



# OPDE*plus*

DRIVE TECHNOLOGY

   100%  
Italian Technology  
Made in Italy



# — The best technology for your application

The **OPDEplus AC drives** family integrates the best certified components to improve reliability and life of the products in performance applications and heavy duty industrial environments.

The continuous R&D improvements **always comply with the certification required** in the main markets, i.e. **CE** (Europe), **UL** (USA), **cUL** (Canada) and **EAC** (Russia)

The integrated control algorithms allow an effective control of **three-phase asynchronous motors** (IM), **Permanent Magnet Synchronous Motors** (PMSM) and **Synchronous Reluctance Motors** (SynRM).

All drives integrate specific **“energy saving”** functions, as the “Online Maximum-Torque-Per-Ampere” algorithms for synchronous motor to better exploit the contributions of electromagnetic and reluctance torque.

One MCU (**microprocessor control unit**), and a unified firmware with control algorithms, dedicated proprietary selfcalibration routines and an **integrated programmable PLC IEC 61131-3** for the overall AC drives family.

A supervisor easy and reliable for start-up and maintenance.

OPDE plus XS			
SIZE			
CM - MM			
	4	8	12
In @ nominal overload [Arms]			
Nominal power Pn @ 400Vac with default overload			
<b>Heavy:</b> 200% x 3 sec. + 150% x 30 sec. [kW]	1,5	3,2	5,5
<b>Light:</b> 120% x 30 sec. [kW]	1,8	3,8	6,5
<b>Standard:</b> 150% x 30 sec. [kW]	1,6	3,4	5,8
<b>Strong:</b> 200% x 30 sec. [kW]	1,3	2,7	4,7

OPDE plus S - M - L - XL										
SIZE										
S				M		L	XL			
	1	3	7	12	15	22	32	40	46	57,5
In @ nominal overload [Arms]										
Nominal power Pn @ 400Vac with default overload										
<b>Heavy:</b> 200% x 3 sec. + 150% x 30 sec. [kW]	0,5	1,5	3	5,5	7,5	11	15	18,5	20	27,3
<b>Light:</b> 120% x 30 sec. [kW]	0,6	1,8	3,6	6,6	9	13,2	18	22,2	24,0	32,8
<b>Standard:</b> 150% x 30 sec. [kW]	0,6	1,7	3,3	6,1	8,3	12,1	16,5	20,4	22,0	30
<b>Strong:</b> 200% x 30 sec. [kW]	0,6	1,4	2,9	5,2	7,1	10,5	14,3	17,6	19	25,9

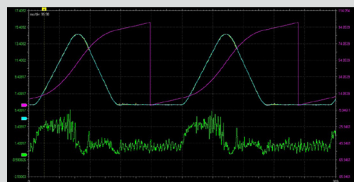
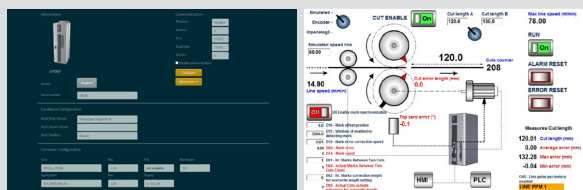
OPDE plus BF1 - BF2 - BF3											
SIZE											
BF1				BF2				BF3			
	70	90	110	150	175	220	250	310	370	460	510
In @ nominal overload [Arms]											
Nominal power Pn @ 400Vac with default overload											
<b>Heavy:</b> 200% x 3 sec. + 150% x 30 sec. [kW]	37	45	55	75	90	110	132	160	200	250	315
<b>Light:</b> 120% x 30 sec. [kW]	45	52	59	83	101	124	149	180	224	284	354
<b>Standard:</b> 150% x 30 sec. [kW]	37	45	55	75	90	110	132	160	200	250	315
<b>Strong:</b> 200% x 30 sec. [kW]	30	37	43	60	73	90	107	130	162	205	255

# Technology

## OPDEplorer *plus*

### Programming, supervision and real time monitoring

**OPDEplorer** is a software developed under Windows environment HTML, XML, that allows the user to optimally configure the drives via PC.



