Panasonic
INDUSTRY

Servo Drives

MINAS A6 Series

IN Your Innovation

IN Your Innovation

IN Your Innovation

Application areas:

Pick-and-place machines

Handling systems

Machine tools

Robots

Printing machines

Automated machines

Materials handling

Packaging machinery

Service

Panasonic Industry Europe's comprehensive service includes an

> expert hotline,

> workshops and

> on-site service,

to ensure the reliable and effective use of our servo drives.

Automation products from Panasonic Industry

With over 100 years of innovation and manufacturing expertise, Panasonic Industry Europe remains committed to its vision of creating "A Better Life, A Better World." Panasonic can look back on decades of experience in the electronics industry and, thanks to its dedicated customer orientation, is a competent and reliable partner for customers throughout Europe when it comes to technical expertise in combination with solution orientation. As a provider of tailor-made solutions, we focus on offering our customers products and services in the Mobility, Living Space and Business sectors that make a difference thanks to our proprietary innovations.

Smart automation technology

The factory of the future will achieve new levels of productivity, effectiveness and profitability through comprehensive networking. Equipment and components from Panasonic Industry Europe offer leading-edge Industry 4.0 features, as connectivity, energy efficiency, reliability and sturdiness play a pivotal role in modern production environments.

The Panasonic Industry Europe portfolio not only offers key electronic components, devices, modules and software but also complete solutions for production lines in a wide variety of industries. Panasonic Industry's comprehensive know-how along the entire value chain, combined with a corporate culture geared to customer needs, enables it to offer customer-specific solutions.

Our experience as a manufacturer and a sales partner for components and products allows us to share our experience with our customers. Customer wishes are specifically integrated into the development of new products, so that we can surpass our role as a supplier and become a competent, long-term partner for our customers.

The most modern servo drives: the MINAS A6 series

With its MINAS A6 series, Panasonic Industry offers a highly dynamic servo driver family with a wide power range from 50W to 15kW for many different areas of applications. The servo drivers and motors of the MINAS A6 series are characterized by a consistently compact and robust but also lightweight design. In addition, they have been equipped with innovative functions for damping resonance frequencies and to eliminate vibration tendencies.

Highly dynamic drive technology in a 400V network for maximum performance

With around 70% market share, 400V applications represent the largest segment in industrial automation. Take advantage of the 400V three-phase network by using the servo drives from Panasonic, which cover a power range from 0.4–5kW (in future up to 22kW).

Proven technology paired with innovative functions and versatile control features such as pulse, analog and network technology with real-time communication characterize our solutions.

... expandable

MINAS A6 Multi series: 400V servo drive system

Compact, modular design for maximum performance

400V servo drive system

› **Compact servo drive in book format:** Only 25mm width per axis on the two-axis-unit

› **Modular design:** One power supply unit supports several servo drivers

› **DC link bus system:** Reliable connection without tools

› **Quick servo control technology:** A frequency response of 3.2kHz enables high-speed operation for maximum productivity

› **Anti-vibration technology:** Suitable for highly precise applications thanks to vibration damping.

› **State-of-the-art network technology:** High-speed communication via EtherCAT with up to 100Mbit/s

› **18 advanced safety functions:** MINAS A6 Multi achieves safety class SIL3

› **Setup via EtherCAT:** Easy configuration and programming over EtherCAT (EoE) using the software tool PANATERM

› **Robust connectors:** Servo motors with round connectors according to IEC, CENELEC, and IEEE

Industries

Packaging industry

Plastics and metal processing

Presses

Quick-connect technology

The MINAS A6 Multi can be wired at the top and bottom. No tools are needed.

DC link bus

Beneath the front cover lies the DC link bus. Thanks to the screwless power bus system it allows quick and easy expansion of the servo drivers.

Modular construction

Several two-axis servo drivers (50mm) can be coupled to just one compact power supply unit (50mm or 100mm width). Thanks to the DC link bus, the expansion is fast and reliable.

Power supply units

Product no.	Size	Input voltage	Rated power
MADMPN14	A	3-phase 380–480V AC	15kW

Servo driver units

Product no.	Size	Number of axes	Rated power
MADM2A4KBX	A	2	For motors 0.4–0.75kW**
MADM2A6KBX	A	2	For motors 0.75–1.5kW**
MADM2AAKBX	A	2	For motors 1.5–3.0kW**
MBDM1ABKBX	B	1	For motors 3.0–5.0kW

** Also combinable

The MINAS product family changes the world of industrial machine automation

Robots

A robot is required to operate stably independent of the constantly changing position, workload, or other condition affecting the robot arm. The MINAS A6 servo drive family guarantees stable operation by reducing the effects of loads to a minimum with the help of "adaptive load control".

Processing machines

With metal-processing machines, it is very difficult to manufacture polygonal bodies with a mirror-like finishing. The MINAS A6 servo drive family realizes a frequency response of 3.2kHz to improve the feedback and to enable a mirror-like finish without lines or streaks.
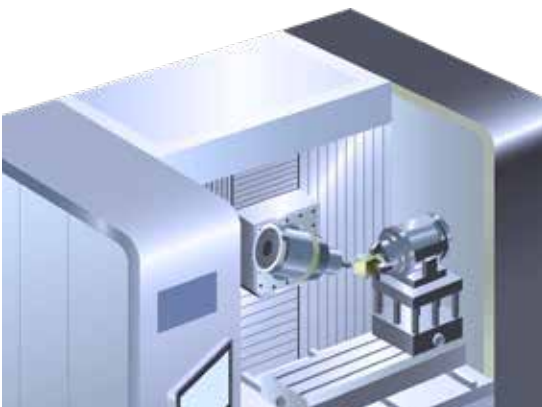
Pick-and-place machines

The MINAS A6 servo drive family shows its versatility especially when used with pick-and-place machines where speed and positional accuracy are a must.
In addition to the high-frequency response, the servo drives deal with random disturbances with the help of the built-in "adaptive load control", thus keeping productivity high.

CNC milling machine

Equipped with servo motors of the MINAS LIQI series for controlling 3 axes (X, Y, Z) and safety light curtains from Panasonic.
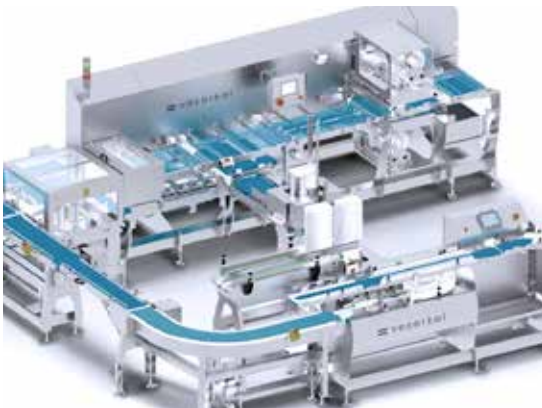
Packaging machine for hamburgers and minced meat

Equipped with MINAS A5 servo motors, FP7 programmable controllers, inverters, touch terminals and sensors from Panasonic.

Press brake for metal sheet

Machine system equipped with MINAS A5 motors with EtherCAT for moving back gauges.

The MINAS A6 series is also available in the EPLAN Data Portal!

MINAS A6 SERIES – FEATURES

Panasonic's MINAS A6 series follows in the footsteps of the highly successful predecessor, the MINAS A5 series. The A6 series has been improved further. At the same time, compatibility with the A5 series has been maintained.

> **Simple communication connection**
> Modbus RTU (see also page 39)

> **One of the smallest and lightest motors**
> Up to 30% shorter than for MINAS A5

> **Suitable for peak top performance demands**
> Improved response frequency

**Analog/pulse type
MINAS A6
servo driver**

**MINAS A6
servo motor**
Rated power: 50W to 5kW

**Network types MINAS A6N (RTEX)
and MINAS A6B (EtherCAT)
servo drivers**

MINAS A6 series	200/400V AC				400V AC
	A6SE	A6SG	A6SF	A6N/A6B	A6 Multi
Rated power	50W–1.5kW (200V AC), 1kW–5kW (400V AC)				400W–5kW
Supply voltage	1/3-phase (200V AC), 3-phase (400V AC)				3-phase
Bandwidth (velocity response)	3200Hz				
Rated rotational speed	2000–3000rpm				
Max. rotational speed	3000–6500rpm				
Rated torque	0.16–15.9Nm (200V AC), 0.64–23.9Nm (400V AC)				
Peak torque	0.48–47.7Nm (200V AC), 2.23–71.6Nm (400V AC)				
Control functions	Position control	Position, velocity, torque control			
IP degree of protection (motor)	IP67				
Control input	Pulse	Pulse, analog	Network		Network

Compatible with MINAS A5 series

Connections designed for compatibility

The A5 series connector cables and connectors can also be used for the A6 series (except for MHMF motors 50W–1000W).

MINAS A5

Identical accessories

EMC filter and braking resistor can be used for both the MINAS A5 series and the MINAS A6 series.

MINAS A6

Compatible flange dimensions

The motor can be exchanged 1:1 at the machine or gear flange.

Improvements and new features of the MINAS A6 series

Even more compact design

Thanks to the split core structure and a new housing, we have been able to reduce not only the length by 30%, but also the weight by up to 15%.

MHMF + MDMF models
200V: 10% lighter, 30% shorter
400V: 15% lighter and shorter

High-resolution 23-bit encoder – can be used as an absolute or incremental rotary encoder

The 20-bit encoder (1048576 pulses per revolution = ppr) has been upgraded to 23 bit (8388608ppr).
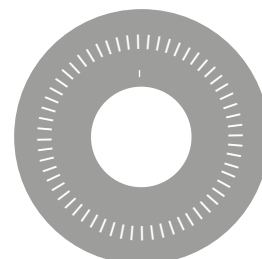
MINAS A6 SERIES – FEATURES

Improvements and new features of the MINAS A6 series

Advanced controller settings

3.2kHz frequency response

3.2kHz

Gain (dB) vs Frequency (Hz)

A6
A5
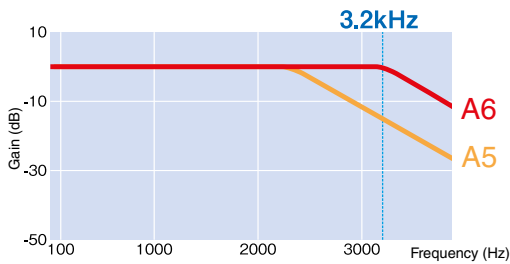
A5   **A6**

Numerous interference bands   Hardly any interference bands

Available with two different seals (single/triple lip)

An oil seal with triple lip has just been developed.
It is ideally suited for protection against ingress of dust and oil in
ambient environments with a high degree of pollution.

Type 1: Single lip   **Type 2: Triple lip**   **NEW!**
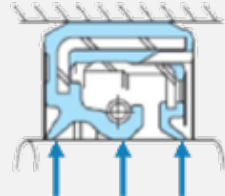
Improved suppression of vibrations

The tendency to vibrate when braking to a standstill is
significantly reduced. This has shortened the transient recovery
time.

Comparison of transient recovery curves

Ball screw drive with high
stiffness

A5Ⅱ
A6

Deviation of the position [per command message]

Elapsed time after command carried out [ms]

Belt drive

A6
A5Ⅱ

Deviation of the position [per command message]

Elapsed time after command carried out [ms]
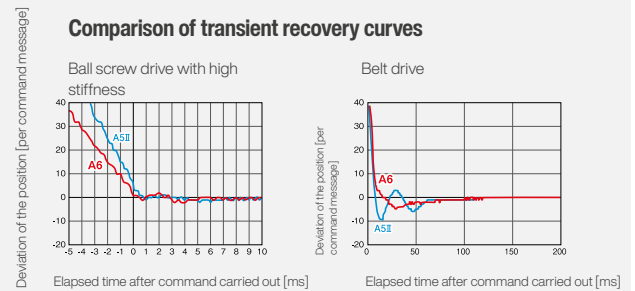
Improved reaction and adjustment to load variations

With load   Without load

Before   After

Variations   Stable

----- : with load
------ : without load
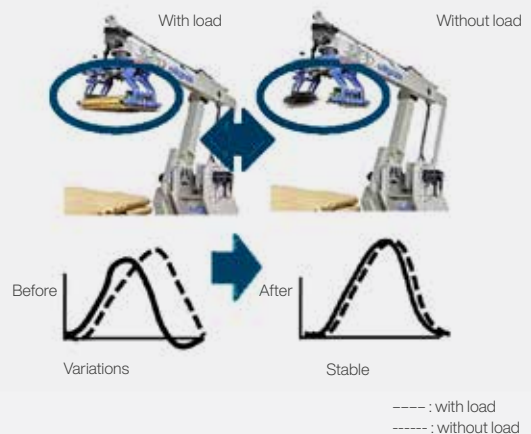
Max. torque

Up to 350% of the nominal torque (MHMF model)

Max. speed

Raised to max. 6500rpm (MHMF model)
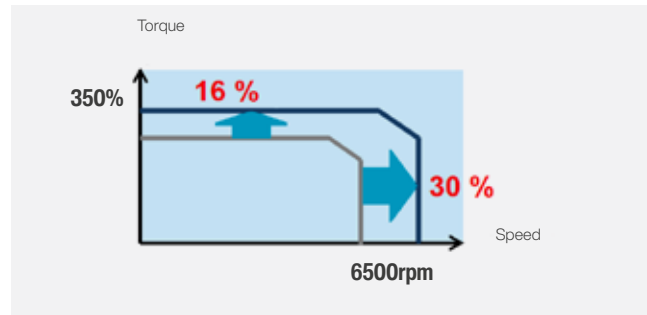
Semi/fully enclosed position control loop

The A6 series enables a setting value of 8Mpps and a response with 4Mpps. This allows for high resolution as well as high-speed operation.

