



**INGEDRIVE MV100**

Frequency Converters

MEDIUM VOLTAGE — AIR COOLED

800 to 4.800 kW  
3,3 to 4,16 kV

***Ingeteam***

# Frequency Converters

air cooled, medium voltage

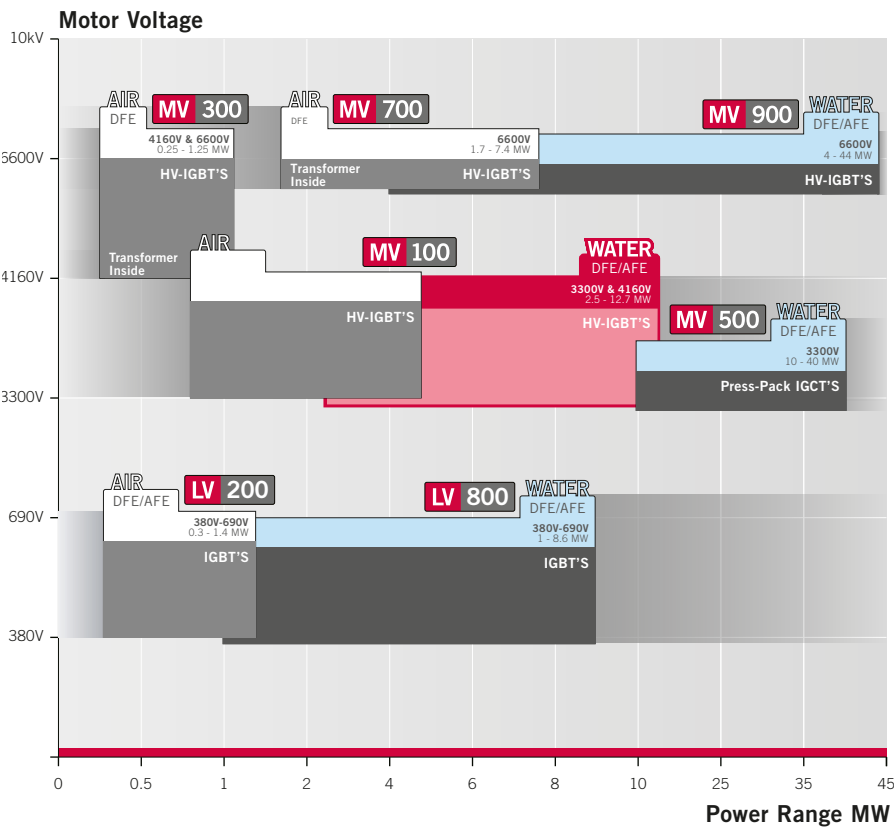
## INGEDRIVE™ MV100 Air

### The most versatile and compact solution for medium-voltage applications.

The INGEDRIVE™ MV100 frequency converter range in its air version has been designed to efficiently control power generation and control 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 latest semiconductors and passive elements on the market. The result is a compact, versatile and reliable family of frequency converters.

Based on the concept of modular design, INGEDRIVE™ MV100 medium-voltage converters cover a wide range of powers and voltages for the most demanding applications in sectors including mining, water treatment and distribution, steelmaking and power generation amongst others. Preferably, its versatile control architecture together with its powerful CPU (Converter ProcessingUnit) 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 as well as dynamic response.

The INGEDRIVE™ MV100 air-cooled frequency converter range extends up to 4.8 MW and is available in 3.3 kV and 4.16 kV.



- Sectors**
- Marine & Offshore
  - Power Generation
  - Mining, Cement, Materials Handling
  - Steelmaking
  - Water Treatment
  - Test Benches and Wind Tunnels





## Main Benefits

### Huge Versatility

The MV100 range is available with different rectifier configurations, both for simple topologies for one single inverter as well as for configurations with a common DC bar in multi-drive solutions..

### Reliable and User Friendly

Since it is designed with a minimum number of components, the 3L-NPC topology with HV-IGBTs makes it highly reliable and user friendly.

### Extensive Range

Its modular design enables it to cover a wide range of powers up to 4.8 MW with a control system capable of controlling any type of motor and generator.

### 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.

### Designed to work at heights

The INGEDRIVE™ MV100 family has been specially designed to work under the most harsh environmental conditions and in the most extreme applications including installations at heights up to 5000 m.a.s.l.

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A proven, scalable, modular architecture with a configurable, high performance design

Powerful protective, communication and control functionalities.

## Control Cabinet and fans

### Cooling System

- High efficient design.
- Redundant variable speed fans (optional).
- Low noise level.
- Air input filters.

