

## 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.
- 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.

### 8.1.1 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  $\pm$  10% 1/3 Phase

380 to 480V  $\pm$  10% 3 Phase

460 to 500V  $\pm$  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.

### 8.1.2 COMBIMASTER Technical Features

Feature	Specification
Mains Voltage	208 to 240V $\pm$ 10% 1/3 Phase 380 to 480V $\pm$ 10% 3 Phase 460 to 500V $\pm$ 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 $\geq$ Class A 230V 1ph Class B Filter $\geq$ Class B 400V 3ph Class A Filter $\geq$ Class A 400V 3ph Class B Filter $\geq$ 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 $\pm$ 10%	0.12 - 0.75kW
	3 AC 208-240V $\pm$ 10%	0.12 - 0.75kW
	3 AC 400-480V $\pm$ 10%	0.37 - 7.5kW
	3 AC 460-500V $\pm$ 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 (40/50°C).....	°C
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.

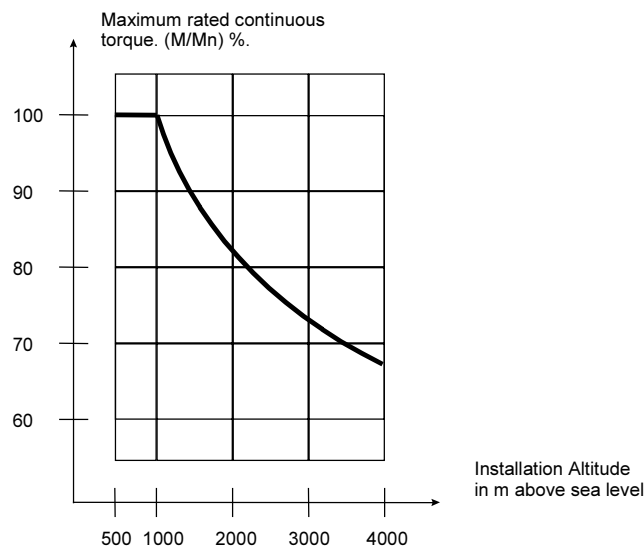
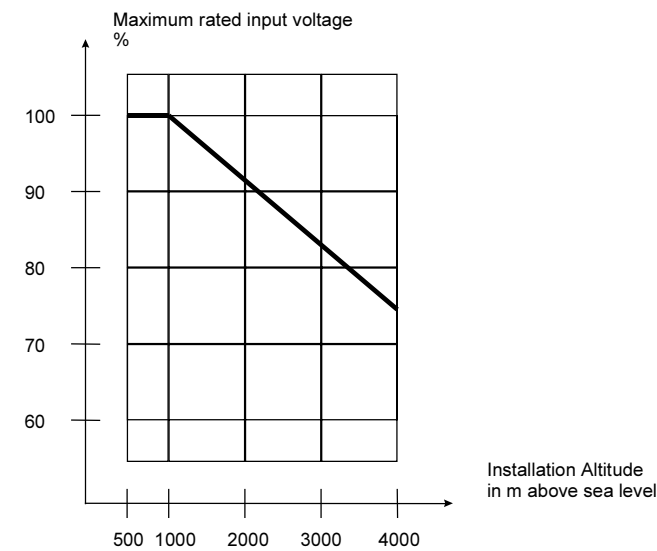
The COMBIMASTER has been optimised to keep its physical dimensions as small as possible, and for maximum reliability. The result of this has led to a DC link with low energy capabilities. Rapidly stopping loads with high inertias will result in over voltage tripping. However, an integrated braking option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

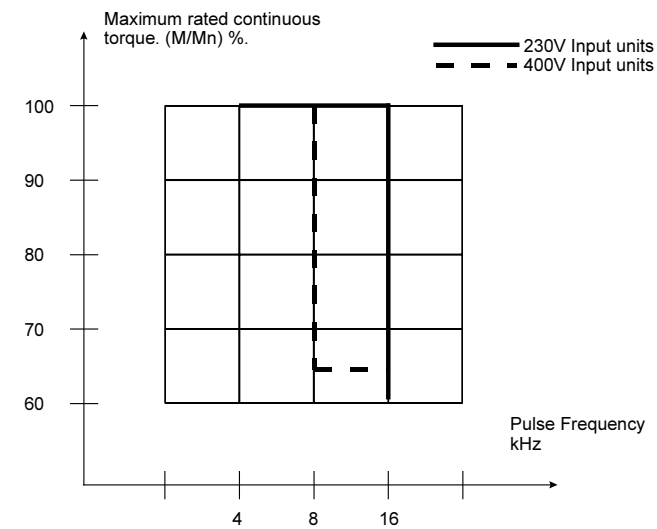
For a Block Diagram of the COMBIMASTER see Figure 8, Page 8/20.

8.3 COMBIMASTER DE-RATING INFORMATION

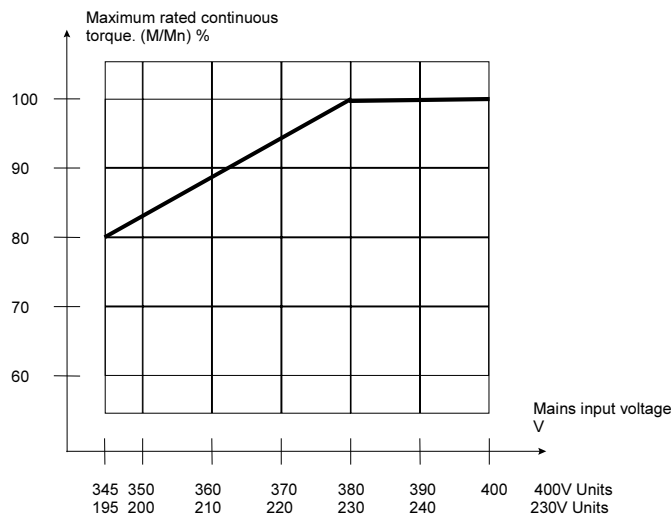
De-rating with altitude



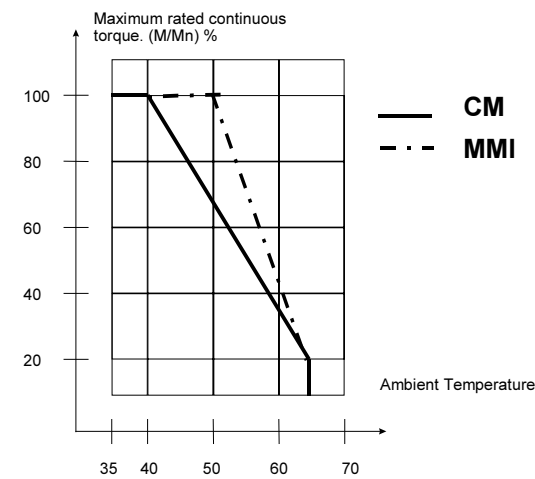
De-rating with switching frequency



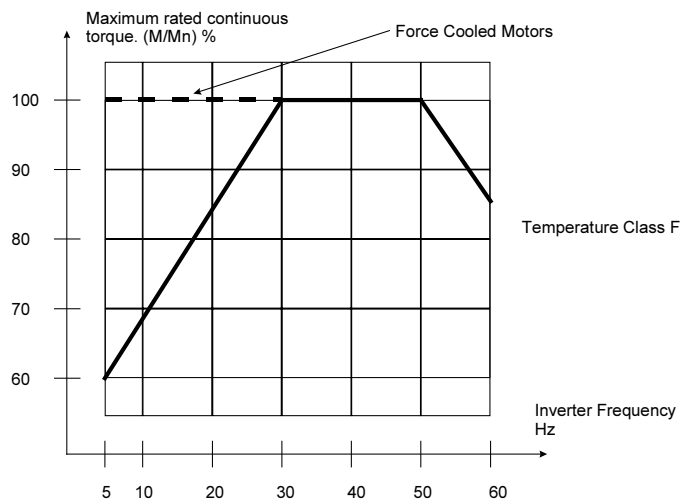
De-rating with mains input voltage



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:

