Derwent
Top 100
Global
Innovator
2020

Energy Saving Drive Solution LS Medium Voltage Drive

LSMV-M1000

3kV 200kVA~3,700kVA
4kV 250kVA~4,700kVA
6kV 400kVA~7,500kVA
10kV 600kVA~11,000kVA
11kV 660kVA~12,500kVA

LS ELECTRIC

Leading You Toward a Greater Future Than You Imagine

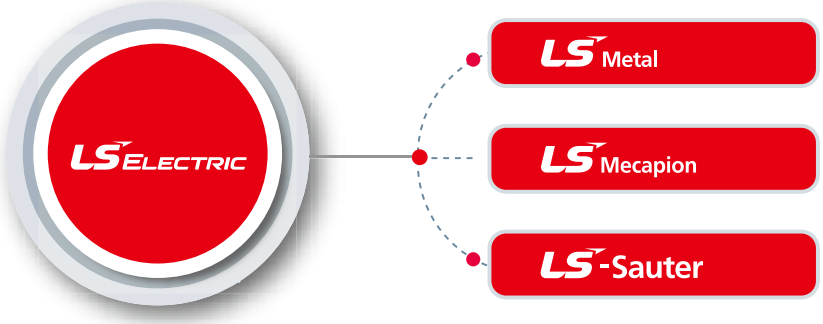
Leaping Beyond Being Korea's No.1 into a Global Top Company in Industrial Electric / Electronic Solutions / Materials & Energy Sectors

Greater Value Together LS

LS Group, a leader of the electric/electronic and energy sectors began as a LG Group's spin-off in 2003.
LS Group is growing again into an organization delivering the best quality and excellent product development insight, and customer-centric total solution packages. Company's mission of becoming the global leader in the industry is to find the reason for its existence in standing and rising together with its customers.

Innovator of Power Solutions & Automation Systems

LS, a global leader in industrial automation systems and power solutions,
provides customers with total solutions.
LS is building win-win relationships with power transmission/distribution,
electric power devices, automation systems, and smart-grid customers with future-oriented technologies and
environment-friendly products that maximize energy efficiency.



Overview

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LS Leads You to the Advanced Industry!

Optimum MV Drive Solution for Industrial Plants & SOC Systems

LS' medium voltage drive consists of compact integrated systems built on cutting-edge technologies, delivering optimum energy-saving solution featuring high efficiency and power factor. The system supports a user-friendly HMI(Human Machine Interface) that allows easy operation and displays desired information for customers' maximum convenience. LS' medium voltage drive offers leading industrial drive solutions with proven reliability and economic viability. It also contributes to energy saving and environment protection in various industries including gas, water treatment, marine, power generation, and cement.

Energy Saving Drive Solution
Medium Voltage Drive

LSMV-M1000

Customized Solutions for Various Industrial Sectors

LS' medium voltage drive offers customized solutions incorporating customer requirements and drawing upon its proven reliability in various industrial sectors.

Series Overview

MV Drive Series	LSMV-M1000
Voltage	3kV/4kV/6kV/10kV/11kV
Capacity	200kVA~12500kVA
Control Mode	V/F, Sensorless Vector
IP Class	Standard IP31 (~IP42 Optional)
Standards	CE, UL(Pending)
Frequency	50/60Hz
Topology	Multi-Level PWM

Major Application Domains

Oil & Gas

- Electric submersible pump
- Reciprocating/Centrifugal compressor
- Conveyor
- Unloading & booster pump

Water Treatment

- Inlet/outlet pump
- Auxiliary pump
- Defoaming pump
- Booster pump

Power Generation

- Boiler feed-water pump
- Condensation pump
- Cooling water pump
- District heating water circulation pump
- Primary and secondary air fan
- Coal mill and conveyor

Metal

- Furnace fan
- Fluid transfer pump
- Conveyor
- Sludge pump
- Quenching pump

Chemical & Plastic

- Extruder
- Mixers
- Coker & wet-gas compressors
- Stirring machine
- Heat exchanger pump

Cement

- Kilns
- Cement mills
- Raw mills
- Crushers
- Exhaust fans
- Main & auxiliary fans

Paper-making

- Boiler fans
- Chippers
- Auxiliary pumps
- Chip refiners
- Vacuum pump

Benefit

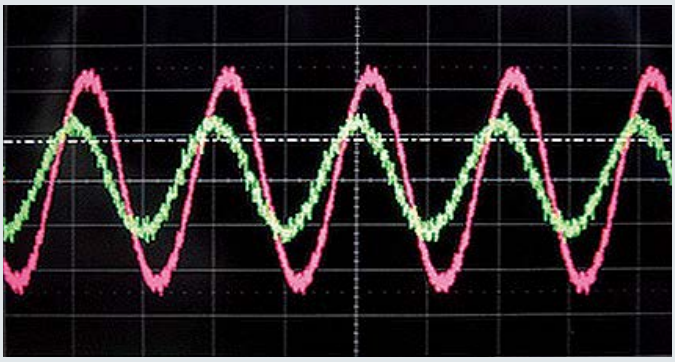
Energy Saving through Efficient Energy Management

LS' medium voltage drive demonstrates a unique compact system built upon optimal design. It is easy to install and constructed to not require input/output filters, offering high efficiency and energy saving benefits.

Improved Power Quality

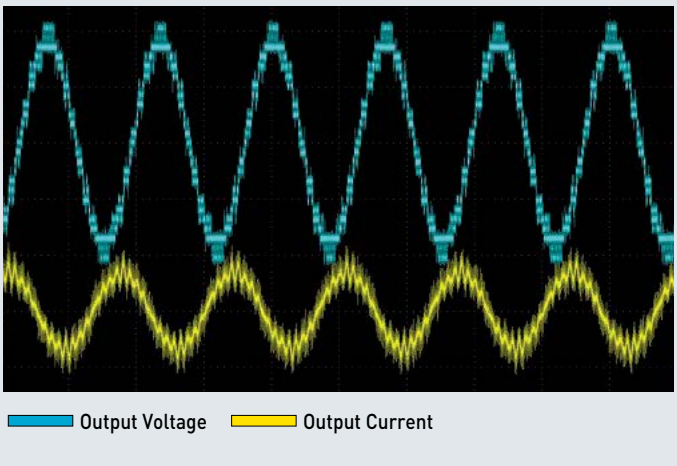
Improved Input Power Quality and THD (Total Harmonic Distortion) by Adopting Multi-winding Phase-shift Transformer

- Application of extended delta-type transformer and separated-type multi-pulse rectifier drastically reduces input power THD, hence complying with IEEE-519 standard.
- Input current almost identical to sine waves eliminates need for additional harmonic filters or active filters on the input side.



Producing Multilevel PWM-type Sinusoidal Output

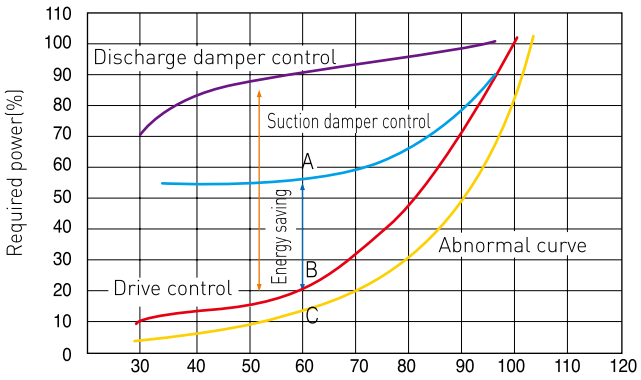
- Compatible with conventional motors and cables to ensure it fits in with existing system design
- Minimal impact of voltage reflection, allowing longer cable length between drive and motor
- Medium voltage drives minimize mechanical stress on motor, eliminating need for additional sine wave filters.



Benefit

Energy Saving

Achieving Energy Saving and Minimum Energy Loss through Optimized Speed Control



[Fan operation characteristics Ex.)
Wind volume, revolution speed, power requirement characteristics]

Energy Saving

The optimum way to save energy from fans, pumps, and blowers is to control the motor speed with drive. This is far more effective in energy saving than fluid control by damper.

Example of Operating Conditions

(1) Motor in use: 3300V, 600kW, 6P (Motor efficiency: 95%)

(2) Operating at 60% of air flow volume (Motor efficiency of 90% at 100% of flow volume)

1. Inlet-side Damper Control Power (A)

$$600 \times 0.55 \times \frac{1}{0.95\ \text{Motor Efficiency}} = 347.4kW \cdots (1)$$

Note) 0.55: Power rate required for damper1s suction control when operating at 60% of air flow volume

2. Drive Control Power

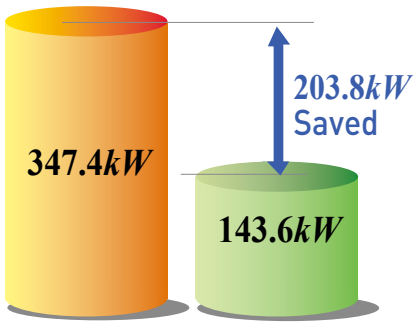
Rated Motor Output (C) $600 \times (0.6)^3 = 129.6kW \cdots\cdots (1)$

Motor Input Power $129.6 \times \frac{1}{0.95\ \text{Motor Efficiency}} = 136.4kW$

Drive Input Power(B) $136.4 \times \frac{1}{0.95\ \text{Drive Efficiency}} = 143.6kW \cdots\cdots (2)$

3. Energy Saving

Drive-enabled annual energy saving [(1)-(2)]



$(347.4\text{-}143.6)kW \times 8{,}000h = 1{,}630{,}400kWh$

(Assuming 8,000 hours annual operating time)

The electricity bill that can be saved per year assuming an electric power tariff of KRW55/kW

$1{,}630{,}400 \times 55 = \$\ 81{,}520$

Increasing Facility Efficiency

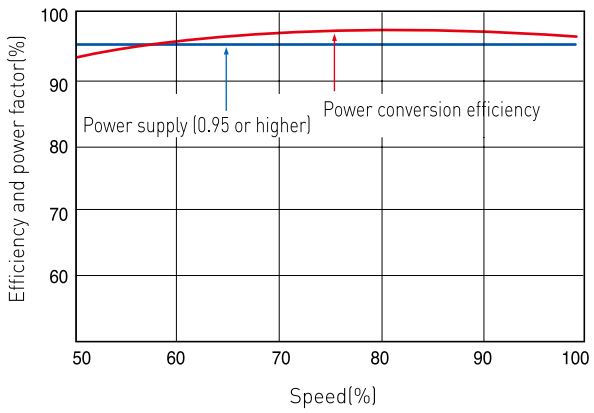
Improving the Productivity with Optimized Facility Operation Ratio

- Effective process control through prompt and flexible speed control in response to change operating environment and demand
- Improving productivity and product quality with optimized facility operation ratio.