### High quality enclosure

- Full front access.
- Protection degree from IP21 to IP42.

### Converter Control Unit

- Powerful CPU for regulation & control with an integrated PLC logic.
- Remote diagnostics, monitoring and control via Web Application without an extra software.
- Extra accessible cabinet for Control Components.
- Modular and scalable Control Topology.
- Robust and certified control design.

### Extra features included as Standard

- Insulation monitoring system.
- UPS system and galvanic isolation with external cabling to ensure maximum control operability.

### Incoming & Control Cabinet

- 12/ 24-pulse input transformer included in extra cabinet as an option.



## Input Cabinet

### Grid & Motor user friendly

- Standard dv/dt filter included, allowing high cable lengths between converter and motor.
- Sinusoidal filter integration in the same cabinet as an option, allowing long cable lengths between converter and motor.

### Accessible input cabinet

- For control and power cabling.
- Top and bottom cabling entry.

### Conexions

- Separated control cabling, power cabling, PE (Protection Earth) and PG (Power Ground).

### Security

- Door Security Interlock System.
- Ground Switch and keys sequence for full security, including control interlock.



## Power Cabinet

### 3-Level voltage source inverter using HV-IGBT power semiconductors

### Human Machine Interface (HMI) on door

- Powerful and easy to use interface.
- Remote and local control available.

### Basic Power Modules

- Based on 4.5 kV / 6.5 kV HV-IGBTs.
- Easy access, maintenance and replacement.
- Fiber optic control cable.

### Power Management Module

- Integration in the Power Cabinet, isolated from basic control electronics via Fiber Optic.

### Key and control Interlocked earthing switch

### Compact & Modular

- Up to 7 BPMs in the same cabinet for AFE+Inverter+Chopper solution.
- 12P / 24P DFE Available in the same dimensions that AFE Solution.

### Pre-charge Module

### Emergency Pushbutton



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## Control features

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



## HMI and Operator Panel

The whole INGEDRIVE family has powerful, user-friendly interface tools developed for parameterisation, 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, parameterisation, with user level definition.
- Operator Panel: User-friendly tool with a touchscreen containing important information such as the general status, measurements, 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 tool package for developing and customising HMIs: Both the Web Application and the Operator Panel are easily customisable so that they can be adapted to client requirements, including the client's own development.

## 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 single drive or 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.  
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).

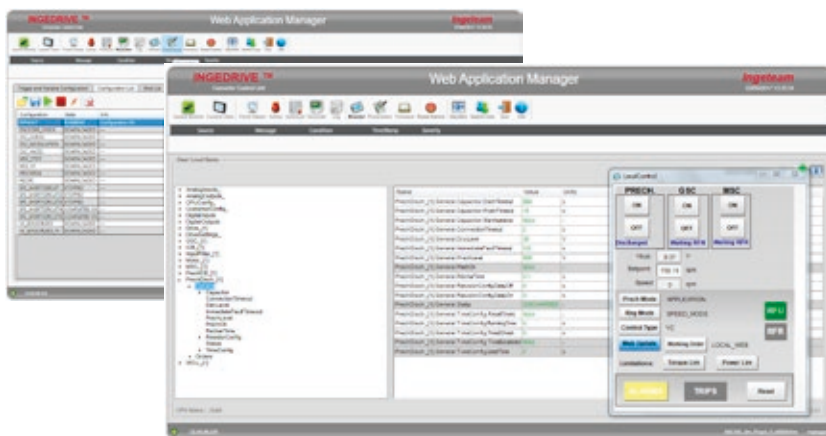
## PLC and Control Software

Standard INGEDRIVE devices contain a PLC whose programming is based on the 61131-3 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 not only managing 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.
- Redundant DC bus option using two AFE rectifiers connected to different power networks.
- 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 (brushed and brushless control).
  - Permanent magnet motors.
  - Vector control.
  - Encoderless vector control.
- Battery control for hybrid topologies.
- Redundant topologies using doubly-fed motors. Synchronous and asynchronous.



