

Low Harmonic Drive Solutions

Reducing the Harmonic Footprint of Variable Speed Drives

Product Brochure



Managing Power Quality



The Importance of Understanding the Effects of Harmonic Distortion

Any distorted voltage and current waveform that deviates from the ideal sinusoidal waveform presents the potential to harm electrical components, which can result in costly repairs and equipment downtime. Non-linear loads connected to the electrical supply in industrial and commercial facilities insert harmonics (waveform distortions) on the power distribution system. Common non-linear loads include solid state motor soft starters, variable speed drives, computers, electronic lighting, welding supplies and uninterruptible power supplies.

The impact of harmonic distortion can appear in many ways: it can cause distribution transformers and supply cables to overheat, resulting in insulation breakdown and failure; electronic displays and lighting may flicker; nuisance tripping of circuit breakers is possible; and damage can occur to electronic equipment, and may even distort readings provided by metering equipment.

The effects of harmonic distortion are not limited to the facilities where electrical equipment is installed. Situations where electrical equipment is installed in residential areas (pumping stations, waste water treatment plants, cooling towers, HVAC Systems) present the potential for equipment in residential and commercial buildings to be impacted -- and even damaged. The Institute of Electrical and Electronics Engineers (IEEE) has established a recommended practice -- IEEE 519-1992 -- which sets reasonable limits for harmonic current and voltage distortion for electrical power systems. This recommended practice provides the foundation for evaluating the level of harmonic distortion in a power distribution system, and the level of action required to mitigate the risks.

Industries such as water and waste water treatment, and HVAC, must meet local requirements to achieve low harmonic levels; this prevents disturbances to equipment in nearby residential properties. Typically, such electrical users need to meet the IEEE 519-1992.



Taking action to deal with harmonic distortion provides many benefits beyond those related to managing risk. Industries with high power consumption, like pulp and paper, metals, oil and gas refineries, cement and chemicals processing, have the opportunity to optimize the quality of power in the facilities by managing disturbances and losses caused by harmonics.

Drives with Harmonic Reduction Solutions Built In

It is very important that professionals responsible for designing and maintaining electrical systems be aware of the potential issues related to harmonic distortion of their power distribution systems -- and know how to manage them in the most efficient and cost effective manner.

There are many factors and components that impact the overall quality of a power distribution system. Variable speed drives are among the many electrical devices included in that group. Manufacturers of variable speed drives offer a variety of answers to the question of how to reduce the level of distortion these devices produce. Most of these solutions involve adding large components like line reactors and special transformers to the variable speed drive installation that help to reduce the level of harmonic distortion. A brief overview of the available solutions is included on page 4.

ABB offers a broad range of harmonic reduction solutions as well. The most recent addition to this offering is the ACS800 Ultra-low Harmonic variable speed drive -- providing the best combination of harmonic reduction, package size and weight, and range of available features.



Ultra-low Harmonic drive

What is an Ultra-low Harmonic Drive?

An Ultra-low Harmonic (ULH) drive has switching IGBT semiconductors in the supply side, instead of a conventional diode bridge. The drive is able to control the line current to sinusoidal waveform. Additionally, the line filter used in an ultra-low harmonic drive typically is designed to attenuate high-order voltage harmonics to reach very low total distortion of both current and voltage.

Benefits

Harmonic mitigation is built right into the ULH drive - - eliminating the need for additional expensive and space-consuming components like line reactors and transformers. This concept ensures the drive meets the IEEE 519-1992 standard at the input terminals of the drive. *The harmonic performance is independent of supply imbalance, unlike 12- and 18-pulse solutions, and avoids any concern related to network resonances.* Total harmonic distortion of the drive is typically 3.5 – 4.5% of the nominal rating and the drive always operates with power factor of 1.

Features

The ULH drive is available in both wall-mounted package and enclosed cabinet-built versions (depending on ratings and options selected).

The power ratings of the wall-mounted type start from 7.5 hp heavy-duty rating and go up to 125 hp normal-duty rating. It is available in the NEMA 1 protection class. The cabinet-built drive is available in the power range of 40 hp up to 2,800 hp, and with NEMA 1, NEMA 1 filtered and NEMA 12 protection class – easily configured and ordered using our standard product catalogs.

