DRAGON FAMILY

Company **ROCON** is a leader in Protection Control and Automation technologies that enables utility and industry customers to improve performance and reliability of their network systems. **ROCON** provides modern solutions for **T&D network**, **Industrial and Distribution Generation objects**. **DRAGON** family comprises a wide range of world-class numerical **Protection relays**, **Bay control units** (**BCUs**), **Annunciators and Transformer Monitoring&AVR systems**.

ROCON Multifunction Protection Relays

The great focus today is high-quality cost-effective Intelligent Electronic Devices (IEDs) that help power producers and distributors to get the best from their plants and networks. Our aim is to assist them in achieving results in most efficient way.

The newest member of ROCON IEDs is DRAGON family that combines a lot of "State of the art" decisions in a single IED with flexible construction and potentiality.

- Simple, cost-effective and compact design with fully integration of all necessary protection and control functions;
- Modular construction that allows flexible extension of I/Os;
- EMC, Insulation, Mechanical and Climatic type tests according to the current IEC/EN standards;
- High availability with less maintenance because of the efficient self-monitoring;
- 80 samples per cycle scan-rate;
- Local Human Machine Interface (HMI) through the front panel keypad, LEDs and LCD numerical/graphical display;
- Simple and user friendly PC based Man Machine Interface (MMI) dialog;
- Configuration and settings via portable PC and MS Windows compatible service MMI program (single program for the entire family);
- IEC 61131 flexible programming allowing new protection and control functions to be added without any influence on the physical wiring;
- Variety of time synchronization protocols: SNTP, IEEE1588 (PTPv2), IRIG-B, 1PPS;
- Communication with SAS upper level via different interfaces including Ethernet LAN with electrical / fiber optic connections;
- Communication protocols according to IEC 61850 ed1/ed2, IEC 60870-5-104, IEC 60870-5-103, DNP-3 and Modbus RTU/TCP.
- Redundancy protocols IEC 62439-3 (PRP/HSR), RSTP
- Integration of Power Transformer "condition monitoring" and AVR functionalities including life time supervision;
- Fully application of Digital substation concept including availability of IEC 61850 based Process bus, Merging units and Intelligent I/O boxes

Application

DRAGON family includes a lot of protection functions for different applications:

- Main and/or backup protection for overhead lines, underground cables, transformers, motors and Busbar;
- Suitable for EHV, HV and MV network; Industry, Transport, Distribution Generation (Wind farms, Solar parks etc.).
- Applicable for all types of neutral grounding (isolated, solid, resistance or resonance);

DRAGON family

Protection and control devices

Feeder protection
– Overcurrent protection and control **RFI D**

Line protection
– Distance protection and control **RLI Dd**
– Differential and Distance protection and control **RLI DI**

Transformer protection
– Transformer differential protection and control **RTI D**

Motor protection
– Motor differential protection and control **RMI D**

Busbar protection
– Centralized Busbar protection **RBP Dc**
– Decentralized Busbar protection **RBP Dd**

Bay control unit

– Bay controller with control and monitoring **RTU D**

– Bay controller with control, monitoring and protection (optional) **RTU Dp**

Transformer monitoring and AVR set RTU Dt

RTU Dt set is applicable for medium and large oil immersed power transformers with Onload tap changers (OLTC).

The set provides safe, reliable, easy to use and cost effective power transformer condition monitoring and AVR functionality. The set is equipped with remote modules which are suitable for indoor and outdoor installation near to the Power Transformer.

Voltage regulation functionality provides:

- Automatic and manual OLTC control of a single power transformer
- Automatic and manual OLTC control of parallel operating power transformers
- Three-phase overcurrent and under / over voltage blocking

In case of parallel operating transformers RTU Dt is able to communicate via IEC 61850 GOOSE messages (IEC 61850-81 protocol). Complete exchange of the necessary voltage control data - analogue as well as binary, is executed via GOOSE.

Annunciator RAU D

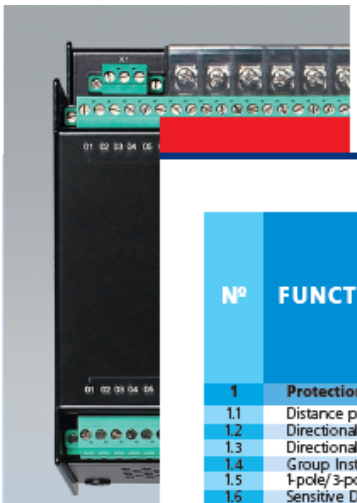
RAU-D is designed to be used for alarm and warning signalization in Conventional and Digital substation automation projects. RAU-D is able to support IEC 61850 and to be part of SAS.

