

Compact and complete

Drive^{IT} low voltage AC drive, ACS 800

It is not by chance that ABB dominates the low-voltage AC drive market. Six generations of drives in three decades, incorporating many successful innovations, testify to a highly market-oriented development program. Now, a new AC drive is making its mark – the ACS 800 for motors rated 1.1 to 500 kW. Industrial IT Enabled to allow connection to almost any control system, this extremely compact, energy-saving drive has everything it needs already integrated.

In March this year, ABB unveiled the latest variable speed drive in its line up of winning drive products. The Drive^{IT} low voltage AC drive, ACS 800, is the sixth generation of drives to be launched by ABB since it entered this market in the early 1970s. ABB has built on the success of each successive generation to become the world's leading manufacturer of AC variable speed drives. Between 1990 and 2001 alone, more than 1,000,000 units were sold,

ranging in output from just over a hundred to several million watts.

These installed units have allowed, over that decade, an average of 64 TWh of energy to be saved each year in countless pump and fan applications **1**. The amount is significant when it is considered that the total annual energy consumption of a country like Finland is about 80 TWh. And underscoring its environmental importance is the fact that the energy saving corresponds to a



reduction of some 32 million tons of CO₂ emissions – about the amount produced by country like Austria.

Maintaining this enviable market position is not made any easier by the hundreds of players, all apparently capable of launching ‘new’ products with innovative features that will change the way customers work.

The reason the market is so competitive is that there is a huge potential for saving energy by installing new drives. Industry can significantly reduce its energy bill by replacing its older drives by new ones like the ACS 800. This is because a drive varies the speed of its electric motor to make, say a fan or a pump, run faster or slower according to production demand. Huge amounts of energy can be saved when the motor driving the fan or pump is no longer operating at full speed. And with only about 3% of the world’s motor population presently using variable speed drives, the market potential is vast.

So in such a competitive market, what is the secret of great innovative product design that keeps ABB in the number one slot? And will the ACS 800 be capable of following up on the impressive success of its forerunners?

Understanding customer needs

Understanding the customers’ needs and the markets in which they operate is the key to everything. While many product features may appear good, if they do not make the life of the customer easier or save them money then the product will very quickly be discarded.

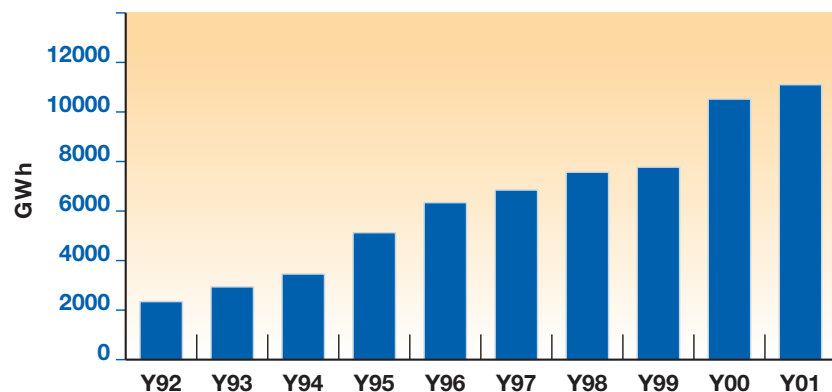
It is also important that customers understand that initial acquisition cost is quite different to lifetime ownership cost. Having a product that continues to save money long after it has been purchased is an important factor that is often overlooked.

Manufacturers, too, have to count costs. Such is the intense competition among them that product price is under constant pressure. Drives are in fact close to reaching their optimum in terms of small size, maximum efficiency and ease of use. Adding valuable features without destroying their affordability is becoming a fine balancing act. As such, all costs in the production chain are now under scrutiny, from manufacturing techniques through to logistics. Each has to be carefully analyzed to ensure a truly competitive product is produced.

Phased product development

At ABB, the development of any new product has to follow a strict code. The complete cycle, from project initiation to market introduction, is broken down into several phases, and progress to the next phase is not possible until all requirements of the current phase have been fulfilled. Checklists exist for each phase to guide project management. Also, each phase needs to be signed off by senior management before the project team can begin work on the next phase. This so-called ‘gate model’ is an integral part of quality assurance.

A key element of product development’s first phase is a detailed market survey to identify what the customers want. Customer interviews are one aspect of this, but ABB’s channel partners, such as OEMs, system integrators and



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technical distributors, are also asked for their feedback.

