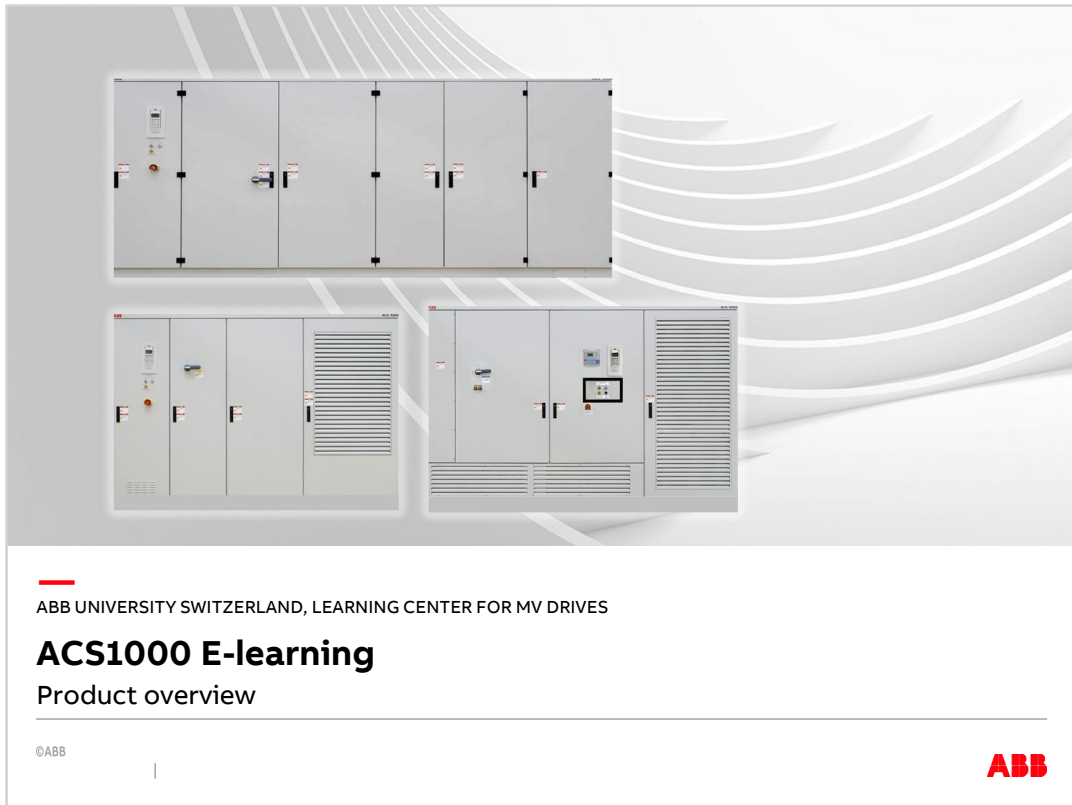




Welcome to the ACS1000 training course.

Some general information about the training course would be useful, in order to organize your time.

The course is structured in several modules, for a total duration of more than four hours.

Of course, the training needs all your concentration and it is obvious that you cannot spend four hours in a row in front of your computer only for this training. On the other hand, you might have some other daily tasks. That means it is not realistic to think the training will be achieved in one day. According to our experience with web-based trainings, such a training is completed usually in three to four days.

Please take this into consideration when organizing your time for this training. We wish you good luck!

Objectives

Upon completion of this part the student will be able to understand and explain to others:

- MV Drives Applications
- The product configurations included in the ACS1000 Medium Voltage Drive family
- ACS1000 rated values
- Key technologies: DTC, IGCT

In this section, you will have an overview of the ACS1000 product family, its applications, basic characteristics, configurations, rated values and key technologies.

Applications



Cement, Mining & Minerals

Crushers, mills, fans and pumps, conveyers, mine hoists



Chemical, Oil & Gas

Compressors, extruders, pumps, mixers, blowers



Marine

Propulsion, pumps



Metals

Bar and rod mills, blast furnace, fans and pumps



Power

Fans, pumps, conveyers, coal mills



Pulp & Paper

Fans, pumps, refiners, vacuum pumps



Water & Waste Water

Pumps



Special Applications,
e.g. Wind Tunnels

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ABB Medium Voltage Drives are used in a wide range of industries and applications, such as cement, mining and minerals, chemical, oil and gas, marine, metals, power plants, pulp and paper, water stations and other special applications. The load could be blowers, fans, conveyors, compressors, extruders, mixers, pumps, refiners, gas and hydro turbine starters, soft starters for large machines, test stands, wind tunnels and so on. ACS1000 can be used in all these areas, mainly for standard applications such as pumps, fans, conveyers, extruders, compressors.

ACS1000 Product Family

ACS1000: Standard drive for induction motors.

Front end: Diode rectifier, 12 pulses or 24 pulses



ACS1000A: Air Cooled Drive

- External transformer
- Power range 0.315... 1.8 MW
- Three power frames: A1, A2, A3
- 2.3, 3.3 and 4 (4.16) kV

ACS1000W: Water Cooled Drive

- External transformer
- Power range 1.8... 5 MW
- Three power frames: W1, W2, W3
- 3.3 and 4 (4.16) kV

ACS1000A: Air Cooled Drive, Integrated

- Integrated (internal) transformer
- Power Range 0.315... 2 MW
- Three power frames: A1, A2, A3
- 3.3 and 4 (4.16) kV

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The ACS1000 is a standard drive for induction motors only.

The front end is a diode rectifier available in a 12-pulse as a standard and a 24-pulse version as an option. ACS1000 is available in Air Cooled and Water Cooled versions. Both versions are supplied by an external input transformer. A version with integrated input transformer, ACS1000i, is available only for air cooled version.

The overall power range of ACS1000 is 315 kilowatts to 5 megawatts.

The air cooled drive with external transformer covers the range from 315 kilowatts to 1.8 megawatts, for motor voltages of 2.3, 3.3 and 4 or 4.16 kilovolts. ACS1000i covers almost the same power range: 315 kilowatts to 2 megawatts, but with motor voltages 3.3 and 4 kilovolts. The water cooled ACS1000 continues the power range from the maximum of the air cooled version: 2 megawatts to 5 megawatts, for motor voltages of 3.3 and 4 kilovolts.

ACS1000A: Air cooled drive

Power: 0.4 - 2 MVA, three frames: A1, A2, A3

Voltage: 2.3, 3.3 and 4 kV

External Transformer

Height:
2000 mm
without
air outlet
hood



Depth = 900 mm Width = 3000 mm

Main Features:

- Sinusoidal output
- Efficiency >98%
- IGCT technology
- Direct Torque Control

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The ACS1000 air cooled drive is rated between 0.4 and 2 megavoltamperes in three frame sizes coded A1, A2, A3, for output voltages of 2.3, 3.3 and 4 kilovolts. The cooling fan of the standard drive is installed in the middle cabinet.

Redundant fan is available as an option.

The main features apply to all ACS1000 drives: Sinusoidal output due to an output sine filter, efficiency greater than 98%, IGCT technology and DTC control technique.

