SIEMENS

MICROMASTER
MICROMASTER Vector
MIDIMASTER Vector
COMBIMASTER
Variable Frequency Inverters for AC Motors up to 90 kW

Catalogue DA 64 - 1998/99

Version B1 **04/99**

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

1. INTRODUCTION

The MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector family of standard drives from Siemens uses the latest IGBT power technology and are the result of many years of experience in the field of inverter technology.

A fully compatible range is offered from 120W to 75kW, or up to 90kW for applications with a quadratic speed/torque characteristic, with high performance Sensorless Vector Control as standard. This offers the user the benefits of high torque and dynamic performance across a broad spectrum of applications.

A parallel range of non-vector drives, the MICROMASTER, from 120W to 7.5kW is ideal for embedded control of low end machines.

For the ultimate in variable speed drive packaging, the COMBIMASTER is on offer (see Section 8), combining motor and inverter in one compact unit.

Ease of use, an excellent price/performance ratio and compact size are guaranteed, along with conformance to the highest quality and reliability standards in the world.

1.1 Product Overview

The MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector are intended for use anywhere in the world and therefore support a wide range of mains voltages:

1/3 phase	208-240V±15%
3 phase	380 - 500V±10%
3 phase	525 - 575V±15% (MIDIMASTER Vector only)

Two levels of operational characteristics are offered:

- MICROMASTER Vector/MIDIMASTER Vector offer high performance Sensorless Vector Control for high torque at low speeds and excellent dynamic performance. This allows use of the drive even in demanding applications such as lifts, hoists and industrial washing machines.
- MICROMASTER offers standard open loop V/F Control and is ideal for simple applications such as pumps and fans.
- Both ranges of drives benefit from the standard inclusion of a PID controller (PI for the MICROMASTER) for closed loop process control.
- All the products make use of the same, simple to use, standard user interface consisting of seven push buttons and LED display.
- User-friendly screwless terminals are used for the control connections.
- An RS485 serial interface is standard, allowing up to 31 drives to be networked to a PLC or PC.
- The drive may be enabled via the keypad, via digital inputs or over the standard RS485 serial interface.
- The motor speed setpoint can be selected, using a digital setpoint, motorised potentiometer, fixed frequency, analogue input or via the serial link.
- Mixed mode control is also available, allowing drive control and setpoint input to be from different sources.
- A DC injection brake is incorporated, allowing DC to be output even when the motor is stationary.
- The drives can be configured to start automatically following a mains break or after a fault.
- The parameter sets are fully compatible between the different product types, reducing the learning time.
- All drives are certified in accordance with VDE, UL and Canadian UL, and are manufactured to ISO9001.
- All drives conform to the requirements of the EC low voltage directive 73/23/EEC and have been awarded the CE mark.
- All drives are guaranteed Y2K (year 2000) compliant.

1.2 Technical Features

DRIVE	MICROMASTER	MICROMASTER Vector	MIDIMASTER Vector
Mains Voltage	1 AC 208 V-240 V±10% 3 AC 208 V-240 V±10% 3 AC 380 V - 500 V±10%		3 AC 208 V - 240 V±10% 3 AC 380 V - 500 V±10% 3 AC 525 V - 575 V±15%
Power Ranges 1 AC 230V 3 AC 230V 3 AC 380-500V 3 AC 525-575V	120 W - 3.0 kW 120 W - 4.0 kW 370 W - 7.5 kW		5.5 (VT 7.5)kW – 45 (VT 45)kW 11 (VT 15)kW – 75 (VT 90)kW 2.2 (VT 4)kW – 37 (VT 45)kW
Protection Level	IP20/NEMA1		IP21/NEMA1 or IP56
Conformance to 55011 A EMC 1 AC 230V 3 AV 230V 3 AC 380-500V 3 AC 525-575V	 Integrated Filter Footprint Filter Footprint Filter Footprint Filter		 Integrated Filter Integrated Filter Integrated Filter Integrated Filter
Conformance to 55011 B EMC 1 AC 230V 3 AV 230V 3 AC 380-500V 3 AC 525-575V	 Footprint Filter Footprint Filter Footprint Filter Footprint Filter		 External Filter External Filter External Filter External Filter
Temperature Range	0 – 50°C		0 – 40°C
Control Method	V/F	Sensorless Vector, FCC, V/F	
Overload Capability [1])	50% for 60 sec 1.5 x rated output current for 60 sec	1.5 x rated output current for 60 sec 2 x rated output current for 3 sec	
Protection Features	Undervoltage, Overvoltage, Overload, Short-circuit, Earth Fault, Motor Pull-out, Motor Overtemperature, Drive Overtemperature		
Maximum Motor Cable Length	see Section 3		see Section 3
Frequency Range	0 – 400 Hz	0 – 650 Hz	0-650 Hz
Setpoint Resolution	0.01 Hz		
Digital Inputs	3 configurable (19 functions)	6 configurable (24 functions)	
Fixed Frequencies	7	8	
Ramp Times	2		
Relay Outputs	1 configurable 110 V AC / 0.3 A 30 V DC / 1.0 A	2 configurable 240 V AC / 0.8 A 30 V DC / 2 A	
Analogue Inputs	1	2	
Analogue Outputs	-	1 configurable	2 configurable
Serial Interface	RS485		
Braking	Compound Braking	Braking Chopper	External Braking Module
Process Control	PI	PID	

[1]) The overload capability relates to the rated output current of the drives (MICROMASTER and MICROMASTER Vector) and to the rated output currents for operation with constant torque (CT, MIDIMASTER Vector).
Duty cycle duration must be at least 5 mins.

Table 1: Technical Features

1.3 Conformity to International Standards

1.3.1 CE Mark:

The MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector frequency inverters comply with the requirements of the Low Voltage Directive, 73/23/EEC. The CE Mark on the units demonstrates this conformity. A declaration of conformity can be issued. The units are certified to comply with the following standards:

EN60204-1 Safety of Machinery, Electrical Equipment or Machines

EN60146-1-1 General Requirements for Semiconductor converters and line commutated converters

1.3.2 Electromagnetic Compatibility:

The MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector frequency inverters will, when correctly installed and put to their intended use, satisfy the requirements of the Directive 89/336/EEC concerning Electromagnetic Compatibility. If the guidelines on installation to reduce the effects of EMI are followed, the relevant requirements for CE certification of the machine will be met.

The table below lists the measured results for emissions of and immunity to interference for MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector inverters. The inverters were installed according to the guidelines with shielded motor cables, shielded control cables and optional mains filters (except for the single phase units):

Test	Measurement	Tested Value	Required limit for EN50081/EN50082
RFI Emissions EN55011 and EN55022	Conducted via Mains cable and radiated through air	1/3 AC 230/400/460V with integral filter >= Class A 1/3 AC with external filter >= Class B (leads - related emissions only)	Class A Class B
ESD Immunity EN61000-4-2	ESD through air ESD through direct contact	Level 4: 15 kV Level 4: 8 kV	8 kV 4 kV
Electric Field Immunity EN61000-4-3	Electric Field applied to unit	10 V/m	26-1000 MHz 10 V/m
Burst Interference Immunity EN61000-4-4	Applied to all cable terminations: Mains Leads Motor Leads Control Leads Braking Resistor/Module Leads DC Link Leads	 Level 4: 4 kV Level 4: 4 kV 4 kV Level 4: 4 kV Level 4: 4 kV	 2 kV 2 kV 2 kV 2 kV 2 kV
Surge Immunity EN61000-4-5	Applied to all mains cables:	4 kV Non-symmetric 2 kV Symmetric	4 kV Non-symmetric 2 kV Symmetric

Table 2: EMC Conformity

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

Quotation Sheet

6SE92 MICROMASTER IP20/NEMA1

0.12 to 3kW 1 phase 230V AC

0.12 to 4kW 3 phase 230V AC

0.37 to 7.5kW 3 phase 380 to 500V AC

6SE32 MICROMASTER Vector IP20/NEMA 1

0.12 to 3kW 1 phase 230V AC

0.12 to 4kW 3 phase 230V AC

0.37 to 7.5kW 3 phase 380 to 500V AC

6SE32 MIDIMASTER Vector IP21/NEMA1 or IP56

5.5 to 45kW (7.5 to 60kW Variable Torque) 3 phase 230V AC

11 to 75kW (15 to 90kW Variable Torque) 3 phase 380 to 500V AC

2.2 to 37kW (4 to 45kW Variable Torque) 3 phase 525 to 575V AC

Technical data

Rated connection voltage	.....	V
Rated mains frequency	.....	Hz
Rated output current at M = const	.....	A
Overload capacity (up to 50% for 60sec)	.....	A
Overload capacity (up to 100% for 3sec)	.....	A
Rated output current at $M \sim n^2$	.....	A
Overload capacity (up to 10% for 60sec)	.....	
Rated output at M = const	.....	kW
Rated output at $M \sim n^2$	.....	kW
Output frequency	from.....to.....	Hz
EMC conformance (EN55011, class A or B)	.....	
Maximum ambient air temperature (40/50° C)	.....	°C
Degree of protection (IP20/IP21/IP56)	.....	
Dimensions (HxWxD)	.....x.....x.....	mm
Weight	.....	kg
MICROMASTER, Order No.	.....	
MICROMASTER Vector, Order No	.....	
MIDIMASTER Vector, Order No	.....	

Voltage source DC link inverters with pulse width modulated outputs. Latest generation IGBT technology in the output stage for high efficiency speed control of three phase AC motors. Units pre-configured for quick commissioning.
Units are UL and CUL listed and designed and built in a factory accorded with ISO9001 VDE/EN certification. Full digital control in microprocessor technology.
All units complies with the requirements of the low voltage directive 73/23 EEC. The units are certified for compliance with CE marks.

Power Section
3 phase diode bridge input or single phase mains filter with diode bridge input. High temperature DC link capacitors. Six pulse self commutating IGBT inverter output stage.

Switching and Protective Devices
Pre-charging input circuit using relay.

Motor Control
Open loop V/F control with configurable voltage boost (6SE92). Field-oriented Vector control using high accuracy output current monitoring with a self adapting motor model (6SE32).

Standard Local Operator Panel
Keys to switch the motor on and off, change the direction of rotation, inching, up/down and parameterisation.
Four digit 7 segment display for setpoint, actual values, parameter values and fault messages.

Optional Intelligent Operator Panel
Dot-matrix LCD display for multilingual text-driven configuration. Non-volatile storage of up to 10 parameter sets. Parameter set upload and download facilities. Master mode for networking up to 31 drives together. RS232 interface.
Direct PC connection possible to read and write parameter sets independently of the inverter.

Connector terminal strip for external operation

MICROMASTER 6SE92
3 configurable 24V binary inputs with 18 selectable functions. (isolated, contacts, DC30V/2A, AC110V/0.3A)
1 configurable relay output with 13 selectable functions.
1 analogue input for setpoint input 0/2 -10V.
1 power supply 15V/50mA for PID sensor and binary inputs.
1 power supply 10 V/10 mA for setpoint potentiometer.
Evaluation of a Motor PTC temperature sensor against a binary output is possible.
All terminals fully short-circuit proof.

MICROMASTER Vector 6SE32
MIDIMASTER Vector 6SE32
6 configurable 24V binary inputs with 24 selectable functions.
2 configurable relay outputs (isolated contacts, DC 30V/2A, AC 240V/08A) with 13 selectable functions.
1 analogue input for setpoint input 0/2 -10V, 0/4 - 20mA,. ±10V
1 additional analogue input 0/2 - 10V, 0/4 - 20mA, for setpoint or PID input.
1 configurable analogue output with 6 selectable functions (0/4 - 20mA (MICROMASTER Vector).
2 analogue outputs with 6 selectable functions each (MIDIMASTER Vector).
1 Motor PTC temperature sensor connection.
1 power supply 15V/50mA for PID sensor and binary inputs.
1 power supply 10 V/10 mA for setpoint potentiometer.
All terminals fully short-circuit proof.

Standard Automation Interface
RS485 serial interface with USS protocol for the connection of up to 31 drives, maximum bus speed 19.2kBd.

Optional High Speed Automation Interface
PROFIBUS DP module for the connection of up to 125 drives, maximum bus speed 12MBd.
CANbus Module, supporting CAN OPEN protocol

Standard Functions

MICROMASTER 6SE92
MICROMASTER Vector 6SE32
MIDIMASTER Vector 6SE32
Open loop V/F speed control for one or several asynchronous, synchronous or reluctance motors.
0 - 650Hz (400Hz for 6SE92) output frequency with 0.01Hz resolution.
50% overload capability as a percentage of nominal current for 60 seconds.
Integrated PID controller, for, e.g. pressure or temperature control.
RS485 serial interface.
Sequence control for an external brake.
Flying start for controlling a motor that is already spinning.
Automatic restart for starting a motor automatically following mains break or fault.
Flexible setpoint input via fixed frequencies, analogue input, motorised potentiometer or serial interface.
Flexible control interface allowing control via keypad, digital inputs or serial interface.
Configurable integral DC brake.
Compound braking for dynamic stopping without external components.
Additive setpoint input via analogue input and fixed frequency/digital setpoint input and control from different sources.
Programmable ramp generator (0 - 650 sec) with S-curve capability.
8 configurable fixed frequencies (7 for the 6SE92).
4 fadeable frequency ranges for suppressing resonances.
Standard integral EMC filter meeting EN55011 class A for single phase units.

Additional Standard Functions 6SE32

MICROMASTER Vector 6SE32
MIDIMASTER Vector 6SE32
Sensorless Vector Control for achieving a high dynamic performance with standard asynchronous motors.
100% overload capability as a percentage of nominal current for 3 seconds.
Integrated braking chopper with configurable duty cycle (MICROMASTER Vector).

Option Range
Console radio interference filter for 208 - 240V / 380 - 500V, EN 55011 class A or B compliant (MICROMASTER and MICROMASTER Vector).
External interference filter for 208 - 240 V/380 - 500 V - EN 55011 Class A or B compliant (MIDIMASTER Vector).
Mains choke.
Brake resistors (MICROMASTER Vector, MIDIMASTER Vector).
Brake units (MIDIMASTER Vector).
Output dV/dt filters.
Output chokes.
Multi-lingual Clear Text Operator Panel.
SIMOVIS PC commissioning and diagnostics program running under Windows 95 or NT.
CB15 PROFIBUS DP Module.
CAN Bus Module, supporting the CAN OPEN protocol.

2. TECHNICAL DESCRIPTION

The MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector form a family of inverters that have been designed to connect directly to the mains utility power supply. They are self-contained units housing all the components required for their operation.

Depending on the supply voltage, power output and level of functionality requirement, the series consists of three variants; MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector. The MICROMASTER should be considered as the low cost option for simple applications.

It comprises of three frame sizes offering IP20 protection. The MICROMASTER Vector is form and fit identical to the MICROMASTER, however its functionality and dynamic performance is much superior with the addition of Sensorless Vector Control, additional I/O and larger intelligent power modules to cope with the additional overload requirements. The MIDIMASTER Vector has identical features to the MICROMASTER Vector whilst extending its power range to 75kW (90kW variable torque). In standard form the protection rating is IP21, however it is also available in IP56 (NEMA 4).

2.1 Power Section

All inverters contain fully integrated power modules mounted on high efficiency heatsinks, cooled by software-controlled fans. Heat dissipation is such that no thermal derating is required for ambient temperatures up to 50°C (40°C for MIDIMASTER Vector).

All of the units are fitted with an uncontrolled input rectifier, a capacitor-buffered DC voltage link and a PWM inverter with IGBT output device.

When the unit is connected to the line supply, the DC link is pre-charged via resistors and pre-charging relays, thus limiting the level of inrush current.

The DC link voltage is then converted into a pulsed variable frequency and voltage system, using latest generation low loss IGBTs combined with fully optimised PWM (Pulsed Width Modulation) waveforms, offering the following advantages:

- Lower inverter and motor losses.
- Motor voltage frequency range: 0 to 650 Hz.
- Motor voltage range: 0 V to the line supply voltage.
- Almost sinusoidal motor currents.
- High motor utilisation.
- Silent motor operation using high switching frequencies up to 16 kHz.
- Inverter protected against short-circuits and earth faults.

An OFF command will not isolate the inverter from the mains. An additional main switch or contactor should be provided to electrically isolate the unit from the line supply.

Slow-acting line fuses can also be used for protection

All MICROMASTER and MICROMASTER Vector units may also be connected directly to a suitably rated clean DC supply using the DC link connections provided.

MICROMASTERs (MM12/2 to MM300/2) specified for use with three phase 230V AC supplies may also be used for single phase 230V AC inputs. All single phase and three phase 230V MICROMASTERs may be operated from a nominal 2ph 208V AC supply.

Caution:
Connection of a 400V 3ph supply to a 1ph or 3ph 230V inverter will destroy the inverter.

2.1.1 Thermal Protection and Automatic De-rating

Losses within the power module rise with increasing switching frequencies, leading to higher heatsink temperatures. Operation of the inverter outside its recommended ambient operating temperature would normally trip the inverter with an over-temperature fault code. To avoid such nuisance tripping, the MICRO/MIDIMASTER Vector automatically reduces its switching frequency (e.g. from 16kHz to 8kHz), thus reducing the temperature of the heatsink, enabling the application to continue running - trip free. Should the load or ambient temperature then reduce, the inverter will first check to see if it is safe to increase the switching frequency again and then do so.

2.1.2 Fast Current Limit

Fast Current Limit (FCL) is a cycle by cycle hardware current limit built into the inverter. Its threshold is set slightly below the software over-current trip threshold (F002) and reacts much quicker, thus preventing spurious and unwanted trips when sudden loads are applied or fast accelerations requested.

2.1.3 Operation from Unearthed Supplies

The MICROMASTER/MICROMASTER Vector range can be connected directly to an unearthed line supply. Whilst operating from such a supply, if one of the input phases is connected directly to earth the inverter will continue to run without consequential damage.

The MICROMASTER/MICROMASTER Vector will trip with an over-current alarm if one of the motor output phases is shorted to earth.

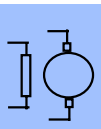
The MIDIMASTER Vector (at 2kHz) will continue to operate if one of the motor output phases is shorted to earth. Operation above 40Hz or at near full load current may result in an over-current trip.

Two or more phases shorted to earth will always result in an over-current trip.

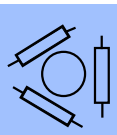
2.1.4 Vector Control Principles

What is vector control?

This is easiest explained through comparison with a DC machine.



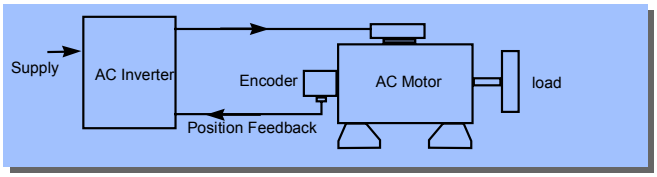
In a DC Machine, the field is a separate winding and therefore the armature current (Torque) and field current (Flux) can be controlled independently.



In an AC Machine, the stator winding currents set the Flux and the Torque; therefore it is difficult to control the Torque and Flux separately.

Independent control of the Flux and Torque producing currents permits optimum performance, i.e. Torque at zero speed, rapid response to load changes etc..

Control of the magnitude of the current, will not allow independent control. Therefore the magnitude and phase - ***"the Vector"*** - of the current must be controlled.



In order to control the Torque and Flux in the AC motor, the stator current must be controlled in magnitude and phase, i.e. the Vector quantity.

To control the phase with reference to the rotor, the rotor position must be known. Hence for full vector control, an encoder **must** be used to tell the inverter the rotor position.

2.1.5 Sensorless Vector Control

Many applications do not need and cannot justify the additional expense of an encoder.

For an inverter to simulate the attributes of an encoder, the software algorithm has to accurately calculate the rotor position and speed by mathematically modelling the fundamental properties of the motor.

To do this the inverter must:

- Monitor the output voltage and current very accurately.
- Calculate motor parameters (Rotor, Stator resistance, leakage inductance etc.).
- Accurately model the motor thermal characteristics.
- Adapt motor parameters in the light of motor operating conditions.
- Have the ability to perform very rapid mathematical calculations. This was made possible using an in-house designed custom ASIC;
- The Flash Floating Point Processor (F^2P^2).

Siemens, pioneers in this technology, has brought within a standard product, almost closed loop vector performance without the need for an encoder.

This has been achieved through the use of a bespoke Flash Floating Point Processor, performing the millions of calculations per second required to achieve the stringent performance criteria. As a result, torque production increases to 150% or more at 0.5Hz and to over 200% at 2.5Hz and through the use of a motor thermal adaptation model, the performance is maintained over the complete temperature range.

The entire MICRO/MIDIMASTER Vector series offer an overload capability of 200% for 3 seconds, making the inverters particularly suitable for arduous applications such as hoists and lifts.

Calculation of motor constants is not necessary, this is done automatically, leaving the user only entering motor parameters and vector tuning parameters to fine tune the inverter.

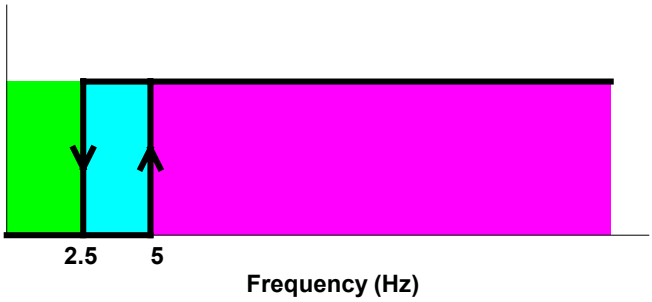
2.1.6 Flash Floating Point Processor

Sensorless Vector Control is a highly demanding real time control process which is typically achieved using DSP processors, RISC processors or multiple microprocessors. The Siemens solution relieves the microprocessor of time consuming repetitive tasks and provides floating point mathematics capability in a custom ASIC. The floating point capability means that control equations are implemented verbatim without continuous re-scaling steps. Through the use of such a system, arithmetic overflows do not happen and full accuracy is always available. The overall result is a reliable product with repeatable dynamic performance. The floating point processor is implemented using entirely combinatorial logic, hence the term 'Flash Floating Point Processor' with performance levels approaching 3 Mflops. The algorithm adopted by the MICRO/MIDIMASTER Vector is virtually identical to that used in the widely accepted MASTERDRIVE range.

2.1.7 Benefits of Sensorless Vector Control

- Excellent speed control with inherent slip compensation.
- High Torque at low speed without excessive boost.
- Lower losses, higher efficiency.
- Higher dynamic performance - better response to step loads.
- Stable operation with large motors.
- Better performance at current limit with improved slip control.

2.1.8 Vector Operating Range



Constant current region

Constant current + searching orientation region

Fully orientated Vector control

The above diagram illustrates the sensorless vector operating regions for the MICRO/MIDIMASTER Vector.

Constant current region

In this region the inverter acts like a current source and independent of load will output the value of current programmed into parameter P083.

E.g. for a 750W motor, P083 may be set to 3.4A, therefore, regardless of the motor load (full load or no load), the motor current will remain at 3.4A.

Continuous Boost (P078) and Starting Boost (P079) are active in this region and offer up to 250% boost capability.

This region is active below approximately 5Hz (whilst the output frequency is ramping up from zero) and below 2.5Hz (whilst the output frequency is ramping down from a frequency above 5Hz). The 2.5Hz hysterisis bandwidth is present to prevent oscillation between the two operating modes. The 2.5Hz and 5Hz values shown are approximately 5% and 10% of the value programmed in P081 - the nominal rating plate frequency for motor.

Constant current and searching orientation region

Whilst operating in this region and the output frequency is ramping up, the back emf from the motor begins to build up. With this information the system will search and lock onto the rotor speed - once locked, it will stay locked until the output frequency is requested to go below 2.5Hz. Slip compensation is also active in this region.

Fully oriented Vector control

In this region, the inverter knows the orientation of the motor and will maintain the frequency setpoint within the operational boundaries of the inverter. Variations in ambient temperature, stator resistance, motor slip etc., are fully compensated for over the complete load operating region.

Sensorless Vector Control is a true closed loop system and depends very much on the integrity of the motor rating plate information and the accuracy of the inverter's current monitoring.

Operation in Sensorless Vector Control (SVC) requires the rating plate data of the connected induction motor to be accurately entered (parameters P080 to P085). These parameters are factory set with the data of Siemens 4-pole 1LA5 motors, and must be adapted if other motors are used. Once SVC mode is invoked (P077=3), the next time the inverter is run, CAL will appear on the display for several seconds, during which time the inverter fully optimises itself and calculates motor model characteristics such as stator resistance, leakage inductance, rotor and stator thermal time constants etc.

The 'Calibration' routine must be performed on a cold motor since the inverter automatically compensates itself for changes in motor temperature.

SVC can be used only for induction motors and for single motor drives or multi-motor drives with a mechanically coupled load.

SVC cannot be used for:

- Synchronous or reluctance motors.
- Multi-motor drives, group drives (several motors connected in parallel at the drive converter output).
- Motors with power ratings less than half of the inverter rating.
- Motors with current requirements greater than those the inverter can supply. i.e. I_{motor} > P083 max.

  In the above cases, a V/f characteristic must be parameterised:

  - P077=0 for applications with linear torque characteristics
  - P077=2 for applications with pump or fan characteristics (square-law torque characteristics, variable torque, VT)

The 'flying start' feature in both MICROMASTER Vector and MIDIMASTER Vector depend on the vector algorithm and therefore must follow the same rules which govern SVC operation.

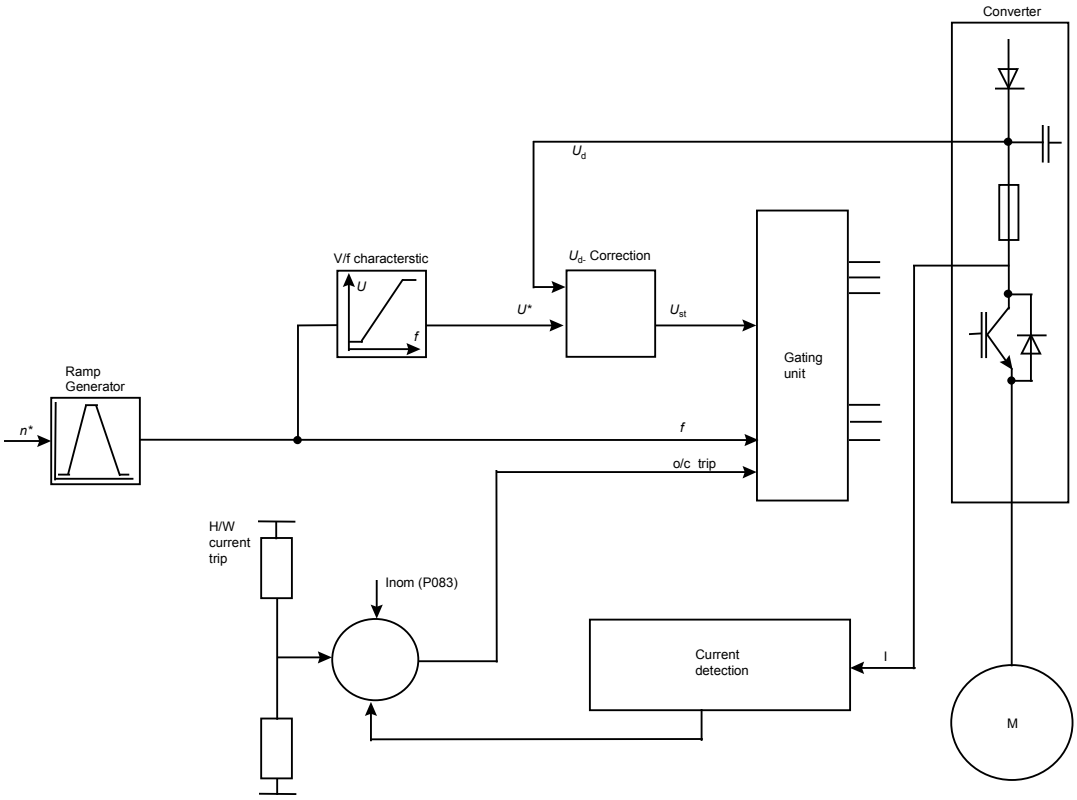
The above restrictions also apply to inverters configured to operate in Flux Current Control mode (FCC, P077=1). This feature has been retained within the vector range to maintain backward compatibility with previous generation MICRO and MIDIMASTERs.

For MIDIMASTER, when a square-law torque characteristic is used, it permits a significantly higher motor current, whereby in almost all cases, the rated output is achieved using the next largest motor (the motor current can be increased via parameter P083).

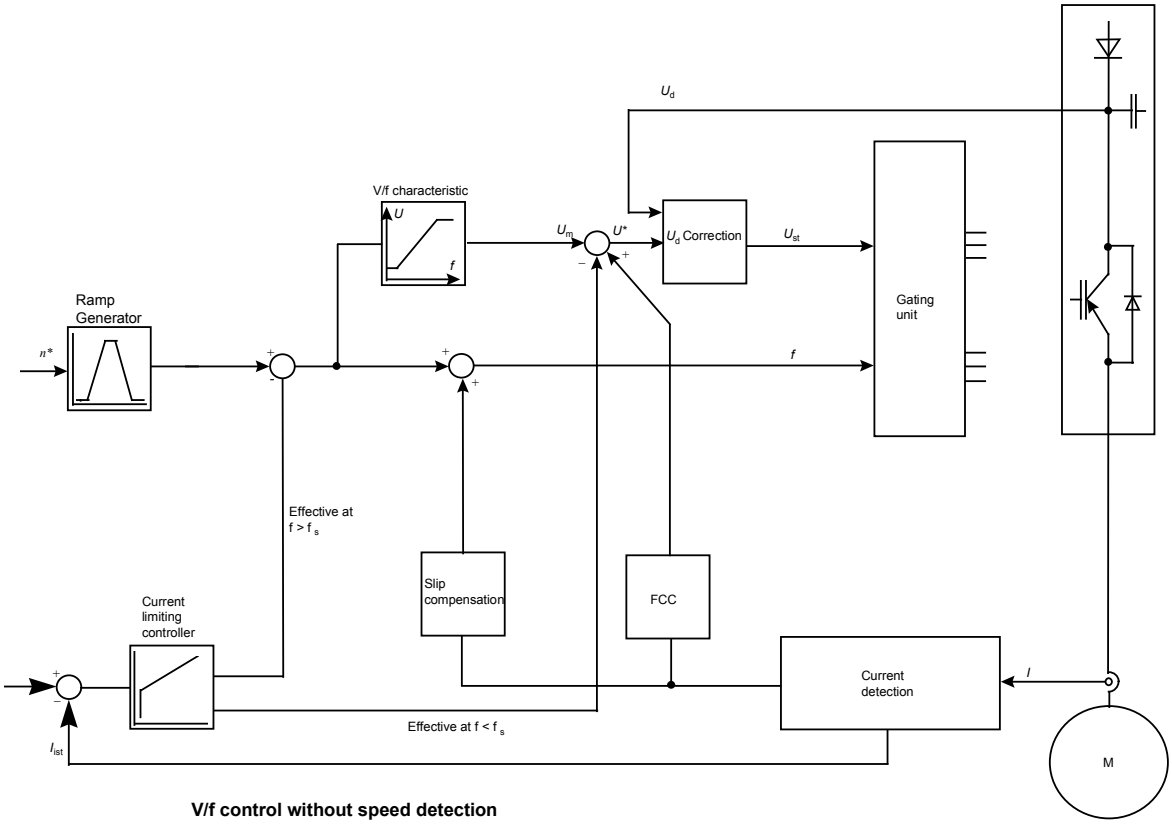
For a specific output, fan and pump drives can have a smaller drive converter.

2.1.9 MICROMASTER and MICRO/MIDIMASTER Vector (in V/f mode)

Open loop frequency control for single-motor and multi-motor drives with induction motors, without any high demands regarding dynamic performance. e.g. pumps and fans, simple traversing drives.



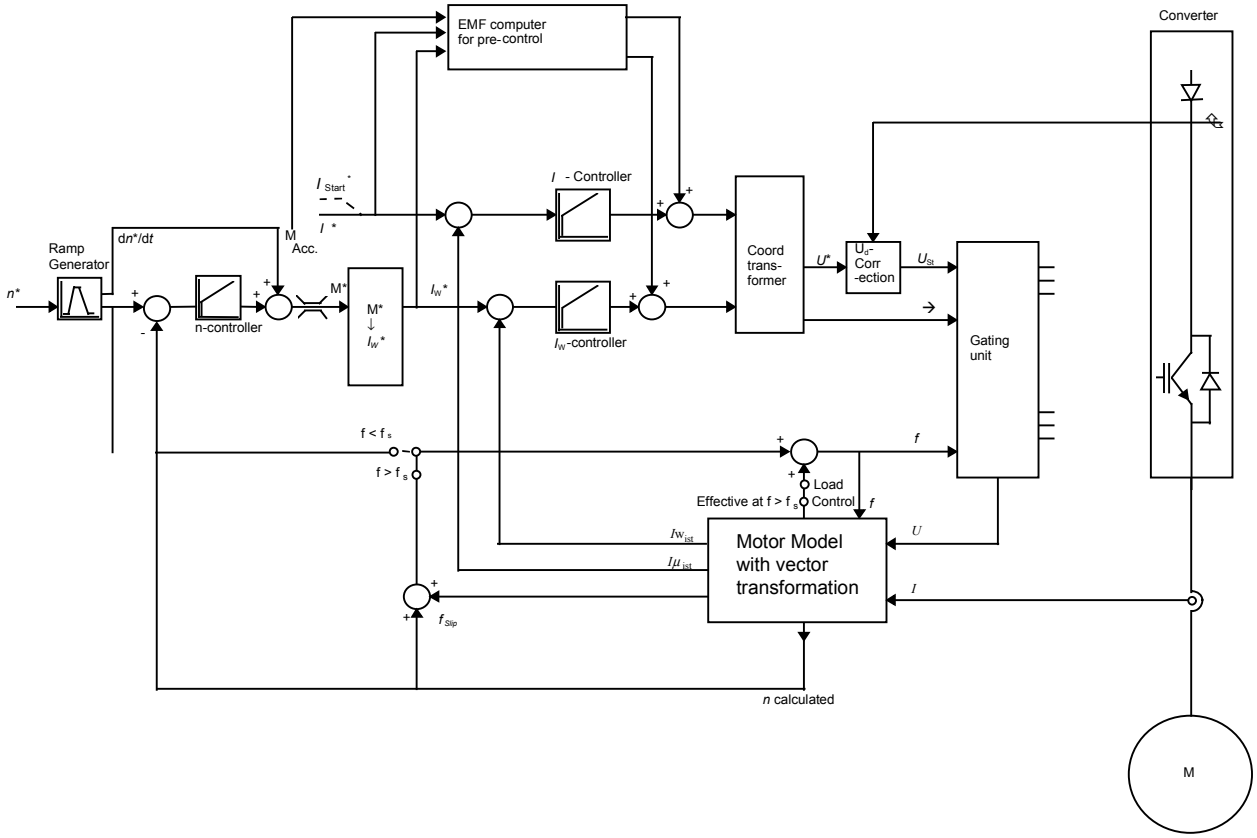
2.1.10 MICRO/MIDIMASTER Vector (in FCC mode)



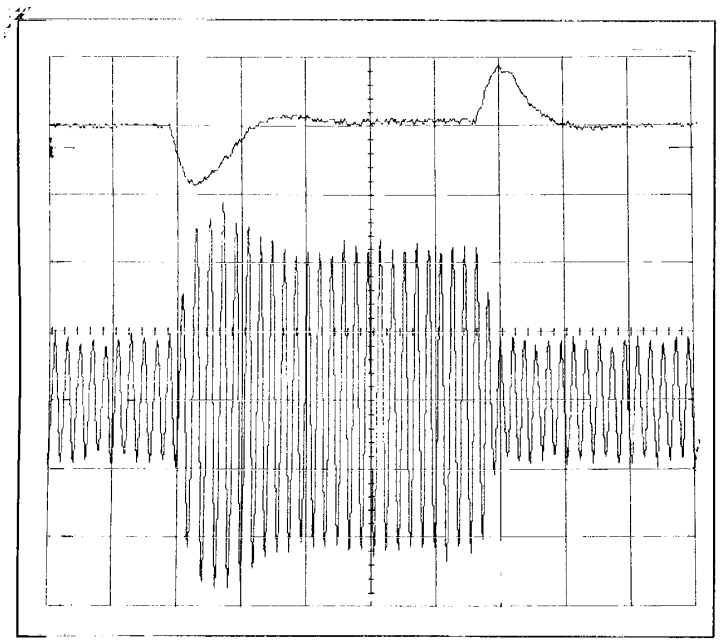
V/f control without speed detection

2.1.11 MICRO/MIDIMASTER Vector (Sensorless Vector Control mode)

Preferably used for single-motor drives with induction motors, from low to high demands regarding dynamic performance, at speed setting ranges of up to 1:10. Suitable for most industrial applications such as extruders, packaging machines, industrial washing machines, lifts and hoists.



2.1.12 Torque and Speed Response



2.1.12.1 Properties of Different Control Versions

Operating Mode	V/f	FCC	SVC
Digital setpoint resolution	0.01		
Analogue setpoint resolution	10 Bit		
Internal frequency resolution	0.01		
Speed accuracy - constant torque region - field weakening region	>2%	<2%[1)] <5%[1)]	≤1% f_{max}/f_n x $f_{slip}/10$ [2)]
Torque rise time	≈ 50ms	<25ms	<10ms
Torque ripple	<2%	<2%	<2%

[1]) With slip compensation.

[2]) The slip values of standard motors are typically:
6% at 1kW, 3% at 10kW, 2% at 30kW, 1% at 100kW.

2.2 Closed Loop PID Control

All MICROMASTER Vector and MIDIMASTER Vector units have a built-in PID controller as standard utilising the second analogue input to monitor the feedback signal (0 - 10V or 0 to 20mA) offering 10 bit accuracy. MICROMASTER offers PI control using the digital input as the setpoint and the analogue input as the feedback signal.

Without any additional circuitry or software, this control function allows slowly changing quantities, for example, temperature or pressure, to be controlled. Closed loop speed control is also possible for slow processes.

The reference value or setpoint is entered directly as a percentage of the controlled variable (0-100%), thus making the system impervious to units of measure derived from transducers measuring quantities like pressure and flow rate. The signal from the transducer is fed into one of the analogue inputs which is then compared with the setpoint. The resultant in motor speed will be such that the error between the setpoint and actual value is minimised.

Further characteristics of the PID control:

- Any display scaling can be selected (P010, P001).
- Separate setting of the P, I and D components.
- Selectable sampling interval and filtering.
- Flexible adaptation to the transducer feedback signal.
- The motor can be shutdown below the minimum frequency - this can be parameterised (P220).
- A message can be output at the minimum and maximum motor frequency - this can be parameterised (relay output, P061 and P062).

Parameters P201 to P220 have been allocated to the PID function.

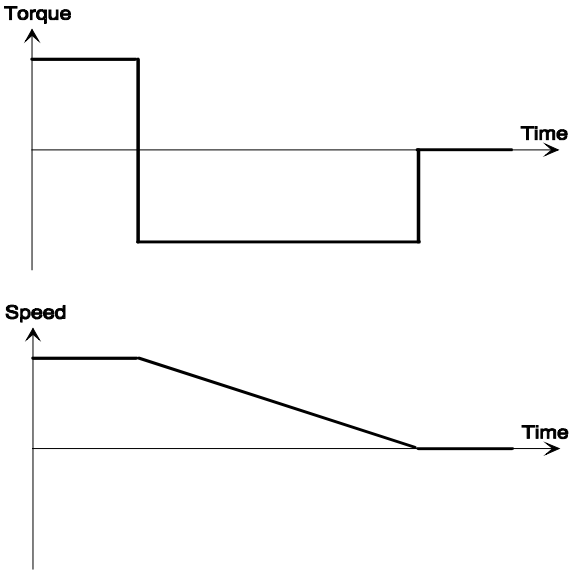
2.3 Compound Braking ™

COMPOUND BRAKING ™ is an effective method of stopping the motor in a controlled fashion, without the need for an external braking resistor. The inverter manages this by applying a controlled amount of DC into the motor windings during ramp down using a new software modulation technique. COMPOUND BRAKING ™ is most effective at lower powers where motor efficiencies are at their lowest.

2.3.1 Merits of COMPOUND BRAKING ™ v's DC Injection and Regenerative Braking

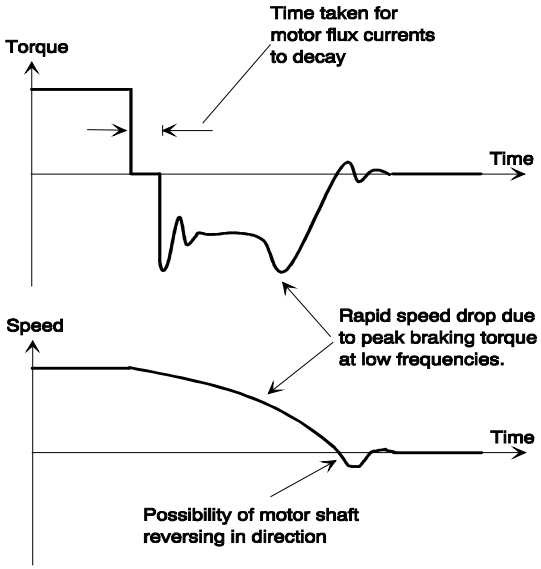
Regenerative Braking

- Energy dissipated in external resistor.
- Excellent braking torque.
- Smooth.
- In control.
- Speed reduces linearly and smoothly.



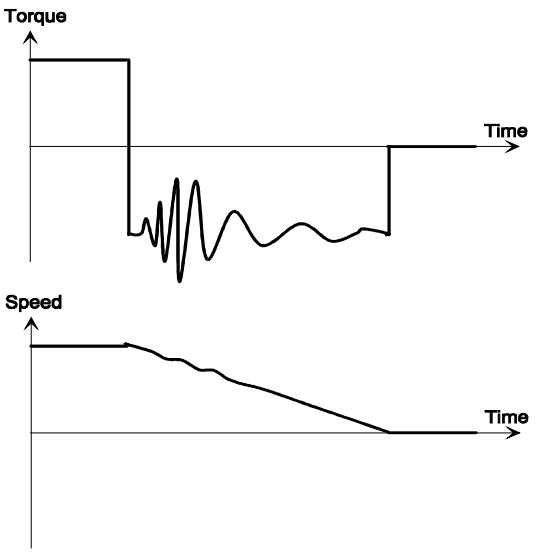
DC Injection Braking

- Energy dissipated in motor.
- Poor braking torque.
- Smooth.
- No control of ramp down.
- 30 - 40% effectiveness of regenerative braking.
- Stopping of motor shaft unknown.



COMPOUND BRAKING™

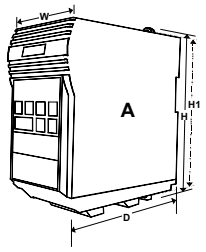
- Energy dissipated in motor.
- Good braking torque.
- In control.
- 50-60% effectiveness of regenerative braking.
- Speed reduces linearly.
- Slight speed ripple may be seen due to oscillating torque - dependent on load inertia.

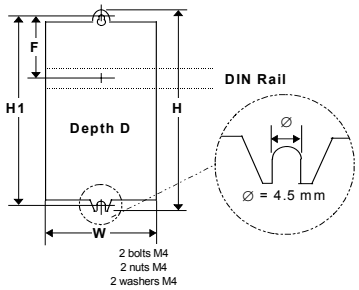


3.1 Technical Comparison Table

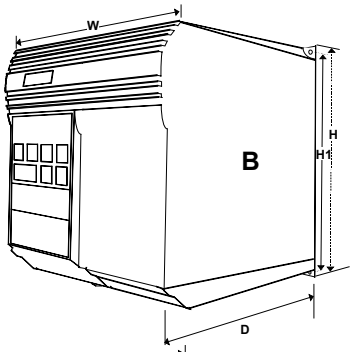
	MICROMASTER 6SE92	MICROMASTER Vector 6SE32	MIDIMASTER Vector 6SE32
Power Range	120 W – 3 kW 230 V 1 AC 120 W – 4 kW 230 V 3 AC 370 W - 7.5 kW 400 V 3 AC	120 W – 3 kW 230 V 1 AC 120 W – 4 kW 230 V 3 AC 370 W - 7.5 kW 400 V 3 AC	5.5 kW – 45 kW 230 V 3 AC 11 kW – 75 kW 400 V 3 AC 2.2 kW – 37 kW 575 V 3 AC
Voltage Range	208 – 240 V +/-10% 380 – 500 V +/- 10%	208 – 240 V +/-10% 380 – 500 V +/- 10%	208 – 240 V +/-10% 380 – 500 V +/- 10% 525 – 575 V +/- 15%
Input Frequency	47-63 Hz	47-63 Hz	47-63 Hz
Power Factor	cos $\Phi \geq 0.98$, Total $\lambda \geq 0.7$	cos $\Phi \geq 0.98$, Total $\lambda \geq 0.7$	cos $\Phi \geq 0.98$, Total $\lambda \geq 0.7$
Power On/Power Off cycles	100,000 (max. guaranteed) 5 sec interval	100,000 (max. guaranteed) 5 sec interval	100,000 (max. guaranteed) 5 sec interval
Inrush Current	No greater than nominal input current	No greater than nominal input current	No greater than nominal input current
Inverter Efficiency	97%	97%	97%
Operating Temperature	0- 50 °C	0- 50 °C	0- 40 °C (50 °C without cover)
Storage Temperature	-40 to +70°C	-40 to +70°C	-40 to +70°C
Relative Humidity	95% non-condensing	95% non-condensing	95% non-condensing
Side by side mounting	No clearance required	No clearance required	No clearance required for IP21 & IP20 units. Clearance between IP56 units to be greater than 150mm.
Degree of protection	IP20 / NEMA 1 (FSA units require optional gland plate to meet NEMA1)	IP20 / NEMA 1 (FSA units require optional gland plate to meet NEMA1)	IP21 / NEMA 1 (Optional IP56 / NEMA 4 also available)
Cooling Method	Software-controlled fan cooling	Software-controlled fan cooling	Fan cooling
Output Frequency	0 – 400 Hz	0 – 650 Hz	0 – 650 Hz
Output Frequency Resolution	0.01 Hz	0.01 Hz	0.01 Hz
Overload Capability	1.5 x rated output current for 60 secs	1.5 x rated output current for 60 secs 2 x rated output current for 3 secs	
Control Method	V/f	SVC, FCC, V/f	SVC, FCC, V/f
Digital Inputs	3 (> 7.5V = high, 33V max)	6 (> 7.5V = high, 33V max)	6 (> 7.5V = high, 33V max)
Analogue input 1	0-10 V/PI input 10 bit resolution, floating differential input	0-10 V, 0/4-20 mA -10 V / +10 V bipolar 10 bit resolution, floating differential input	0-10 V, 0/4-20 mA -10 V/ +10 V bipolar 10 bit resolution, floating differential input
Analogue input 2	N/A	0-10 V, 0/4-20 mA PID input, 10 bit resolution	0-10 V, 0/4-20 mA PID input, 10 bit resolution
Analogue output 1	N/A	0/4 – 20 mA with 500Ω max. load 10 bit resolution	0/4 – 20 mA 500Ω max. load 10 bit resolution
Analogue output 2	N/A	N/A	0/4 – 20 mA 500Ω max. load
Relay output 1	30 V DC 1 A, 110 V AC 0.3 A, Normally Open Contacts	30 V DC 2 A, 240 V AC 0.8 A Changeover Contacts	30 V DC 2 A, 240 V AC 0.8 A Changeover Contacts
Relay output 2	N/A	30 V DC 2 A, 240 V AC 0.8 A Normally open contacts	30 V DC 2 A, 240 V AC 0.8 A Normally open contacts
RS485 Interface	D-type	D-type / terminal strip	D-type / terminal strip
Braking Chopper	N/A	Built-in	Optional external module
Compound Braking	Yes	Yes	Yes
Fast Current Limit	Yes	Yes	Yes
PID closed loop control	Built-in PI	Built-in PID	Built-in PID
Motor Protection - external	PTC input on digital input	Dedicated PTC input	Dedicated PTC input
Motor Protection - internal	I^2t	I^2t (UL approved)	I^2t (UL approved)
Inverter Protection	Line to Earth short circuit protection Line to Line short circuit protection Overtemperature protection Overvoltage protection Overcurrent protection	Line to Earth short circuit protection Line to Line short circuit protection Overtemperature protection Overvoltage protection Overcurrent protection	Line to Earth short circuit protection Line to Line short circuit protection Overtemperature protection Overvoltage protection Overcurrent protection

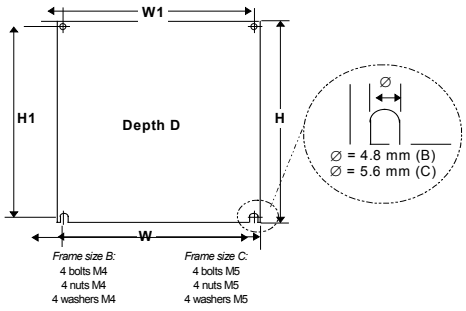
3.2 Dimensions and Weights



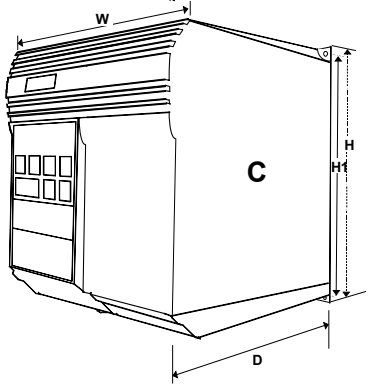


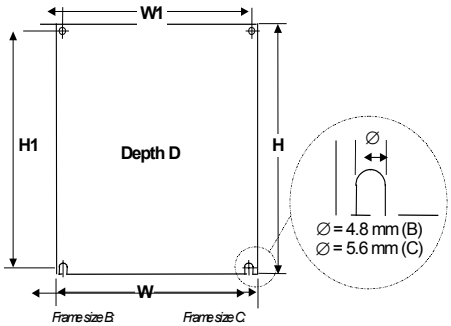
Frame Size A





Frame Sizes B





Frame Sizes C

MICROMASTER and MICROMASTER Vector inverters must be secured to a suitable vertical surface by M4 bolts, washers and nuts.

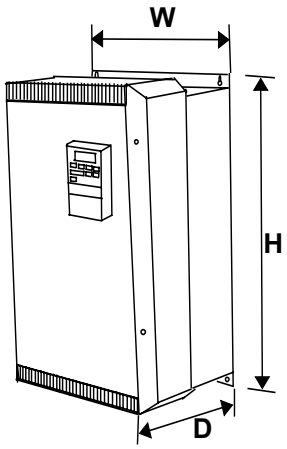
Frame size A units requires two bolts. (M4)

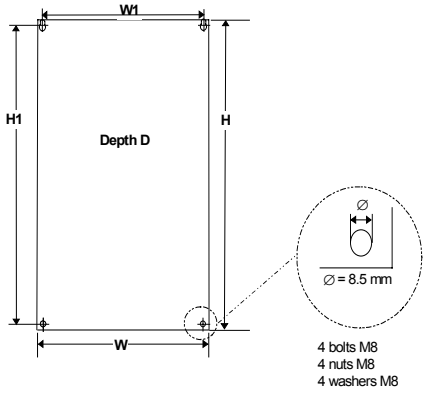
Frame size B requires four bolts. (M4)

Frame size C requires four bolts. (M5)

Model	MMxxx 1 AC 230 V Class A Filter	MMxxx/2 1/3 AC 230 V Without Filter	MMxxx/3 3 AC 400 - 500V Without Filter	Frame Dimensions (mm)										
MM12	A	A	-											
MM25	A	A	-	Frame										Weight
MM37	A	A	A	Size	H		W		D	H1	W1	F		(kg/lb)
MM55	A	A	A											
MM75	A	A	A	A	175	x	73	x	141	160	-	55		0.8 / 1.8
MM110	B	B	A	B	184	x	149	x	172	174	138	-		2.6 / 5.7
MM150	B	B	A	C	215	x	185	x	195	204	174	-		5 / 11
MM220	C	C	B											
MM300	C	C	B											
MM400	-	C	C											
MM550	-	-	C											
MM750	-	-	C											

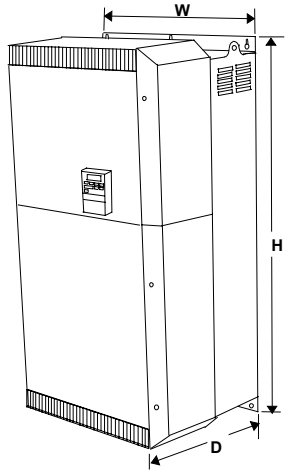
Table 1: MICROMASTER and MICROMASTER Vector Frame Sizes

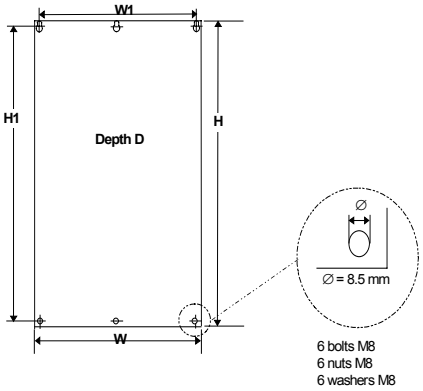




Frame Sizes 4, 5 and 6

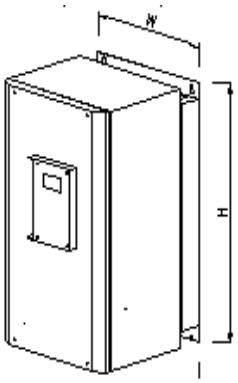
MIDIMASTER Vector - Frame Size 4, 5 and 6
IP21 Standard
IP20 with integrated filter

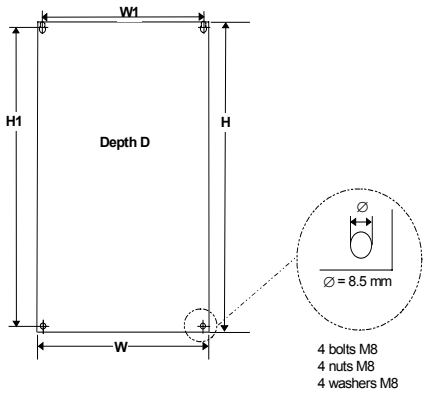




Frame Size 7

MIDIMASTER Vector - Frame Size 7
IP21 standard
IP20 with integrated filter





(6 bolts M8 - FS7)
(6 nuts M8 - FS7)
(6 washers M8 - FS7)

Frame Sizes 4, 5 and 6

MIDIMASTER Vector - Frame sizes 4, 5, 6 and 7

IP56 protected

MIDIMASTER Vector Type	Frame Size 3 AC 208 – 240 V	3 AC 400 – 500 V	3 AC 525 – 575 V
MDV220/4	-	-	4
MDV400/4	-	-	4
MDV550/2	4	-	-
MDV550/4	-	-	4
MDV750/2	4	-	-
MDV750/3	-	4	-
MDV750/4	-	-	4
MDV1100/2	5	-	-
MDV1100/3	-	4	-
MDV1100/4	-	-	4
MDV1500/2	6	-	-
MDV1500/3	-	5	-
MDV1500/4	-	-	5
MDV1850/2	6	-	-
MDV1850/3	-	5	-
MDV1850/4	-	-	5
MDV2200/2	6	-	-
MDV2200/3	-	6	-
MDV2200/4	-	-	6
MDV3000/2	7	-	-
MDV3000/3	-	6	-
MDV3000/4	-	-	6
MDV3700/2	7	-	-
MDV3700/3	-	6	-
MDV3700/4	-	-	6
MDV4500/2	7	-	-
MDV4500/3	-	7	-
MDV5500/3	-	7	-
MDV7500/3	-	7	-

Table 2: MIDIMASTER Vector Frame Sizes

Frame Dimensions (mm)								
Standard Model:						**IP21 / NEMA 1**		
Frame Size	H		W		D	H1	W1	Weight (approx) kg
4	450	x	275	x	210	430	235	11
5	550	x	275	x	210	530	235	15
6	650	x	275	x	285	630	235	27
7	850	x	420	x	310	830	374	56
Model with Integrated EMC Filter:						**IP20 / NEMA 1**		
Frame Size	H		W		D	H1	W1	Weight (approx) kg
4	700	x	275	x	210	680	235	19
5	800	x	275	x	210	780	235	24
6	920	x	275	x	285	900	235	39
7	1150	x	420	x	310	1130	374	90
Model with enhanced protection:						**IP56 / NEMA 4/12**		
Frame size	H		W		D	H1	W1	Weight (approx) kg
4	675	x	360	x	351	649	313	30
5	775	x	360	x	422	749	313	40
6	875	x	360	x	483	849	313	54
7	1150	x	500	x	570	1112	451	100

Note:
Dimension "D" for the IP21 and the IP20 units includes the front control panel. If an OPM2 Clear Text Display is fitted then an additional 30mm will be required.

Dimension D for the IP56 units does NOT include the front panel access door - add 25mm to include this extra depth.

Table 3: MIDIMASTER Vector Dimensions & Weights

3.3 IP Protection

The IP number defines the level of Ingress Protection (IP) for the particular inverter.

MICROMASTER and MICROMASTER Vector models have an IP rating of IP20 (US equivalent NEMA 1).

MIDIMASTER Vector models have an IP rating of IP21 (US equivalent NEMA 1) or IP56 (US equivalent NEMA 4/12).

Table 4 explains what the numbers in the IP rating mean in terms of ingress protection:

First Number IP**X**xx	**Second Number** IPx**X**x	**Third Number (not quoted)** IPxx**X**
0 No protection	**0** No protection	**0** No protection
1 Protected against solid objects of 50mm or bigger	**1** Protected against water falling vertically	**1** Protected against 0.225J impact
2 Protected against solid objects of 12mm or bigger	**2** Protected against direct sprays up to 15 deg. From vertical	**2** Protected against 0.375J impact
3 Protected against solid objects of 2.5mm or bigger	**3** Protected against direct sprays up to 60 deg. From vertical	**3** Protected against 0.5J impact
4 Protected against solid objects of 1mm or bigger	**4** Protected against sprays from all directions	**5** Protected against 2.0J impact
5 Protected against dust (limited ingress)	**5** Protected against low pressure jets from all directions	**7** Protected against 6.0J impact
6 Protected against dust (totally)	**6** Protected against high pressure jets from all directions	**9** Protected against 20.0J impact
	7 Protected against immersion between 15cm and 1m	
	8 Protected against immersion under pressure	

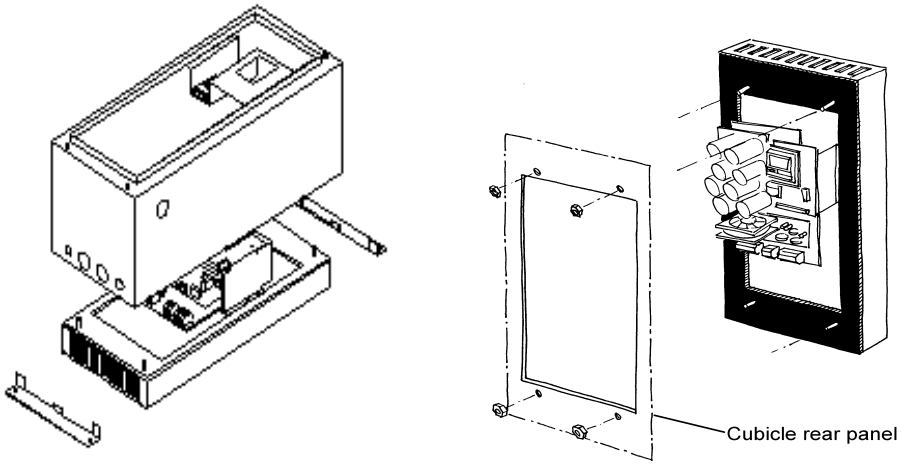
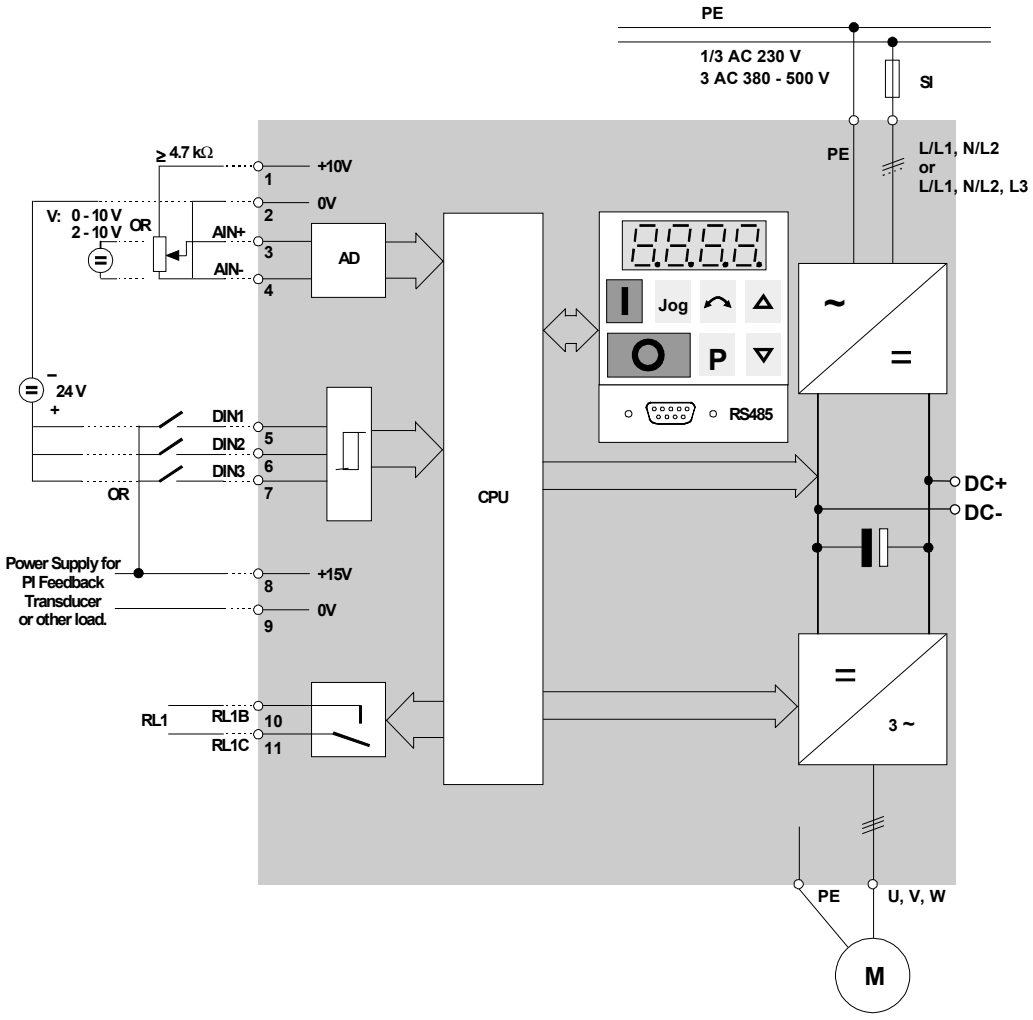


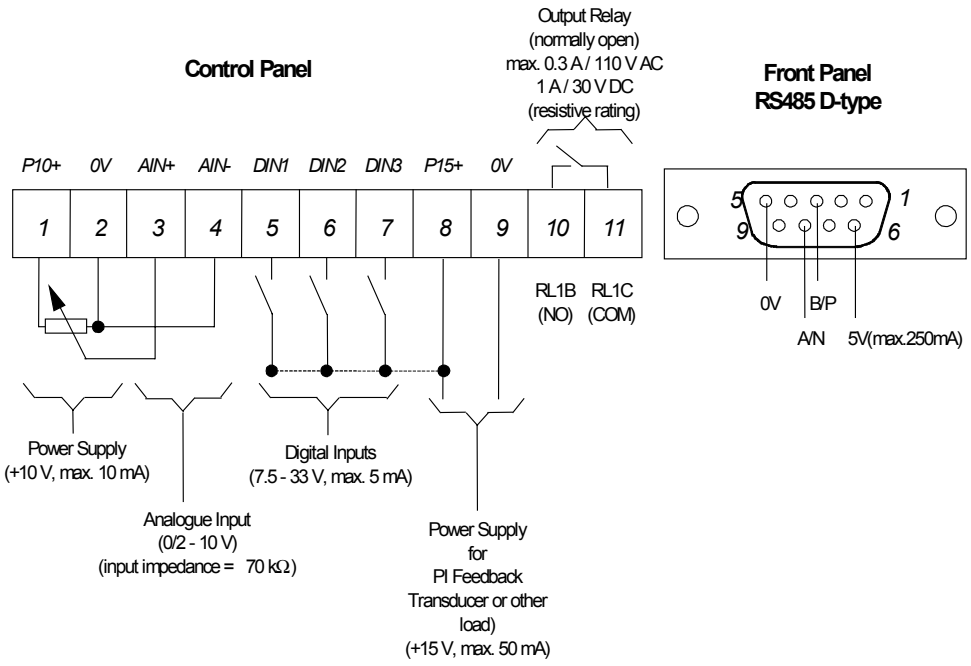
Figure 2: MIDIMASTER Vector IP56 - Cubicle Installation

The IP56 / NEMA 4/12 MIDIMASTER Vector unit can be installed within a larger enclosure with its heatsink protruding though the back plate of the cubicle. This installation method ensures that the heat from the inverter is dissipated into the outside environment without the need for additional cooling fans. The IP56 protection rating is thus maintained.