With variable speed drives the conclusions of many surveys are often the same. In a survey of 279 US readers, for example, the trade magazine *Control Engineering* asked what features were most desired in variable speed drives. Sixty-three percent responded with 'simple controls and setups', 45% said 'a convenient operator interface', 45% mentioned 'programmability' and 37% were concerned about 'pricing.'

Customer surveys conducted over the past five years invariably show these as the four most desired features. But to turn this knowledge into innovative product design, it has to be enhanced by field experience and detailed knowledge of the way drives are installed and operated. Building on its large installed base, ABB has come up with a number of product innovations and has incorporated these in the new ACS 800 series.

Ease of use, plus versatility

Something that the surveys also showed was that customers expect ease of use, even though the ACS 800 is specifically designed to cope with the demands made on it by extruders, mixers, grinders, ski lifts, cranes, engine test rigs, winders, spinning machines, and so on. These applications are inherently complex and require a certain amount of drive programming by engineers.

It is important, therefore, to clearly understand what customers mean by 'ease of use'. Are they concerned about how easy the drive is to install or is the

2 The Drive^{IT} ACS 800 makes use of an innovative new cabling principle never before used with AC drives. The power supply and motor cables are connected into a separate cabling pedestal that is bolted to the floor.



concern related to how easy the drive is to start-up and commission?

Customers expect 'ease of use' in both cases. The designers of the ACS 800 therefore set about addressing all the areas that would ensure this requirement is met.

Industrial IT

The Drive^{IT} Low Voltage AC Drive, ACS 800, is a building block in ABB's Industrial IT architecture. As such, it adheres to Industrial IT design standards and has functionality built in that allows multiple products to interact seamlessly as components of real-time automation and information systems. Since it is Industrial IT Enabled, the ACS 800 can be easily integrated in the Industrial IT architecture in a 'plug and produce' manner.

Innovative cabling system

Cabling drives can be time-consuming. And where time is money any technique that reduces both is highly desirable.

The dilemma is this: The power output of drives is increasing while the drives themselves are becoming progressively smaller. However, the higher the power rating the bigger the cables need to be. Technicians are finding it increasingly difficult to connect the cabling, which is still done by hand, as the drives become smaller.

The ACS 800 overcomes this problem by way of an innovative new cabling principle never before used with AC drives. The power supply and motor cables of the higher-power, bookshelf-style drives are connected into a separate cabling pedestal that is bolted to the floor **2**. Once all the cabling is completed, the

3 After the cabling has been completed, the drive is wheeled over the pedestal and then locked into position.



drive is wheeled over the pedestal and then locked into position **3**.

A big advantage of this method is that the pedestal can be fitted and tested before the drives are delivered. These are simply slotted straight into position, ready for commissioning.

The drive can also be easily removed at any time without having to disconnect the cables. By speeding up maintenance and minimizing any process downtime, this saves time as well as money.

Petri Schroderus is the project manager for the bookshelf-style ACS 800-02, available for outputs from 90 to 500 kW: “One of the key ways to prove you are the technology leader is to create the smallest drive. This raises the stakes in the marketplace, because having the smallest drive and yet still having all the necessary power electronics inside,

means that some clever work has been done.”

Schroderus goes on “Here we were faced with a true contradiction: cables are thick and heavy and do not bend easily. Also, access is needed for maintenance purposes. Our solution was perfect. We were able to make the smallest drive and yet ensure good access to cabling. And it didn’t take us long to develop the prototype, either. Once we had it, it wasn’t long before we had the best solution.”

From bookshelf to flat pack

Another innovation is causing quite a stir in the marketplace. It is so simple that the question might well be asked why no one has thought of it before.

Most modern industrial plants have only limited floor space, and the drive

industry has responded by introducing so-called ‘bookshelf’ designs for its higher-rated models. These are narrow enough to sit comfortably between cubicles in a control room.

Petri Schroderus explains: “The problem was that while customers in some markets prefer the bookshelf construction because they need to save floor space, others clearly don’t have that need and are more interested in drives with less depth. We were being pushed in two contradictory directions. But eventually, after three months of trial and error, and long days and nights, we managed to solve the problem.”

ABB’s solution is to make the ACS 800 bookshelf drive capable of being turned through 90 degrees. The control panel, which is normally on the front of the drive, can then be attached to the side.

The drive either can be installed conventionally – that is, bookshelf – with the control panel on the front of the unit, allowing drives to be placed side by side to save space, or turned 90 degrees and mounted flat against a wall with the control panel moved to what now becomes the front of the drive.

There is no need to specify the type of mounting when ordering, because there are slots for the control panel on each side of the module, enabling the panel to be easily moved. No extra hardware or wiring is needed.