Parametrization support (Wizard)



Digital Softscope function



Upload/Download of FW & SW data



Motors and sensors database



I/O Management



Parameters saving on USB



Alarms Management and history details

## Control features

### Advanced Features

- Fundamental output frequency 0 - 2000 [Hz]
- Switching frequency (PWM) up to 18 [kHz]
- Speed loop bandwidth up to 200 [Hz]
- Current loop bandwidth up to 2000 [Hz]
- Update cycle internal loop: speed, current, positioning and speed task
- PLC task synchronized with the main PWM loop
- Flying Start for IM/PMSM/SynRM
- Two memory banks
- Mechanical System Identification
- Non linear electrical motor parameters identification

### Advanced Application Software

- Electrical gear
- PID regulator/ PID
- Positioning System
- Winder and Unwinder with Servodiameter
- Spindle indexing (Stop in position)
- Linear and Rotary Flying Cutter Starter
- Full electric injection moulding machine
- Digital fast electric axes with SPI
- Servo pump applications
- Custom applications

\* For switching frequency out of range, contact the technical office of BDF DIGITAL S.p.A.

## LOGICLAB 5

### On-board embedded PLC and applications

**LogicLab 5** is an efficient and user friendly environment that develops specific PLC applications that extended the basic features of BDF Digital drives. The standard PLC catalogue can be extended, on demand, to cover many industrial market needs.



STANDARD IEC 61131-3 (IL, ST, LD, FBD, SFC)



Parameters saving on USB



Main PLC task synchronized with PWM cycle

	OPDEplus (PMSM/IM) (OPDEplus S-L-M-XL; BF1,2,3 XS - CM - MM)
Permanent Magnet Synchronous motors (PMSM)	Closed loop with each of the fbk1 and fbk2 sensors
	Built in features for anisotropic motors (PMSM-IPM as MTPA and d-axis phasing @ standstill)
	Sensorless (wide range) optimized for low speed high torque and high speed spindle motors
Asynchronous motors (IM)	Closed loop FOC with each of the fbk1 and fbk2 sensors
	VF control, Modified VF control and optimized VF control with torque compensation
	Sensorless (wide range) optimized for low speed high torque and high speed spindle motors
Synchronous Reluctance Motors (SynRM & AsynRM)	Closed loop with each of fbk1 and fbk2
	Optimized closed loop and sensorless control with flux linkage curves
	Motor control over a wide range of flux weakening
PWM	~ Max 18 [kHz]*
Control loop bandwidth	Current loop: 1400~2000 [Hz] Max
	Speed loop: Max 200 [Hz]
	The max-min range depends of the overall computational effort

# OPDEplus S-M-L-XL BF1-2-3

Continuous control  
and pure power

Designed to control  
every type of electric  
machine in the  
worldwide industrial  
automation market.

Capability of a high  
current overload, the  
products are also  
designed for **air,  
water and gas cooling**  
(e.g. compressors  
applications).

