



E-Learning, DC drives

DC Drives Rebuild Products G566e Part 2

© ABB Group
November 8, 2021 | Slide 1
MODERNIZATION_02_R0101

Power and productivity
for a better world™ **ABB**

Welcome to the DC drives training module about rebuild products.

If you need help navigating this module, please click the Help button in the top right-hand corner.
To view the presenter notes as text, please click the Notes button in the bottom right corner.

Objectives

This training module covers:

- Product portfolio for DC drives
 - DC Converter modules
 - DC Enclosed converters
 - Panel solutions
 - Rebuild Kits
 - Upgrade Kits
- Handling of DC drives with implemented function block programs

This training module covers:

- Product portfolio for ABB DC drives: This includes: DC Converter Modules, DC Enclosed Converters, Panel solutions, Rebuild Kits and Upgrade Kits.
- Handling of DC drives with implemented function block programs.

Product Portfolio ABB DC Drives



© ABB Group
November 8, 2021 | Slide 3
MODERNIZATION_02_R0101

This is the product portfolio for ABB DC drives. It consists of DC drives converter modules in different power sizes, enclosed converters or drive cabinets, and the rebuild solutions like the panel solution, upgrade kits and the rebuild kit.

All products can be used for DC drive modernization.

DCS400 Module



Technical characteristics

- 20 ... 1000 A DC (9 ... 522 kW)
- 230 ... 500 V AC
- 0 ... 580 V DC

Benefits

- Most compact converter module
- Easy to order, install and commission
- Commissioning assistant guides
- Integrated field excitation:
→ 3 wires IN and 4 wires OUT
- Macros available for fast commissioning
- Inputs and outputs are free configurable

© ABB Group
November 8, 2021 | Slide 4
MODERNIZATION_02_R0101



The ABB standard drive DCS400 is available from 20 to 1000 Amps DC or 9 to 522 kilowatts. The voltage level can vary between 230 and 500 volts AC. The output voltage of the DCS400 can be between 0 and 580 volts DC.

Benefits of the DCS400 include:

- It is the most compact converter module for shunt-wound motors,
- It is easy to order, install and to commission,
- There is a commissioning assistant available which guides you through the several steps,
- There is an integrated field excitation according to the concept 3 wires in and 4 wires out,
- Macros are available for fast commissioning and
- All inputs and outputs are free configurable

DCS800-S Module



Technical characteristics

- 20 ... 5200 A DC (9 ... 4800 kW)
- 230 ... 1000 V AC
- 0 ... 1160 V DC

Benefits

- Most compact converter module
- Scalable to all applications
- Internal 3-phase exciter (D1 – D4)
- Covers the widest power range with the same technology
- Free programmable by means of integrated IEC 61131 PLC

© ABB Group
November 8, 2021 | Slide 5
MODERNIZATION_02_R0101

ABB

The industrial drive DCS800 is also available as a converter module in different power sizes. It is usable from 20 to 5200 amps DC or 9 to 4800 kilowatts. It can be connected to an electrical network between 230 volts and 1000 volts AC. The output voltage can then vary between 0 and 1160 volts DC.

Benefits include:

- It is the most compact converter as a 6-pulse bridge,
- It is scalable to all applications,
- The internal 3-phase field exciter is embedded for converter sizes D1 to D4,
- It is free programmable by means of an integrated PLC according to the standard IEC 61131.
- The DCS800 is easy to install and provides a commissioning assistant.

DCS800-A (1) Enclosed converter



Technical characteristics

- 20 ... 20000 A DC (5 kW ... 18 MW)
- 0 ... 1500 V DC
- 230 ... 1200 V AC
- IP21 ... IP54 available

Benefits

- Individually adaptable to customer requirements
- High power solutions in 6- and 12-pulse
- User defined accessories like external PLC or automation systems included

© ABB Group
November 8, 2021 | Slide 6
MODERNIZATION_02_R0101

ABB

Enclosed converters are ready-made drive solutions. They are available from 20 to 20000 amps DC or 5 kilowatts to 18 megawatts. They can be connected to an AC network between 230 to 1200 volts AC. Due to the enclosure, the IP class is higher up to IP54.

All enclosed converters are individually adaptable to customer requirements. They are typically used for high-power solutions in 6- or 12-pulse technology. Also user defined accessories like external PLCs or automation systems can be included, if required.

ABB enclosed converters are manufactured according to marine standards, UL or C8A.

