ACS2000 industrial drive
The flexibility you require. The reliability you expect
Get more using less

- Optimized Power Consumption
- Time and Cost Savings
- Process Efficiency
The forerunner of technology
Over 100 years of innovation

- **1920**: Production start with mercury arc rectifiers
- **1969**: AC drive development started
- **1975**: High power PWM drive
- **1982**: First full-digital controlled converters PxD series
- **1985**: Megastar 3-level pulse width modulation (PWM) MV drive with digital flux vector control
- **1995**: Direct torque control (DTC)
- **1997**: IGCT based MV drive with DTC

- **1999**: IGBT based high power LV drive with DTC, air and liquid cooled
  First MV multidrive with PEBB technology
- **2005**: First MV drive with VSI-MF topology
- **2009**: Insulated gate bipolar transistor (IGBT), active neutral point clamping 5 level (ANPC-5L) MV drive
- **2011**: All-compatible platform
- **2014**: Easy to use, reliable and efficient general purpose MV drive
  DCT880 Thyristor Power Controller enhances portfolio
- **2016**: DCS880 first DC drives with TÜV-certified STO (SIL3Ple)
- **2018**: Model predictive pulse pattern control (MP3C)
Reliable across all applications
ACS2000 masters simple and demanding applications and fulfills the needs for your specific performance.

- Cement, mining and minerals
  Conveyors, crushers, mills, mine hoists, fans and pumps

- Chemical, oil and gas
  Pumps, compressors, extruders, mixers and blowers

- Pulp and paper
  Fans, pumps, refiners, vacuum pumps, chippers, conveyors, mills

- Marine
  Fans, pumps, compressors, propulsion, thrusters

- Food and beverage
  Fans, pumps and sugar mills

- Power generation
  Fans, pumps, conveyors and coal mills

- Utility and infrastructure
  Pumps and fans

- Metals
  Fans and pumps
ACS2000 industrial drive
The flexibility you require
Configurable drive to meet your specific needs
Meet the requirements and fit into your industrial environment
Use the ACS2000 in every global operation

Market specific product variants

**NEMA market specific design**
- NEMA motors
- Americas
- ANSI / IEEE / NEMA industry standards
- 4.16 kV
- UL / CSA certification

**IEC market specific design**
- IEC motors
- EMEA / Asia Pacific
- IEC / EN / CE industry standards
- 6.0 kV / 6.6 kV / 6.9 kV
Design flexibility for smooth supply integration
Three variants for easy grid connection

**Direct to line**
- Small footprint, light weight
- Easy to retrofit to DOL motors
- Simple installation

**Integrated transformer**
- Simple installation
- Galvanic isolation
- Voltage matching

**External transformer**
- Lower heat loss in e-room
- Galvanic isolation
- Voltage matching
Design flexibility for smooth integration into your supply network
The drive is available with dual line side connection configurations DFE and AFE.

**Diode front end (DFE) – 24 pulse**
- Simple
- Reliable diode 24-pulse rectifier solution enables compliance with all common harmonic standards
- DFE enables drive configurations for industry specific solutions e.g. motors in hazardous areas or long motor cables

**Active front end (AFE)**
- Regenerative
- Innovative AFE solution, which is compliant with all common harmonic standards
- The AFE feature enables regeneration, which allows energy efficient continuous braking leading to significant energy savings

**Integrated transformer**
- Small footprint, light weight
- Easy to retrofit to DOL motors
- Simple installation

**External transformer**
- Lower heat loss in e-room
- Galvanic isolation
- Voltage matching

**Direct-to-line (DTL)**
- Simple installation
- Galvanic isolation
- Voltage matching
Benefit from the compact footprint

**IEC 6 kV DTL**
- Length: 2'205 mm (Frame 1) 3'800 mm (Frame 2)
- Height: 2'490 mm (incl. cooling fan)
- Depth: 1'140 mm

**IEC 6 kV DFE external transformer**
- Length: 2'180 mm (Frame 1) 2'530 mm (Frame 2) 2'530 mm (Frame 3) 2'530 mm (Frame 4)
- Height: 2'490 mm (incl. cooling fan)
- Depth: 1'140 mm