Reducing Operation and Maintenance Costs

- Soft starting eliminates network instability and process risks from starting current and voltage drop.
- Reducing maintenance frequency and costs with decreased motor stress and extended equipment service life.

Guaranteeing High Operating Efficiency and Power Factor



Power Conversion Efficiency Ratio

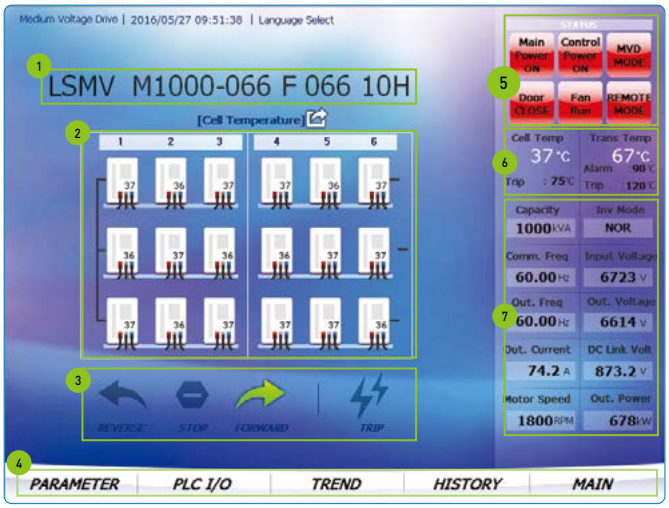
- Delivering a high power factor at 95% or above with an independent built-in system without additional power factor corrector
- Improving system efficiency with a drive-only system configuration without input/output filters

Benefit

User Convenience

Monitoring (HMI)

Standard HD HMI Monitoring Maximizes User Convenience



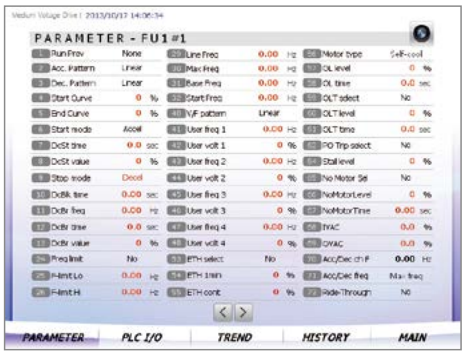
- 10.2 inch touch screen
- Supporting multi languages (Korean, English, Chinese, Russian, Spanish, Thai, and Portuguese)
- Control and system state monitoring
- Powerful data control (data logging, diagnostics, and information)
- User-centric convenience (HD display, high data throughput, user-friendly interface)
- Supporting dedicated editor for changing display items (Optional).

1. MVD Model Name
2. Cell Mode
3. MVD Operation
4. Menu Selection
5. Power/Fan Status
6. Temperature Display
7. MVD Mode

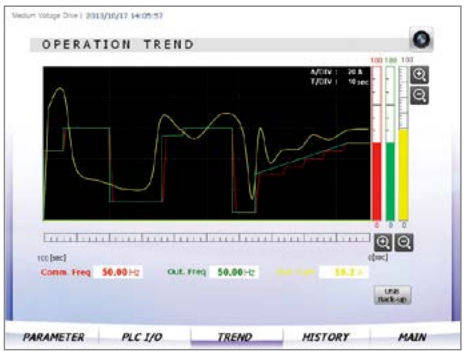
External Interface

Serial I/F (RS-232C) | Serial I/F (RS422/485) | Serial I/F (RS-485) | USB I/F | Ethernet I/F

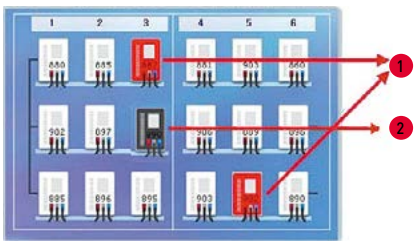
Event history monitoring



All parameters setting monitoring



Real time signal trend monitoring

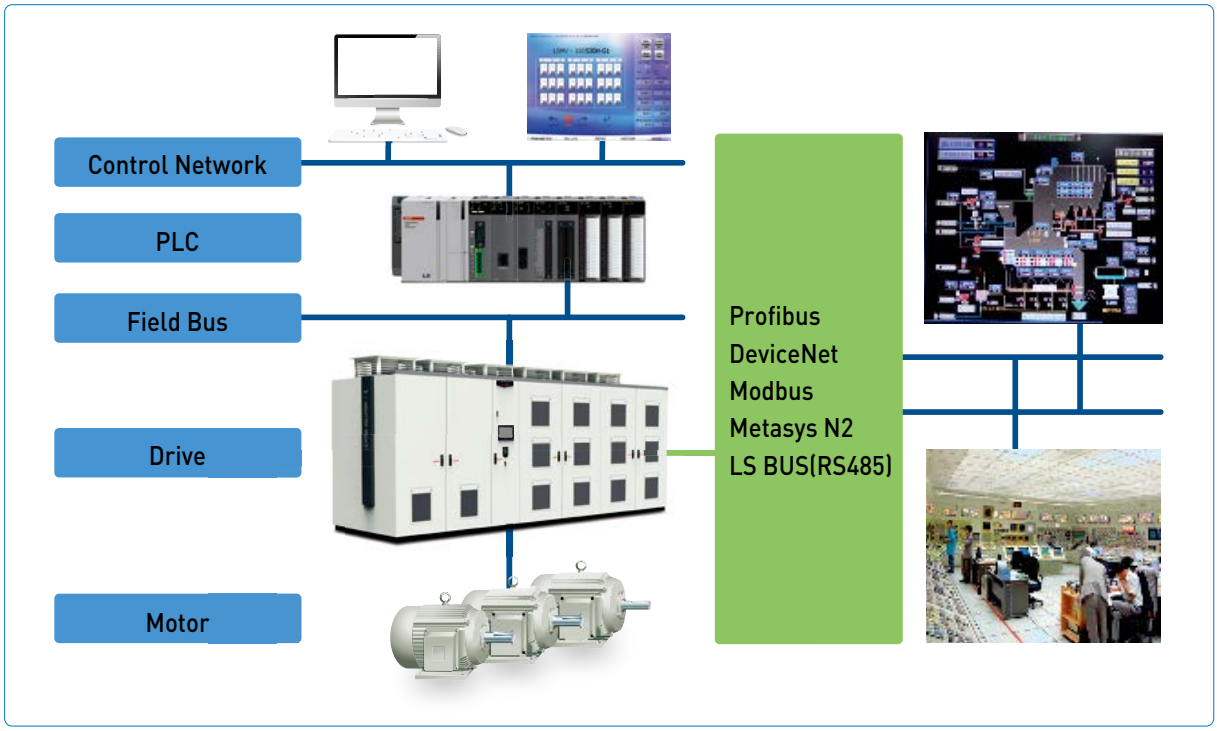


1. U3 and W5 Cells are in Failure Mode
2. V2 Cell is in Bypass Mode

Each cell status monitoring

Communication

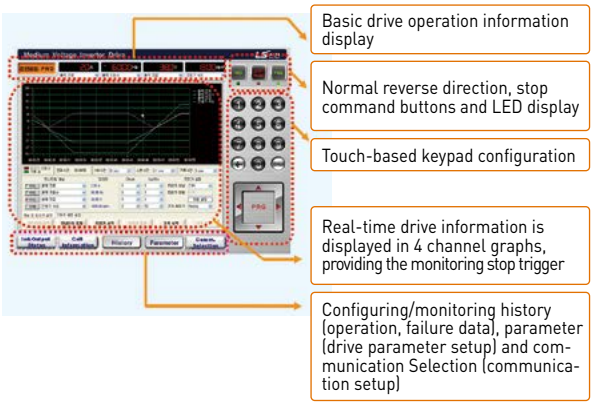
- Standard built-in PLC supports customization (I/O extensibility, etc.)
- Providing the improved system compatibility with field-bus communication options



Monitoring

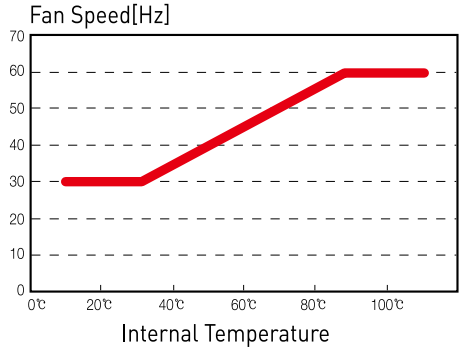
MV System View(Option)

- MV System View is a PC (Windows XP and Window 7 - compatible)-based software that uses RS485/232 communication links between MVD and PC to control/ monitor MVD.
- Communication standards and a built-in system view enables flexible application in various systems.
  It facilitates remote operation and operating state monitoring by higher-level systems.



Optimized PID Control of Cooling Fan According to Heat Release

Reducing fan noise, power consumption and extending fan service life by optimizing cooling fan speed control in proportion to the drive internal temperature



Function

Improving Reliability through Various Control Functions

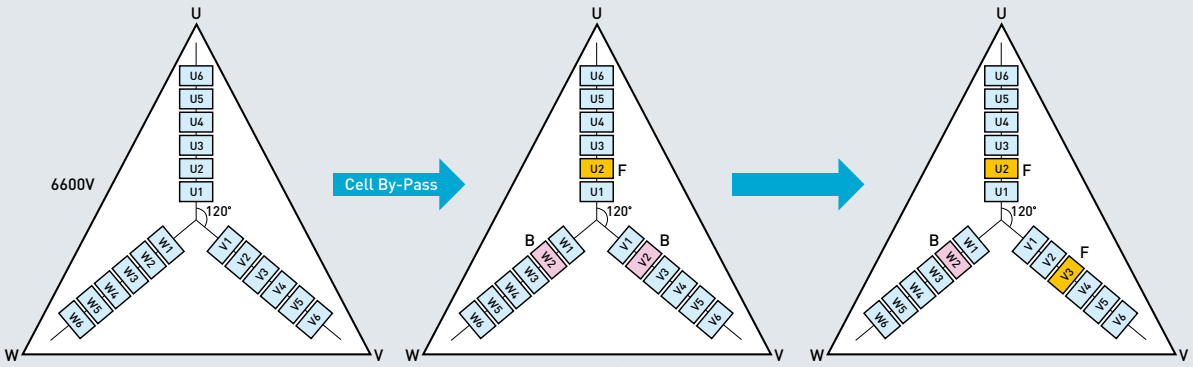
LS's medium voltage drives offer highly reliable optimum solutions by providing sensorless vector control, flying start, ride-through, and many more functions.

