Digital electronic drives for SSP servopumps

fieldbus, smart start-up, smart maintenance

P/Q CONTROL

SMART START-UP

BALANCED — DYNAMIC — SMOOTH — HIGH
SMART TUNING

MULTIPLE AXIS

SMART MAINTENANCE

CE

c UL us LISTED

D-MP-T-SP-BC-022/K

① Drive power supply - input
② Servomotor power supply - output
③ Serial RS485 communication port
④ IN/OUT signals
⑤ Safe Torque Off (STO)
⑥ CANopen
⑦ PROFIBUS DP, EtherCAT or PROFINET
⑧ Servomotor resolver

D-MP

Electronic drive exploits the modern techno-logy of servo drives to accurately control pres-sure and flow in hydraulic systems through Smart Servopumps (SSP).
Atos PC software allows to customize the SSP configuration and via the Smart Start-up function guides the user step by step during the commissioning phases.
Multiple axis function allows to manage custo-mized settings for up to 4 axes.
Smart Maintenance provides information on health condition of SSP and allows to plan in advance the replacement of worn com-ponents, maximizing productivity and mini-mizing maintenance costs.
For more info please refer to AS050.

General Features:
• DB9 serial port RS485 always present
• Fast plug-in connectors input/output for CANopen
• DB9 connector for PROFIBUS DP
• RJ45 connectors input/output for EtherCAT, PROFINET IO RT/IRT
• DB15 connector for servomotor resolver always present
• Fast plug-in connector for STO always present
• Ambient temperature range: -10 ÷ +50 °C
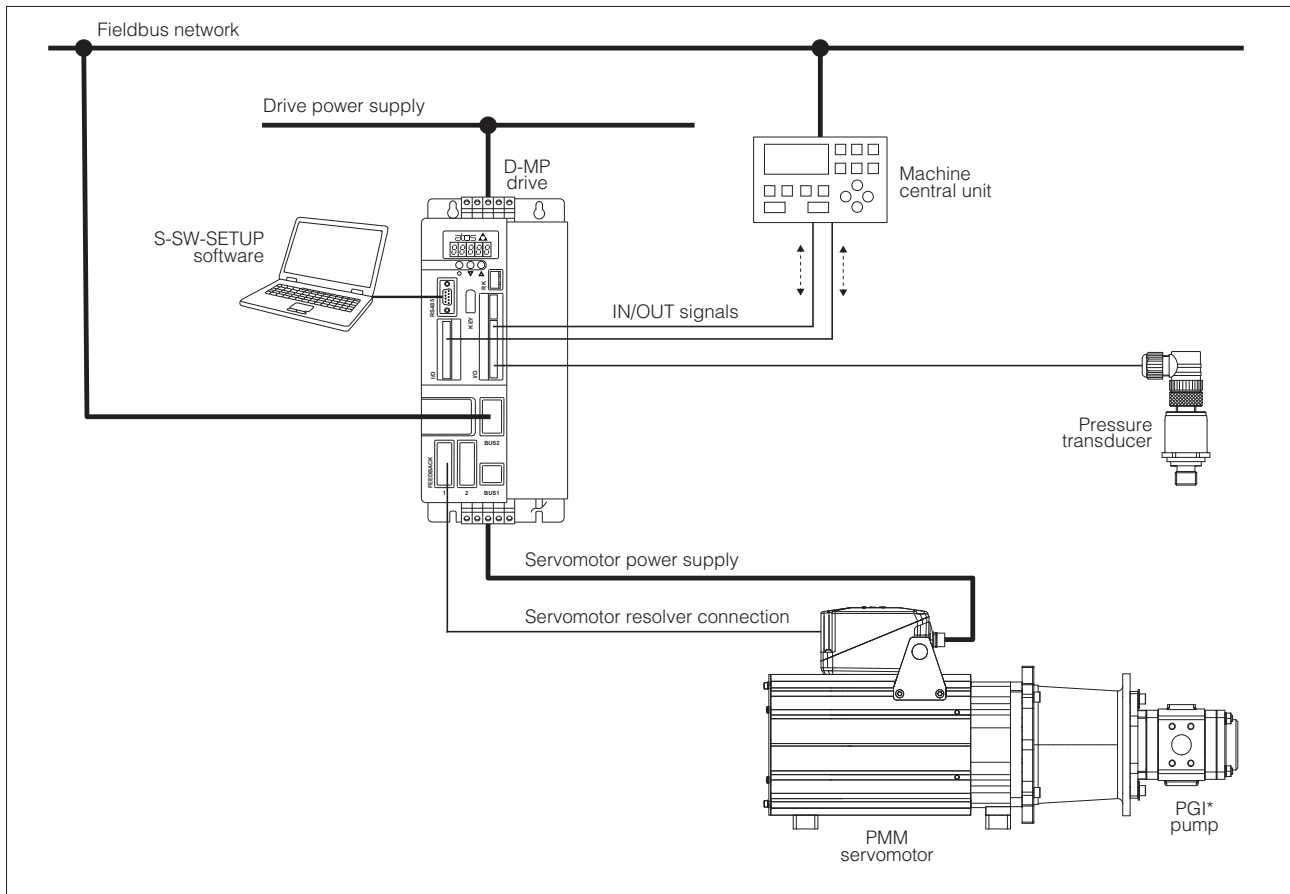• IP20 protection degree
• CE and UL marking

Software Features:
• Intuitive graphic interface
• Smart Maintenance
• Smart Start-up
• Multiple axis
• Smart tuning
• Setting of SSP functional parameters
• Complete diagnostics
• Internal oscilloscope function

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1 **MODEL CODE**

D-MP	-	T-SP	-	BC	-	022	/	K		*

Electronic drive
in wall mounting format

Control mode:
T-SP = high performances p/Q control

Fieldbus interface, serial port RS485 always present:

NP = not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EP = PROFINET RT/IRT

Series number

STO function, see section **12** :
K = Safe Torque Off (STO) - always present

Rated current [Arms], see section **6** :

022 = 22 A	**060** = 57,5 A	**140** = 140 A
032 = 32 A	**090** = 87 A	**165** = 165 A
046 = 46 A	**100** = 100 A	**210** = 210 A

BLOCK DIAGRAM EXAMPLE

Fieldbus network

Drive power supply

D-MP drive

S-SW-SETUP software

Machine central unit

IN/OUT signals

Pressure transducer

Servomotor power supply

Servomotor resolver connection

PMM servomotor

PGI* pump

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3 **DRIVE SETTINGS AND PROGRAMMING TOOLS** - see tech. table **AS800**

Drive functional parameters and configurations, can be easily set and optimized using Atos S-SW-SETUP programming software connected via serial port RS485 to the drive.
For fieldbus versions, the software permits drive parameterization through serial port RS485 also if the drive is connected to the central machine unit via fieldbus.

S-SW-SETUP permits to have many features so as Smart Start-up, Multiple axis and Smart tuning for an easy and rapid commissioning. For detailed info refer to **AS050**.

S-SW-SETUP support: NP (Serial)
BC (CANopen)   EH (EtherCAT)
BP (PROFIBUS DP) EP (PROFINET)

Note: for detailed descriptions of settings, wirings and installation procedures, please refer to the user manuals included in the S-SW-SETUP

Serial port RS485 connection

KIT S-A-PS-USB/DB9 adapter

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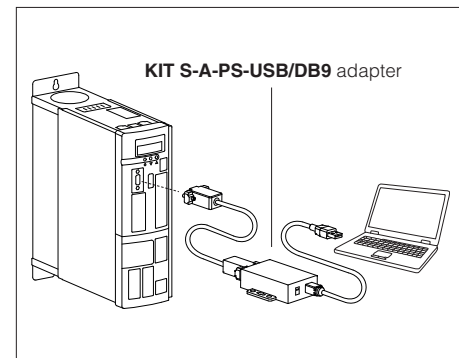
4 **FIELDBUS** - see tech. table **GS510**

Fieldbus allows drive direct communication with machine control unit for digital reference, drive diagnostics and settings. These execution allow to operate the drive through fieldbus or analog signals available on the connectors.

