Frequency Converters

Air Cooled  Medium Voltage
1700 to 11100kW
6 to 6.9kV

Ingeteam
INGEDRIVE™ MV700
The most compact and robust solution for medium-voltage applications

The INGEDRIVE™ MV700 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 reliable family of frequency converters.

Based on the concept of modular design and thanks to the built-in transformer, INGEDRIVE™ MV700 medium-voltage converters cover a wide range of power supply and output power 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™ MV700 air-cooled frequency converter range extends up to 11.1 MW and is available in 6 to 6.9kV voltage configurations.
Main Benefits

Robustness and Reliability
The topology used in the MV700 range based on multi-pulse rectifiers, DFEs, and 5L-HB-NPC inverters, with HV-IGBTs, provides this range with a high level of robustness and reliability.

Extensive Range
Its modular design enables it to cover a wide range of powers up to 11.1 MW with a control system capable of controlling any type of motor.

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 optional built-in sinusoidal filter at the converter outlet.

Designed to Work at Heights
The INGEDRIVE™ MV700 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 5,000 m.
Modular and scalable based on a tested and validated high-performance design

It includes advanced control, protection and communications functional features.

Control and cooling cabinet

Cooling system
- Highly-efficient design.
- Redundant cooling with variable speed (optional).
- Low noise level.
- Air inlet filters.

High-quality packaging
- Front access for all user and maintenance actions.
- Protection level from IP21 to IP42.

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.

Key and control of grounding switch
- Touch screen for local control (HMI)
- Powerful, user-friendly interface.
- Remote and local accessible control.

Emergency stop button
Power Cabinet

- 24-pulse DFE rectifier
- Precharge module
- Multi-pulse transformer, VPI

Inverter with 5L HB-NPC topology based on HV-IGBT semiconductors

Basic Power Modules (BPMs)
- Based on 4,500 V HV-IGBTs.
- Easy access, maintenance and exchange
  Control via optic fibre.

Compact and modular
- Possibility of duplicating the inverter for higher powers.

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

Input/output cabinet

High compatibility with the motor
- dv/dt filter included as standard, permitting long distances between the motor and the converter.
- Sinusoidal filter integration in the same cabinet (optional).

Easily-accessible cabinets
- For control and power cabling.
- Available with upper or lower inlet (optional).

Connections
- Ground connection and capacity for EMC cable feeders.
- Control cabling, power cabling, protection earth and power ground.

Safety
- Earthing switch and keys sequence for maximum safety including door blocking.
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 customising the HMI: both the Web Application and the Operator Panel are easily customisable so that they can be adapted to client requirements, permitting the customised 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] with the following characteristics:

- **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 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. INGEDRIVE™ MV700 makes it possible to control the inverter part based on a 5-level H-Bridge topology, adapting itself to the requirements of different applications with the following functional features:

- 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.
  - Encoderless vector control.
- Redundant topologies using doubly-fed motors: Synchronous and Asynchronous.
Certification

The MV700 series complies with the IEC standards for medium-voltage equipment as well as having certifications such as the following:

- CE marked certificates.
- Asbestos Free.
- Green Passport.

Topologies

Single-Drive Solutions:
Standard applications based on a single motor fed by a DFE converter.
Sequential startup of several motors

Redundant single-drive solutions:
Applications which consists of motors doubly fed by two converters with DFE rectifier phase.
Why Ingeteam?

**flexible + customized**

One of Ingeteam’s hallmarks by which our clients recognise us is our flexibility and ability to adapt 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.

Customisation, 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-customisable solutions. These two cornerstones are complemented with demanding quality standards which all of our products are subjected to, allowing Ingeteam to offer:

<table>
<thead>
<tr>
<th><strong>More than 45 years’ experience in power converters</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Load tests of all equipment at rated current</strong></th>
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</thead>
<tbody>
<tr>
<td>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.</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Manufactured 100% in Europe</strong></th>
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</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
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Ingeteam
# Frequency Converters

![Image of Frequency Converters](image)

**6600 Vac**

<table>
<thead>
<tr>
<th>Rectifier Type</th>
<th>Power kW</th>
<th>Current A</th>
<th>Width mm</th>
<th>Weight kg</th>
<th>Width(1) mm</th>
<th>Width(2) mm</th>
<th>Weight kg</th>
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</thead>
<tbody>
<tr>
<td>24 Pulse</td>
<td>1700</td>
<td>171</td>
<td>3610</td>
<td>6800</td>
<td>3610</td>
<td>7200</td>
<td>7200</td>
</tr>
<tr>
<td></td>
<td>1900</td>
<td>191</td>
<td>3610</td>
<td>6800</td>
<td>4210</td>
<td>7500</td>
<td>7500</td>
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<tr>
<td></td>
<td>2100</td>
<td>212</td>
<td>3610</td>
<td>7200</td>
<td>4210</td>
<td>8200</td>
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<td>252</td>
<td>3610</td>
<td>7200</td>
<td>4210</td>
<td>8600</td>
<td>8600</td>
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<tr>
<td></td>
<td>3000</td>
<td>302</td>
<td>3610</td>
<td>7600</td>
<td>4210</td>
<td>8600</td>
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<tr>
<td></td>
<td>3400</td>
<td>342</td>
<td>3610</td>
<td>7600</td>
<td>4210</td>
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<tr>
<td></td>
<td>3700</td>
<td>373</td>
<td>3610</td>
<td>7600</td>
<td>4210</td>
<td>8600</td>
<td>8600</td>
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<tr>
<td></td>
<td>5000</td>
<td>504</td>
<td>4410</td>
<td>12780</td>
<td>2800*</td>
<td>13330</td>
<td>13330</td>
</tr>
<tr>
<td></td>
<td>5500</td>
<td>554</td>
<td>4410</td>
<td>12780</td>
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<td></td>
<td>6500</td>
<td>655</td>
<td>4410</td>
<td>14780</td>
<td>2800**</td>
<td>15740</td>
<td>15740</td>
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<td>6900</td>
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<td>4410</td>
<td>14780</td>
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<td>7400</td>
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<td>2800**</td>
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<td>4410</td>
<td>14780</td>
<td>2800**</td>
<td>15740</td>
<td>15740</td>
</tr>
</tbody>
</table>

