LC Automation
control & safety

www.lcautomation.com

a.c. Inverters & soft starters




a.c. Inverters & soft starters

Save energy!

– use a.c. inverters *(variable speed drives)*

Energy is saved by reducing the speed of an a.c. induction motor. In order to estimate the potential cost savings there are four main points to consider:

1 What type of load is the motor driving?

There are two types of load to consider when looking at energy saving, constant torque loads and variable torque loads.

Typical constant torque loads

- Screw compressors
- Piston pumps
- Bellows

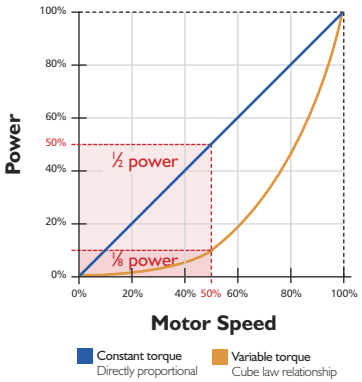
Energy saving with constant torque loads is directly proportional to the motor speed.

Typical variable torque loads

- Centrifugal fans
- Centrifugal pumps
- Regenerative turbines

Energy saving with variable torque loads is much greater, this is because of the cube law relationship with this type of load, a 50% reduction in speed saves 87.5% of the original full speed power. For a typical application a 20% speed reduction is achievable and would save 50% of the original full speed power.

Torque/speed laws

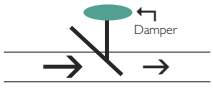


2 How is the process being controlled?

For many industrial and commercial applications the fans or pumps originally specified have proved to be oversized with little or no control. In these instances simply slowing down the motor produces energy saving without affecting the process quality.

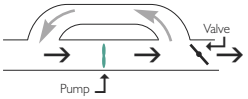
Mechanical control as detailed also provides opportunities for energy saving. The principle is to remove any mechanical restrictions and control the flow by slowing down the motor.

Mechanical flow control (e.g. damper)



Mechanical flow control offers no energy saving. Savings can be made by reducing the pump or fan speed and leaving the mechanical control fully open.

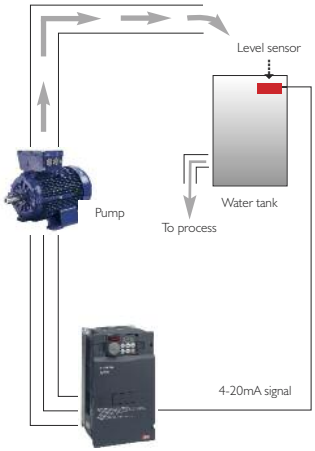
Re-circulation flow control (e.g. valve)



The re-circulation, or full flow system uses 100% of the full power requirement ALL of the time. Savings can be made by reducing the pump or fan speed and leaving the valve control fully open.

Please note: Consideration must be given to all parameters that may influence the control system. Typical examples that could affect the control requirements are outside temperature, humidity or changes to the process material. To compensate for these influences additional control measures may be required.

Installation requiring PI control



Example pumping solution

GOT1000 HMI

F700 a.c. inverter

Fluid pressure sensor

Pump

3 How much energy will be saved?

Calculating energy saving for variable torque loads

Step 1:

Determine the cost of the power currently used

Current cost (£s)	kW x T x C = £X	
kW = Power used by motor (measure if possible)	T = Time motor runs per year (hours)	C = Power cost (£s) per kW hour

NOTE: Don't forget to include the climate change levy to the basic kWh rate

Step 2:

Determine the cost of the power at reduced speed

Reduced cost (£s)	$\frac{kW \times S^3 \times T \times C}{Ed} = £Y$		
kW = Power used by motor at full speed (measure if possible) Ed = Efficiency of inverter (assume 0.9)	S = Reduced speed/ full speed (50% = ½ or 0.5) *Remember* *S = ½* *S^3 = ⅛*	T = Power cost (£s) per kW hour	C = Power cost (£) per kW hour

NOTE: Don't forget to include the climate change levy to the basic kWh rate

Step 3:

Energy savings per year

Savings (£s)	X – Y per year = £Z
X = Cost of power currently used	Y = Cost of reduced power/speed

4 What is the payback time?

Step 4:

Overall payback time

Payback time (No. of years)	$\frac{\text{cost of inverter system}}{£Z \text{ (energy saving per year)}}$

FR-D700 series – Ultra compact a.c. inverters

MITSUBISHI ELECTRIC

FR-D700 a.c. inverters are the smallest members of the Mitsubishi FR-700 family, setting new standards of control and performance in a stand-alone ultra compact unit.

Features

- Exceptional energy saving for an ultra compact unit
- Built in safety stop function, for direct connection to a safety system
- High starting torque for demanding applications
- Built in keypad with display and one-touch digital dial control
- On board component life monitor
- Source logic safety input
- DIN rail mounting with adapter

Suitable applications include:

- Simple applications where space is very limited
- Feeder and conveyor lines
- Machine tools
- Fans and pumps
- Doors and gates

Technical specification

Output range 1-phase 0.1-2.2kW
3-phase 0.4-7.5kW

Frequency range 0.2-400Hz

Power supply
Single-phase . . . 200-240V, 50Hz input
Three-phase . . . 380-480V, 50Hz input

Overload rating . . . Up to 200% available

FR-D720S – single phase

				EMC Noise Filters		External Brake Resistors	
Rated Motor Current	Rated Current	Order Code	List Price	Order Code	List Price	Order Code	List Price
0.1kW	0.8A	FR-D720S-008SC-EC	£111.00	FFR-CS-050-14A-RF1	£13.50	—	—
0.2kW	1.4A	FR-D720S-014SC-EC	£121.00	FFR-CS-050-14A-RF1	£13.50	—	—
0.4kW	2.5A	FR-D720S-025SC-EC	£132.50	FFR-CS-050-14A-RF1	£13.50	FR-ABR-0.4K	£18.00
0.75kW	4.2A	FR-D720S-042SC-EC	£154.00	FFR-CS-050-14A-RF1	£13.50	FR-ABR-0.75K	£24.50
1.5kW	7A	FR-D720S-070SC-EC	£188.00	FFR-CS-080-20A-RF1	£19.50	FR-ABR-2.2K	£32.00
2.2kW	10A	FR-D720S-100SC-EC	£264.50	FFR-CS-110-26A-RF1	£25.50	FR-ABR-2.2K	£32.00