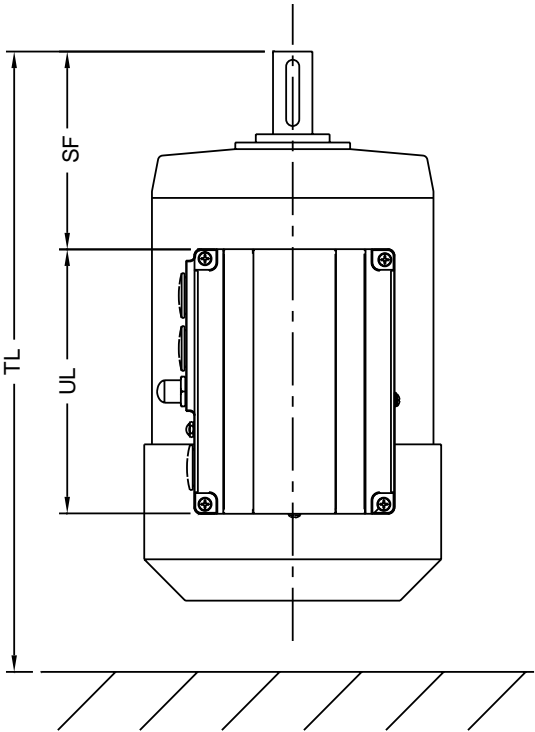
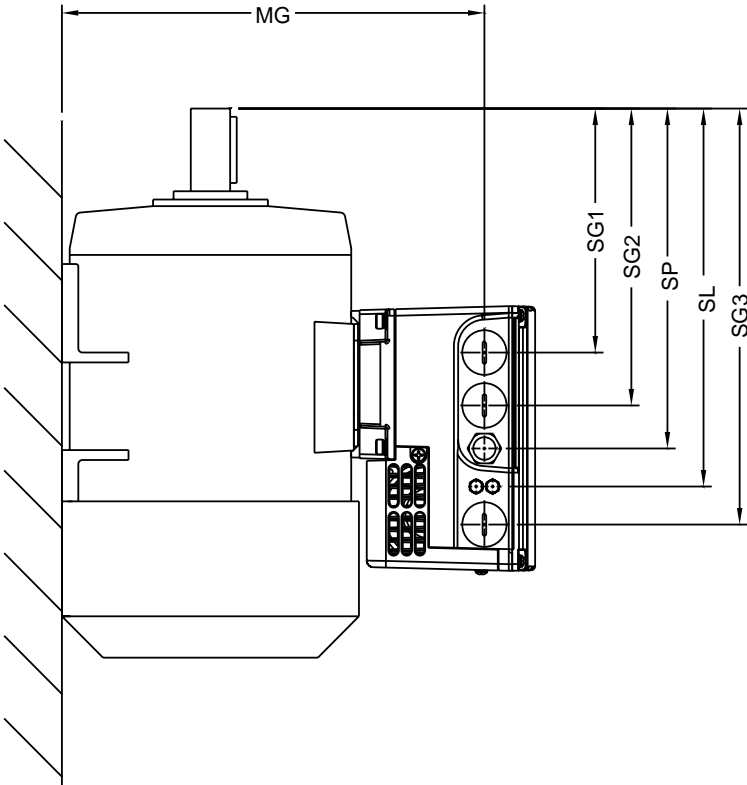
- The rotor turns freely without rubbing.
- The motor is assembled and aligned properly.
- The transmission elements are adjusted correctly (e.g. belt tension) and the transmission element is suitable for the given operating conditions.
- All electrical connections, mounting screws and connecting elements 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.

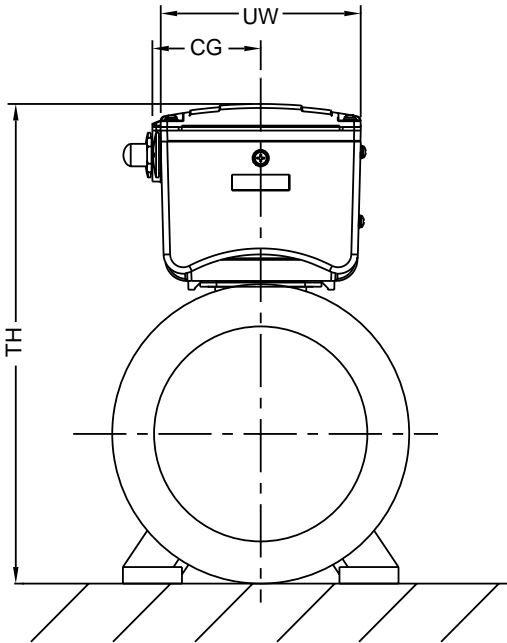
The above list is not meant to be exhaustive - additional checks may also be required.



COMBIMASTER – Dimensions – Case Size A



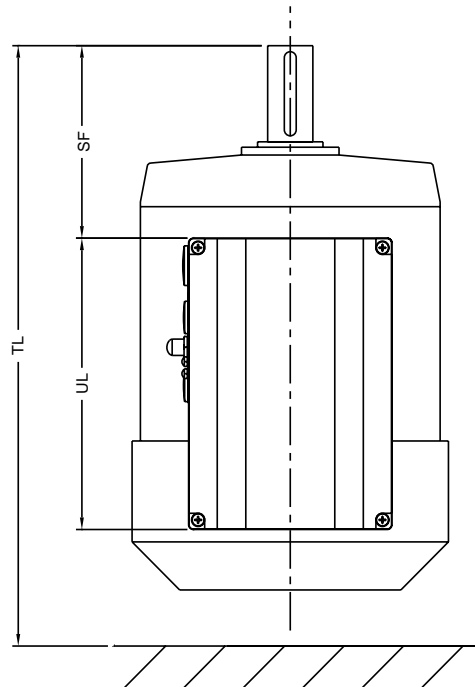
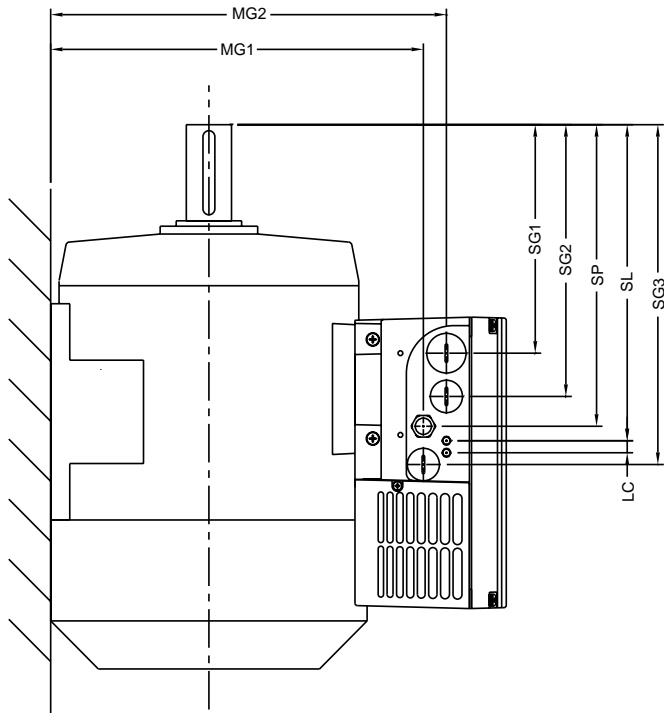
		MOTOR FRAME SIZE				
		56	63	71	80	90
DIMENSION	TH	230	237	255	278	296
	CG	66	66	66	66	66
	UW	122	122	122	122	122
	TL <sub>min</sub>	205	244	269	303	361
	SF	48	55	46	107	136
	UL	160	160	160	160	160
	MG	199	206	224	247	265
	SG1	76	83	74	135	164
	SG2	108	115	106	167	196
	SP	134	141	132	193	222
	SL	157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



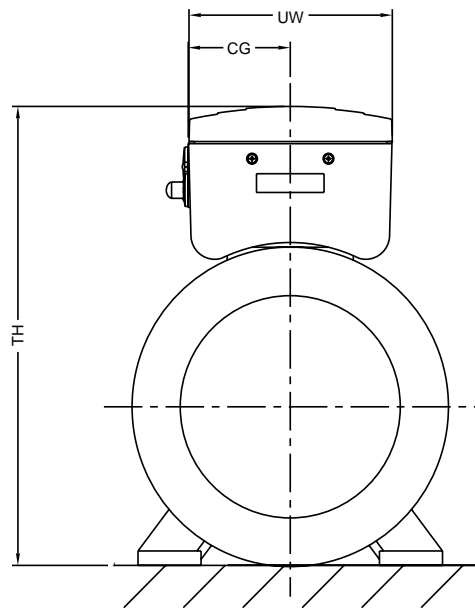
Dimensions in mm

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
TH	317	333	357	396
CG	86	86	86	86
UW	171	171	171	171
TL <sub>min</sub>	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

