



# Master VDC

## **FLYWHEEL SOLUTIONS**

## 3:3 100-600 kVA







Flywheel compatible

ONLINE



service

Service

1st start

SmartGrid ready

## HIGHLIGHTS

#### **CLEAN ENERGY**

An eco-friendly, battery-free uninterruptible power system.

#### HIGH EFFICIENCY INNOVATIVE TECHNOLOGY

Modular expansion options for more power and runtime.

#### LONG OPERATING LIFE

20 year design life for the flywheel component compared with 7 years for a typical battery.

#### LOW MAINTENANCE COSTS

Easy to install and maintain.

Master VDC is a scaleable system comprised of one or more UPS units and VDC-XE/ VDC-XXE flywheels. Master VDC is ideal for modern ECO targeted data centres looking to achieve the lowest possible PUE ratios and highest levels of reliability. Master VDC UPS provide a number of advantages over more traditional batteryequipped systems including: up to 99% efficiency, a compact footprint (up to 50% reduction), lower Total Cost of Ownership (TCO) and almost instantaneous recharge times. A single flywheel module provides sufficient runtime for the start-up of a local standby generator to power the UPS, which then provides a continuous quality power supply. The entire system can be scaled for reliable power (N+x) and increased runtime via the parallel operation of several UPS and/or flywheel modules (and a small battery pack if required, for additional reliability). In a standard configuration (1 x UPS and 1 x flywheel), the runtime available

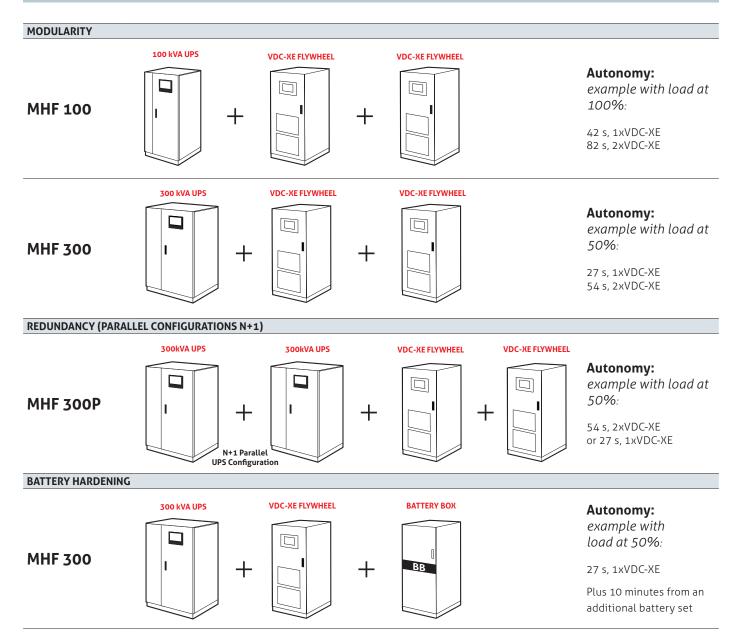
is more than sufficient to allow the UPS to ride through short breaks in mains power.

#### Flywheel VDC-XE/VDC-XXE

Thanks to their extremely high levels of reliability, the VDC series of flywheel energy storage systems provide UPS with a secure and reliable source of power that forms the first line of defence against interruptions to the mains power supply; a fundamental defence for all mission critical applications. The VDC flywheel systems are fully independent standalone devices. They are designed for applications such as data centres, hospitals and industrial installations. They provide a clean source of back up power by converting the kinetic energy stored within a rotating mass into electrical power using a built-in IGBT-based converter.

VDC series flywheels store kinetic energy in the form of a rotating mass (spinning at 36000 RPM) within a vacuum-sealed

## MASTER VDC CONFIGURATION EXAMPLES



container. The VDC build technology includes a rotor made from aerospace-grade steel, a high speed permanent magnet motor/generator and contact-free magnetic bearings that levitate and sustain the rotor during operation with no mechanical friction. These technical features allow VDC models to achieve very high levels of efficiency.