FR-D740 – three phase

				EMC Noise Filters		External Brake Resistors	
Rated Motor Current	Rated Current	Order Code	List Price	Order Code	List Price	Order Code	List Price
0.4kW	1.2A	FR-D740-012SC-EC	£170.50	FFR-CSH-036-8A-RF1	£27.50	FR-ABR-H0.4K	£18.00
0.75kW	2.2A	FR-D740-022SC-EC	£188.00	FFR-CSH-036-8A-RF1	£27.50	FR-ABR-H0.75K	£24.50
1.5kW	3.6A	FR-D740-036SC-EC	£212.50	FFR-CSH-036-8A-RF1	£27.50	FR-ABR-H1.5K	£32.00
2.2kW	5A	FR-D740-050SC-EC	£305.50	FFR-CSH-080-16A-RF1	£36.00	FR-ABR-H2.2K	£37.00
3.7kW	8A	FR-D740-080SC-EC	£417.50	FFR-CSH-080-16A-RF1	£36.00	FR-ABR-H3.7K	£49.50
5.5kW	12A	FR-D740-120SC-EC	£578.00	FFR-MSH-170-30A-RF1	£41.00	FR-ABR-H5.5K	£67.00
7.5kW	16A	FR-D740-160SC-EC	£793.00	FFR-MSH-170-30A-RF1	£41.00	FR-ABR-H7.5K	£109.00

FR-D700 DIN rail mounting adapters

Description	Order Code	List Price
DIN rail mounting adapter; 68mm wide	FR-UDA01	£10.50
DIN rail mounting adapter; 108mm wide	FR-UDA02	£15.50

Go to pages 20-21 for options and accessories

FR-E700 series – Compact a.c. inverters

The FR-E700 series are compact a.c. inverters with integrated RS485, Modbus RTU and USB interfaces. Plug in option cards are also available to connect to open networks including ProfiBus DP, DeviceNet and CC-Link.

Features

- Built in RS485/Modbus RTU interface
- Network options include ProfiBus DP, DeviceNet and CC-Link *(see options and accessories on page 20)*
- Built in safety stop function, for direct connection to a safety system
- USB port for high speed monitoring
- Built in keypad with display and one-touch digital dial control
- Exceptional motor shaft handling at low speeds
- On board component life monitor
- Sensorless vector control
- Advanced auto-tuning
- Overload capacity increased to 200%
- Current limiting
- 150% torque down to 1Hz

Suitable applications include:

- Space limited applications which still require network connectivity
- Conveyor systems
- Textile and printing machines
- Fans and pumps
- Doors and gates

Technical specification

Output range 1-phase 0.1-2.2kW
3-phase 0.4-15kW

Frequency range 0.2-400Hz

Power supply
Single-phase . . . 200-240V, 50Hz input
Three-phase . . . 380-480V, 50Hz input

Overload rating . . . Up to 200% available

FR-E720S – single phase

				EMC Noise Filters		External Brake Resistors	
Rated Motor Current	Rated Current	Order Code	List Price	Order Code	List Price	Order Code	List Price
0.1kW	0.8A	FR-E720S-008SC-EC	£138.50	FFR-CS-050-14A-RF1	£13.50	—	—
0.2kW	1.5A	FR-E720S-015SC-EC	£145.00	FFR-CS-050-14A-RF1	£13.50	—	—
0.4kW	3.0A	FR-E720S-030SC-EC	£151.00	FFR-CS-050-14A-RF1	£13.50	FR-ABR-0.4K	£18.00
0.75kW	5.0A	FR-E720S-050SC-EC	£175.50	FFR-CS-080-20A-RF1	£19.50	FR-ABR-0.75K	£24.50
1.5kW	8.0A	FR-E720S-080SC-EC	£277.00	FFR-CS-080-20A-RF1	£19.50	FR-ABR-2.2K	£32.00
2.2kW	11A	FR-E720S-110SC-EC	£325.00	FFR-CS-110-26A-RF1	£25.50	FR-ABR-2.2K	£32.00

FR-E740 – three phase

				EMC Noise Filters		External Brake Resistors	
Rated Motor Current	Rated Current	Order Code	List Price	Order Code	List Price	Order Code	List Price
0.4kW	1.6A	FR-E740-016SC-EC	£271.00	FFR-MSH-040-8A-RF1	£32.00	FR-ABR-H0.4K	£18.00
0.75kW	2.6A	FR-E740-026SC-EC	£287.00	FFR-MSH-040-8A-RF1	£32.00	FR-ABR-H0.75K	£24.50
1.5kW	4A	FR-E740-040SC-EC	£309.00	FFR-MSH-040-8A-RF1	£32.00	FR-ABR-H1.5K	£32.00
2.2kW	6A	FR-E740-060SC-EC	£427.50	FFR-MSH-095-16A-RF1	£41.00	FR-ABR-H2.2K	£37.00
3.7kW	9.5A	FR-E740-095SC-EC	£568.00	FFR-MSH-095-16A-RF1	£41.00	FR-ABR-H3.7K	£49.50
5.5kW	12A	FR-E740-120SC-EC	£689.00	FFR-MSH-170-30A-RF1	£41.00	FR-ABR-H5.5K	£67.00
7.5kW	17A	FR-E740-170SC-EC	£950.00	FFR-MSH-170-30A-RF1	£41.00	FR-ABR-H7.5K	£109.00
11kW	23A	FR-E740-230SC-EC	£1,004.00	FFR-MSH-300-50A-RF1	£91.00	FR-ABR-H11K	£176.50
15kW	30A	FR-E740-300SC-EC	£1,174.00	FFR-MSH-300-50A-RF1	£91.00	FR-ABR-H15K	£212.50

See page 21 for Mitsubishi FR Configurator
a.c. inverter programming and setup software

Go to pages 20-21 for options and accessories

FR-F700 series – Energy saving a.c. inverters

MITSUBISHI ELECTRIC

FR-F700 a.c. inverters provide exceptional energy saving capabilities in variable torque applications including pumps and ventilation fans. They are also suitable for or any application with reduced overload requirements.