5 GENERAL CHARACTERISTICS

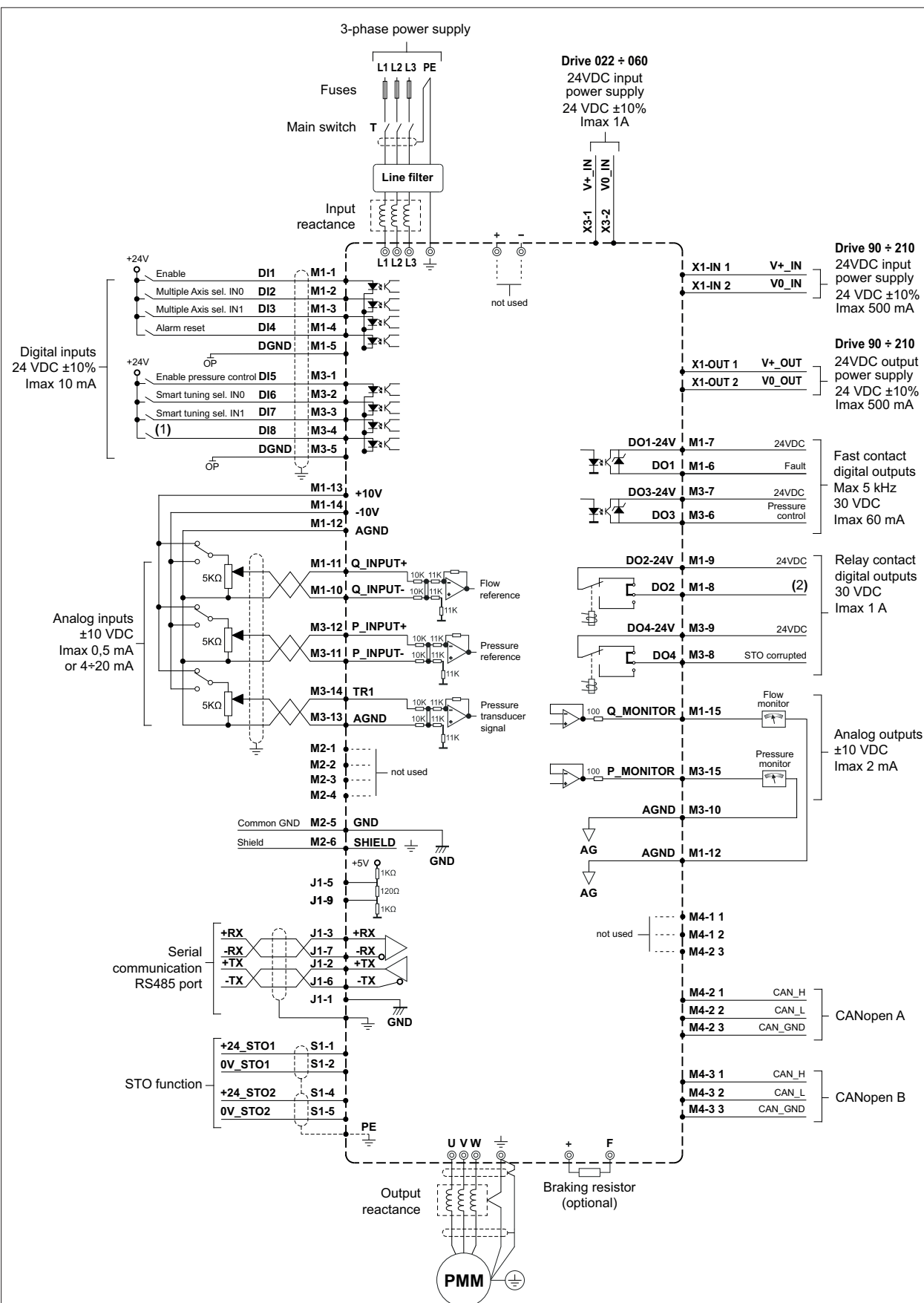|	
Assembly position	Wall mounting
Ambient temperature range	-10 ÷ 50°C ; the maximum ambient temperature of D-MP is 50°C ; a derating is necessary
Altitude	0 ÷ 1000 m ; current derating for higher altitudes
Humidity	5÷ 85%
Vibration	1g (57 Hz ≤ frequency ≤ 150Hz)
Cooling	Fan
Compliance	CE according to Low Voltage Directive (LVD) 2014/35/EU and to EMC directive 2014/30/EU UL marking attesting that the device complies with the essential requirements of the UL 61800-5-1 RoHS Directive 2011/65/EU as last update by 2015/863/EU

6 ELECTRICAL CHARACTERISTICS

Drive type		**022**	**032**	**046**	**060**	**090**	**100**	**140**	**165**	**210**
Rated current	[A]	22	32	46	57.5	87	100	140	165	210
Overload current **(1)**	[A]	44	64	92	115	174	200	280	330	420
Rated power	[kW]	11	15	22	30	45	55	75	90	110
Rated IN voltage	[V]	200 V -10% ÷ 480 V +10% @ 45 ÷ 65 Hz				400 V -10% ÷ 480 V +10% @ 45 ÷ 65 Hz				
PWM frequency **(2)**	[kHz]	1 ÷ 15							1 ÷ 10	
Network type		Grounded (TT, TN) corner earthed or not earthed, ungrounded (IT)								
Max shorts circuit current	[A]	5000				10000				
Overvoltage category		3								
Protective class		I								
Thermal braking current	[A]	15	25	45	45	89	109	149	179	219
Peak current	[A]	30	50	85	85	138	138	188	225	275
Braking voltage	[V]	780								
24VDC input power supply		24 V_{DC} ±10% @ max 1,0 A for drives type 022, 090, 100, 140, 165, 210 24 V_{DC} ±10% @ max 1,3 A for drives type 032 24 V_{DC} ±10% @ max 1,8 A for drives type 046, 060								
24VDC output power supply		24 V_{DC} ±10% @ max 500 mA - only for drives type 090, 100, 140, 165, 210								
Digital inputs		24 V_{DC} ±10% @ max 10 mA								
Digital outputs - fast contact		30 V_{DC} @ max 60 mA (max 5 kHz)								
Digital outputs - relay contact		30 V_{DC} @ max 1 A								
Analog inputs		±10 V @ max 0,5 mA or 4 ÷ 20 mA (settable with specific dip-switch - see S-MAN-HW manual)								
Analog outputs		±10 V @ max 2 mA								
Pressure transducer power supply		+24 V_{DC} @ max 100 mA (E-ATR-8 see tech table **GS465**)								
Protection degree to DIN EN60529		IP20								
Analog reference resolution		12 bit								
Speed control mode		Field-Oriented Control								
Braking resistance		External (see tech table **AS810**)								
Filter		External (see tech table **AS810**)								
Reactance		External - recommended for high power (> 45kW) (see tech table **AS810**)								
Communication interface		Serial Atos ASCII coding	CANopen EN50325-4 + DS408		PROFIBUS DP EN50170-2/IEC61158		EtherCAT, PROFINET IO RT / IRT EC 61158			
Communication physical layer		insulated RS485	optical insulated CAN ISO11898		optical insulated RS485		Fast Ethernet, insulated 100 Base TX			
Recommended wiring cable for logic and 24VDC power supply		LiYCY shielded cables - max conductor size: 1,5 mm² 1,5 mm² max 30 m for 24 V_{DC} power supply - 0,5 mm² max 30 m for logic Notes: for pressure transducer wiring cable please consult the transducer datasheet								
Recommended wiring cable for drive and servomotor power supply		see section **13**								

(1) 200% overload for maximum 3s and 155% for 30s
(2) Default is 5 kHz

3-phase power supply

L1 L2 L3 PE

Fuses

Main switch **T**

Line filter

Input reactance

Drive 022 ÷ 060
24VDC input power supply
24 VDC ±10%
Imax 1A

V+_IN   V0_IN

X3-1   X3-2

L1 L2 L3

+   −

not used

Drive 90 ÷ 210
24VDC input power supply
24 VDC ±10%
Imax 500 mA

X1-IN 1   V+_IN
X1-IN 2   V0_IN

Drive 90 ÷ 210
24VDC output power supply
24 VDC ±10%
Imax 500 mA

X1-OUT 1   V+_OUT
X1-OUT 2   V0_OUT

+24V

Signal		Term
Enable	DI1	M1-1
Multiple Axis sel. IN0	DI2	M1-2
Multiple Axis sel. IN1	DI3	M1-3
Alarm reset	DI4	M1-4
	DGND	M1-5

OP

+24V

Signal		Term
Enable pressure control	DI5	M3-1
Smart tuning sel. IN0	DI6	M3-2
Smart tuning sel. IN1	DI7	M3-3
(1)	DI8	M3-4
	DGND	M3-5

OP

Digital inputs
24 VDC ±10%
Imax 10 mA

M1-13   +10V
M1-14   -10V
M1-12   AGND

M1-11   Q_INPUT+
M1-10   Q_INPUT−

5KΩ   10K 11K   Flow reference   11K

M3-12   P_INPUT+
M3-11   P_INPUT−

5KΩ   10K 11K   Pressure reference   11K

M3-14   TR1
M3-13   AGND

5KΩ   10K 11K   Pressure transducer signal   11K

Analog inputs
±10 VDC
Imax 0,5 mA
or 4÷20 mA

	Term	
	M2-1	
	M2-2	not used
	M2-3	
	M2-4	

Common GND   M2-5   GND
Shield   M2-6   SHIELD   GND

+5V   1KΩ   120Ω   1KΩ

J1-5
J1-9

Serial communication RS485 port

	Term	
+RX	J1-3	+RX
-RX	J1-7	-RX
+TX	J1-2	+TX
-TX	J1-6	-TX
	J1-1	GND

STO function

	Term
+24_STO1	S1-1
0V_STO1	S1-2
+24_STO2	S1-4
0V_STO2	S1-5
	PE

U V W

Output reactance

+   F

Braking resistor (optional)

