MASTER GUARD

MASTERGUARD

Uninterruptible Power Supplies

Series C

10-60kVA

UPS Catalogue

Important note!

The technical data enclosed is for general information. Please note the operating instructions and the references indicated on the products are for installation, operation and maintenance.

Product designations

All product designations used are trademarks or product names of Chloride S.p.A. or other companies.

Person to contact

MASTER GUARD

Uninterruptible Power Supply Systems

UPS Systems 10-60 kVA

Catalogue UPS • 2003

Series C

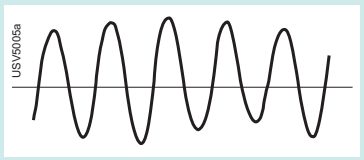
MASTERGUARD protects

However imperfect a supply may be, MASTERGUARD protects.
This uninterruptible power supply uses on-line technology, the most reliable of its kind. This enables MASTERGUARD to smooth out any irregularity in the supply, to effortlessly render any power outage harmless and give sufficient reserves to maintain the supply autonomously during any prolonged power failure.

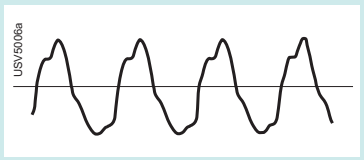
Application examples:

- DP equipment and systems
- Computer centres
- Process control systems
- Control rooms/Scada systems
- Communications systems
- ISDN systems
- Drives in continuous production processes
- Production and automation systems
- Life support systems in hospitals
- Air traffic control systems
- Safety systems in power stations
- Broadcasting studios
- Transport systems
- Personal computers
- Workstations
- Servers and networks
- and many other installations.

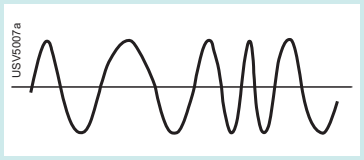
- True on-line UPS using double-conversion technology
- Vector control



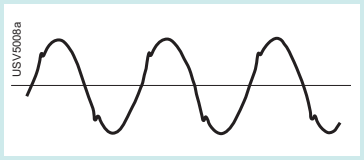
Voltage fluctuations



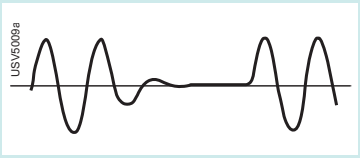
Distorted voltage curve



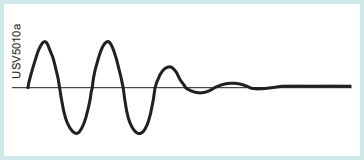
Frequency fluctuations



Superimposed interference voltage



Short black-outs

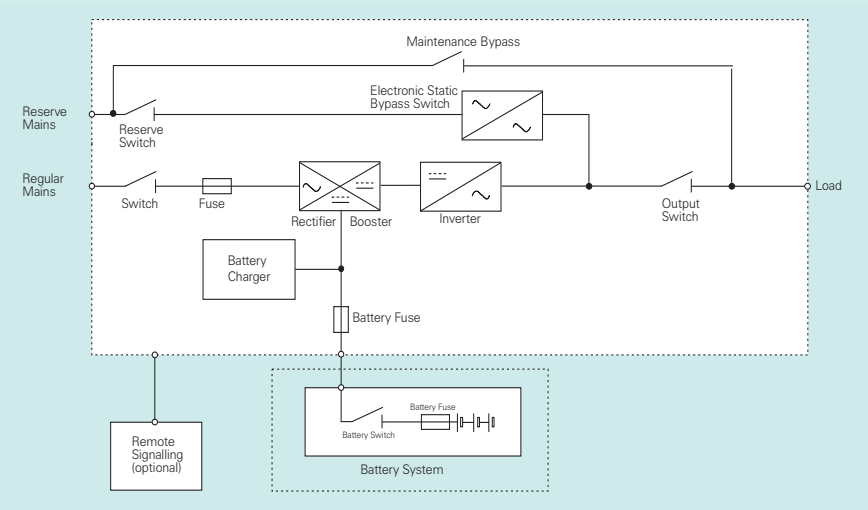


Power failure

Scope

The following specification describes a continuous duty three phase, static, IGBT Uninterruptible Power System (UPS). The UPS shall automatically provide continuity of electrical power, within defined limits and without interruption, upon failure or degradation of the commercial AC source.
The continuity of conditioned electric power shall be defined by the battery system for the autonomy time period; the battery system will be automatically recharged by the UPS upon restoration of the commercial AC source.

System description



Series C is an intelligent double conversion UPS. The systems shall operate on a DSP-based IGBT inverter. Through Vector Control technology, the performance of the inverter shall be enhanced, and shall be capable of providing reliable, high quality AC power. In order to increase system redundancy, an independent electronic static bypass shall be integrated into the UPS. By adding system components, such as parallel kits, safety and disconnecting devices, system bypass switches, as well as software and communications solutions, it shall be possible to set up elaborate systems ensuring the complete protection of the supplied loads.

The system

The UPS shall provide high quality AC power for electronic equipment loads and shall offer the following benefits:

- Increased power quality, for optimal and safe operation of loads.
- Full noise rejection, for complete load protection against upstream network disturbances.
- Full compatibility with all types of loads, including heavily non-linear ones.
- Power blackout protection in case of power outages.
- Full battery care, to preserve the useful life of the battery system.
- Transformer-less design, allowing reduced footprint and weight (galvanic isolation transformers are available as standard options).

The UPS shall automatically provide continuity of electrical power, within the defined limits and without interruption, upon failure or degradation of the commercial AC source. The length of the backup time, i.e. autonomy time in the event of network failure, shall be determined by the battery capacity.

Models Available

The Series C range shall include three phase input/output models as specified in the following table:

MODEL	Rating (kVA)
Series C/10	10
Series C/15	15
Series C/20	20
Series C/30	30
Series C/40	40
Series C/50	50
Series C/60	60

General requirements

Applied standards

Masterguard GmbH is certified by the German TÜV as a company with a quality management system according to DIN EN ISO 9001 and the environment management system ISO 14001.
Series C shall have the CE mark in accordance with the Safety and EMC Directives 73/23, 93/68 and 89/336, 92/31, 93/68. Series C is designed and manufactured in accordance with the following international standards:

- EN50091-1-1 General and safety requirements
- EN50091-2 EMC requirements
- IEC/EN62040-3 Performance and Operating requirements

Components and materials

All materials and parts contained within the UPS shall be new and in current production, and to ensure maximum reliability, they shall be used well within the parameters recommended by the supplier.

Neutral/Earth

Series C neutral output shall be electrically isolated from the UPS chassis. Series C shall not modify the neutral state. Consequently, the downstream distribution shall be of the same type as the input distribution, as long as the upstream neutral is connected to the UPS.

MASTERGUARD Series C
UPS Systems 10-60 kVA

Device description

In this section the main functional blocks of Series C and operating modes of this UPS are described.