A5
Setting value 4Mpps

A6
Setting value 8Mpps
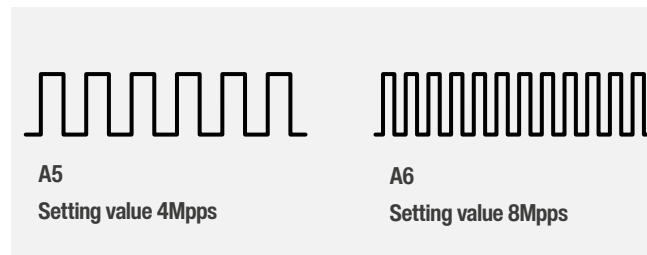
General features

External encoders for full-closed control

Using an external encoder or linear displacement measuring system ensures high-precision position control.
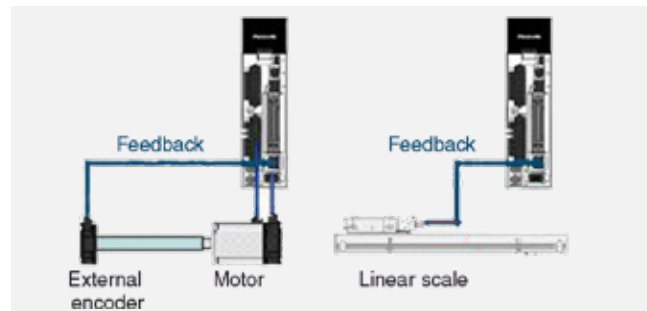
Real-time auto-gain tuning

Automatic tuning after completion of multiple operations. The automatic vibration suppression function minimizes damage to the equipment. Additional mode and stiffness parameters enable easy response frequency-optimization for specific machine types such as high-friction, belt-driven machines or machines with low-friction ball screw drives.

Belt drive

Ball screw drive

Manual and automatic notch filters

Highly sensitive notch filters log resonance frequencies and adapt them automatically.
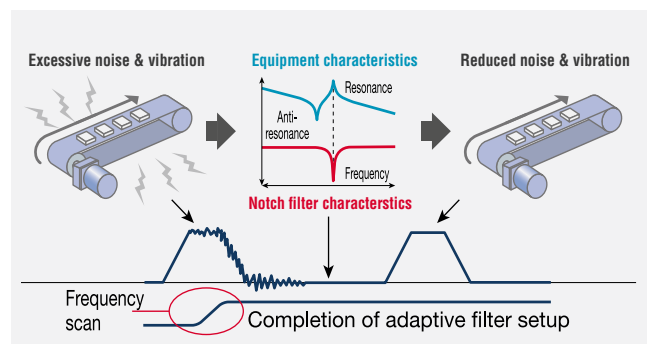
General features

Manual and automatic damping filters

Damping filters that can be set automatically suppress the equipment's resonance, which greatly reduces axis vibration at machine stoppage.

Without damping filter

With damping filter

Judder

Vibration-free
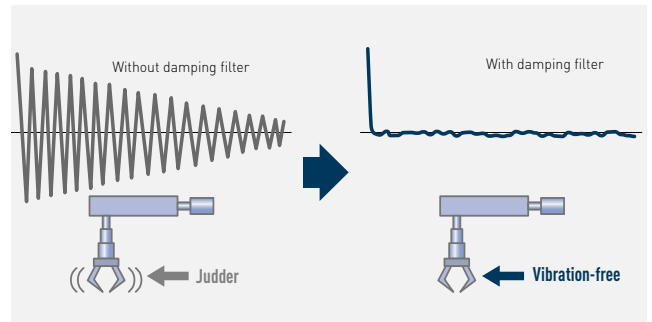
Integrated safety function STO (Safe Torque Off)

Safety functions based on safety standards: ISO13849-1(PL e, CAT3), EN61508(SIL3), EN62061(SILCL3), EN61800-5-2(SIL3, STO), IEC61326-3-1, IEC60240-1.

Safety equipment

Electromechanical safety shutdown
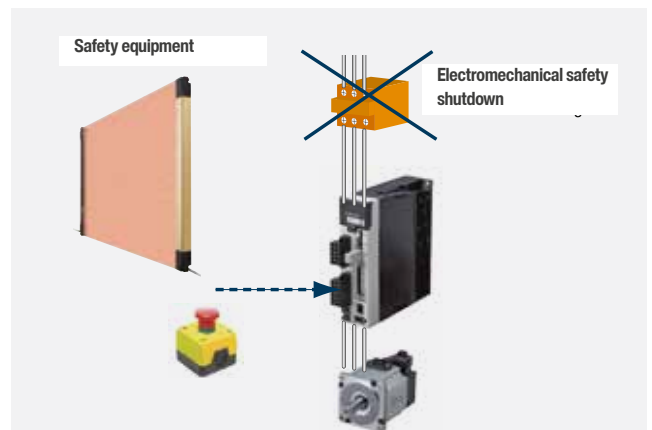
Dynamic brake

For dynamic braking that protects material.

Torque limit

Torque limit is an indispensable function for torque-controlled applications or generally for protection against mechanical damages.

Motor speed

In operation

Braking

Standstill

Setting 2

Setting 3

Setting 1

3-step control setting

Control parameters are activated according to the operating condition (deceleration during operation, stopping during fast positioning, standstill). By controlling the motion it is possible to perform even faster positioning with a lower vibration tendency.
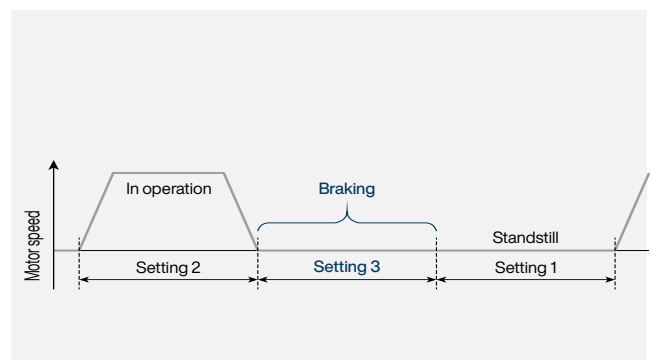
Software tool PANATERM with motion simulation

PANATERM reads response frequency data from the actual machine. A simplified simulation function allows you to check gain and filter effects without you having to adjust the actual parameter settings of the equipment.
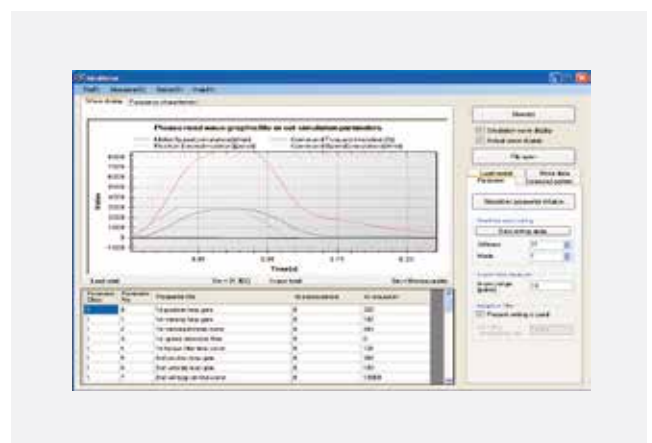
Servo drivers and motors

		200/400V AC					400V AC
Model		**Standard**	**RS485 communication**	**Multifunction**	**Network**		**400V AC modular**
		A6SE	A6SG	A6SF	A6N	A6B	A6 Multi
Servo drivers	RTEX	-	-	-	x	-	-
	EtherCAT	-	-	-	-	x	x
	External encoder	-	-	x	x		x
	Safety function STO	-	-	x	x		x
	Advanced safety function	-	-	-	-		x
	RS232/485 (Modbus)	-	x	x	-		-
	Velocity control, torque control	-	-	x	x		x
	Position control with dig. I/O (like MINAS A4P)	x	x	x	-		-
	Position control	x	x	x	x		x

	Model	MSMF		MDMF		MHMF	
		Low inertia		**Medium inertia**		**High inertia**	
	Rated power W	Flange size ☐ mm	Rated rotational speed (max.) rpm	Flange size ☐ mm	Rated rotational speed (max.) rpm	Flange size ☐ mm	Rated rotational speed (max.) rpm
200V AC	50	38	3000 (6000)	–	–	40	3000 (6500)
	100			–	–		
	200	60		–	–	60	
	400			–	–		
	750	80		–	–	80	3000 (6000)
	1000	80/100	3000 (6000)/ 3000 (5000)	130	2000 (3000)	80/130	3000 (6000)/ 2000 (3000)
	1500	100	3000 (5000)			130	2000 (3000)
400V AC	200	-	-	-	-	60	3000 (6500)
	400	-	-	-	-		
	750	-	-	-	-	80	3000 (6000)
	1000	100	3000 (5500)	130	2000 (3500)	80/130	3000 (6000)/ 2000 (3500)
	1500					130	2000 (3500)
	2000					176	
	3000	120					
	4000	130	3000 (5000)	176			
	5000				2000 (3000)		2000 (3000)
	Features	Low to high power range, low inertia, suitable for all kinds of applications, also suitable for high-speed applications, especially for machinery with high rigidity and repetition rate		Medium to high power range, medium inertia, suitable for belt-driven machinery with low rigidity		Low to high power range, high inertia, suitable for belt-driven machinery with low rigidity	
	Applications	Equipment for transistor production (like bonders, SMD machinery), packaging machines, machines for food production, etc.		Conveyor machinery, robots, textile machines, etc.		Conveyor machinery, robots, machines for LCD production, etc.	

Servo driver model codes 100/200/400V AC

MAD	L	N	1	5	S	E

Frame:				Type:
MAD: A				**Pulse/analog type:**
MBD: B				SE: Standard (pulse)
MCD: C				SF: Multifunction (pulse, analog)
MDD: D				SG: RS485 (pulse)
MED: E				
MFD: F				

L: A6 series

Network type:
NE: Without STO (RTEX)
NF: With STO (RTEX)
BE: Without STO (EtherCAT)
BF: With STO (EtherCAT)

Safety function:
N: Without STO
T: With STO

Supply voltage:
1: 1-phase, 100V AC
3: 3-phase, 200V AC
5: 1-/3-phase , 200V AC
4: 3-phase, 400V AC

Maximum rated current:

0: 6A	5: 40A
1: 8A	8: 60A
2: 12A	A: 100A
3: 22A	B: 120A
4: 24A	

Servo motor model codes 100/200V AC

MSM	F	5A	Z	L	1	A1

Motor model				Motor specifications:
MSM: Low inertia				(shaft type, holding brake, oil seal, encoder clamp):
MDM: Medium inertia				A-D, G, H, S-V; 1-8
MHM: High inertia				

F: A6 series

1: Standard

Rated power:

5A: 50W	08: 750W
01: 100W	09: 1kW (Ø 80mm)
02: 200W	10: 1kW (Ø 100/130mm)
04: 400W	15: 1.5kW

L: Standard absolute encoder (connector type)

A: Absolute encoder without battery (lead-wire type)

Supply voltage:
1: 100V
2: 200V
Z: 100V/200V

Servo motor model codes 400V AC

MSM	F	10	4	A1	G	9		M

Motor model
MSM: Low inertia
MDM: Medium inertia
MHM: High inertia

F: A6 series

Rated power:
10: 1kW
15: 1.5kW
20: 2kW
30: 3kW
40: 4kW
50: 5kW

Supply voltage:
4: 400V AC

Oil seal:
9: Single lip
A: Triple lip

M: Magnet

Shaft type:
G: Without key-way shaft,
   without holding brake
H: With key-way shaft, with holding brake

Encoder type:
L1: Standard (connector type)
A1: Encoder without battery
   (lead-wire type)

Power supply model codes A6 Multi

MAD	M	P	N	1	4

Frame:
MAD: A

M: A6 Multi series

Module type:
P: Power supply

Supply voltage:
4: 3-phase, 400V AC

Rated power:
1: 15kW

Safety function:
N: Without safety function

Servo driver model codes A6 Multi 400V AC

MAD	M	2	A	4	K	B	X

Frame:
MAD: A
MBD: B

M: A6 Multi series

Axis unit type
1: 1-axis unit
2: 2-axis unit

Safety function:
A: With STO

Other Features:
X: Advanced safety function

Network type:
B: EtherCAT

Supply voltage:
K: 560V DC

Rated power:
4: 750W
6: 1.5kW
A: 3kW
B: 5kW

Connections and interfaces

Connector type (200V DC: frame A – F)

Wiring of Main Connector
Connection to input power

Mains
Residual current device

Circuit Breaker (MCCB)

Noise Filter (NF)
(optional)

Magnetic Contactor (MC)

Reactor (L)
(optional)
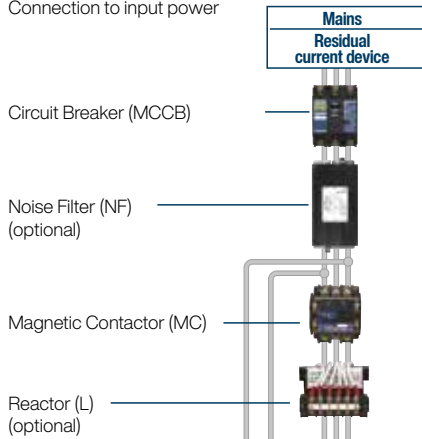
Charge lamp
Lights while the main power is ON.