PMM

Term		Signal
DO1-24V	M1-7	24VDC
DO1	M1-6	Fault
DO3-24V	M3-7	24VDC
DO3	M3-6	Pressure control

Fast contact digital outputs
Max 5 kHz
30 VDC
Imax 60 mA

Term		Signal
DO2-24V	M1-9	24VDC
DO2	M1-8	(2)
DO4-24V	M3-9	24VDC
DO4	M3-8	STO corrupted

Relay contact digital outputs
30 VDC
Imax 1 A

Q_MONITOR   M1-15   Flow monitor   100
P_MONITOR   M3-15   Pressure monitor   100

Analog outputs
±10 VDC
Imax 2 mA

AGND   M3-10
AG

AGND   M1-12
AG

	Term
	M4-1 1
not used	M4-1 2
	M4-2 3

Term		Signal
M4-2 1		CAN_H
M4-2 2		CAN_L
M4-2 3		CAN_GND

CANopen A

Term		Signal
M4-3 1		CAN_H
M4-3 2		CAN_L
M4-3 3		CAN_GND

CANopen B

(1) The behavior of **DI8** vary depending on the SSP execution:
   1: Not used - (SSP with single pump)
   2: Single pump activation - (SSP with double pump)

(2) The behavior of **DO2** vary depending on the SSP execution:
   1: STO test suggested - (SSP with single pump, without /D option)
   2: Smart cooling active - (SSP with single pump, with /D option)
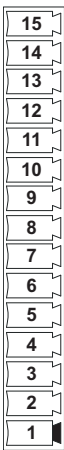   3: Single pump mode active - (SSP with double pump)

D-MP-*- **022 032 046 060**

D-MP-*- **090 100 140 165 210**

(*) type of BUS2 connectors change according to the fieldbus interface

PROFIBUS DP (BP)   Ethernet (EH, EP)

BUS2   BUS2

Connectors	Description	IEC specifications		UL specifications	
		Tightening torque [Nm]	Wire size [mm²]	Tightening torque [Lbin]	Wire size [AWG]
M1	IN/OUT analog and digital signals	0,4	0,2 - 1,5	4	30 - 14
M3	IN/OUT analog and digital signals - p/Q control	0,4	0,2 - 1,5	4	30 - 14
M2	Not used - available only for gnd and shield connections	0,4	0,2 - 1,5	4	30 - 14
M4-1	Not used - servomotor thermal sensor	0,4	0,2 - 1,5	4	30 - 14
M4-2	CANopen interface A - always present - to be used only for the BC version	0,6	0,2 - 2,5	5	30 - 12
M4-3	CANopen interface B - always present - to be used only for the BC version	0,6	0,2 - 2,5	5	30 - 12
X3	24VDC input power supply - only for 022, 032, 046, 060	0,6	0,2 - 2,5	5	30 - 12
X1-IN	24VDC input power supply - only for 090, 100, 140, 165, 210	0,6	0,2 - 2,5	5	30 - 12
X1-OUT	24VDC output power supply - only for 090, 100, 140, 165, 210	0,6	0,2 - 2,5	5	30 - 12
S1	Safe Torque Off - STO function	0,6	0,2 - 2,5	5	30 - 12
J1	Serial RS485 communication port	-	-	-	-
J2	Servomotor resolver	-	-	-	-
BUS2	Fieldbus optional boards - only for BP	-	-	-	-
	Fieldbus optional boards - only for EH, EP	-	-	-	-
KEY	Not used - connector for parameterization key	-	-	-	-
RK	Not used - connector for hand-held or remote keypad	-	-	-	-

8.1 M1 connector - IN/OUT digital and analog signals

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
M1	1	**DI1**	Enable (24 V_{DC}) or disable (0 V_{DC}), referred to DGND	Input - on/off signal
	2	**DI2**	Multiple axis selection IN0, referred to DGND	Input - on/off signal
	3	**DI3**	Multiple axis selection IN1, referred to DGND	Input - on/off signal
	4	**DI4**	Alarm reset	Input - on/off signal
	5	**DGND**	Common gnd for digital input	Common gnd
	6	**DO1** (1)	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to DO1-24V	Output - on/off signal **Software selectable**
	7	**DO1-24V**	DO1 power supply 24 V_{DC}	Input - power supply
	8	**DO2** (2)	For SSP with single pump execution, without /D option: STO test suggested (24 V_{DC}) or not suggested (0 V_{DC}), referred to DO2-24V For SSP with single pump execution, with /D option: Smart cooling active (24 V_{DC}) or not active (0 V_{DC}), referred to DO2-24V For SSP with double pump execution: Single pump ON active (24 V_{DC}) or not active (0 V_{DC}), referred to DO2-24V	Output - on/off signal **Software selectable**
	9	**DO2-24V**	DO2 power supply 24 V_{DC}	Input - power supply
	10	**Q_INPUT-**	Negative flow reference input signal for Q_INPUT+	Input - analog signal
	11	**Q_INPUT+**	Flow reference input signal: ±10 V_{DC} / 4 ÷ 20 mA maximum range Default is 0 ÷ 10 V_{DC}	Input - analog signal **Dip-switch selectable**
	12	**AGND**	Common gnd for Q_MONITOR and stabilized power supply	Common gnd
	13	**+10V**	Stabilized power supply +10V - Current: max 10 mA	Output power supply
	14	**-10V**	Stabilized power supply -10V - Current: max 10 mA	Output power supply
	15	**Q_MONITOR**	Flow monitor output signal: ±10 V_{DC} maximum range, referred to AGND Default is 0 ÷ 10 V_{DC} (10V = 3276,7 rpm)	Output - analog signal **Software selectable**

(1) Digital output with fast contact   **(2)** Digital output with relay contact

8.2 M3 connector - IN/OUT digital and analog signals - **p/Q** control connections

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
M3	1	**DI5**	Enable (24 V_{DC}) or disable (0 V_{DC}) p/Q control, referred to DGND	Input - on/off signal
	2	**DI6**	Pressure smart tuning selection IN0, referred to DGND	Input - on/off signal
	3	**DI7**	Pressure smart tuning selection IN1, referred to DGND	Input - on/off signal
	4	**DI8**	For SSP with single pump execution: (not used) For SSP with double pump execution: Enable (24 V_{DC}) or disable (0 V_{DC}) single pump, referred to DGND	Input - on/off signal
	5	**DGND**	Common gnd for digital input	Common gnd
	6	**DO3** (1)	Smart maintenance alert (24 V_{DC}) or not alert (0 V_{DC}), referred to DO3-24V	Output - on/off signal **Software selectable**
	7	**DO3-24V**	DO3 power supply 24 V_{DC}	Input - power supply
	8	**DO4** (2)	STO corrupted (24 V_{DC}) or not corrupted (0 V_{DC}), referred to DO4-24V	Output - on/off signal **Software selectable**
	9	**DO4-24V**	DO4 power supply 24 V_{DC}	Input - power supply
	10	**AGND**	Common gnd for P_MONITOR	Common gnd
	11	**P_INPUT-**	Negative pressure reference input signal for P_INPUT+	Input - analog signal
	12	**P_INPUT+**	Pressure reference input signal: ±10 V_{DC} / 4 ÷ 20 mA maximum range Default is 0 ÷ 10 V_{DC}	Input - analog signal **Dip-switch selectable**
	13	**AGND**	Common gnd for transducer signal	Common gnd
	14	**TR1**	Signal pressure transducer: ±10 V_{DC} / 4 ÷ 20 mA maximum range Default is 4 ÷ 20 mA	Input - analog signal **Dip-switch selectable**
	15	**P_MONITOR**	Pressure monitor output signal: ±10 V_{DC} maximum range, referred to AGND Default is 0 ÷ 10 V_{DC} (10V = 819,2 bar)	Output - analog signal **Software selectable**

**(1)** Digital output with fast contact   **(2)** Digital output with relay contact

**Remote pressure transducer connections** - examples
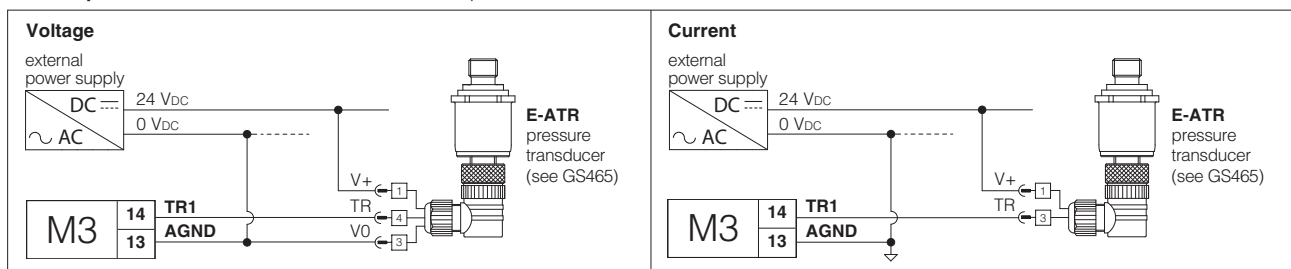
8.3 M2 connector - not used - available only for common GND and SHIELD connection