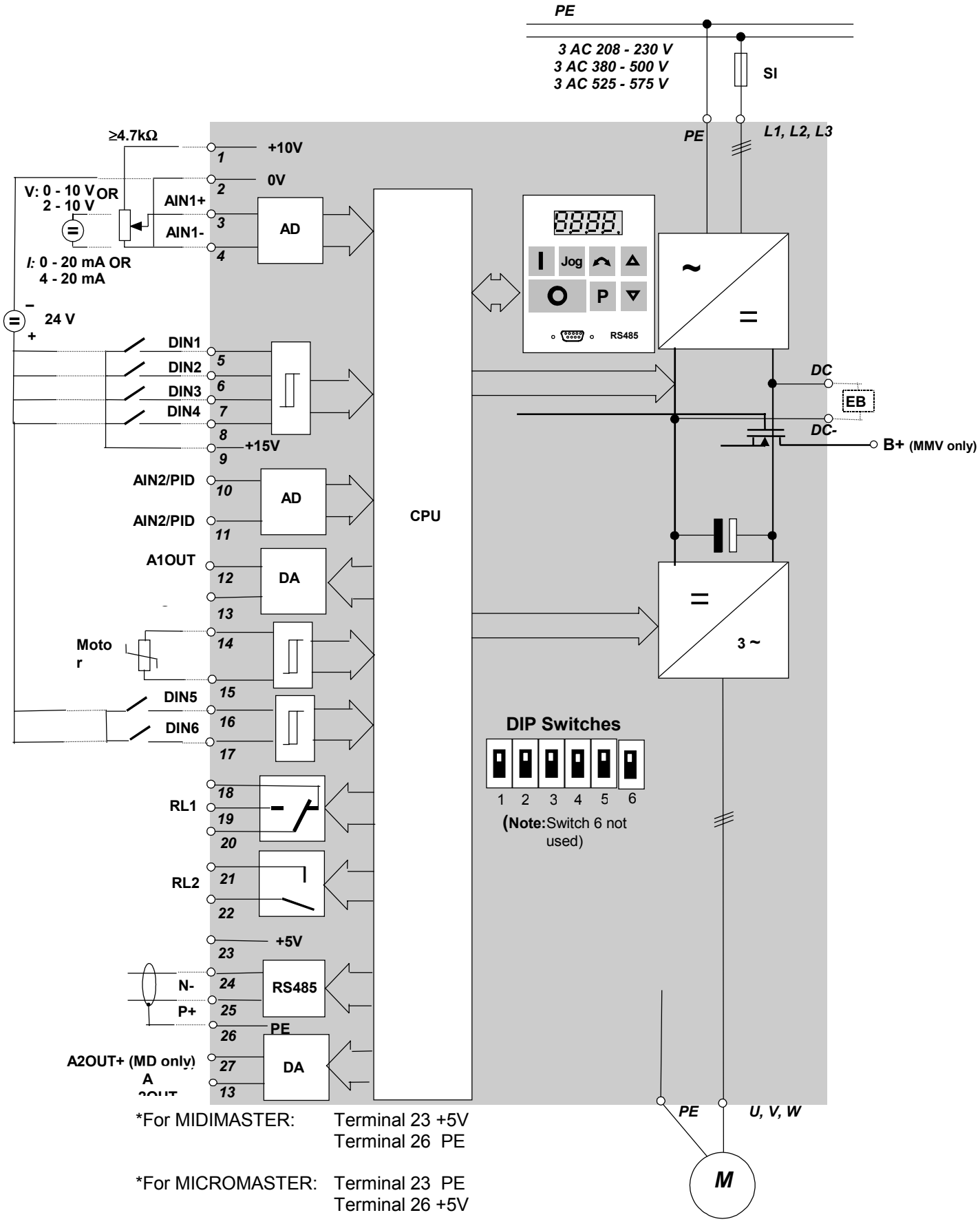
3.4 Control Connections

MICROMASTER:



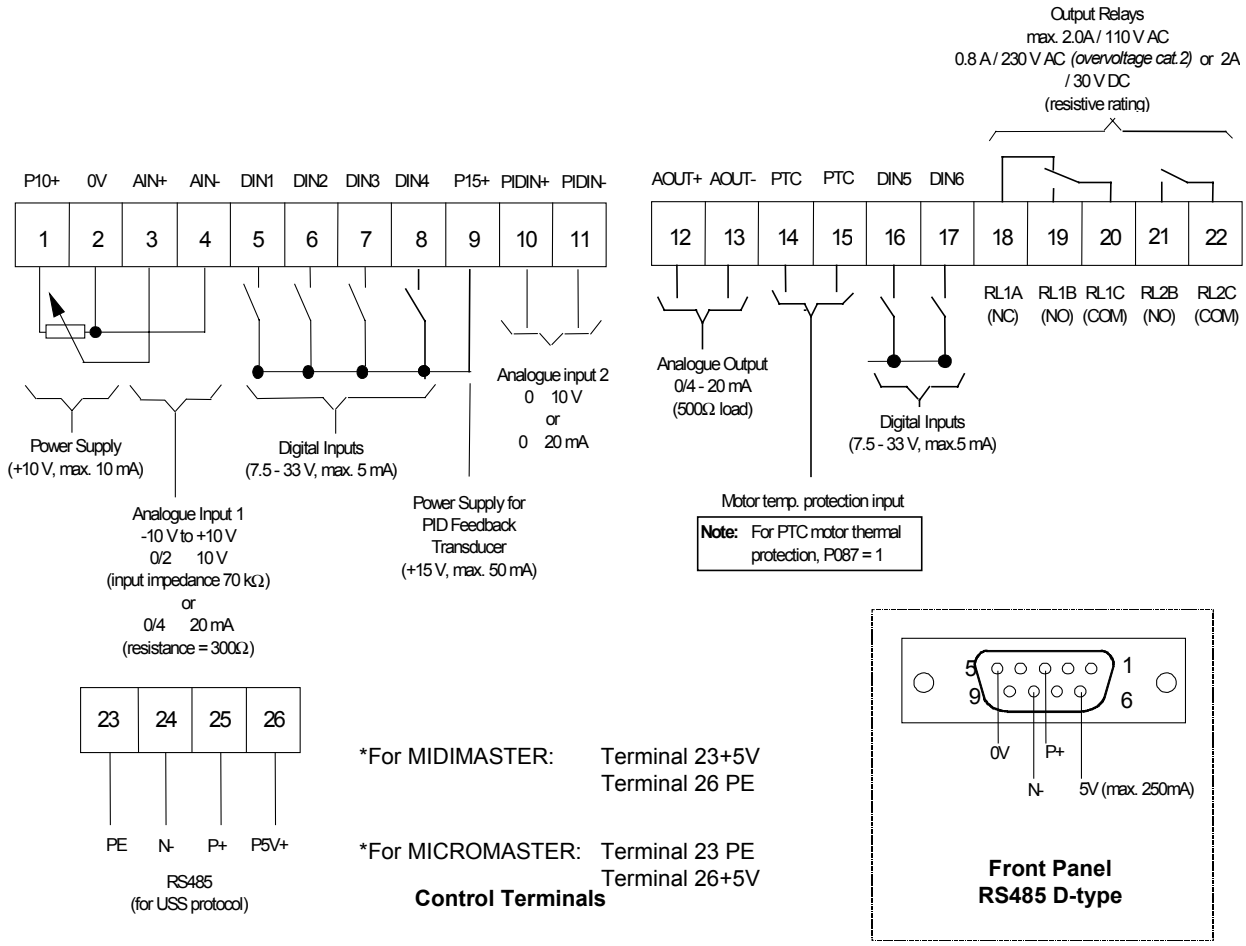


MICROMASTER Vector / MIDIMASTER Vector Control - Connections:



*For MIDIMASTER: Terminal 23 +5V
Terminal 26 PE

*For MICROMASTER: Terminal 23 PE
Terminal 26 +5V



MICROMASTER Vector / MIDIMASTER Vector control connections

3.5 Mains Input

The inverters are compatible with mains supplies which do not inject interference above the limits specified in the following standards:

IEC / EN 61000-4-4: (VDE 0847 Part 4-4)	Fast transients / burst interference:	4 kV
IEC / EN 61000-4-5: (VDE 0847 Part 4-5)	Voltage surges:	4 kV (common mode) 2 kV (differential mode)
IEC / EN 61000-4-11: (VDE 0847 Part 4-11	Voltage dips:	30% reduction 60 ms 10% reduction 100 ms
	Voltage interruptions:	>95% for 5 secs
	Voltage fluctuations:	V_{nom} +/- 10%
IEC / EN 61000-2-4: (VDE 0839 Part 2-4)	Compatibility levels in industrial plants for low-frequency conducted disturbances Class 3, 10% THD	

3.6 Mains Harmonics and Supply Impedance

Mains Harmonics

When the inverter is operating it gives rise to a non-sinusoidal current from the mains supply with harmonics. The approximate percentage of the fundamental of these harmonics, based on a 1% mains impedance, is shown in the table below. The amplitude of the harmonics can be reduced by fitting input chokes. The order numbers of suitable chokes providing an additional impedance of 2% or 4% are shown in the tables below.

Supply Impedance

The ratio of inverter rated power/mains short circuit power should never be less than 0.5%. This means that the voltage drop when the inverter is fully loaded should be greater than or equal to 0.5% of the nominal voltage. If the mains impedance is below this value the lifetime of the electrolytic capacitors could be reduced. To overcome this effect, 2% input chokes should be fitted. If a further reduction of harmonic currents is required, 4% input chokes can be fitted.

Inverter type Supply Voltage	Harmonic number order (1 = base harmonic)	Harmonic current relative to mains harmonics with 1% mains impedance (%)	Harmonic current relative to mains harmonics with 2% mains impedance (%)	Harmonic current relative to mains harmonics with 4% mains impedance (%)
230 V 1AC	1	100	100	100
	3	87.9	83.1	76.2
	5	68.2	56.9	41.3
	7	45.5	29.2	14.3
	9	24.2	10.8	6.3
	11	9.1	7.7	6.3
	13	6.1	6.2	3.2
230 V 3 AC (Inverter <= 22 kW)	1	100	100	100
	5	72.9	56.3	39.4
	7	48.4	31.3	14.7
	11	10.6	6.6	6.9
	13	5.5	6.6	3.4
230 V 3 AC (Inverter > 22 kW)	1	100	100	100
	5	32	29.2	26.0
	7	9.6	7.9	6.9
	11	7.8	7.0	5.9
	13	3.7	3.6	3.4
400/500 V 3 AC (Inverter <= 37 kW)	1	100	100	100
	5	72.5	62.0	41.0
	7	52.6	36.7	16.5
	11	17.0	7.4	7.3
	13	7.2	6.2	3.2
400/500 V 3 AC (Inverter >37 kW)	1	100	100	100
	5	42.7	37.8	32.6
	7	17.7	13.2	9.2
	11	6.7	7.1	6.9
	13	4.0	3.5	3.3

3.7 Maximum Motor Cable Lengths

Inverter Power kW	Rated voltage V	Size	Without output choke		With output choke	
			Unscreened cable m	Screened cable m	Unscreened cable m	Screened cable m
MICROMASTER / MICROMASTER Vector						
0.12 - 1.5	208-240 ±10%	A, B	200	200	250	225
2.2 – 4.0	208-240 ±10%	C	185	150	235	185
0.37 - 1.5	380-500 ± 10%	A	110	80	185	125
2.2 – 3.0	380-500 ± 10%	B	170	140	220	170
4.0 - 7.5	380-500 ± 10%	C	200	200	300	250
MIDIMASTER Vector						
5.5	208-240 ±10%	4	200	50	250	80
7.5 - 11	208-240 ±10%	4, 5	300	200	350	225
15 - 22	208-240 ±10%	6	300	300	350	325
30 - 45	208-240 ±10%	7	300	300	350	325
7.5 - 18.5	380-500 ± 10%	4, 5	150	75	200	100
22 - 37	380-500 ± 10%	6	200	150	250	175
45 - 75	380-500 ± 10%	7	300	300	350	325
2.2 - 18.5	525-575 ± 10%	4,5	100	100	150	125
22 - 37	525-575 ± 10%	6	150	150	200	175

The maximum cable lengths quoted above relate to constant torque applications under the following conditions:

- Rated voltage:
  Max. 460V for MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector voltage range 3AC 380 - 500 V
- Pulse frequency as supplied:
  16 kHz max. for 230 V MICROMASTER and MICROMASTER Vector
  4 kHz max. For 400 V MICROMASTER, MICROMASTER Vector and all MIDIMASTER Vector equipment
- Overload:
  1.5 x rated output current for MICROMASTER and MICROMASTER Vector
  1.5 x rated output current for MIDIMASTER Vector in constant torque applications

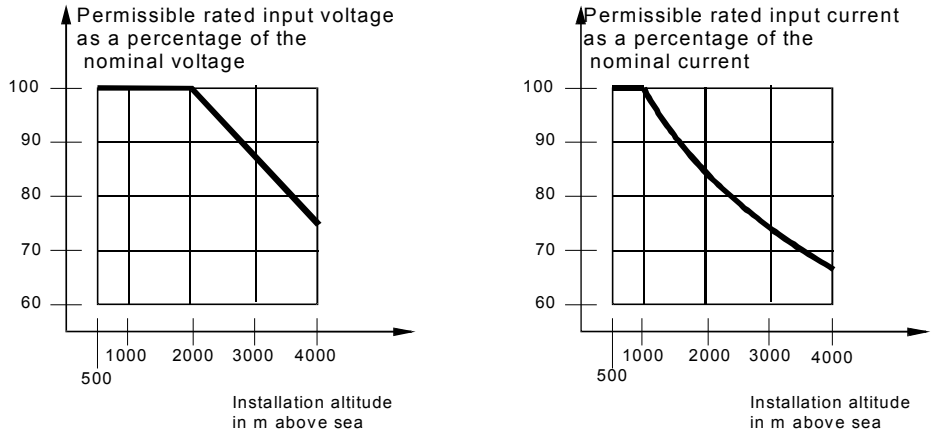
To extend the cable lengths:

1. Use the smallest inverter model from the next size range.
2. Use an output choke (see sections 6.32, 6.33).

Note: Optimal operation in ‘Vector control’ mode is compromised by very long motor cables. In this situation the power procurement system in the inverter is unable to replicate the motor sufficiently accurately.

3.8 Derating

3.8.1 Voltage and Current Derating with Respect to Altitude



3.8.2 Maximum Output Current with respect to the Pulse Frequency

Due to higher switching losses at increased switching frequencies, certain inverters may have their maximum continuous current (100%) derated if the switching frequency is changed from the default value

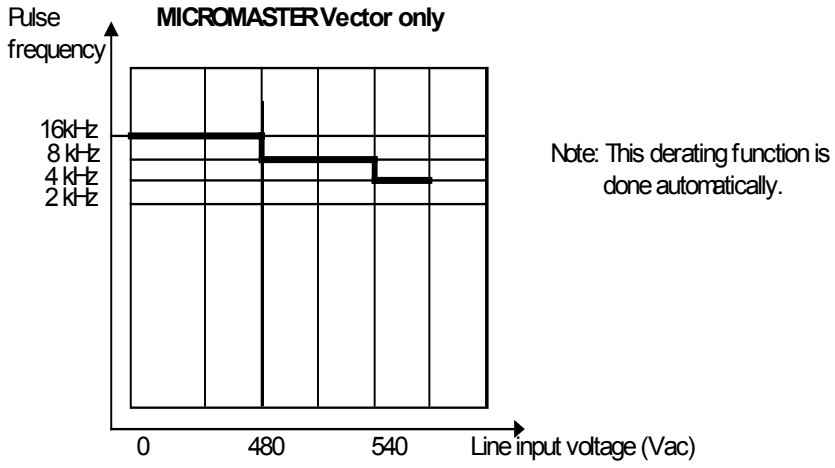
Model	% of full load de-rating	
	16 kHz	8 kHz
MMV75/3	80	100
MMV110/3	50	80
MMV150/3	50	80
MMV220/3	80	100
MMV300/3	50	80
MMV400/3	50	80
MMV550/3	50	80
MMV750/3	50	80

Note: *If switching frequency is 2 kHz or 4 kHz then derating does not occur on the above inverters.*

Model	% of full load de-rating	
	16 kHz	8 kHz
MDV550/2	39	75
MDV750/2	64	90
MDV1100/2	55	75
MDV1500/2	38	68
MDV1850/2	43	79
MDV2200/2	38	68
MDV750/3	55	100
MDV1100/3	39	75
MDV1500/3	64	90
MDV1850/3	55	75
MDV2200/3	40	75
MDV3000/3	47	88
MDV3700/3	40	75
MDV550/4	75	100
MDV750/4	55	100
MDV1100/4	39	75
MDV1500/4	64	90
MDV1850/4	55	75

Note: *On all Frame Size 6 575V and all Frame Size 7 MIDIMASTER Vector inverters, the switching frequency can only be either 2kHz or 4kHz*

3.8.3 Maximum Output Pulse Frequency with Respect to Line Input Voltage



3.9 Recommended Fuse Ratings

MICROMASTER, MICROMASTER Vector, MIDIMASTER Vector

Mains Supply Voltage	Versions MM = MICROMASTER MMV = MICROMASTER Vector MDV = MIDIMASTER Vector	Recommended Fuse Rating A	Recommended Fuse (duty class gL) Order code	Maximum cable diameter (mm^2)
1 AC 230 V	MM12, MMV12, MM25, MMV25, MM37, MMV37	10	**3NA3803**	4
	MM55, MMV55, MM75, MMV75	16	**3NA3805**	4
	MM110, MMV110, MM150, MMV150,	20	**3NA3807**	4
	MM220, MMV220	25	**3NA3810**	4
	MM300, MMV300 (a)	32	**3NA3812**	4
1 AC 230 V, 3 AC 230 V **(b)**	MM12/2, MMV12/2, MM25/2, MMV25/2, MM37/2, MMV37/2, MM55/2, MMV55/2, MM75/2, MMV75/2	10	**3NA3803**	4
	MM110/2, MMV110/2, MM150/2, MMV150/2	16	**3NA3805**	4
	MM220/2, MMV220/2	20	**3NA3807**	4
	MM300/2, MMV300/2 (a)	25	**3NA3810**	4
	MM400/2, MMV400/2 (c)	32	**3NA3812**	4
3 AC 380 V - 500 V	MM37/3, MMV37/3, MM55/3, MMV55/3, MM75/3, MMV75/3, MM110/3, MMV110/3, MM150/3, MMV150/3,	10	**3NA3803**	4
	MM220/3, MMV220/3, MM300/3, MMV300/3	16	**3NA3805**	4
	MM400/3, MMV400/3, MM550/3, MMV550/3	20	**3NA3807**	4
	MM750/3, MMV750/3	25	**3NA3810**	4
3 AC 230 V	MDV550/2	50	**3NA3820**	16
	MDV750/2, MDV1110/2	63	**3NA3822**	35
	MDV1500/2	80	**3NA3824**	35
	MDV1850/2, MDV2200/2	100	**3NA3830**	35
	MDV3000/2	160	**3NA3036**	95
	MDV3700/2, 4500/2	200	**3NA3140**	95
3 AC 380 V - 500 V	MDV750/3, MDV1100/3	35	**3NA3814**	16
	MDV1500/3, MDV1850/3	50	**3NA3820**	35
	MDV2200/3, MDV3000/3	80	**3NA3824**	35
	MDV3700/3	100	**3NA3830**	35
	MDV4500/3	125	**3NA3032**	95
	MDV5500/3	160	**3NA3036**	95
	MDV7500/3	200	**3NA3140**	95
3 AC 525 V - 575 V	MDV220/4, MDV400/4	10	**3NA3803-6**	16
	MDV550/4	16	**3NA3805-6**	16
	MDV750/4	25	**3NA3810-6**	16
	MDV1100/4, MDV1500/4	35	**3NA3814-6**	16, 35
	MDV1850/4, MDV2200/4	50	**3NA3820-6**	35
	MDV3000/4	63	**3NA3822-6**	35
	MDV3700/4	80	**3NA3824-6**	35

Table 3: Recommended Slow-acting Line Fuses

(a) MM(V(300 and MM(V)300/2 require an external choke (e.g. 4EM6100-3CB) and a 30 A mains fuse for single phase.

(b) Assumes 3-phase supply. If a single-phase supply is used, the input current ratings and fuses for single-phase MICROMASTERS will apply.

(c) Operation only on 3 AC 230 V.

3.10 Compliance with EMC Directive

All manufacturers / assemblers of electrical apparatus which performs a complete intrinsic function which is placed on the market as a single unit intended for the end user must comply with the EMC directive EEC/89/336 after January 1996. There are three routes by which the manufacturer/assembler can demonstrate compliance:

1. *Self-Certification*
   This is a manufacturer's declaration that the European standards applicable to the electrical environment for which the apparatus is intended have been met. Only standards which have been officially published in the Official Journal of the European Community can be cited in the manufacturer's declaration.
2. *Technical Construction File*
   A technical construction file can be prepared for the apparatus describing its EMC characteristics. This file must be approved by a 'Competent Body' appointed by the appropriate European government organisation. This approach allows the use of standards which are still in preparation.
3. *EC Type-Examination Certificate*
   This approach is only applicable to radio communication transmitting apparatus.

The MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector units do not have an intrinsic function until connected with other components (e.g. a motor). Therefore, the basic units are not allowed to be CE marked for compliance with the EMC directive. However, full details are provided below of the EMC performance characteristics of the products when they are installed in accordance with the wiring recommendations in section 9.3.

Three classes of EMC performance are available as detailed below. Note that these levels of performance are only achieved when using the default switching frequency (or less) and a maximum motor cable length of 25 m.

Class 1: General Industrial

Compliance with the EMC Product Standard for Power Drive Systems EN 61800-3 for use in **Second Environment (Industrial)** and **Restricted Distribution**.

EMC Phenomenon	**Standard**	**Level**
Emissions:		
Radiated Emissions	EN 55011 (VDE 0875 Part 11)	Level A1 *
Conducted Emissions	EN 61800-3 (VDE 0160 Part 100)	*
Immunity:		
Electrostatic Discharge	EN 61000-4-2 (VDE 0847 Part 4-2)	8 kV air discharge
Burst Interference	EN 61000-4-4 (VDE 0847 Part 4-4)	2 kV power cables, 1 kV control
Radio Frequency Electromagnetic Field	IEC 1000-4-3 (VDE 0847 Part 4-3)	26-1000 MHz, 10 V/m

** Emission limits not applicable inside a plant where no other consumers are connected to the same electricity supply transformer*

Class 2: Filtered Industrial

This level of performance will allow the manufacturer/assembler to self-certify their apparatus for compliance with the EMC directive for the industrial environment as regards the EMC performance characteristics of the power drive system. Performance limits are as specified in the Generic Industrial Emissions and Immunity standards EN 50081-2 and EN 50082-2.

EMC Phenomenon	**Standard**	**Level**
Emissions:		
Radiated Emissions	EN 55011 (VDE 0875 Part 11)	Level A1
Conducted Emissions	EN 55011 (VDE 0875 Part 11)	Level A1
Immunity:		
Supply Voltage Distortion	EN 61000-2-4 (VDE 0839 Part 2-4)	
Voltage Fluctuations, Dips, Unbalance, Frequency Variations	IEC 1000-2-1	
Magnetic Fields	EN 61000-4-8 (VDE 0847 Part 4-8)	50 Hz, 30 A/m
Electrostatic Discharge	EN 61000-4-2 (VDE 0847 Part 4-2)	8 kV air discharge
Burst Interference	EN 61000-4-4 (VDE 0847 Part 4-4)	2 kV power cables, 2 kV control
Radio Frequency Electromagnetic Field, amplitude modulated	ENV 50 140 (VDE 0847 Part 3)	80-1000 MHz, 10 V/m, 80% AM, power and signal lines
Radio-frequency Electromagnetic Field, pulse modulated	ENV 50 204 (VDE V 0847 Part 204)	900 MHz, 10 V/m 50% duty cycle, 200 Hz repetition rate

Class 3: Filtered - for residential, commercial and light industry

This level of performance will allow the manufacturer / assembler to self-certify compliance of their apparatus with the EMC directive for the residential, commercial and light industrial environment as regards the EMC performance characteristics of the power drive system. Performance limits are as specified in the generic emission and immunity standards EN 50081-1 and EN 50082-1.

EMC Phenomenon	**Standard**	**Level**
Emissions:		
Radiated Emissions	EN 55022 (VDE 0878 Part 22)	Level B1
Conducted Emissions	EN 55022 (VDE 0878 Part 22)	Level B1
Immunity:		
Electrostatic Discharge	EN 61000-4-2 (VDE 0847 Part 4-2)	8 kV air discharge
Burst Interference	EN 61000-4-4 (VDE 0847 Part 4-4)	1 kV power cables, 0.5 kV control

Note:
The MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector units are intended ***exclusively for professional applications****. Therefore, they do not fall within the scope of the harmonics emissions specification EN 61000-3-2.*

Compliance Table (MM & MMV):

Model No.	**EMC Class**
MM12 - MM300, MMV12 - MMV300	Class 2
MM12/2 - MM400/2, MMV12/2 - MMV400/2	Class 1
MM12/2 - MM400/2, MMV12/2 - MMV400/2 with external filter (see table) *1 phase input only*	Class 2*
MM37/3 - MM750/3, MMV37/3 - MMV750/3	Class 1
MM37/3 - MM750/3, MMV37/3 - MMV750/3 with external filter (see selection table)	Class 2*

Compliance Table (MDV):

Model No.	**EMC Class**
MDV550/2 - MDV4500/2	Class 1
MDV750/3 - MDV7500/3 with class A external filter (see table)	Class 2*
MDV750/3 - MDV3700/3 with class B external filter (see table)	Class 3
MDV750/4 - MDV3700/4	Class 1

* If the installation of the inverter reduces the radio frequency field emissions (e.g. by installation in a steel enclosure), Class 3 radiated emission limits will typically be met.

Filter Part Numbers and Standards:

Inverter Model No.	Class A Filter Part No.	Class B Filter Part No.	Standard
MM12 - MM300 MMV12 - MMV300	Built-in		EN 55011 / EN 55022
MM12/2 - MM25/2 MMV12/2 - MMV25/2		**6SE3290-0BA87-0FB0**	EN 55011 / EN 55022
MM37/2 - MM75/2 MMV37/2 - MMV75/2		**6SE3290-0BA87-0FB2**	EN 55011 / EN 55022
MM110/2 - MM150/2 MMV110/2 - MMV150/2		**6SE3290-0BB87-0FB4**	EN 55011 / EN 55022
MM220/2 - MM300/2 MMV220/2 - MMV300/2		**6SE3290-0BC87-0FB4**	EN 55011 / EN 55022
MM37/3 - MM150/3 MMV37/3 - MMV150/3	**6SE3290-0DA87- 0FA1**	**6SE3290-0DA87-0FB1**	EN 55011 / EN 55022
MM220/3 - MM300/3 MMV220/3 - MMV300/3	**6SE3290-0DB87- 0FA3**	**6SE3290-0DB87-0FB3**	EN 55011 / EN 55022
MM400/3 - MM750/3 MMV400/3 - MMV750/3	**6SE3290-0DC87- 0FA4**	**6SE3290-0DC87-0FB4**	EN 55011 / EN 55022
MDV550/2	**6SE3290-0DG87- 0FA5**	**6SE2100-1FC20**	EN 55011 / EN 55022
MDV750/2	**6SE3290-0DH87- 0FA5**	**6SE2100-1FC20**	EN 55011 / EN 55022
MDV1100/2 - MDV1850/2	**6SE3290-0DJ87- 0FA6**	**6SE2100-1FC21**	EN 55011 / EN 55022
MDV2200/2	**6SE3290-0DJ87- 0FA6**		EN 55011 / EN 55022
MDV3000/2 - MDV4500/2	**6SE3290-0DK87- 0FA7**		EN 55011 / EN 55022
MDV 750/3 - MDV1100/3	**6SE3290-0DG87- 0FA5**	**6SE2100-1FC20**	EN 55011 / EN 55022
MDV1500/3 - MDV1850/3	**6SE3290-0DH87- 0FA5**	**6SE2100-1FC20**	EN 55011 / EN 55022
MDV2200/3 - MDV3700/3	**6SE3290-0DJ87- 0FA6**	**6SE2100-1FC21**	EN 55011 / EN 55022
MDV4500/3 - MDV7500/3	**6SE3290-0DK87- 0FA7**		EN 55011 / EN 55022

Note:
Maximum mains supply voltage when filters are fitted is 460 V for MIDIMASTER Vector and 480 V for MICROMASTER / MICROMASTER Vector.

It is not permissible to use radio interference suppression filters and filters to reduce cable-borne noise when the inverter is connected to un-earthed supplies.

3.11 EMC Footprint Filters for MICROMASTER and MICROMASTER Vector

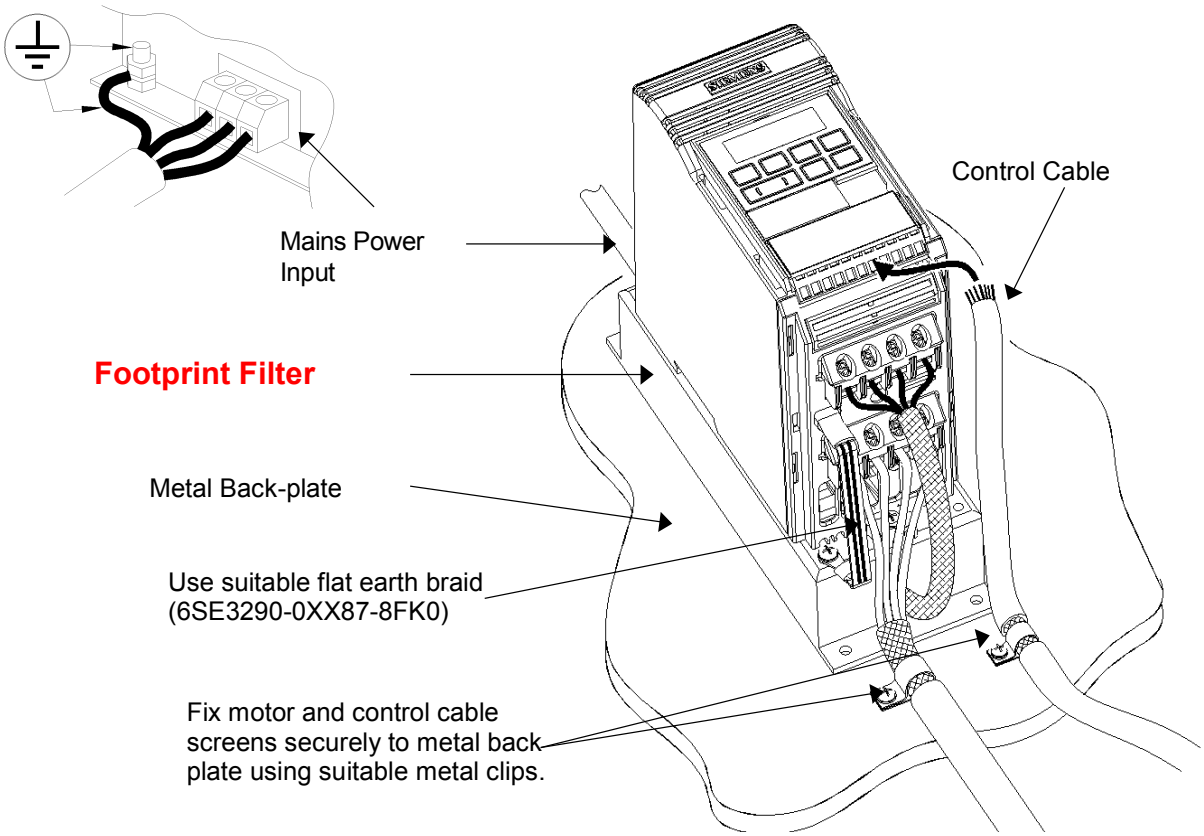


Figure 3.11.1: Wiring guidelines to minimise effects of EMI - MICROMASTER and MICROMASTER Vector Frame Size A

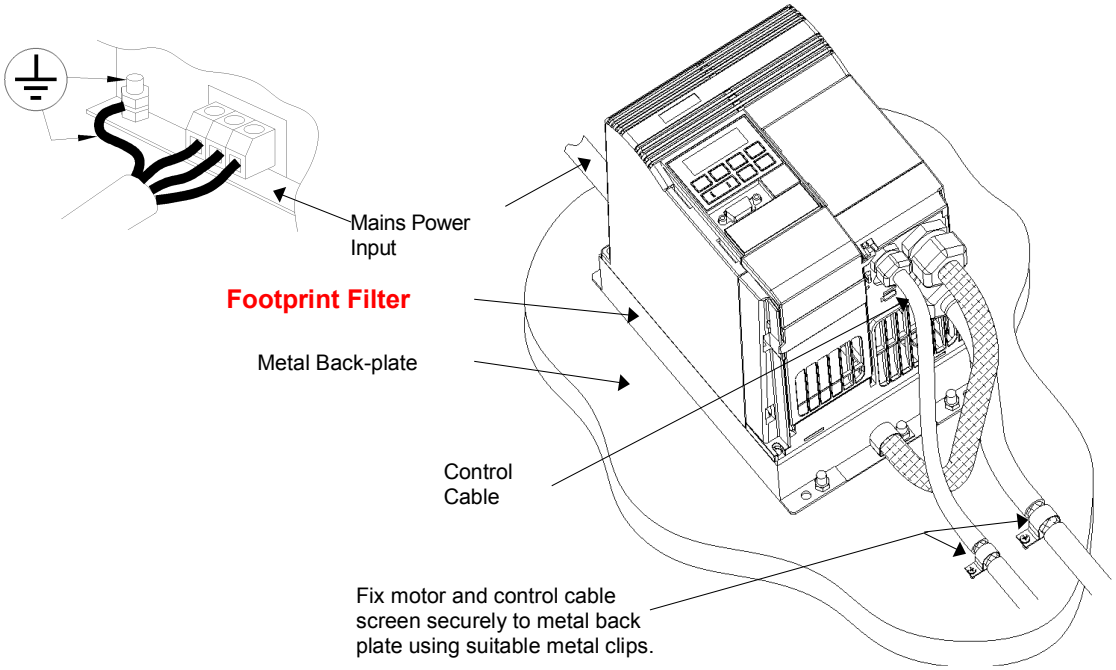


Figure 3.11.2: Wiring guidelines to minimise effects of EMI - MICROMASTER and MICROMASTER Vector Frame Size B

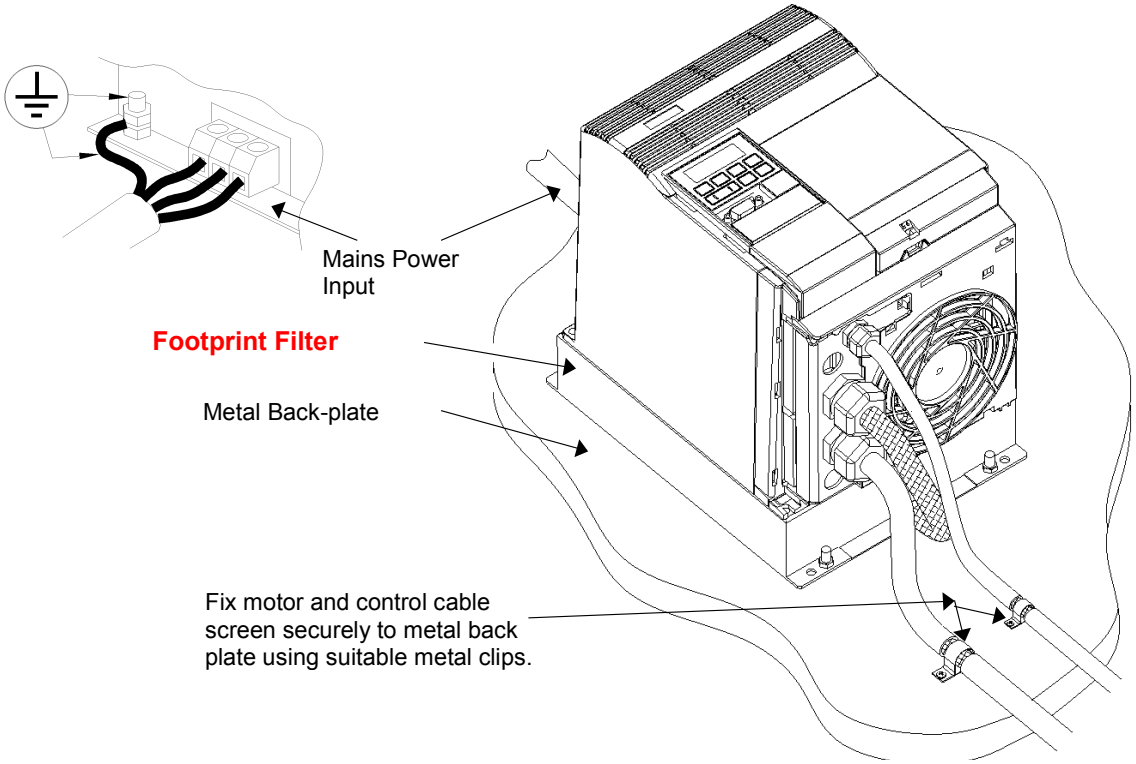


Figure 3.11.3 Wiring guidelines to minimise effects of EMI - MICROMASTER and MICROMASTER Vector Frame Size C

The inverters are designed to operate in an industrial environment where a high level of Electro-Magnetic Interference (EMI) can be expected. Usually, good installation practices will ensure safe and trouble-free operation. If problems are encountered, the following guidelines may prove useful. In particular, grounding of the system at the inverter, as described below, may prove effective.

(1) Ensure that all equipment in the cubicle is well earthed using short, thick earthing cable connected to a common star point or busbar. It is particularly important that any control equipment that is connected to the inverter (such as a PLC) is connected to the same earth or star point as the inverter via a short, thick link. Flat conductors (e.g. braids or metal brackets) are preferred as they have lower impedance at high frequencies.

The return earth from motors controlled by the inverter should be connected directly to the earth connection (PE) on the associated inverter.

(2) On the MIDIMASTER Vector, use saw-tooth washers when mounting the inverter and ensure that a good electrical connection is made between the heatsink and the panel, removing paint if necessary.

(3) Wherever possible, use screened leads for connections to the control circuitry. Terminate the ends of the cable neatly, ensuring that unscreened wires are as short as possible. Use cable glands whenever possible.

(4) Separate the control cables from the power connections as much as possible, using separate trunking, etc. If control and power cables cross, arrange the cables so that they cross at 90° if possible.

(5) Ensure that contactors in the cubicle are suppressed, either with R-C suppressors for AC contactors or 'flywheel' diodes for DC contactors, fitted to the coils. Varistor suppressors are also effective. This is particularly important if the contactors are controlled from the relay on the inverter.

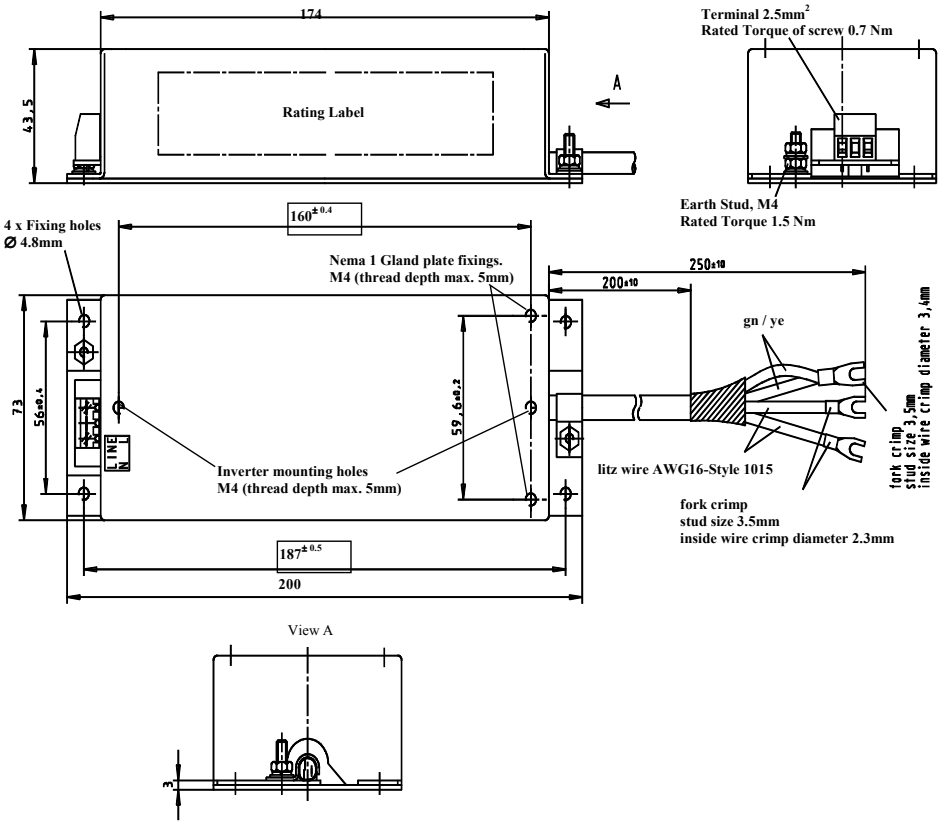
(6) Use screened or armoured cables for the motor connections and ground the screen at both ends via the cable glands.

(7) If the drive is to be operated in an Electro-magnetic noise-sensitive environment, the RFI filter should be used to reduce the conducted and radiated interference from the inverter. For optimum performance, there should be a good conductive bond between filter and metal mounting plate.

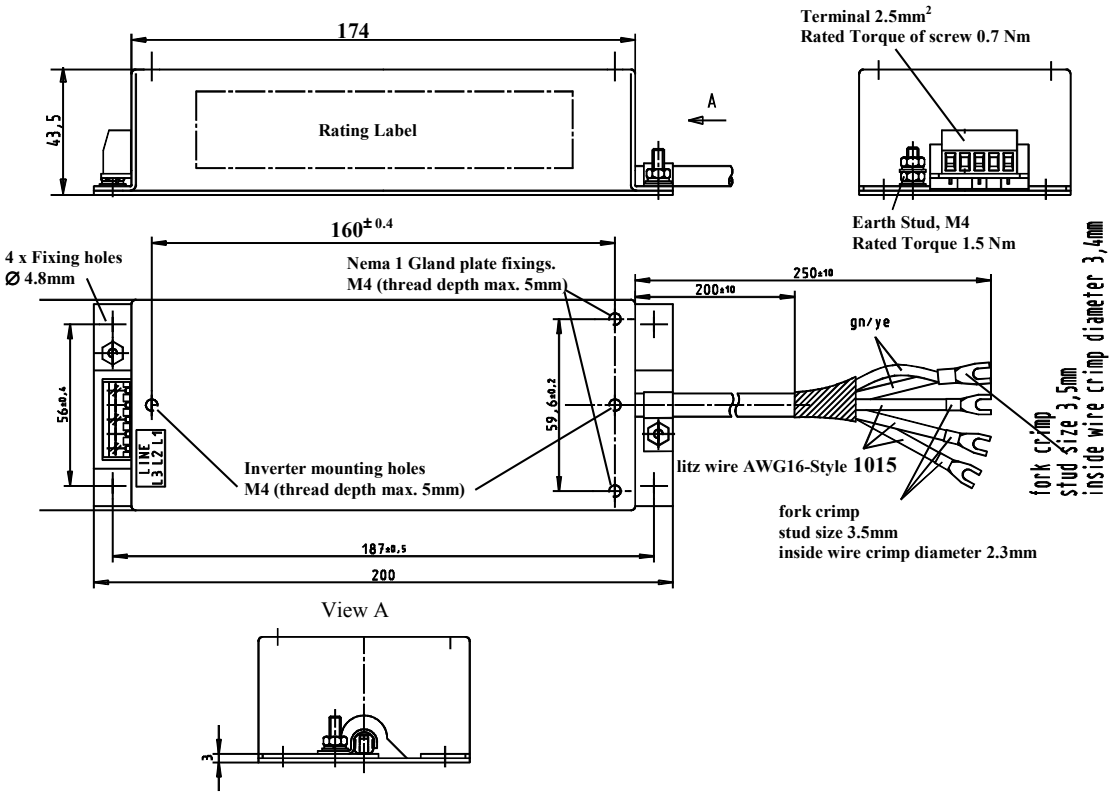
(8) If a line EMC filter and commutating reactors are simultaneously used, then the line EMC filter must be located between the drive converter and commutating reactor (line choke).