Features

- Exceptional real time energy saving
- Integrated PLC functions
- Built in EMC and RFI filter
- Built in RS485, Modbus and BacNet interfaces
- Full range of communication options
- Built in control panel allows quick setting, monitoring and diagnostics
- Long service life
- IP54 version (FR-F746), also available

Suitable applications include;

- Variable torque applications
- Pumps and fans
- Heating, ventilation and air conditioning

Technical specification

Output range 0.75-630kW
Frequency range 0.5-400Hz
Power supply . . . Three phase 380-480V
Overload rating . . . Up to 150% available

FR-F740S – three phase

(Combined chassis and control card)

Rated Motor Current	Rated Current	Order Code	List Price	External Brake Resistors Order Code	External Brake Resistors List Price
0.75kW	2.3A	FR-F740-00023-EC	£522.00	FR-ABR-H0.75K	£24.50
1.5kW	3.8A	FR-F740-00038-EC	£556.00	FR-ABR-H1.5K	£32.00
2.2kW	5.2A	FR-F740-00052-EC	£615.00	FR-ABR-H2.2K	£37.00
3.7kW	8.3A	FR-F740-00083-EC	£703.00	FR-ABR-H3.7K	£49.50
5.5kW	12.6A	FR-F740-00126-EC	£786.00	FR-ABR-H5.5K	£67.00
7.5kW	17A	FR-F740-00170-EC	£915.00	FR-ABR-H7.5K	£109.00
11kW	25A	FR-F740-00250-EC	£1,033.00	FR-ABR-H11K	£176.50
15kW	31A	FR-F740-00310-EC	£1,282.00	FR-ABR-H15K	£212.50
18.5kW	38A	FR-F740-00380-EC	£1,571.00	—	—
22kW	47A	FR-F740-00470-EC	£2,097.00	FR-ABR-H22K	£386.50
30kW	62A	FR-F740-00620-EC	£2,621.00	—	—

FR-AF740 – three phase (Chassis only)

Rated Motor Current	Rated Current	Order Code	List Price	Control Card Order Code	Control Card List Price
37kW	77A	FR-AF740-00770-EC	£2,986.00	FR-CF70-EC	£272.00
45kW	93A	FR-AF740-00930-EC	£3,681.00	FR-CF70-EC	£272.00
55kW	116A	FR-AF740-01160-EC	£4,417.00	FR-CF70-EC	£272.00
90kW	180A	FR-AF740-01800-EC	£4,662.50	FR-CF70-ECT	£302.50
110kW	216A	FR-AF740-02160-EC	£5,310.50	FR-CF70-ECT	£302.50
132kW	260A	FR-AF740-02600-EC	£6,087.50	FR-CF70-ECT	£302.50
160kW	325A	FR-AF740-03250-EC	£7,537.50	FR-CF70-ECT	£302.50
185kW	361A	FR-AF740-03610-EC	£8,655.50	FR-CF70-ECT	£302.50
220kW	432A	FR-AF740-04320-EC	£10,255.50	FR-CF70-ECT	£302.50
250kW	481A	FR-AF740-04810-EC	£12,294.50	FR-CF70-ECT	£302.50
280kW	547A	FR-AF740-05470-EC	£13,482.50	FR-CF70-ECT	£302.50
315kW	610A	FR-AF740-06100-EC	£16,445.50	FR-CF70-ECT	£302.50
355kW	683A	FR-AF740-06830-EC	£16,711.50	FR-CF70-ECT	£302.50
400kW	770A	FR-AF740-07700-EC	£17,505.50	FR-CF70-ECT	£302.50
450kW	866A	FR-AF740-08660-EC	£26,387.50	FR-CF70-ECT	£302.50
500kW	962A	FR-AF740-09620-EC	£40,546.50	FR-CF70-ECT	£302.50
560kW	1094A	FR-AF740-10940-EC	£45,226.50	FR-CF70-ECT	£302.50
630kW	1212A	FR-AF740-12120-EC	£48,350.50	FR-CF70-ECT	£302.50

Please remember to order the control card

See page 21 for
Mitsubishi FR Configurator
a.c. inverter programming and setup software

Go to pages 20-21 for options and accessories

FR-A700 – High duty a.c. inverters

MITSUBISHI ELECTRIC

Features

- Integrated PLC functions
- Built in EMC and RFI filter
- Built in RS485, Modbus RTU interface
- Network comms options
- Easy integration with positioning systems using SSCNET III
- Self diagnosis for easy maintenance
- Extended service life
- 4 x overload capacity
- Open or closed loop motor control
- Exceptional starting torque

Suitable applications include;

- Fixed torque applications
- Conveyor and handling systems
- Mechanical engineering
- Process plant engineering

Technical specification

Output range 0.4-500kW
Frequency range 0.2-400Hz
Power supply . . . Three phase 380-500V
Overload rating . . . Up to 250% available in high duty setting

FR-A700 a.c. inverters combine performance, function, and advanced power control technologies with the high-performance required in mechanical engineering or process plant applications.

Features include real sensorless vector control and online auto-tuning, to provide excellent speed stability and smooth motor shaft rotation even at very low speed.

Other functions include controlled power reduction after emergency shutdown, optional closed-loop control and integrated PLC functions.

FR-A740 – three phase
(Combined chassis and control card)

Rated Motor Current	Rated Current	Order Code	List Price	External Brake Resistors Order Code	External Brake Resistors List Price
0.4kW	1.5A	FR-A740-00023-EC	£611.00	FR-ABR-H0.4K	£18.00
0.75kW	2.5A	FR-A740-00038-EC	£648.00	FR-ABR-H0.75K	£24.50
1.5kW	4A	FR-A740-00052-EC	£707.00	FR-ABR-H1.5K	£32.00
2.2kW	6A	FR-A740-00083-EC	£792.00	FR-ABR-H2.2K	£32.00
3.7kW	9A	FR-A740-00126-EC	£878.00	FR-ABR-H3.7K	£49.50
5.5kW	12A	FR-A740-00170-EC	£1,003.00	FR-ABR-H5.5K	£67.00
7.5kW	17A	FR-A740-00250-EC	£1,121.00	FR-ABR-H7.5K	£109.00
11kW	23A	FR-A740-00310-EC	£1,368.00	FR-ABR-H11K	£176.50
15kW	31A	FR-A740-00380-EC	£1,663.00	FR-ABR-H15K	£212.50
18.5kW	38A	FR-A740-00470-EC	£2,186.00	FR-ABR-H22K	£386.50
22kW	44A	FR-A740-00620-EC	£2,713.00	FR-ABR-H22K	£386.50

FR-AF740 – three phase (Chassis only)

