

Extending the Danfoss offering















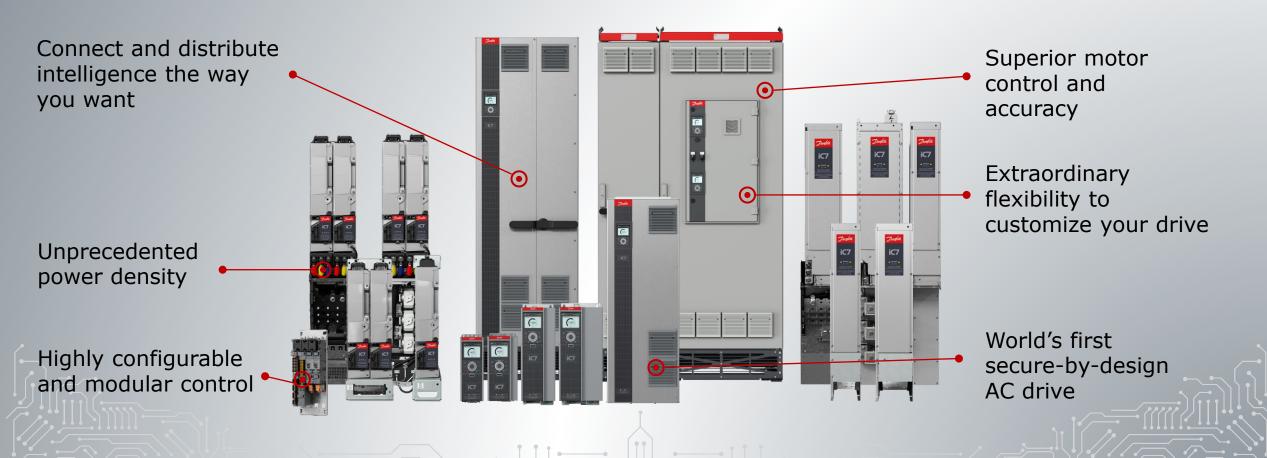






Raising the bar even higher





A new dimension of intelligence sets you free







iC7-Automation

High flexibility for demanding industrial applications

iC7-Marine
Cutting-edge performance
for demanding marine
applications

iC7-Hybrid
Intelligent power conversion
to drive electrification and
power conversion



WORLD'S MOST RELIABLE DRIVE

UNMATCHED KNOWLEDGE | FULL DIGITAL TRACEABILITY | THE LATEST SIMULATION TECHNIQUES COMPREHENSIVE TESTING | AUTOMATED ROBOTIC ASSEMBLY



Intelligent



Gain new levels of intelligence Use computing power on the edge Precisely optimize your application



Versatile



Benefit from embedded flexibility and agility



Future-proof



Improve your competitiveness Open up new opportunities





WORLD'S MOST RELIABLE DRIVE

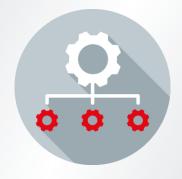
UNMATCHED KNOWLEDGE | FULL DIGITAL TRACEABILITY | THE LATEST SIMULATION TECHNIQUES COMPREHENSIVE TESTING | AUTOMATED ROBOTIC ASSEMBLY



Highest design standards



Six Theta® and Six Sigma® deliver robust and reliable products while reducing sensitivity to variances



100% Simulated



More reliable hardware. 100% simulated software. Highly automated testing.



Robot assembly



Elimination of typical production errors by consistent and reproducible manufacturing quality





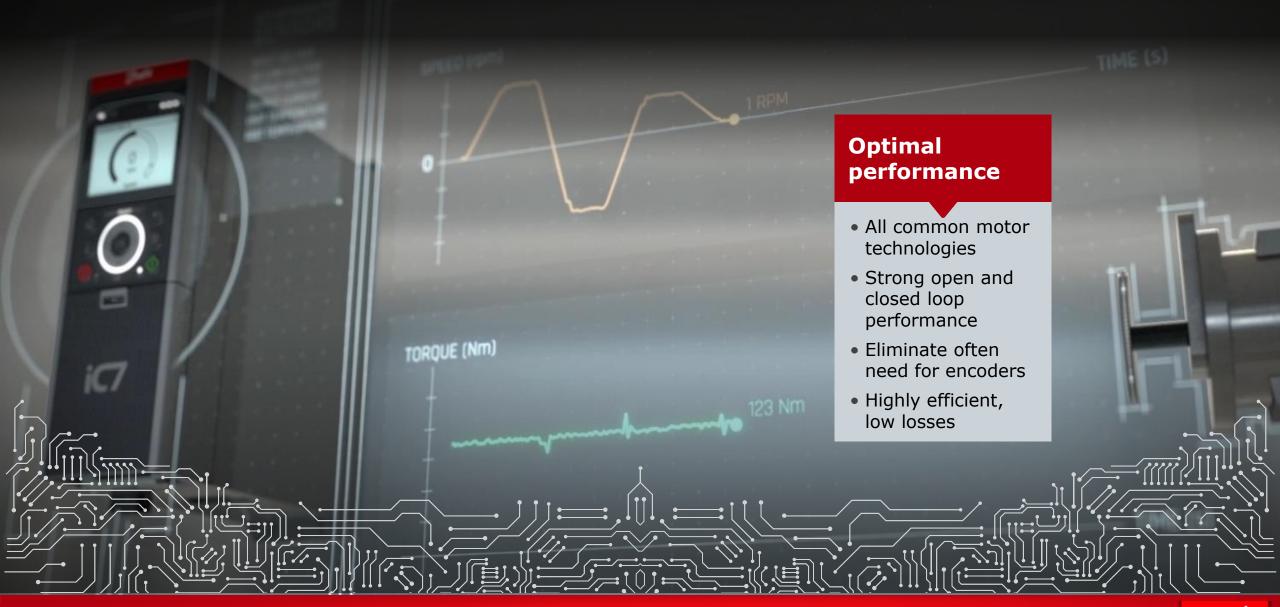


iC7-Automation Technology Highlights

Quality redefined



Superior motor control



The digital drive optimizes your engineering



Protect your data and your know-how

Ready and growing

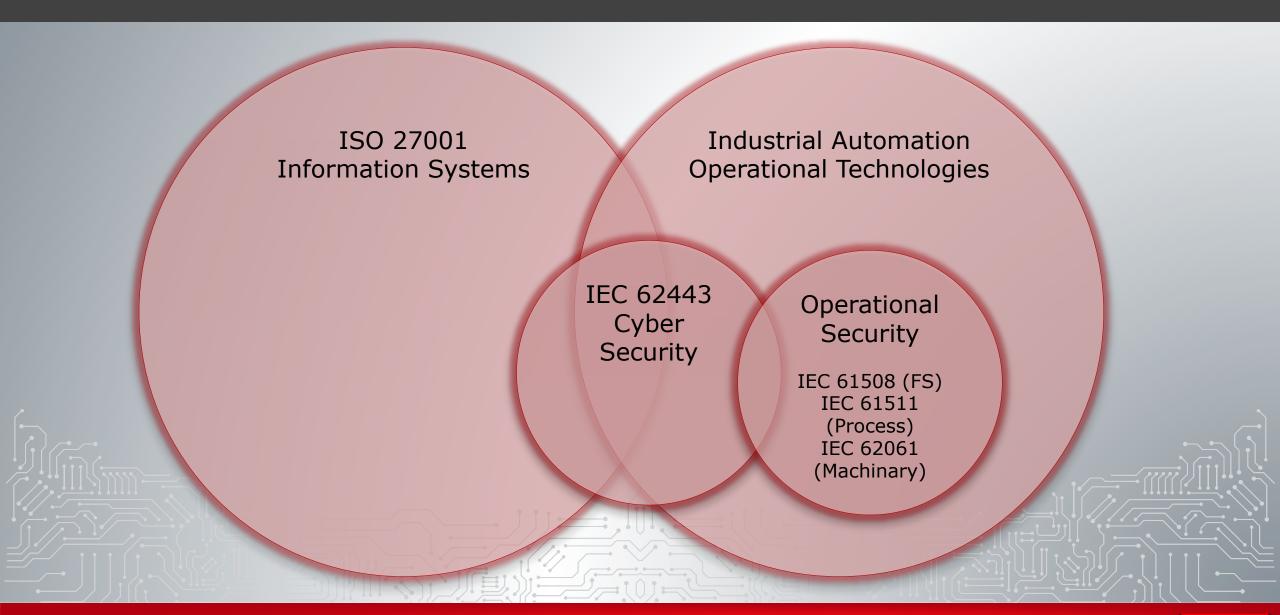
Invest less today

- Hardware encryption
- Signed software (Danfoss & own)
- Flexible user management
- Follow latest standards

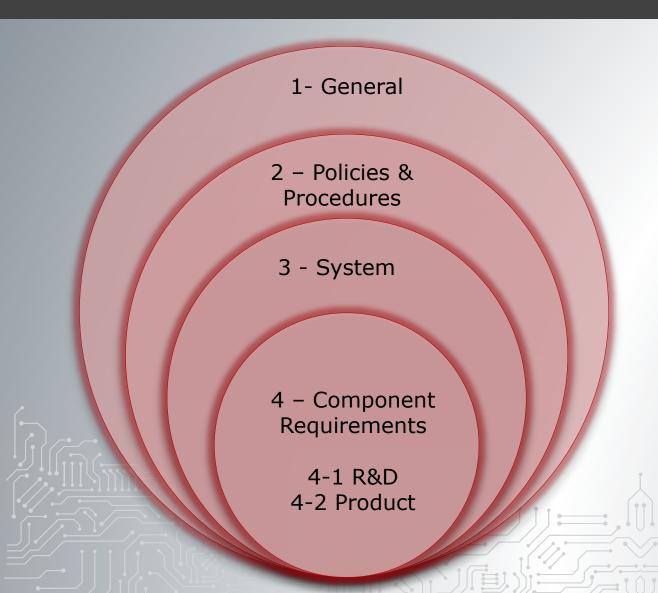




Cyber Security – Standards & Risk Management



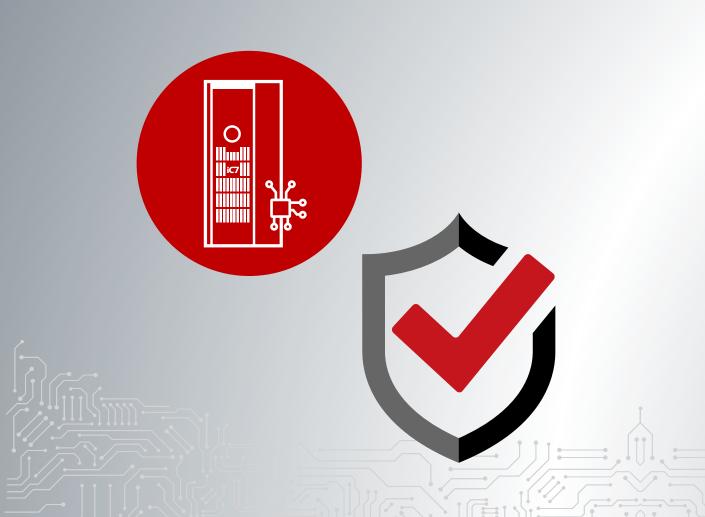
IEC 62443 – Industrial Cyber Security



- IEC 62443 is organized into four groups
- The standard is not entirely complete yet
- Each stakeholder (system integrator, operator) and manufacturer) must fulfil their part of the standard
- Product IEC 62443-4-2 requirements is only a small part if the standard

Cyber security





Signed software

- Trusted firmware only
- Encrypted firmware and application

Access control

- Role based user access
- Temporary access to trusted users

Hardware based!

