



**INGEDRIVE LV 800**

Frequency Converters

LOW VOLTAGE — WATER COOLED

1000 to 8600 kW  
380 to 690 V

***Ingeteam***

# Frequency Converters

water cooled, low voltage

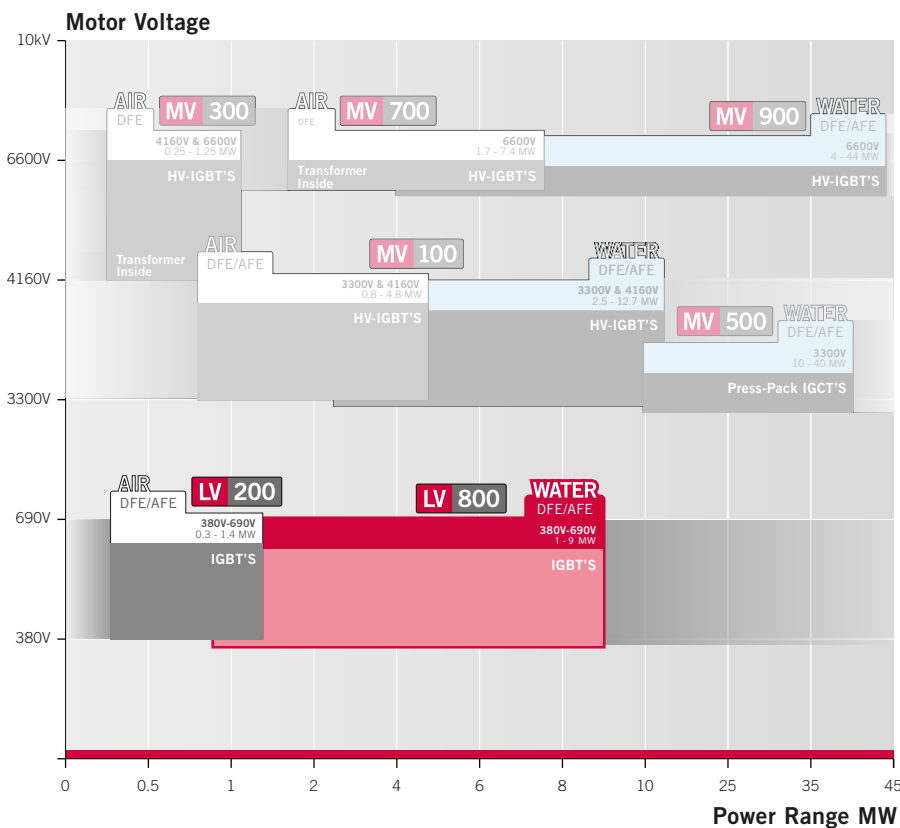
## INGEDRIVE™ LV800

The most flexible, modular low-voltage equipment range on the market.

The INGEDRIVE™ LV800 frequency converter range has been designed to efficiently control energy consumption in any sector requiring high levels of exchange with minimal space and maintenance. Ingeteam has invested more than four decades of experience in designing and manufacturing power converters, applying all of its know-how and including the latest advances in control electronics, with the most reliable semiconductors and passive elements on the market. The result is a robust, compact and efficient family of frequency converters.

Based on the concept of modular design and thanks to the built-in transformer, INGEDRIVE™ LV800 medium-voltage converters cover a wide range of power supply voltages for the most demanding applications in sectors including mining, steelmaking and water pumping amongst others. Likewise, its versatile control architecture together with its powerful CPU (Converter Processing Unit) makes it possible to control any type of electrical rotary machine (be it induction, synchronous or permanent magnet) with the best possible performance in terms of speed and torque precision.

The INGEDRIVE™ LV800 frequency converter range extends up to 8.6MW and is available from 380V to 690V.



**Sectors**  
 Energy Generation  
 Mining, Cement, Materials Transport  
 Steelmaking  
 Water Treatment and Distribution.  
 Test Benches and Wind Tunnels.







## Main Benefits

### Versatility

Its great modularity and huge range of possible combinations make the LV800 a versatile device suitable for many applications.

### Robustness and Integrity

The LV800 range offers different rectification configurations and a two level inverter based on IGBT power semiconductors, making this range highly robust.