**IEC 6 kV DFE integrated transformer**
- Length: 3'330 mm (Frame 1) 4'380 mm (Frame 2) 4'930 mm (Frame 3) 5'130 mm (Frame 4)
- Height: 2'490 mm (incl. cooling fan)
- Depth: 1'140 mm

**IEC 6 kV AFE external transformer**
- Length: 1'705 mm (Frame 1) 3'000 mm (Frame 2)
- Height: 2'490 mm (incl. cooling fan)
- Depth: 1'140 mm

ACS2000’s compact size and light weight, ensure low transportation costs and less space required
Operation in hazardous areas

- **Non-sparking motors** Ex ec (former nA)
  - Induction motors up to 23 MW
    - HXR 355 to 560 (cast iron)
    - AMI 400 to 1000 (modular)
  - ACS2000 DFE/AFE*

- **Increased safety motors** Ex eb (former e)
  - Induction motors up to 7 MW
    - HXR 355 to 560 (cast iron)
    - AMI 400 to 630 (modular)
  - ACS2000 DFE with sine filter

- **Ex db (former d)** flameproof motors
  - Induction motors up to 7 MW
    - AMD...R 355 to 500
    - AMD...T 500 to 900
  - All Ex eb machines with drives must be certified by an authorized certification body.

- **Ex p** pressurized motors
  - Same products and frames as for Ex ec
  - ACS2000 DFE/AFE*

**General:** for all cases only grounded EMC or sine filter is allowed – floating filters are not permitted in hazardous area.

* ACS2000 AFE: dedicated special input transformer required in accordance with ACS2000 transformer specification. Consider this solution only for 4Q applications - $$$
Choose an output sine filter to gain perfect output power

Clean motor waveform

With a sine filter, side effects of an inverter such as voltage reflections and common mode voltages will be totally eliminated

Use a sine filter for:

- **Retrofitting** of old motors with an aged insulation system
- Very **long** motor cables
- Special application such as electric submersible pumps (ESP) and conveyors in underground mines
**Best fit for your application**
Range of pre-engineered options for easy customization

### Selection of pre-engineered options

- Operation at elevated ambient temperature
- Customized spare parts package
- Isolator and earthing switch up to 13.8 kV
- Reduced noise level
- Safe Torque Off with energized drive
- Permanent magnet motor control
- Operation at high altitude
- Marine – design and spot approval
- Operation for 3.3 – 5.5 kV motors
- Integrated transformer up to 22 kV input voltage
- EU preferential origin
- Supply voltage tolerance up to +20%
- Variety of fieldbus communication methods between customer and drive
ACS2000 industrial drive
The reliability you expect
High personnel safety
Arc resistant design and DC grounding switch

Certified functional safety features and an integrated DC grounding switch make your system safe and reliable.

**ABB Standard**
- Interlocked doors
- DC bus grounding switch

**Arc fault resistant**
- Arc fault resistant design and certification in accordance with IEC62271-200
- Workforce and property are protected from dangerous electric arcs with the ACS2000’s arc resistant design.

**Functional Safety**
- SIL3 / Ple certified stop functions in accordance with IEC60204-1
  - Emergency off
  - Emergency stop
- SIL3 / Ple certified safety functions in accordance with IEC61800-5-2
  - Safe torque off
High personnel safety
Arc resistant design

Arc fault

- Arc faults are caused by a breakdown of the insulation
- Short circuit currents flow through ionized air, called an arc
- As a primary effect, high energy is released, causing a pressure, sound and heat wave
- Harmful gases and particles represent a secondary danger

Arc fault safety: ABB’s approach – the 4 safety classes

- Class I: Protection based on arc prevention
  Equipment damage in case of an arc: severe
- Class II: Protection based on arc resistant cabinet structure
  Equipment damage in case of an arc: severe
- Class III: Protection based on external arc fault limitation and elimination
  Equipment damage in case of an arc: moderate
- Class IV: Fast arc elimination
  Equipment damage in case of an arc: negligible

