





Series 500 Automation and Control IEDs

Overview

The series 500 IEDs fully address the most demanding applications, such as utility transmission and distribution systems, power plants, transportation or industrial applications, by combining diverse I/O options, advanced user-programming and high-performing control in a highly reliable, flexible and powerful device platform.

Object orientation and state-of-the-art toolset allow straightforward engineering throughout the system life-cycle without compromising user requirements. Designed with IEC 61850 and other open standards in mind the series 500 products are future-proof and can be seamlessly integrated in multivendor distributed systems.

Product Overview

 Programmable Automation Controller	High-capacity I/O programmable controller or remote terminal unit for highly demanding standalone or distributed applications.
 Programmable Automation Controller	High-availability variant of the DCU 500, featuring hot swappable power supplies and redundant CPUs.
 Bay Controller	Utility transmission and sub-transmission bay control unit featuring protection-related functions.
 Transformer Controller	Transformer control unit featuring voltage regulation and tap changer control.

Key Features

- Multiple Communication Options
- Distributed Automation According to IEC 61850
- IEC 61131-3 PLC Programming
- Built-in Control and Protection Functions
- Watchdog and Self-monitoring
- Web-based Interface
- Redundant and Hot Swappable Options
- Full-color HMI Option

Customer Benefits

- Single High-performing Platform
- Integrated Automation, Protection, Measurement and Recording
- Highly Adaptable
- Easy to Specify, Configure, Test and Maintain
- Flexible I/O Configurations
- IEC 61850 Process Bus Capable Architecture



Open Automation

Enhanced Programming

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Integrated Engineering

Engineering is fully integrated in the Automation Studio toolset whether a device oriented or a distributed control system approach is required. While being highly adaptable products, configuration and maintenance efforts are reduced with features like templates, libraries, copy-paste or drag-and-drop.

Automation Studio is a unique easy to use environment providing a range of features from matrix and diagram editors to simulation and online device monitoring as well as data extraction and analysis.

These features are complemented with unified project system integration, comparison and productivity wizards or import/export including IEC 61850 SCL that make enhanced system functions simple to setup, visualize and manage.

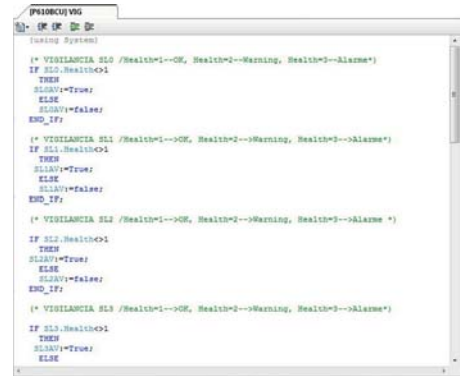
Distributed Applications

The IED 500 family products were designed with IEC 61850 in mind in every aspect and thereby provide open system design and full compatibility with other compliant devices, engineering tools and systems.

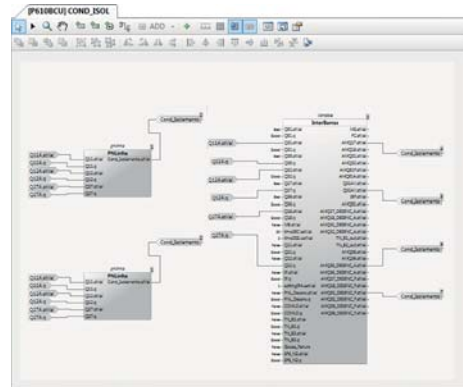
Functions, built-in or user-defined, are object-oriented and provide algorithm encapsulation through data point inputs and outputs. This approach allows simplified adoption of modern object-oriented engineering approaches such as IEC 61850. The user may fully define the logical node classes and logical device allocation in each configuration providing unmatched logical configuration capabilities.

Fine-tuned communication performance with regard to GOOSE messaging allows sophisticated distributed automation architectures to be deployed with full confidence and reliability.

