# **RipEX – Radio modems**



RipEX

## **RipEX2**

- 1.7 Mbps / 300 kHz / 256QAM
- 4× ETH, 1× SFP, 1× COM, 1× USB,
- RipEX compatible
- All RipEX features plus:
  - 6.25 300 kHz channel size
  - ACM, Adaptive FEC
  - RADIUS
  - HW tamper proof
  - Expansion ready mPCle
  - Full-duplex

**RipEX** is a **radio modem platform** renowned for overall data throughput in any real-time environment. RipEX radio modems are native IP devices, Software Defined with Linux OS that have been designed with attention to detail, performance and quality. All relevant state-of-the-art concepts have been carefully implemented.

**RipEX, 1st generation**, is a best-in-class **compact radio modem** proven within the market since 2011 and used in thousands of installations.

**RipEX2, 2nd generation**, was introduced in 2018. This **more powerful standard radio modem** provides significant improvements, especially in terms of data speed, security and number of interfaces.

**RipEX-HS**, a **fully redundant** 19' hot-standby **master station** with two radios and two power supplies and available for both, RipEX and RipEX2, is the final member of the RipEX family.

All RipEX devices provide a 24/7 reliable service for mission-critical applications like SCADA & Telemetry for Electric and Water Utilities, Oil & Gas distribution and many other applications.



## RipEX

- 166 kbps / 50 kHz / 16DEQAM
- 1× ETH, 2× COM, 1× USB
- Solar ready
- 0.1 10 watts
- - 40 to +70 °C
- WiFi management
- Customized protocols
- Backup routes
- Fast remote access

, RVCOW

IPsec

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### **General overview**



	RipEX	RipEX2
Max. Gross data rate	166 kbps	1.7 Mbps
Gross data rate / 25 kHz	83 kbps	167 kbps
Interfaces	1x ETH, 2x COM, 1x USB	4x ETH, 1x SFP, 1x COM, 1x USB
lPsec	Yes	Yes
RADIUS	No	Yes
Modulations	CPFSK - 16DEQAM	CPFSK - 256QAM
Channel size	6.25 - 50 kHz	6.25 - 300 kHz
Stream mode	Yes	No
Full duplex	No	Yes

## Native IP device

**Bridge mode** – uses a **Transparent protocol** on the Radio channel, i.e. packets received on any interface are broadcast to the respective interfaces on all units in the network. Packets received on COM are broadcast to all COM's at all remote sites, allowing you to connect more RTU's to each remote unit.

**Router mode** – RipEX works as a standard IP Router with all interfaces (Radio and 1-5 Ethernets) and all COM ports without any compromise. Each of the five Ethernet ports on RipEX2 can be configured either as a switch or a router. There is an option of two protocols on the Radio channel: **Flexible** – unlimited anti-collision meshing without base stations or **Base driven** where all packet transmissions are managed by the local base station.

- Switch switched or routed Ethernet ports (RipEX2)
- Terminal server Serial-Ethernet converters, 5 independent sessions
- TCP proxy converts TCP to UDP, eliminates transfer of TCP overhead
- ARP proxy any IP address simulating (for RTU's without routing capabilities within the same subnet)
- Subnets unlimited number of virtual Ethernet interfaces (IP aliases)
- Shaping traffic management between Ethernet and Radio interface
- IPsec, GRE, Firewall, DHCP, VLAN, NAPT, QoS...

## Data speed & Throughput

- Possible Network throughput is achieved by
  - Min. Rx/Tx switching and synchronization times
  - Optimum Radio protocol for the application
  - Optimization
    - payload data and headers compression
    - packet flow optimization on Radio channel
- Different data speeds for individual links
- Auto-speed receiver is automatically adjusted to the data rate of the incoming frame
- ACM and Adaptive FEC (RipEX2)
- Stream mode transmitting starts immediately on the Radio channel, without waiting for the end of the received frame on COM => zero latency

## Security & Integrity

- Licensed radio bands
- FEC, interleaving, proprietary data compression
- CRC32 data integrity control on Radio channel
- Proprietary protocol on Radio channel
- Backup routes
- Digitally signed FW (RipEX2)
- Management https, ssh,
- Role-based access control
- AES256 encryption
- IPsec encrypted end-to-end tunnel
- Firewall Layer 2 MAC, Layer 3 IP, Layer 4 TCP/UDP

Channel size	Gross data rate		Possible Network throughput	
	RipEX	RipEX2	RipEX	RipEX2
6.25 kHz	21 kbps	42 kbps	> 25 kbps	> 50 kbps
12.5 kHz	42 kbps	83 kbps	> 50 kbps	> 100 kbps
25 kHz	83 kbps	167 kbps	> 100 kbps	> 200 kbps
50 kHz	167 kbps	333 kbps	> 200 kbps	> 400 kbps
100 kHz	-	555 kbps	-	> 700 kbps
150 kHz	-	925 kbps	-	> 1.1 Mbps
200 kHz	-	1.1 Mbps	-	> 1.4 Mbps
250 kHz	-	1.3 Mbps	-	> 1.7 Mbps
300 kHz	-	1.7 Mbps	-	> 2.1 Mbps

## Radio protocols

- Transparent / Bridge
- Repeater(s) supported
- No collision avoidance capability
- Flexible / Router
  - Unlimited Tree topology
  - Multi-polling and report-by-exception concurrently
  - Nomadic mode automatic routing
- Base driven / Router
  - Star topology, repeaters supported
     Optimized for TCP/IP (IEC104)
  - Optimized for TCP/IP (IEC104)
  - Fair distribution of channel capacity among all remotes

