Smart Distribution

AMEU October 2021



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How power distribution has changed



The distribution network is central to the overall energy system

Most DER connections, network losses and power quality issues occur at MV/LV network level



Distribution networks are evolving







In a traditional grid, the energy flow is unidirectional from power plant to consumers The production is adapted to the consumption if possible:

installed power = total consumption

In a modern grid, a part of the production is distributed.

- The consumption is adapted to the production: installed power is optimized.
- The MV distribution network requires to be remotely monitored and controlled

As the MV network complexity grows, so does the need for an enhanced network management

Distribution Challenges



EcoStruxure[™] for Substation Automation

Substation Automation is the implementation of Eco 21



Substation Automation



Connected devices, real-time control & open software, analytics & services

Easergy T300 FRTU

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Easergy T300 – value proposition

attention, Minalatt

Increase Network Reliability & continuity Availability - Quality of Supply – energy consumption

Reduce outages time – SAIDI SAIFI

- Fault detection for any MV neutral system
- Upstream Broken Conductor detection
- Centralized and decentralized automation network reconfiguration
- Benefits less regulator Penalties , bonus granted

Improve power quality

- Voltage monitoring
- Transformer neutral cut out detection
- Power quality measurement
- Contract with guarantee of quality

Enable DER integration

Accurate voltage measurement

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Cost of resulting consumer perturbations

S: distributor benefits W: Non-distributed energy

 $S = W \times c \times dt$

dt: outage time reduction thanks to networks remote control <u>c: 20 to 50 time</u>s selling price: according to country wealth





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Easergy T300 – value proposition

Optimize Network Efficiency, performance

Reduced Total cost of ownership – Operational Efficiency

Reduce network losses

- MV and LV Power measurement with demand value
- Keep voltage measurement within limit

Optimize investments

- Modular design for multi-distribution network applications
- Intergraton in RMU => Smart RMU
- Harsh environment design for increased IEDs longevity
- Reduce transformer fault and extend lifetime

Reduce maintenance costs

 Condition Monitoring for increased assets longevity & reliability - reduce number of intervention
 Remote firmware and configuration update



WITH thermal monitoring



WITHOUT thermal monitoring



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Easergy T300 – value proposition

Maximize Safety & Security People safety – Resilience - Compliance

 Protect your people and asset 25Y of experience and 100K+ RTUs delivered Secured control sequences Mobile applications – for easy maintenance 	indiana presentation	
 Ensure resilience Secure data exchange Integrated firewall Port hardening management Authentication/ Authorization – Radius server 	De la companya de la	+
 Demonstrate compliance Certified Cybersecurity Certified R&D and delivery capabilities (ISO 27000) 		

Penetration test report

EcoXpert



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A modular solution... for every secondary distribution application



Every Distribution Automation application may be covered with a few Easergy T300 module types

- Underground cables distribution networks
 - MV/LV substation monitoring and control (kiosks, chambers)
 - DER connection substation

Overhead lines distribution networks

- LBS controller
- \circ Sectionalizer
- \circ MV line
- \circ End of line monitoring

Easergy T300 is a modular Feeder RTU (4 modules)



Condition Monitoring*

* Consult us for availability

Easergy T300 – a modular architecture, highly specialized All-in-one module #1: Easergy HU250 (so-called "CPU" or "RTU")

Easergy HU250: a versatile platform for the complete management of your MV/LV substation

Embedded operator HMI	Push buttons and LEDs		
Cybersecurity	RBAC, Secure Authentication, etc.		
Remote communications	 SCADA and Centralized network management Peer-to-peer substations 		
Local communications	 External 3rd party IEDs (Ethernet, Serial) Easergy T300 modules (separate Ethernet link) 		
Secure Wi-Fi access	Allows operators to simply access the webserver on site		
Configuration	Local (Wi-Fi or Ethernet cable) and remote (3G/4G Radio, Fo)		
Specific automation	May be programmed with IEC 61131-3 logic (ATS, SHG,)		
Global functions	e.g. remote/local operation, automation enable/disable		
Condition monitoring	Substation temperature, flooding, intrusion		
Protocols	 IEC 61850 Client/ Server/ Gateway, IEC 60870-5-104 Client/Server, DNP3 Client/ Server /Peer-to-Peer, Modbus TCP/RTU (Master/ Slave) 		
Clock synchronization	 SNTP and protocols GPS (requires the optional 3G/LTE modem box) 		
Operating temperature	-40 to +70°C		