Rated Motor Current	Rated Current	Order Code	List Price	Control Card Order Code	Control Card List Price
30kW	57A	FR-AF740-00770-EC	£2,988.00	FR-CA70-EC	£795.00
37kW	71A	FR-AF740-00930-EC	£3,683.00	FR-CA70-EC	£795.00
45kW	86A	FR-AF740-01160-EC	£4,419.00	FR-CA70-EC	£795.00
55kW	110A	FR-AF740-01800-EC	£4,660.00	FR-CA70-EC	£795.00
75kW	144A	FR-AF740-02160-EC	£5,308.00	FR-CA70-ECT	£1,121.00
90kW	180A	FR-AF740-02600-EC	£6,085.00	FR-CA70-ECT	£1,121.00
110kW	216A	FR-AF740-03250-EC	£7,535.00	FR-CA70-ECT	£1,121.00
132kW	260A	FR-AF740-03610-EC	£8,653.00	FR-CA70-ECT	£1,121.00
160kW	325A	FR-AF740-04320-EC	£10,253.00	FR-CA70-ECT	£1,121.00
185kW	361A	FR-AF740-04810-EC	£12,292.00	FR-CA70-ECT	£1,121.00
220kW	432A	FR-AF740-05470-EC	£13,480.00	FR-CA70-ECT	£1,121.00
250kW	481A	FR-AF740-06100-EC	£16,443.00	FR-CA70-ECT	£1,121.00
280kW	547A	FR-AF740-06830-EC	£16,709.00	FR-CA70-ECT	£1,121.00
315kW	610A	FR-AF740-07700-EC	£17,503.00	FR-CA70-ECT	£1,121.00
355kW	683A	FR-AF740-08660-EC	£26,385.00	FR-CA70-ECT	£1,121.00
400kW	770A	FR-AF740-09620-EC	£40,544.00	FR-CA70-ECT	£1,121.00
450kW	866A	FR-AF740-10940-EC	£45,224.00	FR-CA70-ECT	£1,121.00
500kW	962A	FR-AF740-12120-EC	£48,348.00	FR-CA70-ECT	£1,121.00

Please remember to order the control card

See page 21 for
Mitsubishi FR Configurator
a.c. inverter programming and setup software

Go to pages 20-21 for options and accessories

a.c. Inverter options and accessories

MITSUBISHI ELECTRIC

Input/output cards and communication options

Description	For use with A700	D700	E700	F700	Order Code	List Price
12-bit digital input function card	●	—	—	●	FR-A7AX	£78.00
12-bit digital input function kit *(safety version)*	—	—	●	—	FR-A7AX-EKit-SC-E	£78.00
7 digital and 2 analogue output card	●	—	—	●	FR-A7AY	£115.00
7 digital and 2 analogue output kit *(safety version)*	—	—	●	—	FR-A7AY-EKit-SC-E	£115.00
3 relay output card	●	—	—	●	FR-A7AR	£78.00
3 relay output kit *(safety version)*	—	—	●	—	FR-A7AR-EKit-SC-E	£78.00
CC-Link interface	●	—	—	●	FR-A7NC	£149.00
CC-Link interface *(safety version)*	—	—	●	—	FR-A7NC-EKit-SC-E	£149.00
LON Works interface	●	—	—	●	FR-A7NL	£219.50
LON Works interface *(safety version)*	—	—	●	—	FR-A7NL-EKit-SC-E	£219.50
Jonson controls Metasys® N2, Siemens FLN & Modbus RTU interface	●	—	—	●	FR-A7N-XLT	£356.00
ProfiBus interface	●	—	—	●	FR-A7NP	£219.50
9-pin D sub connector for ProfiBus interface	●	—	—	●	FR-D-Sub9-A7NP	£32.00
ProfiBus interface *(safety version)*	—	—	●	—	FR-A7NP-EKit-SC-E	£219.50
ProfiBus interface with 9-pin D sub connector *(safety version)*	—	—	●	—	FR-A7NP-EKit-SC-E-01	£219.50
DeviceNet interface	●	—	—	●	FR-A7ND	£219.50
DeviceNet interface *(safety version)*	—	—	●	—	FR-A7ND-EKit-SC-E	£219.50
SSCNET III interface	●	—	—	—	FR-A7NS	£436.00
Modbus TCP, Ethernet/IP, Profinet & BACNet interface	●	—	—	●	FR-A7N-ETH	£350.00
12V encoder power supply terminal block	●	—	—	—	FR-A7PS	£179.50
Encoder master/slave card	●	—	—	—	FR-A7AL	£305.50
Encoder feedback	●	—	—	—	FR-A7AP	£139.50

Replacement/additional parameter units and cables

Description	For use with A700	D700	E700	F700	Order Code	List Price
Replacement simple keypad	—	●	●	—	FR-PA07	£36.00
Replacement LCD parameter unit	●	—	—	●	FR-DU07	£46.50
Replacement LCD parameter unit; IP54 version	●	—	—	●	FR-DU07-IP54	£48.50
Extension cable for replacement LCD parameter unit; 1m	●	—	—	●	FR-CB201-ADP-KIT	£25.50
Extension cable for replacement LCD parameter unit; 3m	●	—	—	●	FR-CB203-ADP-KIT	£34.00
Extension cable for replacement LCD parameter unit; 5m	●	—	—	●	FR-CB205-ADP-KIT	£49.50
LCD parameter unit with keypad & extended functions	●	●	●	●	FR-PU07-01	£87.50
LCD parameter unit with keypad, extended functions & battery backup	●	●	●	●	FR-PU07BB-L	£153.00
Extension cable for LCD parameter unit with keypad; 1m	●	●	●	●	FR-CB201	£19.50
Extension cable for LCD parameter unit with keypad; 3m	●	●	●	●	FR-CB203	£30.00
Extension cable for LCD parameter unit with keypad; 5m	●	●	●	●	FR-CB205	£44.50

Accessories and cables

Description	For use with A700	D700	E700	F700	Order Code	List Price
RS485 4-port hub (connect up to 2 inverters to a serial network)	●	●	●	●	FR-RJ45-HUB4	£73.00
RS485 10-port hub (connect up to 8 inverters to a serial network)	●	●	●	●	FR-RJ45-HUB10	£143.50
Interconnecting cable for RS485 hub; 1m	●	●	●	●	FR-A5-CBL-1	£11.00
Interconnecting cable for RS485 hub; 2.5m	●	●	●	●	FR-A5-CBL-2.5	£13.00
Interconnecting cable for RS485 hub; 5m	●	●	●	●	FR-A5-CBL-5	£15.00
RS485 terminal resistor	●	●	●	●	FR-RJ45-TR	£23.50
RS485 multidrop cable and connector	●	●	●	●	FR-CB2-485	£14.00
USB to RS232 adapter	●	—	—	—	USB-RS232	£29.00

a.c. Inverter options and accessories (continued)

FR-BU2 brake units are used when a large brake torque is necessary.