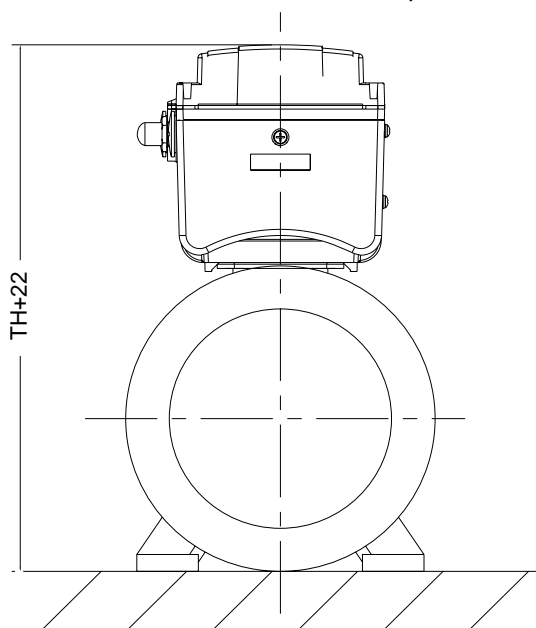


Dimensions in mm

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)

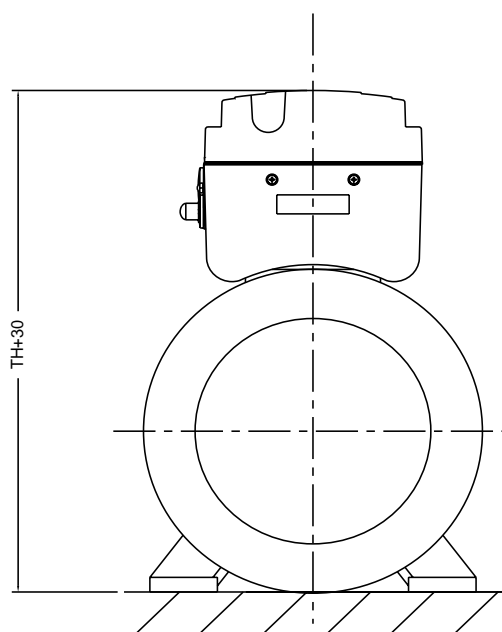
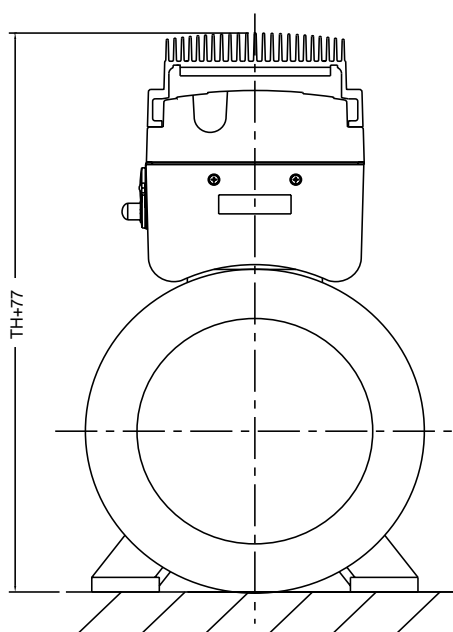


### COMBIMASTER - Case Size B – Deep Covers

Deeper Covers:

- i) Resistor Brake (incl. Heatsink)
- ii) Mechanical Brake + Class B Filter (>4.0kW)

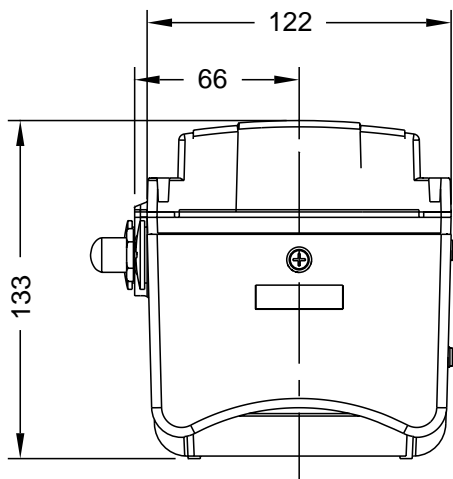
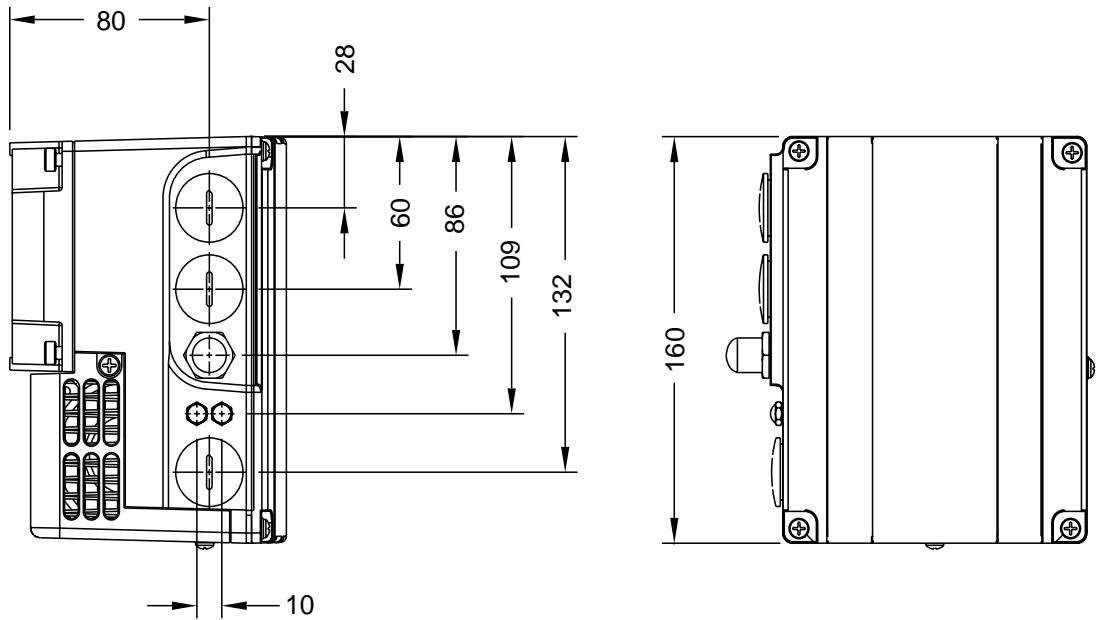
(for Dimension TH for Case Size B , please refer to table on Page 8/10)



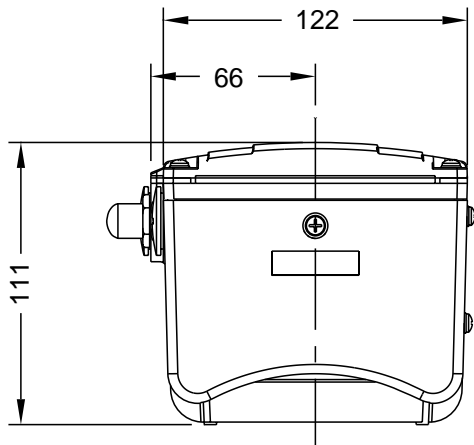
Dimensions in mm.

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



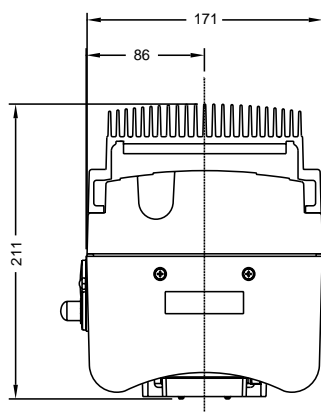
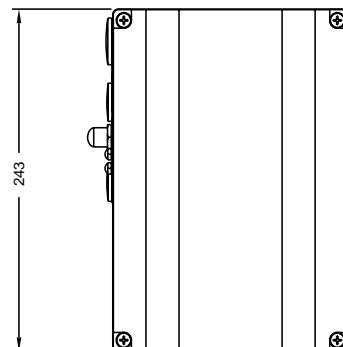
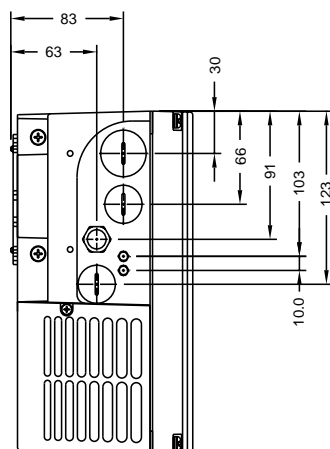
Note : Deep Cover (used for Electromechanical  
Brake Control unit  
& Class B Filter – 400V only)



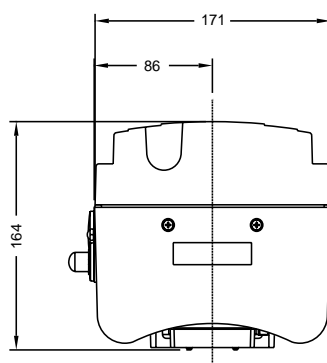
With Normal Cover

Dimensions in mm.