(1) Transformer cabinet  (2) Converter cabinet  Depth: 1750 mm – Height: 2825 mm  * Depth: 1200 mm – Height: 2825 mm  ** Depth: 1200 mm – Height: 3125 mm

### Considerations

- **Motor Type:** Squirrel Cage Induction
- **Performance:** 96.5%
- **Power Factor:** 0.90
- **Ambient Temperature:** 0 °C to 40 °C (max.)
- **Up to 50 °C with reduction factor**
- **Load Type:** Constant torque with reduction factor <10Hz
- **Network voltage:** < 13.8 kV
- **Altitude:** < 1000 m above sea level (Metres above sea level)
  Up to 5000 m above sea level with reduction factor

### Electrical Drawing

![Diagram of Frequency Converters](image)

- Control Unit + Communication Module
- TRANSFORMER AND RECTIFIER
- 3x24 PULSE
- FIVE LEVEL HC-NPC INVERTER
- Dv/dt Filter
- Air Cooling System
“The use of speed converters for controlling flow allows for energy savings of over 30% compared to conventional systems”
## Standard Characteristics

### Hardware Interface

<table>
<thead>
<tr>
<th>Analog Input/Output:</th>
<th>Digital Input/Output:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inputs: 2</td>
<td>Inputs: 6</td>
</tr>
<tr>
<td>Outputs: 2 (&lt;4MVA)</td>
<td>Outputs: 10</td>
</tr>
<tr>
<td>Outputs: 0 (&gt;4MVA)</td>
<td></td>
</tr>
</tbody>
</table>

- Emergency control: 2
- Basic control panel: E-Step, access to the CPU and local-remote switch
- Redundant Encoder (Except for sensorless control) [Encoder not supplied with the drive]

<table>
<thead>
<tr>
<th>Various</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour touch screen (HMI) - 7”</td>
</tr>
<tr>
<td>Varnished PCBs</td>
</tr>
<tr>
<td>Support bars and door retainers (only marine applications)</td>
</tr>
<tr>
<td>Lifting supports</td>
</tr>
<tr>
<td>RAL7035 colour</td>
</tr>
<tr>
<td>IP21 protection grade</td>
</tr>
<tr>
<td>CE marking and Green Passport certification</td>
</tr>
<tr>
<td>Halogen-free and flame resistant materials</td>
</tr>
</tbody>
</table>

### Electrical Components

- Dephaser transformer for 24P rectifier
- Preloading and unloading internal system
- Long-lasting polypropylene capacitors

### Functional Features

- Protection against voltage dips
- Protection against grid dips
- Flying start functional feature
- Encoderless vector control

### Software

- Programming + remote Ingeteam app access - No licence required
| **Optional Features** | | |
|----------------------|------------------|
| **Hardware Interface** | Extended hardware interface package | Analog Inputs: +2 |
| | Emergency control extension with cable breakage detection: +5 | |
| | Emergency control with cable breakage detection and short-circuit detection | |
| | BCP control panel + NFU control and equipment connection | |
| | I/O module for additional connectivity | |
| | External heating resistors, control and power supply (up to 300 W) | |
| | External cooling: control and power supply | |
| | External PT100 meters (up to 8 channels) | |
| **Communications** | Profibus-DP, Modbus TCP, CAN Open, Modbus RTU, DeviceNet, O.F. Adaptador | |
| | Other field communications protocols | |
| **Various** | Special protection level (up to IP42) | Special RAL paint |
| | Customised indicators in the cabinet | Marine packaging |
| | MCT sealing modules | Heating resistor (to prevent condensation) |
| **Electrical Components** | Monitored output switch | |
| | Input/Output manual switch | EMI filter |
| | Internal UPS | |
| | Excitation module for synchronous motors (Ref.: MC9101-A) | Auxiliary power supply source |
| | Upper access to network cables | Upper access to motor cables |
| | Upper access to control cables | Grid voltage > 6.9 kV, but < 11 kV |
| | Redundant cooling | Ground isolation monitoring system |
| **Auxiliary UPS** | UPS/Frequency: 400 Vac (±10%) / 50/60Hz (±10%) | Supplied by Customer |
| (Supplied by Customer) | UPS/Frequency: 440Vac (±10%) / 50/60 Hz (±10%) | |
| | UPS/Frequency: 480Vac (±10%) / 50/60 Hz (±10%) | |
| **Certification** | CCS, RINA, RRR, TL | **Others** |
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 360º CRS programme

24/7 support included.
Direct access to design engineers and I+D

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

Once the warranty period has expired, Ingeteam offers its clients the option to extend out-of-hours customer support services provided by the Ingdrive technical support team by means of customised 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 offer comprehensive, customised 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.