ABB offers IAC certified arc resistant design with arc elimination as an option
# High personnel safety

IAC certified arc resistant design with arc elimination

Non-ABB Medium Voltage Drives

Certified safe for personnel ACC. TO IEC 62477-2: 2018

<table>
<thead>
<tr>
<th>Arc-proof class</th>
<th>Class I</th>
<th>Class II</th>
<th>Class III</th>
<th>Class IV</th>
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</thead>
<tbody>
<tr>
<td>Based on design ACC. TO IEC 60146-1-1 IEC 61800-4</td>
<td>Based on arc resistant enclosure</td>
<td>Based on HV-FUSES</td>
<td>Based on protection firing and/or fast detection</td>
<td></td>
</tr>
</tbody>
</table>

| Equipment damage in case of arc | Severe | Severe | Moderate | Negligible |
High personnel safety
Visual comparison of Arc Proof Classes

**Class II**
23 kA, 0.5 s, protection class IP54

**Class IV**
28 kA, 0.5 s, protection class IP42
Functional Safety – Stop Categories

**Emergency off, EOff** (category 0 stop)
- INU stops modulating, DC discharges
- MCB is opened
- Motor coasts to a stop, under its own inertia

**Emergency stop, ESTOP** (category 1 stop)
- A controlled ramp down of motor speed to Zero.
- If actual speed does not reduce to Zero in the time preset on the timer relay, EOff is executed

**Safe Torque Off**
- Implementation through EOff
- MCB is opened and drive is discharged
- Motor coasts to a stop, under its own inertia

**Safe Torque Off** Engineered option
- Motorized output isolator added
- A controlled ramp down of motor speed to Zero after which isolator is opened and motor terminals grounded
- EOff is executed as secured backup if a) motor speed does not reduce and b) isolator does not open in the time preset on the timer

Functions comply with the highest performance requirements in machinery safety: SIL 3/PL e

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Increase productivity due to precise process control

The ACS2000 drive control platform uses ABB’s direct torque control (DTC) for increased process efficiency.

Benefits:

• Uniform product quality of your process
• Precise control of motor condition
• Accurate torque and speed control, also at low speed, as well as full starting torque
• No pre-defined switching frequency, for each control cycle the optimum switching parameter is used
• Reduces energy consumption
• Limitation of produced harmonics
Reliable performance of constant torque loads

Benefits:

- Applications where the torque loading is not a function of speed
- Setting default points for minimum and maximum speed in between which constant torque is requested
- Due to high dynamic response to torque changes, uniform product quality
- Thickness, flatness and tension control
Made in EU

ACS2000 IEC is produced in Poland, giving origin guarantee
ACS2000 industrial drive
The configuration you need
## ACS2000 – Hardware overview

Frames, voltages and power

<table>
<thead>
<tr>
<th>Configuration</th>
<th>IEC 6.0 kV</th>
<th>IEC 6.6 kV</th>
<th>IEC 6.9 kV</th>
<th>NEMA 4.16 kV</th>
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<tr>
<td></td>
<td>DTL / AFE</td>
<td>DFEe / DFEi</td>
<td>DTL / AFE</td>
<td>DFEe / DFEi</td>
</tr>
<tr>
<td>Frame 1</td>
<td>250 – 800 kW</td>
<td>250 – 800 kW</td>
<td>275 – 880 kW</td>
<td>275 – 880 kW</td>
</tr>
<tr>
<td>Frame 2</td>
<td>900 – 1600 kW</td>
<td>900 – 1600 kW</td>
<td>990 – 1760 kW</td>
<td>990 – 1760 kW</td>
</tr>
<tr>
<td>Frame 4</td>
<td>2500 – 3200 kW</td>
<td>2750 – 3520 kW</td>
<td>2875 – 3680 kW</td>
<td>2875 – 3680 kW</td>
</tr>
</tbody>
</table>

DTL direct-to-line  
AFE active front end with external transformer  
DFEe diode front end with external transformer  
DFEi diode front end with integrated transformer
ACS2000 – NEMA 4 kV DTL
Small footprint, light weight