Hardware

Basic (1/2 19") and extended (1/1 19") construction with graphical display - see Fig. 1 and Fig.2. Alpha-numerical display is also available.

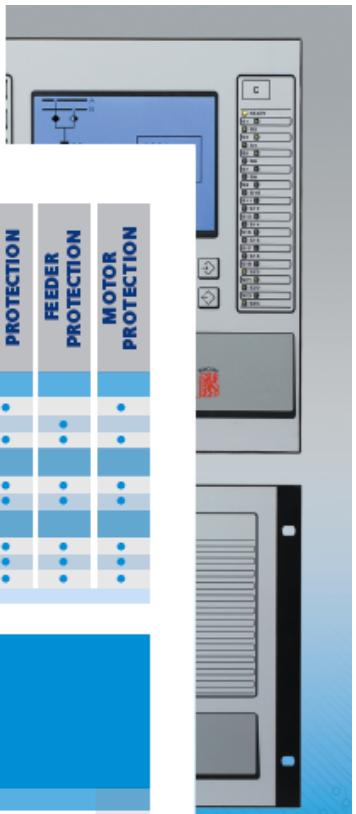
fig.1

fig.2



TECHNICAL DATA

Nº	FUNCTIONS	IEC 61850	ANSI	LINE DIFFERENTIAL & DISTANCE PROTECTION	TRANSFORMER PROTECTION	FEEDER PROTECTION	MOTOR PROTECTION
1	**Protection**						
1.1	Distance protection - 5+1 zones	PDIS	21/21N	•			
1.2	Directional DT/IDMT Overcurrent protection	PTOC	50, 51, 67	•	•	•	•
1.3	Directional DT/IDMT Earth fault Protection	PTOC	50N/51N/67N	•	•	•	•
1.4	Group Instantaneous overcurrent protection	PIOC				•	
1.5	1-pole/3-pole multi-shot Autoreclosing	RREC	79	•		•	
1.6	Sensitive Directional Earth fault protection Wattmetric/Admitance	PSDE	67Ns	•	•	•	•
1.7	Transient/Intermittent earth fault protection	PTEF	67 NIEF	•		•	
1.8	High harmonics content earth fault protection	PTOC	51NHA			•	
1.9	Cold load pick-up		51C	•		•	
1.10	Thermal overload protection	PTTR	49	•	•	•	•
1.11	Phase discontinuity I2/I1 detection	PTOC	46PD	•	•	•	•
1.12	ARC protection	SARC		•	•	•	•
1.13	Negative-sequence Overcurrent protection	PTOC	46	•	•	•	•
1.14	Definite time under current protection	PTUC	37	•		•	•
1.15	Starting time supervision	PMSS	48				•
1.16	Loss of load protection	PTUC	37				•
1.17	Number of starts limitation	PMRI	66				•
1.18	Stalled rotor protection	PRTR	51LR				•
1.19	Cooling system failure protection	CCGR					•
1.20	Directional over/under power protection	PDOP/PDUP	32/37	•	•	•	•
1.21	Motor differential protection	PDIF	87M				•
1.22	Breaker failure protection	RBRF	51BF	•	•	•	•
1.23	Pole discordance protection	QIUB	52PD	•	•	•	•
1.24	Over/under voltage protection	PTOV/PTUV	59/27	•	•	•	•
1.25	Neutral voltage displacement protection	PTOV	59G	•	•	•	•
1.26	Positive sequence over/under voltage protection	PTOV/PTUV	47O+/47U+	•	•	•	•
1.27	Negative sequence overvoltage protection	PTOV	47O	•	•	•	•
1.28	Over/under frequency protection	PTOF/PTUF	81O/81U	•	•	•	•
1.29	Rate of frequency change	PFRC	81R	•		•	•
1.30	Voltage vector shift					•	
1.31	Line differential protection	PDIF	87L	•			
1.32	Transformer differential protection	PDIF	87T		•		
1.33	Restricted earth fault protection	PDIF	87N		•	•	
1.34	Overexcitation protection	PVPH	24		•		
1.35	Loss of excitation (loss of field)	PVPH	40				•
1.36	Low impedance Busbar differential protection	PDIF	87BB				
1.37	User defined logical functions			•	•	•	•
2	**Measurement and calculation**						
2.1	Phase currents true RMS	MMXU		•	•	•	•
2.2	Fundamental (1st harm.) current	MSQI		•	•	•	•
2.3	Residual current 3Io	MMXU		•	•	•	•
2.4	Current in the neutral	MMXU			•		•
2.5	Positive sequence current I1	MSQI		•	•	•	•
2.6	Negative sequence current I2	MSQI		•	•	•	•
2.7	Phase voltage	MMXU		•	•	•	•
2.8	Phase to phase voltage true RMS	MMXU		•	•	•	•
2.9	Fundamental (1st harmonic) voltage	MSQI		•	•	•	•
2.10	Residual voltage $3U_0$	MMXU		•	•	•	•
2.11	Positive sequence voltage U_1	MSQI		•	•	•	•
2.12	Negative sequence voltage U_2	MSQI		•	•	•	•
2.13	Frequency f	MMXU		•	•	•	•
2.14	Rate of frequency df/dt	MMXU		•		•	•
2.15	Active, Reactive and Apparent power	MMXU		•	•	•	•
2.16	Current-voltage angle, cos ϕ	MMXU		•	•	•	•
2.17	Energy measurement	MMTR		•	•	•	•
2.18	2nd to 15th harmonic and THD	MHAI		•	•	•	•
2.19	Temperature	STMP			•		•
3	**Monitoring and control**						
3.1	Fault locator	RFLO	21FL	•		•	
3.2	Trip circuit supervision	SSWI	74 TC	•	•	•	•
3.3	Current circuits symmetry/sum monitoring	TCTR	TCM	•	•	•	•
3.4	Voltage circuits /fuse failure monitoring	TVTR	60	•	•	•	•
3.5	Primary equipment local remote control	CSWI		•	•	•	•
3.6	Circuit breaker condition monitoring	SCBR	CBCM	•	•	•	•
3.7	Lockout logic /Latching Acknowledgement		86	•	•	•	•
3.8	Clockwise and anticlockwise phase rotation monitoring			•	•	•	•
3.9	Min/Max and average values monitoring – I, U, P, Q, S, cos ϕ	MMXU		•	•	•	•
3.10	Upper/lower limits monitoring - I, U, P, Q, S, cos ϕ			•	•	•	•