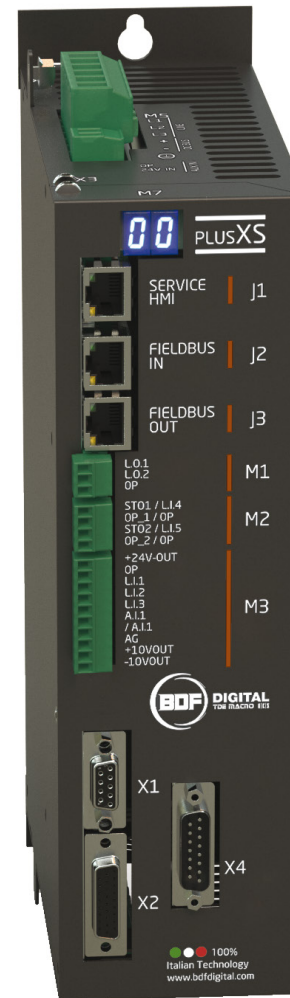


# → OPDEplus XS

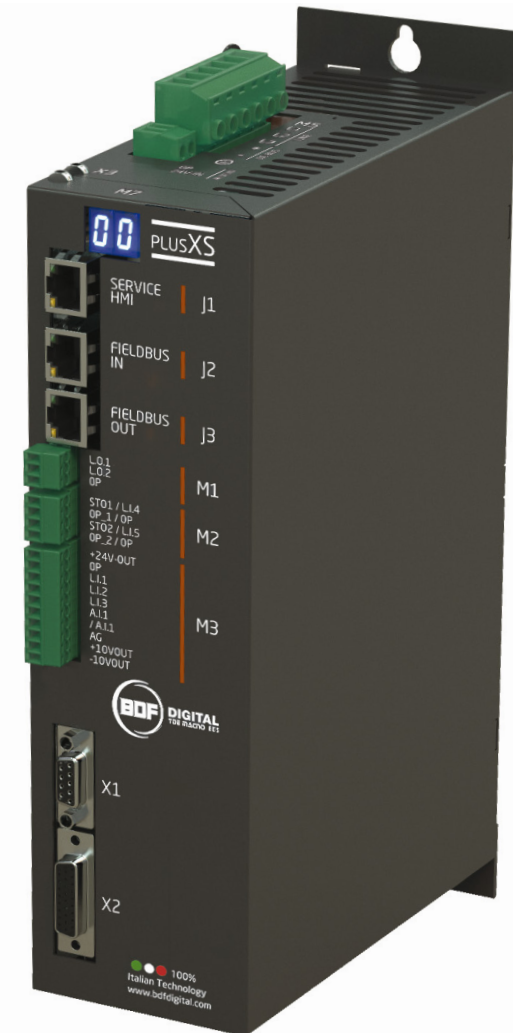
## Universal connection and innovation

One product for all needs.  
Designed to control every type of electric machine in the worldwide industrial automation market.

Multifieldbus Built-in-connectivity  
and one connector to manage  
a wide Feedback range.



**CM**  
(CAN Multifeedback)



**MM**  
(Multibus Multifeedback)

# OPDEplus S-M-L-XL



STO (Safe Torque Off)  
PLe (UNI EN ISO 13849-1)  
SIL3 (EN 61800-5-2)

Integrated Drive to Drive interface SPI  
Regulation Power Supply 24 VDC  
(Back-Up power supply)

\*AC Input: 3 x (200V - 10% ÷ 3 x 480V + 10%)  
DC Input: Vdc (280-10% ÷ 680 + 10%)

RS 485 Modbus RTU for PC programming  
and device interfacing  
(configuration software)

Connector for the remote keypad

USB Key

Frequency Input  
(4 channels or Up / Down frequency)

I/O ANALOG / DIGITAL

Fieldbus interface



1° - 2° Feedback Sensor  
motor and application

U/V/W motor power and external braking resistor  
connection (brake chopper built in)

CAN A/B interfaces **CANopen**

Motor thermal probes (PTC, NTC, KTY84-130,  
KTY83-110, PT1000)

Dimension	S	M	L	XL
H - mm	303	303	322	322
L - mm	89	116	137	194
P / D - mm	253	253	253	253
<b>Kg</b>	4	5,2	5,7	9,6

\* See installation manual for more details

\* AC Input: 3 x (200V - 10% ÷ 3 x 480V + 10%)  
 DC Input: Vdc (280-10% ÷ 680 + 10%)

# OPDEplus XS



RS 485 Modbus RTU (CM)  
 PC programming and device interfacing:  
 EtherNet Modbus TCP/IP (MM)  
 RS 485 Modbus RTU (CM)

Regulation Power Supply 24 VDC  
 (Back-Up)

Multi fieldbus interface for  
 all industrial ethernet standards fieldbuses  
 Ethercat / Profinet (MM)  
 CANopen (CM)

N. 2 configurable digital output  
 STO (SIL3 - PLe) safety function  
 or additional 2 digital input

N. 3 configurable digital input  
 N.1 configurable analog inputs ± 10V  
 Potentiometer Supply ± 10V

Resolver feedback  
 2° External Feedback and/or  
 Simulated Encoder

Motor control feedback (CM/MM)