## Long range

- One radio hop over 50 km
- Line of sight not required
- Carrier output power 0.1 10W
- Exceptional data sensitivity
- Any unit can work simultaneously as a repeater
- Unlimited number of repeaters on the way
  Any IP network can interconnect RipEX units

## Easy to configure and maintain

- Web interface or CLI via SSH
- Wizards fast and simple setup
- Non-intrusive management via USB using either ETH/USB adapter or WiFi/USB adapter with DHCP
- Fast remote access only the effective data are transferred over the air, html page downloaded from the local unit
- External flash disc automatic configuration, SW keys and FW upgrade

## Reliability

- Units tested in a climatic chamber and in real traffic
- Heavy-duty industrial components
- Industrial rugged die-cast aluminium case
- IP40 or IP51
  -40 to +70 °C
- -40 (0 +70 (
- 3 year warranty

## **Diagnostics & Network Management**

- Statistic logs for interfaces and communication links
- Historical and on-line values displayed in graphs
- 20 periods (e.g. days) of history
- Watched values (RSS, Ucc, Temp, PWR, etc.) also from neighbouring units
- SNMP v3 including Traps and Informs
- HW Alarm input, HW Alarm output
- Monitoring Real time/Save-to-file analysis of communication over any of the interfaces

## Scalability

#### SW feature keys

- Advance features only when and where needed
- Router, Speed, COM2 (SFP), 10W, Backup routes, (Duplex), Master
- Free Master-key trial for 30 days in every RipEX

#### **HW models**

- The same HW for Base, Repeater or Remote stations
- Internal GPS module NTP synchronization - mPCle slot for expansion boards (RipEX2) GPS, 4G/3G/2G, 2x RS232...

## SCADA protocols

- Modbus, IEC101, DNP3, PR2000, Comli, DF1, Profibus, Async Link, C24, Cactus, RP570, Slip, Siemens 3964(R), IEC104, DNP3/TCP, Modbus TCP and others
- SCADA serial protocol addresses are mapped to RipEX addresses
- TCP(UDP) protocols can be handled transparently or using Terminal server or TCP proxy
- Embedded Modbus RTU / Modbus TCP converter
- Each packet is transferred as an acknowledged unicast

#### **Backup routes**

- Tested alternative paths between two RipEX units
- Automatic switch-over to backup gateway, if primary route fails due to packet loss or weak RSS
- Backup gateway can be behind Radio or Eth interfaces
- Unlimited number of Alternative paths
- Alternative path priority assignment

## Energy savings

- Solar ready
- Sleep mode wake up triggered by Sleep digital input or by internal RTC (RipEX2)
- Save mode wake up by a received packet from Radio channel or by Sleep digital input

## **RipEX-HS**

- Fully redundant hot-standby master station
- Fully monitored
- Automatic switchover capability on detection of failure
- Auto toggle mode periodically switches units regardless of failure
- Two booted-up standard RipEX units inside
- Switch-over time < 2 s
- Two independent power supplies
- One or two antenna connectors
- Hot swappabble
- 19" rack 3U



