

SmartVFD HVAC232/402

Variable speed drives for induction- and permanent magnet motors, with built-in RFI filters. EMC and LVD compliant.

GENERAL

SmartVFD HVAC232/402 variable frequency drives provide step-less speed control for various applications:

- Pumps
- Fans
- Compressors

FEATURES

- Compact size - saves space in your equipment cabinet
- Models available up to 5.5 kW
- Permanent magnet motor support
- Energy-optimization feature
- Programmable FB (Fieldbus) process data
- Settable limit supervisions
- Temperature measurement with temperature sensor option board OPTBH
- Flexible side-by-side mounting with screws or DIN-rail as standard for MI1-MI3 frame sizes
- Single rating suitable for both pump and fan or machine applications
- Maximum ambient temperature: +50 °C for most drives
- Fire mode feature
- Integrated RFI-filters
- All models available with Class C2 EMC filter
- Wide input and output connection possibilities
- Configurable inputs and outputs
- 30-second Start-Up Wizard
- Easy “keypad to remote” change with 1 button
- Parameter upload/download even without main power to the drive with COMP-LOADER and SmartDrive-USBC accessory
- Quiet motor operation with adjustable switching frequency from 4 kHz up to 16 kHz
- Overtemperature ride-through
- Motor pre-heat
- Power ride-through
- Automatic restart
- Integrated PID controller
- COMP-IP21-KIT# kit , COMP-NEMA1-KIT#
- Built-in RS-485 Modbus communication



SPECIFICATIONS

Mains Connection

Input voltage U_{in} :

208 ... 240 V, -15% ... +10% 1~

380 ... 480 V, -15% ... +10% 3~

Input frequency: 45 ... 66 Hz

Connection to mains: Once per minute or less (normal case)

Supply Network

Networks:

SmartVFD HVAC232/402 cannot be used with corner-grounded networks.

Short circuit current:

Maximum short circuit current has to be < 50 kA

Motor Connection

Output voltage: $0 \dots U_{in}$

Output current:

Continuous rated current I_N at ambient temperature max. +50 °C (depends on the unit size), overload:

- $1.5 \times I_{Nmax}$
- 1 min / 10 min

Starting current/torque: Current $2 \times I_N$ for 2 sec in every 20 sec period. Torque depends on motor.

Output frequency: $0 \dots 320$ Hz

Frequency resolution: 0.01 Hz

Control connections

Digital input:

Positive, Logic 1: $18 \dots +30$ V, Logic 0: $0 \dots 5$ V
Negative, Logic 1: $0 \dots 10$ V, Logic 0: $18 \dots 30$ V
 $R_i = 10$ k Ω (floating)

Analogue input voltage: $0 \dots +10$ V, $R_i = 250$ k Ω

Analogue input current: $0(4) \dots 20$ mA, $R_i \leq 250$ Ω

Analogue output: $0 \dots 10$ V, $R_L \geq 1$ k Ω ;
 $0(4) \dots 20$ mA, $R_L \leq 500$ Ω ,
Selectable through microswitch

Digital output:

Open collector, max. load 35 V/50 mA (floating)

Relay output:

Switching load: 250 VAC/3 A, 24 VDC/3 A

Auxiliary voltage: ± 20 %, max. load 50 mA

Control Characteristics

Control method:

Frequency Control U / f

Open-Loop Sensorless Vector Control

Switching frequency: $1 \dots 16$ kHz; Factory default 4 kHz

Frequency reference: Resolution 0.01 Hz

Field weakening point: $30 \dots 320$ Hz

Acceleration time: $0.1 \dots 3000$ sec

Deceleration time: $0.1 \dots 3000$ sec

Ambient Conditions

Operating temperature:

-10 °C (no frost) $\dots +40/50$ °C

(depends on the unit size): rated loadability I_N

Side by side installation for MI1-3 it is always (40 °C);

For IP21 frames or using COMP-IP21-KITx / COMP-NEMA1-KITx kit options in MI1-3 the maximum temperature is also 40 °C)

Storage temperature: -40 °C $\dots +70$ °C

Air quality:

Chemical vapors:

IEC 721-3-3, unit in operation, class 3C2

Solid particles:

IEC 721-3-3, unit in operation, class 3S2

Altitude:

100% load capacity (no derating) up to 3281 ft. (1000 m).

Above 3281 ft. (1000 m), 1% derating for each additional 328 ft. (100 m); max. 6562 ft. (2000 m)

Relative humidity:

$0 \dots 95$ % RH, non-condensing, non-corrosive, no dripping water

Vibration: $3 \dots 150$ Hz

EN60068-2-6:

Displacement amplitude 1 (peak) mm at $3 \dots 15.8$ Hz

Max acceleration amplitude 1 g at $15.8 \dots 150$ Hz

Shock

IEC 68-2-27: UPS Drop Test (for applicable UPS weights)

Storage and shipping: max 15 g, 11 ms (in package)

Enclosure class: IP20.

MI1...MI3 upgrade with COMP-NEMA1-KITx / COMP-NEMA1-KITx enclosure.

Pollution degree: PD2

Electromagnetic Compatibility

(EMC)

Immunity: Complies with EN50082-1, -2, EN61800-3

Emissions: 230 V: Complies with EMC category C2;

400 V: Complies with EMC category C2;

Safety:

For safety: EN61800-5, CE

For EMC: EN61800-3, CE

Protections

Overvoltage protection: Yes

Undervoltage protection: Yes

Earth-fault protection:

In case of earth fault in motor or motor cable, only the frequency converter is protected

Unit overtemperature protection: Yes

Motor overload protection: Yes

Motor stall protection (fan/pump blocked): Yes

Motor underload protection

(pump dry / belt broken detection): Yes

Short-circuit protection of +24 V and +10 V

reference voltages: Yes

Overcurrent protection: Trip limit $4.0 \times I_N$ instantaneously

MODELS

Table 1. Mains voltage 208-240 V, 50/60 Hz, 1~ series.

Part number	Rated loadability		Motor shaft power		Nominal input current [A]	Mechanical size	Weight [kg]
	100% continuous current I _N [A]	150% overload current [A]	P [HP]	P [KW]			
HVAC232-P37-20	2.4	3.6	0.5	0.37	5.7	MI1	0.55
HVAC232-P55-20	2.8	4.2	0.75	0.55	6.6	MI1	0.55
HVAC232-P75-20	3.7	5.6	1.0	0.75	8.3	MI2	0.70
HVAC232-1P1-20	4.8	7.2	1.5	1.1	11.2	MI2	0.70
HVAC232-1P5-20	7.0	10.5	2.0	1.5	14.1	MI2	0.70
HVAC232-2P2-20*	9.6	14.4	3.0	2.2	22.1	MI3	0.99

* The maximum ambient operating temperature of this drive is 40 °C

Table 2. Mains voltage 380-480 V, 50/60 Hz, 3~ series.