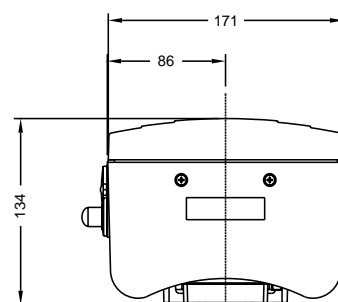
## MICROMASTER Integrated - Case Size B



With Pulse Resistor  
Brake Unit Cover



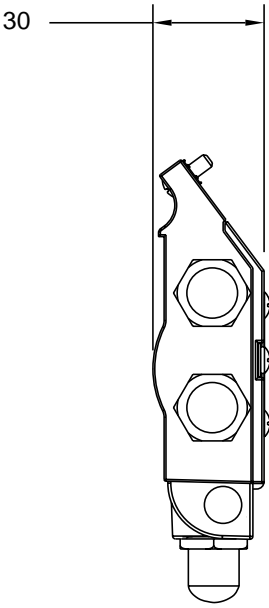
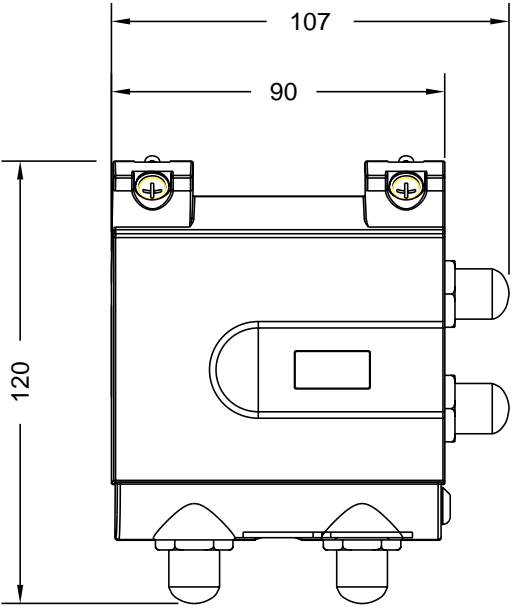
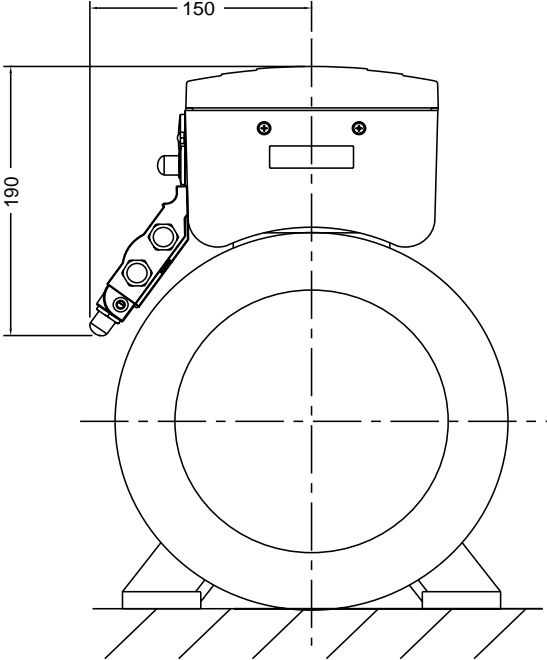
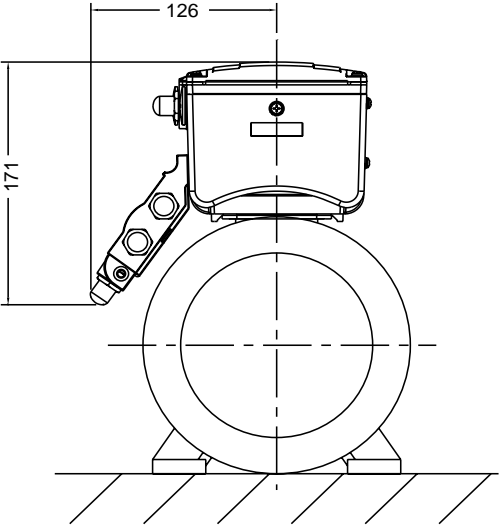
With Electromechanical  
Brake Unit Cover  
(also used for :  
4kW, 5.5kW & 7.5kW  
class B filter units).



With Normal Cover

Dimensions in mm.

COMBIMASTER Option – Profibus Module CB155




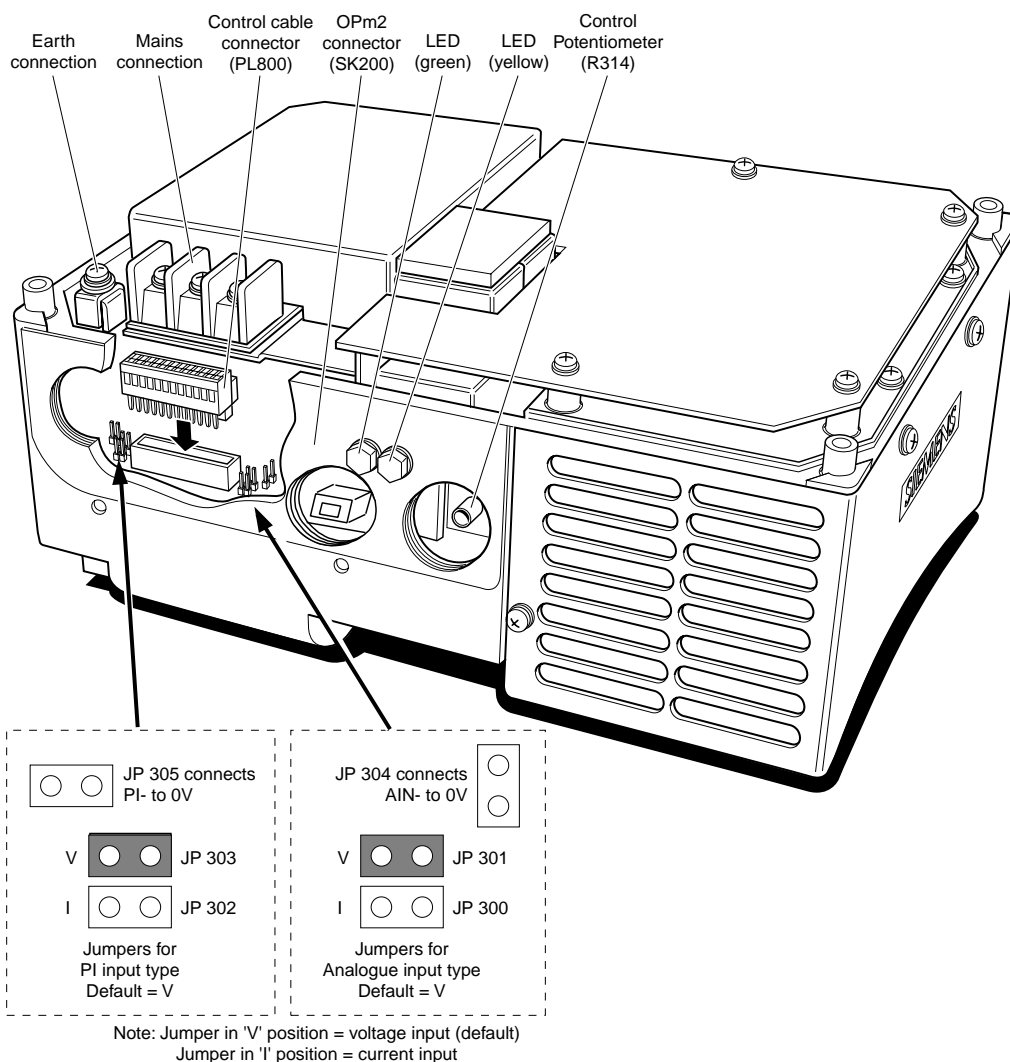
## 8.4.2 Electrical Installation


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).