MICROMASTER AND MICROMASTER Vector - Footprint filter dimensions

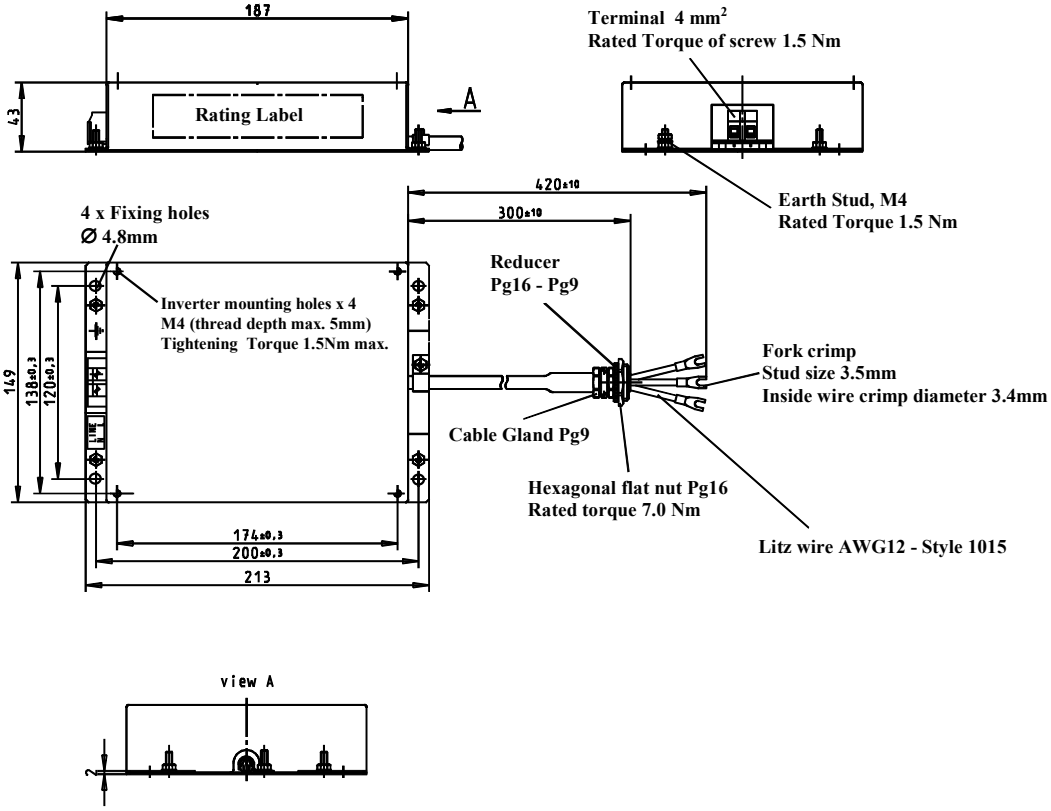
6SE3290-0BA87-0FB0, 6SE3290-0BA87-0FB2



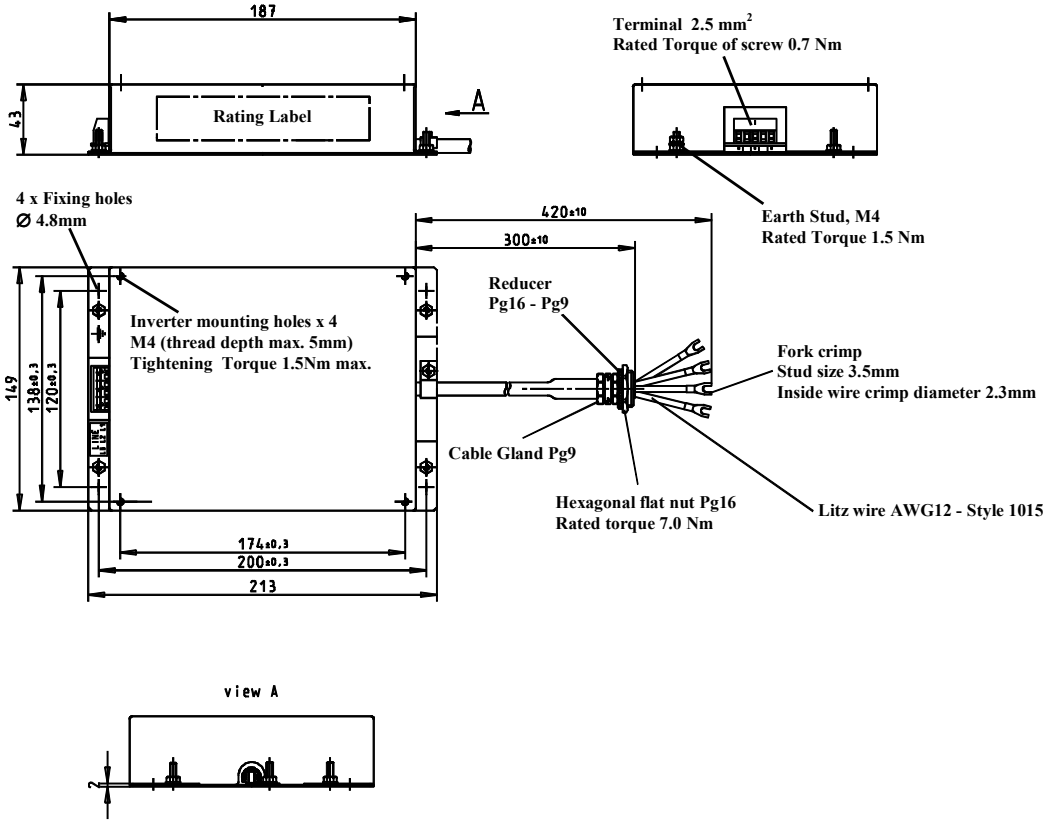
6SE3290-0DA87-0FA1,6SE3290-0DA87-0FB



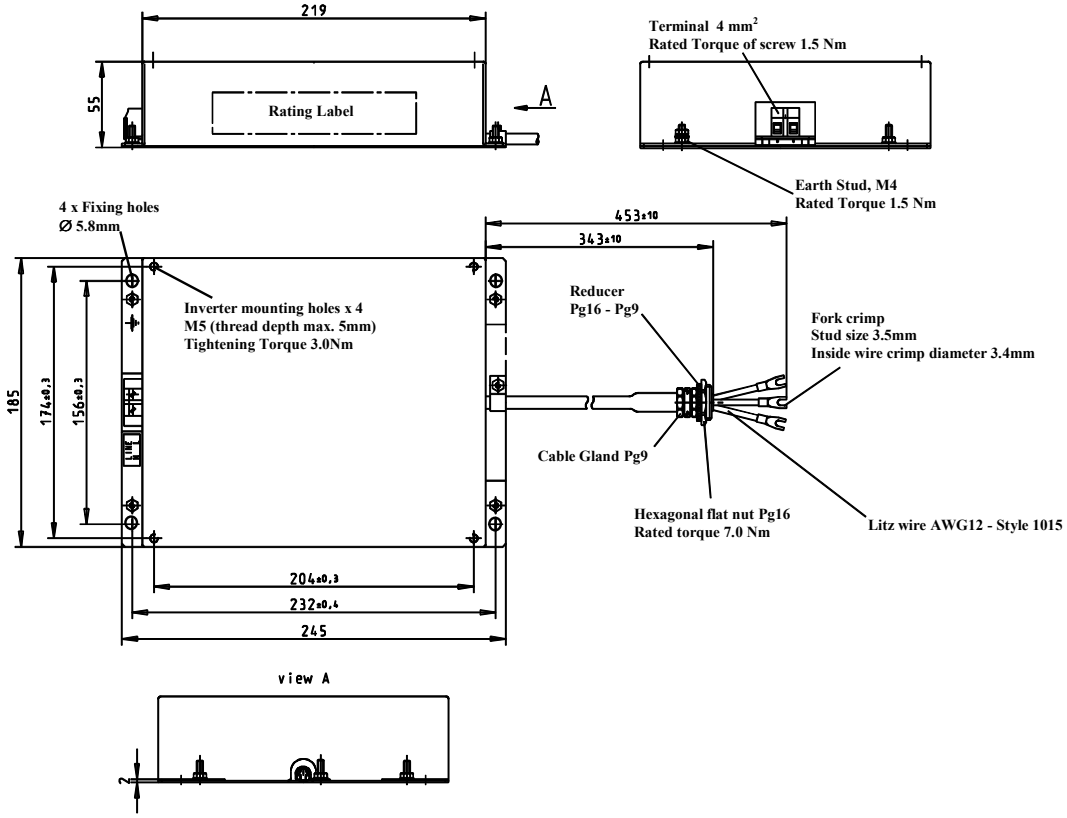
6SE3290-0BB87-0FB4



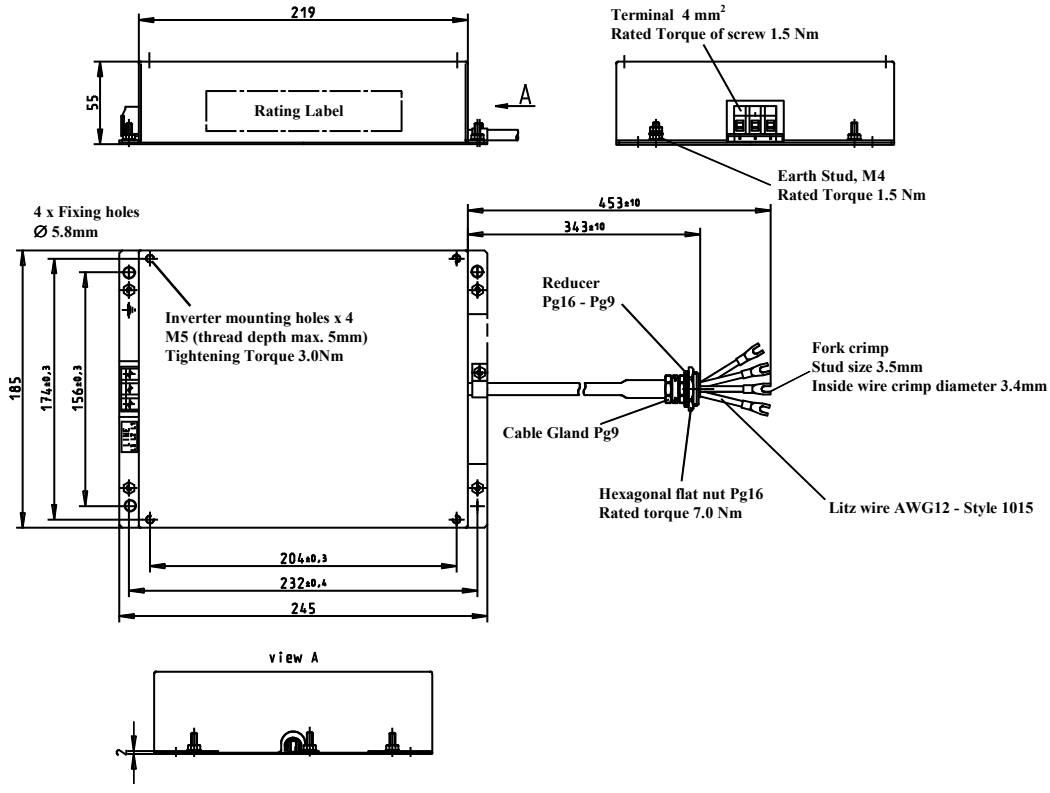
6SE3290-0DB87-0FA3, 6SE3290-0DB87-0FB3



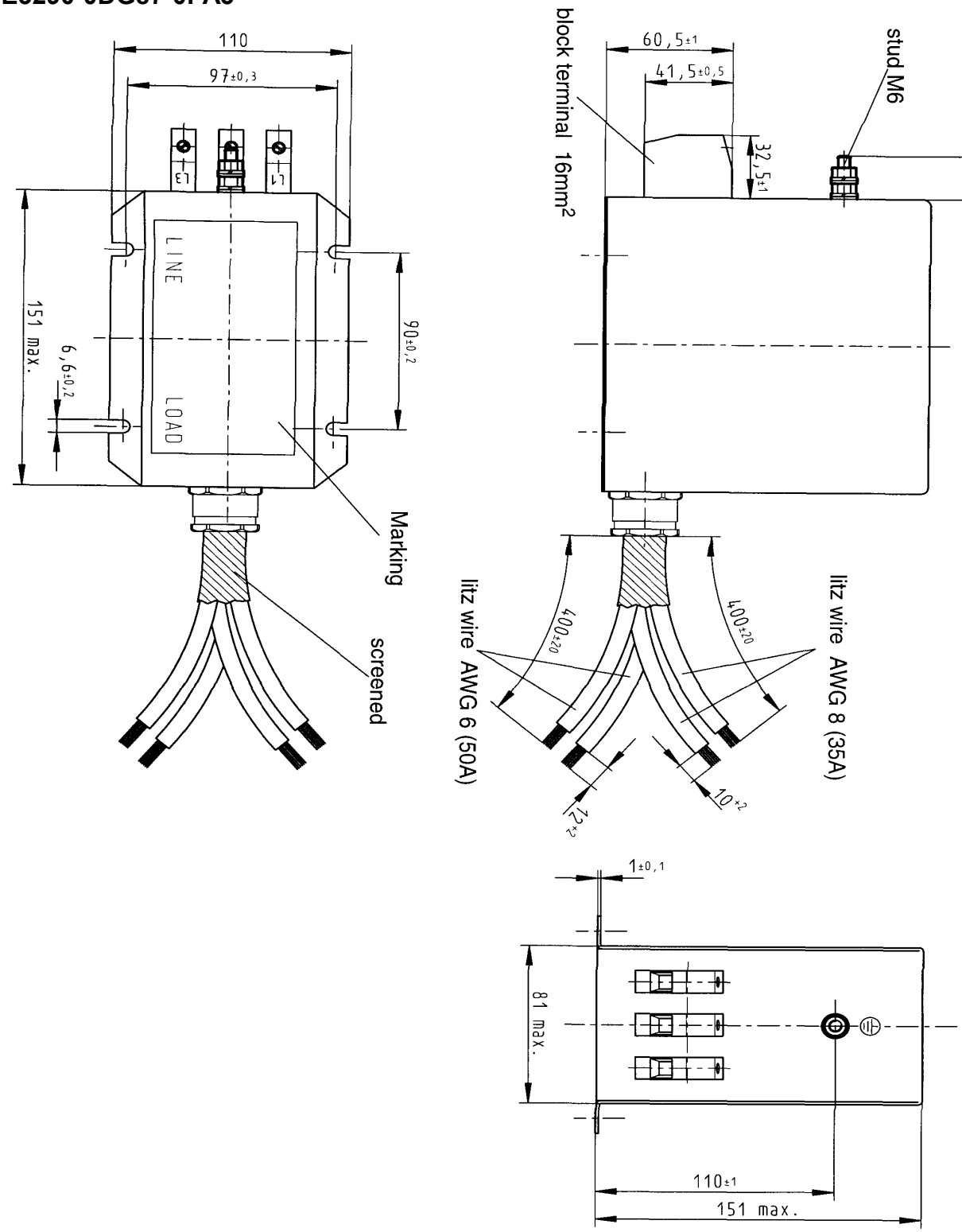
6SE3290-0BC87-0FB4



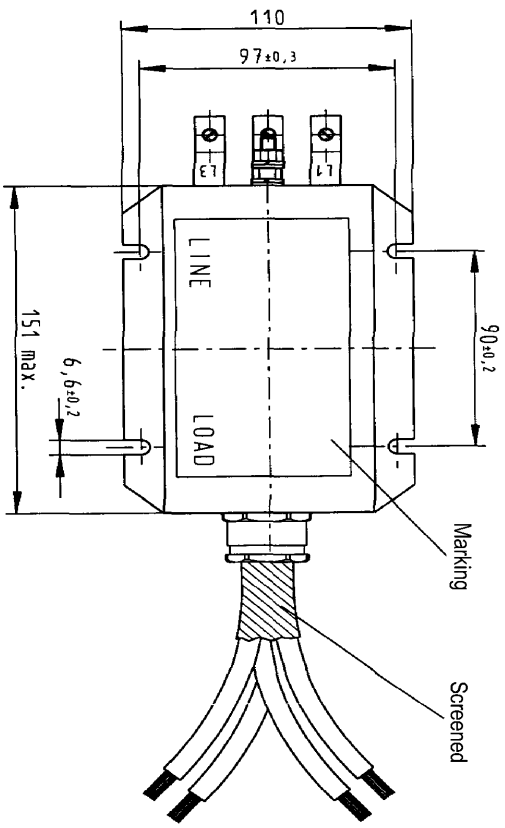
6SE3290-0DC87-0FA4, 6SE3290-0DC87-0FB4

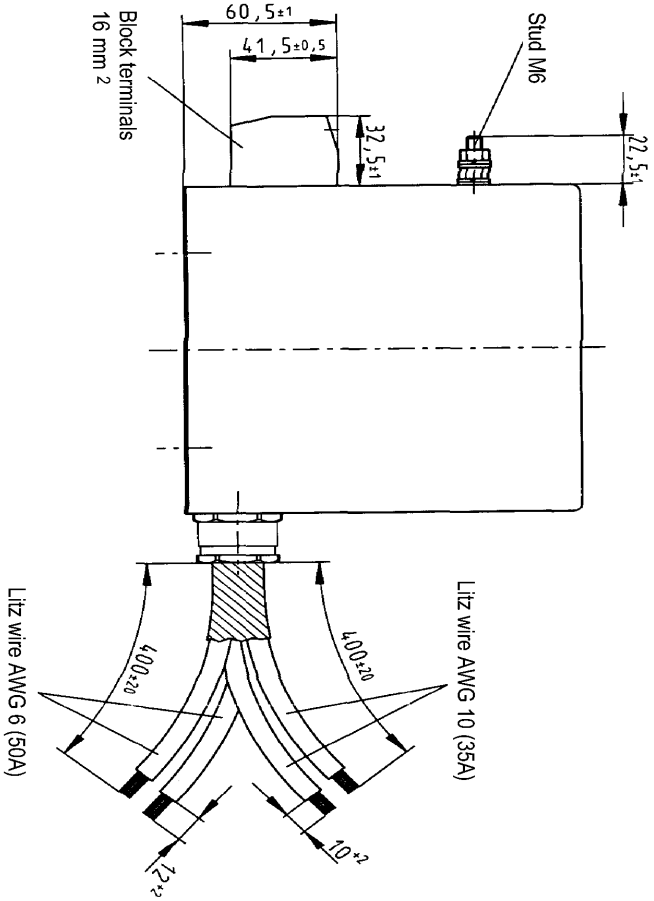


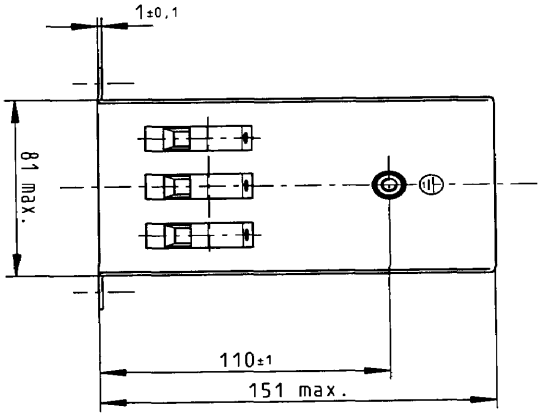
6SE3290-0DG87-0FA5



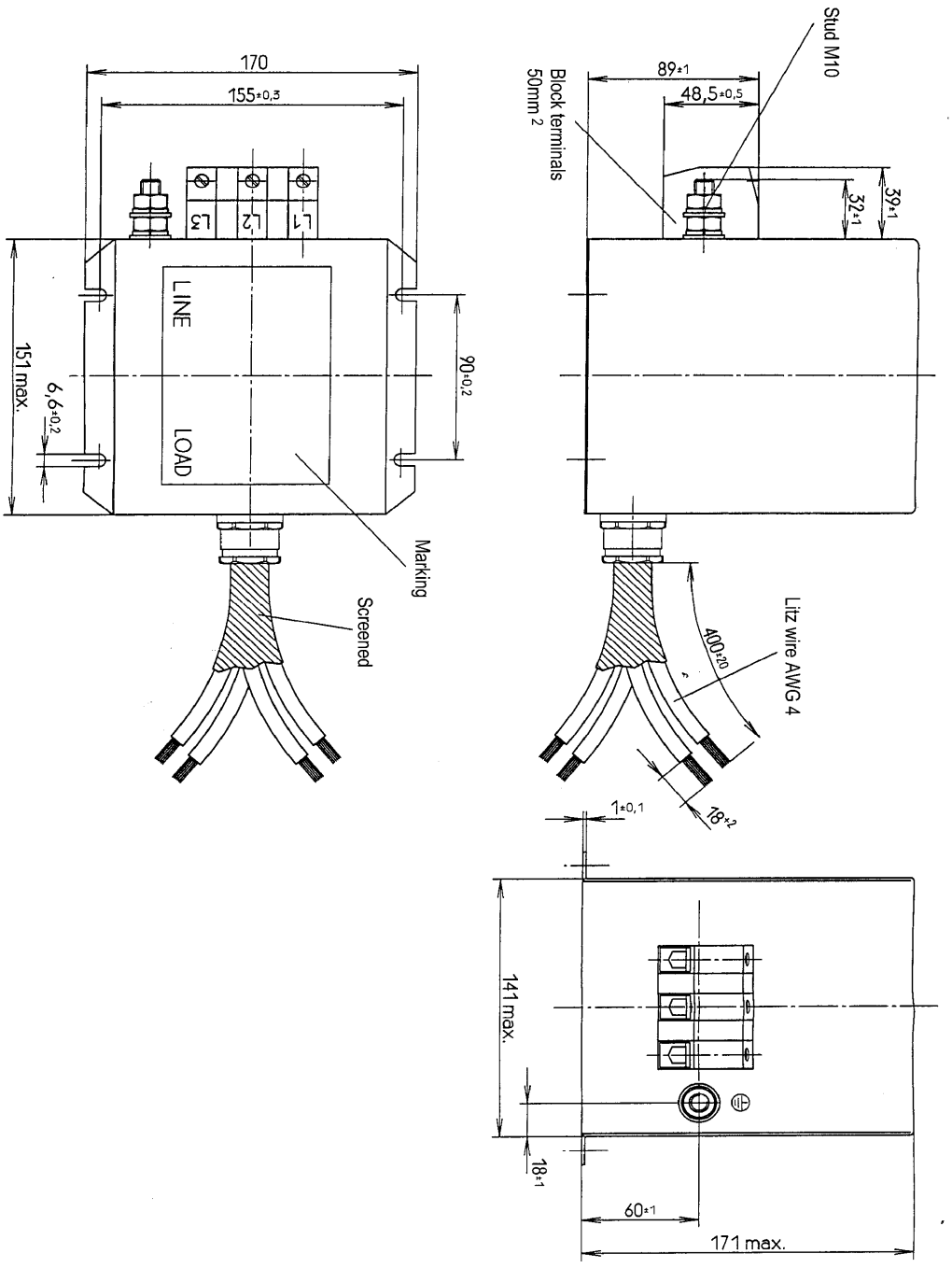
6SE3290-0DH87-0FA5



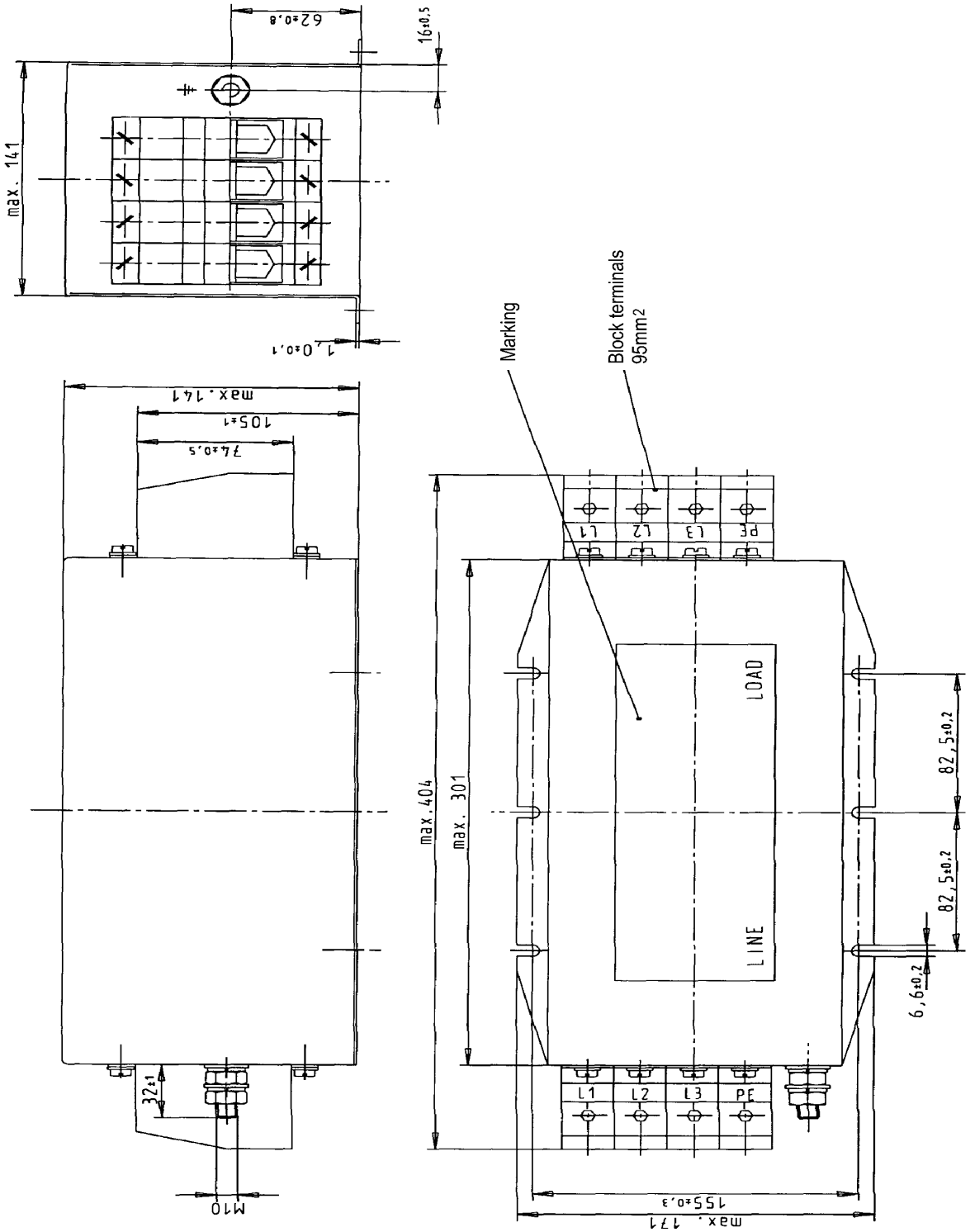




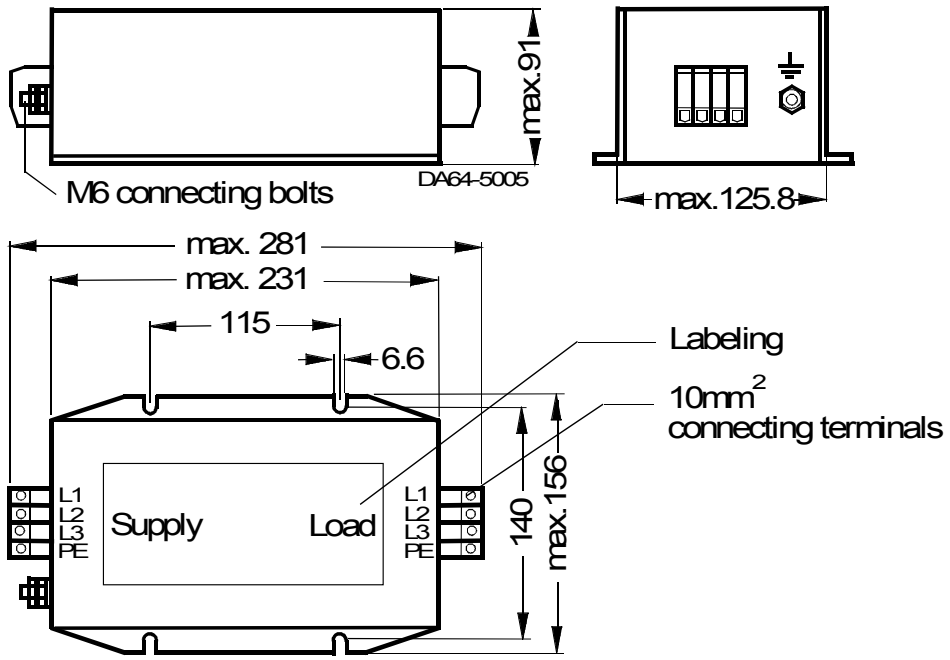
6SE3290-0DJ87-0FA6



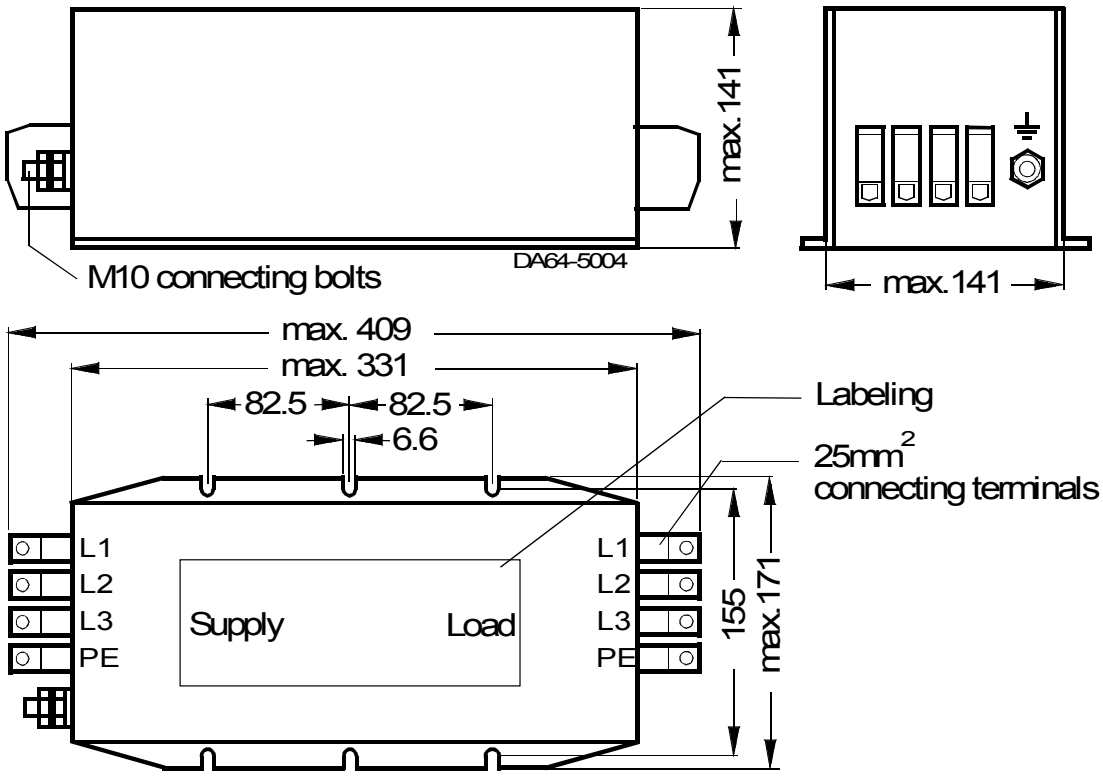
6SE3290-0DK87-0FA7



6SE2100-1FC20 Class B EMC Input Filter



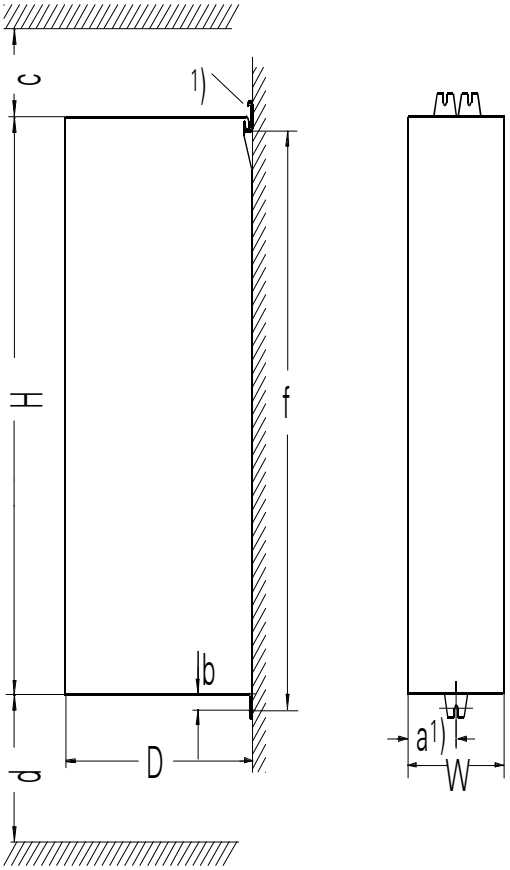
6SE2100-1FC21 Class B EMC Input Filter



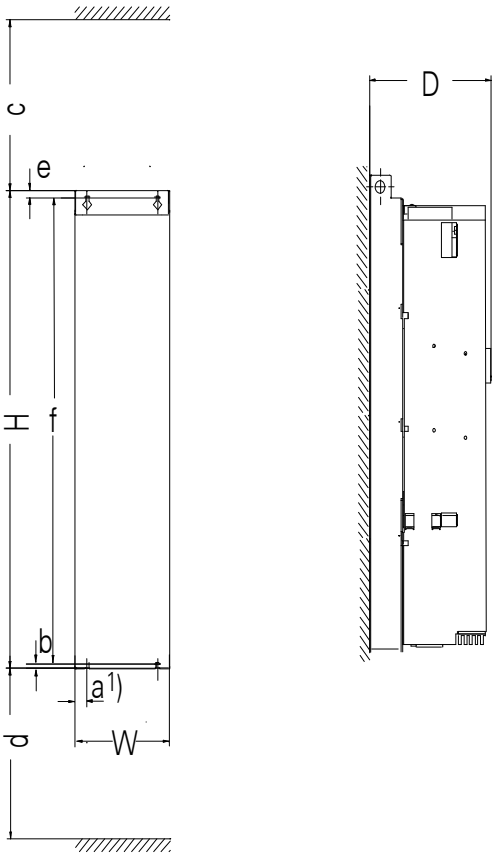
3.12 dV/dt Output Filters

(MASTER DRIVES series)

dV/dt Output Filters Frame Sizes B and C



Frame Size E



dV/dt Output Filter Frame Size: E&S

Output dV/dt Filters - Dimensions and Weights

Filter Frame Size	B	C	E
H [mm]	425	600	1050
W [mm]	135	180	250
D [mm]	350	350	350
a [mm]	67.5	90	45 1)
b [mm]	16	16	10
c [mm]	100	100	350
d [mm]	250	250	400
f [mm]	425	600	1025
Weight approx. [kg]	20	27	55

B: 6SE7016-2FB87-1FD0
6SE7021-5FB87-1FD0

C: 6SE7022-2FC87-1FD0
6SE7023-4FC87-1FD0
6SE7024-7FC87-1FD0

E: 6SE7026-0HE87-1FD0
6SE7028-2HE87-1FD0

1) 2 lugs, left and right

For further details see DA65.10

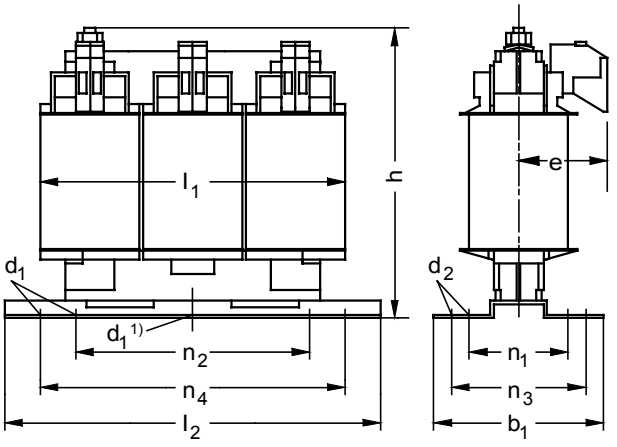
3.13 Input chokes

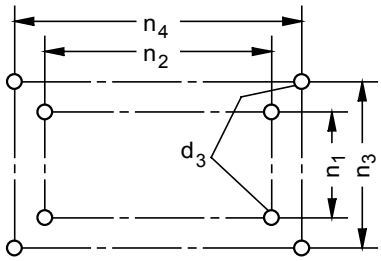
4EP three-phase line reactors

$I_{Ln} \leq 35{,}5$ A

Dimensions

With terminals, for any arrangement of the reactor





n_3 and n_4 mounting holes acc. to EN 60852-4

n_1 and n_2 mounting holes acc. to DIN 41308

Three-phase input choke Type	b_1 max. mm	d_1 mm	d_2 mm	d_3 mm	e max. mm	h max. mm	l_1 max. mm	l_2 max. mm	n_1 ±IT12 mm	n_2 ±IT12 mm	n_3 ±IT12 mm	n_4 ±IT12 mm
4EP32	57.5	4.8	9	M4	56	108	78	88.5	34	1)	42.5	79.5
4EP33	64	4.8	9	M4	55	122	96	124	33	1)	44	112
4EP34	73	4.8	9	M4	59	122	96	124	42	1)	53	112
4EP35	68	4.8	9	M4	57	139	120	148	39	90	48	136
4EP36	78	4.8	9	M4	62	139	120	148	49	90	58	136
4EP37	73	5.8	11	M5	60	159	150	178	49	113	53	166
4EP38	88	5.8	11	M5	67	159	150	178	64	113	68	166
4EP39	99	7	13	M6	62	181	182	219	56	136	69	201
4EP40	119	7	13	M6	72	181	182	219	76	136	89	201

Retaining slot at the centre of the foot

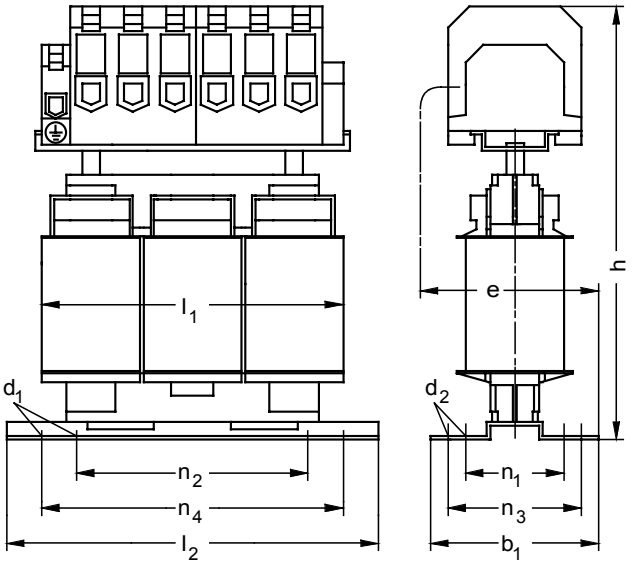
Terminal 8WA9200 (for $I_{Ln} \leq 15$ A)	Cross-sections:	Solid	0.5 mm² to 6.0 mm²
		Stranded	1.5 mm² to 4.0 mm²
Terminal RKW 110 or TRKSD 10	Cross-sections:	Solid	1.0 mm² to 16.0 mm²
(for I_{Ln} 16 A to 35.5 A)		Stranded	1.0 mm² to 10.0 mm²

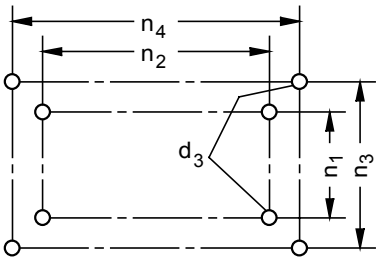
4EP three-phase line reactors

I_{LN} 36 A to 50 A

Dimensions

With terminals, for any arrangement of the reactor





n_3 and n_4 mounting holes acc. to EN 60852-4

n_1 and n_2 mounting holes acc. to DIN 41308

Three-phase input choke Type	b_1 max. mm	d_1 mm	d_2 mm	d_3 mm	e max. mm	h max. mm	l_1 max. mm	l_2 max. mm	n_1 ±IT12 mm	n_2 ±IT12 mm	n_3 ±IT12 mm	n_4 ±IT12 mm
4EP38	88	5.8	11	M5	86	193	150	178	64	113	68	166
4EP39	99	7	13	M6	91.5	220	182	219	56	136	69	201
4EP40	119	7	13	M6	101.5	220	182	219	76	136	89	201

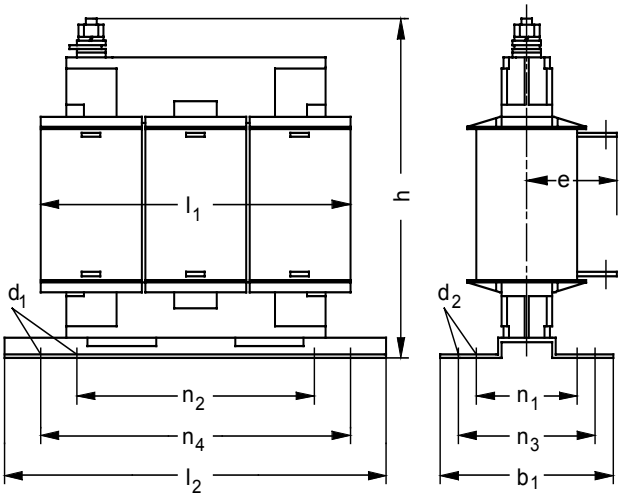
Terminal 8WA1304 (for I_{Ln} 40 A to 50 A)	Cross-sections:	Solid	1.0 mm² to 16.0 mm²
		Stranded	10.0 mm² to 25.0 mm²
		Stranded	2.5 mm^2 to 16.0 mm^2
Associated grounding terminal, EK 16/35		Solid	2.5 mm² to 16.0 mm²
		Stranded	4.0 mm² to 16.0 mm²

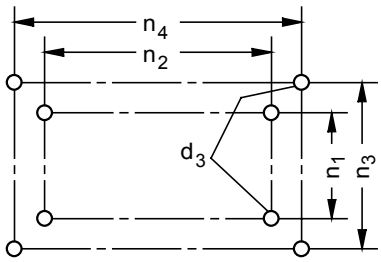
4EP three-phase line reactors

$I_{Ln} \geq 51$ A

Dimensions

With terminals, for any arrangement of the reactor

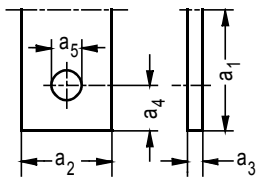




n_3 and n_4 mounting holes acc. to EN 60852-4

n_1 and n_2 mounting holes acc. to DIN 41308

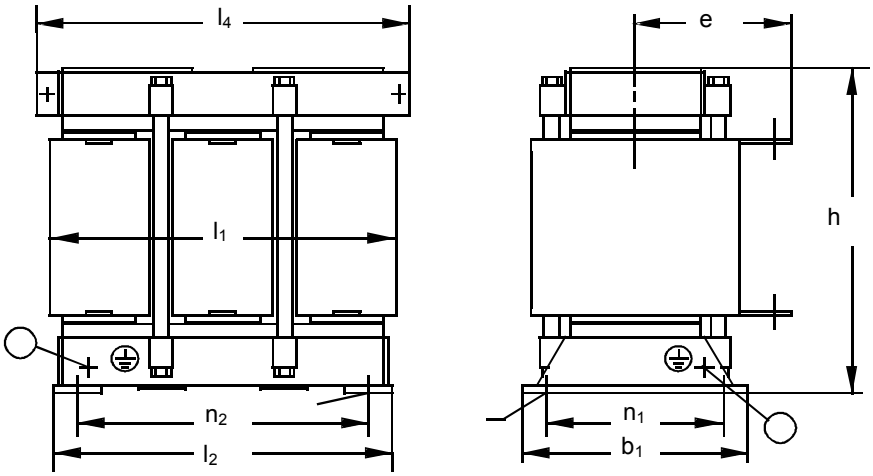
Three-phase line reactor Type	b_1 max. mm	d_1 mm	d_2 mm	d_3 mm	e max. mm	h max. mm	l_1 max. mm	l_2 max. mm	n_1 ±IT12 mm	n_2 ±IT12 mm	n_3 ±IT12 mm	n_4 ±IT12 mm
4EP38	88	5.8	11	M5	76	153	150	178	64	113	68	166
4EP39	99	7	13	M6	73	179	182	219	56	136	69	201
4EP40	119	7	13	M6	83	179	182	219	76	136	89	201

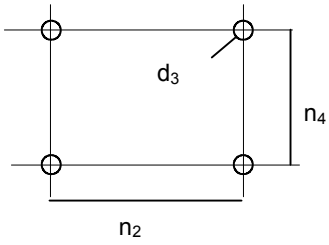
Flat connector	Rated current I_{Ln} A	a_1 mm	a_2 mm	a_3 mm	a_4 mm	a_5 mm
	51 to 80	30	20	3	10	9
	81 to 200	35	25	5	12.5	11

4EU three-phase line reactors

Dimensions

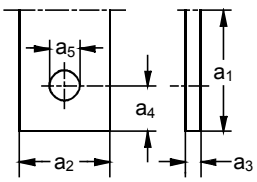
With flat connectors, for mounting the reactor on horizontal surfaces





Mounting holes

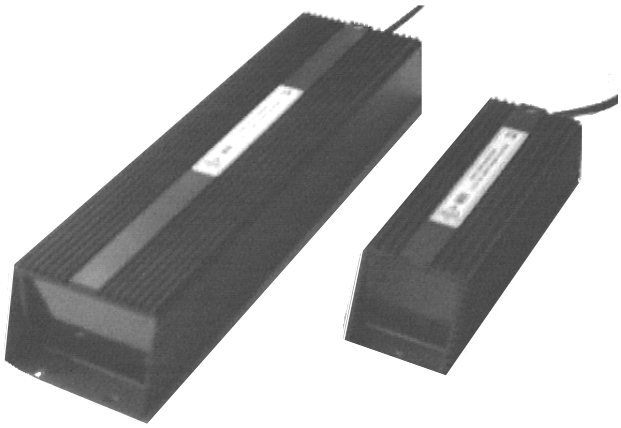
Three-phase mains choke Type	b_1 max. mm	d_1 mm	d_2 mm	d_3 mm	e max. mm	H max. mm	l_1 max. mm	l_2 max. mm	l_4 max. mm	n_1 ± IT12 mm	n_2 ± IT12 mm	① ②
4EU24	104	7	13	M6	80	220	219	206	196	70	176	M6
4EU25	128	7	13	M6	97	220	219	206	196	94	176	M6
4EU27	146	10	18	M8	114	250	255	235	280	101	200	M6
4EU30	155	10	18	M8	116	280	285	264	310	118	224	M6
4EU36	169	10	18	M8	180	335	345	314	360	138	264	M6
4EU39	174	12	18	M10	197	385	405	366	410	141	316	M6
4EU43	194	15	22	M12	212	435	458	416	460	155	356	M6
4EU45	221	15	22	M12	211	435	458	416	460	182	356	M6
4EU47	251	15	22	M12	231	435	458	416	460	212	356	M6
4EU50	195	12.5	12.5	M10	220	565	533	470	518	158	410	M12
4EU52	220	12.5	12.5	M10	242	565	533	470	518	183	410	M12

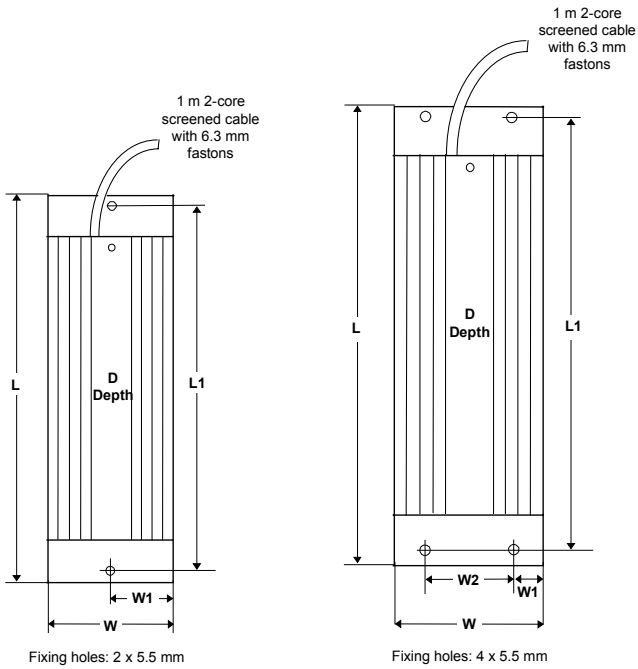
Flat connector	Rated current I_{Ln} A			a_1 mm	a_2 Mm	a_3 mm	a_4 mm	a_5 mm	a_6 mm	a_7 mm
	45	to	80	30	20	3	10	9	-	-
	81	to	200	35	25	5	12.5	11	-	-
	201	to	315	40	30	6	15	14	-	-
	316	to	800	50	40	6	20	14	-	-
	801	to	1000	50	40	8	20	14	-	-

3.14 MICROMASTER Vector - Braking Resistors

The braking resistors are for use with the MICROMASTER Vector range of inverters. They enable high inertia loads to be decelerated rapidly. During deceleration of the motor and load, excess energy is returned to the inverter and is stored in the dc-link capacitors. This causes an increase in the dc-link voltage which, if too high, will trip the inverter. The inverter dissipates the excess energy to the externally-mounted braking resistor.

The resistor case is manufactured from extruded aluminium to dissipate the heat generated during braking/deceleration.





The resistors must be installed in a vertical position and secured to a metal surface (> 0.5 m^2 area) using two/four M5 screws. They are convection-cooled, so a free space of at least 100 mm must be left above and below the components to allow an unimpeded air flow. The resistor must be mounted at least 50 mm from the side of the inverter to prevent excessive heating of the units.

The thermal cut-out switch supplied with the braking resistor should be installed directly onto the resistor body.

Resistor Order No.	Continuous Rating W	Peak Rating (5% duty cycle) W	Resistance (Tol. ± 10%) (Ω)	Pk. volts DC V	Dimensions L mm	L1 mm	W mm	W1 mm	W2 mm	D mm	Weight kg	Inverter Type
6SE3290-0CA87-2RA0	40	800	200	450	200	190	57	28	-	54	1.3	MMV12 - MMV75 MMV12/2 - MMV75/2
6SE3290-0CB87-2RA0	80	1600	100		280	271	57	28	-	54	1.7	MMV110 - MMV150 MMV110/2 - MMV150/2
6SE3290-0CC87-2RA0	200	4000	40		338	330	80	20	40	54	3.1	MMV220 - MMV300 MMV220/2 - MMV400/2
6SE3290-0DA87-2RA0	80	1600	400	900	280	270	57	28	-	54	1.7	MMV37/3 -MMV150/3
6SE3290-0DB87-2RA0	150	3000	200		280	271	83	23	40	54	2.5	MMV220/3 - MMV300/3
6SE3290-0DC87-2RA0	400	7500	85		400	390	103	28	40	52	3.8	MMV400/3 - MMV750/3

During braking, the inverter dissipates the braking energy of the motor and load to the externally mounted resistor. The lower the value of the external resistor the greater the braking power. The resistors are able to dissipate large amounts of energy for short periods but when used continuously, the rating is considerably less. To protect the resistor and the inverter from overload, the MICROMASTER Vector 'chopper circuit' (P070) limits the duty cycle (ratio of 'time on' to 'time off') to 5% (12 seconds in 4 minutes). This reduces the maximum dissipation level of the resistor.

The resistor must be adequately rated to withstand the resulting power dissipation.

3.15 Electronic Braking Module (EBU) & Braking Resistors for MIDIMASTER Vector

Using the Electronic Brake Unit (EBU) and Brake Resistor options, the rotational kinetic energy of the motor and load is regenerated back into the inverter and is converted into heat within the external braking resistors, thus significantly improving the braking effect. The inverter DC link voltage increases during this regenerative operation and its rise is limited by the EBU and the braking resistor.

A reference voltage is established from the incoming mains ac supply. This is compared with the dc link voltage, derived in the inverter. If the dc link voltage is excessively high (which occurs during regenerative braking) the power switch is triggered to reduce this voltage by dissipating energy to the external resistors. The continuous rated power of the braking resistors is 10 % of their peak power. The minimum permissible resistance value for maximum brake unit power for each EBU is specified in the tables below. The duty cycle of the power switch is limited to approximately 10% (typically 5 seconds on, 45 seconds off) to protect the braking resistors from excessive energy dissipation.

The Electronic Brake Unit/s (EBU) should be mounted directly next to the MIDIMASTER Vector unit, and connected to the inverter DC link and Braking Resistor using short-screened feeder cables.

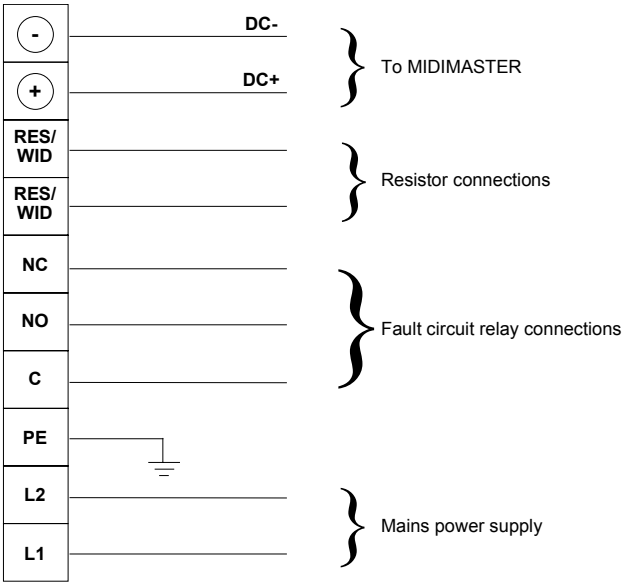
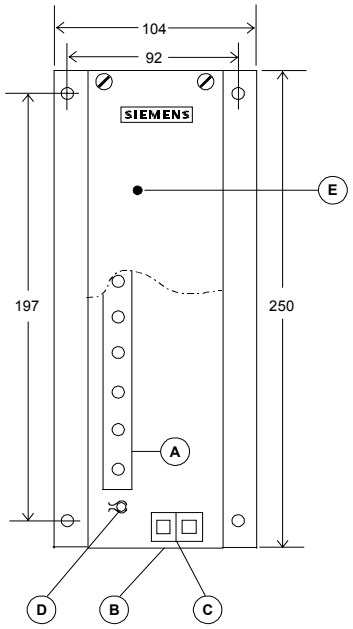


Figure 1: Terminal Block Diagram of the Electronic Brake Unit (EBU)



Depth: 146 mm

Fixing holes: 4 x 6.5 mm diameter

Weight: 2.2 kg

All measurements in millimetres.

A Terminal Rail X1 *(see section 4.2)*

B Cable entries

C Cable ties

D Internal fuse 38 mm (100 mA time delay)

E ON/Fault LED

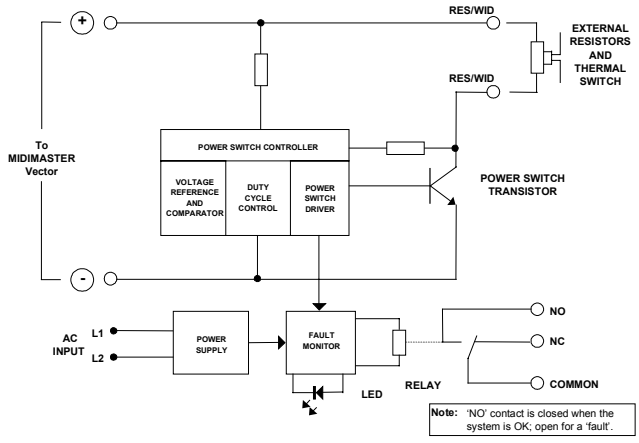


Figure 1: Block Diagram - Electronic Braking Unit

Figure 2: Block Diagram of the Electronic Brake Unit with External Brake Resistor

EBU Technical Specifications

Ambient temperature:	0 to 40°C
Storage/transport temperature:	-30 to +85°C
Degree of protection:	IP20,
External braking resistors:	IP20
Humidity (non-condensing):	0 to 95%

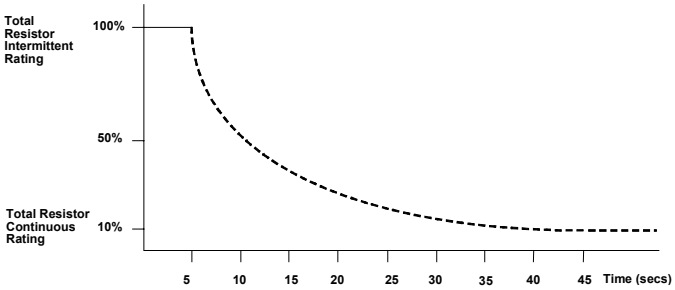


Figure 3: Timing Diagram for the Electronic Brake Unit

Resistor Type	A	B	D	E
Dimensions L x W x H (mm)	560 x 185 x 150	560 x 365 x 150	560 x 365 x 150	495 x 425 x 300
MIDIMASTER Vector Mains Supply Voltage	208 -240	208 - 240	380 - 500	380 - 500
Resistance (Ω)	20	10	40	20
Pulse Power (kW)	7.5	15	15	30
Average Power (kW)	1.25	2.5	2.5	5
Part Number (MLFB)	**6SE3213-6SP87-0RA0**	**6SE3221-4SP87-0RA0**	**6SE3214-0TP87-0RA0**	**6SE3222-4TP87-0RA0**

During braking, the EBU dissipates the braking energy of the motor and load to the external power resistors. The lower the value of the external resistor the greater the braking power. The resistors can dissipate large amounts of energy for short periods but when used continuously, their dissipation is considerably less. In order to protect the resistors from overload, the EBU limits its duty cycle (ratio of time on to time off) to 10%. This reduces the maximum dissipation level to that shown in Figure 3.

Inverter Model	EBU		Associated Resistor Data					
Type	EBU Model Order No.	Min. Total Resistance Value per EBU Ω	Resistor Order No.	Res. Ω	Peak Instantaneous rating (5 sec) kW	20% Duty Rating kW	Cont. Rating kW	Peak. volts DC V
MD(V)550/2 to MDV4500/2	**6SE3190-0CX87-2DA0**	10	**6SE3213-6SP87-0RA0**	20	7.5	5	1.25	380
			6SE3221-4SP87-0RA0	10	15	10	2.5	380
MD(V)750/3 to MDV7500/3	**6SE3190-0DX87-2DA0**	20	**6SE3214-0TP87-0RA0**	40	15	10	2.5	950
			6SE3222-4TP87-0RA0	20	30	20	5	950
MDV220/4 to MD(V)3700/4	***For EBU availability for these inverters, contact your local Siemens sales office.***							

Braking Resistors

Resistor Type	Order Number	Continuous Rating kW	Peak Inst. Rating kW	Resistance (Ohms) Ω	Notes
A	**6SE3213-6SP87-0RA0**	1.25	7.5	20	Only for mains supplies
B	**6SE3221-4SP87-0RA0**	2.5	15	10	208 V - 240 V
D	**6SE3214-0TP87-0RA0**	2.5	15	40	Only for mains supplies
E	**6SE3222-4TP87-0RA0**	5	30	20	380 V - 500 V

If the EBU is to be used with high inertia loads (or very short ramp-down times), additional resistors may be required to be connected in parallel or several EBUs to be connected in parallel.

Braking Power for 208 - 240 V Inverters

Inverter Type	Inverter Rating kW	Braking Power (minimum)	Peak Braking Power kW	Total Number of External Braking Units Required	Total Number of Resistors Required	Type of Resistor/s
MDV550/2	5.5	Medium	7.5	1	1	A
		High	15	1	1	B
MDV750/2	7.5	Medium	7.5	1	1	A
		High	15	1	1	B
MDV1100/2	11	Medium	7.5	1	1	A
		High	15	1	1	B
MDV1500/2	15	Low	7.5	1	1	A
		Medium	15	1	1	B
		High	30	2	2	B
MDV1850/2	18.5	Low	7.5	1	1	A
		Medium	15	1	1	B
		High	30	2	2	B
MDV2200/2	22	Low	7.5	1	1	A
		Medium	15	1	1	B
		High	30	2	2	B
MDV3000/2	30	Low	15	1	1	B
		Medium	15	1	1	B
		High	30	2	2	B
MDV3700/2	37	Low	15	1	1	B
		Medium	30	2	2	B
		High	45	3	3	B
MDV4500/2	45	Low	15	1	1	B
		Medium	30	2	2	B
		High	60	4	4	B

Braking Power for 380 - 500 V Inverters

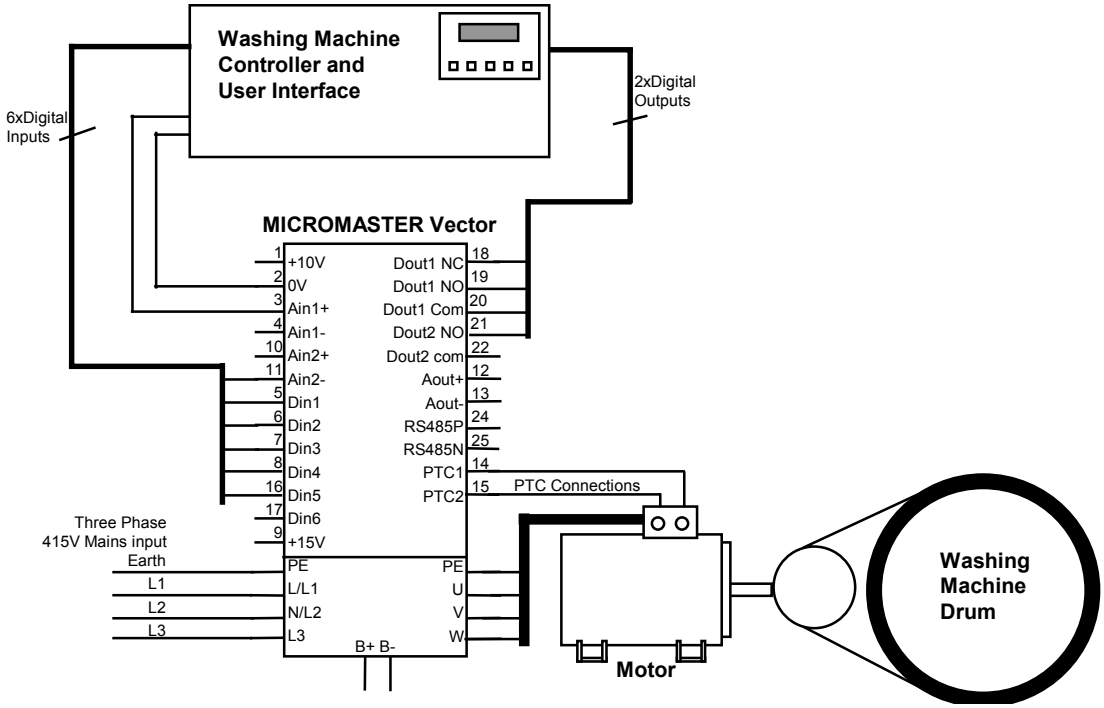
Inverter Type	Inverter Rating kW	Braking Power (minimum)	Peak Braking Power kW	Total Number of External Braking Units Required	Total Number of Resistors Required	Type of Resistor/s
MDV750/3	11(VT)	Medium	15	1	1	D
		High	15	1	1	D
MDV1100/3	11	Medium	15	1	1	D
		High	15	1	1	D
MDV1500/3	15	Medium	15	1	1	D
		High	15	1	1	D
MDV1850/3	18.5	Low	15	1	1	D
		Medium	15	1	1	D
		High	30	1	1	E
MDV2200/3	22	Low	15	1	1	D
		Medium	15	1	1	D
		High	30	1	1	E
MDV3000/3	30	Low	15	1	1	D
		Medium	30	1	1	D
		High	60	2	2	E
MDV3700/3	37	Low	15	1	1	D
		Medium	30	1	1	E
		High	60	2	2	E
MDV4500/3	45	Low	15	1	1	D
		Medium	30	1	1	E
		High	60	2	2	E
MDV5500/3	55	Low	15	1	1	D
		Medium	60	2	2	E
		High	90	3	3	E
MDV7500/3	75	Low	30	1	1	E
		Medium	60	2	2	E
		High	120	4	4	E

Note:
*Do **not** connect together the RES/WID output of parallel EBUs when using multiple EBUs.*

4. STANDARD APPLICATIONS

4.1 Industrial Washing Machine

A typical washing machine application presents a problem due to the requirements for a very smooth torque at low speed and a very high spin speed. The high starting torque and fast dynamic response of the MICROMASTER Vector allow smooth rotation of the drum under all conditions enabling it to be used in such an application without problem.



In the example shown, the typical speed at the start of a wash cycle is 5Hz and during the spin cycle it is as high as 150Hz. The control system in the example is a custom designed unit, reflecting the high sales volume of such a system.

The drive is controlled via the digital inputs which are configured for start, direction control, binary coded fixed frequencies and selection of ramp rates. This gives a high degree of flexibility by allowing the selection of 8 fixed frequencies in both directions and 2 different ramp up/ramp down times, one for the wash cycle and one for the spin cycle. A further refinement in the design is the use of the analogue input on the drive for an extra degree of control. This allows the controller to trim a preset fixed frequency to an exact frequency for a speciality wash such as silk.

The relay outputs of the drive are configured to switch when the setpoint is reached and when a fault is detected. In this application, a motor with an inbuilt PTC is used as the motor can reach very high temperatures. The PTC is connected directly to the drive and the drive will switch the motor off and report a fault if it gets too hot.

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

System Specifications:

Motor	7.5 kW 230 V 3 phase induction motor with built-in PTC thermistor
Control System	Custom controller
Drive	MICROMASTER Vector 6SE32 7.5 kW 380 V
Drive Control Interface	Digital input control with Run Right, Run Left, 8 fixed frequencies, 2 selectable ramp rates, additional adjustment of fixed frequency by analogue input

Parameter settings for this application which are changed from their defaults:

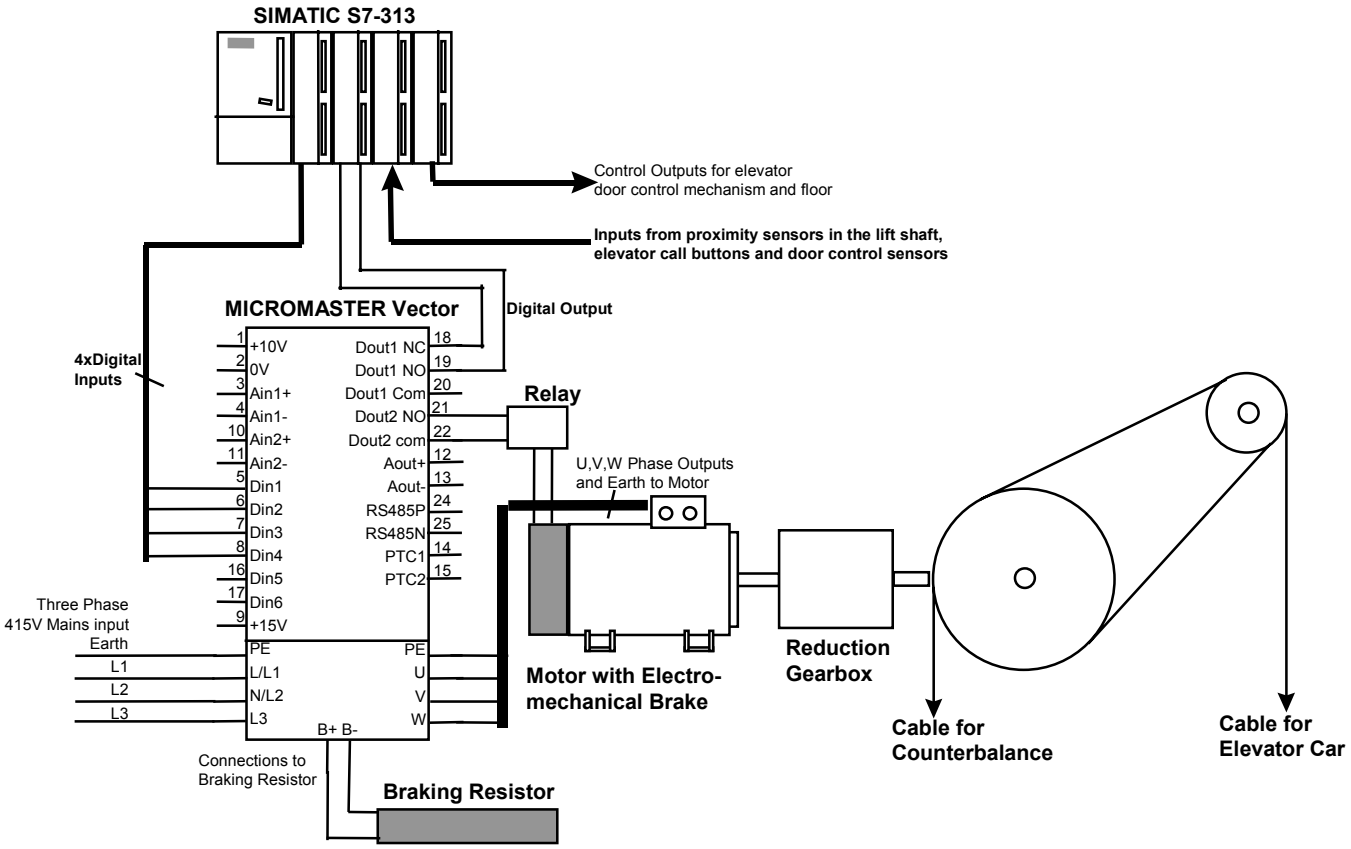
Note that P009 must be set to 2 or 3 before parameter numbers above P009 can be modified.

Number	Value	Meaning
P002	1.0	Ramp Up time 1.0 s
P003	1.0	Ramp Down time 1.0 s
P006	2	Fixed Frequency Operation
P007	0	Drive control via digital inputs
P013	150.00	Maximum output frequency 150.00 Hz
P024	1	Analogue Input Setpoint (0-50 Hz) added to selected frequency
P033	20.0	Alternative Ramp Up time 20.0 s
P034	20.0	Alternative Ramp Down time 20.0 s
P043	20.00	Fixed Frequency 3 = 20.00 Hz
P044	40.00	Fixed Frequency 4 = 40.00 Hz
P046	60.00	fixed Frequency 5 = 60.00 Hz
P047	80.00	Fixed Frequency 6 = 80.00 Hz
P048	100.00	fixed Frequency 7 = 100.00 Hz
P049	150.00	Fixed Frequency 8 = 150. 00Hz
P053	17	Din 3 Binary Coded fixed frequency selection of fixed frequencies 1 to 8
P054	17	Din 4 Binary Coded fixed frequency selection of fixed frequencies 1 to 8
P055	17	Din 5 Binary Coded fixed frequency selection of fixed frequencies 1 to 8
P356	16	Select between normal and alternative ramp rates
P062	7	Inverter setpoint reached
P077	3	Sensorless Vector control mode
P080	0.85	Motor rating plate power factor = 0.85
P082	1380	Motor rating plate speed = 1380 RPM
P083	3.30	Motor rating plate current = 3.3 A
P087	1	Enable Motor PTC Protection

The motor rating plate parameters correspond to a 1LA2 750W 4 pole motor connected in Delta.
(7.5kW)

4.2 Elevator Car Control

The car in a typical elevator system, in combination with the counterbalance, presents a high inertia load to the drive system. This means that the drive must produce a high starting torque from the motor to ensure smooth starting. The MICROMASTER Vector and MIDIMASTER Vector are ideal for such an application as they are rated for a 200% overload for 3 seconds eliminating the need for drive derating. Vector control and configurable S-Curves allow smooth travel for the elevator car under all conditions as well as maintaining passenger comfort, particularly during the critical start and stop phases. The MICROMASTER and MIDIMASTER Vector drives also offer configurable braking resistor options, DC output when the motor is stopped and motor prefluxing.



In the example shown, a MICROMASTER Vector is used in a small (3 floor) lift system. A braking resistor is used to enhance the stopping performance of the elevator system. There are 2 fixed frequencies, 50Hz equating to 1m/s and 6Hz for when the lift is approaching a stop. The ramp times are 3 seconds with 0.7 seconds of ramp smoothing. Control is over the digital inputs which are used to select run direction (Din1, Din2), fixed frequency (Din3, Din4) and in this case, DC injection brake enable (Din5). One output relay is used for operating the motor brake, the other is configured to report faults to the lift controller.

After releasing the motor brake, the lift is accelerated along the shaft, reaching its 50Hz operating speed. There are proximity sensors in the lift shaft which are connected to the PLC and which inform the system that the elevator car is approaching a floor and that it should slow down and then stop. When the car passes the first proximity sensor, the lift is decelerated to its lower speed. When the second is passed, the lift stops and the motor brake is reapplied.

A SIMATIC S7-313 was selected as a controller with the performance and expansion capability to handle all the I/O from proximity sensors, request switches in the lift and floors, indicators, etc.

System Specifications:

Motor	7.5 kW 400 V 3 phase induction motor with electromechanical brake
Control System	SIMATIC S7-313 PLC, with I/O Modules, 64 digital inputs, 32 digital outputs
Drive	MICROMASTER Vector 6SE32 7.5 kW 400 V
Drive Control Interface	Digital input control with Run Right, Run Left, 2 fixed frequencies

Parameter settings for this application which are changed from their defaults:

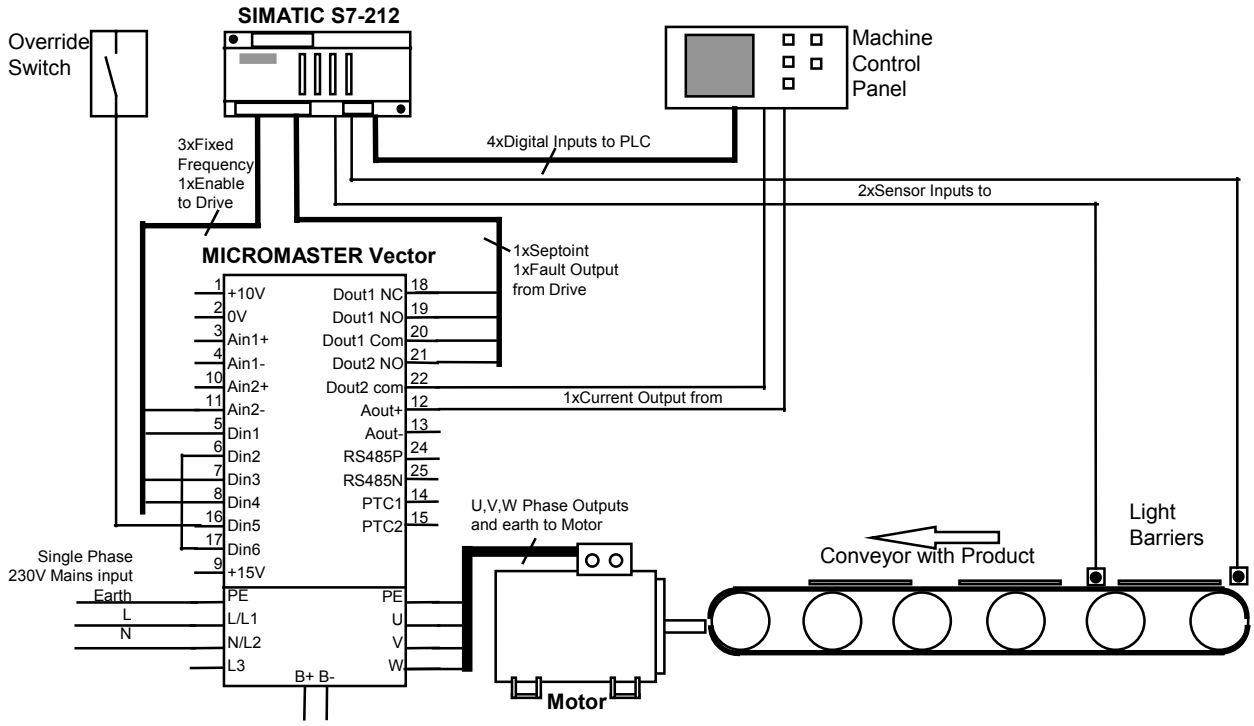
Note that P009 must be set to 2 or 3 before parameter numbers above P009 can be modified.

Number	Value	Meaning
P002	3.0	Ramp Up time 3.0 s
P003	3.0	Ramp Down time 3.0 s
P004	0.7	0.7 s Ramp Smoothing
P006	2	Fixed Frequency Operation
P007	0	Drive control via digital inputs
P012	2.00	Minimum output frequency 2.00 Hz (motor brake applied at this frequency)
P041	15.00	Fixed Frequency 1 = 50.00 Hz (Din1)
P042	3.50	Fixed Frequency 2 = 6.00 Hz (Din2)
P061	4	Operate external brake
P062	6	Fault indication
P063	0.5	Brake applied for 0.5 s at minimum frequency before starting
P064	1.0	Brake applied for 1.0 s at minimum frequency before stopping
P073	100	100% DC braking applied when requested via Din5
P075	1	Braking Resistor value
P077	3	Sensorless Vector control mode
P080	0.82	Motor rating plate power factor = 0.82
P082	1455	Motor rating plate speed = 1455 RPM
P083	15.3	Motor rating plate current = 15.3 A

The motor rating plate parameters correspond to a 1LA7 7.5 kW 4 pole motor connected in Star.
(7.5kW)

4.3 Ceramic Tile Conveyor

In a typical ceramic application, a conveyor is used to transport the tiles to a stacker. The conveyor is necessary to ensure that the tiles are equally spaced on each row of the stacker. In the application below, the conveyor is started when the tile being loaded crosses the first light barrier and is stopped when the tile crosses the second light barrier.



The drive is started and stopped by the Simatic S7-212 PLC using Din1. The selection of the required motor frequency is achieved using Dins 4 and 5 which are configured as binary coded fixed frequency inputs, so 2 inputs can select between 4 frequencies. Din2 is used to select between ramp rates. This configuration allows the system to be used for different product types with faster frequencies and a shorter ramp up/down for smaller, lighter tiles.

The user selects the product type on the machine operator panel which communicates the information to the PLC via 4 digital inputs. 2 digital outputs from the PLC are used as an information feedback path. The panel is also used to control and visualise the process. The drive output relays are connected to the PLC and indicate the required output frequency is reached and also the occurrence of a fault state. The analogue output of the drive is connected directly to the control panel and is used to indicate the motor current. If the current is consistently high it is an indication that the motor bearing or some other moving part is wearing and will shortly require maintenance. An override switch is connected directly to Din6 on the drive and allows the user to quickly switch the drive output off (OFF2) without having to remove power.

The MICROMASTER Vector is particularly suitable for this application due to high and controlled starting torque allowing for very short ramp times without causing the motor to slip and also due to consistent response times resulting in accurate spacing between the tiles.

A SIMATIC S7-212 was selected as a cost-effective controller with sufficient I/O for this application.

System Specifications:

Motor	1.1 kW 400 V 3 phase AC squirrel cage motor type 1LA2
Control System	SIMATIC S7-212 PLC, 8 digital inputs, 6 digital outputs
Drive	MICROMASTER Vector 6SE32 1.1 kW 400 V
Drive Control Interface	Digital input control with Run Right, 4 fixed frequencies, 2 selectable ramps, OFF2

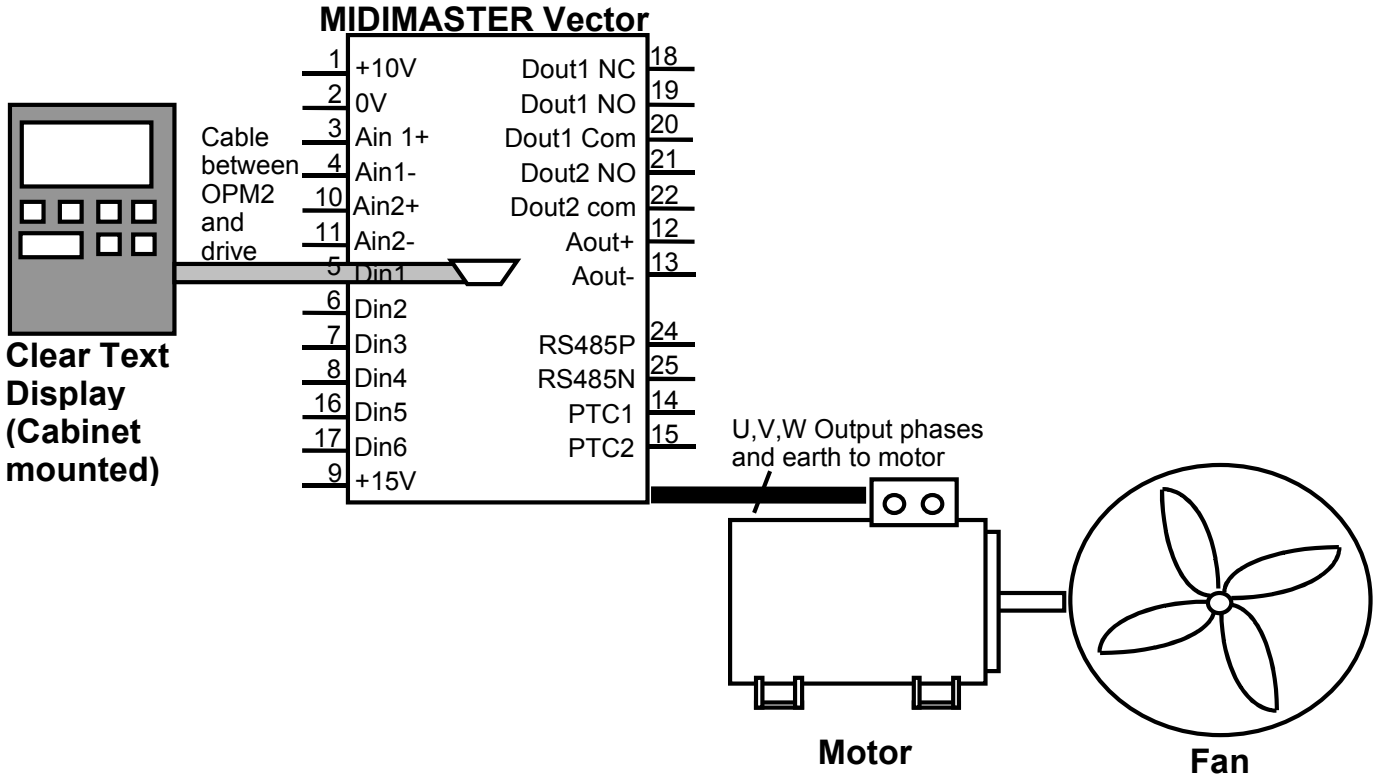
Parameter settings for this application which are changed from their defaults:

Number	Value	Meaning
P002	0.1	Ramp Up time 0.1 s
P003	0.1	Ramp Down time 0.1 s
P006	2	Fixed Frequency
P007	0	Drive control via digital inputs
P009	3	Allow access to all parameters
P013	75.00	Maximum output frequency 75.00 Hz
P025	2	Analogue Output shows motor current
P033	1.0	Alternative Ramp Up time 1.0 s
P034	1.0	Alternative Ramp Down time 1.0 s
P041	25.00	Fixed Frequency 1 = 25.00 Hz
P042	35.00	Fixed Frequency 2 = 35.00 Hz
P043	55.00	fixed Frequency 3 = 55.00 Hz
P044	75.00	Fixed Frequency 4 = 75.00 Hz
P052	16	Din 2 Select between normal and alternative ramp times
P053	17	Din 3 Binary Coded fixed frequency selection of fixed frequencies 1 to 4
P054	17	Din 4 Binary Coded fixed frequency selection of fixed frequencies 1 to 4
P055	17	Din 5 Binary Coded fixed frequency selection of fixed frequencies 1 to 4
P356	4	Din 6 OFF2 (disable output)
P062	7	Inverter setpoint reached
P077	3	Sensorless Vector control mode
P080	0.80	Motor rating plate power factor = 0.80
P082	1410	Motor rating plate speed = 1410 RPM
P083	2.7	Motor rating plate current = 2.7 A

The motor rating plate parameters correspond to a 1LA2 1.1 kW 4 pole motor connected in Star.
(1.1kW)

4.4 Energy Saving Variable Speed Fan Operation

A fan system with a mechanical variable flow device (such as a throttle valve) can be upgraded to an electronically controlled system with great benefits in power saving and operating noise.



Note that the Clear Text Display module is included free of charge with each MIDIMASTER Vector.

In the example shown, a MIDIMASTER Vector is used to control the speed of a ventilation fan. The drive is configured with a quadratic torque control curve, so that at speeds below the 50Hz nominal speed the power consumption is vastly reduced as the motor current reduces quadratically in relation to the output frequency.

Due to the IP21 protection rating of the drive, it is mounted in a cabinet and operated by the Clear Text Display which is mounted in the cabinet door and connected to the MIDIMASTER Vector with a cable. As well as switching the fan on and off the speed may be varied by using the Clear Text Display panel. This is achieved by pressing the Up Arrow key to increase the speed and the Down Arrow key to decrease the speed.

This is known as the motorised potentiometer function. The drive is configured so that the speed settings made with the keys are memorised even after a power fail. A further refinement is the flying start function which allows the drive to synchronise itself to the fan even if the fan is already turning (e.g. following a power break or fault condition). The reverse key on the display is disabled to prevent inadvertent damage to the fan. All required information such as speed, current and drive status is on the display.

If resonances are experienced in the system these can be suppressed by using the skip frequency bands P014, P027, P028 and P029.

