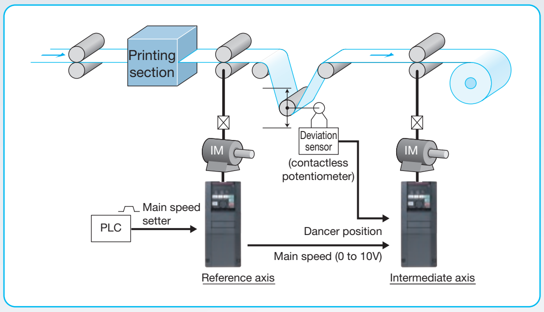
*1: For the CA type, the monitor output terminal F/C operates as terminal CA (analog current output: 0 to 20 mADC), not as terminal FM (pulse train output).

Application example

BEST SUITED FOR EVERY MACHINE

Line Control (Winding and Unwinding)





Point

Material tension is kept constant by employing speed control and torque control to eliminate slack and uneven winding. By using a motor with the speed ratio most appropriate for the machine, the inverter capacity can be downsized.

Typical industries

- Textile industry
- Steel industry
- Pulp, paper, paper products manufacturing industries

Dancer control NEW

The dancer control detects the dancer roll positions and performs PID operation to keep the sheet tension constant.

Traverse function NEW

The traverse function, used for the traverse axis of spinning machine, prevents uneven winding or collapsing.

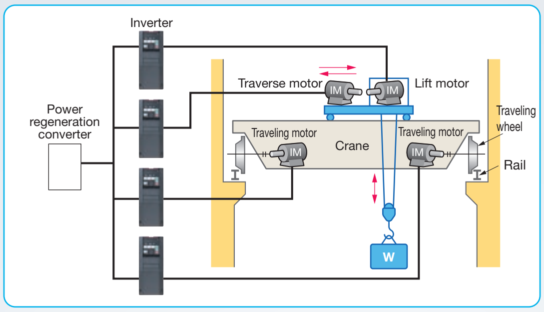
Torque accuracy

	Real sensorless vector control	Vector control
Torque control range	1 : 20	1 : 50
Absolute torque accuracy[*1]	±20%	±10%[*3]
Repetitive torque accuracy[*2]	±10%	±5%[*3]

[*1] Difference between the actual torque and the torque command
[*2] Fluctuation between the average of the actual torque and the actual measured torque (repeatability of the torque)
[*3] When online auto tuning (adaptive magnetic flux observer) enabled

Cranes





Point

Relentless operation is possible with HD rating when lifting. And when traveling, vibrations applied to objects being conveyed are suppressed with anti-sway control, facilitating efficient operation.

Typical industries

- Lumber, wood product manufacturing industries
- Steel industry
- Warehousing
- Water transportation
- Textile industry
- Metal products manufacturing

High torque at low speed

[Starting torque] ■Real sensorless vector control 200% (ND rating)
■Vector control 200% (ND rating)
(150% of initial setting for the 5.5K and higher)
[Zero-speed torque] ■Vector control: 200% (Select HD rating.)

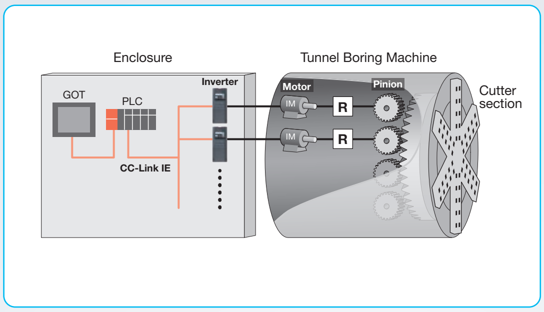
PLC function NEW

By employing synchronous operation for gate-type cranes, positional displacement of both axes is corrected during travel, achieving highly accurate control without using an external controller.

Anti-sway control NEW

When an object is moved by a crane, swinging at the time of stopping is suppressed on the crane's transverse axis or traveling axis.
This control cuts down the tact time and facilitates efficient operation.