- Secure boot chain
- Dedicated chip fast and secure encryption

Certifed

- IEC 62443-4-1
- IEC 62443-4-2 P

Robust in harsh conditions











iC7-Automation Cross-product platform

Danfoss iC7-Automation - Hardware











Frequency Converters (FC)

Air-cooled System Modules

Liquid-cooled System Modules P

Enclosed Drives (ED)



Danfoss iC7-Automation



Integrated multipurpose "Industry **Application**" software







iC7-Automation

High flexibility for demanding industrial applications

Frequency Converters

| Voltage | 3 x 380-500 -15%/+10% |
|---------------------|---------------------------------------------|
| Output current | 1.3-1260 A |
| Enclosure rating | IP20 IP21, UL Type 1 IP54, UL Type 12 |

System Modules

Air-cooled | Liquid-cooled | P

| | Voltage | 380-500 | 525-690 |
|---|-------------------|--------------------|----------------|
| 1 | | -15%/+ | 10% |
| • | Output current | 385-4870 A | 416- 6400 A |
| | Enclosure | IP00, UL open type | |

Enclosed Drives

| Voltage | 3 x 380-500 -15%/+10% |
|-------------------|---------------------------------|
| Output current | 206-1710 A |
| Enclosure | IP21 UL Type 1 |
| rating | IP54 UL Type 12 |





The future of automation

Optimize challenging applications Unparalleled performance Unprecedented security

> For applications in: Food & Beverage Chemicals Metals Mining & Minerals Oil & Gas Pulp & Paper ... and more

iC7-Automation

Extruding, injecting & pressing

Machine types:

- Piston/screw extruders
- Injection molders
- Presses
- Die-casting machines



Mixing, extracting & separating

Machine types:

- Scroll/screen centrifuges
- Bowl centrifuges
- Decanters

compressing Machine types:

Auxiliary industrial fans

High-power

pumping,

ventilation &

- Auxiliary industrial pumps
- Auxiliary industrial compressors

Downhole pressurizing

Machine types:

- Artificial lift
- Oil pumps
- Fracking pumps

Drilling, boring & grinding

Machine types:

- Tunnel boring
- Ball mill drums
- Shredders







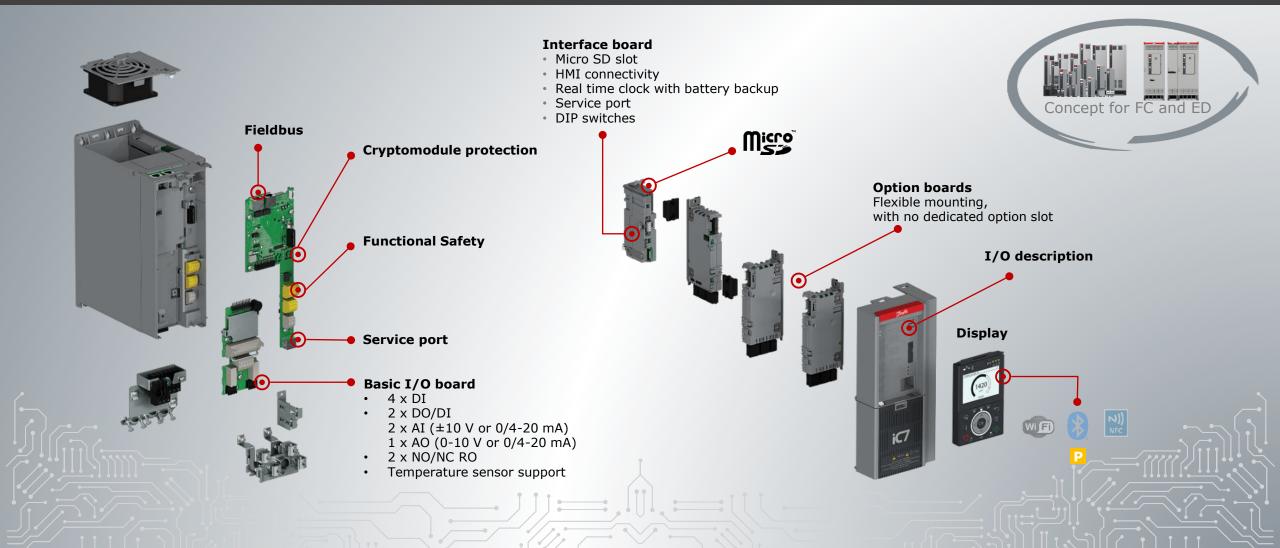






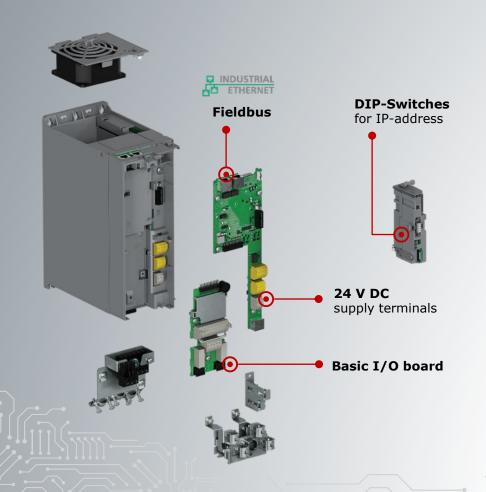
Integrated control unit — Powerful control with flexible functionality





Integrated control unit — The right fieldbus at the right time





Enabled by default

- Dual ethernet port always on board
- RS-485 board as variant P
- 24V-back as standard
- DIP-Switches for IP-address

Flexible protocols

- Select protocol via license
- Order from factory or change yourself



Flexible I/Os

Order the drive with or without basic I/O

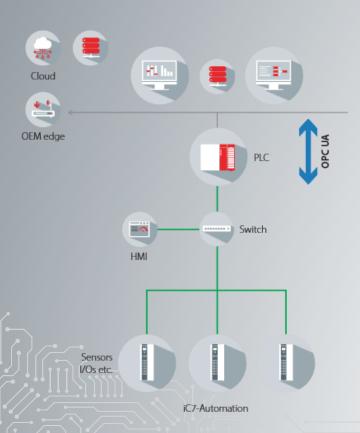


OPC UA (Open Platform Communication – Unified Architecture)



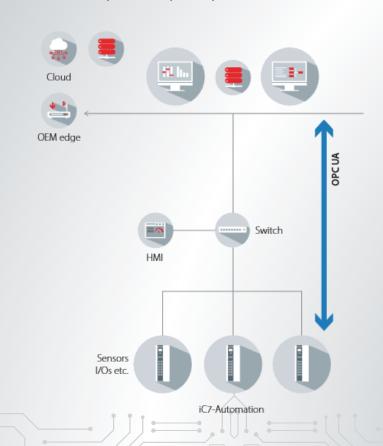
Until now

DCS/SCADA/MES/ERP

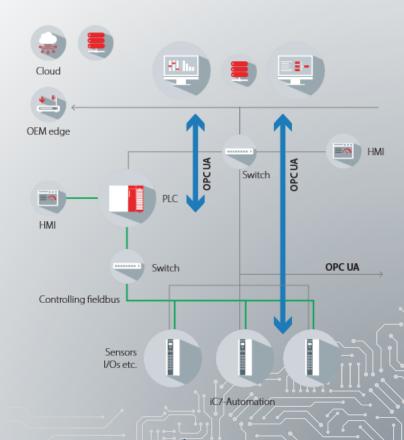


From now on

DCS/SCADA/MES/ERP











Integrated control unit — Scaled functional safety





Hardware

- Basic I/Os and function require no option slot
- Additional Safe I/O and encoder inputs available as an option when required
- Required features can be configured by order

Safe Stop

- STO SIL3/PL e
- Dual channel input (galvanic isolated)
- STO feedback signal

Advanced functions P

- SS1-t, SS1-r, SLS, SMS,
- SS2, SOS, SDI
- SBC, SSM

Safe fieldbus D

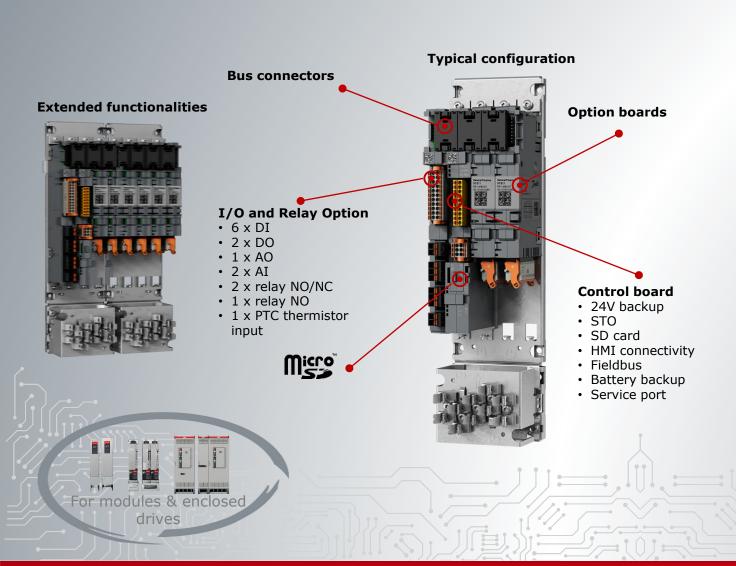
- PROFIsafe (up to 90 kW)
- CIP Safety
- Safety over EtherCAT