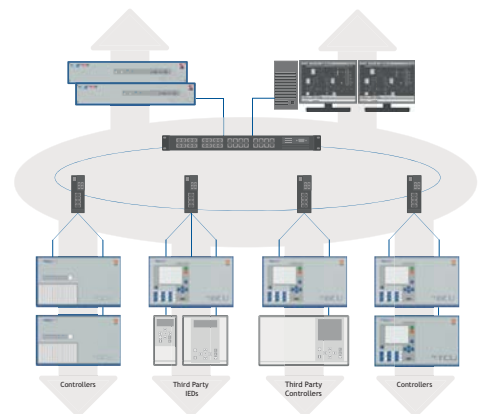
The IED 500 core platform is also ready to support future IEC 61850 requirements such as seamless redundancy and synchronized sampled values for process bus applications in upcoming hardware editions.



```
PROGRAM VIG
Using System
(* VIGILANCIA SLO /Health1-->OK, Health2-->Warning, Health3-->Alarme*)
IF SLO.HealthC01
THEN
SLOAV=True;
ELSE
SLOAV=False;
END_IF;
(* VIGILANCIA S11 /Health1-->OK, Health2-->Warning, Health3-->Alarme *)
IF S11.HealthC01
THEN
S11AV=True;
ELSE
S11AV=False;
END_IF;
(* VIGILANCIA S12 /Health1-->OK, Health2-->Warning, Health3-->Alarme *)
IF S12.HealthC01
THEN
S12AV=True;
ELSE
S12AV=False;
END_IF;
(* VIGILANCIA S13 /Health1-->OK, Health2-->Warning, Health3-->Alarme *)
IF S13.HealthC01
THEN
S13AV=True;
ELSE
S13AV=False;
END_IF;
```



IEC 61131-3 Programming.



Fully-integrated IEC 61850 Automation Systems.

User and Process Interface

User Interface Options

The local interface (BCU 500 and TCU 500 only) includes a bright high-contrast color LCD, 16 programmable alarms, keypad and 8 function keys. DCU 500 and DCU 500H provide a LED-based I/O status interface.

The local LCD may display multiple mimic pages that, together with the menu/window system, provide access to all functions running on the device, including operation and control, monitoring, management of operational settings, setting groups and operating modes, recent events, etc.

Complementary to the local interface and toolset, an embedded webserver is available at the front or rear Ethernet ports providing access to all local operations as well as to trend, fault or disturbance data. This allows interaction with the device and associated process locally or remotely without requiring external software tools.

User Interface	BCU 500	TCU 500	DCU 500	DCU 500H
Color LCD	●			
Programmable Alarm / Indication LEDs	●			
Functional Keys	●			
IED Status LEDs			●	
Digital I/O Status LEDs				●
Integrated Webserver			●	

Versatile Local I/O Options

Both pre-defined and fully specifiable I/O module configurations are available, allowing the 500 series devices to match the specific requirements of each application.

The DCU 500 and DCU 500H offer field-replaceable modules for enhanced flexibility whereas the BCU 500 and TCU 500 provide factory assembled options for product standardization.

Data Acquisition Modules

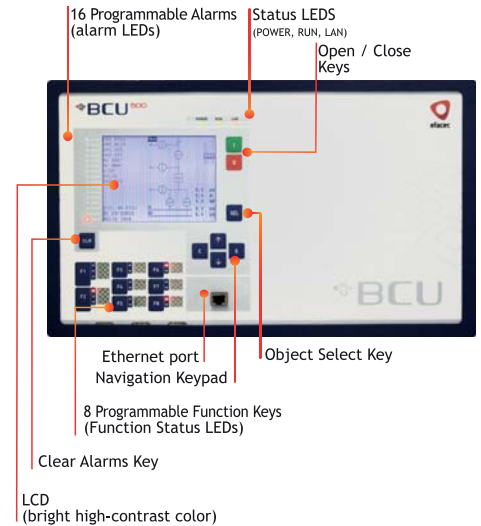
Data acquisition modules support low-level processing of single, double, n-bits, pulse counting for binary I/O data and filtering for analog data.

Analog AC current and voltage inputs, available at the BCU 500 and TCU 500, also include internal channel summation, selection and compensation which allow the application of multiple CT/VT arrangements without additional external hardware.