Functional blocks

The UPS shall consist of the following major functional blocks:

- AC/DC converter. The rectifier shall be capable of delivering the necessary power to the DC bus to drive the inverter, absorbing virtually only active power from the upstream network (Power Factor Correction).
- Battery Charger. This device shall be able to completely recharge the battery bank, by delivering DC power to the batteries with a very low voltage and residual current ripple.
- Booster. This DC/DC converter will boost the rectifier/battery DC voltage, creating a split DC bus, which will allow the inverter to recreate the AC nominal voltage without the need of an output transformer.
- DC/AC converter. The IGBT transformer-less inverter shall be controlled by a Digital Signal Processor (DSP), see section "Digital Vector Control system" for details.
- Static bypass with separate input feeder. The electronic static switch on the reserve supply shall be capable of switching the load from the inverter line to the direct line, and vice-versa, with a Make Before Break (MBB) transition, either upon manual or automatic command (see section "Digital Vector Control system" for details).
- Manual maintenance bypass switch. This manual switch shall allow complete internal maintenance of the unit without interruptions to the load power supply.
- Integrated batteries into the UPS cabinet (10 - 40 kVA range) for basic autonomies.
- Matching battery cubicles for extended battery autonomies.

Microprocessor diagnostics and control

Operation and control of the UPS shall be provided through the use of microprocessor controlled logic. Indications, measurements and alarms together with battery autonomy shall be shown on a back-illuminated graphical LCD display. The procedures for start up, shut down and manual transfer of the load to bypass and return from bypass shall be described by clear step-by-step actions, reported on the user manual and assisted through the LCD display. Control of the power electronics modules will be optimised in order to provide:

- An optimum three-phase supply of the load.
- Controlled charging of the battery.
- Minimum phase effects upon the upstream supply network.

Redundancy, preventative monitoring

In order to maximise the reliability of the system, the control unit shall monitor a wide number of operating parameters of the rectifier, inverter and battery. All the important operating parameters, such as temperature, frequency and voltage stability at the system output, as well as all the load parameters and internal system values shall be continuously monitored and controlled for irregularities. The system shall react automatically prior to a critical situation for the UPS or the load, in order to ensure the supply of the load even in the most critical situations.

Remote diagnosis and control

Using an advanced remote diagnosis and control system, it shall be possible to monitor and control the UPS from a remote location such as a service centre in order to maintain the reliability of the system at nominal levels.

Digital Vector Control system

By using digital signal processors (DSP), Series C shall implement the most advanced Digital Vector Control system. Special arithmetic algorithms shall be implemented to ensure quick and flexible processing of measuring data. As a result, controlled variables shall be rapidly generated and transferred to the IGBT drivers in PWM mode (Pulse Width Modulation). Thus, real time control of inverter electronics shall be possible. This results in advantages concerning the performance of power components. Advantages involved shall include:

- Improved short circuit behaviour, since the individual phases can be quickly and individually controlled
- Synchronism or phase angle precision between UPS output and reserve supply even in the event of a distorted mains voltage.
- High flexibility and reliability in parallel operations. Furthermore, parallel blocks can be placed in different rooms.

Intelligent Double Conversion operating modes

Series C adopts Intelligent Double Conversion technology which allows UPS to operate in double conversion or digital interactive mode according to the selected priority. The UPS will operate as follows:

Double Conversion Mode

Normal

The IGBT inverter continuously supplies the load. The rectifier derives power from the mains supply and converts it into DC power for the inverter. The AC/DC rectifier corrects the load power factor to a value of >0.95 and, for the 10 - 40 kVA range, also reduces the input current total harmonic distortion (THDI) to a value of less than 8%.
The battery charger automatically maintains the battery in a fully charged and optimum operational condition.
The IGBT inverter is constantly synchronised to the direct input line, thus allowing load transfer from the inverter to the direct bypass line without any interruption in power to the load in the event of overload or inverter stop.

Overload

If the inverter stops, via operator intervention or due to an overload, the UPS automatically transfers to the direct line (if available) without interruption. When the overload ceases, return to the inverter is automatic. This enables Series C to handle the inrush current of the load without the need to over-size the UPS.
The transfer to direct line is only allowed when voltage and frequency of the mains power supply are within limits. In the event of an overload with an unsuitable mains supply, Series C prevents the transfer and the inverter continues to supply the load for a period, depending on the degree of overload. Appropriate visual and audible alarms inform the user of the particular abnormal operating condition.

Emergency

If the mains supply has failed or is outside tolerance limits, the batteries are used to power the load. The user is alerted to the battery discharge through visual and audible alarms and the battery capacity is displayed on the graphical display. It is possible to extend the autonomy remaining by turning OFF non-essential loads. The warning indicator on Series C will display battery operation.

Return to normal conditions

When the mains power supply returns within tolerance limits, Series C resumes normal operation. The battery charger automatically recharges the battery to ensure maximum autonomy in the shortest possible timeframe.

Recharge

Even if batteries are completely discharged, the rectifier/charger shall automatically restart upon restoration of the commercial AC source and shall take over the inverter after a programmable delay. This shall be a fully automatic function and shall cause no interruption to the critical load.

Digital interactive mode

If priority has been set to digital interactive mode, intelligent double conversion technology shall allow Series C to continuously monitor the condition of the input supply to ensure maximum reliability for critical users. On the basis of the analysis performed, it shall decide whether to supply the load through direct line or conditioned line.

Device description

This operational mode, which allows significant energy savings by increasing overall UPS AC/AC efficiency, is primarily intended for general purpose ICT applications. However, it does not provide the same output power quality as when the UPS is operated in Double Conversion mode. Therefore, it shall be necessary to verify whether this mode is appropriate for special applications. Digital Interactive mode shall not be available for parallel systems.

Normal

The operating mode will depend on the quality of the mains during the recent past. If the line quality has remained within permitted tolerance levels, the direct line continuously supplies the critical AC load through the static switch. Control of the IGBT inverter constantly operates and is synchronised with the direct line. In the event of any deviation from the selected input power tolerance levels, this ensures that the load can be transferred to the conditioned line without any break in supply
If the direct line failure rate has reached outside permitted parameters, Series C shall supply the load from the conditioned line.
The battery charger supplies the energy necessary to maintain the optimal charging level to the battery.

Inverter stop or overload

If the Inverter is stopped either by the operator or due to an overload, there is no transfer to the conditioned line and the load continues to be supplied by the direct line. Mains voltage and frequency values must remain within the specified tolerance limits.
In the event of an overload lasting more than the maximum specified capacity, the load is transferred to the conditioned line, which will supply it for a specific time depending on the level of overload.
In the event of an overload and an unsuitable mains supply, Series C transfers the load from the direct line to the conditioned line (assuming Series C was operating from direct line) and the inverter continues to supply the critical load for a time that depends on the degree of the overload and the UPS features. Visual and audible alarms alert the user to the problem.

Emergency (the mains supply has failed or is outside tolerance limits)

If Series C is supplying the load via direct line and the mains supply reaches outside the tolerance levels (adjustable by software), the load will be transferred from the direct line to the conditioned line. The load is powered from the mains via the rectifier and inverter, provided the input mains remains within its nominal tolerance. If the input mains is outside these limits, batteries are used to power the load via the inverter. The user is alerted to the battery discharge by visual and audible alarms and the autonomy remaining is displayed on the graphical display. At this time, it is possible to extend the autonomy remaining by turning off non-essential loads.