Modular control unit - Powerful and flexible control





Built for modules

- Modular mounting plate mechanics
- Configurable and scalable according to the need
- One mounting plate includes slots for 4 options
- Fast cabling
- Screen connection

Different but same

- Functionalities like integrated control unit
- Control unit can be placed in the panel

Safe Stop

- STO SIL3/PL e
- Dual channel input (galvanic isolated)
- STO feedback signal

Advanced functions

- SS1-t, SS1-r, SLS, SMS,
- SS2, SOS, SDI
- SBC, SSM

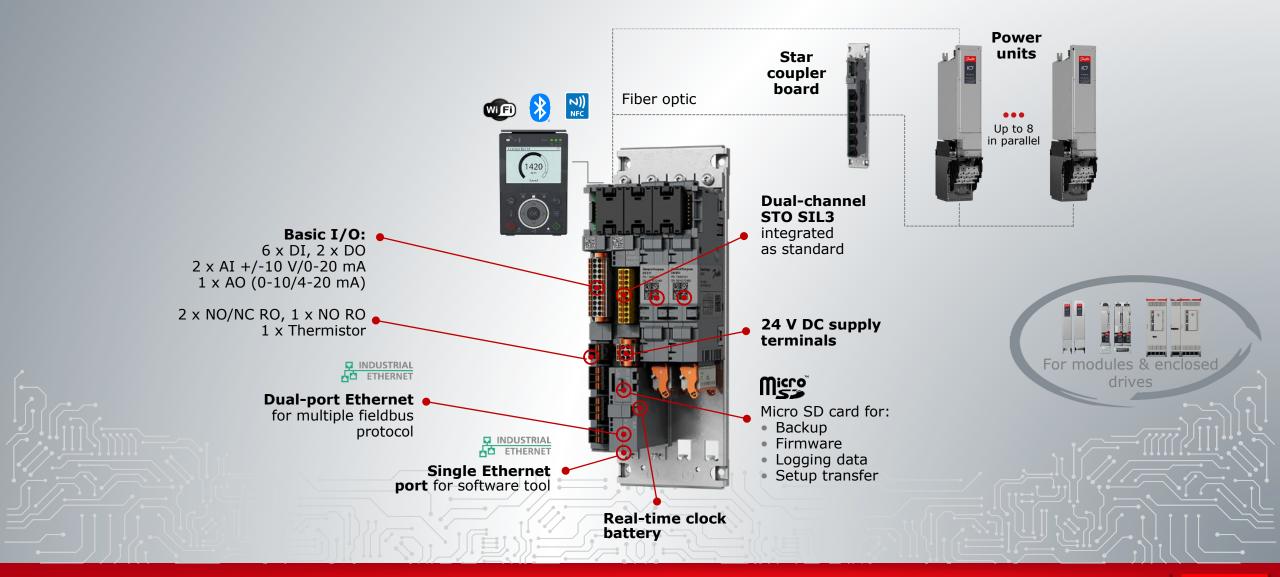
Safe fieldbus

- PROFIsafe (up to 200-2700kW)
- CIP Safety
- Safety over EtherCAT



Modular control unit - Powerful and flexible control





Option boards





- Many options fit the entire iC7 series
- Plug and play
- The number of option slots varies according to product type and size
- Mount options flexibly, with no dedicated option slots
- No need for a fieldbus option! It's included

| | Frequency | Frequency Enclosed converter drive | System modules | |
|-------------------------------|-----------|------------------------------------|----------------|----------|
| | converter | | INU | AFE |
| General purpose OC7C0 | • | • | • | |
| Relay OC7R0 | - | • | - | |
| Encoder/Resolver Option OC7M0 | • | | • | |
| I/O & relay OC7C1 | | • | - | - |
| Safety I/O + I | - | • | • | |
| Temperature measurement OC7T0 | - | • | • | <u>-</u> |
| Voltage measurement OC7V0 | | | | |
| Digital 230 V AC Input OC7D0 | • | I | I | I |

iC7-Automation filter offering





dU/dt filter OF7U1

590 A 880 A



LCL10, 11 and LCL11W filter for AFE OF7Z3

514 A (LCL10) 816 A (LCL11)



820 A (LCL11W)



Common-mode filter OFXC1

590 A 880 A



Sine-wave filter OF7S1

170 A



Advanced harmonic filter OF7P2

480 A

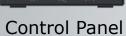
| | Frequency converter | Air-cooled system module | Enclosed drive |
|--------------------------------|------------------------|--------------------------------|-------------------|
| Advanced Harmonic Filter OF7P2 | Х | | |
| LCL Filter for AFE OF7Z3 | | X | X |
| Sine-wave Filter OF7S1 | X | | |
| dU/dt Filter | | x | X |
| dU/dt and CM Filter | | X | Х |
| Common-mode Filter | | X | X |



Control panel options









Control Panel Wireless P



Wireless Panel P



Blind Panel

Highlights

| • | 00 | 2.8" monochrome display |
|---|------|------------------------------------|
| • | 000 | Dedicated user profiles P |
| • | 023 | NFC P |
| • | 08 | Wi-Fi (client and access) |
| • | 00 | Force-feedback on buttons |
| • | 28 | Bluetooth Low Energy (BLE) ready P |
| • | 000 | Memory for parameter backup P |
| • | 0004 | Halo indicator (Detailed alarm) |
| • | 0004 | Status indicator |





MyDrive[®] tools



Support over the entire lifecycle

- **1** Select & Dimension
 - -The right product
 - -The right power size
 - -The application software that fits the application best
- 2 Validate
 Energy efficiency & harmonic mitigation simulations
- **3 Commissioning & Service**Fast, reliable and professional





Select & Dimension

MyDrive® Select

Adapt

- MyDrive® Programming I
- MyDrive® Insight

Validate

MyDrive® ecoSmart MyDrive® Harmonics

Commissioning & Service

MyDrive[®] Insight

1

2)

3



Same look and feel on any device

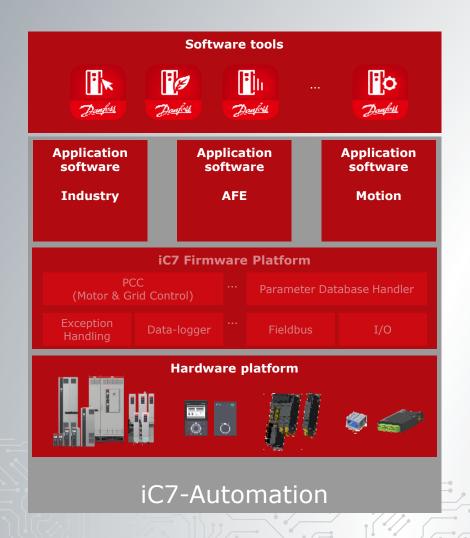




- Common user interface scales and adapts to all display sizes
- Controls are optimized for button, touch or PC interfaces
- Free engineering, commissioning and monitoring tools

Dedicated application packages





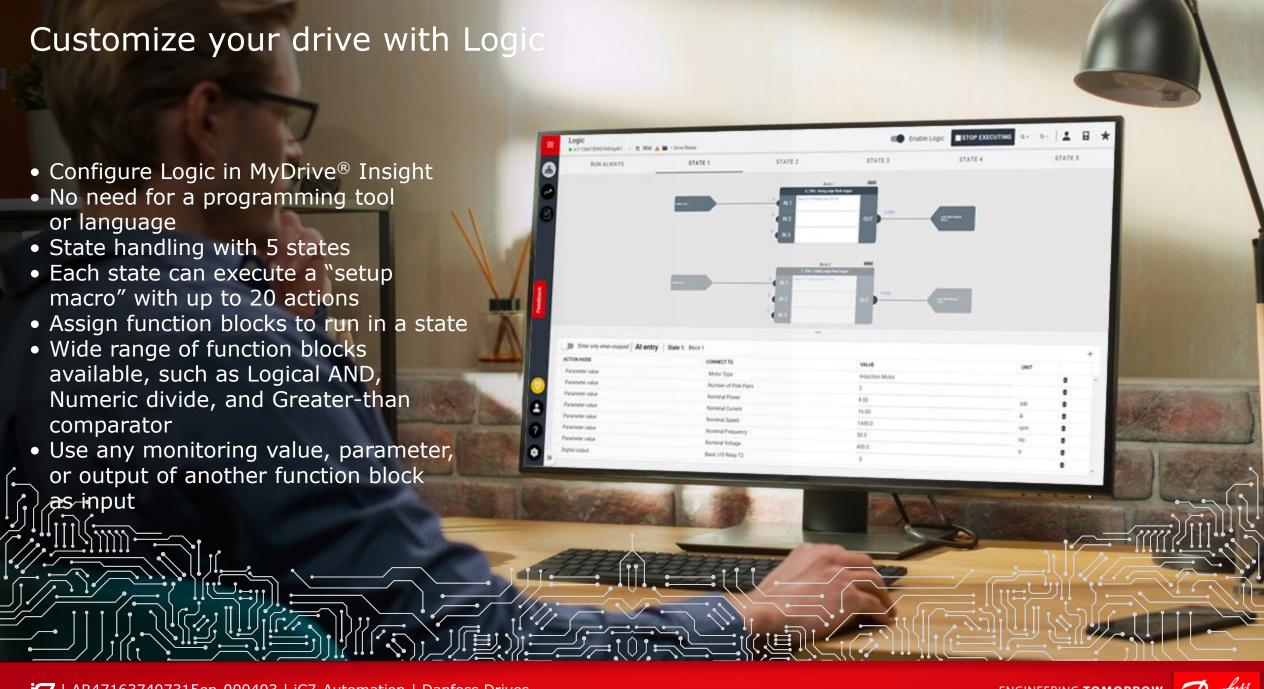
Concept

- iC7 hardware platform
- Common firmware: Motor control, fieldbus,...
- Dedicated application layer

