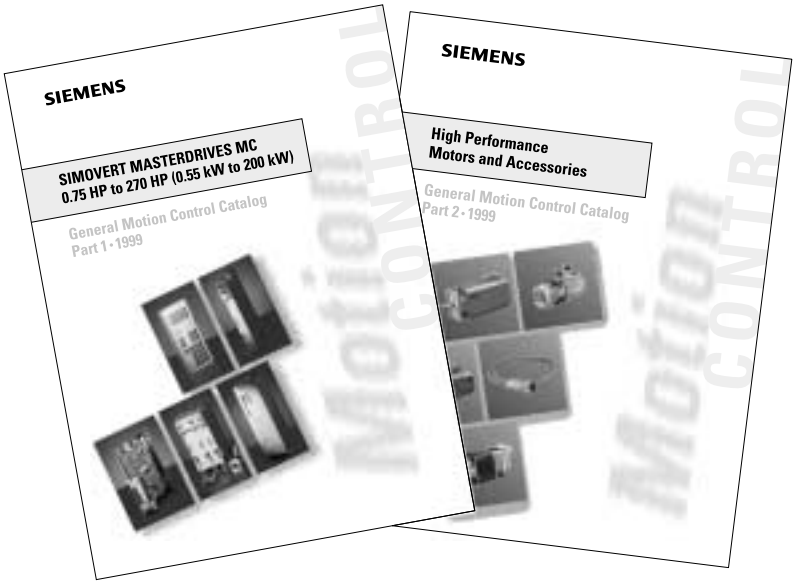
Siemens MASTERDRIVE MC Family

Siemens offers a broad range of AC drives, including the MICROMASTER, MIDIMASTER, and MASTERDRIVE families. The MASTERDRIVE family is further divided into vector control (VC) and motion control (MC). This section will focus on the MASTERDRIVE MC. These drives are specially designed for servo drive application. Drives are available from 0.55 kW to 200 kW (0.75 HP to 270 HP). Selection and ordering information, as well as engineering information and dimension drawings, can be found in Part 1 of the General Motion Control Catalog, available from your local Siemens sales representative.

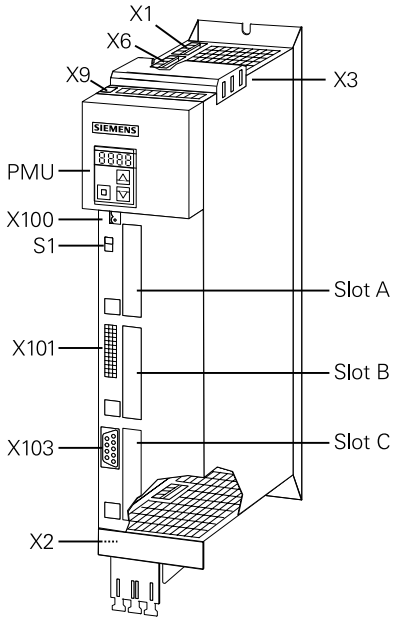


The MASTERDRIVE MC family consists of Compact PLUS, Compact, and Chassis units.

MC Drive	kW	HP
Compact PLUS	0.55 - 18.5	0.75 - 25
Compact	2.2 - 37	3 - 50
Chassis	45 - 200	60 - 270

Power Connections

The following drawing is a layout illustration of a 4 kW Compact PLUS drive. X9, X100, X101, and X103 are control terminals for user wiring. The main power supply (380 - 480 VAC) is connected to X1. A feature of the drive is the X3 DC bus link which allows for quick connection of one unit to another in multi-drive configurations. Terminals are provided on X6 for braking resistors and a precharge module. Programming is done with the PMU keypad. The servomotor is connected to X2. Three slots (slot A, B, and C) are provided for option boards.



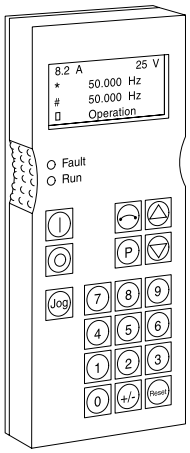
Programming and Operating Sources

Acces is gained to the MASTERDRIVE MC for programming operating parameters and motion profiles from the following sources:

Operator Control Panel (OP1S)
Parameterization Unit (PMU)
Various Serial Interfaces
PC Based Software (Simovis)