DCS800-A (2) Single drive



- Ready made cubicle to run a DC motor consisting of
 - Converter modules to supply armature and field windings
 - Protection devices and interface to the AC supply, engineered and interconnected
 - Interface to the process, pre-engineered and wired
- All features as with DCS800-S
- Design help via DriveSize
- Dedicated, pre-engineered solution to supply “stand-alone” DC motors
 - Protection class IP21 or IP54
 - Fully tested drive cabinet
 - Full set of drawings

© ABB Group
November 8, 2021 | Slide 7
MODERNIZATION_02_R0101

ABB

Enclosed converters can be split into 2 groups. The first group is the single drive. This is a ready-made cubicle to run a DC motor consisting of:

- The converter modules to supply armature and field windings,
- The protection devices and interface to the AC supply, which are engineered and interconnected,
- The interface to the process, which is pre-engineered and wired

The cubicle has all the same features as the DCS800 converter module. It can be designed by means of the software tool 'DriveSize'.

Finally it is a dedicated, pre-engineered solution to supply “stand-alone” DC motors. The cubicle can be ordered with protection class IP21 or IP54. It is fully tested and will be delivered with a full set of drawings.

DCS800-A (3) Group and multi drive



- All features and functions as with a DCS800 single drive
- Only one AC incoming supply necessary for several (or a group of) DC motors supplied and controlled by the converters because of an AC distribution inside the cubicle
- Dedicated, pre-engineered solution to supply several DC motors belonging to one section
- Dedicated, pre-engineered solution for high-power drives
($U_{AC} < 1200 \text{ V}$, $I_{DC} > 5 \text{ kA}$)
based on 6-pulse, 12-pulse parallel, serial or hard-paralleled converters

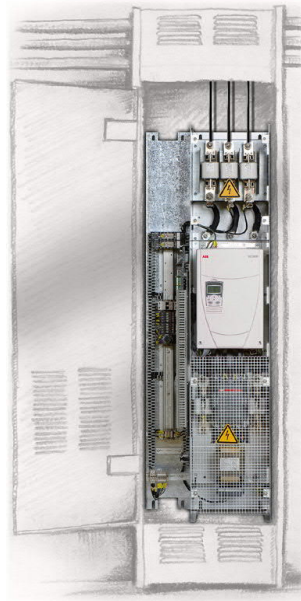
© ABB Group
November 8, 2021 | Slide 8
MODERNIZATION_02_R0101



The other kind of enclosed converters are the group drives. All features and functions as with a DCS800 single drive are present. There is only one AC incoming supply necessary for several or a group of DC motors. They are supplied and controlled by the converters, because of an AC distribution inside the cubicle.

Finally it is a dedicated, pre-engineered solution to supply several DC motors belonging to one section. There are many variations of drives, for example 6-pulse and 12-pulse in parallel, serial or hard-parallel configuration.

DCS800-E series (Compact) Pre-assembled drive-kits (1)



Technical characteristics

- 20 ... 450 A DC (5 ... 315 kW)
- 0 ... 700 V DC
- 400, 525, 600 V AC

Benefits

- DCS800 module with all necessary accessories mounted on a panel
- Very fast installation and commissioning
- Shut-down time minimized
- Fits into TYRAK and Rittal cabinets

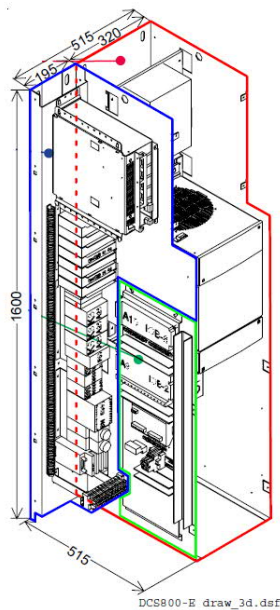
© ABB Group
November 8, 2021 | Slide 9
MODERNIZATION_02_R0101



Pre-assembled drive kits belonging to the DCS800 E-series are available from 20 to 2000 amps DC or 5 to 315 kilowatts. They can be connected to the mains between 230 and 600 volts AC.

The DCS800 module with all necessary accessories is mounted on a panel. Advantages of the E-series are a very fast installation and commissioning and therefore the shut-down time is minimized. It fits into TYRAK and Rittal cabinets.