Tunnel Boring Machines



Point

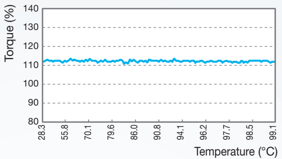
Inverters can be used to provide high starting torque for digging, and for transferring earth and sand after digging. A lineup of products compatible with the IP55 protective structure is available as a separate series.

Typical industries

Construction industry

Real sensorless vector control

Motors are controlled without encoders, which are susceptible to hazardous environment. Use of such motors naturally provides higher reliability. Torque accuracy has also improved because the temperature is better controlled.



Temperature/torque characteristics

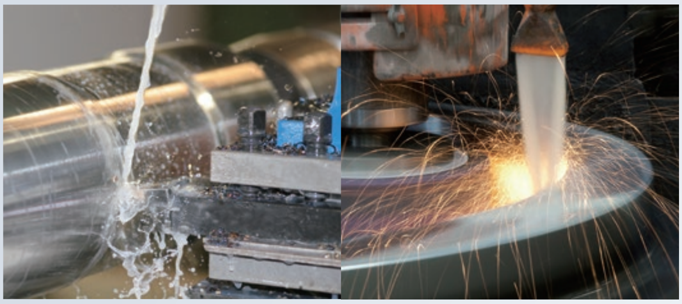
Droop control

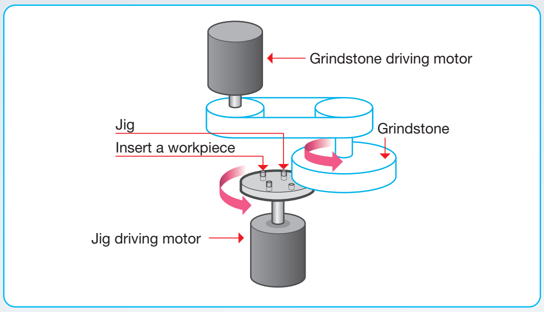
This function balances the load between motors when using multiple inverters.

CC-Link IE communication

CC-Link IE communication enables a programmable controller or a GOT to control multiple inverters. By using Ethernet cables, less wiring is required.

Machine Tools





Point

The rotation speed can be set according to the material being processed. Stable high-speed rotation is also possible.

Typical industries

Metal products manufacturing

High-speed operation

[Operating frequency] ■V/F control 590 Hz
■Vector control 400 Hz
■Real sensorless vector control 400 Hz

Torque limit function

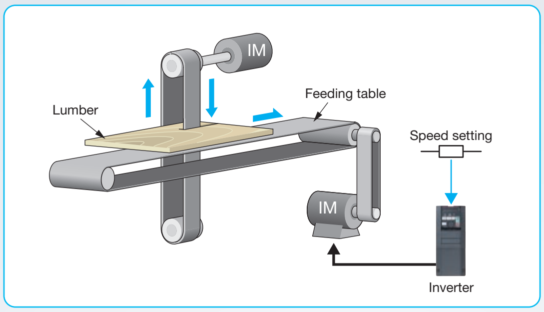
This is effective in preventing machine damage (tool damage prevention, etc.) due to sudden disturbance torque.

Orientation control (vector control)

The inverter can adjust the stop position (Orientation control) using an encoder attached to a place such as the main shaft of the machine.

BEST SUITED FOR EVERY MACHINE

Wood Processing Machines



Point Even when processing areas of varying hardness such as lumber knots, processing time delays are suppressed by minimizing reductions in motor speed.

Typical industries

- Lumber, wood product manufacturing industries
- Forestry

Real sensorless vector control, vector control

Improved speed response to sudden load fluctuations when compared with the previous model (FR-A700).