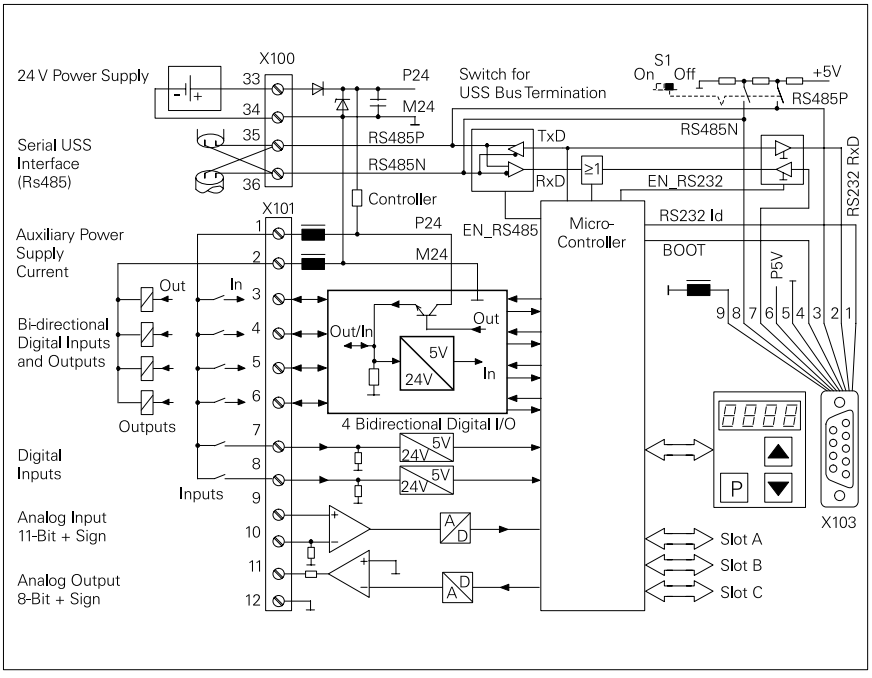
PMU and OP1S

Parameters, such as ramp times, minimum and maximum frequencies, and modes of operation are easily set. The changeover key ("P") toggles the display between a parameter number and the value of the parameter. The up and down pushbuttons scroll through parameters and are used to select a parameter value, once the "P" key sets the parameter. The OP1S has a numbered key pad for direct entry. In the event of a failure the inverter switches off and a fault code appears in the display. In addition the drive can be started, stopped, and reversed. The OP1S stores up to eight parameter sets.



Control Terminals

The following schematic illustrates the control wiring of one control board available for the Compact PLUS. The control unit (CU) is the "brains" of the drive. The control unit controls all drive functions such as start, stop, acceleration, deceleration, motor voltage and frequency, monitoring, and other functions.



24 Volt Power Supply

When the DC link is charged control voltage is supplied by an internal source. In addition, a 24 volt power supply can be connected to the drive. This enables parameterization and monitoring of the unit even when the DC link voltage has been discharged. The 24 VDC can be cascaded on AC - AC units via terminals 33 and 34 of X100. X100 also provides a connection to cascade a serial USS interface (RS485). Switch S1 is used to turn the USS interface on and off.

X101 Control Terminal

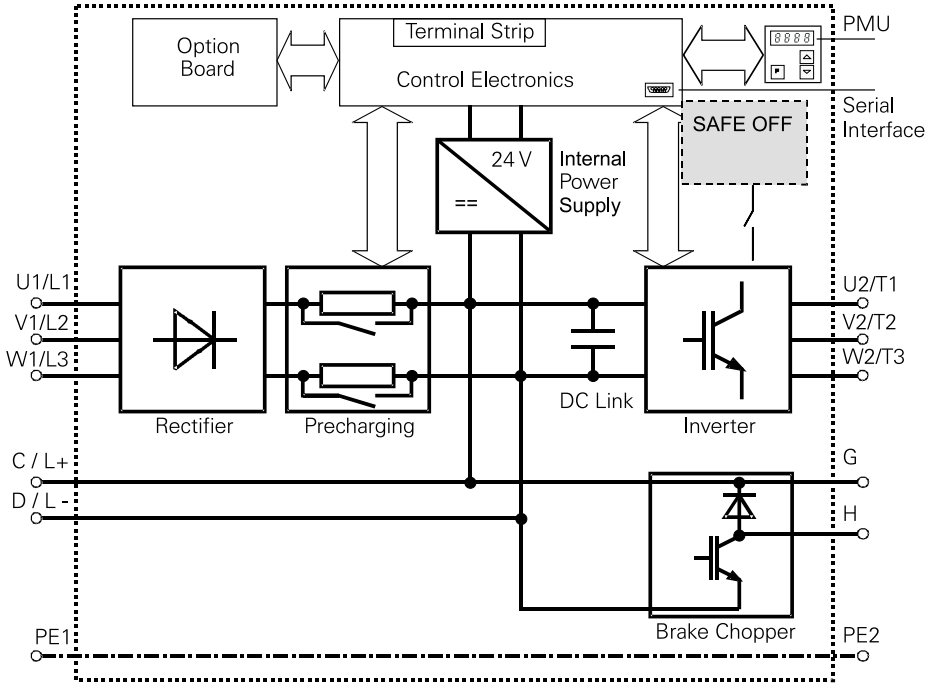
There are four bidirectional digital inputs and outputs. These can be programmed for various functions. Outputs, for example, can be programmed to signal a run or stop condition. Inputs can be programmed as start/stop commands. There are two additional digital inputs, which can be used for high speed inputs with a sampling time of 1 µs. There is one analog input and one analog output.