They are equipped with a control panel for monitoring different values, setting parameters and displaying the alarm history. Cascading the units helps to achieve optimum sizing.

Brake resistors are not fitted and need to be ordered separately.

Go to pages 16-19 for FR-700 series a.c. inverters

Brake units for three phase high duty inverters

Rated Motor Current	0% ED	10% ED	50% ED	100% ED	Order Code	List Price
7.5kW	5	10	27	47	FR-BU2-H7.5K	£504.50
15kW	5	13	40	74	FR-BU2-H15K	£532.00
30kW	5	20	72	137	FR-BU2-H30K	£560.00
55kW	5	37	140	268	FR-BU2-H55K	£602.00
75kW	5	49	174	331	FR-BU2-H75K	£815.00

Brake resistors

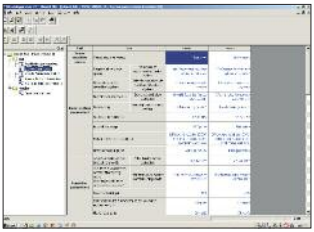
Description	Order Code	List Price
32Ω 990W continuous	FR-BR-H15K	£412.50
16Ω 1990W continuous	FR-BR-H30K	£758.00
8Ω 3910W continuous	FR-BR-H55K	£814.00

Inverter output dv/dt reduction filters

Output filters efficiently reduce the voltage rise time, motor heat generation, insulation stressing and motor noise generation

Rated Motor Current	Power Loss	For use with Frequency Inverters: FR-D720S	FR-D740	FR-E720S	FR-E740	FR-A740	FR-F740	Order Code	List Price
10A	25W	●	●	●	●	●	●	FFR-DT-10A-SS1	£82.00
25A	45W	●	●	●	●	●	●	FFR-DT-25A-SS1	£107.00
47A	60W	—	—	—	●	●	●	FFR-DT-47A-SS1	£183.50
93A	75W	—	—	—	—	●	●	FFR-DT-93A-SS1	£271.00
124A	110W	—	—	—	—	●	●	FFR-DT-124A-SS1	£298.50
182A	140W	—	—	—	—	●	●	FFR-DT-182A-SS1	£403.00
330A	240W	—	—	—	—	●	●	FFR-DT-330A-SS1	£682.00
500A	340W	—	—	—	—	●	●	FFR-DT-500A-SS1	£915.00
610A	380W	—	—	—	—	●	●	FFR-DT-610A-SS1	£985.00
683A	410W	—	—	—	—	●	●	FFR-DT-683A-SS1	£1,062.00
790A	590W	—	—	—	—	●	●	FFR-DT-790A-SS1	£1,412.00
1100A	760W	—	—	—	—	●	●	FFR-DT-1100A-SS1	£1,892.00
1500A	1100W	—	—	—	—	—	●	FFR-DT-1500A-SS1	£2,646.00

FR Configurator - programming software for Mitsubishi 700 series a.c.inverters



FR-Configurator is a powerful tool for operating and managing your a.c. inverters from a standard PC.

Features

- Up to 32 networked a.c. inverters can be operated simultaneously
- Analyser tests the resonant frequency of the machine as it accelerates
- Trace function, emulates an oscilloscope
- Test operation function and tuning
- Diagnostics and help functions

Benefits

- Comprehensible functions display data, analogue, oscillograph & alarms
- Analysis of inverter status provides a thorough error correction
- Test operation provides simulation and adjustment via auto-tuning.
- Extensive online help provides support with settings and operation

Description	Order Code	List Price
FR Configurator software for 700 series a.c. inverters	FR-Configurator-M	£59.00
RS485 programming cable (PU Port)	SC-FR-PC	£110.00

Sirius 3RW30 – Soft starters 1.5 to 55kW

SIEMENS

Sirius 3RW30 soft starters reduce motor voltage through variable phase control and increase it in ramp-like mode from a selectable starting voltage up to mains voltage.

During starting, these devices limit the torque as well as the current and prevent the shocks which arise during direct starts or star-delta starts. In this way, mechanical loads and mains voltage dips can be reliably reduced.

Soft starting reduces the stress on the connected equipment and results in lower wear and therefore trouble-free production. Selectable start values mean the soft starters can be adjusted to the requirements of the application and, unlike star-delta starters, are not restricted to two stage starting with fixed voltage ratios.

Features

- Soft start only
- Compact size
- Uninterrupted switching without current peaks
- Simple installation and commissioning
- Compact, space-saving design
- Screw terminal connection
- Integrated jumper contacts

Technical specification

Supply voltage . . . . . .200-480V a.c.
Ramp up time 0-20s
Starting voltage 40-100%
Ambient temperature . . . -25 to +60°C

Frame Size	Dimensions h x w x d (mm)
00	95 x 45 x 150
0	125 x 45 x 150
2	160 x 55 x 170
3	170 x 70 x 190

Control voltage, 24V a.c./d.c.

Motor Rated Voltage @ 400V	Output Current @ 40°	Frame Size	Order Code	List Price
1.5kW	3.6A	00	3RW3013-1BB04	£88.73
3kW	6.5A	00	3RW3014-1BB04	£102.25
4kW	9A	00	3RW3016-1BB04	£117.46
5.5kW	12.5A	00	3RW3017-1BB04	£131.82
7.5kW	17.6A	00	3RW3018-1BB04	£151.26
11kW	25A	0	3RW3026-1BB04	£171.61
15kW	32A	0	3RW3027-1BB04	£206.18
18.5kW	38A	0	3RW3028-1BB04	£254.35
22kW	45A	2	3RW3036-1BB04	£312.65
30kW	63A	2	3RW3037-1BB04	£381.10
37kW	72A	2	3RW3038-1BB04	£451.23
45kW	80A	3	3RW3046-1BB04	£518.83
55kW	106A	3	3RW3047-1BB04	£578.83

Control voltage, 110-230V a.c./d.c.