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
M2	1	NC	-	Do not connect
	2	NC	-	Do not connect
	3	NC	-	Do not connect
	4	NC	-	Do not connect
	5	GND	Common gnd	
	6	SHIELD	Shield	

8.4 X3 connector - 24VDC input power supply - only for drives type **022 ÷ 060**

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
X3	1	V+_IN	Power supply 24 V_{DC}	Intput - power supply
	2	V0_IN	Power supply 0 V_{DC}	Gnd - power supply
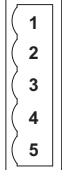
8.5 X1-IN connector - 24VDC Input power supply - only for drives type **090 ÷ 210**

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
X1-IN	1	V+_IN	Power supply 24 V_{DC}	Input - power supply
	2	V0_IN	Power supply 0 V_{DC}	Gnd - power supply
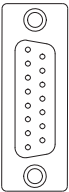
8.6 X1-OUT connector - 24VDC output power supply - only for drives type **090 ÷ 210**

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
X1-OUT	1	V+_OUT	Power supply 24 V_{DC}	Output - power supply
	2	V0_OUT	Power supply 0 V_{DC}	Gnd - power supply

8.7 S1 connector - Safe Torque Off (STO)

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
S1	1	+24V_STO1	Power supply for STO1 - first safety system channel Voltage: +24 V_{DC} ±10 % - Current: max 10 mA	Input - power supply
	2	0V_STO1		Gnd - power supply
	3	NC	-	Do not connect
	4	+24V_STO2	Power supply for STO2 - second safety system channel Voltage: +24 V_{DC} ±10 % - Current: max 10 mA	Input - power supply
	5	0V_STO2		Gnd - power supply

8.8 J2 connector - Servomotor resolver - DB15 - 15 pin
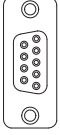
CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
J2 female (drive view)	1	**Thermal sensor +**	Servomotor thermal sensor - positive input (KTY or PT)	Input - analog signal
	2	**Thermal sensor +**	Servomotor thermal sensor - negative input (KTY or PT)	Input - analog signal
	3	**RESEX+**	-	
	4	**RESEX-**	-	
	5	**COS+ , 1C/R**	-	
	6	**NC**	-	Do not connect
	7	**NC**	-	Do not connect
	8	**NC**	-	Do not connect
	9	**COS- , 1C/R**	-	
	10	**SIN+ , 1C/R**	-	
	11	**SIN- , 1C/R**	-	
	12	**NC**	-	Do not connect
	13	**NC**	-	Do not connect
	14	**NC**	-	Do not connect
	15	**NC**	-	Do not connect

Servomotor resolver cable connection - example - see tech table **AS810**

D-MP DRIVE			PMM SERVOMOTOR	
J2		S-C-RSV-DB15/M23/* 20	**M23**	
Thermal sensor +	1		8	Thermal sensor +
Thermal sensor -	2		9	Thermal sensor -
RESEX+	3		7	RESEX+
RESEX-	4		10	RESEX-
COS+ , 1C/R	5		5	COS+ , 1C/R
COS- , 1C/R	9		6	COS- , 1C/R
SIN+ , 1C/R	10		14	SIN+ , 1C/R
SIN- , 1C/R	11		4	SIN- , 1C/R
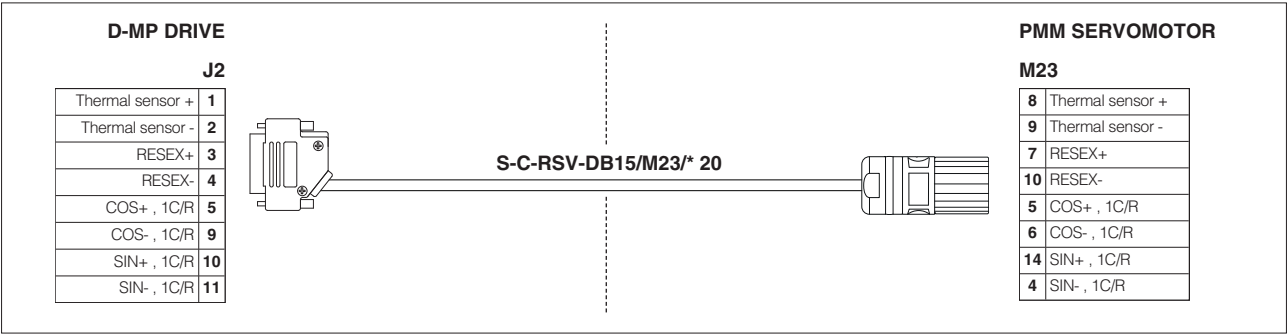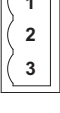
Note: for more information about PMM servomotor, please refer tech table **AS400**.

8.9 J1 connector - Serial RS485 communication port - DB9 - 9 pin
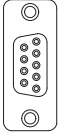
CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
J1 female (drive view)	1	**NC**	-	Do not connect
	2	**TX+**	Transmitter	
	3	**RX+**	Receiver	
	4	**NC**	-	Do not connect
	5	**NC**	-	Do not connect
	6	**TX-**	Transmitter	
	7	**RX-**	Receiver	
	8	**NC**	-	Do not connect
	9	**NC**	-	Do not connect

8.10 M4-2 and M4-3 connectors - CANopen (BC) - always present (not use for NP, BP, EH, EP)
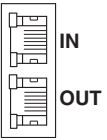
CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
M4-2 1 2 3 main	1	**CAN_HA**	Bus line (high)	
	2	**CAN_LA**	Bus line (low)	
	3	**CAN_GND**	Signal zero data line	
M4-3 1 2 3	1	**CAN_HB**	Bus line (high)	
	2	**CAN_LB**	Bus line (low)	
	3	**CAN_GND**	Signal zero data line	

Note: connect the CANopen network to the M4-2 (M4-3 is for proprietary messaging only). For more information, refer S-MAN-HW manual.

8.11 BUS2 connector - PROFIBUS DP (BP)

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
BUS2	1	**SHIELD**	Shield	
	2	**NC**	-	Do not connect
	3	**LINE_B**	Bus line (B)	
	4	**DE**	Control's signal for repeater	
	5	**DGND**	Data line and termination signal zero	
	6	**+5V**	Termination supply signal	
	7	**NC**	-	Do not connect
	8	**LINE_A**	Bus line (A)	
	9	**NC**	-	Do not connect

8.12 BUS2 connectors IN/OUT - Ethernet (EH, EP)

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
BUS2 IN OUT	1	**TX+**	Transmitter (white/orange)	
	2	**RX+**	Receiver (orange)	
	3	**TX-**	Transmitter (white/green)	
	4	**NC**	-	Do not connect
	5	**NC**	-	Do not connect
	6	**RX-**	Receiver (green)	
	7	**NC**	-	Do not connect
	8	**NC**	-	Do not connect

Note: perform the cables connection following the IN and OUT indications.