Rotor

Integral with hub

Configuration

Vertical for optimum efficiency

Magnetic Levitation

Fully active, levitates

the rotating components

## MASTER VDC: UPS MODULE SPECIFICATIONS

INPUT         State         State         State           Nominal voltage         380 - 400 - 415 Vac three-phase         -	MODELS	MHF 100	MHF 120	MHF 160	MHF 200	MHF 250	MHF 300	MHF 400	MHF 500	MHF 600	
frequency         45 - 65 Hz           Power factor         > 0.99           Harmonic current distortion         39,87 HDi           Soft Start         0 - 100% in 120° (selectable)           Frequency tolerance         ± 2% (selectable) from ± 1% to ± 5% from front panel)           Standard equipment provided         Back Feed protection, separable bypass line           BATTERIES         7           Type         Flywheels           Recharge voltage compensation         -0.5 Vx°C           OUTPUT         700           Nominal power (IVA)         100         120         160         200         250         300         450         540           Number of phases         380 - 400 - 415 Vac three-phase + N         540         540         540           Number of phases         380 - 400 - 415 Vac three-phase + N         541 stability         ± 1%         540           Voltage distortion         < 1% with linear load / 53% with non-linear load											
Power factor         > 0.99           Harmonic current distortion         <3%6 THDi	Nominal voltage		380 - 400 - 415 Vac three-phase								
Harmonic current distortion         <396 Th0i           Soft start         0 - 100% in 120" (selectable)           Frequency tolerance         ± 2% (selectable from 1 % to ± 5% from front panel)           Standard equipment provided         Back Feed protection; separable bypass line           BATTERIES         2ero           Recharge voltage compensation         -0.5 Vx°C           OUTPUT         -0.5 Vx°C           Nominal power (kVA)         100         120         160         220         250         300         400         500         600           Active power (kVA)         90         108         144         180         225         270         360         450         540           Numbar of phases         3 + N	Frequency										
Soft start         0 - 100% in 120" (selectable)           Frequency tolerance         ± 2% (selectable) from 1% to the 5% from from tone)           BartTERIES         Back Feed protection; separable bypass line           Type         Flywheels           Recharge voltage compensation         -0.5 Vx*C           OUTPUT         Total 1% to the 5% from from tone panel           Nominal power (kW)         100         120         160         200         250         300         400         500         600           Active power (kW)         90         108         144         180         225         270         360         450         540           Nominal power (kW)         90         108         144         180         225         270         360         450         540           Number of phases         3 + N         Nominal voltage         3 + N         Static stability         1 + 1%         Dynamic stability         1 + 1%         Dynamic stability         1 + 1%         Dynamic stability         1 + 2% 6% in 10 ms         Frequency stability on battery         -005%         Frequency stability on battery         -005%         Static stability         -005%         -000         1000         1400         1 - 200         2400         2400         2100 × 1000	Power factor										
frequency tolerance         ± 2% (selectable from ± 1% to ± 5% from front panel)           Standard equipment provided         Back Feed protection; separable bypass line           BATTERIES           Type         Flywheels           Ripple current         Zero           Becharge voltage compensation         -0.5 Vx°C           OUTPUT         100         120         160         200         250         300         400         500         600           Active power (kW)         90         108         144         180         225         270         360         450         540           Number of phases         380 - 400 - 415 Vac three-phase + N         540         540         540           Normal voltage         380 - 400 - 415 Vac three-phase + N         51 lpeack/lrms         570         540           Orparmic stability         ± 1%         0.05%         56         560         560         560         560         560         560         500         1000         1400         1700         2100         2400           Dynamic stability         56 of 000         800         910         1000         1400         1700         2100         2400           Dimensions (WADxH) (mm)         800 x 850 x 1900 <td>Harmonic current distortion</td> <td></td> <td colspan="9"></td>	Harmonic current distortion										
Standard equipment provided         Back Feed protection; separable bypass line           BATTERIES	Soft start				0 - 100 <sup>0</sup>	% in 120'' (se	lectable)				
BATTERIES         Flywheels           Type         Flywheels           Bipple current         Zero           Recharge voltage compensation         -0.5 Vx°C           OUTPUT         100         120         160         200         250         300         400         500         600           Active power (kW)         90         108         144         180         225         270         360         450         540           Number of phases         380 - 400 - 415 Vac three-phase + N         5tatic stability         ± 1%6         100         120         160         200         250         300         400         540         540           Nominal voltage         380 - 400 - 415 Vac three-phase + N         5tatic stability         ± 1%6         100         1400         100         100         1400         100         100         100         100         100         100         100         100         100         100         100         1000         1000         1000         1000         1000         1000         1000 × 1000         1000 × 1000 × 1000         1000 × 10	Frequency tolerance										