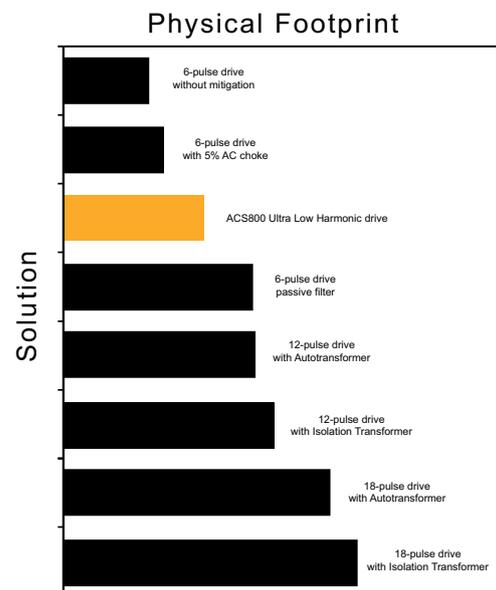


Where it can be used

The ABB ACS800 ULH drive is the ideal solution for those drive installations where low harmonic content is desired or mandated. Its performance and simplicity of installation make it suitable to a wide range of industries and applications. Typical industries include HVAC, water and wastewater treatment, mining, metals, and pulp and paper mills. The most common applications for these drives are pumps, fans, compressors and conveyors.

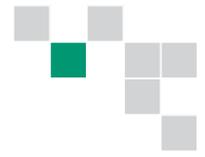


Solution vs. Physical Footprint Chart



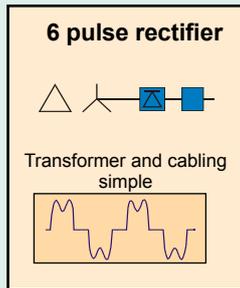
Comparison of the overall footprint of the ACS800 ULH drives vs. other available harmonic reduction solutions.

Solution Comparison



Many Options; One Real Solution

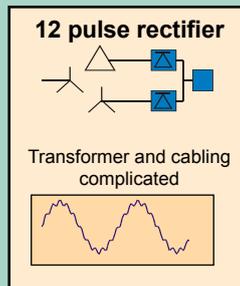
Each of the popular methods of harmonic-reducing variable speed drive packages is described below, including information about standard 6-pulse drives without any harmonic reduction. Most manufacturers of variable speed drives offer each of the solutions provided, with the exception of the Ultra-low Harmonic solution. ABB is unique in offering this version of our popular ACS800 product specifically designed to optimize the harmonic reduction solution.



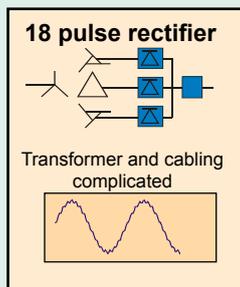
6-pulse drive, no harmonic reduction – 6-pulse drive without any reactors is the cheapest and simplest drive configuration; can produce 50 – 90% total distortion.

6-pulse drive with reactors – Reactors may be located either at AC side in the input, or in DC link of the drive; typical harmonic distortion is 25 – 35%.

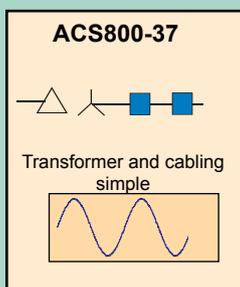
6-pulse drives with passive filter – This solution adds a low-pass filter in series with the drive. This is a low-cost solution, but can cause load-dependent voltage drop and may reduce available power.



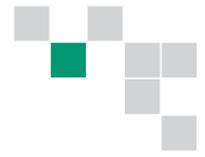
12-pulse drive – In 12-pulse drives, two rectifiers are connected parallel and are fed by a phase shifting transformer. Phase-shifted 6-pulse line currents of each rectifier sum up on the primary side of the transformer and, as a result, certain harmonic components are cancelled through the primary winding connection. The level of harmonic performance is impacted by line imbalance. The transformer can be either an isolating transformer or autotransformer.



18-pulse drive – Same operation principle as the 12-pulse drive, but the design has a higher part count and greater complexity. Harmonic performance is better than in 12-pulse drive but still sensitive to network voltage imbalance. This solution will typically meet the requirements of IEEE 519, if the supply voltage phases are balanced to within 1% - which may be difficult to achieve.



Ultra-low Harmonic drive – This solution is configured to enable the drive to control the line current to near sinusoidal waveform quality. The line filter used in the Ultra-low harmonic drive is designed to attenuate high-order voltage harmonics to reach very low total distortion of both current and voltage. In this case, the drive package meets the IEEE 519 standard at the input terminals, and is not susceptible to unbalanced supply voltages (which is an issue for the 18-pulse solution).

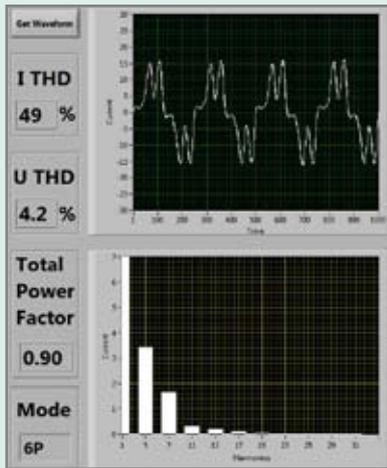


Measurement results

The Analysis is Done – We Have a Winner!