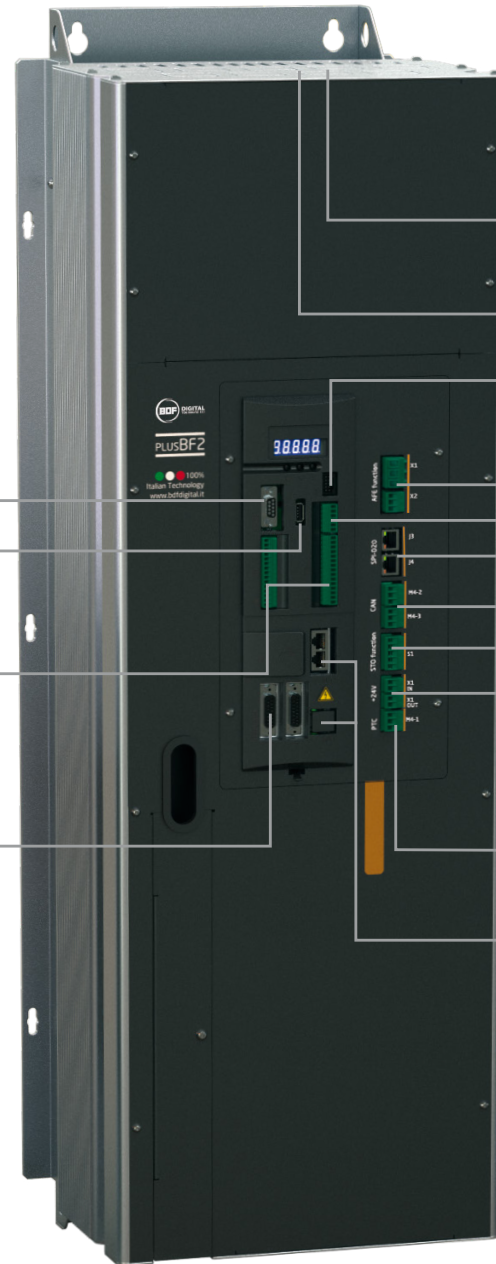
U/V/W motor power and external braking resistor  
 connection (brake chopper built in)

Motor thermal  
 (ON/OFF, PTC, NTC, KTY 84-130,  
 KTY 83 - 110, PT1000)

Dimension	CM - MM
H - mm	276
L - mm	73
P / D - mm	168
<b>Kg</b>	2,5

\* See installation manual for more details

# OPDEplus BF1-2-3



RS 485 Modbus RTU for PC programming and device interfacing (configuration software)

USB Key

N. 8 configurable digital input  
N. 4 configurable digital input  
N. 3 configurable analog inputs  $\pm 10V/4 \div 20 \text{ mA}/0 \div 20 \text{ mA}$

N. 2 configurable analog outputs  $\pm 10V$   
Potentiometer Supply  $\pm 10V$

1° - 2° Feedback Sensor motor and application

\* AC Input:  $3 \times (200V - 10\% \div 3 \times 480V + 10\%)$   
DC Input:  $V_{dc} (280-10\% \div 680 + 10\%)$

U/V/W motor power and external braking resistor connection (brake chopper built in)

Connector for the remote keypad

synchronism (only for AFE or FFE)

Frequency Input (4 channels or Up / Down frequency)

Integrated Drive to Drive interface SPI

CAN A/B interfaces **CANopen**

STO (Safe Torque Off)

PLe (UNI EN ISO 13849-1)

SIL3 (EN 61800-5-2)

Regulation Power Supply 24 VDC  
(Back-Up power supply)

Motor thermal probes  
(PTC, NTC, KTY84-130, KT83-110, PT1000)

Fieldbus interface & MODBUS TCP-IP



Dimension	BF1	BF2	BF3
H - mm	556	978	978
L - mm	248	309	484
P / D - mm	300	315	315
<b>Kg</b>	25	50	85

\* See installation manual for more details



# Static converters

OPDEplus drives can also be applied as regenerative units in industrial automation as AC/DC rectifiers and bidirectional power exchange (absorption or regeneration) depending on the needs. Instead of using dissipative braking resistors, this technology allows energy savings with grid regeneration. Sizes used as regenerative units are **OPDEplus XL, BF 1,2,3**.