### Reliable and User Friendly

Since it is designed with a minimum number of components, the two level topology with IGBTs makes it highly reliable and user friendly.

### Easy Maintenance

It has been designed to minimise and facilitate maintenance and user tasks.

### Highly Compatible

Designed for both new and existing motors thanks to its built-in sinusoidal filter at the converter outlet.

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INGEDRIVE™ LV800 drives are **EMI ready**, guaranteeing the safety and better performance of your installation.

## Control cabinet

### Control Unit

- Powerful CPU for regulation and control, with a built-in PLC for basic control logic.
- Remote diagnostics, monitoring and control via a web application without the need to install any additional software.
- Easily accessible cabinet and main components.
- Modular and scalable control topology.
- Robust, certified control design.



## Cooling cabinet

### Cooling system

- Highly-efficient design.
- Redundant cooling pump.
- Internal air / water exchanger. Minimal air loss.

### High-quality packaging

- Front access for all user and maintenance actions.
- Protection level from IP44 to IP54.

### Easily-accessible cabinets

- Control and power cabling.
- Available with upper or lower inlet.



## Power cabinets

### Output

- Sinusoidal filter included as option, permitting long distances between the motor and the converter or connection to the old motor.

### Precharge resistor

### Input Filter Inductance Common mode design

- Water cooled heatsinks.
- Extraction rails for easy maintenance.

### Inverter with two-level topology based on IGBT semiconductors Basic power modules [BPM]

- Based on IGBTs.
- Easy access, maintenance and exchange.

### Power management module

- Built into the power cabinet and communication with the CPU via fibre optic.

### Input/output cabinet

#### Input

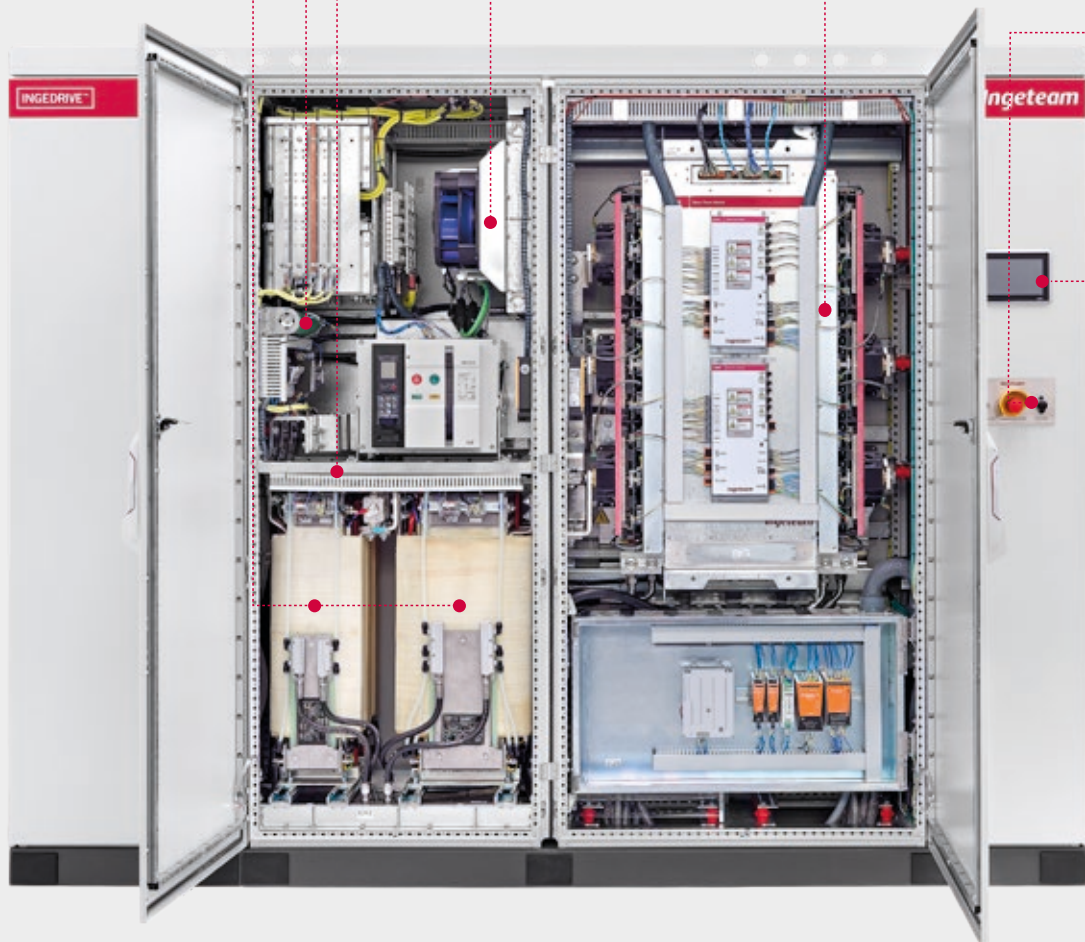
- DFE rectifier option (6P/12P/18P/24P) or AFE (with integrated sinusoidal grid filter).