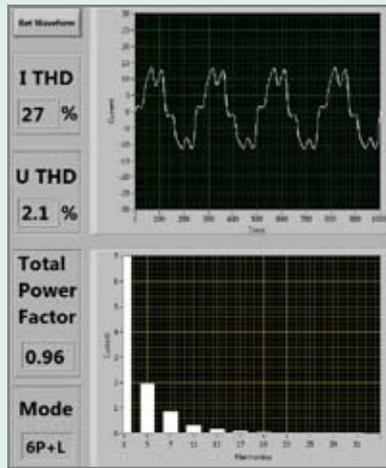
The following graphics indicate the actual level of harmonic distortion produced by the variable speed drive type mentioned. The results speak for themselves – the ACS800 ULH produces the least harmonic distortion of all solutions tested. Note that the actual level of harmonic distortion will vary from installation to installation due to the variety of distribution system configurations and components connected. However, the relative difference between each of these variable speed drive types on the same system will be the same.

6-pulse drive, no harmonic reduction



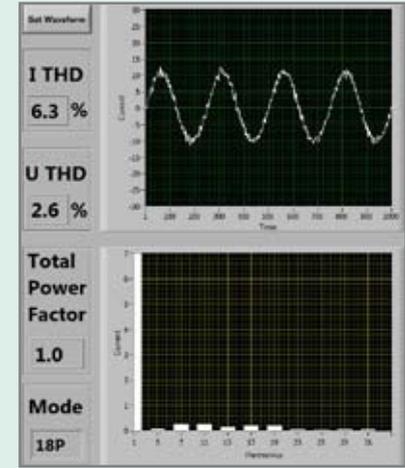
6-pulse drives without any harmonic reduction have dramatic impact on the power distribution system – in this case the level of distortion is 49% and reduces the power factor to .90.

6-pulse drive with reactors

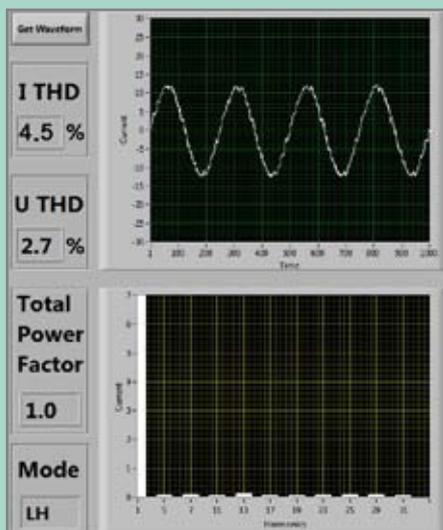


The level of harmonic distortion is reduced when reactors are added to 6-pulse drives, but is still significant. Power factor is also impacted.

18-pulse drive



The 18-pulse solution offers very good reduction of harmonic distortion. The problem with this solution is the size and weight of the package due to the special transformers used. Unbalanced supply voltages are also an issue. A relatively small percentage of voltage imbalance can cause an 18-pulse drive solution to fail to meet IEEE519.



ACS800 Ultra-low Harmonic drive

The ACS800 Ultra-low Harmonic drive solution provides the best overall management of harmonic distortion of all solutions tested. There is no need for additional reactors or transformers which makes it more compact than the 18-pulse solution and is not impacted by unbalanced supply voltages and retains IEEE519 levels of harmonic reduction.





Ultra-low Harmonic drive, wall mounted

ACS800-U31, 7.5 to 125 Hp

Simple low-harmonic solution

There is an increasing concern among end users and power companies about the harmful effects of harmonics. Harmonic distortion may disturb or even damage sensitive equipment connected in the same environment. Harmonic standards thus are becoming stricter and there is a growing demand for low harmonic solutions.

The ACS800-U31 drive offers an easy solution to the problem of harmonics. The solution itself is incorporated in the drive, eliminating the need for any additional filtering equipment or complicated and large multi-pulse transformer arrangements.

Meets the strictest standards

The ACS800-U31 eliminates low-order harmonics with the active converter controlled with DTC, and high order harmonics with an LCL line filter. The result is exceptionally low-harmonic content in the network-- exceeding the requirements set by standard IEEE519 at the drive input terminals, even on the weakest AC line network. The ACS800-U31 provides you with a simple, compact and complete solution to meet stringent power quality standards.

Beats external solutions

The ACS800-U31 does not require a dedicated multi-pulse transformer and thus eases installation, in terms of cabling arrangements; the drive also requires less floor space. Harmonic performance is better than with 12- and 18-pulse solutions. Passive or active external filtering devices are avoided with the ACS800-U31, making the solution compact and simple. Other advantages of the ACS800-U31 are that it always operates with unity power factor 1, and is impervious to AC line voltage imbalances up to and over 3%. The system efficiency also is better than 12- and 18-pulse solutions, since no phase-shifting transformer is required.