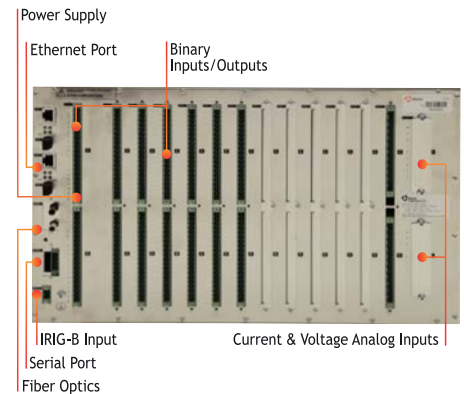
I/O Options		BCU 500	TCU 500	DCU 500	DCU 500H
I/O Limits	Chassis Configuration	1	2	3	
Maximum I/O Capacity		304	296	288	296
Digital I/O Points* (inputs/outputs)		264/136		256/128	
Analog DC Inputs*		32			
Analog AC Inputs		8	16	24	0
Base I/O					
8 DI + 8 DO		●			
I/O Expansion Cards					
Digital I/O Expansion Card Types (up to 8)					
16 DI Expansion Card					
32 DI Expansion Card					
8 DI + 8 DO Expansion Card		12	10	8	12
16 DI + 8 DO Expansion Card					
16 DO Expansion Card					
DC Analog Inputs Expansion Card Types (up to 4)					
8 DC Analog Inputs Expansion Card		12	10	8	12
AC Analog Inputs Expansion Card Types					
8 AC Analog Inputs Expansion Card		1	2	3	0

● - Base feature

* Non-simultaneous inputs and outputs (8 digital I/O expansion cards considered)



BCU 500 Local User Interface.



BCU 500 Rear Panel.

Communications, Monitoring and Recording

Extended Communication Capabilities

In parallel with IEC 61850 capabilities each device can also be used as a multiprotocol communication master and/or slave station. Standard protocols like IEC 60870-5-101/104, DNP 3.0, IEC 60870-5-103 or Modbus are available.

Integration of other monitoring devices, retrofits, multivendor systems and future expansions are hence made simple with certified implementations of IEC 61850 as well as other open communication protocols that convey a high degree of integration and interoperability to the whole product family.

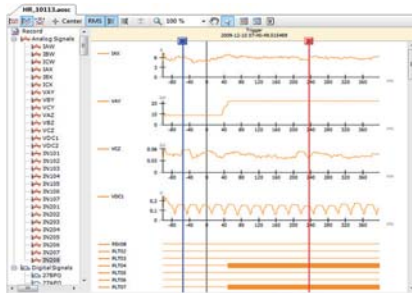
Recording

The general purpose event recorder with millisecond or better precision can store at least 25000 events of any data source.

The disturbance recorder can be configured according to complex trigger options such as trips, analog channel supervision or any user-defined logic. Disturbance files are stored in native COMTRADE format and include both analog and binary information.

In addition to event and disturbance recorders a general purpose statistical trend recorder is available to generate load diagrams or similar trend data. All data is kept in non-volatile memory and FTP protocol is also available for data access.

Variable Name	Start Date	End Date	Value
14 23	2010-09-02 14:49:09.24	2010-09-02 14:49:09.24	Alarm Group 7
15	2010-09-02 14:49:09.251	2010-09-02 14:49:09.251	Alarm Group 7
16	2010-09-02 14:49:09.254	2010-09-02 14:49:09.254	Alarm Group 7
17	2010-09-02 14:49:09.256	2010-09-02 14:49:09.256	Alarm Group 7
18	2010-09-02 14:49:09.258	2010-09-02 14:49:09.258	Alarm Group 7
19	2010-09-02 14:49:09.261	2010-09-02 14:49:09.261	Alarm Group 7
20	2010-09-02 14:49:09.263	2010-09-02 14:49:09.263	Alarm Group 7
21	2010-09-02 14:49:09.265	2010-09-02 14:49:09.265	Alarm Group 7
22	2010-09-02 14:49:09.267	2010-09-02 14:49:09.267	Alarm Group 7
23	2010-09-02 14:49:09.269	2010-09-02 14:49:09.269	Alarm Group 7
24	2010-09-02 14:49:09.271	2010-09-02 14:49:09.271	Alarm Group 7
25	2010-09-02 14:49:09.273	2010-09-02 14:49:09.273	Alarm Group 7
26	2010-09-02 14:49:09.275	2010-09-02 14:49:09.275	Alarm Group 7
27	2010-09-02 14:49:09.277	2010-09-02 14:49:09.277	Alarm Group 7
28	2010-09-02 14:49:09.279	2010-09-02 14:49:09.279	Alarm Group 7
29	2010-09-02 14:49:09.281	2010-09-02 14:49:09.281	Alarm Group 7
30	2010-09-02 14:49:09.283	2010-09-02 14:49:09.283	Alarm Group 7



Data Records.