## AFE

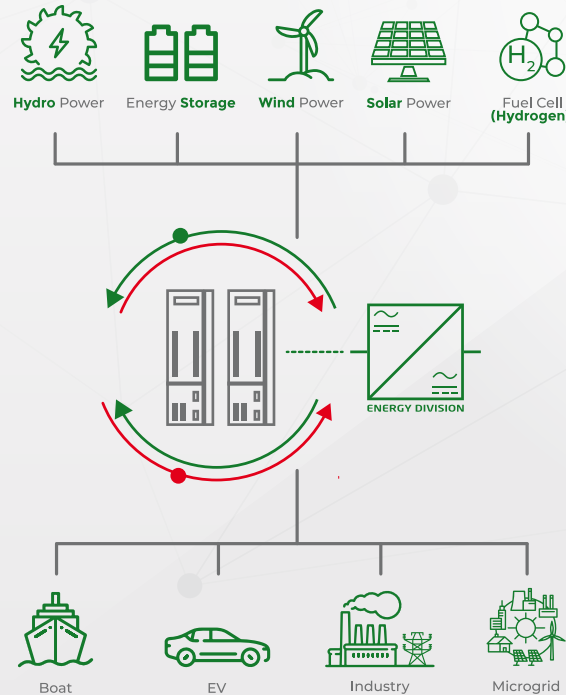
### Active Front End

- **Regenerative AC/DC Unit**
- **Main voltage compensation**
- **Current THD lower than 3%**
- **Operation with or without insulating transformer**
- **Size: 40, 48, 60A with UR certification + BF1, BF2, BF3**
- **µGrid: Grid forming, Grid connected and Grid following operating mode**
- **Black Start**
- **Island mode**
- **Integrated SM (State machine) for uGrid transition mode (load and peak shaving vs island mode)**
- **Droop (Voltage/Frequency) for DG load shaving**

## DC/DC

### Interleaved step up/down converter

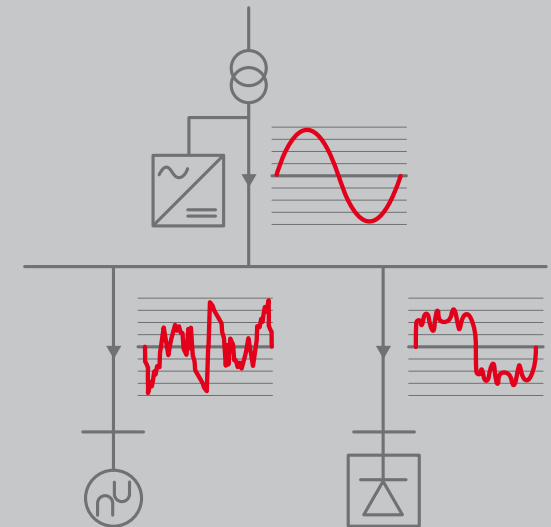
- **Single or parallel configurability**
- **Designed for Marine uGrid configurations and battery charger**
- **Integrated LC output filter**



## AHF

### Active Harmonic Filter

- **Suitable for marine, hospitals and oil/gas plants**
- **Delete harmonics components up to 50th order**
- **Simple cabinet integration**



