



Smart Drive

S-Series AC Drives

SWP / SWP-VT / SE1

S-Series
AC DRIVE

TB Wood's
BERGES
electronics



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SMART DRIVE PLUS

AC Variable Speed Drive 0.37–160 kW

Smart Drive Plus is the natural evolution of the Smart Drive family adding ultimate motor control to established Smart drive benchmarks of control and ease of use.

Smart Drive Plus technology, a revolutionary and patented motor control strategy. Technology delivers 100% torque at 0.0 Hz allowing this unique open loop product to be used without any feedback device in many traditional closed loop applications.

Only the motor name plate data is required to achieve optimum performance, the drive continuously and automatically determines and tracks the key motor characteristics required for vector control.

Smart Drive Plus can be commissioned using the unique Smart Drive CE Plus software designed for use on pocket pc's. Communication takes place without wires using infrared light to quickly and accurately transfer data.

Key Benefits

- True evolution of range, maintaining same footprint and connector arrangement as original
- Fast and accurate parameter configuration using unique Smart Drive Manager Plus CE and Smart Drive Manager Plus PC.
- Small mechanical envelope
- Rugged industrial operation 50 °C ambient rating
- Simple mechanical & electrical installation
- Simple operation, powerful features & easy to use
- Fast setup, 14 basic parameters
- Real time motor current, motor speed and kW indication
- Debugging using troubleshooting & P0
- 150% overload for 60 secs (175% for 2 secs)
- Keypad control
- Spin start
- **100% torque at 0.0 Hz (no encoder)**
- Built in PID controller for feedback control systems
- Speed regulation <1%
- Torque control
- Dual high speed serial communication interfaces
 - Optical (IrDA) interface for commissioning and low bandwidth control systems (115 kbps)
 - RS485/ Modbus RTU interface for high bandwidth control (9kb to 115 kbps)



Key Physical Features

- Pluggable control terminals
- Easy access key slots for simple installation
- Easy access contactor style power terminals for intuitive easy wiring
- Help card for basic parameter description and terminal layout
- Easy to use keypad with bright LED display
- IP20
- Integral RFI filter
- Integral braking transistor (not size 1)
- 3 phase line choke (size 4, 5 & 6)

Key Control I/O Features

- Programmable I/O for flexible control
- 12 bit bipolar analogue input, 8 ms sample time
- 2nd analogue input for PID feedback control systems
- Positive logic digital inputs (active high), 8 ms sampling
- 24 V/100 mA user supply output
- 0..10 V & 4..20 mA analog output, 8 ms update
- Galvanically isolated and short circuit proof

Key Programming Features

- Silent motor running with 32 kHz ultra-quiet switching
- 8 preset speeds
- Mains dip ride through
- Skip frequency
- Last 4 trips stored
- 2 kHz output frequency
- Parameter lock
- Hours run & kWh meters
- Speed scaling factor for master- slave arrangements
- 2nd deceleration ramp for rapid stop

A Revolution Evolution – 21st Century Motor Control

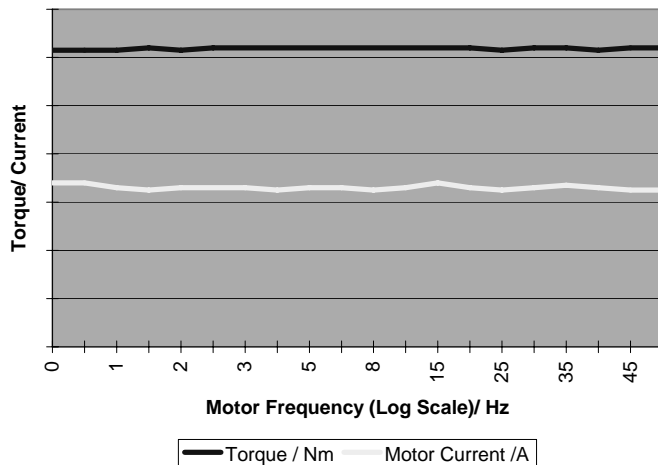
Smart Drive Plus revolutionary and patented vector control strategy provides smooth, controlled full torque through zero speed in open loop mode, without the need for motor tachogenerators or encoders.

The ultrafast torque control ensures it is the ideal drive for applications across the industrial spectrum. **Fast** enough for pulse loads like jogging machines and industrial washers. **Powerful** enough for high starting torque applications like crushers and fully loaded conveyors. **Smooth** enough for hoists and cranes.

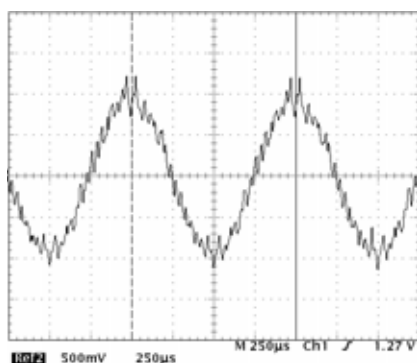
Only motor nameplate details are required to achieve optimum performance. Smart Drive Plus automatically performs an automatic tuning routine measuring vital motor inductances, resistances, currents and power factor with the motor at standstill. After the initial tuning, these values are constantly adapted in real time to ensure that performance is maintained irrespective of changes arising out of motor heating.

Non linearities are further corrected using highly sophisticated measurement and compensation techniques to give a very high quality sine wave output. This results in smooth operation from zero up to 2 kHz output frequency, without discontinuity and making this range of products ideal for high speed applications such as machine tool spindles.

Torque vs Motor Frequency (Log Scale)
Showing Full Torque Across The Speed Range



Ultra-smooth high frequency current waveform, ideal for
machine tool spindle applications



4 easy steps to ***Incredible Performance***

Step 1

Connect motor to drive (check star/ delta connection) & apply power to drive

Step 2

Input motor data from motor name plate:

P1-07 motor rated voltage

P1-08 motor rated current

P1-09 motor rated frequency

Step 3

Change mode to *P4-01 = 0*

Step 4

Autotune, *P4-02 = 1*

.....drive performs a static automatic tuning routine, after which motor performance is optimised for dynamic response, energy saving and maximum torque

ELECTRICAL DATA

SMART DRIVE PLUS SIZE 1 (Integral RFI Filter)

Model	SWP-xxxxxxxH11	K2D0003	K2D0007
Motor output rating - industrial 150% o/l	kW	0.37	0.75
Motor output rating - industrial 150% o/l	HP	0.5	1.0
Supply voltage/ phases	V +/- 10%	220-240 / 1Ø	
Supply fuse or MCB rating	A	6-10	10
Output voltage/ phases	V	0-240 / 3Ø	
Output current	A	2.3	4.3
Max motor cable length	m	25	

SMART DRIVE PLUS SIZE 2 (Integral RFI Filter, braking transistor)

Model	SWP-xxxxxxxH12	K2D0015	K2D0022	K400007	K400015	K400022	K400040
Motor output rating - industrial 150% o/l	kW	1.5	2.2	0.75	1.5	2.2	4
Motor output rating - industrial 150% o/l	HP	2.0	3.0	1.0	2.0	3.0	5.0
Supply voltage/ phases	V +/- 10%	220-240 / 1Ø			380-480 / 3Ø		
Supply fuse or MCB rating	A	20	30	6-10	10	10	20
Output voltage/ phases	V	0-240 / 3Ø			0-480 / 3Ø		
Output current	A	7	10.5	2.2	4.1	5.8	9.5
Max motor cable length	m	100	100	50	100	100	100
Min brake resistor	Ω	33	22	47	47	47	33

SMART DRIVE PLUS SIZE 3 (Integral RFI Filter, braking transistor)

Model	SWP-xxxxxxxH12	K200030	K200040	K200055	K200075	K400055	K400075	K400110	K400150
Motor output rating - industrial 150% o/l	kW	3.0	4.0	5.5	7.5	5.5	7.5	11.0	15.0
Motor output rating - industrial 150% o/l	HP	4	5	7.5	10.0	7.5	10.0	15.0	20.0
Supply voltage/ phases	V +/- 10%	220-240 / 3Ø or 1Ø (with 50% derating)					380-480 / 3Ø		
Supply fuse or MCB rating	A	32	32	50	50	32	32	50	50
Output voltage/ phases	V	0-240 / 3Ø					0-480 / 3Ø		
Output Amps - industrial 150% overload	A	14	18	25	30	14	18	25	30
Max motor cable length	m	100							
Min brake resistor	Ω	15				22			

SMART DRIVE PLUS SIZE 4 (Integral RFI Filter, braking transistor, 3 phase line choke)

Model	SWP-xxxxxxxH12	K200110	K200150	K200185	K400185	K400220	K400300	K400370
Motor output rating - industrial 150% o/l	kW	11	15	18.5	18.5	22	30	37
Motor output rating - industrial 150% o/l	HP	15	20	25	25	30	40	50
Supply voltage/ phases	V +/- 10%	220-240 / 3Ø or 1Ø (with 50% derating)				380-480 / 3Ø		
Supply fuse or MCB rating	A	80-100	100	100-125	80	80-100	100	100-125
Output voltage/ phases	V	0-240 / 3Ø				0-480 / 3Ø		
Output Amps - industrial 150% overload	A	46	61	72	39	46	61	72
Max motor cable length	m	100						
Min brake resistor	Ω	6				12		

SMART DRIVE PLUS SIZE 5 (Integral RFI Filter, braking transistor, 3 phase line choke)

Model	SWP-xxxxxxxH12	K200220	K200300	K200370	K200450	K400450	K400550	K400750	K400900
Motor output rating - industrial 150% o/l	kW	22	30	37	45	45	55	75	90
Motor output rating - industrial 150% o/l	HP	30	40	50	60	60	75	100	120
Supply voltage/ phases	V +/- 10%	220-240 / 3Ø or 1Ø (with 50% derating)					380-480 / 3Ø		
Supply fuse or MCB rating	A	160	200	250-300	250-300	160	200	250-300	250-300
Output voltage/ phases	V	0-240 / 3Ø					0-480 / 3Ø		
Output Amps - industrial 150% overload	A	89	110	150	180	90	110	150	180
Max motor cable length	m	100							
Min brake resistor	Ω	3					6		

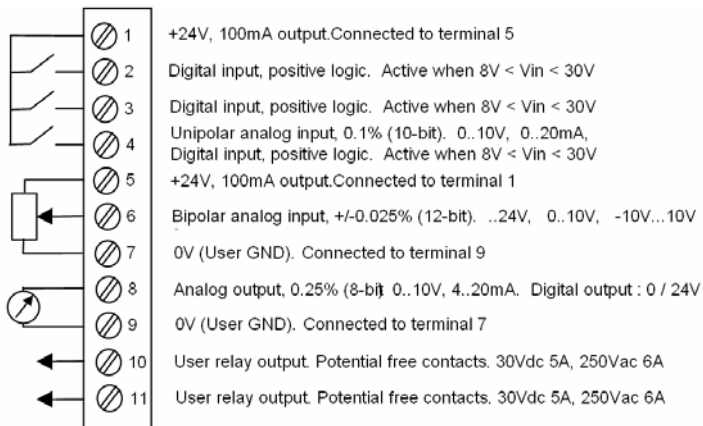
SMART DRIVE PLUS SIZE 6 (Integral RFI Filter, braking transistor, 3 phase line choke)

Model	SWP-xxxxxxxH12	K200550	K200750	K200900	K401100	K401320	K401600
Motor output rating - industrial 150% o/l	kW	55	75	90	110	132	160
Motor output rating - industrial 150% o/l	HP	75	100	120	150	175	250
Supply voltage/ phases	V +/- 10%	220-240 / 3Ø or 1Ø (with 50% derating)				380-480 / 3Ø	
Supply fuse or MCB rating	A	315-350	400	450-500	315-350	400	450-500
Output voltage/ phases	V	0-240 / 3Ø				0-480 / 3Ø	
Output Amps - industrial 150% overload	A	202	240	300	202	240	300
Max motor cable length	m	100					
Min brake resistor	Ω	3			6		