### Water/Air exchanger

### Touch screen for local control [HMI]

- Powerful, user-friendly interface.
- Remote and local accessible control.

### Emergency stop button



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## Control Features

In order to analyse the potential, architecture and adaptability of the control system offered by INGEDRIVE™ equipment, the following three areas need to be considered:



### HMI and Operator Panel

The whole INGEDRIVE™ family has powerful, user-friendly interface tools developed for parametrisation, commissioning, use and maintenance and for users of all levels, using the following:

- Web Application: Embedded in the CPU with functional features such as software updating, alarms log, parametrisation, with user level definition.
- Operating panel: user-friendly tool with a touch screen containing important information such as the general status, measurement, alarms and basic local control functional features.
- Remote Diagnosis, Control and Log: The whole INGEDRIVE™ family offers clients powerful tools for commissioning and support based on web technology. This server technology only requires a web browser, allowing remote access via Ethernet to all enabled functional features.
- Customized panels: Ingeteam offers a package of tools for developing and customizing the HMI: both the web application and the operating panel are easily customizable so that they can be adapted to client requirements, permitting customized development according to the client's own requirements.

### Hardware Architecture

The control hardware is based on standard shared modules for the whole INGEDRIVE™ family, both in low and medium voltage. The control system consists of the following main modules: PMM [Power Management Module] and CPU [Converter Processing Unit] which permit a multi-drive configuration and can be used for different topologies.

#### The main characteristics are as follows:

- Reliable hardware based on standard modules.
  - Versatile modular design.
  - Validated in different application sectors.
- Advanced processing capacity.
  - DSP processor for regulation and control functions and PLC microprocessor for control logic functions.
- Powerful interface for inputs and outputs.
  - High-resolution measurements.
  - Option for digital/analog input/output expansion.
  - Permits communication with multiple field buses.
- High electromechanical resistance.
  - Robust design with metal casing.
  - EMC-certified (IEC 60092 / IEC 61800).

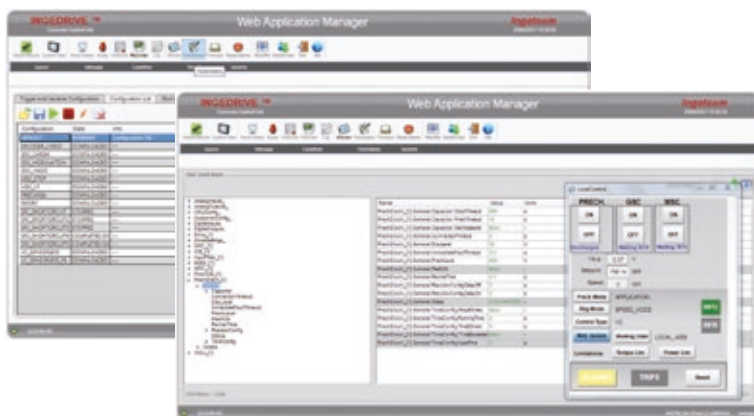
## PLC and Control Software

Standard INGEDRIVE™ devices contain a PLC whose programming is based on the IEC61131-3 standard, allowing the client to use their own logic and program their own signals and communication according to their needs. The INGEDRIVE™ family's control system is so powerful and versatile that it can be adapted to the different converter topologies of the whole range, such as the following:

- Two-level inverter.
- Three-level NPC inverter with vector modulation or selective harmonic elimination.
- 5-level inverters with H-Bridge topology.