Cell Bypass Function

Automatically bypass of failed cells if cells connected in series randomly fail during operation, allowing continuous operation.

Operate Cell Bypass Function (In Auto Setup)

- F : Bypass following cell failure
- B : Auto bypass



Normal Operation

Condition 1) U2 Fails
Restart after automatic bypass of V2/W2

Condition 2) Additional Failure Occurs in V3 Phase Excluding U Phase
V2 Bypassed at discretion is returned to normal mode

Flying Start

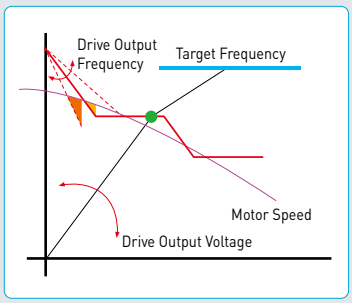
Automatically estimates speed of the rotating motor to reach the frequency without any system failure(trip)

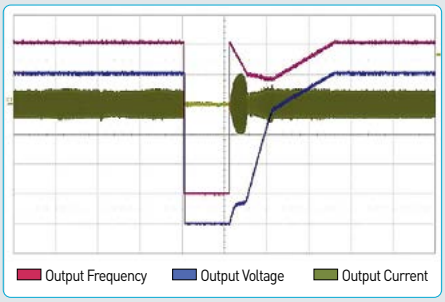
Example of Flaying Start

- Select flying start at the same time as power application
- Reset after trip
- Automatic restart
- Restart after ride-through

Quick Speed Estimation

- Reduce speed estimation time by controlling the drive output frequency speed reduction
- Reduce estimation time by reducing output frequency
- Reducing estimation time by controlling voltage response





Function

Ride-through Capability

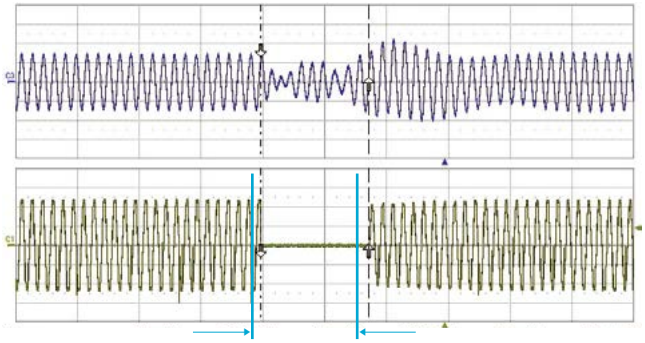
Mechanical energy of load is regenerated to continue operation for up to 5 cycles when power outage occurs. It allows continuous operation without stopping the drive or system.

Improving Power Quality and Reducing Industrial Damage

- Unpredictability
- Irregularity
- Response to force majeure events

MV drive output current

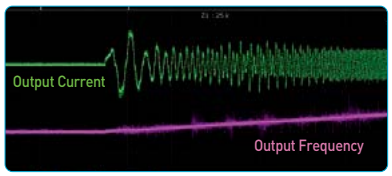
MV drive input voltage



Ride-through time

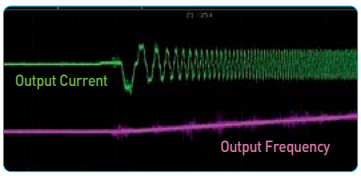
Anti-current Hunt Algorithm in Resonance Area

Continuous drive operation possible in the resonant area followed by application of the drive



Residual area avoidance function not applied

Residual current hunting makes continuous operation not possible



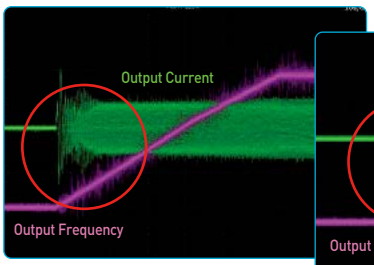
Resonant area avoidance function applied

Continuous operation possible in spite of residual current hunting

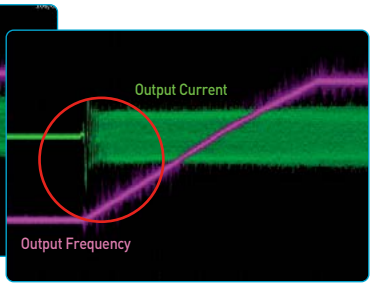
Sensorless Vector Function

Improved Starting Torque and Accurate Torque Control

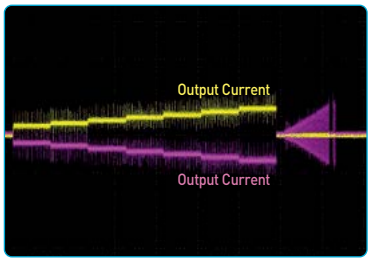
Powerful sensorless algorithm improves speed and torque control precision in low-speed area



V/F control



Sensorless vector control

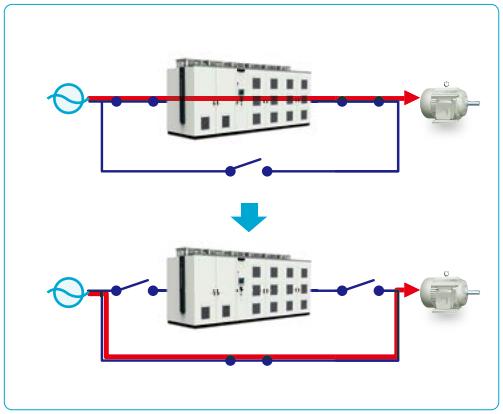


Auto-tuning function

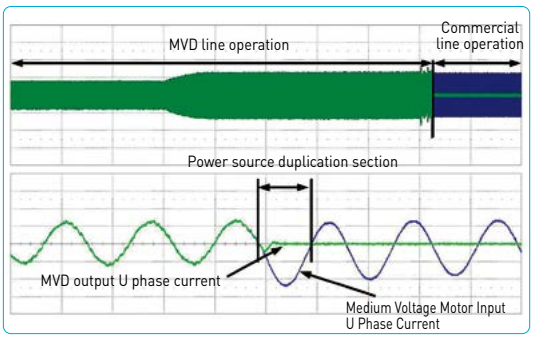
Synchronous Transfer Function

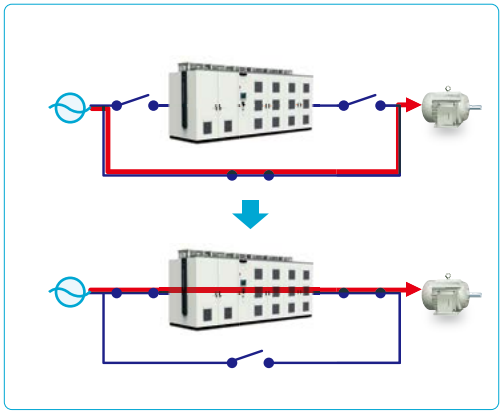
- Switching motor power from medium voltage drive to commercial power (bypass mode) or vice versa (drive mode)
- Synchronous transfer function performs synchronization of the phases of two power sources while motor is running, enabling power transfer and prevention of ensuing over-current

- Short up/down transfer time
- Ensuring reliability with over-current

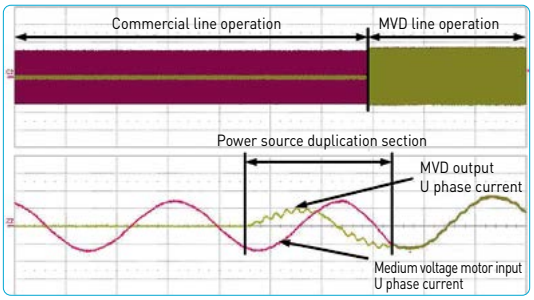


Inv mode → Grid mode(Up)





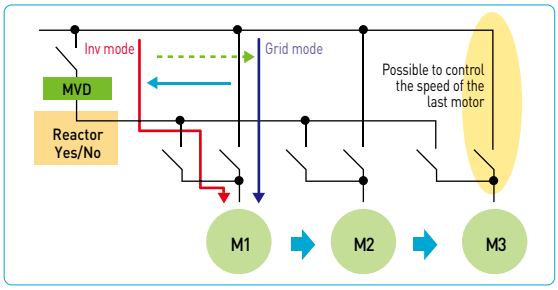
Grid mode → Inv mode(Down)



Multi Motor Transfer

Multi-motor synchronous transfer function allows users to start multiple (up to 3) MV motors sequentially in drive mode and control the last motor speed

1. Start M1 motor in Inv Mode and transfer it to Grid Mode
2. Start M2 motor in Inv Mode and transfer it to Grid Mode
3. Start M3 motor in Inv Mode to control speed



Note) Delivering uninterrupted motor current requires reactor option.

LSMV-M1000 Series!

Next Generation Motor Drive Solutions Enabling Energy Saving in Various Industrial Domains!

Multi-winding Phase-shift Transformer

- Multi-winding phase-shift transformer is in place with taps for change in input voltage.
- Reducing power harmonics with multi-pulse filtering in compliance with IEEE standards
- Eliminating need for harmonic filter and power factor-improving condenser

Master Control Module

- Master control module to control multi-level PWM output voltage with a total of unit cells and fiber optic communication link.
- User-centric HMI to support system diagnostics and monitoring

Cell Drive Module

- Low-voltage single-phase drives in serial connection per phase, generating multi level 3 phase output voltage. It is designed to ensure easy cell maintenance.
- Each cell performs PWM switching in distributed control mode and has default built-in cell protection and bypass functions.