# Technical parameters

Preserve land:155-55 (30-26 (200-00) (30-30) (30-30) (30-30) (30-30)(113-171, 20-31) (201 - 201 -	Radio parameters	RipEX	RipEX2			
Convergency0.501/251/2019/ktConvergencyConv	•	135–154; 154–174; 215-240; 300–320; 320–340; 340–360; 368–400;				
Finances41.0 am41.0 am	Channel spacing		6.25 / 12.5 / 25 / 50 / 100 / 150 / 200 / 250 / 300 kHz			
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Bit Outgoine         0.15 00 Windgramme	FEC (Forward Error Correction)	On/Off, 3/4	On/Off, 2/3, 3/4, 5/6			
Bay SpainContinueRis Tartino		· · · ·	up to 1.7 Mbps			
Rein Trained <indian< td="">         - and dien / 2000AU / 38 kbr           Sowkey         - and dien / 2000AU / 38 kbr         - and dien / 2000AU / 38 kbr           Perinser         900 SUNCE (nagline GMD         - and dien / 2000AU / 38 kbr           Prinser poored         900 VIDC (nagdine GMD         900 VIDC (nagdine GMD           Res         500 VIDC (nagdine GMD         900 VIDC (nagdine GMD           See mode         300 VIDC (nagdine GMD         900 VIDC (nagdine GMD           See mode         200 VIDC (nagdine GMD         900 VIDC (nagdine GMD           See mode         200 VIDC (nagdine GMD         900 VIDC (nagdine GMD           See mode         200 VIDC (nagdine GMD         900 VIDC (nagdine GMD           See mode         100 VIDC (nagdine GMD         900 VIDC (nagdine GMD           See mode         100 VIDC (nagdine GMD         900 VIDC (nagdine GMD           See mode         100 VIDC (nagdine GMD         900 VIDC (nagdine GMD           See mode         100 VIDC (nagdine GMD         900 VIDC (nagdine GMD           See mode         100 VIDC (nagdine GMD         900 VIDC (nagdine GMD           See mode         100 VIDC (nagdine GMD         900 VIDC (nagdine GMD           See mode         100 VIDC (nagdine GMD         900 VIDC (nagdine GMD           See mode         100 VIDC (n</indian<>	· ·					
Selection	• •					
Promy pase:         Dim 30 VC, mignine GMD           Rc         GWT 33 V A WORLY (Reduce tr 2 V)         S.W           Tr.(Generation IF Fourmal and modulation)         51-40 W         S.S. SW           Stare mode         2 W         SW           Stare mode         2 W         SW           Stare mode         1 W W         SW           Stare mode         1 W W         SW           Stare mode         1 W W SW         SW           Stare mode         1 W W SW         SW           Stare mode         2 W SW         SW W SW           Stare mode         1 W W SW         SW W SW           Stare mode         1 W W SW W SW W SW W SW W SW         SW W SW		- 99 dBm / 16DEQAM / 25 kHz - 93 dBm / 256QAM / 25 kHz				
Promy pase:         Dim 30 VC, mignine GMD           Rc         GWT 33 V A WORLY (Reduce tr 2 V)         S.W           Tr.(Generation IF Fourmal and modulation)         51-40 W         S.S. SW           Stare mode         2 W         SW           Stare mode         2 W         SW           Stare mode         1 W W         SW           Stare mode         1 W W         SW           Stare mode         1 W W SW         SW           Stare mode         1 W W SW         SW           Stare mode         2 W SW         SW W SW           Stare mode         1 W W SW         SW W SW           Stare mode         1 W W SW W SW W SW W SW W SW         SW W SW	Electrical					
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Same mode         2W           Bineration         5W           Interface         V10100 Base.7 Auto. MUMD/K PL46         4x 1010000 Base.7 Auto. MUMD/K PL46           SPP         No         101000 Base.7 Auto. MUMD/K PL46         4x 1010000 Base.7 Auto. MUMD/K PL46           SPP         No         1020076000 Base.7 Auto. MUMD/K PL46         10000 Base.7 Auto. MUMD/K PL46           COM 1         Rescar 10000 Base.7 Auto. MUMD/K PL46         Must.20000 Base.7 Auto. MUMD/K PL46           COM 2         OWD 11/1000 Base.7 Auto. MUMD/K PL46         Must.20000 Base.7 Auto. MUMD/K PL46           COM 2         OWD 11/1000 Base.7 Auto. MUMD/K PL46         Must.20000 Base.7 Auto. MUMD/K PL46           COM 2         OWD 12/200 base.7 Auto. MUMD/K PL46         Must.20000 Base.7 Auto. MUMD/K PL46           COM 2         COM 2000 Base.7 Auto. MUMD/K PL46         Must.2000 Base.7 Auto. MUMD/K PL46           Autora         Autora         Autora         Autora         Autora           COM 2000 Base.7 Auto. MUMD/K PL46         Must.2000 Base.7 Auto. MUMD/K PL46         Must.2000 Base.7 Auto. MUMD/K PL46           EDD and         Desc. ETH.COMM.COMZ, Rx, Tx, Status.         Status.XX IX IX COM         Must.2000 Base.7 Auto. MUTO.2000 Base.7 A						
InterfaceImage: second sec	•					
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COM 1         R5222 / 108F 300 - 11.500 bps         R5222 R8345 SV configurater / DB9F 200 - 1.600 -	Ethernet	1x 10/100 Base-T Auto MDI/MDIX / RJ45	4x 10/100/1000 Base-T Auto MDI/MDIX / RJ45			
CDM1300 hps 1 15 200 kps300 kps 1 15 200 kpsCOM 2SSR 2558 205 Virol (Algebee 2001)SSR 201 Vield ACSM 2SSR 211 Vield ASSR 201 Vield AAntonaLTNC fernals / 20 othing (Kr/L) or 20 TVC fernals / 20 Othing / 20 Othing (Kr/L) or 20 TVC fernals / 20 Othing /	SFP					
COM 2         90-109F         ARS223           UBB         VERSIZ         VERSIZ           UBB         VERSIZ         VERSIZ           Common         VERSIZ         VERSIZ           VERSIZ         VER	COM 1					
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Adama         1x PNC Formal (FWT) of 2x CPC Ret-73 - different HW model         2x NC figuralies '1x RV and '50 chms sw configuralies '1x RV for '1x Rx + 1x Ts sw configuralies '1x RV for '1x Rx + 1x	COM 2					