Main standard features

- Meets IEEE519-1992 at Drive input terminals
- Wall mounting
- Compact design
- UL Type 1 protection class
- Built in low harmonic LCL filter
- Coated boards
- Extensive, programmable I/O
- Long lifetime cooling fan and capacitors
- Inputs galvanically isolated
- 3 I/O and fieldbus extension slots inside
- Alphanumeric multilingual control panel with a start-up assistant feature

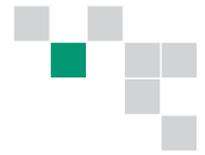
Options for ACS800-U31

- Braking chopper
- EMC filter for 1st environment, restricted distribution according to EN 61800-3
- EMC filter for 2nd environment, unrestricted distribution according to EN 61800-3
- Analog and digital I/O extension modules
- Fieldbus modules
- Pulse encoder interface module
- Resolver interface



Ratings and dimensions

ACS800-U31



ACS800 - U31 - XXXX - 2
5 + XXXX

Type code	Frame size	Input A	I_{max} A	Normal Duty		Heavy-duty use		Noise Level dBA	Air flow ft ³ /min	Heat Dissipation BTU/hr
				I_{2N} A	P_N Hp	I_{2HD} A	P_{HD} Hp			
3-phase supply voltage 208, 220, 230, 240. The power ratings are valid at nominal voltage, 240Vac (50 & 60Hz)										
ACS800-U31-0011-2	R5	32	52	32	10	26	7.5	70	206	1730
ACS800-U31-0016-2	R5	44	68	45	15	38	10	70	206	2380
ACS800-U31-0020-2	R5	55	90	56	20	45	10	70	206	3110
ACS800-U31-0025-2	R5	70	118	69	25	59	15	70	206	3760
ACS800-U31-0030-2	R5	82	144	83	30	72	20	70	206	4500
ACS800-U31-0040-2	R6	112	168	114	40	84	25	73	238	5420
ACS800-U31-0050-2	R6	140	234	143	50	117	30	73	238	7260
ACS800-U31-0060-2	R6	157	264	157	60	132	40	73	238	8650
3-phase supply voltage 380, 400, 415, 460, 480, 500. The power ratings are valid at nominal voltage, 480Vac 60Hz										
ACS800-U31-0020-5	R5	29	52	29	20	25	15	70	206	2240
ACS800-U31-0025-5	R5	33	61	34	25	30	20	70	206	2600
ACS800-U31-0030-5	R5	44	68	45	30	37	25	70	206	3420
ACS800-U31-0040-5	R5	54	90	55	40	47	30	70	206	4140
ACS800-U31-0050-5	R5	65	118	67	50	57	40	70	206	4960
ACS800-U31-0060-5	R5	76	144	78	60	62	50	70	206	5980
ACS800-U31-0070-5	R6	112	168	114	75	88	60	73	238	8030
ACS800-U31-0100-5	R6	129	234	132	100	114	75	73	238	9570
ACS800-U31-0120-5	R6	145	264	156	125	125	100	73	238	11620
3-phase supply voltage 525, 575, 600. The power ratings are valid at nominal voltage, 575Vac 60Hz										
ACS800-U31-0060-7	R6	53	62	54	50	43	40	73	238	5980
ACS800-U31-0070-7	R6	73	79	75	60	60	50	73	238	8030
ACS800-U11-0100-7	R6	86	99	88	75	71	60	73	238	9570

Frame size	UL Type 1			
	Height (in)	Width (in)	Depth (in)	Weight (lbs)
R5	32.1	10.4	15.4	143
R6	38.2	11.8	17.3	220.5

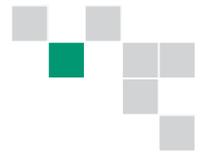
Enclosure
 Degree of Protection:
 UL Type 1(Standard)
 Paint color:
 NCS 1502-Y (RAL 90021/PMS 420C)

NOTES:

- I_{max} current available for 10 seconds at start.
- I_{2N} continuous base current at 40°C (104°F). Overload cycle 110% I_{2N} for 1 minute / 5 minutes allowed.
- I_{2HD} continuous base current at 40°C (104°F). Overload cycle 150% I_{2HD} for 1 minute / 5 minutes allowed.
- Current ratings do not change with different supply voltages.
- Horsepower ratings are based on NEMA motor ratings for typical 4-pole motors (1800 rpm). Check motor nameplate current for compatibility.

Ultra-low Harmonic drive, cabinet-built

ACS800-37, 125 to 2800 Hp



Simple low harmonic solution

There is increasing concern among end users and power companies about the harmful effects of harmonics. Harmonic distortion may disturb or even damage sensitive equipment connected in the same environment. Harmonic standards thus are becoming stricter and there is a growing demand for low harmonic solutions.