Communication Interfaces	
Service/Engineering (Front Panel)	
10/100BASE-TX	●
Operation or Service/Engineering (Rear Panel)	
IRIG-B Input	●
RS232/RS485 (Copper, Plastic or Glass Fiber)	●
RS232/RS485 (Copper, Plastic or Glass Fiber)	○
RS232/RS485 (Copper, Plastic or Glass Fiber)	○
Dual 10/100BASE-TX or Dual 100BASE-FX	●
Time Synchronization	
IRIG-B Input	●
SNTP Client	●
By Communication Protocol	●
IEC 61850	
IEC 61850 Server and GOOSE	●*
Communication Protocols (Slaves)	
IEC 60870-5-104 (TCP/IP)	○
IEC 60870-5-101 (Serial)	○
IEC 60870-5-103 (Serial)	○
DNP 3.0 (Serial and/or TCP/IP)	○
MODBUS (Serial and/or TCP/IP)	○
Others (Please Contact)	○
Communication Protocols (Masters)	
IEC 60870-5-104 (TCP/IP)	○
IEC 60870-5-101 (Serial)	○
IEC 60870-5-103 (Serial)	○
DNP 3.0 (Serial and/or TCP/IP)	○
MODBUS (Serial and/or TCP/IP)	○
Others (Please Contact)	○

- - Base feature
- - Optional feature
- * - Optional feature for DCU 500 and DCU 500H

Measurement and Metering

Accurate measurement of magnitude, angle, power, energy, impedance and frequency for three-phase systems or other non-phase related current and voltage signals is available.

Clock Synchronization

Real-time clock synchronization can be performed via SNTP, IRIG-B, by communication protocol or set at the local interface.

Built-in Control and Protection

Protection Functions

A set of complementary built-in protection functions is also available in both BCU 500 and TCU 500, such as current, voltage and frequency functions.

Control and Supervision Functions

In both BCU 500 and TCU 500 selectable firmware functions allow control and supervision of up to 20 circuit breakers and switches with optional synchronism-check in BCU 500. Secondary system supervision functions such as of instrument transformers or trip circuits are included.

Control functions feature direct or select-before-operate controls, secure hardwired or distributed interlocking and multi-level authority sources.

Transformer Control Functions

The TCU 500 combines voltage regulation and tap changer control with functions such as fan and pump control and protection supervision (Buchholz, overpressure, temperature monitoring, among others).

Voltage regulation provides control of voltage in any winding for up to 6 transformers in parallel. It can be applied on two- or three- winding transformers (with priority winding selection). Operation of multiple transformers is based on circulating current minimization or master/slave control.

Line drop compensation, supervision of tap changer operation and a two time constant thermal overload replica are also available.



Functions						
Protection	ANSI	BCU 500	TCU 500	DCU 500	DCU 500H	IEC 61850
(Directional) Phase Overcurrent (Optional Directionality)	50/51/67	● 3	● 3			PTOC/RDIR
(Directional) Earth-Fault Overcurrent (Optional Directionality)	50N/51N/67N	● 3	● 3			PTOC/RDIR
Thermal Overload	49		● 1			PTTR
Phase Overvoltage	59	● 3	● 3			PTOV
Zero Sequence Overvoltage	59N	● 3	● 3			PTOV
Phase Undervoltage	27	● 3	● 3			PTUV
Underfrequency	81	● 3	● 3			PTUF
Overfrequency	81	● 3	● 3			PTOF
Frequency Rate-of-Change	81	● 3	● 3			PFRC