Standard Applications
MICROMASTER
MICROMASTER Vector
MIDIMASTER Vector

System Specifications:

Motor	18.5 kW 400 V 3 phase squirrel cage motor
Control System	Clear Text Display unit
Drive	MIDIMASTER Vector 6SE32 18.5 kW 400 V
Drive Control Interface	Keypad control with start, stop and motorised potentiometer (reverse and jog functions disabled)

Parameter settings for this application which are changed from their defaults:

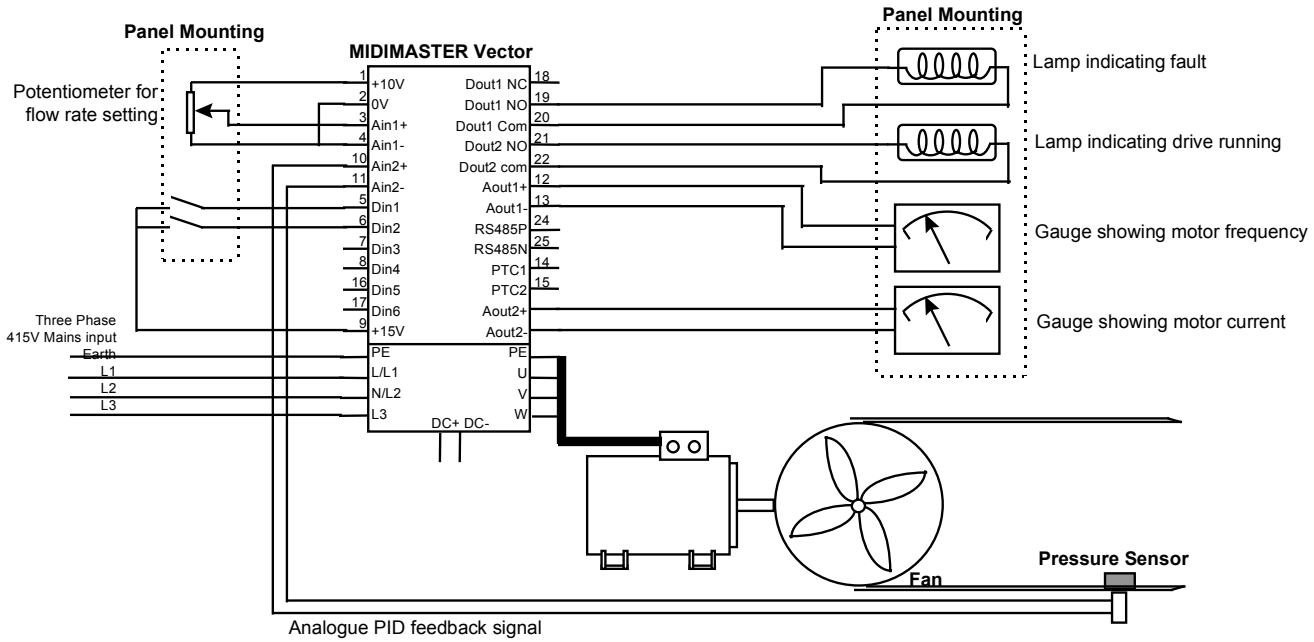
Note that P009 must be set to 2 or 3 before parameter numbers above P009 can be modified

Number	Value	Meaning
P006	2	Motorised potentiometer enabled
P011	1	Motorised potentiometer adjustment settings stored on power down
P016	3	Flying Start in forward direction enabled
P077	2	Quadratic V/F curve selected
P080	0.86	Motor rating plate power factor = 0.86
P082	1465	Motor rating plate speed = 1465 RPM
P083	34.5	Motor rating plate current = 34.5 A
P122	0	Reverse Key disabled
P123	0	Jog Key disabled
P125	0	Reverse direction disabled

The motor rating plate parameters correspond to a 1LA5 18.5 kW 4 pole motor connected in Star.
(18.5kW)

4.5 Ventilation System Using Closed Loop PID Control

In applications such as Clean Room Ventilators, it is necessary for a constant pressure to be maintained within the ventilator. This can be achieved by driving the fan within the ventilator with a MICROMASTER, MICROMASTER Vector or MIDIMASTER Vector which have built-in PID controllers (PI in the case of MICROMASTER) allowing a closed loop process control system to be designed without external controllers. The actual value processor can be directly connected to the analogue input of the drive and powered directly from the +15V power supply available from the terminal block.



In the example shown, a MIDIMASTER Vector is used and the required ventilator pressure is set by using the analogue input. The feedback signal from the pressure sensor is connected to the second analogue input which is configured for PID control. The drive is switched on and off via the digital input and a second input is used for resetting any faults which occur.

The drive itself is mounted within the cabinet and the control switches and speed potentiometer are fitted to the cabinet door. Two indicator lamps are used, connected directly to the output relays to indicate drive running and fault occurred. Two analogue gauges are used, connected to the analogue outputs of the drive, to show motor speed and motor current.

The pressure across the ventilator can be varied between 1 and 2 Bar. The pressure sensor selected outputs a 4 to 20mA signal whereby 4mA corresponds to 0 Bar and 20mA corresponds to 4 Bar.

Note that when the PID mode is enabled (by setting P201 to 1) the setpoints are referred to percentages of the process value rather than absolute values. This means that in the example described, a setpoint of 50 means 50% which equates to 5 Bar. Since the setpoint is from the analogue input, the analogue maximum value (P022) needs to be changed to 50 (50% corresponding to 8 Bar) and the minimum to 25 (25% corresponding to 4 Bar).

The following procedure should be followed to set the P, I and D terms:

1. If possible, select fast ramp up and ramp down times (P002, P003).
2. In this case P211 (0% setpoint value) should be set to 25% to correspond to the 1 Bar minimum pressure.
3. P212 (100% setpoint value) should be set to 50% to correspond to the 2 Bar maximum pressure.
4. Switch on the system and allow the speed of the fan to stabilise.

5. Increase P202 (Proportional Gain) until the fan speed starts to oscillate, then reduce P202 by 5%.

The system is now being controlled using only proportional control.

6. Check the control loop error by subtracting the value in P210 (feedback transducer value) from the setpoint value. If the error is not acceptable then the I term will need to be set.

7. When using I gain it is advisable to enter a value into P207 (Integral Capture Range) to reduce instability particularly when the error is very large, e.g. during ramp up. Typically, P207 should be set to 1.5 times the error established when using P Gain only.

8. Set P203 (Integral Gain) to the smallest value which gives acceptably fast settling to the required value.

9. If derivative gain is required, this must be set by using an oscilloscope to observe the change in feedback response to a step change in setpoint.

For this example, the value of P gain was set at 0.2 and I gain 0.05. D gain was not required.

Two further refinements in this design are the use of flying start to allow the drive to synchronise onto a spinning motor and automatic start on power up so that the drive will start when power is applied if the run switch is closed.

System Specifications:

Motor	11 kW 400 V 3 phase induction motor
Control System	Panel mounted switches and potentiometer, pressure sensor output used as closed loop feedback direct to drive
Drive	MIDIMASTER Vector 6SE32 11 kW 400 V
Drive Control Interface	Digital input control with Run Right and Fault Reset, Analogue setpoint select

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

Parameter settings for this application which are changed from their defaults:

Note that P009 must be set to 2 or 3 before parameter numbers above P009 can be modified.

Number	Value	Meaning
P002	3.00	Ramp Up time 3.0 seconds
P003	3.00	Ramp Down time 3.0 seconds
P006	1	Analogue setpoint control
P007	0	Front panel keys disabled
P015	1	Automatic start on power up if run switch is enabled
P016	3	Flying Start in forward direction enabled
P021	25.00	Minimum analogue setpoint 25%
P022	50.00	Maximum analogue setpoint 50%
P026	2	Analogue output 2 indicates motor current
P052	10	Din2 used to reset drive fault
P062	1	Relay output 2 indicates drive running
P077	2	Quadratic V/F curve selected
P080	0.83	Motor rating plate power factor = 0.83
P082	1460	Motor rating plate speed = 1460 RPM
P083	21.9	Motor rating plate current = 21.9 A
P201	1	PID closed loop control enabled
P202	0.2	Proportional Gain coefficient 0.2
P203	0.05	Integral Gain coefficient 0.05
P207	10	Integral error is cleared if the error between setpoint and feedback >10%
P211	25.00	0 setpoint corresponds to 25%
P212	50.00	Full setpoint corresponds to 50%
P323	1	Analogue input 2 (PID input) configured for 4 – 20 mA

The motor rating plate parameters correspond to a 1LA7 11 kW 4 pole motor connected in Star.
(11kW)

5. USER INTERFACES

5.1 Communications, Operator Control and Visualisation

The operator control and visualisation of MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector are identical.

The frequency inverters can be controlled, visualized and parameterised either at the inverter itself or externally:

1. At the drive converter via:
   - The 7-key membrane keypad included as standard
   - The optional OPM2 plain text operator control panel
   - The control terminal strip
2. Externally via:
   - The serial RS 485 interface
   - The optional OPM2 plain text operator control panel
   - The optional PROFIBUS module
   - A PC with SIMOVIS

5.2 Standard Operator Control Panel

The standard operator control panel possesses 7 keys and 4 x 7 segment LED displays and includes the following functions:

- Frequency inverter start-up.
- Operator control.
- Motor On/off, increase/decrease motor frequency setpoint.
- Selection of clockwise/counter-clockwise direction of rotation, inching frequency via the jog key.
- Starting and stopping with a preset frequency.
- Displaying motor frequency setpoints and actual values.
- Displaying and changing parameters.
- Displaying frequency inverter status.
- Displaying alarm messages.
- Displaying and resetting fault messages.

The function keys can be individually inhibited. For safety reasons, the OFF key is always active.

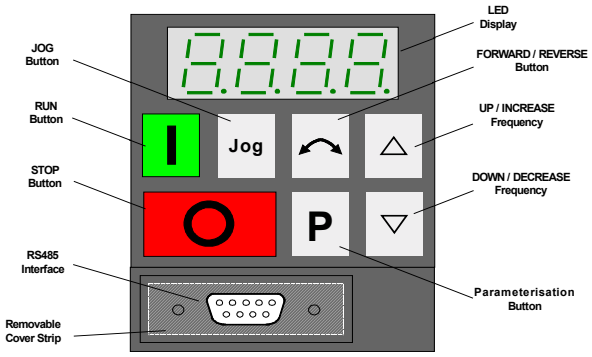


Figure 1: Standard Operator Control Panel

There is a 9-pin SUB-D socket connector (X502) on the membrane keypad which provides access to the RS 485 interface. This is also the interface to allow the optional PROFIBUS Module or Clear Text Operator Panel to be connected. The drive can be connected directly to a PC by using the RS232 interface on the Clear Text Operator Panel.

5.3 Serial RS 485 Interface

The RS 485 interface of the MICROMASTER and MIDIMASTER operates with the USS protocol, can be networked with 31 nodes through a bus and permits a maximum data transmission rate of 19.2 kbit/s.

The RS 485 interface is accessible via a SUB-D socket connector (see **Table 1** for Pin Assignment) and, on the 6SE32 drives, control terminal strip.

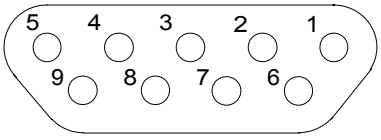


Figure 5.2: Pin Layout of the SUB-D socket connector

Terminal	Function, information
1	NC (not connected)
2	NC
3	Send-and-receive line RS 485, two-wire, positive differential input/output B/P
4	NC
5	Reference potential, 0V
6	5V/250mA power supply
7	NC
8	Send-and-receive line, RS 485, two-wire negative differential input/output A/N
9	NC

Table 5.1: Pin assignment for the SUB-D socket connector

Notes:

1. *Also refer to the documentation: "Universal Serial Interface Protocol Specification":*
   Order No. E20125-D0001-S302-A1 (German)
   Order No. E20125-D0001-S302-A1-7600 (English)
2. *If the PROFIBUS Module is connected to the SUB-D socket on the front panel, then the internal RS 485 connections of the 6SE32 drive (terminals 23 and 24) may not be used.*
3. *If the Clear Text Display is connected to the SUB-D socket on the front panel, then the internal RS485 connections on the 6SE32 drive (terminals 23 and 24) must not be connected to a PC, PLC or any other serial bus master.*
4. *It is not possible to connect simultaneously the PROFIBUS Module and the Clear Text Display to the drive.*

5.4 Control Terminal Strips

All of the functions required to operate and monitor MICROMASTER and MIDIMASTER are accessible via control terminal strips.

- Control commands, e.g. on/off, clockwise/counter-clockwise, inching.
- Analog setpoint inputs.
- Digital set-point inputs, e.g. fixed frequency.
- Digital outputs, e.g. operation, alarm.
- Analog outputs eg. frequency setpoint, output current.

The response times of the inputs are as follows:

Digital input:	25 ms, depending on the debounce time (P056)
Analog input:	15 ms for step signals (> 0.5 V)
RS 485 interface:	25 ms

For further information on using the control terminals, see section 3.4.

5.5 Clear Text Display (Optional)

5.5.1 Use of the Clear Text Display

The optional Clear Text Display is intended to enhance the ease of use of the MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector. It is also intended for use with the COMBIMASTER. The user is offered a text-driven format for commissioning, parameterising, configuring and operating the inverter. The following features are included:

- Illuminated high resolution LCD screen with adjustable contrast.
- 7 languages.
- Central device for up to 31 inverters which are networked together via USS.
- Up to 10 parameter sets can be stored in non-volatile memory for uploading and downloading between the clear text operator panel and the drive.
- Help texts for diagnosing faults.
- Isolated RS232 interface for connecting to a PC.

The Clear Text Panel is a push fit to the front of the drive (no screws necessary) and is removed by pulling the clip underneath the unit.

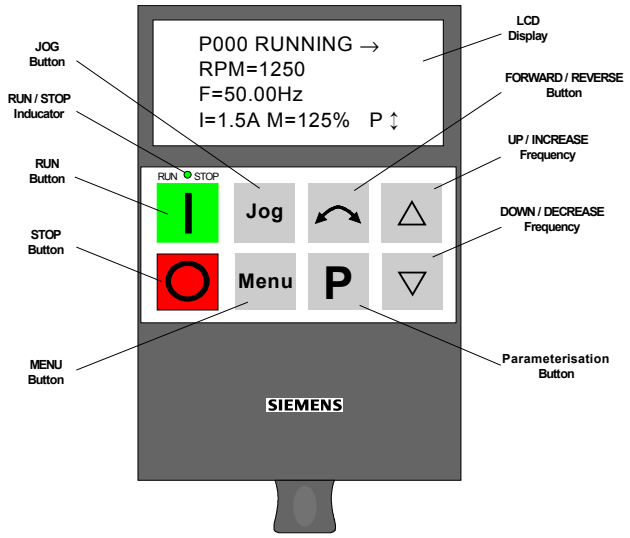
The unit may be connected to the drive via a cable and used as a hand-held terminal. The unit can also be fitted to a cabinet door and thus used as a low cost man machine interface for one or more drives in a cabinet.

If the Clear Text Display is used as interface converter RS232 / RS484, an additional 6V DC supply is required. In this case the operator panel can be used without the inverter. See section 5.5.2 for a specification of the interface.

The Clear Text Display is automatically activated when it is connected to a drive or powered up.

Dimensions H x W x D	130 mm x 73 mm x 40 mm
Current drain at 5 V	200 mA
Degree of protection	IP 54
Maximum cable length	5 m

Table 5.2: Technical Data



The keys represent the same functions as on the standard operator panel except the Menu key, which selects the main menu screen at any time. Indications as to which keys to use are shown in the right-hand column of the screen.

All the main functions are accessible from the main menu screen.

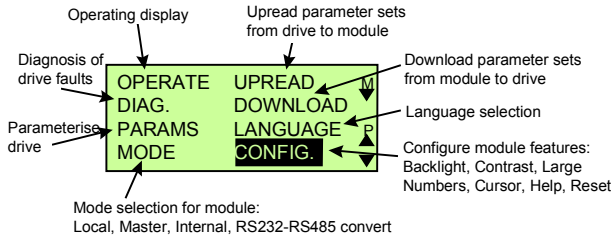
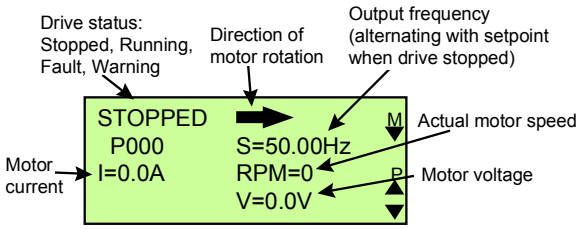


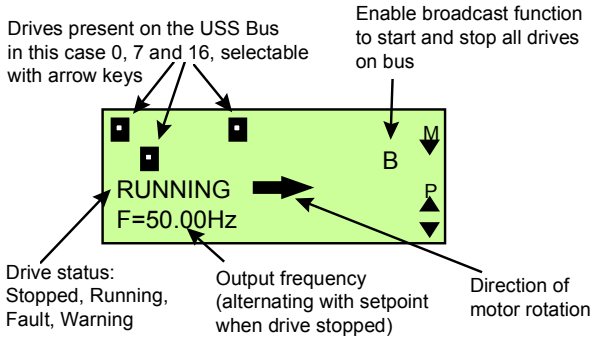
Figure 5.3: Main Menu Screen

Pressing the Menu and ↓ keys simultaneously causes a help screen, displaying the key features of the Clear Text display module, to appear.

On power-up, unless configured otherwise, the panel will show the Operating Display.



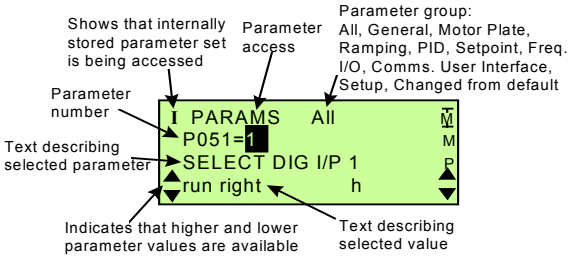
Operating Display when in LOCAL mode.



Operating Display when in MASTER mode.

The status LED indicates whether the drive is running. When the LED is green, the drive is running and when it is red the drive is stopped.

When accessing drive parameters, help texts are associated with the parameter and the parameter values.



5.5.2 RS232 Interface

The Clear text Display is fitted with an RS232 interface to allow the drive to be connected to a PC.

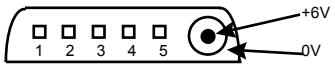


Figure 5.4: Pin Layout of the RS232 edge connector

Terminal	Function, information
1	NC (not connected)
2	External TxD
3	External RxD
4	External RTS
5	Isolated 0V

Table 5.3 below gives the ordering information for the OPM2 Clear Text Display Screen.

The RS235 interface requires an external power supply to operate. The specification of the power supply interface is as follows:

Voltage tolerance 6V±0.5V

Max Supply Current when connected to drive 50mA, when not connected to drive 250mA

Connecting Plug

- Outside diameter 3.5mm

- Inside diameter 1.35mm

Designation	Order No.
OPM2 Clear Text Display	6SE 3290-0XX87-8BF0
Connecting cable OPM 3m	6SX 7010-0AB03
PC Connecting cable 1m	6SE3290-0XX87-8SK0

Table 5.3: Ordering Information

5.6 PROFIBUS Module CB15

This option allows the MICROMASTER, MICROMASTER Vector or MIDIMASTER Vector to be controlled via a PROFIBUS-DP serial bus (SINEC L2-DP).

PROFIBUS-DP is a cost-effective high-speed serial communication system optimised for the actuator/sensor area where very short system reaction times are critical. It operates as a decentralised I/O system whereby the traditional wiring to the sensors and actuators is replaced by an RS485 serial bus system linking the stations together.

The suitability of the system for such applications has been recently enhanced by the extension of the bus speed up to 12MBd. The protocol is defined as DIN19245 and also as EN50170 guaranteeing open, multi-vendor communications between PROFIBUS-DP stations.

Up to 125 stations can be networked together using this single bus system and a very flexible data structure allows the system to be optimised to exactly match the requirements of each device.

PROFIBUS-DP lies at the heart of the new generation of SIMATIC S7 automation systems offered by Siemens. Using this single bus system, all engineering, visualisation and PLC control operations can be integrated. To configure a SIMATIC based automation system, all that is required is the associated STEP7 configuration tool running on a PC. Bus configuration is performed by using a drag and drop technique in a graphically displayed PROFIBUS-DP network.

Below are listed some of the advantages of automating a system with PROFIBUS-DP:

- Only one single network for operator panels, drives, sensors, actuators, PLCs.
- Cost savings in installation time and cabling.
- Ease of commissioning with the SIMATIC S7 PLC system and STEP7 software.
- Flexibility to expand or modify the automation system at a later date.
- Simple integration into higher level process visualisation systems such as PCS7.
- Remote diagnostics reduce the down-time in the event of a problem.

Features of CB15 PROFIBUS Option:

- Permits fast cyclic communications via a PROFIBUS connection.
- Supports all PROFIBUS baud rates up to 12MBd.
- Control of up to 125 inverters using PROFIBUS-DP protocol (with repeaters).
- Conforms with EN50170 guaranteeing open communications on a serial bus system. It can be used with other PROFIBUS-DP/SINEC L2-DP peripheral devices on the serial bus. Data format conforms to the VDI/VDE directive 3689 “PROFIBUS Profile for Variable Speed Drives”.
- Acyclic communications channel for connecting SIMOVIS or other service tools.
- Support for the PROFIBUS control commands SYNC and FREEZE.
- Can be easily configured using the S7 Manager software, or any proprietary PROFIBUS commissioning tool.
- Simple integration into a SIMATIC S5 or S7 PLC system using specially designed functional blocks (S5) and software modules (S7).
- Simply plugs into the front of the inverter in the same way as the Clear Text Display module.
- No separate power supply necessary.
- Digital and analogue inputs can be read and digital and analogue outputs controlled via the serial bus.
- 5 msec response time to process data.
- Output frequency (and therefore motor speed) can be controlled locally on the drive or over the serial bus.

- Multi-mode operation possible, whereby control data can be input via the terminal block (digital inputs) and setpoint over the serial bus. Alternatively, the setpoint can be from a local source (analogue input) with the drive control over the serial bus.
- All drive parameters are accessible over the serial link.

The PROFIBUS module is a push fit into the front of the drive. The clip at the bottom must be pulled down to release the module.

Notes:

1. *PROFIBUS Module can only be inserted or removed from the drive when the drive is powered off.*
2. *If the PROFIBUS Module is connected to the SUB-D socket on the front panel, then the internal RS 485 connections of the 6SE32 drive (terminals 23 and 24) must not be used.*
3. *PROFIBUS module must not be connected to the drive with a cable.*
4. *PROFIBUS module cannot be used simultaneously with the Clear Text Display module.*

The data structure for communication over PROFIBUS-DP can be either PPO type 1 or PPO type 3 as specified in VDI/VDE 3689. This means in practice that process data (control words, setpoints in the transmitted telegram and status words, actual values in the received telegram) are always sent. Parameter data exchange may, however, be blocked if bus bandwidth or PLC memory space is at a premium. The data structure, and thus the PPO type, is normally specified by the bus master. If no PPO type is specified (e.g. if a combined PROFIBUS DP/PROFIBUS FMS bus master is used), the default PPO type is type 1 (parameter data exchange enabled).

Process data from the serial link always has a higher priority than parameter data. This means that a setpoint change or drive control change command will be processed faster than a parameter change command.

Parameter write access over the serial link can be enabled or blocked as required. Parameter read access is permanently enabled, allowing continuous read-out of drive data, diagnostics, fault messages etc. A visualisation system can thus be realised with minimal effort.

Local control of the drive with the On, Off, Jog and Reverse buttons is possible at all times in an identical fashion to when the module is not present.

The PROFIBUS cable is connected to the 9 way SUB-D socket on the front of the PROFIBUS Module.

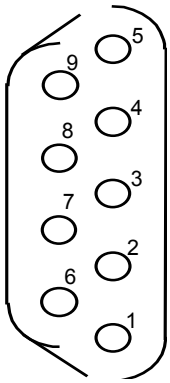


Figure 5: Pin Layout of the PROFIBUS SUB-D socket connector

Terminal	Function, information
1	NC (not connected)
2	NC
3	Send- and receive line RS 485, two wire, positive differential input/output B/P
4	Request to send (RTS)
5	Reference potential, OV
6	5V isolated power supply for termination resistors
7	NC
8	Send and receive line, RS 485, two wire negative differential input/output A/N
9	NC

Table 4: Pin assignment for the SUB-D socket connector

The shield of the cable must be connected to the housing of the SUB-D connector. The following cable lengths and data transfer rates are possible.

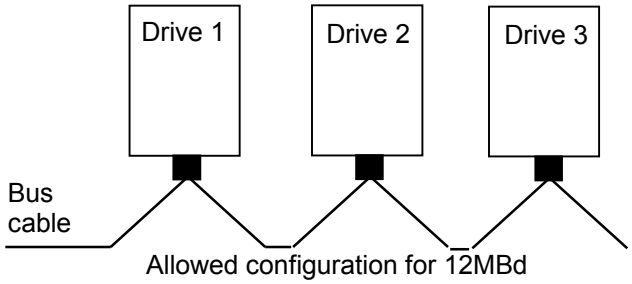
Data transfer rate (Kbit/s)	**Max. cable length of a segment (m)**
9.6	1200
19.2	1200
93.75	1200
187.5	1000
500	400
1500	200
12000	100

Table 5: Maximum Cable Lengths for Data Transfer Rates

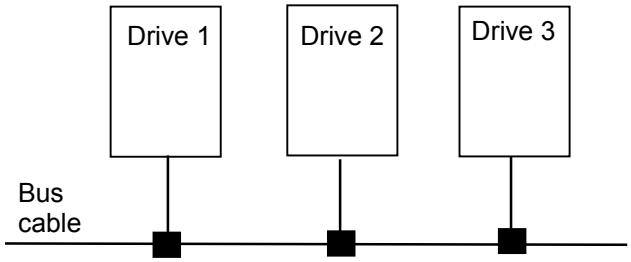
A segment can be extended by using RS 485 repeaters.

Recommendation: SINEC L2 repeater RS 485 (Order No.: 6ES7972-0AA00-0XA0).

For reliable operation of the serial bus system, the cable must be terminated at both ends using terminating resistors. For operation at 12MBd, cables must be terminated in connectors with a built-in damping network. Additionally, for 12MBd operation, no stub length from the main bus cable is allowed.



Allowed configuration for 12MBd



Not permitted for 12MBd

Suitable SINEC-L2 DP connectors and cable for reliable operation up to 12MBd are listed below in Table 6:

Order Number	Description
6ES7 972-0BB10-0XA0	Bus Connector with PG interface
6ES7 972-0BA10-0XA0	Bus connector without PG interface
6XV1830-0AH10	Bus cable 20m-1000m

Table 6: Order Numbers for Connectors and Cables

A floppy disk is supplied with the PROFIBUS module containing the handbook and 2 data files for configuring the relevant PLC system.

Quick Guide to setting up PROFIBUS Communications

- The bus cable between the master device and the drive must be connected correctly. This includes the necessary termination resistors and (for 12MBd) the terminating network.
- The bus cable must be screened and the screen must be connected to the housing of the cable connector.
- The PROFIBUS master must be configured correctly so that communications can be realized with a DP slave using PPO type 1 or PPO type 3 (only PPO type 1, if the PPO type cannot be configured via remote operator control).
- When using COM ET software with a SIMATIC S5, the correct type description file must be used, so that an IM 308B/C can be configured as bus master. When using the Simatic Manager for an S7, the Object Manager must be loaded.
- The bus must be operational (for a SIMATIC module, the operator control panel switch must be set to RUN).
- The bus baud rate must not exceed 12 MBd.
- The PROFIBUS Module must be correctly fitted to the inverter and the inverter must be powered up.
- The slave address for the drive (parameter P918) must be set so that it corresponds to the slave address configured at the PROFIBUS master, and must be uniquely defined on the bus.

Installation should be in conformance with EMC directives and regulations *(this is described in detail in the operating manuals for the drive and the PLC).*

Dimensions H x W x D	115 mm x 102 mm x 30 mm
Degree of protection	IP 21
Maximum bus speed	12 MBd

Table 7: Technical data

Designation	Order No.
PROFIBUS module CB15	6SE3290-0XX87-8PB0
Block package for SIMATIC S5 DVA_S5 Supplied as 3.5” floppy disk	6DD1800-0SW0
Block package for SIMATIC S7 including DVA_S7 and Drives Object Manager. Supplied as CD	6SX7005-0CB00

Table 5.8: PROFIBUS Ordering information

5.7 CANbus Module

The CANbus Module supports the CAN Open protocol. It meets the requirements of CAN Specification DS402. All inverter parameters can be accessed via the Bus. There are no restrictions regarding the parameters in specification DS402.

The input/output signals of the inverter are operated across this gateway. The “Device Profile” for Input/Output Modules (DS401) is not implemented.

Designation	Order No.
CANbus Module	6SE3290-0XX87-8CB0

Table 5.9: CANbus Ordering information

5.8 Control and Commissioning with SIMOVIS (Option)

The SIMOVIS drive commissioning software operates under Windows 95 or NT and can be used to configure the MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector drives.

SIMOVIS offers the following benefits:

- Access from the same PC to one or several drives connected to the same serial bus.
- Storage of parameter sets on the PC.
- Control and monitoring of the drives.
- Simplified, text-driven, access to all parameters within the drive.
- Upread and download of entire parameter sets.
- Off-line configuration for altering parameter sets stored on the PC hard disk drive without a connection to the drive.
- Interface to the S7 Manager to allow configuring of drives on a PROFIBUS DP* link within an automation system.

The minimum recommended PC specification for operation of SIMOVIS is a 90MHz Pentium unit with 32MB of RAM, 200MB hard drive and WINDOWS95 or NT4.0.

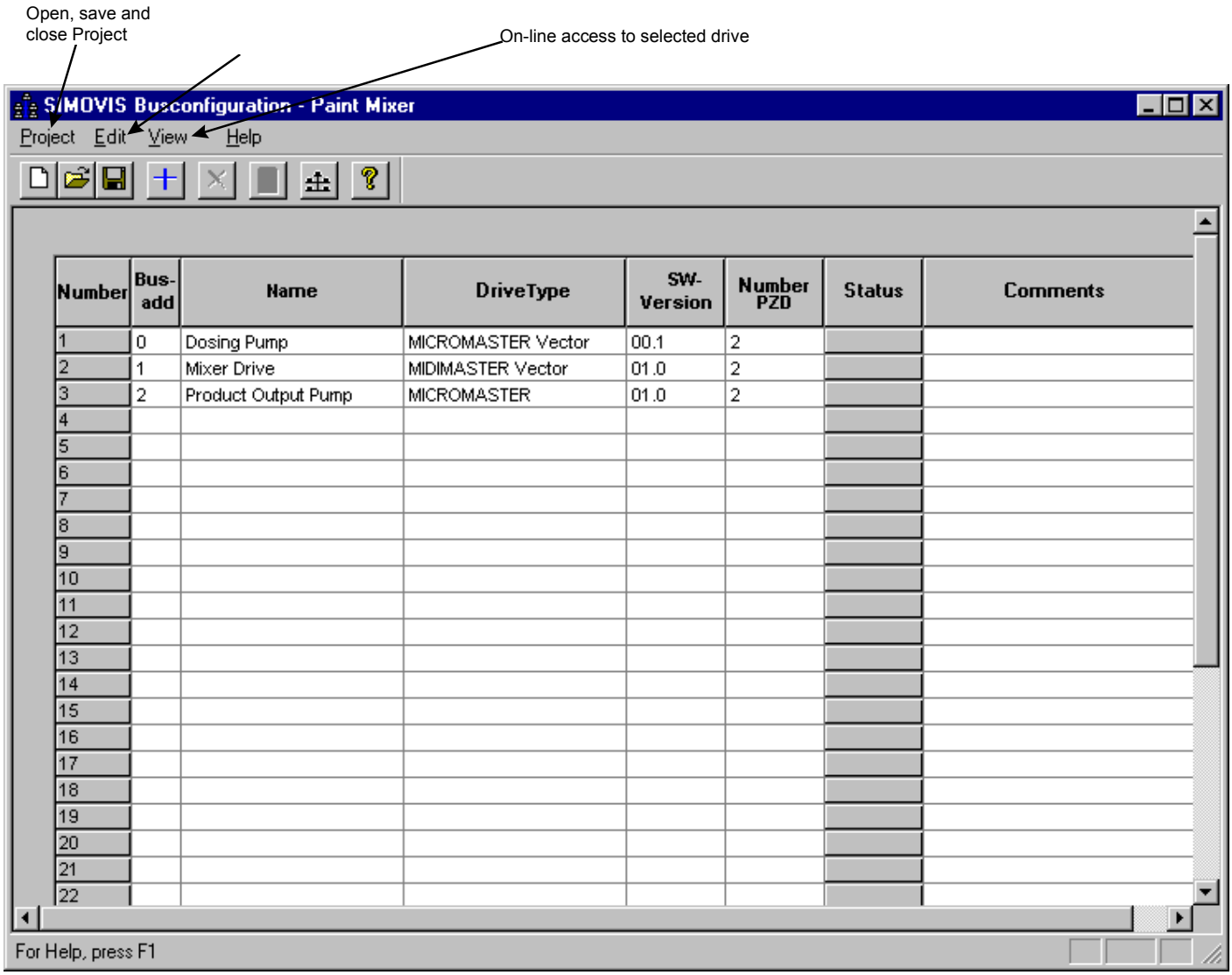
Designation	Order No.
SIMOVIS Standalone Version	6SE3290-0XX87-8SA1
Block package for SIMATIC S7 including DVA_S7 and Object Manager	6SX7005-0CB00

Table 5.10: SIMOVIS Ordering information

5.8.1 Standalone Operation of SIMOVIS

For direct configuration of one or more drives, SIMOVIS communicates over the PC serial port, COM1 or COM2. An RS232/485 converter must be connected between the PC and the drive. The Clear Text Display module is suitable for this purpose.

Following installation, the “Buskon” program must be called to define whether one or more drives is connected to the PC. For each connected drive, the drive type must be selected from the hardware directory and the bus address must match the value programmed into P091 in the drive.



Number	Bus-add	Name	DriveType	SW-Version	Number PZD	Status	Comments
1	0	Dosing Pump	MICROMASTER Vector	00.1	2		
2	1	Mixer Drive	MIDIMASTER Vector	01.0	2		
3	2	Product Output Pump	MICROMASTER	01.0	2		
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

Figure 6: Example screen from "Buskon" program showing a project where 3 drives are connected to the PC

SIMOVIS is then started by selecting the drive from the list and selecting drive parameterisation from the edit menu. The drive parameter list (or part thereof) can be accessed from the "Parameter" menu.

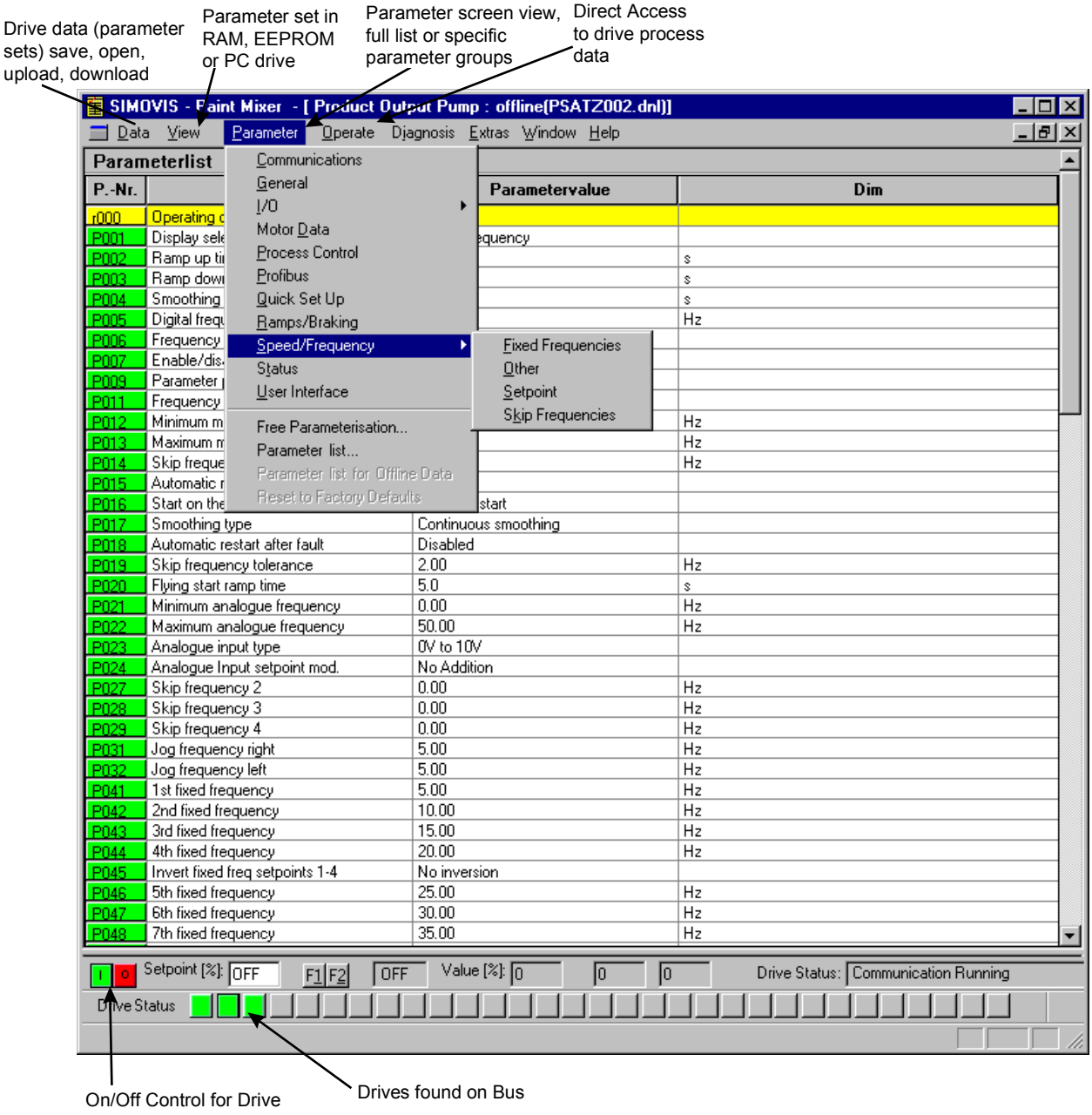


Figure 7: Example screen from SIMOVIS where access to the whole parameter list has been selected.

5.8.2 Operation of SIMOVIS within an Automation System

SIMOVIS can access the drives on a PROFIBUS DP system when run on a PC or PG with Step 7 V3.2 or higher. In this case the Buskon program is not used and SIMOVIS can be called directly by selecting the required drive from the Step7 HWConfig program once the PROFIBUS network has been configured. Access to the drive parameters is identical to the standalone case. Details on how to configure the automation system are to be found in the relevant Step7 documentation.

The hardware requirement for SIMOVIS is identical to that for Step 7.

5.9 Diagnostics, Fault Codes and Parameter Listings

The MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector have two levels of alarm function, **Warnings** and **Faults.**

1. ***Warnings***
   The first level involves a warning which occurs when an inverter operating parameter such as current voltage or temperature has reached its limiting value. When this happens, the display flashes (and a bit is set in the message returned by the serial link) but the inverter does not trip. When the cause of the warning has been removed, e.g. reduction of a load which was causing the inverter to current limit, then the warning is automatically reset.

   The last occurring warning number is stored in parameter P931. It is possible to configure an output relay to change state when a warning occurs using parameters P061 or P062 (not 6SE92). Alternatively the relay can be selectively switched by a current limit, voltage limit, motor overtemperature or slip limit (6SE32 only) warning.

   The warning messages are always accessible via the serial interface by reading parameter P931. The warning buffer can be cleared by writing it to 0.

2. ***Faults***
   The second level of alarm is a fault. As soon as a fault condition is detected, the inverter output is shut down and a flashing error code is displayed (and a bit is set in the message returned by the serial link). The inverter can only be reset when the cause of the fault has been removed. The fault can then be acknowledged by pressing the P key on the operator panel twice, toggling a digital input (if an input has been so configured) or via the serial interface.

   The last occurring fault code is stored in parameter P930. It is possible to configure an output relay to change state when a fault occurs using parameters P061 or P062 (not 6SE92).

   Following acknowledgement of a fault code, the inverter goes into a switch-on inhibit state. The inverter must then be actively switched off (with the keypad, digital input or serial interface depending on what control method has been configured) before it can be switched back on. This can be disabled by setting parameter P018 in which case the inverter will attempt to restart as soon as the fault has been acknowledged.

   The fault buffer can be cleared by writing it to 0. Parameters P140, P141, P142 and P143 contain respectively the most recent fault, and 2nd, 3rd and 4th most recent.

5.10 Parameter List

Key:

• = These parameters can also be changed during operation

✧✧✧ = The set value is dependent on the drive converter type

Parameter	Function	Range [factory setting]	
		MICROMASTER	MICRO/MIDIMASTER Vector
P000	Operating display	-	-
P001 •	Display selection	0 - 8 [0]	0 - 9 [0]
P002 •	Ramp-up time (seconds)	0 - 650.0 [10.0]	0 - 650.0 [10.0]
P003 •	Ramp-down time (seconds)	0 - 650.0 [10.0]	0 - 650.0 [10.0]
P004 •	Smoothing (seconds)	0 - 40.0 [0.0]	0 - 40.0 [0.0]
P005 •	Digital frequency set-point (Hz)	0.00 - 400.00 [5.00]	0.00 - 650.00 [5.00]
P006	Frequency set-point type selection	0 - 2 [0]	0 - 3 [0]
P007	Enable/disable front panel	0 - 1 [1]	0 - 1 [1]
P009 •	Parameter protection setting	0 - 3 [0]	0 - 3 [0]
P010	Display scaling	-	0.00 - 500.00 [1.00]
P011	Frequency set-point memory	0 - 1 [0]	0 - 1 [0]
P012 •	Minimum motor frequency (Hz)	0.00 - 400.00 [0.00]	0.00 - 650.00 [0.00]
P013 •	Maximum motor frequency (Hz)	0.00 - 400.00 [50.00]	0.00 - 650.00 [50.00]
P014 •	Skip frequency 1 (Hz)	0.00 - 400.00 [0.00]	0.00 - 650.00 [0.00]
P015 •	Automatic restart after mains fail	0 - 1 [0]	0 - 1 [0]
P016 •	Start on the fly	0 - 2 [0]	0 - 4 [0]
P017 •	Smoothing type	1 - 2 [1]	1 - 2 [1]
P018 •	Automatic restart after fault	0 - 1 [0]	0 - 1 [0]
P019 •	Skip Frequency Tolerance	0.00 - 10.00 [2.00]	0.00 - 10.00 [2.00]
P020 •	Flying Start Ramp Time (s)	0.5 - 25.0 [2.00]	-
P021 •	Minimum analogue frequency (Hz)	0.00 - 400.00 [0.00]	0.00 - 650.00 [50.00]
P022 •	Maximum analogue frequency (Hz)	0.00 - 400.00 [50.00]	0.00 - 650.00 [50.00]
P023 •	Analogue input 1 type	0 - 2 [0]	0 - 3 [0]
P024 •	Analogue set-point addition	0 - 2 [0]	0 - 2 [0]
P025 •	Analogue output 1	-	0 - 105 [0]
P026 •	Analogue output 2	-	0 - 105 [0] MIDI
P027 •	Skip frequency 2 (Hz)	0.00 - 400.00 [0.00]	0.00 - 650.00 [0.00]
P028 •	Skip frequency 3 (Hz)	0.00 - 400.00 [0.00]	0.00 - 650.00 [0.00]
P029 •	Skip frequency 4 (Hz)	0.00 - 400.00 [0.00]	0.00 - 650.00 [0.00]
P031 •	Jog frequency right (Hz)	0.00 - 400.00 [5.00]	0.00 - 650.00 [5.00]
P032 •	Jog frequency left (Hz)	0.00 - 400.00 [5.00]	0.00 - 650.00 [5.00]
P033 •	Jog ramp-up time (seconds)	0 - 650.0 [10.0]	0 - 650.0 [10.0]
P034 •	Jog ramp-down time (seconds)	0 - 650.0 [10.0]	0 - 650.0 [10.0]
P040	Positioning function	-	0.1 [0]
P041 •	Fixed frequency 1 (Hz)	0.00 - 400.00 [5.00]	0.00 - 650.00 [5.00]
P042 •	Fixed frequency 2 (Hz)	0.00 - 400.00 [10.00]	0.00 - 650.00 [10.00]
P043 •	Fixed frequency 3 (Hz)	0.00 - 400.00 [15.00]	0.00 - 650.00 [15.00]
P044 •	Fixed frequency 4 (Hz)	0.00 - 400.00 [20.00]	0.00 - 650.00 [20.00]

Parameter	Function	Range [factory setting]	
		MICROMASTER	MICRO/MIDIMASTER Vector
P045	Inversion fixed set-points for fixed frequencies 1 - 4	0 - 7 [0]	0 - 7 [0]
P046	Fixed frequency 5 (Hz)	0.00 - 400.00 [25.00]	0.00 - 650.00 [25.00]
P047	Fixed frequency 6 (Hz)	0.00 - 400.00 [30.00]	0.00 - 650.00 [35.00]
P048	Fixed frequency 7 (Hz)	0.00 - 400.00 [35.00]	0.00 - 650.00 [40.00]
P049	Fixed frequency 8 (Hz)	-	0.00 - 650.00 [0.00]
P050	Inversion fixed set-points 5 - 8	0 - 7 [0]	0 - 7 [0]
P051	Selection control function, DIN1 (terminal 5)	0 - 19 [1]	0 - 24 [1]
P052	Selection control function DIN2 (terminal 6)	0 - 19 [2]	0 - 24 [2]
P053	Selection control function DIN3 (terminal 7)	0 - 19 [6]	0 - 24 [6]
P054	Selection control function DIN4 (terminal 8)	-	0 - 24 [6]
P055	Selection control function DIN5 (terminal 16)	-	0 - 24 [6]
P356	Selection control function DIN5 (terminal 17) 1	-	0 - 24 [6]
P056	Digital input debounce time	0 - 2 [0]	0 - 2 [0]
P057	Digital input delayed trip (seconds)	-	0 - 650.0 [1.0]
P061	Selection relay output 1	0 - 13 [6]	0 - 13 [6]
P062	Selection relay output 2	0 - 4 [8]	0 - 13 [8]
P063	External brake release delay (seconds)	0 - 20.0 [1.0]	0 - 20.0 [1.0]
P064	External brake stopping time (seconds)	0 - 20.0 [1.0]	0 - 20.0 [1.0]
P065	Current threshold for relay (A)	0 - 99.9 [1.0]	0 - 300.0 [1.0]
P066	Compound braking	0 - 1 [0]	0 - 250 [0]
P069	Automatic ramp extension disable	-	0 - 1 [1]
P070	Braking Resistor Duty Cycle	-	0 - 4 [0] MMV
P071 •	Slip compensation (%)	-	0 - 200 [0]
P072 •	Slip limit (%)	-	0 - 500 [250]
P073 •	DC injection braking (%)	0 - 250 [0]	0 - 250 [0]
P074 •	Motor derating curve as temperature protection	0 - 1 [0]	0 - 7 [0]
P075 •	Braking chopper enable	-	0 - 1 [0] (MMV)
P076 •	Pulse frequency	0 - 7 [0 or 4]	0 - 7 [0 or 4]
P077	Control mode	0 - 2 [1]	0 - 3 [1]
P078 •	Continuous boost (%)	0 - 250 [100]	0 - 250 [100]
P079 •	Starting boost (%)	0 - 250 [0]	0 - 250 [0]
P080	Nominal rating plate motor power factor (cosϕ)	-	0.00 - 1.00 [50.00]
P081	Nominal frequency for motor (Hz)	0.00 - 400.00 [50.00]	0.00 - 650.00 [✧✧✧]
P082	Nominal speed for motor (RPM)	0 - 9999 [✧✧✧]	0 - 9999 [✧✧✧]
P083	Nominal current for motor (A)	0.1 - 99.9 [✧✧✧]	0.1 - 99.9 [✧✧✧]
P084	Nominal voltage for motor (V)	0 - 1000 [✧✧✧]	0 - 1000 [✧✧✧]
P085	Nominal power for motor (kW)	0 - 75.0 [✧✧✧]	0.12 - 75.0 [✧✧✧]
P086 •	Motor current limit (%)	0 - 250 [150]	0 - 250 [150]

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

Parameter	Function	Range [factory setting]	
		MICROMASTER	**MICRO/MIDIMASTER Vector**
P087 •	Motor PTC enable	-	0 - 1 [0]
P088	Automatic calibration	-	0 - 1 [1]
P089 •	Stator resistance (Ohm)	0.01 - 100.00 [✧✧✧]	0.01 - 199.00 [✧✧✧]
P091 •	Slave address	0 - 30 [0]	0 - 30 [0]
P092 •	Baud rate	3 - 7 [6]	3 - 7 [6]
P093 •	Serial link Timeout (seconds)	0 - 240 [0]	0 - 240 [0]
P094 •	Serial link nominal system set-point (Hz)	0.00 - 400.00 [50.00]	0.00 - 650.00 [50.00]
P095 •	USS compatibility	0 - 2 [0]	0 - 2 [0]
P099 •	Option Module type	0 - 2 [0]	0 - 2 [0]
P101 •	Operation for Europe / USA	0 - 1 [0]	0 - 1 [0]
P111	Inverter power rating (kW/hp)	0.0 - 75.0 [✧✧✧]	0.0 - 75.0 [✧✧✧]
P112 •	Inverter type	1 - 8 [✧✧✧]	1 - 8 [✧✧✧]
P113 •	Drive model	0 - 29 [✧✧✧]	0 - 29 [✧✧✧]
P121	Enable/disable RUN button	0 - 1 [1]	0 - 1 [1]
P122	Enable/disable FORWARD/REVERSE button	0 - 1 [1]	0 - 1 [1]
P123	Enable/disable JOG button	0 - 1 [1]	0 - 1 [1]
P124	Enable/disable button and button	0 - 1 [1]	0 - 1 [1]
P125 •	Reverse direction inhibit	0 - 1 [1]	0 - 1 [1]
P128 •	Fan switch off delay time	0-600 [120]	0-600 [120] MMV
P131 •	Frequency set-point (Hz)	0.00 - 400.00 [-]	0.00 - 650.00 [-]
P132 •	Motor current (A)	0.0 - 99.9 [-]	0.0 - 300.0 [-]
P133 •	Motor torque (% of nominal value)	0 - 250 [-]	0 - 250 [-]
P134 •	DC link voltage (V)	0 - 1000 [-]	0 - 1000 [-]
P135 •	Motor RPM	0 - 9999 [-]	0 - 9999 [-]
P137 •	Motor Voltage (V)	0 - 1000 [-]	0 - 1000 [-]
P138	Instantaneous rotor/shaft speed (Hz)	-	0.00 - 650.00 [-]
P139	Peak output current detect	0.0-99.9 [-]	-
P140	Most recent fault code	0 - 255 [-]	0 - 255 [-]
P141	Most recent fault code - 1	0 - 255 [-]	0 - 255 [-]
P142	Most recent fault code - 2	0 - 255 [-]	0 - 255 [-]
P143	Most recent fault code - 3	0 - 255 [-]	0 - 255 [-]
P186 •	Motor instantaneous current limit (%)	-	0 - 500 [200]
P201 •	PID closed loop mode	0 - 2 [0]	0 - 1 [0]
P202 •	P-gain, PID controller	0.0 - 999.9 [1.0]	0.0 - 999.9 [1.0]
P203 •	I-gain, PID controller	0.00 - 99.9 [0.00]	0.00 - 99.9 [0.00]
P204 •	D-gain, PID controller	-	0.0 - 999.9 [0.0]
P205 •	Sampling rate	1 - 2400 [1]	1 - 2400 [1]
P206 •	Sensor filtering	0 - 255 [0]	0 - 255 [0]
P207 •	Integral capture range (%)	0 - 100 [100]	0 - 100 [100]
P208	Actual value processor type	0 - 1 [0]	0 - 1 [0]
P210	Actual value reading (%)	0.00 - 100.00 [-]	0.00 - 100.00 [-]
P211 •	0 % set-point	0.00 - 100.00 [0.00]	0.00 - 100.00 [0.00]

Parameter	Function	Range [factory setting]	
		MICROMASTER	**MICRO/MIDIMASTER Vector**
P212 •	100 % set-point	0.00 - 100.00 [100.00]	0.00 - 100.00 [100.00]
P220	Minimum frequency mode	0 - 1 [0]	0 - 1 [0]
P321	Analogue input 2 - Minimum Frequency	-	0.00 - 650.00 [0.00]
P322 •	Analogue input 2 - Maximum Frequency	-	0.00 - 650.00 [0.00]
P323	Analogue input 2 type	-	0 - 2 [0]
P386 •	Vector speed control loop gain - proportional term	-	0.0 - 20.0 [1.0]
P387	Vector speed control loop gain - integral term	-	0.01 - 10.0 [1.0]
P720 •	Direct input/output functions	0 - 1 [0]	0 - 7 [0]
P721	Analogue input 1 voltage (V)	0.0 - 10.0 [-]	0.0 - 10.0 [-]
P722 •	Analogue output 1 current (mA)	-	0.0 - 20.0 [-]
P723	State of digital inputs	0 - 7 [-]	0 - 31 [-]
P724 •	Relay output control	0 - 1 [0]	0 - 3 [0]
P725	Analogue input 2 voltage (V)	-	0.0 - 10.0 [-]
P726 •	Analogue output 2 current (mA)	-	0.0 - 20.0 [0] MIDI
P910 •	Local/Remote mode	0 - 4 [0]	0 - 4 [0]
P922	Software version	0 - 9999 [-]	0 - 9999 [-]
P923 •	Equipment system number	0 - 255 [0]	0 - 255 [0]
P930	Most recent fault code	0 - 9999 [-]	0 - 255 [-]
P931	Most recent warning type	0 - 9999 [-]	0 - 99 [-]
P944	Reset to factory default settings	0 - 1 [0]	0 - 1 [0]
P971 •	EEPROM storage control	0 - 1 [1]	0 - 1 [1]

Table 10: Parameter List

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

6.1 MICROMASTER / MICROMASTER Vector

MICROMASTER / MICROMASTER Vector, 1ph 208-240V ±10% with integrated Filter
IP20 (NEMA 1)

Product		Motor Power	Rated Output Current	Maximum Continuous Output Current	Input Current	Dimensions H x W x D	Weight approx.	Inverter Order no.	
MICRO-MASTER	**MICROMASTER Vector**	kW	A	A	A	mm	kg	**MICROMASTER**	**MICROMASTER Vector**
MM12	MMV12	0.12	0.75	0.9	1.8	147x73x141	0.95	**6SE9210-7BA40**	**6SE3210-7BA40**
MM25	MMV25	0.25	1.5	1.7	3.2	147x73x141	0.95	**6SE9211-5BA40**	**6SE3211-5BA40**
MM37	MMV37	0.37	2.1	2.3	4.6	147x73x141	0.95	**6SE9212-1BA40**	**6SE3212-1BA40**
MM55	MMV55	0.55	2.6	3.0	6.2	147x73x141	0.95	**6SE9212-8BA40**	**6SE3212-8BA40**
MM75	MMV75	0.75	3.5	3.9	8.2	147x73x141	0.95	**6SE9213-6BA40**	**6SE3213-6BA40**
MM110	MMV110	1.1	4.8	5.5	11	184x149x172	2.6	**6SE9215-2BB40**	**6SE3215-2BB40**
MM150	MMV150	1.5	6.6	7.4	14.4	184x149x172	2.6	**6SE9216-8BB40**	**6SE3216-8BB40**
MM220	MMV220	2.2	9.0	10.4	20.2	215x185x195	5.0	**6SE9221-0BC40**	**6SE3221-0BC40**
MM300 1)	MMV300 1)	3.0	11.8	13.6	28.3	215x185x195	5.0	**6SE9221-3BC40**	**6SE3221-3BC40**

MICROMASTER/ MICROMASTER Vector, 1ph/3ph 208-240V±10% unfiltered
IP20 (NEMA1)

Product		Motor Power	Rated Output Current	Maximum Continuous Output Current	Input Current		Dimensions H x W x D	Weight approx.	Inverter Order no.	
MICRO-MASTER	**MICROMASTER Vector**	kW	A	A	A		mm	kg	**MICROMASTER**	**MICROMASTER Vector**
MM12/2	MMV12/2	0.12	0.75	0.9	1.8	1.1	147x73x141	0.9	**6SE9210-7CA40**	**6SE3210-7CA40**
MM25/2	MMV25/2	0.25	1.5	1.7	3.2	1.9	147x73x141	0.9	**6SE9211-5CA40**	**6SE3211-5CA40**
MM37/2	MMV37/2	0.37	2.1	2.3	4.6	2.7	147x73x141	0.9	**6SE9212-1CA40**	**6SE3212-1CA40**
MM55/2	MMV55/2	0.55	2.6	3.0	6.2	3.6	147x73x141	0.9	**6SE9212-8CA40**	**6SE3212-8CA40**
MM75/2	MMV75/2	0.75	3.5	3.9	8.2	4.7	147x73x141	0.9	**6SE9213-6CA40**	**6SE3213-6CA40**
MM110/2	MMV110/2	1.1	4.8	5.5	11	6.4	184x149x172	2.4	**6SE9215-2CB40**	**6SE3215-2CB40**
MM150/2	MMV150/2	1.5	6.6	7.4	14.4	8.3	184x149x172	2.4	**6SE9216-8CB40**	**6SE3216-8CB40**
MM220/2	MMV220/2	2.2	9.0	10.4	20.2	11.7	215x185x195	4.8	**6SE9221-0CC40**	**6SE3221-0CC40**
MM300/2 1)	MMV300/2 1)	3.0	11.8	13.6	28.3	16.3	215x185x195	4.8	**6SE9221-3CC40**	**6SE3221-3CC40**
MM400/2	MMV400/2	4.0	15.9	17.5	-	21.1	215x185x195	4.8	**6SE9221-8CC13**	**6SE3221-8CC40**

1) MMV300 and MMV300/2 require an external choke (e.g. 4EM4807 - 8CB) for single phase voltages and a 32A mains fuse.

MICROMASTER / MICROMASTER Vector, - 3 ph 380-500V±10% unfiltered

IP20 (NEMA 1)

Product		Motor Power	Rated Output Current		Maximum Continuous Output Current		Input Current	Dimensions H x W x D	Weight approx.	Inverter Order no.	
MICRO-MASTER	**MICROMASTER Vector**	kW	400V A	500V A	400V A	500V A	A	mm	kg	**MICROMASTER**	**MICROMASTER Vector**
MM37/3	MMV37/3	0.37	1.05	0.95	1.2	1.06	2.2	147x73x141	0.9	**6SE9211-1DA40**	**6SE3211-1DA40**
MM55/3	MMV55/3	0.55	1.5	1.3	1.6	1.45	2.8	147x73x141	0.9	**6SE9211-4DA40**	**6SE3211-4DA40**
MM75/3	MMV75/3	0.75	2.0	1.8	2.1	1.9	3.7	147x73x141	0.9	**6SE9212-0DA40**	**6SE3212-0DA40**
MM110/3	MMV110/3	1.1	2.8	2.5	3.0	2.7	4.9	147x73x141	0.9	**6SE9212-7DA40**	**6SE3212-7DA40**
MM150/3	MMV150/3	1.5	3.7	3.3	4.0	3.6	5.9	147x73x141	0.9	**6SE9214-0DA40**	**6SE3214-0DA40**
MM220/3	MMV220/3	2.2	5.2	4.6	5.9	5.3	8.8	184x149x172	2.4	**6SE9215-8DB40**	**6SE3215-8DB40**
MM300/3	MMV300/3	3.0	6.8	6.0	7.7	6.9	11.1	184x149x172	2.4	**6SE9217-3DB40**	**6SE3217-3DB40**
MM400/3	MMV400/3	4.0	9.2	8.1	10.2	9.1	13.6	215x185x195	4.8	**6SE9221-0DC40**	**6SE3221-0DC40**
MM550/3	MMV550/3	5.5	11.8	10.4	13.2	11.8	17.1	215x185x195	4.8	**6SE9221-3DC40**	**6SE3221-3DC40**
MM750/3	MMV750/3	7.5	15.80	13.9	17.0	15.2	22.1	215x185x195	4.8	**6SE9221-5DC40**	**6SE3221-5DC40**

MICROMASTER/MICROMASTER Vector, with integrated filter, Class A, 3 ph 380V - 480V±10%, IP20 (NEMA 1)

Product		Motor Power	Rated Output Current		Maximum Continuous Output Current		Input Current	Dimensions H x W x D	Weight approx.	Inverter Order no.	
MICRO-MASTER	MICRO-MASTER Vector	kW	400 V A	V A	400 V A	V A	A	mm	kg	MICROMASTER	MICROMASTER Vector
MM220/3F	MMV220/3F	2,2	5,2	4,6	5,9	5,3	8,8	184x149x172	2.4	**6SE9215-8DB50**	**6SE3215-8DB50**
MM300/3F	MMV300/3F	3,0	6,8	6,0	7,7	6,9	11,1	184x149x172	2.4	**6SE9217-3DB50**	**6SE3217-3DB50**
MM400/3F	MMV400/3F	4,0	9,2	8,1	10,2	9,1	13,6	215x185x195	4.8	**6SE9221-0DC50**	**6SE3221-0DC50**
MM550/3F	MMV550/3F	5,5	11,8	10,4	13,2	11,8	17,1	215x185x195	4.8	**6SE9221-3DC50**	**6SE3221-3DC50**
MM750/3F	MMV750/3F	7,5	15,80	13,9	17,0	15,2	22,1	215x185x195	4.8	**6SE9221-5DC50**	**6SE3221-5DC50**

6.2 MIDIMASTER Vector

MIDIMASTER Vector, 3 ph 208 V – 240 V±10%
IP21 (NEMA 1)

Product	Rated Inverter Output Current M = const.	Rated Inverter Output Current M ~ n²	Input current (max. current)	Motor Rating for M = konst.		Motor Rating for M ~ n²		Dimensions H x B x T	Weight approx.	Product
	A	A	A	KW	hp	kW	hp	mm	kg	Order no.
MDV550/2	22	28	32	5.5	7.5	7.5	10	475x275x210	11	**6SE3222-3CG40**
MDV750/2	28	42	45	7.5	10	11	15	550x275x210	14.5	**6SE3223-1CG40**
MDV1100/2	42	-	61	11	15	-	-	550x275x210	15.5	**6SE3224-2CH40**
MDV1500/2	54	68	75	15	20	18.5	25	650x275x285	26.5	**6SE3225-4CH40**
MDV1850/2	68	80	87	18.5	25	22	30	650x275x285	27.0	**6SE3226-8CJ40**
MDV2200/2	80	95	100	22	30	30	40	650x275x285	27.5	**6SE3227-5CJ40**
MDV3000/2	104	130	143	30	40	37	50	850x420x310	55.0	**6SE3231-0CK40**
MDV3700/2	130	154	170	37	50	45	60	850x420x310	55.5	**6SE3231-3CK40**
MDV4500/2	154	-	170	45	60	-	-	850x420x310	56.5	**6SE3231-5CK40**

MIDIMASTER Vector, 3 ph 380 – 500V±10%
IP21 (NEMA 1)

Product	Rated Inverter Output Current 2) M = const.	Rated Inverter Output Current 1) 2) M ~ n²	Input current for 400V (max. current)	Motor Rating for M = const.		Motor Rating for M ~ n²		Dimensions H x B x T	Weight approx.	Product
	A	A	A	kW	hp	kW	hp	mm	kg	Order no.
MDV750/3	19	23.5	30	-	-	11	15	450x275x210	11.5	**6SE3221-7DG40**
MDV1100/3	26	30	32	11	15	15	20	450x275x210	12.0	**6SE3222-4DG40**
MDV1500/3	32	37	41	15	20	18.5	25	550x275x210	16.0	**6SE3223-0DH40**
MDV1850/3	38	43.5	49	18.5	25	22	30	550x275x210	17.0	**6SE3223-5DH40**
MDV2200/3	45	58	64	22	30	30	40	650x275x285	27.5	**6SE3224-2DJ40**
MDV3000/3	58	71	79	30	40	37	50	650x275x285	28.0	**6SE3225-5DJ40**
MDV3700/3	72	84	96	37	50	45	60	650x275x285	28.5	**6SE3226-8DJ40**
MDV4500/3	84	102	113	45	60	55	75	850x420x310	57.0	**6SE3228-4DK40**
MDV5500/3	102	138	152	55	75	75	100	850x420x310	58.5	**6SE3231-0DK40**
MDV7500/3	138	168	185	75	100	90	120	850x420x310	60.0	**6SE3231-4DK40**

MIDIMASTER Vector, 3 ph 525 – 575V±15%,
IP21 (NEMA 1)

Product	Rated Inverter Output Current M = const.	Rated Inverter Output Current 1) M ~ n²	Input current (max. current)	Motor Rating for M = const.		Motor Rating for M ~ n²		Dimensions H x B x T	Weight approx.	Product
	A	A	A	kW	hp	kW	hp	mm	kg	Order no.
MDV220/4	3.9	6.1	7	2.2	3	4	5	450x275x210	11.0	**6SE3213-8FG40**
MDV400/4	6.1	9	10	4	5	5.5	7.5	450x275x210	11.5	**6SE3216-1FG40**
MDV550/4	9	11	12	5.5	7.5	7.5	10	450x275x210	11.5	**6SE3218-0FG40**
MDV750/4	11	17	18	7.5	10	11	15	450x275x210	11.5	**6SE3221-1FG40**
MDV1100/4	17	22	24	11	15	15	20	450x275x210	12.0	**6SE3221-7FG40**
MDV1500/4	22	27	29	15	20	18.5	25	550x275x210	16.0	**6SE3222-2FH40**
MDV1850/4	27	32	34	18.5	25	22	30	550x275x210	17.0	**6SE3222-7FH40**
MDV2200/4	32	41	45	22	30	30	40	650x275x285	27.5	**6SE3223-2FJ40**
MDV3000/4	41	52	55	30	40	37	50	650x275x285	28.5	**6SE3224-1FJ40**
MDV3700/4	52	62	65	37	50	45	60	650x275x285	28.5	**6SE3225-2FJ40**

1) Overload capacity 10% for 60 secs.

2) Based on 400V input voltage; current changes in inverse proportion at other voltages.