External regenerative resistor
(optional)
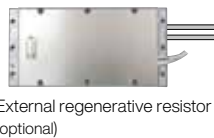
A short wire is not required for
A-frame and B-frame.
• For handling and wiring in case
of using external regenerative
resistor, please refer to the manual.

Use this cable only
for a motor with brake.

Brake cable
(optional)

DC Power supply
for brake DC24 V
(to be supplied by customer)

Ground (earth)

Encoder cable

Motor

Front Panel
Indicates parameters and errors

Panasonic

Display LED

Mode switching button

Data setting button

SET Button

Connection to PC
USB mini-B cable
(To be supplied by customer)

Setup support software "PANATERM"
Please download from our web site.

**Connection to RS232, RS485
or host controller**
Communication with host controller
(X2 connector is not installed on A6SE + A6SG.)

Connection to Safety by-pass plug
Use this connection when not configuring
a safety circuit. (Standard accessory)
(X3 connector is not installed on A6SE + A6SG.)

Connection to host controller
50-pin for I/O signals

Interface cable
(optional)

Controller

Connection to external scale
Connect to external device,
e.g. feedback scale
(X5 connector is not installed on A6SE + A6SG.)

Connection to encoder
Encoder cable dedicated to a specific
model is available as option.

Terminal block type
Frame F is terminal block
type. Terminate the cable or
connect it to the terminal
block.
(Photo: F-frame)

X1
X2

XA

X4

XB

X5

X6

Product Finder: For Servo Drives
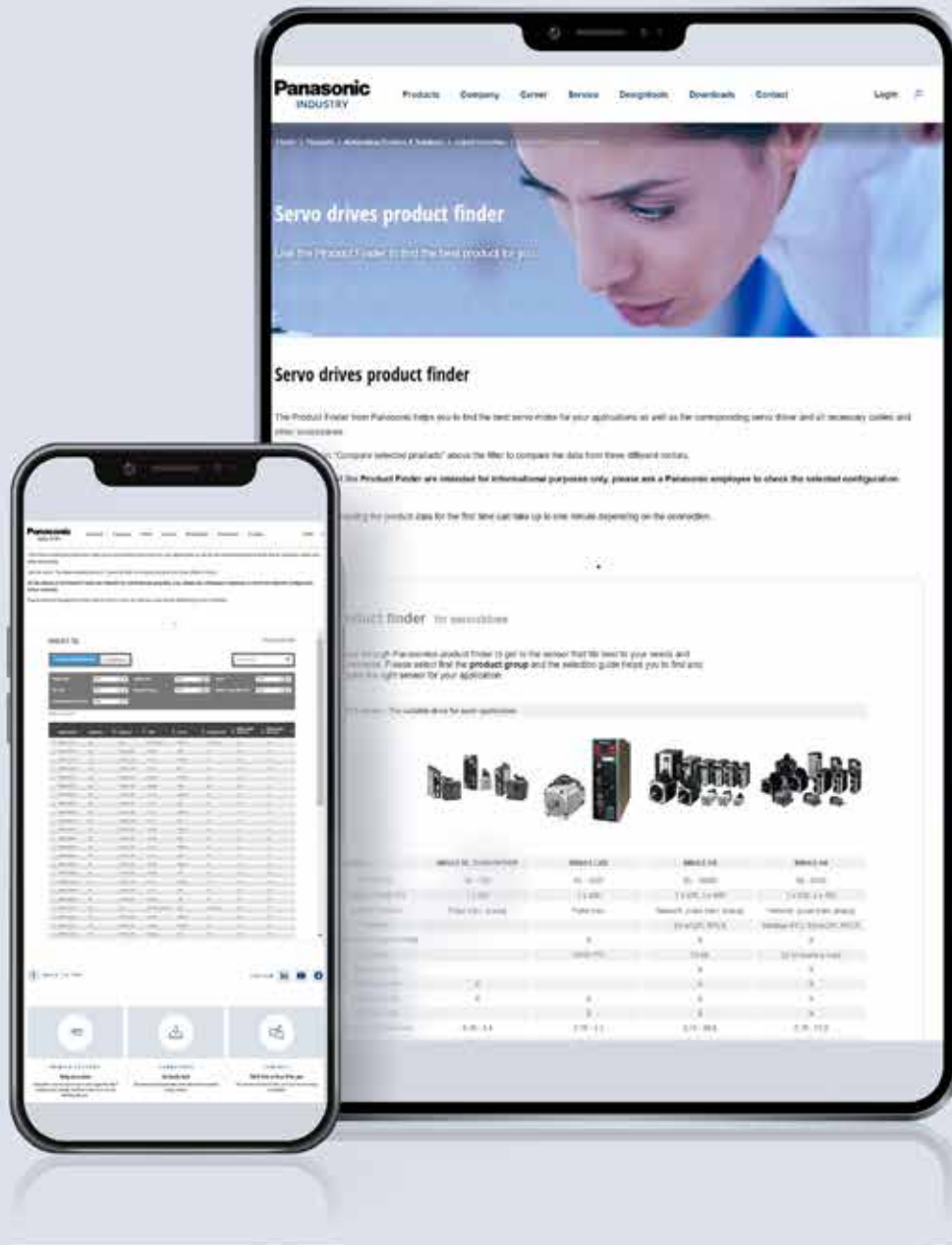
Find the best servo drive within seconds!

Overview of MINAS A6 motors, servo drivers and accessories 200V AC

	Rated power W	Flange size □ mm	Max. torque Nm	Max. nom. rotation speed rpm	Motor	Holding brake	Degree of protection IP67	Key shaft	Encoder	
					Servo motor					
					Low inertia 200V AC class					
Low inertia	50	38	0.16 (0.48)	3000 (6000)	MSMF5AZL1U1		x	x	23-bit encoder 8388608ppr	
					MSMF5AZL1V1	x	x	x		
	100		0.32 (0.95)		MSMF012L1U1		x	x		
					MSMF012L1V1	x	x	x		
	200	60	0.64 (1.91)		MSMF022L1U1		x	x		
					MSMF022L1V1	x	x	x		
	400		1.27 (3.82)		MSMF042L1U1		x	x		
					MSMF042L1V1	x	x	x		
	750	80	2.39 (7.16)		MSMF082L1U1		x	x		
					MSMF082L1V1	x	x	x		
	1000		3.18 (9.55)		MSMF092L1U1		x	x		
					MSMF092L1V1	x	x	x		
		100	3.18 (9.55)	3000 (5000)	MSMF102L1G5		x	x		
					MSMF102L1H5	x	x	x		
	1500		4.77 (14.3)		MSMF152L1G5		x	x		
					MSMF152L1H5	x	x	x		
					Medium inertia 200V AC class					
Medium inertia	1000	130	4.77 (14.3)	2000 (3000)	MDMF102L1G5		x	x	23-bit encoder 8388608ppr	
					MDMF102L1H5	x	x	x		
	1500		7.16 (21.5)		MDMF152L1G5		x	x		
					MDMF152L1H5	x	x	x		
					High inertia 200V AC class					
High inertia	50	40	0.16 (0.56)	3000 (6500)	MHMF5AZL1U1		x	x	23-bit encoder 8388608ppr	
					MHMF5AZL1V1	x	x	x		
	100		0.32 (1.11)		MHMF012L1U1		x	x		
					MHMF012L1V1	x	x	x		
	200	60	0.64 (2.23)		MHMF022L1U1		x	x		
					MHMF022L1V1	x	x	x		
	400		1.27 (4.46)		MHMF042L1U1		x	x		
					MHMF042L1V1	x	x	x		
	750	80	2.39 (8.36)	3000 (6000)	MHMF082L1U1		x	x		
					MHMF082L1V1	x	x	x		
	1000		3.18 (11.1)		MHMF092L1U1		x	x		
					MHMF092L1V1	x	x	x		
		130	4.77 (14.3)	2000 (3000)	MHMF102L1G5		x	x		
					MHMF102L1H5	x	x	x		
	1500		7.16 (21.5)		MHMF152L1G5		x	x		
					MHMF152L1H5	x	x	x		

Motor type: □□□□L1□ = standard,

□□□□A1□ = encoder without battery
(For further information, please refer to the 'Catalogue of batteryless absolute encoder motor)

Servo drivers		Cables				Filter	Brake resistor
		Motor cable		Encoder cable			
Model	Frame	For motors without holding brake	For motors with holding brake	23-bit incremental	23-bit absolute	EMC filter	Model
Low inertia 200V AC class							
MADL☐05☐☐	A	MFMCA0☐☐0WJD	--	MFECA0☐☐0WJD	MFECA0☐☐0GJE (with battery box)	FN2080-6-06 or FS21238607	BWD250100
		--	MFMCA0☐☐0WJD*				
		MFMCA0☐☐0WJD	--				
		--	MFMCA0☐☐0WJD*				
MADL☐15☐☐		MFMCA0☐☐0WJD	--				BWD250072
		--	MFMCA0☐☐0WJD*				
MBDL☐25☐☐	B	MFMCA0☐☐0WJD	--				
		--	MFMCA0☐☐0WJD*				
MCDL☐35☐☐	C	MFMCA0☐☐0WJD	--				
		--	MFMCA0☐☐0WJD*				
MDDL☐45☐☐	D	MFMCA0☐☐0WJD	--			FN2090-10-06	BWD500035
		--	MFMCA0☐☐0WJD*				
MDDL☐55☐☐		MFMCD0☐☐2GCD	--	MFECA0☐☐0GTD	MFECA0☐☐0GTE (with battery box)		
		--	MFMCA0☐☐2HCD				
		MFMCD0☐☐2GCD	--				
		--	MFMCA0☐☐2HCD				
Medium inertia 200V AC class							
MDDL☐45☐☐	D	MFMCD0☐☐2GCD	--	MFECA0☐☐0GTD	MFECA0☐☐0GTE (with battery box)	FN2090-10-06	BWD500035
		--	MFMCA0☐☐2HCD				
MDDL☐55☐☐		MFMCD0☐☐2GCD	--				
		--	MFMCA0☐☐2HCD				
High inertia 200V AC class							
MADL☐05☐☐	A	MFMCA0☐☐7WFD	--	MFECA0☐☐0WJD	MFECA0☐☐0GJE (with battery box)	FN2080-6-06 or FS21238607	BWD250100
		--	MFMCA0☐☐7XFD				
		MFMCA0☐☐7WFD	--				
		--	MFMCA0☐☐7XFD				
MADL☐15☐☐		MFMCA0☐☐0WFD-EU	--				BWD250072
		--	MFMCA0☐☐0XFD				
MBDL☐25☐☐	B	MFMCA0☐☐0WFD-EU	--				
		--	MFMCA0☐☐0XFD				
MCDL☐35☐☐	C	MFMCA0☐☐0WFD-EU	--				
		--	MFMCA0☐☐0XFD				
MDDL☐55☐☐	D	MFMCA0☐☐0WFD-EU	--			FN2090-10-06	BWD500035
		--	MFMCA0☐☐0XFD				
MDDL☐45☐☐		MFMCD0☐☐2GCD	--	MFECA0☐☐0GTD	MFECA0☐☐0GTE (with battery box)		
		--	MFMCE0☐☐2HCD				
MDDL☐55☐☐		MFMCD0☐☐2GCD	--				
		--	MFMCE0☐☐2HCD				

☐ .. ☐☐ **Servo driver type**, see page 16

☐☐ = **Cable length** (m)

* For MSMF motors with a holding brake < 1.5kW, an additional brake cable MFMCB0☐☐0PJT-EU is required for the motor cable.