9 DRIVE AND SERVOMOTOR POWER CONNECTIONS

D-MP-*- **022**
D-MP-*- **032**

D-MP-*- **046**
D-MP-*- **060**

D-MP-*- **090**
D-MP-*- **100**
D-MP-*- **140**

D-MP-*- **165**
D-MP-*- **210**

L1	
L2	Drive power supply - input
L3	
U	Servomotor power supply - output
V	(pass the cables through the toroid inside present, without
W	the shield and ground)
+	DC Bus connection (not used)
-	
+	Brake resistor connection
F	
PE	Connection PE and shield
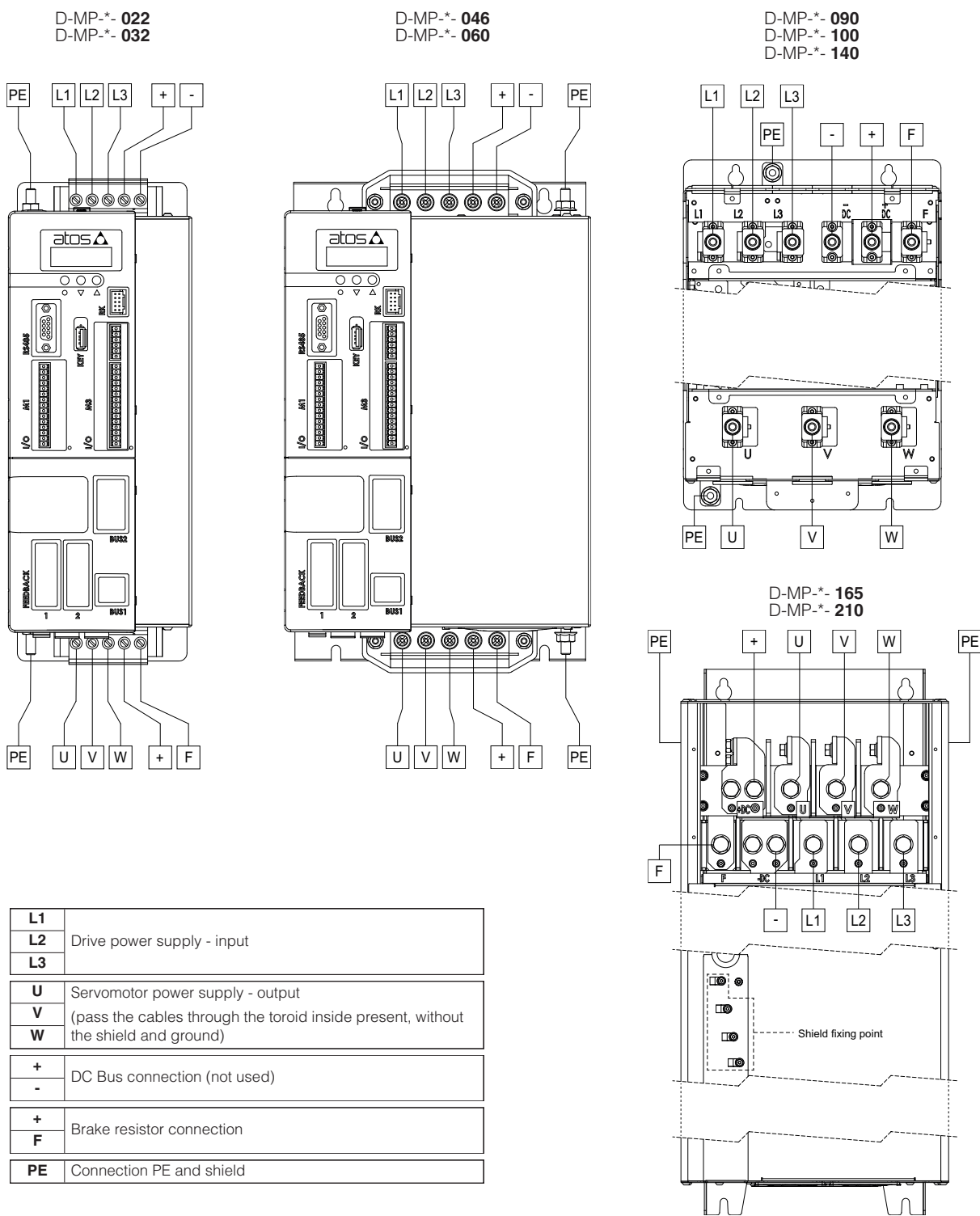
10 DISPLAY

On the drive front panel is available a numeric display to view the drive status and/or alarms condition. For more information, please refer S-MAN-SW manual.

Note: the 3 keys, ● (S selection), ▼ (- decrease), ▲ (+ increase) are not used
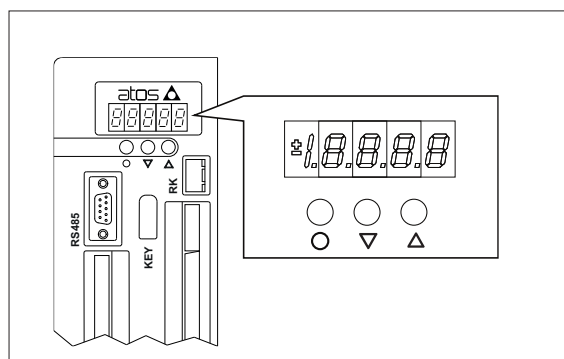
11 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drives are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **AS050** and in the user manuals included in the S-SW-SETUP programming software.
Generic electrical output signals of the drive (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

11.1 Drive power supply (L1, L2, L3)
The drive must be connected to the main power supply through terminals L1, L2, L3 and with the ground cable connected to the PE stud (see section 9).
When connecting drives type 022 ÷ 060A to 3-phase supply mains we recommend using a 3-phase reactance (see tech table **AS810**).
For drives type 090 ÷ 210 the 3-phase input reactance is mandatory. The 3-phase reactance is used to reduce the current peaks on the diode bridge DB and the effective value of the current through the capacitors. It is also used to reduce interference from the supply line to the drive and from the drive to the line.
The drive must be wired steadily through appropriately sized cables (see section 13).

Notes: drives type 022 ÷ 060 feature a soft-start function built in the drive;
the reactance can be omitted only for particular cases (in this case contact Atos technical office)

⚠ A correct installation to the main power supply is required according to IEC 61800-5-1

⚠ Ultra-fast fuses must be installed between the main power supply and the drive (see section 14)

11.2 Servomotor power supply (U, V, W)
The servomotor must be connected to terminals U, V, W and with the ground cable connected to the PE stud (see section 9).
For drives type 090 ÷ 140 pass the servomotor 3-phase through the present toroid inside, without shield and ground. Connect the servomotor by means of shielded or armored cables only and ground the shield on the converter side as well as on servomotor side. If shielded cables cannot be used, the servomotor cables should be placed in a metallic raceway connected to ground.
Atos recommends to use a 3-phase reactance between the drive and the servomotor; with cables longer than 50 meters, the reactance is mandatory (for more information please consult Atos technical office).
Any short circuit between U, V, W will cause the drive to shut down. If the interruption between the servomotor and the drive is obtained by means of electromagnetic switches (such as contactors, thermal relays and the like) ensure that the drive is disabled before cutting off the connection between the servomotor and the drive (in order not to damage the contactors).
The servomotor must be wired steadily through appropriately sized cables (see section 13).

11.3 24VDC input power supply (V+_IN and V0_IN)
Through the pins 1 and 2 of the X3 connector (for drives type 022 ÷ 060 see 8.4) or X1-IN connector (for drives type 090 ÷ 210 see 8.5) is possible to power the drive logic and servomotor sensor (mandatory for drives type 022 ÷ 060 no self powered).
The drives type 090 ÷ 210 generates internally a 24 V_{DC} auxiliary supply through the main power supply; the drive logic can be supply through X1-IN connector with an external 24 V_{DC} without produce conflict between the internally generated voltage and the auxiliary power supplied externally (is used the source with higher voltage level). This feature allows to configure the drive without main power supply and keep the drive logic switched on even in the absence of the drive main power supply.

11.4 24VDC output power supply (V+_OUT and V0_OUT)
Only for drives type 090 ÷ 210 the 24V_{DC} output power supply is available on pins 1 and 2 of the X1-OUT connector (see 8.6).
This voltage can be used only to provide an auxiliary supply for digital I/O to the drive and provides an auxiliary supply for STO channels function (the auxiliary supply must be interrupted by suitable safety contacts). The output current is internally limited to a 500mA; protection against external over-current and short-circuit.

11.5 Flow reference input signals (Q_INPUT+)
The drive is designed to receive an analog reference input signal (pin 11 on M1) for the servomotor rotation speed.
Flow reference input signal is factory preset, default is 0 ÷ 10 V_{DC}.
Drive with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).

⚠ Input signal can be reconfigured between voltage and current within a maximum range of ±10 V_{DC} or 4 ÷ 20 mA, using specific dip-switch present on the drive. Set the dip-switch with the drive powered off and before making the electrical connections as it would not be possible to remove the cover with connectors wired (see S-MAN-HW installation manual).

11.6 Pressure reference input signal (P_INPUT+)
The drive is designed to receive an analog reference input signal (pin 12 on M3) for the system pressure.
Pressure reference input signal is factory preset, default is 0 ÷ 10 V_{DC}.
Drive with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).

⚠ Input signal can be reconfigured between voltage and current within a maximum range of ±10 V_{DC} or 4 ÷ 20 mA, using specific dip-switch present on the drive. Set the dip-switch with the drive powered off and before making the electrical connections as it would not be possible to remove the cover with connectors wired (see S-MAN-HW installation manual).

11.7 Flow monitor output signal (Q_MONITOR)
The drive generates an analog output signal (pin 15 on M1) for servomotor actual rotation speed.
The monitor output signal can be software set to show other signals available in the drive.
Default is 0 ÷ 10 V_{DC} (10V = 3276,7 rpm). For more information please refer S-MAN-SW programming software manual.

11.8 Pressure monitor output signal (P_MONITOR)
The drive generates an analog output signal (pin 15 on M3) to the system actual pressure.
The monitor output signal can be software set to show other signals available in the drive.
Default is 0 ÷ 10 V_{DC} (10V = 819,2 bar). For more information please refer S-MAN-SW programming software manual.