ACS1000i: Air cooled drive with integrated transformer

ACS1000i: only Air Cooled

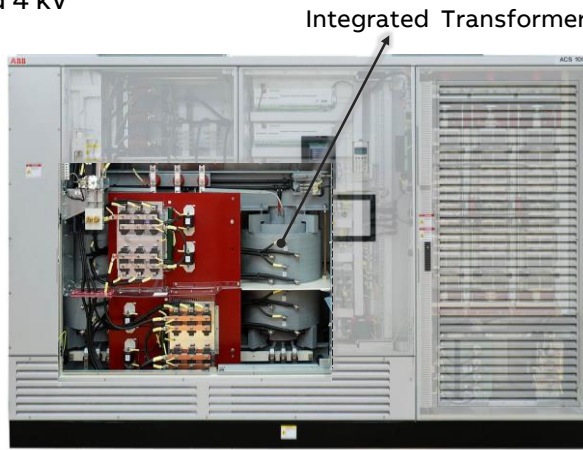
Power: 0.4 – 2.4 MVA, three frames: A1, A2, A3

Voltage: 3.3 and 4 kV

Height (without fan hood):

A1: 2050 mm

A2, A3: 2150 mm



Maximum height

(with redundant fan hood and IP42):

A1: 2617 mm

A2, A3: 2662 mm

Depth = 1121 mm Width = 3300 mm

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The ACS1000i is also air cooled, only 300 millimeters wider than the version with external transformer ACS1000A, but the input transformer is integrated into the cabinet. The power range is the same as for ACS1000A, but it comes only in two voltage ranges: 3.3 and 4 kilovolts.

As we will see in the module dedicated to ACS1000i, it has two air cooling circuits: One for the inverter cabinet and the second for the integrated transformer.

ACS1000W: Water Cooled drive

Power: 2 - 6 MVA , three frames: W1, W2, W3
Voltage: 3.3 and 4kV

Height: 2002 mm

With redundant fan:
2332 mm



Depth = 900 mm Width = 4200 mm for W1 frame size or:
Width = 4700 mm for W2 and W3 frame size
External Transformer

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The ACS1000 water cooled drive is rated between 2 and 6 megavoltamperes, for voltage outputs of 3.3 and 4 kilovolts. On the right hand side of the drive is the water cooling unit which is a re-circulating system. As the air cooled versions, it comes in three power ranges: W1, W2 and W3.

ACS1000 Rating Plate

ABB Switzerland Ltd CH-5300 Turgi			Made in Switzerland		
Type	ACS1000-040-W03B-E2-011				
Rated input voltage / 3-ph	2 x 2305	V	Rated aux. voltage / 3-ph	480	V
Rated input current	584	A	Rated aux. current / 3-ph	6.9	A
Rated input frequency	60	Hz	Rated aux. voltage / 1-ph	120	V
Max. permissible short-circuit current	15	kA, 1s (symmetr.)	Rated aux. current / 1-ph	6.4	A
Rated output voltage	0 ... 4000	V / 3-phase	Weight	3505 / 7727	kg / lbs
Rated output current	627	A	Cooling / design pressure	Water max. 10 bar 4 ... 33°C	
Rated output frequency	60	Hz	Enclosure class	IP 42	
Output frequency range	0 ... 66	Hz	Production Ref. No.	0011094184/000110	
Duty class	continuous duty, 110% overload (1 min. every 10 min.)		Serial No.	3BHB901005966	
Year of construction			2015		
Compliant to IEC 60146-1-1					

Type code: ACS1000-040-W03B-E2-011

Manufacturing key: ACS1014-W3-W0-00-F722-B0E0-3C30-000A-00000-EN

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The type code on the rating plate contains information about the basic characteristics of the drive: voltage level, power, rectifier, cooling method.

In our example the type code is ACS1000-040-W03B-E2-011.

The first seven characters, ACS1000, represent of course the drive type. The next three digits are the rated system voltage; 040 means 4 kilovolts. This parameter defines the used hardware, not necessarily the output or motor voltage. The motor voltage must match the "Rated Output Voltage" on the name plate. In this example, the hardware voltage of the type code is the same as the rated output voltage. But if high voltage spikes are expected in the system, a 4 kilovolts drive might operate a 3.3 kilovolts motor. In this case the "Rated output voltage" on the name plate will be "0 to 3300" volts instead of "0 to 4000".

The next three characters will code the cooling method and frame size; here, W03 is a water cooled drive, frame W3.

B is the subframe size, the rated power of the motor. For frame W03, B means 6000 horse power or 4500 kilowatts.

The next two characters E2 represent the configuration to the grid. The letter designates the position of the main transformer and type of rectifier: E means external transformer with diode rectifier, J is integrated transformer also with diode rectifier. The digit times six gives the number of the rectifier pulses.

Possible values for ACS1000: E2 means 12 pulse diode rectifier with external transformer, E4 means 24 pulse rectifier with external transformer, J4 means 24 pulse rectifier with integrated transformer.

The next two digits 01 are the number of connected motors. And the final digit will be 0 for standard drives or 1 for engineered solutions. It is 1 in our case.

The previous type code used until 2014, named now Manufacturing Key, is still needed for the software download main control board.

In the Medium Voltage Drives database there are documents explaining both versions of type code.

The Rated Input Voltage is another information needed when downloading the software to the main board.

Manufacturing or Fabrication Key

MRK: ACS1144-A1-H3-00-SJ02-F0WM-3C40-050C-00UA2-EN



```
cmd.exe - Shortcut - I_acs ACS1000 ACS1144-A1-H3-00-SJ02-F0WM-3C40-050C-00UA2-EN

*** Downloading ACS1000 loading package to FLASH memory ***

Phase 1/16: Checking DDCS communication and target board
Phase 2/16: Preparing files and checking components

--- Generate inverter data (ACS1000) according to typecode, wait...

Please select the air cooling fan type
from the following list:

AC - A
EC - E

[A/E]:
```

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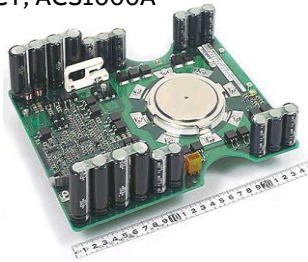
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The new type code is listed on the rating plate located on the outside of the drive and is not used for the programming of the AMC board. On the inside of the control door there is a sticker with the manufacturing key, the “old” type code, necessary to download the software to the AMC board. If this sticker is missing, please check the installed base database, or contact the Project Manager. The Manufacturing Key provides also information about the code of drive options necessary during the software download.