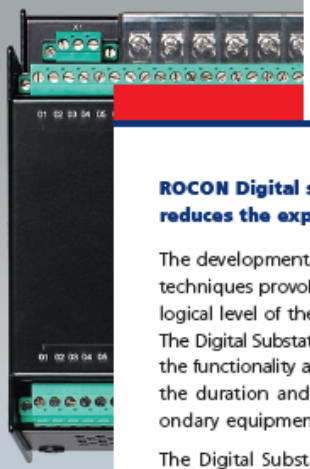


№	FUNCTIONS	IEC 61850	ANSI	LINE DIFFERENTIAL & DISTANCE PROTECTION	TRANSFORMER PROTECTION	FEEDER PROTECTION	MOTOR PROTECTION
3	**Monitoring and control**						
3.11	Temperature monitoring	TTMP			•		•
3.12	Synchronism check	RSYN	25	•		•	
3.13	Signalization			•	•	•	•
4	**Recorders**						
4.1	Event/fault recorder			•	•	•	•
4.2	Disturbance recorder	RADR		•	•	•	•
5	**Additional functions**						
5.1	PC-based Man Machine interface service program (MMI)			•	•	•	•
5.2	Time Synchronisation – data communication channel	LTIM		•	•	•	•
5.3	Self supervision with internal event list			•	•	•	•