Part number	Rated loadability		Motor shaft power		Nominal input current [A]	Mechanical size	Weight [kg]
	100% continuous current I _N [A]	150% overload current [A]	P [HP]	P [KW]			
HVAC402-P55-20	1.9	2.9	0.75	0.55	2.8	MI1	0.55
HVAC402-P75-20	2.4	3.6	1	0.75	3.2	MI1	0.55
HVAC402-1P1-20	3.3	5	1.5	1.1	4	MI2	0.70
HVAC402-1P5-20	4.3	6.5	2	1.5	5.6	MI2	0.70
HVAC402-2P2-20	5.6	8.4	3	2.2	7.3	MI2	0.70
HVAC402-3P0-20	7.6	11.4	4	3	9.6	MI3	0.99
HVAC402-4P0-20	9	13.5	5	4	11.5	MI3	0.99
HVAC402-5P5-20	12	18	7.5	5.5	14.9	MI3	0.99

PRODUCT IDENTIFICATION CODE

HVAC 40 2 - 1P5 - 20

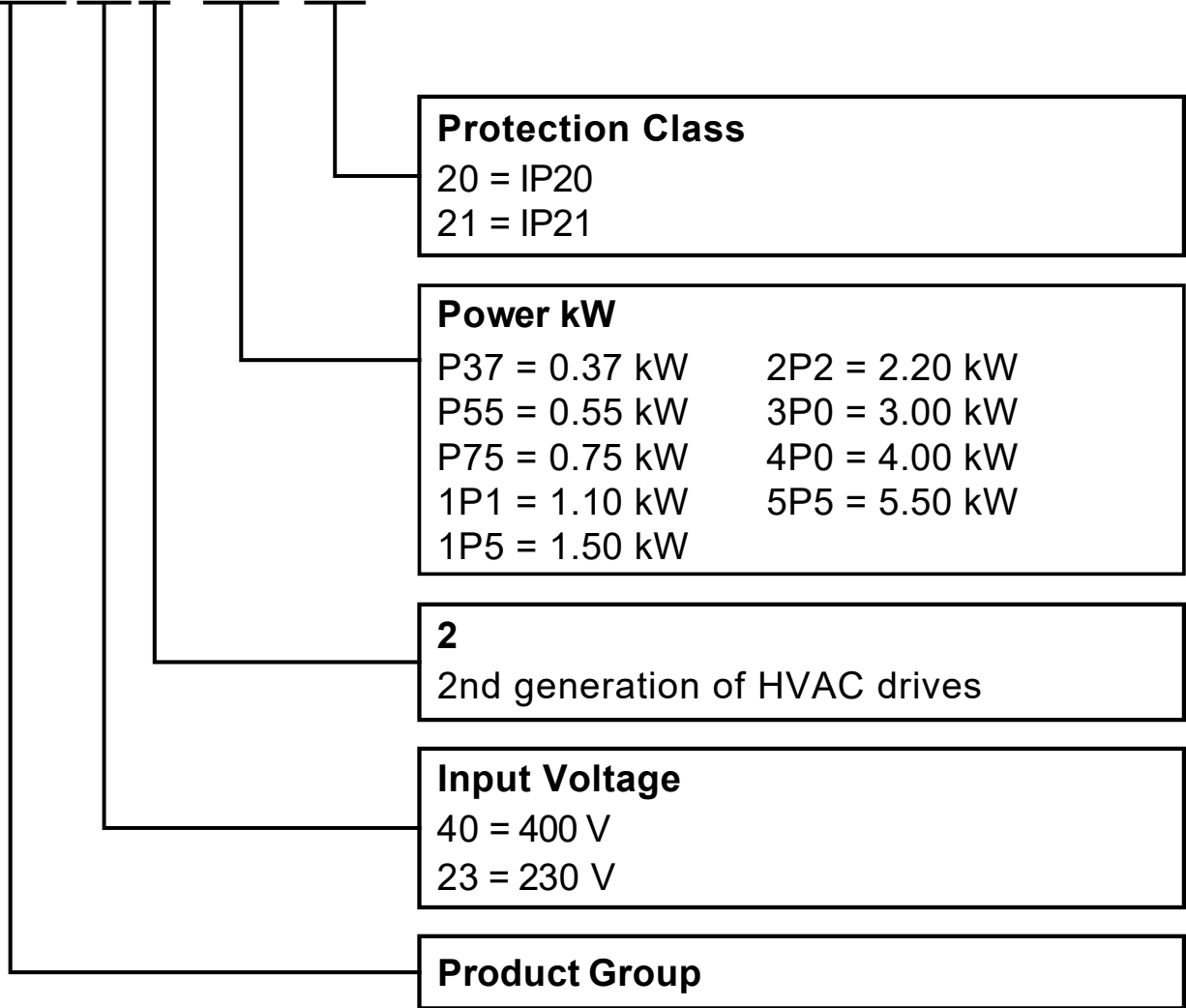


Fig. 1. SmartVFD HVAC232/402 type designation code.

MECHANICAL MOUNTING

There are two possible ways to mount SmartVFD HVAC232/402 onto the wall.

- For MI1-MI3, either screw or DIN-rail mounting;
- For MI4-MI5, screw or flange mounting.

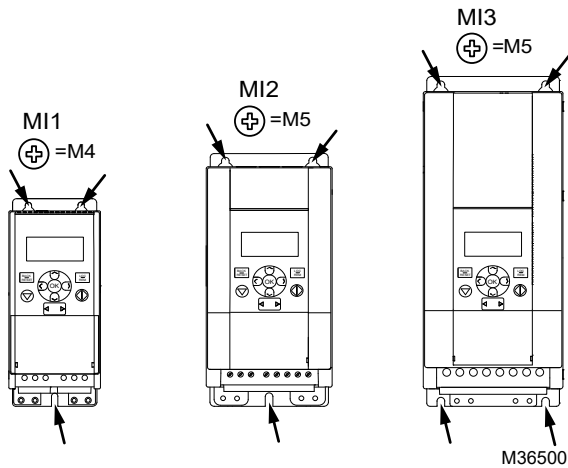


Fig. 2. Screw mounting, MI1 - MI3

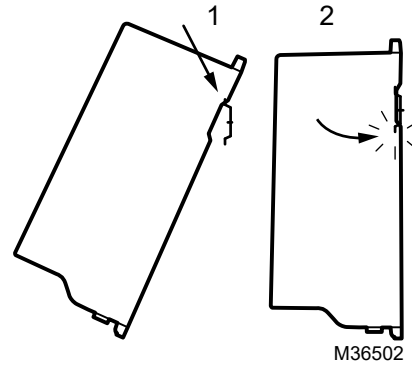


Fig. 3. DIN-rail mounting, MI1 - MI3

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NOTE: See the mounting dimensions on the back of the drive. For more details, see Manual 27-652 in Chapter 3.1

COOLING

Enough clearance shall be left above and below the frequency converter to ensure sufficient air circulation and cooling. You will find the required dimensions for clearance in the table below.

If several units are mounted above each other the required free space equals C + D. Moreover, the outlet air used for cooling by the lower unit must be directed away from the air intake of the upper unit.

The amount of cooling air required is indicated below. Also make sure that the temperature of the cooling air does not exceed the maximum ambient temperature of the converter.