[Response speed]

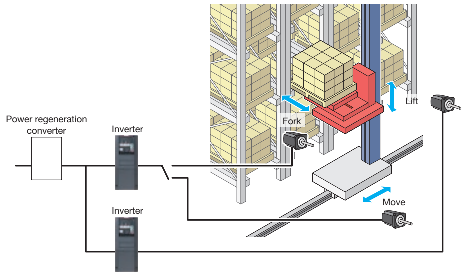
- ■Real sensorless vector control 50 Hz*1 (A700: 20 Hz)
- ■Vector control 130 Hz (A700: 50 Hz)

*1: At 3.7 kW with no load. Differs depending on the load conditions and motor capacity.

Torque limiting function

This function is effective in preventing machine damage (tool damage, etc.) due to sudden disturbance torque.

Conveyance



Point The new series offers a wealth of functionality suited to applications such as high-accuracy conveyance and target position stoppage, which contributes to reduction in tact time.

Typical industries

- Steel industry
- Lumber, wood product manufacturing industries
- Water transportation, fishing industry
- Metal products manufacturing
- Textile industry
- Warehousing

PM sensorless vector control

Multiple axes are strictly controlled to run at the same speed without using a driving belt. This control method provides driving accurate enough for transporting glass substrates without damaging them. Simple positioning control is also available.

(when high frequency superposition control selected in combination with MM-CF)

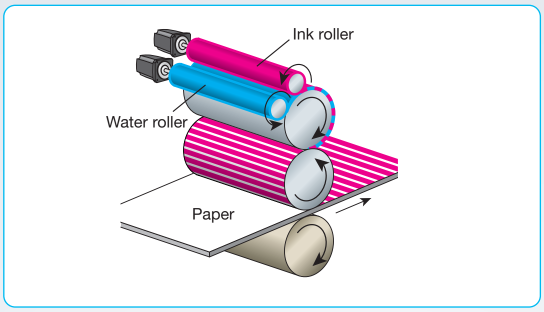
Increased magnetic excitation deceleration NEW

Deceleration time can be reduced without a brake resistor.
Tact time can be eliminated at conveyor lines, etc.

PLC function NEW

When a few sensors are used to check the presence of goods on a conveyor and the arrival of such goods, the inverter can directly receive such signals from the sensors for the PLC control.

Printing Machines



Point The highly-accurate speed control minimizes color unevenness and displaced prints.

Typical industries

- Printing and related industries

Speed control

	Real sensorless vector control	Vector control	PM sensorless vector control
Speed response	50 Hz*1	130 Hz	50 Hz
Speed control range	1:200 (when power drive at 0.3 Hz to 60 Hz)	1:1500 (both driving/ regeneration*2)	1:1000*3 (when HD rating selected)

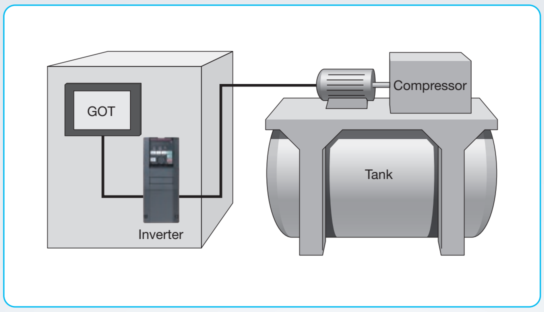
*1: At 3.7 kW with no load. Differs depending on the load conditions and motor capacity.
*2: If using regeneration unit (option) during regeneration
*3: When high frequency superposition control selected in combination with the MM-CF

PM sensorless vector control

The speed fluctuations of the ink roller axis and water roller axis are minimized to eliminate print unevenness.

[Speed fluctuation ratio] ±0.05% (Digital input)
"No encoder" means less trouble and higher reliability.

Compressors



Point The PM sensorless vector control is useful in generating high starting torque. By using this control method with an IPM motor, much power can be saved. This small motor also makes the machine small.

Typical industries

Steel industry	Metal products manufacturing
Lumber, wood product manufacturing industries	Textile industry
Water transportation, fishing industry	Warehousing

PM sensorless vector control

Smooth operation is possible even at start-up under high load.