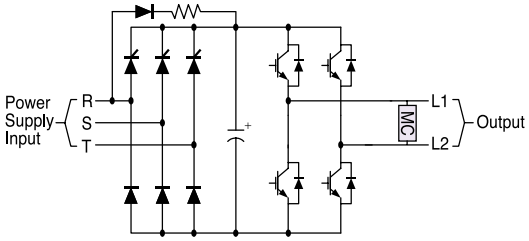
At 6.6kV 3000kVA

Cell Drive Module

Design

Power Cell

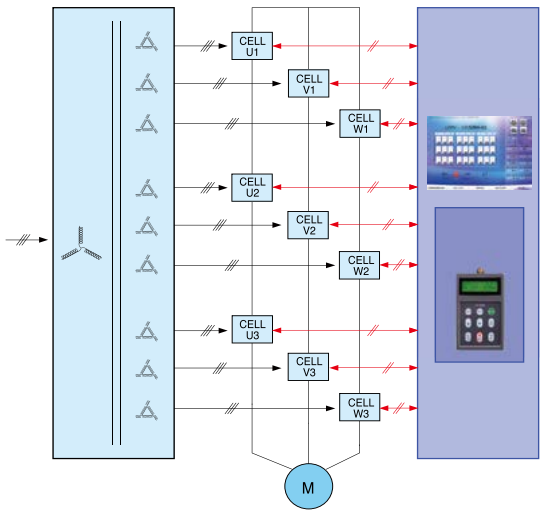
• Additional R/S/T and P/N check PIN allows for safe cell state monitoring



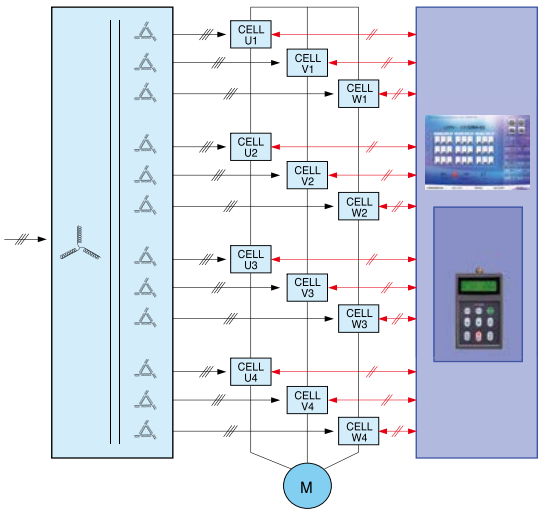
1 Fiber Optic Board (Cell side)
2 Output Terminal (T1, T2)
3 AC630V, Input Terminal (L1, L2, L3)
4 Fiber Optic Board (Control panel side)

System Circuit Diagram

3kV Class

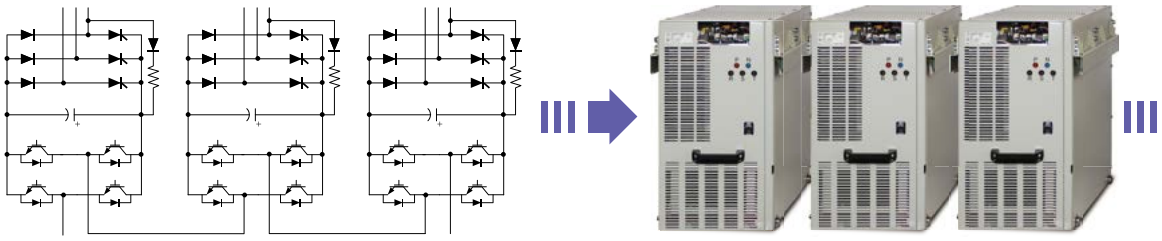


4kV Class

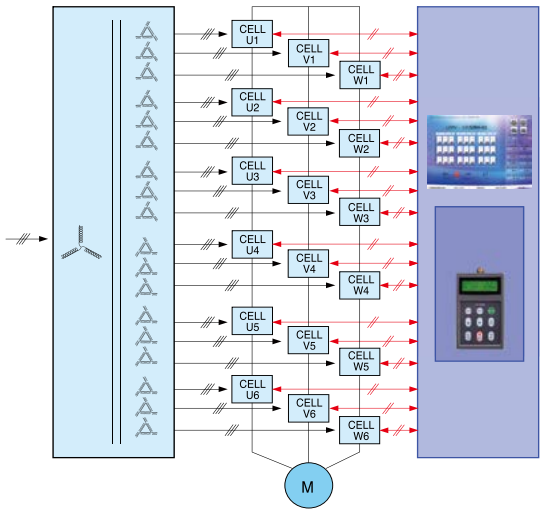


Cascaded H-bridge Multi-level Drive

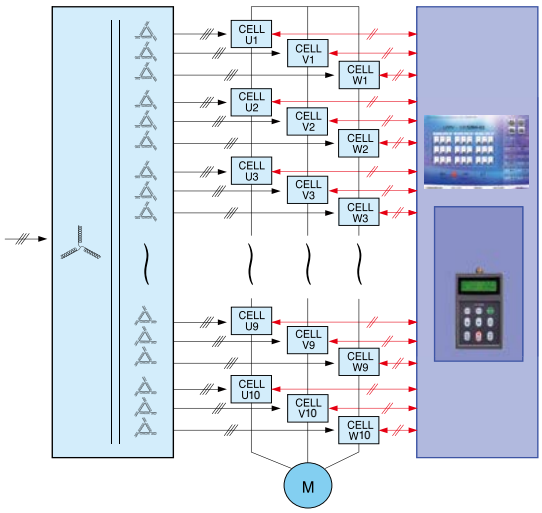
- Adopting multi-winding phase-shift transformer lowers input THD (Eliminating the need for input filters)
- Multiple voltage steps allow lower output THD (Eliminating the need for output filters)
- Reducing common mode voltage and leakage current (Effective to extend motor service life)
- Enabling complete modularization of power module circuits
- Modular design makes easy voltage increase
- Continuous operation possible through individual power cell failure
- Minimal impact of voltage reflection allows for longer cable distance between drive and motor



6kV Class



11kV Class



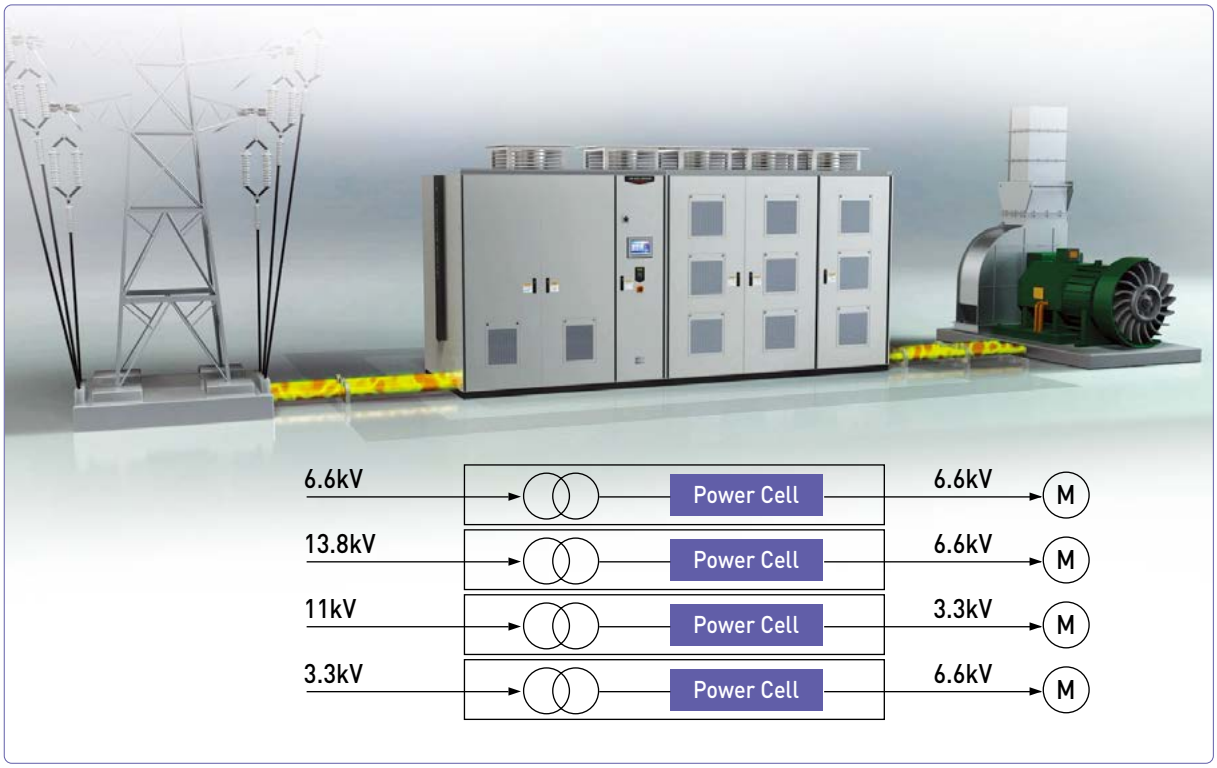
Design

Compact Design

Minimizing Installation Footprint and Investment Costs by an Optimized Drive Design

Adaptability(Flexible input/output voltage variation)

M1000 Provides the customized solutions which support different input and output voltage ranges.



Design flexibility(separated transformer installation)

M1000 is available with a separate transformer cabinet.
This helps adjust the footprint of the drive and optimize the plant layout.

Design flexibility (Oil Type Transformer)

The dry type transformer can be substitute to oil type transformer which is able to be installed at outdoor.

Selection and Ordering Data

User-centric Customized Solutions

With its proven reliability and perfect green energy solution,
LS MV Drive fully satisfies the needs of each and every customer.