Return to normal conditions

When the mains supply returns within tolerance limits, Series C continues to supply the load via the conditioned line for a period of time dependant on the direct line failure rate (the conditioned line draws power from the mains not the battery). When the direct line has stabilised, Series C returns to normal operation. The battery charger automatically begins to recharge the battery. Consequently, maximum autonomy is guaranteed in the shortest possible time.

Maintenance bypass

If for any reason the UPS has to be taken out of service for maintenance or repair, the UPS shall be provided with an internal maintenance bypass switch which enables a load transfer to reserve supply with no interruption in power to the critical load. Bypass isolation shall be complete, all serviceable components such as fuses, power modules etc. shall be isolated.

Operation Without Battery

If the battery is taken out of service for maintenance, it shall be disconnected from the rectifier by means of battery switches provided in the UPS or in the external battery cabinet. During the maintenance, the UPS will continue to operate and meet the performance criteria specified, except for back-up capability.

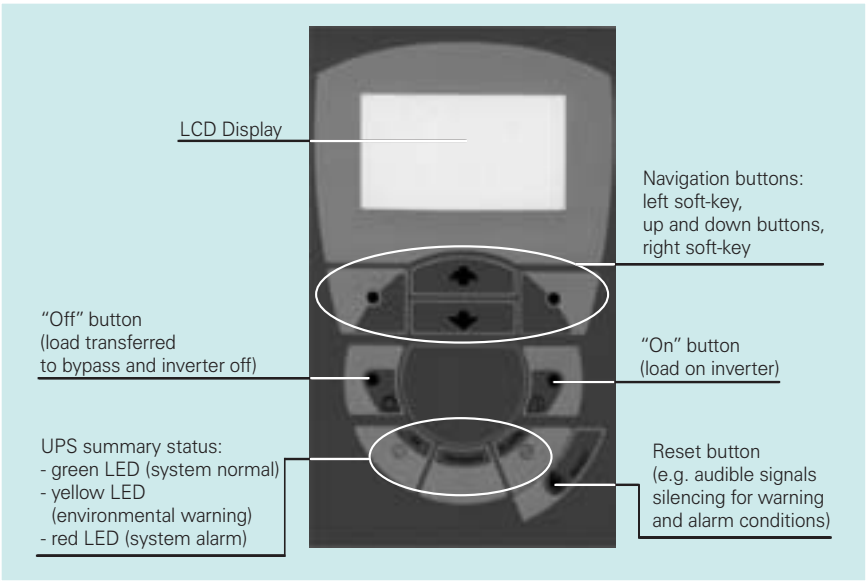
Monitoring and control interfaces

General

The UPS shall incorporate the necessary controls, instruments and indicators to allow the operator to monitor the system status and performance, as well as take any appropriate action. Furthermore interfaces shall be available, which allow extended monitoring and control, as well as service functions.

LCD display and control panel

The control panel of Series C includes a back-lit Liquid Crystal Display (LCD with 8 lines x 12 characters, which can display graphic diagrams and symbols) for complete UPS monitoring and control. Complete access to all LCD menus is possible through navigation push buttons located below the screen. This navigation group includes two buttons - "up" and "down" - for menu scrolling and two software-assigned push buttons: the function linked to these two buttons is displayed on the lower right and lower left corners of the LCD during navigation.



Default display page

The default page continuously displays a single-line diagram of the UPS. The main functional blocks and power paths of the UPS are displayed using simple universal technical symbols, making it possible to instantly understand the overall status of the UPS. On the same screen, the output load percentage measurement is permanently displayed, using three histograms (one for each output phase). In case the UPS is not in normal functioning mode, it is possible to access the "Warning and Alarm" summary page directly from the default page; warnings and alarms shall be identified by text strings and codes. In battery operation, the display shall switch between warning code and estimated backup time in minutes.

Monitoring and control interfaces

After 30 seconds of inactivity (e.g. no buttons pressed) the display reverts to the default page.

Main Menus description
Using the navigation push buttons it is possible to access the following menus:

Measurements
From this menu it is possible to access the sub-menus, which display the measured values from each UPS functional block. Below is shown a subset of the available measurements related to the input/output power ports of the UPS:

Output (for each phase)		
Voltage	Current	Frequency
Active Power	Reactive Power	Apparent Power
Input (for each phase)		
Voltage	Current	Frequency
Bypass (for each phase)		
Voltage	Current	Frequency
Battery		
Voltage	Current (recharge and discharge)	

Battery Test
From this menu it is possible to set the battery test parameters or to initiate a manually requested test. Results of the test will be shown at the end of the procedure. See also "Automatic Battery Test".

UPS Parameters settings
From this menu it is possible to modify some settings related to input/output signals and functions of the UPS.

LCD Display settings
From this menu it is possible to select languages for the messages (languages available are English, Italian, German, French, Spanish and Portuguese) and the contrast of the LCD to allow regulation for optimal user visibility.

General Information
From this menu it is possible to access general information about the UPS (e.g. firmware revision, release date etc.).

Communication interfaces

Volt-free contact ports
Volt-free contacts shall be provided by Series C conforming to the requirements of IBM AS/400 and other computer types. This interface shall be via a 9 pin D socket wired as indicated in table no. 1.

Serial interface
Series C will be equipped with two serial ports. The interface shall be a D type connector with 9 pins for serial communication. The function of each pin shall beas indicated in table no. 2.
See section "Battery Management Modules (only upon request)" for the details about connectivity applications that can be used with these ports.

E.P.O.

An Emergency Power Off (E.P.O.) contact shall be available on the unit. When this connection is open, with the inverter or static bypass supporting the load, the logic circuit will immediately power down the UPS output.

LIFE.net

In order to increase the overall reliability of the system, Series C will be compatible with LIFE.net communication kit, allowing connection to MASTERGUARD's LIFE.net monitoring service.
LIFE.net shall allow the remote monitoring of the UPS through telephone lines or GSM link in order to ensure the maximum reliability of the UPS throughout its operational life. The monitoring shall be a true 24 hour, 365 day service thanks to a unique feature that allows trained Service Engineers to remain in constant electronic contact with the service centre and therefore the UPSs. The UPS shall automatically telephone the service centre at defined intervals to provide detailed information that shall be analysed in order to predict near term problems. In addition, it shall be possible to control the UPS remotely. The transmission of UPS data to the Command Centre shall take place via the integrated modem at the following intervals:

- ROUTINE: settable between 5 minutes and 2 days (typically once a day).
- EMERGENCY: when a problems occurs or the parameters are outside the tolerance limits.
- MANUAL: following the request of the command centre.

During the call the command centre shall:

- Identify the UPS connected.
- Request the data stored in the UPS memory during the time interval since the last connection.
- Request real time information from the UPS (selectable).