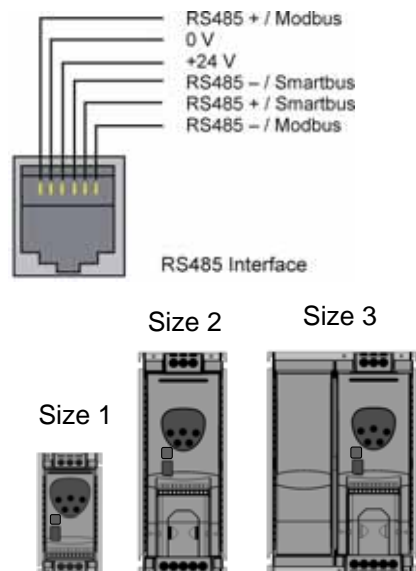
SPECIFICATION

- Supply frequency 48 to 62 Hz
- Max. permissible 3-phase supply imbalance 3%
- Max. ambient temperature 50 °C
- Max. altitude 2000 m
- Derate above 1000 m, 1% / 100 m
- For higher switching frequencies, derate output current 5% / °C above max. ambient up to 50 °C
- I x t protection above 100% output current
- 150% overload protection for 60 sec
- 175% overload allowable for 2 sec
- Storage temperature -40 to +60 °C
- Options:
 - SW-Manager CE Plus & SW-Manager PC Plus
 - Smartport Plus
 - RS485 data cables and accessories
 - Smartlink
 - Gateway options
 - 3ROUT (3 Relay Output)
 - Isolated USB to RS485 adaptor
 - Smartfilter
 - Smartbrake
 - Input Chokes
 - Output Filters

CONTROL TERMINAL ARRANGEMENT



COMMUNICATION INTERFACE



Smart Drive Plus DIMENSIONS

	Size 1	Size 2	Size 3	Size 4	Size 5 *	Size 5 **	Size 6
Length / mm	155	260	260	520	1045	1100	1100
Width / mm	80	100	171	340	340	340	340
Depth / mm	130	175	175	220	220	330	330
Weight/ kg	1.1	2.6	5.3	28	67	68	55 ***
Fixings	2 * M4		4 * M4		4 * M8		
Power Terminal torque settings	1 Nm			4 Nm	8 Nm		

* Size 5 – 90 A and 110 A ratings

** Size 5 – 150 A and 180 A ratings

*** Size 6 has external line choke weighing 27 kg

ENCLOSURE - NON VENTED DIMENSIONS (mm)

DRIVE POWER RATING	SEALED UNIT		
	W	H	D
Size 1 0.75 kW 200 V	250	300	200
Size 1 1.5 kW 200 V	300	400	250
Size 2 1.5 kW 200 V / 2.2 kW 400 V	300	400	300
Size 2 2.2 kW 200 V / 4 kW 400 V	450	600	300

ENCLOSURE - VENTED DIMENSIONS (mm)

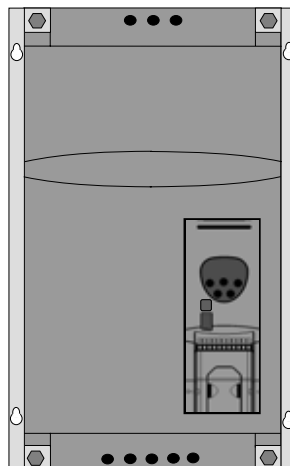
DRIVE POWER RATING	VENTED UNIT			FORCE VENTED (WITH FAN)			
	W	H	D	W	H	D	Air Flow
Size 1 (1.5 kW)	300	400	150	200	300	150	> 15 m ³ / h
Size 2 (4 kW)	400	600	250	300	400	250	> 45 m ³ / h
Size 3 (15 kW)	600	800	300	400	600	250	> 80 m ³ / h
Size 4 (22 kW)	600	1000	300	600	800	300	> 300 m ³ / h
Size 4 (37 kW)	N/A	N/A	N/A	600	800	300	> 300 m ³ / h
Size 5 (90 kW)	N/A	N/A	N/A	800	1600	300	> 900 m ³ / h
Size 6 (160 kW)	N/A	N/A	N/A	800	2000	300	> 1000 m ³ / h

Size 5*

Size 5 & 6

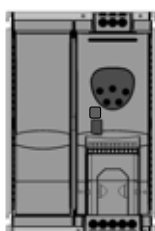


Size 4



Size 2


Size 3



Size 1

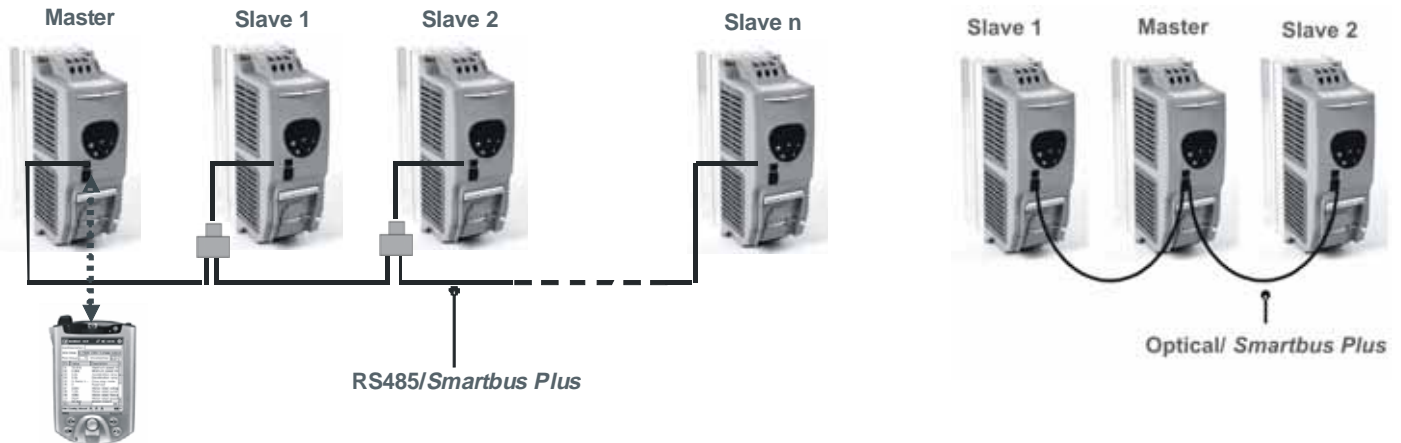


Communication Interfaces

	Interface	Protocol	Baud (bps)	Purpose	Connections
	RS485	Modbus RTU	9k6 – 115k	High bandwidth control systems	<ul style="list-style-type: none"> • Drive to plc • Drive to fieldbus gateway
		Smartbus Plus	115k	Low bandwidth control systems	<ul style="list-style-type: none"> • Drive to pc (PC Software) • Drive to drive (unlimited slaves)
	Optical	IrdA	Smartbus Plus	115k	Drive to drive (max. 2 slaves)
				Commissioning	Commissioning

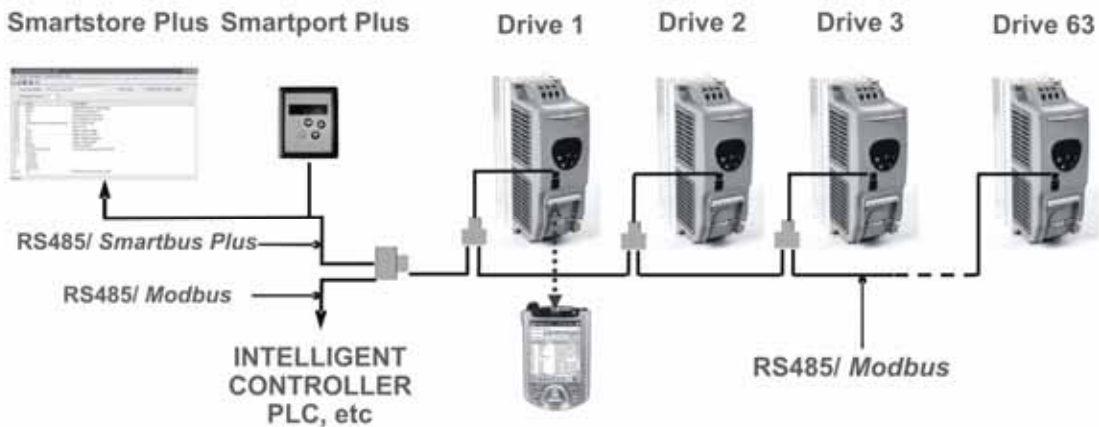
Master – Slave/ Drive to Drive Communication

Master – slave networks can be easily created by connecting the communication ports. SW-Manager CE Plus can be used for commissioning individual drives through the optical port even when the drives are connected in an RS485 network.



Drive Networks to Intelligent Controllers

High bandwidth control systems can be created for up to 63 drives connected to an intelligent network with RS485 / Modbus RTU. Smartport Plus and/ or SW-Manager Plus can run on the same network using an RS485/ Smartbus Plus connection for monitoring purposes, but not for control.

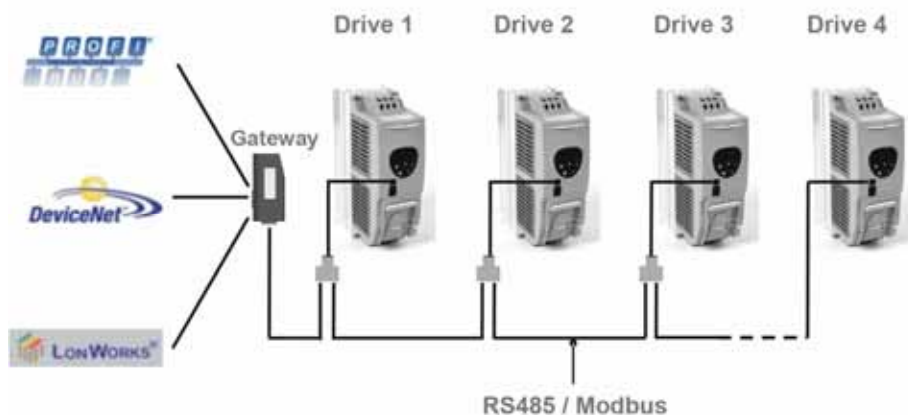


Fieldbus Communication

Smart Drive Plus connects to high speed communication networks via a gateway.

1 DeviceNet gateway can connect with up to 4 Smart Drives.

1 Profibus gateway can connect with up to 8 Smart Drives.



SMART DRIVE VT

Variable Torque

Dedicated to control of fans and pumps requiring standard duty

AC Variable Speed Drive 1.5–160 kW

Smart Drive VT provides ease of use plus simple installation and commissioning, making it the lowest cost solution for virtually all variable torque applications.

Innovative and compact the Smart Drive VT range combines good looks with robustness, reliability and effortless performance.

Energy saving is maximised using the sleep mode and the automatic energy optimiser function, which reduces the motor voltage to match the load.

Coherent operation using a unified control interface across the entire range and with only 14 standard parameters to adjust, Smart Drive's legendary ease of use could not be easier or quicker to get started with. For the more advanced user the extended parameter set gives access to powerful additional functionality.

Smart Drive VT's optical interface allows communication with other control equipment and also with the unique SW-Manager CE Plus for fast and accurate product configuration.