DCS800-E series (Compact) Pre-assembled drive-kits (2)



- Power unit, auxiliary unit and I/O unit are mounted at one plate
- Additional mechanical mounting equipment is available for TYRAK8/L (Types YxMK, YxML, YxMp)
- Additional pulp and paper equipment can be ordered



DCS800-E mounting supports



Sliding rails in cabinet bottom

© ABB Group
November 8, 2021 | Slide 10
MODERNIZATION_02_R0101

ABB

The panel consists of the power unit including the DCS800 converter module, fuses and main contactor, the auxiliary unit and the I/O unit.

Additional mechanical mounting equipment is available for TYRAK 8, which should be ordered.

Additional pulp and paper equipment can be ordered, too.

DCS800-EV series (Vario) Pre-assembled drive-kits (1)



© ABB Group
November 8, 2021 | Slide 11
MODERNIZATION_02_R0101

Technical characteristics

- 25 ... 2000 A DC (5 kW ... 1.4 MW)
- 525 or 600 V AC version

Benefits

- DCS800 module with all necessary accessories mounted and fully cabled on a panel, designed for GE cabinets
- Old cabinets and busbars can be reused
- Fully factory tested according to DCS800-A standard
- Very fast and easy installation including very fast commissioning reduces shut-down time to a minimum

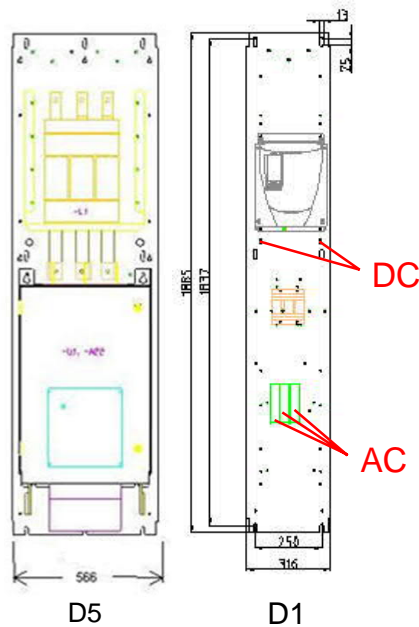


The DCS800 Vario is another option to modernize quickly. Solutions are available from 25 to 2000 amps DC or 5 kilowatts to 1.4 megawatts. ABB provides a 525 volt and a 600 volt version.

The DCS800 module with all the necessary accessories is mounted and fully cabled on a panel. Old cabinets and busbars can be reused. The panel is fully factory tested according to the DCS800 A standard.

Finally, it provides a very fast and easy installation including very fast commissioning which reduces shut-down time to a minimum.

DCS800-EV series (Vario) Pre-assembled drive-kits (2)



Three separate units available

- Power unit
- Auxiliary unit
- I/O unit
- Fits for GE Siltron Enclosed Converters
- Options are available

© ABB Group
November 8, 2021 | Slide 12
MODERNIZATION_02_R0101

ABB

There are three separate units available. One is the power unit with the converter module, commutation choke and fuses. The second part is the auxiliary unit for additional contactors, relays and other devices. The third part is the I/O unit with the IOB-2 and IOB-3 boards.

The height of the panel is always 1885 millimeters. The width of D1 to D4 converter modules is 316 millimeters. The D5 version has a width of 566 millimeters.

The panel fits into GE Siltron enclosed converters.

Options for the panels are available to expand the basic functionality.

DCS800-R Rebuild Kit (1)

Digital control-kit for existing power stacks



Technical characteristics

- 20 ... 20000 A DC (5 kW ... 18 MW)
- 0 ... 1160 V DC
- 230 ... 1200 V AC

Benefits

- Reuse long life components like power stacks, cabinets, busbars and cabling
- Very cost-effective solution
- Tailor made solutions for old BBC drives, ASEA TYRAK drives and other manufacturers
- Open for nearly all existing DC drives

© ABB Group
November 8, 2021 | Slide 13
MODERNIZATION_02_R0101

ABB

The DCS800 R is the rebuild kit used for modernization. With the rebuild kit, DC currents from 20 to 20000 amps DC can be supported. Also connecting to a 1200 volt AC network is possible.

Benefits of the rebuild kit include:

- Reuse of long life components like power stacks, cabinets, busbars and cabling.
- A very cost effective solution but requires competent engineering skills.
- Tailor made solutions for old BBC drives, ASEA TYRAK drives and other manufacturers.
- It can be used with nearly all existing DC drives including DC drives from third parties.

DCS800-R Rebuild Kit (2)

Components of the rebuild kit



Components

- DCS800-S D1 frame with electronics, power supply and field exciter (option)
- PIN-48 boards for thyristor connection
- PIN-51 board, the measuring board as well as REB-1, REB-2 and REB-3
- Amount of components depends on the needs and application
- ABB provides different ones!