[Starting torque] 1.5 kW or lower: 200%, 2.0 kW or higher: 150%
When high frequency superposition control selected in combination with MM-CF

PID control

Pressure can be automatically adjusted by converting signals from the encoder to inverter input signals and feeding them back.

Parallel operation function NEW

Even a large compressor can be operated by FR-A842-P inverters with parallel operation function, which can operate a 630 kW or higher motor.

PLC function

CONTRIBUTION TO FACTORY AUTOMATION

The PLC function will help you to provide the control sequence best suited for the machine specifications.

1 Inverter operation sequence customized for the machine

- A set of operations (operation at different signal inputs, signal and monitor outputs at different inverter status, etc.) can be freely programmed in accordance with the machine specifications. For example, a shutter opening/closing can be performed based on a signal from a sensor, or based on the opening/closing times.
  Control programs can be created in sequence ladders using the inverter setup software (FR Configurator2).

2 Realizes the decentralized control

- The control of the whole system is decentralized to inverters that mange their subordinating devices individually.
- A group of dedicated sequence programs is created and saved in each inverter. The master controller no longer has to process all the sequence programs, and the decentralized system accepts program changes more flexibly.

3 Automatic operation in accordance with the time

- With the real-time clock, automatic operation can be performed at certain times (when the optional LCD operation panel (FR-LU08) is used).

4 Useful functions

• User parameter

Up to 50 parameters, which are linked with the data registers, can be saved. The variables (data registers) used in the PLC function can be saved as inverter parameters. Furthermore, parameter settings can be saved in the EEPROM of inverter. When results of calculation using the PLC function are saved in the parameters, the data can be retained after the power is turned OFF.

• User initiated fault

Inverter output can be shut off under conditions other than those of the existing protective functions. Up to five specific fault-initiating conditions can be set to activate a protective function and shut off the inverter output.

• Monitored item for the user

Special register values can be displayed for monitoring on the operation panel. Arbitrary data designated by the user such as results of calculation using the PLC function can be displayed.

• Inverter parameter read/write

Parameter settings can be changed using sequence programs. The acceleration/deceleration patterns can also be set with sequence programs to be changed at certain operation statuses. You can choose RAM or EEPROM to save the parameter settings. When the settings are changed frequently, choose RAM.

• PID function

Two different loops of PID inverter operations can be pre-set, and those can be controlled using sequence programs.

• Inverter operation lock

The inverter operation can be restricted for the command sources other than the sequence programs.

PLC function

Item	Description
I/O	
General-purpose I/O	Sequence programs enable I/O signal transmission to/from the inverter and its plug-in options.
Analog I/O	Sequence programs enable reading of analog input values or analog output transmission by the inverter, and analog output transmission to the plug-in options.
Pulse train I/O	Sequence programs enable pulse train inputs (to terminal JOG) and pulse train outputs (from terminal F/C(FM)).
Inverter parameter read/write	Sequence programs enable inverter parameter write/read.
User parameter	Fifty user parameters (Pr.1150 to Pr.1199) are available and are linked with the data registers D206 to D255, which accept direct access by sequence programs.
CC-Link	A plug-in option (FR-A8NC) enables handling of remote registers as arbitrary data in the sequence programs.
Special function	
PID operation	Inverter's PID operations can be set (up to two loops).
User initiated fault	Up to five fault-initiating conditions can be set to activate a protective function.
Fault clear	The protective function occurring in the inverter can be reset.
Inverter operation lock	Inverters can start up while the PLC function is running.
Monitored item for the user	Desired data is displayable on the operation panel.