Motor Rated Voltage @ 400V	Output Current @ 40°	Frame Size	Order Code	List Price
1.5kW	3.6A	00	3RW3013-1BB14	£88.73
3kW	6.5A	00	3RW3014-1BB14	£102.25
4kW	9A	00	3RW3016-1BB14	£117.46
5.5kW	12.5A	00	3RW3017-1BB14	£131.82
7.5kW	17.6A	00	3RW3018-1BB14	£151.26
11kW	25A	0	3RW3026-1BB14	£176.61
15kW	32A	0	3RW3027-1BB14	£206.18
18.5kW	38A	0	3RW3028-1BB14	£254.35
22kW	45A	2	3RW3036-1BB14	£312.65
30kW	63A	2	3RW3037-1BB14	£381.10
37kW	72A	2	3RW3038-1BB14	£451.23
45kW	80A	3	3RW3046-1BB14	£518.83
55kW	106A	3	3RW3047-1BB14	£578.83

NOTE: Selection of the soft starter depends on the rated motor current.

The Sirius 3RW30/ 3RW40 solid state soft starters are designed for easy starting conditions. One load < 10 x one motor. In the event of deviating conditions or increased switching frequency, it may be necessary to choose a larger device. Siemens recommends the use of the selection and simulation programme Win-Soft Starter.

Sirius 3RW40 – Soft starters 5.5 to 250kW

SIEMENS

3RW40 soft starters are only half the size of comparable star-delta starters, saving valuable space in your control cabinet.

Configuring and mounting the 3RW40 soft starters is quick and easy with simple 3-wire connection. Larger versions (frame size 6 or 12), are suitable for explosion-proof motors with increased safety type of protection EEx e according to ATEX directive 94/9/EC.

Features

- Soft start/soft stop
- Uninterrupted switching without current peaks
- Simple installation and commissioning
- Compact, space-saving design
- Solid state motor overload and intrinsic device protection
- Adjustable current limiting
- Optional thermistor motor protection (up to frame size 3)
- Integrated remote reset (up to frame size 3)
- Two-phase control method (polarity balancing)
- Low power loss
- Screw terminal connection
- Integrated jumper contacts

Technical specification

Supply voltage . . . . . .200-6000V a.c.
Ramp up/down time 0-20s
Starting voltage 40-100%
Ambient temperature . . . -25 to +60°C

Frame Size	Dimensions h x w x d (mm)
0	125 x 45 x 155
2	160 x 55 x 170
3	170 x 70 x 190
6	550 x 370 x 311
12	650 x 370 x 347

Control voltage, 24V a.c./d.c.

Motor Rated Voltage @ 400V	Output Current @ 40°	Frame Size	Order Code	List Price
5.5kW	12.5A	0	3RW4024-1BB04	£196.04
11kW	25A	0	3RW4026-1BB04	£231.53
15kW	32A	0	3RW4027-1BB04	£274.63
18.5kW	38A	0	3RW4028-1BB04	£329.55
22kW	45A	2	3RW4036-1BB04	£392.08
30kW	63A	2	3RW4037-1BB04	£464.75
37kW	72A	2	3RW4038-1BB04	£539.96
45kW	80A	3	3RW4046-1BB04	£608.40
55kW	106A	3	3RW4047-1BB04	£662.48

Control voltage, 110-230V a.c./d.c.

Motor Rated Voltage @ 400V	Output Current @ 40°	Frame Size	Order Code	List Price
5.5kW	12.5A	0	3RW4024-1BB14	£196.04
11kW	25A	0	3RW4026-1BB14	£231.53
15kW	32A	0	3RW4027-1BB14	£274.63
18.5kW	38A	0	3RW4028-1BB14	£329.55
22kW	45A	2	3RW4036-1BB14	£392.08
30kW	63A	2	3RW4037-1BB14	£464.75
37kW	72A	2	3RW4038-1BB14	£539.96
45kW	80A	3	3RW4046-1BB14	£608.40
55kW	106A	3	3RW4047-1BB14	£662.48

Control voltage, 110V a.c./d.c.

Motor Rated Voltage @ 400V	Output Current @ 40°	Frame Size	Order Code	List Price
75kW	134A	6	3RW4055-6BB34	£701.35
90kW	162A	6	3RW4056-6BB34	£878.80
132kW	230A	12	3RW4073-6BB34	£980.20
160kW	280A	12	3RW4074-6BB34	£1,098.50
200kW	356A	12	3RW4075-6BB34	£1,284.40
250kW	432A	12	3RW4076-6BB34	£1,698.45

Control voltage, 230V a.c./d.c.

Motor Rated Voltage @ 400V	Output Current @ 40°	Frame Size	Order Code	List Price
75kW	134A	6	3RW4055-6BB44	£701.35
90kW	162A	6	3RW4056-6BB44	£878.80
132kW	230A	12	3RW4073-6BB44	£980.20
160kW	280A	12	3RW4074-6BB44	£1,098.50
200kW	356A	12	3RW4075-6BB44	£1,284.40
250kW	432A	12	3RW4076-6BB44	£1,698.45

SSW06 – Soft starters 4 to 750kW

SSW06 series soft starters are designed to accelerate, decelerate and protect three phase induction motors. The control of the voltage is applied to the motor by the thyristors triggering angle variation, allowing the soft start to start and stop an electric motor smoothly.

The SSW06 allows the torque to be adjusted to the needs of the load, keeping the required current as low as possible for the starting procedure.

Integral bypass contacts eliminate heat dissipation once the motor is at full voltage. This improves energy saving while reducing it's size, saving money and space in your control panel.

Standard features

- Start cycle: 300% of full load current for 30 seconds:
  - 10 starts per hour (10 to 820A)
  - 5 starts per hour (950 to 1400A)
- 6 programmable isolated digital inputs
- 3 programmable relay outputs
- 1 analogue output
- 1 differential analogue input
- Integrated by-pass (up to 820A)
- Keypad with double display (LCD and LED)

Control features

- Pump control
- Acceleration and deceleration
- Independently adjustable ramps
- Kick start
- Pedestal voltage
- Starting current limitation

Protective features

- Motor overload
- Under and overcurrent
- Power supply phase loss
- Motor phase loss
- Thyristor fault
- Phase sequence
- Soft starter over temperature
- External fault

Technical specification

Supply voltage . . . . . .200-575V a.c.
Ambient temperature
10 to 820A . . . . . 0 to +55°C
950 to 1400A . . . . . 0 to +40°C
Display readings . . full motor diagnostics, I/O status and faults
Certifications . . . . . CE, UL, cUL, S-IRAM and Gost

Frame Size	Weight (kg)	Dimensions h x w x d (mm)
1	3.3	256 x 130 x 182
2	8.5	370 x 132 x 244
3	18.5	440 x 223 x 278
4	41.5	550 x 370 x 311
5	55	650 x 370 x 347
6	120	795 x 540 x 358
7	107	895 x 569 x 346
8	217	1235 x 685 x 433

Control voltage, 90-250V a.c.