### AFE plus - FFE plus - DC/DC plus

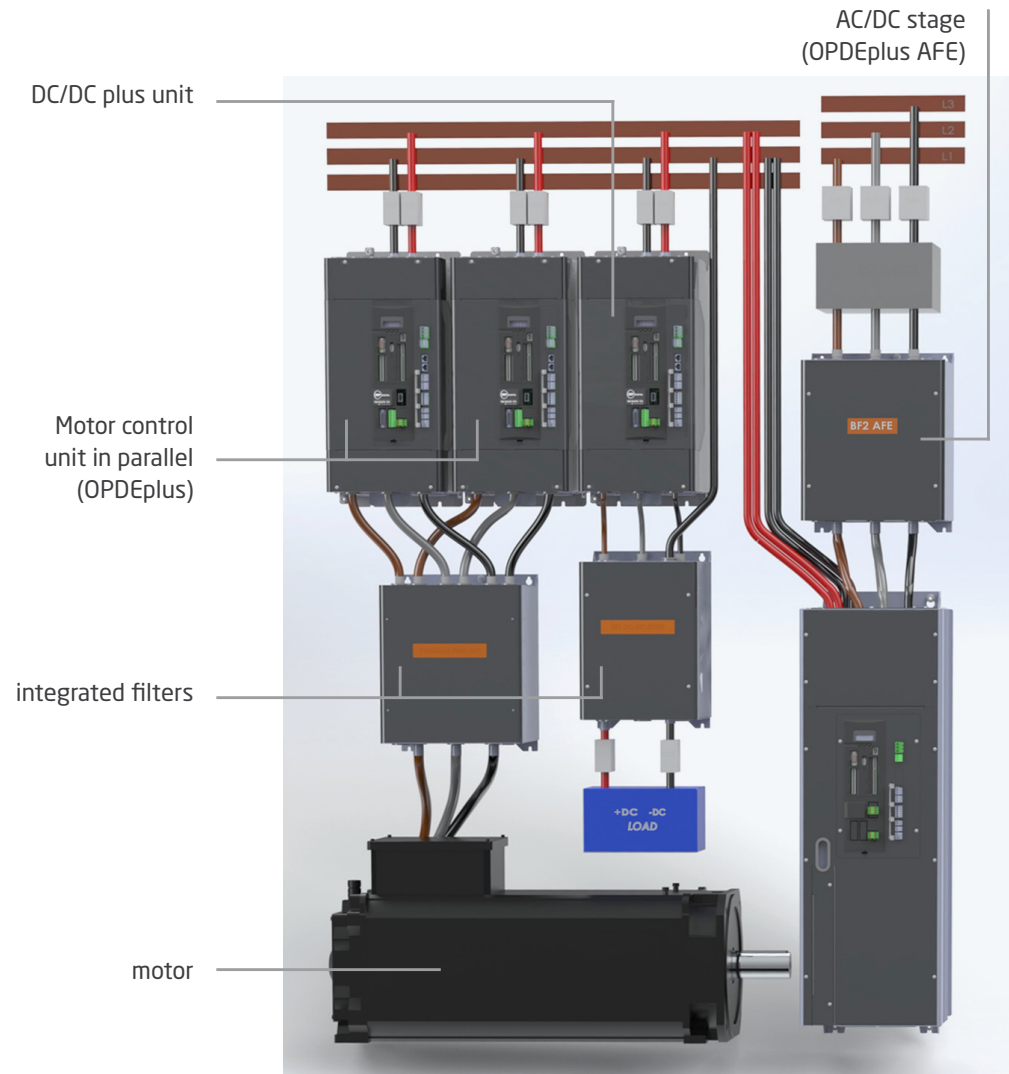
	XL			BF1				BF2			BF3			
Model	40	48	60	70	90	110	150	175	220	250	310	370	460	510
In @ Light Overload 120% x 30 sec. [Arms]	47,4	54,5	68,1	79,3	103	118,4	165,8	195,4	248,6	281,8	348,2	414,4	522,4	570
In @ Standard Overload 150% x 30 sec. [Arms]	42,2	48,5	60,6	70,6	91,7	105,4	147,6	173,9	221,3	250,9	310	368,9	465	507

# — Max feasibility in the automation & energy markets

Parallel motor control solutions with DC-link common bus and regenerative AFE unit

- *OPDEplus family covers the overall automation needs*
- *Motor control, AFE, static conversion capabilities are all handled with the same control unit*
- *The common OPDexplorer plus interface helps the auto tuning, the parametrization and setting of all the converters*
- *The integrated filters reduce the cabinet space allocation*
- *The integrated Drive to Drive channel allows to parallelize up to 8 power units*
- *The cohesistance of a EtherNet-based fieldbus with the integrated CANopen extends the flexibility of our products*
- *BF1|2|3 power units can be mounted with hybrid SiC modules to avoid power derating at high Pwm switching frequency*