№	TECHNICAL DATA
6	**Hardware***
6.1	Power supply 110 - 220VDC/VAC, 24 – 72VDC/VAC, 220VDC/VAC (-20%+20%)
6.2	Phase current 1A/5A, 0.1 – 40 In
6.3	Phase current 1A/5A, 0.01 – 1.6 In
6.4	Residual Current – sensitive 0.2 A, 0. 1 – 40 Ion
6.5	Voltage inputs 100/110V (phase-phase/$3U_0$) 0.005 – 2.00 Un
6.6	Binary inputs 220VDC, 110VDC, 48VDC, 24VDC, 220VAC, 110VAC (±20%)
6.7	Binary outputs, Switching voltage 250VDC/VAC
6.8	Real time clock
6.9	Keypad and display – graphical 640x480 dot matrix or 4 x 20 LCD
6.10	LED indication – 24 LEDs
6.11	Dimensions 1/2 x19" (WxHxD) 225/266/133 – max weight 3.4 kg
6.12	Dimensions 1x19" (WxHxD) 465/266/133 – max weight 5.2 kg
7	**Communication interfaces ****
7.1	Electrical Ethernet 100BASE-TX - RJ45 connector
7.2	Optical Ethernet 100BASE-FX – LC connector, ST connector
7.3	Electrical RS485
7.4	Real time synchronization IRIG-B – coaxial cable BNC connector or FO MM ST connector
7.5	IEEE C37.94/G704, ST or LC connectors for Line differential protection
7.6	RJ 45 front panel interface for communication with PC loaded MMI program
7.7	PPS input – coaxial cable BNC connector or FO MM ST 820nm
8	**Communication protocols ****
8.1	IEC 61850 ed1/ed2
8.2	IEC 61850-9-2LE
8.3	IEC 60870-5-103
8.4	IEC 60870-5-104
8.5	Modbus RTU/TCP, DNP 3.0 RTU/TCP
8.6	SNTP/PTP/IRIG-B/PPS
8.7	FTP
8.8	Web-server HTTP

* For the number of current and voltage inputs and binary inputs and outputs - see the respective Ordering vector in www.roconbg.com.

** For the different sets of communication interfaces and protocols - see the respective Ordering vector in www.roconbg.com.



ROCON Digital substation concept mandatory reduces the expenses

The development from the conventional to the digital techniques provokes a great progress into the technological level of the T&D substations and Power plants. The Digital Substation Concept (DSC) considerably raises the functionality and operational reliability, and reduces the duration and expenses for the power object secondary equipment installation and maintenance.

The Digital Substation is a term applied to electrical substations where operation is managed between distributed intelligent electronic devices (IEDs) interconnected by communication network.

One of the most important features of the DSC is the level of communication redundancy. Two types of DSC redundancy are simultaneously available – at a communication level and at a physical level.

At a communication level IEC 61850 edition 2 allows two redundancy protocols with zero recovery time to be defined in the IEC standard 62439-3 and to be applied for the Station and the Process bus - Parallel Redundancy protocol (PRP) and High Availability Seamless Redundancy protocol (HSR).

At a physical level, the proposed new approach is to use data flows for the current and voltage sampled values (SV) from different physical sources – separate Merging Units (MU) connected to different CT cores and VTs. This means that each Protection device (PD) of the definite bay is able to receive IEC61850-9.2LE data for the currents and voltages from more than one physical source. Moreover each IED is equipped internally with Ethernet switch that makes unnecessary the application of the external one.

The upper mentioned approach of the DSC provides high level reliability and 100% operability in case of single element failure (device or connection). Moreover in case of "turnkey" project, the overall expenses for the digital substation should be significantly less than the conventional.

The high level of the DSC reliability obtained via the upper mentioned redundancy allows the implementation of combine main and back-up protection functionalities in a single device and installing of only two separate devices - Main and Backup. Each of the devices can be physically reserved.

A new vision to the Digital Substation Concept allows company ROCON first in the world to offer IED with embedded RedBox providing gateway between PRP and HSR topology.

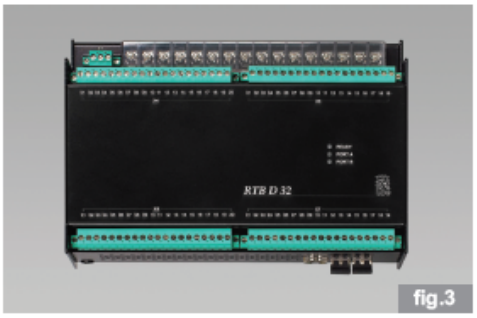


fig.3

Digital substation components

Combined MU with I/O box

The following typical HW features are available – see Fig.3:

- Two Ethernet ports 100 Mb FO supporting IEC62439-3 PRP/HSR
- One Ethernet port 100 Mb RJ45 for communication with PC based MMI program
- Time synchronization via PTPv2 or PPS
- Up to 4 current and 4 voltage channels
- Up to 32 binary inputs
- Up to 18 binary outputs