X103 Terminal

An OP1S, PC, or other device can be connected to X103 serial port. An internal link to the USS RS485 interface makes it possible to communicate with other devices which are connected to the serial USS interface.

SAFE OFF

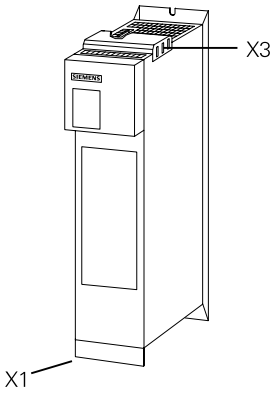
SAFE OFF is a function that prevents unintended movement or restarting of a drive after shutdown. This function is available as an option in Compact PLUS drives.



Rectifier Unit

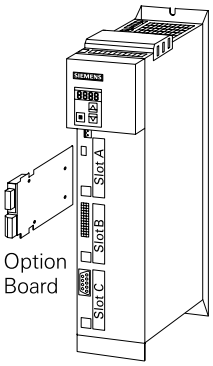
The rectifier unit can be used with one or more inverters. Rectifier units are available in 41, 120, and 230 amps. Main power is connected to X1. Rectified DC voltage (510 - 650 VDC) is supplied to connected inverters through X3. There are some advantages to using one Compact PLUS rectifier unit to supply multiple inverters:

- One drive in braking mode can regenerate energy via the DC link (X3) to supply energy to drives in motoring mode.
- Built-in braking chopper requiring only a resistor for excess regeneration.
- Less input line components. For example, main line to rectifier as opposed to individual breakers and line rectifiers to each unit



Option Boards

Up to three option boards can be installed in the Compact PLUS unit. The encoder board for the servomotor (closed-loop motion control) must be plugged into slot C. An additional encoder board for the controlled machine can be plugged into one of the other slots.



Option Boards	Slot		
	A	B	C
Encoder Boards			
SBP			■
SBR	NP	NP	■
SBM			■
Communication Boards			
CBP	■		
CBC	■		
SIMOLINK Board			
SLB		■	
Expansion Boards			
EB1			
EB2			

Preferred Slot ■
Possible Slot
Not Possible NP

Encoder Boards

The encoder board selected would depend on the encoder or resolver used with the servomotor or controlled machine. A maximum of two encoder boards can be used with the Compact PLUS.

SBP The SBP is used to connect pulse encoders to the drive. The SBP can also be used to monitor an external encoder, such as might be connected to the driven machine.

SBR1 All normally available 2, 4, and 6-pole resolvers can be connected to this option board.

SBR2 This encoder board is also used to connect a resolver. In addition, this board provides pulse-encoder simulation. This simply means that the SBR2 generates 1024 pulses per resolver pole-pair.

SBM The SBM is used for sine/cosine encoders as well as absolute value encoders.

Communication Boards

There are a number of communication boards available for use with the MASTERDRIVE MC. The CBP board is used to connect the drive over the open field bus, PROFIBUS-DP. This protocol gives the MASTERDRIVE MC connection to all of Siemens automation products for a totally integrated solution. A maximum of two communication boards can be used.

SIMOLINK Board

The SLB board is used for peer-to-peer communication with other drives via SIMOLINK. SIMOLINK is a high speed (11 mbaud) fiber optic ring bus that allows various data to be passed from one drive to the next. When used with MASTERDRIVE MC, SIMOLINK provides the media for synchronizing all MC drives on the ring. An application example of synchronized MASTERDRIVE MC drives used to control offset printing can be found in the **Applications** section of this book.