Type         Flywheels           Ripple current         Zero           Recharge voltage compensation         -0.5 Vx*C           OUTPUT         -0.5 Vx*C           Mominal power (IkW)         100         120         160         200         250         300         400         500         600           Active power (IkW)         90         108         144         180         225         270         360         450         540           Number of phases         3 + N	Standard equipment provided		Back Feed protection; separable bypass line								
Ripple current         Zero           Recharge voltage compensation         -0.5 V/°C           OUTPUT         -0.5 V/°C           Nominal power (kVA)         100         120         160         200         250         300         400         500         600           Active power (kW)         90         108         144         180         225         270         360         450         540           Number of phases         3 + N	BATTERIES										
Recharge voltage compensation         -0.5 Vx*C           OUTPUT         -0.5 Vx*C           Nominal power (kVA)         100         120         160         200         250         300         400         500         600           Active power (kVA)         90         108         144         180         225         270         360         450         540           Number of phases         3 + N	Туре	Flywheels									
OUTPUT         Intervent         Intervent <thintervent< th=""> <thint< td=""><td></td><td colspan="9">Zero</td></thint<></thintervent<>		Zero									
Nominal power (kVA)         100         120         160         200         250         300         400         500         600           Active power (kW)         90         108         144         180         225         270         360         450         540           Number of phases         3 + N         Nominal voltage         1 + N         No         Nominal voltage         1 + N         Nominal voltage         1 + N         No	Recharge voltage compensation	-0.5 Vx°C									
Active power (kW)       90       108       144       180       225       270       360       450       540         Number of phases       3+N       3+N       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       4       4       3						-		-			
Number of phases       3 + N         Nominal voltage       380 - 400 - 415 Vac three-phase + N         Static stability       ± 1%         Dynamic stability       ± 5% in 10 ms         Voltage distortion       < 1% with linear load / < 3% with non-linear load	Nominal power (kVA)	100	120	160	200	250	300	400	500	600	
Nominal voltage         380 - 400 - 415 Vac three-phase + N           Static stability         ± 1%           Dynamic stability         ± 5% in 10 ms           Voltage distortion         < 1% with linear load / < 3% with non-linear load		90	108	144	180	225	270	360	450	540	
Static stability $\pm 1\%$ Dynamic stability $\pm 1\%$ Watage distortionCrest factorFrequency stability on batteryFrequency stability on battery0.05%FrequencyOverload110% for 60 minutes; 125% for 10 minutes; 150% for 1 minuteINFO FOR INSTALLATIONWeight (kg)656700800 x 850 x 19001000 x 850 x 1900CommunicationsDouble RS232 + dry contacts (configurable)CommunicationsDouble RS232 + dry contacts + 2 slots for communications interfaceAmbient temperature0°C / +40°CRelative humidity<95% non-condensing	Number of phases	3 + N									
Dynamic stability       ± 5% in 10 ms         Voltage distortion       < 1% with linear load / < 3% with non-linear load	-		380 - 400 - 415 Vac three-phase + N								
Synthetic stress         Synthetic stress           Voltage distortion         < 1% with linear load / < 3% with non-linear load	Static stability										
Crest factor         3:1 lpeack/Irms           Frequency stability on battery         0.05%           Frequency         50 or 60 Hz (selectable)           Overload         110% for 60 minutes; 125% for 10 minutes; 150% for 1 minute           INFO FOR INSTALLATION         Weight (kg)         656         700         800         910         1000         1400         1700         2100         2400           Dimensions (WxDxH) (mm)         800 x 850 x 1900         1000 x 850 x 1900         1500 x 1000 x 1900         2100 x 1000 x 1900           Remote signals         dry contacts (configurable)              Communications         Double R5232 + dry contacts + 2 slots for communications interface             Ambient temperature         0°C / + 40°C              Relative humidity         <95% non-condensing							-				
Frequency stability on battery         0.05%           Frequency         50 or 60 Hz (selectable)           Overload         110% for 60 minutes; 125% for 10 minutes; 150% for 1 minute           INFO FOR INSTALLATION	Voltage distortion	< 1% with linear load / < 3% with non-linear load									