Overview of MINAS A6 motors, servo drivers and accessories 400V AC

	Servo motor							
Rated power W	Flange size □ mm	Max. torque Nm	Rated rotational speed (max.) rpm	Motor	Holding brake	Degree of protection IP67	Key shaft	Encoder
Low inertia 400V AC class								
1000	100	3.18 (9.55)	3000 (5500)	MSMF104□G9M		x	x	23-bit encoder 8388608ppr
1000	100	3.18 (9.55)	3000 (5500)	MSMF104□H9M	x	x	x	23-bit encoder 8388608ppr
1500	100	4.77 (14.3)	3000 (5500)	MSMF154□G9M		x	x	23-bit encoder 8388608ppr
1500	100	4.77 (14.3)	3000 (5500)	MSMF154□H9M	x	x	x	23-bit encoder 8388608ppr
2000	100	6.37 (19.1)	3000 (5500)	MSMF204□G9M		x	x	23-bit encoder 8388608ppr
2000	100	6.37 (19.1)	3000 (5500)	MSMF204□H9M	x	x	x	23-bit encoder 8388608ppr
3000	120	9.55 (28.7)	3000 (5500)	MSMF304□G9M		x	x	23-bit encoder 8388608ppr
3000	120	9.55 (28.7)	3000 (5500)	MSMF304□H9M	x	x	x	23-bit encoder 8388608ppr
4000	130	12.7 (38.2)	3000 (5000)	MSMF404□G9M		x	x	23-bit encoder 8388608ppr
4000	130	12.7 (38.2)	3000 (5000)	MSMF404□H9M	x	x	x	23-bit encoder 8388608ppr
5000	130	15.9 (47.8)	3000 (5000)	MSMF504□G9M		x	x	23-bit encoder 8388608ppr
5000	130	15.9 (47.8)	3000 (5000)	MSMF504□H9M	x	x	x	23-bit encoder 8388608ppr
Medium inertia 400V AC class								
1000	130	4.77 (14.3)	2000 (3500)	MDMF104□G9M		x	x	23-bit encoder 8388608ppr
1000	130	4.77 (14.3)	2000 (3500)	MDMF104□H9M	x	x	x	23-bit encoder 8388608ppr
1500	130	7.16 (21.5)	2000 (3500)	MDMF154□G9M		x	x	23-bit encoder 8388608ppr
1500	130	7.16 (21.5)	2000 (3500)	MDMF154□H9M	x	x	x	23-bit encoder 8388608ppr
2000	130	9.55 (28.7)	2000 (3500)	MDMF204□G9M		x	x	23-bit encoder 8388608ppr
2000	130	9.55 (28.7)	2000 (3500)	MDMF204□H9M	x	x	x	23-bit encoder 8388608ppr
3000	130	14.3 (43.0)	2000 (3500)	MDMF304□G9M		x	x	23-bit encoder 8388608ppr
3000	130	14.3 (43.0)	2000 (3500)	MDMF304□H9M	x	x	x	23-bit encoder 8388608ppr
4000	176	19.1 (57.3)	2000 (3500)	MDMF404□G9M		x	x	23-bit encoder 8388608ppr
4000	176	19.1 (57.3)	2000 (3500)	MDMF404□H9M	x	x	x	23-bit encoder 8388608ppr
5000	176	23.87 (71.6)	2000 (3000)	MDMF504□G9M		x	x	23-bit encoder 8388608ppr
5000	176	23.87 (71.6)	2000 (3000)	MDMF504□H9M	x	x	x	23-bit encoder 8388608ppr
High inertia 400V AC class								
200	60	0.64 (2.23)	3000 (6500)	MHMF024□U9M		x	x	23-bit encoder 8388608-ppr
200	60	0.64 (2.23)	3000 (6500)	MHMF024□V9M	x	x	x	23-bit encoder 8388608-ppr
400	60	1.27 (4.46)	3000 (6500)	MHMF044□U9M		x	x	23-bit encoder 8388608-ppr
400	60	1.27 (4.46)	3000 (6500)	MHMF044□V9M	x	x	x	23-bit encoder 8388608-ppr
750	80	2.39 (8.36)	3000 (6000)	MHMF084□U9M		x	x	23-bit encoder 8388608-ppr
750	80	2.39 (8.36)	3000 (6000)	MHMF084□V9M	x	x	x	23-bit encoder 8388608-ppr
1000	80	3.18 (11.1)	3000 (6000)	MHMF094□U9M		x	x	23-bit encoder 8388608-ppr
1000	80	3.18 (11.1)	3000 (6000)	MHMF094□V9M	x	x	x	23-bit encoder 8388608-ppr
1000	130	4.77 (14.3)	2000 (3500)	MHMF104□G9M		x	x	23-bit encoder 8388608-ppr
1000	130	4.77 (14.3)	2000 (3500)	MHMF104□H9M	x	x	x	23-bit encoder 8388608-ppr
1500	130	7.16 (21.5)	2000 (3500)	MHMF154□G9M		x	x	23-bit encoder 8388608-ppr
1500	130	7.16 (21.5)	2000 (3500)	MHMF154□H9M	x	x	x	23-bit encoder 8388608-ppr
2000	176	9.55 (28.7)	2000 (3500)	MHMF204□G9M		x	x	23-bit encoder 8388608-ppr
2000	176	9.55 (28.7)	2000 (3500)	MHMF204□H9M	x	x	x	23-bit encoder 8388608-ppr
3000	176	14.3 (43.0)	2000 (3500)	MHMF304□G9M		x	x	23-bit encoder 8388608-ppr
3000	176	14.3 (43.0)	2000 (3500)	MHMF304□H9M	x	x	x	23-bit encoder 8388608-ppr
4000	176	19.1 (57.3)	2000 (3500)	MHMF404□G9M		x	x	23-bit encoder 8388608-ppr
4000	176	19.1 (57.3)	2000 (3500)	MHMF404□H9M	x	x	x	23-bit encoder 8388608-ppr
5000	176	23.9 (71.6)	2000 (3000)	MHMF504□G9M		x	x	23-bit encoder 8388608-ppr
5000	176	23.9 (71.6)	2000 (3000)	MHMF504□H9M	x	x	x	23-bit encoder 8388608-ppr

□ **Motor type** (L1 = standard, A1 = encoder without battery)

Servo drivers		Cables				Filter	Brake resistor
		Motor cable		Encoder cable			
Model	Frame	For motors without holding brake	For motors with holding brake	23-bit, incremental	23-bit, absolute	EMC filter	Model
Low inertia 400V AC class							
MDDL□64□□	D	MFMCA0□□4YUD	--	MFECA0□□0YYE	MFECA0□□0YYD (with battery box)	FN3268-7-44	BWD500150
		--	MFMCA0□□4ZUD				
		MFMCA0□□4YUD	--				
		--	MFMCA0□□4ZUD				
MEDL□84□□	E	MFMCA0□□4YUD	--				BWD500100
		--	MFMCA0□□4ZUD				
MFDL□A4□□	F	MFMCA0□□5YUD	--			FN3268-16-44	BWD600047
		--	MFMCA0□□5ZUD				
MFDL□B4□□		MFMCA0□□5YUD	--				
		--	MFMCA0□□5ZUD				
		MFMCA0□□5YUD	--				
		--	MFMCA0□□5ZUD				
Medium inertia 400V AC class							
MDDL□54□□	D	MFMCA0□□4YUD	--	MFECA0□□0YYE	MFECA0□□0YYD (with battery box)	FN3268-7-44	BWD500150
		--	MFMCA0□□4ZUD				
MDDL□64□□		MFMCA0□□4YUD	--				
		--	MFMCA0□□4ZUD				
MEDL□84□□	E	MFMCA0□□4YUD	--				BWD500100
		--	MFMCA0□□4ZUD				
MFDL□A4□□	F	MFMCA0□□5YUD	--			FN3268-16-44	BWD600047
		--	MFMCA0□□5ZUD				
MFDL□B4□□		MFMCA0□□5YUD	--				
		--	MFMCA0□□5ZUD				
		MFMCA0□□5YUD	--				
		--	MFMCA0□□5ZUD				
High inertia 400V AC class							
MDDL□44□□	D	MFMCA0□□3YUD	--	MFECA0□□0YYE	MFECA0□□0YYD (with battery box)	FN3268-7-44	On request
		--	MFMCA0□□3ZUD				
		MFMCA0□□3YUD	--				
		--	MFMCA0□□3ZUD				
MDDL□54□□		MFMCA0□□3YUD	--				BWD500150
		--	MFMCA0□□3ZUD				
MDDL□64□□		MFMCA0□□3YUD	--				
		--	MFMCA0□□3ZUD				
MDDL□54□□		MFMCA0□□4YUD	--				
		--	MFMCA0□□4ZUD				
MDDL□64□□		MFMCA0□□4YUD	--				
		--	MFMCA0□□4ZUD				
MEDL□84□□	E	MFMCA0□□4YUD	--				BWD500100
		--	MFMCA0□□4ZUD				
MFDL□A4□□	F	MFMCA0□□5YUD	--			FN3268-16-44	BWD600047
		--	MFMCA0□□5ZUD				
MFDL□B4□□		MFMCA0□□5YUD	--				
		--	MFMCA0□□5ZUD				
		MFMCA0□□5YUD	--				
		--	MFMCA0□□5ZUD				

□.□□ **Servo driver type**, see page 16   □□ = **Cable length** (m)

MINAS A6 motors, MINAS A6 Multi servo drivers and accessories 400V AC

				Servo motor				
Rated power W	Flange size □ mm	Max. torque Nm	Rated rotational speed (max.) rpm	Motor	Holding brake	Degree of protection IP67	Key shaft	Encoder
Low inertia MINAS A6 Multi 400V AC class								
1000	100	3.18 (9.55)	3000 (5500)	MSMF104□G9M		x	x	23-bit encoder 8388608ppr
				MSMF104□H9M	x	x	x	
1500		4.77 (14.3)		MSMF154□G9M		x	x	
				MSMF154□H9M	x	x	x	
2000		6.37 (19.1)		MSMF204□G9M		x	x	
				MSMF204□H9M	x	x	x	
3000	120	9.55 (28.7)		MSMF304□G9M		x	x	
				MSMF304□H9M	x	x	x	
4000	130	12.7 (38.2)	3000 (5000)	MSMF404□G9M		x	x	
				MSMF404□H9M	x	x	x	
5000		15.9 (47.8)		MSMF504□G9M		x	x	
				MSMF504□H9M	x	x	x	
Medium inertia MINAS A6 Multi 400V AC class								
1000	130	4.77 (14.3)	2000 (3500)	MDMF104□G9M		x	x	23-bit encoder 8388608ppr
				MDMF104□H9M	x	x	x	
1500		7.16 (21.5)		MDMF154□G9M		x	x	
				MDMF154□H9M	x	x	x	
2000		9.55 (28.7)		MDMF204□G9M		x	x	
				MDMF204□H9M	x	x	x	
3000		14.3 (43.0)		MDMF304□G9M		x	x	
				MDMF304□H9M	x	x	x	
4000	176	19.1 (57.3)		MDMF404□G9M		x	x	
				MDMF404□H9M	x	x	x	
5000		23.87 (71.6)	2000 (3000)	MDMF504□G9M		x	x	
				MDMF504□H9M	x	x	x	
High inertia MINAS A6 Multi 400V AC class								
400	60	1.27 (4.46)	3000 (6500)	MHMF044□U9M		x	x	23-bit encoder 8388608ppr
				MHMF044□V9M	x	x	x	
750	80	2.39 (8.36)	3000 (6000)	MHMF084□U9M		x	x	
				MHMF084□V9M	x	x	x	
1000		3.18 (11.1)		MHMF094□U9M		x	x	
				MHMF094□V9M	x	x	x	
1000	130	4.77 (14.3)	2000 (3500)	MHMF104□G9M		x	x	
				MHMF104□H9M	x	x	x	
1500		7.16 (21.5)		MHMF154□G9M		x	x	
				MHMF154□H9M	x	x	x	
2000	176	9.55 (28.7)		MHMF204□G9M		x	x	
				MHMF204□H9M	x	x	x	
3000		14.3 (43.0)		MHMF304□G9M		x	x	
				MHMF304□H9M	x	x	x	
4000		19.1 (57.3)		MHMF404□G9M		x	x	
				MHMF404□H9M	x	x	x	
5000		23.9 (71.6)	2000 (3000)	MHMF504□G9M		x	x	
				MHMF504□H9M	x	x	x	
				□ **Motor type** (L1 = standard, A1 = encoder without battery)				