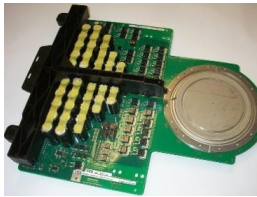
IGCT Technology

IGCT: Integrated Gate Commutated Thyristor

IGCT, ACS1000A



IGCT, ACS1000W



- IGCT delivers the benefits of IGBT's with the added robustness required for MV drive applications.
- Conducts like a thyristor
- Switches like a transistor
- Low on-state and switching losses

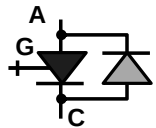
IGCT's in ACS1000: RC-IGCT's, "Reverse Conducting"



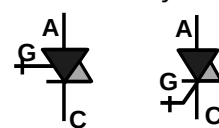
- GCT, Gate Commutated Thyristor
- Diode
- Housing

RC-IGCT

Equivalent electrical diagram



RC-IGCT Symbol



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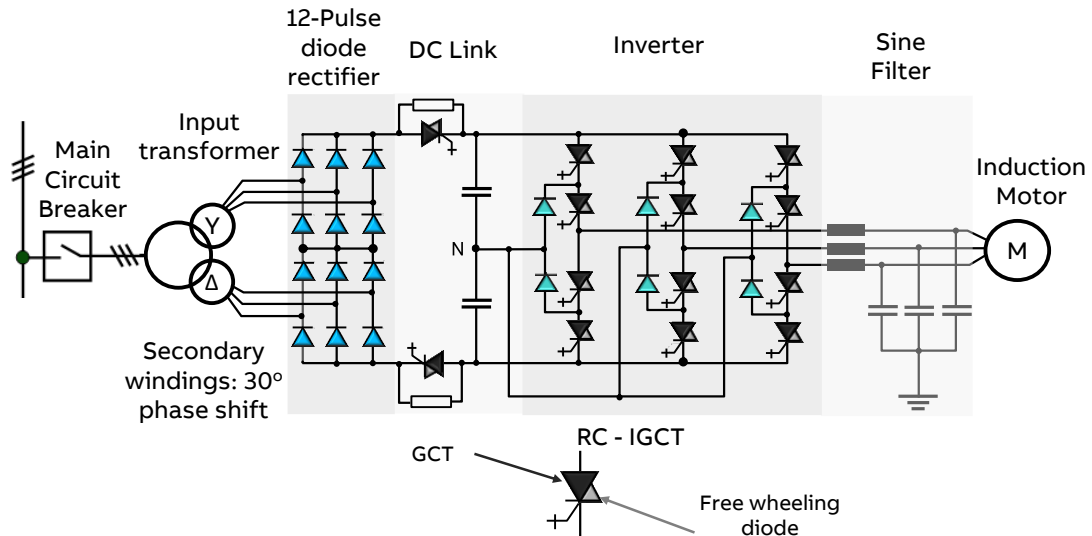
The power semiconductor switch used in ACS1000 is the IGCT, Integrated Gate Commutated Thyristor. The IGCT was specially developed for medium voltage industrial applications. The semiconductor wafer is a GCT, or Gate Commutated Thyristor. Like a GTO, or Gate Turned Off thyristor, it is a fully controllable switch. The GCT can be turned on or off by gate signals. But, due to its technology, it is much faster and more efficient than a GTO: the losses are 40% lower than in the case of GTO. The gate driver, with a special electrical and mechanical design, is integrated into the same single unit with the semiconductor, in order to reduce the circuit inductance. The interface with the external circuit is reduced to a DC power supply connector and a fiber optic receiver for on and off control. A light signal on the fiber optic receiver will turn the IGCT on; cutting off the light at the receiver will turn off the IGCT. In both ways, the switching sequence takes less than three microseconds.

Practically, the IGCT combines the speed of an IGBT with the robustness and reliability of a thyristor. It has a high turn-off rating, so no snubber circuit is necessary in applications without series IGCT's. And please remember the entire control interface is reduced to a DC power supply connector and a fiber optic cable, resulting also in a high reliability and high electromagnetic immunity. The IGCT's in all ACS1000 drives are RC-IGCT's or "Reverse Conducting" IGCT's: The power semiconductor includes a free-wheeling or reverse conducting diode in anti-parallel with the GCT. Anode A and Cathode C are marked according to the thyristor; for the diode they are in opposite direction.

ACS1000 Topology, External Transformer (A/W)

Front end: 12-Pulse rectifier – Standard

24-Pulse rectifier – Option



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From the supply network to the motor, a drive system configuration with external transformer consists of the following elements: The Main Circuit Breaker, a 12-pulse input transformer with two secondary windings, 30 degrees phase shift between the secondary windings. The drive, a Voltage Source Inverter VSI, consists of: the standard front end of the drive which is a 12 pulse diode rectifier composed of two 6-pulse bridges in series. The DC Link, containing two protection IGCT's and the DC link capacitors, which smooth the DC link voltage; the 3 phases of the Inverter, which modulate the DC voltage in order to re-create a variable frequency variable voltage 3-phase system at the motor terminals; an output sine filter which eliminates virtually all inverter switching harmonics to the motor and keeps motor and bearings free of common mode voltages. The output of the drive will supply the induction motor.

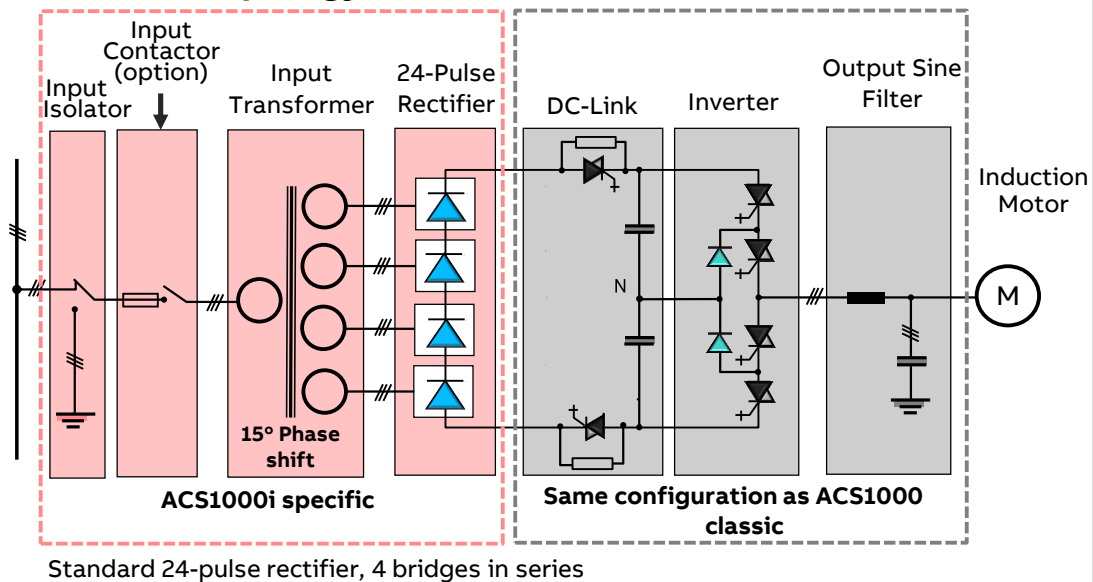
The Main Circuit Breaker, the input transformer and the motor are not part of the converter scope; the drive topology includes only the rectifier, DC link, Inverter and sine filter.

The option 24 pulse rectifier has a second 12 pulse bridge in parallel with the first one.

For 24 pulse rectifier, a transformer with four secondary windings, 15 degrees phase shift is necessary.

Please note the symbol of the 14 power switches, the IGCT's, in the drive main diagram.

ACS1000i Topology



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From the DC Link to the motor, ACS1000i has the same topology as the version with external transformer: the DC Link with two protection IGCT's and the capacitor bank, the inverter and the sine filter. Here, only one phase was represented for the inverter and sine filter.

