FR-Family

Frequency Inverters

Intelligent Drive Technology
Top of Every Class

MITSUBISHI

A700

DANGER:Risk of injury and electric shock
■Read the manual and follow the safety instructions before use.
■Isolate from supply and wait 10 minutes before removing this cover.
■Ensure proper earth connection.
CAUTION:Risk of fire
■Mount the inverter on a non-combustible surface.

400V

Cost-Effective /// **Reliable** /// **Safe** ///
User-Friendly /// **Network-Capable** /// **Flexible** ///

Universally accepted

Frequency inverters made by Mitsubishi Electric carry all the major national and international marks of conformity.

Installed over 10 million times

Drives for all conceivable applications: there's something for everyone at Mitsubishi Electric! With more than 10 million of our frequency inverters installed we are one of the largest manufacturers in the world. Day after day, in heavy-duty industrial use, our frequency inverters prove their high levels of cost-effectiveness, reliability, functionality and flexibility.

Frequency inverters developed by Mitsubishi Electric are used routinely in many sectors and systems – and that's not all. Mitsubishi Electric know-how also features in many frequency inverters made by other manufacturers who are utterly convinced by its technical edge and economic benefit.

Always one step ahead of technology

The new technologies applied by Mitsubishi Electric in developing their frequency inverters result in highly dynamic drive systems and genuine power misers. Two new functions indicative of this innovative strength are RSV Control (Real Sensorless Vector Control) and OEC Control (Optimum Excitation Control).

Meeting global norms and standards

Mitsubishi Electric's frequency inverters meet all the standards and specifications laid down in the EU Low Voltage Directive 73/23/EEC and the Machinery Directive 98/37/EC. Needless to say, all the units carry the CE mark and are certified as conforming to UL, cUL and GOST.

Contents

The six ingredients for success

Cost effectiveness

Energy savings of up to 60% can be made by using Mitsubishi frequency inverters, thereby also reducing CO_2 emissions and protecting the environment.

Reliability

Safe and fault-free operation is guaranteed by various protective mechanisms and overload functions, top-quality temperature-resistant capacitors, permanently lubricated fans and dual-coated power and control PCBs.

Standards

In addition to complying with well-known international norms and standards, the frequency inverters are also certified by the Det Norske Veritas foundation (DNV).

Easily replaced fan unit during servicing

Second RS-485 interface

Choice of several easy-to-install boards available as frequency inverter add-ons

Integrated EMC filter with disable function

RJ-45 port for programming unit and
RS-485 communication interface

Removable parameter unit
with digital dial operation

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Removable terminal block

Convenience

The integral multifunction user panel, complete with digital dial, facilitates rapid and efficient input of all necessary drive parameters. It can also provide display of various performance data and error messages.
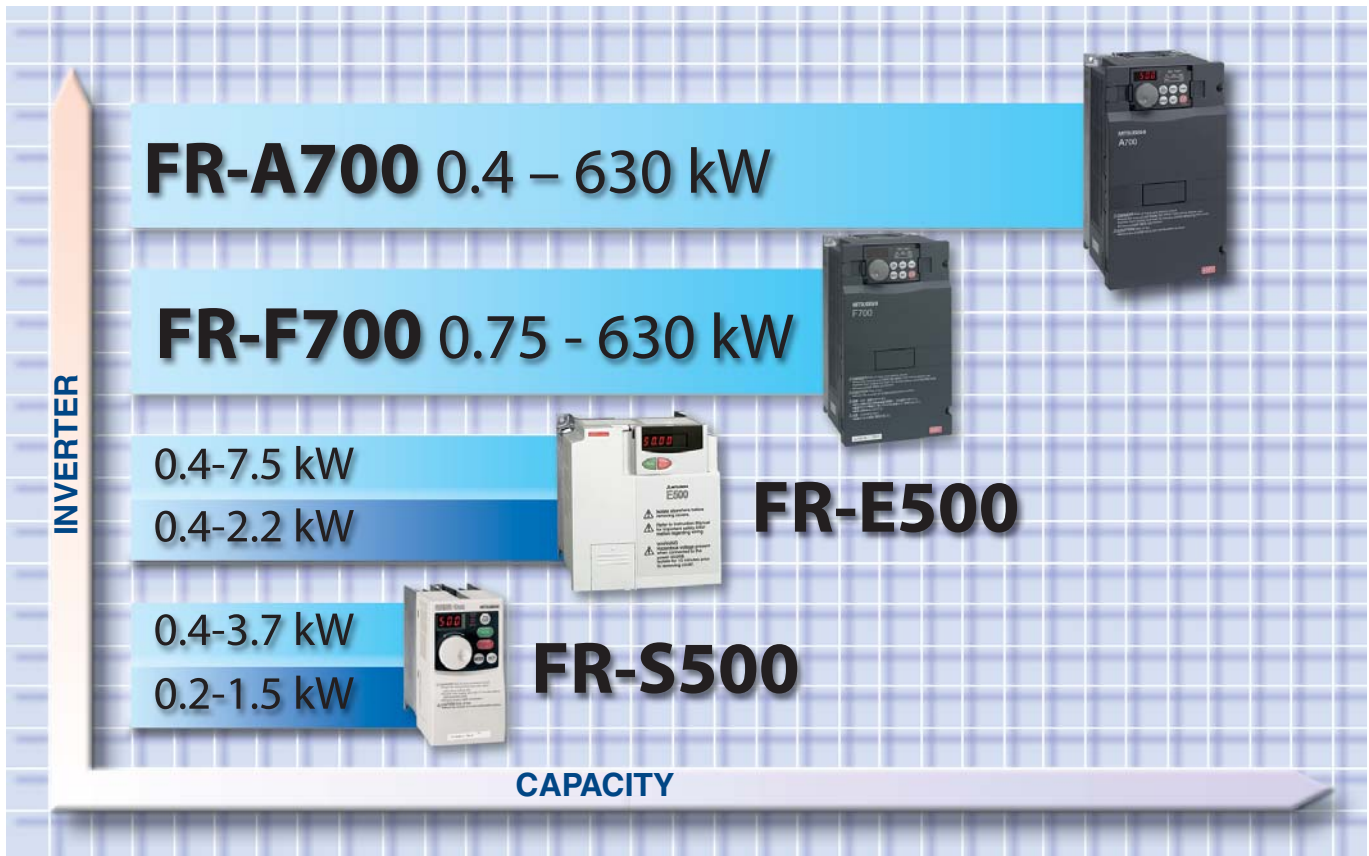
Flexibility

Compatible with all major field bus systems such as Profibus/DP, DeviceNet, CC-Link, CANopen, Modbus and LonWorks (the international communication standard in building services automation).
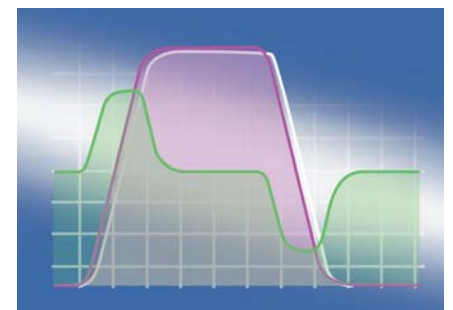
Functionality

Functionality, compatibility and perfect mechanical design are the main features of the frequency inverters supplied by Mitsubishi Electric.

Not all features are available on all Inverters. Please check applicability.

The right solution every time

FR-A700 0.4 – 630 kW

FR-F700 0.75 - 630 kW

0.4-7.5 kW
0.4-2.2 kW

FR-E500

0.4-3.7 kW
0.2-1.5 kW

FR-S500

INVERTER

CAPACITY

A diverse product range helps you make the right product choice.

Well set

Mitsubishi Electric always has the right drive system for straightforward and complex applications alike. With so many sizes, outputs and features, the right frequency inverter solution is available for every conceivable drive requirement.

Indeed, in applications where space is at a premium, it can pay to know that Mitsubishi Electric frequency inverters have numerous overload versions.

In many cases a smaller frequency inverter can be used - logically resulting in reduced purchase costs, lower running costs and a smaller footprint.

The majority of frequency inverters supplied by Mitsubishi Electric come as standard with 200% overload capacity. The benefit for the user is that our frequency inverters offer double the output of comparable types made by our competitors.

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FR-A700 –
High-end inverter

These new frequency inverters, developed by Mitsubishi Electric, boast cutting-edge technologies for optimum motor torque and speed control.

Up for new challenges

The FR-A700 series offers high-tech drive engineering at its best. The key features required in a modern day, high-end, frequency inverter include; drive performance, the range of drive functions and technology as well as control functions, compatibility and overall mechanical design. The new line of FR-A700 frequency inverters combines all these features to maximum effect in terms of performance, cost-effectiveness and flexibility for mechanical engineering and process plant engineering applications.

Technology functions, such as "Real Sensorless Vector Control" and "Online Autotuning", provide excellent speed stability and smooth motor-shaft rotation. Other functions include controlled power reduction after emergency shutdown, numerous digital inputs and outputs, integrated PLC functions, and many other new features which characterise the latest generation of high-end inverters to be engineered by Mitsubishi Electric.

The FR-A700 is suitable for use in a broad range of applications e.g. conveying and handling systems

Intelligent solutions for every requirement

Dynamics and precision: FR-A700

FR-A700 at a glance

Power range
FR-A740: 0.4 – 630 kW

Input
380 – 480/500* V AC 3ph (50/60 Hz)

Output frequency
0 – 400 Hz

Protection
up to 22 kW IP20, from 30 kW IP00

Control
V/f, OEC, RSV, CLV

Integrated interfaces
Modbus RTU, RS485, USB

Optional extras
Analogue + digital I/Os,
encoder feedback, master-save

Network links
CC-Link, Profibus/DP, Ethernet, SSCNET,
CANopen, DeviceNet, LonWorks

EMC protection
Integrated

*Depends on performance class

The new drive behind your success

FR-A700: The wide power zone, of 0.4 to 630 kW's, is covered by range of conveniently sized units.

Intelligent functions for any application

■ Sensorless vector control (RSV)

Equipped with their new RSV function (Real Sensorless Vector Control), Mitsubishi Electric frequency inverters have the ability to control the speed and torque of a single-phase a.c. motor without an encoder. The result is maximum performance across the full speed range in terms of dynamic response, precision and control. The motor thus sustains optimum dynamic speed characteristics, smooth rotation and

Suspended loads can be positioned accurately thanks to motor and encoder feedback.

high starting torque. As such, the FR-A700 is capable of achievements which used to be the reserve of high-end d.c. or servo systems.

■ Autotuning

Precise motor data forms the basis for optimum control of the vector drive without an encoder. The new generation of inverters comes with an autotuning function which identifies all the parameters required for the motor model in less than one minute, even if the motor is not running.

Sufficient memory is available to store data records for up to two motors. Online autotuning offers the facility to automatically record and offset changes to the data in operation, e.g. caused by changes in temperature.

Another tuning process (easy gain tuning) simplifies optimisation of the speed regula-
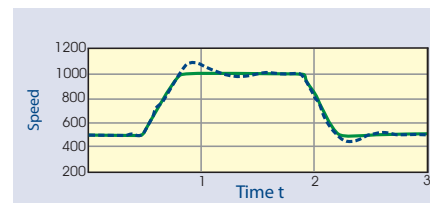
Without tuning (blue line) there are significant variations in the setpoint speed, whereas there is a great reduction in overshoot with tuning (green line).

tor. The sequential response of the motor is automatically detected and the control parameters adjusted for optimum performance. Labour-intensive manual tuning of the control parameters is a thing of the past.

■ Economy-rate positioning

The FR-A700 can also be used for positioning in conjunction with the "Closed Loop Vector Control". The control in this case is taken care of by a sequencer, digital inputs or a network.

PLC functions

The PLC functions integrated in the FR-A700 mean optimum tailoring to the requirements of the user. The PLC offers direct access to all the drive parameters and will, on request, undertake plant management as a stand-alone control and monitoring unit.

Mitsubishi Electric's programming software GX Developer is a straightforward tool for programming the PLC functions.
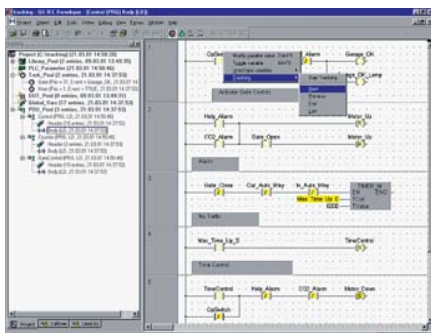
Clear user interface layout with project navigator for rapid programmiung

Network-capable

The FR-A700 is highly versatile in terms of communication options. It is supplied as standard with an integrated USB port and a link to Modbus RTU. Other optional network connections include Profibus/DP, CC-Link, Ethernet and CANopen right through to the motion control network SSCNET III.

Integration in positioning systems

All the frequency inverters in the FR-A700 series can be used with servo drives within a motion system. Connection is simple using Plug and Play via SSCNET III. The FR-A700 can even work as a leading axis drive. As such, there is no reason why the drives cannot be integrated further in existing control concepts.

Self-diagnosis for easy maintenance

Frequency inverters in the FR-A700 range monitor their own operational reliability. The innovative diagnosis and maintenance functions monitor all the components which are subject to wear and issue prior warning when due. Precautions are therefore in place to prevent failure and long downtimes.

Many protective mechanisms and overload functions guarantee fault-free operation and therefore supreme availability and operational reliability.

Extended service life

Mitsubishi Electric frequency inverters are noted for their durability. The FR-A700 also sets the benchmark in terms of product life. It is designed to last for over 10 years giving an investment which pays time after time.

Fourfold overload capacity

Many manufacturers of frequency inverters have specified various overload rating classes for their products - but rarely more than two. The FR-A700 is designed for no less than four overload ranges! This makes it easier to select the best frequency inverter for any application.

Tuning made simple

Convenient operation

The FR-DU07 parameterising unit, complete with digital dial and 7-segment LED display, is supplied with the product for manual access to all parameters and operating modes. Other parameter units can be supplied on request.

The FR Configurator parameter setting software provides a number of handy functions. These include a graphical machine analysis tool for optimising the drive system or an automatic conversion tool for a smooth changeover from a previous model to the latest generation of machines.

The FR-A700 has an integrated USB interface for connecting a PC or notebook.

FR-F700 –
The power saving inverter

Pump systems in industry - one domain of the FR-F700 frequency inverters

User-friendly operation

The built-in "digital dial" permits the efficient input of all the necessary drive parameters, cutting down on both programming and start-up time.

Long service life

The FR-F700 can lay claim to a 10-year service life thanks to advanced capacitors and ventilators. These features, along with its simple maintenance and automatic warning signals, make the FR-F700 one of the most reliable inverters on the market.

Economic powerhouse: the FR-F700

The frequency inverters in the FR-F700 range have been specially designed for pump and fan applications including heating, ventilation and air-conditioning installations. Besides their protection ratings IP00/IP20 (FR-F740) and IP54 (FR-F746), the outstanding features of these power-saving frequency inverters include their simple but safe operation and start-up, perfect control management and optional network-capability.

Effective energy savings

Pumps and fans are particularly good targets for great reductions in energy consumption. Energy costs can be slashed by up to 60%, notably in the lower speed or light load range of such applications.

Additional energy savings are effected by the cutting-edge "OEC technology" developed by Mitsubishi Electric. It supplies the motor with the optimum magnetic flux at any given time, thereby reducing losses. The result is maximum motor performance teamed with supreme efficiency.

FR-F740/746 at a glance

Power range
FR-F740: 0.75 – 630 kW
FR-F746: 0.75 – 55 kW

Input
380 – 480/500* V AC 3ph (50/60 Hz)

Output frequency
0 – 400 Hz

Protection
FR-F740: up to 30 kW IP20,
from 37 kW IP00
FR-F746: IP54

Control
V/f, OEC, SMFV

Integrated interfaces
Modbus RTU, RS485

Optional extras
Analogue + digital I/Os

Network links
CC-Link, Ethernet, Profibus/DP, LonWorks, DeviceNet, Siemens FLN, Metasys N2

*Depends on performance class

FR-E500 –
The compact inverter

The inverters in the FR-E500 series are all-rounders and miniature masterpieces given their compact size.

Small and powerful

These inverters continue to prove their worth in many applications, from textile machinery, conveying and handling systems, door and gate opening mechanisms right through to fans and pumps. Featuring Mitsubishi Electric's advanced vector control they can reach a torque of 150% at a frequency of just one hertz. Even with highly variable motor characteristics this is still possible thanks to the autotuning function. This means as much power as you could possibly want, in any operating environment and even at the lowest speeds.

Intelligent control

Thanks to the integrated PID control these inverters can be used, for example, to control pump flow or for temperature control without any additional expense.

Precision movement of products and goods with an FR-E500, even over long distances.

Minimum running noise

The FR-E500 line has a "Soft PVM" function, representing an advancement from the conventional noise reduction functions. If this function is selected there is a considerable reduction in running noise and disturbance voltage, even with low timing frequencies. With frequency jumps programmed to be released at specific times, the operating noise is comparable to a gentle rush of water.

Network-capable

The FR-E500 can be connected to open field bus systems like Profibus/DP, DeviceNet and CC-Link. Further communication facilities, such as the integrated RS485 interface enable multi-drop applications, with up to 32 stations, and permit links to PCs and visual display systems.

Never taller than 150 mm and yet up to 7.5 kW in output: the FR-E500

FR-E500
at a glance

Power range
FR-E520S EC: 0.4 – 2.2 kW
FR-E540 EC: 0.4 – 7.5 kW

Input
FR-E520S EC: 200-240 V AC 1ph (50/60 Hz)
FR-E540 EC: 380-480 V AC 3ph (50/60 Hz)

Output frequency
0 – 400 Hz

Protection
IP 20

Control
V/f, Vector Control

Integrated interfaces
RS 485

Network links
Profibus/DP, CC-Link, DeviceNet, CANopen

FR-S500 –
The micro inverter

Revolving doors and gateways are often controlled with FR-S500 frequency converters

User friendliness

The inbuilt parameter unit, with digital dial, allows efficient input of all the necessary drive parameters. For the user this means time savings and therefore cost reductions. An alternative possiblity is to use an optional multilingual alphanumeric parameter unit with integral copy function.

Rapid installation

Given its compact and neat design, the FR-S500 is synonymous with ease of installation and rapid start-up. It can also easily be installed on a DIN rail in the switch cabinet.

Compact and user-friendly: the FR-S500

The frequency inverters in the FR-S500 series set the benchmark in the microdrive sector and make it easier to take the first step into modern variable-speed drive technology. They are characterised by their ultra-compact size and an impressive array of technology functions. The FR-S500 series is therefore the ideal solution for simple drive requirements with space constraints.

Small but
high-powered

The FR-S500 series is highly versatile for applications in craft, trade and industry. The inverter's power module allows automatic torque boost if required, as it is designed with up to 200% overload capacity, which has a substantial stabilising effect on the drive response. Its range of application is very broad, due in part to its user-friendliness.

FR-S500
at a glance

Power range
FR-S520: 0.2 – 1.5 kW
FR-S540: 0.4 – 3.7 kW

Input
FR-S520: 200-240 V AC 1ph (50/60 Hz)
FR-S540: 380-480 V AC 3ph (50/60 Hz)

Output frequency
0 – 120 Hz

Protection
IP 20

Control
V/f, automatic torque boost

Integrated interfaces
RS485

Peripherals and software

Configuring the drive via a Windows laptop
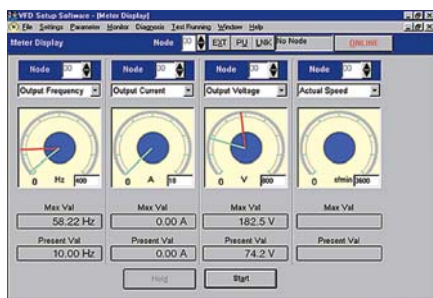
Handy parameter units

For added ease and convenience users may opt for integrated parameter units (FR-S500 only) or clip-on parameter units (for all other inverters). A numeric keypad is available for direct input of numerical values. A four-line LCD display provides plain text information about performance data, parameter names, status signals and error messages – in eight languages.
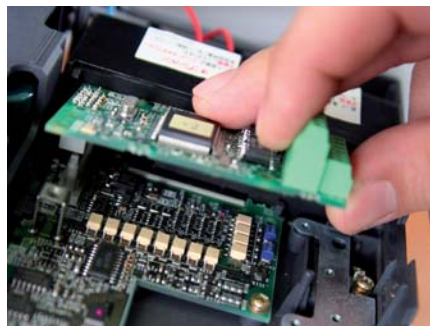
User-friendly set-up software

The user-friendly set-up software runs on Windows, i.e. the inverters can be configured using standard PCs. Several inverters can be set up, operated and monitored in parallel in one network. Connection is either via an RS458 interface or the optional SC-FR PC adapter cable.

Parameter units FR-DU07 and FR-PA02-02

Wide range of expansion options

Optional extras are available to optimise and expand system capability. Additional brake components, reactors and filters guarantee operation even in difficult conditions.

Quick and easy setting of the inverter

The range of functions can be expanded by optional boards, such as additional analogue/digital inputs/outputs.

Strong and smart

The separate Floor Standing Unit (FSU) for FR-F740 Inverters is a simple way of accommodating a free-standing frequency inverter system complying with protection class IP20 for installation in an electrical operating area.

The robust base units come pre-assembled and permit optional integration of a link reactor, a circuit breaker or – if required – an additional EMC filter.

FR-A 740 on IP-20 protection class base unit

Connector system for time-saving installation

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Increased productivity
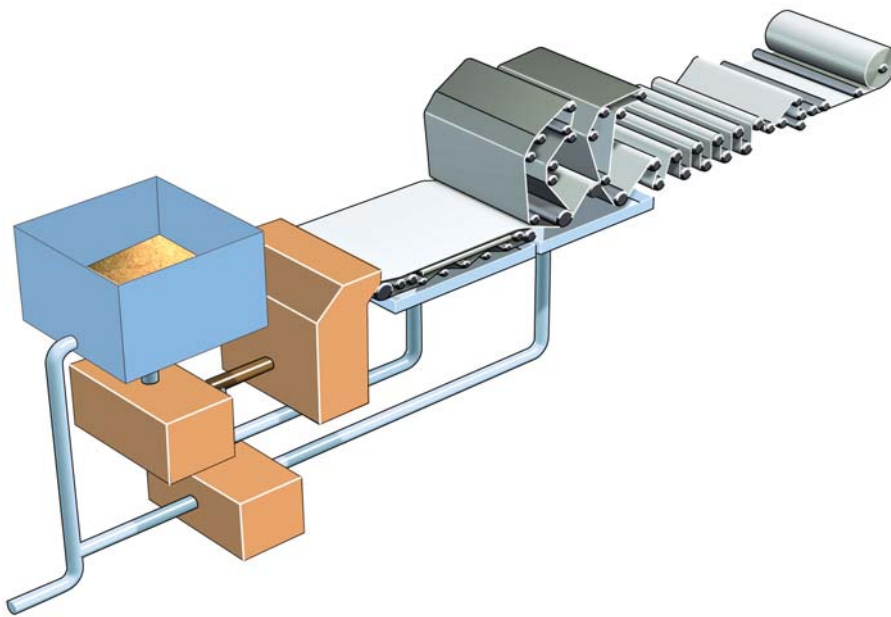
Simplified schematic of paper production

Synchronism – the ultimate priority

Precise synchronism of the drives is synonymous with maximum productivity and top quality in the printing and paper production industry. The drives need to retain control of the sheets throughout the entire printing and production process. The intelligent motor control function in Mitsubishi frequency inverters processes the actual values in next to no time and matches the speed and torque to the specified setpoint. This prevents the sheets from tearing or bunching.

Another feature which helps in this regard is the power-down braking function which controls the deceleration of all the drives after a power failure or an emergency machine shutdown. All this translates into maximum productivity and quality.

An advanced version of this control has the ability to operate up to four motors consecutively in alternate and/or changeover mode via one single frequency inverter.

Prepared for the toughest assignments

High temperatures and high air humidity are routine conditions in the printing and paper industry. The capacitors in the top-of-the-range models, the FR-F700 and FR-A700, are therefore designed to withstand internal temperatures of 105°C. The power and control PCBs have two coatings and the cooling fans are housed in sealed, specially lubricated industrial bearings. There is no better way to prepare frequency inverters to meet human and mechanical requirements.
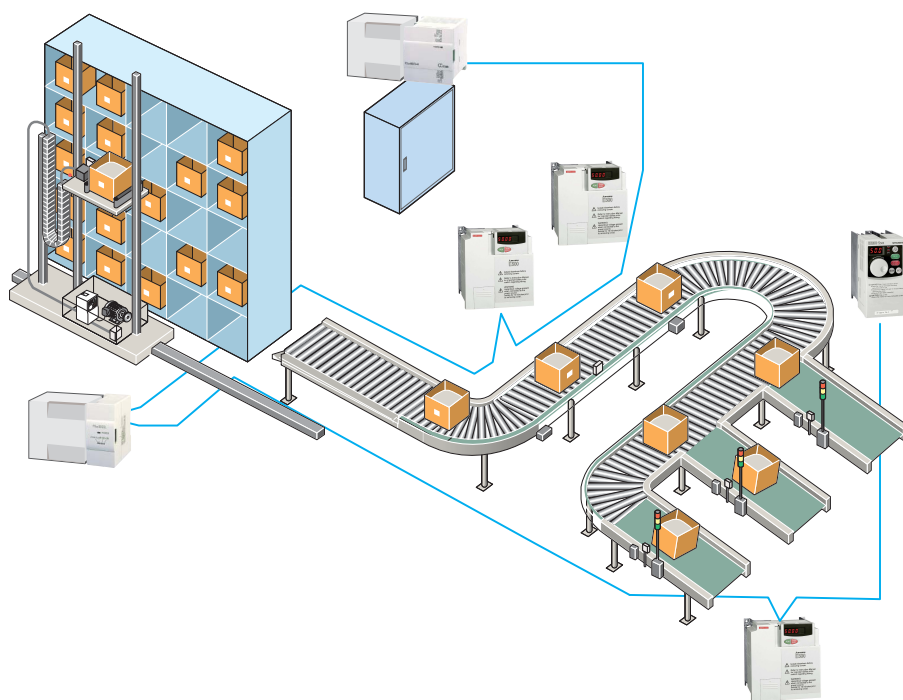
Productivity in paper production has one size parameter: tonnes per hour

Optimum speed

Palletising and warehousing in a high rack stacking system

This is precisely where top speed and torque response times are required for efficient compensation for sudden changes in load. Response times of no more than 5 ms are guaranteed to prevent product congestion and avert any risk to the follow-up process.

Rapid installation and start-up

Customers in the haulage and logistics sector want Plug and Play in order to cut installation and start-up times. Our frequency inverters are therefore fitted as standard with an integrated EMC filter and an integrated brake unit. All part of being prepared for anything.

Saving where motors never stop, Mitsubishi Electric inverters work round the clock!

Rapid response times essential

Conveyor belts and stock logistics systems need constant speeds and velocities for rapid and systematic transportation of products. As such, the dynamic response generated by the drives needs to be the same when the conveyor belt is empty and when it is full. If there are sudden variations in load, e.g. caused by materials piling up in an uncontrolled way on the conveyor belt, then the drives need to react as quickly as possible in order to smooth the flow of materials.

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Extreme cost efficiency

Frequency inverter

Following digital-to-analogue conversion the set rotation speed of a motor is relayed to a frequency inverter.

The temperature is adjusted to help the fluid maintain the correct viscosity.

Analogue-to-digital conversion helps to control the flow rate.
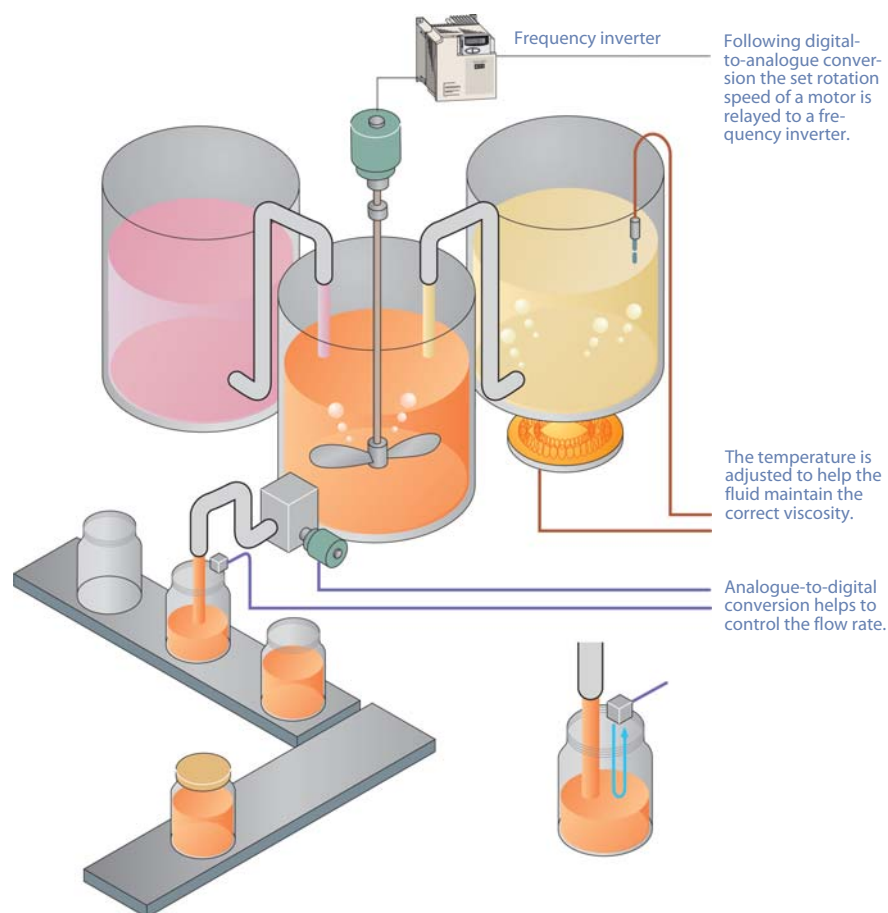
The conversion of analogue values is an important aspect of automation technology and facilitates process control.

Replacing conventional DC drives with modern three-phase drives will always mean one less cost-intensive maintenance chore. This in turn will mean far fewer drive failures which at worst bring the entire mixing or stirring machinery to a standstill.

Optimum energy efficiency, e.g. in complex pumping applications

Saving energy when starting and braking

The OEC technology (Optimum Excitation Control) developed by Mitsubishi Electric combines maximum drive efficiency with minimum power consumption. The only thing supplied to the connected motor is the magnetic flux which brings about the optimum degree of efficiency at all times. This leads to inordinate improvement in energy efficiency is achieved, particularly in the acceleration and braking phases.

Variable speed and efficiency

Maximum efficiency is required from each individual drive in pump and fan applications as well as in mixers and stirrers.

In comparison with mechanical solutions, frequency inverters developed by Mitsubishi Electric are always able to tap the full potential when it comes to savings in energy consumption.

Potential savings

Too powerful and too expensive!

Energy costs are rising all the time. Over half of the power consumed in industry is accounted for by electric motors. Up to 96% of the life cycle costs of a motor are accounted for by energy costs. Unfortunately, when analysing costs, it is precisely this point which is paid precious little attention or is ignored altogether. The biggest potential source of savings is frequently disregarded.

For example, in order to guarantee that an air handling plant will run smoothly even at full load, which is seldom the case, and to have spare capacity for expansion the systems fans are often over specified. In some cases fans in these applications can be operating at an average efficiency of 65% or less.

In addition, in conventional systems the equipment is usually controlled by mechanical ventilation flaps which slashes efficiency levels, especially with medium loads. The flap control function can very easily be replaced by the use of frequency inverters and the power consumption reduced by 20 to 60%.