The ACS800-37 drive offers an easy solution to the problem of harmonics. The solution itself is incorporated in the drive, eliminating the need for any additional filtering equipment or complicated and large multi-pulse transformer arrangements.

Meets the strictest standards

The ACS800-37 eliminates low-order harmonics with the active converter controlled with DTC, and high order harmonics with an LCL line filter. The result is exceptionally low-harmonic content in the network--exceeding the requirements set by standard IEEE519 at the drive input terminals, even on the weakest AC line network. The ACS800-37 provides you with a simple, compact, and complete solution to meet stringent power quality standards.

Beats external solutions

The ACS800-37 does not require a dedicated multi-pulse transformer and thus eases installation in terms of cabling arrangements; the drive also requires less floor space. Harmonic performance is better than both 12- and 18-pulse solutions. Passive or active external filtering devices are avoided with the ACS800-37, making the solution compact and simple. Other advantages of the ACS800-37 are that it always operates with unity power factor 1, and is impervious to AC line voltage imbalances up to and over 3%. The system efficiency also is better than 12- and 18-pulse solutions, since no phase-shifting transformer is required.

Extensive range of features

In line with other ACS800 cabinet-built drives, the ACS800-37 offers a wide variety of standardized configurations to adapt to different application requirements. The smart module concept enables easy maintenance and redundancy in the high power range where multiple identical power modules make one power structure. If one power module fails, the drive may be operated at reduced capacity.

Main standard features

- Meets IEEE519-1992 at Drive input terminals
- Compact design
- UL Type 1 protection class
- Built in low harmonic LCL filter
- EMC filter for 2nd environment, unrestricted distribution according to EN 61800-3
- Main switch with IR fuses
- Line contactor
- Removable air circuit breaker (in frame size nxR8i)
- Du/dt filters (in frame size nxR8i)
- Coated boards
- Extensive, programmable I/O
- Long lifetime cooling fan and capacitors
- Inputs galvanically isolated
- 3 I/O and fieldbus extension slots inside
- Alphanumeric multilingual control panel with a start-up assistant feature

Options for ACS800-37

- Analog and digital I/O extension modules
- Braking chopper and resistor
- Cabinet heater
- Customer terminal block
- Du/dt filters (in frame sizes R7i-R8i)
- Grounding monitoring for ungrounded network
- EMC filter for 1st environment, restricted distribution according to EN 61800-3
- Fieldbus modules
- UL Type 1 Filtered or UL Type 12 enclosure classes
- Emergency stop, category 0 or 1
- Output for motor fan
- Pulse encoder interface module
- Prevention of unexpected start up of motor
- Bottom entry and exit of cables
- 1 or 2 thermistor relays
- 3, 5 or 8 PT100 relays



Plus, tailor-made accessories through ABB's application engineering.