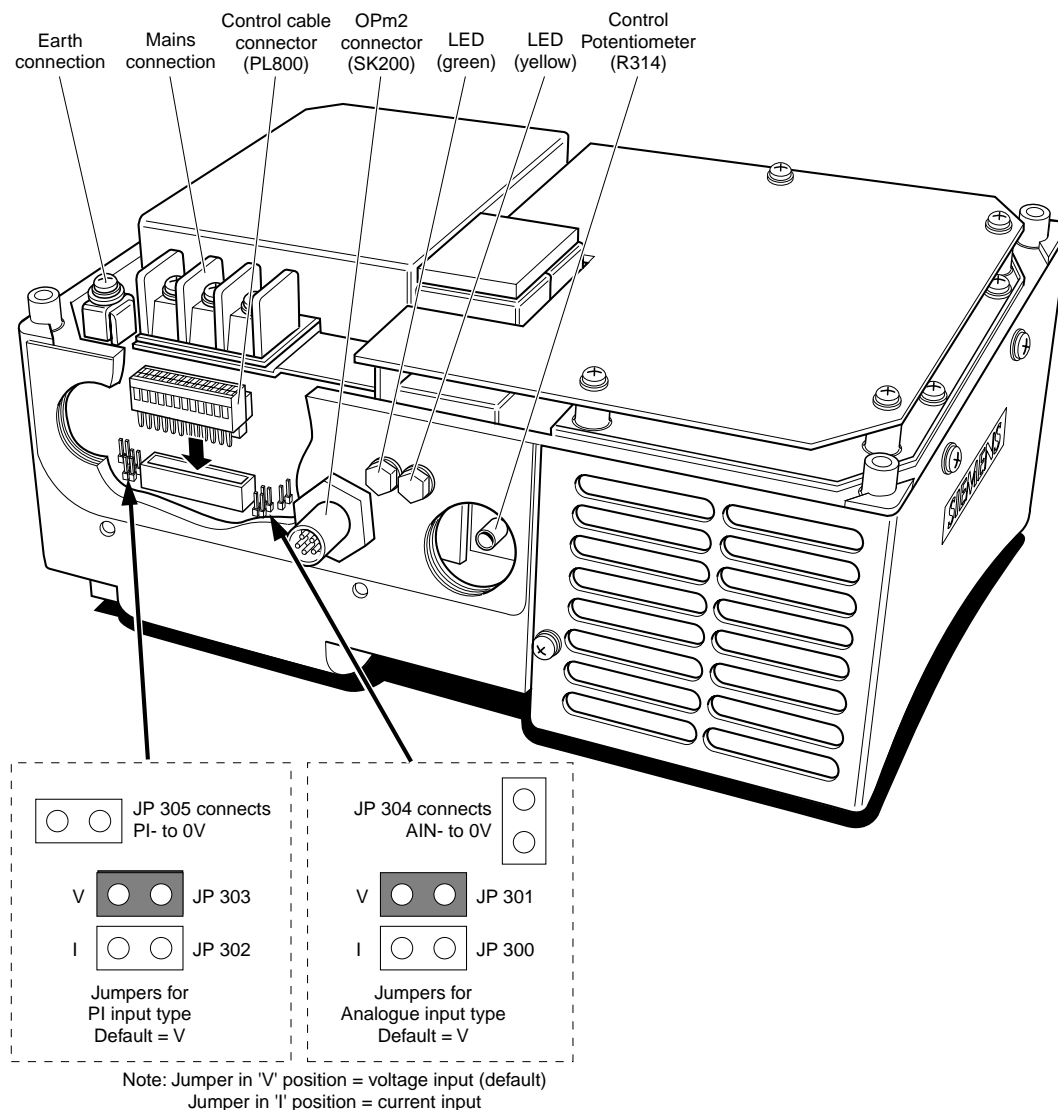
	<p><b>Caution</b></p> <p>The printed circuit boards contain CMOS components that are particularly sensitive to static electricity. For this reason, avoid touching the boards or components with your hands or metal objects.</p>
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	<p><b>IMPORTANT</b></p> <p>Ensure that the following tightening torques are used:</p> <table border="0"> <tr> <td>Access cover retaining screws:</td> <td>4.0Nm</td> </tr> <tr> <td>PG connection:</td> <td>1.0Nm</td> </tr> <tr> <td>Electrical terminal screws:</td> <td>1.0Nm</td> </tr> </table>	Access cover retaining screws:	4.0Nm	PG connection:	1.0Nm	Electrical terminal screws:	1.0Nm
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

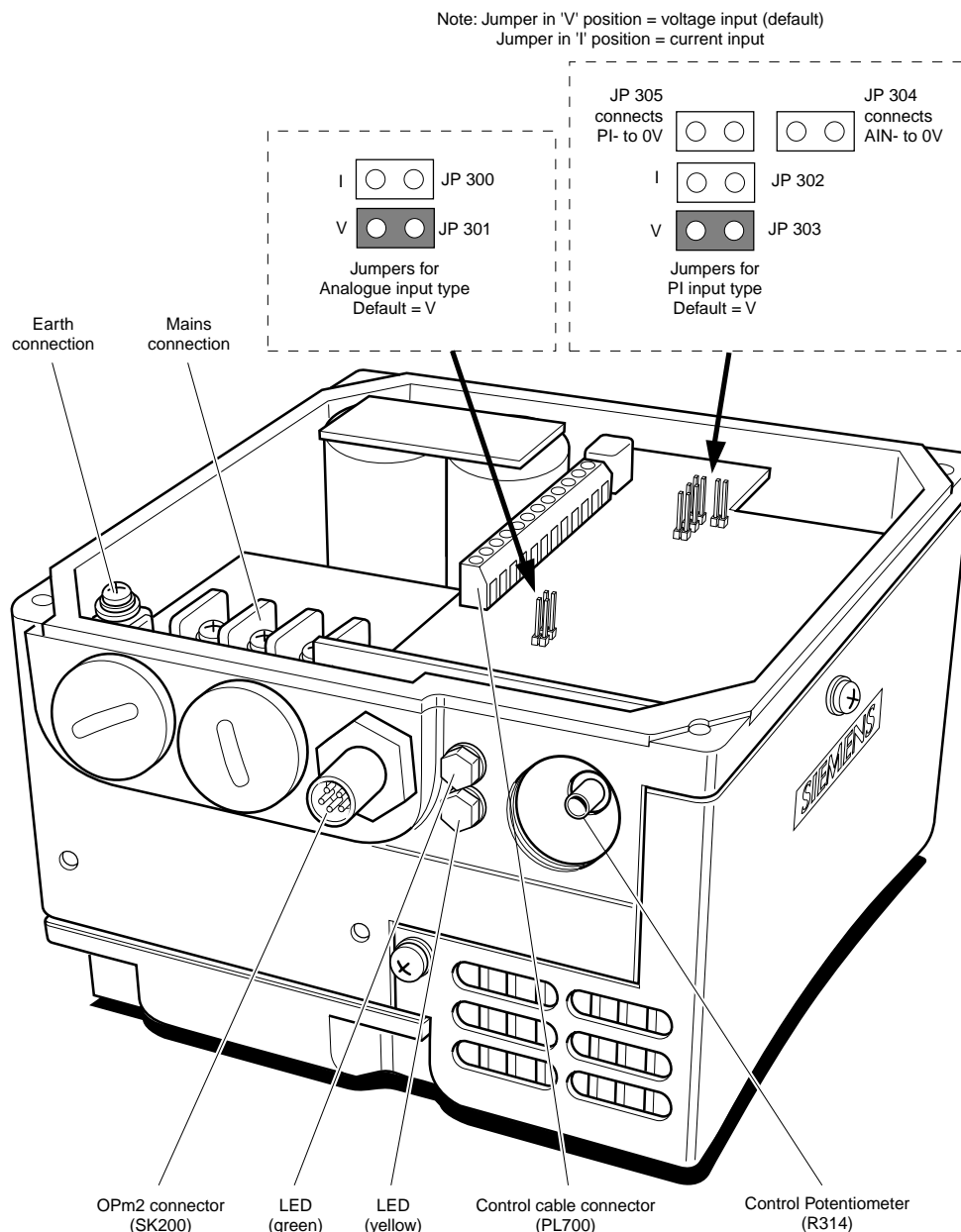


	<b>IMPORTANT</b>
	Ensure that the following tightening torques are used:
	Access cover retaining screws: 4.0Nm
	PG connection: 1.0Nm
	Electrical terminal screws: 1.0Nm

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

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






	<p><b>IMPORTANT</b></p> <p>Ensure that the following tightening torques are used:</p> <table style="width: 100%; border: none;"> <tr> <td>Electrical terminal screws:</td> <td style="text-align: right;">1.0Nm</td> </tr> <tr> <td>Access cover retaining screws:</td> <td style="text-align: right;">4.0Nm</td> </tr> <tr> <td>PG connection:</td> <td style="text-align: right;">1.0Nm</td> </tr> <tr> <td>Control connection PL700 screws:</td> <td style="text-align: right;">0.5Nm</td> </tr> <tr> <td>Earth connection:</td> <td style="text-align: right;">1.5Nm</td> </tr> </table>	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
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										
<p>Check that the supply voltage is correct for the COMBIMASTER used (see section 7) by referring to the rating label</p>											