The rectifier is completely different. It is a 24 pulse rectifier, consisting of four 6-pulse bridges in series. The series configuration decreases the voltage drop across one bridge. With this configuration, it was possible to use standard diode modules, with two diodes per module. Consequently, the mechanical design of the rectifier was simplified and its size was reduced. This made room for the integrated transformer.

The integrated transformer is also a 24 pulses one: it has four secondary windings, 15 degrees phase shift between them.

A grounding switch combined with input isolator is another characteristic of ACS1000i. In normal operation, as in the figure, the input isolator section is closed and the grounding part is open. When the drive is not energized, the input isolator will open when the grounding switch is grounded.

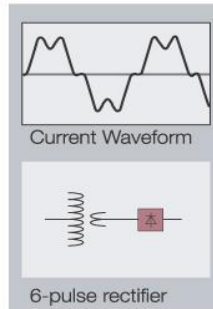
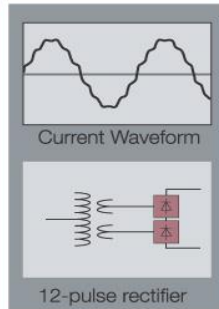
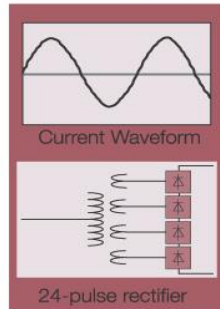
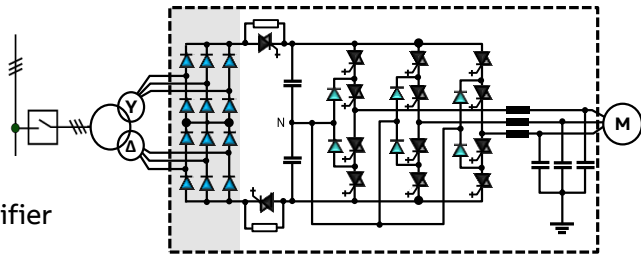
In the versions with external transformer, only the grounding switch is installed. An option available only for ACS1000i is the Integrated Main Circuit Breaker, or Input contactor.

ACS1000 – Rectifier

Standard ACS1000A and
ACS1000W: 12 pulse rectifier

24 pulse rectifier available as
option for ACS1000A and
ACS1000W

ACS1000i: Always 24 pulse rectifier



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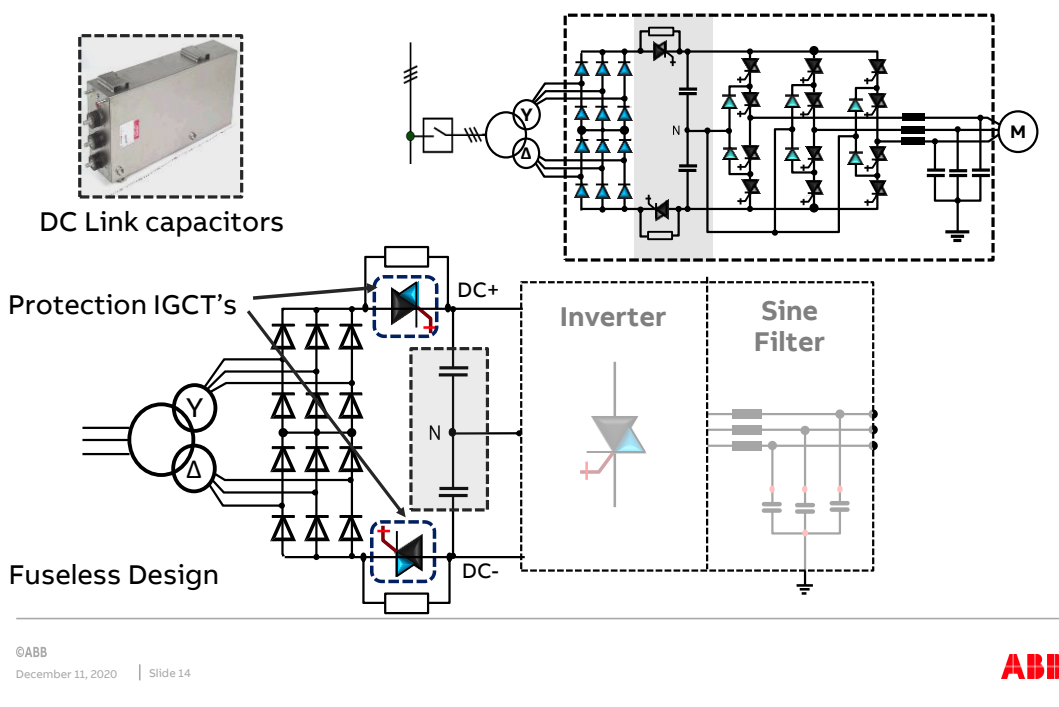
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ACS1000 is based on the three-level voltage source inverter technology. The versions with external transformer have a 12 pulse rectifier as a front end, 24 pulse rectifier is an option. The selection of a 24-pulse rectifier is based on a harmonics analysis of the customer's network; the 12-pulse rectifier is capable to provide the whole power to the drive for the maximum power range of the drive. The harmonics distortion level for 12 pulse rectifier is acceptable for most of the customers' networks.

ACS1000i is equipped with a 24 pulse diode rectifier as default.

ACS1000 – DC Link and Protection IGCTs

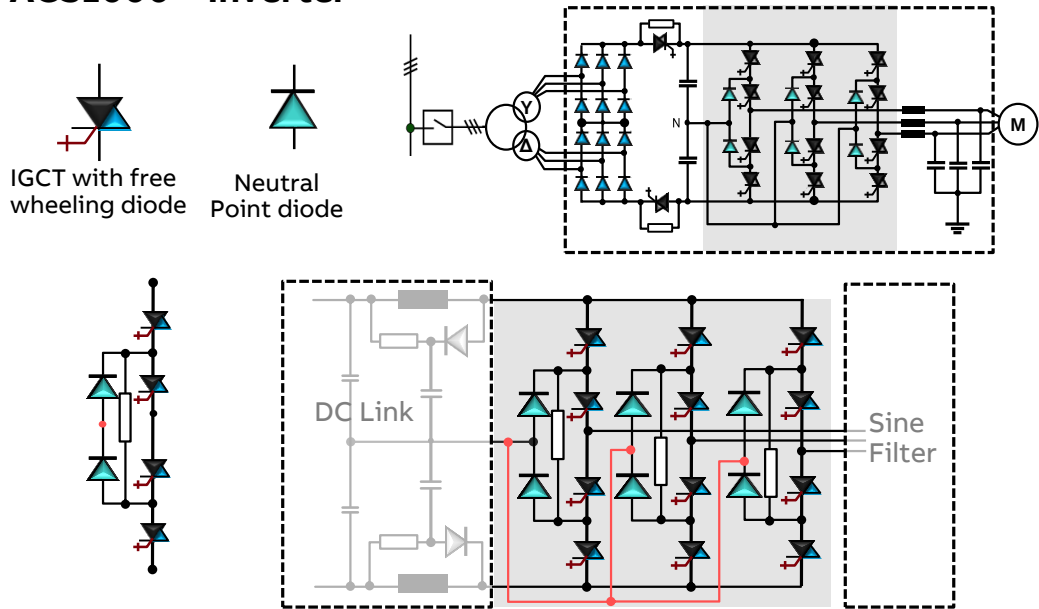


The main components of the DC Link are the DC Link capacitors, to smooth the ripples of the DC voltage and to uncouple the rectifier from the inverter. Each capacitor casing contains two capacitors, one connected between DC plus and neutral point N and the other between the neutral point and DC minus.