Andam         2 http://actional/actiona/actional/actional/actional/act	USB		USB 3.0 / Host A			
Interfection         Txt HW alarm input, tx HW alarm output, tx Sleep input         Ixt HW alarm mout, tx Sleep input           Indication LEDs	Antenna					
Indication LEPo         Indication LEPo           LED panel         Power, ETH, COMT, COMZ, Pa, Ta, Status         SY, AUX, RX, TX, COM           ETH         No         At RAIS-2 LED, Ix SFP - Ix LED           Environmental         P40, P51         P42, P52           Environmental         P40, P51         P42, P52           Environmental         P40, P51         P42, P52           Deparing Interpretation         - 400 e-70 (- 40 to +100 f)         Contemp (- 100 (-	Inputs/Outputs		1x HW alarm input, 1x HW alarm output, 1x Sleep input,			
LED panel         Power, ETH, COMI, COME, Rx, Tx, Status         STR, AUX, RX, TX, COM           ETH         No         4K R.45 - 2X LED, Tx SEP - 1x LED           Environmental         PC:06 (trigents Fratection)         P40, P51         P42, P52           MTGF (Max Time Setwen Falue)         > 900.000 hours (> 100 years)         >           Opending humperature         - 400 to 70° (- 400 to 158 °F)         >           Opending humperature         - 400 to 70° (- 400 to 158 °F)         >           Casing         Rogged discast aluminum         OH x 150 W x 12D D xm (2.4 x 7.2 x 4.9 m)           Mechanical         S0 H x 150 W x 113 D nm (1.3 7.5 5 x 4.65 m)         0H x 150 W x 12D D xm (2.4 x 7.2 x 4.9 m)           Weight         1.1 kg (2.4 hos)         1.5 kg (3.4 hos)         0H x 150 W x 12D D xm (2.4 x 7.2 x 4.9 m)           Weight         1.1 kg (2.4 hos)         1.5 kg (3.4 hos)         0H x 150 W x 12D D xm (2.4 x 7.2 x 4.9 m)           Weight         1.1 kg (2.4 hos)         1.5 kg (3.4 hos)         0H x 150 W x 12D D xm (2.4 x 7.2 x 4.9 m)           Weight         1.1 kg (2.4 hos)         1.5 kg (3.4 hos)         0H x 150 W x 12D D xm (2.4 x 7.2 x 4.9 m)           Weight         1.1 kg (2.4 hos)         1.5 kg (3.4 hos)         0H x 150 W x 12D D xm (2.4 x 7.2 x 4.9 m)           Weight         1.1 kg (2.4 hos)         1.5 kg (3.4 hos)		······································	plus 2x DI, 2x DO, 1x difDI (when mPCle-COMS is not used)			
ETHNo4F.R.45 - 2x.LED, 'n SFP - 1x LEDEnvironmentalP40, P51P42, P52PCode (rignes Frotection)P40, P51P42, P52PCode (rignes Frotection)> 500.000 fors (> 100 years)						
Environmental         PP Code (hypense Fredection)         IP 40, IP51         IP 42, IP52           P Code (hypense Fredection)         > 900.000 hoors (> 100 years)						
PC ddd (rsynass Protaction)         P40. P51         P42, P52           MTBF (Masn Time Bakeen Palure)         > 900000 hours (> (00 years)            Operating tomanity         = 40 to +70 ° (< 40 to +150 °F)	ETH	No	4x RJ45 - 2x LED, 1x SFP - 1x LED			
MIDEF (Nean Time Between Pialure)         > 900.000 hours (> 100 years)           Operating Impendive         > 400 to > 70° (< 100 to +136 °F)						
Operating temperature         -400 + 70° C(-400 + 158 °f)           Operating humidity         5 to 59% non-condensing           Mechanica			IP42, IP52			
Operating humidly              56 95% non-condensing            Mechanical               Casing						
Casing         Rugged die-dast aluminum           Dimensions         50 Hxt 150 W xt 150 D mm (1.37 x 5 y x 4.6 in)         60 Hxt 165 W xt 125 D xm (2.34 x 7.2 x 4.9 in)           Weight         1.1 kg (2.4 lab)         1.56 kg (3.4 lab)         1.56 kg (3.4 lab)           Mouring         Divratily Laberatedet, 19" Rack shelf         Image (1.56 kg (3.4 lab))         1.56 kg (3.4 lab)           SW         Bridge / Router (+Switch)         Bridge / Router (+Switch)         Image (1.50 kg (1.	· • ·	,,, _,				
Casing         Rugged die-dast aluminum           Dimensions         50 Hxt 150 W xt 150 D mm (1.37 x 5 y x 4.6 in)         60 Hxt 165 W xt 125 D xm (2.34 x 7.2 x 4.9 in)           Weight         1.1 kg (2.4 lab)         1.56 kg (3.4 lab)         1.56 kg (3.4 lab)           Mouring         Divratily Laberatedet, 19" Rack shelf         Image (1.56 kg (3.4 lab))         1.56 kg (3.4 lab)           SW         Bridge / Router (+Switch)         Bridge / Router (+Switch)         Image (1.50 kg (1.	Mechanical					
Weight1.1 kg (2.4 kbs)1.55 kg (3.4 kbs)MountingDN val., L-bracket, Fla-bracket, 19" Rack shelfSWOperating modesBridge / RouterUser protocols on COMModous, EC 101, DNP3, PR2000, Comil, DF1, Profibus, Async. Link, C24, Cactus, RP570, Sip, Siemens 3964(R)User protocols on ChemetModous TCP, EC 104, DNP3 CP2, Comil TCPSerial to P convertorsModous TCP, EC 104, DNP3 TCP, Terminal serverRadio protocolsTransparen, Flexible, Base drivenMainser applicationsYesReport by exceptionYesReport by exceptionStore-and-forward; Every unit: Unlimited numberOptimizationPayload data and Ethernet / P / TCP / UDP header compression, Packet flow on Radio channel optimizationNTP (Network Time Protocol)Cilent, Server (synchronized from internal GPS)SecurityKesRecrets accounts2 levels (Guest, Admin)Access accounts2 levels (Guest, Admin)LeryptionAss256PrecYesVaNYes, EEE 802.10VaNNoNoYesDisported strainedYes (Duest, Caputa - P, Layer 4 - TCP/UDPHW tanger proofNoNoYesDisported strained strained strained strained strained strainesPr		Rugged die-cast aluminium				