The service centre shall analyse historical data and issue a regular detailed customer report informing him of the UPS operational condition and any critical conditions.
The LIFE.net centre allows the possibility to activate the option LIFE-SMS delivery system, where the customer can receive a SMS notification in case one of the following events will be activated.

- Mains power failure.
- Mains power recovered.
- Reserve line failure.
- Load supplied by reserve.

Table 1

PIN	Description	Function
1	Bypass active (normally closed)	Volt-free contact 'bypass operation'
2	Low Battery (normally closed)	Volt-free contact 'battery discharged'
3	Summary alarm (normally closed)	Volt-free contact 'summary alarm'
4	Mains failure (normally closed)	Volt-free contact 'power failure'
5	Ground	
6	Bypass active (normally open)	Volt-free contact 'bypass operation'
7	Low Battery (normally open)	Volt-free contact 'battery discharged'
8	Summary alarm (normally open)	Volt-free contact 'summary alarm'
9	Mains failure (normally open)	Volt-free contact 'power failure'

The voltage-free contacts shall be rated at 24V, 1A.

Table 2

Serial #1 (e.g. LIFE.net port); connector D type, 9 pins, male.		
PIN	Description	Function
1	Not used	
2	RXD	Receive RS232
3	TXD	Transmit RS232
4	Not used	
5	Ground RS232	Signal ground for receiving and transmitting
6	Not used	
7	Not used	
8	Not used	
9	Not used	

Serial #2 (e.g. PPVis port); connector D type, 9 pins, female.		
PIN	Description	Function
1	Ground	Shielding
2	TXD	Transmit RS232
3	RXD	Receive RS232
4	Not used	
5	Ground RS232	Signal ground for receiving and transmitting
6	Not used	
7	RTS	Transmit enable RS232
8	Not used	
9	Not used	

Battery management

Using Advanced Battery Care (ABC) Series C shall preserve the design battery life. By following environmental recommendations given by battery manufacturers, ABC shall allow to meet or exceed the declared design life. The main battery care features are described below.

Operating Parameters

When operating with maintenance free, valve regulated lead acid batteries (VRLA), the default parameters per cell shall be as follows:

End of discharge voltage (V)	1.65
Shutdown imminent alarm	Controlled by dedicated algorithm
Nominal voltage (V)	2.0
Battery discharging alarm (V)	2.20 @ 20°C
Float voltage (V)	2.27 @ 20°C
High voltage alarm (V)	2.4

Automatic Battery Test

The operating condition of the batteries shall be automatically tested by the control unit at selectable intervals, e.g. weekly, fortnightly or monthly. A short-time discharge of the battery will be made to confirm that all battery blocks and connecting elements are in good working order. In order to preclude a faulty diagnosis, the test will be launched, at the earliest, 24 hours after the last battery discharge. The battery test will be performed without any risk to the user, even if the battery is completely defective. A detected battery fault shall be alerted to the user. The battery test shall not cause any degradation in terms of expected life of the battery system. The automatic battery test parameters (e.g. activation, time interval etc.) shall be settable through the graphical LCD display (see section "LCD display and control panel"); also, it shall be possible to initiate a manual battery test using the same interface.

Ambient Temperature Compensated Battery Charger

The float voltage shall be automatically adjusted as a function of the temperature in the battery compartment (see technical tables for details) to maximise battery operating life.

Time Compensated End Of Discharge Voltage

When the discharge time becomes longer than 1 hour, the shutdown voltage shall be automatically increased, to avoid deep discharge to the battery due to a light load. The adjustment of the EOD voltage shall be controlled by a dedicated algorithm; it shall be also possible to modify the algorithm parameters using PPVis connectivity tool (see section "PPVIS surveys Monitoring Software").

Mechanical data

Enclosure

The UPS shall be housed in a space-saving modular enclosure with front doors and removable panels (protection as standard to IP 21 for 10 - 40 kVA range, IP 20 for 50 - 60 kVA). The enclosure shall be made of zintec coated sheet steel. The doors shall be lockable.

Ventilation

Forced air cooling will ensure that all the components are operated within their specification. For 50 -60 kVA range, the cooling air entry shall be in the base and the air exit at the top of the device. The enclosure shall be installed with at least 400 mm of free space between device and ceiling at the top in order to allow an unhindered cooling air exit. For 10 - 40 kVA range the cooling air entry shall be in the front panel and the air exit in the rear panel; clearance required in the rear of the unit shall be at least 100mm for ventilation reasons.

Cable entry

Cable entry shall be from the bottom or bottom-side of the cabinet. Top cable entry shall be available as standard for 50 - 60 kVA range (not valid for special versions).

Enclosure design

All the surfaces of the enclosure shall be finished with an electrostatically applied epoxy coat. The coating shall have a thickness of at least 60 microns. Standard colour of the enclosure shall be RAL 7035 (light grey).

Access to integrated subassemblies

For 50 - 60 kVA range, all internal subassemblies shall be accessible, for typical and most frequent maintenance, from the front of the unit via hinged doors. Rear access shall not be required for installation or servicing. The UPS shall be fork-liftable from the front after the removal of the bottom trim panel.
For 10 - 40 kVA range, the UPS will be movable on casters.

MASTERGUARD Series C
UPS Systems 10-60 kVA

Technical data (10 - 40 kVA range)

			10	15	20	30	40
Rectifier							
Nominal input voltage		V	400				
Input phases			3 Ph + N				
Input voltage tolerance	Full output load	%	-30/+15	-30/+15	-25/+15	-25/+15	-25/+15
	75% output load	%			-30/+15	-30/+15	-30/+15
Nominal frequency		Hz	50/60 [selectable]				
Frequency tolerance		%	±10%				
Maximum input power	Float	kVA	9.0	13.0	18.0	27.0	36.0
	Recharge	kVA	10.0	14.4	20.0	30.0	41.0
Power factor	@ nominal input voltage		> 0.95				
Input current distortion	at full load	%	< 8				
Inrush current		A	< $I_{input\ max}$				
Battery charger							
Battery nominal voltage		V	288	288	288	384	384
Output voltage	Operating at 20°C	V	327	327	327	436	436
Battery float voltage temperature compensation		V/°C %	-3 mV cell / °C				
Battery ripple current (1)		%	< 5				
Output current		A	5	5	5	5	10
Inverter							
Nominal power rating	@ 40°C	kVA	10	15	20	30	40
	@ 25°C	kVA	11	16.5	22	33	44
Nominal active power rating		kW	8	12	16	24	32
Power factor			0.8				
Overload	for 5 minutes	%	125				
	for 30 seconds	%	150				
Short-circuit current	300 % @ 50 Hz	ms	10				
	150% @ 50 Hz	s	5				
Output voltage rating		V	400 [380/415 selectable]				
Output frequency		Hz	50/60				
Static output voltage stability	for input AC voltage variations within limits and 100% load variations	%	±1				
Dynamic output voltage stability	for 100% load variations	%	Complies with IEC/EN 62040-3, Class 1 (VFI, SS, 111)				
Phase angle precision	with balanced loads	degrees	±1				
	with 100% unbalanced loads	degrees	±2				
Output frequency stability	with mains synchronism	%	±1 [2, 3, 4 selectable]				
	with internal quartz oscillator	%	0,1				
Frequency variation rate		Hz/s	<1 [0.1 to 2 selectable]				
Output voltage distortion	Linear full load		<2%				
	Non-linear full load		Complies with IEC/EN 62040-3				
Load peak factor without derating		I_{pk}/I_{RMS}	3				
Neutral conductor sized up to		$I_{out\ nominal}$	1.6				
Automatic output power upgrading with temperature	@ 25°C	%	110				
	@ 30°C	%	105				
	@ 40°C	%	100				
Static switch							
Voltage rating		V	400 [380/415 selectable]				
Nominal frequency		Hz	50/60 [auto selection]				
Frequency tolerance		%	±2 [0.2 to 6 selectable]				
Voltage tolerance		%	±10 [5 to 15 selectable]				
Maximum overload capacity	for 5 minutes	%	125				
	for 30 seconds	%	150				