Key Benefits

- True evolution of range, maintaining same footprint and connector arrangement as original
- Fast and accurate parameter configuration using unique SW-Manager CE Plus and SW-Manager PC Plus
- Small mechanical envelope
- Rugged industrial operation 50 °C ambient rating
- Simple mechanical & electrical installation
- Simple operation, powerful features & easy to use
- Fast setup, 14 basic parameters
- Real time motor current, motor speed and kW indication
- Debugging using troubleshooting & P0
- Standard duty 110% overload for 60 secs
- Keypad control
- Spin start
- Built in PID controller for feedback control systems
- Automatic energy optimiser
- Sleep mode
- Intelligent fire mode
- Dual high speed serial communication interfaces
 - Optical (IrDA) interface for commissioning and low bandwidth control systems (115 kbps)
 - RS485 / Modbus RTU interface for high bandwidth control (9k6 to 115 kbps); optional BACnet and Metasys N2 protocols



Key Physical Features

- Pluggable control terminals
- Easy access key slots for simple installation
- Easy access contactor style power terminals for intuitive easy wiring
- Help card for basic parameter description and terminal layout
- Easy to use keypad with bright LED display
- IP20
- Integral RFI filter
- Integral braking transistor
- 3 phase line choke (size 4, 5 & 6)

Key Control I/O Features

- Programmable I/O for flexible control
- 12 bit bipolar analogue input, 8 ms sample time
- 2nd analogue input for PID feedback control systems
- Positive logic digital inputs (active high), 8 ms sampling
- 24 V / 100 mA user supply output
- 0..10 V & 4..20 mA analog output, 8 ms update
- Galvanically isolated and short circuit proof

Key Programming Features

- Silent motor running with 32 kHz ultra-quiet switching
- 8 preset speeds
- Mains dip ride through
- Skip frequency
- Last 4 trips stored
- 120 Hz output frequency
- Parameter lock
- Hours run & kWh meters
- Speed scaling factor for master-slave arrangements
- 2nd deceleration ramp for rapid stop

ELECTRICAL DATA

SMART DRIVE VT SIZE 2 (Integral RFI Filter, braking transistor)

Model	SWPL-xxxxxxH12	200015	200022	400015	400022	400040
Motor output rating	kW	1.5	2.2	1.5	2.2	4
Motor output rating	HP	2.0	3.0	2.0	3.0	5.0
Supply voltage/ phases	V +/- 10%	220-240 / 1Ø		380-480 / 3Ø		
Supply fuse or MCB rating	A	20	30	10	10	20
Output voltage/ phases	V	0-240 / 3Ø		0-480 / 3Ø		
Output current – 110% overload	A	7	10.5	4.1	5.8	9.5
Max motor cable length	m	100				
Min brake resistor	Ω	33	22	47	47	33

SMART DRIVE VT SIZE 3 (Integral RFI Filter, braking transistor)

Model	SWPL-xxxxxxH12	200030	200040	200055	400055	400075	400110	400150
Motor output rating	kW	3.0	4.0	5.5	5.5	7.5	11.0	15.0
Motor output rating	HP	4	5	7.5	7.5	10.0	15.0	20.0
Supply voltage/ phases	V +/- 10%	220-240 / 3Ø or 1Ø (with 50% derating)			380-480 / 3Ø			
Supply fuse or MCB rating	A	32	32	50	32	32	50	50
Output voltage/ phases	V	0-240 / 3Ø			0-480 / 3Ø			
Output Amps – 110% overload	A	14	18	25	14	18	25	30
Max motor cable length	m	100						
Min brake resistor	Ω	15			22			

SMART DRIVE VT SIZE 4 (Integral RFI Filter, braking transistor, 3 phase line choke)

Model	SWPL-xxxxxxH12	200075	200110	200150	200185	200220
Motor output rating	kW	7.5	11	15	18.5	22
Motor output rating	HP	10	15	20	25	30
Supply voltage/ phases	V +/- 10%	220-240 / 3Ø or 1Ø (with 50% derating)				
Supply fuse or MCB rating	A	80	80-100	100	100-125	160
Output voltage/ phases	V	0-240 / 3Ø				
Output Amps – 110% overload	A	39	46	61	72	90
Max motor cable length	m	100				
Min brake resistor	Ω	6				

Model	SWPL-xxxxxxH12	400185	400220	400300	400370	400450
Motor output rating	kW	18.5	22	30	37	45
Motor output rating	HP	25	30	40	50	60
Supply voltage/ phases	V +/- 10%	380-480 / 3Ø				
Supply fuse or MCB rating	A	80	80-100	100	100-125	160
Output voltage/ phases	V	0-480 / 3Ø				
Output Amps – 110% overload	A	39	46	61	72	90
Max motor cable length	m	100				
Min brake resistor	Ω	12				

SMART DRIVE VT SIZE 5 (Integral RFI Filter, braking transistor, 3 phase line choke)

Model	SWPL-xxxxxxH12	200300	200370	200450	400550	400750	400900
Motor output rating	kW	30	37	45	55	75	90
Motor output rating	HP	40	50	60	75	100	120
Supply voltage/ phases	V +/- 10%	220-240 / 3Ø or 1Ø (with 50% derating)			380-480 / 3Ø		
Supply fuse or MCB rating	A	200	250-300	250-300	200	250-300	250-300
Output voltage/ phases	V	0-240 / 3Ø			0-480 / 3Ø		
Output Amps – 110% overload	A	110	150	180	110	150	180
Max motor cable length	m	100					
Min brake resistor	Ω	3			6		

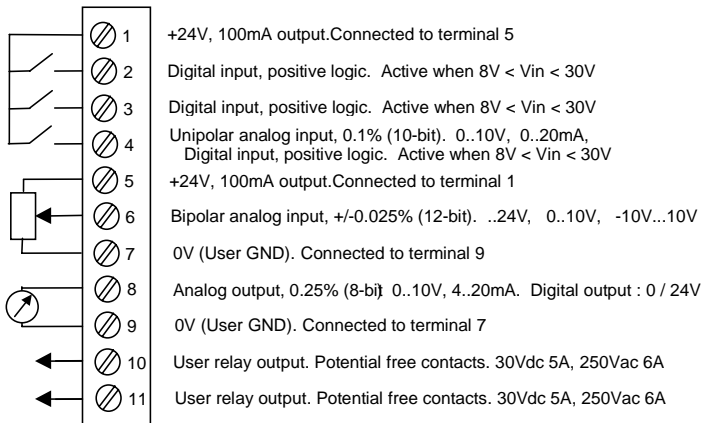
SMART DRIVE VT SIZE 6 (Integral RFI Filter, braking transistor, external 3 phase line choke)

Model	SWPL-xxxxxxH12	401100	401320	401600
Motor output rating	kW	110	132	160
Motor output rating	HP	150	175	250
Supply voltage/ phases	V +/- 10%	380-480 / 3Ø		
Supply fuse or MCB	A	315	350	400
Output voltage/ phases	V	0-480 / 3Ø		
Output Amps - 110% overload	A	202	240	300
Max motor cable length	m	100		
Min brake resistor	Ω	6		

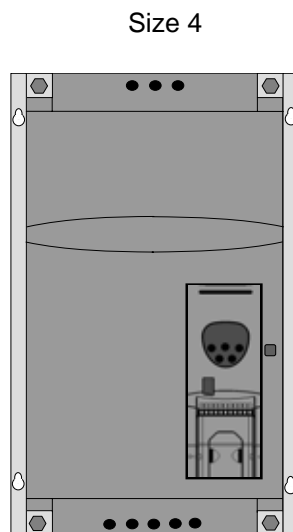
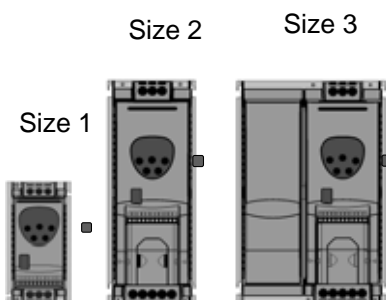
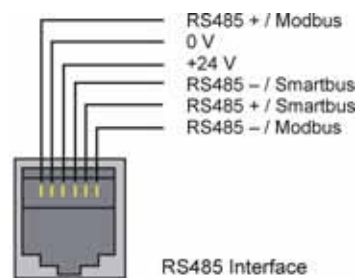
SPECIFICATION

- Supply frequency 48 to 62 Hz
- Max. permissible 3-phase supply imbalance 3%
- Max. ambient temperature 50 °C
- Max. altitude 2000 m
- Derate above 1000 m, 1% / 100 m
- For higher switching frequencies, derate output current 5% / °C above max. ambient up to 50 °C
- I x t protection above 100% output current
- 110% overload protection for 60 sec
- 125% overload allowable for 2 sec
- Storage temperature -40 to +60 °C
- Options:
 - SW-Manager CE Plus & SW-Manager PC Plus
 - Smartport Plus
 - RS485 data cables and accessories
 - Smartlink
 - Gateway options
 - 3ROUT (3 Relay Output)
 - Isolated USB to RS485 adaptor
 - Smartfilter
 - Smartbrake
 - Input Chokes
 - Output Filters

CONTROL TERMINAL ARRANGEMENT



COMMUNICATION INTERFACE



SMART DRIVE DIMENSIONS

	Size 2	Size 3	Size 4	Size 5 *	Size 5**	Size 6
Length / mm	260	260	520	1045	1100	1100
Width / mm	100	171	340	340	340	340
Depth / mm	175	175	220	220	330	330
Weight/ kg	2.6	5.3	28	67	68	55 ***
Fixings	2 * M4	4 * M4	4 * M8			
Power Terminal torque settings	1 Nm		4 Nm	8 Nm		

* Size 5 – 90 A and 110 A ratings

** Size 5 – 150 A and 180 A ratings

*** Size 6 has external line choke weighing 27 kg

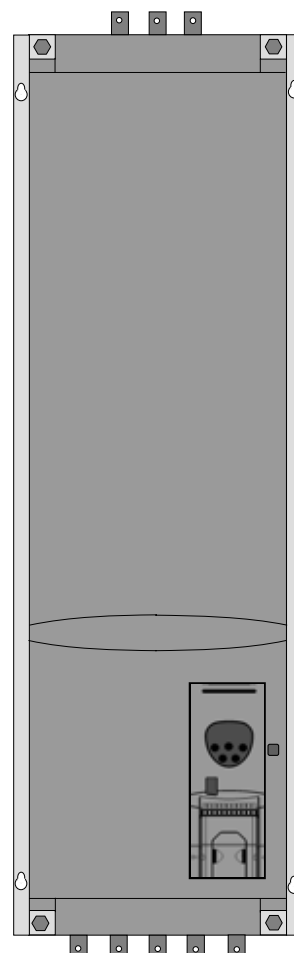
ENCLOSURE - NON VENTED DIMENSIONS (mm)

DRIVE POWER RATING	SEALED UNIT		
	W	H	D
Size 2 1.5 kW 200 V / 2.2 kW 400 V	300	400	300
Size 2 2.2 kW 200 V / 4 kW 400 V	450	600	300

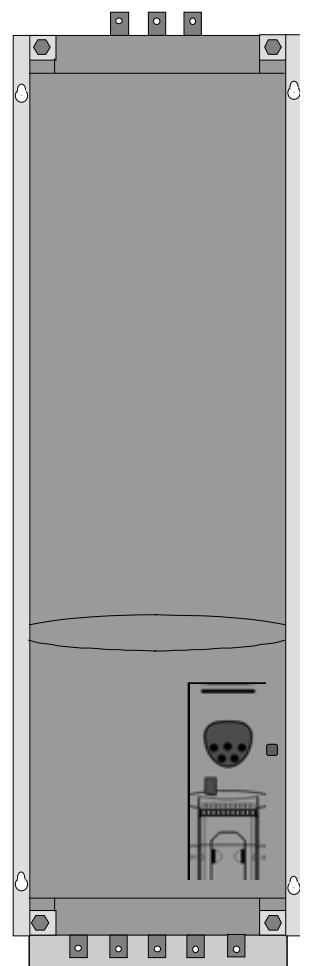
ENCLOSURE – VENTED DIMENSIONS (mm)