© ABB Group
November 8, 2021 | Slide 14
MODERNIZATION_02_R0101



Components of the rebuild kit always include a DCS800 S D1 frame with electronics, power supply board and, optionally, a field exciter. The heat sink with semiconductors is not built-in. Also the PIN 48 board is part of the kit. The amount of boards depends on the hardware configuration. One PIN 48 board can fire 6 thyristors. The PIN 51 board, which is used for measurements, is part of the kit as well as the specially designed rebuild boards REB 1, REB 2 and REB 3.

Depending on the hardware configuration, the amount of boards should be selected according to specific needs. Note that ABB provides different kinds of rebuild kits.

DCS800-R Rebuild Kit for TYRAK 8

Tailor made rebuild kits



Typical scope of delivery



Components

- TYRAK 8 rebuild kit is a pre-mounted panel solution, which includes all necessary components
- The panel is designed to be easily mounted onto a TYRAK 8 cabinet door, using the existing mounting clamps

How it works

- The cabinets, cablings and most power installations, like thyristors, main contactor, etc. are kept while the old analogue electronic and control circuits are replaced by a digital control unit

© ABB Group
November 8, 2021 | Slide 15
MODERNIZATION_02_R0101

ABB

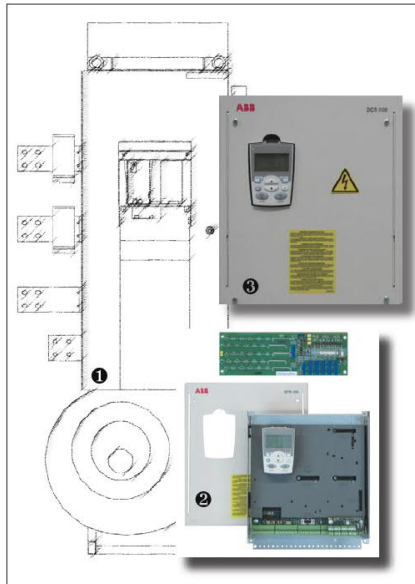
A special rebuild kit is the TYRAK 8 rebuild kit. It is a pre-mounted panel solution which includes all necessary components. The panel is designed to be easily mounted onto a TYRAK 8 cabinet door, using the existing mounting clamps.

How it works: The cabinets, cablings and most power installations, like thyristors, main contactors and so on, are kept while the old analogue electronic and control circuits are replaced by a digital control unit.

Circuit diagrams are made so that they fit original schematics.

DCS800-R Upgrade Kits

Tailor made upgrade kits for DCS



Different solutions available

- Upgrade Kit A5 to D5
- Upgrade Kit A6/7 to D6/7
- Upgrade Kit C2b to DCS800
- Upgrade Kit C3 to DCS800
- Upgrade Kit C4 to DCS800

Content

- POW-4 (electronics power supply)
- CON-4 with DSL-4
- DCS800 Control Panel
- Cables

© ABB Group
November 8, 2021 | Slide 16
MODERNIZATION_02_R0101



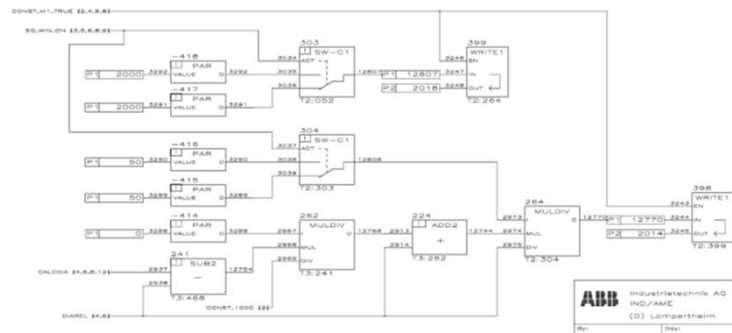
Another option of modernizing are the upgrade kits. Typically, they can be used for all older DCS products. With this solution the hardware will remain and only the electronics will be changed.

There are different upgrade kits available, for example from DCS500 A5 to DCS800 D5 or from DCS600 / DCV700 C4 to DCS800.

The content of the upgrade kit includes the POW 4 board, the CON 4 board, the DSL 4 board, a DCS800 Control Panel and some cables.

Do not forget the field excitation!