(Left side vertical label: High inertia)

| Servo drivers		Cables				Filter	Brake resistor
		Motor cable		Encoder cable			
Model	Frame	For motors without holding brake	For motors with holding brake	23-bit, incremental	23-bit, absolute	EMC filter	Model
Low inertia MINAS A6 Multi 400V AC class							
MADM2A6KBX	A	MFMCA0☐☐1YUD	--	MFECA0☐☐0YYE	MFECA0☐☐0YYD (with battery box)	Depends on configuration	Motor design depends on application
		--	MFMCA0☐☐1ZUD				
		MFMCA0☐☐1YUD	--				
		--	MFMCA0☐☐1ZUD				
MADM2AAKBX		MFMCA0☐☐1YUD	--				
		--	MFMCA0☐☐1ZUD				
		MFMCA0☐☐2YUD	--				
		--	MFMCA0☐☐2ZUD				
MBDM1ABKBX	B	MFMCA0☐☐2YUD	--			Depends on configuration	
		--	MFMCA0☐☐2ZUD				
		MFMCA0☐☐2YUD	--				
		--	MFMCA0☐☐2ZUD				
Medium inertia MINAS A6 Multi 400V AC class							
	A	MFMCA0☐☐1YUD	--	MFECA0☐☐0YYE	MFECA0☐☐0YYD (with battery box)	Depends on configuration	Motor design depends on application
		--	MFMCA0☐☐1ZUD				
		MFMCA0☐☐1YUD	--				
		--	MFMCA0☐☐1ZUD				
MADM2AAKBX		MFMCA0☐☐1YUD	--				
		--	MFMCA0☐☐1ZUD				
		MFMCA0☐☐2YUD	--				
		--	MFMCA0☐☐2ZUD				
MBDM1ABKBX	B	MFMCA0☐☐2YUD	--			Depends on configuration	
		--	MFMCA0☐☐2ZUD				
		MFMCA0☐☐2YUD	--				
		--	MFMCA0☐☐2ZUD				
High inertia MINAS A6 Multi 400V AC class							
MADM2A4KBX	A	MFMCA0☐☐0YUD	--	MFECA0☐☐0YYE	MFECA0☐☐0YYD (with battery box)	Depends on configuration	Motor design depends on application
		--	MFMCA0☐☐0ZUD				
MADM2A4KBX,		MFMCA0☐☐0YUD	--				
		--	MFMCA0☐☐0ZUD				
MADM2A6KBX		MFMCA0☐☐0YUD	--				
		--	MFMCA0☐☐0ZUD				
		MFMCA0☐☐1YUD	--				
MADM2A6KBX, MADM2AAKBX		--	MFMCA0☐☐1ZUD				
		MFMCA0☐☐1YUD	--				
		--	MFMCA0☐☐1ZUD				
MADM2AAKBX		MFMCA0☐☐1YUD	--				
		--	MFMCA0☐☐1ZUD				
		MFMCA0☐☐2YUD	--				
		--	MFMCA0☐☐2ZUD				
MADM2AAKBX, MBDM1ABKBX	B	MFMCA0☐☐2YUD	--			Depends on configuration	
		--	MFMCA0☐☐2ZUD				
		MFMCA0☐☐2YUD	--				
		--	MFMCA0☐☐2ZUD				

☐☐ = **Cable length** (m)

MINAS A6N with RTEX protocol

RTEX (Realtime Express)

Thanks to its high transmission speed and sampling rate, this fast, real-time Ethernet bus for automation is particularly well suited for highly dynamic single and multiple axes position control tasks.

The communication between master and slaves happens in real time.

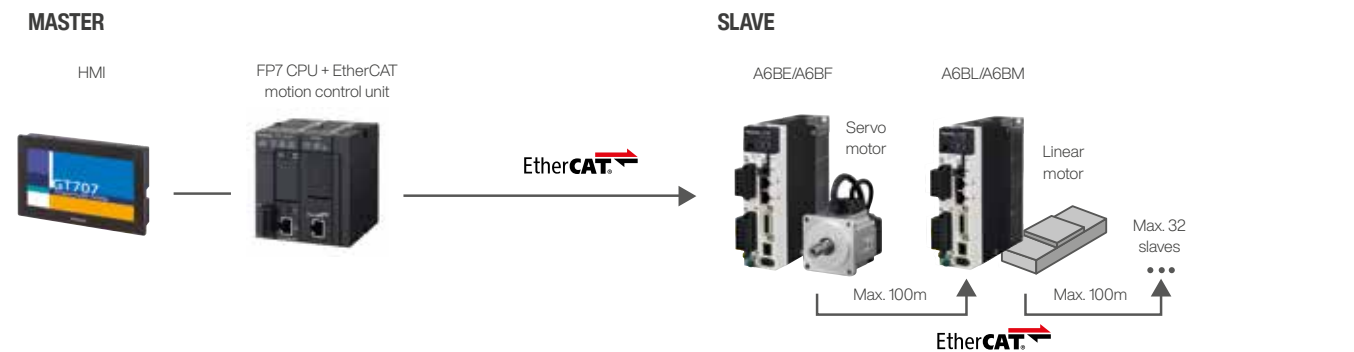### Easy mounting and reliable connections thanks to ring topology

MASTER

Host Controller

SLAVE

Servo   Servo   Servo

Max. 32 slaves

Max. 100m   Max. 100m

CAT5e
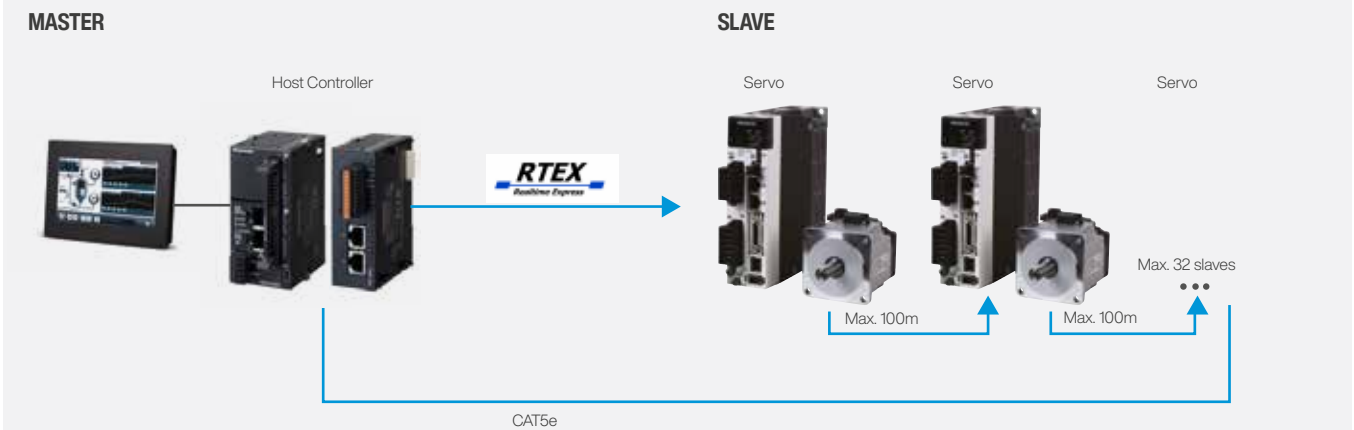
MINAS A6B with EtherCAT protocol

EtherCAT (Ethernet for Control Automation Technology)

This Ethernet-based field bus system offers similiarly outstanding features like RTEX. However, unlike RTEX, EtherCAT is an open, standardized field bus. This has the advantage that data can be exchanged with other servo drivers if they have an EtherCAT port.

MASTER

HMI   FP7 CPU + EtherCAT motion control unit

EtherCAT

SLAVE

A6BE/A6BF   A6BL/A6BM

Servo motor   Linear motor

Max. 32 slaves

Max. 100m   Max. 100m

EtherCAT

Features		MINAS A6N RTEX		MINAS A6B EtherCAT
General features		Supports position, velocity and torque control		
		Manual and automatic vibration suppression (adjustable in the driver)		
		Conforms to the following safety standards: ISO13849-1(PL e, CAT3), EN61508(SIL3), EN62061(SILCL3), EN61800-5-2(SIL3, STO), IEC61326-3-1, IEC60240-1		
		Easy wiring using standard Ethernet cables (CAT5e, up to 100m between units)		
Real-time communication 100Mbit/s		RTEX protocol		CAN over EtherCAT (CoE)
Full control of		up to 16 axes	up to 8 axes	up to 64 axes
PLC + Compatible positioning units		FP0H + AFP0HM4N / AFP0HM8N	AFPXHM8N16PD	FP7 + AFP7MC16EC / AFP7MC32EC / AFP7MC64EC

For more data about MINAS A6 servo controllers and motors such as technical data, dimensional diagrams, and torque characteristics, please use this download link:

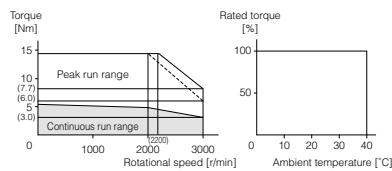## Examples of servo motor torque characteristics
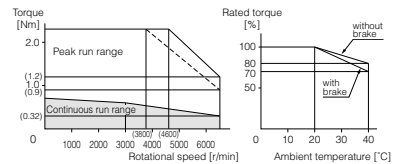
Motor with low inertia:

| MSMF5AZL1☐☐ | With oil seal |
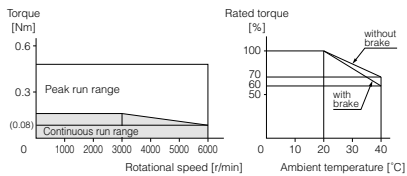
Motor with middle inertia:

| MDMF102L1☐☐ | With oil seal |

Motor with high inertia:

| MHMF022L1☐☐ | With oil seal |

Examples of servo motor dimension diagrams

MSMF – low inertia (50–1500W, 200V AC)

| 50-100W | Side | Front | Key-way dimensions |

1) Encoder connector (JN2)
2) Brake connector
3) Motor connector

| 200-1000W | Side | Front | Key-way dimensions |

1) Encoder connector (JN2)
2) Brake connector
3) Motor connector
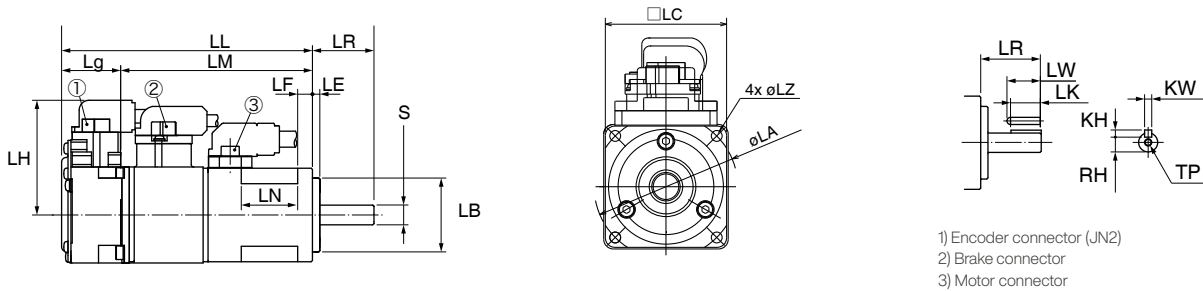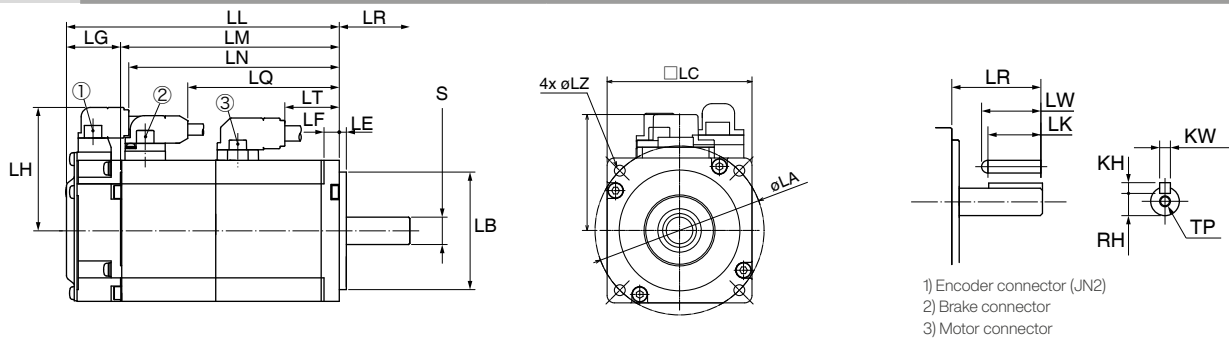
MINAS A6V servo drives (24/48V DC)

Low voltage, high performance

Features:

› Servo drives and servo motors

› 24/48V DC input voltage

› 50/100/133/200/266W

› 23-bit absolute encoder

› Modbus RTU communication

› Network types: EtherCAT, RTEX (Realtime Express)

› Position, velocity, and torque control

› Rated rotational speed up to 3000rpm

DC-powered servo drives are very common in drive technology for applications where there is no AC or three-phase current network available. Especially in the area of drive technology for vehicles and the medical field there is a need for motors with battery voltages. These motors round off Panasonic's portfolio of drive technology products.