DRIVE POWER RATING	VENTED UNIT			FORCE VENTED (WITH FAN)				Air Flow
	W	H	D	W	H	D		
Size 2 (4 kW)	400	600	250	300	400	250		> 45 m ³ / h
Size 3 (15 kW)	600	800	300	400	600	250		> 80 m ³ / h
Size 4 (22 kW)	600	1000	300	600	800	300		> 300 m ³ / h
Size 4 (45 kW)	N/A	N/A	N/A	600	800	300		> 300 m ³ / h
Size 5 (90 kW)	N/A	N/A	N/A	800	1600	300		> 900 m ³ / h
Size 6 (160 kW)	N/A	N/A	N/A	800	2000	300		> 1000 m ³ / h


Size 5*



Size 5 & 6

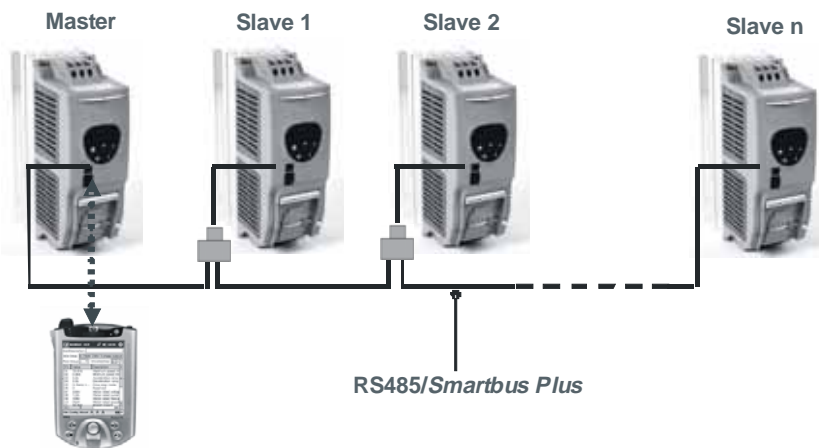


Communication Interfaces

	Interface	Protocol	Baud (bps)	Purpose	Connections
	RS485	<i>Modbus RTU</i>	9k6 – 115k	High bandwidth control systems	<ul style="list-style-type: none"> • Drive to plc • Drive to fieldbus gateway
		<i>Smartbus Plus</i>	115k	Low bandwidth control systems	<ul style="list-style-type: none"> • Drive to pc (PC Software) • Drive to drive (unlimited slaves)
	Optical	IrdA	115k	Small, low bandwidth control systems	Drive to drive (max. 2 slaves)
				Commissioning	Commissioning

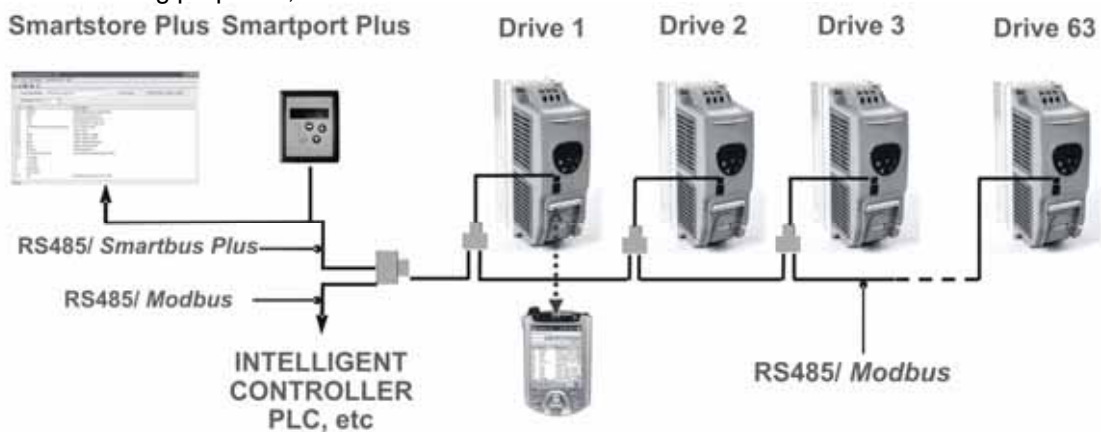
Master – Slave/ Drive to Drive Communication

Master – slave networks can be easily created by connecting the communication ports. SW-Manager CE Plus can be used for commissioning individual drives through the optical port even when the drives are connected in an RS485 network.



Drive Networks to Intelligent Controllers

High bandwidth control systems can be created for up to 63 drives connected to an intelligent network with RS485/Modbus RTU. Smartport Plus and/or SW-Manager Plus can run on the same network using an RS485/Smartbus Plus connection for monitoring purposes, but not for control.

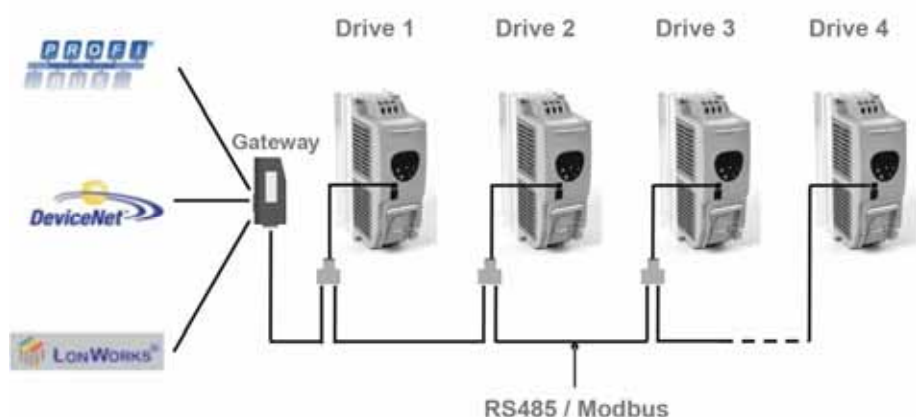


Fieldbus Communication

Smart Drive Plus connects to high speed communication networks via a gateway.

1 DeviceNet gateway can connect with up to 4 Smart Drives.

1 Profibus gateway can connect with up to 8 Smart Drives.



SMART Economy DRIVE 1

Easy to use, low power, low cost

AC Variable Speed Drive 0.37–4.0 kW

Rich in features the Smart Economy Drive is the most commercially competitive Smart Drive in the Smart Drive family.

Innovative and compact the Smart Economy Drive range combines good looks with robustness, reliability and easy to use performance.

The product is dedicated to low power applications where total costs are ultra-competitive, including:

- Competitive purchase price
- Low installation costs
- Low technical support costs

Smart Economy Drive has only 14 standard parameters to adjust in its basic form, thus Smart Drive's legendary ease of use could not be easier or quicker to get started with.

Smart Economy Drive can be supplied with or without an internal RFI filter.

Key Benefits

- Small mechanical envelope
- Rugged industrial 50 °C ambient rating for hot and tough applications
- Simple mechanical & electrical installation
- Simple operation, powerful features easy to use
- Fast setup, factory default settings ok for most applications, only 14 basic parameters (40 max)
- Motor current and rpm indication
- Debugging using troubleshooting & P-00
- 150% overload for 60 secs (175% for 2 secs)
- Keypad control
- Integral RFI filter option



Key Physical Features

- Easy access key slots for simple installation
- Easy access contactor style power terminals for intuitive easy wiring
- Help card for basic parameter description and terminal layout
- Easy to use keypad with bright LED display
- IP20
- 5 mm pitch, rising clamp control terminals

Key Control I/O Features

- Programmable I/O for flexible control
- Analogue input 12 bit resolution for accuracy
- Positive logic digital inputs (active high)
- Galvanically isolated and short circuit proof

Key Programming Features

- Silent motor running with 32 kHz ultra-quiet switching
- 4 preset speeds
- "DC Injection" braking on enable to stop free wheeling motors
- Mains dip ride through
- Skip frequencies
- Last 4 trips stored
- Parameter lock
- Hours run meter
- Speed scaling factor for master- slave arrangements
- Emergency (fast) stop function



LISTED 2A00
Power Conversion Equipment
E226333

ELECTRICAL DATA

Smart Economy Drive (INTEGRAL RFI FILTER) SIZE 1

Model	SE1-xxxxxxxH11	K2S0003	K2S0007	K2S0015	K400007	K400015
Motor output rating	kW	0.37	0.75	1.5	0.75	1.5
Motor output rating	HP	0.5	1.0	2.0	1.0	2.0
Supply voltage/ phases	V +/- 10%	220-240 / 1Ø			380-480 / 3Ø	
Supply fuse or MCB rating	A	10	10	20	5	10
Output voltage/ phases	V	0-240 / 3Ø			0-480 / 3Ø	
Output current	A	2.3	4.3	7.0	2.2	4.1
Max motor cable length	m	25			10	

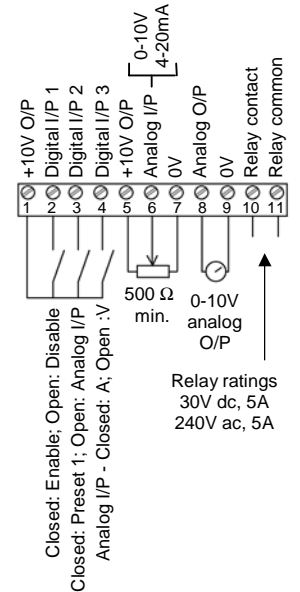
Smart Economy Drive (INTEGRAL RFI FILTER) SIZE 2

Model	SE-xxxxxxxH11	K2S0022	K400022	K400040
Motor output rating	kW	2.2	2.2	4
Motor output rating	HP	3.0	3.0	5.0
Supply voltage/ phases	V +/- 10%	220-240 / 1Ø		380-480 / 3Ø
Supply fuse or MCB rating	A	30	10	16
Output voltage/ phases	V +/- 10%	0-240 / 3Ø		0-480 / 3Ø
Output current	A	10.5	5.8	9.5
Max motor cable length	m	100		

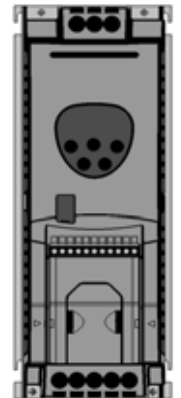
Smart Economy Drive "VOLTAGE DOUBLER" SIZE 1 & 2 (USA/ HP ONLY)

Model	SE-xxxxxxx-USA	K1S0005	K1S0010	K1S0015
Motor output rating	HP	0.5	1.0	1.5
Frame size		1	2	
Supply voltage/ phases	V +/- 10%	110-115 / 1Ø		
Supply fuse or MCB rating	A	20	20	30
Output voltage/ phases	V	0-230 / 3Ø		
Output current	A	2.3	4.3	5.8
Max motor cable length	m	25	100	

Control Terminal Arrangement (default)



Size 2



Size 1



Smart Economy DIMENSIONS

	Size 1	Size 2
Length / mm	155	260
Width / mm	80	100
Depth / mm	130	175
Weight/ kg	1.1	2.6
Fixings	2 * M4	
Power terminal torque settings	1 Nm	1 Nm
Control terminal torque settings	0.5 Nm	0.5 Nm

ENCLOSURE - NON VENTED DIMENSIONS (mm)

DRIVE POWER RATING	SEALED UNIT		
	W	H	D
Size 1 0.37 kW 200 V	200	250	200
Size 1 0.75 kW 200 V / 400 V	250	300	200
Size 1 1.5 kW 200 V / 400 V	300	400	250
Size 2 2.2 kW 400 V	300	400	300
Size 2 2.2 kW 200 V / 4.0 kW 400 V	450	600	300

ENCLOSURE - VENTED DIMENSIONS (mm)

DRIVE POWER RATING	VENTED UNIT			FORCE VENTED (WITH FAN)			
	W	H	D	W	H	D	Air Flow
Size 1 All ratings	300	400	150	200	300	150	> 15m³ / h
Size 2 All ratings	400	600	250	200	400	250	> 45m³ / h

SPECIFICATION

- Supply frequency 48 to 62 Hz
- Max. permissible 3-phase supply imbalance 3%
- Max. ambient temperature 50 °C
- Max. altitude 2000 m
- Derate above 1000 m, 1% / 100 m
- Derate output current 5% / °C above max. ambient temp up to 50 °C
- I x t protection above 100% output current
- 150% overload protection for 60 sec
- 175% overload allowable for 2 sec
- Storage temperature -40 to +60 °C
- Options:
 - EMC filter
 - Input Chokes & Output Filters
 - 2ANIN, dual analogue input
 - 2ROUT, dual relay output
 - PICON, feedback control (PI)
 - HVACO, HVAC relay output

ENCLOSED SMARTDRIVE IP55 / NEMA 12

Easy to use, low power, low cost

AC Variable Speed Drive 0.37–4.0 kW

The ultimate drive for harsh environments. The IP55 / NEMA 12 rated drive has been designed to expand the success of the Smartdrive Economy and Smartdrive Plus product ranges.