ACS1000 features a fuseless protection concept. The design uses two protection IGCT's for circuit protection. The protection IGCT's, which are placed between the rectifier and the DC link, can, unlike the conventional fuses, directly isolate the inverter from the power supply side. This is achieved in 25 micro seconds, which is faster than the operational performance of fuses.

In parallel with each protection IGCT there is a pre-charge resistor.

ACS1000 – Inverter



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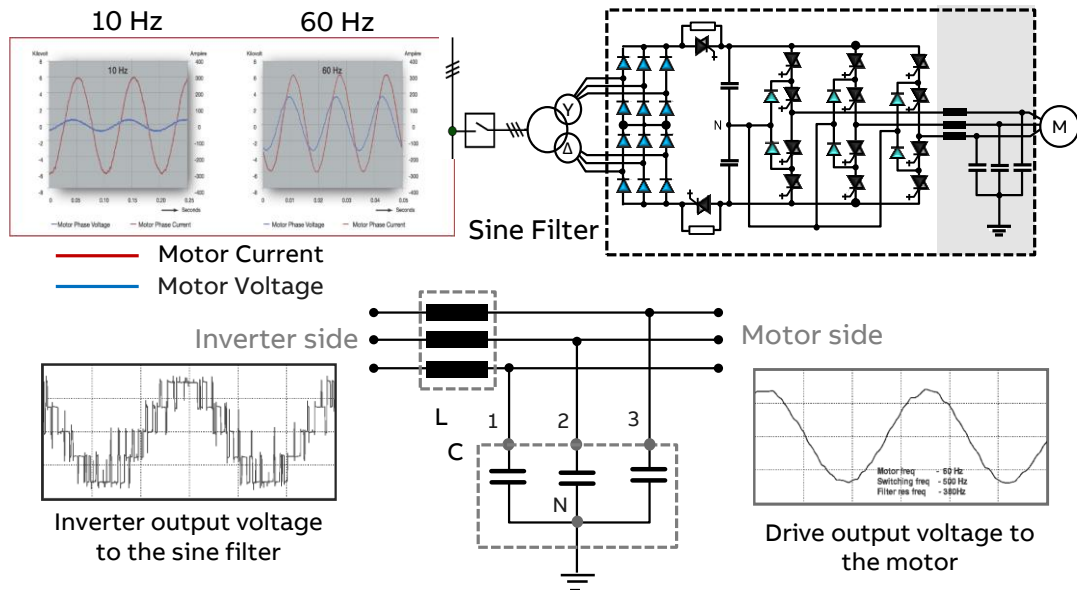
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The ACS1000 is a 3-level Voltage Source Inverter VSI. It has three phase modules, one per motor phase.

Each phase module of the 3-phase inverter bridge consists of a combination of 4 IGCT's and 2 neutral point diodes for 3-level switching operation. On the ACS1000, the IGCT's always have included in the silicon wafer a diode referred to as a freewheeling or anti-parallel diode.

ACS1000 – Sine Filter



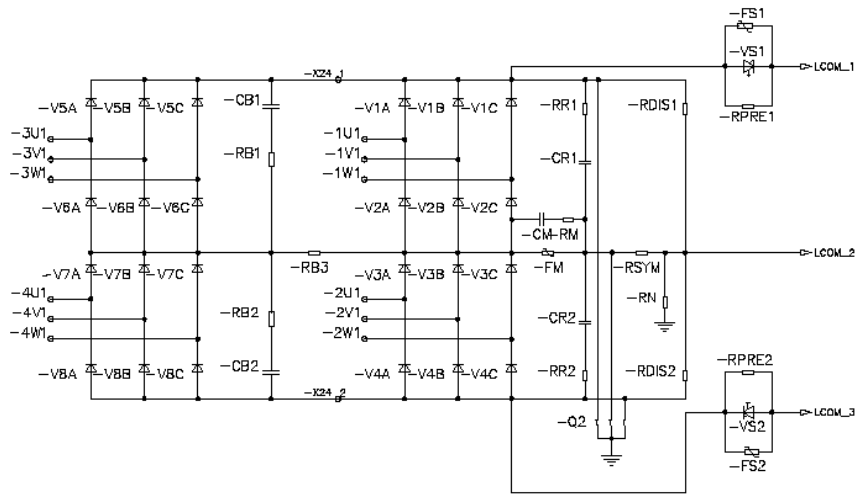
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The output sine filter is used in all ACS1000 family drives. This is an actively controlled LC low pass filter which eliminates virtually all inverter switching harmonics to the motor and hence keeps the motor and bearings free of common mode voltage. The switching harmonics at the output of the inverter are practically eliminated by the sine filter; the drive output voltage to the motor is a quasi sinusoidal wave form. The sine filter operates on the entire speed range.

Options ACS1000A and ACS1000W – 24 Pulse Rectifier



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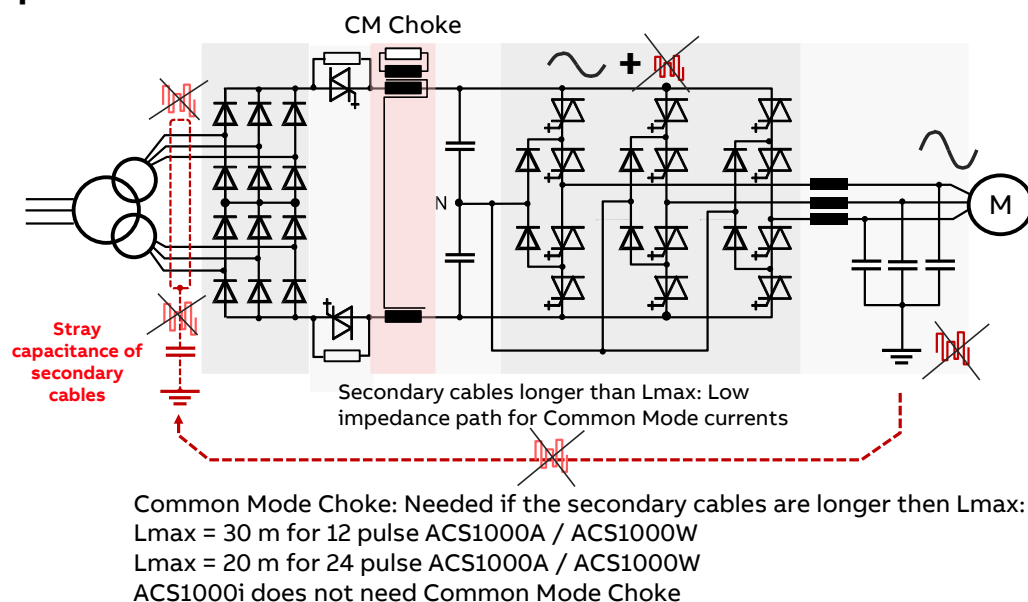
ABB

ACS1000A or ACS1000W with external transformer: 24 pulse rectifier available as option, two 12 pulse bridges in parallel.