Parallel I/O connector
DVOP24701-EU

Ext. scale connector
DVOPM20026-EU

Serial bus connector (Modbus)
DVOPM20024CAB020

Encoder connector
MFECAOXXOEAG (incremental)
MFECAOXXOEAH-EU (absolute)

USB connector
CABMINIUSB5D

Motor connector
MFMCAOXX1UT

Control power connector
DVOPM24600-EU

Main power connector
DVOP24700-EU
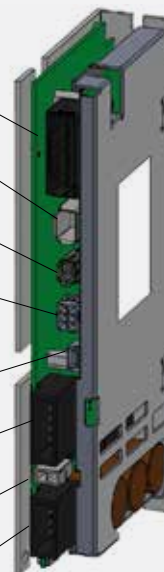
Servo driver specifications:

Type	A6V	
Input voltage	24V DC	48V DC
Rated power	50, 100, 133W	50, 100, 200, 266W
Control mode	Position control, velocity control, torque control, fully closed control with external encoder or linear scale	
Encoder feedback	23-bit absolute, serial	
Communication	USB, RS232, RS485	
Network	EtherCAT, RTEX	
Inputs (multifunction type)	5 multifunction inputs, 2 pulse inputs, 1 analog input, Modbus	
Inputs (network type)	8 multifunction inputs	
Outputs (multifunction type)	3 multifunction outputs, 1 analog output, A/B/Z-phase pulse output	
Outputs (network type)	2 multifunction outputs, A/B/Z-phase pulse output, 1 alarm output	
Weight	0.35kg approx.	
Dimensions (W x H x D in mm)	89 x 30 x 180	

Servo motor specifications:

		MSMF (low inertia)				MHMF (high inertia)					MQMF (flat type)				
Rated power		50W	100W	50W	100W	133W	50W	100W	200W	266W	100W	133W	100W	200W	266W
Supply voltage		24V DC		48V DC		24V DC	48V DC				24V DC		48V DC		
Flange size		☐38mm				☐60mm	☐40mm		☐60mm		☐60mm	☐80mm	☐60mm	☐80mm	
Rotational speed (rpm)	Rated	3000	3000	3000		2000	3000		3000	2000	3000	2000	3000	3000	2000
	Max.	5000	4600	6000		3500	6500		4500	3000	6500	3500	6500	5000	3500
Torque (Nm)	Rated	0.16	0.32	0.16	0.32	0.64	0.16	0.32	0.64	1.27	0.32	0.64	0.32	0.64	1.27
	Peak	0.48	0.95	0.48	0.95	1.91	0.56	1.11	2.23	4.46	1.11	2.23	1.11	2.23	4.46
Motor length (without shaft)*		72mm	92mm	72mm	92mm	67.5mm	53.5mm	67.5mm	67.5mm	84.5mm	56.2mm	62.3mm	56.2mm	62.3mm	74.8mm
Encoder resolution		23-bit absolute				23-bit absolute					23-bit absolute				
Brake		with / without				with / without					with / without				

* Without brake/oil seal

Types:

Supply voltage	Driver			Motor			
	Pulse	EtherCAT	RTEX	Rated power	Low inertia	High inertia	Flat type
24V DC	MVDLN4CSF (Multifunction)	MVDLN4CBE	MVDLN4CNE	50W	MSMF5ACL1☐2	--	--
	MVDLN4CSG (RS485)						
	MVDLN5CSF (Multifunction)	MVDLN5CBE	MVDLN5CBE	100W	MSMF01CL1☐2	--	MQMF01CL1☐2
	MVDLN5CSG (RS485)			133W	--	MHMF1ECL1☐2	MQMF1ECL1☐2
48V DC	MVDLN4BSF (Multifunction)	MVDLN4BBE	MVDLN4BNE	50W	MSMF5ABL1☐2	MHMF5ABL1☐2	--
	MVDLN4BSG (RS485)			100W	MSMF01BL1☐2	MHMF01BL1☐2	MQMF01BL1☐2
	MVDLN5BSF (Multifunction)	MVDLN5BBE	MVDLN5BNE	200W	--	MHMF02BL1☐2	MQMF02BL1☐2
	MVDLN5BSG (RS485)			266W	--	MHMF2JBL1☐2	MQMF2JBL1☐2

Applications:

Medical technology, laboratories

Robots

AGVs (automated guided vehicles in households and warehouses, lawnmowers, etc.)

☐ = Motor specification

Oil seal	Brake	Shaft	
		Round	With key-way
Without	Without	A	S
	With	B	T
With	Without	C	U
	With	D	V

All dimensions are in mm

Cables

Motor cable MINAS A6 200V AC				
For motors without holding brake	MFMCA0□□0WJD (Please see also related brake cable: *)	MSMF	50W–1kW	
	MFMCA0□□7WFD	MHMF	50W–100W	
	MFMCA0□□0WFD-EU	MHMF	200W–1kW	
	MFMCD0□□2GCD	MSMF, MDMF, MHMF	1kW–2kW	
For motors with holding brake	MFMCA0□□7XFD	MHMF	50W–100W	
	MFMCA0□□0XFD	MHMF	200W–1kW	
	MFMCA0□□2HCD	MSMF, MDMF, MHMF	1kW–2kW	
*Brake cable	MFMCB0□□0PJT-EU	MSMF	50W–1kW	
	□□ and xx in pictures = cable length (m)			

All dimensions are in mm

Encoder cable MINAS A6 200V AC

For motors with 23-bit incremental encoder	MFECA0☐☐0WJD	MSMF, MHMF	50W–1kW	
	MFECA0☐☐0GTD	MSMF, MDMF, MHMF	1kW–5kW	
For motors 23-bit absolute encoder (with battery box)	MFECA0☐☐0GJE	MSMF, MHMF	50W–1kW	
	MFECA0☐☐0GTE	MSMF, MDMF, MHMF	1kW–5kW	

☐☐ and xx in pictures = cable length (m)

MINAS A6 SERIES − ACCESSORIES

All dimensions are in mm

Motor cable MINAS A6 400V AC

For motors without holding brake	MFMCA0☐☐3YUD	200W–1kW	
	MFMCA0☐☐4YUD	1kW–2kW	
	MFMCA0☐☐5YUD	3kW–5kW	
For motors with holding brake	MFMCA0☐☐3ZUD	200W–1kW	
	MFMCA0☐☐4ZUD	1kW–2kW	
	MFMCA0☐☐5ZUD	3kW–5kW	
	☐☐ and xx in pictures = cable length (m)		

Encoder cable MINAS A6 400V AC & MINAS A6 Multi

For motors with 23-bit incremental encoder	MFECA0☐☐0YYE	200W–5kW	
For motors with 23-bit absolute encoder (with battery box)	MFECA0☐☐0YYD	200W–5kW	
	☐☐ and xx in pictures = cable length (m)		

All dimensions are in mm

Motor cable MINAS A6 Multi

For motors without holding brake	MFMCA0☐☐0YUD	400W–1kW	Front view Shielded cable
	MFMCA0☐☐1YUD	1kW–1.5kW	
	MFMCA0☐☐2YUD	2kW–5kW	
For motors with holding brake	MFMCA0☐☐0ZUD	400W–1kW	Front view Shielded cable
	MFMCA0☐☐1ZUD	1kW–1.5kW	
	MFMCA0☐☐2ZUD	2kW–5kW	
	☐☐ = cable length (m)		

Motor cable MINAS A6V 24/48V DC

For motors with/without holding brake	MFMCA0☐☐UT	200/400W
	☐☐ and xx in pictures = cable length (m)	

Encoder cable MINAS A6V 24/48V DC

For motors with 23-bit incremental encoder	MFECA0☐☐0EAG	200/400W
For motors 23-bit absolute encoder (with battery box)	MFECA0☐☐0EAH-EU	200/400W
	☐☐ and xx in pictures = cable length (m)	

All dimensions are in mm

Control cable (PLC – MINAS A6 servo driver), 200/400V AC			
For direct connections with FP series programmable controllers	FP0H, FP0R	For 1 axis DV0P0988WP-1 (PNP types)	
	FP7 positioning unit	For 2 axes DV0P0976W1 (line driver) DV0P0975W1 (transistor)	

Other accessories:

|	Product no.	Details/Comments/Dimensions		
Cables	**Control cable 200/400V AC**			
	DV0P4360	50W–5kW	50-pin	I/O cable X4, loose wires, 2m
	DVOP4360P	50W–5kW	50-pin	I/O cable X4, loose wires, 2m, position control
	DVOP4360V	50W–5kW	50-pin	I/O cable X4, loose wires, 2m, velocity control
	DV0PM20024CAB020	50W–5kW	8-pin	Communication cable X2, RS485, RS232, loose wires, 2m
	DV0PM20025CAB020	50W–5kW	8-pin	Safety function cable X3, loose wires, 2m
	DV0P0800-EU	50W–5kW	26-pin	I/O cable X4, loose wires, 2m
	Programming cable 200/400V AC			
	CABMINIUSB5D	50W–5kW	USB	
Connector set	**Connector set for servo driver 200V AC**			
	DV0P4350-EU	50W–5kW	50-pin	I/Os, X4
	DV0P0770-EU	50W–5kW	26-pin	I/Os, X4
	DV0PM20026-EU	50W–5kW	–	External encoder connector X5
	Connector set encoder, servo motor without holding brake 200V AC			
	DV0PM24581-EU	50/100W	–	MINAS A6 MHMF, IP67
	DV0PM24582-EU	200W-1kW	–	MINAS A6 MHMF, IP67
	DV0PM20035-EU	50W-1kW	–	MINAS A6 MSMF, IP67
	DV0PM20036-EU	1kW-2kW	–	MINAS A6 MSMF, MDMF; MHMF 1–1,5kW
	DV0PM20036A	1kW-2kW	–	Angled type; MINAS A6 MSMF, MDMF; MHMF 1–1,5kW
	Connector set encoder, servo motor with holding brake 200V AC			
	DV0PM20040-EU	50W-1kW	–	MINAS A6 MSMF, IP67
	DV0PM20038-EU	1kW-2kW	–	MINAS A6 MSMF, MDMF; MHMF 1–1,5kW
	DV0PM20038A	1kW-2kW	–	Angled type; MINAS A6 MSMF, MDMF; MHMF 1–1,5kW
	Connector set for servo drives 400V AC & MINAS A6 400V Multi			
	DV0PM14576-EU	1kW–5kW	–	For cables used to connect motors and encoders
Miscellaneous	**EMC filter 200V AC**			
	FN2080-6-06	50W-750W	1-phase	250V AC
	FN2090-10-06	1kW-1.5kW	1-/3-phase	250V AC
	FS21238607	50W-750W	1-phase	Footprint filter, 250V AC
	FN3268-7-44	1kW-3kW	3-phase	400V AC
	FN3268-16-44	4kW-5kW	3-phase	400V AC
	DV0P1460	50W-22kW	1-phase	Ferrite core, noise filter
	Braking resistors 200V AC			
	BWD250100	50W-100W	1-phase	100Ω, 100W, 600V AC	110 x 80 x 15 (L x W x D in mm)
	BWD250072	200W-750W	1-phase	72Ω, 100W, 600V AC	
	BWD500035	1kW-1.5kW	1-phase	35Ω, 200W, 600V AC	216 x 80 x 15 (L x W x D in mm)
	EMC filter 400V AC			
	FN3268-7-44	1kW-2kW	3-phase	400V AC
	FN3268-16-44	3kW-5kW	3-phase	400V AC
	Braking resistors 400V AC			
	BWD500150	1kW-1.5kW	3-phase	150Ω, 100W, 600V AC	216 x 80 x 15 (L x W x D in mm)
	BWD500100	2kW	3-phase	100Ω, 100W, 600V AC	216 x 80 x 15 (L x W x D in mm)
	BWD600047	3kW-5kW	3-phase	47Ω, 240(400)W, 600V AC	216 x 80 x 30 (L x W x D in mm)
	Braking resistors MINAS A6 Multi 400V AC			
	Motor design depending on application			
	Miscellaneous MINAS A6 Multi 400V AC			
	DV0PM24621-EU	USB license dongle "PANATERM for Safety"		

MINAS A6 SERIES − ACCESSORIES
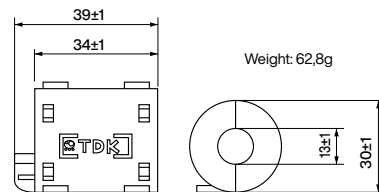
EMC filter