Mounting         DIN rail, L-bracket, Fist-bracket, 19° Rack shelf           SW           SW           Operating modes         Bridge / Router         Bridge / Router (+Switch)           User protocols on COM         Modbus, IEC 101, DPA3, PR2000, Com, DF1, Proflux, Async Link, C24, Caclus, RP570, Silp, Siemens 3984(R)           Baser protocols on CDM         Modbus TCP, DIP3 / DNP3 TCP. Com IT CP           Serial to P convertors         Modbus TCP, DIP3 / DNP3 TCP. Terminal server           Rating protocols         Transparent, Flexible, Base driven           Multi master applications         Yes           Report by exception         Yes           Collision Avoidance Capability         Yes           Report by exception         Yes           Collision Avoidance Capability         Yes           Report by exception         Yes	Dimensions	50 H x 150 W x 118 D mm (1.97 x 5.9 x 4.65 in)	60 H x 185 W x 125 D x mm (2.34 x 7.2 x 4.9 in)			
SW         Deretaing modes         Bridge / Router         Bridge / Router (+Switch)           User protocols on COM         Modbus, EC (101, DNP3, PR2000, Comit, DF1, Profibus, Async Link, C24, Cactus, RP570, Slip, Siemens 3964(R)           User protocols on Ethernet         Modbus TCP, EC 104, DNP3 TCP, Comit TCP         Serial to P convertors         Modbus RTU / Modbus TCP, DNP3 TCP, Terminal server           Radio protocols         Transparent, Flexible, Base driven         Transparent         Remote Communication           Wit master applications         Yes         Report by exception         Yes           Collision Avoidance Capability         Yes         Remote to Remote communication         Yes           Report by exception         Yes         Store-and-forward; Every unit; Unlimited number         Repeaters           Collision Avoidance Capability         Yes         Store-and-forward; Every unit; Unlimited number         Repeaters           Store-and-forward; Every unit; Unlimited number         Collexity         Yes         Reseaters           Store-and-forward; Every unit; Unlimited number         Collexity         Repeaters         Reseaters           Store-and-forward; Every unit; Unlimited form internal GPS)         Store-and-forward; Every unit; Unlimited form internal GPS)         Recentation         Reseaters           Store (Suppting)         Alevels (Guest, Admin) x unlimited users         <			1.55 kg (3.4 lbs)			
Operating modes         Bridge / Router         Bridge / Router (+Switch)           User protocols on COM         Modbus. IEC101, DNP3, PR2000, Conli, DF1, Profibus, Async Link, C24, Cactus. RP570, Silp, Siemens 3964(R)           User protocols on Elhernet         Modbus RTU / Modbus TCP., ED19, DNP3 TCP., Terminal server           Radio protocols         Transparent, Flexible, Base driven           Multi master applications         Yes           Collsion Avidance Capability         Yes           Collsion Avidance Capability         Yes           Collsion Avidance Capability         Yes           Collsion Avidance Capability         Yes           Report by exception         Yes           Collsion Avidance Capability         Yes           Repaters         Store-and-forward; Every unit; Unimited number           Optimization         Paydad data and Elhernet / / P / TCP / UDP header compression, Packet flow on Radio channel optimization           NTP (Network Time Protocol)         Client, Server (synchronized from internal GPS)           Saccurity         Access acco	Mounting	DIN rail, L-bracket, Flat-bracket, 19" Rack shelf	DIN rail, L-bracket, Flat-bracket, 19" Rack shelf			
Liser protocols on COM         Modus, EC 101, DNP3, PR2000, Comil, DF1, Profibus, Async Link, C24, Cactus, RP570, Silp, Siemens 3984(R)           Liser protocols on Ethernet         Modus RT0 / ReC104, DNP3 TCP, Comil TCP           Serial to P convertors         Modus RT0 / Modus RT0 / DNP3 TCP, Terminal server           Radio protocols         Transparent, Flexible, Base driven           Milli master applications         Yes           Report by exception         Yes           Remote to Remote communication         Yes           Remote communication         Yes           Remote to Remote communication         Yes           Report by exception         Store-end-forward, Every unit, Unlimited number           Optimization         Payload data and Ehernet / P / TCP / UDP header compression, Packet flow on Radio channel optimization           NPT (Network Time Protocol)         Client. Server (synchronized from intenal GPS)           Security         Security           Management         AES256           Flerwall         Security           VAN         Yes, IEEE 802.10           RADUS         No           Parele to Remark to Management         Layer 2 - MAC, Layer 3 - P, Layer 4 - TCP/UDP           HW amper proof         No         Yes           Diagneetics and Management         Layer 2 - MAC, Layer 3 - P, Layer 4 -			1			
User protocols on Ethernet     Modbus TCP, IEC104, DNP3 TCP, Comil TCP       Serial of P convertors     Mudbus RTU / Modbus TCP, DNP3 / DNP3 / DNP3 TCP, Terminal server       Radio protocols     Transparent, Floxible, Base driven       Mult master applications     Yes       Report by exception     Yes       Collsion Avoidance Capability     Yes       Remote to Remote communication     Yes       Optimization     Payload data and Ethernet / IP / TCP / UDP header compression, Packet flow on Radio channel optimization       NTP (Network Time Protocol)     Clent, Server (synchronized from internal GPS)       Security     Kes       Management     HTTP, HTTPS (own certificate), SSH       Access accounts     2 levels (Guest, Admin)     4 levels (Guest, Tech, Admin) x unlimited users       Encryption     AES266     Pase       Pasec     Yes     Yes       VAN     Yes, IEE 802.1Q     Yes       Firewall     Layer 2 - MAC, Layer 3 - P, Layer 4 - TCP/UDP     Yes       HW tamper proof     No     Yes       Diagnostics and Management     Yes (ping with RSS, Data Quality, Homogenity)       Guidin It testing     Yes (ping with RSS, Data Quality, Homogenity)       Watched values     Pavices - Ccr, Temp, PVR, YSWR, HM Alam Input Radio Channel       Graphs     For Watched values and Stalistics       Stalistics <t< td=""><td></td><td></td><td></td></t<>						