A 24 pulse transformer is needed in this case, four secondary windings, 15 degrees phase shift.

The standard ACS1000i is already equipped with a 24 pulse rectifier, four 6-pulse bridges in series.

Options ACS1000A and ACS1000W – Common Mode Choke



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The Common Mode Choke is not a standard feature of ACS1000A or ACS1000W, but it is not really an option either. It is needed if the secondary cables, the cables between the Input transformer and the drive, are longer than 30 meters for ACS1000 with 12 pulse rectifier or 20 meters for ACS1000 with 24 pulse rectifier. If the secondary cables are longer than these values, the stray capacitance of the cables is big enough to provide a low impedance path for the high frequency harmonics rejected by the Sine Filter, which will return into the system as Common Mode currents.

The Common Mode currents can cause EMC problems with ACS1000 control, medium to short term damage to transformer or cable insulation, stress on transformer cables, risk of Ground Fault tripping.

To eliminate the phenomena of Common Mode currents in case the secondary cables are longer than the maximum specified, the Common Mode Choke option is used.

With Common Mode choke, the maximum length of secondary cables is 200 meters for 12 pulse ACS1000 and 150 meters for 24 pulse ACS1000W.

For 24 pulse ACS1000A the maximum length is 20 meters, because a Common Mode choke cannot be installed in this type of drive.

Option ACS1000A with Common Mode Choke

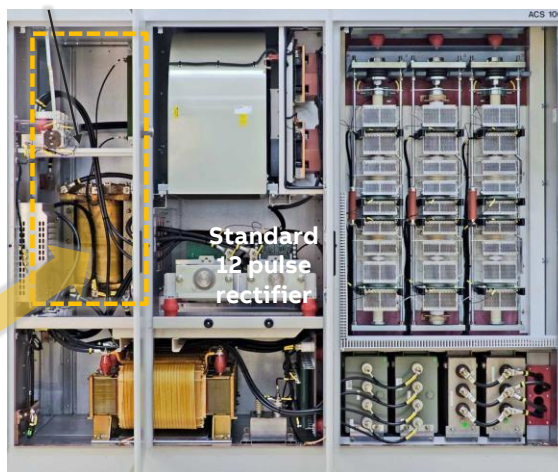


ACS1000A 24 pulse,
second 12 pulse rectifier

24 pulse rectifier: Not possible in
ACS1000A with Common Mode Choke

Spare space for
Common Mode
Choke **OR** for
24 pulse rectifier

Here: Common
Mode Choke
installed, 24 pulse
rectifier not
possible.



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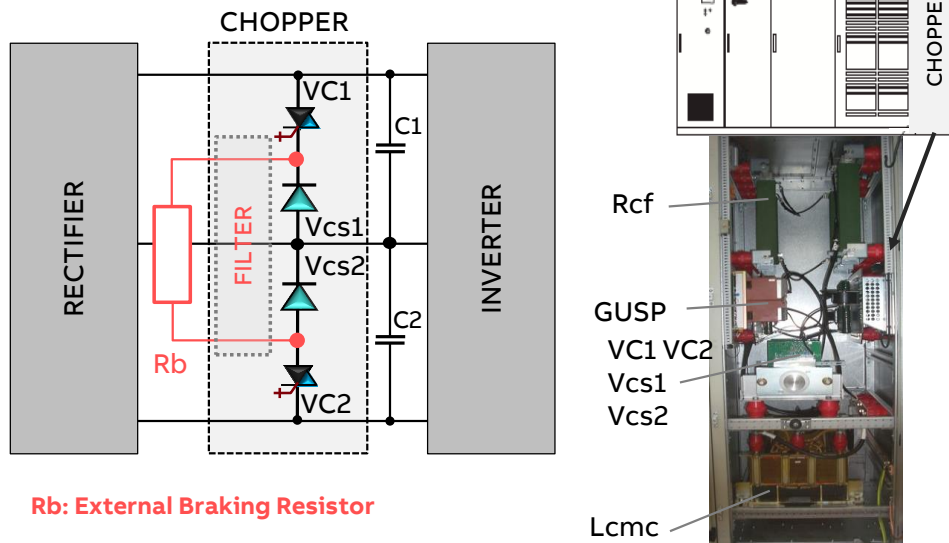
ABB

In ACS1000 air cooled with external transformer, the Common Mode Choke, if needed, is installed in the spare space behind the grounding switch. The Common Mode Choke in the middle and the damping resistors up right are visible here.

On the other hand, a 24-pulse configuration of ACS1000 would require a second 12 pulse rectifier module in parallel with the standard one. But the only available extra space in the drive is this one, behind the grounding switch. Since in our drive a Common Mode Choke is already installed, the 24 pulse configuration is not possible. Of course, the other way around applies as well: In a 24 pulse configuration of ACS1000 air cooled there is no room for the Common Mode Choke. Meaning, if the system requires a 24 pulse configuration, the maximum acceptable length of the secondary cables is 20 meters!

In ACS1000 Water cooled the Common Mode Choke is installed also in an available space inside the drive. But the second rectifier of ACS1000W is installed in another cabinet located at the left side of the drive. Consequently, the option Common Mode Choke with 24 pulse rectifier is possible for ACS1000W.

Options ACS1000 – Braking Chopper



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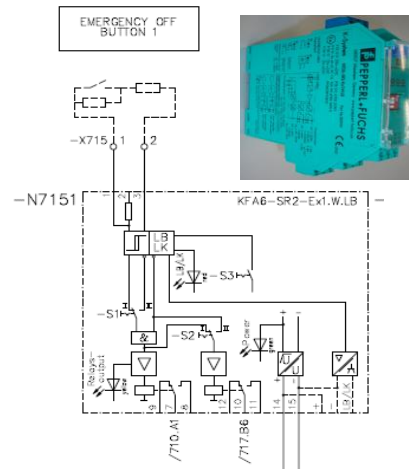
The Braking Chopper is an option available for all types of ACS1000. It is located in a separate cabinet placed on the right side of the drive. It is intended for drive applications where it is required to bring a machine driven by an ACS1000 to standstill faster than the load inertia would allow on a non-regenerative drive, such as in case of an emergency stop, when the deceleration time must be reduced or when a fan idling in an air flow has to be stopped.

Electrically, it is placed in the DC link, between the rectifier and the inverter. The main components of the braking chopper are two IGCT's and two freewheeling diodes. When the drive is braking, the energy fed back to the drive will charge the DC link. When the DC link voltage raises above a pre-set limit, the control of ACS1000 will turn on the two IGCT's and the braking energy will be discharged over the braking resistor. The braking resistor is installed outside the drive and it is not part of the scope of supply. The IGCT's are supplied by a Gate Unit Supply Power installed in the unit.