Available in switched or non-switched units.

Switched Units

- Local Power Isolator
- Local Potentiometer for speed control
- Drive Fwd/Rev switch

Key Benefits

- Wash down duty IP55/NEMA 12
- Wall mountable
- Resists low-pressure water, dust, dirt and chemicals
- Rugged industrial 40 °C ambient rating for hot and tough applications
- Conduit cable entry
- Switched or non switched
- Infra red capability
- Keypad Control
- Integral RFI filter option
- Small mechanical size



Industry Sectors

- Food processing
- Bottling
- Pumping
- Chemical
- Waste Water
- HVAC



UL Pending



ELECTRICAL DATA

SMARTDRIVE E SIZE 1 (with internal RFI) (-0 Unswitched, -1 Switched)

Model	SE1K-xx-xxxx-D-11-0 (Unswitched) SE1K-xx-xxxx-D-11-1 (Switched)	2S-0003	2S-0007	2S-0015	40-0007	40-0015
Motor output rating	kW	0.37	0.75	1.5	0.75	1.5
Supply voltage/ phases	V +/- 10%	220-240 / 1Ø		380-480 / 3Ø		
Supply fuse or MCB rating	A	10	10	20	5	10
Output voltage/ phases	V	0-240 / 3Ø		0-480 / 3Ø		
Output current	A	2.3	4.3	7.0	2.2	4.1
Max motor cable length	m	25		25		

SMARTDRIVE E SIZE 2 (with internal RFI) (-0 Unswitched, -1 Switched)

Model	SE1K-xx-xxxx-D-11-0 (Unswitched) SE1K-xx-xxxx-D-11-1 (Switched)	2S-0022	40-0022	40-0040
Motor output rating	kW	2.2	2.2	4
Supply voltage/ phases	V +/- 10%	220-240 / 1Ø		380-480 / 3Ø
Supply fuse or MCB rating	A	30	10	16
Output voltage/ phases	V +/- 10%	0-240 / 3Ø		0-480 / 3Ø
Output current	A	10.5	5.8	9.5
Max motor cable length	m	100		

Size 1
Non-switched



Size 1
Switched



SMARTDRIVE PLUS SIZE 1 (with internal RFI) (-0 Unswitched, -1 Switched)

Model	SWP-xx-xxxx-D-11-0 (Unswitched) SWP-xx-xxxx-D-11-1 (Switched)	2S-0003	2S-0007	2S-0015
Motor output rating	kW	0.37	0.75	1.5
Supply voltage/ phases	V +/- 10%	220-240 / 1Ø		
Supply fuse or MCB rating	A	6-10	10	20
Output voltage/ phases	V	0-240 / 3Ø		
Output current	A	2.3	4.3	7.0
Max motor cable length	m	25		

SMARTDRIVE PLUS SIZE 2 (with internal RFI, with internal braking transistor) (-0 Unswitched, -1 Switched)

Model	SWP-xx-xxxx-D-12-0 (Unswitched) SWP-xx-xxxx-D-12-1 (Switched)	2S-0015	2S-0022	40-0007	40-0015	40-0022	40-0040
Motor output rating	kW	1.5	2.2	0.75	1.5	2.2	4
Supply voltage/ phases	V +/- 10%	220-240 / 1Ø			380-480 / 3Ø		
Supply fuse or MCB rating	A	20	30	6-10	10	10	20
Output voltage/ phases	V	0-240 / 3Ø			0-480 / 3Ø		
Output current	A	7	10.5	2.2	4.1	5.8	9.5
Max motor cable length	m	100	100	50	100	100	100
Min brake resistor	Ω	33	22	47	47	47	33

SMARTDRIVE DIMENSIONS

	Size 1	Size 2
Length / mm	200	310
Width / mm	140	164.8
Depth / mm	162	176
Fixings	2 * M4	4 * M4
Power terminal torque settings	1 Nm	
Control terminal torque settings	0,5 Nm	



Dynamic Braking Resistor

- Available for Smartdrive Plus Size 2
- Mounts into the rear of the heatsink
- 100R, 200W continuous
- Part Number: OPTSWBRAREI5

SMART Single Phase DRIVE 1

*Digital control for single phase
motors*

AC Variable Speed Drive 0.37–1.1 kW

The Smart Single Phase Drive 1 is the world's first fully digital, fully packaged variable speed drive for controlling low power single phase motors.

Designed to be cost effective and easy to use, the Smart Single Phase Drive 1 is for use with PSC (Permanent Split Capacitor) or Shaded-Pole Single-Phase induction motors.

Smart Single Phase Drive 1 uses a revolutionary motor control strategy to achieve reliable intelligent starting of single phase motors.

Smart Single Phase Drive 1 has only 14 standard parameters to adjust in its basic form. The Smart Single Phase Drive's legendary ease of use ensures quick and easy drive commissioning. For the more advanced user the extended parameter set gives access to powerful additional functionality.

Key Benefits

- 115V & 220V ratings
- Single phase input/ single phase output
- Small mechanical envelope
- Rugged industrial operation 50°C ambient rating
- Simple mechanical & electrical installation
- Simple operation, powerful features & easy to use
- Fast setup, factory default settings ok for most applications, only 14 basic parameters (40 max)
- Variable torque or constant torque
- Unique programmable boost feature to achieve intelligent starting
- Motor current and rpm indication
- Debugging using troubleshooting & P-00
- 150% overload for 60 secs (175% for 2 secs)
- Keypad control



Key Physical Features

- Easy access key slots for simple installation
- Easy access contactor style power terminals for intuitive easy wiring
- Help card for basic parameter description and terminal layout
- Easy to use keypad with bright LED display
- IP20
- 5 mm pitch, rising clamp control terminals

Key Control I/O Features

- Programmable I/O for flexible control
- Analogue input 12 bit resolution for accuracy
- Positive logic digital inputs (active high)
- Galvanically isolated and short circuit proof

Key Programming Features

- Silent motor running with 32kHz ultra-quiet switching
- 4 preset speeds
- Mains dip ride through
- Skip frequencies
- Last 4 trips stored
- Parameter lock
- Hours run meter
- Speed scaling factor for master - slave arrangements
- Ten selectable V/f curves



LISTED 2A00
Power Conversion Equipment
E226333

ELECTRICAL DATA

Smart Single Phase Drive SIZE 1

Model	SP1-xxxxxxxH01	K1S0003	K2S0003	K2S0007
Motor output rating	kW	-	0.37	0.75
Motor output rating	HP	0.5	0.5	1.0
Supply voltage/ phases	V +/- 10%	110-115/ 1Ø	220-240/ 1Ø	
Supply fuse or MCB rating	A	7.0	10.0	20
Output voltage/ phases	V	0-115/ 1Ø	0-240/ 1Ø	
Output current	A	4.3	4.3	7.0
Max motor cable length	m	25		

Smart Single Phase Drive SIZE 2
(INTEGRAL BRAKING TRANSISTOR)

Model	SP1-xxxxxxxH02	K1S0005	K2S0011
Motor output rating	kW	-	1.1
Motor output rating	HP	0.75	1.5
Supply voltage/ phases	V +/- 10%	110-115/ 1Ø	220-240/ 1Ø
Supply fuse or MCB rating	A	20	20
Output voltage/ phases	V +/- 10%	0-115/ 1Ø	0-240/ 1Ø
Output current	A	10.5	10.5
Max motor cable length	m	100	
Min brake resistor	Ω	22	22

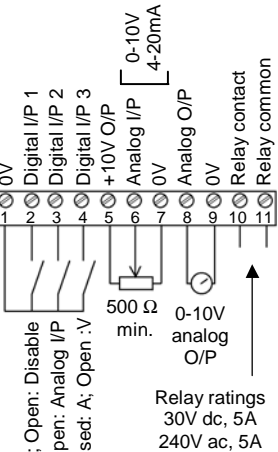
SPECIFICATION

- Supply frequency 48 to 62 Hz
- Max. ambient temperature 50 °C
- Max. altitude 2000 m
- Derate above 1000 m, 1% / 100 m
- Derate output current 5% / °C above max. ambient temp up to 50 °C
- I x t protection above 100% output current
- 150% overload protection for 60 sec
- 175% overload allowable for 2 sec
- Storage temperature -40 to +60 °C
- Options:
 - Optifilter
 - Input Chokes & Output Filters
 - 2ANIN, dual analogue input
 - 2ROUT, dual relay output
 - PICON, feedback control (PI)
 - HVACO, HVAC relay output

Control Terminal
Arrangement (default)

Smart Single Phase DIMENSIONS (mm)

	Size 1	Size 2
Length	155	260
Width	80	100
Depth	130	175
Weight (kg)	1.1	2.6
Fixings	2 * M4	
Power terminal torque settings	1 Nm	1 Nm



ENCLOSURE - NON VENTED DIMENSIONS (mm)

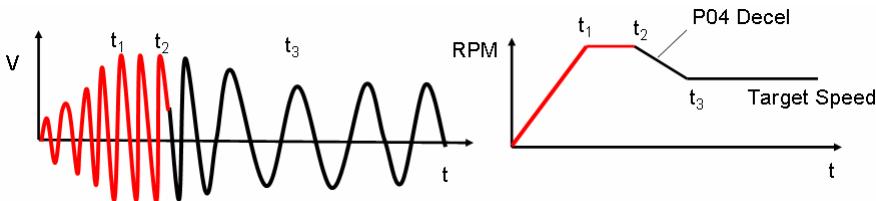
DRIVE RATING	SEALED UNIT		
	W	H	D
Size 1 All ratings	300	400	200
Size 2 All ratings	450	600	300

ENCLOSURE – VENTED DIMENSIONS (mm)

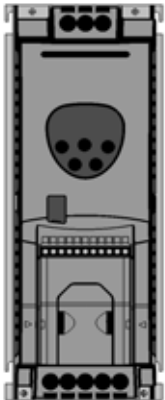
DRIVE RATING	VENTED UNIT			FORCE VENTED/ WITH FAN			
	W	H	D	W	H	D	Air Flow
Size 1 All ratings	300	400	150	200	300	150	>15m³/h
Size 2 All ratings	400	600	250	300	400	250	>45m³/h

SPECIAL BOOST PHASE OPERATION

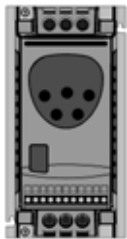
To ensure reliable starting, the Smart Single Phase Drive initially ramps the motor voltage up to rated frequency and voltage, before reducing the frequency and voltage to the desired operating point, see diagrams below.