Furthermore, the control system is capable of managing not only single-drive but also multi-drive configurations, adapting itself to the requirements of different applications with the following functional features:

- Multidrive topology adapted to the application's requirements.
- DC bus voltage regulation using DFE or AFE technology.
- Posibilidad de Bus DC redundante usando dos rectificadores AFE conectados a redes diferentes.
- Frequency converter for hybrid topologies: Static Frequency Converter.
- Option to control multiple types of machine with auto-tuning control algorithms developed for each type of motor.
  - Asynchronous motor.
  - Synchronous motor (brush / brushless).
  - Permanent magnet motors.
  - Vector control.
  - Control vectorial sin encoder (sensorless).
- Battery control for hybrid topologies.
- Redundant topologies using doubly-fed motors: Synchronous and Asynchronous.





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## Certification

The LV800 series complies with the IEC low-voltage equipment as well as having certifications such as the following:

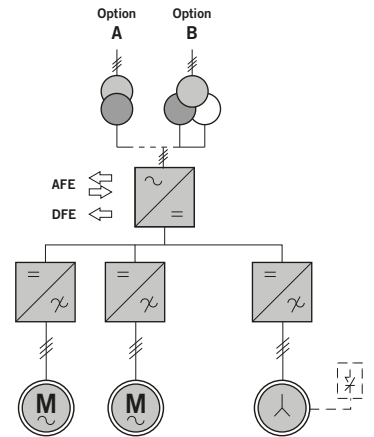
- CE marked certificates
- Marine application certification: BV, DNV-GL, LR, etc.
- Asbestos Free
- Green Passport



## Topologies

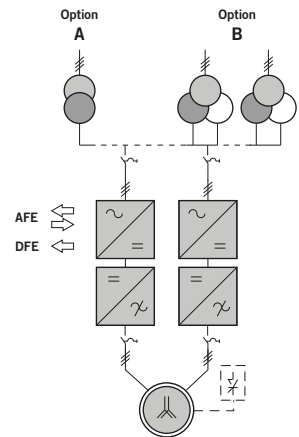
### Multi-Drive Solutions:

Multi-drive applications in which several inverter stages are connected to a common DC bus. When some motors brake, others can accelerate, transferring the energy between both via their DC bus connection. (Example: Mill stands with coilers and decoilers for the metal industry).



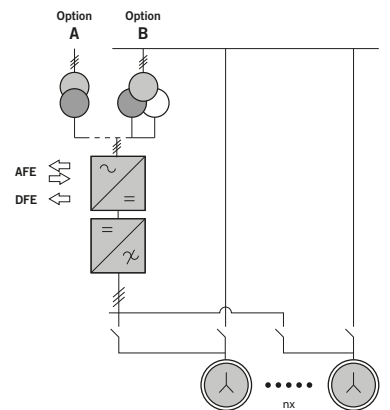
### Redundant single-drive solutions:

Applications which consists of motors doubly fed by two converters whose rectifier phase can be DFE or AFE.



### Single-Drive Solutions:

Standard applications based on a single motor fed by an AFE or DFE converter. Sequential startup option of several motors.





## Why Ingeteam?

### *flexible + customized*

One of Ingeteam's cornerstones and hallmarks by which our clients recognise us is our flexibility and ability to customize our products, services and solutions which, together with the high standards of quality in our products, make INGEDRIVE a leading reference in the major sectors where we are present.

**Flexibility:** Adapting ourselves to design requirements, adapting our products to specific applications, offering flexible service and support whenever and wherever our clients need it.

**Customization:** Taking the core of any INGEDRIVE device, namely the power stack, Ingeteam's design and engineering department adapts the final product to comply with the client's requirements, without compromising reliability or robustness and increasing usability and optimisation for each application. We not only manufacture devices but also personalise them to offer the best solution in a wide range of sectors including the marine sector, industry, mining, and oil & gas. Perhaps this is why 90% of our clients rate us as being flexible and as providing highly-customizable solutions. These two cornerstones are complemented with demanding quality standards which all of our products are subjected to, allowing Ingeteam to offer:



#### **More than 45 years' experience in power converters**

Over 45 years' experience in power electronics for applications in a wide range of sectors including energy generation, industry, mining and the marine sector have created an extensive, solid knowledge base. This enables our design and engineering department to advise our clients on the best option and adapt equipment and software to each particular application, thus offering custom-made solutions.