Application example

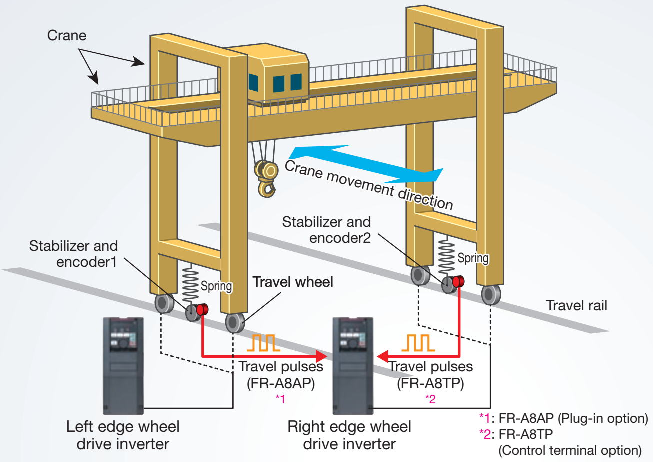
Crane control

Point

The traveled distance (total number of travel pulses) of each wheel is directly read from the encoder installed at the wheel. The pulses from the two wheels are then compared, and their speed is adjusted to synchronize the wheel positions. There is no need to use an external controller to offset speed, allowing high accuracy control.

User initiated fault

Up to five protective functions operating under specific conditions can be set. Protective functions can be triggered to block inverter output at such times as when positional displacements are not eliminated even after offsetting speed over a fixed period of time, or pulses from the PLGs on both wheels are not input.



*1: FR-A8AP (Plug-in option)
*2: FR-A8TP
(Control terminal option)

Conveyor control

Point

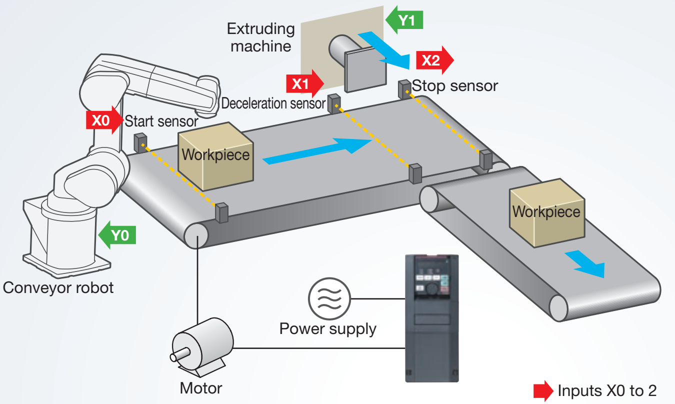
The workpiece positions detected by sensors are directly reported to the inverter, and the inverter sends out the operation commands to the conveyor robot and to the extruding machine. Whole control can be performed by an inverter, in accordance with the movement of its peripheral equipment.

Inverter parameter read/write

Changes can be made to inverter parameters from the sequence program. The acceleration/deceleration time and pattern can be set based on the type of workpiece.

Inverter operation lock

Operation is possible only when the sequence function is enabled. Changes to settings caused by operator error can be avoided.



🟥 Inputs X0 to 2
🟩 Outputs Y0 to 1

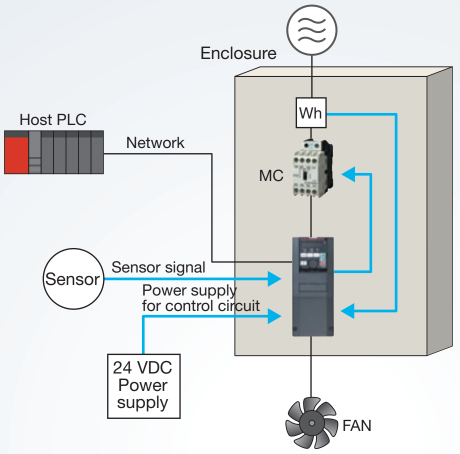
Fan control

Point

Signals sent via the enclosure (relay panel, etc.) such as input magnetic contactor signals, watt hour meter signals, and sensor signals can be read directly into the inverter and controlled. A fan can be controlled in accordance with the conditions without using relays, etc.
Furthermore, by using an external 24 VDC power source for the control power supply, input machine signals can be turned ON and OFF regardless of whether there is an input power source. And by employing an external 24 VDC power supply for the control power, input machine signals can be turned ON and OFF, regardless of the existence of a main circuit power supply.