Size 2



Size 1



SW-MANAGER CE PLUS

Unique wireless programming tool

SW-Manager CE Plus is a Windows Compact Edition application program for pocket pc's, allowing quick and accurate communication with Smart Drive & VT for parameter management and network monitoring using infra-red optical communication.

Parameter sets are stored as files on the pocket pc and can be edited simply using the easy to use graphical interface. Full parameter descriptions facilitate programming, fast and accurate data transfer saves commissioning time and ensures commissioning accuracy. A simple configuration menu allows SW-Manager CE Plus to operate in a variety of different languages.

In monitor mode, SW-Manger CE Plus provides real-time feedback of drive operation displaying speed, current, power, etc. in addition to drive control features including start, stop and set speed.

SW-Manager CE Plus saves time and money and improves product quality during any system or machine assembly process. It also ensures on going life-time costs are minimised as service levels are guaranteed with fast access to proven parameter settings.

The infra-red communication between the SW-Manager CE Plus and Smart Drive Plus & VT functions through transparent materials such as glass or perspex allowing Smart Drive configuration or monitoring to take place through an appropriate enclosure window.

Key Benefits

- Fast and accurate data transfer
- Multi-language, real text parameter descriptions

Key Operating Features

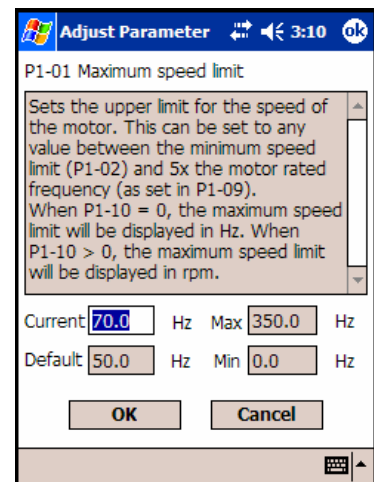
- Multi-language
- On-line & off-line parameter editing
- Copy facility
- Remote Smart Drive control and monitoring

Website Available

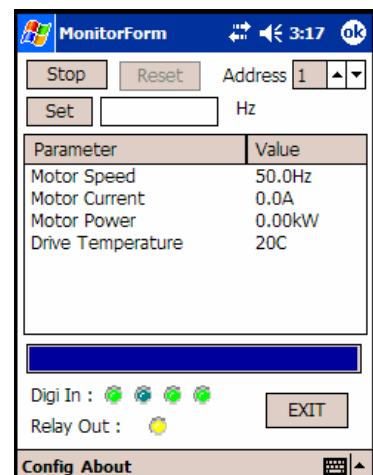
- SW-Manager CE Plus is available for all Smart Drive products as a free of charge download from www.bergeselectronic.com



Screen parameter editing screen:



Screen showing internal parameter monitoring:



SWP Drive Manager

PC programming tool

SWP Drive Manager is a Windows application program for pc's, allowing quick and accurate communication with Smart Drive Plus and Smart Drive VT networks for parameter management and network monitoring.

Key Benefits

- Plug and go, simple and easy PC control
- Individual drive or drive network use
- PC based data storage and file management

Key Physical Features

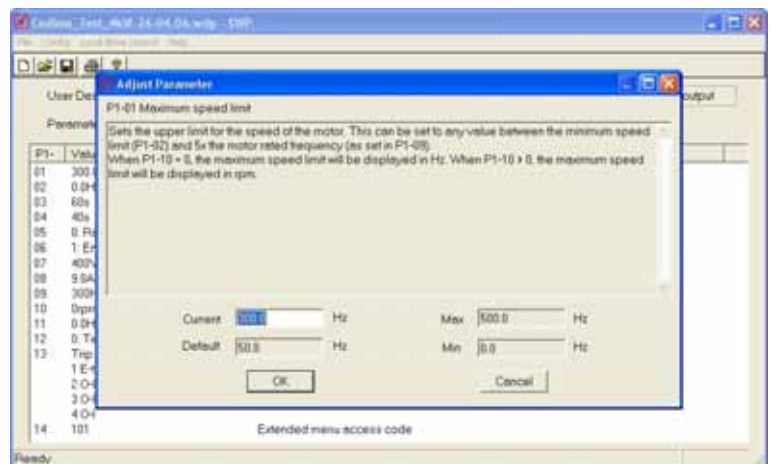
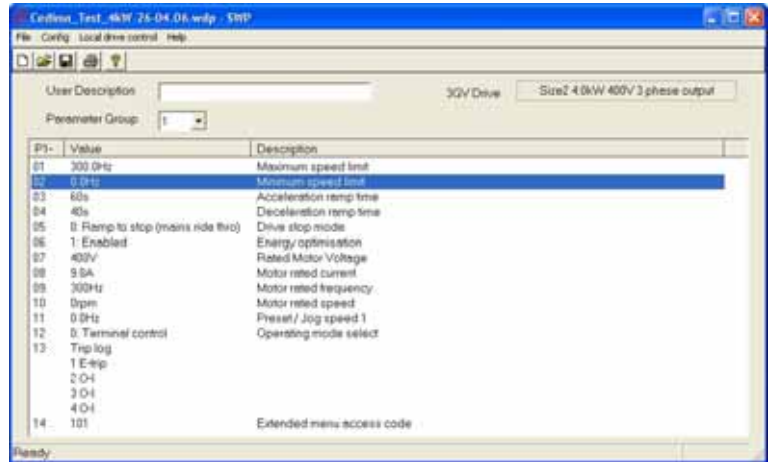
- Connects to computer USB port
- Runs on Windows 2000 & XP

Key Operating Features

- Parameter set transfer to or from an SW-Manager CE Plus
- File management: naming, storing, printing, emailing etc.
- Connects to Smart Drive Plus and Smart Drive VT using USB-RS485 converter cable
- For drive network management including configuration, monitoring and control
- Parameter Export facility allows the user to insert parameter settings in other programs e.g. Microsoft WORD (*.rtf format)

Website Available

- SWP Drive Manager is available for all SWP products as a free of charge download from www.bergeselectronic.com



SMART 485AD

485AD is an isolated USB to RS485 communications adaptor designed for use with SW-Manager PC Plus.



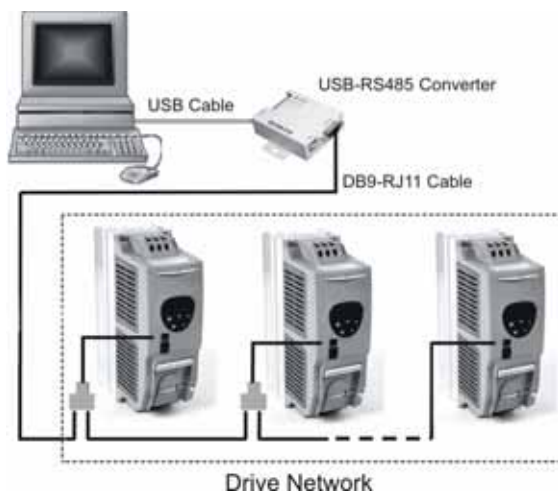
Key Benefits

- To provide interface between PC and drive
- For use the SW-Manager PC Plus software
- Panel mount possibility
- Provides electrical isolation between PC and drive network

Components in the package

- USB-485 adaptor
- User and Installation guides
- SW-Manager PC Plus Installation CD
- USB cable
- DB9 – RJ11 cable
- Windows Driver CD

Configuration



SMART RS485 data cable splitter

RS485 data cable splitter is an RJ11 1 to 2 way connection block



Smart Drive Plus & Smart Drive VT Plug-in Options

SMART 3ROUT

3ROUT provides 2 additional programmable relay outputs

Specification

- Max relay switching voltage: 250 VAC/ 220 VDC
- Max relay switching current: 1 A
- Max input voltage: +/- 50 VDC
- Conformity: IP00, UL94V-0
- Environmental: -10 °C ... +50 °C
- Dimensions: 56 x 33 (not pins) x 14mm

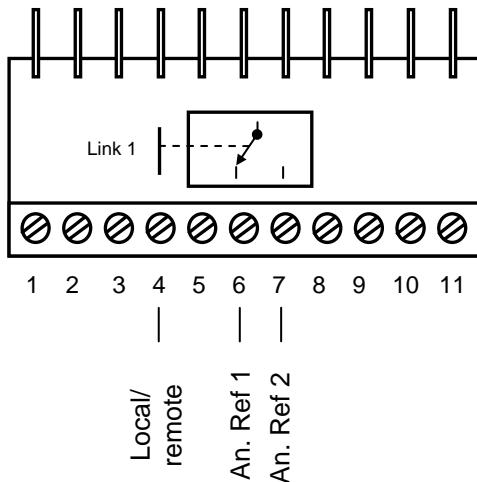
New Enclosed Design

All plug-in options available for all Smart Drive ranges have now been redesigned and are fully enclosed



SMART 2ANIN

2ANIN allows automatic switching between 2 analogue references. Typically used for local (voltage) / remote (current) reference switching



Specification

- Analogue input 1: ± 10 VDC or 4...20 mA
- Analogue input 2: ± 10 VDC or 4...20 mA
- Max input voltage: ± 50 VDC
- Conformity: IP00, UL94V-0
- Environmental: $-10^{\circ}\text{C} \dots +50^{\circ}\text{C}$
- Dimensions: 56 x 33 (not pins) x 14mm

New Enclosed Design

All plug-in options available for all Smart Drive ranges have now been redesigned and are fully enclosed

Smart Drive SE & SP Plug-in Options

SMART 2ROUT

2ROUT provides a programmable second relay output

Programming the second relay output

The second relay output is derived from the analogue output terminal of the Smart Drive and its operation is user defined by appropriate parameter settings.

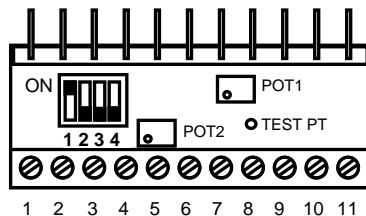
Specification

- Max relay switching voltage: 250 VAC / 220 VDC
- Max relay switching current: 1 A
- Max input voltage: ± 50 VDC
- Conformity: IP00, UL94V-0
- Environmental: $-10^{\circ}\text{C} \dots +50^{\circ}\text{C}$
- Dimensions: 56 x 33 (not pins) x 14 mm



SMART PICON

Low cost analogue PI controller for simple feedback control systems



	Switch Open (OFF)	Switch Closed (ON)
S1	Integral gain 0.1 s	Integral gain 1 s
S2	Integral gain 0.1 s	Integral gain 10 s
S3	Feedback format 0..10 V	Feedback format 4..20 mA
S4	Reference format 0..10 V	Reference format 4..20 mA

Key Benefits

- Small physical size
- Potted for robustness and environmental protection
- Minimal setup for quick and easy commissioning
 - Integral gain set by 2 switches
 - Proportional gain set by potentiometer
- Built in reference potentiometer for convenient setup of feedback reference point

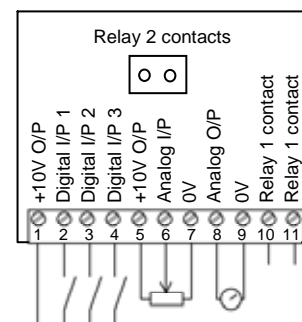
Specification

- Rated reference input ± 10 VDC or 4..20 mA
- Proportional gain range 0.2..30
- Rated feedback input ± 10 VDC or 4..20 mA
- Integral gain settings 0.1 s, 1 s, 10 s
- Max input voltage ± 50 VDC
- Conformity IP00, UL94V-0
- Environmental -10°C .. $+50^{\circ}\text{C}$
- Dimensions 56 x 33 (not pins) x 16mm



SMART HVACO

HVACO provides a 2 relays for typical “drive running” & “drive tripped” indicators



Specification

- Max relay switching voltage: 250 VAC / 220 VDC
- Max relay switching current: 1 A
- Max input voltage: ± 50 VDC
- Conformity: IP00, UL94V-0
- Environmental: -10°C ... $+50^{\circ}\text{C}$
- Dimensions: 56 x 33 (not pins) x 14mm

SMARTPORT PLUS

Remote keypad and display

Smartport Plus is an intelligent device with its own microcontroller, which connects to either a single Smart Drive Plus or VT or a network of Smart Drives using an electrical interface.