Figure 3: Electrical Connection Diagram - Case Size A

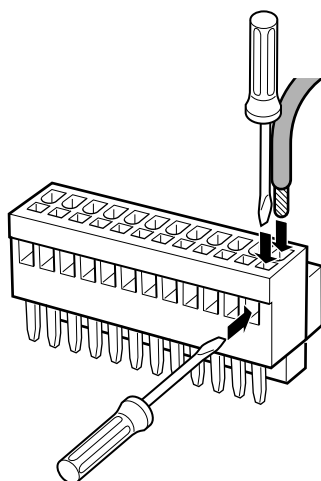


Figure 4 Operation of Screw-less Connectors for PL800 on Case Size B

#### 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°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.

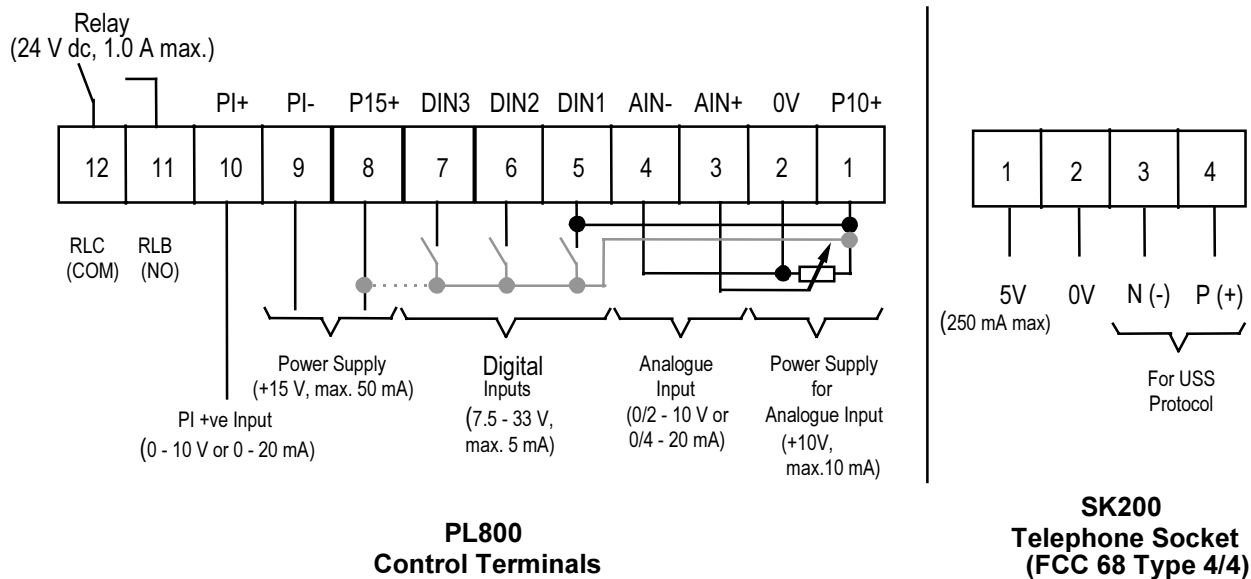


Figure 5: Control Terminal Connections - Case Size B, Issue A

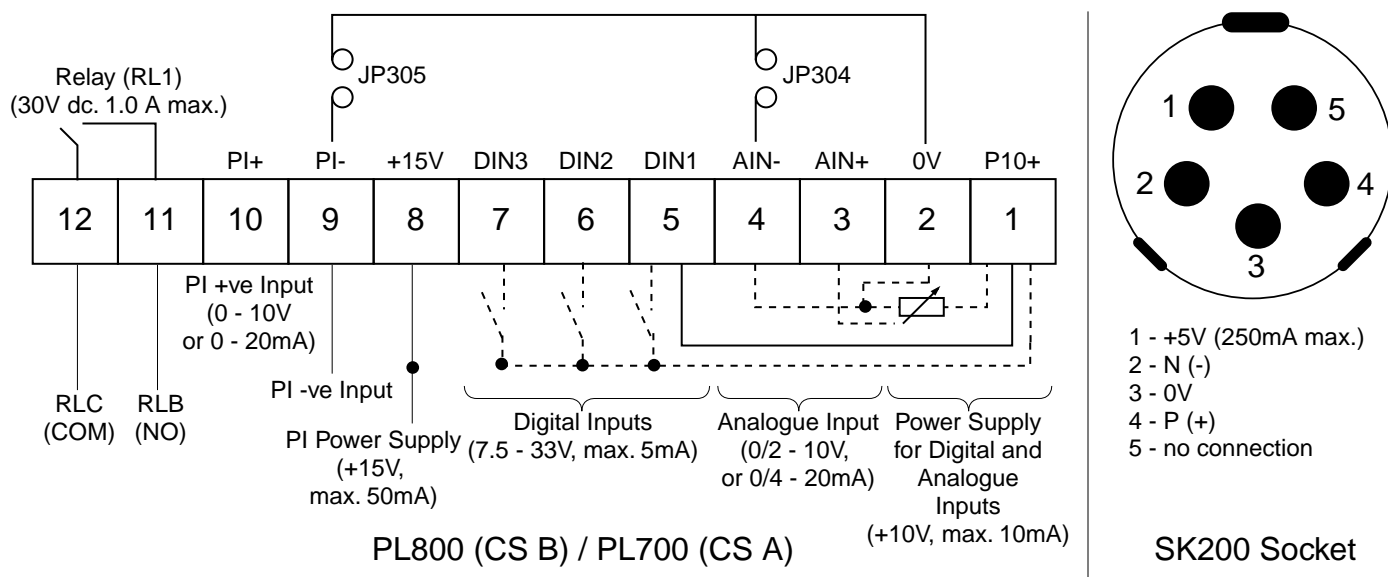


Figure 6: Control Terminal Connections - Case Size A and Case Size B, Issue B

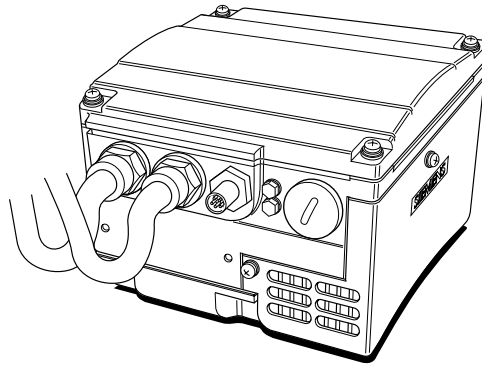


Figure 7 Cable Connections with Drip Loop (Case Size A illustrated)