Result: wasted energy

Oversized fan, pump and motor systems combined with continuous operation at maximum capacity means many systems are operated at levels far below ideal in terms of efficiency. This leads to excess power consumption which can only really be explained by ignorance or poor practise.

A Mitsubishi frequency inverter is a safe investment

Countermeasures

The power consumption of slow running motors can be reduced if the speed is controlled by changing the frequency. The frequency inverter allows the motor to be adjusted to the load. Frequency inverters which generate variable frequencies and voltage levels save energy, reduce wear on the motor and minimise wear and tear on the motor-driven assembly.

They also allow far greater flexibility when it comes to organising operating prorecedures.
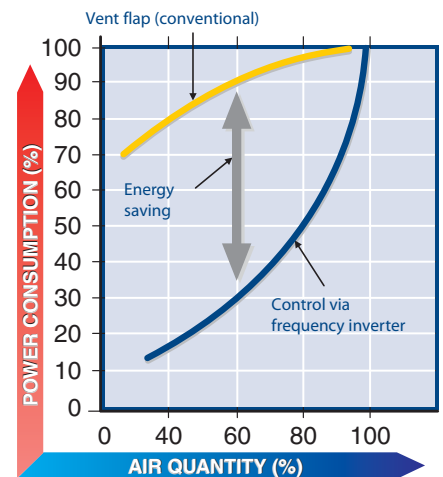
Example: A motor controlled by a frequency inverter (blue line) is using the energy to extract air. The mechanically throttled motor doing the same task but operated directly on the mains (yellow line) is wasting a large amount of the energy.

Save on energy costs by investing in the Mitsubishi Electric family of inverters

A world of applications

Mitsubishi frequency inverters are used in a wide range of areas.

Mitsubishi Electric operates eight branches in Europe, where it has maintained a presence for more than 25 years and developed a constantly growing and far-extending network comprising links to other companies and reliable partnerships.

On the technical side, three manufacturing and automation centres form the basis of tailored automated solutions, further centres already being planned.

A Europe-wide network, the European Service Group (ESG), provides interfaces to experienced engineers and offers distributors support throughout every phase of the project.

Mitsubishi products are found in a variety of industrial, infrastructure and service sector contexts, ranging from critical applications in the pharmaceuticals industry to state-of-the-art leisure and entertainment facilities. Here are just a few examples of recent applications:

- Agriculture
  - Irrigation systems
  - Plant handling systems
  - Sawmills

- Building management
  - Smoke detection monitoring
  - Ventilation and temperature control
  - Lift (elevator) control
  - Automated revolving doors
  - Telephone management
  - Energy management
  - Swimming pool management

- Construction
  - Steel bridge manufacturing
  - Tunnel boring systems

- Food and drink
  - Bread manufacture
    (mixing/baking)
  - Food processing
    (washing/sorting/slicing/packaging)

- Leisure
  - Multiplex cinema projection
  - Animated mechatronics
    (museums/theme parks)

- Medical
  - Respiration machine testing
  - Sterilization

- Pharmaceutical/chemical
  - Dosing control
  - Pollution measurement systems
  - Cryogenic freezing
  - Gas chromatography
  - Packaging

- Plastics
  - Plastic welding systems
  - Energy management systems for
    injection moulding machines
  - Loading/unloading machines
  - Blow moulding test machines
  - Injection moulding machines

- Printing

- Textiles

- Transportation
  - Sanitation on passenger ships
  - Sanitation on rail rolling stock
  - Fire tender, pump management
  - Waste disposal truck management

- Utilities
  - Waste water treatment
  - Fresh water pumping
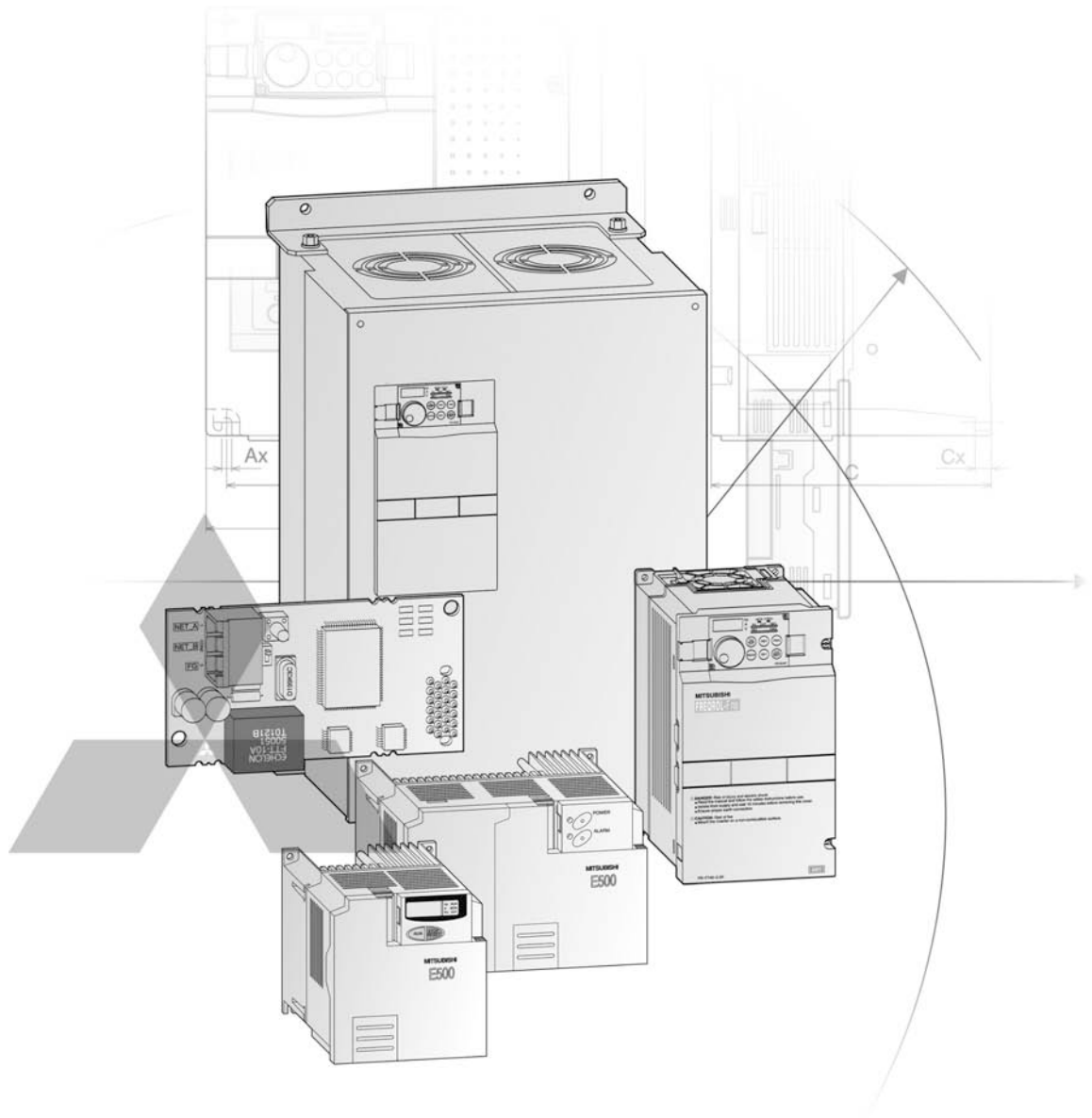
Technical Information Section

Further Publications within the Industrial Automation Range

Technical Catalogues

MELSERVO and Motion Controller Technical Catalogue

Product catalogue for servo motors and servo amplifiers of the MR-J series and Motion Controller with SSCNET connection

MELSEC PLC and HMI Technical Catalogue

Product catalogues for programmable logic controllers, operator terminals and accessories for the MELSEC PLC series

MELFA Robots Technical Catalogue

Product catalogue for Mitsubishi Electric industrial robots.

Further service supplies

This technical catalogue is designed to give an overview of the extensive range of the Mitsubishi Electric frequency inverters. If you cannot find the information you require in this catalogue, there are a number of ways you can get further details on configuration and technical issues, pricing and availability.

For technical issues visit the www.mitsubishi-automation.com website.

Our website provides a simple and fast way of accessing further technical data and up to the minute details on our products and services. Manuals and catalogues are available in several different languages and can be downloaded for free.

For technical, configuration, pricing and availability issues contact our distributors and partners.

Mitsubishi partners and distributors are only too happy to help answer your technical questions or help with configuration building. For a list of Mitsubishi Electric partners please see the back of this catalogue or alternatively take a look at the "contact us" section of our website.

About this technical catalogue

This catalogue is a guide to the range of products available. For detailed configuration rules, system building, installation and configuration the associated product manuals must be read. You must satisfy yourself that any system you design with the products in this catalogue is fit for purpose, meets your requires and conforms to the product configuration rules as defined in the product manuals.

Specifications are subject to change without notice. All trademarks acknowledged.

MITSUBISHI ELECTRIC

FREQUENCY INVERTERS

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INVERTER SERIES

1

Mitsubishi Electric Frequency Inverters

The great variety of the Mitsubishi Electric frequency inverter models makes it easy for the user to choose the optim um inverter for his application.

There are basically four different inverter series:

● FR-S500E
● FR-E500
● FR-F700
● FR-A700.

The inverters are available with an output range from 0.2 kW to 630 kW.

With most Mitsubishi Electric frequency inverters an overload capacity of 200 % is standard. This means they deliver double the performance of the competing inverters with the same rating. Mitsubishi Electric inverters also have active current limiting. This provides the perfect response characteristics of the current vector system and gives you the confidence you need for demanding drive applications.

The system instantly identifies over currents and limits them automatically with fast response, allowing the motor to continue operating normally at the current threshold.

Mitsubishi Electric inverters are also able to communicate with industry standard bus systems making it possible to integrate frequency inverters as part of a complete automation system.

Mitsubishi Electric inverters are real energy savers achieving maximum drive capacity utilisation with minimum power consumption. Flux optimisation ensures that the connected motor only gets exactly the amount of magnetic flux required for optimum efficiency. This is particularly important at low speeds as motors are normally using a voltage/frequency control system.
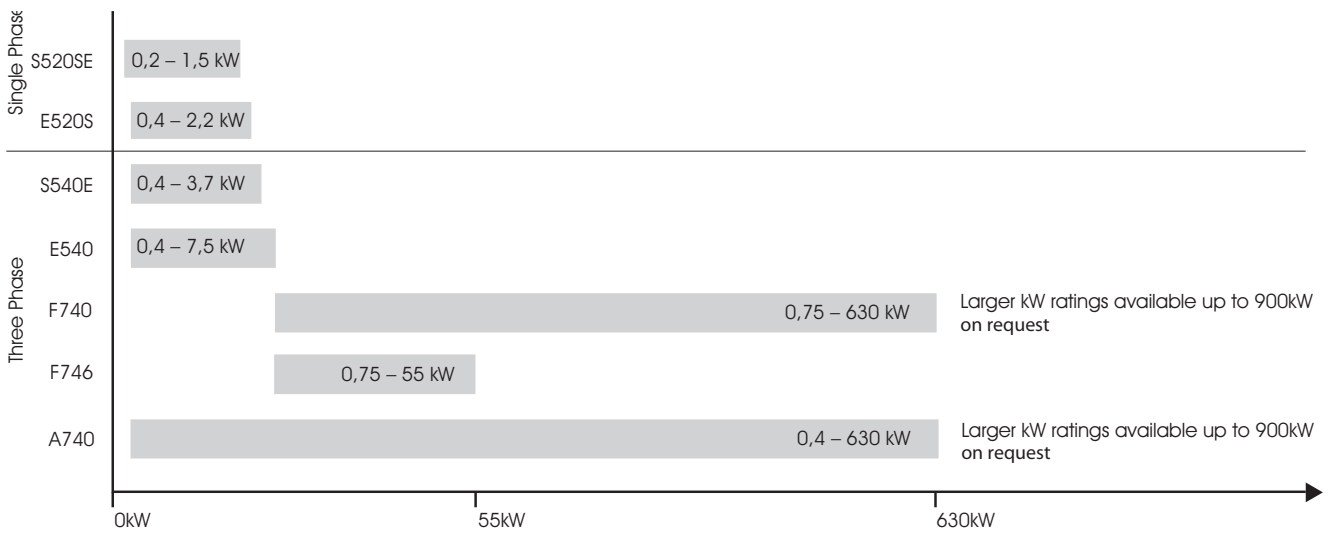
Feature	FR-S500E	FR-E500	FR-F700	FR-A700
Rated motor output range	0.2–3.7 kW	0.4–7.5 kW	0.75–630 kW	0.4–630 kW
Frequency range	0.5–120 Hz	0.2–400 Hz	0.5–400 Hz	0.2–400 Hz
Power supply	Single phase, 200–240 V (-15 %/+10 %) Three-phase, 380–480 V (-15 %/+10 %)	Single phase, 200–240 V (-15 %/+10 %) Three-phase, 380–480 V (-15 %/+10 %)	Three-phase, 380–480 or 500 V (-15 %/+10 %)	Three-phase, 380–480 or 500 V (-15 %/+10 %)
Protection	IP 20	IP 20	FR-F700: IP 00 / IP 20 FR-F746: IP54	IP 00 / IP 20
Special functions	● V/f control	● V/f control ● Magnetic flux vector control	● Traverse function ● Switch motor to direct mains operation ● Advanced PID function (multi pump function) ● Regeneration avoidance function ● Flying start ● V/f control ● Simple magnetic flux vector control ● Life time diagnostics	● Torque control ● Positon control ● Real sensorless vector control ● Closed loop vector control ● Traverse function ● Regeneration avoidance function ● Integrated PLC function ● Easy gain tuning ● Life time diagnostics
Specifications	Refer to page 10	Refer to page 14	Refer to page 18	Refer to page 24

MITSUBISHI ELECTRIC

FR-S500E Micro Inverters
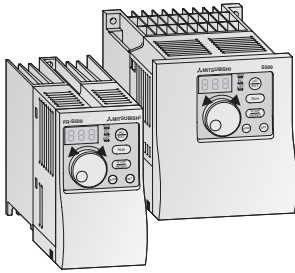
The FR-S500E offers advantages such as the easy to use setting dial and a RS485 communications interface as standard. Other features include automatic restart after power failure, a maintenance timer and a second electronic thermal function.

The ultra-compact frequency inverters FR-S500Ecan support numerous applications.

Typical applications include:
- Material transport systems such as conveyor belts, chain conveyors, feed belts, transport belts and worm conveyors
- Saws, millling cutters, grinding and drilling machines
- Pumps
- Fans
- Door drives

FR-E500 Compact Inverters
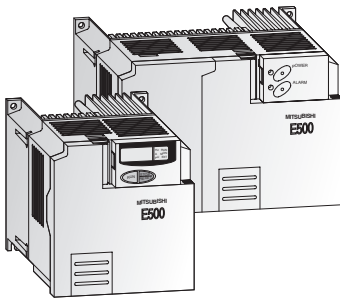
Due to its versatility and compact dimensions, the FR-E500 is a frequency inverter that can solve most of your individual drive tasks. Its extensive functions make it a flexible solution for applications such as:
- Textile machines such as spinning machines, knitting machines, weaving looms
- Material transport systems such as chain, belt, and screw conveyors

- Door and gate drives
- Machines for working of metal, stone, wood, and plastics
- Palettisers, material-handling technology
- Pumps and ventilating

FR-F700 Energy Saving Inverters
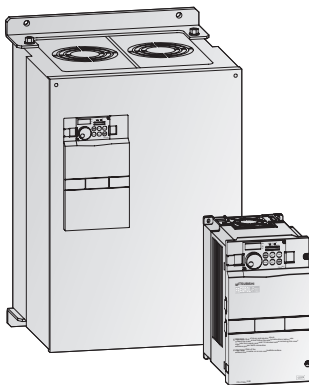
Mitsubishi Electric's FR-F700 series is a range of frequency inverters with truly exceptional power conservation capabilities. The inverters of the FR-F740/FR-F746 series are ideal for pumps, ventilation fans and applications with reduced overload requirements such as:
- Air conditioning systems, e.g. in building management
- Air extraction systems
- Fans and blowers
- Hydraulics systems

- Compressors
- Sewage and drains systems
- Ground water pumps
- Heat pumps
- Drive systems with high idling rates

FR-A700 High End Inverters
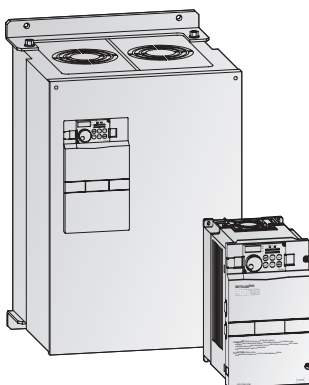
The new FR-A700 frequency inverters combine innovative functions and reliable technology with maximum power, economy and flexibility.

The FR-A740 is the appropriate inverter for demanding drive tasks with requirements for high torque and excellent frequency precision. Its extensive functions allow adaption to many applications. The outstanding drive features of the FR-A740 suit various needs, like:

- Conveyor technology
- Chemical machines
- Winding machines
- Printing machines
- Cranes and lifting gear
- High-bay warehousing systems
- Extruders
- Centrifuges
- Machine tools

1

INVERTER SERIES

⅄ MITSUBISHI ELECTRIC

Intelligent Motor Control Functions

Compatible with many new applications

- PID control
  The integrated PID control for example supports a flow control for pumps.
- Torque boost
  Torque boost selection is possible.

Comprehensive protection functions for safe operation

- Built-in electronic overcurrent protection
- Selection of the protection function for automatic retry after alarm occurence.

Flexible 5-point V/f curve

The integrated flexible 5-point V/f curve enables you to match the torque curve perfectly to the characteristics of your machine.
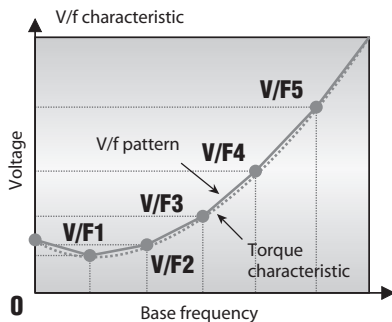
Magnetic flux vector control

The integrated flux vector control (except FR-S500E) of the inverters system makes it possible to achieve high torques, even at low motor speeds.

High accuracy/fast response speed operation by vector control can be performed with a general-purpose motor without encoder when the real sensorless vector control of the FR-A700 inverter series is used.

When the FR-A7AP is mounterd to the FR-A700, full-scale vector control operation can be performed using a motor with encoder. Fast response/high accuracy speed control (zero speed control, servo lock), torque control, and position control can be performed. Vector control offers excellent control characteristics when compared to V/F control and other control techniques, achieving the control characteristics equal to those of DC machines.

Compatible with numerous I/Os

- Multi-speed operation
  (15 different pre-selected speeds are available)
- 0/4 to 20 mA and 0 to 5 V DC / 0 to 10 V DC control input
- Multi-input terminals: selection of different input functions
- Multi-output terminals: selection of different output functions
- 24 V external power supply output (permissible values: 24 V DC/0.1 A)

Operating functions and other convenient functions

- Frequency jumps (three points) to avoid the machine's resonant frequency
- Fast acceleration/deceleration mode
- Full monitoring capabilities for monitoring actual operating time and much more
- Switch between two sets of motor characteristics by means of a second parameter function
- Zero current detection

Second electronic thermal function

This function is used to rotate two motors of different rated currents individually by a single inverter.

Regeneration avoidance function

The regeneration avoidance function of the FR-F700 and FR-A700 can prevent the inverter from being shut down by regenerative overvoltages when strong regenerative loads cause power to be released into the frequency inverter (for example when braking the motor or with loads that actively drive the motor).

The inverter can automatically increase the output frequency or disable the braking ramp when a programmed threshold value is reached. The response sensitivity, dynamics and working range are all adjustable.

For example, this function can prevent a shutdown with an overvoltage error when the speed of a fan controlled by the inverter is increased by the draft from another fan operating in the same ventilation duct. The function then temporarily increases the output frequency above the setpoint value.

This function can also be used to brake loads with the DC bus voltage, without using braking modules.

Automatic restart after instantaneous power failures

In pump and fan applications normal operation can be continued automatically after brief power failures. The system simply re-activates the coasting motor and automatically accelerates it back up to its setpoint speed.

The graphic below shows how the frequency inverter can respond to a brief power outage. Instead of coasting down completely and stopping, the motor is automatically "caught" by the frequency inverter and re-accelerated back up to its previous speed.
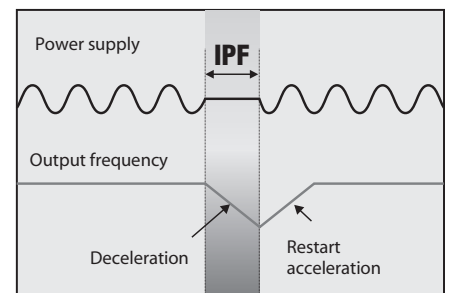
Maintenance timer

The maintenance timer function (except FR-E500) can be used to monitor the service life of different components.

Communication

Extended I/O for additional control functions

The following I/Os are included as standard equipment on the inverters. The number of I/Os depends on the inverter model.

● Contact inputs
● Analog inputs
● Open collector outputs
● Relay outputs
● Analog outputs

The contact inputs, open collector outputs and relay outputs can all be used for a wide range of functions.

The switching status of the input and output terminals can be displayed on the control panel.

In addition the FR-A700 is equipped with a pulse input for positioning.

Remote I/Os

Instead of using the remote I/Os of a PLC you can use a network connection to both read out the status of the frequency inverter's inputs and set its outputs (only FR-F700 and FR-A700).

Expansion slot

The frequency inverter has up to 3 expansion slot (except FR-S500) that can be used to install an I/O expansion module or a network module. These modules are cards that are installed by plugging them into the slot in the inverter.

Communications capability as a standard function

An RS485 interface for data communications is standard equipment of all inverters. The interface serves for data exchange for example with a personal computer.

Support for integration in larger networks

Open communications with standard industrial bus systems can be implemented easily with optional expansion cards (except FR-S500).

This makes it possible to integrate the frequency inverter in large-scale automation systems.

The following networks are supported by the inverters:

● CC-Link
● LON Works (FR-F700/FR-A700)
● Profibus/DP
● DeviceNet
● CANopen (FR-E500/FR-A700)
● RS485
● Modbus RTU as standard (FR-F700/FR-A700)
● USB (FR-A700)
● SSCNET III (FR-A700)
● Ethernet (FR-F700/FR-A700)

Air conditioner

FR-F700

PC for network management

Pump

FR-F700

FR-A7NL

FR-A7NL

LonWorks NETWORK
Open network topology

Lighting

Security system

PLC system (e.g. Mitsubishi Electric

FR-F700

FR-A700

Up to 42 inverters

FR-A7NC

FR-A7NC

**CC-Link Network
PROFIBUS/DP
DeviceNet
RS485
Modbus RTU**
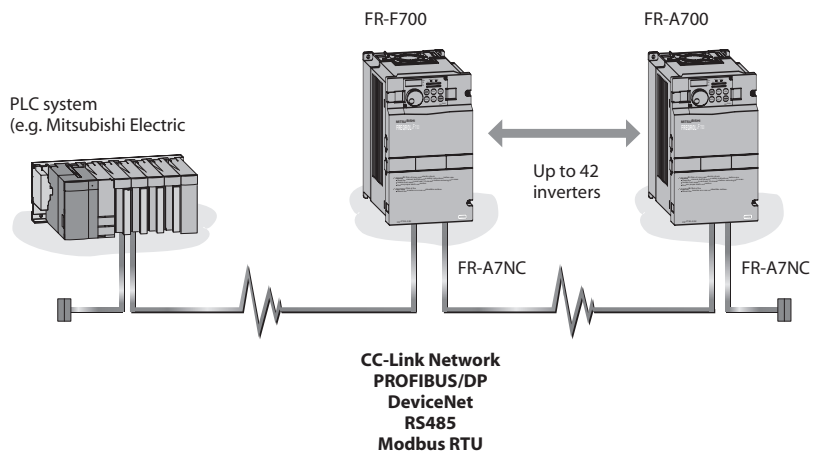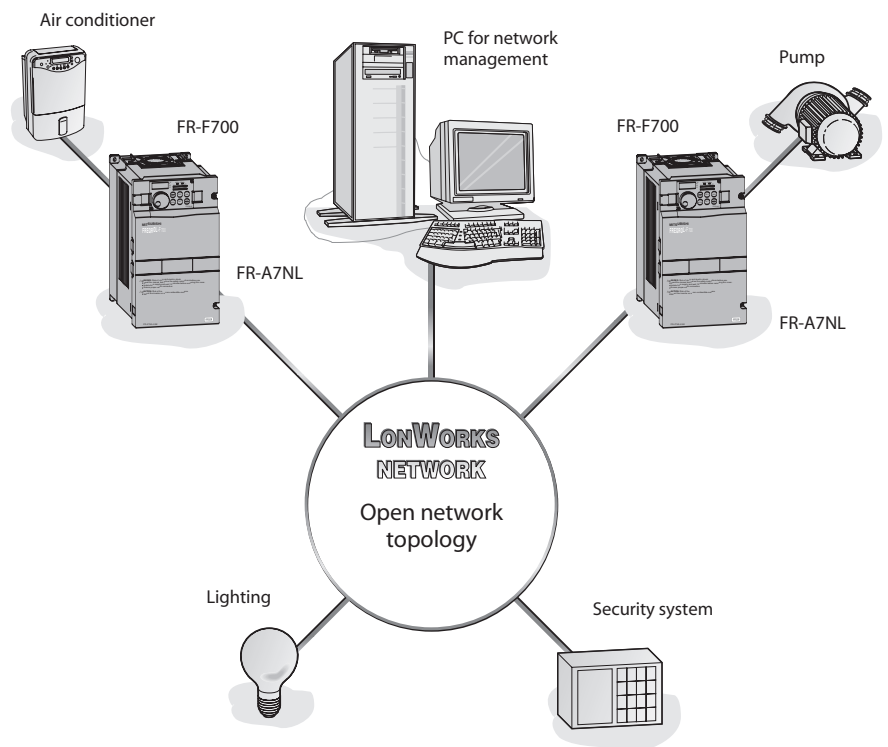
User-friendly Operation

Easy configuration with control panel or software

A control panel is included as standard equipment with the inverters FR-F700 and FR-A700. The FR-S500 is equipped with a integrated control panel. All these three panels use a digital dial for making the settings. For the FR-E500 the operation panel PA02-02 is optional.

The control panel makes operation of the inverter simple and intuitive and displays operating parameters and alarm messages. The integrated digital dial control provides fast and efficient access to all key drive parameters.

The optional FR-PU04 and FR-PU07 control panels features a long-life LC-display with a backlight and integrated numeric keypad for direct entry of operating parameters. The user interface can be displayed in eight different languages. This panels are designed as a remote unit that is connected to the inverter with a cable. For FR-F700/FR-A700 inverters a fixed installation is also possible.
It also supports definition of user groups with which you can implement editable parameter sets that can then be selected as required for specific applications.

FR-DU07

In addition to control panel operation the frequency inverter can also be connected to a standard PC via an RS-485 port and operated from the PC with the optional VFD setup software package or FR-Configurator. Using this software you can configure, operate and monitor multiple frequency inverters, either in a network or directly from a single PC or notebook computer.

FR-PU07

User-friendly

In addition to allowing you to enter and display configuration and control parameters the integrated control panel can also be used to monitor and display current operating data and alarm messages.
The information is output on a 4-digit LED display.

You can monitor all the current status parameters of both the inverter itself and the connected motor. Problems and malfunctions are indicated by error codes.

One-touch operation

Simple and intuitive configuration and operation save both time and money. The control panel's jog shuttle "digital dial" control provides much faster access to all key drive parameters than would be possible with conventional buttons and keys.

You can also use the dial to continuously adjust the speed of the connected motor.
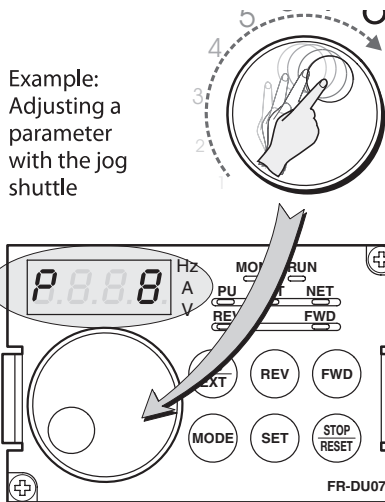
Example: Adjusting a parameter with the jog shuttle

FR-DU07

Removable panel with parameter copy function

The control panel (except for FR-S500) is removable and can also be connected installed remotely, for example in the door of a switchgear cabinet. It also features a useful copy function with which you can copy the parameter settings of one frequency inverter to another.

Alarm log

The control panel stores an alarm log for up to 8 alarm messages that can be displayed and checked on the panel. The alarm details in the log include frequency, current, voltage and cumulative operating time at the time of the alarm.

Switch between direct and external control

The frequency inverter can be controlled directly via the control panel (PU mode) or via external signals (EXT mode).

FR-DU07
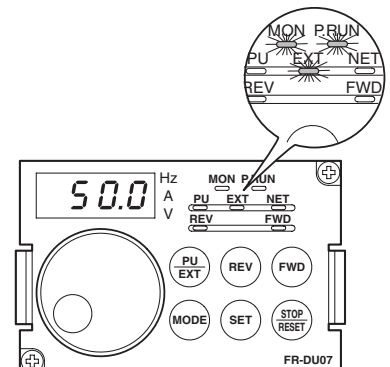
Maintenance and Standards

Simplified Maintenance

Easy access to cooling fans

The easily accessible cooling fans can be replaced quickly and easily, if required. The integrated cooling fan can be switched OFF automatically in stand-by operation to increase its lifetime significantly.

Easy installation and maintenance

Since the control and power terminal block is easy of access, the installation and maintenance of the inverter is also very easy.

All connection points are designed as screw terminals. The housing includes a cable routing facility which can be removed for installing.

Service timer

The frequency inverters of the FR-F700 and FR-A700 series all have an integrated service timer that automatically triggers an alarm after a set number of operating hours. This feature can be used for monitoring the frequency inverter itself or a peripheral component. The values of the mean output current and the service timer can also be output as analog signals.

Modern diagnostics functions further extend service life

The ageing of the main circuit capacitors, the control circuit power capacitor, the internal cooling fans and the inrush current limiter circuit can be checked with the monitoring functions (FR-A700 and FR-F700). If the inrush resistor overheats an alarm is displayed.

The alarms for the main circuit capacitors, control circuit capacitor, inrush current limiter and internal fans can all be output to a network or via the optional FR-A7AY module.

This makes it possible to prevent malfunctions by configuring diagnostics alarms to be triggered when the end of the service life is reached.

The inverter also has an internal program that can evaluate the ageing of the main circuit capacitors. This feature is only available when a motor is connected to the inverter.

Environment-Friendly and International Compliance

Electromagnetic compatibility

Latest technologies have been used to significantly reduce the interference levels generated by this frequency inverter.

Regarding its electromagnetic compatibility the frequency inverters complies with the European EMC directives.

To meet these standards noise filters have been developed for each performace range.

The FR-F700 and FR-A700 conform to the strict electromagnetic compatibility regulations of the European Union (EMC Directive, Environment 2, EN 61800-3). In order to meet these standards the inverters are fitted with a new, integrated interference suppression filter, which can easily be deactivated with a jumper if necessary.

You can also further limit the make current and reduce network interference by fitting the input of the inverter with an optional AC reactor and a DC reactor, which is connected to special terminals on the inverter unit.

Circuit boards with two coats of protective varnish

The frequency inverters with the E1 designation (standard, type 01800 and above) have circuit boards with two coats of protective varnish.