Possible cabinet configuration



MAIN FEATURES	OPDEplus (PMSM / IM) (S / M / L / XL / BF1 / BF2 / BF3)	OPDEpXS (CM)	OPDEpXS (MM)
<b>Auto 24V</b>	Yes (Optional)	Yes (Optional)	Yes (Optional)
<b>Sensor feedback 1</b>	Resolver (direct decode)	Resolver (direct decode), integrated with DB9 conn.	Resolver (direct decode), integrated with DB9 conn.
	HiRes resolver (AD2s1210)		
	Hiperface (ST/MT)	Hiperface (ST/MT)	Hiperface (ST/MT)
	SinCos Incremental	SinCos Incremental	SinCos Incremental
	SinCos Absolute	SinCos Absolute	SinCos Absolute
	Every rotary EnDat 01/02/21/22 (with automatic recognition of the parameters) ST/MT	Every rotary EnDat 01/02/21/22 (with automatic recognition of the parameters) ST/MT	Every rotary EnDat 01/02/21/22 (with automatic recognition of the parameters) ST/MT
	Every linear EnDat 01/02/21/22 (with automatic recognition of the parameters) ST/M	Every linear EnDat 01/02/21/22 (with automatic recognition of the parameters) ST/M	Every linear EnDat 01/02/21/22 (with automatic recognition of the parameters) ST/M
	Biss B/C (ST/MT) + Linear	Biss B/C (ST/MT) + Linear	Biss B/C (ST/MT) + Linear
	Tamagawa (ST/MT)	Tamagawa (ST/MT)	Tamagawa (ST/MT)
	TTL (fln max 300 kHz)	TTL	TTL (fln max 300 kHz)
TTL + Hall (fln max 300 kHz)	TTL + Hall (fln max 300 kHz)	TTL + Hall (fln max 300 kHz)	
Hiperface DSL (ST/MT)			
<b>Sensor feedback 2</b>	Resolver (direct decode)	Resolver (direct decode)	Resolver (direct decode)
	HiRes resolver (AD2s1210)	HiRes resolver (AD2s1210)	HiRes resolver (AD2s1210)
	SinCos Incremental	SinCos Incremental	SinCos Incremental
	Every rotary EnDat 01/02/21/22 (with automatic recognition of the parameters) ST/MT	Rotary and linear EnDat 2.1/2.2 (ST/MT)	Rotary and linear EnDat 2.1/2.2 (ST/MT)
	Every linear EnDat 01/02/21/22 (with automatic recognition of the parameters) ST/MT	* Every linear EnDat 01/02/21/22 (with automatic recognition of the parameters) ST/MT	* Every linear EnDat 01/02/21/22 (with automatic recognition of the parameters) ST/MT
	Biss-B/Biss-C (ST/MT) + Linear	Biss-B/Biss-C (ST/MT) + Linear	Biss-B/Biss-C (ST/MT) + Linear
	TTL (fln max 300 kHz)	TTL (fln max 300 kHz)	TTL (fln max 300 kHz)
	Hiperface DSL (ST/MT)	Hiperface DSL (ST/MT)	Hiperface DSL (ST/MT)
<b>Thermal Probes</b>	PT1000/NTC/PTC/KTY84-130/ KTY83-110/I23	PT1000/NTC/PTC/KTY84-130/ KTY83-110/I23	PT1000/NTC/PTC/KTY84-130/ KTY83-110/I23
<b>Simulated Encoder</b>	Yes (only 2nd fbk)***	Yes (only 2nd fbk)	Yes (only 2nd fbk)
<b>Fieldbus *More Fieldbuses can be integrated On demand</b>	CanOpen (on CanA)	Yes	No
	Profinet (TPS1 board)	No	No
	EtherCat (ET1100 board)	No	No
	EtherCat (NetX90)	No	EtherCat (NetX90)
	Profinet (NetX90)	No	Profinet (NetX90)
	MODBUS TCP-IP (NetX90)	Yes	MODBUS TCP-IP (NetX90)
	Profibus	No	No
Anybus M30 (EtherNetIP/DeviceNet)			
<b>CanBus</b>	Integrated (1 x CanA + 1 x CanB)	Integrated (1 x CanA)	No
<b>Modbus RTU (Rs485)</b>	Yes	Yes	Yes
<b>Modbus TCP-IP (3rd Ethernet)</b>	Yes (via NetX90 or Profinet)	No	Yes
<b>Frequency input</b>	Yes (fln max 500 kHz)	No	No
<b>Digital Input</b>	8	3	3
<b>Digital Output</b>	4 x 200 mA	2 x 200 mA	2 x 200 mA
<b>Analog input</b>	3 x ±10V and 4/20 mA (12 bit)	1 x ±10V OR 4/20 mA (12 bit)	1 x ±10V OR 4/20 mA (12 bit)
<b>Analog Output</b>	2	0	0
<b>STO</b>	Yes - (SIL3 - Ple)	Yes (SIL3 - Ple)	Yes (SIL3 - Ple)
<b>Remote keypad</b>	Yes (Optional)	Yes (Optional)	Yes (Optional)
<b>Certification * Except AFE/FFE drive</b>	CE/UL/EAC	CE/UL/EAC	CE/UL/EAC