Ordering Data

Model Number

LSMV M1000 – □□□ □ □□□ □□□

LS Medium Voltage Drive

Input Voltage

030 : 3.0[kV]
033 : 3.3[kV]
041 : 4.16[kV]
060 : 6.0[kV]
066 : 6.6[kV]
100 : 10.0[kV]
110 : 11.0[kV]

Input Frequency

F : 50[Hz]
S : 60[Hz]

Output Voltage

030 : 3.0[kV]
033 : 3.3[kV]
041 : 4.16[kV]
060 : 6.0[kV]
066 : 6.6[kV]
100 : 10.0[kV]
110 : 11.0[kV]

Total Capacity

200 : 200[kVA]	22H : 2200[kVA]
250 : 250[kVA]	24H : 2400[kVA]
300 : 300[kVA]	25H : 2500[kVA]
380 : 380[kVA]	30H : 3000[kVA]
400 : 400[kVA]	31H : 3100[kVA]
500 : 500[kVA]	33H : 3300[kVA]
600 : 600[kVA]	37H : 3700[kVA]
630 : 630[kVA]	40H : 4000[kVA]
660 : 660[kVA]	41H : 4100[kVA]
750 : 750[kVA]	45H : 4500[kVA]
800 : 800[kVA]	47H : 4700[kVA]
900 : 900[kVA]	49H : 4900[kVA]
950 : 950[kVA]	50H : 5000[kVA]
10H : 1000[kVA]	60H : 6000[kVA]
12H : 1200[kVA]	66H : 6600[kVA]
13H : 1300[kVA]	75H : 7500[kVA]
15H : 1500[kVA]	83H : 8300[kVA]
16H : 1600[kVA]	90H : 9000[kVA]
18H : 1800[kVA]	10M : 10000[kVA]
19H : 1900[kVA]	11M : 11000[kVA]
20H : 2000[kVA]	13M : 12500[kVA]

Capacity Line-up by Voltage

Classification	MV VFD Capacity												
3kV Class	200	300	400	500	600	750	1000	1200	1500	2000	2500	3000	3700
4kV Class	250	380	500	630	750	950	1200	1500	1900	2500	3100	3700	4700
6kV Class	400	600	800	1000	1200	1500	2000	2500	3000	4000	5000	6000	7500
10kV Class	600	900	1200	1500	1800	2200	3000	3700	4500	6000	7500	9000	11000
11kV Class	660	1000	1300	1600	2000	2400	3300	4100	4900	6600	8300	10000	12500

※Call us for details

Selection and Ordering Data

Standard Specifications

Item		Standard Rating												
3kV Class	LSMVM1000-03□□■■■	200	300	400	500	600	750	10H	12H	15H	20H	25H	30H	37H
	50/60Hz													
	Output Capacity(kVA)	200	300	400	500	600	750	1000	1200	1500	2000	2500	3000	3700
	Rated Current(A)	35	53	70	88	105	131	175	218	260	350	438	525	657
	Maximum Applicable Motor Capacity(kW) *Note1)	160	240	320	400	480	600	800	960	1200	1600	2000	2400	2960
4kV Class	LSMVM1000-041□□■■■	250	380	500	630	750	950	12H	15H	19H	25H	31H	37H	47H
	50/60Hz													
	Output Capacity(kVA)	250	380	500	630	750	950	1200	1500	1900	2500	3100	3700	4700
	Rated Current(A)	35	53	70	88	105	131	175	218	260	350	438	525	657
	Maximum Applicable Motor Capacity(kW) *Note1)	200	304	400	504	600	760	960	1200	1520	2000	2480	2960	3760
6kV Class	LSMVM1000-06□□■■■	400	600	800	10H	12H	15H	20H	25H	30H	40H	50H	60H	75H
	50/60Hz													
	Output Capacity(kVA)	400	600	800	1000	1200	1500	2000	2500	3000	4000	5000	6000	7500
	Rated Current(A)	35	53	70	88	105	131	175	218	260	350	438	525	657
	Maximum Applicable Motor Capacity(kW) *Note1)	320	480	640	800	960	1200	1600	2000	2400	3200	4000	4800	6000
10kV Class	LSMVM1000-100□■■■	600	900	12H	15H	18H	22H	30H	37H	45H	60H	75H	90H	11M
	50/60Hz													
	Output Capacity(kVA)	600	900	1200	1500	1800	2200	3000	3700	4500	6000	7500	9000	11000
	Rated Current(A)	35	53	70	88	105	131	175	218	260	350	438	525	657
	Maximum Applicable Motor Capacity(kW) *Note1)	480	720	960	1200	1440	1760	2400	2960	3600	4800	6000	7200	8800
11kV Class	LSMVM1000-110□■■■	660	10H	13H	16H	20H	24H	33H	41H	49H	66H	83H	10M	13M
	50/60Hz													
	Output Capacity(kVA)	660	1000	1300	1600	2000	2400	3300	4100	4900	6600	8300	10000	12500
	Rated Current(A)	35	53	70	88	105	131	175	218	260	350	438	525	657
	Maximum Applicable Motor Capacity(kW) *Note1)	528	800	1040	1280	1600	1920	2640	3280	3920	5280	6640	8000	10000
Power Factor		About 95% (at rated speed and load conditions)												
Efficiency		About 97% (at rated speed and load conditions)												
Input Current THD		Satisfies IEEE standard 519-1992												
Input	Main Circuit	3 phase 3 kV/3.3 kV/4.16 kV/6 kV/6.6 kV/10 kV ±10%, 50/60 Hz *Note2)												
	Control Circuit	3 phase 220 V/380 V/440 V ±10%, 50/60 Hz ±5%												
Output	Rated Voltage	3 phase 3 kV/3.3 kV/4.16 kV/6 kV/6.6 kV/10 kV Max. 37 level												
	Output Frequency	0 ~ 120 Hz												
Control	Overload Resistance	60 seconds at 120% (at normal duty)												
Operation	System Monitoring	10.2 inches HMI : eXP60 (Standard)												
Signal in/Output	PLC	XGK input: 32 channels, output: 32 channels												
Protection Features		Over-current, Drive overload, Output cable earth fault, Electronic thermal, Output cable opening output cable open phase, Input over-voltage, Input under-voltage, Input cable open phase, Cell DC over-voltage, Cell overheating, Transformer overheating and etc.												
Communication Function		RS-485 built in Option : DeviceNet, Profibus, Modbus-RTU, Metasys N2												
Architec-ture	Protection	IP31(Standard)~IP42(option)												
	Cell Bypass	Built-in default (manual/auto bypass)												
Installation Environment	Cooling Mode	Air cooling, Redundant fan(Option)												
	Ambient Temperature	0~40°C												
	Humidity	Max. 85% (No Condensation)												
	Altitude	1,000m or below												
	Installation	Installation: indoor *Note3)												
Input Transformer		Class H, air cooling, N/+5%/10% or -5%/N/+5% (Oil type transformer as option)												

* Note 1) Motor Power Factor 0.8.
*Note 2) Call us for other voltage specifications.
*Note 3) Install the HVAC system as well when installing the product herein.

Options

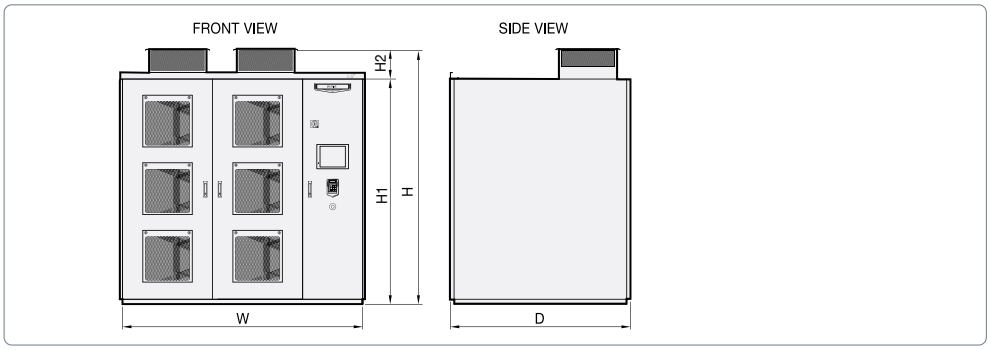
Type		Function
Local Drive	Additional Local Drive Box	RUN/STOP Input : Current/Voltage speed reference Monitoring(Meter) : Current, RPM Switch : Emergency stop
Communication Card	RS-485	
	Modbus RTU	
	Profibus	
	Device NET	
	Metasys N2	
PLC Function	Analogue Input	No. of input channels (max. 16 channels per slot)
		Voltage input(DC 1~5V, DC 0~5V, DC 0~10V, DC -10~10V)
		Current input(DC 4~20mA, DC 0~20mA)
		Select range (select in PLC program)
		Resolution(1/16,000)
	Analogue Output	No. of output channels (max. 8 channels per slot)
		Voltage output(DC 1~5V, DC 0~5V, DC 0~10V, DC -10~10V)
		Current output(DC 4~20mA, DC 0~20mA)
		Select range (select in PLC program)
		Resolution(1/16,000)
	Digital Input	No. of input channels (max. 16 channels per slot)
		Rated input voltage(DC 24V)
		Rated input current(4mA)
		Common (Com) mode (16 points/1COM)
		Insulation mode (photocoupler)
	Digital Output	No. of output channels (max. 16 channels per slot)
		Rated input voltage(DC12/24, AC110/220V)
		Rated input current (1 point: 2A, Common: 5A)
		Common (Com) mode (16 points/1COM)
		Insulation mode (relay)
	Thermoresistor Input	No. of input channels (max. 4 channels per slot)
		Input sensor type(PT100, JPT100)
		Input temperature range(PT100 : -200 ~ 850°C, JPT100 : -200 ~ 640°C)
		Precision(room temperature[25°C]:±0.2% within, full range[0~55°C]:±0.3% within)

Note 1) Can select up to 4 options among the following PLC options
Ex) 2 additional analogue inputs, 1 additional digital input, 1 additional thermoresistor input
Note 2) As synchronous transfer function uses 2 PLC slots, reducing available options to 2,
be sure to call our sales representative if you need PLC extension base.