Expansion Boards

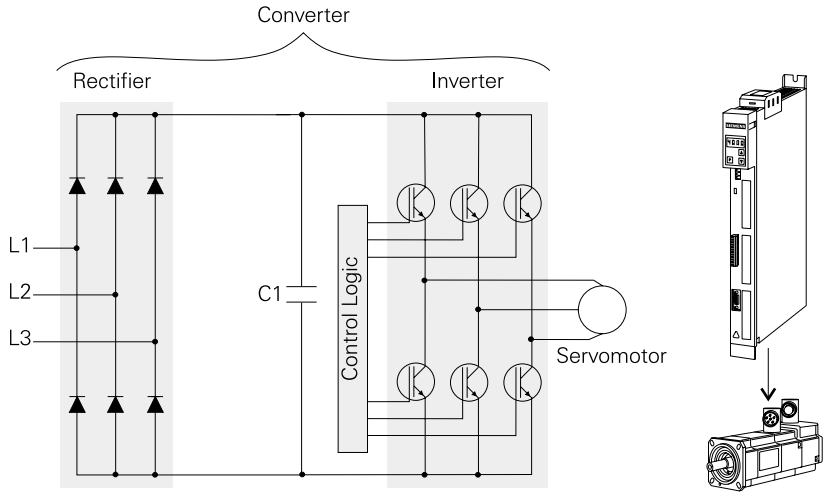
Expansion boards are used to expand the number of digital and analog inputs and outputs. The EB1 board has three digital inputs and four bidirectional digital I/O. Bidirectional I/O can be configured as a digital input or output. One of the analog inputs is used as a voltage or current reference input. Two of the analog inputs can also be configured as digital inputs.

The EB2 board has two digital inputs, one analog input, and one analog output. In addition, the EB2 has four relay contacts. Three of the contacts are normally open (NO) and one of the contacts can be configured as normally open (NO) or normally closed (NC).

I/O	EB1	EB2
Digital Inputs	3	2
Bidirectional Digital I/O	4	0
Analog Inputs	3	1
Analog Outputs	2	1
Relay Outputs	0	4
Input for 24 V Power Supply	1	1

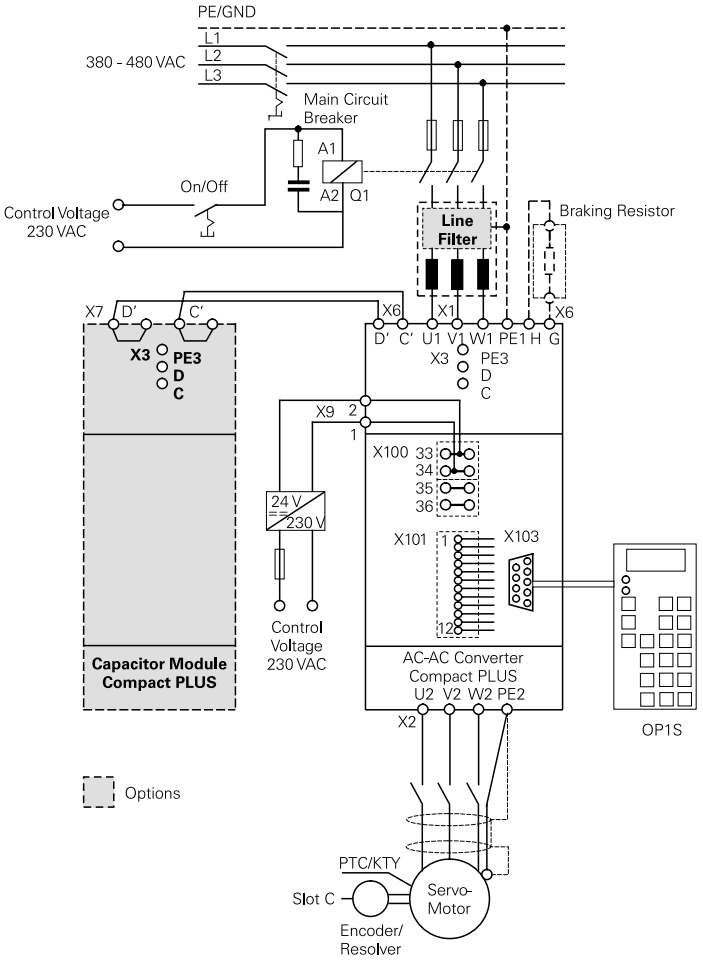
AC - AC (Converter)

The terms AC - AC and DC - AC refers to methods of configuring drives. AC - AC in the MASTERDRIVE MC family refers to a single drive, connected to an AC source, controlling an AC servomotor with an encoder or resolver.