Wi-Fi hotspot with control access for local connection

Easergy T300 incorporates an embedded Wi-Fi hotspot for local connection to:

- · Embedded web server via a laptop, tablet or smart phone
- Easergy Builder

Flexible communication ports

These communications ports can accommodate modern boxes. These modern boxes can be added on site and enable for very flexible updating during the product lifecycle. The moderns boxes available are:

- RS232/485 modem box for WAN or LAN communication.
 2G/3G modem box for WAN
- communication
- 4G European and US standard modern box with GPS clocks for accurate time synchronization
 ZigBee receiver conforming to IEEE 802 15.4

Ethernet ports

These ports can accommodate one of the following options: • WAN communication • LAN communication for third-party IEDs

USB port

One USB host port for multi-purpose use



(11116)

USB port

One mini USB port dedicated for maintenance

Dedicated dual Ethernet port for Easergy T300 modules

This Dual Ethernet port daisy-chain is dedicated for communication between Easergy T300 modules and connection to a laptop with Easergy Builder or an internet browser for connection to a web server

Serial RS485 Modbus port

This port is used for the connection to the Easergy communication power supply and can be used for third-party Modbus IEDs

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Easergy T300 – a modular architecture, highly specialized

All-in-one module #2: Easergy SC150 (so-called "MV switch controller")

Easergy SC150: a compact box that provides advanced functions for MV line and MV switchgear management

Embedded operator HMI	Push buttons and LEDs
MV switch automation	 Embedded algorithms for Control and monitoring, interlock (e.g. earthing switch) Hit-and-run function Sectionalizer automation with overcurrent trip fault memorization
MV Fault detection	 Advanced fault detection (ANSI 50/50N, 51/51N, 67N) Broken conductor (ANSI 47)
MV monitoring	 Currents and voltages measurement Power measurement (IEC 62557-12 up to 40th harmonic) Power quality (IEC 61000-4-30 class S) Availability with VPSI V3 voltage sensors Disturbance recording (COMTRADE) MV fault currents measurement up to 20In
MV sensors	Currents: 1 or 5 A CTs (direct connection to SC150) Voltages: VPIS-VO, VDS, LPVT and VTs
Module configuration	Directly from HU250 webserver
Inter-module connection	Ethernet switch (2 ports)
Operating temperature	-40 to +70°C

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Easergy T300 – a modular architecture, highly specialized

All-in-one module #3: Easergy LV150 (so-called "MV/LV transformer monitoring")

			Display of information by coloured LEDs Module status 		
Easergy LV150: th management and a	e perfect answer to optimize LV network assets (MV/LV transformer, etc.)		Alarm status		3 customisable LEDs
Embedded operator HMI	Push buttons and LEDs				-
LV Fault detection	MV and LV outages Broken conductor (ANSI 47) Neutral cutout, blown fuse				
LV monitoring	 Currents and voltages measurement Power measurement (IEC 62557-12 up to 40th harmonic) Power quality (IEC 61000-4-30 class S) 	adi.u	FPI and voltage indications • Voltage presence status		I
LV sensors	 Currents: 1 or 5 A CTs (direct connection to LV150) Voltages: transformer LV output cables 		Dainy chain LAN Internal Ethernet LAN for Easergy T300 modules Ethernet 10/100 Base	LV160 Schenkler	
Condition monitoring	 Transformer temperature Option: MV & LV cables temperature (ZigBee sensors) 				Current acquisition • 3 phase and neutral acquisition
Module configuration	Directly from HU250 webserver		3 temperature sensors inputs		
Inter-module connection	Ethernet switch (2 ports)	1	 Measurement: -55°C to 250°C (-67°F to 482°F) Resolution: 1°C (1°F) 		Voltage acquisition
Local communications	Ethernet switch (communication to HU250)		 3 analog inputs for connection of 3 wire PT100 temperate sensors 		 3 phase and neutral acquisitor through a voltage adapter
Operating temperature	-40 to +70°C		PT100		Daisy chain power supply