\* Depending by 1st feedback configuration. The use of 4S0012 on 2nd feedback has to be checked

\*\* For switching frequency out of range, contact the technical office of BDF DIGITAL S.p.A. The maximum switching frequency may be limited by software applications

POWER HW FEATURES	OPDEplus (PMSM / IM) (S / M / L / XL)	OPDEpXS (CM / MM)	OPDEplus (PMSM / IM) BF1	OPDEplus (PMSM/IM) BF2	OPDEplus (PMSM / IM) BF3
<b>External +24V auxiliary supply voltage</b>	Yes	Yes	Yes	Yes	Yes
<b>Internal +24V auxiliary supply voltage</b>	No	Yes (optional)	Yes	Yes	Yes
<b>Maximum rated voltage</b>	480Vac, 3 phases, 50/60 [Hz]	480Vac, 3 phases, 50/60 [Hz]	480Vac, 3 phases, 50/60 [Hz]	480Vac, 3 phases, 50/60 [Hz]	480Vac, 3 phases, 50/60 [Hz]
<b>Network type</b>	Neutral-Grounded TT and TN system and not grounded IT system Corner-grounded TT, TN and IT system	Neutral-Grounded TT and TN system and not grounded IT system	Neutral-Grounded TT and TN system and not grounded IT system	Neutral-Grounded TT and TN system and not grounded IT system Corner-grounded TT, TN and IT system	Neutral-Grounded TT and TN system and not grounded IT system Corner-grounded TT, TN and IT system
<b>Integrated EMI filter (EN 61800-3)</b>	No	Yes	No	No	No
<b>DC/AC version (without AC/DC stage)</b>			Yes (optional)	Yes (optional)	Yes (optional)
<b>Integrated braking unit</b>	Yes	Yes	Yes (optional)	Yes (optional)	Yes (optional)
<b>Internal braking resistor</b>	No	Yes	No	No	No
<b>External braking resistor</b>	Yes	Yes	Yes	Yes	Yes
<b>Available rated current (@ standard overload) (A)</b>	<b>S</b> 1A / 3A / 7A 7.12A <b>M</b> 15A / 22A L 32A <b>XL</b> 40A / 48A / 60A	4A 8A 12A	70A 90A 110A 150A	175A 220A 250A	310A 370A 460A 510A
<b>Rated output power (kW)</b>	<b>S</b> 0,5 / 1,5 / 3 / 5,5 <b>M</b> 7,5 / 11 L 15 <b>XL</b> 18,5 / 22 / 30	1,8 4,0 5,5	37 45 55 75	90 110 132	160 200 250 300
<b>Sizes with removable power terminal blocks (main line side / motor side)</b>	S/M/L	XS	No	No	No
<b>Removable cooling fan</b>	Yes	No	Yes	Yes	Yes
<b>Cooling fan of capacitor bank</b>	<b>S / M</b> Not present <b>L / XL</b> Dedicated cooling fan	Same cooling fan of heatsink	Different cooling fan of heatsink	Different cooling fan of heatsink	Different cooling fan of heatsink
<b>Removable cooling fan of capacitor bank (if present) (can be made by customer)</b>	Yes	No	No	No	No
<b>Control of cooling fan / fans</b>	Yes, ON/OFF	Yes, PWM	Yes, PWM	Yes, PWM	Yes, PWM
<b>Removable capacitors bank (can be made by maintenance department)</b>	<b>S / M / L / XL</b> Yes	No	No	No	No
<b>PWM Switching frequency (KHz) **</b>	1..18	1..18 1..18	1..15	1..10	1..8

\*\*\* f\_out\_Max = 4 Mhz with 5 V\_out version

# Market & Applications

## Automation

GLASS | PACKAGING | PLASTIC | METALS | PAPER | HVACR |  
ROBOTICS | TEXTILE | CABLEWAY

## Energy

WIND | HYDRO | HYDROGEN | SOLAR | STORAGE

## Machine tools

TURNING | MILLING | BENDING | CUTTING | MARBLE WORKING



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