Available packages

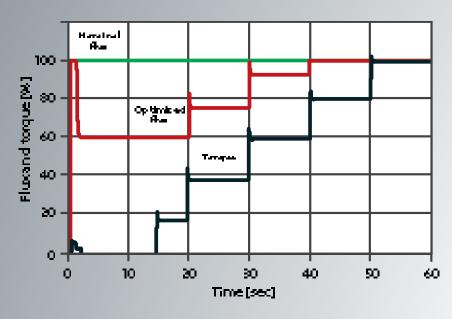
| | Industry | Motion | Marine | Hybrid | HVAC | Water |
|----------------|----------|--------|--------|--------|------------|-------|
| iC7-Automation | • | • | | | | |
| iC7-Marine | | | - | | | |
| iC7-Hybrid | | | | | | |
| iC7-HVAC | | | | | - I | |
| iC7-Aqua | | | | | | = I |

- Application can be selected during ordering
- Switch from some application to another
- Custom applications are possible [1]



Superior motor shaft control – even at low speed





Example

Automatic Energy Optimization (AEO) reduces magnetization flux in induction motors, according to the working point

Out-of-the-box performance

- Induction and copper rotor motors
- Surface and interior PM motors
- Synchronous reluctance motors

Eliminate encoder

- Great zero-speed performance
- High torque linearity and repeatability
- Market-leading static accuracy and dynamic performance
- Less maintenance and higher uptime

Support function package

- Automatic motor adaption
- Flying start

Feed back

Kinetic backup



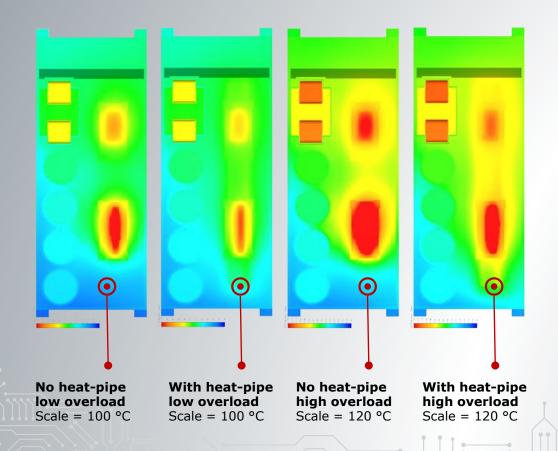
Overview of motor control principles



| | Description | Relevance | Application examples |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FVC+ Flux Vector Control + | High performance based on true field orientation and seamless four quadrant operation Induction motors, PM motors and SynRM motors Speed and torque control Open-loop or closed-loop control with encoder | Good and well-damped shaft performance Closed-loop applications Torque control High power motors (> 100 kW) Zero and low speed control Speed reversal Fast torque limiting Dynamic and fast DC-link overvoltage control | Extruders Hoists and cranes Winding, unwinding Generator Dynamometers, test benches Textile machines Propulsion, thrusters Conveyers |
| VVC+ Voltage Vector Control + | Medium performance based on steady state model Induction motors and PM motors Speed control only Open-loop control Closed-loop control only for induction motors Less sensitive to motor parameter errors | When motor data is unavailable When AMA is impractical to run High motor speed, above ~300 Hz fundamental frequency, depending on motor design | Pumps Fans and blowers Chillers High speed compressors High speed drilling Simple conveyers |
| U/f Volts-per-Hertz | Low-medium performance based on steady state model Frequency control Limited auxiliary functions (flying start, over voltage control, current limit) | Troubleshooting situations Low complexity test of drives When exact output frequency is required Non-motor loads | PumpsFansNon-motor loads |

Highest energy efficiency...





...in the product

- Highest defined IE efficiency class
- Low stand-by losses

...in the installation

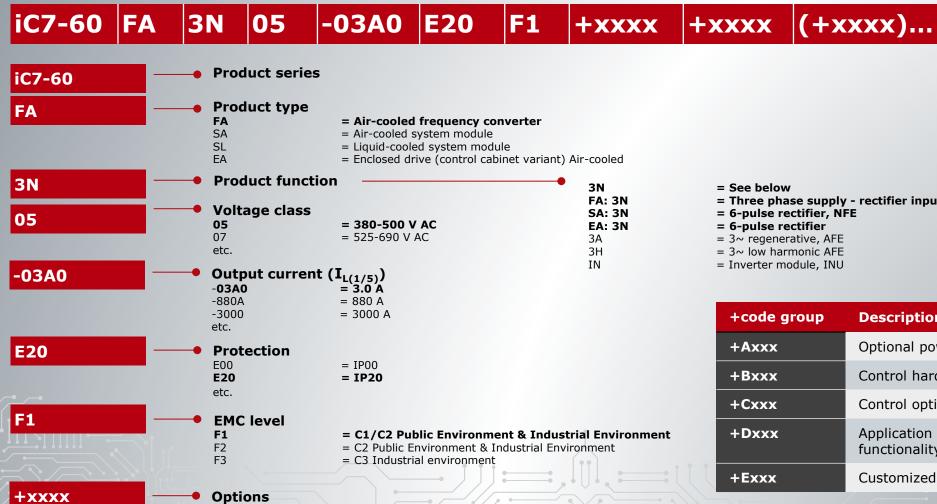
- Less need for climate control due to innovative cooling concepts
- Intelligent heat management and design

...in the application

- Operate the latest high efficiency motor technologies
- Efficient motor control
- Automatic Energy Optimization

Model code





| = See below |
|----------------------------------------|
| = Three phase supply - rectifier input |
| = 6-pulse rectifier, NFE |
| = 6-pulse rectifier |
| = 3~ regenerative, AFE |
| = 3~ low harmonic AFE |
| = Inverter module, INU |

| +code group | Description |
|-------------|---------------------------------------------------|
| +Axxx | Optional power hardware features |
| +Bxxx | Control hardware |
| +Cxxx | Control options |
| +Dxxx | Application software and additional functionality |
| +Exxx | Customized settings (for reference only) |

+xxxx



Frequency converter overview

Key specifications

- Compact bookshelf design
 - no extra space required between drives
- Isolated cooling channel
- Integrated EMC filters (C1, C2, C3) & DC chokes
- Superior power density

- Pluggable power terminals up to 43 A
- Replaceable fans
- STO SIL 3/PLe as standard
- Dual Ethernet on board
- External 24 V supply is standard

| Voltage rating 3x 380-500 V AC, -15%/+10 |
|--------------------------------------------------------|
| Current range 1.3-126 |
| Overload capacity 110% and 150/1609 |
| Protection rating IP20, IP21, UL Type 1, IP54, UL Type |
| Rated temperature -25 to 50 °C/-13 to 122 °C |
| Nominal temperature 45 °C/113 °F average |
| Maximum temperature (with derating) 60 °C/140 |
| Environmental PD2/3 |
| Rated altitude < 1000 m/3280 |
| Maximum altitude (with derating) 4400 m/1443! |

^{2]} Frames Fx09-Fx12: For low overload conditions, the maximum permissible ambient air temperatures without derating are 40° C (104° F) average over 24 hours duration; and 45° C (113° F) for 1 hour duration, respectively.





Air cooled modules overview



Key specifications

- High power density in compact enclosure
- Easy fan exchange
- Outstanding integration unit option
 - Easy mounting in cabinets
 - Optional output filters incorporated
 - No need to disconnect power cables when exchanging the module
- Flexible cooling arrangements using back-channel cooling

- Reduction of spare parts stock
- Scalable and flexible control (separate and modular)
- Easy paralleling
- Lightweight and service-friendly power unit design: 65/75 kg

| Voltage rating | 3x 380-500 V AC, -15%/+10% |
|-------------------------------------|----------------------------|
| Current range (IL) | 385-4870 A |
| Overload | 110%/150% 1/5 min |
| Protection rating | IP00/UL Open type |
| Rated temperature | -15 to 40 °C/5 to 104 °F |
| Maximum temperature (with derating) | 55 °C/131 °F* |
| Environmental | PD2/C4 |
| Rated altitude | < 1000 m/3280 ft |
| Maximum altitude (with derating) | 4000 m/13124 ft |



Enclosed drives overview

Key specifications

- Largest selection of configurable options
- Standard 6-pulse and LHD variant
- Safe door-in-door compartment with access to 24 V equipment
- Flexible cable entry/exit arrangement
- Segregated IP54 channel for cooling the power electronics devices

- Factory cabinet-built drives with customized options
- Paralleling of 3-phase drives with no need for output filters
- Extremely fast exchange of modules
- Highly flexible solution with off-the-shelf components

| <u> </u> | ■ ■ |
|----------|------------|
| | |
| - | |
| | |

| Voltage rating | 3 x 380-500 V AC, -15%/+10% |
|-------------------------------------|---------------------------------|
| Current range (IL) | 206-1710 A |
| Overload | 110%/150% 1/5 min* |
| Protection rating | IP21/UL Type 1, IP54/UL Type 12 |
| Rated temperature | -15 to 40 °C/5 to 104 °F |
| Maximum temperature (with derating) | 50 °C/131 °F* |
| Environmental | PD2/PD3 |
| Rated altitude | < 1000 m/3280 ft |
| Maximum altitude (with derating) | 4000 m/13124 ft |
| Maximum and due (with defaulty) | 4000 111/13124 10 |

* 1/10 min for FE9, FE10







iC7-Automation Frequency Converter



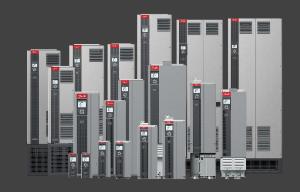
Frequency converter overview

Key specifications

| Frame | Fx02 | Fx03 | Fx04 | Fx05 | Fx06 | Fx07 | Fx08 | Fx09 | Fx10 | Fx11 | Fx12 |
|---------------------|------|------|------|------|------|------|------|------|------|------|------|
| Max. current [A] | 12.5 | 16 | 31 | 43 | 73 | 106 | 170 | 385 | 588 | 799 | 1260 |
| Max. power [kW] | 5.5 | 7.5 | 15 | 22 | 37 | 55 | 90 | 200 | 315 | 450 | 710 |
| Max. power [HP] | 7.5 | 10 | 20 | 30 | 50 | 75 | 125 | 300 | 450 | 600 | 900 |

| Voltage rating | 3x 380-500 V AC, -15%/+10% |
|-------------------------------------|------------------------------------------|
| Current range | 1.3-1260 A |
| Overload capacity | 110% and $150/160\%^{1]}$ |
| Protection rating | IP20, IP21, UL Type 1, IP54, UL Type 12 |
| Rated temperature | -25 to 50 °C/-13 to 122 °F ^{2]} |
| Nominal temperature | 45 °C/113 °F average ^{2]} |
| Maximum temperature (with derating) | 60 °C/140 °F |
| Environmental | PD2/3C3 |
| Rated altitude | < 1000 m/3280 ft |
| Maximum altitude (with derating) | 4500 m/14764 ft |

^{• 1] 160%} for FA2-FA4 and 150% for FX5 - FX12



^{2]} Frames Fx09-Fx12: For low overload conditions, the maximum permissible ambient air temperatures without derating are 40° C (104° F) average over 24 hours duration; and 45° C (113° F) for 1 hour duration, respectively.