Protection device with embedded RedBox

The following typical HW features are available – see Fig.4 and Fig. 5:

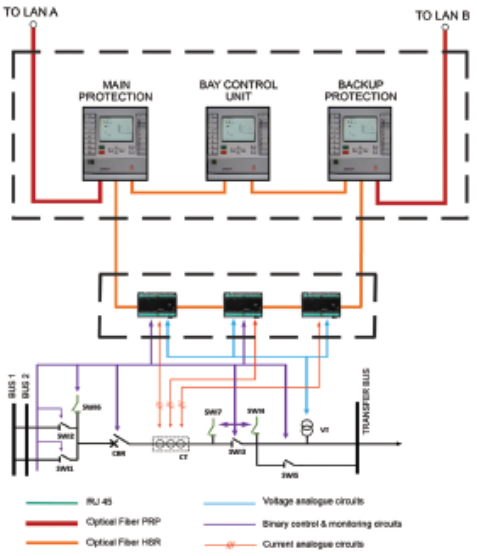


fig.6 IED level

fig.4

- Process Bus - 100 Mb/1Gb FO

– Two Ethernet ports supporting IEC62439-3, PRP/HSR

– One Ethernet port **Interlink** in case of **RedBox** functionality

– Each analog value can be received by one or two different MUs (main + backup)


fig.5

– Up to 8 SV streams operating simultaneously

– Each stream is reserved via PRP/HSR

- Two ports C37.94 or USART in case of Teleprotection
- Station Bus 100 Mb UTP or FO

– Two Ethernet ports supporting RSTP, IEC62439-3 PRP/HSR

– One Ethernet port 100 Mb RJ45 for communication with the PC based MMI program

- Binary inputs/outputs (optional) for position monitoring of external control switches and for activation of visual and audible alarms in the object

Communication architecture overview

IED level

- Each Bay represents part of Process Bus as HSR ring with embedded RedBox in the two PDs connected to Lan-A and Lan B – see Fig. 6.
- PRP is also available

Bay level

- Process bus - PRP topology, Protection and Control devices (PDs & BCUs) exchanging information with MUs & I/Os via IEC61850-9.2LE / IEC61850-GOOSE (process bus) and with Station Level (Station bus) – see Fig 7.

Station level

- Station bus – PRP topology, via IEC61850-MMS and GOOSE between IED and SAS Workstations – see Fig.8.

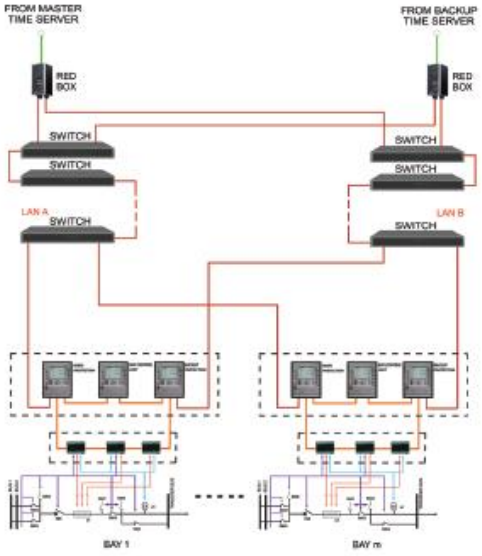


fig.7 Bay level

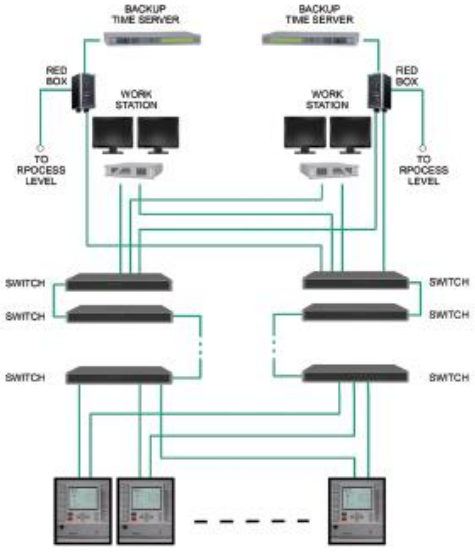


fig.8 Station level