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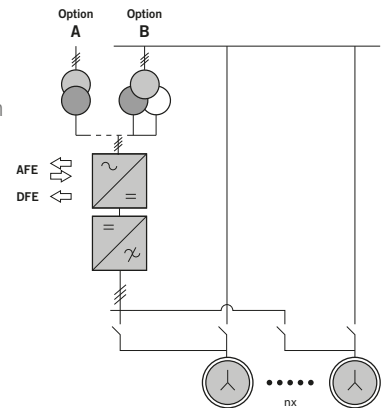
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## Topologies

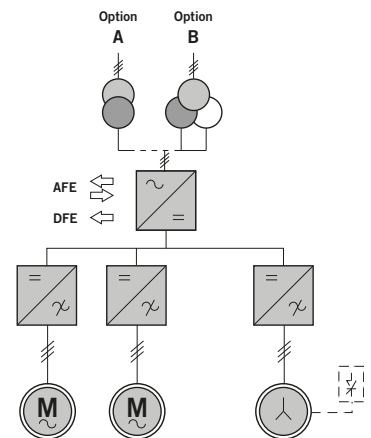
### Single-drive solution:

a standard application consisting of one motor with a winding fed through a DFE or AFE converter. Sequential synchronous start as an option.



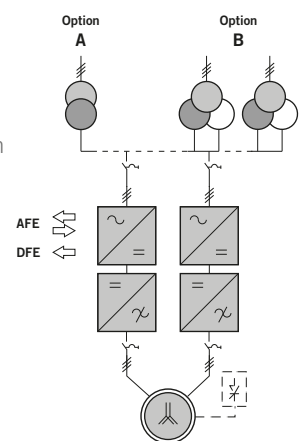
### Redundant single-drive solution:

an application consisting of a motor with two windings fed by two inverters. The rectifier side can be DFE or AFE.



### Multi-drive solution:

Multi-drive application in which several inverters are connected to one single DC bus. While some motors can be braking, others can be motoring, thus transferring energy between themselves through the DC bus (i.e. tension reels on reversing cold mills in the metal industry and test bench applications).



## Certification

The MV100 series complies with the IEC standards for medium-voltage equipment as well as having certifications such as the following:

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



## Why Ingeteam?

### *flexible + customized*

One of Ingeteam's cornerstones and hallmarks by which our clients recognise us is our flexibility and ability to customise 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 main element of any INGEDRIVE™ equipment which is the BPM (Basic Power Module) or power module. Ingeteam's design and engineering department adapts the final product to comply with each client's specific 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 over 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, customisation and quality of our products are key points which make our clients consider us as technological partners..



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3300 V <sub>AC</sub>				With dV/dt output filter		With sinusoidal output filter		
Rectifier Type	Power kW	Current A	Width mm	Weight kg	Width mm	Weight kg		
 <b>12 Pulse</b> <small>V<sub>IN</sub> = 2x 1850 V<sub>AC</sub></small>  <b>DFE</b>	800	161	1810	1410	1810	1780		
	1100	222						
	1500	302						
	1800	363						
	<b>24 Pulse</b> <small>V<sub>IN</sub> = 4x 1850 V<sub>AC</sub></small>	800	161	1810	1600	2010	2000	
		1100	222					
		1500	302					
		1800	363					
		2250	453	3610	3000	3610	3700	
		2750	554					
		3240	653					
		3600**	725					
<b>36 Pulse</b> <small>V<sub>IN</sub> = 6x 1850 V<sub>AC</sub></small>	4200	846	5410	4500	5410	5500		
	4800	967						
 <b>With ext. transformer (Xsc 15%)</b> <small>V<sub>IN</sub> = 3300 V<sub>AC</sub></small>  <b>AFE</b>	800	161	1810	1700	2010	2100		
	1100	222						
	1500	302						
	1800	363						
	2250	453	3610	3400	4010	4100		
	2750	554						
	3240	653						
	3600**	725						
	4200	846	5410	5100	6010	6100		
	4800	967						
<b>With ext. transformer and input LC filter (Xsc 7%)</b> <small>V<sub>IN</sub> = 3300 V<sub>AC</sub></small>	800	161	2610	2300	2610	2700		
	1100	222						
	1500	302						
	1800	363						
	2250	453	5210	4600	5210	5300		
	2750	554						
	3240	653						
	3600**	725						
	4200	846	7810	6900	7810	8000		
	4800	967						
<b>Transformerless</b> <small>V<sub>IN</sub> = 3300 V<sub>AC</sub></small>	800	151	2610	2500	2610	2900		
	1100	222						
	1500	302						
	1800	363						
	2250	453	5210	5000	5210	5700		
	2750	554						
	3240	653						
	3600**	725						
	4200	846	7810	7500	7810	8500		
	4800	967						

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

Depth: 1170 mm Height: 2380 mm (cabinet) 2770 mm (cabinet+fans)