Table 3. Min. clearances around AC drive

Min. clearance in inches (mm)				
Type	A*	B*	C	D
MI1	0.8 (20)	0.8 (20)	3.9 (100)	2 (50)
MI2	0.8 (20)	0.8 (20)	3.9 (100)	2 (50)
MI3	0.8 (20)	0.8 (20)	3.9 (100)	2 (50)

* only above 40 °C ambient

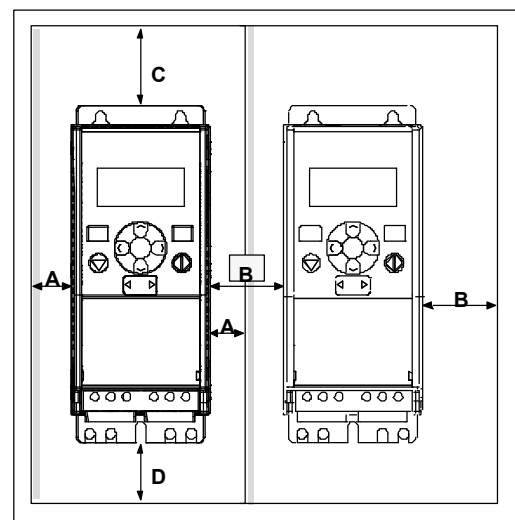


Fig. 4. Mounting space

DIMENSIONS

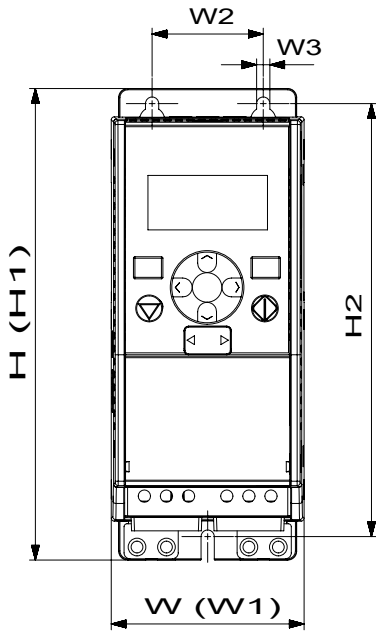


Fig. 5. SmartVFD HVAC232/402 dimensions, MI1 - MI3.

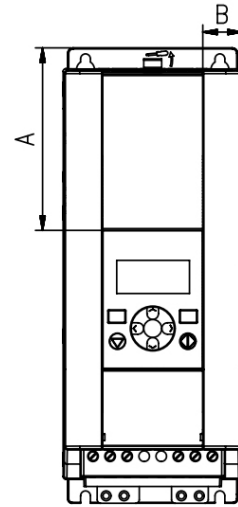
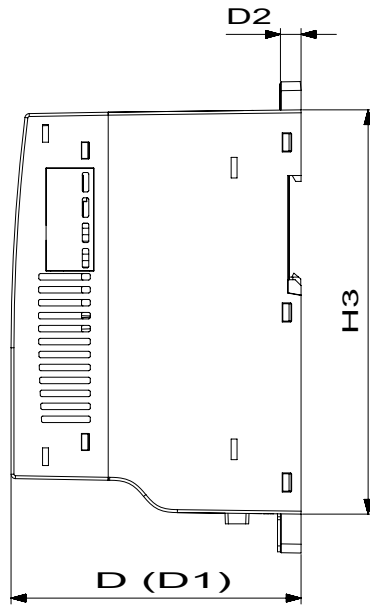


Fig. 6. SmartVFD HVAC232/402 dimensions, MI2 - 3 Display Location

Table 4. Dimensions in inches (mm)

	Frame	
	MI2	MI3
A	0.7 (17)	0.9 (22.3)
B	1.7 (44)	4 (102)

Table 5. SmartVFD HVAC232/402 dimensions in inches (mm)

Type	H1	H2	H3	W1	W2	W3	D1	D2
MI1	6.3 (160)	5.8 (147)	5.4 (137)	2.6 (66)	1.5 (38)	0.18 (4.6)	3.9 (99)	0.28 (7)
MI2	7.7 (196)	7.2 (183)	6.7 (170)	3.5 (89)	2.5 (64)	0.22 (5.6)	4.0 (102)	0.28 (7)
MI3	10 (254)	9.6 (244)	9.0 (229)	3.9 (99)	3.0 (76)	0.22 (5.6)	4.3 (109)	0.28 (7)

Table 6. SmartVFD HVAC232/402 frame dimensions and weights

Frame	Dimensions in inches (mm)			Weight in lbs (kg)*
	W	H	D	
MI1	2.6 (66)	6.3 (160)	3.9 (99)	1.1 (0.5)
MI2	3.5 (89)	7.7 (196)	4.0 (102)	1.6 (0.7)
MI3	3.9 (99)	10 (254)	4.3 (109)	2.2 (1)

* without shipping package

CABLING AND FUSES

Use cables with heat resistance of at least 70 °C.

The cables and the fuses must be dimensioned according to the tables below.

The fuses function also as cable overload protection.

These instructions apply only to cases with one motor and one cable connection from the frequency converter to the motor. In any other case, ask the factory for more information.

Table 7. Cable types required to meet standards.

EMC category	cat. C2	cat. C4
Mains cable types	1	1
Motor cable types	3	1
Control cable types	4	4

Table 8. Cable type descriptions.

Cable type	Description
1	Power cable intended for fixed installation and the specific mains voltage. Shielded cable not required. (NKCABLES / MCMK or similar recommended)
2	Power cable equipped with concentric protection wire and intended for the specific mains voltage. (NKCABLES / MCMK or similar recommended).
3	Power cable equipped with compact low-impedance shield and intended for the specific mains voltage. (NKCABLES / MCCMK, SAB / ÖZCUY-J or similar recommended). *360° earthing of both motor and FC connection required to meet the standard
4	Screened cable equipped with compact low-impedance shield (NKCABLES / Jamak, SAB / ÖZCuY-O or similar).

Table 9. Cable and fuse sizes for SmartVFD HVAC232/402, 208 - 240 V, 1~.

Frame	Power [kW]	Fuse [A]	Mains cable Cu [mm ²]	Motor cable Cu [mm ²]	Terminal cable size (min/max)			
					Main terminal [mm ²]	Earth terminal [mm ²]	Control terminal [mm ²]	Relay terminal [mm ²]
MI1	0.25...0.55	10	2*1.5+1.5	3*1.5+1.5	1.5-4	1.5-4	0.5-1.5	0.5-1.5
MI2	0.75...1.50	20	2*2.5+2.5	3*1.5+1.5	1.5-4	1.5-4	0.5-1.5	0.5-1.5
MI3	2.2*	32	2*6+6	3*1.5+1.5	1.5-6	1.5-6	0.5-1.5	0.5-1.5

* The maximum ambient operating temperature of this drive is 40 °C!

Table 10. Cable and fuse sizes for SmartVFD HVAC232/402, 380 - 480 V, 3~.