Serial to P convertors       Modbus RTU / Modbus TCP, DNP3 / DNP3 TCP, Terminal server         Radio protocols       Transparent, Flexible, Base driven         Multi master applications       Yes         Report by exception       Yes         Collision Avoidance Capability       Yes         Remote to Remote communication       Yes         Report by exception       Store-and-forward; Every unit; Unlimited number         Report breact communication       Yes         Report breact communication       Cellisch Server (synchronized from internal GPS)         Security       Cellent, Server (synchronized from internal GPS)         Security       AES256         Encryption       AES256         Presc       Yes         VAN       Yes, IEEE 802.1Q         RADUS       No         Frewall       Layer 2 - MAC, Layer 3 - P, Layer 4 - TCP/UDP         Wut apper prof       No       Yes         Dignostics and Management       Yes (prign with RSS, Data Quality, Homogenity)         Watched values       Yes (prign with RSS, Data Quality, Homogenity) <td>· ·</td> <td>· · · · · · · · · · · · · · · · · · ·</td> <td>C24, Cactus, RP570, Slip, Slemens 3964(R)</td>	· ·	· · · · · · · · · · · · · · · · · · ·	C24, Cactus, RP570, Slip, Slemens 3964(R)			
Radio protocols       Transparent, Flexible, Base driven         Mult master applications       Yes         Collision Avoidance Capability       Yes         Remote to Remote communication       Yes         Renote to Remote communication       Yes         Optimization       Payload data and Ethernet / IP / TCP / UDP header compression, Packet flow on Radio channel optimization         NTP (Network Time Protocol)       Client, Server (synchronized from internal GPS)         Security	•					
Report by exception         Yes           Collision Avoidance Capability         Yes           Remote to Rmote communication         Yes           Repeaters         Store-and-forward; Every unit; Unlimited number           Optimization         Payload data and Ethermel / IP / TCP / UDP header compression, Packt flow on Radio channel optimization           NTP (Network Time Protocol)         Client, Server (synchronized from internal GPS)           Security         Store-and-forward; Every unit; Unlimited number           Management         HTTP, HTTPS (own certificate), SSH           Access accounts         2 levels (Guest, Admin)         4 levels (Guest, Tech, SecTech, Admin) x unlimited users           Encryption         AES256		Transparent, Flexible, Base driven				
Collision Avoidance Capability       Yes         Remote communication       Yes         Repeaters       Store-and-forward; Every unit; Unlimited number         Optimization       Payload data and Ethermet / IP / TCP / UDP header compression, Packet flow on Radio channel optimization         NTP (Network Time Protocol)       Client, Server (synchronized from internal GPS)         Security       Management         Management       HTTP, HTTPS (own certificate), SSH         Access accounts       2 levels (Guest, Admin)       4 levels (Guest, Tech, SecTech, Admin) x unlimited users         Encryption       AES256       Fereore         VLAN       Yes, IEEE 802.1Q       Fereore         RADUS       No       Yes         Firewall       Layer 2 - NAC, Layer 3 - P, Layer 4 - TCP/UDP       Fereore         Wt tamper proof       No       Yes         Diagnostics and Management       Yes (ping with RSS, Data Quality, Homogenity)       Yes         Watched values       Sevice - Ucc, Temp, PWR, VSWR, HW Alarm Input Radio channel - RSScom, DQcom, TXLost [%] User interfaces - ETH [RWTX], COM [RWTX], COM [RWTX]       Security         Statistics       For Watched values and Statistics       For RWTX Packets on User interfaces (ETH, COM, COM2] User data and Radio protocol (Repeates, Lost, ACK etc.) on Radio channel       Security         Statistics, Neighbours, Grap	Multi master applications					
Remote to Remote communication         Yes           Repeaters         Store-and-forward; Every unit; Unlimited number           Optimization         Payload data and Ethernet / IP / TCP / UDP header compression, Packet flow on Radio channel optimization           NTP (Network Time Protocol)         Client, Server (synchronized from internal CPS)           Security	· · · ·					
Repeaters       Store-and-forward; Every unit; Unlimited number         Optimization       Payload data and Ethermet / IP / TCP / UDP header compression, Packet flow on Radio channel optimization         NTP (Network Time Protocol)       Client, Server (synchronized from internal GPS)         Security       Stere-and-forward; Every unit; Unlimited number         Management       HTTP, HTTPS (own certificate), SSH         Access accounts       2 levels (Guest, Admin)       4 levels (Guest, Tech, SecTech, Admin) x unlimited users         Encryption       AES256	· · ·					