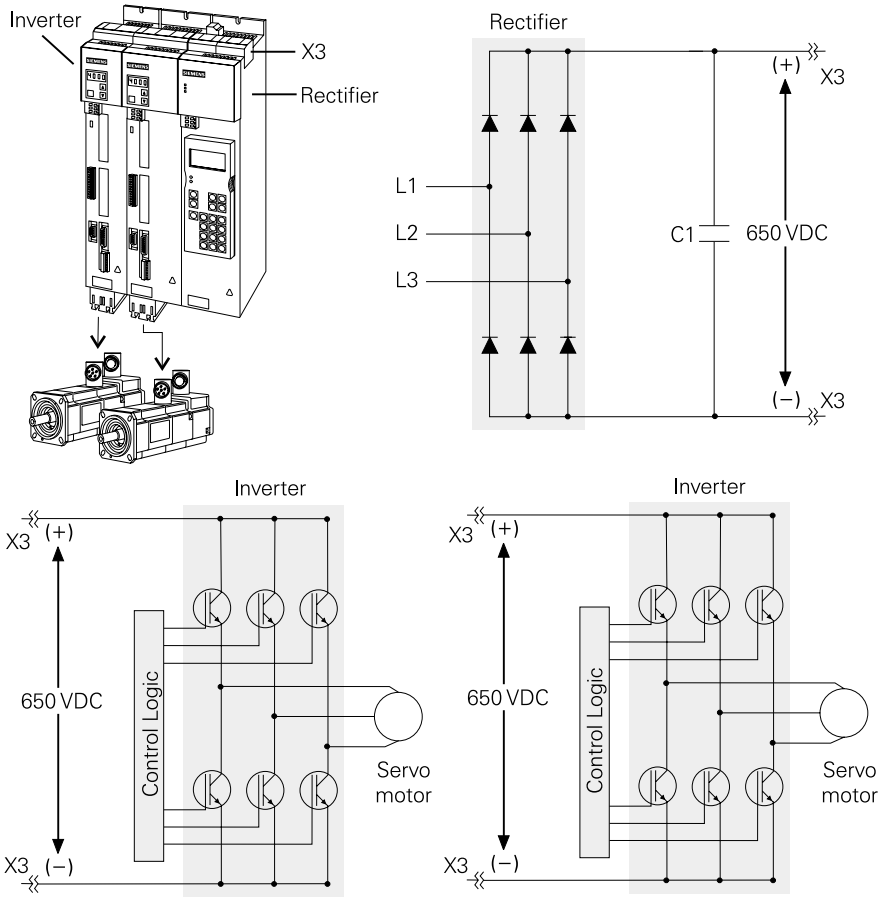
AC - AC Example

The following example shows the concept of an AC - AC configuration. Three-phase power is applied to the drive through the main circuit breaker. A line contactor (Q1) connects/disconnects the system to/from the power supply. The line contactor is controlled by an on/off switch connected to a 230 VAC power supply. The 24 volt power supply, connected to X9, is required for maintaining communication and diagnostics when the supply voltage (380 - 480 VAC) is removed. An output contactor can be used to connect/disconnect the servomotor from the drive at U2, V2, and W2. Digital inputs/outputs are configured on X101. An OP1S operator panel can be connected to X103. As an option, a capacitor module or brake resistor can be added to absorb short-time energy peaks. A line filter can be included to further reduce RFI if local codes require.