11.9 Enable input signal (DI1)
To enable the servomotor control, supply a 24 V_{DC} on pin 1 of the M1: Enable input signal allows to enable/disable servomotor control, without removing the electrical power supply to the drive; it is used to keep active the communication and the other driver functions when the drive must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Input is optoisolated from the internal regulation (24 V_{DC} ±10% @ Imax 10 mA).

11.10 Multiple axis selection input signal (DI2 and DI3)
Two on-off input signals are available on pin 2 and pin 3 of the M1 connector to select one of the four axis parameters setting, stored into the drive.
Switching the active setting of axis during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).
Supply a 24 V_{DC} or a 0 V_{DC} on pin 2 and/or pin 3 of the M1, to select one of the PID settings as indicated by binary code table at side.

Input is optoisolated from the internal regulation (24 V_{DC} ±10% @ Imax 10 mA).

AXIS SELECTION				
PIN	SET 1	SET 2	SET 3	SET 4
M1-2	0	24 V_{DC}	0	24 V_{DC}
M1-3	0	0	24 V_{DC}	24 V_{DC}

11.11 Alarm reset input signal (DI4)
Alarm reset input signal allows to clear all alarms present into the drive: to reset the drive alarms, supply 24 V_{DC} on pin 4 of the M1.

Input is optoisolated from the internal regulation (24 V_{DC} ±10% @ Imax 10 mA).

11.12 Fault output signal (DO1)

This output signal (pin 6 on M1) indicates fault conditions of the drive (reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the status of the Enable input signal.
This output signal can be used as digital output by software selection.

Notes: when STO function is enabled the fault output signal is set to 0 VDC (see section ⌷12⌷);
digital output with fast contact (max 5 kHz)

11.13 STO test suggested output signal (DO2) - for SSP with single pump execution, without /D option

This output signal (pin 8 on M1) indicates that the STO test is suggested (see section ⌷12⌷).
STO test suggested corresponds to 24 VDC, while not suggested corresponds to 0 VDC.
STO test suggested logical output signal is not intended as a fault condition.
This output signal can be used as digital output by software selection.

Note: digital output with relay contact

11.14 Smart cooling active output signal (DO2) - for SSP with single pump execution, with /D option

This output signal (pin 8 on M1) indicates the working conditions to which the internal gear pump (PGI*) is subject to rapid overheating.
For /D option (see **AS100**) this digital output condition can be used to manage (using an external relay) the JO-DL cartridge installed on the manifold block.
Smart cooling active corresponds to 24 VDC, while not active corresponds to 0 VDC.
Smart cooling active logical output signal is not intended as a fault condition.
This output signal can be used as digital output by software selection.

Note: digital output with relay contact

11.15 Single pump mode ON active output signal (DO2) - for SSP with double pump execution

For the double pump execution, a venting valve must be energized to vent the first pump.
This output signal (pin 8 on M1) can be used to energize the venting valve (see **AS100**).
Single pump active corresponds to 24 VDC (exclusion of the first pump), while not active corresponds to 0 VDC.
This output signal can be used as a digital output via software selection.

Note: digital output with relay contact

11.16 Enable p/Q control input signal (DI5)

By default, the p/Q control is always active.
Through S-SW-SETUP software, it's possible to modify the configuration of the drive so that the p/Q control can be enabled/disabled via this digital input:
- when digital input is set to 0VDC, p/Q control is disabled and the drive performs just flow control
- when digital input is set to 24VDC, p/Q control is enabled and the drive performs flow and pressure control

Input is optoisolated from the internal regulation (24 VDC ±10% @ Imax 10 mA).

11.17 Pressure smart tuning selection input signals (DI6 and DI7)

Pressure smart tuning selection can be switched from Dynamic (default) to Balanced or Smooth via software, fieldbus or using DI6 and DI7 digital inputs (pin 2 and 3 on M3), as shown at side; if requested, performances can be further customized directly tuning each single PID control parameter.

PIN	SMART TUNING SELECTION		
	DYNAMIC	BALANCED	SMOOTH
M3-2	0	24 VDC	0
M3-3	0	0	24 VDC

Inputs are optoisolated from the internal regulation (24 VDC ±10% @ Imax 10 mA).

11.18 Single pump mode activation input signals (DI8) - for SSP with double pump execution

By default, the system operates with automatic single pump mode activation enabled. In this mode, the drive automatically excludes the first pump and uses the second pump when necessary.
Through S-SW-SETUP software, the drive can be configured to control the single pump activation via a digital input signal. This allows manual activation or deactivation of the single pump mode according to the digital input status:
- when digital input is set to 0 VDC, the single pump is not activated and the system works with both pumps
- when digital input is set to 24 VDC, single pump is activated and the drive excludes the first pump and works in single pump mode, operating only the second pump
To enable the single pump mode activation, supply a 24 VDC on pin 4 of the M3: this signal allows to enable/disable the single pump activation.

Input is optoisolated from the internal regulation (24 VDC ±10% @ Imax 10 mA).

11.19 Smart maintenance alert output signal (DO3)

This output signal (pin 6 on M3) indicates that smart maintenance must be performed.
Smart maintenance alert corresponds to 24 VDC, while not alert corresponds to 0 VDC.
This output signal can be used as digital output by software selection.

Note: digital output with fast contact (max 5 kHz)

11.20 STO corrupted output signal (DO4)

This output signal (pin 8 on M3) indicates the presence of fault conditions or the need for specific actions for the STO function.
The STO corrupted corresponds to 24 VDC, while not corrupted corresponds to 0 VDC.
This output signal can be used as digital output by software selection.

Note: digital output with relay contact

11.21 Remote pressure transducer input signals (TR1)

Analog remote pressure transducers can be directly connected to the drive.
Analog input signal (pin 14 on M3) is factory preset, default is 4 ÷ 20 mA.
Refer to pressure transducer characteristics to select the transducer type according to specific application requirements.

⚠ Input signal can be reconfigured between voltage and current within a maximum range of ±10 VDC or 4 ÷ 20 mA, using specific dip-switch present on the drive. Set the dip-switch with the drive powered off and before making the electrical connections as it would not be possible to remove the cover with connectors wired (see S-MAN-HW installation manual).

⌷12⌷ **STO FUNCTION - /K** always present

The drive implements the Safe Torque Off (STO) function as a prevention of unexpected starts according to 2006/42/EC Machinery Directive (MD) - standard EN 61800-5-2.
This function is enabled setting 0 VDC on both +24V_STO1 and +24V_STO2 channels. It prevents the generation of a rotating magnetic field removing the power semiconductor control voltage allowing short-term operations (such as cleaning and / or maintenance work on parts of non-electrical devices of the machine) without disconnecting drive power supply or the connection between the drive and the servomotor.
For detailed descriptions, please refer to the S-MAN-HW installation manual.

⚠ The STO function must be tested periodically as indicated in the S-MAN-HW manual to avoid the servomotor control is automatically disabled.

⚠ If the STO function is not used, both channels +24V_STO1 and +24V_STO2 must be permanently connected to the 24V voltage.

⚠ Even if the STO function is not used, it is still necessary to periodically test the STO function.

13 POWER AND PROTECTION CABLES SIZE

13.1 IEC specifications

Drive type	Servomotor type (1)	Drive power cables [mm²]	Servomotor power cables [mm²]	Drive, servomotor power cables and braking cables tightening torque [Nm]	Protection cables [mm²]	Protection cables tightening torque [Nm]	Power cables max length [m]
		L1 , L2 , L3	U , V , W	L1 , L2 , L3 U , V , W + , F	PE	PE	L1 , L2 , L3 U , V , W
D-MP-*-022	PMM-*-1009	6	6	1,7	6	8,5	50 (2)
D-MP-*-032	PMM-*-1015	10	10	1,7	10		
D-MP-*-046	PMM-*-1024	16	16	3,8	16		
D-MP-*-060	PMM-*-1032	25	25	3,8	16		
D-MP-*-090	PMM-*-2042	50	50	15 - 20	35	15 - 20	
D-MP-*-100	PMM-*-2055	70	70	15- 20	35		
D-MP-*-140		70	70	15 - 20	50		
D-MP-*-165	PMM-*-2080	95	95	25 - 30	70	25 - 30	
D-MP-*-210	PMM-*-2100	95	95	25 - 30	70		

(1) For more information about PMM servomotor, please refer tech table **AS400**
(2) With cables longer than 50 meters, 3-phase reactance between the drive and the servomotor is mandatory
For more information please consult Atos technical office