MIDIMASTER Vector, with integrated Filter, Class A, 3 ph 208 V - 240 V±10%, IP20 (NEMA 1)

Product	Rated Inverter Output Current M = const.	Rated Inverter Output Current 1) M ~ n²	Input current (max. current)	Motor Rating for M = const.		Motor Rating for M ~ n²		Dimensions H x B x T	Weight approx.	Product
	A	A	A	kW	hp	kW	hp	mm	kg	Order no.
MDV550/2	22	28	32	5.5	7.5	7.5	10	700x275x210	18	**6SE3222-3CG50**
MDV750/2	28	42	45	7.5	10	11	15	800x275x210	22	**6SE3223-1CG50**
MDV1100/2	42	-	61	11	15	-	-	800x275x210	23	**6SE3224-2CH50**
MDV1500/2	54	68	75	15	20	18.5	25	920x275x285	37	**6SE3225-4CH50**
MDV1850/2	68	80	87	18.5	25	22	30	920x275x285	38	**6SE3226-8CJ50**
MDV2200/2	80	95	100	22	30	30	40	920x275x285	38	**6SE3227-5CJ50**
MDV3000/2	104	130	143	30	40	37	50	1150x420x310	85	**6SE3231-0CK50**
MDV3700/2	130	154	170	37	50	45	60	1150x420x310	86	**6SE3231-3CK50**
MDV4500/2	154	-	170	45	60	-	-	1150x420x310	87	**6SE3231-5CK50**

MIDIMASTER Vector, with integrated Filter, Class A, 3 ph 380 – 460V±10%, IP20 (NEMA 1)

Product	Rated Inverter Output Current 2) M = const.	Rated Inverter Output Current 1) 2) M ~ n²	Input current for 400V (max. current)	Motor Rating for M = konst.		Motor Rating for M ~ n²		Dimensions H x B x T	Weight approx.	Product
	A	A	A	kW	hp	kW	hp	mm	kg	Order no.
MDV750/3	19	23.5	30	-	-	1	15	700x275x210	19	**6SE3221-7DG50**
MDV1100/3	26	30	32	11	15	15	20	700x275x210	19	**6SE3222-4DG50**
MDV1500/3	32	37	41	15	20	18.5	25	800x275x210	23	**6SE3223-0DH50**
MDV1850/3	38	43.5	49	18.5	25	22	30	800x275x210	24	**6SE3223-5DH50**
MDV2200/3	45	58	64	22	30	30	40	920x275x285	38	**6SE3224-2DJ50**
MDV3000/3	58	71	79	30	40	37	50	920x275x285	39	**6SE3225-5DJ50**
MDV3700/3	72	84	96	37	50	45	60	920x275x285	39	**6SE3226-8DJ50**
MDV4500/3	84	102	113	45	60	55	75	1150x420x310	87	**6SE3228-4DK50**
MDV5500/3	102	138	152	55	75	75	100	1150x420x310	88	**6SE3231-0DK50**
MDV7500/3	138	168	185	75	100	90	120	1150x420x310	90	**6SE3231-4DK50**

1) Overload capacity 10% for 60 secs.

2) Based on 400V input voltage; current changes in inverse proportion at other voltages.

MIDIMASTER Vector, 3 ph 208 – 240V±10%, IP56 (NEMA 4/12)

Product	Rated Inverter Output Current M = const.	Rated Inverter Output Current 1) M ~ n²	Input current (max. current)	Motor Rating for M = const.		Motor Rating for M ~ n²		Dimensions 3) H x B x T	Weight approx.	Product
	A	A	A	kW	hp	kW	hp	mm	kg	Order no.
MDV550/2	22	28	32	5.5	7.5	7.5	10	675x360x351	30	**6SE3222-3CS45**
MDV750/2	28	42	45	7.5	10	11	15	775x360x422	39	**6SE3223-1CS45**
MDV1100/2	42	-	61	11	15	-	-	775x360x422	40	**6SE3224-2CS45**
MDV1500/2	54	68	75	15	20	18.5	25	875x360x483	50	**6SE3225-4CS45**
MDV1850/2	68	80	87	18.5	25	22	30	875x360x783	52	**6SE3226-8CS45**
MDV2200/2	80	95	100	22	30	30	40	875x360x783	54	**6SE3227-5CS45**
MDV3000/2	104	130	143	30	40	37	50	1150x500x570	95	**6SE3231-0CS45**
MDV3700/2	130	154	170	37	50	45	60	1150x500x570	96	**6SE3231-3CS45**
MDV4500/2	154	-	170	45	60	-	-	1150x500x570	97	**6SE3231-5CS45**

MIDIMASTER Vector, 3 ph 380 – 500V±10% IP56 (NEMA 4/12)

Product	Rated Inverter Output Current 2) M = const.	Rated Inverter Output Current 1) 2) M ~ n²	Input current for 400V (max. current)	Motor Rating for M = const.		Motor Rating for M ~ n²		Dimensions 3) H x B x T	Weight approx.	Product
	A	A	A	kW	hp	kW	hp	mm	kg	Order no.
MDV750/3	19	23.5	30	-	-	11	15	675x360x351	29	**6SE3221-7DS45**
MDV1100/3	26	30	32	11	15	15	20	675x360x351	30	**6SE3222-4DS45**
MDV1500/3	32	37	41	15	20	18.5	25	775x360x422	39	**6SE3223-0DS45**
MDV1850/3	38	43.5	49	18.5	25	22	30	775x360x422	40	**6SE3223-5DS45**
MDV2200/3	45	58	64	22	30	30	40	875x360x483	50	**6SE3224-2DS45**
MDV3000/3	58	71	79	30	40	37	50	875x360x483	52	**6SE3225-5DS45**
MDV3700/3	72	84	96	37	50	45	60	875x360x483	54	**6SE3226-8DS45**
MDV4500/3	84	102	113	45	60	55	75	1150x500x570	97	**6SE3228-4DS45**
MDV5500/3	102	138	152	55	75	75	100	1150x500x570	99	**6SE3231-0DS45**
MDV7500/3	138	168	185	75	100	90	120	1150x500x570	100	**6SE3231-4DS45**

1) Overload capacity 10% for 60 secs.

2) Based on 400V input voltage; current changes in inverse proportion for other voltages.

3) The “D” dimension for IP56 devices does not include the operator panel cover - please allow an extra 25mm.

MIDIMASTER Vector, 3 ph 525 – 575V±15%, IP56 (NEMA 4/12)

Product	Rated Inverter Output Current M = const.	Rated Inverter Output Current 1) M ~ n²	Input current (max. current)	Motor Rating for M = const.		Motor Rating for M ~ n²		Dimensions 3) H x B x T	Weight approx.	Product
	A	A	A	kW	hp	kW	hp	mm	kg	Order no.
MDV220/4	3.9	6.1	7	2.2	3	4	5	675x360x351	28	**6SE3213-8FS45**
MDV400/4	6.1	9	10	4	5	5.5	7.5	675x360x351	29	**6SE3216-1FS45**
MDV550/4	9	11	12	5.5	7.5	7.5	10	675x360x351	29	**6SE3218-0FS45**
MDV750/4	11	17	18	7.5	10	11	15	675x360x351	29	**6SE3221-1FS45**
MDV1100/4	17	22	24	11	15	15	20	675x360x351	30	**6SE3221-7FS45**
MDV1500/4	22	27	29	15	20	18.5	25	775x360x422	39	**6SE3222-2FS45**
MDV1850/4	27	32	34	18.5	25	22	30	775x360x422	40	**6SE3222-7FS45**
MDV2200/4	32	41	45	22	30	30	40	875x360x483	50	**6SE3223-2FS45**
MDV3000/4	41	52	55	30	40	37	50	875x360x483	52	**6SE3224-1FS45**
MDV3700/4	52	62	65	37	50	45	60	875x360x483	54	**6SE3225-2FS45**

1) Overload capacity 10% for 60 secs.

2) Based on 400V input voltage; current changes in inverse proportion for other voltages.

3) The “D” dimension for IP56 devices does not include the operator panel cover - please allow an extra 25mm.

6.3 Options

6.3.1 Option overview

Options	Order No.	MICROMASTER	MICROMASTER Vector	MIDIMASTER Vector
EMV-Filter Class A, meeting EN55011	See section 6.3.2/3	Integrated (single phase devices, 3 phase devices 380 - 480V, 2.2 – 7.5 kW) footprint filter (3 phase devices)		integrated or external
EMV-Filter Class B, meeting EN55022	See section 6.3.2/3	footprint filter	footprint filter	external
Mains chokes	See section 6.3.2/3	available	available	available
Brake resistors	See section 3.14/15	-	available	available
Brake module I	See section 3.14/15	-	integrated	available
Output - dV/dt filter	See section 6.3.2/3	available	available	available
Output chokes	See section 6.3.2/3	available	available	available
Earthing strip for MM/MMV, size A	**6SE3290-0XX87-8FK0**	available		-
NEMA cable connector plate for size A	**6SE3290-0XX 87-8NA0**	available		-
Multi-lingual clear text operator panel (OPM2)	**6SE3290-0XX 87-8BF0**	available		supplied
Connectable cable OPM2 - inverter, 3m	**6SE3290 0XX87-8PKO**	available		
Connectable cable RS232 PC - OPM2, 1m	**6SE3290-0XX87-8SK0**	available		
SINOVIS PC program for Windows 95 and NT	**6SE3290-0XX87-8SA1**	available		
PROFIBUS DP module CB 15 for baud rates up to 12 Mb/s	**6SE3290-0XX 87-8PB0**	available		
CANbus Module, supports the CAN OPEN protocol	**6SE3290-0XX87-8CB0**	available		
Software package DVA - S5 to incorporate the inverter into a SIMATIC S5 - control via USS protocol or Profibus DP	**6DD1800-0SW0**	available		
Software package DVA - S7 to incorporate the inverter into a SIMATIC S7 - control via USS protocol or Profibus DP	**6SX7005-0CB00**	available		

6.3.2 Options MICROMASTER/MICROMASTER Vector

Power kW	Designation	Inverter Order No.	Radio interference filter Class A Order No.	Radio interference filter Class B Order No.	Nominal current A
MICROMASTER/MICROMASTER Vector 1 AC 208 – 240 V					
0.12	MM12	**6SE9210-7BA40**	integrated	-	
0.12	MM12/2	**6SE9210-7CA40**	-	**6SE3290-0BA87-0FB0**	3
0.12	MMV12	**6SE3210-7BA40**	integrated	-	
0.12	MMV12/2	**6SE3210-7CA40**	-	**6SE3290-0BA87-0FB0**	3
0.25	MM25	**6SE9211-5BA40**	integrated	-	
0.25	MM25/2	**6SE9211-5CA40**	-	**6SE3290-0BA87-0FB0**	3
0.25	MMV25	**6SE3211-5BA40**	integrated	-	
0.25	MMV25/2	**6SE3211-5CA40**	-	**6SE3290-0BA87-0FB0**	3
0.37	MM37	**6SE9212-1BA40**	integrated	-	
0.37	MM37/2	**6SE9212-1CA40**	-	**6SE3290-0BA87-0FB2**	10
0.37	MMV37	**6SE3212-1BA40**	integrated	-	
0.37	MMV37/2	**6SE3212-1CA40**	-	**6SE3290-0BA87-0FB2**	10
0.55	MM55	**6SE9212-8BA40**	integrated	-	
0.55	MM55/2	**6SE9212-8CA40**	-	**6SE3290-0BA87-0FB2**	10
0.55	MMV55	**6SE3212-8BA40**	integrated	-	
0.55	MMV55/2	**6SE3212-8CA40**	-	**6SE3290-0BA87-0FB2**	10
0.75	MM75	**6SE9213-6BA40**	integrated	-	
0.75	MM75/2	**6SE9213-6CA40**	-	**6SE3290-0BA87-0FB2**	10
0.75	MMV75	**6SE3213-6BA40**	integrated	-	
0.75	MMV75/2	**6SE3213-6CA40**	-	**6SE3290-0BA87-0FB2**	10
1.1	MM110	**6SE9215-2BB40**	integrated	-	
1.1	MM110/2	**6SE9215-2CB40**	-	**6SE3290-0BB87-0FB4**	22
1.1	MMV110	**6SE3215-2BB40**	integrated	-	
1.1	MMV110/2	**6SE3215-2CB40**	-	**6SE3290-0BB87-0FB4**	22
1.5	MM150	**6SE9216-8BB40**	integrated	-	
1.5	MM150/2	**6SE9216-8CB40**	-	**6SE3290-0BB87-0FB4**	22
1.5	MMV150	**6SE3216-8BB40**	integrated	-	
1.5	MMV150/2	**6SE3216-8CB40**	-	**6SE3290-0BB87-0FB4**	22
2.2	MM220	**6SE9221-0BC40**	integrated	-	
2.2	MM220/2	**6SE9221-0CC40**	-	**6SE3290-0BC87-0FB4**	32
2.2	MMV220	**6SE3221-0BC40**	integrated	-	
2.2	MMV220/2	**6SE3221-0CC40**	-	**6SE3290-0BC87-0FB4**	32
3.0	MM300	**6SE9221-3BC40**	integrated	-	
3.0	MM300/2	**6SE9221-3CC40**	-	**6SE3290-0BC87-0FB4**	32
3.0	MMV300	**6SE3221-3BC40**	integrated	-	
3.0	MMV300/2	**6SE3221-3CC40**	-	**6SE3290-0BC87-0FB4**	32

Power kW	Designation	Mains choke 2% Order No.	Mains choke 4% Order No.	Output choke 1) f_{max} = 120 Hz f_{puls} <= 4 kHz Order No.	Output filter dv/dt f_{max} = 300 Hz f_{puls} <= 4 kHz Order No.
MICROMASTER/MICROMASTER Vector 1 AC 208 - 240V					
0.12	MM12		**4EM4605-4CB**	**6SE7016-1ES87-1FE0**	
0.12	MM12/2		**4EM4605-4CB**	**6SE7016-1ES87-1FE0**	
0.12	MMV12		**4EM4605-4CB**	**6SE7016-1ES87-1FE0**	
0.12	MMV12/2		**4EM4605-4CB**	**6SE7016-1ES87-1FE0**	
0.25	MM25		**4EM4605-4CB**	**6SE7016-1ES87-1FE0**	
0.25	MM25/2		**4EM4605-4CB**	**6SE7016-1ES87-1FE0**	
0.25	MMV25		**4EM4605-4CB**	**6SE7016-1ES87-1FE0**	
0.25	MMV25/2		**4EM4605-4CB**	**6SE7016-1ES87-1FE0**	
0.37	MM37		**4EM4605-4CB**	**6SE7016-1ES87-1FE0**	
0.37	MM37/2		**4EM4605-4CB**	**6SE7016-1ES87-1FE0**	
0.37	MMV37		**4EM4605-4CB**	**6SE7016-1ES87-1FE0**	
0.37	MMV37/2		**4EM4605-4CB**	**6SE7016-1ES87-1FE0**	
0.55	MM55		**4EM4605-6CB**	**6SE7016-1ES87-1FE0**	
0.55	MM55/2		**4EM4605-6CB**	**6SE7016-1ES87-1FE0**	
0.55	MMV55		**4EM4605-6CB**	**6SE7016-1ES87-1FE0**	
0.55	MMV55/2		**4EM4605-6CB**	**6SE7016-1ES87-1FE0**	
0.75	MM75		**4EM4700-0CB**	**6SE7016-1ES87-1FE0**	
0.75	MM75/2		**4EM4700-0CB**	**6SE7016-1ES87-1FE0**	
0.75	MMV75		**4EM4700-0CB**	**6SE7016-1ES87-1FE0**	
0.75	MMV75/2		**4EM4700-0CB**	**6SE7016-1ES87-1FE0**	
1.1	MM110	**4EM4605-8CB**	**4EM4807-4CB**	**4EP3601-3DS**	
1.1	MM110/2	**4EM4605-8CB**	**4EM4807-4CB**	**4EP3601-3DS**	
1.1	MMV110	**4EM4605-8CB**	**4EM4807-4CB**	**4EP3601-3DS**	
1.1	MMV110/2	**4EM4605-8CB**	**4EM4807-4CB**	**4EP3601-3DS**	
1.5	MM150	**4EM4704-2CB**	**4EM4807-6CB**	**4EP3601-3DS**	
1.5	MM150/2	**4EM4704-2CB**	**4EM4807-6CB**	**4EP3601-3DS**	
1.5	MMV150	**4EM4704-2CB**	**4EM4807-6CB**	**4EP3601-3DS**	
1.5	MMV150/2	**4EM4704-2CB**	**4EM4807-6CB**	**4EP3601-3DS**	
2.2	MM220	**4EM4704-3CB**	**4EM4912-2CB**	**4EP3601-3DS**	
2.2	MM220/2	**4EM4704-3CB**	**4EM4912-2CB**	**4EP3601-3DS**	
2.2	MMV220	**4EM4704-3CB**	**4EM4912-2CB**	**4EP3601-3DS**	
2.2	MMV220/2	**4EM4704-3CB**	**4EM4912-2CB**	**4EP3601-3DS**	
3.0	MM300	**4EM4807-8CB**	**4EM4912-5CB**	**4EP3601-3DS**	
3.0	MM300/2	**4EM4807-8CB**	**4EM4912-5CB**	**4EP3601-3DS**	
3.0	MMV300	**4EM4807-8CB**	**4EM4912-5CB**	**4EP3601-3DS**	
3.0	MMV300/2	**4EM4807-8CB**	**4EM4912-5CB**	**4EP3601-3DS**	

1) Use of a larger inverter is an alternative to using an output choke (see section 3)

Power kW	Designation	Inverter Order No.	Radio interference filter Class A Order No.	Nominal current [A]	Radio interference filter Class B Order No.	Nominal current [A]
MICROMASTER/MICROMASTER Vector 3 AC 208 - 240						
0.12	MM12/2	**6SE9210-7CA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.12	MMV12/2	**6SE3210-7CA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.25	MM25/2	**6SE9211-5CA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.25	MMV25/2	**6SE3211-5CA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.37	MM37/2	**6SE9212-1CA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.37	MMV37/2	**6SE3212-1CA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.55	MM55/2	**6SE9212-8CA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.55	MMV55/2	**6SE3212-8CA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.75	MM75/2	**6SE9213-6CA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.75	MMV75/2	**6SE3213-6CA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
1.1	MM110/2	**6SE9215-2CB40**	**6SE3290-0DB87-0FA3**	12	**6SE3290-0DB87-0FB3**	12
1.1	MMV110/2	**6SE3215-2CB40**	**6SE3290-0DB87-0FA3**	12	**6SE3290-0DB87-0FB3**	12
1.5	MM150/2	**6SE9216-8CB40**	**6SE3290-0DB87-0FA3**	12	**6SE3290-0DB87-0FB3**	12
1.5	MMV150/2	**6SE3216-8CB40**	**6SE3290-0DB87-0FA3**	12	**6SE3290-0DB87-0FB3**	12
2.2	MM220/2	**6SE9221-0CC40**	**6SE3290-0DC87-0FA4**	25	**6SE3290-0DC87-0FB4**	25
2.2	MMV220/2	**6SE3221-0CC40**	**6SE3290-0DC87-0FA4**	25	**6SE3290-0DC87-0FB4**	25
3.0	MM300/2	**6SE9221-3CC40**	**6SE3290-0DC87-0FA4**	25	**6SE3290-0DC87-0FB4**	25
3.0	MMV300/2	**6SE3221-3CC40**	**6SE3290-0DC87-0FA4**	25	**6SE3290-0DC87-0FB4**	25
4.0	MM400/2	**6SE9221-8CC13**	**6SE3290-0DC87-0FA4**	25	**6SE3290-0DC87-0FB4**	25
4.0	MMV400/2	**6SE3221-8CC40**	**6SE3290-0DC87-0FA4**	25	**6SE3290-0DC87-0FB4**	25

Power kW	Designation	Mains choke 2% Order No.	Mains choke 4% Order No.	Output choke 1) f_{max} = 120 Hz f_{puls} <= 4 kHz Order No.	Output filter dv/dt f_{max} = 300 Hz f_{puls} <= 4 kHz Order No.
MICROMASTER/MICROMASTER Vector 3 AC 208 - 240V					
0.12	MM12/2		**4EP3200-1US**	**6SE7016-1ES87-1FE0**	
0.12	MMV12/2		**4EP3200-1US**	**6SE7016-1ES87-1FE0**	
0.25	MM25/2		**4EP3200-1US**	**6SE7016-1ES87-1FE0**	
0.25	MMV25/2		**4EP3200-1US**	**6SE7016-1ES87-1FE0**	
0.37	MM37/2		**4EP3200-1US**	**6SE7016-1ES87-1FE0**	
0.37	MMV37/2		**4EP3200-1US**	**6SE7016-1ES87-1FE0**	
0.55	MM55/2		**4EP3200-1US**	**6SE7016-1ES87-1FE0**	
0.55	MMV55/2		**4EP3200-1US**	**6SE7016-1ES87-1FE0**	
0.75	MM75/2		**4EP3200-1US**	**6SE7016-1ES87-1FE0**	
0.75	MMV75/2		**4EP3200-1US**	**6SE7016-1ES87-1FE0**	
1.1	MM110/2		**4EP3200-1US**	**4EP 3601-3DS**	
1.1	MMV110/2		**4EP3200-1US**	**4EP3601-3DS**	
1.5	MM150/2		**4EP3400-1US**	**4EP3601-3DS**	
1.5	MMV150/2		**4EP3400-1US**	**4EP3601-3DS**	
2.2	MM220/2		**4EP3400-1US**	**4EP3601-3DS**	
2.2	MMV220/2		**4EP3400-1US**	**4EP3601-3DS**	
3.0	MM300/2		**4EP3500-0US**	**4EP3601-3DS**	
3.0	MMV300/2		**4EP3500-0US**	**4EP3601-3DS**	
4.0	MM400/2		**4EP3600-4US**	**4EP3601-3DS**	
4.0	MMV400/2		**4EP3600-4US**	**4EP3601-3DS**	

1) Use of a larger inverter is an alternative to using an output choke (see section 3)

Power kW	Designation	Inverter Order No.	Radio interference filter Class A 1) Order No.	Nominal current [A]	Radio interference filter Class B 1) Order No.	Nominal current [A]
MICROMASTER/MICROMASTER Vector 3 AC 380 - 500V						
0.37	MM37/3	**6SE9211-1DA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.37	MMV37/3	**6SE3211-1DA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.55	MM55/3	**6SE9211-4DA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.55	MMV55/3	**6SE3211-4DA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.75	MM75/3	**6SE9213-6DA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
0.75	MMV75/3	**6SE3213-6DCA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
1.1	MM110/3	**6SE9212-7DA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
1.1	MMV110/3	**6SE3212-2DA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
1.5	MM150/3	**6SE9214-0DA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
1.5	MMV150/3	**6SE3214-0DA40**	**6SE3290-0DA87-0FA1**	6	**6SE3290-0DA87-0FB1**	6
2.2	MM220/3	**6SE9215-8DB40**	**6SE3290-0DB87-0FA3**	12	**6SE3290-0DB87-0FB3**	12
2.2	MMV220/3	**6SE3215-8DB40**	**6SE3290-0DB87-0FA3**	12	**6SE3290-0DB87-0FB3**	12
3.0	MM300/3	**6SE9217-3DB40**	**6SE3290-0DB87-0FA3**	12	**6SE3290-0DB87-0FB3**	12
3.0	MMV300/3	**6SE3217-3DB40**	**6SE3290-0DB87-0FA3**	12	**6SE3290-0DB87-0FB3**	12
4.0	MM400/3	**6SE9221-0DC40**	**6SE3290-0DC87-0FA4**	25	**6SE3290-0DC87-0FB4**	25
4.0	MMV400/3	**6SE3221-0DC40**	**6SE3290-0DC87-0FA4**	25	**6SE3290-0DC87-0FB4**	25
5.5	MM550/3	**6SE9221-3DC40**	**6SE3290-0DC87-0FA4**	25	**6SE3290-0DC87-0FB4**	25
5.5	MMV550/3	**6SE3221-3DC40**	**6SE3290-0DC87-0FA4**	25	**6SE3290-0DC87-0FB4**	25
7.5	MM750/3	**6SE9221-5DC40**	**6SE3290-0DC87-0FA4**	25	**6SE3290-0DC87-0FB4**	25
7.5	MMV750/3	**6SE3221-5DC40**	**6SE3290-0DC87-0FA4**	25	**6SE3290-0DC87-0FB4**	25

1) Maximum mains voltage for the use of the radio interference filter 480V

Power kW	Designation	Mains choke 2% 2) Order No.	Mains choke 4% 2) Order No.	Output choke 3) f_{max} = 120 Hz f_{puls} <= 4 kHz Order No.	Output filter dv/dt f_{max} = 300 Hz f_{puls} <= 4 kHz Order No.
MICROMASTER/MICROMASTER Vector 3 AC 380 - 500V					
0.37	MM37/3	**4EP3200-2US (4EP3200-2US)**	**3x4EM4605-4CB**	**6SE7016-1ES87-1FE0**	**6SE7016-2FB87-1FD0**
0.37	MMV37/3	**4EP3200-2US (4EP3200-2US)**	**3x4EM4605-4CB**	**6SE7016-1ES87-1FE0**	**6SE7016-2FB87-1FD0**
0.55	MM55/3	**4EP3200-2US (4EP3200-2US)**	**3x4EM4605-4CB**	**6SE7016-1ES87-1FE0**	**6SE7016-2FB87-1FD0**
0.55	MMV55/3	**4EP3200-2US (4EP3200-2US)**	**3x4EM4605-4CB**	**6SE7016-1ES87-1FE0**	**6SE7016-2FB87-1FD0**
0.75	MM75/3	**4EP3200-2US (4EP3200-2US)**	**3x4EM4605-4CB**	**6SE7016-1ES87-1FE0**	**6SE7016-2FB87-1FD0**
0.75	MMV75/3	**4EP3200-2US (4EP3200-2US)**	**3x4EM4605-4CB**	**6SE7016-1ES87-1FE0**	**6SE7016-2FB87-1FD0**
1.1	MM110/3	**4EP3200-2US (4EP3200-2US)**	**3x4EM4605-4CB**	**6SE7016-1ES87-1FE0**	**6SE7016-2FB87-1FD0**
1.1	MMV110/3	**4EP3200-2US (4EP3200-2US)**	**3x4EM4605-4CB**	**6SE7016-1ES87-1FE0**	**6SE7016-2FB87-1FD0**
1.5	MM150/3	**4EP3200-1US (4EP3200-1US)**	**3x4EM4605-6CB**	**4EP3601-3DS**	**6SE7016-2FB87-1FD0**
1.5	MMV150/3	**4EP3200-1US (4EP3200-1US)**	**3x4EM4605-6CB**	**4EP3601-3DS**	**6SE7016-2FB87-1FD0**
2.2	MM220/3	**4EP3200-1US (4EP3200-1US)**	**3x4EM4605-6CB**	**4EP3601-3DS**	**6SE7016-2FB87-1FD0**
2.2	MMV220/3	**4EP3200-1US (4EP3200-1US)**	**3x4EM4605-6CB**	**4EP3601-3DS**	**6SE7016-2FB87-1FD0**
3.0	MM300/3	**4EP3400-2US (4EP3300-0US)**	**3x4EM4807-4CB**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
3.0	MMV300/3	**4EP3400-2US (4EP3300-0US)**	**3x4EM4807-4CB**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
4.0	MM400/3	**4EP3400-1US (4EP3400-3US)**	**3x4EM4807-6CB**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
4.0	MMV400/3	**4EP3400-1US (4EP3400-3US)**	**3x4EM4807-6CB**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
5.5	MM550/3	**4EP3500-0US (4EP3600-8US)**	**4EP3700-7US (4EP3800-8US)**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
5.5	MMV550/3	**4EP3500-0US (4EP3600-8US)**	**4EP3700-7US (4EP3800-8US)**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
7.5	MM750/3	**4EP3600-4US (4EP3600-2US)**	**4EP3801-0US (4EP3800-8US)**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
7.5	MMV750/3	**4EP3600-4US (4EP3600-2US)**	**4EP3801-0US (4EP3800-8US)**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**

2) For voltages over 460V the chokes in brackets should be used.

3) Use of a larger inverter is an alternative to using an output choke (see section 3).

Power kW	Designation	Inverter Order No.	Radio interference filter Class A Order No.	Nominal current [A]	Radio interference filter Class B Order No.	Nominal current [A]
MICROMASTER/MICROMASTER Vector 3 AC 380 - 480V ±10%, with integrated filter, Class A						
2.2	MM220/3F	**6SE9215-8DB50**	**integrated**	-	**-**	-
2.2	MMV220/3F	**6SE3215-8DB50**	**integrated**	-	**-**	-
3.0	MM300/3F	**6SE9217-3DB50**	**integrated**	-	**-**	-
3.0	MMV300/3F	**6SE3217-3DB50**	**integrated**	-	**-**	-
4.0	MM400/3F	**6SE9221-0DC50**	**integrated**	-	**-**	-
4.0	MMV400/3F	**6SE3221-0DC50**	**integrated**	-	**-**	-
5.5	MM550/3F	**6SE9221-3DC50**	**integrated**	-	**-**	-
5.5	MMV550/3F	**6SE3221-3DC50**	**integrated**	-	**-**	-
7.5	MM750/3F	**6SE9221-5DC50**	**integrated**	-	**-**	-
7.5	MMV750/3F	**6SE3221-5DC50**	**integrated**	-	**-**	-

Power kW	Designation	Mains choke 2% 2) Order No.	Mains choke 4% 2) Order No.	Output choke 3) f_{max} = 120 Hz f_{puls} <= 4 kHz Order No.	Output filter dv/dt f_{max} = 300 Hz f_{puls} <= 4 kHz Order No.
MICROMASTER/MICROMASTER Vector 3 AC 380 - 480V ±10%, with integrated filter, Class A					
2.2	MM220/3F	**4EP3200-1US (4EP3200-1US)**	**3x4EM4605-6CB**	**4EP3601-3DS**	**6SE7016-2FB87-1FD0**
2.2	MMV220/3F	**4EP3200-1US (4EP3200-1US)**	**3x4EM4605-6CB**	**4EP3601-3DS**	**6SE7016-2FB87-1FD0**
3.0	MM300/3F	**4EP3400-2US (4EP3300-0US)**	**3x4EM4807-4CB**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
3.0	MMV300/3F	**4EP3400-2US (4EP3300-0US)**	**3x4EM4807-4CB**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
4.0	MM400/3F	**4EP3400-1US (4EP3400-3US)**	**3x4EM4807-6CB**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
4.0	MMV400/3F	**4EP3400-1US (4EP3400-3US)**	**3x4EM4807-6CB**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
5.5	MM550/3F	**4EP3500-0US (4EP3600-8US)**	**4EP3700-7US (4EP3800-8US)**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
5.5	MMV550/3F	**4EP3500-0US (4EP3600-8US)**	**4EP3700-7US (4EP3800-8US)**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
7.5	MM750/3F	**4EP3600-4US (4EP3600-2US)**	**4EP3801-0US (4EP3800-8US)**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**
7.5	MMV750/3F	**4EP3600-4US (4EP3600-2US)**	**4EP3801-0US (4EP3800-8US)**	**4EP3601-3DS**	**6SE7021-5FB87-1FD0**

2) For voltages over 460V the chokes in brackets should be used.

3) Use of a larger inverter is an alternative to using an output choke (see section 3).

6.3.3 Options MIDIMASTER Vector

The options detailed in the following tables apply to MIDIMASTER Vector IP20 (NEMA1) and IP56 (NEMA 4/12)

Power kW	Designation	Inverter (IP21) Order No.	Radio interference filter Class A 1) 2) Order No.	Nominal current A	Radio interference filter Class B 3) Order No.	Nominal current A
MIDIMASTER Vector 3 AC 208 - 240V ±10%,						
5.5 (M=const.)	MDV550/2	**6SE3222-3CG40**	**6SE3290-0DG87-0FA5**	34	**6SE2100-1FC20**	38
7.5 (M=const.)	MDV750/2	**6SE3223-1CG40**	**6SE3290-0DH87-0FA5**	49	**6SE2100-1FC20**	38
11 (M=const.)	MDV1100/2	**6SE3224-2CH40**	**6SE3290-0DJ87-0FA6**	96	**6SE2100-1FC21**	75
15 (M=const.) 18.5 (M~n²)	MDV1500/2	**6SE3225-4CH40**	**6SE3290-0DJ87-0FA6**	96	**6SE2100-1FC21**	75
18.5 (M=const.) 22 (M~n²)	MDV1850/2	**6SE3226-8CJ40**	**6SE3290-0DJ87-0FA6**	96	**6SE2100-1FC21**	75
22 (M=const.) 30 (M~n²)	MDV2200/2	**6SE3227-5CJ40**	**6SE3290-0DJ87-0FA6**	96	**6SE3290-0DK87-0FB7**	180
30 (M=const.) 37 (M~n²)	MDV3000/2	**6SE3231-0CK40**	**6SE3290-0DK87-0FA7**	180	**6SE3290-0DK87-0FB7**	180
37 (M=const.) 45 (M~n²)	MDV3700/2	**6SE3231-3CK40**	**6SE3290-0DK87-0FA7**	180	**6SE3290-0DK87-0FB7**	180
45 (M=const.)	MDV4500/2	**6SE3231-5CK40**	**6SE3290-0DK87-0FA7**	180	**6SE3290-0DK87-0FB7**	180

1) Devices with integrated filter Class A can also be supplied (see section 6.2).

2) Class A filters can be integrated into IP56 (NEMA 4/12) devices.

3) Class B filters require a separate housing appropriate to their type.

Power kW	Designation	Mains choke 2% Order No.	Mains choke 4% Order No.	Output choke 4) f_{max} = 120 Hz f_{puls} <= 4 kHz Order No.	Output filter dv/dt f_{max} = 300 Hz f_{puls} <= 4 kHz Order No.
MIDIMASTER 3 AC 208-240V					
5.5 (M=const.)	MDV550/2	-	**4EP3600-5US**	**4EP3700-5DS**	-
7.5 (M=const.)	MDV750/2	-	**4EP3700-2US**	**4EP3700-5DS**	-
11 (M=const.)	MDV1100/2	-	**4EP3800-2US**	**4EP3700-6DS**	-
15 (M=const.) 18.5 (M~n²)	MDV1500/2	-	**4EP3800-7US**	**6SE7028-2HS87-1FE0**	-
18.5 (M=const.) 22 (M~n²)	MDV1850/2	-	**4EP3900-2US**	**6SE7028-2HS87-1FE0**	-
22 (M=const.) 30 (M~n²)	MDV2200/2	-	**4EP3900-2US**	**6SE7028-2HS87-1FE0**	-
30 (M=const.) 37 (M~n²)	MDV3000/2	-	**4EP4000-2US**	**6SE7031-5ES87-1FE0**	-
37 (M=const.) 45 (M~n²)	MDV3700/2	-	**4EU2451-2UA00**	**6SE7031-5ES87-1FE0**	-
45 (M=const.)	MDV4500/2	-	**4EU2551-4UA00**	**6SE7031-8ES87-1FE0**	-

4) Use of a larger inverter is an alternative to using an output choke (see section 3)

Power kW	Designation	Inverter (IP21) Order No.	Radio interference filter Class A 1) 2) 3) Order No.	Nominal current A	Radio interference filter Class B 1) 4) Order No.	Nominal current A
MIDIMASTER Vector 3 AC 380-500V						
11 (M~n²)	MDV750/3	**6SE3221-7DG40**	**6SE3290-0DG87-0FA5**	34	**6SE2100-1FC20**	38
11 (M=const.) 15 (M~n²)	MDV1100/3	**6SE3222-4DG40**	**6SE3290-0DG87-0FA5**	34	**6SE2100-1FC20**	38
15 (M=const.) 18.5 (M~n²)	MDV1500/3	**6SE3223-0DH40**	**6SE3290-0DH87-0FA5**	49	**6SE2100-1FC20**	38
18.5 (M=const.) 22 (M~n²)	MDV1850/3	**6SE3223-5DH40**	**6SE3290-0DH87-0FA5**	49	**6SE2100-1FC20**	38
22 (M=const.) 30 (M~n²)	MDV2200/3	**6SE3224-2DJ40**	**6SE3290-0DJ87-0FA6**	96	**6SE2100-1FC21**	75
30 (M=const.) 37 (M~n²)	MDV3000/3	**6SE3225-5DJ40**	**6SE3290-0DJ87-0FA6**	96	**6SE2100-1FC21**	75
37 (M=const.) 45 (M~n²)	MDV3700/3	**6SE3226-8DJ40**	**6SE3290-0DJ87-0FA6**	96	**6SE2100-1FC21** **6SE3290-0DK87-0FB7**	75 180
45 (M=const.) 55 (M~n²)	MDV4500/3	**6SE3228-4DK40**	**6SE3290-0DK87-0FA7**	180	**6SE3290-0DK87-0FB7**	180
55 (M=const.) 75 (M~n²)	MDV5500/3	**6SE3231-0DK40**	**6SE3290-0DK87-0FA7**	180	**6SE3290-0DK87-0FB7**	180
75 (M=const.) 90 (M~n²)	MDV7500/3	**6SE3231-4DK40**	**6SE3290-0DK87-0FA7**	180	**6SE3290-0DK87-0FB7**	180

1) Maximum mains voltage for the use of radio interference filter 460V.

2) Devices with integrated filter Class A can also be supplied (see section 6.2).

3) Class A filters can be integrated into IP56 (NEMA 4/12).

4) Class B filters require a separate housing appropriate to their type.

Power kW	Designation	Mains choke 2% 4) 5) Order No.	Mains choke 4% 4) 5) Order No.	Output choke 6) f_{max} = 120 Hz f_{puls} <= 4 kHz Order No.	Output filter dv/dt f_{max} = 300 Hz f_{puls} <= 4 kHz Order No.
MIDIMASTER Vector 3 AC 380-500V					
11	MDV750/3	**4EP3600-5US (4EP3600-3US)**	**4EP3900-5US (4EP4001-0US)**	**4EP3700-5DS**	**6SE7021-5FB87-1FD0**
11 (M=const.) 15 (M~n²)	MDV1100/3	**4EP3700-2US (4EP3700-6US)**	**4EP3900-5US (4EP4001-0US)**	**4EP3700-5DS**	**6SE7022-2FC87-1FD0**
15 (M=const.) 18.5 (M~n²)	MDV1500/3	**4EP3700-5US (4EP3700-1US)**	**4EP4001-1US (4EP4001-2US)**	**4EP3700-5DS**	**6SE7023-4FC87-1FD0**
18.5 (M=const.) 22 (M~n²)	MDV1850/3	**4EP3800-2US (4EP3801-2US)**	**4EU2451-4UA00 (4EU2451-5UA00)**	**4EP3700-5DS**	**6SE7024-7FC87-1FD0**
22 (M=const.) 30 (M~n²)	MDV2200/3	**4EP3800-7US (4EP3900-1US)**	**4EU2451-4UA00 (4EU2551-1UB00)**	**4EP3700-7DS**	**6SE7024-7FC87-1FD0**
30 (M=const.) 37 (M~n²)	MDV3000/3	**4EP3900-2US (4EP4000-1US)**	**4EU2551-2UB00 (4EU2551-3UB00)**	**6SE7028-2HS87-1FE0**	**6SE7026-0HE87-1FD0**
37 (M=const.) 45 (M~n²)	MDV3700/3	**4EP4000-2US (4EP4000-8US)**	**4EU2751-1UB00 (4EU2551-3UB00)**	**6SE7028-2HS87-1FE0**	**6SE7028-0HE87-1FD0**
45 (M=const.) 55 (M~n²)	MDV4500/3	**4EP4000-6US (4EP4000-8US)**	**4EU2751-1UB00 (4EU2751-3UB00)**	**6SE7031-5ES87-1FE0**	**6SE7031-7HS87-1FD0**
55 (M=const.) 75 (M~n²)	MDV5500/3	**4EU2451-2UA00 (4EU2551-2UA00)**	**4EU2751-1UB00 (4EU2751-6UB00)**	**6SE7031-5ES87-1FE0**	**6SE7031-7HS87-1FD0**
75 (M=const.) 90 (M~n²)	MDV7500/3	**4EU2551-4UA00 (4EU2551-6UA00)**	**4EU2751-2UB00 (4EU3051-0UB00)**	**6SE7031-8ES87-1FE0**	**6SE7032-3HS87-1FD0**

4) For voltages over 460V the chokes in brackets should be used.

5) For M~n^2 the next larger mains choke should be used.

6) Use of a larger inverter is an alternative to using an output choke (see section 3).

Power KW	Designation	Inverter (IP21) Order No.	Radio interference filter Class A 1) Order No.	Nominal current [A]	Radio interference filter Class B 1) Order No.	Nominal current [A]
MIDIMASTER Vector 3 AC 525-575V						
2.2 (M=const.) 4 (M~n²)	MDV220/4	**6SE3213-8FG40**	-	-	-	-
4 (M=const.) 5.5 (M~n²)	MDV400/4	**6SE3216-1FG40**	-	-	-	-
5.5 (M=const.) 7.5 (M~n²)	MDV550/4	**6SE3218-0FG40**	-	-	-	-
7.5 (M=const.) 11 (M~n²)	MDV750/4	**6SE3221-1FG40**	-	-	-	-
11 (M=const.) 15 (M~n²)	MDV1100/4	**6SE3221-7FG40**	-	-	-	-
15 (M=const.) 18.5 (M~n²)	MDV1500/4	**6SE3222-2FH40**	-	-	-	-
18.5 (M=const.) 22 (M~n²)	MDV1850/4	**6SE3222-7FH40**	-	-	-	-
22 (M=const.) 30 (M~n²)	MDV2200/4	**6SE3223-2FJ40**	-	-	-	-
30 (M=const.) 37 (M~n²)	MDV3000/4	**6SE3224-1FJ40**	-	-	-	-
37 (M=const.) 45 (M~n²)	MDV3700/4	**6SE3225-2FJ40**	-	-	-	-

Power kW	Designation	Mains choke 2% Order No.	Mains choke 4% Order No.	Output choke 1) f_{max} = 120 Hz f_{puls} <= 4 kHz Order No.	Output filter dv/dt f_{max} = 300 Hz f_{puls} <= 4 kHz Order No.
MIDIMASTER Vector 3 AC 525-575V					
2.2 (M=const.) 4 (M~n²)	MDV220/4	**4EP3400-3US**	**3 x 4EM4807-1CB**	**6SE7022-2FS87-1FE0**	**6SE7021-5FB87-1FD0**
4 (M=const.) 5.5 (M~n²)	MDV400/4	**4EP3600-8US**	**3 x 4EM4911-7CB**	**6SE7022-2FS87-1FE0**	**6SE7021-5FB87-1FD0**
5.5 (M=const.) 7.5 (M~n²)	MDV550/4	**4EP3600-2US**	**4EP3800-8US**	**6SE7022-2FS87-1FE0**	**6SE7021-5FB87-1FD0**
7.5 (M=const.) 11 (M~n²)	MDV750/4	**4EP3600-3US**	**4EU3800-8US**	**6SE7022-2FS87-1FE0**	**6SE7021-5FB87-1FD0**
11 (M=const.) 15 (M~n²)	MDV1100/4	**4EP3700-6US**	**4EP4001-0US**	**6SE7023-4FS87-1FE0**	**6SE7022-2FC87-1FD0**
15 (M=const.) 18.5 (M~n²)	MDV1500/4	**4EP3700-1US**	**4EP4001-0US**	**6SE7023-4FS87-1FE0**	**6SE7023-4FC87-1FD0**
18.5 (M=const.) 22 (M~n²)	MDV1850/4	**4EP3801-2US**	**4EP4001-2US**	**6SE7023-4FS87-1FE0**	**6SE7023-4FC87-1FD0**
22 (M=const.) 30 (M~n²)	MDV2200/4	**4EP3800-1US**	**4EP4001-2US**	**6SE7024-7FS87-1FE0**	**6SE7023-4FC87-1FD0**
30 (M=const.) 37 (M~n²)	MDV3000/4	**4EP3900-1US**	**4EU2551-1UB00**	**6SE7026-0HS87-1FE0**	**6SE7024-7FC87-1FD0**
37 (M=const.) 45 (M~n²)	MDV3700/4	**4EP4000-7US**	**4EU2551-1UB00**	**6SE7028-2HS87-1FE0**	**6SE7024-7FC87-1FD0**

6) Use of a larger inverter is an alternative to using an output choke (see section 3)

7. MOTOR DATA

7.1 Engineering Information

A detailed description of the motors is provided in the following catalogues:

M 11: LV motors: Squirrel Cage Induction motors

DA 47: Reluctance motors: Synchronous motors for variable-speed drives

DA 48: SIEMOSYN motors: permanent-magnet synchronous motors

The engineering guidelines specified here refer to Siemens 1LA5, 1LA6 and 1LA7 induction motors as well as Siemens force-ventilated 1LA5 motors. If third-party induction motors are used, their specific engineering data must be observed.

All types of load characteristics are possible; only the most important will be discussed here:

- Constant-torque Drives

When M = const. ("Constant Torque", CT)

- Fan and pump drives

with M ~ n² ("Variable Torque", VT).

Torque Utilisation of Motors:

The motor best suited for a specific application depends on its permissible torque characteristic over the speed range.

The typical characteristics of the permissible continuous torque for a self-ventilated motor with a 50 Hz rated frequency are illustrated in **Figure 1.** As a result of the low cooling effect at low speeds, the torque which can be utilised is significantly lower than at 50 Hz. The torque de-rating factor is not the same for all motors. The assignment tables from Page 7/6 onwards specify the torque de-rating as a function of the speed in the frequency range of f = 0 Hz to 50 Hz when utilised to temperature rise class F.

For frequencies above rated frequency f_n, the voltage remains constant when the maximum drive converter output voltage has been reached. In this range, the motor is operated in field weakening. The torque which can be thermally utilised decreases with approx. f_n/f. As the stall torque decreases with $(f_n/f)^2$, the safety margin to the stall torque decreases and the drive load capability is lower.

For MICROMASTER and MIDIMASTER drives with a field-weakening range f = 50 Hz to 100 Hz, the output up to 100 Hz decreases for 1LA5, 1LA6 and 1LA7 motors by approximately 10%.

The assignment tables indicate that Siemens 1LA5/1LA6/1LA7 induction motors, when utilised according to temperature rise class F, in the control range 1:2, can generally be operated at 100% rated torque. When utilised according to temperature rise class B, the permissible torque for 1LA5/1LA6/1LA7 motors must be reduced by approximately 10%.

Force-ventilated Motors:

In addition to self-ventilated 1LA5 1LA6 and 1LA7 motors, force-ventilated 1LA5/1LA7 motors can also be used. According to **Figure 1,** the permissible S1-torque can be used, at rated frequency, down to standstill.

It is practical to use force-ventilated motors, if high torque utilisation is required, even at the lowest speeds.

Standard motors with pole numbers greater than 4 are to be operated at speeds > approx. 2200 RPM (e.g. in the field-weakening range). Thus, for self-ventilated motors the fan noise is decreased.

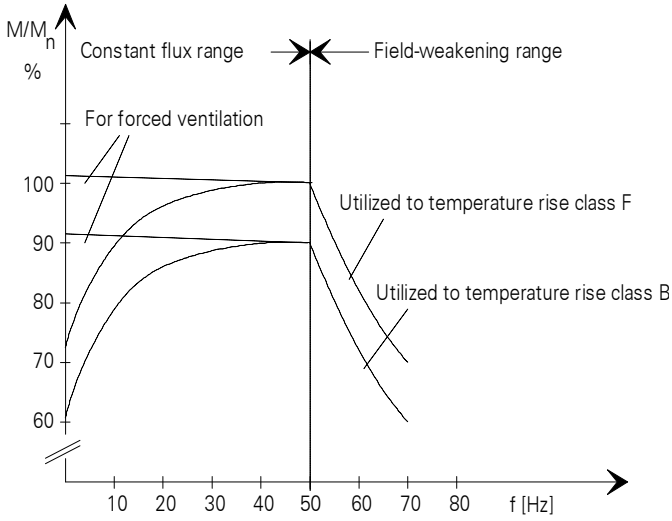


Figure 1: Typical Characteristic Of The Permissible Torque For Force-Ventilated Motors (e.g. 1LA5/1LA6/1LA7) with 50 Hz Rated Frequency. (Precise values for 1LA5, 1LA6 and 1LA7 motors can be taken from the Assignment Tables on Page 7/6 onwards).

Maximum Speeds:

The maximum mechanical speeds for 1LA5, 1LA6 and 1LA7 motors are specified in Catalogue M11.

Motor Protection:

For **MICROMASTER Vector and MIDIMASTER Vector** this is realised using PTC thermistors. The PTC thermistor is connected at the control terminal strip. If the motor protection function is activated (parameter P087 = 1), the drive converter is shutdown if a high signal level is present at the PTC input (fault code F004 is displayed).

For **MICROMASTER** this is achieved using a digital input as an external trip signal, together with a PTC and additional resistor. Please see the operating instructions for further details.

Connecting Motors Through Longer Feeder Cables:

Long feeder cables between the motor and drive converter or several parallel motor feeder cables (group drives), result in additional re-charging currents due to the cable capacitance. The drive converters must also supply these additional currents. This can activate the drive converter current limiting and cause the unit to shutdown with an "overcurrent" fault message (F002).

Further, when fed from PWM drive converters with long motor feeder cables, voltage spikes at the motor can occur due to voltage reflections.

Depending on the drive converter supply voltage, motor frame size and cable length between the motor and drive converter, output reactors or d*V*/d*t* filters are required and/or larger drive converters must be selected.

Further, to reduce the cable capacitance, a higher cable cross-section should be used (for **MICROMASTER** up to 3 kW: 2.5 mm^2, up to 5.5 kW: 4 mm^2; for **MIDIMASTER** up to 5.5 kW: 6 mm^2, up to 15 kW: 10 mm^2, for MD 1500/2: 16 mm^2, up to 22 kW, 16 mm^2, up to 37 kW, 25 mm^2).

For MICROMASTER, it is generally more favorable to select a higher-rating drive converter than to use an output reactor or d*V*/d*t* filter (see Section 3.7).

For cable lengths up to 125 metres, it is sufficient to use the next largest MICROMASTER or MIDIMASTER; up to 200 metres, the next but one largest (i.e. 2 steps higher).

The output reactor ordering data is specified in Section 6 - Options. In this case, the maximum permissible output frequency is 120 Hz at a maximum switching frequency of 4 kHz.

Operating Motors with Degree of Protection "d":

Siemens 1MJ6 squirrel cage motors can be operated from the line supply (direct on-line) as well as from a drive converter, as explosion-protected motors with flameproof enclosure "d". The flameproof enclosure ensures explosion protection for the drives. The Physikalisch-Technische Bundesanstalt (German regulatory body) has issued a general certificate of conformance for converter operation of these motors. 1MJ6 motors include PTC thermistors, which are integrated into the stator winding. If 1MJ6 motors are to be connected to drive converters, then, just like the 1LA5 and 1LA6 motors having the same output, the maximum permissible torque must be reduced.

The internal I^2t calculation also allows the motor to be thermally monitored. Various motor-output de-rating curves can be parameterised (P074), which limits the motor current as a function of the frequency, and provides an alarm (P931 = 5; motor overtemperature - **MICROMASTER Vector/MIDIMASTER Vector** only).

The "alarm" and "fault" signals can also be output via the binary outputs.

1MJ6 motors include PTC thermistors, which are integrated into the stator winding. If 1MJ6 motors are to be connected to drive converters, then, just like the 1LA5 and 1LA6 motors having the same output, the maximum permissible torque must be reduced.

1MJ6 motors have, as standard, a terminal box with degree of protection increased safety "e" (EEx e). Voltage peaks can occur at the motor when fed from a PWM converter if long motor feeder cables are used due to voltage reflection. The terminal boxes, degree of protection EEx e are only permitted for the following maximum voltage peaks due to the air and creapage distances:

- Up to frame size 225M (660 V terminal boxes) for voltage peaks up to 1078 V.
- From frame size 250M (100 V terminal boxes) for voltage peaks up to 1633 V.

In order that these maximum permissible voltage peaks are not exceeded at the terminal boxes, the following conditions should be observed:

230 V supply voltage:

When using 1MJ motors (EEx e terminal boxes) no restriction.

400 V supply voltage:

- Only possible when using the standard 4 kHz switching frequency.
- Output reactor and flameproof terminal boxes (k53) or: dV/d*t* filter.

460 V to 500 V supply voltage:

- Only possible when using the standard 4 kHz switching frequency.
- dV/d*t* filter.

575 V supply voltage:

- Only possible when using the standard 4 kHz switching frequency.
- Flameproof terminal boxes (K53).
- dV/d*t* filter.

Note:
For 1MJ motors, PTC thermistors and tripping devices (refer to Catalogue NS2) are specified. Code for installing PTC thermistors in the motor:
A15 for tripping 1MJ motors
A16 for alarm and tripping 1MJ motors.

7.2 Motor - Drive Converter Assignment

The induction motors assigned in tables on Page 6/7 and onwards guarantee an optimum utilisation of the motor and drive converter.

7.2.1 Rated Motor Current Greater than the Rated Drive Converter Current

If the drive is to have a larger motor than that specified in the assignment tables (e.g. if the drive is to be exclusively operated in the partial-load range), then the following limit should be observed:

The maximum drive converter current (short-time current) should be greater than or at least the same as the rated motor current of the connected motor or, if applicable, the sum of the rated motor currents of the connected motors (for multi-motor drives).

Otherwise, the peak currents which can occur could cause the drive to be tripped due to overcurrent, as the leakage inductance and therefore the current ripple is higher for larger motors.

7.2.2 Fan and Pump Drives with 1LA5, 1LA6 and 1LA7 Motors: ("Variable Torque", VT)

Fan and pump drives with load characteristic $M \sim n^2$ only require the full torque at rated speed. Generally, increased starting torques for load surges are not encountered. Thus, the inverter requires no overload capability.

For fan and pump drives, the motors and converters are assigned in the tables, so that

The motor current at full torque at the rated operating point is less than or equal to the continuous drive converter current.

The favourable pulse pattern allows, in almost all situations at the rated operating point, the same shaft outputs as for line supply operation (direct online), if the motors are utilised according to temperature rise class F.

For MIDIMASTER, when the quadratic voltage-frequency characteristic (P077 = 2) is used, a significantly higher continuous current is possible, so that in almost all cases the rated output is achieved with the next largest motor ("Variable Torque", VT).

Thus, for any specified output, fan and pump drives can use a smaller drive converter.

7.2.3 Information regarding the tables

These tables allow a drive package consisting of motor and inverters to be quickly selected. 2-, 4-, 6- and 8-pole induction motors and rated motor voltages of 230 V, 400 V and 500 V at 50 Hz are listed. This is based on the fact that the motors are utilised according to temperature rise class F, and continuous operation S1. The tables only cover single-motor drives with operation in the constant-flux range. For special applications, the motor currents must be individually determined, and then the drive converter selected (e.g. for group drives, field-weakening operation or high overload).

The shaft output P_{list} specified in the tables refers to the rated speed n_n of the particular motor. The permissible S1 torque in the appropriate speed range (for constant-torque applications), and at the appropriate speed point (for fan and pump applications), is obtained as follows:

$$M_{permissible} = \frac{P_{list} \cdot 9550}{n_n} \; in \; Nm$$

P_{list}: shaft output in kW at n_n specified in the table

n_n: rated motor speed in RPM

At the time of writing, Siemens 1LA5/1LA2 motors are due to be replaced with 1LA7 motors. Please check with your sales representatives which motors are currently available in 1LA7 construction.

In the following tables, the last digit of the motor order number (shown as a ".") is for the type of construction. Please see M1 catalogue.

7.2.4 230 V 3 phase AC Supply Voltage 2 Pole Motor

Shaft Output for inverter supply (permissible to temperature rise class F)				**1LA2, 1LA5, 1LA6, 1LA7 three-phase squirrel-cage induction motors**			
Load characteristic VT ($M \sim n^2$)	Load characteristic CT (M = const.) Speed Control Range			3-ph. 230 V AC rated voltage 50 Hz			
	1:2	1:5	1:10	Rated output		Motor	Frame size
kW	kW	kW	kW	kW		Order No.	
0.12	0.12	0.09	0.07	0.12		1LA2 060-2AA1 .	56
0.22	0.20	0.19	0.15	0.25		1LA2 063-2AA1 .	63
0.26	0.25	0.2	0.15	0.25		1LA2 063-2AA1 .	63
0.33	0.31	0.25	0.2	0.37		1LA7 070-2AA1 .	71
0.38	0.37	0.25	0.2	0.37		1LA7 070-2AA1 .	71
0.50	0.44	0.4	0.32	0.55		1LA7 073-2AA1 .	71
0.57	0.55	0.4	0.32	0.55		1LA7 073-2AA1 .	71
0.68	0.61	0.6	0.4	0.75		1LA7 080-2AA1 .	80
0.78	0.75	0.6	0.4	0.75		1LA7 080-2AA1 .	80
0.9	0.83	0.83	0.7	1.1		1LA7 083-2AA1 .	80
1.15	1.1	0.9	0.7	1.1		1LA7 083-2AA1 .	80
1.25	1.15	1.15	0.9	1.5		1LA7 090-2AA1 .	90 S
1.55	1.5	1.2	0.9	1.5		1LA7 090-2AA1 .	90 S
1.8	1.6	1.6	1.4	2.2		1LA7 096-2AA1 .	90 L
2.3	2.2	1.8	1.4	2.2		1LA7 096-2AA1 .	90 L
2.7	2.4	2.4	1.8	3		1LA7 106-2AA1 .	100 L
3.1	3	2.5	1.8	3		1LA7 106-2AA1 .	100 L
3.6	3.3	3.3	2.6	4		1LA7 113-2AA1 .	112 M
4.1	4	3.3	2.6	4		1LA7 113-2AA1 .	112 M
5.6	5.5	4.4	3.8	5.5		1LA7 130-2AA1 .	132 S
7.7	7.0	6.0	5.1	7.5		1LA7 131-2AA1 .	132 S
7.7	7.5	6.0	5.1	7.5		1LA7 131-2AA1 .	132 S
11.1	7.9	7.9	7.6	11		1LA7 163-2AA1 .	160 M
11.1	11	8.8	7.6	11		1LA7 163-2AA1 .	160 M
11.6	11.6	11.6	10.6	15		1LA7 164-2AA1 .	160 M
15.2	15	12.4	10.6	15		1LA7 164-2AA1 .	160 M
18.7	15.8	15.5	13.3	18.5		1LA7 166-2AA1 .	160 L
18.7	18.5	15.5	13.3	18.5		1LA7 166-2AA1 .	160 L
22	21	18.2	16	22		1LA2 183-2AA1 .	180 M
22	22	18.2	16	22		1LA2 183-2AA1 .	180 M
28	25	25	22	30		1LA2 206-2AA1 .	200 L
31.1	30.0	23.7	17.9	30		1LA2 206-2AA1 .	200L
32.3	29.3	28.1	22.1	37		1LA2 207-2AA1 .	200L
38.3	37.0	29.2	22.1	37		1LA2 207-2AA1 .	200L
39.2	35.6	34.2	26.9	45		1LA5 223-2AA1 .	225M
46.6	45.0	35.5	26.9	45		1LA5 223-2AA1 .	225M
48.0	43.5	41.8	32.9	55		1LA6 253-2AB1 .	250M

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

Shaft Output for inverter supply (permissible to temperature rise class F)				**Motor**	**MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector**				
Load characteristic ($M \sim n^2$)	Load characteristic (M = const.) Speed Control Range			Rated output	Standard model (MM)	Standard model with integrated filter Class A [1])	Model with vector control (MMV and MDV)	Model with vector control (MMV and MDV) with integrated filter Class A [1])	
	1:2	1:5	1:10						
kW	kW	kW	kW	kW	Order No.	Order No.	Order No.	Order No.	Type
0.12	0.12	0.09	0.07	0.12	6SE9210-7CA40	6SE9210-7BA40	6SE3210-7CA40	6SE3210-7BA40	MM(V)12(/2)
0.22	0.20	0.19	0.15	0.25	6SE9210-7CA40	6SE9210-7BA40	6SE3210-7CA40	6SE3210-7BA40	MM(V)12(/2)
0.26	0.25	0.2	0.15	0.25	6SE9211-5CA40	6SE9211-5BA40	6SE3211-5CA40	6SE3211-5BA40	MM(V)25(/2)
0.33	0.31	0.25	0.2	0.37	6SE9211-5CA40	6SE9211-5BA40	6SE3211-5CA40	6SE3211-5BA40	MM(V)25(/2)
0.38	0.37	0.25	0.2	0.37	6SE9212-1CA40	6SE9212-1BA40	6SE3212-1CA40	6SE3212-1BA40	MM(V)37(/2)
0.50	0.44	0.4	0.32	0.55	6SE9212-1CA40	6SE9212-1BA40	6SE3212-1CA40	6SE3212-1BA40	MM(V)37(/2)
0.57	0.55	0.4	0.32	0.55	6SE9212-8CA40	6SE9212-8BA40	6SE3212-8CA40	6SE3212-8BA40	MM(V)55(/2)
0.68	0.61	0.6	0.4	0.75	6SE9212-8CA40	6SE9212-8BA40	6SE3212-8CA40	6SE3212-8BA40	MM(V)55(/2)
0.78	0.75	0.6	0.4	0.75	6SE9213-6CA40	6SE9213-6BA40	6SE3213-6CA40	6SE3213-6BA40	MM(V)75(/2)
0.9	0.83	0.83	0.7	1.1	6SE9213-6CA40	6SE9213-6BA40	6SE3213-6CA40	6SE3213-6BA40	MM(V)75(/2)
1.15	1.1	0.9	0.7	1.1	6SE9215-2CB40	6SE9215-2BB40	6SE3215-2CB40	6SE3215-2BB40	MM(V)110(/2)
1.25	1.15	1.15	0.9	1.5	6SE9215-2CB40	6SE9215-2BB40	6SE3215-2CB40	6SE3215-2BB40	MM(V)110(/2)
1.55	1.5	1.2	0.9	1.5	6SE9216-8CB40	6SE9216-8BB40	6SE3216-8CB40	6SE3216-8BB40	MM(V)150(/2)
1.8	1.6	1.6	1.4	2.2	6SE9216-8CB40	6SE9216-8BB40	6SE3216-8CB40	6SE3216-8BB40	MM(V)150(/2)
2.3	2.2	1.8	1.4	2.2	6SE9221-0CC40	6SE9221-0BC40	6SE3221-0CC40	6SE3221-0BC40	MM(V)220(/2)
2.7	2.4	2.4	1.8	3	6SE9221-0CC40	6SE9221-0BC40	6SE3221-0CC40	6SE3221-0BC40	MM(V)220(/2)
3.1	3	2.5	1.8	3	6SE9221-3CC40	6SE9221-3BC40	6SE3221-3CC40	6SE3221-3BC40	MM(V)300(/2)
3.6	3.3	3.3	2.6	4	6SE9221-3CC40	6SE9221-3BC40	6SE3221-3CC40	6SE3221-3BC40	MM(V)300(/2)
4.1	4	3.3	2.6	4	6SE9221-8CC13	-	6SE3221-8CC40	-	MM(V)400(/2)
5.6	5.5	4.4	3.8	5.5	-	-	6SE3222-3CG40	6SE3222-3CG50	MDV550/2
7.7	7.0	6.0	5.1	7.5	-	-	6SE3222-3CG40	6SE3222-3CG50	MDV550/2
7.7	7.5	6.0	5.1	7.5	-	-	6SE3223-1CG40	6SE3223-1CG50	MDV750/2
11.1	7.9	7.9	7.6	11	-	-	6SE3223-1CG40	6SE3223-1CG50	MDV750/2
11.1	11	8.8	7.6	11	-	-	6SE3224-2CH40	6SE3224-2CH50	MDV1100/2
11.6	11.6	11.6	10.6	15	-	-	6SE3224-2CH40	6SE3224-2CH50	MDV1100/2 [2])
15.2	15	12.4	10.6	15	-	-	6SE3225-4CH40	6SE3225-4CH50	MDV1500/2
18.7	15.8	15.5	13.3	18.5	-	-	6SE3225-4CH40	6SE3225-4CH50	MDV1500/2
18.7	18.5	15.5	13.3	18.5	-	-	6SE3226-8CJ40	6SE3226-8CJ50	MDV1850/2
22	21	18.2	16	22	-	-	6SE3226-8CJ40	6SE3226-8CJ50	MDV1850/2
22	22	18.2	16	22	-	-	6SE3227-5CJ40	6SE3227-5CJ50	MDV2200/2
28	25	25	22	30	-	-	6SE3227-5CJ40	6SE3227-5CJ50	MDV2200/2
31.1	30.0	23.7	17.9	30	-	-	6SE3231-0CK40	6SE3231-0CK50	MDV3000/2
32.3	29.3	28.1	22.1	37	-	-	6SE3231-0CK40	6SE3231-0CK50	MDV3000/2
38.3	37.0	29.2	22.1	37	-	-	6SE3231-3CK40	6SE3231-3CK50	MDV3700/2
39.2	35.6	34.2	26.9	45	-	-	6SE3231-3CK40	6SE3231-3CK50	MDV3700/2
46.6	45.0	35.5	26.9	45	-	-	6SE3231-5CK40	6SE3231-5CK50	MDV4500/2
48.0	43.5	41.8	32.9	55	-	-	6SE3231-5CK40	6SE3231-5CK50	MDV4500/2

1) MICROMASTER and MICROMASTER Vector inverters with integrated filter are only suitable for single phase mains supplies.

2) Currently, higher outputs are not possible for VT.