Ratings and dimensions

ACS800-37

ACS800 - 37 - XXXX - 5 + XXXX
7

Type code	Frame size	Input A	I_{max} A	Normal Duty		Heavy-duty use		Noise Level dBA	Air flow ft ³ /min	Heat Dissipation BTU/Hr
				I_{2N} A	P_N Hp	I_{2HD} A	P_{HD} Hp			
3-phase supply voltage 380, 400, 415, 460, 480, 500. The power ratings are valid at nominal voltage, 480Vac 60Hz										
ACS800-37-0070-5+C129	R6	112	168	114	75	88	60	73	295	8200
ACS800-37-0100-5+C129	R6	129	234	132	100	114	75	73	295	9600
ACS800-37-0120-5+C129	R6	145	264	156	125	125	100	73	295	11600
ACS800-37-0170-5+C129	R7i	180	291	192	150	156	125	74	765	20500
ACS800-37-0210-5+C129	R7i	220	355	240	200	183	150	74	765	27300
ACS800-37-0260-5+C129	R8i	270	438	302	250	226	150	75	1860	30700
ACS800-37-0320-5+C129	R8i	329	530	361	300	273	200	75	1860	37600
ACS800-37-0400-5+C129	R8i	410	660	437	350	340	250	75	1860	47800
ACS800-37-0460-5+C129	R8i	473	762	504	400	393	300	75	1860	54700
ACS800-37-0510-5+C129	R8i	536	863	571	450	445	350	75	1860	61500
ACS800-37-0610-5+C129	R8i	630	1016	672	550	524	400	75	1860	78600
ACS800-37-0780-5+C129+H359	2xR8i	803	1294	856	700	667	550	77	3770	88800
ACS800-37-0870-5+C129+H359	2xR8i	900	1458	965	800	752	650	77	3770	109000
ACS800-37-1160-5+C129+H359	2xR8i	1200	1941	1284	1050	1001	850	77	3770	150000
ACS800-37-1330-5+C129+H359	3xR8i	1376	2217	1467	1250	1143	1000	78	6030	157000
ACS800-37-1820-5+C129+H359	3xR8i	1888	2956	1956	1650	1524	1300	78	6030	229000
ACS800-37-2200-5+C129+H359	4xR8i	2344	3670	2428	2050	1892	1600	79	7530	277000
3-phase supply voltage 525, 550, 575, 600, 690. The power ratings are valid at nominal voltage, 575Vac 60Hz										
ACS800-37-0060-7+C129	R6	53	86	54	50	43	40	73	294	6142
ACS800-37-0070-7+C129	R6	73	120	75	60	60	50	73	294	8190
ACS800-37-0100-7+C129	R6	86	142	88	75	71	60	73	294	9554
ACS800-37-0170-7+C129	R7i	125	202	133	125	104	100	74	765	27300
ACS800-37-0210-7+C129	R7i	146	235	156	150	121	100	74	765	30700
ACS800-37-0260-7+C129	R8i	180	301	193	200	150	150	75	1860	41000
ACS800-37-0320-7+C129	R8i	250	417	268	250	209	200	75	1860	51200
ACS800-37-0400-7+C129	R8i	300	502	322	300	251	250	75	1860	61500
ACS800-37-0440-7+C129	R8i	344	571	367	350	286	300	75	1860	64900
ACS800-37-0540-7+C129	R8i	400	668	429	450	334	350	75	1860	71700
ACS800-37-0790-7+C129+H359	2xR8i	593	985	632	650	493	500	77	3770	120000
ACS800-37-0870-7+C129+H359	2xR8i	657	1091	700	750	545	600	77	3770	126000
ACS800-37-1160-7+C129+H359	2xR8i	853	1425	914	1000	713	750	77	3770	157000
ACS800-37-1330-7+C129+H359	3xR8i	1001	1663	1067	1150	831	900	78	6030	185000
ACS800-37-1510-7+C129+H359	3xR8i	1164	1879	1206	1300	940	1050	78	6030	212000
ACS800-37-2320-7+C129+H359	4xR8i	1729	2791	1791	2000	1396	1500	79	7530	304000
ACS800-37-2780-7+C129+H359	5xR8i	2091	3472	2228	2450	1736	1900	79	10550	362000
ACS800-37-3310-7+C129+H359	6xR8i	2470	3987	2559	2800	1999	2200	79	11300	413000

Frame size	Width	Height UL Type 1	Height UL Type 12	Depth top entry/exit ^{b)}	Weight
	in	in	in	in	lb
R6	16.9	83.9	91.1	25.4	550
R7i	24.8	83.9	91.1	25.4	880
R8i	48.4 ^{A)}	83.9	91.1	25.4	2646
2xR8i	107.5	83.9	91.1	25.4	4982
3xR8i	139.0	83.9	91.1	25.4	6746
4xR8i	178.3	83.9	91.1	25.4	7937
5xR8i	225.6	83.9	91.1	25.4	10538
6xR8i	243.4	83.9	91.1	25.4	10869

^{A)} 60.2 in if equipped with 1st environment filter and common motor terminal.
^{B)} The depth without the handle.

NOTES:

- I_{max} current available for 10 seconds at start.
- I_{2N} continuous base current at 40°C (104°F).
Overload cycle 110% I_{2N} for 1 minute / 5 minutes allowed.
- I_{2HD} continuous base current at 40°C (104°F).
Overload cycle 150% I_{2HD} for 1 minute / 5 minutes allowed.
- Current ratings do not change with different supply voltages.
- The rated current of the ACS800 must be greater than or equal to the rated motor current to achieve the rated motor power given in the table.
- Horsepower ratings are based on NEMA motor ratings for typical 4-pole motors (1800 rpm). Check motor nameplate current for compatibility.

Enclosure

Degree of Protection:
 UL Type 1 (Standard)
 UL Type 1 Filtered and UL Type 12 (opt)
 Paint color:
 Light beige RAL 7035 semi-gloss

Communications options

Fieldbus control



ABB industrial drives have connectivity to most major automation systems. This is achieved with a dedicated gateway concept between the fieldbus systems and ABB drives.

The fieldbus gateway module easily can be mounted inside the drive. Because of the wide range of fieldbus gateways, your choice of automation system is independent of your decision to use first-class ABB AC drives!

Manufacturing flexibility

Drive control

The drive control word (16 bit) provides a wide variety of functions from start, stop and reset to ramp generator control. Typical setpoint values such as speed, torque and position can be transmitted to the drive with 15 bit accuracy.

Drive monitoring

A set of drive parameters and/or actual signals, such as torque, speed, position, current etc., can be selected for cyclic data transfer, providing fast data for operators and the manufacturing process.