### Block Diagram

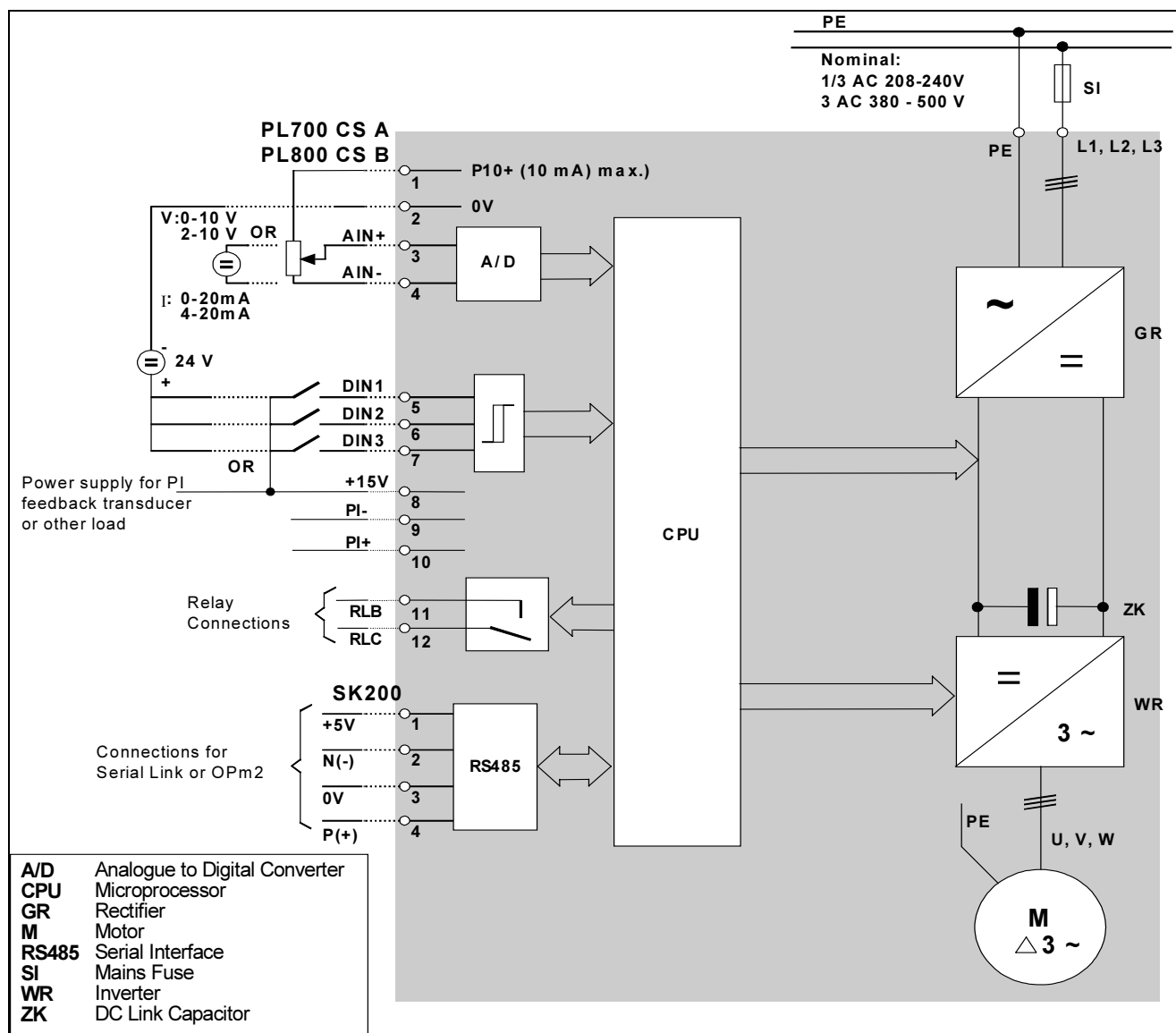
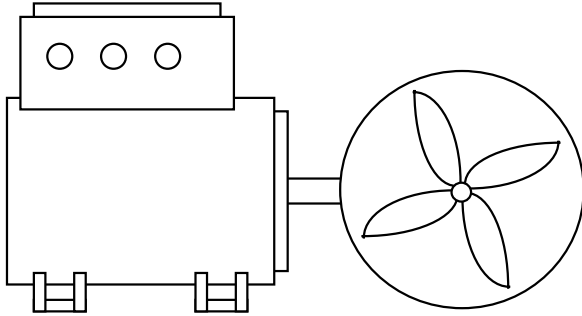


Figure 8 Block Diagram

## 8.5 COMBIMASTER Standard Applications

### 8.5.1 COMBIMASTER Fan Application

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

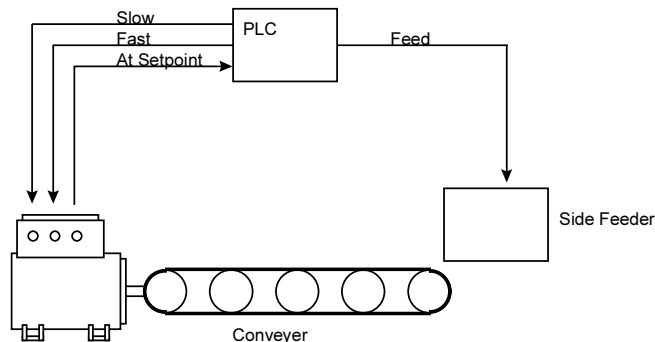


The application requires the fan speed to be adjusted to minimise the power consumption of the fan. Once the speed has been set, an external switch is used to start and stop the fan.

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 conveyor 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 conveyor 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

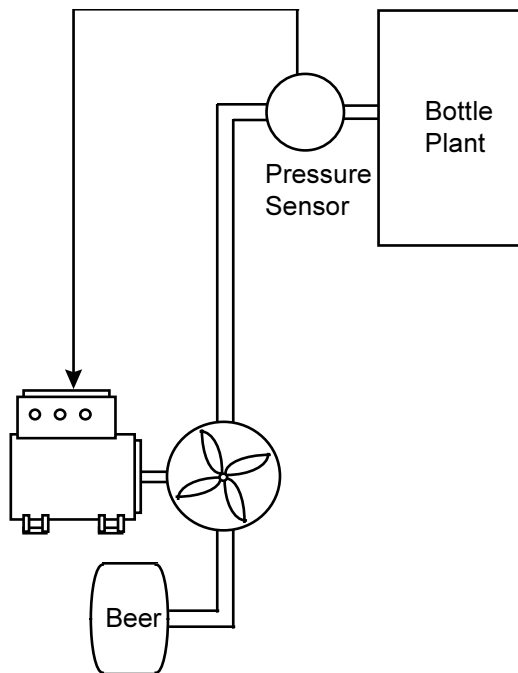
#### Notes on using PI Control

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)

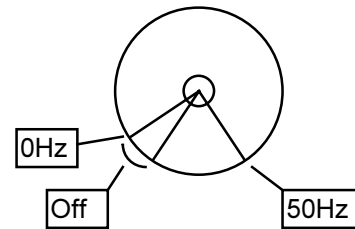
2. Externally via:

- 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.

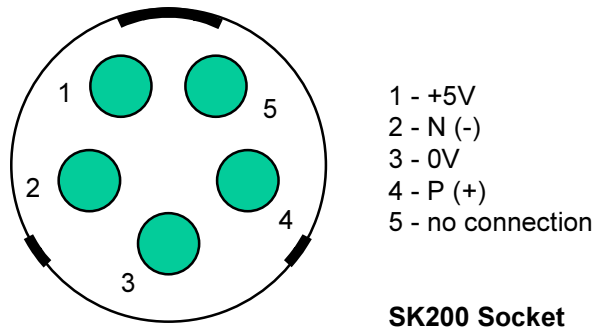
Status information is provided via the two LEDs on the side of the COMBIMASTER. The following table shows the possible status indications.

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.



#### 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.

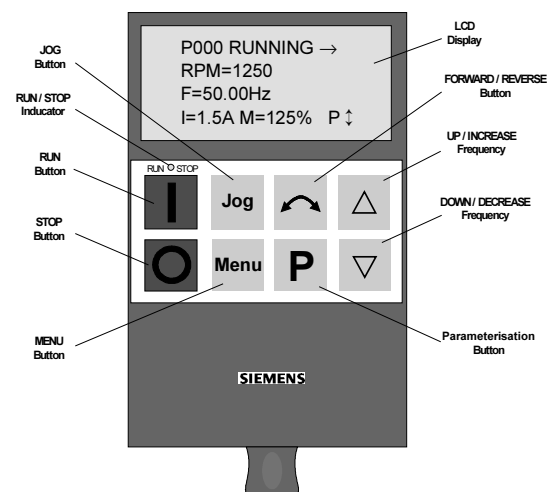


Figure 9 Main Menu Screen

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	
		A	W	2pole rpm	4pole rpm	2pole Nm	4pole Nm	2pole	4pole
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 W	Input supply current A	mm <sup>2</sup>	Rated current 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							
Type	Inverter Case Size	unfiltered Motor 2 pole Order No.	Motor 4 pole Order No.	Class A filter Motor 2 pole Order No.	Motor 4 pole Order No.	Class B filter 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 2<sup>nd</sup> 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	<b>M41</b>	<b>6SE9996-0XA02</b>
Resistor Braking unit for CS B	-	<b>6SE9996-0XA11</b>
Mechanical brake control for CS B	-	<b>6SE9996-0XA10</b>
Fan assembly for CS A	<b>M41</b>	<b>6SE9996-0XA01</b>
Electro-Mechanical brake control for CS A (Available August 1999)	-	<b>6SE9996-0XA07</b>
PROFIBUS module CB155 (for CS B issue A units only)	-	<b>6SE9996-0XA20</b>
PROFIBUS module CB155 (for CS A units, and CS B issue B units)	-	<b>6SE9996-0XA18</b>
PROFIBUS T Connector	-	<b>6SE9996-0XA21</b>
PROFIBUS Terminator	-	<b>6SE9996-0XA22</b>
PROFIBUS Cable 1m	-	<b>6SE9996-0XA23</b>
PROFIBUS Cable 5m	-	<b>6SE9996-0XA24</b>
PROFIBUS Cable 10m	-	<b>6SE9996-0XA25</b>
PROFIBUS cable link	-	<b>6SE9996-0XA26</b>
OPM2 (Clear text display)	-	<b>6SE3290-0XX87-8BF0</b>
Cable for OPM2 (unscreened for CS B issue A units only)	-	<b>6SE9090-0XX87-8SK0</b>
Cable for OPM2 (screened for CS A units, and CS B issue B units)	-	<b>6SE9996-0XA31</b>
SIMOVIS Standalone Version	-	<b>6SE3290-0XX87-8SA0</b>
Reference Manual (English)	-	<b>6SE9996-0XA35</b>
Operating instructions (English)	-	<b>6SE9996-0XA36</b>

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.