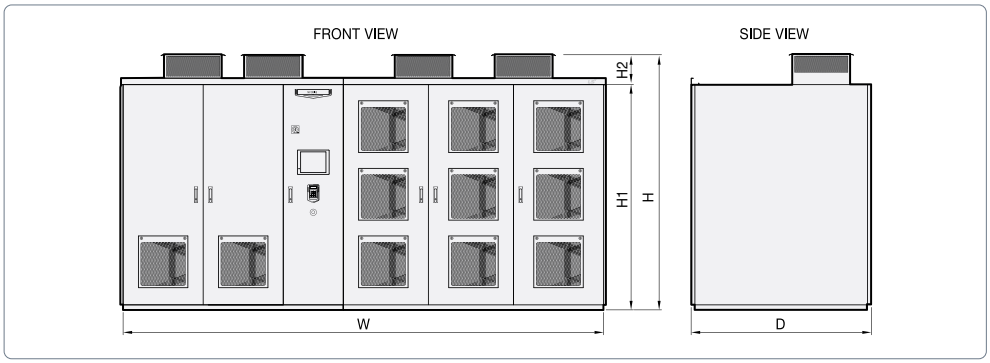
Technical Data

Schematic Drawing of LSMV-M1000

A Type



B Type



Note) Size of the width excludes 'side cover' size (25mm each side)
If more than one units are connected to each other, 'side covers' are to be installed on each side

Dimension and Weight

Voltage [V]	Power Frequency [Hz]	Output Capacity [kVA]	Rated Current [A]	Product Model No.	Max. Applicable Motor Capacity [kW] Note 1)	Panel Size[mm] 2)					Approximate Weight [kg]	Panel Type
						Width	Depth	Height				
						W	D	H	H1	H2		
3000	50/60	180	35	LSMVM1000-030□030200	144	1600	1800	2650	2350	300	2504	A
		270	53	LSMVM1000-030□030300	216	1600	1800	2650	2350	300	2629	A
		360	70	LSMVM1000-030□030400	288	1600	1800	2650	2350	300	2808	A
		450	88	LSMVM1000-030□030500	360	1600	1800	2650	2350	300	3112	A
		540	105	LSMVM1000-030□030600	432	1600	1800	2650	2350	300	3247	A
		680	131	LSMVM1000-030□030750	544	3600	1800	2650	2350	300	4806	B
		900	175	LSMVM1000-030□03010H	720	3600	1800	2650	2350	300	5285	B
		1100	218	LSMVM1000-030□03012H	880	3600	1800	2650	2350	300	5670	B
		1360	260	LSMVM1000-030□03015H	1088	3600	1800	2650	2350	300	5933	B
		1810	350	LSMVM1000-030□03020H	1448	4600	1900	2850	2550	300	8073	B
		2270	438	LSMVM1000-030□03025H	1816	4600	1900	2850	2550	300	8747	B
		2720	525	LSMVM1000-030□03030H	2176	4700	2100	2850	2550	300	10644	B
		3360	657	LSMVM1000-030□03037H	2688	4700	2100	2850	2550	300	11568	B
3300	50/60	200	35	LSMVM1000-033□033200	160	1600	1800	2650	2350	300	2504	A
		300	53	LSMVM1000-033□033300	240	1600	1800	2650	2350	300	2629	A
		400	70	LSMVM1000-033□033400	320	1600	1800	2650	2350	300	2808	A
		500	88	LSMVM1000-033□033500	400	1600	1800	2650	2350	300	3112	A
		600	105	LSMVM1000-033□033600	480	1600	1800	2650	2350	300	3247	A
		750	131	LSMVM1000-033□033750	600	3600	1800	2650	2350	300	4806	B
		1000	175	LSMVM1000-033□03310H	800	3600	1800	2650	2350	300	5285	B
		1200	218	LSMVM1000-033□03312H	960	3600	1800	2650	2350	300	5670	B
		1500	260	LSMVM1000-033□03315H	1200	3600	1800	2650	2350	300	5933	B
		2000	350	LSMVM1000-033□03320H	1600	4600	1900	2850	2550	300	8073	B
		2500	438	LSMVM1000-033□03325H	2000	4600	1900	2850	2550	300	8747	B
		3000	525	LSMVM1000-033□03330H	2400	4700	2100	2850	2550	300	10644	B
		3700	657	LSMVM1000-033□03337H	2960	4700	2100	2850	2550	300	11568	B

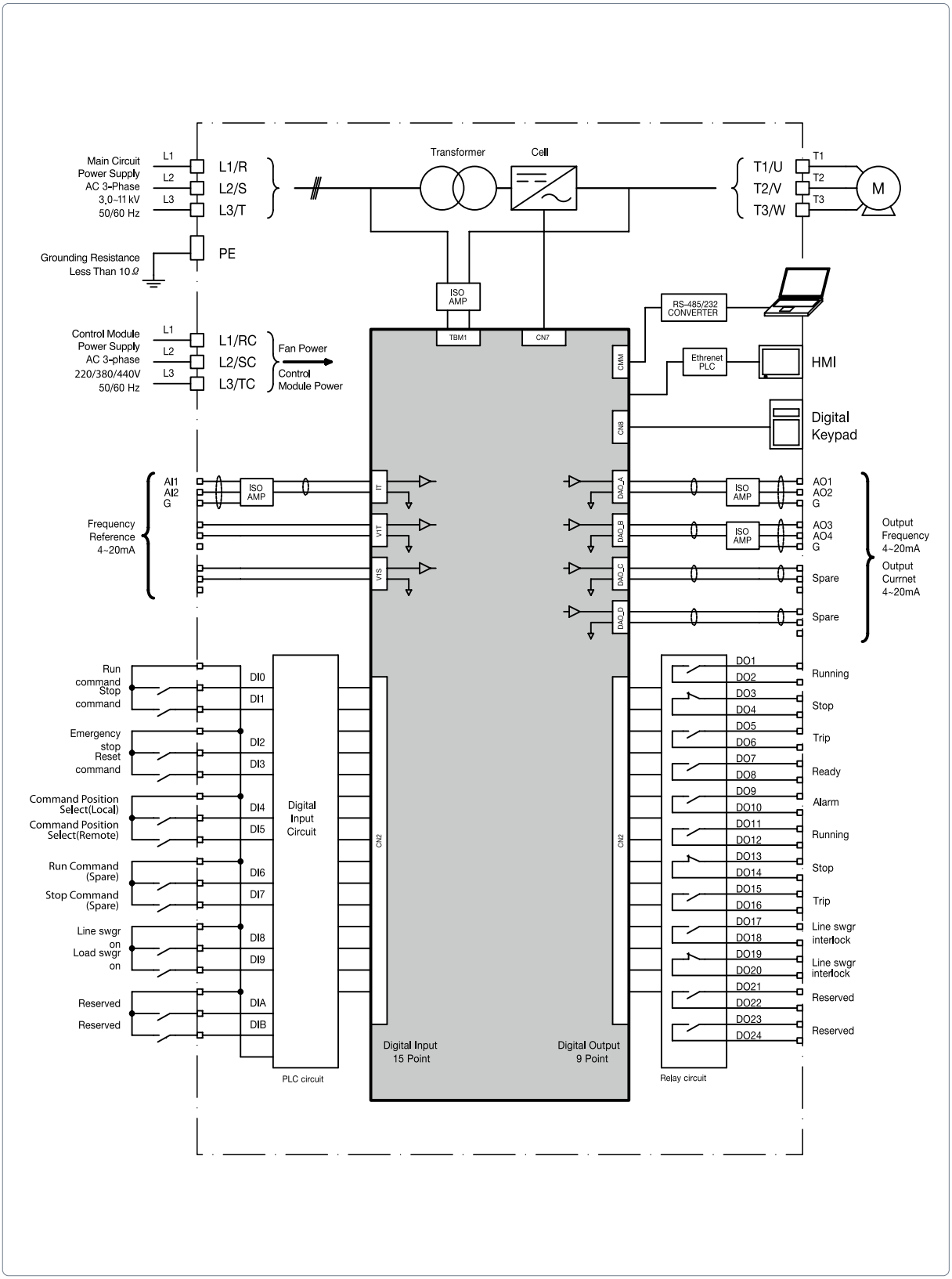
Dimension and Weight

Voltage [V]	Power Frequency [Hz]	Output Capacity [kVA]	Rated Current [A]	Product Model No.	Max. Applicable Motor Capacity[kW] 1)	Panel Size[mm] 2)					Approximate Weight [kg]	Panel Type
						Width	Depth	Height				
						W	D	H	H1	H2		
4160	50/60	250	35	LSMVM1000-041□041250	200	2000	1800	2650	2350	300	3121	A
		380	53	LSMVM1000-041□041380	304	2000	1800	2650	2350	300	3351	A
		500	70	LSMVM1000-041□041500	400	2000	1800	2650	2350	300	3615	A
		630	88	LSMVM1000-041□041630	504	2000	1800	2650	2350	300	3873	A
		750	105	LSMVM1000-041□041750	600	2000	1800	2650	2350	300	4124	A
		950	131	LSMVM1000-041□041950	760	4000	1800	2650	2350	300	6051	B
		1200	175	LSMVM1000-041□04112H	960	4000	1800	2650	2350	300	6401	B
		1500	218	LSMVM1000-041□04115H	1200	4000	1800	2650	2350	300	6909	B
		1900	260	LSMVM1000-041□04119H	1520	4000	1800	2650	2350	300	7430	B
		2500	350	LSMVM1000-041□04125H	2000	5000	1900	2850	2550	300	9870	B
		3100	438	LSMVM1000-041□04131H	2480	5000	1900	2850	2550	300	10622	B
		3700	525	LSMVM1000-041□04137H	2960	5500	2200	2850	2550	300	12861	B
		4700	657	LSMVM1000-041□04147H	3760	5500	2200	2850	2550	300	14681	B
6000	50/60	360	35	LSMVM1000-060□060400	288	2400	1800	2650	2350	300	3589	A
		540	53	LSMVM1000-060□060600	432	2400	1800	2650	2350	300	4019	A
		720	70	LSMVM1000-060□060800	576	2400	1800	2650	2350	300	4463	A
		900	88	LSMVM1000-060□06010H	720	2400	1800	2650	2350	300	4752	A
		1090	105	LSMVM1000-060□06012H	872	2400	1900	2650	2350	300	5110	A
		1360	131	LSMVM1000-060□06015H	1088	4800	1900	2650	2350	300	7959	B
		1800	175	LSMVM1000-060□06020H	1440	4800	1900	2650	2350	300	8652	B
		2200	218	LSMVM1000-060□06025H	1760	4800	1900	2650	2350	300	9317	B
		2720	260	LSMVM1000-060□06030H	2176	4800	1900	2650	2350	300	10091	B
		3630	350	LSMVM1000-060□06040H	2904	6600	1900	2850	2550	300	13718	B
		4540	438	LSMVM1000-060□06050H	3632	6600	1900	2850	2550	300	15057	B
		5450	525	LSMVM1000-060□06060H	4360	6900	2200	2850	2550	300	18766	B
		6810	657	LSMVM1000-060□06075H	5448	6900	2200	2850	2550	300	21456	B
6600	50/60	400	35	LSMVM1000-066□066400	320	2400	1800	2650	2350	300	3589	A
		600	53	LSMVM1000-066□066600	480	2400	1800	2650	2350	300	4019	A
		800	70	LSMVM1000-066□066800	640	2400	1800	2650	2350	300	4463	A
		1000	88	LSMVM1000-066□06610H	800	2400	1800	2650	2350	300	4752	A
		1200	105	LSMVM1000-066□06612H	960	2400	1900	2650	2350	300	5110	A
		1500	131	LSMVM1000-066□06615H	1200	4800	1900	2650	2350	300	7959	B
		2000	175	LSMVM1000-066□06620H	1600	4800	1900	2650	2350	300	8652	B
		2500	218	LSMVM1000-066□06625H	2000	4800	1900	2650	2350	300	9317	B
		3000	260	LSMVM1000-066□06630H	2400	4800	1900	2650	2350	300	10091	B
		4000	350	LSMVM1000-066□06640H	3200	6600	1900	2850	2550	300	13718	B
		5000	438	LSMVM1000-066□06650H	4000	6600	1900	2850	2550	300	15057	B
		6000	525	LSMVM1000-066□06660H	4800	6900	2200	2850	2550	300	18766	B
		7500	657	LSMVM1000-066□06675H	6000	6900	2200	2850	2550	300	21456	B
10000	50/60	600	35	LSMVM1000-100□100600	480	Note 2)						
		900	53	LSMVM1000-100□100900	720							
		1200	70	LSMVM1000-100□10012H	960							
		1500	88	LSMVM1000-100□10015H	1200							
		1800	105	LSMVM1000-100□10018H	1440							
		2200	131	LSMVM1000-100□10022H	1760							
		3000	175	LSMVM1000-100□10030H	2400							
		3700	218	LSMVM1000-100□10037H	2960							
		4500	260	LSMVM1000-100□10045H	3600							
		6000	350	LSMVM1000-100□10060H	4800							
		7500	438	LSMVM1000-100□10075H	6000							
		9000	525	LSMVM1000-100□10090H	7200							
		11000	657	LSMVM1000-100□10011M	8800							