Drive diagnostics

Accurate and reliable diagnostic information can be obtained via the alarm, limit and fault words, reducing drive and production downtime.

Drive parameter handling

Total integration of the drives in the production process is achieved by single parameter read/write, up to complete parameter set-up or download.



Reduced installation and engineering effort

Cabling

Substituting the large amount of conventional drive control cabling with a single communication cable reduces costs and increases system reliability.

Design

The use of fieldbus control reduces engineering time at installation, due to the modular structure of the hardware and software.

Commissioning and assembly

The modular machine configuration allows pre-commissioning of single machine sections and provides easy and fast assembly of the complete installation.

Currently available modules

- PROFIBUS (+K454)
- DeviceNet (+K451)
- ControlNet (+K462)
- Modbus (+K458)
- Ethernet (+K466)
- CANopen (+K457)
- InterBUS-S (+K453)

NOTE: Additional Fieldbus module options are available. Contact your local ABB representative for more information.

Additional I/O options

Standard I/O can be extended by using analog and digital extension modules or pulse encoder interface modules which are mounted in the slots on the ASC800 control board. The control board has two slots available for extension modules. More extension modules can be added with the I/O extension adapter, which has three additional slots. The available number and combination of I/O's depends on the control software used. The standard application software supports 2 analog, 2 digital extension modules, and 1 encoder interface module.

Optional I/O

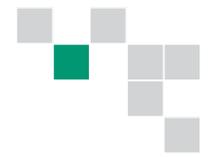
Analog I/O extension module RAIO-01 (+L500)

- **2 analog inputs:** galvanically isolated from 24 V supply and ground
 - $\pm 0(2)\dots 10$ V, $0(4)\dots 20$ mA or $\pm 0\dots 2$ V, resolution 12 bits
- **2 analog outputs:** galvanically isolated from 24 V supply and ground
 - $0(4)\dots 20$ mA, resolution 12 bit

Digital I/O extension module RDIO-01 (+L501)

- **3 digital inputs:** individually galvanically isolated
 - Signal level 24 to 250 V DC or 115/230 V AC
- **2 relay (digital) outputs:**
 - Form C contacts
 - 24 V or 115/230 V AC
 - Max. 2 A





Technical specification

Mains connection

Voltage and power range	3-phase, $U_{2IN} = 208$ to 240 V, $\pm 10\%$, except -37 3-phase, $U_{5IN} = 380$ to 500 V, $\pm 10\%$ 3-phase, $U_{7IN} = 525$ to 690 V, $\pm 10\%$ (600 V UL, CSA)
Short Circuit Current Rating (SCCR)	ACS800-U1,-U31 = 65ka ACS800-U2,-37 = 100ka
Frequency	48 to 63 Hz
Power factor ACS800-U31,-37	$\cos\phi_1 = 1$ (fundamental) $\cos\phi = 0.99$ (total)
Efficiency (at nominal power)	97%

Motor connection

Voltage for > 500 V units	3-phase output voltage $0 \dots U_{2IN} / U_{5IN} / U_{7IN}$
Frequency	$0 \dots \pm 300$ Hz
Field weakening point	$8 \dots 300$ Hz
Motor control	ABB's exclusive Direct Torque Control (DTC)
Torque control	Torque step rise time
Open loop	<5 ms with nominal torque
Closed loop	<5 ms with nominal torque
	Non-linearity:
Open loop	$\pm 4\%$ with nominal torque
Closed loop	$\pm 1\%$ with nominal torque
Speed control	Static accuracy
Open loop	10% of motor slip
Closed loop	0.01% of nominal speed
	Dynamic accuracy
Open loop	0.3...0.4% sec. with 100% torque step
Closed loop	0.1...0.2% sec. with 100% torque step

Environmental

Ambient temperature	
Transport	-40...+70°C
Storage	-40...+70°C
Operation	-15...+50°C, no frost allowed 40...50°C at reduced output current (1% / 1°C)
Cooling method	Dry clean air
Altitude	
0...1000 m	without derating
1000...4000 m	with derating ~ (1% / 100 m) (600 V units 1000...2000 m with derating)
Relative humidity	5 to 95%, no condensation allowed
Protection class	
UL Type 1	standard for -37
UL Type 1 filtered	option for -37
UL Type 12	option for -37
Paint color	-37: RAL 7035 -U31: NCS 1502-Y (RAL 90021, PMS 420 C)
Contamination levels	No conductive dust allowed
Storage	IEC60721-3-1, Class 1C2 (chemical gases), Class 1S2 (solid particles)
Transportation	IEC60721-3-2, Class 2C2 (chemical gases), Class 2S2 (solid particles)
Operation	IEC60721-3-3, Class 3C1/3C2* (chemical gases), Class 3S2 (solid particles)
	C = chemically active substances S = mechanically active substances * coated circuit boards