Highlights

Length:
- 1'940 mm (Frame 1)
- 2'915 mm (Frame 2)
- 3'485 mm (Frame 3)

Height:
- 2'106 mm (converter only)
- 2'500 mm (incl. cooling fan)

Depth:
- 1'140 mm

UL/cUL certified

Product

4.16 kV system voltage
2'100 – 4'100 kg
ACS2000 – IEC 6 kV DTL
Small footprint, light weight

Highlights

Length:
- 2'205 mm (Frame 1)
- 3'800 mm (Frame 2)

Height:
- 2'100 mm (converter only)
- 2'490 mm (incl. cooling fan)

Depth:
- 1'140 mm

Product

6.0 – 6.9 kV system voltage

2'300 – 4'310 kg
ACS2000 – IEC 6 kV DFEe
Lowest cooling demand, perfect voltage matching

**Highlights**

- **Length:**
  - 1'730 mm (Frame 1)
  - 2'180 mm (Frame 2)
  - 2'530 mm (Frame 3)
  - 2'530 mm (Frame 4)

- **Height:**
  - 2'100 mm (converter only)
  - 2'490 mm (incl. cooling fan)

- **Depth:**
  - 1'140 mm

- **Product**

  - 6.0 – 6.9 kV system voltage
  - 1'600 – 2'340 kg

Diode front end, external transformer (DFE)
ACS2000 – IEC 6 kV DFEi
Simple installation, perfect voltage matching

**Highlights**

- **Length:**
  - 3'330 mm (Frame 1)
  - 4'380 mm (Frame 2)
  - 4'930 mm (Frame 3)
  - 5'130 mm (Frame 4)

- **Height:**
  - 2'100 mm (converter only)
  - 2'490 mm (incl. cooling fan)

- **Depth:**
  - 1'140 mm

- **6.0 – 6.9 kV system voltage**

- **3'500 – 8'800 kg**

Diode front end, integrated transformer (DFEi)
ACS2000 – IEC 6 kV AFE
Regenerative, low harmonic

**Highlights**

- **Length:**
  - 1’705 mm (Frame 1)
  - 3’000 mm (Frame 2)

- **Height:**
  - 2’100 mm (converter only)
  - 2’490 mm (incl. cooling fan)

- **Depth:**
  - 1’140 mm

- **6.0 – 6.9 kV system voltage**

- **1’580 – 2’590 kg**
Service and support
Services to match your needs
Service and support
Services to match your needs

Every ACS2000 is equipped with ABB Ability™ to enable remote condition monitoring.

Your service needs depend on your operation, life cycle of your equipment and business priorities.

We have identified our customers’ four most common needs and defined service options to satisfy them.
Global support available locally

At your service

Over 130 years servicing our customers
Over 1,200 field service engineers
~ 600 service partners
services in more than 70 countries
~ 50 service workshops

Global and regional service hubs supporting countries
Local service presence
ABB Motion Services

How?
- ABB Motion OneCare: The modular service agreement tailored to your needs
- Partnered solutions: Bringing expertise and capabilities together to enhance your business performance
- Recovery services: Fast intervention when something goes wrong
- Data and Advisory services: Better decision making
- Planned services: Protect your investment and avoid costly downtime
- Modernization and Performance improvement services: Optimal performance and lifetime extensions
- Reliability: Maximizing uptime, Delivering service excellence
- Energy efficiency and Circularity: Reducing carbon emissions and waste, Driving the tomorrow
- Life-cycle management: Extending life cycle, Enhancing performance

Why?
- WHAT
- HOW

Our Expertise

Your Advantage

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Service and support
ABB Ability™ Condition Monitoring for drives
ABB Ability™ Condition Monitoring for drives
Keeping you one step ahead of process upsets

ABB Ability™ Condition Monitoring for drives consists of a suite of services designed to provide key information about drive events and changes in behavior – ensuring your equipment is always available, reliable and well maintained.

The standard package gives you industry leading capabilities to fit your own monitoring needs – whether you want to view the drive status through ABB’s internet portal or integrate it into your existing monitoring systems.