Technical data (10 - 40 kVA range)

			10	15	20	30	40
Bypass SCR characteristics	I^2t @ T_{vj} = 125 °C	A^2s	18000				
	I_{TSM} @ T_{vj} = 125 °C, 10 ms	A	1900				
In-phase switching mode	bypass / inverter	ms	Make Before Break (0 ms)				
	inverter / bypass	ms					
UPS data							
Maximum input power	Float	kVA	9	13	18	27	36
	Recharge	kVA	10	14.4	20	30	41
No load dissipated power		W	300	300	300	500	600
Maximum dissipated power	Float	W	700	1050	1450	2150	2800
	Recharge	W	800	1150	1550	2250	3000
AC/AC efficiency – digital interactive mode (2)	100% of load	%	98				
AC/AC efficiency – double conversion mode (2)	100% of load	%	91				
Maximum noise level	@ 1 meter	dBA	< 50	< 50	< 50	< 52	< 52
EMC class			EN 50091-2 Class A				
Degree of protection			IP 21				
Dimensions	Height	mm	1400	1400	1400	1600	1600
	Width	mm	500	500	500	550	550
	Depth	mm	822	822	822	822	822
Weight without integrated batteries		kg	145	145	145	190	210
Frame colour		RAL scale	7035				
Cooling			Forced				
Cable entry			Bottom/Side				
Equipment mobility			On casters				
Environmental							
Temperature	Operating	°C	0 - 40				
	Max average daily (24 hrs)	°C	35				
	Maximum (8 hrs)	°C	40				
Maximum relative humidity	@ 20°C (not condensing)	%	90				
Elevation without derating (-1.2% Pn every 100 m above 1000 m up to 3000 m)		m	1000				
Battery							
Optimum battery temperature (3)		°C	20				
Power Output		kW	8.5	12.8	17	25.5	34
Recommended no. cells	VRLA		144	144	144	192	192
	Wet		144	144	144	192	192
	NiCd		225	225	225	300	300
End of discharge voltage		V	238	238	238	316	316
End of discharge current		A	36	54	72	81	108
Charging current		A	5	5	5	5	10

(1) < 0,01 C_{10} for standard battery configuration.
(2) For tolerances see IEC/EN 60146-1-1 or DIN VDE 0558.
(3) The expected battery life is defined at 20°C. For every increment of 10° above 20°C the expected life is halved.

Note: The data shown are typical and are not specifically defined; furthermore the data refer to 25°C ambient temperature and PF=1 where not specified. Not all data shown apply simultaneously and are subject to change without notice. If options described in chapter "Options" are added, data shown in "Technical data (10 - 40 kVA range)" may be affected.

MASTERGUARD Series C
UPS Systems 10-60 kVA

Technical data (50 - 60 kVA range)

			50	60
Rectifier				
Nominal input voltage		V	400	
Input phases			3 Ph + N	
Input voltage tolerance	Full output load	%	-25/+15	-25/+15
	75% output load	%	-30/+15	-30/+15
Nominal frequency		Hz	50/60 [selectable]	
Frequency tolerance		%	± 10	
Maximum input power	Float	kVA	45	54
	Recharge	kVA	50	60
Power factor	@ nominal input voltage		> 0.95	
Input current distortion	at full load	%	< 25	
Inrush current		A	< $I_{input\ max}$	
Battery charger				
Battery nominal voltage		V	396	396
Output voltage	Operating at 20°C	V	449	449
Battery float voltage temperature compensation		V/°C %	-3 mV cell / °C	
Battery ripple current (1)		%	< 5	
Output current		A	10	10
Inverter				
Nominal power rating	@ 40°C	kVA	50	60
	@ 25°C	kVA	55	66
Nominal active power rating		kW	40	48
Power factor			0.8	
Overload	for 5 minutes	%	125	
	for 30 seconds	%	150	
Short-circuit current	300 % @ 50 Hz	ms	10	
	150% @ 50 Hz	s	5	
Output voltage rating		V	400 [380/415 selectable]	
Output frequency		Hz	50/60	
Static output voltage stability	for input AC voltage variations within limits and 100% load variations	%	±1	
Dynamic output voltage stability	for 100% load variations	%	Complies with IEC/EN 62040-3, Class 1 (VFI, SS, 111)	
Phase angle precision	with balanced loads	degrees	±1	
	with 100% unbalanced loads	degrees	±2	
Output frequency stability	with mains synchronism	%	±1 [2, 3, 4 selectable]	
	with internal quartz oscillator	%	0.1	
Frequency variation rate		Hz/s	<1 [0.1 to 2 selectable]	
Output voltage distortion	Linear full load		<2%	
	Non-linear full load		Complies with IEC/EN 62040-3	
Load peak factor without derating		I_{pk}/I_{RMS}	3	
Neutral conductor sized up to		$I_{out\ nominal}$	1.6	
Automatic output power upgrading with temperature	@ 25°C	%	110	
	@ 30°C	%	105	
	@ 30°C	%	100	
Static switch				
Voltage rating		V	400 [380/415 selectable]	
Nominal frequency		Hz	50/60 [auto selection]	
Frequency tolerance		%	±2 [0.2 to 6 selectable]	
Voltage tolerance		V	±10 [5 to 15 selectable]	
Maximum overload capacity	for 5 minutes	%	125	
	for 30 seconds	%	150	

Technical data (50 - 60 kVA range)