This feature is available as an option for the models up to type 01160. The twin coating on the internal PCBs provides even better protection against environmental influences. This is particularly important in applications sewage plants where the switchgear cabinets are exposed to aggressive fermentation gases that can reduce the service life of the equipment.

International standards

The inverters are designed so that they can be used worldwide without any additional modifications or certifications.
- The units conform to the international standardsCE, UL, cUL, Gost, CCC, ISO 9001 and ISO 14001. In addition the series FR-F700 and FR-A700 conformt o the standards DNV standards.
- User-selectable positive or negative switching logic. Users can select positive or negative switching logic for input and output signals, enabling flexible and simple adaptation of the units for varying world market requirements.

- Multilingual programming/control unit (optional)
- Support for a variety of international industrial bus systems
- Internationally standardised, frequency inverter configuration software package for MS Windows, with multilingual user interface

These features make the inverters a truly international product that meets all relevant standards and can be easily adjusted for national requirements.

2

SPECIFICATIONS
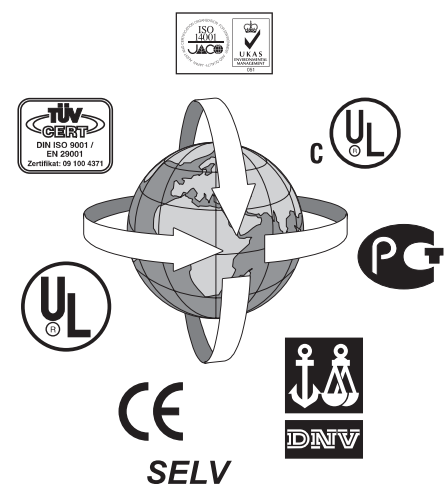
The FR-S500E Series
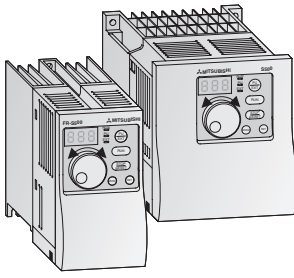
The FR-S500E with V/f voltagefrequency control is a pace-setter in the miniature drive system class. It features ultracompact dimensions, simple and secure operation and a wide range of technology functions. The integrated jog shuttle control gives the user fast, direct access to all important drive parameters.

Output range:

0.2 – 3.7 kW,
200 – 240 V / 380 – 480 V

Available accessories:

Optional control units, versatile options and useful accessories are available for this frequency inverter.

Please refer to page 34 for details.

Technical Details FR-S500E

Product line			FR-S520SE				FR-S540E				
			-0.2 k	-0.4k	-0.75 k	-1.5 k	-0.4 k	-0.75 k	-1.5 k	-2.2 k	-3.7 k
Output	Applicable motor capacity* ①	kW	0.2	0.4	0.75	1.5	0.4	0.75	1.5	2.2	3.7
	Rated motor capacity	kVA	0.5	1.0	1.6	2.8	0.9	1.6	2.7	3.7	5.9
	Rated current*	A	1.4	2.5	4.1	7.0	1.2 (1.3)*	2.3 (2.5)*	3.7 (4.1)*	5.3 (5.8)*	7.7 (8.5)*
	*Overload capacity ②		200 % of rated motor capacity for 0.5 s; 150 % for 1 min. (ambient temperature not higher than 50 ℃)								
	Voltage ③		3phase, 0 V up to power supply voltage								
Input	Power supply voltage		1phase, 200–240 V AC, -15 % / +10 %				3phase, 380–480 V AC, -15 % /+10 %				
	Voltage range		170–264 V AC at 50 / 60 Hz				325–528 V AC at 50 / 60 Hz				
	Frequency range		50 / 60 Hz ±5 %				50 / 60 Hz ±5 %				
	Rated input capacity ④	kVA	0.9	1.5	2.5	4.4	1.5	2.5	4.5	5.5	9.5
Control specifications	Control method		V/f control or automatic torque boost control								
	Modulation method		Sinusoidal PWM, Soft PW								
	PWM switching frequency	kHz	0.7 – 14.5, user adjustable								
	Frequency range	Hz	0.5 – 120								
	Frequency resolution	Analog	From terminals 2–5: 1/500 of maximum set frequency (input 5 V DC); 1/1000 (input 10 V, 20 mA DC)								
		Digital	0.1 Hz (less than 100 Hz), 1 Hz (100 Hz or higher)								
	Frequency precision		±1 % of max. output frequency (temperature range 25 ℃±10 ℃) during analog input; ±0.5 % of max. output frequency during digital input (set via Digital Dial)								
	Voltage / frequency characteristics		Base frequency adjustable from 0 to 120 Hz								
	Possible starting torque		≥ 150 % / 5 Hz (with automatic torque boost)								
	Torque boost		Manual torque boost; selectable between 0–30 %								
	Acceleration / deceleration time		0, 0.1 to 999 s (may be set individually for acceleration and deceleration)								
	Acceleration / deceleration characteristics		Linear or S-pattern acceleration/deceleration mode selectable								
	Braking torque ⑤	Regenerative	0.2 k: 150 %; 0.4 k and 0.75 k: 100 %; 1.5 k: 50 %; 2,2 k and 3,7 k: 20 %								
		DC braking	Braking time and braking moment adjustable, Operating frequency: 0–120 Hz, operating time: 0–10 s, voltage: 0–15 % (externally adjustable)								
	Current stall prevention operation level		Operation current level setting 0–200 %, user adjustable								
	High-response current restriction level		Operation level is fixed, enable/disable selection								
	Motor protection		Electronic motor protection relay (rated current user adjustable)								
Control signals for operation	Frequency setting signal	Analog input	0–5 V DC, 0–10 V DC, 0/4–20 mA								
		Digital input	From control panel (parameter unit), RS-485 or network								
	Operation functions		Maximum and minimum frequency setting, frequency jump operation, external thermal input selection, instantaneous power failure restart operation, forward run/reverse run prevention, slip compensation, operation mode selection, PID control, computer link or open network operation								

* The values in brackets indicate the values for an ambient temperature up to 40 ℃ without restriction of PWM.

⩕ MITSUBISHI ELECTRIC

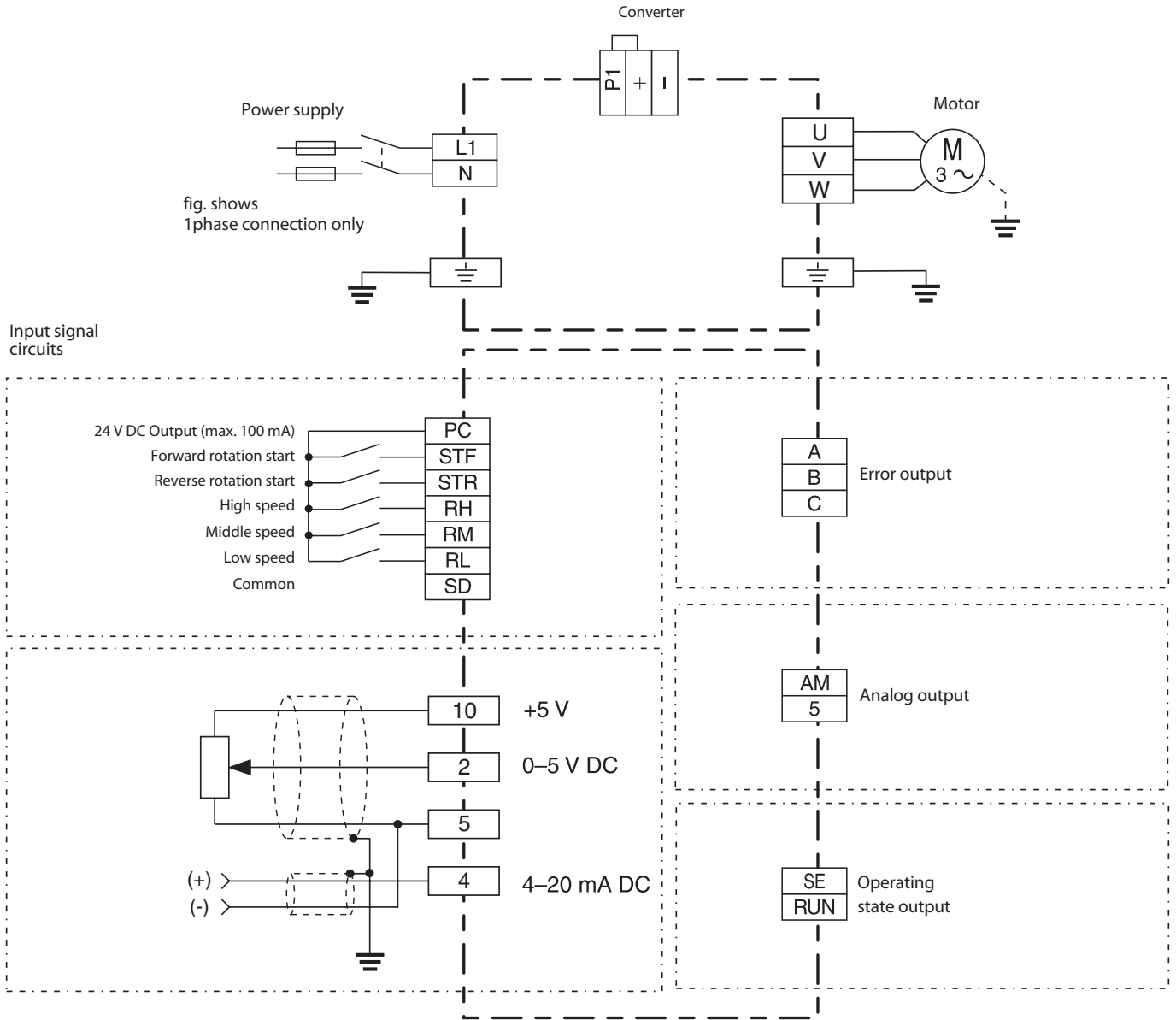| Product line			FR-S520SE				FR-S540E				
			-0.2 k	-0.4 k	-0.75 k	-1.5 k	-0.4 k	-0.75 k	-1.5 k	-2.2 k	-3.7 k
Control signals for operation	Input signals	Start signal	Individual selection of forward / reverse run Start signal self retaining input								
		Multi-speed selection	Up to 15 speeds can be preset in the range of 0–120 Hz. The current speed can be adjusted during operation via the control panel.								
		2nd function	Selects 2nd function (acceleration time, deceleration time, torque boost, base frequency, electronic overcurrent protection)								
		Selection of current input	Frequency setting via current input signal 0/4 to 20 mA DC (terminal 4)								
		External thermal input	Stopping the inverter with an externally mounted thermal relay								
		PU<->External operation	Switch between the operating modes "PU" and "External"								
		PID control	Select PID control								
		Output stop	Instant cutoff of inverter output (frequency and voltage)								
		Alarm reset	The error indication (alarm signal) is reset with the reset of the protective function.								
	Output signals	Operation status	1 output type (open collector output) selectable: Inverter running, frequency reached, frequency detection, overload warning, zero current detection, output current detection, maximum PID, minimum PID, PID forward run, PID reverse run, operation ready, current average value monitor signal, maintenance timer alarm, minor failure and error. Instead of the open collector output type 1 relay contact can be selected for the output (230 V AC; 0.3 A / 30 V DC; 0.3 A).								
		Analog signal	One of the following output types can be selected: Output frequency, motor current, analog output (0–5 V DC with 1mA full scale).								
Display option	Displayed on integrated control panel	Operating state	Output voltage, motor current, frequency setting value, operation speed								
		Alarm display	Error messages are displayed after a protective function has been activated. Up to 4 error codes can be stored.								
	Additional displays on parameter unit FR-PU04	Operating state	Signal status of input and output terminals								
		Interactive operating guide	Interactive guide for operation and troubleshooting via help function								
Protection	Functions		Overcurrent cutoff (during acceleration, deceleration, constant speed), regenerative overvoltage cutoff (during acceleration, deceleration, constant speed), overload cutoff (motor/inverter), fin overheating, fan error [6], overcurrent cut off, ground fault during start [7], external motor protection signal [8], PU connection error, number of retries, communications error, CPU error, undervoltage [9]								
	Protective structure		IP 20								
Others	Cooling		Self-cooling	Self-cooling	Self-cooling	Fan cooling	Self-cooling	Self-cooling	Fan cooling	Fan cooling	Fan cooling
	Stray power	(W)	20	45	50	85	40	50	80	110	170
	Weight	(kg)	0.6	0.8	1.0	1.5	1.5	1.5	1.5	1.6	1.7
Order information		Order no.	158459	158460	158461	158462	158463	158464	158465	158466	158467

Remarks:

① The specifications of the rated motor capacity are related to a motor voltage of 230 V for 1phase output and 440 V for 3phase output (max. ambient temperature of 50 °C).

② The overload capacity indicated in % is the ratio of the overload current to the inverters rated current. For repeated duty, allow time for the inverter and motor to return to or below the temperature and 100% load.

③ The maximum output voltage cannot exceed the input voltage. The maximum output voltage may be programmed individually, but it must be input voltage.

④ The input capacity changes with the values of the power supply side inverter impedances (including those of the input reactor and cables).

⑤ The braking torque indicated is short-duration average torque (which varies with motor loss) when the motor alone is decelerated from 50Hz in the shortest time and is not a continuous regenerative torque. When the motor is decelerated from the frequency higher than the base frequency, the average deceleration torque will reduce. Since the inverter does not contain a brake resistor, use the optional brake resistor when regenerative energy is large. A brake unit (e.G. BU-UFS) may also be used.

⑥ Only valid for frequency inverters equipped with a cooling fan.

⑦ To activate the function, set parameter 40 to "1".

⑧ The input OH is activated by the parameters on the function assignment of the input terminals (Pr. 60 to Pr. 63).

⑨ When undervoltage or instantaneous power failure has occurred, alarm display or alarm output is not provided but the inverter itself is protected. Overcurrent, regenerative overvoltage, or other protection may be activated at power restoration according to the operating condition.

2 SPECIFICATIONS

Block Diagram FR-S500E (Source Logic)

Converter

Power supply

Motor

P1 + I

L1
N

U
V
W

M
3 ~

fig. shows
1phase connection only

Input signal
circuits

24 V DC Output (max. 100 mA) — PC
Forward rotation start — STF
Reverse rotation start — STR
High speed — RH
Middle speed — RM
Low speed — RL
Common — SD

A
B   Error output
C

10   +5 V

2   0–5 V DC

5

4   4–20 mA DC

(+)
(-)

AM
5   Analog output

SE   Operating
RUN   state output

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Assignment of Signal Terminals

Function	Terminal	Terminal name	Description
Control connection	STF	Forward rotation start	The motor rotates forward, if a signal is applied to terminal STF. If the signals STF and STR are applied simultaneously, the STOP command is executed.
	STR ③	Reverse rotation start	The motor rotates reverse, if a signal is applied to terminal STR. If the signals STF and STR are applied simultaneously, the STOP command is executed.
	RH, RM, RL ③	Multi-speed selection	Up to 15 different output frequencies can be preset; for the speed commands the following priorities apply: Jog, speed selection (RH, RM, RL, RX) and AU.
Common	SD ①	Common sink for contact input/reference potential	A determined control function is activated, if the corresponding terminal is connected to the terminal SD. The SD terminal is isolated from the digital circuits via optocouplers. When connecting the transistor output (open collector output), such as a programmable controller (PLC), connect the negative external power supply for transistor output to this terminal to prevent a malfunction caused by undesirable currents. When source logic has been selected, connect this terminal with 0V of the external power supply.
	PC ①	+24VDC output and common source for contact input/reference potential	24 V DC / 0.1 A output via PC-SD In sink logic, when activated by open collector transistors (e.g. PLC) the positive pole of an external power supply has to be connected to the PC terminal. In source logic, the PC terminal serves as common reference point for the control inputs.
Setting value specification	10	Voltage output for potentiometer	Output voltage 5VDC. Max. output current 10mA Recommended potentiometer: 1 kΩ, 2 W linear (multi-turn potentiometer)
	2	Input for frequency setting value signal	The voltage setting value 0–5 (10) V is applied to this terminal. The voltage range is preset to 0–5 V. The input resistance is 10 kΩ. The maximum permitted voltage is 20 V.
	5	Reference point for frequency setting value signal	Terminal 5 is the reference point for all analog setting values and for the analog output signal AM. The terminal is not isolated from the reference potential of the control circuit and should not be earthed for reasons of noise immunity.
	4	Input for current setting value signal 0/4–20mADC	The current setting value signal (4–20m A DC) is applied to this terminal. The input is active only if the AU signal is set. The function of the AU signal is assigned via parameters 60 to 63. The input resistance is 250Ω., the maximum permitted current is 30 mA. By default, this signal is set to 0 Hz at 4 mA and 50 Hz at 20 mA.
Signal outputs	A, B, C ④ ⑤	Potential free alarm output	The alarm is output via relay contacts (C-B = Normally Open, C-A = Normally Closed). The maximum contact load is 230 V AC / 0.3 A or 30 V DC / 0.3 A.
	RUN ② ④	Signal output for motor operation	The output is switched low (that means, that the voltage of terminal SE is output), if the inverter output frequency is equal to or higher than the starting frequency. The output is switched high, if no frequency is output or the DC brake is in operation. The maximum contact load is 24 V DC / 0.1 A. (The voltage drop is 3.4 V maximum, when the signal is on.)
	SE ⑥	Reference potential for signal outputs	Reference potential for the signal RUN. This terminal is isolated from the reference potential of the control circuit 5 and SD.
	AM	Analog output	The output can be used for external frequency output or motor current output. The functions are determined by parameters. A DC voltmeter can be connected. The output signal across terminals AM-5 is factory set to about 5 V DC at 50 Hz and is proportional to the corresponding output frequency. The max. output voltage is 5 V. The maximum permitted output current is 1 mA.
Interface	—	Connection of control panel (RS485)	Communications via RS485 I/O standard: RS485, Multi-drop operation, max. 19200 Baud

Remarks:

① The terminals PC and SD must not be connected to each other nor to the protective earth terminal. In source logic, the terminal PC serves as common reference point for the control inputs. In sink logic, the terminal SD serves as common reference point for the control inputs.

② Low indicates that the open collector output transistor is on (conducts). High indicates that the transistor is off (does not conduct).

③ The following function assignments of the input terminals are supported: RL, RM, RH, RT, AU, STOP, MRS, OH, REX, JOG, RES, X14, X16 und (STR).

④ The following function assignments of the output terminals are supported: RUN, SU, OL, FU, RY, Y12, Y13, FDN, FUP, RL,Y93, Y95, LF und ABC.

⑤ To be compliant with the European directive (Low Voltage Directive), the operating capacity of relay outputs (A, B, C) should be 30 V DC 0.3 A.

⑥ When source logic has been selected, connect this terminal with the positive pole of the external power supply.

Assignment of Main Circuit Terminals

Funkction	Terminal	Terminal name	Description
Main circuit connection	L1, N	Power supply 1phase	Power supply of the inverter types FR-S520SE (200–240 V AC, 50/60 Hz)
	L1, L2, L3	Power supply 3phase	Power supply of the inverter types FR-S540E (380–480 V AC, 50/60 Hz)
	+, −	External brake unit connection	An external brake unit can be connected to the terminals + and −.
	P1, +	DC reactor connection	An optional DC reactor can be connected to the terminals P1 and +. Before connecting the DC reactor, disconnect the jumper from terminals P1 and +.
	U, V, W	Motor connection	Voltage output of the inverter (3phase, 0 V up to input voltage, 0.5–120 Hz)
	⏚	PE	Protective earth connection of inverter

The FR-E500 Series
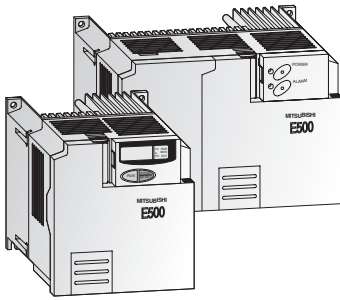
The FR-E500 with SLV control sets new standards for compact vector-controlled drive systems. The inverters of the FR-E500 series are packed with advanced features, including the Soft PWM system for reducing motor noise, powerful torque control and fast-response current control for motor acceleration and deceleration.

Output range:

0.4 – 7.5 kW,
200 – 240 V / 380 – 480 V

Available accessories:

Optional control units, versatile options and useful accessories are available for this frequency inverter.

Please refer to page 34 for details.

Technical Details FR-E500

Product line			FR-E520S				FR-E540						
			0.4 k	0.75 k	1.5 k	2.2 k	0.4 k	0.75 k	1.5 k	2.2 k	3.7 k	5.5 k	7.5 k
Output	Rated motor capacity [kW] ①	150 % Overload capacity ❶	0.75	1.1	2.2	3	0.75	1.1	2.2	3	4	7.5	11
		200 % Overload capacity ❷	0.4	0.75	1.5	2.2	0.4	0.75	1.5	2.2	4	5.5	7.5
	Rated current [A] ⑤	150 % Overload capacity ❶	3.6	5	9.6	12	1.8	3	4.9	6.7	9.5	14	21
		200 % Overload capacity ❷	2.5	4	7	10	1.6 (1.4)	2.6 (2.2)	4 (3.8)	6 (5.4)	9.5 (8.7)	12	17
	Rated output capacity kVA		0.95	1.5	2.7	3.8	1.2	2.0	3.0	4.6	7.2	9.1	13.0
	Overload capacity ②	❶	150 % of rated motor capacity for 0.5 s; 120 % for 1 min. (max. ambient temperature = 50 °C)										
		❷	200 % of rated motor capacity for 0.5 s; 150 % for 1 min. (max. ambient temperature = 50 °C)										
	Voltage ③		3-phase, 0 V up to power supply voltage										
Input	Power supply voltage		1-phase, 200–240 V AC, −15 % / +10 %				3-phase, 380–480 V AC, −15 % / +10 %						
	Voltage range		170–264 V AC at 50 / 60 Hz				323–528 V AC at 50 / 60 Hz						
	Frequency range		50 / 60 Hz ± 5 %				50 / 60 Hz ± 5 %						
	Rated input capacity ④ kVA		1.5	2.3	4.0	5.2	1.5	2.5	4.5	5.5	9	12	17
Control specifi-cations	Control method		Extended flux vector control with online auto tuning of motor data or V/f control										
	Modulation control		Sine evaluated PWM, Soft PW										
	Carrier frequency		0.7–14.5 kHz (user adjustable)										
	Frequency range		0.2–400 Hz										
	Frequency resolution	Analog	From terminals 2-5: 1/500 of maximum set frequency (input 5 V DC); 1/1000 (input 10 V, 20 mA DC)										
		Digital	0.01 Hz / 50 Hz										
	Frequency precision		±0.5 % of max. output frequency (temperature range 25 °C±10 °C) during analog input; ±0.01 % of max. output frequency during digital input										
	Voltage / frequency characteristics		Base frequency adjustable from 0 to 400 Hz; constant torque or variable torque selectable										
	Possible starting torque		≥ 150 % / 1 Hz, ≥ 200 % / 3Hz (for vector control oder slip compensation)										
	Torque boost		Manual torque boost; selectable between 0–30 %										
	Acceleration / deceleration time		0.01; 0.1 to 3600 s individual settings										
	Acceleration / deceleration characteristics		Linear or S-form course, user selectable										
	Braking torque	Regenerative ⑦	0.4 k and 0.75 k: 100 % or more; 1.5 k: 50 % or more; 2.2 k to 7.5 k: 20 % or more										
		DC braking	Braking time and braking moment adjustable, Operating frequency: 0–120 Hz, operating time: 0–10 s, voltage: 0–30 %										
	Current stall prevention operation level		Operation current level setting possible (0–200 % variable), enable/disable selection										
	Voltage stall prevention operation level		Operation level is fixed, enable/disable selection										
	High-response current restriction level		Operation level is fixed, enable/disable selection										
	Motor protection		Electronic motor protection relay (rated current user adjustable)										

Remarks:

Explanation for ① to ⑧ see next page.

MITSUBISHI ELECTRIC

Product line			FR-E520S				FR-E540						
			0.4 k	0.75k	1.5 k	2.2 k	0.4 k	0.75 k	1.5 k	2.2 k	3.7 k	5.5 k	7.5 k
Control signals for operation	Frequency setting values	Analog input	0–5 V DC, 0–10 V DC, 0/4–20 mA										
		Digital input	From control panel (parameter unit), RS-485 or network										
	Input signals	Starting signal	Individual selection of forward / reverse run Starting signal self retaining input										
		Multi-speed selection	Up to 15 set speeds (each speed can be set between 0 and 400 Hz; speed can be changed via control panel or during operation)										
		2nd function	Selects 2nd function (acceleration time, deceleration time, torque boost, base frequency, electronic overcurrent protection)										
		Selection of current input	Frequency setting via current input signal 0/4 to 20 mA DC										
		External thermal input	Stopping the inverter with an externally mounted thermal relay										
		PU<->external operation	Switch over between the operating modes "PU" and "External"										
		V/F<->flux vector control	External switching between V/F control and general-purpose flux vector control										
		Output stop	Instant cutoff of inverter output (frequency and voltage)										
		Error reset	The error indication (alarm signal) is reset with the reset of the protective function										
	Operation functions		Maximum and minimum frequency setting, frequency jump operation, external thermal input selection, instantaneous power failure restart operation, forward/reverse run prevention, slip compensation, operation mode selection, off-line auto tuning function, PID control, computer link operation (RS485), open network operation										
	Output signals	Operation status	2 output types (open collector output) can be selected: inverter running, frequency reached, frequency detection, overload warning, zero return detection, output current detection, maximum PID, minimum PID, PID forward run, PID reverse run, operation ready, minor failure and error. 1 relay contact can be selected for the output (230 V AC; 0.3 A / 30 V DC; 0.3 A)										
		Analog signal	One of the following output types can be selected: output frequency, motor current, output voltage, analog output (0–10 V DC).										
Display option	Displayed on control panel (FR-PU04/FR-PA02-02)	Operating state	Output frequency, motor current, output voltage, frequency setting value, operation speed										
		Alarm display	Error messages are displayed after a protective function is activated. Up to 4 error codes can be stored.										
	Additional displays on control panel FR-PU04	Operating state	Signal status of input and output terminals										
		Interactive operating guide	Interactive guide for operation and troubleshooting via help function										
Protection	Functions		Overcurrent cutoff (during acceleration, deceleration, constant speed), regenerative overvoltage cutoff, undervoltage [6], instantaneous power failure [6], overload cutoff (electronic thermal relay), brake transistor error, ground fault overcurrent, output short circuit, stall prevention, overload warning, brake transistor overheating, fin overheating, fan error [8], option error, parameter error, PU connection error, output phase error										
	Protection rating		IP 20										
Others	Cooling		Self-cooling		Fan cooling					Self-cooling		Fan cooling	
	Power loss (kW)		45	50	85	100	45	50	85	100	160	285	390
	Weight (kg)		1.9	1.9	2.0	2.0	1.9	1.9	2.0	2.1	2.1	3.8	3.8
Order information		Order no.	102938	102939	102940	102941	69197	69198	69200	69201	69204	102942	102943

Remarks:

[1] The specifications of the rated motor capacity are related to a motor voltage of 230 V resp. 400 V.

[2] The overload capacity indicated in % is the ratio of the overload current to the inverters rated current. For repeated duty, allow time for the inverter and motor to return to or below the temperature and 100 % load.

[3] The maximum output voltage cannot exceed the power supply voltage. The maximum output voltage may be set as desired below the power supply voltage.

[4] The power supply capacity changes with the values of the power supply side inverter impedances (including those of the input reactor and cables).

[5] The rated output current in the parentheses applies when low acoustic noise operation is to be performed at an ambient temperature higher than 40 °C with the parameter 72 (PWM frequency selection) value set to 2 kHz or higher.

[6] When undervoltage or instantaneous power failure has occurred, alarm display or alarm output is not provided but the inverter itself is protected. Overcurrent, regenerative overvoltage, or other protection may be activated at power restoration according to the operating condition.

[7] The braking torque indicated is short-duration average torque (which varies with motor loss) when the motor alone is decelerated from 50 Hz in the shortest time and is not a continuous regenerative torque. When the motor is decelerated from the frequency higher than the base frequency, the average deceleration torque will reduce. Since the inverter does not contain a brake resistor, use the optional brake resistor when regenerative energy is large. A brake unit BU may also be used.

[8] Not valid for the inverters FR-E540-0.4 k, -0.75 k and FR-E520S-0.1 k to -0.4 k which are not equipped with a cooling fan.

SPECIFICATIONS

2

Block Diagram FR-E500 (Source Logic)

MITSUBISHI ELECTRIC

Assignment of Signal Terminals

Function	Terminal		Description
Control connection	STF	Forward rotation start	The motor rotates forward, if a signal is applied to terminal STF.
	STR	Reverse rotation start	The motor rotates reverse, if a signal is applied to terminal STR.
	RH, RM, RL	Multi-speed selection	Preset of 15 different output frequencies; programmable.
	MRS	Output stop	The signal stops the output frequency without regard to the delay time; programmable.
	RES	RESET input	An activated protective circuit is reset, if a signal is applied to the terminal RES (t > 0,1 s).
Common	SD	Common sink for contact input/reference potential	A determined control function is activated, if the corresponding terminal is connected to the terminal SD. The SD terminal is isolated from the digital circuits via optocouplers. Common reference potential (sink logic) for 24 V DC/0.1 A output (PC terminal).
	PC	+24 V DC output	24 V DC / 0.1 A output; reference potential for source logic
Setting value specification	10	Voltage output for potentiometer	Output voltage 5 V DC Max. output current 10 mA Recommended potentiometer: 1 kΩ, linear
	2	Input for frequency setting value signal	The voltage setting value 0–5 (10) V is applied to this terminal. The voltage range is preset to 0–5 V. The input resistance is 10 kΩ.
	5	Reference point for frequency setting value signal	Terminal 5 is the reference point for all analog setting values and for the analog output signal AM. The terminal is not isolated from the reference potential of the control circuit and **must not be earthed**.
	4	Input for current setting value signal 0/4–20 mA DC	The current setting value signal (0/4–20 mA DC) is applied to this terminal. The input resistance is 250Ω.
Signal outputs	A, B, C	Potential free alarm output	The alarm is output via relay contacts; programmable. The maximum contact load is 230 V AC / 0,3 A or 30 V DC / 0,3 A.
	RUN	Signal output for motor operation	The output is switched low, if the inverter output frequency is equal to or higher than the starting frequency. The output is switched high, if no frequency is output or the DC brake is in operation. (programmable)
	FU	Signal output for monitoring output frequency	The output is switched low once the output frequency exceeds a value preset in parameter 42 (or 43). Otherwise the FU output is switched high. (programmable)
	SE	Reference potential for signal outputs	Reference potential for the signals RUN and FU. This terminal is isolated from the reference potential of the control circuit PC/SD.
	AM	Analog output	One of 3 monitoring functions can be selected, e.g. external frequency output. The functions are determined by parameters. A DC voltmeter can be connected. The max. output voltage is 10 V.
Interface	—	Connection of control panel (RS485)	Communications via RS485 I/O standard: RS485, Multi-Drop operation, max. 19200 Baud

Assignment of Main Circuit Terminals

Function	Terminal	Terminal name	Description
Main circuit connection	L1, L2, L3*	Power supply 1phase	Power supply of the inverter types FR-E520S (200–240 V AC, 50/60 Hz)
	L1, L2, L3	Power supply 3phase	Power supply of the inverter FR-E540 (380–480 V AC, 50/60 Hz)
	+, −	External brake unit connection	An external brake unit can be connected to the terminals + and − .
	+, PR	Optional external brake resistor connection	An optional external brake resistor can be connected to the terminals + and PR.
	P1, +	DC reactor connection	An optional DC reactor can be connected to the terminals P1 and +. Disconnect the jumper from terminals P1 and + before.
	U, V, W	Motor connection	Voltage output of the inverter (3-phase, 0 V up to power supply voltage, 0.2–400 Hz)
	⏚	PE	Protective earth connection of inverter

The FR-F700 Series
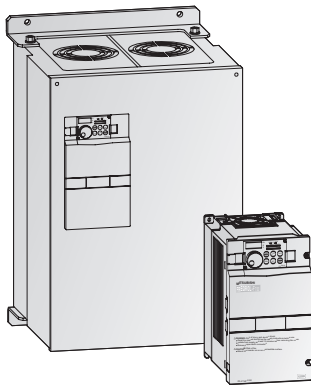
The FR-F700 is distinguished by its high energy-conservation potential. Major energy savings are achieved especially in the important lower speed ranges and during the run-up and braking phases. At an initial frequency of 35 Hz, for instance, the energy savings come to 57 % when compared with conventional concepts. The OEC (Optimum Excitation Control) technology effects an additional 10 % energy saving. It provides the ideal flux to the motor at all times.