7.2.5 230 V 3 phase AC Supply Voltage 4 Pole Motor

Shaft Output for inverter supply (permissible to temperature rise class F)				**1LA2, 1LA5, 1LA6, 1LA7 three-phase squirrel-cage induction motors**			
Load characteristic VT (M ~ n2)	Load characteristic CT (M = const.)			3-ph. 230 V AC rated voltage 50 Hz			
	Speed Control Range			Rated output		Motor	Frame size
	1:2	1:5	1:10				
kW	kW	kW	kW	kW		Order No.	
0.12	0.12	0.09	0.07	0.12		1LA2 060-4AB1 .	63
0.20	0.18	0.18	0.14	0.25		1LA7 070-4AA1 .	71
0.26	0.25	0.19	0.14	0.25		1LA7 070-4AA1 .	71
0.31	0.29	0.28	0.2	0.37		1LA7 073-4AA1 .	71
0.38	0.37	0.28	0.2	0.37		1LA7 073-4AA1 .	71
0.49	.42	0.4	0.3	0.55		1LA7 080-4AA1 .	80
0.57	.55	0.4	0.3	0.55		1LA7 080-4AA1 .	80
0.64	.57	.57	0.4	0.75		1LA7 083-4AA1 .	80
0.78	.75	0.6	0.4	0.75		1LA7 083-4AA1 .	80
0.85	.78	.78	0.6	1.1		1LA7 090-4AA1 .	90 S
1.15	1.1	0.8	0.6	1.1		1LA7 090-4AA1 .	90 S
1.2	1.1	1.1	0.8	1.5		1LA7 096-4AA1 .	90 L
1.55	1.5	1.1	0.8	1.5		1LA7 096-4AA1 .	90 L
1.6	1.5	1.5	1.3	2.2		1LA7 106-4AA1 .	100 L
2.3	2.2	1.7	1.3	2.2		1LA7 106-4AA1 .	100 L
2.4	2.2	2.2	1.7	3		1LA7 107-4AA1 .	100 L
3.1	3	2.4	1.7	3		1LA7 107-4AA1 .	100 L
3.1	2.9	2.9	2.3	4		1LA7 113-4AA1 .	112 M
4.2	4	3.2	2.3	4		1LA7 113-4AA1 .	112 M
5.7	5.5	4.4	3.7	5.5		1LA7 130-4AA1 .	132 S
7.5	5.9	5.9	5.3	7.5		1LA7 133-4AA1 .	132 M
7.7	7.5	6.2	5.3	7.5		1LA7 133-4AA1 .	132 M
11.2	7.6	7.6	7.6	11		1LA7 163-4AA1 .	160 M
11.2	11	9.1	7.9	11		1LA7 163-4AA1 .	160 M
12.1	12.1	12.1	10.9	15		1LA7 166-4AA1 .	160 L
15.3	15	12.7	10.9	15		1LA7 166-4AA1 .	160 L
18.7	15.7	14.6	12.4	18.5		1LA2 183-4AA1 .	180 M
18.7	18.5	14.6	12.4	18.5		1LA2 183-4AA1 .	180 M
22.2	20	17.8	15.2	22		1LA2 186-4AA1 .	180 L
22.2	22	17.8	15.2	22		1LA2 186-4AA1 .	180 L
27	24	24	21	30		1LA2 207-4AA1 .	200 L
30.6	30.0	24.5	20.9	30		1LA2 207-4AA1 .	200L
35.4	29.9	28.9	25.8	37		1LA5 220-4AA1 .	225S
37.7	37.0	30.2	25.8	37		1LA5 220-4AA1 .	225S
43.1	36.3	35.1	31.4	45		1LA5 223-4AA1 .	225M
45.9	45.0	36.7	31.4	45		1LA5 223-4AA1 .	225M
52.7	44.4	42.9	38.4	55		1LA6 253-4AA1 .	250M

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

Shaft Output for inverter supply (permissible to temperature rise class F)				**Motor**	**MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector**				
Load characteristic ($M \sim n^2$)	Load characteristic (M = const.) Speed Control Range			Rated output	Standard model (MM)	Standard model with integrated filter Class A [1]	Model with vector control (MMV and MDV)	Model with vector control (MMV and MDV) with integrated filter Class A [1]	
kW	1:2 kW	1:5 kW	1:10 kW	kW	Order No.	Order No.	Order No.	Order No.	Type
0.12	0.12	0.09	0.07	0.12	6SE9210-7CA40	6SE9210-7BA40	6SE3210-7CA40	6SE3210-7BA40	MM(V)12(/2)
0.20	0.18	0.18	0.14	0.25	6SE9210-7CA40	-	6SE3210-7CA40	-	MM(V)12(/2) [2]
0.26	0.25	0.19	0.14	0.25	6SE9211-5CA40	6SE9211-5BA40	6SE3211-5CA40	6SE3211-5BA40	MM(V)25(/2)
0.31	0.29	0.28	0.2	0.37	6SE9211-5CA40	-	6SE3211-5CA40	-	MM(V)25(/2) [2]
0.38	0.37	0.28	0.2	0.37	6SE9212-1CA40	6SE9212-1BA40	6SE3212-1CA40	6SE3212-1BA40	MM(V)37(/2)
0.49	.42	0.4	0.3	0.55	6SE9212-1CA40	-	6SE3212-1CA40	-	MM(V)37(/2) [2]
0.57	.55	0.4	0.3	0.55	6SE9212-8CA40	6SE9212-8BA40	6SE3212-8CA40	6SE3212-8BA40	MM(V)55(/2)
0.64	.57	.57	0.4	0.75	6SE9212-8CA40	-	6SE3212-8CA40	-	MM(V)55(/2) [2]
0.78	.75	0.6	0.4	0.75	6SE9213-6CA40	6SE9213-6BA40	6SE3213-6CA40	6SE3213-6BA40	MM(V)75(/2)
0.85	.78	.78	0.6	1.1	6SE9213-6CA40	-	6SE3213-6CA40	-	MM(V)75(/2) [2]
1.15	1.1	0.8	0.6	1.1	6SE9215-2CB40	6SE9215-2BB40	6SE3215-2CB40	6SE3215-2BB40	MM(V)110(/2)
1.2	1.1	1.1	0.8	1.5	6SE9215-2CB40	-	6SE3215-2CB40	-	MM(V)110(/2) [2]
1.55	1.5	1.1	0.8	1.5	6SE9216-8CB40	6SE9216-8BB40	6SE3216-8CB40	6SE3216-8BB40	MM(V)150(/2)
1.6	1.5	1.5	1.3	2.2	6SE9216-8CB40	-	6SE3216-8CB40	-	MM(V)150(/2) [2]
2.3	2.2	1.7	1.3	2.2	6SE9221-0CC40	6SE9221-0BC40	6SE3221-0CC40	6SE3221-0BC40	MM(V)220(/2)
2.4	2.2	2.2	1.7	3	6SE9221-0CC40	-	6SE3221-0CC40	-	MM(V)220(/2) [2]
3.1	3	2.4	1.7	3	6SE9221-3CC40	6SE9221-3BC40	6SE3221-3CC40	6SE3221-3BC40	MM(V)300(/2)
3.1	2.9	2.9	2.3	4	6SE9221-3CC40	-	6SE3221-3CC40	-	MM(V)300(/2) [2]
4.2	4	3.2	2.3	4	6SE9221-8CC13	-	6SE3221-8CC40	-	MM(V)400(/2)
5.7	5.5	4.4	3.7	5.5	-	-	6SE3222-3CG40	6SE3222-3CG50	MDV550/2
7.5	5.9	5.9	5.3	7.5	-	-	6SE3222-3CG40	6SE3222-3CG50	MDV550/2
7.7	7.5	6.2	5.3	7.5	-	-	6SE3223-1CG40	6SE3223-1CG50	MDV750/2
11.2	7.6	7.6	7.6	11	-	-	6SE3223-1CG40	6SE3223-1CG50	MDV750/2
11.2	11	9.1	7.9	11	-	-	6SE3224-2CH40	6SE3224-2CH50	MDV1100/2
12.1	12.1	12.1	10.9	15	-	-	6SE3224-2CH40	6SE3224-2CH50	MDV1100/2 [3]
15.3	15	12.7	10.9	15	-	-	6SE3225-4CH40	6SE3225-4CH50	MDV1500/2
18.7	15.7	14.6	12.4	18.5	-	-	6SE3225-4CH40	6SE3225-4CH50	MDV1500/2
18.7	18.5	14.6	12.4	18.5	-	-	6SE3226-8CJ40	6SE3226-8CJ50	MDV1850/2
22.2	20	17.8	15.2	22	-	-	6SE3226-8CJ40	6SE3226-8CJ50	MDV1850/2
22.2	22	17.8	15.2	22	-	-	6SE3227-5CJ40	6SE3227-5CJ50	MDV2200/2
27	24	24	21	30	-	-	6SE3227-5CJ40	6SE3227-5CJ50	MDV2200/2
30.6	30.0	24.5	20.9	30	-	-	6SE3231-0CK40	6SE3231-0CK50	MDV3000/2
35.4	29.9	28.9	25.8	37	-	-	6SE3231-0CK40	6SE3231-0CK50	MDV3000/2
37.7	37.0	30.2	25.8	37	-	-	6SE3231-3CK40	6SE3231-3CK50	MDV3700/2
43.1	36.3	35.1	31.4	45	-	-	6SE3231-3CK40	6SE3231-3CK50	MDV3700/2
45.9	45.0	36.7	31.4	45	-	-	6SE3231-5CK40	6SE3231-5CK50	MDV4500/2
52.7	44.4	42.9	38.4	55	-	-	6SE3231-5CK40	6SE3231-5CK50	MDV4500/2

1) MICROMASTER inverters with integrated filter are only suitable for single phase mains supplies.

2) VT only possible with MICROMASTER on three phase mains supplies.

3) Currently, higher outputs are not possible for VT.

7.2.6 230 V 3 phase AC Supply Voltage 6 Pole Motors

Shaft Output for inverter supply (permissible to temperature rise class F)				**1LA2, 1LA5, 1LA6, 1LA7 three-phase squirrel-cage induction motors**			
Load characteristic VT ($M \sim n^2$)	Load characteristic CT (M = const.)			3-ph. 230 V AC rated voltage 50 Hz			
	Speed Control Range			Rated output		Motor	Frame size
	1:2	1:5	1:10				
kW	kW	kW	kW	kW		Order No.	
0.12	0.11	0.08	0.06	0.12		1LA7 070-6AA1 .	71
0.25	0.25	.17	0.13	0.25		1LA7 073-6AA1 .	71
0.37	.34	.25	.18	0.37		1LA7 080-6AA1 .	80
0.55	0.47	0.38	0.27	0.55		1LA7 083-6AA1 .	80
0.75	0.67	0.52	0.38	0.75		1LA7 090-6AA1 .	90 S
1.1	0.95	0.77	0.55	1.1		1LA7 096-6AA1 .	90 L
1.5	1.35	1.0	0.77	1.5		1LA7 106-6AA1 .	100 L
2.2	1.9	1.6	1.2	2.2		1LA7 113-6AA1 .	112 M
2.9	2.7	2.2	1.7	3		1LA7 130-6AA1 .	132 S
4.1	4	3.0	2.2	4		1LA7 133-6AA1 .	132 M
5.7	5.1	4.2	3.4	5.5		1LA7 134-6AA1 .	132 M
6.6	5.2	5.2	4.6	7.5		1LA7 163-6AA1 .	160 M
7.7	6.6	5.5	4.6	7.5		1LA7 163-6AA1 .	160 M
10.4	6.9	6.9	6.9	11		1LA7 166-6AA1 .	160 L
11.2	10.4	8.5	7	11		1LA7 166-6AA1 .	160 L
11.7	11.7	11.5	9.7	15		1LA2 186-6AA1 .	180 L
15.2	15	11.5	9.7	15		1LA2 186-6AA1 .	180 L
18.7	15.4	14.4	12.2	18.5		1LA2 206-6AA1 .	200 L
18.7	18.5	14.4	12.2	18.5		1LA2 206-6AA1 .	200 L
22.2	19.3	17.4	14.7	22		1LA2 207-6AA1 .	200 L
22.2	22	17.4	14.7	22		1LA2 207-6AA1 .	200 L
27	24	24	24	30		1LA5 223-6AA1 .	225 M
30.6	28.8	23.0	19.2	30		1LA5 223-6AA1 .	225M
34.1	28.4	27.5	20.6	37		1LA6 253-6AA1 .	250M
37.7	35.5	28.4	23.7	37		1LA6 253-6AA1 .	250M
41.4	34.6	33.4	25.1	45		1LA6 280-6AA1 .	280S
45.9	43.1	34.5	28.8	45		1LA6 280-6AA1 .	280S
50.6	42.3	40.9	30.7	55		1LA6 283-6AA1 .	280M

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MICROMASTER Vector

MIDIMASTER Vector

Shaft Output for inverter supply (according to temperature rise class F)				**Motor**	**MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector**				
Load characteristic ($M \sim n^2$)	Load characteristic (M = const.) Speed Control Range			Rated output	Standard model (MM)	Standard model with integrated filter Class A [1])	Model with vector control (MMV and MDV)	Model with vector control (MMV and MDV) with integrated filter Class A [1])	
	1:2	1:5	1:10						
kW	kW	kW	kW	kW	Order No.	Order No.	Order No.	Order No.	Type
0.12	0.11	0.08	0.06	0.12	6SE9210-7CA40	6SE9210-7BA40	6SE3210-7CA40	6SE3210-7BA40	MM(V)12(/2)
0.25	0.25	.17	0.13	0.25	6SE9211-5CA40	6SE9211-5BA40	6SE3211-5CA40	6SE3211-5BA40	MM(V)25(/2)
0.37	.34	.25	.18	0.37	6SE9212-1CA40	6SE9212-1BA40	6SE3212-1CA40	6SE3212-1BA40	MM(V)37(/2)
0.55	0.47	0.38	0.27	0.55	6SE9212-8CA40	6SE9212-8BA40	6SE3212-8CA40	6SE3212-8BA40	MM(V)55(/2)
0.75	0.67	0.52	0.38	0.75	6SE9213-6CA40	6SE9213-6BA40	6SE3213-6CA40	6SE3213-6BA40	MM(V)75(/2)
1.1	0.95	0.77	0.55	1.1	6SE9215-2CB40	6SE9215-2BB40	6SE3215-2CB40	6SE3215-2BB40	MM(V)110(/2)
1.5	1.35	1.0	0.77	1.5	6SE9216-8CB40	6SE9216-8BB40	6SE3216-8CB40	6SE3216-8BB40	MM(V)150(/2)
2.2	1.9	1.6	1.2	2.2	6SE9221-0CC40	6SE9221-0BC40	6SE3221-0CC40	6SE3221-0BC40	MM(V)220(/2)
2.9	2.7	2.2	1.7	3	6SE9221-3CC40	6SE9221-3BC40	6SE3221-3CC40	6SE3221-3BC40	MM(V)300(/2)
4.1	4	3.0	2.2	4	6SE9221-8CC40	-	6SE3221-8CC40	-	MM(V)400(/2)
5.7	5.1	4.2	3.4	5.5	-	-	6SE3222-3CG40	6SE3222-3CG50	MDV550/2
6.6	5.2	5.2	4.6	7.5	-	-	6SE3222-3CG40	6SE3222-3CG50	MDV550/2
7.7	6.6	5.5	4.6	7.5	-	-	6SE3223-1CG40	6SE3223-1CG50	MDV750/2
10.4	6.9	6.9	6.9	11	-	-	6SE3223-1CG40	6SE3223-1CG50	MDV750/2
11.2	10.4	8.5	7	11	-	-	6SE3224-2CH40	6SE3224-2CH50	MDV1100/2
11.7	11.7	11.5	9.7	15	-	-	6SE3224-2CH40	6SE3224-2CH50	MDV1100/2 [2)]
15.2	15	11.5	9.7	15	-	-	6SE3225-4CH40	6SE3225-4CH50	MDV1500/2
18.7	15.4	14.4	12.2	18.5	-	-	6SE3225-4CH40	6SE3225-4CH50	MDV1500/2
18.7	18.5	14.4	12.2	18.5	-	-	6SE3226-8CJ40	6SE3226-8CJ50	MDV1850/2
22.2	19.3	17.4	14.7	22	-	-	6SE3226-8CJ40	6SE3226-8CJ50	MDV1850/2
22.2	22	17.4	14.7	22	-	-	6SE3227-5CJ40	6SE3227-5CJ50	MDV2200/2
27	24	24	24	30	-	-	6SE3227-5CJ40	6SE3227-5CJ50	MDV2200/2
30.6	28.8	23.0	19.2	30	-	-	6SE3231-0CK40	6SE3231-0CK50	MDV3000/2
34.1	28.4	27.5	20.6	37	-	-	6SE3231-0CK40	6SE3231-0CK50	MDV3000/2
37.7	35.5	28.4	23.7	37	-	-	6SE3231-3CK40	6SE3231-3CK50	MDV3700/2
41.4	34.6	33.4	25.1	45	-	-	6SE3231-3CK40	6SE3231-3CK50	MDV3700/2
45.9	43.1	34.5	28.8	45	-	-	6SE3231-5CK40	6SE3231-5CK50	MDV4500/2
50.6	42.3	40.9	30.7	55	-	-	6SE3231-5CK40	6SE3231-5CK50	MDV4500/2

1) MICROMASTER inverters with integrated filter are only suitable for single phase mains supplies.

2) Currently, higher outputs are not possible for VT.

7.2.7 230 V 3 phase AC Supply Voltage 8 Pole Motors

Shaft Output for inverter supply (permissible to temperature rise class F)				**1LA2, 1LA5, 1LA6, 1LA7 three-phase squirrel-cage induction motors**			
Load characteristic VT ($M \sim n^2$)	Load characteristic CT (M = const.)			3-ph. 230 V AC rated voltage 50 Hz			
	Speed Control Range			Rated output		Motor	Frame size
	1:2	1:5	1:10				
kW	kW	kW	kW	kW		Order No.	
0.11	0.10	0.08	0.06	0.12	1LA5 073-8AB1 .	-	71
0.19	0.18	0.17	0.12	0.25	1LA5 083-8AB1 .	-	80
0.37	0.35	0.24	0.18	0.37	1LA5 090-8AB1 .	-	90 S
0.52	0.48	0.37	0.28	0.55	1LA5 096-8AB1 .	-	90 L
0.7	0.63	0.53	0.4	0.75	1LA5 106-8AB1 .	-	100 L
1.1	1.0	0.8	0.6	1.1	1LA5 107-8AB1 .	-	100 L
1.35	1.2	1.1	0.8	1.5	1LA5 113-8AB1 .	-	112 M
2.0	1.8	1.6	1.2	2.2	1LA5 130-8CB1 .	-	132 S
2.6	2.5	2.1	1.7	3	1LA5 133-8CB1 .	-	132 M
4.1	4	2.9	2.2	4	1LA5 163-8CB1 .	-	160 M
						-	
5.7	5	4	3.4	5.5	1LA5 164-8CB1 .	-	160 M
6.3	5	5	4.7	7.5	1LA5 166-8CB1 .	-	160 L
7.7	6.3	5.7	4.7	7.5	1LA5 166-8CB1 .	-	160 L
10.5	7.0	7	6.8	11	1LA5 186-8AB1 .	-	180 L
11.1	10.5	8.2	6.8	11	1LA5 186-8AB1 .	-	180 L
10.9	10.9	10.8	8.8	15	1LA5 207-8AB1 .	-	200 L
15.2	14	10.8	8.8	15	1LA5 207-8AB1 .	-	200 L
18.5	14.7	14.7	14.7	18.5	1LA6 220-8AB1 .	-	225 S
19	18.5	17	16.1	18.5	1LA6 220-8AB1 .	-	225 S
22	18.9	18.9	18.9	22	1LA6 223-8AB1 .	-	225 M
22.6	22	20.2	19.1	22	1LA6 223-8AB1 .	-	225 M
	23	23	23	30	1LA6 253-8AB1 .	-	250 M
30.7	28.2	23.9	20.9	30	1LA6 253-8AB1 .	-	250M
33.5	27.3	27.2	19.4	37	1LA6 280-8AA1 .	-	280S
37.9	34.8	29.5	25.8	37	1LA6 280-8AA1 .	-	280S
40.7	33.2	33.1	23.6	45	1LA6 283-8AA1 .	-	280M
46.0	42.3	35.9	31.4	45	1LA6 283-8AA1 .	-	280M
49.7	40.5	40.4	28.9	55	1LA6 310-8AA1 .	-	315S

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MICROMASTER Vector

MIDIMASTER Vector

Shaft Output for inverter supply (permissible to temperature rise class F)				**Motor**	**MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector**				
Load characteristic ($M \sim n^2$)	Load characteristic (M = const.) Speed Control Range			Rated output	Standard model (MM)	Standard model with integrated filter Class A [1])	Model with vector control (MMV and MDV)	Model with vector control (MMV and MDV) with integrated filter Class A [1])	
	1:2	1:5	1:10						
kW	kW	kW	kW	kW	Order No.	Order No.	Order No.	Order No.	Type
0.11	0.10	0.08	0.06	0.12	6SE9210-7CA40	6SE9210-7BA40	6SE3210-7CA40	6SE3210-7BA40	MM(V)12(/2)
0.19	0.18	0.17	0.12	0.25	6SE9211-5CA40	6SE9211-5BA40	6SE3211-5CA40	6SE3211-5BA40	MM(V)25(/2)
0.37	0.35	0.24	0.18	0.37	6SE9212-1CA40	6SE9212-1BA40	6SE3212-1CA40	6SE3212-1BA40	MM(V)37(/2)
0.52	0.48	0.37	0.28	0.55	6SE9212-8CA40	6SE9212-8BA40	6SE3212-8CA40	6SE3212-8BA40	MM(V)55(/2)
0.7	0.63	0.53	0.4	0.75	6SE9213-6CA40	6SE9213-6BA40	6SE3213-6CA40	6SE3213-6BA40	MM(V)75(/2)
1.1	1.0	0.8	0.6	1.1	6SE9215-2CB40	6SE9215-2BB40	6SE3215-2CB40	6SE3215-2BB40	MM(V)110(/2)
1.35	1.2	1.1	0.8	1.5	6SE9216-8CB40	6SE9216-8BB40	6SE3216-8CB40	6SE3216-8BB40	MM(V)150(/2)
2.0	1.8	1.6	1.2	2.2	6SE9221-0CC40	6SE9221-0BC40	6SE3221-0CC40	6SE3221-0BC40	MM(V)220(/2)
2.6	2.5	2.1	1.7	3	6SE9221-3CC40	6SE9221-3BC40	6SE3221-3CC40	6SE3221-3BC40	MM(V)300(/2)
4.1	4	2.9	2.2	4	6SE9221-8CC40	-	6SE3221-8CC40	-	MM(V)400(/2)
5.7	5	4	3.4	5.5	-	-	6SE3222-3CG40	6SE3222-3CG50	MDV550/2
6.3	5	5	4.7	7.5	-	-	6SE3222-3CG40	6SE3222-3CG50	MDV550/2
7.7	6.3	5.7	4.7	7.5	-	-	6SE3223-1CG40	6SE3223-1CG50	MDV750/2
10.5	7.0	7	6.8	11	-	-	6SE3223-1CG40	6SE3223-1CG50	MDV750/2
11.1	10.5	8.2	6.8	11	-	-	6SE3224-2CH40	6SE3224-2CH50	MDV1100/2
10.9	10.9	10.8	8.8	15	-	-	6SE3224-2CH40	6SE3224-2CH50	MDV1100/2 [2)]
15.2	14	10.8	8.8	15	-	-	6SE3225-4CH40	6SE3225-4CH50	MDV1500/2
18.5	14.7	14.7	14.7	18.5	-	-	6SE3225-4CH40	6SE3225-4CH50	MDV1500/2
19	18.5	17	16.1	18.5	-	-	6SE3226-8CJ40	6SE3226-8CJ50	MDV1850/2
22	18.9	18.9	18.9	22	-	-	6SE3226-8CJ40	6SE3226-8CJ50	MDV1850/2
22.6	22	20.2	19.1	22	-	-	6SE3227-5CJ40	6SE3227-5CJ50	MDV2200/2
	23	23	23	30	-	-	6SE3227-5CJ40	6SE3227-5CJ50	MDV2200/2
30.7	28.2	23.9	20.9	30	-	-	6SE3231-0CK40	6SE3231-0CK50	MDV3000/2
33.5	27.3	27.2	19.4	37	-	-	6SE3231-0CK40	6SE3231-0CK50	MDV3000/2
37.9	34.8	29.5	25.8	37	-	-	6SE3231-3CK40	6SE3231-3CK50	MDV3700/2
40.7	33.2	33.1	23.6	45	-	-	6SE3231-3CK40	6SE3231-3CK50	MDV3700/2
46.0	42.3	35.9	31.4	45	-	-	6SE3231-5CK40	6SE3231-5CK50	MDV4500/2
49.7	40.5	40.4	28.9	55	-	-	6SE3231-5CK40	6SE3231-5CK50	MDV4500/2

1) MICROMASTER inverters with integrated filter are only suitable for single phase mains supplies.

2) Currently, higher outputs are not possible for VT.

7.2.8 400 V 3 phase AC Supply Voltage 2 Pole Motors

Shaft Output for inverter supply (permissible to temperature rise class F)				**1LA2, 1LA5, 1LA6, 1LA7 three-phase squirrel-cage induction motors**			
Load characteristic VT ($M \sim n^2$)	Load characteristic CT (M = const.)			3-ph. 400 V AC rated voltage 50 Hz			
	Speed Control Range			Rated output		Motor	Frame size
	1:2	1:5	1:10				
kW	kW	kW	kW	kW		Order No.	
0.39	0.37	0.30	0.24	0.37		1LA7 070-2AA1 .	
0.49	0.44	0.44	0.36	0.55		1LA7 073-2AA1 .	
0.57	0.55	0.45	0.36	0.55		1LA7 073-2AA1 .	
0.66	0.61	0.60	0.49	0.75		1LA7 080-2AA1 .	
0.78	0.75	0.61	0.49	0.75		1LA7 080-2AA1 .	
0.97	0.89	0.88	0.72	1.1		1LA7 083-2AA1 .	
1.1	1.1	0.90	0.71	1.1		1LA7 083-2AA1 .	
1.3	1.2	1.2	1.0	1.5		1LA7 090-2AA1 .	
1.6	1.5	1.2	0.9	1.5		1LA7 090-2AA1 .	90 S
1.9	1.7	1.7	1.4	2.2		1LA7 096-2AA1 .	90 L
2.3	2.2	1.8	1.4	2.2		1LA7 096-2AA1 .	90 L
2.8	2.5	2.5	1.9	3		1LA7 106-2AA1 .	100 L
3.2	3	2.5	1.9	3		1LA7 106-2AA1 .	100 L
3.7	3.5	3.3	2.6	4		1LA7 113-2AA1 .	112 M
4.1	4	3.3	2.6	4		1LA7 113-2AA1 .	112 M
4.7	4.4	4.4	3.8	5.5		1LA7 130-2AA1 .	132 S
5.6	5.5	4.4	3.8	5.5		1LA7 130-2AA1 .	132 S
6.4	5.7	5.7	5.1	7.5		1LA7 131-2AA1 .	132 S
7.7	7.5	6.1	5.1	7.5		1LA7 131-2AA1 .	132S
11.1	8	8	7.6	11		1LA7 163-2AA1 .	160 M
11.1	11	8.8	7.6	11		1LA7 163-2AA1 .	160 M
14.2	11.1	11.1	10.6	15		1LA7 164-2AA1 .	160 M
15.2	14.2	12.4	10.6	15		1LA7 164-2AA1 .	160 M
18.7	15.1	15.1	13.3	18.5		1LA7 166-2AA1 .	160 L
18.7	18.5	15.7	13.3	18.5		1LA7 166-2AA1 .	160 L
22	19.8	18	16	22		1LA2 183-2AA1 .	180 M
22	22	18	16	22		1LA2 183-2AA1 .	180 M
30	23	23	22	30		1LA2 206-2AA1 .	200 L
30	30	25	22	30		1LA2 206-2AA1 .	200 L
37	31	31	27	37		1LA2 207-2AA1 .	200 L
37	37	31	27	37		1LA2 207-2AA1 .	200 L
45	39	38	35	45		1LA5 223-2AA1 .	225 M
45.2	44.6	37.2	32.3	45		1LA5 223-2AA1 .	225M
54.7	44.4	43.6	34.5	55		1LA6 253-2AB1 .	250M
55.3	54.5	45.5	39.5	55		1LA6 253-2AB1 .	250M
74.6	60.6	59.5	47.1	75		1LA6 280-2AC1 .	280S
75.4	74.3	62.1	53.8	75		1LA6 280-2AC1 .	280S
89.6	72.7	71.4	56.5	90		1LA6 283-2AC1 .	280M

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

Shaft Output for inverter supply (permissible to temperature rise class F)				**Motor**	**MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector**				
Load characteristic ($M \sim n^2$)	Load characteristic (M = const.) Speed Control Range			Rated output	Standard model (MM)	Standard model with integrated filter Class A [1])	Model with vector control (MMV and MDV)	Model with vector control (MMV and MDV) with integrated filter Class A [1])	
kW	1:2 kW	1:5 kW	1:10 kW	kW	Order No.	Order No.	Order No.	Order No.	Type
0.39	0.37	0.30	0.24	0.37	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.49	0.44	0.44	0.36	0.55	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.57	0.55	0.45	0.36	0.55	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.66	0.61	0.60	0.49	0.75	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.78	0.75	0.61	0.49	0.75	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
0.97	0.89	0.88	0.72	1.1	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
1.1	1.1	0.90	0.71	1.1	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.3	1.2	1.2	1.0	1.5	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.6	1.5	1.2	0.9	1.5	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
1.9	1.7	1.7	1.4	2.2	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
2.3	2.2	1.8	1.4	2.2	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
2.8	2.5	2.5	1.9	3	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
3.2	3	2.5	1.9	3	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
3.7	3.5	3.3	2.6	4	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
4.1	4	3.3	2.6	4	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
4.7	4.4	4.4	3.8	5.5	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
5.6	5.5	4.4	3.8	5.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
6.4	5.7	5.7	5.1	7.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
7.7	7.5	6.1	5.1	7.5	6SE9221-5DC40	-	6SE3221-5DC40	-	MM(V)750/3
11.1	8	8	7.6	11	-	-	6SE3221-7DG40	6SE3221-7DG50	MDV750/3
11.1	11	8.8	7.6	11	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
14.2	11.1	11.1	10.6	15	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15.2	14.2	12.4	10.6	15	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	15.1	15.1	13.3	18.5	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	18.5	15.7	13.3	18.5	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	19.8	18	16	22	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	22	18	16	22	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
30	23	23	22	30	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
30	30	25	22	30	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	31	31	27	37	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	37	31	27	37	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45	39	38	35	45	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45.2	44.6	37.2	32.3	45	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
54.7	44.4	43.6	34.5	55	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.3	54.5	45.5	39.5	55	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
74.6	60.6	59.5	47.1	75	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.4	74.3	62.1	53.8	75	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3
89.6	72.7	71.4	56.5	90	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3

7.2.9 400 V 3 phase AC Supply Voltage 4 Pole Motors

Shaft Output for inverter supply (permissible to temperature rise class F)				**1LA2, 1LA5, 1LA6, 1LA7 three-phase squirrel-cage induction motors**			
Load characteristic VT ($M \sim n^2$)	Load characteristic CT (M = const.)			3-ph. 400 V AC rated voltage 50 Hz			
	Speed Control Range			Rated output		Motor	Frame size
kW	1:2 kW	1:5 kW	1:10 kW	kW		Order No.	
0.39	0.37	0.29	0.23	0.37		1LA7 073-4AA1 .	71
0.44	0.41	0.41	0.35	0.55		1LA7 080-4AA1 .	80
0.58	0.55	0.44	0.34	0.55		1LA7 080-4AA1 .	80
0.60	0.57	0.56	0.48	0.75		1LA7 083-4AA1 .	80
0.79	0.75	0.59	0.46	0.75		1LA7 083-4AA1 .	80
0.87	0.83	0.82	0.70	1.1		1LA7 090-4AA1 .	90S
1.2	1.1	0.87	0.68	1.1		1LA7 090-4AA1 .	90S
1.2	1.1	1.1	1.0	1.5		1LA7 096-4AA1 .	90L
1.6	1.5	1.1	0.8	1.5		1LA7 096-4AA1 .	90 L
1.7	1.5	1.5	1.3	2.2		1LA7 106-4AA1 .	100 L
2.3	2.2	1.7	1.3	2.2		1LA7 106-4AA1 .	100 L
2.3	2.5	2.4	1.8	3		1LA7 107-4AA1 .	100 L
3.2	3	2.4	1.8	3		1LA7 107-4AA1 .	100 L
3.2	3	3	2.4	4		1LA7 113-4AA1 .	112 M
4.2	4	3.2	2.4	4		1LA7 113-4AA1 .	112 M
4.6	4.3	4.3	3.7	5.5		1LA7 130-4AA1 .	132 S
5.7	5.5	4.5	3.7	5.5		1LA7 130-4AA1 .	132 S
6	5.4	5.4	5.3	7.5		1LA7 133-4AA1 .	132 M
7.7	7.5	6.2	5.3	7.5		1LA7 133-4AA1 .	132M
11	7.7	7.7	7.7	11		1LA7 163-4AA1 .	160 M
11.2	11	9.1	7.9	11		1LA7 163-4AA1 .	160 M
15	11.6	11.6	10.9	15		1LA7 166-4AA1 .	160 L
15.3	15	12.7	10.9	15		1LA7 166-4AA1 .	160 L
18.5	15	14.6	12.4	18.5		1LA2 183-4AA1 .	180 M
18.7	18.5	14.6	12.4	18.5		1LA2 183-4AA1 .	180 M
22	18.7	17.8	15.2	22		1LA2 186-4AA1 .	180 L
22	22	17.8	15.2	22		1LA2 186-4AA1 .	180 L
30	22	22	21	30		1LA2 207-4AA1 .	200 L
30	30	24	21	30		1LA2 207-4AA1 .	200 L
37	30	30	30	37		1LA5 220-4AA1 .	225 S
37	37	33	30	37		1LA5 220-4AA1 .	225 S
45	37	37	35	45		1LA5 223-4AA1 .	225 M
45.4	45.0	37.2	32.4	45		1LA5 223-4AA1 .	225M
55.0	43.2	42.7	34.4	55		1LA6 253-4AA1 .	250M
55.4	55.0	45.5	39.6	55		1LA6 253-4AA1 .	250M
75.0	58.9	58.3	46.9	75		1LA6 280-4AA1 .	280S
75.6	75.0	62.1	54.0	75		1LA6 280-4AA1 .	280S
90.0	70.7	69.9	56.3	90		1LA6 283-4AA1 .	280M

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

Shaft Output for inverter supply (permissible to temperature rise class F)				**Motor**	**MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector**				
Load characteristic ($M \sim n^2$)	Load characteristic (M = const.) Speed Control Range			Rated output	Standard model (MM)	Standard model with integrated filter Class A [1])	Model with vector control (MMV and MDV)	Model with vector control (MMV and MDV) with integrated filter Class A [1])	
	1:2	1:5	1:10						
kW	kW	kW	kW	kW	Order No.	Order No.	Order No.	Order No.	Type
0.39	0.37	0.29	0.23	0.37	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.44	0.41	0.41	0.35	0.55	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.58	0.55	0.44	0.34	0.55	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.60	0.57	0.56	0.48	0.75	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.79	0.75	0.59	0.46	0.75	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
0.87	0.83	0.82	0.70	1.1	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
1.2	1.1	0.87	0.68	1.1	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.2	1.1	1.1	1.0	1.5	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.6	1.5	1.1	0.8	1.5	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
1.7	1.5	1.5	1.3	2.2	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
2.3	2.2	1.7	1.3	2.2	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
2.3	2.5	2.4	1.8	3	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
3.2	3	2.4	1.8	3	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
3.2	3	3	2.4	4	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
4.2	4	3.2	2.4	4	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
4.6	4.3	4.3	3.7	5.5	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
5.7	5.5	4.5	3.7	5.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
6	5.4	5.4	5.3	7.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
7.7	7.5	6.2	5.3	7.5	6SE9221-5DC40	-	6SE3221-5DC40	-	MM(V)750/3
11	7.7	7.7	7.7	11	-	-	6SE3221-7DG40	6SE3221-7DG50	MDV750/3
11.2	11	9.1	7.9	11	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15	11.6	11.6	10.9	15	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15.3	15	12.7	10.9	15	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.5	15	14.6	12.4	18.5	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	18.5	14.6	12.4	18.5	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	18.7	17.8	15.2	22	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	22	17.8	15.2	22	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
30	22	22	21	30	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
30	30	24	21	30	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	30	30	30	37	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	37	33	30	37	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45	37	37	35	45	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45.4	45.0	37.2	32.4	45	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.0	43.2	42.7	34.4	55	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.4	55.0	45.5	39.6	55	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.0	58.9	58.3	46.9	75	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.6	75.0	62.1	54.0	75	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3
90.0	70.7	69.9	56.3	90	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3

7.2.10 400 V 3 phase AC Supply Voltage 6 Pole Motors

Shaft Output for inverter supply (permissible to temperature rise class F)				**1LA2, 1LA5, 1LA6, 1LA7 three-phase squirrel-cage induction motors**			
Load characteristic VT ($M \sim n^2$)	Load characteristic CT (M = const.)			3-ph. 400 V AC rated voltage 50 Hz			
	Speed Control Range			Rated output		Motor	Frame size
	1:2	1:5	1:10				
kW	kW	kW	kW	kW		Order No.	
0.37	0.34	0.27	0.21	0.37		1LA7 080-6AA1 .	80
0.55	0.50	0.40	0.31	0.55		1LA7 083-6AA1 .	80
0.75	0.68	0.55	0.43	0.75		1LA7 090-6AA1 .	90S
1.10	1.00	0.80	0.63	1.1		1LA7 096-6AA1 .	90L
1.5	1.35	1.0	0.75	1.5		1LA7 106-6AA1 .	100 L
2.2	2.0	1.6	1.2	2.2		1LA7 113-6AA1 .	112 M
3.0	2.8	2.2	1.7	3		1LA7 130-6AA1 .	132 S
4.0	3.7	3.0	2.3	4		1LA7 133-6AA1 .	132 M
5.4	4.9	4.2	3.4	5.5		1LA7 134-6AA1 .	132 M
7.7	6.8	5.5	4.6	7.5		1LA7 163-6AA1 .	160M
10.1	7.1	7.1	7	11		1LA7 166-6AA1 .	160 L
11.2	10.1	8.5	7	11		1LA7 166-6AA1 .	160 L
14.6	11.5	11.5	9.7	15		1LA2 186-6AA1 .	180 L
15.2	14.6	11.5	9.7	15		1LA2 186-6AA1 .	180 L
18.2	14.7	14.4	12.2	18.5		1LA2 206-6AA1 .	200 L
18.7	18.2	14.4	12.2	18.5		1LA2 206-6AA1 .	200 L
21	18.2	17.4	14.7	22		1LA2 207-6AA1 .	200 L
22	21	17.4	14.7	22		1LA2 207-6AA1 .	200 L
30	22	22	22	30		1LA5 223-6AA1 .	225 M
31	30	28	26	30		1LA5 223-6AA1 .	225 M
36	30	30	30	37		1LA6 253-6AA1 .	250 M
37	36	32	30	37		1LA6 253-6AA1 .	250 M
44	37	37	37	45		1LA6 280-6AA1 .	280 S
45.6	43.5	36.8	25.7	45		1LA6 280-6AA1 .	280S
53.3	42.4	42.0	39.1	55		1LA6 283-6AA1 .	280M
55.7	53.2	45.0	31.4	55		1LA6 283-6AA1 .	280M
72.6	57.9	57.3	53.3	75		-	315S
75.9	72.5	61.3	42.8	75		-	315S
87.2	69.4	68.8	64.0	90		-	315M

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MICROMASTER Vector

MIDIMASTER Vector

Shaft Output for inverter supply (permissible to temperature rise class F)				**Motor**	**MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector**				
Load characteristic ($M \sim n^2$)	Load characteristic (M = const.) Speed Control Range			Rated output	Standard model (MM)	Standard model with integrated filter Class A [1])	Model with vector control (MMV and MDV)	Model with vector control (MMV and MDV) with integrated filter Class A [1])	
	1:2	1:5	1:10						
kW	kW	kW	kW	kW	Order No.	Order No.	Order No.	Order No.	Type
0.37	0.34	0.27	0.21	0.37	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.55	0.50	0.40	0.31	0.55	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.75	0.68	0.55	0.43	0.75	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
1.10	1.00	0.80	0.63	1.1	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.5	1.35	1.0	0.75	1.5	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
2.2	2.0	1.6	1.2	2.2	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
3.0	2.8	2.2	1.7	3	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
4.0	3.7	3.0	2.3	4	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
5.4	4.9	4.2	3.4	5.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
7.7	6.8	5.5	4.6	7.5	6SE9221-5DC40	-	6SE3221-5DC40	-	MM(V)750/3
10.1	7.1	7.1	7	11	-	-	6SE3221-7DG40	6SE3221-7DG50	MDV750/3
11.2	10.1	8.5	7	11	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
14.6	11.5	11.5	9.7	15	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15.2	14.6	11.5	9.7	15	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.2	14.7	14.4	12.2	18.5	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	18.2	14.4	12.2	18.5	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
21	18.2	17.4	14.7	22	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	21	17.4	14.7	22	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
30	22	22	22	30	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
31	30	28	26	30	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
36	30	30	30	37	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	36	32	30	37	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
44	37	37	37	45	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45.6	43.5	36.8	25.7	45	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
53.3	42.4	42.0	39.1	55	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.7	53.2	45.0	31.4	55	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
72.6	57.9	57.3	53.3	75	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.9	72.5	61.3	42.8	75	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3
87.2	69.4	68.8	64.0	90	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3

7.2.11 400 V 3 phase AC Supply Voltage 8 Pole Motors

Shaft Output for inverter supply (permissible to temperature rise class F)				**1LA2, 1LA5, 1LA6, 1LA7 three-phase squirrel-cage induction motors**			
Load characteristic VT ($M \sim n^2$)	Load characteristic CT (M = const.) Speed Control Range			3-ph. 400 V AC rated voltage 50 Hz			
	1:2	1:5	1:10	Rated output	Motor	Motor	Frame size
kW	kW	kW	kW	kW	Order No.	Order No.	
0.36	0.32	0.27	0.21	0.37	1LA5 090-8AB1 .	-	90S
0.53	0.47	0.40	0.32	0.55	1LA5 096-8AB1 .	-	90L
0.72	0.65	0.54	0.43	0.75	1LA5 106-8AB1 .	-	100L
1.06	0.95	0.79	0.63	1.1	1LA5 107-8AB1 .	-	100L
1.4	1.3	1.1	0.8	1.5	1LA5 113-8AB1 .	-	112 M
2.2	1.9	1.5	1.2	2.2	1LA5 130-8CB1 .	-	132 S
2.8	2.6	2.1	1.7	3	1LA5 133-8CB1 .	-	132 M
3.7	3.5	2.9	2.2	4	1LA5 163-8CB1 .	-	160 M
5.2	4.7	4	3.4	5.5	1LA5 164-8CB1 .	-	160 M
7.7	6.4	5.7	4.7	7.5	1LA5 166-8CB1 .	-	160L
10	7	7	6.8	11	1LA5 186-8AB1 .	-	180 L
11.1	10	8.2	6.8	11	1LA5 186-8AB1 .	-	180 L
13.4	10.5	10.5	8.8	15	1LA5 207-8AB1 .	-	200 L
15.2	13.4	10.8	8.8	15	1LA5 207-8AB1 .	-	200 L
17.4	14	14	14	18.5	1LA6 220-8AB1 .	-	225 S
18.7	17.4	16.8	16	18.5	1LA6 220-8AB1 .	-	225 S
21	17.8	17.8	17.8	22	1LA6 223-8AB1 .	-	225 M
22	21	20	19	22	1LA6 223-8AB1 .	-	225 M
28	21	21	21	30	1LA6 253-8AB1 .	-	250 M
30	28	27	26	30	1LA6 253-8AB1 .	-	250 M
35	29	29	29	37	1LA6 280-8AB1 .	-	280 S
37	35	34	30	37	1LA6 280-8AB1 .	-	280 S
43	36	36	36	45	1LA6 283-8AB1 .	-	280 M
45.2	41.8	38.3	28.1	45	1LA6 283-8AA1 .	-	280M
51.3	40.7	40.7	39.7	55	1LA6 310-8AA1 .	-	315S
55.3	51.1	46.8	34.3	55	1LA6 310-8AA1 .	-	315S
70.0	55.6	55.6	54.2	75	1LA6 313-8AA1 .	-	315M
75.4	69.7	63.8	46.8	75	1LA6 313-8AA1 .	-	315M
84.0	66.7	66.7	65.0	90	1LA6 316-8AA1 .	-	315L

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

Shaft Output for inverter supply (permissible to temperature rise class F)				**Motor**	**MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector**				
Load characteristic ($M \sim n^2$)	Load characteristic (M = const.) Speed Control Range			Rated output	Standard model (MM)	Standard model with integrated filter Class A [1])	Model with vector control (MMV and MDV)	Model with vector control (MMV and MDV) with integrated filter Class A [1])	
	1:2	1:5	1:10						
kW	kW	kW	kW	kW	Order No.	Order No.	Order No.	Order No.	Type
0.36	0.32	0.27	0.21	0.37	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.53	0.47	0.40	0.32	0.55	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.72	0.65	0.54	0.43	0.75	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
1.06	0.95	0.79	0.63	1.1	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.4	1.3	1.1	0.8	1.5	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
2.2	1.9	1.5	1.2	2.2	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
2.8	2.6	2.1	1.7	3	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
3.7	3.5	2.9	2.2	4	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
5.2	4.7	4	3.4	5.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
7.7	6.4	5.7	4.7	7.5	6SE9221-5DC40	-	6SE3221-5DC40	-	MM(V)750/3
10	7	7	6.8	11	-	-	6SE3221-7DG40	6SE3221-7DG50	MDV750/3
11.1	10	8.2	6.8	11	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
13.4	10.5	10.5	8.8	15	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15.2	13.4	10.8	8.8	15	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
17.4	14	14	14	18.5	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	17.4	16.8	16	18.5	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
21	17.8	17.8	17.8	22	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	21	20	19	22	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
28	21	21	21	30	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
30	28	27	26	30	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
35	29	29	29	37	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	35	34	30	37	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
43	36	36	36	45	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45.2	41.8	38.3	28.1	45	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
51.3	40.7	40.7	39.7	55	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.3	51.1	46.8	34.3	55	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
70.0	55.6	55.6	54.2	75	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.4	69.7	63.8	46.8	75	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3
84.0	66.7	66.7	65.0	90	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3

7.2.12 500 V 3 phase AC Supply Voltage 2 Pole Motors

Shaft Output for inverter supply (permissible to temperature rise class F)				**1LA2, 1LA5, 1LA6, 1LA7 three-phase squirrel-cage induction motors**			
Load characteristic VT ($M \sim n^2$)	Load characteristic CT (M = const.)			3-ph. 500 V AC rated voltage 50 Hz			
	Speed Control Range			Rated output	Motor	Motor	Frame size
	1:2	1:5	1:10				
kW	kW	kW	kW	kW	Order No.	Order No.	
0.39	0.37	0.30	0.24	0.37	1LA5 070-2AA3 .	-	71
0.53	0.49	0.45	0.36	0.55	1LA5 073-2AA3 .	-	71
0.57	0.55	0.45	0.36	0.55	1LA5 073-2AA3 .	-	71
0.72	0.67	0.61	0.49	0.75	1LA5 080-2AA3 .	-	80
0.78	0.75	0.61	0.49	0.75	1LA5 080-2AA3 .	-	80
1.1	0.98	0.90	0.72	1.1	1LA5 083-2AA3 .	-	80
1.1	1.1	0.90	0.71	1.1	1LA5 083-2AA3 .	-	80
1.4	1.3	1.2	0.99	1.5	1LA5 090-2AA3 .	-	90S
1.6	1.5	1.2	0.9	1.5	1LA5 090-2AA3 .	-	90 S
2.1	1.9	1.8	1.4	2.2	1LA5 096-2AA3 .	-	90 L
2.3	2.2	1.8	1.4	2.2	1LA5 096-2AA3 .	-	90 L
3	2.8	2.5	1.9	3	1LA5 106-2AA3 .	-	100 L
3.2	3	2.5	1.9	3	1LA5 106-2AA3 .	-	100 L
4	3.8	3.3	2.6	4	1LA5 113-2AA3 .	-	112 M
4.1	4	3.3	2.6	4	1LA5 113-2AA3 .	-	112 M
4.7	4.4	4.4	3.8	5.5	1LA5 130-2CA3 .	-	132 S
5.6	5.5	4.4	3.8	5.5	1LA5 130-2CA3 .	-	132 S
7.3	6.7	6.1	5.1	7.5	1LA5 131-2CA3 .	-	132 S
7.7	7.5	6.1	5.1	7.5	1LA5 131-2CA3 .	-	132S
11.1	8.5	8.5	7.6	11	1LA5 163-2CA3 .	-	160 M
11.1	11	8.8	7.6	11	1LA5 163-2CA3 .	-	160 M
15.2	12.5	12.4	10.6	15	1LA5 164-2CA3 .	-	160 M
15.2	15	12.4	10.6	15	1LA5 164-2CA3 .	-	160 M
18.7	17.1	15.7	13.3	18.5	1LA5 166-2CA3 .	-	160 L
18.7	18.5	15.7	13.3	18.5	1LA5 166-2CA3 .	-	160 L
22	22	18	16	22	1LA5 183-2AA3 .	-	180 M
22	22	18	16	22	1LA5 183-2AA3 .	-	180 M
30	27	25	22	30	1LA5 206-2AA3 .	-	200 L
30	30	25	22	30	1LA5 206-2AA3 .	-	200 L
37	35	31	27	37	1LA5 207-2AA3 .	-	200 L
37	37	31	27	37	1LA5 207-2AA3 .	-	200 L
45	45	38	35	45	1LA6 223-2AB5 .	-	225 M
45.2	45.0	37.2	32.3	45	1LA6 223-2AB5 .	-	225M
55.3	50.1	45.4	34.5	55	1LA6 253-2AB5 .	-	250M
55.3	55.0	45.5	39.5	55	1LA6 253-2AB5 .	-	250M
75.4	68.3	61.9	47.1	75	1LA6 280-2AC5 .	-	280S
75.4	75.0	62.1	53.8	75	1LA6 280-2AC5 .	-	280S
90.4	82.0	74.3	56.5	90	1LA6 283-2AC5 .	-	280M

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

Shaft Output for inverter supply (permissible to temperature rise class F)				**Motor**	**MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector**				
Load characteristic ($M \sim n^2$)	Load characteristic (M = const.) Speed Control Range			Rated output	Standard model (MM)	Standard model with integrated filter Class A [1])	Model with vector control (MMV and MDV)	Model with vector control (MMV and MDV) with integrated filter Class A [1])	
	1:2	1:5	1:10						
kW	kW	kW	kW	kW	Order No.	Order No.	Order No.	Order No.	Type
0.39	0.37	0.30	0.24	0.37	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.53	0.49	0.45	0.36	0.55	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.57	0.55	0.45	0.36	0.55	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.72	0.67	0.61	0.49	0.75	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.78	0.75	0.61	0.49	0.75	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
1.1	0.98	0.90	0.72	1.1	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
1.1	1.1	0.90	0.71	1.1	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.4	1.3	1.2	0.99	1.5	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.6	1.5	1.2	0.9	1.5	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
2.1	1.9	1.8	1.4	2.2	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
2.3	2.2	1.8	1.4	2.2	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
3	2.8	2.5	1.9	3	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
3.2	3	2.5	1.9	3	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
4	3.8	3.3	2.6	4	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
4.1	4	3.3	2.6	4	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
4.7	4.4	4.4	3.8	5.5	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
5.6	5.5	4.4	3.8	5.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
7.3	6.7	6.1	5.1	7.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
7.7	7.5	6.1	5.1	7.5	6SE9221-5DC40	-	6SE3221-5DC40	-	MM(V)750/3
11.1	8.5	8.5	7.6	11	-	-	6SE3221-7DG40	6SE3221-7DG50	MDV750/3
11.1	11	8.8	7.6	11	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15.2	12.5	12.4	10.6	15	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15.2	15	12.4	10.6	15	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	17.1	15.7	13.3	18.5	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	18.5	15.7	13.3	18.5	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	22	18	16	22	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	22	18	16	22	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
30	27	25	22	30	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
30	30	25	22	30	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	35	31	27	37	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	37	31	27	37	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45	45	38	35	45	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45.2	45.0	37.2	32.3	45	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.3	50.1	45.4	34.5	55	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.3	55.0	45.5	39.5	55	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.4	68.3	61.9	47.1	75	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.4	75.0	62.1	53.8	75	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3
90.4	82.0	74.3	56.5	90	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3

7.2.13 500 V 3 phase AC Supply Voltage 4 Pole Motors

Shaft Output for inverter supply (permissible to temperature rise class F)				**1LA2, 1LA5, 1LA6, 1LA7 three-phase squirrel-cage induction motors**			
Load characteristic VT ($M \sim n^2$)	Load characteristic CT (M = const.)			3-ph. 500 V AC rated voltage 50 Hz			
	Speed Control Range			Rated output	Motor	Motor	Frame size
	1:2	1:5	1:10				
kW	kW	kW	kW	kW	Order No.	Order No.	
0.39	0.37	0.29	0.23	0.37	1LA5 073-4AB3 .	-	71
0.49	0.44	0.44	0.35	0.55	1LA5 080-4AA3 .	-	80
0.58	0.55	0.44	0.34	0.55	1LA5 080-4AA3 .	-	80
0.67	0.61	0.60	0.48	0.75	1LA5 083-4AA3 .	-	80
0.79	0.75	0.59	0.46	0.75	1LA5 083-4AA3 .	-	80
0.98	0.89	0.88	0.70	1.1	1LA5 090-4AA3 .	-	90S
1.2	1.1	0.87	0.68	1.1	1LA5 090-4AA3 .	-	90S
1.3	1.2	1.2	0.95	1.5	1LA5 096-4AA3 .	-	90L
1.6	1.5	1.1	0.8	1.5	1LA5 096-4AA3 .	-	90 L
1.8	1.7	1.7	1.3	2.2	1LA5 106-4AA3 .	-	100 L
2.3	2.2	1.7	1.3	2.2	1LA5 106-4AA3 .	-	100 L
3	2.5	2.4	1.8	3	1LA5 107-4AA3 .	-	100 L
3.2	3	2.4	1.8	3	1LA5 107-4AA3 .	-	100 L
3.5	3.2	3.2	2.4	4	1LA5 113-4AA3 .	-	112 M
4.2	4	3.2	2.4	4	1LA5113-4AA3 .	-	112 M
4.6	4.3	4.3	3.7	5.5	1LA5 130-4CA3 .	-	132 S
5.7	5.5	4.5	3.7	5.5	1LA5 130-4CA3 .	-	132 S
6.8	6.4	6.2	5.3	7.5	1LA5 133-4CA3 .	-	132 M
7.7	7.5	6.2	5.3	7.5	1LA5 133-4CA3 .	-	132M
11.2	8.3	8.3	7.9	11	1LA5 163-4CA3 .	-	160 M
11.2	11	9.1	7.9	11	1LA5 163-4CA3 .	-	160 M
15.3	13.2	12.7	10.9	15	1LA5 166-4CA3 .	-	160 L
15.3	15	12.7	10.9	15	1LA5 166-4CA3 .	-	160 L
18.7	17	14.6	12.4	18.5	1LA5 183-4AA3 .	-	180 M
18.7	18.5	14.6	12.4	18.5	1LA5 183-4AA3 .	-	180 M
22	22	17.5	15	22	1LA5 186-4AA3 .	-	180 L
22	22	17.5	15	22	1LA5 186-4AA3 .	-	180 L
30	26	24	21	30	1LA5 207-4AA3 .	-	200 L
30	30	24	21	30	1LA5 207-4AA3 .	-	200 L
37	34	33	30	37	1LA6 220-4AA5 .	-	225 S
37	37	33	30	37	1LA6 220-4AA5 .	-	225 S
45	43	37	35	45	1LA6 223-4AA5 .	-	225 M
45.4	45.0	37.1	32.3	45	1LA6 223-4AA5 .	-	225M
55.4	49.5	44.8	34.3	55	1LA6 253-4AA5 .	-	250M
55.4	55.0	45.4	39.5	55	1LA6 253-4AA5 .	-	250M
75.5	67.4	61.1	46.8	75	1LA6 280-4AA5 .	-	280S
75.6	75.0	61.9	53.8	75	1LA6 280-4AA5 .	-	280S
90.6	80.9	73.3	56.2	90	1LA6 283-4AA5 .	-	280M

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

Shaft Output for inverter supply (permissible to temperature rise class F)				**Motor**	**MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector**				
Load characteristic ($M \sim n^2$)	Load characteristic (M = const.) Speed Control Range			Rated output	Standard model (MM)	Standard model with integrated filter Class A [1])	Model with vector control (MMV and MDV)	Model with vector control (MMV and MDV) with integrated filter Class A [1])	
	1:2	1:5	1:10						
kW	kW	kW	kW	kW	Order No.	Order No.	Order No.	Order No.	Type
0.39	0.37	0.29	0.23	0.37	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.49	0.44	0.44	0.35	0.55	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.58	0.55	0.44	0.34	0.55	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.67	0.61	0.60	0.48	0.75	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.79	0.75	0.59	0.46	0.75	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
0.98	0.89	0.88	0.70	1.1	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
1.2	1.1	0.87	0.68	1.1	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.3	1.2	1.2	0.95	1.5	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.6	1.5	1.1	0.8	1.5	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
1.8	1.7	1.7	1.3	2.2	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
2.3	2.2	1.7	1.3	2.2	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
3	2.5	2.4	1.8	3	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
3.2	3	2.4	1.8	3	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
3.5	3.2	3.2	2.4	4	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
4.2	4	3.2	2.4	4	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
4.6	4.3	4.3	3.7	5.5	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
5.7	5.5	4.5	3.7	5.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
6.8	6.4	6.2	5.3	7.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
7.7	7.5	6.2	5.3	7.5	6SE9221-5DC40	-	6SE3221-5DC40	-	MM(V)750/3
11.2	8.3	8.3	7.9	11	-	-	6SE3221-7DG40	6SE3221-7DG50	MDV750/3
11.2	11	9.1	7.9	11	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15.3	13.2	12.7	10.9	15	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15.3	15	12.7	10.9	15	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	17	14.6	12.4	18.5	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	18.5	14.6	12.4	18.5	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	22	17.5	15	22	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	22	17.5	15	22	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
30	26	24	21	30	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
30	30	24	21	30	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	34	33	30	37	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	37	33	30	37	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45	43	37	35	45	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45.4	45.0	37.1	32.3	45	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.4	49.5	44.8	34.3	55	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.4	55.0	45.4	39.5	55	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.5	67.4	61.1	46.8	75	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.6	75.0	61.9	53.8	75	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3
90.6	80.9	73.3	56.2	90	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3

7.2.14 500 V 3 phase AC Supply Voltage 6 Pole Motors

Shaft Output for inverter supply (permissible to temperature rise class F)				**1LA2, 1LA5, 1LA6, 1LA7 three-phase squirrel-cage induction motors**			
Load characteristic VT ($M \sim n^2$)	Load characteristic CT (M = const.) Speed Control Range			3-ph. 500 V AC rated voltage 50 Hz			
	1:2	1:5	1:10	Rated output	Motor	Motor	Frame size
kW	kW	kW	kW	kW	Order No.	Order No.	
0.38	0.36	0.27	0.21	0.37	1LA5 080-6AA3 .	-	80
0.43	0.40	0.39	0.32	0.55	1LA5 083-6AA3 .	-	80
0.57	0.53	0.40	0.31	0.55	1LA5 083-6AA3 .	-	80
0.58	0.54	0.53	0.44	0.75	1LA5 090-6AA3 .	-	90S
0.78	0.73	0.55	0.43	0.75	1LA5 090-6AA3 .	-	90S
0.85	0.79	0.78	0.64	1.1	1LA5 096-6AA3 .	-	90L
1.1	1.1	0.80	0.63	1.1	1LA5 096-6AA3 .	-	90L
1.2	1.1	1.1	0.88	1.5	1LA5 106-6AA3 .	-	100 L
1.6	1.5	1.0	0.75	1.5	1LA5 106-6AA3 .	-	100 L
1.6	1.5	1.5	1.2	2.2	1LA5 113-6AA3 .	-	112 M
2.3	2.1	1.6	1.2	2.2	1LA5 113-6AA3 .	-	112 M
2.5	2.3	2.2	1.7	3	1LA5 130-6CA3 .	-	132 S
3.1	3	2.2	1.7	3	1LA5 130-6CA3 .	-	132 S
3.2	2.9	2.9	2.3	4	1LA5 133-6CA3 .	-	132 M
4.1	3.7	3.0	2.3	4	1LA5 133-6CA3 .	-	132 M
4.0	3.8	3.8	3.4	5.5	1LA5 134-6CA3 .	-	132 M
5.7	5.5	4.2	3.4	5.5	1LA5 134-6CA3 .	-	132 M
5.9	5.6	5.5	4.6	7.5	1LA5 163-6CA3 .	-	160 M
7.7	7.1	5.5	4.6	7.5	1LA5 163-6CA3 .	-	160 M
11.2	7.5	7.5	7	11	1LA5 166-6CA3 .	-	160 L
11.2	11	8.5	7	11	1LA5 166-6CA3 .	-	160 L
15.2	12.7	11.5	9.7	15	1LA5 186-6AA3 .	-	180 L
15.2	15	11.5	9.7	15	1LA5 186-6AA3 .	-	180 L
18.7	16.7	14.4	12.2	18.5	1LA5 206-6AA3 .	-	200 L
18.7	18.5	14.4	12.2	18.5	1LA5 206-6AA3 .	-	200 L
22	21	17.4	14.7	22	1LA5 207-6AA3 .	-	200 L
22	22	17.4	14.7	22	1LA5 207-6AA3 .	-	200 L
31	26	26	26	30	1LA6 223-6AA5 .	-	225 M
31	30	28	26	30	1LA6 223-6AA5 .	-	225 M
37	34	32	30	37	1LA6 253-6AA5 .	-	250 M
37	37	32	30	37	1LA6 253-6AA5 .	-	250 M
45	43	40	40	45	1LA6 280-6AA5 .	-	280 S
45.6	45.0	36.8	32.2	45	1LA6 280-6AA5 .	-	280S
55.6	48.1	44.3	35.7	55	1LA6 283-6AA5 .	-	280M
55.7	55.0	45.0	39.3	55	1LA6 283-6AA5 .	-	280M
75.8	65.6	60.4	48.7	75	1LA6 310-6AA5 .	-	315S
75.9	75.0	61.3	53.6	75	1LA6 310-6AA5 .	-	315S
91.0	78.8	72.5	58.4	90	1LA6 313-6AA5 .	-	315M

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

Shaft Output for inverter supply (permissible to temperature rise class F)				**Motor**	**MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector**				
Load characteristic ($M \sim n^2$)	Load characteristic (M = const.) Speed Control Range			Rated output	Standard model (MM)	Standard model with integrated filter Class A [1])	Model with vector control (MMV and MDV)	Model with vector control (MMV and MDV) with integrated filter Class A [1])	
	1:2	1:5	1:10						
kW	kW	kW	kW	kW	Order No.	Order No.	Order No.	Order No.	Type
0.38	0.36	0.27	0.21	0.37	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.43	0.40	0.39	0.32	0.55	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.57	0.53	0.40	0.31	0.55	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.58	0.54	0.53	0.44	0.75	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.78	0.73	0.55	0.43	0.75	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
0.85	0.79	0.78	0.64	1.1	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
1.1	1.1	0.80	0.63	1.1	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.2	1.1	1.1	0.88	1.5	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.6	1.5	1.0	0.75	1.5	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
1.6	1.5	1.5	1.2	2.2	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
2.3	2.1	1.6	1.2	2.2	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
2.5	2.3	2.2	1.7	3	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
3.1	3	2.2	1.7	3	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
3.2	2.9	2.9	2.3	4	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
4.1	3.7	3.0	2.3	4	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
4.0	3.8	3.8	3.4	5.5	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
5.7	5.5	4.2	3.4	5.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
5.9	5.6	5.5	4.6	7.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
7.7	7.1	5.5	4.6	7.5	6SE9221-5DC40	-	6SE3221-5DC40	-	MM(V)750/3
11.2	7.5	7.5	7	11	-	-	6SE3221-7DG40	6SE3221-7DG50	MDV750/3
11.2	11	8.5	7	11	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15.2	12.7	11.5	9.7	15	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15.2	15	11.5	9.7	15	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	16.7	14.4	12.2	18.5	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	18.5	14.4	12.2	18.5	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	21	17.4	14.7	22	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	22	17.4	14.7	22	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
31	26	26	26	30	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
31	30	28	26	30	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	34	32	30	37	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	37	32	30	37	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45	43	40	40	45	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45.6	45.0	36.8	32.2	45	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.6	48.1	44.3	35.7	55	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.7	55.0	45.0	39.3	55	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.8	65.6	60.4	48.7	75	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.9	75.0	61.3	53.6	75	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3
91.0	78.8	72.5	58.4	90	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3

7.2.15 500 V 3 phase AC Supply Voltage 8 Pole Motors

Shaft Output for inverter supply (permissible to temperature rise class F)				**1LA2, 1LA5, 1LA6, 1LA7 three-phase squirrel-cage induction motors**			
Load characteristic VT ($M \sim n^2$)	Load characteristic CT (M = const.) Speed Control Range			3-ph. 500 V AC rated voltage 50 Hz			
	1:2	1:5	1:10	Rated output	Motor	Motor	Frame size
kW	kW	kW	kW	kW	Order No.	Order No.	
0.37	0.34	0.27	0.21	0.37	1LA5 090-8AB3 .	-	90S
0.55	0.51	0.40	0.32	0.55	1LA5 096-8AB3 .	-	90L
0.75	0.70	0.54	0.43	0.75	1LA5 106-8AB3 .	-	100L
1.1	1.0	0.79	0.63	1.1	1LA5 107-8AB3 .	-	100L
1.5	1.4	1.1	0.8	1.5	1LA5 113-8AB3 .	-	112 M
2.2	2.1	1.5	1.2	2.2	1LA5 130-8CB3 .	-	132 S
3	2.8	2.1	1.7	3	1LA5 133-8CB3 .	-	132 M
3.8	3.5	2.9	2.2	4	1LA5 163-8CB3 .	-	160 M
5.7	5.4	4	3.4	5.5	1LA5 164-8CB3 .	-	160 M
7.7	6.8	5.7	4.7	7.5	1LA5 166-8CB3 .	-	160L
11.1	7.6	8.2	6.8	11	1LA5 186-8AB3 .	-	180 L
11.1	11	8.2	6.8	11	1LA5 186-8AB3 .	-	180 L
15	11.7	10.8	8.8	15	1LA5 207-8AB3 .	-	200 L
15.2	15	10.8	8.8	15	1LA5 207-8AB3 .	-	200 L
18.7	15.8	15.8	15.8	18.5	1LA6 220-8AB5 .	-	225 S
18.7	18.5	16.8	16	18.5	1LA6 220-8AB5 .	-	225 S
22	20	20	19	22	1LA6 223-8AB5 .	-	225 M
22	22	20	19	22	1LA6 223-8AB5 .	-	225 M
30	24	24	24	30	1LA6 253-8AB5 .	-	250 M
30	30	27	26	30	1LA6 253-8AB5 .	-	250 M
37	32	32	30	37	1LA6 280-8AB5 .	-	280 S
37	37	34	30	37	1LA6 280-8AB5 .	-	280 S
45	41	40	37	45	1LA6 283-8AB5 .	-	280 M
45.2	45.0	38.3	28.1	45	1LA6 283-8AA5 .	-	280M
55.2	45.7	45.4	42.1	55	1LA6 310-8AA5 .	-	315S
55.3	55.0	46.8	34.3	55	1LA6 310-8AA5 .	-	315S
75.2	62.3	62.0	57.4	75	1LA6 313-8AA5 .	-	315M
75.4	75.0	63.8	46.8	75	1LA6 313-8AA5 .	-	315M
90.3	74.7	74.3	68.9	90	1LA6 316-8AA5 .	-	315L

MICROMASTER

MICROMASTER Vector

MIDIMASTER Vector

Shaft Output for inverter supply (permissible to temperature rise class F)				**Motor**	**MICROMASTER, MICROMASTER Vector, and MIDIMASTER Vector**				
Load characteristic ($M \sim n^2$)	Load characteristic (M = const.) Speed Control Range			Rated output	Standard model (MM)	Standard model with integrated filter Class A [1])	Model with vector control (MMV and MDV)	Model with vector control (MMV and MDV) with integrated filter Class A [1])	
	1:2	1:5	1:10						
kW	kW	kW	kW	kW	Order No.	Order No.	Order No.	Order No.	Type
0.37	0.34	0.27	0.21	0.37	6SE9211-1DA40	-	6SE3211-1DA40	-	MM(V)37/3
0.55	0.51	0.40	0.32	0.55	6SE9211-4DA40	-	6SE3211-4DA40	-	MM(V)55/3
0.75	0.70	0.54	0.43	0.75	6SE9212-0DA40	-	6SE3212-0DA40	-	MM(V)75/3
1.1	1.0	0.79	0.63	1.1	6SE9212-7DA40	-	6SE3212-7DA40	-	MM(V)110/3
1.5	1.4	1.1	0.8	1.5	6SE9214-0DA40	-	6SE3214-0DA40	-	MM(V)150/3
2.2	2.1	1.5	1.2	2.2	6SE9215-8DB40	-	6SE3215-8DB40	-	MM(V)220/3
3	2.8	2.1	1.7	3	6SE9217-3DB40	-	6SE3217-3DB40	-	MM(V)300/3
3.8	3.5	2.9	2.2	4	6SE9221-0DC40	-	6SE3221-0DC40	-	MM(V)400/3
5.7	5.4	4	3.4	5.5	6SE9221-3DC40	-	6SE3221-3DC40	-	MM(V)550/3
7.7	6.8	5.7	4.7	7.5	6SE9221-5DC40	-	6SE3221-5DC40	-	MM(V)750/3
11.1	7.6	8.2	6.8	11	-	-	6SE3221-7DG40	6SE3221-7DG50	MDV750/3
11.1	11	8.2	6.8	11	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15	11.7	10.8	8.8	15	-	-	6SE3222-4DG40	6SE3222-4DG50	MDV1100/3
15.2	15	10.8	8.8	15	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	15.8	15.8	15.8	18.5	-	-	6SE3223-0DH40	6SE3223-0DH50	MDV1500/3
18.7	18.5	16.8	16	18.5	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	20	20	19	22	-	-	6SE3223-5DH40	6SE3223-5DH50	MDV1850/3
22	22	20	19	22	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
30	24	24	24	30	-	-	6SE3224-2DJ40	6SE3224-2DJ50	MDV2200/3
30	30	27	26	30	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	32	32	30	37	-	-	6SE3225-5DJ40	6SE3225-5DJ50	MDV3000/3
37	37	34	30	37	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45	41	40	37	45	-	-	6SE3226-8DJ40	6SE3226-8DJ50	MDV3700/3
45.2	45.0	38.3	28.1	45	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.2	45.7	45.4	42.1	55	-	-	6SE3228-4DK40	6SE3228-4DK50	MDV4500/3
55.3	55.0	46.8	34.3	55	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.2	62.3	62.0	57.4	75	-	-	6SE3231-0DK40	6SE3231-0DK50	MDV5500/3
75.4	75.0	63.8	46.8	75	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3
90.3	74.7	74.3	68.9	90	-	-	6SE3231-4DK40	6SE3231-4DK50	MDV7500/3

8.1 COMBIMASTER Introduction

COMBIMASTER combines the inverter and motor as a single module offering particular advantages in terms of ease of installation and commissioning.