CC-Link

A plug-in option (FR-A8NC) enables handling of remote registers as arbitrary data in the sequence programs.
A variety of equipment inside the factory can be centrally controlled with a CC-Link Network.



Inverter setup software

FR Configurator2 (SW1DND-FRC2)

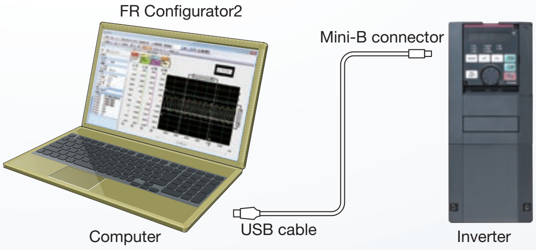
DELIVERING A COMFORTABLE INVERTER OP

From inverter startup to maintenance, this versatile software allows the user to specify settings easily at the computer.

[Compatible operating systems]
Windows® 10, Windows® 8.1/Pro/Enterprise, Windows® 8, Windows® 7, (32-bit, 64-bit), Windows Vista® (32-bit)

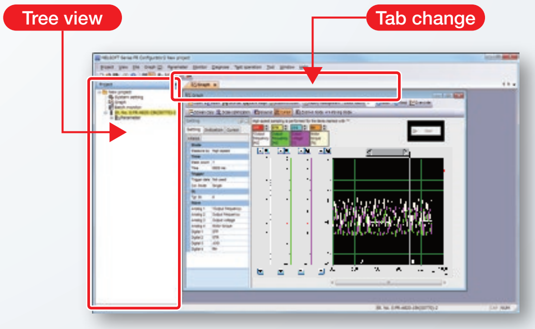
Easy connection with a USB cable

A USB connector (Mini-B connector) is provided as standard. Easy connection to the computer without the need for a converter.



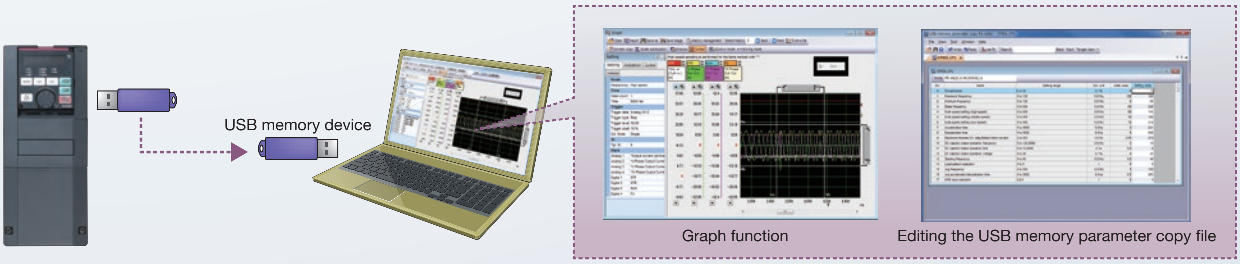
Intuitive user interface

Connected inverters are displayed in tree view format. Windows for each function can be accessed by changing the tab for maximum efficiency.



Work can be carried out away from the equipment using a USB memory device

By loading trace data and parameter settings copied to a USB memory device into FR Configurator2, analysis and adjustments can be carried out with ease away from the equipment.

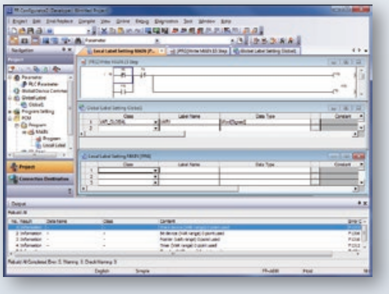


Graph function

Editing the USB memory parameter copy file

Sequence control (Developer function)

The Developer function is used for creating sequence programs and writing them to the inverter to enable the use of the PLC function of the inverter.



Free trial version Supported

The function with the marking above is available in the free trial version (usable free of charge with limited functions). It can be downloaded at Mitsubishi Electric FA Global Website.