Output range:

0.75 – 630 kW, 380 – 480 V
(Typ 01800: 380 – 500 V)

Available accessories:

Optional control units, versatile options and useful accessories are available for this frequency inverter.
Please refer to page 34 for details.

2

SPECIFICATIONS

Technical Details FR-F740-00023 to -01160

Series			FR-F740													
			00023	00038	00052	00083	00126	00170	00250	00310	00380	00470	00620	00770	00930	01160
Output	Rated motor capacity [1] [kW]	120% overload capacity (SLD) [5]	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
		150% overload capacity (LD)	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
	Rated current [A] [6]	120% overload capacity (SLD) [5] — I rated [6]	2.3	3.8	5.2	8.3	12.6	17	25	31	38	47	62	77	93	116
		I max. 60 s	2.5	4.2	5.7	9.1	13.9	18.7	27.5	34.1	41.8	51.7	68.2	84.7	102.3	127.5
		I max. 3 s	2.8	4.6	6.2	10	15.1	20.4	30	37.2	45.6	56.4	74.4	92.4	111.6	139.2
		150% overload capacity (LD) — I rated [6]	2.1	3.5	4.8	7.6	11.5	16	23	29	35	43	57	70	85	106
		I max. 60 s	2.5	4.2	5.8	9.1	13.8	19.2	27.6	34.8	42	51.6	68.4	84	102	127.2
		I max. 3 s	3.1	5.2	7.2	11.4	17.2	24	34.5	43.5	52.5	64.5	85.5	105	127.5	159
	Output capacity [kVA]	SLD [5]	1.8	2.9	4.0	6.3	9.6	13	19.1	23.6	29.0	35.8	47.3	58.7	70.9	88.4
		LD	1.6	2.7	3.7	5.8	8.8	12.2	17.5	22.1	26.7	32.8	43.4	53.3	64.8	80.8
	Overload current rating [2]	SLD	120 % of rated motor capacity for 3s; 110 % for 1 min. (max. ambient temperature 40 °C) – typical for pumps and fans													
		LD	150 % of rated motor capacity for 3s; 120 % for 1 min. (max. ambient temperature 50 °C) – typical for conveyor belts and centrifuges													
	Voltage [3]		3-phase AC, 0 V to power supply voltage													
	Frequency range		0.5–400 Hz													
	Control method		V/f control, optimum excitation control or simple magnetic flux vector control													
	Modulation control		Sine evaluated PWM, Soft PWM													
	Carrier frequency		0.7 kHz–14.5 kHz (user adjustable)													
Input	Power supply voltage		3-phase, 380–480 V AC, −15% / +10%													
	Voltage range		323–528 V AC at 50 / 60 Hz													
	Power supply frequency		50 / 60 Hz ±5%													
	Rated input capacity [4] [kVA]	SLD [5]	2.8	5.0	6.1	10	13	19	22	31	37	45	57	73	88	110
		LD	2.5	4.5	5.5	9	12	17	20	28	34	41	52	66	80	100
Others	Cooling		Self cooling			Fan cooling										
	Protective structure		IP20 [7]										IP00			
	Power loss [kW]	SLD [5]	0.06	0.08	0.1	0.16	0.19	0.24	0.34	0.39	0.49	0.58	0.81	1.0	1.17	1.51
		LD	0.05	0.08	0.09	0.14	0.18	0.22	0.31	0.35	0.44	0.52	0.71	0.93	1.03	1.32
	Frequency inverter weight [kg]		3.5	3.5	3.5	3.5	3.5	6.5	6.5	7.5	7.5	13	13	23	35	35
Order information [8]	Frequency Inverters		156569	156570	156571	156572	156573	156594	156595	156596	156597	156598	156599			
	Input Power Frame													169827	169828	169829
	Control Card FR-CF70-EC													189878	189878	189878

Remarks:

Explanation for [1] to [8] see next page.

MITSUBISHI ELECTRIC

Technical Details FR-F740-01800 to -12120

Series			FR-F740															
			01800	02160	02600	03250	03610	04320	04810	05470	06100	06830	07700	08660	09620	10940	12120
Output	Rated motor capacity [1] [kW]	120% overload capacity (SLD) [5]	90	110	132	160	185	220	250	280	315	355	400	450	500	560	630
		150% overload capacity (LD)	75	90	110	132	160	185	220	250	280	315	355	400	450	500	560
	Rated current [A] [6]	120% overload capacity (SLD) [5] · I rated [6]	180	216	260	325	361	432	481	547	610	683	770	866	962	1094	1212
		I max.60 s	198	238	286	357	397	475	529	602	671	751	847	953	1058	1203	1333
		I max.3 s	216	259	312	390	433	518	577	656	732	820	924	1039	1154	1313	1454
		150% overload capacity (LD) · I rated [6]	144	180	216	260	325	361	432	481	547	610	683	770	866	962	1094
		I max.60 s	173	216	259	312	390	433	518	577	656	732	820	924	1039	1154	1313
		I max.3 s	216	270	324	390	487	541	648	721	820	915	1024	1155	1299	1443	1641
	Output capacity [kVA]	SLD [5]	137	165	198	248	275	329	367	417	465	521	587	660	733	834	924
		LD	110	137	165	198	248	275	329	367	417	465	521	587	660	733	834
	Overload current rating [2]	SLD	120 % of rated motor capacity for 3s; 110 % for 1 min. (max. ambient temperature 40 ℃) – typical for pumps and fans														
		LD	150 % of rated motor capacity for 3s; 120 % for 1 min. (max. ambient temperature 50 ℃) – typical for conveyor belts and centrifuges														
	Voltage [3]		3-phase AC, 0 V to power supply voltage														
	Frequency range		0.5–400 Hz														
	Control method		V/f control, optimum excitation control or simple magnetic flux vector control														
	Modulation control		Sine evaluated PWM, Soft PWM														
	Carrier frequency		0.7 kHz–6 kHz (user adjustable)														
Input	Power supply voltage		3-phase, 380–500 V AC, −15% / +10%														
	Voltage range		323–550 V AC at 50 / 60 Hz														
	Power supply frequency		50 / 60 Hz ±5%														
	Rated input capacity [4] [kVA]	SLD [5]	137	165	198	248	275	329	367	417	465	520	587	660	733	834	924
		LD	110	137	165	198	248	275	329	367	417	465	520	587	660	733	834
Others	Cooling		Fan cooling														
	Protective structure		IP00														
	Power loss [kW]	SLD [5]	2.7	3.3	3.96	4.8	5.55	6.6	7.5	8.4	9.45	10.65	12.0	13.5	15.0	16.8	18.9
		LD	2.25	2.7	3.3	3.96	4.8	5.55	6.6	7.5	8.4	9.45	10.65	12.0	13.5	15.0	16.8
	Frequency inverter weight [kg]		37	50	57	72	72	110	110	220	220	220	260	260	370	370	370
	Reactor weight [kg]		20	22	26	28	29	30	35	38	42	46	50	57	67	85	95

Order information [8]	Frequency Inverters															
	Input Power Frame	169830	169831	169832	169833	169834	169835	169836	169837	169838	169839	169840	169841	169842	169843	169844
	Control Card FR-CF70-ECT	189879	189879	189879	189879	189879	189879	189879	189879	189879	189879	189879	189879	189879	189879	189879

Remarks:

[1] The performance figures at the rated motor capacity are based on a motor voltage of 400 V.

[2] The overload capacity in % is the ratio of the overload current to the inverter's rated current in the respective operating mode. For repeated duty cycles allow sufficient time for the inverter and the motor to cool below the temperature reached at 100 % load. The waiting periods can be calculated using the r.m.s. current method ($I^2 \times t$), for which knowledge of the duty is.

[3] The maximum output voltage cannot exceed the power supply voltage. The output voltage can be varied over the entire power supply voltage range.

[4] The rated input capacity varies depending on the impedance values on the power supply side of the inverter (including the cables and input reactor).

[5] When the load curve with 120 % overload capacity is selected the maximum permitted ambient temperature is 40℃.

[6] When operating with carrier frequencies ≥ 2.5 kHz this value is reduced automatically as soon as the frequency inverter exceeds 85% of the rated output current.

[7] When the cable bushing for the optional expansion cards is broken out the unit has an IP 00 protection rating.

[8] The inverter types FR-F740-02160 and above are all delivered with PCBs with two coats of protective varnish. For types FR-F740 00023 through 01800 varnished PCBs are standard. The double-coated version is available as an option.

Technical Details FR-F746-00023 to -01160

Series			FR-F746													
			00023	00038	00052	00083	00126	00170	00250	00310	00380	00470	00620	00770	00930	01160
Output	Rated motor capacity ① [kW]	120% overload capacity (SLD) ⑤	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
		150% overload capacity (LD)	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
	Rated current [A]	120% overload capacity (SLD) ⑤ — I rated ⑥	2.3	3.8	5.2	8.3	12.6	17	25	31	38	47	62	77	93	116
		I max. 60 s	2.5	4.2	5.7	9.1	13.9	18.7	27.5	34.1	41.8	51.7	68.2	84.7	102.3	127.5
		I max. 3 s	2.8	4.6	6.2	10	15.1	20.4	30	37.2	45.6	56.4	74.4	92.4	111.6	139.2
		150% overload capacity (LD) — I rated ⑥	2.1	3.5	4.8	7.6	11.5	16	23	29	35	43	57	70	85	106
		I max. 60 s	2.5	4.2	5.8	9.1	13.8	19.2	27.6	34.8	42	51.6	68.4	84	102	127.2
		I max. 3 s	3.1	5.2	7.2	11.4	17.2	24	34.5	43.5	52.5	64.5	85.5	105	127.5	159
	Output capacity [kVA]	SLD ⑤	1.8	2.9	4.0	6.3	9.6	13	19.1	23.6	29.0	35.8	47.3	58.7	70.9	88.4
		LD	1.6	2.7	3.7	5.8	8.8	12.2	17.5	22.1	26.7	32.8	43.4	53.3	64.8	80.8
	Overload current rating ②	SLD	120 % of rated motor capacity for 3s; 110 % for 1 min. (max. ambient temperature 30 ℃) – typical for pumps and fans													
		LD	150 % of rated motor capacity for 3s; 120 % for 1 min. (max. ambient temperature 40 ℃) – typical for conveyor belts and centrifuges													
	Voltage ③		3-phase AC, 0 V to power supply voltage													
	Frequency range		0.5–400 Hz													
	Control method		V/f control, optimum excitation control or simple magnetic flux vector control													
	Modulation control		Sine evaluated PWM, Soft PWM													
	Carrier frequency		0.7 kHz–14.5 kHz (user adjustable)													
Input	Power supply voltage		3-phase, 380–480 V AC, -15% / +10%													
	Voltage range		323–528 V AC at 50 / 60 Hz													
	Power supply frequency		50 / 60 Hz ± 5 %													
	Rated input capacity ④ [kVA]	SLD ⑤	2.8	5.0	6.1	10	13	19	22	31	37	45	57	73	88	110
		LD	2.5	4.5	5.5	9	12	17	20	28	34	41	52	66	80	100
Others	Cooling		Fan cooling													
	Protective structure		IP54													
	Power loss [kW]	SLD ⑤	0.06	0.08	0.1	0.16	0.19	0.24	0.34	0.39	0.49	0.58	0.81	1.0	1.17	1.51
		LD	0.05	0.08	0.09	0.14	0.18	0.22	0.31	0.35	0.44	0.52	0.71	0.93	1.03	1.32
	Frame size		C					D		E		F		G	H	
	Frequency inverter weight [kg]		12.5	12.5	12.5	12.5	12.5	18.5	18.5	21.5	21.5	30	30	30	42	42
Order information			163796	163797	163798	163799	163800	163801	163802	163803	163804	163805	163806	163807	163808	163809

Remarks:

① The performance figures at the rated motor capacity are based on a motor voltage of 400 V.

② The overload capacity in % is the ratio of the overload current to the inverter's rated current in the respective operating mode. For repeated duty cycles allow sufficient time for the inverter and the motor to cool below the temperature reached at 100% load. The waiting periods can be calculated using the r.m.s. current method (I² × t), for which knowledge of the duty.

③ The maximum output voltage cannot exceed the power supply voltage. The output voltage can be varied over the entire power supply voltage range.

④ The rated input capacity varies depending on the impedance values on the power supply side of the inverter (including the cables and input reactor).

⑤ When the load curve with 120% overload capacity is selected the maximum permitted ambient temperature is 30℃.

⑥ When operating with carrier frequencies ≥ 2.5 kHz this value is reduced automatically as soon as the frequency inverter exceeds 85% of the rated output current.

MITSUBISHI ELECTRIC

Common Specifications FR-F700

| FR-F740 / FR-F746			Description
Control specifications	Frequency setting resolution	Analog input	0.015 Hz / 0–50 Hz (terminal 2, 4: 0–10 V / 12 bit) 0.03 Hz / 0–50 Hz / (terminal 2, 4: 0–5 V / 11 bit, 0–20 mA / 11 bit, terminal 1: −10–+10 V / 12 bit) 0.06 Hz / 0–50 Hz (terminal 1: 0–±5 V / 11 bit)
		Digital input	0.01 Hz
	Frequency accuracy		±0.2 % of the maximum output frequency (temperature range 25° ±10 °C) via analog input; ±0.01 % of the set output frequency (via digital input)
	Voltage / frequency characteristics		Base frequency adjustable from 0 to 400 Hz; selection between constant torque, variable torque or optional flexible 5-point V/f characteristics
	Starting torque		120 % (3 Hz) when set to simple magnetic flux vector control and slip compensation
	Acceleration / deceleration time		0; 0.1 to 3600 s (can be set individually)
	Acceleration / deceleration characteristics		Linear or S-form course, user selectable
	DC injection brake		Operating frequency (0–120 Hz), operating time (0–10 s) and operating voltage (0–30 %) can be set individually. The DC brake can also be activated via the digital input.
	Stall prevention		Respones threshold 0–150%, user adjustable, also via analog input
	Motor protection		Electronic motor protection relay (rated current user adjustable)
Control signals for operation	Frequency setting values	Analog input	Terminal 2, 4: 0–5 V DC, 0–10 V DC, 0/4–20 mA Terminal 1: 0–±5 V DC, 0–±10 V DC
		Digital input	Operation panel or optional expansion board
	Start signal		Available individually for forward rotation and reverse rotation. Start signal automatic self-holding input (3-wire input) can be selected.
	Input signals		Any of 12 signals can be selected using parameters 178 to 189 (input terminal function selection): multi speed, second parameter function, terminal 4 input, JOG operation, automatic restart after instantaneous power failure, external thermal relay input, FR-HC connection (inverter operation enable signal) and FR-HC connection (instantaneous power failure detection), control panel operation/external interlock signal, External DC injection brake operation start, PID control, control panel operation, control panel<->external operation, output stop, start self-holding, traverse function selection, forward/reverse rotation command, inverter reset, PTC thermistor input, PID forward/reverse operation switchover, control panel<->NET, NET<->external operation, command source switchover
	Output signals	Operating state	Any of 7 signals can be selected using parameter 190 to 196 (output terminal function selection): Frequency control status, instantaneous power failure (under voltage), overload warning, output frequency detection, second output frequency detection, regenerative brake with pre-alarm (01800 and above), electronic thermal relay function with pre-alarm, control panel operation mode, inverter operation ready, output current detection, zero current detection, PID lower limit, PID upper limit, PID forward rotation/reverse rotation, commercial power supply-inverter switchover, direct mains operation motor 1-4, frequency inverter operation motor 1-4, inverter running start command ON, deceleration at an instantaneous power failure, PID control activated, re-start, PID output suspension, life time alarm, alarm output 3 (OFF signal), power savings average value update timing, current average monitor, alarm output2, maintenance timer alarm, remote outputs, minor failure output, alarm output, traverse operation, open-collector outputs (5 outputs), relay outputs (2 outputs), alarm code outputs (4 bits via open-collector)
		When using the FR-A7AY, FR-A7AR option	In addition to the above operating modes parameters 313-319 (function selection for the additional 7 output terminals) can also be used to assign the following four signals: control circuit capacitor life, main circuit capacitor life, cooling fan life, inrush current limit circuit life (Only positive logic can be set for extension terminals of the FR-A7AR)
		Analog output	You can also use parameter 54 (assign analog current output) and 158 (assign analog voltage output) to assign the following displays to one or both outputs: output frequency, motor current (steady or peak), output voltage, frequency setting value, motor running speed, converter output voltage (steady or peak), electronic thermal relay function load factor, input voltage, output voltage, load meter, reference voltage output, motor load factor, energy saving effect, regenerative brake circuit duty (01800 and above), PID set point, PID process value
Display	Control unit display (FR-PU07/ FR-DU07)	Operating state	Output frequency, motor current (steady or peak value), output voltage, alarm indication, frequency setting, motor running speed, converter output voltage (steady or peak value), electronic thermal load factor, input power, output power, road meter, cumulative energization time, actual operation time, motor load factor, watt-hours meter, power saving effect, cumulative saving power, regenerative brake circuit duty (01800 and above), PID set point, PID process value, PID deviation monitor, I/O terminal monitor, optional input terminal monitor (FR-DU07 only), optional output terminal monitor (FR-DU07 only), option fitting state monitor (FR-PU07 only), terminal assignment state (FR-PU07 only)
		Alarm definition	Alarm definition is displayed when the protective function is activated, the output voltage/current/frequency/cumulative energization time right before the protection function was activated and the past 8 alarm definitions are stored.
		Interactive guidance	Operation guide/trouble shooting with a help function (FR-PU07 only)
Protection	Protective functions		Overcurrent cutoff (during acceleration, deceleration or at constant speed), overvoltage cutoff (during acceleration, deceleration or at constant speed), inverter protection thermal operation, motor protection thermal operation, heatsink overheat, instantaneous power failure occurence, under voltage, input phase failure, motor overload, output short circuit, ground fault overcurrent, output phase failure, external thermal relay operation, PTC thermistor operation, option alarm, parameter error, control unit disconnection, retry count excess, CPU alarm, power supply short for control panel, 24 V DC power output short, output current detection value over, inrush resistance overheat, communication error (frequency inverter), analog input alarm, internal circuit alarm (15 V DC power supply), fan fault, overcurrent stall prevention, overvoltage stall prevention, electronic thermal pre-alarm, control unit stop, maintenance timer alarm (FR-DU07 only), MT-BU5 external brake module overload (01800 and above), parameter write error, copy error, operation panel lock, parameter copy error

Block Diagram FR-F700

Intermediate circuit connections

*The CN8 connector is provided with the inverter 01800 or more.

3phase AC power supply

Motor

Control circuit mains supply connection

ON / OFF — Jumper for activating the integrated interference suppression filter

Protective earth

Main circuit

Control circuit

Control input signals

Terminal	Signal
PC	24 V DC Output (max. 100 mA)
STF	Forward rotation start
STR	Reverse rotation start
STOP	Start self-retaining selection
RH	High speed (Multi-speed selection)
RM	Middle speed
RL	Low speed
RT	Second function selection
JOG	Jog mode
MRS	Output stop
AU	Current input selection / PTC
CS	Selection of automatic restart
SD	Common
RES	Reset

AU / PTC

SOURCE / SINK

Relay outputs

Terminal	Description
A1, B1, C1	Relay output 1 (Alarm output)
A2, B2, C2	Relay output 2

Open collector outputs

Terminal	Description
RUN	Running (Motor operation)
SU	frequency setting value/current value comparison
IPF	Instantaneous power failure
OL	Overload
FU	Frequency detection
SE	Power supply for OC outputs

Frequency setting inputs

Frequency setting potentiometer 0,5 W 1 kΩ

Terminal	Value
10E	+10 V
10	+5 V
2	0–5 V DC (0–10 V DC 4–20 mA DC)*
5	
1	0–±10 V DC (0–±5 V DC)*
4	4–20 mA DC (0–5 V DC 0–10 V DC)*

Auxiliary input (+) (-)

Current input (+) (-)

PU Connector

Analog

Terminal	Description
AM	Analog signal output (0 – 10 V DC / 1 mA)
CA	Analog signal output (0/4 – 20 mA)
5	Analog output common

RS-485 terminal

Terminal	Description
TXD+, TXD-	Data transmission
RXD+, RXD-	Data reception
SG	GND (Ground)
VCC	5 V (max. 100 mA)

* Input area can be set via parameters.

Connector/Slot for one plug-in option connection

Assignment of Main Circuit Terminals

Function	Terminal	Designation	Description
Main circuit connection	L1, L2, L3	Mains supply connection	Mains power supply of the inverters (380–480 V AC, 50/60 Hz); (380-500 V for FR-F700- 01800 and above)
	P/+, N/−	External brake unit connection	An optional external brake resistor can be connected to the terminals P and N or you can connect a optional high power factor converter.
	P1, P/+	DC reactor connection	An optional DC reactor can be connected to the terminals P1 and P/+. The jumper on terminals P1 and P/+ must be removed when this optional choke coil is used on frequency inverter models 01160 and below. The DC reactor supplied with the unit must be installed on frequency inverter models 01800 and above.
	U, V, W	Motor connection	Voltage output of the inverter (3-phase, 0 V up to power supply voltage, 0.5–400 Hz)
	L11, L21	Control circuit mains supply connection	To use external power for the control circuit connect the mains power to L11/L21 (and remove jumpers L1 and L2).
	CN8	Ext. brake transistor control	Control connection for the MT-BU5 external brake module (for FR-F700-01800 or above)
	⏚	PE	Protective earth connection of inverter

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Assignment of Signal Terminals

Function	Terminal	Designation	Description
Control connection (programmable)	STF	Forward rotation start	The motor rotates forward, if a signal is applied to terminal STF.
	STR	Reverse rotation start	The motor rotates reverse, if a signal is applied to terminal STR.
	STOP	Start self-retaining selection	The start signals are self-retaining, if a signal is applied to terminal STOP.
	RH, RM, RL	Multi-speed selection	Preset of 15 different output frequencies
	JOG	Jog mode selection	The JOG mode is selected, if a signal is applied to terminal JOG (factory setting). The inverters FR-A 540L-G 375 k and 450 k are not equipped with a JOG terminal. The start signals STF and STR determine the rotation direction.
	RT	Second parameter settings	A second set of parameter settings is selected, if a signal is applied to terminal RT.
	MRS	Output stop	The inverter lock stops the output frequency without regard to the delay time. You can select a make or break signal for the controller inhibit function by changing parameter 17.
	RES	RESET input	An activated protective circuit is reset, if a signal is applied to the terminal RES (t > 0,1 s).
	AU	Current input selection	The 0/4–20mA signal on terminal 4 is enabled by a signal on the AU terminal.
		PTC input	If you connect a PTC temperature sensor you must assign the PTC signal to the AU terminal and set the slide switch on the control circuit board to the PTC position.
	CS	Automatic restart after instantaneous power failure	The inverter restarts automatically after a power failure, if a signal is applied to the terminal CS.
Common	SD	Reference potential (0V) for the PC terminal (24V)	When "sink" control logic is selected by setting the control signal jumper a specific control function is triggered when the corresponding control terminal is connected to the SD terminal. When "source" control logic is selected and you are using external 24V power you must connect the 0V of the external power supply to terminal SD. The SD terminal is isolated from the digital electronics with optocouplers.
	PC	24 V DC output	Internal power supply 24 V DC/0,1 A output
Setting value specification	10 E	Voltage output for potentiometer	Output voltage 10 V DC. Max. output current 10 mA. Recommended potentiometer: 1 kΩ, 2 W linear
	10		Output voltage 5 V DC. Max. output current 10 mA. Recommended potentiometer: 1 kΩ, 2 W linear
	2	Input for frequency setting value signal	The setting value 0–10 V or 0/4–20 mA is applied to this terminal. You can switch between voltage and current setpoint values with parameter 73. The input resistance is 10 kΩ.
	5	Frequency setting common and analog outputs	Terminal 5 provides the common reference potential (0V) for all analog set point values and for the analog output signals CA (current) and AM (voltage). The terminal is isolated from the digital circuit's reference potential (SD). This terminal should not be grounded.
	1	Auxiliary input for frequency setting value signal 0–±5 (10) V DC	An additional voltage setting value signal of 0–±5 (10) V DC can be applied to terminal 1. The voltage range is preset to 0–±10 V DC. The input resistance is 10 kΩ.
	4	Input for setting value signal	The setting value 0/4–20 mA or 0–10 V is applied to this terminal. You can switch between voltage and current setpoint values with parameter 267. The input resistance is 250 Ω. The current setting value is enabled via terminal function AU.
Signal output (programmable)	A1, B1, C1	Potential free Relay output 1 (Alarm)	The alarm is output via relay contacts. The block diagram shows the normal operation and voltage free status. If the protective function is activated, the relay picks up. The maximum contact load is 200 V AC / 0.3 A or 30 V DC / 0.3 A.
	A2, B2, C2	Potential free Relay output 2	Any of the available 42 output signals can be used as the output driver. The maximum contact load is 230 V AC / 0.3 A or 30 V DC / 0.3 A.
	RUN	Signal output for motor operation	The output is switched low, if the inverter output frequency is equal to or higher than the starting frequency. The output is switched high, if no frequency is output or the DC brake is in operation.
	SU	Signal output for frequency setting value/current value comparison	The SU output supports a monitoring of frequency setting value and frequency current value. The output is switched low, once the frequency current value (output frequency of the inverter) approaches the frequency setting value (determined by the setting value signal) within a preset range of tolerance.
	IPF	Signal output for instantaneous power failure	The output is switched low for a temporary power failure within a range of 15 ms ≤ t_IPF ≤ 100 ms or for under voltage.
	OL	Signal output for overload alarm	The OL is switched low, if the output current of the inverter exceeds the current limit preset in parameter 22 and the stall prevention is activated. If the output current of the inverter falls below the current limit preset in parameter 22, the signal at the OL output is switched high.
	FU	Signal output for monitoring output frequency	The output is switched low once the output frequency exceeds a value preset in parameter 42 (or 43). Otherwise the FU output is switched high.
	SE	Reference potential for signal outputs	The potential that is switched via open collector outputs RUN, SU, OL, IPF and FU is connected to this terminal.
	CA	Current output 0–20 mA	One of 18 monitoring functions can be selected, e.g. external frequency output. CA and AM output can be used simultaneously. The functions are determined by parameters. An amperemeter can be connected (measuring range: 0–20 mA).
	AM	Analog output 0–10 V (1 mA)	One of 18 monitoring functions can be selected, e.g. external frequency output. CA and AM output can be used simultaneously. The functions are determined by parameters. A DC voltmeter can be connected. The max. output voltage is 10 V.
Interface	—	Connection of control panel (via RS485 terminal)	Communications via RS485 I/O standard: RS485, Multi-Drop operation, 4,800 – 38,400 Baud (overall length: 500 m)
	—	RS484 terminal (via RS485 terminal)	Communications via RS485 I/O standard: RS485, Multi-Drop operation, 300 – 38,400 Baud (overall length: 500 m)

The FR-A700 Series
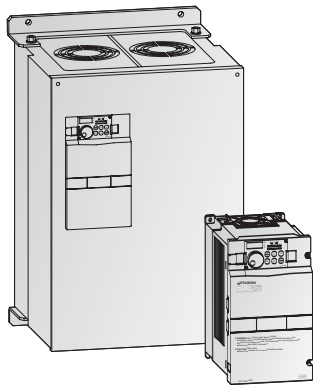
The FR-A700 series is pure high technology. This new generation of Mitsubishi Electric inverters combine innovative functions and reliable technology with maximum power, economy and flexibility. Among many other features it enables Online Autotuning for outstanding speed constancy, excellent smooth running performance for wear-free operation of a synchronous motors, controlled shut down after emergency stops and a large number of digital inputs and outputs.

Output range:

0.4 – 630 kW, 380 – 480 V
(as typ 01800: 380 – 500 V)

Available accessories:

Optional control units, versatile options and useful accessories are available for this frequency inverter.

Please refer to page 34 for details.

Technical Details FR-A740-00023 to -01160

Series			FR-A740														
			00023	00038	00052	00083	00126	00170	00250	00310	00380	00470	00620	00770	00930	01160	01800
Output	Rated motor capacity [1] [kW]	120% overload capacity (SLD)	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	90
		150% overload capacity (LD)	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
		200% overload capacity (ND)	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
		250% overload capacity (HD)	0.25	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45
	Rated current [A] [3]	120% overload capacity (SLD)	2.3	3.8	5.2	8.3	12.6	17	25	31	38	47	62	77	93	116	180
		150% overload capacity (LD)	2.1	3.5	4.8	7.6	11.5	16	23	29	35	43	57	70	85	106	144
		200% overload capacity (ND)	1.5	2.5	4	6	9	12	17	23	31	38	44	57	71	86	110
		250% overload capacity (HD)	0.8	1.5	2.5	4	6	9	12	17	23	31	38	44	57	71	86
	Output capacity [2] [kVA]	SLD	1.8	2.9	4.0	6.3	9.6	13.0	19.1	23.6	29.0	35.8	47.3	58.7	70.9	88.4	137
		LD	1.6	2.7	3.7	5.8	8.8	12.2	17.5	22.1	26.7	32.8	43.4	53.3	64.8	80.8	110
		ND	1.1	1.9	3.0	4.6	6.9	9.1	13.0	17.5	23.6	29.0	33.5	43.4	54.1	65.5	100
		HD	0.6	1.1	1.9	3.0	4.6	6.9	9.1	13.0	17.5	23.6	29.0	33.5	43.4	54.1	80
	Overload current rating [4]	SLD	110% of rated motor capacity for 60 s; 120% for 3 s (max. ambient temperature 40 °C) – inverse time characteristics														
		LD	120% of rated motor capacity for 60 s; 150% for 3 s (max. ambient temperature 50 °C) – inverse time characteristics														
		ND	150% of rated motor capacity for 60 s; 200% for 3 s (max. ambient temperature 50 °C) – inverse time characteristics														
		HD	200% of rated motor capacity for 60 s; 250% for 3 s (max. ambient temperature 50 °C) – inverse time characteristics														
	Voltage [5]		3-phase AC, 0 V to power supply voltage														
	Frequency range		0.2 – 400 Hz														
	Control method		Soft-PWM control/high carrier frequency PWM control (selectable from among V/f control, advanced magnetic flux vector control and real sensorless vector control)														
	Regenerative braking torque		100 % torque / 2 % ED					20 % torque / continuous [6]					20 % torque / continuous				
Input	Power supply voltage		3-phase, 380–480 V AC, −15% / +10%														
	Voltage range		323–528 V AC at 50 / 60 Hz														
	Power supply frequency		50 / 60 Hz ±5%														
	Rated input capacity [7] [kVA]	SLD	2.5	4.5	5.5	9	12	17	20	28	34	41	52	66	80	100	137
		LD	2.1	4	4.8	8	11.5	16	20	27	32	37	47	60	73	91	110
		ND	1.5	2.5	4.5	5.5	9	12	17	20	28	34	41	52	66	80	100
		HD	0.8	1.5	2.5	4.5	5.5	9	12	17	20	28	34	41	52	66	80
Others	Cooling		Self cooling			Fan cooling											
	Protective structure [9]		IP20 [8]											IP00			
	Power loss [kW]	SLD	0.06	0.082	0.98	0.15	0.21	0.28	0.39	0.4	0.55	0.69	0.97	1.18	1.36	1.78	2.65
		LD	0.05	0.08	0.09	0.14	0.18	0.22	0.31	0.35	0.44	0.52	0.71	0.93	1.03	1.32	2.0
		ND	0.05	0.065	0.075	0.1	0.15	0.2	0.25	0.29	0.4	0.54	0.65	0.81	1.02	1.3	1.54
		HD	0.043	0.05	0.06	0.075	0.1	0.146	0.18	0.21	0.29	0.4	0.54	0.65	0.74	1.02	1.14
	Frequency inverter weight [kg]		3.8	3.8	3.8	3.8	3.8	7.1	7.1	7.5	7.5	13	13	23	35	35	37

Order information		00023	00038	00052	00083	00126	00170	00250	00310	00380	00470	00620	00770	00930	01160	01800
	Frequency Inverters	169826	169797	169798	169799	169800	169801	169802	169803	169804	169805	169806				
	Input Power Frame												169827	169828	169829	169830
	Control Card FR-CA70-EC												169877	169877	169877	169877

Remarks:

Explanation for [1] to [9] see next page.