#### **Load tests of all equipment at rated current**

With the aim of including the latest advances in power electronics in INGEDRIVE™ equipment, Ingeteam boasts the largest power electronics laboratory in southern Europe and one of the biggest in the world. The testing and validating facilities cover a surface area of 13.000 m2 with a capacity for testing equipment over 40MVA and with voltages up to 6.6 kV and a team of international engineers and researchers.

Hence, Ingeteam offers combined or specific tests, besides the routine tests carried out on all INGEDRIVE™ equipment.



#### **Manufactured 100% in Europe**

Ingeteam designs and manufactures the entire INGEDRIVE™ range in its logistics and manufacturing centres in Europe. Ingeteam always works with mainly european leading brands and directly controls the entire manufacturing process to thus ensure the final quality of its products.

Hence, the flexibility, development capacity, customization and quality of our products are key points which make our clients consider us as technological partners.

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380 - 480 V <sub>AC</sub>			w/o filter	With dV/dt output filter	With sinusoidal filter	
Rectifier Type	Power kW	Current A	Width mm	Width mm	Width mm	
 <b>DFE</b>	<b>12 Pulse</b>		1810	2210	2610	
	770	1200	1810	2210	2610	
	960	1500	2210	2610	3010	
	1440	2250	3210	4010		
	1830	2850	3210	4010	2610 <sup>†</sup>	
	1930 <sup>**</sup>	3000	2010 <sup>†</sup>	2410		
	2750	4275	2010 <sup>†</sup>	2410 <sup>†</sup>	2810 <sup>†</sup>	
	2890 <sup>**</sup>	4500	3210 <sup>†</sup>	4010 <sup>†</sup>		
	5280	8200	3210 <sup>†</sup>	4010 <sup>†</sup>		
	5500 <sup>**</sup>	8550			4810 <sup>†</sup>	
	5790 <sup>**</sup>	9000				
	<b>18 Pulse</b>		3950	6145	2410 <sup>†</sup>	2810 <sup>†</sup>
		4340 <sup>**</sup>	6750			3810 <sup>†</sup>
	<b>24 Pulse</b>		1830	2850	3210	4010 <sup>†</sup>
		1930 <sup>**</sup>	3000	3210	4010	2610
		2750	4275	2010 <sup>†</sup>	2410	
		2890 <sup>**</sup>	4500	2010 <sup>†</sup>	2410 <sup>†</sup>	2810 <sup>†</sup>
		5280	8200	3210 <sup>†</sup>	4010 <sup>†</sup>	
		5500 <sup>**</sup>	8550	3210 <sup>†</sup>	4010 <sup>†</sup>	
		5790 <sup>**</sup>	9000			4810 <sup>†</sup>
	 <b>AFE</b>	840	1200	2410	2810	3210
1050		1500	2410	2810	3210	
1580		2250	2810	3210	3610	
2000		2850	2410 <sup>†</sup>	2810 <sup>†</sup>	3210	
2100 <sup>**</sup>		3000	2410 <sup>†</sup>	2810 <sup>†</sup>	3210 <sup>†</sup>	
3000		4275	2610 <sup>†</sup>	3010 <sup>†</sup>		
3160 <sup>**</sup>		4500	2610 <sup>†</sup>	3010 <sup>†</sup>	3410 <sup>†</sup>	
4310		6145	3610 <sup>†</sup>	4210 <sup>†</sup>		
4740 <sup>**</sup>		6750			5010 <sup>†</sup>	
5760		8200	4410 <sup>†</sup>	5210 <sup>†</sup>		
6010 <sup>**</sup>		8550	4410 <sup>†</sup>	5210 <sup>†</sup>		
6320 <sup>**</sup>		9000			6010 <sup>†</sup>	

<sup>\*\*</sup> Double winding motor required (not applicable when using sinusoidal output filter)