An additional filter circuit in the braking chopper limits the voltage transients across the external braking resistor.

In the control circuit, an optional I/O board, IOEC 4, is required for the braking chopper.

Hazardous Zone Devices



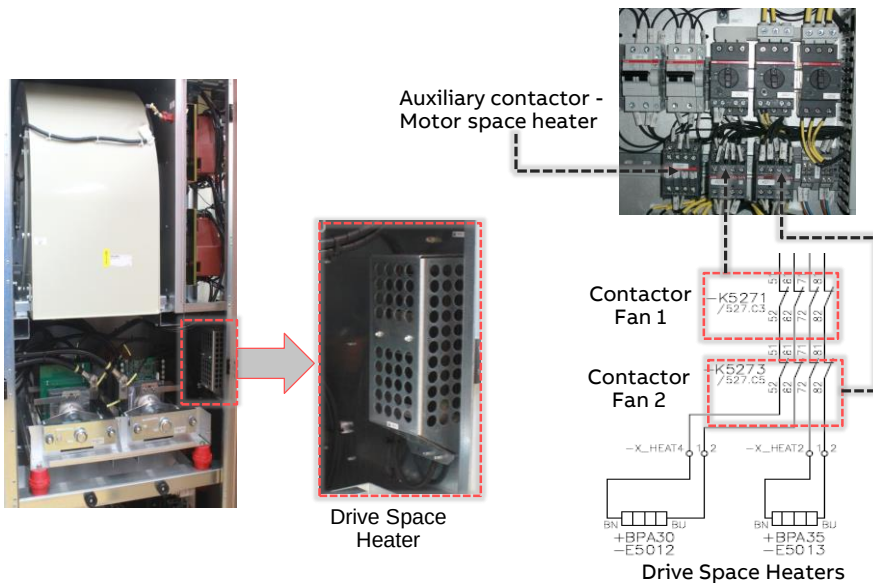
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Different types of safety barriers, such as isolation amplifiers for digital signals, smart transmitters for analogue signals, are available as options to be used in zones with explosion risk, such marine platforms, refineries, etc.

Harsh Environmental Conditions



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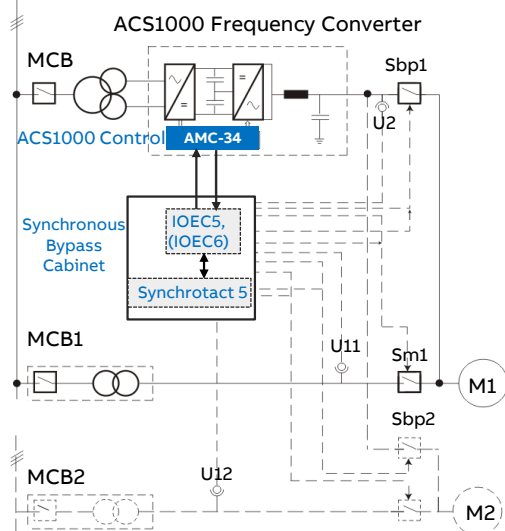
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For harsh environmental conditions, optional space heaters are available: drive space heaters and motor space heaters. The optional space heaters protect the motor or the cabinet from condensation.

The motor space heater requires an extra auxiliary contactor. The drive space heaters are turned on when the cooling system is switched off.

Options ACS1000 – Synchronized Start-up Bypass

Synchronized Bypass Cabinet
installed on the left side of ACS1000



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The Synchronized Bypass is an option used for automatic transfer of motors to the line after a soft start. Up to 4 motors can be transferred to the line using the Synchronous Bypass option. Each motor is started by the drive; for instance, for motor 1, the drive main circuit breaker MCB and the circuit breaker for bypass Sbp1 are closed and the motor is accelerated to the network frequency. The voltage transformer U2 measures one phase of the drive output while the voltage transformer U11 measures the corresponding phase of the network voltage for motor 1. They are connected to a synchronization relay Synchrotact 5.

When the drive output voltage is in synchronism with the network voltage the circuit breakers of motor 1, MCB1, and Sm1 are closed. Both, the drive and the network are connected to the motor for a couple of cycles.

The drive current is reduced to zero and when the motor is fully driven by the network, the drive breakers MCB and Sbp1 are opened and the motor is left on the network. The drive is ready for the next motor. This technique provides a bumpless transfer from drive to network.

For multimotor transfer, circuit breakers and possibly voltage transformers U12 to U14 for each motor are needed. U12 to U14 are needed if the motors 2 to 4 are supplied by different networks. The synchronization and transfer process is coordinated by the main control board of ACS1000, AMC34, located in the control unit.

The synchronization relay Synchrotact 5 and the bypass control interface equipment consisting of relay logic and I/O boards IOEC5 for motor 1 and IOEC6 for motors 2 to 4 are installed in the Synchronous Bypass Cabinet, usually located at the left side of the drive.

Please note that the voltage transformers U11 to U14 and U2 measure only one phase of the drive output and the supply network. Consequently, Synchrotact 5 cannot determine the phase rotation. It is very important for the commissioning engineer to verify the accuracy of the connections for the power cables and measuring transformers. A wrong phase rotation will damage the drive and possibly the motor.

Options ACS1000 Water Cooled – Redundant Pump

Swedewater



Cooling Pumps

Armatec



Cooling Pumps

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Some mentions about the options for Water Cooled ACS1000:

Two types of Water Cooling Units are available in ACS1000 Water cooled: Design A, Swedewater and Design B, used starting 2014, Armatec. Characteristic for Swedewater: black cooling pump partially hidden by a blue deionizing resin tank. Armatec: green pump visible in the middle of the unit. Swedewater is available either with pressurized expansion vessel or open expansion vessel.

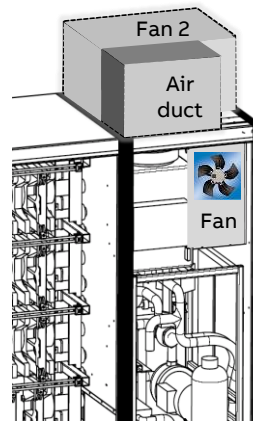
For all versions, the standard Water Cooling Unit is equipped with one pump. Redundant pump is available as option in both designs. In Swedewater units the two pumps are installed vertically behind the deionizing resin tank. In Armatec units, both pumps are visible in the middle of the unit.

Options ACS1000 Water Cooled – Redundant fan

Redundant Fan

- Only available in combination with Redundant Cooling Pump
- Placed on top of the drive's water cooling unit
- Height: 30 cm. 1 m clearance needed above.

Redundant Fan Position



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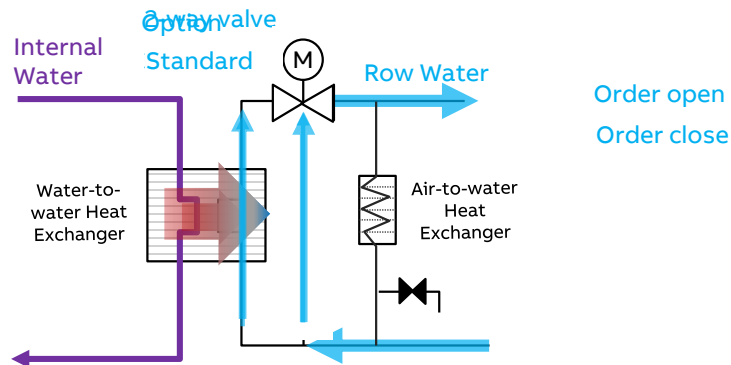
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For the cooling of the capacitors and resistors in the power part, the ACS1000 water cooling unit is equipped also with a cooling fan. An option, available only for water cooling units with redundant pump, is redundant cooling fan. The redundant fan and its air duct is placed in the top of the Water cooling unit.