Optimization         Payload data and Ethernet / IP / TCP / UDP header compression, Packet flow on Radio channel optimization           NTP (Network Time Protocol)         Client, Server (synchronized from internal GPS)           Security         Security           Management         HTTP, HTTPS (own certificate), SSH           Access accounts         2 levels (Guest, Admin)         4 levels (Guest, Tech, SecTech, Admin) x unlimited users           Encryption         AES256         Imagement         Yes           VAN         Yes         Imagement         Yes           RADIUS         No         Yes         Yes           Firewall         Layer 2 - MAC, Layer 3 - IP, Layer 4 - TCP/UDP         Yes         Yes           Diagnostics and Maagement         Yes (ping with RSS, Data Quality, Homogenity)         Yes         Yes           Radio link testing         Yes (ping with RSS, Data Quality, Homogenity)         Yes         Yes           Watched values         Device – Ucc, Temp, PWR, VSWR, HW Alarm Input Radio channel – RSScom, DQ com, TXLost [%] User interfaces = THI [RxTx], COMI [RxTx], COM2 [RxTx]         Yes         Yes           Statistics         For Rx/Tx Packets on User interfaces [CHI, COM1, COM2] User data and Radio protoci (Repeates, Lost, ACK etc.) on Radio channel         Yes         Yes           Statistics, Neighbours, Graphs         So Privatched values and Statistics						
Security         Management       HTTP, HTTPS (own certificate), SSH         Access accounts       2 levels (Guest, Admin)       4 levels (Guest, Tech, SecTech, Admin) x unlimited users         Encryption       AES256         IPsec       Yes         VLAN       Yes, IEEE 802.1Q         RADIUS       No       Yes         Firewall       Layer 2 - MAC, Layer 3 - IP, Layer 4 - TCP/UDP         HW tamper proof       No       Yes         Diagnostics and Management         Radio link testing       Yes (ping with RSS, Data Quality, Homogenity)         Watched values       Device - Ucc, Temp, PWR, VSWR, HW Alarm Input Radio channel - RSScom, DQ.com, TXL.ost [%] User interfaces - ETH [Rx/Tx], COMI [Rx/Tx]         Statistics       For Rx/Tx Packets on User interfaces (ETH, COM1, COM2) User data and Radio protocol (Repeates, Lost, ACK etc.) on Radio channel         Graphs       For Watched values and Statistics         History (Statistics, Neighbours, Graphs)       20 periods (configurable, e.g. days)         SNMP       SNMPv1, SNMPv2c, SNMPv3, SNMP Traps for Watched values	•					
Management     HTTP, HTTPS (own certificate), SSH       Access accounts     2 levels (Guest, Admin)     4 levels (Guest, Tech, SecTech, Admin) x unlimited users       Encryption     AES256       IPsec     Yes       VLAN     Yes, EEE 802.1Q       RADIUS     No       Firewall     Layer 2 - MAC, Layer 3 - IP, Layer 4 - TCP/UDP       HW tamper proof     No     Yes       Diagnostics and Management       Radio link testing     Yes (ping with RSS, Data Quality, Homogenity)       Watched values     Yes (ping with RSS, Data Quality, Homogenity)       User interfaces – ETH [Rx/Tx], COMI [Rx/Tx], COM2 [Rx/Tx]       Statistics     For Rx/Tx Packets on User interfaces (ETH, COM1, COM2) User data and Radio protocol (Repeates, Lost, ACK etc.) on Radio channel       Graphs     For Watched values and Statistics       History (Statistics, Neighbours, Graphs)     20 periods (configurable, e.g. days)       SNMP     SNMPv2, SNMPv2, SNMPv3, SNMP Traps for Watched values	NTP (Network Time Protocol)					
Access accounts       2 levels (Guest, Admin)       4 levels (Guest, Tech, SecTech, Admin) x unlimited users         Encryption       AES256         IPsec       Yes         VLAN       Yes, IEEE 802.1Q         RADIUS       No       Yes         Firewall       Layer 2 - MAC, Layer 3 - IP, Layer 4 - TCP/UDP         HW tamper proof       No       Yes         Diagnostics and Management       Yes (ping with RSS, Data Quality, Homogenity)       Yes         Radio link testing       Yes (ping with RSS, Data Quality, Homogenity)       Yes         Watched values       Device - Ucc, Temp, PWR, VSWR, HW Alarm Input Radio channel - RSScom, DQcom, TxLost [%] User interfaces - ETH [RVTX], COMI [RxTx], COM2 [RxTx]       For Rx/Tx Packets on User interfaces (ETH, COM1, COM2) User data and Radio protocol (Repeates, Lost, ACK etc.) on Radio channel         Graphs       For Watched values and Statistics       Statistics         History (Statistics, Neighbours, Graphs)       20 periods (configurable, e.g. days)       SNMPv1, SNMPv2c, SNMPv3, SNMP Traps for Watched values	Security					
Encryption       AES256         IPsec       Yes         VLAN       Yes, IEEE 802.1Q         RADIUS       No       Yes         Firewall       Layer 2 - MAC, Layer 3 - IP, Layer 4 - TCP/UDP       Yes         HW tamper proof       No       Yes         Diagnostics and Management       Radio link testing       Yes (ping with RSS, Data Quality, Homogenity)         Badio channel – RSScom, DQcom, TXLost [%]       User interfaces – ETH [Rx/Tx], COM1 [Rx/Tx], COM2 [Rx/Tx]         Statistics       For Rx/Tx Packets on User interfaces (ETH, COM1, COM2)         Graphs       For Watched values and Statistics         History (Statistics, Neighbours, Graphs)       20 periods (configurable, e.g. days)         SNMP       SNMPv1, SNMPv2c, SNMP Traps for Watched values						