200V AC:

FN2080-6-06 for servo driver MINAS A6 50–750W, 1-phase / FN2090-10-06 for servo driver MINAS A6 1–1.5kW, 1-phase
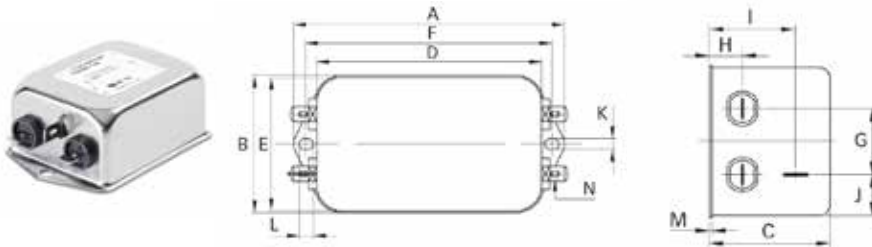
Dimensions (mm)	FN2080-6-06	FN2080-10-06
A	113.5	156
B	57.5	57.5
C	45.4	45.4
D	94	130.5
E	56	56
F	103	143
G	25	25
H	12.4	12.4
I	32.4	32.4
J	15.5	15.5
K	4.4	5.3
L	6	6
M	1	1
N	6.3 x 0.8	6.3 x 0.8

FS21238607 for servo driver MINAS A6 50–750W, 1-phase

DV0P1460 with ferrite core

Weight: 62,8g

400V AC:

FN3268-7-44 for servo driver MINAS A6 1–2kW, 3-phase / FN3268-16-44 for servo driver MINAS A6 3–5kW, 3-phase
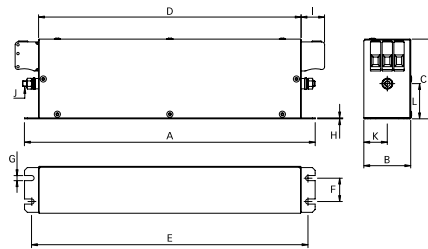
Dimensions (mm)	FN3268-7-44	FN3268-16-44
A	190	250
B	40	45
C	70	70
D	160	220
E	180	235
F	20	25
G	4.5	5.4
H	1	1
I	22	22
J	M5	M5
K	20	22.5
L	29.5	29.5

RTEX – the multi-axis Ethernet servo system

The RTEX positioning units support MINAS A6N network servo drives. A mutually optimized system consisting of PLC and servo driver greatly simplifies installation and reduces time needed for design.

Commercially available Ethernet cable
(shielded, category 5e)

MINAS dedicated
software tool **PANATERM 6**

CPU
TOOL port

I/O signals, for example from limit and origin proximity switches are directly wired to the servo amp of each axis.

Positioning unit RTEX
dedicated software tool
Control Configurator PM

Programming tool
Control FPWIN Pro
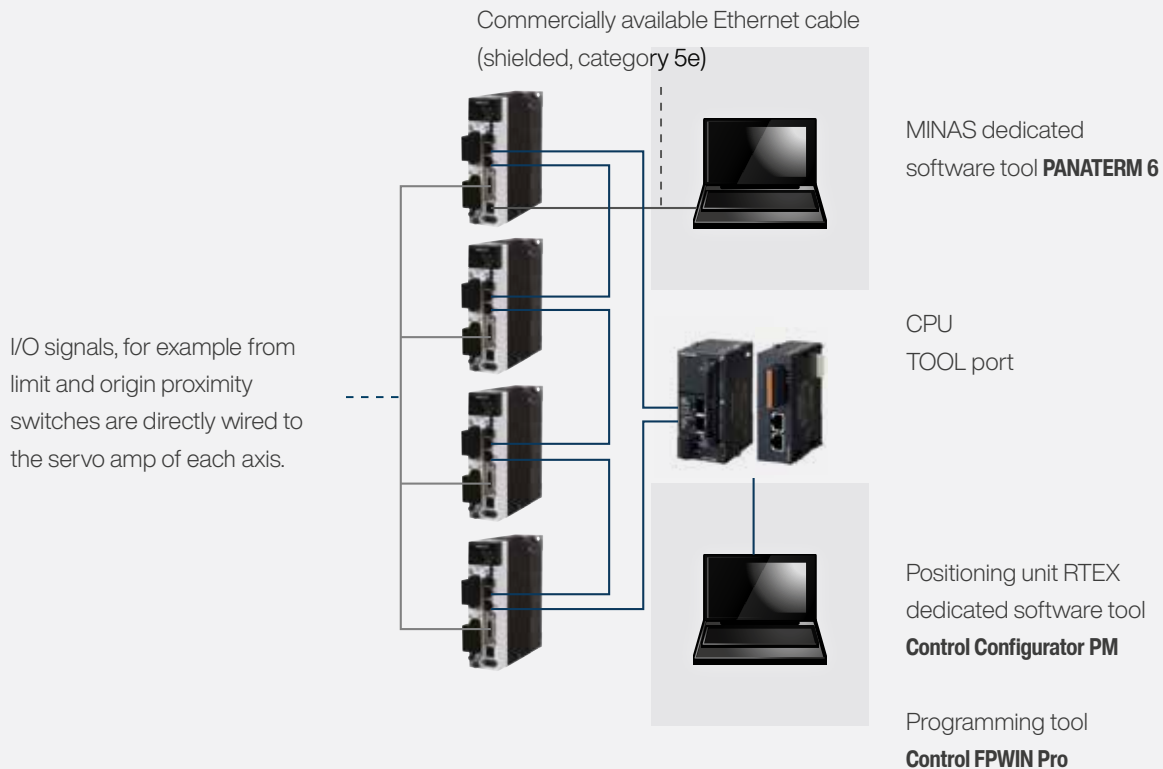
The main advantages of the RTEX positioning units:

› **Unique:** Allows easy control of network servos with an ultra-compact PLC.

› Allows **highly accurate** control of multi-axis position control using high-speed 100Mbit/s communication.

› **Minimization** of wiring costs by using commercially available Ethernet cables.

› **Position control** of 4 or 8 axes for servo drivers with Ethernet (RTEX) interface.

› **Easy** configuration with the software Control Configurator PM instead of complex programming.

› Includes manual pulser input allowing support for **precision teaching**.

System configuration

Panasonic's compact PLC FP0H can be easily expanded with up to 2 RTEX positioning units
(max. 2 x 8 axes + 4 axes (CPU)).

Product	Number of axes	Output type		Product no.
Positioning units FP0H	4	RTEX Ethernet	Electronic gear, electronic clutch, electronic cam control	AFP0HM4N
	8			AFP0HM8N
Control Configurator PM	For all RTEX units			AFPS66510

Motion control libraries for Control FPWIN Pro (PLC)

The motion control library contains the most important function blocks, e.g.

› for relative or absolute position control

› and for home returns with linear axes.

Panasonic offers libraries for all motion control tasks.

CPU Motion Control Library

Position control with FP series control units (FP0R, FP-X, FPXH, FP0H, FP7)

PP Motion Control Library

› Positioning with PP motion control unit FP0H

› FP7: Library is included in the PLC programming software Control FP-WIN Pro.

RTEX Motion Control Library

Positioning with RTEX positioning unit FP0H

Simply download the software from the Panasonic website: https://industry.panasonic.eu/downloads

Advantages of PLC programs using the Motion Control Library

› **Free** – just download it from Panasonic's website

› **Simple** – easy programming and installation

› **Efficient** – ready-made function blocks, set parameters instead of writing complex programs

› **Compliant** – compliant with IEC 61131- 3

› **Universal** – hardware-independent (works for every Panasonic PLC)

› **Flexible** – expandable for up to 256 axes

› **Fast** – fast and easy commissioning (ready-to-use example programs)

Function block from the MC_CPU_Library Motion library used for an application

Time chart

Drilling setup
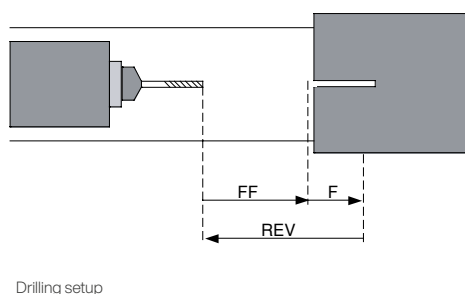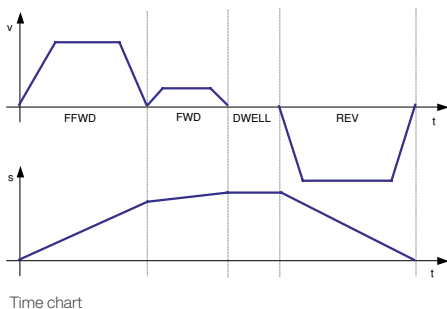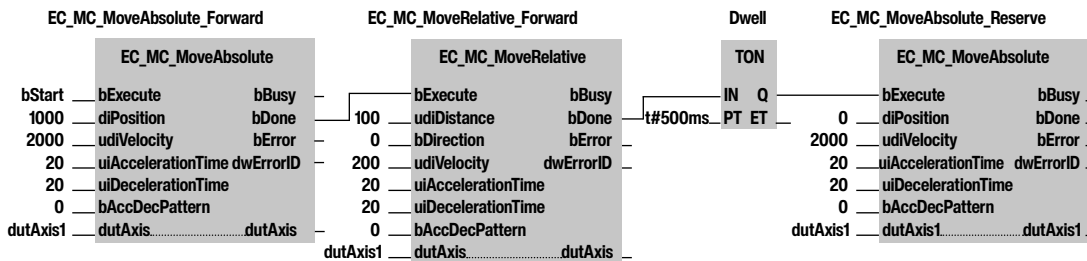
Modbus RTU protocol

Modbus

Field Bus

Advantages

Improved performance

❯ No position deviation caused by lost pulse signals (considerably improved reliability)

Improved functions

❯ Editing parameters (moment of inertia, damping frequency)

❯ Servo data logging (collection of data related to the utilization factor and torque for remote monitoring of machines)

Reduced cost

❯ Easy adding and removing of axes (simplified wiring thanks to bus system)

❯ Less time needed for commissioning, e.g. thanks to instantaneous registration of the axis position

Features

❯ MINAS A6 series field bus

❯ Modbus RTU is an open, serial (RS232 or RS485) protocol based on a master/slave or client/server architecture.

❯ Widely used protocol due to its ease of operation and reliability

❯ Cost-effective solution for programmable controllers based on RS485

❯ Controlling a servo drive system based on the CANopen motion control profile CiA is possible

Simple complete motion control solution with one Panasonic compact PLC

Modbus RTU library for Motion Control

RS485

Modbus RTU

FP0R

A6SF

Max. 31 axes

Optional: Temperature controllers, sensors
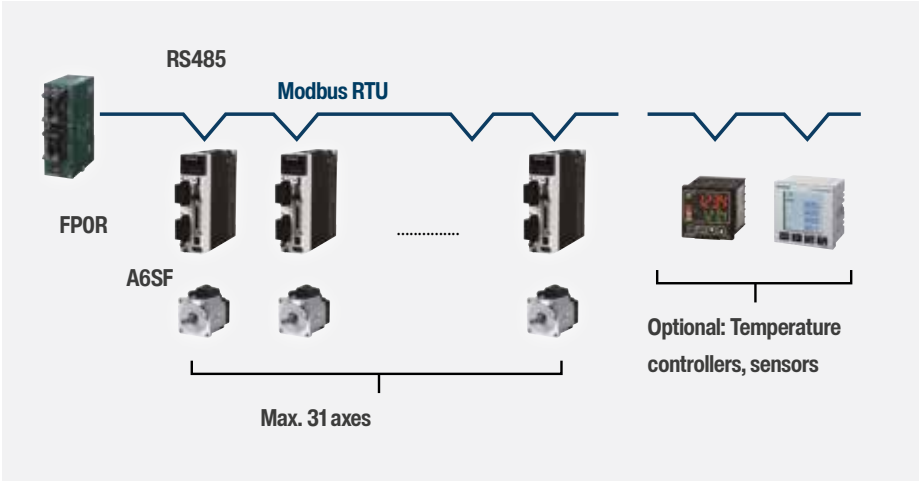
Direct access to servo drive parameters from the PLC

**Panasonic Control FPWIN Pro**

Libraries

The libraries enable serial communication (RS232, RS485) between the FP series PLCs and servo drivers of the MINAS A6 series.

> The communication protocols for the drivers are also included in the libraries.

> The libraries allow full read and write access to the parameters.

> They also record the status and position data of the axes.

> The RS232 interface (optional RS485) is already included with the FP series.

> With RS232 connections, the first driver can be used as a gateway to downstream drivers so that all drivers can communicate with the PLC.