Optional services include digitally enabled remote assistance by ABB technical support, advanced analytics and reporting, and a range of other features to make your maintenance operations more effective.
ABB Ability™ Condition Monitoring for drives
What you get

Solid fact-based decision making
Get the facts, and the history, to help run your operations better and more safely.

Always stay one step ahead of problems
Recognize early signs of possible failures and assess the risks, before they turn into serious operational issues.

Find the root cause of process issues
Remotely access data from ABB drives built-in sensors to track the cause of problems. Get back to smooth operation quickly with data back-ups.

Remotely analyze and optimize drives
Get critical drive information anywhere anytime – even in difficult to access sites, or when a site visit is impossible.
Tailor your drive monitoring to perfectly fit your needs

1. Select your drives
2. Install the connectivity device
3. Get access to the Condition Monitoring standard options and choose your additional options
4. Access directly to the ABB portal or activate data transfer via Cloud Interface
5. Start monitoring
6. Make proactive decisions – built on real-time information

*Available in your own monitoring system via Cloud Interface.

**Please check availability for your own monitoring system via Cloud Interface with your local ABB representative.
Tailor your drive monitoring to perfectly fit your needs

Standard package

Get these benefits from the standard package

**Condition Monitoring**
Continuously monitor your drive performance through ABB portal, remotely, without need for on-site presence or through your own monitoring system using data transfer via **Cloud Interface**

**Alarm Management**
Create flexible alerts and warning notifications, and have them sent to the right people for rapid action

**Asset Health**
Generate professional maintenance reports, tailored to your needs, about the state of your drives

**Team Support**
Wherever you are, you can access and analyze drive signal data and information, and then provide valuable support to your team

**Backup Management**
Back up and safely protect your drive parameters
Tailor your drive monitoring to perfectly fit your needs

Additional options

And select from these options, based on your need

- **Powertrain Monitoring**
  Combine key information from Condition Monitoring for drives and from Smart Sensors for motors and bearings, to monitor your complete powertrain

- **Condition-Based Maintenance**
  Assess the risk profiles of your drives to do efficient, proactive maintenance, based on condition rather than routines

- **Offline Data Collection**
  Upload and analyze data from your drives without using on-line connectivity to the internet

- **Expert Reports**
  Get our drive professionals to review your data and advise on maintenance planning, with an Expert Report service

- **Remote Assistance**
  Connect to ABB’s helpdesk, to get expert support and problem solving, with full visibility of your drives online
Minimizing your downtime by easy maintainability
Simple service and maintenance of ACS2000

Fast commissioning by “DriveStartupTM” software (step-by-step guidance)

Fast maintenance due to easy front access to the drive

Withdrawable phase modules allow quick replacement of components
Total cost of ownership
Choose the most economical solution
Consider total cost of ownership (TCO) instead of VSD purchase price only

Purchase of VSDs is often based on initial / first hand cost only

Consider TCO (CAPEX & OPEX)

CAPEX main items:
- VSD
- VSD heat loss cooling system

OPEX main items:
- MAINTENANCE cost of VSD and heat loss cooling system
- ENERGY cost of VSD and heat loss cooling system

ABB’s drive experts support you in selecting the most economical solution for your specific project.

- Consider TCO over the expected VSD lifetime > 20 years
- Specify / Select the most economical drive for your project requirements
VSD system design and selection criteria

- Consider TCO over the expected VSD lifetime > 20 years
- Specify / Select the most economical drive for your project requirements

### VSD power supply connection point
- 3.3 - 11 (33 kV) kV

### VSD transformer location
- Integrated solution
- External solution

**Impact on:**
- VSD system efficiency
- Power supply connection point
- VSD heat losses into E-house
- HVAC Capex and OPEX
- E-house size
- E-house HVAC

### Environmental conditions
Temperature, dust, corrosive air, etc.

### VSD heat loss cooling method

<table>
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<tr>
<th><strong>Air cooling</strong></th>
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<tbody>
<tr>
<td>Ventilation</td>
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<td>HVAC</td>
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<table>
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<tr>
<th><strong>Water cooling</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant cooling water</td>
</tr>
<tr>
<td>Fin-Fan cooler or Chiller</td>
</tr>
</tbody>
</table>