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Technical Details FR-A740-01800 to -12120

Series			FR-A740													
			02160	02600	03250	03610	04320	04810	05470	06100	06830	07700	08660	09620	10940	12120
Output	Rated motor capacity ① [kW]	120% overload capacity (SLD)	110	132	160	185	220	250	280	315	355	400	450	500	550	630
		150% overload capacity (LD)	90	110	132	160	185	220	250	280	315	355	400	450	500	560
		200% overload capacity (ND)	75	90	110	132	160	185	220	250	280	315	355	400	450	500
		250% overload capacity (HD)	55	75	90	110	132	160	185	220	250	280	315	355	400	450
	Rated current [A] ③	120% overload capacity (SLD)	216	260	325	361	432	481	547	610	683	770	866	962	1094	1212
		150% overload capacity (LD)	180	216	260	325	361	432	481	547	610	683	770	866	962	1094
		200% overload capacity (ND)	144	180	216	260	325	361	432	481	547	610	683	770	866	962
		250% overload capacity (HD)	110	144	180	216	260	325	361	432	481	547	610	683	770	866
	Output capacity ② [kVA]	SLD	165	198	248	275	329	367	417	465	521	587	660	733	834	924
		LD	137	165	198	248	275	329	367	417	465	521	587	660	733	834
		ND	110	137	165	198	248	275	329	367	417	465	521	587	660	733
		HD	84	110	137	165	198	248	275	329	367	417	465	521	587	660
	Overload current rating ④	SLD	110 % of rated motor capacity for 60 s; 120 % for 3 s (max. ambient temperature 40 °C) − inverse time characteristics													
		LD	120 % of rated motor capacity for 60 s; 150 % for 3 s (max. ambient temperature 50 °C) − inverse time characteristics													
		ND	150 % of rated motor capacity for 60 s; 200 % for 3 s (max. ambient temperature 50 °C) − inverse time characteristics													
		HD	200 % of rated motor capacity for 60 s; 250 % for 3 s (max. ambient temperature 50 °C) − inverse time characteristics													
	Voltage ⑤		3-phase AC, 0 V to power supply voltage													
	Frequency range		0.2 − 400 Hz													
	Control method		Soft-PWM control/high carrier frequency PWM control (selectable from among V/f control, advanced magnetic flux vector control and real sensorless vector control)													
	Regenerative braking torque (nax. value / permissible duty)		20 % torque / cont.	10 % torque / continuous												
Input	Power supply voltage		3-phase, 380−500 V AC, -15 % / +10 %													
	Voltage range		323−550 V AC at 50 / 60 Hz													
	Power supply frequency		50 / 60 Hz ±5 %													
	Rated input capacity [kVA]	SLD	165	198	247	275	329	366	416	464	520	586	660	733	833	924
		LD	137	165	198	247	275	329	366	416	464	520	586	659	733	833
		ND	110	137	165	198	248	275	329	367	417	465	521	587	660	733
		HD	84	110	137	165	198	248	275	329	367	417	465	521	587	660
Others	Cooling		Fan cooling													
	Protective structure		IP00													
	Power loss [kW]	SLD	2.9	3.57	3.8	4.2	5.02	5.5	6.4	7.2	8.19	8.6	10.37	11.5	13.2	14.94
		LD	2.4	2.9	3.0	3.8	4.2	5.1	5.5	6.4	7.2	8.0	8.6	10.2	11.5	13.20
		ND	1.9	2.4	2.5	3.0	4.0	4.2	5.0	5.5	6.5	7.0	7.3	8.1	9.3	10.5
		HD	1.44	1.9	1.97	2.5	2.57	4.0	4.2	5.0	5.5	6.5	7.0	6.91	8.1	9.3
	Frequency inverter weight [kg]		50	57	72	72	110	110	175	175	175	260	260	370	370	370
	Reactor weight [kg]		22	26	28	29	30	35	38	42	46	50	57	67	85	95

Order information	Frequency Inverters														
	Input Power Frame	169831	169832	169833	169834	169835	169836	169837	169838	169839	169840	169841	169842	169843	169844
	Control Card FR-CA70-ECT	190051	190051	190051	190051	190051	190051	190051	190051	190051	190051	190051	190051	190051	190051

Remarks:

① The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi Electric 4-pole standard motor.

② The rated output capacity indicated assumes that the output voltage is 440 V.

③ When operating the inverter of 75K (type 02160) or more with a value larger than 2 kHz set in Pr. 72 PWM frequency selection, the rated output current is max. 85 %.

④ The % value of the overload current rating indicates the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100 % load.

⑤ The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the pulse voltage value of the inverter output side voltage remains unchanged at about √2 that of the power supply

⑥ For the 11K to 22K capacities (type 00310 to 00620), using the dedicated external brake resistor (FR-ABR) will achieve the performance of 100 % torque/6 % ED.

⑦ The power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).

⑧ When the hook of the inverter front cover is cut off for installation of the plug-in option, the inverter changes to an open type (IP00).

⑨ FR-DU07: IP40 (except for the PU connector)
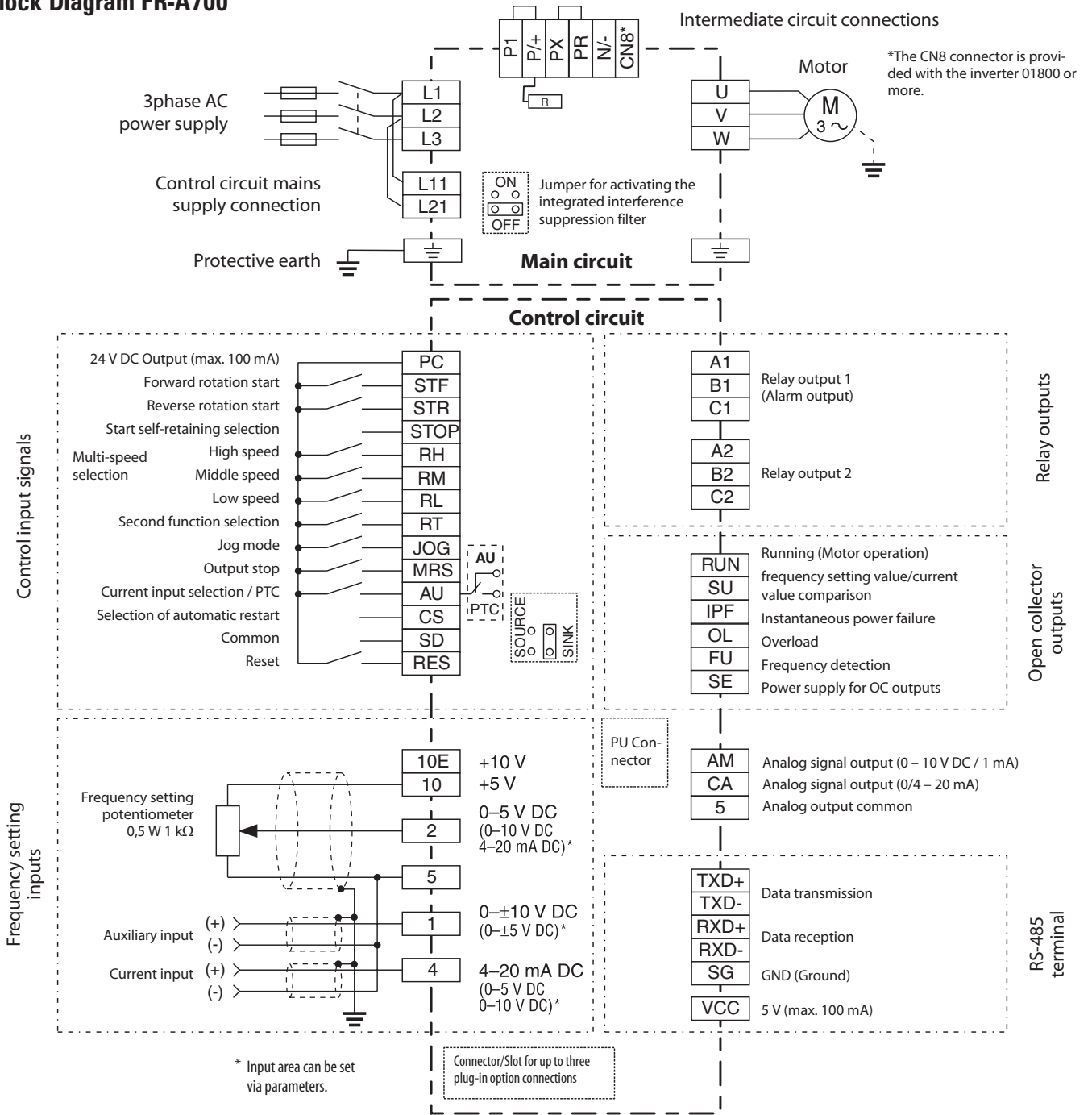
Common Specifications FR-A700

FR-A740			Description
Control specifications	Control method		Soft-PWM control/high carrier frequency PWM control (selectable from among V/F control, advanced magnetic flux vector control and real sensorless vector control) / vector control (when used with option FR-A7AP) [1]
	Frequency setting resolution	Analog input	0.015 Hz / 0–50 Hz (terminal 2, 4: 0–10 V / 12 bit) 0.03 Hz / 0–50 Hz / (terminal 2, 4: 0–5 V / 11 bit, 0–20 mA / 11 bit, terminal 1: −10−+10 V / 12 bit) 0.06 Hz / 0–50 Hz (terminal 1: 0−±5 V / 11 bit)
		Digital input	0.01 Hz
	Frequency accuracy		±0.2 % of the maximum output frequency (temperature range 25° ± 10 ℃) via analog input; ±0.01 % of the set output frequency (via digital input)
	Voltage / frequency characteristics		Base frequency adjustable from 0 to 400 Hz; selection between constant torque, variable torque or optional flexible 5-point V/f characteristics
	Starting torque		200 % 0.3 Hz (0.4 K to 3.7 K), 150 % 0.3 Hz (5.5 K or more) (under real sensorless vector control or vector control)
	Torque boost		Manual torque boost
	Acceleration / deceleration time		0; 0.1 to 3600 s (can be set individually), linear or S-pattern acceleration/deceleration mode, backlash measures acceleration/deceleration can be selected.
	Acceleration / deceleration characteristics		Linear or S-form course, user selectable
	DC injection brake		Operating frequency (0–120 Hz), operating time (0–10 s) and operating voltage (0–30 %) can be set individually. The DC brake can also be activated via the digital input.
	Stall prevention operation level		Operation current level can be set (0 to 220 % adjustable), whether to use the function or not can be selected
	Motor protection		Electronic motor protection relay (rated current user adjustable)
	Torque limit level		Torque limit value can be set (0 to 400 % variable)
Control signals for operation	Frequency setting values	Analog input	Terminal 2, 4: 0–5 V DC, 0–10 V DC, 0/4–20 mA Terminal 1: 0−±5 V DC, 0−±10 V DC
		Digital input	Input using the setting dial of the operation panel or parameter unit Four-digit BCD or 16 bit binary (when used with option FR-A7AX)
	Start signal		Available individually for forward rotation and reverse rotation. Start signal automatic self-holding input (3-wire input) can be selected.
	Input signals	Common	Any of 12 signals can be selected using parameters 178 to 189 (input terminal function selection): from among multi speed selection, remote setting, stop-on-contact, second function selection, third function selection, terminal 4 input selection, JOG operation selection, selection of automatic restart after instantaneous power failure, flying start, external thermal relay input, inverter operation enable signal (FR-HC/FR-CV connection), FR-HC connection (instantaneous power failure detection), PU operation/external inter lock signal , external DC injection brake operation start, PID control enable terminal, brake opening completion signal, PU operation/external operation switchover, load pattern selection forward rotation reverse rotation boost, V/F switching, load torque high-speed frequency, S-pattern acceleration/deceleration C switchover, pre-excitation, output stop, start self-holding selection, control mode changing, torque limit selection, start-time tuning start external input, torque bias selection 1, 2 [1], P/PI control switchover, forward rotation command, reverse rotation command, inverter reset, PTC thermistor input, PID forward reverse operation switchover, PU-NET operation switchover, NET-external operation switchover, and command source switchover
		Pulse train input	100 kpps
	Output signals	Operating status	Any of 7 signals can be selected using parameter 190 to 196 (output terminal function selection): from among inverter running, up-to-frequency, instantaneous power failure/undervoltage, overload warning, output frequency (speed) detection, second output frequency (speed) detection, third output frequency (speed) detection, regenerative brake prealarm, electronic thermal relay function pre-alarm, PU operation mode, inverter operation ready, output current detection, zero current detection, PID lower limit, PID upper limit, PID forward rotation reverse rotation output, commercial power supply-inverter switchover MC1, commercial power supply-inverter switchover MC2, commercial power supply-inverter switchover MC3, orientation completion [1], brake opening request, fan fault output, heatsink overheat pre-alarm , inverter running/start command on, deceleration at an instantaneous power failure, PID control activated, during retry, PID output interruption, life alarm, alarm output 1, 2, 3 (power-off signal), power savings average value update timing, current average monitor, maintenance timer alarm, remote output, forward rotation output [1], reverse rotation output*1, low speed output, torque detection, regenerative status output [1], start-time tuning completion, in-position completion [1], minor failure output and alarm output. Open collector output (5 points), relay output (2 points) and alarm code of the inverter can be output (4 bit) from the open collector
		When using the FR-A7AY, FR-A7AR option	In addition to the above operating modes parameters 313-319 (function selection for the additional 7 output terminals) can also be used to assign the following four signals: control circuit capacitor life, main circuit capacitor life, cooling fan life, inrush current limit circuit life (Only positive logic can be set for extension terminals of the FR-A7AR)
		Pulse train output	50 kpps
		Analog output	You can select any signals using Pr. 54 FM terminal function selection (pulse train output) and Pr. 158 AM terminal function selection (analog output) from among output frequency, motor current (steady or peak value), output voltage, frequency setting, operation speed, motor torque, converter output voltage (steady or peak value), electronic thermal relay function load factor, input power, output power, load meter, motor excitation current, reference voltage output, motor load factor, power saving effect, regenerative brake duty ,PID set point, PID measured value, motor output, torque command, torque current command, and torque monitor.
Display	Control unit display (FR-PU07/ FR-DU07)	Operating state	Output frequency, motor current (steady or peak value), output voltage, frequency setting, running speed,motor torque, overload, converter output voltage (steady or peak value), electronic thermal relay function load factor, input power, output power, load meter, motor excitation current, cumlative energization time, actual operation time, motor load factor, cumulative power, energy saving effect, cumulative saving power, regenerative brake duty, PID set point, PID measured value, PID deviation, inverter I/O terminal monitor, input terminal option monitor [2], output terminal option monitor [2], option fitting status [3], terminal assignment status [3], torque command, torque current command, feed back pulse [1], motor output
		Alarm definition	Alarm definition is displayed when the protective function is activated, the output voltage/current/frequency/cumulative energization time right before the protection function was activated and the past 8 alarm definitions are stored.
		Interactive guidance	Operation guide/trouble shooting with a help function [3]

FR-A740		Description
Protection	Protective functions	Overcurrent during acceleration, overcurrent during constant speed, overcurrent during deceleration, overvoltage during acceleration, overvoltage during constant speed, overvoltage during deceleration, inverter protection thermal operation, motor protection thermal operation, heatsink overheat, instantaneous power failure occurrence, undervoltage, input phase failure, motor overload, output side earth (ground) fault overcurrent, output short circuit, main circuit element overheat, output phase failure, external thermal relay operation, PTC thermistor operation, option alarm, parameter error, PU disconnection, retry count excess, CPU alarm, operation panel power supply short circuit, 24VDC power output short circuit, output current detection value excess, inrush current limit circuit alarm, communication alarm (inverter), USB error, opposite rotation deceleration error, analog input error, fan fault, overcurrent stall prevention, overvoltage stall prevention, regenerative brake prealarm, electronic thermal relay function prealarm, PU stop, maintenance timer alarm[2], brake transistor alarm, parameter write error, copy operation error, operation panel lock, parameter copy alarm, speed limit indication, encoder no-signal [1], speed deviation large [1], overspeed [1], position error large [1], encoder phase error [1]

Remarks:

[1] Only when the option (FR-A7AP) is mounted

[2] Can be displayed only on the operation panel (FR-DU07).

[3] Can be displayed only on the parameter unit (FR-PU07/FR-PU04).

2

SPECIFICATIONS

2

Block Diagram FR-A700

Intermediate circuit connections

P1 | P/+ | PX | PR | N/- | CN8*

R

*The CN8 connector is provided with the inverter 01800 or more.

Motor
M 3 ~

3phase AC power supply — L1 L2 L3

Control circuit mains supply connection — L11 L21

ON / OFF — Jumper for activating the integrated interference suppression filter

Protective earth

Main circuit

U V W

Control circuit

Control input signals

24 V DC Output (max. 100 mA)	PC
Forward rotation start	STF
Reverse rotation start	STR
Start self-retaining selection	STOP
Multi-speed selection — High speed	RH
Middle speed	RM
Low speed	RL
Second function selection	RT
Jog mode	JOG
Output stop	MRS
Current input selection / PTC	AU
Selection of automatic restart	CS
Common	SD
Reset	RES

AU
PTC
SOURCE / SINK

Frequency setting inputs

10E	+10 V
10	+5 V
2	0–5 V DC (0–10 V DC 4–20 mA DC)*
5	
1	0–±10 V DC (0–±5 V DC)*
4	4–20 mA DC (0–5 V DC 0–10 V DC)*

Frequency setting potentiometer 0,5 W 1 kΩ

Auxiliary input (+) (-)

Current input (+) (-)

* Input area can be set via parameters.

PU Connector

Connector/Slot for up to three plug-in option connections

Relay outputs

A1	
B1	Relay output 1 (Alarm output)
C1	
A2	
B2	Relay output 2
C2	

Open collector outputs

RUN	Running (Motor operation)
SU	frequency setting value/current value comparison
IPF	Instantaneous power failure
OL	Overload
FU	Frequency detection
SE	Power supply for OC outputs

AM	Analog signal output (0 – 10 V DC / 1 mA)
CA	Analog signal output (0/4 – 20 mA)
5	Analog output common

RS-485 terminal

TXD+	
TXD-	Data transmission
RXD+	
RXD-	Data reception
SG	GND (Ground)
VCC	5 V (max. 100 mA)

Assignment of Main Circuit Terminals

Function	Terminal	Designation	Description
Main circuit connection	L1, L2, L3	Mains supply connection	Mains power supply of the inverters (380–480 V AC, 50/60 Hz); (380-500 V – 01800 and above)
	P/+, PR	Brake resistor connection	An optional brake resistor (FR-ABR) can be connected across these terminals. The PR terminal is provided only for type 00023 – 00620.
	P/+, N/-	Brake unit connection	A brake unit (FR-BU and BU, MT-BU5), power regeneration common converter (FR-CV) or regeneration common converter (MT-RC) and high power factor converter (FR-HC, MT-HC) can be connected to these terminals.
	P/+, P1	DC reactor connection	An optional DC reactor can be connected to the terminals P1 and P/+. The jumper on terminals P1 and P/+ must be removed when this optional choke coil is used on frequency inverter models 01160 and below. The DC reactor supplied with the unit must be installed on frequency inverter models 01800 and above.
	PR, PX	Built-in brake circuit connection	When the jumper is connected across terminals PR and PX (initial status), the built-in brake reactor circuit is valid. The PX terminal is provided only for type 00023 – 00250.
	U, V, W	Motor connection	Voltage output of the inverter (3-phase, 0 V up to power supply voltage, 0.5–400 Hz)
	L11, L21	Power supply for control circuit	To use external power for the control circuit connect the mains power to L11/L21 (and remove jumpers L1 and L2).
	CN8	Ext. brake transistor control	Control connection for the MT-BU5 external brake module
	⏚	PE	Protective earth connection of inverter

Assignment of Signal Terminals

Function	Terminal	Designation	Description
Control connection (programmable)	STF	Forward rotation start	The motor rotates forward, if a signal is applied to terminal STF.
	STR	Reverse rotation start	The motor rotates reverse, if a signal is applied to terminal STR.
	STOP	Start self-retaining selection	The start signals are self-retaining, if a signal is applied to terminal STOP.
	RH, RM, RL	Multi-speed selection	Preset of 15 different output frequencies according to the combination of the RH, RM and RL signals.
	JOG	Jog mode selection	The JOG mode is selected, if a signal is applied to this terminal (factory setting). The start signals STF and STR determine the rotation direction.
		Pulse train input	The JOG terminal can be used as pulse train input terminal (parameter 291 setting needs to be changed)
	RT	Second parameter settings	A second set of parameter settings is selected, if a signal is applied to terminal RT.
	MRS	Output stop	The inverter lock stops the output frequency without regard to the delay time.
	RES	RESET input	An activated protective circuit is reset, if a signal is applied to the terminal RES (t > 0,1 s).
	AU	Current input selection	The 0/4–20mA signal on terminal 4 is enabled by a signal on the AU terminal.
		PTC input	If you connect a PTC temperature sensor you must assign the PTC signal to the AU terminal and set the slide switch on the control circuit board to the PTC position.
	CS	Automatic restart after instantaneous power failure	The inverter restarts automatically after a power failure, if a signal is applied to the terminal CS.
Common	SD	Reference potential (0V) for the PC terminal (24V)	When "sink" control logic is selected by setting the control signal jumper a specific control function is triggered when the corresponding control terminal is connected to the SD terminal. When "source" control logic is selected and you are using external 24V power you must connect the 0V of the external power supply to terminal SD. The SD terminal is isolated from the terminals 5 and SE with optocouplers.
	PC	24 V DC output	Internal power supply 24 V DC/0,1 A output
Setting value specification	10 E	Voltage output for potentiometer	Output voltage 10 V DC. Max. output current 10 mA. Recommended potentiometer: 1 kΩ, 2 W linear
	10		Output voltage 5 V DC. Max. output current 10 mA. Recommended potentiometer: 1 kΩ, 2 W linear
	2	Input for frequency setting value signal	The setting value 0 to 5 V DC (or 0–10 V, 0/4–20 mA) is applied to this terminal. You can switch between voltage and current setpoint values with parameter 73. The input resistance is 10 kΩ.
	5	Frequency setting common and analog outputs	Terminal 5 provides the common reference potential (0V) for all analog set point values and for the analog output signals CA (current) and AM (voltage). The terminal is isolated from the digital circuit's reference potential (SD). This terminal should not be grounded.
	1	Auxiliary input for frequency setting value signal 0–±5 (10) V DC	An additional voltage setting value signal of 0–±5 (10) V DC can be applied to terminal 1. The voltage range is preset to 0–±10 V DC. The input resistance is 10 kΩ.
	4	Input for setting value signal	The setting value 0/4–20 mA or 0–10 V is applied to this terminal. You can switch between voltage and current setpoint values with parameter 267. The input resistance is 250 Ω. The current setting value is enabled via terminal function AU.
Signal output (programmable)	A1, B1, C1	Potential free relay output 1 (Alarm)	The alarm is output via relay contacts. The block diagram shows the normal operation and voltage free status. If the protective function is activated, the relay picks up. The maximum contact load is 200 V AC / 0.3 A or 30 V DC / 0.3 A.
	A2, B2, C2	Potential free relay output 2	Any of the available 42 output signals can be used as the output driver. The maximum contact load is 230 V AC / 0.3 A or 30 V DC / 0.3 A.
	RUN	Signal output for motor operation	The output is switched low, if the inverter output frequency is equal to or higher than the starting frequency. The output is switched high, if no frequency is output or the DC brake is in operation.
	SU	Signal output for frequency setting value/current value comparison	The SU output supports a monitoring of frequency setting value and frequency current value. The output is switched low, once the frequency current value (output frequency of the inverter) approaches the frequency setting value (determined by the setting value signal) within a preset range of tolerance.
	IPF	Signal output for instantaneous power failure	The output is switched low for a temporary power failure within a range of 15 ms $\leq t_{IPF} \leq$ 100 ms or for under voltage.
	OL	Signal output for overload alarm	The OL is switched low, if the output current of the inverter exceeds the current limit preset in parameter 22 and the stall prevention is activated. If the output current of the inverter falls below the current limit preset in parameter 22, the signal at the OL output is switched high.
	FU	Signal output for monitoring output frequency	The output is switched low once the output frequency exceeds a value preset in parameter 42 (or 43). Otherwise the FU output is switched high.
	SE	Reference potential for signal outputs	The potential that is switched via open collector outputs RUN, SU, OL, IPF and FU is connected to this terminal.
	FM	Connection for measuring instrument	One of 18 monitoring functions can be selected, e.g. external frequency output. FM and AM output can be used simultaneously. The functions are determined by parameters. — Output item: output frequency (initial setting), permissible load current 2 mA, 1440 pulses/s at 60 Hz
		Open collector output	Signals can be output from the open collector terminals by setting parameter 291 (max. output pulse 50 kpulses/s)
	AM	Analog signal output 0–10 V DC (1 mA)	Output item: output frequency (initial setting), output signal 0 to 10 V DC, permissible load current 1 mA (load impedance >10 kΩ), 8 bit
Interface	—	PU connector	A parameter unit can be connected. Communications via RS485 I/O standard: RS485, Multi-Drop operation, 4,800 – 38,400 Baud (overall length: 500 m)
	—	RS484 terminal (via RS485 terminal)	Communications via RS485 I/O standard: RS485, Multi-Drop operation, 300 – 38,400 Baud (overall length: 500 m)
	—	USB connector	This USB interface is used to connect the inverter to a peronal computer (conforms to USB1.1)

Parameter Overview

For simple variable-speed operation of the inverter, the initial setting of the parameters may be used as they are.

Set the necessary parameters to meet the load and operational specifications.
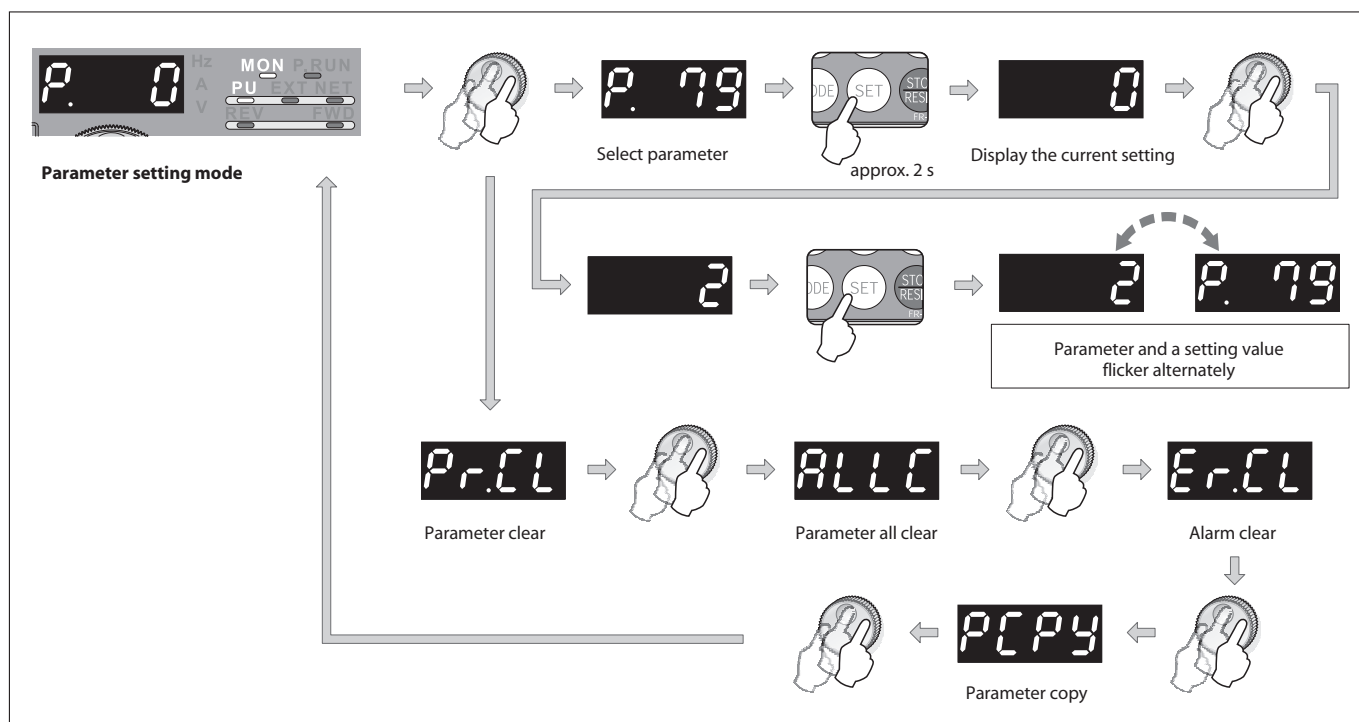
Parameter setting, change and check can be made from the operation panel or by the Software FR-Configurator (see page 42 for more details).

The following list is an overview on the capabilities and functions of each inverter. For details of parameters, refer to the appropriate instruction manual see www.mitsubishi-automation.de.