IPsec       Yes         VLAN       Yes, IEEE 802.1Q         RADIUS       No         Firewall       Layer 2 - MAC, Layer 3 - IP, Layer 4 - TCP/UDP         HW tamper proof       No         Ves       Yes         Diagnostics and Management       Yes         Radio link testing       Yes (ping with RSS, Data Quality, Homogenity)         Device – Ucc, Temp, PWR, VSWR, HW Alarm Input Radio channel – RSScom, DQcom, TXLost [%] User interfaces – ETH [Rx/Tx], COM2 [Rx/Tx]         Statistics       For Rx/Tx Packets on User interfaces (ETH, COM1, COM2) User data and Radio protocol (Repeates, Lost, ACK etc.) on Radio channel         Graphs       For Watched values and Statistics         History (Statistics, Neighbours, Graphs)       20 periods (configurable, e.g. days)         SNMP       SNMPv1, SNMPv2c, SNMPv3, SNMP Traps for Watched values			4 levels (Guest, Tech, SecTech, Admin) x unlimited users			
VLAN       Yes, IEEE 802.1Q         RADIUS       No       Yes         Firewall       Layer 2 - MAC, Layer 3 - IP, Layer 4 - TCP/UDP       Yes         HW tamper proof       No       Yes         Diagnostics and Management       Yes         Radio link testing       Yes (ping with RSS, Data Quality, Homogenity)       Yes         Device – Ucc, Temp, PWR, VSWR, HW Alarm Input Radio channel – RSScom, DQcom, TXLost [%] User interfaces – ETH [Rx/Tx], COM2 [Rx/Tx]       Yes         Statistics       For Rx/Tx Packets on User interfaces (ETH, COM1, COM2) User data and Radio protocol (Repeates, Lost, ACK etc.) on Radio channel         Graphs       For Watched values and Statistics         History (Statistics, Neighbours, Graphs)       20 periods (configurable, e.g. days)         SNMP       SNMPv1, SNMPv2c, SNMP Taps for Watched values						
RADIUS     No     Yes       Firewall     Layer 2 - MAC, Layer 3 - IP, Layer 4 - TCP/UDP     Yes       HW tamper proof     No     Yes       Diagnostics and Management     Yes (ping with RSS, Data Quality, Homogenity)     Yes       Radio link testing     Yes (ping with RSS, Data Quality, Homogenity)     User of the constraint of the constr						
HW tamper proof     No     Yes       Diagnostics and Management     Particle Proof     Yes (ping with RSS, Data Quality, Homogenity)       Radio link testing     Yes (ping with RSS, Data Quality, Homogenity)       Watched values     Device – Ucc, Temp, PWR, VSWR, HW Alarm Input Radio channel – RSScom, DQcom, TXLost [%] User interfaces – ETH [Rx/Tx], COM1 [Rx/Tx], COM2 [Rx/Tx]       Statistics     For Rx/Tx Packets on User interfaces (ETH, COM1, COM2) User data and Radio protocol (Repeates, Lost, ACK etc.) on Radio channel       Graphs     For Watched values and Statistics       History (Statistics, Neighbours, Graphs)     20 periods (configurable, e.g. days) SNMP       SNMPV1, SNMPV2c, SNMP Traps for Watched values			Yes			
Diagnostics and Management         Radio link testing       Yes (ping with RSS, Data Quality, Homogenity)         Watched values       Device – Ucc, Temp, PWR, VSWR, HW Alarm Input Radio channel – RSScom, DQcom, TXLost [%] User interfaces – ETH [Rx/Tx], COM1 [Rx/Tx], COM2 [Rx/Tx]         Statistics       For Rx/Tx Packets on User interfaces (ETH, COM1, COM2) User data and Radio protocol (Repeates, Lost, ACK etc.) on Radio channel         Graphs       For Watched values and Statistics         History (Statistics, Neighbours, Graphs)       20 periods (configurable, e.g. days) SNMP						
Radio link testing       Yes (ping with RSS, Data Quality, Homogenity)         Watched values       Device – Ucc, Temp, PWR, VSWR, HW Alarm Input Radio channel – RSScom, DQcom, TXLost [%] User interfaces – ETH [Rx/Tx], COM1 [Rx/Tx]         Statistics       For Rx/Tx Packets on User interfaces (ETH, COM1, COM2) User data and Radio protocol (Repeates, Lost, ACK etc.) on Radio channel         Graphs       For Watched values and Statistics         History (Statistics, Neighbours, Graphs)       20 periods (configurable, e.g. days)         SNMP       SNMPv1, SNMPv2c, SNMP v3, SNMP Traps for Watched values	HW tamper proof	No	Yes			
Watched values       Device – Ucc, Temp, PWR, VSWR, HW Alarm Input Radio channel – RSScom, DQcom, TXLost [%] User interfaces – ETH [Rx/Tx], COM1 [Rx/Tx]         Statistics       For Rx/Tx Packets on User interfaces (ETH, COM1, COM2) User data and Radio protocol (Repeates, Lost, ACK etc.) on Radio channel         Graphs       For Watched values and Statistics         History (Statistics, Neighbours, Graphs)       20 periods (configurable, e.g. days)         SNMP       SNMPv1, SNMPv2c, SNMPv3, SNMP Traps for Watched values						
Watched values     Radio channel – RSScom, DQcom, TXLost [%] User interfaces – ETH [Rx/Tx], COM1 [Rx/Tx], COM2 [Rx/Tx]       Statistics     For Rx/Tx Packets on User interfaces (ETH, COM1, COM2) User data and Radio protocol (Repeates, Lost, ACK etc.) on Radio channel       Graphs     For Watched values and Statistics       History (Statistics, Neighbours, Graphs)     20 periods (configurable, e.g. days)       SNMP     SNMPv1, SNMPv2c, SNMPv3, SNMP Traps for Watched values	Radio link testing					
Statistics         User data and Radio protocol (Repeates, Lost, ACK etc.) on Radio channel           Graphs         For Watched values and Statistics           History (Statistics, Neighbours, Graphs)         20 periods (configurable, e.g. days)           SNMP         SNMPv1, SNMPv2c, SNMPv3, SNMP Traps for Watched values	Watched values	Radio channel – RSScom, DQcom, TXLost [%]				
History (Statistics, Neighbours, Graphs)     20 periods (configurable, e.g. days)       SNMP     SNMPv1, SNMPv2c, SNMPv3, SNMP Traps for Watched values		For Rx/Tx Packets on User interfaces (ETH, COM1, COM2)				
	History (Statistics, Neighbours, Graphs)	20 periods (configurable, e.g. days)				
	Approvals	CE (RED), FCC, ATEX, RoHS CE (RED), FCC, RoHS				