Depth: 605 mm

<sup>†</sup>Depth: 1205 mm

Height: 2165 - 2205 mm

525 - 690 V <sub>AC</sub>			w/o filter	With dV/dt output filter	With sinusoidal filter
Rectifier Type	Power kW	Current A	Width mm	Width mm	Width mm
 <b>DFE</b>	<b>12 Pulse</b>				
	1150	1200	1810	2210	2610
	1440	1500	1810	2210	2610
	2170	2250	2210	2610	3010
	2750	2850	3210	4010	
	2890**	3000	3210	4010	2610 <sup>†</sup>
	4130	4275	2010 <sup>†</sup>	2410 <sup>†</sup>	
	4340**	4500	2010 <sup>†</sup>	2410 <sup>†</sup>	2810 <sup>†</sup>
	7930	8200	3210 <sup>†</sup>	4010 <sup>†</sup>	
	8260**	8550	3210 <sup>†</sup>	4010 <sup>†</sup>	
	8690**	9000			3810 <sup>†</sup>
	<b>18 Pulse</b>				
	5930	6145	2410 <sup>†</sup>	2810 <sup>†</sup>	
	6520**	6750			3810 <sup>†</sup>
	<b>24 Pulse</b>				
	2750	2850	3210	4010	
	2890**	3000	3210	4010	2810 <sup>†</sup>
	4130	4275	2010 <sup>†</sup>	2410 <sup>†</sup>	
	4340**	4500	2010 <sup>†</sup>	2410 <sup>†</sup>	3810 <sup>†</sup>
	7930	8200	3210 <sup>†</sup>	4010 <sup>†</sup>	
	8260**	8550	3210 <sup>†</sup>	4010 <sup>†</sup>	
8690**	9000			4810 <sup>†</sup>	
 <b>AFE</b>	1210	1200	2410	2810	3210
	1510	1500	2410	2810	3210
	2270	2250	2810	3210	3610
	2870	2850	2410 <sup>†</sup>	2810 <sup>†</sup>	
	3030**	3000	2410 <sup>†</sup>	2810 <sup>†</sup>	3210 <sup>†</sup>
	4310	4275	2610 <sup>†</sup>	3010 <sup>†</sup>	
	4540**	4500	2610 <sup>†</sup>	3010 <sup>†</sup>	3410 <sup>†</sup>
	6200	6145	3610 <sup>†</sup>	4210 <sup>†</sup>	
	6820**	6750			5010 <sup>†</sup>
	8280	8200	4410 <sup>†</sup>	5210 <sup>†</sup>	
	8630**	8550	4410 <sup>†</sup>	5210 <sup>†</sup>	
	9090**	9000			6010 <sup>†</sup>

\*\* Double winding motor required (not applicable when using sinusoidal output filter)

Depth: 605 mm

<sup>†</sup>Depth: 1205 mm

Height: 1955 mm



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## Considerations

**Motor type:** Squirrel Cage induction

**Performance:** 95%

**Power factor:** 0,9

**Ambient temperature:** 0 °C to 40 °C (max.). Up to 50 °C with reduction factor

Dv/dt filter required for distances between converter/motor > 40m

**Load type:** Variable torque

**Altitude:** < 2000 m.a.s.l. (metres above sea level)

## Standard Characteristics

### Hardware Interface

Analog inputs: 2

Analog outputs: 2

Digital inputs: 9

Digital outputs: 10

Emergency control with wire break detection: 4

Basic control panel: E-Stop, CPU access and local-remote switch

Redundant Encoder (Except for sensorless control) [Encoder not supplied with the drive]

### Miscellaneous

Lighting and socket in control cabinet

Color operation touch screen (HMI) - 7"

Space heaters (to avoid condensation in enclosures)

Varnished boards

Fixing rods and door retainers (only marine applications)

Lifting lugs

RAL7035 cabinet color

IP44. IP54 with suitable MCT sealing modules [Water]

CE Marking and green passport certification

Halogen free and flame retardant materials

Road truck packing (basic wooden box)

### Electronic Components

Input filter (AFE and 6P DFE only)

Input contactor (only for AFE and 6P DFE)