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Easergy T300 – a modular architecture, highly specialized

All-in-one module #4: Easergy PS50 (so-called "power supply")

Easergy PS50: a unique power supply with communication capability for the ultimate MV/LV substation power management

Embedded operator HMI	Push button (reset) and LEDs	
Power supply monitoring	 Battery availability check Periodic battery discharge (typically once a day) Battery status indication (analogue value) Battery capacity indication (analog value) DC outputs consumption (motor supply, external telecom device and Easergy T300 supply) 	
RTU protection	 Neutral cutout Overvoltage (10 kV insulation, 20 kV surge) 	
Battery connection	1 single 12 V battery, typically 24 or 38 Ah	
Battery management	Temperature-compensated chargeCharging current limitation	
Battery protection	 Reverse polarity (wrong battery connection) Deep discharge 	
Condition monitoring	 Battery temperature Battery resistance (analog value provided in Ω) PS50 internal temperature 	
Module configuration	Directly from HU250 webserver	
Inter-module connection	RS-485 switch (2 ports), Modbus RTU protocol	
Operating temperature	-40 to +70°C	



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Easergy T300 and cybersecurity

Embedded cybersecurity features

Easergy T300 includes as a standard <u>and without external devices</u>, the following cybersecurity features according to IEC 62443-4-2

- Software integrity with firmware signature on all modules
- Secure communication between Easergy T300 and associated webserver tool with local or remote connections using HTTPS, SSH and SFTP
- Radius server for User identification and authentication
- IEC 62351-8: user access management (Role Based Access Control)
- IEC 62351-5: Secure Authentication for communication protocols (DNP3 and IEC 104)
- Port hardening management
- IP communication filter
- Secured log storage
- Secure development lifecycle IEC 62443-4-1 (SDL)
- Certified R&D and delivery capabilities (ISO27000)
- Penetration test report
- Creating a cybersecurity policy with CAE Cybersecurity Admin Expert

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Network Management and SCADA

Cyber features

Security policy

(RBAC,...)

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RADIUS serve

Security Console

Easergy T300 main use cases



MV/MV switching substation

- o Incomer and feeder remote control & monitoring
- Protection relay and FPI monitoring
- Substation power supply (protections, PM)
- \circ Sectionalizer automatism of OH feeders
- \circ Auto Transfer Source of incomers, coupling

Ring Main Unit, kiosk, chamber substation

- o Incomer remote control
- o Incomer FPI

MV/LV distribution substation

- o Incomer and feeder remote control & monitoring
- Sectionalizer automatism of OH feeders
 - o Transfo monitoring

Pole mounted controller

- LBS or CAP remote control & monitoring
- Sectionalizer automatism
 - o Transformer monitoring

MV/LV consumer substation connected to two MV feeders

- o Incomer and feeder remote control & monitoring
- Auto Transfer Source of incomers

Underground Self Healing architecture



RM6 Connected Advanced – Overview



RM6, the world's #1 ring main unit

Over 1,800,000 functions installed in secondary distribution networks

RM6 is a fully SF6-insulated switchboard for secondary distribution networks.

Customer Values

- Safety: Visible earthing switch
- Simplicity: MV cable test through earthing system
- Large scope: 5 functions, busbar coupler, 200A CB transformer protection
- Flexibility: 2-3-5 function free combination
- Smart connect: RTU, Self-powered Relays, FPI, Sensors
- Wide application: Utilities, buildings, airports, solar, wind, marine, railway...

RM6 has been widely applied in utilities in over 50 countries, including ERDF(France), SGCC(China), MKS(Russia), SEC(Saudi Arabia), SA PN(Australia)...



12kV-25kA-630A 17.5kV-21kA-630A 24kV-20kA 630A



Q&A

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