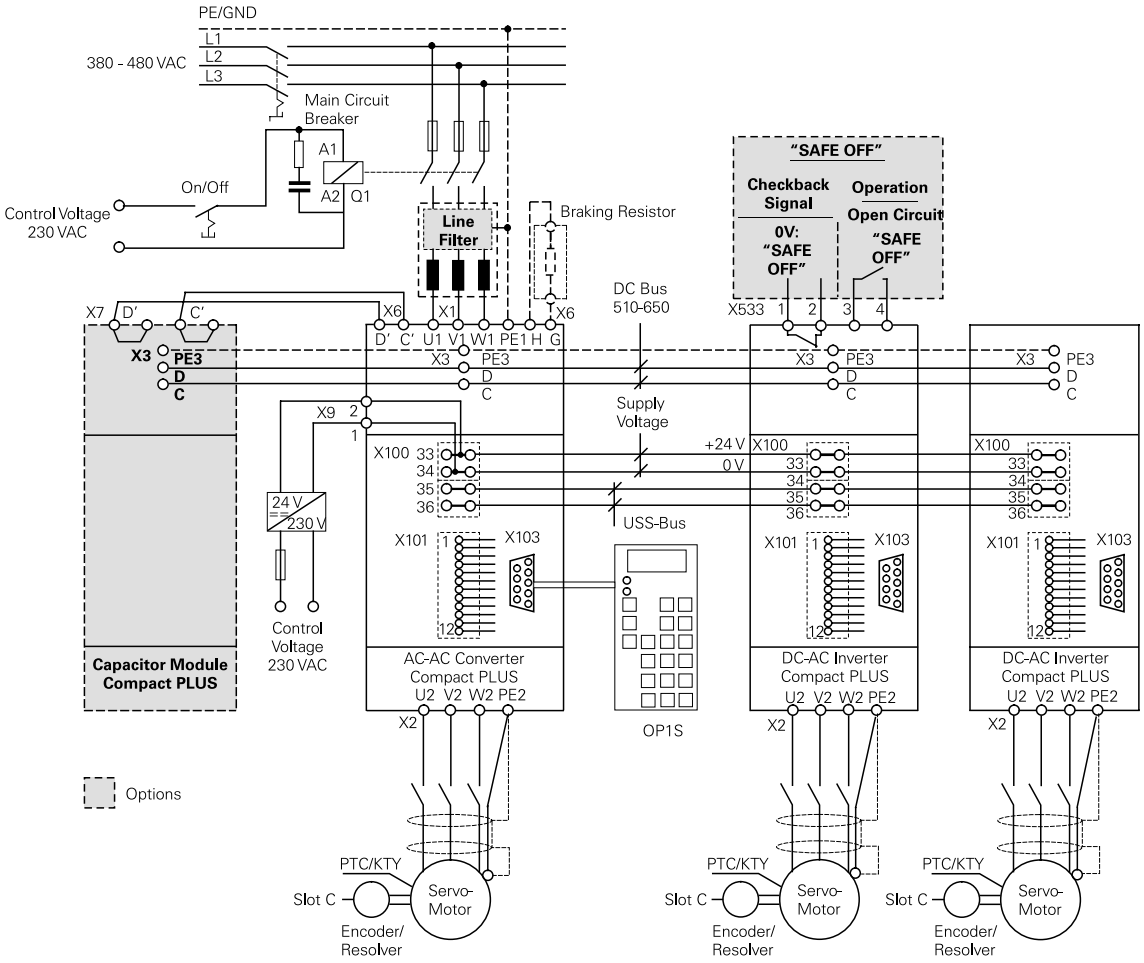
DC - AC (Inverter)

The MASTERDRIVE MC can also be configured so that one unit acts as a common DC bus (rectifier) for two or more AC inverters. In the following illustration, for example, one DC unit (rectifier) supplies DC power to two DC - AC units (inverters) through connector X3. The combined total output of the inverters must not be greater than the DC power supplied by the rectifier unit. This is referred to as a common bus arrangement. Multi-axis control is one situation where a common bus arrangement would be used. This configuration allows for multiple axes to be connected to the same DC bus for sharing energy.



Common Bus Example Using Compact PLUS

The following drawing illustrates a multi-axis, common bus setup. A single AC - AC can be used to further supply the DC bus and 24 VDC control power of up to two additional DC - AC (inverter) units. This is due to an oversized input rectifier bridge and internal power supply in the AC - AC unit. Multi-axis systems can be implemented in a compact and efficient manner. If one axis is braked, the braking energy is fed back into the DC link and made available to the other connected motors. Excess energy can further be reduced by means of an external braking resistor. In this example the “SAFE OFF” and capacitor module options have been added.

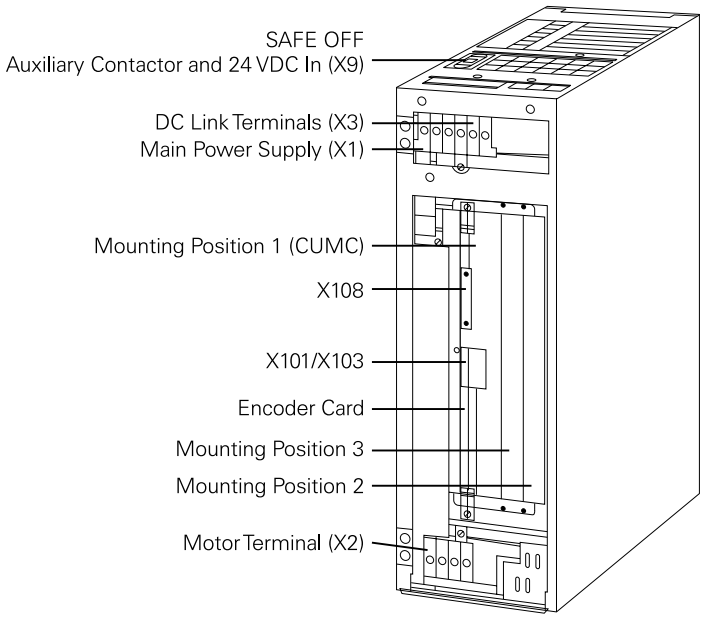


MASTERDRIVE MC Compact and Chassis

The MASTERDRIVE MC compact and chassis drives have the same features as the Compact PLUS. Drives are available as AC - AC and DC - AC. These drives can be configured for multi-axis control. Compact and chassis drives can be programmed and operated from the Operator Control Panel (OP1S), Parameterization Unit (PMU), and various serial interfaces.