13.2 UL specifications

Drive type	Servomotor type (1)	Drive power cables [AWG / kcmil]	Servomotor power cables [AWG / kcmil]	Drive, servomotor power cables and braking cables tightening torque [Lbin-in]	Protection cables [AWG] PE [UL] (2)	Protection cables [AWG] PE [CSA] (3)	Protection cables tightening torque [Lbin-in] PE	Power cables max length [ft] L1 , L2 , L3 U , V , W
		L1 , L2 , L3	U , V , W	L1 , L2 , L3 U , V , W + , F				
D-MP-*-022	PMM-*-1009	AWG 8	AWG 8	15	10	10	75	164 (4)
D-MP-*-032	PMM-*-1015	AWG 6	AWG 6	15	8	10		
D-MP-*-046	PMM-*-1024	AWG 3	AWG 4	40	8	8		
D-MP-*-060	PMM-*-1032	AWG 2	AWG 3	40	8	8		
D-MP-*-090	PMM-*-2042	AWG 1	AWG 1	132.3-177	6	6	133-177	
D-MP-*-100	PMM-*-2055	AWG 1/0	AWG 1/0	132.3-177	4	4		
D-MP-*-140		AWG 4/0	AWG 4/0	132.3-177	4	4		
D-MP-*-165	PMM-*-2080	250 Kcmil	250 Kcmil	221.3-265.5	3	3		
D-MP-*-210	PMM-*-2100	350 Kcmil	350 Kcmil	221.3-265.5	3	3		

(1) For more information about PMM servomotor, please refer tech table **AS400**
(2) Article 250.122 - Table 250.122 of the NEC (UL)
(3) CSA C22.2 No. 274, Table 9 (CSA)
(4) With cables longer than 164 ft, 3-phase reactance between the drive and the servomotor is mandatory
For more information please consult Atos technical office

14 FUSES

Drive type	Min. short circuit current [A]	Input current without input reactance [A]	Input current with input reactance [A]	Rated current [A]	I²t clearing @660V, 20°C [A²s]	Rated voltage [V]	Manufacturer (1)	Type	Size
D-MP-*-022	280	31,3	26,0	50	770	700	BUSSMANN	170M1414	000 (3)
D-MP-*-032	380	42,2	38	63	1450	700	BUSSMANN	170M1415	000 (3)
D-MP-*-046	500	58,5	54,5	80	2550	700	BUSSMANN	170M1416	000 (3)
D-MP-*-060	650	71,5	68,1	100	4650	700	BUSSMANN	170M1417	000 (3)
D-MP-*-090	1400		103	200	15169	690	Littelfuse	PSR030xx0200 (2)	030
D-MP-*-100	1400		118	200	15169	690	Littelfuse	PSR030xx0200 (2)	030
D-MP-*-140	2100	10000	166	315	61830	690	Littelfuse	PSR030xx0315 (2)	030
D-MP-*-165	2100		195	315	61830	690	Littelfuse	PSR030xx0315 (2)	030
D-MP-*-210	3800		249	450	160110	690	Littelfuse	PSR030xx0450 (2)	030

Notes: fuses with higher current rating than the recommended ones must not be used; fuses with lower current rating can be used.
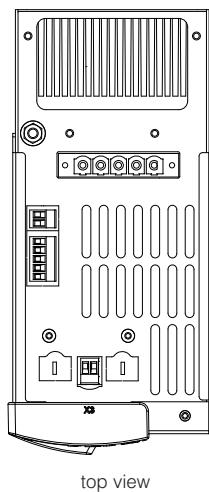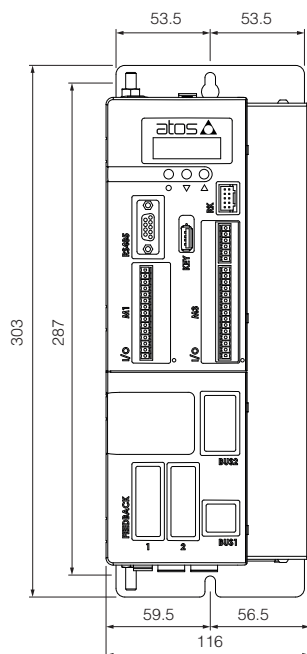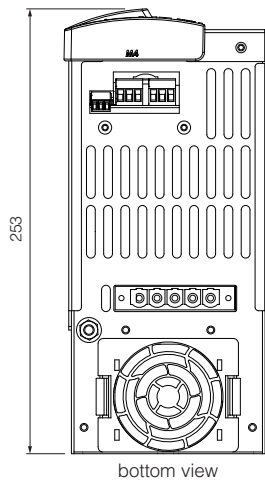
(1) Fuses from other manufacturers can be used if they meet the ratings and the melting curve of the fuse mentioned in the table
(2) "**xx**" defines the termination type that can be: US/UL/DS/DL/FS/FL
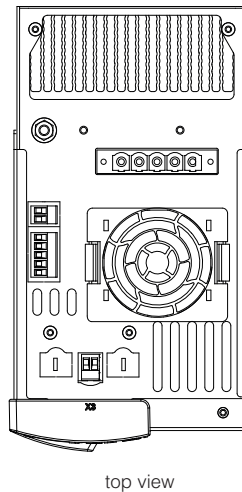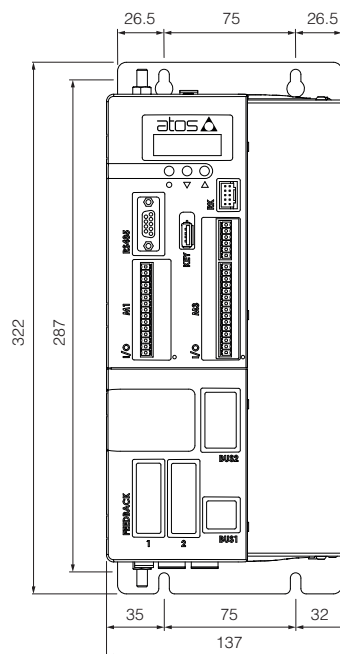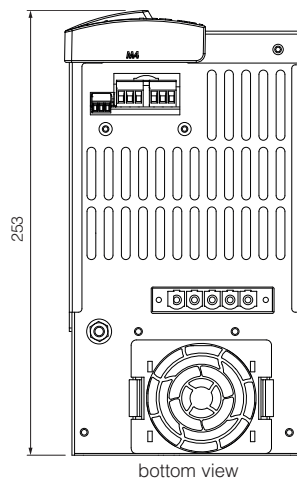(3) According to IEC 60269

D-MP-*-022
Fixing screws = M4
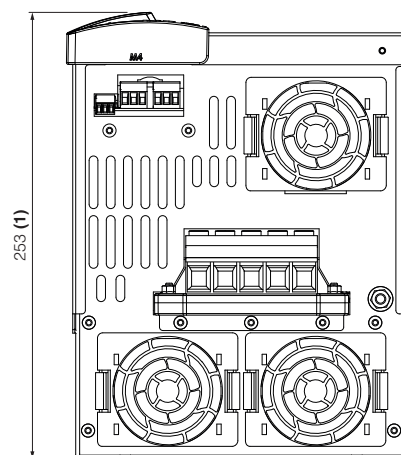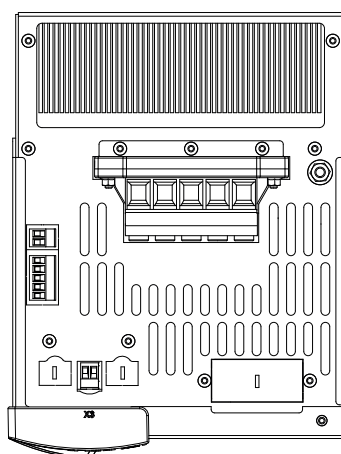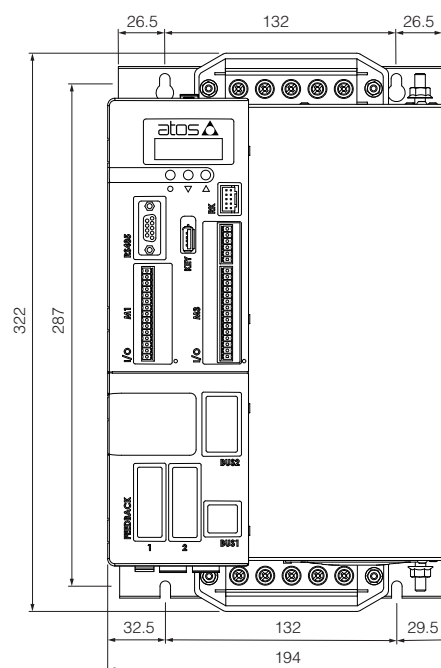
D-MP-*-032
Fixing screws = M4