Internal Precharge and Discharge System

Long life Polypropylene Capacitors

### Functionalities

Black Out Prevention

Fault Ride Through Capability

Encoder / encoderless vector control

Flying Start Functionality

### Software

Programming plus Ingewebapp Remote Access. No license required

### Documentation

Documentation set (2 printed + 2 digital) in English or Spanish

Optional Features		
Hardware interface	Extended hardware interface/package	Analog inputs: +2 Analog outputs: +2 Digital inputs: +10 Digital outputs: +10
	Extended emergency control circuit with wire break detection: +5	
	Emergency control with wire break + short-circuit detection	
	Extended control panel: BCP + drive connection and NFU control	
	Expansion IO modules for additional connectivity	
	External heaters control and feeding (up to 300W)	
	External fans control and feeding	
	External Pt100 measurement (up to 8 channels)	
Communications	F.O.Adaptor	
	Profibus-DP, Modbus TCP, CAN Open, Modbus RTU, DeviceNet	
	Other Fieldbus Communication Protocol	
Miscellaneous	Filter for primary coolant [for water cooled drives]	
	Primary sea water cooling [for water cooled drives]	
	Side cooling pipes access [for water cooled drives]	
	MCT sealing modules	
	Special RAL painting	
	Reactive power compensation only for converters with AFE rectifiers	
	Special degree of protection	
	Customized cabinet indications (placed on door)	
	Vibration Dampers	
	Packing for maritime transportation	
Electrical Components	Internal UPS	
	Input circuit breaker instead of contactor for 6P and AFE rectifiers	
	Output breaker*	
	Output manual switch	
	EMI filter	
	Insulation Monitoring System (Only for transformerless connection)	
	Excitation module for synchronous motors	
	Special auxiliary supply voltage	
	Grid side top power cable access	
	Motor side top power cable access	
	Control top cable access	
	Sinusoidal filter	
	Dynamic Braking Chopper	
Documentation	Additional documentation set and language	
Certification	DNV-GL, LR, BV, CCS, RINA, RRR, TL, Others	
Witness FAT	Per day. Only standard tests included	
Overloads	Derating at low frequencies & overloads	

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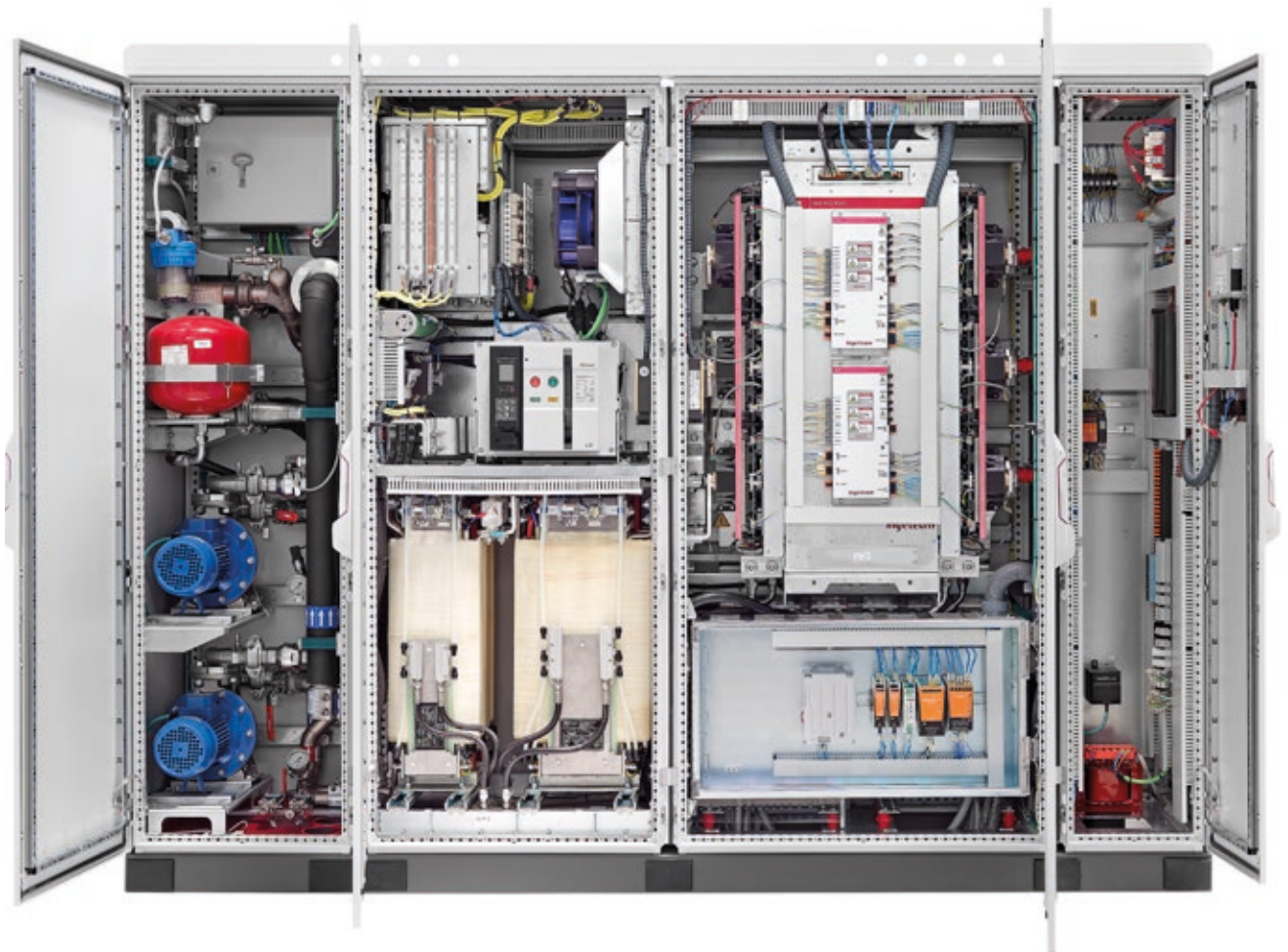
**CRS  
360°**