Frequency converter overview



| Voltage | 3 x 380-500 V |
|----------------|---------------|
| Output current | 1.3-1260 A |

Highlights

- Space saving
 - Compact bookshelf design
 - No extra space needed between drives
 - Isolated cooling channel
 - Integrated EMC filters and DC chokes
- Superior power density
 - 30% smaller on average than competitor products
- Easy to install and service
 - Pluggable power terminals through frame FA05 (43A/22kW)
 - Replaceable fans

| Frame | Fx02 | Fx03 | Fx04 | Fx05 | Fx06 | Fx07 | Fx08 | Fx09 | Fx10 | Fx11 | Fx12 | |
|--------------------|------------|------------|------------|------------|------|------|------|----------|----------|----------|----------|--|
| Max. power [kW] | 5,5 | 7,5 | 15 | 22 | 37 | 55 | 90 | 200 | 315 | 450 | 710 | |
| IP20 Open type | • | • | • | • | • | • | • | • | Ø | Ø | • | |
| IP21 Type 1 | \bigcirc | \bigcirc | \bigcirc | \bigcirc | | | | | | | | |
| IP54/55 Type 12 | | | | | | | | ⊘ | | | Ø | |

Configure the power hardware to your application



Pluggable and easy-to-use connectors

- Pluggable power connectors up to 43 A
- Pluggable control connectors
- Color-coding of connectors: Black, Grey, Yellow

Built in brake chopper & DC link connection

- Standard up to 43 A, optional above
- Compatible brake resistor offering

Optional built-in fuses and disconnect

Depending on IP rating and size

Hardware adaptations

- Coating Increased hardware protection
- Heatsink access panel in large units
- Extra touch protection in large units





Flexible mounting





Side-by-side mounting (including sine-wave filter)

Highlights

- Flexible mounting orientation
- Side-by-side mounting
- Sine-wave-filters size aligned with frequency converter frame sizes, up to frame Fx05

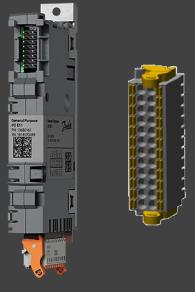
| | IP20 | IP21 | Side-by- Side | Full robustness | IP reduced to IP 00 |
|--------------------------|-----------|-----------|------------------|-----------------|------------------------|
| Vertical | FA02-FA12 | FK06-FK12 | • | • | - |
| Horizontal (rotated 90°) | FA02-FA05 | - | - | - | - |
| Turned upside down | - | - | - | - | - |
| On back side | FA02-FA12 | FK06-FK12 | - | - | • |

^{*} Vibration and shock





Control options



- Two variants
 - FAxxa 1 option for low depth
 - FAxx**b** 2, 3 or 4 options for more flexibility
 - No FAxxa to FAxxb upgrade kit
- FA06 FA12 always have 4 option slots
- Always with pluggable connectors for fast exchange
- Mount options flexibly, with no dedicated option slots



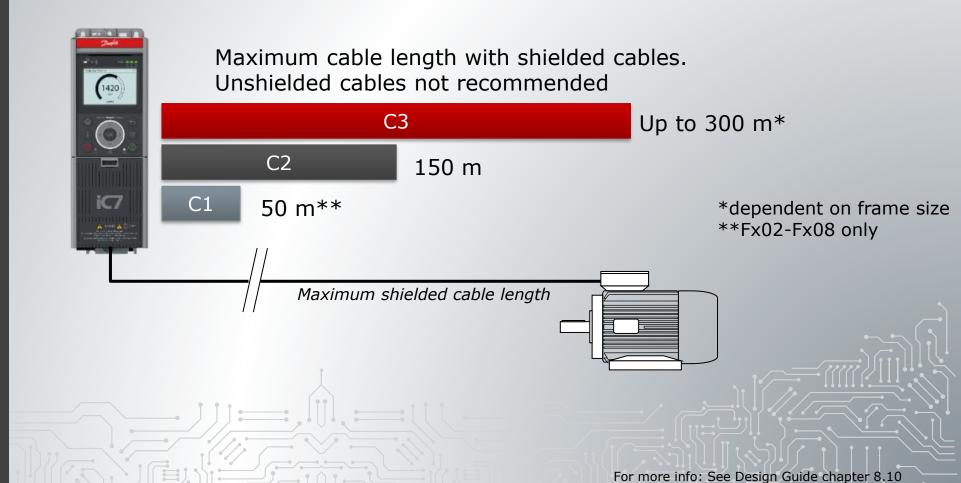
| Slot | FA02a | FA02b | FA03a | FA03b | FA04a | FA04b | FA05a | FA05b |
|---------|-------|-------|-------|-------|-------|-------|-------|-------|
| A | • | • | - | - | • | • | - | - |
| В | | • | | - | | • | | - |
| С | | | | - | | - | | - |
| D | | | | | | | | - |
| E | | | | | | | | |
| Options | 1 | 2 | 1 | | 1 | 3 | 1 | 4 |
| | / / / | | | _ | | | | |

| | | Frequency | Enclosed | System modules | | |
|---|-------------------------------|-----------|----------|----------------|-----|--|
| | | converter | drive | INU | AFE | |
| | General purpose OC7C0 | • | • | • | | |
| | Relay OC7R0 | • | • | • | | |
| ı | Encoder/Resolver Option OC7M0 | • | • | • | | |
| | I/O & relay OC7C1 | | • | • | • | |
| ı | Safety I/O + Encoder OC7S0 | • | • | • | | |
| | Temperature measurement OC7T0 | - | • | - | • | |
| I | Voltage measurement OC7V0 | | | | | |
| | Digital 230 V AC Input OC7D0 | • | I | I | I | |



EMC compliance rating – Cable length

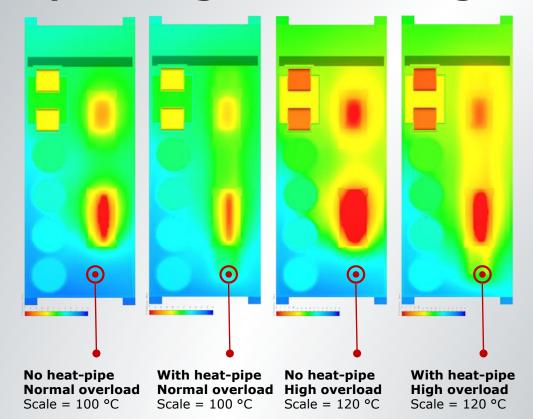
All frames Fx02-Fx12 comply to EN/IEC 61800-3





Frequency converter thermal design

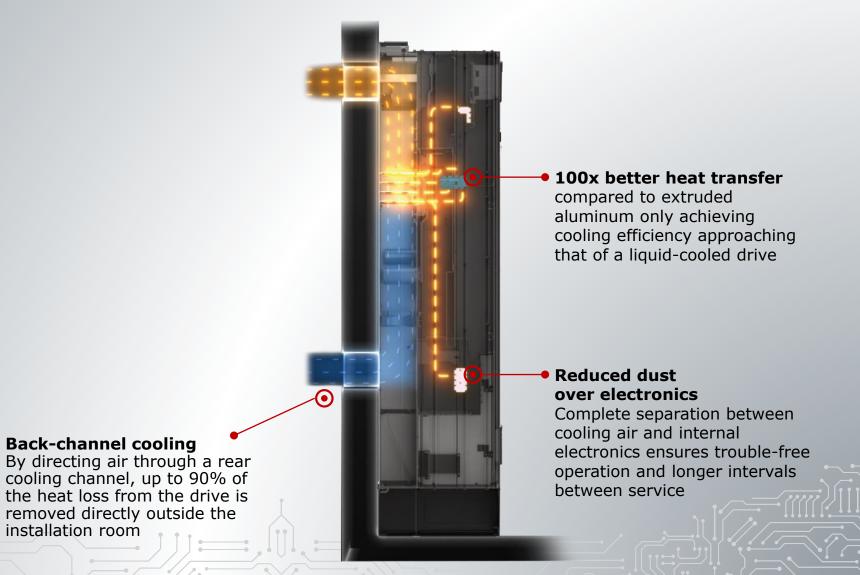
Optimizing thermal design



- Patented fan control optimizes the drive lifetime
- Lower losses
 - In the drive
 - In your application/machine
- Bigger drives
 - Heat pipes
- Back-channel cooling