● - Base feature

(n) - Maximum number of available functions

Built-in Functions

Functions						
Control and Supervision	ANSI	BCU 500	TCU 500	DCU 500	DCU 500H	IEC 61850
Automatic Reclosing	79	● 3				RREC
Synchronism and Voltage Check	25	● 6				RSYN
Circuit Breaker Failure	51BF	● 3				RBRF
Circuit Breaker Close / Lockout	86	● 1	● 1			RCBL
Automatic Voltage Control			● 1			ATCC
Fuse Failure / VT Supervision		● 3	● 3			RVTS
CT Supervision		● 3	● 3			RCTS
Circuit Breaker Control / Supervision	52	● 6	● 6			CSWI / XCBR
Circuit Switch Control / Supervision	89	● 15	● 15			CSWI / XSWI
Tap Changer Control / Supervision			● 6			YLTC
Transformer Pump and Fan Control / Supervision			●			CCGR
Transformer Protection Supervision			●			SPTR
Distributed Automation		●	●	●	●	GGIO
Programmable Automation (IEC 61131-3)		●	●	●	●	GAPC <small>(or user defined)</small>
Monitoring	ANSI	BCU 500	TCU 500	DCU 500	DCU 500H	IEC 61850
Three-Phase Accurate Measurements		● 6	● 3			MMXU / MSQI
Single-Phase Accurate Measurements		● 3	● 3			MMXN
Metering (Optional Pulse Counting)		● 6	● 3			MMTR
Current / Voltage Disturbance Recorder		●	●			RDRE
Chronological Event Log		●	●	●	●	
Load Diagram / Statistical Trend Recorder		●	●	●	●	
Fault Report		●	●			
Self-Tests and Watchdog		●	●	●	●	
Platform Options						
Availability Options		BCU 500	TCU 500	DCU 500	DCU 500H	
Hardware Watchdog and Auto-rese (Detection of hardware and RTOS failures)				●		
Software Failure Detection and Recovery (Self-healing of software module failures)				●		
High-availability Configuration (Hot-pluggable Power Supply and Dual-CPU)					●	
Second CPU Card					○	
Second Power Supply					●	
Power Supply Options						
24/48/60 V d.c. (19 V to 72 V)		○				
48/60/110/125 V d.c. (38 V to 150 V)		○		○		
110/125/220 V d.c. (88 V to 300 V) 115/230 V a.c. (80 V to 265 V)		○		○		

● - Base feature | ○ - Optional feature
(n) Maximum number of available functions

Device Platform

Platform Overview

The 500 series products are rack-mountable and based on a common platform featuring high-performance hardware and modular software.