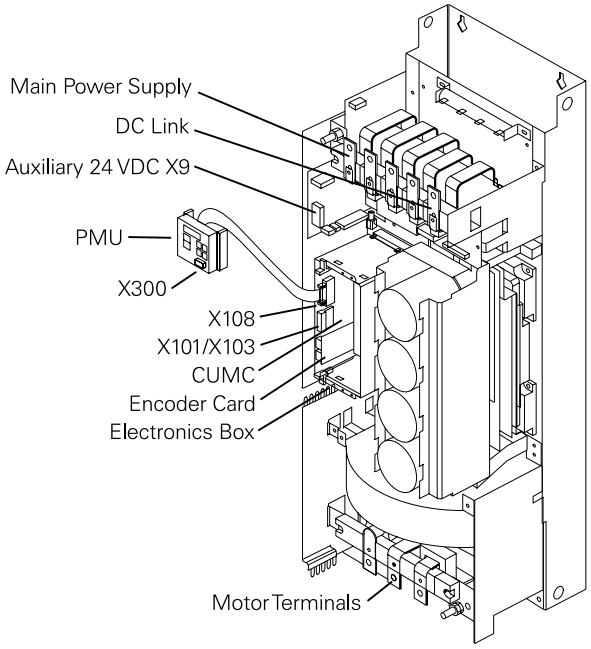
Compact Drive

The compact drive is available in four frame or enclosure sizes. The following drawing is a layout illustration of enclosure sizes A, B, and C. A larger enclosure is available for size D. The main power supply (380 - 480 VAC) is connected to X1. The DC link is available at X3. The servomotor is connected to X2.



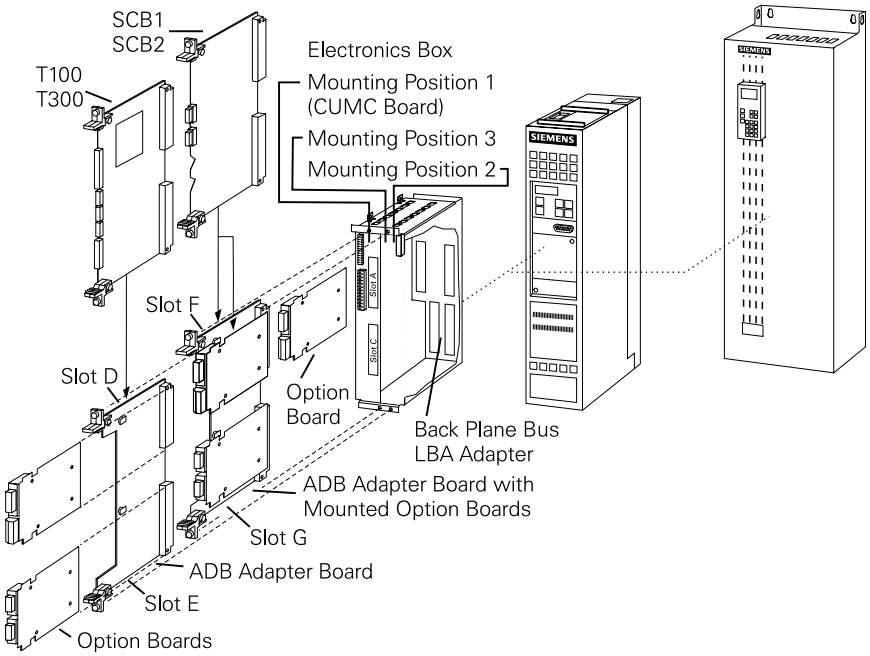
Chassis Drive

The chassis drive uses an open architecture for cabinet mounting. The following drawing illustrates enclosure sizes E and F. A similar larger enclosure is available for size G.