Function	Free trial version
Parameter list	○
Diagnosis	○
Graph	×
Batch monitor	×
Test operation	○
I/O terminal monitor	×
Convert	○

Function	Free trial version
Developer	×
USB memory parameter copy file edit	×
Ethernet parameter setting	○
iQSS backup file conversion	○
Help	○

○: Available, ×: Not available

A full functional trial version, which has the same functionality as the release version, is also offered for a limited period of 20 days.

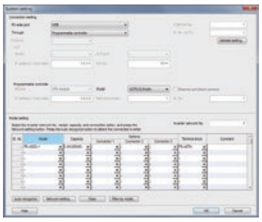
OPERATING ENVIRONMENT

1 Efficient startup settings

System settings

Free trial version **Supported**

This sets the method used to connect the inverters and the computer. Automatic recognition of connected inverters can also be set. The station number, model, capacity, and plug-in options of the connected inverters can also be set manually.



Test operation

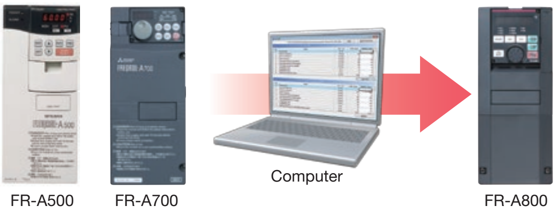
Free trial version **Supported**

Operating commands, frequency settings, and the operating mode can be set for the selected inverter.

Conversion function

Free trial version **Supported**

Parameters can be set with the parameter auto conversion function when renewing from the FR-A700 series or FR-A500 series.

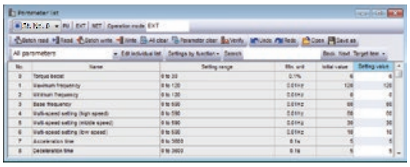


2 Perform pre-operation adjustments and checks during operation with ease

Parameter list

Free trial version **Supported**

Parameters for selected station numbers can be displayed and changed.

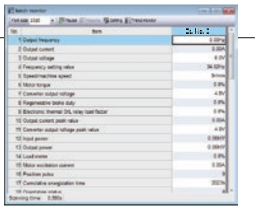


I/O signals can be assigned using settings by function.

Offline auto tuning

Tuning is performed in wizard format after specifying necessary parameter settings.

Batch monitor function



Multiple inverter monitor items can be monitored simultaneously.

With a terminal monitor, the ON/OFF status can be monitored.

USB memory parameter copy file edit

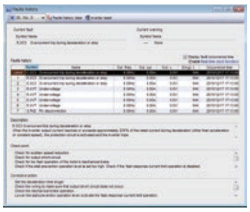
Parameter settings (USB memory device parameter copy file) read from the inverter to a USB memory device can be edited. With the iQSS backup file conversion function, the files in the backup/restore format generated by the GOT can be converted and edited.

3 Easy-to-follow platform facilitates easy maintenance

Diagnosis (fault history)

Free trial version **Supported**

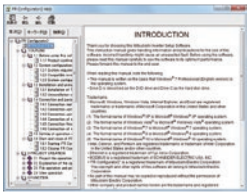
Inverter fault history can be read and displayed together with the alarm occurrence time.
Activating faults can be displayed, and inverters can also be reset.



Help

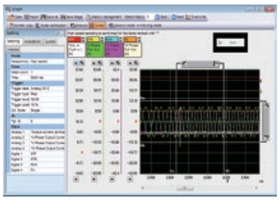
Free trial version **Supported**

Displays the content of inverter and software Instruction Manuals.



Graph function

Inverter data can be sampled and displayed in a graphical format. Trace data can also be read and displayed in a graph.



Life diagnosis

Free trial version **Supported**

Life information read from the inverter is displayed.
Check marks appear in the life alarm fields of inverter parts that have exceeded their replacement schedule.
Diagnosis results can also be output to a file.