DCS 500 with block program inside GAD – Graphic Application Designer



- DCS 500 system structure:
 - Motor Control Structure
 - Application Programming Area

- Both parts are working together as one program only

© ABB Group
November 8, 2021 | Slide 18
MODERNIZATION_02_R0101



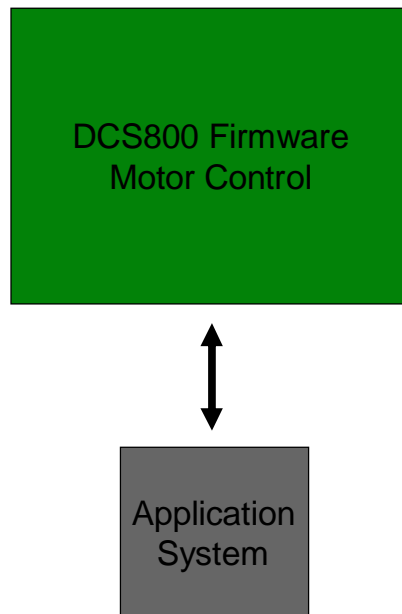
The DCS500 with a block program inside can be found quite often. Those application programs have been developed in the GAD software tool and afterwards downloaded to the drive.

The DCS500 system structure worked in this way:

- Calculation of the motor control structure and calculation of the application programming area additionally.
- Both parts are working together as one program only.
- In most cases, the DCS500 application program is a serial communication – for example for Profibus-configuration, 12-pulse-configuration or a digital output function.

Remember Situation in the DCS800

We have two different systems!



- Motor control structure is fixed implemented and cannot be changed
- Application program is beside the motor control structure and affects it only
- Additional function blocks in-between the motor control structure are impossible with a free selectable execution order!
- DCS800 provides 2 application systems
 - CoDeSys (Control Builder DCS800)
 - Free programmable
 - Adaptive Program
 - 16 blocks available

© ABB Group
November 8, 2021 | Slide 19
MODERNIZATION_02_R0101



Now let us recall what we have already learned about the DCS800 drive.

In this drive, the motor control logic is fixed implemented and cannot be changed. The application programming area is beside the motor control structure and affects it only. Additional function blocks in-between the motor control structure are impossible with a free selectable execution order!

The DCS800 provides two application systems. The first one is the DCS800 Control Builder. It is free programmable with different programming languages. The second one is the adaptive program, which is easy to learn but only provides 16 blocks.

How to read a DCS 500 application program

Diagram file exists (*.QOD)

- Shows the firmware and application structure plan
- Very easy to understand if complete!

If no diagram file exists

- Upload all parameters from the DCS 500 to your PC and compare the parameters to default
- Construct the actual program (only for experts!)
- Draw a complete firmware structure diagram

Notice comments

- Register known problems of the program
- Which new functions are required

If a DCS500 block program is inside the drive, it is important to find out the functionality.

If a diagram file exists, it shows the firmware and the application structure plan. It is very easy to understand but you should check if it is really complete.

If no diagram file exists, it is possible to upload all DCS500 parameters to the PC and to try to construct the actual application program. This is for experts only! With this information, it is possible to redraw the complete firmware structure diagram afterwards.

In this step it is important to notice some additional comments.

- Register known problems of the old application program.
- Which new functions are required by the customer?

Evaluate the complexity!

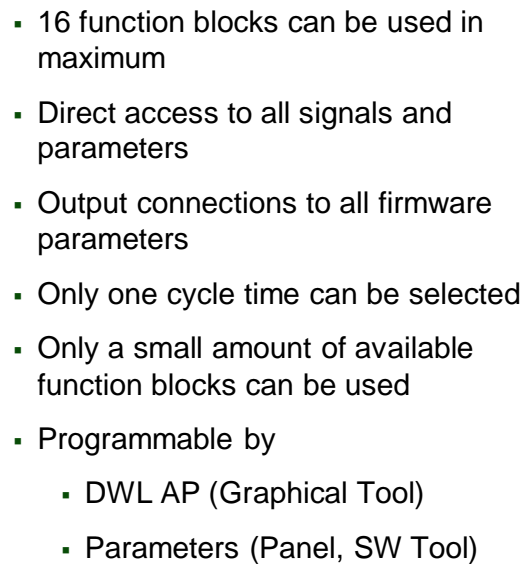
These questions are important before doing a conversion:

- Which function blocks have been used in the old application program?
- Are all function blocks available which are needed?
 - If not, create it by yourself in CoDeSys!
- How many function blocks are required?
- Is the programmer able to handle the software tools?
- Time to replace the system!
- Hardware available to do tests?
- Engineering effort and investment!