			50	60
Bypass SCR characteristics	I^2t @ T_{vj} = 125 °C	A^2s	80000	
	I_{TSM} @ T_{vj} = 125 °C, 10 ms	A	4000	
In-phase switching mode	bypass / inverter	ms	Make Before Break (0 ms)	
	inverter / bypass	ms		
UPS data				
Maximum input power	Float	kVA	45	54
	Recharge	kVA	50	60
No load dissipated power		W	800	800
Maximum dissipated power	Float	W	3200	3850
	Recharge	W	3550	4200
AC/AC efficiency – digital interactive mode (2)	100% of load	%	98	
AC/AC efficiency – double conversion mode (2)	100% of load	%	92	92
Maximum noise level	@ 1 meter	dBA	< 55	< 55
EMC class			EN 50091-2 Class RS	
Degree of protection			IP 20	
Dimensions	Height	mm	1780	1780
	Width	mm	620	620
	Depth	mm	835	835
Weight		kg	260	260
Frame colour		RAL scale	7035	
Cooling			Forced	
Cable entry			Bottom / Front / Top	
Required service access			Front / Top	
Environmental				
Temperature	Operating	°C	0 - 40	
	Max average daily (24 hrs)	°C	35	
	Maximum (8 hrs)	°C	40	
Maximum relative humidity	@ 20°C (not condensing)	%	90	
Elevation without derating (-1.2% Pn every 100 m above 1000 m up to 3000 m)		m	1000	
Battery				
Optimum battery temperature (3)		°C	20	
Power Output		kW	42.5	51
Recommended no. cells	VRLA		198	198
	Wet		198	198
	NiCd		310	310
End of discharge voltage		V	327	327
End of discharge current		A	130	156
Charging current		A	10	10

(1) < 0,01 C_{10} for standard battery configuration.
(2) For tolerances see IEC/EN 60146-1-1 or DIN VDE 0558.
(3) The expected battery life is defined at 20°C. For every increment of 10° above 20°C the expected life is halved.

Note: The data shown are typical and are not specifically defined; furthermore the data refer to 25°C ambient temperature and PF=1 where not specified. Not all data shown apply simultaneously and are subject to change without notice. If options described in chapter "Options" are added, data shown in "Technical data (50 - 60 kVA range)" may be affected.

MASTERGUARD Series C
UPS Systems 10-60 kVA

Options

Remote alarm unit

A remote alarm panel shall be available for the display of individual important messages of the UPS. Upon request, it shall be possible to connect up to 4 UPS systems to one alarm unit. The length of the connecting cable must not exceed 300 m.

Backfeed protection (only upon request)

In the event of failure of the reserve static switch SCR, this option shall prevent any potential risk from electric shock on the UPS input AC terminals. The option shall include a contact which activates an external switching device such as an electromechanical relay. The external switching device shall be included in the option only upon specific request.

Extended battery charger

It shall be possible to increase the UPS battery recharging capacity by adding additional battery chargers to the standard one. These additional boards shall be housed inside the UPS cabinet.

Battery Management Modules (only upon request)

With measuring modules connected to the battery blocks, enhanced battery management shall be possible offering the following features:

- Measuring of the condition of each individual battery block by means of separate battery measuring modules (BMM).
- Analysis of each battery block through measuring of the minimum and maximum voltage values.

External isolation transformer

This option shall be a double wound transformer housed in a matching cubicle. Upon specific requirement, the transformer shall be provided with an electrostatic screen and/or with low inrush current. The option shall be used to isolate the UPS output from the load or the rectifier/reserve input from the mains AC input.

Dust filters

The option shall improve the protection degree of the air entrance from IP21 (IP20) to IP30 (IP31) for specific applications such as dusty environments. The filter shall be housed in the UPS cubicle (IP20/IP21).

Input low THDi option (50 - 60 kVA only)

Series C features active input harmonic reduction as standard in the 10 - 40 kVA range. For 50 - 60 kVA UPS, a low input current distortion option shall be available, which shall reduce the THDi to less than 10%, without significantly affecting AC/AC efficiency. The option will be housed inside the UPS cubicle.

Empty battery cubicle

Matching empty battery cubicles shall be available and shall include the following:

- Cubicle.
- Disconnecting device.
- Fuses.
- Safety screen.
- Power terminal block.

Three cubicle sizes shall be available:

	Width (mm)	Depth (mm)	Height (mm)	Weight (kg)
Type A	820	830	1780	220
Type A1	550	800	1600	100
Type A2	500	800	1400	90

Empty options cubicle

A matching cubicle shall be available for customised applications such as:

- Input/Output voltage matching transformers.
- Customised distribution boards.
- Customised applications.

There shall be three sizes to choose from:

	Width (mm)	Depth (mm)	Height (mm)	Weight (kg)
Type A	820	830	1780	180
Type A1	550	800	1600	85
Type A2	500	800	1400	70

Telephone switch for LIFE.net

The installation of this telephone switch for LIFE.net shall allow the customer to use a telephone line normally used for other purposes (fax or telephone).

MopUPS Shutdown and monitoring software

The main function of the MopUPS software shall be the safe shutdown of the operating system in the event of a power failure. Other functions include:

1. Automatic actions for events-email, messages, etc.
2. Recording of event log and status information on files.
3. Viewing and monitoring of UPS in real time.
4. Programmed system shutdown.
5. Remote monitoring of UPS connected to network server using Named Pipes or TCP/IP.

ManageUPS adapter

This option shall include a complete package (including hardware adapter, slot-in for 10 - 40 kVA range) to ensure monitoring and control of the networked UPS through TCP/IP protocol.
The adapter permits:

- UPS monitoring from an NMS via SNMP.
- UPS monitoring from PC via Web Browser.
- Sending of e-mail messages on occurrence of events.

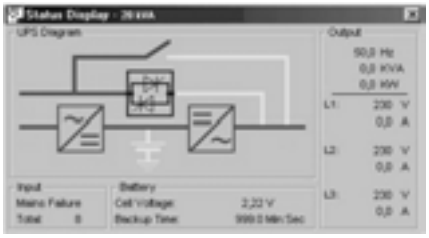
ManageUPS, in conjunction with MopUPS, shall also permit safe shutdown of the operating systems.

Options

PPVIS surveys Monitoring Software

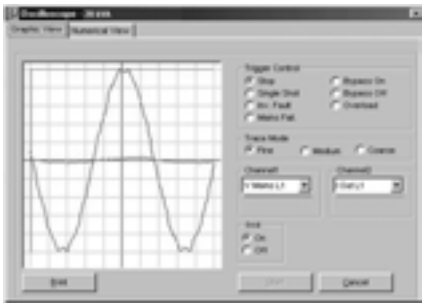
The survey images displayed below supply the user with essential information on the connected UPS:

State indication - power flux survey



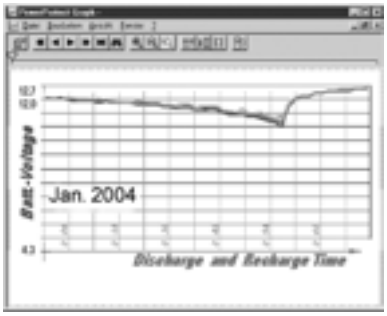
- Current state of components (UPS).
- Display of output voltage, UPS performance and load currents.
- Number of power failures.
- Battery cell voltage.
- Available backup time.

The oscilloscope - measuring of network or load conditions



- Dual-carrier measuring of the curves of input or output voltages or currents.
- Flexible definable trigger conditions capable of being coupled onto the most different events, as e.g. when a mains failure occurs.

Battery display - Recognizing of parasitic effects in the early stages (for single blocks monitoring, BMM option is needed, see "Battery Management Modules (only upon request)".