Frame	Power [kW]	Fuse [A]	Mains cable Cu [mm ²]	Motor cable Cu [mm ²]	Terminal cable size (min/max)			
					Main terminal [mm ²]	Earth terminal [mm ²]	Control terminal [mm ²]	Relay terminal [mm ²]
MI1	0.37...0.75	6	3*1.5+1.5	3*1.5+1.5	1.5-4	1.5-4	0.5-1.5	0.5-1.5
MI2	1.1...2.2	10	3*1.5+1.5	3*1.5+1.5	1.5-4	1.5-4	0.5-1.5	0.5-1.5
MI3	3.0...5.5	20	3*2.5+2.5	3*2.5+2.5	1.5-6	1.5-6	0.5-1.5	0.5-1.5

Power cabling

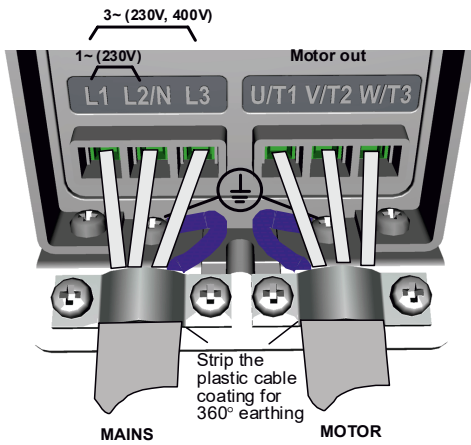


Fig. 7. SmartVFD HVAC232/402 power connections, MI1

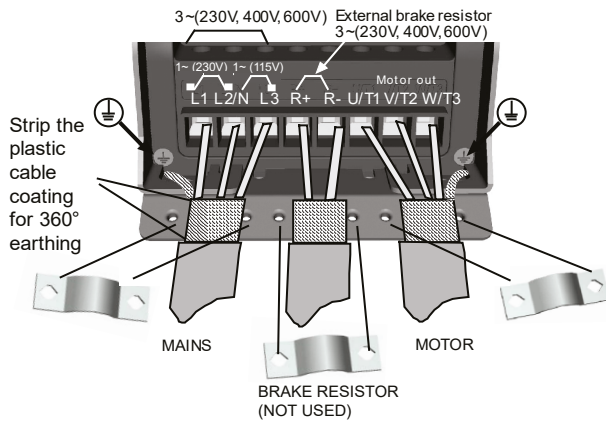


Fig. 8. SmartVFD HVAC232/402 power connections, MI2 - MI3

i **NOTE:** Tightening torque for power cables is 0.5...0.6 Nm (4...5 in-lbs).

Control cabling

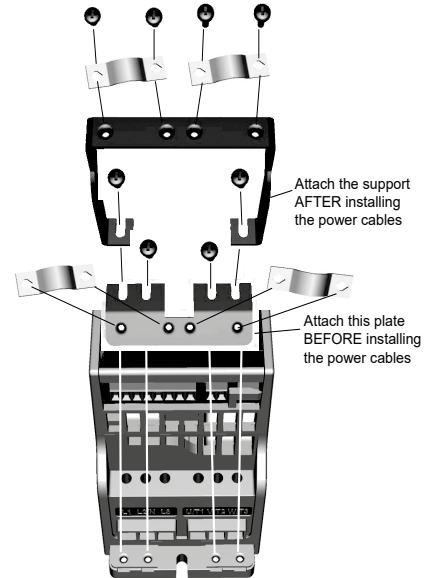


Fig. 9. Mount the PE-plate and API cable support, MI1 - MI3.

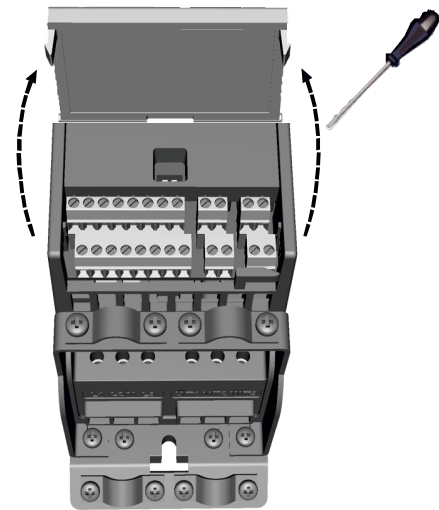


Fig. 10. Open the lid, MI1 - MI3.

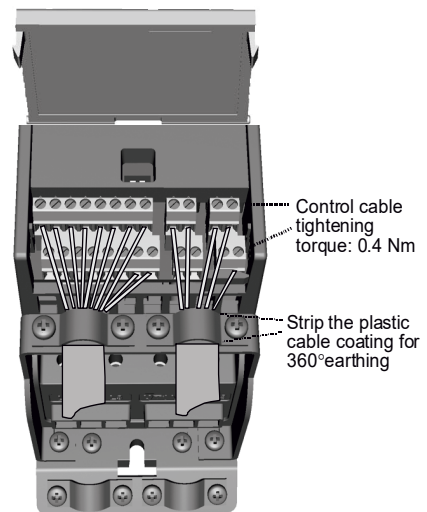


Fig. 11. Install the control cables. MI1 - MI3.

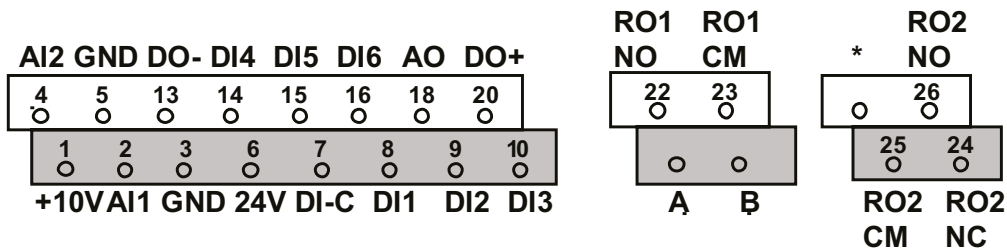


Fig. 12. SmartVFD HVAC232/402 Compact control connection terminals.

The table below shows the SmartVFD HVAC232/402 control connections with the terminal numbers.

Table 11. SmartVFD HVAC232/402 General purpose application default I/O configuration and connections for control board P = Programmable function.

1...10 kΩ	Terminal	Signal	Factory preset	Description		
	1	+10 Vref	Ref. voltage out	Maximum load 10 mA		
	2	AI1	Analogue signal in 1	Freq. reference ^{P)}	0...10 V, Ri = 250 kΩ	
	3	GND	I/O signal ground			
	6	24 Vout	24 V output for DI's	±20%, max. load 50 mA		
	7	DI_C	Digital Input Common	Digital Input Common for DI1-DI6, refer to manual 27-652 ENG, "Table 18. DI Sink Type"		
	8	DI1	Digital input 1	Start forward ^{P)}	Positive Logic 1: 18...30 V, Negative Logic 1: 0...10 V,	
	9	DI2	Digital input 2	Start reverse ^{P)}	Positive Logic 0: 0...5 V, Negative Logic 0: 18...30 V; Ri = 10 kΩ (floating)	
	10	DI3	Digital input 3	Fault reset ^{P)}		
	A	A	RS-485 signal A	FB Communication	Negative	
	B	B	RS-485 signal B	FB Communication	Positive	
	4	AI2	Analogue signal in 2	PID actual value and frequency reference ^{P)}	Default: 0(4)...20 mA, Ri ≤ 250 Ω Other: 0...10 V, Ri = 250 kΩ Selectable through microswitch	
	5	GND	I/O signal ground	Digital Output Common		
	13	DO-	Digital Output Common			
	14	DI4	Digital input 4	As DI1		
	15	DI5	Digital input 5	As DI1, Selectable through microswitch		
	16	DI6	Digital input 6	As DI1		
	18	AO	Analogue Output	Output frequency ^{P)}	Selectable through microswitch 0(4)...20 mA, R _L ≤ 500 Ω, 0...10 V, R _L ≥ 1 kΩ	
	20	DO	Digital signal out	Active = READY ^{P)}	Open collector, max. load 35 V / 50 mA	
	22	RO1 NO		Relay out 1	Active = RUN ^{P)}	Switching load: 23 RO1 CM 250 VAC / 3 A, 24 VDC / 3 A
	23	RO1 CM				
	24	RO2 NC		Relay out 2	Active = FAULT ^{P)}	Switching load: 25 RO2 CM 250 VAC / 3 A, 24 VDC / 3 A
	25	RO2 CM				
	26	RO2 NO				

Fig. 13. Control inputs and outputs – API Full.