Motor	Output Current	Frame Size	Order Code	List Price
4kW	10A	1	SSW06-0010-T-2257-ESZ	£529.00
7.5kW	16A	1	SSW06-0016-T-2257-ESZ	£545.00
11kW	23A	1	SSW06-0023-T-2257-ESZ	£600.00
15kW	30A	1	SSW06-0030-T-2257-ESZ	£647.00
22kW	45A	2	SSW06-0045-T-2257-ESZ	£785.00
30kW	60A	2	SSW06-0060-T-2257-ESZ	£860.00
45kW	85A	2	SSW06-0085-T-2257-ESZ	£1,111.00
55kW	130A	2	SSW06-0130-T-2257-ESZ	£1,390.00
90kW	170A	3	SSW06-0170-T-2257-ESZ	£1,701.00
110kW	205A	3	SSW06-0205-T-2257-ESZ	£2,139.00
132kW	255A	4	SSW06-0255-T-2257-ESZ	£2,638.00
160kW	312A	4	SSW06-0312-T-2257-ESZ	£2,735.00
200kW	365A	4	SSW06-0365-T-2257-ESZ	£2,843.00
220kW	412A	5	SSW06-0412-T-2257-ESZ	£3,365.00
250kW	480A	5	SSW06-0480-T-2257-ESZ	£4,165.00
315kW	604A	5	SSW06-0604-T-2257-ESZ	£4,646.00
370kW	670A	6	SSW06-0670-T-2257-ESZ	£5,285.00
410kW	820A	6	SSW06-0820-T-2257-ESZ	£6,247.00

Control voltage, 110 or 220V a.c.

Motor	Output Current	Frame Size	Order Code	List Price
550kW	950A	7	SSW06-0950-T-2257-ESH2Z	£11,590.00

Control voltage, 220V a.c.

Motor	Output Current	Frame Size	Order Code	List Price
600kW	1100A	8	SSW06-1100-T-2257-ESH2Z	£13,317.00
750kW	1400A	8	SSW06-1400-T-2257-ESH2Z	£17,096.00

SSW06 – Soft starter accessories

Remote keypad with double display (LCD and LED)

Description	Order Code	List Price
Remote keypad	HMI-SSW06-LCD	£90.00
Remote keypad with mounting kit	KMR-SSW06	£13.00
Remote keypad cable; 1m	CAB-HMI-SSW06-1	£13.00
Remote keypad cable; 2m	CAB-HMI-SSW06-2	£15.00
Remote keypad cable; 3m	CAB-HMI-SSW06-3	£19.00
Remote keypad cable; 5m	CAB-HMI-SSW06-5	£29.00

I/O expansion modules

Description	Order Code	List Price
KEIO module for soft plc application: 6 isolated digital inputs, 6 relay digital outputs	KEIO-SSW06	£258.00
PT100 temperature transducer (5 sensor inputs)	K-PT100	£145.00

Communication kits

Description	Order Code	List Price
ProfiBus DP communication kit	KFB-PD	£391.00
ProfiBus DP-PV1 communication kit	KFB-PDPV1	£411.00
DeviceNet communication kit	KFB-DN	£337.00
DeviceNet drive profile communication kit	KFB-DD	£448.00
Ethernet/IP communication kit	KFB-ENIP	£822.00
RS-485 interface	KRS-485	£68.00
USB communication kit	KUSB	£62.00
Superdrive kit	KSDG2	£24.00

IP20 kits (Polyurethane)

Description	Order Code	List Price
Size 2 IP20 kit (85 to 130A)	KIT-IP20-M2	£80.00
Size 3 IP20 kit (170 to 205A)	KIT-IP20-M3	£90.00
Size 4 and 5 IP20 kit (255 to 604A)	KIT-IP20-M4-M5	£97.00
Size 6 IP20 kit (670 to 820A)	KIT-IP20-M6	£185.00

External current transformers

Description	Order Code	List Price
255A	ECA-SSW06-255A	£124.00
312A	ECA-SSW06-312A	£126.00
365A	ECA-SSW06-365A	£129.00
412A	ECA-SSW06-410A	£158.00
480A	ECA-SSW06-480A	£158.00
604A	ECA-SSW06-604A	£163.00
670A	ECA-SSW06-670A	£163.00
820A	ECA-SSW06-820A	£163.00
950A	ECA-SSW06-950A	£189.00
1100A	ECA-SSW06-1100A	£193.00
1400A	ECA-SSW06-1400A	£196.00

SSW07 – Soft starters with digital signal processor 7.5 to 220kW

The SSW07 soft starter with digital signal processor (DSP) control is designed for high performance motor starts and stops. Easy to set up, it simplifies start up activities and daily operation.

Integral bypass contacts eliminate heat dissipation once the motor is at full voltage. This improves energy saving while reducing it's size, saving money and space in your control panel.

Standard features

- 220-575V, 50/60Hz input power supply
- Start cycle: 300% of full load current for 30 seconds:
  - 10 starts per hour with ventilation kit
  - 3 starts per hour without ventilation kit
- 3 isolated digital inputs
- 2 programmable relay outputs
- A range of communication options:
- Built in EMC filter (Class A)

Protective features

- Motor overload
- Phase sequence
- Motor phase loss
- Locked rotor
- Thyristors overload and overcurrent
- Heatsink overtemperature
- External fault
- Open bypass contact
- Frequency out of range
- Electronic supply undervoltage

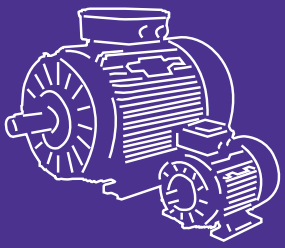
Technical specification

Motor voltage . . . . . .220-575V a.c.
Control voltage . . . . . .110-240V a.c.
Starting time 1-40s
Kick start . . . . . off or 0.2-2s
Deceleration time . . . . . 1 to 40s
Relay outputs . . . . . 2 N/O (1A)
Initial voltage adjustment . . . .30 to 90%
Ambient temperature . . . . . 0 to +55°C

Frame Size	Weight (kg)	Dimensions h x w x d (mm)
1	1.3	162 x 95 x 157
2	3.3	209 x 141 x 202
3	7.6	276 x 218 x 220
4	11.5	331 x 227 x 242

Control voltage, 110-250V a.c.