Function	FR-S500E	FR-E 500	FR-F700	FR-A700
Basic parameters	●	●	●	●
Parameters for standard drive operation	●	●	●	●
Settings of control outputs	●	●	●	●
Automatic torque boost	●	—	—	—
2nd parameter settings	●	●	●	●
3nd parameter settings	—	—	—	●
Display functions	●	●	●	●
Restart	●	●	●	●
Operation settings	●	●	●	●
Vector control	—	●	●	●
Adjustable 5 points V/F	—	—	●	●
Orientation control	—	—	—	●
Encoder feedback	—	—	—	●
Pulse train input	—	—	—	●
Conditional position feed function	—	—	—	●
Torque command	—	—	—	●
Torque limit	—	—	—	●
Torque bias	—	—	—	●
Speed limit	—	—	—	●
Easy gain tuning	—	—	—	●
Adjustment function	—	—	—	●
Control system functions	—	—	—	●
Communication functions	●	●	●	●
PLC function	—	—	—	●
PID control	●	●	●	●
Commercial power supply switch-over	—	—	●	●
Backlash	—	—	●	●
Display	●	●	●	●
Variable current limiting	—	—	●	●
Output current detection	●	●	●	●
Auxiliary function	●	●	●	●
Restart	●	●	●	●
Cumulative monitor clear	—	●	●	●
User functions	—	●	●	●
Terminal functions selection	●	●	●	●
Multi-speed setting	●	●	●	●
Help functions	—	●	●	●
Slip compensation	●	●	●	●

MITSUBISHI ELECTRIC

Function	FR-S500E	FR-E 500	FR-F700	FR-A700
Life check	—	—	●	●
Special functions	—	—	●	●
Power failure stop	—	—	●	●
Load torque high speed frequency control	—	—	—	●
Stop-on contact control	—	—	—	●
Brake sequence function	—	—	—	●
Droop control	—	—	—	●
Other functions	—	—	●	●
Remote outputs	—	—	●	●
Maintenance functions	●	—	●	●
Current average monitor	●	—	●	●
PID Sleep function	—	—	●	—
Advanced PID control	—	—	●	—
Traverse function	—	—	●	●
Regeneration avoidance function	—	—	●	●
Free parameter	—	—	●	●
Energy saving monitor	—	—	●	●
Calibration function	●	●	●	●
Analog current output calibration function	—	—	●	●
Help functions	●	●	●	●

2

SPECIFICATIONS

Setting parameters (example)

Parameter setting mode

Select parameter

approx. 2 s

Display the current setting

Parameter and a setting value flicker alternately

Parameter clear

Parameter all clear

Alarm clear

Parameter copy

General Operating Conditions for all Inverters

Specifications	FR-S500E	FR-E500	FR-F700	FR-A700
Ambient temperature in operation	-10 °C to +50 °C (non-freezing)	-10 °C to +50 °C (non-freezing) [1]	FR-F740: -10 °C to +50 °C; FR-F746: -10 °C to +40 °C (non-freezing) [2]	-10 °C to +50 °C (non-freezing)
Storage temperature [3]	-20 to +65 °C	-20 to +65 °C	-20 to +65 °C	-20 to +65 °C
Ambient humidity	Max. 90 % (non-condensing)	Max. 90 % (non-condensing)	Max. 90 % (non-condensing)	Max. 90 % (non-condensing)
Altitude	Max. 1000 m above sea level. [4]	Max. 1000 m above sea level. [4]	Max. 1000 m above sea level.	Max. 1000 m above sea level.
Protective structure	Enclosed type IP 20	Enclosed type IP 20	FR-F740: IP 00 / IP 20 [5] FR-F746: IP 54	IP 00 / IP 20
Shock resistance	10 G (3 times each in 3 directions)	10 G (3 times each in 3 directions)	10 G (3 times each in 3 directions)	10 G (3 times each in 3 directions)
Vibration resistance	0.6 G: resistance to vibrations from 10 to 55 Hz for 2 hours along all 3 axes	0.6 G: resistance to vibrations from 10 to 55 Hz for 2 hours along all 3 axes	Max. 0.6 G (2.9m/s² or less for the 04320 or more.)	Max. 5.9 m/s² or less (2.9 m/s² or less for the models from FR-A740-04320 or above)
Ambient conditions	For indoor use only, avoid environments containing corrosive gases, install in a dust-free location.	For indoor use only, avoid environments containing corrosive gases, install in a dust-free location.	For indoor use only, avoid environments containing corrosive gases, install in a dust-free location.	For indoor use only, avoid environments containing corrosive gases, install in a dust-free location.
Approvals	UL / CSA / CE / EN / GOST / CCC	UL / CSA / CE / EN / GOST / CCC	FR-F740: CE/UL/cUL/DNV/GOST; FR-F746: CE/GOST / CCC	CE/UL/cUL/DNV/GOST / CCC

Remarks:

[1] For selection of the load characteristics with variable torque the max. temperature is 40 °C.

[2] For selection of the load characteristics with a 120 % overload rating the max. temperature is 40 °C (F740) and 30 °C (F746).

[3] The product may only be exposed to the full extremes of this temperature range for short periods (e.g. during transportation).

[4] After that derate by 3 % for every extra 500 m up to 2500 m.

[5] When the cable bushing for the optional expansion cards is broken out the unit has an IP 00 protection rating.

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Internal and External Options
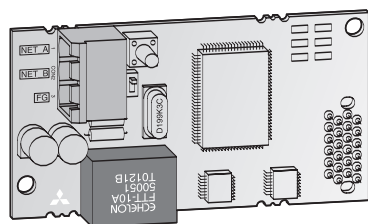
A large number of options allows an individual adoption of the inverter to the according task. The options can be installed quickly and easily. Detailed information on installation and functions is included in the manual of the options.

The options can be divided into two major categories:

● Internal options
● External options

Internal options

The internal options comprise input and output extensions as well as communications options supporting the operation of the inverter within a network or connected to a personal computer or PLC.

External Options

In addition to the FR-PU07 control panel that enables interactive operation of the frequency inverter the available external options also include additional EMC noise filters, reactors for improving efficiency and brake units with brake resistors.

Option			Description	FR-S500E	FR-E500	FR-F700	FR-A700
Internal options	Digital input		Input of the frequency setting via BCD or binary code	—	—	●	●
	Digital output		Selectable standard output signals of the inverter can be output at the open collector.	—	—	●	●
	Expansion analog output		Selectable additional signals can be output and indicated at the analog output.	—	—	●	●
	Relay output		Selectable standard output signals of the inverter can be output through relay terminals.	—	—	●	●
	Orientation control, Encoder feedback contro (PLG), Vector control		This option is used for position control and precise speed control.	—	—	—	●
	Communications	SSCNET	Integration of a frequency inverter into a SSCNET.	—	—	—	●
		Profibus/DP	Integration of a frequency inverter into a Profibus/DP network.	—	●	●	●
		DeviceNet [TM]	Integration of a frequency inverter into a DeviceNet.	—	●	●	●
		CC-Link	Integration of a frequency inverter into a CC-Link network.	—	●	●	●
		LonWorks	Integration of a frequency inverter into a LonWorks network.	—	—	●	—
		CANopen	Integration of a frequency inverter into a CANopen network.	—	●	—	●
		Ethernet	Integration of a frequency inverter into a Ethernet network.	—	—	●	●

Option		Description	FR-S500E	FR-E500	FR-F700	FR-A700
External options	Control panel (8 languages)	Interactive control panel with LCD display.	●	●	●	●
	FR-Configurator software	Parameterization and setup software for the Mitsubishi Electric inverter series.	●	●	●	●
	EMC noise filter	Noise filter for compliance with EMC directives.	●	●	●	●
	Brake unit	For an improvement of the brake capacity. For high inertia loads and active loads. Used in combination with a resistor unit.	●	●	●	●
	External brake resistor	To improve the brake capacity of the inverter. Depending on the inverter type it is used in combination with a brake unit.	●	●	●	●
	DC reactor AC chokes	For increased efficiency, reduction of mains feedback and compensation of voltage fluctuations.	●	●	●	●
	Floor standing unit FSU	IP 20 physical contact protection in a freely-locatable floor-standing unit. Detailed information on request.	—	—	●	●

Overview Internal Options

Internal options		Description	Remarks/Specifications	Type	Applicable inverter	Art. no.
16-bit digital input		Interface for the input of the frequency setting via 4-digit BCD or 16-bit binary code, setting of gain and bias supported.	Input: 24 V DC; 5 mA; open collector or switching signal, sink or source logic	FR-A7AX	FR-F700 FR-A700	156775
Digital output		Selectable of 43 standard output signals of the inverter can be output at the open collector. The outputs are isolated with optocouplers.	Output load: 24V DC; 0.1 A, sink or source logic	FR-A7AY	FR-F700 FR-A700	156776
Expansion analog output		Selectable 2 of 18 additional signals (e.g. output frequency, output voltage, output current) can be output and indicated at the analog output. Display on measuring gauge: 20 mA DC or 5 V (10 V) DC	Output: max. 0–10 V DC; 0–20 mA; Resolution: 3 mV at voltage output, 1 μA at current output, accuracy: ±10%			
Relay output		Selectable 3 of 43 standard output signals of the inverter can be output through relay terminals.	Switching load: 230 V AC/0.3 A, 30 V DC/0.3 A	FR-A7AR	FR-F700 FR-A700	156777
Vector control and orientation/encoder		Vector control with encoder can be performed.	5 V TTL differential 1024–4096 pulse 11 – 30 V HTL complimentary	FR-A7AP	FR-A700	166133
		The main spindle can be stopped at a fixed position (orientation) in combination with a pulse encoder. The motor speed is sent back and the speed is maintained constant.				
Communi-cations	CC-Link	Option board for the integration of a frequency inverter into a CC-Link network. The operation, display functions, and parameter settings can be controlled by a PLC.	Maximum transfer distance: 1200 m (at 156 kBaud)	FR-E5NC	FR-E500	104558
				FR-A7NC	FR-F700 FR-A700	156778
	CAN Open	Option board for integration of a frequency inverter in a CAN Open network. Operation, display functions and parameter settings can be controlled by a computer (PC etc.) or a PLC.	Maximum transfer rate: 1 MBaud	OI-FR-E5NCO	FR-E500	139378
				FR-A7NCA	FR-A700	141403
	Ethernet	Option board for integration of a frequency inverter in a Ethernet network. Operation, display functions and parameter settings can be controlled by a computer (PC etc.) or a PLC.	Only NA version	FR-A7NE	FR-A700	on request
	LonWorks	Option board for integration of a frequency inverter in a LonWorks network. Operation, display functions and parameter settings can be controlled by a computer (PC etc.) or a PLC.	Connection of up to 64 inverters supported. Maximum transfer rate: 78 kBaud	FR-A7NL	FR-F700 FR-A700	156779
	Profibus/DP	Option board for the integration of a frequency inverter into a Profibus/DP network. The operation, display functions, and parameter settings can be controlled by a computer (PC etc.) or a PLC.	Connection of up to 126 inverters supported. Maximum transfer rate: 12 MBaud	FR-A7NP	FR-F700 FR-A700	158524
			D-Sub9 connection adapter for FR-A7NP	FR-D-Sub9	FR-F700 FR-A700	191751
			Connection of up to 42 inverters supported.	FR-E5NP	FR-E500	104556
	DeviceNet ™	Option board for the integration of a frequency inverter into a DeviceNet. The operation, display functions, and parameter settings can be controlled by a computer (PC etc.) or a PLC.	Maximum transfer rate: 10 MBaud	FR-A7ND	FR-F700 FR-A700	158525
				FR-E5ND	FR-E500	104557
	SSCNET III	Option board for the integration of a frequency inverter into the Mitsubishi Electric servo system network SSCNET III. The operation and display functions can be controlled by Motion Controller (Q172H CPU, Q173H CPU).	Maximum transfer rate: 50 MBaud	FR-A7NS	FR-A700	141403

Mounting example of an internal option

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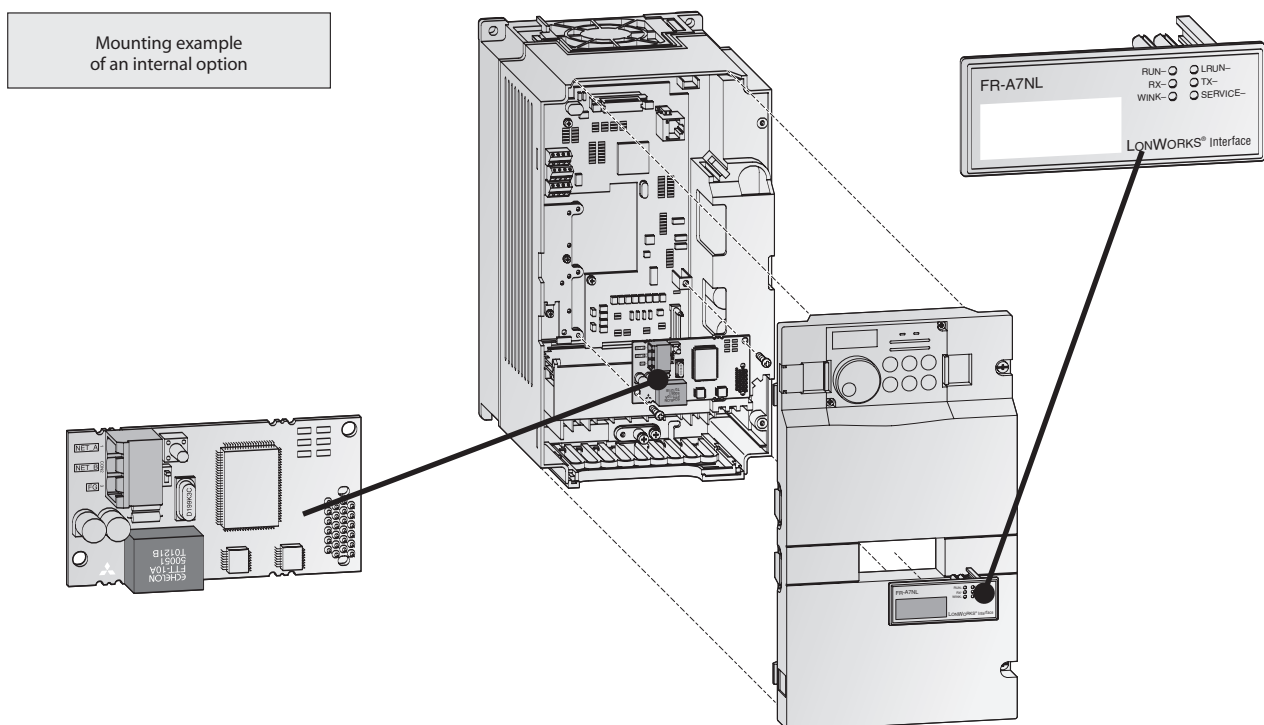
Overview External Options

External options	Description	Remarks/Specifications	Type	Applicable inverter	Art. no.
Control panel (parameter unit)	Interactive standard control panel	Please refer to page 8 for details.	FR-PA02-02	FR-E500	103686
	Interactive control panel with LCD display (8 languages).	Please refer to page 39 for details.	FR-PU04	All	67735
			FR-PU07	All	166134
			FR-DU07	All	157514
Control panel cover	Cover for the backside of the control panel FR-PA02-02 or FR-PU04	Connection adapter integrated.	FR-ESP	FR-E500	125323
Connection cable for remote control panel	Cable for a remote connection of the control panel FR-PU04 or FR-PU07.	Available length: 1; 2.5 and 5 m	FR-A5 CBL	All	1 m: 70727 2.5 m: 70728 5 m: 70729
Adapter	Connection adapter for FR-DU07	Required for remote connection of the FR-DU07 with FR-A5CBL	FR-ADP	All	157515
Interface cable	Communications cable for RS232 or RS485 interface to connect an external personal computer	Length 3 m; can be used for example with the setup/configuration software	SC-FR PC	All	88426
USB-RS232 converter	Port converter adapter cable from RS-232 to USB	USB specification 1.1, 0.35 m long	USB-RS232	FR-F700	155606
VFD setup software	Parameterization and setup software for Mitsubishi Electric inverter.	Please refer to page 42 for details.	—	All 500 series	159746
FR-Configurator	Parameterization and setup software for Mitsubishi Electric inverter.		—	All 700 series	190586
DIN rail mounting set	Adapter for mounting frequency inverters on a DIN rail.	When using the DIN rail adapters, filters can not be footprint mounted.	FR-UDA 01	FR-S500 (<0.75 k)	130833
			FR-UDA 02	FR-S500 (>1.5 k)	130832
EMC noise filter	Noise filter for compliance with EMC directives.	Please refer to page 36 for details.	FFR -☐ ☐, FR-, FN -☐☐	All	refer to page 36
AC chokes	For increased efficiency, reduction of mains feedback and compensation of voltage fluctuations.	Please refer to page 38 for details.	FR-BAL-B	FR-E500, FR-A700, FR-F700	refer to page 38
DC reactor ①	DC reactor for compensation of voltage fluctuations.	Please refer to page 39 for details.	MT-HEL ①	FR-A700 FR-F700	refer to page 39
Brake units	For an improvement of the brake capacity. For high inertia loads and active loads. Used in combination with a resistor unit.	Please refer to page 40 for details.	MT-BU 5, BU-UFS	FR-A700 FR-F700	refer to page 40
External brake resistors	To improve the brake capacity of the inverter; is used in combination with a brake unit	Please refer to page 41 for details.	MT-BR 5, RUFC	FR-E500	refer to page 41

① A DC reactor is included as standard equipment with frequency inverters FR-F740-01800 through 12120 and FR-A740-01800 through 12120. These reactors are essential for operation and must be installed.

Installing an EMC noise filter on an FR-E540	Installing an EMC noise filter on an FR-F700
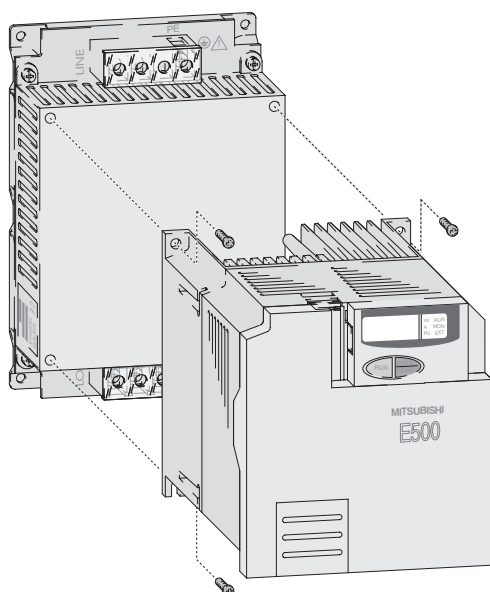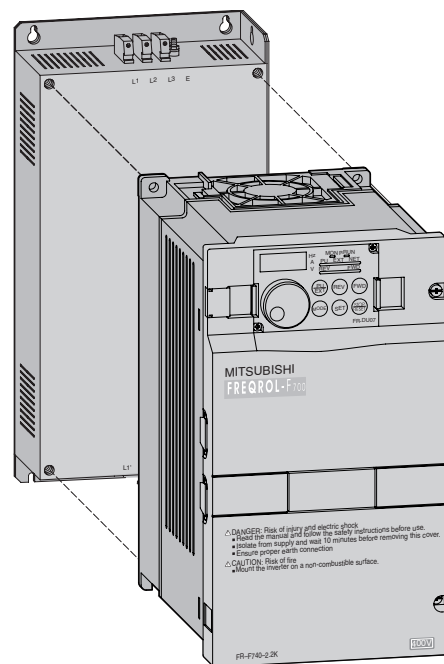
■ Noise Filters for FR-S520/540
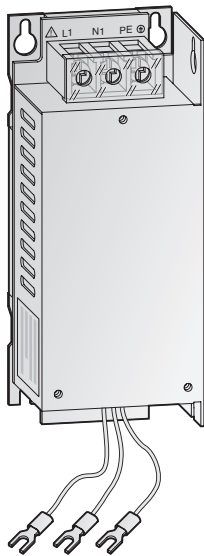
Noise filters for FR-S500 series

For complying with the EMC directives of the European Community regarding the electromagnetic compatibility, the FR-S500E inverter has to be equipped with a noise filter across the input circuit. Additionally it has to be installed and wired according to the EMC directives.

To ensure a proper and safe operation of the components follow the points below:
● For the selection of a ground fault protective switch or relay take the leakage current of the filter into account.
● Ensure a perfect grounding of the filter, if you do not intend to use a protective switch or relay across the input circuit.

Filter	Frequency inverter	Power loss [W]	Rated current [A]	Leakage current [mA]	Weight [kg]	Art no.
FFR-S520S-14A-RF1 ①	FR-S520SE-0.2 k–0.75 k	6.5	14	< 7	0.8	152736
FFR-S520S-20A-RF1 ②	FR-S520SE-1.5 k	12	20	< 10	1.0	152740
FFR-S540-8A-RF100 ③	FR-S540E-0.4–1.5 k	5.1	8	< 10	0.8	138425
FFR-S540-13A-RF100 ③	FR-S540E-2.2–3.7 k	7.1	13	< 10	0.9	138423

① The filters can provide conformity with the limits for: Environment 1 (unrestricted distribution) with motor cable lenght of up to 30 m, Environment 1 (restricted distribution) with motor cable lenght of up to 75 m, 100 A limits of Environment2 with motor cable lengths of up to 75 m.

② The filters can provide conformity with the limits for: Environment 1 (unrestricted distribution) with motor cable lenght of up to 30 m, Environment 1 (restricted distribution) with motor cable lenght of up to 100 m, 100 A limits of Environment2 with motor cable lengths of up to 100 m.

③ The filters can provide conformity with the limits for: Environment 1 (unrestricted distribution) with motor cable lenght of up to 20 m, Environment 1 (restricted distribution) with motor cable lenght of up to 100 m, 100 A limits of Environment2 with motor cable lengths of up to 100 m.

■ Noise Filters for FR-E520/540
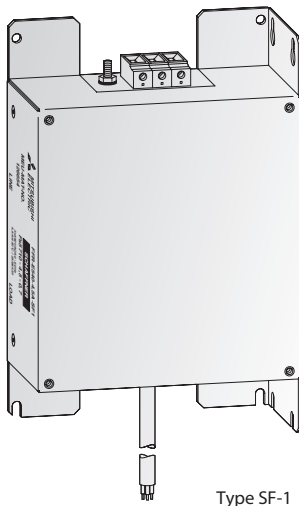
Noise filters for FR-E500 series

For complying with the EMC directives of the European Community regarding the electromagnetic campatibility, the FR-E500 inverter has to be equipped with a noise filter across the input circuit. Additionally it has to be installed and wired according to the EMC directives. The filters are designed to reduce conducted noise voltages to comply with the limits defined for Environments 1 and 2.

To ensure a proper and safe operation of the components follow the points below:

● Ground the filter prior to applying the power supply.
● For the selection of a ground fault protective switch or relay take the leakage current of the filter into account.
● Ensure a perfect grounding of the filter, if you do not intend to use a protective switch or relay across the input circuit.

Type SF-1

Filter	Frequency inverter	Power loss [W]	Leakage current [mA]	Weight [kg]	Art. no.
FFR-E520S-14A-SC1	FR-E520SE-0.2 k–0.75 k	11	< 30	1.3	152727
FFR-E520S-26A-SC1	FR-E520SE-1.5 k – 2.2 k	17	< 30	1.3	152730
FFR-E540-4.5A-SF1	FR-E540E-0.4 k–0.75 k	4	< 30	1.3	126654
FFR-E540-15A-SF1	FR-E540E-1.5 k–3.7 k	12	< 30	1.45	126655
FFR-E540-27A-SF1	FR-E540E-5.5 k–7.5 k	25	< 30	1.7	126656

The filters can provide conformity with the limits for Environment 1 (unrestricted distribution) with motor cable lengths of up to 20 m (shielded) and for Environment 1 (restricted distribution) with motor cable lengths of up to 100 m (shielded), and thus also with the 100 A limits of Environment 2 with motor cable lengths of up to 100 m.

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ACCESSORIES

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■ Noise Filters for FR-A/F740-00023 to FR-A/F740-01800

Noise filters conforming to EN 61800-3 and EN 55011

The noise filters listed below make it possible to comply with the requirements for Environment 1 (category C1, unrestricted distribution) with shielded motor cables up to 20m long and the requirements of Environment 1 (category C2, restricted distribution) with shielded motor cables up to 100m long. This also provides compliance with the 100A limits for Environment 2 with shielded cables up to 100m long.

The frequency inverters of the FR-F740/FR-A740 series are fitted with an integrated EMC noise filter for industrial environments (Environment 2).

They meet the emission requirements of EN 61800-3, Category C3 with 5m motor power supply cables (shielded) at a carrier frequency of 2kHz.

The filters listed here are thus only necessary for these inverters in special cases.

Th FFR-BS-□□□□-□□□A-SF□□□ filters are configured for "footprint" installation, which means that the base plate of the frequency inverter is bolted onto the filter unit, so that the entire assembly can then be bolted onto the mounting plate in a switchgear cabinet.

Filter	Frequency inverter	Power loss [W]	Leakage current [mA]	Rated current [A]	Weight [kg]	Art. no.
FFR-BS-00126-18A-SF100	FR-A/F 740-00023–00126	11.5	< 30	18	1.25	193677
FFR-BS-00250-30A-SF100	FR-A/F 740-00170–00250	15.8	< 30	30	1.8	193678
FFR-BS-00380-55A-SF100	FR-A/F 740-00310–00380	27.1	< 30	55	2.42	193679
FFR-BS-00620-75A-SF100	FR-A/F 740-00470–00620	43.9	< 30	75	4.25	193680
FFR-BS-00770-95A-SF100	FR-A/F 740-00770	45.8	< 30	95	6.7	193681
FFR-BS-00930-120A-SF100	FR-A/F 740-00930	44.9	< 30	120	10.0	193682
FFR-BS-01800-180A-SF100	FR-A/F 740-00170–00250	60.7	< 30	180	12.0	193683

■ Noise Filters for FR-A/F740-02160 to FR-A/F740-12120
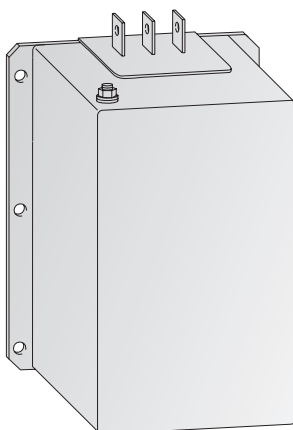
Noise filters conforming to EN 61800-3

The extremely compact line of FN 3359 filters provides the user with an efficient noise suppression at low room requirements.

The FN 3359 filters can be used to conform to the requirements of EN 61800-3 and can maintain the required noise emission levels in Environment 1 (restricted distribution) with motor power cables up to 100m long

(shielded), and thus also the requirements for Environment 2 up to the same motor cable length.

"Footprint" installation on the frequency inverter base plate is not possible with the FN3359-□□□-28/99 filters. These units must be installed next to the frequency inverter.

Filter	Frequency inverter	Power loss [W]	Leakage current [mA]	Rated current [A]	Weight [kg]	Art. no.
FN 3359-250-28	FR-A/F 740-02160–02600	38	< 6	250	7	104663
FN 3359-400-99	FR-A/F 740-03250–04320	51	< 6	400	10.5	104664
FN 3359-600-99	FR-A/F 740-04810–06100	65	< 6	600	11	104665
FN 3359-1000-99	FR-A/F 740-06830–09620	84	< 6	1000	18	104666
FN 3359-1600-99	FR-A/F 740-10940–12120	130	< 6	1600	27	130229

These filters enable compliance with the requirements for Environment 1 (restricted distribution) with shielded motor cables up to 100m length, and thus also with the requirements of Environment 2 with the same cable lengths.

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ACCESSORIES

■ Noise Filters for FR-F746-00023 to FR-F746-01160

Noise Filters conforming to EN 61800-3

The noise filters listed below make it possible to comply with the requirements for Environment 1 (unrestricted distribution) with shielded motor cables up to 20 m long and the requirements of Environment 1 (restricted distribution) with shielded motor cables up to 100 m long. This also provides compliance with the 100 A limits for Environment 2 with shielded cables up to 100 m long.

They meet the emission requirements of EN 61800-3, Category C1 and EN 55011, Class B with 5m motor power supply cables (shielded).

The frequency inverters of the FR-F746 series are fitted with an integrated EMC noise filter for industrial environments (Environment 2). They meet the emission requirements of EN 61800-3, Category C3 with 5 m motor power supply cables (shielded) at a clock frequency of 2 kHz.
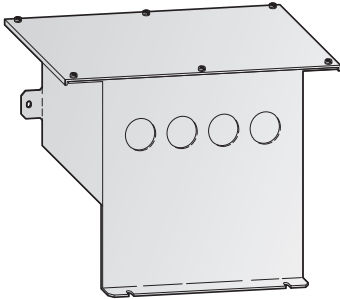
Filter	Frequency inverter	Power loss [1] [W]	Leakage current [mA]	Rated current [A]	Weight [kg]	Art. no.
FFR-AF-IP54-21A-SM2	FR-F746-00023 – FR-F746-00126	9.26	< 30	21	3.2	201551
FFR-AF-IP54-44A-SM2	FR-F746-00170 – FR-F746-00250	20.3	< 30	44	4.4	201552
FFR-AF-IP54-62A-SM2	FR-F746-00310 – FR-F746-00380	23	< 30	62	5.4	201553
FFR-AF-IP54-98A-SM2	FR-F746-00470 – FR-F746-00620	51.8	< 30	98	7.7	201554
FFR-AF-IP54-117A-SM2	FR-F746-00770	61.6	< 30	117	10.6	201555
FFR-AF-IP54-172A-SM2	FR-F746-00930 – FR-F746-01160	128.7	< 30	172	16	201556

[1] Power dissipation at 20 °C and rated current with copper cables

■ AC Chokes for Three-Phase FR-E500, FR-F700 and FR-A700

Three-phase mains supply chokes

The three-phase mains supply chokes FR-BAL-B-□□k for the frequency inverters FR-A740 compensate voltage fluctuations and simultaneously increase the efficiency.

Applying the appropriate power choke an overall efficiency of up to 90% can be achieved.

The use of a power choke is especially recommended for mains circuits where high capacities are switched, for example, via thyristors.
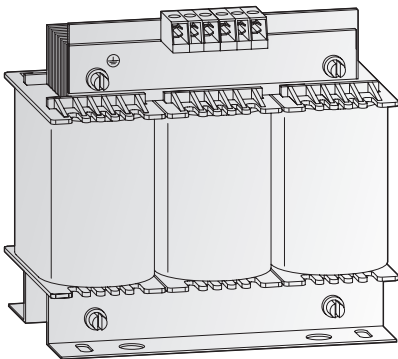
Choke	Frequency inverter	L [mH]	Current [A]	Power loss [W]	Weight [kg]	Art. no.
FR-BAL-B-4.0 k	FR-E540-0.4 k – 4.0 k, FR-F740-00023–00083 FR-A740-00023–00126	2.340	12	31	3.0	87244
FR-BAL-B-5.5k	FR-E540-5.5 k, FR-F740-00126 FR-A740-00170	1.750	16	44	3.7	87245
FR-BAL-B-7.5 k	FR-E540-7.5 k, FR-F740-00170 FR-A740-00250	1.220	23	59	5.5	87246
FR-BAL-B-11k/-15 k	FR-F740-00250–00310 FR-A740-00310–00380	0.667	42	68	10.7	71053
FR-BAL-B-22 k	FR-F740-00380–00470 FR-A740-00470–00620	0.483	58	77	11.2	87247
FR-BAL-B-30 k	FR-F740-00620 / FR-A740-00770	0.369	76	86	11.6	87248
FR-BAL-B-37 k	FR-F740-00770 / FR-A740-00930	0.295	95	113	18.6	87249
FR-BAL-B-45 k	FR-F740-00930 / FR-A740-01160	0.244	115	118	21.4	71054
FR-BAL-B-55 k	FR-F740-01160 / FR-A740-01800	0.191	147	120	22.6	87250

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ACCESSORIES

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■ DC Reactors for FR-F700 / FR-A700

DC link reactors

The DC link reactor is included as standard equipment with inverter models FR-F740-01800 and above. This reactor is essential for the operation of the inverter and must be installed.