- With a VSD, motor voltage can be different from the line voltage
- Power & speed dictate the motor design
Case study: 2.5 MW air-cooled pump drive
Heat losses external vs. internal transformer

Integrated transformer
- Typical VSD with integrated transformer efficiency: 96%
- Converter losses into E-house: 4%
- High E-house A/C equipment cost (CAPEX)
- High A/C aux. power demand (CAPEX & OPEX)
- High cooling air flow demand

External transformer
- Typical VSD with external transformer efficiency: 97%
- Converter losses into E-house: 2%
- External transformer efficiency: 99%

50% less E-house cooling (A/C) with external transformer solution compared to integrated transformer solution
CAPEX savings
• Needs one less transformer, saving the cost of 33kV / 6.6kV step down transformer

OPEX savings (power consumption)
• Assumed transmission losses of step-down transformers: 1% (assumed 600 kW/h)
• Saving potential: 4.26 million kWh per year
ABB Access
Scan the QR code to access 24/7 self-services for ABB drives, motors and PLCs

- **Device information**
  Easy Access to detailed product information and EcoDesign data

- **Documentation**
  Quick Access to user manuals and SmartGuide instructions

- **Report issues**
  Fast Access to issue reporting

- **Contact**
  Access ABB contacts and search Channel partners
Want to check ABB Access in action, but you don’t have ABB drive, motor or PLC at hand? No problem! Simply scan the example QR codes and get familiarized with ABB Access.
The ACS2000 industrial drive
Reference cases
Optimized pumping process in a large-scale desalination plant

Application: Water&wastewater, pumps

Customer needs
- Stringent harmonic requirements
- High process pressures
- Operation under harsh environmental conditions

Solution
ABB offered a drive and motor package: ACS2000, 24 pieces, ACS800, 32 pieces

Values
- Water & Wastewater, Pu Process optimization
- Smooth process integration
- Application specific product mps
Mining in a harsh environment with an ACS2000

Application: Mining, conveyors

Customer needs
Trustworthy and reliable drive
• The customer insisted that the ACS2000 is included in the OEM offering.

Solution
ACS2000, 42 pieces equipped with AFE and DTL

Values
• Cost savings – lower transportation costs due to compact footprint
• Reduced floor space
• Clear and transparent communication between ABB and the end user
• Application specific product
ABB offers reliable solutions with the ACS2000

Application: Oil & Gas, combustion air blower

Customer needs
Trustworthy and reliable drive
• The customer insisted that the ACS2000 is included in the OEM offering.

Solution
ACS2000, 2 pieces
Previous order:
ACS2000, 14 pieces for pump application

Values
• Positive past experience
• Reliable product
• Good relationship of ABB with end user and OEM
ACS2000 allows tailored solution

Application: Oil & Gas, subsea MPP

Customer needs
- Highest personnel safety
- Suitable and certified for installation on an offshore platform
- Permanent magnet motor
- 1.5 km cable length

Solution
ACS2000, 2 pieces equipped with:
- Arc resistant design with active arc elimination
- Output sine filter suitable for output voltage boosting up to 7 kV
- Permanent magnet motor control
- Marine design with ABS spot approval

Values
Marine certification, high personnel safety, application specific product
ACS2000 in action on a large oilfield

Application: Oil & Gas, ESP

Customer needs
• Long motor cables (>4 km)
• Highest personnel safety

Solution
ACS2000, 12 pieces equipped with:
• Arc resistant design with active arc elimination
• 6.6 kV output voltage to compensate the voltage drop along the long motor cables

ABB also provided the switchgear, which was tested together with the drive at ABB.

Values
• ABB’s extensive expertise enabled valued support
• High personnel safety
• Application specific product
Why ACS2000?
Key values

01. High personnel safety
02. Maximum motor compatibility
03. Design flexibility for smooth integration
04. Customer specific solution for demanding applications