FEATURES / FUNCTIONS

Table 12. Easy to set-up features

Feature	Functions	Benefit
30-second Start-up wizard	Quick wizard allows you to set up basic parameters upon first power-up of drive.	Speeds up drive set-up for basic parameters. Includes fire mode set-up if needed.
"Keypad – Remote" Operation	Push the Local/Remote button.	Single button operation to change the control to manual (keypad) and back. Useful function when commissioning and testing applications
Quick Setup Menu	Only the most commonly used parameters are visible in basic view to provide easier navigation. The full view can be seen after P16.2 in SmartVFD HVAC232/402 Parameter conceal is deactivated by changing the value to 0.	Easy navigation through the most common parameters
SmartVFD HVAC232/402 Commissioning Tool	1. Parameter sets can be uploaded and downloaded with this tool. 2. Easy to use PC-tool for commissioning the SmartVFD HVAC232/402 Inverters. Connection with SmartDrive-USBC and MCA adapter, COMP-LOADER, to the USB port of the PC. PC-tools available for download free of charge from http://inverter.ecc.emea.honeywell.com/download-centre.htm	Parameter copying easily from 1 inverter to another. Easy download of parameter sets created with PC-tool Parametering with PC Saving settings to PC Comparing parameter settings

Table 13. Compact and robust design with easy installation

Feature	Functions	Benefit
Compact size	Minimum clearance above and below the drive is required for cooling airflow.	Minimum space requirements.
Integrated RFI-filters	The part numbers comply with EN61800-3 category C2 as standard. This level is the required level for public electricity networks such as buildings.	Easy selection and installation of products. Space savings cost savings
Max. ambient temperature +50 °C (some exceptions)	High maximum ambient operating temperature.	Uninterruptible operation.
Side by side mounting with screws or DIN-rail as standard	SmartVFD HVAC232/402 MI1-MI3 can be mounted side by side with no space between the units either with screws or on DIN-rail as standard. (For MI4-MI5, side-to-side installation is not allowed and there is no DIN rail option.) Dimensions for screw mounting can be found also on the back of the inverter.	Easy installation. Space savings.

Table 14. Uninterruptible operation functions

Feature	Functions	Benefit
Overtemperature ride-through	Automatically adjusts switching frequency to adapt to unusual increase in ambient temperature.	Uninterruptible operation.
Power ride-through	Automatically lowers motor speed to adapt to sudden voltage drop such as power loss.	Uninterruptible operation.
Auto restart function	Auto restart function can be configured to make VFD restart automatically once fault is addressed.	Uninterruptible operation.

Table 15. VFD and motor control features

Feature	Functions	Benefit
Flying start	Ability to get an already spinning fan under speed control	Improved performance Ease of application
Inbuilt PID controller	Capability to make a standalone system with sensor connected directly to the inverter for complete PI- control.	Cost saving

OPTIONAL ACCESSORIES

Table 16. Door mounting kit and PC interface

Part Number	Description
HVACDOORKIT	SmartVFD HVAC232/402 door mounting kit
SmartDrive-USBC	SmartVFD HVAC232/402 Commissioning Cable
COMP-LOADER	Interface used for PC communication with SmartDrive-USBC

Table 17. Option boards (all boards are varnished)

Part Number	Description
OPTB1	6 x DI/DO, each I/O can be individually
OPTB2	7 x Relay output + 1 input for a thermistor
OPTB4	1 x AI, 2 x AO (isolated)
OPTB5	3 x Relay output
OPTB9	1 x RO, 5 x DI (42-240 VAC)
OPTBH	3 x thermistor input (support for PT1000 and NI1000 sensors)
OPTE9	ModbusTCP

Table 18. Option boards covers

Part Number	Description
ENC-Slot MI1-MI3	External cover kit HVAC232/402 MI1-MI3

Table 19. Optional enclosures

Part Number	Description
COMP-IP21-KIT1	Upgrade enclosure MI1 frame
COMP-IP21-KIT2	Upgrade enclosure MI2 frame
COMP-IP21-KIT3	Upgrade enclosure MI3 frame
COMP-NEMA1-KIT1	IP21 enclosure upgrade kit with additional wiring terminal cover for SmartDrive Compact size MI1
COMP-NEMA1-KIT2	IP21 enclosure upgrade kit with additional wiring terminal cover for SmartDrive Compact size MI2
COMP-NEMA1-KIT3	IP21 enclosure upgrade kit with additional wiring terminal cover for SmartDrive Compact size MI3

Power losses

If the operator wants to raise the switching frequency of the drive for some reason (typically e.g. in order to reduce the motor noise), this inevitably affects the power losses and cooling requirements.

For different motor shaft power, operator can select the switching frequency according to the graphs below.