4160 V <sub>AC</sub>		With dV/dt output filter			With sinusoidal output filter		
Rectifier Type	Power kW	Current A	Width mm	Weight kg	Width mm	Weight kg	
 <b>DFE</b> 12 Pulse <small>V<sub>IN</sub> = 2x 2350 V<sub>AC</sub></small>	800	128	1810	1500	2010	2150	
	1100	176					
	1500	240					
	1800	288					
	24 Pulse <small>V<sub>IN</sub> = 4x 2350 V<sub>AC</sub></small>	800	128	1810	1600	2010	2250
		1100	176				
		1500	240				
		1800	288				
		2250	360	3610	3000	4010	4200
		2750	439				
		3240	518				
		3600**	575				
36 Pulse <small>V<sub>IN</sub> = 6x 2350 V<sub>AC</sub></small>	4200	671	5410	4500	6010	6300	
	4800	767					
 <b>AFE</b> With ext. transformer (Xsc 15%) <small>V<sub>IN</sub> = 4160 V<sub>AC</sub></small>	800	128	1810	1700	2010	2300	
	1100	176					
	1500	240					
	1800	288					
	2250	360	3610	3400	4010	4600	
	2750	439					
	3240	518					
	3600**	575					
	4200	671	5410	5100	6010	6900	
	4800	767					
With ext. transformer and input LC filter (Xsc 7%) <small>V<sub>IN</sub> = 4160 V<sub>AC</sub></small>	800	128	2610	2800	2810	3400	
	1100	176					
	1500	240					
	1800	288					
	2250	360	5210	5600	5610	6800	
	2750	439					
	3240	518					
	3600**	575					
	4200	671	7810	8400	8410	10200	
	4800	767					
Transformerless <small>V<sub>IN</sub> = 4160 V<sub>AC</sub></small>	800	128	2610	3100	2810	3700	
	1100	176					
	1500	240					
	1800	288					
	2250	360	5210	6200	5610	7400	
	2750	439					
	3240	518					
	3600**	575					
	4200	671	7810	9300	8410	11100	
	4800	767					

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

Depth: 1170 mm Height: 2380 mm (cabinet) 2770 mm (cabinet+fans)

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## Considerations

**Motor type:** Squirrel Cage Type with Efficiency: 96.5% & Power Factor: 0.90

**Ambient Temperature:** 0 °C to +40 °C (max) up to 50 °C with derating

**Chopper braking resistor excluded & to be placed external to cabinet**

**Load Type:** Variable and/or constant torque

**Altitude:** < 1,000 m.a.s.l. / Up to 5000 m.a.s.l. with power derating

## Standard Characteristics

<b>Hardware Interface</b>	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]
<b>Miscellaneous</b>	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
	IP21
	CE Marking and green passport certification
	Halogen free and flame retardant materials
<b>Electronic Components</b>	Insulation Monitoring System (Except for transformerless connection)
	Internal Precharge and Discharge System
	Long life Polypropylene Capacitors
	Internal UPS
<b>Functionalities</b>	Black Out Prevention
	Fault Ride Through Capability
	Sensorless vector control
	Flying Start Functionality
<b>Software</b>	Programming plus Ingewebapp Remote Access. No license required
<b>Documentation</b>	Documentation set (2 printed + 2 digital) in English or Spanish

**Optional Features**

<b>Hardware interface</b>	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	
	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)	
<b>Communications</b>	Profibus-DP, Modbus TCP, DeviceNet, Profibus DP, CAN Open, Modbus RTU, DeviceNet	
	Other Fieldbus Communication Protocol	
<b>Miscellaneous</b>	Special degree of protection (Up to IP42)	
	Reactive power compensation only for converters with AFE rectifier	
	Special RAL painting	
	Customized cabinet indications (placed on door)	
	Packing for maritime transportation	
	MCT sealing modules	
<b>Electrical Components</b>	Output breaker	
	Output manual switch	
	EMI filter	
	Insulation Monitoring System (Only for transformerless connection)	
	Excitation module for synchronous motors (Ref.: MC9101-A)	
	Special auxiliary supply voltage	
	Grid side top power cable access	
	Motor side top power cable access	
	Control top cable access	
	Over Voltage Limiter Unit (OVLU)	
	Dynamic Braking Chopper	
	Redundant fans	
	Integrated transformer Vin < 11kV	
<b>Documentation</b>	Additional documentation set and language	
<b>Certification</b>	DNV – GL, LR, BV, CCS, ABS, RINA, RRR, TL, Others	

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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.**  
Parque Tecnológico de Bizkaia, Edificio 110  
48170, Zamudio. Bizkaia. Spain  
[ingedrive.info@ingetteam.com](mailto:ingedrive.info@ingetteam.com)

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[www.ingetteam.com](http://www.ingetteam.com)