Communication via RS232

Communication software   **FP series PLCs**

MINAS A6

RS232/Modbus
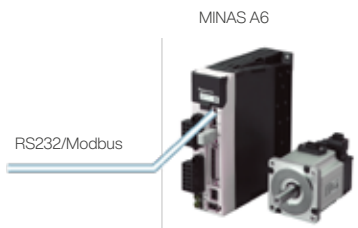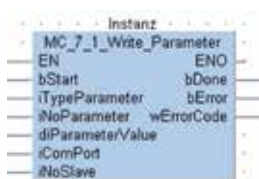
Communication via RS485

Communication software   **FP series PLCs**

MINAS A6 no. 1   MINAS A6 no. 2   MINAS A6 no. 15

RS485/Modbus
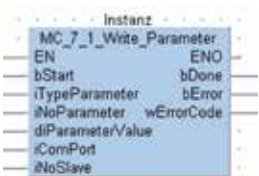
Download the software free of charge from Panasonic's website: https://industry.panasonic.eu/downloads

Software Configurator PM for RTEX

**User-friendly, user-friendly commissioning**

The Configurator PM offers numerous configuration options

› Axis and parameter settings

› Data table creation

› JOG operations

› Home return

› Data monitor settings

› and other settings for easy test operation

Parameter settings

The details of the settings can be displayed in a table.
Details on how to create settings for each category are
explained in the box below. Parameters can be copied between
axes.

Advantage: In instances where many settings are shared among
the axes, this can reduce the number of repeat inputs.
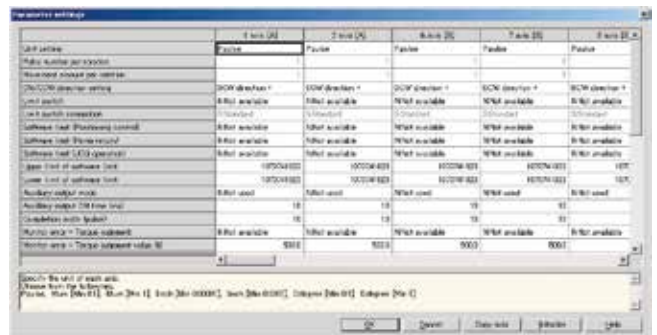
Data table creation

› User-friendly data entry similar to an Excel sheet

› Data tables are displayed in an easy-to-understand manner

› Export of data tables to CSV format for document
   management systems, etc.

› Data ranges of a CSV file can be added to a table quickly with
   cut and paste

› A separate table for each axis (or each set of interpolation
   axes)

**Advantage**: Data is clearly arranged for fast easy handling
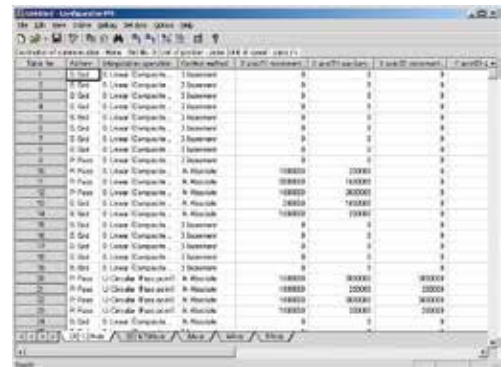
Tool operations

Each axis can be operated by test sequences independently of
the operation modes (PROG and RUN) of the RTEX unit (or the
programmable controllers).
JOG operation and teaching can be carried out easily to index
positioning points. Test operation is possible without having to
create a rudder program.

Advantage: Trial operation in advance saves time
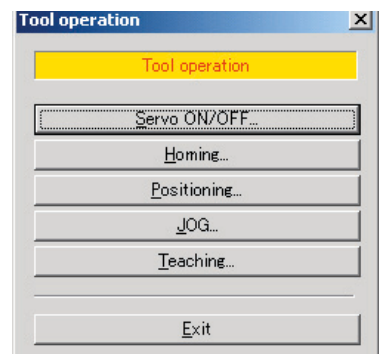
Configuring servo drivers

PANATERM configuration software

For MINAS AC servo motors & drive amplifiers

PANATERM assists users in making parameter and control settings as well as creating and analyzing data tables during operation. The software can be installed on any commercially available personal computer. The connection to the MINAS series is established via the USB port.

Setup and basic functions

> Auto-tuning

> Gain adjustment and inertia ratio measurement

> Line graph display
  The line graph diagram shows command and current velocity, torque, and the tracking error.

> Display of the absolute encoder settings

> Parameter setting
  After a parameter has been defined on the screen, it will immediately be sent to the driver. Frequently used parameters can be listed separately in a second display.
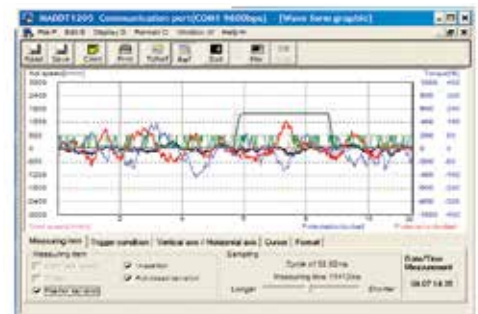
Line graph display

Monitoring function

Parameters and status can be monitored, e.g. operation mode, speed, torque, error and warning. overview of command/feedback pulses, load ratio, regenerative resistive load ratio and many more.

Monitor

Analysis of mechanical operation data (frequency analysis)

Frequency characteristics of a machine can be measured for display in a Bode diagram.

Simply download the software from Panasonic's website: https://industry.panasonic.eu/downloads

Software for designing drives

M-SELECT software

M-SELECT is a software program to help you select the correct motor capacity and servo driver from Panasonic's MINAS series. Find the optimal type of motor with regards to the mechanical layout and the dynamic requirements. It is a very valuable tool for mechanical engineering as it also provides CAD data in 2D and 3D. The software offers a complete analysis and detailed usage instructions for the MINAS series in all sizes.

Selecting the motor capacity
in just four steps:

1. Select mechanical parts and input their parameters (figure 1)
The user can select parts from a database with all mechanical standard parts (gears, coupling, spindle axis, etc.).

2. Determine the motion profile (figure 2)
Display and determine speed, position and ramps, etc.

3. Select the correct motor series (figure 3)
- › 1- or 3-phase
- › Input voltage
- › Specify torque, etc.

The software calculates the parameters for the selected series. The various criteria are evaluated with OK or NG (not good).

4. Result (figure 4)
Check and print result

Simply download the software from Panasonic's website:
https://industry.panasonic.eu/downloads
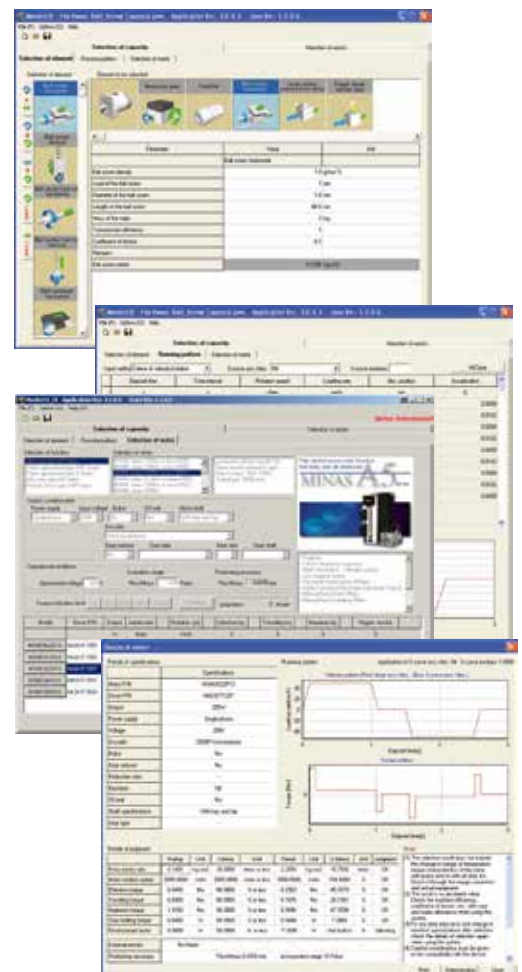
QUICK START GUIDES   FREE!

Quick start guides

The Quick start guides are intended to help you set up a MINAS servo drive system.

They are based on information from the MINAS series manuals and the practical experience of our engineers.
Step-by-step instructions will guide you through connecting a PLC to a MINAS servo driver and setting the most important parameters in the PC configuration software PANATERM.

Available Quick start guides in our download center (also in other languages):

Easy download from the Panasonic website: https://industry.panasonic.eu/downloads

QS2000, Position control by pulse and direction signals (MINAS A5/A5E/A6SG/A6SF)

QS2001, Position control by block operation using input signals (MINAS A6SG/A6SF)

QS2002, Position control by block operation using Modbus commands (MINAS A6)

QS2003, Position control in EtherCAT networks (MINAS A5B/A6B)

QS2004, Position control using RTEX (MINAS A5N/A6N)

QS3000, Velocity control (MINAS A5/A6F)

QS4000, Torque control (MINAS A5/A6)

QS5000, PANATERM – Trial run

QS5001, PANATERM – Auto-tuning

QS5002, PANATERM – Fit gain tuning

QS10000, Position control with Beckhoff host controller over EtherCAT (MINAS A6 Multi)

QS10001, PANATERM – Ethernet over EtherCAT (EoE) (MINAS A6 Multi)

QS10002, PANATERM for Safety – Safe Torque Off (STO) (MINAS A6 Multi)

QS10003, PANATERM for Safety – Safe Stop 1 (SS1) (MINAS A6 Multi)

QS10004, PANATERM for Safety – Safe Speed Monitoring (SSM) (MINAS A6 Multi)

QS10005, Position control with Omron host controller over EtherCAT (MINAS A6 Multi)

QS10006, Position control with TRIO host controller over EtherCAT (MINAS A6 Multi)

More Quick start guides for the MINAS series are being prepared.

MOTION CONTROL COMPREHENSIVE SOLUTIONS

MINAS A6 series servo drives

Highly dynamic servo drives with state-of-the-art technology. Large power range (50W to 15kW) combined with a light-weight and compact design. Innovative functions for damping resonance frequencies and to eliminate vibration tendencies. Multiple control features such as pulse, analog, and network technology in real-time communication (100Mbit/s). With the MINAS A6V series (24V or 48V DC input voltage) and the MINAS A6 Multi in book size format, Panasonic rounds off its portfolio of drive technology products.

3 Year Warranty

FP series PLCs

The PLC comes already equipped with the functionality required for position control tasks. FP0R is capable of controlling up to 4 axes independently. The FP-XH has an integrated Ethernet-based communication bus (RTEX), and the CPU of the FP0H can be expanded with modular positioning units to control up to 20 axes. The modular FP7 series can control 64 axes independently or synchronously in the network.

Motion control libraries, configuration and programming software

The PLC programming software Control FPWIN Pro (compliant with IEC 61131-3) and the free configuration software PANATERM, M-SELECT and GM Programmer shorten the time required for commissioning. In addition, you can download motion control libraries for free including special function blocks, with which complex positioning tasks can be solved quickly and efficiently.

HM touch terminals

Touch terminals allow humans and machines to interact with each other. The machine's role therein is to display data, results, messages, etc. and to receive instructions and execute tasks assigned by operators. Panasonic's innovative touch terminals are ideally suited for these tasks. They are optimally suited both for factory and building automation. Panasonic HMIs cover a wide spectrum, ranging in size from a compact 3" touch terminal to a color 21" display for sophisticated applications.

Motion Controller GM1

Motion controllers offer a compact solution for complex motion control applications. Panasonic Industry presents the first motion controller in its comprehensive lineup: the GM1 combines features of motion functions with the functionality of a PLC like a positioning unit, a network unit, an I/O unit, and a high-frequency counter in one compact controller. The space-saving "all-in-one" solution reduces the occupied space in the cabinet and allows for response times to be as low as 0.5ms. For the integration in an Industry 4.0 environment, the GM1 motion controller is equipped with OPC UA client and server functions.

IN Your Innovation

Motion controller
GM1 series

Combines programmable logic and motion control in one device (supports EtherCAT/RTEX communication protocols)

› **High-speed response for fast data exchange and networking**
Shortest command cycle: 0.5ms

› **Synchronous control for complex multi-axis systems**
EtherCAT type: max. 32 axes
RTEX type: max. 16 axes

› **All in one – motion, network, I/O**
General-purpose I/O: 16 inputs and 16 outputs
High-speed counter: 2 channels

› **Two independent Ethernet connectors**
for e. g. EtherNet/IP, CODESYS protocol, OPC UA, Modbus-TCP

› **Easy programming**
Configuration software GM Programmer based on CODESYS (compliant with IEC 61131-3)

RTEX type

EtherCAT type

NEW!

Panasonic
INDUSTRY

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