Advanced technology – the key to compactness

The new drive is narrow even by bookshelf standards. With 90 to 200 kW ver-

sions measuring only 250 mm wide and 200–500 kW units only 350 mm wide, for certain powers the ACS 800 is only one sixth the width of its competitors

The compactness and optional mounting were made possible by using the latest technologies, such as new-generation trench gate IGBTs and an innovative cooling system. This technology is a product of ABB's heavy investment in R&D, and one of the reasons the company is the leader in the field.

Ever since the launch in 1994 of Direct Torque Control (DTC) – a hugely innovative motor control technique – ABB has been recognized as a key innovator in drive technology. DTC is still the only technology that ensures the fastest torque and speed response for any drive. And it achieves a high level of motor control without the need for an expensive tachometer, which is often required to feed back signals in demanding applications, for example in the pulp and paper industry.

It is not just financial investment in R&D that is needed. “If you want to be the best in this market, then you have to set the highest targets imaginable,” says Petri Schroderus. “You must be willing to take the risks and live with the consequences of those risks because not everything works. This is the only way to be number one.”

Schroderus continues “It is essential that the design team work in an environment where *all* ideas are encouraged and are *never, ever* talked down. I am pleased to say we had a first-class team whose ingenuity and innovation is re-

flected in the exciting products we now have – and that only two years were needed from initial concept to finished product.”

A further example of this innovation is the computer modeling of the airflow around the heat sink. This has resulted in a smaller heat sink with increased airflow capacity for improved cooling.

The reduction in size of many of the parts means that components which would normally be added externally to the drive, can now be fitted inside as standard, thereby speeding up installation.

Thus, the drive comes with a large AC choke for drive protection and harmonics filtering built-in as standard. A brak-

Drive^{IT} ACS 800 family of variable speed drives. Four wall-mounted units are shown in the foreground.



ing chopper, an RFI filter, a common mode filter for motor protection and up to three plug-in type modules for optional functions can be fitted inside the drive as accessories.

Enclosure extension

For applications that require extra components, such as contactors, fuse switches, etc, the ACS 800-02 can have an enclosure extension fitted to it.

This gives users the option of adding line-input extras without having to install the drive in a cabinet. The extension, which comes with a fuse switch and a customer terminal block, features top entry and exit of cables.

The enclosure can be supplied with any number of options chosen by the customer.

Easy commissioning and advanced programming

In keeping with the 'ease of use' theme, the entire ACS 800 series features easier commissioning through an intelligent control panel known as a Start-up Assistant.

This is basically a keypad that guides the user through both start-up and commissioning using plain-language text, rather than complex parameter numbers and codes.

The alphanumeric text is directly connected to the parameter numbers. What is really new is that the user can reach the function he requires without knowing parameter numbers. As with PCs, many things can now be done without wondering about which numbers to select.

“Besides expecting products to be easy to use, customers are also demanding that the companies that make the products are easy to work with.”

When the drive is first switched on it recognizes whether or not it has been commissioned before, and if not asks the question: “Do you want to use the start-up wizard?” From here, it is a logical, step-by-step procedure with plenty of ‘help’ options along the way.

The ACS 800 is the only AC drive that has an intelligent control panel of this kind. No questions are asked that could be irrelevant to the task being undertaken. For example, after the user has selected the application and control mode only questions related to the relevant application macro and motor control technology will be asked.

In conjunction with the easy start-up and commissioning, ABB has introduced adaptive programming, which increases the intelligence of the drive through custom applications or custom drive programming. This shifts the intelligence in the application, traditionally done through PLCs, to the drive.

Adaptive programming consists of a set of blocks that can be programmed to perform any operation from a predefined set of functions.

The hidden success factor

There is, however, another interpretation of the words ‘ease of use.’ Besides expecting products to be easy to use, customers are also demanding that the com-

panies who make the products are easy to work with.

ABB has discovered that this can be the difference between making or breaking sales, and that it is becoming as important as product features in terms of its ability to persuade a customer to buy a drive.

It means providing ever-higher levels of technical customer service. Each customer installation is unique. And while drives are simple to install and use there can still be hurdles to overcome within a customer’s plant. Such issues include the effect of harmonics, electromagnetic compatibility (EMC), energy saving, application know-how, and the drive’s adaptability to customers’ specific needs.

In each of these areas, and many more, ABB has itself adapted to the challenge, and incorporated in the ACS 800 features that will ensure the company’s position as the leading manufacturer of AC variable speed drives in the future.

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