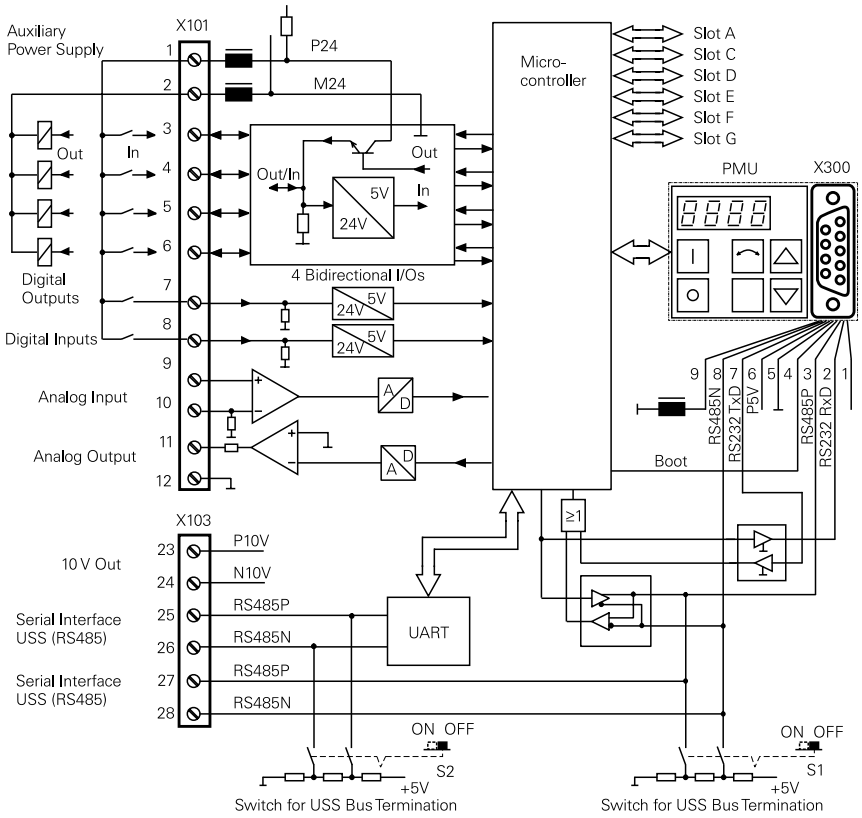
Electronics Box

The compact and chassis units have an electronics box for control and option boards. There are up to six slots available for mounting option boards in the electronics box. The slots are designated with the letters A to G. Slot B does not exist in the compact and chassis units. An LBA (Local Bus Adapter) is required if mounting positions 2 or 3 are needed. In addition, adapter boards (ADB) are necessary for Slots D and E, and F and G when utilizing the half-size option boards.



CUMC Control Board

The compact and chassis motion control drive uses the same main control board (CUMC). The CUMC board is located in the electronics box. Control wiring is the same for both drives.



X101

X101 is similar to the Compact PLUS. There are four bidirectional digital inputs and outputs. These can be programmed for various functions. Outputs, for example, can be programmed to signal a run or stop condition. Inputs can be programmed as start/stop commands. There are two additional digital inputs, one analog input, and one analog output.

X103

X103 is two USS RS485 serial interfaces, which make it possible to communicate with other connected serial devices.

X300

An OP1S or PC can be connected to X300 for programming.

Option Boards

Up to six boards can be installed in the electronics box of the compact and chassis units. The encoder board for closed-loop control must be plugged into slot C. An additional encoder board for the machine encoder can be plugged into one of the other slots. A maximum of two expansion boards, two communication boards, and two encoder boards can be used.

Option Boards	Mounting Position						Maximum No. of Components in Electronics Box
	1 CUMC CUR		3		2		
	Slots						
	A	C	F	G	D	E	
Encoder Boards							
SBP							
SBR	NP		NP	NP	NP	NP	
SBM							
Communication Boards*							
CBP			NP		NP		
SIMOLINK Board							
SLB							
Expansion Boards**							
EB1							
EB2							

Preferred Slot
Possible Slot
Not Possible NP

* Use Slot G with T100/T300
**Use Slot A or C with T100/T300

Review 6

1. The maximum kW available in a Compact unit is _____ kW.

2. The main power supply of a Compact PLUS is connected to _____ .

3. A 24 volt power supply can be cascaded on Compact PLUS AC - AC units from one drive to the next utilizing connector X _____ .

4. The preferred slot for the SBP encoder board is _____ .

5. The _____ board is used to communicate with PROFIBUS-DP.

6. A single drive, that includes a rectifier and inverter in one unit, is referred to as a _____ .

7. An _____ is required if mounting positions 2 or 3 are needed in the electronics box of a Compact or Chassis unit.