Back-channel cooling





Fx09 & Fx10

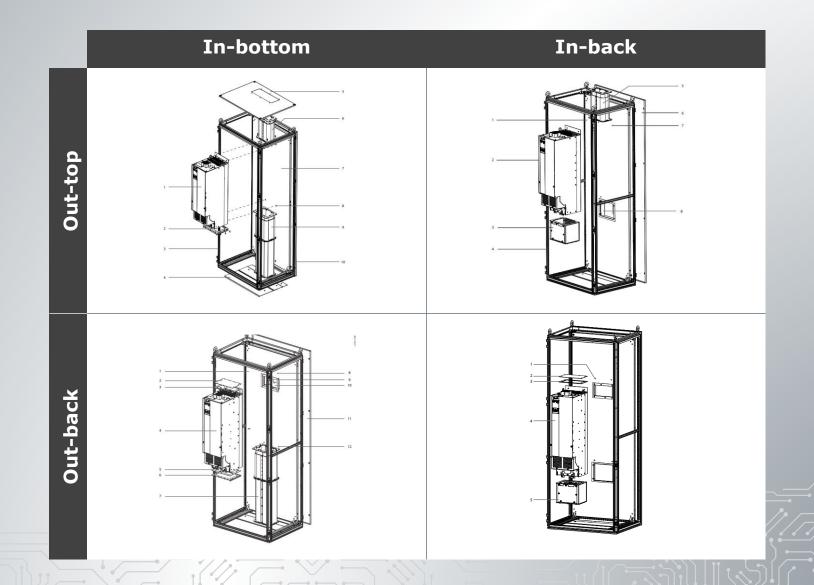
Back-channel cooling kits

| Frame | Intake | Exhaust | Number |
|-------------|--------|---------|----------|
| FA09 | bottom | top | 176F4038 |
| FA09 | bottom | back | 176F4040 |
| FA09 | back | top | 176F4042 |
| FA09 | back | back | 176F4045 |
| FK09a/FB09a | back | back | 176F4184 |
| FK09c/FB09c | back | back | 176F4190 |
| FA10 | bottom | top | 176F4039 |
| FA10 | bottom | back | 176F4041 |
| FA10 | back | top | 176F4043 |
| FA10 | back | back | 176F4046 |
| FK10a/FB10a | back | back | 176F4185 |
| FK10c/FB10c | back | back | 176F4191 |





Back-channel cooling IP20







Fx11 & Fx12

Back-channel cooling kits

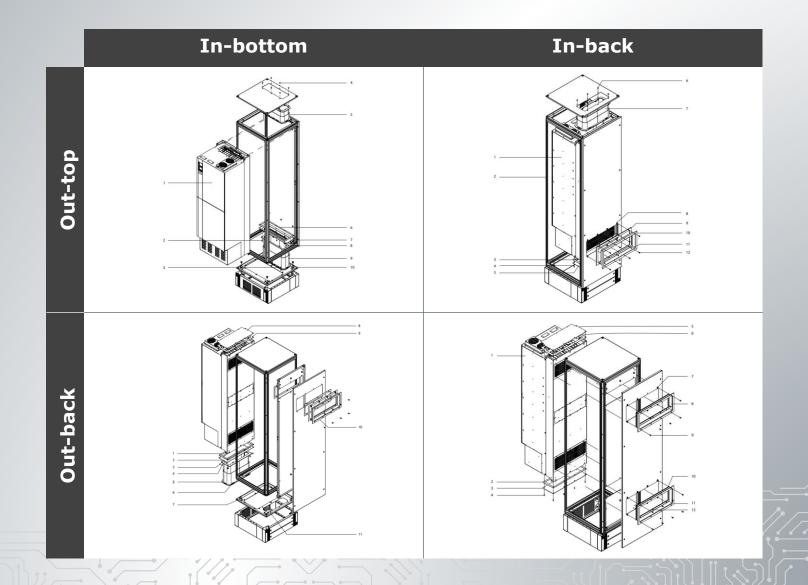
| Frame | Intake | Exhaust | | Number |
|-----------|--------|---------|----------------------------------|----------|
| FA11 | bottom | top | for 600 mm (24 in) cabinet width | 176F4047 |
| FA11 | bottom | top | for 800 mm (32 in) cabinet width | 176F4192 |
| FA11 | back | back | | 176F4057 |
| FA11 | back | top | | 176F4061 |
| FA11 | bottom | back | for 600 mm (24 in) cabinet width | 176F4059 |
| FA11 | bottom | back | for 800 mm (32 in) cabinet width | 176F4193 |
| FA11 | back | top | | 176F4061 |
| FK11/FB11 | back | back | | 176F4168 |
| FA12 | bottom | top | for 800 mm (32 in) cabinet width | 176F4048 |
| FA12 | back | back | | 176F4058 |
| FA12 | back | top | | 176F4062 |
| FA12 | bottom | back | for 800 mm (32 in) cabinet width | 176F4060 |
| FA12 | back | top | | 176F4062 |
| FK12/FB12 | back | back | | 176F4169 |

Bottom plate size does vary between the 600 and 800 mm variant





Back-channel cooling IP20



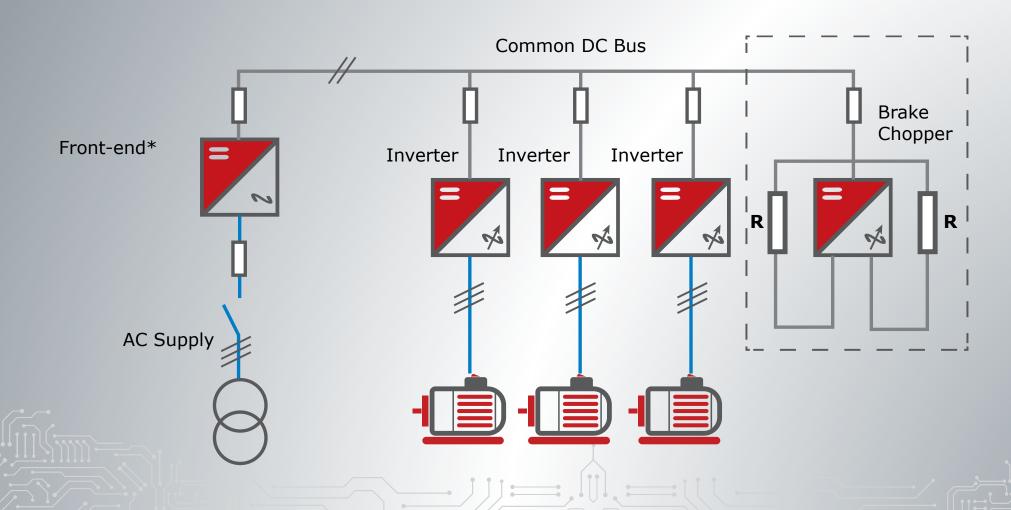




Air-cooled system modules

Air-cooled system modules — Common DC bus





*Front-end can be either AFE or NFE





Inverter & AFE modules



| Voltage rating | 3x 380-500 V AC -15%/+10% | | |
|-------------------|------------------------------|--|--|
| Output current | 385-4870 A | | |
| Protection rating | IP00, UL Open type | | |

Highlights

- Ultra compact
- Modular and configurable drive
- STO and SS1-t (SIL3) as standard
- Scalable & modular control platform
- Powerful hardware-based security including end-to-end encrypted data transfer
- Connectivity with multiple fieldbuses
- Easy cabinet integration using integration unit
- Superior motor control performance







Key specifications - Active front-end modules

| | Active front-end | | | | | | | | |
|--------------------------------------------------------|------------------|-------------|--------------|---------------|---------------|---------------|---------------|---------------|--|
| Size | AM10 | AM11 | 2 x AM10 | 2 x AM11 | 3 x AM11 | 4 x AM11 | 5 x AM11 | 6 x AM11 | |
| Nominal current, I _N [A] @400 V | 324- 525 | 593- 833 | 940- 1052 | 1236- 1664 | 1899- 2501 | 2859- 3338 | 3726- 4165 | 4594- 5002 | |
| Low overload current, I _L [A] @400 V | 317- 514 | 580- 816 | 920- 1030 | 1210- 1630 | 1860- 2450 | 2800- 3270 | 3650- 4080 | 4500- 4900 | |
| High overload current, I _H [A] @400 V | 263- 426 | 464- 678 | 735- 850 | 980- 1360 | 1575- 2030 | 2231- 2710 | 2888- 3390 | 3544- 4070 | |
| DC power at I _L [kW] @400 V | 216- 349 | 394- 555 | 625- 700 | 822- 1107 | 1263- 1664 | 1902- 2221 | 2479- 2771 | 3056- 3327 | |





Key specifications - Inverter modules

| | Inverter modules | | | | | | | | |
|--------------------------------------------------------|------------------|-------------|---------------|---------------|---------------|---------------|---------------|---------------|--|
| Size | IM10 | IM11 | 2 x IM10 | 2 x IM11 | 3 x IM11 | 4 x IM11 | 5 x IM11 | 6 x IM11 | |
| Nominal current, I _N [A] @400 V | 394- 603 | 672- 899 | 1021- 1123 | 1287- 1746 | 1797- 2563 | 2695- 3349 | 3492- 4145 | 4410- 4972 | |
| Low overload current, I _L [A] @400 V | 385- 590 | 658- 880 | 1000- 1100 | 1260- 1710 | 1760- 2510 | 2640- 3280 | 3240- 4060 | 4320- 4870 | |
| High overload current, I _H [A] @400 V | 320- 490 | 547- 731 | 830- 913 | 1050- 1420 | 1470- 2090 | 2200- 2730 | 2840- 3370 | 3590- 4050 | |
| Typical motor power [kW] @400 V | 200- 315 | 355- 500 | 560- 630 | 710- 900 | 1000- 1400 | 1500- 1800 | 1900- 2200 | 2400- 2700 | |
| Typical motor power [HP] @460 V | 270- 420 | 475- 670 | 750- 840 | 950- 1210 | 1340- 1880 | 2010- 2410 | 2550- 2950 | 3220- 3620 | |