Fig. 14. Power loss for MI1 at 230 VAC, single phase

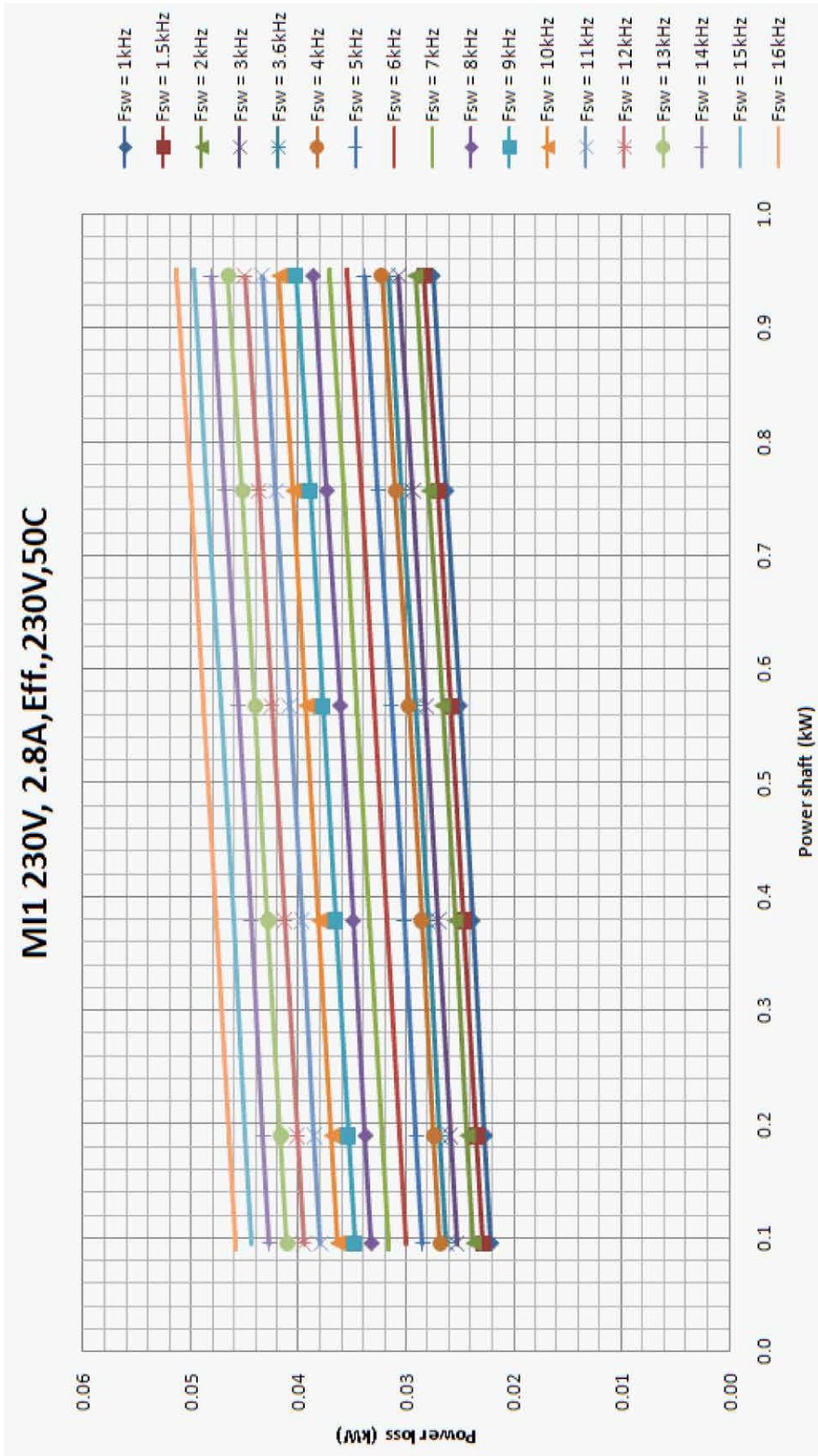


Fig. 15. Power loss for MI2 at 230 VAC, single phase

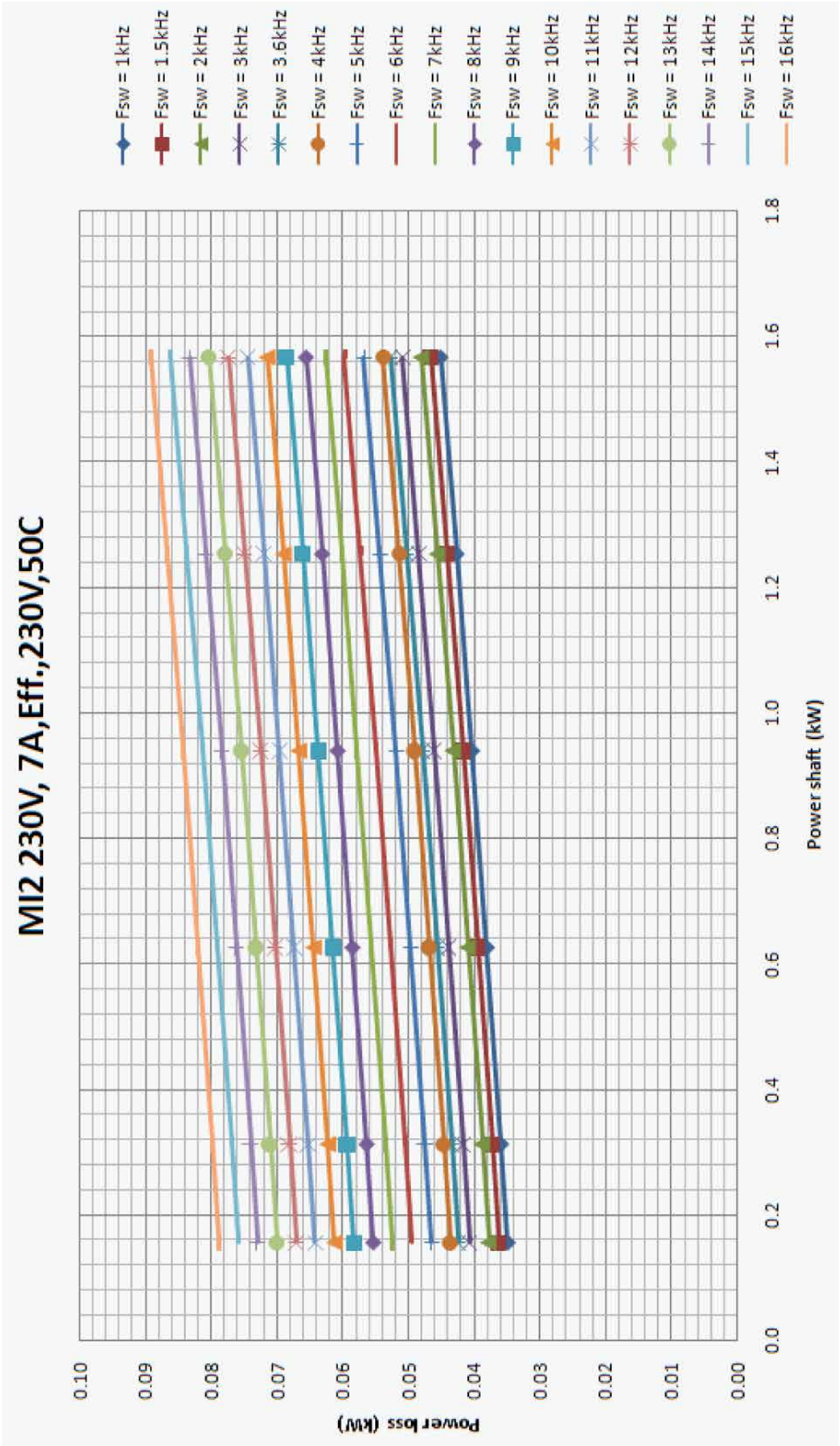