Mass [kg]	
D-MP-*-022	5.2
D-MP-*-032	5.7

bottom view

bottom view

top view

top view

D-MP-*-046
D-MP-*-060

Fixing screws = M4

Mass [kg]	
D-MP-*-046	9.6
D-MP-*-060	

253 **(1)**

bottom view

26.5 132 26.5

atos △

322 287

32.5 132 29.5

194

top view

(1) This measure differs from previous D-MP series 10

AS500

D-MP-*-090
D-MP-*-100
D-MP-*-140

Fixing screws = M6

Mass [kg]	
D-MP-*-090	
D-MP-*-100	25
D-MP-*-140	

300 (1)

bottom view

49 (1) 150 49 (1)

556 (1) 531 (1)

49 (1) 150 49 (1)

248 (1)

RS485

KEY

RK

I/O I/O

FEEDBACK
1 2 BUS1
BUS2

SAFE FUNCTION

SPEED

CAN

STO FUNCTION

+24V

PTC

top view
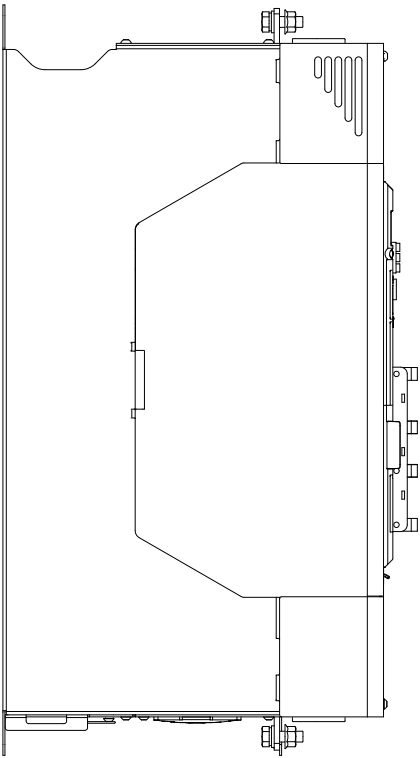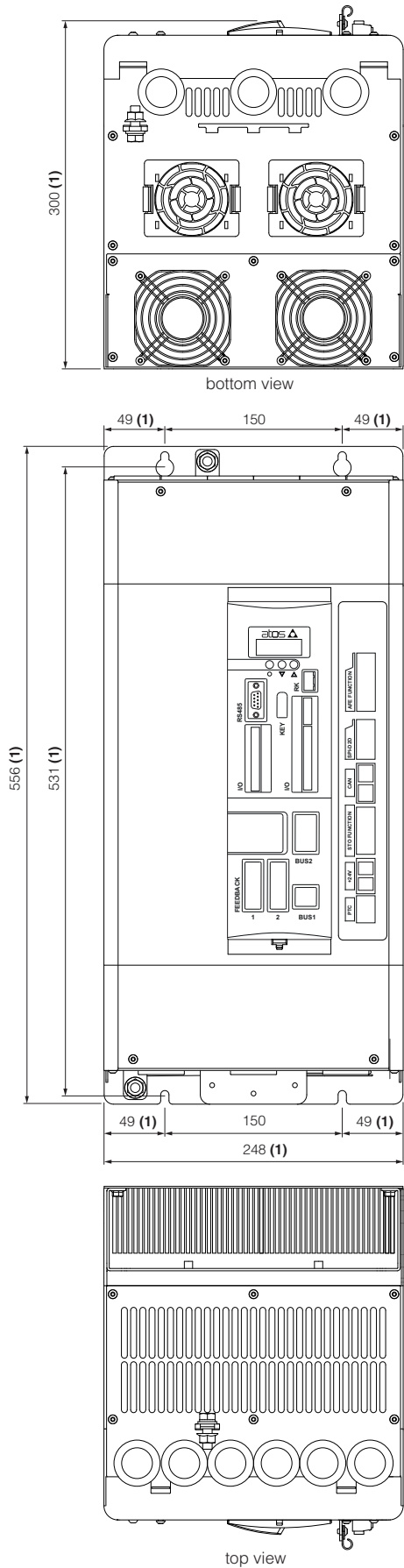
(1) This measure differs from previous D-MP series 10

D-MP-*-165
D-MP-*-210

Fixing screws = M8

Mass [kg]	
D-MP-*-165	50
D-MP-*-210	

bottom view

315 (1)

210 (1)   22.5 (1)

978 (1)

936 (1)

210 (1)   22.5 (1)

255 (1)

309 (1)

top view

(1) This measure differs from previous D-MP series 10

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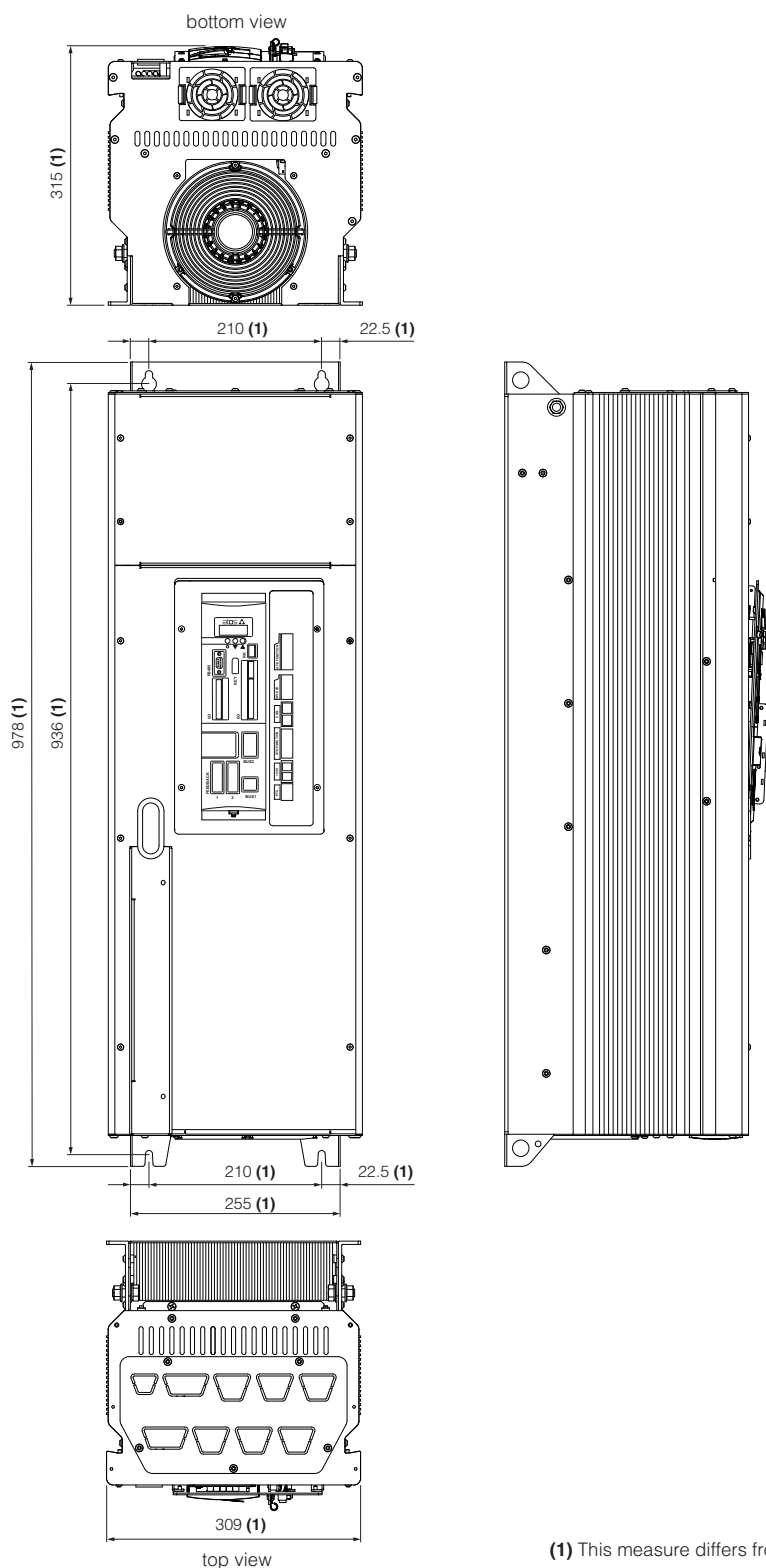
16 **RELATED DOCUMENTATION**

AS050	Basics for Smart Servopumps - SSP	**AS800**	Programming tools for pumps & servopumps
AS100	SSP Smart Servopumps	**AS810**	Accessories for servopumps
AS200	Sizing criteria for servopumps	**AS910**	Operating and maintenance information for servopumps
AS300	PGI cast iron internal gear pumps, high pressure	**GS510**	Fieldbus
AS320	PGIX2 cast iron double internal gear pumps	**QA100**	Quickstart for SSP servopumps commissioning
AS350	PGIL aluminium internal gear pumps	**S-MAN-HW**	Servopumps installation manual
AS400	PMM high performance synchronous servomotors	**S-MAN-SW**	Servopumps programming software manual