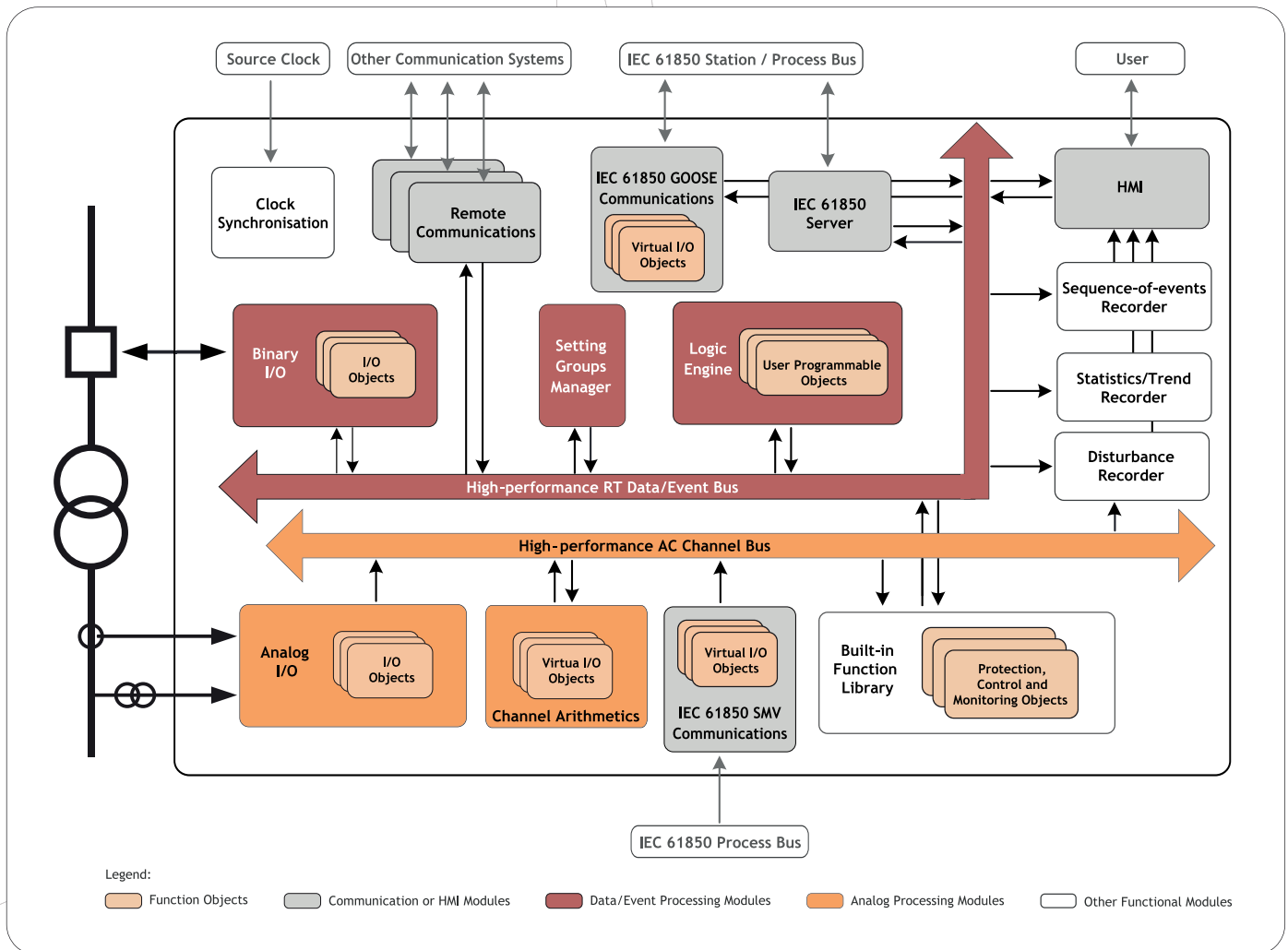
The multiprocessor architecture and optimized design ensure the availability of processing power for all active functions. This common platform simplifies all engineering procedures from specification to commissioning as well as operation and maintenance by reducing the learning curve and leveraging know-how.

High-availability Options

The DCU 500H offers a high-availability configuration with hot-pluggable dual power supplies, redundant field-replaceable CPU and communication cards. In this configuration user programs and other device functions operate in bumpless mode ensuring no program control steps are lost in case of CPU failover. DCU 500H devices are programmed as single CPU devices ensuring no additional engineering cost is required in such applications.

Self-diagnostics

Self-diagnosis includes watchdog, watchdog output, self-tests and supervision of all hardware components, including memory, I/O cards and communication ports, and of all built-in software modules. A test mode, suitable to validate device operation, can also be set.



Applications

Application Overview

The 500 series platform enables unprecedented balance between cost, performance and adaptability to user requirements in high demanding applications. The modular architecture, object-oriented function design, powerful user programming and free allocation of functions enable the deployment of both complex distributed architectures and standalone configurations.

Product and Life-cycle Support

The openness of series 500 family and the support throughout the life-cycle ensure future-proof technology and allow stepwise investment strategies. Efacec also provides a full range of services from training and support to engineering and maintenance that ensures you have products best fit for your requirements.



Example Application Description		
<p>BCU 500</p>	<ul style="list-style-type: none"> • Double breaker or breaker-and-a-half topologies • Complex user-defined automation schemes and distributed automation • Synchronism-check included • Multi-bay control in one single device • Control functions, including load shedding and restoration 	
<p>TCU 500</p>	<ul style="list-style-type: none"> • Voltage regulation for up to 6 transformers in parallel • Minimization of circulating current or Master/Slave control • Control and supervision of tap-changers • Voltage regulation for three-windings transformers, with priority voltage level • Information exchange between different voltage regulators • Optional line drop compensation 	
<p>DCU 500</p>	<ul style="list-style-type: none"> • Remote terminal unit • High I/O capacity • User programmability • Remote terminal unit • Integration of third party devices • Multiple protocol support 	
<p>DCU 500H</p>	<ul style="list-style-type: none"> • Programmable automation controller for power plant distributed control systems • High availability hardware 	



Automation Business Unit

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View the product on our website. Due to continuous development, the characteristics may change without notice. Not valid as a contractual item.

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