The height of the redundant fan is 30 centimeters. However, 1 meter clearance above the drive is needed for exchanging the fan.

Options ACS1000 Water Cooled – Three-way Valve



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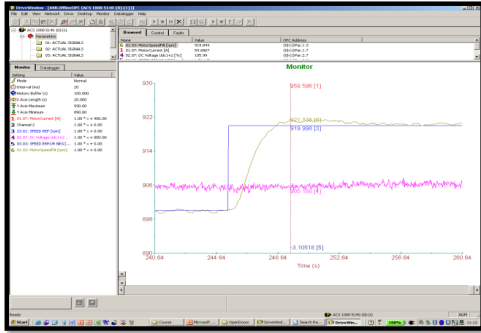
In water cooled ACS1000, the heat of the water cooled components is transferred to an external cooling circuit via a water-to-water heat exchanger. In standard drives, in order to control the temperature of the internal water, the flow through the heat exchanger is modified by a two-way valve. This will modify also the flow in the external water cooling circuit, which is actually the same.

If a constant flow is needed in the external circuit, a three-way valve is available as an option.

To adjust the heat transfer through the heat exchanger, the three-way valve will direct more or less water through the heat exchanger and the rest through a bypass; the flow in the external circuit is not disturbed.

Options ACS1000 – DriveWindow

DriveWindow: Programming and troubleshooting PC tool for ACS drives



- Displaying system configuration
- Monitoring actual signal values
- Viewing and changing parameters
- Fault logging
- Event logging
- Data logging for fast and accurate measurements
- Controlling the drive
- Backing up and restoring data

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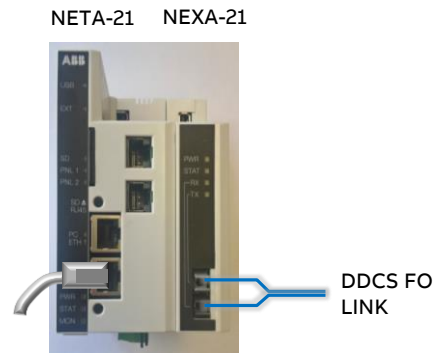
DriveWindow is a optional software tool used to access measurements and diagnostic data, set parameters and to control the drive in local operation mode as an alternative to the control panel. It offers several functions for commissioning and monitoring of ABB drives.

ABB Ability™ Condition Monitoring Services

ABB Ability™ Services

- Drive events, fault logger, selected set of signals
- Dataloggers and parameter backups within events
- Parameter viewing and editing
- Fault reset of the drive
- **No motor control possible, for security and safety.**

NETA-21 – Remote Monitoring Tool



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ABB Ability™ Condition Monitoring is a service that delivers accurate, real-time information about drive events to ensure the equipment is available, reliable and sufficiently maintained.

It offers automatic and continuous collection of performance data of the drives into a centralized database.

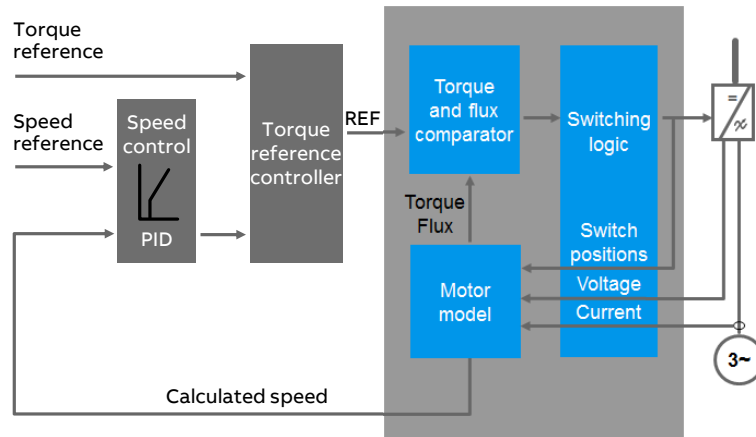
The data; drive events, selected set of signals, dataloggers, parameter files and troubleshooting instructions enable faster fault tracing. The service is safe, since the motor control is not possible through it.

In order to be able to offer ABB Ability Remote Condition Monitoring services, the Remote Monitoring Tool NETA-21 is installed in every ACS1000.

The optional DDCS adaptor NEXA-21 is needed with Medium Voltage Drives.

The commissioning of the NETA-21 with NEXA-21 and the internet connectivity needs to be done together with the commissioning of the drive.

Direct Torque Control DTC



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The control method used in ACS1000 is Direct Torque Control, short DTC. It is a unique motor control method for AC drives developed by ABB, based on the field oriented control theory developed in the 1980's.

With Direct Torque Control, the field orientation and torque control are achieved without speed feedback, using an adaptive motor model and the current feedback, DC link voltages and previous switching combination as input variables.

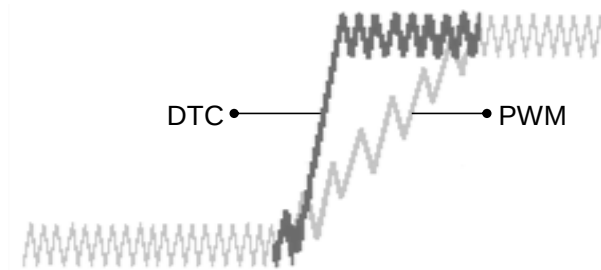
Based on these data, a fast Digital Signal Processor calculates every 25 microseconds the actual values of the fundamental motor variables, magnetizing flux and motor torque.

Torque and flux comparators compare the actual values with the reference values produced by the torque and flux reference controllers.

The outputs of the torque and flux hysteresis comparators are the Torque Status and Flux Status. Based on the Torque and Flux Status, the next switching combination is picked up from an Optimal Switching table.

Switching is done when necessary; no modulator is involved, no switching pattern, no speed feedback required.

Benefits of DTC



- Very fast torque step response time
- Full torque at zero speed
- High speed accuracy
- Minimal inverter switching losses at maximal control performance

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DTC provides excellent speed control accuracy even without pulse encoder feedback. It virtually eliminates the excitation of any torque resonances on the motor shaft by avoiding explicitly assigned PWM modulation frequencies. Control of the drive is immediate and smooth under all conditions and the audible noise in the motor is considerably reduced compared to other control methods. The torque response times are up to ten times faster than with conventional control methods such as current vector control. This results in minimum torque ripple and most accurate static speed and torque control.



Thank you for your attention.

Our overview about the ACS1000 Medium Voltage Drive ends here.

More options are available in all types of ACS1000; they will be mentioned in the following modules.

You may now go ahead and move on to the next module