Note 1) Motor Power Factor 0.8
Note 2) Call our sales representative for the dimension of 10kV/11kV class products.

Technical Data

Standard Connection Diagram



Circuit Terminals

Number	Application
L1(R)	Main circuit input voltage rating 3kV/3.3kV/4.16kV/6kV/6.6kV/10kV/11kV,±10%(TAP "0" in the),50/60Hz
L2(S)	
L3(T)	
U	Main circuit output voltage 3kV/3.3kV/4.16kV/6kV/6.6kV/10kV/11kV,0~120Hz
V	
W	
Ground	Grounding resistance: 〈 Less than 10 Ω
L1(RC)	2 Phase, 220V Control power 3 Phase, 220V, 380V, 440V 50Hz or 60Hz (Voltage : ±10%, Frequency : ±5%,)
L2(SC)	
L3(TC)	

Control Circuit

Type	Terminal No.	Signal Name	Functional Description	Function
Analogue Input	AI1	Freq Reference	Operating command input	User Selection (DC 0~10V or 4~20mA
	AI2			
Analogue Output	A01	Output Speed	Feedback operating speed feedback	User Selection (DC 0~10V or 4~20mA) Spare 2 Signal
	A02			
	A03	Output Current	Feedback output current feedback	
	A04			
	A05	Output Speed	Reserve	
	A06			
	A07	Output Current	Reserve	
	A08			
Digital Input	DI0	Rst	Reset	FX/RX/RST/JOG/BX/Speed-L/ Speed-M/Speed-H/Speed-X/Xcel-L/ Xcel-M/Xcel-H/Up/Down/3-Wire/ Analog hold/Ana. Change/Xcel stop/Loc Rem / Door Open/Trans.OHW/Trans.OHT/ Motor OHT/Fan Trip/Ext Trip1/Ext Trip2/ Medium Voltage/Run Enable/ Control LV/PLC_Error/None
	DI1	Ext Trip	External failure	
	DI2	Fx	Normal direction operation	
	DI3	Rx	Reverse direction operation	
	DI4	Trans. OHT	Transformer overheating	
	DI5	Fan Trip	Fan failure	
	DI6	Medium Voltage	Apply input power	
	DI7	Run Enable	Operation possible	
	DI8	Control LV	Control power loss	
	DI9	Reserve	-	
	DI10	Reserve	-	
	DI11	Reserve	-	
	DI12	Reserve	-	
	DI13	Reserve	-	
	DI14	BX	Emergency stop	
Digital Output	AXA1	Ready	Control power read	None/FDT-1/FDT-2/FDT-3/FDT-4/FDT-5/OL/IOL/ Stall/OV/LV/OH/Lost Command/Run/Stop/Steady/ Speed Search/Ready/Warning/FAN RUN/ NORMAL/OCT/Cell_ByPass/RUN_MV
	AXA2	FAN RUN	Fan operation command	
	AXA3	RUN	MVD in operation	
	AXA4	Warning	MVD warning	
	AXA5	Reserve	-	
	AXA6	Reserve	-	
	AXA7	Reserve	-	
	AXA8	Reserve	-	
	30ACB	TRIP	MVD failure	

Technical Data

Protective Function

Individual Cell Production Function

Protection Function	Description
Over Current	It occurs when cell output current is at or over a standard level.
Over Voltage	If the main circuit DC voltage rises over a standard level due to regenerative energy from motor braking or generation load or power system voltage surges and over voltage trip occurs, it cuts off power to drive and stop free run.
Arm Short	It occurs when the IGBT arm or output short circuits. Drive output is cut off and free run stopped in case of arm short circuit
Communication Error	It occurs if there is a communication problem between the cell and master.
Cell Overheat	It occurs if the internal heatsink's cell temperature rises over a standard level.
NTC Open	It occurs when cell's internal temperature sensor fails and there is a problem in temperature measurement.
Low Voltage	It occurs when the main circuit DC voltage falls below a standard level.

System Protection Function

Protection Function	Description
Over Current	If the output current of MV drive reaches 140% or more of rated current, output is cut off and free run stopped.
Over Load	If the output current of the MV drive reaches 120% or more of the rated current and stays at that level for 1 minute or longer, output is cut off and free run stopped.
Ground Fault	If phase imbalance of output current occurs at or above a standard level following a grounding fault of the output cable of MV drive, output is cut off and free run stopped.
Motor Over Load	If the MV drive output current exceeds OL level and the OL time set for the rated motor current, output is cut off and free run stopped.
E-thermal	If the motor is deemed to be overheated at or above a standard level based on the theoretical calculation of motor temperature rise (based on MV drive output frequency and output current), output is cut off and free run stopped.
Low Current (No Motor Trip)	It occurs when it is deemed that the motor connection is broken due to switch gear failure on the output side while the MV drive is operating or starting, output is cut off and free run stopped.
Output Phase Open	It is a function to protect the MV drive from open phase of the output cable during operation.
Input Phase Open	It is a function to protect the MV drive from open phase of the input cable during operation
Input Over Voltage	It occurs when the main transformer input voltage reaches 120% or more of the MV drive rated voltage and cuts off output.
Input Low Voltage	It occurs when the main transformer input voltage reaches 70% or less of the MV drive rated voltage and cuts off output.
DC Over Voltage	If DC voltage of any of the cells used in the MV drive exceeds 1050V, output is cut off.
Cell Overheat	If any of the cells reaches 75℃ or more, it is regarded as failure and output is cut off.
Trans Overheat	If the main transformer temperature reaches 120℃ or more, failure is detected through the multi-function digital input.
BX	It is a fault used for the MV drive emergency stop. Power is cut off at user□s decision when an emergency occurs and signal is received through switch or external signal link.
Motor Overheat	If trip signal of motor temperature sensor is received through digital input, output is cut off.
Fan Error	If a fan installed on the top to cool the MV drive fails and signal is received through the digital input, output is cutoff.
Ext Trip1, Ext Trip2	Contacts can be configured as faults in accordance with fault stop and sequence setup configured by users to handle specific events other than tripping.
Control Low Voltage	It occurs when power is not supplied following a problem in the MV drive control power and output is cutoff.
PLC Error	If a problem occurs in the PLC installed within the MV drive and PLC failure contact is received from the digital input, output is cutoff.
Can Error	It is a protection function that activates if there is a communication problem between the MV drive controller and cell. It is interlinked with the cell bypass operation as configured.
Cell Trip	It is a protection function that allows the master to trip cells where faults have occurred.

Appendix

Installation

Installation Environment

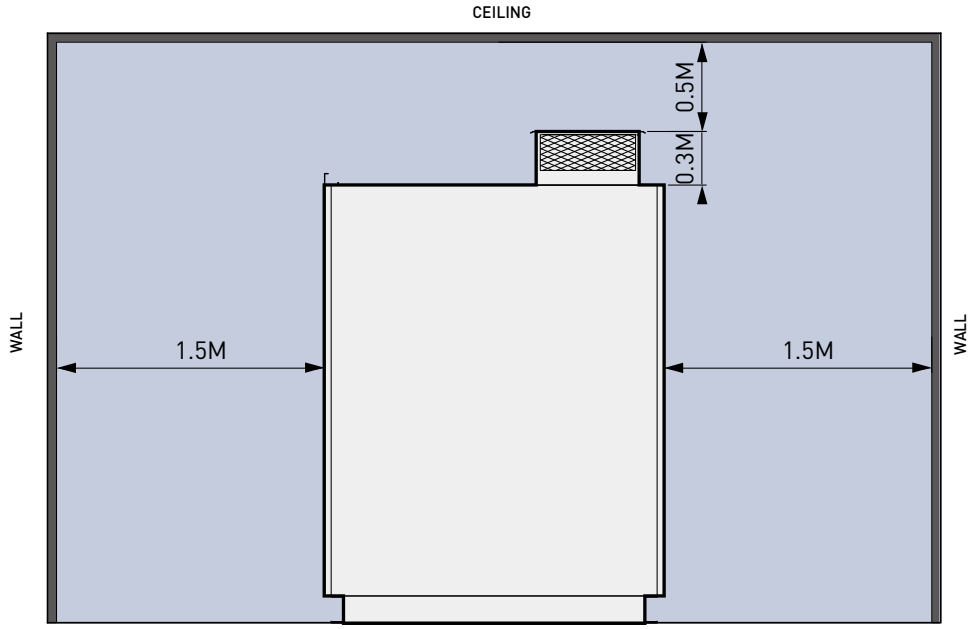
M-series products should be installed in an environment where the following conditions are met:

- Ambient temperature : 0 ~ 40°C
- Ambient humidity : 85% or less (no dew formation)
- No water dropping from above
- No direct exposure to dust
- No existence of corrosive liquid or gas
- Absence of excessive vibration

Space equal to the product footprint should be secured in advance in reference to applicable drawing when product is to be installed.