Smartport Plus behaves as the remote keypad and display for the Smart Drive on the network which has the same serial address. The physical layout and the operation of the Smartport Plus keypad and display mimic the Smart Drive exactly.

Key Benefits

- Real time keypad and display operation mimics Smart Drive
- Single electrical interface for power and data
- Communicates with any single drive across a network
- Connects automatically to any Smart Drive Plus or VT
- IP54 rating, when through panel mounted
- Connect 2 Smartports to a single drive to display speed/power/current at the same time
- Membrane keypad
- Bright LED display
- Parameter lock function available

General Specification

- Signal Interface: Standard 6-way RJ11 connector with 3m cable included
- Supply Input: 10 V...36 VDC, 30 mA
- RS485 signal: industry standard 2-wire +5V differential
- Environmental: Operational 0...50 °C
- Storage: -40 °C...60 °C
- Relative Humidity: < 95% (non condensing)
- Protection rating: IP54



Configurations

- Depending on the requirements of the application, Smartport Plus can be used in the 4 different configurations:

- One Smartport Plus with one drive



- Two Smartport Plus units with one drive



- One Smartport Plus with multiple drives



- Two Smartport Plus units with multiple drives



SMARTFILTER

RFI line filters

Smart Drive Size 1, 2 & 3

Footprint or side mounting filters for compliance with EMC standards for conducted emissions.

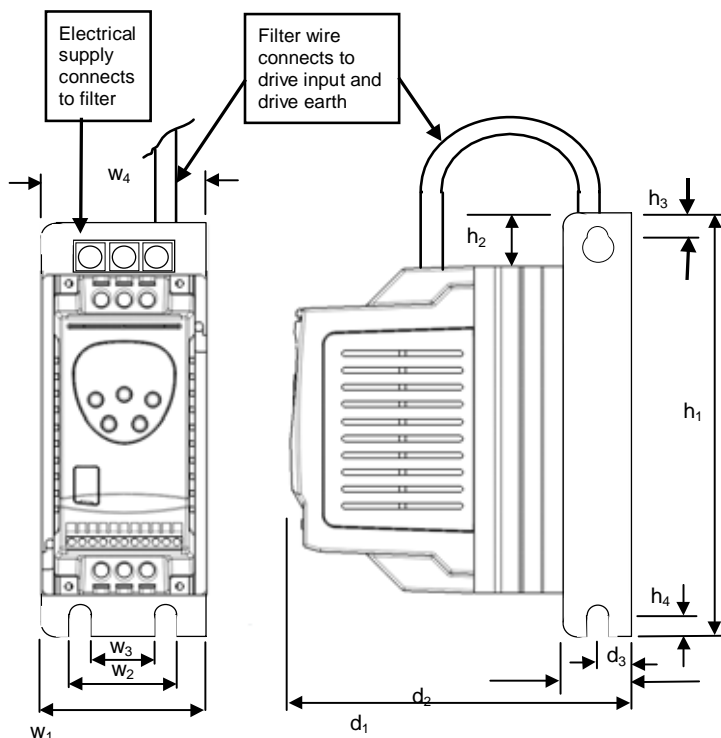
Note: all Smart Drives inherently comply with the EMC radiated emission standards (EN 61000), when good wiring practice is employed.

Smartfilters are mechanically easy to install and to retrofit and the provision of filter-drive cables significantly reduces electrical wiring time.

A key feature of all Smartfilters is the predominant use of high specification inductive components rather than lower cost capacitive components. This substantially improves earth leakage performance and is of particular benefit for medical , domestic and multi-drive system applications where earth leakage breakers will trip less readily.



Specification



Drive Size		1	1	2	2	3
Smartfilter model SW-xxxxxx		EMC 2S1	EMC 201	EMC 2S2	EMC 202	EMC 203
Supply voltage +/- 10%	V	220-240	220-480	220-240	220-480	220-480
Phases		1	3	1	3	3
Output current max	A	16	6	25	16	30
Earth leakage	mA	<1.6	<30	<1.6	<30	<30
Dimensions						
W1	mm	90	90	114	114	186.60
W2	mm	65.50	65.50	75.50	75.50	148
W3	mm	54.50	54.50	64.50	64.50	137
W4	mm	60	60	70	70	146.60
h1	mm	200	200	300	300	300
h2	mm	30	30	20	20	20
h3	mm	5.50	5.50	5.50	5.50	6.22
h4	mm	6.50	6.50	6.50	6.50	6.50
d1	mm	175	175	225	225	225
d2	mm	46	46	51	51	51
d3	mm	23	23	25.60	25.60	-
Weight (filter only)	kg	0.5	0.5	0.9	0.9	0.9
Compliance with Conducted Emissions standards *						
EN 50081-1 (Domestic): motor-drive cable length						
Drive Fsw = 8 kHz	m	10	3	5	5	5
Drive Fsw = 16 kHz	m	5	3	5	5	5
Drive Fsw = 32 kHz	m	5	3	5	5	5
EN50081-2 (industrial): motor-drive cable length						
Drive Fsw = 8 kHz	m	40	10	35	35	30
Drive Fsw = 16 kHz	m	30	10	30	30	30
Drive Fsw = 32 kHz	m	25	8	25	25	25

* When screened cable is used and connected as per Smart Drive manual employing good wiring practice

SW-BRAKE

Dynamic braking resistors

Smart Drive Size 2 to 6

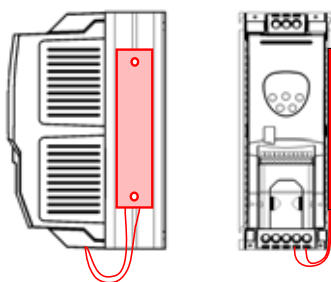
SW-brake dynamic braking resistors are designed specifically for the Smart Drive range. For use with high inertia loads which need to be stopped rapidly, SW-brake dynamic braking resistors assist the Smart Drive manage the electrical energy returned from the motor during braking, by converting it to heat energy.

Key Benefits

- Smart Drive software protects the SW-brake from overload, hence no need for expensive overload relays are required
- Internal fusible element ensures fail safe operation
- Connects to side of drive, using heatsinking properties of heatsink to prevent overheating
- No space envelope penalty, fits on side of drive
- Serial parallel arrangements for more demanding applications

Key Physical Features

- IP21, robust assembly
- Wire wound
- Metal clad housing



Please make
notes *here.....*

Specification

- SW-brake for Smart Drive Size 2 and 3
 - 100 Ω , 200 W continuous, 12 kW peak for 0.125 s
 - Dimensions 188 x 40 x 9 mm
- SW-brake for Smart Drive Size 4, 5 & 6
 - 33 Ω , 500 Watt continuous, 21 kW peak for 0.125 s
 - Dimensions 330 x 80 x 12 mm

INPUT CHOKES

*Reduce supply harmonic distortion
and protect Smart Drive against
harmful supply disturbances*

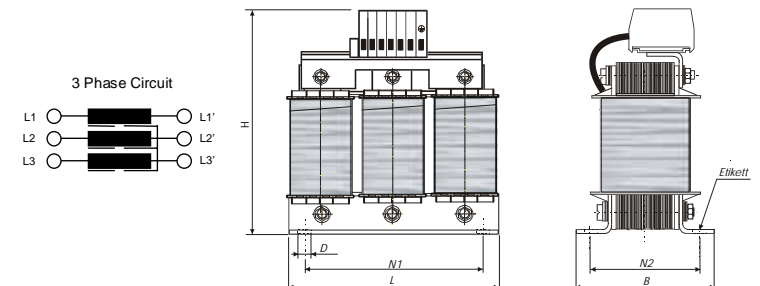
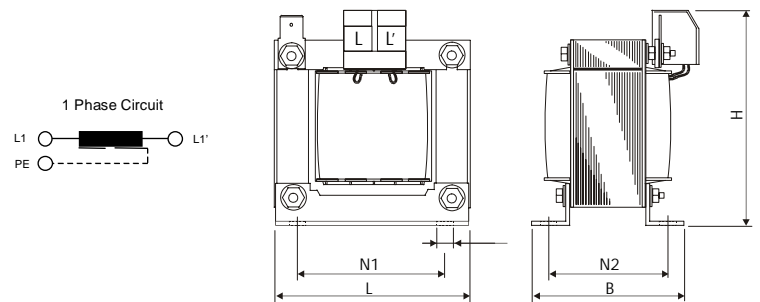
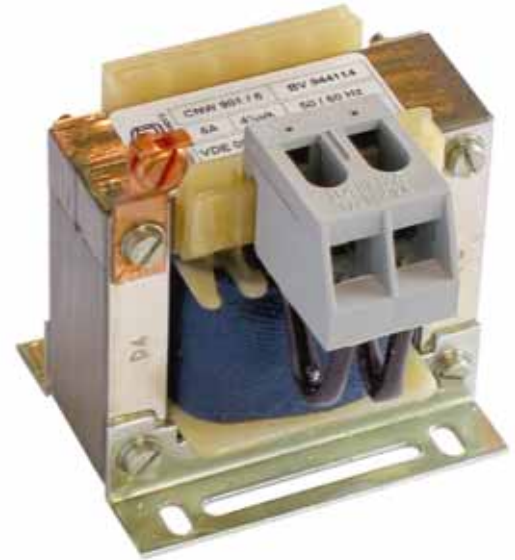
Most types of drive products create supply harmonic distortion owing to the configuration of the power input circuit. Input chokes are used to reduce the effects of the Smart Drive upon supply harmonic distortion (see below).

Input chokes are also used to protect the power input circuits of the Smart Drive against voltage spikes which might originate from lightning strikes or other equipment on the same supply. Small power Smart Drives are particularly susceptible to this on certain supplies where lightning occurs or if there are other power electronic devices which cause notching on the supply ie welders, dc drives etc.

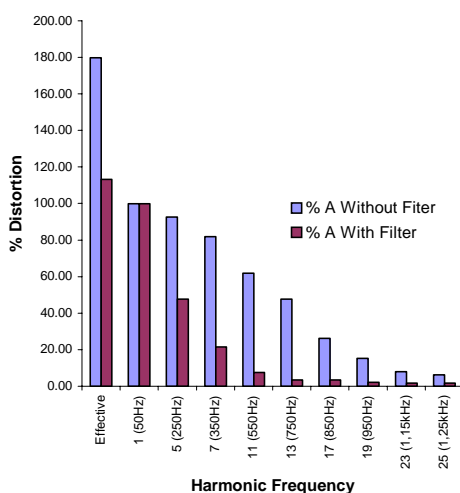
Input chokes are available for Smart Drive size 1, 2 and 3.

Smart Drive sizes 4, 5 & 6 include 3 phase line chokes as part of the products basic design, this significantly improves the robustness of these products and is a key specification benefit.

A range of input chokes for 12 pulse systems are available on request.



Fourier Analysis of Harmonic Distortion



The graph shows the effect of using an input choke on typical 4 kW / 5 HP drive. The 50 Hz current is used as a reference and is the current which delivers the useful power to the motor. The reduction in the total effective (RMS) current is clear.