Frequency         50 or 60 Hz (selectable)           Overload         110% for 60 minutes; 125% for 1 minutes; 150% for 1 minute           INFO FOR INSTALLATION         Verload           Weight (kg)         656         700         800         910         1000         2400           Dimensions (WxDxH) (mm)         800 x 850 x 1900         1000 x 1000 x 1900         2100 x 1000 x 1900           Remote signals         dry contacts (configurable)           Remote controls         ESD and bypass (configurable)           Communications         Double RS232 + dry contacts + 2 slots for communications interface           Ambient temperature         0°C / +40°C           Relative humidity         295% non-condensing           Colour         Dark greg RAL 7016           Noise level at 1 m         63 - 68 dBA         70 - 72 dBA         70 dBA         70 dBA           IP rating         IP20 (others on request)           Smart Active efficiency         up to 98.5%           Standards         Safety: EN 62040-1-1 (Directive 2014/35/EU); EMC: EN 62040-2 (Directive 2014/30/EU)           Classification in a	Crest factor				3	3:1 lpeack/lrm	IS				
Overload         110% for 60 minutes; 125% for 10 minutes; 150% for 1 minute           INFO FOR INSTALLATION         656         700         800         910         1000         1400         1700         2100         2400           Dimensions (WxDxH) (mm)         800 x 850 x 1900         1000 x 850 x 1900         1500 x 1000 x 1900         2100 x 1000 x 1900         x 1900           Remote signals         dry contacts (configurable)         ESD and bypass (configurable)         x         x         x 1000 x 1900         x 1900<	Frequency stability on battery					0.05%					
INFO FOR INSTALLATION           Weight (kg)         656         700         800         910         1000         1400         1700         2100         2400           Dimensions (WxDxH) (mm)         800 x 850 x 1900         1000 x 850 x 1900         1500 x 1000 x 1900         2100 x 1000 x 1900         2100 x 1000 x 1900         2100 x 1000 x 1900         1900           Remote signals         dry contacts (configurable)            1900 <td< td=""><td>Frequency</td><td><u> </u></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	Frequency	<u> </u>									
Weight (kg)         656         700         800         910         1000         1400         1700         2100         2400           Dimensions (WxDxH) (mm)         800 x 850 x 1900         1000 x 850 x 1900         1500 x 1000 x 1900         2100 x 1000 x 1900           Remote signals         dry contacts (configurable)          2100 x 1000 x 1900         2100 x 1000 x 1900           Remote controls         ESD and bypass (configurable)               Communications         Double RS232 + dry contacts + 2 slots for communications interface               Ambient temperature         0°C / +40°C	Overload			110% for 60	minutes; 12	5% for 10 mi	nutes; 150%	for 1 minute			
Dimensions (WxDxH) (mm)800 x 850 x 19001000 x 850 x 19001500 x 1000 x 19002100 x 1000 x 1900Remote signalsdry contacts (configurable)Remote controlsESD and bypass (configurable)CommunicationsDouble RS232 + dry contacts + 2 slots for communications interfaceAmbient temperature0°C / +40°CRelative humidity<95% non-condensing	INFO FOR INSTALLATION										
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Remote controlsESD and bypass (configurable)CommunicationsDouble RS232 + dry contacts + 2 slots for communications interfaceAmbient temperature0°C / +40°CRelative humidity<95% non-condensing		800 x 85	0 x 1900	100				000 x 1900	2100 x 10	000 x 1900	
CommunicationsDouble RS232 + dry contacts + 2 slots for communications interfaceAmbient temperature0°C / +40°CRelative humidity<95% non-condensing	Remote signals										
Ambient temperature0°C / +40°CRelative humidity<95% non-condensing	Remote controls				ESD and	bypass (conf	igurable)				
Relative humidity       <95% non-condensing	Communications		D	ouble RS232	+ dry contac	ts + 2 slots fo	or communica	ations interfa	ce		
Colour       Dark grey RAL 7016         Noise level at 1 m       63 - 68 dBA       70 - 72 dBA       70 dBA       70 dBA         IP rating       IP20 (others on request)       IP20 (others on request)       IP20 (others on request)         Smart Active efficiency       up to 98.5%       IP20 (others on request)       IP20 (others on request)         Standards       Safety: EN 62040-1-1 (Directive 2014/35/EU); EMC: EN 62040-2 (Directive 2014/30/EU)       IP20 (others on request)         Classification in accordance with IEC 62040-3       (Voltage Frequency Independent) VFI - SS - 111       IP20 (others on request)	Ambient temperature					0°C / +40°C					
Noise level at 1 m63 - 68 dBA70 - 72 dBA70 dBA70 dBAIP ratingIP20 (others on request)Smart Active efficiencyup to 98.5%StandardsSafety: EN 62040-1-1 (Directive 2014/35/EU); EMC: EN 62040-2 (Directive 2014/30/EU)Classification in accordance with IEC 62040-3(Voltage Frequency Independent) VFI - SS - 111	Relative humidity				<959	% non-conde	nsing				
IP rating       IP20 (others on request)         Smart Active efficiency       up to 98.5%         Standards       Safety: EN 62040-1-1 (Directive 2014/35/EU); EMC: EN 62040-2 (Directive 2014/30/EU)         Classification in accordance with IEC 62040-3       (Voltage Frequency Independent) VFI - SS - 111	Colour										
Smart Active efficiencyup to 98.5%StandardsSafety: EN 62040-1-1 (Directive 2014/35/EU); EMC: EN 62040-2 (Directive 2014/30/EU)Classification in accordance with IEC 62040-3(Voltage Frequency Independent) VFI - SS - 111	Noise level at 1 m										
Standards       Safety: EN 62040-1-1 (Directive 2014/35/EU); EMC: EN 62040-2 (Directive 2014/30/EU)         Classification in accordance with IEC 62040-3       (Voltage Frequency Independent) VFI - SS - 111	0	IP20 (others on request)									
Classification in accordance with IEC 62040-3 (Voltage Frequency Independent) VFI - SS - 111	Smart Active efficiency										
IEC 62040-3 (Voltage Frequency Independent) VFI - 55 - 111	Standards	Safety: EN 62040-1-1 (Directive 2014/35/EU); EMC: EN 62040-2 (Directive 2014/30/EU)									
Moving the UPS transpallet		(Voltage Frequency Independent) VFI - SS - 111									
			transpallet								