The reactors listed below are available as optional equipment for frequency inverter models FR-F740-00023 through 01160.
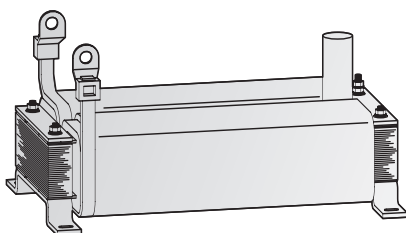
Application (inverter)	Reactor	Power loss [W]		Weight [kg]	Art. no.
		at 120%	at 150%		
FR-A/F 740-01800	FR-HEL-H90K	128	121	20	
FR-A/F 740-02160	FR-HEL-H110K	138	128	22	
FR-A/F 740-02600	FR-HEL-H132K	140	138	26	
FR-A/F 740-03250	FR-HEL-H160K	162	140	28	
FR-A/F 740-03610	FR-HEL-H185K	245	162	29	
FR-A/F 740-04320	FR-HEL-H220K	265	245	30	
FR-A/F 740-04810	FR-HEL-H250K	285	265	35	The DC link reactor MT-HEL is included as standard equipment with the respective frequency inverter.
FR-A/F 740-05470	FR-HEL-H280K	315	285	38	
FR-A/F 740-06100	FR-HEL-H315K	350	315	42	
FR-A/F 740-06830	FR-HEL-H355K	400	350	46	
FR-A/F 740-07700	FR-HEL-H400K	460	400	50	
FR-A/F 740-08660	FR-HEL-H450K	540	460	57	
FR-A/F 740-09620	FR-HEL-H500K	635	540	67	
FR-A/F 740-10940	FR-HEL-H560K	770	635	85	
FR-A/F 740-12120	FR-HEL-H630K	960	770	95	

Note:

The AC supply choke can also be used as an alternative to the DC link reactor on frequency inverter models FR-F740-01160 and below.

■ Control Panels

The control panels FR-PU04 and FR-PU07 with extended functions provide a 10-key keypad for a direct entering of numerical values. A 4-row LC display returns operational data, parameter names or status and error messages in uncoded text.
The control panels displays text in the following selectable languages: English, German, French, Spanish, Swedish, Italian, Finnish, and Japanese.

In addition to the functions of the standard control panel the FR-PU04 and FR-PU07 displays and monitors 21 different values (like frequency, current, voltage, etc.) and states in total.

The control units FR-PU04 and FR-PU07 are used instead of the standard control units FR-DU04 and FR-DU07 and can be replaced by this after use.

The control panel FR-PU07 conforms to the protection rating IP40.

Control panel		Description	Art. no.
FR-PA02-02	FR-E500	Interactive control panel with LCD display	103686
FR-DU07	All inverters	Interactive control panel with LCD display	157514
FR-DU07-IP54	All inverters	Interactive control panel with LCD display	207067
FR-PU04	All (with limitations)	Interactive control panel with LCD display	67735
FR-PU07	FR-F700 / FR-A700	Interactive control panel with LCD display	166134

3

ACCESSORIES
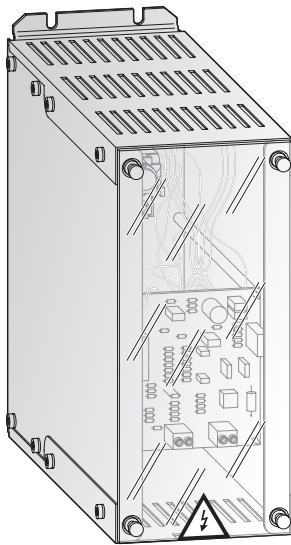
■ Brake Units BU-UFS

For a braking torque higher than 20 % or a duty cycle higher than 30 % an external brake unit including the adequate brake resistors has to be installed.

The brake units BU-UFS listed below are cascadeable so that the optimum size can always be achieved.

The brake units here are not fitted with brake resistors, which must be ordered separately (see below).

The configurations in the table are only general recommendations. Please consult Mitsubishi Electric Electric for advice on matching the correct brake modules and brake resistors for your application.

Frequency inverter	Brake unit	Rated voltage	Max. peak current [A]	Max. instan- taneous power [kW]	Max. duty cycle	Art. no.
FR-S520SE , FR-E520S	BU-UFS22J	230 V	34	12.7	10%	127962
FR-S540E , FR-E540 , FR-F740-00023 – 00250, FR-A740-00023 – 00250	BU-UFS22	400 V	34	25	10%	127947
FR-F740-00250 – 00470, FR-A740-00250 – 00470	BU-UFS40	400 V	55	41	10%	127948
FR-F740-00470 – 01160, FR-A740-00470 – 01160	BU-UFS110	400 V	140	105	5%	127950

■ Brake Resistors for Brake Unit BU-UFS
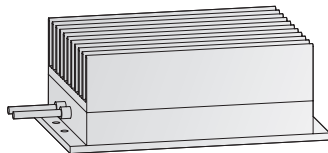
The brake resistors RUFC are designed for the exclusive use in combination with a brake unit BU-UFS.

Please note that the specifications for the allowed duty cycle (ED max.) included in the instruction manual for the brake unit.

Type	Application	Regenerative brake duty	Resistance [Ω]	Capacity [W]	Art. no.
RUFC22	BU-UFS 22	10%	1 x 24	2000	129629
RUFC40 (Set)	BU-UFS 40	10%	2 x 6.8	2000	129630
RUFC110 (Set)	BU-UFS 110	10%	4 x 6.8	2000	129631

■ Brake Unit MT-BU5 for FR-F700/FR-A700
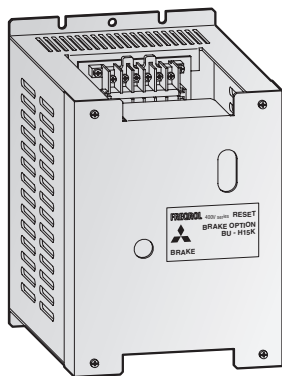
The MT-BU5 external brake units can be used with frequency inverter models FR-F740-01800 and above. These inverters are fitted with a connector via which the MT-BU5 brake unit is controlled directly. This connection also makes it possible for the FR-F740 to handle the protection of the MT-BU5 against thermal overloads.

Brake resistors must be chosen in accordance with your application's requirements. The configurations in the table are only general recommendations. Please consult Mitsubishi Electric for advice on matching the correct brake modules and brake resistors for your application.

Brake unit	Frequency inverter	Number of required units	Braking torque	Art. no.
MT-BU5-H75 k	FR-F740/FR-A740-01800	1 x MT-BR5-H75 k	100%, 10% ED	125700
MT-BU5-H150 k	FR-F740/FR-A740-02160 – 03250	2 x MT-BR5-H75 k	100%, 10% ED	125701
MT-BU5-H220 k	FR-F740/FR-A740-03250 – 04320	3 x MT-BR5-H75 k	100%, 10% ED	125702
MT-BU5-H280 k	FR-F740/FR-A740-04320 – 05470	4 x MT-BR5-H75 k	100%, 10% ED	125703
MT-BU5-H375 k	FR-F740/FR-A740-05470 – 07700	5 x MT-BR5-H75 k	100%, 10% ED	125705

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■ **External Brake Resistor MT-BR5 for Brake Unit MT-BU5**
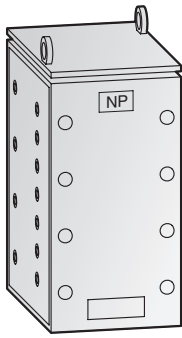
The brake resistor MT-BR5 for the frequency inverters FR-F740 /E1 is used exclusively in combination with a brake unit.

Brake resistor	Regenerative brake duty	Resistance [Ω]	Art. no.
MT-BR5-H75 k	6%	6.5	125699

■ **External Brake Resistors FR-ABR-(H)☐☐k for FR-E500 and FR-A700**
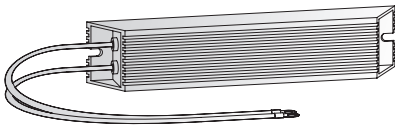
Among the capacity range of 0.4 k to 7.5 k (FR-E500) or 00023 to 00620 (FR-A700) the inverter is equipped with an internal brake chopper as standard.

An improvement of the brake duty is achieved by the use of an external brake resistor with a higher rated capacity.

The duty cycle is selectable via parameter 30 and can, according to the inverter, be specified to up to 10 % respectively 30 % via parameter 70.

Frequency inverter	Brake resistor	Regenerative brake duty	Resistor [Ω]	Art. no.
FR-ABR-0.4 k		10 % (ED)	200	46788
FR-ABR-0.75 k	FR-E520S	10 % (ED)	100	46602
FR-ABR-2.2 k		10 % (ED)	60	46787
FR-ABR-H 0.4 k	FR-E540-0.4 k, FR-A740-00023	10 % (ED)	1200	46601
FR-ABR-H 0.75 k	FR-E540-0.75 k, FR-A740-00038	10 % (ED)	700	46411
FR-ABR-H 1.5 k	FR-E540-1.5 k, FR-A740-00052	10 % (ED)	350	46603
FR-ABR-H 2.2 k	FR-E540-2.2 k, FR-A740-00083	10 % (ED)	250	46412
FR-ABR-H 3.7 k	FR-E540-3.7 k, FR-A740-00126	10 % (ED)	150	46413
FR-ABR-H 5.5 k	FR-E540-5.5 k, FR-A740-00170	10 % (ED)	110	50045
FR-ABR-H 7.5 k	FR-E540-7.5 k, FR-A740-00250	10 % (ED)	75	50049
FR-ABR-H 11 k	FR-A740-00310	6 % (ED)	52	191577
FR-ABR-H 15 k	FR-A740-00380	6 % (ED)	2 x 18 seriel	191578
FR-ABR-H 22 k	FR-A740-00470 – 00620	6 % (ED)	2 x 52 parallel	191579

3

ACCESSORIES

3

ACCESSORIES

■ Setup Software

The Setup Software VFD-Setup and FR-Configurator are powerful tools for the operation of your frequency inverter. The software runs under all versions of MS Windows and therefore allows the inverter operation via any conventional personal computer. Several frequency inverters can be set up, operated, and monitored simultaneously across a network or via a personal computer or laptop.

The VFD setup software is designed for the frequency inverters FR-S500, FR-E500, and FR-F700FR-A700 series.

The FR-Configurator is especially designed for the FR-A700 series.

The connection between personal computer and inverter is established either via an RS485 network or directly via an SC-FR PC adapter cable available separately.
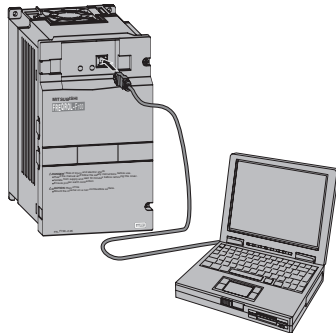
Benefits

● System settings

Due to the network capabilities of the inverter up to 32 frequency inverters can be operated simultaneously.

● Parameter settings

By means of overall and function related overviews different parameters can be adjusted easily.

● Display functions

The comprehensible display functions enable data, analog, oscillograph, and alarm displays.

● Diagnostics

The analysis of the inverter status provides a thorough error correction.

● Test operation

The test operation provides a simulation of the operation and adjustment via the auto-tuning function.

● File management

Parameters can be saved on the personal computer and printed out.

● Help

The extensive online help provides support concerning all questions regarding settings and operation.

Parameter setting
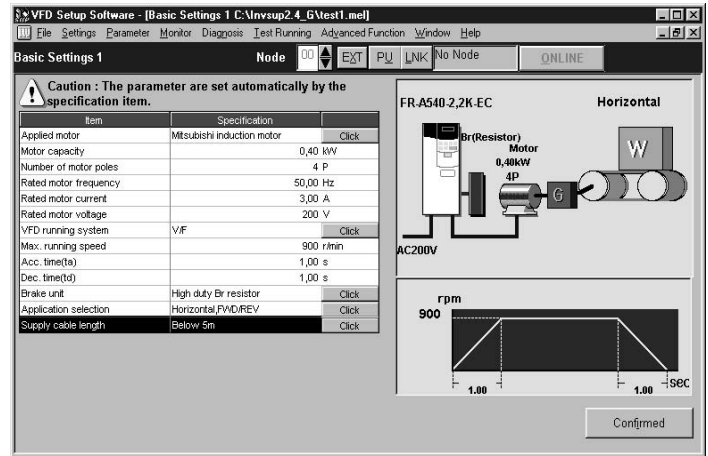
Display and monitor

Test operation

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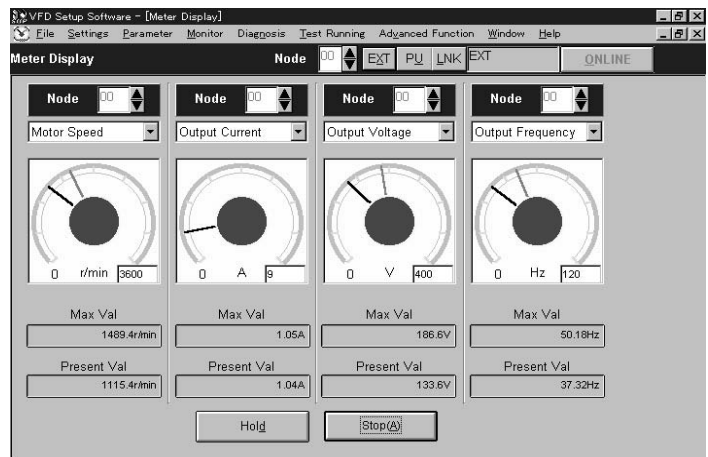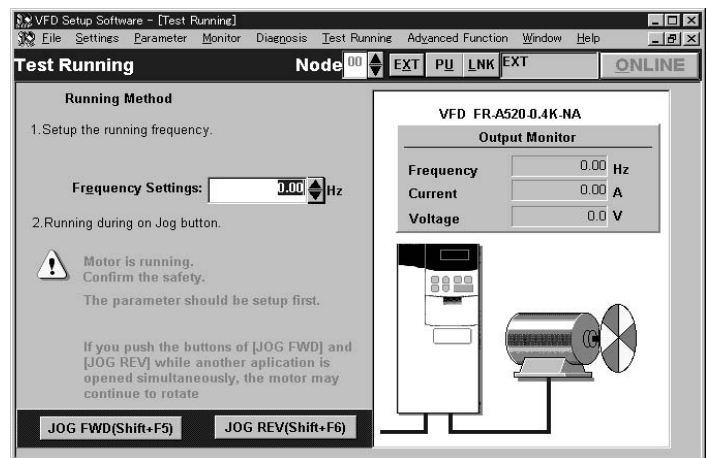
■ Control Panel FR-PA02-02 and FR-DU07/FR-DU07-IP54

FR-PA02-02
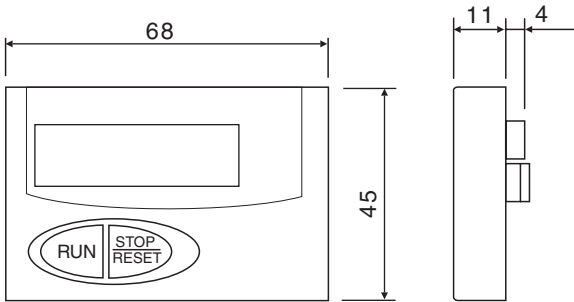
FR-DU07
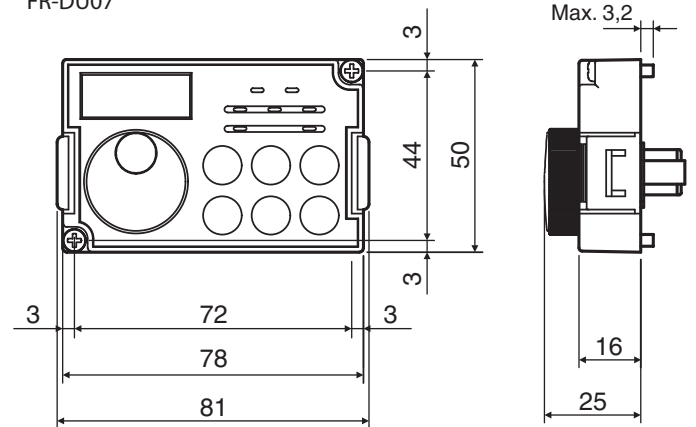
All dimensions in mm

■ Control Panel FR-PU04
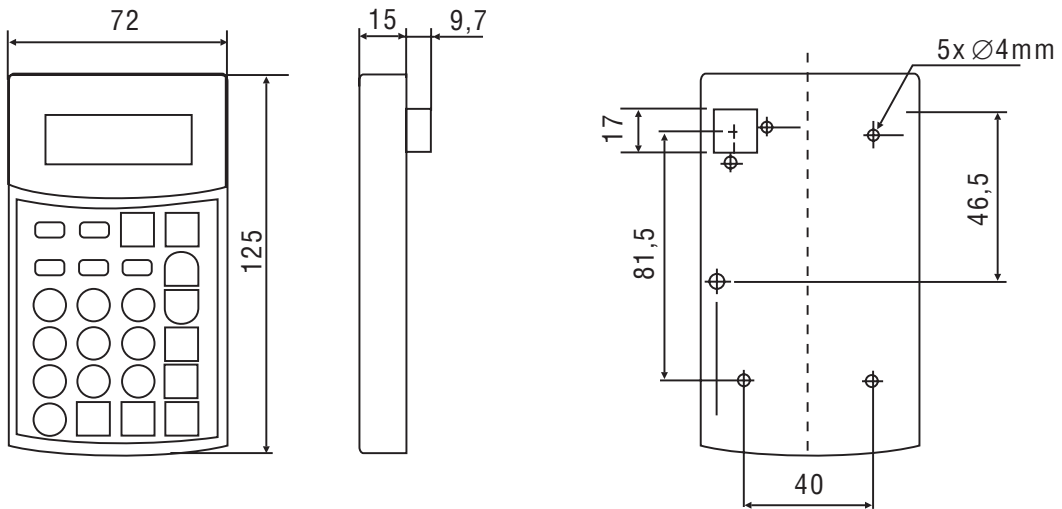
All dimensions in mm

■ Control Panel FR-PU07/FR-DU07-IP54

All dimensions in mm

4

DIMENSIONS

4

■ **FR-S520SE-0.2 k to 0.75 k**
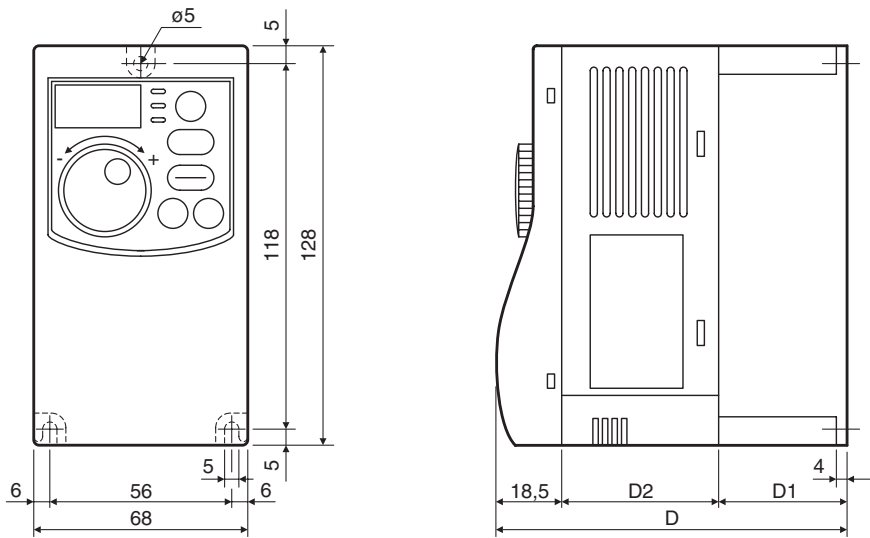
Type	D	D1	D2
FR-S520SE-0.2 k	80.5	10	52
FR-S520SE-0.4 k	142.5	42	82
FR-S520SE- 0.75 k	162.5	62	82

All dimensions in mm

■ **FR-S520SE-1.5 k and FR-S540E-0.4 k to 3.7 k**
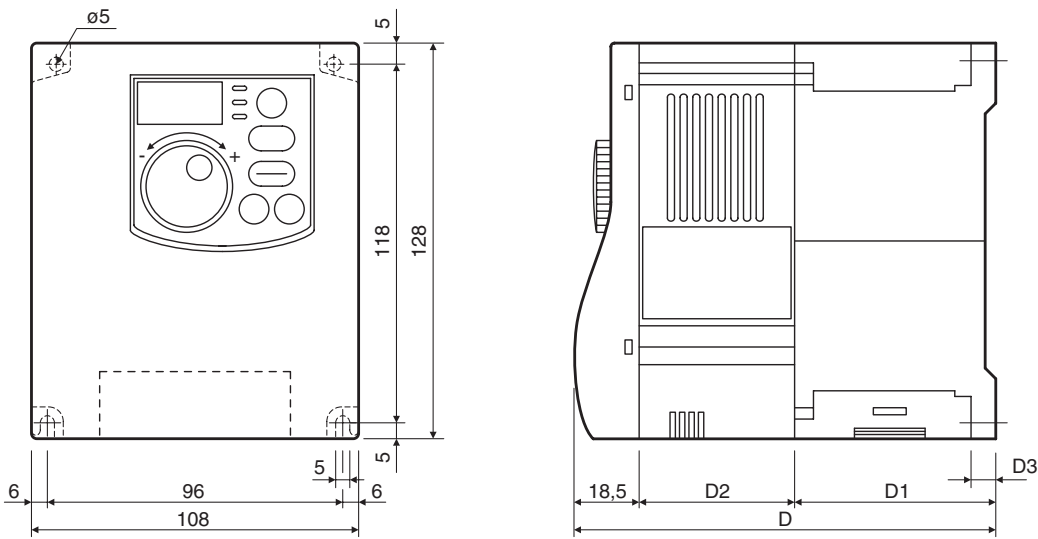
Type	D	D1	D2	D3
FR-S500SE-1.5 k	155.5	65	72	8
FR-S540E-0.4 k	129.5	59	52	5
FR-S540E-0.75 k	129.5	59	52	5
FR-S540E-1.5 k	135.5	65	52	8
FR-S540E-2.2 k	155.5	65	72	8
FR-S540E-3.7 k	165.5	65	82	8

All dimensions in mm

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■ **FR-E540-0.4 k to 3.7 k and FR-E520S-04 k to 2.2 k**

2 x ø 5

6

138

150

5

6

6

128

6

140

A1

61

11

A
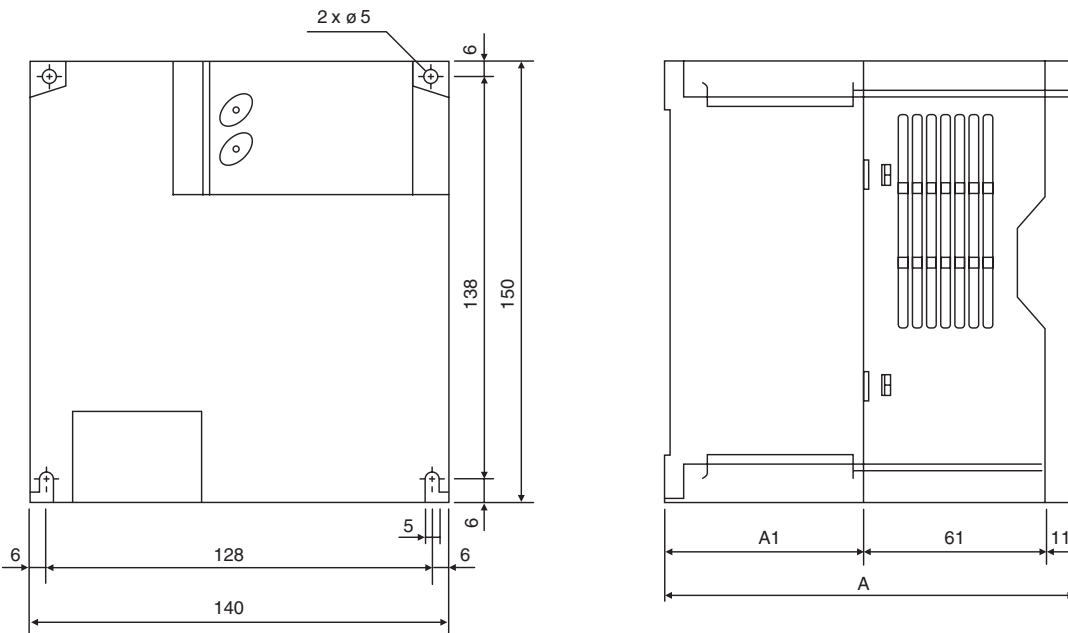
Type	A	A1
FR-E540 0.4 k / 0.75 k	116	44
FR-E540 1.5 k / 2.2 k / 3.7 k	136	64
FR-E520S 0.4 k / 0.75 k	136	64
FR-E520S 1.5 k / 2.2 k	156	84

All dimensions in mm

■ **FR-E540-5.5 k and 7.5 k**

2 x ø 5

6

138

150

5

6

6

208

6

220

73

64

11

148

All dimensions in mm

4

DIMENSIONS

■ FR-F740 / FR-F746
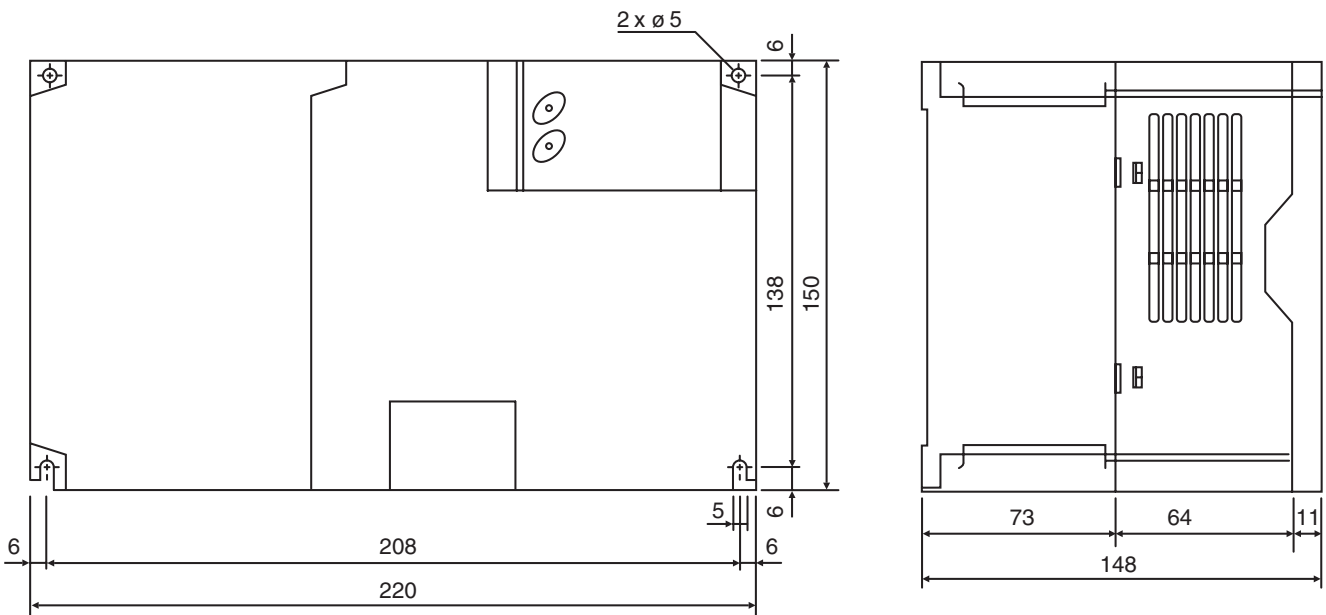
Case type A

Case type B

Case type C
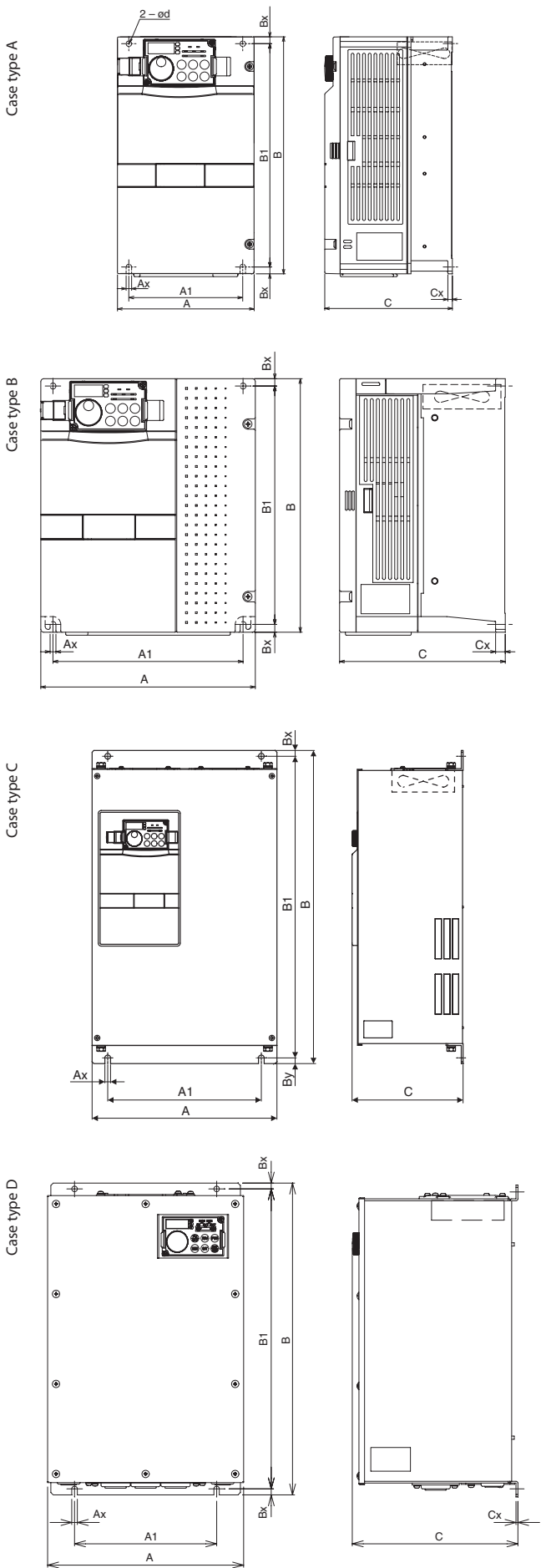
Case type D

Type	A	A1	Ax	B	B1	Bx	C	Cx	d	Case type
FR-F740-00023 – FR-F740-00126	150	125	6	260	245	7.5	140	5	6	A
FR-F740-00170, FR-F740-00250	220	195	6	260	245	7.5	170	10	8	B
FR-F740-00310, FR-F740-00380	220	195	6	300	285	7.5	190	10	8	B
FR-F740-00470, FR-F740-00620	250	230	10	400	380	10	190	10	10	B
FR-F740-00770	325	270	10	550	530	10	195	3.2	10	C
FR-F740-00930, FR-F740-01160	435	380	12	550	525	15	250	3.2	12	C
FR-F740-01800	435	380	12	550	525	15	250	3.2	12	C
FR-F740-02160, FR-F740-02600	465	400		620	595	15	300	3.2	12	C
FR-F740-03250, FR-F740-03610	465	400		740	715	15	360	3.2	12	C
FR-F740-04320 – FR-F740-04810	498	400	49	1010	984	13	380	3.2	12	C
FR-F740-05470 – FR-F740-06830	680	600	40	1010	984	13	380	3.2	12	C
FR-F740-07700 – FR-F740-08660	790	635	80	1330	1300	15	440	3.2	12	C
FR-F740-09620 – FR-F740-12120	995	900	47.5	1580	1550	15	440	3.2	12	C
FR-F746-00023 – FR-F746-00126	249	180	7	395	380	7.5	210	2.3		D
FR-F746-00170 – FR-F746-00250	319	255	7	395	380	7.5	240	2.3		D
FR-F746-00310 – FR-F746-00380	319	258	10	445	425	10	260	2.3		D
FR-F746-00470, FR-F746-00620	354	312	10	560	540	10	260	2.3		D
FR-F746-00770	360	300	10	590	570	10	265	3.2		D
FR-F746-00930, FR-F746-01160	471	411	12	660	635	15	320	3.2		D