Specification

	Smart Drive Size	Rated Voltage	Phase	Rated Current A	Inductance/ limb mH
SW-CNW901-16	Size 1	< 230V	1	16	1.8
SW-CNW901-25	Size 2			25	1.1
SW-CNW903-6	Size 1	< 500V	3	6	4.8
SW-CNW903-10	Size 2			10	2.9
SW-CNW903-36	Size 3			36	0.81

Dimensions

	L mm	B mm	H mm	N1 mm	N2 mm	ØD mm	Mass kg
SW-CNW901-16	78	78	80	56	49	Ø4.8 x 9	1.1
SW-CNW901-25	85	95	95	64	59	Ø4.8 x 9	1.8
SW-CNW903-6	95	56	107	56	43	Ø4.8 x 9	1.3
SW-CNW903-10	125	71	127	100	55	Ø4.8 x 9	2.5
SW-CNW903-36	155	77	185	130	72	Ø8 x 12	7.2

OUTPUT FILTERS

Output filters improve the quality of the output waveform

Smart Drives, like the majority of other inverter drives have unfiltered outputs. In the majority of applications this will give satisfactory performance, however, in a small number of applications output filtering is strongly recommended to improve system functionality, reliability and longevity. These applications include:

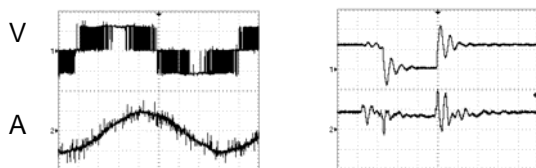
- Long motor cables, up to 200 m
- High capacitance motor cables (i.e. typical "pyro" wire, used for fire protection)
- Multiple motors connected in parallel
- Motors without inverter grade insulation (typically older motors)

A range of high quality output filters are available for Smart Drive with the following key features:

- Limits output voltage gradient, typically $< 200 \text{ V}/\mu\text{s}$
- Limits transient over voltages at the motor terminals, typically $< 1000 \text{ V}$
- Suppression of mains conducted interference in lower frequency ranges
- Compensation of capacitive load currents
- Reduction of RFI emissions from the motor cable
- Reduction of motor losses and audible noise caused by ripple

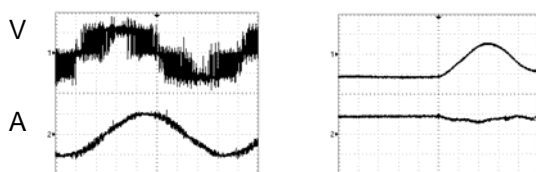
Comparison of characteristics:

Without filter



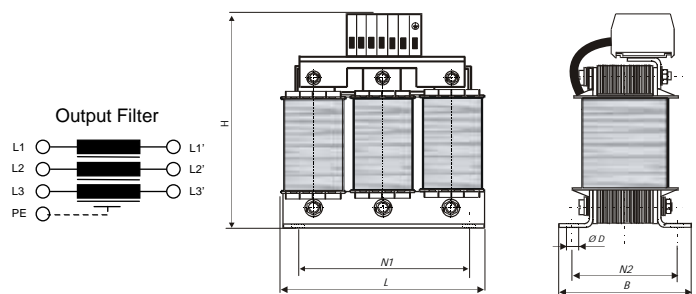
Switching pulse

With filter



Switching pulse

Note with filter that switching pulse rises slower and to a lower amplitude.



Specification

	Smart Drive Size	Rated Voltage	Phase	Rated Current A	Inductance/limb mH
SW-OUTF1-xx	Size 1	< 500V	3	8	2
SW-OUTF2-xx	Size 2			12	1.3
SW-OUTF3-xx	Size 3			30	0.5
SW-OUTF4-xx	Size 4			75	0.22
SW-OUTF5-xx	Size 5			180	0.09
SW-OUTF6-xx	Size 6			250	0.065

Dimensions

	L mm	B mm	H mm	N1 mm	N2 mm	ØD mm	Mass kg
SW-OUTF1-xx	100	90	75	60	48	4	1.5
SW-OUTF2-xx	125	115	85	100	55	5	3
SW-OUTF3-xx	155	160	105	130	57	8	4.5
SW-OUTF4-xx	190	255	125	170	68	8	10
SW-OUTF5-xx	240	310	155	190	106	11	22
SW-OUTF6-xx	300	390	210	240	121	11	40

APPLICATION TIPS

Soft start

Soft starting of any application protects the mechanical drive system reducing wear and tear on bearings, belts, etc. Soft starting also reduces direct on line starting currents from 600% to 100 - 150% of motor rated current.

Motor-drive selection

The number one problem experienced by inexperienced drive users is matching the motor and drive voltage; ensure that the motor terminal box connection (star or delta) corresponds with the drive voltage.

Low speed motor operation

When an application requires a motor to run for long periods of time at low speeds, typically less than 1/3 base speed, and particularly when additional boost is applied, the motor should be force cooled.

EMC

Good cable management is the key to solving EMC problems. Always use screened cable between the drive and the motor and keep control and power cabling separated by at least 100mm. Where control and power cables must cross, ensure that they do so at 90°.

Generators

Soft starting is key in reducing generator costs as a system can be dimensioned for continuous rather than start-up operation (4 - 6 times reduction). A contactor should be placed between the generator and the drive, which should be activated by the Smart Drive's drive healthy output relay. Thus, in the event of a generator over-voltage, the drive will trip causing the contactor to open removing the potentially harmful over-voltage from the drive.

Freewheeling Fans

For Smart Drive E, use dc injection braking on enable to bring free-wheeling fans to rest before starting to control. Starting a drive into a free-wheeling motor creates a direct short-circuit, which damages the drive and the motor.

Variable torque (radial & axial fans)

Variable torque mode can be used to drive radial fans and pumps. Axial/ centrifugal fans or displacement pumps should be driven in constant torque mode (i.e. heavy duty/ 150% overload).

1 phase supplies

Smart Drive offers high power single phase input, three phase output operation up to 45 kW.

Energy Saving

In general, reducing the speed of a process will save energy. Using PI/ feedback control, energy saving can be maximised by running a motor at its optimum speed for a particular situation.

Variable feed rate

It is often useful to run a particular process at optimum power/ load in a wood-saw. A first Smart Drive can be used to drive the primary process and a second Smart Drive can be used to control the feed of the work piece into the primary process. A PI controller uses the load output from the primary Smart Drive as the feedback parameter and then changes the speed of the feed drive to keep the primary process at optimum load.

Harmonics

Drives inherently create harmonic distortion, however the effects can be significantly reduced using input line chokes. Size 4, 5 & 6 drives have integral line chokes giving rise to a significant advantage over other products which require external line chokes. 12 pulse systems can be employed to further reduce harmonic distortion.

Enclosure design

Drive system enclosure design requires a compromise between 1, managing the heat created by the drive(s) in order to keep the enclosure cool to increase component lifetime and 2, the need to seal the enclosure for environmental and safety reasons. "Through hole" mounting where the heatsink is put through a hole in the panel allows the sensitive control electronics to be totally sealed in the front of the panel, whilst the heat generating components in the rear of the panel can be kept cool with "dirty" air.

Long Cables

Ideally a drive should be placed as close as possible to the driven motor. The maximum cable length is specified in the manual, this is for armoured or screened cable. If a non screened cable is used the length can be increased by 50%. When using an output filter the cable length can be doubled.

Parallel Motors

When parallel motors are connected to a drive the extra capacitance of the parallel motors can cause problems. To rate a drive, sum the power ratings of all the motors and add 10 - 15% extra. Take care in checking the total length of the parallel motor cables does not exceed the maximum specified in the user manual – see above "Long Cables". The capacitance effect can be reduced if the motor cabling is "daisy chained" i.e. connected from the drive to motor 1, then motor 1 to motor 2, etc. rather than each motor being connected directly to the drive output directly.

Option Part Number Information

Part No.	Description	Comprises
Smart Drive Plus und Smart Drive VT Optionen		
OPTSSWDCE50F	SW-Manager CE Plus	SW-Manager CE (software pre-installed on Pocket PC)
OPTSWPRKP	Smartport Plus, Remote Keypad	Smartport & data cable 3,0 m
OPTSPRS48503	RS485 data cable, 0.30 m	Cable with RJ11 terminations at each end
OPTSPRS485DC	RS485 data cable, 1.0 m	Cable with RJ11 terminations at each end
OPTSPRS48530	RS485 data cable, 3.0 m	Cable with RJ11 terminations at each end
OPTSPRS485CS	RS485 data cable splitter	RS485 splitter, 1 to 2 connection
OPTSWP485USB	Isolated RS485 to USB PC adapter kit	Isolated RS485 to USB adapter, USB cable & RJ11 cable
OPTSPROFBG04	Profibus gateway	Profibus gateway, 0.3 m cable (RJ11 – 9 way D type)
OPTSDEVNBG04	DeviceNet Gateway	DeviceNet Gateway, 0.3 m cable (RJ11 – 9 way D type)
OPTSLONWBG04	LONworks Gateway	LONworks Gateway, 0.3 m cable (RJ11 – 9 way D type)
OPTSWP3OUTIC	Smart Drive 3 Relay output	3ROUT interface card
Smart Drive E und Smart Drive E1 Options		
OPT-SE-2ANIN	Smart Drive Dual Analogue Input	2ANIN interface card
OPT-SE-2ROUT	Smart Drive Dual Relay Output	2ROUT interface card
OPT-SE-PICON	Smart Drive PI Control Card (analogue)	PICON interface card
OPT-SE-1HVAC	Smart Drive HVAC Relay Output	HVAC interface card
Common Options		
OPTSWEEMC2S1	Smartfilter, Size 1, 220-240 V, 1 Phase, 16 A	External EMC Filter unit (Footprint)
OPTSWEEMC2S1	Smartfilter, Size 2, 220-240 V, 1 Phase, 25 A	External EMC Filter unit (Footprint)
OPTSWEEMC201	Smartfilter, Size 1, 220-480 V, 3 Phase, 6 A	External EMC Filter unit (Footprint)
OPTSWEEMC202	Smartfilter, Size 2, 220-480 V, 3 Phase, 16 A	External EMC Filter unit (Footprint)
OPTSWEEMC203	Smartfilter, Size 3, 220-480 V, 3 Phase, 30 A	External EMC Filter unit (Footprint)
OPTSWBARES2	Smartbrake, Size 2, 100R, 200 W	External Brakeresistor unit
OPTSWBARES4	Smartbrake, Size 4, 33R, 500 W	External Brakeresistor unit
SW-CNW901-16	Smart Drive, Size 1, 220-240 V, 1 Phase, 16 A	Input Inductor
SW-CNW901-25	Smart Drive, Size 2, 220-240 V, 1 Phase, 25 A	Input Inductor
SW-CNW903-06	Smart Drive, Size 1, 380-480 V, 3 Phase, 6 A	Input Inductor
SW-CNW903-10	Smart Drive, Size 2, 380-480 V, 3 Phase, 10 A	Input Inductor
SW-CNW903-36	Smart Drive, Size 3, 380-480 V, 3 Phase, 36 A	Input Inductor
SW-OUTF1-008	Smart Drive Output Filter, Size 1, 480 V, 8.0 A	Output Filter
SW-OUTF2-012	Smart Drive Output Filter, Size 2, 480 V, 12.0 A	Output Filter
SW-OUTF3-030	Smart Drive Output Filter, Size 3, 480 V, 30.0 A	Output Filter
SW-OUTF4-075	Smart Drive Output Filter, Size 4, 480 V, 75.0 A	Output Filter
SW-OUTF5-180	Smart Drive Output Filter, Size 5, 480 V, 180.0 A	Output Filter
SW-OUTF6-250	Smart Drive Output Filter, Size 6, 480 V, 250.0 A	Output Filter I



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