## MASTER VDC: FLYWHEEL MODULE SPECIFICATIONS

MODEL	VDC-XE	VDC-XXE						
POWER	'							
Maximum power	300 kW							
Max. energy storage	4000 kWs	6000 kWs						
Flywheel rotation speed	from 36 750 to 24 500 rpm	from 36 750 to 14 000 rpm						
INPUT								
Recharge voltage	400-60	0 Vdc						
Recharge current	15-50 A (adjustable)							
Efficiency	99.4%							
OUTPUT								
Discharge voltage	400-520 Vdc (adjustable)							
Voltage stability	+/- 1%							
Voltage ripple	≤ 2%							
INFO FOR INSTALLATION								
Ambient temperature	-10°C / +40°C							
Relative humidity	90% non-condensing							
Colour	Dark grey RAL 7016							
Noise level at 1 m	≤ 68 dBA							
Dimensions (WxDxH) [mm]	762 x 762 x 1872							
Weight [kg]	821							
IP rating	IP 20							
Standards	EMC EN 61000-6-4:2001; EMC EN 61000-6-2:2001; Saf	ety EN 60204-1; Directives: 2014/35/EU; 2014/30/E						

## MASTER VDC: (FLYWHEEL ONLY) RUNTIME IN SECONDS

VDC-XE 300 kW		MHF 100	MHF 120	MHF 160	MHF 200	MHF 250	MHF 300	MHF 400	MHF 500	MHF 600
Number of FLYWHEELS	POWER	100	120	160	200	250	300	400	500	600
1	100%	40	33	22	15	9	5	-	-	-
2		79	65	49	39	30	24	14	8	-
3		118	98	73	58	46	38	28	20	14
4		156	129	97	77	61	51	38	30	23
5		195	162	121	97	77	60	48	38	31
Number of FLYWHEELS	POWER	100	120	160	200	250	300	400	500	600
1	75%	54	45	33	25	17	11	5	-	-
2		106	88	65	52	41	34	24	16	10
3		157	131	98	78	62	51	38	30	23
4		208	173	129	103	82	68	51	40	33
5		260	217	162	129	103	86	64	51	42
Number of FLYWHEELS	POWER	100	120	160	200	250	300	400	500	600
1	50%	82	68	51	40	32	25	11	5	4
2		159	132	99	79	63	52	39	30	23
3		237	197	147	118	94	78	58	46	38
4		313	260	195	156	124	103	77	61	51
5		391	326	244	195	156	129	97	77	64
Number of FLYWHEELS	POWER	100	120	160	200	250	300	400	500	600
1	25%	160	135	101	80	64	53	39	26	23
2		313	260	195	156	124	103	77	61	50
3		465	387	290	232	185	154	115	92	76
4		614	511	383	306	245	204	152	122	101
5		767	639	479	383	306	255	191	152	126

All runtimes refer to UPS with 0.9 pf and 94% efficiency for 100%, 75% and 50% load, and 92% efficiency for 25% load. With no battery connected.