Please consider also the dimensions of the corresponding DC reactors (see pages 48 and 49)

4

DIMENSIONS

All dimensions in mm

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■ FR-A700

Case type A

2 – ød

Case type B
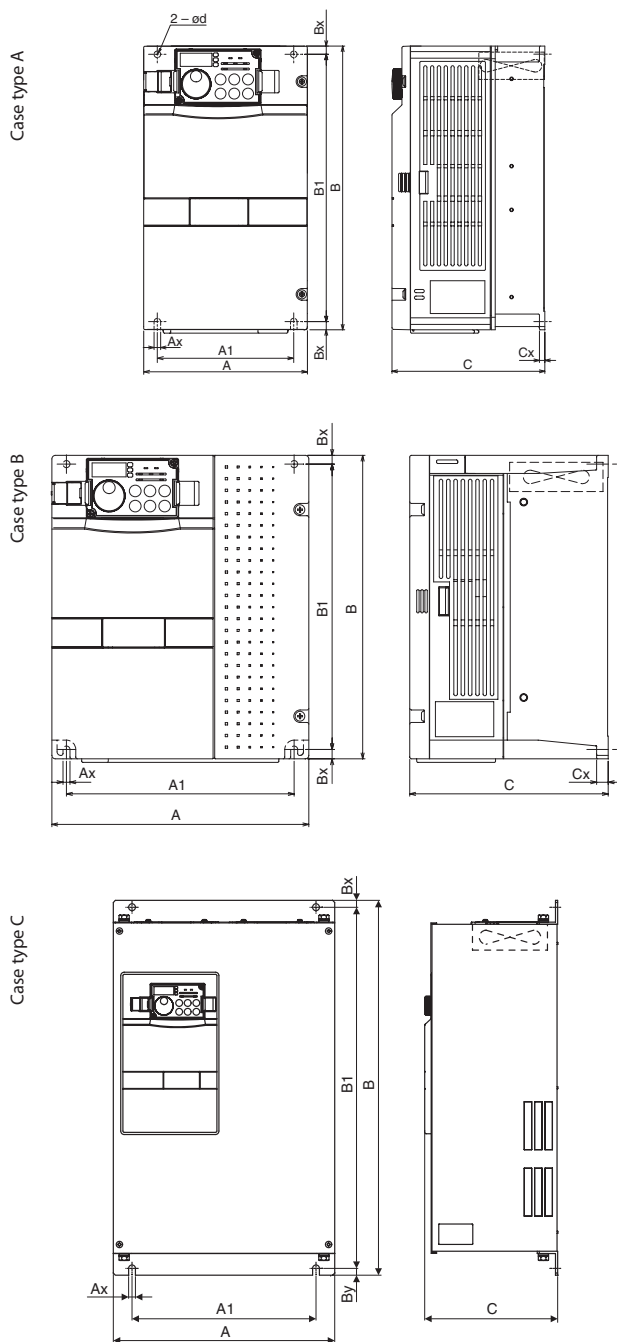
Case type C

Type	A	A1	Ax	B	B1	Bx	C	Cx	d	Case type
FR-A740-00023 – FR-A740-00126	150	125	6	260	245	7.5	140	5	6	A
FR-A740-00170, FR-A740-00250	220	195	6	260	245	7.5	170	10	8	B
FR-A740-00310, FR-A740-00380	220	195	6	300	285	7.5	190	10	8	B
FR-A740-00470, FR-A740-00620	250	230	10	400	380	10	190	10	10	B
FR-A740-00770	325	270	10	550	530	10	195	3.2	10	C
FR-A740-00930, FR-A740-01160	435	380	12	550	525	15	250	3.2	12	C
FR-A740-01800	435	380	12	550	525	15	250	3.2	12	C
FR-A740-02160, FR-A740-02600	465	400		620	595	15	300	3.2	12	C
FR-A740-03250, FR-A740-03610	465	400		740	715	15	360	3.2	12	C
FR-A740-04320 – FR-A740-04810	498	400	49	1010	984	13	380	3.2	12	C
FR-A740-05470 – FR-A740-06830	680	600	40	1010	984	13	380	3.2	12	C
FR-A740-07700 – FR-A740-08660	790	635	80	1330	1300	15	440	3.2	12	C
FR-A740-09620 – FR-A740-12120	995	900	47.5	1580	1550	15	440	3.2	12	C

Please consider also the dimensions of the corresponding DC reactors (see pages 48 and 49)

4

DIMENSIONS

All dimensions in mm

■ DC Reactors FR-HEL-H90K
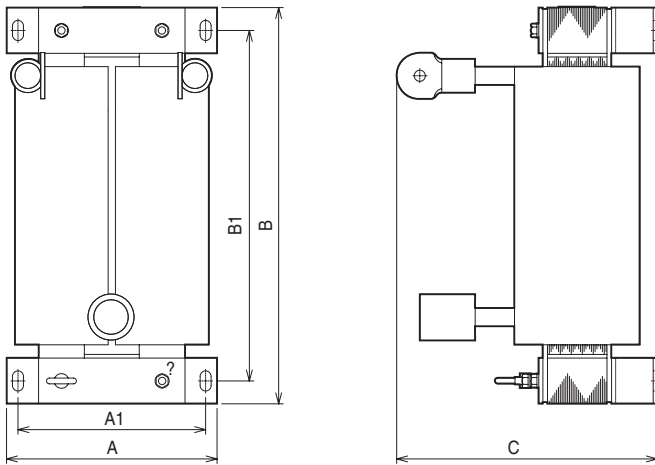
Choke	Frequency inverter	A	A1	B	B1	C	Weight [kg]
FR-HEL-H90K	FR-A/F 740-01800	150	130	340	310	190	20

All dimensions in mm

■ DC Reactors FR-HEL-H110K – 160K
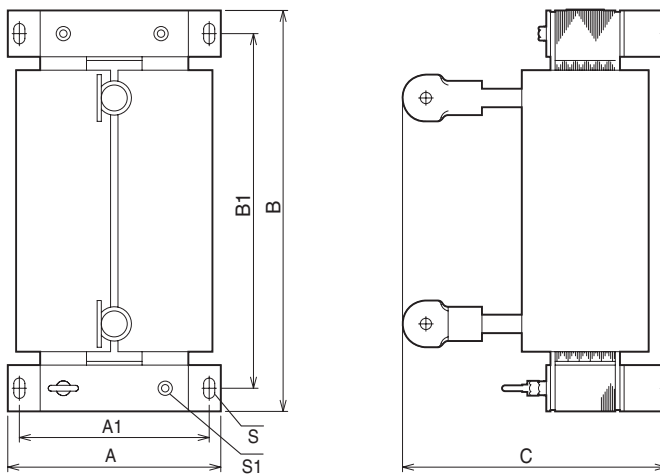
Choke	Frequency inverter	A	A1	B	B1	C	S	S1	Weight [kg]
FR-HEL-H110K	FR-A/F 740-02160	150	130	340	310	195	M6	M6	22
FR-HEL-H132K	FR-A/F 740-02600	175	150	405	370	200	M8	M6	26
FR-HEL-H160K	FR-A/F 740-03250	175	150	405	370	205	M8	M6	28

All dimensions in mm

■ DC Reactors FR-HEL-H185K – 355K
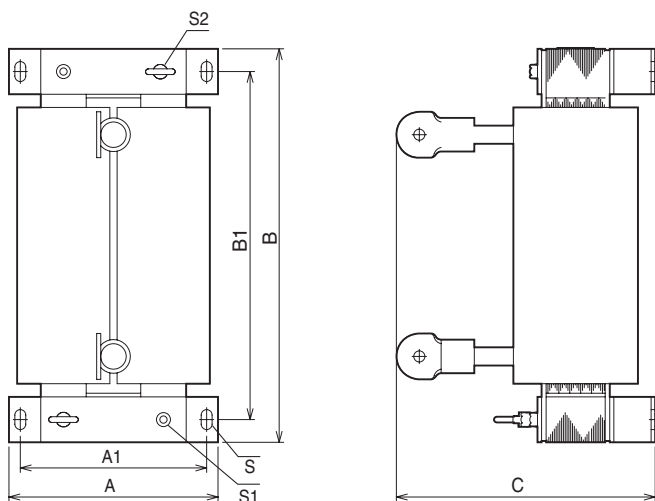
Choke	Frequency inverter	A	A1	B	B1	C	S	S1	S2	∅	Weight [kg]
FR-HEL-H185K	FR-A/F 740-03610	175	150	405	370	240	M8	M6	–	M12	29
FR-HEL-H220K	FR-A/F 740-04320	175	150	405	370	240	M8	M6	M6	M12	30
FR-HEL-H250K	FR-A/F 740-04810	190	165	440	400	250	M8	M8	M8	M12	35
FR-HEL-H280K	FR-A/F 740-05470	190	165	440	400	255	M8	M8	M8	M16	38
FR-HEL-H315K	FR-A/F 740-06100	210	185	495	450	250	M10	M8	M8	M16	42
FR-HEL-H355K	FR-A/F 740-06830	210	185	495	450	250	M10	M8	M8	M16	46

All dimensions in mm

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DIMENSIONS

■ DC Reactors FR-HEL-H400K – 450K
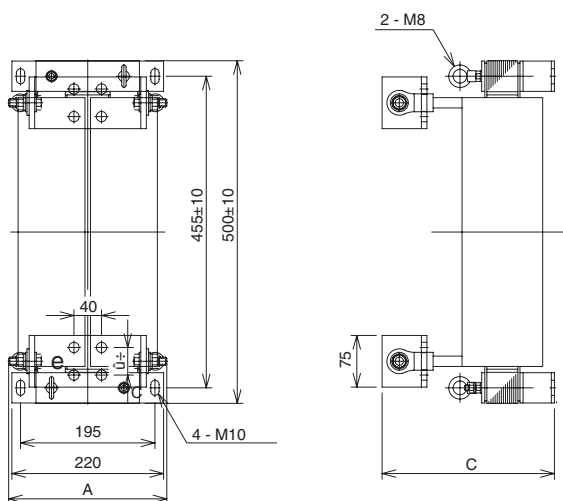
Choke	Frequency inverter	A	C	Weight [kg]
FR-HEL-H400K	FR-A/F 740-07700	235	250	50
FR-HEL-H450K	FR-A/F 740-08660	240	270	57

All dimensions in mm

■ DC Reactors FR-HEL-H500K – 630K
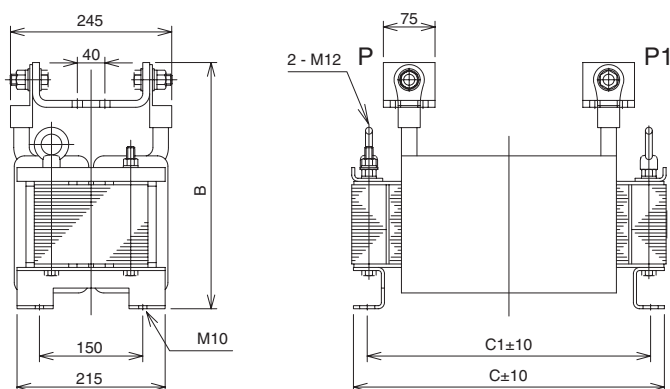
Choke	Frequency inverter	B	C	C1	Weight [kg]
FR-HEL-H500K	FR-A/F 740-09620	345	455	405	67
FR-HEL-H560K	FR-A/F 740-10940	360	460	410	85
FR-HEL-H630K	FR-A/F 740-12120	360	460	410	95

All dimensions in mm

■ AC Chokes FR-BAL-B-☐☐k
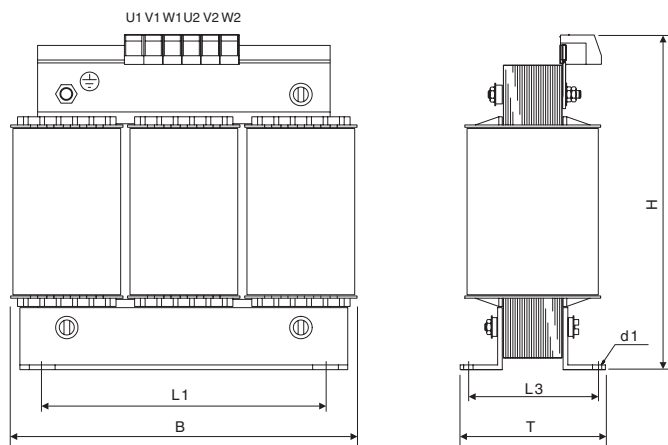
Choke	Frequency inverter	B	T	H	L1	L3	d1	Weight [kg]
FR-BAL-B-4.0 k	FR-E540-0.4 k – 4.0 k, FR-F740-00023–00083 FR-A740-00023–00126	125	82	130	100	56	5 x 8	3.0
FR-BAL-B-5.5 k	FR-E540-5.5 k, FR-F740-00126 FR-A740-00170	155	85	145	130	55	8 x 12	3.7
FR-BAL-B-7.5 k	FR-E540-7.5 k, FR-F740-00170 FR-A740-00250	155	100	150	130	70	8 x 12	5.5
FR-BAL-B-11 k	FR-F740-00250–00310 FR-A740-00310–00380	155	100	150	130	70	8 x 12	5.5
FR-BAL-B-15 k	FR-F740-00250–00310 FR-A740-00310–00380	190	115	210	170	79	8 x 12	10.7
FR-BAL-B-22 k	FR-F740-00380–00470 FR-A740-00470–00620	190	115	210	170	79	8 x 12	11.2
FR-BAL-B-30 k	FR-F740-00620 / FR-A740-00770	190	118	230	170	79	8 x 12	3.0
FR-BAL-B-37 k	FR-F740-00770 / FR-A740-00930	210	128	265	175	97	8 x 12	3.7
FR-BAL-B-45 k	FR-F740-00930 / FR-A740-01160	230	165	280	180	122	8 x 12	5.5
FR-BAL-B-55 k	FR-F740-01160 / FR-A740-01800	240	140	305	190	97	11 x 12	10.7

All dimensions in mm

4

DIMENSIONS

■ Noise Filters for FR-S500
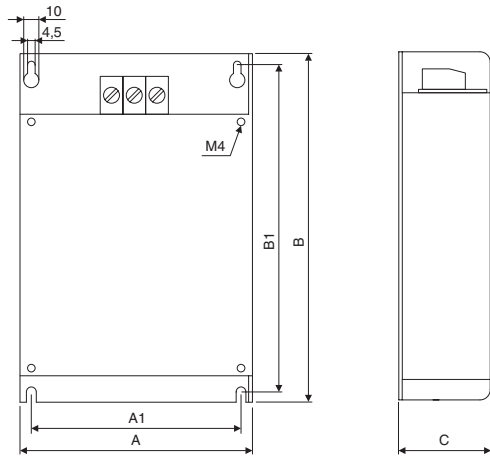
Filter	Frequency inverter	A	A1	B	B1	C
FFR-S520S-14A-RF1	FR-S520SE-0,2 k–0,75 k	70	56	168	158	38
FFR-S520S-20A-RF1	FR-S520SE-1,5 k	110	96	168	158	38
FFR-S540-8A-RF100	FR-S540E-0,4–1,5 k	112	96	168	158	40
FFR-S540-13A-RF100	FR-S540E-2,2–3,7 k	112	96	168	158	45

All dimensions in mm

■ Noise Filters for FR-E520
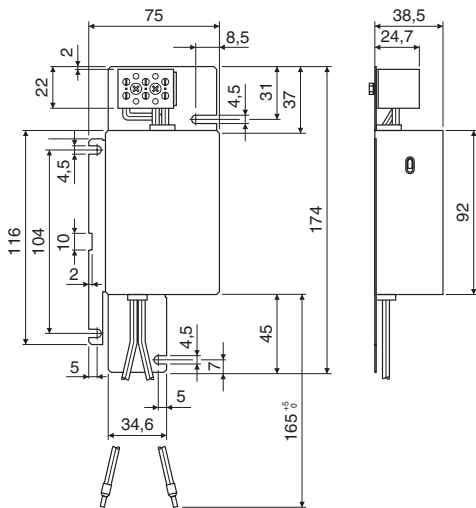
Filter	Frequency inverter	A	A1	B	B1	C
FFR-E520S-14A-SC1	FR-E520S EC-0,4 k – 0,75 k	75	—	92	—	38,5
FFR-E520S-26A-SC1	FR-E520S EC-1,5 k – 2,2 k	75	—	92	—	38,5

All dimensions in mm

■ Noise Filters for FR-E540
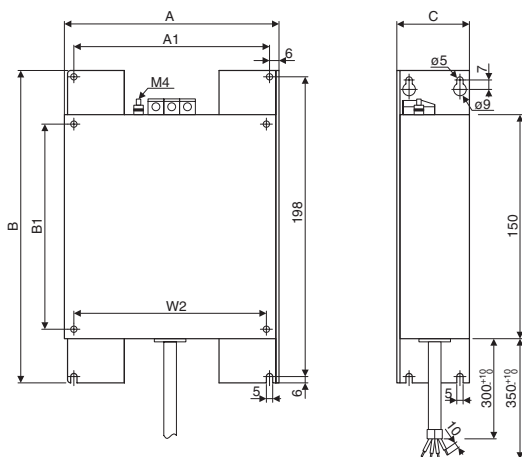
Filter	Frequency inverter	A	A1	B	B1	C
FFR-E540-4,5A-SF1	FR-E540 EC-0,4 k–0,75 k	140	128	210	138	46
FFR-E540-15A-SF1	FR-E540 EC-1,5 k–3,7 k	140	128	210	138	46
FFR-E540-27A-SF1	FR-E540 EC-5,5 k–7,5 k	220	208	210	138	55

All dimensions in mm

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■ Noise Filters for FR-A/F 740-00023 to FR-A/F 740-01800
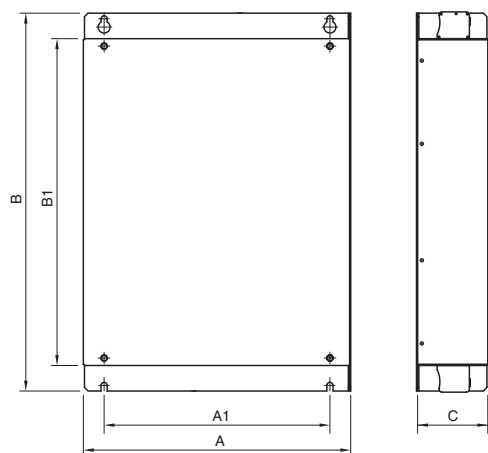
Filter	Frequency inverter	A	A1	B	B1	C
FFR-BS-00126-18A-SF100	00023–00126	150	110	315	260	50
FFR-BS-00250-30A-SF100	00170/00250	220	180	315	260	60
FFR-BS-00380-55A-SF100	00310/00380	221,5	180	360	300	80
FFR-BS-00620-75A-SF100	00470/00620	251,5	210	476	400	80
FFR-BS-00770-95A-SF100	00770	340	280	626	550	90
FFR-BS-00930-120A-SF100	00930	450	380	636	550	120
FFR-BS-01800-180A-SF100	00930/01800	450	380	652	550	120

All dimensions in mm

■ Noise Filters for FR-A/F 740-02160 to FR-A/F 740-12120
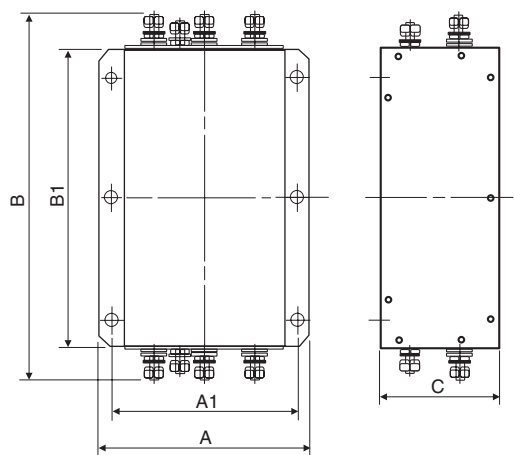
Filter	Frequency inverter	A	A1	B	B1	C
FN 3359/250/28	02160–02600	230	205	360	300	125
FN 3359/400/99	03250–04320	260	235	386	300	115
FN 3359/600/99	04810–06100	260	235	386	300	135
FN 3359/1000/99	06830–09620	280	255	456	350	170
FN 3359/1600/99	10940–12120	300	275	586	400	160

All dimensions in mm

■ Noise Filters for FR-F746-00023 to FR-F746-01160
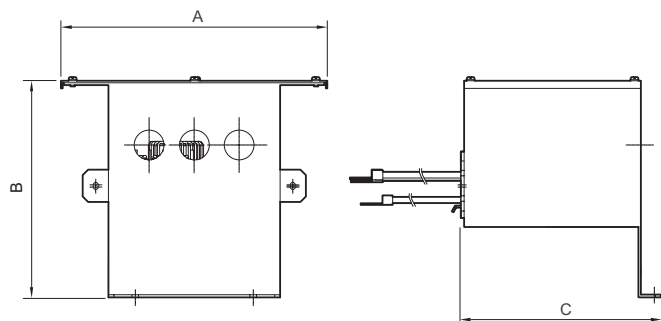
Filter	Frequency inverter	A	B	C
FFR-AF-IP54-21A-SM 2	00023 – 00126	248,5	201	186,5
FFR-AF-IP54-44A-SM 2	00170 – 00250	318,5	231	231,5
FFR-AF-IP54-62A-SM 2	00310 – 00380	318,5	251	239,5
FFR-AF-IP54-98A-SM 2	00470 – 00620	350	251	308
FFR-AF-IP54-117A-SM 2	00770	325	185	308
FFR-AF-IP54-172A-SM 2	00930 – 01160	464	301,5	481

All dimensions in mm

■ **Brake Units BU-UFS**
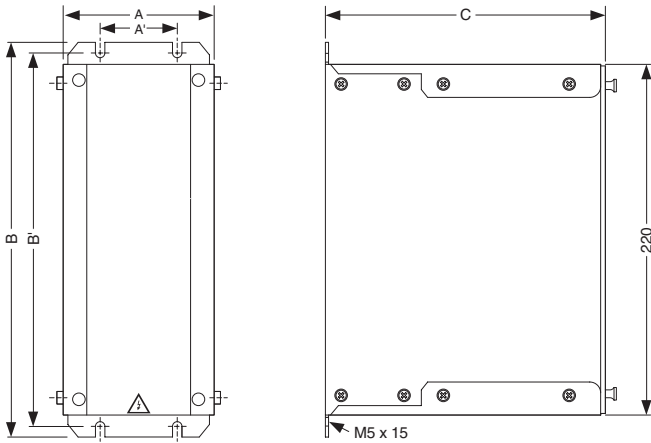
Brake unit	A	A'	B	B'	C	Weight [kg]
BU-UFS22J	100	50	250	240	175	2.4
BU-UFS22	100	50	250	240	175	2.5
BU-UFS40	100	50	250	240	175	2.5
BU-UFS110	107	50	250	240	195	3.9

All dimensions in mm

■ **External Brake Resistor RUFC**
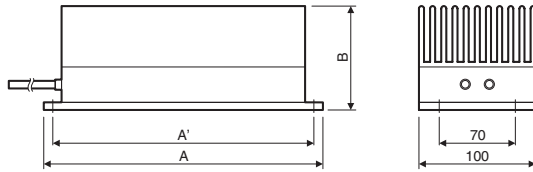
Brake resistor	A	A'	B	Weight [kg]
RUFC22	310	295	75	4.7
RUFC40	365	350	75	9.4
RUFC110	365	350	75	18.8

Remark: RUFC40 contains a set of two brake resistors, and RUFC110 contains a set of four brake resistors as shown on the left.

All dimensions in mm

■ **Brake Units MT-BU5**
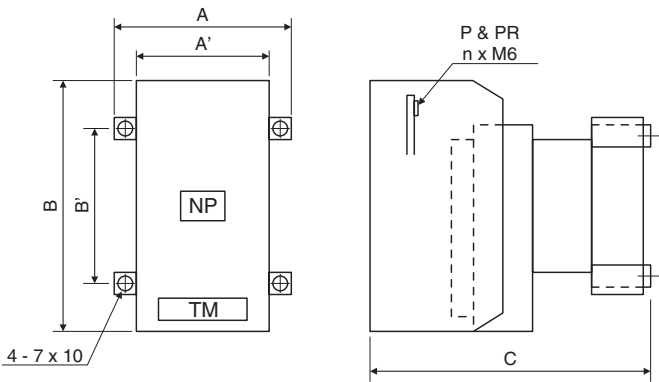
Brake unit	A	A'	B	B'	C	Weight [kg]
MT-BU5-H75K	118	90	200	100	256.5	1.5
MT-BU5-H150K	188	160	200	100	256.5	3.0
MT-BU5-H220K	258	230	200	100	256.5	4.5
MT-BU5-H280K	328	300	200	100	256.5	6.0
MT-BU5-H375K	398	370	200	100	256.5	7.5

All dimensions in mm

■ **External Brake Resistor MT-BR5**
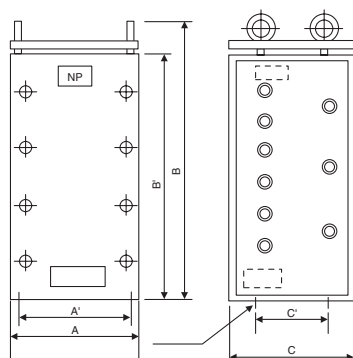
Brake resistor	A	A'	B	B'	C	C'	Weight [kg]
MT-BR5-H75 k	510	480	885	800	465	300	70

All dimensions in mm

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■ **External Brake Resistors FR-ABR-□□k**
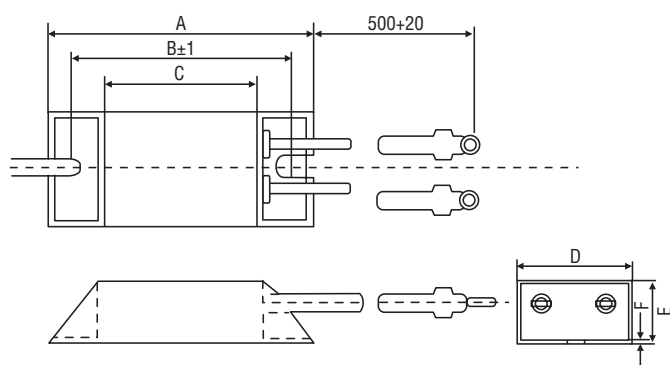
Brake resistor	A	B	C	D	E	F	Weight [kg]
FR-ABR-0.4 k	115	100	75	40	20	2.5	0.2
FR-ABR-0.75 k	140	125	100	40	20	2.5	0.2
FR-ABR-1.5 k	215	200	175	40	20	2.5	0.4
FR-ABR-2.2 k	240	225	200	50	25	2.0	0.5

All dimensions in mm

■ **External Brake Resistors FR-ABR-H□□k**
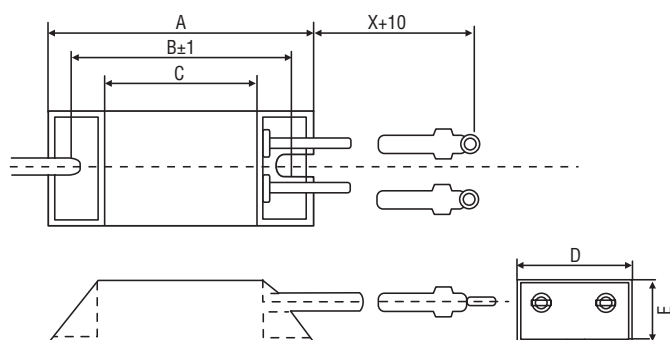
Brake resistor	A	B	C	D	E	X	Weight [kg]
FR-ABR-H0.4 k	115	100	75	40	20	500	0.2
FR-ABR-H0.75 k	140	125	100	40	20	500	0.2
FR-ABR-H1.5 k	215	200	175	40	20	500	0.4
FR-ABR-H2.2 k	240	225	200	50	25	500	0.5
FR-ABR-H3.7 k	215	200	175	60	30	500	0.8
FR-ABR-H5.5 k	335	320	295	60	30	500	1.3
FR-ABR-H7.5 k	400	385	360	80	40	500	2.2
FR-ABR-H 11 k	400	—	—	100	50	700	3.2
FR-ABR-H 15 k	300	—	—	100	50	700	2,4 (x2) seriel
FR-ABR-H 22 k	400	—	—	100	50	700	3,3 (x2) parallel

All dimensions in mm

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DIMENSIONS

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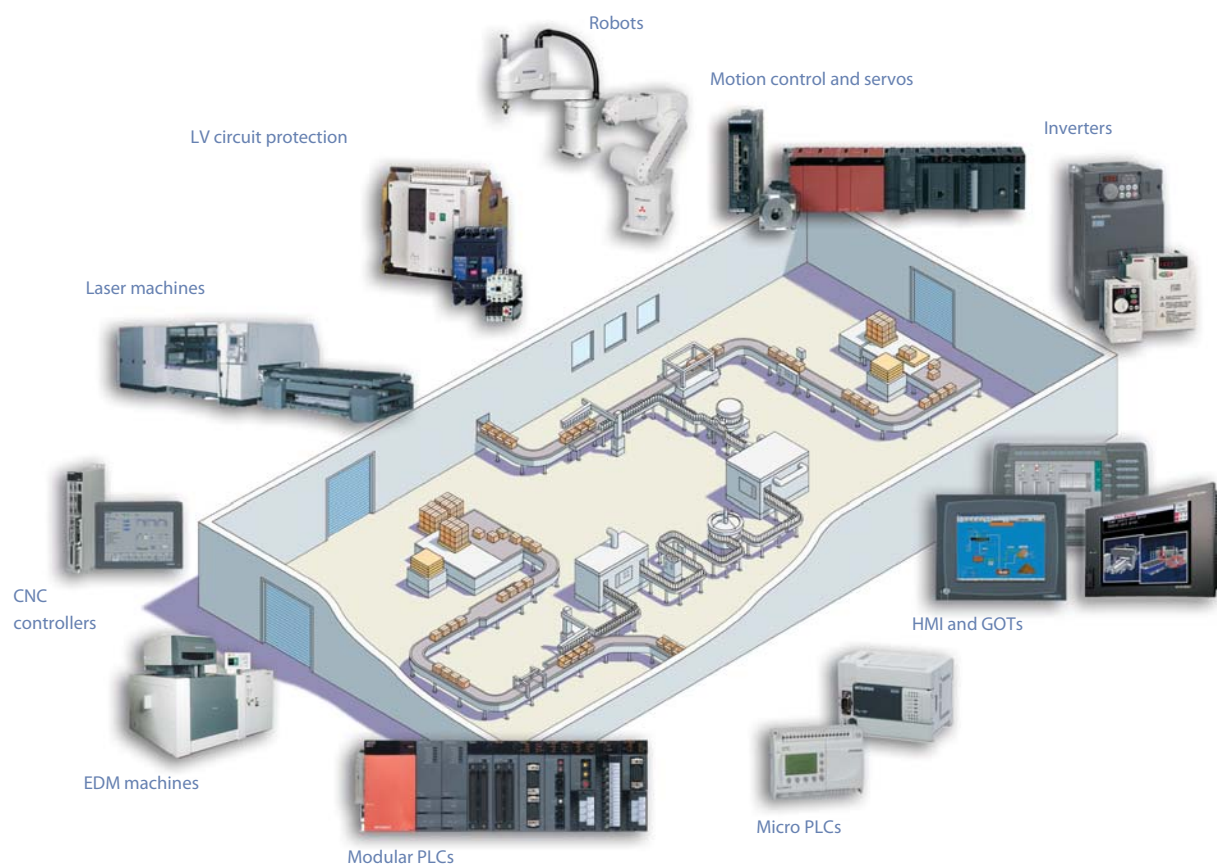
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