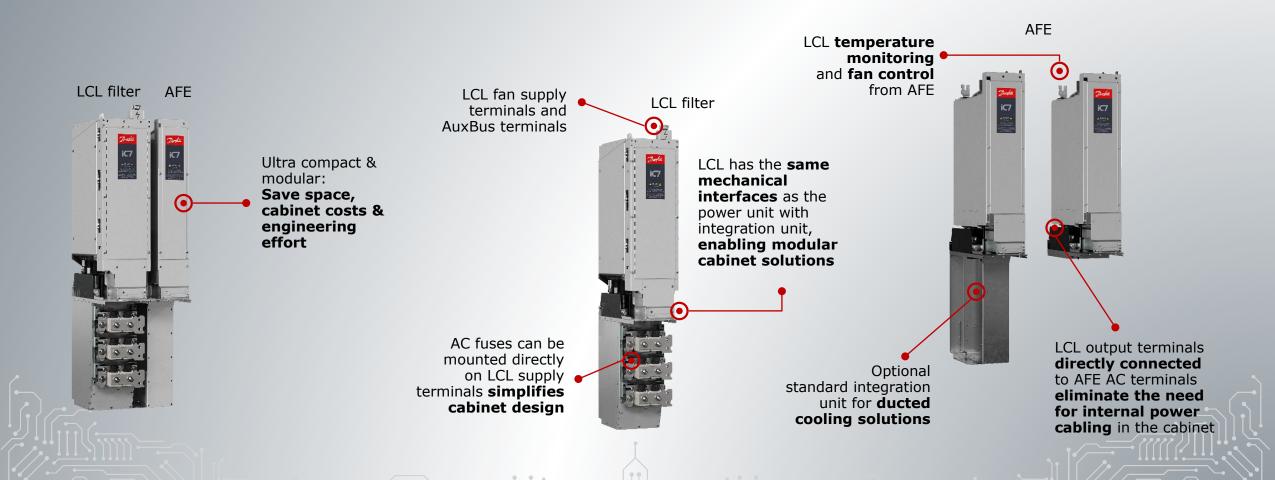
Key specifications - Active front-end modules and Inverter modules

| Voltage rating | 3x 380-500 V AC, -15%/+10% |
|--------------------------------------------------|----------------------------|
| Current range (I_L) Active front-end modules | 317-4900 A |
| Current range (I _L) Inverter modules | 385-4870 A |
| Overload | 110%/150% 1/5 min |
| Protection rating | IP00/UL Open type |
| Rated temperature | -15 to 40 °C/5 to 104 °F |
| Maximum temperature (with derating) | 55 °C/131 °F* |
| Environmental | PD2/C4 |
| Rated altitude | < 1000 m/3280 ft |
| Maximum altitude (with derating) | 4000 m/13124 ft |



Active Front-end (AFE) modules – features and benefits





Air-cooled inverter modules – features and benefits





Ultra compact & modular: Save space, cabinet costs & engineering effort

> Slide-in / pull out solution for easy power unit installation with no interference from motor cables

Integration unit with optional built-in HF common-mode or/and dU/dt filter reduces design & integration effort

DC-side terminals on top with DC fuse option available

> Integrated thermal monitoring of filters for increased robustness and uptime

Spacious output busbars for paralleled motor cables simplify cabinet design

Flexible cooling arrangements: cooling air intake from front (traditional) or base.

Back-channel cooling reduces CAPEX and **OPEX** of e-room cooling needs

33% smaller enclosure footprint compared to next best alternative





Air-cooled system modules

Industry-leading power density



Highlights

- New technologies deliver advanced filter integration and thermal management
- Smaller enclosures or fewer cabinet sections required. Filters integrate under the module
- Reduced total busbar length: fit more modules within a fixedwidth cabinet
- Reduced total assembly weight
- Fewer units to be installed
- Electrical room size reduction



Air-cooled system modules

Engineered for integration



Highlights

- Ease of installation and scalability each unit is designed and tested as thermally independent
- Reduced engineering and assembly time
- Designed for efficient enclosure installation
- Optional integration units
- Reduced testing time





Easy integration

iC7 cabinet integration solution with integration units





Air-cooled system modules

Industry benchmark cooling efficiency



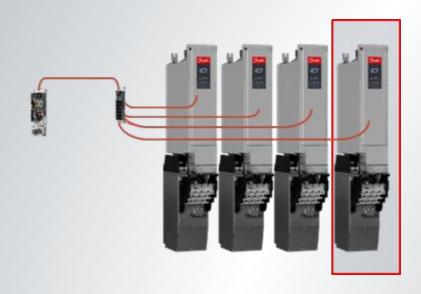
Highlights

- Industry benchmark for efficient cooling arrangement including the thermal load of integrated power options
- Market-exclusive IP54 cooling channel reduces ownership costs and simplifies cooling design
- Energy savings
- Reduced installation time
- Operation cost savings reduced heat load in the installation location
- Installation cost savings



Redundancy

Optimized uptime with power unit redundancy ensures process continuity and safety



- Switch to a reduced power configuration in case of a failure and prevent any interruption or damage to the process.
- No immediate need to replace a power unit thus fewer spare units needed in stock.



Air-cooled system modules — Engineered for easy integration



- iC7 air-cooled system modules are developed for a wide range of cabinet solutions:
 - lean basic variant
 - variants with an integration unit
 - can include both common mode and dU/dt filter

- Unified form factor and mechanical interfaces minimize engineering effort
- Integration unit enables market-unique backchannel cooling solutions for system modules

 Scalable and modular control unit







Inverter module with short integration unit IR10/11



Inverter module with standard integration unit IR10/11



AFE module AM10/11



AFE module with integration unit AR10/11



AFE module & LCL filter with standard integration unit AR10/11



LCL filter LCL10/11

Air-cooled system modules



Inverter modules with no integration unit

- Basic mechanics supports side-by-side mounting on a wall
- Output filters are available as loose options
- Compact dimensions
 - IM10 W x D x H: 170 x 502 x 990 mm
 - IM11 W x D x H: 210 x 502 x 990 mm
- Lightweight
 - IM10: 65 kg
 - IM11: 75 kg



DC-side terminals on top with optional DC fuse assembly available

Common-mode and dU/dt filters available as loose options



as staggered busbars: for paralleled cables

Air-cooled system modules with integration unit





Inverter modules with integration unit Optional integration units enable:

- Common mode and du/dt filter integration
- Support for both traditional and ducted cooling solutions
- Easy power unit removal (or mounting) to the integration unit without removing motor cables
- Power extension by paralleling: use the same mechanics from 200 kW up to MW range

Dimensions

Dimensions and weight: INU and AFE modules, LCL filters

| Module type | | Inverter | | Al | LCL filters | |
|-------------|--------|----------|------|------|-------------|-------------|
| Frame | | IM10 | IM11 | AM10 | AM11 | LCL10/LCL11 |
| [mm] | Width | 170 | 210 | 170 | 210 | 260 |
| | Height | 990 | 990 | 990 | 990 | 1530 |
| | Depth | 502 | 502 | 502 | 502 | 553 |
| [kg] | Weight | 65 | 75 | 65 | 75 | - |
| | | | | | | |
| [in] | Width | 6.7 | 8.3 | 6,7 | 8.3 | 10.2 |
| <u></u> | Height | 39 | 39 | 39 | 39 | 60.2 |
| | Depth | 19.8 | 19.8 | 19.8 | 19.8 | 21.8 |
| [lb] | Weight | 143 | 165 | 143 | 165 | _ |

Dimensions

Dimensions and weight: INU, AFE and NFE modules with short integration unit

| Module type | | Inverter with i | Inverter with integration unit | | AFE with integration unit | | |
|-------------|--------|-----------------|--------------------------------|------|---------------------------|------|--|
| Frame | | IR10 | IR11 | AR10 | AR11 | NR11 | |
| [mm] | Width | 235 | 235 | 235 | 235 | 235 | |
| | Height | 1302 | 1302 | 921 | 921 | 921 | |
| | Depth | 553 | 553 | 553 | 553 | 553 | |
| [kg] | Weight | 90 | 100 | 72 | 82 | - | |
| | | | | | | | |
| [in] | Width | 9.3 | 9.3 | 9.3 | 9.3 | 9.3 | |
| , | Height | 51.3 | 51.3 | 36.3 | 36.3 | 36.3 | |
| , | Depth | 21.8 | 21.8 | 21.8 | 21.8 | 21.8 | |
| [lb] | Weight | 198 | 221 | 159 | 181 | - | |

Dimensions

Dimensions and weight: INU and AFE modules with standard integration unit

| Module type | | Inverter with i | ntegration unit | AFE with integration unit | | |
|----------------------------------------------|--------|-----------------|-----------------|---------------------------|------|--|
| Frame | | IR10 | IR11 | AR10 | AR11 | |
| [mm] | Width | 235 | 235 | 235 | 235 | |
| | Height | 1530 | 1530 | 1530 | 1530 | |
| | Depth | 553 | 553 | 553 | 553 | |
| [kg] | Weight | 92 | 102 | 78 | 88 | |
| | | | | | | |
| [in] | Width | 9.3 | 9.3 | 9.3 | 9.3 | |
| , | Height | 60.2 | 60.2 | 60.2 | 60.2 | |
| <u>, </u> | Depth | 21.8 | 21.8 | 21.8 | 21.8 | |
| [lb] | Weight | 202.8 | 224.9 | 172 | 194 | |





Air-cooled enclosed drives



Air-cooled enclosed drives

6-pulse enclosed drives



| Voltage rating | 3 x 380-500 V AC -15%/+10% |
|-------------------|-----------------------------------|
| Output current | 206-1710 A |
| Protection rating | IP21/UL Type 1 IP54/UL Type 12 |

- Save space with world-class power density
- Safe door-in-door access to the control compartment
- Pull out the drives without removing power cables
- IP54 segregated cooling channel with option for back-channel cooling
- Wide range of pre-designed options



Air-cooled enclosed drive overview



Key specifications

| Enclosure size | FE09 | FE10 | NE11+ IE11 | NE11+ 2 x IE10 | 2 x NE11+ 2 x IE11 |
|---------------------|---------|---------|---------------|-------------------|-----------------------|
| Nominal current [A] | 206-385 | 480-588 | 658-880 | 1000-1100 | 1260-1710 |
| Power [kW] | 110-200 | 250-315 | 355-500 | 560-630 | 710-900 |
| Max Power [HP] | 250 | 450 | 650 | 900 | 1300 |

| Voltage rating | 3 x 380-500 V AC, -15%/+10% |
|-------------------------------------|---------------------------------|
| Current range | 206-1710 A |
| Overload | 110%/150% 1/5 min* |
| Protection rating | IP21/UL Type 1, IP54/UL Type 12 |
| Rated temperature | -15 to 40 °C/5 to 104 °F |
| Maximum temperature (with derating) | 50 °C/131 °F* |
| Environmental | PD2/PD3 |
| Rated altitude | < 1000 m/3280 ft |
| Maximum altitude (with derating) | 4000 m/13124 ft |
| | |