Installation Space

Sufficient space should be secured to cool down the product during the operation and facilitate maintenance.



Ambient Temperature

This product should be installed at a location not exposed to severe environment changes in order to maintain product reliability. Temperature around the product and air allowed into the LSMV should be maintained at 40°C... or below. When the product is installed in a confined place, an additional cooling fan or air conditioner should be installed to keep the room temperature at or below 40°

Blocking of Foreign Materials

Particular care should be taken to keep foreign materials such as dust or metal debris from finding their way into product while it is being installed. Extra care should be taken to keep foreign materials from flowing into the transformer. Do not leave installation tools or unused parts inside the panel after installation.

Appendix

Maintenance

Daily & Regular Trouble Check

To prevent advance failure of the MV drive and ensure operational reliability over an extended period of time, check the product as described in the following table. Trouble checks include a daily check that can be performed during operation (Table 1) and regular checks that are performed when power is cutoff and operation has stopped (Table 2).

When performing a regular check, make sure that the keypad at the front of a cell is completely turned off to prevent damage from electric shocks.

Table 1 Daily Check Items

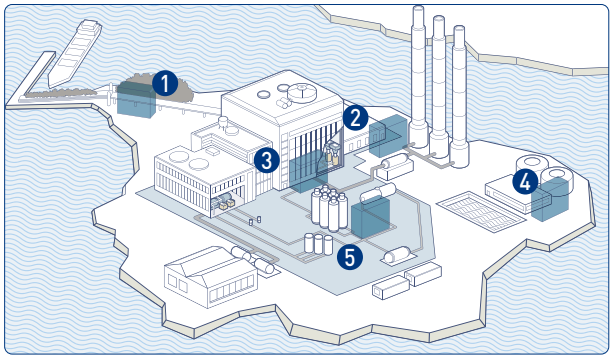
Check Location	Check Items	Check Description
System	Ambient Temperature	Check ambient temperature, humidity, dust, hazardous gas, oil leak, and the like
	System in General	Check abnormal vibration and noise
	Power Voltage	Check if the main circuit voltage and control voltage are normal
Main circuit	Transformer	Check for abnormal odor, sound, and noise
Cooling System	Cooling Fan	Check for abnormal vibration and noise
		Check and clean air filter
Display	Instrument	Check measurement accuracy and indicator reading

Table 2. Regular Check Items (Once / Year)

Check Location	Check Items	Check Description
Main Circuit	Transformer, Power Supply, Cell Panel	Check the insulation between the main circuit terminal and ground and between terminals with the insulation resistance meter
		Check if any screw, bolt, or connector is loose
		Check if any part is overheating
		Clean the inside of the panel
	Cable	Check for cable shield damage, deterioration
	Transformer	Check if the primary side voltage and secondary side voltage are normal
	Cell	Check for smoothing capacitor leaks
		Check if the smoothing capacitor is swollen
		Measure and check smoothing capacitor capacitance
		Check if any screw or bolt is loose
		Check if normal circuit and control circuit fuses are normal
		Clean dust built up inside product and heat sink
		Check if the protection circuit and indicator circuit operate as intended
Control Circuit	Operation	Check if the product operates as intended
	Relay	Check if the timer operates as intended
		Check if there is any damage to the contact.
		Check for abnormal odor and discoloring
	Board	Check power supply voltage
		Check for abnormal vibration and noise
Cooling System	Cooling Fan	Check operating direction

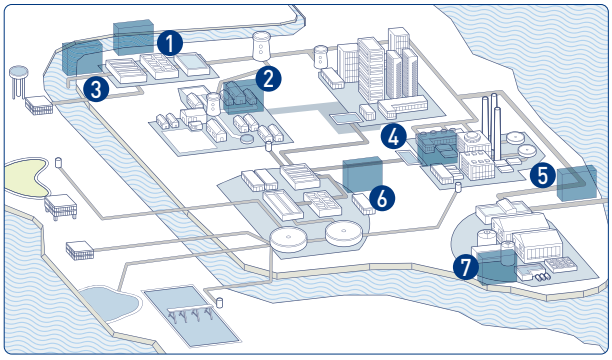
Application Sectors

Power Generation



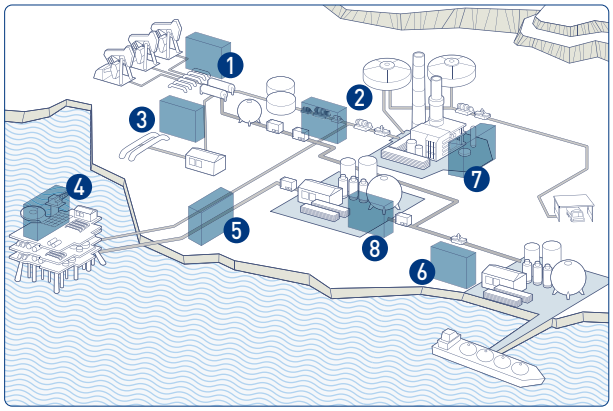
1. Coal Conveyors
   - Coal Mill
2. Induced Draft Fan
3. Forced Draft Fan
   - Primary Air Fan
   - Secondary Air Fan
   - Gas Recirculation Fan
4. Sea Water Lifting Pump
5. Circulating Water Pump
   - Boiler Feed Pump
   - Condensate Extraction Pump
   - Cooling Water Pump

Water Treatment



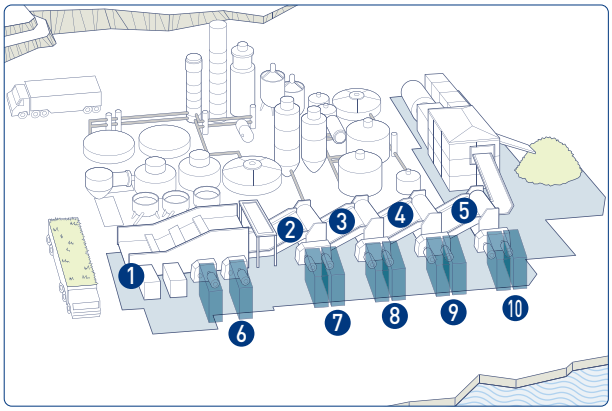
1. Transfer Pump
   - Distribution Pump
   - Booster Pump
2. Distribution Pump
   - Booster Pump
3. Raw Water Intake Pump
4. Process Feed-Water Pump
   - District Heating Pump
   - Cooling Water Pump
   - Slurry Pump
5. Feed-Water Pump
6. Influent and Effluent Pump
   - Treatment Pump/Fan
7. Intake Pump
   - Brine Pump
   - Booster Pump
   - High Pressure Pump

Oil-Gas & Chemical



1. Loading Pump
   - Injection Pump
2. Compressor
3. Injection Pump
4. Loading Pump
5. Delivery Pump
6. Loading Pump
7. Compressor
   - Injection Pump
   - Boosting Pump
   - Loading Pump
8. Compressor
   - Injection Pump
   - IDF
   - FDF

Sugar Mill



1. Cane Knife
2. Pressure Feed
3. Pressure Feed
4. Pressure Feed
5. Pressure Feed
6. Cane Shredder
7. Mill
8. Mill
9. Mill
10. Mill

Appendix

Form for quotation

1	**Name of Application**	
2	**Type of Load**	☐ Pump ☐ Fan ☐ Blower ☐ Compressor ☐ Others
3	**Torque Characteristics**	☐ Variable Torque ☐ Proportional Torque ☐ Constant Torque ☐ Constant Output J(GD^2/4) kg·㎡
4	**Operation Conditions**	Motor Current_____A , Annual Operation Time_____hours
5	**Motor Specifications**	☐ Squirrel-Cage Induction motor ☐ Wound-Rotor Type Motor ☐ Existing ☐ New Output _____kW , Voltage_____V , Frequency _____Hz , Pole Number _____P Speed _____min , Rated Current ____A , Efficiency _____% , Power, Factor_____%
6	**Speed Control Range**	Minimum_____/min to Maximum_____/min or Minimum_____/Hz to Maximum_____/Hz
7	**Acceleration/Deceleration Time Setting**	Acceleration Time_____Second(s)/_____min Deceleration Time_____Second(s)/_____min
8	**Overload Capacity**	_____% /_____Second(s)
9	**By-Pass Operation Circuit**	☐ Required < ☐ Automatic ☐ Manual >
10	**Power Supply Specifications**	Main Circuit Voltage _____V , _____Hz Control Circuit Voltage ☐ 220V 3P ☐ 380V 3P ☐ 440V 3P ☐ Others _____V 3P
11	**Ambient Conditions**	Indoors ☐ Ambient Temperature _____℃, ☐ Humidity_____% or less ☐ Air-Conditioning Facility (☐ Provided ☐ Not Provided) ☐ Install Space (Width _____mm ☐ Height _____mm ☐ Depth _____mm) ☐ Cable Entry (☐ Bottom ☐ Top)
12	Option	

Energy Saving Drive Solution
Medium Voltage Drive
LSMV-M1000

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LS is engaged in business all over the world.
LS global network includes 7 overseas corporations,
12 overseas branches, and 224 clients in 77 countries.

▶ R&D

R&D campus

Focuses on gaining competitive advantages through development of next generation platforms

Power device R&D center

Leading technology in electric industry and continuously developing future-growth dynamic engines

Automation R&D Center

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PT&T (Testing laboratory)

Internationally-renowned testing center that has formed partnerships with the UL, CE, KEMA and CESI

▶ Factory

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Cheonan factory (Korea)
PLC, AC drive, HMI, DCS, PV module

Busan factory (Korea)
HV TR, HVDC, FACTS

Wuxi factory (China)
Electric products

Dalian factory (China)
MV/LV switchgear, MV contactor

Hanoi factory (Vietnam)
MV/LV switchgear, Mold TR

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We open up a brighter future through
efficient and convenient energy solutions.

Safety Instructions

- For your safety, please read user's manual thoroughly before operating.
- Contact the nearest authorized service facility for examination, repair, or adjustment.
- Please contact qualified service technician when you need maintenance.
  Do not disassemble or repair by yourself!
- Any maintenance and inspection shall be performed by the personnel having expertise concerned.

- According to The WEEE Directive, please do not discard the device with your household waste.

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