Fig. 16. Power loss for MI3 at 230V AC, single phase

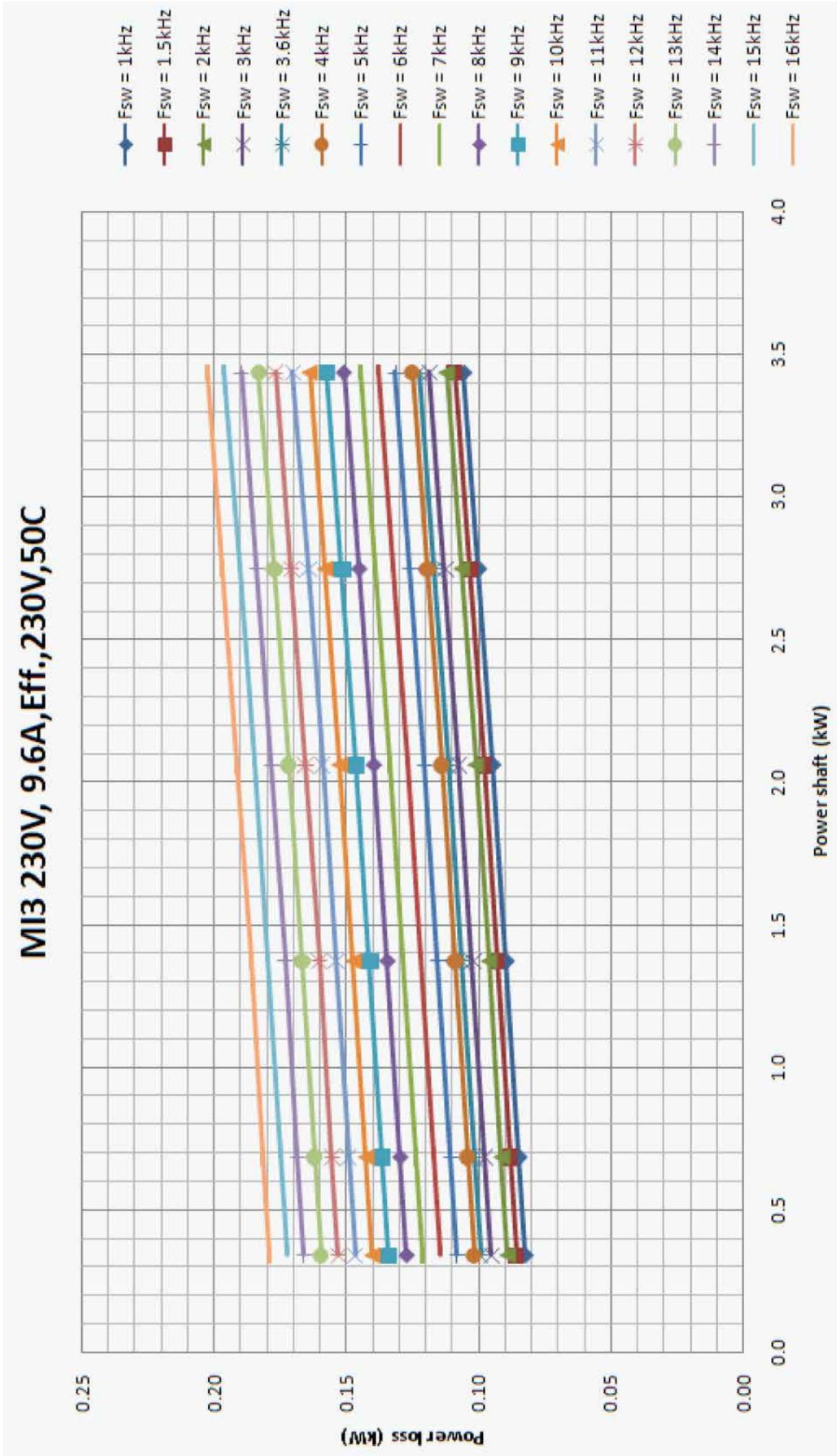


Fig. 17. Power loss for MI1 at 400 VAC, three phases

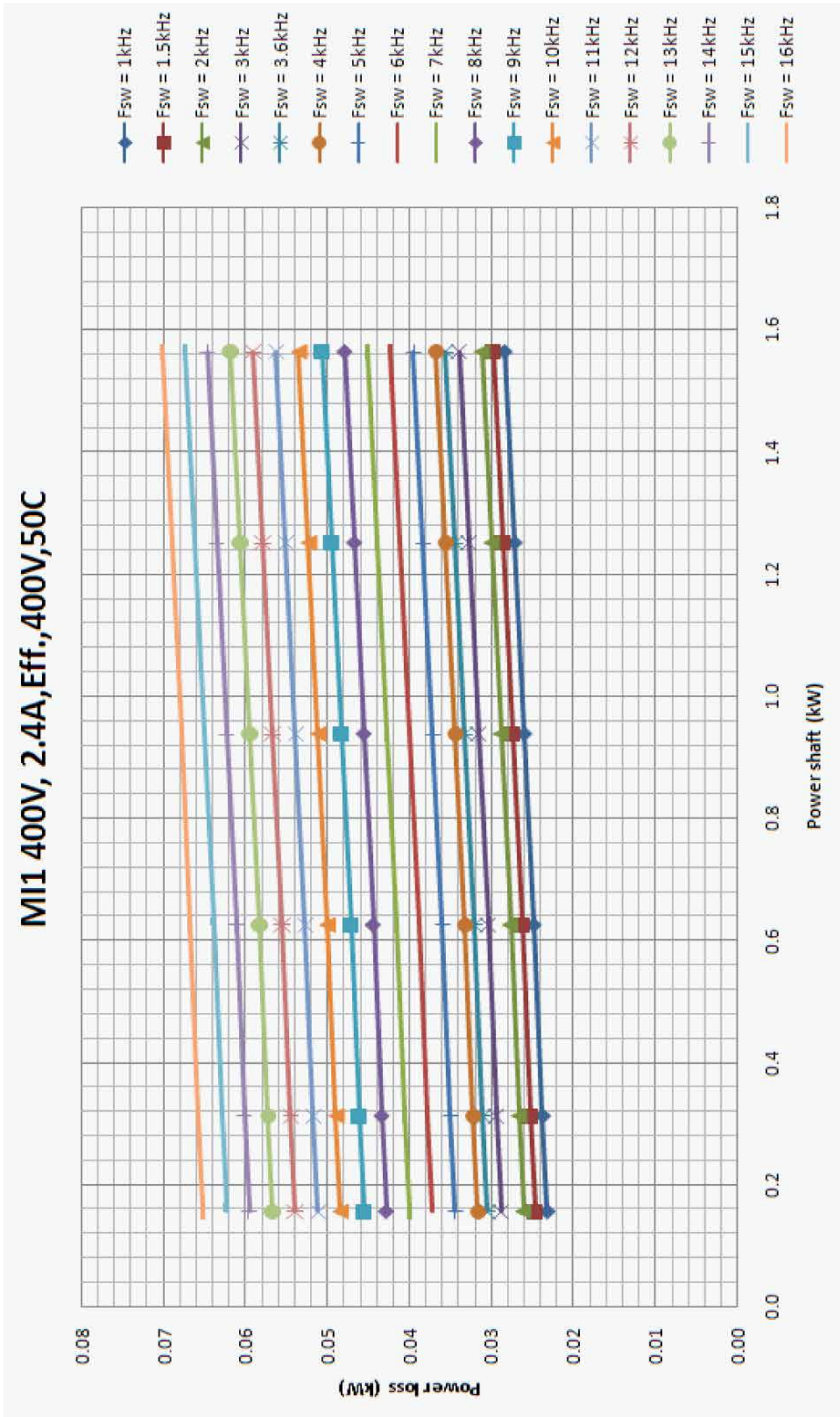


Fig. 18. Power loss for MI2 at 400 VAC, three phases