- Measuring of the condition of each individual battery block by means of separate battery measuring modules (BMM).
- Through mouse click: Analysis of each battery block with measuring of the minimum and maximum voltage values.

Connectivity tables

The following table shows the connectivity solutions which can be used on Series C. For further details, please refer to the Connectivity Solutions specifications.

Single Connectivity Solutions Table for Series C	
ManageUPS	Internal slot-in card(*) or external (box) network adapter (uses one serial port)
MopUPS	Standard serial port (both can be used)
PPVis	Serial Port #1 and #2 can be used
LIFE.net	Only Serial Port #1 can be used

Simultaneous (up to 2) Connectivity Solutions Table for Series C			
Use the two different serial ports and/or the internal slot cards(*)			
	ManageUPS	MopUPS	LIFE.net
ManageUPS	Yes	Yes	Yes
MopUPS	Yes	Yes	Yes
LIFE.net	Yes	Yes	No
PPVis	Yes	Yes	Yes

(*) Only for 10 – 40 kVA range

MASTERGUARD Series C
UPS Systems 10-60 kVA

Parallel Configuration

Series C uninterruptible power systems shall have the capability to be connected in parallel for multi module configurations between units of the same rating. The maximum number of UPS in modular parallel configuration shall be 8. The load sharing shall be equal between the individual UPS systems, at any output load percentage.

The parallel connection of UPS shall increase redundancy (for reliability) and power.

Redundancy. If the installation requires more than one unit in redundant configuration, the power of each UPS should not be lower than Ptot/(N-1) where:

Ptot = Total load power
N = Number of UPS units in parallel
1 = Minimum coefficient of redundancy

Under normal operating conditions, the power delivered to the load shall be shared between the number of UPS units connected to the parallel bus. In case of an overload the configuration is able to deliver Pov x N without transferring the load onto the reserve, where:

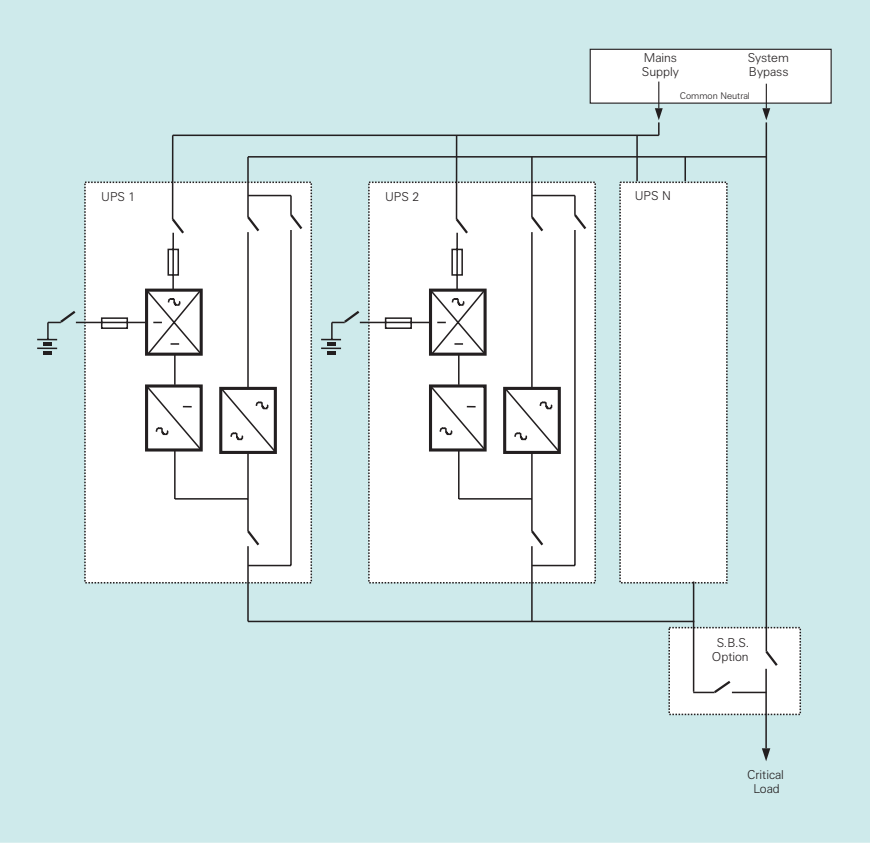
Pov = Max overload power of a single UPS
N = Number of UPS units in parallel

In the event of a failure of one of the UPS units, the faulty unit shall be disconnected from the parallel bus and the load shall be supplied from the remaining units without any break in supply continuity.

Power. It shall be possible to increase the power of the system using a non-redundant parallel configuration (redundancy coefficient = 0). In this case, all connected UPS units shall deliver the rated power, and in the event of a unit failure or overload the system shall transfer the load to reserve.

Modular parallel operations

The UPS systems of the Series C shall be capable of operating in parallel modular configuration. For this purpose, UPS systems of the same rating shall be connected in parallel to form multi module configurations.
The parallel connection of UPS shall improve reliability or the total output power or both. When Series C is supplied with the parallel kit option, up to 8 equal UPS units can be operated in parallel for power upgrade or increase of redundancy. This option can also be added on at a later date in the field. It shall consist of one subassembly POB (Parallel Operation Board) and 25 pole, screened data lines to the neighbouring UPS modules. A multi module system shall be controlled and monitored automatically by controlling the individual UPS systems (distributed control system). The communication bus which connect the paralleled units shall be arranged as a loop, allowing proper parallel operations even in the case of a single interruption occurring to this bus (first-failure proof bus). The reserve lines and inverters included in each UPS share the load, at any load percentage.
See figure below for details about the power connections.



System bypass switches
A system bypass switch shall be available as an option for the modular parallel configuration. This shall include two power disconnect switches. The ratings available shall be:

	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
160 A	1400	440	840	190
400 A	1780	620	858	300

Special Versions

Series C can be customised to achieve full galvanic isolation and voltage adaptation for specific load requirements.
The following versions are available upon order:

T-version

Series C-T includes an internal isolation transformer on the input. This transformer is installed in the place of batteries and allows full galvanic isolation between the load and the input mains utility. Technical data will change accordingly to the following table.

DESCRIPTION			UPS power rating						
		kVA	10	15	20	30	40	50	60
Electrical data									
INPUT	Voltage	Vrms	400V, 3Ø (+N), + 15%, (-30% with derating)						
	Current (single phase)	Arms	15	22	29	42	68	85	100
	Frequency	Hz	50/60 Hz auto selection						
OUTPUT	Power rating	kVA	10	15	20	30	40	50	60
		kW	8	12	16	24	32	40	48
	Voltage	Vrms	380, 400, 415V, 3Ø+N						
	Current @ 400 Vrms	Arms	14	22	29	43	58	72	87
	Frequency	Hz	50/60 Hz auto selection						
	Wave form	-	sinusoidal						
Max dissipation (@ nominal load and battery in recharge)		W	970	1400	1860	2750	4173	5220	6300
Mechanical data									
Depth		mm	822					835	
Width		mm	500			550		620	
Height		mm	1400			1600		1780	
Weight (without batteries)		kg	280			380	460	560	
Max. noise level (@ 1m)		dBA	<55			<58		<58	

A further variation of T version, intended for electrically harsh environments, is also available. This version, called Series C-R, features TVSS (Transient Voltage Surge Suppressors) connected in parallel to the input transformer primary winding; these devices are housed within the UPS cubicle. For further information about the improved immunity grade of Series C-R to voltage surges, please contact MASTERGUARD Support.