Motor	Output Current	Frame Size	Order Code	List Price
7.5kW	17A	1	SSW07-0017-T-5SZ	£329.00
11kW	24A	1	SSW07-0024-T-5SZ	£366.00
15kW	30A	1	SSW07-0030-T-5SZ	£382.00
22kW	45A	2	SSW07-0045-T-5SZ	£446.00
30kW	61A	2	SSW07-0061-T-5SZ	£525.00
45kW	85A	2	SSW07-0085-T-5SZ	£651.00
55kW	130A	3	SSW07-0130-T-5SZ	£944.00
90kW	171A	3	SSW07-0171-T-5SZ	£1,199.00
110kW	200A	3	SSW07-0200-T-5SZ	£1,421.00
132kW	255A	4	SSW07-0255-T-5SH2Z	£1,607.00
160kW	312A	4	SSW07-0312-T-5SH2Z	£1,667.00
200kW	365A	4	SSW07-0365-T-5SH2Z	£1,732.00
220kW	412A	4	SSW07-0412-T-5SH2Z	£2,050.00



See pages 152-154

. . . for our range of

IE2 High efficiency induction motors

SSW07 – Soft starter accessories

Remote keypad with double display (LCD and LED)

Description	Order Code	List Price
Remote keypad	HMI-LOCAL-SSW07	£67.00
Remote keypad with mounting kit	HMI-REMOTE-SSW07	£130.00
Remote keypad cable; 1m	CAB-RS-1	£9.00
Remote keypad cable; 2m	CAB-RS-2	£13.00
Remote keypad cable; 3m	CAB-RS-3	£17.00
Remote keypad cable; 5m	CAB-RS-5	£20.00
Remote keypad cable; 7.5m	CAB-RS-7.5	£25.00
Remote keypad cable; 10m	CAB-RS-10	£29.00

Communication kits and cables

Description	Order Code	List Price
RS-232 communication kit	KRS-232-SSW07	£51.00
RS-485 communication kit	KRS-485-SSW07	£77.00
DeviceNet communication kit & keypad connection	KFB-DN-SSW07	£114.00
Superdrive kit (RS-232 kit, 3m cable & software)	KSDG2-SSW07	£86.00
RS232 cable; 3m	CAB-COMM-3	£29.00
RS232 cable; 10m	CAB-COMM-10	£63.00

Accessories

Description	Order Code	List Price
Size 2 ventilation kit (45 to 85A)	VENTILATION-KIT-M2	£26.00
Size 3 ventilation kit (130 to 200A)	VENTILATION-KIT-M3	£37.00
PTC kit for motor	KIT-PTC-SSW07-MOTOR	£48.00
Size 3 IP20 kit (130 to 200A)	KIT-IP20-SIZE3	£24.00
Size 4 IP20 kit (255 to 412A)	KIT-IP20-SIZE4	£40.00

DLW/DLWM – Enclosed direct-on-line starters

Single (DWLM) and 3-phase (DWL) direct-on-line starters, assembled with or without thermal overload relay. Please note; separate short circuit protection is also required.

Features

- Thermal overload relay reset integrated into the stop button
- Independant start/stop contacts (from main contactor and overload relay)
- Durable, insulated plastic enclosure

Technical specification

Power ranges:
0.25 to 3.7kW . . 230V - 1 phase; 50Hz
0.09 to 18.5kW . 400V - 3 phase; 50Hz
Proection rating IP65
Cable connections . . Top, bottom or rear
Ambient temperature . . . . . Up to 40°C
Enclosure dimensions:
Size 02 . . . . . h155 x w90 x d98mm
Size 04 . . . . . h185 x w105 x d111mm
Size 06 . . . . . h210 x w120 x d126mm

Size 02 - single-phase

Motor Power (kW) at 230V a.c.	Overload Relay	Setting Range	Order Code	List Price
0.25	●	1.8 - 2.8A	DLWM-7D24P65-R06	£30.25
0.37	●	2.8 - 4A	DLWM-7D24P65-R07	£30.25
0.55 - 0.75	●	4 - 6.3A	DLWM-7D24P65-R08	£30.25
1.1	●	6.3 - 8A	DLWM-7D24P65-R09	£30.25

Size 02 - 3-phase

Motor Power (kW) at 400V a.c.	Overload Relay	Setting Range	Order Code	List Price
0.09	●	0.28 - 0.4A	DLW-7D34P65-R01	£30.26
0.12 - 0.18	●	0.4 - 0.63A	DLW-7D34P65-R02	£30.26
0.25	●	0.56 - 0.8A	DLW-7D34P65-R03	£30.26
0.37	●	0.8 - 1.2A	DLW-7D34P65-R04	£30.26
0.55	●	1.2 - 1.8A	DLW-7D34P65-R05	£30.26
0.75 - 1.1	●	1.8 - 2.8A	DLW-7D34P65-R06	£30.26
1.5	●	2.8 - 4A	DLW-7D34P65-R07	£30.26
2.2	●	4 - 6.3A	DLW-7D34P65-R08	£30.26
3	●	5.6 - 8A	DLW-7D34P65-R09	£30.26
0.09 - 3	—	0.28 - 8A	DLW-7D34P65	£16.38

Size 04 - single-phase

Motor Power (kW) at 230V a.c.	Overload Relay	Setting Range	Order Code	List Price
1.5	●	8 - 12.5A	DLWM-12D24P65-R30	£37.04
2.2	●	10 - 15	DLWM-18D24P65-R31	£39.75
3 - 3.7	●	15 - 23A	DLWM-25D24P65-R33	£45.58

Size 04 - 3-phase

Motor Power (kW) at 400V a.c.	Overload Relay	Setting Range	Order Code	List Price
4	●	7 - 10A	DLW-9D34P65-R29	£38.11
5.5	●	8 - 12.5A	DLW-12D34P65-R30	£38.79
7.5	●	11 - 17A	DLW-18D34P65-R32	£41.62
11	●	15 - 23A	DLW-25D34P65-R33	£47.72

Size 06 - 3-phase

Motor Power (kW) at 400V a.c.	Overload Relay	Setting Range	Order Code	List Price
15	●	22 - 32A	DLW-32D34P65-R34	£62.86
18.5	●	25 - 40A	DLW-40D34P65-R35	£97.41

Empty enclosures with ON/OFF operation

Size	For use with . . .	Order Code	List Price
04	CWM9 - CWM25 contactors with overload relay	EB04P-IP65	£11.03
06	CWM32 contactors with overload relay	EB06AP-IP65	£12.38
06	CWM32 - CWM40 contactors with overload relay	EB06BP-IP65	£14.76