- If all points are clear, select the new application area!

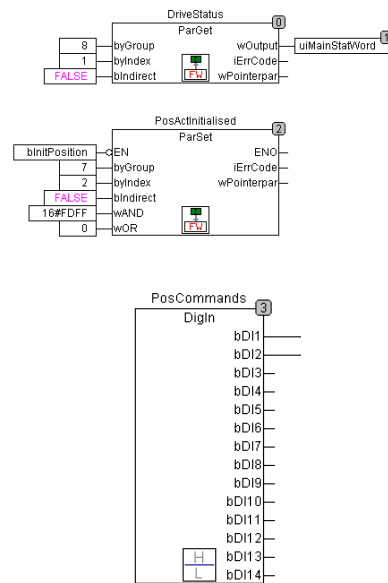
Application programs are often very complex. The following questions help to find out the functions needed!

- Which function blocks have been used in the old application program?
- Are all function blocks available which are needed? If not, create it by yourself in CoDeSys!
- How many function blocks are required?
- Is the programmer able to handle the software tools?
- How much time do we have to replace the old system?
- Is there any hardware available to do tests?
- What is the engineering effort and the investment?
- If all points are clear, select the new application area!



- A maximum of 16 function blocks can be used,
- Direct access to all signals and parameters,
- Output connections to all firmware parameters,
- Only one cycle time can be selected,
- Only a small amount of available function blocks can be used.
- Adaptive program is programmable by the graphical tool DWL AP or directly by setting parameters by using the control panel or software tool.

Features of CoDeSys



- Free programming without limitations!? (Limitation is the load of the cycle time!)
- 6 programming languages
- Know-how protection possible by password
- Structured programming
- Self-designed function blocks can saved in libraries
- ABB Memory Card is needed
- Programmable by
 - CoDeSys Software Tool

© ABB Group
November 8, 2021 | Slide 23
MODERNIZATION_02_R0101



The features of CoDeSys should be also discussed to get a feeling for the system:

- Free programming without limitations. The limitation is mainly the load of the cycle time.
- 6 programming languages are available.
- Know-how protection possible by password.
- Structured programming possible with different program parts.
- Self-designed function blocks can be saved in libraries.
- The ABB Memory Card is needed as a hardware dongle and to store the program code.
 - It is programmable by the CoDeSys software tool

Important questions



- Size of the application program!
 - Only 2 or 3 function blocks needed?
 - Complex expressions or calculations?
- Total costs of the project?
- Knowledge of the existing programming tools?
 - CoDeSys needs a lot of experience!
 - DWL AP can be learned in one day!
- Test equipment present?
 - DCS800 Demo Unit
 - Further test equipment

© ABB Group
November 8, 2021 | Slide 24
MODERNIZATION_02_R0101



Important questions to decide about the application system:

- What is the size of the application program? Is it a small one with only 2 or 3 blocks or do we need any complex expressions?
- What are the total costs of the project? A reason for this question is: Adaptive program is free of charge and CoDeSys programming needs optional equipment.
- Is there knowledge of the programming tools present?
- It is recommended to have test equipment available like the DCS800 Demo Unit.

Transfer the program to DCS800

- This must be done manually!
- Adaptive Program
 - Select important firmware parameters
 - Select function blocks
 - Connect and activate the blocks
- CoDeSys
 - Select important firmware parameters
 - Select programming language
 - Select function blocks / functions
 - Create new parameters
 - Download the software to ABB Memory Card
 - Connect and activate the software

© ABB Group
November 8, 2021 | Slide 25
MODERNIZATION_02_R0101



How to transfer an application program to the DCS800? This must be done manually!

- With adaptive program, select important firmware parameters, select the function blocks and connect and activate the program.
- In CoDeSys, select important firmware parameters, select the programming language needed, select function blocks or functions, create new parameters and download the software to the ABB Memory Card.

Summary

Key points of this module are:

- Product portfolio for DC drives
 - Converter modules
 - Enclosed converters
 - Panel solutions
 - Rebuild Kits
 - Upgrade Kits
- Handling of DC drives with implemented function block programs

Key points of this module are:

- Product portfolio for ABB DC drives, which includes: DC Converter Modules, DC Enclosed Converters, Panel solutions, Rebuild Kits and Upgrade Kits.
- Handling of DC drives with implemented function block programs.

Power and productivity
for a better world™