LAM-version

Series C-LAM includes two internal transformers for isolation and voltage adaptation from 400V to 208/220V phase to phase. These transformers are installed in place of batteries: the one on the input (isolation transformer) allows full galvanic isolation and voltage adaptation (208/220 primary side, 400V secondary side), the one on the output (auto-transformer) allows voltage adaptation (400V primary side, 208/220V secondary side). Technical data will change accordingly to the following table.

DESCRIPTION			UPS power rating						
		kVA	10	15	20	30	40	50	60
Electrical data									
INPUT	Voltage	Vrms	208/220V, 3Ø (+N), + 15%, (-30% with derating)						
	Current (single phase)	Arms	33	50	66	99	132	165	198
	Frequency	Hz	60 Hz						
OUTPUT	Power rating	kVA	10	15	20	30	40	50	60
		kW	8	12	16	24	32	40	48
	Voltage	Vrms	208/220V, 3Ø+N						
	Current @ 208 Vrms	Arms	28	42	56	84	111	139	167
	Frequency	Hz	60 Hz						
	Wave form	-	sinusoidal						
Max dissipation (@ nominal load and battery in recharge)		W	1170	1716	2262	3353	4977	6220	7450
Mechanical data									
Depth		mm	822					835	
Width		mm	500			550		620	
Height		mm	1400			1600		1780	
Weight (without batteries)		kg	350			470	583	720	
Max. noise level (@ 1m)		dBA	<55			<58		<58	

MASTERGUARD Series C
Selection and Ordering Data

UPS units 10 to 60 kVA

Version			Order No. extension	Order No.
				6 S U 6 2 - □□ - □□□□□ - □□ A 0 (0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15)
Basic version:	Type:	Rating:		
UPS, I/O: 3/3-ph, 380/400/415 V, 50/60 Hz[1]	SU 62 10 SU 62 15 SU 62 20 SU 62 30 SU 62 40 SU 62 50 SU 62 60	10 kVA 15 kVA 20 kVA 30 kVA 40 kVA 50 kVA 60 kVA	10 15 20 30 40 50 60	
Variations:	Versions	Standard T Version LAM Version R Version	1 4 7 8	
	Battery Config. (only internal)	No Battery Integrated With Battery Integrated (only 10-40 kVA, 5Y)	A B	
	Paralell	Single Parallel	A B	
	EMI Class	Standard CLASS B	0 4	
	Input THD	Standard THD < 10% only for 50/60 kVA	0 5	
	Input/Dust Filter	Standard IP 30 (IP 31 for 10-40 kVA)	0 5	
	Extended Battery Charger	Standard + 1 extension + 2 extension	A B C	
				0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 6 S U 6 2 - □□ - □□□□□ - □□ A 0

1) Standard factory settings shown in bold; deviations must be specifically ordered

Integrated options cross-check compatibility table

Version	T Version	LAM Version	R Version	Parallel kit	EMI Class B additional filters	Additional input THDi filter(*)	Extra IP (IP31/ IP30	First additional battery charger	Second additional battery charger	Top cable entry(*)
Integrated batteries (10-40 kVA only)	**No**	**No**	**No**	**Yes**	**Yes**	**N.A.**	**Yes**	**Yes**	**No**	**N.A.**
T Version		**N.A.**	**N.A.**	**Yes**	**Yes**	**No**	**Yes**	**Yes**	**No**	**No**
LAM Version			**N.A.**	**Yes**	**No**	**No**	**Yes**	**Yes**	**No**	**No**
R Version				**Yes**	**No**	**No**	**Yes**	**Yes**	**No**	**No**
Parallel kit					**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
EMI Class B additional filters						**No**	**Yes**	**Yes**	**Yes**	**No**
Additional input THDi filter (50-60 kVA)							**Yes**	**No**	**No**	**No**
Extra IP (IP31/IP30)								**Yes**	**Yes**	**Yes**
First additional battery charger									**Yes**	**Yes**
Second additional battery charger										**No**

(*) Only for 50 – 60 kVA range

Accessories

Description	Order No.
Parallel kit	6SU56 72-0AA00-0AA0
MopUPS	-
SNMP-adapter, external SNMP-adapter, slot card	6SU59 31-0CB02 6SU59 31-0CB22
LIFE.net kit	-
RAU	6SU56 73-1AB00-0AA0
SBS 400A (1780 mm height) 160A (1400 mm height)	 6SU56 33-0FC00-0AF0 6SU56 33-0DC00-0AF0
Empty Battery Cabinets 1400 mm height 1600 mm height 1780 mm height	 6SU66 61-0CA00-0AA0 6SU66 61-0EA00-0AA0 6SU66 61-0GA00-0AA0

Quality and environmental management

Quality management

The quality management system for development, manufacturing, sales and service is certified in accordance with DIN EN ISO 9001.

The quality targets of Masterguard GmbH impose a high level of customer and process orientation.
Product quality is complemented by quality of logistics and service.

Environmental management

The environmental management system for development, manufacturing, sales and service is certified in accordance with DIN EN ISO 14 001.

Masterguard GmbH has thus committed itself to operational and product related environmental protection.

In accepting a positive approach to the environment, our suppliers are included as an important link in the resource-sparing production chain.

Environmental protection

High quality, modern product design, advanced production techniques and efficient management of resources result in an optimum use of raw materials and maximum reliability.

For example, the use of the latest technology minimises power losses. Materials selected for environmental compatibility improve both useful life and suitability for recycling. Unique solutions, such as battery management, increase product life and reduce maintenance costs.

Standards in the field of uninterruptible power supplies

DIN EN ISO 9001	Quality management system
DIN EN ISO 14 001	Environmental management
DIN IEC 721	Climatic classes
DIN VDE 0100	Regulations on the construction of heavy current systems with nominal votages up to 1000 V
DIN VDE 0106	Protection against electrical shock, classification of electrical and electronic equipment
DIN VDE 0510	Accumulators and battery systems
DIN VDE 0532	Transformers and chokes
DIN VDE 0558	Semiconductor rectifiers and inverters and their use, e.g. uninterruptible power supply systems (UPS)
DIN 40 040	Class of use and reliability information for communications and electronic components
DIN 41 772	Rectifiers, semiconductor rectifiers
DIN 45 635	Noise measurement on machines
DIN 54 840	Marking of plastic parts
DIN 57 636, part 21	Selectivity of fuses
EN 50 091	UPS product standard
EN 55 022	Interference suppression in electrical equipment and systems
EN 60 529	IP protection types
EN 60 950	Safety
EN 61 000-4	Electrical interference immunity
SN 36 350-2	Environmental requirements
VDI 2243	Design of technical products for recycling

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