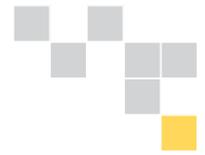
Product compliance

UL & cUL (508A or 508C) and CSA C22.2 NO.14-95, C-Tick, GOST R NEC 430.126(A)(2) Motor Overtemperature Protection
Quality assurance system ISO 9001 and
Environmental system ISO 14001
CE (Available)
Low Voltage Directive 73/23/EEC with amendment 93/68/EEC
Machinery Directive 98/37/EC
EMC Directive 89/336/EEC with amendment 93/68/EEC

EMC (according to EN 61800-3)

2nd environment, unrestricted distribution category C3 as standard in -37 (frame sizes R7i-nxR8i), option in the others
1st environment, restricted distribution category C2 as option up to 1000 A input current

Drive Services



Through its large variety of drive lifecycle services and worldwide service network ABB aims for high drive availability and long lifetime.

Training and learning

The ABB University provides eLearning and hands-on classroom training for its ACS800 drives. Look for the training courses on www.abb.com/abbuniversity.

Installation and commissioning

ABB's professional installation and commissioning service uses certified engineers to install and adjust ABB drives according to the application requirements as well as to instruct the user on how to operate the drive.

Support line services

The support line network provides fast and efficient support for ABB drive users. The service is available via e-mail and telephone: 1-800-HELP365 option #4.

Maintenance and repair

ABB recommends regular preventative maintenance for AC drives throughout their lifetime.

Maintaining drives in accordance with the maintenance schedules ensures drive maximum availability, minimum repair costs, optimized performance and extended lifetime. Maintenance can be performed on a contract basis.

Drive preventative maintenance (PM) consists of annual drive inspections and component replacements according to the product specific maintenance schedules, using PM kits which contain all the service parts and materials specified for a certain preventative maintenance.

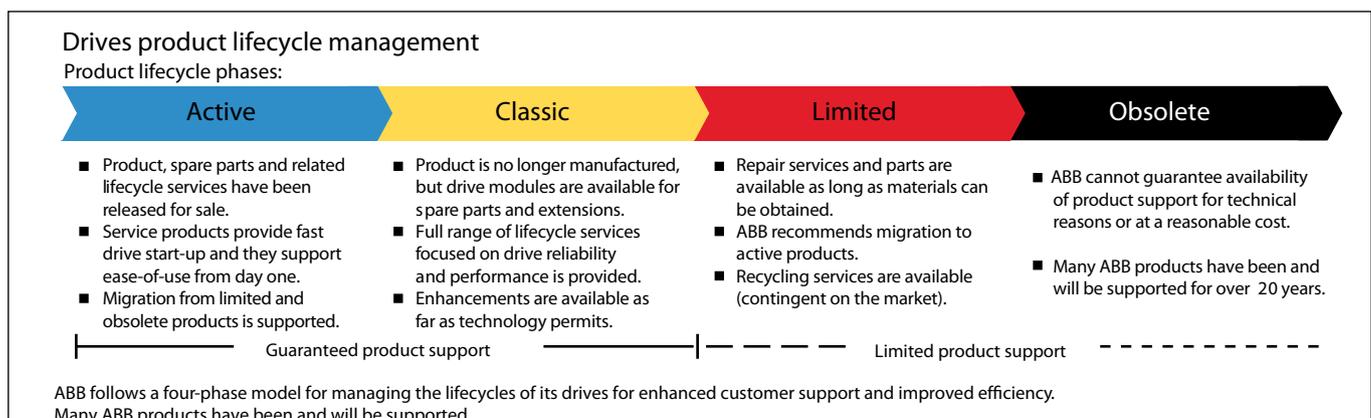
ABB's certified engineers provide maintenance and repair services on site and in ABB authorized workshops.

Work services include e.g:

- Module maintenance and repair services - instead of performing module maintenance or repair on site, modules can be sent to an ABB workshop. It is often practical to carry out preventive maintenance at the same time.
- Exchange unit service - a convenient and fast way to fix a problem with a drive is to order an exchange module. A refurbished drive is immediately shipped to the customer (subject to availability). The defective but repairable unit will be returned to ABB.

Spare part services

Genuine ABB factory-certified drive parts are delivered quickly worldwide. They guarantee full compatibility and are available throughout the drive's lifetime.





Contact and web information

For US support www.abb.us/drives

For Global support www.abb.com/motors&drives

ABB's worldwide presence is built on strong local companies working together with the local distributor and channel partner network across borders to achieve a uniform level of services for all our customers. By combining the experience and know-how gained in local and global markets, we ensure that our customers in all industries can gain the full benefit from our products.

For further details about all our variable speed drive products and services please contact your nearest ABB office or visit the ABB website: [http:// www.abb.us/drives](http://www.abb.us/drives)

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