- No cables are required between inverter and motor.
- A very high level of protection is offered (IP55) allowing use in harsh environments such as those in the HVAC and food and drinks industries.
- A standard Siemens low voltage AC motor is used and therefore both 2 and 4 pole variants and a wide range of standard flange types are available.
- Both constant torque and variable torque control is possible, limited only by motor thermal performance.
- The optional EMC filter, meeting EN55011 Class A or Class B, is integrated within the electronics housing.
- COMBIMASTER carries the CE mark for both EMC conformance and conformance to the low voltage directive.
- For simple applications a potentiometer is built-in for setting the motor speed and no other adjustment is necessary.
- The unit may also be controlled using digital inputs, the standard RS485 serial interface or the same Clear Text Display module as is available for the MICROMASTER.
- The motor speed setpoint may be input in the same way as for the MICROMASTER.
- A wide range of options is available, i.e. integrated Class A and Class B filters, built-in braking module (pulse resistor and electromechanical types are available), CB155 PROFIBUS module supporting bus baud rates up to 12MBd, SIMOVIS PC commissioning software and the MICROMASTER Clear Text Display Module OPM2.

8.1.1 COMBIMASTER Product Overview

The COMBIMASTER is intended for use anywhere in the world and therefore supports a wide range of mains voltages:

208 to 240V ± 10% 1/3 Phase

380 to 480V ± 10% 3 Phase

460 to 500V ± 10% 3 Phase

For basic applications, the COMBIMASTER can be considered as a simple variable speed motor. All that is needed is to connect the Mains and start the motor at the desired speed using the built in potentiometer control.

For more demanding applications, the COMBIMASTER provides most of the features of the renowned MICROMASTER range of variable speed drives. The COMBIMASTER can be configured using the same Clear Text Display as MICROMASTER, and has a compatible parameter set to minimise learning time.

These features include:

- Standard PI controller for closed loop process control.
- An RS485 serial interface is standard allowing up to 31 drives to be networked to a PLC or PC using the USS standard protocol.
- The drive may be enabled via digital inputs or over the standard RS485 serial interface, or from the built in potentiometer.
- The motor speed setpoint may be selected using a digital setpoint, motorised potentiometer, fixed frequency, analogue input or via the serial link.
- Mixed mode control is also available allowing drive control and setpoint input to be from different sources.
- A DC injection brake is incorporated which also allows DC to be output when the motor is stationary.
- The motor may be configured to start automatically following a mains break or a fault.
- The parameter sets are compatible between the different product types, reducing the learning time.
- IP55 Protection means that installation in all usual motor environments is possible.
- All drives are certified in accordance with VDE, UL and Canadian UL and are manufactured to ISO9001.
- All drives conform to the requirements of the EC low voltage directive 73/23/EEC, the electromagnetic compatibility directive 89/336/EEC, and carry the CE mark.

8.1.2 COMBIMASTER Technical Features

Feature	Specification
Mains Voltage	208 to 240V ± 10% 1/3 Phase 380 to 480V ± 10% 3 Phase 460 to 500V ± 10% 3 Phase
Power Ranges 1 AC 208-240V 3 AC 208-240V 3 AC 400-480V 3 AC 460-500V	 0.12 - 0.75kW 0.12 - 0.75kW 0.37 - 7.5kW 0.37 - 7.5kW
Protection Level	IP55 (Inverter IP65)
Conformance to EN55011 A EMC	Integrated Filter
Conformance to EN55011 B EMC	Integrated Filter
Temperature Range	-10°C to 40°C
Control Method	V/f
Overload Capability	1.5 x rated output current
Protection Features	Under voltage, Over voltage, Overload, Short circuit, Motor Pull-out, Locked Rotor, Motor Overtemperature, Inverter Overtemperature
Output Frequency Range	0 – 140 Hz (Motor dependent)
Set point Resolution	0.05 Hz
Digital Inputs	3
Fixed Frequencies	7
Skip Frequency Bands	4
Relay Outputs	1 configurable 24V DC 1A
Analogue Inputs	1 for set point and 1 for PI sensor & Built in potentiometer
Serial Interface	RS485
Dynamic Braking	Braking Module
Process Control	PI

8.1.3 COMBIMASTER Options Overview

The COMBIMASTER can be enhanced by a range of specially designed options:

Accessory	IP Rating	Integrated/External
EMC Filter for EN55011A	IP65	Integrated
EMC Filter for EN55011B	IP65	Integrated
Multilingual Clear Text Display Module - OPm2	IP54	External
PROFIBUS Module for Baud Rates up to 12MBd - CB155	IP65	External fitted to inverter housing
Braking Module	IP65	Integrated
SIMOVIS PC based commissioning program for Windows 95 and NT	-	-

8.1.4 COMBIMASTER International Standards Conformity

CE Mark:

The COMBIMASTER complies with the requirements of the Low Voltage Directive, 73/23/EEC, and the EMC directive 89/336/EEC. The CE Mark on the units demonstrates this conformity. A declaration of conformity can be issued. The units are certified to comply with the following standards:

EN60204-1 Safety of Machinery, Electrical Equipment or Machines

EN60146-1-1 General Requirements for Semiconductor converters and line commutated converters

Electromagnetic Compatibility:

The table below lists the measured results for emissions of and immunity to interference for COMBIMASTER. The drives were installed according to the guidelines with shielded control cables and optional mains filters.

Test	Measurement	Tested Value	Required limit for EN50082/50082
RFI Emissions EN55011 (VDE 0875 Part 11)	Conducted via Mains cable and radiated through air	230V 1ph Class A Filter ≥ Class A 230V 1ph Class B Filter ≥ Class B 400V 3ph Class A Filter ≥ Class A 400V 3ph Class B Filter ≥ Class B	Class A Class B Class A Class B
ESD Immunity EN61000-4-2 (VDE 0847 Part 4-2)	ESD through air ESD through direct contact	Level 4 15kV Level 4 8kV	Level 3 8kV Level 3 4kV
Electric Field Immunity EN61000-4-3 (VDE 0847 Part 4-3)	Electric Field applied to unit	10V/m	26-1000MHz 10V/m
Burst Interference Immunity EN61000-4-4 (VDE 0847 Part 4-4)	Applied to all cable terminations: Mains Leads Motor Leads Control Leads Braking Resistor/Module Leads DC Link Leads	 Level 4: 4kV Level 4: 4kV 4kV Level 4: 4kV Level 4: 4kV	 2kV 2kV 2kV 2kV 2kV
Surge Immunity EN61000-4-5 (VDE 0847 Part 4-5)	Applied to all mains cable:	4kV Asymmetric 2kV Symmetric	4kV Asymmetric 2kV Symmetric

Table 1 - Test Results

8.1.5 COMBIMASTER Quotation Sheet

1UA7 COMBIMASTER	1 AC 208-240V ± 10%	0.12 - 0.75kW
	3 AC 208-240V ± 10%	0.12 - 0.75kW
	3 AC 400-480V ± 10%	0.37 - 7.5kW
	3 AC 460-500V ± 10%	0.37 - 7.5kW

Technical Data

Rated Supply Voltage ……V

Rated frequency……Hz

Rated current ……A

Overload capacity (up to 50% for 60s) ……A

Rated output ……kW

Continuous output without overload ……kW

EMC conformance (EN55011A or B) ……

Maximum ambient air temperature (40/50ºC)…….ºC

Degree of protection (IP55/IP65) …….

Mechanical dimensions (H) ……x(W)…..……..x(D)……..…mm

Weight ……..kg

Variable speed low voltage AC motors based on a combination of high quality, standard Siemens induction motor, and voltage source DC link inverters with pulse width modulated outputs. Latest generation IGBT technology in the output stage for high efficiency speed control of the motor. Units pre-configured for quick commissioning.

Manufactured in accordance with DIN VDE. Units are designed and built in a factory awarded with ISO9001 certification.

Power Section
3 phase diode bridge input with optional class A or Class B mains filter. High temperature DC link capacitors. Six pulse self commutating IGBT inverter output stage.

Switching and Protective Devices
Pre-charging input circuit using relay, where required.

Motor Control
Open loop V/f control with configurable voltage boost.

Local Control
Operable 'straight from the box' using built in potentiometer to start/stop, and control speed. Optionally, can be configured to operate from digital input/analogue input/fixed frequency control etc. as per MICROMASTER.

Optional User Text Display OPm2
Dot-matrix LCD display for multilingual text-driven configuration. Non-volatile storage of up to 10 parameter sets. Parameter set upload and download facilities. Master mode for networking up to 31 drives together. RS232 interface.

Control Terminals

- 3 configurable 24V binary inputs with 18 selectable functions.
- 1 configurable relay output with 13 selectable functions.
- 1 analogue input for setpoint input 0/2 - 10V, 0/4 - 20mA.
- 1 additional analogue input 0 - 10V, 0 - 20mA for PI input.
- 1 Motor PTC temperature sensor connection. (Integrated, order PTC with COMBIMASTER.
- 1 power supply 15V/50mA for actual value processing.
- All terminals fully short-circuit proof.

Standard Automation Interface
RS485 serial interface with USS protocol for the connection of up to 31 drives, maximum bus speed 19.2kBd.

Optional Automation Interface
PROFIBUS DP module for the connection of up to 125 drives, maximum bus speed 12MBd.

Standard Functions:

- Open loop V/f speed control.
- 0 – 140 Hz output frequency (motor dependent) with 0.05 Hz resolution.
- 150% overload capability as a percentage of nominal torque for 60 seconds.
- Integrated PI controller.
- RS485 serial interface.
- Sequence control for an external brake option.
- Flying start to allow restart when already spinning.
- Automatic restart for starting automatically following mains break or fault.
- Flexible setpoint input via fixed frequencies, analogue input, 'motorised potentiometer' or serial interface.
- Flexible control interface allowing control via digital inputs analogue input, or serial interface.
- Configurable DC brake which can also be used when motor stationary.
- Multi-mode operation allowing setpoint and control from different sources.
- Two programmable ramp generators (0 - 650s) each with S-curve capability.
- 7 fixed frequencies.
- 4 configurable skip frequency bands for suppressing resonance.
- Optional EMC filter meeting EN55011 Class A or B.

Option Range

- Multi-lingual Clear Text Display.
- SIMOVIS commissioning program running under Windows 95 or NT.
- CB155 PROFIBUS Module.
- Pulse resistor Braking Unit (integrated).
- Electromechanical Brake Control (integrated).

8.2 COMBIMASTER Technical Description

COMBIMASTER is supplied ready to be connected to the mains and includes all of the components required for operation.

The COMBIMASTER comes in two inverter case sizes covering eight different motor type frame sizes:

Motor frame 56
Motor frame 63
Motor frame 71
Motor frame 80
Motor frame 90
Motor frame 100
Motor frame 112
Motor frame 132

Access to the electrical connections can be achieved by removing the top cover. Please ensure that the operating instructions have been carefully read and always make sure that power is disconnected from the unit whilst undertaking electrical or mechanical work.

8.2.1 Power Section

The power section is cooled via a cut-out in the motor fan cowl, which allows a component of the air, normally used to cool the motor, to impinge against the high efficiency heat sink of the inverter. The advanced heat sink design available for COMBIMASTER means that the extra fan cooling will not be required even for constant torque.

Note:
Constant torque is limited by the thermal performance of the motor at low speeds. See Section 8.3 for details.

The inverter is thermally isolated from the motor and thus its temperature is completely independent from the motor temperature.

All of the units have an uncontrolled input rectifier, a capacitor-buffered DC voltage link, and a PWM inverter with IGBT power devices.

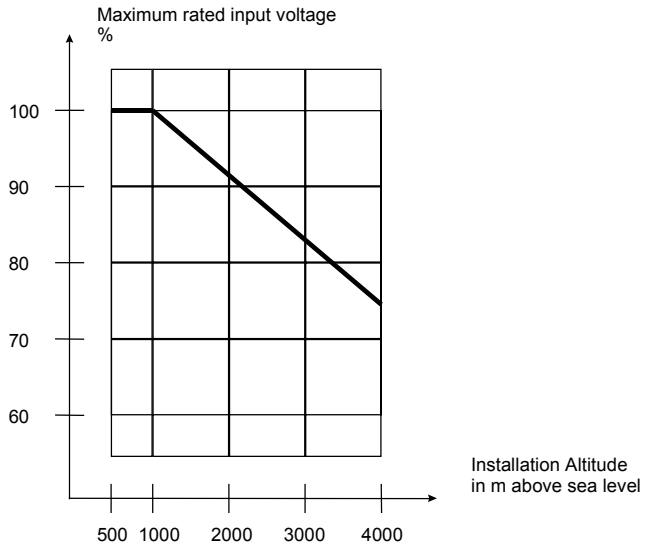
The COMBIMASTER has been optimised to keep its physical dimensions as small as possible, and for maximum reliability. The result of this has lead to a DC link with low energy capabilities. Rapidly stopping loads with high inertias will result in over voltage tripping. However, an integrated braking option is now available, which will enable fast stopping in most applications.

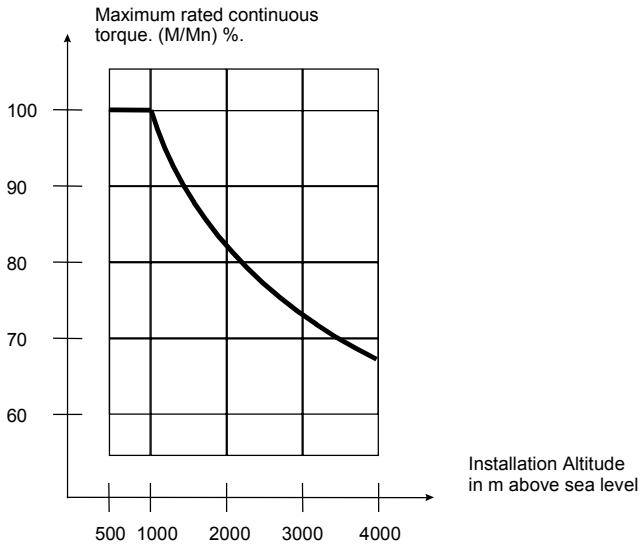
A main switch or isolator should be provided to electrically isolate the unit from the line supply. Slow-acting line fuses can also be used for protection. See section 8.7.

For a Block Diagram of the COMBIMASTER see Figure 8, Page 8/20.

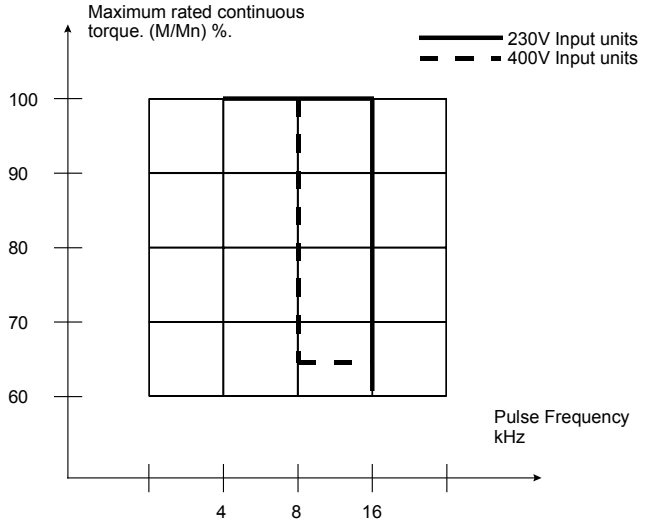
8.3 COMBIMASTER DE-RATING INFORMATION

De-rating with altitude

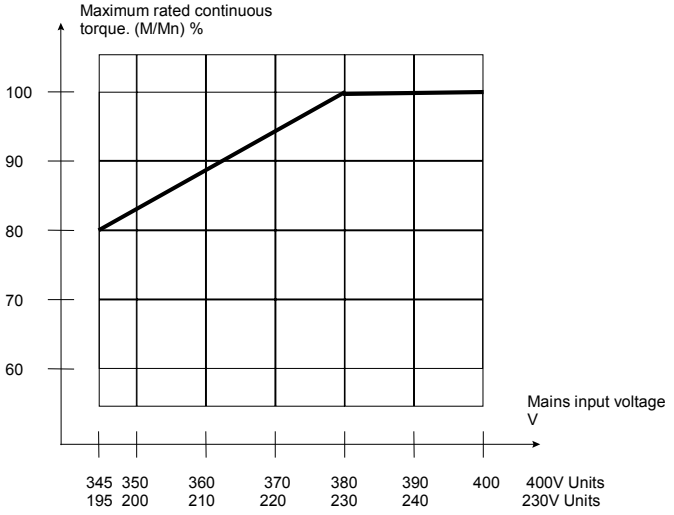




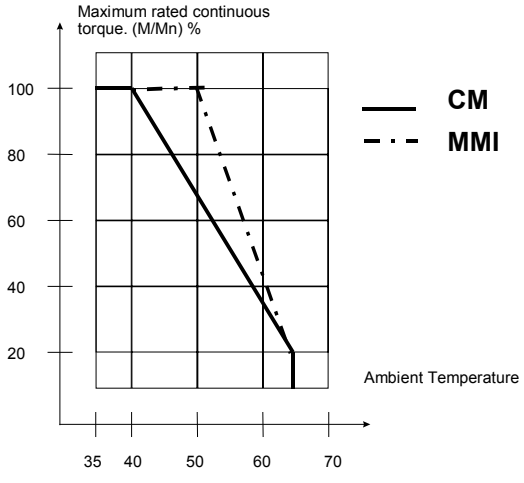
De-rating with switching frequency



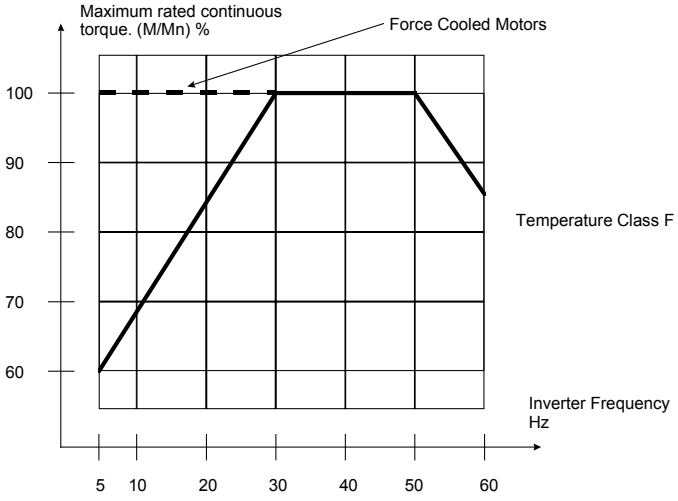
De-rating with mains input voltage



De-rating with temperature



De-rating with inverter frequency



8.4 COMBIMASTER INSTALLATION

WARNING

To guarantee the safe operation of the equipment it must be installed and commissioned by qualified personnel only.

Take particular note of the general and regional installation and safety regulations regarding work on high voltage installations (e.g. VDE), as well as the relevant regulations regarding the correct use of tools and personal protective gear.

Use the lifting eyes provided if the motor has to be lifted. Do not lift machine sets (e.g. built-on gearboxes, fan units) by suspending the individual machines!

Always check the capacity of the hoist before lifting any equipment.

Wiring Guidelines to Minimise the Effects of EMI

The COMBIMASTER is designed to operate in an industrial environment where a high level of Electromagnetic Interference (EMI) can be expected. Usually, good installation practices will ensure safe and trouble free operation. However, if problems are encountered, the following guidelines may prove useful. In particular, grounding of the system 0V at the inverter, as described below, may prove effective.

(1) Ensure that all equipment is well earthed using short, thick earthing cable connected to a common star point or bus bar. It is particularly important that any control equipment that is connected to the inverter (such as a PLC) is connected to the same earth or star point as the inverter via a short, thick link. Flat conductors (e.g. metal brackets) are preferred as they have lower impedance at high frequencies.

(2) Wherever possible, use screened leads for connections to the control circuitry. Terminate the ends of the cable neatly, ensuring that unscreened wires are not left visible.

(3) Separate the control cables from the power connections as much as possible, using separate trunking, etc. If control and power cables cross, arrange the cables so that they cross at 90° if possible.

(4) Ensure that contactors in the cubicle are suppressed, either with R-C suppressers for AC contactors or 'flywheel' diodes for DC contactors, **fitted to the coils**. Varistor suppressers are also effective. This is particularly important if the contactors are controlled from the relay connection on the COMBIMASTER.

(5) Use screened or armoured cables for the power connections and ground the screen at both ends via the cable glands.

On no account must safety regulations be compromised when installing the COMBIMASTER!

8.4.1 Mechanical Installation

Figures 1-7 show dimensional information for all COMBIMASTER variants.

Note:
'Case size' refers to the type of inverter housing mounted on the motor. 'Motor frame' refers to the motor frame size only.

Remove or tighten down screw-in lifting eyes prior to using the COMBIMASTER.

Stable foundations or mounting conditions, exact alignment of the motors and a well-balanced transmission element are essential for quiet, vibration-free running. If necessary, insert shims under the motor's feet to prevent strain, or balance the whole rotor and transmission element.

Always use the correct tools for fitting and removing transmission elements (coupling halves, pulleys, pinions, etc.).

The rotors are dynamically balanced with the full featherkey inserted as standard. Since 1991 the type of balance has been marked on the drive end of the shaft (shaft end face). **F** denotes balanced with **full** featherkey; **H** denotes balanced with **half** featherkey. Bear in mind the type of balance used when fitting the transmission element.

Poor running characteristics can arise in cases where the transmission elements have a length ratio of hub length to length of shaft end < 0.8 and they run at speeds of > 1500 rpm. In such cases rebalancing may be necessary, e.g. by reducing the distance by which the featherkey protrudes from the transmission element and the shaft surface.

WARNING

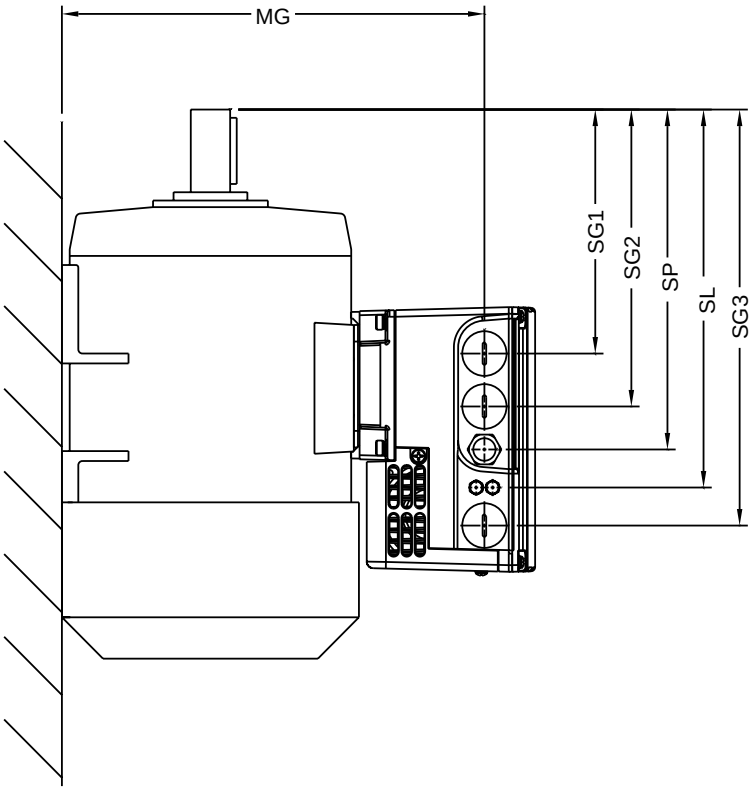
Take suitable precautions to prevent transmission elements from being touched. If the COMBIMASTER is started up without a transmission element attached, the featherkey must be secured in position to prevent it from flying off while the shaft is rotating.

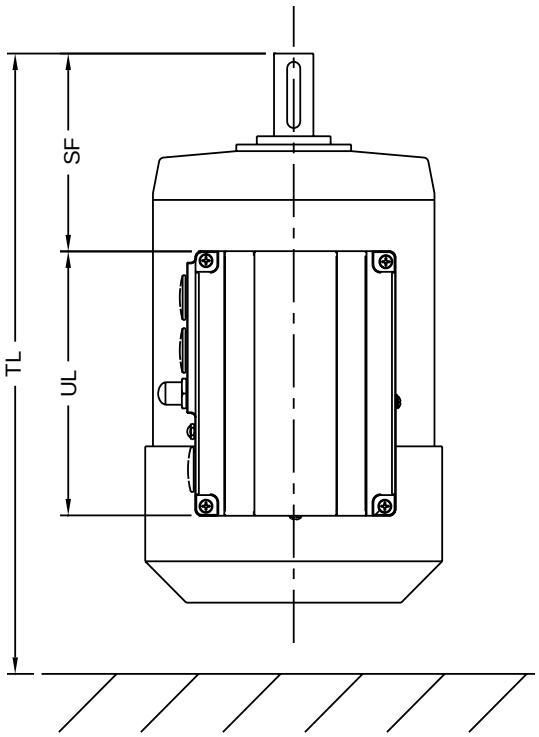
Please check the following prior to commissioning:

- The rotor turns freely without rubbing.
- The motor is assembled and aligned properly.
- The transmission elements are adjusted correctly (e.g. belt tension) and the transmission element is suitable for the given operating conditions.
- All electrical connections, mounting screws and connecting elements are tightened and fitted correctly.
- All protective conductors are installed properly.
- Any auxiliary equipment that might be fitted (e.g. brakes) is in working order.
- Protection guards are installed around all moving and live parts.
- The maximum speed *(see rating plate)* is not exceeded. Note that the maximum speed is the highest operating speed permitted for short periods. Remember that motor noise and vibration are worse at this speed and bearing life is reduced.

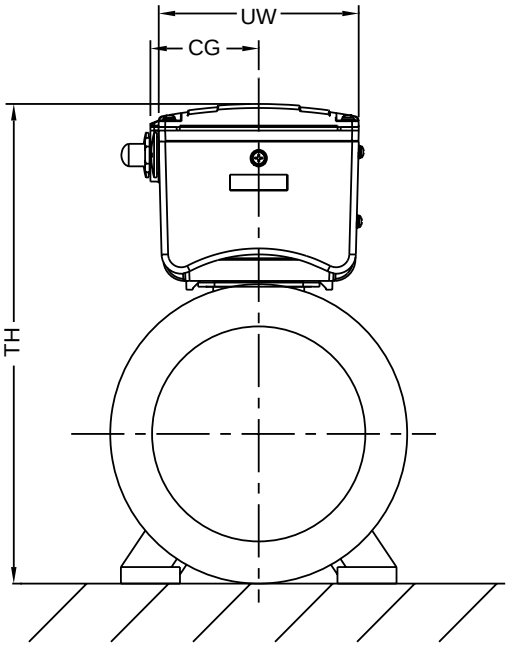
The above list is not meant to be exhaustive - additional checks may also be required.

COMBIMASTER – Dimensions – Case Size A





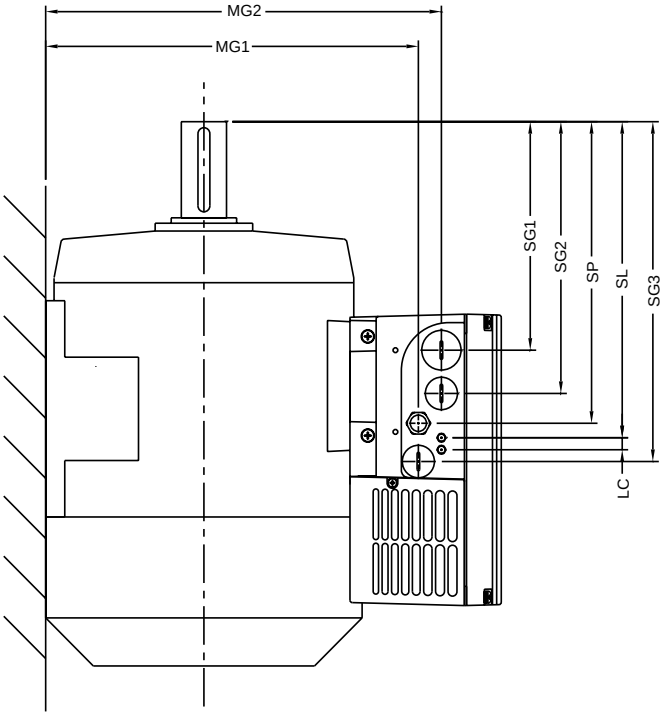
		MOTOR FRAME SIZE				
		56	**63**	**71**	**80**	**90**
DIMENSION	**TH**	230	237	255	278	296
	CG	66	66	66	66	66
	UW	122	122	122	122	122
	TL $_{min}$	205	244	269	303	361
	SF	48	55	46	107	136
	UL	160	160	160	160	160
	MG	199	206	224	247	265
	SG1	76	83	74	135	164
	SG2	108	115	106	167	196
	SP	134	141	132	193	222
	SL	157	164	155	216	245
	SG3	180	187	178	239	268
	LC	10	10	10	10	10

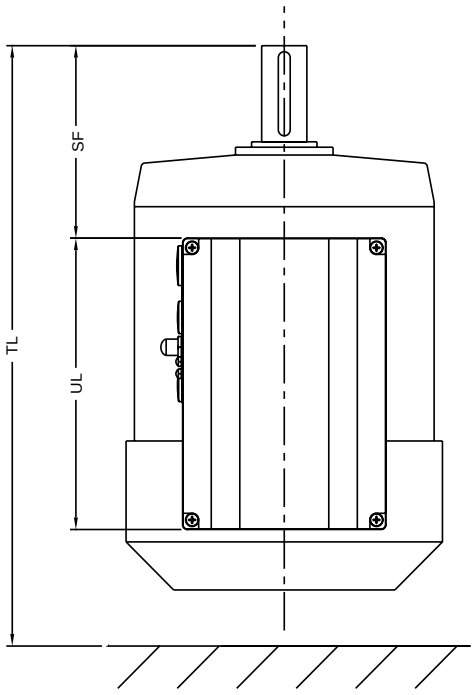


Dimensions in mm

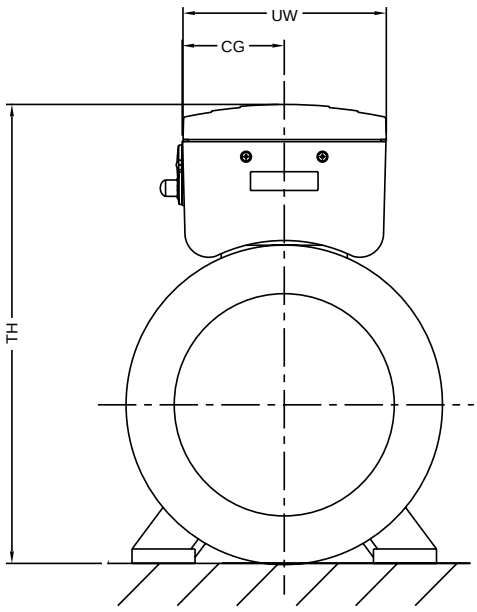
For detailed Motor Dimension drawings, please refer to Siemens Catalogue M11 (ref.: E20002-K1711-A101-A3-7600), Section 8 Dimension Drawings.

COMBIMASTER – Dimensions – Case Size B





		MOTOR FRAME SIZE			
		90	100	112	132
DIMENSION	TH	317	333	357	396
	CG	86	86	86	86
	UW	171	171	171	171
	TL ...	361	424	445	506
	SF	90	139	139	175
	UL	243	243	243	243
	MG1	249	265	289	323
	MG2	269	285	309	348
	SG1	120	169	169	205
	SG2	156	205	205	241
	SP	181	230	230	266
	SL	193	242	242	278
	SG3	213	262	262	298
	LC	10	10	10	10

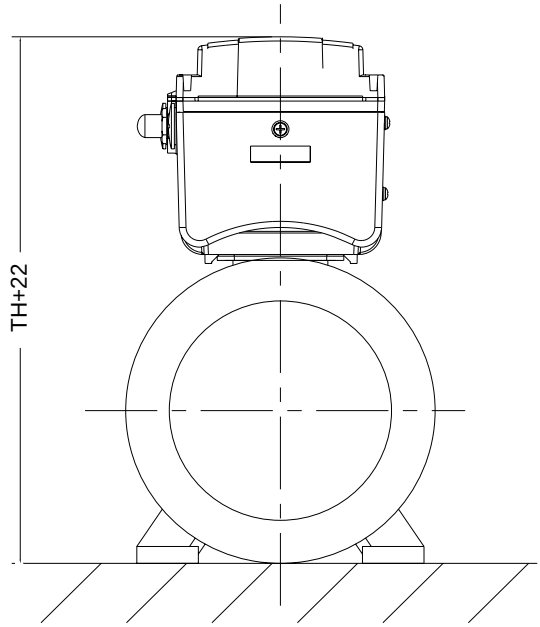


Dimensions in mm

For detailed Motor Dimension drawings, please refer to Siemens Catalogue M11 (ref.: E20002-K1711-A101-A3-7600), Section 8 Dimension Drawings.

COMBIMASTER - Case Size A - Deep Cover

Deep Cover – used for Electromechanical Brake Control Unit & Class B Filter (400V only)
(for Dimension TH for Case Size A , please refer to table on Page 8/9)



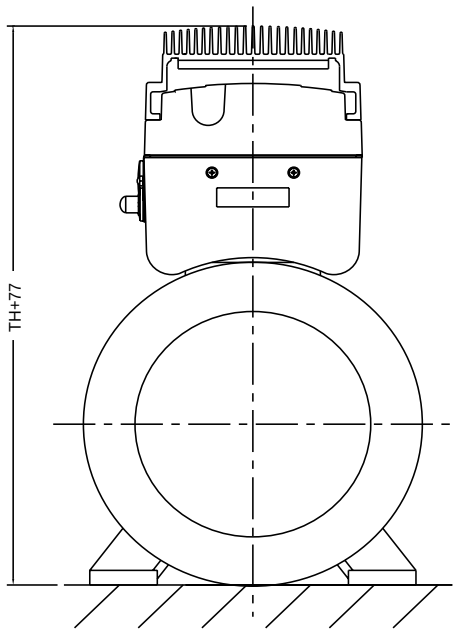
COMBIMASTER - Case Size B – Deep Covers

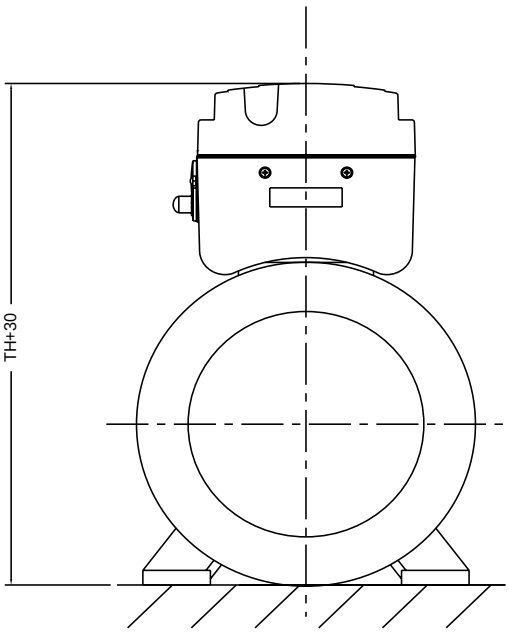
Deeper Covers:

i) Resistor Brake (incl. Heatsink)

ii) Mechanical Brake + Class B Filter (>4.0kW)

(for Dimension TH for Case Size B , please refer to table on Page 8/10)

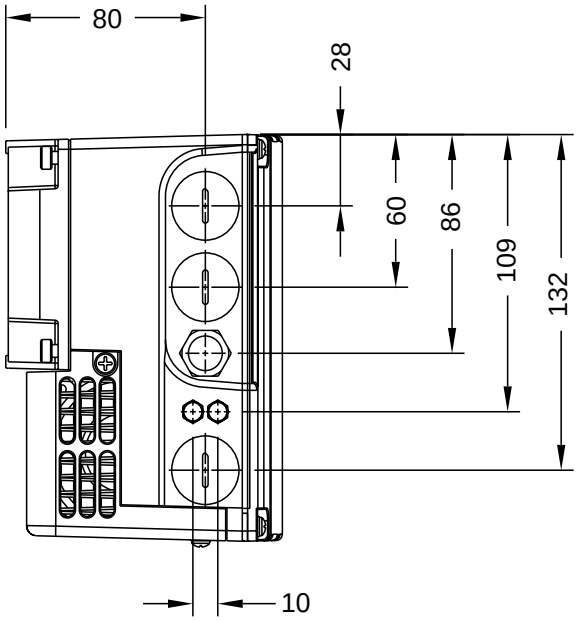


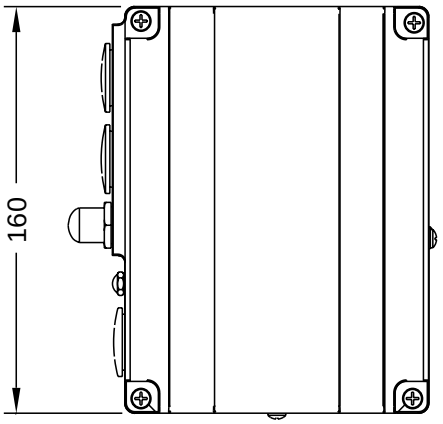


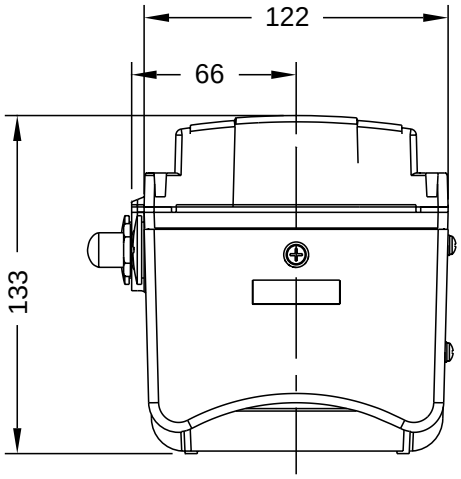
Dimensions in mm.

For detailed Motor Dimension drawings, please refer to Siemens Catalogue M11 (ref.: E20002-K1711-A101-A3-7600), Section 8 Dimension Drawings.

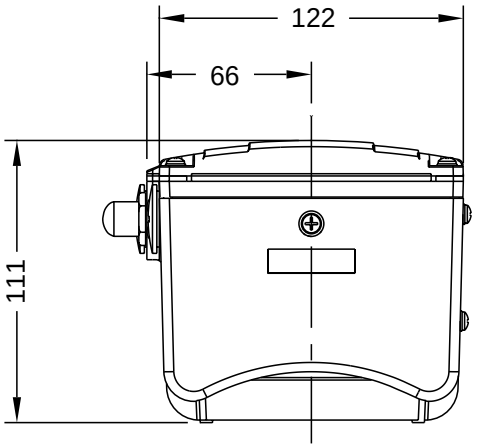
MICROMASTER Integrated - Case Size A







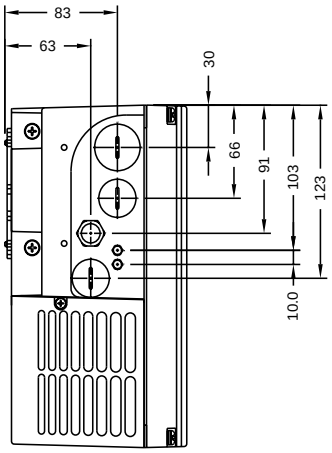
Note : Deep Cover (used for Electromechanical Brake Control unit & Class B Filter – 400V only)

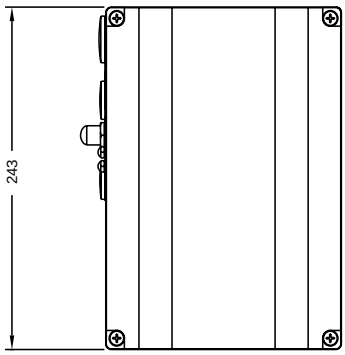


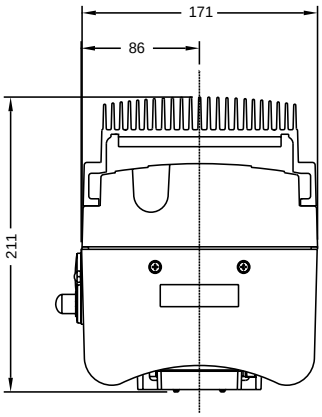
With Normal Cover

Dimensions in mm.

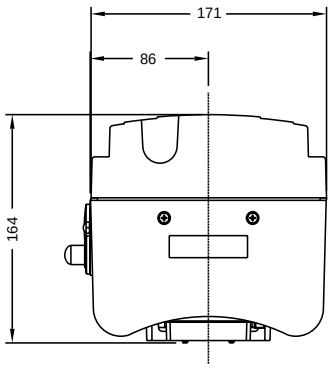
MICROMASTER Integrated - Case Size B



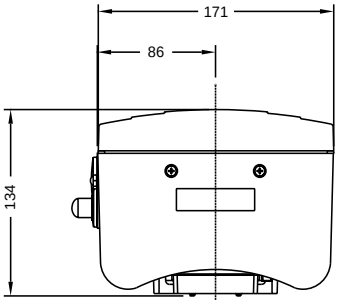




With Pulse Resistor Brake Unit Cover



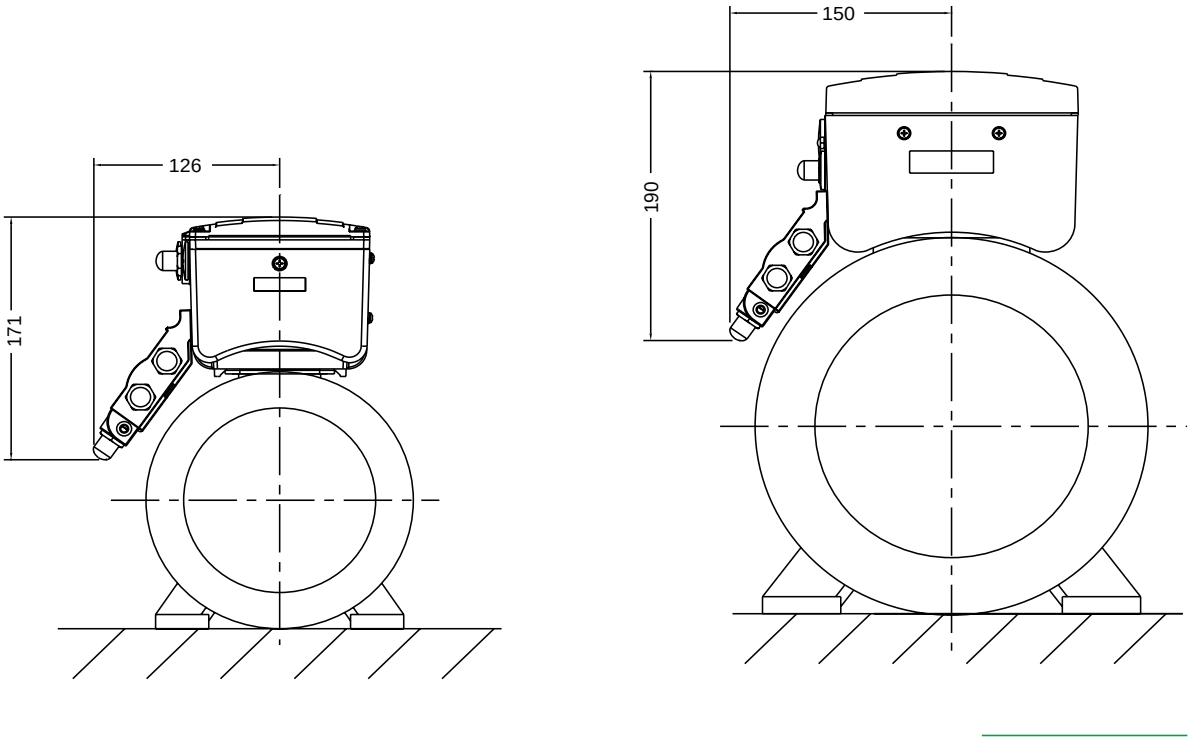
With Electromechanical Brake Unit Cover (also used for : 4kW, 5.5kW & 7.5kW class B filter units).

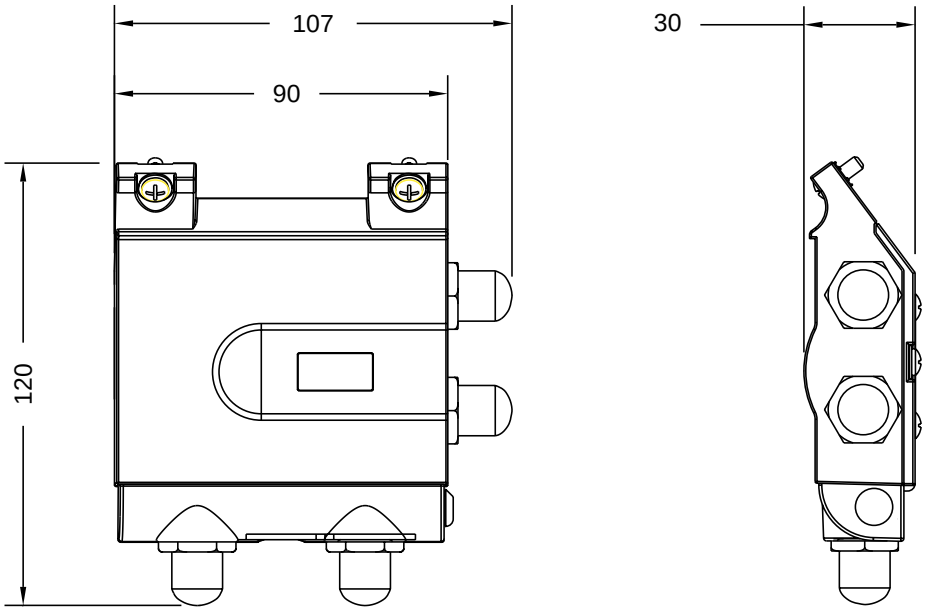


With Normal Cover

Dimensions in mm.

COMBIMASTER Option – Profibus Module CB155





8.4.2 Electrical Installation

Remove the four M5 cross-head screws on the inverter's cover to access the electrical terminals.

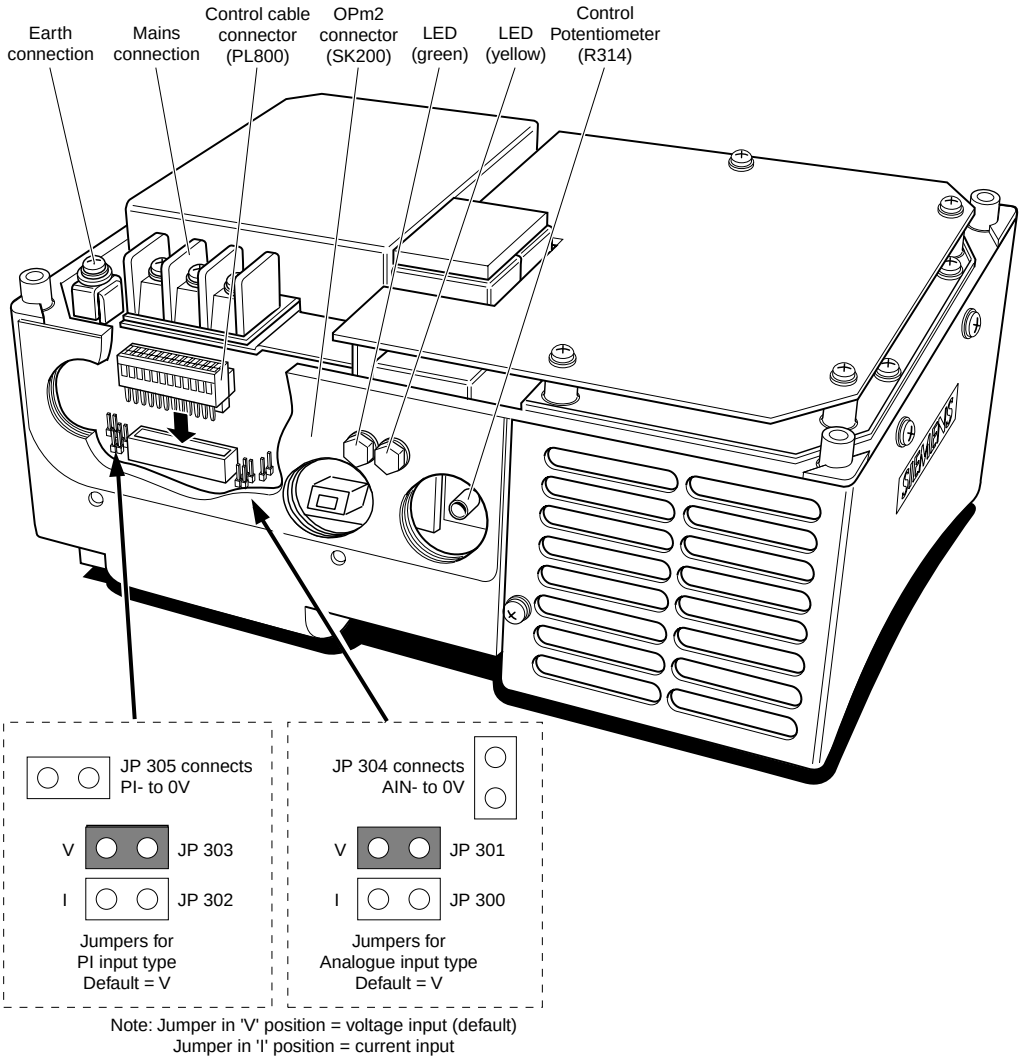
Notes:

(1) Refer to the Data table in section 8.7 for cable sizes.

(2) We recommend introducing a `drip loop' when connecting the mains and control cables (see *Figure 7*).

Caution

The printed circuit boards contain CMOS components that are particularly sensitive to static electricity. For this reason, avoid touching the boards or components with your hands or metal objects.



IMPORTANT

Ensure that the following tightening torques are used:

Access cover retaining screws:	4.0Nm
PG connection:	1.0Nm
Electrical terminal screws:	1.0Nm

Check that the supply voltage is correct for the COMBIMASTER used (see section 7) by referring to the rating label

Figure 1: Electrical Connection Diagram - Case Size B, Issue A

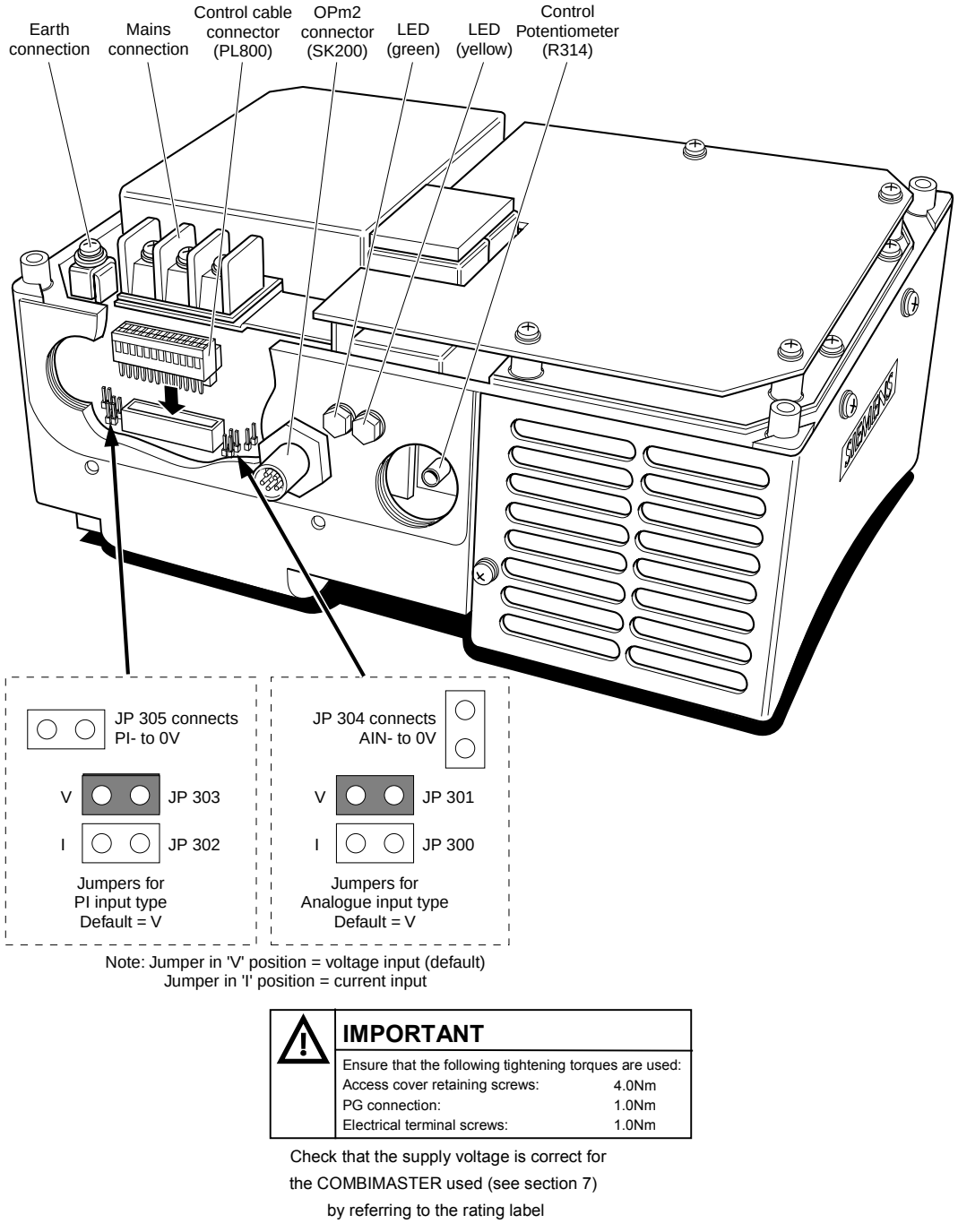
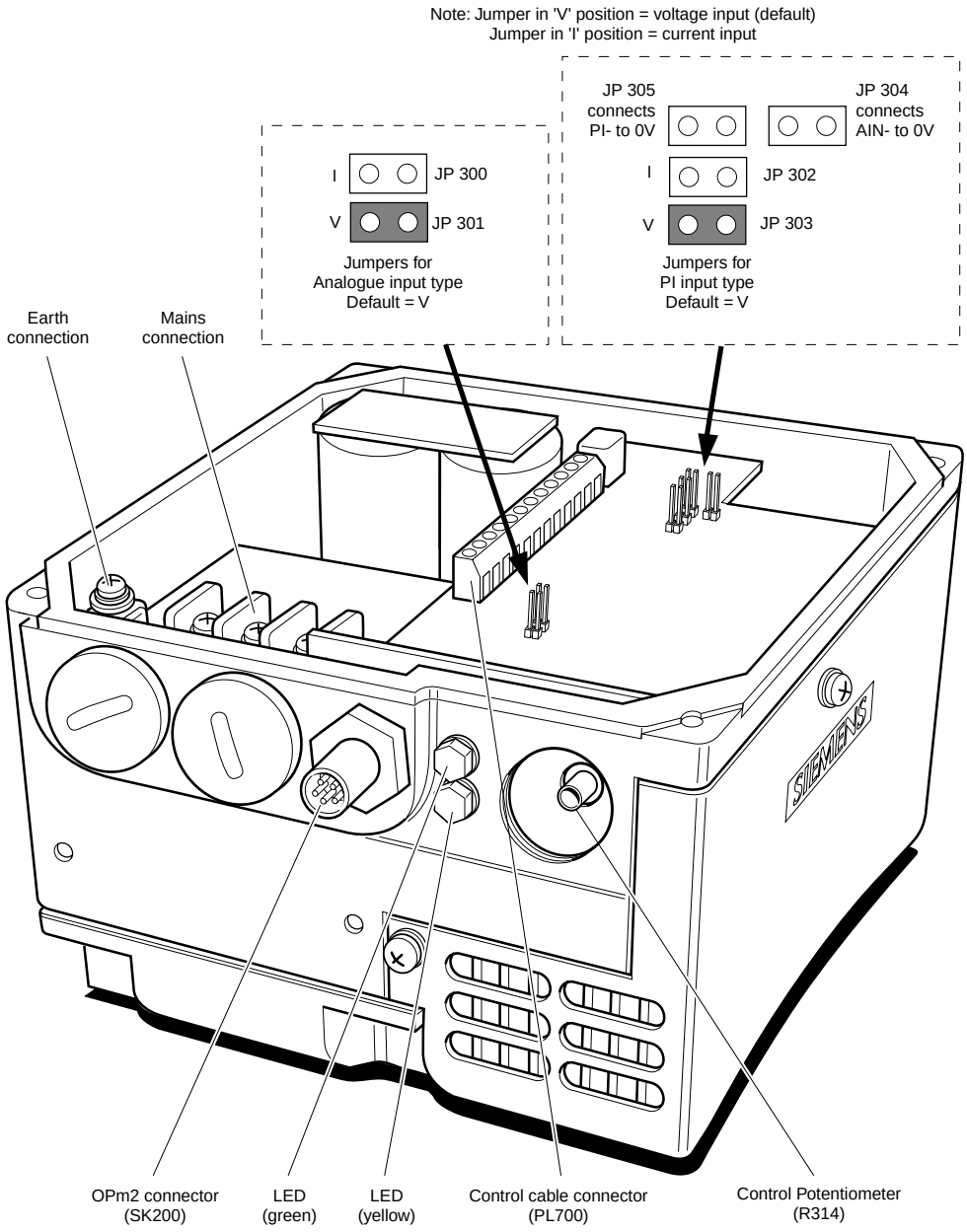


Figure 2: Electrical Connection Diagram - Case Size B, Issue B



IMPORTANT

Ensure that the following tightening torques are used:

Electrical terminal screws:	1.0Nm
Access cover retaining screws:	4.0Nm
PG connection:	1.0Nm
Control connection PL700 screws:	0.5Nm
Earth connection:	1.5Nm

Check that the supply voltage is correct for the COMBIMASTER used (see section 7) by referring to the rating label

Figure 3: Electrical Connection Diagram - Case Size A

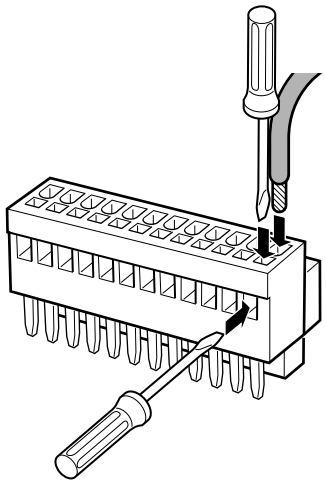


Figure 4 Operation of Screw-less Connectors for PL800 on Case Size B

8.4.2.1 Mains Cable Connections

Ensure that the power source supplies the correct voltage and is designed for the necessary current. Ensure that the appropriate circuit-breakers with the specified current rating are connected between the power supply and COMBIMASTER (see section 8.7).

Use Class 1 60/75^{o}C copper wire only.

Feed the control cable into the inverter via the appropriate gland hole (see Figure 1 to Figure 3).

Use a screened cable *(*for cross-section of each core see section 8.7).

Feed the power cable into the inverter via the appropriate gland hole (see Figure 1 to Figure 3). Connect the power leads to terminals L1, L2, L3 and the separate earth.

Use a 4 - 5 mm cross-tip screwdriver to tighten the terminal screws.

8.4.2.2 Control Cable Connections

	**CAUTION** The control and power supply cables must be laid separately. They must not be fed through the same cable conduit/trunking.

Use screened cable for the control lead.

Case Size A

Connect the control wires to PL700 in accordance with the information given in Figure 6. Use a 1.8mm blade screwdriver to tighten the screw terminals.