**CUSTOMER  
RELATIONSHIP  
SERVICE**

## INGEDRIVE™ Support

In our commitment to offering our clients complete and personalised solutions, Ingeteam offers a 360° CRS (Customer Relationship Service) with all of our product range, providing you with comprehensive consultancy, direct technical support, training and maintenance services throughout the lifetime of our products.

360° CRS is a dynamic, personalised service that covers all of stages and contact points between Ingeteam and our clients. The 360° CRS programme is supported by a professional technical team whose goal is client satisfaction and continuous improvement of products and services, always hand in hand with the latest advances and technologies in each application sector.





## The following services are part of the 360° CRS programme



### Support with technicians and engineers. Direct access to design engineers and R+D

During the warranty period, in the event of an incident, Ingeteam guarantees assistance with key technicians and engineers providing advice and high-quality support to our clients.

Additionally, Ingeteam offers its clients the option to extend out-of hours customer support services provided by the Ingedrive technical support team by means of customized contracts to suit the needs of our clients.



### 25-year life cycle incl. service + spares

Ingeteam guarantees the repair service of the entire INGEDRIVE™ family for a period of 25 years as of the date of purchase of our equipment.



### Remote Access

INGEDRIVE™ products are ready to be monitored remotely which enables Ingeteam's technical team to offer our clients the option to track and analyse any incident in a device remotely.



### Commissioning

The commissioning of INGEDRIVE™ equipment is carried out by highly-qualified, multidisciplinary staff with experience in a wide range of sectors, to ensure your installation has best adaptation and best performance. This, together with the fact that devices leave the factory having been completely tested and verified, makes the commissioning time considerably shorter.



### Spare Parts Stock

Ingeteam has designed the INGEDRIVE™ range based on the concept of power stacks. This enables us to have a permanent stock of main converter components in our logistical and manufacturing centres, reducing the supply times for immediately attending to potential emergencies to a minimum.



### Repairs [Field Service]

Anytime, anywhere. The aim of INGEDRIVE™ Support is to minimise the impact of a potential stoppage or incident in our devices.



### Technical Support and Engineering

Ingeteam offers its clients pre-sales technical and engineering support in order to provide assistance and advice during the initial stages and from the project definition to the commissioning of our equipment and delivery of our installations.



### Training [Training Centre]

Ingeteam's team of course leaders offers comprehensive, customized theory and practical programmes to meet the training requirements of its clients.

Ingeteam has a specific area for providing theory and practical classes where we have specific material and converters with different topologies from the entire INGEDRIVE™ range. The different options can be summarised in two levels in which the subject content and depth of learning is adapted to the student and to the aim of the course.

- User Level Course:  
Explains maintenance and troubleshooting Aimed at users and end users.
- Expertise Level Course:  
Aimed at equipment commissioning engineers. Suitable for integrators.

**Ingeteam Power Technology S.A.**  
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***Ingeteam***

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