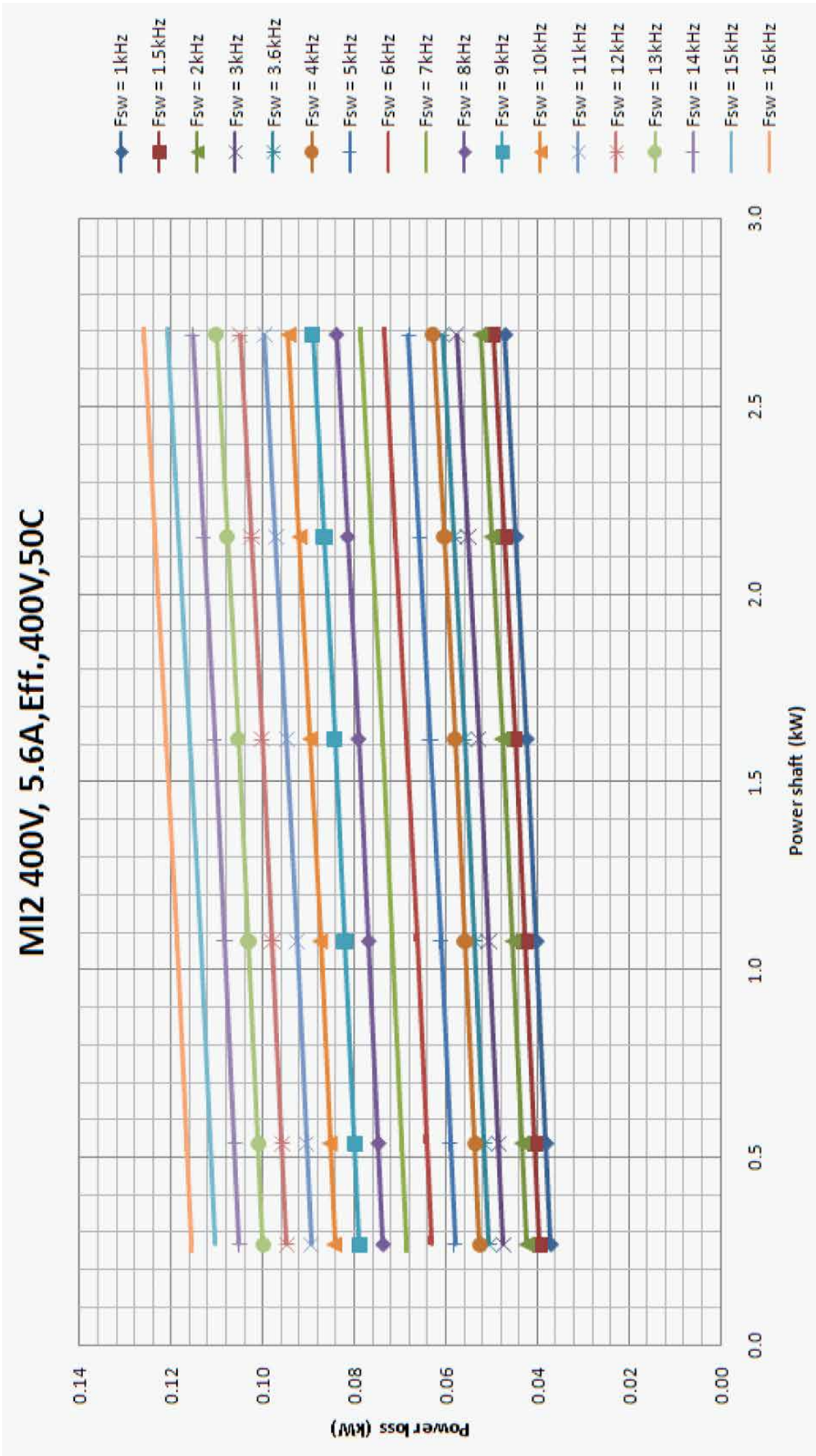
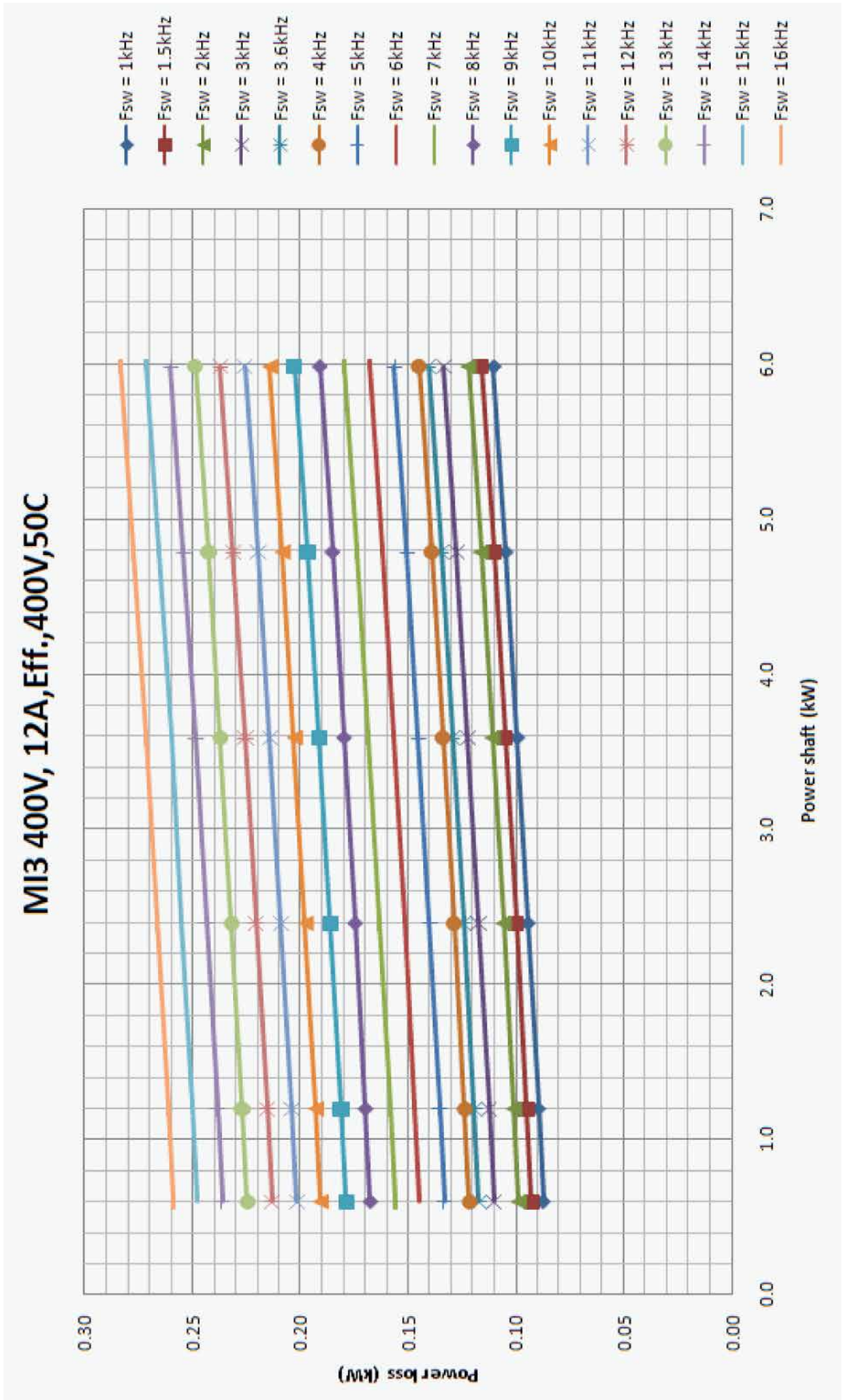


Fig. 19. Power loss for MI3 at 400 VAC, three phases



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