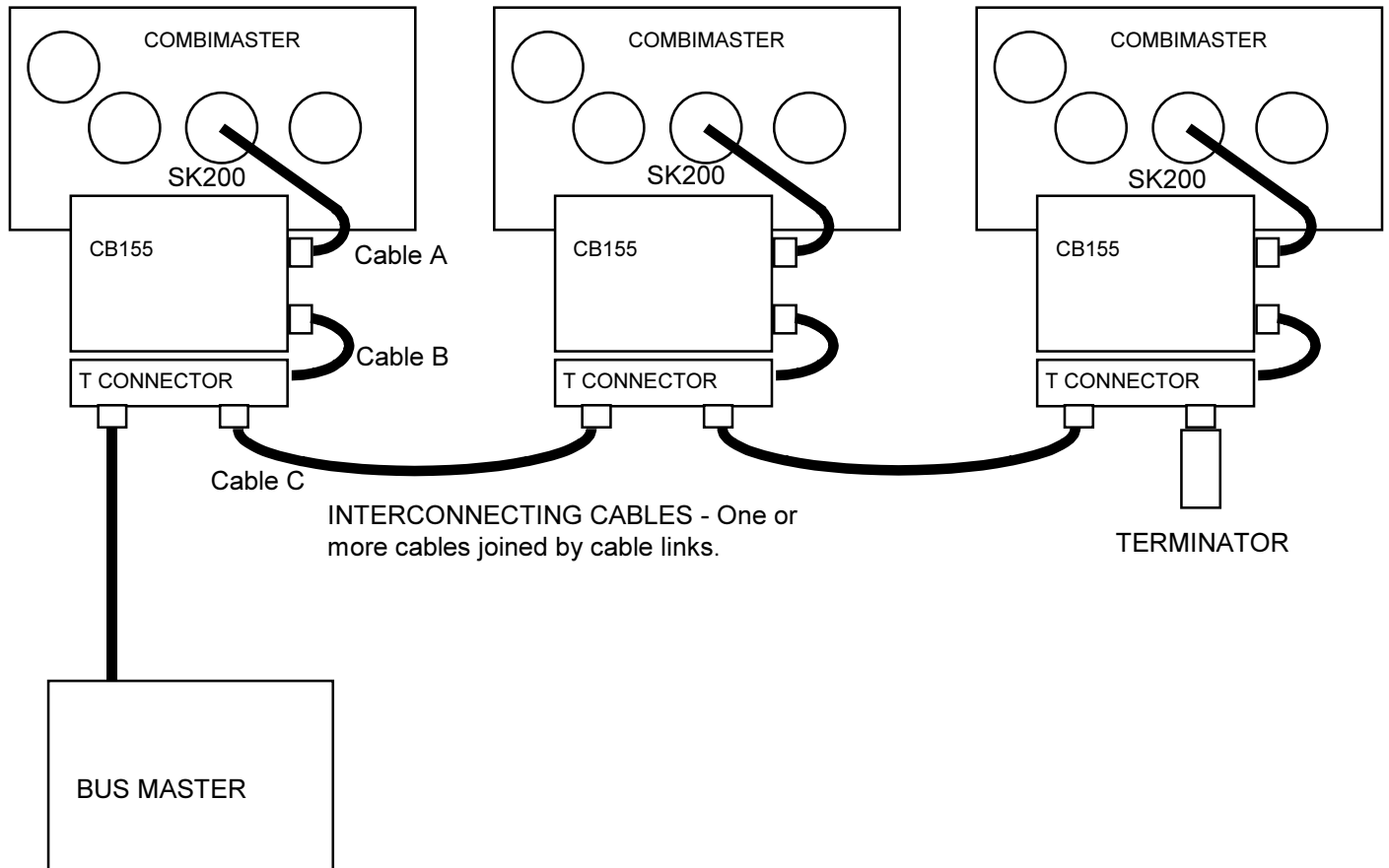


Figure 10: Typical PROFIBUS installation, showing use of accessories

PROFIBUS Component	Order Number	Drawing Reference
PROFIBUS module CB155 (for issue B units) (for issue A units)	<b>6SE9996-0XA18</b> <b>6SE9996-0XA20</b>	Includes Cable A
PROFIBUS T Connector	<b>6SE9996-0XA21</b>	Includes Cable B
PROFIBUS Terminator	<b>6SE9996-0XA22</b>	
PROFIBUS Cable 1m	<b>6SE9996-0XA23</b>	Cable C
PROFIBUS Cable 5m	<b>6SE9996-0XA24</b>	Cable C
PROFIBUS Cable 10m	<b>6SE9996-0XA25</b>	Cable C
PROFIBUS cable link	<b>6SE9996-0XA26</b>	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.

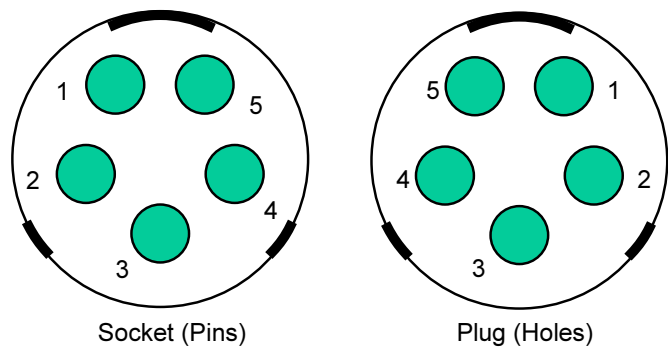


Figure 11: Pin Arrangement for the 5-way circular PROFIBUS Connector

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

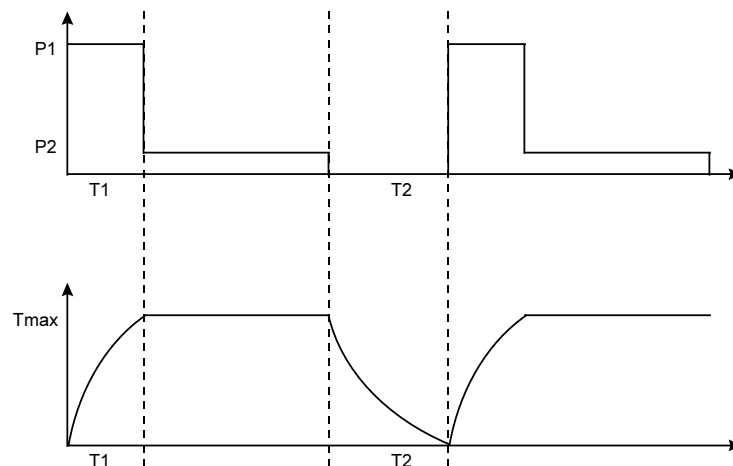
stopping the system more quickly than would otherwise be possible.

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 ( $T_{max}$ ) 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:

$0.9 \times V_{\text{mains}}$  for  $V_{\text{mains}} = 208\text{V to } 240\text{V}$

$0.45 \times V_{\text{mains}}$  for  $V_{\text{mains}} = 380\text{V to } 500\text{V}$

## 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 2<sup>nd</sup> 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 2<sup>nd</sup> 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	<b>6SE9611-1DF10-Z=C87</b>
2.2kW 400V MICROMASTER Integrated for 1LA7 4 pole motor	<b>6SE9615-8DD10-Z=C87</b>
370W 400V MICROMASTER Integrated for 1LA7 2 pole motor	<b>6SE9611-1DF10-Z=C87+M88</b>
2.2kW 400V MICROMASTER Integrated for 1LA7 2 pole motor	<b>6SE9615-8DD10-Z=C87+M88</b>
370W 400V MICROMASTER Integrated for 1LA7 4 pole motor, Class A Filter and inverter fan	<b>6SE9611-1DF50-Z=C87+M41</b>
370W 400V MICROMASTER Integrated for 1LA7 2 pole motor, Class A Filter and inverter fan	<b>6SE9611-1DF50-Z=C87+M41+M88</b>