Case Size B

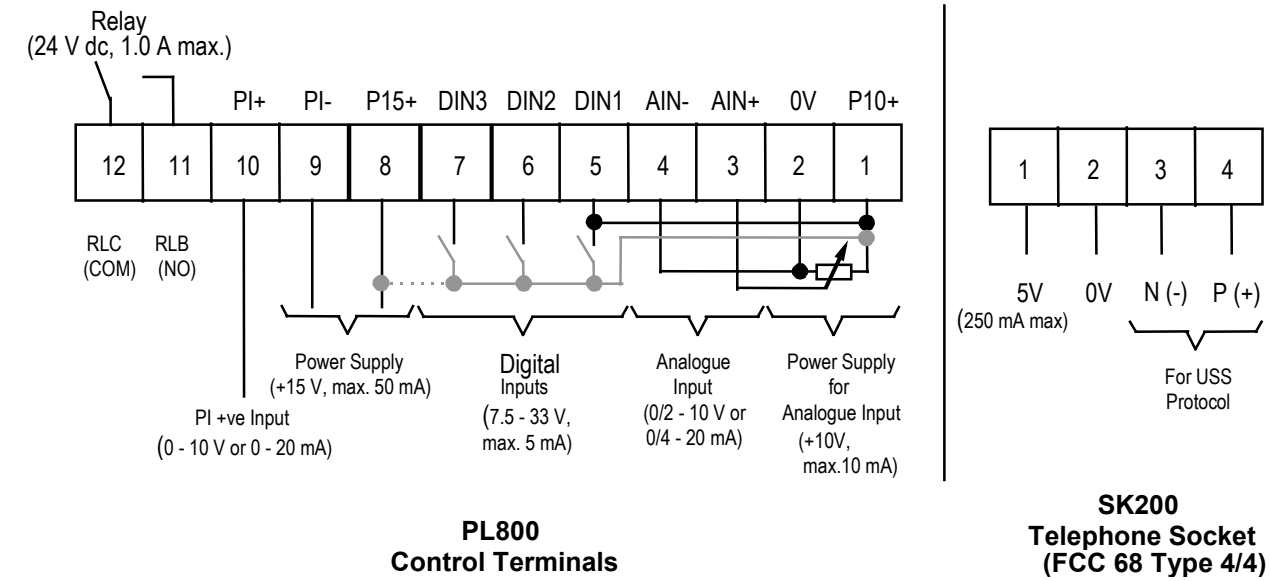
Unplug connector block PL800 from the PCB and connect the control wires in accordance with the information given in Figure 5 or Figure 6. Use a 1.8mm blade screwdriver to open the screw-less terminals *(*also see Figure 4): Plug the connector block back into the PCB.

Case Size A and B

Refit the cover and tighten the four securing screws.

Note:
*A wire link **must** be fitted between control terminals 5 (DIN1) and 1 (P10+) otherwise the COMBIMASTER will not operate when control potentiometer R314 is used. The wire link must be removed when operation via a run/stop switch is required. This link is factory fitted.*

Optionally, terminal 8 (+15V) may be used instead of terminal 1 - also for the digital inputs.



PL800
Control Terminals

SK200
Telephone Socket
(FCC 68 Type 4/4)

Figure 5: Control Terminal Connections - Case Size B, Issue A

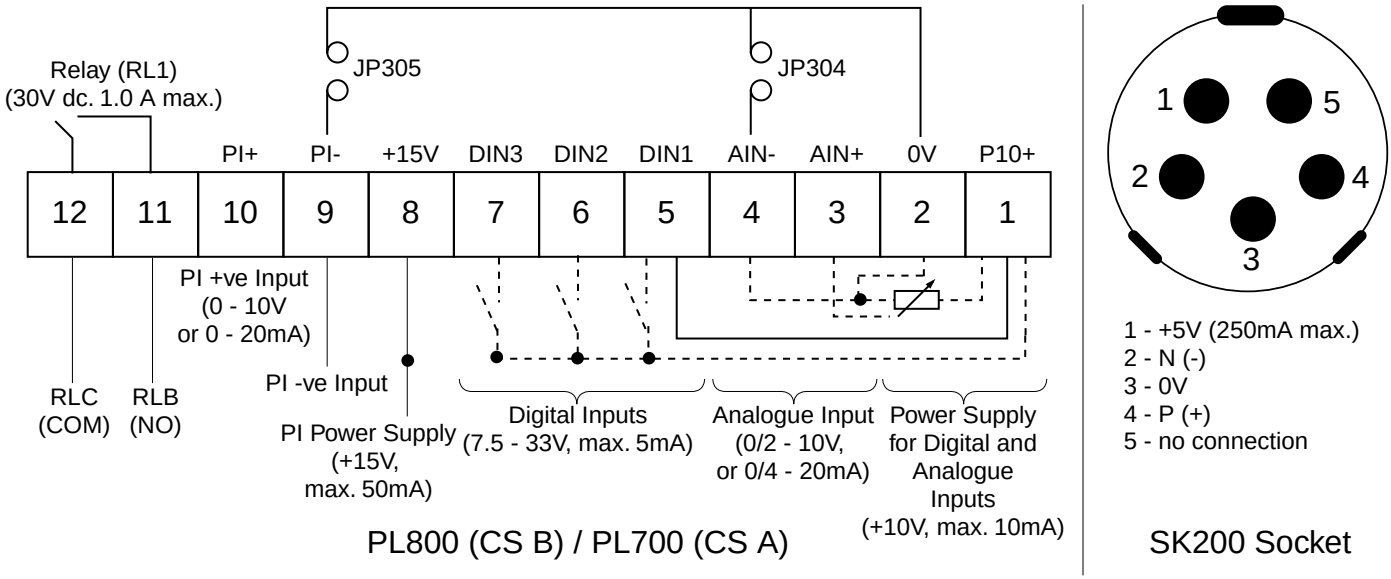


Figure 6: Control Terminal Connections - Case Size A and Case Size B, Issue B

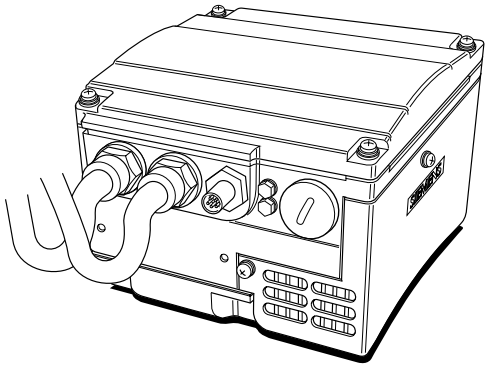


Figure 7 Cable Connections with Drip Loop (Case Size A illustrated)

Block Diagram

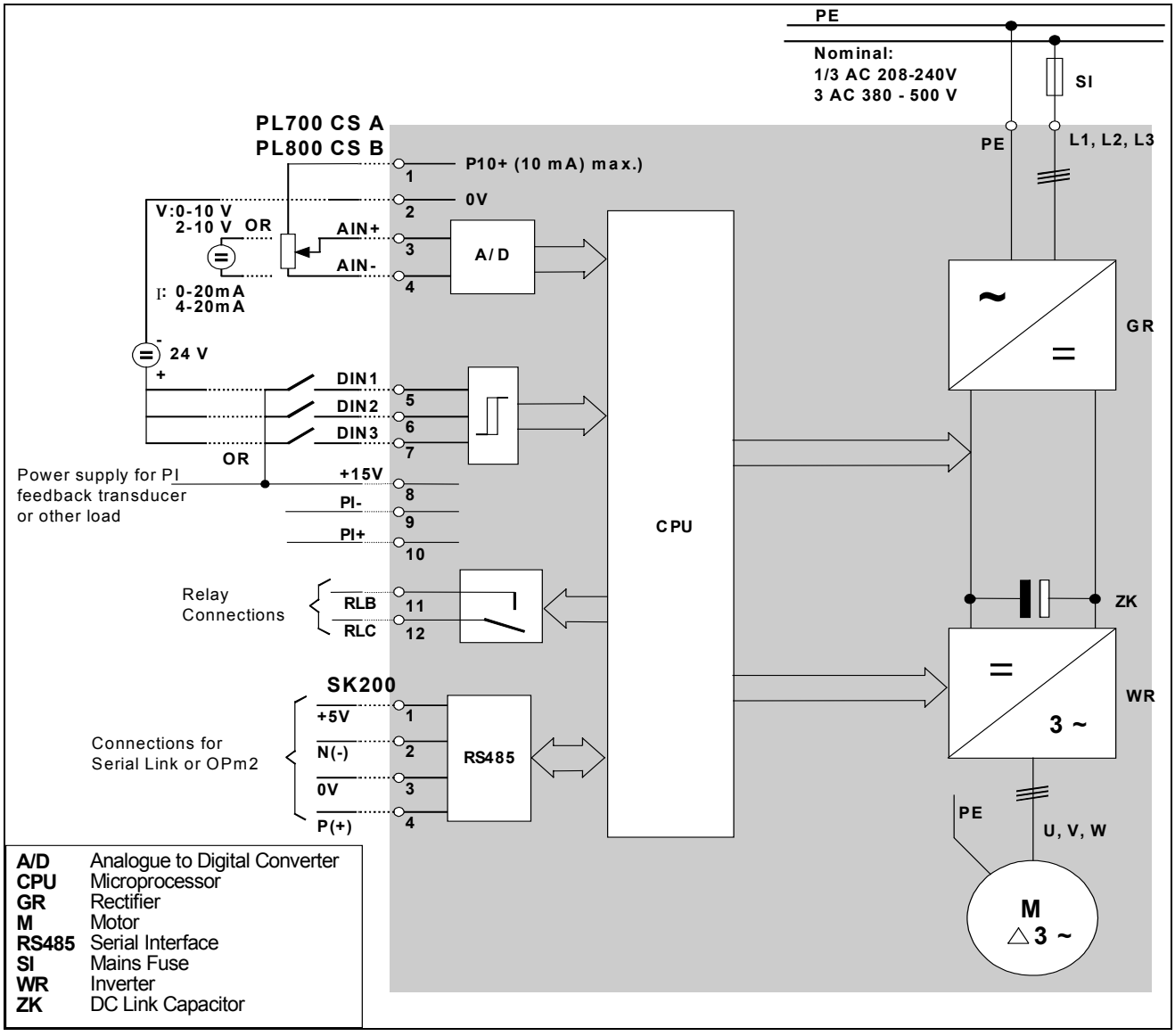
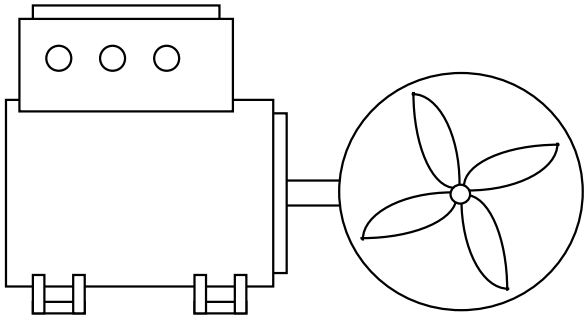


Figure 8 Block Diagram

8.5 COMBIMASTER Standard Applications

8.5.1 COMBIMASTER Fan Application

In this application, a ventilation fan is driven by a COMBIMASTER unit.

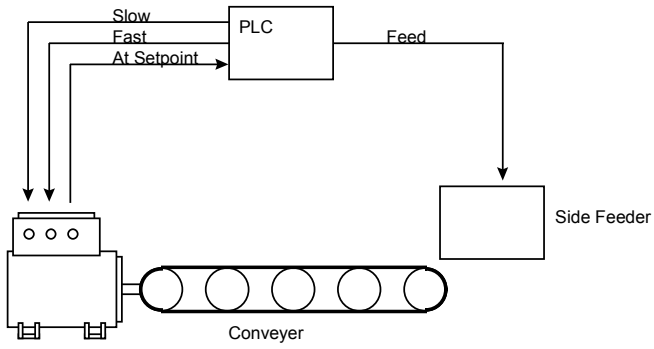


The application requires the fan speed to be adjusted to minimise the power consumption of the fan. Once the speed has been set, an external switch is used to start and stop the fan.

This application can be realised without the need to change any of the COMBIMASTER parameters:

The switch is wired into digital input 1 (DIN 1). Power is applied to the COMBIMASTER, the switch is set from stop to start, and the built in potentiometer is adjusted until the fan is running at the required speed. Once the speed is set, the switch can be used to start and stop the fan.

8.5.2 Two-speed Conveyor Belt



A conveyer belt is required to operate at two speeds. One speed is required for transporting product, and a slower speed is needed while the product is placed onto the conveyer belt from a side feed mechanism.

The whole system is controlled by a PLC. The PLC controls the COMBIMASTER from 2 digital signals and also needs to know when the belt has reached the slow speed, so that it can instruct the side feed mechanism to place the product onto the conveyor belt.

The two speeds are 10Hz for the slow speed, and 45Hz for the fast speed.

Note that before setting parameters higher than P009, it is necessary to set P009 to 2 or 3.

This application is simply realised using the COMBIMASTER parameter set. An OPm2 clear text display is used for setting the parameters as follows.

P006 = 2 - Fixed Frequency setpoint

P053 = 18 - DIN 3 selects Fixed Frequency 1 with run

P052 = 18 - DIN 2 selects Fixed Frequency 2 with run

P041 = 10.0 - Slow setpoint

P042 = 45.0 - Fast setpoint

P012 = 10.0 Minimum speed = 10Hz (this is needed for the slow setpoint relay output).

P061 = 5 - Relay indicates inverter speed less than or equal to minimum frequency (P012)

The PLC can now select the slow speed with DIN 3, the fast speed with DIN 2. If neither speed is selected, the motor will stop.

When the motor is at or below the slow speed (minimum frequency) this will be indicated by the relay, allowing the side feeder to be activated by the PLC.

8.5.3 PI Application

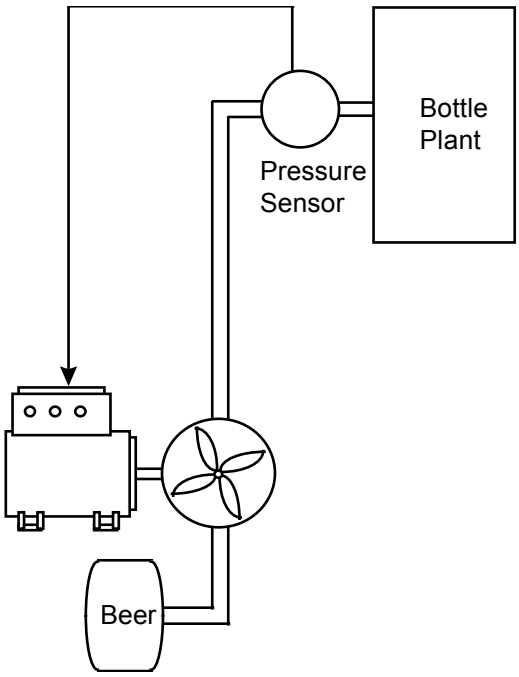
Notes on using PI Control

When using PI control, the concept of having a setpoint in Hz is meaningless. What is needed is a setpoint in terms of the process being controlled (pressure, temperature, speed etc.).

The COMBIMASTER works around this problem, by using percentage setpoints. This allows the PI system to cope with any process for which a suitable actual value processor can be connected. When PI is enabled, (P201 = 2), all setpoint sources are interpreted as percent. i.e. a setpoint of 50.0 now means 50%, not 50hz.

This can be clarified by the following example.

8.5.4 Brewery Bottling Plant



In this application, a bottling plant at a brewery needs to have a regulated pressure of 4 bar in the liquid that feeds the machine. The COMBIMASTER is driving a pump which pumps the liquid from the cellar, and regulates the pressure at the machine using the built in PI control function of COMBIMASTER.

The actual value processor requires a 15V 30mA supply, and provides a proportional 20mA signal where 20mA represents 5 bar, and 0mA represents 0 bar. In this case, a setpoint of 0(%) means 0 Bar, and a setpoint of 100(%) means 5 Bar. I.E. The setpoints match the 0 to 20mA range of the sensor. Therefore, to achieve a pressure of 4 Bar, a setpoint of 80% should be used.

The COMBIMASTER can both power the actual value processor, and directly interface to the 20mA feedback signal using the integrated PI interface.

A Digital setpoint is used, since the pressure is always required to be fixed at 4 Bar (80%)

Parameters:

Note that before setting parameters higher than P009, it is necessary to set P009 to 2 or 3.

P006 = 0 - Digital Setpoint

P005 = 80 - Setpoint of 80%

P201 = 2 - Use PI Control

Set other parameters as necessary for the application, i.e. for digital start/stop or keypad (OPM2) start/stop the COMBIMASTER.

Setting the PI Gains

When setting the PI gains, the following should be remembered. Higher gain will result in faster and more accurate control, but will also result in less stable operation and potential oscillation.

When setting the P gain, switch on the COMBIMASTER, and increase P202 (P gain) until the system just starts to become unstable, then reduce P202 by about 5%. The COMBIMASTER will now be controlling the pressure as accurately as possible using only proportional control - there is always some error if the I gain (P203) is 0. This error can be determined by looking at P210. This shows the actual value in %. Subtracting this from the setpoint, gives the error in %.

If the error with Proportional gain only is too large, then it will be necessary to use Integral gain (P203). When using P203, it is normally also necessary to use P207 (Integral Capture range) to reduce instability, particularly with slow response systems. The integral capture range sets the I term to zero while the error is large. This prevents a large integral error from building up while ramping to setpoint. A good rule of thumb is to set P207 to 1.5 times the error with P gain only. The I gain should be set to the lowest value which provides fast enough error elimination. Even very small values (<0.5) will eliminate the error.

In the example above, with P gain only, the error is 4%. Setting P207 to 7 and P203 to 0.5 eliminates the error.

Ramp Times (PI Application)

The inverter ramp times also have an effect on the reaction time and stability. Short ramp times will reduce stability, but improve system response. Long ramp times will improve stability, but slow system response.

In particular, ramp times should not be set much shorter than the response of the system being controlled. For example, in a heating system where the system can adjust the temperature only slowly, (say 1% per minute), having short ramp times will, in many cases, cause the PI system to oscillate between minimum frequency and maximum frequency.

8.6 COMBIMASTER User Interfaces

8.6.1 Communications, Operator Control and Visualization

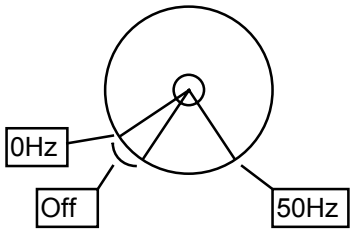
The operator control and visualization of COMBIMASTER, is compatible with the MICROMASTER, MICROMASTER Vector and MIDIMASTER Vector range of standalone inverters.

The frequency inverters can be controlled and parameterised at the inverter itself or externally via the interfaces provided.

1. At the inverter via:
   - The built in potentiometer and signal LEDs
   - The control terminal strip
   - The optional OPM2 clear text display (control and parameterisation)
2. Externally via:
   - The serial RS 485 interface
   - The optional OPM2 clear text display
   - The optional PROFIBUS module
   - A PC with SIMOVIS

8.6.2 Built-in Potentiometer and Signal LEDs

The COMBIMASTER is shipped factory configured, to be controlled via the built in potentiometer. The potentiometer is configured to give a stop command when fully anticlockwise, and to control the speed of the motor in the range of 0 to 50Hz (0 to 3000rpm for a 2 pole motor, and 0 to 1500 rpm for a 4 pole motor) as shown in the diagram below.



Note that if the potentiometer is not set fully anticlockwise when power is applied, it will need to be turned fully anticlockwise before the motor will start. This prevents unexpected motor starting at switch on.

To use the potentiometer to start and stop, it is necessary to fit a wire link into either DIN1 to +15, or DIN2 to +15. This also allows the direction of rotation to be selected. (Link to DIN 1 causes forwards rotation on right. Link to DIN 2 causes reverse rotation on left (10V output from the inverter may be used instead of the 15V.

It is also possible to control the start/stop of the COMBIMASTER from the DIN 1 and DIN 2 signals on the control terminal strip. By default, these represent on right, and on left respectively. This means that the potentiometer can be set to a fixed speed, and the motor can be started and stopped, in either direction, by an external switch.

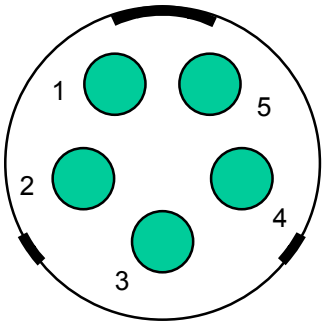
Status information is provided via the two LEDs on the side of the COMBIMASTER. The following table shows the possible status indications.

LED State		COMBIMASTER Status
Green	Yellow	
ON	ON	Mains power on, COMBIMASTER not running (STANDBY)
ON	OFF	COMBIMASTER running, as per control commands (ON)
Flashing	Flashing	Current limit warning
Flashing	ON	COMBIMASTER over temperature
ON	Flashing	Motor over temperature
OFF	ON	Other fault (e.g. tripped)
OFF	Flashing	Mains Under voltage
OFF	OFF	Mains supply fault (e.g. faulty external switch)

By default, it is possible to clear trip conditions using DIN3

8.6.3 Serial RS 485 Interface

The RS 485 interface of the COMBIMASTER operates with the USS protocol, can be networked with 31 nodes through a bus and permits a maximum data transmission rate of 19200 Baud. The RS 485 interface is accessible via a circular IP65 connector (SK200). The figure below gives the pin assignment.



1 - +5V
2 - N (-)
3 - 0V
4 - P (+)
5 - no connection

SK200 Socket

Notes:
Also refer to the documentation: "Using the USS protocol for 6SE21 SIMOVERT drive converters and MICROMASTER":
Order No. E20125-B0001-S302-A1 (German)
Order No. E20125-B0001-S302-A1-7600 (English)

It is not possible to simultaneously connect the PROFIBUS Module and the Clear Text Display to the drive.

8.6.4 Control Terminal Strips

All of the functions required to operate and monitor COMBIMASTER are accessible via control terminal strips.

- Control commands, e.g. on/off, clockwise/counter-clockwise, jog.
- Analogue setpoint input.
- Digital setpoint inputs, e.g. fixed frequency.
- Digital output, e.g. operation, alarm.

The response times of the inputs are as follows:

- Digital input:
  20 ms, depending on the de-bounce time (P056).
- Analogue input:
  approx. 15 ms for step signals (> 0.5 V).
- RS 485 interface (SK200 only, not available on terminal strip):
  approx. 5 - 20 ms.

8.6.5 Clear Text Display (Optional)

The optional Clear Text Display is intended to enhance the ease of use of the COMBIMASTER, and to allow parameterisation, if the factory settings are not suitable for the application. The user is offered a text-driven format for commissioning, parameterising, configuring and operating the inverter. The following features are included:

- Illuminated high resolution LCD screen with adjustable contrast.
- 7 languages.
- Central device for up to 31 inverters which are networked together via USS.
- Up to 10 parameter sets can be stored in non-volatile memory for uploading and downloading.
- Help texts for diagnosing faults.
- RS232 interface for connecting to a PC.

The unit is connected to the drive via a cable and used as a hand-held terminal. A mounting kit is also provided to allow the unit to be fitted to a cabinet door and thus used as a low cost man machine interface.

A 6V power supply may be connected to allow access to the internally stored parameters without connecting the panel to a drive.

The Display is automatically activated when it is connected to a COMBIMASTER or powered up.

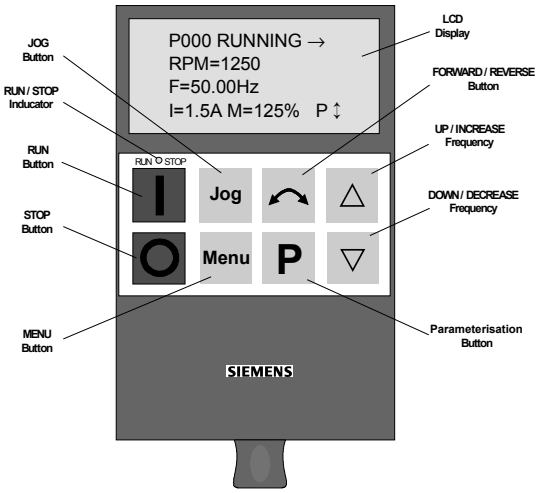


Figure 9 Main Menu Screen

Dimensions H x W x D	130 mm x 73 mm x 40 mm
Current drain at 5 V	200 mA
Degree of protection	IP54

Table 2: Technical Data

All the main functions are accessible from this screen. On power-up, unless configured otherwise, the panel will show the Operating Display. The status LED indicates whether the drive is running.

8.6.6 RS232 Interface

The Clear Text Display is fitted with an RS232 interface to allow the drive to be connected to a PC. Note that an external 9V power supply (unregulated) is required to use this feature.

Section 8.7 gives the ordering information for the OPM2 Clear Text Operator Panel together with all the other options.

8.7 COMBIMASTER Selection and Ordering Data

8.7.1 COMBIMASTER Motor Data Tables

COMBIMASTER			**Motor**						
Type	Inverter Case Size	Input Supply current	Rated Power	Rated speed		Rated Torque		Frame Size	
				2pole	4pole	2pole	4pole	2pole	4pole
		A	W	rpm	rpm	Nm	Nm		
1 AC 208 V – 240 V									
CM12	CS A	1,8	120	2710	1315	0,41	0,88	56	63
CM25	CS A	3,2	250	2725	1325	0,86	1,8	63	71
CM37	CS A	4,6	370	2750	1375	1,3	2,5	71	71
CM55	CS A	6,2	550	2790	1395	1,9	3,7	71	80
CM75	CS A	8,2	750	2850	1395	2,5	5,1	80	80
3 AC 208 V – 240 V									
CM12/2	CS A	1,1	120	2710	1315	0,41	0,88	56	63
CM25/2	CS A	1,9	250	2725	1325	0,86	1,8	63	71
CM37/2	CS A	2,7	370	2750	1375	1,3	2,5	71	71
CM55/2	CS A	3,6	550	2790	1395	1,9	3,7	71	80
CM75/2	CS A	4,7	750	2850	1395	2,5	5,1	80	80
3 AC 380 V – 480 V									
CM37/3	CS A	2,2	370	2750	1375	1,3	2,5	71	71
CM55/3	CS A	2,8	550	2790	1395	1,9	3,7	73	80
CM75/3	CS A	3,7	750	2850	1395	2,5	5,1	80	80
CM110/3	CS A	4,9	1100	2835	1410	3,7	7,5	80	90S
CM150/3	CS A	5,9	1500	2860	1410	5,0	10	90S	90L
CM150/3	CS B†	4.2	1500	2860	1410	5.0	10	90S	90L
CM220/3	CS B	4,7	2200	2850	1420	7,4	15	90L	100L
CM300/3	CS B	6,4	3000	2895	1430	9,8	20	100L	100L
CM400/3	CS B	10,0	4000	2895	1435	13	27	112M	112M
CM550/3	CS B	12,2	5500	2910	1450	18	36	132S	132S
CM750/3	CS B	16,0	7500	2910	1450	25	49	132S	132M
3 AC 460 V – 500 V									
CM37/3	CS A	2,2	370(430)*	2750**	1375**	1,3	2,5	71	71
CM55/3	CS A	2,8	550(630)*	2790**	1395**	1,9	3,7	73	80
CM75/3	CS A	3,7	750(860)*	2850**	1395**	2,5	5,1	80	80
CM110/3	CS A	4,9	1100(1300)*	2835**	1410**	3,7	7,5	80	90S
CM150/3	CS A	5,9	1500(1750)*	2860**	1410**	5,0	10	90S	90L
CM150/3	CS B†	3.5	1500 (1750)*	2860**	1410**	5.0	10	90S	90L
CM220/3	CS B	4,7	2200(2550)*	2850**	1420**	7,4	15	90L	100L
CM300/3	CS B	6,4	3000(3450)*	2895**	1430**	9,8	20	100L	100L
CM400/3	CS B	10,0	4000(4600)*	2895**	1435**	13	27	112M	112M
CM550/3	CS B	12,2	5500(6300)*	2910**	1450**	18	36	132S	132S
CM750/3	CS B	16,0	7500(8600)*	2910**	1450**	25	49	132S	132M

† - Available for existing applications, for new applications, use the COMBIMASTER with CS A inverter.

* - Figures in brackets show power for motor operation at 60Hz/460V.

** - Speed shown is for 50Hz motor frequency. Speed is approximately 20% higher at 60Hz.

8.7.2 COMBIMASTER Cable and Fuse Selection Tables

COMBIMASTER				**Recommended mains cable cross-section**	**Recommended fuse (duty class gG/gL)**	
Type	Inverter Case Size	Rated power	Input supply current		Rated current	
		W	A	mm²	A	Order No
1 AC 208 V – 240 V						
CM12	CS A	120	1.8	1.0	10	3NA3803
CM25	CS A	250	3.2	1.0	10	3NA3803
CM37	CS A	370	4.6	1.0	10	3NA3803
CM55	CS A	550	6.2	1.0	10	3NA3803
CM75	CS A	750	8.2	1.5	16	3NA3805
3 AC 208 V – 240 V						
CM12/2	CS A	120	1.1	1.0	10	3NA3803
CM25/2	CS A	250	1.9	1.0	10	3NA3803
CM37/2	CS A	370	2.7	1.0	10	3NA3803
CM55/2	CS A	550	3.6	1.0	10	3NA3803
CM75/2	CS A	750	4.7	1.0	10	3NA3803
3 AC 380 V – 480 V						
CM37/3	CS A	370	2.2	1.0	10	3NA3803
CM55/3	CS A	550	2.8	1.0	10	3NA3803
CM75/3	CS A	750	3.7	1.0	10	3NA3803
CM110/3	CS A	1100	4.9	1.0	10	3NA3803
CM150/3	CS A	1500	5.9	1.0	10	3NA3803
CM150/3	CS B†	1500	4.2	1.0	10	3NA3803
CM220/3	CS B	2200	4.7	1.0	10	3NA3803
CM300/3	CS B	3000	6.4	1.5	16	3NA3805
CM400/3	CS B	4000	10.0	1.5	16	3NA3805
CM550/3	CS B	5500	12.2	2.5	20	3NA3807
CM750/3	CS B	7500	16.0	2.5	20	3NA3807
3 AC 460 V – 500 V						
CM37/3	CS A	370	2.2	1.0	10	3NA3803
CM55/3	CS A	550	2.8	1.0	10	3NA3803
CM75/3	CS A	750	3.7	1.0	10	3NA3803
CM110/3	CS A	1100	4.9	1.0	10	3NA3803
CM150/3	CS A	1500	5.9	1.0	10	3NA3803
CM150/3	CS B†	1500	4.2	1.0	10	3NA3803
CM220/3	CS B	2200	4.7	1.0	10	3NA3803
CM300/3	CS B	3000	6.4	1.5	16	3NA3805
CM400/3	CS B	4000	10.0	1.5	16	3NA3805
CM550/3	CS B	5500	12.2	2.5	20	3NA3807
CM750/3	CS B	7500	16.0	2.5	20	3NA3807

† - Available for existing applications, for new applications, use the COMBIMASTER with CS A inverter.

8.7.3 Order Numbers

COMBIMASTER							
		unfiltered		Class A filter		Class B filter	
Type	Inverter Case Size	Motor 2 pole Order No.	Motor 4 pole Order No.	Motor 2 pole Order No.	Motor 4 pole Order No.	Motor 2 pole Order No.	Motor 4 pole Order No.
1 AC 208 V - 240V							
CM12	CS A	**1UA7053-2BU0•**	**1UA7060-4BU0•**	**1UA7053-2BA0•**	**1UA7060-4BA0•**	**1UA7053-2BB0•**	**1UA7060-4BB0•**
CM25	CS A	**1UA7063-2BU0•**	**1UA7070-4BU0•**	**1UA7063-2BA0•**	**1UA7070-4BA0•**	**1UA7063-2BB0•**	**1UA7070-4BB0•**
CM37	CS A	**1UA7070-2BU0•**	**1UA7073-4BU0•**	**1UA7070-2BA0•**	**1UA7073-4BA0•**	**1UA7070-2BB0•**	**1UA7073-4BB0•**
CM55	CS A	**1UA7073-2BU0•**	**1UA7080-4BU0•**	**1UA7073-2BA0•**	**1UA7080-4BA0•**	**1UA7073-2BB0•**	**1UA7080-4BB0•**
CM75	CS A	**1UA7080-2BU0•**	**1UA7083-4BU0•**	**1UA7080-2BA0•**	**1UA7083-4BA0•**	**1UA7080-2BB0•**	**1UA7083-4BB0•**
3 AC 208 V – 240 V							
CM12/2	CS A	**1UA7053-2BU1•**	**1UA7060-4BU1•**	-	-	-	-
CM25/2	CS A	**1UA7063-2BU1•**	**1UA7070-4BU1•**	-	-	-	-
CM37/2	CS A	**1UA7070-2BU1•**	**1UA7073-4BU1•**	-	-	-	-
CM55/2	CS A	**1UA7073-2BU1•**	**1UA7080-4BU1•**	-	-	-	-
CM75/2	CS A	**1UA7080-2BU1•**	**1UA7083-4BU1•**	-	-	-	-
3 AC 380 V - 480 V							
CM37/3	CS A	**1UA7070-2BU2•**	**1UA7073-4BU2•**	**1UA7070-2BA2•**	**1UA7073-4BA2•**	#	#
CM55/3	CS A	**1UA7073-2BU2•**	**1UA7080-4BU2•**	**1UA7073-2BA2•**	**1UA7080-4BA2•**	#	#
CM75/3	CS A	**1UA7080-2BU2•**	**1UA7083-4BU2•**	**1UA7080-2BA2•**	**1UA7083-4BA2•**	#	#
CM110/3	CS A	**1UA7083-2BU2•**	**1UA7090-4BU2•**	**1UA7083-2BA2•**	**1UA7090-4BA2•**	#	#
CM150/3	CS A	**1UA7090-2CU2•**	**1UA7096-4CU2•**	**1UA7090-2CA2•**	**1UA7096-4CA2•**	#	#
CM150/3†	CS B	**1UA7090-2BU2•**	**1UA7096-4BU2•**	**1UA7090-2BA2•**	**1UA7096-4BA2•**	**1UA7090-2BB2•**	**1UA7096-4BB2•**
CM220/3	CS B	**1UA7096-2BU2•**	**1UA7106-4BU2•**	**1UA7096-2BA2•**	**1UA7106-4BA2•**	**1UA7096-2BB2•**	**1UA7106-4BB2•**
CM300/3	CS B	**1UA7106-2BU2•**	**1UA7107-4BU2•**	**1UA7106-2BA2•**	**1UA7107-4BA2•**	**1UA7106-2BB2•**	**1UA7107-4BB2•**
CM400/3	CS B	**1UA7113-2BU2•**	**1UA7113-4BU2•**	**1UA7113-2BA2•**	**1UA7113-4BA2•**	**1UA7113-2BB2•**	**1UA7113-4BB2•**
CM550/3	CS B	**1UA7130-2BU2•**	**1UA7130-4BU2•**	**1UA7130-2BA2•**	**1UA7130-4BA2•**	**1UA7130-2BB2•**	**1UA7130-4BB2•**
CM750/3	CS B	**1UA7131-2BU2•**	**1UA7133-4BU2•**	**1UA7131-2BA2•**	**1UA7133-4BA2•**	**1UA7131-2BB2•**	**1UA7133-4BB2•**
3 AC 460 V – 500 V							
CM37/3	CS A	**1UA7070-2BU3•**	**1UA7073-4BU3•**	-	-	-	-
CM55/3	CS A	**1UA7073-2BU3•**	**1UA7080-4BU3•**	-	-	-	-
CM75/3	CS A	**1UA7080-2BU3•**	**1UA7083-4BU3•**	-	-	-	-
CM110/3	CS A	**1UA7083-2BU3•**	**1UA7090-4BU3•**	-	-	-	-
CM150/3	CS A	**1UA7090-2CU3•**	**1UA7096-4CU3•**	-	-	-	-
CM150/3†	CS B	**1UA7090-2BU3•**	**1UA7096-4BU3•**	-	-	-	-
CM220/3	CS B	**1UA7096-2BU3•**	**1UA7106-4BU3•**	-	-	-	-
CM300/3	CS B	**1UA7106-2BU3•**	**1UA7107-4BU3•**	-	-	-	-
CM400/3	CS B	**1UA7113-2BU3•**	**1UA7113-4BU3•**	-	-	-	-
CM550/3	CS B	**1UA7130-2BU3•**	**1UA7130-4BU3•**	-	-	-	-
CM750/3	CS B	**1UA7131-2BU3•**	**1UA7133-4BU3•**	-	-	-	-

† Available for existing applications, for new applications, use the 1.5kW COMBIMASTER with CS A inverter.

Position 12 (shown as •) is used for the construction type from the Siemens M11 catalogue.

Case size A, 3 Phase, 400V: Class B filters - available from 2nd Quarter 99.

8.7.4 Option Order Numbers for COMBIMASTER and MICROMASTER Integrated

CB155 PROFIBUS with T connector and Terminator

Resistor Braking Unit (CS B only)

Mechanical Brake Control (CS B unit shown)

The following options can be ordered separately, or can be added to the COMBIMASTER Order Number using the option short code, if one exists.

All the options can be customer fitted if required.

Option	Short Code	Order Number
Fan assembly for CS B	**M41**	**6SE9996-0XA02**
Resistor Braking unit for CS B	**-**	**6SE9996-0XA11**
Mechanical brake control for CS B	**-**	**6SE9996-0XA10**
Fan assembly for CS A	**M41**	**6SE9996-0XA01**
Electro-Mechanical brake control for CS A (Available August 1999)	**-**	**6SE9996-0XA07**
PROFIBUS module CB155 (for CS B issue A units only)	**-**	**6SE9996-0XA20**
PROFIBUS module CB155 (for CS A units, and CS B issue B units)	**-**	**6SE9996-0XA18**
PROFIBUS T Connector	**-**	**6SE9996-0XA21**
PROFIBUS Terminator	**-**	**6SE9996-0XA22**
PROFIBUS Cable 1m	**-**	**6SE9996-0XA23**
PROFIBUS Cable 5m	**-**	**6SE9996-0XA24**
PROFIBUS Cable 10m	**-**	**6SE9996-0XA25**
PROFIBUS cable link	**-**	**6SE9996-0XA26**
OPM2 (Clear text display)	**-**	**6SE3290-0XX87-8BF0**
Cable for OPM2 (unscreened for CS B issue A units only)	**-**	**6SE9090-0XX87-8SK0**
Cable for OPM2 (screened for CS A units, and CS B issue B units)	**-**	**6SE9996-0XA31**
SIMOVIS Standalone Version	**-**	**6SE3290-0XX87-8SA0**
Reference Manual (English)	**-**	**6SE9996-0XA35**
Operating instructions (English)	**-**	**6SE9996-0XA36**

Notes: Short Codes applicable to 1UA7- Order numbers

Options from the M11 Motor Catalogue (LV Induction Motors)

It is also possible to use the options from the M11 Motor Catalogue with the COMBIMASTER. In order to do this, use the option short code from the M11, and add it to the end of the COMBIMASTER base Order Number, preceded by the letters -Z=. See the M11 catalogue for details of which options are available.

Position 12 of the COMBIMASTER Order Number is used to select flange options and type of construction.

Values for position 12 of the Order Number (Construction Type)

0 - IMB3
1 - IMB5
1 - IMV1 (without canopy)
2 - IMB14 (with small flange)
3 - IMB14 (with large flange)
4 - IMV1 (with canopy)
6 – IM B 35

Note:
The fan assembly is NOT required if the inverter is used with a SIEMENS 1LA5 or 1LA7 2 or 4 pole motor with the modified fan cover to allow inverter cooling from the motor fan.

8.8 COMBIMASTER Options

8.8.1 Clear Text Display

The optional Clear Text Display is intended to enhance the ease of use of the COMBIMASTER. For a detailed description, please refer to section 5.

8.8.2 PROFIBUS CB155

This option allows the COMBIMASTER to be controlled via a PROFIBUS-DP serial bus (SINEC L2-DP).

Features:

- Permits fast cyclic communications via a PROFIBUS connection.
- Supports all PROFIBUS baud rates up to 12MBd.
- Control of up to 125 inverters using PROFIBUS-DP protocol (with repeaters).
- Conforms with the relevant parts of DIN 19245 and EN50170, guaranteeing open communications on a serial bus system. It can be used with other PROFIBUS-DP/SINEC L2-DP peripheral devices on the serial bus. Data format conforms to the VDI/VDE directive 3689 “PROFIBUS Profile for Variable Speed Drives”.
- Can be easily configured using Siemens COM ET 200, COM ET Windows or S7 Manager software.
- Simple integration into a SIMATIC S5 or S7 PLC system using specially designed functional blocks (S5) and software modules (S7).
- Simply fits to the side of the COMBIMASTER inverter using two screws.
- No separate power supply necessary.
- Digital and analogue inputs can be read and the digital output controlled via the serial bus.
- Approx. 5 ms response time to process data.
- Output frequency (and therefore motor speed) can be controlled locally on the drive or over the serial bus.
- Multi-mode operation possible, whereby control data can be input via the terminal block (digital inputs) and setpoint over the serial bus. Alternatively, the setpoint can be from a local source (analogue input) with the drive control over the serial bus.
- All drive parameters are accessible over the serial link.

The PROFIBUS module fits to the side of the COMBIMASTER using two screws.

COMBIMASTER PROFIBUS Accessories

- The following PROFIBUS accessories are available for COMBIMASTER. All are rated IP65 minimum.
- CM PROFIBUS T Connector - This fits to the PROFIBUS module, and allows in/out PROFIBUS cables to be connected. It also contains the necessary terminating network for 12 Mbaud operation. It is fitted with two female circular connectors, and the cable to the CB155.
- CM PROFIBUS Terminator - This houses the resistive terminating devices required at each end of a PROFIBUS link. It can be fitted to the last COMBIMASTER T piece in the link.
- CM PROFIBUS Cable 1m - 1 metre PROFIBUS cable fitted with two male circular connectors.
- CM PROFIBUS Cable 5m - 5 metre PROFIBUS cable fitted with two male circular connectors.
- CM PROFIBUS Cable 10m - 10 metre PROFIBUS cable fitted with two male circular connectors.
- CM PROFIBUS cable link (10cm) - 10cm of PROFIBUS cable fitted with 2 female circular connectors, for connecting two lengths of cable.

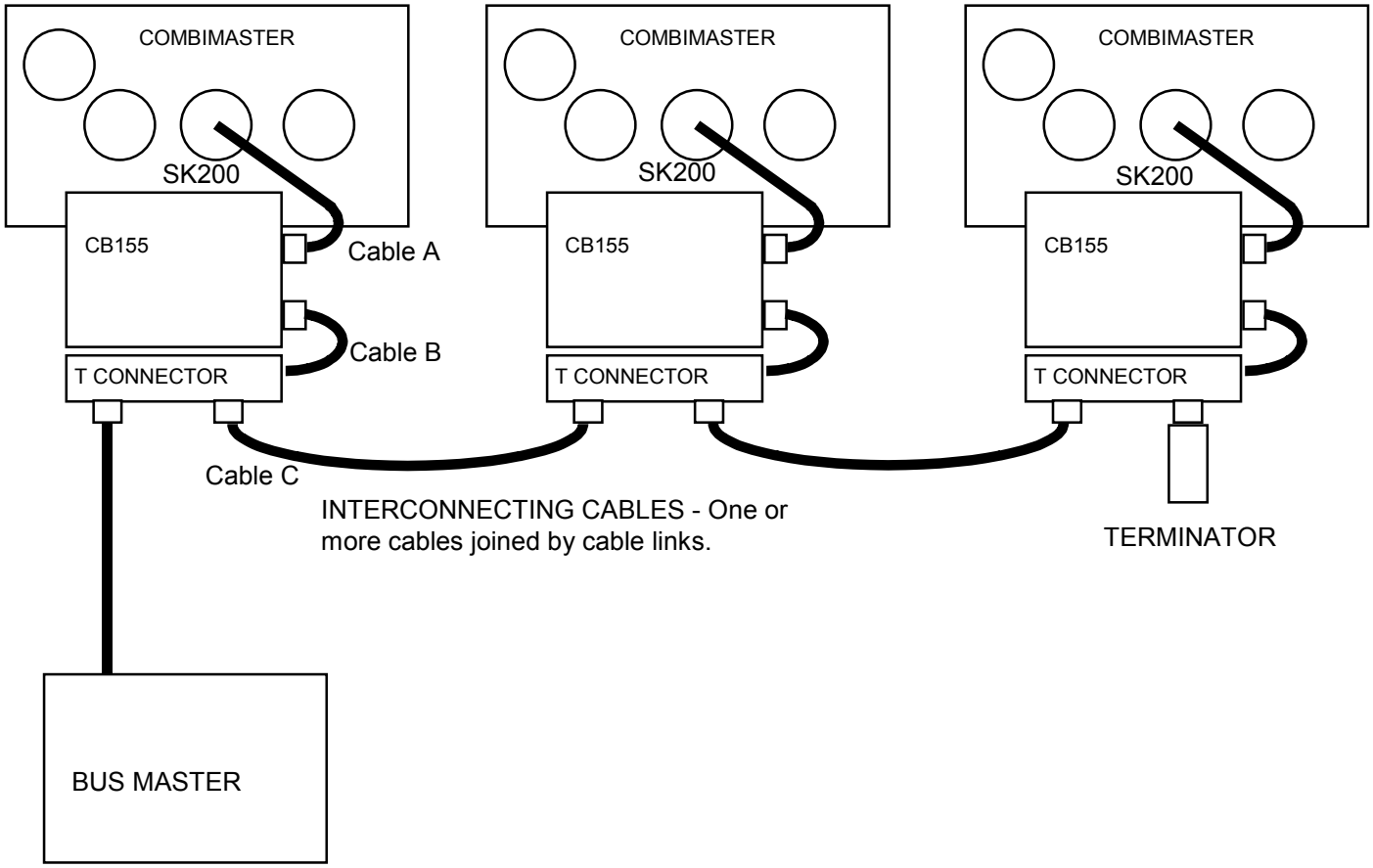


Figure 10: Typical PROFIBUS installation, showing use of accessories

PROFIBUS Component	Order Number	Drawing Reference
PROFIBUS module CB155 (for issue B units) (for issue A units)	**6SE9996-0XA18** **6SE9996-0XA20**	Includes Cable A
PROFIBUS T Connector	**6SE9996-0XA21**	Includes Cable B
PROFIBUS Terminator	**6SE9996-0XA22**	
PROFIBUS Cable 1m	**6SE9996-0XA23**	Cable C
PROFIBUS Cable 5m	**6SE9996-0XA24**	Cable C
PROFIBUS Cable 10m	**6SE9996-0XA25**	Cable C
PROFIBUS cable link	**6SE9996-0XA26**	Used for joining lengths of cable C

Notes:

1. *A Clear Text Display (OPM2) is required to set the COMBIMASTER parameters prior to connecting the PROFIBUS module.*
2. *The PROFIBUS Module may only be connected or disconnected from the drive when the drive is powered off.*
3. *The PROFIBUS module must only be connected to the drive with the cable supplied for the purpose.*
4. *The PROFIBUS module cannot be used simultaneously with the Clear Text Display module.*

The data structure for communication over PROFIBUS-DP can be either PPO type 1 or PPO type 3 as specified in VDI/VDE 3689. This means in practice that process data (control words, setpoint in the transmitted telegram and status words, actual values in the received telegram) is always sent.

Parameter data exchange may, however, be blocked if bus or PLC memory space is at a premium. The data structure and thus the PPO type is normally specified by the bus master. If no PPO type is specified (e.g. if a combined DP/FMS bus master is used), then the default PPO type is type 1 (parameter data enabled).

Parameter write access over the serial link can be enabled or blocked as required. Parameter read access is permanently enabled, allowing continuous read out of drive data, diagnostics, fault messages etc. A visualisation system can thus be realised with minimal effort.

The PROFIBUS cable is connected to the 5-way miniature circular socket on the side of the PROFIBUS Module, via a special ‘T’ connector which fits to the edge of the module.

This T connector allows the PROFIBUS module to be disconnected from the bus in the event of a fault, without breaking the PROFIBUS link. The pin designation of the circular connectors is given below.

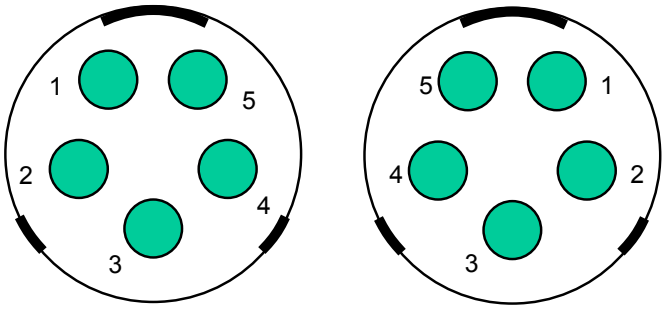


Figure 11: Pin Arrangement for the 5-way circular PROFIBUS Connector

Note that the socket is used on the PROFIBUS module, and the cable links. The plug is used on the interconnecting cables.

Terminal	Function, information
1	+5V
2	N (-)
3	0V
4	P (+)
5	no connection

Table 3: Pin Assignment for the 5-way circular PROFIBUS Connector

The following cable lengths and data transfer rates are possible:

Data transfer rate (Kbit/s)	Max. cable length of a segment (m)
9.6	1200
19.2	1200
93.75	1200
187.5	1000
500	400
1500	200
12000	100

Table 4: Cable Lengths

A segment can be extended by using RS 485 repeaters.

Recommendation: RS 485 repeater
(Order No.: 6ES7 972-0AA00-0XA0).

For reliable operation of the serial bus system, the cable must be terminated at both ends using terminating resistors. For operation at 12MBd, cables must be terminated in connectors with a built-in damping network (built into T Connector). Additionally, for 12MBd operation, no stub length from the main bus cable is allowed.

Suitable SINEC-L2 DP connectors and cable for reliable operation up to 12MBd are listed in section 8.7.

A floppy disk is supplied with the PROFIBUS module containing the handbook and two data files for configuring the relevant PLC system.

Quick Guide to setting up PROFIBUS Communications

- The bus cable between the master device and the drive must be connected correctly. Use should be made of the IP65 T connector, which contains the damping network for 12MBd, and the resistive termination connector, which should be fitted at each end of the bus. In a multi drive bus, the termination may be provided by other system components.
- The bus cable must be screened and the screen must be connected to the housing of the cable connector.
- The PROFIBUS master must be configured correctly so that communications can be realized with a DP slave using PPO type 1 or PPO type 3 (only PPO type 1, if the PPO type cannot be configured via remote operator control).
- For COM ET 200 software, the correct type description file must be used, so that an IM 308B/C can be configured as bus master.
- The bus must be operational (for a SIMATIC module, the operator control panel switch must be set to RUN).
- The bus baud rate must not exceed 12 MBd.
- The PROFIBUS Module must be correctly fitted to the inverter and the inverter must be switched on.
- The slave address for the drive (parameter P918) must be set so that it corresponds to the slave address configured at the PROFIBUS master, and must be uniquely defined on the bus. Note that a Clear Text Display (OPM2) is required for setting the COMBIMASTER parameters prior to connection of the PROFIBUS module.
- Installation should be in conformance with EMC directives and regulations.

Dimensions H x W x D	115 mm x 102 mm x 30 mm
Degree of protection	IP 65
Maximum bus speed	12 MBd

8.8.3 Pulse Resistor Braking Unit (for CS B only)

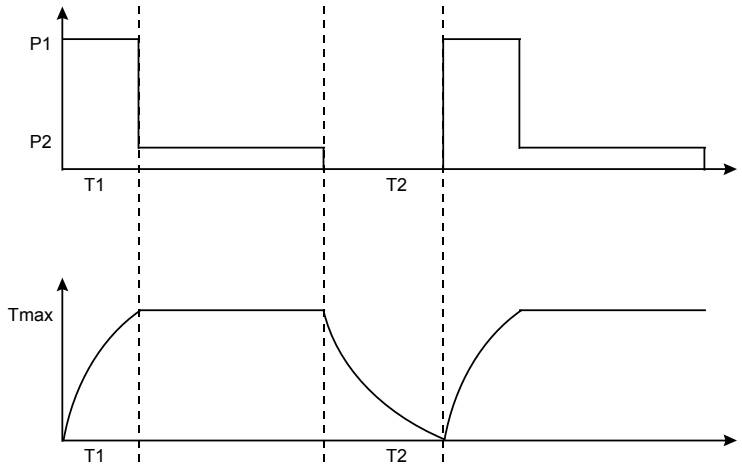
The pulse resistor braking unit gives the COMBIMASTER increased immunity to over voltage trips, and can also be used to provide up to 7kW (peak) of braking power for stopping the system more quickly than would otherwise be possible.

The braking unit fits in place of the standard cover for the inverter unit and requires no wiring. It houses the braking control electronics, and a 7kW (peak) braking resistor with heat sink. Full IP65 environmental protection is maintained.

Technical Overview

The electronics operates completely independently of the inverter electronics, monitoring the DC link voltage. During braking, the motor will regenerate, causing the DC link voltage to rise. When a set threshold is reached, the unit switches the resistor onto the DC link, causing the regenerated energy to be dissipated as heat in the resistor and preventing an over voltage trip.

While the resistor is switched on, its temperature will rise. When a threshold temperature (Tmax) is reached, the unit will limit the power in the resistor to approximately 5% of the peak power. (350W). If the temperature continues to rise, the resistor will be disabled completely, until the temperature has reduced. The following diagrams show the relationship between braking power, and resistor temperature with time.



Figures given below are for a 7kW (peak) braking unit. T1 and T2 are variable, depending on ambient temperature. However typical figures are given.

P1 - 7kW
P2 - 350W
T1 - 5 Seconds typical
T2 - 100 Seconds typical

Protection

In the event of a braking unit fault, it is possible for the resistor to become permanently connected, and to overheat. The resistor temperature is monitored by an internal circuit and, if it becomes too hot, this is indicated by a fault relay.This relay should be used to control an external contactor, to remove power from the COMBIMASTER. See the braking unit operating instructions for more information.

8.8.4 Electromechanical Brake Control

The electromechanical brake control, allows the COMBIMASTER to directly control an electromechanical brake.

The brake control fits in place of the standard cover for the inverter unit. Full IP65 environmental protection is maintained.

The unit provides an output to drive the coil of a DC electromechanical brake. It can be configured for both fast and slow operation of the coil. The unit is set up using the parameters P062, P063 and P064, which allows full control of the brake release time, and brake stopping time.

Brake coil voltage output will be 180VDC for 400V mains input, and 205VDC for 230V mains input.

Note that the coil voltage for 400V units of 180VDC is not suitable for the standard Siemens electromechanical brake option G26.

For other mains voltages, the coil voltage will be:

0.9*Vmains for Vmains = 208V to 240V

0.45*Vmains for Vmains = 380V to 500V

8.9 MICROMASTER Integrated

MICROMASTER Integrated is the inverter from the COMBIMASTER range of variable speed motors.

MICROMASTER Integrated has been designed for adaptation to many different motor types. The key to this process is the 'motor interface plate' (MIP). This is a custom designed part, which adapts the motor terminal box mounting points to the mounting points of the MICROMASTER Integrated. It also performs the electrical interface so that once the MIP has been fitted to the motor, fitting and removing the inverter becomes a very simple operation.

This approach offers the opportunity to use the MICROMASTER Integrated in a wide range of OEM applications where the standard Siemens Motor is not suitable, or where the OEM already uses a range of non Siemens Motors, and does not wish to change.

MICROMASTER Integrated is compatible with all the same inverter options and accessories as the COMBIMASTER.

For further information, please contact your local sales office.

8.9.1 Order Numbers

MICROMASTER INTEGRATED				
Type	Inverter Case Size	Unfiltered Order No.	Class A filter Order No.	Class B filter Order No.
1 AC 230 V				
MI12	CS A	**6SE9610-7BF10-Z=C••**	**6SE9610-7BF50-Z=C••**	**6SE9610-7BF60-Z=C••**
MI25	CS A	**6SE9611-5BF10-Z=C••**	**6SE9611-5BF50-Z=C••**	**6SE9611-5BF60-Z=C••**
MI37	CS A	**6SE9612-0BF10-Z=C••**	**6SE9612-0BF50-Z=C••**	**6SE9612-0BF60-Z=C••**
MI55	CS A	**6SE9612-6BF10-Z=C••**	**6SE9612-6BF50-Z=C••**	**6SE9612-6BF60-Z=C••**
MI75	CS A	**6SE9613-4BF10-Z=C••**	**6SE9613-4BF50-Z=C••**	**6SE9613-4BF60-Z=C••**
3 AC 230V				
MI12/2	CS A	**6SE9610-7CF10-Z=C••**	-	-
MI25/2	CS A	**6SE9611-5CF10-Z=C••**	-	-
MI37/2	CS A	**6SE9612-0CF10-Z=C••**	-	-
MI55/2	CS A	**6SE9612-6CF10-Z=C••**	-	-
MI75/2	CS A	**6SE9613-4CF10-Z=C••**	-	-
3 AC 400 V- 500 V (480 V)				
MI37/3	CS A	**6SE9611-1DF10-Z=C••**	**6SE9611-1DF50-Z=C•• ***	**#**
MI55/3	CS A	**6SE9611-4DF10-Z=C••**	**6SE9611-4DF50-Z=C•• ***	**#**
MI75/3	CS A	**6SE9611-8DF10-Z=C••**	**6SE9611-8DF50-Z=C•• ***	**#**
MI110/3	CS A	**6SE9612-7DF10-Z=C••**	**6SE9612-7DF50-Z=C•• ***	**#**
MI150/3	CS A	**6SE9613-7DF10-Z=C••**	**6SE9613-7DF50-Z=C•• ***	**#**
MI150/3†	CS B	**6SE9613-7DD10-Z=C••**	**6SE9613-7DD50-Z=C•• ***	**6SE9613-7DD60-Z=C··***
MI220/3	CS B	**6SE9615-8DD10-Z=C••**	**6SE9615-8DD50-Z=C•• ***	**6SE9615-8DD60-Z=C··***
MI300/3	CS B	**6SE9617-3DD10-Z=C••**	**6SE9617-3DD50-Z=C•• ***	**6SE9617-3DD60-Z=C··***
MI400/3	CS B	**6SE9621-1DD10-Z=C••**	**6SE9621-1DD50-Z=C•• ***	**6SE9621-1DD60-Z=C··***
MI550/3	CS B	**6SE9621-3DD10-Z=C••**	**6SE9621-3DD50-Z=C•• ***	**6SE9621-3DD60-Z=C··***
MI750/3	CS B	**6SE9621-7DD10-Z=C••**	**6SE9621-7DD50-Z=C•• ***	**6SE9621-7DD60-Z=C••***

* - Filtered units suitable for mains voltages up to 480V +10%.

† - Available for existing applications, for new applications, use the 1.5kW CS A MICROMASTER Integrated.

- Case size A, 3 Phase, 400V: Class B filters - available 2nd Quarter 99.

MICROMASTER Integrated Order Numbers must always have a customer code, or a MIP code added.

The customer code is added by appending a -Z=C•• to the Order Number where •• is the customer number. If no customer code has been assigned, the MIP code must be used (see table below). (Customer/MIP codes are NOT used for COMBIMASTER 1UA7 numbers.)

To specify an inverter set up for a two pole motor, the option code M88 should be used.

For further clarification, see the table of examples below.

MIP/Customer Codes - one of these MUST be used.

Inverter and Motor interface plate combination	Customer/MIP Codes
Case Size A / B MICROMASTER Integrated with 1LA7 Motor Interface Plate	C87
Case Size A or B MICROMASTER Integrated with no interface plate (spare inverter)	C00

The following options can be ordered separately, or can be added to the MICROMASTER Integrated Order Number using the option short code, if one exists.

All the options can be customer fitted if required.

Option	Short Code	Order Number
Fan assembly for CS B	M41	**6SE9996-0XA02**
Resistor Braking unit for CS B	-	**6SE9996-0XA11**
Mechanical brake control for CS B	-	**6SE9996-0XA10**
Fan assembly for CS A	M41	**6SE9996-0XA01**
Mechanical brake control for CS A *		**6SE9996-0XA07**
PROFIBUS module CB155 (for CS B issue A units only)	-	**6SE9996-0XA20**
PROFIBUS module CB155 (for CS A units, and CS B issue B units)	-	**6SE9996-0XA18**
PROFIBUS T Connector	-	**6SE9996-0XA21**
PROFIBUS Terminator	-	**6SE9996-0XA22**
PROFIBUS Cable 1m	-	**6SE9996-0XA23**
PROFIBUS Cable 5m	-	**6SE9996-0XA24**
PROFIBUS Cable 10m	-	**6SE9996-0XA25**
PROFIBUS cable link	-	**6SE9996-0XA26**
OPM2 (Clear text display)	-	**6SE3290-0XX87-8BF0**
Cable for OPM2 (unscreened for CS B issue A units only)	-	**6SE3290-0XX87-8SK0**
Cable for OPM2 (screened for CS A units, and CS B issue B units)	-	**6SE9996-0XA31**
Applications Handbook (English)	-	**6SE9996-0XA35**
Operating Instructions (English)	-	**6SE9996-0XA36**

* Mechanical Brake options for Case Size A units : availability due 2nd Qtr 1999. Please consult your sales office for latest information.

Example MICROMASTER Integrated Order Numbers

Product	Order number
370W 400V MICROMASTER Integrated for 1LA7 4 pole motor	**6SE9611-1DF10-Z=C87**
2.2kW 400V MICROMASTER Integrated for 1LA7 4 pole motor	**6SE9615-8DD10-Z=C87**
370W 400V MICROMASTER Integrated for 1LA7 2 pole motor	**6SE9611-1DF10-Z=C87+M88**
2.2kW 400V MICROMASTER Integrated for 1LA7 2 pole motor	**6SE9615-8DD10-Z=C87+M88**
370W 400V MICROMASTER Integrated for 1LA7 4 pole motor, Class A Filter and inverter fan	**6SE9611-1DF50-Z=C87+M41**
370W 400V MICROMASTER Integrated for 1LA7 2 pole motor, Class A Filter and inverter fan	**6SE9611-1DF50-Z=C87+M41+M88**

Index

Catalogues issued by the Division

Automation and Drives
Interactive Catalogues on CD-ROM
Components for Automation — CA 01

Analysis
Gas Analysis — PA 10
Components for Sample Preparation — PA 11
Liquid Analysis — PA 20
PGC 102, RGC 202 and PGC 302 Gas Chromatographs — PA 30

Drive Systems
Variable-Speed Drives
DC Motors — DA 12
SIMOREG Panel-Mount Power Converters — DA 21
SIMOREG Cabinet-Mount Power Converters — DA 22
SIMOVERT PM Modular Inverter System — DA 45
SIMOVERT A Current-Controlled Converters — DA 62
MICROMASTER, MIDIMASTER Voltage-Controlled Inverters — DA 64
SIMOVERT MASTERDRIVES Voltage-Controlled Inverters — DA 65
SIMOVERT P Voltage-Controlled Inverters — DA 66
SIVOLT A/V Three-Phase and Single-Phase Power Controllers — DA 68
SITOR Modules and Power Converter Cabinets — DA 92
Commutating and Smoothing Reactors and Inductors — DA 93
SITOR Protective Equipment — DA 94
SITOR Drivers and Triggers — DA 95
SIMADYN C Control System — DA 97
MODULPAC C Control System — DA 98
SIMADYN D Digital Control System — DA 99
SIMODRIVE Drive Systems for Machine Tools — NC 60.1,
- 1PH2, 1PH3, 1PH4, 1PH7 Main Spindle Motors — NC 60.2
- 1FK6, 1FN1, 1FS5, 1FT5, 1FT6 Servomotors
- SIMODRIVE 611 Inverter System

See under Complete Catalogues for SINUMERIK & SIMODRIVE
Low-Voltage Three-Phase Motors
- Planning Documents — M 10
- Squirrel-Cage Motors — M 11

High-Voltage Three-Phase Motors — M 2
Starters and Resistor Units — AW 1

SINUMERIK & SIMODRIVE Systems for Machine-tool Automation
- Ordering Catalogue — NC 60.1
- Technical Catalogue — NC 60.2
- Connectivity and System Components — NC Z

SINUMERIK 840C — NC 36
WS 8000 Equipment Packages (Electrical Cabinets) — AR 80, ST 80

SIMATIC HMI/COROS Operation and Observation

SIMATIC Industrial Automation Systems
SIMATIC PCS Process Monitoring System — ST 45
SIMATIC S5/PC/505 Automation Systems — ST 50
Components for Totally Integrated Automation (SIMATIC S7/M7/C7/PC, SIMATIC HMI/NET) — ST 70
Supplementary Components — ST 71
SIMATIC PCS 7 Process Control System — ST PCS 7

Electrical Installations and Wiring
Fuse and Circuit-Breaker Systems — I 2.1
Building Systems using *instabus EIB*

The Range of Flush-Mounting Modular In-Line Units — I 2.11
Characteristic Curves for Low-Voltage Fuses — I 2.21
STAB Wall-Mounting Distribution Boards — I 2.31
SIKUS Free-Standing Distribution Boards — I 2.32
SIPRO Universal System — I 2.33
SIKUS 3200 Side-by-Side Electrical Cabinet System — I 2.34
Installation Distribution Boards — I 2.35
8PU Busbar System — I 2.36
DELTA Switches — I 2.4

Information and Training for Automation and Drive Engineering
Courses and Computer Based Training — ITC
SIMATIC NET/SINEC Industrial Communications Systems — IK 10

Combinable Equipment
General Catalogue on Combinable Equipment — KT 01

SITOP power Power Supply and SITOP connection System Cabling — KT 10
MOBY-I, MOBY-L RF Identification Systems — KT 21
SIWAREX Weighing and Metering Systems — KT 30
SICOMP SMP 16 and AMS Industrial Microcomputers — KT 51
SICOMP SMP Industrial Microcomputer — KT 52
Printers and Monitors — KT 61
Cabinet Construction System for SIMATIC PCS 7 — KT 71

Switching Devices
Low-voltage Switching Equipment — NS K
Intercommunicating Switching Devices, Switching Devices for Load Feeders, SIRIUS 3R, SIGUARD Safety Equipment, Control and Signalling Devices, Switching Devices for Power Distribution, Transformers and Power Supplies,
Control Switches, Modular In-line Terminals
- Supplementary Catalogue on Extra Range: Items No Longer Produced, Spares — NS E
- Products and Systems for Power Distribution — NS PS
- SICUBE 8MC und 8MF System Cabinets — NV
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