* 1/10 min for FE9, FE10





Air-cooled enclosed drives

Low-harmonic or regenerative enclosed drives



| Voltage rating | 3 x 380-500 V AC -15%/+10% |
|-------------------|-----------------------------------|
| Output current | 385-1710 A |
| Protection rating | IP21/UL Type 1 IP54/UL Type 12 |

- Save space with world-class power density
- Safe door-in-door access to the control compartment
- Pull out the drives without removing power cables
- IP54 segregated cooling channel with option for back-channel cooling
- Clean grid connection, THDi < 5%



Air-cooled enclosed drive overview

Key specifications

| Enclosure size | AE10 + IE10 | AE11 + IE11 | 2 x AE10 + 2 x IE10 | 2 x AE11 + 2 x IE11 |
|---------------------|-------------|-------------|------------------------|------------------------|
| Nominal current [A] | 385-590 | 658-880 | 1000-1100 | 1260-1710 |
| Power [kW] | 200-315 | 355-500 | 560-630 | 710-900 |
| Max Power [HP] | 450 | 650 | 900 | 1300 |



| Voltage rating | 3 x 380-500 V AC, -15%/+10% |
|-------------------------------------|-----------------------------|
| Current range | 385-1710 A |
| Overload | 110%/150% 1/5 min |
| Protection rating | IP21/UL Type 1 |
| Rated temperature | -15 to 40 °C/5 to 104 °F |
| Maximum temperature (with derating) | 50 °C/131 °F* |
| Environmental | PD3/3C3 |
| Rated altitude | < 1000 m/3280 ft |
| Maximum altitude (with derating) | 4000 m/13124 ft |

Air-cooled enclosed drives – features and benefits

•





Separate cooling channels for main and auxiliary cooling offer better reliability and lower maintenance costs

Wide range of options:

Input devices Output filters Top cabling Back-channel cooling **Auxiliary options**



Easy power unit replacement without removing motor cables

Innovative cooling arrangements: optional back-channel cooling reduces CAPEX and OPEX of e-room cooling needs





Air-cooled enclosed drives power density

Ultra-compact enclosed drive



iC7-Automation Enclosed Drive 315 kW: 800 mm

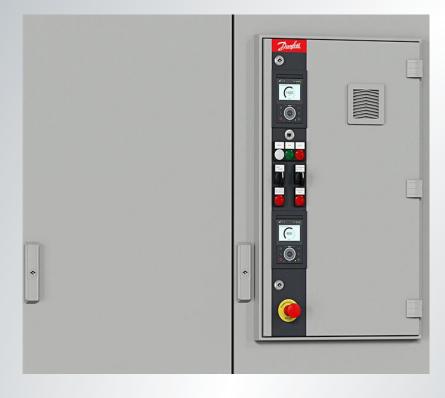
Next-best alternative 315 kW: 1200 mm

- Highly compact design with high power density
- Small footprint: Occupies 42 % less floor space than alternatives



Air-cooled enclosed drives door-in-door

Easy and safe access



Easy access control compartment

- Door-in-door compartment mounted to the cabinet frame
- Easy and safe access to control and auxiliary devices
- Swings out for power unit access

Features

- Control unit and selected options
- Customer terminals for control cables
- EMC earthing and pull relief for control cables
- Optional auxiliary equipment
- Control panel mounted on the door



Air-cooled enclosed drives serviceability

Easy serviceability



- Effortless exchange:
 - Lightweight power units
 - No need to disconnect motor cables
- Front access to motor cable terminals on integration unit
- Service table and optional service beam for easy maintenance
- Cooling fans
- Integrated in single assembly
 - Easy access at front hatch



Air-cooled enclosed drives cooling

Dedicated cooling channel



- IP54 segregation between main cooling channel and cabinet interior
- Back-channel cooling option enables air inlet and outlet at the rear of the cabinet
- Efficient output filter cooling by integration in main cooling channel
- Main heat losses extracted from E-room
- Filterless design ensures equal superior thermal performance for both IP21 and IP54



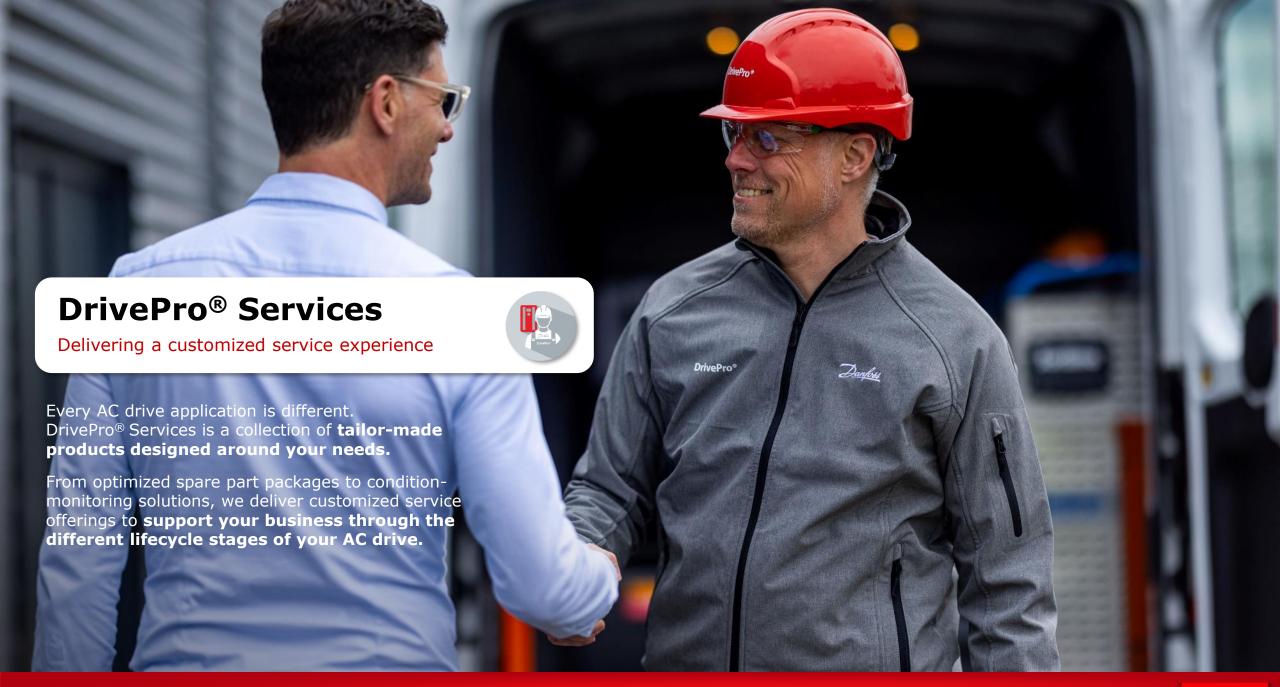


Air-cooled enclosed drives options

Engineered for easy integration

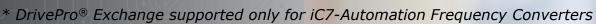
| G-group Control & Input options functions | Mains contactor, mains switch, air circuit breaker, earthing device |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| I-group Control & functions Auxiliary options | Motor heater control, motor fan control, motor brake control, cabinet heater, service socket, aux voltage supply, signal lights |
| K-group Installation & access Mechanical options | Gland plate, cabling from top |
| M-group Output & protection Output options | Common mode filter, dU/dt filter without common mode filter, dU/dt filter with common mode filter |
| O-group Cooling efficiency Cooling options | Back-channel cooling, cooling flange |
| Q-group Maintain & service Service options | Power unit service beam |





DrivePro® Services

- **DrivePro® Site Assessment** Complete on-site survey with detailed report
- **DrivePro® Start-up** Take the complexity out of commissioning
- **DrivePro® Extended Warranty** Get the longest coverage available in the industry
- **DrivePro® Spare Parts** Plan your spare part package ahead of time, for no delays
- **DrivePro® Exchange*** Reduce costly downtime with fast replacement of power converters





First-mover controls conveyor systems with iC7-Automation



Brasserie Caulier Péruwelz, Belgium

Brewery bottling line conveyors



- Nominal throughput increased to 20,000 bottles per hour
- Improved productivity



- Lower CO₂ emissions
- Less water consumption



- · Easy to program using MyDrive® Insight software
- iC7-Automation is easy to mount, connect, install and use
- Intelligent and intuitive operation



Food and Beverage

Fast upgrade to IE5 efficiency with iC7-Automation



AB InBev Hoegaarden® Belgium

Brewery bottling line conveyors



IE5 energy efficiency

Fast installation and commissioning: **2 days**



Easy integration with future upgrades

Future proofed with easy scalability

Cybersecure-by-design



iC7-Automation

VLT® OneGearDrive

Effortless control: Kohberg Bakery thrives with iC7-Automation



Kohberg bakery Denmark

Bread roll conveyor line



- Improved efficiency
- Lower CO₂ emissions
- Improved overview of energy consumption



- iC7-Automation delivers servo functionality
- Fast installation and commissioning



- Highly adaptable for the future with easy scalability of iC7-**Automation**
- New functionalities can be activated with no replacement of control boards, no shutdown required





Wehrliau pumping station, Region Bern, Switzerland

Water pumping station



- Clean power network & high efficiency thanks to low-harmonic front end and installation close to the motor
- 30% smaller footprint with compact & reliable iC7 drives for speed control



- Reliable & high-quality drinking water supply of up to
- **20,000** liters per minute
- Maintenance time reduced from several hours to just a few minutes

Electrification of horizontal directional drilling rig

Herrenknecht, Netherlands

Conversion of horizontal directional drilling (HDD) rig from hydraulic to electric



- Boosts supply from
 400 to 700 V DC
 for HDD
- 40-50% smaller generator thanks to minimal harmonics



• High torque accuracy in mobile rig





Hvala

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